DENSO ROBOT

RC7 CONTROLLER

Teach Pendant Panel Editor

Panel Designer

USER'S MANUAL

Foreword

This manual sets forth the Panel Designer, a teach pendant panel editor that enables you to create teach pendant (TP) panel screen software on the computer screen.

This is a supplement to the Setting Manual and WINCAPSIII Guide.

Note for the global type of robot controllers

Version 2.801 or earlier: When the "External auto limited mode" is selected, teach pendant (TP) panel screen software cannot run in External auto mode. (Refer to the RC7M Controller Manual.)

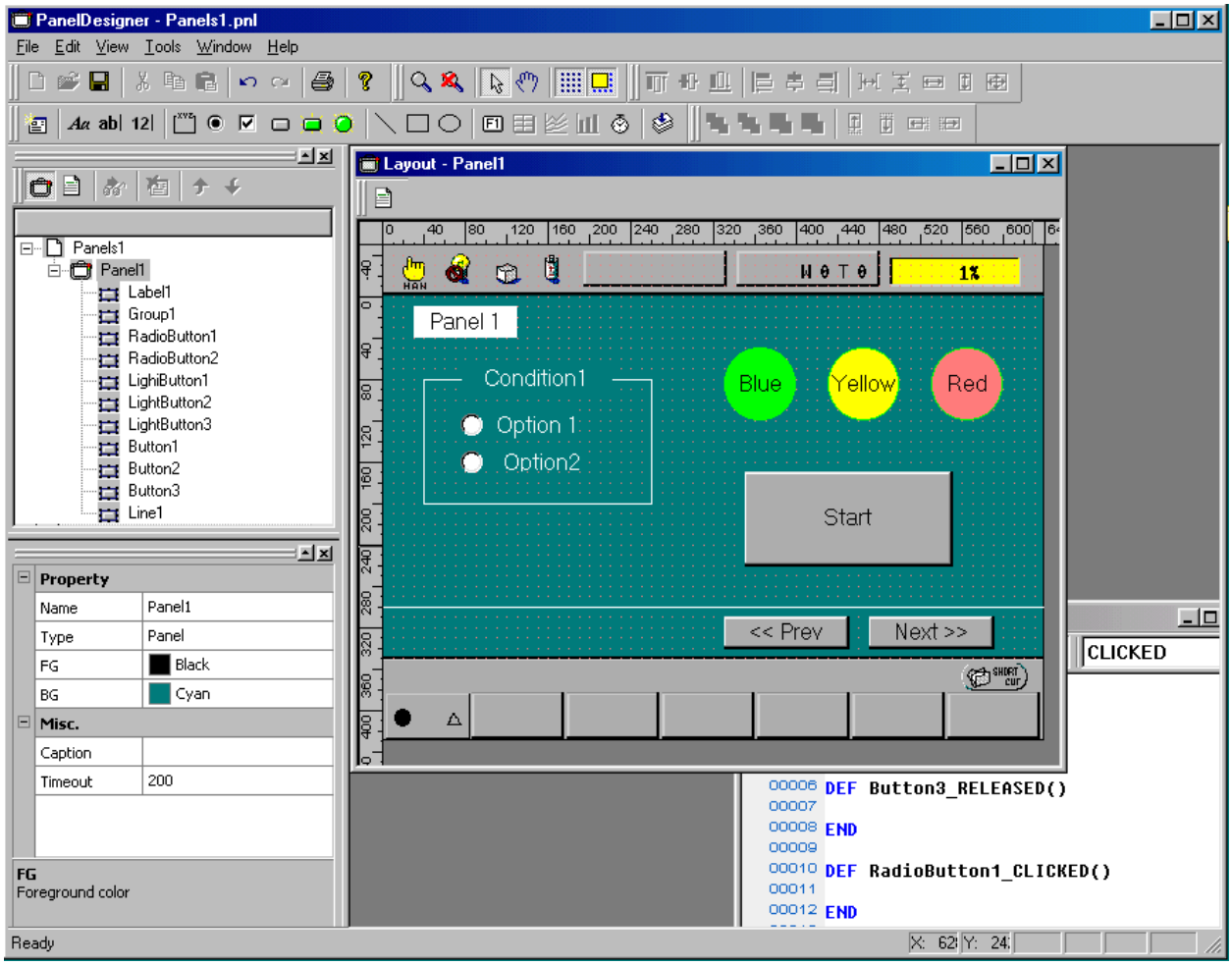
Version 2.802 or later: Even in External auto mode, TP panel screen software can run except that RUN and COTINUERUN commands (TP panel control languages) cannot execute.

Contents

Chapter 1 Panel Designer Overview

WINCAPSIII includes the Panel Designer, a teach pendant editor for creating teach pendant (TP) panel screen software by simply arranging parts on the computer screen and then specifying action source code for the events associated with them.

This chapter outlines the procedures involved.



Creating TP Panel Screens

1.1 Overview of Procedures for Creating TP Panel Data

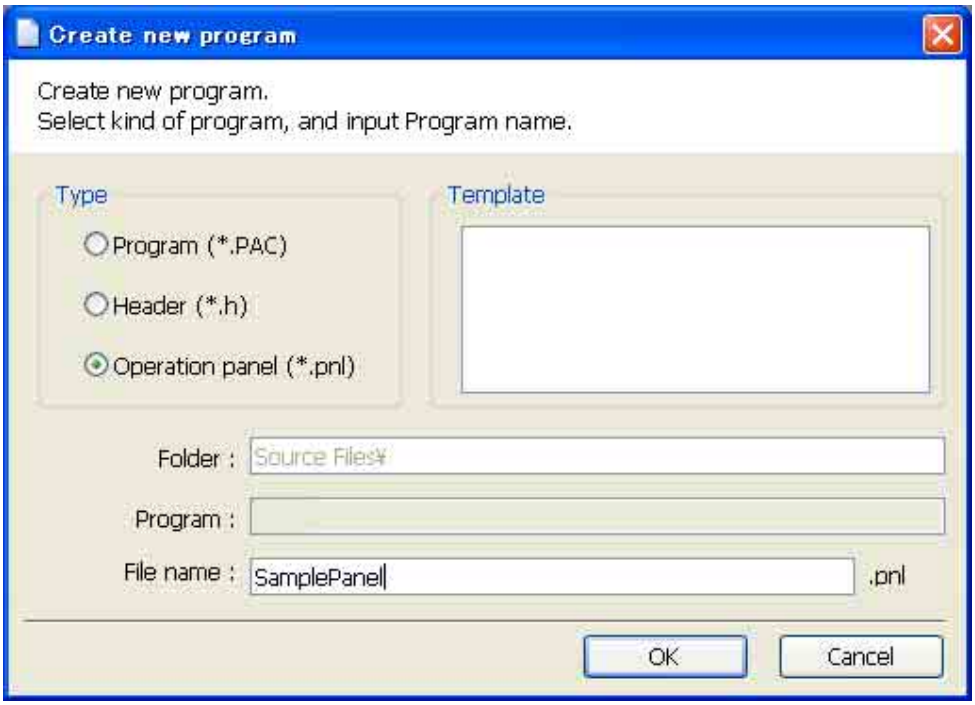
The procedure for creating TP panel data consists of the following five basic steps.

(1) Load editor

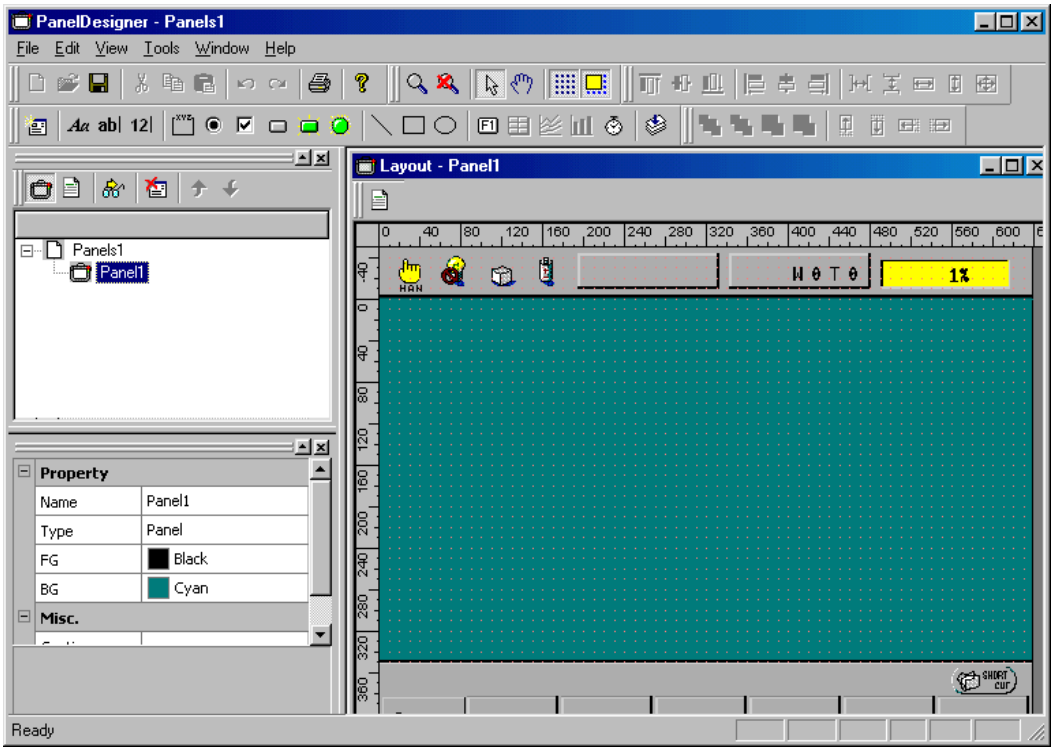
1) In WINCAPSIII, choose Project | Add Program to display the "Create new program" dialog.

2) In Type, select Operation panel (*.pnl), enter the desired file name, and press OK to start the Panel Designer.

Note: To open existing TP panel data, double-click it in the Program List.



"Create new program" Dialog in WINCAPSIII

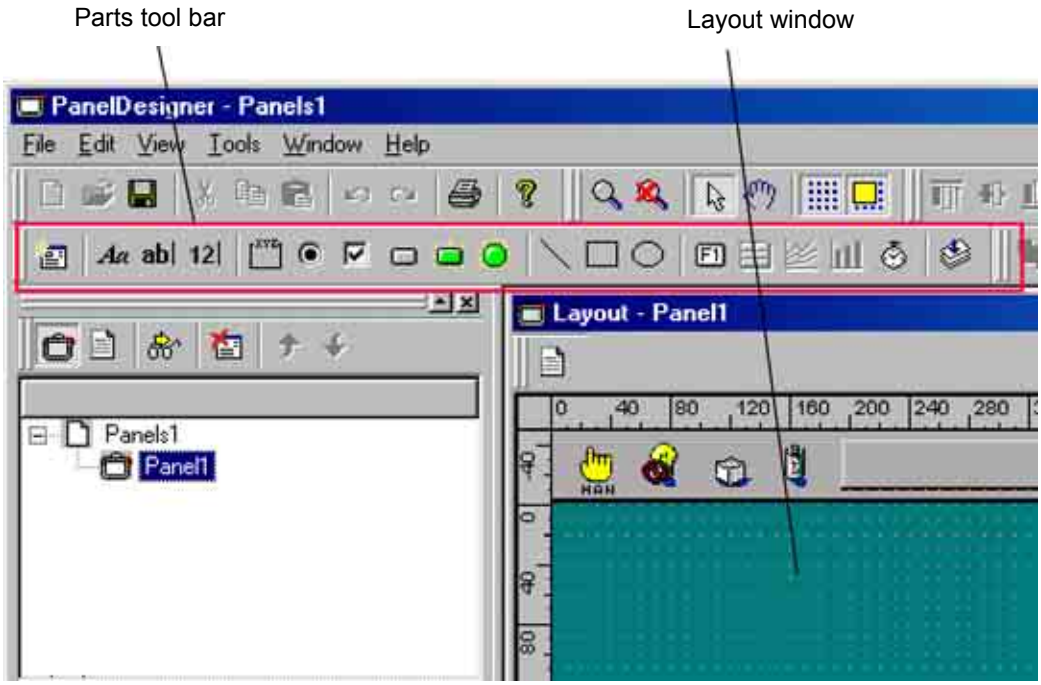


Panel Designer Window for New Panel Layout

(2) Create panel layout

Select the necessary parts from the Parts tool bar and arrange them in the Layout window to create the TP panel screen.

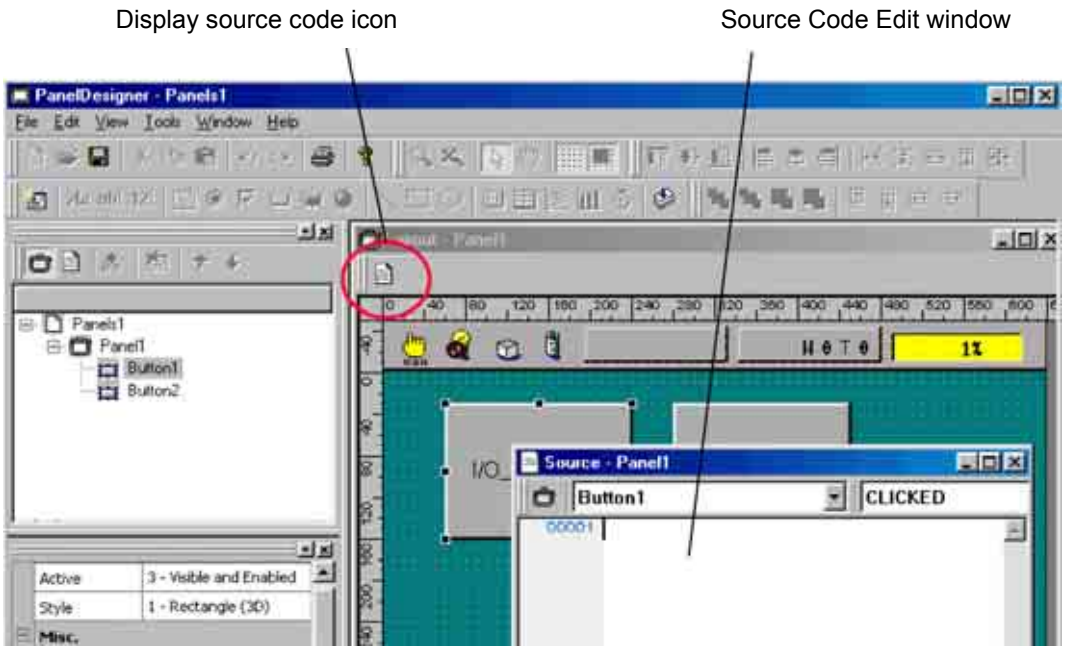
For further details, see Chapter 2 "Creating TP Panels."



(3) Edit action source code

1) Click the Display source code icon in the Layout window to display the Source Code Edit window.
2) Add to the Source Code Edit window the action source code for when the part is pressed.

   For further details, see Section 2.2.2 "Specifying Action Source Code for Parts."



(4) Compile

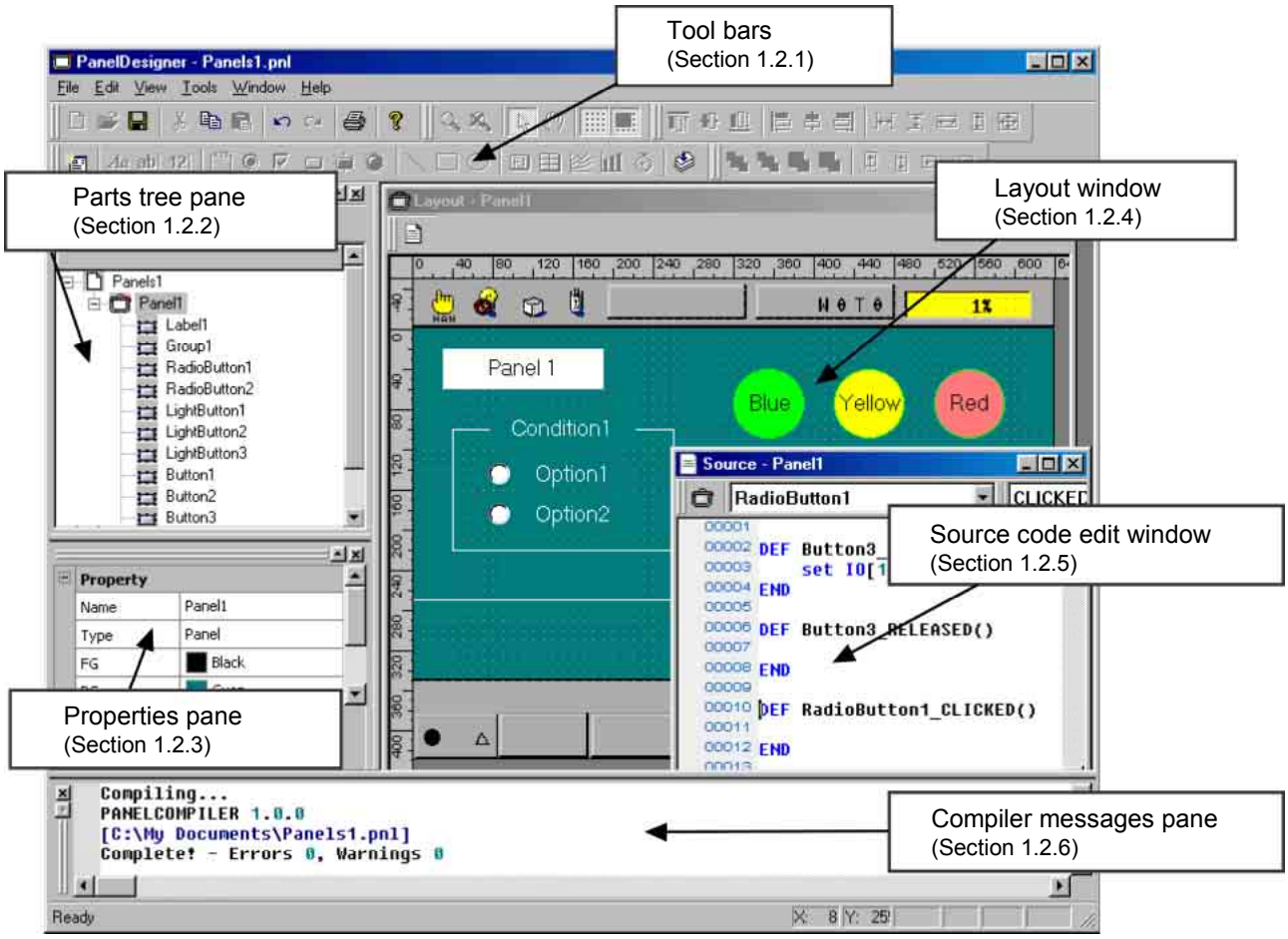
Compile the action source code just written to check for syntax, typing, or other errors. Progress and other messages from the compiler appear in a pane near the bottom of the main editor window.

(5) Send data to the controller

Send the newly created TP panel file to the controller, using WINCAPSIII. Note that using the teach pendant as an operating panel requires reconfiguring the teach pendant.

1.2 Editor Screen Functional Description

The following figure gives the editor screen layout. The following pages describe the individual components.



Panel Designer Screen Layout

1.2.1 Tool Bars

The editor provides the following handy tool bars for creating TP panel data.

(1) Main tool bar

This provides the following buttons.

	Name	Description
	New	Create a new TP panel file.
	Open...	Open an existing TP panel file.
	Save	Save the current file to disk, overwriting any older version there.
	Cut	Move the contents of the selected range to the system clipboard.
	Copy	Copy the contents of the selected range to the system clipboard.
	Paste	Insert the clipboard contents at the current cursor position.
	Undo	Reverse the effects of the last operation.
	Redo	Undo the last undo operation--in other words, repeat the last operation.
	Print	Print the current screen.
	About	Display the About screen indicating the editor's version number, etc.

(2) Zoom grid tool bar

These buttons change the Layout window magnification, toggle the grid display on and off, etc.

	Name	Description
	Zoom	Change the magnification ratio for the selected region.
	Cancel Zoom	Cancel zooming and return the Layout window to the standard (100%) magnification.
	Pan	Shift the display screen in the specified direction.
	Grid	Toggle the grid display on and off.
	Snap	Toggle automatic grid positioning on and off.

(3) Layout tool bar

These buttons assign uniform positioning, spacing, or size to the selected parts.

	Name	Description
	Align Top	Align along the upper edge.
	Align Middle	Align vertical centers.
	Align Bottom	Align along the lower edge.
	Align Left	Align along the left edge.
	Align Center	Align horizontal centers.
	Align Right	Align along the right edge.
	Space across	Standardize horizontal spacing.
	Space down	Standardize vertical spacing.
	Same width	Standardize width.
	Same height	Standardize height.
	Same size	Standardize size.

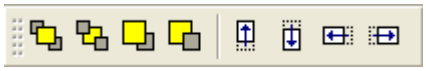
(4) Parts tool bar

Most of these buttons select a part to add to the panel layout in the Layout window.

	Name	Description
	New panel	Create a new panel layout.
	Select parts	Select a part pointed with this cursor.
Aa	Label	Add part: label.
ab|	Text box	Add part: text box.
12|	Numerical value input box	Add part: numerical input box.
	Group box	Add part: group box.
	Radio button	Add part: radio buttons.
	Check box	Add part: check box.
	Push button	Add part: push button.
	Illuminated push button	Add part: illuminated push button.
	Pilot lamp	Add part: pilot lamp.
	Line	Add part: line.
	Rectangle	Add part: rectangle.
	Oval	Add part: oval.
F1	Function key	Add part: function key.
	Timer	Add part: timer.
	Compile	Translate the corresponding TP panel file into executable format.

(5) Move tool bar

These buttons move parts around the panel layout and within the file's part hierarchy.



	Name	Description
	Front	Move to the top layer.
	Back	Move to the bottom layer.
	Forward	Move forward one layer.
	Backward	Move backward one layer.
	Nudge up	Move up. Simultaneously holding down the Shift key moves 5 pixels each time.
	Nudge down	Move down.
	Nudge left	Move left.
	Nudge right	Move right.

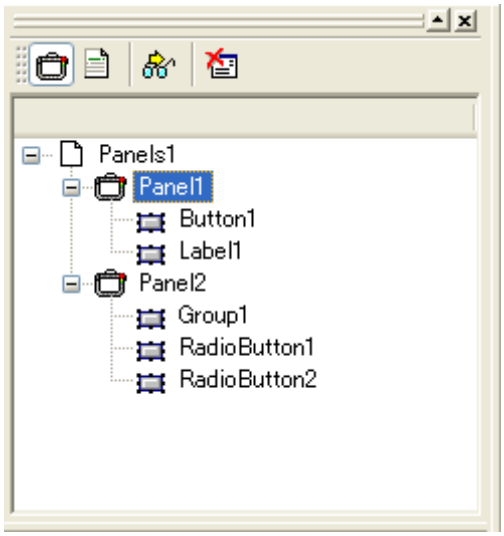
1.2.2 Parts Tree Pane

This displays the current file's panels and parts in tree format.

(1) Parts Tree pane

The following figure shows a sample Parts Tree pane.

Double-clicking on a part displays its panel layout.



(2) Parts tool bar

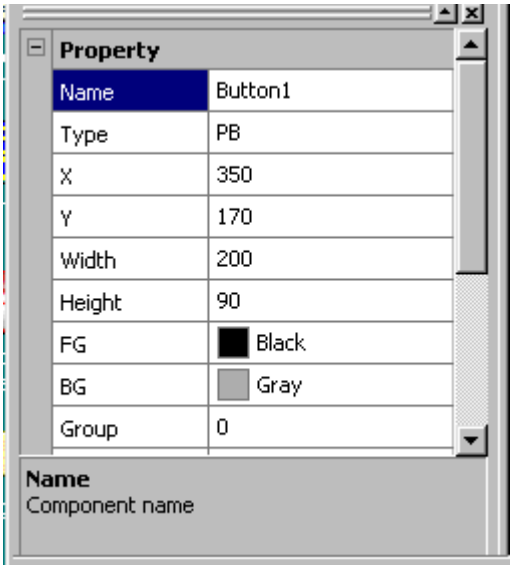
This provides the following buttons.

	Name	Description
	Layout form	Specify the Layout window as target.
	Source form	Specify the Source Code Edit window as target.
	Layout window	Display the target window specified above.
	Erase panel	Delete a panel layout from the TP panel data.

1.2.3 Properties Pane

This accesses the position, size, and other properties for a part.

The list of properties depends on the part type. For further details, see Section 1.5.1 "Property Lists."



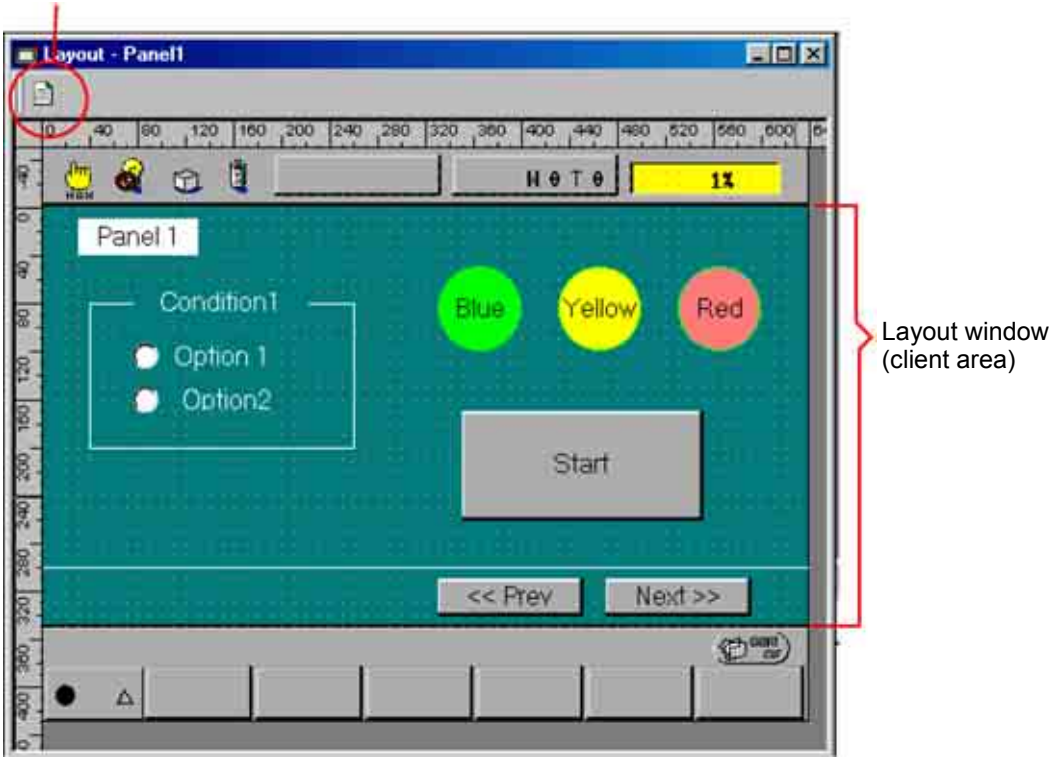
Properties Pane

1.2.4 Layout Window

This window is for designing teach pendant TP panel screen software by placing parts on this screen and then adjusting their positions and sizes with the cursor keys or rubber band drag operations.

Clicking on the Display source code icon displays the corresponding Source Code Edit window.

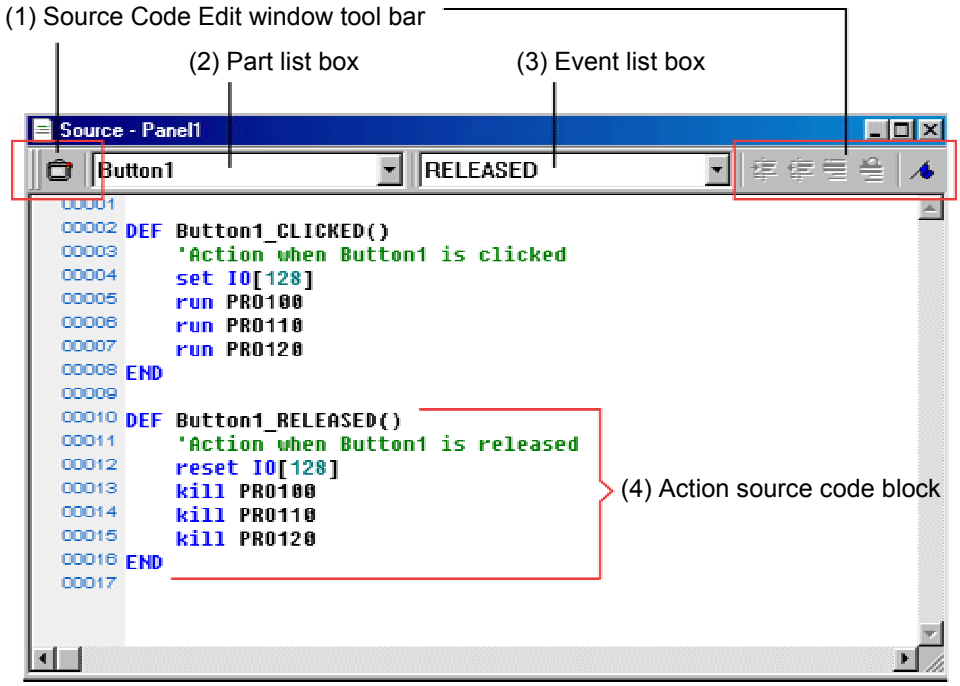
Display source code icon



Layout Window

1.2.5 Source Code Edit Window

This window is for assigning action source code to events associated with the parts on the current panel layout.



Source Code Edit Window

(1) Source Code Edit window tool bar

	Name	Description
	Layout window	Display the corresponding panel layout.
	Indent	Shift the selected lines one tab position to the right.
	Outdent	Shift the selected lines one tab position to the left.
	Comment out	Comment out the selected lines.
	Undo comment block	Cancel commenting out for the selected lines.
	Bookmark	Toggle bookmark on the current source code line.
	Next bookmark	Move the cursor to the next bookmark.
	Previous bookmark	Move the cursor to the previous bookmark.
	Clear bookmarks	Cancel all bookmark definitions.
	Find and replace	Find the specified string and optionally replace it.

Note: Setting a bookmark on a code line displays a square marker ( ) to its left.

(2) Part list box

Select the part for which to assign action source code.

(3) Event list box

This lists the events available for the selected part. Selecting one automatically generates the corresponding skeleton action source code block on the editor screen.

Example: Skeleton action source code block for pressing Button1

```
DEF Button1_CLICKED()

END
```

(4) Action source code block

Flesh out the skeleton with action source code.

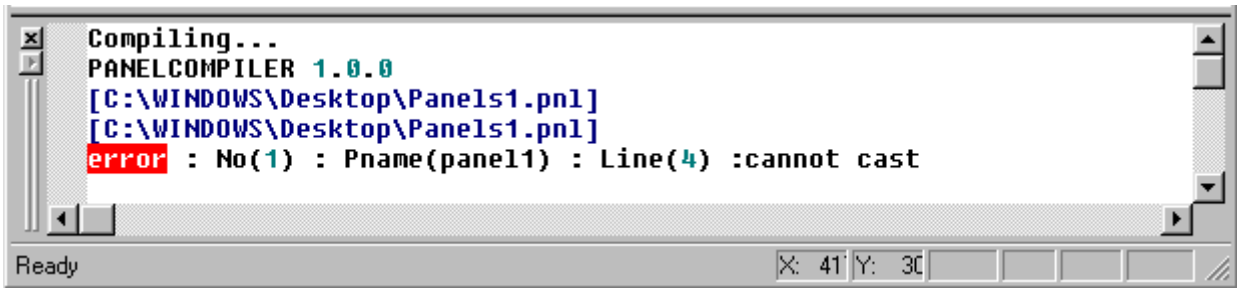
Example: Action source code block for pressing Button1

```
DEF Button1_CLICKED()
    Set IO[128]              ' turn I/O variable #128 ON
    Run PRO100               ' run PRO100
END
```

1.2.6 Compiler Messages Pane

This displays progress and other messages from the compiler as it compiles the TP panel data.

Double-clicking on an error message line displays the corresponding source code in a Source Code Edit window.



Compiler Messages Pane

1.2.7 Menus

This section lists the editor's menus and menu commands.

(1) File

Menu Command		Description
	New	Create new TP panel file.
	Open…	Open an existing TP panel file.
	Close	Close the current file, first displaying the dialog box for saving if current file edits have not been saved.
	Save	Save the current file to disk, displaying the dialog box for saving if the file is new.
	Save As…	Save the current file to disk under a new name.
	Print…	Print the contents of the current window: Layout or Source Code Edit.
	Print Preview…	Display a print image on the screen instead of sending data to the printer.
	Printer Setting	Display the dialog box for specifying printer settings.
	Import...	Read panel layouts from another TP panel file.
	Most recently used files	This section lists the last few TP panel files saved.
	Exit	Close the editor.

(2) Edit

Menu Command		Description
	Undo	Reverse the effects of the last operation.
	Redo	Undo the last undo operation--in other words, repeat the last operation.
	Cut	Move the contents of the selected range to the system clipboard.
	Copy	Copy the selected parts or string to the system clipboard.
	Paste	Insert the clipboard contents at the current cursor position.
	Delete	Delete the selected parts or string.
	Find	Display the dialog box for finding (and optionally replacing) the specified string.

(3) View

Menu Command		Description
	Tool bar	Toggle display of tool bars.
	Status bar	Toggle display of status bar.
	Tree bar (Parts tree)	Toggle display of the Parts Tree pane.
	Property bar (Property)	Toggle display of the Properties pane.
	Panel layout	Display the corresponding panel layout.
	Grid	Toggle the grid display on and off.
	Snap to grid	Toggle automatic grid positioning on and off.

Menu Command		Description
	Zoom Normal	Cancel zooming and return the Layout window to the standard (100%) magnification.
	Zoom Percent	Change the magnification ratio for the Layout window (50%, 75%, 100%, 200%).

(4) Tool

Menu Command		Description
	Options…	Specify the compiler output version.
	Compile	Translate the corresponding TP panel file into executable format.

(5) Window

Menu Command		Description
	Close	Close the currently selected window.
	Close all windows	Close all open editor windows.
	Cascade	Display all open windows with the same size and overlapped with only their title bars visible.
	Tile	Display all open windows as individual rectangles dividing up the screen.
	Arrange Icons	Align the icons for minimized windows in the lower left corner of the main editor window.
	List windows	Display a list of all windows.

(6) Help

Menu Command		Description
	Help	Display the editor's help file.
	About Panel Designer	Display the About screen indicating the editor's version number, etc.

1.3 Creating and Modifying Panel Layouts

1.3.1 Adding Parts

Adding parts to a panel is a three-step procedure.

(1) Open the Layout window

To create a new panel, choose the File|New menu command or press the tool bar button New panel.

To modify an existing panel layout, select the Layout form button on the Parts tool bar and double-click on the corresponding Layout window icon or press the Display panel button.

(2) Select a part

Selecting a part from the Parts tool bar displays the part mark at the current cursor position in the Layout window.

(3) Add the part

Clicking in the Layout window adds the part with the default size at that location.

Note: Dragging the part at this point then adjusts the size.

1.3.2 Modifying Panel Layouts

The following methods are available for modifying part positions and sizes in Layout windows.

(1) Moving parts

1) Drag the part with the mouse (whenever the move cursor is visible)
2) Use a cursor key
3) Use the Move tool bar
4) Modify the position properties x and y

(2) Changing size

1) Drag part frame's rubber band
2) Modify the properties width and height
3) If multiple parts are currently selected, use the Layout tool bar buttons for standardizing spacing and size

(3) Aligning

If multiple parts are currently selected, use the Layout tool bar buttons for centering parts or aligning them along the specified edge.

Note: For function keys, the property Index automatically determines the position and size.

(4) Changing layers

Select the part to reorder and either choose Move on the right-click menu or press a button in the tool bar's Order section.

Note: Changing the part order automatically updates the Parts Tree pane accordingly.

1.3.3 Changing Part Properties

The Properties pane provides facilities for modifying the parts name, color, and other properties.

1.3.4 Deleting Panel Layouts

Select the panel layouts to delete on the Parts Tree pane and press the Delete panel button.

1.3.5 Importing Panel Layouts from Another TP Panel File

Use the following procedure to import panels from another TP panel file, with extension .pnl.

(1) Use the File|Import menu command to specify the source TP panel file.

(2) Select the panel layouts to import from the list for the file and press the Import button to add them to the Parts Tree pane.

1.4 Adding Action Source Code

A Source Code Edit window is for specifying the events to take in response to a CLICKED, RELEASED, or other state change event associated with the corresponding part on the panel layout.

1.4.1 Writing Action Source Code

(1) Open the Source Code Edit window

Use one of the following methods to open the Source Code Edit window for the part.

1) Double-click on the part in the Layout window.
2) Select the part in the Layout window and press the Display layout button.
3) Select the panel layout on the Parts Tree pane, make sure that the Source form button is pressed, and press the Display panel button.

(2) Select the part

Check whether the part appears in the Part list box at the top of the Source Code Edit window. If it does not, select it with the list box.

(3) Select the event

The Event list box gives the events available for the selected part. Selecting one automatically generates the corresponding 3-line action source code block skeleton on the editor screen.

Example: Skeleton action source code block for pressing Button1

```
DEF Button1_CLICKED()

END
```

(4) Add action source code

Flesh out the skeleton with action source code.

Example: Action source code block for pressing Button1

Example: Action source code block for pressing Button1

```
DEF Button1_CLICKED()
    Set IO[128]          ' turn I/O variable #128 ON
    Run PRO100           ' run PRO100
    Run PRO200           ' run PRO200
END
```

1.4.2 Checking (Compiling) Action Source Code

Compile the action source code just written to check for syntax, typing, or other errors. Progress and other messages from the compiler appear in a pane near the bottom of the main editor window. Double-clicking on an error message displays the corresponding source code in a Source Code Edit window.

1.5 Miscellaneous

1.5.1 Property Lists

The following table lists the position, size, and other properties that can appear in the Properties pane.

Note: The list displayed in the Properties pane depends on the part type.

Name	Description	Notes
name	Name	Unique identifier for the part
type	Part type	This is fixed for each part.
x	x-coordinate	Reference position relative to the x- and y-axes within the teach pendant screen's drawing range
y	y-coordinate	
width	Width	Width in pixels relative to the reference corner (x, y)
height	Height	
fg	Foreground color	Specify these colors with the list box.
bg	Background color	
group	Group number	Group number to which the part belongs
active	Active/inactive setting	Select with the list box.
style	Display style	Select with the list box.
caption	Display string	String to display on part surface **Note:** Use the Ctrl+Enter key combination to insert a line break in multiline text.
fsize	Font size	0: Super small, 1: Small, 2: Medium, 3: Large
justify	Caption positioning	0: Center, 1: Right-justified, 2: Left-justified
thickness	Line width	Line thickness in pixels **Note:** The 0 setting produces flood fill.
myGroup	Group number	Unique to a particular group box
state	State	Select ON, OFF, or other state with the list box.
value	Input value	Unique to numerical input boxes
text	Input text	Unique to text boxes
index	Function number	Unique to function keys
interval	Interval	Unique to timers
timeout	Timeout limit	Applicable when no button, line or any other parts are selected. (A single timeout property per TP panel file can be defined.)
release-mode	RELEASED event execution condition	Applicable when no button, line or any other parts are selected. (A single release-mode property per TP panel file can be defined.) [Version 2.32 or later]

1.5.2 Event List

The Event list box is for selecting a CLICKED, RELEASED, or other state change event associated with the part.

Note: The events available depend on the part type.

Event	Description
CLICKED	Button pressed
RELEASED	Button released
TIMER	Interval elapsed
REFRESH	Screen refreshed
INITIALIZE	Initializable TP panel opened [Version 2.32 or later]
DONE	OK button pressed [Version 2.32 or later]

1.5.3 Action Source Code Syntax

Action source code blocks consist of two kinds of statements:

(1) TP panel control commands

Chapter 4 gives TP panel control language syntax; Section 5.1 "List of TP Panel Control Commands."

(2) Read/write access to part properties

Note: The properties available depend on the part type.

Such accesses use the standard dot notation: part_name.property.

```
Example 1: Reading the current state for radio button RadioBtn
        DEFINT iState
        IState = RadioBtn.State

Example 2: Setting button width to 200
        Button.Width = 200
```

1.5.4 Sending Data to Controller

Use WINCAPSIII to send the created TP panel data to the controller. Before data transfer, WINCAPSIII compiles the last saved data. If the TP panel data is being edited, therefore, be sure to save any data modifications before data transfer.

1.5.5 Important Note on Radio Buttons

Makes sure that only one, the default, has ON in its state property. The editor does not check sets of radio buttons for multiple ON settings. Sending such data to the controller produces a TP panel screen with multiple ON settings exactly as specified.

Chapter 2 Creating TP Panels

Chapter 1 gave an overview of the procedures for arranging objects (parts) on panel layouts using mouse operations on the computer screen, assigning action source code, and adjusting their size, position, color, and other properties.

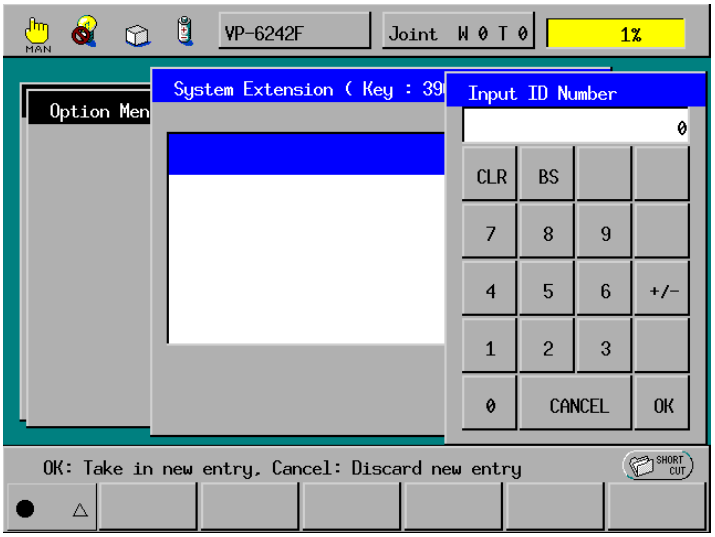
This chapter gives the detailed procedures for creating TP panels. The teach pendant provides a clean slate on which to display such user-specified panel layouts. A folder can have only one TP panel file specifying a series of such panel layouts.

2.1 Configuring Teach Pendant

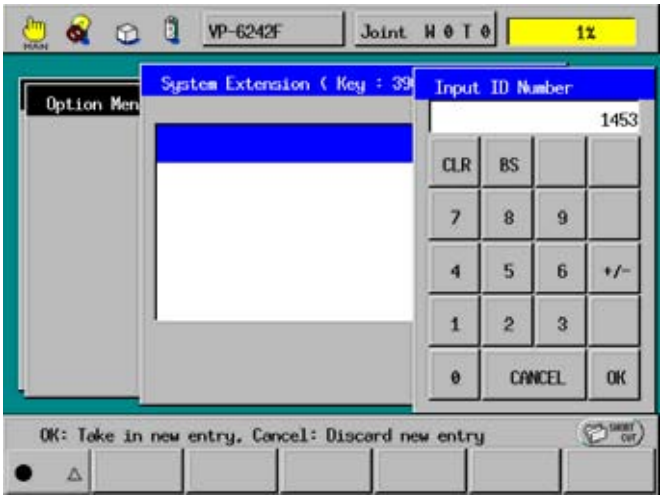
2.1.1 Enabling TP Panel Operation

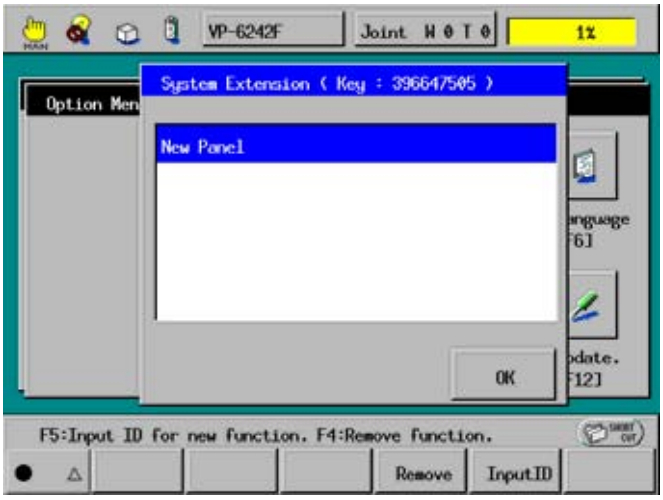
Add support for TP panel operation to the teach pendant with the following procedure.

Step 1 From the teach pendant top screen, press [F6 Set]—[F7 Options.]—[F8 Extnsion]—[F5 Input ID] to display the following screen.

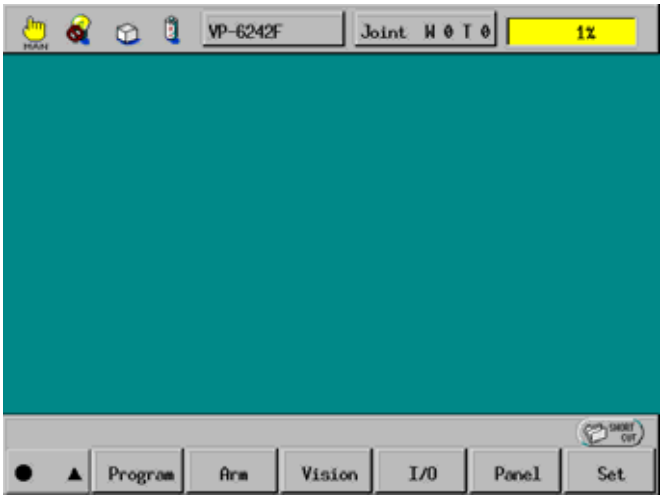


Step 2 Type the password "1453" and press the OK button to display the list of additional functionality available.





Step 3 Press the OK button to return to the top screen and confirm that the F5 label now reads Panel.



Press [F5 Panel] to start the TP panel screen software.

Note: Enabling TP panel operation disables the RC5-compatible TP panel operation assigned to F9.

2.1.2 Specifying the Start Mode of TP Panel Screen Software [Version 2.32 or later]

Note: For Version 2.31 or earlier, see Section 2.1.3 "Automatically Displaying TP Panel Screens."

The teach pendant provides the following setting for specifying the start mode of TP panel screen software.

The four choices of the start mode parameters are available by the combination of "what starts TP panel screen software--booting the controller or pressing [F5 Panel]" and "which TP panel screen appears first" as listed below.

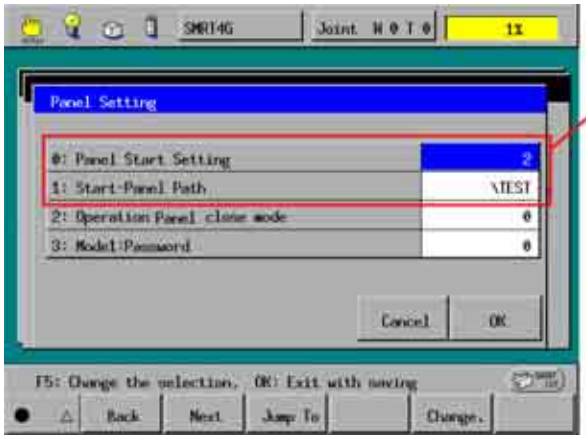
Start Mode of TP Panel Screen Software

Start mode parameter "0: Panel Start Setting"	Path of TP panel screen that should appear first "1: Start-Panel Path"	a) "What starts TP panel screen software" b) "Which TP panel screen appears at the start"	Remarks
0	--	a) Pressing [F5 Panel] b) Current directory* of the Program List	
1	To be specified	a) Booting the controller b) TP panel screen specified by "Start-Panel Path" or a) Pressing [F5 Panel] b) Current directory* of the Program List	Select this parameter to run TP panel screen software when the controller boots.
2	To be specified	a) Pressing [F5 Panel] b) TP panel screen specified by "Start-Panel Path"	Select this parameter to display the TP panel screen predetermined without changing the current directory.
3	To be specified	a) Booting the controller or Pressing [F5 Panel] b) TP panel screen specified by "Start-Panel Path"	

*The "Current directory of the Program List" refers to the following.

The current directory is displayed here.

Step 1 Press [F6 Set]—[F7 Options.]—[F9 Panel] to display the following screen.



Parameters relating to the start mode of TP panel screen software

Step 2 Set the "0: Panel Start Setting" parameter to any of 0 to 3 (defined on the previous page).

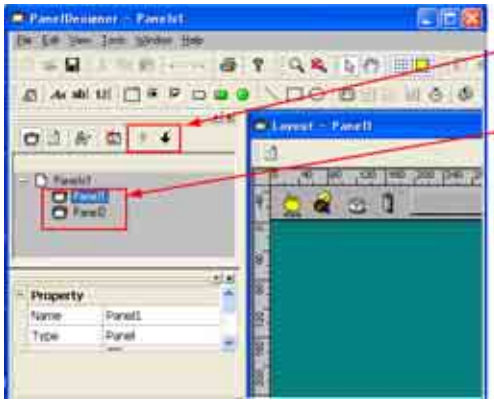
Step 3 If the "0: Panel Start Setting" parameter is any of 1 to 3, specify the directory where the desired TP panel screen is located, to the "1: Start-Panel Path" parameter.

Example: \TEST

As shown above, delimit the path with backslash "\". This example calls up the TP panel screen located in the "TEST" folder.

If the "1: Start-Panel Path" parameter is not specified, the root directory (folder at the top of the directory tree structure) applies.

Note 1: The "1: Start-Panel Path" parameter can only specify a path. If more than one TP panel screen is defined, the one that is located at the top when complied with Panel Designer will be displayed at the start of TP panel screen software.



Pressing this changes the order of TP panels.

The TP panel at the top of the directory tree structure appears when the controller boots.

Note 2: After the teach pendant panel screen is switched to a different one located in the Start-Panel Path (or in the current directory of the Program List) with the PAGE_CHANGE command, exiting from the TP panel screen software and restarting it calls up the last TP panel screen.

However, after the teach pendant panel screen is switched to a different one located in the path other than the Start-Panel Path (and the current directory of the Program List), doing the same calls up the TP panel screen located in the Start-Panel Path (or in the current directory of the Program List) just as when the controller boots.

2.1.3 Automatically Displaying TP Panel Screens [Version 2.31 or earlier]

Note: For Version 2.32 or later, see Section 2.1.2 "Specifying the Start Mode of TP Panel Screen Software."

The teach pendant provides the following setting for automatically displaying TP panel screen software when the controller boots.

Step 1 Press [F6 Set]—[F7 Options.]—[F9 Panel] to display the following screen.

Step 2 Set the first setting to 1 to enable automatic loading and the second (path) to the folder containing the TP panel screen software.

Step 3 Test by rebooting the controller.

Note: An error message on the teach pendant screen blocks automatic display.

2.1.4 Specifying the Close Mode of TP Panel Screen Software [Version 2.32 or later]

The teach pendant provides the following setting for exiting the TP panel screen software.

Close mode parameter "2: Operation Panel Close Mode"	Close mode
0	SHIFT + CANCEL (default) Pressing the Cancel key with the Shift key held down exits the TP panel screen software.
1	SHIFT + CANCEL + Password Pressing the Cancel key with the Shift key held down and entering the password exits the TP panel screen software. The password should be specified with the password entry parameter "3: Mode1: Password."
2	CANCEL Pressing the Cancel key exits the TP panel screen software.

Step 1 Press [F6 Set]—[F7 Options.]—[F9 Panel] to display the following screen.

Specify the close mode of TP panel screen software.

Step 2 Set the "2: Operation Panel Close Mode" parameter to any of 0 to 2.

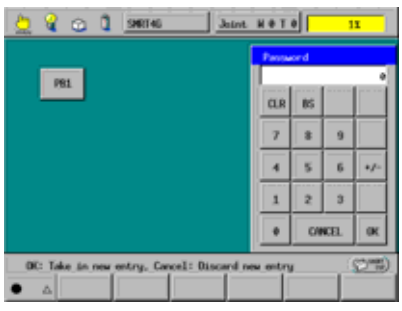
0: SHIFT + CANCEL
1: SHIFT + CANCEL + Password (Proceed to Step 3.)
2: CANCEL

Step 3 If the "Operation Panel Close Mode" parameter is set to 1, enter an arbitrary password to the "3: Mode1: Password" parameter.

Note: The password entry range is from -2147483648 to 2147483647.

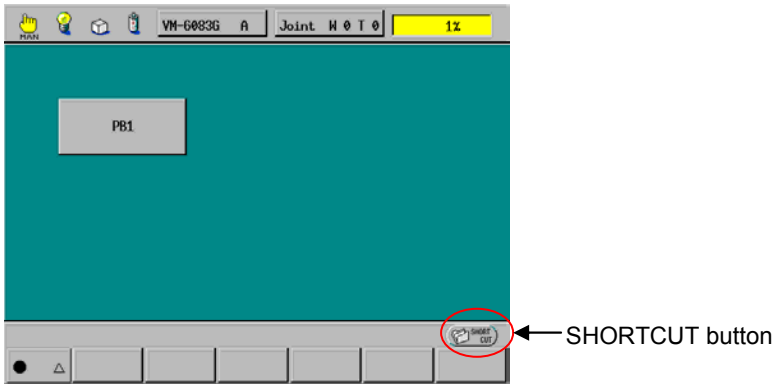
When you attempt to exit the TP panel screen software by pressing the Cancel key with the Shift key held down, the password entry window appears as shown below. You need to enter the password and press the OK button. If the password entered here matches the one preset to the "3: Mode1: Password" parameter, the TP panel screen software exits.

Tip: If you forget the password, enter 273958314 to exit the TP panel screen software.

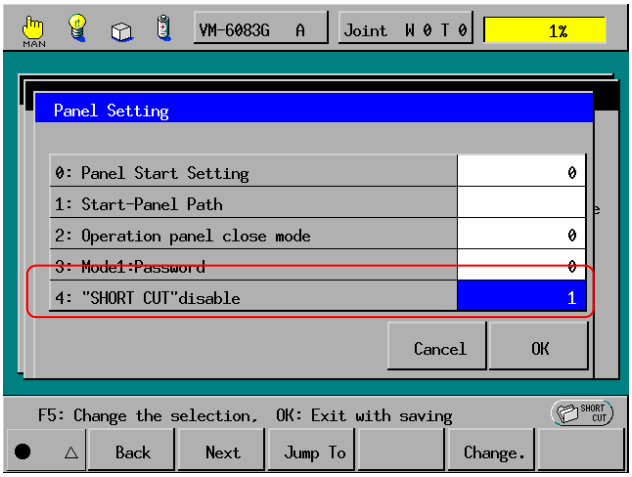


2.1.5 Hiding the Shortcut Button [Version 2.6 or later]

You can hide the SHORTCUT button to prevent it from being pressed inadvertently when the TP panel screen is active.



Step 1 Press [F6 Set]—[F7 Options.]—[F9 Panel] to display the Panel Setting screen.



Step 2 Select [4: “SHORTCUT” disable] and change the parameter by pressing [F5 Change.].

Pressing the OK button enables the setting.

Parameters for [4: “SHORTCUT” disable] on the Panel Setting screen

Parameter	Description	Remarks
0	Display the SHORTCUT button when the TP panel screen is active	Default
1	Hide the SHORTCUT button when the TP panel screen is active	

2.2 Using Parts

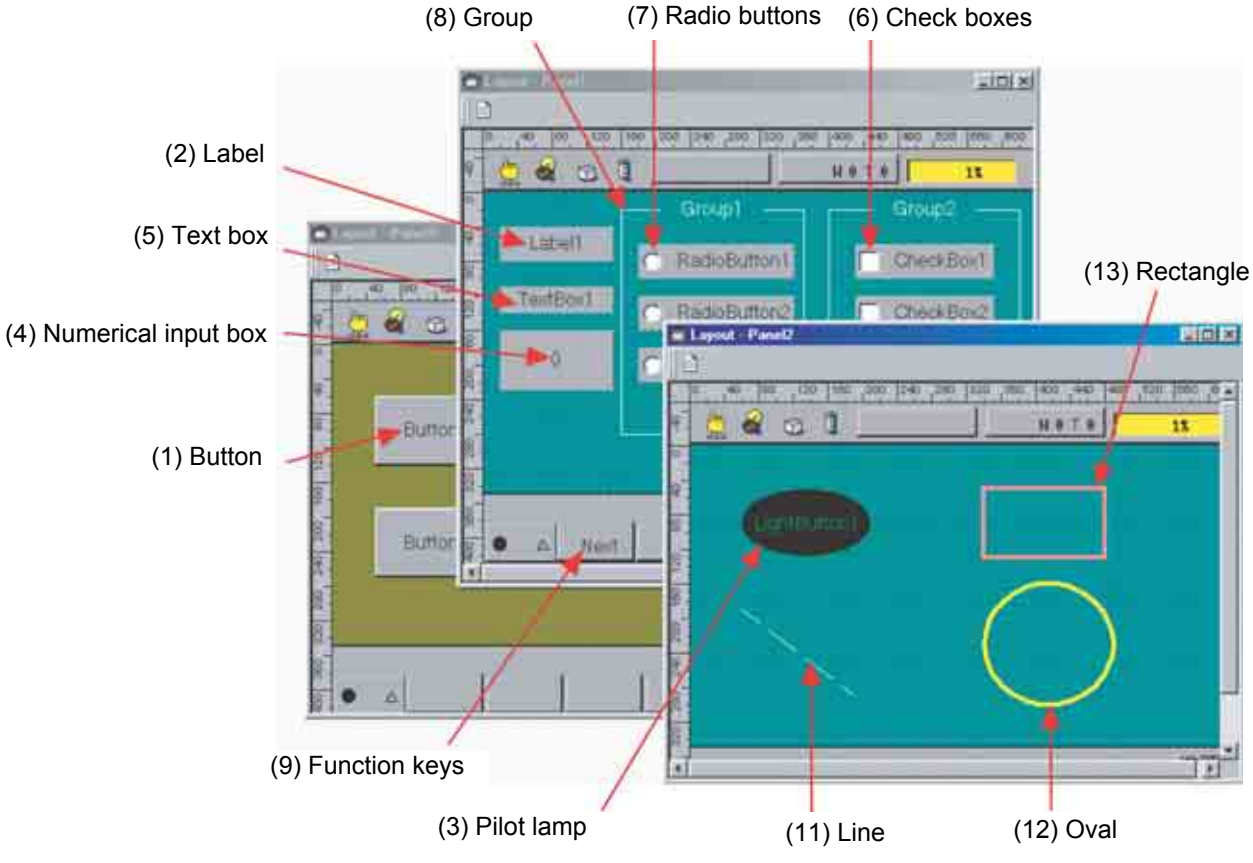
2.2.1 Parts and Their Functions

The following table lists the 14 part types available for building TP panel screen software.

Parts

	Part	Function	Refer to:
(1)	Button	Functions as a push button.	Section 2.2.6 [1]
(2)	Label	Displays text.	[2]
(3)	Pilot lamp	Indicates on/off setting.	[3]
(4)	Numerical input box	Accepts a numerical value from the ten-key pad.	[4]
(5)	Text box	Accepts text from the keyboard.	[5]
(6)	Check box	Turns setting on and off.	[6]
(7)	Radio button	Selects from a group of mutually exclusive choices.	[7]
(8)	Group	Provides mutually exclusive operation for a group of radio buttons.	[8]
(9)	Function key	Configures a teach pendant function key (F1 to F12) for use as a push button.	[9]
(10)	Timer (not shown below)	Triggers action source code at a fixed interval.	[10]
(11)	Line	Displays a straight line.	[11]
(12)	Oval	Displays a circle or oval.	[12]
(13)	Rectangle	Displays a square or rectangle.	[13]
(14)	Illuminated push button (not shown below)	Combines push button and pilot lamp operation.	[14]

Sample TP Panel Screens



2.2.2 Specifying Action Source Code for Parts

A part on a TP panel screen responds to button presses and other events by executing action source code that reads or modifies part properties and performs other operations.

Action Source Code Syntax

An action source code block has the following structure.

```
DEF object_event
    desired operations
END
```

Selecting an object and an event in the editor automatically generates a skeleton consisting of the first (DEF) and last (END) lines. The developer needs only supply the source code specifying the desired response.

The table below lists the possibilities.

Note: The events available depend on the part type.

Event	Description
CLICKED	Button pressed
RELEASED	Button released (See Section 2.2.3.)
TIMER	Interval elapsed
REFRESH	Screen refreshed
INITIALIZE [Version 2.32 or later]	Initializable TP panel opened
DONE [Version 2.32 or later]	OK button pressed

Action Source Code Statements

Action source code blocks consist of two kinds of statements: TP panel control commands and read/write accesses to part properties. Accesses use the standard dot notation: part_name.property.

For a list of part properties and possible values, see Section 3.3.4 "Object Properties."

Action source code blocks can use global variables of type integer, float, double, or string, local variables, and folder variables.

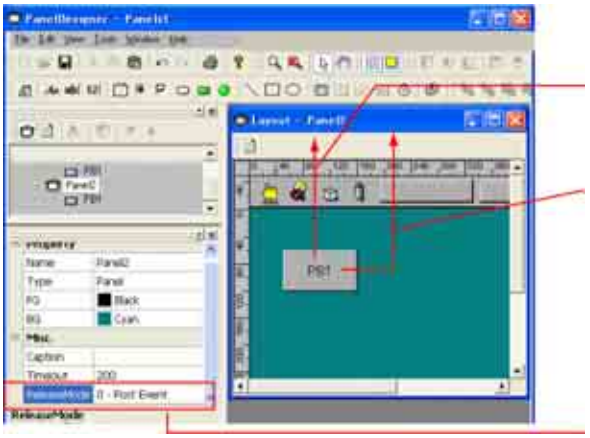
2.2.3 Specifying the RELEASED Event Execution Condition [Version 2.32 or later]

2.2.3.1 Release-mode property added

The release-mode property is added to the property screen, making it possible to specify the RELEASED event execution condition. The property provides the following setting.

Release-mode parameter	The RELEASED event executes:	Remarks
0 - Post Event	Even if a press on the part is released outside the part.	Default in Version 2.32 or later
1 - No Event	Only when a press on the part is released within the part.	Fixed to this setting in Version 2.31 or earlier

Specifying the RELEASED event execution condition



Note: The release-mode parameter can be contained, one per panel file. Changing the parameter applies to all parts containing the RELEASED event.

2.2.3.2 Notes on using the RELEASED event

The RELEASED event cannot be executed if any other screen appears on the current TP panel screen. The following example using the push-button shows the detail.

■ What blocks the execution of the RELEASED event

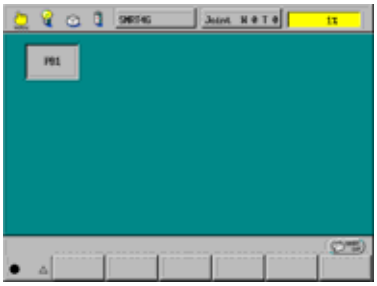
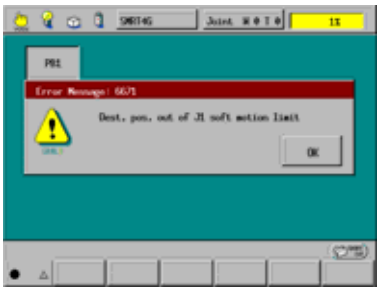
If any of the following conditions arises when the push-button is being pressed, the RELEASE event cannot be executed.

(1) When an error occurs.

(2) When the PRINTMSG command displays the message.

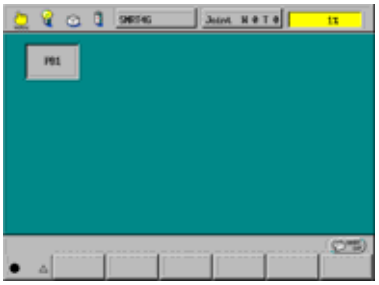
(3) When the PAGE_CHANGE command switches TP panel screens, using the timer.

If blocking the execution of the RELEASED event with the above conditions raises a problem, use a workaround in your program as shown on the next page.

Push-button being pressed		If any of the following conditions arises, releasing the push-button does not execute the RELEASED event:
		(1) When an error occurs. 
		(2) When the PRINTMSG command displays the message. 
		(3) When the PAGE_CHANGE command switches TP panel screens, using the timer. 

■ Program example requiring a workaround

The program example given below turns I/O [128] on only when the push-button is being pressed, so it requires a workaround. (While I/O [128] is on, the external equipment operates.)

Only when the push-button is being pressed, I/O [128] is on.	Program example
	DEF PB1_CLICKED() set IO[128] END DEF PB1_RELEASED() reset IO[128] END

■ Workarounds to the occurrence of errors

(1) Workaround 1

With the supervisory task mode or its extension being enabled, run the following supervisory task that causes a fail-safe operation (that is, turn I/O [128] off) if an error occurs. (Refer to the SETTING-UP MANUAL, Chapter 3, Sections 3.4.10 and 3.4.11.)

```
Program TSR1
   DEFINT ERRCODE
    INITWAITERR              'Initialize WAITERROR data.
       WHILE 1
     ERRCODE=WAITERROR       'Wait until an error occurs.
     IF GETERRLVL(ERRCODE)>1 'If Level 2 or higher error occurs,
       RESET IO[128]         'turn I/O[128] off as fail-safe operation.
       INITWAITERR           'Initialize WAITERROR data.
     ENDIF
   WEND
END
```

(2) Workaround 2

Use a supervisory task that monitors the deadman switch (Enable switch) state and add such a process that turns I/O [128] on or off when the deadman switch is pressed or released, respectively. Accordingly, if an error occurs, releasing the deadman switch causes a fail-safe operation (turn I/O [128] off).

(3) Workaround 3

Modify the program to turn I/O [128] on for the specified time length when the push-button is pressed and to cause no change when the push-button is released. This produces inching-like motion.

Also change the PRINTMSG and PAGE_CHANGE commands to turn I/O [128] on or off when the switch is pressed or released, respectively.

2.2.4 INITIALIZE Event [Version 2.32 or later]

The INITIALIZE event can be added to each panel. It is used to initialize the TP panel layout.

The INITIALIZE event will be called when any of the following conditions arises.

(1) When pressing [F5 Panel] starts the TP panel screen software.

(2) When booting the controller starts the TP panel screen software.

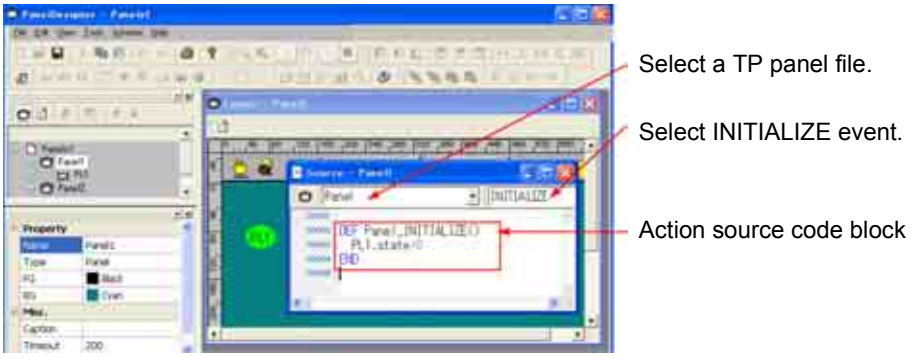
(3) When the PAGE_CHANGE command switches the TP panel screen.

Step 1

Select a TP panel file, and the INITIALIZE event only becomes available.

Selecting the INITIALIZE event automatically generates a skeleton consisting of the first (DEF) and last (END) lines as shown below.

```
DEF Panel_INITIALIZE()
END
```



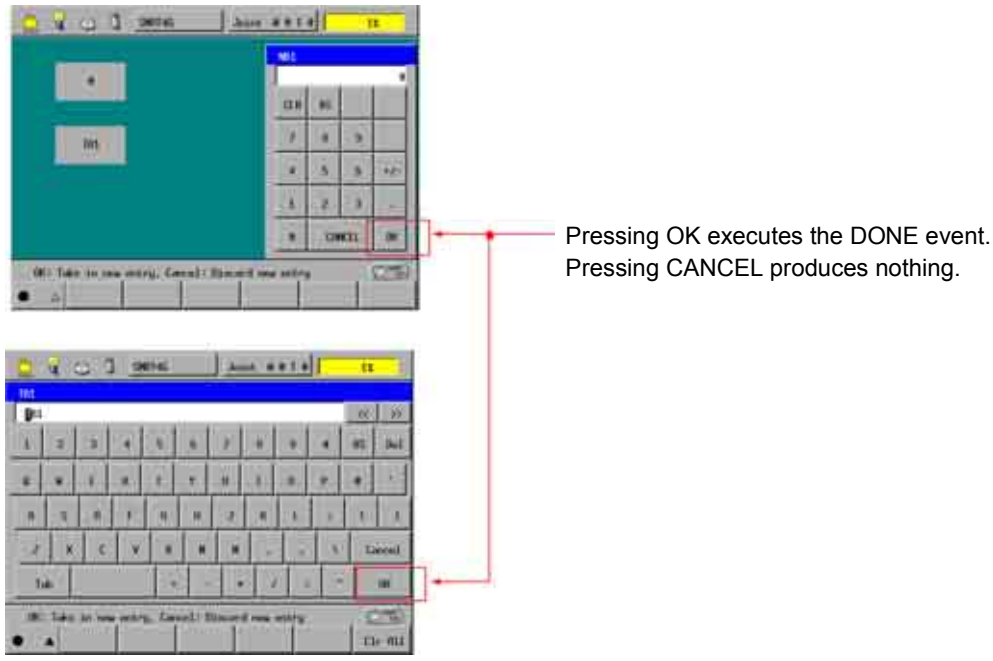
Step 2

Flesh out the skeleton with action source code.

Note: The PAGE_CHANGE command cannot be used for this source code.

2.2.5 DONE Event [Version 2.32 or later]

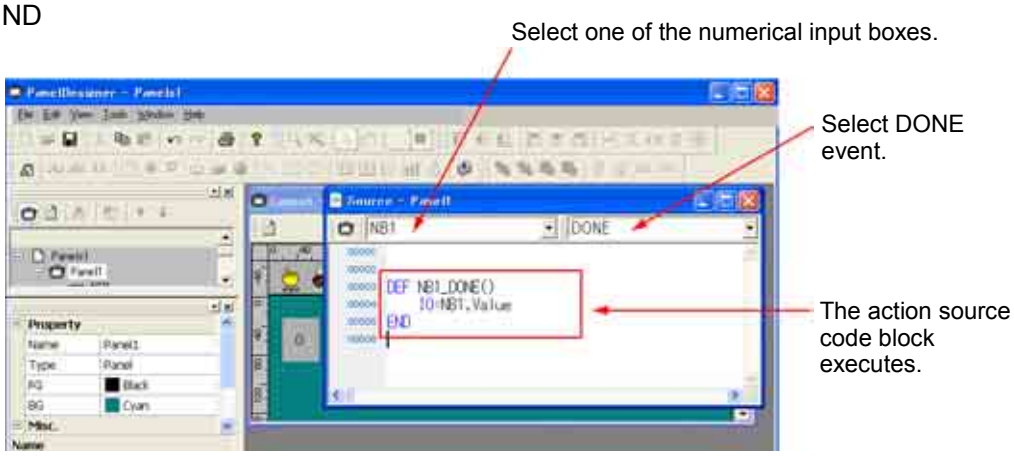
The DONE event is added to the "Numerical input box" and "Text box." Pressing the OK button on the numerical input box or the text box executes the DONE event.



Example: Numerical input box

Step 1 Select one of the numerical input boxes and select the DONE event. The action source code block in the following skeleton will be executed.

```
DEF NB1_DONE()
END
```



DONE event example: "IO=NB1.Value"

In this example, pressing the OK button sets the property value of the selected part to a global variable.

2.2.6 Part Descriptions

[1] Button

This part has two events: CLICKED and RELEASED.

Button Example

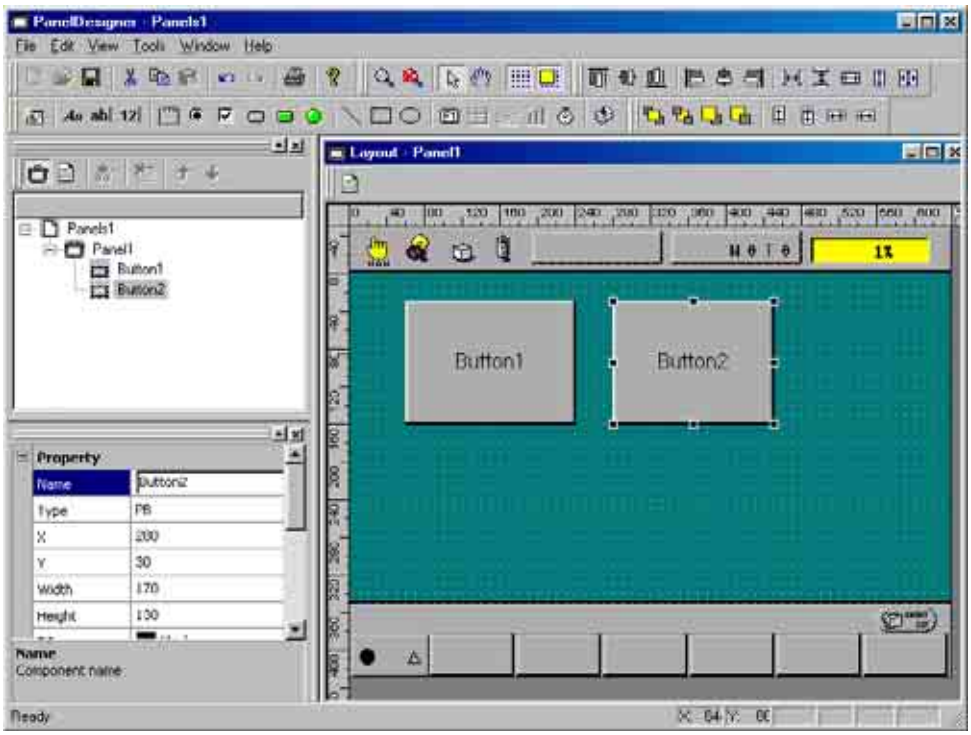
The following example illustrates the procedure for creating two buttons: one (labeled "I/O operation") that turns I/O variable #24 on as long as it is pressed and another (labeled "Program_run") that runs a program (Sample pro).

Step 1

Create a panel layout with two buttons.

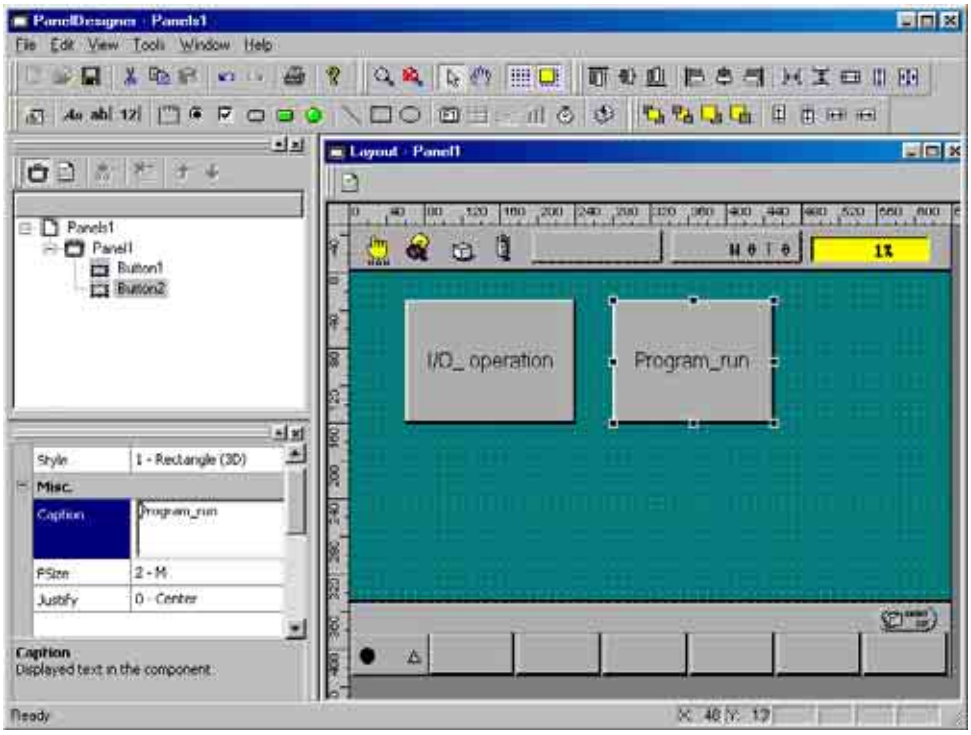
The buttons can go anywhere within the boundaries of the teach pendant screen.

All parts, not just buttons, have a unique name providing read/write accesses to part properties from the part itself as well as other parts on the same TP panel. The editor uses as its default Button plus a number, but the developer is free to change names. The following example simply uses the default names: "Button1" and "Button2."



Step 2

Label the buttons by changing their caption properties.

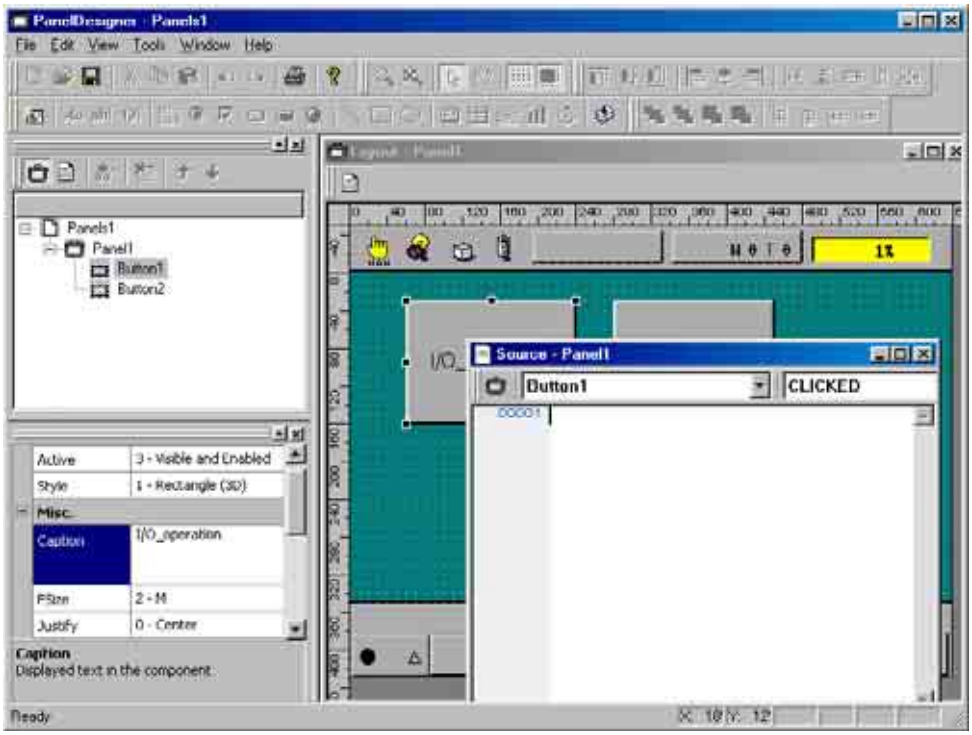


Step 3

Adding action source code

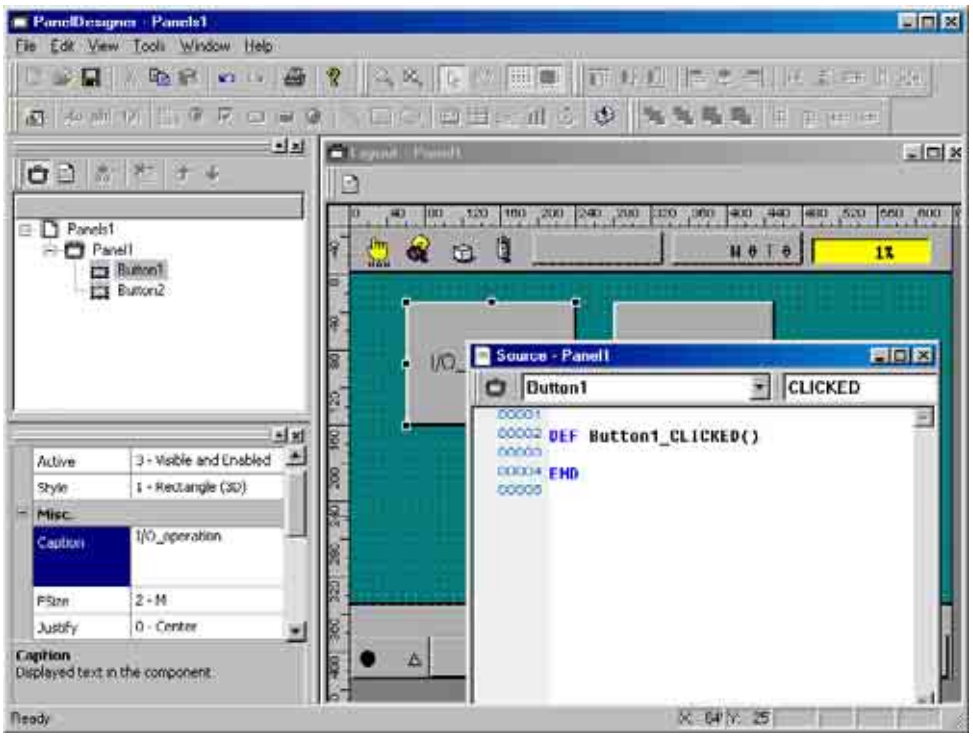
A button has separate action source code blocks for the events CLICKED and RELEASED. The following example shows how to add action source code for these two events.

Double-clicking the button labeled "I/O operation" opens an empty Source Code Edit window.



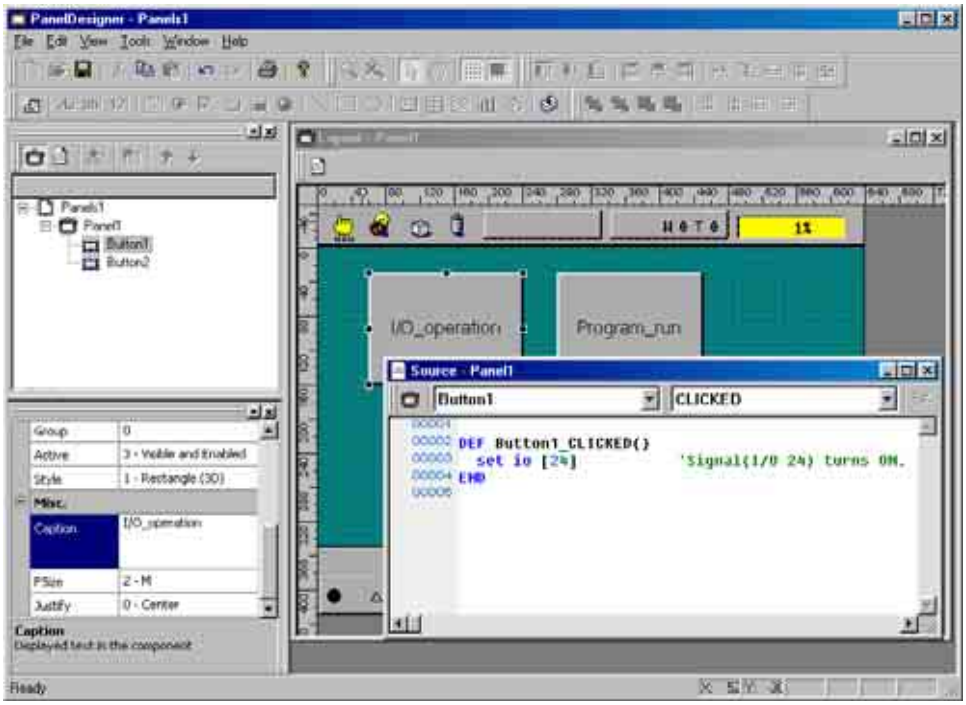
Step 4

Start by adding action source code to turn I/O variable #24 on when the button is pressed. Selecting the combination Button1 and CLICKED from the Part and Event list boxes at the top of the Source Code Edit window automatically generates the corresponding 3-line action source code block skeleton on the editor screen.

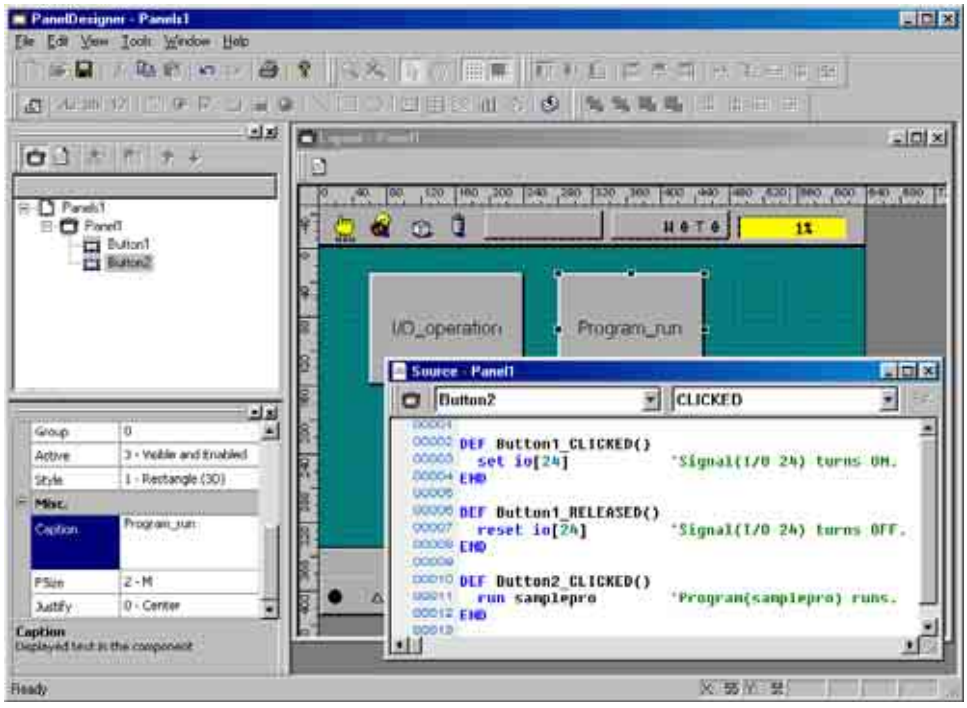


Step 5

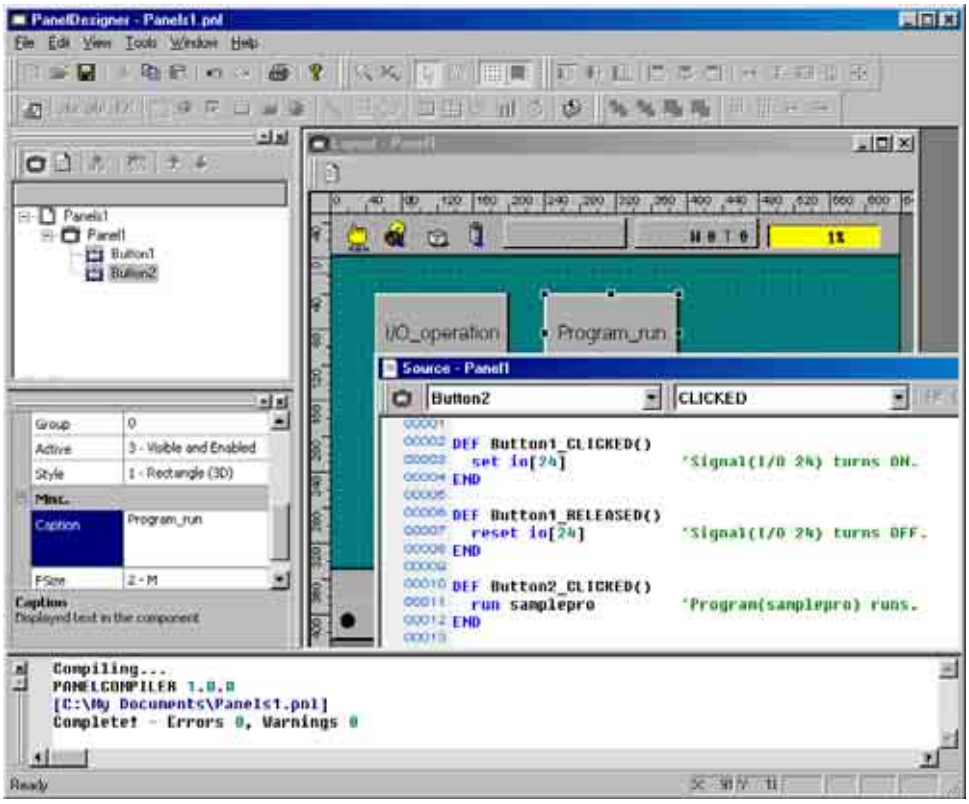
Flesh out the skeleton with action source code.



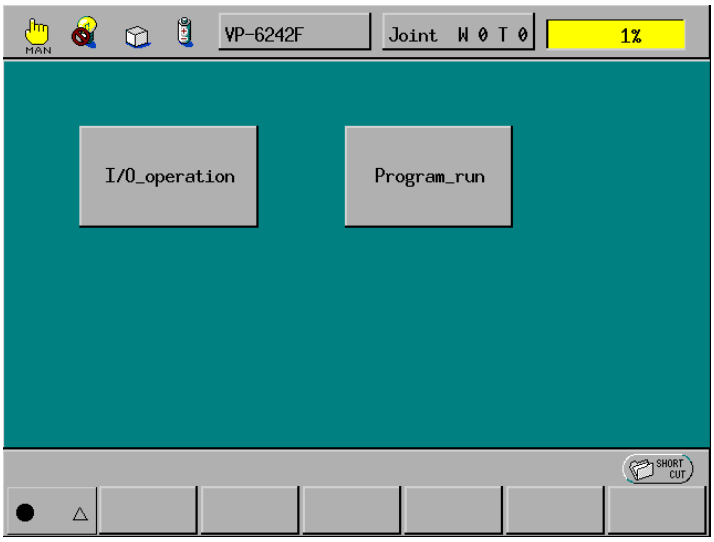
Step 6 Similarly add action source code to turn I/O variable #24 off when Button1 is released (RELEASED) and to run a program (Sample pro) when Button2 is pressed (CLICKED).



Step 7 When the panel layout is complete, save it to disk, and compile the file to check for syntax, typing, or other errors.



Step 8 If the compile operation is successful, download the results to the controller with WINCAPSIII.



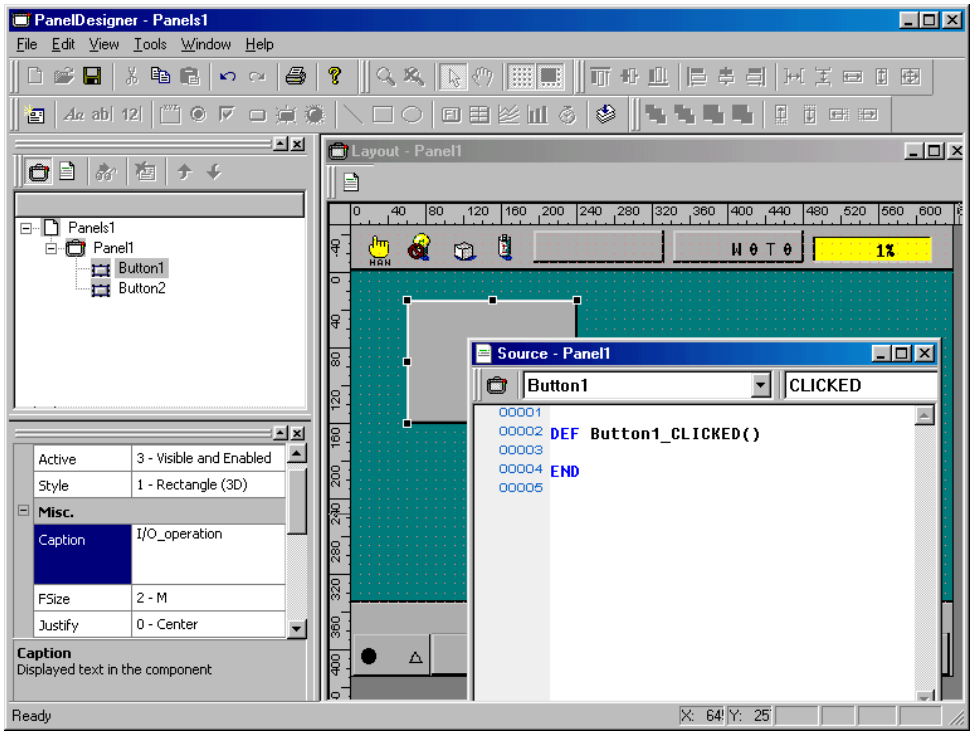
Step 9 **Changing button properties**

Color, position, and other button properties support read/write access from the part itself as well as other parts on the same TP panel using the standard dot notation: part_name.property.

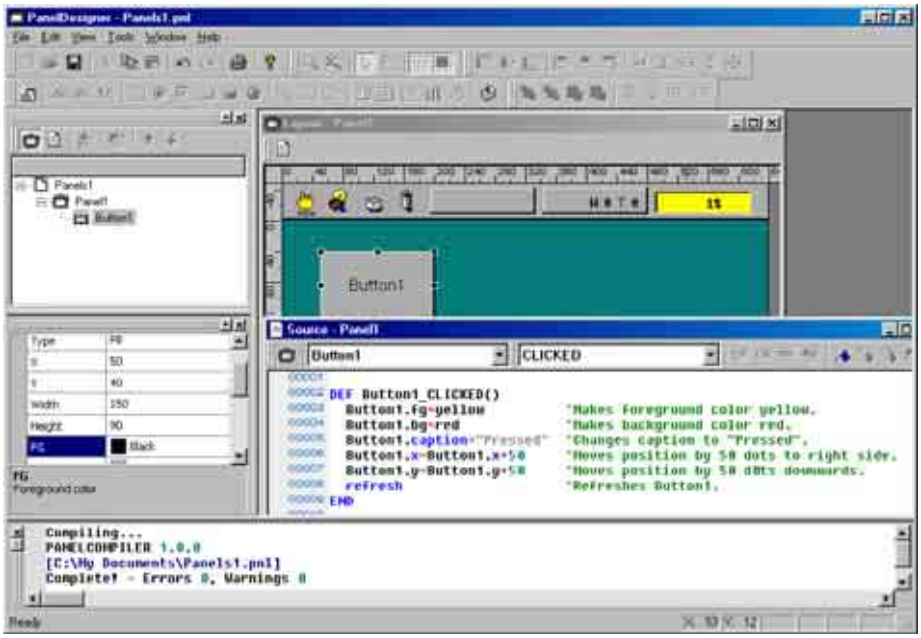
For a list of part properties and possible values, see Section 3.3.4 "Object Properties."

The following example changes the foreground color (.fg), background color (.bg), display text (.caption), horizontal position (.x), and vertical position (.y).

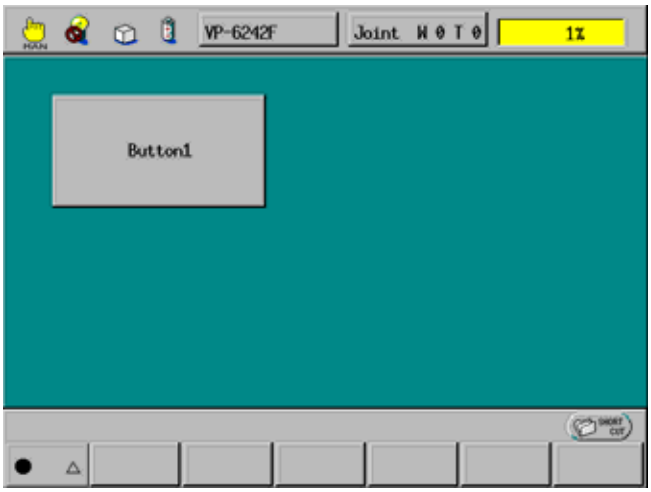
Start by loading the editor, adding a button, and opening the corresponding Source Code Edit window as above.



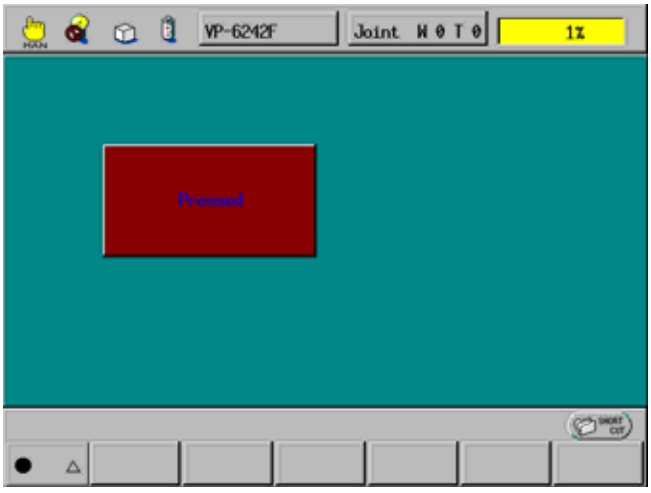
Step 10 Type in the source code as shown below.



Step 11 Save the edits, compile the file, and download the results to the controller as before.



TP Panel Screen with Button Pressed



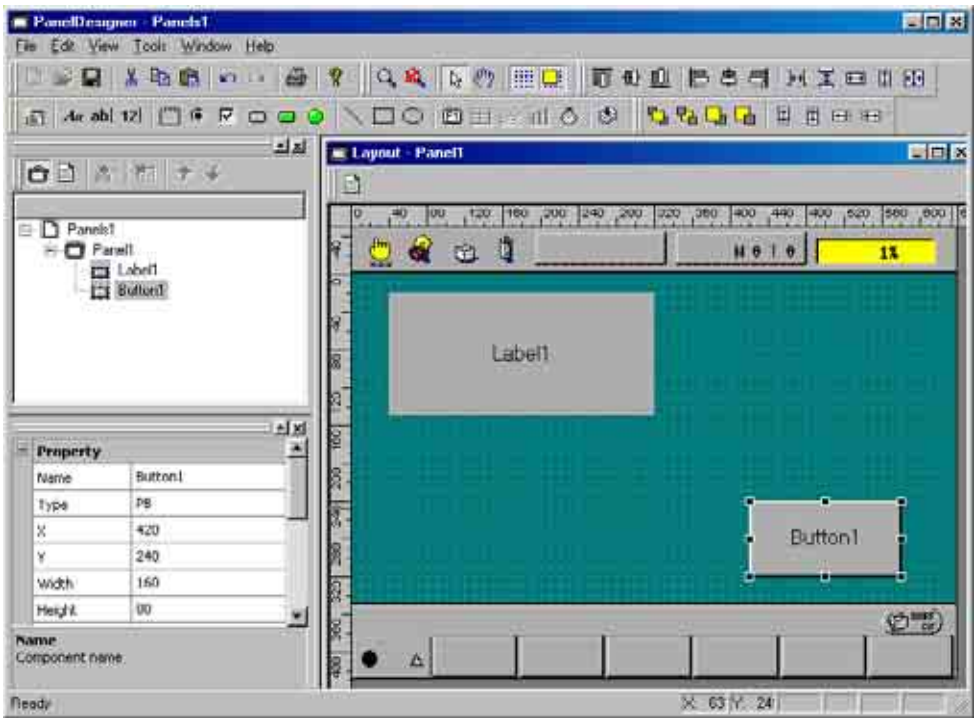
[2] Label

This part simply displays text. It supports no events, so does not accept action source code.

Label Example

The following example shows how pressing a button on the same screen can change label properties.

Step 1 Load the editor and place a label and a button on the panel layout.



Step 2

Changing label properties

The label properties for display text, color, font size, and character position support read/write access using the standard dot notation: part_name.property.

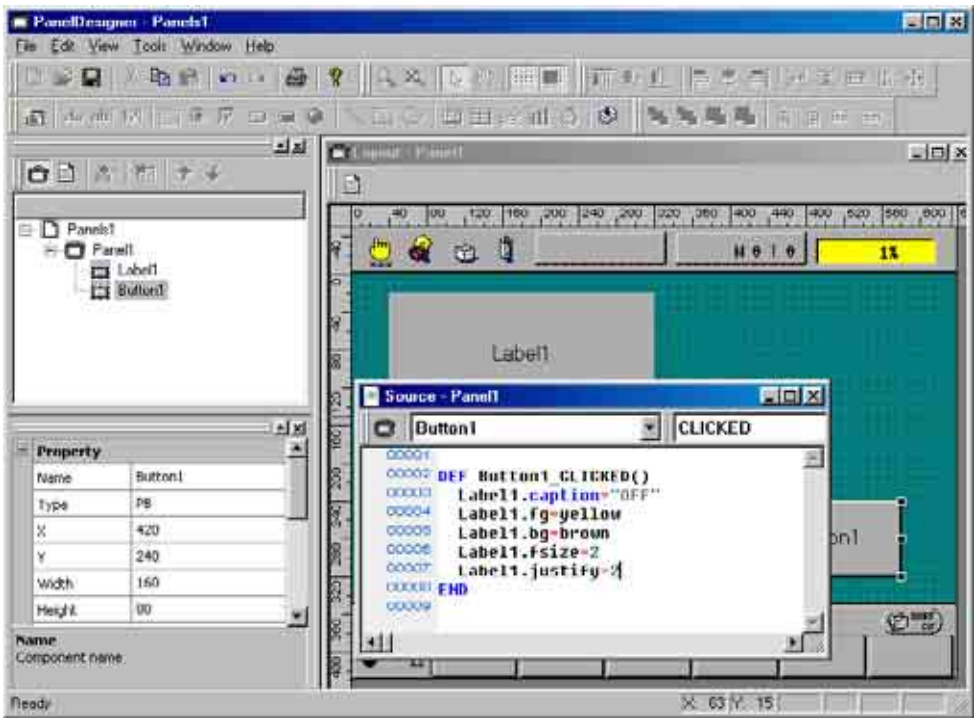
Changing the display text for the part named Label1 to "Off" requires the following line.

Label1.caption="Off"

Changing the foreground color to yellow, the background color to brown, the font size to big, and the character position to left-justified requires the following lines.

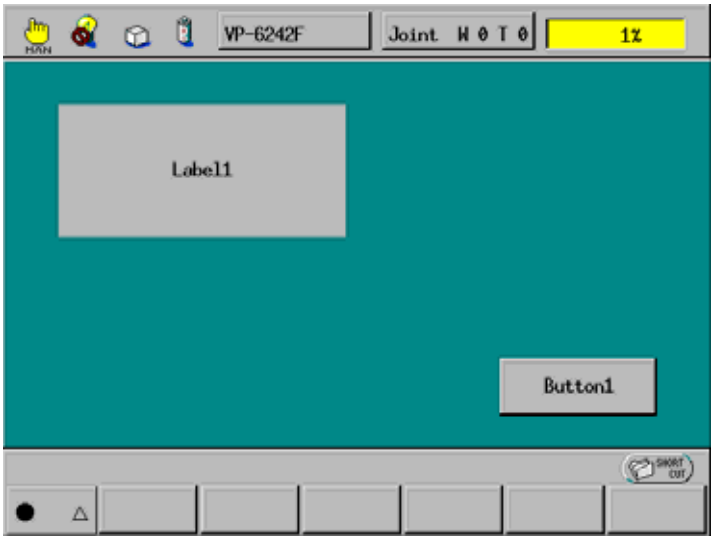
Label1.fg=yellow	Foreground color: Yellow
Label1.bg =brown	Background color: Brown
Label1.fsize=2	Font size: Big
Label1.justify=2	Character position: Left-justified

Add the above to the skeleton created in the Source Code Edit window for pressing Button1.

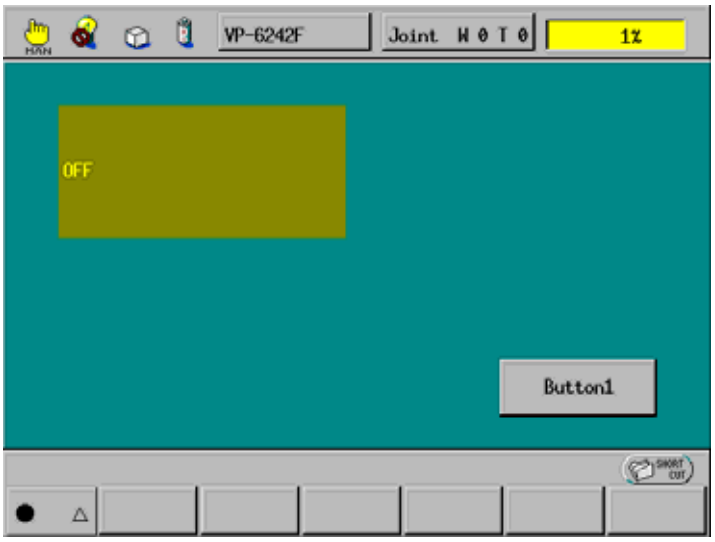


Step 3 Compiling this panel layout and downloading it to the controller produces the following display when the button is pressed.

Before pressing button



After pressing button



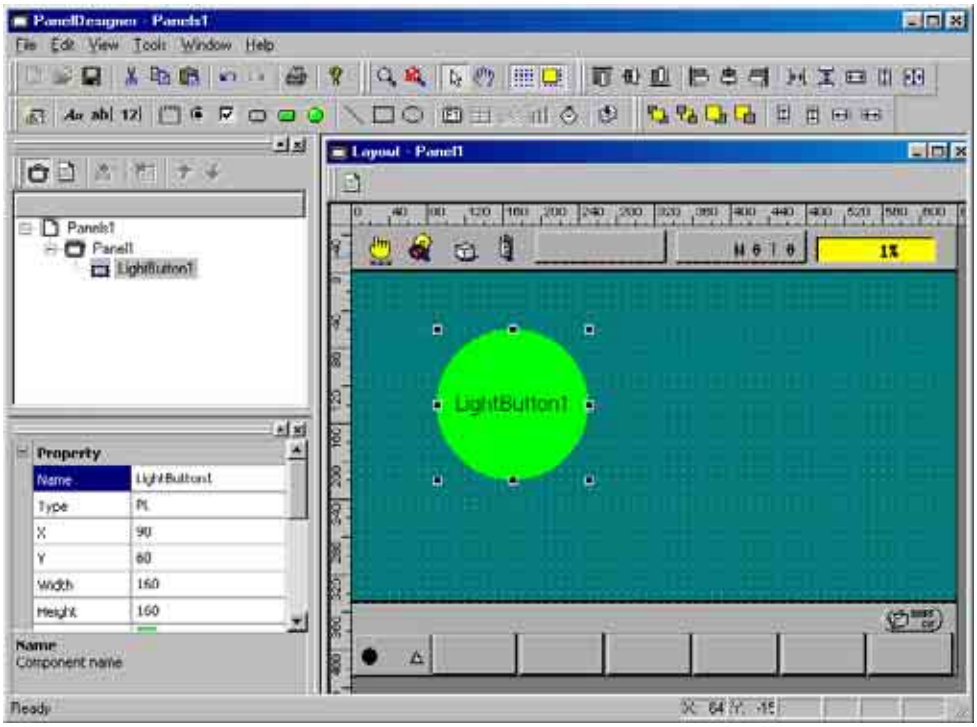
[3] Pilot Lamp

This part has two display states (ON and OFF) and generates REFRESH events at regularly scheduled intervals to allow visual monitoring of some state.

Lamp Example

The following example uses a lamp to monitor an I/O state.

Step 1 Load the editor and place a lamp on the panel layout.

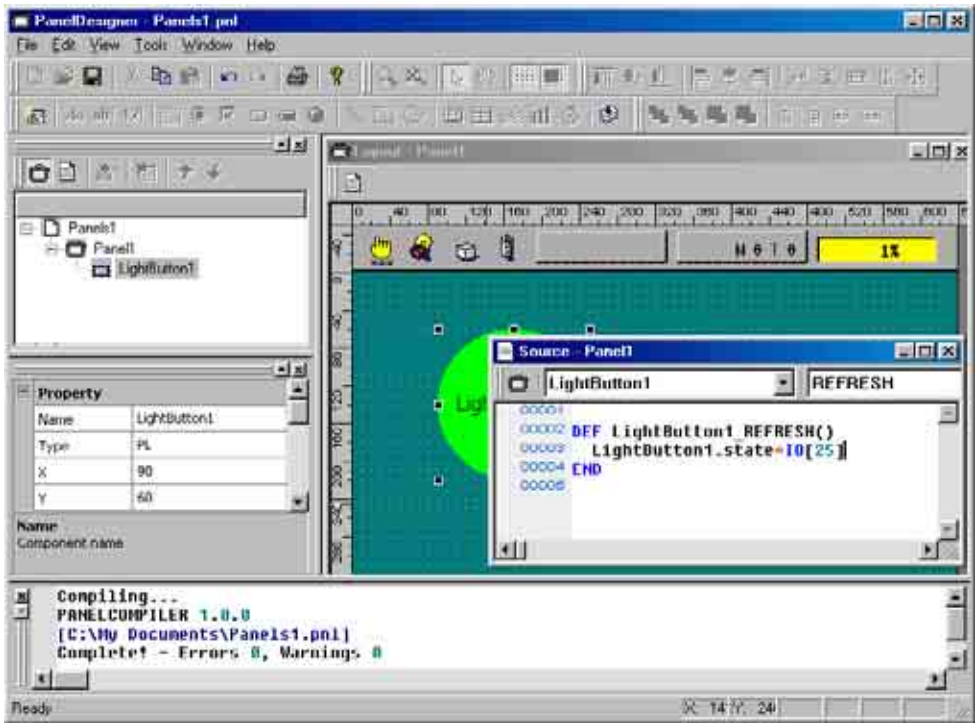


Step 2

Adding action source code

This part generates REFRESH events at regularly scheduled intervals. Use these to visually monitor I/O variable #25 by turning the lamp ON and OFF as appropriate. In the Source Code Edit window, select the lamp's REFRESH event and add the following line to the skeleton automatically created.

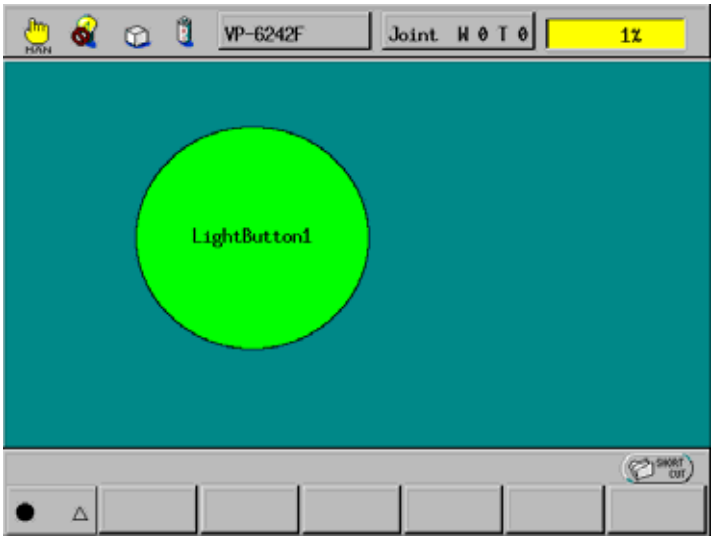
This statement means update the lamp state from the IO[25] state.



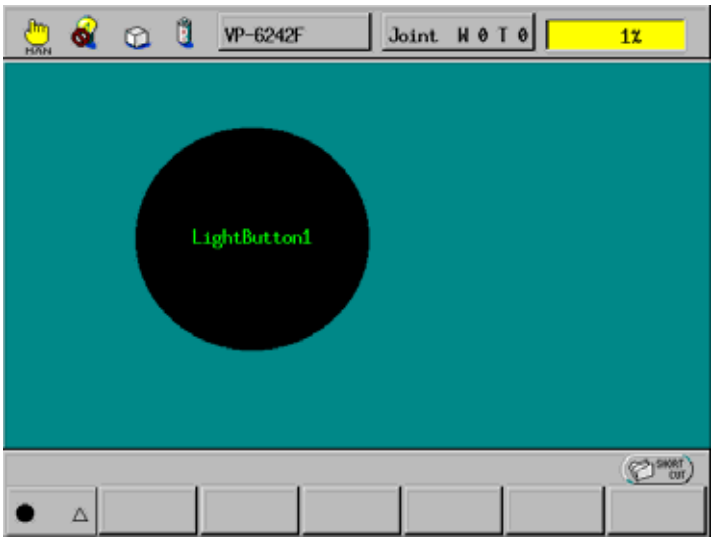
Step 3

Compiling this panel layout and downloading it to the controller produces the following displays.

Lamp on



Lamp off



Step 4

Changing lamp properties

The procedures for accessing properties are the same as for all other parts.

[4] Numerical Input Box

This part is a button that displays a numerical value. Pressing this button switches the pendant operation screen to ten-key pad input for directly updating that value.

This part has CLICKED and RELEASED events similar to those for buttons.

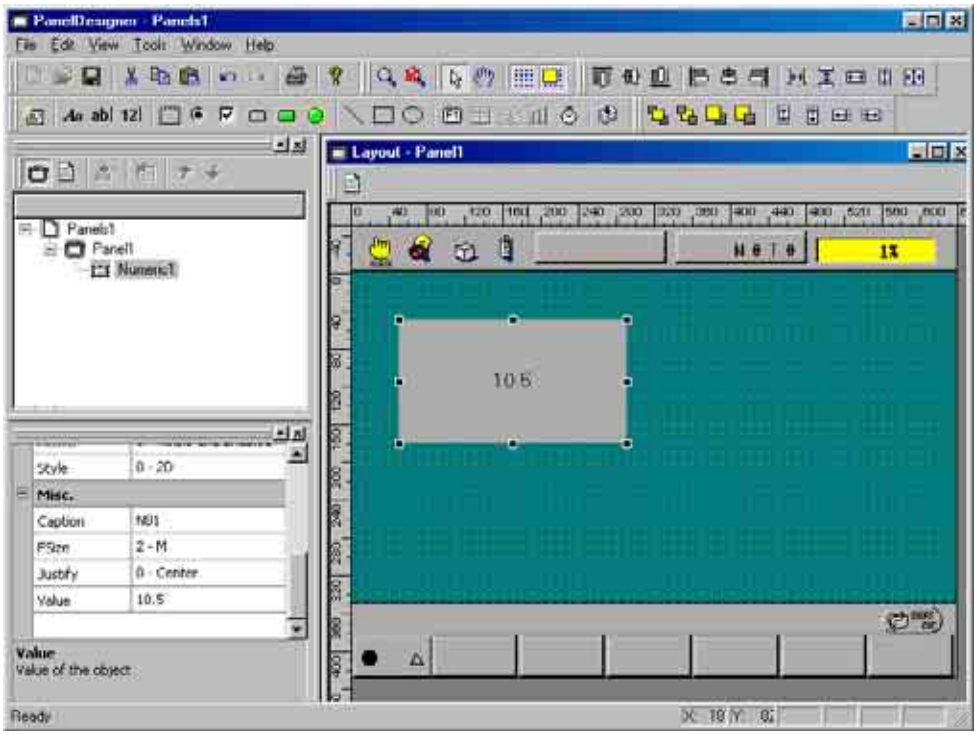
Note: In Version 2.32 or later, the DONE event is added to this part. For details, see Section 2.2.5 "DONE Event."

Numerical Input Box Example

Step 1

Load the editor and place a numerical input box on the panel layout.

(Optional) Specify an initial value.



Step 2

Adding action source code

The procedures for adding action source code are the same as for buttons.

Step 3

Changing numerical input box properties

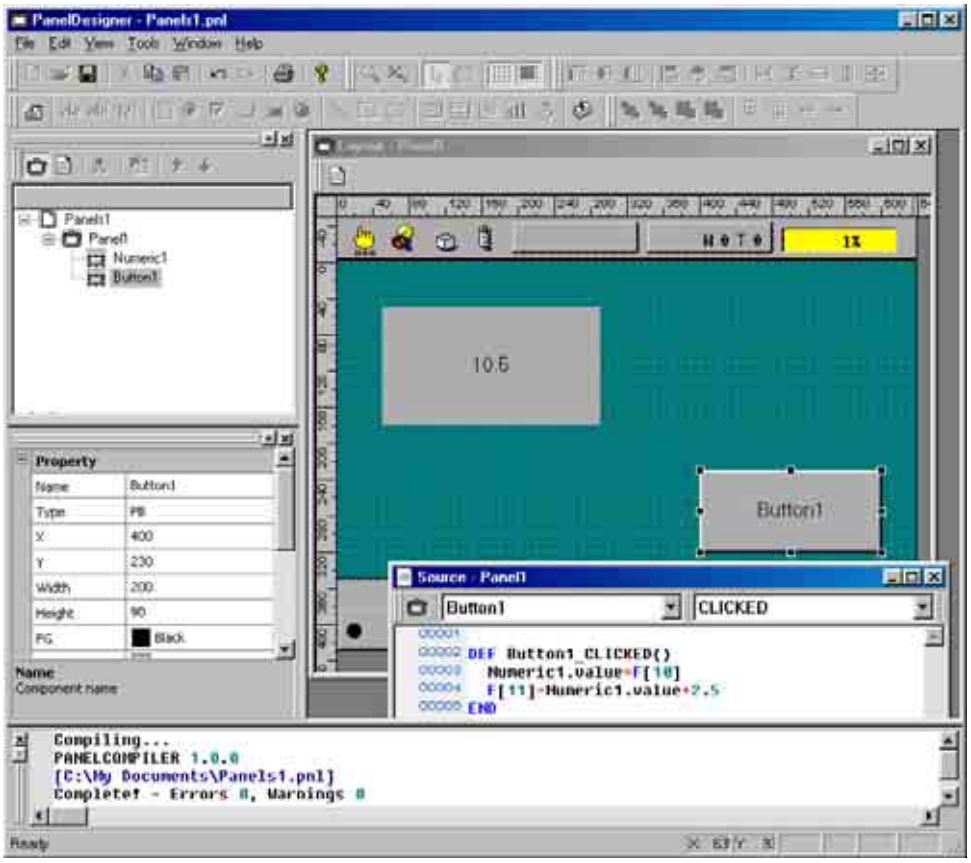
In addition to the color, position, and other properties that this part shares with buttons, it has the unique properties of a floating-point value (.value) and display format, decimal or hexadecimal (.style).

This example uses a button press on the same screen to read global string variable #10 into a text box and store that value in global string variable #11.

Load the editor and place a numerical input box and button on the panel layout.

Open the Source Code Edit window, select Button1 and CLICKED to create the action source code skeleton, and add the following lines.

The procedures for accessing properties are the same as for all other parts.



[5] Text Box

This part is a button that displays a string. Pressing this button switches the pendant operation screen to keyboard input for directly updating that string.

This part has CLICKED and RELEASED events similar to those for buttons.

Note: In Version 2.32 or later, the DONE event is added to this part. For details, see Section 2.2.5 "DONE Event."

Text Box Example

Step 1

Load the editor and place a text box on the panel layout.

(Optional) Specify an initial value.

Step 2

Add action source code

This part has CLICKED and RELEASED events similar to those for buttons.

Step 3

Changing text box properties

In addition to the color, position, and other properties that this part shares with buttons, this part it has the unique property of a display string (.text).

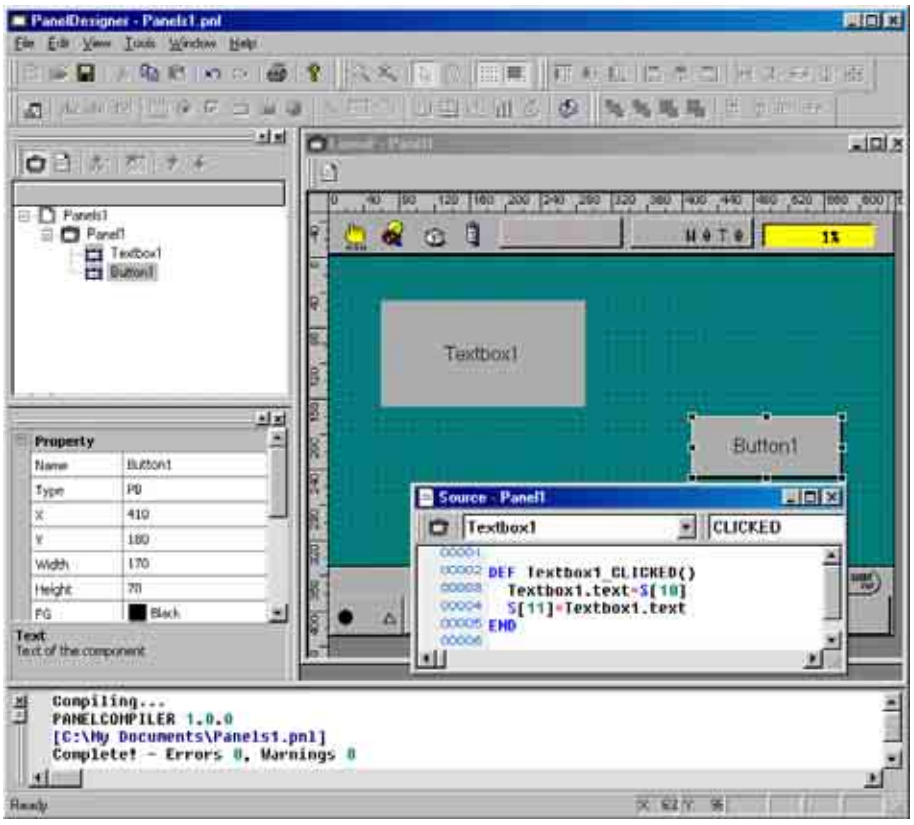
This example uses a button press on the same screen to read global string variable #10 into a text box and store that value in global string variable #11.

Load the editor and place a text box and button on the panel layout.

Open the Source Code Edit window, select Button1 and CLICKED to create the action source code skeleton, and add the following lines.

The procedures for accessing properties are the same as for all other parts.

```
Textbox1.text=S[10]
S[11]=Textbox1.text
```



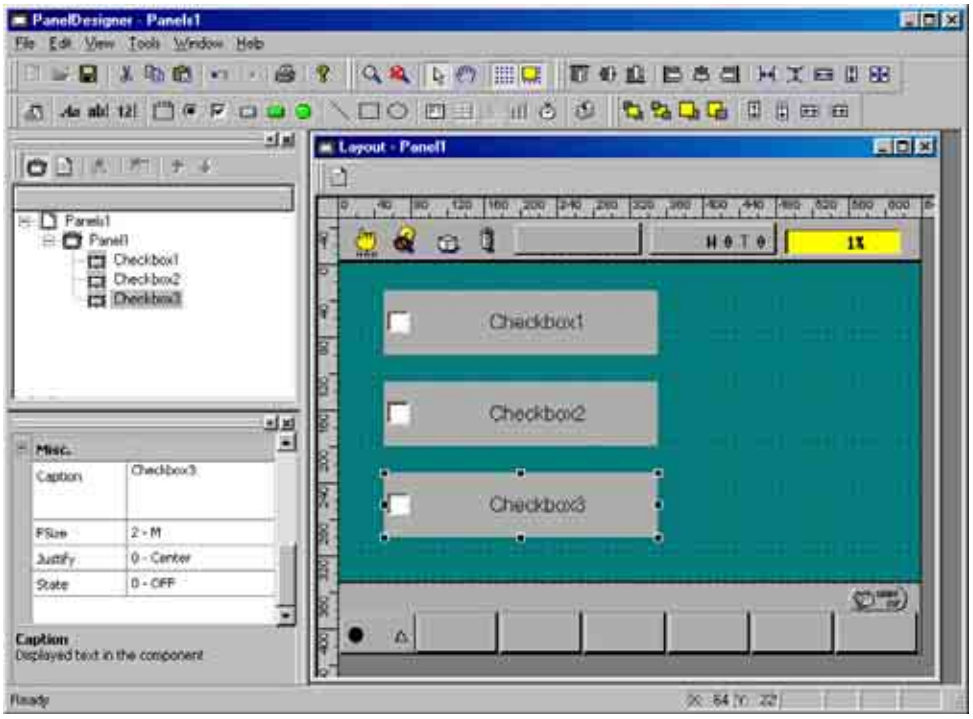
[6] Check Box

This part toggles a setting between on and off. Access to this setting is via the property state.

This part has other properties similar to buttons and labels.

Check Box Example

Step 1 Load the editor and place a check box on the panel layout.



Step 2 **Adding action source code**

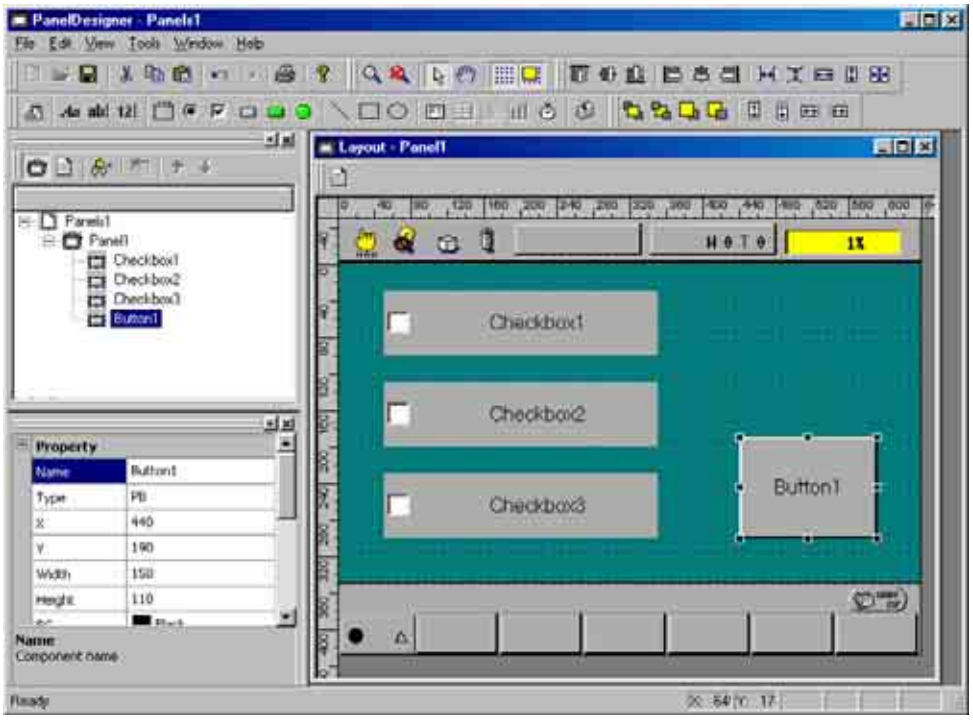
This part has CLICKED and RELEASED events similar to those for buttons.

Step 3

Read/write access to check box properties

This example shows how pressing a button on the same screen can update IO[24] to IO[26] from a set of check boxes.

Add a button to the panel layout.

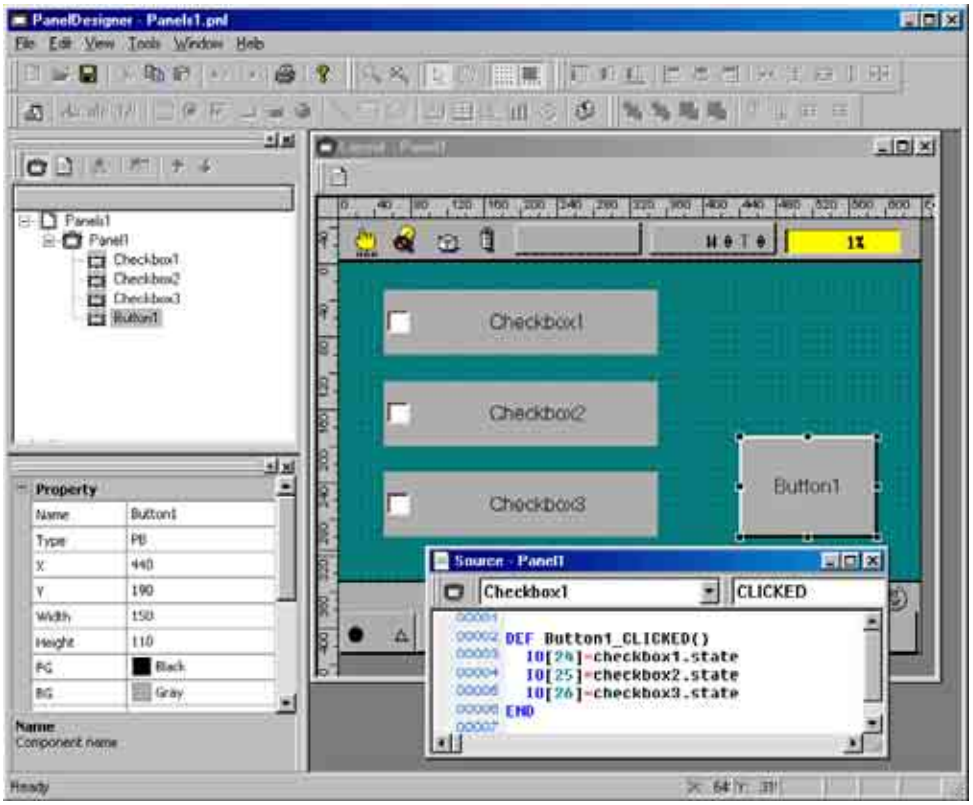


Step 4

Open the Source Code Edit window, select Button1 and CLICKED to create the action source code skeleton, and add the following lines for reading the check box properties (.state).

IO[24] = checkbox1.state
IO[25] = checkbox2.state
IO[26] = checkbox3.state

Compile this panel layout, download it to the controller, and test.



[7] Radio Button

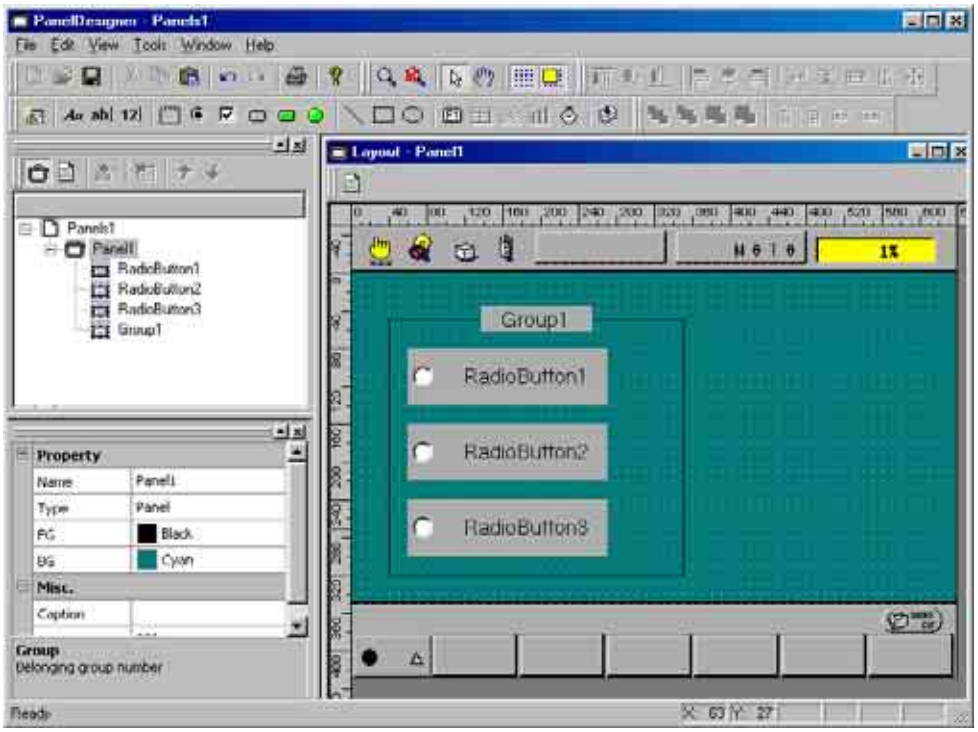
A group (described below) of these parts provides a set of mutually exclusive settings.

These parts have ON/OFF properties (.state) similar to those for lamps and check boxes.

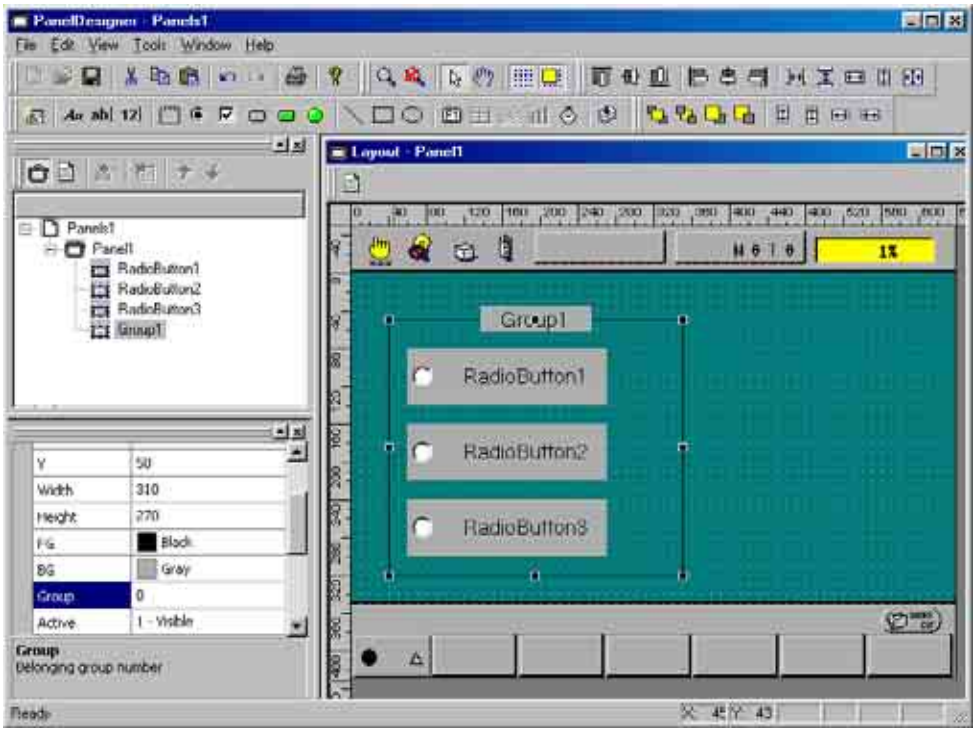
Radio Button Example

The following example uses radio buttons for three mutually exclusive settings.

Step 1 Load the editor and place a group with three radio buttons on the panel layout.



Step 2 Set the property group for all radio buttons to the group number for the group to ensure mutually exclusive operation of the radio buttons within the group. This example uses group number 0.



Step 3 **<u>Adding action source code</u>**

This part has CLICKED and RELEASED events similar to those for buttons.

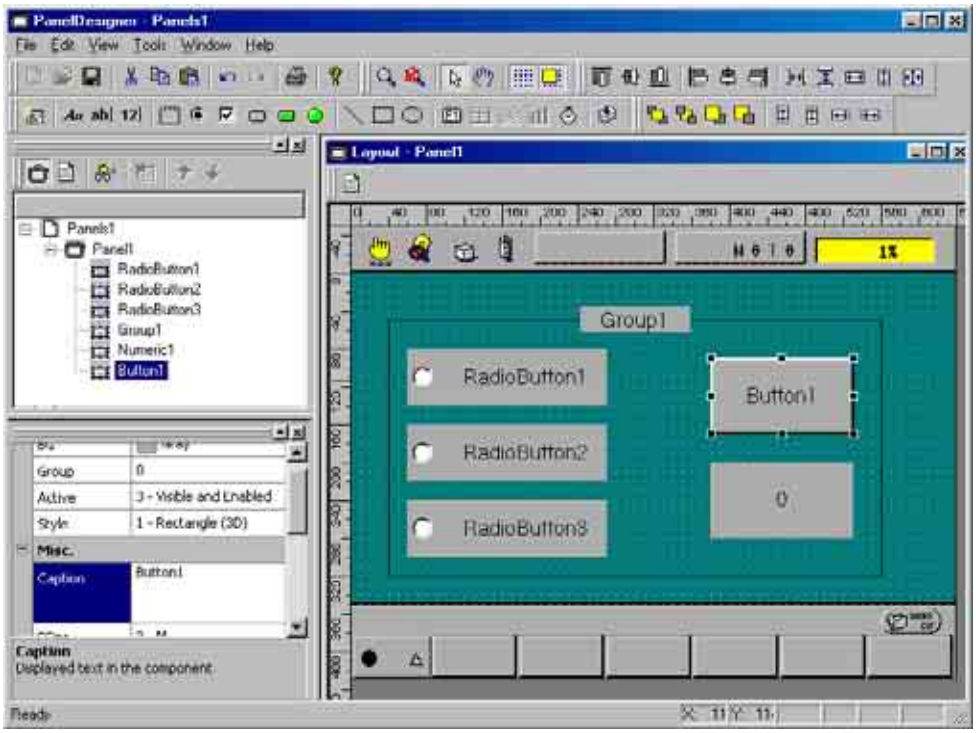
Step 4

Changing radio button properties

Radio buttons have properties similar to those for buttons and labels.

This example shows how pressing a button (Button1) on the same screen can update both the corresponding output (IO[24] to IO[26]) and a numerical input box from the corresponding global float variable (F[10] to F[12]) based on the current states of the radio buttons (RadioButton1 to RadioButton3).

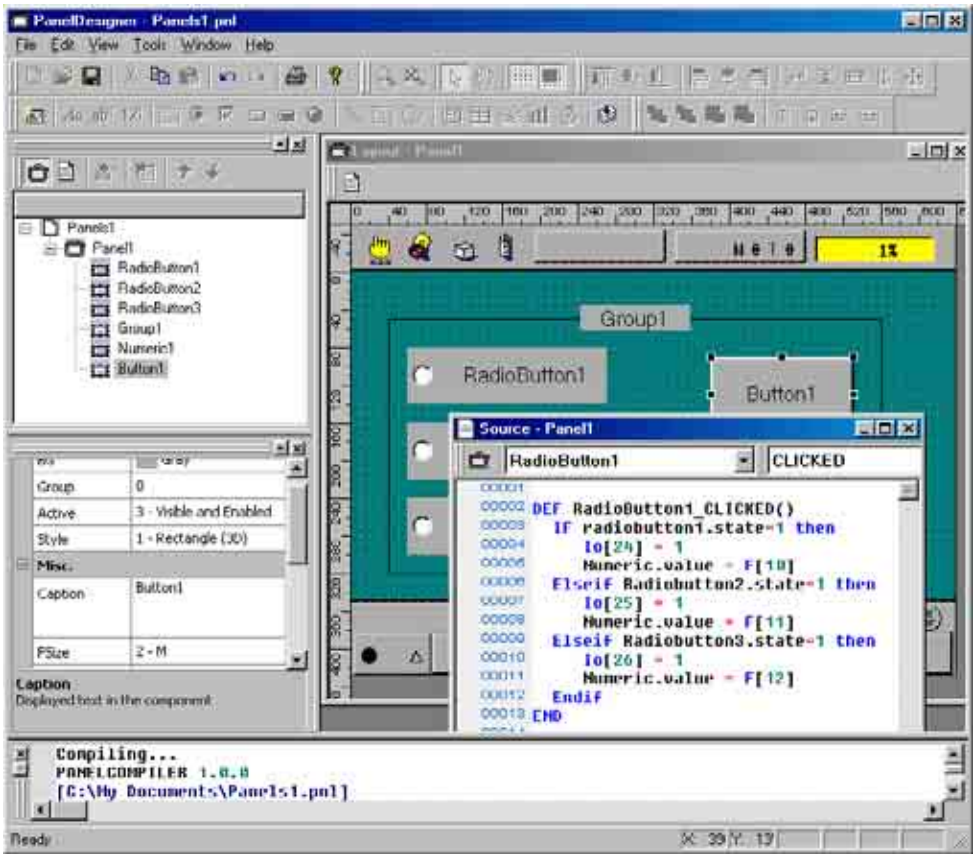
Add the button and numerical input box to the panel layout.



Step 5

Open the Source Code Edit window, select Button1 and CLICKED to create the action source code skeleton, and add the following IF statement branching on the radio button properties (.state).

```
If radiobutton1.state=1 then
  Io[24] = 1
  Numeric1.value = F[10]
Elseif radiobutton2.state=1 then
  Io[25] = 1
  Numeric2.value = F[11]
Elseif radiobutton3.state=1 then
  Io[26] = 1
  Numeric1.value = F[12]
End if
```



Compile this panel layout, download it to the controller, and test.

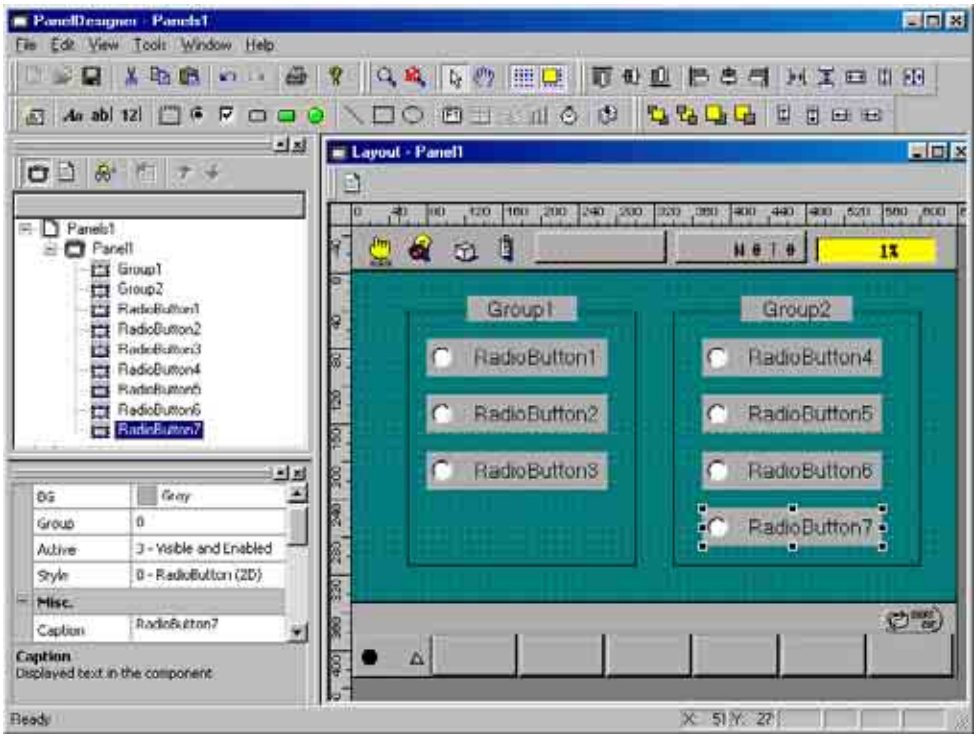
[8] Group

This part provides mutually exclusive operation for a set of radio buttons.

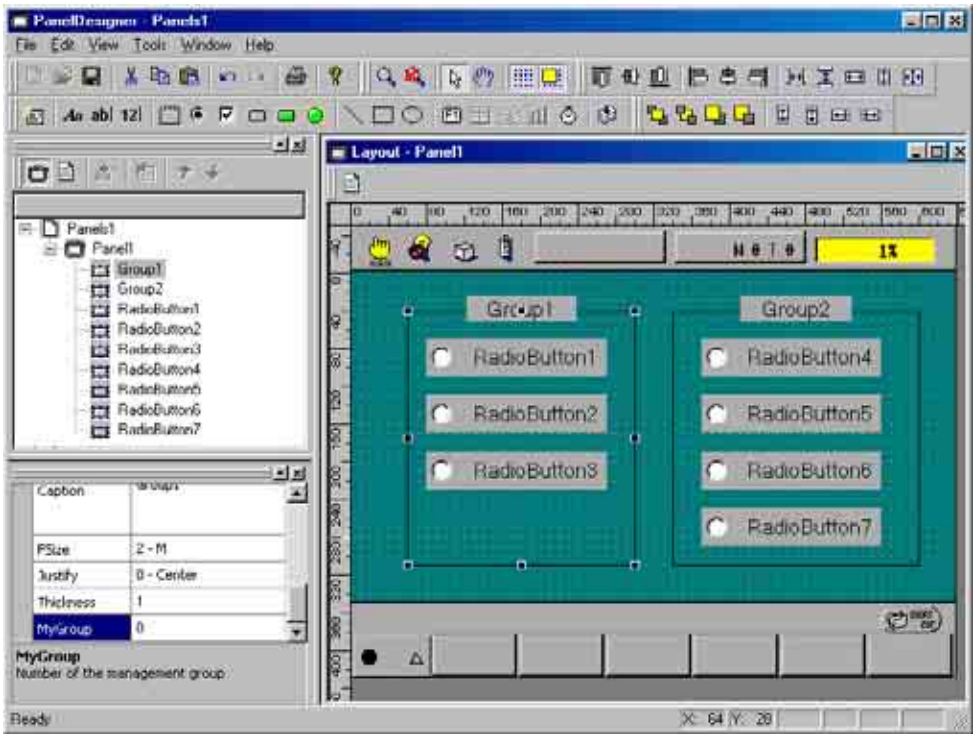
Group Example

The following example demonstrates mutually exclusive operation with two sets of radio buttons.

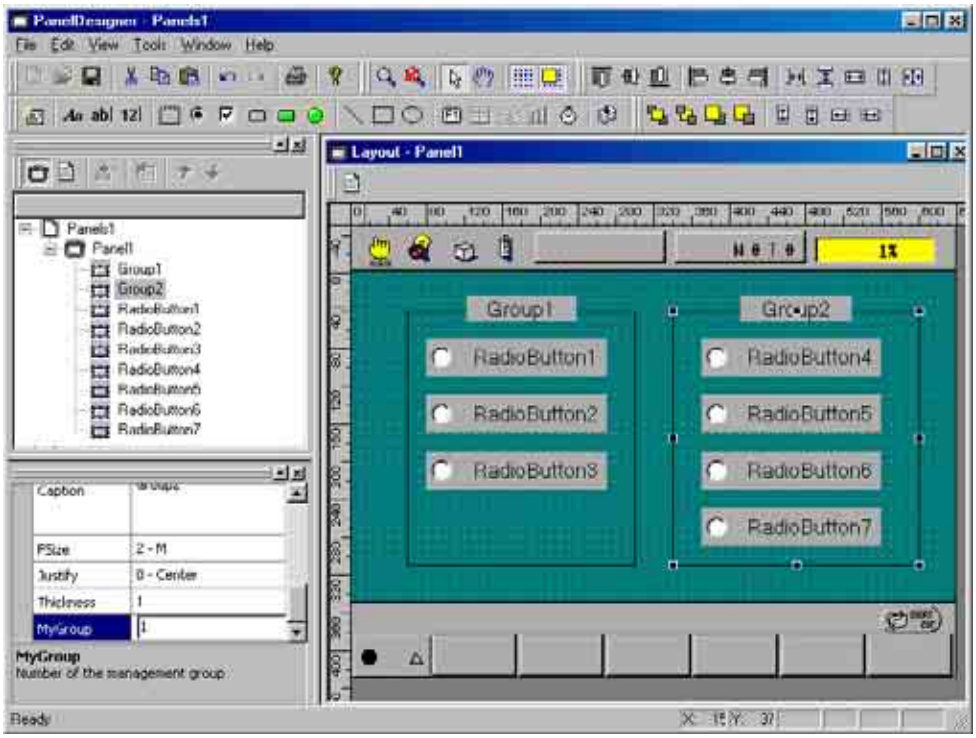
Step 1 Place two groups with three and four radio buttons respectively on the panel layout.



Step 2 Assign group number 0 to Group1 and 1 to Group2.



Step 3 Set the property group for all radio buttons to the group number for the group to which they belong to ensure mutually exclusive operation within the group.



[9] Function Key

This part resembles buttons in assigning captions to pendant function keys and action source code to function key presses, but it lacks the position properties of other parts because the pendant function keys have fixed positions, specified by number (.index).

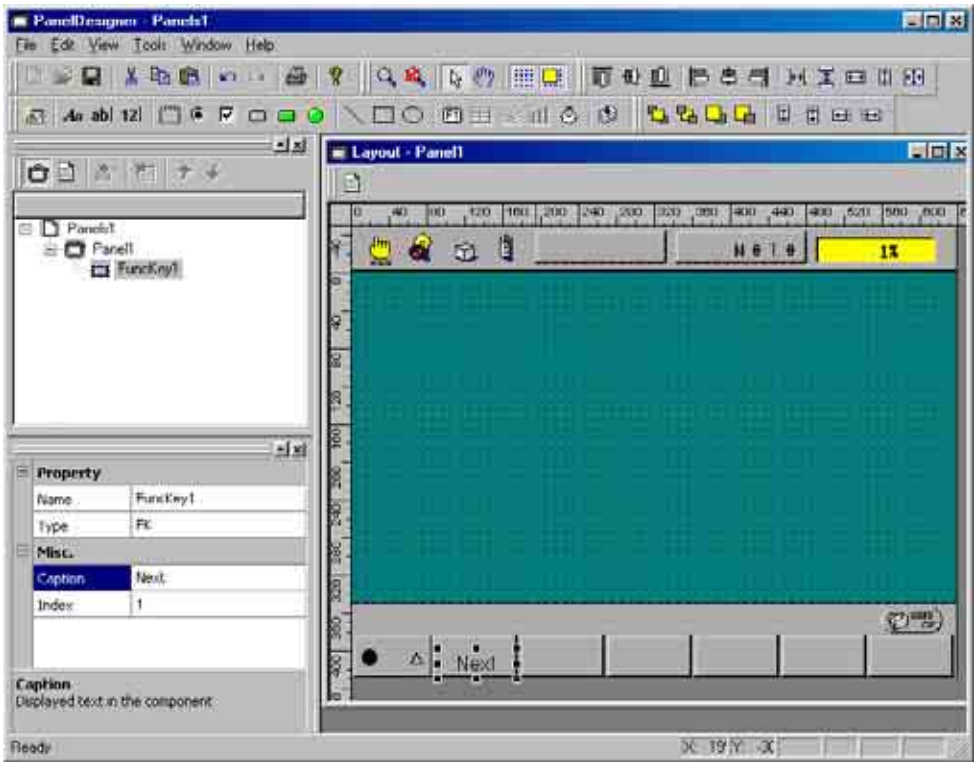
Note: In Version 2.32 or later, the RELEASED event is added to this part.

Function Key Example

Step 1

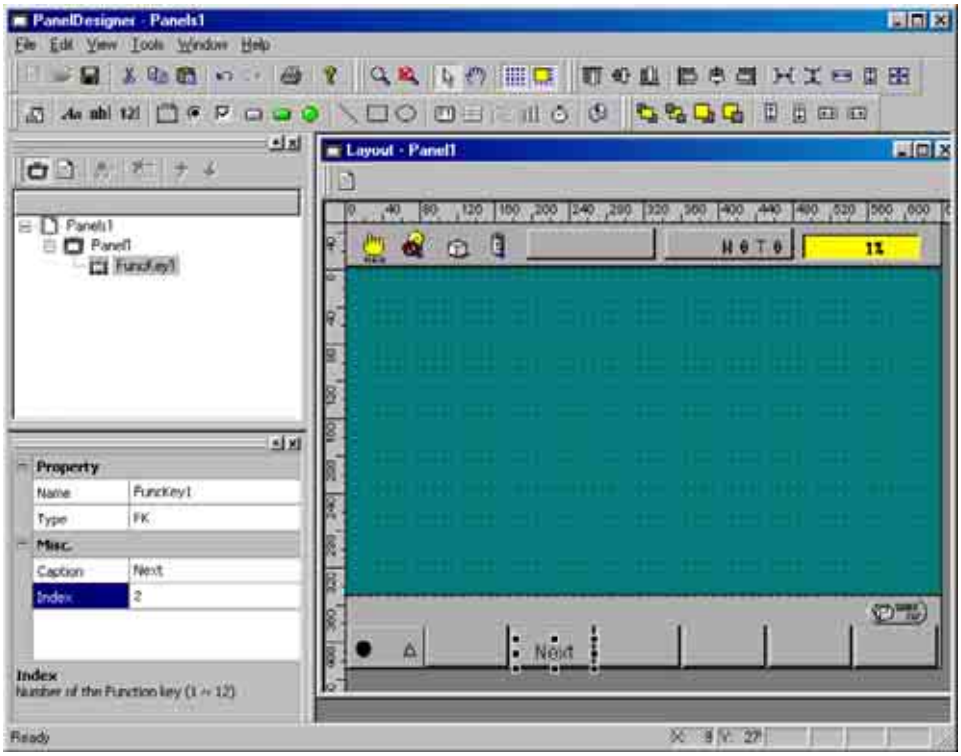
Load the editor and place the function key anywhere on the panel layout in the Layout window. Note, however, that the final result will not appear at this position, but on the corresponding function key on the teach pendant screen.

Specify "Next panel" as the display text (.caption) for the function key.



Step 2

Specify the desired function key number (0 to 9). This example uses #2.

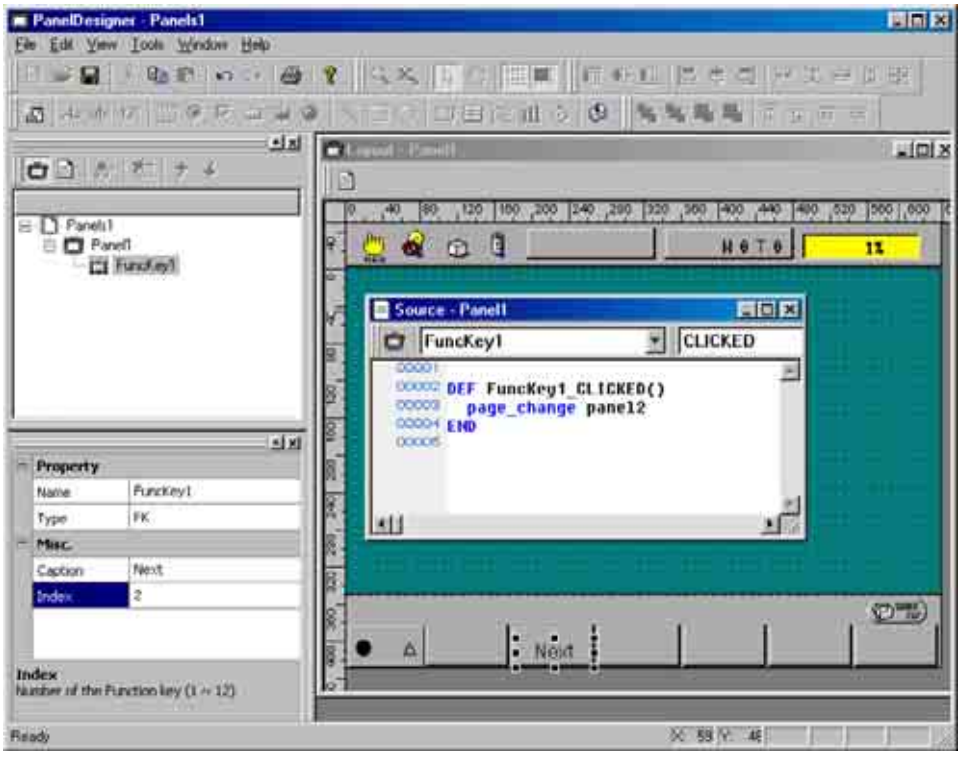


Step 3

Adding action source code

This part differs from buttons and other parts in supporting only a single event, CLICKED.

This example responds to the key press by switching to a different panel, Panel2.



Step 4

Changing function key properties

This part differs from other parts in offering only a single property, caption. Access is the same as for other parts.

[10] Timer

This part automatically triggers action source code for the TIMER event at the interval specified by the property interval.

Timer Example

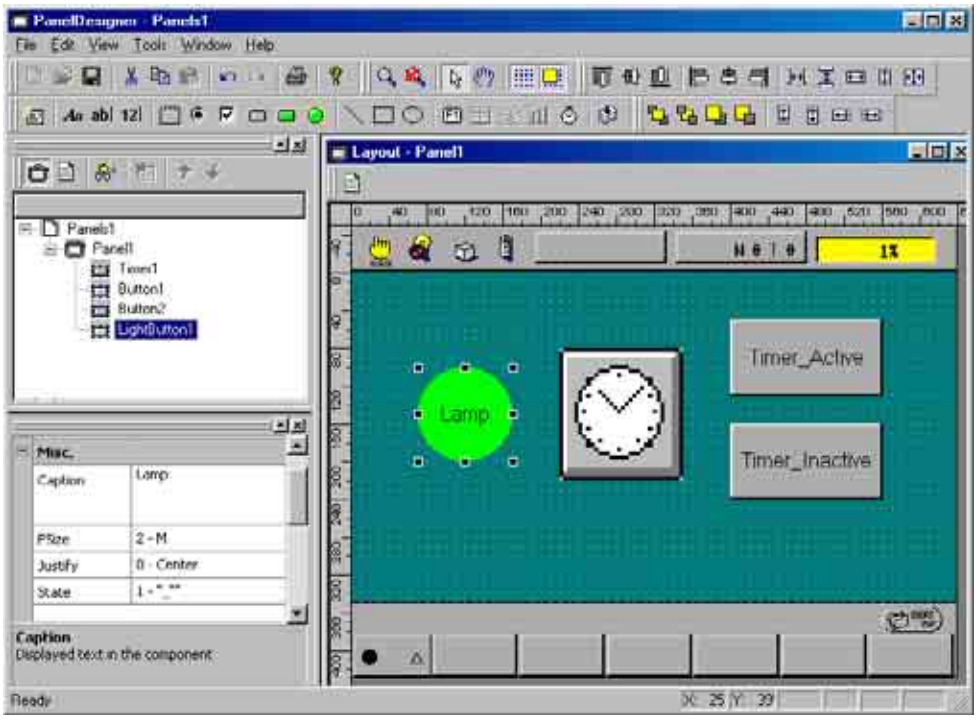
Step 1 Load the editor and place a timer anywhere on the panel layout in the Layout window. Note, however, that the final result will not appear on the teach pendant screen.

Step 2 **Changing timer properties**

The main properties here are active, which controls (and indicates) timer status, and interval, which controls event frequency.

This example uses buttons to enable and disable a timer which alternately switches a pilot lamp on and off.

Load the editor and place a timer, two buttons, and a pilot lamp on the panel layout in the Layout window.



Step 3

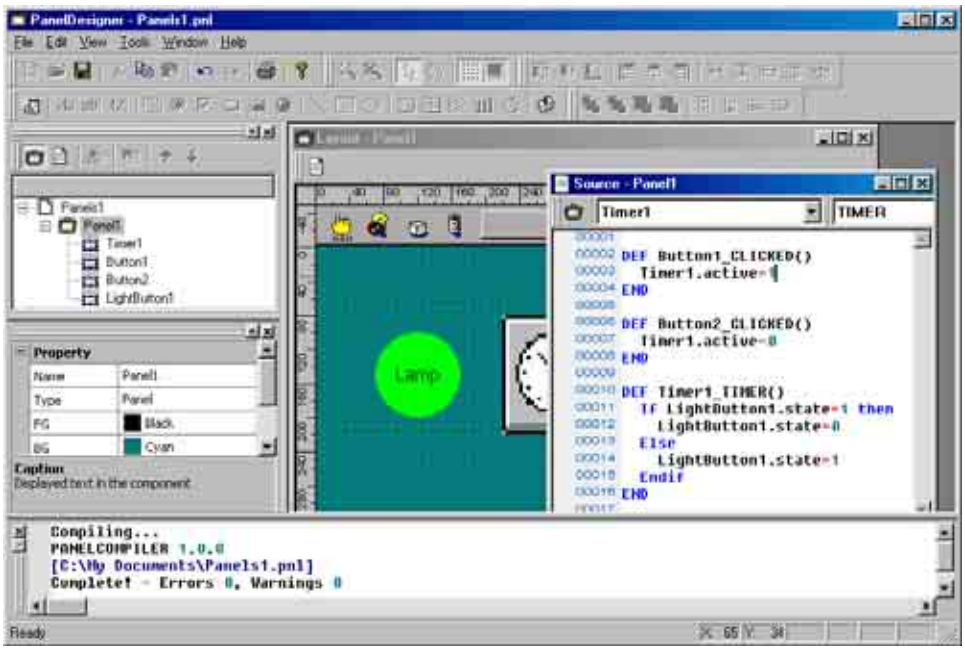
Adding action source code

Open the Source Code Edit window, select Timer1 and TIMER, create the action source code skeleton, and add the following line to switch the lamp ON and OFF.

```
If Lightbutton1.state = 1 then
  Lightbutton1.state = 0
Else
  Lightbutton1.state = 1
End if
```

Add the following lines so that the CLICKED events for Button1 ("Start") and Button2 ("Stop") respectively enable and disable the timer.

```
Timer1.active = 1
Timer1.active = 0
```



[11] Line

This part draws a straight line with the specified pattern on the panel layout.

The parts line, oval, and rectangle are for drawing only. They support no events. Nevertheless, other parts on the same screen can still change their properties.

Line Example

Step 1 Load the editor and place a line on the panel layout.

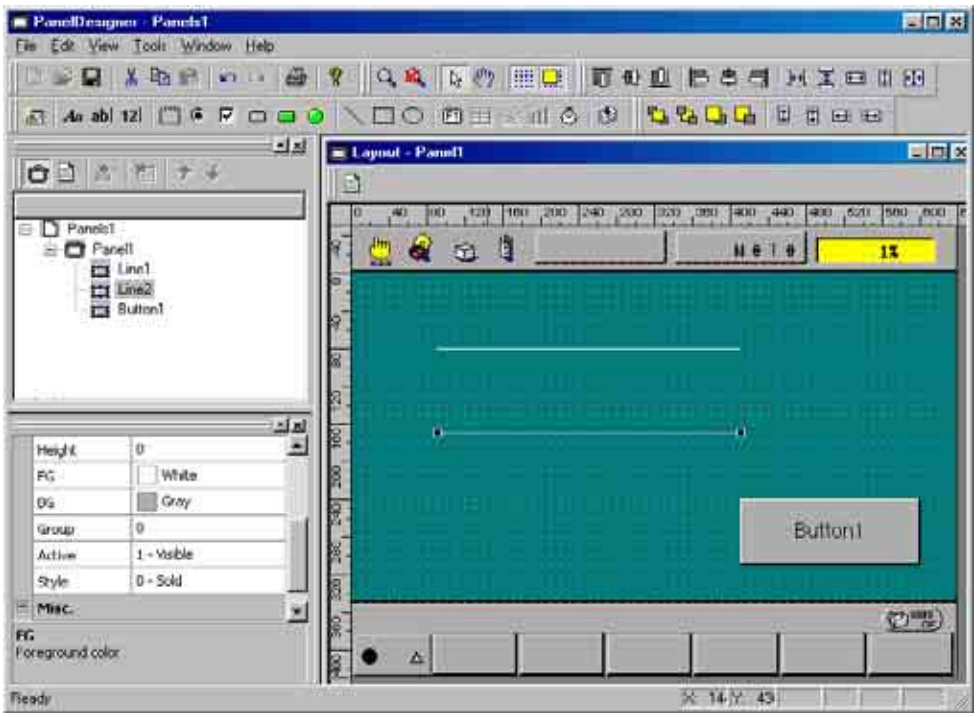
Step 2

Changing line properties

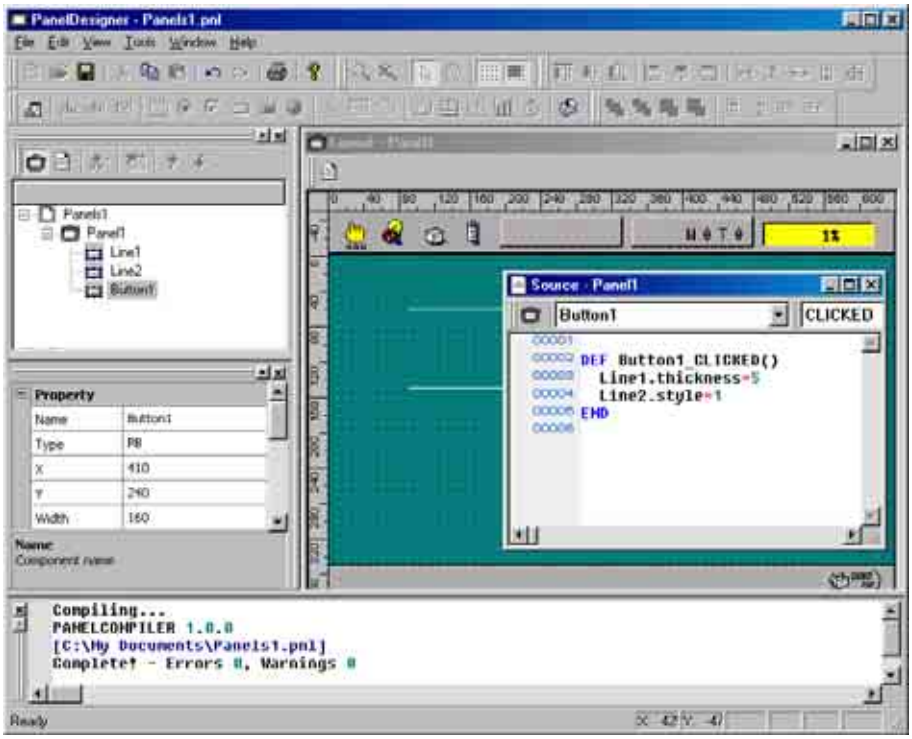
Like all drawing parts, the main properties here are line type (.style) and line thickness (.thickness).

The following example uses a button press to change line thickness and style.

Add a second line and a button to the panel layout.



Step 3 Open the Source Code Edit window and add the following action source code for changing the line 1 thickness to 5 pixels and the line 2 style to dotted line when the button is pressed.



Step 4 Compiling this panel layout and downloading it to the controller produces the following displays.

Before button press

After button press

[12] Oval

This part draws an oval with the specified pattern on the panel layout.

The parts line, oval, and rectangle are for drawing only. They support no events. Nevertheless, other parts on the same screen can still change their properties.

Oval Example

Step 1 Load the editor and place an oval on the panel layout.

Step 2 **Changing oval properties**

Like all drawing parts, the main properties here are line type (.style) and line thickness (.thickness).

The procedures for accessing properties are the same as for all other parts.

[13] Rectangle

This part draws a rectangle with the specified pattern on the panel layout.

The parts line, oval, and rectangle are for drawing only. They support no events. Nevertheless, other parts on the same screen can still change their properties.

Rectangle Example

Step 1 Load the editor and place a rectangle on the panel layout.

Step 2 **Changing rectangle properties**

Like all drawing parts, the main properties here are line type (.style) and line thickness (.thickness).

The procedures for accessing properties are the same as for all other parts.

[14] Illuminated Push Button

An illuminated push button combines button and lamp operation. It therefore supports CLICKED, RELEASED, and REFRESH events for adding action source code.

The property state gives the lamp's current state just as it does for lamps and check boxes.

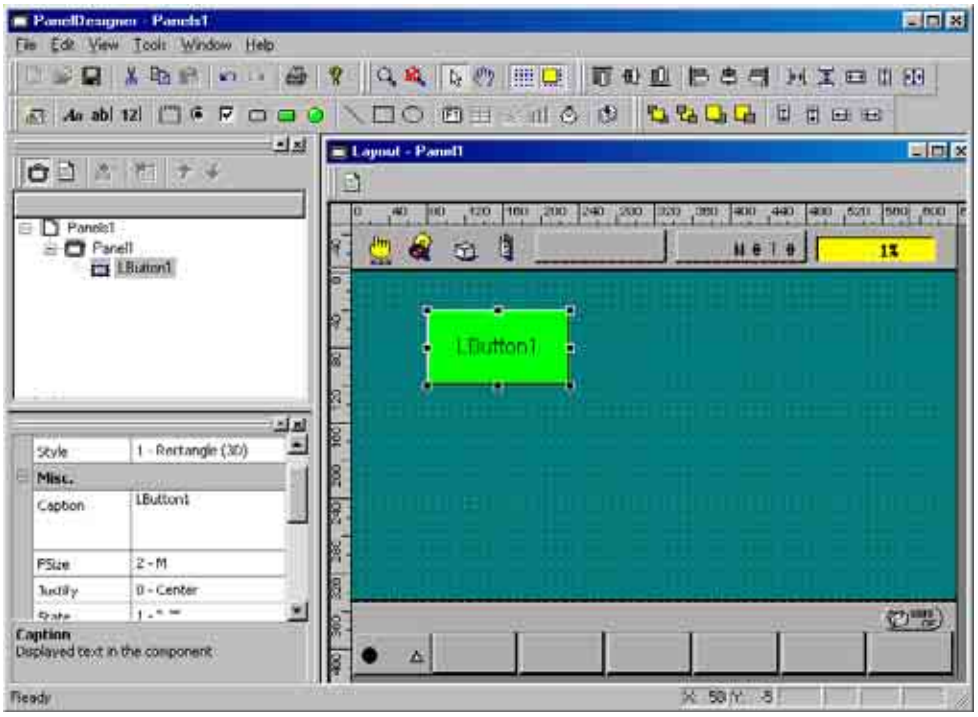
Illuminated Push Button Example

Step 1 Load the editor and place the button just as you would with a regular button.

Step 2 **Changing illuminated push button properties**

The following example uses illuminated push buttons to run a program and display an I/O state. Pressing this button runs a program in the same folder. (This program waits two seconds and then turns IO[24] on.) The lamp in the button tracks IO[24].

Add the necessary parts to the panel layout.

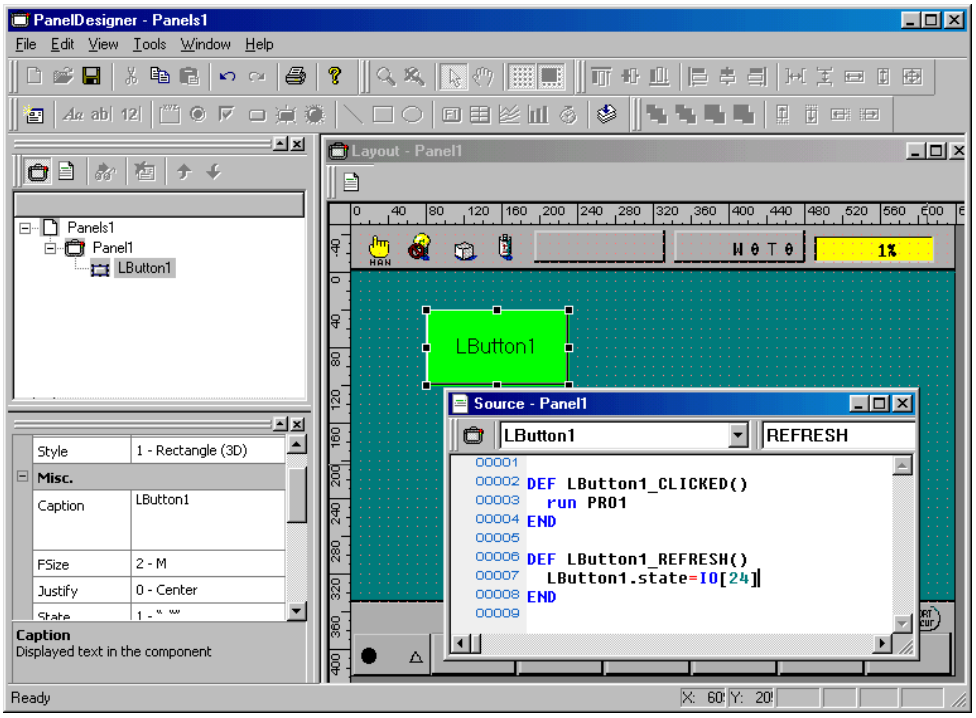


Step 3

Adding action source code

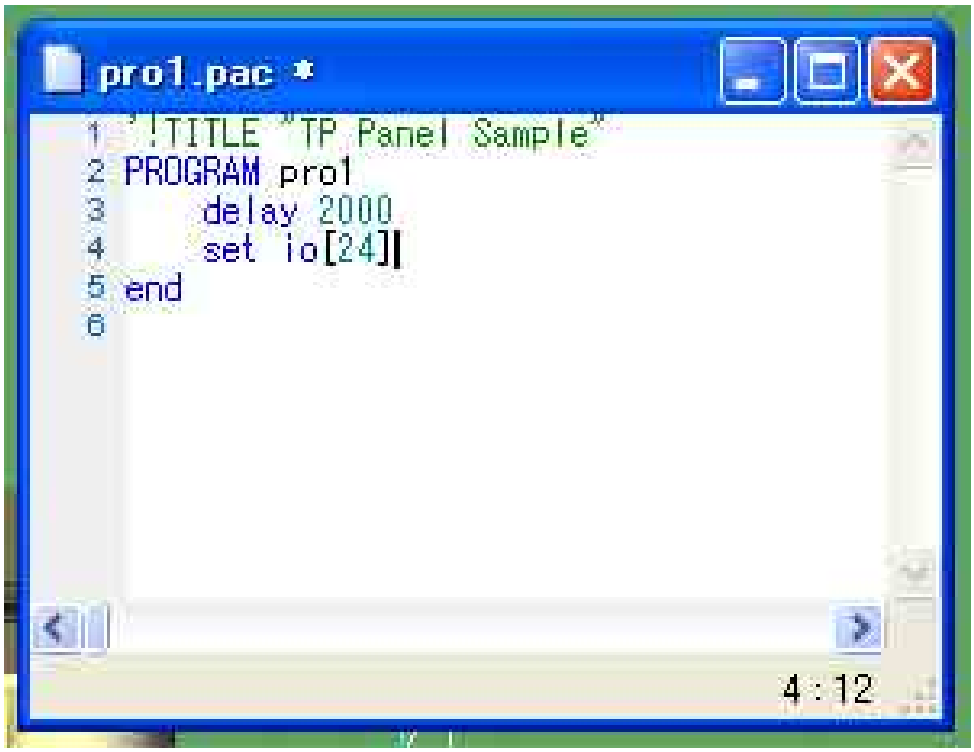
This part supports three events for adding action source code: CLICKED, RELEASED, and REFRESH. This example uses only two.

lbutton1.state = io[24] ' copy IO[24] state into Lightbutton1



Step 4

Write the program to run using WINCAPSIII.



Compile this and the panel layout, download them to the controller, and test.

2.3 Interfaces with PAC Language and System

Data exchange between the PAC language and the TP panel is via global and folder variables.

The interface with the system uses the SYSSTATE command and I/O variables.

2.3.1 Reading and Displaying PAC Variables

A TP panel can access PAC global and folder variables, but not local ones. Folder variables require EXTERN declarations; global ones do not.

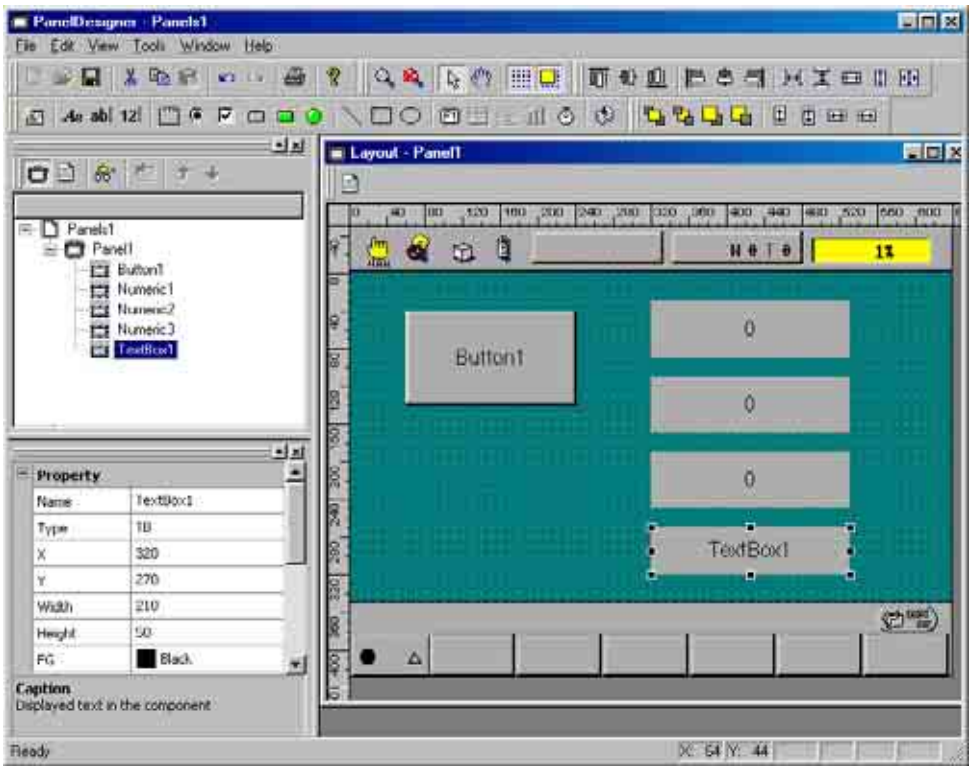
The following examples display such variables on TP panels.

Example Displaying Global Variables

Accessing a global variable uses array notation with the array name indicating the type: I for integer, F for float, D for double, and S for string. Global integer variable #10, for example, is I[10].

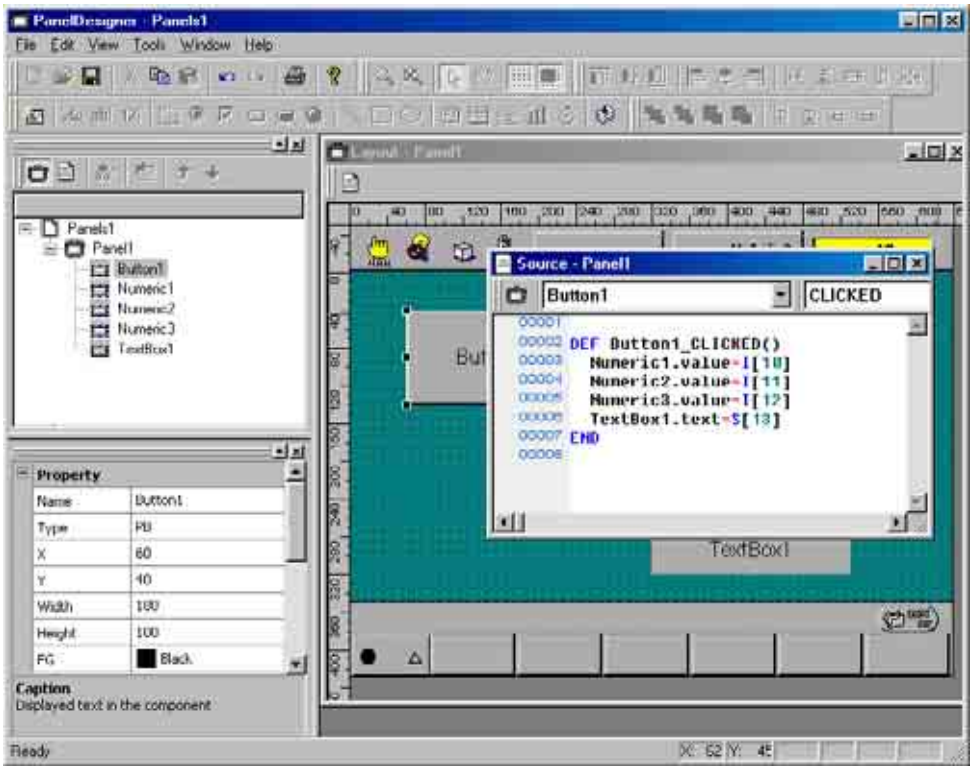
The following example displays a global variable of each type in a numerical input box (or text box for the string) when a button is pressed.

Step 1 Load the editor and place a button, three numerical input boxes for displaying the three numerical variables, and a text box for displaying the string variable on the panel layout.

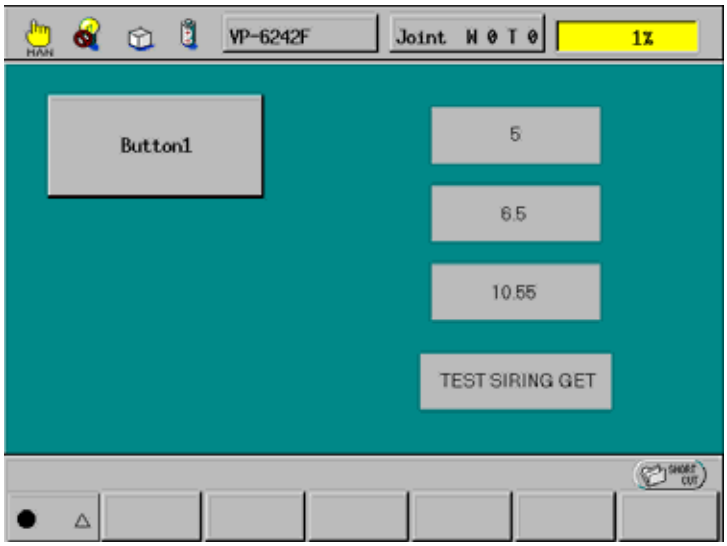


Step 2 Open the Source Code Edit window and add the following action source code for when this button is pressed. This example copies global integer variable #10, float variable #11, and double variable #12 to numerical input boxes and global string variable #13 to a text box.

```
Numeric1.value = I[10]
Numeric2.value = F[11]
Numeric3.value = D[12]
Textbox1.text = S[13]
```



Step 3 Compiling this panel layout and downloading it to the controller produces a display similar to the following when the button is pressed.



Example Displaying Folder Variables

Accessing folder variables in action source code for a button or other part requires first declaring them with EXTERN plus a reserved word (DEFINT, DEFSNG, DEFDBL, or DEFSTR) indicating the type. To access folder integer variable itest, for example, the action source code must first declare it with the following statement.

EXTERN DEFINT itest

The following example displays a folder variable of each type in a numerical input box (or text box for the string) when a button is pressed.

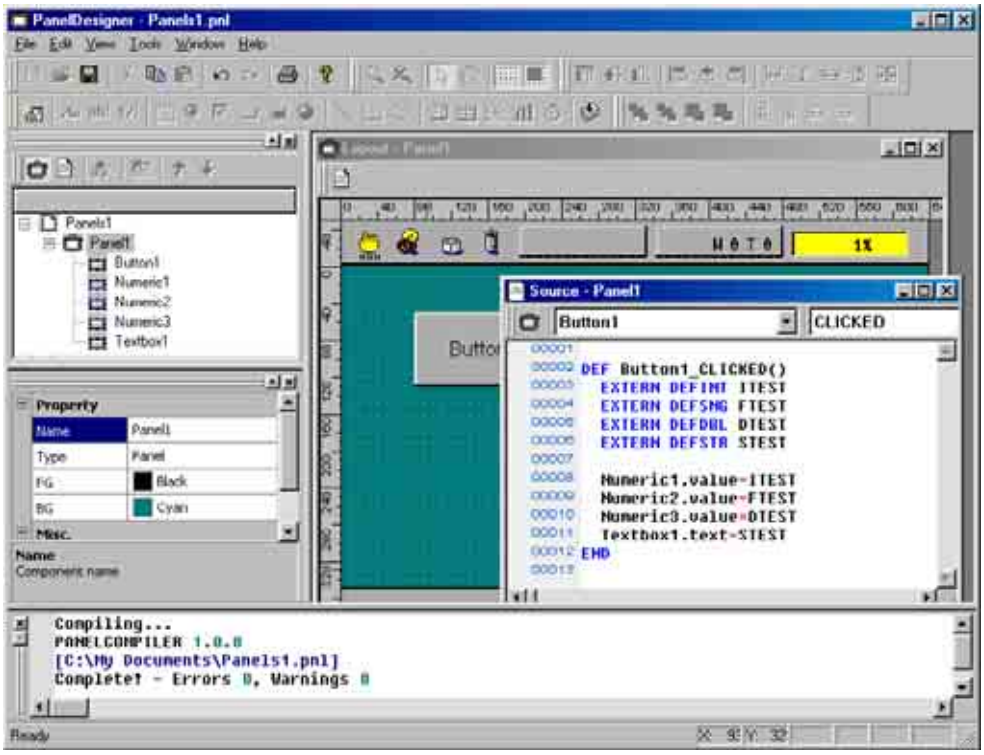
Step 1 Load the editor and place a button, three numerical input boxes for displaying the three numerical variables, and a text box for displaying the string variable on the panel layout.

Note that the layout is identical to that for the global variable example above.

Step 2 Open the Source Code Edit window and add the following action source code for when this button is pressed. This example copies integer ITEST, float FTEST, and double DTEST to numerical input boxes and string STEST to a text box.

```
EXTERN DEFINT ITEST
EXTERN DEFSNG FTEST
EXTERN DEFDBL DTEST
EXTERN DEFSTR STEST

Numeric1.value = ITEST
Numeric2.value = FTEST
Numeric3.value = DTEST
Textbox1.text = STEST
```



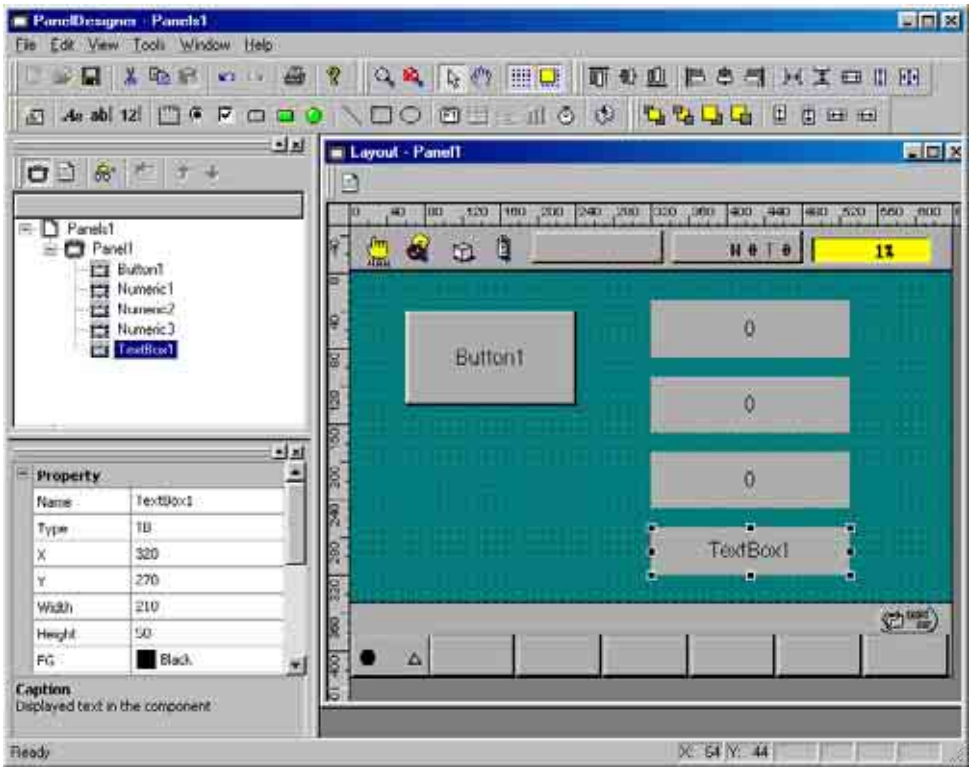
2.3.2 Modifying PAC Variables

Modifying PAC variables is simply the write access counterpart of the read access described in the preceding section.

Example Modifying Global Variables

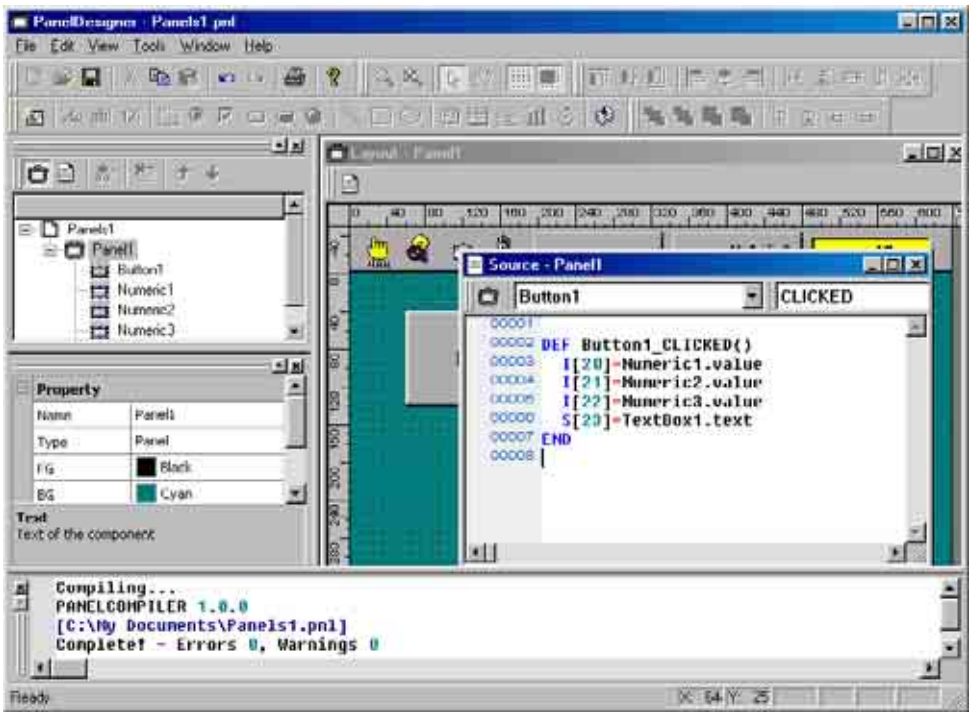
The following example updates a global variable of each type from the corresponding numerical input box (or text box for the string) when a button is pressed.

Step 1 Load the editor and place a button, three numerical input boxes for specifying the three numerical values, and a text box for specifying the string on the panel layout.



Step 2 Open the Source Code Edit window and add the following action source code for when this button is pressed. This example copies the three numerical values to global integer variable #20, float variable #21, and double variable #22 and the string to global string variable #23.

```
I[20]=Numeric1.value
F[21]=Numeric2.value
D[22]=Numeric3.value
S[23]=Textbox1.text
```



Example Modifying Folder Variables

Accessing folder variables in action source code for a button or other part requires first declaring them with EXTERN plus a reserved word (DEFINT, DEFSNG, DEFDBL, or DEFSNG) indicating the type.

The following example updates a folder variable of each type from the corresponding numerical input box (or text box for the string) when a button is pressed.

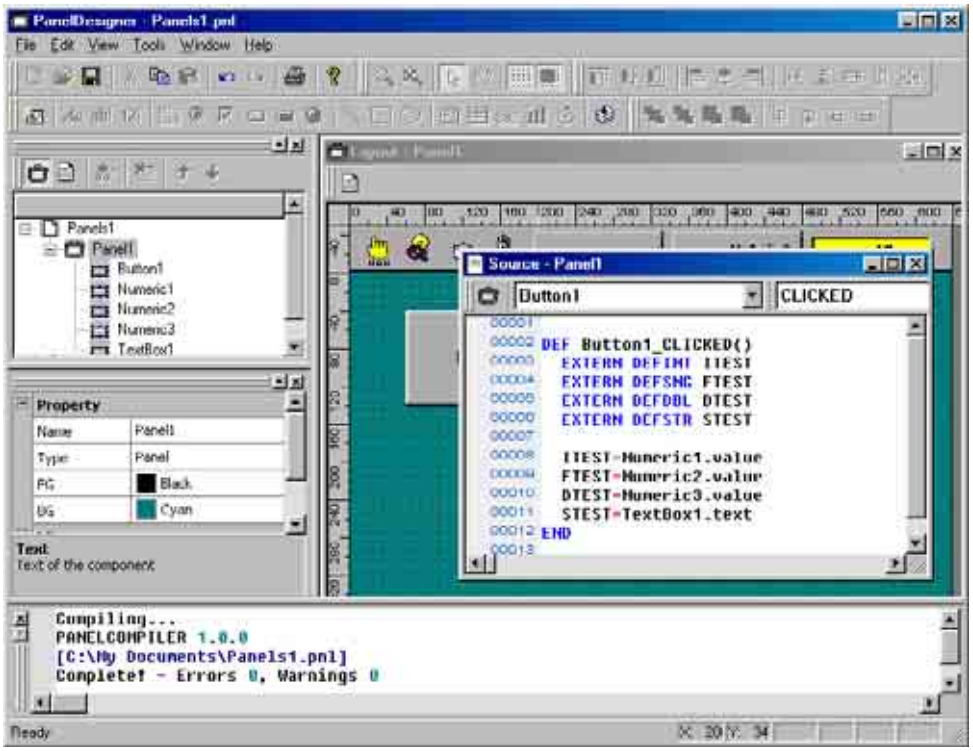
Step 1 Load the editor and place a button, three numerical input boxes for specifying the three numerical values, and a text box for specifying the string on the panel layout.

Note that the layout is identical to that for the global variable example above.

Step 2 Open the Source Code Edit window and add the following action source code for when this button is pressed. This example copies integer ITEST, float FTEST, and double DTEST to numerical input boxes and string STEST to a text box.

```
EXTERN DEFINT ITEST
EXTERN DEFSNG FTEST
EXTERN DEFDBL DTEST
EXTERN DEFSTR STEST

ITEST=Numeric1.value
FTEST=Numeric2.value
DTEST=Numeric3.value
STEST=Textbox1.text
```



2.3.3 Reading I/O States

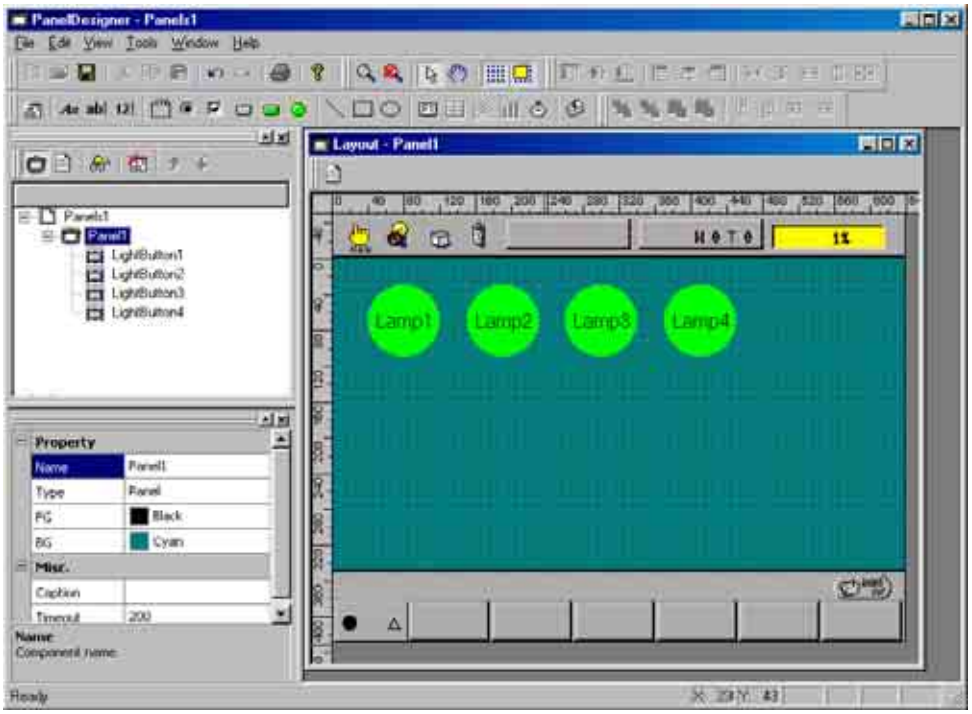
A TP panel can read robot controller I/O states via global I/O variables or local I/O variables declared with DEFIO. We postpone discussion of the latter to the local variable description below.

Example Using Global I/O Variables

Accessing a global I/O variable uses array notation with the array name IO.

This example monitors global I/O variables #24 to #27 with lamps updated at regularly scheduled intervals.

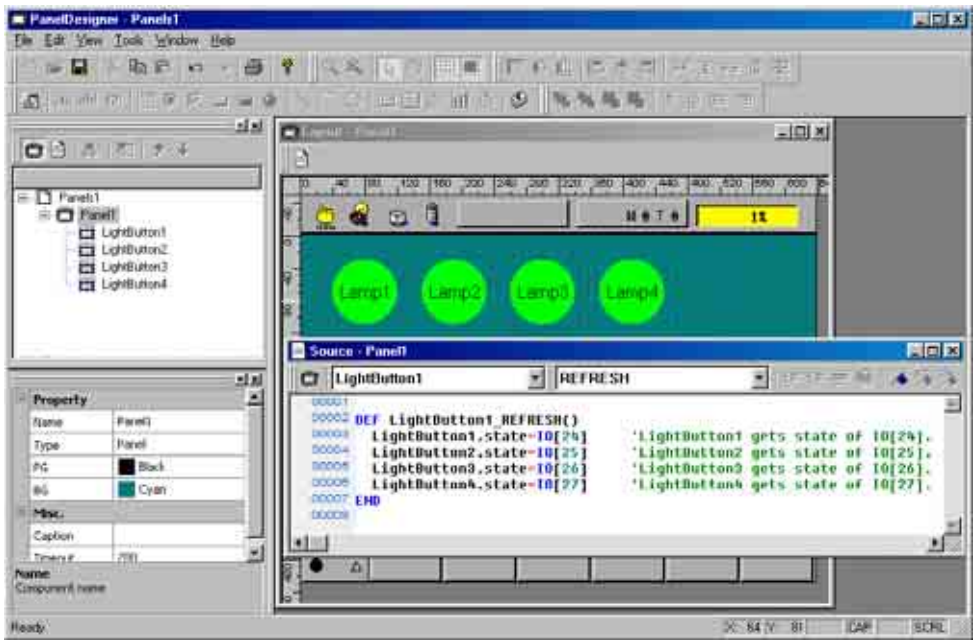
Step 1 Load the editor and place four lamps on the panel layout.



Step 2

In the Source Code Edit window, select the REFRESH event for one lamp (This example uses LightButton1.) and add the following action source code for copying the I/O states to the lamps at regularly scheduled intervals to the skeleton automatically created.

```
LightButton1.state = IO[24]    ' copy I/O variable #24 state into LightButton1
LightButton2.state = IO[25]    ' copy I/O variable #25 state into LightButton2
LightButton3.state = IO[26]    ' copy I/O variable #26 state into LightButton3
LightButton4.state = IO[27]    ' copy I/O variable #27 state into LightButton4
```



2.3.4 Modifying I/O States

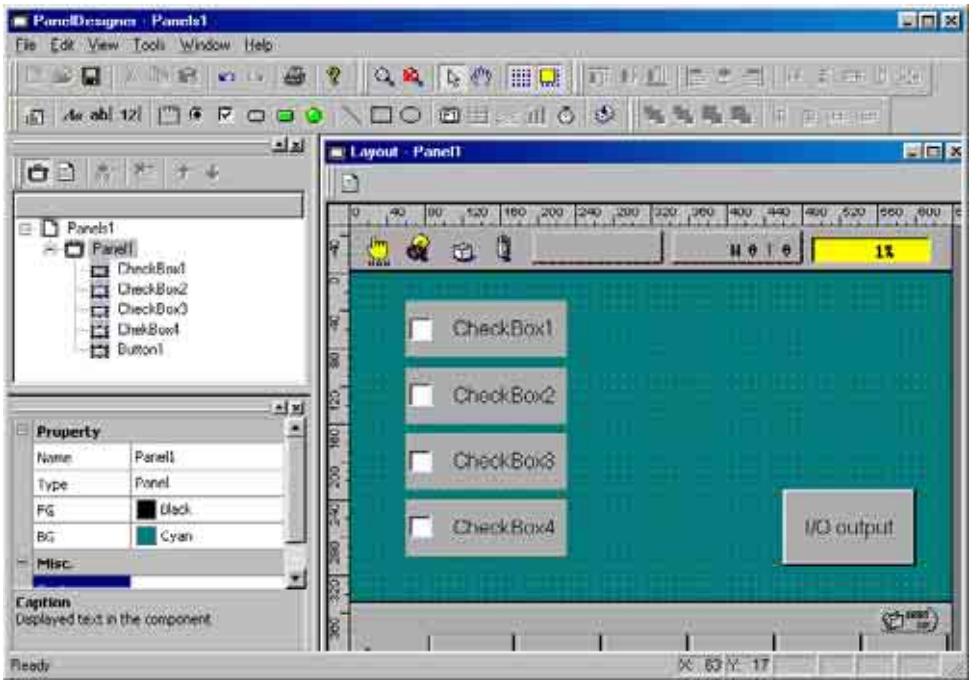
Use the SET and RESET commands to modify system I/O states.

ON: SET IO[I/O number]
OFF: RESET IO[I/O number]

Example Modifying I/O States

The following example updates I/O variables #28 to #31 from the corresponding check boxes when a button is pressed.

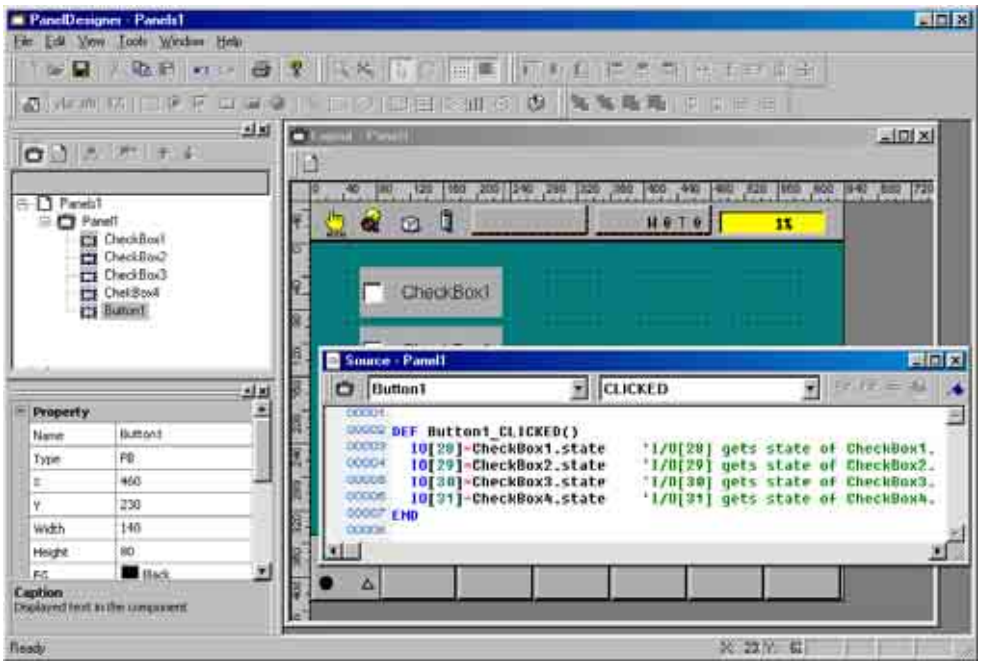
Step 1 Load the editor and place four check boxes and a button on the panel layout.



Step 2

Open the Source Code Edit window and add the following action source code for updating the outputs from the check boxes.

```
IO[28]=Checkbox1.state      ' update I/O variable #28 from Checkbox1
IO[29]=Checkbox2.state      ' update I/O variable #29 from Checkbox2
IO[30]=Checkbox3.state      ' update I/O variable #30 from Checkbox3
IO[31]=Checkbox4.state      ' update I/O variable #31 from Checkbox4
```



2.3.5 Reading System Status

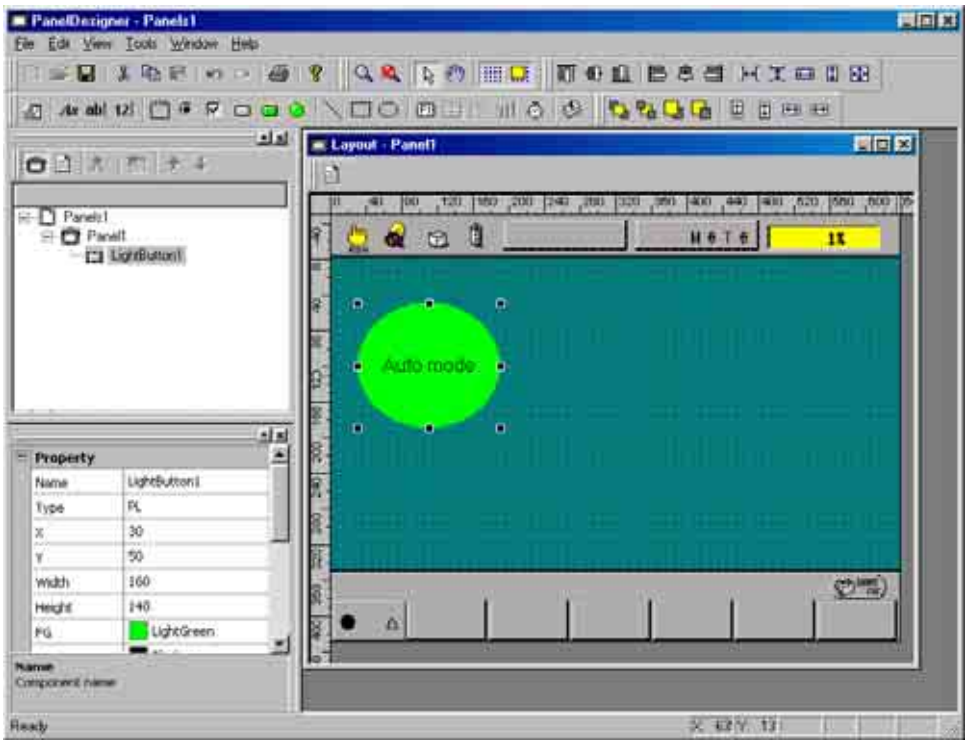
The SYSSTATE command reads the system status.

For further details on this and other commands, see Chapter 5 "Command Reference."

Example Reading System Status

The following example lights a lamp when the controller is in automatic mode.

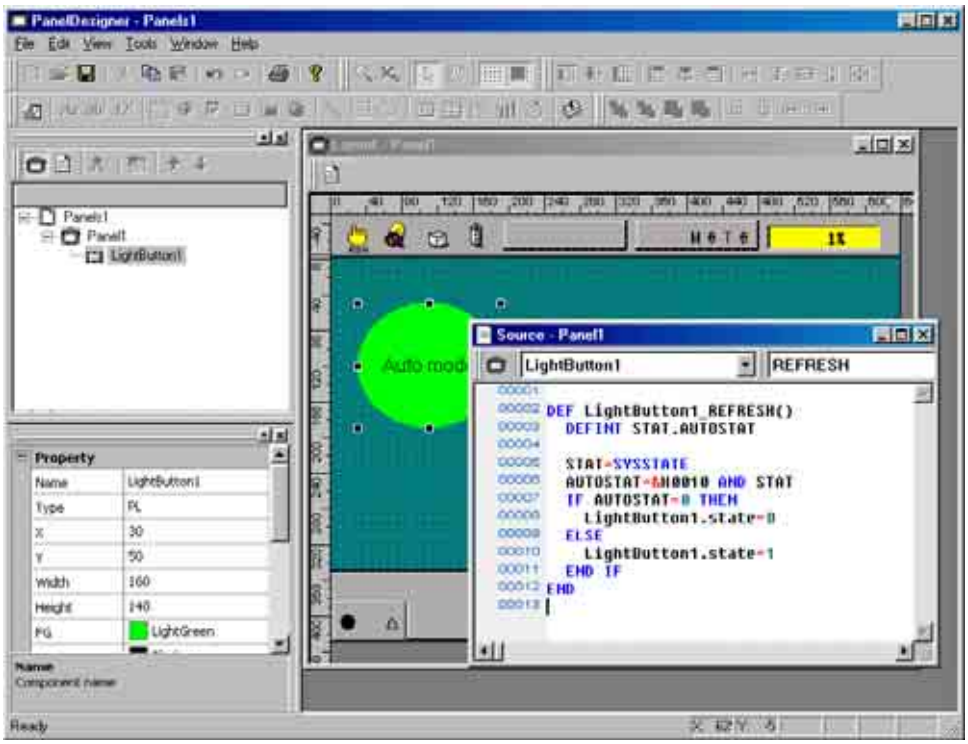
Step 1 Load the editor and place a lamp on the panel layout.



Step 2 In the Source Code Edit window, select the lamp's REFRESH event and add the following action source code for updating the lamp based on the mode data read from the controller at regularly scheduled intervals to the skeleton automatically created. (This example uses the default name LightButton1.)

```
DEFINT STAT, AUTOSTAT

STAT=SYSSTATE
AUTOSTAT = &H0010 AND STAT
IF AUTOSTAT = 0 THEN
  LIGHTBUTTON1.state = 0
ELSE
  LIGHTBUTTON1.STATE = 1
END IF
```



2.4 Switching TP Panels

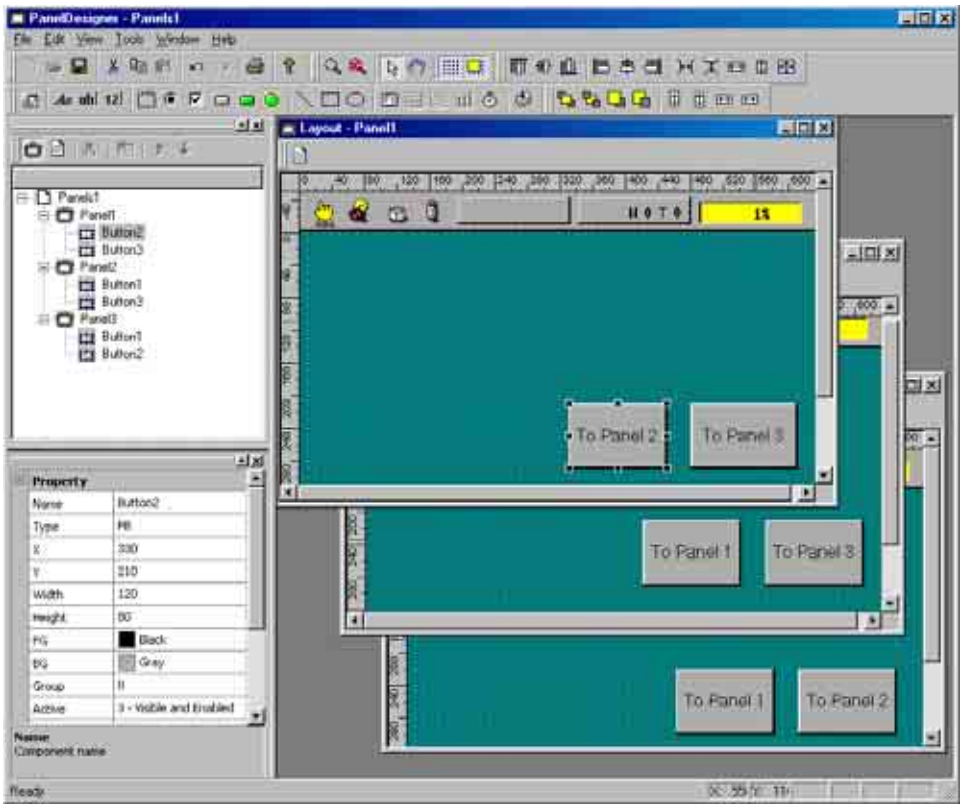
The PAGE_CHANGE command switches the teach pendant screen to a different TP panel in the same folder or even one in a different folder. It has the following syntax.

Same folder: PAGE_CHANGE panel_name
Different folder: PAGE_CHANGE path_name.panel_name
Root folder: PAGE_CHANGE \panel_name

2.4.1 Example Switching in Same Folder

The following example has three panel layouts in the same folder with two buttons on each for freely moving between them.

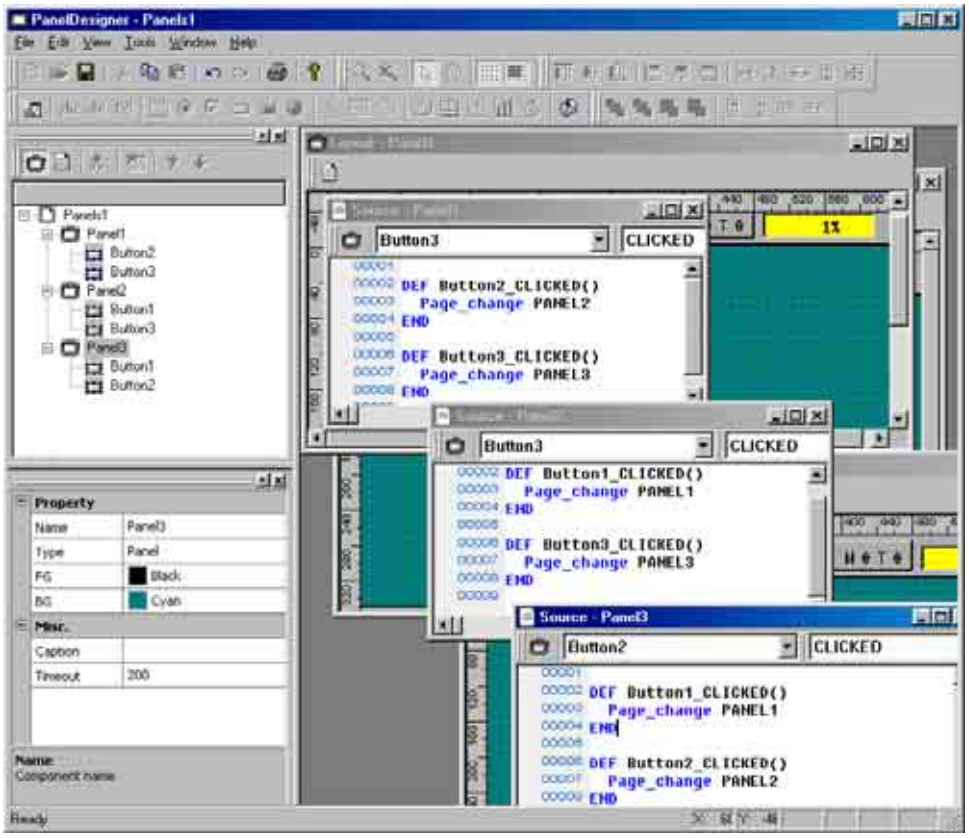
Step 1 Load the editor, create three panel layouts with two buttons on each, and label the buttons for the two other panel layouts.



Step 2

Open Source Code Edit windows for the panel layouts and add the appropriated line from the following action source code to each button's CLICKED event.

```
PAGE_CHANGE PANEL1    ' switch screen to PANEL1
PAGE_CHANGE PANEL2    ' switch screen to PANEL2
PAGE_CHANGE PANEL3    ' switch screen to PANEL3
```



Compile the panel layouts, download them to the controller, and test.

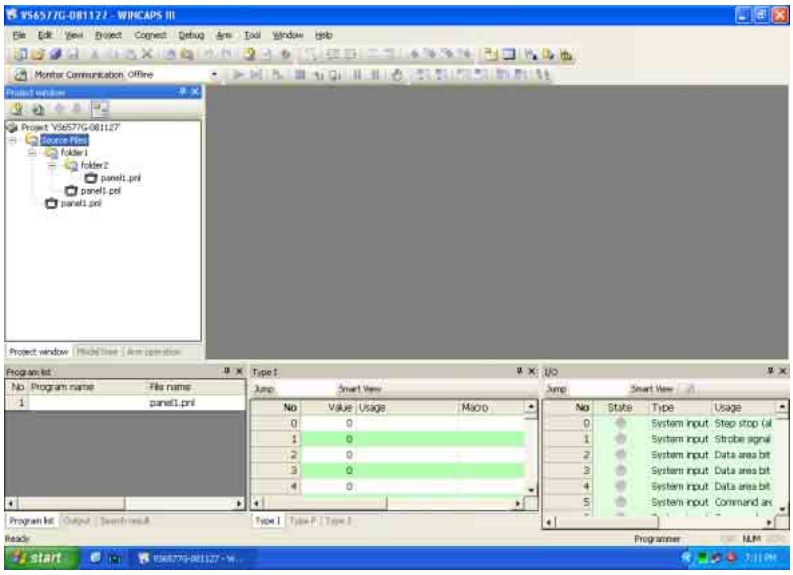
2.4.2 Example Switching Between Folders

The following example has three panel layouts all in different folders in a 3-level hierarchy with two buttons on each for freely moving between them.

Step 1

Create the 3-level hierarchy with WINCAPSIII.

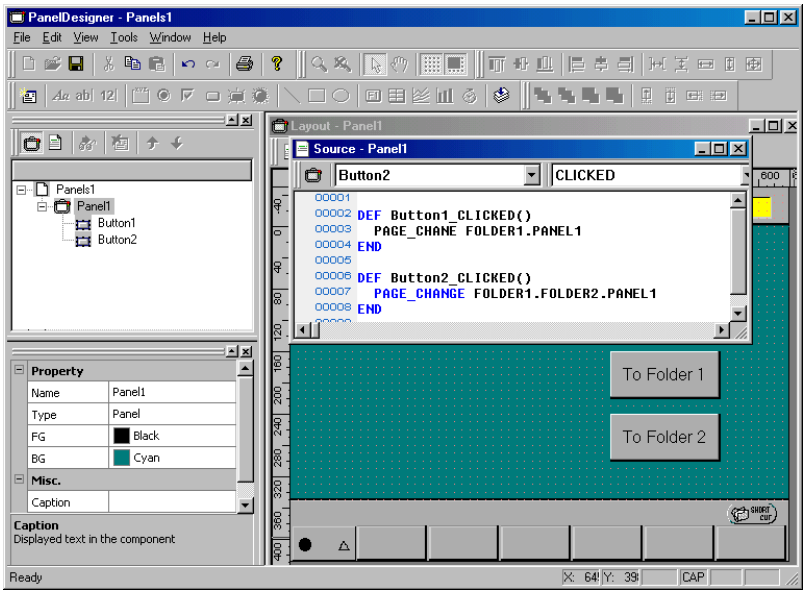
Load the editor, create three panel layouts, one at each level, with two buttons on each, and label the buttons for the two other panel layouts.



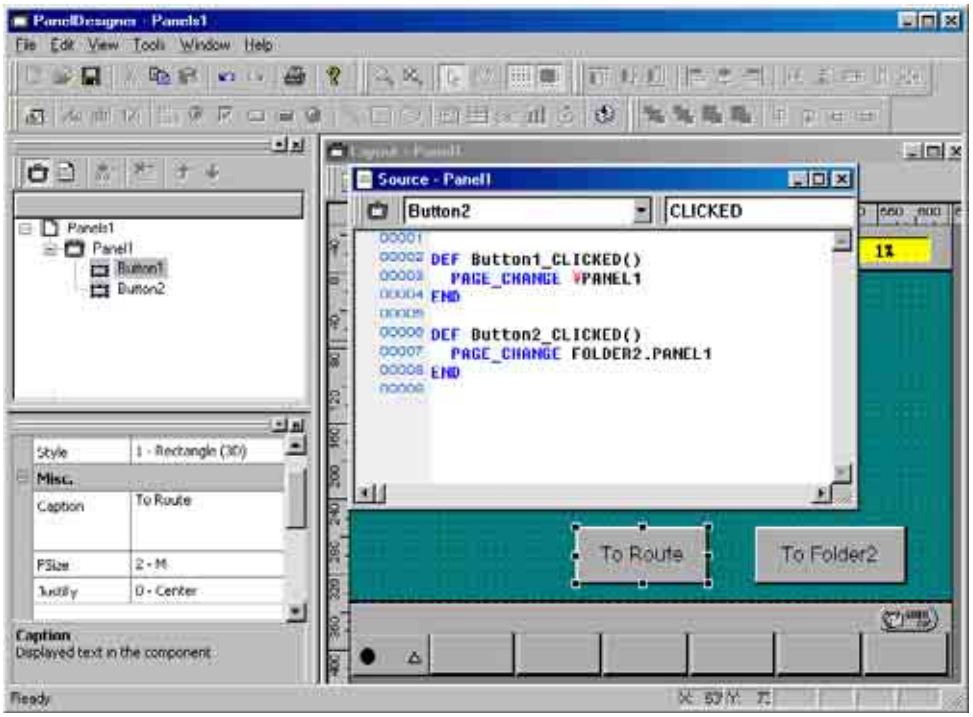
Step 2

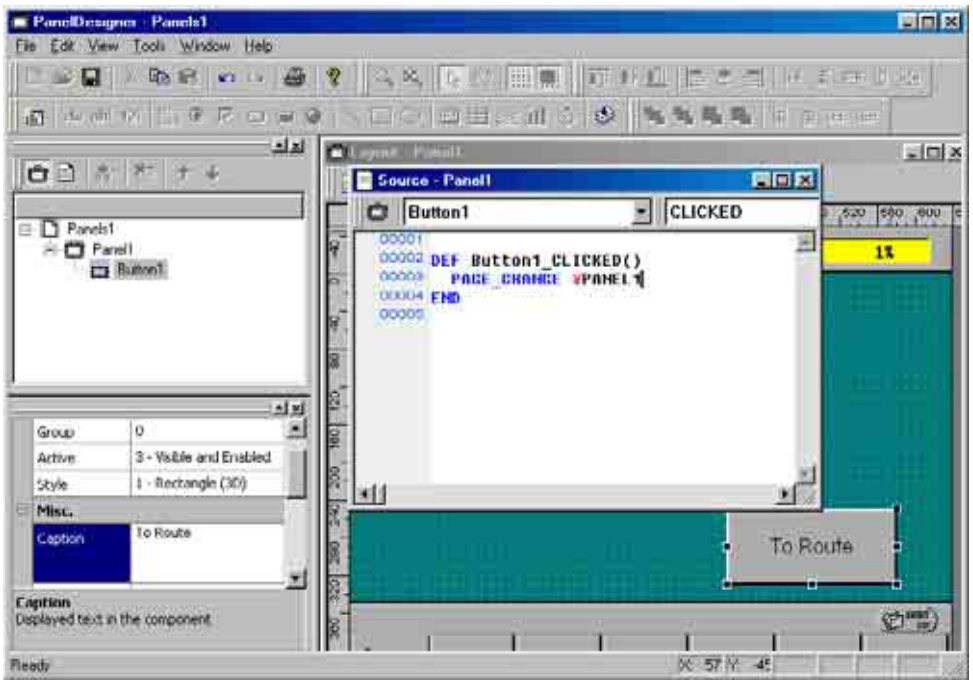
Open Source Code Edit windows for the panel layouts and add the appropriated line from the following action source code to each button's CLICKED event.

```
PAGE_CHANGE FOLDER1.PANEL1   ' switch screen to PANEL1 in FOLDER1
                               relative to the current folder
PAGE_CHANGE FOLDER2.PANEL1   ' switch screen to PANEL1 in FOLDER2
                               relative to the current folder
PAGE_CHANGE FOLDER1.FOLDER2.PANEL1
                             ' switch screen to PANEL1 in
                               FOLDER1.FOLDER2 relative to the current
                               folder
PAGE_CHANGE \PANEL3          ' switch screen to PANEL1 in the root folder
                               using absolute folder reference
```



Step 2
(continued)





Compile the panel layouts, download them to the controller, and test.

2.5 Flow Control

The TP panel control language has three types of flow control statements: conditional branches IF... END IF and IF... THEN... ELSE..., SELECT... CASE, and iteration FOR... NEXT.

The following sections give examples.

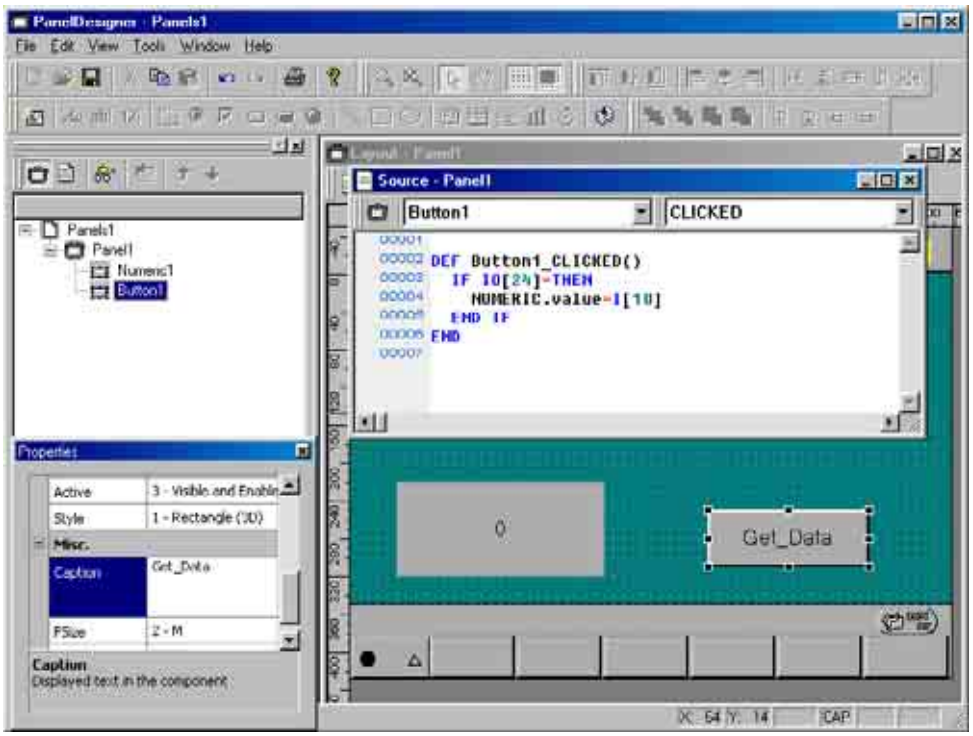
2.5.1 Conditional Branching

Example Using IF... END IF

The following IF statement example reads a global variable into a numerical input box if an I/O condition is met.

Step 1 Load the editor and place a numerical input box and a button to trigger the test on the panel layout.

Step 2 Open the Source Code Edit window and add action source code updating the numerical input box from global integer variable #10 only if I/O variable #24 is 1 when this button is pressed.



Compile the panel layout, download it to the controller, and test.

Example Using SELECT... CASE

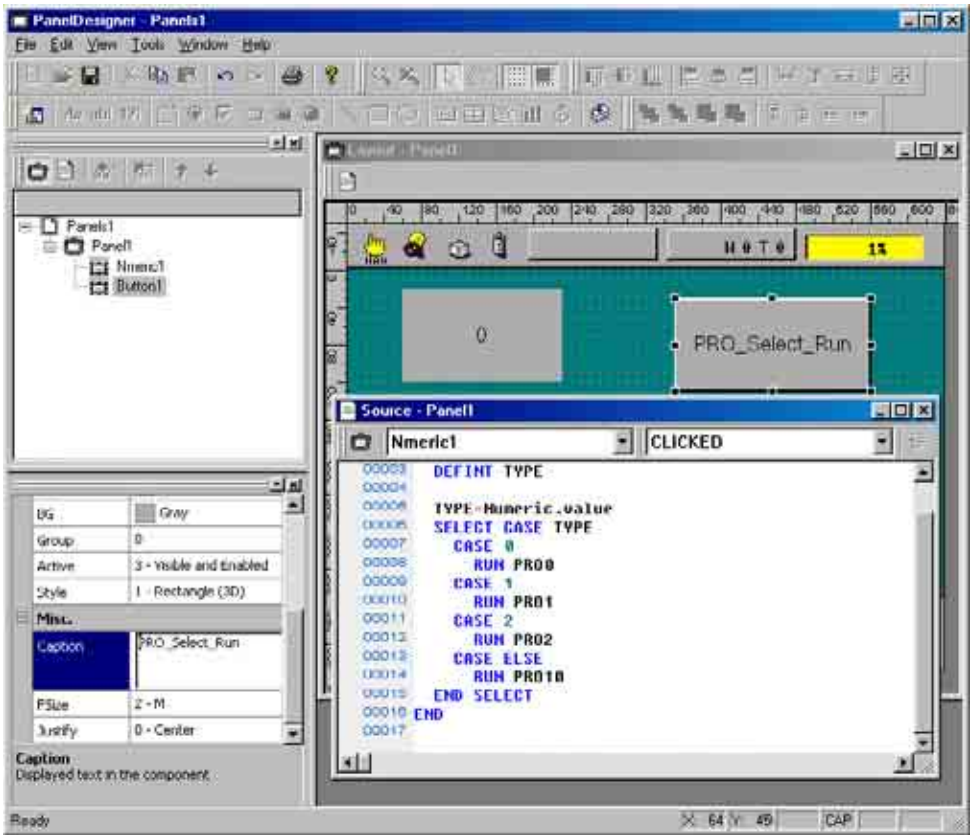
The following SELECT... CASE example runs a different program according to the value in a numerical input box when a button is pushed.

Step 1 Load the editor and place a button and a numerical input box on the panel layout.

Step 2 Open the Source Code Edit window and add the following action source code for the button's CLICKED event.

```
DEFINT TYPE

 TYPE = Numeric1.value
 SELECT CASE TYPE
  CASE 0
   RUN PRO0
  CASE 1
   RUN PRO1
  CASE 2
   RUN PRO2
  CASE ELSE
   RUN PRO10
 END SELECT
```



Compile the panel layout, download it to the controller, and test.

2.5.2 Iteration

Example Using FOR...NEXT

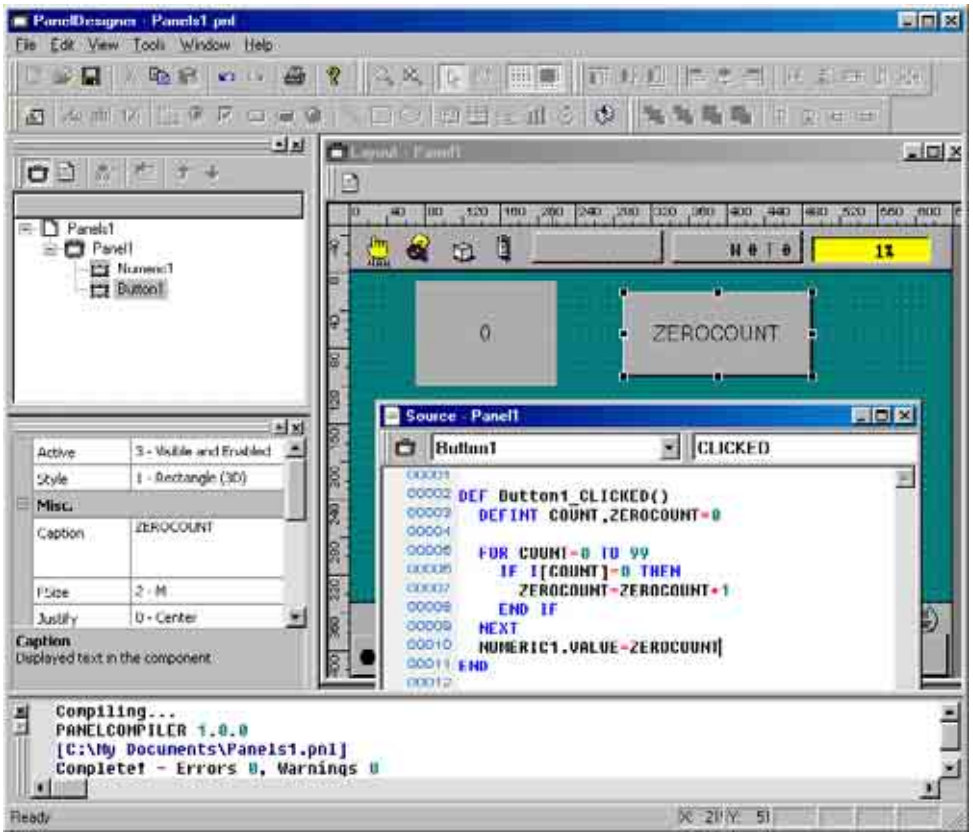
The following FOR... NEXT example counts the number of zero values in global integer variables #0 to #99 when a button is pushed and displays the result in a numerical input box.

Step 1 Load the editor and place a button and a numerical input box on the panel layout.

Step 2 Open the Source Code Edit window and add the following action source code for the button's CLICKED event.

```
DEFINT COUNT,ZEROCOUNT=0

 FOR COUNT = 0 TO 99
  IF I[COUNT] = 0 THEN
    ZEROCOUNT = ZEROCOUNT + 1
  END IF
 NEXT
 NUMERIC1.VALUE = ZEROCOUNT
```



Compile the panel layout, download it to the controller, and test.

2.6 Local Variables

The TP panel control language supports local variables of type integer, float, double, string, and I/O.

Declaring a variable inside an action source code block makes it local--that is, accessible only that block.

```
DEF Button1_CLICKED()
  DEF Button1_CLICKED()
  DEFINT COUNT,ZEROCOUNT=0

  FOR COUNT = 0 TO 99
    IF I[COUNT] = 0 THEN
      ZEROCOUNT = ZEROCOUNT + 1
    END IF
  NEXT
  NUMERIC1.VALUE = ZEROCOUNT

END
```

Valid range for COUNT and ZEROCOUNT

Example Using Local Variables

The following example copies global variables into local ones when a button is pressed, manipulates the local variables, and copies the results back to the original global variables.

Step 1 Load the editor and place a button on the panel layout.

Step 2

Open the Source Code Edit window and add the following action source code for

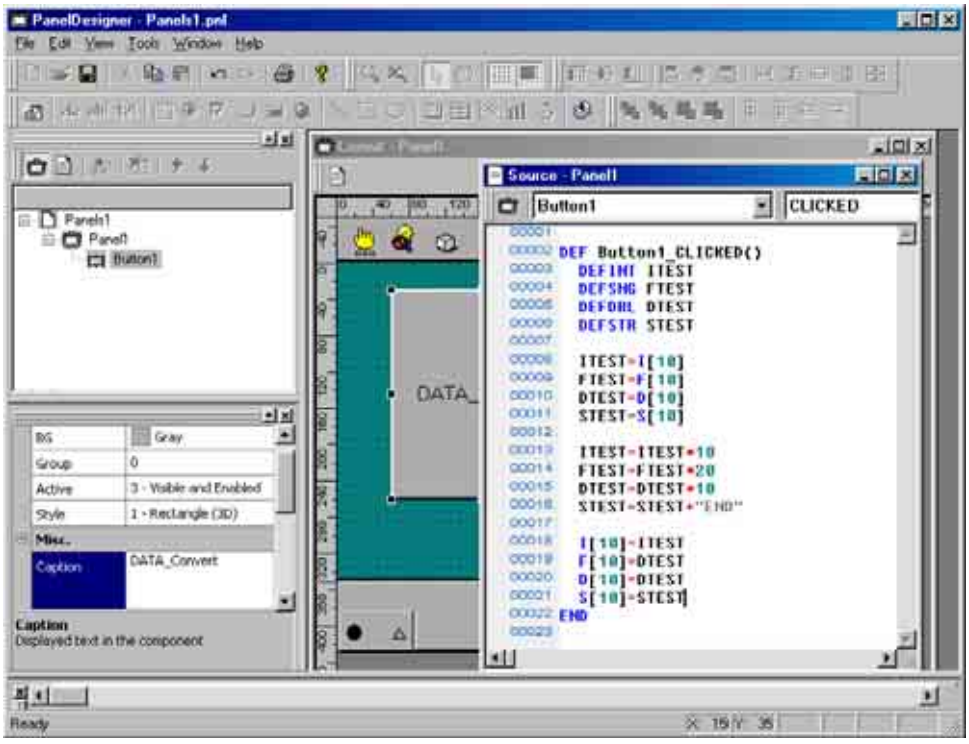
* reading global integer variable #10 into a local integer variable, multiplying it by 10, and writing the result back
* reading global float variable #10 into a local float variable, multiplying it by 20, and writing the result back
* reading global double variable #10 into a local double variable, multiplying it by 10, and writing the result back
* reading global string variable #10 into a local string variable, adding "end," and writing the result back

```
DEFINT ITEST
DEFSNG FTEST
DEFDBL DTEST
DEFSTR STEST

ITEST = I[10]
FTEST = F[10]
DTEST = D[10]
STEST = S[10]

ITEST = ITEST * 10
FTEST = FTEST * 20
DTEST = DTEST * 10
STEST = STEST + “END”

I[10] = ITEST
F[10] = FTEST
D[10] = DTEST
S[10] = STEST
```



Compile the panel layout, download it to the controller, and test.

Chapter 3 TP Panel Control Language's Structural Elements

3.1 Language Elements

The TP panel control language has the following structural elements.

identifier	Name distinguishing a structural element
variable	Temporary storage for data
constant	Data with a fixed value
operator	Symbol indicating an operation on one or two values
expression	Combination of structural elements yielding a value
command	Built-in PAC language instruction

3.2 Names

This section sets forth the TP panel control language's rules.

Names representing commands and variables must comply with the following rules.

- Names consist of letters, digits, and underscores. The first character must be a letter. Note that there is no distinction between upper and lower case.
- The following characters cannot be used in identifiers: period, slash, backslash, space, colon, semicolon, single quote, double quote, and asterisk.
- Certain characters are used as operators, so cannot be used in identifiers: +, -, *, /, (,), etc.
- A space or other delimiter must separate a name from other words on either side.
- The maximum permissible length for a name is 64 characters.

3.3 Identifiers and Variables

3.3.1 Variables

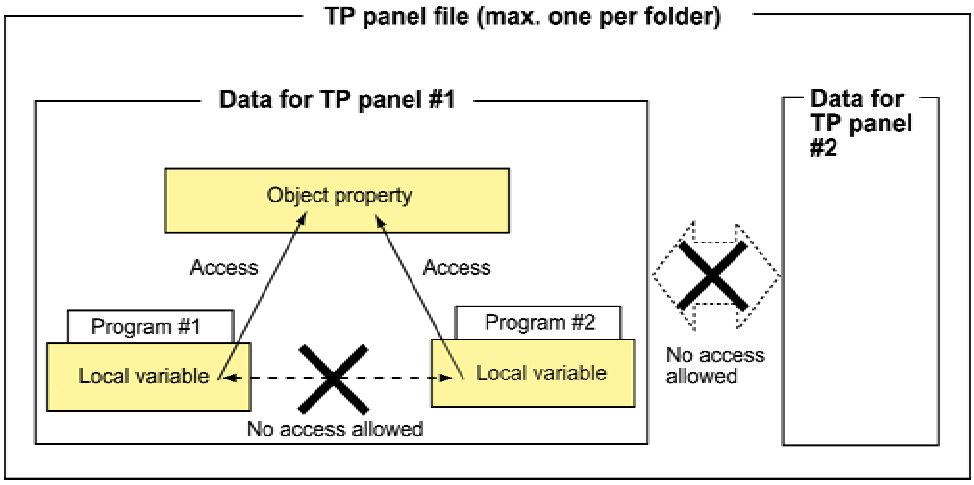
Variables represent temporary storage for data. There are global variables, local variables, and, for TP panel parts, object properties.

A global variable is accessible from all TP panel files.

A local variable is accessible only within the program defining it. Another program running concurrently may define its own local variable with the same name, but the two never interact because they are considered entirely separate variables.

An object property is accessible only within the TP panel file defining the object (part).

The following figure illustrates the relationships between parts objects and programs.



3.3.2 Global Variables

These have names consisting of one or two letters indicating the type--I for integer, F for float, D for double, S for string, and IO for I/O--and a number in brackets ([]). These names are predefined by the system, so can be used without declarations.

I: integer, -2147483648 to +2147483647

F: single-precision floating point, -3.402823E+38 to 3.402823E+38

D: double-precision floating point, -1.7976931348623157E+308 to 1.7976931348623157E+308

S: string, up to 243 bytes long

IO: I/O line

Examples: I[1], F[1], D[1], S[1], IO[1]

3.3.3 Local Variables

These have the same types as global ones.

I	integer	-2147483648 to +2147483647
F	single-precision floating point	-3.402823E+38 to 3.402823E+38
D	double-precision floating point	-1.7976931348623157E+308 to 1.7976931348623157E+308
S	string	up to 243 bytes long
I/O	I/O line	

A local variable must be defined with a type declaration directive before it can be used.

Note: The TP panel control language does not share the PAC language's support for indirect reference or post-positions.

3.3.4 Object Properties

Object properties provide read/write access to TP panel screen part internals using the standard dot notation: part_name.property.

Examples:

(1) Change the caption for the part named Button1 to "Button"

(2) Read the state for the part named LightButton1 into I[1]

The following table lists parts, their events, and their properties.

Object Properties for TP Panel Screen Parts

Part Type	Property Name	Type	Meaning	Notes
Button Events: CLICKED, RELEASED	x and y	I	Upper left corner coordinates	Position relative to the upper left corner of the drawing region. This corner must be within the teach pendant drawing range.
	width and height	I	Part dimensions in pixels	These define the corner opposite the reference corner (x, y): (x+width, y+height). Negative means left or up of the reference corner; positive, right or down.
	fg and bg	I	Foreground and background colors	1: White, 0: Black, 1: Blue, 2: Green, 3: Cyan, 4: Red, 5: Magenta, 6: Brown, 7: Light Gray, 8: Gray, 9: Light Blue, 10: Light Green, 11: Light Cyan, 12: Light Red, 13: Light Magenta, 14: Yellow
	group	I	Group number	Group to which part belongs
	active	I	Visible and active settings	0: Invisible & inactive Add 1 for visible and 2 for active. Note that 3 is the only setting producing events. (CLICKED and RELEASED).
	style	I	Display style	0: 2D rectangle, 1: 3D rectangle, 2: 2D oval, 3: 3D oval
	caption	S	Display text	String, max. 80 bytes
	fsize	I	Font size	0: Tiny, 1: Small, 2: Standard, 3: Big
	justify	I	Caption positioning	0: Centered, 1: Right-justified, 2: Left-justified

Part Type	Property Name	Type	Meaning	Notes
Label Events: None	x and y	I	Upper left corner coordinates	Position relative to the upper left corner of the drawing region. This corner must be within the teach pendant drawing range.
	width and height	I	Part dimensions in pixels	These define the corner opposite the reference corner (x, y): (x+width, y+height). Negative means left or up of the reference corner; positive, right or down.
	fg and bg	I	Foreground and background colors	1: White, 0: Black, 1: Blue, 2: Green, 3: Cyan, 4: Red, 5: Magenta, 6: Brown, 7: Light Gray, 8: Gray, 9: Light Blue, 10: Light Green, 11: Light Cyan, 12: Light Red, 13: Light Magenta, 14: Yellow
	group	I	Group number	Group to which part belongs
	active	I	Active setting	0: Invisible, 1: Visible
	caption	S	Display text	String, max. 80 bytes
	fsize	I	Font size	0: Tiny, 1: Small, 2: Standard, 3: Big
	justify	I	Caption positioning	0: Centered, 1: Right-justified, 2: Left-justified
Lamp Events: REFRESH	x and y	I	Upper left corner coordinates	Position relative to the upper left corner of the drawing region. This corner must be within the teach pendant drawing range.
	width and height	I	Part dimensions in pixels	These define the corner opposite the reference corner (x, y): (x+width, y+height). Negative means left or up of the reference corner; positive, right or down.
	fg and bg	I	Foreground and background colors	1: White, 0: Black, 1: Blue, 2: Green, 3: Cyan, 4: Red, 5: Magenta, 6: Brown, 7: Light Gray, 8: Gray, 9: Light Blue, 10: Light Green, 11: Light Cyan, 12: Light Red, 13: Light Magenta, 14: Yellow
	group	I	Group number	Group to which part belongs
	active	I	Active setting	0: Invisible, 1: Visible
	style	I	Display style	0: 2D rectangle, 1: 3D rectangle, 2: 2D oval, 3: 3D oval
	caption	S	Display text	String, max. 80 bytes
	fsize	I	Font size	0: Tiny, 1: Small, 2: Standard, 3: Big
	justify	I	Caption positioning	0: Centered, 1: Right-justified, 2: Left-justified **Note:** This setting is ignored for style settings 2 and 3.
	state	I	State	0: Out, 1: On

Part Type	Property Name	Type	Meaning	Notes
Line	x and y	I	Upper left corner coordinates	Position relative to the upper left corner of the drawing region. This corner must be within the teach pendant drawing range.
	width and height	I	Part dimensions in pixels	These define the corner opposite the reference corner (x, y): (x+width, y+height). Negative means left or up of the reference corner; positive, right or down.
	fg and bg	I	Foreground and background colors	1: White, 0: Black, 1: Blue, 2: Green, 3: Cyan, 4: Red, 5: Magenta, 6: Brown, 7: Light Gray, 8: Gray, 9: Light Blue, 10: Light Green, 11: Light Cyan, 12: Light Red, 13: Light Magenta, 14: Yellow
	group	I	Group number	Group to which part belongs
	active	I	Active setting	0: Invisible, 1: Visible
	style	I	Display style	0: Solid line 1 to 7: Dash (dashed line) 8 to 14: Dash double (alternate long and two short dashed line)
	thickness	I	Line thickness	The 0 setting produces a line width of 2.
Numerical Input Button Events: CLICKED, RELEASED	x and y	I	Upper left corner coordinates	Position relative to the upper left corner of the drawing region. This corner must be within the teach pendant drawing range.
	width and height	I	Part dimensions in pixels	These define the corner opposite the reference corner (x, y): (x+width, y+height). Negative means left or up of the reference corner; positive, right or down.
	fg and bg	I	Foreground and background colors	1: White, 0: Black, 1: Blue, 2: Green, 3: Cyan, 4: Red, 5: Magenta, 6: Brown, 7: Light Gray, 8: Gray, 9: Light Blue, 10: Light Green, 11: Light Cyan, 12: Light Red, 13: Light Magenta, 14: Yellow
	group	I	Group number	Group to which part belongs
	active	I	Visible and active settings	0: Invisible & inactive. Add 1 for visible and 2 for active. Note that 3 is the only setting producing events. (CLICKED and RELEASED).
	style	I	Display style	0: 2D, 1: 3D
	caption	S	Display text	String, max. 80 bytes
	fsize	I	Font size	0: Tiny, 1: Small, 2: Standard, 3: Big
	justify	I	Caption positioning	0: Centered, 1: Right-justified, 2: Left-justified
	value	D	Input value	Equivalent to variable of type double

Part Type	Property Name	Type	Meaning	Notes
Oval (Circle)	x and y	I	Upper left corner coordinates	Position relative to the upper left corner of the drawing region. This corner must be within the teach pendant drawing range.
	width and height	I	Part dimensions in pixels	These define the corner opposite the reference corner (x, y): (x+width, y+height). Negative means left or up of the reference corner; positive, right or down.
	fg and bg	I	Foreground and background colors	1: White, 0: Black, 1: Blue, 2: Green, 3: Cyan, 4: Red, 5: Magenta, 6: Brown, 7: Light Gray, 8: Gray, 9: Light Blue, 10: Light Green, 11: Light Cyan, 12: Light Red, 13: Light Magenta, 14: Yellow
	group	I	Group number	Group to which part belongs
	active	I	Active setting	0: Invisible, 1: Visible
	style	I	Display style	0: Solid line 1 to 7: Dash (dashed line) 8 to 14: Dash double (alternate long and two short dashed line)
	thickness	I	Line thickness	The 0 setting produces flood fill.
Rectangle	x and y	I	Upper left corner coordinates	Position relative to the upper left corner of the drawing region. This corner must be within the teach pendant drawing range.
	width and height	I	Part dimensions in pixels	These define the corner opposite the reference corner (x, y): (x+width, y+height). Negative means left or up of the reference corner; positive, right or down.
	fg and bg	I	Foreground and background colors	1: White, 0: Black, 1: Blue, 2: Green, 3: Cyan, 4: Red, 5: Magenta, 6: Brown, 7: Light Gray, 8: Gray, 9: Light Blue, 10: Light Green, 11: Light Cyan, 12: Light Red, 13: Light Magenta, 14: Yellow
	group	I	Group number	Group to which part belongs
	active	I	Active setting	0: Invisible, 1: Visible
	style	I	Display style	0: Solid line 1 to 7: Dash (dashed line) 8 to 14: Dash double (alternate long and two short dashed line)
	thickness	I	Line thickness	The 0 setting produces flood fill.

Part Type	Property Name	Type	Meaning	Notes
Text Box Events: CLICKED, RELEASED	x and y	I	Upper left corner coordinates	Position relative to the upper left corner of the drawing region. This corner must be within the teach pendant drawing range.
	width and height	I	Part dimensions in pixels	These define the corner opposite the reference corner (x, y): (x+width, y+height). Negative means left or up of the reference corner; positive, right or down.
	fg and bg	I	Foreground and background colors	1: White, 0: Black, 1: Blue, 2: Green, 3: Cyan, 4: Red, 5: Magenta, 6: Brown, 7: Light Gray, 8: Gray, 9: Light Blue, 10: Light Green, 11: Light Cyan, 12: Light Red, 13: Light Magenta, 14: Yellow
	group	I	Group number	Group to which part belongs
	active	I	Visible and active settings	0: Invisible & inactive. Add 1 for visible and 2 for active. Note that 3 is the only setting producing events. (CLICKED and RELEASED).
	style	I	Display style	0: 2D, 1: 3D
	caption	S	Display text	String, max. 80 bytes
	fsize	I	Font size	0: Tiny, 1: Small, 2: Standard, 3: Big
	justify	I	Caption positioning	0: Centered, 1: Right-justified, 2: Left-justified
	text	S	Input text	Equivalent to variable of type string
Group	x and y	I	Upper left corner coordinates	Position relative to the upper left corner of the drawing region. This corner must be within the teach pendant drawing range.
	width and height	I	Part dimensions in pixels	These define the corner opposite the reference corner (x, y): (x+width, y+height). Negative means left or up of the reference corner; positive, right or down.
	fg and bg	I	Foreground and background colors	1: White, 0: Black, 1: Blue, 2: Green, 3: Cyan, 4: Red, 5: Magenta, 6: Brown, 7: Light Gray, 8: Gray, 9: Light Blue, 10: Light Green, 11: Light Cyan, 12: Light Red, 13: Light Magenta, 14: Yellow
	group	I	Group number	Group to which part belongs
	active	I	Active setting	0: Invisible, 1: Visible
	caption	S	Display text	String, max. 80 bytes
	fsize	I	Font size	0: Tiny, 1: Small, 2: Standard, 3: Big
	justify	I	Caption positioning	0: Centered, 1: Right-justified, 2: Left-justified
	thickness	I	Line thickness	The 0 setting produces a line width of 2.
	myGroup	I	Group number	Number identifying group

Part Type	Property Name	Type	Meaning	Notes
Check Box Events: CLICKED, RELEASED	x and y	I	Upper left corner coordinates	Position relative to the upper left corner of the drawing region. This corner must be within the teach pendant drawing range.
	width and height	I	Part dimensions in pixels	These define the corner opposite the reference corner (x, y): (x+width, y+height). Negative means left or up of the reference corner; positive, right or down.
	fg and bg	I	Foreground and background colors	1: White, 0: Black, 1: Blue, 2: Green, 3: Cyan, 4: Red, 5: Magenta, 6: Brown, 7: Light Gray, 8: Gray, 9: Light Blue, 10: Light Green, 11: Light Cyan, 12: Light Red, 13: Light Magenta, 14: Yellow
	group	I	Group number	Group to which part belongs
	active	I	Visible and active settings	0: Invisible & inactive. Add 1 for visible and 2 for active. Note that 3 is the only setting producing events. (CLICKED and RELEASED).
	style	I	Display style	0: 2D check box 1: 3D check box 2: 3D button
	caption	S	Display text	String, max. 80 bytes **Note:** Specifying too long a string produces string overlap on the button surface.
	fsize	I	Font size	0: Standard, 1: Small, 2: Big
	justify	I	Caption positioning	0: Centered, 1: Right-justified, 2: Left-justified
	state	I	State	0: Off, 1: On

Part Type	Property Name	Type	Meaning	Notes
Radio Button Events: CLICKED, RELEASED	x and y	I	Upper left corner coordinates	Position relative to the upper left corner of the drawing region. This corner must be within the teach pendant drawing range.
	width and height	I	Part dimensions in pixels	These define the corner opposite the reference corner (x, y): (x+width, y+height). Negative means left or up of the reference corner; positive, right or down.
	fg and bg	I	Foreground and background colors	1: White, 0: Black, 1: Blue, 2: Green, 3: Cyan, 4: Red, 5: Magenta, 6: Brown, 7: Light Gray, 8: Gray, 9: Light Blue, 10: Light Green, 11: Light Cyan, 12: Light Red, 13: Light Magenta, 14: Yellow
	group	I	Group number	Group to which part belongs
	active	I	Visible and active settings	0: Invisible & inactive. Add 1 for visible and 2 for active. Note that 3 is the only setting producing events. (CLICKED and RELEASED).
	style	I	Display style	0: 2D check box 1: 3D check box 2: 3D button
	caption	S	Display text	String, max. 80 bytes **Note:** Specifying too long a string produces string overlap on the button surface.
	fsize	I	Font size	0: Tiny, 1: Small, 2: Standard, 3: Big
	justify	I	Caption positioning	0: Centered, 1: Right-justified, 2: Left-justified
	state	I	State	0: Off, 1: On
Function Key Events: CLICKED	caption	S	Display text	String
	index	I	Function key number	1 to 12
Timer Events: TIMER	x and y	I	Upper left corner coordinates	Position relative to the upper left corner of the drawing region. This corner must be within the teach pendant drawing range.
	group	I	Group number	Group to which part belongs
	active	I	Active setting	0: Inactive, 1: Active
	interval	I	Interval	Spacing, in ms, between events

Part Type	Property Name	Type	Meaning	Notes
Illuminated Push Button Events: CLICKED, RELEASED, REFRESH	x and y	I	Upper left corner coordinates	Position relative to the upper left corner of the drawing region. This corner must be within the teach pendant drawing range.
	width and height	I	Part dimensions in pixels	These define the corner opposite the reference corner (x, y): (x+width, y+height). Negative means left or up of the reference corner; positive, right or down.
	fg and bg	I	Foreground and background colors	1: White, 0: Black, 1: Blue, 2: Green, 3: Cyan, 4: Red, 5: Magenta, 6: Brown, 7: Light Gray, 8: Gray, 9: Light Blue, 10: Light Green, 11: Light Cyan, 12: Light Red, 13: Light Magenta, 14: Yellow
	group	I	Group number	Group to which part belongs
	active	I	Visible and active settings	0: Invisible & inactive. Add 1 for visible and 2 for active. Note that 3 is the only setting producing events. (CLICKED and RELEASED).
	style	I	Display style	0: 2D rectangle, 1: 3D rectangle, 2: 2D oval, 3: 3D oval
	caption	S	Display text	String, max. 80 bytes
	fsize	I	Font size	0: Tiny, 1: Small, 2: Standard, 3: Big
	justify	I	Caption positioning	0: Centered, 1: Right-justified, 2: Left-justified **Note:** This setting is ignored for style settings 2 and 3.
	state	I	State	0: Out, 1: On

3.3.5 Folder Variables

To access a folder variable declared by a PAC program in the same folder, a TP panel file must first declare it with an EXTERN declaration.

Example: EXTERN DEFINT AAA ' declare folder variable with name AAA

Read/write access then uses the same syntax as normal variables.

Examples:

```
AAA = LightButton1.state    ' read lamp LightButton1 state into folder variable AAA
I[2] = AAA                  ' copy contents of folder variable AAA into global
                              variable I[2]
```

3.4 TP Panel Program

A TP panel program consists solely of action source code blocks with the following structure.

```
DEF Object_Event
  desired operations
END
```

Selecting an object and an action in the editor automatically generates a skeleton consisting of the first (DEF) and last (END) lines. The developer needs only supply the source code specifying the desired response.

The table below lists the possibilities.

Note: The actions available depend on the part type.

Event	Description
CLICKED	Button pressed
RELEASED	Button released
TIMER	Interval elapsed
REFRESH	Screen refreshed

For further details, see Section 2.2.2 "Specifying Action Source Code for Parts."

One TP panel program cannot access the local variables in another.

3.5 Data Types

The TP panel control language supports three types of data:

(1) String data (S)

A string can be up to 243 bytes long.

(2) Numerical data (I, F, and D)

There are three types here.

I: integer, -2147483648 to +2147483647

F: single-precision floating point, -3.402823E+38 to 3.402823E+38

D: double-precision floating point, -1.7976931348623157E+308 to 1.7976931348623157E+308

(3) I/O data (IO)

I/O data expresses the I/O port status (ON/OFF) as a numeric value.

3.6 Type Conversion

Mixing data of different numerical types involves type conversion using the following rules.

- Assigning a numerical value to a numerical variable of a different type involves first converting that value to the target variable's type. (implicit casting)
- An expression mixing two numerical values of different types usually involves first converting the one with lower precision to the type with higher precision. (promoting)
- The only exception to the preceding rule involves bitwise logical operators, which always convert their operands to integers and yield integer results.
- Converting a floating point value to an integer rounds toward zero, yielding the first integer between the original value and zero. Examples: 1.23 -> 1 and -1.23 -> -1.
- Assigning a double-precision floating point (double) value to single-precision (float) one rounds the mantissa off to seven decimal digits.

3.7 Constants

A constant is an expression representing a fixed value.

The TP panel control language supports four types of constants: integer (I), float (F), double (D), and string (S).

The following describes them individually.

(1) Integer constants

These cover the range -2147483648 to +2147483647.

There are two ways to specify them: in decimal and binary notation. There is no hexadecimal notation.

Decimal Notation

These are integer constants specified in standard decimal notation.

Examples: 32767, -125, +10

Binary Notation

These are integer constants specified in a binary notation consisting of a prefix (&B) and a string of binary digits (0 or 1). Using this binary notation, the valid range for (32-bit) integer constants is &B0 to &B11111111111111111111111111111111.

Examples: &B110, &B0011

(2) Float constants

These are single-precision floating point constants with up to 7-digit mantissas over the range -3.402823E+38 to 3.402823E+38.

There are two ways to specify them: in decimal and exponential (E) notation.

Examples: 1256.3, -9.345E-06

(3) Double constants

These are double-precision floating point constants with up to 15-digit mantissas over the range -1.79769313486231E+308 to 1.79769313486231E+308.

There are two ways to specify them: in decimal and exponential (E) notation.

Example 1: 1256.325468

This has more than 7 decimal digits, so does not fit in a float.

Example 2: -9.345E-06

(4) String constants

These are constants consisting of up to 128 characters, enclosed in double quotes (").

Example: "PAC"

3.8 Expressions and Operators

Expressions evaluate to a value. An expression can be anything from a single "element" (constant or variable) to an arithmetic formula combining such elements with operators. The PAC language offers expressions for all data types that it supports. This section describes operators and their operations on elements in expressions.

(1) Assignment operator (=)

An assignment statement "assigns" (copies) the result of evaluating the expression on the right side of this operator to the variable on the left.

(2) Arithmetic operators

The following table lists these operators and gives their order of precedence during expression evaluation.

Arithmetic Operators

Operator	Description	Order of Precedence
^	Exponentiation	Highest
-	Unary minus	↕
*, /	Multiplication and division	↕
MOD	Modulus	↕
+, -	Addition and subtraction	Lowest

Sign of Division Results

Left element \ Divisor (right element)	+	0	-
+	+	Error	+
0	0	Error	0
-	-	Error	+

(3) Relational operators

Relational operators compare two numerical values and return a Boolean result: 1 for true and 0 for false. The archetypical use is as the conditional expression in a flow control statement.

Relational Operators

Operator	Description
=	equal
<>	not equal
<	less than
>	greater than
<=	less than or equal
=.	approximately equal
>=	greater than or equal

(4) Bitwise logical operators

These operators perform bit arithmetic (logical) operations on the bits of their operands.

Note that operands are first converted to integers, if necessary.

Bitwise Logical Operators

Operator	Description
NOT	Invert
AND	Logical product
OR	Logical sum
XOR	Mutually exclusive OR

Example: I1 = &B1100 XOR &B0101

The result is &B1001 because the bits differ only in the first and fourth positions.

(5) String operator (+)

This operator concatenates (joins) two strings.

Example: A = "ABC" + "DEF"

String A becomes "ABCDEF."

(6) Order of precedence for arithmetic, bit arithmetic, and relational operators

The following table gives the order of precedence for mixtures of these operators during expression evaluation.

Operator	Description	Order of Precedence
^	Exponentiation	Highest
-	Unary minus	↑
*, /	Multiplication and division	
MOD	Modulus	
+, -	Addition and subtraction	
NOT	Invert	
AND	Logical product	
OR	Logical sum	
XOR	Mutually exclusive OR	↓
=, <>, <, >, <=, >=	Relational operators	Lowest

When two operators have the same order of precedence, expression evaluation is from left to right. To override this behavior, explicitly specify the order of evaluation with parentheses,

Chapter 4 TP Panel Control Language Syntax

4.1 Statements and Lines

A TP panel control language program consists of lines with one statement per line. A line can be up to 255 bytes long.

A statement is the minimum unit for PAC language programming. It consists of a single command.

A command consists of the command name plus parameters specifying additional information to the command.

4.2 Character Set

The TP panel control language uses ASCII letters, digits, and certain special characters. It does not distinguish between upper and lower case.

These special characters consist of the arithmetic operators (+, -, *, and /) plus the following.

comma (,):	Delimiter for parameters
single quote ('):	In-line counterpart of the REM command
double quote ("):	Beginning and end markers for a string constant
space:	Delimiter before and after instruction name

4.3 Reserved Words

Command names, the MOD operator, and other words are reserved--that is, have a preassigned function in processing the TP panel control language, so cannot be used and names for variables, panels, etc.

TP Panel Reserved Word List

if, then, else, elseif, while, do, return, print, add_widget, msgbox, page_change,
set, reset, run, kill, suspend, suspendall, killall, caption, fg, bg, timeout,
defint, defsng, defdbl, defstr, defio, in, out, break, continue, var, def, pend,
for, refresh, extern, begin, end, wend, next, endif, status, str$, continuerun,
io, i, f, d, s, sysstate, curoptmode, time$, date$, timer, select, case, is, to,
deadmanstate, sprintf$, releasemode, pnlccver, chr$, step

4.4 Declaration Directives

These specify names and types for variables, constants, functions, and other items so that the program can use them. There are three major types.

(1) Type declarations

These specify types for variables and constants.

Type Declaration Directives

Type	Command	Example
integer	DEFINT	DEFINT AA,AB
float	DEFSNG	DEFSNG BA,BB
double	DEFDBL	DEFDBL CA,CB
string	DEFSTR	DEFSTR DA,DB

They can also simultaneously initialize the variables.

Examples:

```
DEFINT AA = 1          ' declare AA as an integer and initialize to 1
DEFSNG BB(10)          ' declare BB as a float array with 10 elements
```

(2) Array declarations

Array declarations use type declaration directives specifying the number of elements. All types except I/O variables support arrays.

Note, however, that type declaration directives cannot initialize arrays.

Array subscripts start at 0.

An array can have up to three dimensions.

An array can have up to 32767 elements in total.

Example:

```
DEFINT CC(3,3,3)       ' declare CC as 3-dimensional integer array
```

(3) I/O variable declarations

These assign variable names to specific I/O ports.

I/O Variable Declarations

Type	Command	Example
I/O variable	DEFIO	DEFIO PORT = BYTE, 104

4.5 Assignment Statements

An assignment statement "assigns" (copies) a value to a variable of some type.

There are two types.

Numerical: This assigns the result of a numerical expression to a numerical variable.

Example: D[2] = 3.14 ' set D[2] to 3.14

String: This assigns the result of a string expression to a string variable.

Example: S[2] = "DENSO"' set S[2] to "DENSO"

4.6 Flow Control Statements

Flow control statements change statement execution order.

There are three main types.

(1) Conditional branching

IF... THEN... ELSE and IF... END IF statements change execution flow based on whether the specified condition is satisfied. Execution branches to the statements following the THEN if the relational expression immediately following the IF evaluates to TRUE (1) and to those following the ELSE otherwise.

(2) SELECT... CASE

Here execution branches to the CASE line matching the result of evaluating the specified arithmetic expression on the SELECT line, executing the statement block between that CASE line and the next one (or END SELECT line). If there is no such match, execution branches to the CASE ELSE block.

(3) Iteration

Here execution of the statement block between the FOR and NEXT lines repeats as long as the condition specified on the FOR line remains satisfied.

4.7 I/O Control Statements

There are three types here.

(1) DI and DO control statements

These directly control I/O ports.

DI/DO Commands

Command	Description
IN	Read data from the I/O port designated by an I/O variable.
OUT	Output data to the I/O port designated by an I/O variable.
SET	Set an I/O port to ON.
RESET	Set an I/O port to OFF.

(2) Teach pendant control statements

These control teach pendant screen I/O.

Teach Pendant Commands

Command	Description
MSGBOX	Display message screen.
PAGE_CHANGE	Display the specified TP panel.
REFRESH	Redraw screen.

4.8 Task Control Statements

These control the multitasking of tasks other than the one containing the statement.

Task Control Commands

Command	Description
RUN	Create/initiate task.
SUSPEND	Interrupt task.
KILL	Delete task.
SUSPENDALL	Interrupt all tasks.
KILLALL	Delete all tasks.
CONTINUERUN	Resume suspended task.

4.9 Functions

The following string functions are available.

String Functions

Function	Description
STR$	Convert a value to a character string.
CHR$	Specify a character using a numeric code.

4.10 System Information

The following commands return system information.

System Information Commands

Command	Description
STATUS	Obtain the program status.
CUROPTMODE	Get the current operation mode.
SYSSTATE	Get the system status of the robot controller.

4.11 Preprocessor

A preprocessor statement controls string substitution or file fetch in compiling programs--that is, translating them into executable form.

Preprocessor Commands

Command	Description
#define	Define macro (symbolic name) for constant or string.
#include	Insert the specified file at this point.

Chapter 5 Command Reference

5.1 List of TP Panel Control Commands

Classified by functions	Commands	Functions	4-axis	6-axis
Declaration Statements				
Local Variable Integer	DEFINT	Declare an integer type variable. The range of the integer is from -2147483648 to 2147483647.	⊙	⊙
Floating-point	DEFSNG	Declare a single precision real type variable. The range of single precision real variables is from -3.402823E+38 to 3.402823E+38.	⊙	⊙
Double-precision	DEFDBL	Declare a double precision real type variable. The range of double precision real type variables is from -1.79769313486231D + 308 to 1.79769313486231D + 308.	⊙	⊙
String	DEFSTR	Declare a character string type variable. You can enter 247 characters or less as a character string.	⊙	⊙
I/O	DEFIO	Declare an I/O variable corresponding to the input/output port.	⊙	⊙
Flow Control Statements				
Repeat	FOR…NEXT	Repeatedly execute a series of instructions between FOR…NEXT sections.	⊙	⊙
Conditional Branch	IF…END IF	Conditionally decide a conditional expression between IF…END IF.	⊙	⊙
	SELECT CASE	Execute a plural condition decision.	⊙	⊙
Input/Output Control Statements				
I/O Port	IN	Read data from the I/O port designated by an I/O variable.	⊙	⊙
	OUT	Output data to the I/O port designated by an I/O variable.	⊙	⊙
	SET	Set an I/O port to ON.	⊙	⊙
	RESET	Set an I/O port to OFF.	⊙	⊙
TP Panel	MSGBOX	Display message screen.	⊙	⊙
	PAGE_CHANGE	Display the specified TP panel.	⊙	⊙
Multitasking Control Statements				
Task Control	RUN	Concurrently run another program.	⊙	⊙
	KILL	Forcibly terminate a task.	⊙	⊙
	SUSPEND	Suspend a task.	⊙	⊙
	SUSPENDALL	Suspend all running programs except supervisory tasks.	⊙	⊙
	KILLALL	Forcibly terminate all tasks except supervisory tasks.	⊙	⊙
	CONTINUERUN	Continue-run tasks.	⊙	⊙
	DEADMANSTATE	Obtain the current deadman switch state.	⊙	⊙
Constants				
Built-in Constants	OFF	Set an OFF (0) value.	⊙	⊙
	ON	Set an ON (1) value.	⊙	⊙
	PI	Set a π value.	⊙	⊙
	FALSE	Set a value of false (0) to a Boolean value.	⊙	⊙
	TRUE	Set a value of true (1) to a Boolean value.	⊙	⊙
Time/Date Control				
Time/Date	DATE$	Obtain the current date.	⊙	⊙
	TIME$	Obtain the current time.	⊙	⊙
	TIMER	Obtain the elapsed time.	⊙	⊙

Classified by functions	Commands	Functions	4-axis	6-axis
Functions				
	STR$	Convert a value to a character string.	⊙	⊙
	CHR$	Convert an ASCII code to a character.	⊙	⊙
	SPRINTF$	Convert an expression to a designated format and returns it as a character string.	⊙	⊙
System Information				
Operation Mode	CUROPTMODE	Get the current operation mode.	⊙	⊙
	SYSSTATE	Get the system status of the robot controller.	⊙	⊙
	STATUS	Obtain the program status.	⊙	⊙
Preprocessor				
Symbol Constants Macro Definitions	#define	Replace a designated constant or macro name in the program with a designated character string.	⊙	⊙
File Fetch	#include	Fetch the preprocessor program.	⊙	⊙

5.2 Declaration Statements

DEFINT (Statement)

Function

Declare an integer variable within the range from –2147483648 to 2147483647.

Format

DEFINT <Variablename>[=<Constant>][,<Variablename>[=<Constant>]...]

Explanation

This statement declares the variable designated by <Variablename> as the integer type variable. By writing a constant after <Variablename>, initialization can be carried out simultaneously with the declaration.

Multiple variable names can be declared at a time by delineating the names using ",".

Related Terms

DEFDBL, DEFSNG, DEFSTR

Example

```
DEFINT lix, liy, liz    'Declare lix, liy, and liz as integer type variables.
DEFINT lix = 1          'Declare lix as an integer type variable and set
                        'the initial value to 1.
```

DEFSNG (Statement)

Function

Declare a single precision real type variable.

The range of single precision real variables is from -3.402823E+38 to 3.402823E+38.

Format

DEFSNG <Variablename>[=<Constant>][,<Variablename>[=<Constant>]...]

Explanation

This statement declares a variable designated by <Variablename> as a single precision real type variable. By writing a constant after <Variablename>, initialization can be done simultaneously with the declaration.

Multiple variable names can be declared at a time by separating them with a comma ",".

Related Terms

DEFDBL, DEFINT, DEFSTR

Example

```
DEFSNG lfx, lfy, lfz    'Declare lfx, lfy, and lfz as single precision real type
                        'variables.
DEFSNG lfx = 1.0        'Declare lfx as a single precision real type variables and
                        'set the initial value to 1.0.
```

DEFDBL (Statement)

Function

Declare a double-precision variable of type real.

The range of double precision real type variables is from -1.79769313486231D + 308 to 1.79769313486231D + 308.

Format

DEFDBL <Variablename>[=<Constant>][,<Variablename>[=<Constant>]...]

Explanation

This statement declares the variable designated by <Variablename> as a double precision real type variable. By writing a constant after <Variablename>, initialization can be performed simultaneously with the declaration.

Multiple variable names can be declared at a time by separating each variable name by a comma (",").

Related Terms

DEFINT, DEFSNG, DEFSTR

Example

```
DEFDBL ldx, ldy, ldz    'Declare ldx, ldy, and ldz as double precision real type
                        'variables.
DEFDBL ldx = 1.0        'Declare ldx as a double precision real type variable and
                        'sets the initial value to 1.0.
```

DEFSTR (Statement)

Function

Declare a string variable.

You can enter 243 characters or less as a character string.

Format

DEFSTR <Variablename>[=<Constant>][,<Variablename>[=<Constant>]...]

Explanation

This statement declares a variable designated by <Variablename> as a character string. By writing a constant after <Variablename>, initialization can be done simultaneously with the declaration.

Multiple variable names can be declared at a time by separating each variable with a comma (",").

Related Terms

DEFDBL, DEFINT, DEFSNG

Example

```
DEFSTR lsx, lsy, lsz    'Declare lsx, lsy, and lsz as character string type
                        'variables.
DEFSTR lsx = "DENSO"    'Declare lsx as a character string type variable and set
                        'the initial value to "DENSO".
```

DEFIO (Statement)

Function

Declare an I/O variable corresponding to the input/output port.

Format

DEFIO <Variablename> = <I/O variable type>,<Port address>[,<Mask data>]

Explanation

This statement declares a variable designated by <Variable name> as an I/O variable.

<I/O variable type> Selects the type of the I/O variable. The I/O variable types include BIT, BYTE, WORD and INTEGER. Designate a range of 1 bit for a BIT type, 8 bits for a BYTE type, 16 bits for a WORD type and 32 bits for an INTEGER type.

<Port address> Designates the starting input/output port number.

<Mask data> In the case of an input port, the AND (product set) from input data and mask data is taken.

In the case of an output port, the AND (product set) from output data and mask data is output, however, the output status of a bit where no mask has been set does not change.

Related Terms

IN, OUT, SET, RESET

Example

```
DEFIO samp1 = BIT, 1
                        'Declare samp1 as a BIT type I/O variable which starts from
                        'port 1. The return value of samp1 becomes a 1-bit integer
                        'of 1 or 0 that expresses the status of port 1.
DEFIO samp2 = BYTE, 10, &B00010000
                        'Declare samp2 with mask data as a BYTE type I/O
                        'variable which starts from port 10. The return value of
                        'samp2 becomes an 8-bit integer of 0 or 16 that expresses
                        'the status of port 10.
DEFIO samp3 = WORD, 15
                        'Declare samp3 as a WORD type I/O variable which starts
                        'from port 15. The return value of samp3 becomes a 16-bit
                        'integer of 0 to &Hffff which expresses the status of the ports
                        'from 15 to 30.
DEFIO samp4 = INTEGER, 1
                        'Declare samp4 as an INTEGER type I/O variable which
                        'starts from port 1. The return value of samp4 becomes a
                        '32-bit integer of 0 to &Hffffffff which expresses the
                        'status of the ports from 1 to 32.
```

Notes

For WORD and INTEGER, a port used as the MSB is assumed to be a sign bit.

The table below lists the allowable range of numeric values and pot numbers used as the MSB.

WORD	Allowable range of numeric values: -32768 to 32767 MSB port No.: Starting port address + 15
INTEGER	Allowable range of numeric values: -2147483648 to 2147483647 MSB port No.: Starting port address + 31

5.3 Flow Control Statements

FOR…NEXT (Statement)

Function

Repeatedly execute a series of instructions between FOR…NEXT sections.

Format

FOR <Variablename> = <Initial value> TO <Final value> [STEP <Increment>]
 :
NEXT [<Variablename>]

Explanation

This statement repeatedly executes a series of instructions between FOR…NEXT according to the condition designated on the FOR line.

Set the initial value of the variable designated by <Variablename> for <Initial value>.

Set the final value of the variable designated by <Variablename> for <Final value>.

Set an increment value between the initial value and the final value for <Increment>. Omitting STEP regards the increment as 1. No negative value can be specified for <Increment>.

You can put another FOR…NEXT in one FOR…NEXT (referred to as a nested construction).

In this case, a different variable must be used for each <Variablename>. Additionally, one FOR…NEXT must be completely inside the other FOR…NEXT.

Example

```
DEFINT li1
 FOR li1 = 1 TO 5      'Repeat the process of FOR…NEXT 5 times.

NEXT                   'Repeat.
```

IF…END IF (Statement)

Function

Conditionally decide a conditional expression between IF…END IF.

Format

IF <Conditional expression> THEN
  :
[ELSEIF <Conditional expression> THEN]
  :
[ELSE]
  :
END IF

Explanation

The execution of a program is controlled with the condition of <Conditional expression>.

If <Conditional expression> of an IF statement is true (except for 0), then the statements between the IF…ELSEIF statement are executed. If the <Conditional expression> is false (0), then <Conditional expression> of an ELSE IF statement is decided. In the same manner as this, ELSEIF ELSE and ELSE…END IF are executed.

Related Terms

IF…THEN…ELSE

Example

```
DIM li1 As Integer
IF li1 = 0 THEN         'When li1 is 0,
PAGE_CHANGE PANEL1      'move to PANEL1.
ELSEIF li1 = 1 THEN     'When li1 is 1,
PAGE_CHANGE PANEL2      'move to PANEL2.
ELSEIF li1 = 2 THEN     'When li1 is 2,
PAGE_CHANGE PANEL3      'move to PANEL3.
ELSE                    'When li1 is any other value,
PAGE_CHANGE PANEL4      'move to PANEL4.
END IF                  'Declare the end to the IF statement.
```

SELECT CASE (Statement)

Function

Execute a plural condition decision.

Format

```
SELECT CASE <Expression>
  CASE <Item>[,<Item>...]
    :
  [CASE ELSE]
END SELECT
```

Explanation

This statement executes a series of instructions after CASE if the value of <Expression> matches <Item> of the CASE statement.

An arithmetic expression or character string can be designated for <Expression>.

A variable, a constant, an expression or a conditional expression can be designated for <Item>.

A conditional expression can be designated as follows.

- <Arithmetic expression 1> TO < Arithmetic expression 2>
  The result of <Expression> is checked if it is <Arithmetic expression 1> or higher, or if it is <Arithmetic expression 2> or lower.
  This statement cannot be used in the case of a character string.
- IS <Comparison operator><Arithmetic expression>
  The result of <Expression> and the value of <Arithmetic expression> are compared.

In the case of a character string, <Comparison operator> is " = ".

A CASE ELSE statement is executed if all CASE statements are not satisfied.

A CASE ELSE statement must be put before an END SELECT statement.

Related Terms

IF…END IF

Example

```
SELECT CASE Index       'Execute this command if the index value matches the CASE
                        'statement value.
  CASE 0                'If the index is 0.
    Button1.caption = "0"
  CASE 1                'If the index is 1.
    Button1.caption = "1"
  CASE 2                'If the index is 2.
    Button1.caption = "2"
  CASE 3                'If n the index is 3.
    Button1.caption = "3"
  CASE 4                'If the index is 4.
    Button1.caption = "4"
  CASE 5                'If the index is 5.
    Button1.caption = "5"
  CASE 6 TO 8           'If the index is 6 to 8.
    Button1.caption = "6-8"
  CASE IS ≥ 9           'If the index is 9 or more.
    Button1.caption = "9-"
END SELECT              'Declare the end of the plural conditional decision statement.
```

5.4 Input/Output Control Statements

IN (Statement)

Function

Read data from the I/O port designated by an I/O variable.

Format

IN <Arithmetic variablename> = <I/O variable>

Explanation

This statement assigns the I/O port data designated by <I/O variable> to the variable designated by <Arithmetic variablename>.

The <I/O variable> is declared using a DEFIO statement or an I/O type variable.

Related Terms

OUT, DEFIO

Example

```
DEFINT Li1, Li2
DEFIO samp1 = INTEGER, 220   'Declare samp1 as an INTEGER type I/O variable
                             'beginning at port 220.
IN Li1 = samp1               'Assign the samp1 data to Li1.
IN Li2 = IO[240]             'Assign the port 240 data to Li2.
OUT samp1 = Li1              'Output the Li1 data from the port declared in samp1.
OUT IO[240] = Li2            'Output the Li2 data from port 240.
```

OUT (Statement)

Function

Output data to the I/O port designated by an I/O variable.

Format

OUT <I/O variable> = <Output data>

Explanation

This statement outputs the value of <Output data> to the port address designated by <I/O variable>.

<I/O variable> is declared using a DEFIO statement or I/O type variable.

Related Terms

IN, DEFIO

Example

```
DEFINT Li1,  Li2
DEFIO samp1 = INTEGER, 220   'Declare samp1 as an INTEGER type I/O variable
                             'beginning at port 220.
IN Li1 = samp1               'Assign the samp1 data to Li1.
IN Li2 = IO[240]             'Assign the port 240 data to Li2.
OUT samp1 = Li1              'Output the Li1 data from the port declared in samp1.
OUT IO[240] = Li2            'Output the Li2 data from port 240.
```

SET (Statement)

Function

Set an I/O port to ON.

Format

SET <I/O variable>[,<Output time>]

Explanation

This statement sets the designated port in <I/O variable> to ON.

If <Output time> is designated a pulse is output. (The output time unit is ms.)

If <Output time> is designated the system does not proceed to the next instruction until this time elapses. The specified output time value is the minimum output time while the actual output time will change according to task priority.

Related Terms

RESET, DEFIO

Example

```
SET IO[240]            'Set BIT port 240 to ON.
SET IO[SOL1]           'Set port specified by I/O variable SOL1 to ON.
SET IO[104 TO 110]     'Set BIT ports 104 to 110 to ON.
IF IO[242] THEN
 RESET IO[240]         'Set BIT port 240 to OFF.
 RESET IO[SOL1]        'Set port specified by I/O variable SOL1 to OFF.
 RESET IO[104 TO 110]  'Set BIT ports 104 to 110 to OFF.
ENDIF
```

RESET (Statement)

Function

Set an I/O port to OFF.

Format

RESET <I/O variable>

Explanation

This statement sets the port specified by <I/O variable> to OFF.

Related Terms

SET, DEFIO

Example

```
SET IO[240]            'Set BIT port 240 to ON.
SET IO[241],40         'Set BIT port 241 to ON for 40 ms.
SET IO[SOL1]           'Set port specified by I/O variable SOL1 to ON.
SET IO[104 TO 110]     'Set BIT ports 104 to 110 to ON.
IF IO[242] THEN
 RESET IO[240]         'Set BIT ports 104 to 110 to OFF.
 RESET IO[SOL1]        'Set port specified by I/O variable SOL1 to OFF.
 RESET IO[104 TO 110]  'Set BIT ports 104 to 110 to OFF.
ENDIF
```

MSGBOX (Statement)

Function

Display message screen.

Format

MSGBOX <message_string>

Explanation

This statement displays the specified message, up to 60 characters long, on the teach pendant's color LCD screen.

Related Terms

MSGBOX "Hello World !"

Notes

This statement does nothing in a CLICKED event source code block for parts (numerical input box and text box) using pop-up windows.

PAGE_CHANGE (Statement)

Function

Display the specified TP panel.

Format

PAGE_CHANGE <panel_name> [, <folders_up>]

where

<panel_name>	TP panel to display on the teach pendant's color LCD screen
<folders_up>	Number of folder levels to step up to reach the folder containing the specified TP panel

Explanation

This statement displays the specified TP panel on the teach pendant's color LCD screen.

Example

```
page_change panel1      'Display specified TP panel
page_change panel1,2    'Move up two folders and display panel1 in that folder
```

5.5 Multitasking Control Statements

RUN (Statement)

Function

Run another program concurrently.

Format

RUN <Programname> [(<Argument>[,<Argument>···])][,<RUN option>]

Explanation

This statement allows the currently executed program to run a program designated in <Programname>. However, the current program cannot run the program itself.

Only values are usable for <Argument>. Even if you specify reference pass, the reference data will automatically be changed to values. But you cannot use local array.

For <RUN option>, there are PRIORITY (or P) and CYCLE (or C).

PRIORITY (or P)

Designates the priority of a program. If ignored, the default value of 128 is set. The smaller the value, the higher the level of priority. The setting range is from 102 to 255.

Note: The priority over of the supervisory task cannot be changed.

CYCLE (or C)

Designates an alternate cycle (time of each cycle when a program is run repeatedly). This option is expressed in msec. The setting range is from 1 to 2,147,483,647.

You cannot start any program that includes arguments when using the cycle option.

Example

```
DEFINT Li1 = 1, Li2 =2, Li3 = 3
RUN samp1 C=1000        'Runs samp1 in parallel n (C=1000).
RUN samp2(Li1)          'Runs samp2 using the Li1 argument in parallel.
RUN samp3(Li1,Li2),PRIORITY = 129
                        'Runs samp3 using the Li1 and Li2 arguments in parallel
                        '(P = 129).
RUN samp4(Li1,Li2),PRIORITY = 150
                        'Runs samp4 using the Li1 and Li2 arguments in parallel
                        '(P = 150).
RUN samp5(Li1,Li2,Li3), P = 120
                        'Runs samp5 using the Li1, Li2, and Li3 arguments in parallel
                        '(P = 120)
```

KILL (Statement)

Function

Forcibly terminate a task.

Format

KILL <Programname>

Explanation

This statement forcibly terminates the task (program) designated by <Programname>. However, it cannot kill a program that contains the statement. If attempted, an error will occur. To forcibly terminate a statement-containing program, use a STOP instruction.

Related Terms

SUSPEND

Example

```
RUN samp1              'Concurrently runs samp1.
   .
   .
   .
KILL samp1             'Ends samp1.
```

SUSPEND (Statement)

Function

Suspend a task.

Format

SUSPEND <Programname>

Explanation

This statement suspends the processing of a designated task. However, it cannot suspend a program that contains the statement.

Related Terms

KILL

Example

```
SUSPEND samp1          'Suspend task execution of samp1.
```

SUSPENDALL (Statement)

Function

Suspend all running programs except supervisory tasks.

Format

SUSPENDALL

Explanation

This statement suspends all tasks except supervisory tasks, makes them enter the "Continue Stop" state, and turns off the "Robot-in-operation" output signal.

Related Terms

SUSPEND, KILLALL

Example

```
SUSPENDALL              'Immediately stop all tasks and enter "Continue Stop" status.
```

KILLALL (Statement)

Function

Forcibly terminate all tasks except supervisory tasks. (Functionally equivalent to the "Program reset" command)

Format

KILLALL

Explanation

This statement forcibly terminates all tasks except supervisory tasks and turns off the "Robot-in-operation" output signal.

Related Terms

KILL, SUSPENDALL

Example

```
KILLALL                 'Terminate all tasks and enter the program reset state.
```

CONTINUERUN (Statement)

Function

Continue-run tasks.

Format

CONTINUERUN

Explanation

Restarts all continue-stopped tasks from the subsequent steps.

Related Terms

KILL, SUSPENDALL

Example

```
CONTINUERUN            'Restart all tasks.
```

DEADMANSTATE (Statement)

Function

Obtain the current deadman switch state.
0: OFF, 1: ON taka

Format

DEADMANSTATE

Explanation

This statement gets the current state of the deadman switch (Enable switch).

Example

```
IO = DEADMANSTATE      'Assign the current deadman state to I0.
```

5.6 Constants

OFF (Built-in constant)

Function

Set an OFF (0) value.

Format

OFF

Explanation

This statement sets an OFF (0) value in an expression.

Related Terms

ON

Example

```
1F I1 = TRUE THEN      'Set the Boolean value to true (1).
  I1 = ON              'Set ON (1) to the integer variable.
ELSEIF I1 = FALSE THEN 'Set the Boolean value to true (1).
  I1 = OFF             'Set OFF (0) to the integer variable.
ELSE
  D1 = PI              'Assign π to the real variable.
ENDIF
```

ON (Built-in constant)

Function

Set an ON (1) value.

Format

ON

Explanation

This statement sets an ON (1) value in an expression.

Related Terms

OFF

Example

```
1F I1 = TRUE THEN      'Set the Boolean value to true (1).
  I1 = ON              'Set ON (1) to the integer variable.
ELSEIF I1 = FALSE THEN 'Set the Boolean value to true (1).
  I1 = OFF             'Set OFF (0) to the integer variable.
ELSE
  D1 = P               'Assign π to the real variable.
ENDIF
```

PI (Built-in constant)

Function

Set a π value.

Format

PI

Explanation

This statement returns a double-precision value of π.

Example

```
1F I1 = TRUE THEN      'Set the Boolean value to true (1).
  I1 = ON              'Set ON (1) to the integer variable.
ELSEIF I1 = FALSE THEN 'Set the Boolean value to true (1).
  I1 = OFF             'Set OFF (0) to the integer variable.
ELSE
  D1 = PI              'Assign π to the real variable.
ENDIF
```

FALSE (Built-in constant)

Function

Set a value of false (0) to a Boolean value.

Format

FALSE

Explanation

This statement sets a value of false (0) to a Boolean value in an expression.

Related Terms

TRUE

Example

```
1F I1 = TRUE THEN      'Set the Boolean value to true (1).
  I1 = ON              'Set ON (1) to the integer variable.
ELSEIF I1 = FALSE THEN 'Set the Boolean value to true (1).
  I1 = OFF             'Set OFF (0) to the integer variable.
ELSE
  D1 = PI              'Assign π to the real variable.
ENDIF
```

TRUE (Built-in constant)

Function

Set a value of true (1) to a Boolean value.

Format

TRUE

Explanation

This statement sets a value of true (1) to a Boolean value.

Related Terms

FALSE

Example

```
1F I1 = TRUE THEN      'Set the Boolean value to true (1).
  I1 = ON              'Set ON (1) to the integer variable.
ELSEIF I1 = FALSE THEN 'Set the Boolean value to true (1).
  I1 = OFF             'Set OFF (0) to the integer variable.
ELSE
  D1 = PI              'Assign π to the real variable.
ENDIF
```

5.7 Time/Date Control

DATE$ (System Variable)

Function

Obtain the current date.

Format

DATE$

Explanation

This statement stores the current date in the following format: "yyyy/mm/dd" (year/month/day).

Related Terms

TIME$

Example

```
defstr ls1
ls1 = DATE$            'Assign the current date to ls1.
```

TIME$ (System Variable)

Function

Obtain the current time.

Format

TIME$

Explanation

This statement stores the current time in the following format: "hh:mm:ss" (Time: minute: second).

Time is displayed using the 24 hour system.

Related Terms

DATE$

Example

```
defstr ls1
ls1 = TIME$            'Assign the current time to ls1.
```

TIMER (System Variable)

Function

Obtain the elapsed time.

Format

TIMER

Explanation

This statement obtains the elapsed time, measured in milliseconds from the time, when the controller power is ON (0).

> **Note: If the elapsed time exceeds 2147483647 milliseconds, the elapsed time will be displayed from -2147483648 milliseconds.**

Example

```
DEFINT li1, li2, li3
li1 = TIMER            'Assign the elapsed time from the reference time to li1.
```

5.8 Character String Functions

STR$ (Function)

Function

Convert a value to a character string.

Format

STR$ (<Expression>)

Explanation

This statement converts the value designated in <Expression> to a character string.

Related Terms

CHR$, SPRINTF$

Example

```
DEFSTR ls1, ls2
ls1 = STR$(20)          'Convert 20 to a string and assign it to ls1.
ls2 = STR$(li1)         'Convert li1 to a string and assign it to ls2.
```

CHR$ (Function)

Function

Convert an ASCII code to a character.

Format

CHR$ (<Expression>)

Explanation

This statement obtains a character with the character code of the value designated in <Expression>.

Related Terms

STR$

Example

```
DEFSTR ls1, ls2
ls1 = CHR$(49)          'Assign a character with the character code of 49 to ls1.
ls2 = CHR$(&H4E)        'Assign a character with the character code of &H4E to ls2.
PB1.caption = "program" + CHR$(13) + CHR$(10) + "start"
                        'Use CR-LF combination as a line delimiter for captions.
```

SPRINTF$ (Function)

Function

Convert an expression to a designated format and returns it as a character string.

Format

SPRINTF$ (<Format>, <Expression>)

Related Terms

STR$

Example

```
SO = SPRINTF$("% d",123)       'Assign "123" to S0.
```

5.9 System Information

CUROPTMODE (Statement)

Function

Get the current operation mode.

Format

CUROPTMODE

Explanation

This statement gets the current operation mode as a value (any of 1 to 4 shown below).
1: Manual, 2: Teach check, 3: Internal auto, 4: External auto

Example

```
I[1] = CUROPTMODE      'Get the current operation mode.
```

SYSSTATE (Statement)

Function

Get the system status of the robot controller.

Format

SYSSTATE

Explanation

This statement gets the system status of the robot controller. The status data differs depending upon the I/O line assignment. Listed below are data that can be obtained.

Bit	0	Robot-in-operation signal
	1	Robot failure signal
	2	Servo ON signal
	3	Robot initialization complete signal (in the I/O standard mode) Robot power on complete signal (in the I/O compatible mode)
	4	Auto mode signal
	5	External mode signal
	6	Dead battery warning signal
	7	Robot warning signal
	8	Continue start permitted signal
	9	SS mode signal
	10	Robot stop signal
	11	Enable Auto signal
	12 to 15	Reserved.
	16	Program start reset signal (in the I/O compatible mode)
	17	CAL complete signal (in the I/O compatible mode)
	18	Teaching signal (in the I/O compatible mode)
	19	Single-cycle end signal (in the I/O compatible mode)
	20 to 23	Reserved.
	24	Command processing complete signal (in the I/O standard mode)
	25 to 31	Reserved.

Example

```
I[1] = SYSSTATE        'Get the system status of robot controller.
```

STATUS (Function)

Function

Obtain the program status.

Format

STATUS (<Programname>)

Explanation

This statement stores the program status of the program designated in <Programname> using an integer.

Value	Status	
1	Running	Executing
2	Stopping	Stopping in progress
3	Suspend	Suspension in progress
4	Delay	Delay in progress
5	Pending	Currently pending
6	Step Stopped	Step stoppage in progress

Example

```
defint li1
li1 = STATUS(samp1)    'Assign the program status of samp1 to li1 using an integer.
```

Notes

This statement cannot obtain the status of its own.

5.10 Preprocessors

#define (Preprocessor statement)

Function

Replace a designated constant or macro name in the program with a designated character string.

Format

#define <Symbol constant> <String>
or
#define <Macro name (Argument)> <Argument included character string>

Explanation

This statement replaces <Symbol constant> or <Macro name> in the program with a designated character string. In the case of a macro name, it is replaced with the arguments already included.

<Symbol constant> or character strings of <Macro name> in " " (double quotations) are not replaced.

You must describe the #define statement on one line.

You must place 1 or more space characters between <Symbol constant> and <String>.

Do not place a space between a macro name and the parentheses of an argument.

<Symbol constant> and <Macro name> must be within 64 characters.

You can use a maximum of 2048 macro names in one program. There is no limitation to the number of macro function arguments you may use.

Example

```
#DEFINE NAME "Denso Corporation"
                        'Assign "DENSO Corporation" to the symbol constant NAME.
S1 = NAME               'Assign "DENSO Corporation" to S1.
```

#include (Preprocessor statement)

Function

Fetch the preprocessor program.

Format

#include "[Path] filename"

#include <[Path] filename>

Explanation

This statement fetches the preprocessor program file, at a position where the #include statement is placed. In the case of " ", if the path of the file is ignored the system searches for the file in the current directory first and then the system directory. In the case of < >, it searches only the system directory. If the path is designated with a full path, it searches only in the directory designated.

You can include the #include statement for a file designated with the #include statement. You can nest up to 8 levels.

The file extension available is H.

Example

```
#include "samp1.h"     'Expand the samp1.h file on this line.
```

RC7 CONTROLLER

Teach Pendant Operating Panel Editor

Panel Designer

User's Manual

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DENSO WAVE INCORPORATED 3M**C

The purpose of this manual is to provide accurate information in the handling and operating of the Panel Designer. Please feel free to send your comments regarding any errors or omissions you may have found, or any suggestions you may have for generally improving the manual.