

GripSwitch (Enabling Switch) Applications with Monitoring Safety Relays

Safety Network-enabled Example

Safety Rating: Category 3, according to EN954-1:1996



Introduction	2
Important User Information	2
General Safety Information	3
Partial Body Access with Slow Machine Speed	4
Application 1: Substituting a GripSwitch for a Tongue Interlock Safeguard ..	5
Application 2: Substituting a GripSwitch for a Light Curtain	9
Application 3: Substituting a GripSwitch for a Guardlocking Interlock	11
Full Body Access with Slow Machine Speed	13
Application 1: Substituting a GripSwitch for a Tongue Interlock Safeguard	14
Application 2: Substituting a GripSwitch for a Light Curtain	17
Additional Resources	19

Introduction

This application note describes how to apply a grip switch style of enabling device, called a GripSwitch. The GripSwitch has a three position trigger switch, which must be squeezed to the center position, to close its safety contacts. Further squeezing or releasing of the trigger switch opens the safety contacts. In addition, release from the fully squeezed position does not close the safety contacts.

Enabling devices are typically used when access to the hazardous portion of the machine is needed while the machine is running. Examples of tasks that use enabling switches are:

- visual observations
- minor adjustments
- troubleshooting
- calibration
- tool changes
- lubrication

IMPORTANT

For some tasks, the operator must place the machine in a reduced performance role. A risk assessment must be performed to determine the level of reduced performance. The concept is that if an unexpected event occurs, the operator will either release or squeeze the actuator of the enabling device to disable the machine and avoid injury.

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://literature.rockwellautomation.com>) 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.

Reproduction of the contents of this manual, in whole or in part, without written permission of Rockwell Automation, Inc., is prohibited.

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

<p>WARNING</p> 	<p>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.</p>
<p>IMPORTANT</p>	<p>Identifies information that is critical for successful application and understanding of the product.</p>
<p>ATTENTION</p> 	<p>Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.</p>
<p>SHOCK HAZARD</p> 	<p>Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.</p>
<p>BURN HAZARD</p> 	<p>Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.</p>

General Safety Information

<p>IMPORTANT</p>	<p>This application example is for advanced users and assumes that you are trained and experienced in safety system requirements.</p>
<p>ATTENTION</p> 	<p>A risk assessment should be performed to make sure all task and hazard combinations have been identified and addressed. The risk assessment may require additional circuitry to help reduce the risk to a tolerable level. Safety circuits must take into consideration safety distance calculations which are not part of the scope of this document.</p>

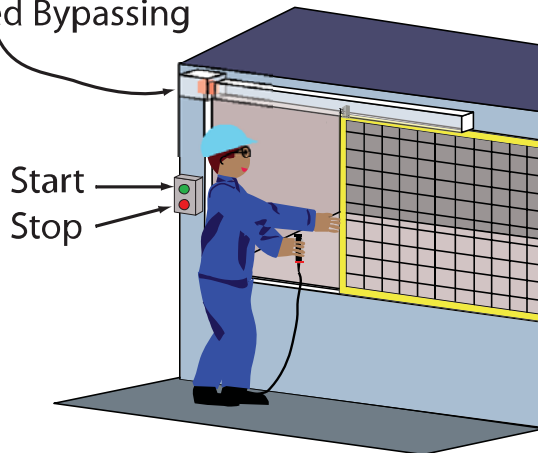
Contact Rockwell Automation to find out more about our safety risk assessment services.

Partial Body Access with Slow Machine Speed

Partial body access is when the operator places only a portion of his or her body into the hazard area. This is reach-through access. While accessing the hazard area, the safeguarding device cannot be closed.

When access is limited to parts of the body and the speed of the machine is slow enough for the operator to avoid the hazard, the enabling switch can be connected directly across the contacts of the primary safety device.

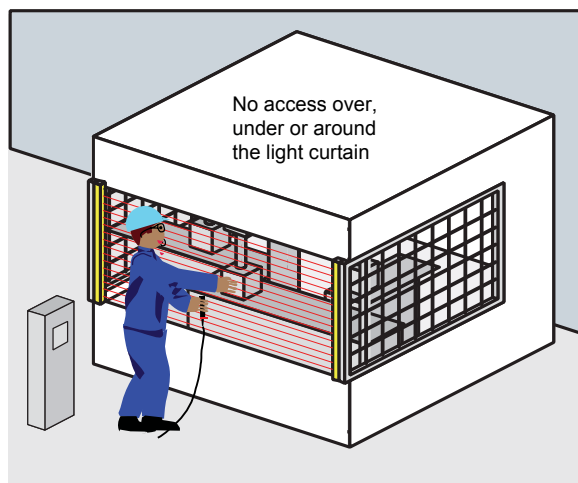
Tongue Interlock
Hidden to Prevent
Uncontrolled Bypassing



440J-A00N with
Basic GripSwitch



When a light curtain is the primary safeguarding device, the enabling switch must be used in conjunction with an interlocking switch.



440J-A02N with MT-GD2
with GripSwitch



Application 1: Substituting a GripSwitch for a Tongue Interlock Safeguard

In this first application, the GripSwitch is used in place of a tongue interlock as the safeguarding device. With partial body access, the operator has control of the access area, so that additional operators cannot access the hazard. The operator must have access to the Start button. After opening the guard, the operator engages the trigger switch to energize the safety relay. The operator then presses the machine Start button to energize the hazard (the motor in the schematic).

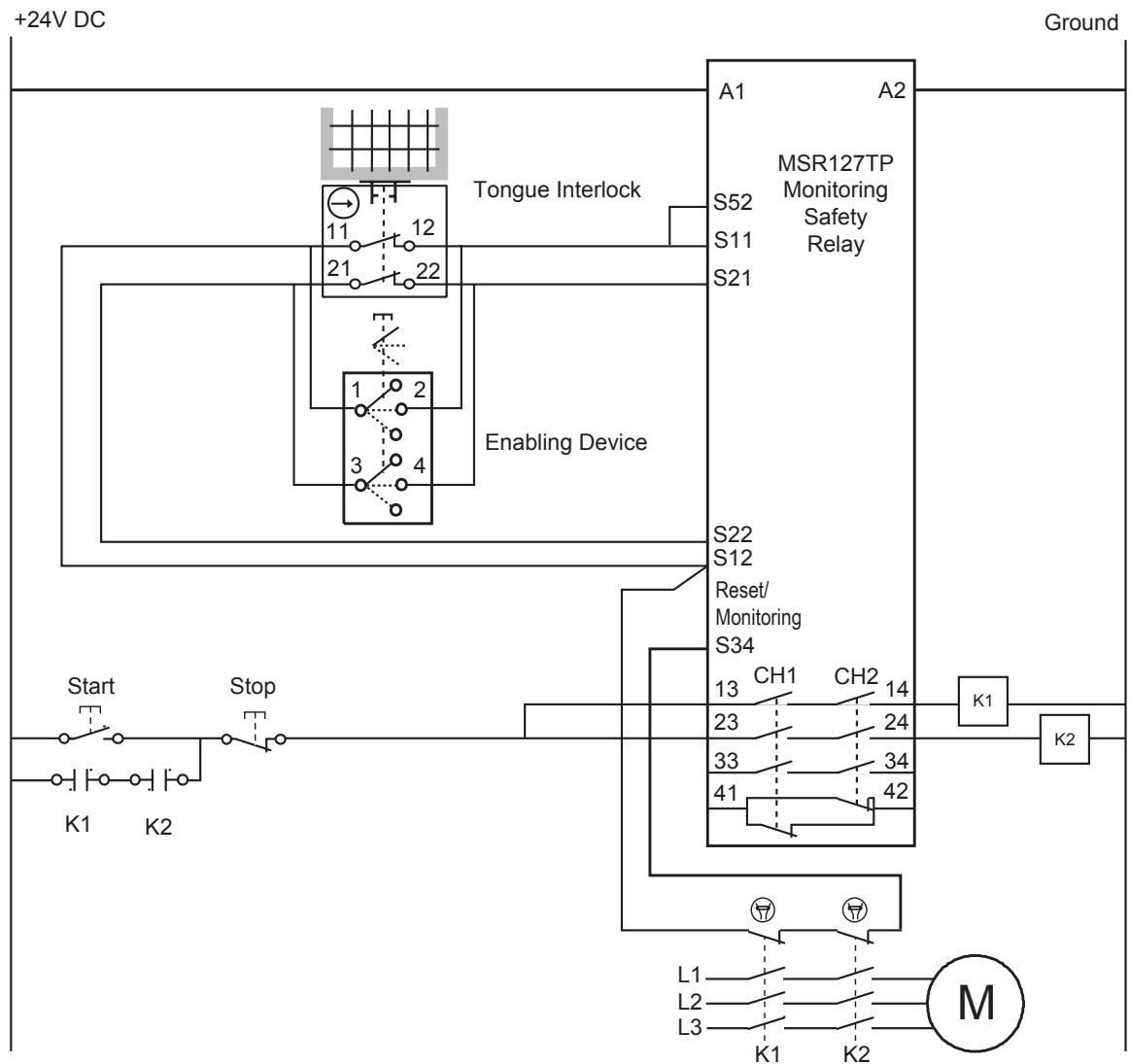
Example Bill of Material

This application example uses these components.

Part Number	Description	Quantity
440K-T11384	Trojan T15 GD2, 2 N.C. contacts, 4 Pin M12 Quick Disconnect	1
889D-F4AC-2	Cable, 4 wire, M12 Quick Disconnect, 2m	1
440J-N21TNPM	Enabling Switch	1
440J-A00N	Holder for Enabling Switch	1
440R-N23132	MSR127TP Monitoring Safety Relay, Automatic Reset, 2 N.C. Safety Inputs, 3 N.O. Safety Outputs, 1 N.C. Auxiliary Output	1
100S-C09DJ14BC	Contactors, 9A, 24V DC Coil with Diode, 3 N.O. Main Contacts, 1 N.O. + 4 N.C. Auxiliary Bifurcated Contacts	2
800FM-F301	Start Button, Green, Flush Operator, "START" Legend, Metal Body	1
800F-MX10	Metal Latch, 1 N.O. Contact	1
800FM-E402	Stop Button, Red, Extended Operator, "STOP" Legend, Metal Body	1
800F-MX01	Metal Latch, 1 N.C. Contact	1

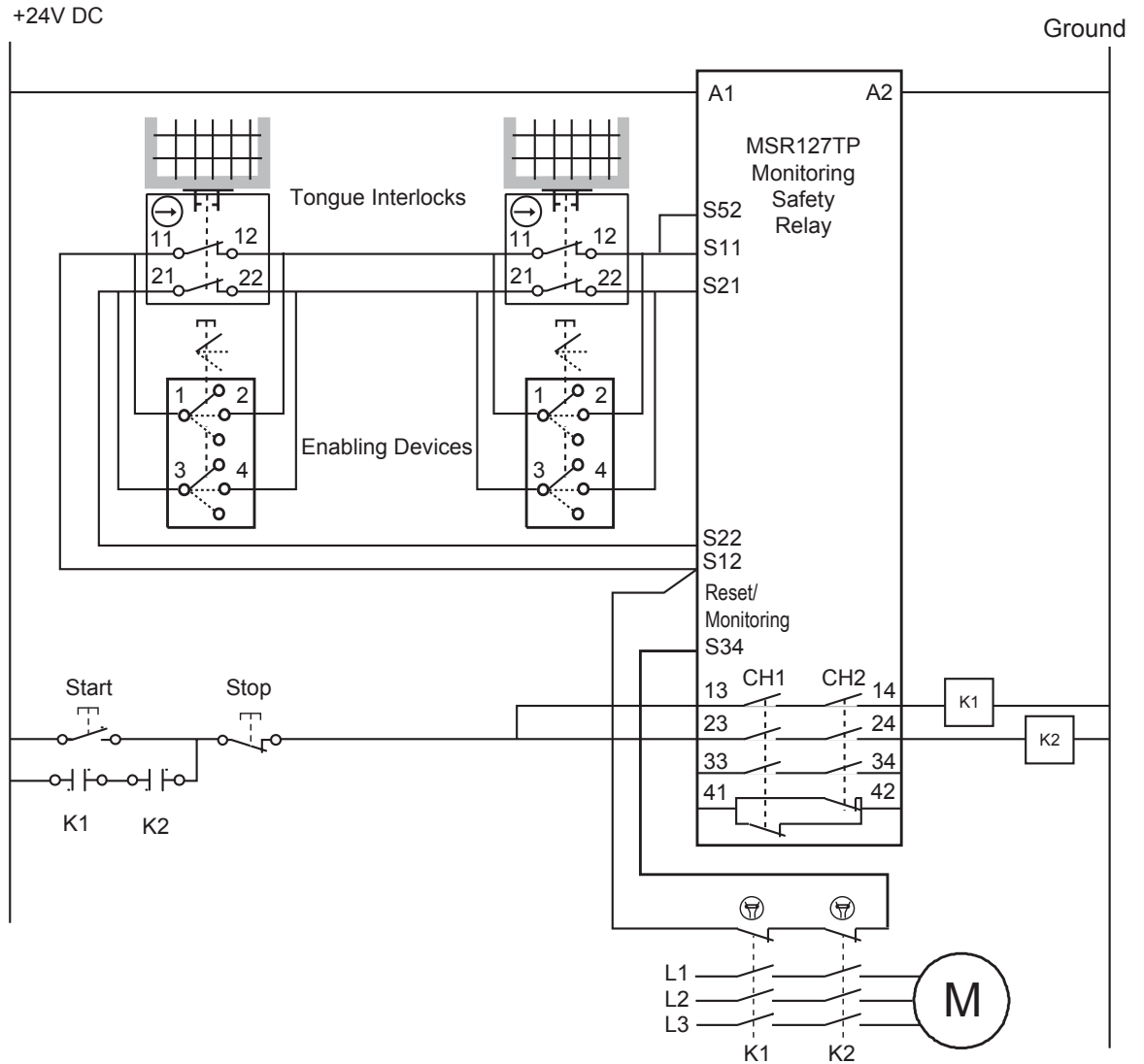
Setup and Wiring

For detailed information on installing and wiring, refer to the product manuals listed in the [Additional Resources](#).



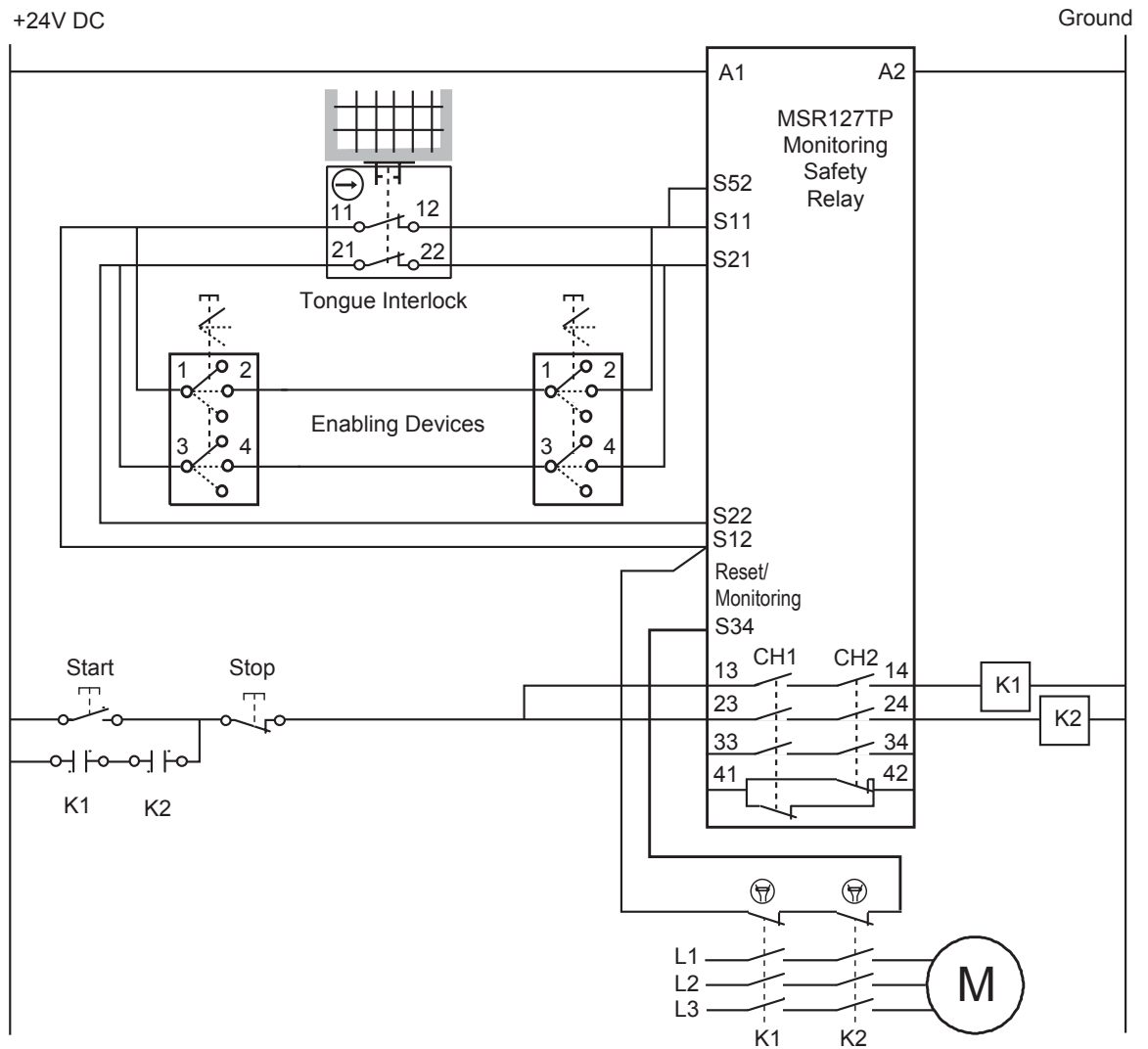
Alternative Setup and Wiring - Multiple Guard Access

If access is needed to multiple gates, then an enabling switch must be used for each gate. One enabling switch must not be used as a substitute for more than one interlocked gate. Although two gates allow access to the same hazard, only one Start button is allowed.



Alternative Setup and Wiring - Multiple Enabling Switches

If access is needed by multiple users of one gate, then multiple enabling switches must be used. All persons having to access the hazard need an enabling switch. In this case, both switches must be actuated to energize the hazard. After actuating both enabling switches, at least one operator must have access to the Start button to energize the hazard.



Alternative Setup and Wiring – Using Enabling Switch Instead of Multiple Gates

ATTENTION



Using the enabling device as a substitute for multiple gates is not recommended. All three guards may be accessed by only one enabling device. Although the operator holding the enabling device is protected, two other operators with no means of alternative protection, may gain access to the hazard.

Application 2: Substituting a GripSwitch for a Light Curtain

Since the light curtain has OSSD outputs (both pulled up to 24V), simply substituting the light curtain with the enabling GripSwitch results in nuisance faults of the light curtain. In this case, the enabling GripSwitch is used in conjunction with a four-circuit interlock switch. The interlock switch uses two normally-closed and two normally-open contacts. An actuator tongue is mounted to the GripSwitch. When the GripSwitch is inserted into the interlock, the light curtain is active. When the GripSwitch is removed from the interlock, the light curtain is disabled and the GripSwitch is enabled.

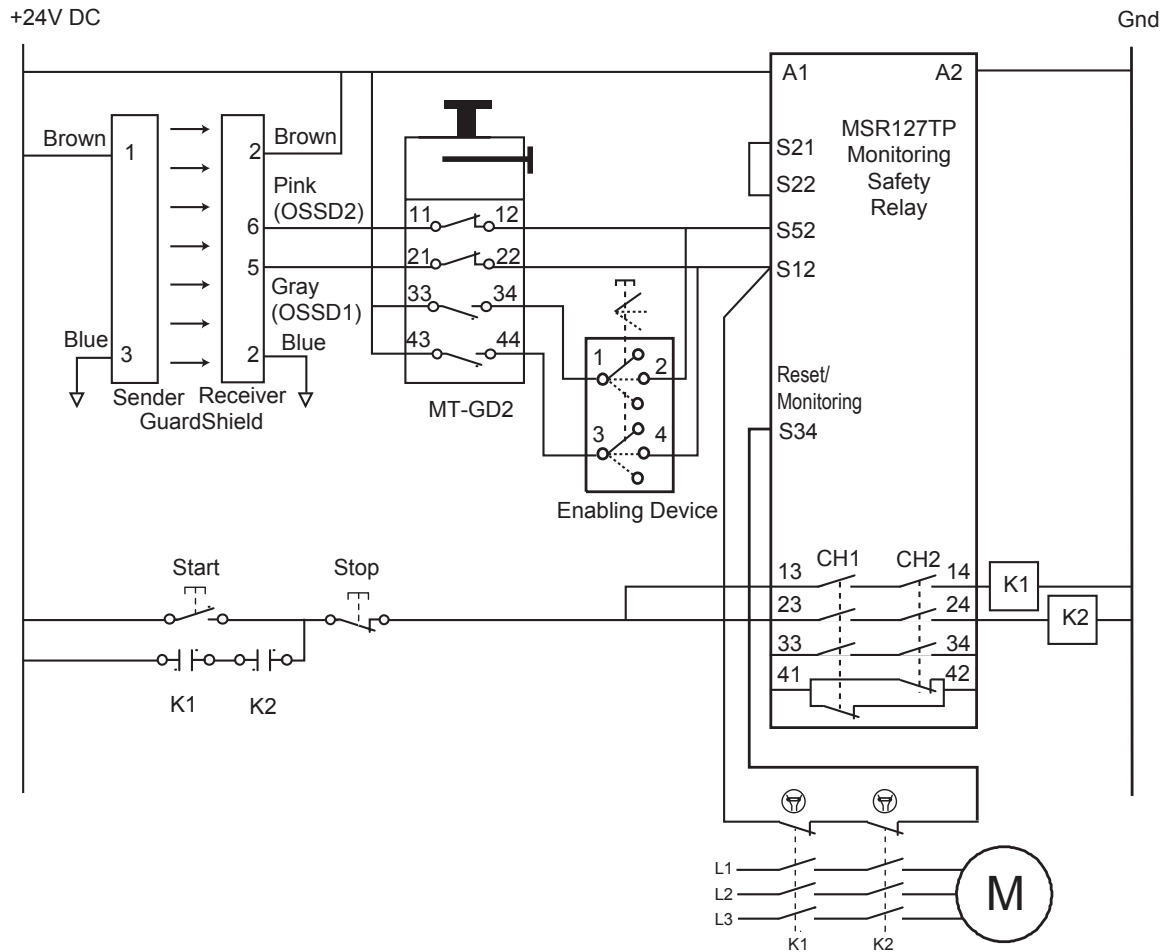
Example Bill of Material

This application example uses these components.

Part Number	Description	Quantity
440L-P4K1280YD	GuardShield Light Curtain, 30mm sensing, 1280mm Protective Height	1
889D-F4AC-2	Mating Cable, 4 Pin, M12 Micro QD for GuardShield Transmitter, 2m.	1
889D-F8AB-5	Mating Cable, 8 Pin, M12 Micro QD for GuardShield Receiver, 5m	1
440K-MT55104	MT, 2 N.C. 2 N.O., Latch Release, M23 Quick Disconnect	1
889M-F12X9AE-2	Mating Cable, M23 Quick Disconnect, 12 pin with 9 wires, 2m	1
440J-N21TNPM	Enabling Switch, 2 N.C. Safety, 1 N.C. Aux.	1
440J-A01N	Right Angle Mounting Plate for One Actuator	1
440J-A02N	Mounting Plate, Flat, Square	1
440R-N23132	MSR127TP Monitoring Safety Relay, Automatic Reset, 2 N.C. Safety Inputs, 3 N.O. Safety Outputs, 1 N.C. Auxiliary Output.	1
100S-C09DJ14BC	Contactors, 9A, 24V DC Coil with Diode, 3 N.O. Main Contacts, 1 N.O. + 4 N.C. Auxiliary Bifurcated Contacts	2
800FM-F301	Start Button, Green, Flush Operator, "START" Legend, Metal Body	1
800F-MX10	Metal Latch, 1 N.O. Contact	1
800FM-E402	Stop Button, Red, Extended Operator, "STOP" Legend, Metal Body	1
800F-MX01	Metal Latch, 1 N.C. Contact	1

Setup and Wiring

For detailed information on installing and wiring, refer to the product manuals listed in the [Additional Resources](#).



Application 3: Substituting a GripSwitch for a Guardlocking Interlock

In some applications, stopping the machine in the middle of a cycle must be prevented. A guardlocking interlock may be used to accomplish this task.

The guard-locking function must be released. Then the enabling switch can be used as a substitute for the interlock contacts.

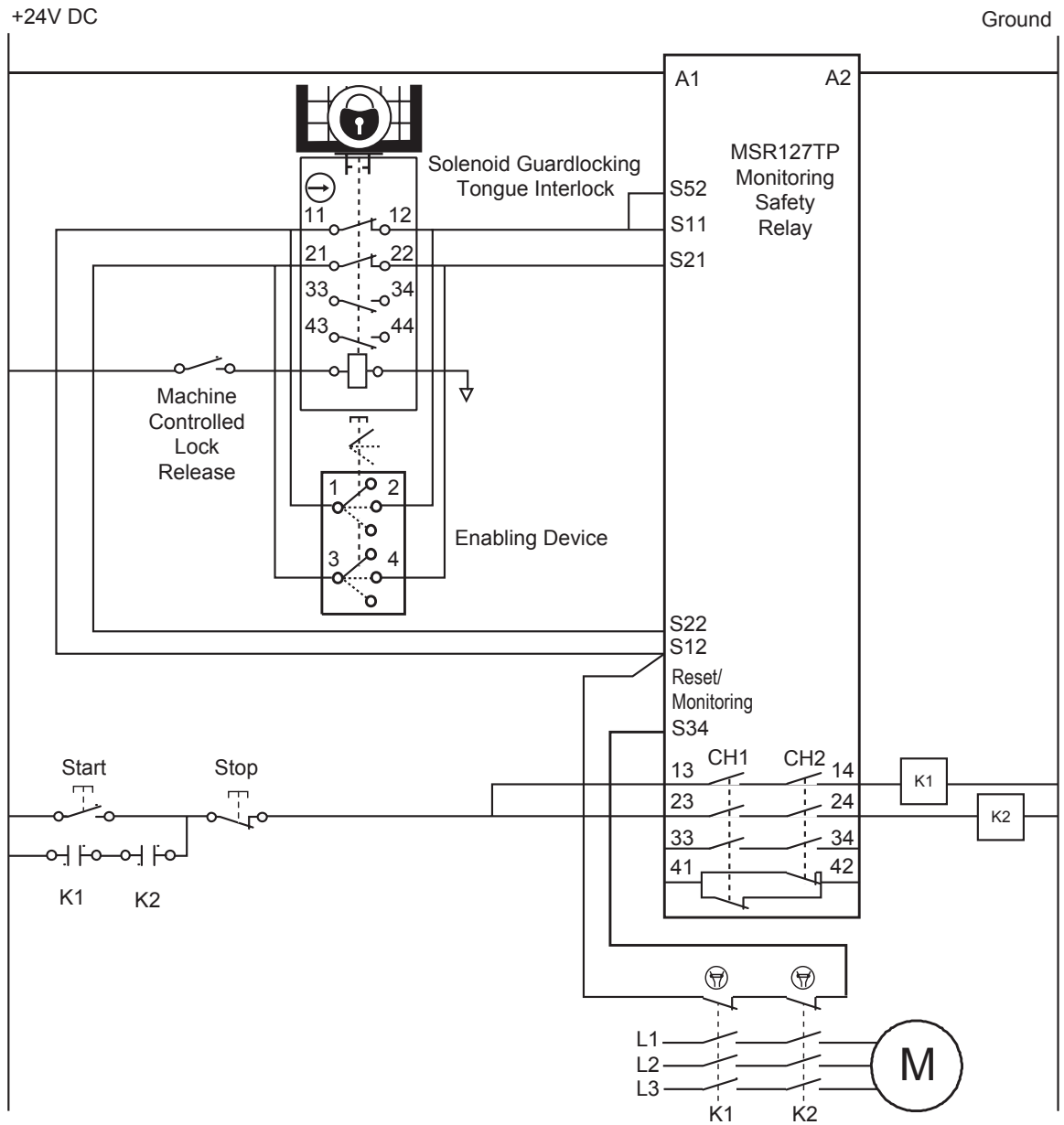
Example Bill of Material

This application example uses these components.

Part Number	Description	Quantity
440G-MT47049	Trojan T15 GD2, 2 N.C. contacts, 4 Pin M12 Quick Disconnect	1
889M-F12X9AE-2	Cable, M23 Quick Disconnect, 12 PIN, 9 Wire, 2m	1
440J-N21TNPM	Enabling Switch	1
440J-A00N	Holder for Enabling Switch	1
440R-N23132	MSR127TP Monitoring Safety Relay, Automatic Reset, 2 N.C. Safety Inputs, 3 N.O. Safety Outputs, 1 N.C. Auxiliary Output	1
100S-C09DJ14BC	Contactor, 9A, 24V DC Coil with Diode, 3 N.O. Main Contacts, 1 N.O. + 4 N.C. Auxiliary Bifurcated Contacts	2
800FM-F301	Start Button, Green, Flush Operator, "START" Legend, Metal Body	1
800F-MX10	Metal Latch, 1 N.O. Contact	1
800FM-E402	Stop Button, Red, Extended Operator, "STOP" Legend, Metal Body	1
800F-MX01	Metal Latch, 1 N.C. Contact	1

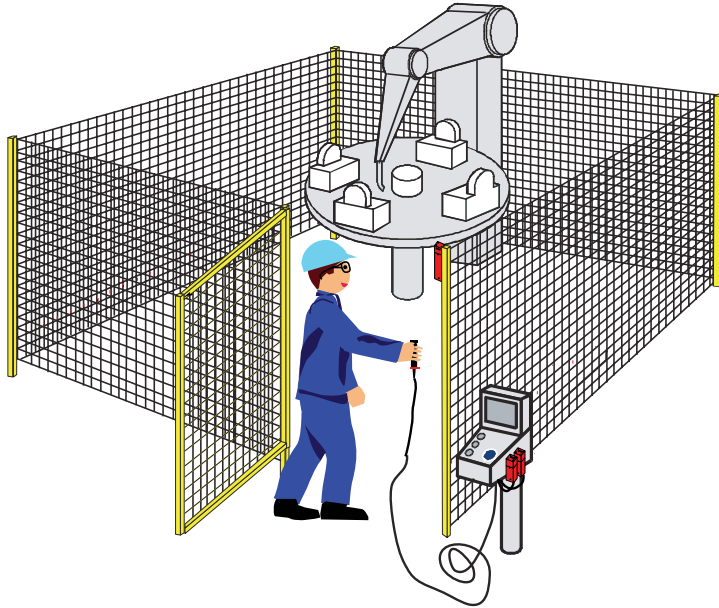
Setup and Wiring

For detailed information on installing and wiring, refer to the product manuals listed in the [Additional Resources](#).



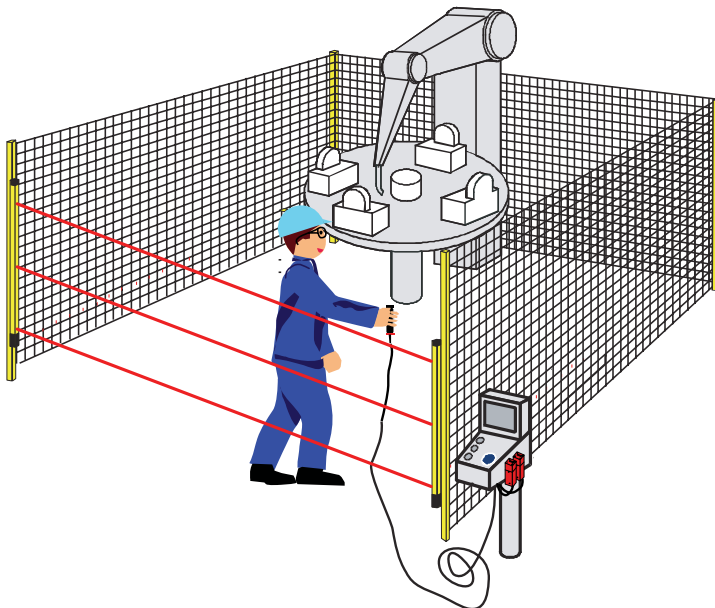
Full Body Access with Slow Machine Speed

With full body access, the safety system must utilize manual reset. This reset may or may not be a monitored reset. Additional contacts are needed when the GripSwitch is used. Using dual interlocks with four contacts each is the preferred solution for the enabling switch holder. The GripSwitch has an additional pushbutton to energize the hazard.



Dual Interlock
GripSwitch
Holder

440J-A04N MT-GD2
GripSwitch



Application 1: Substituting a GripSwitch for a Tongue Interlock Safeguard

With the jumpers set at X1/X2 and X3/X4, the reset of the MSR144 is not monitored. A reset button can still be used, but a short across the reset cannot be detected. This approach is advantageous when GripSwitch operation is needed.

When the GripSwitch is removed from its holder, the interlocks A and B perform 3 functions:

1. Bypass the primary safeguard.

The primary safeguard is the tongue interlock switch on the guard. The guard may be opened to allow entry into the hazard area. Contacts 11/12 and 21/22 of interlock A disable the primary interlock, and contacts 33/34 and 43/44 allow the use of the GripSwitch.

2. Disable the start switch on the control panel.

To avoid potential unexpected start-up, the start button on the control panel must be disabled. Contact 21/22 of interlock B disables this button. Contact 43/44 of interlock B allows the use of the GripSwitch start button. This is a momentary button; it must be held closed to allow the hazard (in this case, the motor) to operate. When the button is released, the hazard stops. If a fault (short or welded contact) of this button occurs, the motor may be stopped by squeezing or releasing the trigger switch.

3. Disable the reset button.

To allow operation of the GripSwitch by one person, the operator must reset the safety system when the trigger switch is actuated. Contact 33/34 of interlock B closes the reset circuit. This automatically resets the MSR144 when the GripSwitch trigger switch is actuated.

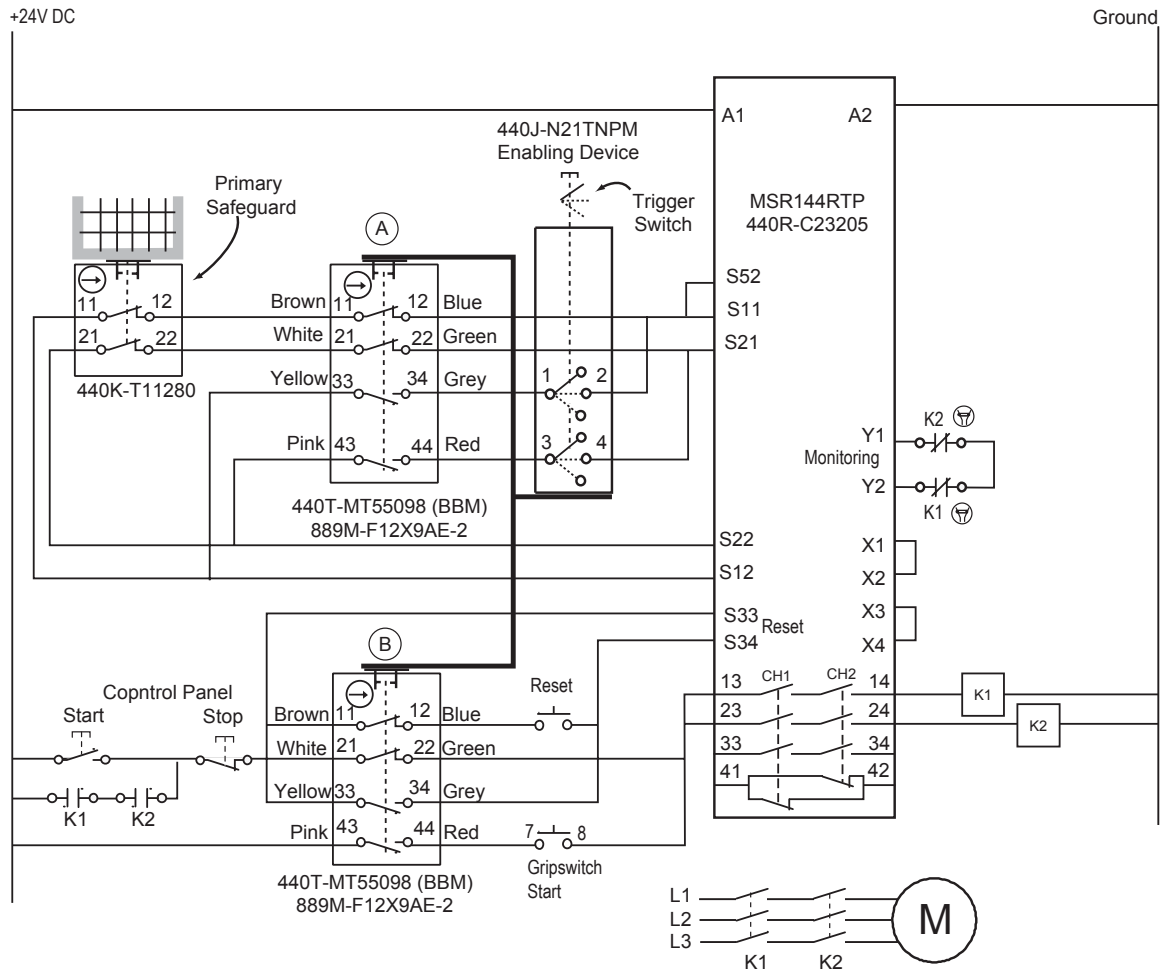
Example Bill of Material

This application example uses these components.

Part Number	Description	Quantity
440K-T11280	Primary Interlock. Trojan T15	1
440K-MT55104	Interlock A, MT-GT2, 2 N.C., 2 N.O., Latch Release, M23 QD	1
440K-MT55098	Interlock B, MT-GD2, 2 N.C., 2 N.O., No Latch Release, M23 QD	1
889M-F12X9AE-2	Mating Cable, M23 Quick Disconnect, 12 pin with 9 wires, 2m	2
440J-N21TNPM-NE	Enabling Switch with Auxiliary Button	1
440J-A03N	Mounting Plate for Two Actuators	1
440J-A04N	U-Shaped Mounting Bracket	1
440R-C23205	MSR144RTP Safety Relay. This relay accepts the MSR230 and MSR238 expansion modules for additional safety outputs. The MSR144RTP can be directly replaced with MSR131 and MSR142 relays with no wiring changes.	1
100S-C09DJ14BC	Contactors, 9A, 24V DC Coil with Diode, 3 N.O. Main Contacts, 1 N.O. + 4 N.C. Auxiliary Bifurcated Contacts	2
800FM-F301	Start Button, Green, Flush Operator, "START" Legend, Metal Body	1
800F-MX10	Metal Latch, 1 N.O. Contact	1
800FM-E402	Stop Button, Red, Extended Operator, "STOP" Legend, Metal Body	1
800F-MX01	Metal Latch, 1 N.C. Contact	1
800FM-F6	Reset Button, Blue, Flush Operator, Metal Body	1
800F-MX10	Metal Latch, 1 N.O. contact	1

Setup and Wiring

For detailed information on installing and wiring, refer to the product manuals listed in the [Additional Resources](#).



Application 2: Substituting a GripSwitch for a Light Curtain

With full body access, the GuardShield Perimeter Access Control PAC safety light curtain may be used as the primary safeguard.

With the jumpers set at X1/X2 and X3/X4, the reset of the MSR144 is not monitored. A reset button may still be used but a short (fault) across the reset cannot be detected. This approach is advantageous when a GripSwitch operation is needed.

When the GripSwitch is removed from its holder, interlocks A and B perform 3 functions:

1. Substitute the GripSwitch for the primary safeguard.

The primary safeguard is the light curtain. The operator can walk through the light curtain to gain access to the hazard area.

Contact 11/12 and 21/22 of interlock A disable the light curtain, and contact 33/34 and 43/44 allow the use of the GripSwitch.

2. Disable the Start switch on the control panel.

To avoid potential unexpected start-up, the Start button on the control panel must be disabled. Contact 21/22 of interlock B disables this button. Contact 43/44 of interlock B allows the use of the GripSwitch Start button. This GripSwitch button is momentary; it must be held closed to allow the hazard (for example, the motor) to operate. When the button is released, the hazard stops. If a fault (short or welded contact) of this button occurs, the motor can be stopped by squeezing or releasing the trigger switch.

3. Disable the reset button.

To allow operation of the GripSwitch by one person, the safety system must be reset when the trigger switch is actuated. Contact 33/34 of interlock B closes the reset circuit. This automatically resets the MSR144 when the GripSwitch trigger switch is actuated.

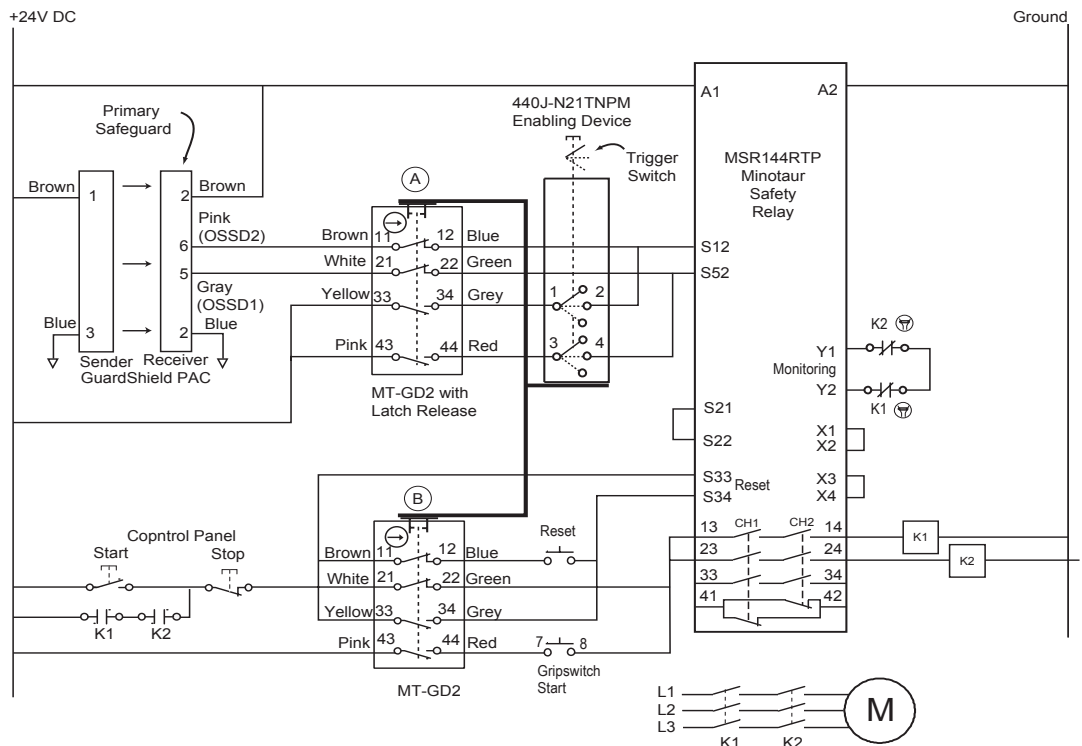
Example Bill of Material

This application example uses these components.

Part Number	Description	Quantity
440L-P4A3400YD	GuardShield PAC, 3 Beam Sensing, 800mm Protective Height	1
889D-F4AC-2	Mating Cable, 4 Pin, M12 Micro QD for GuardShield Transmitter, 2m	1
889D-F8AB-5	Mating Cable, 8 Pin, M12 Micro QD for GuardShield Receiver, 5m	1
440K-MT55104	Interlock A, MT-GT2, 2 N.C., 2 N.O., Latch Release, M23 QD	1
440K-MT55098	Interlock B, MT-GD2, 2 N.C., 2 N.O., No Latch Release, M23 QD	1
889M-F12X9AE-2	Mating Cable, M23 Quick Disconnect, 12 pin with 9 wires, 2m	2
440J-N21TNPM-NP	Enabling Switch with Jog Button	1
440J-A03N	Mounting Plate for Two Actuators	1
440J-A04N	U-Shaped Mounting Bracket	1
440R-C23205	MSR144RTP Safety Relay. This relay accepts the MSR230 and MSR238 expansion modules for additional safety outputs. The MSR144RTP can be directly replaced with MSR131 and MSR142 relays with no wiring changes.	1
100S-C09DJ14BC	Contactor, 9A, 24V DC Coil with Diode, 3 N.O. Main Contacts, 1 N.O. + 4 N.C. Auxiliary Bifurcated Contacts	2
800FM-F301	Start Button, Green, Flush Operator, "START" Legend, Metal Body	1
800F-MX10	Metal Latch, 1 N.O. Contact	1
800FM-E402	Stop Button, Red, Extended Operator, "STOP" Legend, Metal Body	1
800F-MX01	Metal Latch, 1 N.C. Contact	1
800FM-F6	Reset Button, Blue, Flush Operator, Metal Body	1
800F-MX10	Metal Latch, 1 N.O. contact	1

Setup and Wiring

For detailed information on installing and wiring, refer to the product manuals listed in the [Additional Resources](#).



Additional Resources

For more information about the products used in this example refer to these Resources.

Resource	Description
Trojan T 15 Installation Instructions, publication 91595/1	Provides installation instructions for the Trojan T15
Safety Catalog, publication S116-CA001A-EN-P	Provides detailed product information and specifications
GuardShield Safety Light Curtain Installation Instructions, publication 75035-270-01(F)	Installations instructions for the GuardShield Safety Light Curtain

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

Allen-Bradley, Rockwell Automation, and GuardShield are trademarks of Rockwell Automation, Inc.
Trademarks not belonging to Rockwell Automation are property of their respective companies.

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Europe/Middle East/Africa: Rockwell Automation, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846