SCORBASE
for Windows

Level 1, Level 3 and SCORBASEpro

SCORBOT-ER 4pc
Controller-PC

User's Manual

ESHED ROBOTEC

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Introducing SCORBASE for Windows

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

SCORBASE for Windows contains all the features of its DOS-based predecessor, but many elements have been redesigned to suit and utilize Windows capabilities. Menus and dialog boxes can be displayed in numerous configurations, thereby simplifying and expanding access to various functions. Positions can be recorded, for example, while programs are being edited.

SCORBASE for Windows provides numerous capabilities:

- Control and real-time status display of five robot axes, gripper and two peripheral axes.

- Full support and real-time status display of 8 digital inputs and 8 digital outputs. SCORBASEpro offers an additional 4 analog inputs and 2 analog outputs. User defined names can be assigned to each I/O.

- Position definition and display as well as manual robot movement in joint coordinates (encoder units). Cartesian coordinates (X,Y,Z, pitch and roll are also available in Level 3 and SCORBASEpro.

- Robot movement definition as joint, linear, or circular, with 10 active speed settings. (Availability depends on level.)

- Default setting of 100 positions and 1000 active program lines.

- Interrupt programming for handling responses to changes in input status.

- Variable programming is available in Level 3 and SCORBASEpro.

- Saving and loading of programs and positions either separately or together.

SCORBASE Levels 1 and 3 provide the same interface as SCORBASEpro, but with fewer programming options. Thus beginners can start at a lower level, and progress through the levels as they become more skilled in robotics programming.

SCORBASEpro can be installed as part of Cell Simulation, an interactive graphic software package, which provides 3D simulation of the robot and other devices in the workcell.

This manual describes all the features and operations for all levels of SCORBASE. When necessary, illustrations show the differences in the levels, and descriptions note the availability of options and commands.

CHAPTER *2*

Starting SCORBASE

The instructions in this chapter are for SCORBASE only.

If you will be installing SCORBASE as part of the Cell Simulation software package, follow the instructions in the chapter, "Starting Cell Simulation," in the Cell Simulation User's Manual.

System Requirements

SCORBASE for Windows requires the following:

- An IBM®-compatible PC with an 80486 33 MHz processor, or higher.
- At least 8 MB of RAM.
- A hard drive with at least 10 MB of free disk space.
- DOS 6.2 or higher, Windows 3.11 (Windows for Workgroups) or Windows 95.
- A VGA or better graphics display.
- A mouse or other pointing device.

Software Copy Protection

The SCORBASE installation disks contain a copy-protection shield which 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 which is updated each time the software is installed (and uninstalled).

When the SCORBASE 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.

Software Installation

The SCORBASE software is supplied in a compressed format on two 3.5" 1.44MB disks. The software is copy-protected, and backup copies of the original disks cannot be used to install the software. Therefore, be sure to protect the original SCORBASE disks.

To install the software, do the following:

1. Start Windows.

2. Close any applications which are open before you begin the installation.

   If you are about to reinstall the software or install a newer version to an existing SCORBASE directory, it is recommended that you backup any existing user-created program and position files before you begin the installation.

   It is also recommended that you remove the previous SCORBASE for Windows installation by means of the Uninstall utility included with the software.

3. Insert disk #1 of the SCORBASE software into a floppy disk drive.

   Make sure the disk is *not* write-protected.

4. Run A:SETUP.EXE (or B:SETUP.EXE).

5. Follow the instructions which appear on the screen.

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

   By default, the software is installed to the directory C:\SBWER4.

   Note: only one installation of SCORBASE can reside on a hard disk.

   When the installation is complete, the SCORBASE program group will appear.
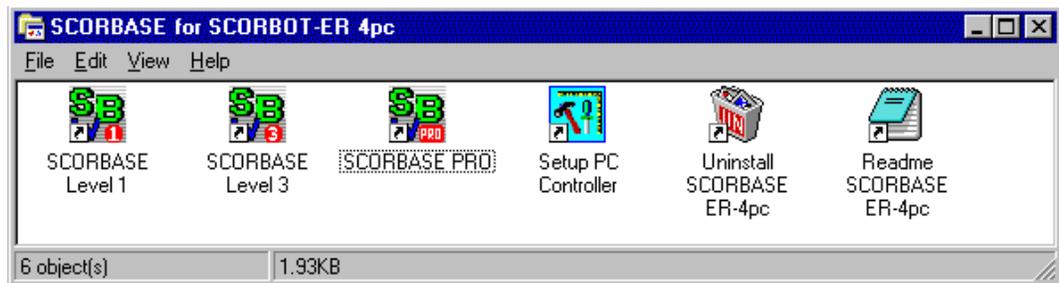
To preserve the display of the SCORBASE program group on the Windows 95 desktop, follow the instructions in the following section.

Windows 95: Keeping the SCORBASE Program Group on the Desktop

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

1. When the installation is complete and the SCORBASE program group is still active, press the backspace key *once*. The Programs folder (group) should now be displayed.

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

Uninstalling the Software

Uninstall removes all components of SCORBASE from your computer hard drive, and restores one user license to the installation disk. The software can then be reinstalled in the same computer or installed in a different computer.

Before you uninstall the software, you should backup any existing user-created program and position files.

To uninstall SCORBASE, do the following:

1. Insert the original disk #1 into the floppy drive. (Make sure it is not write-protected.)

2. From the SCORBASE for SCORBOT-ER 4pc program group, select Uninstall.

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

Activating the Software

To start SCORBASE, do the following:

1. Make sure that all hardware (computer, robot, controller, accessories) which will be used with SCORBASE is installed and connected according to the installation procedures detailed in the user manuals supplied with the robot and controller.

2. Turn on the computer. Then turn on the controller (SCORPOWER control box).

   If hardware is not installed, SCORBASE will load and operate in simulation mode.

3. Activate Windows.

4. Double click on one of the SB icons (SBW1, SBW3 or SBWpro).

   The SCORBASE application window will appear.

   Only one application of SCORBASE can be active at a time.

   The following illustrations show the application windows for SCORBASE Level 1 and SCORBASEpro.
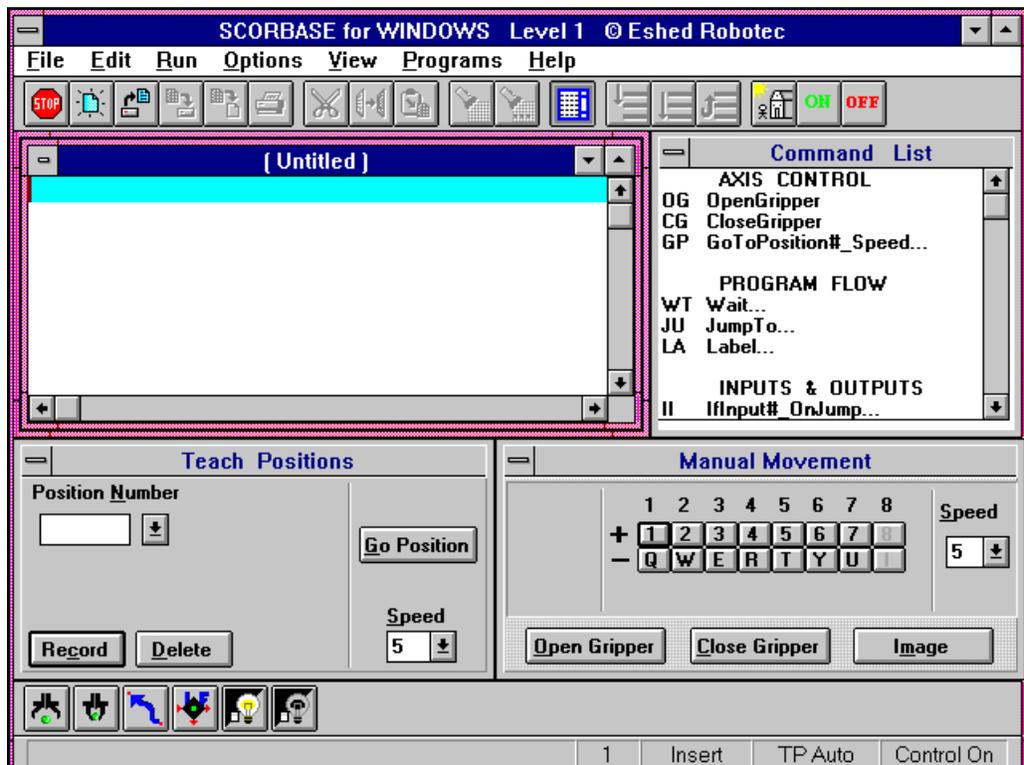
SCORBASE Level 1
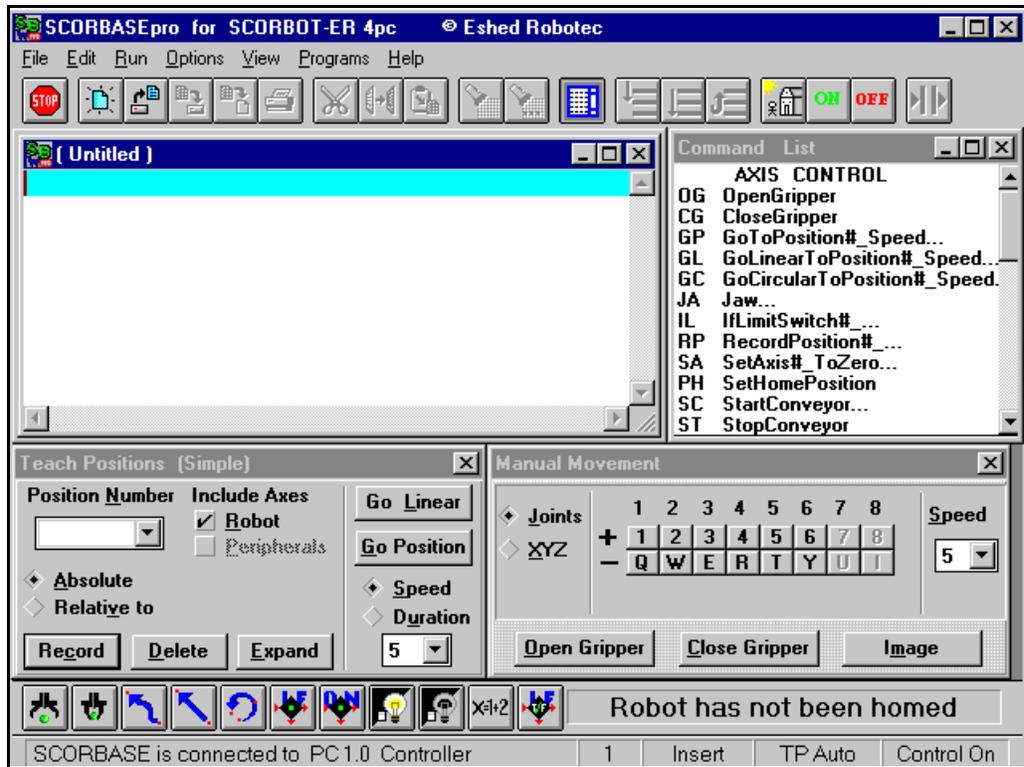
SCORBASEpro

Qutting the Software

To quit SCORBASE, use any of the following standard Windows methods:

♦ In SCORBASE, select File|Exit.

♦ Double click the Control-Menu box in the title bar.

♦ Press [Alt]+F4

➤

Overview

The SCORBASE Window

The figure below shows the elements of the main SCORBASE screen:

Title Bar	Contains the usual Windows controls for sizing and closing the application screen.
Menu Bar	Contains menus with SCORBASE commands. Some commands are accessible from the tool bar (icons), while some are accessible only in the menus.
Tool Bars	Contain icons which represent the most frequently used functions and commands. The number of icons displayed varies according to the level of SCORBASE. To select a tool, simply click on the icon.
Status Bar	Displays, at the bottom of the screen, information regarding the SCORBASE software, modes of operation, current activity, and so on. When you position the mouse over an icon, a description of the icon appears in the status bar.

File Menu
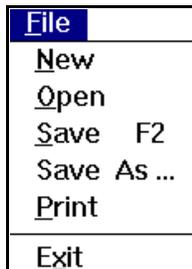
The File menu contains the usual Windows functions which allow you to load, save and print files containing robot programs and positions, and to exit the software.

Up to five programs can be opened and edited at a time. However, it is recommended that you close the currently open file (including Untitled) before you open another (new or existing) program file.

New	Opens a new, untitled, file for a robot program.
Open	Opens an existing file containing a robot program and its associated positions file.
Save (F2)	Saves the currently active robot program and/or associated positions file.
Save As...	Saves the currently active robot program and/or positions under a new file name.
Print	Prints the currently active robot program file.
Exit	Quits SCORBASE.
	If changes to a program or position file have been made but not yet saved, a warning message will be displayed.

For more information on SCORBASE file management, see Chapter 8.

Edit Menu

The Edit menu contains the usual Windows functions which allow you to edit files containing robot programs.

	Cut	Deletes selected text or lines from the program file and places it on the Windows and SCORBASE clipboards.
	Copy	Places a copy of selected text or lines from the program file on the Windows and SCORBASE clipboard.
	Paste	Inserts the contents of the SCORBASE clipboard into the program file.
	Find	Opens a dialog box which allows you to search for a particular string of text, SCORBASE command or command argument:
	Find Next (F3)	Repeats the last Find operation for the next occurrence.
	Find Previous	Repeats the last Find operation for the preceding occurrence.
	Command/Remark * / ...	Inserts/deletes asterisk at beginning of a command line. Toggles the command line between a remark and an executable command.
	Go to Line...	Opens a dialog box which displays the total number of lines in the program and prompts you for a line number. The program editor will jump to the line you specify.
	Command List	Icon only. The icon toggles the display of the SCORBASE command list off and on.

For more information on these and additional SCORBASE editing functions, see Chapter 6.

Run Menu

The Run menu contains the SCORBASE commands for homing the robot and peripheral axes and executing programs.

If the software is operating off-line, only the Run program options will be available in this menu.

| Search Home - All Axes | Homes both the robot and any configured peripheral axes. |

| Search Home - Robot | Homes the robot axes only. |

| Search Home - Peripherals | Homes the peripheral axes only. |

Since the robot and peripheral axes should be homed before you perform on-line operations such as recording positions or executing robot programs, you should begin each working session by executing the Search Home routine.

When SCORBASE is operating in off-line or simulation mode (not communicating with controller), the homing routine initializes encoder and XYZ home values according to a software definition.

| Control On (F5) | Enables servo control of the axes. |

| Control Off | Disables servo control of the axes. When control is off, axes cannot be moved. |

When the software is operating in off-line or simulation mode (not communicating with the controller), it simulates responses according to the state of control.

	Go Home - All Axes	Sends both the robot and all configured peripheral axes to their home position.
	Go Home - Robot	Sends the robot to its home position.
	Go Home - Peripherals	Sends any configured peripheral axes to their home position.
	Run Single Line (F6)	Executes the current program line. This line is highlighted in the program window.
	Run Single Cycle (F7)	Executes the program once.
	Run Continuously (F8)	Executes the program in an endless loop. When the last line is reached, the program jumps automatically to line 1.
	Pause (F10)	Stops the program and movement of all axes only after the current command has been executed. (Level 3 and Pro.)
	Stop (F9)	Immediately stops program execution and movement of all axes.

Pause and Stop are software methods for halting program execution. In an actual emergency situation, you should use the EMERGENCY button on the teach pendant or power box.

For more information on robot homing and control, see Chapter 4.

For more information on program execution, see Chapter 7.

Options Menu

Options
√ <u>L</u>ine Number
√ O<u>n</u> - Line
O<u>f</u>f - Line
<u>S</u>imulation
<u>F</u>ile
<u>I</u>nput & Output Names
<u>L</u>oad user screens
S<u>a</u>ve user screens
S<u>e</u>tup

The Options menu allows you to define your preferences for operating the software.

Line Number

Toggles the display of program line numbers in the program window on and off.

On-Line

SCORBASE communicates with the controller. The robot, peripheral axes and I/Os execute all commands.

Off-Line

SCORBASE does not communicate with the controller, even though it may be connected. Axis movement commands are not executed, and recorded positions are not required. Controller I/Os are not switched; I/O states are read from the Digital and Analog I/O dialog boxes (where you can manipulate them to simulate changes in their state).

Off-line mode is useful for checking and debugging programs.

Simulation

SCORBASE does not communicate with the controller (even if it is connected), but simulates its operation. The software pauses for the actual time it would take for commands (e.g., Wait, Go Position) to be executed. Requires valid recorded positions. Controller I/Os are not switched; I/O states are read from the Digital and Analog I/O dialog boxes (where you can manipulate them to simulate changes in their state).

Simulation is useful for checking and debugging programs. It is intended for use with the optional Cell Simulation software.

File

Opens a dialog box which allows you to define whether programs and positions will be saved and/or loaded together or separately.

Input & Output Names	Opens a dialog box which lets you define the text or names you want associated with the input and output ports.

When you load SCORBASE, the I/O names are automatically loaded and displayed in the Digital and Analog I/O dialog boxes. The names are not attached to any specific program.

Load User Screen	Loads a user-defined set of dialog boxes and screen layout.

Whenever you select the option User Screen from the View menu, the display will be determined by the currently loaded User Screen file.

Save User Screen	Saves a user-defined set of dialog boxes and screen layout.

Once you have determined the screen display which is most suitable to your screen resolution and your programming needs, you should save this layout to a User Screens file. User Screens files have the extension USR. You can create and save as many of them as you want.

Setup	SCORBASEpro: Opens a submenu which contains a list of options regarding software parameters for the robot and peripheral devices.

Levels 1 and 3: Opens only the Peripheral Setup dialog box.

For more information on SCORBASE setup options, see Chapter 9.

View Menu

View
Graphic Display
Simulation & Teach
Simulation & Run
Combo Screen
Edit Screen
Teach Screen
Run Screen
User Screen
List Positions
Teach Positions
Manual Movement
Encoder Counts
XYZ
Digital I/O
Analog I/O
Log File
Message Screen
Edit Line

The first three options are not available in the standard SCORBASE software installation. They are available only when SCORBASE is installed together with the Cell Simulation software.

The screen options in the View menu allows you to display a predefined set of SCORBASE dialog boxes and menus. The specific screen layout depends upon the level of SCORBASE currently in use.

Combo Screen	Displays the dialog boxes and menus used for editing programs and recording positions:

- Command List
- Teach Positions / Teach Positions (Simple)
- Manual Movement
- Program window(s)

Edit Screen	Displays the dialog boxes and menus used for editing programs:

- Command List
- Program window(s)

Teach Screen	Displays the dialog boxes and menus used for teaching and recording positions (Level 3 and Pro).

- Teach Positions (Expanded)
- Robot Movement
- Program window(s)

Run Screen	Displays the dialog boxes and menus used for program execution.

- Encoders (Level 3 and Pro)
- XYZ (Level 3 and Pro)
- Digital I/O
- Program window(s)

| User Screen | Displays the currently loaded set of dialog boxes which have been selected, sized and positioned by the user, and saved to a file through the Options menu. |

Refer also to the section which describes the Programs menu later in this chapter.

The second set of options in the View menu is a list of the various dialog boxes which can be displayed. The availability of options depends upon the level of SCORBASE currently in use.

| List Positions | Opens a dialog box which displays the coordinates of positions currently loaded in SCORBASE. Allows you to delete positions and and print the list of positions. |

| Teach Position | Opens a dialog box which allows you to defined and record positions, and to send the robot and/or peripheral axes to recorded positions. |

For complete details on teaching and recording positions, see Chapter 5.

| Manual Movement | Opens a dialog box which allows you to assume direct manual control of the robot's movement from the keyboard, or by clicking with the mouse on the screen. If peripheral axes are connected, they too can be controlled from this screen. |

For more details on moving the axes, see Chapter 4.

| Encoder Counts | Opens a box which displays the current values of the encoders for each of the axes. (Pro.) |

These values are set to 0 (or nearly 0) whenever the Search Home command is executed. The values change whenever the robot or peripheral axes are moved more than 10 encoder units.

| XYZ | Opens a box which displays the current Cartesian (XYZ) values for each of the robot axes. (Level 3 and Pro.) |

The values change whenever the robot axes are moved more than 1mm (X,Y,Z axes) or 1° (pitch and roll axes).

Digital I/O	Opens a dialog box which displays the current status of each digital input and output. The outputs can be switched from this dialog box. In addition, the state of digital inputs can be simulated by the user—a useful way of testing program execution off-line.
Analog I/O	Opens a dialog box which displays the current status of each analog input and output and allows the user to change analog output values.
Log File	The SCORBASE log file records error messages, the start of each cycle during program execution, and Print to Log command lines as they are executed.
	The Log file is initialized (cleared) each time SCORBASE is loaded. (Level 3 and Pro.)
Message Screen	When a program which contains a Print to Screen command line begins execution, the Message screen is automatically activated and displayed. This screen is also activated if a Print to Screen command line is executed (by means of Run Single Line).
	Once activated, the Message screen shows the start of each cycle during program execution and all Print to Screen command lines as they are executed.
	The Message screen is cleared each time it is closed.
Edit Line	Brings the currently selected (blue-highlighted) program line into view. Useful for returning to a specific line after scrolling through a long program.

Programs Menu

```
┌─────────────────────────┐
│ Programs                │
│  Cascade                │
│  Tile                   │
│  Arrange Icons          │
│  Close All              │
├─────────────────────────┤
│ √1 C:\SBW\PRO\DEMOPRO.SBP│
└─────────────────────────┘
```
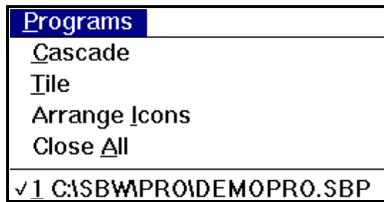
SCORBASE loads each robot program into a separate window within a larger program window; this enables you to edit programs while keeping other SCORBASE windows and dialog boxes active and accessible.

Up to five programs can be opened and edited at a time. However, it is recommended that you close the currently open file (including Untitled) before you open another (new or existing) program file.

The Programs menu defines how the windows containing individual program files are displayed within the program window.

Cascade	The usual Windows control for resizing and layering open windows so that each title bar is visible.
Tile	The usual Windows control for resizing and arranging the open windows side by size.
Arrange Icons	The usual Windows control for realigning the icons of programs which have been minimized.
Close All	Closes all open windows which are used for program editing.
File List	Displays a list of the program files which are currently open.

The Cascade or Tile setting remains in effect until changed.

CHAPTER **4**

Homing and Control

Homing

Search Home   Level 1, Level 3, Pro

The location of the robot and peripheral axes is monitored by encoders which track the amount of movement relative to a fixed home position. To obtain repeatable performance, this reference position must be identical each time the robot and peripheral axes are used. Thus, before you begin on-line operations, such as recording positions and executing programs, *the homing routine must be executed*.

When switching to on-line mode after operating the software in off-line or simulation mode, the homing routine must be executed, even if the robot was previously homed.

When SCORBASE is operating on-line, a warning message will appear if you attempt to execute movement commands before the axes have been homed. However, the axes can be manipulated from the Manual Movement or Robot Movement dialog boxes without first being homed.

The Run menu allows you to select a command to home the robot axes only, the peripheral axes only, or both together.

To execute the homing routine, do any of the following:

- Select **Run | Search home - all axes**
- Click the Search Home icon (to home all configured axes).
- Select **Run | Search home - robot**
- Select **Run | Search home - peripherals**

The Search Home command executes the homing routine for the robot and any peripheral devices which have configured in the **Options|Setup|Peripherals** menu.

During the homing procedure, SCORBASE displays a checklist which indicates whether each of the axes has reached its home position. Each time an axis is successfully homed, a checkmark appears next to the name of the axis. At the completion of the robot homing, a checkmark appears next to Robot and a message in the status line will indicate that the robot has been home.

```
┌─────────────────────────┐    ┌─────────────────────────┐
│      Homing axis 1      │    │      Homing B ( 8 )     │
│   ☐        Axis 1       │    │                         │
│   ☑        Axis 2       │    │   ☑        Axis 7       │
│   ☑        Axis 3       │    │   ☐        Axis 8       │
│   ☑ .      Axis 4       │    │                         │
│   ☑        Axis 5       │    │  ┌───────────────────┐  │
│   ☐        Axis 6       │    │  │ To  abort  homing │  │
│   ☐        Robot        │    │  │ procedure   press │  │
│  ┌───────────────────┐  │    │  │ EMERGENCY button  │  │
│  │ To  abort  homing │  │    │  └───────────────────┘  │
│  │ procedure   press │  │    └─────────────────────────┘
│  │ EMERGENCY button  │  │
│  └───────────────────┘  │
└─────────────────────────┘
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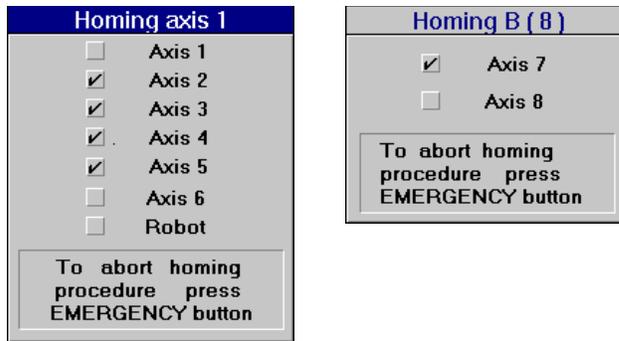
If both robot and peripheral axes are being homed, the peripheral homing message box will appear after the robot homing is completed.

By default, the robot axes are homed in the following order: Shoulder (Axis 2), Elbow (Axis 3), Pitch (Axis 4), Roll (Axis 5), Base (Axis 1), Gripper (Axis 6). In SCORBASEpro this order can be redefined through the **Options|Setup| Robot** menu.

To abort the homing while the operation is in progress, do one of the following:

⬩ Press the red EMERGENCY button on the controller.

⬩ Press the EMERGENCY key on the teach pendant.

When SCORBASE is operating in the simulation or off-line mode, the homing routine is not required, although it can be executed. Doing so will initialize Joint and XYZ values according to a software definition. All encoders will be set to 0, while the robot Cartesian coordinates will be set according to a software model.

Go Home   Level 1, Level 3, Pro

After axes have been homed, you can send them back to their home position at any time, by doing one of the following :

⬩ Select **Run | Go home - all axes**

⬩ Select **Run | Go home - robot**

⬩ Select **Run | Go home - peripherals**

This command will not work in simulation or off-line mode unless the **Run | Search Home** command has first been executed.

Control

Control On / Control Off   **Level 1, Level 3, Pro**

The Control On state enables servo control of the axes. In the Control Off state axis movement commands cannot be executed.

When SCORBASE is loaded, it automatically sets the Control On state if communication with the controller is established. If not, the Control Off state is set.

The controller will automatically disable control if an impact condition, trajectory error or thermic overload error occurs during execution of a movement command. If you attempt to move the axes when control is disabled, a Control Off message will be displayed.

To enable control and resume servo control of the axes, do any of the following:

- Select **Run | Control On**
- Click the Control ON icon.
- Press the **F5** key.

To disable control, do either of the following:

- Select **Run | Control Off**
- Click the Control OFF icon.

When SCORBASE is operating in off-line mode, the Control On/Off state cannot be altered.

When SCORBASE is operating in simulation mode the Control On/Off commands can be altered by the user. The software will then simulate the selected control mode. If, for example, Control Off has been selected, a Control Disabled message will appear when you attempt to run a program.

CHAPTER **5**

Position Teaching

The following SCORBASE windows are used in the process of defining
and recording positions.

 ⬥ Manual Movement
   Robot Movement

 ⬥ Teach Positions (Level 1)
   Teach Positions (Simple) (Level 3 and Pro)
   Teach Positions (Expanded) (Level 3 and Pro)

 ⬥ List Positions

 ⬥ Encoders (Level 3 and Pro)

 ⬥ XYZ (Level 3 and Pro)

To activate the dialog boxes which are most useful for position teaching
mode, select **View |Teach Screen**. In Level 1 select **View | Combo
Screen**.

The screen layout which will appear depends on the currently loaded level
of SCORBASE, as shown in the following examples.
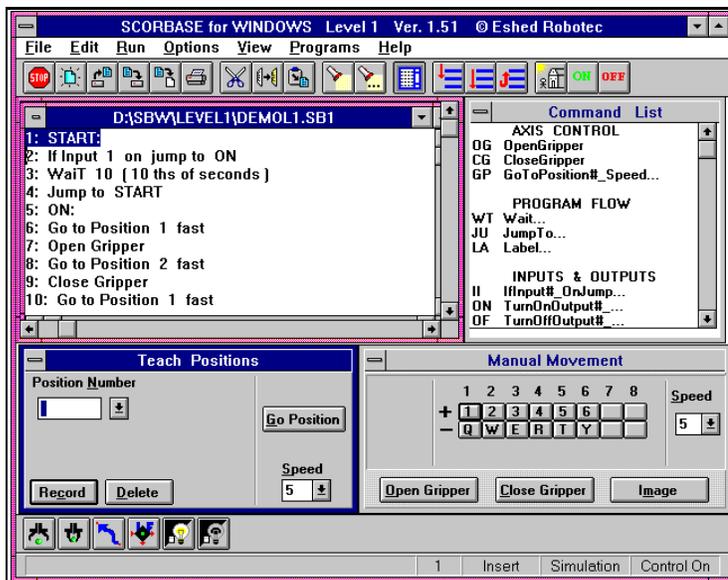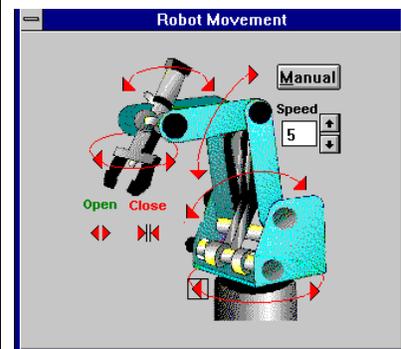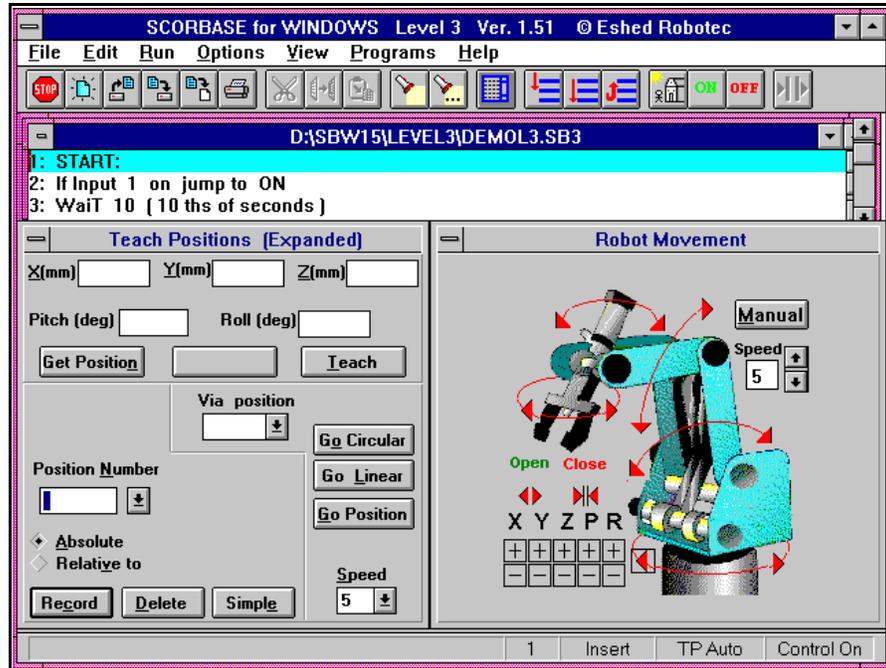
Level 1

Level 3
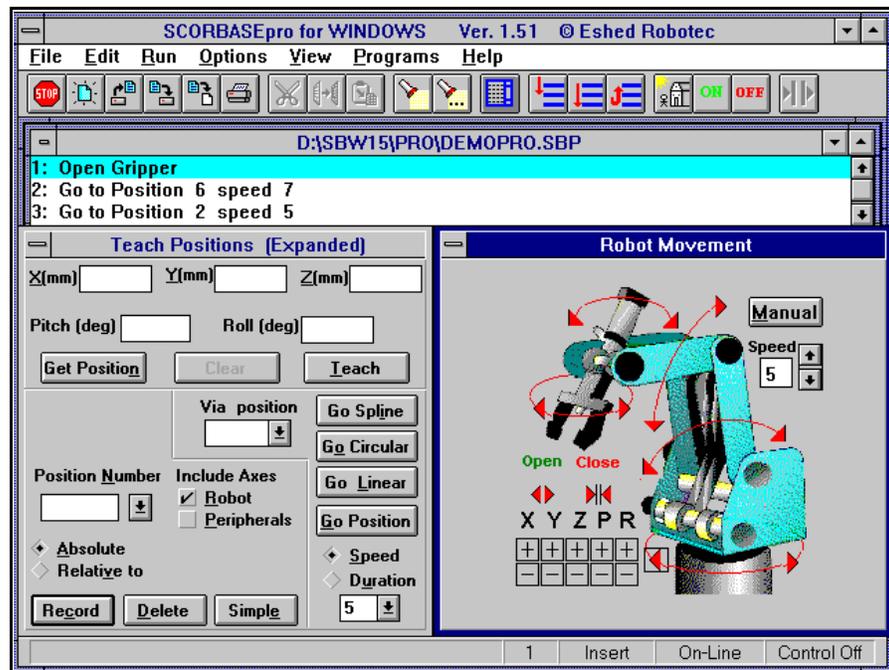
Pro

Since it is often necessary to manipulate the robot and test its movements while recording positions, these screens also allows you to manually control the robot's movements and to execute Go Position commands.

You may find it helpful to also open the List Positions, XYZ and/or Encoders dialog boxes when recording positions.

Cartesian and Joint Coordinate Systems

♦ *Joint Coordinate System*

When the axes move, the encoders attached to the robot motors generate a series of electrical signals. The number of signals is proportional to the amount of axis motion. The robot controller counts the signals and determines how far an axis has moved.

Joint coordinates specify the location of each axis in encoder counts.

When the coordinate system is set to the **Joint** mode, manual movement commands cause the robot to move one joint.

The positions and movements of **peripheral axes**, if connected to the robotic system, are always according to encoder counts.
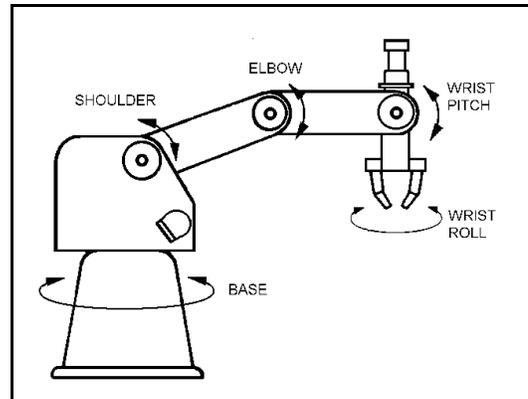
Joint Coordinates

♦ *Cartesian (XYZ) Coordinate System*

The Cartesian, or XYZ, coordinate system is a geometric system used to specify the position of the robot's TCP (tool center point) by defining its distance, in linear units, from the point of origin (the center bottom of the robot base), along three linear axes.

To complete the position definition, the pitch and roll of the gripper are specified in angular units.

When the coordinate system is set to the **XYZ** mode:

♦ Manual movement commands to the X, Y or Z axis result in a linear motion of the **tool center point (TCP)** along the respective axis, while maintaining a constant orientation of the tool.

♦ Manual movement commands to the pitch or roll axis will change the orientation of the tool, while maintaining a constant TCP position.
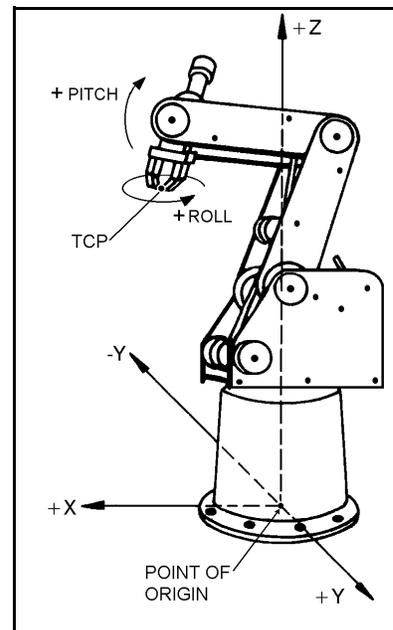
Cartesian Coordinates

Manual Movement Dialog Box

The Manual Movement dialog box allows you to assume direct control of the robot and peripheral axes. By clicking with the mouse on the screen, or pressing keys on the keyboard, you move the axes.

Level 1   *Level 3 and Pro*

The robot can be manipulated from this dialog box before it has been homed. In fact it is often necessary to bring the robot into a more suitable position before initiating the homing routine. However, an axis limit error message may appear during manipulation of a robot which has not been homed.

Movement of an axis continues as long as the button or key is pressed, or until a software or hardware limit is reached.

The following chart explains how clicking the buttons (or pressing the keys on the keyboard) moves the robot's joints.

Joints (Joints only in Level 1; option in Level 3 and Pro.) When Joints is selected, clicking the buttons (or pressing the keys on the keyboard) moves the robot's joints, as shown in the following chart:

Keys	Joint Motion
1 / Q	Rotates the BODY to the right and left
2 / W	Moves the SHOULDER up and down.
3 / E	Moves the ELBOW up and down.
4 / R	Moves the wrist (PITCH) up and down.
5 / T	Rotates the wrist (ROLL) to the right and left.
7 / U	Moves peripheral axis (if connected)
8 / I	Moves peripheral axis (if connected)

XYZ (Level 3 and Pro) When XYZ is selecting, clicking (or pressing they keys on the keyboard) moves the TCP along X, Y and Z axes, as shown in the following chart.

Keys	XYZ Motion
1 / Q	TCP moves along X+ and X– axes.
2 / W	TCP moves along Y+ and Y– axes.
3 / E	TCP moves along Z+ and Z– axes.
4 / R	Axes move in order to change the pitch; TCP position does not change.
5 / T	Roll moves; TCP position does not change.

Open Gripper / Close Gripper   Completely opens and closes the gripper.

Speed   Selects the speed of manual movement. 10 is the fastest; 1 the slowest; 5 is the default.

Robot Movement Dialog Box

Note: *If the Robot Movement screen displays incorrectly on your monitor, try changing your system settings to VGA 800x600 with **small** fonts.*

This screen allows you to assume direct manual control of the robot's movements by clicking with the mouse on the screen.

The robot can be manipulated from this dialog box before it has been homed. In fact it is often necessary to bring the robot into a more suitable position before initiating the homing routine. However, an axis limit error message may appear during manipulation of a robot which has not been homed.
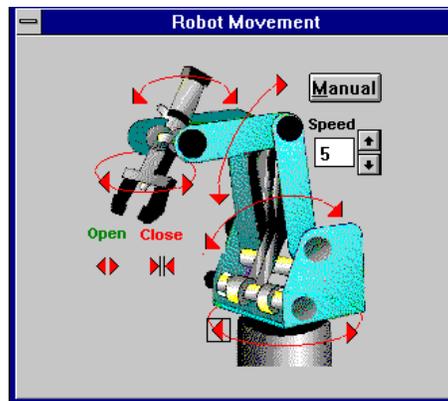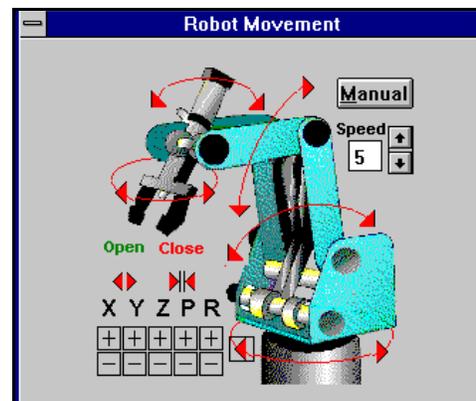
Level 1   *Level 3, Pro*

Arrows   Click on the arrows on the axes to move individual joints and the gripper.

Movement of an axis or the gripper continues as long as the arrow is pressed, or until a software or hardware limit is reached.

Open / Close	Click on the Open and Close buttons to toggle the gripper between completely open and completely closed.
+ and −	Click on the + and − buttons below the XYZPR to move the robot's TCP (tool center point) along its X, Y and Z axes. (Pro.)
	Movement of the TCP continues as long as the button or key is pressed, or until a software or hardware limit is reached.
Speed	Selects the speed of manual movement. 10 is the fastest; 1 the slowest; 5 is the default.
Manual	Opens the Manual Movement screen, which also allows you to move the axes by means of clicking on the screen, but without a diagram of the robot.

"Record" and "Teach"

Although the terms **teach** and **record** are often used interchangeably in robotics, SCORBASE for Windows makes the following distinction:

♦ *Record* position: the controller records the position according to the current coordinates of the robot and/or peripheral axes.

Record commands always record Joint coordinates.

♦ *Teach* position: the user records the position by specifying values for the position coordinates. (Available in Level 3 and Pro.)

Teach commands always record XYZ coordinates.

Although you can enter coordinates for all five axes (XYZPR), the Teach Position function is most effectively used for position modification; that is, for changing only one of the coordinates of a position. You can therefore adjust a position's location. Or you can use the coordinates of an existing position to create a new position whose location differs slightly from the first.

Although positions may be recorded or taught in either Joint or Cartesian coordinates, the axes can be instructed to move to positions in either coordinate system. The controller software converts the coordinate values according to the movement command which is issued. Similarly, position coordinates can be displayed in either system.

Absolute and Relative Positions

- ♦ An *absolute position* is a fixed location in world space. It can defined in either Cartesian or joint coordinate values.

- ♦ A *relative position* is a position whose coordinates define a specific offset from another position. A relative position is linked to a reference position. If the coordinates of the reference position change, the relative position moves along with it, maintaining the same offset. It can defined in either Cartesian or joint coordinate values.

  A position which is defined as *relative to current* means the specified offset will be computed from wherever the robot is located at the time it is sent to the relative position.

Teach Positions Dialog Box

The Teach Positions screen allows you to record positions and send the axes to the recorded positions.

The Teach Position Dialog box in Level 1 contains the following options:
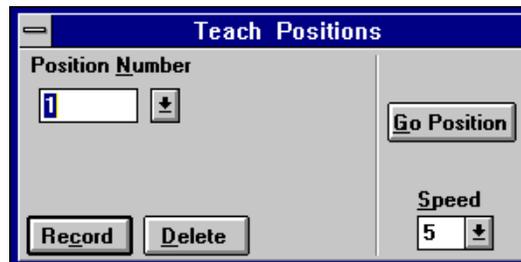
Level 1

Position Number	A numerical name for the position.
Record	Records a position, in joint coordinates, for the robot and/or the peripheral axes according to their current location. Up to 101 positions can be recorded, numbered sequentially from 1 to 101.
Delete	Deletes the displayed position.
Go Position	Executes the Go Position command. Sends the axes to the selected position.
Speed	Selects the speed of movement for the Go to Position movement. 10 is the fastest; 1 the slowest.

The Teach Positions (Simple) dialog box (Level 3) contains the *additional* options:
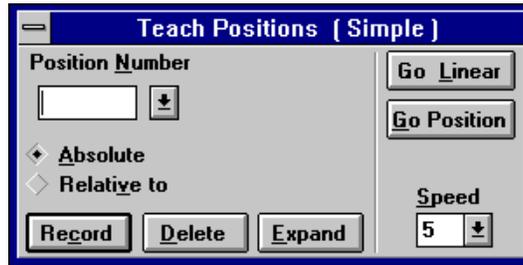
Level 3

Absolute / Relative to	Defines whether the positions coordinates are absolute values in space, or offset values relative to another position.
	When Relative to is selected, a **Relative To** field appears. Select either an existing position or **current**.
	A position which is **relative to current** means the specified offset will be computed from wherever the robot is located at the time it is sent to the relative position.
Go Linear	Executes the Go Linear to Position command. This command sends the robot's TCP (tool center point) from its current position to a recorded position along a linear path (straight line).
	The linear motion applies only to the robot axes, although peripheral axes might also move as a result of the command.
Expand	Opens the Teach Positions (Expanded) screen.

The Teach Positions (Simple) dialog box (SCORBASEpro) contains the *additional* options:
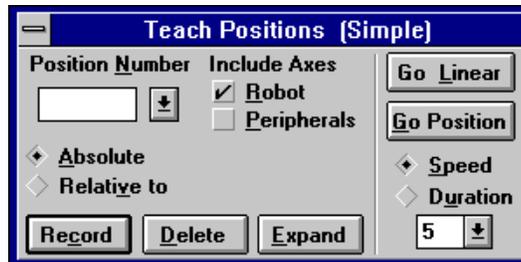
Pro

Include Axes	Instructs the controller to record coordinates for either the robot or the peripheral axes, or both.
Duration	Defines the time it will take to complte a Go to Position or Go Linear movement. Defined in 10ths of a second.

The Teach Positions (Expanded) dialog box (Level 3 and Pro) contains the *additional* options:

Teach Positions (Expanded) — Level 3	Teach Positions (Expanded) — Pro

Level 3   *Pro*

X(mm), Y(mm) Z(mm), Pitch (deg) Roll (deg)	Fields for displaying and changing the Cartesian coordinates of the selected position.
Get Position	Displays the Cartesian coordinates of the selected position.
Clear	Clears all position coordinate fields.
Teach	Records the position defined by the Cartesian coordinates. Up to 100 positions can be recorded.
Go Circular	Executes the Go Circular to Position command. This commands sends the robot in a circular path to the first specified position through the second one.
	The circular motion applies only to the robot although peripheral axes might also move as a result of the command.
Duration	Defines the time it will take to complte a Go to Position or Go Linear movement. Defined in 10ths of a second.
Via position	Selects the intermediate position through which the Go Circular movement passes.
Simple	Opens the Simple Teach screen, which has only basic Record Position functions.

Record and Teach Positions

Record Absolute Joint Position   Level 1, Level 3, Pro

To record an absolute Joint position, do the following:

* Move the robot to the position whose coordinates you want to record.

* In the Position Number field in the Teach Positions dialog box, select an existing position or enter a new number.

* (Level 3 and Pro) Select **Absolute**.

* (Pro): Select the Include Axes option (either or both):

    * **Robot**: to record a position for the robot axes.

    * **Peripherals**: to record a position for the peripheral axes.

* Click **Record**. The current coordinates of the axes will be recorded for the selected position.

Teach Absolute XYZ Position   Level 3, Pro

To record an absolute XYZ position (based on the coordinates of an existing position), do the following:

* In the Position Number field in the Teach Positions (Expanded) dialog box, select a position number.

* Click Get Position. The XYZ coordinates of the position now appear at the top of this dialog box.

* In the Position Number field enter a different number (or leave unchanged if you are modifying the coordinates of the displayed position).

* (Level 3 and Pro) Select **Absolute**.

* (Pro): Select the Include Axes option (either or both):

    * **Robot**: to record a position for the robot axes.

    * **Peripherals**: to record a position for the peripheral axes.

* In one or more of the coordinate fields, enter a new value (in millimeters).

* Click **Teach**. You have now recorded a new position.

    Warning: If you click Record, the current coordinates of the axes will be written to the selected position.

* Click **Go Position**. Check to see that the robot moves to the position as intended (since SCORBASE does not check the validity of the XYZ coordinates.)

Record Relative Joint Position   Level 3, Pro

To record a relative Joint position, do the following:

- ⬥ Make sure you have first recorded the reference position.
- ⬥ Move the robot to the position whose coordinates you want to record as relative to another position.
- ⬥ In the Position Number field in the Teach Positions (Simple) dialog box, enter a position number.
- ⬥ Select **Relative To**, and enter a number for the reference position in the **Relative to** field.
- ⬥ Click **Record**.
  You have now recorded a relative position.

A position which is **relative to current** means the specified offset will be computed from wherever the robot is located at the time it is sent to the relative position.

If the reference position changes, the relative position also moves.

Teach Relative XYZ Position   Level 3, Pro

To record a relative XYZ position, do the following:

- ⬥ Make sure you have first recorded the reference position.
- ⬥ In the Position Number field, in the Teach Positions (Expanded) dialog box, enter a position number.
- ⬥ Select **Relative To**, and enter the number of the reference position in the **Relative to** field.
  All XYZ coordinate fields are blank or show 0.
- ⬥ In one of more of the coordinate fields, enter a new value (in millimeters).
- ⬥ Click **Teach**.
  You have now recorded a relative position.

A position which is **relative to current** means the specified offset will be computed from wherever the robot is located at the time it is sent to the relative position.

If the reference position changes, the relative position also moves.

Go to Position Movement

The Teach Positions dialog boxes include options for instructing the robot to move to a position. These are the same commands which can be used in robot programs, as described in detail in Chapter 6.

Go Position   **Level 1, Level 3, Pro**

This command sends the robot to a recorded position along a path calculated by the controller, not necessarily a straight line, and usually a curved path. This is termed continuous path (CP) movement.

Go Linear   **Level 3, Pro**

This command sends the robot's TCP (tool center point) from its current position to a recorded position along a linear path (straight line).

The linear motion applies only to the robot axes, although peripheral axes might also move as a result of the command.

Go Circular   **Level 3, Pro**

This command sends the robot in a circular path to the first specified position through the second one.

The circular motion applies only to the robot although peripheral axes might also move as a result of the command.

List Positions Dialog Box

List Positions   **Level 1, Level 3, Pro**

The List Positions dialog box displays and allows you to delete and print positions currently loaded in SCORBASE memory.

List Positions	File name: C:\SBW\PRO\DEMOPRO.PNT									
Robot coordinates: ◇ XYZ ◆ Joints				Update	Print		Delete	DeleteAll		
#	AX-1	AX-2	AX-3	AX-4	AX-5	AX-7	AX-8	Type	RelTo	Coor.
1	0	-3187	0	0	0			Abs.		Joint
2	0	-3187	0	0	0			Abs.		Joint
3	0	0	0	0	0			Abs.		Joint
4	0	0	0	0	0			Abs.		Joint
5	0	-3187	0	0	0			Abs.		Joint
6	0	0	0	0	0			Abs.		Joint
7	0	-3187	0	0	0			Abs.		Joint
8	0	-3187	0	0	0			Abs.		Joint
19	0	0	0	0	0			Abs.		Joint
20	0	0	0	-235	235			Abs.		Joint
21	0	-1380	0	0	0			Abs.		Joint
22	0	-2665	0	0	0			Abs.		Joint
23	0	-2665	-1285	0	0			Abs.		Joint
29	0	-739	0	0	0			Abs.		Joint
30	0	0	0	0	0			Abs.		Joint
31	-3505	287	-2195	0	-1			Abs.		Joint
33	-7304	-1178	930	0	-1			Abs.		Joint

Level 3, Pro

Update	Refreshes the list of positions.
Print	Prints the displayed list to a connected printer.
Delete	Deletes the selected positions from SCORBASE memory.
Delete All	Deletes all listed positions from SCORBASE memory.
Robot Coordinates: XYZ/Joints:	Selects the coordinate system in which robot positions are listed. Peripheral positions are always in joint coordinates. (Joints only in Level 1)

Current positions remain in SCORBASE memory:

♦ When **File|New** is selected.

♦ When **Options|File|Load Program** is selected AND **File|Open|***filename.SBn* is selected.

Current positions are removed from memory:

♦ When **Options|File|Load Positions** is selected AND **File|Open|***filename.PNT* is selected.

♦ When **Options|File|Load Both** is selected AND **File|Open|***filename.SBn* is selected.

SBn may be the extension SB1, SB3 or SBP, depending on the SCORBASE level in which the program file was saved.

For more information on SCORBASE file management, see Chapter 8.

Encoder Counts Dialog Box

Encoder Counts   Pro

The Encoders window displays the current values of the encoders for each of the axes.

These values change whenever the axes are moved.

These values are set to 0 (or near zero) whenever the Search Home command is executed.

XYZ Dialog Box

The XYZ window displays the current Cartesian (XYZ) values for each of the robot axes.
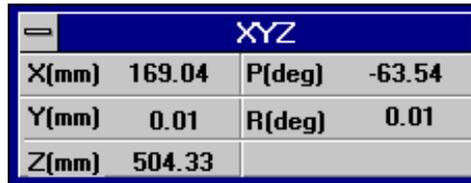
XYZ			
X(mm)	169.04	P(deg)	-63.54
Y(mm)	0.01	R(deg)	0.01
Z(mm)	504.33		

The values change whenever the robot axes are moved more than 1mm (X,Y,Z axes) or $1°$ (pitch and roll axes).

The values shown in the example here are the XYZ values after the Search Home command is executed.

Using a Teach Pendant with SCORBASE

The teach pendant is a hand-help terminal which permits the operator direct control of the robot and peripheral axes. In addition to controlling movement of the axes, the teach pendant is used for recording positions, sending the axes to recorded positions, and other functions.

To control the axes from the teach pendant, SCORBASE must be operating in the on-line mode, and the Teach/Manual switch on the teach pendant must be switched to TEACH. This disables control of the axes from the keyboard and the SCORBASE dialog boxes.

All teach pendant operations will be reflected in the SCORBASE dialog boxes; for example, positions recorded by the teach pendant will appear in the Position Number list in the Teach Positions dialog box; encoder and XYZ values will change in the Encoder Counts and XYZ dialog boxes.

Teach pendant operation is described fully in the *Teach Pendant for Controller-PC User's Manual*.

Program Editing

The following windows are used for program editing:

♦ Program window.

♦ Command List.

To begin editing a program, open a program file window by selecting **File|Open** or **File|New**. If the desired program window is already open, simply bring the cursor into the window.

Up to five programs can be opened and edited at a time. However, it is recommended that you close the currently open file (iincluding Untitled) before you open another (new or existing) program file.

To activate the dialog boxes which are most useful for program editing, select **View | Edit Screen**.

The screen layout which will appear depends on the currently loaded level of SCORBASE, as shown in the following examples:
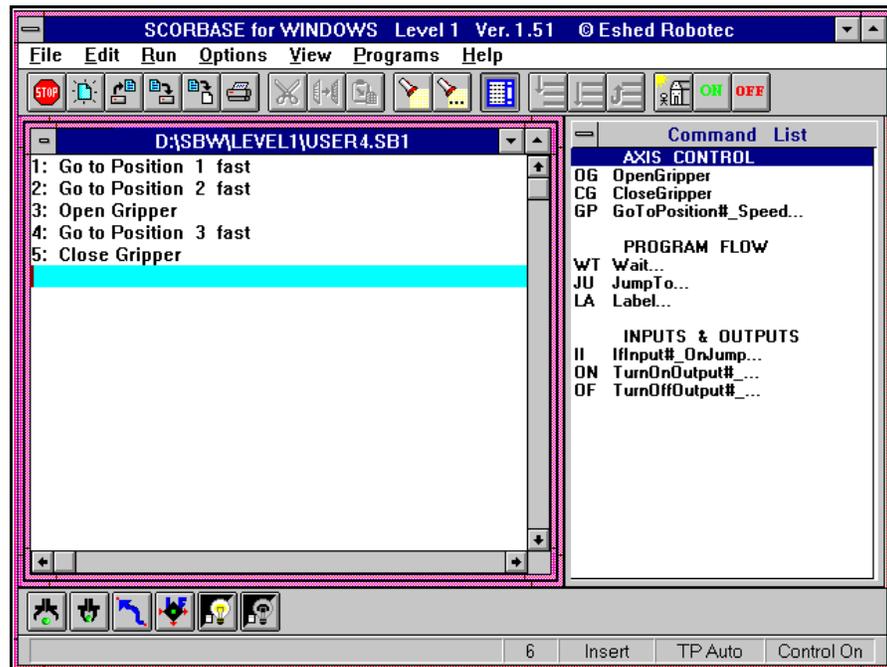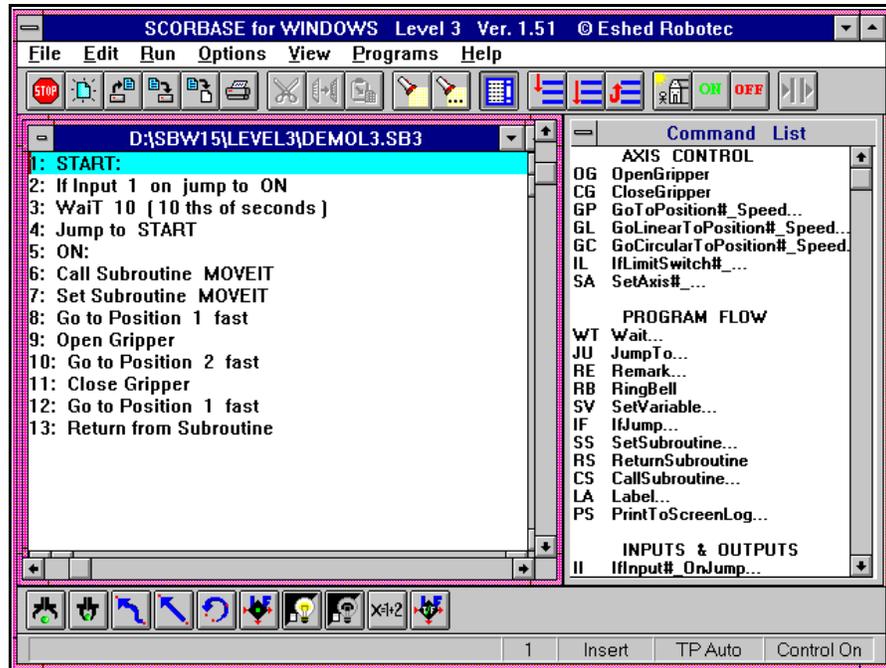
Level 1

Level 3
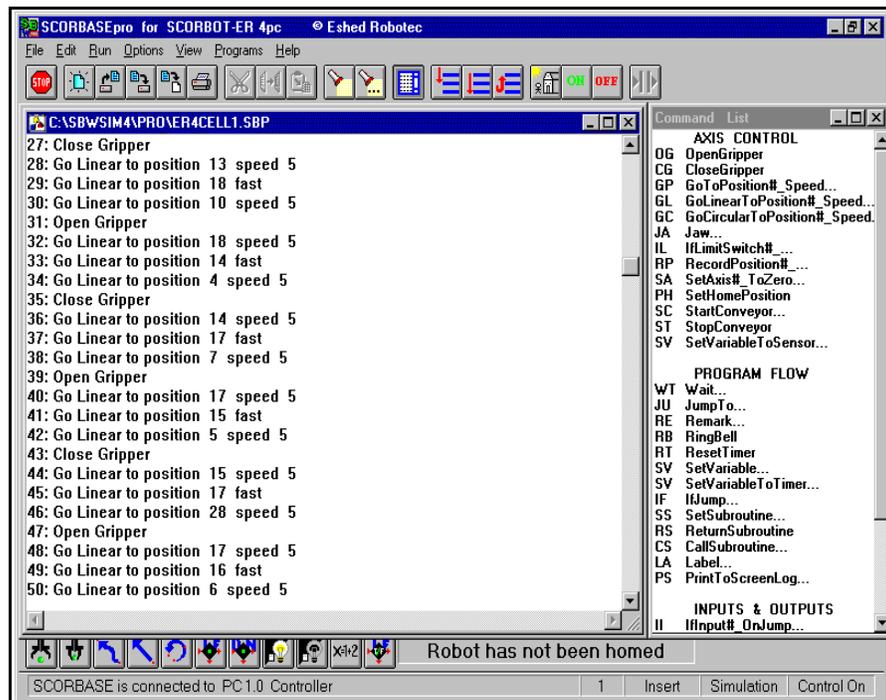
Pro

Editing Tools

(icon only)   Toggles the display of the SCORBASE Command List off and on.

To create a program line, do one of the following:

 ♦ Double click on any of the commands in the Command list.

 ♦ Click on one of the SCORBASE command icons in the tool bar.

 ♦ Press the hot-key pair which activates the command. For example, to write a Go Position command, type GP.

When the command requires additional parameters (indicated by **#_** and/or and **...**), a dialog box will open and prompt you.

SCORBASE programs are edited by means of the usual Windows text editing tools, which can be accessed by icons or the Edit menu.

The Edit menu contains the usual Windows functions which allow you to edit files containing robot programs:

Cut   Deletes selected text or lines from the program file and places it on the SCORBASE and Windows clipboards.

Copy   Places a copy of selected text or lines from the program file on the SCORBASE and Windows clipboards.

Paste   Inserts the contents of the SCORBASE clipboard into the program file.

Find   Opens a dialog box which allows you to search for a particular string of text, SCORBASE command or command argument:

 • **Arbitrary**: any text string.

 • **Command**: a SCORBASE command.

- **Argument**: a parameter in a SCORBASE command, such as a position number, a label, or an operation.

You can click on the arrow to display and select from a list of all commands or arguments used in the program file.

Or you can type in the search string. If so, make sure Arbitrary or the appropriate option is selected. (e.g., the search will find "Go Position" if Arbitrary is selected, but not if Argument is selected.

| Find Next (F3) | Use also **Find\|Down\|Find.**

Repeats the last Find operation for the next occurrence.

| Find Previous | Use also **Find\|Up\|Find**.

Repeats the last Find operation for the preceding occurrence.

| Command/Remark * / ... | Inserts/deletes asterisk at beginning of a command line. Toggles the command line between a remark and an executable command.

Alternately, click with the right mouse button on the command line to add or remove the asterisk.

The asterisk/remark will be maintained on the program line is copied or cut and pasted.

| Go to Line... | Opens a dialog box which displays the total number of lines in the program and prompts you for a line number.

Go To Line ...
Total number of lines: 8.

✓ OK   ✗ Cancel
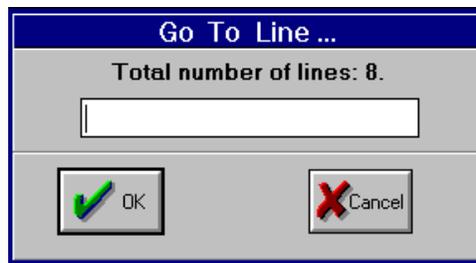
Enter a number and click on OK. The program editor will jump to the specified line.

In addition, use the keyboard for the following functions:

[Ins]	Toggles between **Insert** and **Overwrite** modes. The active mode is shown in the Status Bar.

- When Insert is active, a new command is inserted into the program at the line currently marked by the cursor.

- When Overwrite is active, a new command replaces the line currently marked by the cursor.

|	
[Del]	Deletes the line or lines currently marked by the cursor.
[Home]	Brings the cursor to the first line of the program.
[End]	Brings the cursor to the last line of the program.
[PgUp]	Displays the previous page of program lines.
[PgDn]	Displays the following page of program lines.
(F4)	The usual Windows function key for displaying the options in a combo box. Can be used instead of clicking on the arrow.
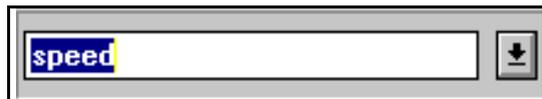
Command List

All SCORBASE programming commands are all available from the Command List and are easily compiled into a robot program.

The list shows the two-letter hot-key combination which allows you to enter commands from the keyboard.

Some of the most commonly used commands can be accessed from the tool bar at the bottom of the screen.

Many commands open dialog boxes for completing the command line parameters.

```
──  Command List
     AXIS CONTROL
OG   OpenGripper
CG   CloseGripper
GP   GoToPosition#_Speed...

     PROGRAM FLOW
WT   Wait...
JU   JumpTo...
LA   Label...

     INPUTS & OUTPUTS
II   IfInput#_OnJump...
ON   TurnOnOutput#_...
OF   TurnOffOutput#_...
```
Level 1

```
──  Command List
     AXIS CONTROL
OG   OpenGripper
CG   CloseGripper
GP   GoToPosition#_Speed...
GL   GoLinearToPosition#_Speed...
GC   GoCircularToPosition#_Speed...
IL   IfLimitSwitch#_...
SA   SetAxis#_ToZero...

     PROGRAM FLOW
WT   Wait...
JU   JumpTo...
RE   Remark...
RB   RingBell
SV   SetVariable...
IF   IfJump...
SS   SetSubroutine...
RS   ReturnSubroutine
CS   CallSubroutine...
LA   Label...
PS   PrintToScreenLog...

     INPUTS & OUTPUTS
II   IfInput#_OnJump...
ON   TurnOnOutput#_...
OF   TurnOffOutput#_...
```
Level 3

```
Command List              _ □ ×
     AXIS CONTROL
OG   OpenGripper
CG   CloseGripper
GP   GoToPosition#_Speed...
GL   GoLinearToPosition#_Speed...
GC   GoCircularToPosition#_Speed...
JA   Jaw...
IL   IfLimitSwitch#_...
RP   RecordPosition#_...
SA   SetAxis#_ToZero...
PH   SetHomePosition
SC   StartConveyor...
ST   StopConveyor
SV   SetVariableToSensor...

     PROGRAM FLOW
WT   Wait...
JU   JumpTo...
RE   Remark...
RB   RingBell
RT   ResetTimer
SV   SetVariable...
SV   SetVariableToTimer...
IF   IfJump...
SS   SetSubroutine...
RS   ReturnSubroutine
CS   CallSubroutine...
LA   Label...
PS   PrintToScreenLog...

     INPUTS & OUTPUTS
II   IfInput#_OnJump...
OI   OnInputInt#_OnJump...
EI   EnableInterrupt#_...
DI   DisableInterrupt#_...
ON   TurnOnOutput#_...
OF   TurnOffOutput#_...
AO   SetAnalogOutput#_...
AI   SetVariableToAnalogInput#_...
```
Pro

Axis Control Commands

OG   Open Gripper   **Level 1, Level 3, Pro**

This commands fully opens the gripper.

CG   Close Gripper   **Level 1, Level 3, Pro**

This command fully closes the gripper (on itself, or on a grasped object).

GP   Go to Position #_Speed ...   **Level 1, Level 3, Pro**

All Go to Position commands open the Go to Position dialog box.

(Level 3 and Pro.) Depending on the command selected, one of the types of movement will be marked. A different type of movement can be selected regardless of the command which opened the dialog box.
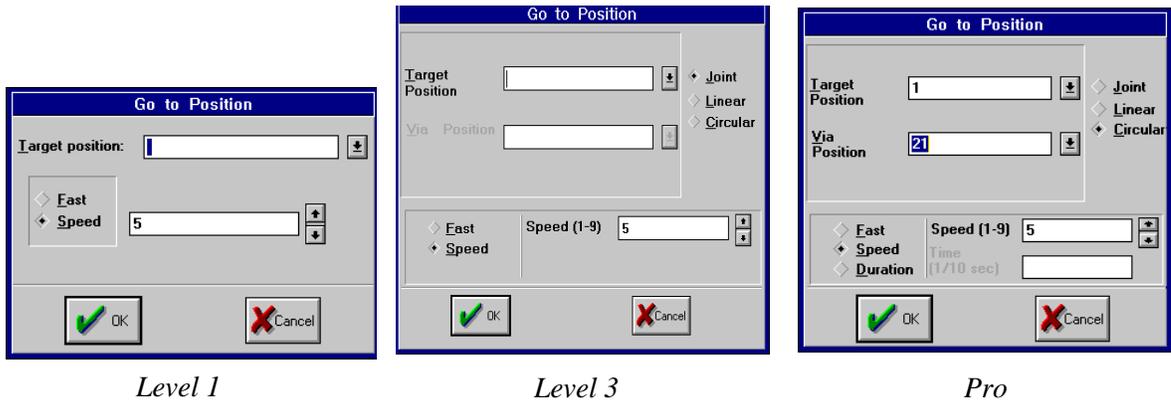
| *Level 1* | *Level 3* | *Pro* |

The Go to Position command sends the robot to a recorded position along a path calculated by the controller, not necessarily a straight line, and usually a curved path.

GL   Go Linear to Position #_Speed ...   **Level 3, Pro**

The Go Linear to Position command sends the robot's TCP (tool center point) from its current position to a recorded position along a linear path (straight line).

The linear motion applies only to the robot axes, although peripheral axes might also move as a result of the command.

GC   Go Circular to Position #_ Speed...   **Level 3, Pro**

The Go Circular to Position command sends the robot in a circular path to the first specified position through the second one.

The circular motion applies only to the robot although peripheral axes might also move as a result of the command.

Target Position	The destination of the movement.
	Enter a number or a variable in this field. Positions which have already been recorded may be selected from the drop-down list.
Via Position.	The intermediate position through which the **Go Circular** movement passes.
	Enter a number or a variable in this field. Positions which have already been recorded may be selected from the drop-down list.

Fast	Executes the movement at the fastest speed possible.
Speed	Executes the movement at a slower speed. Enter a number from 1 through 9, or a variable, in the **Speed** field.
Duration	Executes the movement in a specific amount of time. Enter a number (tenths of a second), or a variable, in the **Time** field. Not available for Go Circular to Position commands.

IL   If Limit Switch #_ ...   Level 3, Pro

This is a conditional jump command. It causes program execution to jump to the line which contains the specified Label if the selected axis limit switch is depressed (on). The command opens a dialog box.
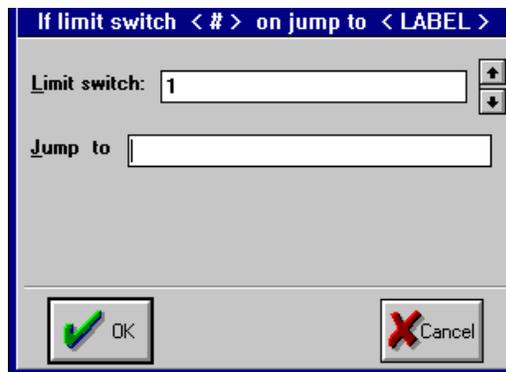
Enter a number or a variable in the **Limit Switch** field.

Enter the name of a Label in the **Jump to** field.

SA   Set Axis #_ ... (to Zero)   Level 3, Pro

This command initializes (sets to 0) the encoder count of the selected axis. The command opens a dialog box.
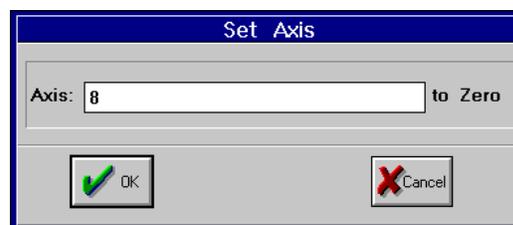

Enter a number or a variable in the **Axis** field.

This command is very useful for performing a cyclical motion of an accessory, such as a conveyor or a rotary table.

JA   Jaw   **Pro**

The Jaw command brings the gripper opening to the specified width. The command opens a dialog box.
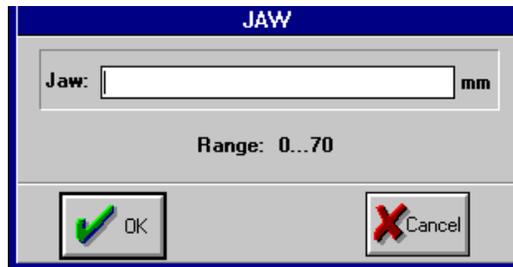
Jaw activates servo control for the gripper, whereas Open Gripper and Close Gripper commands disconnect the gripper axis from the servo control loop.

Enter a number or a variable in the **Jaw** field.

Accuracy cannot be guaranteed if the width is less than 5 mm or greater than 65 mm.

Unless you need the Jaw command for a specific application, the Open Gripper and Close Gripper commands are recommended.

RP   Record Position #_ ...   **Pro**

When the Record Position command is executed during program execution, the controller records the current location of the robot arm for the specified position. The command opens a dialog box.

Enter a number or a variable in the **Record Present Position** field.

This command is useful for palletizing applications.

PH   Set Home Position   **Pro**

When executed at run time, this command changes the Home position of the robot. All current axes positions are reset to 0.

Use this command with caution! It immediately changes the physical location of all the recorded positions.

SC   Start Conveyor   Pro

The Start Conveyor command starts continuous motion of a conveyor, and thus enables it to operate as a "speed controlled" conveyor. Movement of the conveyor will continue until a Stop Conveyor command is encountered.

*This command can only be used when the conveyor is connected and operated as **axis 8**. It can be used with either a 12V or 24V conveyor.*

The command opens a dialog box.

Enter a number or a variable in the **Speed** field.

Select a direction of movement.

When operating a "speed controlled" conveyor by means of the Start/Stop Conveyor commands, do not record positions and/or use the Set Axis (to Zero) command for the conveyor in the same program.

ST   Stop Conveyor   Pro

The Stop Conveyor command stops the continuous motion of a conveyor which was initiated by a Start Conveyor command.

SV   Set Variable to (Gripper) Sensor   Pro

The Set Variable to Sensor command allows you to assign the value of the gripper opening to a variable.

Refer to the descriptions of the Set Variable commands in the following section.

Program Flow Commands

WT   Wait ... (10ths of a second)   **Level 1, Level 3, Pro**

The Wait command halts program execution for the specified time. The command opens a dialog box.
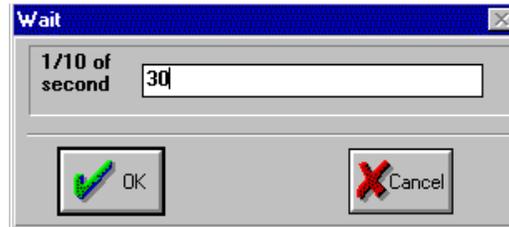
Enter a number or a variable in the **10ths of Second** field.

JU   Jump To ...   **Level 1, Level 3, Pro**

This is an unconditional jump command which causes program to jump to the line which contains the specified Label and to continue from that point. The command opens a dialog box.

In the **Jump to** field, enter the name of a Label. (Be sure to include a line

Level 1   *Level 3, Pro*

with this Label in your program.)

A conditional jump command (Level 3, Pro) can be entered by selecting **If**. This is comparable to selecting the **IF Jump,** command which opens the same dialog box with **If** selected.

RE   Remark ...   **Level 3, Pro**

You can insert a comment (remark) line into the program for explanation and documentation. The command opens a dialog box.
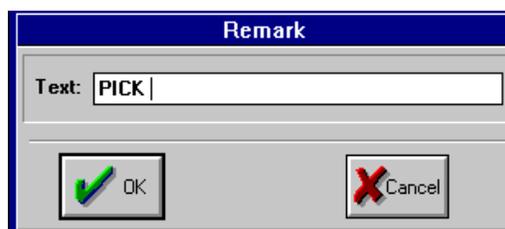
Enter text and spaces of up to 47 characters.

RB   Ring Bell   **Level 3, Pro**

When executed, this command produces an audio signal which is heard through the computer's internal loudspeaker.

RT   Reset Timer   **Pro**

SCORBASE contains a timer which measures time in units of tenths of a second, starting at the time SCORBASE is loaded, or the point at which the timer is reset.

The Reset Time command resets the value of the SCORBASE timer to 0.

To use the timer, it must be assigned to a variable, by means of the Set Variable command.

SV   Set Variable   **Level 3**

SV   Set Variable to Computation   **Pro**

The Set Variable (Level 3) or Set Variable to Computation (Pro) command allows you to assign a value or an expression (result of a specific computation) to a variable.

All Set Variable commands open the Set Variable dialog box.
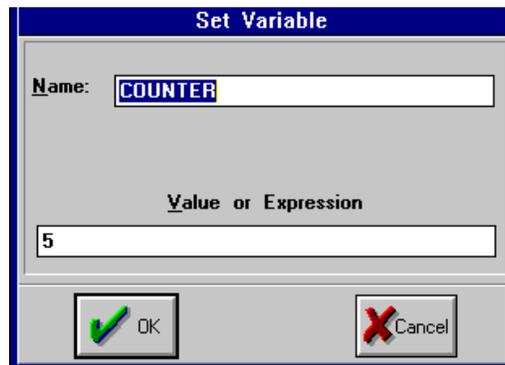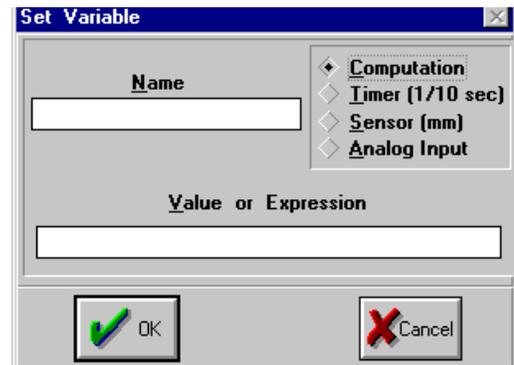
Level 3   *Pro*

In Level 3, variables can be assigned the value of an integer or the result of a computation.

In SCORBASEpro, variable values can be derived from several sources. Depending on the command selected, one of the settings will be marked. A different setting can be selected regardless of the command which opened the dialog box.

In the **Name** field, enter the name of the variable. The first letter of the name must be an alphabetic letter.

In the **Value or Expression** field, enter a value or a computation.

* To set the variable to a value, enter a valid integer (any value, +/− 1000000) or enter a variable name.

♦ To set the variable to the result of a computation, enter a string which consists of two arguments and an operator. An argument can be either an integer or a variable. An operator can be any of the following:

Arithmetic Operators

+	Addition
*	Multiplication
−	Subtraction
/	Division

Algebraic Operators

%	Modulus (returns the remainder of the first argument divided by the second).
**	Power (raises the first argument to the power of the second argument).

Logical (Boolean) Operators

&	And
|	Or
^	Exclusive or

The result of a logical operation is 1 (true) or 0 (false). Any operand with a non-zero value is considered true, while a zero value is considered false.

Comparison Operators

<	Less than
>	Greater than
<=	Less than or equal to
>=	Greater than or equal to
<>	Not equal

By default, = is assumed to be the operator. You do not need to include it in the Value or Expression field.

Examples:

```
Set Variable COUNT = COUNT - 1

Set Variable C = A * C

Set Variable POS = P >= 1

Set Variable V1 = V <> 1

Set Variable VAR_A = A % 3

Set Variable M = M ^ 1

Set Variable R = 3 ** 2
```

For more information on variables, refer to the section, "Variable Programming," at the end of this chapter.

SV Set Variable to Timer   **Pro**

Sets the variable to the value of the SCORBASE timer. During operation the variable is set to the timer value (in tenths of a second).
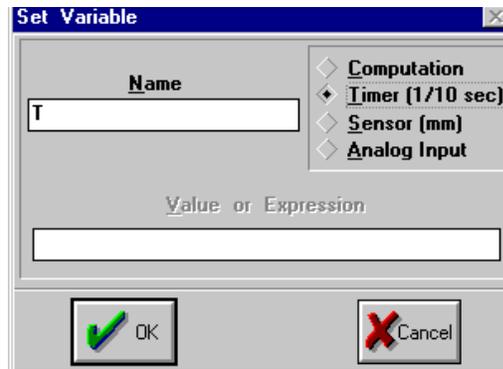
In the **Name** field, enter the name of the variable.

The value of the variable is the time measured since the Reset Timer (RT) command was executed.

The value can be checked by using the IF <Condition> Jump command. Actions can then be generated according to the time measured. For example:

```
IF T > 30 jump to LABEL
```

For more information on variables, refer to the section, "Variable Programming," at the end of this chapter.

SV Set Variable to Sensor   **Pro**

Sets the variable to the value of the **gripper** opening. During operation the specified variable is set to the value (in millimeters) of the gripper opening.
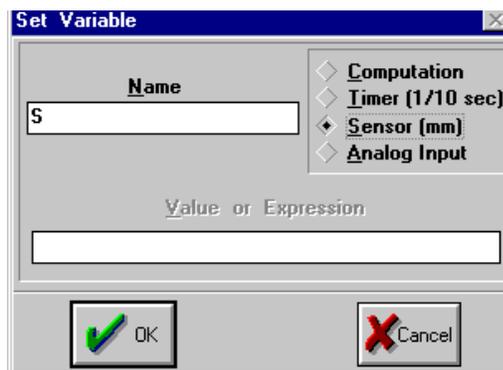
In the **Name** field, enter the name of the variable.

For more information on variables, refer to the section, "Variable Programming," at the end of this chapter.

AI Set Variable to Analog Input   **Pro**

Sets the variable to the value of an analog input.
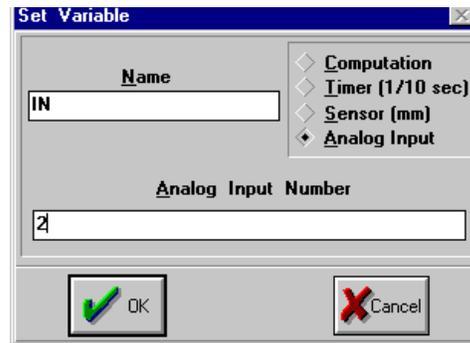
In the **Analog Input Number** field, enter the number of the input whose value you want to assign to the variable.

For more information on variables, refer to the section, "Variable Programming," at the end of this chapter.

IF If Jump ...   **Level 3, Pro**

This is a conditional jump command, which is used to check the value of variables. If the condition is true, program execution will jump to the line which contains the specified Label. The command opens a dialog box.
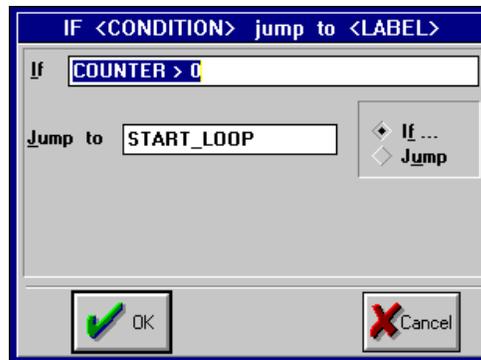
Level 3

In the **If** field enter the variable name. Then enter a comparison operator. Then enter the second variable name, or a number.

In the **Jump to** field, enter the name of a **Label**. (Be sure to include a line with this Label in your program.)

The comparison operators used for this command are the same as those used for the Set Variable command. For example:

```
If COUNTER > 0 jump to START_LOOP
```

In addition, use two equal signs (==) for equal operators. For example:

```
If COUNTER == 0 jump to END
```

An unconditional jump command (Level 3, Pro) can be entered by selecting **Jump**. This is comparable to selecting the **IF Jump,** command which opens the same dialog box with **Jump** selected.

SS   Set Subroutine ...   Level 3, Pro

The Set Subroutine command marks the beginning of the specified subroutine. You can program up to 64 subroutines.
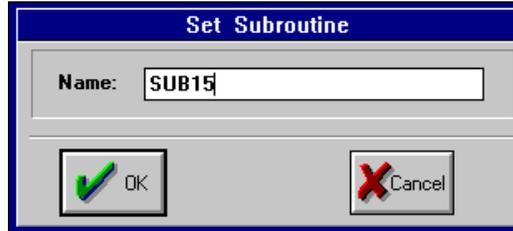
In the **Name** field, enter a name for the subroutine. The first character of the name must be a letter.

Enter **Set Subroutine** commands and subroutine command blocks *only at the end of a program*. Enter **Call Subroutine** commands anywhere within the program to cause the program to jump to and execute subroutines.

RS   Return Subroutine ...   Level 3, Pro

The Return from Subroutine command marks the end of a subroutine. At run time it terminates the execution of the subroutine, and the program resumes execution at the line which follows the **Call Subroutine** command.

CS   Call Subroutine ...   Level 3, Pro

The Call Subroutine command activates (calls) the specified subroutine. The command opens a dialog box similar to the Set Subroutine dialog box.

LA   Label ...   Level 1, Level 3, Pro

The Label command is used to mark a specific place in the program which will be referenced by a Jump command. The command opens a dialog box.

In the **Label** field, enter a name.

Do not include blank spaces; use an underscore.

PS   Print to Screen & Log ...   **Level 3, Pro**

The Print command allows you to included comments within the program, and to define whether they are displayed at run time in the SCORBASE Log file, written to the SCORBASE Log file, or both.

Regardless of your selection, the text of the Print line will appear in the program's Message Screen at run time.

The command opens a dialog box.
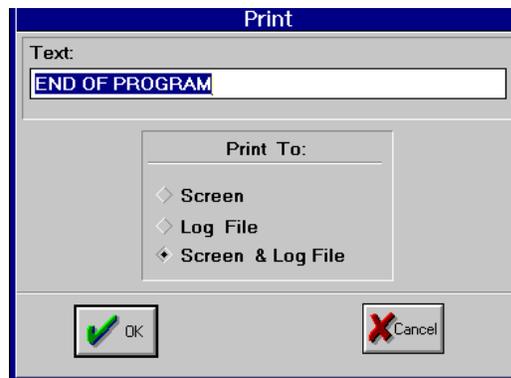
Enter text and spaces of up to 48 characters.

To print the actual value of a variable, place the variable name in single quote marks. For example: VAR X='X' will print as VAR X=50.

Select: **Screen**, **Log File** or **Screen & Log File**.

Input/Output Commands

II   If Input #_ On Jump ...   **Level 1, Level 3, Pro**

The If Input command causes the program to jump to the specified lable or to call a subroutine if the state of the tested input matches the status specified (ON or OFF). All If Input commands open a dialog box.
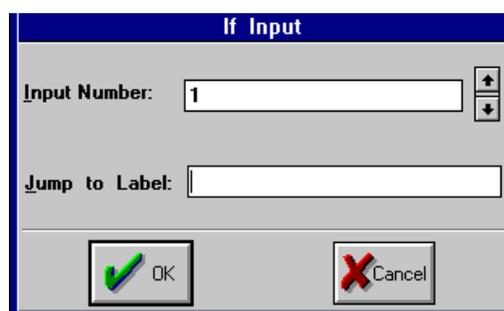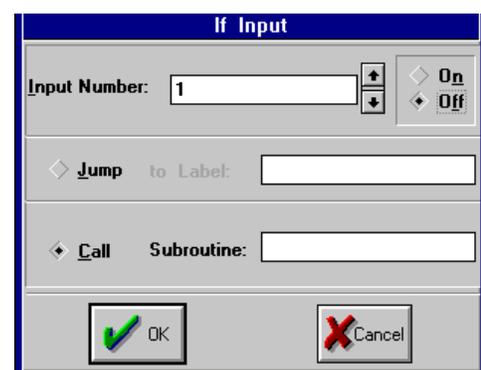
Level 1   *Level 3, Pro*

In Level 1 this command causes the program to jump to the specified label if the tested digital input is ON.

In Level 3 and SCORBASEpro this command causes the program to jump to the specified label or to call a subroutine if the state of the tested digital input matches the status specified (ON or OFF).variable values can be derived from several sources. Depending on the command selected, one of the settings will be marked. A different setting can be selected regardless of the command which opened the dialog box.

In the **Input Number** field, enter the number of an input, or a variable.

Select the state of the input (ON or OFF).

Select either Jump or Call Subroutine; then complete the active field.

- ⬥ In the **Jump to** field, enter the name of a Label.
- ⬥ In the **Call Subroutine** field, enter the name of a Subroutine.

OI   On Input Interrupt #_ On Jump ...   Pro

This command sets the condition for an input interrupt service. The service (Call Subroutine or Jump to) will be performed whenever the condition (input status) is satisfied, regardless of the current program flow. The command opens a dialog box.

By default, "ANY" appears in the Input Number field.
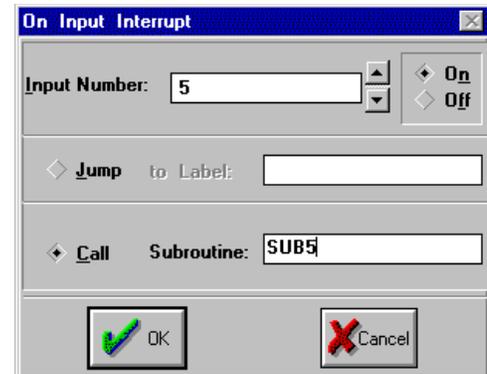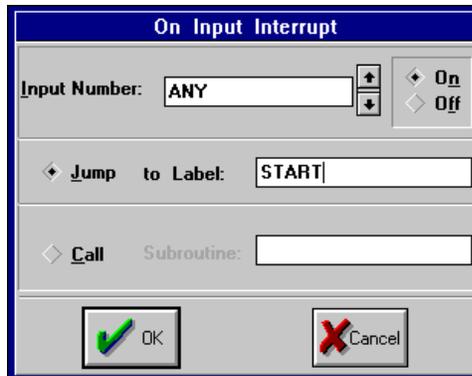
In the **Input Number** field, enter, any of the following:

- ⬥ Number of an input
- ⬥ A variable
- ⬥ The word ANY.

Select the state of the input:

- ⬥ **On** causes an interrupt when the input switches on.
- ⬥ **Off** causes an interrupt when the input switches off.

Select either **Jump** or **Call Subroutine**; then complete the active field.

- ⬥ In the **Jump to** field, enter the name of a Label.

- ⬥ In the **Call Subroutine** field, enter the name of a Subroutine, or a variable.

  If you enter a variable, the subroutine selected is determined by the value of the variable at the time the interrupt command is initially processed, and not when the actual interrupt is executed.

An interrupt command causes the program to abandon (interrupt) the command it is currently executing (which can also be a movement or a delay) and to immediately execute the command specified for this interrupt. If the specified command is a Call Subroutine, the program will resume from the point where it was suspended as soon as the subroutine completes its execution.

An interrupt command can be disabled and enabled by means of the Enable Interrupt and Disable Interrupt command (see below).

Examples:

```
On Input Interrupt 1 on jump to START
```

When input 1 switches ON , the program is suspended and reactivated from Label START.

```
On Input Interrupt 5 on call sub. SUB5
```

When input 5 is turned on, the program immediately calls subroutine SUB5. If any axes are moving when the interrupt occurs, they will stop. When the subroutine is completed (Return from Subroutine command is reached), the axes will reassume the position and status that were interrupted, and the program will continue from the point where it was interrupted.

```
On input interrupt ANY off call sub. Z
```

Whenever any of the inputs is turned off, an immediate call to subroutine Z will occur.

DI   Disable Interrupt #_ ...   **Pro**

The Disable Interrupt command causes the specified input interrupt to become inactive. When an interrupt is inactive, it is disregarded until the Enable Interrupt command reactivates it. The command opens a dialog box.
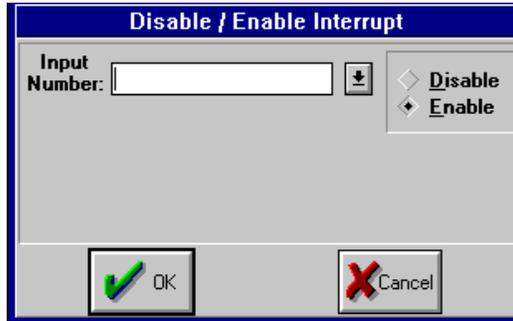
In the **Input Number** field, enter an input number, a variable, or the word ALL.

EI   Enable Interrupt #_ ...   **Pro**

The Disable Interrupt command causes the specified input interrupt to become inactive. When an interrupt is inactive, it is disregarded until the Enable Interrupt command reactivates it.

This command has the same format as the Disable command. You can change the Disable/Enable setting regardless of the command which opened the dialog box.

Example

```
Set Subroutine SUBA
Disable Input Interrupt ALL
.
.
.
Enable Input Interrupt ALL
Return from Subroutine
```

To prevent interrupt commands from interfering with one another, they can be embedded in subroutines. Subroutine SUBA is an interrupt servicing subroutine.

ON **Turn On Output #_ ...**   **Level 1, Level 3, Pro**

This command sets the state of the specified output. The command opens the Turn Output dialog box, with the **On** option selected.

In Level 1 and Level 3, this command controls digital outputs only.
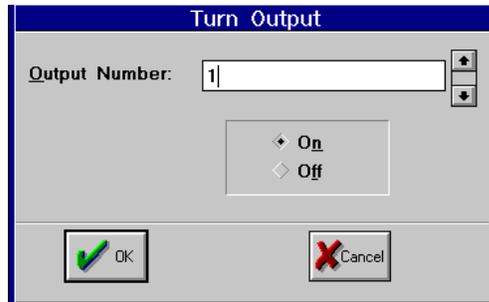
Level 1, 3

In the **Output Number** field, enter a number or a variable.

A Turn Off output command can be entered by selecting **Off**.

In SCORBASEpro this command opens the Turn Output dialog box with **Digital** and **On** selected.
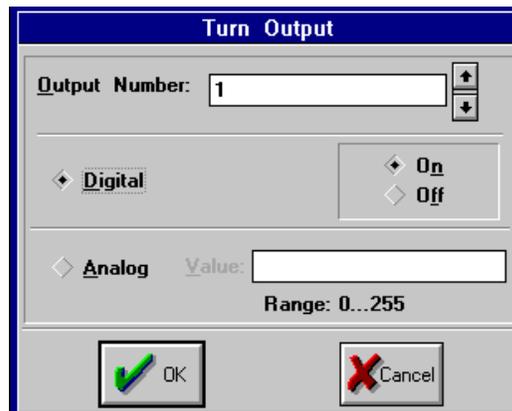
Pro

In the **Output Number** field, enter a number or a variable.

A Turn Off output command can be entered by selecting **Off**.

A Set Analog command can be entered by selecting **Analog** and entering a number or variable in the **Value** field.

OF **Turn Off Output #_ ...**   **Level 1, Level 3, Pro**

This command sets the state of the specified output. The command opens the Turn Output dialog box, with the **Off** option selected.

In Level 1 and Level 3, this command controls digital outputs only.

In the **Output Number** field, enter a number or a variable.

A Turn Off output command can be entered by selecting **On**.

In SCORBASEpro this command opens the Turn Output dialog box with **Digital** and **On** selected.

In the **Output Number** field, enter a number or a variable.

A Turn Off output command can be entered by selecting **Off**.

A Set Analog command can be entered by selecting **Analog** and entering a number or variable in the **Value** field.

AO   Set Analog Output   Pro

This command sets the state of the specified analog output. The command opens the same dialog box as the Turn Output command.

Pro
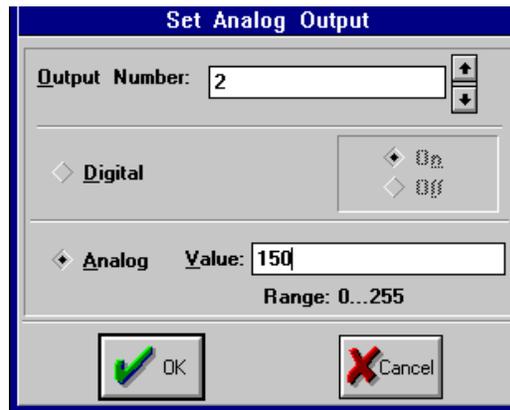
In the **Output Number** field, enter a number (1 or 2) or a variable.

A digital output command can be entered by selecting **Digital** and selecting either **On** or **Off**.

AI   Set Variable to Analog Input   Pro

Refer to the descriptions of the Set Variable commands in the preceding section.

Variable Programming

SCORBASE Level 3 and SCORBASEpro allow variable programming. Variables are useful for creating loops and subroutines in robot programs. They let you write commands that change as the state of the robot or its environment changes during program execution.

To use a variable, it must be defined by means of the Set Variable command.

Variables can have names of up to 22 characters. It is recommended, however, that you use names which are as short as possible. The first letter of the name must be an alphabetic letter.

When programming in SCORBASE, you can specify a variable instead of a numeric value in most editing commands, as shown in the examples in the figure below. The characters X and Z are used here as variables.
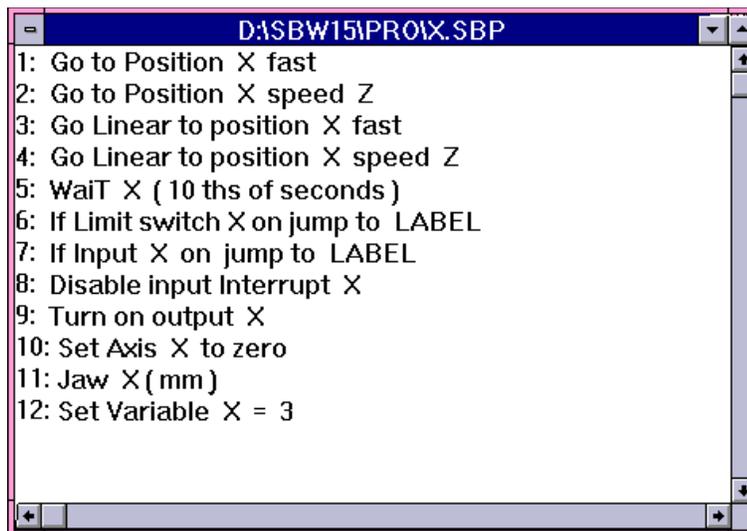
You *cannot use a variable* to specify a Label or a Subroutine.

If, at run time, the program encounters a variable whose value is not defined or is out of range, an error message is displayed.

The actual (current) value of a variable can be displayed in the status line at the bottom of the screen by selecting the Set Variable command line in which the variable appears and executing Run Single Line. This will execute and display the result of a Computation, or read and display the current value of the Timer, Sensor or Analog Input, according to the specific Set Variable command.

The Print to Screen & Log (PS) command can also be used to print the actual value of a variable, by placing the variable name within single quote marks in the text to be printed; for example: `VAR X='X'` will print as VAR X=50.

Examples:

```
Go to Position A fast
```

Whenever this command is executed, the robot is sent to a variable position A, whose value is determined at run time.

```
Turn on output PP
```

This command will turn on a variable output, PP, according to the value of PP at run time.

Sample Program 1
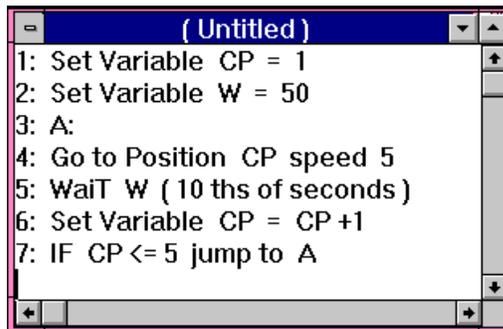
```
( Untitled )
1: Set Variable  CP  =  1
2: Set Variable  W  =  50
3: A:
4: Go to Position  CP  speed  5
5: WaiT  W  ( 10 ths of seconds )
6: Set Variable  CP  =  CP + 1
7: IF  CP <= 5  jump to  A
```

This program moves the gripper consecutively from one position to the next, waits 5 seconds at each position, and continues until it reaches the fifth position in the positions table.

Sample Program 2
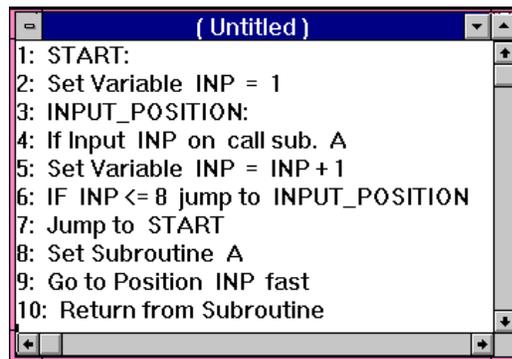
```
( Untitled )
1: START:
2: Set Variable  INP  =  1
3: INPUT_POSITION:
4: If Input  INP  on  call sub.  A
5: Set Variable  INP  =  INP + 1
6: IF  INP <= 8  jump to  INPUT_POSITION
7: Jump to  START
8: Set Subroutine  A
9: Go to Position  INP  fast
10: Return from Subroutine
```

This program sequentially scans all inputs 1 through 8, and sends the robot to the positions which correspond to the ON inputs.

Program Execution

The following SCORBASE windows are used for activating and monitoring program execution.

- ⬧ Program Window
- ⬧ Digital I/O
- ⬧ XYZ (Level 3 and Pro)
- ⬧ Log File (Level 3 and Pro)
- ⬧ Message Screen (Level 3 and Pro)
- ⬧ Analog I/O (Pro)
- ⬧ Encoders (Pro)

To activate the dialog boxes which are most useful for program execution, select **View | Run Screen**.

The screen layout which will appear depends on the currently loaded level of SCORBASE, as shown in the following examples.
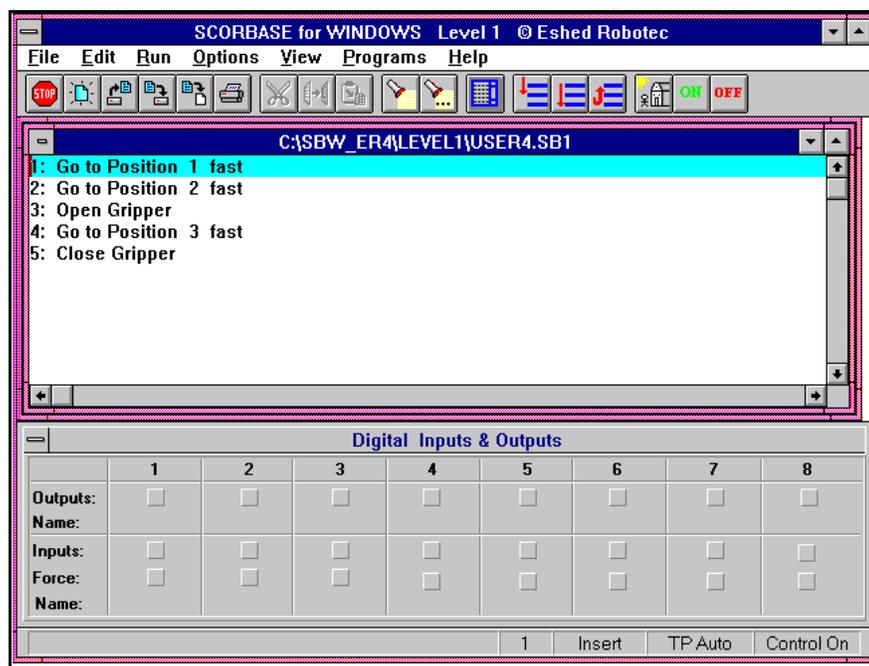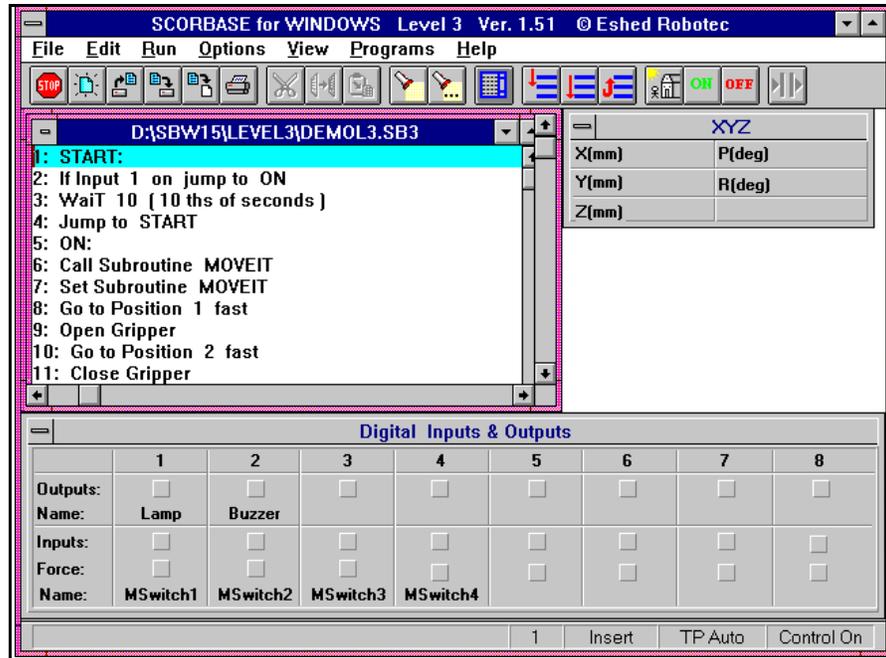
Level 1

Level 3
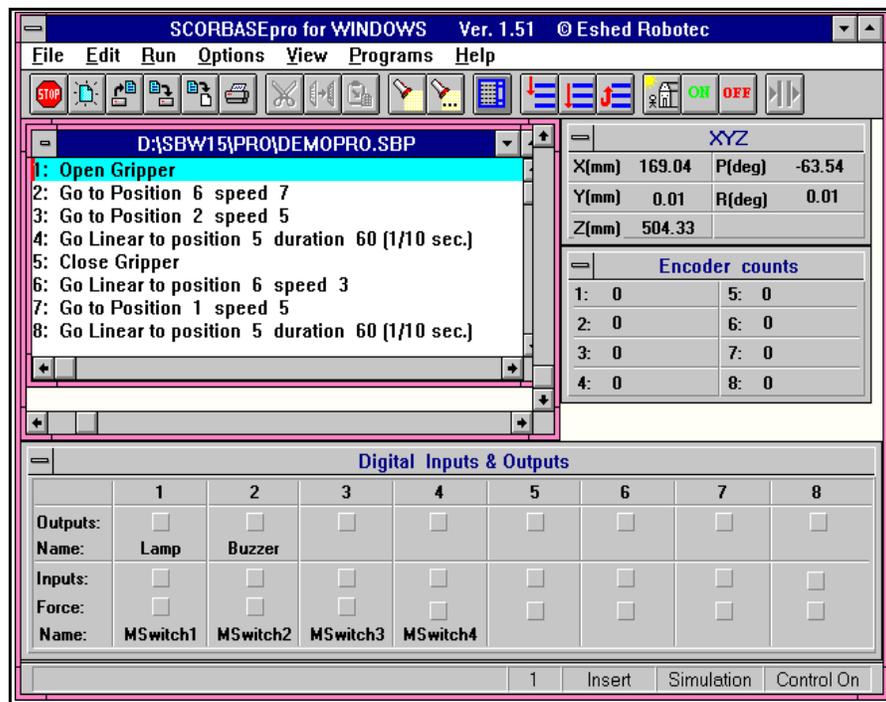
Pro

Program Execution

To start execution of a program, place the cursor on any line in the active Program window and do one of the following:

 ⬩ Click on one of the Run icons in the tool bar.

 ⬩ Click on one of the Run options in the Run Menu.

 ⬩ Press the function key for the run option.

*The [Run] key on the teach pendant **cannot be used** to start execution of SCORBASE programs.*

Always restart execution of a program from the first line after you have changed program data (e.g., recorded new coordinates for a position, edited a program line, etc.).

If you are about to run a program which contains an "If Input..." or "On Input Interrupt..." command, and you have forced (simulated) any output states by means of the Digital Inputs & Outputs dialog box, the following warning and prompt will appear:
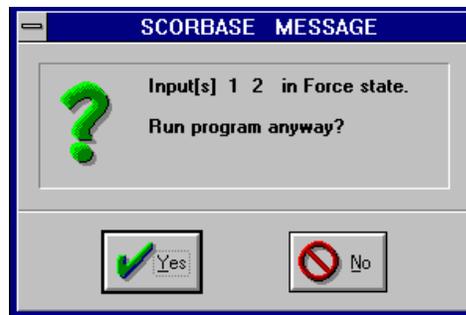
[F6]   Run Single Line   **Level 1, Level 3, Pro**

Executes the currently selected (highlighted') program line.

[F7]   Run Single Cycle   **Level 1, Level 3, Pro**

Executes the program once, from the point at which it was started. Execution ends when the last line of the program is reached, regardless of the line at which execution was begun.

[F8]   Run Continuously   **Level 1, Level 3, Pro**

Executes the program in an endless loop, from the point at which it was started. When the last line of the program is reached, execution jumps automatically to the first line of the program.

Halting Program Execution

To immediately halt (abort) execution of a running program, do one of the following:

- ◆ Click on the Stop icon in the toolbar.
- ◆ Select **Run | Stop**.
- ◆ Press F9.
- ◆ Press the red EMERGENCY button on the controller.
- ◆ Press the ABORT key on the teach pendant.

[F9]   Stop   **Level 1, Level 3, Pro**

Immediately stops program execution and movement of all axes.

Make sure the SCORBASE application is the currently active window before you press F9.

[F10]   Pause   **Level 3, Pro**

Stops program execution only after the current command has been executed. Thus, axes may continue moving (to complete their motion) after the Pause command is issued.

Pause and Stop are software methods for halting program execution. In an actual emergency situation, you should use the EMERGENCY button on the controller, or the ABORT key on the teach pendant.

Digital Inputs & Outputs Dialog Box

All levels of SCORBASE can monitor and control 8 digital inputs and 8 digital output.

The Digital Inputs & Outputs dialog box shows the status of the SCORBOT controller's digital inputs and outputs. The display is available in on-line, off-line and simulation modes of operation.

Names can be assigned to the I/Os by means of the **Options|Input & Output Names** menu. Refer to Chapter 9 for more details.

The Digital Inputs & Outputs dialog box can also be used to manually toggle the state of SCORBOT controller's digital inputs and outputs.

- ◆ When the controller receives a real or simulated input signal from an external device, a checkmark appears in the corresponding input box. When the signal is switched off, the checkmark disappears.

Manipulating input signal allows you to test a program by simulating input signals at the points in a program where another machine is due to output a signal to the robot controller

♦ When an Output On command is simulated or actually sent from the SCORBOT controller to an external device, a checkmark appears in the corresponding output box. When the signal is switched off, the checkmark is cleared.

Manipulating output signals allows you to send and test signals to external devices without having to write and execute a program command.

Digital Input Signals   Level 1, Level 3, Pro

To simulate the receipt of an input signal (e.g., Input 1), do the following.

♦ Click the **Force** checkbox for Input 1. A checkmark will appear. This will now allow you to simulate the receipt of an input signal.

♦ Click the **Input** checkbox for Input 1. A checkmark will appear. This serves as an Input On signal.

♦ Again click the **Input** checkbox for Input 1. The checkmark will

disappear. The input is now off.

Wait a moment for the checkmark to appear after clicking a checkbox.

The input LED on the controller will *not light* up when the input is simulated, even when working on-line.

Digital Output Signals   Level 1, Level 3, Pro

To send (or simulate) an output signal (e.g., Output 1), click the **Output** checkbox for Output 1. A checkmark will appear. This creates an Output On signal.


Wait a moment for the checkmark to appear after clicking a checkbox.

Analog Inputs & Outputs Dialog Box

In addition to the digital inputs and outputs, SCORBASEpro can monitor and control 4 analog inputs and 2 analog outputs.

The Analog Inputs & Outputs dialog box shows the status of the SCORBOT controller's analog inputs and outputs. The display is available in both on-line and off-line modes of operation. However, output values can only be manipulated when SCORBASE is operating on-line.

Analog Input Signals   Pro

When the controller receives an analog input signal from an external device, the value (strength) of the signal will be reflected in the **Input Value** field.

Analog Output Signals   Pro

To set the value of an analog output signal, enter a value in the **Output Value** field. *The controller must be operating in on-line mode.*

XYZ Dialog Box

XYZ Coordinates   Level 3, Pro

The XYZ window displays the current Cartesian (XYZ) values for each of the robot axes.
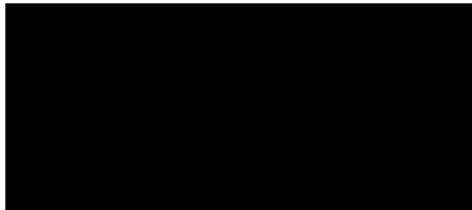
The values change whenever the robot axes are moved more than 1mm (X, Y, Z axes) or 1° (pitch and roll axes).

Encoder Counts Dialog Box

Encoder Counts   Pro

The Encoders window displays the current values of the encoders for each of the axes.
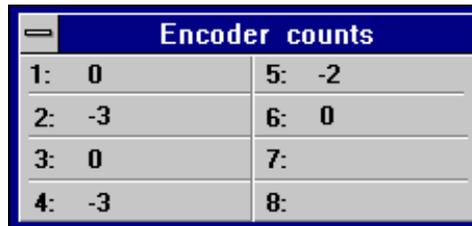
These values change whenever the axes are moved more than 10 encoder units.

These values are set to 0 whenever the Search Home command is executed.

Log File

SCORBASE Log   Level 3, Pro

The SCORBASE log file records error messages, the start of each cycle during program execution, and **Print to Log** command lines as they are executed.

To display the log file, select **View |Log File**.
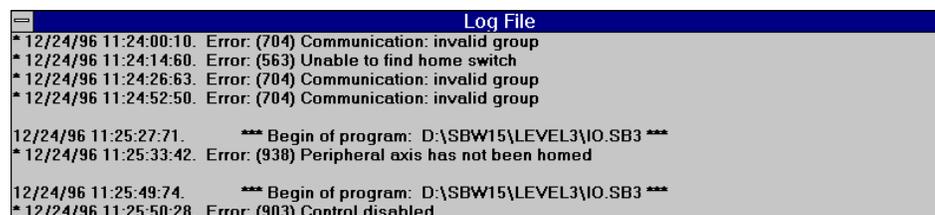

The Log file is initialized (cleared) each time SCORBASE is loaded.

Message Screen

Program Log   Level 3, Pro

When a program which contains a **Print to Screen** command line begins execution, the Message screen is automatically activated and displayed. This screen is also activated if a Print to Screen command line is executed (by means of Run Single Line).

```
┌─────────────────────────────────────────────────────────────────────────┐
│═                              Message  Screen                             │
├─────────────────────────────────────────────────────────────────────────┤
│12/24/96 11:32:31:62.        *** Begin of program:  D:\SBW15\LEVEL3\IO.SB3 ***│
│12/24/96 11:32:32:01. DONE                                                 │
│12/24/96 11:32:32:39. DONE                                                 │
│12/24/96 11:32:32:89. DONE                                                 │
│                                                                           │
│12/24/96 11:32:44:31.        *** Begin of program:  D:\SBW15\LEVEL3\DEMOL3.SB3 ***│
│                                                                           │
│                                                                           │
└─────────────────────────────────────────────────────────────────────────┘
```

Once activated, the message screen shows the start of each cycle during program execution and all Print to Screen command lines as they are executed.

As long as the Message screen remains open it will display data from all programs and commands which are executed.

The Message screen is cleared each time it is closed.

Selecting **View** |**Message Screen** displays the Message screen on top of all other dialog boxes. lank.

CHAPTER *8*

File Management

SCORBASE programs and positions are saved in separate files, which can be loaded and saved in either separate or combined operations.

By default, positions and programs files are saved in one combined operation and have the same name with different extensions:

- ♦ Program files have the extension SB1, SB3, SBP, according to the level of SCORBASE in which they are saved.

- ♦ Position files have the extension PNT.

By default, files are placed in subdirectory Level1, Level3 or Pro, according to the level of SCORBASE in which they are written and saved.

Programs written in lower levels of SCORBASE are upwardly compatible.

Loading a program from a higher level of SCORBASE into a lower level (from Level 3 to Level 1, for example) will cause the program to display the line COMMAND NOT AVAILABLE whenever it encounters, and does not recognize, a command from the higher level.

File Options

To define the manner in which files will be loaded or saved, select **Options | File**.

This opens a dialog box which allows you to define whether programs and positions will be saved and/or loaded separately or together.
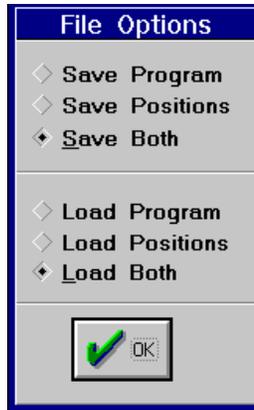
- ◆ **Save/Load Program**: Only program lines will be saved or loaded during a file operation.

- ◆ **Save/Load Positions**: Only positions will be saved or loaded during a file operation.

- ◆ **Save/Load Both**: both program lines and positions will be saved or loaded during a file operation. This is the default setting.

File Management

SCORBASE files are managed by means of the usual Windows file tools, which can be accessed by icons or the File menu.

The selected file option will affect the way you are prompted to load and save program and position files. Refer to the information at the end of this section for guidance.

Up to five programs can be opened and edited at a time. However, it is recommended that you close the currently open file (including Untitled) before you open another (new or existing) program file.

| New | Opens a new, untitled, program file window for a robot program. |

| | Open | Opens a file management dialog box for selecting an existing file containing a robot program and/or its associated position file, depending on the selected file option. |
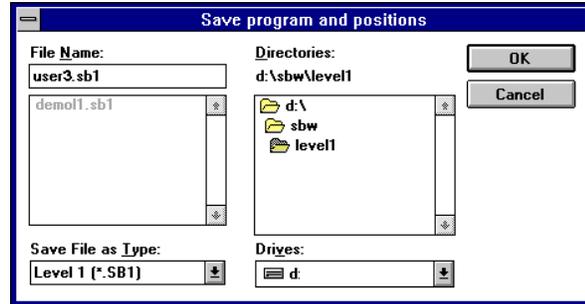
Files are located in the subdirectories Level1, Level3 or Pro, according to the level of SCORBASE in which they were written and saved.

After a program file is selected, the program is displayed in the Program file window.

| | Save (F2) | Saves the currently active robot program and/or position file, depending on the selected file option. If the file is untitled, opens a file management dialog box for defining the file name. |

Files are saved to the subdirectories Level1, Level3 or Pro, depending on the level of SCORBASE which is active at the time of the save.

| | Save As... | Opens a file management dialog box for saving the currently active robot program and/or positions under a new file name. The title of the dialog box will change in accordance with the selected file option. |

| | Print | Prints the currently active robot program file. |

| | Exit | Quits SCORBASE. If changes to a program or position file have been made but not yet saved, a warning message will be displayed. |

The names of *empty programs will not appear in the list of program files*. If you have recorded positions but have not entered any program lines, and then saved both, the program file (e.g., PROG.SB3) will not appear in the list of program files, although its associated position file PROG.PNT will appear in the list of position files.

Therefore, it is recommended that you write at least one program line (e.g., Remark: XXX), to ensure that the program file name will be listed when you attempt to load it.

All positions which are currently loaded in SCORBASE *will remain* in memory when you do either of the following:

⬧ Select **File|New**.

⬧ Select **Options|File|Load Program** AND
   File|Open|*filename.SBP*.

All positions which are currently loaded in SCORBASE *will be removed* from SCORBASE memory when you do either of the following:

⬧ Select **Options|File|Load Positions** AND
   File|Open|*filename.PNT*.

⬧ Select **Options|File|Load Both** AND
   File|Open|*filename.SBP*.

All positions which are currently loaded in SCORBASE *will be saved* in the position file associated with the program when the currently active program is saved (with Save Both file option selected).

To avoid confusion regarding which positions and/or programs are being loaded or saved, the following is recommended:

⬧ Maintain the default **Load Both** and **Save Both** settings in the **Options|File** dialog box.

⬧ Keep the **List Positions** dialog box open. The listing will be updated whenever new or different positions are loaded.

⬧ Close the currently open program window (including Untitled) before you open another (new or existing) program file.

CHAPTER **9**

System Setup

Display Options

Program Windows

SCORBASE loads each robot program into separate program file windows contained within a larger program window. This allows you to edit programs while keeping other SCORBASE menus active and accessible.

It is recommended, however, that you close the currently open program window (including Untitled) before you open another (new or existing) program file.

The Programs menu defines how the frames containing individual program files are displayed within the program window. The menu options are available only when at least one program is loaded.

Cascade	The usual Windows control for resizing and layering open windows so that each title bar is visible.
Tile	The usual Windows control for resizing and arranging the open windows side by size.
Arrange Icons	The usual Windows control for realigning the icons of programs which have been minimized.
Close All	Closes all open program files and windows.
File List	Displays a list of the program files which are currently open.

The Cascade or Tile setting remains in effect until changed.

Clicking with the right mouse button on the title bar of many of the dialog boxes in SCORBASE will open a quick menu which includes the option **Always on Top**. Use this option to ensure that a dialog box remains displayed and accessible when other windows are opened.

User Screens

SCORBASE allows you to define and display screen layouts which suit your monitor and personal preferences.

Once you have determined a layout which is suitable to your screen resolution and your programming needs, save this layout definition to a file by selecting **Options | Save User Screen**.

This opens a file management dialog box for defining the name of the file. User Screen files have the extension USR, and are saved to the SCORBASE program directory.

You can create and save and unlimited number of User Screen definition files. However, only one User Screen definition can be active at a time. Select **Options | Load User Screen**, and select another file to activate a different User Screen definition.

Whenever you select the option **View | User Screen**, the display is determined by the currently loaded User Screen definition file.

The file USER1.USR is the default user screen definition file.

Line Number

SCORBASE allows you to toggle the display of line numbers in the program window off and on. Select **Options | Line Numbers**.

By default, program line numbers are displayed.

Input & Output Names

SCORBASE allows you to define the text or names you want associated with the inputs and outputs and displayed in the I/O dialog boxes.

To create names for the I/Os, select **Options | Input & Output Names**.

This opens the Input & Output Names dialog box.

Level 1, Level 3

In SCORBASEpro names can also be given to the analog I/Os.

To insert text, bring the cursor to the desired field and type in the text. A name may have up to 9 characters.

Pro

Click **OK** to record these names.

When you close the Input & Output Names dialog box, the names are automatically saved. These names will be loaded whenever any level of SCORBASE is loaded. The names are not attached to a specific robot program or level of SCORBASE.

If you close the dialog box without clicking on OK, the text you entered will not be recorded.

Operation Modes

SCORBASE can be operated in an on-line, off-line or simulation mode. Off-line and simulation modes are available even when SCORBASE is connected to a controller.

To choose the mode of operation, do one of the following:

* Select **Options | On-Line**
* Select **Options | Off-Line**
* Select **Options | Simulation**

On-Line

When operating on-line, SCORBASE communicates with the controller. The robot, peripherals and I/Os execute all commands.

By default, SCORBASE will load and operate on-line (communicating) with the robot controller. However, if a controller is not connected, or if a connected controller is not turned on when SCORBASE is activated, the software will load and operate in the simulation mode.

When switching to on-line mode after operating the software in off-line or simulation mode, the status line message will indicate that the robot has not been homed.

If you experience difficulty in switching from off-line to on-line mode, do the following:

- Press the controller EMERGENCY button.

- Wait 10 seconds.

- Release the EMERGENCY button.

- Again try to switch to on-line mode.

Off-Line

When operating off-line, SCORBASE does not communicate with the controller, even though it may be connected and turned on. Axis movement commands are not executed and the controller's inputs and outputs are not switched.

Although actual I/O's are not switched during off-line operation, the Digital Inputs & Outputs dialog box will reflect the I/O status which results from the execution of program commands or user manipulation of the I/Os in the dialog box.

Off-line operation is useful for program debugging.

Simulation

When operating in simulation, SCORBASE does not communicate with the controller but simulates its operation. The software pauses for the actual time it would take for commands (e.g., Wait, Go Position) to be executed. Controller I/Os are not switched; I/O states are read from the Digital and Analog I/O dialog boxes (where you can manipulate them to simulate changes in their state).

Simulated program execution requires valid recorded positions.

Simulation is useful for checking and debugging programs. It is intended for use with the optional Cell Simulation software.

Robot System Parameters

SCORBASEpro permits the manipulation of robot system parameters when the software is operating on-line or off-line (but not in simulation mode).

To view or change system parameters, select **Options | Setup.**

Pro

This opens the Setup submenu, which contains a list of options regarding software parameters for the robot and peripheral devices.

(In SCORBASE Levels 1 and 3, selecting Setup opens the Peripheral Setup dialog box only; see below.)

Setup options are intended for system managers and experienced SCORBASE users.

Do not attempt to manipulate the data in these screens unless you are authorized to do so.

Select **Default All** to reset the values of all system parameters to their factory-defined default settings.

Most of the parameters dialog boxes contain the following set of buttons:

Apply	Applies the parameters you have defined in the dialog box to the current SCORBASE session.
Close	Closes the dialog box. If you close the dialog box without clicking on Apply, the parameters you have defined will not take effect.
Default	Resets the parameters defined in the dialog box to the factory-defined default settings.
Help	(not currently available)
Open	Loads parameters from a saved file.

Save	Saves the parameters defined in the dialog box to a file. Once saved, these parameters will be loaded whenever SCORBASE is activated. Select Default to restore factory-defined parameters.
Save As	Saves the parameters defined in the dialog box to a file with a new name. Once saved, these parameters will be loaded whenever SCORBASE is activated. Select Default to restore factory- defined parameters.

Parameter data files are located in the SCORBASE subdirectory PAR.

Peripheral Setup

SCORBASE allows you to define the devices which are connected and operated by the controller as axes 7 and 8.

Do not change the peripheral setup unless you are authorized to do so.

To define the devices, select **Options |Peripheral Setup**. A dialog box will open.

Click on the arrow to open the list of available devices.

Then click on the desired device.

Speed Controlled Conveyor

Either the 12V or 24V conveyor belt can serve as a speed controlled conveyor. To operate the conveyor with speed control, you must connect and define the conveyor for **axis 8**.

To define and use a speed controlled conveyor, select the option **speed controlled conveyor**, which appears at the bottom of the list of devices for **axis 8** in the Peripheral Setup dialog box.

When operating a speed controlled conveyor by means of the Start/Stop Conveyor commands, do not record positions and/or use the Set Axis (to Zero) command for the conveyor in the same program.

Control Parameters

Selecting **Control** opens the Control Parameters dialog box which displays and allows you to alter the control parameters for each axis.

Do not attempt to manipulate the data in this screen unless you are authorized to do so.

Pro

Robot Parameters

Selecting **Robot** opens a dialog box which displays and allows you to change the order in which the robot axes are homed.

Do not attempt to manipulate the data in this screen unless you are authorized to do so.

The gripper (Axis 6) cannot be homed first, even if so defined in this dialog box; it will be homed only after another axis has been homed first.
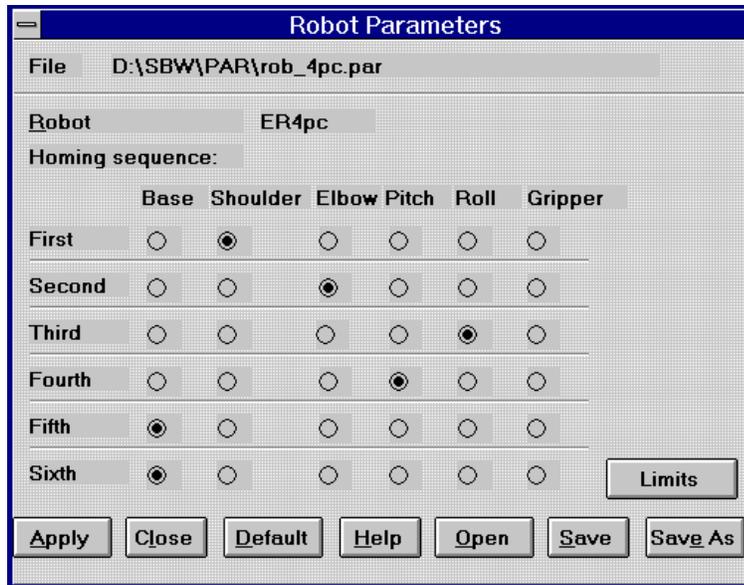
Pro

Selecting **Limits** opens another dialog box which displays and allows you to alter the dimensions of the robot's Cartesian (XYZ) working envelope.
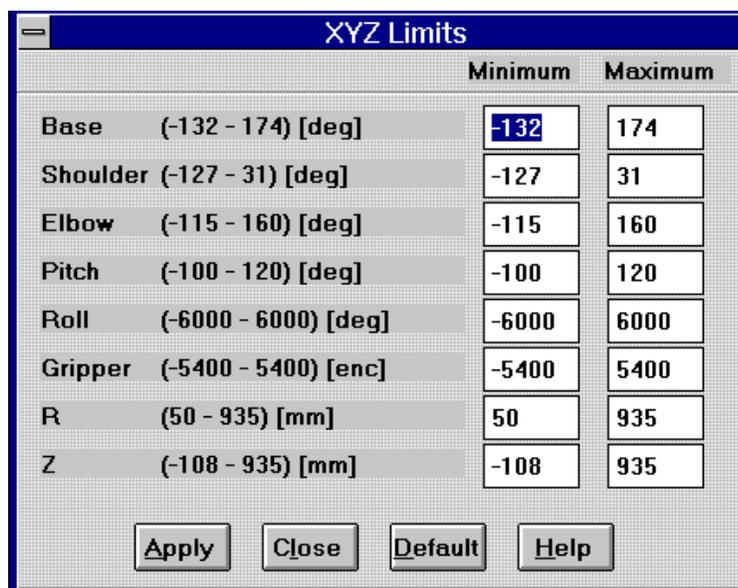

Pro

Motion Parameters

Selecting **Motion** opens a dialog box which displays and allows you to alter the movement parameters for the axes.

Do not attempt to manipulate the data in this screen unless you are authorized to do so.
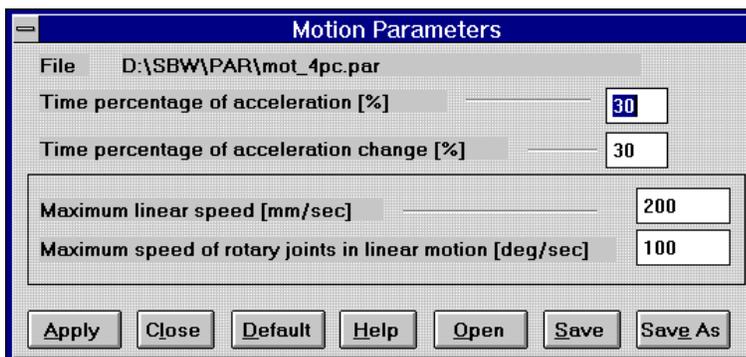
Pro

Trapezoid Trajectories

The SCORBOT-ER 4pc controller utilizes a *paraboloid* movement profile, which causes the motors to accelerate slowly until maximum speed is reached, and then decelerate at the same rate.

Controlled-path applications, such as welding and spray painting, usually require a *trapezoid* movement, in which the motors accelerate and decelerate quickly at the start and end of movement, with a constant speed along the path.

To enable trapezoid trajectories, use the Motion Parameters dialog box. Reduce the values for Time Percentage of Acceleration and Time Percentage of Acceleration Change.

Save the new parameters to a file, which can be loaded whenever an application requires trapezoid trajectories. Select Default to reset the motion parameters to the factory-defined values.

Note that the motion parameter values are applied to both robot and peripheral axes.

Software Initialization

The SCBSPRO.INI file, which initializes the SCORBASEpro software, has several optional switches which allow you to change the way the software is activated.

To alter the switches in the SCBSPRO.INI command line, do the following:

1. In the SCORBASE program folder (group), select one of the SCORBASE icons (e.g., SCORBASE PRO).

2. Press **[Alt]+[Enter]**.

    ♦ In Windows 3.1, the **Program Item Properties** dialog box will open.

    Make changes in the **Command Line** field.

    ♦ In Windows 95, the **SCORBASE (PRO) Properties** dialog box will open. Click on the **Shortcut** tab if it is not already selected.

    Make changes in the **Target** field.

The following switches can be included in the command line.
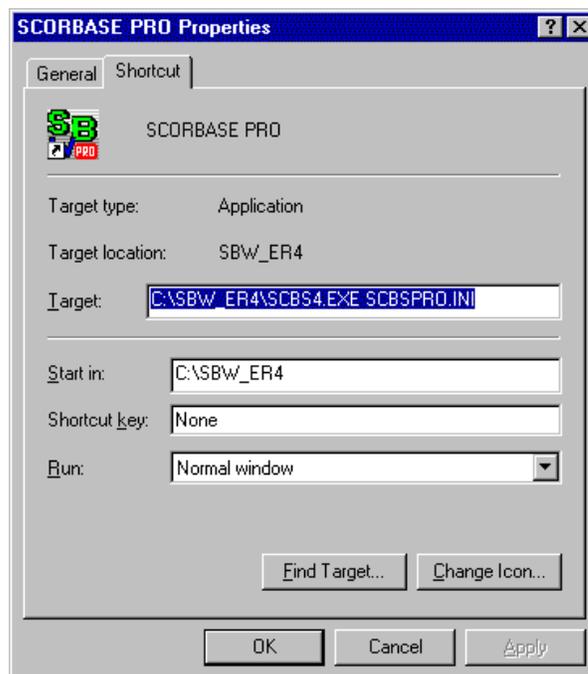
/ONL[INE]	Loads SCORBASE in on-line mode, unless communication with the controller is not established. For example: SCBS SCBSPRO.INI /ONL
	If you exit SCORBASE when the software is operating in off-line mode, SCORBASE will load in off-line mode the next time it is activated.
/H	Loads SCORBASE and automatically executes the homing routine after SCORBASE is loaded. For example: SCBS SCBSPRO.INI /H
/R=*program*	Loads SCORBASE and automatically executes the specified SCORBASE program, then exits SCORBASE.
	The switch can be used to activate SCORBASE from another Windows application. For example: SCBS SCBSPRO.INI /R=ROB.SBP
/L=*program*	Loads SCORBASE and automatically opens the specified SCORBASE program and its associated position file. For example: SCBS SCBSPRO.INI /L=ROB.SBP

More than one switch can be used. For example:

SCBS SCBSPRO.INI /ONL /H /L=APPL1.SBP

This will activate SCORBASEpro in on-line mode, home the robot, and load the program APPL1.

Software License

During the 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.

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

  After installing the software from a disk which 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 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.