OMRON

Programmable Terminal NA-series

Practice Guide
Subroutine Functions

NA5-15□101□
NA5-12□101□
NA5-9□001□
NA5-7□001□

SYSMAC
always in control

V449-E1-01

■ Introduction

This guide provides reference information when designing NA screens. It does not provide safety information. Be sure to obtain the NA-series Programmable Terminal User's Manuals, read and understand the safety points and other information required for use, and test sufficiently before actually using the equipment.

Terms and Conditions Agreements

Thank you for your usage of products of Omron Corporation (“Omron”). Without any special agreements, these terms and conditions shall apply to all transactions regardless of who sells.

● Definitions of Terms

- Omron product(s): Omron’s factory automation system devices, general control devices, sensing devices, and electronic/mechanical components.
- Catalogues: Any and all catalogues (including “Best Components” and other catalogues), specifications, instructions and manuals relating to Omron products, including electronically provided data.
- Conditions: Use conditions, rating, performance, operating environment, handling procedure, precautions and/or prohibited use of Omron products described in the catalogues.
- User application(s): Application of Omron products by a customer, including but not limited to embedding/using Omron products into customer’s components, electronic circuit boards, devices, equipment or systems.
- Conformity: (a)conformity, (b)performance, (c) no infringement of intellectual property of third party , (d)compliance with laws and regulations, and (e) conformity to various standards of Omron products in user applications.

● Note about Descriptions

Understand the followings as to contents of the catalogues.

- Rating and performance is tested separately. Combined conditions are not warranted.
- Reference data is intended to be used just for reference. Omron does NOT guarantee that the Omron Product can work properly in the range of reference data.
- Examples are intended for reference. Omron does not warrant the conformity in usage of the examples.
- Omron may discontinue Omron products or change specifications of them because of improvements or other reasons.

● Note about Use

Adopt and use Omron products considering the following cautions.

- Use the product in conformance to the conditions, including rating and performance.
- Check the conformity and decide whether or not Omron products are able to be adopted. Omron makes no guarantees about the conformity.
- Make sure in advance that electricity is properly supplied to Omron products and they are set up rightly in your system for intended use.
- When you use Omron products, ensure the followings: (i) allowance in aspect of rating and performance, (ii) safety design which can minimize danger of the application when the product does not work properly, (iii) systematic safety measures to notify danger to users, and (iv) periodical maintenance of Omron products and the user application.
- Omron assumes no responsibility for any direct or indirect loss, damage and expense resulting from infection of our products, installed software, any computer devices,

computer programs, network, and databases with the followings:
- DDoS attack (distributed DoS attack),
- Computer virus and other technically harmful program, and
- Unauthorized access.

Please conduct the followings by yourself: (i) antivirus software, (ii) data input/output, (iii) lost data

recovery, (iv) protections against computer virus that contaminate Omron products or the installed software, and (v) measures to protect Omron products from unauthorized access.

- Omron products are designed and manufactured as commodity for general industrial products. For this reason, the usages (a) to (d) are to be unintended. Omron makes no guarantees on Omron products, if you use Omron products for those purposes.

However, special applications that Omron expects or usages with especial agreement are excluded.

(a) Applications requiring high-level safety (e.g. nuclear control facilities, combustion facilities, aerospace and aviation facilities, railroad facilities, elevating facilities, amusement facilities, medical facilities, safety devices or other applications which has possibility to influence lives or bodies)

(b) Applications requiring high reliability (e.g. gas/water/electricity supply system, 24-hour operating system, applications handling with rights/property, such as payment system)

(c) Applications in a harsh condition or environment (e.g. outdoor facilities, facilities with potential of chemical contamination or electromagnetic interference, facilities with vibration or impact, facilities on continual operation for a long period).

(d) Applications under conditions or environment which are not described in the catalogues

- Omron products in the catalogues are not intended to be used in automotive applications (including two-wheel vehicles). Please DO NOT use Omron products in automotive applications. Contact our sales personnel for automotive products.

● Warranty

Warranty of Omron products is subject to followings.

- Warranty Period: One year after your purchase. However, except when there is a separate statement in the catalogues.
- Coverage: Omron will provide one of the services listed below, on the basis of Omron's decision.
  (a) Free repairing of the malfunctioning Omron products (except electronic/mechanical components) at Omron maintenance service sites.
  (b) Free replacement of the malfunctioning Omron products with the same number of substitutes.
- Exceptions: This warranty does not cover malfunctions caused by any of the followings.
  (a) Usage in the manner other than its original purpose
  (b) Usage out of the conditions
  (c) Usage out of Note about Use in these conditions
  (d) Remodeling/repairing by anyone except Omron
  (e) Software program by anyone except Omron
  (f) Causes which could not be foreseen by the level of science and technology at the time of shipment of the products.

(g) Causes outside Omron or Omron products, including force majeure such as disasters

● Limitation of Liability

The warranty described in this Terms and Conditions Agreements is a whole and sole liability for Omron products. There are no other warranties, expressed or implied. Omron and its distributors are not liable for any damages arisen from or relating to Omron products.

● Export Controls

Customers of Omron products shall comply with all applicable laws and regulations of other relevant countries with regard to security export control, in exporting Omron products and/or technical documents or in providing such products and/or documents to a non-resident. Omron products and/or technical documents may not be provided to customers if they violate the laws and regulations.

Contents

1 Related Manuals

The following manuals are related to this manual.

Cat.No.	Model	Manual's Title
W504	SYSMAC-SE2□□□	Sysmac Studio Version 1 Operation Manual
V117	NA5-15W□□□□ NA5-12W□□□□ NA5-9W□□□□ NA5-7W□□□□	Programmable Terminal User's Manual (Hardware)
V118	NA5-15W□□□□ NA5-12W□□□□ NA5-9W□□□□ NA5-7W□□□□	Programmable Terminal User's Manual (Software)
V119	NA5-15W□□□□ NA5-12W□□□□ NA5-9W□□□□ NA5-7W□□□□	Programmable Terminal User's Manual (Device Connection)
V120	NA5-15W□□□□ NA5-12W□□□□ NA5-9W□□□□ NA5-7W□□□□	Programmable Terminal Startup Guide

2 Overview

2-1 What Is Subroutine?

A function on NS series to create and execute your own, simple program is called macro. This function is called *Subroutine* in NA series.

Subroutine can perform a function that is not supported by NA's basic function as with the existing macro:
- Set desired processing on an event freely, and
- Discriminate arithmetic operations and conditions.

2-2 Subroutine Language Specification

NA series subroutine is described in VisualBasic.

You can use commands written in Visual Basic in NA series subroutine. However, not all the VisualBasic functions and commands used on Windows PC cannot be used.
Operations of VisualBasic commands are limited on NA series.

Additional Information

Commands for NA series consist of operators/functions described in Subroutine Reference Manual, NA-only functions and NA-only objects.
Select Help (H) - Instruction Word (I) under SysmacStudio Menu Bar. Then you can see Subroutine Reference Manual.

Precautions for Correct Use

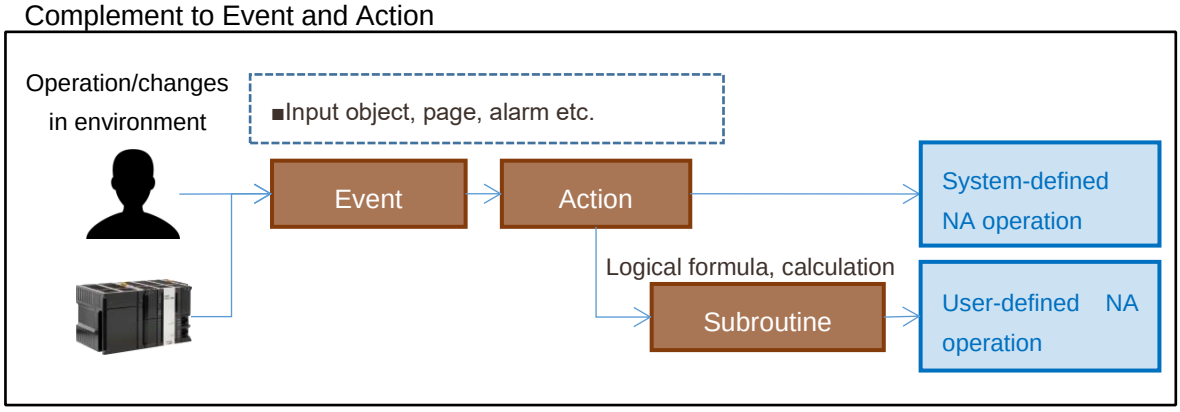
VisualBasic of NA series doesn't have library install/import function to connect external devices. For this reason, external devices that require library installation and operation by driver cannot be installed to NA.

2-3 Operation Overview

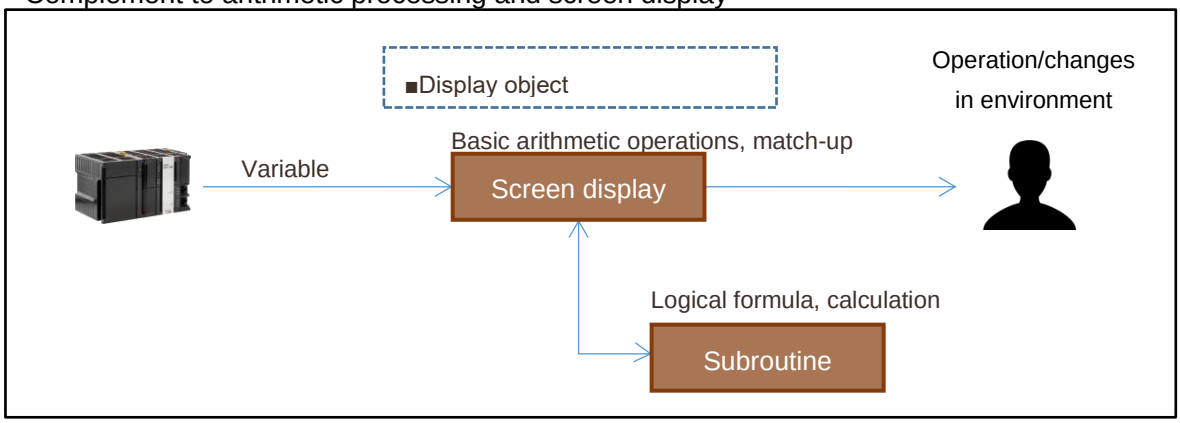
NA series subroutines are used to execute the following two processings:

- ○ Complement Event and Action, and
- ○ Complement arithmetic processing and screen display.

Complement to Event and Action



Complement to arithmetic processing and screen display



Additional Information

Refer to page 31, “Supplementary Note” for details.Commands for NA series consist of operators/functions described in Subroutine Reference Manual, NA-only functions and NA-only objects.
Select Help (H) - Instruction Word (I) under SysmacStudio Menu Bar. Then you can see Subroutine Reference Manual.

3 Event and Action

3-1 What Are Event and Action?

NA series can detect operations from outside and data changes with Event function.
Various controls are possible if you set basic operations and subroutines to an Action and register that Action with a detected Event.

3-2 Types of Event

The actions with what subroutines can be registered on NA series are to be registered with the following five types of event.

Type	Where to set	Event that a subroutine is settable
Global event	NA's setting screen, global events in Multiview Explorer	Start a project, conditions, fixed cycle, Function Key operation
Page event	NA's setting screen, events and actions when a screen page is opened	Open a page, close a page, conditions, Function Key operation
Object event	NA's setting screen, events and actions when a component on the screen is selected.	Major settable items differ by component (e.g. Touch, Release). Some components don't have setting items.
Alarm event	NA's setting screen, events and actions when an alarm item that is described in User alarm/Multiview Explorer is selected	Issuing an alarm, checked, cancelled
IAG event	NA's setting screen, events and actions when an IAG component on the screen is selected	The event which is created at the same time that IAG is made.

Additional Information

IAG (Intelligent Application Gadget) is the function loaded on NA series. It modularizes a project to re-use it easily. You can develop a screen with speed and ease.

Precautions for Correct Use

Only on-screen IAG component that has registered an event can be set for IAG event. If an event has not been registered on an IAG component, any registrable event is not listed even though you select an IAG component. As a result, you cannot inscribe an action.

3-2-1 Events Settable to Global /Page Event

Event	Description	Global event	Page event
Condition	Occurs when the set condition is met.	○	○
Click F1 key[*1 *3]	Occurs when F1 key is released.	○	○
Touch F1 key[*1]	Occurs when F1 key is pressed.	○	○
Release F1 key[*1 *3]	Occurs when F1 key is released.	○	○
Click F2 key[*1 *3]	Occurs when F2 key is released.	○	○
Touch F2 key[*1]	Occurs when F2 key is pressed.	○	○
Release F2 key[*1 *3]	Occurs when F2 key is released.	○	○
Click F3 key[*1 *3]	Occurs when F3 key is released.	○	○
Touch F3 key[*1]	Occurs when F3 key is pressed.	○	○
Release F3 key[*1 *3]	Occurs when F3 key is released.	○	○
Periodic execution	Occurs in determined intervals.	○	-
Start project[*2]	Occurs when a project is formatted.	○	-
Display page	Occurs while a page is displayed.	-	○
Non-display page	Occurs while a page is hidden.	-	○

*1) Setting for F1-F3 keys of page events has priority over those of projects.
That means you can set two operations to one key and use them: the operation of a function which is set with a project and the one which performs in a specific page.

*2) Result of access to external variables is not certified at the start of a project just after start-up. Avoid the processing that requires access to external variables.

*3) Both Click and Release occur when an object is released, but performances at page switching are different:
- Click event is not issued when a page is switched with pressing an object, and
- Release event is issued when a page is switched with pressing an object.

3-2-2 Events Assignable to Object Event

Event	Description
Click[*1]	Generated when an object is released.
Touch	Occurred while an object is pressed.
Release[*1]	Occurred while an object is released.
Change Select	Generated when selected item is changed.
Checked	Occurred when you check a box.
Unchecked	Occurred when you uncheck a box.

*1) Both Click and Release occur when an object is released, but performances at page switching are different:
- Click event is not issued when a page is switched with pressing an object,
- Release event is issued when a page is switched with pressing an object.

Components and assignable events

Component	Click	Touch	Release	Checked	Unchecked	Change Select
Button	○	○	○	-	-	-
Momentary Button	○	○	○	-	-	-
Reset Button	○	○	○	-	-	-
Set Button	○	○	○	-	-	-
Toggle Button	○	○	○	-	-	-
Ellipse	-	○	○	-	-	-
Curve	-	○	○	-	-	-
Rectangle	-	○	○	-	-	-
Triangle	-	○	○	-	-	-
Polygon	-	○	○	-	-	-
Line	-	○	○	-	-	-
Polyline	-	○	○	-	-	-
Flags	-	○	○	-	-	-
Label	-	○	○	-	-	-
Data Edit	-	○	○	-	-	-
Data Display	-	○	○	-	-	-
DateTime	-	○	○	-	-	-
Textbox	-	○	○	-	-	-
Arrow (except curved)	-	○	○	-	-	-
Checkbox	-	-	-	○	○	-
Radio Button	-	-	-	○	○	-
Tab Control	-	-	-	-	-	○
Drop-down	-	-	-	-	-	○
Listbox	-	-	-	-	-	○

Additional Information

The following components (not listed) cannot be set to the events:
- Lamp (bit/data),
- Standard Control (slider),
- Gauge (circle/semicircle/horizontal/vertical),
- HMI Control (trend graph/line graph/media player/user alarm viewer/recipe viewer).

NOTE: User alarm viewer has no assignable event item. However, events can be set on User alarm on which each user alarm condition is registered.

Precautions for Correct Use

Since National flag is consisted with image components, you can set a Touch/Release event to it as is the case with image components.
Except curved arrows, Touch/Release events are able to be set on most arrows.
Factory equipment images (e.g. conveyor, tank) have no assignable event.

3-2-3 Events Assignable to User Alarm Event

Event	Description
Acknowledged	Occurs when a user alarm is checked.
Cleared	Occurs when a user alarm is cancelled.
Raised	Occurs when a user alarm is issued.

3-2-4 Events Assignable to IAG Object Event

Event	Description
(User-defined name)	Occurred according to an event generation condition of an IAG component.

Precautions for Correct Use

You cannot set a new event (e.g. Touch/Click) to an object of IAG component placed on the screen.
It is necessary to register an operation event as the event that IAG component issues before you create an IAG component.

3-2-5 Events Assignable with IAG Project

Actions on which the usable subroutines are set can be registered to the events below. I

Type	Where to set	Event that a subroutine is settable
IAG component screen event	IAG creating screen, events and actions when an IAG component is opened.	Conditions
Object event	IAG creating screen, events and actions when a component placed in IAG component frame is selected.	Major settable items differ by component (e.g. Touch, Release). Some components don't have setting items.

Precautions for Correct Use

IAG component event basically conforms to a page event and an object event at NA screen creation.
Since IAG component has no notion of page, the events related to page open/close operation of external function key are not available.

3-3 Configuration for Action

Prepared action items for basic operation (e.g. screen switching) make NA control easier.

Standard actions for events include subroutines with NA series.
Select Subroutine in Action Settings, and enter the name of the subroutine to variable. Then you can execute the subroutine that is assigned as an action for each event.

Additional Information

Actions settable to an event have various configuration items other than subroutine.
Refer to page 28, "Supplementary Note".

4 Subroutine

4-1 Types of Subroutine

Three types of subroutines are used with NA series.

Type	Description	Trigger	Operation condition
Global subroutine	Common subroutine in a whole project. It is created under a global subroutine of HMI project.	Global event Page event Object event User alarm event Call from Global subroutine	All time
Page subroutine	Subroutine for each page. You can generate it with code editor of HMI project page. Also a subroutine can be created directly for each event of an object in a page.	Page event Object event	A target page is displayed.
IAG subroutine	You can describe executable subroutines inside IAG components with the operation event of IAG component's objects.	IAG object event	A page with IAG is displayed.

Additional Information

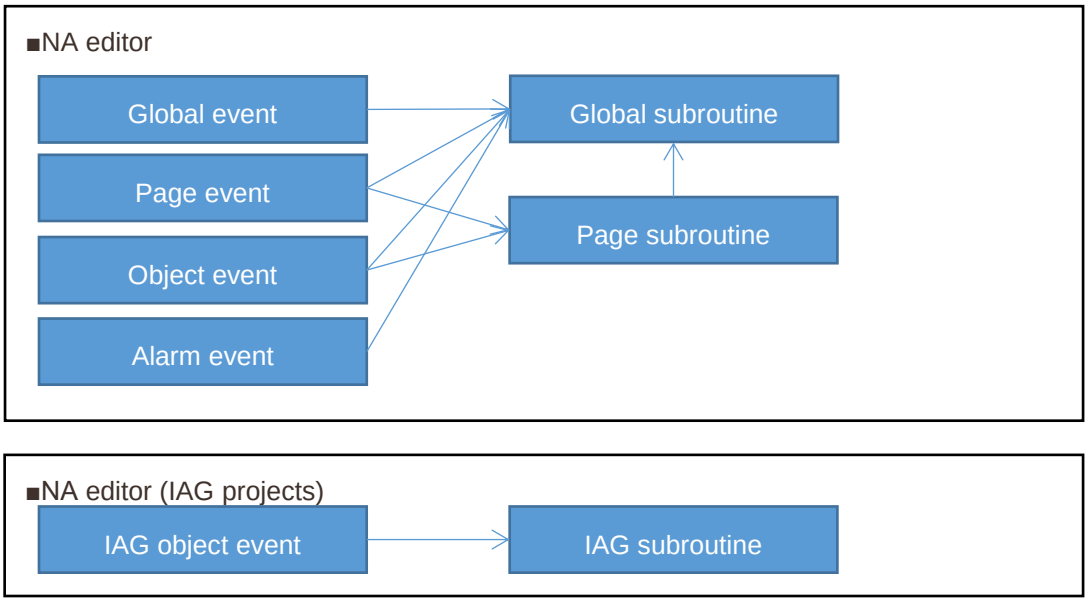
You can refer to the subroutine names of each item in a list using code explorer of SysmacStudio.

Precautions for Correct Use

Subroutines described inside IAG components are not able to be referenced from a project's code explorer in NA editor.
You can refer to them from only a project in which that IAG component has been created.

4-2 Call Out a Subroutine

In NA series, you can execute an Event that contains a subroutine by setting a subroutine name as a parameter. The subroutine should be set to the Event's Action.



Precautions for Correct Use

Global subroutines are able to be called out from all the events and executed.
A Page subroutine that is described in another page cannot be called out to execute it.
To call and execute that subroutine, describe its name in the subroutine code (nesting).

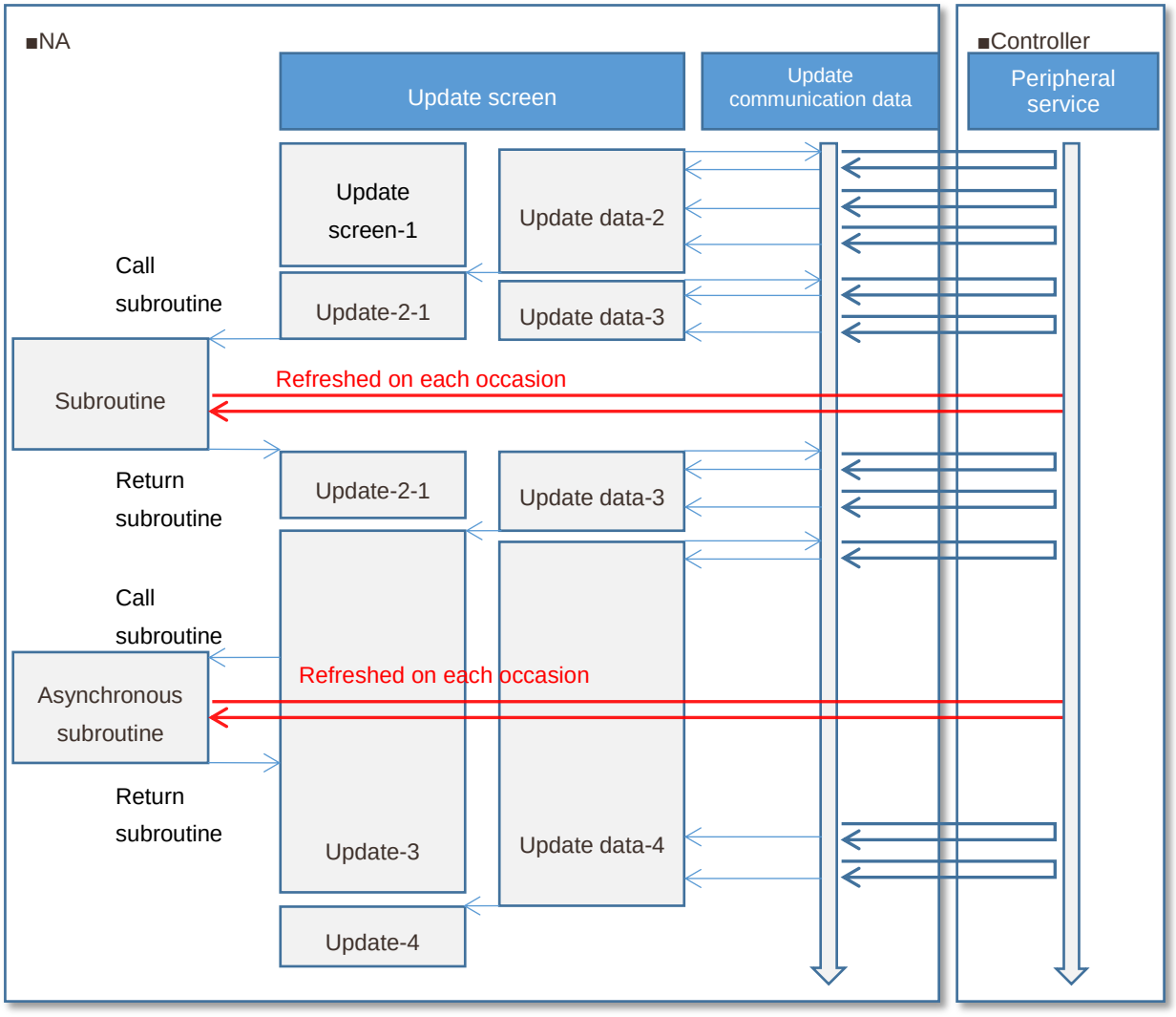
4-3 Operation

Regardless of the type of subroutine, every subroutine is executed as a synchronous operation after an event is driven. All other processings stop until the subroutine process ends.

A global subroutine has configuration for variable asynchronous operation of an event. The subroutine processing which is set on the event's action with this configuration is implemented as asynchronous operation.

When a global variable that is mapped by a controller is accessed, communication is started. It happens because current variable of a controller's main unit is updated when the code accesses.

The following shows interior behaviors in NA while a subroutine is executed.



Precautions for Correct Use

Frequent repetition processing (e.g. For Next) or access to controller's global variable may slow down screen update processing.
Asynchronous configuration for events will prevent it.

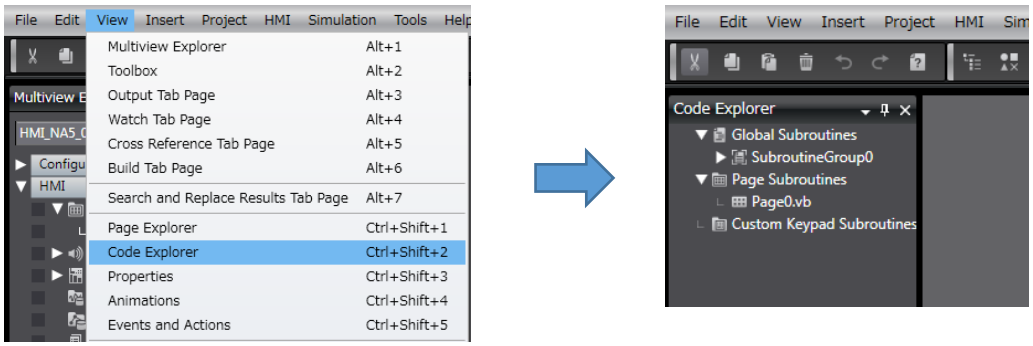
4−4 Location to Describe

Basic functions for locations where to describe subroutines are explained in this section.

4-4-1 Code Explorer

Code Explorer is useful to display and edit code that used in a project.

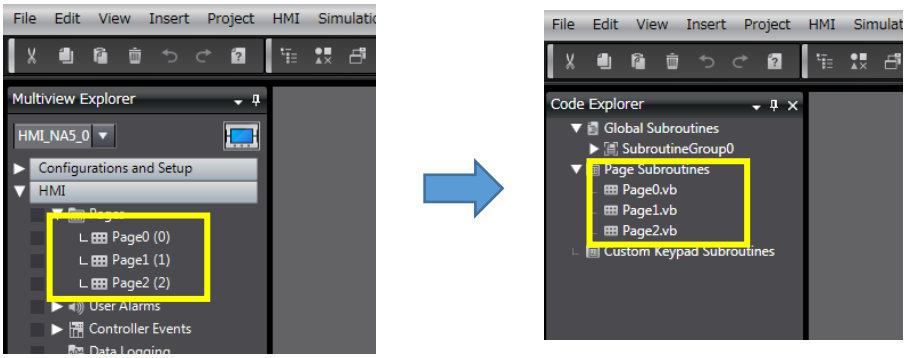
Code Explorer is displayed at the left side of the same window of Multiview Explorer or Page Explorer. You can access all the code of a project easily.
Select Code Explorer to display it. The screen will appear (below).



A global subroutine “SubroutineGroup0” and a page subroutine for Page0 “Page0.vb” has been generated initially in Code Explorer.
When a new page is added in HMI, Multiview Explorer, then the subroutine for the page is added in Code Explorer.

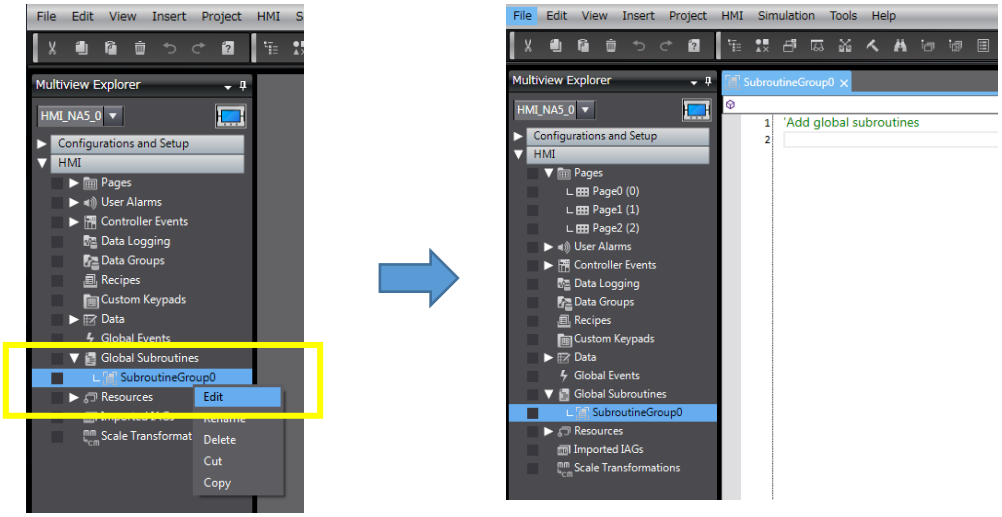
[Example]
Add Page1 and Page2 to the current page. Page1.vb and Page2.vb are added in Code Explorer.

Double-click the page title which you want to edit. Code Editor screen appears.



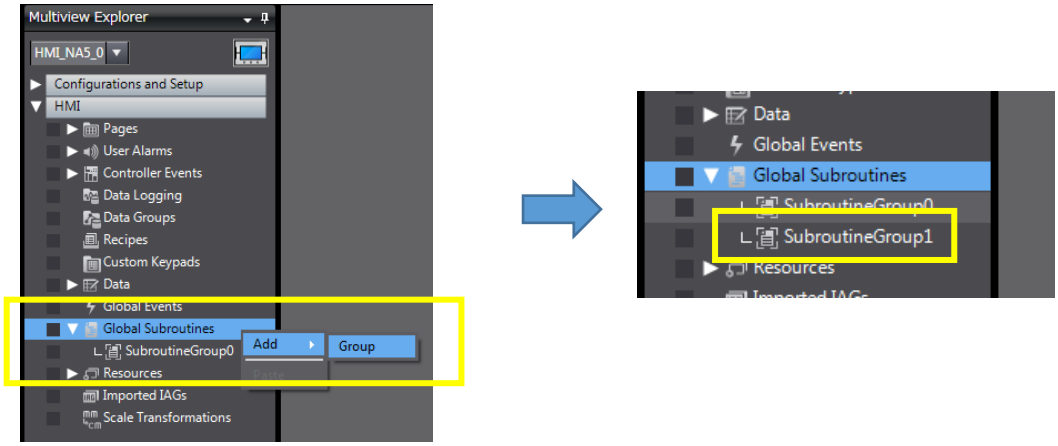
4-4-2 Global Subroutine

Select the subroutine group name under Global Subroutines in Multiview Explorer. Right-click it and a sub menu appears. Click Edit, then the code of the subroutine group is displayed.
Global subroutines are written in this screen.



You can add a group name for global subroutine.

Select Global Subroutines in Multiview Explorer and right-click it. A sub menu appears. Click Add - Group, then a new subroutine group is created.



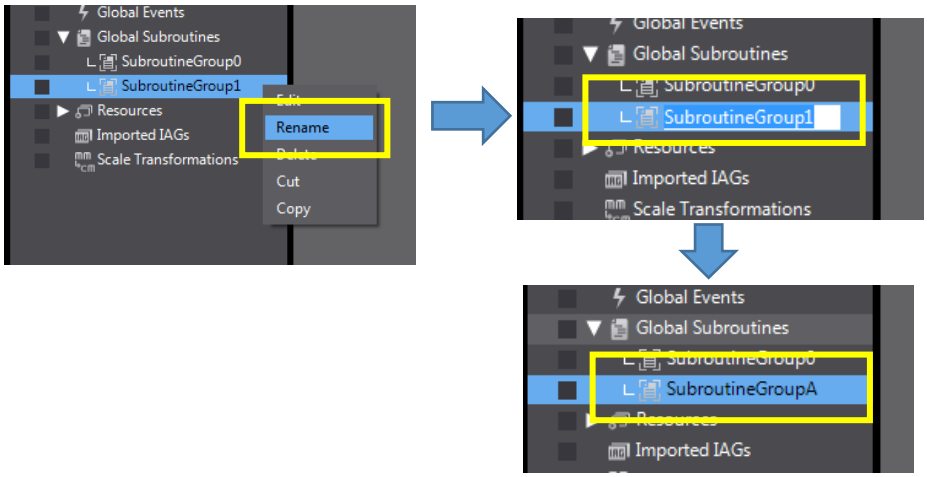
Additional Information

Every subroutine code of all the events in a project can be described in Global Subroutines area.
Adding groups and name them functions name makes it easier to handle them as global subroutines by function.

○ Change subroutine's group name

Choose the subroutine group in Global Subroutines/Multiview explorer. Right-click it, then the submenu appears. Click Change Name to change the name of the subroutine group.

[Example]
Change "SubroutineGroup1" to "SubroutineGroup_A"



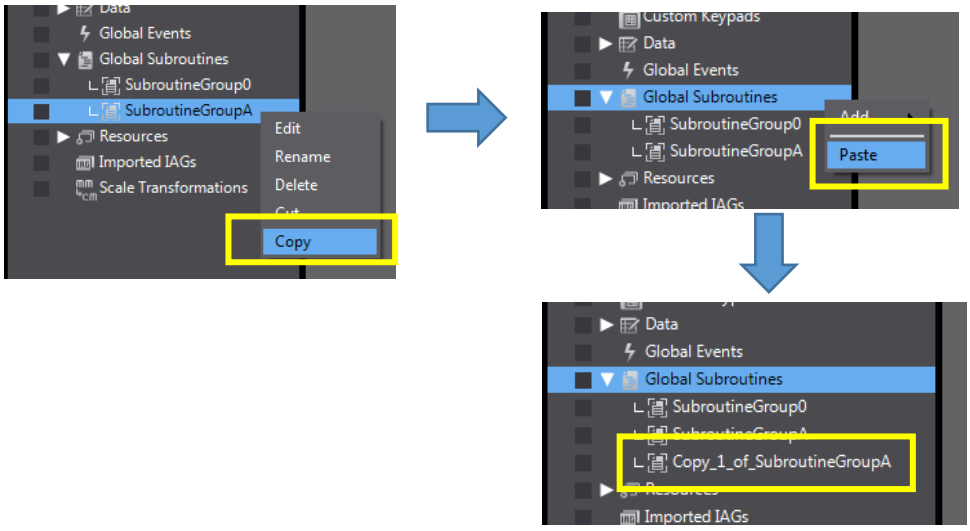
○ Copy a global subroutine group

Choose the subroutine group in Global Subroutines/Multiview Explorer. Right-click it, then the sub menu appears. Select Copy.

Right-click Global Subroutine in Multiview Explore. Select Paste in the sub menu.

Copy of the subroutine group including code is pasted.
Change the group name to identify it easily. Use Rename.

Build error results if more than one subroutines with the same name exist in one project. To avoid the error, change the subroutine name in the copied group.

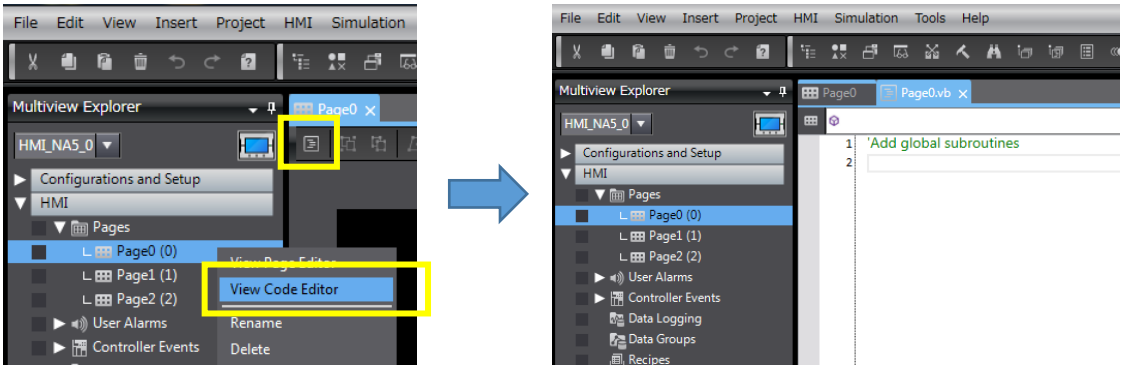


4-4-3 Page Subroutine

Choose the page name in HMI/Multiview Explorer. Right-click it, then the submenu appears. Select View Code Editor to display the code of the page.

The code is also shown clicking  icon in Page Editor screen.

Page subroutines are described in the screen below.

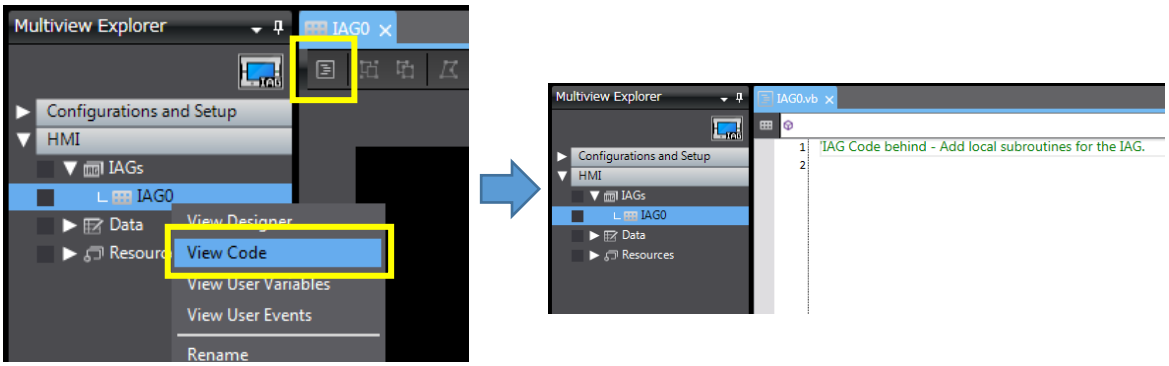


4-4-4 Code View of IAG Component Creation Screen

Select the IAG component and right-click to display submenu. Click View Code, then the code of the page is shown.

The code is also shown clicking  icon in Design view screen.

Subroutines of IAG project is described in the screen below.

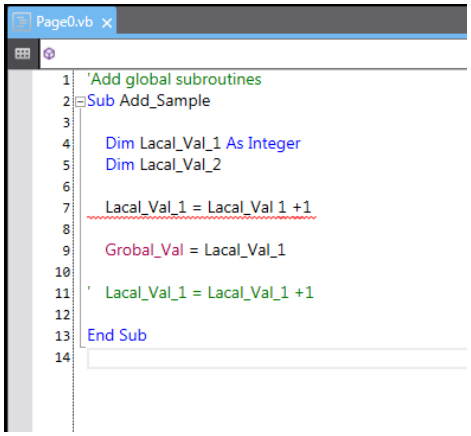


4-5 Assistance Function

4-5-1 Color Code

A code screen where subroutines are described has Color code to support users to write syntaxes.

The followings are examples of Color code.



- Blue : Reserved word for VB system. E.g. Sub, Dim, Call
- Red : Variable which registered in Global variable list
- Green : Comment line. A line with a "' "on the head becomes a comment line.
- Red underline : Syntax error

Additional Information

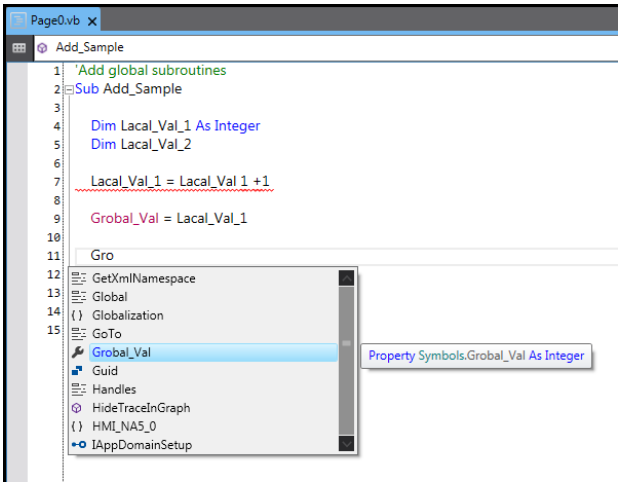
There are two types of syntax error display: which is displayed on input and which shows an error after build execution.
An error display after build execution (with red underline) doesn't automatically disappear even if corrected.
It disappears after the build is executed again and ensured that it is correct.

4-5-2 IntelliSense

When you enter an object name or a library command name to edit code, the code editor automatically shows a list of candidate. This function is called IntelliSense.
Using IntelliSense, you can check a variable's spelling or objects and methods to be used.

If a context of VB program is right, IntelliSense is automatically popped-up.
If not, you are possibly making a mistake.

Ctrl-Alt-Space makes IntelliSense popped-up anywhere and shows every possible option.

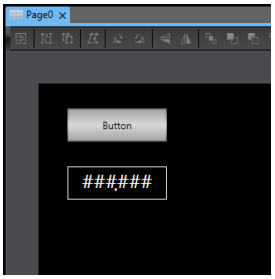


5 Subroutine Creating Procedure

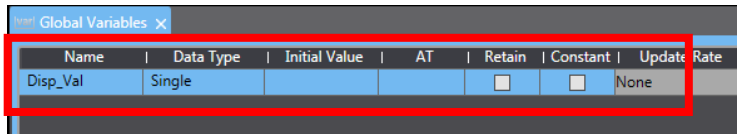
5-1 NA Project

The following is a procedure to set subroutines on events and actions on the component placed on the screen.

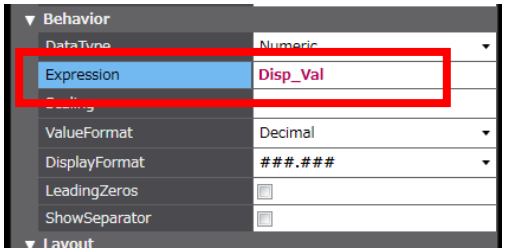
1. Put a button and a data display component on a Page screen.



2. Enter a variable which is to be assigned to the data display component in Global Variables table.
[Example]
A single type variable Disp_Val is registered.

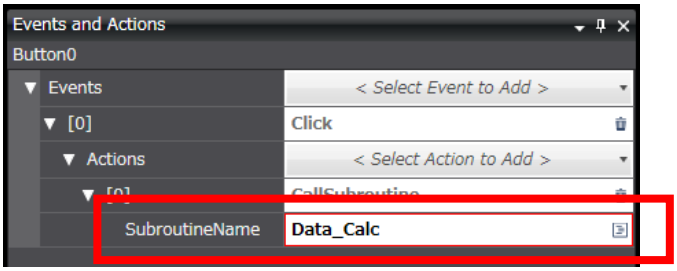


3. Enter the variable of the previous section, Disp_Val, in Conditional Expression/Operation field in Data display component property.

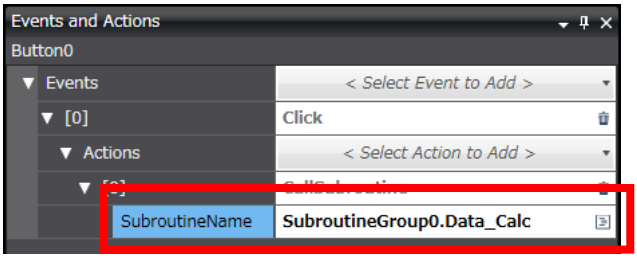


4. Choose Click in Events field of Events and Actions.
Enter the subroutine's name in SubroutineName to assign the subroutine to the action.
[Example]
SubroutineName: Data_Calc

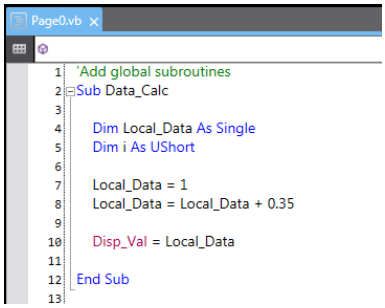
NOTE: The frame of Subroutine Name field is red (means error) because the subroutine code has not been described yet at this point.



5. If you want to describe the subroutine code in Global subroutine, enter the subroutine name with its global subroutine group name.

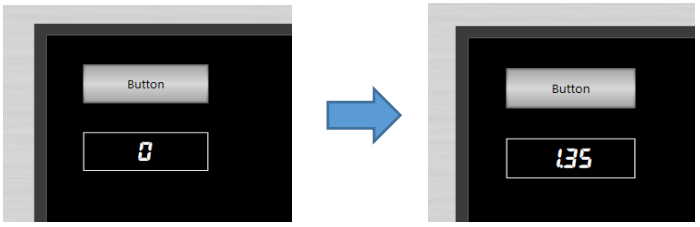


6. Open the code editor of the current screen to write the code. Execute the build to test.



7. Startup a simulator to check operation.

   Confirm if the data display component shows the result of subroutine after pressing the onscreen button.



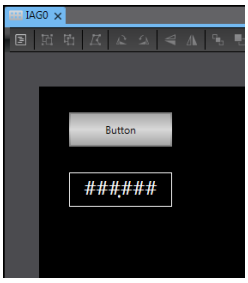
Additional Information

- A subroutine is executed only once and ends after it is called out.
- Declared variables in a subroutine cannot be assigned to screen components.
- Only variables which registered in Global Variables table can be assigned to screen components.
- In order to display a variable that declared and operated in a subroutine, execute the following processes for a variable registered in Global Variables table:
  1) Assign it to a component's property, and
  2) Substitute the value within the subroutine process.

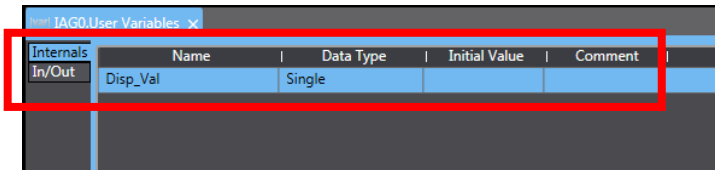
5-2 IAG Project

Subroutines in IAG projects are described basically in the same way as those in NA projects. The following is a procedure to assign subroutines to events and actions of onscreen components.

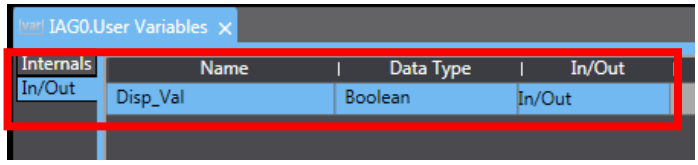
1. Place a button and a data display component on a screen of IAG component.



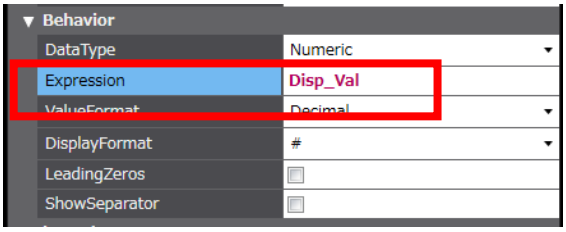
Open IAG user variable view.
Enter a variable to be assigned to the data display component in Internal variable table/IO variable table.
[Example]
A single type variable Disp_Val is registered.



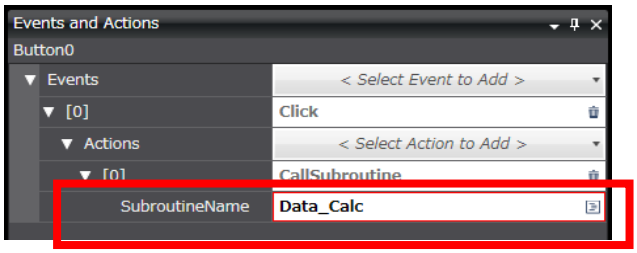
NOTE:
Internal variable table is for the variables used only within IAG. IO variable table is used when you use the same variable in the screen with the IAG component. It is necessary to change IO configuration, from In to In/Out.



2. Enter the variable of the previous section, Disp_Val, in Conditional Expression/Operation field in Data display component property.

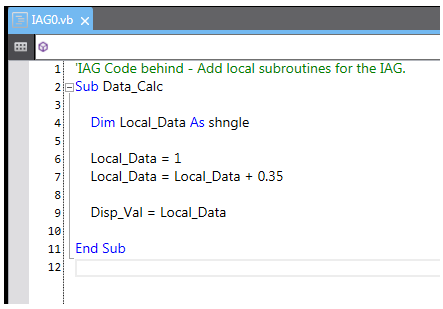


3. Choose Click in Event field of Event and Action.
Enter the subroutine's name in SubroutineName to assign the subroutine to the action.
[Example]
SubroutineName: Data_Calc



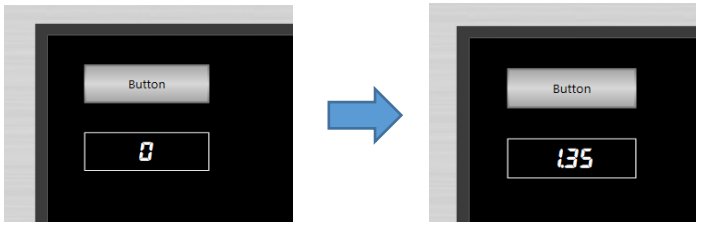
NOTE: The frame of Subroutine Name field is red (means error) because the subroutine code has not been described yet at this point.

4. Open the code editor of the current screen to write the code. Execute the build to test.



5. Startup a simulator to check operation.

   Confirm if the data display component shows the result of subroutine after pressing the onscreen button.



Additional Information

- A subroutine is executed only once and ends after it is called out.
- Declared variables in a subroutine cannot be assigned to screen components.
- Only variables which registered in Global Variables table can be assigned to screen components.
- In order to display a variable that declared and operated in a subroutine, execute the following processes for a variable registered in Global Variables table:
  1) Assign it to a component's property, and
  2) Substitute the value within the subroutine process.

Supplementary Note

1. Action Table

The following table shows the Actions (incl. subroutines) settable to Events.

Action	Description	Event				
		Global	Page	Object	User alarm	IAG*1
Stop-Buzzer	Turn off a buzzer.	○	○	○	○	○
Start-Buzzer	Turn on a buzzer.	○	○	○	○	○
Start-Buzzer (only once)	Turn on a buzzer that sounds for only 0.25 sec.	○	○	○	○	○
Subroutine	Execute a subroutine that is registered in Global Subroutines/Page Subroutines.	○	○	○	○	○
Format-User alarm log	Clear User alarm log.	○	○	○	○	○
Close-Page	Close a designated page.	○	○	○	○	-
Subtract-Variable	Subtract an intended value from an intended variable.	○	○	○	○	○
Eject-SDmemory card	Make a SD memory card ready for ejection.	○	○	○	○	○
Control Input	Permit/prohibit input from a touch panel.	○	○	○	○	○
Exit-Critical session	Indicate the end of a critical session.	○	-	-	-	-
Addition-Variable	Add an intended value to an intended variable.	○	○	○	○	○
Inverse-Variable	Invert an intended Boolean type variable.	○	○	○	○	○
Login	Display login page.	○	○	○	○	○
Logout	Logout	○	○	○	○	○
Format-Variable	Assign an intended Boolean type variable to False.	○	○	○	○	○
Save-Screen shot	Capture a screen displayed on HMI main unit.	○	○	○	○	○

*1) "○" means an Action that is settable on IAG project screen can response to an Event, and "-" means not.

In the usual NA editor, the action which can be allocated to an event of onscreen IAG component is the same as an object.

Action	Description	Global	Page	Object	User alarm	IAG
Seting-IME type	Change IME language setting.	○	○	○	○	○
Setting- Input focus	Set a focus to enter data.	-	○	○	-	-
Setting-User language	Change project's language setting.	○	○	○	○	-
Substitution-Variable	Assign an intended variable to an intended value.	○	○	○	○	○
Display-Page (User alarm)	Display a page that is assigned to an intended user alarm.	○	○	○	○	-
Display-Document (Full screen)	Display a file (e.g. PDF) in full-screen.	○	○	○	○	○
Display-Document (Window)	Display a file (e.g. PDF) in a window.	○	○	○	○	○
Display-Page	Display a page.	○	○	○	○	-
Display-Previous page	Display a previously shown page.	○	○	○	○	○
Display-System menu	Display system menu.	○	○	○	○	○
Display-Trouble shooter	Display NJ/NX series trouble shooter.	○	○	○	○	○
Start- Data log	Start data logging.	○	○	○	○	-
Stop-Data log	Stop data logging.	○	○	○	○	-
Start-Critical section	Indicate beginning of a critical section.	○	-	-	-	-
Event trigger	Assign a user event of IAG object.	-	-	-	-	○

Precautions for Correct Use

An Event Trigger is displayed only on the action setting of IAG component and its object that consists of IAG component. It isn't shown in usual NA editor.
An Event Trigger is an action item which is assigned to an event of IAG component. The event is occurred by operating onscreen IAG component.

2. Data Type Table

Both Global variables (NA) and Local variables (declared in a subroutine) are referenced. The local variables declared in a subroutine cannot be assigned to onscreen components or conditional expressions.

Type	Description/Value range
Boolean	True(other than 0) or False（0）
Short	16-bit signed integer -32,768 to 32,767 (signed)
Integer	32-bit signed integer -2,147,483,648 to 2,147,483,647 (signed)
Long	64-bit signed integer -9,223,372,036,854,775,808 to 9,223,372,036,854,775,807(9.2...E+18) (signed)
UShort	16-bit unsigned integer 0 to 65,535 (unsigned)
Char	
UInteger	32-bit unsigned integer 0 to 4,294,967,295 (unsigned)
Ulong	64-bit unsigned integer 0 to 18,446,744,073,709,551,615(1.8...E+19) (unsigned)
Single	Single-precision (32-bit) floating point number -3.4028235E+38 to -1.401298E-45 (negative values) 1.401298E-45 to 3.4028235E+38 (positive values)
Double	Double-precision (64-bit) floating point number -1.79769313486231570E+308 to -4.94065645841246544E-324 (negative values) 4.94065645841246544E-324 to 1.79769313486231570E+308 (positive values)
String	0 to approx. billion Unicode characters
SByte	8-bit signed integer -128 to 127 (signed)
Byte	8-bit unsigned integer 0 to 255 (unsigned)
TimeSpan	A structure that expresses time interval。
Date	0:00:00 on January 1, 0001 through 23:59:59 on December 31, 9999
Decimal	16-byte 0 to +/-79,228,162,514,264,337,593,543,950,335 (+/-7.9...E+28) (without a decimal point) 0 to +/-7.9228162514264337593543950335 (down to 28 decimal places) Min. number other than 0: +/-0.0000000000000000000000000001(+/-1E-28)

3. Function

You can write Functions in a program code that can be described with NA's code editor, in addition to Subroutines.

Functions are not to be registered in Action Settings as Subroutine, but can be called from a subroutine.

Item	Allocation to Action Configuration	Call from subroutine
Subroutine	○	○
Action	×	○

Functions have data type attribution, and able to return the operation result by value.
Also, they can take one or more variables as argument at run time.

Item	Argument	Return value
Subroutine	×/○*1	Not mandatory
Action	○	Mandatory

Subroutines don't have own data type attribute, thus suitable for the process not concerning the result.
[Example] Screen transition, sequential execution of plural subroutines

On the other hand, Functions are suitable for the process judging the result and controlling because they have own data type attribute.
[Example] Assigning different parameters to one operation expression in sequence to switch control according to the result

*1) If a subroutine has arguments, it cannot be assigned to Action setting.
Generate a subroutine without arguments, and call a subroutine with arguments.

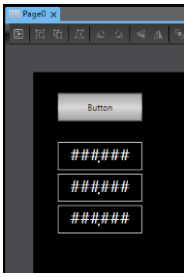
 Additional Information

Processes, for example, making the same decision repeatedly in a subroutine are functioned. It enables to summarize decision processes and to reduce amount of program code.
Also, functioned decision expressions make batch correction/change possible by modifying the expressions in the function.

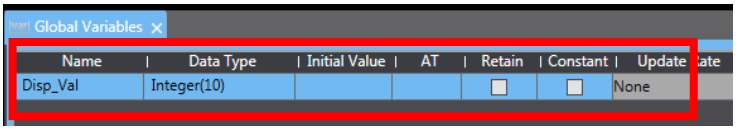
3-1. Function Creating Procedure

The following is the function describing procedure of NA project to call from a subroutine and use.

1. Place buttons and data display components on the NA page screen as the right illustration shows.

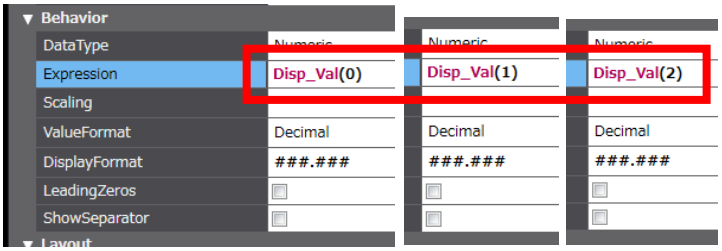


2. Enter a variable which is allocated to the data display component in Global Variables table.
[Example]
Variable: Disp_Val
Data type: Integer
Array: 10



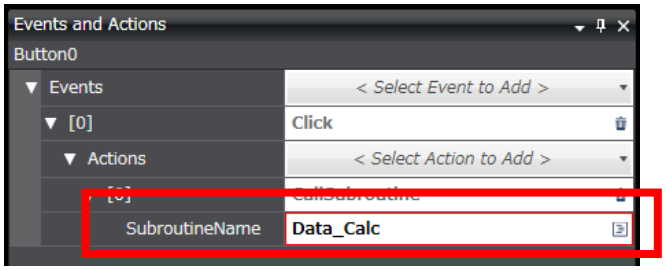
3. Enter the variable Disp_Val, described in the previous section, in the property fields of three data display components on the screen.

Different array numbers are set to each variable.

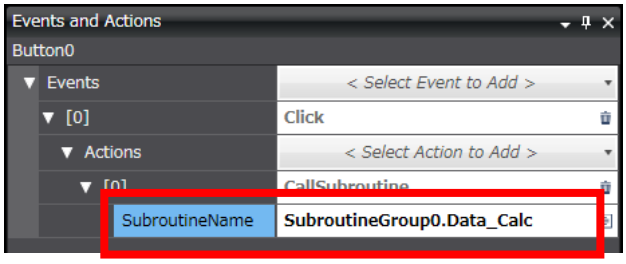


4. Select Click from events of buttons and actions. Set a subroutine to Action.
Enter the name of subroutine.
[Example]
Subroutine name: Data_Calc

NOTE: The frame of Subroutine Name is displayed in red (means an error) because the subroutine has not been completed at this point.



5. If you write a subroutine code in Global Subroutines, describe its subroutine name with Global Subroutine Group name.



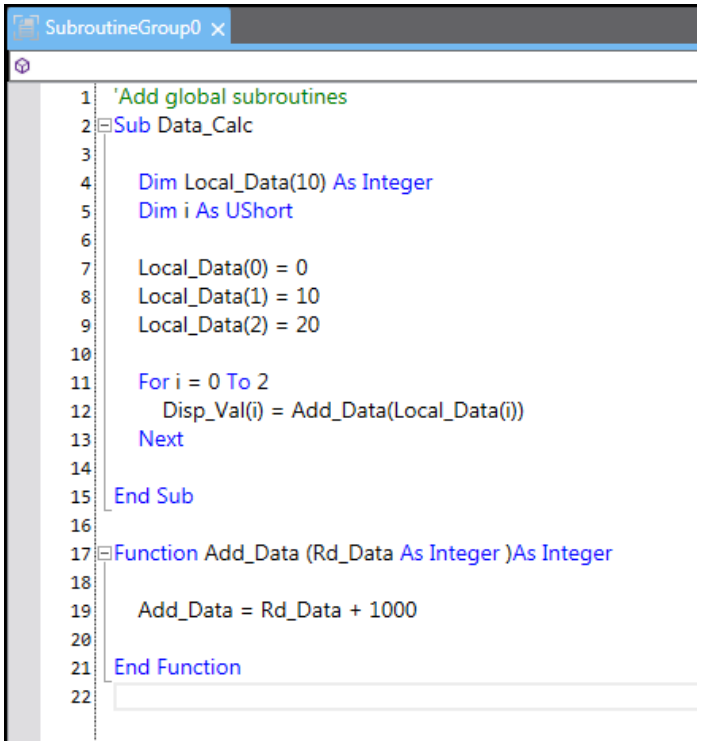
6. Open Code Editor of the current screen or Global Subroutine Group and enter the code in the right illustration.

[Description]
Declare Local_Data, an array variable, in the subroutine Data_Calc. Substitute different values into each variable.

The following process is executed repeatedly: Execute the function Add_Data for the global variable Disp_Val. Then substitute the returned value.

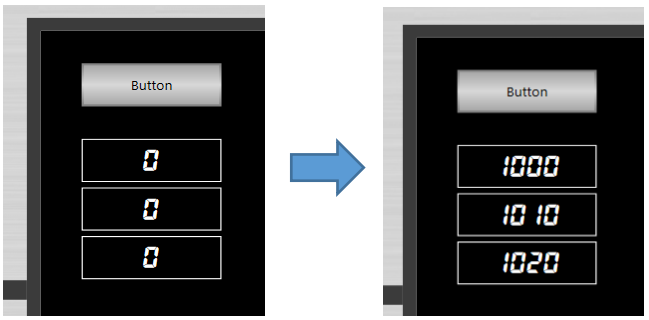
Array variable Data_Calc is given to Add_Data as an argument.

In function Add_Data, 1000 is added to the passed value, and it is substituted as a return value.



7. Startup Simulator to confirm the subroutine's operation.

Click the button on the screen. Check if the data display components show the result of subroutine.



Additional Information

- A function is executed only once and closed after it is called out.
- A simple expression is remade into a function in the sample above. Separating operation part (Function) and external variables exchanging part (Subroutine) in complex and repeating operation is useful to reduce program lines and to simplify the processing in a program.

Revision History

Revision code	Date	Revised content
01	October 2018	Original production

OMRON Corporation **Industrial Automation Company**
Tokyo, JAPAN
Contact: www.ia.omron.com

Regional Headquarters
OMRON EUROPE B.V.
Wegalaan 67-69, 2132 JD Hoofddorp
The Netherlands
Tel: (31)2356-81-300/Fax: (31)2356-81-388

OMRON ELECTRONICS LLC
2895 Greenspoint Parkway, Suite 200
Hoffman Estates, IL 60169 U.S.A
Tel: (1) 847-843-7900/Fax: (1) 847-843-7787

OMRON ASIA PACIFIC PTE. LTD.
No. 438A Alexandra Road # 05-05/08 (Lobby 2),
Alexandra Technopark,
Singapore 119967
Tel: (65) 6835-3011/Fax: (65) 6835-2711

OMRON (CHINA) CO., LTD.
Room 2211, Bank of China Tower,
200 Yin Cheng Zhong Road,
PuDong New Area, Shanghai, 200120, China
Tel: (86) 21-5037-2222/Fax: (86) 21-5037-2200

Authorized Distributor:

Cat. No. V449-E1-01 1018 (1018)