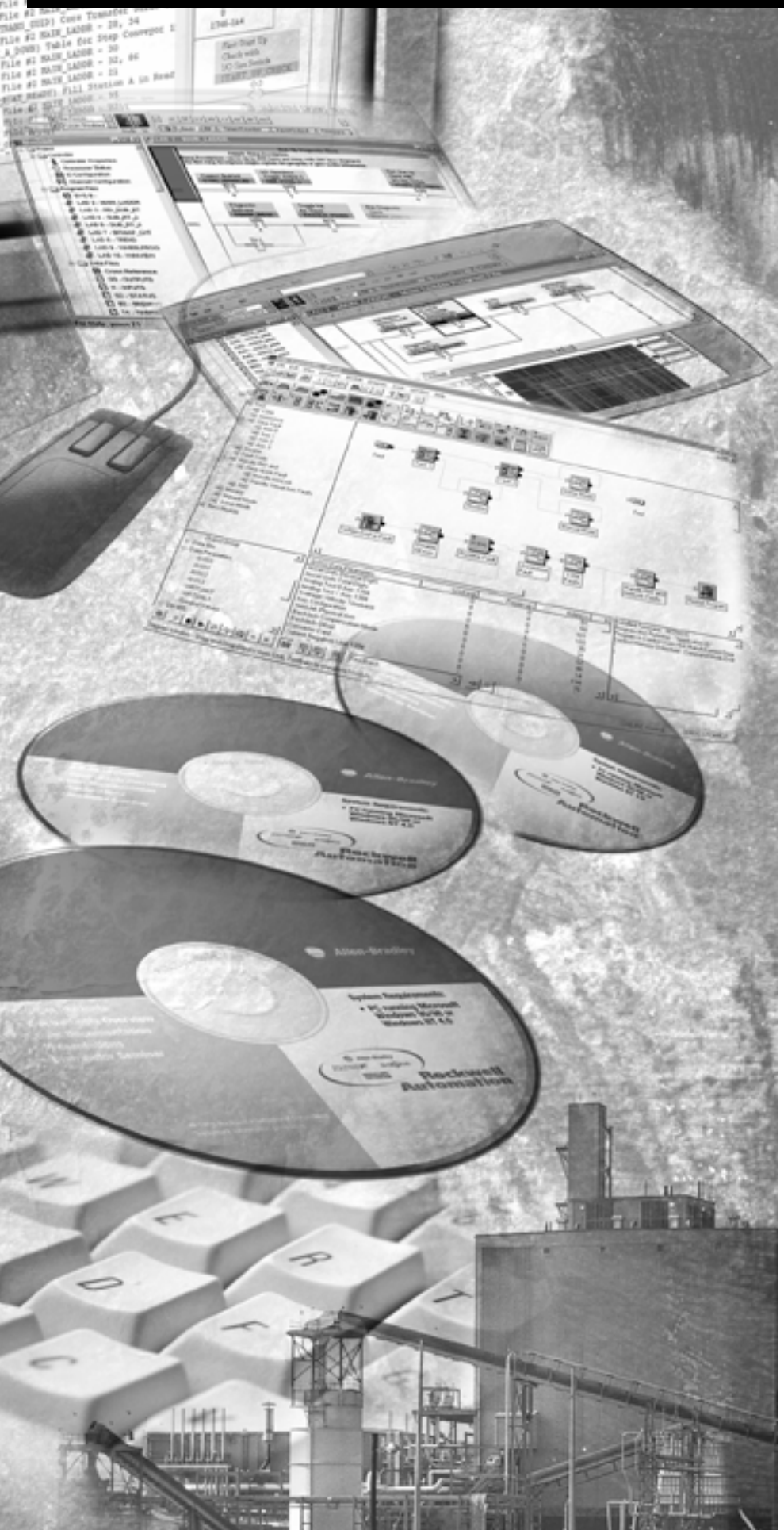

Allen-Bradley

GuardLogix Safety Application Instruction Set

1756-L61S, 1756-L62S, 1756-LSP

Reference Manual

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.ab.com/manuals/gi) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual 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.

IMPORTANT

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

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
- recognize the consequence

SHOCK HAZARD

Labels may be located on or inside the drive to alert people that dangerous voltage may be present.

BURN HAZARD

Labels may be located on or inside the drive to alert people that surfaces may be dangerous temperatures.

Emergency Stop Instruction (ESTOP)

Chapter 4

Enable Pendant Instruction (ENPEN)

Chapter 5

Light Curtain Instruction (LC)

Chapter 6

Five-Position Mode Selector Instruction (FPMS)

Chapter 7

Redundant Output with Continuous Feedback Monitoring Instruction (ROUT)

Chapter 8

Two-Hand Run Station Instruction (THRS)

Chapter 9

Index

Introduction

This reference manual is intended to describe Rockwell Automation's GuardLogix Safety Application Instruction Set for Safety Integrity Level (SIL) 3, Category (CAT) 4 applications.

Manual Set-Up

This manual describes the GuardLogix Safety Application Instruction Set, including wiring and programming examples.

Section	Title	Description
Chapter 1	Safety Application Instructions General Information	Information about using the instructions within a safety system that has a controller and I/O modules.
Chapter 2	Diverse Input Instruction (DIN)	Operation, Ladder Logic Description, and Relationship of I/O Wiring to Instruction Parameters for the Diverse Input Instruction (DIN).
Chapter 3	Redundant Input Instruction (RIN)	Operation, Ladder Logic Description, and Relationship of I/O Wiring to Instruction Parameters for the Redundant Input Instruction (RIN).
Chapter 4	Emergency Stop Instruction (ESTOP)	Operation, Ladder Logic Description, and Relationship of I/O Wiring to Instruction Parameters for the Diverse Input Instruction (DIN).
Chapter 5	Enable Pendant Instruction (ENPEN)	Operation, Ladder Logic Description, and Relationship of I/O Wiring to Instruction Parameters for the Enable Pendant Instruction (ENPEN).
Chapter 6	Light Curtain Instruction (LC)	Operation, Ladder Logic Description, and Relationship of I/O Wiring to Instruction Parameters for the Light Curtain Instruction (LC).
Chapter 7	Five-Position Mode Selector Instruction (FPMS)	Operation, Ladder Logic Description, and Relationship of I/O Wiring to Instruction Parameters for the Five-Position Mode Selector Instruction (FPMS).
Chapter 8	Redundant Output with Continuous Feedback Monitoring Instruction (ROUT)	Operation, Ladder Logic Description, and Relationship of I/O Wiring to Instruction Parameters for the Redundant Output with Continuous Feedback Monitoring Instruction (ROUT).
Chapter 9	Two-Hand Run Station Instruction (THRS)	Operation, Ladder Logic Description, and Relationship of I/O Wiring to Instruction Parameters for the Two-Hand Run Station Instruction (THRS).

Understanding Terminology

The following table defines abbreviations used in this manual.

Abbreviation	Type	Description
AP	Input	Active Pin
BP	Output	Buttons Pressed
BT	Output	Button Tiedown
CB	Output	Cycle Buttons
CHA	Input	Channel A
CHB	Input	Channel B
CI	Output	Cycle Inputs
CR	Input	Circuit Reset
CRHO	Output	Circuit Reset Held On
EN	Input	Enable
FB1	Input	Feedback 1
FB2	Input	Feedback 2
FP	Output	Fault Present
FR	Input	Fault Reset
IFT	Input	Input Filter Time
II	Output	Inputs Inconsistent
IN1 to IN5	Input	Input 1 to Input 5
LBF	Output	Left Button Failure
LBNC	Input	Left Button Normally Closed
LBNO	Input	Left Button Normally Opened
LCB	Output	Light Curtain Blocked
LCM	Output	Light Curtain Muted
MLC	Input	Mute Light Curtain
MMS	Output	Multiple Modes Selected
NM	Output	No Mode
O1 to O5	Output	Output 1 to Output 5
O1FF	Output	Output 1 Feedback Failure
O2FF	Output	Output 2 Feedback Failure
RBF	Output	Right Button Failure
RBNC	Input	Right Button Normally Closed
RBNO	Input	Right Button Normally Opened
SA	Output	Station Active
SAF	Output	Station Active Failure

Related Documentation

The table below provides a listing of publications that contain important information about GuardLogix Controller systems.

For	Read this document	Document number
Information on installing the GuardLogix Controller	GuardLogix Controller Installation Instructions	1756-IN045
Information on configuration and programming for the GuardLogix System	GuardLogix User Manual	1756-UM020
Safety information for using the GuardLogix Controller system in SIL 3/ CAT 4 applications.	GuardLogix Controller Systems Safety Reference Manual	1756-RM093
Information on installing DeviceNet Safety I/O Modules	DeviceNet Safety I/O Installation Instructions	1791DS-IN001
Information on configuration and programming for DeviceNet Safety I/O Modules	DeviceNet Safety I/O User Manual	1791DS-UM001
Information on the Logix5000 Instruction Set	Logix5000™ General Instruction Set Reference Manual	1756-RM003
Information on programming Logix5000 controllers	Logix™ Common Procedures Programming Manual	1756-PM001
Information on using RSLogix 5000 Import/Export Utility	Logix™ Import Export Reference Manual	1756-RM084

If you would like a manual, you can:

- download a free electronic version from the internet at **www.rockwellautomation.com/literature**.
- purchase a printed manual by contacting your local Allen-Bradley distributor or Rockwell Automation sales office.

Safety Application Instructions General Information

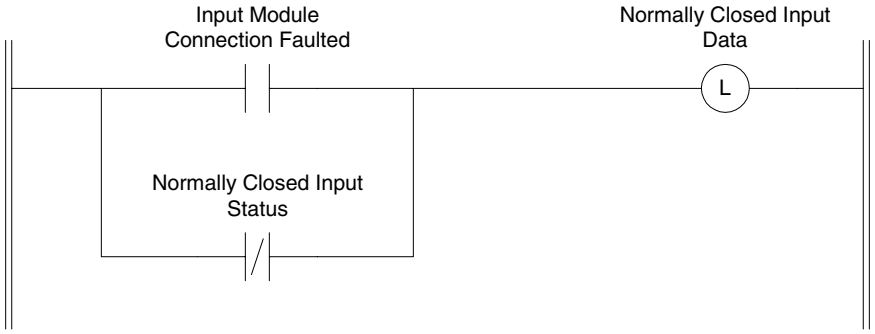
This chapter provides general information about using the safety application instructions within a safety system that has a controller and I/O modules.

De-Energize to Trip System

The GuardLogix Safety controller is part of a de-energize to trip system. This means that all of its outputs are set to zero when a fault is detected.

In addition, the GuardLogix Safety controller automatically sets any input values associated with faulty input modules to zero. As a result, any inputs being monitored by one of the diverse input instructions (DIN or THRS) should have the normally closed input conditioned by logic such as that shown in Figure 1.1.

Figure 1.1 Example Ladder Logic for Instructions that Use Diverse Inputs



The exact ladder logic depends on your specific system requirements, and the functionality of the Safety input module. The result, however, should be the same: to create a Safe state of one for the normally closed input of the diverse input instructions. This example logic actually overrides the input value in the input tag.

The normally closed input of the diverse input instruction should be placed in a Safe state whenever the connection to the input module is lost, or the normally closed input point is faulted.

The input value should remain intact to represent the actual state of the field device when there is a connection and the normally closed input point is not faulted.

Failure to implement this type of logic does not create an unsafe condition, but it does result in the instruction latching an Inputs Inconsistent fault, requiring a clear fault operation to be performed.

System Dependencies

The safety application instructions depend on the safety I/O modules, controller operating system, and the ladder logic to perform portions of the safety functions.

Input and Output Line Conditioning

Safety I/O modules provide pulse test and monitoring capabilities. If the module detects a failure, it sets the offending input or output to the Safe state and reports the failure to the controller.

The failure indication is made via the input or output point status, and is maintained for a configurable amount of time, or until the failure is repaired, which ever comes last.

IMPORTANT Ladder logic must be included in the application program to latch these I/O point failures and ensure proper restart behavior.

For more information on Safety I/O modules, refer to the *DeviceNet Safety I/O User Manual*, publication 1791DS-UM001.

I/O Module Connection Status

A CIP Safety system provides connection status for each I/O device in the safety system. If an input connection failure is detected, the operating system sets all associated inputs to the de-energized (Safe) state, and reports the failure to the ladder logic. If an output connection failure is detected, the operating system can only report the failure to the ladder logic.

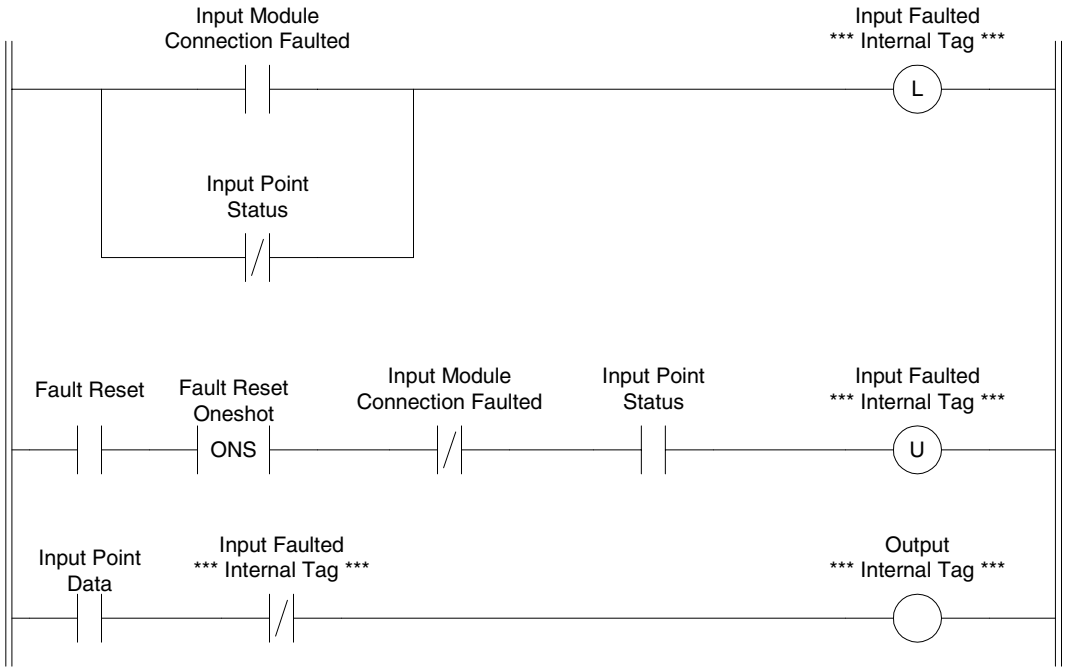
IMPORTANT Ladder logic must be included in the application program to monitor and latch any connection failures and ensure proper restart behavior.

How to Latch and Reset Faulted I/O

The diagrams in Figure 1.2 and Figure 1.3 provide examples of the ladder logic required to latch and reset an I/O module connection or point failure. Figure 1.2 shows the ladder logic for an input point, Figure 1.3 shows the ladder logic for an output point.

IMPORTANT Both of these diagrams are examples, and are for illustrative purposes only. The suitability of this logic depends upon your specific system requirements.

Figure 1.2 Example Ladder Logic to Latch and Reset an Input



The first rung latches an internal indication that either the module connection or the specific input point has failed.

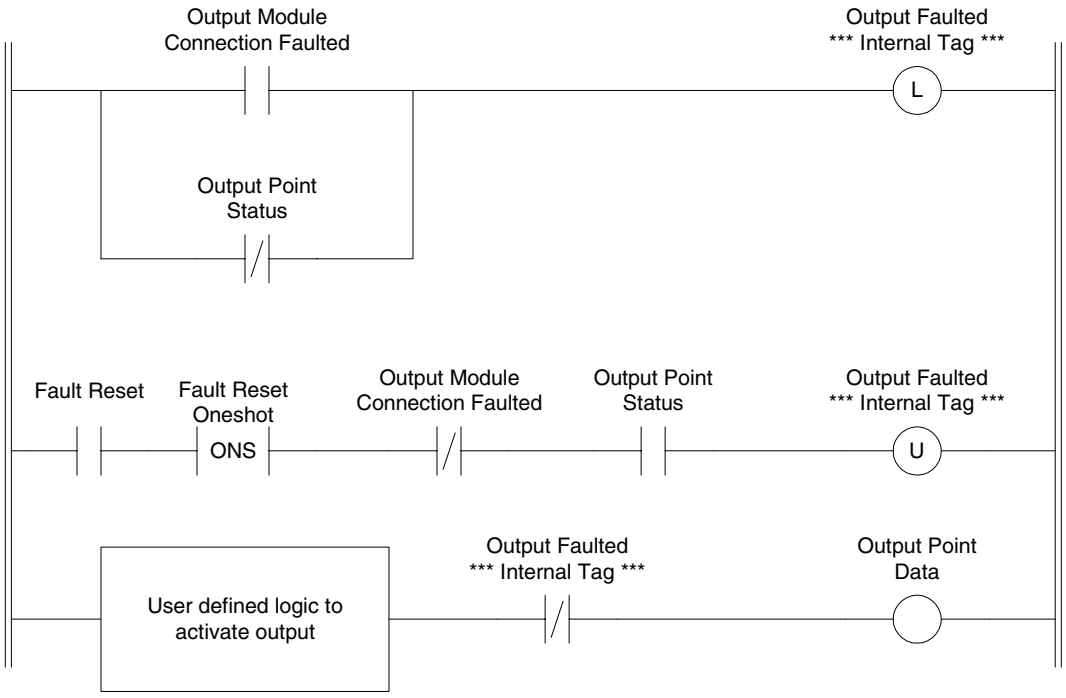
The second rung resets the internal indication, but only if the fault has been repaired, and only on the rising edge of the Fault Reset signal. This prevents the safety function from automatically restarting if the Fault Reset signal gets stuck on.

The third rung shows the input point data used in combination with the internal fault indication to control an output.

The output is internal data that may be used in combinational logic later to drive an actual output. If an actual output is used directly, it may or may not require logic similar to that shown in Figure 1.3 for latching and resetting output connection failures.

The Fault Reset contact shown in these examples is typically activated as a result of operator action. The Fault Reset could be derived as a result of combinational logic or directly from an input point (in which case it may or may not require conditioning of its own).

Figure 1.3 Example Ladder Logic to Latch and Reset an Output



The ladder logic in Figure 1.3 has the same latch and reset concept as that shown in Figure 1.2.

The first rung latches an internal indication that either the module connection or the specific output point has failed.

The second rung resets the internal indication, but only if the fault has been repaired, and only on the rising edge of the Fault Reset signal. This prevents the safety function from automatically restarting if the Fault Reset signal gets stuck on.

The third rung includes application-specific logic to drive the state of an output point. This logic is conditioned by the output faulted internal indicator.

False Rung State Behavior

The information provided in this manual regarding the GuardLogix Safety application instructions depicts the “True Rung State” (Relay Ladder Logic) behavior of the instructions.

The “False Rung State” behavior is exactly the same (internal state machines continue to run and change states based on the inputs) except that all outputs, including prompts and fault indicators, are set to zero when the instructions are disabled or on a false rung.

I/O Point Mapping

Input

The following table identifies the mapping between the Safety I/O modules Input points and the controller tags when the Safety I/O module's Input Status module definition is configured for Point Status or Combined Status.

Note that *moduleName* is the name you assign to the I/O module.

Table 1.1 Input Point Mapping

I/O Module Point	Controller Tag Reference		
	Data	**Point Status**	**Combined Status**
IN 0	*moduleName*:I.Pt00Data	*moduleName*:I.Pt00InputStatus	*moduleName*:I.InputStatus
IN 1	*moduleName*:I.Pt01Data	*moduleName*:I.Pt01InputStatus	
IN 2	*moduleName*:I.Pt02Data	*moduleName*:I.Pt02InputStatus	
…	…	…	
IN n	*moduleName*:I.PtnData	*moduleName*:I.PtnInputStatus	

Output

The following table identifies the mapping between the Safety I/O modules Output points and the controller tags when the Safety I/O module's Input Status module definition is configured for Point Status or Combined Status.

Note that *moduleName* is the name you assign to the I/O module.

Table 1.2 Output Point Mapping

I/O Module Point	Controller Tag Reference		
	Data	**Point Status**	**Combined Status**
OUT 0	*moduleName*:O.Pt00Data	*moduleName*:I.Pt00OutputStatus	*moduleName*:I.OutputStatus
OUT 1	*moduleName*:O.Pt01Data	*moduleName*:I.Pt01OutputStatus	
OUT 2	*moduleName*:O.Pt02Data	*moduleName*:I.Pt02OutputStatus	
…	…	…	
OUT n	*moduleName*:O.PtnData	*moduleName*:I.PtnOutputStatus	

Diverse Input Instruction (DIN)

Overview

The basic purpose of the Diverse Input Instruction is to emulate the input functionality of a safety relay in a software programmable environment which is intended for use in SIL3/CAT4 safety applications.

Operation

Normal Operation

This instruction monitors the states of two input channels and turns on Output 1 when the following conditions are met:

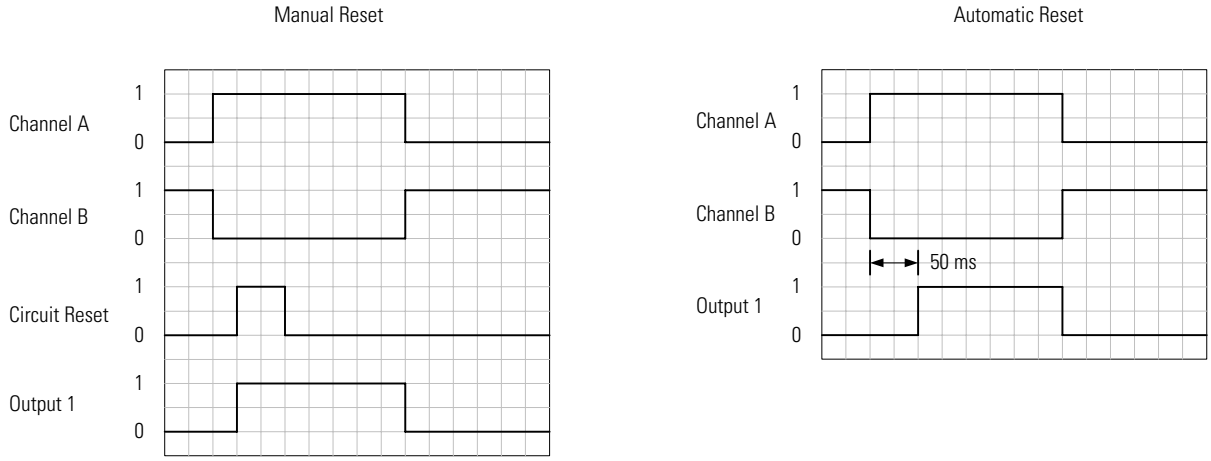
- When using Manual Reset: both inputs are in the Active state and the Circuit Reset input is transitioned from a zero to a one.
- When using Automatic Reset: both inputs are in the Active state for 50 ms.

This instruction turns Output 1 off when either one or both of the input channels returns to the Safe state.

The Diverse Input (DIN) instruction has one input channel that is normally open and one that is normally closed. This means that a zero on the normally open channel and a one on the normally closed channel represents the Safe state and vice-versa for the Active state. (See the De-Energize to Trip System section on page 1-1 for information about how to condition the input data associated with the normally closed channel.)

These normal operation state changes are shown in the following timing diagrams.

Figure 2.1 Normal Operation



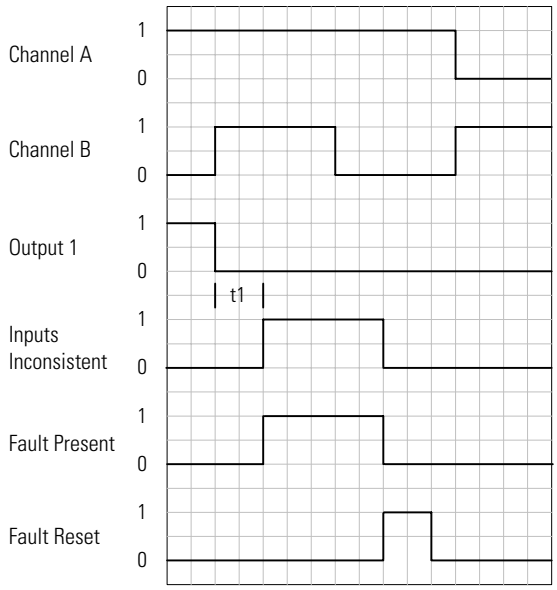
Operation with Inconsistent Inputs

This instruction generates a fault if the input channels are in inconsistent states (one Safe and one Active) for more than the specified period of time. The inconsistent time period is 500 ms.

This fault condition is enunciated via the Inputs Inconsistent and the Fault Present outputs. Output 1 cannot enter the Active state while the Fault Present output is active. The fault indication is cleared when the offending condition is remedied and the Fault Reset input is transitioned from zero to one.

These state changes are shown in the following timing diagram.

Figure 2.2 Inputs Inconsistent, Fault Present, and Fault Reset Operation



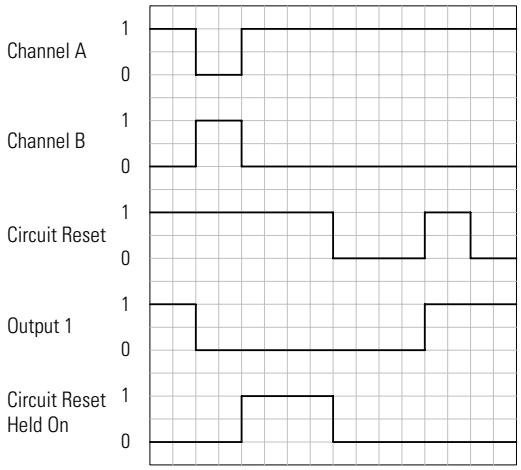
t1 - Inconsistent Time Period

Operation with Circuit Reset Held On - Manual Reset Only

This instruction also sets the Circuit Reset Held On output prompt if the Circuit Reset input is set (1) when the input channels transition to the Active state.

These state changes are shown in the following timing diagram.

Figure 2.3 Circuit Reset and Circuit Reset Held On Operation

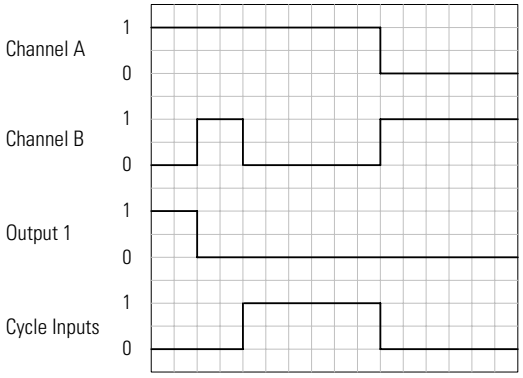


Cycle Inputs Operation

If, while Output 1 is active, one of the input channels transitions from the Active state to the Safe state and back to the Active state before the other input channel transitions to the Safe state, the Cycle Inputs output prompt is set, and Output 1 cannot enter the Active state again until both input channels cycle through their Safe states.

These state changes are shown in the following timing diagram.

Figure 2.4 Cycle Inputs Operation



Ladder Logic Description

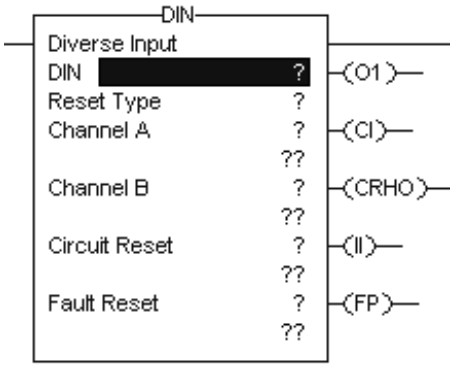


Table 2.1 Diverse Input (DIN) Instruction Parameters

Parameter	Short Name	Type	Data Type	Description	Safe, Active and Initial Values
DIN	—	—	Pre-defined Data Type	This parameter is used to maintain instruction-specific information. **Do not use the same pre-defined data type tag name in more than one instruction.**	—
Reset Type	—	Input	Boolean	The reset type determines whether the instruction is using Manual or Automatic reset for Output 1.	Manual or Automatic
Channel A	—	Input	Boolean	Channel A Input (Normally Open)	Safe = 0, Active = 1
Channel B	—	Input	Boolean	Channel B Input (Normally Closed)	Safe = 1, Active = 0
Circuit Reset	—	Input	Boolean	Circuit Reset Input Manual Reset - Sets Output 1 after Channel A and Channel B transition from the Safe state to the Active state, and the Circuit Reset input transitions from zero to one. Automatic Reset - Visible, but not used.	Initial = 0, Reset = 1
Fault Reset	—	Input	Boolean	After fault conditions are corrected for the instruction, the fault outputs for the instruction are cleared when this input transitions from off to on.	Initial = 0, Reset = 1
Output 1	O1	Output	Boolean	Output 1 is set to the Active state when input conditions are met.	Safe = 0, Active = 1
Cycle Inputs	CI	Prompt Output	Boolean	Cycle Inputs prompts for action. Before Output 1 is turned on, Channel A and Channel B inputs must be cycled through their Safe States at the same time before the circuit can be reset. This prompt is cleared when Channel A and Channel B transition to the Safe state.	Initial = 0, Prompt = 1

Table 2.1 Diverse Input (DIN) Instruction Parameters

Parameter	Short Name	Type	Data Type	Description	Safe, Active and Initial Values
Circuit Reset Held On	CRHO	Prompt Output	Boolean	Manual Reset - The Circuit Reset Held On prompt is set when both input channels transition to the Active states, and the Circuit Reset input is already on. The Circuit Reset Held On prompt is cleared when the Circuit Reset input is turned off. Automatic Reset - Visible, but not used.	Initial = 0, Prompt = 1
Inputs Inconsistent	II	Fault Output	Boolean	This fault is set when Channel A and Channel B inputs are in inconsistent states (one Safe and one Active) for a period of time greater than the Inconsistent Time Period (listed below). This fault is cleared when Channel A and Channel B inputs return to consistent states (both Safe or both Active) and the Fault Reset input transitions from off to on. Inconsistent Time Period: 500 ms	Initial = 0, Fault = 1
Fault Present	FP	Fault Output	Boolean	This is set whenever a fault is present in the instruction. Output 1 cannot enter the Active state when Fault Present is set. Fault Present is cleared when all faults are cleared and the Fault Reset input transitions from off to on.	Initial = 0, Fault = 1

Relationship of I/O Wiring to Instruction Parameters

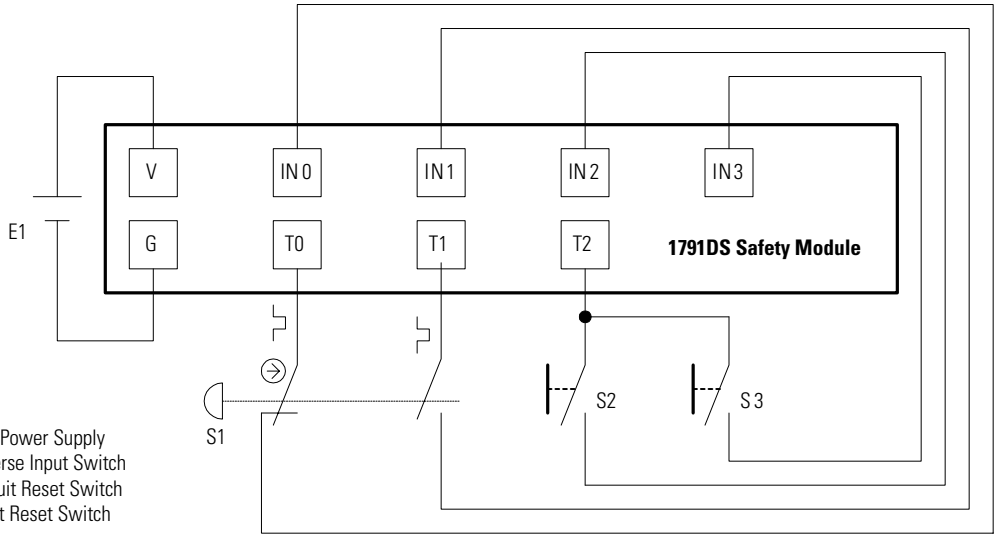
Diverse Input with Manual Reset Wiring and Programming

Wiring Example

The following wiring diagram is one example of how to wire a 2-channel switch having diverse inputs to a 1791DS Safety I/O module to comply with EN954-1 Category 4.

Figure 2.5 Diverse Input Wiring Diagram - Manual Reset

The inputs shown on this wiring diagram correspond to the inputs for the instruction.



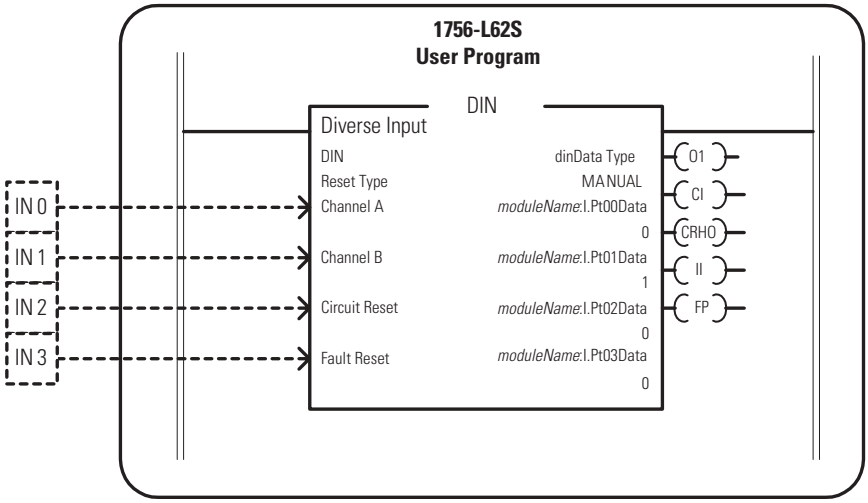
E1 - 24V Power Supply
S1 - Diverse Input Switch
S2 - Circuit Reset Switch
S3 - Fault Reset Switch

S1 as shown is in the Active state. IN0 - Normally Open, IN1 - Normally Closed.

Programming Example

The following programming example shows how the Diverse Input instruction with Manual Reset can be applied to the wiring diagram shown in Figure 2.5, Diverse Input Wiring Diagram - Manual Reset.

Figure 2.6 Diverse Input Programming Example - Manual Reset



EN954-1 Category 4 requires that inputs be independently pulse tested. RSLogix 5000 programming software is used to configure the following I/O module parameters for pulse testing.

Table 2.2 Input Configuration

Input Point	Type	Point Mode	Test Source
0 (*IN0*)	Single	Safety Pulse Test	0 *(T0)*
1 (*IN1*)	Single	Safety Pulse Test	1 *(T1)*
2 (*IN2*)	Single	Safety	None
3 (*IN3*)	Single	Safety	None

Table 2.3 Test Output

Test Output Point	Point Mode
0 *(T0)*	Pulse Test
1 *(T1)*	Pulse Test
2 *(T2)*	Power Supply
3 *(T3)*	Not Used

Diverse Input with Automatic Reset Wiring and Programming

Wiring Example

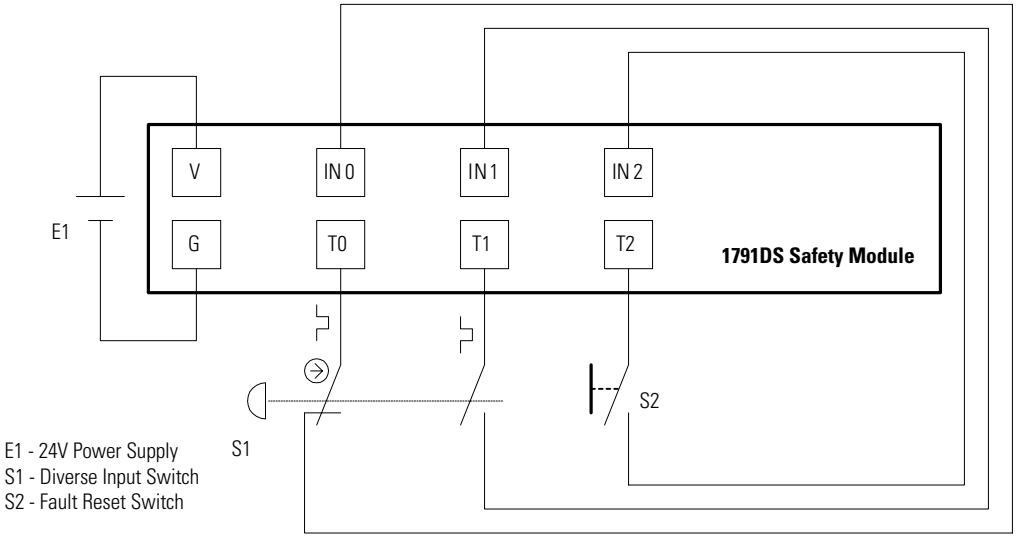
The following wiring diagram is one an example of how to wire a 2-channel switch having diverse inputs to a 1791DS Safety I/O module to comply with EN954-1 Category 4.

ATTENTION

Various safety standards (EN 60204, EN 954) require that when using the Automatic Circuit Reset feature, other measures must be implemented to ensure that an unexpected (or unintended) startup will not occur in the system or application.

Figure 2.7 Diverse Input Wiring Diagram - Automatic Reset

The inputs shown on this wiring diagram correspond to the inputs for the instruction.

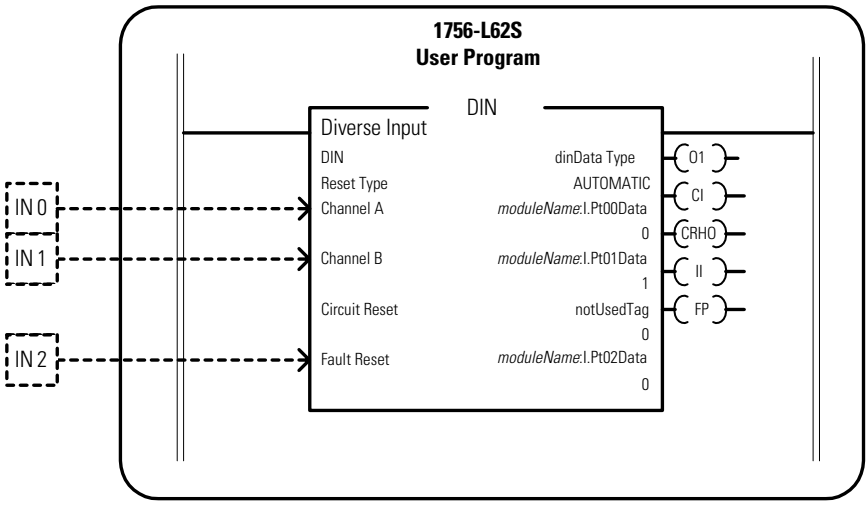


S1 as shown is in the Active state. IN0 - Normally Open, IN1 - Normally Closed

Programming Example

The following programming example shows how the Diverse Input instruction with Automatic Reset can be applied to the wiring diagram shown in Figure 2.7, Diverse Input Wiring Diagram - Automatic Reset.

Figure 2.8 Diverse Input Programming Example - Automatic Reset



EN954-1 Category 4 requires that inputs be independently pulse tested. RSLogix 5000 programming software is used to configure the following I/O module parameters for pulse testing.

Table 2.4 Input Configuration

Point	Type	Point Mode	Test Source
0 (*IN0*)	Single	Safety Pulse Test	0 *(T0)*
1 (*IN1*)	Single	Safety Pulse Test	1 *(T1)*
2 (*IN2*)	Single	Safety	None

Table 2.5 Test Output

Point	Point Mode
0 *(T0)*	Pulse Test
1 *(T1)*	Pulse Test
2 *(T2)*	Power Supply

Redundant Input Instruction (RIN)

Overview

The basic purpose of the Redundant Input Instruction is to emulate the input functionality of a safety relay in a software programmable environment which is intended for use in SIL3/CAT4 safety applications.

Operation

Normal Operation

This instruction monitors the states of two input channels and turns on Output 1 when the following conditions are met:

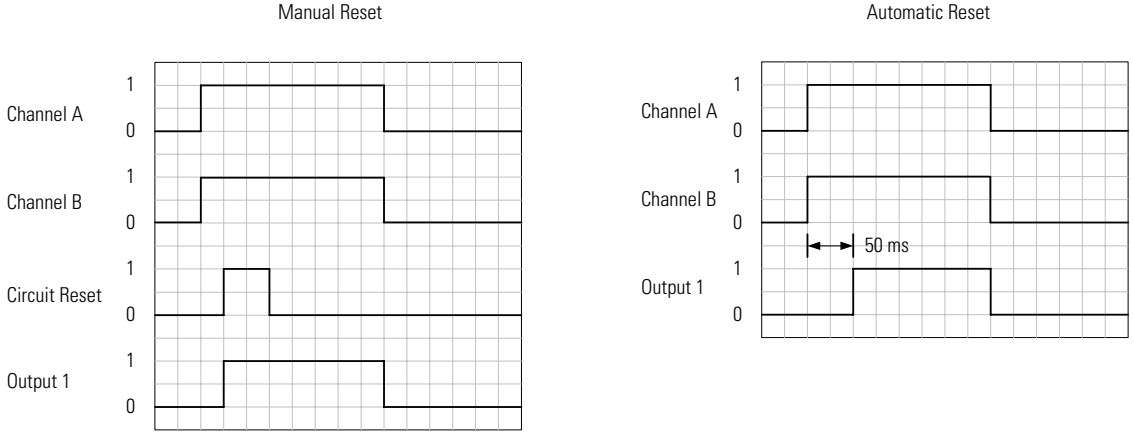
- When using Manual Reset: both inputs are in the Active state and the Circuit Reset input is transitioned from a zero to a one.
- When using Automatic Reset: both inputs are in the Active state for 50 ms.

This instruction turns Output 1 off when either one or both of the input channels returns to the Safe state.

Both input channels for the Redundant Input (RIN) instruction are normally open. This means zeros on both channels represent the Safe state, and ones on both channels represent the Active state.

These normal operation state changes are shown in the following timing diagrams.

Figure 3.1 Normal Operation



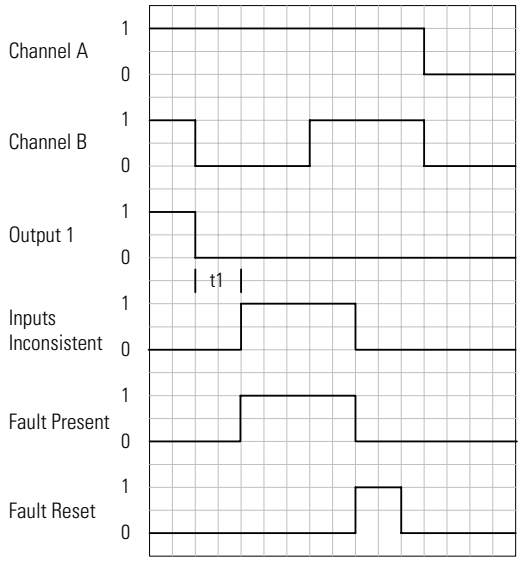
Operation with Inconsistent Inputs

This instruction generates a fault if the input channels are in inconsistent states (one Safe and one Active) for more than the specified period of time. The inconsistent time period is 500 ms.

This fault condition is enunciated via the Inputs Inconsistent and the Fault Present outputs. Output 1 cannot enter the Active state while the Fault Present output is active. The fault indication is cleared when the offending condition is remedied and the Fault Reset input is transitioned from zero to one.

These state changes are shown in the following timing diagram.

Figure 3.2 Inputs Inconsistent, Fault Present, and Fault Reset Operation

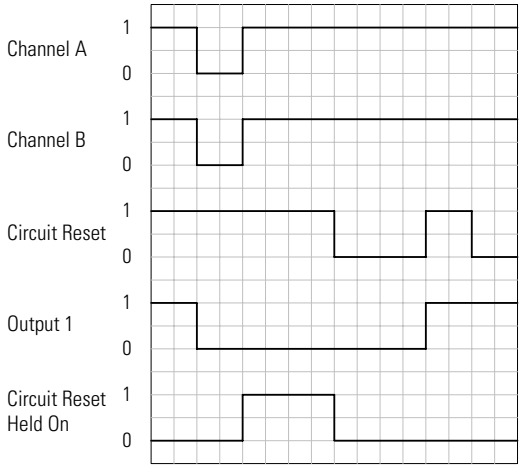


Operation with Circuit Reset Held On - Manual Reset Only

This instruction also sets the Circuit Reset Held On output prompt if the Circuit Reset input is set (1) when the input channels transition to the Active state.

These state changes are shown in the following timing diagram.

Figure 3.3 Circuit Reset and Circuit Reset Held On Operation

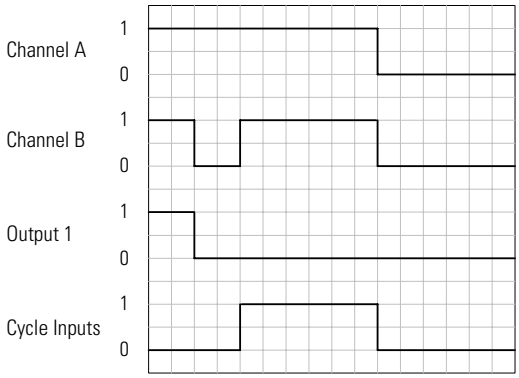


Cycle Inputs Operation

If, while Output 1 is active, one of the input channels transitions from the Active state to the Safe state and back to the Active state before the other input channel transitions to the Safe state, the Cycle Inputs output prompt is set, and Output 1 cannot enter the Active state again until both input channels cycle through their Safe states.

These state changes are shown in the following timing diagram.

Figure 3.4 Cycle Inputs Operation



Ladder Logic Description

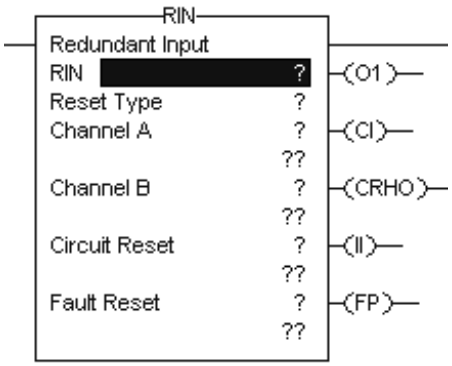


Table 3.1 Redundant Inputs (RIN) Instruction Parameters

Parameter	Short Name	Type	Data Type	Description	Safe, Active and Initial Values
RIN	—	—	Pre-defined Data Type	This parameter is used to maintain instruction-specific information. **Do not use the same pre-defined data type tag name in more than one instruction.**	—
Reset Type	—	Input	Boolean	The reset type determines whether the instruction is using Manual or Automatic reset for Output 1.	Manual or Automatic
Channel A	—	Input	Boolean	Channel A Input (Normally Open)	Safe = 0, Active = 1
Channel B	—	Input	Boolean	Channel B Input (Normally Open)	Safe = 0, Active = 1
Circuit Reset	—	Input	Boolean	Circuit Reset Input Manual Reset - Sets Output 1 after Channel A and Channel B transition from the Safe state to the Active state, and the Circuit Reset input transitions from zero to one. Automatic Reset - Visible, but not used.	Initial = 0, Reset = 1
Fault Reset	—	Input	Boolean	After fault conditions are corrected for the instruction, the fault outputs for the instruction are cleared when this input transitions from off to on.	Initial = 0, Reset = 1
Output 1	O1	Output	Boolean	Output 1 is set to the Active state when input conditions are met.	Safe = 0, Active = 1
Cycle Inputs	CI	Prompt Output	Boolean	Cycle Inputs prompts for action. Before Output 1 is turned on, Channel A and Channel B inputs must be cycled through their Safe States at the same time before the circuit can be reset. This prompt is cleared when Channel A and Channel B transition to the Safe state.	Initial = 0, Prompt = 1

Table 3.1 Redundant Inputs (RIN) Instruction Parameters

Parameter	Short Name	Type	Data Type	Description	Safe, Active and Initial Values
Circuit Reset Held On	CRHO	Prompt Output	Boolean	Manual Reset - The Circuit Reset Held On prompt is set when both input channels transition to the Active states, and the Circuit Reset input is already on. The Circuit Reset Held On prompt is cleared when the Circuit Reset input is turned off. Automatic Reset - Visible, but not used.	Initial = 0, Prompt = 1
Inputs Inconsistent	II	Fault Output	Boolean	This fault is set when Channel A and Channel B inputs are in inconsistent states (one Safe and one Active) for a period of time greater than the Inconsistent Time Period (listed below). This fault is cleared when Channel A and Channel B inputs return to consistent states (both Safe or both Active) and the Fault Reset input transitions from off to on. Inconsistent Time Period: 500 ms	Initial = 0, Fault = 1
Fault Present	FP	Fault Output	Boolean	This is set whenever a fault is present in the instruction. Output 1 cannot enter the Active state when Fault Present is set. Fault Present is cleared when all faults are cleared and the Fault Reset input transitions from off to on.	Initial = 0, Fault = 1

Relationship of I/O Wiring to Instruction Parameters

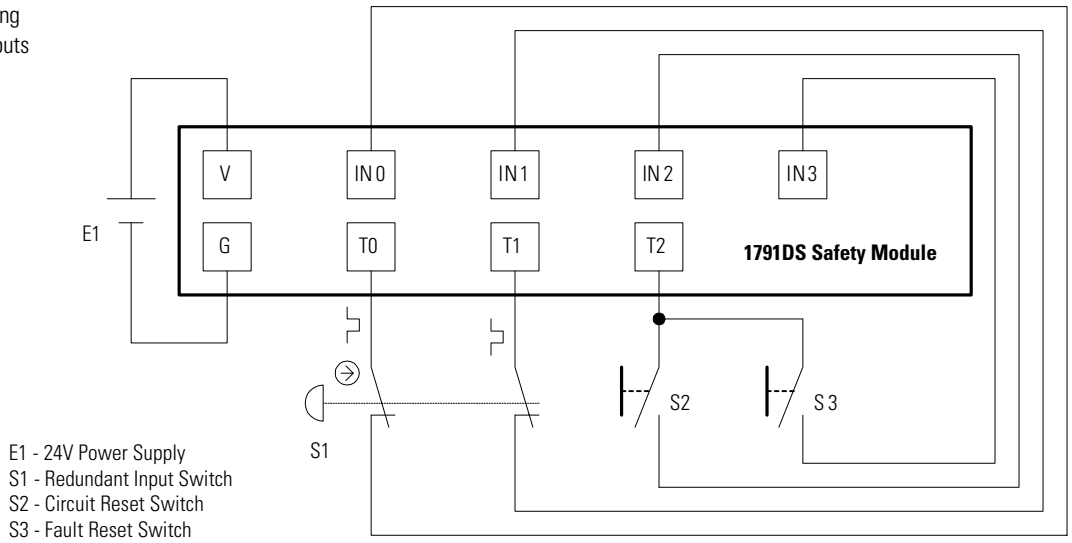
Redundant Input with Manual Reset Wiring and Programming

Wiring Example

The following wiring diagram is one example of how to wire a 2-channel switch having two normally open contacts to a 1791DS Safety I/O module to comply with EN954-1 Category 4.

Figure 3.5 Redundant Input Wiring Diagram - Manual Reset

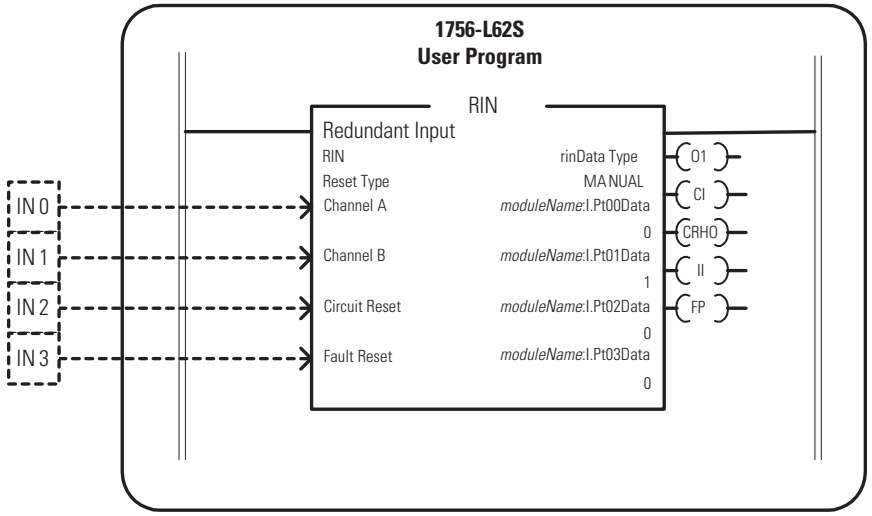
The inputs shown on this wiring diagram correspond to the inputs for the instruction.



Programming Example

The following programming example shows how the Redundant Input instruction with Manual Reset can be applied to the wiring diagram shown in Figure 3.5, Redundant Input Wiring Diagram - Manual Reset.

Figure 3.6 Redundant Input Programming Example - Manual Reset



EN954-1 Category 4 requires that inputs be independently pulse tested. RSLogix 5000 programming software is used to configure the following I/O module parameters for pulse testing.

Table 3.2 Input Configuration

Input Point	Type	Point Mode	Test Source
0 (*IN0*)	Single	Safety Pulse Test	0 *(T0)*
1 (*IN1*)	Single	Safety Pulse Test	1 *(T1)*
2 (*IN2*)	Single	Safety	None
3 (*IN3*)	Single	Safety	None

Table 3.3 Test Output

Test Output Point	Point Mode
0 *(T0)*	Pulse Test
1 *(T1)*	Pulse Test
2 *(T2)*	Power Supply
3 *(T3)*	Not Used

Redundant Input with Automatic Reset Wiring and Programming

Wiring Example

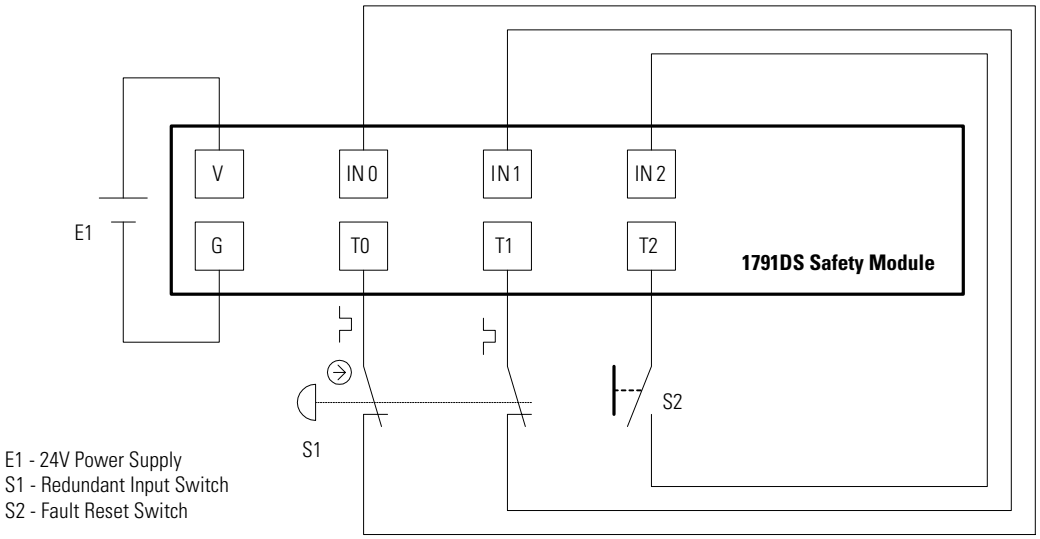
The following wiring diagram shows one example of how to wire a 2-channel switch having two normally open contacts to a 1791DS Safety I/O module to comply with EN954-1 Category 4.

ATTENTION

Various safety standards (EN 60204, EN 954) require that when using the Automatic Circuit Reset feature, other measures must be implemented to ensure that an unexpected (or unintended) startup will not occur in the system or application.

Figure 3.7 Redundant Input Wiring Diagram - Automatic Reset

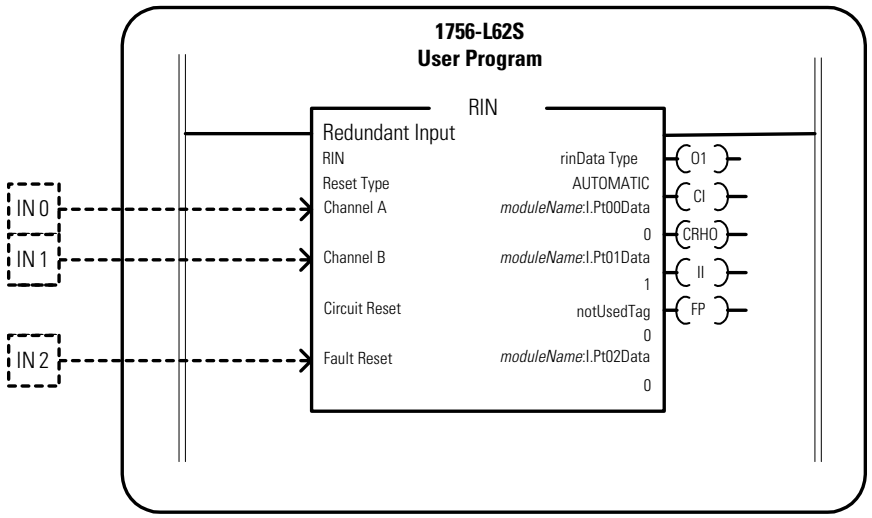
The inputs shown on this wiring diagram correspond to the inputs for the instruction.



Programming Example

The following programming example shows how the Redundant Input instruction with Automatic Reset can be applied to the wiring diagram shown in Figure 3.7, Redundant Input Wiring Diagram - Automatic Reset.

Figure 3.8 Redundant Input Programming Example - Automatic Reset



EN954-1 Category 4 requires that inputs be independently pulse tested. RSLogix 5000 programming software is used to configure the following I/O module parameters for pulse testing.

Table 3.4 Input Configuration

Input Point	Type	Point Mode	Test Source
0 (*IN0*)	Single	Safety Pulse Test	0 *(T0)*
1 (*IN1*)	Single	Safety Pulse Test	1 *(T1)*
2 (*IN2*)	Single	Safety	None

Table 3.5 Test Output

Test Output Point	Point Mode
0 *(T0)*	Pulse Test
1 *(T1)*	Pulse Test
2 *(T2)*	Power Supply

Emergency Stop Instruction (ESTOP)

Overview

The basic purpose of the Emergency Stop Instruction is to emulate the input functionality of a safety relay in a software programmable environment which is intended for use in SIL3/CAT4 safety applications.

Operation

Normal Operation

This instruction monitors the states of two input channels and turns on Output 1 when the following conditions are met:

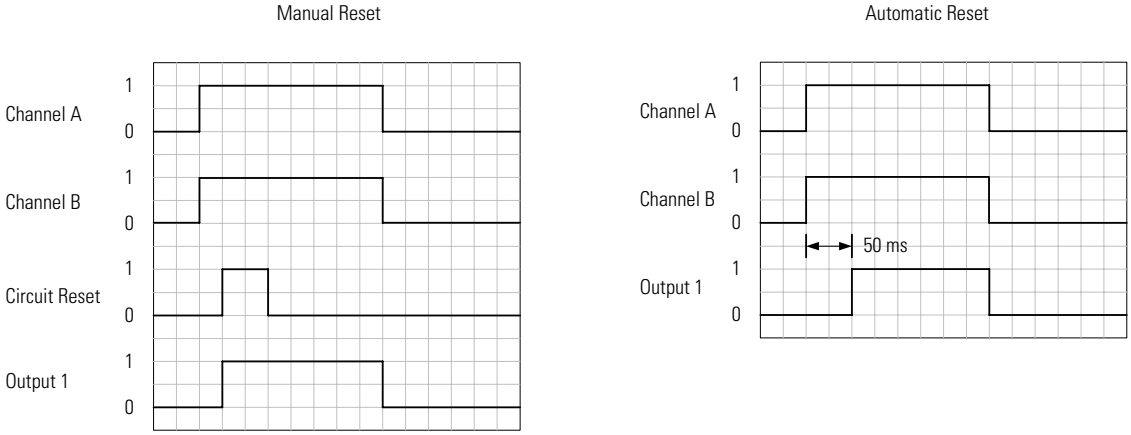
- When using Manual Reset: both inputs are in the Active state and the Circuit Reset input is transitioned from a zero to a one.
- When using Automatic Reset: both inputs are in the Active state for 50 ms.

This instruction turns Output 1 off when either one or both of the input channels returns to the Safe state.

Both input channels for the Emergency Stop instructions are normally open. This means zeros on both channels represent the Safe state, and ones on both channels represent the Active state.

These normal operation state changes are shown in the following timing diagrams.

Figure 4.1 Normal Operation



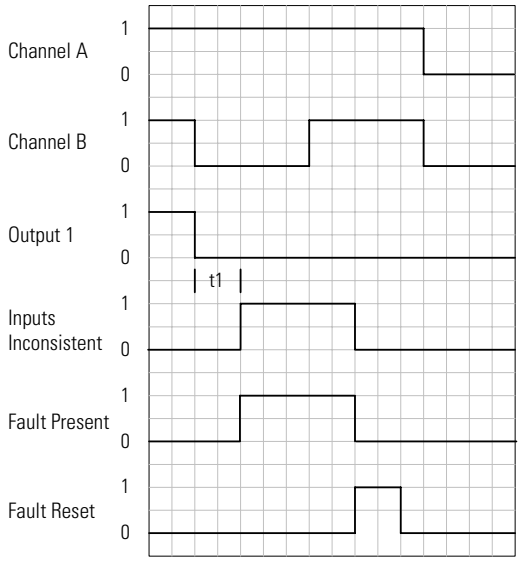
Operation with Inconsistent Inputs

This instruction generates a fault if the input channels are in inconsistent states (one Safe and one Active) for more than the specified period of time. The inconsistent time period is 500 ms.

This fault condition is enunciated via the Inputs Inconsistent and the Fault Present outputs. Output 1 cannot enter the Active state while the Fault Present output is active. The fault indication is cleared when the offending condition is remedied and the Fault Reset input is transitioned from zero to one.

These state changes are shown in the following timing diagram.

Figure 4.2 Inputs Inconsistent, Fault Present, and Fault Reset Operation

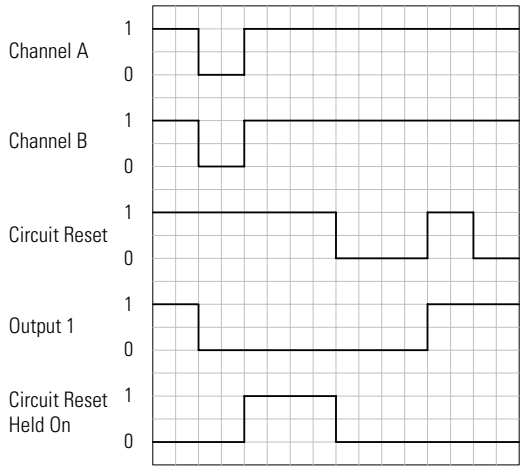


Operation with Circuit Reset Held On - Manual Reset Only

This instruction also sets the Circuit Reset Held On output prompt if the Circuit Reset input is set (1) when the input channels transition to the Active state.

These state changes are shown in the following timing diagram.

Figure 4.3 Circuit Reset and Circuit Reset Held On Operation

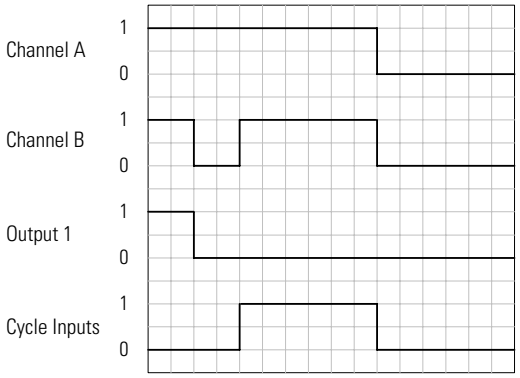


Cycle Inputs Operation

If, while Output 1 is active, one of the input channels transitions from the Active state to the Safe state and back to the Active state before the other input channel transitions to the Safe state, the Cycle Inputs output prompt is set, and Output 1 cannot enter the Active state again until both input channels cycle through their Safe states.

These state changes are shown in the following timing diagram.

Figure 4.4 Cycle Inputs Operation



Ladder Logic Description

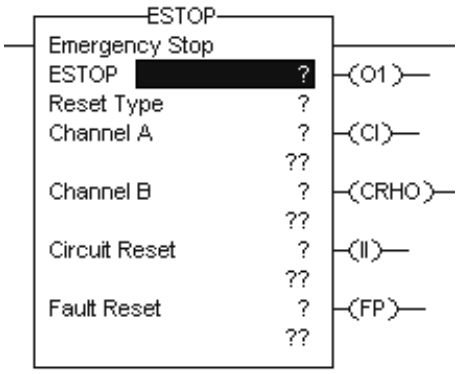


Table 4.1 Emergency Stop Instruction Parameters

Parameter	Short Name	Type	Data Type	Description	Safe, Active and Initial Values
ESTOP	—	—	Pre-defined Data Type	This parameter is used to maintain instruction-specific information. **Do not use the same pre-defined data type tag name in more than one instruction.**	—
Reset Type	—	Input	Boolean	The reset type determines whether the instruction is using Manual or Automatic reset for Output 1.	Manual or Automatic
Channel A	—	Input	Boolean	Channel A Input (Normally Open)	Safe = 0, Active = 1
Channel B	—	Input	Boolean	Channel B Input (Normally Open)	Safe = 0, Active = 1
Circuit Reset	—	Input	Boolean	Circuit Reset Input Manual Reset - Sets Output 1 after Channel A and Channel B transition from the Safe state to the Active state, and the Circuit Reset input transitions from zero to one. Automatic Reset - Visible, but not used.	Initial = 0, Reset = 1
Fault Reset	—	Input	Boolean	After fault conditions are corrected for the instruction, the fault outputs for the instruction are cleared when this input transitions from off to on.	Initial = 0, Reset = 1
Output 1	O1	Output	Boolean	Output 1 is set to the Active state when input conditions are met.	Safe = 0, Active = 1
Cycle Inputs	CI	Prompt Output	Boolean	Cycle Inputs prompts for action. Before Output 1 is turned on, Channel A and Channel B inputs must be cycled through their Safe States at the same time before the circuit can be reset. This prompt is cleared when Channel A and Channel B transition to the Safe state.	Initial = 0, Prompt = 1

Table 4.1 Emergency Stop Instruction Parameters

Parameter	Short Name	Type	Data Type	Description	Safe, Active and Initial Values
Circuit Reset Held On	CRHO	Prompt Output	Boolean	Manual Reset - The Circuit Reset Held On prompt is set when both input channels transition to the Active states, and the Circuit Reset input is already on. The Circuit Reset Held On prompt is cleared when the Circuit Reset input is turned off. Automatic Reset - Visible, but not used.	Initial = 0, Prompt = 1
Inputs Inconsistent	II	Fault Output	Boolean	This fault is set when Channel A and Channel B inputs are in inconsistent states (one Safe and one Active) for a period of time greater than the Inconsistent Time Period (listed below). This fault is cleared when Channel A and Channel B inputs return to consistent states (both Safe or both Active) and the Fault Reset input transitions from off to on. Inconsistent Time Period: 500 ms	Initial = 0, Fault = 1
Fault Present	FP	Fault Output	Boolean	This is set whenever a fault is present in the instruction. Output 1 cannot enter the Active state when Fault Present is set. Fault Present is cleared when all faults are cleared and the Fault Reset input transitions from off to on.	Initial = 0, Fault = 1

Relationship of I/O Wiring to Instruction Parameters

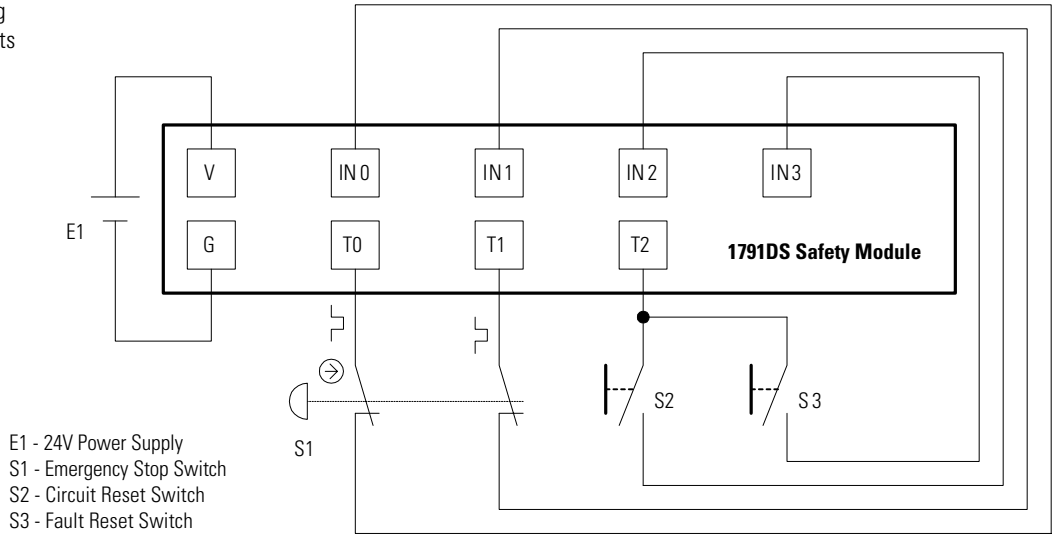
Emergency Stop with Manual Reset Wiring and Programming

Wiring Example

The following wiring diagram shows one example of how to wire a 2-channel Emergency Stop switch having two normally open contacts to a 1791DS Safety I/O module to comply with EN954-1 Category 4.

Figure 4.5 Emergency Stop Wiring Diagram - Manual Reset

The inputs shown on this wiring diagram correspond to the inputs for the instruction.

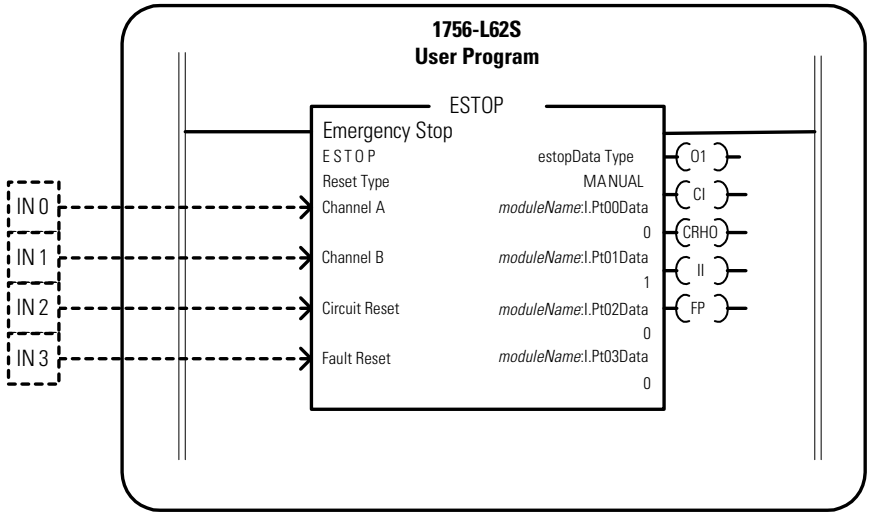


E1 - 24V Power Supply
S1 - Emergency Stop Switch
S2 - Circuit Reset Switch
S3 - Fault Reset Switch

Programming Example

The following programming example shows how the Emergency Stop instruction with Manual Reset can be applied to the wiring diagram shown in Figure 4.5, Emergency Stop Wiring Diagram - Manual Reset.

Figure 4.6 Emergency Stop Programming Example - Manual Reset



EN954-1 Category 4 requires that inputs be independently pulse tested. RSLogix 5000 programming software is used to configure the following I/O module parameters for pulse testing.

Table 4.2 Input Configuration

Input Point	Type	Point Mode	Test Source
0 (*IN0*)	Single	Safety Pulse Test	0 *(T0)*
1 (*IN1*)	Single	Safety Pulse Test	1 *(T1)*
2 (*IN2*)	Single	Safety	None
3 (*IN3*)	Single	Safety	None

Table 4.3 Test Output

Test Output Point	Point Mode
0 *(T0)*	Pulse Test
1 *(T1)*	Pulse Test
2 *(T2)*	Power Supply
3 *(T3)*	Not Used

Emergency Stop with Automatic Reset Wiring and Programming

Wiring Example

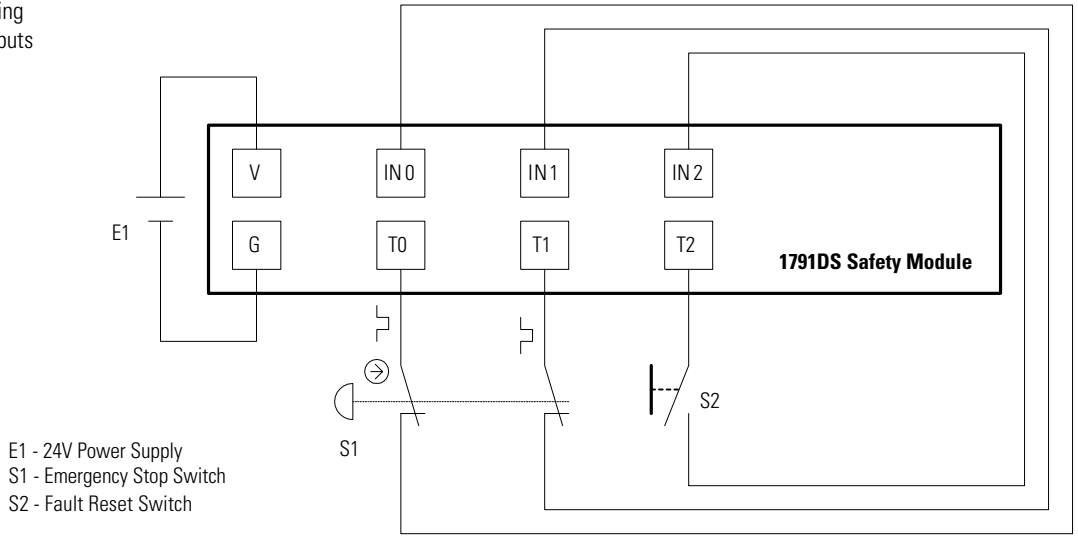
The following wiring diagram shows one example of how to wire a 2-channel Emergency Stop switch having two normally open contacts to a 1791DS Safety I/O module to comply with EN954-1 Category 4.

ATTENTION

Various safety standards (EN 60204, EN 954) require that when using the Automatic Circuit Reset feature, other measures must be implemented to ensure that an unexpected (or unintended) startup will not occur in the system or application.

Figure 4.7 Emergency Stop Wiring Diagram - Automatic Reset

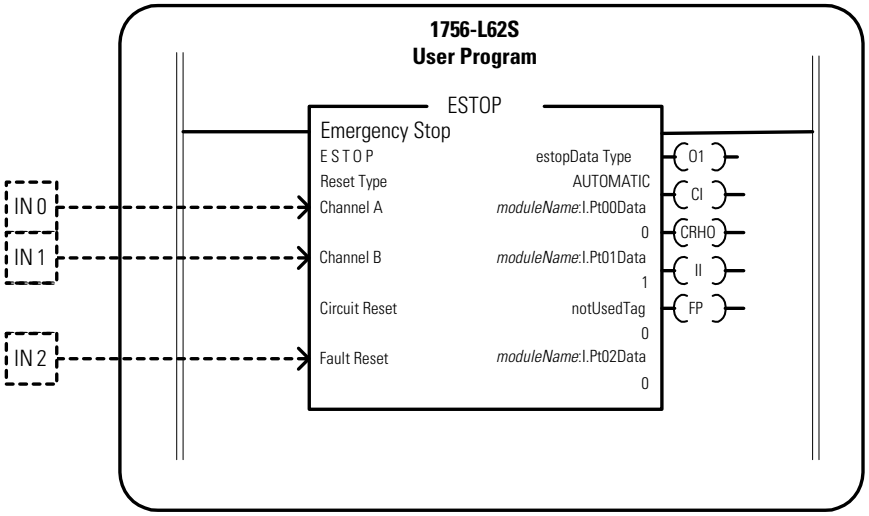
The inputs shown on this wiring diagram correspond to the inputs for the instruction.



Programming Example

The following programming example shows how the Emergency Stop instruction with Automatic Reset can be applied to the wiring diagram shown in Figure 4.7, Emergency Stop Wiring Diagram - Automatic Reset.

Figure 4.8 Emergency Stop Programming Example - Automatic Reset



EN954-1 Category 4 requires that inputs be independently pulse tested. RSLogix 5000 programming software is used to configure the following I/O module parameters for pulse testing.

Table 4.4 Input Configuration

Input Point	Type	Point Mode	Test Source
0 (*IN0*)	Single	Safety Pulse Test	0 *(T0)*
1 (*IN1*)	Single	Safety Pulse Test	1 *(T1)*
2 (*IN2*)	Single	Safety	None

Table 4.5 Test Output

Test Output Point	Point Mode
0 *(T0)*	Pulse Test
1 *(T1)*	Pulse Test
2 *(T2)*	Power Supply

Enable Pendant Instruction (ENPEN)

Overview

The basic purpose of the Enable Pendant Instruction is to emulate the input functionality of a safety relay in a software programmable environment which is intended for use in SIL3/CAT4 safety applications.

Operation

Normal Operation

This instruction monitors the states of two input channels and turns on Output 1 when the following conditions are met:

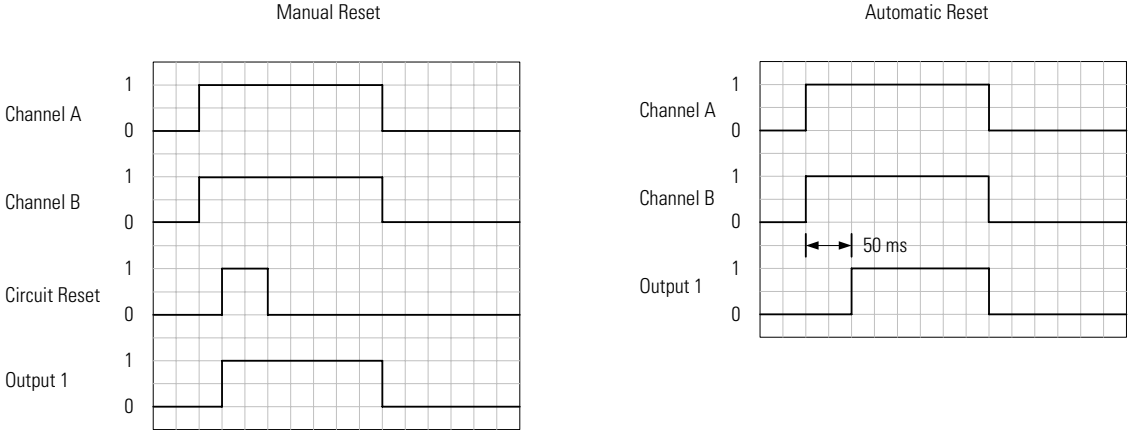
- When using Manual Reset: both inputs are in the Active state and the Circuit Reset input is transitioned from a zero to a one.
- When using Automatic Reset: both inputs are in the Active state for 50 ms.

This instruction turns Output 1 off when either one or both of the input channels returns to the Safe state.

Both input channels for the Enable Pendant instruction are normally open. This means zeros on both channels represent the Safe state, and ones on both channels represent the Active state.

These normal operation state changes are shown in the following timing diagrams.

Figure 5.1 Normal Operation



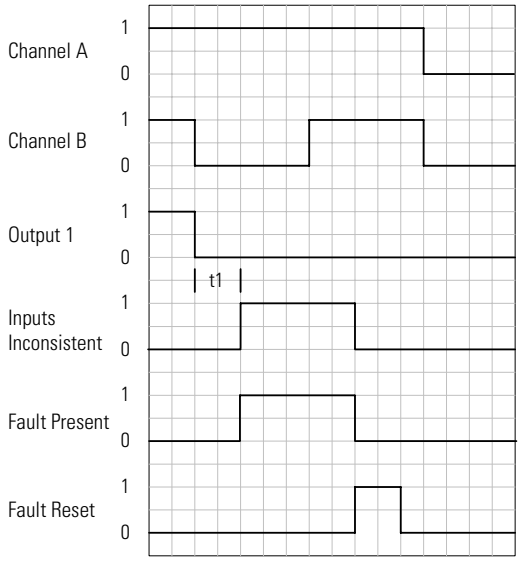
Operation with Inconsistent Inputs

This instruction generates a fault if the input channels are in inconsistent states (one Safe and one Active) for more than the specified period of time. The inconsistent time period is 3 seconds.

This fault condition is enunciated via the Inputs Inconsistent and the Fault Present outputs. Output 1 cannot enter the Active state while the Fault Present output is active. The fault indication is cleared when the offending condition is remedied and the Fault Reset input is transitioned from zero to one.

These state changes are shown in the following timing diagram.

Figure 5.2 Inputs Inconsistent, Fault Present, and Fault Reset Operation

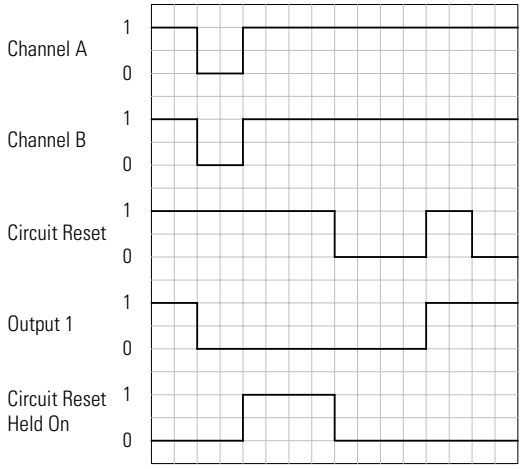


Operation with Circuit Reset Held On - Manual Reset Only

This instruction also sets the Circuit Reset Held On output prompt if the Circuit Reset input is set (1) when the input channels transition to the Active state.

These state changes are shown in the following timing diagram.

Figure 5.3 Circuit Reset and Circuit Reset Held On Operation

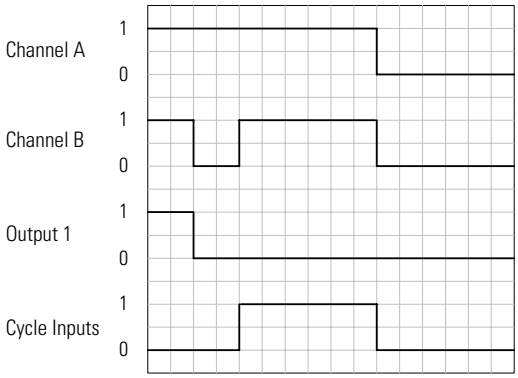


Cycle Inputs Operation

If, while Output 1 is active, one of the input channels transitions from the Active state to the Safe state and back to the Active state before the other input channel transitions to the Safe state, the Cycle Inputs output prompt is set, and Output 1 cannot enter the Active state again until both input channels cycle through their Safe states.

These state changes are shown in the following timing diagram.

Figure 5.4 Cycle Inputs Operation



Ladder Logic Description

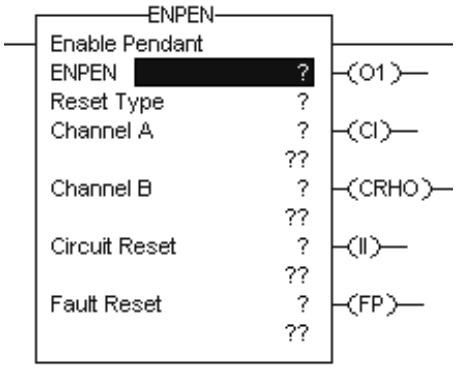


Table 5.1 Enable Pendant Instructions Parameters

Parameter	Short Name	Type	Data Type	Description	Safe, Active and Initial Values
ENPEN	—	—	Pre-defined Data Type	This parameter is used to maintain instruction-specific information. **Do not use the same pre-defined data type tag name in more than one instruction.**	—
Reset Type	—	Input	Boolean	The reset type determines whether the instruction is using Manual or Automatic reset for Output 1.	Manual or Automatic
Channel A	—	Input	Boolean	Channel A Input (Normally Open)	Safe = 0, Active = 1
Channel B	—	Input	Boolean	Channel B Input (Normally Open)	Safe = 0, Active = 1
Circuit Reset	—	Input	Boolean	Circuit Reset Input Manual Reset - Sets Output 1 after Channel A and Channel B transition from the Safe state to the Active state, and the Circuit Reset input transitions from zero to one. Automatic Reset - Visible, but not used.	Initial = 0, Reset = 1
Fault Reset	—	Input	Boolean	After fault conditions are corrected for the instruction, the fault outputs for the instruction are cleared when this input transitions from off to on.	Initial = 0, Reset = 1
Output 1	O1	Output	Boolean	Output 1 is set to the Active state when input conditions are met.	Safe = 0, Active = 1
Cycle Inputs	CI	Prompt Output	Boolean	Cycle Inputs prompts for action. Before Output 1 is turned on, Channel A and Channel B inputs must be cycled through their Safe States at the same time before the circuit can be reset. This prompt is cleared when Channel A and Channel B transition to the Safe state.	Initial = 0, Prompt = 1

Table 5.1 Enable Pendant Instructions Parameters

Parameter	Short Name	Type	Data Type	Description	Safe, Active and Initial Values
Circuit Reset Held On	CRHO	Prompt Output	Boolean	Manual Reset - The Circuit Reset Held On prompt is set when both input channels transition to the Active states, and the Circuit Reset input is already on. The Circuit Reset Held On prompt is cleared when the Circuit Reset input is turned off. Automatic Reset - Visible, but not used.	Initial = 0, Prompt = 1
Inputs Inconsistent	II	Fault Output	Boolean	This fault is set when Channel A and Channel B inputs are in inconsistent states (one Safe and one Active) for a period of time greater than the Inconsistent Time Period (listed below). This fault is cleared when Channel A and Channel B inputs return to consistent states (both Safe or both Active) and the Fault Reset input transitions from off to on. Inconsistent Time Period: 3 s	Initial = 0, Fault = 1
Fault Present	FP	Fault Output	Boolean	This is set whenever a fault is present in the instruction. Output 1 cannot enter the Active state when Fault Present is set. Fault Present is cleared when all faults are cleared and the Fault Reset input transitions from off to on.	Initial = 0, Fault = 1

Relationship of I/O Wiring to Instruction Parameters

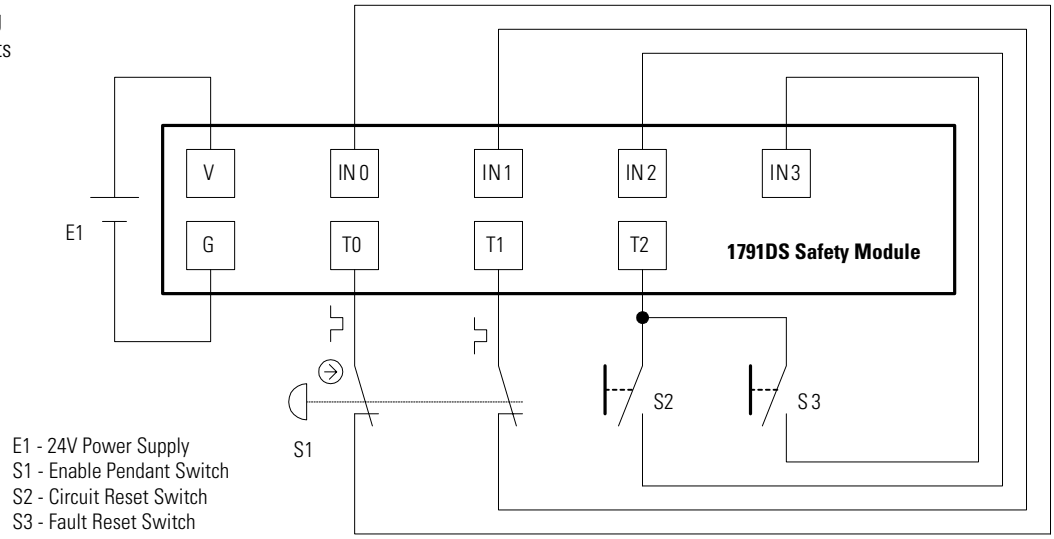
Enable Pendant with Manual Reset Wiring and Programming

Wiring Example

The following wiring diagram is one example of how to wire a 2-channel switch having two normally open contacts to a 1791DS Safety I/O module to comply with EN954-1 Category 4.

Figure 5.5 Enable Pendant Wiring Diagram - Manual Reset

The inputs shown on this wiring diagram correspond to the inputs for the instruction.

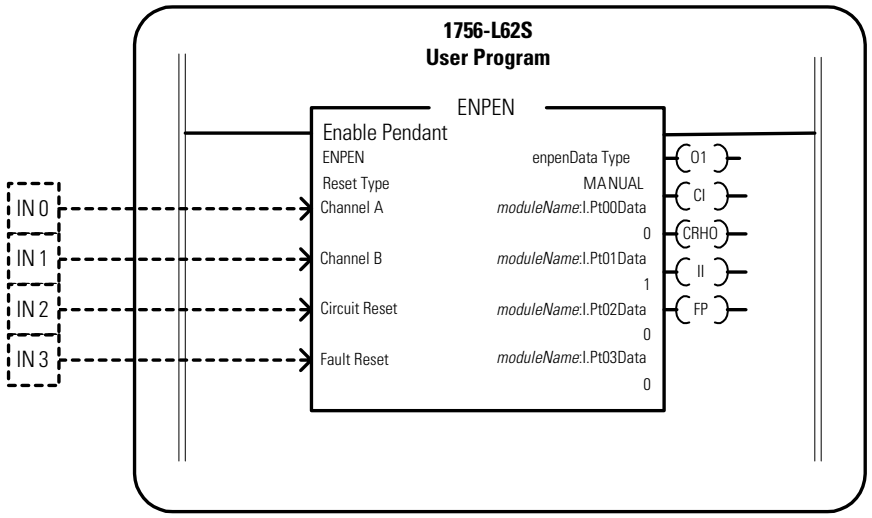


E1 - 24V Power Supply
S1 - Enable Pendant Switch
S2 - Circuit Reset Switch
S3 - Fault Reset Switch

Programming Example

The following programming example shows how the Enable Pendant instruction with Manual Reset can be applied to the wiring diagram shown in Figure 5.5, Enable Pendant Wiring Diagram - Manual Reset.

Figure 5.6 Enable Pendant Programming Example - Manual Reset



EN954-1 Category 4 requires that inputs be independently pulse tested. RSLogix 5000 programming software is used to configure the following I/O module parameters for pulse testing.

Table 5.2 Input Configuration

Input Point	Type	Point Mode	Test Source
0 (*IN0*)	Single	Safety Pulse Test	0 *(T0)*
1 (*IN1*)	Single	Safety Pulse Test	1 *(T1)*
2 (*IN2*)	Single	Safety	None
3 (*IN3*)	Single	Safety	None

Table 5.3 Test Output

Test Output Point	Point Mode
0 *(T0)*	Pulse Test
1 *(T1)*	Pulse Test
2 *(T2)*	Power Supply
3 *(T3)*	Not Used

Enable Pendant with Automatic Reset Wiring and Programming

Wiring Example

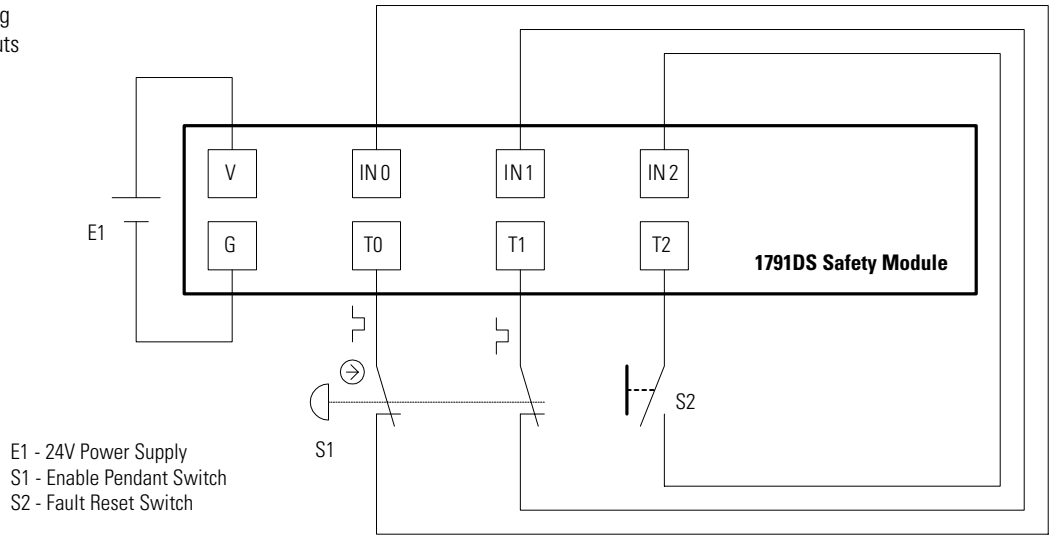
The following wiring diagram is one example of how to wire a 2-channel switch having two normally open contacts to a 1791DS Safety I/O module to comply with EN954-1 Category 4.

ATTENTION

Various safety standards (EN 60204, EN 954) require that when using the Automatic Circuit Reset feature, other measures must be implemented to ensure that an unexpected (or unintended) startup will not occur in the system or application.

Figure 5.7 Enable Pendant Wiring Diagram - Automatic Reset

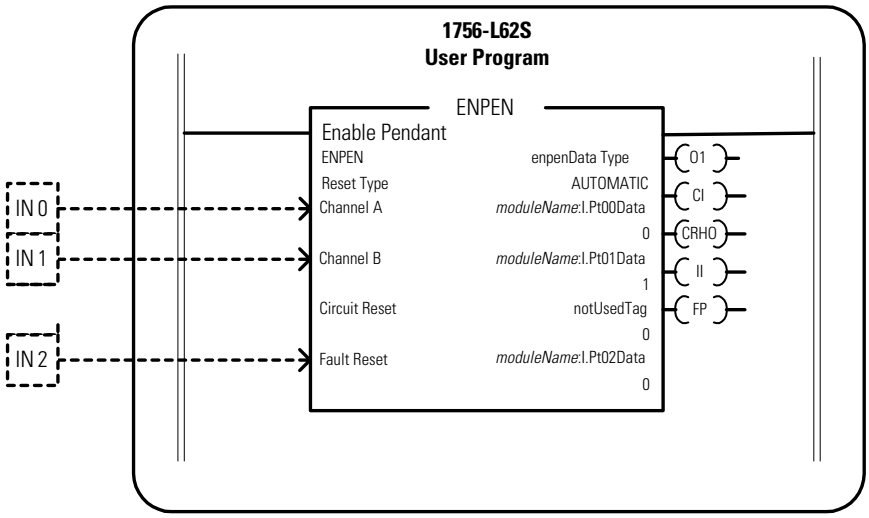
The inputs shown on this wiring diagram correspond to the inputs for the instruction.



Programming Example

The following programming example shows how the Enable Pendant instruction with Automatic Reset can be applied to the wiring diagram shown in Figure 5.7, Enable Pendant Wiring Diagram - Automatic Reset.

Figure 5.8 Enable Pendant Programming Example - Automatic Reset



EN954-1 Category 4 requires that inputs be independently pulse tested. RSLogix 5000 programming software is used to configure the following I/O module parameters for pulse testing.

Table 5.4 Input Configuration

Input Point	Type	Point Mode	Test Source
0 (*IN0*)	Single	Safety Pulse Test	0 *(T0)*
1 (*IN1*)	Single	Safety Pulse Test	1 *(T1)*
2 (*IN2*)	Single	Safety	None

Table 5.5 Test Output

Test Output Point	Point Mode
0 *(T0)*	Pulse Test
1 *(T1)*	Pulse Test
2 *(T2)*	Power Supply

Light Curtain Instruction (LC)

Overview

The basic purpose of the Light Curtain Instruction is to provide a manual and an automatic circuit reset interface from a programmable controller to a light curtain used in SIL3/CAT4 safety applications.

Many Light Curtains pulse test their two outputs; OSSD1 and OSSD2. If these outputs are wired directly into GuardLogix controller inputs, the pulse test needs to be filtered. Otherwise, the GuardLogix controller may mistake the LO pulse test for a light curtain blockage.

Note that most light curtains do provide 'controllers' or 'relays' that essentially filter out the pulse test and provide two dry contacts for OSSD1 and OSSD2. If using these devices, then OSSD1 and OSSD2 can be wired directly to the GuardLogix controller.

If you are NOT using the light curtain 'controller' or 'relay', then the GuardLogix controller must provide the pulse test filtering. There are two ways for the GuardLogix controller to filter this signal. The first is hardware- based digital input filters on the Safety input modules. For more information on Safety I/O modules, refer to the *DeviceNet Safety I/O User Manual*, publication 1791DS-UM001. The second is a software- based filter in the Light Curtain instruction. For information on the software-based filter, see Input Filter Time on page 6-6 of this manual.

Of these two methods, the hardware filter is preferred. If the digital input filters the LO signals for longer than the LO pulse test width, then the hardware filter will filter out the pulse test. For example, if the Light Curtain signals pulse LO for 100 µs during a pulse test, then the hardware must filter out LO signals that are 100 µs or longer. Note that the Safety DeviceNet I/O modules have a configurable filter of 0 to 126 ms.

If the hardware filter cannot filter the pulse test, or you choose not to use the hardware filter, then the filtering must be done in the GuardLogix controller ladder logic. Software based filters look at the input once every program cycle. Theoretically, every time the GuardLogix controller looks at OSSD1, it may be LO if the pulse test is occurring at that exact time. In other words, you may have to make your software filter long enough to scan OSSD1 multiple times before the filter times out, and OSSD1 is set logically LO.

Setting the software filter time higher than the GuardLogix controller's Safety task period ensures that the input must be LO for three consecutive scans before the software filter times out. For example, if the GuardLogix controller's Safety task period is 5 ms, a software filter time of 10 ms requires three LO scans. If the filter time is 15 ms, four LO scans are required. The downside of using a longer hardware or software filter is that this filter time must be directly added to the calculation of the light curtain safety reaction time.

Operation

Normal Operation

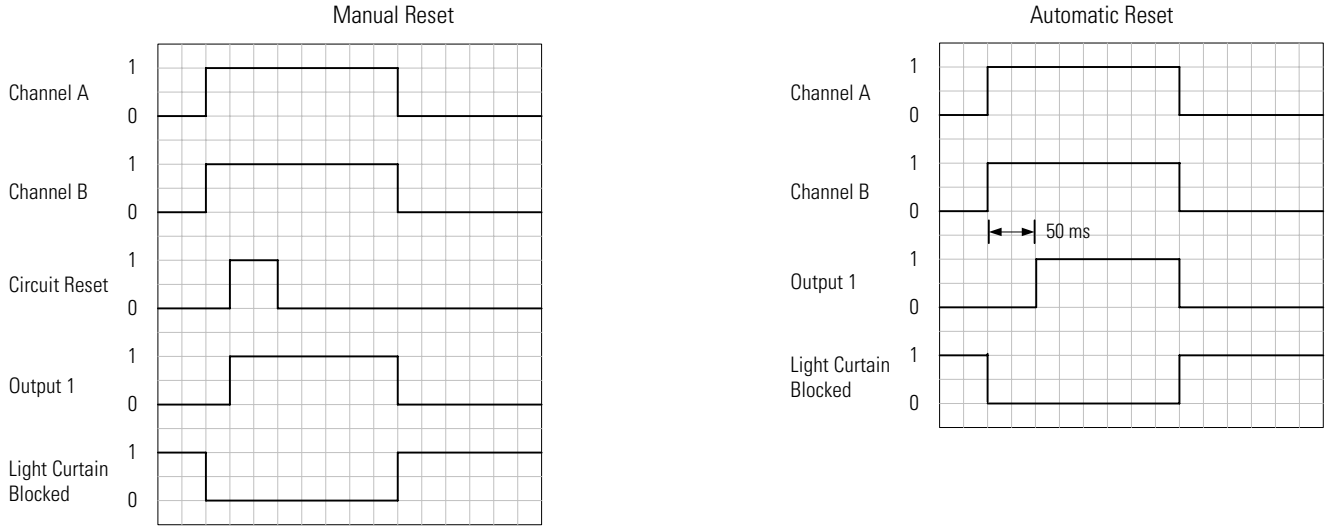
This instruction monitors the states of two input channels and turns on output 1 when the following conditions are met:

- When using Manual Reset: both inputs are in the Active state when the Circuit Reset input is transitioned from a zero to a one.
- When using Automatic Reset: both inputs are in their Active state for 50 ms.

The instruction turns output 1 off when either one or both of the input channels return to the Safe state.

These normal operation state changes are shown in the following timing diagrams.

Figure 6.1 Normal Operation



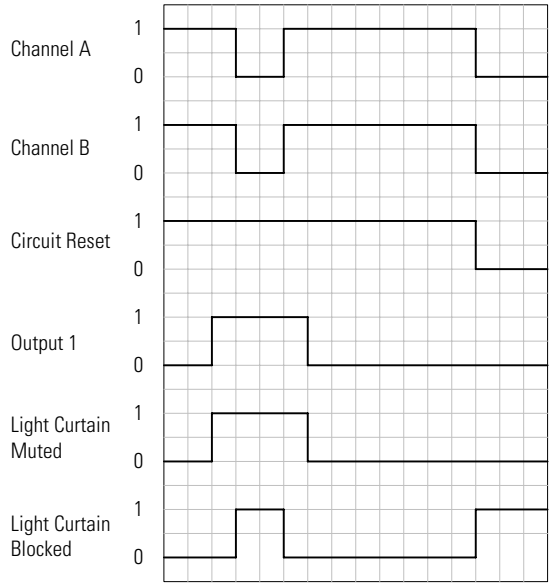
Light Curtain Muting Operation

The one exception to the above Output 1 control is Light Curtain Muting which, when enabled, permits the inputs to leave the Active state and output 1 to remain on. The Light Curtain Muted output represents the value of the Mute Light Curtain input and indicates that the light curtain is not being used.

This instruction also has a Light Curtain Blocked output which indicates when the input channels are NOT in the Active state (ones).

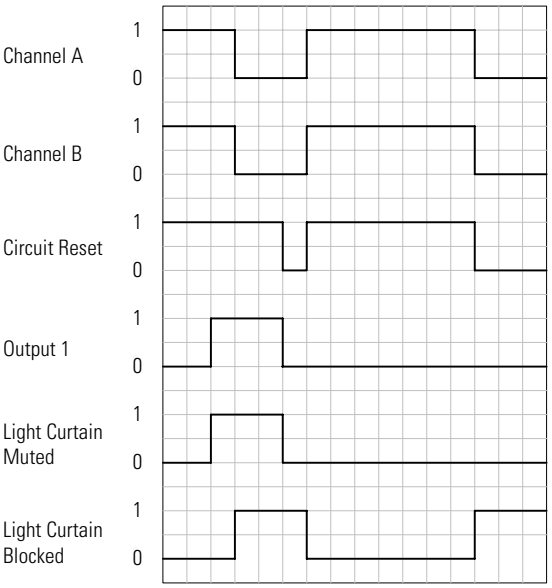
These state changes are shown in the following timing diagrams.

Figure 6.2 Light Curtain Muting Operation - Example 1



If the Mute Light Curtain input is not set properly, or the light curtain is blocked after the muting period is finished, the behavior of this instruction reverts back to the behavior defined earlier when no muting is present.

Figure 6.3 Light Curtain Muting Operation - Example 2

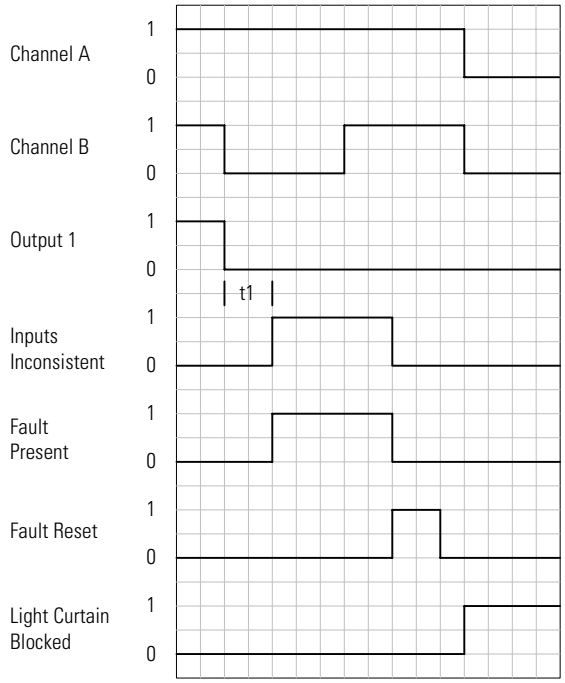


Inputs Inconsistent Operation

This instruction generates a fault if the input channels are in inconsistent states (one Safe and one Active) for more than 500 ms. This fault condition is enunciated via the Inputs Inconsistent and the Fault Present outputs. Output 1 cannot enter the Active state while the Fault Present output is active. The fault indication is cleared when the offending condition is remedied and the Fault Reset input is transitioned from zero to one.

These state changes are shown in the following timing diagram.

Figure 6.4 Inputs Inconsistent Operation



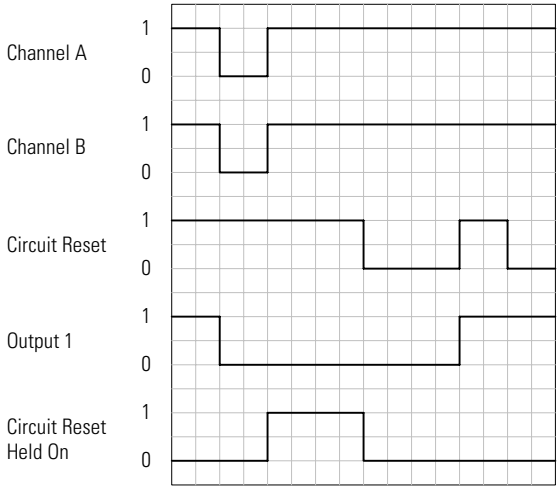
t1 - Inputs Inconsistent Time Period

Circuit Reset Held On Operation (Manual Reset Mode Only)

This instruction also sets the Circuit Reset Held On output prompt if the Circuit Reset input is set (1) when the input channels transition to the Active state.

These state changes are shown in the following timing diagram.

Figure 6.5 Circuit Reset Held On Operation

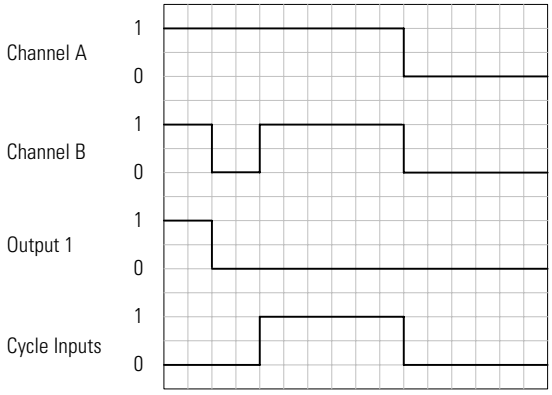


Cycle Inputs Operation

If, while Output 1 is active, one of the input channels transitions from the Active state to the Safe state and back to the Active state before the other input channel transitions to the Safe state, this instruction sets the Cycle Inputs output prompt, and Output 1 cannot enter the Active state again until both input channels cycle through their Safe states.

These state changes are shown in the following timing diagram.

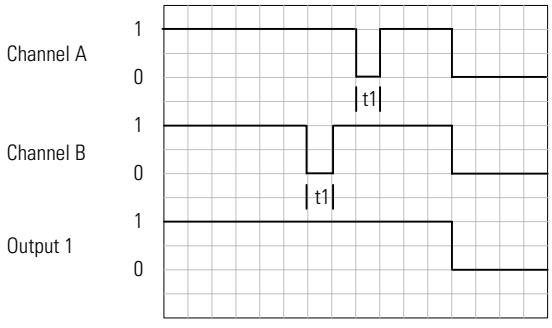
Figure 6.6 Cycle Inputs Operation



Input Filter Time

When an input filter time is specified, then, for that length of time, an input channel is allowed to go to the Safe state while the other channel is in the Active state without Output 1 going to its Safe state. However, Output 1 will go to the Safe state when both input channels are in the Safe state at the same time.

Figure 6.7 Input Filter Time



t1 ≤ input filter time

Ladder Logic Description

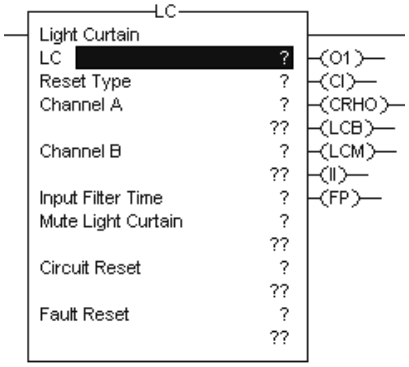


Table 6.1 Light Curtain Instruction Parameters

Parameter	Short Name	Type	Data Type	Description	Safe, Active and Initial Values
LC	—	—	Pre-defined Data Type	This parameter is used to maintain instruction-specific information. **Do not used the same pre-defined data type tag name in more than one instruction.**	—
Reset Type	—	Input	Boolean	The reset type determines whether the instruction is using Manual or Automatic reset for Output 1	Manual or Automatic
Channel A	—	Input	Boolean	Channel A Input	Safe = 0, Active = 1
Channel B	—	Input	Boolean	Channel B Input	Safe = 0, Active = 1
Input Filter Time	—	Input	Time	This is a selectable time, from 0 to 20 ms, used for filtering of the output pulse testing by the light curtain.	Initial = 0 ms
Mute Light Curtain	—	Input	Boolean	Permits muting of the light curtain when it is not being used.	Initial = 0, Mute Light Curtain = 1
Circuit Reset	—	Input	Boolean	Circuit Reset Input Manual Reset - Sets Output 1 after Channel A and Channel B transition from the Safe state to the Active state, and the Circuit Reset input transitions from zero to one. Automatic Reset - Visible, but not used.	Initial = 0, Reset = 1
Fault Reset	—	Input	Boolean	After fault conditions are corrected for the instruction, the fault outputs for the instruction are cleared when this input transitions from off to on.	Initial = 0, Reset = 1
Output 1	O1	Output	Boolean	Output 1 is set to the Active state when input conditions are met.	Safe = 0, Active = 1

Table 6.1 Light Curtain Instruction Parameters

Parameter	Short Name	Type	Data Type	Description	Safe, Active and Initial Values
Cycle Inputs	CI	Prompt Output	Boolean	Cycle Inputs prompts for action. Before Output 1 is turned on, Channel A and Channel B inputs must be cycled through their Safe States at the same time before the circuit can be reset. This prompt is cleared when Channel A and Channel B transition to the Safe state.	Initial = 0, Prompt = 1
Circuit Reset Held On	CRHO	Prompt Output	Boolean	Manual Reset - The Circuit Reset Held On prompt is set when both input channels transition to the Active states, and the Circuit Reset input is already on. The Circuit Reset Held On prompt is cleared when the Circuit Reset input is turned off. Automatic Reset - Visible, but not used.	Initial = 0, Prompt = 1
Light Curtain Blocked	LCB	Indicator Output	Boolean	This is indicates that the light curtain is blocked or has lost power.	Initial = 0, Blocked = 1
Light Curtain Muted	LCM	Indicator Output	Boolean	This indicates that the light curtain is muted (not being used).	Initial = 0, Muted = 1
Inputs Inconsistent	II	Fault Output	Boolean	This fault is set when Channel A and Channel B inputs are in inconsistent states (one Safe and one Active) for a period of time greater than 500 ms. This fault is cleared when Channel A and Channel B inputs return to consistent states (both Safe or both Active) and the Fault Reset input transitions from off to on.	Initial = 0, Fault = 1
Fault Present	FP	Fault Output	Boolean	This is on whenever a fault is present in the instruction. Output 1 cannot enter the Active state when Fault Present is set. Fault Present is cleared when all faults are cleared and the Fault Reset input transitions from off to on.	Initial = 0, Fault = 1

Relationship of I/O Wiring to Instruction Parameters

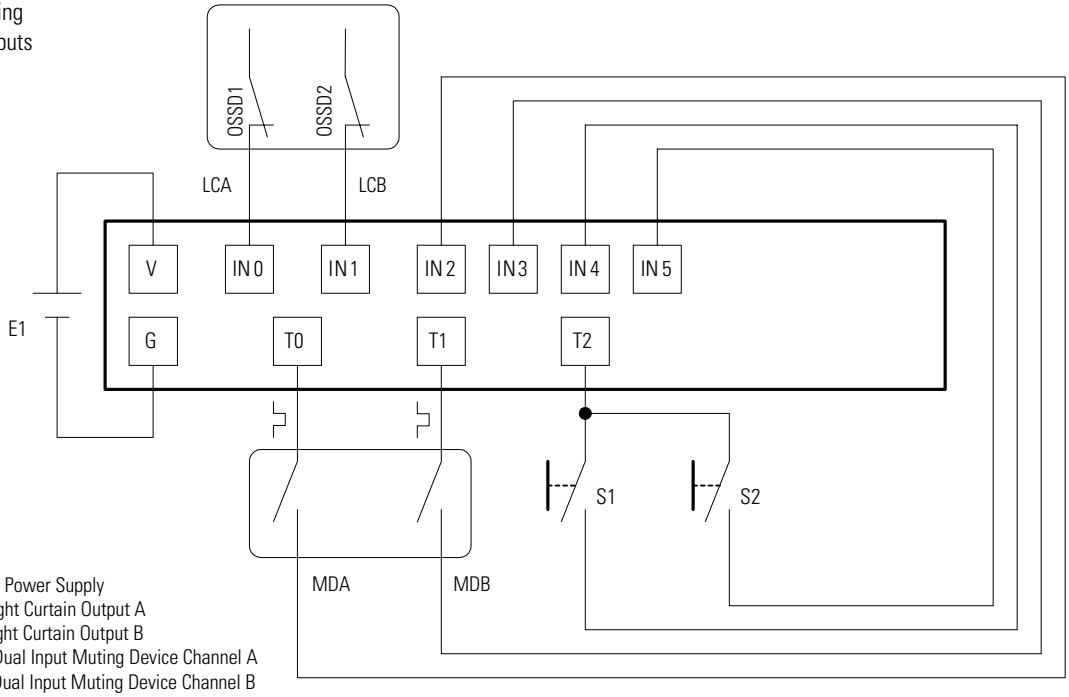
Light Curtain with Manual Reset Wiring and Programming

Wiring Example

The following wiring diagram is one example of how to wire a light curtain's two normally open outputs and two inputs required for muting to a 1791DS Safety I/O module to comply with EN954-1 Category 4.

Figure 6.8 Light Curtain Wiring Diagram - Manual Reset

The inputs shown on this wiring diagram correspond to the inputs for the instruction.

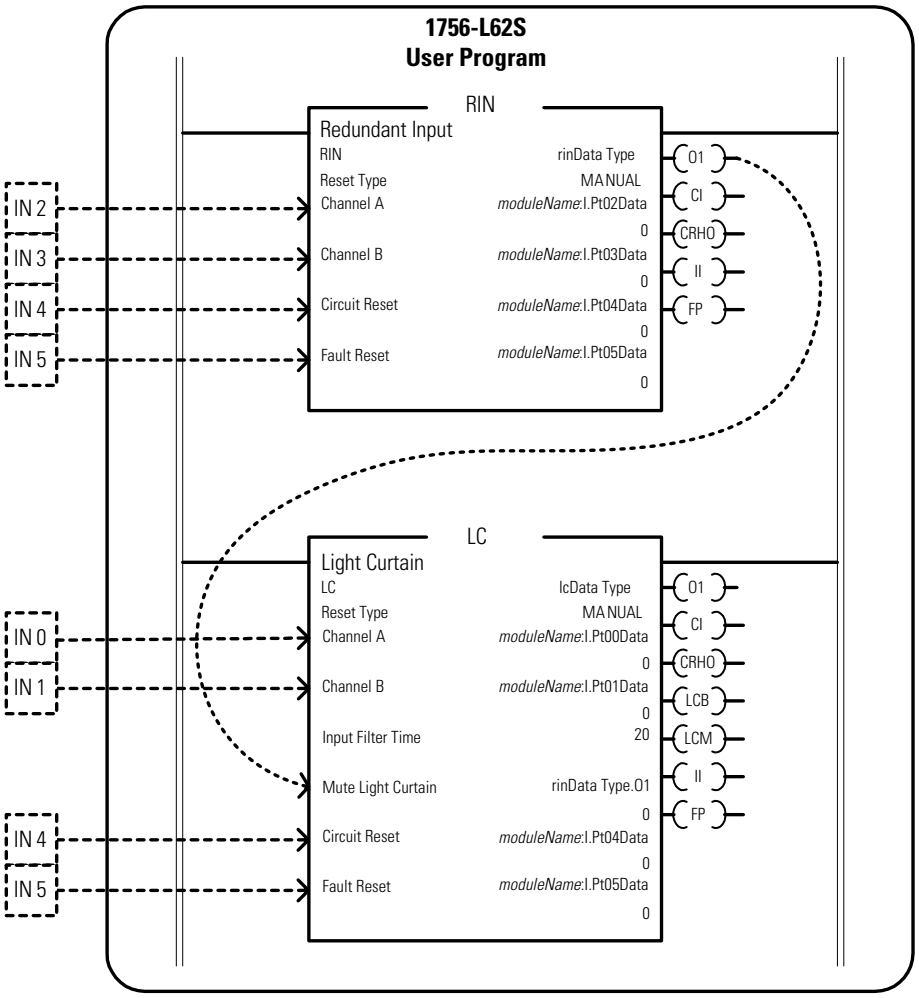


E1 - 24V Power Supply
LCA - Light Curtain Output A
LCB - Light Curtain Output B
MDA - Dual Input Muting Device Channel A
MDB - Dual Input Muting Device Channel B
S1 - Circuit Reset Switch
S2 - Fault Reset Switch

Programming Example

The following programming example shows how the Light Curtain instruction with Manual Reset can be applied to the wiring diagram shown in Figure 6.8, Light Curtain Wiring Diagram - Manual Reset.

Figure 6.9 Light Curtain Programming Example - Manual Reset



EN954-1 Category 4 requires that inputs be independently pulse tested. RSLogix 5000 programming software is used to configure the following I/O module parameters for pulse testing.

Table 6.2 Input Configuration

Input Point	Type	Point Mode	Test Source
0 (*IN0*)	Single	Safety	None
1 (*IN1*)	Single	Safety	None
2 (*IN2*)	Single	Safety Pulse Test	0 *(T0)*
3 (*IN3*)	Single	Safety Pulse Test	1 *(T1)*
4 (*IN4*)	Single	Safety	None
5 (*IN5*)	Single	Safety	None

Table 6.3 Test Output

Test Output Point	Point Mode
0 *(T0)*	Pulse Test
1 *(T1)*	Pulse Test
2 *(T2)*	Power Supply
3 *(T3)*	Not Used

Light Curtain with Automatic Reset Wiring and Programming

Wiring Example

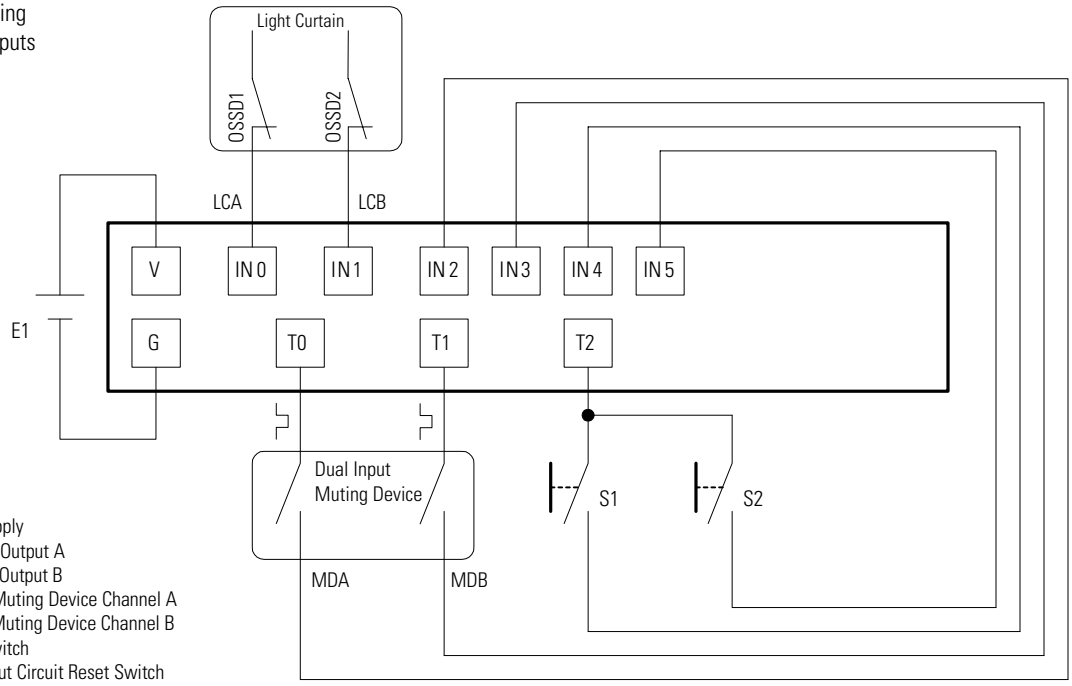
The following wiring diagram is one example of how to wire a light curtain's two normally open outputs and two inputs required for muting to a 1791DS Safety I/O module to comply with EN954-1 Category 4.

ATTENTION

Various safety standards (EN 60204, EN 954) require that when using the Automatic Circuit Reset feature, other measures must be implemented to ensure that an unexpected (or unintended) startup will not occur in the system or application.

Figure 6.10 Light Curtain Wiring Diagram - Automatic Reset

The inputs shown on this wiring diagram correspond to the inputs for the instruction.

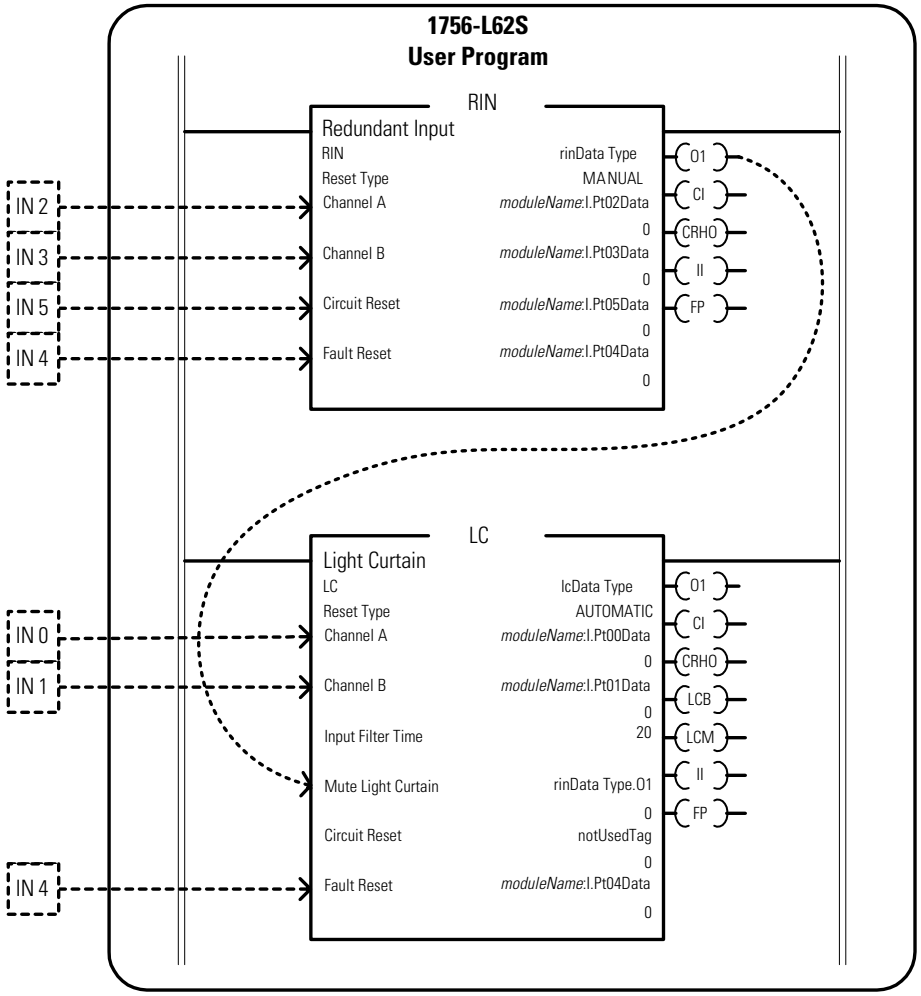


E1 - 24V Power Supply
LCA - Light Curtain Output A
LCB - Light Curtain Output B
MDA - Dual Input Muting Device Channel A
MDB - Dual Input Muting Device Channel B
S1 - Fault Reset Switch
S2 - Redundant Input Circuit Reset Switch

Programming Example

The following programming example shows how the Light Curtain instruction with Automatic Reset can be applied to the wiring diagram shown in Figure 6.8, Light Curtain Wiring Diagram - Manual Reset.

Figure 6.11 Light Curtain Programming Example - Automatic Reset



EN954-1 Category 4 requires that inputs be independently pulse tested. RSLogix 5000 programming software is used to configure the following I/O module parameters for pulse testing.

Table 6.4 Input Configuration

Input Point	Type	Point Mode	Test Source
0 (*IN0*)	Single	Safety	None
1 (*IN1*)	Single	Safety	None
2 (*IN2*)	Single	Safety Pulse Test	0 *(T0)*
3 (*IN3*)	Single	Safety Pulse Test	1 *(T1)*
4 (*IN4*)	Single	Safety	None
5 (*IN5*)	Single	Safety	None

Table 6.5 Test Output

Test Output Point	Point Mode
0 *(T0)*	Pulse Test
1 *(T1)*	Pulse Test
2 *(T2)*	Power Supply
3 *(T3)*	Not Used

Five-Position Mode Selector Instruction (FPMS)

Overview

The basic purpose of the Five-Position Mode Selector Instruction is to provide an interface from a programmable controller to a three-to-five-position selector switch used in SIL3/CAT4 safety applications.

Operation

The Five-Position Mode Selector Instruction has five outputs that are associated with five inputs. Its main job is to enable one of the five outputs when its associated input goes active.

It has two faults; one for more than one input active, and the other for no inputs active. These faults occur when the associated inputs conditions exist for more than 250 ms. However, all outputs are immediately set to zero upon detection of either input fault condition.

Faults may be cleared by the rising edge of the Fault Reset signal, but only after the input fault condition has been cleared.

Ladder Logic Description

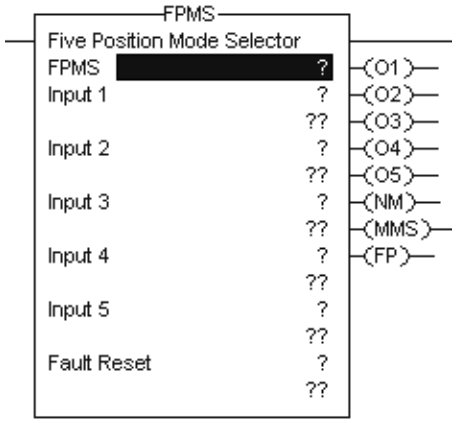


Table 7.1 Five-Position Mode Selector Switch Instruction Parameters

Parameter	Short Name	Type	Data Type	Description	Safe, Active and Initial Values
FPMS	—	—	Pre-defined Data Type	This parameter is used to maintain instruction-specific information. **Do not use the same pre-defined data type tag name in more than one instruction.**	—
Input 1	—	Input	Boolean	Mode 1 Selected Input	Safe = 0, Active = 1
Input 2	—	Input	Boolean	Mode 2 Selected Input	Safe = 0, Active = 1
Input 3	—	Input	Boolean	Mode 3 Selected Input	Safe = 0, Active = 1
Input 4	—	Input	Boolean	Mode 4 Selected Input	Safe = 0, Active = 1
Input 5	—	Input	Boolean	Mode 5 Selected Input	Safe = 0, Active = 1
Fault Reset	—	Input	Boolean	After fault conditions are corrected for the instruction, the Fault Present output for the instruction is cleared when this input transitions from off to on.	Initial = 0, Reset = 1
Output 1	O1	Output	Boolean	Output associated with Input 1	Safe = 0, Active = 1
Output 2	O2	Output	Boolean	Output associated with Input 2	Safe = 0, Active = 1
Output 3	O3	Output	Boolean	Output associated with Input 3	Safe = 0, Active = 1
Output 4	O4	Output	Boolean	Output associated with Input 4	Safe = 0, Active = 1
Output 5	O5	Output	Boolean	Output associated with Input 5	Safe = 0, Active = 1
No Mode	NM	Fault	Boolean	No Mode Selected Fault	Initial = 0, Fault = 1
Multiple Modes Selected	MMS	Fault	Boolean	More than One Mode Selected Fault	Initial = 0, Fault = 1
Fault Present	FP	Fault	Boolean	This is set whenever a fault is present in the instruction. An Output cannot enter the Active state when Fault Present is set. Fault Present is cleared when all faults are cleared and the Fault Reset input transitions from off to on.	Initial = 0, Fault = 1

Relationship of I/O Wiring to Instruction Parameters

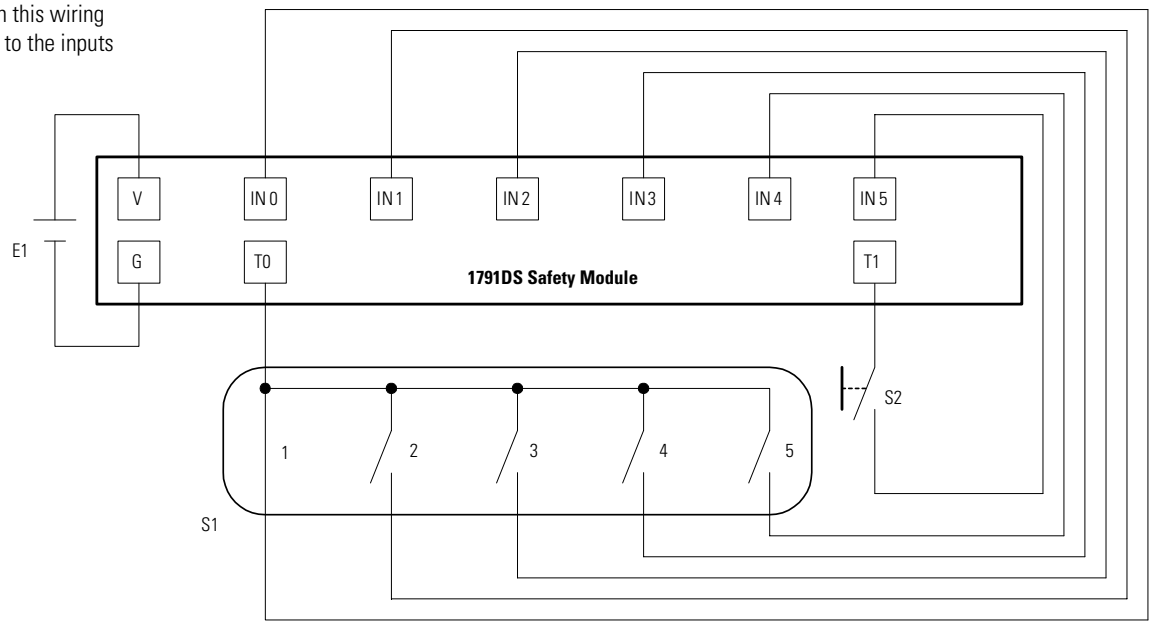
Five-Position Mode Selector Wiring and Programming

Wiring Example

The following wiring diagram is one example of how to wire a five-position selector switch to a 1791DS Safety I/O module to comply with EN954-1 Category 4.

Figure 7.1 Five-Position Selector Switch Wiring Diagram

The inputs shown on this wiring diagram correspond to the inputs for the instruction.

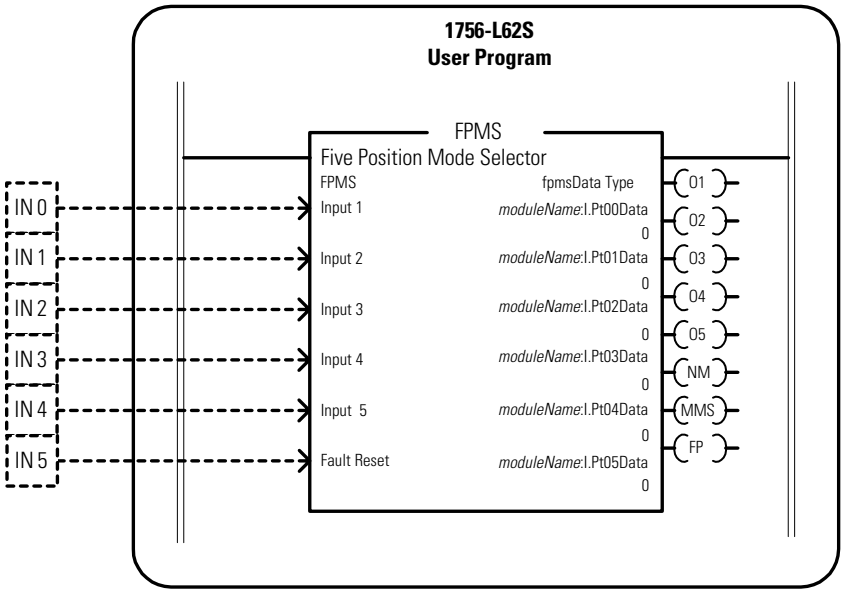


E1 - 24V Power Supply
S1 - Five-Position Selector Switch (shown with Position 1 selected)
S2 - Fault Reset Switch

Programming Example

The following programming example shows how the Five-Position Mode Selector instruction can be applied to the wiring diagram shown in Figure 7.1, Five-Position Selector Switch Wiring Diagram.

Figure 7.2 Five-Position Mode Selector Programming Example



RSLogix 5000 programming software is used to configure the following I/O module parameters.

Table 7.2 Input Configuration

Point	Type	Point Mode
0 (*IN0*)	Single	Safety
1 (*IN1*)	Single	Safety
2 (*IN2*)	Single	Safety
3 (*IN3*)	Single	Safety
4 (*IN4*)	Single	Safety
5 (*IN5*)	Single	Safety

Table 7.3 Output

Point	Point Mode
0	Power Supply
1	Power Supply
2	Not Used
3	Not Used

Redundant Output with Continuous Feedback Monitoring Instruction (ROUT)

Overview

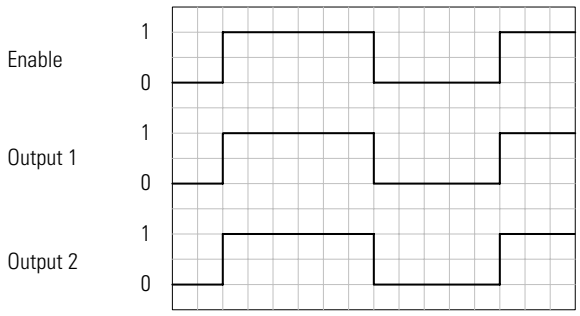
The basic purpose of the Redundant Output with Continuous Feedback Monitoring Instruction is to emulate the output functionality of a safety relay in a software programmable environment which is intended for use in SIL3/CAT4 safety applications.

The Redundant Output with Continuous Feedback Monitoring Instruction can be used in two ways:

- Redundant Output with Negative Feedback (RONF)
- Redundant Output with Positive Feedback (ROPF)

Operation

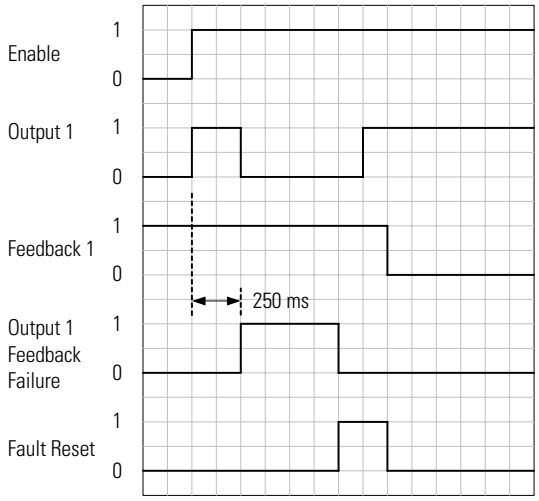
This instruction monitors a single logical input and activates two field outputs when the logical input goes Active.

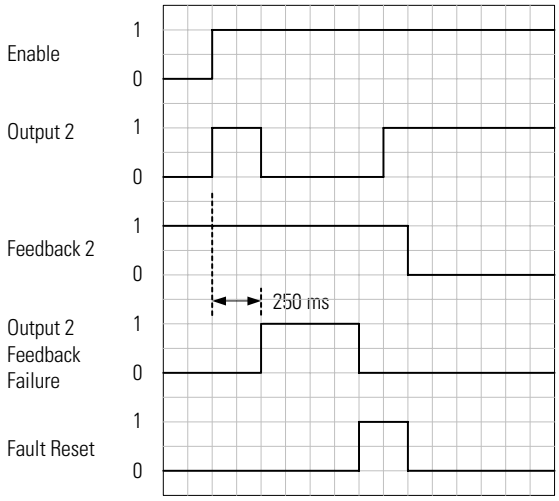


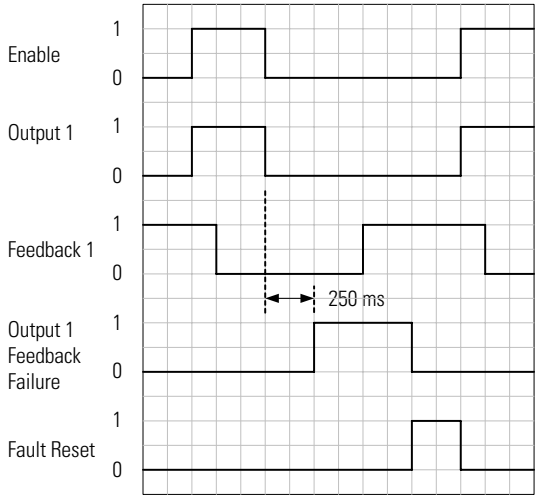
It also monitors a feedback channel for each field output and generates a fault if both channels do not, within a time limit, indicate the desired state of the associated outputs.

Instruction operation is illustrated in the following timing diagrams.

Figure 8.1 Negative Feedback Examples







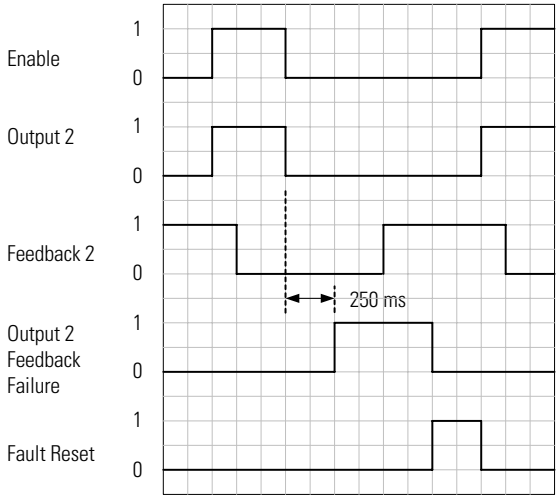
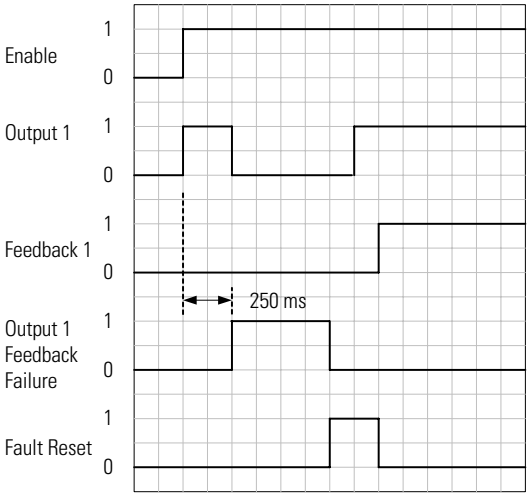
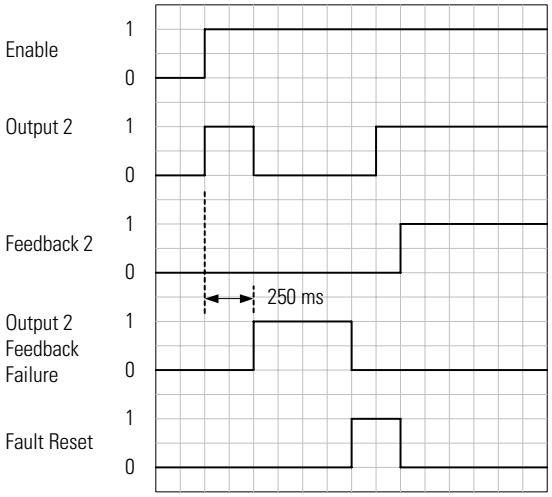
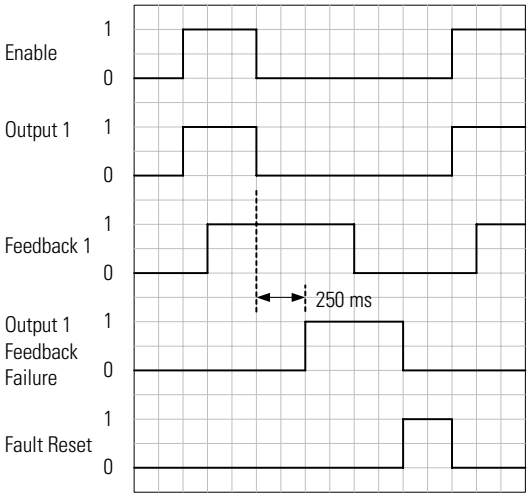
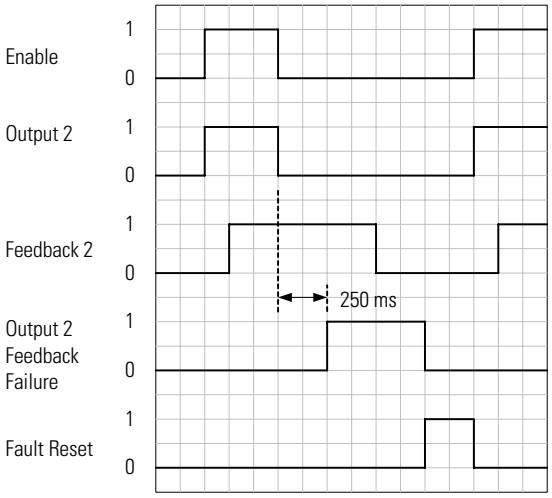


Figure 8.2 Positive Feedback Examples









Ladder Logic Description

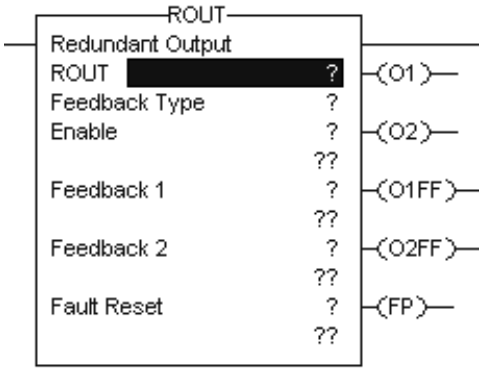


Table 8.1 Redundant Output with Continuous Feedback Instruction Parameters

Parameter	Short Name	Type	Data Type	Description	Safe, Active and Initial Values
ROUT	—	—	Pre-defined Data Type	This parameter is used to maintain instruction-specific information. **Do not use the same pre-defined data type tag name in more than one instruction.**	—
Feedback Type	—	Input	Boolean	The feedback type determines whether the instruction is using negative or positive feedback.	Negative (RONF) or Positive (ROPF)
Enable	—	Input	Boolean	Input to Enable the Redundant Outputs	Safe = 0, Active = 1
Feedback 1	—	Input	Boolean	Feedback from a device either directly or indirectly controlled by Output 1.	RONF: Off = 1, On = 0 ROPF: Off = 0, On = 1
Feedback 2	—	Input	Boolean	Feedback from a device either directly or indirectly controlled by Output 2.	RONF: Off = 1, On = 0 ROPF: Off = 0, On = 1
Fault Reset	—	Input	Boolean	After fault conditions are corrected for the instruction, the Fault Present output for the instruction is cleared when this input transitions from off to on.	Initial = 0, Reset = 1
Output 1	O1	Output	Boolean	Output 1 of the redundant outputs.	Safe = 0, Active = 1
Output 2	O2	Output	Boolean	Output 2 of the redundant outputs.	Safe = 0, Active = 1
Output 1 Feedback Failure	O1FF	Fault	Boolean	Output 1 Feedback is not indicating the correct state of Output 1 within 250 ms	Initial = 0, Fault = 1
Output 2 Feedback Failure	O2FF	Fault	Boolean	Output 2 Feedback is not indicating the correct state of Output 2 within 250 ms	Initial = 0, Fault = 1
Fault Present	FP	Fault	Boolean	This is set whenever a fault is present in the instruction. Outputs cannot enter the Active state when Fault Present is set. Fault Present is cleared when all faults are cleared and the Fault Reset input transitions from off to on.	Initial = 0, Fault = 1

Relationship of I/O Wiring to Instruction Parameters

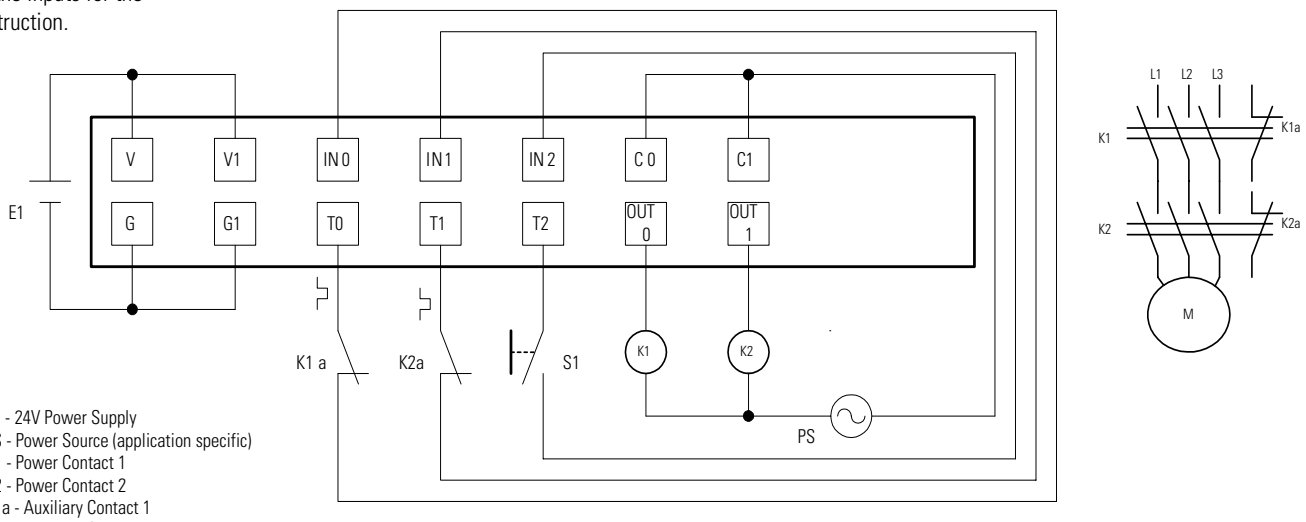
Redundant Output with Negative Feedback Wiring and Programming

Wiring Example

The following wiring diagram is one example of how to wire two contactors and normally open auxiliary contacts to a 1791DS Safety I/O module to comply with EN954-1 Category 4.

Figure 8.3 Redundant Output with Negative Feedback Wiring Diagram

The inputs shown on this wiring diagram correspond to the inputs for the instruction.

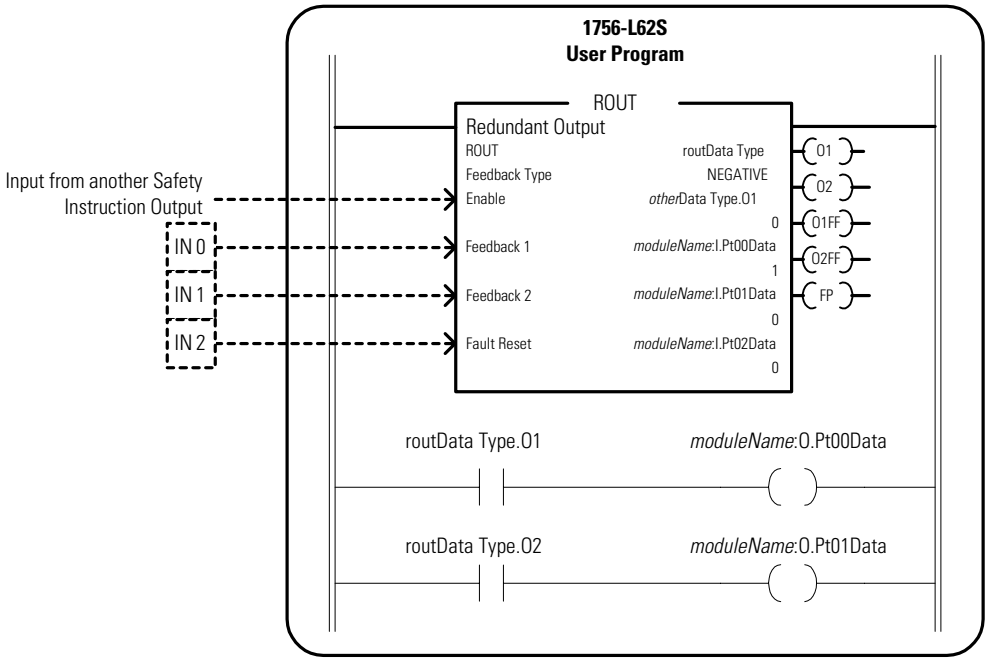


E1 - 24V Power Supply
PS - Power Source (application specific)
K1 - Power Contact 1
K2 - Power Contact 2
K1a - Auxiliary Contact 1
K2a - Auxiliary Contact 2
S1 - Fault Reset Switch

Programming Example

The following programming example shows how the Redundant Output instruction with negative feedback can be applied to the wiring diagram shown in Figure 8.3, Redundant Output with Negative Feedback Wiring Diagram.

Figure 8.4 Redundant Output with Negative Feedback Programming Example



EN954-1 Category 4 requires that inputs be independently pulse tested. RSLogix 5000 programming software is used to configure the following I/O module parameters for pulse testing.

Table 8.2 Input Configuration

Input Point	Type	Point Mode	Test Source
0 (*IN0*)	Single	Safety Pulse Test	0 *(T0)*
1 (*IN1*)	Single	Safety Pulse Test	1 *(T1)*
2 (*IN2*)	Single	Safety	None

Table 8.3 Test Output

Test Output Point	Point Mode
0 *(T0)*	Pulse Test
1 *(T1)*	Pulse Test
2 *(T2)*	Power Supply
3 *(T3)*	Not Used

Table 8.4 Output Configuration

Point	Type	Point Mode
0 (*OUT0*)	Single	Safety
1 (*OUT1*)	Single	Safety

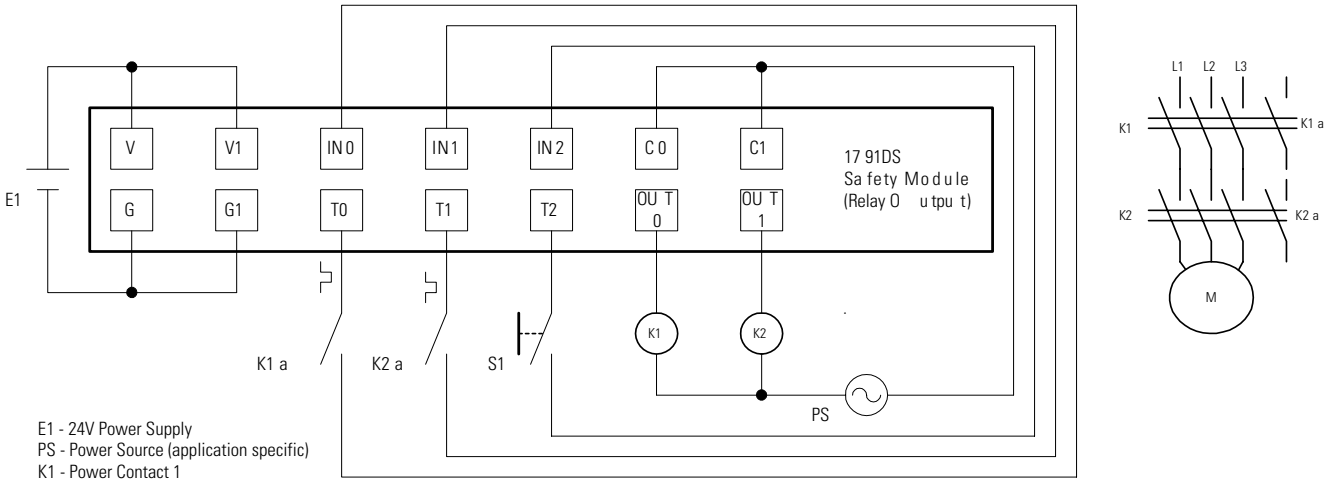
Redundant Output with Positive Feedback Wiring and Programming

Wiring Example

The following wiring diagram is one example of how to wire two contactors and normally open auxiliary contacts to a 1791DS Safety I/O module to comply with EN954-1 Category 4.

Figure 8.5 Redundant Output with Positive Feedback Wiring Diagram

The inputs shown on this wiring diagram correspond to the inputs for the instruction.

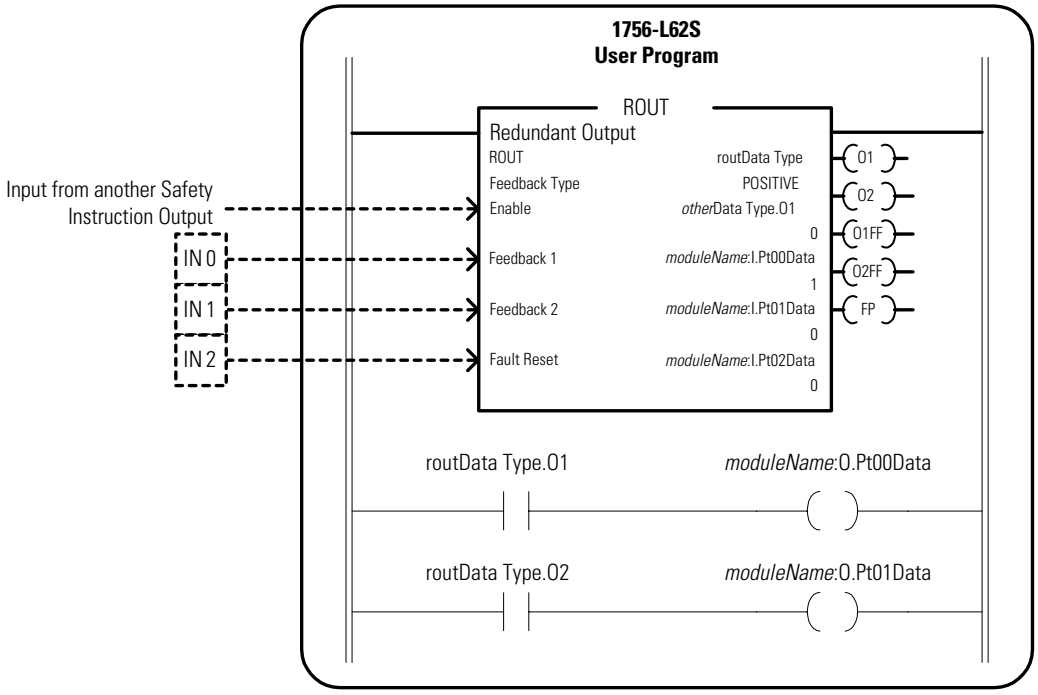


E1 - 24V Power Supply
PS - Power Source (application specific)
K1 - Power Contact 1
K2 - Power Contact 2
K1a - Auxiliary Contact 1
K2a - Auxiliary Contact 2
S1 - Fault Reset Switch

Programming Example

The following programming example shows how the Redundant Output instruction with positive feedback can be applied to the wiring diagram shown in Figure 8.5, Redundant Output with Positive Feedback Wiring Diagram.

Figure 8.6 Redundant Output with Positive Feedback Programming Example



EN954-1 Category 4 requires that inputs be independently pulse tested. RSLogix 5000 programming software is used to configure the following I/O module parameters for pulse testing.

Table 8.5 Input Configuration

Input Point	Type	Point Mode	Test Source
0 (*IN0*)	Single	Safety Pulse Test	0 *(T0)*
1 (*IN1*)	Single	Safety Pulse Test	1 *(T1)*
2 (*IN2*)	Single	Safety	None

Table 8.6 Test Output

Test Output Point	Point Mode
0 *(T0)*	Pulse Test
1 *(T1)*	Pulse Test
2 *(T2)*	Power Supply
3 *(T3)*	Not Used

Table 8.7 Output Configuration

Point	Type	Point Mode
0 (*OUT0*)	Single	Safety
1 (*OUT1*)	Single	Safety

Two-Hand Run Station Instruction (THRS)

Overview

The basic purpose of the Two-Hand Run Station instruction is to provide a method to incorporate two diverse input buttons used as a single operation start button into a software programmable environment which is intended for use in SIL3/CAT4 safety applications.

A run station can also be inserted or removed from controlling the process by using an Active Pin input in this instruction. The Two-Hand Run Station with Active Pin Instruction takes the four inputs (two from each button) and turns them into one signal for the rest of the application.

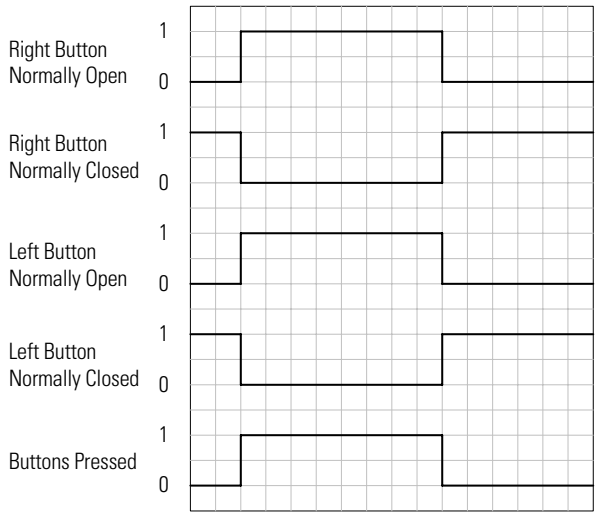
Operation

Normal Operation

The Two-Hand Run Station instruction takes the four inputs (two from each button) and turns them into one signal for the rest of the application.

These normal operation state changes are shown in the following timing diagram.

Figure 9.1 Normal Operation



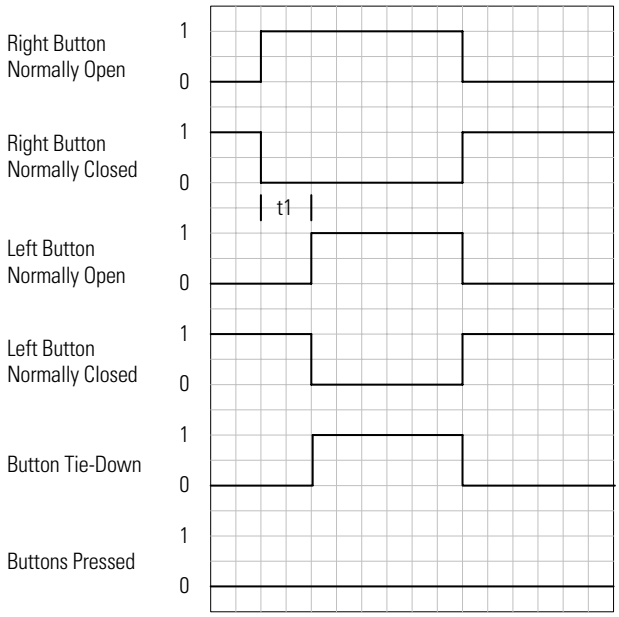
(See the De-Energize to Trip System section on page 1-1 for information about how to condition the input data associated with the normally closed channel.)

Button Tie-Down Operation

The Two-Hand Run Station instruction also monitors the four inputs to make sure none of them fail or are intentionally defeated. If the buttons are not pressed within 500 ms (t1) of each other, this instruction generates a Button Tie-Down condition and prevents the Buttons Pressed output from entering the Active state.

These state changes are shown in the following timing diagram.

Figure 9.2 Button Tie-Down Operation

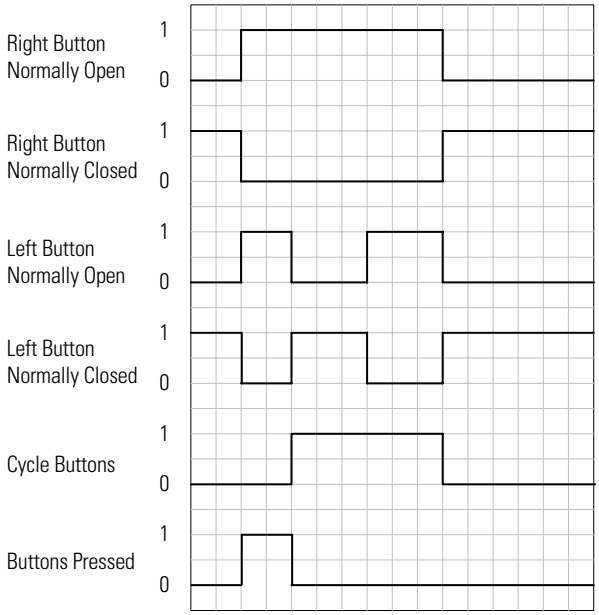


Cycle Buttons Operation

If, while Buttons Pressed is active, one of the buttons transitions from the Active state to the Safe state and back to the Active state before the other button transitions to the Safe state, this instruction sets the Cycle Buttons output prompt, and prevents the Buttons Pressed output from entering the Active state again until both buttons cycle through their Safe states.

These state changes are shown in the following timing diagram.

Figure 9.3 Cycle Buttons Operation



Button Fault Operation

This instruction also monitors the individual inputs from each button. If the two contacts for one of the buttons are in opposite safety states for more than 250 ms (t1), the appropriate fault is set (Left Button Fault or Right Button Fault). The Fault Present output is also set.

The Buttons Pressed output is set to the Safe state whenever one of these faults exists.

These state changes are shown in the following timing diagrams.

Figure 9.4 Left Button Fault Operation

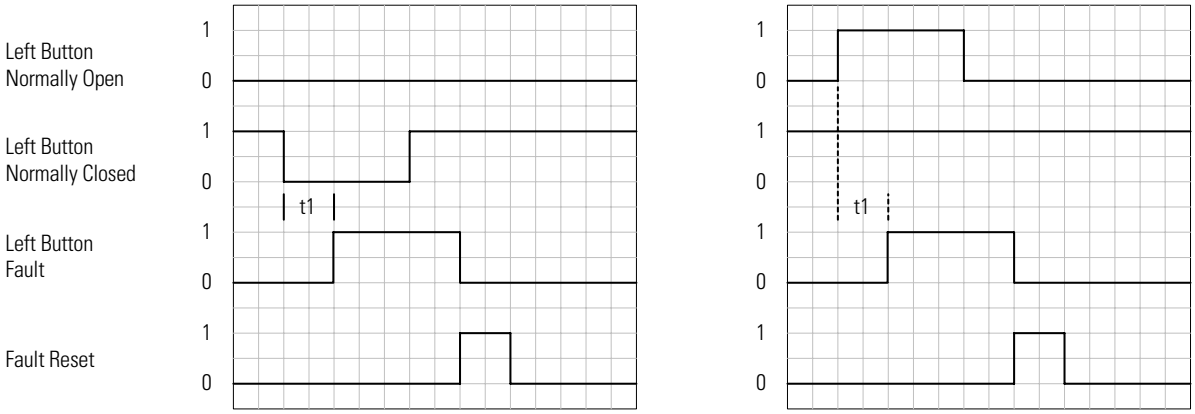
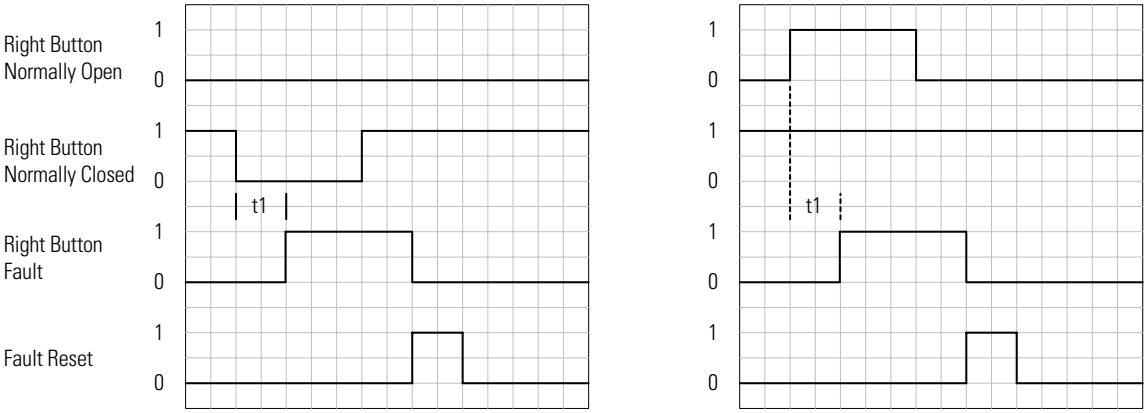


Figure 9.5 Right Button Fault Operation



Ladder Logic Description

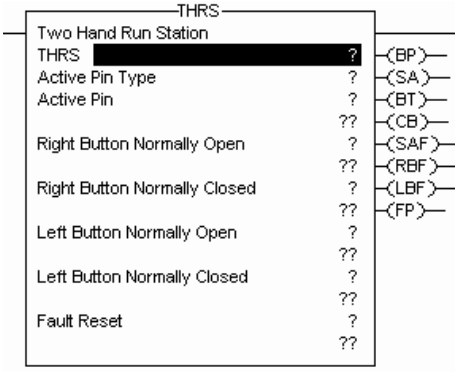


Table 9.1 Two-Hand Run Station Instruction Parameters

Parameter	Short Name	Type	Data Type	Description	Safe, Active and Initial Values
THRS	—	—	Pre-defined Data Type	This parameter is used to maintain instruction-specific information. **Do not use the same pre-defined data type tag name in more than one instruction.**	—
Active Pin Type	—	Input	Boolean	The Active Pin type determines whether or not the input and outputs specific to the Active Pin are processed.	Enabled or Disabled
Active Pin	—	Input	Boolean	Active Pin for run station Active Pin Enabled - When set, the Buttons Pressed output can enter the Active state. When clear, the Buttons Pressed output remains off. Active Pin Disabled - Visible, but not used.	Initial = 0, Set = 1
Right Button Normally Open	—	Input	Boolean	Right Button N.O. Contact Input	Safe = 0, Active = 1
Right Button Normally Closed	—	Input	Boolean	Right Button N.C. Contact Input	Safe = 1, Active = 0
Left Button Normally Open	—	Input	Boolean	Left Button N.O. Contact Input	Safe = 0, Active = 1
Left Button Normally Closed	—	Input	Boolean	Left Button N.C. Contact Input	Safe = 1, Active = 0
Fault Reset	—	Input	Boolean	Fault Reset Input Active Pin Enabled - When transitioned from off to on, and the fault cause has been cleared, the Right Button Fault, Left Button Fault and Station Active Fault outputs are cleared. Active Pin Disabled - When transitioned from off to on, and the fault cause has been cleared, the Right Button Fault and Left Button Fault outputs are cleared.	Initial = 0, Reset = 1

Table 9.1 Two-Hand Run Station Instruction Parameters

Parameter	Short Name	Type	Data Type	Description	Safe, Active and Initial Values
Buttons Pressed	BP	Output	Boolean	Output is enabled when the run station buttons are pressed and no faults are present.	Safe = 0, Active = 1
Station Active	SA	Indicator Output	Boolean	Output is enabled when the run station is active. Active Pin Enabled - Set indicates that the station is active. Cleared indicates that the station is inactive. Active Pin Disabled - Visible, but not used, always zero.	Initial = 0, Active = 1
Button Tiedown	BT	Indicator Output	Boolean	Indicates that both buttons were not pressed within 500 ms of each other. Cleared when both buttons are released.	Initial = 0, Active = 1
Cycle Buttons	CB	Prompt Output	Boolean	Set when the Button Tiedown indicator is set. Cleared when the Button Tiedown indicator is cleared.	Initial = 0, Active = 1
Station Active Fault	SAF	Fault Output	Boolean	Active Pin Enabled - Fault is set when the station is inactive. Active Pin Disabled - Visible, but not used, always zero.	Initial = 0, Active = 1
Right Button Fault	RBF	Fault Output	Boolean	There is a right button fault. Set when the Right Button Normally Closed and the Right Button Normally Open inputs are not both energized or not both de-energized within 250 ms.	Initial = 0, Active = 1
Left Button Fault	LBF	Fault Output	Boolean	There is a left button fault. Set when the Left Button Normally Closed and the Left Button Normally Open inputs are not both energized or not both de-energized within 250 ms.	Initial = 0, Active = 1
Fault Present	FP	Fault Output	Boolean	One or more of the faults are present. Active Pin Enabled - Set when the Station Active Fault, Right Button Fault or Left Button Fault outputs are set. Cleared when the Station Active Fault, Right Button Fault and Left Button Fault outputs are cleared. Active Pin Disabled - Set when the Station Right Button Fault or Left Button Fault outputs are set. Cleared when the Right Button Fault and Left Button Fault outputs are cleared and the Fault Reset input transitions from off to on.	Initial = 0, Active = 1

Relationship of I/O Wiring to Instruction Parameters

Two-Hand Run Station with Active Pin Disabled Wiring and Programming

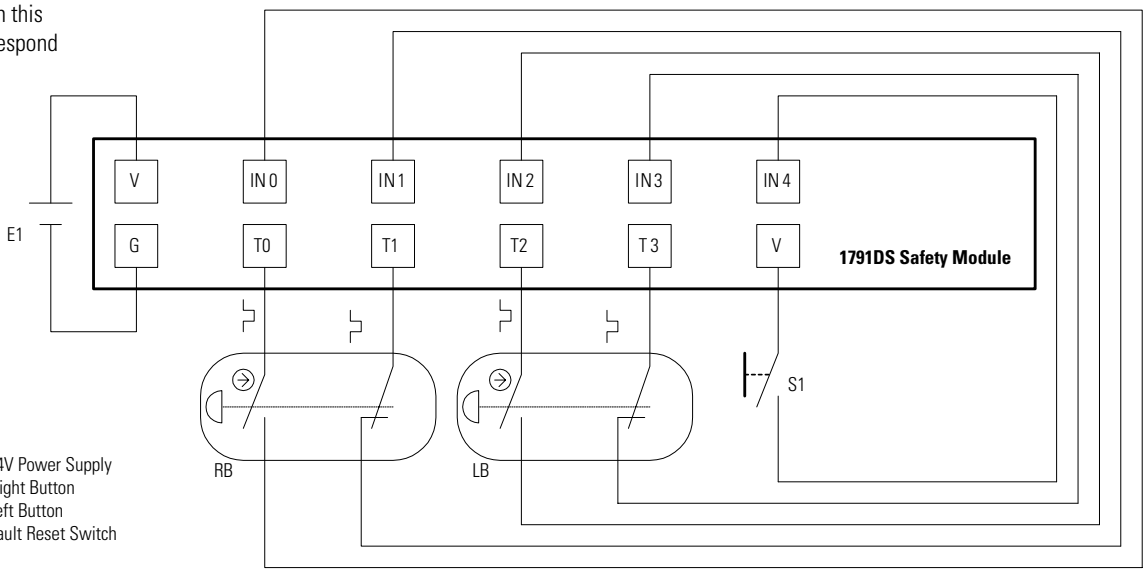
Wiring Example

IMPORTANT The Two-Hand Run Station is wired properly when the four run button inputs are in the safe state when the run buttons are released.

The following wiring diagram is one example of how to wire Right and Left push buttons to a 1791DS Safety I/O module to comply with EN954-1 Category 4. Each Push Button has 2 diverse input channels.

Figure 9.6 Two-Hand Run Station with Active Pin Disabled Control Wiring Diagram

The inputs shown on this wiring diagram correspond to the inputs for the instruction.

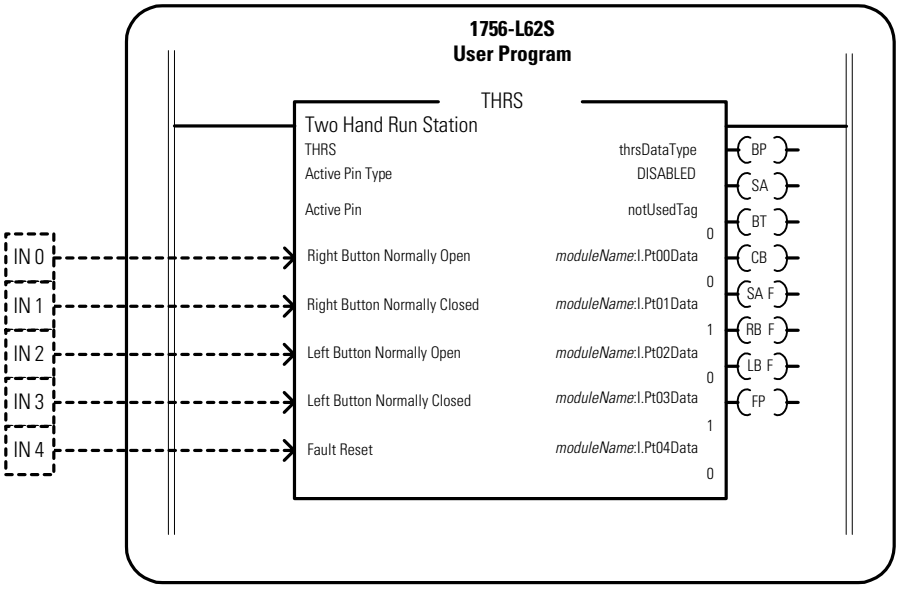


E1 - 24V Power Supply
RB - Right Button
LB - Left Button
S1 - Fault Reset Switch

Programming Example

The following programming examples show how the Two-Hand Run Station without Active Pin instruction can be applied to the wiring diagram shown in Figure 9.6, Two-Hand Run Station with Active Pin Disabled Control Wiring Diagram. One example shows Active Pin disabled, and the other shows Active Pin enabled.

Figure 9.7 Two-Hand Run Station Programming Example - Active Pin Disabled



EN954-1 Category 4 requires that inputs be independently pulse tested. RSLogix 5000 programming software is used to configure the following I/O module parameters for pulse testing.

Table 9.2 Input Configuration

Input Point	Type	Point Mode	Test Source
0 (*IN0*)	Single	Safety Pulse Test	0 *(T0)*
1 (*IN1*)	Single	Safety Pulse Test	1 *(T1)*
2 (*IN2*)	Single	Safety Pulse Test	2 *(T2)*
3 (*IN3*)	Single	Safety Pulse Test	3 *(T3)*
4 (*IN4*)	Single	Safety	None

Table 9.3 Test Output

Test Output Point	Point Mode
0 *(T0)*	Pulse Test
1 *(T1)*	Pulse Test
2 *(T2)*	Pulse Test
3 *(T3)*	Pulse Test

Two-Hand Run Station with Active Pin Enabled Wiring and Programming

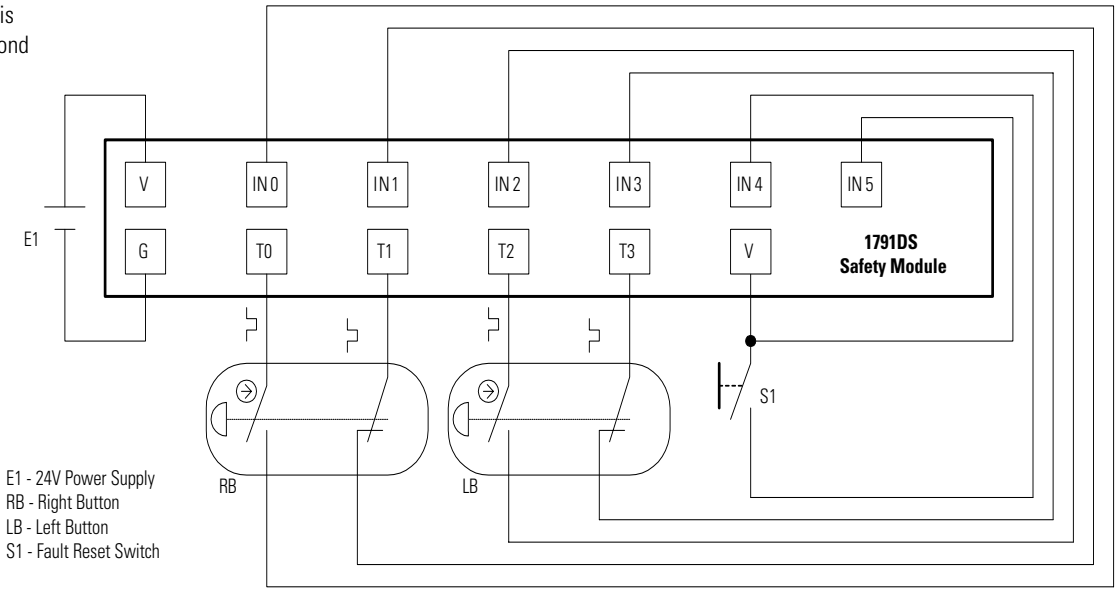
Wiring Examples

IMPORTANT The Two-Hand Run Station is wired properly when the four run button inputs are in the safe state when the run buttons are released.

The following wiring diagram is one example of how to wire Right and Left push buttons to a 1791DS Safety I/O module to comply with EN954-1 Category 4. Each Push Button has 2 diverse input channels.

Figure 9.8 Two-Hand Run Station with Active Pin Enabled Control Wiring Diagram (Active Pin High - Run Station Connected to System)

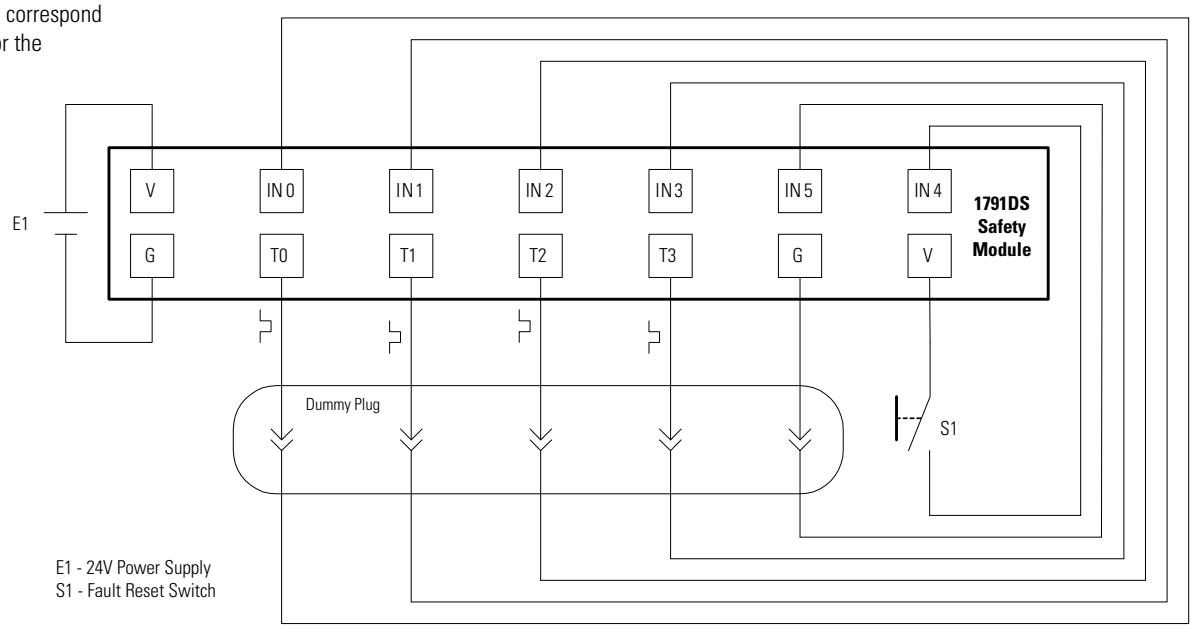
The inputs shown on this wiring diagram correspond to the inputs for the instruction.



The following wiring diagram is one example of how to wire a Dummy Plug to a 1791DS Safety I/O module to comply with EN954-1 Category 4. Each Push Button has 2 diverse input channels.

Figure 9.9 Two-Hand Run Station with Active Pin Enabled Control Wiring Diagram (Active Pin Low - Run Station Not Connected to System)

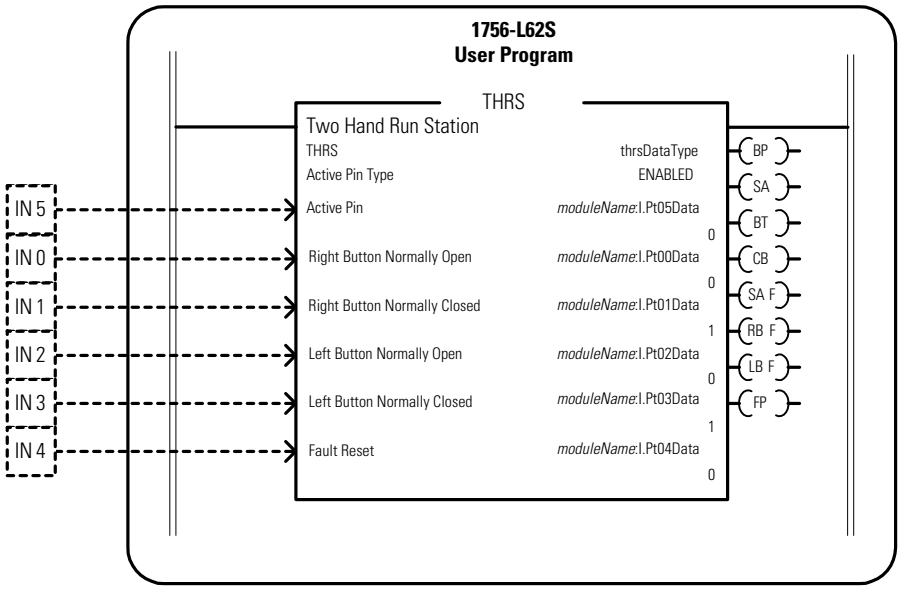
The inputs shown on this wiring diagram correspond to the inputs for the instruction.



Programming Example

The following programming examples show how the Two-Hand Run Station with Active Pin instruction can be applied to the wiring diagram shown in Figure 9.8, Two-Hand Run Station with Active Pin Enabled Control Wiring Diagram (Active Pin High - Run Station Connected to System). One example shows Active Pin disabled, and the other shows Active Pin enabled.

Figure 9.10 Two-Hand Run Station Programming Example - Active Pin Enabled



EN954-1 Category 4 requires that inputs be independently pulse tested. RSLogix 5000 programming software is used to configure the following I/O module parameters for pulse testing.

Table 9.4 Input Configuration

Input Point	Type	Point Mode	Test Source
0 (*IN0*)	Single	Safety Pulse Test	0 *(T0)*
1 (*IN1*)	Single	Safety Pulse Test	1 *(T1)*
2 (*IN2*)	Single	Safety Pulse Test	2 *(T2)*
3 (*IN3*)	Single	Safety Pulse Test	3 *(T3)*
4 (*IN4*)	Single	Safety	None
5 (*IN5*)	Single	Safety	None

Table 9.5 Test Output

Test Output Point	Point Mode
0 *(T0)*	Pulse Test
1 *(T1)*	Pulse Test
2 *(T2)*	Pulse Test
3 *(T3)*	Pulse Test

P

R

S

T

W

Z

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