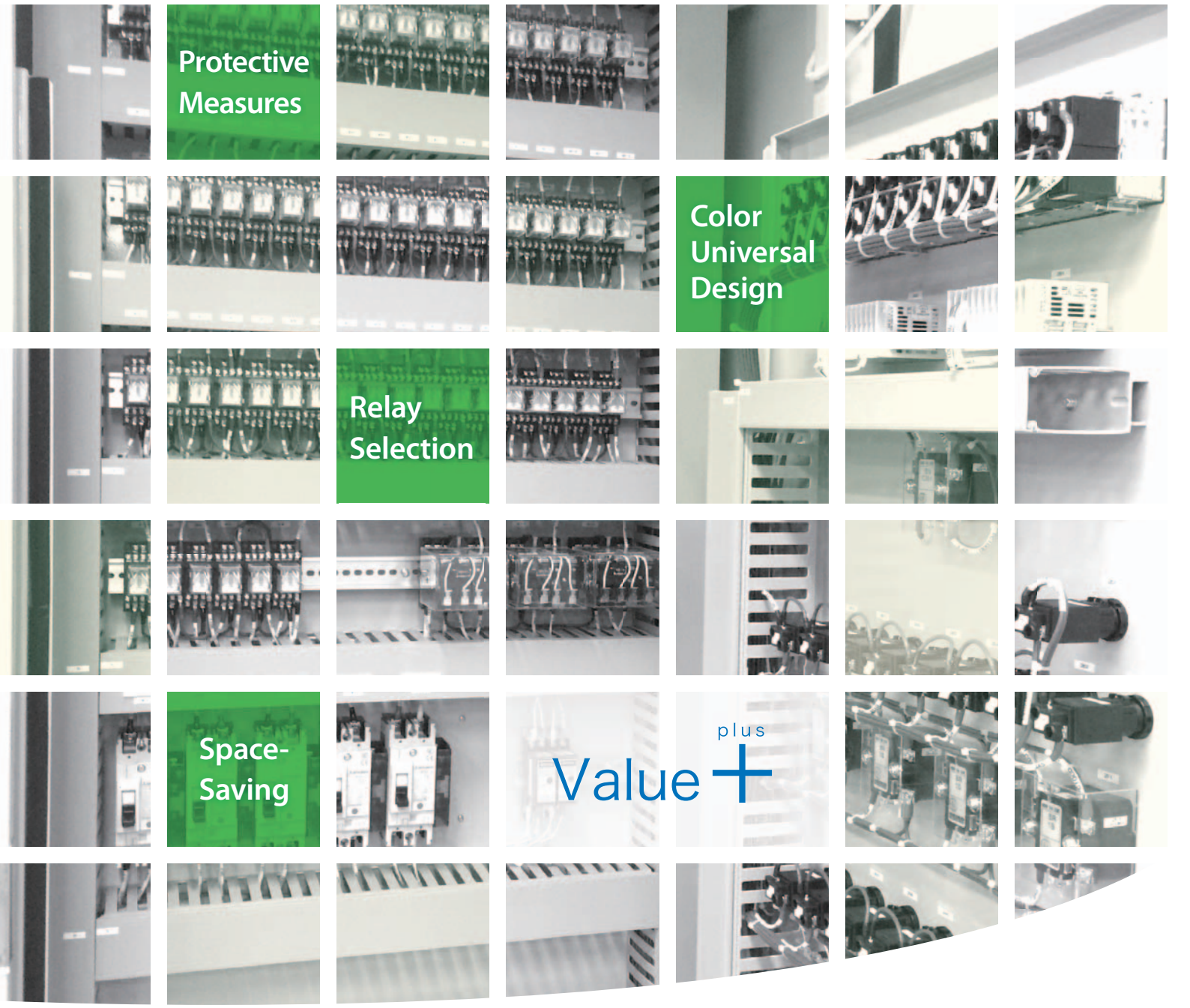
New Value for Control Panels

OMRON

Control Panel Basics Volume 2



realizing

plus Value +

Basic Information on Control Panel Design

Changes in the market require handling a wide variety of control panel issues.
Control Panel Basics describes OMRON's wealth of knowhow and information and provides easy-to-understand descriptions of the knowledge required to solve these issues through concrete examples.

In volume 2, we provide knowhow on Control Panel Design, from Motor Protective Measures, to Relay Selection, Color Universal Design, and Saving Space.

Control Panel Basics | Volume 2

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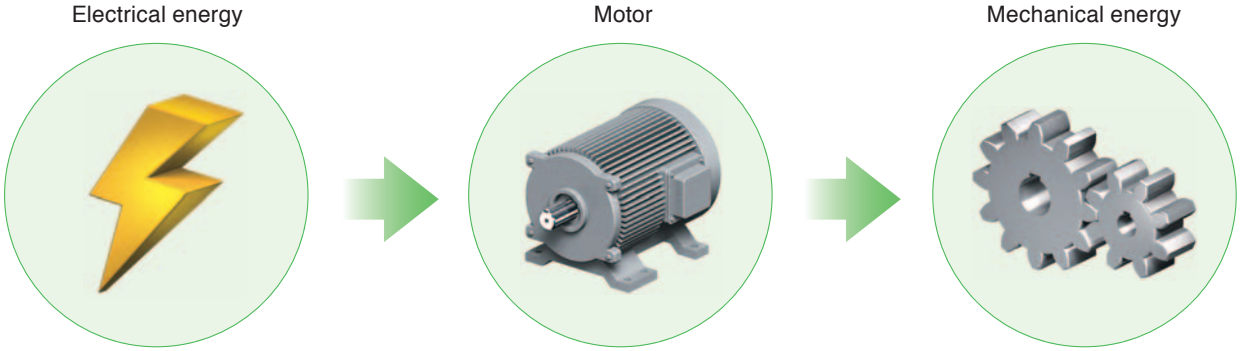
Measures for Serious Device (Motor) Failures

Implementing Protective Measures for Failures of Important Devices

In general, when devices are used for a long period of time, they deteriorate over that time, and ultimately fail.
To minimize the effects of device failure, we recommend that you implement protective measures in advance for important devices.
This section discusses motors, which are important devices.

Motors

A motor converts electrical energy to mechanical energy.
Due to its characteristics, a motor has both an electrical structure and a mechanical structure , and it fulfills very important roles.



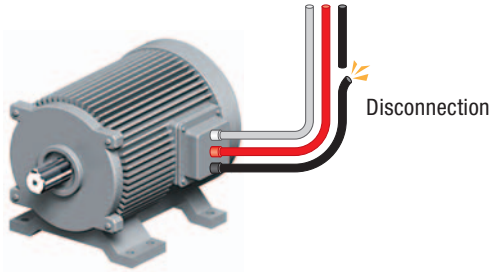
There are various failure types that lead to motor failure.
By detecting abnormal signals and using them to stop the motor, motor failure and damage to the motor's load can be avoided.
Major examples of motor failures and products that can be used to detect motor abnormalities are introduced on the right-hand page.

One Point !

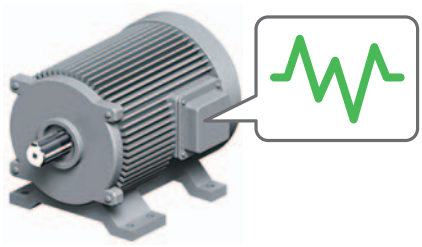
Are just breakers and thermal relays insufficient as protective measures?

Not all types of motors and operation can be protected with just breakers and thermal relays.

Example:
Breakers can not detect phase loss.



General thermal relays can not detect
phase loss during operation,
so operation may not be stable.

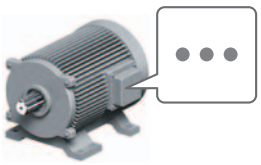


Motor Failure Examples (Phenomena)

Phase-loss Errors

Example:
Disconnection of a power line

Failure to start



Burning due to phase-loss operation

Unstable operation

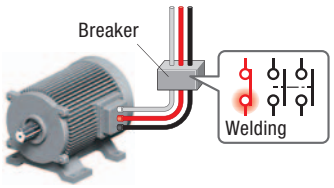
- Stopping of operation when the load is heavy.
- Intermittent starting and stopping, etc.

Phase loss when starting

Phase loss during operation

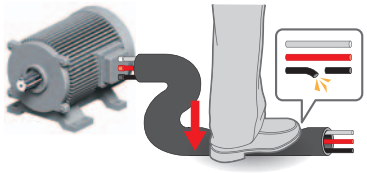
Causes

Welded contacts inside a breaker

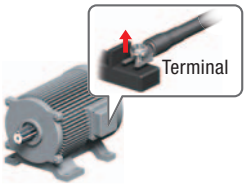


Disconnection

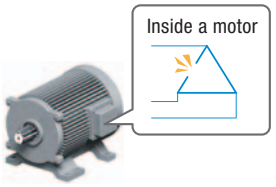
- Wheels rolling over or people stepping on lines
- Cables bent too far, etc.



Loose screws
(contact failure in wiring)

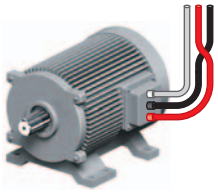


Phase loss inside a motor



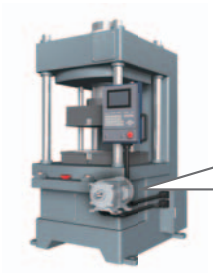
Reversed-phase (Phase-sequence) Errors

Incorrect wiring causes reverse rotation of the motor.

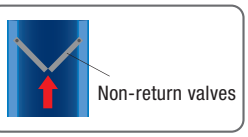


Incorrect wiring

- Movable equipment
- Incorrect phase on power line side

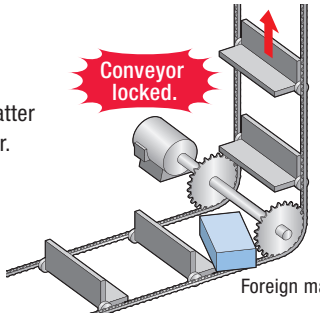


Reverse rotation of motor will damage valves in pumps.



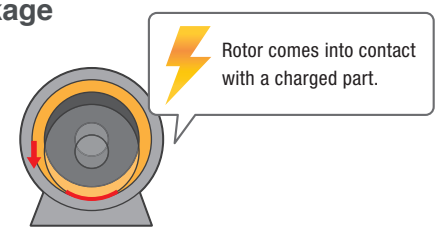
Overloads

Caught foreign matter locks up the motor.



Current Leakage

Insulation deterioration or metal wear



Cross-section view of motor

Recommended Protective Relays

Detect Phase loss and Phase sequence

Phase-sequence Phase-loss Relays
K8AK-PH

Precaution when Selecting Relays:
"Better Too Big Than Too Small" Does Not Apply

Circuit Reliability will be Increased by Selecting a Suitable Relay for the Load.

With a computer or smartphone, you may want to select a hard disk or memory with extra capacity.
In general, something larger often works well to substitute for something smaller, as in the saying "better too big than too small".
However, that does not work with relays. The structural conditions required in a control relay to carry a large current as opposed to a minute current are different, so a suitable relay must be selected.
Selecting a suitable relay will help increase the reliability of the relay circuit.
You need to understand relay characteristics and correctly select relays to increase the quality of control circuits.

Relay Selection Methods

Switching High-capacity Loads

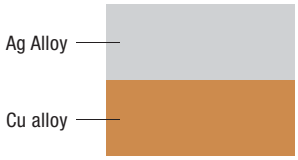
An important thing that determines the contact breaking capacity is the size of the gap between contacts of the same pole. Double-break contacts (see right-hand page) with a wide gap are effective. An Ag alloy with high conductivity is generally used for the contact material. However, Ag alloys are not suitable to switch minute loads that do not generate arcs when switching because organic films easily forms on the contact surfaces.

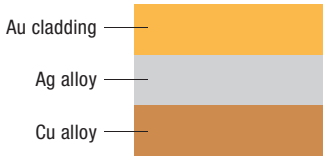
Switching Minute Loads

To reduce the probability of contact failure, using bifurcated contacts (see right-hand page) with two contact points is more effective than using single contacts with one contact point. Also, the arcs that are generated when switching minute loads are small, so they do not remove oxide and other films. Therefore, Au or Au alloys that resist corrosion are used for the contact material.
However, they are not suitable to switch large currents due to the smaller contacts and lower conductivity in comparison with Ag alloys.

Differences and Trends in Contact Materials

Ag alloy	Au-clad Contacts
Ag alloys have high conductivity and are effective in switching large loads. Some corrosion occurs, but the switching arcs have a cleaning effect that removes organic films that form on contact surfaces.	The contact surfaces are clad with Au, which has a high resistance to corrosion, to increase resistance to corrosion. The formation of a resistive film will be suppressed, and arcing will be also reduced to make these contacts effective for minute loads.





Switching capacity	
High	Low
Resistance to corrosion	
Low	High

Note: Au: Gold, Ag: Silver, Cu: Copper.

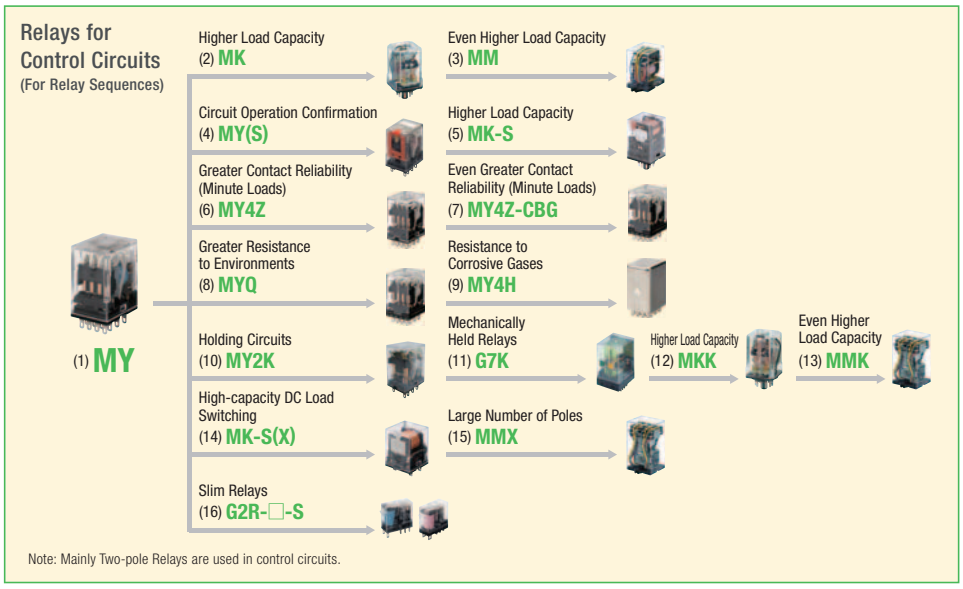
Differences in Contact Configuration and Application Examples

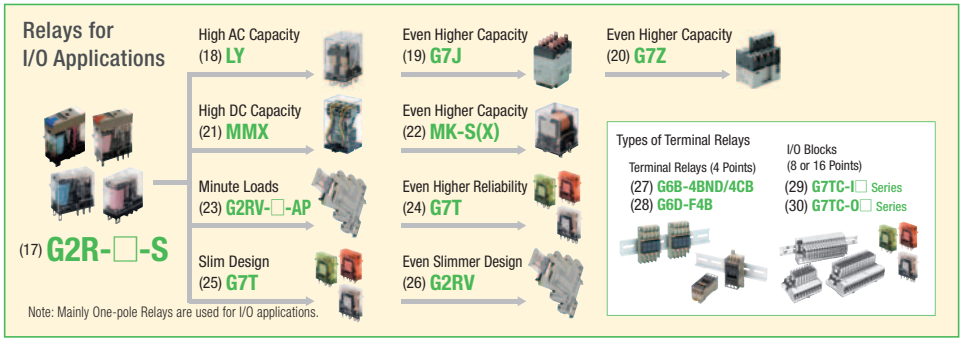
Contact Configuration	Common Loads	Application Examples
Double-break contacts 	High-capacity loads Guideline: Loads over 15 A Note: For relays, 40 A for AC and 10 A for DC.	Switching compressors and heaters Control applications for switching motors
Single contacts  Moving contact Fixed contact Contact image	General loads Guideline: 0.05 to 15 A	General sequence circuits
Bifurcated contacts  Moving contact Fixed contact Contact image	Minute loads Guideline: Less than 0.05 A	PLC inputs, signal applications, and self-holding circuits
Crossbar Bifurcated Contacts  Moving contact Fixed contact Contact image	Minute loads Guideline: Less than 0.01 A Note: Contact reliability is increased because nearly line contact is achieved and the weight per surface area is larger.	Alarm applications (Infrequent applications)

High capacity

Low capacity

Major Examples of Relay Models, Contact Configuration, and Contact Materials





	Model	Contact configuration	Contact materials
(1)	MY	Single	2-pole: Ag alloy 3-pole: Ag alloy 4-pole: Au cladding + Ag alloy
(2)	MK	Single	Ag alloy
(3)	MM	Single	Ag alloy
(4)	MY(S)	Single	2-pole: Ag alloy 4-pole: Au cladding + Ag alloy
(5)	MK-S	Single	Ag alloy
(6)	MY4Z	Bifurcated	Au cladding + Ag alloy
(7)	MY4Z-CBG	Crossbar bifurcated	Au cladding + Ag alloy
(8)	MYQ	Bifurcated	Au plating + Ag alloy
(9)	MY4H	Bifurcated	Au plating + Ag alloy
(10)	MY2K	Single	Au plating + Ag alloy
(11)	G7K	Single	Au plating + Ag alloy
(12)	MKK	Single	Ag alloy
(13)	MMK	Single	Ag alloy
(14)	MK-S(X)	Double break	Ag alloy
(15)	MMX	Single	Ag alloy
(16)	G2R-□-S	Single	Ag alloy
(17)	G2R-□-S	Single	Ag alloy
(18)	LY	Single	Ag alloy
(19)	G7J	Double break	Ag alloy
(20)	G7Z	Double break	Ag alloy
(21)	MMX	Single	Ag alloy
(22)	MK-S(X)	Double break	Ag alloy
(23)	G2RV-□-AP	Single	Au plating + Ag alloy
(24)	G7T for input	Crossbar bifurcated	Au cladding + Ag alloy
(25)	G7T for output	Single	Ag alloy
(26)	G2RV	Single	Ag alloy
(27)	G6B-4BND	Single	Ag alloy
(27)	G6B-4CB	Single	Ag alloy
(28)	G6D-F4B	Single	Ag alloy
(29)	G7TC-I□ Series	Crossbar bifurcated	Au cladding + Ag alloy
(30)	G7TC-O□ Series	Single	Ag alloy

Color Universal Design

Adding Kindness to Manufacturing

What Is Color Universal Design?

Color universal design was developed to provide products, facilities, buildings, environments, services, and information to as many individuals as possible in consideration of people with color weakness.

Percentage of People with Color Weakness

In Japan, one man in 20 and one woman in 500, and over 3.2 million people across Japan are assumed to have color weakness. The percentage of people with color weakness is even higher in Europe and the United States, and it is 8% to 10% in the West and 2% to 4% in Africa among men. Over 200 million people are assumed to have color weakness in the world.

The Value of Color Universal Design

Designing for poeple with color weakness will benefit people with normal color vision because it will produce well-organized, easy-to-understand designs. Therefore, color universal design is valuable to all people.
Pushbutton switches and other operation switches are used not only on production lines in factories, but in public facilities, transportation, other infrastructure applications, food machines, and medical equipment, as just a few examples. At a medical site, an operating mistake can end up in life-threatening accidents. In the infrastructure, fatal accidents, traffic accidents, fires, and other accidents can be the result of a single operating mistake. Let us build a kinder working environment by improving the social color environment to make it easier to use by people with various types of color vision.

Simulations of How People with Non-standard Color Vision See Colors

People with Normal Color Vision (Type C)

Simulation of People with Color Weakness (Type P)

We need to provide a clear contrast in the use of colors on nameplates and in text displayed on touch panels and other devices.

Examples of Colors That Are Difficult to Distinguish

There is insufficient contrast between the colors of the text and background, so the text is hard to read or it is even possible that the presence of the text will not be noticed.

Examples of Colors That Are Easy to Distinguish

There is a clear contrast between the colors of the text and background. A bright text color is used on a dark background, or a dark text color is used on a bright background.

The information on this page is based on information, estimation results, concepts, and examples from the Color Universal Design Organization (NPO).

Recommended Operation Devices

Conforms to Color Universal Design *

Designs with Easily Recognized Color Combinations

Push-button Switches
A22N Search for "OMRON A22N" for details.

Mounting Collar
The yellow lever provides a clear contrast to the black Mounting Collar.

Switch Blocks
Parts with the same shapes but different functions are distinguished with blue and orange.
The moving parts are also distinguishable as follows:
Green moving part on a blue case
Red moving part on an orange case

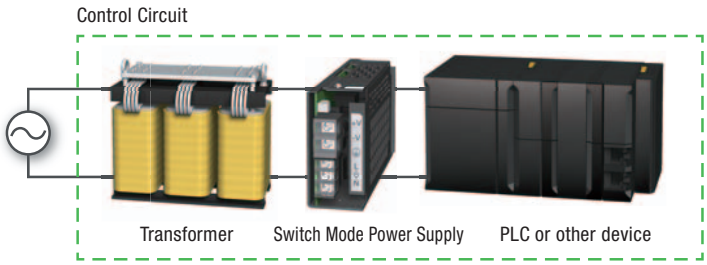
Reinforcement Plate
The Reinforcement Plate, which holds the Units mounted to the Mounting Collar together, is distinguishable by its white color.

* The yellow-blue-white and red-blue-white color combinations conform to color universal design.

Ideas to Save Space in Control Panels

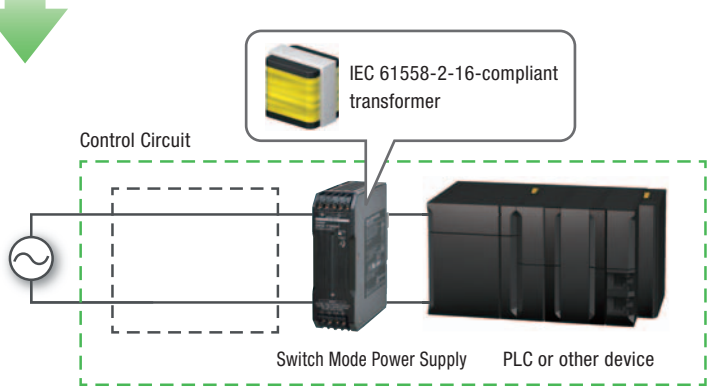
Eliminating Transformers for Control Circuits (Using a Switch Mode Power Supply with a Transformer Conforming to IEC 61558-2-16)

IEC 60204-1 in the Machinery Directive specifies that, if AC power is supplied to a control circuit, a transformer must be used in the control circuit and the transformer must have separate (compound) windings.



The transformer can sometimes be eliminated.

IEC 61558-2-16 also states that a switch mode power supply that uses a transformer with separate (compound) windings satisfies the above condition.
That means that a transformer in a control circuit can be eliminated by using this type of switch mode power supply.



Recommended Power Supplies

For 380 to 480 VAC

Worldwide 3-phase Power Supply
Resistant in tough environments
Easy and fast installation
The most compact class on the market

Switch Mode Power Supplies
(120-W, 240-W, 480-W, and 960-W models)

S8VK-T

Search for "OMRON S8VK-T" for details.

For 100 to 240 VAC

Reliable and Easy Operation-Worldwide Power Supply
Resistant in tough environments
Easy and fast installation
The most compact class on the market

Switch Mode Power Supplies
(15-W, 30-W, 60-W, 120-W, 240-W, and 480-W models)

S8VK-G

Search for "OMRON S8VK-G" for details.

One Point ! The industrial power supply voltage in the world is often 380 to 480 VAC.

Area	Industrial power supply voltage
USA	Three-phase, 460 or 480 V
Europe	Three-phase, 380, 400, or 415 V
Thailand	Three-phase, 380 V

Area	Industrial power supply voltage
China	Three-phase, 380 V
India	Three-phase, 400 or 415 V
Japan	Three-phase, 200 V

New Value for Control Panels

OMRON offers products and services to solve your diverse control panel challenges and contributes to growing your business.

plus Value+

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