

# Extending TestStand Functionality by Custom Step Types

Mohammed Ashiq S

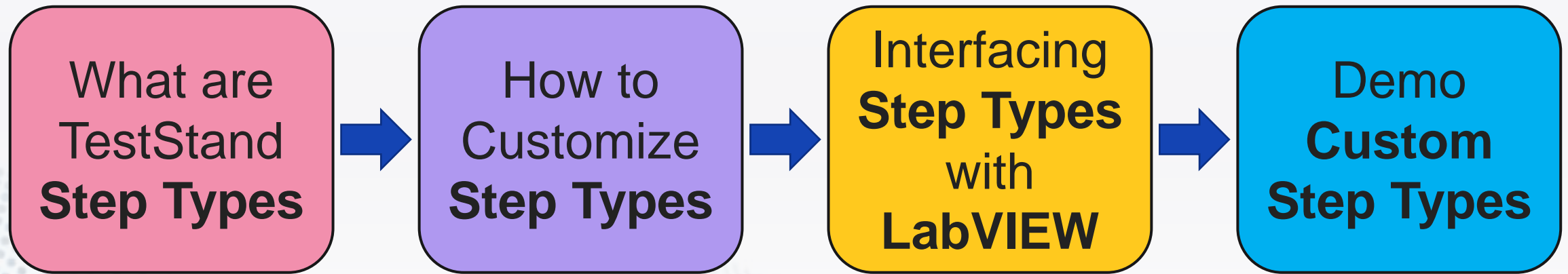


CLD



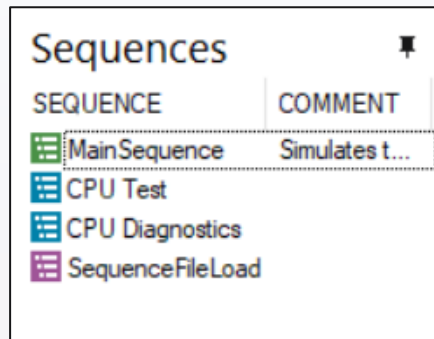
TestStand  
Developer

# Agenda



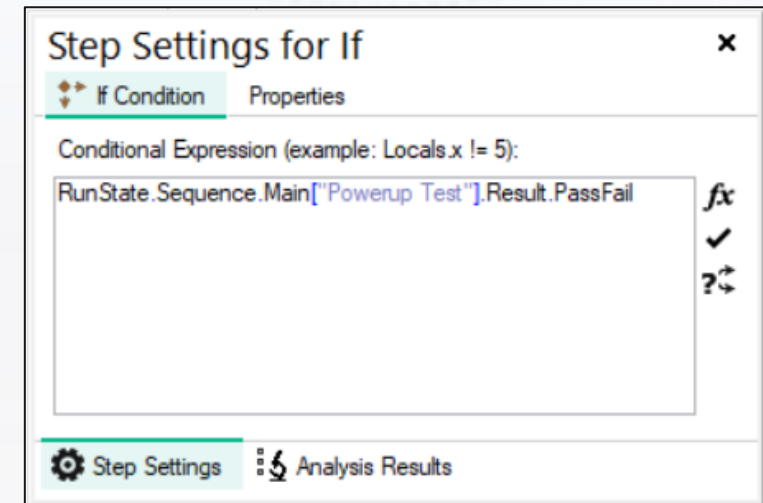
# What Are TestStand Step Types ?

Step Types are the basic components of a TestStand Sequence



Steps: MainSequence

STEP	DESCRIPTION	SETTINGS
- Setup (2)		
Simulation Dialog	Action, Computer Sequence Simulation Dialog.vi	
Turn Vacuum Table On	Action, Vacuum On.vi	
<End Group>		
- Main (17)		
Powerup Test	Pass/Fail Test, Powerup Test.vi	
If the Powerup Test fails, do not test any additional components.		
If	{Powerup Test}.Result.PassFail	
CPU Test	Call CPU Test in <Current File>	
ROM Test	Pass/Fail Test, ROM Test.vi	
RAM Test	Pass/Fail Test, RAM Test.vi	
Video Test	Numeric Limit Test, 0 < x < 10, microseconds, Video T...	
Keyboard Test	Numeric Limit Test, x > 5, Keyboard Test.vi	
If any of the preceding tests failed, perform diagnostics on the failed component(s) to get more information on the mode of failure		
If	ThisContext.SequenceFailed	
CPU Diagnostics	Call CPU Diagnostics in <Current File>	Precondition, Load Option, Unload Option
ROM Diagnostics	Pass/Fail Test, ROM Diagnostics.vi	Precondition, Load Option, Unload Option

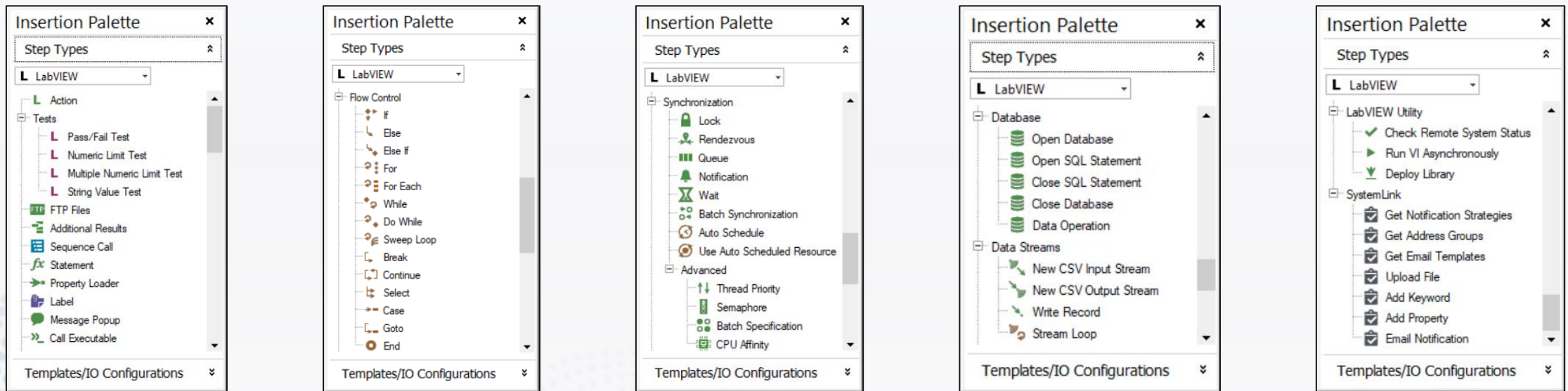


Basically, every step of TestStand Sequence is a **Step Type**



# Built-In Step Types

TestStand has lot of Built-in Step Types available from Insertion Palette



These Step Types can be used to create any kind of sequence flows

# Are they sufficient 😬?

## 😊 Sufficient

*when*

- Sequence needs only standard/basic step functionalities
- Steps are configured from typing in Step Settings

## Need More 😞

*when*

- Sequence needs custom step functionalities
- Needs more intuitive interface for configuring step settings

Okay, let's see how to customize them ↴

What are  
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How to  
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Interfacing  
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Demo  
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Step Types

## Let us understand first how a Step Type works

[Step Execution](#)  
[TestStand Help](#)

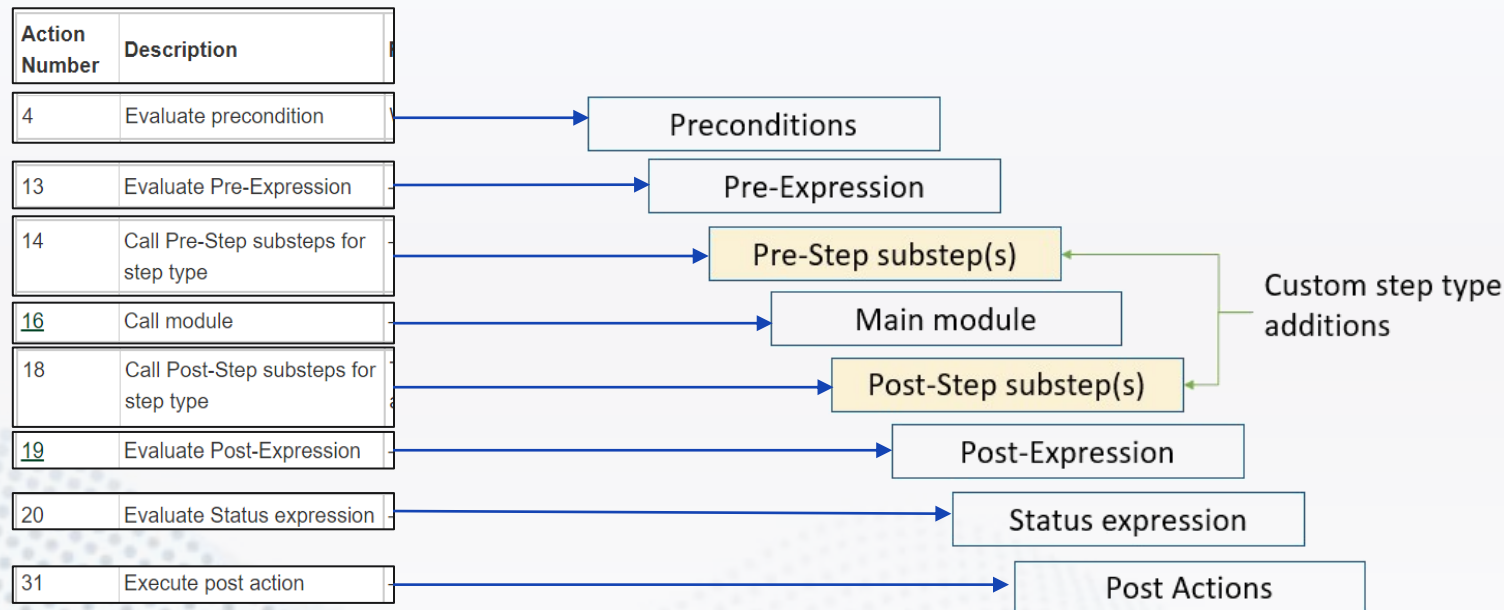
Depending on the options you specify when you configure a step, a step performs multiple actions as it executes. The following table lists the most common actions a step can take, in the order the step performs them.

Usually, a step performs only a subset of these actions depending on the configuration of the step and the test station.



# Customizing Step Types

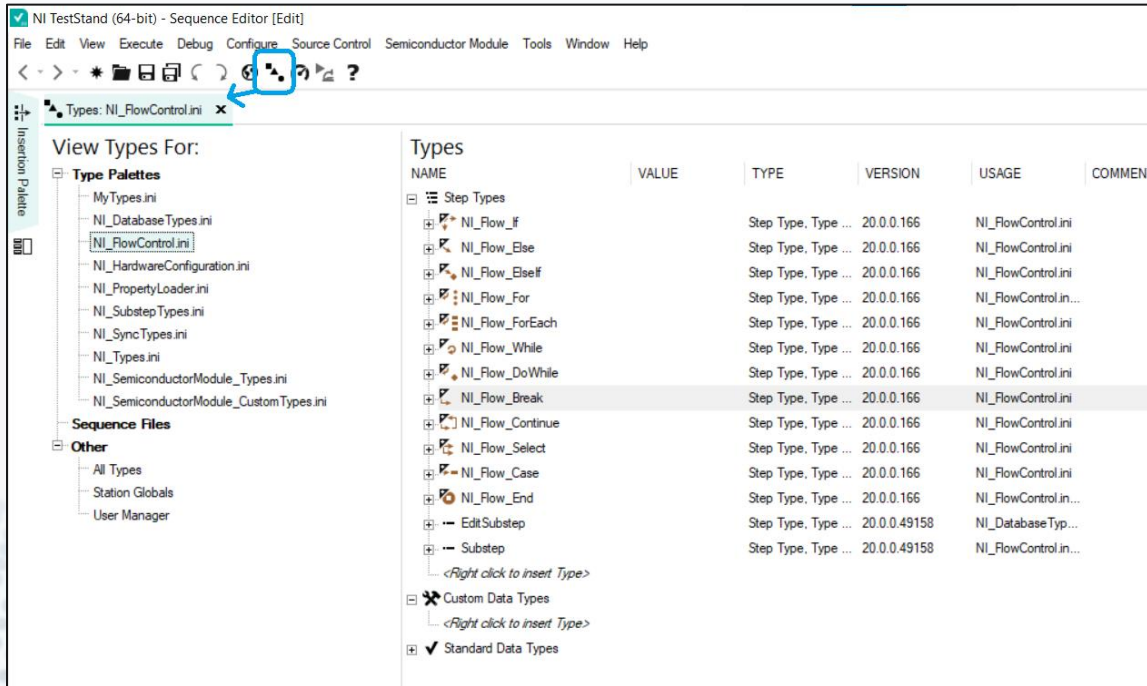
To Customize a Step Type, we are mainly focusing on **Custom Step Type Additions** in the execution order,



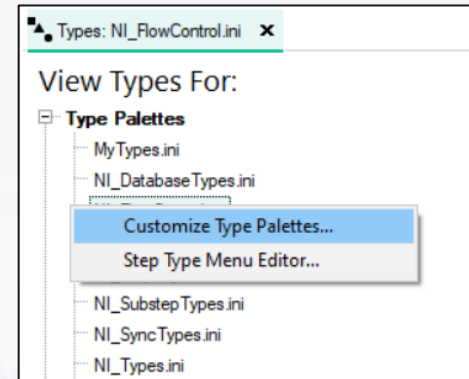
- Most of the Step Types which does not call any other Code Module will not have a Main Module (that we don't need)
- And we can add our own Code Modules to Pre/Post – Step Substep(s)

So, whenever the step is executed, our custom Substep Code Modules get executed too.

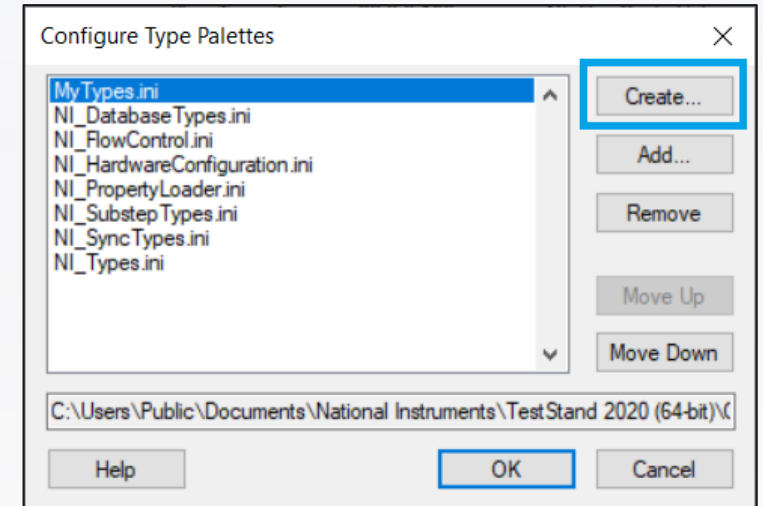
# Creating a Custom Step Type



Navigate to Types (Ctrl + T)



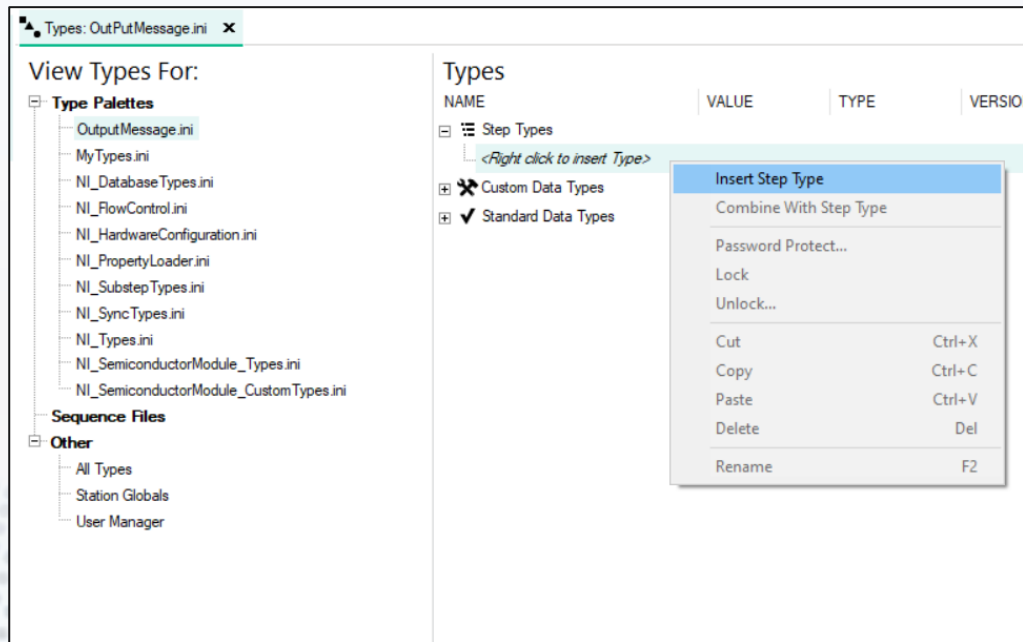
Right Click & select  
**Customize Type Palettes...**



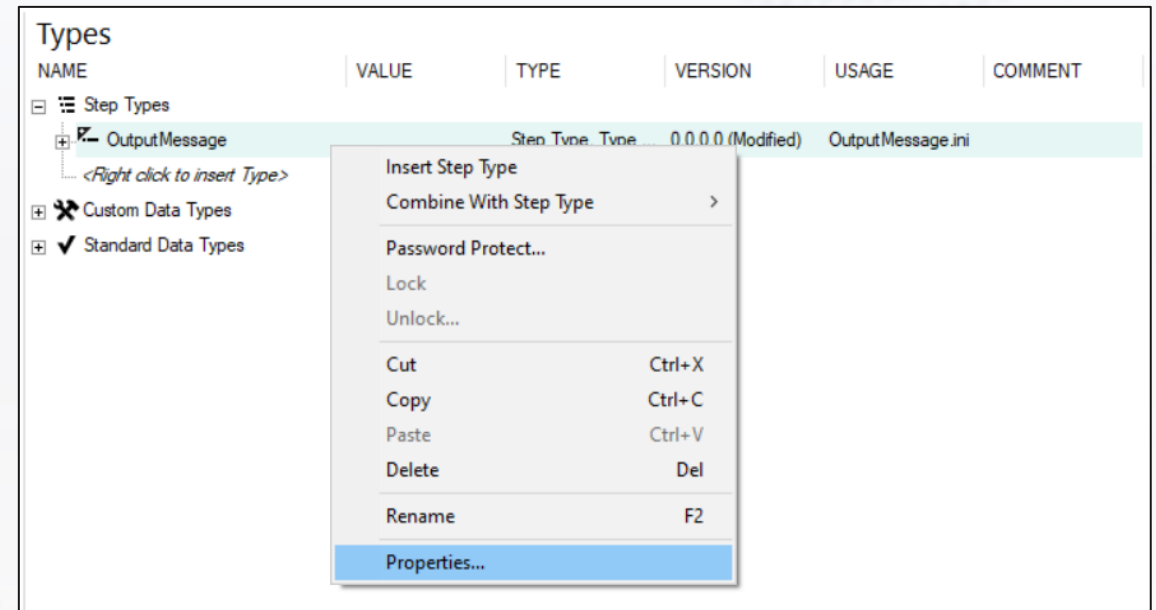
Create new Type Palette



# Creating a Custom Step Type

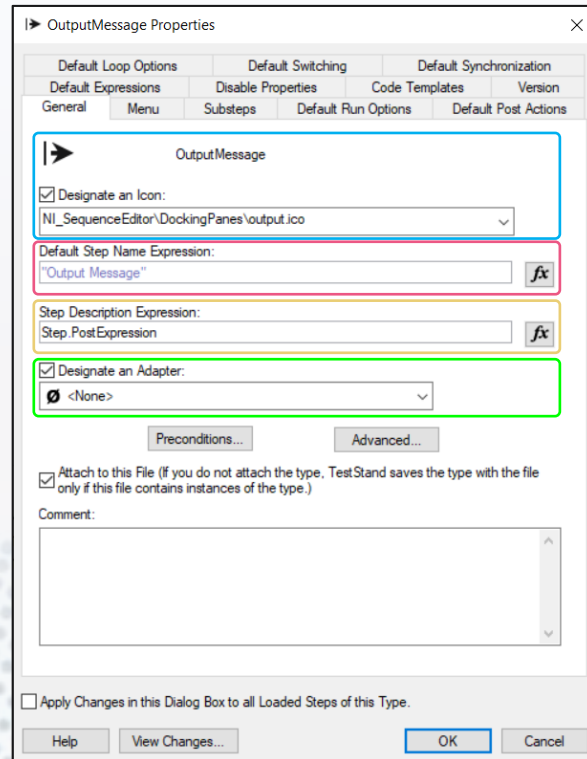


Insert Step Type

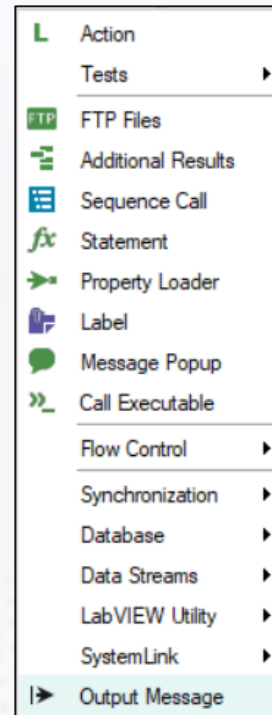


Open Properties (Double Click)

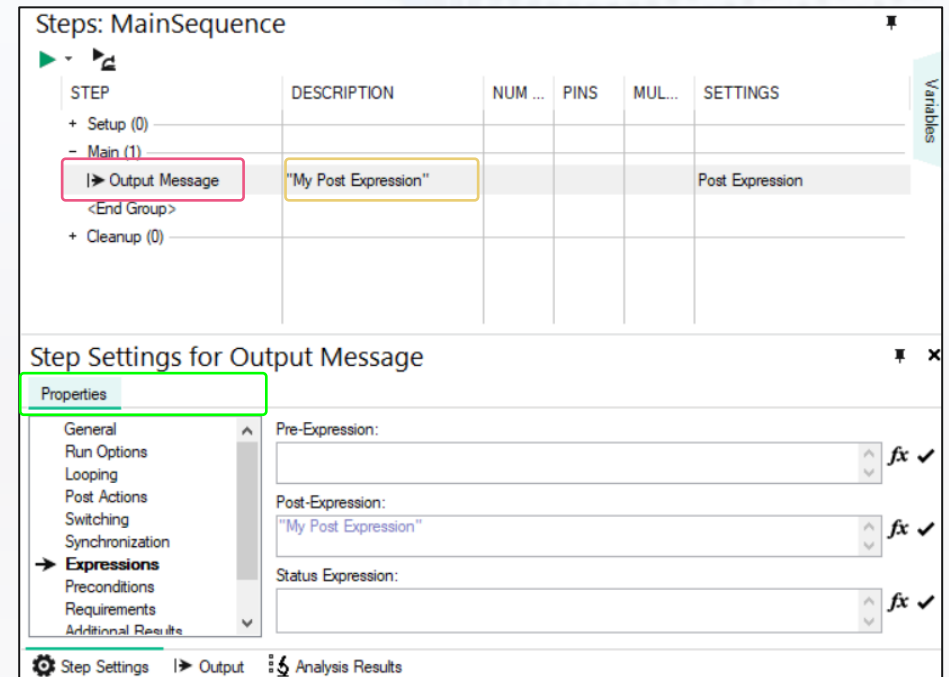
# Creating a Custom Step Type



Configure the General Properties



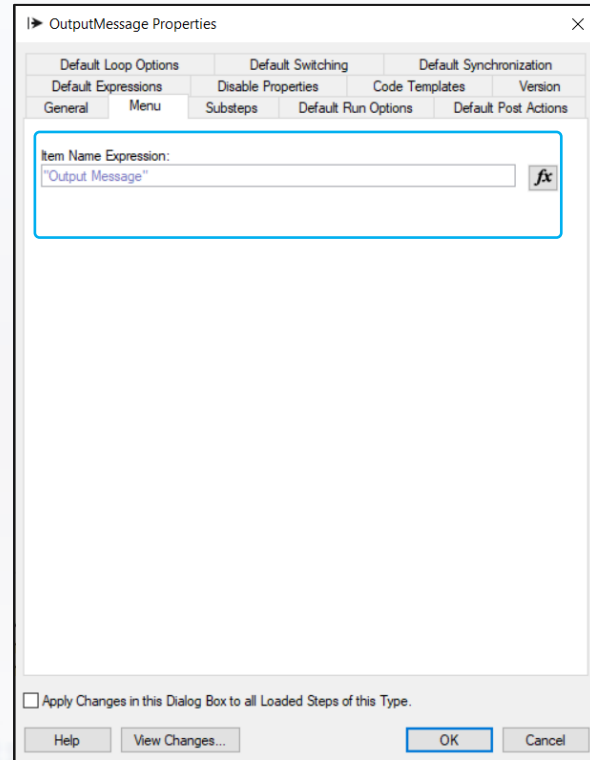
Icon



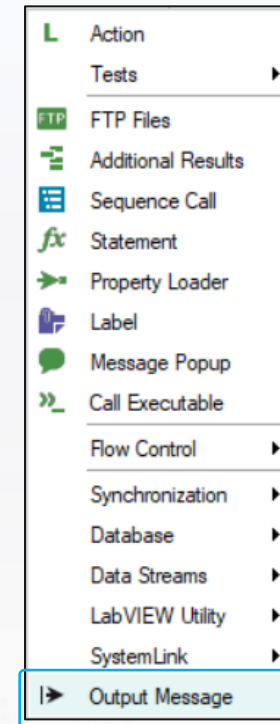
STEP	DESCRIPTION	NUM ...	PINS	MUL...	SETTINGS
+ Setup (0)					
- Main (1)					
> Output Message	"My Post Expression"				Post Expression
<End Group>					
+ Cleanup (0)					

Default Step Name, Step Description & No Main Module

# Creating a Custom Step Type



Configure the Menu

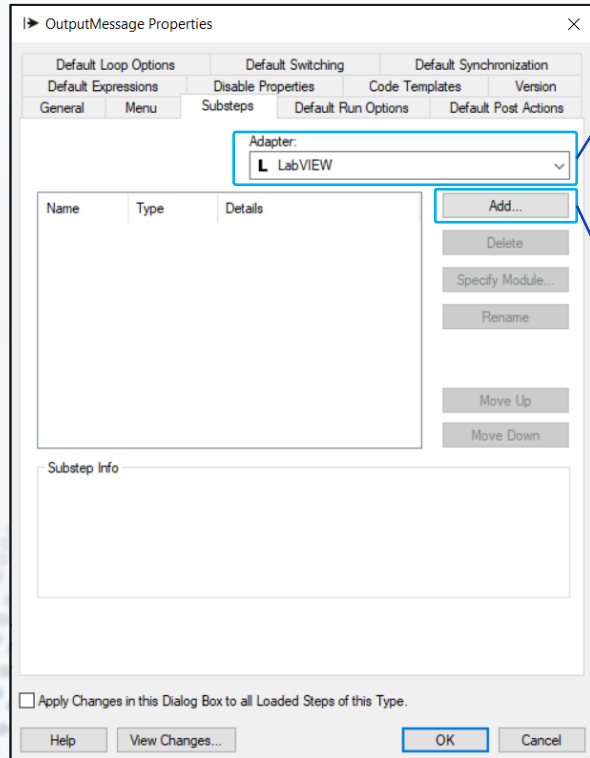


Item Name under Insertion Palette



# Creating a Custom Step Type

[Using Substeps](#)  
[TestStand Help](#)



Select the Adapter  
(for the Substep modules)

- L Post-Step
- L Pre-Step
- L Edit
- L Custom

## Edit Substep

The Edit substep typically calls a substep code module that launches a dialog box in which you can edit the values of the custom step properties. For example, an Edit substep might launch a dialog box in which you specify the high and low limits for a test. The Edit substep might then store the high and low limit values as step properties.

## Custom Substeps

You can create a custom substep named **OnNewStep** for TestStand to call each time you create a new step of that type. For example, the built-in **If** step type uses an OnNewStep substep to insert a matching **End** step.

Configure the Substeps

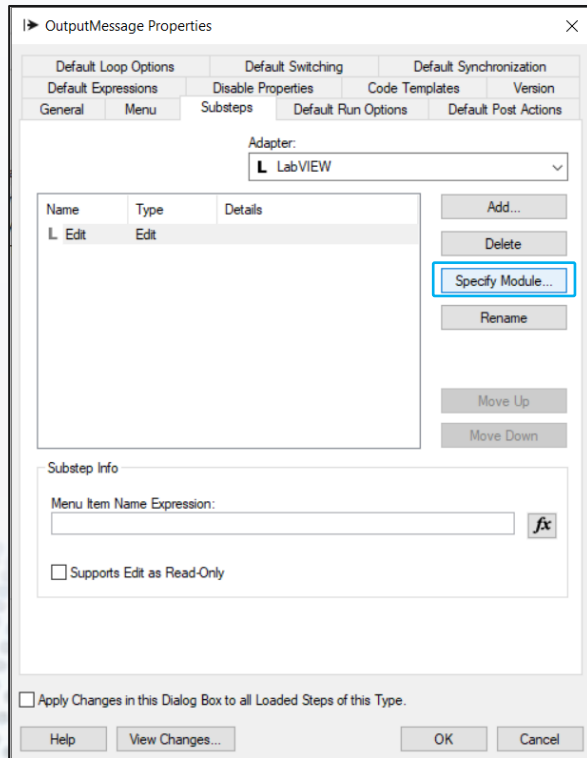
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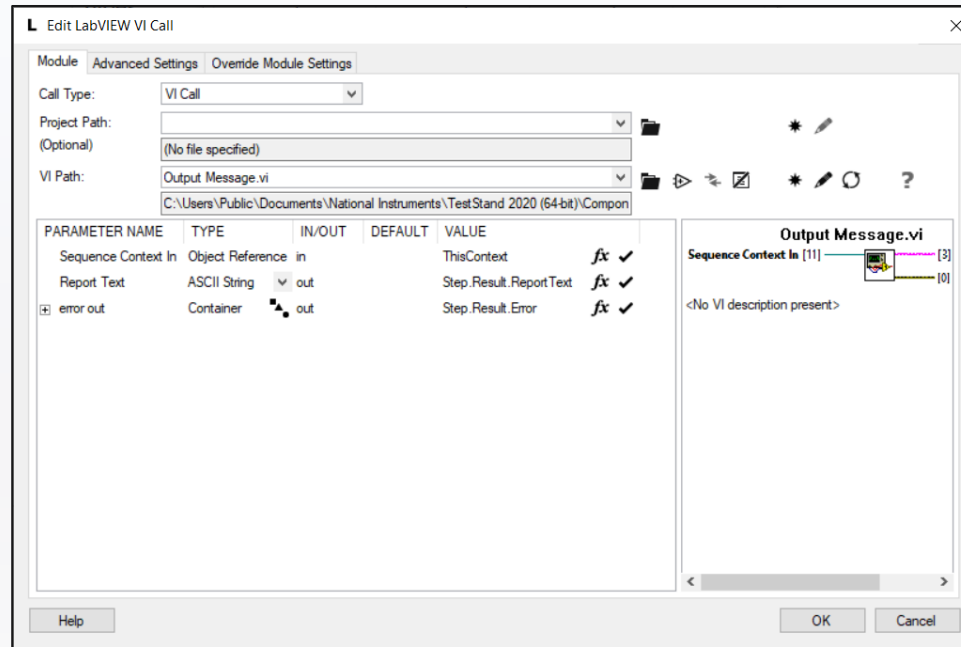
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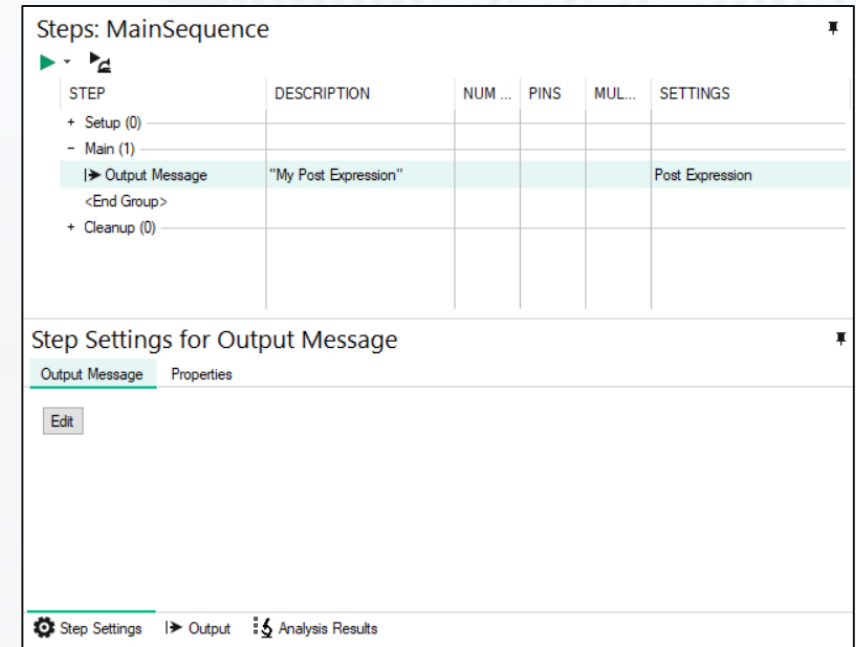
# Creating a Custom Step Type



Add an Edit Substep & Specify Module



Create a New VI for Edit Substep



An Edit button will appear, by which we can invoke the Edit Substep Code module (the VI)

# Customize the Step Type as Required

## Add Required Variables under the Step

Types	NAME	VALUE	TYPE	VERSION	USAGE
Step Types					
OutputMessage			Step Type, Type Definition	0.0.0.7	OutputMessage.j...
Result			Container		
Message		""	String		
Category		""	String		
Use_Severity_Exp	False		Boolean		
Severity	[Information] (0)		Message_Severity (Enumeration)		
Severity_Exp	""		String		
EditSubstep			Step Type, Type Definition	20.0.0.49158	NI_Database Typ...

Step Settings for Output Message				
Output Message	Properties			
General		NAME	VALUE	TYPE
Run Options		Result		Container
Looping		Message	""	String
Post Actions		Category	""	String
Switching		Use_Severity_Exp	False	Boolean
Synchronization		Severity	[Information] (0)	Message_Severity (Enumeration)
Expressions		Severity_Exp	""	String
Preconditions				
Requirements				
Additional Results				
Property Browser				

OutputMessage Properties

Default Loop Options Default Switching Default Synchronization

Default Expressions Disable Properties Code Templates Version

General Menu Substeps Default Run Options Default Post Actions

OutputMessage

☒ Designate an Icon:

NI\_SequenceEditor\DockingPanels\output.ico

Default Step Name Expression:

"Output Message"

Step Description Expression:

Step.Message + "|" + Step.Category + "|" + (Step.Use\_Severity\_Exp ? Step.Sev

☒ Designate an Adapter:

<None>

Attach to this File (If you do not attach the type, TestStand saves the type with the file only if this file contains instances of the type.)

Comment:

☐ Apply Changes in this Dialog Box to all Loaded Steps of this Type.

Help View Changes... OK Cancel

fx Expression Browser

Variables/Properties Operators/Functions TestStand API

Step

Result

Message (String)

Category (String)

Use\_Severity\_Exp (Boolean)

Severity (Enumeration)

Severity\_Exp (String)

Locals

Parameters

FileGlobals

StationGlobals

ThisContext

RunState

Variable:

Step

Replace Insert

Expression:

Step.Message + "|" +  
Step.Category + "|" +  
( Step.Use\_Severity\_Exp ? Step.Severity\_Exp : Str(Step.Severity) )

Help OK Cancel

Step Variables are stored under Property Browser

Custom build the Step Description String

What are  
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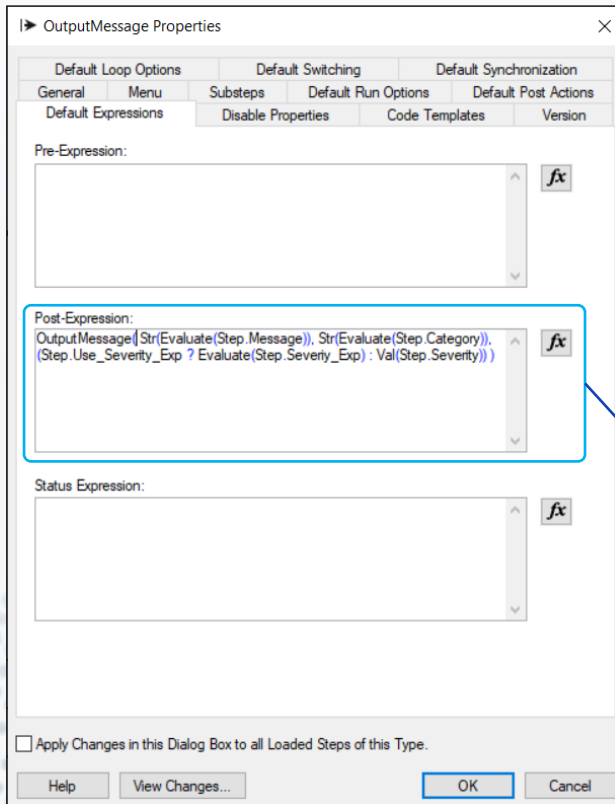
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# Customize the Step Type as Required



Add Custom Post Expression

**OutputMessage(String message, String category = "", Number severity = 0, [Number textColor], [String icon])**

Parameter 1: A string containing the message to be displayed in the output window.

Parameter 2: (Optional) Specifies the category of the message. If you do not specify a category, the output message will be considered uncategorized. You can define your own categories. The default value is an empty string.

Parameter 3: (Optional) Specifies the severity of the message. The valid values are:  
 0 - (Default) OutputMessageSeverity\_Information.  
 1 - OutputMessageSeverity\_Warning.  
 2 - OutputMessageSeverity\_Error.

Parameter 4: (Optional) Specifies the text color used to display the message. Use a color constant such as tsBlack, or use the RGB function to specify a color using component color values.

Parameter 5: (Optional) Specifies the name of the icon file related to the output message. The TestStand Engine obtains the icons from the <TestStand> ComponentsIcons and <TestStand Public> ComponentsIcons directories. This parameter is optional and the default icon is selected based on the severity of the message.

Returns: This function always returns 0.

Method Reference

Parameter	Expression
Message	Str(Evaluate(Step.Message))
Category	Str(Evaluate(Step.Category))
Severity	Step.Use_Severity_Exp ? Evaluate(Step.Severity_Exp) : Val(Step.Severity))

Form the **OutputMessage()** method call with step variables

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# Interfacing Step Types with LabVIEW

**Types**

NAME	VALUE	TYPE	VERSION	USAGE
Step Types				
Output Message		Step Type, Type Definition	0.0.0.7	OutputMessage.i...
Result		Container		
Message	""	String		
Category	""	String		
Use_Severity_Exp	False	Boolean		
Severity	[Information] (0)	Message_Severity (Enumeration)		
Severity_Exp	""	String		
EditSubstep		Step Type, Type Definition	20.0.0.49158	NI_DatabaseTyp...

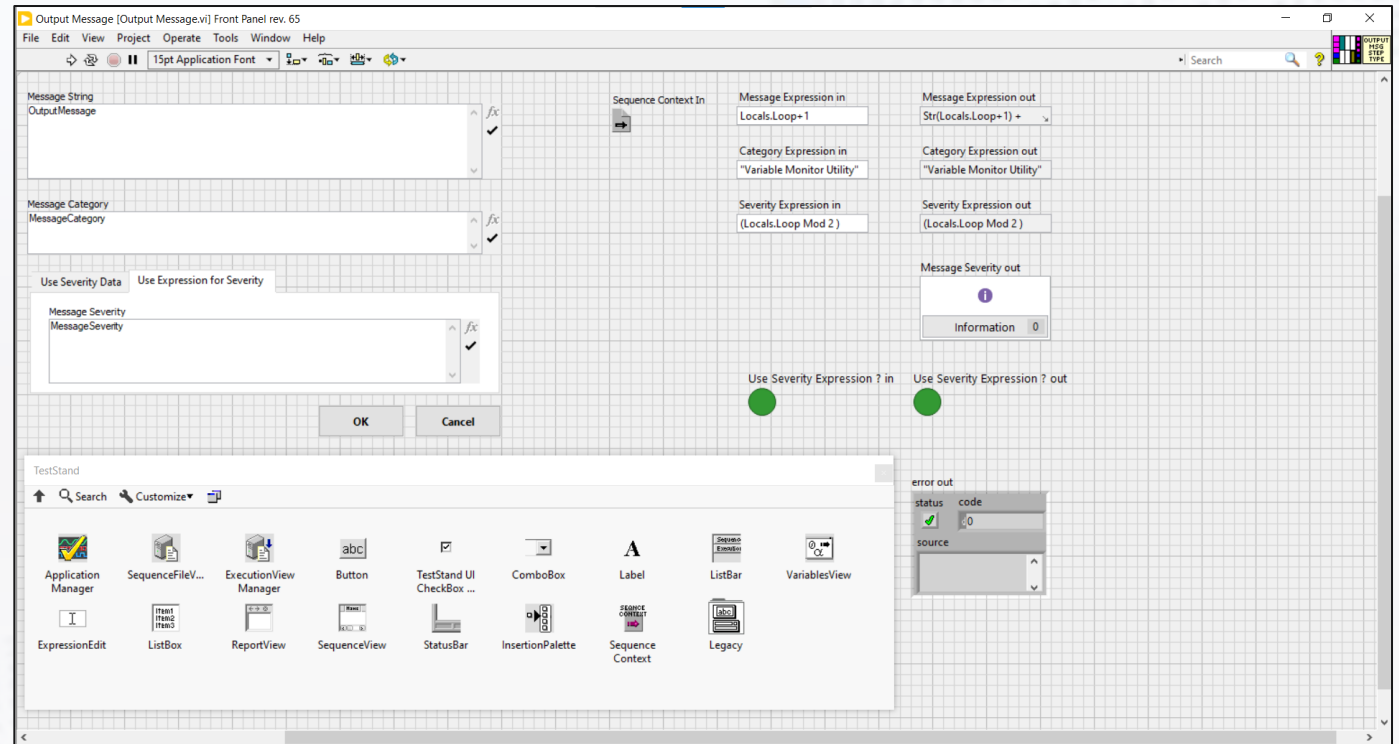
Context Help

**Output Message [Output Message.vi] (4833)**

Sequence Context In [1]  
 Message Expression in [0]  
 Category Expression in [5]  
 Severity Expression in [7]  
 Message Severity [9]  
 Use Severity Expression ? in [11]

OUTPUT MSG STEP TYPE

[4] Message Expression out  
 [6] Category Expression out  
 [8] Severity Expression out  
 [10] Message Severity  
 [15] Use Severity Expression ? out  
 [14] error out



Customize the VI Front Panel & Connector Pane to Handle the Step Variables

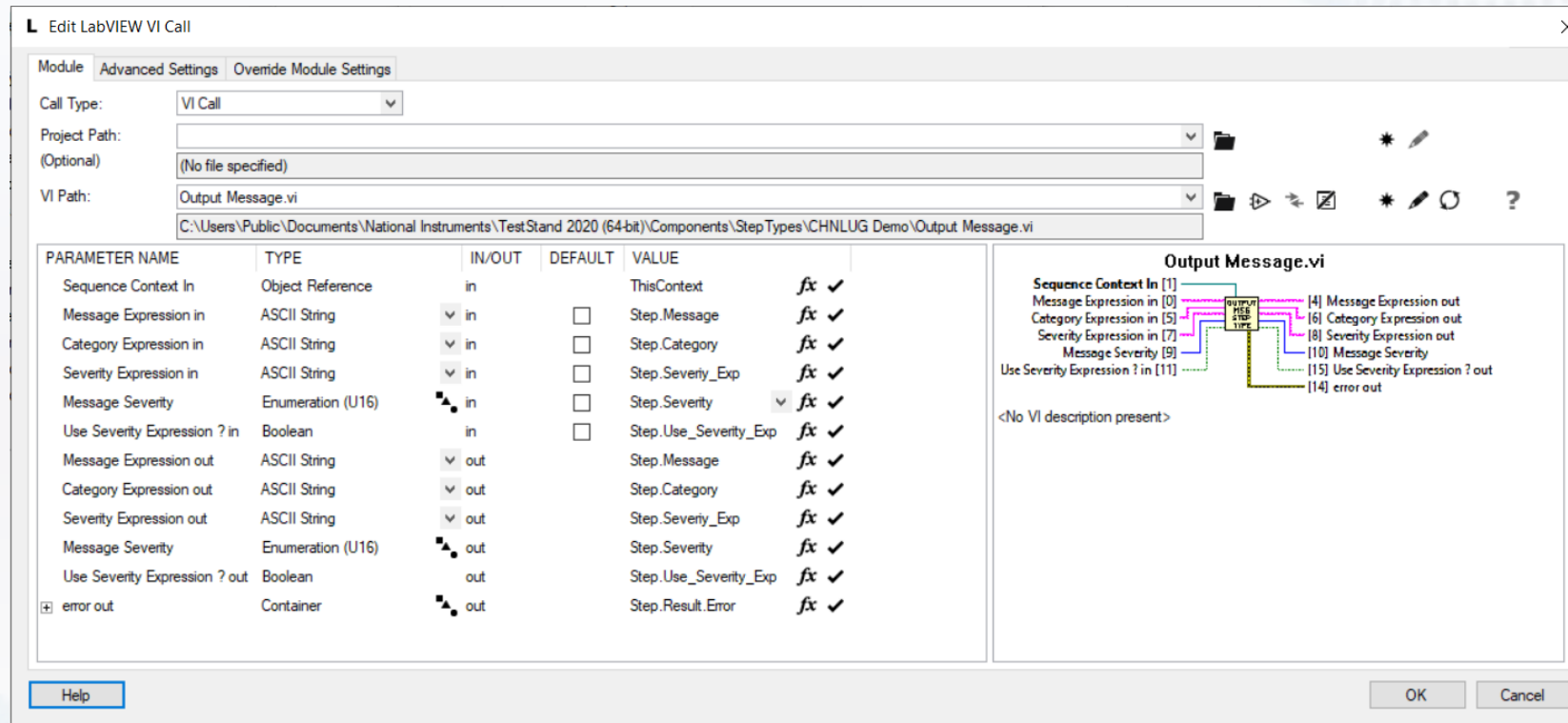
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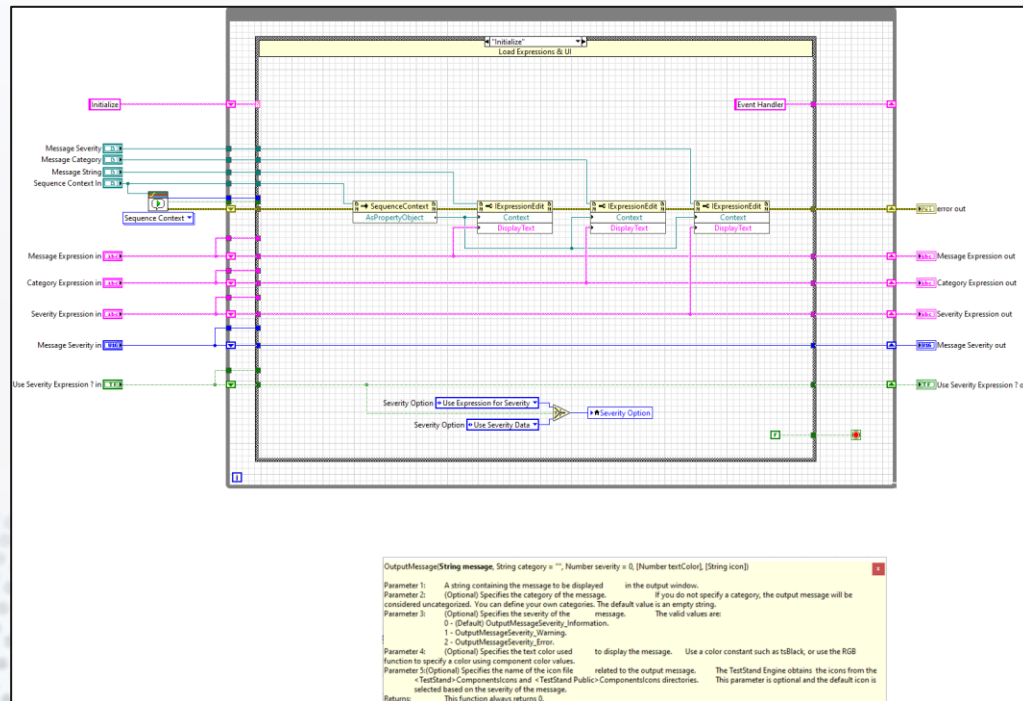
# Interfacing Step Types with LabVIEW



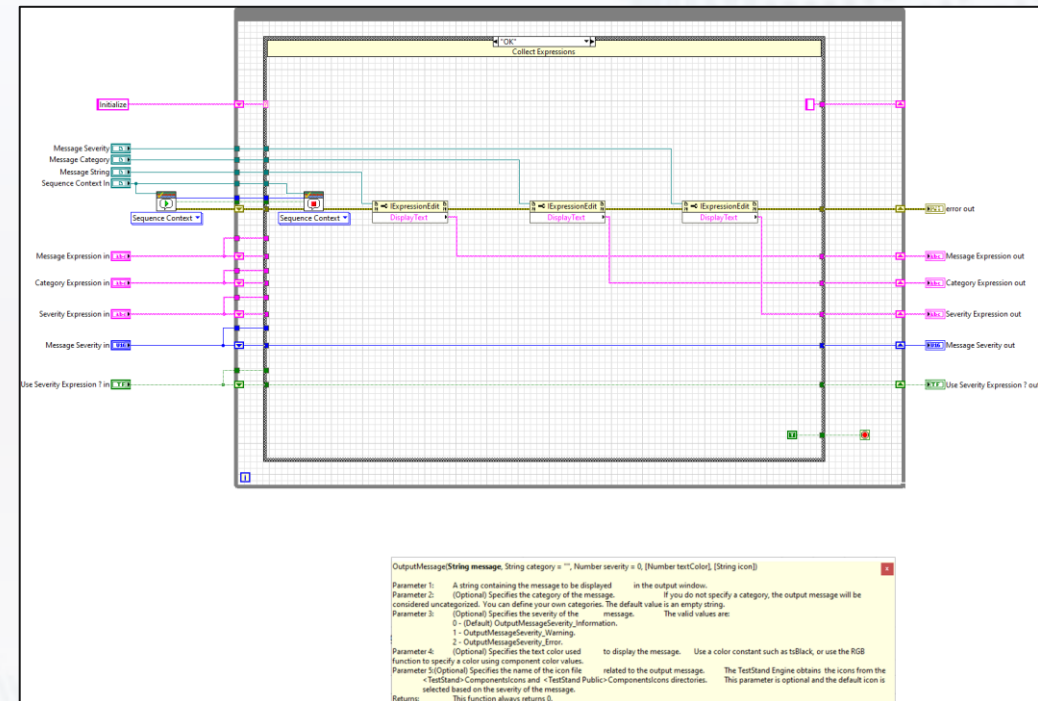
Configure the Edit Substep VI Module Call



# Interfacing Step Types with LabVIEW



Use the TestStand API to update UI



Upon exit with OK, collect the Data from TestStand ActiveX Controls

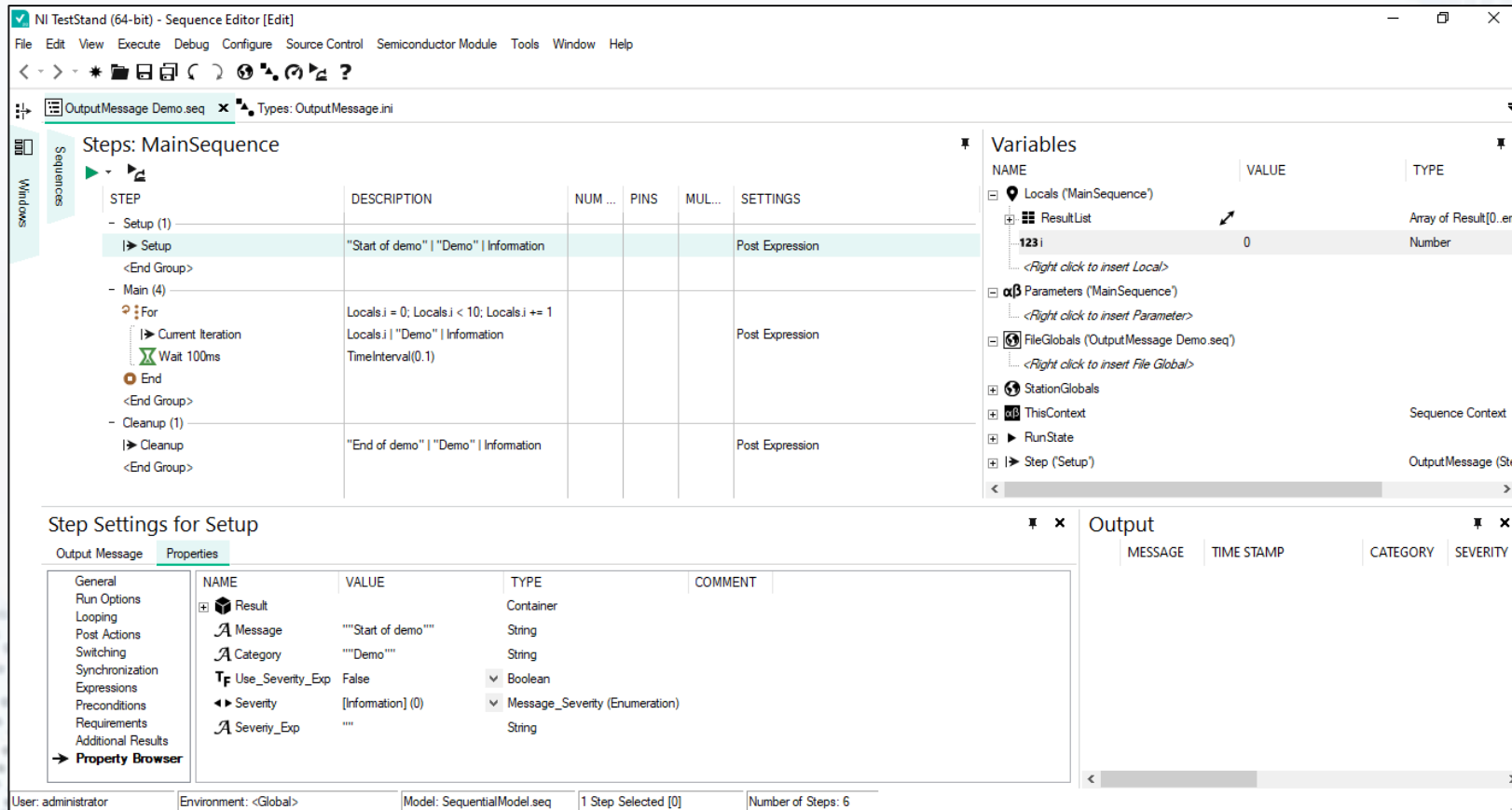
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# Live Demo



NI TestStand (64-bit) - Sequence Editor [Edit]

File Edit View Execute Debug Configure Source Control Semiconductor Module Tools Window Help

OutputMessage Demo.seq x Types: OutputMessage.ini

Steps: MainSequence

STEP	DESCRIPTION	NUM ...	PINS	MUL...	SETTINGS
- Setup (1)					
> Setup	"Start of demo"   "Demo"   Information				Post Expression
<End Group>					
- Main (4)					
> For	Locals.i = 0; Locals.i < 10; Locals.i += 1				Post Expression
> Current Iteration	Locals.i   "Demo"   Information				
> Wait 100ms	TimeInterval(0.1)				
> End					
<End Group>					
- Cleanup (1)					
> Cleanup	"End of demo"   "Demo"   Information				Post Expression
<End Group>					

Step Settings for Setup

Output Message Properties

General	NAME	VALUE	TYPE	COMMENT
Result			Container	
Message	""Start of demo""		String	
Category	""Demo""		String	
Use_Severity_Exp	False		Boolean	
Severity	[Information] (0)		Message_Severity (Enumeration)	
Severity_Exp	""		String	

Output

MESSAGE	TIME STAMP	CATEGORY	SEVERITY
---------	------------	----------	----------

User: administrator Environment: <Global> Model: SequentialModel.seq 1 Step Selected [0] Number of Steps: 6

Use **Edit** button or **Ctrl + E** shortcut to invoke the edit module

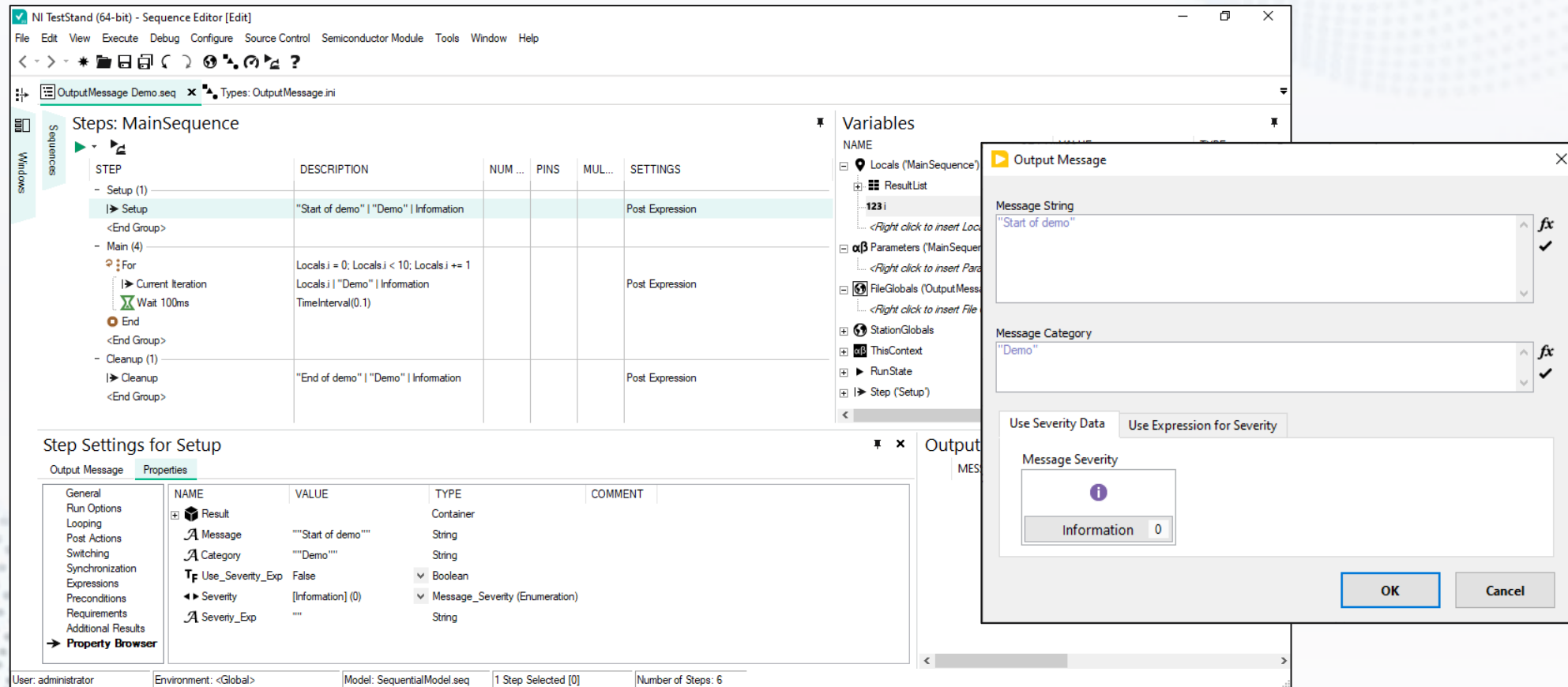
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OutputMessage Demo.seq x Types: OutputMessage.ini

### Steps: MainSequence

STEP	DESCRIPTION	NUM ...	PINS	MUL...	SETTINGS
- Setup (1)					
> Setup	"Start of demo"   "Demo"   Information				Post Expression
<End Group>					
- Main (4)					
> For	Locals.i = 0; Locals.i < 10; Locals.i += 1				
> Current Iteration	Locals.i   "Demo"   Information				Post Expression
> Wait 100ms	TimeInterval(0.1)				
End					
<End Group>					
- Cleanup (1)					
> Cleanup	"End of demo"   "Demo"   Information				Post Expression
<End Group>					

### Step Settings for Setup

Output Message Properties

General	NAME	VALUE	TYPE	COMMENT
Run Options	Result		Container	
Looping	Message	""Start of demo""	String	
Post Actions	Category	""Demo""	String	
Switching	Use_Severity_Exp	False	Boolean	
Synchronization	Severity	[Information] (0)	Message_Severity (Enumeration)	
Expressions	Severity_Exp	""	String	
Preconditions				
Requirements				
Additional Results				

User: administrator Environment: <Global> Model: SequentialModel.seq 1 Step Selected [0] Number of Steps: 6

### Output Message Dialog

Message String: "Start of demo" ☒ fx

Message Category: "Demo" ☒ fx

Use Severity Data Use Expression for Severity

Message Severity: Information 0

OK Cancel

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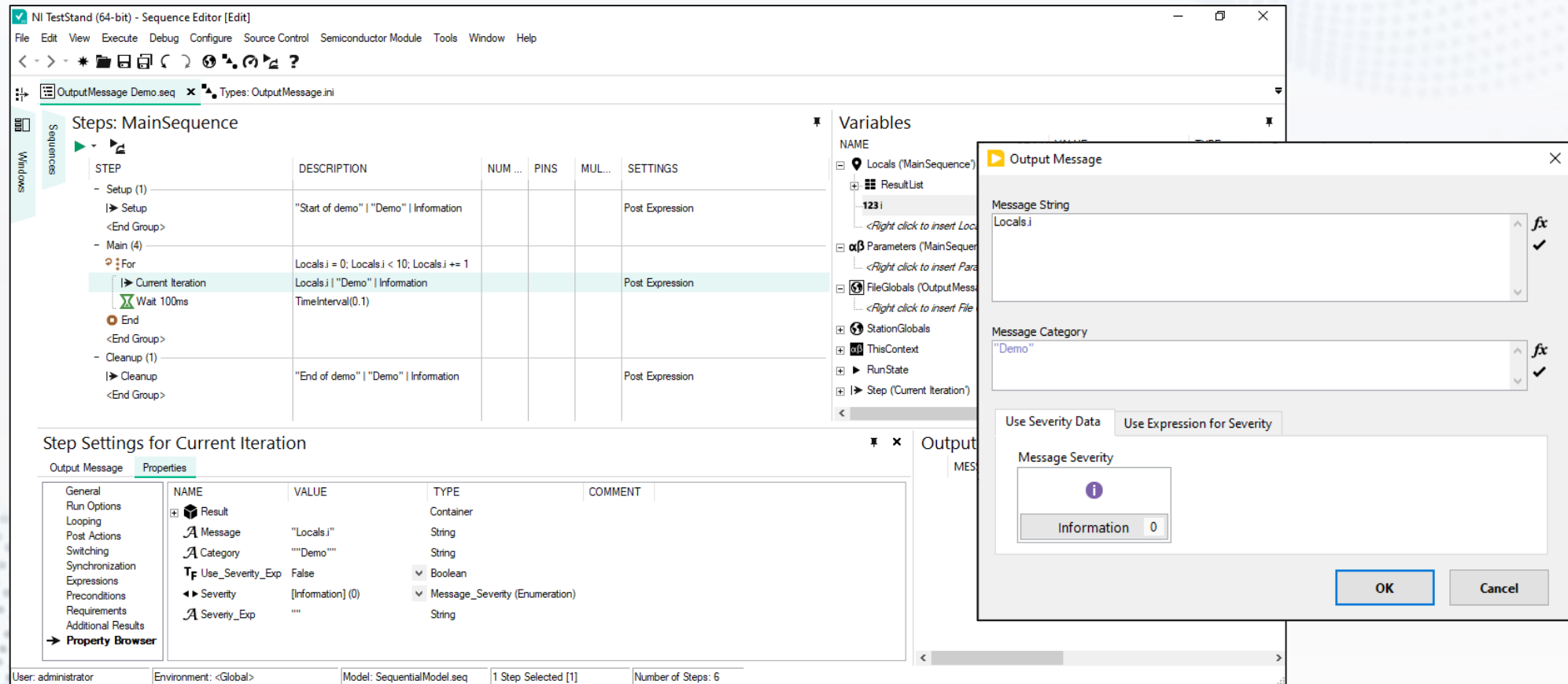
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# Live Demo



The screenshot displays the NI TestStand (64-bit) - Sequence Editor [Edit] window. The main sequence, 'MainSequence', contains several steps: Setup (1), Main (4), and Cleanup (1). The 'Main' group is expanded, showing a 'For' loop with 'Current Iteration' and a 'Wait 100ms' step. The 'Current Iteration' step is selected, and its 'Step Settings' are shown in the bottom panel. The 'Output Message' step is highlighted in the 'Properties' tab, showing the message string 'Locals.i', category 'Demo', and severity 'Information 0'. The 'Output Message' dialog box is also open, showing the same configuration.

**Steps: MainSequence**

STEP	DESCRIPTION	NUM ...	PINS	MUL...	SETTINGS
- Setup (1)					
> Setup	"Start of demo"   "Demo"   Information				Post Expression
<End Group>					
- Main (4)					
> For	Locals.i = 0; Locals.i < 10; Locals.i += 1				
> Current Iteration	Locals.i   "Demo"   Information				Post Expression
> Wait 100ms	TimeInterval(0.1)				
<End Group>					
- Cleanup (1)					
> Cleanup	"End of demo"   "Demo"   Information				Post Expression
<End Group>					

**Step Settings for Current Iteration**

**Output Message Properties**

NAME	VALUE	TYPE	COMMENT
Result		Container	
Message	"Locals.i"	String	
Category	"Demo"	String	
Use_Severity_Exp	False	Boolean	
Severity	[Information] (0)	Message_Severity (Enumeration)	
Severity_Exp		String	

**Output Message Dialog**

Message String: Locals.i

Message Category: Demo

Use Severity Data: Use Expression for Severity

Message Severity: Information 0

OK Cancel

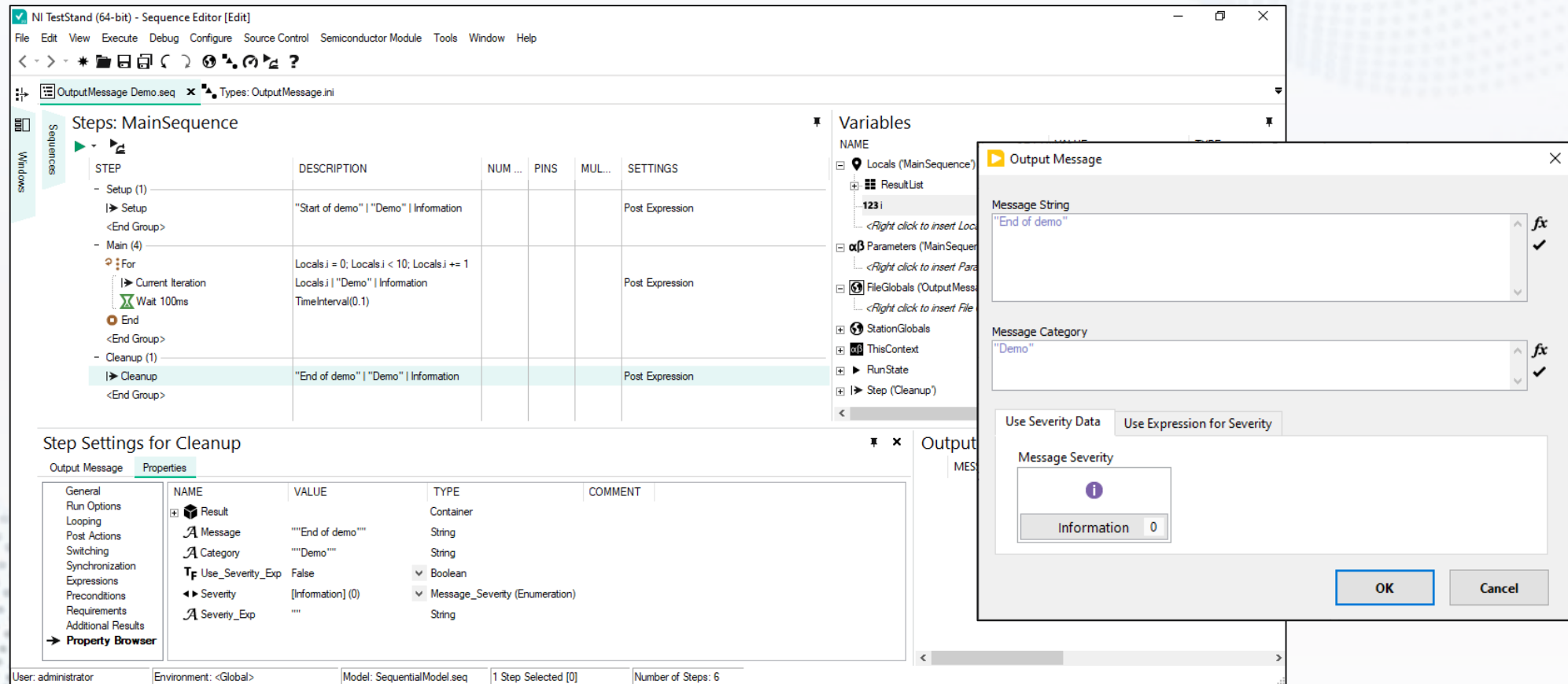
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NI TestStand (64-bit) - Sequence Editor [Edit]

File Edit View Execute Debug Configure Source Control Semiconductor Module Tools Window Help

OutputMessage Demo.seq x Types: OutputMessage.ini

### Steps: MainSequence

STEP	DESCRIPTION	NUM ...	PINS	MUL...	SETTINGS
- Setup (1)					
> Setup	"Start of demo"   "Demo"   Information				Post Expression
<End Group>					
- Main (4)					
> For	Locals.i = 0; Locals.i < 10; Locals.i += 1				Post Expression
> Current Iteration	Locals.i   "Demo"   Information				
> Wait 100ms	TimeInterval(0.1)				
End					
<End Group>					
- Cleanup (1)	"End of demo"   "Demo"   Information				Post Expression
<End Group>					

### Step Settings for Cleanup

Output Message Properties

General	NAME	VALUE	TYPE	COMMENT
Run Options	Result		Container	
Looping	Message	""End of demo""	String	
Post Actions	Category	""Demo""	String	
Switching	Use_Severity_Exp	False	Boolean	
Synchronization	Severity	[Information] (0)	Message_Severity (Enumeration)	
Expressions	Severity_Exp	""	String	
Preconditions				
Requirements				
Additional Results				

User: administrator Environment: <Global> Model: SequentialModel.seq 1 Step Selected [0] Number of Steps: 6

### Output Message Dialog

Message String: "End of demo"

Message Category: "Demo"

Use Severity Data Use Expression for Severity

Message Severity: Information 0

OK Cancel

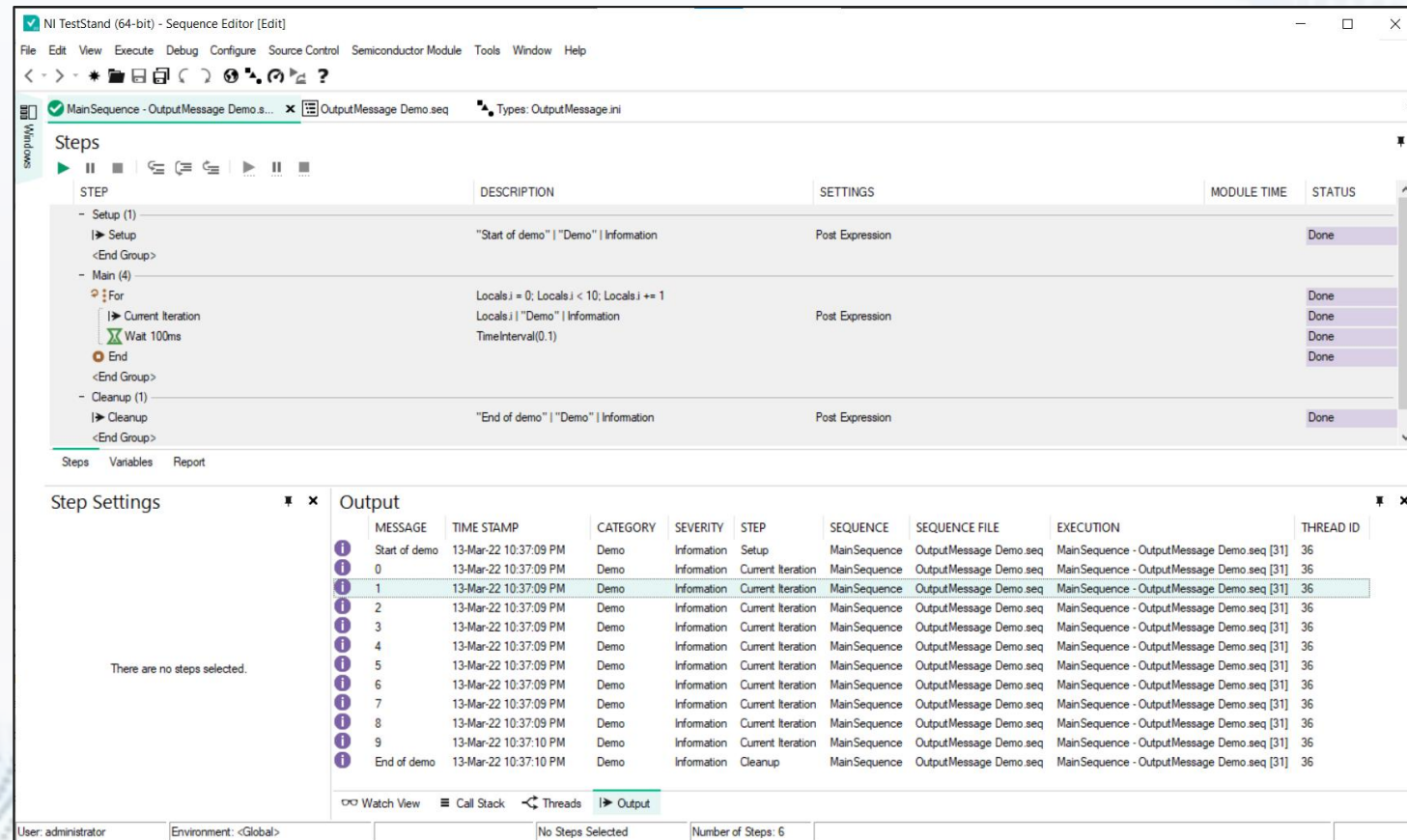
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NI TestStand (64-bit) - Sequence Editor [Edit]

File Edit View Execute Debug Configure Source Control Semiconductor Module Tools Window Help

MainSequence - OutputMessage Demo.s... x OutputMessage Demo.seq Types: OutputMessage.ini

### Steps

STEP	DESCRIPTION	SETTINGS	MODULE TIME	STATUS
- Setup (1)				
> Setup	"Start of demo"   "Demo"   Information	Post Expression		Done
<End Group>				
- Main (4)				
For	Locals.i = 0; Locals.j < 10; Locals.j ++ 1			Done
> Current Iteration	Locals.j   "Demo"   Information	Post Expression		Done
Wait 100ms	TimeInterval(0.1)			Done
End				Done
<End Group>				
- Cleanup (1)				
> Cleanup	"End of demo"   "Demo"   Information	Post Expression		Done
<End Group>				

### Step Settings

There are no steps selected.

### Output

MESSAGE	TIME STAMP	CATEGORY	SEVERITY	STEP	SEQUENCE	SEQUENCE FILE	EXECUTION	THREAD ID
Start of demo	13-Mar-22 10:37:09 PM	Demo	Information	Setup	MainSequence	OutputMessage Demo.seq	MainSequence - OutputMessage Demo.seq [31]	36
0	13-Mar-22 10:37:09 PM	Demo	Information	Current Iteration	MainSequence	OutputMessage Demo.seq	MainSequence - OutputMessage Demo.seq [31]	36
1	13-Mar-22 10:37:09 PM	Demo	Information	Current Iteration	MainSequence	OutputMessage Demo.seq	MainSequence - OutputMessage Demo.seq [31]	36
2	13-Mar-22 10:37:09 PM	Demo	Information	Current Iteration	MainSequence	OutputMessage Demo.seq	MainSequence - OutputMessage Demo.seq [31]	36
3	13-Mar-22 10:37:09 PM	Demo	Information	Current Iteration	MainSequence	OutputMessage Demo.seq	MainSequence - OutputMessage Demo.seq [31]	36
4	13-Mar-22 10:37:09 PM	Demo	Information	Current Iteration	MainSequence	OutputMessage Demo.seq	MainSequence - OutputMessage Demo.seq [31]	36
5	13-Mar-22 10:37:09 PM	Demo	Information	Current Iteration	MainSequence	OutputMessage Demo.seq	MainSequence - OutputMessage Demo.seq [31]	36
6	13-Mar-22 10:37:09 PM	Demo	Information	Current Iteration	MainSequence	OutputMessage Demo.seq	MainSequence - OutputMessage Demo.seq [31]	36
7	13-Mar-22 10:37:09 PM	Demo	Information	Current Iteration	MainSequence	OutputMessage Demo.seq	MainSequence - OutputMessage Demo.seq [31]	36
8	13-Mar-22 10:37:09 PM	Demo	Information	Current Iteration	MainSequence	OutputMessage Demo.seq	MainSequence - OutputMessage Demo.seq [31]	36
9	13-Mar-22 10:37:10 PM	Demo	Information	Current Iteration	MainSequence	OutputMessage Demo.seq	MainSequence - OutputMessage Demo.seq [31]	36
End of demo	13-Mar-22 10:37:10 PM	Demo	Information	Cleanup	MainSequence	OutputMessage Demo.seq	MainSequence - OutputMessage Demo.seq [31]	36

User: administrator Environment: <Global> No Steps Selected Number of Steps: 6

What are  
TestStand  
Step Types

How to  
Customize  
Step Types

Interfacing  
Step Types  
with  
LabVIEW

Demo  
Custom  
Step Types



# Thank You



<https://github.com/ItsMeAshiq/TestStand-OutputMessage>