DENSO ROBOT

Programming Support Tool

WINCAPSIII GUIDE

Preface

Thank you for purchasing our programming support tool, WINCAPS III.

WINCAPS III is a package for efficiently developing and validating robot operation programs (PACs). It permits checking of robot operation, variables, and I/O from a computer connected to the robot controller. It also supports managing program files as projects, storing frequently used programs in program banks, and various other program management functions.

Before using WINCAPS III, read this manual carefully to safely get the maximum benefit from your WINCAPS III system.

After you have finished reading this manual, keep it handy for speedy reference.

Important

To ensure operator safety, be sure to read the precautions and instructions in "SAFETY PRECAUTIONS."

How this book is organized

This book consists of the following.

Chapter 1 Overview

Describes the WINCAPS III features, product components, operating environment, and installation procedure.

Chapter 2 Basic Functions and Operational Flow

Describes the basic functions, operational flow and editor categories of WINCAPS III.

Chapter 3 Starting Up/Shutting Down

Describes the WINCAPS III starting-up and shutting-down procedures, its windows, tools and menus.

Chapter 4 Creating a Project

Describes project creation methods, settings and data processing.

Chapter 5 Writing Programs

It also describes the auxiliary functions and control functions for program creation.

Chapter 6 Arm 3D View Window

Describes operation of arm 3D viewing and handling 3D data to check for collisions with peripheral equipment.

Chapter 7 Online Functions

Describes the online functions (monitoring and debugging) of WINCAPS III. Describes monitor functions for checking robot status and debugging functions to directly debug robot controller programs on your PC.

Chapter 8 Logging

Describes the log functions of WINCAPS III. Describes error logs, operation logs, control logs and other types and log acquisition timing using such devices as error triggers.

Chapter 9 Vision Manager

Describes vision functions using the μVision optional viewing device for WINCAPS III.

Chapter 10 Appendices

Contains related information.

CONTENTS

Chapter 1 Overview

1.1 WINCAPS III Features

WINCAPS III is a package for efficiently developing and validating Denso robot operation programs (PACs). It permits checking of robot operation, variables, and I/O from a computer connected to the robot controller. It also supports managing program files as projects, storing frequently used programs in program banks, and various other program management functions.

1.2 Robot Controller and WINCAPS III Versions

Use the same version of WINCAPS III as that of the robot controller software.

If the WINCAPS III and robot controller software versions differ, connection may not be possible and usable functions may be limited.

- If the version of the robot controller software is more recent than that of WINCAPS III
  In such cases it is necessary to update WINCAPS III with the WINCAPS III trial version that comes with the robot set. The license is unchanged.
- If the version of the robot controller software is older than that of WINCAPS III
  Ver.2.0 and higher of the robot controller can be used. However, functions not compatible with the controller cannot be used.
  In addition, match the version of the output code selected in the Project Properties (select Property from the Project menu and use the Compile tab displayed in the dialog box) to that of the robot controller software connected to.

Note

The following functions cannot be used with versions older than Ver.2.6 of the robot controller software.

- Certain log functions (trace log (single / multi), variables log, I/O log)
- Online (debugging) functions
  For versions of robot controller software prior to Ver.2.0, use WINCAPS II.

1.3 Product Components and Operating Environment

1.3.1 Product components

Your WINCAPS III package should contain the following items.

Software

WINCAPS III Installer Product CD-ROM

License certificate

The WINCAPS III license is written on this. The reverse is a user registration card.

Instruction manual (printed versions optional)

WINCAPS III Guide (this document)

The software Help function contains the WINCAPS III Guide (this manual).

1.3.2 Operating environment

WINCAPS III requires the following computer environment to operate effectively.

Operating System

Microsoft Windows 7 (32-bit & 64-bit)

Microsoft Windows Vista

Microsoft Windows XP SP1 or later

CPU

Pentium 4 or later

Memory

512 megabytes or more

Hard disk drive

500 megabytes or more free

Others

A graphics processing unit (GPU) is recommended for displaying 3D data.

1.3.3 License certificate and user registration

1) Retaining License for Service
The User ID on the license identifies your copy of this product. It is required for after-sales service, so file the license for future reference.
2) User Registration
User registration holds the key to our efforts to provide the best possible after-sales service. Registration ensures timely arrival of notification of technical enhancements and upgrade availability.

Procedure

To register as a user, use the web address given on license.

1.3.4 WINCAPS III trial and light versions

WINCAPS III is available in the trial and light versions in addition to the product version.

Trial and Light Versions	Difference from Product Version
WINCAPS III Light version	• This comes with the optional mini-pendant purchased. • Unavailable functions Printing, simulation function, 3D data import, monitoring interval setting, a part of program bank
WINCAPS III Trial version	• This comes with the robot set purchased. • Unavailable functions Only a program named "PRO1.pac" is editable.

Note

- The trial and light versions show "Trial" and "Light" on the status bar at the bottom of the screen, respectively.
- Entering the license key of the product version to the trial or light version makes it available as a product version.

1.3.5 Note on languages

Use the same language for WINCAPS III and the robot controller.

Otherwise, different encodings can lead to the following problems when receiving data from the robot controller, when opening projects, etc.

- Editing and saving programs or string variables with garbled text can corrupt data.
- Project and file names can be garbled, making it impossible to open the project.

1.4 Installing WINCAPS III

1.4.1 Before you begin

Always uninstall any existing WINCAPS III versions before installing a new version on your computer.
For the procedure, refer to 1.4.4 "Uninstalling" (P. 7).

Note

Be sure to shut down all other applications before installing or uninstalling this software.

1.4.2 Installing WINCAPS III

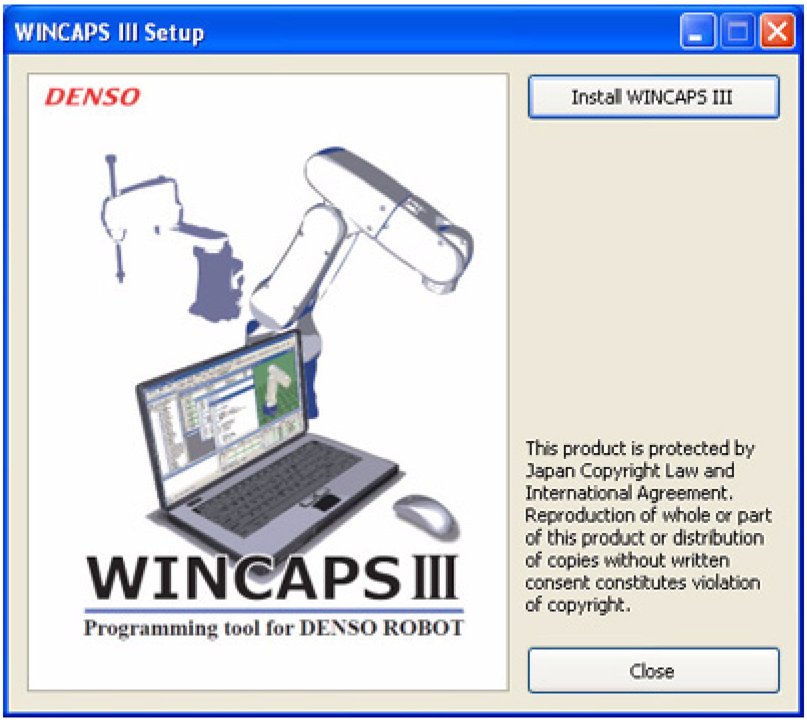
The following is the procedure for installing this software.

Operating procedure

1. **First shut down all Windows applications.**

2. **Load the installer.**

Insert the product CD into the computer CD-ROM drive and wait for the following set-up screen to appear.



WINCAPS III Setup

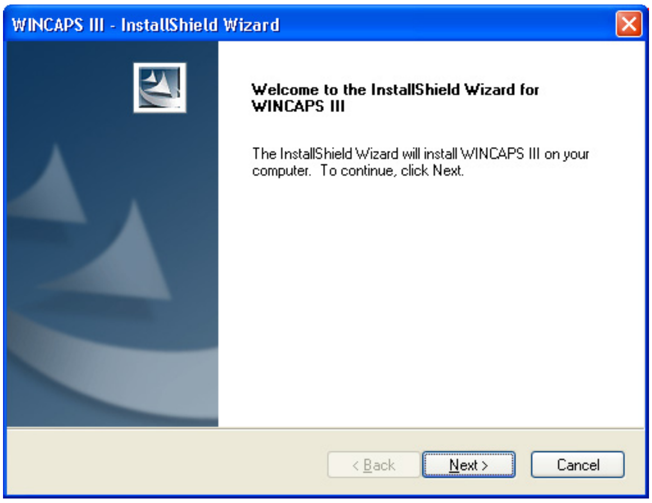
This product is protected by Japan Copyright Law and International Agreement. Reproduction of whole or part of this product or distribution of copies without written consent constitutes violation of copyright.

Note

If the set-up screen is not displayed, right-click on the CD-ROM drive under My Computer and choose Open on the menu that appears. Double-click on setup.exe on the CD-ROM file list to display the set-up screen.

3. Press the install WINCAPS III button to display the WINCAPS III - InstallShield Wizard dialog box.

Follow the screen instructions to configure the installation.



WINCAPS III - InstallShield Wizard

Welcome to the InstallShield Wizard for WINCAPS III

The InstallShield Wizard will install WINCAPS III on your computer. To continue, click Next.

There are three items to specify.

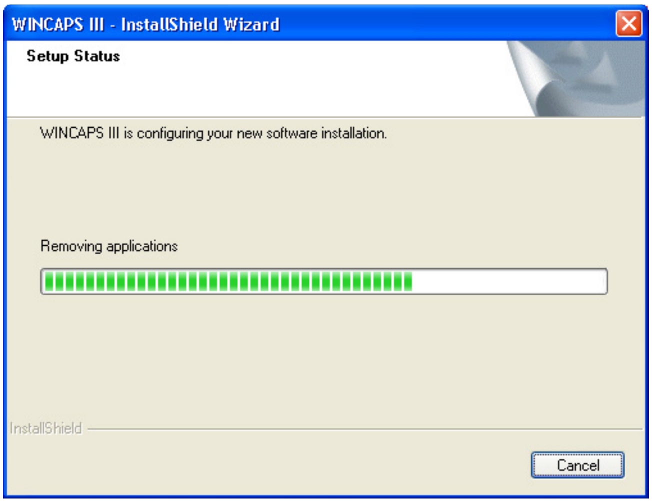
1) Acceptance of the end user license agreement (EULA)
2) License key input
3) Select the folder where the program is installed.

Note

The installer may take a while before starting installation of WINCAPS III since it installs components required for communication and 3D drawing prior to WINCAPS III.

4. Double-check the folder specification and press the OK button.

Proceed with the install operation.



WINCAPS III - InstallShield Wizard

Setup Status

WINCAPS III is configuring your new software installation.

Removing applications

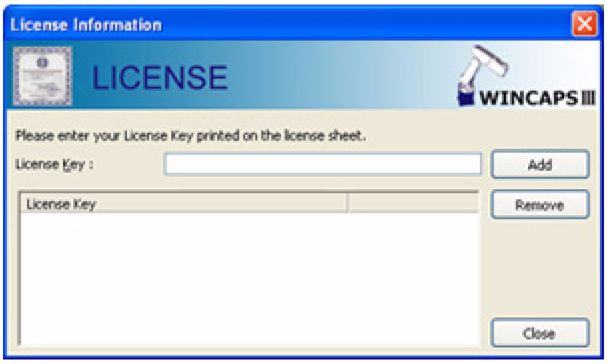
Note

Restart the computer if the installation process ends with a message advising you to do so.

If the required modules are not installed, these will be installed prior to WINCAPS III. Some modules may require you to restart the computer; return to WINCAPS III installation after having done so.

1.4.3 Registering license

During installation a License Information dialog box will appear.



Please enter your License Key printed on the license sheet.

License Key :

Enter the user ID printed on the license included with the product to the License Key field, and press the Add button.

Input the license key printed on the installation disc label for Light or Trial versions.

If the user ID appears under License Key, press the Close button.

Note

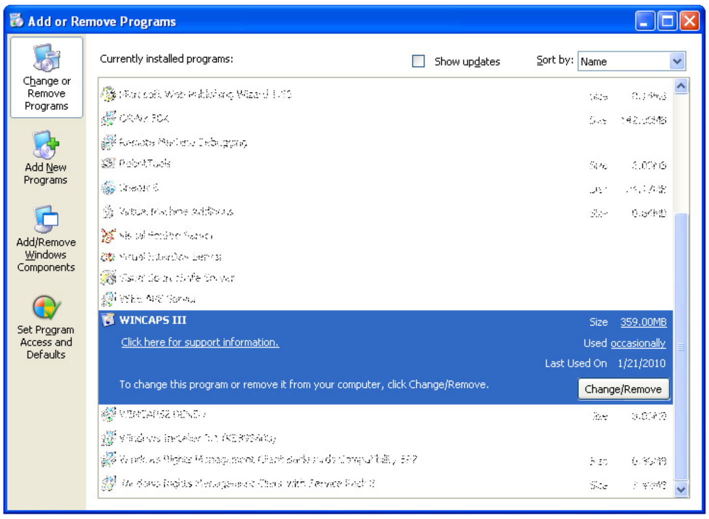
- Skipping over this license registration process loads WINCAPS III in test drive mode with limited functionality.
- To register at a later date, choose Help|License... to display the above dialog box.

1.4.4 Uninstalling

The following is the procedure for uninstalling this software.

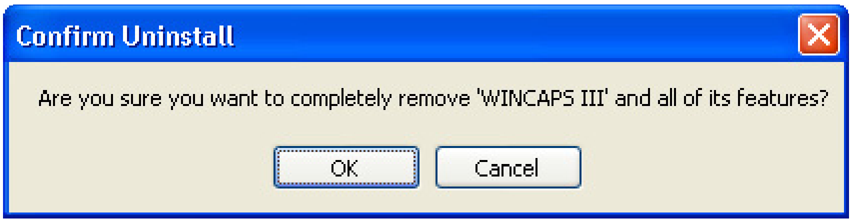
Operating procedure

1. **From the Start menu, choose Settings|Control panel and then Add or Remove programs.**


Add or Remove Programs
Change or Remove Programs
Add New Programs
Add/Remove Windows Components
Set Program Access and Defaults
Currently installed programs:
Show updates
Sort by: Name
WINCAPS III
Size 359.00MB
Click here for support information.
Used occasionally
Last Used On 1/21/2010
Change/Remove

To change this program or remove it from your computer, click Change/Remove.

2. **Choose WINCAPS III and then press the Change/Remove button to display a confirmation dialog box.**



Are you sure you want to completely remove 'WINCAPS III' and all of its features?

3. **Press the OK button to proceed with the uninstall operation.**

Note

- If a dialog box appears warning of shared files, press the Leave all button.
- Installing WINCAPS III also installs ORiN2 SDK and VRC. To uninstall ORiN2 SDK and VRC, first check that no other applications use these and then uninstall them using the same procedure as above.

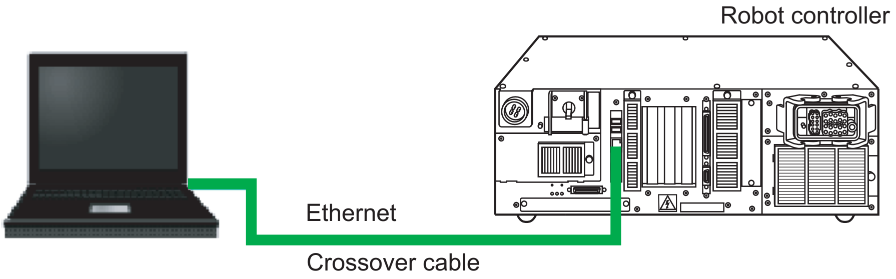
1.5 Connecting to Robot Controller

There are two ways to connect the computer to a robot controller.

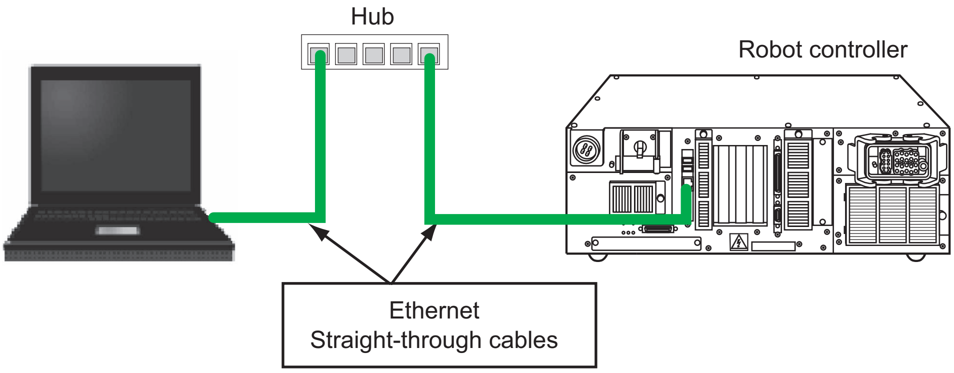
Ethernet connection

This method uses an LAN interface (CN4) to connect the computer to the robot controller.

Direct connection

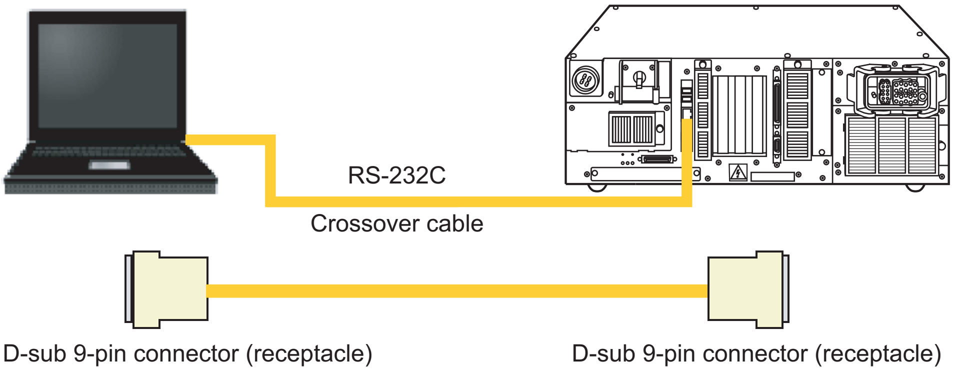


Connection via a hub



RS-232C connection

This method uses a serial port (CN1) to connect the computer to the robot controller.


RS-232C
Crossover cable
D-sub 9-pin connector (receptacle)
D-sub 9-pin connector (receptacle)

Chapter 2 Basic Functions and Operational Flow

2.1 WINCAPS III Basic Functions

The following describes the product's basic functions.

Communications

Communicating with a robot controller over an Ethernet or serial link.

Writing programs

Program using a PAC editor. For further details on programs, please refer to the programming manual. The editor provides the following functions.

- Displaying line numbers
- Color-coded syntax highlighting
- Easy command input using an automatically scrolling list
- Automatic indenting
- Comment blocks
- Bookmarks

Program bank

This library holds programs covering handy DENSO robot functionality. For further details on programs, please refer to Programming Manual II.

Users can customize programs registered in the program bank. They can also add their own.

Online monitoring

WINCAPS III monitors controller status, providing immediate access to variables, I/O values, and other quantities.

Online debugging

WINCAPS III shifts control from the robot controller, allowing the operator to run robot programs held in the robot controller from the computer running WINCAPS III.

Breakpoints, Step check, and other debugging facilities allow checking variables and I/O during operation.

Arm 3D View

This is for visualizing the robot motion and posture on the PC screen. Loading 3D data or creating simple objects enables the user to check interference with the equipment and movements of workpieces and tools without running the actual robot.

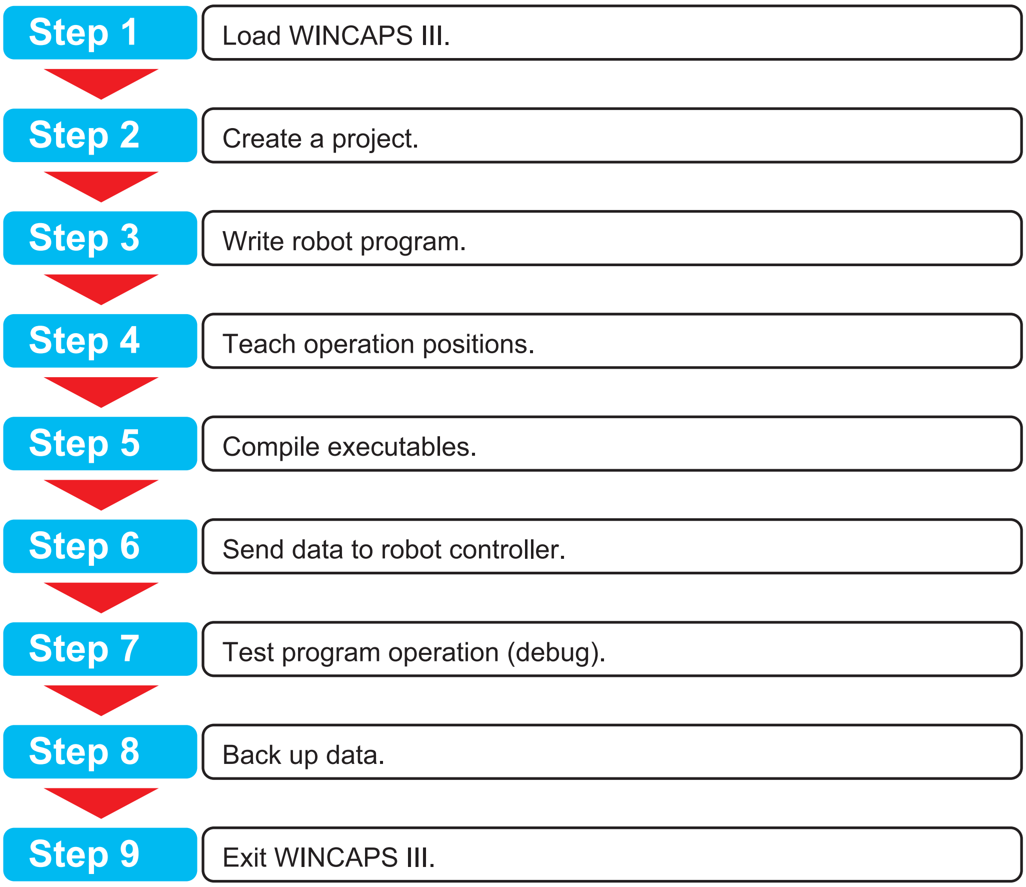
Logging

The following functions for logging variables, I/O values, and error messages are available for efficient program debugging.

- Error log
- Operation log
- Control log
- Trace log
- Variable log
- I/O log
- Single servo data log

2.2 Steps in Writing Robot Programs

The following shows the WINCAPS III work flow for writing a program and validating its operation.



Step 1 Load WINCAPS III.

Step 2 Create a project.

Step 3 Write robot program.

Step 4 Teach operation positions.

Step 5 Compile executables.

Step 6 Send data to robot controller.

Step 7 Test program operation (debug).

Step 8 Back up data.

Step 9 Exit WINCAPS III.

Step 1: Load WINCAPS III.

Launch WINCAPS III.

For further details, refer to Chapter 3 "Starting Up/Shutting Down" (P. 13).

Step 2: Create a project.

This project contains all necessary data for the target robot.

For further details, refer to Chapter 4 "Creating a Project" (P. 50).

Step 3: Write robot program.

Write the robot operation program using the built-in editor.

For further details, refer to Chapter 5 "Writing Programs" (P. 70).

Step 4: Teach operation positions.

Specify operation positions by manipulating the virtual robot in the Arm 3D view window.

For further details, refer to Chapter 6 "Arm 3D View Window" (P. 92).

Note

Using simple modeling and importing 3D data creates an on-screen simulation for specifying the robot's operation range and detecting collisions with surrounding equipment.

Step 5: Compile executables.

The compiler converts project programs to executables for execution by the robot controller.

For further details, refer to Chapter 5 "Writing Programs" (P. 70).

Step 6: Send data to robot controller.

Connect to the robot controller and send it the data necessary for robot operation.

For further details, refer to 4.7 "Link with Robot Controller" (P. 59).

Step 7: Test program operation (debug).

Use WINCAPS III online functions to examine program flow, determine the robot's operation range, and detect collisions with surrounding equipment. Modify the program to eliminate any problems detected. Repeat the compile-debug cycle until no such problems remain.

For further details, refer to Chapter 7 "Online Functions" (P. 107).

Note

- WINCAPS III directly controls robot controller program operation.
- Trace logging allows efficient validation of multitasking and other complex program flow as well as easy analysis of interactions with other programs.
- I/O logging simplifies timing adjustments with neighboring equipment for use in optimizing operation and reducing cycle times.

Step 8: Back up data.

Use WINCAPS III to save the robot controller's internal data in projects.

For further details, refer to 4.7.2 "Data transfers" (P. 60).

Step 9: Exit WINCAPS III.

For further details, refer to Chapter 3 "Starting Up/Shutting Down" (P. 13).

2.3 User Levels and Access Rights

WINCAPS III's two user access levels, operator and programmer, ensure data security by limiting access to advanced functionality and sensitive data.

The user specifies which on the log-in screen when WINCAPS III first starts.

For further details on logging in, refer to 3.1 "Loading WINCAPS III" (P. 13).

Operator level

Level enabling PAC program creation / editing and other basic operations.

It blocks changes to WINCAPS III settings.

It does not require a password.

Programmer level

Level enabling changes in project settings and other higher operations.

It allows changes to WINCAPS III settings.

It requires a password.

For further details on setting this password, refer to 3.1.2 "Programmer password" (P. 17).

Differences in functions due to user levels are as follows.

Function	Operator	Programmer
Creating a new project	○	○
Writing / editing programs	○	○
Data transfers	○	○
Online (monitoring/debugging functions)	○	○
Addition of controller function extension	○	○
Altering project properties	△*	○
Altering parameters	×	○
Reading / writing arm parameters	×	○

*Only communications settings can be changed

Note

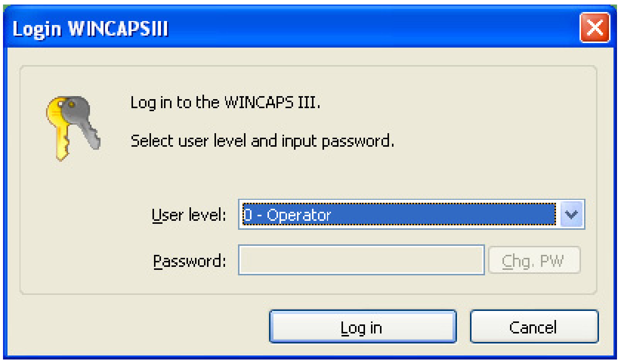
Changing user levels while WINCAPS III is running requires returning to the dialog box for logging in.

Chapter 3 Starting Up/Shutting Down

3.1 Loading WINCAPS III

Operating procedure

1. **On the Start menu, choose All Programs|DENSO FACTORY WARE|WINCAPS III|WINCAPS III to display the dialog box for logging in.**



Login WINCAPSIII

Log in to the WINCAPS III.

Select user level and input password.

User level: 0 - Operator

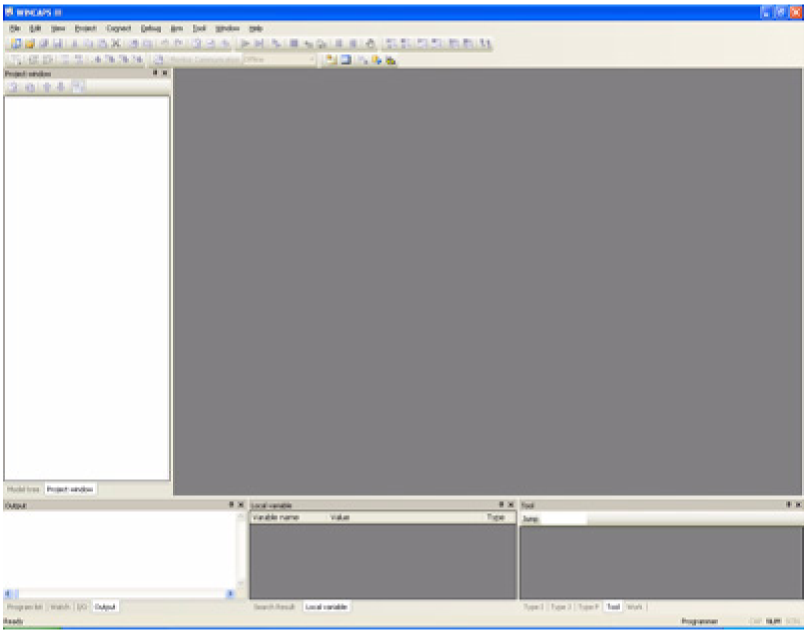
Password:

2. **Specify user level and password.**

The user level choices are 0-operator and 1-programmer.

The latter requires a password.

3. **Press the Log in button to load WINCAPS III.**



3.1.1 WINCAPS III basic settings

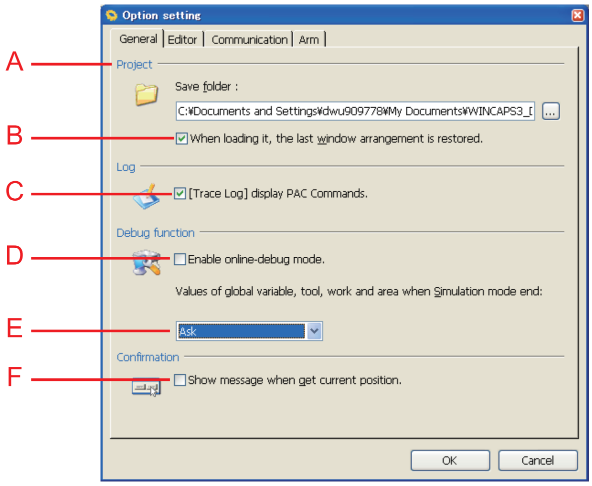
Operating procedure

1. **Choose Tool|Option to display the dialog box for configuring such software options.**

2. **Click the tab containing the desired configuration option.**

The dialog box has the following three tabs.

General tab



Project

Save folder :

C:¥Documents and Settings¥dwu909778¥My Documents¥WINCAPS3_[

☑ When loading it, the last window arrangement is restored.

Log

☑ [Trace Log] display PAC Commands.

Debug function

□ Enable online-debug mode.

Values of global variable, tool, work and area when Simulation mode end:

Ask

Confirmation

□ Show message when get current position.

A: Project

This field specifies a folder for saving projects. This becomes the default folder for saving new projects.

B: When loading it, the last window arrangement is restored.

Opens project with the program window and 3D view window in the same place as when last closed.

C: [Trace Log] display PAC Commands.

Selecting this check box adds a Code column displaying souce code to the Trace log window.

* Note that large logs can take considerable time to display.

D: Debug function

Selecting this check box enables debugging.

E: Values of global variable, tool, work and area when Simulation mode end

Switches the display of the dialog message that appears when exiting the simulation mode.

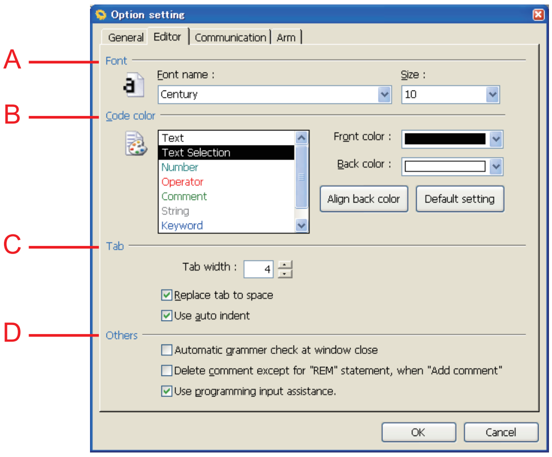
F: Show message when get current position.

A confirmation message is displayed when acquiring position. Turn this ON to avoid overwriting position data by mistake.

Note

- Leaving it deselected disables all debugging functions, so selecting one during online operation triggers an error message.
- WINCAPS III always starts with debugging disabled.

Editor tab



Font name : Century

Size : 10

Text
Text Selection
Number
Operator
Comment
String
Keyword

Front color :

Back color :

Tab width : 4

☑ Replace tab to space

☑ Use auto indent

☐ Automatic grammer check at window close

☐ Delete comment except for "REM" statement, when "Add comment"

☑ Use programming input assistance.

A: Font

This area specifies the font type and size for Program edit windows.

B: Code color

This area specifies the colors for highlighting text in the Program edit window. Select the text type, then choose text color with Front color and surrounding color as Back color.

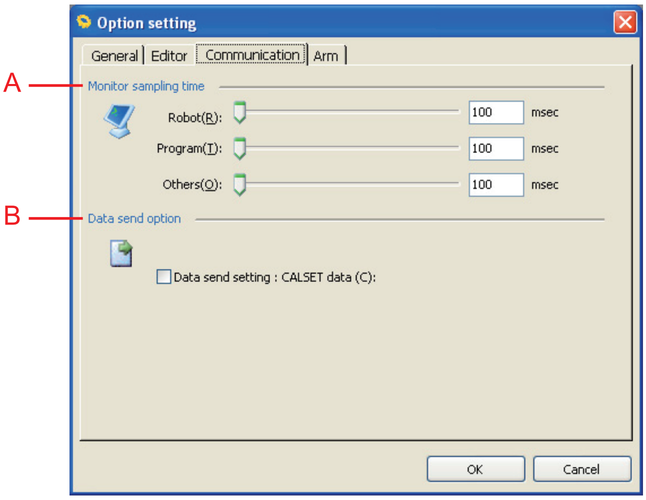
C: Tab

This area specifies the tabs for Program edit windows.

D: Others

Selecting this check box automatically runs a syntax check on the selected program before closing the Program edit window. Select the check box to delete comments other than those in REM for Adding Comments.

Communication tab



Robot(R): 100 msec

Program(T): 100 msec

Others(O): 100 msec

☐ Data send setting : CALSET data (C):

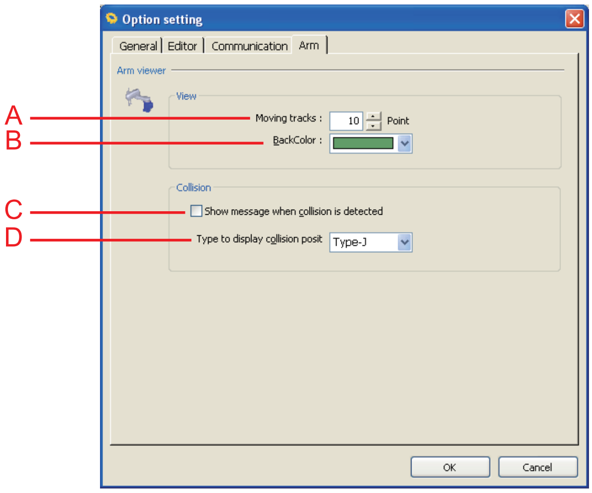
A: Monitor sampling time

This area specifies the intervals at which to monitor robot controller operation.

B: Data send option

The options in this area configure data transfers to the robot controller.

Arm tab



Moving tracks : 10 Point

BackColor : 🟩

□ Show message when collision is detected

Type to display collision posit Type-J

A: Moving tracks

Sets the point numbers for the robot operation trajectory displayed in the Arm 3D view window.

B: BackColor

This sets the Arm 3D View window background color.

C: Show message when collision is detected

Select to display the Collision dialog box when a collision is detected.

D: Type to display collision position

Choose the method of displaying the robot's position when a collision occurs.

3. When configuration is complete, press the OK button.

Pressing the Cancel button instead discards all changes.

Note

Moving to another tab does not save changes. To save your new settings, always press the OK button.

3.1.2 Programmer password

Using WINCAPS III at the programmer level requires logging in with a password.

Register one with your first login.

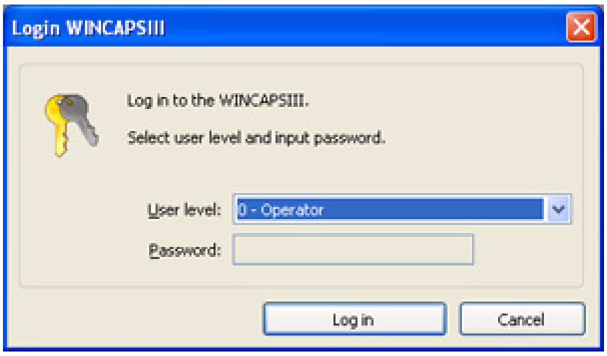
Note

Passwords are case sensitive.

3.1.2.1 Registering a password

Operating procedure

1. In the Login WINCAPSIII dialog box, choose 1-programmer as the user level to enable password input.



Login WINCAPSIII

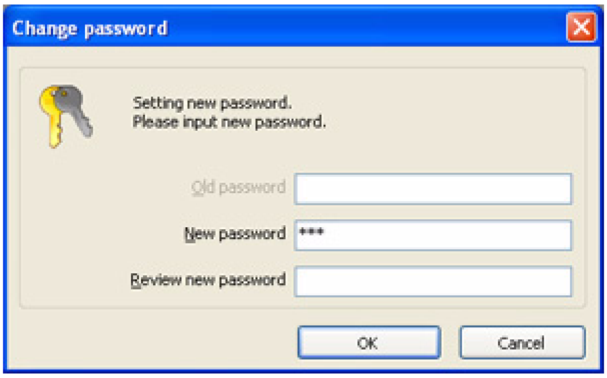
Log in to the WINCAPSIII.

Select user level and input password.

User level: 0 - Operator

Password:

2. Enter the desired password and press the Login button to display the dialog box for changing the password.



Change password

Setting new password.
Please input new password.

Old password

New password ***

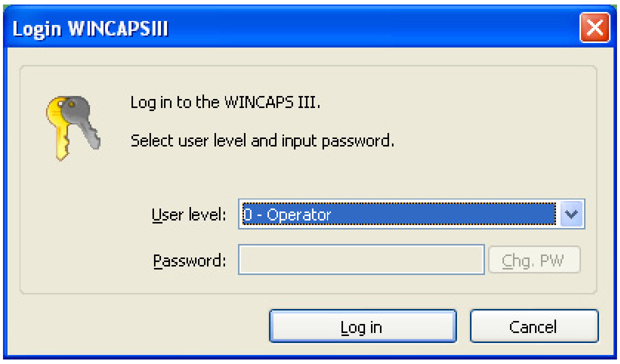
Review new password

3. Re-enter the new password in the Review new password field and press the OK button to register the password.

3.1.2.2 Changing the password

Operating procedure

1. **Choose Tool|Re-Login to display the dialog box for logging in.**



Login WINCAPSIII

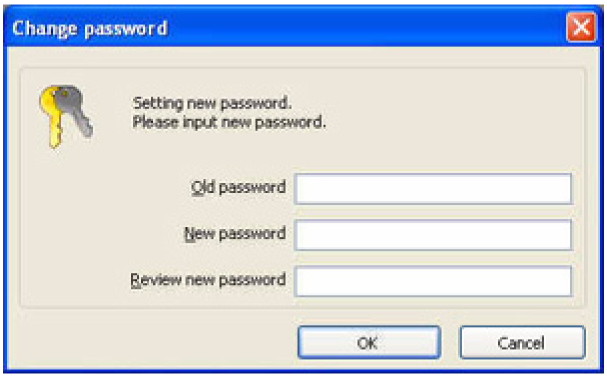
Log in to the WINCAPS III.

Select user level and input password.

User level: 0 - Operator

Password:

2. **Press the Chg. PW button to display the dialog box for changing the password.**



Change password

Setting new password.
Please input new password.

Old password

New password

Review new password

3. **Enter three passwords: the current password in the first field and the new one in the other two.**

4. **Press the OK button to update the password.**

3.2 WINCAPS III Screen Descriptions

3.2.1 Screen components

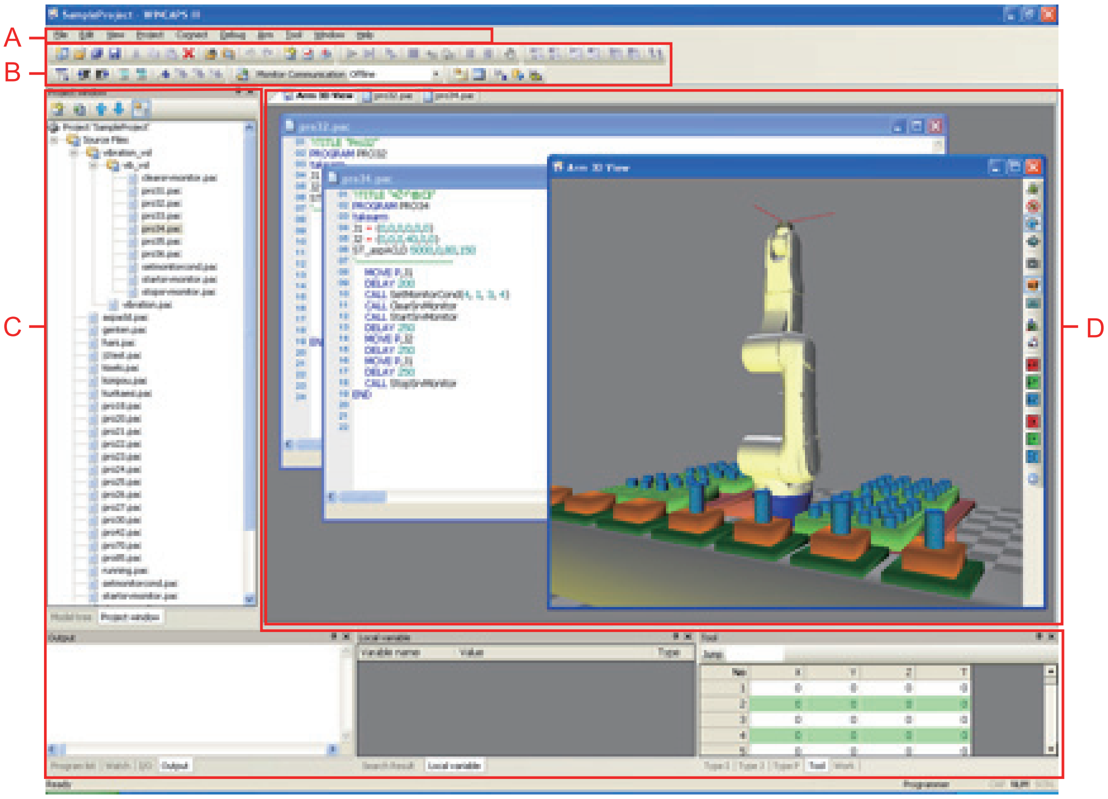
WINCAPS III uses the following general screen layout.

Note

WINCAPS III offers the user considerable flexibility in rearranging screen elements to match the needs at hand.

For further details on screen customization, refer to 3.2.6 "Screen operations" (P. 41).

The screen shots in this document use the default layout, so may not necessarily match what appears on your screen.



A: Menus

This area displays the following ten menu items available in WINCAPS III.

- File menu
- Edit menu
- View menu
- Project menu
- Connect menu
- Debug menu
- Arm menu
- Tool menu
- Window menu
- Help menu

For further details on menu items, refer to 3.2.2 "Menu items" (P. 21).

B: Toolbars

This area displays the following six toolbars that provide user alternate access to most menu items with button icons.

- Standard toolbar
- Edit toolbar
- View toolbar
- Link Mode toolbar
- Debug toolbar
- Log toolbar

For further details on toolbars, refer to 3.2.3 "Toolbars" (P. 30).

C: Docking view

The Docking view area displays various types of information windows showing the results of a project-wide search, compile error messages, variables and I/O values, etc.

For further details on the Docking view, refer to 3.2.4 "Docking view" (P. 32).

D: Program view

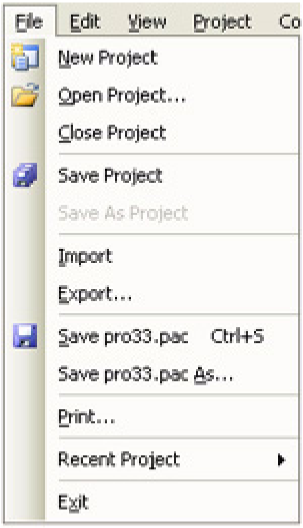
The Program view area displays the source code, Arm 3D View window, etc.

For further details on the Program view, refer to 3.2.5 "Program view" (P. 38).

3.2.2 Menu items

The following describes each WINCAPS III menu item.

3.2.2.1 File menu



New Project

This is for creating a new project.

Open Project...

This is for opening an existing project.

Close Project

This closes the currently open project. If the project has program edits or other unsaved modifications, a dialog box asks whether you wish to save them.

Save Project

This saves the currently open project.

Save As Project

This is for saving the currently open project under a new name. It creates a folder under a specified name and copies all current project data into the folder.

Import

This is for reading in .csv files containing variables and log data exported from other projects.

Export...

This exports variables, I/O values, and log data in standard .csv format for use by other applications.

Save

This saves the program or header file selected in the Program view area.

Save As...

This saves the program or header file selected in the Program view area under a different name.

It adds saved file into a project.

Print...

This is for printing programs, variables, and a list of I/Os.

Recent Projects

This displays recently used projects.

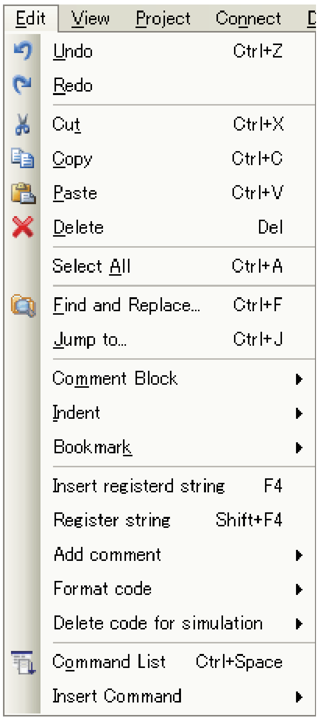
Choosing one opens it.

Exit

This is for shutting down the program.

If the project has program edits or other unsaved modifications, a dialog box asks whether you wish to save them.

3.2.2.2 Edit menu



Undo

This cancels the last operation, returning edits to the preceding state.

Redo

This repeats the operation canceled with Undo.

Cut

This moves to the Windows clipboard and deletes the contents selected in the Program edit window.

Copy

This copies to the Windows clipboard the contents selected in the Program edit window.

It does not delete the original.

Paste

This copies the clipboard contents to the selected portion of the Program edit window.

Delete

This deletes the area selected in the Program edit window.

Select All

This selects the entire contents of the Program edit window.

Find and Replace...

This replaces occurrences of one string with another.

Jump to...

This is for moving the cursor to a line, specified by number, in the Program edit window.

Comment Block

This submenu converts the lines selected in the Program edit window to and from comments.

Indent

This submenu controls indenting of the lines selected in the Program edit window

Bookmark

This is for working with bookmarks.

Insert registered string

Previously registered character strings are placed in the program.

Register string

Commonly used character strings can be registered in advance and placed in programs through shortcuts.

Add comment

Selecting this automatically adds texts written in the application columns of variables and I/O lists to the source code as comments.

Format code

The program code is shaped into a standard form. Line indents are inserted and blank spaces inside the code added or deleted automatically.

Delete code for simulation

Deletes code for simulation functions.

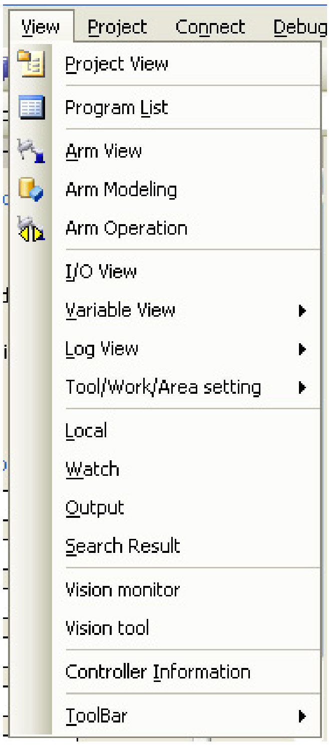
Command List

Selecting this automatically displays a scrolling list of commands available with auto-completion at the cursor position.

Insert Command

This is for inserting a command selected from the command input list at the cursor position in the predetermined syntax.

3.2.2.3 View menu



Project View

This displays the Project view window.

Program List

This displays the Program list window.

Arm View

This displays the Arm view window.

Arm Modeling

This displays the Arm modeling window.

Arm Operation

This displays the Arm operation window.

I/O View

This displays an I/O window in the Docking view area.

Variables View

This submenu displays variables of specified types in the Docking view area.

Log View

This submenu displays Log windows of specified types in the Program view area.

Tool/Work/Area setting

This submenu displays windows for specifying tools, work pieces, and areas.

Local

This displays local variables in the Docking view area.

Watch

This displays the Watch window in the Docking view area.

Output

This displays output in the Docking view area.

Search Result

The results are displayed when Search / replace is executed.

Vision monitor

This toggles display of the Vision monitor window.

Vision tool

This toggles display of the Vision tool window

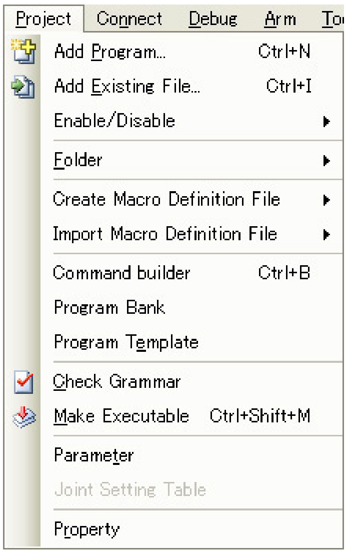
Controller Information

This displays basic information of the controller.

ToolBar

This submenu controls the display of toolbars.

3.2.2.4 Project menu



Add Program...

This is for creating a new program and adding it to the current project.

Add Existing File...

This submenu is for copying the selected program into the current project folder to add it in the project.

Enable/Disable

This submenu controls usage of a file within the project.

Enabled programs can be executables.

Folder

This submenu is for creating, renaming, and importing folders. Programs of other projects can be imported as folders.

Create Macro Definition File

This submenu is for creating header files defining macro names of variables and I/O ports.

Import Macro Definition File

This submenu is for reading the content of header files defining macro names to apply it to variables and I/O ports.

Command builder

This submenu is for displaying the Command builder dialog box to support PAC commands input.

Program Bank

This displays a dialog box with programs covering handy DENSO robot functionality.

Developers can also add their own work to this open-ended library.

Program Template

This submenu is for creating a typical program merely by entering parameters in accordance with guidances.

Check Grammar

This runs a syntax check on the selected program. The results appear in an Output window.

Make Executable

This updates the executables for the project. An Output window tracks progress and error messages from the compiler.

Parameter

This displays the dialog box for specifying project parameters.

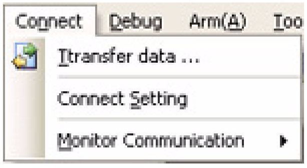
Joint Setting Table

This displays the dialog box for specifying joint settings. Axis settings are used in SMRT4G, MC2F and Added axes.

Property

This submenu displays the dialog box containing property sheets of communication, compile, variables, and I/O items for referring to them or configuring the project.

3.2.2.5 Connect menu



Transfer Data...

This is for exchanging data with the robot controller.

Connect Setting

This opens the Property dialog box to the Communications settings tab, the one for configuring the communications link for the project.

Monitor Communication

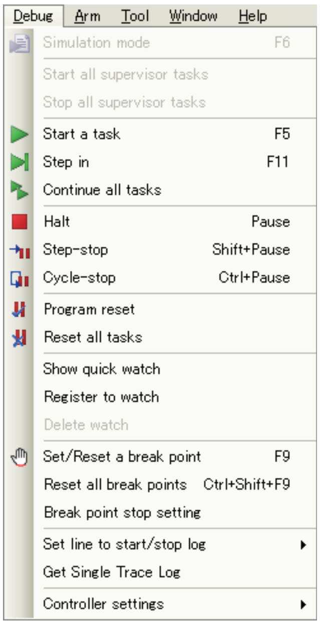
This submenu specifies the connection to the robot controller.

- Offline:
  WINCAPS III operates alone, without connecting to the robot controller.
- Monitoring:
  WINCAPS III connects to the robot controller and displays its internal data. Specify the data update intervals with Tool|Option.
- Debugging:
  WINCAPS III controls automatic program operation from the computer, debugging programs by modifying their variables and I/ O values as they run.

3.2.2.6 Debug menu

Note

The Debug menu is available in WINCAPS III connected with the robot controller version 2.7 or later.



Simulation mode

Start the simulation function.

This enables checking of cycle time or operation posture.

Start all supervisor tasks

This starts all supervisory tasks.

Stop all supervisor tasks

This stops all supervisory tasks.

Start a task

This starts the selected program.

Step in

This executes one program step.

If a step includes CALL text, execution pauses at the first step in that function.

Continue all tasks

This resumes suspended tasks.

Halt

This suspends program execution.

Step-stop

Program execution runs through to the end of the current step.

Cycle-stop

Program execution runs through to the end of the current cycle.

Program reset

This returns the current program to its starting point.

Reset all tasks

This returns all programs to their starting points.

Show quick watch

This displays the current values of all variables and I/O ports currently selected in the Program edit window.

Register to watch

Add the currently selected quick watch items to the watch list in the Watch window.

Delete watch

This deletes the watch items selected in the Watch window.

Set/Reset a break point

This specifies whether program execution breaks at the step currently under the cursor in the Program edit window.

Reset all break points

This clears all breakpoints.

Break point stop setting

This specifies whether hitting a breakpoint pauses the current program only or all programs.

Set line to start/stop log

One way to specify a logging range is to select it in the Program edit window. Another is to specify starting or stopping for the current line in the Program edit window.

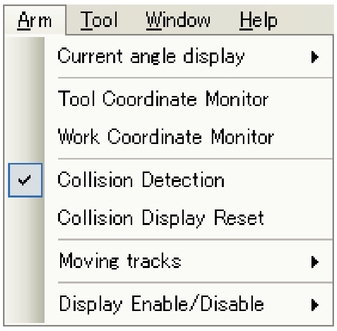
Get Single Trace Log

This displays the trace log for the specified program, a listing of the program steps executed and their execution times.

Controller settings

This submenu controls controller operation: turning motors and machine locks ON and OFF and specifying times for reading control logs.

3.2.2.7 Arm menu



Current angle display

This submenu controls the display, in the Arm 3D View window, of current values for arm angle variables of types P, J, T, and J-EX. It also supports copying of those values.

Tool Coordinate Monitor

This toggles the display of the current tool number and coordinate axis in the Arm 3D view window.

Work Coordinate Monitor

This toggles the display of the current work number and coordinate axis in the Arm 3D view window.

Collision Detection

Selecting this toggles collision detection.

Collision Display Reset

This removes collision results from the display.

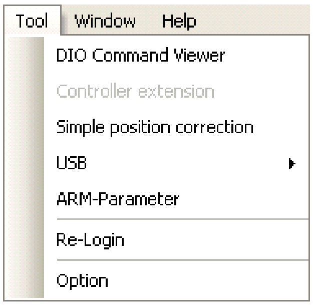
Moving tracks

Sets the display of the trajectory the flange tip moved through.

Display Enable/Disable

This submenu controls display of elements in the Arm 3D view window: floor, arm, tool, work, area, and obstacles.

3.2.2.8 Tool menu



DIO Command Viewer

This displays the DIO command viewer dialog box for displaying standard command patterns or those with mini I/O assignments. During debugging, this dialog box also allows batch setting of command patterns for dummy I/O.

Controller extension

This is available only in the online monitoring mode.

Simple position correction

Robot position can be corrected easily with WINCAPS III.

USB

This is for reading or writing project data from/to a USB memory.

ARM-Parameter

Reads/writes arm parameters needed for controller settings.

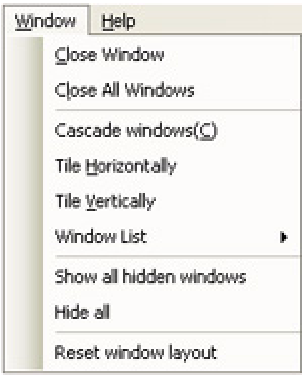
Re-Login

This returns to the dialog box for logging in, the only way to changing user levels while WINCAPS III is running

Option

This displays the dialog box for configuring such software options as the editor's syntax highlighting colors and communications time out limits.

3.2.2.9 Window menu



Close Window

This closes the program or header file selected in the Program view area.

Close All Windows

This closes the following Program view window types: Arm 3D view, Vision monitor, and Program edit.

Cascade windows

This stacks all windows of the above types so that they overlap each other, with the title bars visible, in the Program view area.

Tile Horizontally

This lines up all windows of the above types horizontally in the Program view area.

Tile Vertically

This lines up all windows of the above types vertically in the Program view area.

Window List

This submenu lists all windows of the above types currently open in the Program view area.

Show all hidden windows

This restores a minimized window to the original size.

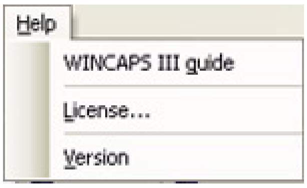
Hide all

This minimizes all windows in the Docking view area to maximize the Program view area. Use this to maximize the Arm 3D view window or Program edit window.

Reset window layout

This returns windows to the default layout.

3.2.2.10 Help menu



WINCAPS III guide

This shows the WINCAPS III help.

License...

This shows the license information.

Version

This shows the version of WINCAPS III.

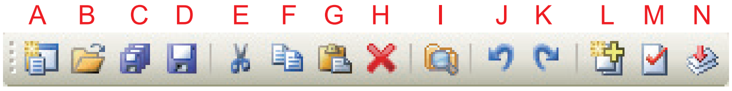
3.2.3 Toolbars

The toolbars provide user alternate access to most menu items with button icons.

Alternatively, you can save screen real estate by turning them off, all or individually.

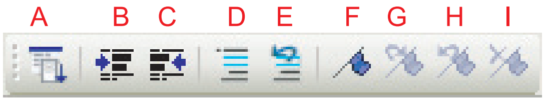
There are six of these toolbars. The following lists map their buttons to the corresponding menu items.

Standard toolbar



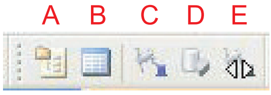
A:	New Project
B:	Open Project...
C:	Save Project
D:	Save
E:	Cut
F:	Copy
G:	Paste
H:	Delete
I:	Find...
J:	Undo
K:	Redo
L:	Create Programs...
M:	Check Syntax
N:	Make Executable

Edit toolbar



A:	Command List
B:	Indent
C:	Unindent
D:	Encomment
E:	Decomment
F:	Set/Clear Bookmark
G:	Next Bookmark
H:	Previous Bookmark
I:	Clear Bookmarks

View toolbar



A: Project View

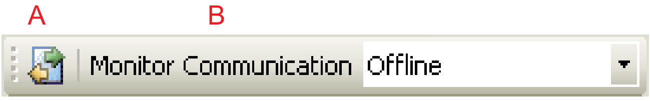
B: Program list

C: Arm view

D: Arm Modeling

E: Arm operation

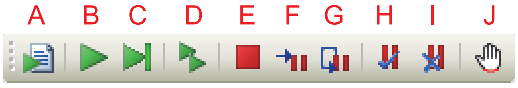
Communication mode toolbar



A: Transfer Data

B: Monitor Communication

Debug toolbar



A: Simulation mode

B: Start a Task

C: Step In

D: Continue All Tasks

E: Halt

F: Step-stop

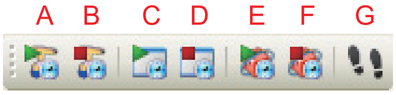
G: Cycle-stop

H: Program Reset

I: Reset All Tasks

J: Toggle Breakpoint

Log toolbar



A: Set/Clear Control Log Start Line

B: Set/Clear Control Log End Line

C: Set/Clear Trace Log Start Line

D: Set/Clear Trace Log End Line

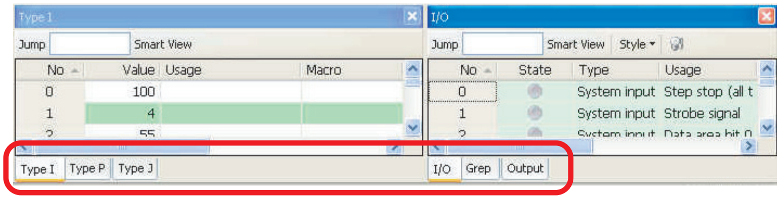
E: Set/Clear Variable Log Start Line

F: Set/Clear Variable Log End Line

G: Single-trace Log

3.2.4 Docking view

The Docking view area provides tab interfaces for switching between members of windows that the user has "docked" (grouped together).



For further details on docking procedures, refer to 3.2.6 "Screen operations" (P. 41).

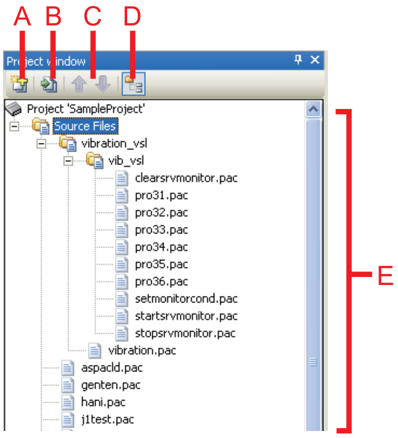
Docking is available for the following window types.

- 3.2.4.1 "Project view" (P. 32)
- 3.2.4.2 "Program list" (P. 33)
- 3.2.4.3 "Arm modeling" (P. 34)
- 3.2.4.4 "Arm operation" (P. 34)
- 3.2.4.5 "I/O window" (P. 35)
- 3.2.4.6 "Variables window" (P. 35)
- 3.2.4.7 "Tool/work/area setting window" (P. 35)
- 3.2.4.8 "Local variables window" (P. 35)
- 3.2.4.9 "Watch window" (P. 36)
- 3.2.4.10 "Output window" (P. 36)
- 3.2.4.11 "Search results window" (P. 36)
- 3.2.4.12 "Vision tool window" (P. 37)

3.2.4.1 Project view

This window lists folders and files in the project.

It has buttons for adding programs, importing files, and other operations.



A: Create Programs...

This button is for creating program, header, and teach pendant (TP) panel files in the project.

B: Import

This button is for adding existing programs to the project.

C: ↑ ↓ button

These buttons are for moving files and folders up and down the file hierarchy.

↑ : Move the selected item up one position.

↓ : Move the selected item down one position.

D: Display files

This button opens a folder, displaying the files inside.

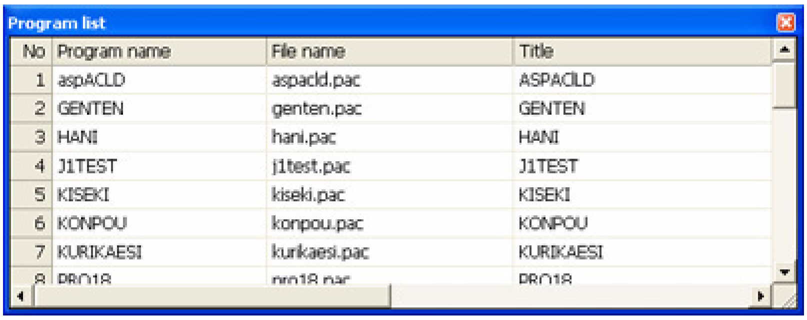
E: List hierarchy

This button lists all files and folders in the project hierarchy.

Double-clicking a program, header, or teach pendant (TP) panel file opens it.

3.2.4.2 Program list

This window lists the programs in the project.



Program list

No	Program name	File name	Title
1	aspACLD	aspacld.pac	ASPACLD
2	GENTEN	genten.pac	GENTEN
3	HANI	hani.pac	HANI
4	J1TEST	j1test.pac	J1TEST
5	KISEKI	kiseki.pac	KISEKI
6	KONPOU	konpou.pac	KONPOU
7	KURIKAESI	kurikaesi.pac	KURIKAESI
8	PRO18	pro18.pac	PRO18

Icon

A key icon is shown for locked files.

Program name

This displays the program name declared in "PROGRAM".

File name

This displays the name of files with programs stored.

Title

This displays the program name declared in '!TITLE "xxxxx".

Usage

This displays the usage status of the program.

Status

Displays the status of the program.

Executing line

Displays the currently executing line number.

Run time

Displays the time from start to end of the program.

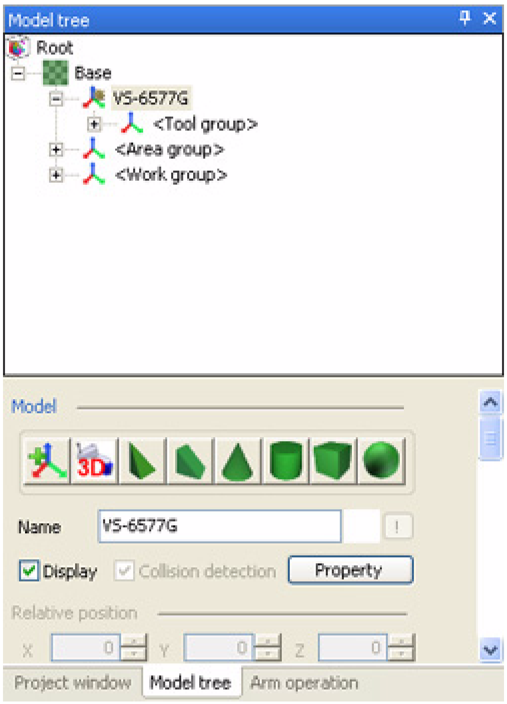
Priority

Displays the priority of the program.

3.2.4.3 Arm modeling

This window is for arranging objects in the Arm 3D view window.

For further details on modeling in the Arm 3D view window and Arm modeling, please refer to Chapter 6 "Arm 3D View Window" (P. 92).



Model tree

Root
- Base
  - VS-6577G
    - <Tool group>
  - <Area group>
  - <Work group>

Model

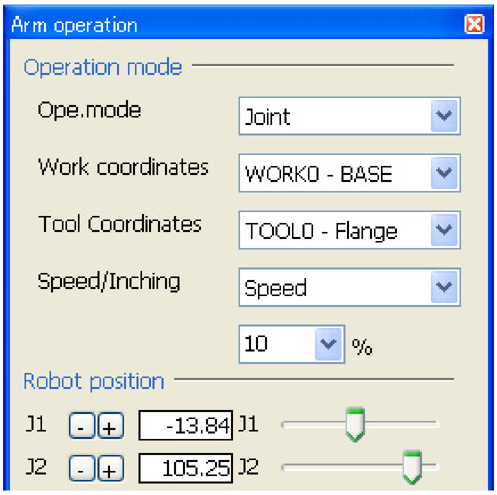
Name: VS-6577G

☑ Display ☑ Collision detection

3.2.4.4 Arm operation

This window is for moving the simulated robot in the Arm view window.

For further details on operating the robot in the Arm view window, please refer to Chapter 6 "Arm 3D View Window" (P. 92).



Arm operation

Operation mode

Ope.mode: Joint

Work coordinates: WORK0 - BASE

Tool Coordinates: TOOL0 - Flange

Speed/Inching: Speed

10 %

Robot position

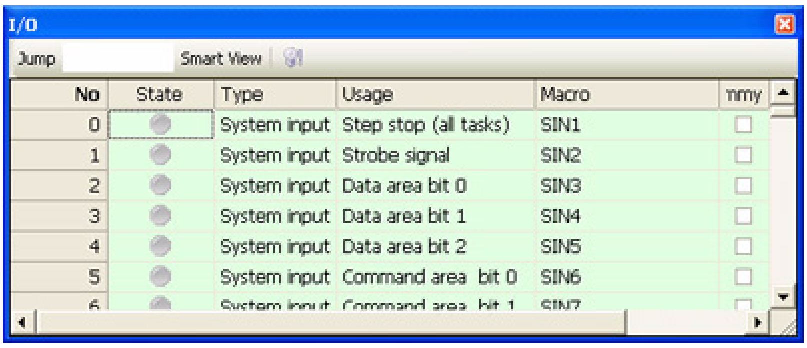
J1 - + -13.84 J1

J2 - + 105.25 J2

3.2.4.5 I/O window

This window type is for monitoring I/O and editing.

For further details on monitoring I/O, please refer to Chapter 7 "Online Functions" (P. 107).

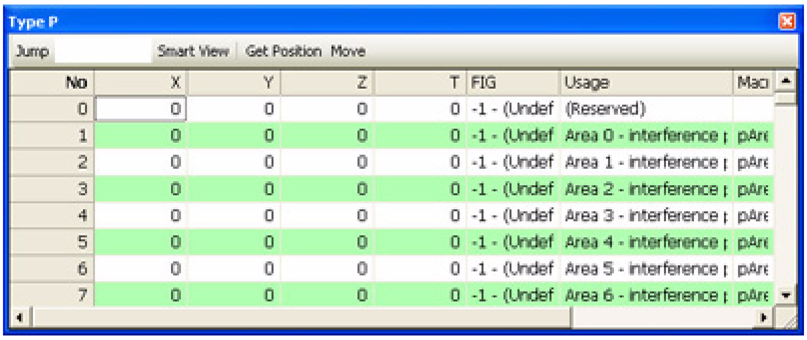


No	State	Type	Usage	Macro	nmy
0	●	System input	Step stop (all tasks)	SIN1	□
1	●	System input	Strobe signal	SIN2	□
2	●	System input	Data area bit 0	SIN3	□
3	●	System input	Data area bit 1	SIN4	□
4	●	System input	Data area bit 2	SIN5	□
5	●	System input	Command area bit 0	SIN6	□
6	●	System input	Command area bit 1	SIN7	□

3.2.4.6 Variables window

This window type is for displaying global variables. Listing or editing is possible.

For further details on monitoring global variables, please refer to Chapter 7 "Online Functions" (P. 107).

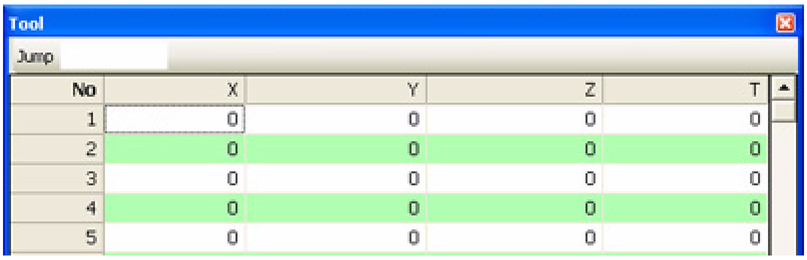


No	X	Y	Z	T	FIG	Usage	Mac
0	0	0	0	0	-1 - (Undef	(Reserved)	
1	0	0	0	0	-1 - (Undef	Area 0 - interference p	pAre
2	0	0	0	0	-1 - (Undef	Area 1 - interference p	pAre
3	0	0	0	0	-1 - (Undef	Area 2 - interference p	pAre
4	0	0	0	0	-1 - (Undef	Area 3 - interference p	pAre
5	0	0	0	0	-1 - (Undef	Area 4 - interference p	pAre
6	0	0	0	0	-1 - (Undef	Area 5 - interference p	pAre
7	0	0	0	0	-1 - (Undef	Area 6 - interference p	pAre

3.2.4.7 Tool/work/area setting window

This window type is for setting tool coordinates, work coordinates and area.

For further details on these coordinates, please refer to Chapter 6 "Arm 3D View Window" (P. 92).

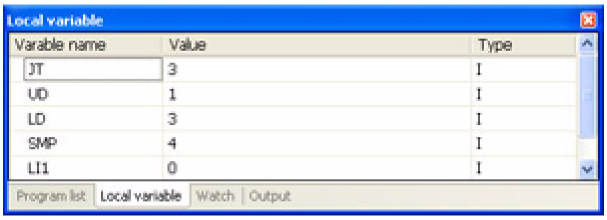


No	X	Y	Z	T
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0

3.2.4.8 Local variables window

This window type is for monitoring the selected local variables.

For further details on monitoring local variables, please refer to Chapter 7 "Online Functions" (P. 107).

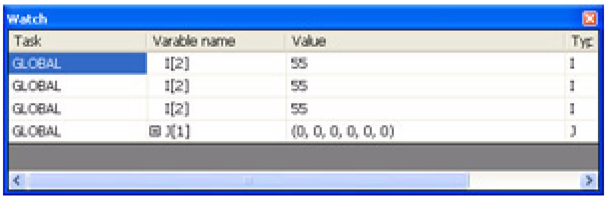


Varable name	Value	Type
JT	3	I
UD	1	I
LD	3	I
SMP	4	I
LI1	0	I

3.2.4.9 Watch window

This window type is for monitoring the values of variables on the watch list.

For further details on watch lists, please refer to Chapter 7 "Online Functions" (P. 107).



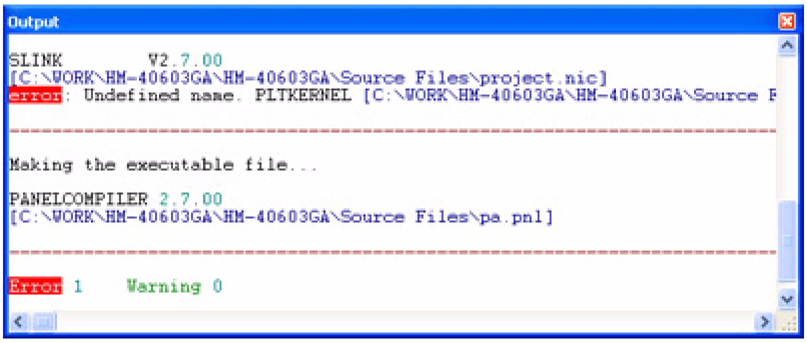
Watch

Task	Varable name	Value	Typ
GLOBAL	I[2]	55	I
GLOBAL	I[2]	55	I
GLOBAL	I[2]	55	I
GLOBAL	⊞ J[1]	(0, 0, 0, 0, 0, 0)	J

3.2.4.10 Output window

This window type displays progress and error messages from the syntax check and compiler.

For further details on such output, please refer to .5.8 "Making Executables" (P. 88)



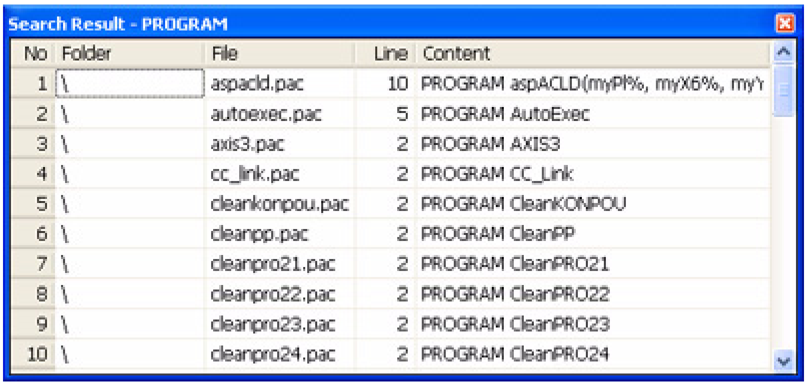
Output

```
SLINK        V2.7.00
[C:\WORK\HM-40603GA\HM-40603GA\Source Files\project.nic]
error: Undefined name. PLTKERNEL [C:\WORK\HM-40603GA\HM-40603GA\Source F

-----------------------------------------------------------------------------

Making the executable file...

PANELCOMPILER 2.7.00
[C:\WORK\HM-40603GA\HM-40603GA\Source Files\pa.pnl]

-----------------------------------------------------------------------------

Error 1    Warning 0
```

3.2.4.11 Search results window

This window type displays the results of a project-wide search.

For further details on this output, please refer to 5.4.1 "Finding and replacing strings" (P. 74).



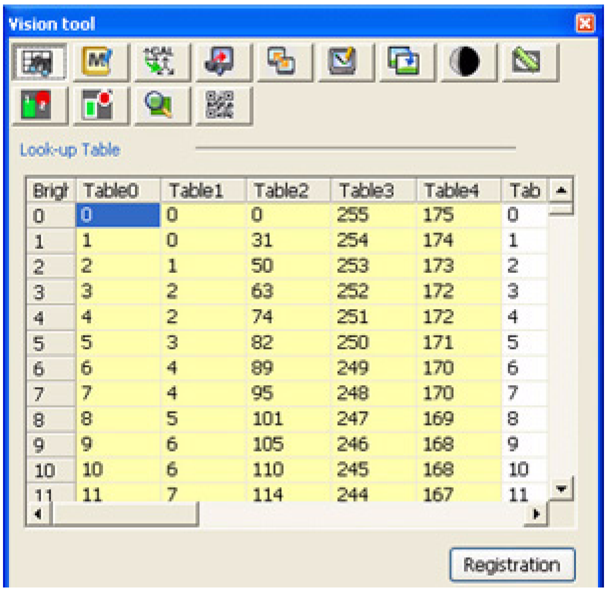
Search Result - PROGRAM

No	Folder	File	Line	Content
1	\	aspacld.pac	10	PROGRAM aspACLD(myPl%, myX6%, my'
2	\	autoexec.pac	5	PROGRAM AutoExec
3	\	axis3.pac	2	PROGRAM AXIS3
4	\	cc_link.pac	2	PROGRAM CC_Link
5	\	cleankonpou.pac	2	PROGRAM CleanKONPOU
6	\	cleanpp.pac	2	PROGRAM CleanPP
7	\	cleanpro21.pac	2	PROGRAM CleanPRO21
8	\	cleanpro22.pac	2	PROGRAM CleanPRO22
9	\	cleanpro23.pac	2	PROGRAM CleanPRO23
10	\	cleanpro24.pac	2	PROGRAM CleanPRO24

3.2.4.12 Vision tool window

This window type is for configuring visual functions.

For further details on this window, please refer to Chapter 9 "Vision Manager" (P. 142).

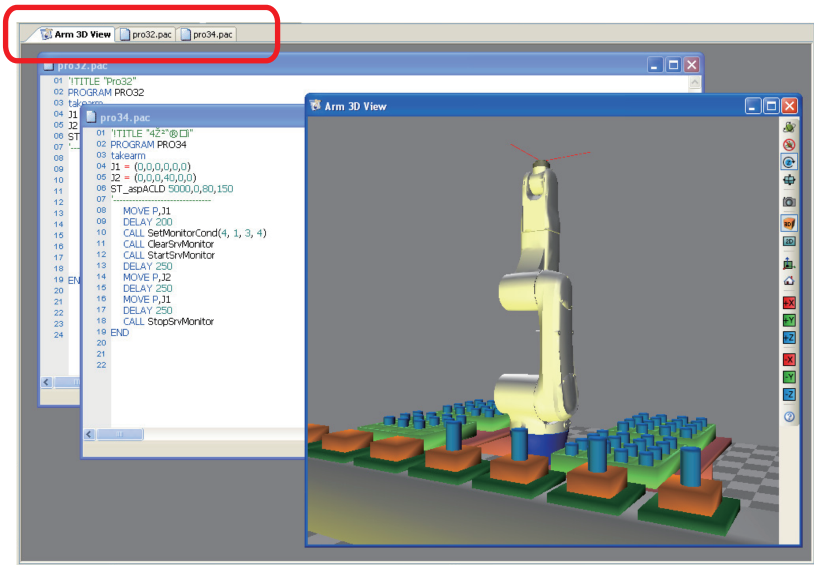


Brigt	Table0	Table1	Table2	Table3	Table4	Tab
0	0	0	0	255	175	0
1	1	0	31	254	174	1
2	2	1	50	253	173	2
3	3	2	63	252	172	3
4	4	2	74	251	172	4
5	5	3	82	250	171	5
6	6	4	89	249	170	6
7	7	4	95	248	170	7
8	8	5	101	247	169	8
9	9	6	105	246	168	9
10	10	6	110	245	168	10
11	11	7	114	244	167	11

3.2.5 Program view

This displays the following window types: Arm 3D view, Vision monitor, and Program edit. If there is a robot controller on line, the list expands to include Task and Log windows.

This area provides a tab interface for switching windows.



```
'!TITLE "4Ž²"®□i"
PROGRAM PRO34
takearm
J1 = (0,0,0,0,0,0)
J2 = (0,0,0,40,0,0)
ST_aspACLD 5000,0,80,150
'-----------------------------
    MOVE P,J1
    DELAY 200
    CALL SetMonitorCond(4, 1, 3, 4)
    CALL ClearSrvMonitor
    CALL StartSrvMonitor
    DELAY 250
    MOVE P,J2
    DELAY 250
    MOVE P,J1
    DELAY 250
    CALL StopSrvMonitor
END
```

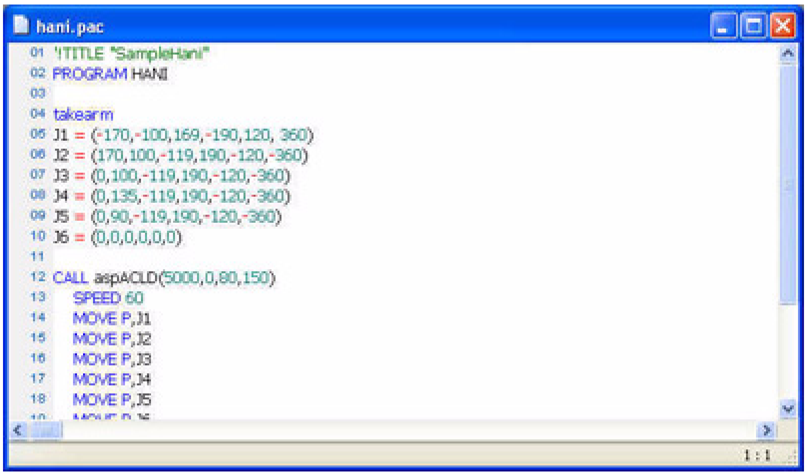
This area displays the following window types.

- 3.2.5.1 "Program edit window" (P. 38)
- 3.2.5.2 "Arm 3D View" (P. 39)
- 3.2.5.3 "Vision monitor window" (P. 39)
- 3.2.5.4 "Log window" (P. 40)

3.2.5.1 Program edit window

This window type is for editing program and header files.

Syntax highlighting displays numbers, operators, comments, and other elements in different colors.

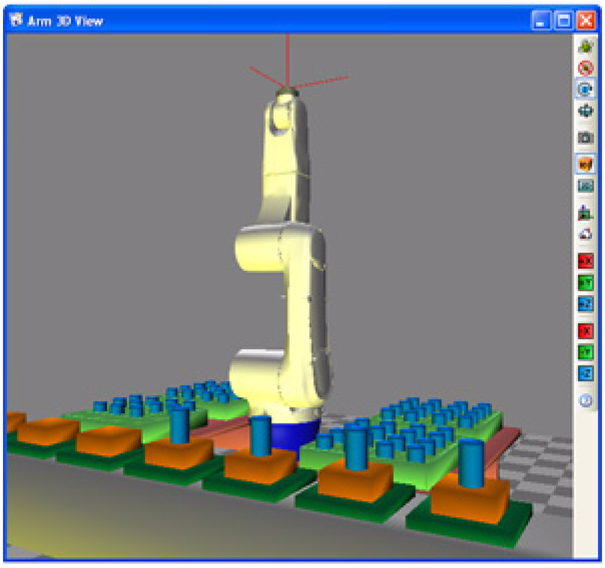


```
'!TITLE "SampleHani"
PROGRAM HANI

takearm
J1 = (-170,-100,169,-190,120, 360)
J2 = (170,100,-119,190,-120,-360)
J3 = (0,100,-119,190,-120,-360)
J4 = (0,135,-119,190,-120,-360)
J5 = (0,90,-119,190,-120,-360)
J6 = (0,0,0,0,0,0)

CALL aspACLD(5000,0,80,150)
    SPEED 60
    MOVE P,J1
    MOVE P,J2
    MOVE P,J3
    MOVE P,J4
    MOVE P,J5
    MOVE P,J6
```

3.2.5.2 Arm 3D View

This 3D window is for checking robot operation.

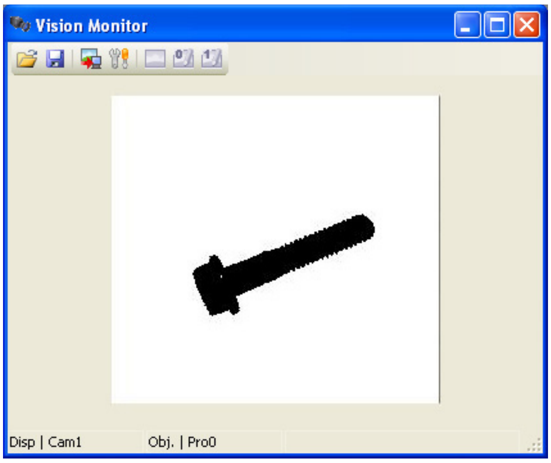
Adding other equipment and devices allows for collision detection.



3.2.5.3 Vision monitor window

This window displays the image from a camera.

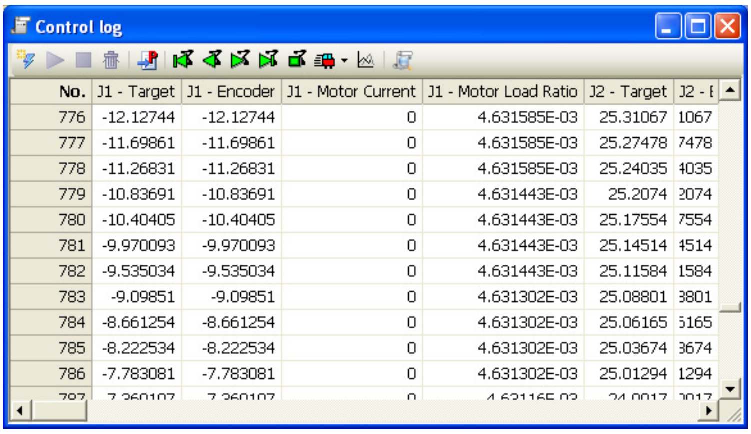
For further details on this window, please refer to Chapter 9 "Vision Manager" (P. 142).



3.2.5.4 Log window

If there is a robot controller on line, this displays log data.

For further details on such logs, please refer to Chapter 8 "Logging" (P. 124).



No.	J1 - Target	J1 - Encoder	J1 - Motor Current	J1 - Motor Load Ratio	J2 - Target	J2 - E
776	-12.12744	-12.12744	0	4.631585E-03	25.31067	1067
777	-11.69861	-11.69861	0	4.631585E-03	25.27478	7478
778	-11.26831	-11.26831	0	4.631585E-03	25.24035	4035
779	-10.83691	-10.83691	0	4.631443E-03	25.2074	2074
780	-10.40405	-10.40405	0	4.631443E-03	25.17554	7554
781	-9.970093	-9.970093	0	4.631443E-03	25.14514	4514
782	-9.535034	-9.535034	0	4.631443E-03	25.11584	1584
783	-9.09851	-9.09851	0	4.631302E-03	25.08801	3801
784	-8.661254	-8.661254	0	4.631302E-03	25.06165	5165
785	-8.222534	-8.222534	0	4.631302E-03	25.03674	3674
786	-7.783081	-7.783081	0	4.631302E-03	25.01294	1294

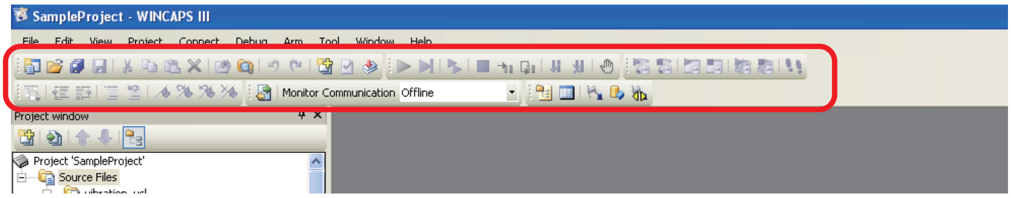
3.2.6 Screen operations

WINCAPS III allows flexible customization of menus, toolbars, and windows on the screen.

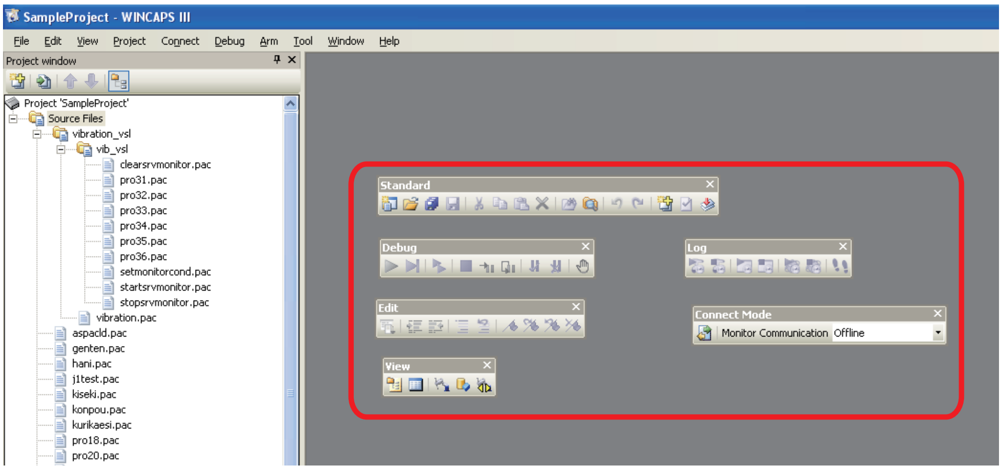
3.2.6.1 Moving toolbars

Toolbars can be dragged anywhere on the screen.

Inside the toolbar display area, they clump together to conserve space.

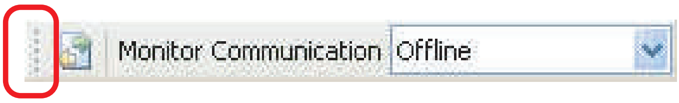

SampleProject - WINCAPS III
File Edit View Project Connect Debug Arm Tool Window Help
Monitor Communication
Offline
Project window
Project 'SampleProject'
Source Files

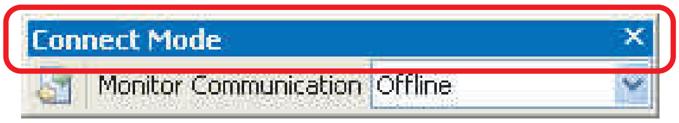
Dragging one outside this area, however, adds a title bar.



Procedure

To drag a toolbar, grab its end tab or title bar (shown in red below).





3.2.6.2 Changing window layout

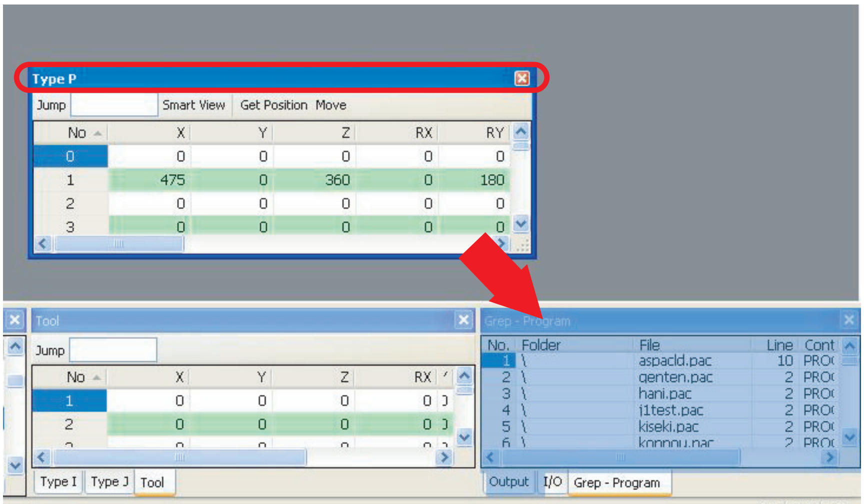
WINCAPS III's flexible layout allows you to freely move its windows anywhere within its application window and to snap them vertically or horizontally to an edge within the application window or just the selected area.

The Docking view area provides tab interfaces for switching between members of windows that the user has "docked"—stacked together within their own display area.

(1) Grouping window for display

Docking adds a freestanding window to another window to form or expand a group.

Just grab the first window's title bar (shown in red) and drag the blue window outline to the second window's title bar. A tab then appears below the stacked windows to indicate successful docking.



No	X	Y	Z	RX	RY
0	0	0	0	0	0
1	475	0	360	0	180
2	0	0	0	0	0
3	0	0	0	0	0

No	X	Y	Z	RX
1	0	0	0	0
2	0	0	0	0

No.	Folder	File	Line	Cont
1	\	aspacld.pac	10	PRO(
2	\	genten.pac	2	PRO(
3	\	hani.pac	2	PRO(
4	\	j1test.pac	2	PRO(
5	\	kiseki.pac	2	PRO(
6	\	konnou.pac	2	PRO(

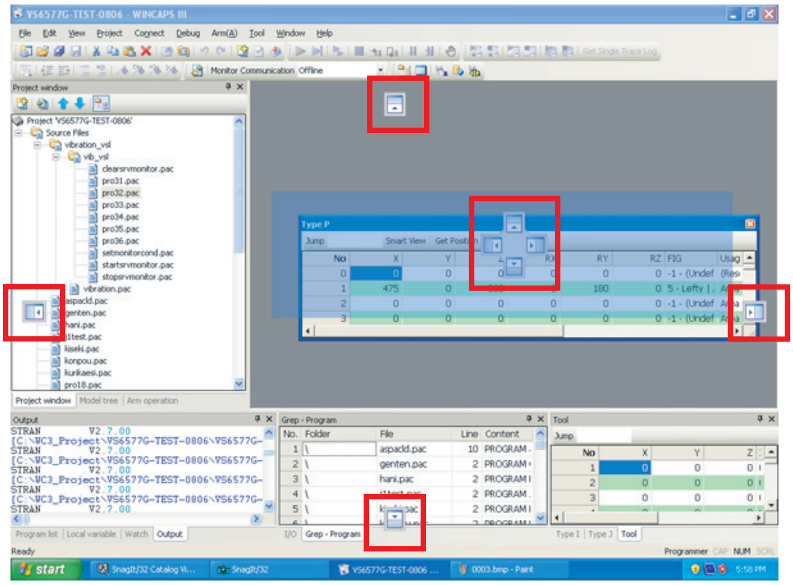
Note

The drag destination is the title bar. Dropping anywhere else produces normal window overlap.

(2) Snapping windows

This operation moves the selected window up against the specified edge.

The first step is grabbing the window's title bar to display the snap arrow icons. These offer two choices: snap within the application window or just within the current area.

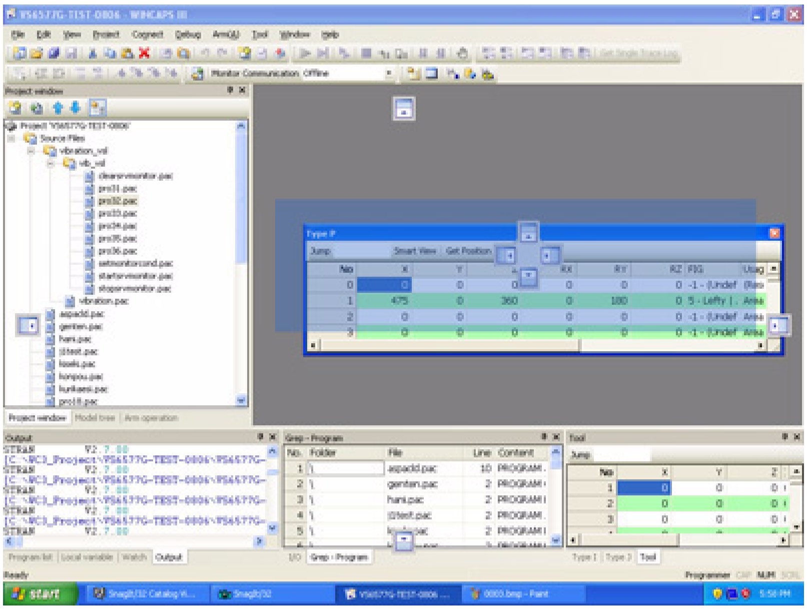

VS6577G-TEST-0806 - WINCAPS III
File Edit View Project Connect Debug Arm(A) Tool Window Help
Project window
Type P
Output
Grep - Program
Tool
Ready

Snapping within application window

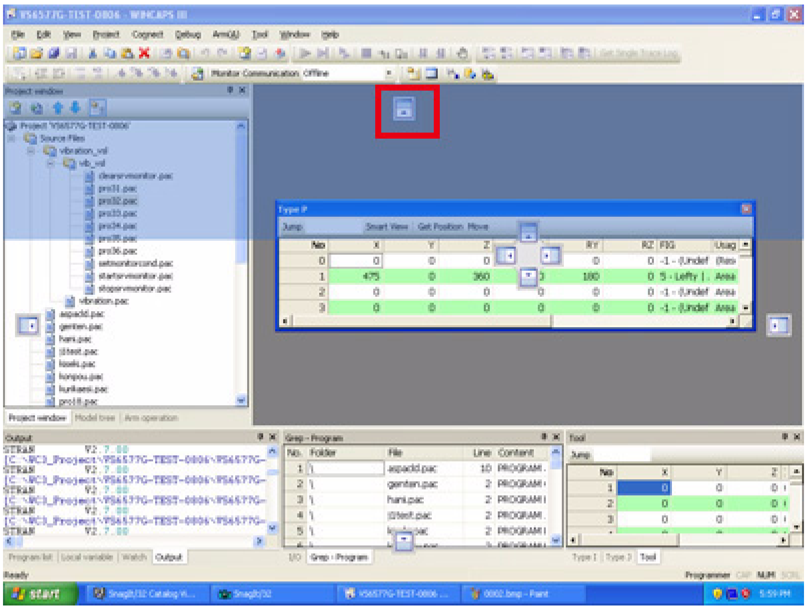
Your first choice is to move windows to an edge of the application window.

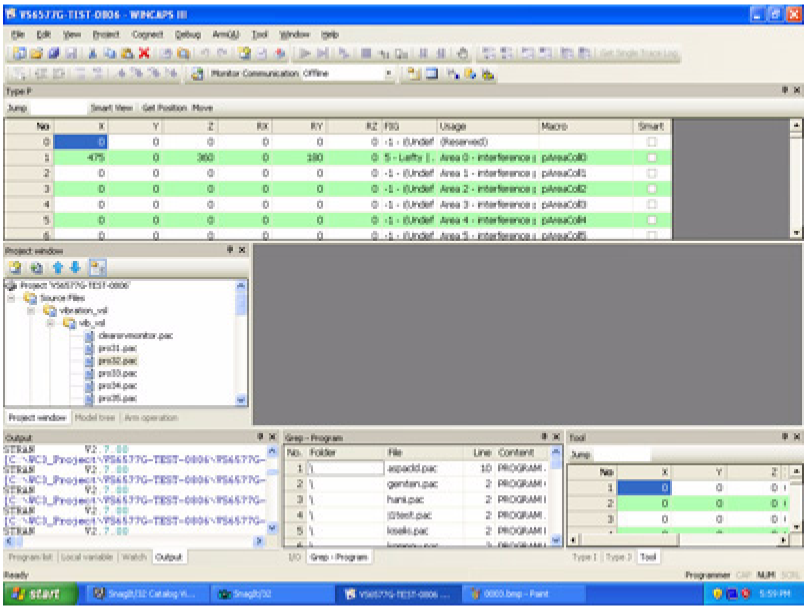
Operating procedure

1. **Start dragging the window's title bar to display the snap icons.**


VS6577G-TEST-0806 - WINCAPS III
File Edit View Project Connect Debug Arm(A) Tool Window Help
Project window
Type P
Output
Grep - Program
Tool
Ready

2. Drop the blue window silhouette on an icon in the outer set to move the window against the corresponding edge of the application window.


VS6577G-TEST-0806 - WINCAPS III
File Edit View Project Connect Debug Arm(U) Tool Window Help
Project window
Type P
Output
Grep - Program
Tool
start

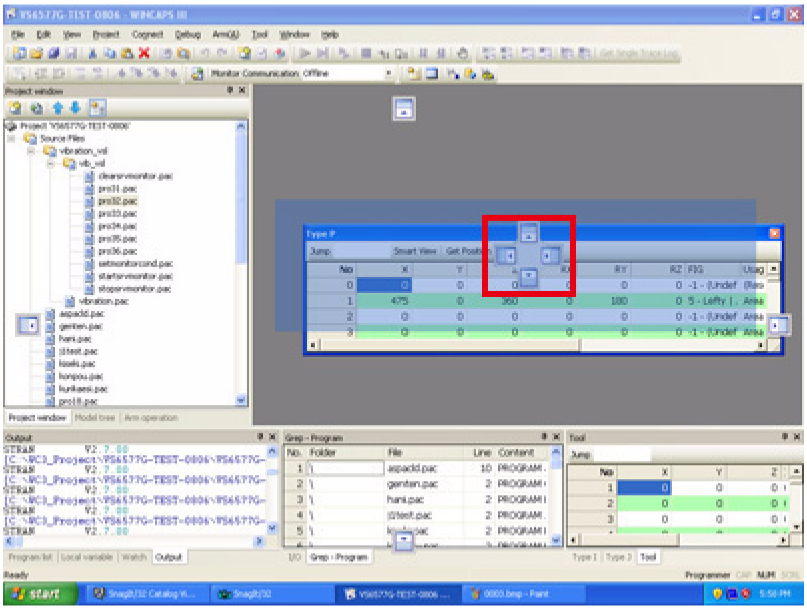

VS6577G-TEST-0806 - WINCAPS III
File Edit View Project Connect Debug Arm(U) Tool Window Help
Type P
Project window
Output
Grep - Program
Tool
start

Snapping within current area

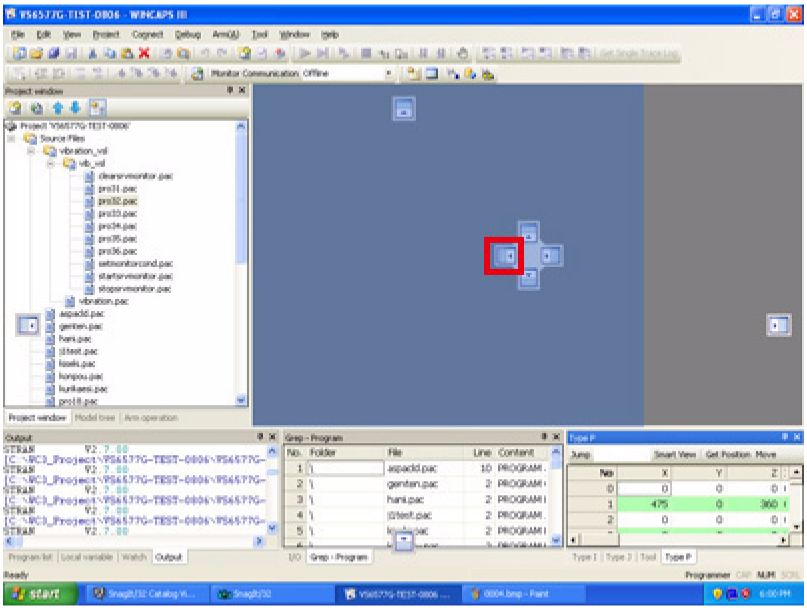
Alternatively, you can snap within the Program view, Docking view, or other area.

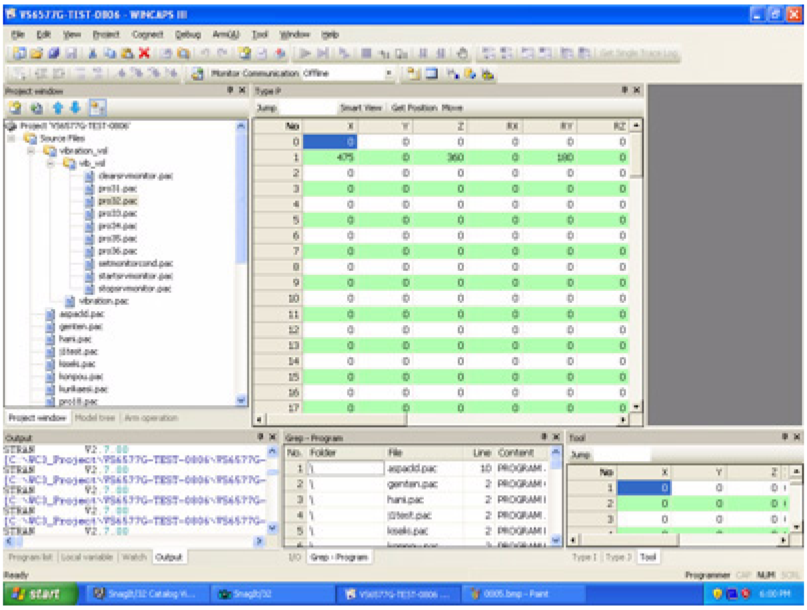
Operating procedure

1. Start dragging the window's title bar to display the snap icons.


VS6577G-TEST-0806 - WINCAPS III
File Edit View Project Connect Debug Arm(A) Tool Window Help
Project window
Type P
Output
Grep - Program
Tool
start

2. Drop the blue window silhouette on an icon in the inner set to move the window against the corresponding edge of the current area.


VS6577G-TEST-0806 - WINCAPS III
File Edit View Project Connect Debug Arm(A) Tool Window Help
Project window
Output
Grep - Program
Type P
start



No	X	Y	Z	RX	RY	RZ
0	0	0	0	0	0	0
1	475	0	360	0	180	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0
11	0	0	0	0	0	0
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0

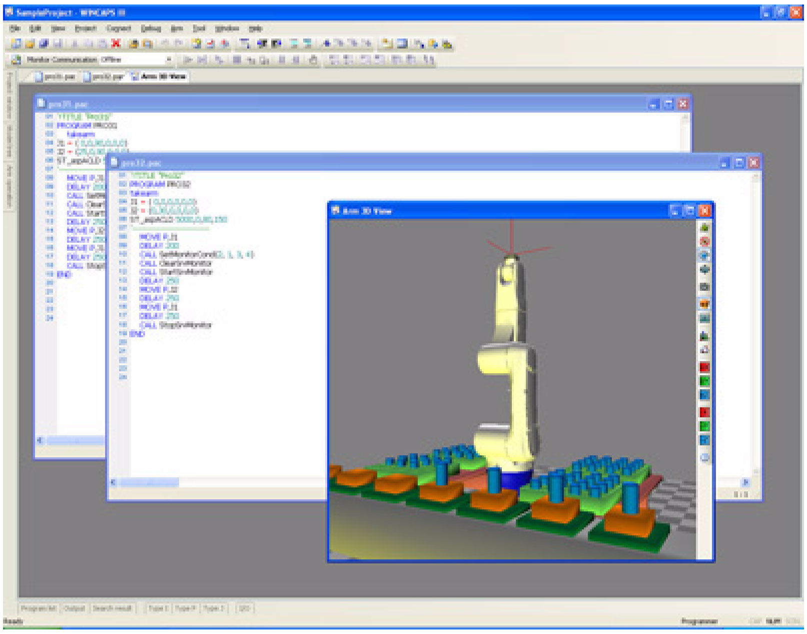
```
STRAN          V2.7.00
[C:\WC3_Project\VS6577G-TEST-0806\VS6577G-
STRAN          V2.7.00
[C:\WC3_Project\VS6577G-TEST-0806\VS6577G-
STRAN          V2.7.00
[C:\WC3_Project\VS6577G-TEST-0806\VS6577G-
STRAN          V2.7.00
[C:\WC3_Project\VS6577G-TEST-0806\VS6577G-
STRAN          V2.7.00
```

No.	Folder	File	Line	Content
1	\	aspadd.pac	10	PROGRAM .
2	\	genten.pac	2	PROGRAM (
3	\	hani.pac	2	PROGRAM I
4	\	i2test.pac	2	PROGRAM .
5	\	koseki.pac	2	PROGRAM I

No	X	Y	Z
1	0	0	0
2	0	0	0
3	0	0	0

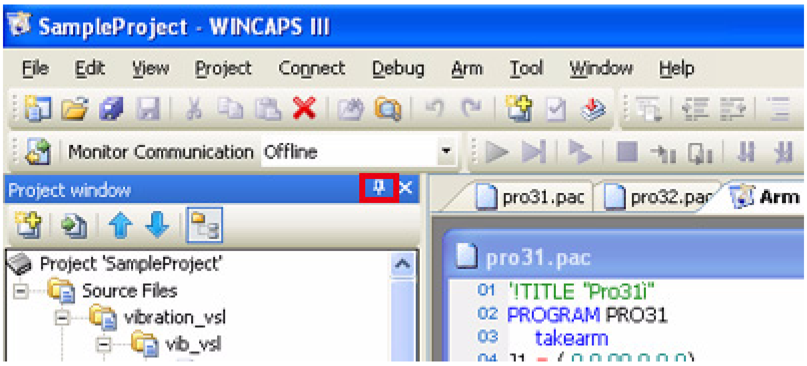
(3) Minimizing Docking view area

This operation minimizes the Docking view area to maximize the Program view area.



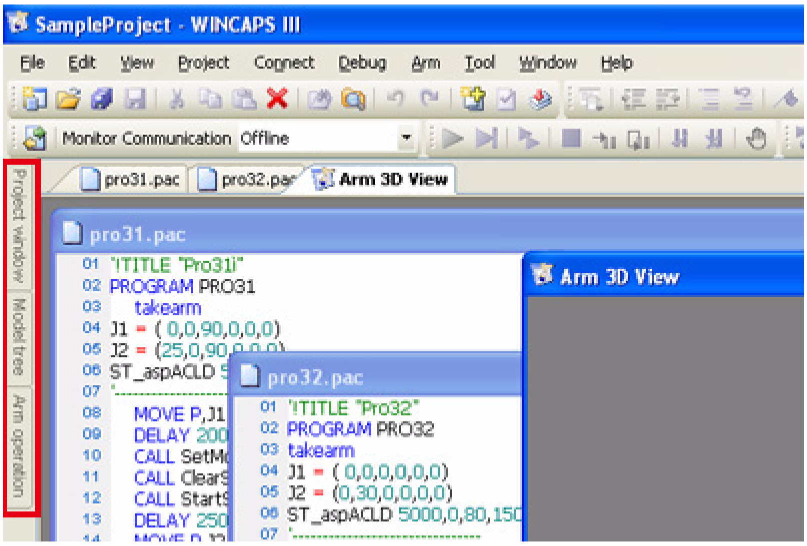
Operating procedure

1. Click the 🖈 icon on the right end of the Docking view title bar.


SampleProject - WINCAPS III
File Edit View Project Connect Debug Arm Tool Window Help
Monitor Communication Offline
Project window
Project 'SampleProject'
Source Files
vibration_vsl
vib_vsl
pro31.pac
pro32.pac
Arm
pro31.pac

```
'!TITLE "Pro31i"
PROGRAM PRO31
   takearm
```

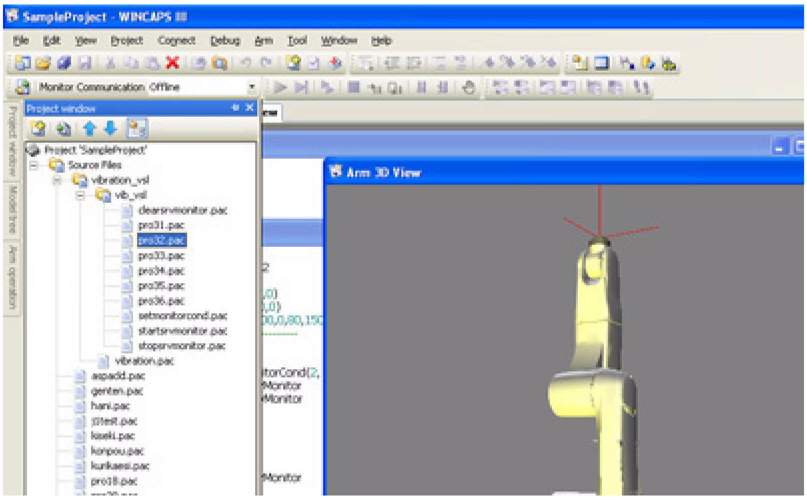
The operation minimizes the Docking view area, showing the tab instead as shown below.


SampleProject - WINCAPS III
File Edit View Project Connect Debug Arm Tool Window Help
Monitor Communication Offline
Project window
Model tree
Arm operation
pro31.pac
pro32.pac
Arm 3D View
pro31.pac
Arm 3D View
pro32.pac

```
'!TITLE "Pro31i"
PROGRAM PRO31
   takearm
J1 = ( 0,0,90,0,0,0)
J2 = (25,0,90
ST_aspACLD 5
'---------
   MOVE P,J1
   DELAY 200
   CALL SetM
   CALL ClearS
   CALL StartS
   DELAY 250
```

```
'!TITLE "Pro32"
PROGRAM PRO32
takearm
J1 = ( 0,0,0,0,0,0)
J2 = (0,30,0,0,0,0)
ST_aspACLD 5000,0,80,150
'---------------------------
```

2. **To temporarily display the minimized window in the Docking view area so that it overlaps the Program view area as shown below, click the tab shown in step 1.**



Note

- To minimize all windows in the Docking view area, select Window|Hide all.
- To restore a minimized window in the Docking view area to the original size, display the minimized window and click the 📌 icon on the right end of the title bar. To restore all minimized windows to the original size, select Window|Show all hidden windows from the Window menu.

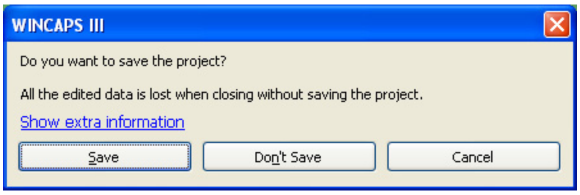
3.3 Quitting WINCAPS III

Operating procedure

1. Choose File|Exit to quit the program.

Note

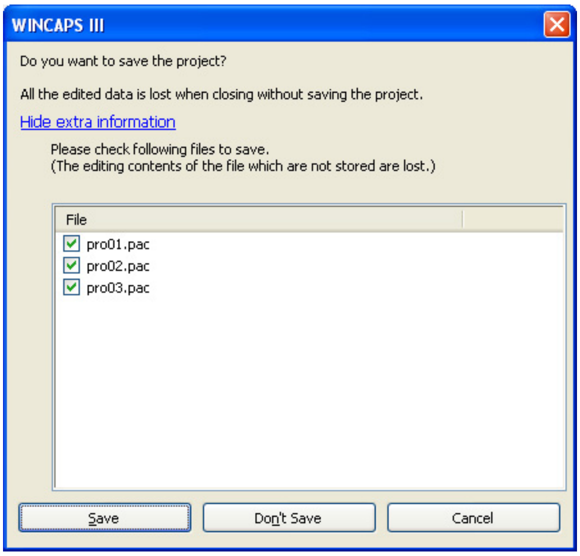
If a project is already being edited, the confirmation dialog appears.



Do you want to save the project?

All the edited data is lost when closing without saving the project.

The edited changes can be selected and saved by pressing Show extra information.



Do you want to save the project?

All the edited data is lost when closing without saving the project.

Please check following files to save.
(The editing contents of the file which are not stored are lost.)

☑ pro01.pac
☑ pro02.pac
☑ pro03.pac

Save button

Overwrites the project.

Don't Save button

This button deletes the edited changes.

Cancel button

Cancels the quitting procedure and reverts to the previous WINCAPS III screen.

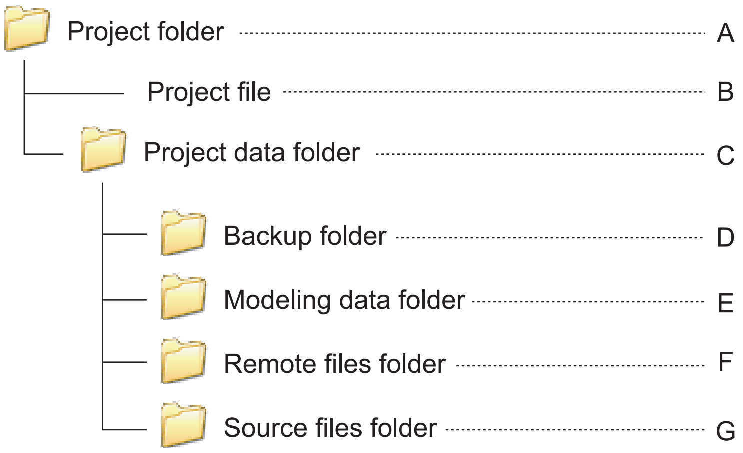
Chapter 4 Creating a Project

4.1 Overview

WINCAPS III manages the programs, parameters, variables, and other data for each robot as a separate project.

4.1.1 Folders

A project uses the following file hierarchy.



A: Project folder

This holds all files for the project.

Its name becomes the project name.

B: Project file

This file, with file extension .wpj. contains data on the project overall.

Double-clicking this file opens the corresponding project. (File extension: .wpj)

C: Project data folder

This folder holds the data for the project.

Its name becomes the project name.

D: Backup folder

This folder holds backup copies of robot controller related data including the power-on time. Receiving data from the connected robot controller automatically creates this folder.

E: Modeling data folder

This folder holds 3D modeling data for the project.

F: Remote files folder

If there is a robot controller on line, the software spools robot controller files here.

G: Source files folder

This folder holds the programs, header files, and teach pendant (TP) panels for the project.

The Project window displays its contents.

4.2 Creating a New Project

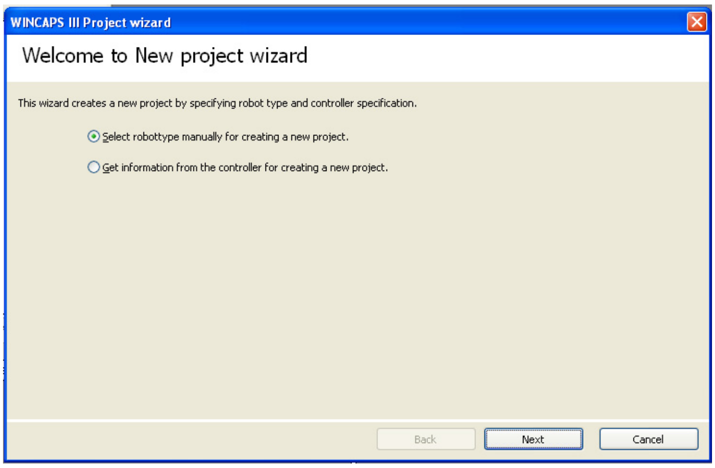
WINCAPS III provides a wizard for creating a new project.

New projects are created using the following two methods.

- Select robot type manually for creating a new project
  This method can be used when the robot is not linked. Used for creating projects in advance of robot installation (when designing equipment, etc.) Match the settings with the controller to link to. Errors will occur during linking if the settings do not match.
- Get information from the controller for creating a new project
  If the robot and the controller are set up, import one of projects held in the robot controller into WINCAPS III to create a new project.
  Using this method does not require newly configuring the robot type and other various settings, but requires that the robot controller and PC (WINCAPS III) be connected with each other for data exchange. When importing a project from the robot controller, it is possible to search for robots connected.

Operating procedure

1. Choose File|New project to load this wizard.



WINCAPS III Project wizard

Welcome to New project wizard

This wizard creates a new project by specifying robot type and controller specification.

● Select robottype manually for creating a new project.

○ Get information from the controller for creating a new project.

The Back button returns the wizard to the preceding screen.

The Next button advances the wizard to the next screen.

The Cancel button exits the wizard.

Note

Starting WINCAPS III Project wizard when the currently open project has unsaved modifications displays the following confirmation dialog, asking whether or not to save unsaved modifications before closing the project.

2. **Follow the wizard's instructions to configure the project.**

There are six items to specify in the case of manual robot type selection.

1) Project name and location
2) Robot type
3) Robot controller options
4) Link type
5) Variables
6) I/O port settings

In the case of project creation from controller information, make settings only for 1) Project name and location, and 4) Link type

Note

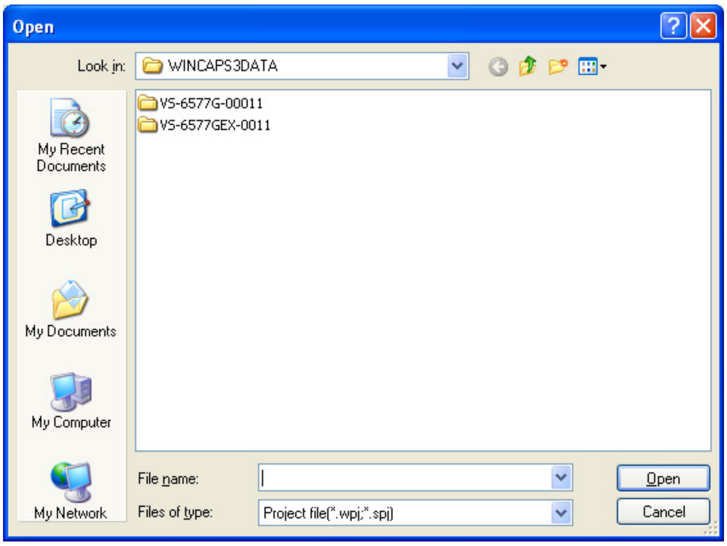
- The last four can be modified at any time, but not the first three:
  - Project name and location
  - Robot type
  - Robot controller options
- There is a basic setting that specifies where WINCAPS III saves new projects. For further details on these settings, please refer to 3.1.1 "WINCAPS III basic settings" (P. 14).
- Do not check the Customer specifications check box displayed by Robot controller options for standard robots. Use for robots with special specifications (with a "#" for the robot type).

3. **When a Complete button appears on the screen, press it to display the new project.**

4.3 Opening an Existing Project

Operating procedure

1. Choose File|Open project to display the Open dialog box.



Note

- The following two types of files can be opened.
  WINCAPS III project data (File extension: .wpj)
  WINCAPS II project data (File extension: .spj)
- If an existing project is currently edited, the confirmation dialog appears, asking whether or not to save unsaved modifications.

4.4 Saving Project

The File menu offers two ways to save the current project.

- Save project
  This saves the currently open project.
- Save project as...
  This creates a folder under a specified name and copies all current project data into the folder.

Note

When executing Save project as..., specify a folder name other than the current project folder name and all folder names contained in the current project folder.

4.5 Configuring a Project

Operating procedure

1. Choose Project|Properties to display the property sheets for the project.

2. Click the tab containing the desired configuration option for the settings.

3. When configuration is complete, press the OK button.

Pressing the Cancel button instead discards all changes.

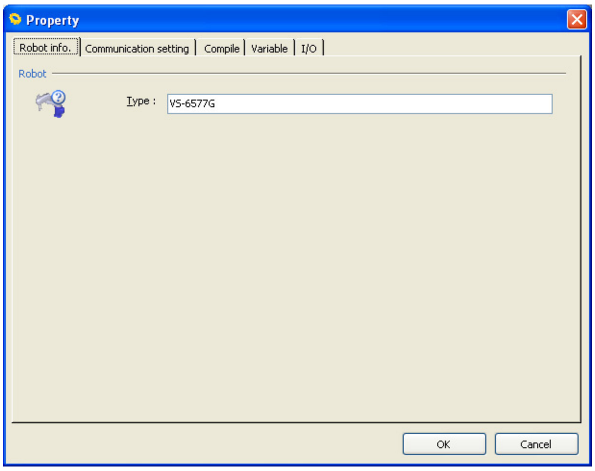
Note

Moving to another tab does not save changes. To save your new settings, always press the OK button.

The dialog box has the following five tabs.

Robot info. tab

This displays project information.



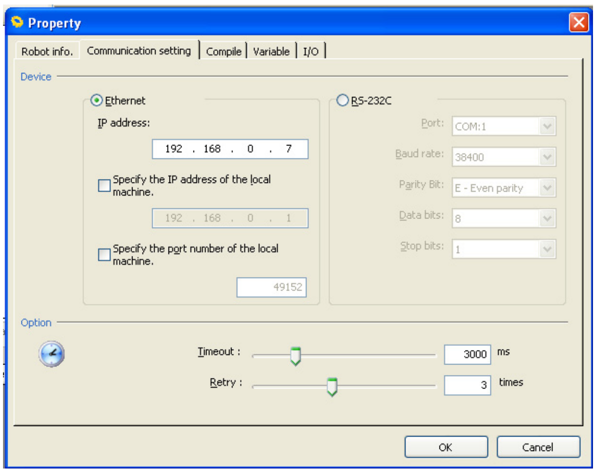
Type : VS-6577G

Type

Displays the robot type.

Communication setting tab

This specifies the communications link to the robot controller plus communications options.



Device

● Ethernet

IP address: 192 . 168 . 0 . 7

□ Specify the IP address of the local machine.

192 . 168 . 0 . 1

□ Specify the port number of the local machine.

49152

○ RS-232C

Port: COM:1

Baud rate: 38400

Parity Bit: E - Even parity

Data bits: 8

Stop bits: 1

Option

Timeout : 3000 ms

Retry : 3 times

Ethernet

Enter the robot controller's IP address.

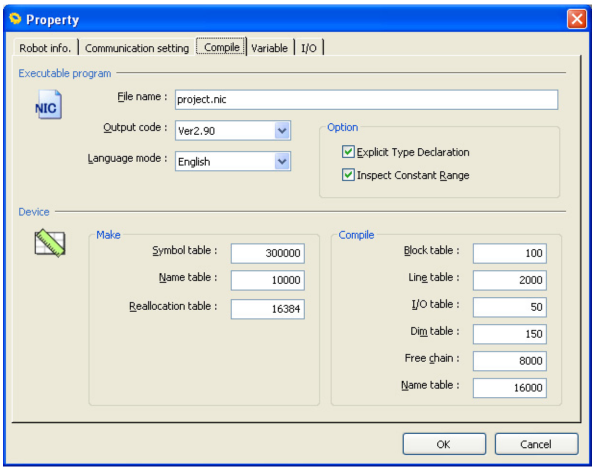
- IP address
  Enter the robot controller's IP address.
- Specify the IP address of the local machine.
  If your PC has several network cards, you can specify the one to use when linking. Specify the network card's IP address.
- Specify the port number of the local machine.
  Check the box and enter the port number if you wish to specify the PC's port number when linking.

RS-232C

Input the RS-232C communications settings in line with those of the robot controller.

Compile tab

Sets data regarding the executable program.



Executable program

File name : project.nic

Output code : Ver2.90

Language mode : English

Option

☑ Explicit Type Declaration

☑ Inspect Constant Range

Device

Make

Symbol table : 300000

Name table : 10000

Reallocation table : 16384

Compile

Block table : 100

Line table : 2000

I/O table : 50

Dim table : 150

Free chain : 8000

Name table : 16000

File name

Specifies a file name when renaming the execution file. By default, a program project file name having the extension "nic" is specified. If you do not wish to overwrite this file or wish to unify all the projects in an executable file name, change this value.

Output code

Sets the software version of the robot controller. Depending upon the version, the output codes of the execution program will differ. If the version specified here is different from the actual software version of the connected controller, an error will occur at the time of communication.

Language mode

Specifies the executable program language.

Explicit Type Declarations

Error will occur unless local variables are explicitly declared with a specification statement or postfix. If this option is found invalid, without explicit descriptions, it will be regarded as a single accuracy variable.

Inspect Constant Range

Checks the range of an argument with the statement described as constant when creating the execution program.

Symbol table

Sets the size of working range for storing information on symbols.

Name table

Sets the size of working range for registering information on names such as label name. This range is used to register information on all names handled by the program files included in the executable file.

Reallocation table

Sets the size of working range for determining the absolute addresses.

Block table

Sets the size of working range for storing the nested state of loops and conditional statement, etc.

Line table

Sets the size of working range for registering line information. The numerical value of this table is equal to the number of all the lines that can be compiled. The same value is equal to the nest level allowed for compiling.

I/O table

Sets the size of working range for registering information on IO variables. The numerical value of this table is equal to the number of defined IO variables.

Dim table

Sets the size of working range for registering information on array variables. The numerical value of this table is equal to the number of array variables that can be defined.

Free chain

Sets the size of working range for registering information address link. This is the range used for solving label addresses, jumping address of branch and loop commands, and global variables.

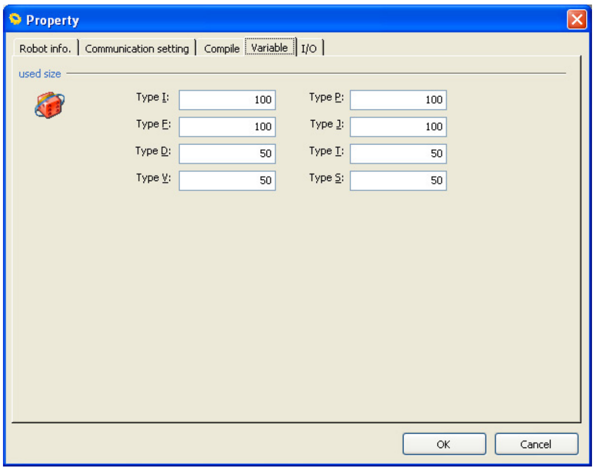
Name table

Sets the size of working range for registering information concerning label and other names. This is the range used for registering information on reserved words and user-defined labels, etc.

Variable tab

This specifies the number of variables used.

Set it to match the number of project variables used by the robot controller.

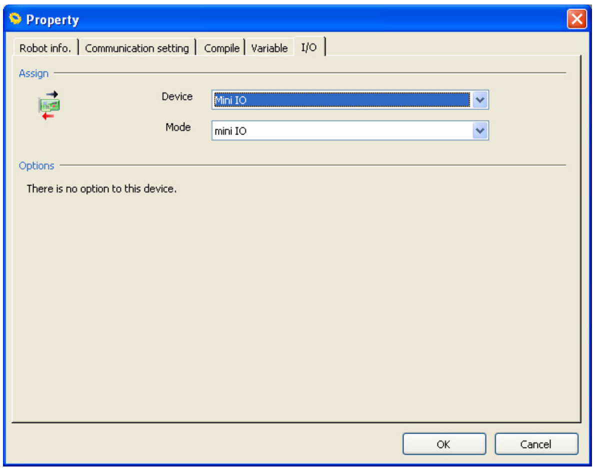


Type I: 100
Type F: 100
Type D: 50
Type V: 50
Type P: 100
Type J: 100
Type T: 50
Type S: 50

I/O tab

This specifies I/O assignments and I/O options.

For further details on I/O specifications / settings for each device, refer to the Option Equipment Manual.



Device: Mini IO
Mode: mini IO

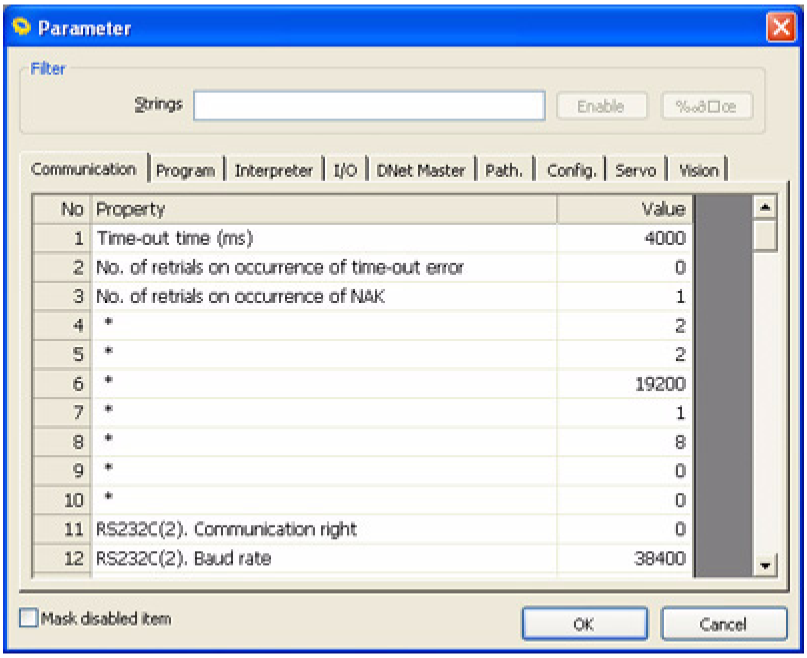
There is no option to this device.

4.6 Configuring Parameters

Operating procedure

1. **Choose Project|Parameters to display the parameter configuration sheets.**

2. **Click the tab containing the desired configuration option.**



No	Property	Value
1	Time-out time (ms)	4000
2	No. of retrials on occurrence of time-out error	0
3	No. of retrials on occurrence of NAK	1
4	*	2
5	*	2
6	*	19200
7	*	1
8	*	8
9	*	0
10	*	0
11	RS232C(2). Communication right	0
12	RS232C(2). Baud rate	38400

The dialog box has the following nine tabs.

- Communication tab
- Program tab
- Interpreter tab
- I/O tab
- DNet Master tab
- Path. tab
- Config. tab
- Servo tab
- Vision tab

Note

- Enabling the filter lists only parameters containing the specified string.
- Selecting the Mask unmodifiable items check box lists only those settings available for editing.

3. **When configuration is complete, press the OK button.**

Pressing the Cancel button instead discards all changes.

Note

Moving to another tab does not save changes. To save your new settings, always press the OK button.

4.7 Link with Robot Controller

WINCAPS III supports two types of links for communicating with a robot controller:

- Ethernet connection
- Serial (RS-232C) connection

For further details, please refer to 1.5 "Connecting to Robot Controller" (P. 8) and the robot controller documentation.

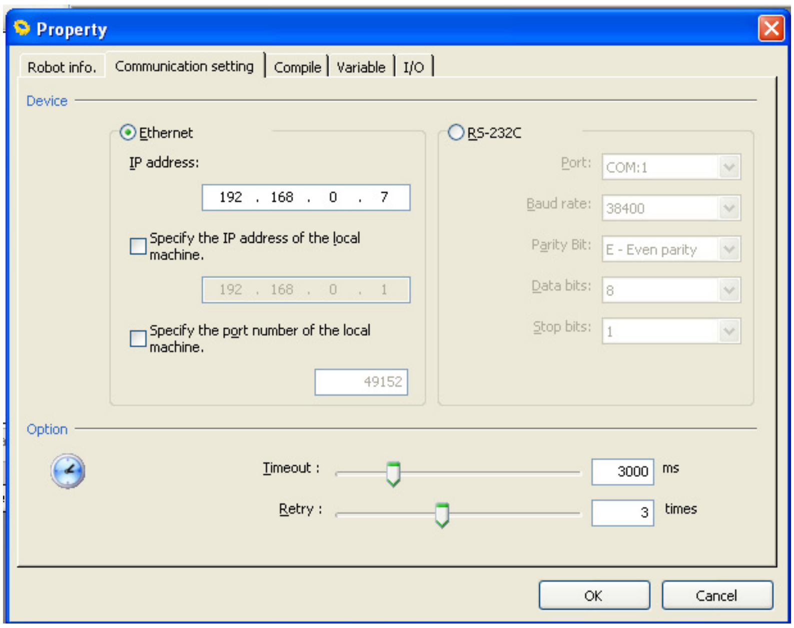
4.7.1 Communications settings

After connecting the link, configure it at the WINCAPS III end.

For further details on configuring the robot controller, please refer to its Setting Guide.

Operating procedure

1. Choose Connect|Settings to open the Property dialog box to the Communications settings tab.



Property

Robot info. | Communication setting | Compile | Variable | I/O

Device

● Ethernet

IP address: 192 . 168 . 0 . 7

□ Specify the IP address of the local machine.

192 . 168 . 0 . 1

□ Specify the port number of the local machine.

49152

○ RS-232C

Port: COM:1

Baud rate: 38400

Parity Bit: E - Even parity

Data bits: 8

Stop bits: 1

Option

Timeout : 3000 ms

Retry : 3 times

OK Cancel

2. Configure the link.

First specify the connection between the computer and the robot controller.

Ethernet connection

All that is needed is the robot controller's IP address.

For further details on determining this, please refer to the robot controller documentation.

Serial (RS-232C) connection

This link requires the following settings.

- Communications port
- Baud rate
- Parity bits
- Data length
- Stop bits

3. **Configure the options:**

   timeout and number of retries.

4. **Press the OK button to save the new settings.**

4.7.2 Data transfers

This link is for exchanging data with the robot controller.

The following data is exchanged.

Program

Data concerning programs. There are two types of data for programs.

Source file

Uncompiled program data

Executable file / map file

Compiled program data

Variable

Data for all variable values.

Tool/Work/Area

Data on tools, work, areas.

Log

All log data. (receivable only)

Set log data in flash fields and so on using Log acquisition settings.

Parameter

All parameter data.

Includes parameters in the Parameter editing screen.

There are five types of data for parameters as follow.

Arm parameters

Parameter on movement of the robot.

- Path tab
- Config. tab
- Servo tab

I/O parameters

Parameters concerning I/O.

- I/O tab
- DNet master tab

Program parameters

Parameters concerning programs.

- Program tab
- Interpreter tab

Communication

Communications settings parameters (receivable only)

- Communication tab

Vision

Parameters concerning visual functions.

- Vision tab

Vision

All visual tools data.

Select Screen data settings on the Transfer data screen.

Configuration

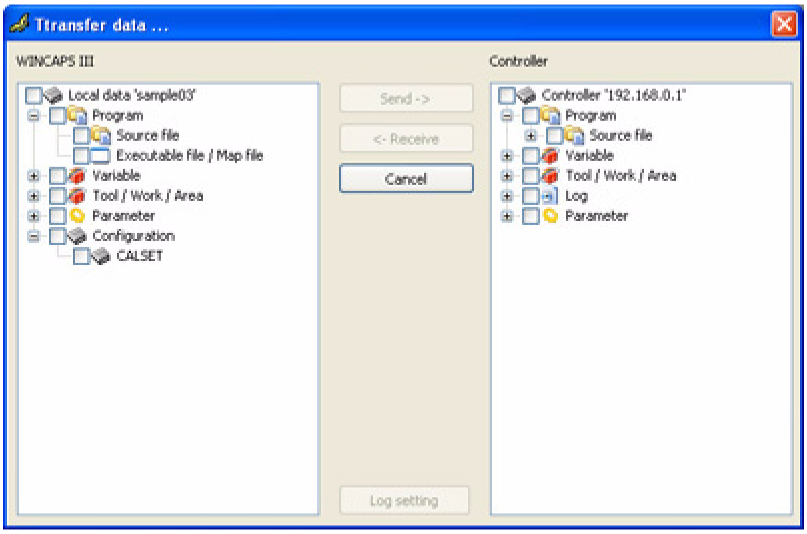
All configuration data (calset values, etc.)

Note

Some items will not appear in the list of transferable data due to WINCAPS III settings or robot controller specifications.

Operating procedure

1. Choose Connect|Transfer data... to display the bidirectional transfer dialog box.



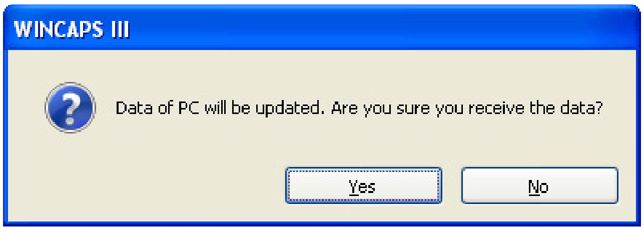
2. Select the data source(s).

Selecting the WINCAPS III check box sends data to the Controller; selecting the Controller one receives.

Note

Selecting multiple sources is perfectly acceptable.

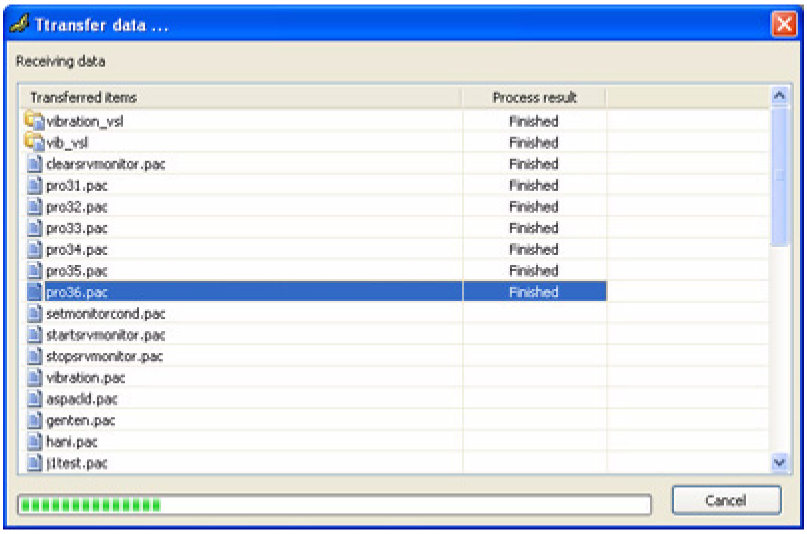
3. **Press the Send or Receive button to display a confirmation dialog box.**



WINCAPS III

Data of PC will be updated. Are you sure you receive the data?

4. **Press the Yes button to start transferring data and display a progress screen.**



Ttransfer data ...

Receiving data

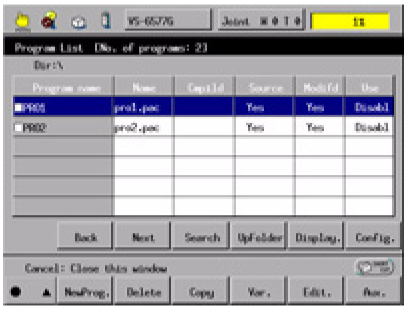
Transferred items	Process result
vibration_vsl	Finished
vib_vsl	Finished
clearsrvmonitor.pac	Finished
pro31.pac	Finished
pro32.pac	Finished
pro33.pac	Finished
pro34.pac	Finished
pro35.pac	Finished
pro36.pac	Finished
setmonitorcond.pac	
startsrvmonitor.pac	
stopsrvmonitor.pac	
vibration.pac	
aspacld.pac	
genten.pac	
hani.pac	
j1test.pac	

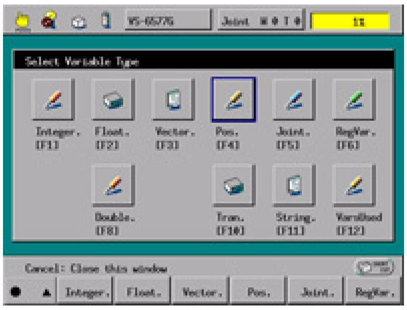
Note

Receiving data from the robot controller updates the WINCAPS III project data, nullifying any program updates in the interim.

⚠Caution

When transferring data to the robot controller, close the Program List window or the Select Variable Type window (if opened) on the teach pendant beforehand; otherwise, the controller cannot load map files or executable files transferred from WINCAPS III.





4.7.3 Arm parameter data transfer

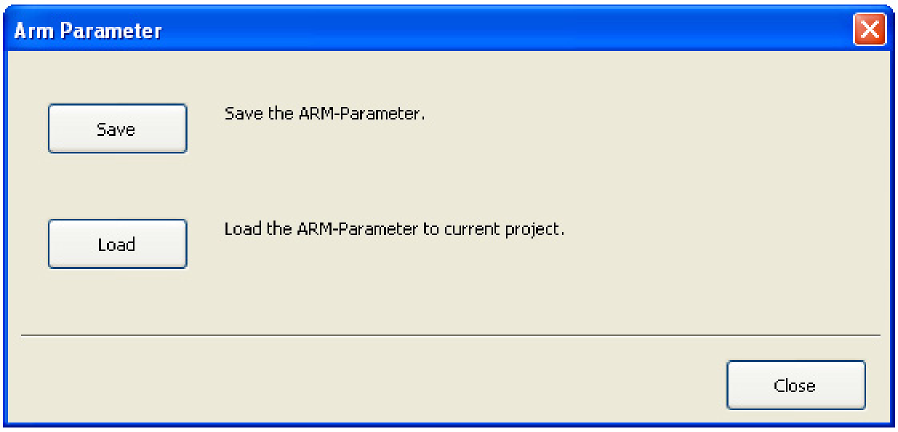
The arm parameters contain a CALSET value deciding the robot's particular position data. CALSET values are included when transferring arm parameters from the robot controller to WINCAPS III, but not vice versa in order to prevent overwriting.

If you wish to transfer arm parameter data including CALSET values to the robot controller, refer to the Robot Installation Protection Guide.

Arm parameters received from the controller can be written to a separate file or loaded as arm data.

Operating procedure

1. **Log in at programmer level.**
2. **Choose Tool|Arm parameters to open the Arm parameter dialog box.**



Save the ARM-Parameter.

Load the ARM-Parameter to current project.

Save button

Writes WINCAPS III project arm parameters to a file.

Load button

Arm data from files below on your PC is uploaded to your current project.

- WAM: WINCAPS III arm data format
- WPJ: Loads only arm data from WINCAPS III projects.
- ARM: WINCAPS II arm data format

4.8 USB Tool

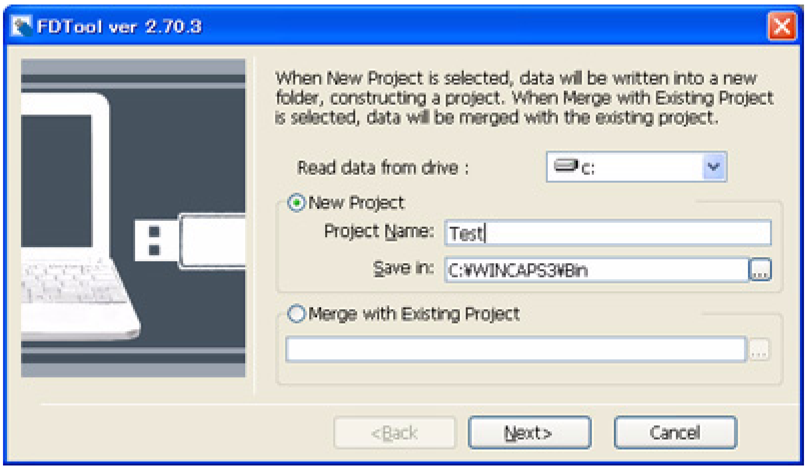
Instead of direct data transfer between a computer running WINCAPS III and the robot controller, a USB memory is available as a media for data exchange between them.

4.8.1 Reading data from USB memory

Follow the FDTool wizard to read data from a USB memory.

Operating procedure

1. **Select Tool|USB|Read to start the FDTool wizard.**



FDTool ver 2.70.3

When New Project is selected, data will be written into a new folder, constructing a project. When Merge with Existing Project is selected, data will be merged with the existing project.

Read data from drive : C:

● New Project

Project Name: Test

Save in: C:¥WINCAPS3¥Bin

○ Merge with Existing Project

Read data from drive

This field specifies a drive for reading a USB memory.

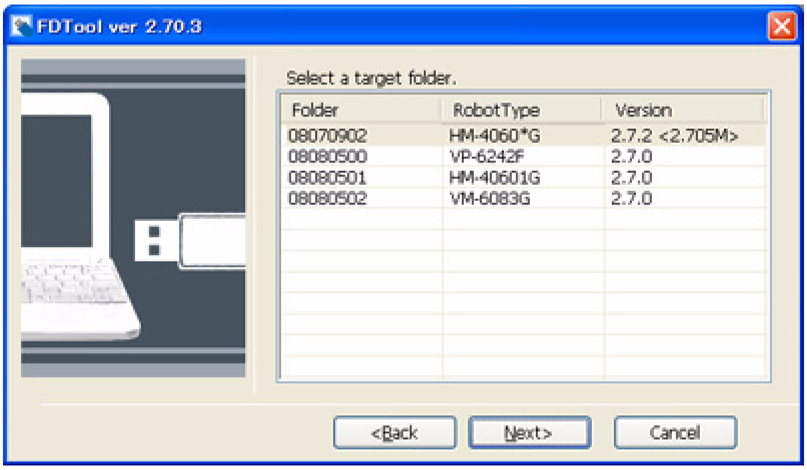
New Project

This radio button is for creating a new project and reading data from a USB memory into the project. Enter a project name and select a location for saving the project.

Merge with Existing Project

This radio button is for selecting an existing project and reading data from a USB memory into the project. The data read from a USB memory merges with data in the existing project.

2. **Click the Next button.**



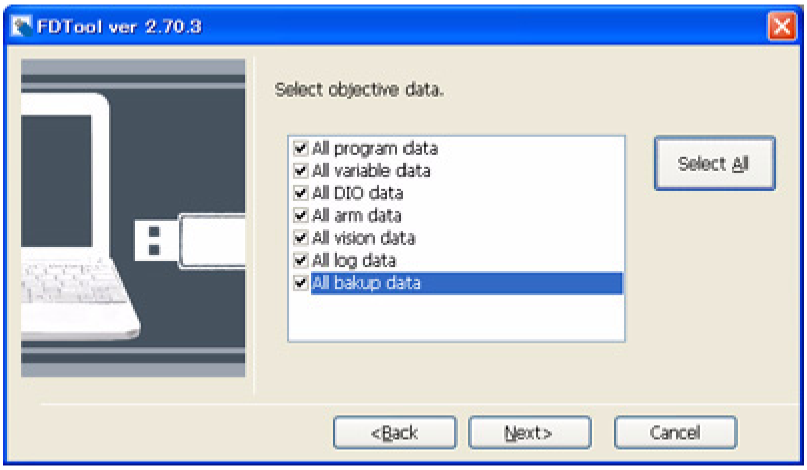
Select a target folder.

Folder	RobotType	Version
08070902	HM-4060*G	2.7.2 <2.705M>
08080500	VP-6242F	2.7.0
08080501	HM-40601G	2.7.0
08080502	VM-6083G	2.7.0

Select a target folder

This area specifies folders in the USB memory to read data from them.

3. **Click the Next button.**



Select objective data.

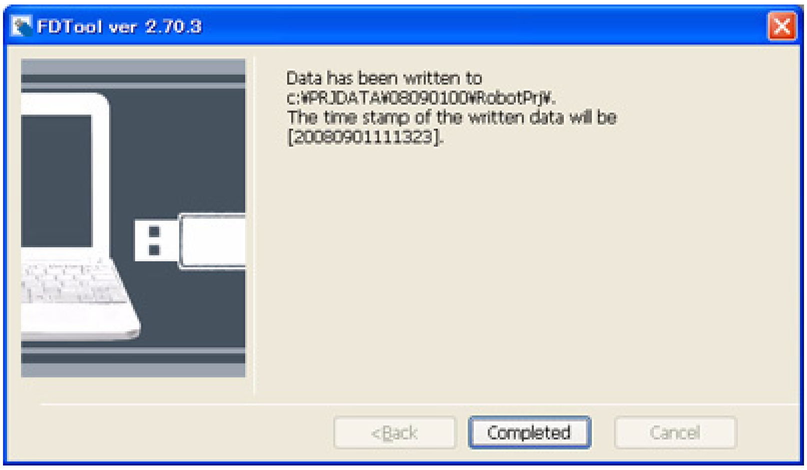
☑ All program data
☑ All variable data
☑ All DIO data
☑ All arm data
☑ All vision data
☑ All log data
☑ All bakup data

Select target data

Selecting these check boxes specify data to read from the USB memory. To read all data, click the Select All button.

4. **Click the Next button to read the specified data from the USB memory.**

Upon completion of reading, the following dialog appears.



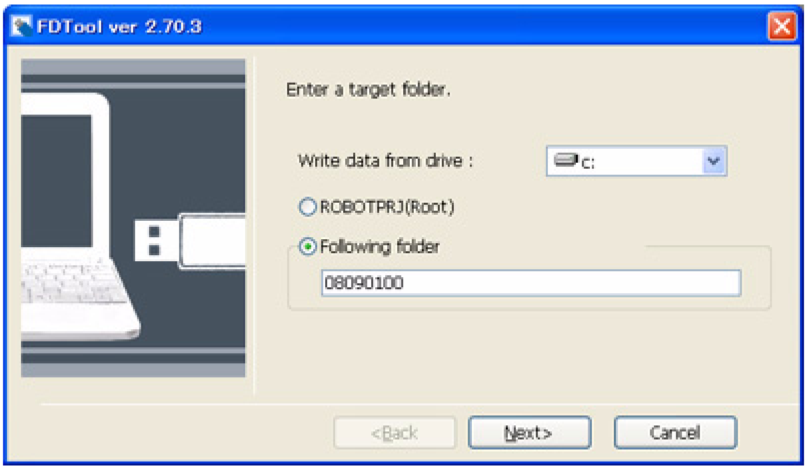
Data has been written to
c:¥PRJDATA¥08090100¥RobotPrj¥.
The time stamp of the written data will be
[20080901111323].

4.8.2 Writing data into USB memory

Follow the FDTool wizard to write data into a USB memory.

Operating procedure

1. Select Tool|USB|Write to start the FDTool wizard.



FDTool ver 2.70.3

Enter a target folder.

Write data from drive : C:

○ ROBOTPRJ(Root)

● Following folder

08090100

Write data into drive

This field specifies a drive for writing into a USB memory.

ROBOTPRJ (Root)

This radio button is for writing the entire project file into a USB memory.

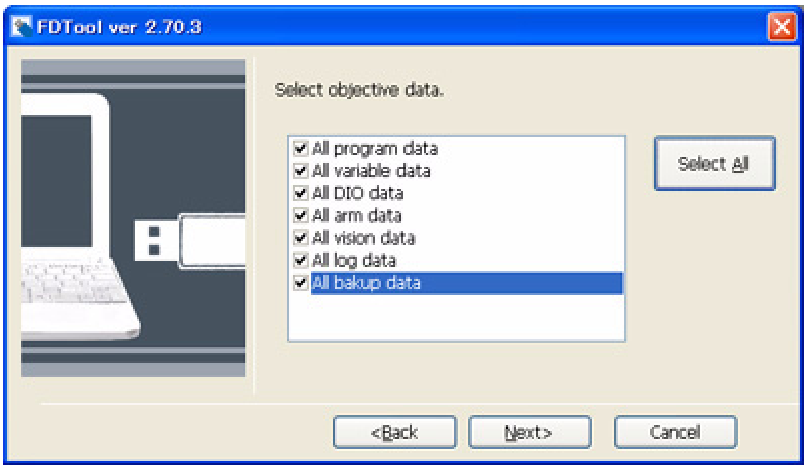
Following folder

This radio button is for specifying a folder in the project and writing data held in the folder into a USB memory.

Note

When writing data into a USB memory, first open a target project and then start the FDTool wizard. The wizard cannot select an unopened project.

2. **Click the Next button.**



Select objective data.

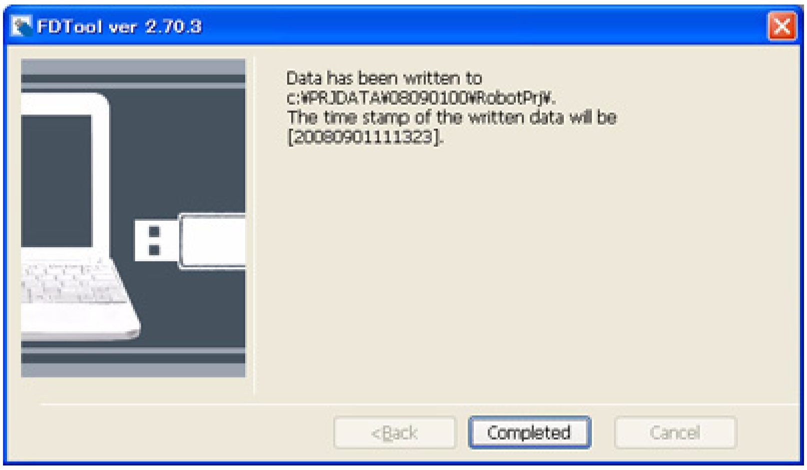
☑ All program data
☑ All variable data
☑ All DIO data
☑ All arm data
☑ All vision data
☑ All log data
☑ All bakup data

Select target data

Selecting these check boxes specify data to write into the USB memory. To write all data, click the Select All button.

3. **Click the Next button to write the specified data into the USB memory.**

Upon completion of writing, the following dialog appears.



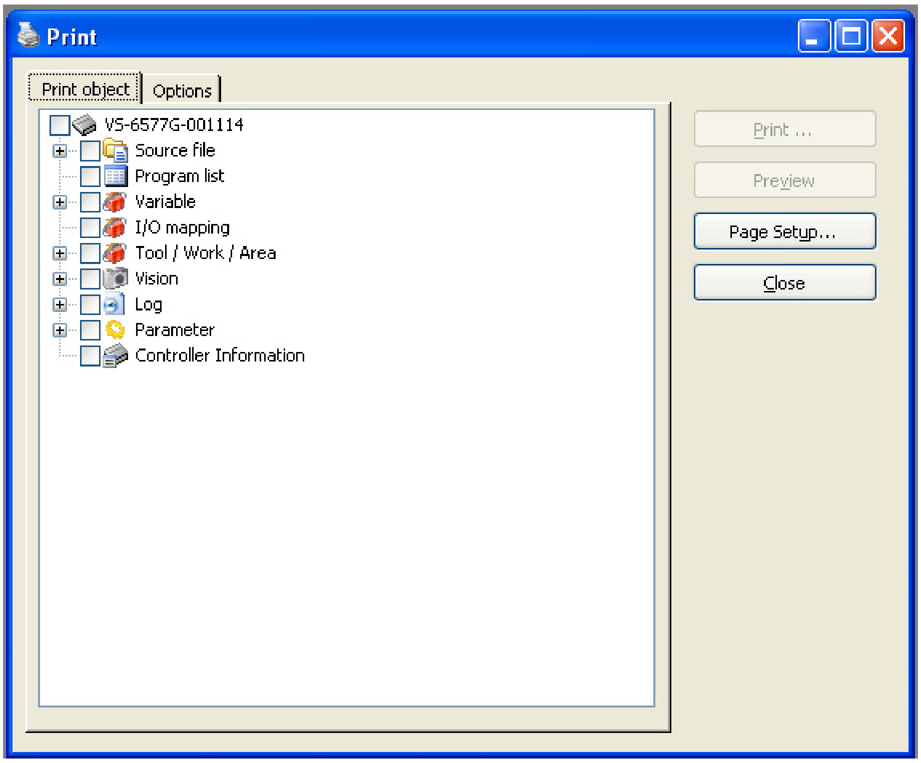
Data has been written to
c:¥PRJDATA¥08090100¥RobotPrj¥.
The time stamp of the written data will be
[20080901111323].

4.9 Print

Project data of various types can be printed out.

Operating procedure

1. Choose File|Print to display the Print dialog box.



2. Select the data you wish to print and press the Preview button.

Check the preview and then make your print out.

Note

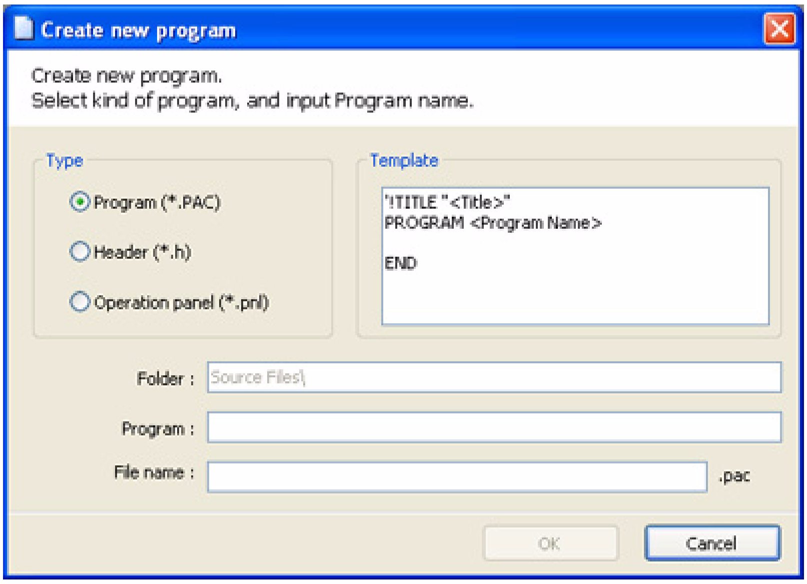
Printing out log data can result in vast amounts of printout pages, hence be sure to check the number of pages using the preview function first before printing.

Chapter 5 Writing Programs

5.1 Creating a New Program

Operating procedure

1. **Choose Project|Add Program... to display the dialog box for creating a new program, header file, or teach pendant (TP) panel.**



Create new program.
Select kind of program, and input Program name.

● Program (*.PAC)
○ Header (*.h)
○ Operation panel (*.pnl)

```
'!TITLE "<Title>"
PROGRAM <Program Name>

END
```

Folder : Source Files\
Program :
File name : .pac

2. **Specify the type.**

There are three choices.

- Program (*.pac)
- Header (*.h)
- Panel designer (*.pnl)

The box to the right automatically displays the corresponding template.

3. **Specify a name (title) for the program.**

The default is to use this program name as the file name.

To use a different file name, enter it in the File name field.

4. **Press the OK button to open a new file based on the template in the corresponding window: a Program edit window in the Program view area for a program or header file or the Panel Designer window for a TP panel.**

Panel Designer procedures appear in the Panel Designer User's Manual separately issued.

Note

- The folder for the new file is the default (shown in gray) currently selected in the Project window. If the target folder already contains a file with the name specified, pressing the OK button displays an error message and returns to the dialog box.
- The limit is one TP panel per folder.

5.2 Leveraging Existing Files

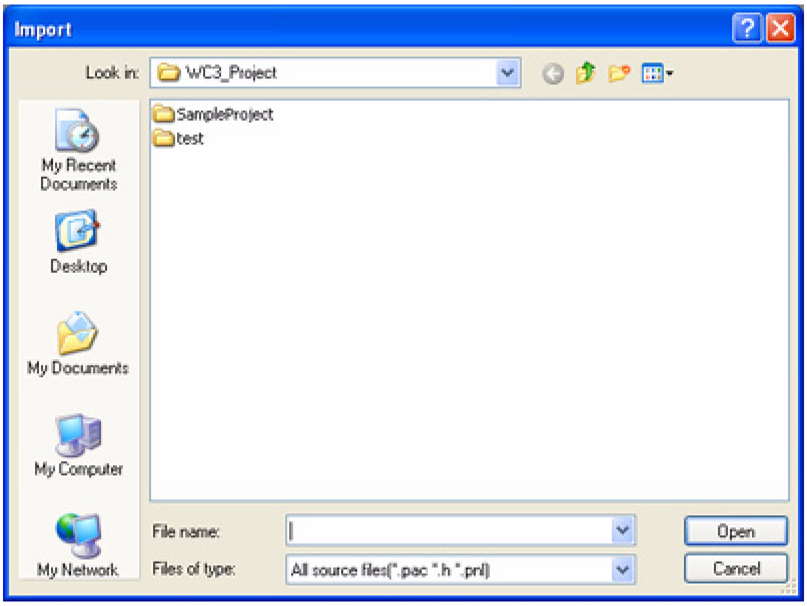
In practice, a key technique is to recycle files from other projects.

There are three file types.

- Program file (*.pac)
- Header file (*.h)
- Teach pendant panel (*.pnl)

Operating procedure

1. **Choose Project|Import... to display an Open dialog box.**



2. **Select the file to add and press the Open button to add it to the Project and Program list windows.**

Note

- The folder for the file is the one currently selected in the Project window. If that folder already contains a file with that name, however, a dialog box asks permission to overwrite it.
- If you wish to import by folders, choose Project|Folder|Import and specify the folder.

5.3 Saving a Program

The following procedure saves edits to the current program.

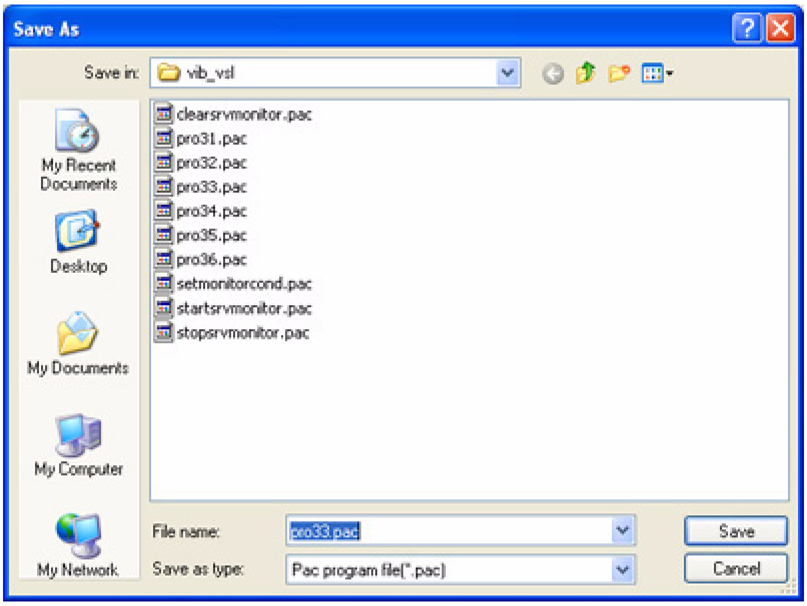
The File menu offers two ways to save modifications to the file in the selected Program edit window.

- Save updates the original file.
- Save As... saves them under a different name.

Only the latter warrants detailed description.

Operating procedure

1. **Choose File|Save As... to display a Save As dialog box.**



Save in: vib_vsl

File name: pro33.pac

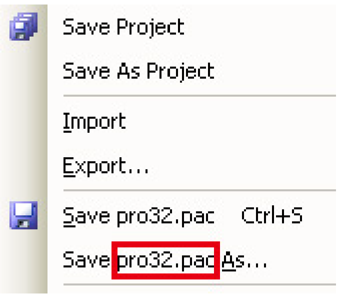
Save as type: Pac program file(*.pac)

2. **Specify the target folder and file name and press the Save button to save the contents of the Program edit window there.**

If that folder already contains a file with that name, however, a dialog box asks permission to overwrite it.

Note

- If there are multiple programs in the Program view area, the file saved is the active one, the one in the currently selected Program edit window.
  The File menu emphasizes this by adding the file name to the two menu items.



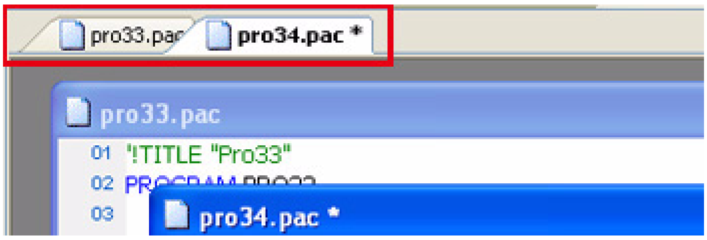
- If that folder already contains a file with that name, however, a dialog box asks permission to overwrite it.

5.4 Editing a Program

Double-clicking a program or header file in the Project or Program list window opens it for editing in a Program edit window.

Note

- If the Project window does not show file names, press its Display files button.
- The Program view area provides a tab interface for switching between files.



Alternatively, tiled and other layouts display multiple files for direct selection.

WINCAPS III provides the following program editing functions.

Configurable Program edit windows

The Program edit window text editor gives the user control over the font, size, and colors for displaying text. Syntax highlighting assigns different colors to distinguish between, for example, operators and comments. For further details on Program edit window display options, refer to 3.1.1 "WINCAPS III basic settings" (P. 14).

Finding and replacing strings

Find and replace strings in headers and programs.

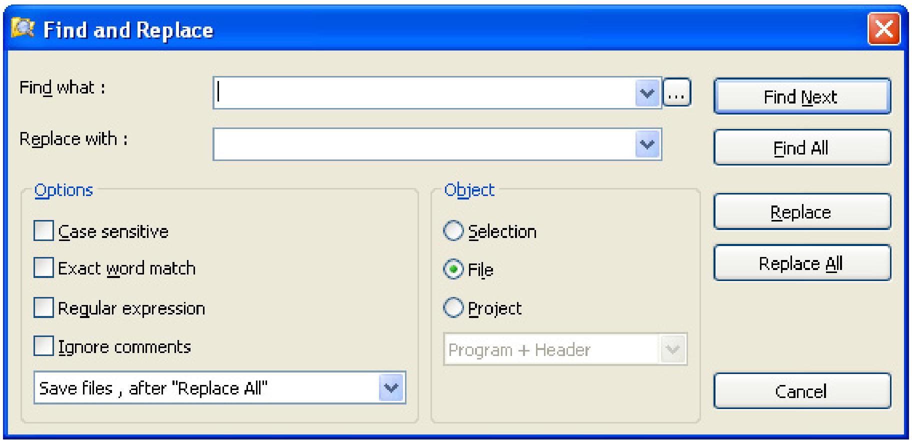
Search ranges and regular expressions can be used.

Other functions

- Jump to...
  This is for moving the cursor to a line, specified by number, in the Program edit window.
- Comment out
  This submenu command changes the lines selected in the Program edit window into comments.
- Indent
  This submenu command indents the lines selected in the Program edit window.
- Bookmark
  This submenu is for working with bookmarks, markers on lines in Program edit windows.
  These markers make it easier to return to that position.
- Helper functions
  These are to help command input by listing candidates and showing command syntax.

5.4.1 Finding and replacing strings

You can specify the range and method to search and replace the character string.



Find and Replace

Find what :

Replace with :

Options

□ Case sensitive

□ Exact word match

□ Regular expression

□ Ignore comments

Save files , after "Replace All"

Object

○ Selection

● File

○ Project

Program + Header

Target items

This field specifies the range of the target to be searched/replaced.

Choose Project to specify the file type.

Option

You can specify various search methods.

You can also select the files when executing Replace all.

Note

Double-clicking a line in the Search results window displays the corresponding program line.

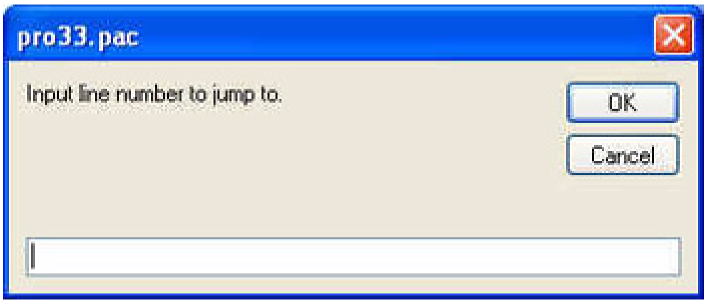
5.4.2 Other editing functions

5.4.2.1 Jump to...

This is for moving the cursor to a line, specified by number, in the Program edit window.

Operating procedure

1. **Choose Edit|Jump to... to display the eponymous dialog box.**



Input line number to jump to.

2. **Enter the line number.**

3. **Press the OK button to move the cursor to that line.**

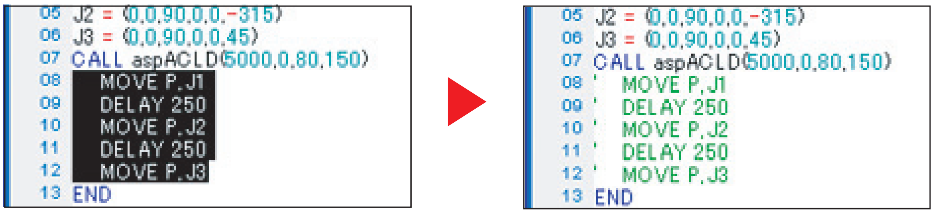
5.4.2.2 Comment out

This submenu command changes the lines selected in the Program edit window into comments.

Operating procedure

1. **Select the lines to comment out.**

2. **Choose Edit|Comment Block|Comment to convert them to comments.**



```
J2 = (0,0,90,0,0,-315)
J3 = (0,0,90,0,0,45)
CALL aspACLD(5000,0,80,150)
   MOVE P,J1
   DELAY 250
   MOVE P,J2
   DELAY 250
   MOVE P,J3
END
```

```
J2 = (0,0,90,0,0,-315)
J3 = (0,0,90,0,0,45)
CALL aspACLD(5000,0,80,150)
'  MOVE P,J1
'  DELAY 250
'  MOVE P,J2
'  DELAY 250
'  MOVE P,J3
END
```

Note

To reverse this operation, select lines and choose Edit|Comment Block|Decomment.

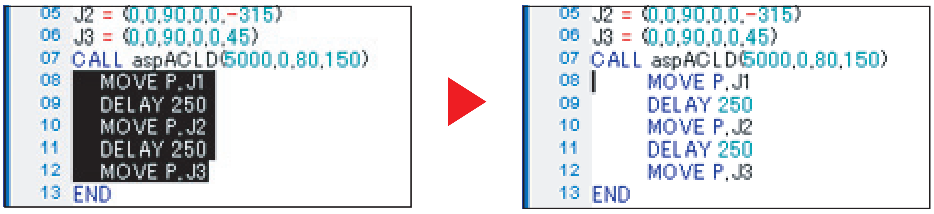
5.4.2.3 Indent

This submenu command indents the lines selected in the Program edit window into comments.

Operating procedure

1. Select the lines to indent.

2. Choose Edit|Indent|Indent to indent them.



```
J2 = (0,0,90,0,0,-315)
J3 = (0,0,90,0,0,45)
CALL aspACLD(5000,0,80,150)
  MOVE P,J1
  DELAY 250
  MOVE P,J2
  DELAY 250
  MOVE P,J3
END
```

```
J2 = (0,0,90,0,0,-315)
J3 = (0,0,90,0,0,45)
CALL aspACLD(5000,0,80,150)
        MOVE P,J1
        DELAY 250
        MOVE P,J2
        DELAY 250
        MOVE P,J3
END
```

Note

To reverse this operation, select lines and choose Edit|Indent|Unindent.

5.4.2.4 Bookmark

This submenu command is for setting a bookmark on the line under the cursor, or moving the cursor to a bookmark.

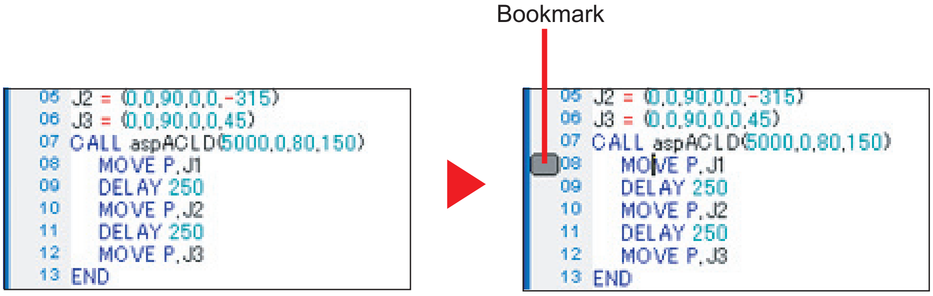
(1) Setting a bookmark

The following is the procedure for setting a bookmark on the line under the cursor.

Operating procedure

1. Move the cursor to the line on which to set the bookmark.

2. Choose Edit|Toggle Bookmark to set the bookmark or, if there is already a bookmark there, delete it.



```
J2 = (0,0,90,0,0,-315)
J3 = (0,0,90,0,0,45)
CALL aspACLD(5000,0,80,150)
    MOVE P,J1
    DELAY 250
    MOVE P,J2
    DELAY 250
    MOVE P,J3
END
```

```
J2 = (0,0,90,0,0,-315)
J3 = (0,0,90,0,0,45)
CALL aspACLD(5000,0,80,150)
    MOVE P,J1
    DELAY 250
    MOVE P,J2
    DELAY 250
    MOVE P,J3
END
```

(2) Moving to a bookmark

There are submenu commands for moving the cursor to a line with a bookmark.

Operating procedure

1. Choose Edit|Bookmark|Next Bookmark to move the cursor downward from the current position to the next bookmark.

To move the cursor upward, choose Edit|Bookmark|Previous Bookmark instead.

(3) Clearing bookmarks

There is a menu command for clearing all bookmarks.

Operating procedure

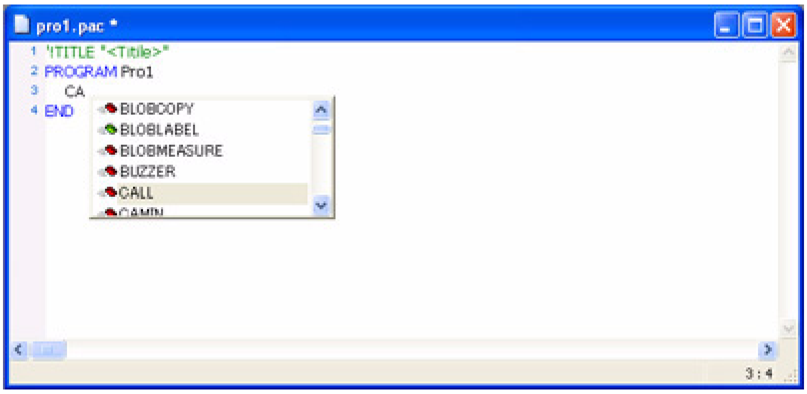
1. **Choose Edit|Bookmark|Clear Bookmarks.**

5.4.2.5 Command candidate function

As you type a command, a command list will appear. (Ctrl + Space key will also display the command list)

The command list will automatically scrolls to the first match.

Typing CA, for example, highlights CALL.



```
'!TITLE "<Title>"
PROGRAM Pro1
    CA
END
```

Selecting a command on this list displays a functional description to the right.

Double-clicking one inserts it in the text.

5.4.2.6 Insert command function

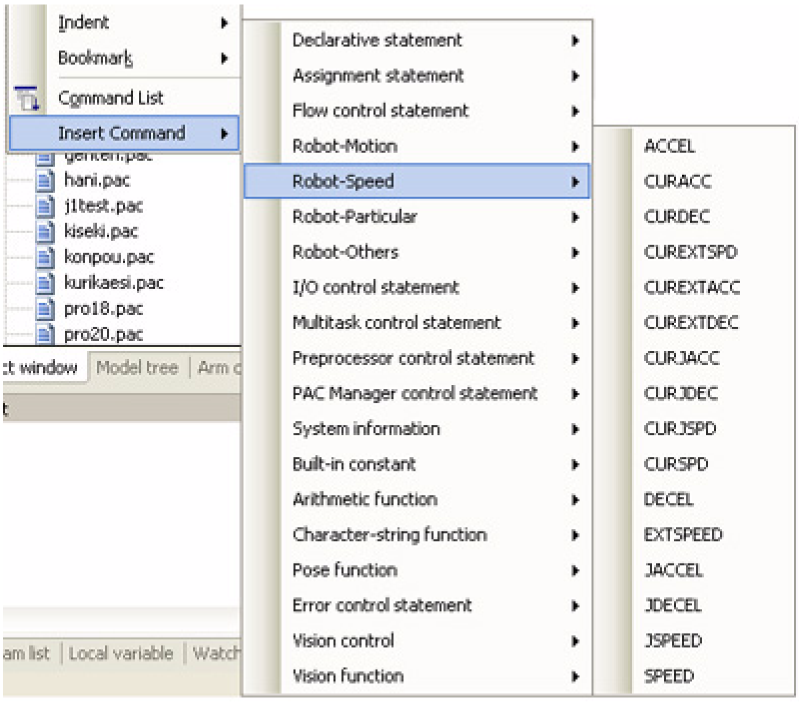
The Insert command submenu lists commands by function.

Selecting a command on this list inserts it into the program being edited.

Operating procedure

1. Move the cursor to the insertion position.

2. Choose Edit|Command Input to list the commands by function.



Note

Choosing a command inserts it with default values for any command parameters.

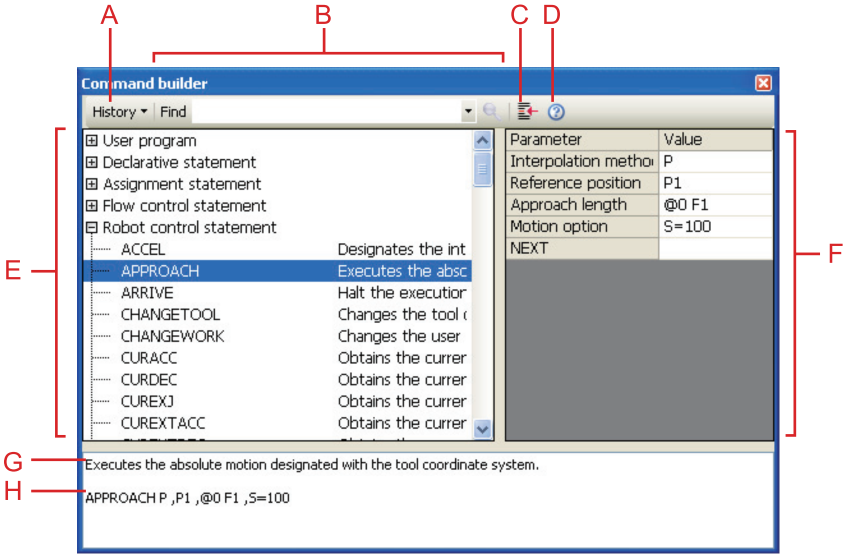
Edit these values without worrying about parameter syntax.

5.4.2.7 Command builder function

This is for command input through Command builder at the cursor point in the program being edited. Necessary parameters can also be input, allowing correct parameter statements.

You can also select from command searches or past commands entered. Help can be referred to for the commands shown, enabling quick command input.

Programs created by users in the project are also displayed, call programs can also be created.



⊞ User program
⊞ Declarative statement
⊞ Assignment statement
⊞ Flow control statement
⊟ Robot control statement

ACCEL	Designates the int
APPROACH	Executes the absc
ARRIVE	Halt the executior
CHANGETOOL	Changes the tool (
CHANGEWORK	Changes the user
CURACC	Obtains the currer
CURDEC	Obtains the currer
CUREXJ	Obtains the currer
CUREXTACC	Obtains the currer

Parameter	Value
Interpolation metho	P
Reference position	P1
Approach length	@0 F1
Motion option	S=100
NEXT	

Executes the absolute motion designated with the tool coordinate system.

APPROACH P ,P1 ,@0 F1 ,S=100

A: History

Select command from history of previously entered commands.

B: Find

Search commands using their names or description.

C: Insert

Selected commands are input at the cursor position on the program editing window.

D: Help

This displays the Help for the selected command.

E: Command list

Commands are listed by category.

P: Parameter

List of parameters for the selected command. Correct commands can be created by input into the values columns.

G: Brief description

Shows a simple description of the command.

H: Input command display

Displays the text inserted for the command, including the input parameters.

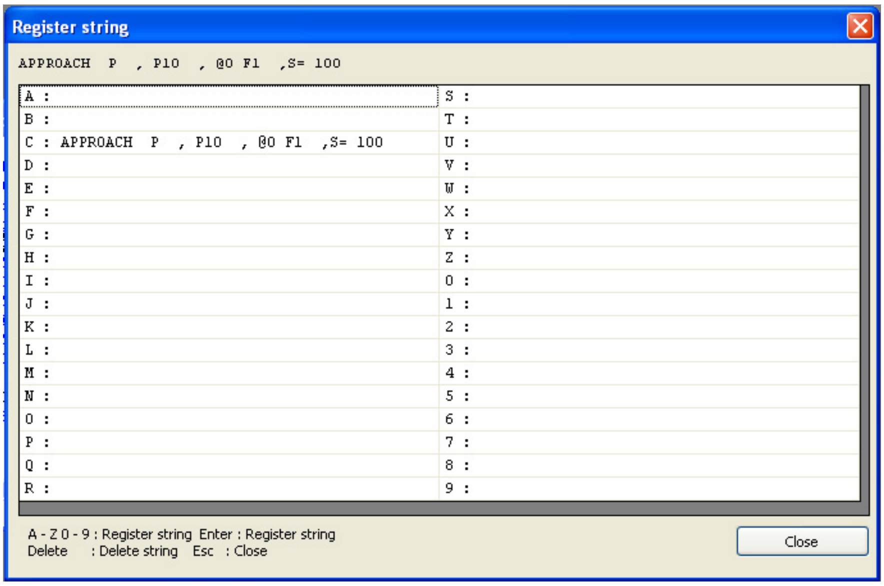
5.4.2.8 Insert registered character string

Allows registration of character strings commonly used in program editing for fast insertion.

(1) Register character string

Operating procedure

1. **Press the desired key to which the selected string should be assigned.**
2. **Choose Edit|Register string.**



APPROACH P , P10 , @0 F1 ,S= 100

A :	S :
B :	T :
C : APPROACH P , P10 , @0 F1 ,S= 100	U :
D :	V :
E :	W :
F :	X :
G :	Y :
H :	Z :
I :	0 :
J :	1 :
K :	2 :
L :	3 :
M :	4 :
N :	5 :
O :	6 :
P :	7 :
Q :	8 :
R :	9 :

A - Z 0 - 9 : Register string Enter : Register string
Delete : Delete string Esc : Close

3. **Press the desired key to which the selected string should be assigned.**

(2) Insert registered character string

Operating procedure

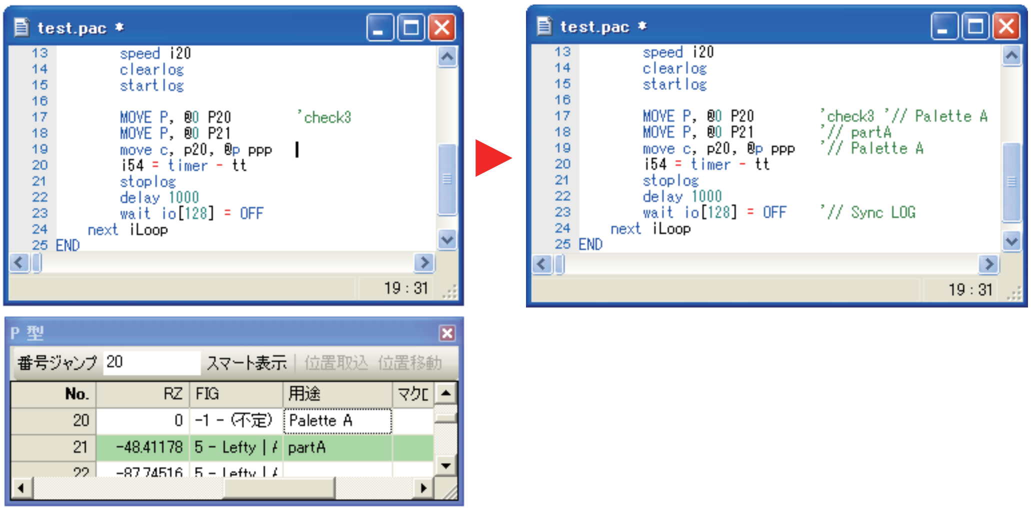
1. **In the Program edit window, move the cursor to the line to which the registered string should be inserted.**
2. **Choose Edit|Insert registered string.**
3. **Press the key to insert the character string into the program edit window.**

5.4.2.9 Add comment function

Automatically adds comments to explain the applications of the variables and I/O during program editing.

Comments are added with "'//" placed after them.

If a further comment is added after changing the application description of the I/O and variables, the content from "'//" onwards is updated.



```
        speed i20
        clearlog
        startlog

        MOVE P, @0 P20          'check3
        MOVE P, @0 P21
        move c, p20, @p ppp
        i54 = timer - tt
        stoplog
        delay 1000
        wait io[128] = OFF
    next iLoop
END
```

No.	RZ	FIG	用途	マクE
20	0	-1 - (不定)	Palette A	
21	-48.41178	5 - Lefty | /	partA	
22	-87.74516	5 - Lefty | /		

```
        speed i20
        clearlog
        startlog

        MOVE P, @0 P20          'check3 '// Palette A
        MOVE P, @0 P21          '// partA
        move c, p20, @p ppp     '// Palette A
        i54 = timer - tt
        stoplog
        delay 1000
        wait io[128] = OFF      '// Sync LOG
    next iLoop
END
```

5.5 Program Bank

The program bank allows robot applications to share library programs/functions originally written for one specific robot or application.

Note

Program samples are already preset in the program bank. For further details on program samples, please refer to Programming Manual II.

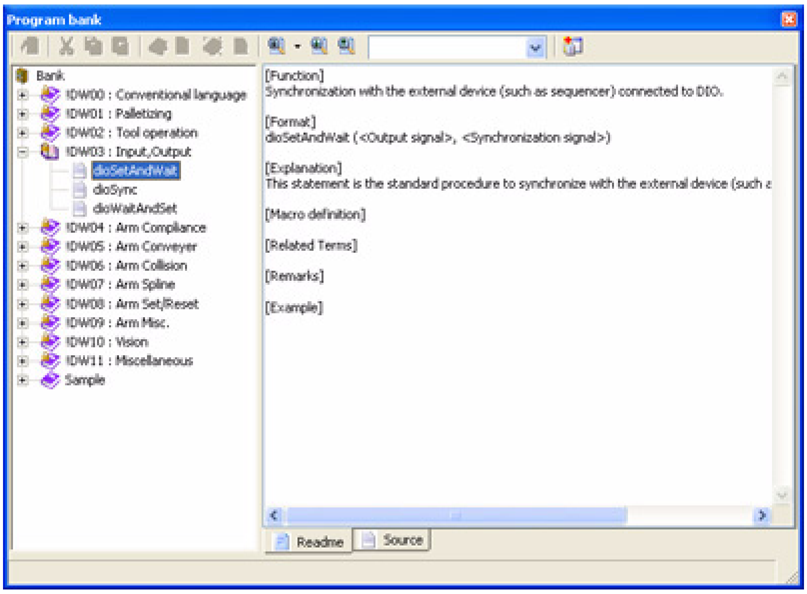
5.5.1 Adding a program to a project

This adds a program from the program bank to a project.

Operating procedure

1. Choose Project|Program Bank to display the eponymous dialog box.

These programs are listed by category. Double-clicking a category displays the programs in that category.



[Function]
Synchronization with the external device (such as sequencer) connected to DIO.

[Format]
dioSetAndWait (<Output signal>, <Synchronization signal>)

[Explanation]
This statement is the standard procedure to synchronize with the external device (such a

[Macro definition]

[Related Terms]

[Remarks]

[Example]

2. Select a program.

Two tabs switch between the documentation and source code for the selected program.

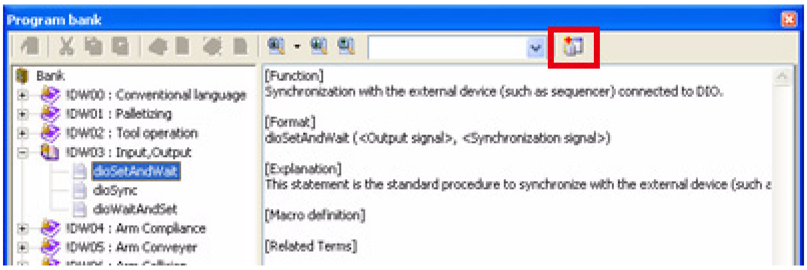
Readme tab

Proper documentation covers function, syntax, usage, conditions, limitations, and other particulars.

Source tab

This displays the source code for the selected program.

3. **Press the Add program button to add the program to the folder selected in the Project window. Other programs within the project can then access this program with CALL statements.**



[Function]
Synchronization with the external device (such as sequencer) connected to DIO.

[Format]
dioSetAndWait (<Output signal>, <Synchronization signal>)

[Explanation]
This statement is the standard procedure to synchronize with the external device (such a

[Macro definition]

[Related Terms]

5.5.2 Adding a program to the program bank

The following procedure adds a user program to the bank register.

Operating procedure

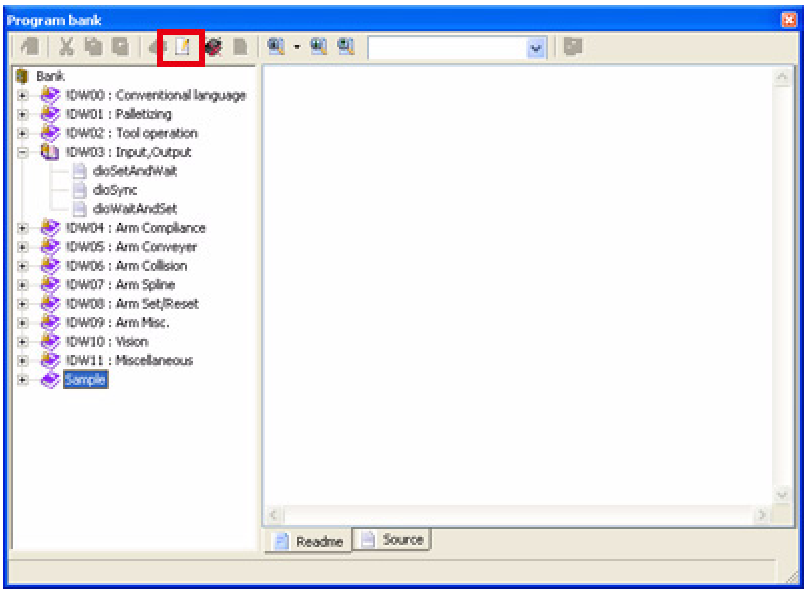
1. **Choose Project|Program Bank to display the dialog box.**

2. **Select the category.**

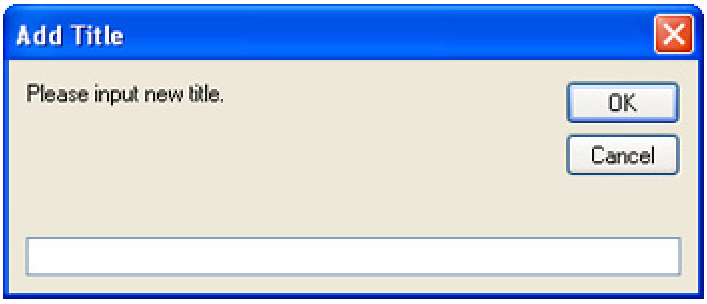
The first dozen categories, with names starting with exclamation points (!DW00 to !DW11: Miscellaneous) are locked, so choose another category.

To add a new category, refer to 5.5.3 "Adding a category" (P. 84).

3. **Press the Add program button to display the Add title dialog box.**



4. **Enter a title for the program and press the OK button.**



Please input new title.

5. **Fill out the two tabs.**

For the Source tab, copying the contents of the corresponding Program edit window is much faster than re-typing the program.

6. **Press the Update button.**

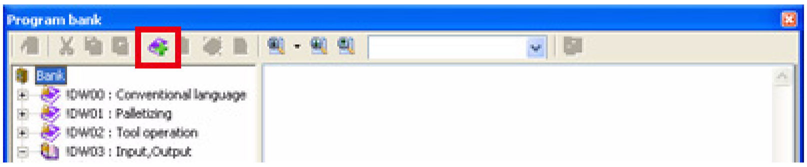
This registers it in the program bank.

5.5.3 Adding a category

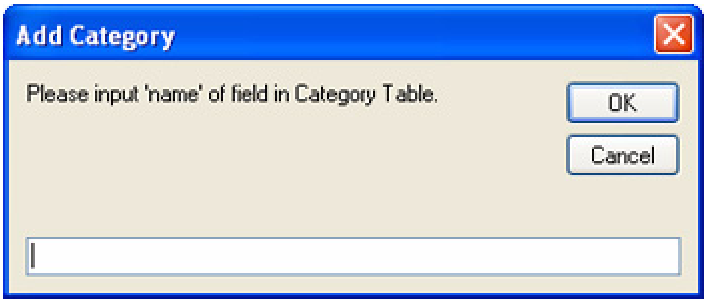
Operating procedure

1. **Select the root category, Bank.**

2. **Press the Add category button to display the eponymous dialog box.**



3. **Enter a name for the category and press the OK button.**



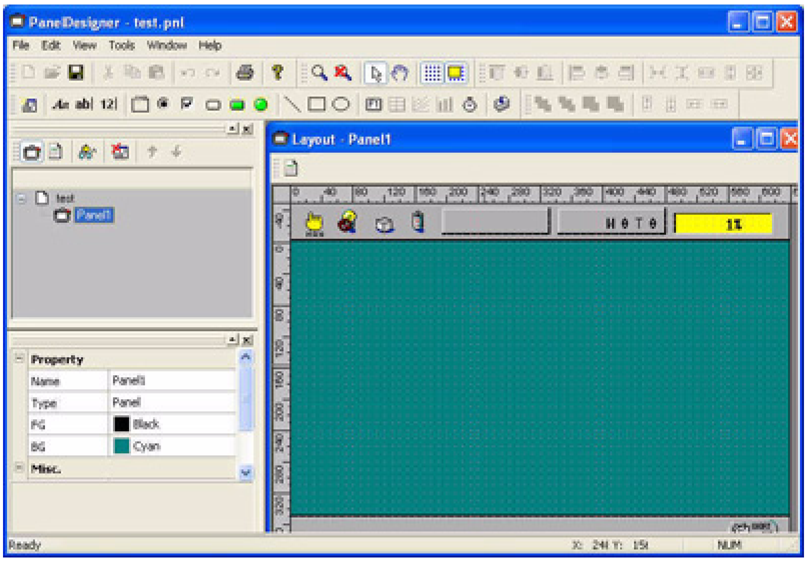
Please input 'name' of field in Category Table.

5.6 Editing a Teach Pendant (TP) Panel

A TP panel represents the interactive image displayed on the screen of the teach pendant attached to the robot controller.

5.6.1 Editing a TP panel

To edit a TP panel (*.pnl), double-click it in the Project or Program list window to open it in the Panel Designer window.



Property	
Name	Panel1
Type	Panel
FG	■ Black
BG	🟦 Cyan
Misc.	

Note

- If the Project window does not show file names, press its Display files button.
- Panel Designer procedures appear in the Panel Designer User's Manual separately issued.

5.7 Folder Functions

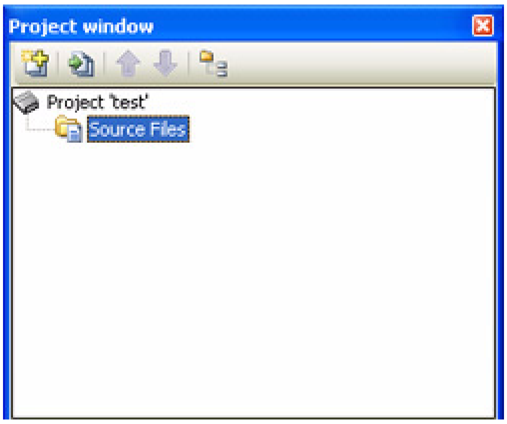
Folders hold the key to hierarchical management of the program files in a project.

Grouping program files into folders by function or type adds structure that makes overall operation easier to understand and encourages compartmentalization, enhancing program portability to other projects.

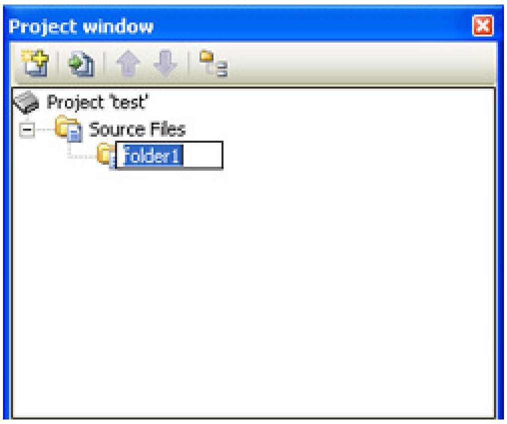
5.7.1 Creating a folder

Operating procedure

1. Select the parent, the folder in the Project window to hold the new folder.



2. Choose Project|Folder|New to create a new folder and select its name for editing.



3. Enter a name for the folder.

Note

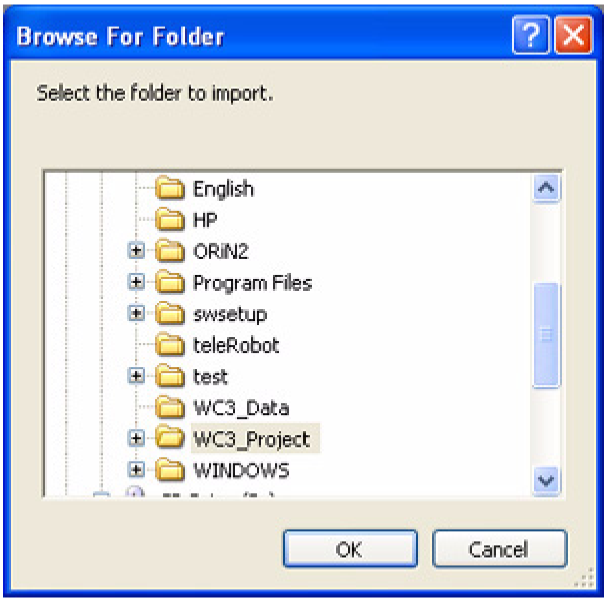
This folder name can be modified at a later date.

5.7.2 Importing an entire folder

Importing a folder is much faster than importing the files one at a time.

Operating procedure

1. **Select a folder in the Project window.**
2. **Choose Project|Folder|Import to display the Browse folders dialog box and specify the folder to import.**


Browse For Folder

Select the folder to import.

3. **Press the OK button to copy the selected folder as well as the files inside to the target folder selected in the Project window.**

Note

If the target folder already contains a file with the same name, however, a dialog box asks permission to overwrite it.

5.8 Making Executables

5.8.1 Checking syntax

The following procedure runs a syntax check on the selected program.

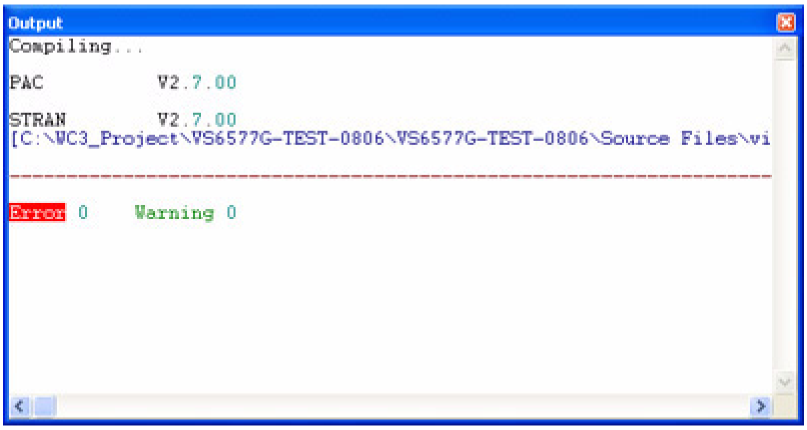
Note

The target is the file in the currently active Program edit window.

Operating procedure

1. **Select the program to check.**

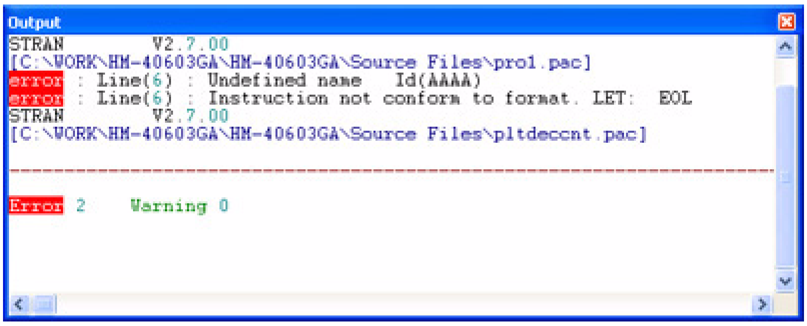
2. **Choose Project|Check Syntax to run the check and display the results in an Output window.**



```
Compiling...

PAC           V2.7.00

STRAN         V2.7.00
[C:\WC3_Project\VS6577G-TEST-0806\VS6577G-TEST-0806\Source Files\vi

-----------------------------------------------------------------------

Error 0    Warning 0
```

A syntax error triggers an error message consisting of an indication, error, the line number, and a brief note in the Output window.

Double-clicking on this message highlights the corresponding line in reverse in a Program edit window.



```
STRAN         V2.7.00
[C:\WORK\HM-40603GA\HM-40603GA\Source Files\pro1.pac]
error : Line(6) : Undefined name   Id(AAAA)
error : Line(6) : Instruction not conform to format. LET:  EOL
STRAN         V2.7.00
[C:\WORK\HM-40603GA\HM-40603GA\Source Files\pltdeccnt.pac]

-----------------------------------------------------------------------

Error 2    Warning 0
```

Note

There is an option for automatically running this check on the program after each save.

Choose Project|Properties to display the project property sheets and look for it on the Compiler tab.

5.8.2 Making executables

This batch operation applies to all files in the project.

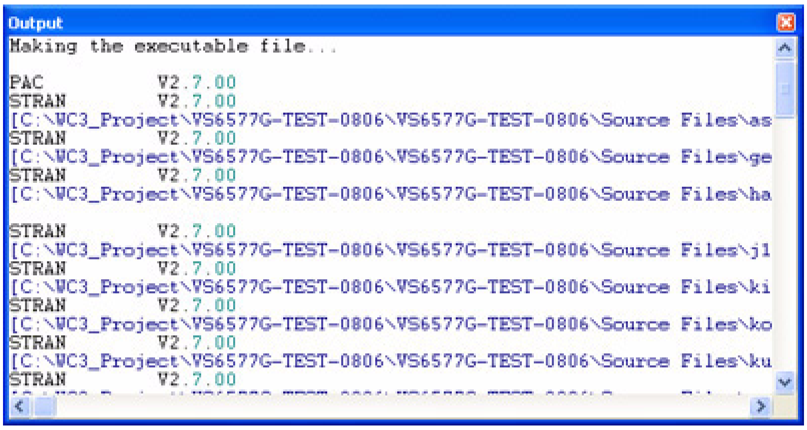
Note

The update is conducted for all programs registered in the project.

Operating procedure

1. Choose Project|Compile to update the executables for the project.

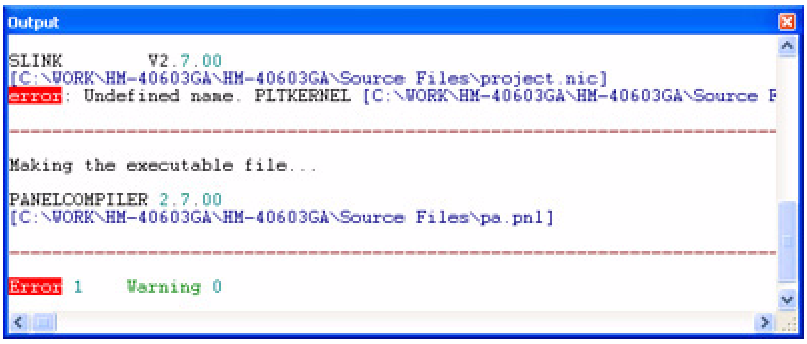
An Output window in the Docking View window tracks progress and error messages from the compiler.



```
Making the executable file...

PAC             V2.7.00
STRAN           V2.7.00
[C:\WC3_Project\VS6577G-TEST-0806\VS6577G-TEST-0806\Source Files\as
STRAN           V2.7.00
[C:\WC3_Project\VS6577G-TEST-0806\VS6577G-TEST-0806\Source Files\ge
STRAN           V2.7.00
[C:\WC3_Project\VS6577G-TEST-0806\VS6577G-TEST-0806\Source Files\ha

STRAN           V2.7.00
[C:\WC3_Project\VS6577G-TEST-0806\VS6577G-TEST-0806\Source Files\j1
STRAN           V2.7.00
[C:\WC3_Project\VS6577G-TEST-0806\VS6577G-TEST-0806\Source Files\ki
STRAN           V2.7.00
[C:\WC3_Project\VS6577G-TEST-0806\VS6577G-TEST-0806\Source Files\ko
STRAN           V2.7.00
[C:\WC3_Project\VS6577G-TEST-0806\VS6577G-TEST-0806\Source Files\ku
STRAN           V2.7.00
```

An error triggers an error message consisting of an indication, error, the line number, and a brief note in the Output window.

Double-clicking on this message highlights the corresponding line in reverse in a Program edit window.



```
SLINK          V2.7.00
[C:\WORK\HM-40603GA\HM-40603GA\Source Files\project.nic]
error: Undefined name. PLTKERNEL [C:\WORK\HM-40603GA\HM-40603GA\Source F

-------------------------------------------------------------------------

Making the executable file...

PANELCOMPILER 2.7.00
[C:\WORK\HM-40603GA\HM-40603GA\Source Files\pa.pnl]

-------------------------------------------------------------------------

Error 1    Warning 0
```

Note

- Checking executable operation requires first downloading it to the robot controller with the procedures in 4.7.2 "Data transfers" (P. 60).
- To specify file names for executables, choose Project|Properties to display the project property dialog box and select the Compiler tab.

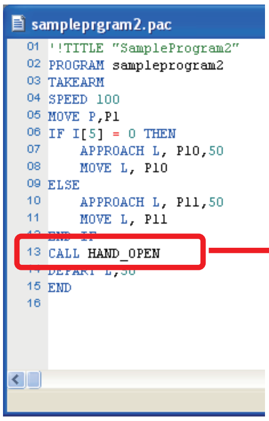
5.9 Simulation function

Cycle time, trajectory, posture, and so on can be checked by running a created program on the PC. In addition, the program can be debugged because variables can be monitored during execution and edited.

5.9.1 Grammar check of simulation function

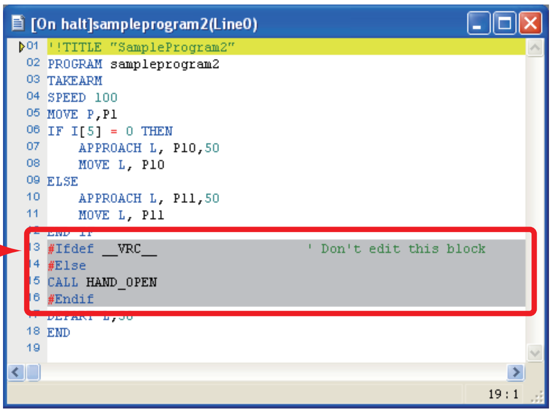
Grammar check of the selected program is performed when entering the simulation mode. Grammar check to run the program with the normal robot controller is performed first, then a grammar check to see if the program can be run with the simulation function is performed. Commands that can be run with the robot controller but cannot be run with the simulation function are enclosed with "#IFDEF...#ENDIF". Commands enclosed by "#IFDEF...#ENDIF" are not run with the simulation function, but they are run with the robot controller, thus they can be sent to the robot controller and used as is.

Select [Edit]-[Delete codes for simulation] to delete the codes ("#IFDEF...", "#ENDIF") added by the grammar check of the simulation function.



```
'!TITLE "SampleProgram2"
PROGRAM sampleprogram2
TAKEARM
SPEED 100
MOVE P,P1
IF I[5] = 0 THEN
    APPROACH L, P10,50
    MOVE L, P10
ELSE
    APPROACH L, P11,50
    MOVE L, P11
END IF
CALL HAND_OPEN
DEPART L,50
END
```

Normal



```
'!TITLE "SampleProgram2"
PROGRAM sampleprogram2
TAKEARM
SPEED 100
MOVE P,P1
IF I[5] = 0 THEN
    APPROACH L, P10,50
    MOVE L, P10
ELSE
    APPROACH L, P11,50
    MOVE L, P11
END IF
#Ifdef __VRC__                   ' Don't edit this block
#Else
CALL HAND_OPEN
#Endif
DEPART L,50
END
```

Simulation mode

5.9.2 Simulation function and global variables

When values of variables, work pieces, tools and areas are modified by the program started in the simulation mode, you can select whether to revert to the values before execution or to save the modified values.

Also, global variables can be edited even while running simulation.

5.9.3 Precautions for simulation function

- Multiple programs cannot be started. “call” and “run” are not supported.
- Simulation function supports part of the commands for calculating cycle time or checking trajectory and operation posture, etc.
- Users must not input "#IFDEF ... #ENDIF" by themselves.
- Programs with arguments are not supported.
- Arm semaphore (axis control right) is not checked. Control rights of all valid axes are automatically obtained.

5.9.4 List of supported commands

Robot control statement

Move, Approach, Depart, Draw, Drive, DriveA, Speed, Accel, Decel, ChangeTool, ChangeWork, Wait, Delay

Multitasking control statement

TakeArm, GiveArm

Flow control statement

For-Next, Do-loop, If-Then-End If, Select Case-End Select

Input output control statement

Set, Reset

Others

Four arithmetic operations, Arithmetic Function, Trigonometric functions, Coordinate conversion, Character string operations

Note

- Free curve function of "MOVE" command (MOVE S) is not supported.
- Simulation function does not check arm semaphore (axis control right).
- Simulation function interprets "true" as "-1". When using "Set" and "Reset" commands, write programs using "ON"/"OFF".
- Vector operation is not supported.

Chapter 6 Arm 3D View Window

The Arm 3D view window displays, in three dimensions, the robot's current position and attitude.

Simulation allows the efficient and safe development of robot control programs without having to connect an actual robot.

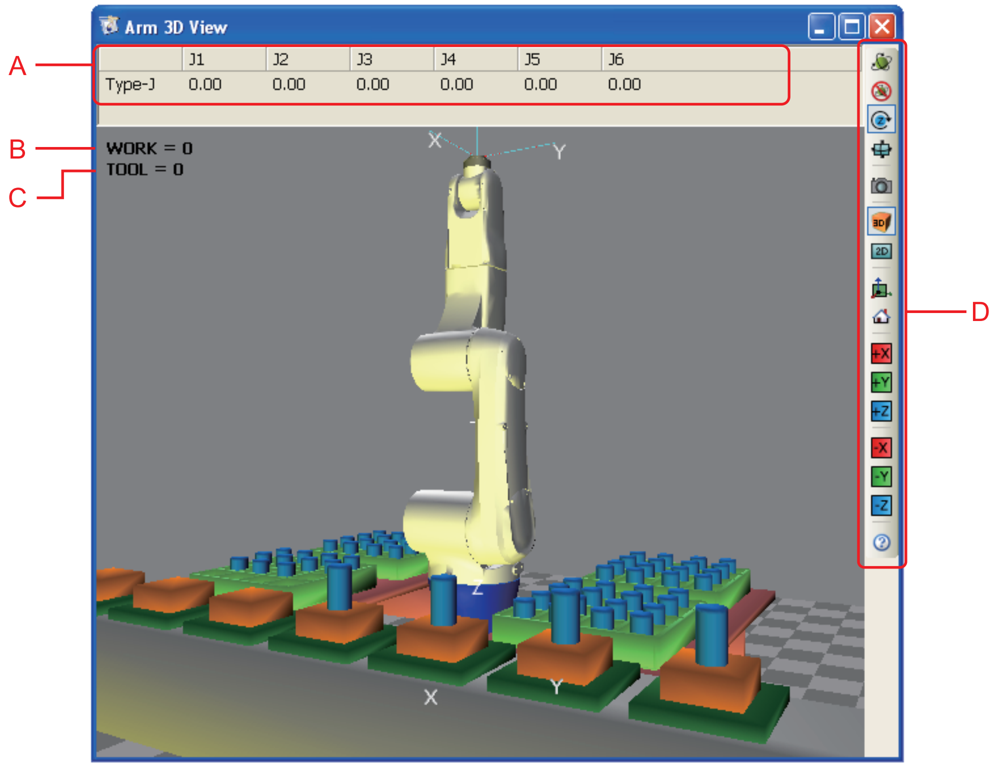
During remote debugging, the robot arm on the screen responds to program commands.

6.1 Screen Descriptions

6.1.1 Arm 3D view

This window displays, in three dimensions, the robot's current position and attitude.

It is for visualizing robot activity, determining the robot's operation range, and, after adding other objects to the layout, detecting collisions with surrounding equipment.



	J1	J2	J3	J4	J5	J6
Type-J	0.00	0.00	0.00	0.00	0.00	0.00

WORK = 0

TOOL = 0

A: Current positions

This area displays the current values of robot position variables of types P, J, T, and J-EX.

The Arm|Display current angles submenu switches the layout here.

B: Work number

This area displays the current work number.

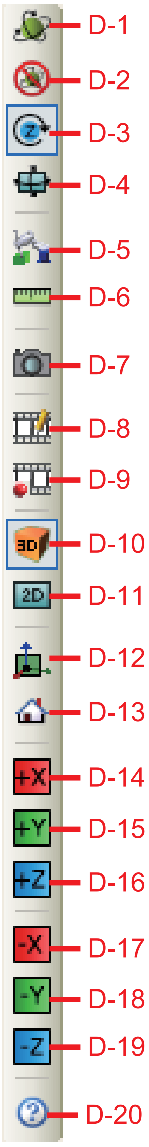
The Arm|Work coordinate monitor submenu switches between display/non-display of the layout here.

C: Tool number

This area displays the current tool number.

The Arm|Tool coordinate monitor submenu switches between display/non-display of the layout here.

D: Arm 3D view tool bar



D-1: Rotate

This rotates the view on the screen using a mouse.

D-2: Fixed view

This fixes the current view on the current position.

D-3: Rotation on Z-axis

This rotates the view on Z-axis using a mouse. (Default)

D-4: Rotate: screen bisection

This rotates the view on the horizontal/vertical axis.

D-5: 3D view teach

This teaches by clicking the object.

D-6: Measure point-to-point distance

This measures the distance between two clicked points.

D-7: Screen shot

This captures the current screen image and saves it as a file.

D-8: Recording setting

This performs video compression settings for recording.

D-9: Recording start and stop

This starts and stops recording.

D-10: 3D screen

This switches the screen to the 3D (perspective projection) mode.

D-11: 2D screen

This switches the screen to the 2D (parallel projection) mode.

D-12: Move origin

This moves the origin of the base coordinates to the center of the screen.

D-13: Whole object

This resizes the display to show the whole object.

D-14: Change view (+X)

This shows the display viewed from the +X direction.

D-15: Change view (+Y)

This shows the display viewed from the +Y direction.

D-16: Change view (+Z)

This shows the display viewed from the +Z direction.

D-17: Change view (-X)

This shows the display viewed from the -X direction.

D-18: Change view (-Y)

This shows the display viewed from the -Y direction.

D-19: Change view (-Z)

This shows the display viewed from the -Z direction.

D-20: Help

This shows the operating procedure in the right corner of the screen.

Moused-based viewing operations

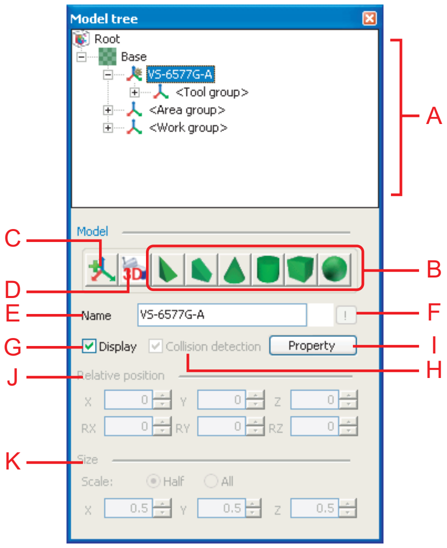
- Rotate: Left button + drag
- Pan: Left / right button hold + drag
- Zoom: Right button + drag

Moused-based robot / object operations

- Select: Left-click
  - Move object view to the center of the screen: Shift + left-click
  - Object full screen display: Alt + left-click
- Move: Ctrl + Left-click
  - Move in a straight line: Coordinate axis Left button + drag
  - Rotate: Ctrl + coordinate axis Left button + drag

6.1.2 Arm modeling

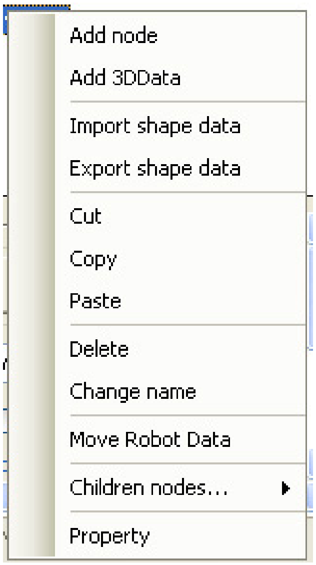
This window is for adding tools, work pieces, obstacles, and other objects to the equipment layout in the Arm 3D view window using 3D data from either the built-in simple modeling software or external sources.



A: Object tree

This shows the object hierarchy behind the Arm 3D view.

Right-clicking anywhere in the object tree area displays the following context menu.



Add node

This is for adding a node underneath the selected object.

Add 3D data

This is for adding an object using 3D data from an external source.

Import shape data

This is for reading in existing modeling data.

Export shape data

This is for saving the modeling data for the selected node or object as a file.

Cut

This moves the selected object to the Windows clipboard.

Copy

This copies the selected object to the Windows clipboard.

Paste

This inserts the object in the Windows clipboard as a child of the currently selected object.

Delete

This deletes the selected nodes and objects.

Change name

This is for changing the name of the selected node or object.

Move Robot Data

This is for moving all data of Base objects including the robot on the object tree.

The robot data moves as a child of the selected node or object.

Children nodes...

All objects below the selected node can be expanded/collapsed, displayed / not displayed, interference checked / not checked.

Property

This displays the property sheets for the selected object.

B: Add buttons

These add an object of the shape indicated on the button. There are six shapes available.

C: Node button

This adds a node.

D: External button

This reads in 3D data from an external source.

E: Name

This field specifies a name for the selected object.

F: Color

This field specifies a color for the currently selected object.

G: Display check box

Selecting this check box displays the currently selected object in the Arm 3D view.

H: Collision detection check box

Selecting this enables collision detection for the currently selected object.

I: Properties button

This displays the property sheets for the currently selected object.

J: Relative position

These fields specify the relative position for the currently selected object.

X, Y, Z	:	Relative x/y/z coordinates in mm.
RX, RY, RZ	:	Angles relative to the corresponding axis, in degrees.

K: Size

These fields specify the dimensions for the object selected on the tree.

X, Y, Z	:	Dimensions along the x-, y-, and z-axes, in mm.

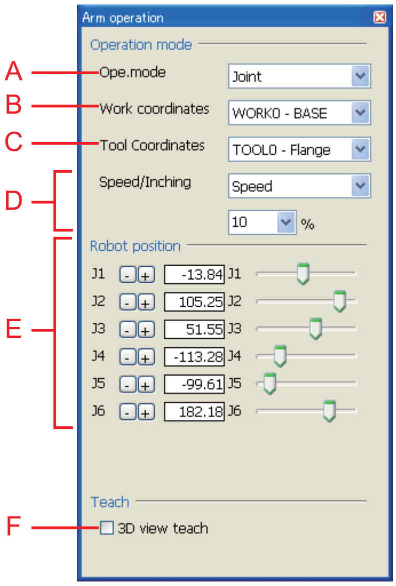
The radio buttons above offer a choice of specifying half- or full-sized measurements.

Note

- If the data of the selected object is 3D data imported, the Size fields specify the magnification. Assuming the original size of the 3D data as "1," specify the magnification.
- Imported 3D objects cannot be edited.
- Entering negative values into the Size fields inverts the object.

6.1.3 Arm operation

This window is for moving the simulated robot in the Arm 3D view window.



Ope.mode: Joint

Work coordinates: WORK0 - BASE

Tool Coordinates: TOOL0 - Flange

Speed/Inching: Speed

10 %

J1 -13.84

J2 105.25

J3 51.55

J4 -113.28

J5 -99.61

J6 182.18

□ 3D view teach

A: Ope. mode

Select movement mode.

- Axes: operates all axes.
- XY-bisection: moves according to the selected work coordinates. RX/RY/RZ rotate around the work coordinates centered on the tool origin point.
- Tool: moves according to the selected tool coordinates. RX/RY/RZ rotate around the work coordinates centered on the tool origin point.

B: Work coordinates

Select work coordinates.

C: Tool coordinates

Select tool coordinates.

D: Speed/Inching

Select normal running or inching.

- Speed: While the "Move position" button is held down, the corresponding robot joint continuously moves at the specified speed (%).
- Inching: Each time the "Move position" button is pressed, the corresponding robot joint inches by the specified amount of movement (mm or degree).

E: Move position buttons

Moves the robot displayed in Arm 3D view in accordance with the selected movement mode.

F: 3D view teach

Teaches the posture symmetry to the surface when clicking an object within the Arm 3D view window.

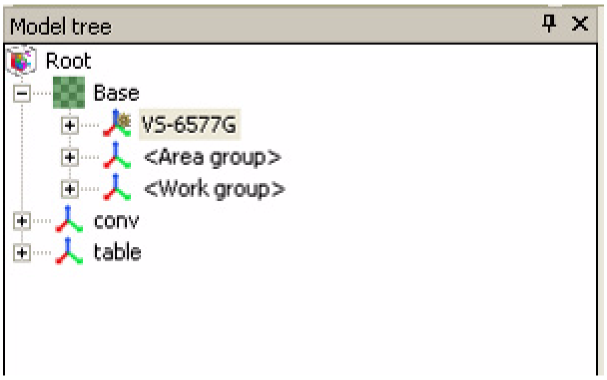
6.2 Simple Modeling

The built-in tool is for quick and dirty modeling of the pallet bench, pallet, work, and other objects.

The Model tree window presents a hierarchical display of the objects in the Arm 3D view.

The top node is Root, which starts out with the following predefined nodes.

Nodes are virtual items to combine multiple objects and name them.



Model tree

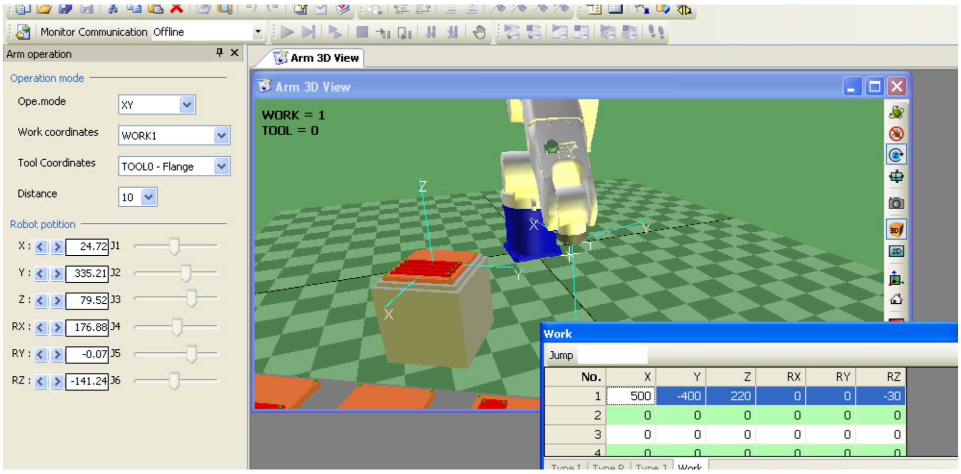
- Root
  - Base
    - VS-6577G
    - <Area group>
    - <Work group>
  - conv
  - table

Work group

This group contains the coordinates for eight work pieces, Work0 to Work7.

Selecting the Display check box in the Model tree window displays the current coordinates in the Arm 3D view window.

The work group node relative positions reflect the Work coordinate settings. Choose View|Tool/Work/Area Settings|Work to display this window for modifying these settings. (Work0 cannot be edited on the base center.)



Monitor Communication Offline

Arm operation

Operation mode

Ope.mode: XY

Work coordinates: WORK1

Tool Coordinates: TOOL0 - Flange

Distance: 10

Robot potition

X :	24.72	J1
Y :	335.21	J2
Z :	79.52	J3
RX :	176.88	J4
RY :	-0.07	J5
RZ :	-141.24	J6

Arm 3D View

WORK = 1
TOOL = 0

Work

Jump

No.	X	Y	Z	RX	RY	RZ
1	500	-400	220	0	0	-30
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0

Tool group

This group contains the coordinates for sixty four tools, Tool0 to Tool63.

Selecting the Display check box in the Model tree window displays the current coordinates in the Arm 3D view window.

The tool group node relative positions reflect the Tool coordinate settings. (Tool0 cannot be edited on the base center.)

Area group

This group contains the coordinates for 32 areas, Area0 to Area31.

Selecting the Display check box in the Model tree window displays the current coordinates in the Arm 3D view window.

Adding nodes

A node may be added anywhere in the object hierarchy.

Select a node on the object tree, right-click, and choose Add node from the context menu that appears to add a new node as a child of the selected one.

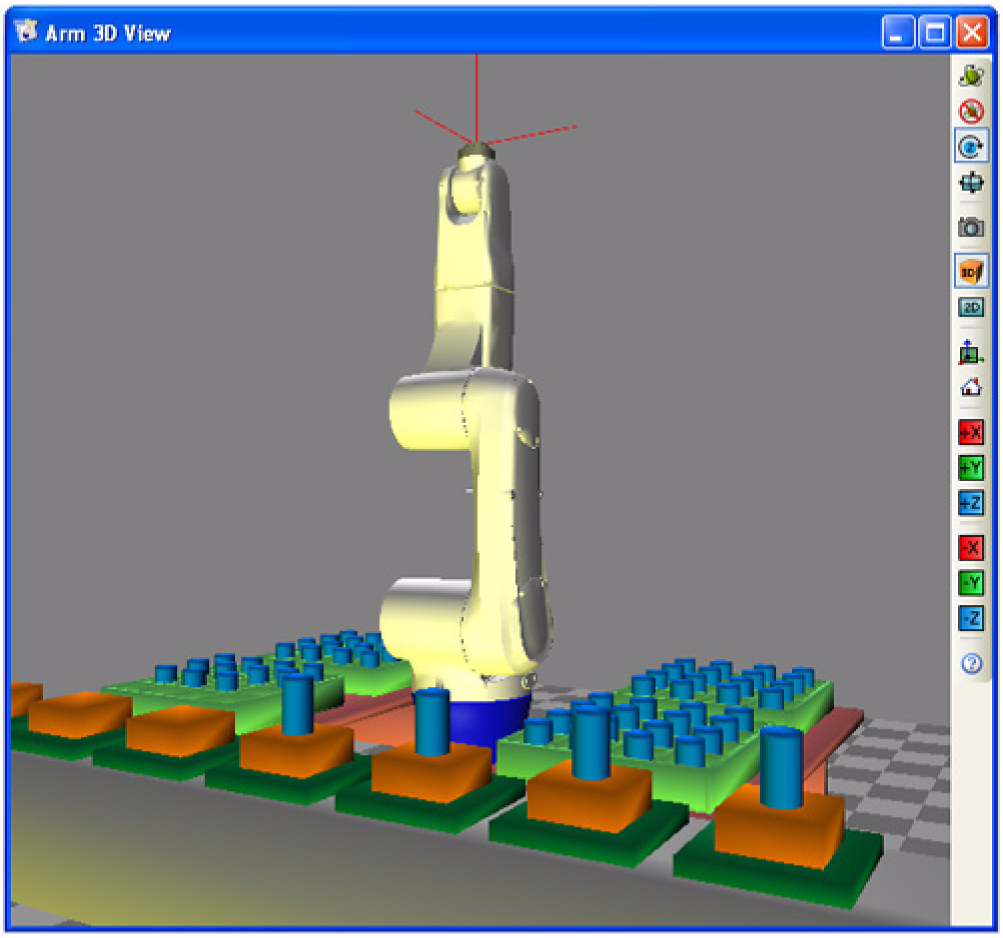
Note

Grouping the pallet, pallet bench, and other objects under a common node, for example, enables copying and pasting them together as a single group.

6.2.1 Adding objects

The following is the procedure for adding the pallet bench, pallet, work pieces, and other objects to the Arm 3D view window.

Layout example



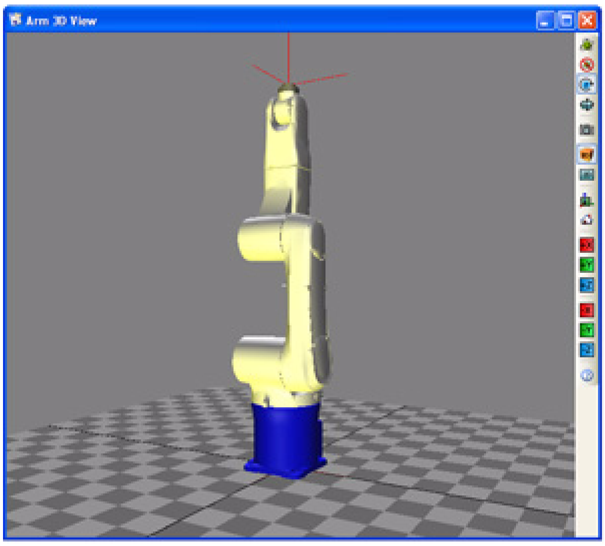
As our example, let's start with the pallet bench.

Operating procedure

1. **Choose View|Arm View to display the modeling window.**

2. **Specify where to add to the model by selecting a node to be the parent.**

3. **Press the ▢ (Box) button in the Model tree window to add a box to the Arm view window.**



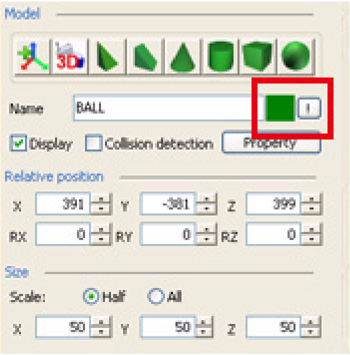
4. **Modify the object to give it a name and a color.**

Change name

Right-click on the object and choose Change name from the context menu that appears to highlight the name, ready for editing.

Changing color

To change the color of an object, press the Pick color button in the Model tree window and choose from the palette that appears.


Model

Name BALL 🟩

☑ Display ☐ Collision detection

Relative position

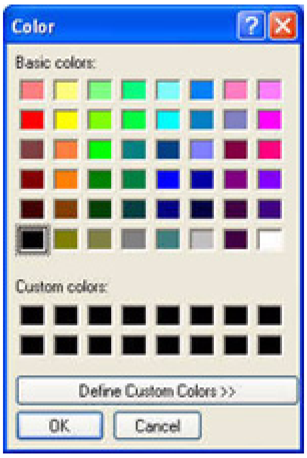
X 391 Y -381 Z 399

RX 0 RY 0 RZ 0

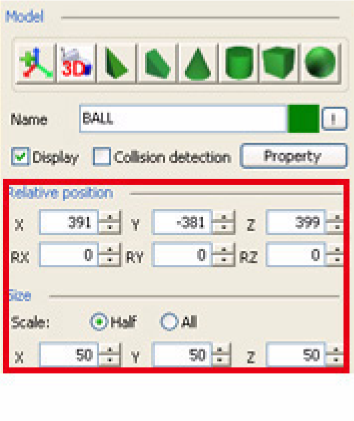
Size

Scale: ● Half ○ All

X 50 Y 50 Z 50



5. **Change the object's position and size.**



Model

Name BALL

☑ Display ☐ Collision detection Property

Relative position

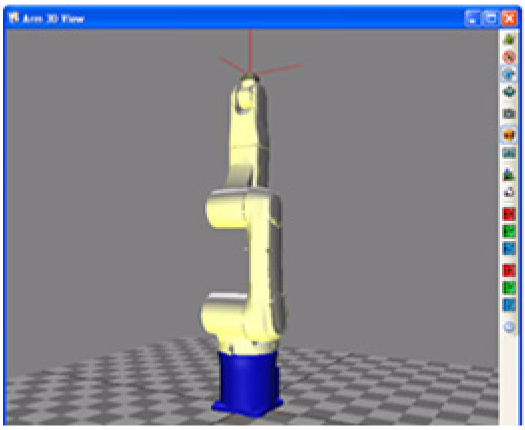
X 391 Y -381 Z 399

RX 0 RY 0 RZ 0

Size

Scale: ● Half ○ All

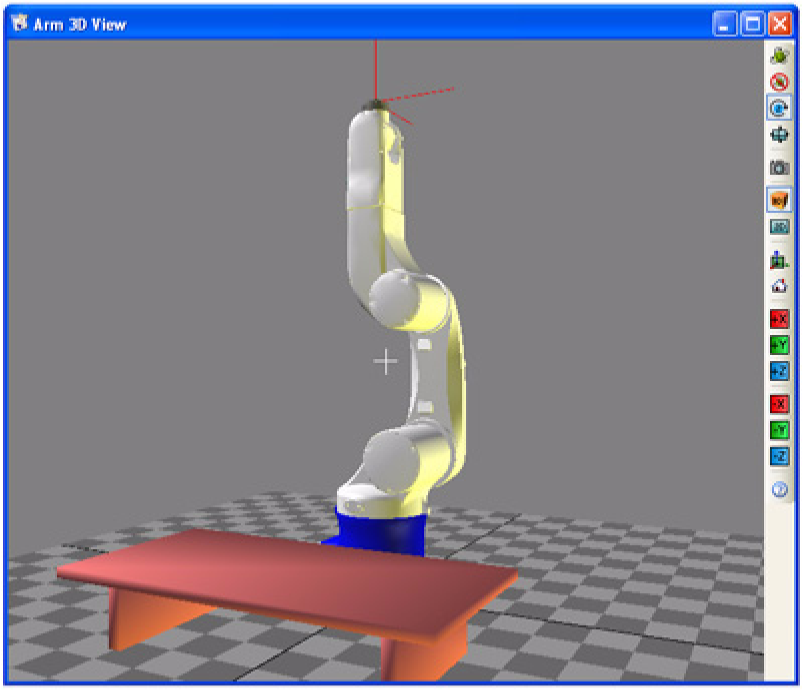
X 50 Y 50 Z 50



6. **Add two more boxes to complete the pallet bench.**

Note

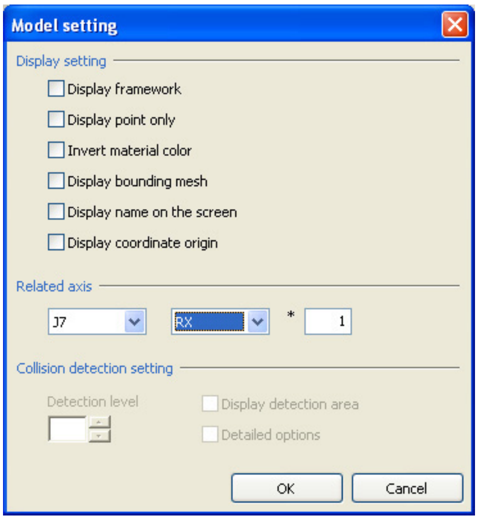
Here, it is faster to copy and paste the above box as the second leg and then again as the starting point for the top.



Note

The way the object is displayed can be altered with the Model tree Property button.

Pressing the Property button displays the dialog box below.



Model setting

Display setting

□ Display framework

□ Display point only

□ Invert material color

□ Display bounding mesh

□ Display name on the screen

□ Display coordinate origin

Related axis

J7 RX * 1

Collision detection setting

Detection level

□ Display detection area

□ Detailed options

Display setting

Sets object display properties.

Related axis

Settings for objects moving in relation to the added axes in the case of projects with added axes or SMT7 controller. Set the axis, movement and movement units.

Collision detection setting

Detection level: Specifies the sensitivity for detection of collisions.

Display detection area: Displays the range for detecting object collisions.

Detailed option: Further options for the range for detecting collisions with imported 3D data.

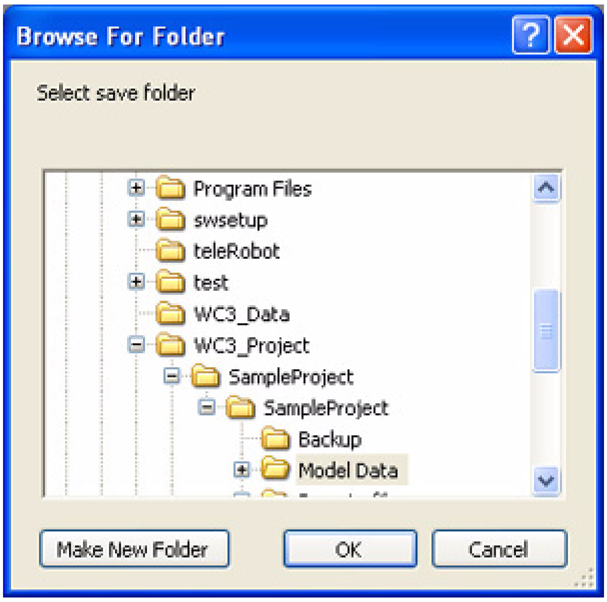
6.2.2 Saving objects

Saving objects as modeling data files allows immediate reuse in other projects.

Operating procedure

1. **Select the object or node to export.**

2. **Right-click and choose Export data from the context menu that appears to display the Browse folders dialog box.**



Browse For Folder

Select save folder

3. **Select the target folder and press the OK button.**

Note

All objects contained in the selected nodes / objects are also saved.

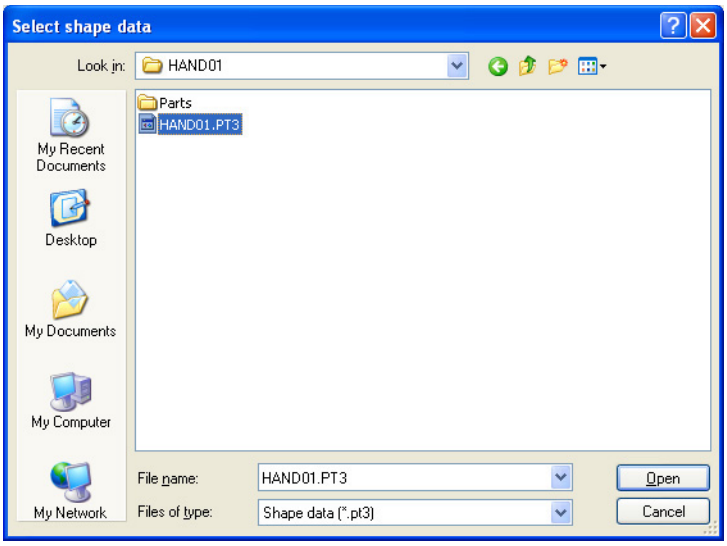
6.2.3 Importing objects

The following is the procedure for reading in modeling data exported from another project.

Operating procedure

1. **Select the parent node for the data.**

2. **Right-click on the object tree and choose Read shape data from the context menu that appears to display the dialog box for selecting a file to import.**



Select shape data

Look in: HAND01

Parts

HAND01.PT3

File name: HAND01.PT3

Files of type: Shape data (*.pt3)

3. **Select a file and press the OK button.**

Selection is limited to shape files (*.pt3).

6.3 Importing 3D Data

The following is the procedure for adding an object using 3D data from an external source.

The following formats are supported.

- Directx file (*.x)
- VRML 2.0 file (*.wrl)

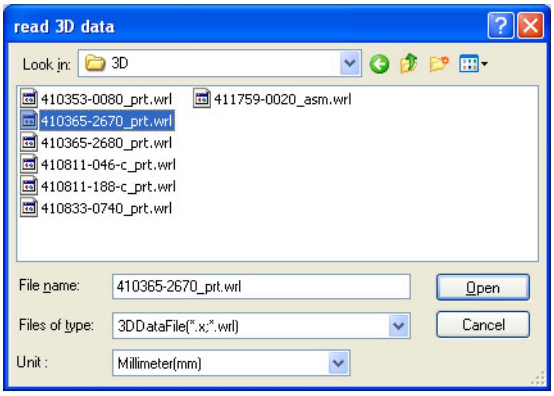
Note

WINCAPS III does not support the VRML 1.0 format.
Use VRML 2.0 (or VRML 97) format data.

Operating procedure

1. Select the parent node for adding the object.

2. Right-click and choose Import modeling data from the context menu that appears to display the dialog box for importing such data.



read 3D data

Look in: 3D

410353-0080_prt.wrl
410365-2670_prt.wrl
410365-2680_prt.wrl
410811-046-c_prt.wrl
410811-188-c_prt.wrl
410833-0740_prt.wrl
411759-0020_asm.wrl

File name: 410365-2670_prt.wrl

Files of type: 3DDataFile(*.x;*.wrl)

Unit : Millimeter(mm)

3. Select a file and press the OK button.

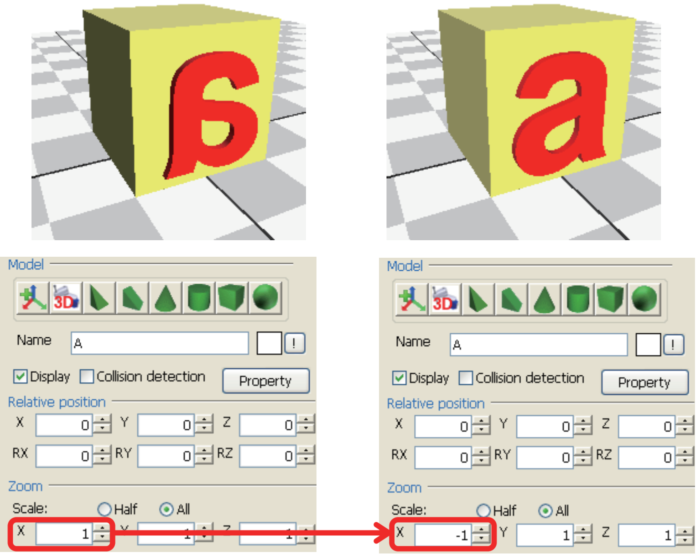
The default format is DirectX. For VRML data, switch the file type to VRML (*.wrl).

The corresponding object appears in the Arm 3D view.

Note

The units of the data scale may differ according to the software on which the 3D data was created. Select the appropriate unit and import.

Imported 3D data may display a mirror image. Enter a negative value in the Scale box to display a normal image.



Model

Name A

☑ Display ☐ Collision detection

Relative position

X 0 Y 0 Z 0

RX 0 RY 0 RZ 0

Zoom

Scale: ○ Half ● All

X 1 Y 1 Z 1

Model

Name A

☑ Display ☐ Collision detection

Relative position

X 0 Y 0 Z 0

RX 0 RY 0 RZ 0

Zoom

Scale: ○ Half ● All

X -1 Y 1 Z 1

Chapter 7 Online Functions

7.1 Overview

These functions are for monitoring robot controller variables, I/O, and other aspects of operation and for checking robot controller program operation under WINCAPS III control.

They cover all phases of robot application development.

Preliminary investigation with no actual equipment

- Equipment layout with 3D modeling
- Collision detection using this 3D model
- Dummy I/O input

Adjusting initial equipment setup

- Modifying variables and I/O
- Running programs

Troubleshooting equipment already in production use

- Monitoring variables and I/O
- Displaying error, operation, variable, I/O, and trace logs

7.1.1 Monitoring and debugging

The online functions serve two basic purposes.

Monitoring

This monitors the status of the robot controller.

Displays the robot's attitude in the Arm 3D view, and the variables, I/O, program executable lines. All types of variables can be edited.

This software can receive all log data and preserve them.

Debugging

In addition to monitor functions, programs in the robot controller can be executed on your PC for debugging.

⚠**Caution**

Debugging is not possible for robot controllers prior to Version 2.7.

The software also debugs programs, using the following functions.

- Adjust robot speeds
- Reset all programs
- Start/stop supervisory tasks
- Run programs
- Choice of Step-stop, Cycle-stop, Halt, and Program Reset
- Step in
- Toggle breakpoint
- Clear all breakpoints
- Breakpoint stop setting
- Dummy I/O for system inputs

7.2 Monitoring

For further details on connecting to a robot controller, refer to 1.5 "Connecting to Robot Controller" (P. 8) and 4.7 "Link with Robot Controller" (P. 59).

7.2.1 Initiating monitoring

Operating procedure

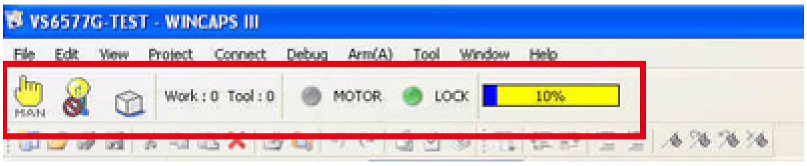
1. Choose Connect|Monitor Communication|Monitoring (online) to initiate monitoring.

Note

This menu command is only available when the robot controller is offline. It is not available during debugging (online).

2. Wait for monitoring to start.

A status bar appears to display the current monitoring status.


VS6577G-TEST - WINCAPS III
File Edit View Project Connect Debug Arm(A) Tool Window Help
MAN
Work : 0 Tool : 0
MOTOR
LOCK
10%

Note

When connection for online operation is complete, WINCAPS III windows automatically display robot controller internal data. Returning online brings you back to the project in the PC. (The received log data also remains in the PC project.)

7.2.2 Monitoring variables

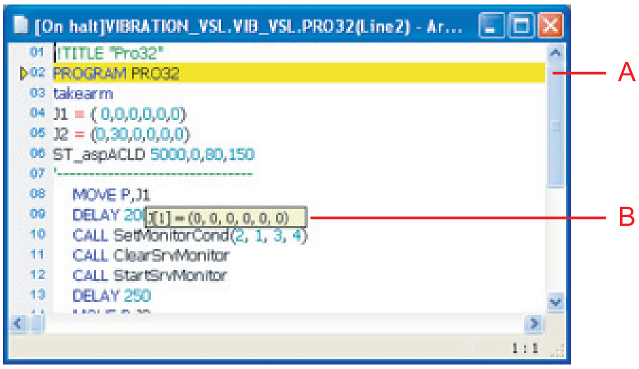
There are three window types for monitoring variables.

7.2.2.1 Adding variables to the watch list

There are two ways to monitor variable's contents: directly selecting it to temporarily display its value as pop-up tip text and adding it to the Watch list.

Operating procedure

1. **Double-click a program in the Project or Program list window to display that file in the Program view area.**



[On halt]VIBRATION_VSL.VIB_VSL.PRO32(Line2) - Ar...

```
!TITLE "Pro32"
PROGRAM PRO32
takearm
J1 = ( 0,0,0,0,0,0)
J2 = (0,30,0,0,0,0)
ST_aspACLD 5000,0,80,150
'--------------------------------
    MOVE P,J1
    DELAY 20 J[1] = (0, 0, 0, 0, 0, 0)
    CALL SetMonitorCond(2, 1, 3, 4)
    CALL ClearSrvMonitor
    CALL StartSrvMonitor
    DELAY 250
```

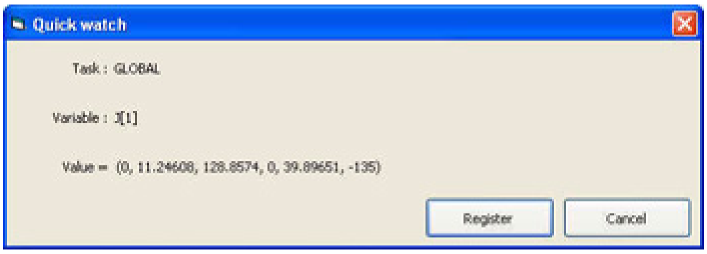
A: Current step (line)

Highlighting indicates the current program line.

B: Variable contents

The contents of the currently selected variable appear as pop-up tip text.

2. **Select a variable and choose Debug|Show Quick Watch to display this dialog box.**



Quick watch

Task : GLOBAL

Variable : J[1]

Value = (0, 11.24608, 128.8574, 0, 39.89651, -135)

3. **Press the Register button to add the selected variable to the Watch list.**

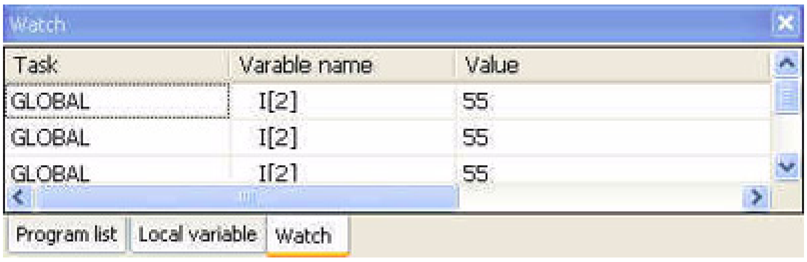
For further details on Watch window settings, refer to 7.2.2 "Monitoring variables" (P. 109).

7.2.2.2 Confirm the registered watch items.

This window displays variables from a user configurable list.

Operating procedure

1. **Choose View|Watch to display this window in the Docking view area.**



Task	Varable name	Value
GLOBAL	I[2]	55
GLOBAL	I[2]	55
GLOBAL	I[2]	55

Task

This displays the program name.

Variable name

This displays the registered variable names.

Value

This displays the variable values.

Type

This displays the variable types.

Log

Select Valid / invalid for the log.

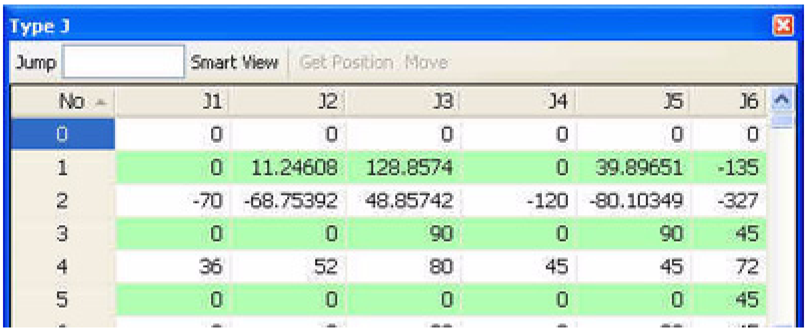
Select Valid if a log is to apply.

7.2.2.3 Checking global variables

This window type displays global variables of types I, F, D, V, P, J, T, and S.

Operating procedure

1. **Choose View|Variables and choose a type from the submenu to add the corresponding window in the Docking view area.**



No	J1	J2	J3	J4	J5	J6
0	0	0	0	0	0	0
1	0	11.24608	128.8574	0	39.89651	-135
2	-70	-68.75392	48.85742	-120	-80.10349	-327
3	0	0	90	0	90	45
4	36	52	80	45	45	72
5	0	0	0	0	0	45

Jump

Displays the specified number.

Smart View

Displays only variables with a check in the Smart column.

No.

Displays the variable numbers.

Value

Displays the value.

Application

The user can enter the application. When the Add comment function is in use, text input for the Application is added to the program as a comment.

Macro name

Enter the name of macros usable in the project.

Smart check box

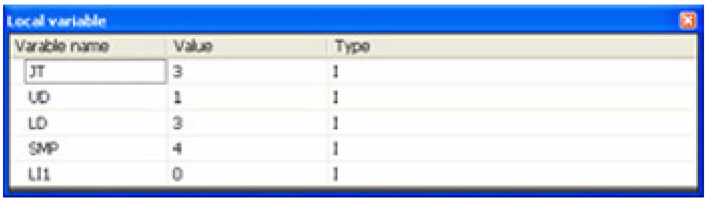
Only those variables checked will be displayed.

7.2.2.4 Checking local variables

This window type displays local variables for the currently selected program.

Operating procedure

1. Choose View|Local Variables to display this window in the Docking view area.



Variable name	Value	Type
JT	3	I
UD	1	I
LD	3	I
SMP	4	I
LI1	0	I

Variable name

Displays the variable names.

Value

Displays the value.

Type

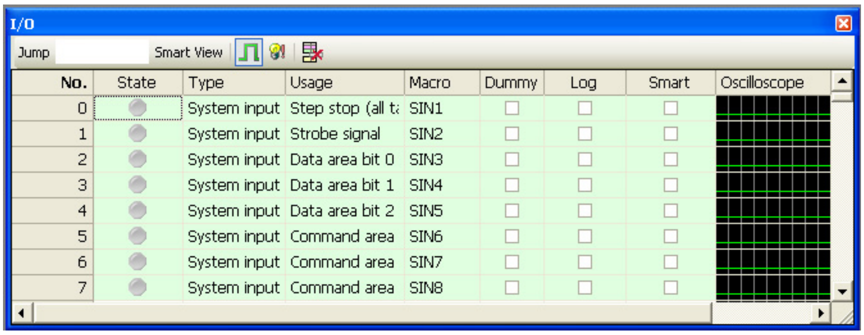
This displays the variable types.

7.2.3 Monitoring I/O

The I/O window shows the current I/O states.

Operating procedure

1. Choose View|I/O Window to display this window in the Docking view area.



No.	State	Type	Usage	Macro	Dummy	Log	Smart	Oscilloscope
0	●	System input	Step stop (all ta	SIN1	□	□	□	
1	●	System input	Strobe signal	SIN2	□	□	□	
2	●	System input	Data area bit 0	SIN3	□	□	□	
3	●	System input	Data area bit 1	SIN4	□	□	□	
4	●	System input	Data area bit 2	SIN5	□	□	□	
5	●	System input	Command area	SIN6	□	□	□	
6	●	System input	Command area	SIN7	□	□	□	
7	●	System input	Command area	SIN8	□	□	□	

Jump

Displays the I/O of the specified number.

Smart View

Displays only I/O with a check in the Smart column.

Oscilloscope display button

Turns on/off the Oscilloscope display.

Dummy input button

Dummy input is possible for I/O with a check in the Dummy column.

Hide unused field button

Pressing this button hides unused fields, fields to which no I/Os are assigned as shown with "--" in the Type column.

No.

I/O port number.

State

A green icon is displayed when on and gray when off. You can switch between on/off by clicking on the icon when in Dummy input mode.

Type

Displays the I/O type. Displays I/O port type: input/output, exclusive/universal, internal/hand I/O, etc.

Application

Users can add comments for each I/O port. Already input in exclusive signals, etc.

Macro name

Input the macro handling the I/O as the name inside the program. This is already input but can be freely changed.

Dummy

Dummy operations are possible for I/O with a check in this column.

Log

I/O with a check in this column will have a log record. The upper limit is 50 at a time.

Smart

Press the Smart view button to display only I/O with a check.

Oscilloscope

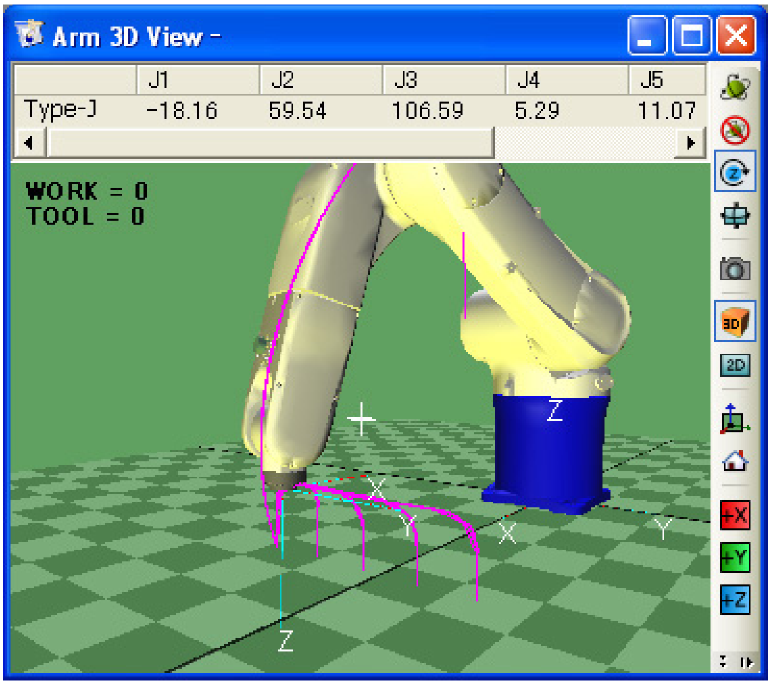
Displays whether the I/O is on/off in oscilloscope fashion. On/off changes can be checked with a time-line.

7.2.4 Monitoring robot

The Arm 3D View window shows the robot's current attitude.

The trajectory of the robot's hand movements can be displayed.

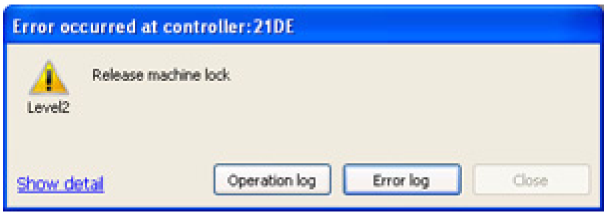
This trajectory display can be operated by choosing Arm|Movement history.



	J1	J2	J3	J4	J5
Type-J	-18.16	59.54	106.59	5.29	11.07

7.2.5 Errors during monitoring

A robot controller error displays a WINCAPS III error message.



Error occurred at controller:21DE

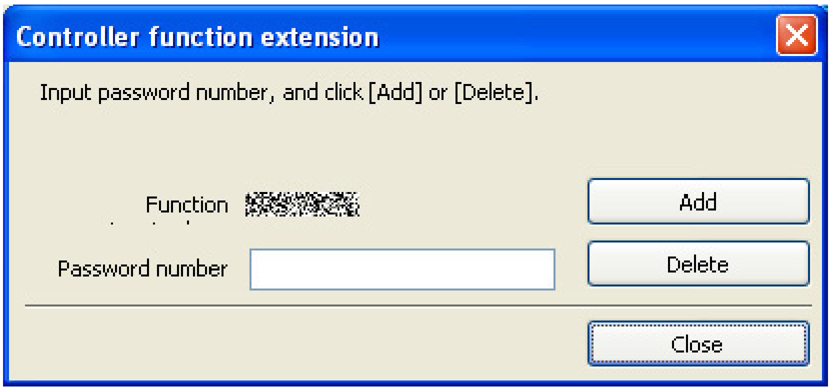
Release machine lock

Level2

7.2.6 Validate the controller function extension

This enables validation/invalidation of controller function extensions from WINCAPS III.

Select Tool|Controller function extension in online (monitor) mode to open the Controller function extension dialog box.



Controller function extension

Input password number, and click [Add] or [Delete].

Function

Password number

Enter the password number for the function to be extended and press on the Add button to validate it.

To invalidate them, enter the validation password number and press the Delete button.

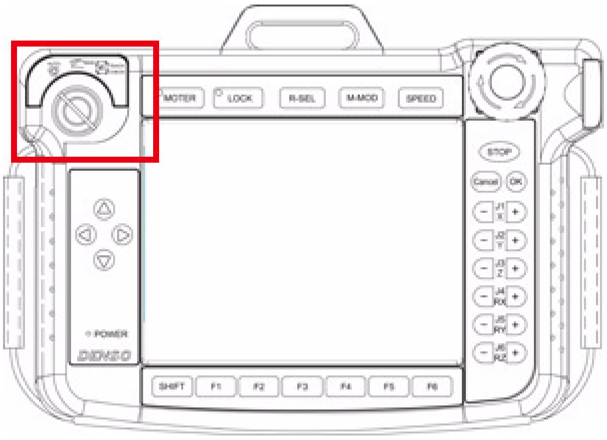
7.3 Using Debugging Robot controller version 2.7 or later

For further details on connecting to a robot controller, refer to 1.5 "Connecting to Robot Controller" (P. 8) and 4.7 "Link with Robot Controller" (P. 59).

7.3.1 Initiating debugging

First the robot controller must satisfy the following conditions.

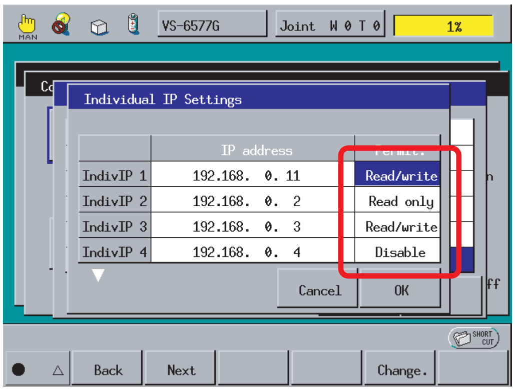
- The mode selector switch (physical switch) on the teach pendant or mini-pendant must be in its AUTO position.



- The communications link must be properly configured.
  Link type

  For Serial (RS-232C) (COM2) : This must allow read/write access.

  Ethernet : The individual address list must allow read/write access from the computer. Only computers with Read/write in the column circled in red can initiate debugging.



Individual IP Settings

	IP address	Permit.
IndivIP 1	192.168. 0. 11	Read/write
IndivIP 2	192.168. 0. 2	Read only
IndivIP 3	192.168. 0. 3	Read/write
IndivIP 4	192.168. 0. 4	Disable

For further details on configuring the robot controller, please refer to its Setting Guide.

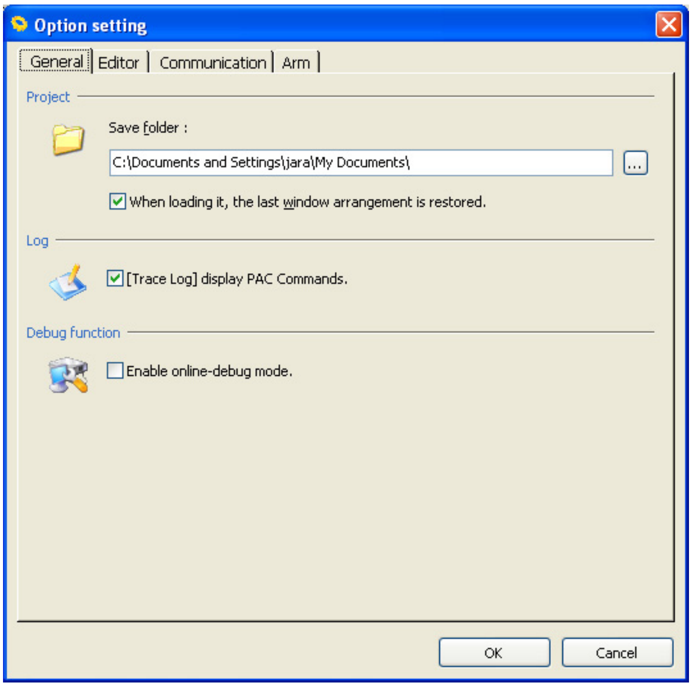
- No PAC programs are running.
- All motors are OFF.

⚠Caution

- The WINCAPS III debugging functions are for running robot programs and controlling operation from the computer.
  To ensure safety, always stay within reach of an Emergency stop button on the teach pendant, the mini-pendant, or the equipment.
- Never debug over a link that puts the equipment out of sight of the operator at the computer.

Operating procedure

1. **Choose Tool|Option and select the Enable online-debug mode check box on the General tab.**



Save folder :
C:\Documents and Settings\jara\My Documents\

☑ When loading it, the last window arrangement is restored.

☑ [Trace Log] display PAC Commands.

☐ Enable online-debug mode.

Note

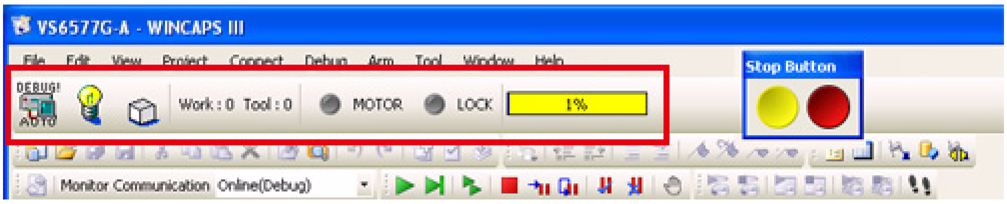
- Leaving Enable online-debug mode deselected disables all debugging functions, so selecting one during online operation triggers an error message.
- WINCAPS III always starts with debugging disabled.

2. **Choose Connect|Debugging (online) to initiate debugging.**

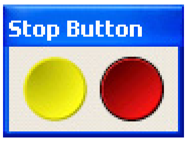
A status bar appears to display the current debugging status.

A Stop button also appears independent of WINCAPS III.

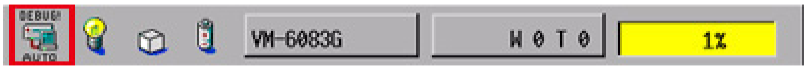
Status bar



Stop button



The teach pendant or mini-pendant also display a Debugging status screen.



Automatic aborting of debugging

WINCAPS III and the robot controller automatically switch to offline operation if any of the following situations arises.

- Someone switches the pendant's mode selector switch away from its AUTO position.
- They detect severance of the link between them.
- They detect severance of the robot controller's link with the teach pendant or mini-pendant.
- The robot controller loses power.
- A password-protected screen saver kicks in.

Side effects

Switching to offline operation triggers the following cleanup operations.

- Stopping PAC programs
- Turning off motors
- Stopping supervisory tasks
- Closing teach pendant (TP) panels
- Clearing all breakpoints
- Clearing all dummy I/O settings

Note

When connection for online operation is complete, WINCAPS III windows automatically display robot controller internal data.

⚠Caution

Debugging imposes the following restrictions.

- Only the computer doing the debugging can run PAC programs (or supervisory tasks) or turn on motors, not a teach pendant, a mini-pendant, I/O devices, or other computers running the ORiN SDK.
- The teach pendant cannot load programs.

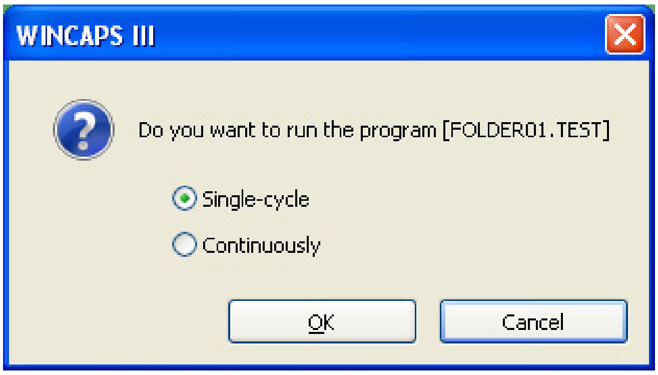
7.3.2 Launch the program from WINCAPS III.

In addition to monitoring, WINCAPS III runs and debugs programs stored inside the robot controller.

Operating procedure

1. **Double-click the program to execute in the Project or Program list window to display it in the Program view area.**

2. **Choose Debug|Start a Task to display a confirmation dialog box.**



WINCAPS III

Do you want to run the program [FOLDER01.TEST]

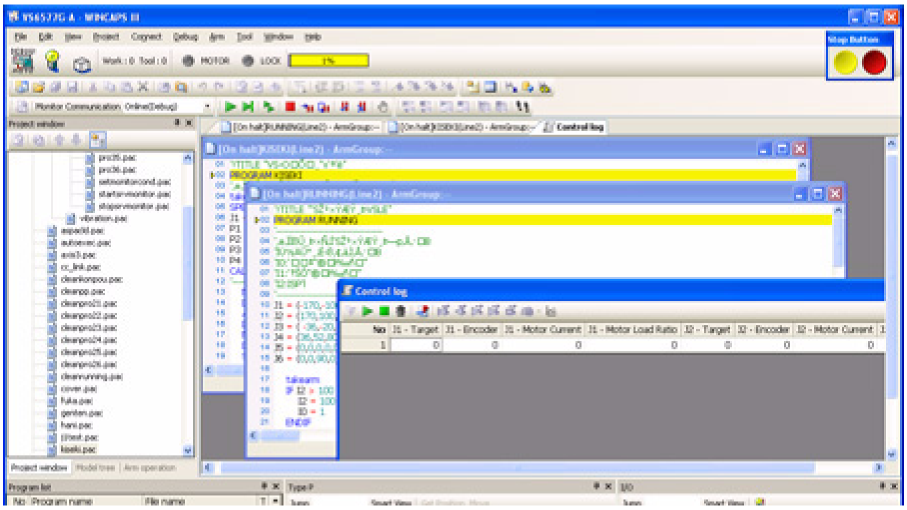
● Single-cycle

○ Continuously

3. **Select an option and press the OK button to run the robot program as specified.**

The robot will operate following the program's commands.

The Arm 3D view, if open, tracks actual robot operation.



Note

When debugging supervisory tasks from WINCAPS III, the following functions are used.

- Step in, Step-stop
- Halt
- Program reset
- Toggle breakpoint

Note that stop commands to all programs, such as Emergency stop and Reset all programs, cannot stop supervisory tasks.

⚠Caution

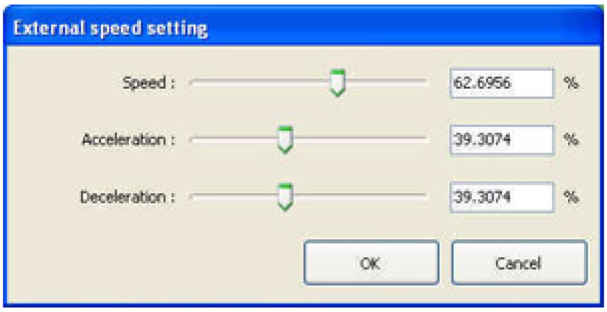
The WINCAPS III buttons are useless if the computer crashes or the communications link is lost. To ensure safety, always stay within reach of an Emergency stop button on the teach pendant, the mini-pendant, or the equipment.

7.3.3 Controller settings

Debugging allows WINCAPS III to modify the robot controller's operating settings.

The following settings are accessible.

- Motor
  These control power to the corresponding motor.
- Machine lock
  The ON setting locks the robot, limiting WINCAPS III control to the simulation.
- I/O lock settings
  These duplicate the teach pendant settings under F4 (I/O), F6 (auxiliary functions), and F7 (I/O Lock).
- External speed settings
  These modify the Speed, Acceleration, and Deceleration speed settings.



External speed setting

Speed : 62.6956 %

Acceleration : 39.3074 %

Deceleration : 39.3074 %

- Automatic mode settings (Standard robot controller specifications only)
  The choices are external and internal.

7.3.4 Input signal dummy operation

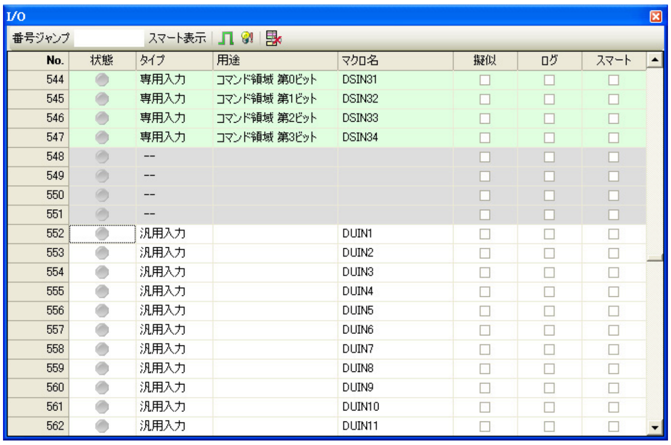
Operation of the program can be checked even without peripheral devices linked by dummy alteration of the I/O input signal.

7.3.4.1 Configuring dummy I/O

Dummy operation of the I/O requires selection of the input signal to be operated.

Operating procedure

1. Choose View|I/O Window to display this window in the Docking view area.

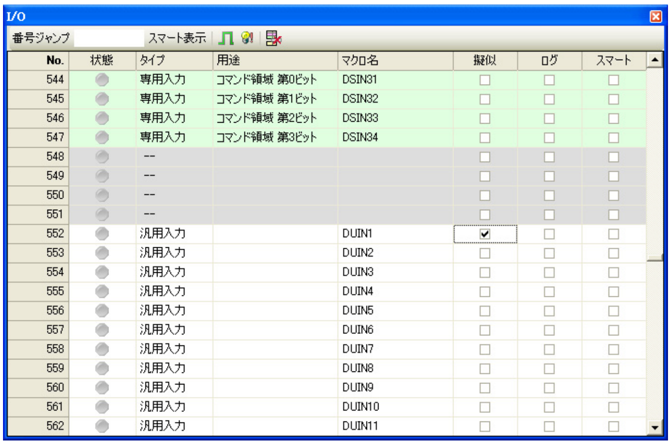


I/O

番号ジャンプ スマート表示

No.	状態	タイプ	用途	マクロ名	擬似	ログ	スマート
544	●	専用入力	コマンド領域 第0ビット	DSIN31	□	□	□
545	●	専用入力	コマンド領域 第1ビット	DSIN32	□	□	□
546	●	専用入力	コマンド領域 第2ビット	DSIN33	□	□	□
547	●	専用入力	コマンド領域 第3ビット	DSIN34	□	□	□
548	●	--			□	□	□
549	●	--			□	□	□
550	●	--			□	□	□
551	●	--			□	□	□
552	●	汎用入力		DUIN1	□	□	□
553	●	汎用入力		DUIN2	□	□	□
554	●	汎用入力		DUIN3	□	□	□
555	●	汎用入力		DUIN4	□	□	□
556	●	汎用入力		DUIN5	□	□	□
557	●	汎用入力		DUIN6	□	□	□
558	●	汎用入力		DUIN7	□	□	□
559	●	汎用入力		DUIN8	□	□	□
560	●	汎用入力		DUIN9	□	□	□
561	●	汎用入力		DUIN10	□	□	□
562	●	汎用入力		DUIN11	□	□	□

2. Switch on the Dummy check box for the dummy operation input signal.

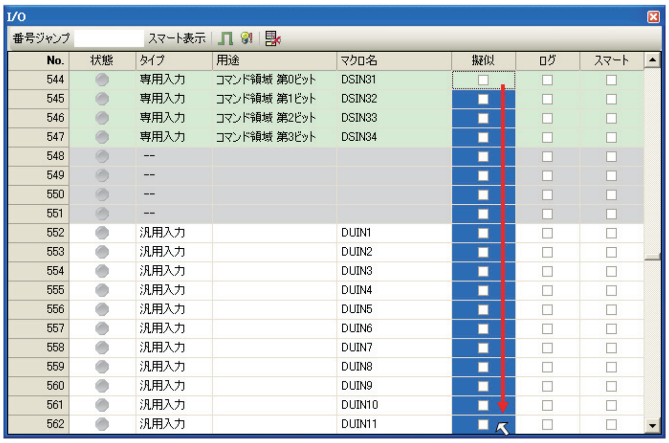


I/O

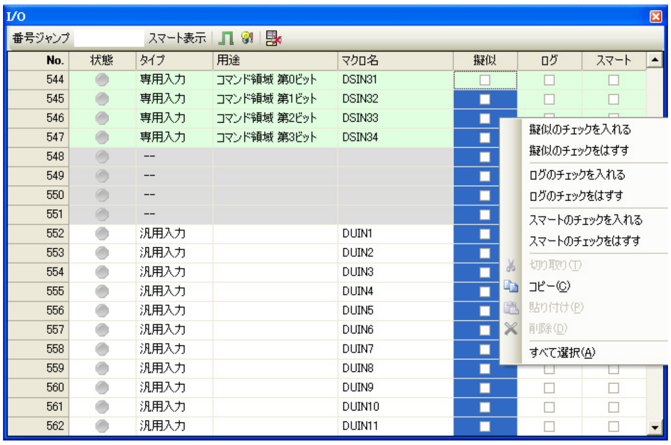
番号ジャンプ スマート表示

No.	状態	タイプ	用途	マクロ名	擬似	ログ	スマート
544	●	専用入力	コマンド領域 第0ビット	DSIN31	□	□	□
545	●	専用入力	コマンド領域 第1ビット	DSIN32	□	□	□
546	●	専用入力	コマンド領域 第2ビット	DSIN33	□	□	□
547	●	専用入力	コマンド領域 第3ビット	DSIN34	□	□	□
548	●	--			□	□	□
549	●	--			□	□	□
550	●	--			□	□	□
551	●	--			□	□	□
552	●	汎用入力		DUIN1	☑	□	□
553	●	汎用入力		DUIN2	□	□	□
554	●	汎用入力		DUIN3	□	□	□
555	●	汎用入力		DUIN4	□	□	□
556	●	汎用入力		DUIN5	□	□	□
557	●	汎用入力		DUIN6	□	□	□
558	●	汎用入力		DUIN7	□	□	□
559	●	汎用入力		DUIN8	□	□	□
560	●	汎用入力		DUIN9	□	□	□
561	●	汎用入力		DUIN10	□	□	□
562	●	汎用入力		DUIN11	□	□	□

If several input signals are set, specify the range by dragging and combine them by selecting Enter dummy check or Remove Dummy check using the mouse right-button menu.



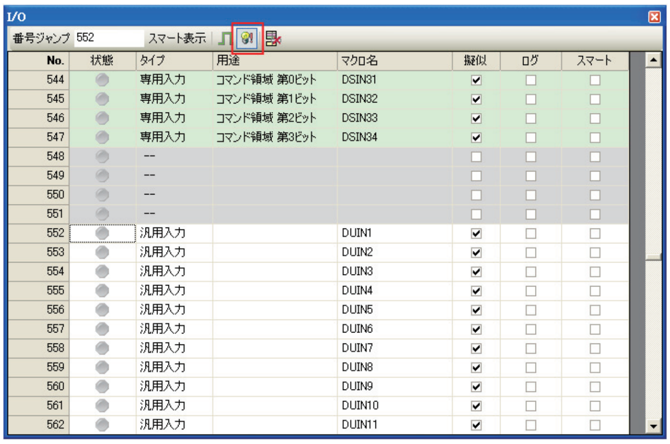
No.	状態	タイプ	用途	マクロ名	擬似	ログ	スマート
544	●	専用入力	コマンド領域 第0ビット	DSIN31	☐	☐	☐
545	●	専用入力	コマンド領域 第1ビット	DSIN32	☐	☐	☐
546	●	専用入力	コマンド領域 第2ビット	DSIN33	☐	☐	☐
547	●	専用入力	コマンド領域 第3ビット	DSIN34	☐	☐	☐
548	●	--			☐	☐	☐
549	●	--			☐	☐	☐
550	●	--			☐	☐	☐
551	●	--			☐	☐	☐
552	●	汎用入力		DUIN1	☐	☐	☐
553	●	汎用入力		DUIN2	☐	☐	☐
554	●	汎用入力		DUIN3	☐	☐	☐
555	●	汎用入力		DUIN4	☐	☐	☐
556	●	汎用入力		DUIN5	☐	☐	☐
557	●	汎用入力		DUIN6	☐	☐	☐
558	●	汎用入力		DUIN7	☐	☐	☐
559	●	汎用入力		DUIN8	☐	☐	☐
560	●	汎用入力		DUIN9	☐	☐	☐
561	●	汎用入力		DUIN10	☐	☐	☐
562	●	汎用入力		DUIN11	☐	☐	☐



No.	状態	タイプ	用途	マクロ名	擬似	ログ	スマート
544	●	専用入力	コマンド領域 第0ビット	DSIN31	☐	☐	☐
545	●	専用入力	コマンド領域 第1ビット	DSIN32	☐	☐	☐
546	●	専用入力	コマンド領域 第2ビット	DSIN33	☐		
547	●	専用入力	コマンド領域 第3ビット	DSIN34	☐		
548	●	--			☐		
549	●	--			☐		
550	●	--			☐		
551	●	--			☐		
552	●	汎用入力		DUIN1	☐		
553	●	汎用入力		DUIN2	☐		
554	●	汎用入力		DUIN3	☐		
555	●	汎用入力		DUIN4	☐		
556	●	汎用入力		DUIN5	☐		
557	●	汎用入力		DUIN6	☐		
558	●	汎用入力		DUIN7	☐		
559	●	汎用入力		DUIN8	☐	☐	☐
560	●	汎用入力		DUIN9	☐	☐	☐
561	●	汎用入力		DUIN10	☐	☐	☐
562	●	汎用入力		DUIN11	☐	☐	☐

3. Press the Dummy input button to reflect the dummy I/O settings in the robot controller.

Press the Dummy input button again to remove the robot controller dummy I/O settings.



番号ジャンプ 552

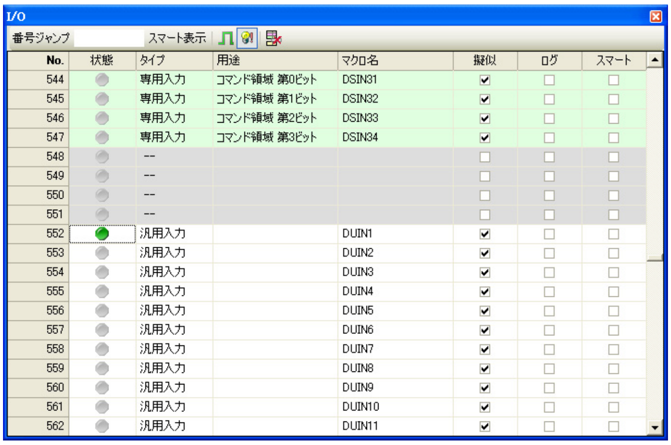
No.	状態	タイプ	用途	マクロ名	擬似	ログ	スマート
544	●	専用入力	コマンド領域 第0ビット	DSIN31	☑	☐	☐
545	●	専用入力	コマンド領域 第1ビット	DSIN32	☑	☐	☐
546	●	専用入力	コマンド領域 第2ビット	DSIN33	☑	☐	☐
547	●	専用入力	コマンド領域 第3ビット	DSIN34	☑	☐	☐
548	●	--			☐	☐	☐
549	●	--			☐	☐	☐
550	●	--			☐	☐	☐
551	●	--			☐	☐	☐
552	●	汎用入力		DUIN1	☑	☐	☐
553	●	汎用入力		DUIN2	☑	☐	☐
554	●	汎用入力		DUIN3	☑	☐	☐
555	●	汎用入力		DUIN4	☑	☐	☐
556	●	汎用入力		DUIN5	☑	☐	☐
557	●	汎用入力		DUIN6	☑	☐	☐
558	●	汎用入力		DUIN7	☑	☐	☐
559	●	汎用入力		DUIN8	☑	☐	☐
560	●	汎用入力		DUIN9	☑	☐	☐
561	●	汎用入力		DUIN10	☑	☐	☐
562	●	汎用入力		DUIN11	☑	☐	☐

Note

- If communications errors occur using DeviceNet or other field networks, dummy input settings cannot be made unless field network display error settings are 1:Default. Refer to Field Network Display Error Parameters in the RC7M Controller Manual Option Equipment Manual regarding such display errors.
- Dummy I/O settings are not possible for applications listed as Reserved for exclusive input. Switch the Dummy check boxes off before using.

7.3.4.2 Input signal on/off operation

Press the Status lamp of the input signal to be turned on/off. When lit green it is on, when gray it is off.



No.	状態	タイプ	用途	マクロ名	擬似	ログ	スマート
544	●	専用入力	コマンド領域 第0ビット	DSIN31	☑	□	□
545	●	専用入力	コマンド領域 第1ビット	DSIN32	☑	□	□
546	●	専用入力	コマンド領域 第2ビット	DSIN33	☑	□	□
547	●	専用入力	コマンド領域 第3ビット	DSIN34	☑	□	□
548	●	--			□	□	□
549	●	--			□	□	□
550	●	--			□	□	□
551	●	--			□	□	□
552	🟢	汎用入力		DUIN1	☑	□	□
553	●	汎用入力		DUIN2	☑	□	□
554	●	汎用入力		DUIN3	☑	□	□
555	●	汎用入力		DUIN4	☑	□	□
556	●	汎用入力		DUIN5	☑	□	□
557	●	汎用入力		DUIN6	☑	□	□
558	●	汎用入力		DUIN7	☑	□	□
559	●	汎用入力		DUIN8	☑	□	□
560	●	汎用入力		DUIN9	☑	□	□
561	●	汎用入力		DUIN10	☑	□	□
562	●	汎用入力		DUIN11	☑	□	□

7.3.4.3 Exclusive input signal on/off operation (DIO command viewer)

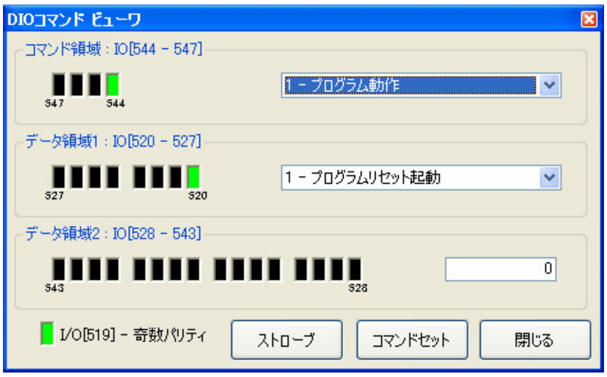
In debugging exclusive input signals can also be dummy operated. (With monitoring non-exclusive input signals can be dummy operated.)

Dummy I/O configuration is the same as for other input signals, but on/off can be operated through the DIO command viewer as well as the standard method.

The DIO command viewer can be used when the I/O assignment mode is Mini I/O exclusive or Standard. Command and data fields are automatically turned on/off in response to the I/O command functions. For I/O commands, refer to the Command Execution Input/Output Signals of the RC7M Controller Manual or the Command Execution Input/Output Signals (standard mode exclusive) of the RC7M Controller Option Equipment Manual.

Operating procedure

1. Choose Tool|DIO command viewer.



DIOコマンド ビューワ

コマンド領域 : IO[544 - 547]　1 - プログラム動作

データ領域1 : IO[520 - 527]　1 - プログラムリセット起動

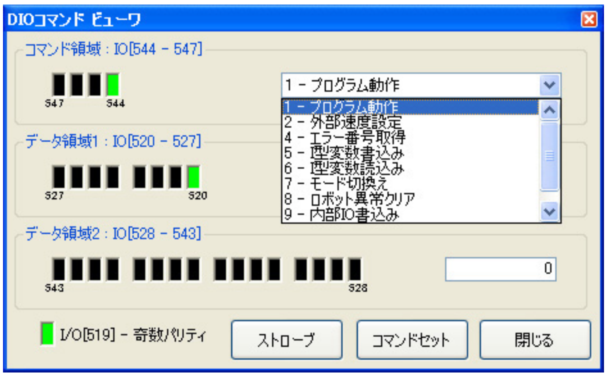
データ領域2 : IO[528 - 543]　0

I/O[519] - 奇数パリティ

(This screen shows standard I/O assignment mode.)

2. **Select desired items from the pull down lists for Command field and Data field 1, and input appropriate values in Data field 2.**

Odd parity is automatically set.



3. **Press the Command set button**

The on/off status of the Command field, Data field 1, Data field 2 and Odd parity are reflected in the robot controller.

4. **Press the Strobe button.**

The robot controller strobe signal will turn off then on again, and the command will be executed.

Chapter 8 Logging

Various types of logs can be recorded for robot operations and viewed or saved.

This data can be put to use to search out the causes of errors and remedy them to shorten cycle time.

Recording times, saving fields and acquisition methods differ according to the type of log.

The number of logs recordable is decided by log types. The number and intervals (fineness) of control logs and servo data logs can be set.

The three types of memory fields for recording log data are as follows.

- DRAM
  Data will be lost in this field when the controller's power is switched off.
- SRAM
  Data is retained even when the power of the controller is switched off (though it will be lost if the memory backup battery fades)
- Flash memory
  Data is retained even when the power of the controller is switched off (even if the memory backup battery fades)

The types of logs usable in WINCAPS III are as follows.

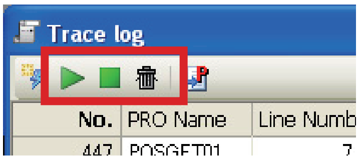
Log name	Acquisition timing	Acquisition interval	No. saved	Data record memory	Error trigger log
Error log	Regularly saved	When errors occur	1,000	SRAM	○
Operation log	Regularly saved	When operational event occurs	1,000	SRAM	○
Control log	Manual / program	Select from 8/16/24/32 ms	1,250 to 30,000	DRAM*	○
Trace logging (multi)	Manual / program	Command execution	10,000	DRAM	○
Single-trace Log	Manual / program	Command execution	10,000	DRAM	×
Variable log	Manual / program	Log opening / update of values	1,000	DRAM	×
I/O log	Manual	Log opening / update of values	1,000	DRAM	×
Joint servo log for particular joint	Program	Select from 1-8 ms	1,250	DRAM	×

* Control log data can be manually copied to flash memory.

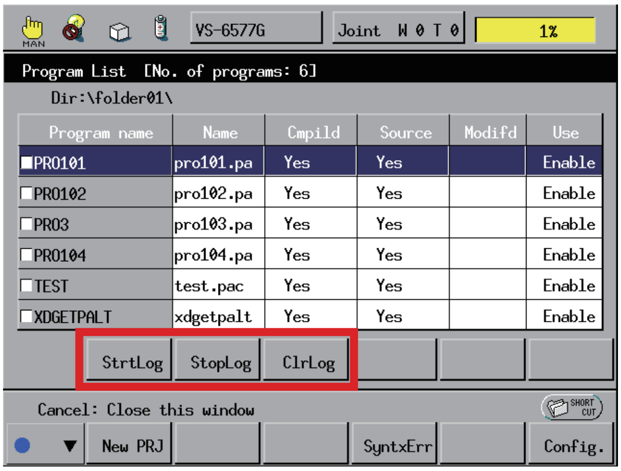
8.1 Log record timing

Logs are recorded at four different times as follows.

- Regular recording
  Error logs and operational logs are regularly recorded. 1,000 logs can be recorded for each, with the latest 1,000 being retained.
- Manual recording by WINCAPS III or the teach pendant.
  Recording can be started and stopped manually using WINCAPS III or the teach pendant.



No.	PRO Name	Line Numb
447	POSGET01	7



Program List [No. of programs: 6]

Dir:\folder01\

Program name	Name	Cmpild	Source	Modifd	Use
■PRO101	pro101.pa	Yes	Yes		Enable
□PRO102	pro102.pa	Yes	Yes		Enable
□PRO3	pro103.pa	Yes	Yes		Enable
□PRO104	pro104.pa	Yes	Yes		Enable
□TEST	test.pac	Yes	Yes		Enable
□XDGETPALT	xdgetpalt	Yes	Yes		Enable

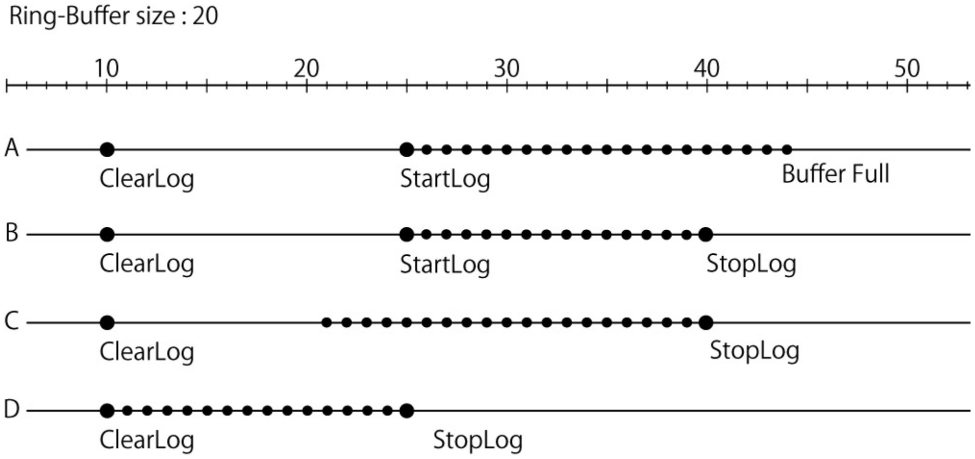
- Recording by program commands
  Settings are available to start / stop log records or clear them in programs. This is used when you wish to record a particular operation in a program. The three commands used are STARTLOG, STOPLOG and CLEARLOG.
  It is also possible to determine the range of logging by specifying program lines in WINCAPS III.
- Error trigger log
  A record log is saved in flash memory when a specified error occurs. Error logs, operational logs, control logs and trace logs (multi) are available. This is used when searching for the causes of errors.
  Errors specifiable by the error trigger are of two types: those specified by error level and those of a particular error code.

8.1.1 Recording by program commands

The timing when logs are recorded can be controlled by program commands, the teach pendant, and WINCAPS III for control / trace / single trace / variable / servo single axis data logs. These logs use a memory field called a ring buffer. The ring buffer has a set capacity and overwrites its oldest data with the latest. By using the three following commands logs can be retained for program-specified areas. Control log commands will be used as examples to explain recording to the ring buffer.

- STARTLOG
  Begins writing of data not to be updated to the ring buffer. When the ring buffer is full of non-updatable data no new logs can be written to it.
- STOPLOG
  Changes log data recorded in the ring buffer at that point into non-updatable data and retains it. If STARTLOG is being executed log data between STARTLOG and STOPLOG will be retained.
- CLEARLOG
  Deletes data retained in the ring buffer, and begins recording of updatable data in new logs.

The relationship between the above three commands and the retained log data is shown here. In this example the ring buffer size is set at 20.



Case A

Recorded control logs from 25-44.

20 control logs are recorded after StartLog, taking up all space in the ring buffer with 20 sets of log data retained.

Case B

Recorded control logs from 25-40.

Only 16 control logs are retained from after StartLog to StopLog.

Case C

Recorded control logs from 21-40.

The 20 control logs recorded up until StopLog are retained.

Case D

Recorded control logs from 10-25.

The 16 control logs recorded from ClearLog to StopLog are retained.

8.1.2 Error trigger log

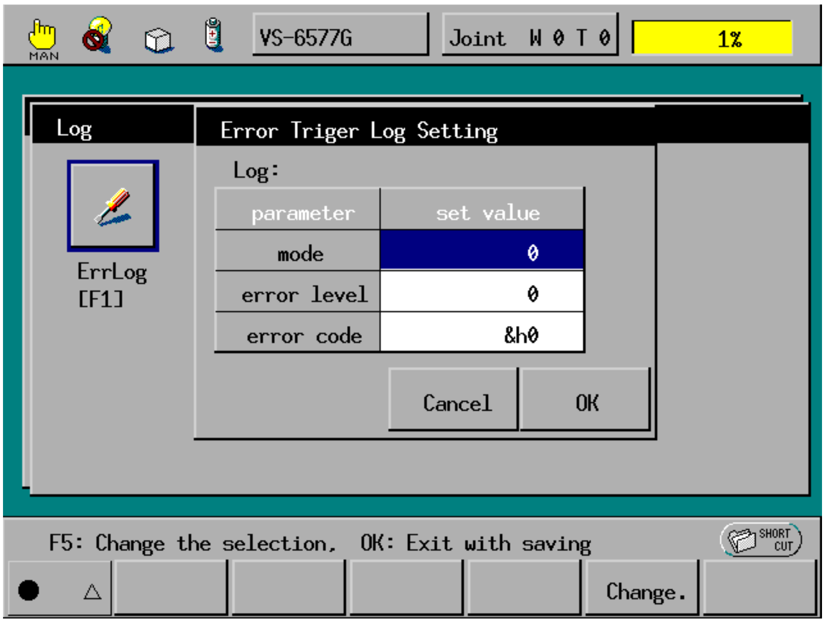
A record log is saved in flash memory when a specified error occurs. Error logs, operational logs, control logs and trace logs (multi) are available. This is used when searching for the causes of errors.

Errors specifiable by the error trigger are of two types: those specified by error level and those of a particular error code.

Configuring with teach pendant

Error trigger logging records a log when the specified error occurs for the first time from the configuration of the error. It does not update the log data until the error is configured again.

Press F6 (Setting)|F2 (Log)|F5 (Error trigger) and specify the error logging mode (1 or 2).



Error Triger Log Setting

Log:

parameter	set value
mode	0
error level	0
error code	&h0

F5: Change the selection, OK: Exit with saving

Mode = 0 : This setting disables all error triggers.

Mode = 1 : An occurrence of an error of the specified error level or higher triggers logging.

Mode = 2 : An occurrence of an error of the specified error code triggers logging.

Configuring with mini-pendant

Press Log|ErrTrig, then specify the error logging mode.

Note

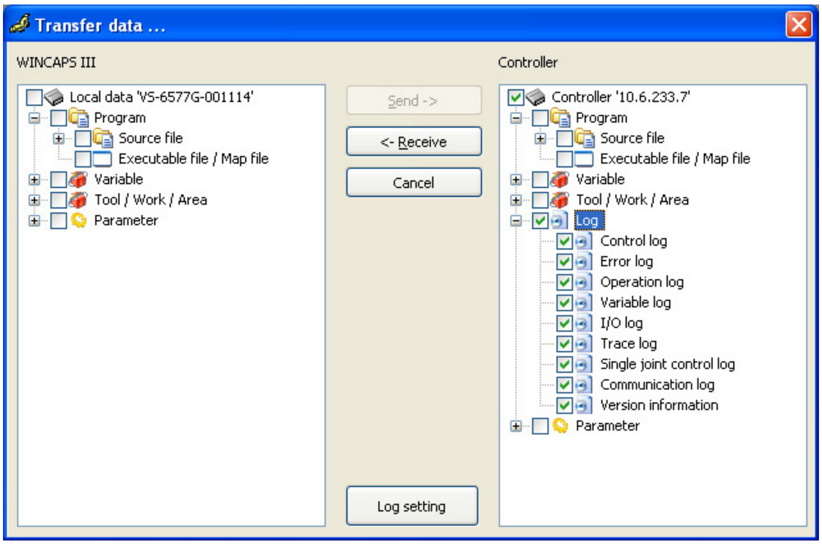
Error trigger logs retain the various recorded logs when a specified error occurs. Log data retained (not updated) through STOPLOG or another command in log operation is saved in flash memory.

If the log is non-empty, a special symbol (○) appears on the first line of this dialog box.

8.2 Acquisition of log data

Log data retained in the controller can be retrieved by the following methods.

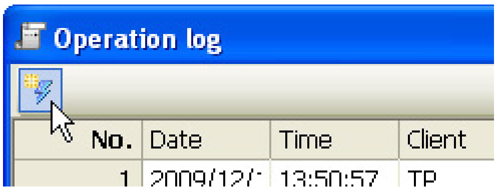
- Data transfer in WINCAPS III
  Log data checked in the robot controller is retrieved into WINCAPS III in the data transfer screen.



- □ Local data 'VS-6577G-001114'
  - □ Program
    - □ Source file
    - □ Executable file / Map file
  - □ Variable
  - □ Tool / Work / Area
  - □ Parameter

- ☑ Controller '10.6.233.7'
  - □ Program
    - □ Source file
    - □ Executable file / Map file
  - □ Variable
  - □ Tool / Work / Area
  - ☑ Log
    - ☑ Control log
    - ☑ Error log
    - ☑ Operation log
    - ☑ Variable log
    - ☑ I/O log
    - ☑ Trace log
    - ☑ Single joint control log
    - ☑ Communication log
    - ☑ Version information
  - □ Parameter

- Transfer using the WINCAPS III log screen
  Log data is received and displayed by pressing the Receive button in the log screens displayed by WINCAPS III. (Not for single servo data logs)



No.	Date	Time	Client
1	2009/12/	13:50:57	TP

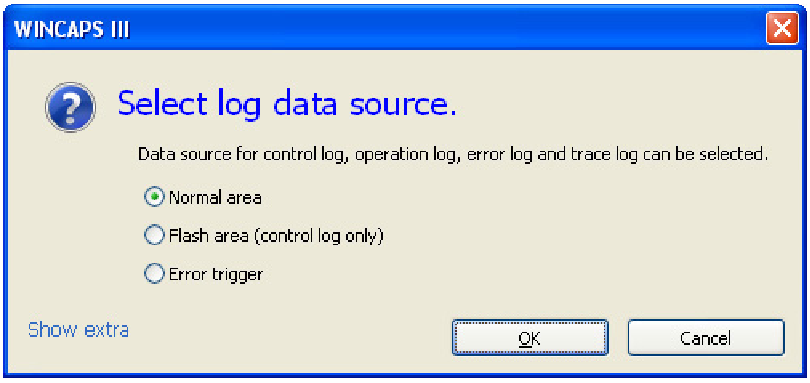
- Retrieval of log data using USB memory
  Log data can be retrieved from the controller to USB memory. DRAM or flash memory can be selected as the retrieval source for control logs. For further details, refer to the Operating Guide.

8.2.1 Log acquisition settings

Some logs contain multiple fields for saving log data. You can specify from which field you will acquire log data with WINCAPS III.

Under default (standard) settings the error and operation logs are acquired from SRAM, and other logs from DRAM.

Selecting the log data on the data transfer screen makes the Select log data source button active.



WINCAPS III

Select log data source.

Data source for control log, operation log, error log and trace log can be selected.

● Normal area

○ Flash area (control log only)

○ Error trigger

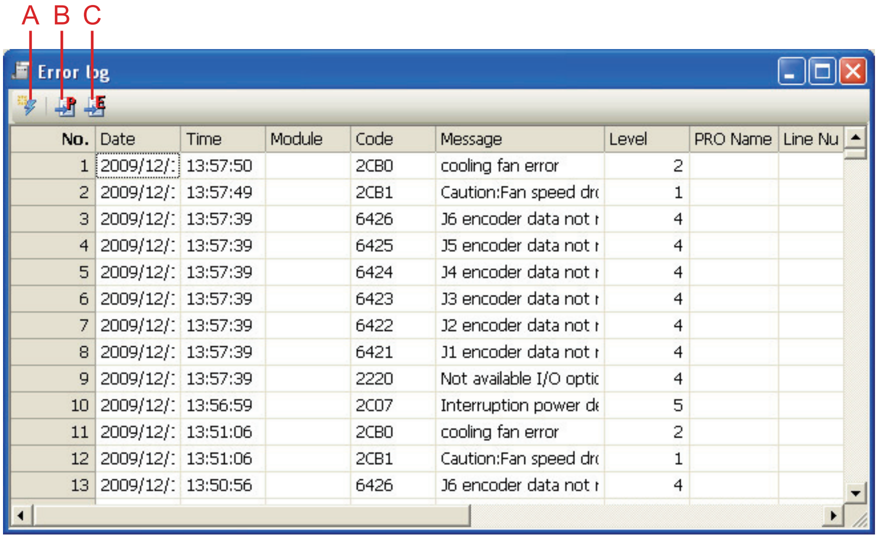
8.3 Detailed description of log types

8.3.1 Error log

Records errors occurring in the controller. The most recent 1,000 errors are recorded. The data is saved in SRAM.

The error log is regularly updated. If you wish to secure particular log data, use error trigger logs or suchlike.

Two or more types of errors may occur simultaneously, but what appears as an error message is only one of those errors. Checking the error log to see other errors that occurred simultaneously or checking the error log in conjunction with the operation log helps in pursuing the cause of errors.



No.	Date	Time	Module	Code	Message	Level	PRO Name	Line Nu
1	2009/12/:	13:57:50		2CB0	cooling fan error	2		
2	2009/12/:	13:57:49		2CB1	Caution:Fan speed drı	1		
3	2009/12/:	13:57:39		6426	J6 encoder data not ı	4		
4	2009/12/:	13:57:39		6425	J5 encoder data not ı	4		
5	2009/12/:	13:57:39		6424	J4 encoder data not ı	4		
6	2009/12/:	13:57:39		6423	J3 encoder data not ı	4		
7	2009/12/:	13:57:39		6422	J2 encoder data not ı	4		
8	2009/12/:	13:57:39		6421	J1 encoder data not ı	4		
9	2009/12/:	13:57:39		2220	Not available I/O optic	4		
10	2009/12/:	13:56:59		2C07	Interruption power dı	5		
11	2009/12/:	13:51:06		2CB0	cooling fan error	2		
12	2009/12/:	13:51:06		2CB1	Caution:Fan speed drı	1		
13	2009/12/:	13:50:56		6426	J6 encoder data not ı	4		

A: Receive button

This receives error log data from the controller and displays it.

B: Jump to source code button

This displays the source code for the error.

C: Error information button

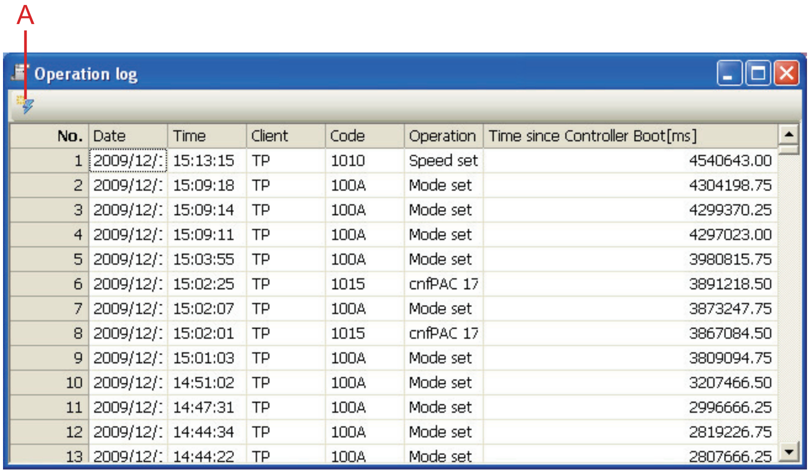
This displays explanations and recovery methods for the errors.

The following items are recorded for the data.

- Date / time
- Code
  Error code
- Level
  Error level
- PRO name, line number
  Name of the program and the line number in which error occurred.
- Time since controller boot

8.3.2 Operation log

This is a record of controller operations. The most recent 1,000 items are recorded. The data is saved in SRAM. The operation log is regularly updated. If you wish to secure particular log data, use error trigger logs or suchlike.



No.	Date	Time	Client	Code	Operation	Time since Controller Boot[ms]
1	2009/12/:	15:13:15	TP	1010	Speed set	4540643.00
2	2009/12/:	15:09:18	TP	100A	Mode set	4304198.75
3	2009/12/:	15:09:14	TP	100A	Mode set	4299370.25
4	2009/12/:	15:09:11	TP	100A	Mode set	4297023.00
5	2009/12/:	15:03:55	TP	100A	Mode set	3980815.75
6	2009/12/:	15:02:25	TP	1015	cnfPAC 17	3891218.50
7	2009/12/:	15:02:07	TP	100A	Mode set	3873247.75
8	2009/12/:	15:02:01	TP	1015	cnfPAC 17	3867084.50
9	2009/12/:	15:01:03	TP	100A	Mode set	3809094.75
10	2009/12/:	14:51:02	TP	100A	Mode set	3207466.50
11	2009/12/:	14:47:31	TP	100A	Mode set	2996666.25
12	2009/12/:	14:44:34	TP	100A	Mode set	2819226.75
13	2009/12/:	14:44:22	TP	100A	Mode set	2807666.25

A: Receive button

This receives operation log data from the controller and displays it.

The following items are recorded for the data.

- Date / time
- Client
  The device that was operated is recorded. (TP: Teach pendant. PC: WINCAPS III, etc. PC. I/O: I/O. SYS:System)
- Operation
- Time since controller boot

8.3.3 Control log

A record of the robot's control, including movement of axes, current values, load ratios, etc.

This is useful in the following cases.

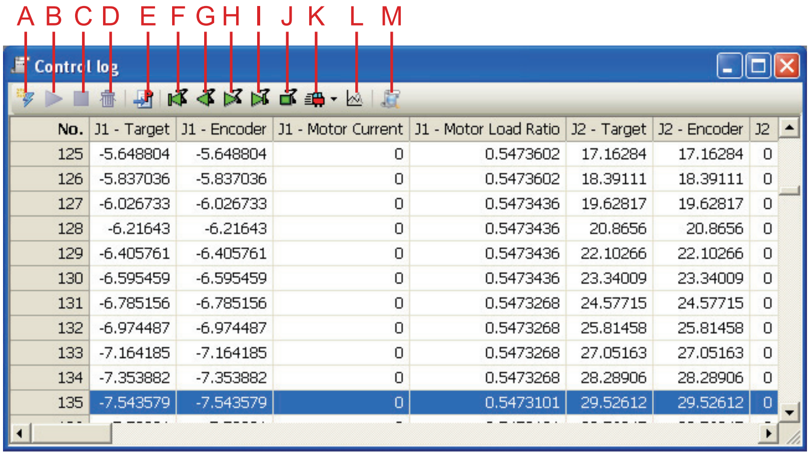
- Checking robot behavior within a specified range.
- Checking the age deterioration of the robot.
- Approximating the minimal load on the motor by predicting load ratios.

The control log recording time can be set by specifying the recording interval and number of records.

Recording can be made manually from the teach pendant or WINCAPS III or through program operations and error triggers.

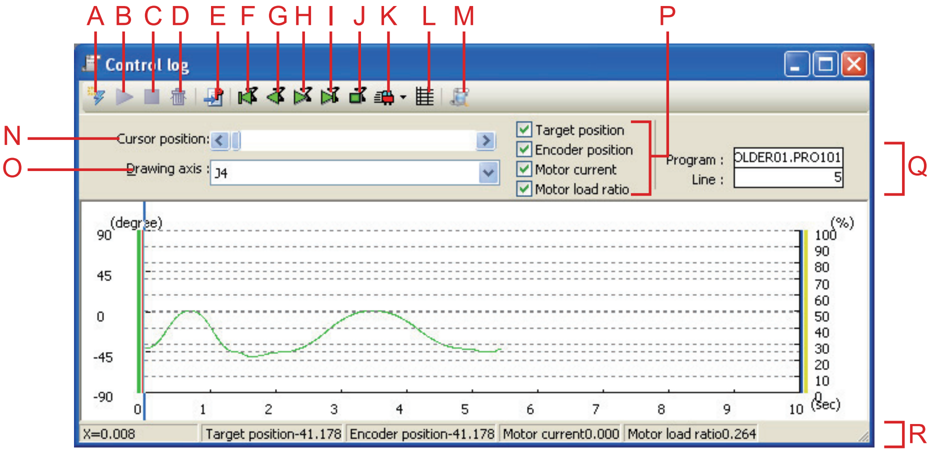
The recording timing of the program is controlled using the STARTLOG, STOPLOG and CLEARLOG commands. For further details, refer to Programming Manual 1.

Grid display



No.	J1 - Target	J1 - Encoder	J1 - Motor Current	J1 - Motor Load Ratio	J2 - Target	J2 - Encoder	J2
125	-5.648804	-5.648804	0	0.5473602	17.16284	17.16284	0
126	-5.837036	-5.837036	0	0.5473602	18.39111	18.39111	0
127	-6.026733	-6.026733	0	0.5473436	19.62817	19.62817	0
128	-6.21643	-6.21643	0	0.5473436	20.8656	20.8656	0
129	-6.405761	-6.405761	0	0.5473436	22.10266	22.10266	0
130	-6.595459	-6.595459	0	0.5473436	23.34009	23.34009	0
131	-6.785156	-6.785156	0	0.5473268	24.57715	24.57715	0
132	-6.974487	-6.974487	0	0.5473268	25.81458	25.81458	0
133	-7.164185	-7.164185	0	0.5473268	27.05163	27.05163	0
134	-7.353882	-7.353882	0	0.5473268	28.28906	28.28906	0
135	-7.543579	-7.543579	0	0.5473101	29.52612	29.52612	0

Graph display



Cursor position:

Drawing axis : J4

☑ Target position

☑ Encoder position

☑ Motor current

☑ Motor load ratio

Program : OLDER01.PRO101

Line : 5

X=0.008 | Target position-41.178 | Encoder position-41.178 | Motor current0.000 | Motor load ratio0.264

A: Receive button

This receives control log data from the robot controller and displays it.

B: Start control log button

This starts or resumes the control log. STARTLOG is executed.

C: Stop control log button

This stops the control log. STOPLOG is executed.

D: Clear control log button

This button clears the currently retained control log. CLEARLOG is executed.

E: Jump to source code button

This displays the source code for the selected log program.

F: Reverse step in button

This reproduction button plays back the control log, producing step-by-step robot motion in the reverse direction in the Arm 3D view.

G: Reverse playback button

This reproduction button plays back the control log, producing robot motion in the reverse direction in the Arm 3D view.

H: Playback motion button

This reproduction button plays back the control log, producing robot motion in the Arm 3D view.

I: Step in button

This reproduction button plays back the control log, producing step-by-step robot motion in the Arm 3D view.

J: Stop control button

This button stops reproduction using the control log.

K: Speed control

This controls the robot operating reproduction speed in the Arm 3D view subject to testing priority. There are two choices.

- Priority to collision detection
  Robot movement is reproduced for each log data line. For collision detection you can prioritize collision determination with slowed down reproduction.
- Priority to actual running times
  Reproduction of operation matches the actual speed. (The collision may not be accurately determined.)

L: Graph display / grid display button

Switches the display style (graph/grid) for the control log data.

M: Control log analysis

The analysis results (predictive load ratio, maximum load ratio, predictive regenerative resistance load ratio) are displayed in the output window.

- Predictive load ratio
  Displays the predictive load ratio for a series of operations in the log range of processes. If the predictive load ratio exceeds 80%, an overload error is likely to occur.
- Maximum load ratio
  Displays the maximum load ratio in the log. At over 100% an overload error will occur.
- Predictive regenerative resistance load ratio
  The predictive load ratio for regenerative resistance is displayed for relevant models.

N: Cursor position

Moves the position of the cursor in the graph.

O: Drawing axis

Selects a data axis displayed in the graph.

P: Select display item

The checked items are displayed in the graph.

Q: Program / Line

Displays the program name and source code line at the cursor position.

R: Status

Displays the cursor position coordinates and the cursor position values of log data displayed in the graph.

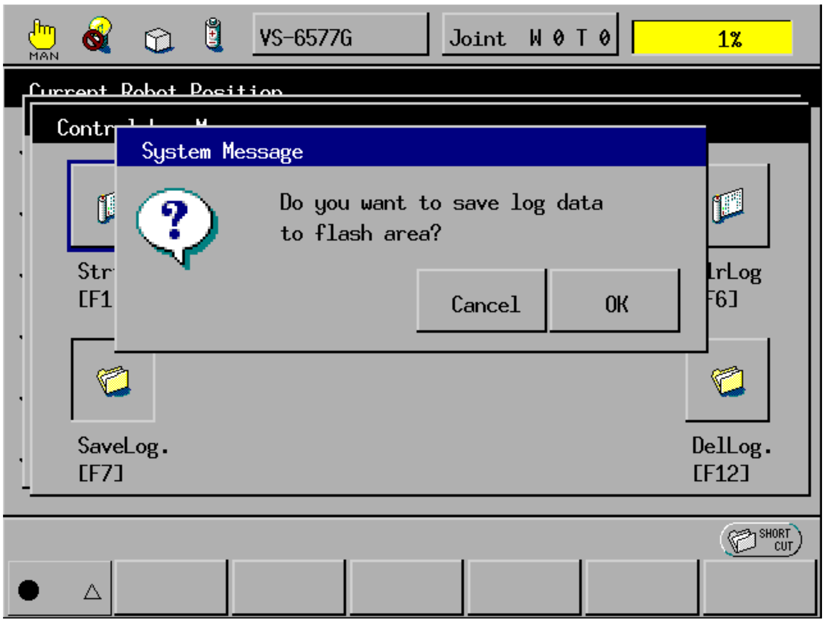
The following items are recorded for the log data.

- Axis command values
  Axis angles commanded by the controller in the specified recording interval
- Axis encoder value
  Current axis angle values (actual values)
- Axis current values
  Current values in the motors of the axes
- Axis load ratios
  Load ratios in the axes
- Regenerative resistance load ratio
  Regenerative resistance load for relevant models
- Program name and Line number
- Time since controller boot

8.3.3.1 Secure control log data

Control logs are recorded in DRAM where data is lost when power is turned off, but can manually be copied to flash memory where it is retained after switchoff.

Manual copying proceeds by F2 (Arm)|F6 (Auxiliary function)|F11 (Control log)|F7 (Save log) in the teach pendant.



Do you want to save log data to flash area?

8.3.3.2 Setting the control log recording interval and number

You can configure the sampling interval and number of logs (control log mode) for recording control logs in the ring buffer.

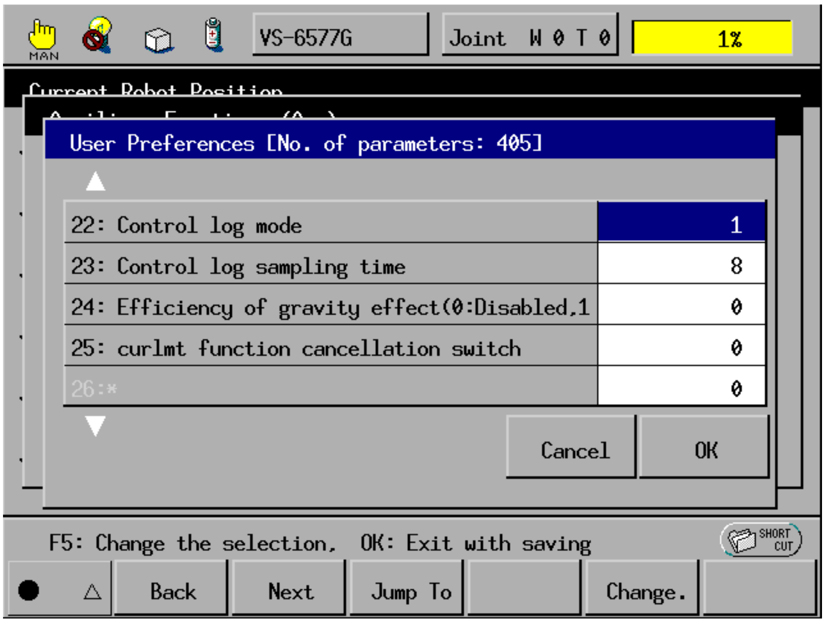
The number of control logs recorded (control log mode) is set in 1-24 units of 1,250 (1,250 - 30,000).

The sampling interval can be set at 8/16/24/32 ms.

The default setting records 10 seconds of log in the ring buffer (control log number: 1,250; sampling interval: 8 ms).

Configuring with teach pendant

Press F2 (Arm)|F6 (Auxiliary function)|F7 (Usage conditions) and enter values for No.22 and No.23.



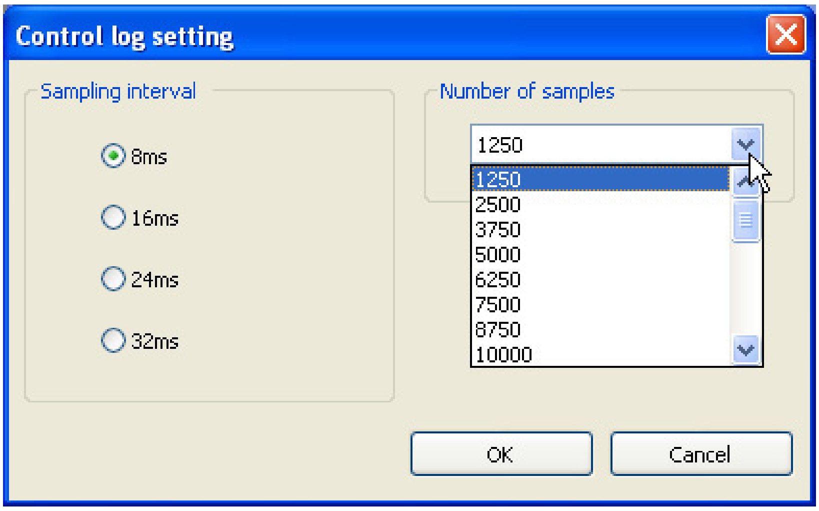
User Preferences [No. of parameters: 405]

22: Control log mode	1
23: Control log sampling time	8
24: Efficiency of gravity effect(0:Disabled,1	0
25: curlmt function cancellation switch	0
26:*	0

F5: Change the selection, OK: Exit with saving

WINCAPS III settings

Choose Debug|Controller Settings / Control log acquisition times in online (debugging) mode.



Control log setting

Sampling interval

◉ 8ms

○ 16ms

○ 24ms

○ 32ms

Number of samples: 1250

Note

The most recent 1,250 error trigger logs are secured regardless of the number setting.

8.3.4 Trace logging (single / multi)

Trace logging records the program execution flow and timing.

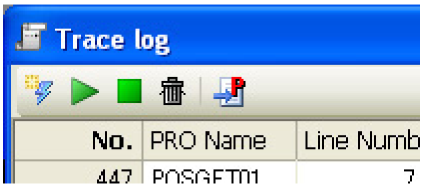
There are two types: single trace logs for recording single program flows and trace logging (multi) for recording multiple program flows.

8.3.4.1 Trace log recording operations

There is no distinction in these operations between single and multi trace logging. Using these operations will record single trace logs and trace logging (multi) for all active programs.

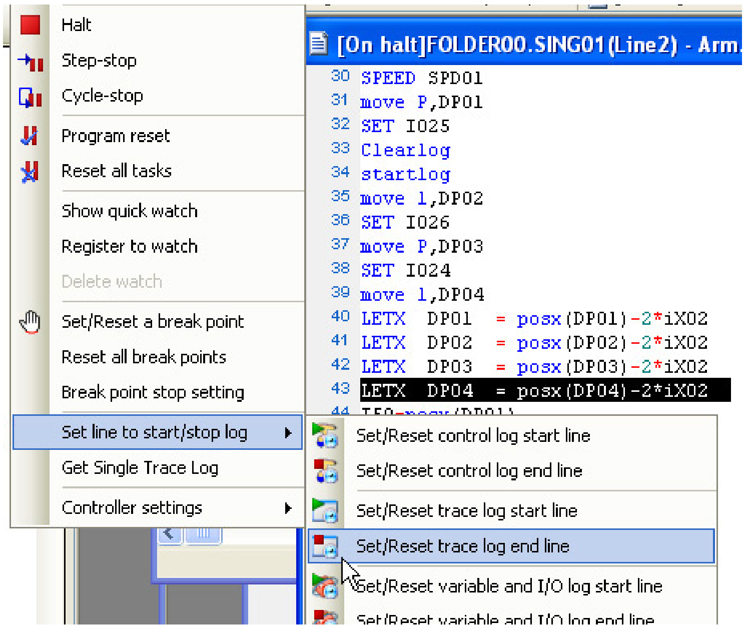
The following methods are used to operate trace logging.

- Manual operation (buttons)
  Using the buttons on the top of the trace log window.



No.	PRO Name	Line Numb
447	POSGET01	7

- Setting recording ranges in the program
  Display the program for recording in online mode (monitoring or debugging), select the command for recording and set the start and end lines.


Halt
Step-stop
Cycle-stop
Program reset
Reset all tasks
Show quick watch
Register to watch
Delete watch
Set/Reset a break point
Reset all break points
Break point stop setting
Set line to start/stop log
Get Single Trace Log
Controller settings
[On halt]FOLDER00.SING01(Line2) - Arm.
Set/Reset control log start line
Set/Reset control log end line
Set/Reset trace log start line
Set/Reset trace log end line
Set/Reset variable and I/O log start line
Set/Reset variable and I/O log end line

```
SPEED SPD01
move P,DP01
SET I025
Clearlog
startlog
move l,DP02
SET I026
move P,DP03
SET I024
move l,DP04
LETX  DP01  = posx(DP01)-2*iX02
LETX  DP02  = posx(DP02)-2*iX02
LETX  DP03  = posx(DP03)-2*iX02
LETX  DP04  = posx(DP04)-2*iX02
```

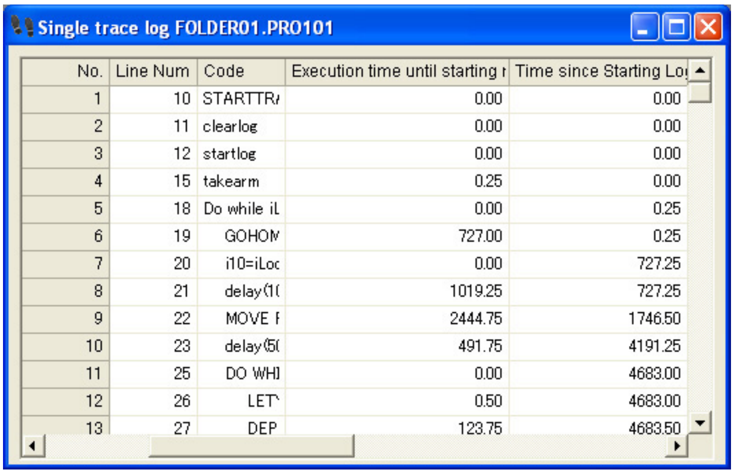
- Command statements
  The following three commands are used for trace logging. For further details on commands, please refer to the Programming Manual.
  STARTTRACELOG: Declares the start of trace log recording.
  STOPTRACELOG: Logs the currently recorded log data.
  CLEARTRACELOG: Clears the trace log data.

8.3.4.2 Single-trace Log

This records the command flow for a single program.

The time required to execute each command is recorded, giving useful data for shortening cycle time and optimizing operations.

Receive log data by specifying a program.



Single trace log FOLDER01.PRO101

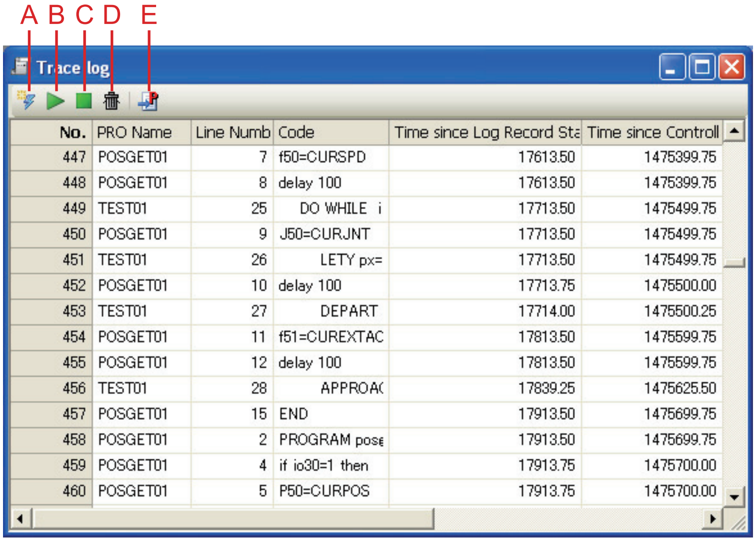
No.	Line Num	Code	Execution time until starting r	Time since Starting Lo
1	10	STARTTR/	0.00	0.00
2	11	clearlog	0.00	0.00
3	12	startlog	0.00	0.00
4	15	takearm	0.25	0.00
5	18	Do while iL	0.00	0.25
6	19	GOHOM	727.00	0.25
7	20	i10=iLoc	0.00	727.25
8	21	delay(1(	1019.25	727.25
9	22	MOVE F	2444.75	1746.50
10	23	delay(5(	491.75	4191.25
11	25	DO WHI	0.00	4683.00
12	26	LET'	0.50	4683.00
13	27	DEP	123.75	4683.50

The data recorded is as follows.

- PRO name, line number
- Code
Program code
- Execution time until starting next [ms]
- Time since log record start [ms]
- Time since controller boot [ms]

8.3.4.3 Trace logging (multi)

Trace logging (multi) records the command line sequence executed for multiple programs running simultaneously.



No.	PRO Name	Line Numb	Code	Time since Log Record Sta	Time since Controll
447	POSGET01	7	f50=CURSPD	17613.50	1475399.75
448	POSGET01	8	delay 100	17613.50	1475399.75
449	TEST01	25	DO WHILE i	17713.50	1475499.75
450	POSGET01	9	J50=CURJNT	17713.50	1475499.75
451	TEST01	26	LETY px=	17713.50	1475499.75
452	POSGET01	10	delay 100	17713.75	1475500.00
453	TEST01	27	DEPART	17714.00	1475500.25
454	POSGET01	11	f51=CUREXTAC	17813.50	1475599.75
455	POSGET01	12	delay 100	17813.50	1475599.75
456	TEST01	28	APPROA(	17839.25	1475625.50
457	POSGET01	15	END	17913.50	1475699.75
458	POSGET01	2	PROGRAM pos€	17913.50	1475699.75
459	POSGET01	4	if io30=1 then	17913.75	1475700.00
460	POSGET01	5	P50=CURPOS	17913.75	1475700.00

A: Receive button

Trace log (multi) data is received from the controller.

B: Start trace log button

This begins trace logging.

C: Stop trace log button

Logs the currently recorded log data.

D: Clear trace log button

Clears the trace log data.

E: Jump to source code button

This displays the program code for the selected log.

The data recorded is as follows.

- PRO name, line number
- Code
  Program code
- Time since log record start [ms]
- Time since controller boot [ms]

8.3.5 Variable log

This records changes (overwriting) of variables.

Variables registered in Watch are recorded. You can set whether to record variable log in the Log column of the WINCAPS III Watch screen.

Recording of variable logs can be operated through setting the log recording range in the WINCAPS III program screen.

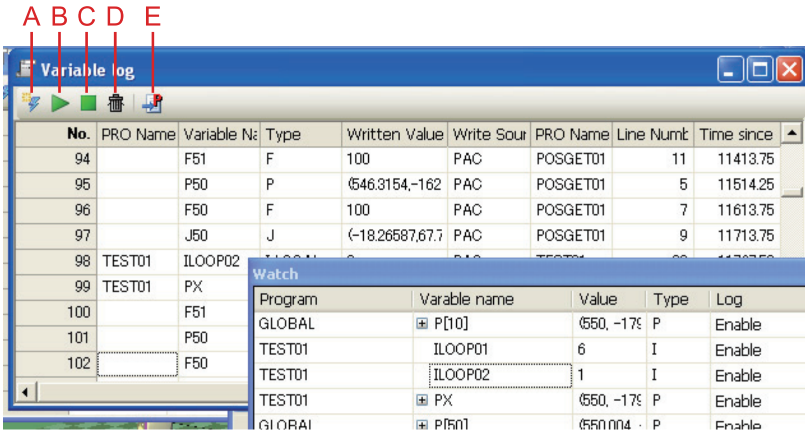
Command statements can also be used.

The following three commands are used for these operations.

- STARTVARLOG
- STOPVARLOG
- CLEARVARLOG

Note

For further details on commands, please refer to the Programming Manual.



No.	PRO Name	Variable Na	Type	Written Value	Write Sour	PRO Name	Line Numb	Time since
94		F51	F	100	PAC	POSGET01	11	11413.75
95		P50	P	(546.3154,-162	PAC	POSGET01	5	11514.25
96		F50	F	100	PAC	POSGET01	7	11613.75
97		J50	J	(-18.26587,67.7	PAC	POSGET01	9	11713.75
98	TEST01	ILOOP02						
99	TEST01	PX						
100		F51						
101		P50						
102		F50						

Program	Varable name	Value	Type	Log
GLOBAL	⊞ P[10]	(550, -179	P	Enable
TEST01	ILOOP01	6	I	Enable
TEST01	ILOOP02	1	I	Enable
TEST01	⊞ PX	(550, -179	P	Enable
GLOBAL	⊞ P[50]	(550.004 ·	P	Enable

A: Receive button

This receives variable log data.

B: Start variable log button

This begins logging the variables.

C: Stop variable log button

This suspends logging.

D: Clear variable log button

This clears saved variable log data.

E: Jump to source code button

This displays the relevant program code for the selected log.

The data recorded in the log is as follows.

- PRO name, variable name
  The name of the program defining the variables and their names
- Type
  The types of variables
- Written values
- Writing source
  The device which altered the variables

- PRO name, line number
  The name of the altered program and line number
- Time since log record start [ms]
- Time since controller boot [ms]

8.3.6 I/O log

This records the I/O status at the start of logging and subsequent I/O changes.

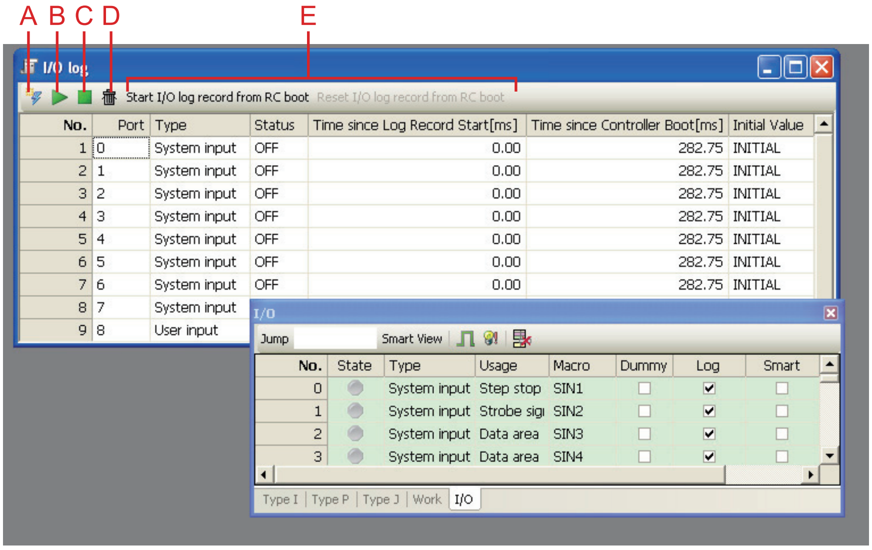
It is mostly used for checking the I/O status / safety circuits / drive preparations when activating equipment.

Operating the recording timing can be performed manually (using WINCAPS III start buttons, etc.) and records taken from controller power on.

Note

Only I/O with checks in the Log column of the WINCAPS III I/O screen are logged.

Log acquisition in programs is not possible.


A
B
C
D
E
I/O log
Start I/O log record from RC boot
Reset I/O log record from RC boot
I/O
Jump
Smart View
Type I
Type P
Type J
Work
I/O

No.	Port	Type	Status	Time since Log Record Start[ms]	Time since Controller Boot[ms]	Initial Value
1	0	System input	OFF	0.00	282.75	INITIAL
2	1	System input	OFF	0.00	282.75	INITIAL
3	2	System input	OFF	0.00	282.75	INITIAL
4	3	System input	OFF	0.00	282.75	INITIAL
5	4	System input	OFF	0.00	282.75	INITIAL
6	5	System input	OFF	0.00	282.75	INITIAL
7	6	System input	OFF	0.00	282.75	INITIAL
8	7	System input				
9	8	User input				

No.	State	Type	Usage	Macro	Dummy	Log	Smart
0	●	System input	Step stop	SIN1	□	☑	□
1	●	System input	Strobe sig	SIN2	□	☑	□
2	●	System input	Data area	SIN3	□	☑	□
3	●	System input	Data area	SIN4	□	☑	□

A: Receive button

This receives I/O log data.

B: Start I/O log button

This begins the I/O log.

C: Stop I/O log button

This suspends logging.

D: Clear I/O log button

This clears saved I/O log data.

E: Start / stop I/O logging from power on button

This starts or stops I/O logging from power on.

The data recorded in the log is as follows.

- Port
  I/O port number.
- Type
  Exclusive input, universal output, etc.

- Status
  Altered status
- Time since log record start
- Time since controller boot
- Initial value
  INITIAL is entered in the value when logging begins.

8.3.7 Joint servo log for particular joint

More detailed recording of motor control.

The recording interval can be set from 1-8 ms.

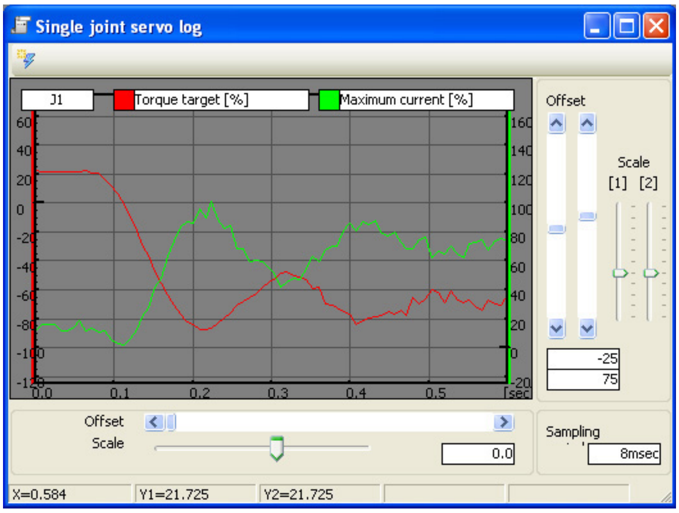
The following data is logged.

- Motor speed command value [rpm]
- Motor speed current (actual) value [rpm]
- Motor torque command value (less torque offset) [% of rating]
- Motor angle difference (motor angle command value - actual motor angle) [Pulse]
- Motor current absolute value (the maximum detected motor 3-phase absolute current value)

The recording range can be specified with the program.

The following programs stored in the program bank are used. For further details, refer to Programming Manual II.

- SetMonitorCond
- StartSrvMonitor
- SotpSrvMonitor
- ClearSrvMonitor



Offset -25
Scale 75

Offset/Scale 0.0

Sampling 8msec

X=0.584 Y1=21.725 Y2=21.725

Chapter 9 Vision Manager

9.1 Overview

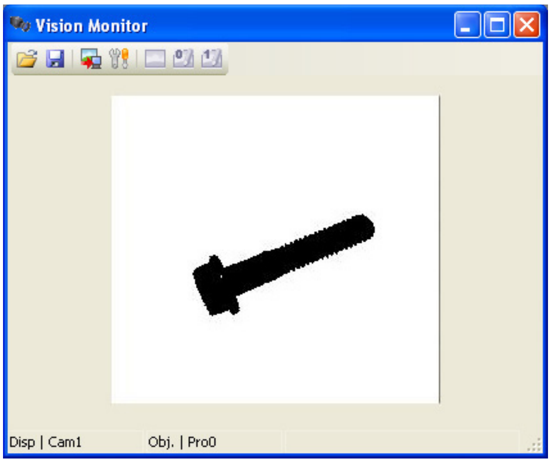
The Vision Manager is for writing robot vision programs in the PAC programming language. Working interactively in the WINCAPS III environment, the programmer defines processing windows, writes search models, and creates lookup tables.

WINCAPS III saves image data in .bmp format and search models in a special data format.

9.1.1 Screen descriptions

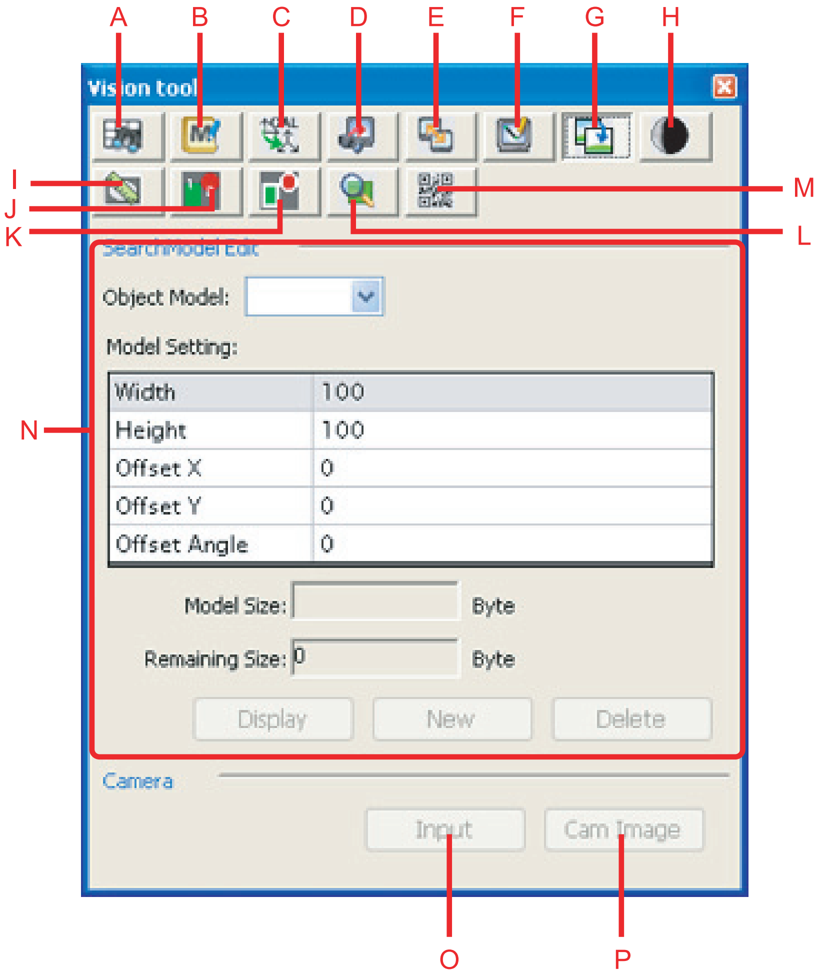
Vision monitor window

This window displays the image from a camera connected to the robot unit. Choose View|Vision Monitor to display it in the Program view area.



Vision tool window

This window is for configuring the Vision Manager. Choose View|Vision Tool to display it in the Docking view area.



Object Model:

Model Setting:

Width	100
Height	100
Offset X	0
Offset Y	0
Offset Angle	0

Model Size: Byte

Remaining Size: 0 Byte

The following buttons switch the configuration area of this window.

A: Lookup table

This button is for specifying lookup tables.

B: Edit macro name

This button is for editing window and search model macro names.

C: Calibrate

This button is for measuring coordinate conversion coefficients.

D: Camera input

This button is for copying a camera image to an image processing screen.

E: Screen display

This button switches the Vision monitor window.

F: Edit window

This button enables window editing.

G: Edit search model

This button enables search model editing.

H: Register digitization

This button is for determining the digitization thresholds for image analysis.

I: Area/Center of gravity/Principal axis

This window is for determining three object features: area, center of gravity, and principal axis.

J: Labeling

This button is for finding and labeling objects in the window.

K: Edge

This button is for detecting edges.

L: Model search

This button is for pattern matching using a search model.

M: Scan code

This button is for reading in a QR Code symbol.

N: Configuration area

This button is for displaying the settings screen for the selected function.

For screen descriptions, refer to 9.2 "Configuring Vision Manager" (P. 145).

O: Capture

This button copies the camera image to the processing screen specified on the Camera input settings screen and displays that data in the Vision monitor window.

P: Camera image

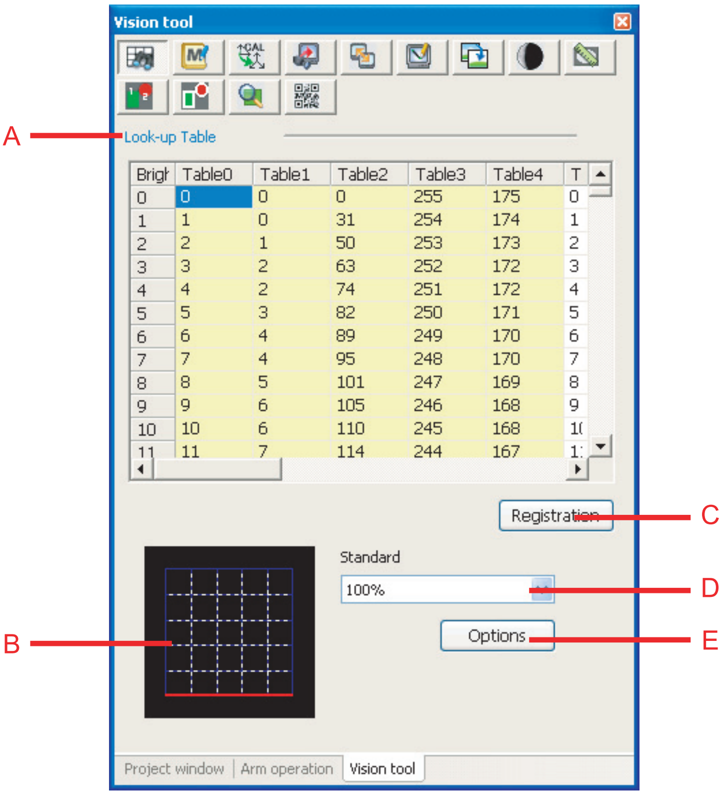
This button switches the Vision monitor window to the camera number specified with the Camera input settings screen.

9.2 Configuring Vision Manager

9.2.1 Configuring lookup tables

Lookup tables specify the camera's input characteristics as well as the display characteristics for the camera image and processing screens. Tables 0 to 4 are reserved for system use; 5 to 15 are user modifiable.

Lookup table screen



Brigh	Table0	Table1	Table2	Table3	Table4	T
0	0	0	0	255	175	0
1	1	0	31	254	174	1
2	2	1	50	253	173	2
3	3	2	63	252	172	3
4	4	2	74	251	172	4
5	5	3	82	250	171	5
6	6	4	89	249	170	6
7	7	4	95	248	170	7
8	8	5	101	247	169	8
9	9	6	105	246	168	9
10	10	6	110	245	168	1(
11	11	7	114	244	167	1:

Standard: 100%

A: Lookup table

This area contains the tables specifying characteristics. (The user-modifiable ones start at number 5.)

B: Graph

This graphs the characteristics for the currently selected column in the Lookup table area.

C: Save button

This button saves search model modifications.

D: Standard table

This field is for choosing a standard table from a pull-down list.

E: Apply

This copies the specified standard table to the selected column in the Lookup table area.

1) Select a column in the Lookup table area.
2) Choose a standard table from the pull-down list.
3) Press the Apply button

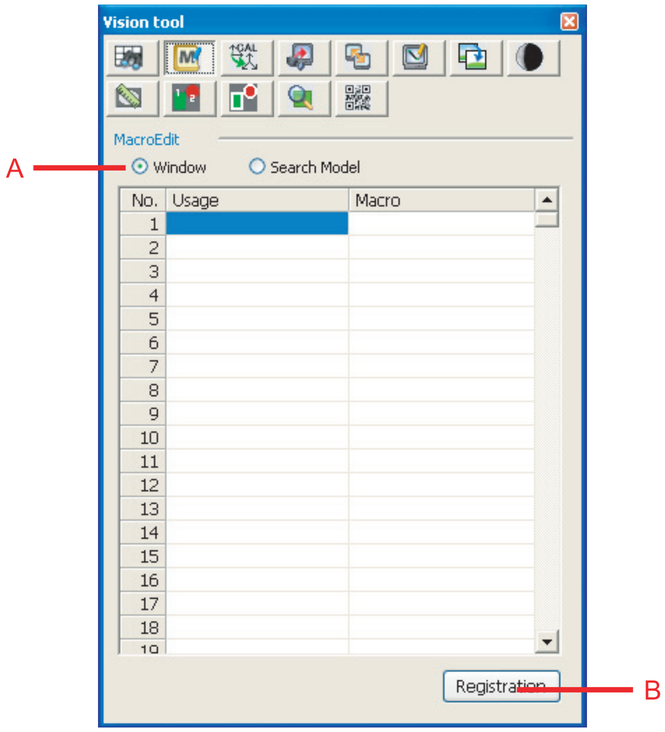
9.2.2 Editing a macro name

This is for editing macro names and application for windows and search models.

Defining macros allows programs to use substitute the macro name for its content.

A macro name must be in single-byte characters. Using other characters renders that portion of the macro definition file unavailable to programs.

Edit macros screen



● Window ○ Search Model

No.	Usage	Macro
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		

A: Macro scope

Specify the macro's scope

B: Save

This button saves modifications to the macro.

Operating procedure

1. **Specify the macro's scope with a radio button: Window or Search model.**
2. **Double-click a cell to highlight its contents for editing. An empty cell has only an cursor.**
3. **Enter the application or macro name.**
4. **Press the Register button.**

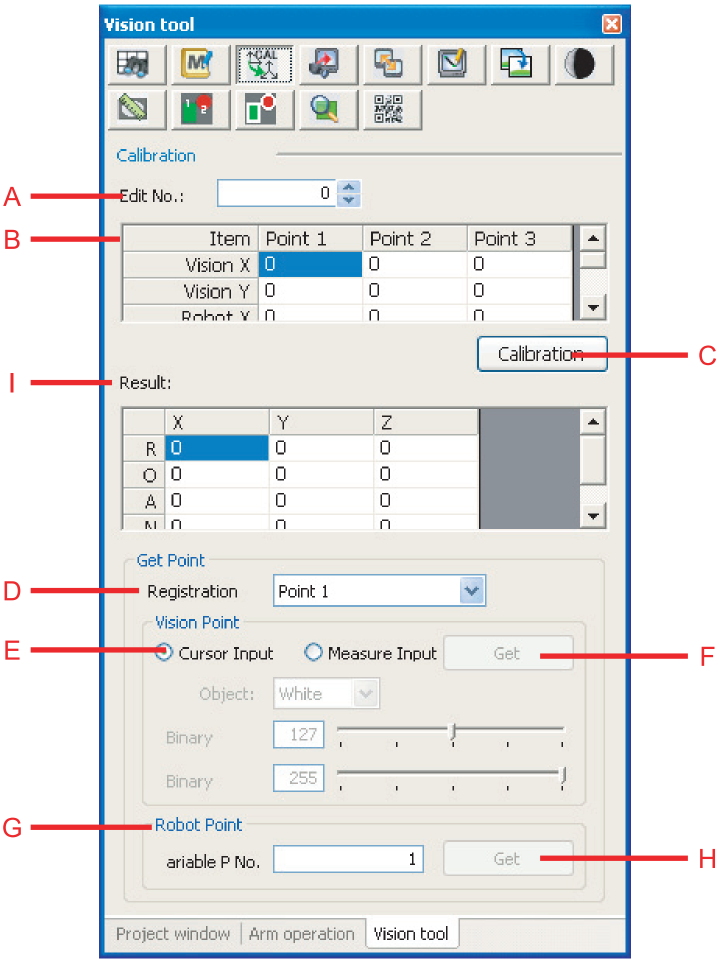
Note

A macro name must be in single-byte characters.

9.2.3 Calibrating

The Calibration settings screen manages thirty two sets of calibration data numbered 0 to 31. A calibration operation calculates conversion coefficients by comparing monitor coordinates with their robot counterparts for three image features and saves both the source data and the coefficients under the specified number.

Calibration settings screen



Calibration

Edit No.: 0

Item	Point 1	Point 2	Point 3
Vision X	0	0	0
Vision Y	0	0	0
Robot X	0	0	0

Result:

	X	Y	Z
R	0	0	0
O	0	0	0
A	0	0	0
N	0	0	0

Registration: Point 1

● Cursor Input ○ Measure Input

Object: White

Binary 127

Binary 255

ariable P No. 1

A: Number to edit

This field specifies the set of calibration data to update.

B: Calibration data table

This table specifies the Vision monitor and robot coordinates for the calibration operation. The operation requires coordinate data for three separate points, numbered 1 to 3.

C: Calibrate

This button initiates calibration.

D: Point to edit

This field specifies the point to edit.

E: Vision window points

These radio buttons specify the method for entering Vision monitor coordinates.

F: Read

This button is for specifying Vision monitor coordinates using the selected input method.

G: P variable number

This field is for specifying, by number, the variable of type P containing the robot coordinates.

H: Read

This button copies the robot coordinates from the specified P variable.

I: Results

This area displays the results of the calibration operation.

9.2.3.1 Calibration procedure

The following is the calibration procedure.

Operating procedure

1. **Select three distinct points.**
2. **Specify the dataset number.**
3. **Enter the Vision monitor coordinates.**

   For further details, refer to 9.2.3.2 "Entering the Vision monitor coordinates" (P. 149).
4. **Enter the robot coordinates.**

   For further details, refer to 9.2.3.3 "Specifying robot coordinates" (P. 151).
5. **Calculate the coordinate conversion coefficients.**

   For further details, refer to 9.2.3.4 "Calibrating" (P. 151).

9.2.3.2 Entering the Vision monitor coordinates

There are the following three ways to enter the Vision monitor coordinates.

- Direct entry: Directly entering numerical values
- Cursor input: Marking the corresponding point in the Vision monitor window with the cursor
- Measurement input: Finding the center of gravity with image analysis

The following are the procedures.

(1) Direct entry

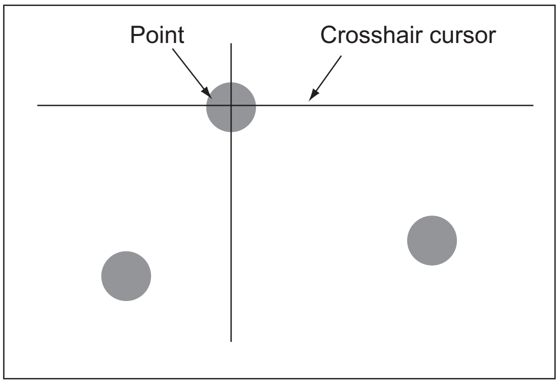
Double-click the x- or y-coordinate cell in the Vision monitor area of the calibration data table and enter a numerical value.

(2) Cursor input

Indicate the corresponding point in the Vision monitor window with the crosshair cursor.

Operating procedure

1. **Display an image in the Vision monitor window.**
2. **Specify the point to edit.**
3. **Select the Cursor input radio button to display the crosshair cursor in the Vision monitor window.**



4. **Move the crosshair cursor to the target coordinates with dragging or with arrow keys.**

   Moving crosshair cursor with keyboard

   ←, →, ↑ and ↓ keys: These four arrow keys move the crosshair cursor in the corresponding direction.

5. **Press the Read button to read in the cursor coordinates.**

(3) Measurement input

Find the center of gravity with image analysis and enter the results as the coordinates.

Operating procedure

1. **Display an image in the Vision monitor window.**

2. **Specify the point to edit.**

3. **Choose the Measurement input radio button to display a selection window in the Vision monitor window**

4. **Move the cursor to the target coordinates with dragging or with arrow keys.**

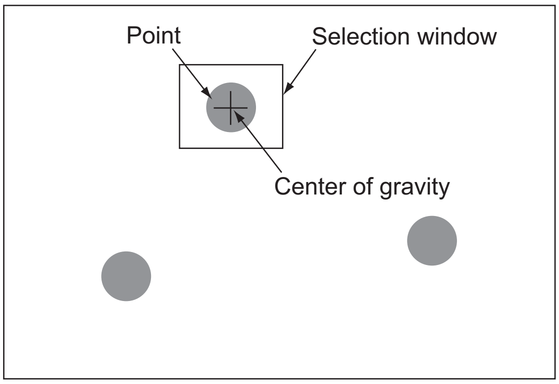
Moving window with keyboard

←, →, ↑ and ↓ keys: These four arrow keys move the window in the corresponding direction.

W and S keys: These keys widen and shrink the window, respectively.

H and L keys: These keys make the window higher and lower, respectively.

5. **Press the Measure button to display the center of gravity.**



6. **Press the Read button to read in the coordinates.**

9.2.3.3 Specifying robot coordinates

There are the following two ways to enter robot coordinates.

- Direct entry: Directly entering numerical values
- Copying variable: Copying coordinates from a robot P variable

The following are the procedures.

Note

Make sure that the Vision monitor coordinates and the robot ones refer to the same point.

(1) Direct entry

Double-click the x-, y-, or z-coordinate cell in the Robot area of the calibration data table and enter a numerical value.

(2) Copying variable

This method copies robot coordinates from the specified P variable.

Operating procedure

1. **Specify the point to edit.**
2. **Move to the P variable field and enter the number for the robot coordinates.**
3. **Press the Read button to read in the coordinates.**

9.2.3.4 Calibrating

A calibration operation calculates conversion coefficients by comparing monitor coordinates with their robot counterparts for three image features. Although WINCAPS III must send calibration data to the robot controller, the robot controller stores only the conversion coefficients.

The conversion library converts robot coordinates using these stored coefficients. User programs can also use it to convert Vision monitor coordinates into robot ones.

Operating procedure

1. **Choose the dataset number for the calibration operation.**
2. **Press the Calibrate button to display a Results window.**

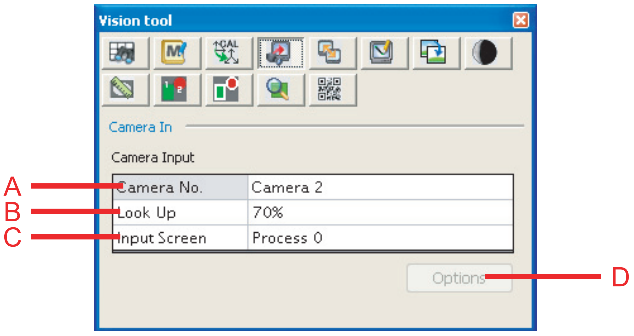
Note

- If an error message indicates problems with coordinate data, double-check the data for the three features.
- Adjust the coordinates until pressing the button successfully yields valid coefficients.

9.2.4 Configuring camera input

The following is the procedure for copying the camera image to an image processing screen.

The following screen controls data transfers from the camera to an image processing screen.



Camera In

Camera Input

Camera No.	Camera 2
Look Up	70%
Input Screen	Process 0

A: Camera number

This field specifies the image source.

B: Lookup

This field specifies the lookup table for adjusting the data.

C: Input

This field specifies the processing screen to receive the camera image.

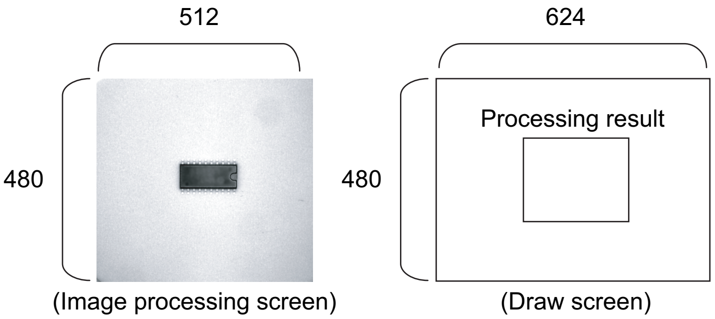
D: Apply

This button copies the camera image to an image processing screen.

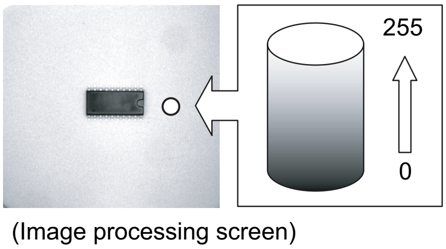
Note

What is a pixel?

The µVision board processes an image as an array of dots called picture elements or pixels. For storage, it handles images up to 512 pixels wide and 480 pixels tall; for drawing, up to 624 by 480.



What is brightness?



Each pixel has a brightness, one of 256 numerical values between 0 and 255. The dark end of this scale is 0; the bright end, 255.

9.2.4.1 Reading in an image

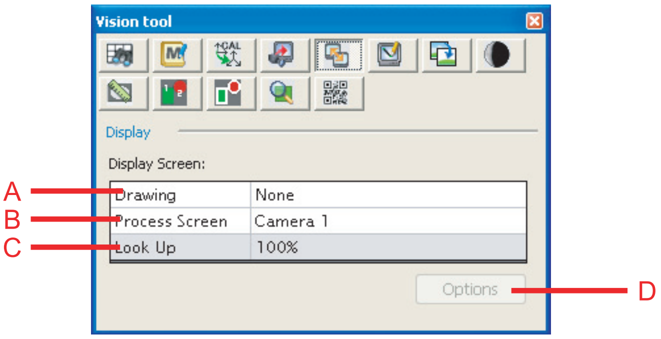
Operating procedure

1. **Specify the source camera by number.**
2. **Specify the lookup table for adjusting the image.**
3. **Specify the Input screen.**
4. **Press the Apply button to copy the camera image to an image processing screen.**

9.2.5 Switching display screens

The Vision monitor window switches between three types of images: camera, processing, and draw.

Screen display settings screen



Display Screen:

Drawing	None
Process Screen	Camera 1
Look Up	100%

A: Draw screen

This field specifies the draw image to display.

B: Camera & processing

This field specifies the camera image or processing image to display.

C: Lookup

This field specifies the lookup table for adjusting the image.

D: Apply

This button switches the Vision monitor window to the specified image.

⚠**Caution**

Image analysis automatically changes the Draw screen setting on this settings screen to Draw screen 1 to display its results there. If the current setting is Draw screen 0, however, the setting changes to Draw screen 0+1.

9.2.5.1 Switching the Vision monitor window display

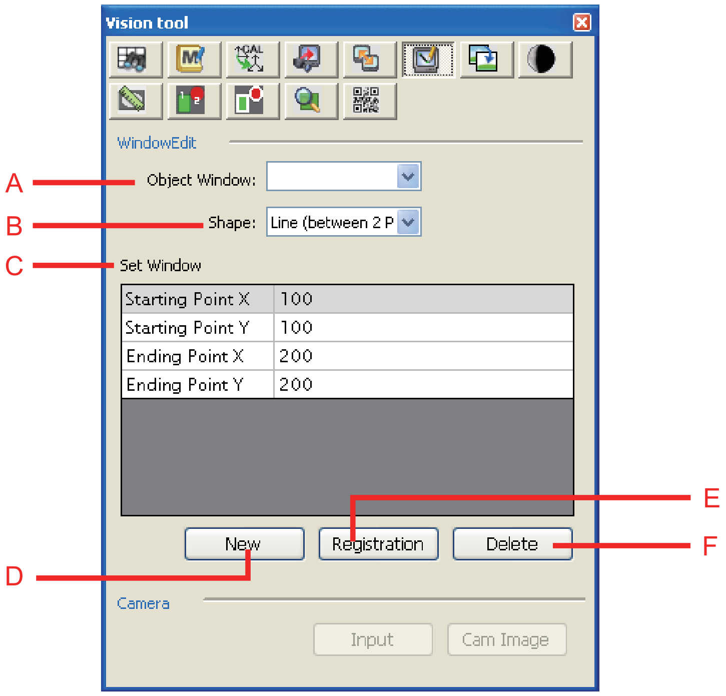
Operating procedure

1. **Select the Draw screen field and specify the draw image to display.**
2. **Select the Camera & processing screen field.**
3. **Specify the lookup table for adjusting the image.**
4. **Press the Apply button to copy the camera image to an image processing screen.**

9.2.6 Editing a window

To edit robot controller window settings, WINCAPS III must first read in their current values.

Edit window settings screen



Object Window:

Shape: Line (between 2 P

Set Window

Starting Point X	100
Starting Point Y	100
Ending Point X	200
Ending Point Y	200

A: Target window

This field specifies the window to edit.

B: Shape

This field specifies the window shape.

C: Window settings

This area lists window settings.

D: New

Creates a new window.

E: Save

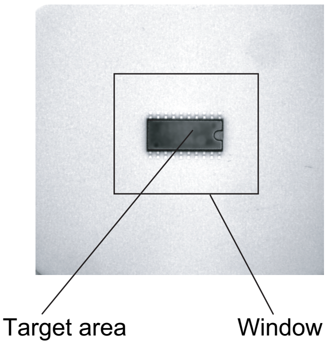
This button saves window modifications.

F: Delete

This button deletes the selected window.

Note

What is a window?



Here a window means the portion of the image that the μVision board is to process. The board remembers the sizes for each window.

There are two ways to edit windows: with Vision Manager and with user programs. The board stores window specifications supplied by user programs in volatile memory, so these disappear when the power is removed.

9.2.6.1 Creating a new search model

Operating procedure

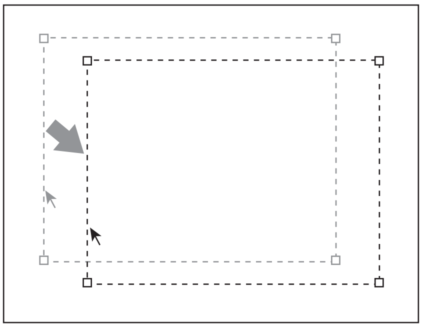
1. **Enter a number for the window in the Target window field.**
2. **Choose a shape.**
3. **Adjust the window size**

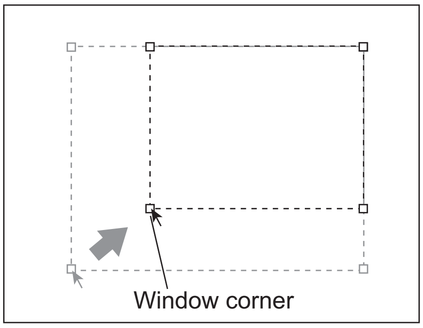
Moving the window

Drag the window outline to move the window.

Changing the window size

Drag a window corner to resize the window.





Note

The Window settings dialog box also permits direct, numerical specification of window position and size.

4. **Press the Register button.**

Note

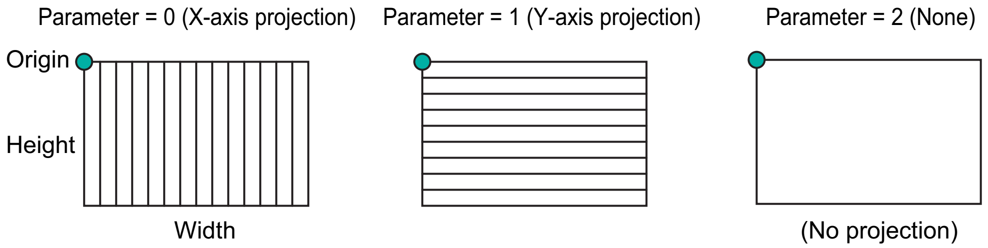
Projection window

Rectangular and sector window shapes add an edge detection direction setting.

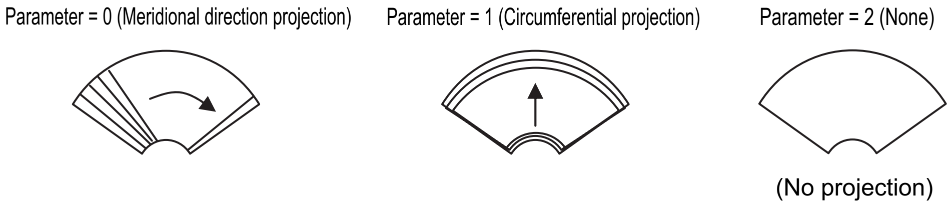
This parameter specifies the scan direction for edge detection. Set this to 2 (none) if edge detection is not used. This is the default setting when a window is first created and after a shape change.

Change this setting to match the measurement method.

- Rectangular window


Parameter = 0 (X-axis projection)
Parameter = 1 (Y-axis projection)
Parameter = 2 (None)
Origin
Height
Width
(No projection)

- Sector window


Parameter = 0 (Meridional direction projection)
Parameter = 1 (Circumferential projection)
Parameter = 2 (None)
(No projection)

9.2.6.2 Editing a window

The following is the procedure for editing a window.

Operating procedure

1. **Enter the window number in the Target window field to display the settings for the window specified on the Window settings screen and display the image in the Vision monitor window.**
2. **Adjust the window size.**
3. **Press the Register button.**

9.2.6.3 Deleting a window

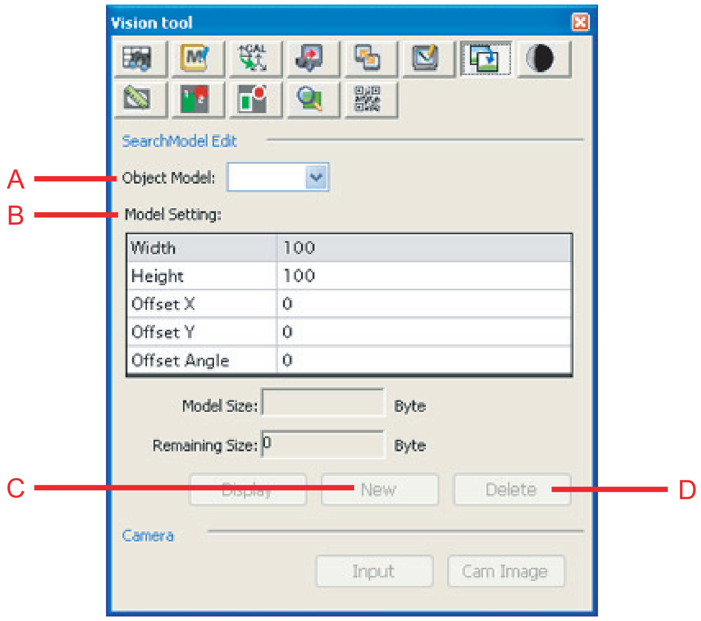
Operating procedure

1. **Enter the number of the window in the Target window field. to display the settings for the window specified on the Window settings screen.**
2. **Press the Delete button.**

9.2.7 Editing a search model

To edit a robot controller search model, WINCAPS III must first read it in.

Search model settings screen



Width	100
Height	100
Offset X	0
Offset Y	0
Offset Angle	0

Model Size: Byte

Remaining Size: 0 Byte

A: Target model

This field specifies the search model.

B: Model settings

This area displays information on the current search model for editing.

C: Save

This button saves search model modifications.

D: Delete

This button deletes the search model.

Note

The offset angle field is not available when the robot controller does not support angle measurements.

9.2.7.1 Creating a new search model

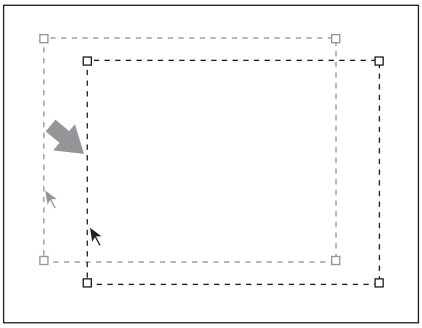
Operating procedure

1. **Enter a number for the new search model in the Target field.**

2. **Adjust the search model shape and offsets.**

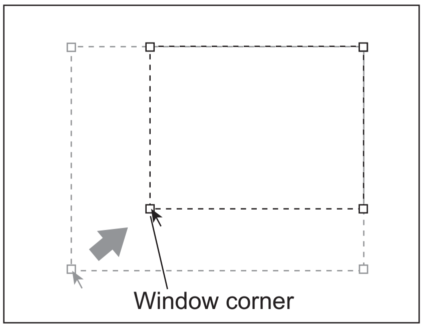
Moving the window

Drag the window outline to move the window.



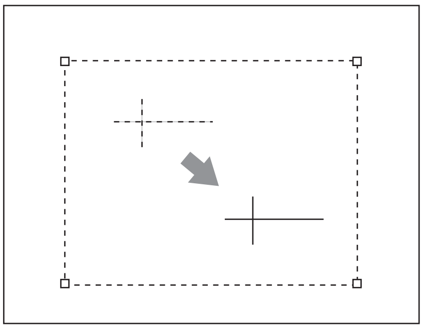
Changing the size

Drag a window corner to resize the window.



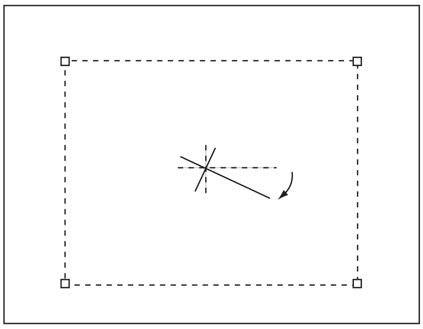
Changing offset

Drag the crosshairs to adjust an offset position.



Changing the offset angle

Drag the long arm of the crosshairs to adjust the offset angle.



3. **Press the Register button.**

9.2.7.2 Modifying a search model

The following is the procedure for editing a search model.

Operating procedure

1. **Choose the search model to edit from the list box to display its data on the Model settings screen and display it in the Vision monitor window.**
2. **Adjust the search model shape and offsets.**
3. **Press the Register button.**

9.2.7.3 Deleting a search model

Operating procedure

1. **Choose the search model to edit from the list box to display its data on the Model settings screen.**
2. **Press the Delete button.**

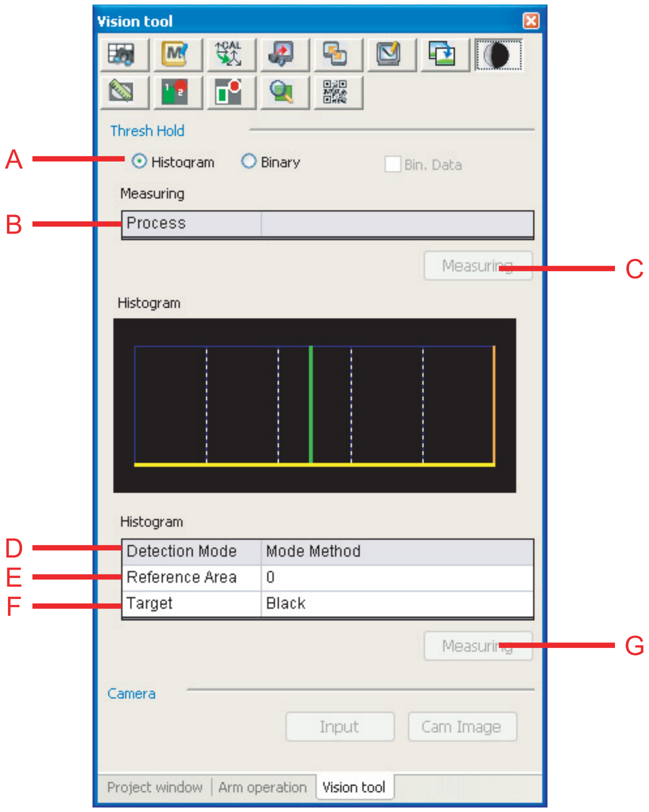
9.2.8 Registering digitization

The following give the procedures for specifying or determining digitization thresholds.

The Register digitization settings screen offers four choices for determining the optimal thresholds: manual specification, calculation with mode method, discriminant analysis, and p-tile threshold calculation.

Radio buttons switch this screen between Histogram settings and Digitization settings.

Digitization/Histogram settings screen



Process	

Detection Mode	Mode Method
Reference Area	0
Target	Black

A: Histogram

This radio button displays the Histogram settings screen.

B: Processing window

This field specifies the processing window range.

C: Calculate histogram

This button displays the histogram.

D: Method

This field specifies the method for entering digitization thresholds.

E: Reference surface

This field specifies the reference area to use for the p-tile threshold calculation.

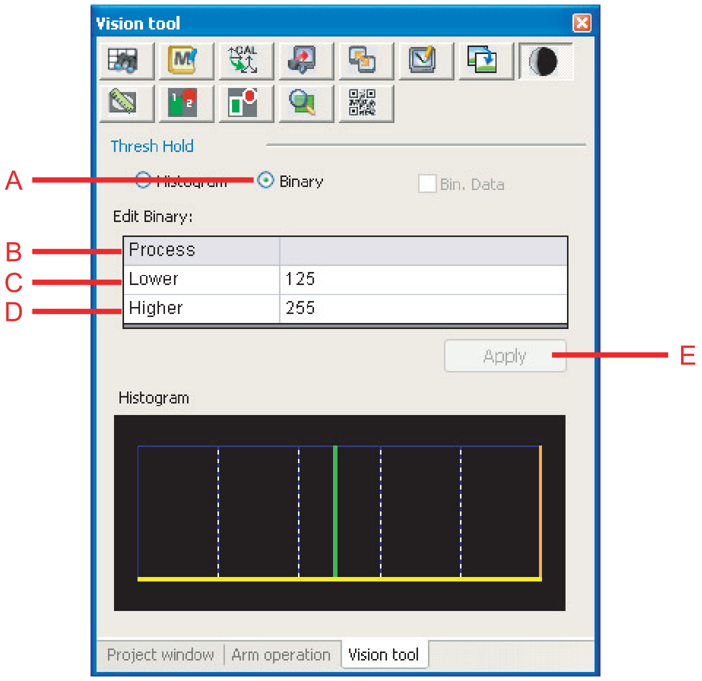
F: Target

This field specifies the target area to use for the p-tile threshold calculation.

G: Measure

This button is for specifying or determining the digitization thresholds for image analysis.

Digitization/Histogram settings screen



Thresh Hold

○ Histogram ● Binary □ Bin. Data

Edit Binary:

Process	
Lower	125
Higher	255

A: Digitization

This radio button displays the Digitization settings screen.

B: Processing window

This field specifies the processing window range.

C: Digitization lower boundary

D: Digitization upper threshold

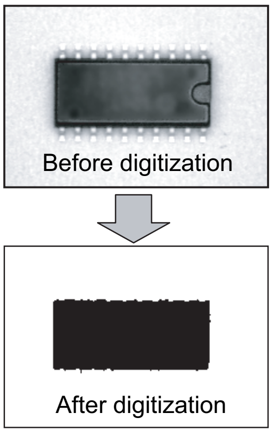
These two fields display/specify the digitization thresholds for image analysis.

E: Apply

This button saves window modifications.

Note

What is digitization?



The DENSO μVision board accepts as camera input gray scale images with 256 possible values for each pixel brightness. Digitization uses brightness thresholds (boundaries) to make each pixel either pure white or jet black. There are two digitization thresholds. Pixels between the two thresholds become white (1); everything else, black (0).

What is a histogram?

This graph gives the brightness frequency distribution for pixels within the specified range inside the window showing the camera image. Displaying the brightness distribution as a graph (histogram) simplifies the task of selecting thresholds for digitizing the image. Histograms allow the DENSO μVision board to automatically determine digitization thresholds.

Figure 1

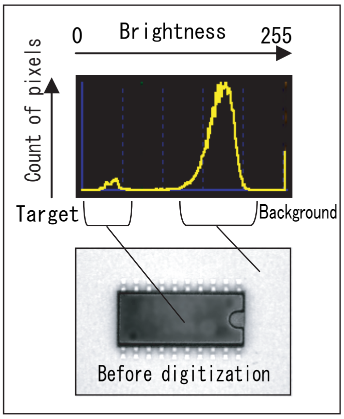
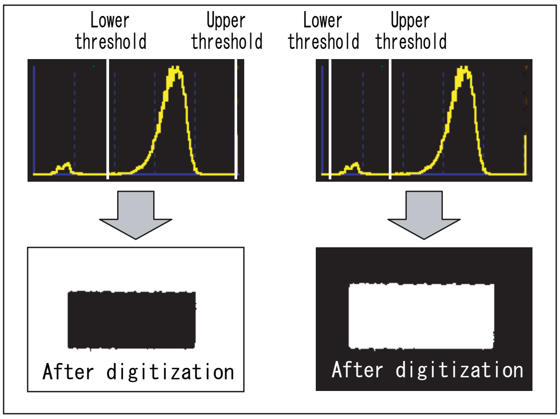


Figure 2



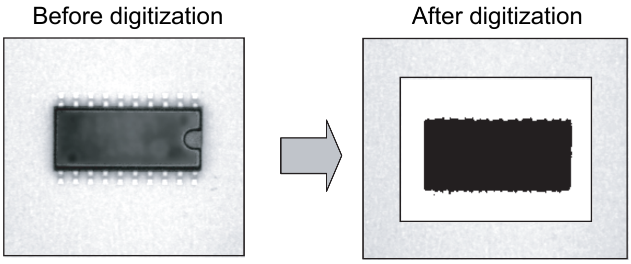
⚠Caution

Only rectangular processing windows (angle = 0) can be selected for image processing.

9.2.8.1 Manually specifying boundaries

Operating procedure

1. **Choose the Histogram radio button to display the Histogram settings screen.**
2. **Select the Processing window to display the histogram calculation window.**
3. **Press the Calculate button to display the histogram.**
4. **Select the Digitization radio button to display the Digitization settings screen.**
5. **Specify the two digitization thresholds and check the lines on the histogram.**
6. **Press the Apply button.**



9.2.8.2 Automatically determining digitization thresholds

Operating procedure

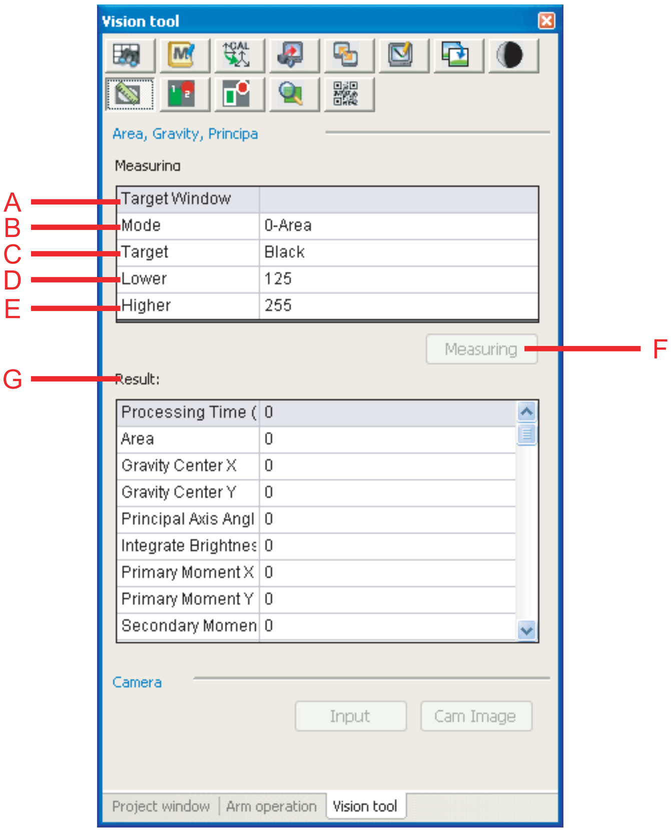
1. **Press the Histogram radio button to display the Histogram settings screen.**
2. **Choose the window to process in the Processing window.**
3. **Choose the method: calculation with mode method, discriminant analysis, or p-tile threshold calculation.**

   If your choice is other than p-tile, proceed to step 5.
4. **(For p-tile only) Specify the reference area and target fields.**
5. **Press the Measure button to display the resulting boundaries on the histogram and save them in the two boundary fields of the Digitization settings screen.**
6. **Select the Digitization radio button to display the Digitization settings screen.**
7. **Press the Apply button**

9.2.9 Calculating area, center of gravity, and principal axis

The following is the procedure for determining three object features: area, center of gravity, and principal axis. This procedure uses the thresholds specified with the Register digitization settings screen.

Feature (SA/CG/PA) settings screen



Area, Gravity, Principa

Measuring

Target Window	
Mode	0-Area
Target	Black
Lower	125
Higher	255

Result:

Processing Time (	0
Area	0
Gravity Center X	0
Gravity Center Y	0
Principal Axis Angl	0
Integrate Brightnes	0
Primary Moment X	0
Primary Moment Y	0
Secondary Momen	0

A: Target window

This field specifies the window range to measure.

B: Feature

This field specifies the feature to extract: surface area, center of gravity, or principal axis.

C: Color

This field specifies the color to use: white or black.

D: Digitization upper threshold

E: Digitization lower threshold

These two fields display/specify the digitization thresholds for image analysis.

F: Measure

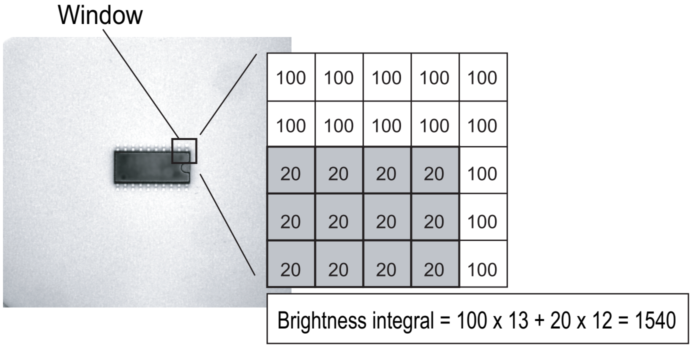
This button determines the specified feature.

G: Results

This area displays a list of measurement results.

Note

What is the brightness integral?

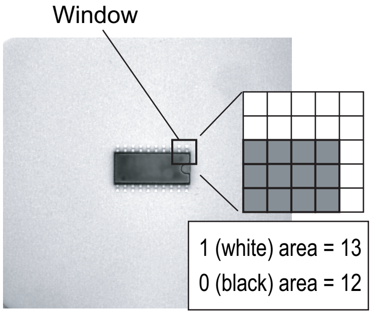


100	100	100	100	100
100	100	100	100	100
20	20	20	20	100
20	20	20	20	100
20	20	20	20	100

Brightness integral = 100 x 13 + 20 x 12 = 1540

The brightness integral is the sum of the brightness values over all camera image pixels within the specified range in the window.

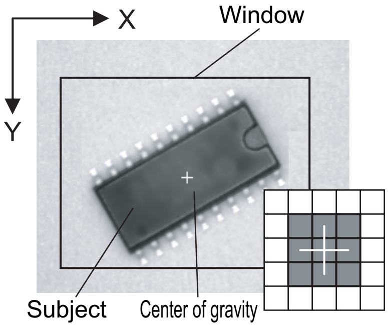
What is the area?



1 (white) area = 13
0 (black) area = 12

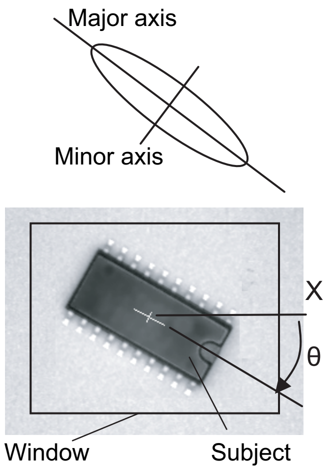
The area is a count of pixels within the specified range in the window having the specified color after digitization: black (0) or white (1). The DENSO μVision board implementation combines on-the-fly digitization and counting, making it unnecessary for programs to first digitize and also leaving the image unaltered on the screen.

What is the center of gravity?



Camera images portray their subjects as flat, so here center of gravity means in the plane. The DENSO μVision board determines the center of gravity by digitizing the pixels within the specified range in the window and then counting either black (0) or white (1) ones. This center of gravity has both x- and y-coordinates.

What is the principal axis angle?

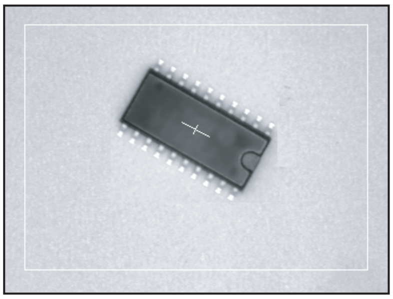


Camera images portray their subjects as flat, but a subject can have its major axis (length) rotated relative to the viewing plane. The minor axis (width) is perpendicular to this axis. The DENSO μVision board defines the angle (θ) from the plane's x-axis to the subject's major axis as the principal axis angle. The DENSO μVision board determines this angle by digitizing the pixels within the specified range in the window and then counting either black (0) or white (1) ones.

9.2.9.1 Extracting features

Operating procedure

1. Choose a target window range to measure.
2. Choose the feature: area, center of gravity, or principal axis.
3. Choose the color: 0-White or 1-Black.
4. Press the Measure button to display the resulting boundaries on the histogram and save them in the two boundary fields of the Digitization settings screen and display them in the Vision monitor window.

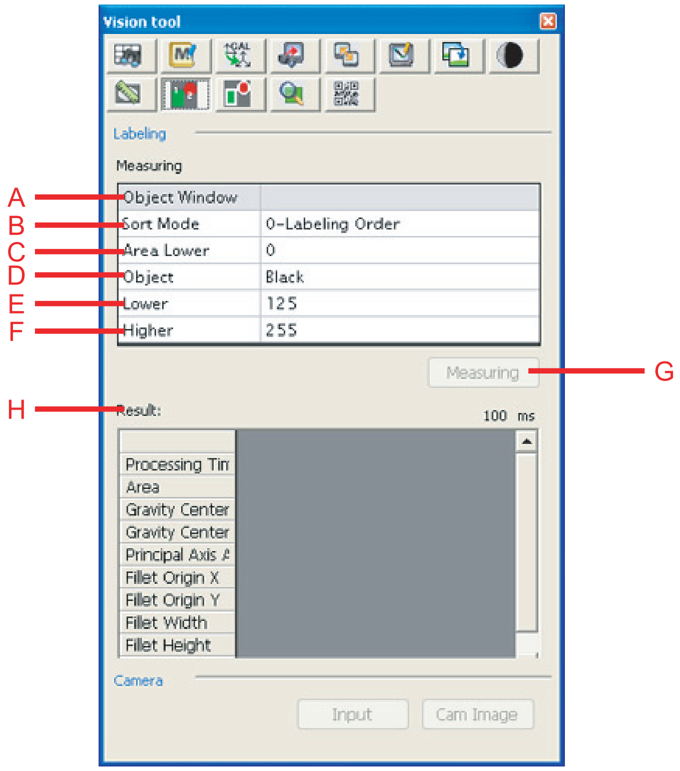


9.2.10 Labeling

This function labels objects within the specified window.

This procedure uses the thresholds specified with the Register digitization settings screen.

Labeling settings screen



Object Window	
Sort Mode	0-Labeling Order
Area Lower	0
Object	Black
Lower	125
Higher	255

A: Target window

This field specifies the window range to measure.

B: Sorting order

This field specifies the display order for the results.

C: Area cutoff

Only objects larger than this value qualify.

D: Color

This field specifies the color to use: white or black.

E: Digitization upper threshold

F: Digitization lower threshold

These two fields display/specify the digitization thresholds for image analysis.

G: Measure

This button is for finding and labeling objects in the window.

H: Results

This area displays a list of measurement results.

Note

What is labeling?

Labeling digitizes the camera image and then sequentially numbers contiguous areas of black (0) or white (1) pixels. (See Figure 1.) The result is a list of individual objects within the specified range in the window. This list includes the following object features: area, center of gravity, principal axis angle, fillet, and circumference. Here fillet means the bounding rectangle, the minimum rectangle enclosing an object. (See Figure 2.) The circumference is the number of pixels just inside this boundary. (See Figure 3.)

Figure 1

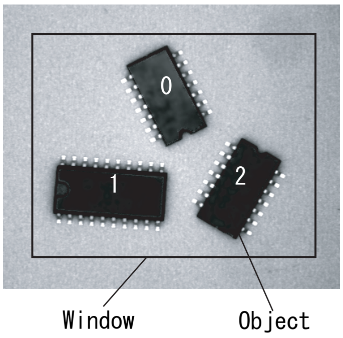


Figure 2

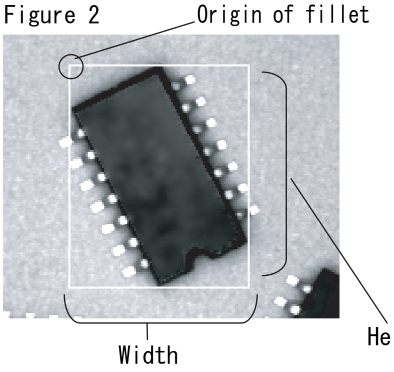
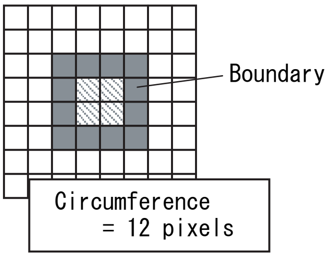


Figure 3



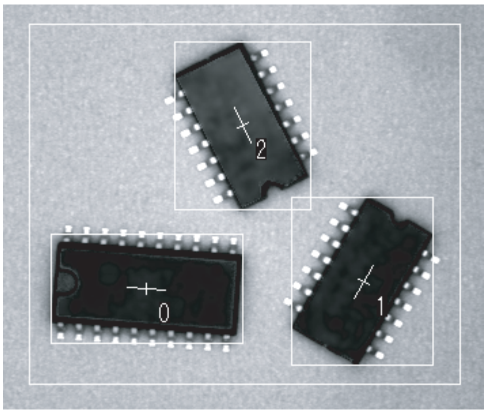
⚠Caution

Only rectangular processing windows (angle = 0) can be selected for image processing.

9.2.10.1 Labeling objects

Operating procedure

1. Choose a target window range to measure.
2. Choose the sorting order: numerical, descending area, or ascending area.
3. Enter the area cutoff, a boundary specifying the minimum size. Objects smaller than this setting are ignored.
4. Choose the color: 0-White or 1-Black.
5. Press the Measure button to display the resulting boundaries on the histogram, save them in the two boundary fields of the Digitization settings screen, and display the results in the Vision monitor window.

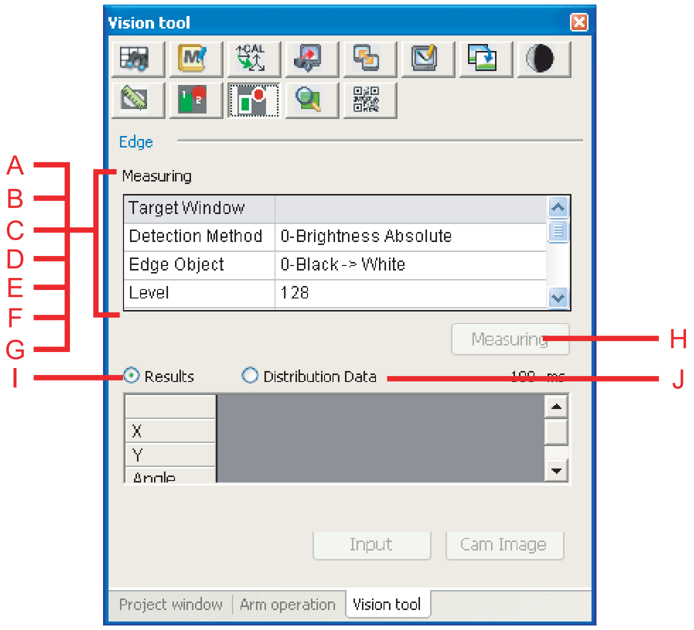


9.2.11 Edge detection

This function detects edges within the specified window.

This measurement uses a projection window (Parameter = 0 or 1).

Edge settings screen



Vision tool

Edge

Measuring

Target Window	
Detection Method	0-Brightness Absolute
Edge Object	0-Black -> White
Level	128

○ Results ○ Distribution Data 100 ms

A: Target window

This field specifies the window range to measure.

B: Method

This field specifies the edge detection method.

C: Transition

This field specifies the transition defining edges.

D: Level

This field specifies the edge detection level.

E: Scan direction

This field specifies the scan direction.

F: Digitization upper threshold

G: Digitization lower threshold

These two fields display/specify the digitization thresholds for image analysis.

H: Measure

This button proceeds with the specified operation.

I: Results

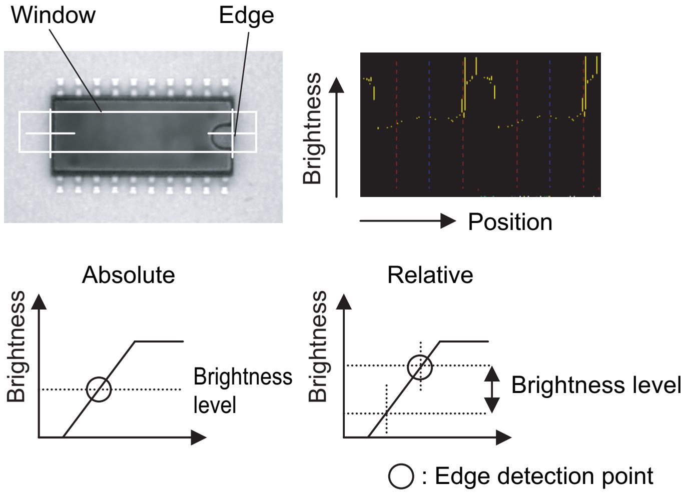
This radio button lists measurement results.

J: Distribution data

This radio button displays the distribution for the measurement results.

Note

What is an edge?



An edge is a brightness transition in the specified window, a boundary between dark grays and light ones. The DENSO μVision board offers edge detection based on brightness levels or on areas. For brightness levels, there is also a choice of absolute and relative levels for detecting transitions. Specifying absolute defines transition as crossing the specified brightness level. Specifying relative defines transition as a change in brightness or surface bigger than the specified threshold.

⚠**Caution**

Here the Target window range can have the following shapes.

- Straight line (scan = 0 or 1)
- Rectangle (scan = 0 or 1)
- Sector (scan = 0 or 1)

9.2.11.1 Specifying measurement conditions

Level

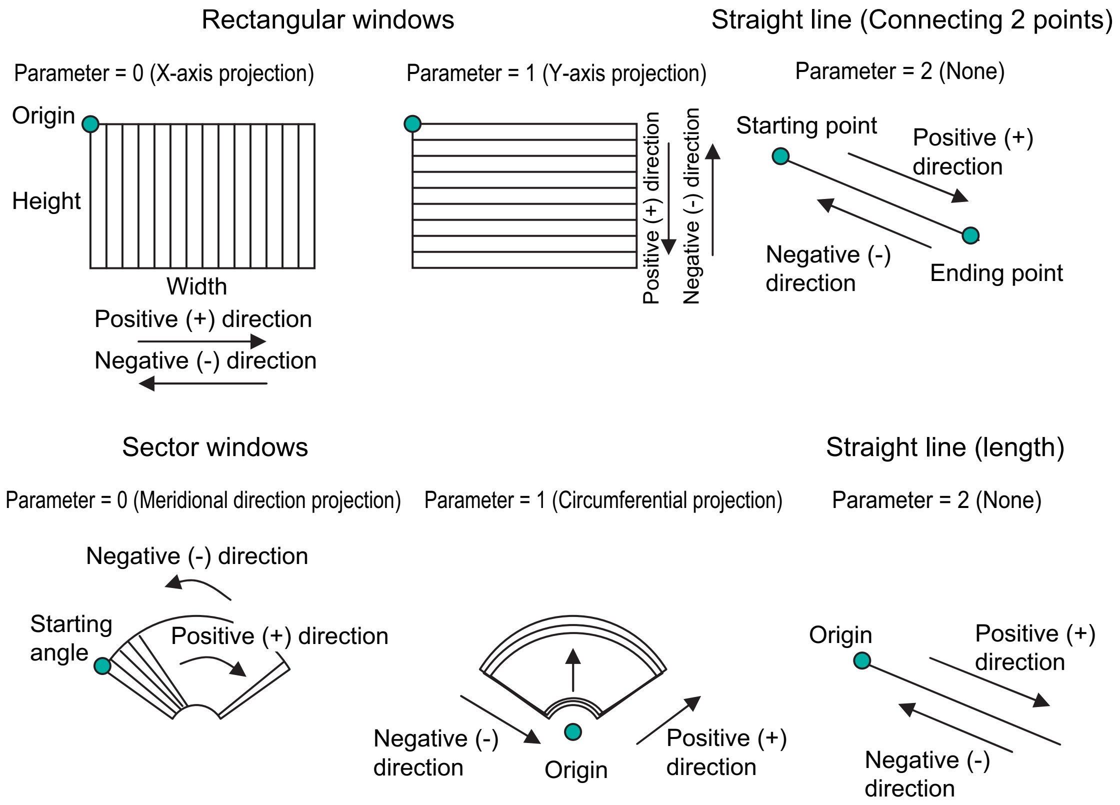
Specify the edge detection level. The range is 0 to 255 for detection using a brightness level (absolute or relative) and 0 to 512 for detection using an area (absolute or relative).

Digitization thresholds

Detection using areas requires specifying the digitization thresholds. Pixels between the two thresholds become white (1); everything else, black (0).

Scan direction

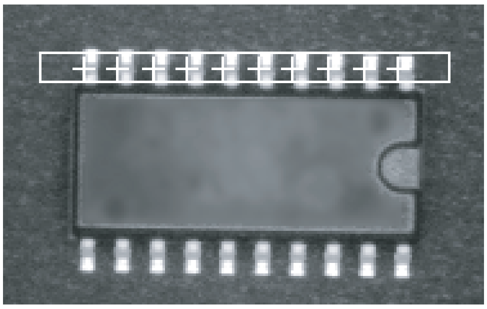
Specify the scan direction. The meaning of Positive and Negative depends on the window shape.



9.2.11.2 Detecting edges

Operating procedure

1. Choose a target window range to measure.
2. Choose the edge detection method: absolute, relative, area relative, or area relative.
3. Choose the Transition(s): 0-Black-to-White, 1-White-to-Black, or 2-Both.
4. Specify the level.
5. Choose the scan direction for scanning in the projection window: Positive or Negative.
6. Press the Measure button to display the resulting boundaries on the histogram, save them in the two boundary fields of the Digitization settings screen, and display the results in the Vision monitor window.



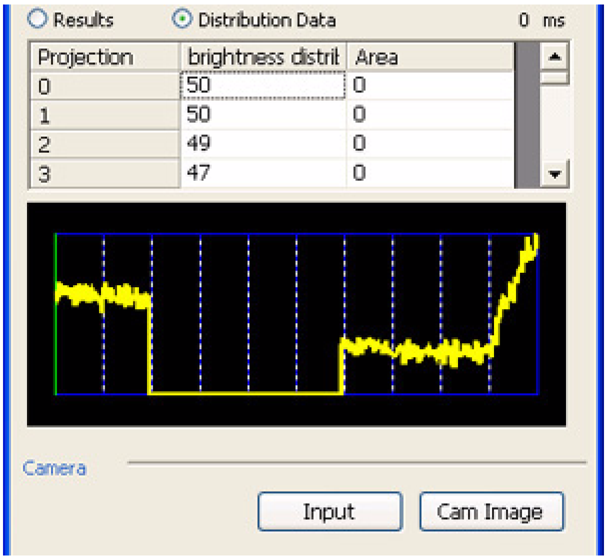
9.2.11.3 Displaying distribution and graph

The Edge settings screen displays the measurement results as either a distribution or a graph. These displays are for checking brightness and area changes in the window.

The graph display also permits checking of the brightness and area distribution for the specified location.

Distribution data

Selecting the Distribution radio button switches to the following display.



○ Results ● Distribution Data 0 ms

Projection	brightness distrit	Area
0	50	0
1	50	0
2	49	0
3	47	0

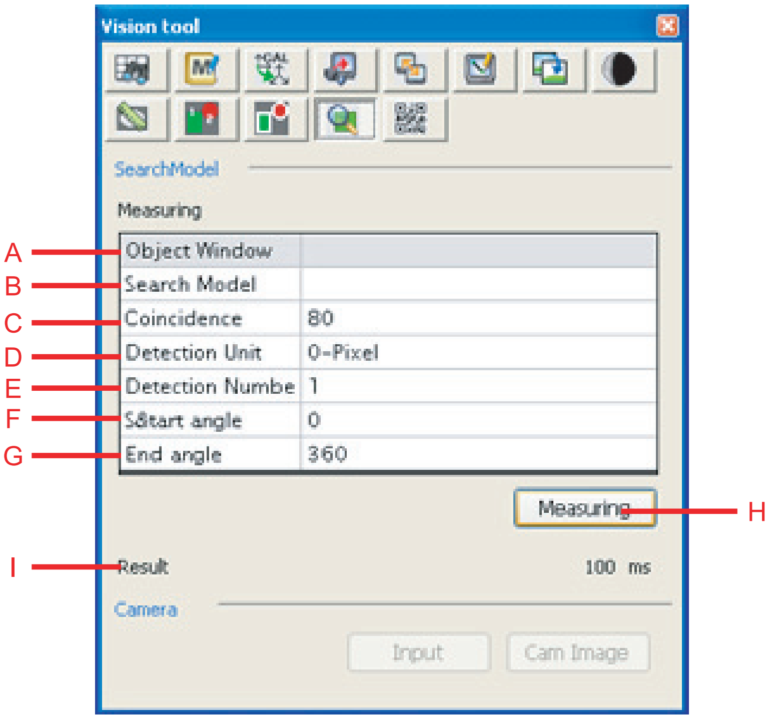
Graph display

Clicking on the Brightness distribution or Area column displays the Brightness distribution graph or Area graph, respectively. It also displays a marker at the projection position for the selected location.

9.2.12 Model search

This function runs pattern matching in the specified window using the specified search model. The search model used must be defined previously.

Model search settings screen



Vision tool

SearchModel

Measuring

Object Window	
Search Model	
Coincidence	80
Detection Unit	0-Pixel
Detection Numbe	1
S8tart angle	0
End angle	360

Result 100 ms

A: Target window

This field specifies the window range to measure.

B: Search model

This field specifies the model for the operation.

C: Match judgment

This field specifies the match judgment criterion.

D: Detection unit

This field specifies the unit for detection.

E: Detection count

This field specifies the maximum number of pattern matches to search for.

F: Starting angle

This field specifies the starting angle for the search.

G: End angle

This field specifies the end angle for the search.

H: Measure

This button proceeds with the operation.

I: Measurement results

This area displays a list of measurement results.

Note

What is a model search?

A search moves standard image data, the search model, over the specified range looking for matches. (See Figure 1.) A search model consists of image data and reference coordinates (OX, OY). (See Figure 2.) The match judgment specifies the minimum similarity, the result of a numerical comparison of the search model and the data at the current position, required to be considered a match. The precision setting specifies pattern matching alignment: at the pixel level or smaller. Subpixel measurements take longer.

Figure 1

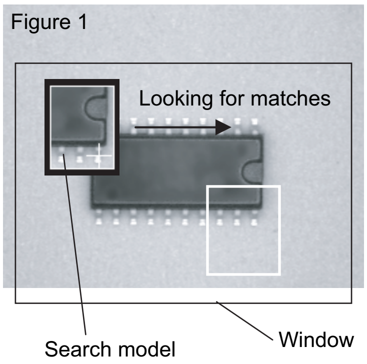
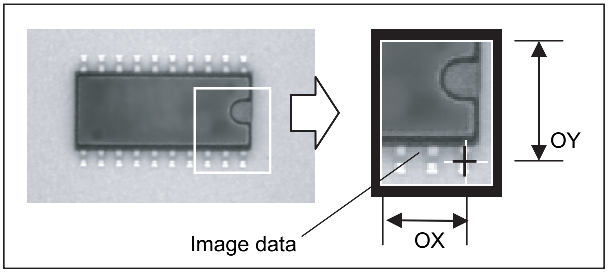


Figure 2 Search model



⚠Caution

- Only rectangular windows (angle = 0) qualify as targets.
- The two angle fields are not available when the robot controller does not support angle measurements.

9.2.12.1 Specifying measurement conditions

Target window range to measure.

Search model

This field specifies the search model to use.

Match judgment

This field specifies the minimum score considered a match.

Detection unit

This field specifies the precision for pattern matching coordinates: pixel or subpixel. Specifying subpixel means that measurements take longer.

Detection count

This field specifies the number of matches expected. Reaching this limit produces normal termination. Otherwise, the operation times out with an error message. In the latter case, try reducing this setting.

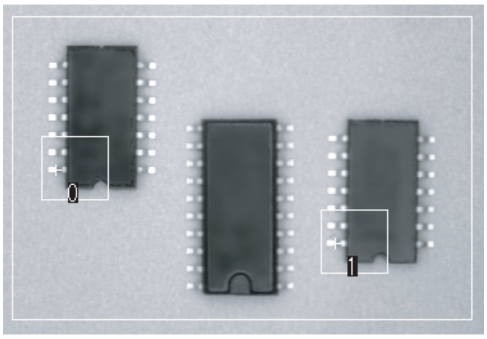
Starting and end angles

These fields specify the angle range for the search. The search looks for matches between the two angles about the origin.

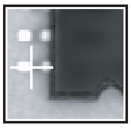
9.2.12.2 Running a model search

Operating procedure

1. **Choose a target window range to measure.**
2. **Choose a search model.**
3. **Specify the match judgment criterion.**
4. **Choose the detection unit: pixel or subpixel.**
5. **Specify the detection count.**
6. **Specify the starting and end angles.**
7. **Press the Measure button to display the resulting boundaries on the histogram, save them in the two boundary fields of the Digitization settings screen, and display the results in the Vision monitor window.**



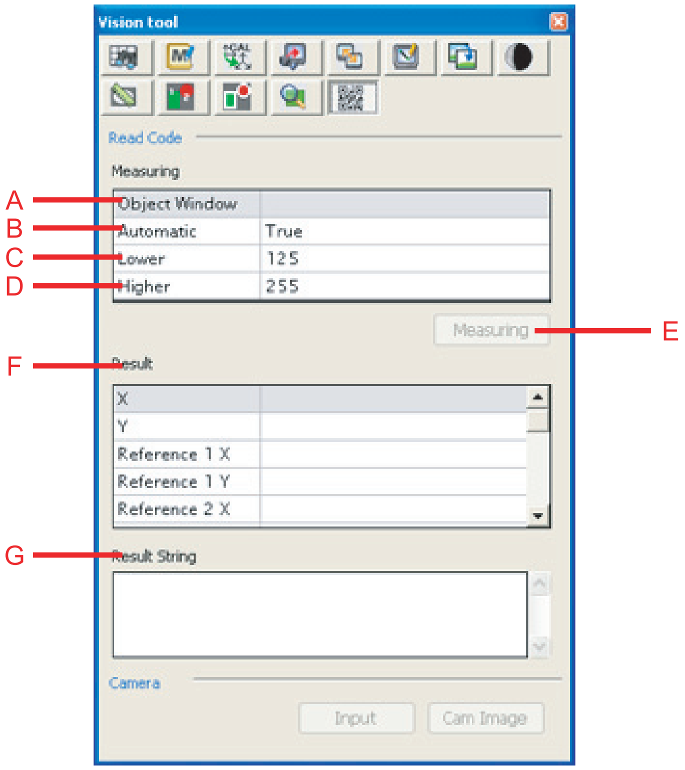
Search model



9.2.13 Reading a QR Code symbol

This function reads in a QR Code symbol from the specified window..

Code reading settings screen



Object Window	
Automatic	True
Lower	125
Higher	255

Result

X	
Y	
Reference 1 X	
Reference 1 Y	
Reference 2 X	

A: Target window

This field specifies the window range to measure.

B: Automatic digitization

Choosing True specifies automatic digitization.

C: Digitization upper threshold

D: Digitization lower threshold

These two fields display/specify the digitization thresholds for image analysis.

E: Measure

This button proceeds with the operation.

F: Results

This area displays a list of measurement results.

G: Result string

This area displays the corresponding string.

9.2.13.1 Specifying measurement conditions

Automatic digitization

Enable or disable automatic digitization. Choosing True specifies automatic digitization.

Digitization thresholds

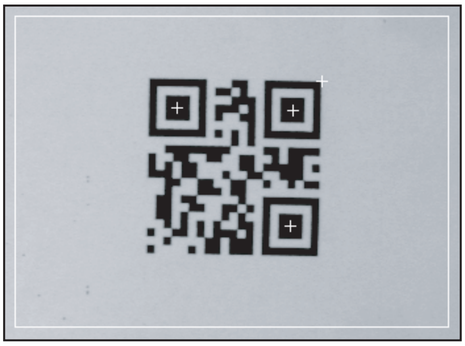
If automatic digitization has been disabled, these two fields specify the two boundaries used in digitization.

9.2.13.2 Reading in a QR Code symbol

Operating procedure

1. **Choose a target window range to measure.**
2. **Enable or disable automatic digitization.**

   Choose True for automatic digitization. Otherwise, specify the thresholds with the Register digitization settings screen.
3. **Press the Measure button to display the resulting boundaries on the histogram, save them in the two boundary fields of the Digitization settings screen, and display the results in the Vision monitor window.**



Chapter 10 Appendices

10.1 List of Prohibited Characters

Use of the following characters is prohibited in file names (e.g., program names and project names).

Using any of those characters results in an error during file transfer between WINCAPS III and the robot controller or during loading or compilation in the robot controller.

Single-byte characters

[\

Double-byte characters

∵ ― Ъ Ы ー ソ ゼ Ⅷ Ⅸ
十 夕 予 申 充 圭 措 啓 貼 端 構 欺 暴 骸
表 房 納 票 能 深 梗 甜 禄 擬
纂 麓 兌 喙 媼 彈 拏 喀 媾 彌 拿 杤 歃 濬
杣 歇 濕 畆 禹 綣 膽 畚 秉 綵 臀 藹 觸 軆
黎 觴 躱 鐚 饉 鷦 倞 鐔 饅 鷭 偆 砡 纊 犾
劯 犱 噂 浬 曾 箪 兔

10.2 Simple position correction function

Robot position can be corrected easily with WINCAPS III.

The three points below can be corrected.

CALSET

Corrects the CALSET value. It rewrites the CALSET value properly with reference to the reference position when a motor is replaced or the CALSET value is deleted.

TOOL

Corrects the value of the selected TOOL. It is used when an end-effector such as a hand is remade, replaced, or newly created.

WORK

Corrects the value of the selected WORK. It is possible to correct the set WORK coordinates all at the same time when the robot mounting position has been changed.

Note

User level: you need to log in as a programmer.

DENSO ROBOT

Programming Support Tool

WINCAPSIII GUIDE

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10N**C

The purpose of this manual is to provide accurate information in the handling and operating of the robot. 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.
In no event will DENSO WAVE INCORPORATED be liable for any direct or indirect damages resulting from the application of the information in this manual.