

Rockwell Automation Library of Process Objects: Restart Inhibit for Large Motor (P_ResInh)

Version 3.5

IMPORTANT

This manual applies to the Rockwell Automation Library of Process Objects version 3.5 or earlier.
For Rockwell Automation Library of Process Objects version 5.0, see

- [PROCES-RM200](#)

For Rockwell Automation Library of Process Objects version 4.0 or later, use the following manuals:

- [PROCES-RM013](#) contains logic instructions
- [PROCES-RM014](#) contains display elements



Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.



WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.



ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.



SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.



BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.



ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

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Notes:

This manual contains updated information for the Rockwell Automation® Library of Process Objects, version 3.5.

Software Compatibility and Content Revisions

Table 1 - Summary of Changes

Topic	Page
Updates Restart Inhibit graphics for cool and hot motors	7, 18
Updates the Hot Start OK and Restart Delay Hot configuration input parameters	10, 19

For the latest compatible software information and to download the Rockwell Automation® Library of Process Objects, see the Product Compatibility and Download Center at <http://www.rockwellautomation.com/rockwellautomation/support/pcdc.page>.

For general library considerations, see Rockwell Automation Library of Process Objects Reference Manual, publication [PROCES-RM002](#).

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
PlantPAx® Distributed Control System Selection Guide, publication PROCES-SG001	Provides information to assist with equipment procurement for your PlantPAx system.
PlantPAx Distributed Control System Reference Manual, publication PROCES-RM001	Provides characterized recommendations for implementing your PlantPAx system.
PlantPAx Distributed Control System Infrastructure Configuration, publication PROCES-UM001	Provides screen facsimiles and step-by-step procedures to configure infrastructure components for your system requirements.
PlantPAx Distributed Control System Application Configuration User Manual, publication PROCES-UM003	Describes procedures to start development of your PlantPAx distributed control system.
Rockwell Automation Library of Process Objects, publication PROCES-RM002	Provides general considerations for the PlantPAx system library of process objects.
FactoryTalk® View Machine Edition User Manual, publication VIEWME-UM004	Provides details on how to use this software package for creating an automation application.
FactoryTalk® View Site Edition User Manual, publication VIEWSE-UM006	Provides details on how to use this software package for developing and running human machine interface (HMI) applications that can involve multiple users and servers, which are distributed over a network.
Logix5000™ Controllers Add-On Instructions Programming Manual, publication 1756-PM010	Provides information for designing, configuring, and programming Add-On Instructions.

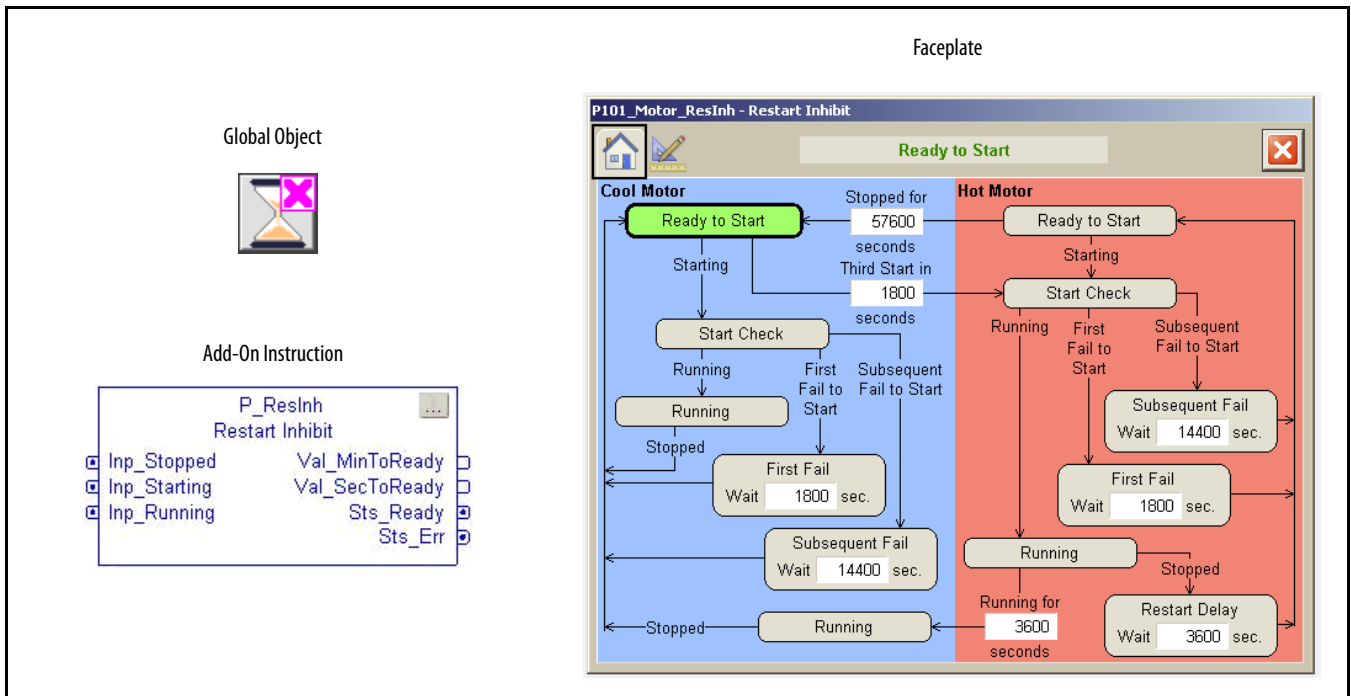
You can view or download publications at <http://www.rockwellautomation.com/literature/>. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Notes:

Restart Inhibit for Large Motor (P_ResInh)

The P_ResInh (Restart Inhibit for Large Motor) Add-On Instruction is used to prevent damage to a large motor through repeated starts. The high starting current for a large motor causes considerable heating. The thermal mass of a large motor is much smaller relative to its horsepower and starting current compared to smaller motors. Repeated starts (or start attempts) over a short time overheat the motor windings, potentially damaging the motor permanently.

The P_ResInh instruction provides a rule-based state model for restarts and is not intended to model or monitor the motor heating. It cannot replace sensor-based motor monitoring devices. It can, however, be a simple solution to avoid overstressing a motor without the cost (money or controller resources) of more extensive modeling and monitoring.



Guidelines

Use this instruction in these situations:

- You have a large motor or other piece of equipment where repeated start/stop cycles or failures to start can damage the equipment.
- The state model of the P_ResInh instruction is appropriate for limiting the restarts of the equipment (three starts rule, hot/cold model, and so on).
- You don't have the sensors or equipment for more advanced motor monitoring or modeling.

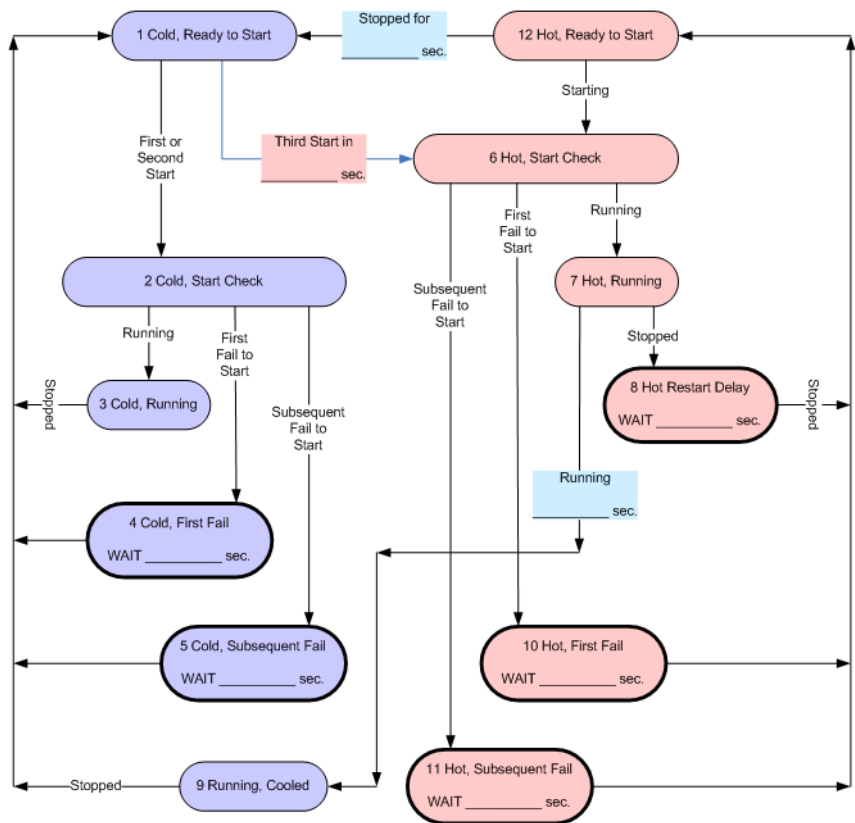
TIP You can also use the P_Perm instruction, especially if the equipment has additional permissive conditions.

Do **not** use this instruction in these situations:

- You have more advanced motor monitoring equipment or motor heating models available. Use the advanced equipment to provide a start permissive instead.
- You have a small motor that can repeatedly start and stop without damage, or a simple thermal cutout that is provided with the motor is sufficient to protect it.

Functional Description

The diagram shows the functional characteristics of the P_ResInh Add-On Instruction.



The following list shows the functional coding for the P_ResInh instruction.

Table 2 - P_ResInh Functional Coding

Input	Starting	Running	Stopped
Inp_Starting	1	Ignored	Ignored
Inp_Running	0	1	Ignored
Inp_Stopped	Ignored	0	1

The P_ResInh instruction provides the following capabilities:

- Ready to Start signal for use by other logic when the motor can be started. Typically, this signal is used as a permissive in a motor based control strategy.
- When the motor is not ready to start, provide a countdown of the time until the motor is ready to start (in minutes and seconds).

Required Files

Add-On Instructions are reusable code objects that contain encapsulated logic that can streamline implementing your system. This instruction lets you create your own instruction set for programming logic as a supplement to the instruction set provided natively in the ControlLogix® firmware. An Add-On Instruction is defined once in each controller project, and can be instantiated multiple times in your application code as needed.

Controller File

The P_ResInh_3_5-00_AOIL5X Add-On Instruction must be imported into the controller project to be used in the controller configuration. The service release number (boldfaced) can change as service revisions are created.

Visualization Files

Controller Code

This section describes the parameter references for this Add-On Instruction.

Restart Inhibit for Large Motor Input Structure

Input parameters include the following:

- Input data elements (Inp_) are typically used to connect field inputs from I/O modules or signals from other objects.
- Configuration data elements (Cfg_) are used to set configurable capabilities and features of the instruction.

Table 3 - P_ResInh Input Parameters

Input Parameter	Data Type	Default	Description
EnableIn	BOOL	1	<p>Ladder Diagram: If the rung-in condition is true, the instruction's Logic routine executes. If the rung-in condition is false, the instruction's EnableInFalse routine executes.</p> <p>Function Block Diagram: If true, or not connected, the instruction's Logic routine executes. If the parameter is exposed as a pin and wired, and the pin is false, the instruction's EnableInFalse routine executes.</p> <p>Structured Text: No effect. The instruction's Logic routine executes.</p>
Inp_Stopped	BOOL	0	Equipment is confirmed stopped.
Inp_Starting	BOOL	0	Equipment is starting, indicating a start attempt.
Inp_Running	BOOL	1	Equipment is confirmed running.
Cfg_ThreeColdStarts	DINT	1800 (1/2 hour)	Seconds within which three starts are allowed (cool motor) (state 1 to state 6). ⁽¹⁾
Cfg_FirstFailCold	DINT	1800 (1/2 hour)	Seconds to wait after first start failure before ready (cool motor) (state 4). ⁽¹⁾
Cfg_SubseqFailCold	DINT	14400 (4 hours)	Seconds to wait after two or more start failures before ready (cool motor) (state 5) ⁽¹⁾ .
Cfg_FirstFailHot	DINT	1800 (1/2 hour)	Seconds to wait after first start failure before ready (hot motor) (state 10) ⁽¹⁾ .
Cfg_SubseqFailHot	DINT	14400 (4 hours)	Seconds to wait after two or more start failures before ready (hot motor) (state 11) ⁽¹⁾ .
Cfg_HotRestartOK	DINT	3600 (1 hour)	Seconds for a running hot motor to become cool (state 7...state 9) ⁽¹⁾ .
Cfg_RestartDelayHot	DINT	3600 (1 hour)	Seconds for a hot motor to wait after stopping before it can be started (state 8) ⁽¹⁾ .
Cfg_HotToCold	DINT	57600 (16 hours)	Seconds for a stopped hot motor to become cool (state 12...state 1) ⁽¹⁾ .

(1) State numbers refer to the state diagram on [page 8](#).

Restart Inhibit for Large Motor Output Structure

Output parameters include the following:

- Value data elements (Val_) are numeric outputs of the instruction for use by the HMI. Values can also be used by other application logic or software packages.
- Status data elements (Sts_) are bit outputs of the instruction for use by the HMI. Status bits can also be used by other application logic.

Table 4 - P_ResInh Output Parameters

Output Parameter	Data Type	Description
EnableOut	BOOL	Enable Output: The EnableOut signal is not manipulated by this instruction. Its output state always reflects EnableIn input state.
Val_MinToReady	DINT	Minutes yet inhibited before ready to start (mmm:ss).
Val_SecToReady	DINT	Seconds yet inhibited before ready to start (mmm:ss).
Val_Fdbk	SINT	Device feedback: 0 = None/Multiple 1 = Stopped 2 = Starting 3 = Running
Val_State	SINT	State Number (see state diagram in Functional Description on page 8) for HMI.
Sts_Ready	BOOL	Permissive for unit to start: 1 = Ready 0 = Not ready
Sts_Err	BOOL	1 = Error in configuration: Invalid Time (use 0...2,147,483).
P_ResInh	BOOL	Unique parameter name for auto-discovery.

Restart Inhibit for Large Motor Local Configuration Tags

Configuration parameters that are arrayed, string, or structure data types cannot be configured as parameters for Add-On Instructions. Configuration parameters of these types appear as local tags to the Add-On Instruction. Local tags can be configured through the HMI faceplates or in the Studio 5000 Logix Designer® application. Open the instruction logic of the Add-On Instruction instance and then open the Data Monitor on a local tag. These parameters cannot be modified by using controller logic or Logix Designer application export/import functionality.

Table 5 - Local Configuration Tags

Tag Name	Data Type	Default	Description
Cfg_Desc	STRING_40	'Restart Inhibit'	Description for display on HMI. The string shows in the title bar of the faceplate.
Cfg_Label	STRING_20	'Restart Inhibit'	Label for graphic symbol displayed on HMI. This string appears on the graphic symbol.
Cfg_Tag	STRING_20	'P_ResInh'	Tagname for display on HMI. This string shows in the title bar of the home tab of the faceplate.

Operations

This section describes the primary operations for Add-On Instructions.

Modes

The P_ResInh Add-On Instruction does not have modes and does not contain a P_Mode instruction instance.

Alarms

The P_ResInh Add-On Instruction provides no alarms. It is typically used to provide a permissive condition for a motor or other equipment, not an interlock that requires an alarm.

Simulation

The P_ResInh Add-On Instruction does not have a Simulation capability. The instruction uses the status of a related motor or drive object, which uses its simulation capability.

Execution

The following table explains the handling of instruction execution conditions.

Table 6 - P_ResInh Execution

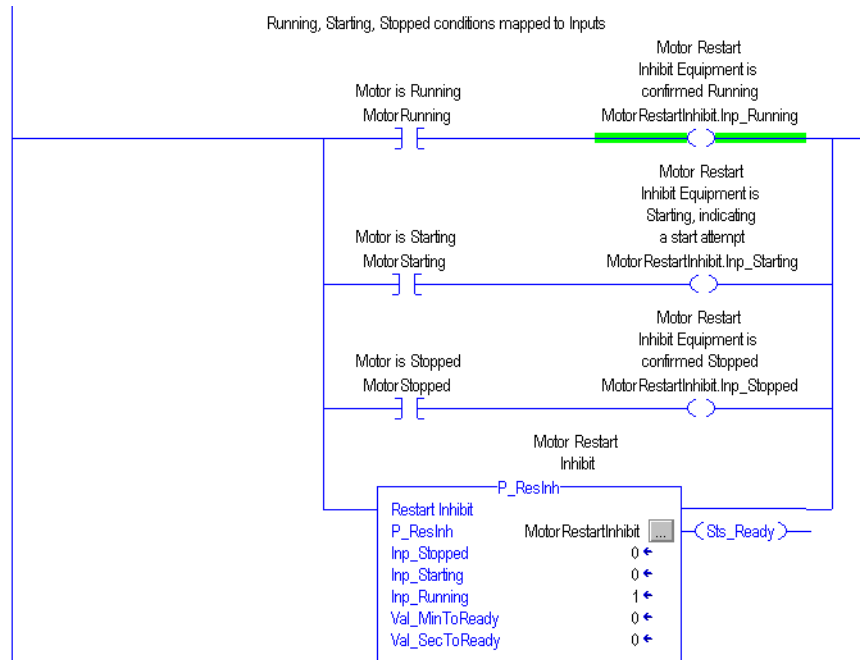
Condition	Description
EnableIn False (false rung)	Processing for EnableIn False (false rung) is handled as if the inputs indicate that the motor is stopped (Inp_Starting = 0, Inp_Running = 0, Inp_Stopped = 1). This action sets the P_ResInh Add-On Instruction be coded on a ladder rung with an XIC of the motor running status. Inp_Running must be set to 1 and Inp_Starting must be set to 0 (their default values) for the instruction to be used in this fashion.
Powerup (prescan, first scan)	On prescan (Program to Run or Powerup), all timers are reset and the P_ResInh instruction reverts to the Cold Motor Stopped state if the motor is stopped, or the Cold Motor Running state if the motor is running. See the State model.

Refer to the Logix5000 Controllers Add-On Instructions Programming Manual, publication [1756-PM010](#), for more information.

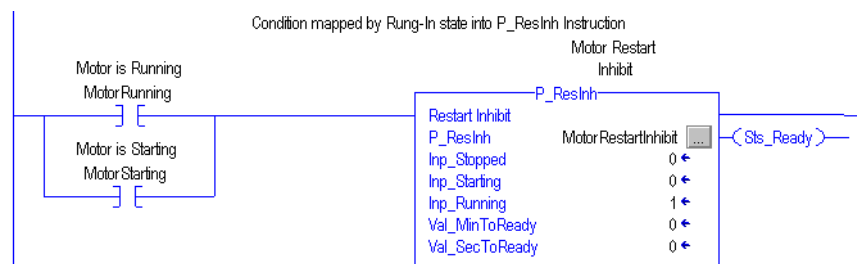
Implementation by Using EnableIn False Feature

For the convenience of Ladder Diagram programmers, the P_ResInh instruction can be used in a Ladder Diagram Routine with the input condition carried by the Rung-In condition instead of being mapped on separate branches.

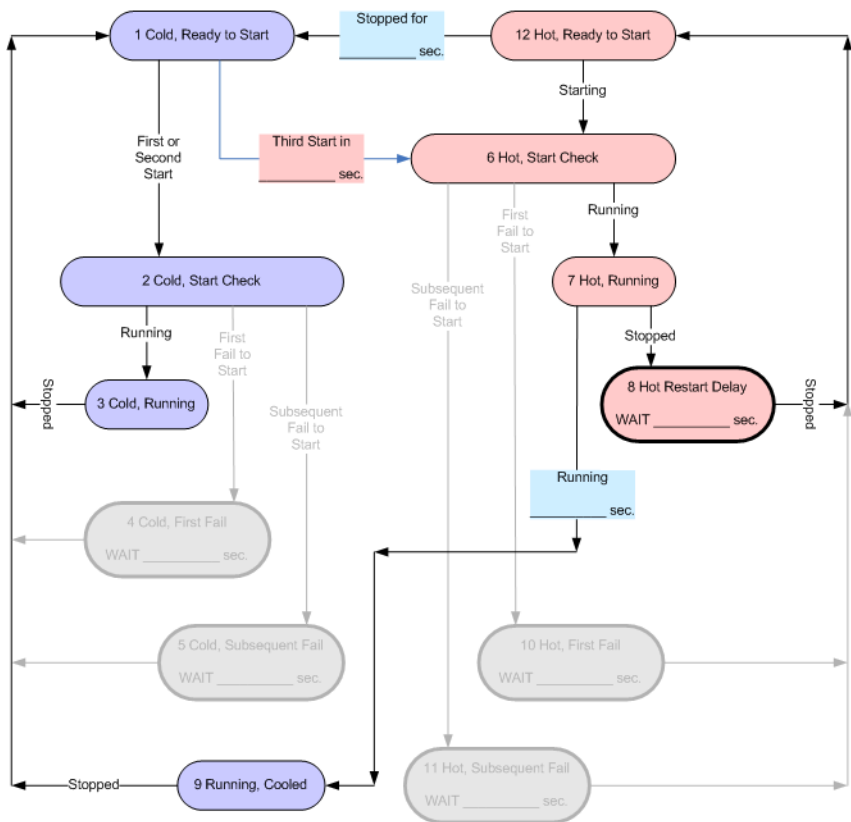
The following illustration shows normal implementation with the input conditions mapped on separate branches.



The following illustration shows EnableIn False implementation with the input condition mapped to the P_ResInh instruction when the Rung-In state is used.




The Rung-In condition determines whether the Add-On Instruction's normal code (Logic Routine) is executed or its EnableIn False code (EnableInFalse Routine) is executed. In the P_ResInh instruction, the EnableIn False code executes the logic for a stopped motor. So to use the Rung-In mapping method, Inp_Running must be set to 1 (its default value). Then when the rung is true, the logic executes for a running motor. When the rung is false, the logic executes for a stopped motor. The Starting Input (Inp_Starting) is not used, so the Fail to Start states are never reached. Effectively, the instruction uses the following state diagram when EnableIn False implementation is used.



Display Elements

A display element (global object) is created once and can be referenced multiple times on multiple displays in an application. When changes are made to the original (base) object, the instantiated copies (reference objects) are automatically updated. Use of global objects, with tag structures in the ControlLogix® system, aid consistency and save engineering time.

Table 7 - P_ResInh Display Elements Description

Display Element Name	Display Element	Description
GO_P_ResInh		Standard Restart Inhibit Global Object.

The following graphic symbol is provided for use on faceplates and end-user process graphic displays.

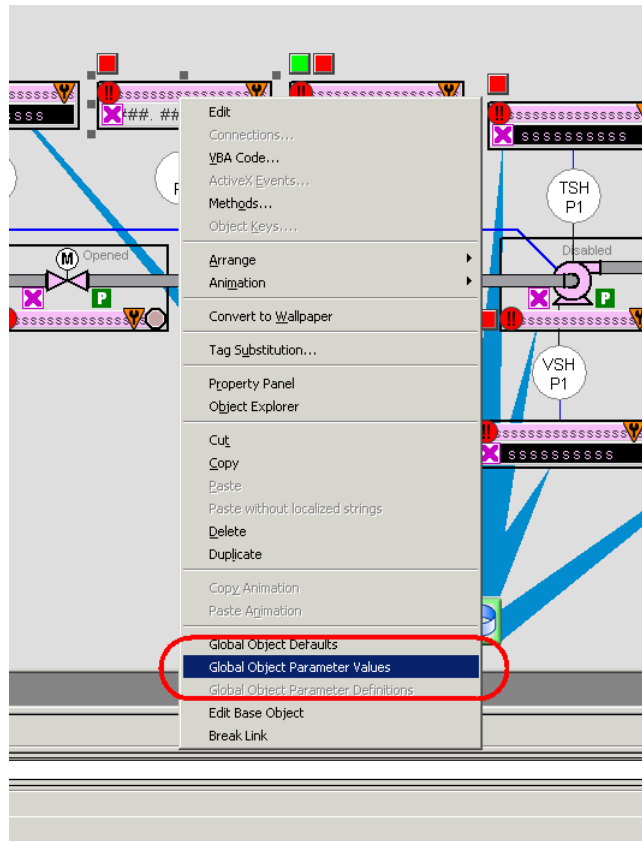


This graphic symbol includes a navigation button that opens the primary faceplate.

Using Display Elements

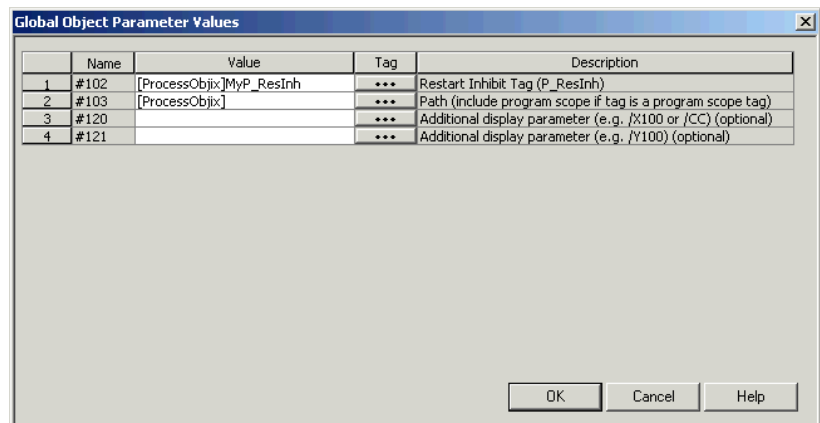
The graphic symbol for P_ResInh instruction can be found in the global object file (RA-BAS) Process Graphics Library.ggfx. Complete the steps to use the graphic symbol.

1. Copy the global object from the global object file and paste it in the display file.



2. In the display, right-click the global object and choose Global Object Parameter Values.

The Global Object Parameter Values dialog box appears.



The global object parameters are as follows.

Parameter	Required	Description
#102	Y	Object tag to point to the name of the associated object Add-On Object in the controller.
#103	Y	Path used for display navigation features to other objects. Include program scope if tag is a program scope tag.
#120	N	Additional parameter to pass to the display command to open the faceplate. Typically used to define position for the faceplate.
#121	N	Additional parameter to pass to the display command to open the faceplate. If defining X and Y coordinate, separate parameters so that X is defined by #120 and Y is defined by #121. This lets the same parameters to be used in subsequent display commands originating from the faceplate.

3. Type the tag or value in the Value column as specified in the Description column.

TIP

Click Browse (ellipsis (...)) to select a tag.

Values for items marked '(optional)' can be left blank.

4. Click OK.

Faceplate

The P_ResInh faceplate consists of two tabs and each tab consists of one or more pages.

Each faceplate title bar contains the value of local configuration tags Cfg_Tag and Cfg_Desc.

Tag - Description

The Operator tab is displayed when the faceplate is initially opened. Click the appropriate icon at the top of the screen to access a specific tab.



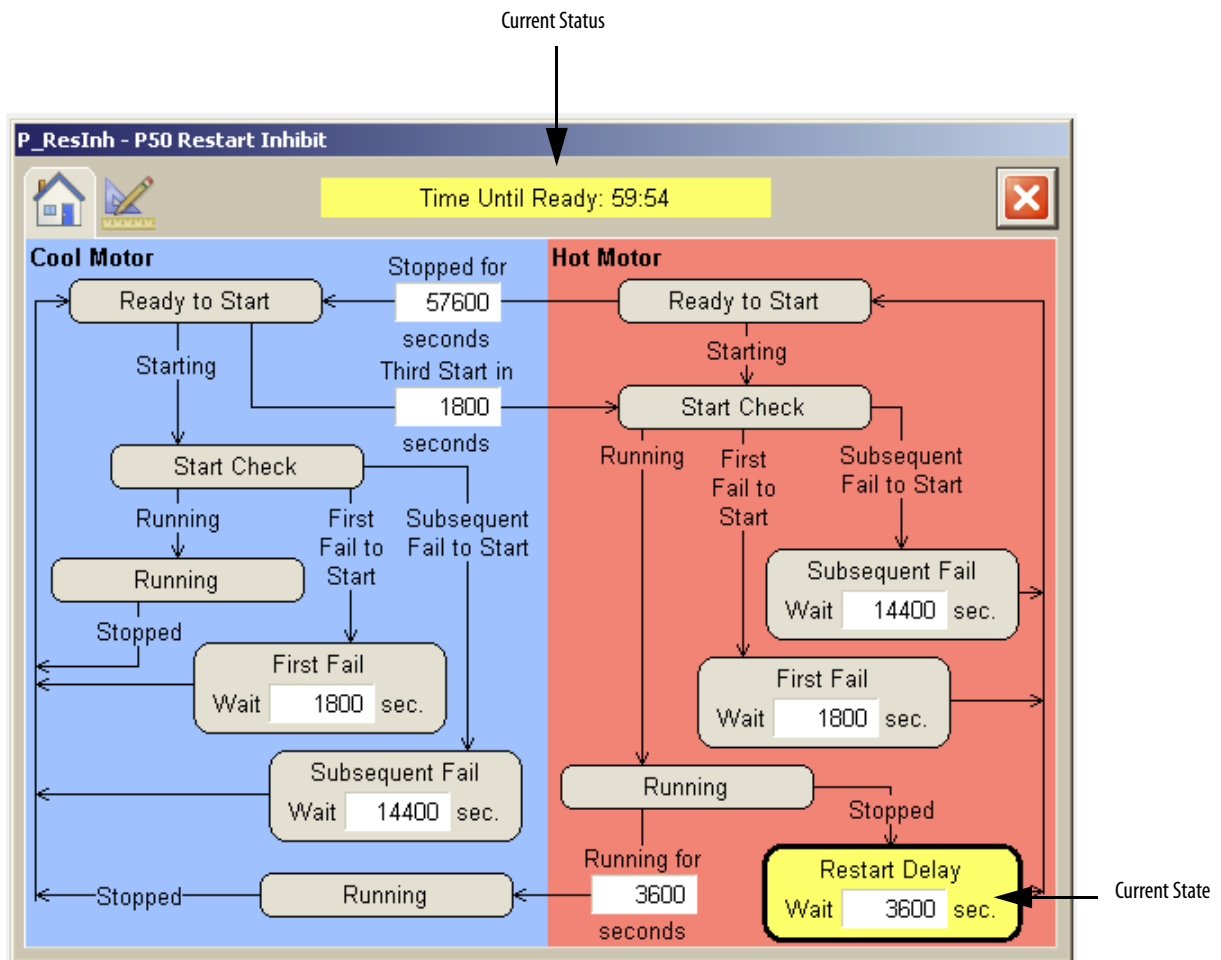
The faceplate provides the means for operators, maintenance personnel, engineers, and others to interact with the P_ResInh instruction instance, including viewing its status and manipulating it through its commands and configuration. When a given input is restricted via FactoryTalk View security, the required user Security Code letter is shown in the tables that follow.

Operator Tab

The Faceplate initially opens to the Operator ('Home') tab. From here, an operator can monitor the device status.

The Operator tab shows the following information:

- A graphical representation of the P_ResInh instruction State Diagram.
- Indication of the current state. The current state is highlighted in Green for ready or active states or yellow for waiting states. The current state also has a bold border.
- The current status appears at the top and displays either Ready to Start or Time Until Ready with an animated countdown timer.



Data entry fields on the Operator tab include the following.

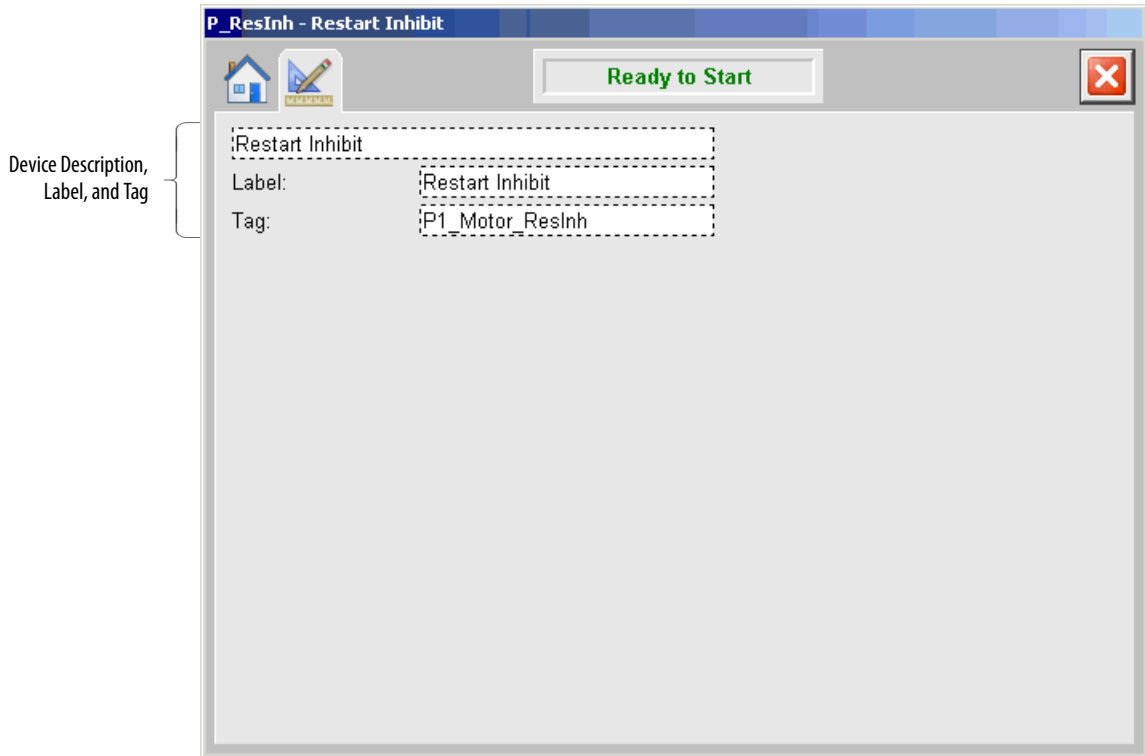
Table 8 - Operator Tab Descriptions

Function	Action	Security Required	Configuration Parameters
Stopped for XX seconds	Type the time, in seconds, for a stopped hot motor to cool.	Configuration and Tuning Maintenance (Code D)	Cfg_HotToCold
Third Start in XX seconds	Type the time, in seconds, during which three motor starts turn a cold motor to hot.		Cfg_ThreeColdStarts
Running for XX seconds	Type the time, in seconds, for a running hot motor to cool.		Cfg_HotRestartOK
Cold, First Fail Wait XX seconds	Type the time, in seconds, to wait after failing to start a cold motor the first time.		Cfg_FirstFailCold
Cold, Subsequent Fail Wait XX seconds	Type the time, in seconds, to wait after failing to start a cold motor two or more times.		Cfg_SubseqFailCold
Hot, First Fail Wait XX seconds	Type the time, in seconds, to wait after failing to start a hot motor the first time.		Cfg_FirstFailHot
Hot, Subsequent Fail Wait XX seconds	Type the time, in seconds, to wait after failing to start a hot motor two or more times.		Cfg_SubseqFailHot
Hot, Restart Delay Wait XX seconds	Type the time, in seconds, to wait after stopping a running hot motor.		Cfg_RestartDelayHot

Engineering Tab

The Engineering tab provides access to device configuration parameters and ranges, options for device and I/O setup, displayed text, and faceplate-to-faceplate navigation settings, for initial system commissioning or later system changes.

On the Engineering tab, you can configure the description, label, and tag for the device.



The following table lists the functions on the Engineering tab.

Table 9 - Engineering Tab Description

Function	Action	Security	Configuration Parameters
Description	Type a text description of the restart inhibit that appears title bar on the Operator Tab of the faceplate.	Engineering Configuration (Code E)	Cfg_Desc
Label	Type a text description that appears on the graphic symbol.		Cfg_Label
Tag	Type the text that appears in the title bar of each faceplate.		Cfg_Tag

Notes:

Notes:

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products.

At <http://www.rockwellautomation.com/support> you can find technical and application notes, sample code, and links to software service packs. You can also visit our Support Center at <https://rockwellautomation.custhelp.com/> for software updates, support chats and forums, technical information, FAQs, and to sign up for product notification updates.

In addition, we offer multiple support programs for installation, configuration, and troubleshooting. For more information, contact your local distributor or Rockwell Automation representative, or visit <http://www.rockwellautomation.com/services/online-phone>.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/rockwellautomation/support/overview.page , or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its products to help ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

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Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete this form, publication [RA-DU002](#), available at <http://www.rockwellautomation.com/literature/>.

Rockwell Automation maintains current product environmental information on its website at <http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page>.

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