Panasonic
INDUSTRY

Products for Energy Management

BEMS

UPS

Micro Grid

HEMS

UPS

UPS

Substation

Wind-power generation
Photovoltaic generation

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Products for Energy Management

Products for Energy Management

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Products for Energy Management

Product examples for specific applications

Recommended products for specific applications

	For photovoltaic power generation system	For battery storage system	For fast charging station	For smart meter	For Lighting/ Outlet Control	For rapid shut down system

AC — For AC load switching: LQ, DW, LF-G, HE PV, HE-S, DJ-H, DZ-S

DC — For DC load switching: EP, HE-V, AQZ PhotoMOS, AQ-A SSR, HE-V

For others: PhotoMOS, AQ-H SSR
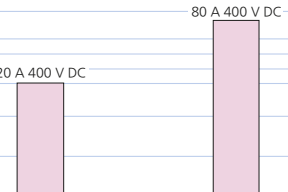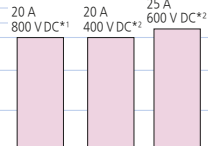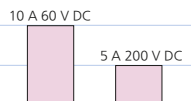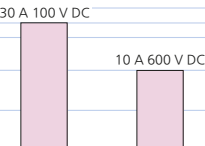
■ For AC Load Switching

Product name	LQ	DW	LF-G *1	HE-S	HE PV *1	DJ-H	DZ-S
Appearance							
Contact arrangement	1 Form A/1 Form C	1 Form A	1 Form A	2 Form A/ 2 Form A 1 Form B	1 Form A	1 Form A	1 Form A
Max. switching capacity	10 A 125 V AC 1a,1c (N.O.) / 5 A 250 V AC 1a,1c (N.O.)	8 A 250 V AC Standard type / 16 A 277 V AC Inrush type	22 A 250 V AC Standard type / 31 A 250 V AC High capacity type (1.5 mm) / 33 A 250 V AC High capacity type (1.8 mm)	40 A 277 V AC	35 A 490 V AC 35 A type / 48 A 490 V AC 48 A type / 90 A 277 V AC 90 A type	50 A 277 V AC	90 A 250 V AC
Latching type availability	−	●	−	−	−	●	●
Rated operating power	0.2 W (1a)	0.2 W (1L) 0.4 W (2L)	1.4 W (when input) 0.17 W (when retained)	1.88 W (when input) 0.17 W (when retained)	1.92 W (when input) 0.31 W (when retained)	1.0 W (1L) 2.0 W (2L)	1.5 W (1L) 3.0 W (2L)
Max. allowable voltage	250 V AC	250 V AC	250 V AC	480 V AC	490 V AC	480 V AC	276 V AC
Contact gap	−	−	1.5 mm/1.8 mm	3.2 mm*2	2.5 mm /3.0 mm	−	−
Ambient temperature	−40 to +85 ℃	−40 to +85 ℃	−40 to +85 ℃	−40 to +85 ℃	−50 to +85 ℃	−40 to +85 ℃	−40 to +85 ℃
Safety standards	UL/C-UL, VDE	UL/C-UL, VDE	UL/C-UL, VDE	UL/C-UL, VDE, CQC	UL/CSA, VDE / UL/C-UL, VDE / UL/C-UL, VDE	UL/C-UL, VDE	Please contact our sales representative for details.

*1: LF-G relays and HE relays PV type are not compliant with electrical safety laws. For compliant types, please contact our sales representative.
*2: Contact gap for each between 1 Form A contacts

■ For DC Load Switching

Product name	EP		HE-V	AQZ PhotoMOS	AQ-A SSR
Appearance	20 A	80 A			
Contact arrangement	1 Form A		2 Form A	1 Form A	1 Form A
Max. switching capacity	20 A 400 V DC	80 A 400 V DC	20 A 800 V DC*1 / 20 A 400 V DC*2 / 25 A 600 V DC*2	10 A 60 V DC / 5 A 200 V DC	30 A 100 V DC / 10 A 600 V DC
Rated operating power	3.9 W	4.2 W	1.9 W (when input) 0.2 W (when retained)	0.01 W (Input current: 10 mA)	0.08-0.64 W (Input voltage: 4 to 32 V)
Max. allowable voltage	1,000 V DC		1,000 V DC	60 V DC / 200 V DC	100 V DC / 600 V DC
Contact gap	— (Capsule contact construction)		3.8 mm (for 1 Form A)	No contact	No contact
Ambient temperature	−40 to +80 ℃		−40 to +85 ℃	−40 to +85 ℃	−20 to +80 ℃
Safety standards	UL/C-UL (20 A type: only UL)		UL/C-UL,VDE	UL, VDE (Please contact our sales representative for details.)	UL/C-UL,VDE (Please contact our sales representative for details.)

*1: Each 1 Form A contact connected in series.
*2: When using each 1 Form A contact independently

Product name	PhotoMOS					AQ-H SSR
Applications	Insulation detection	Battery monitoring		Communication	Main relay driving	Main relay driving
Part No.	AQV258*	AQW214EH	AQW216EH	AQY210EH	AQY212EH	AQH2223
Appearance						
Contact arrangement	1 Form A	2 Form A	2 Form A	1 Form A	1 Form A	1 Form A
Continuous load current	20 mA	100 mA	40 mA	130 mA	550 mA	—
ON-state RMS current	—	—	—	—	—	0.9 A
Load voltage	1,500 V	400 V	600 V	350 V	60 V	—
Repetitive peak OFF-state voltage	—	—	—	—	—	600 V
I/O isolation voltage	1,500 V AC	5,000 V AC	5,000 V AC	5,000 V AC	5,000 V AC	5,000 V AC
Safety standards	UL, VDE	UL, VDE	UL, VDE	UL, VDE	UL, VDE	UL/C-UL, VDE

*If you require the high I/O isolation voltage type, please contact our sales representative.

Product Introduction

HE relays PV type 90 A

1. High capacity	● Max. switching current: 90 A ● Electrical expected life: 　• 80 A 277 V AC Min. 10×10^3 ope. 　• 90 A 250 V AC Min. 10^3 ope.
2. Compact size and low operating power	● W: 38 × L: 33 × H: 38.8 mm ● Rated operating power: 1,920 mW ● Holding power: 310 mW 　(when applied 40 %V of coil holding voltage)
3. Safety standards	● Compliant with European photovoltaic standard VDE0126 ● Contact gap: 3.0 mm

HE-S relays

1. High-capacity and long life (Form A contact)	● 35 A 277 V AC 30×10^3 ope. (Standard type), 50×10^3 ope. (Long life type) ● 20 A 277 V AC 100×10^3 ope. (Standard type), 200×10^3 ope. (Long life type)
2. Compact size and low operating power	● W: 30 × L: 36 × H: 40 mm ● Operating power: 1,880 mW ● Holding power: 170 mW 　(when applied 30 %V of coil holding voltage)
3. Safety standards	● Mirror contact mechanisms (Compliant with EN60947-4-1) ● VDE0126 compliant ● Contact gap: 3.2 mm

DZ-S relays
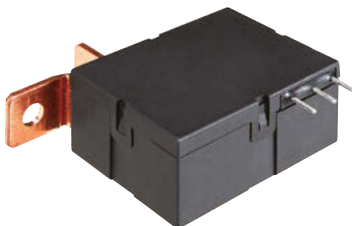
1. High capacity	● Max. switching current: 90 A ● Electrical expected life: 　90 A 250 V AC Min. 10×10^3 ope.
2. Compact size and low operating power	● W: 38.5 × L: 30 × H: 17.5 mm ● Rated operating power: 1.5 W (1 coil latching) 　　　　　　　　　　　　3.0 W (2 coil latching)
3. Safety standards	● IEC62055-31 UC3 compliant

Photovoltaic Power Generation System

Recommended products

HE-V

For cutoff of solar strings

AQZ

For electrical shock prevention and bypass (efficiency improvement)

LF-G
HE-PV
HE-S

• For AC safety cutoff
• For operation in stand alone mode

[Junction box]

EP

For DC safety cutoff

Inverter

Power distributor

Grid

Load

Stand alone

[Power conditioner]

Storage battery

AQ-A
EP
HE-V

• Battery charge/discharge switching
• For DC safety cutoff
• ★ For inrush current prevention
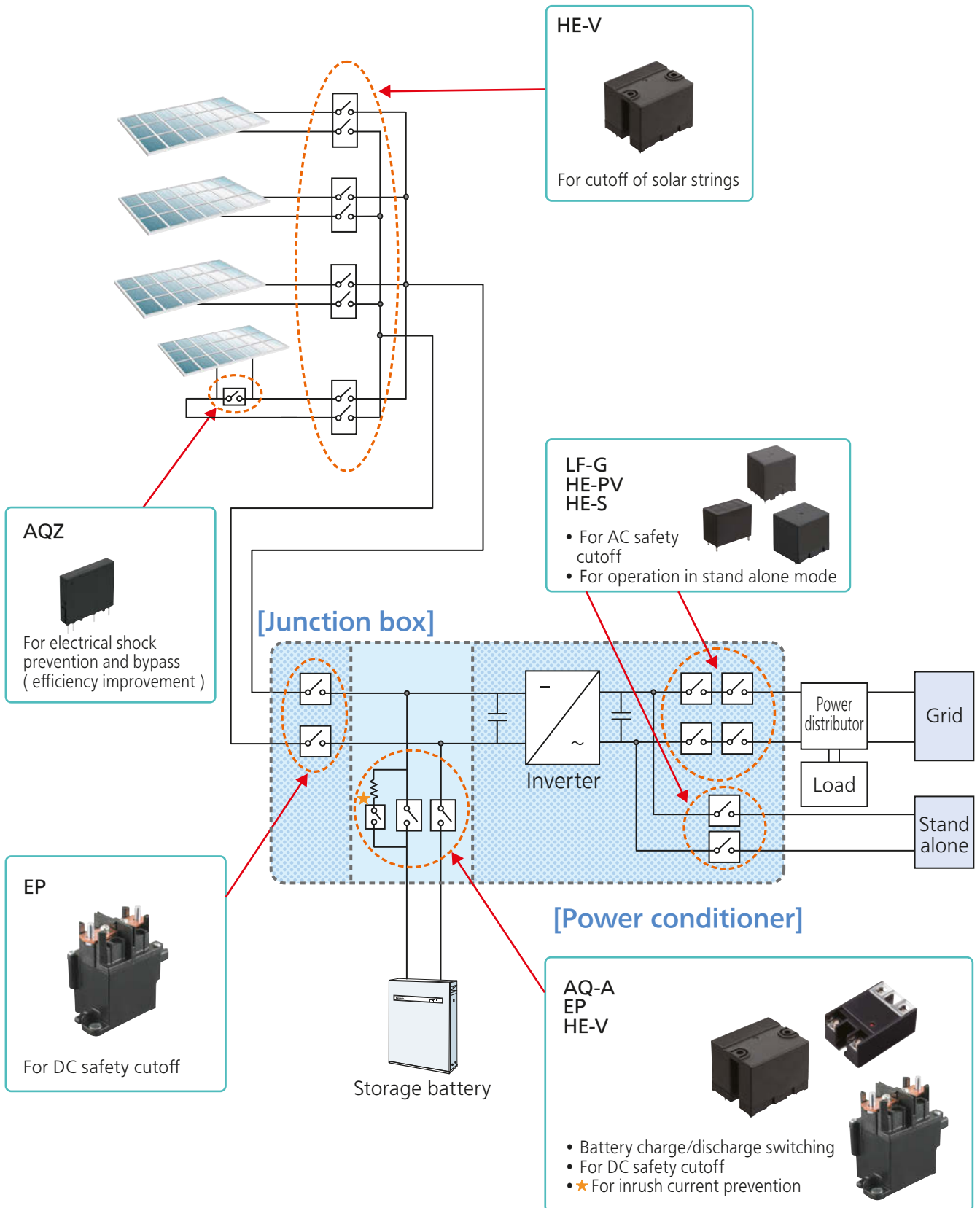
Photovoltaic Power Generation System

Recommended products (DC side)

For Solar strings

HE-V

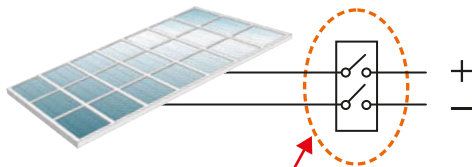| Recommended relay	**HE-V (2a 20 A 1,000 V DC*)** High-voltage cutoff relay capable of simultaneously cutting off the positive (+) and negative (−) terminals by serially connecting the 1 Form A contact. Up to 1,000 V DC cutoff

*1,000 V DC is the maximum allowable voltage when each 1 Form A contact is connected in series. The rating is 800 V DC.
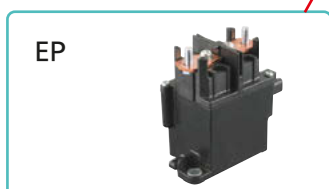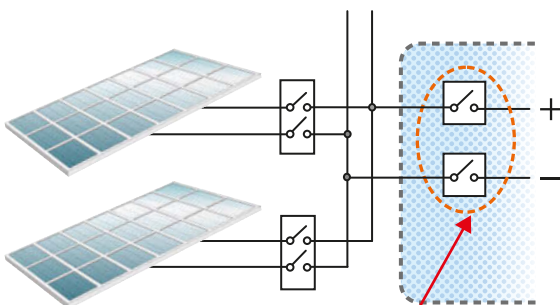
● When something shades the solar panels or a defect occurs, the total power generation efficiency of the system decreases. In such cases, the total power generation efficiency can be maintained by bypassing low-efficiency panels or cutting off strings using relays.

● In case of a disaster, such as fire, system safety can be maintained by shorting each solar panel. (E.g. electrical shock prevention of firefighters)

● Remote control is possible for maintenance work, reducing maintenance costs.

For Junction box connectors
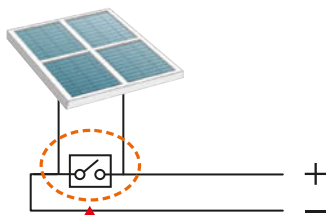
AQZ PhotoMOS

Recommended relay	**AQZ PhotoMOS (1 a 10 A 60 V DC)** PhotoMOS capable of frequent switching, improving system reliability

For Junction boxes and Solar inverter

EP

● In case of a disaster, such as fire, system safety can be maintained by cutting off the DC line.

● Remote control is possible for maintenance work, reducing maintenance costs.

● Large current cuttoff possible during malfunction when connecting storage battery. (80 A type)
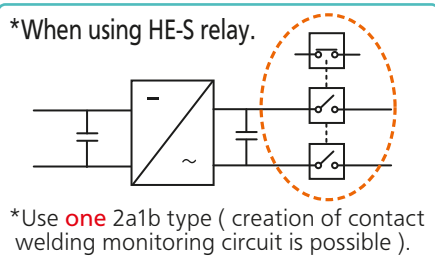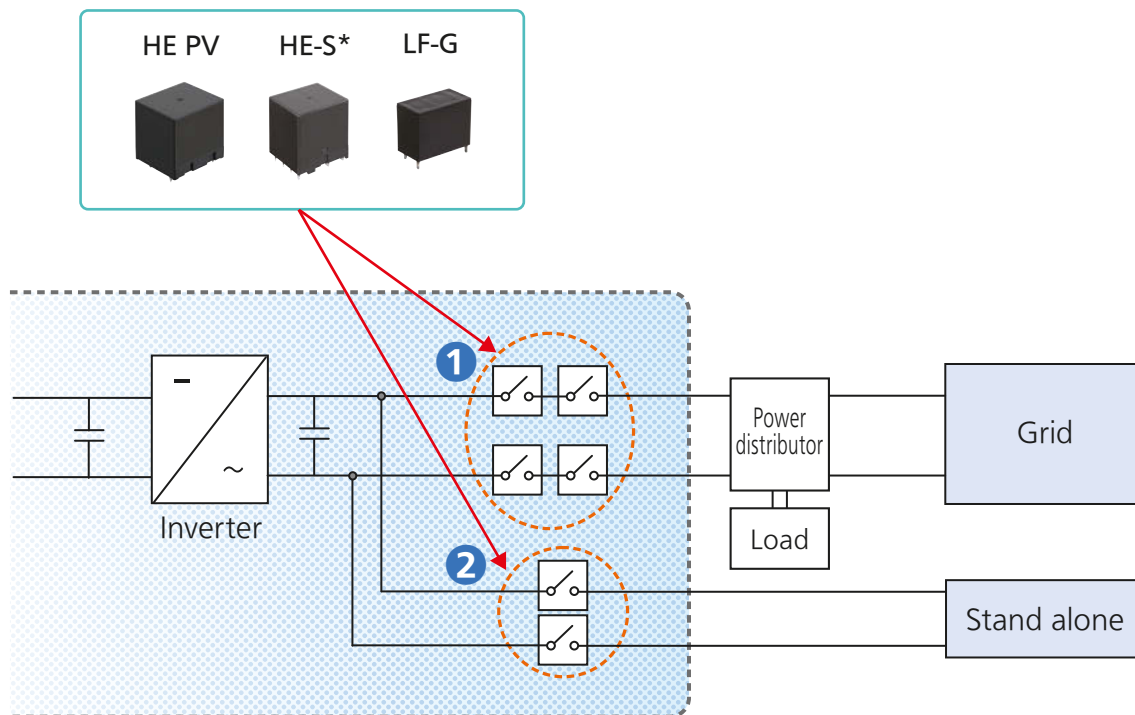
Recommended relay	**EP (1a 20 A, 80 A 1,000 V DC*)** High-voltage cutoff relay with capsule contact construction, which provide high reliability

*1,000 V DC is the maximum allowable voltage. The rating is 400 V DC.

Recommended products (AC side)

*When using HE-S relay.

*Use **one** 2a1b type (creation of contact welding monitoring circuit is possible).

Recommended relay

- **LF-G (1a 22 A, 33 A 250 V AC)**
  Compact power relay with a 1.5 mm or 1.8 mm contact gap
- **HE-S (2a/2a1b 40 A 277 V AC)**
  Two contacts compact power relay with 3.2 mm contact gap
- **HE PV (1a 35 A, 48 A, 90 A 277 V AC)**
  Compact power relay with a 2.5 mm/3.0 mm contact gap, capable of switching from 35 A to 90 A

❶ For Safety Cutoff on the AC side

● Relays are used for safety cutoff on the grid (power network). The relay must cutoff the circuit to prevent abnormal currents that occur from affecting the commercial power supply. Power relays are required as safety measures to protect the power supply system.

❷ For operation in stand-alone mode

● Relay contacts will be ON during a power outage and use of the stand-alone function is possible. The relays are used for stand-alone mode.

Battery Storage System

Recommended products

1 LF-G HE-S HE PV

(LF-G/HE PV: 1a 22 A-90 A 250 V AC)
(HE-S: 2a/2a1b 40 A 277 V AC)

4 EP HE-V AQ-A SSR

(EP: 1a 20 A 1,000 V DC*[1])
(HE-V: 2a 20 A 1,000 V DC*[2])
(AQ-A: 1a 10 A 600 V DC)

*1: 1,000 V DC is Max. switching voltage.
The rating is 400 V DC.
*2: 1,000 V DC is Max. switching voltage when each
1 Form A contact is connected in series.
The rating is 800 V DC.

5 **6** PhotoMOS

Max. load voltage 1,500 V are available.
For available types, please contact our
sales representative.
For detailed application, see page 11.

2 **3** EP AQ-A SSR

(EP: 1a 20 A, 80 A 1,000 V DC*)
(AQ-A: 1a 10 A 600 V DC)

*1,000 V DC is Max. switching voltage.
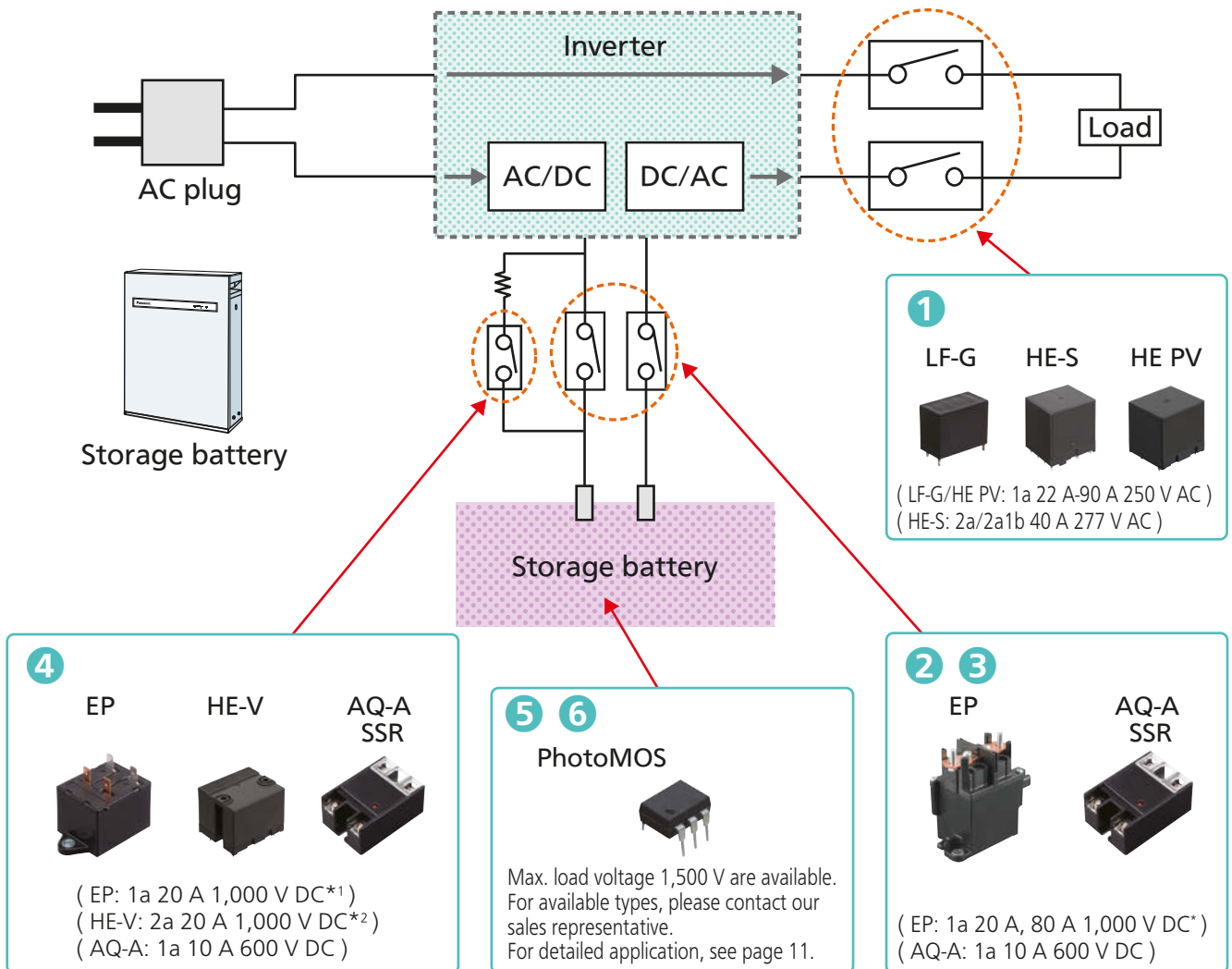The rating is 400 V DC.

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1 For Safety Cutoff on the AC side

● Relays are used for safety cutoff on the grid (power network). The relay must cutoff the circuit to prevent abnormal currents that occur from affecting the commercial power supply. Power relays are required as safety measures to protect the power supply system.

2 For Safety Cutoff on the DC Side

● Power relays are required as safety measures in the event of a defect in or malfunction of the battery or system.

❸ For Charge and Discharge

● AQ-A SSR (PhotoMOS) is used to switch charge and discharge. We recommend solid state relays for applications where there will be frequent ON/OFF switching.

Charge control

Discharge control

Storage battery
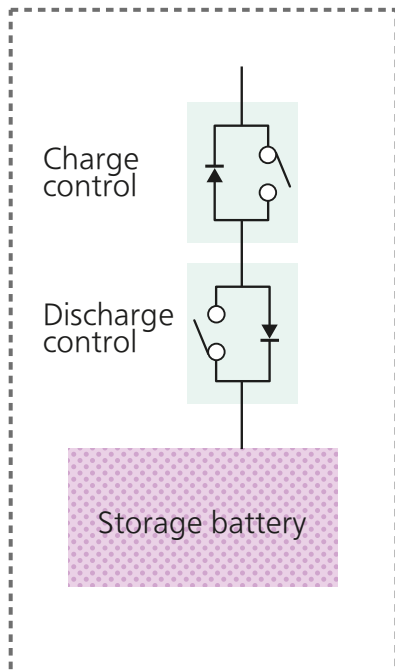
1 **Regular operation**
Turn ON both solid state relays for charge and discharge control. Current flows in both directions.

2 **Over-charge prevention**
In order to prevent over charging, the solid state relay on the charge control side turns OFF.
On the discharge side, current will flow because there is a diode.

3 **Over-discharge prevention**
In order to prevent over discharging, the solid state relay on the discharge control side turns OFF.
On the charge side, current will flow because there is a diode.
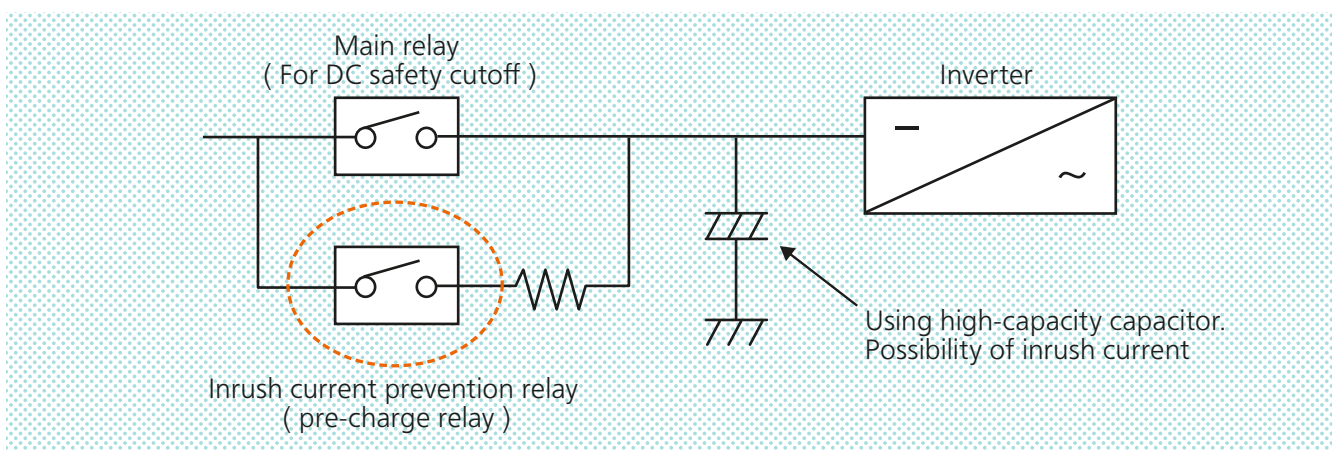
Charge and discharge control is possible by effectively utilizing the internal diodes of the solid state relay.

* If you want to use charge and discharge control by internal diodes of the solid state relay, please contact our sales representative.
(Maximum switching capacity differs from output section.)

Equivalence circuit of output side

3 ─   4 +
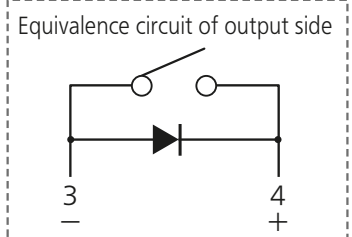
❹ For preventing an inrush current into capacitors when charging (pre-charge circuit)

● AQ-A SSR (PhotoMOS), HE-V relay, and 10 A and 20 A types of EP relays are used for preventing an inrush current into capacitors when charging. We recommend solid state relays for miniaturization and HE-V relay and 10 A and 20 A types of EP relays for high voltages.

Main relay
(For DC safety cutoff)

Inverter

Using high-capacity capacitor. Possibility of inrush current

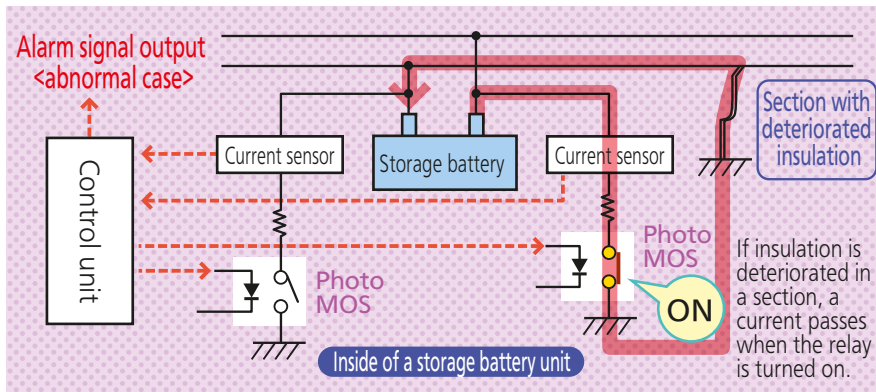Inrush current prevention relay
(pre-charge relay)

During device startup, the inrush current prevention relay turns ON and the main relay turns ON after the capacitor is charged.
Effective for protection against inrush currents that occur when charging the capacitor.

Battery Storage System

5 For Insulation Detection

●PhotoMOS are used for monitoring storage battery units for insulation deterioration
If the insulation in a unit deteriorates, a ground-fault current passes when the relay is turned on, and a sensor detects the current. High load voltage type PhotoMOS are ideal for use with storage batteries, which carry high voltage.

Alarm signal output
<abnormal case>

Current sensor Storage battery Current sensor

Section with deteriorated insulation

Control unit

Photo MOS

Photo MOS

ON

Inside of a storage battery unit

If insulation is deteriorated in a section, a current passes when the relay is turned on.

(When insulation of high voltage area and chassis is deteriorated)

1. PhotoMOS is turned on.
2. The current sensor detects a ground-fault current.
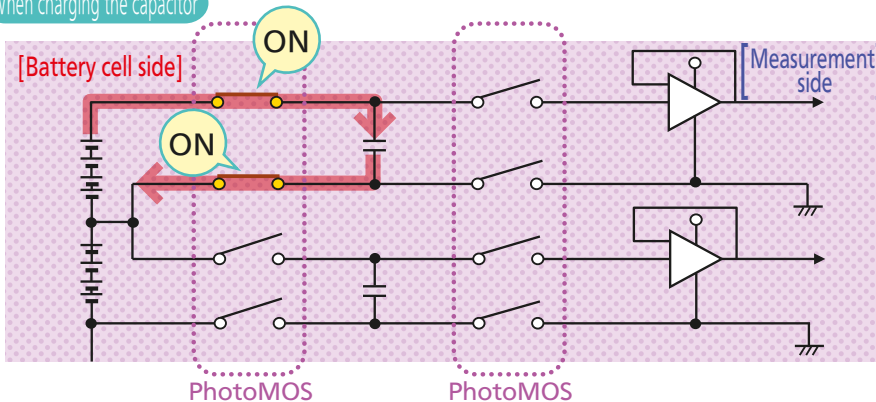3. An alarm signal is output.

➡ Current

6 For Battery Monitoring

●PhotoMOS are used in a circuit for monitoring charging voltages of a battery cell group.
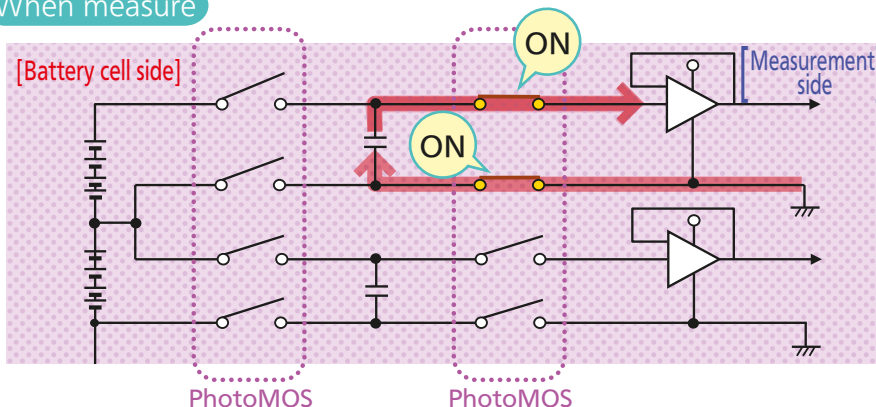Compact PhotoMOS capable of frequent switching are ideal for this type of use.
Use of the relays allows for insulation from high voltage areas.

When charging the capacitor

[Battery cell side]

ON

ON

[Measurement side]

PhotoMOS PhotoMOS

1. PhotoMOS on the battery cell side are turned on.
2. The capacitor is charged.

When measure
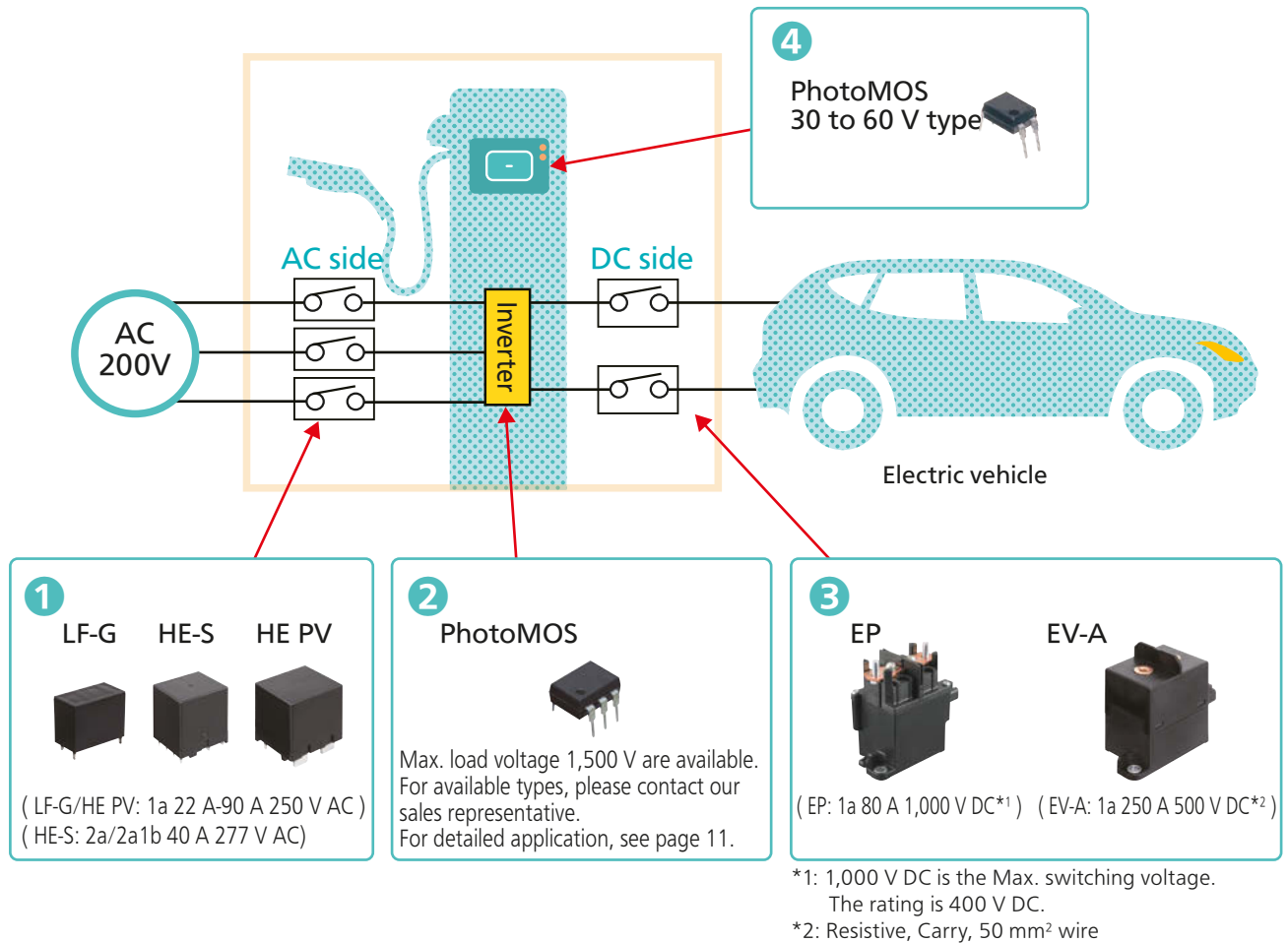
[Battery cell side]

ON

ON

[Measurement side]

PhotoMOS PhotoMOS

1. PhotoMOS on the battery cell side are turned off.
2. PhotoMOS on the measurement side are turned on.
3. The voltage of capacitor (= voltage of battery cell group) is measured.

Fast Charging Station

Recommended products

④
PhotoMOS
30 to 60 V type

AC side   DC side

AC 200V

Inverter

Electric vehicle

①
LF-G   HE-S   HE PV

(LF-G/HE PV: 1a 22 A-90 A 250 V AC)
(HE-S: 2a/2a1b 40 A 277 V AC)

②
PhotoMOS

Max. load voltage 1,500 V are available.
For available types, please contact our
sales representative.
For detailed application, see page 11.

③
EP   EV-A

(EP: 1a 80 A 1,000 V DC*1)   (EV-A: 1a 250 A 500 V DC*2)

*1: 1,000 V DC is the Max. switching voltage.
    The rating is 400 V DC.
*2: Resistive, Carry, 50 mm² wire

❶ For Safety Cutoff on the AC side

●Relays are used for safety cutoff on the grid (power network). The relay must cutoff the circuit to prevent abnormal currents that occur from affecting the commercial power supply. Power relays are required as safety measures to protect the power supply system.

❷ For Insulation Detection

●PhotoMOS are used for monitoring fast charging stations for insulation deterioration.
If the insulation in a station deteriorates, a ground-fault current passes when the relay is turned on, and a sensor detects the current. High load voltage type PhotoMOS are ideal for use with fast charging stations, which carry high voltage.
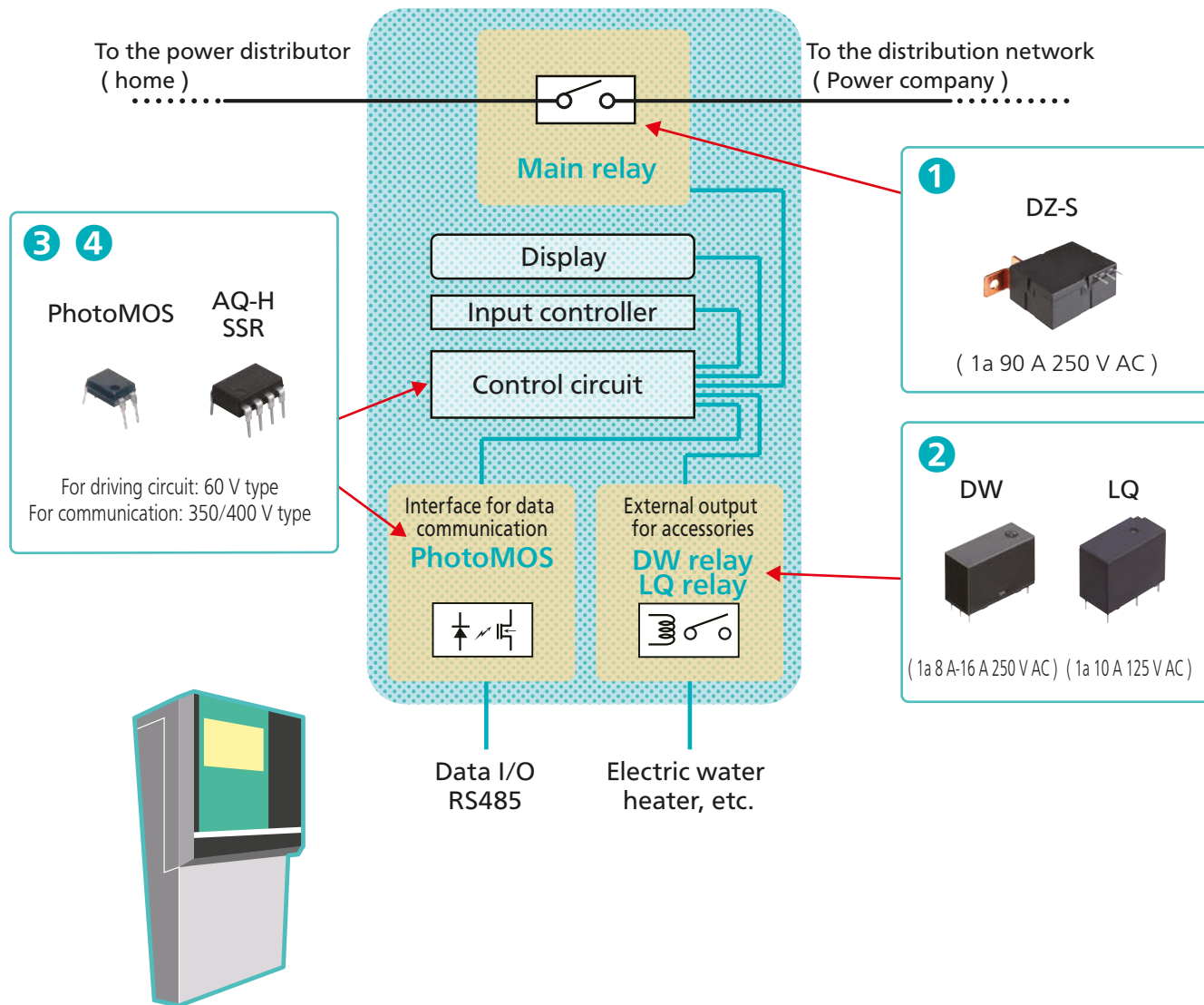
❸ For Safety Cutoff on the DC Side

●Power relays are required as safety measures in the event of a defect in or malfunction of the battery or system.

❹ For Signal Control   For IC card activation

●For models that require the use of IC cards for charge control, etc.,
low on-resistance type PhotoMOS are used for signal control.

Smart Meter

Recommended products

To the power distributor
(home)

To the distribution network
(Power company)

Main relay

Display

Input controller

Control circuit

❸ ❹

PhotoMOS | AQ-H SSR

For driving circuit: 60 V type
For communication: 350/400 V type

Interface for data communication
PhotoMOS

External output for accessories
DW relay
LQ relay

Data I/O
RS485

Electric water
heater, etc.

❶ DZ-S

(1a 90 A 250 V AC)

❷ DW | LQ

(1a 8 A-16 A 250 V AC) (1a 10 A 125 V AC)

❶ For Main Power Cutoff

● Main relays are used for cutting off the main power. There is demand for a remote cutoff function for rolling blackouts, a prepaid system, safety measures, responses to non-payment of electric bills, etc.

❷ For External Output of Accessories

● Relays are used for driving a contactor to turn on a electric water heater using power at night.

❸ For Driving Main Relays

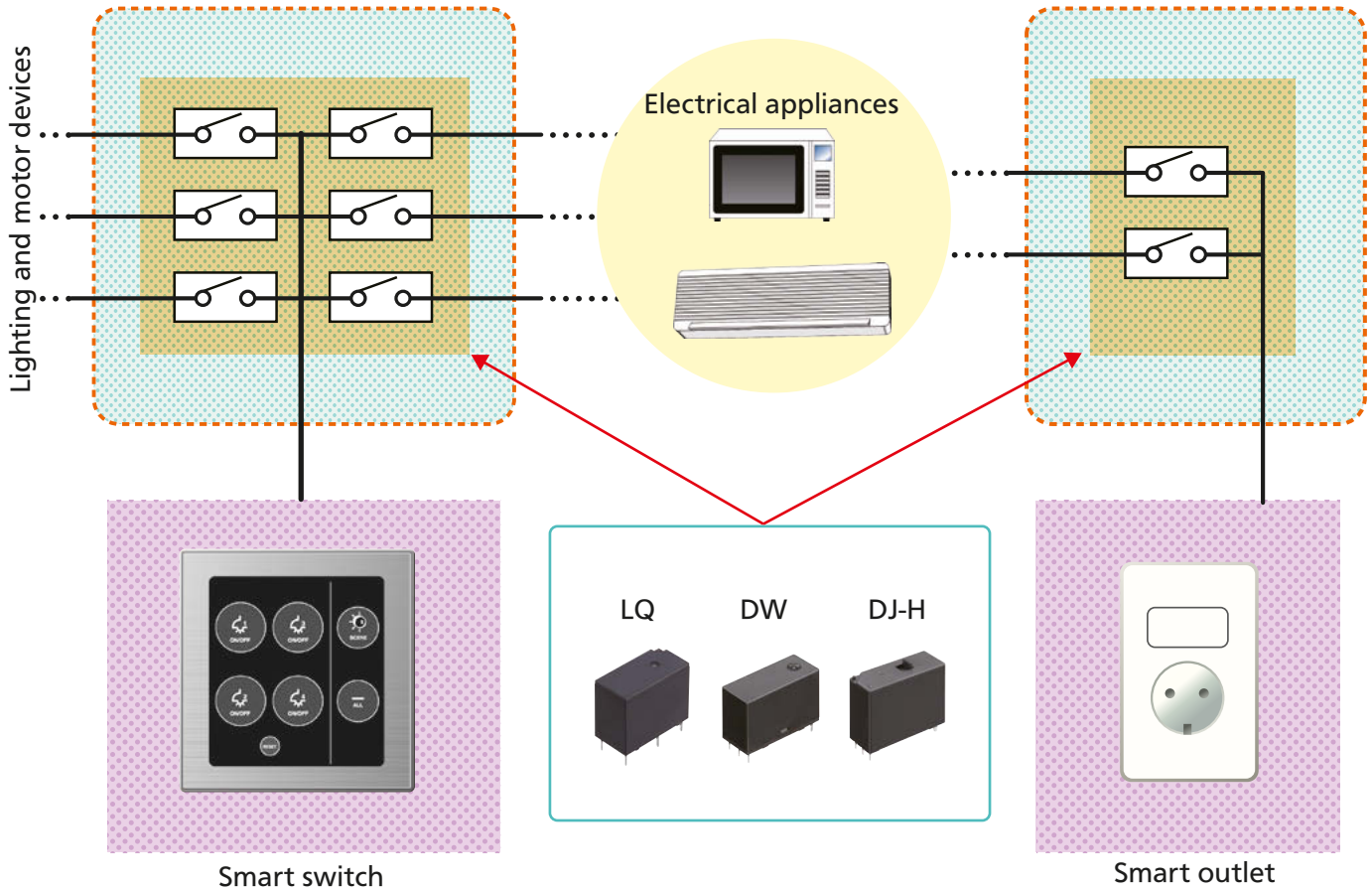● PhotoMOS and AQ-H SSRs are used for driving main relays.

❹ For Data Communications

● PhotoMOS are used as output contacts for external communications.

Lighting/Outlet Control

Recommended products

Lighting and motor devices

Electrical appliances

LQ   DW   DJ-H

Smart switch

Smart outlet
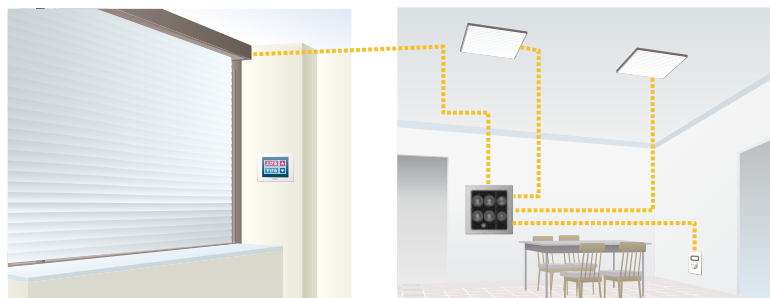
Remote control applications

● Relays are used in remote control applications. Smart switches with built-in relays make remote control, collective control and visualization of electricity usage possible.
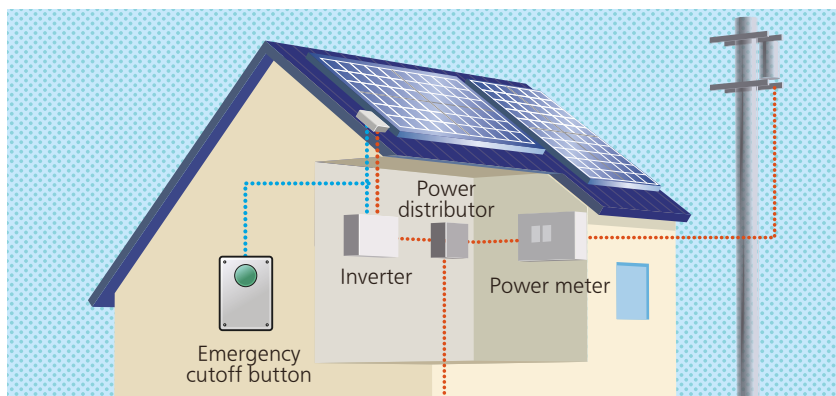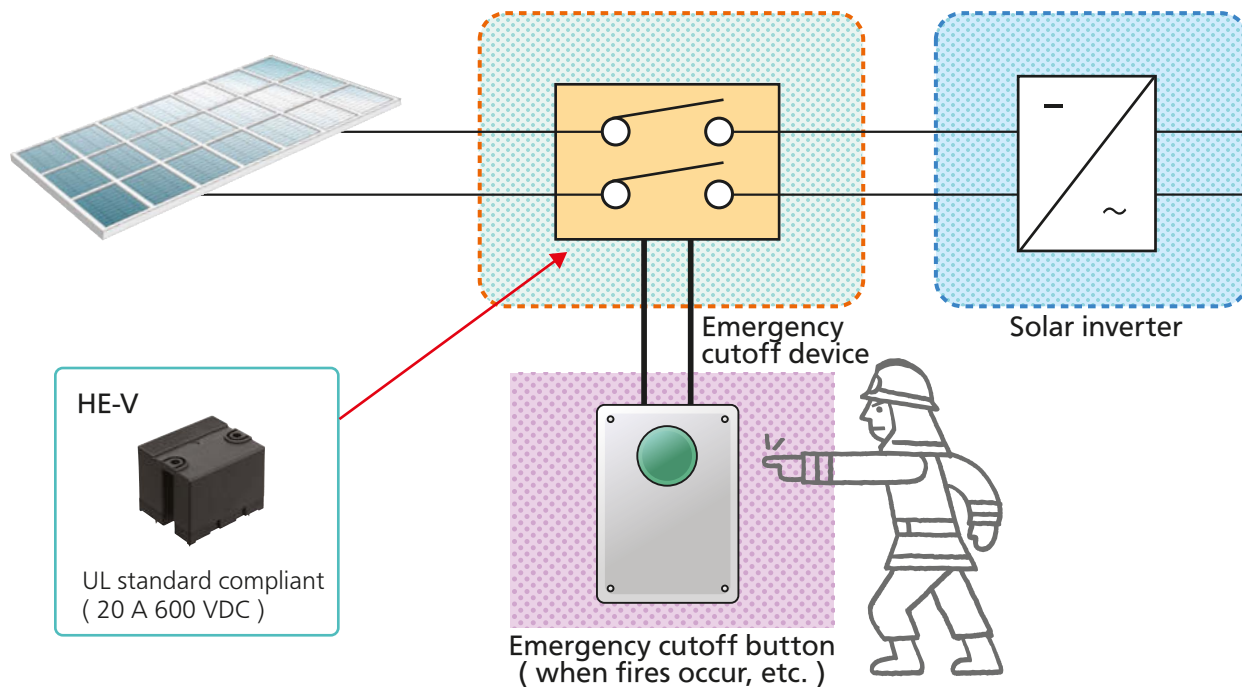
Applications for automatic cutoff during earthquakes

● Power relays can be used in safety cutoff applications when earthquake tremors are detected.

Rapid Shutdown System (NEC2014 690.12)

Recommended products

For power line emergency cutoff device of photovoltaic power generation system

Emergency cutoff device

Solar inverter

HE-V

UL standard compliant
(20 A 600 VDC)

Emergency cutoff button
(when fires occur, etc.)

Power distributor

Inverter

Power meter

Emergency cutoff button

For power line cutoff during firefighting

[What is a rapid shutdown system?]

This is a system designed to cut off the DC power line on the panel side of photovoltaic power generation equipment. In North America, the NFPA (National Fire Protection Association) is likely to soon define this (690.12) and legislate it into law within NEC2014 (National Electric Code 2014), due to the occurrence of electrocution among firefighters when putting out fires. Also, in Germany installation of this system is a requirement to obtain fire insurance.

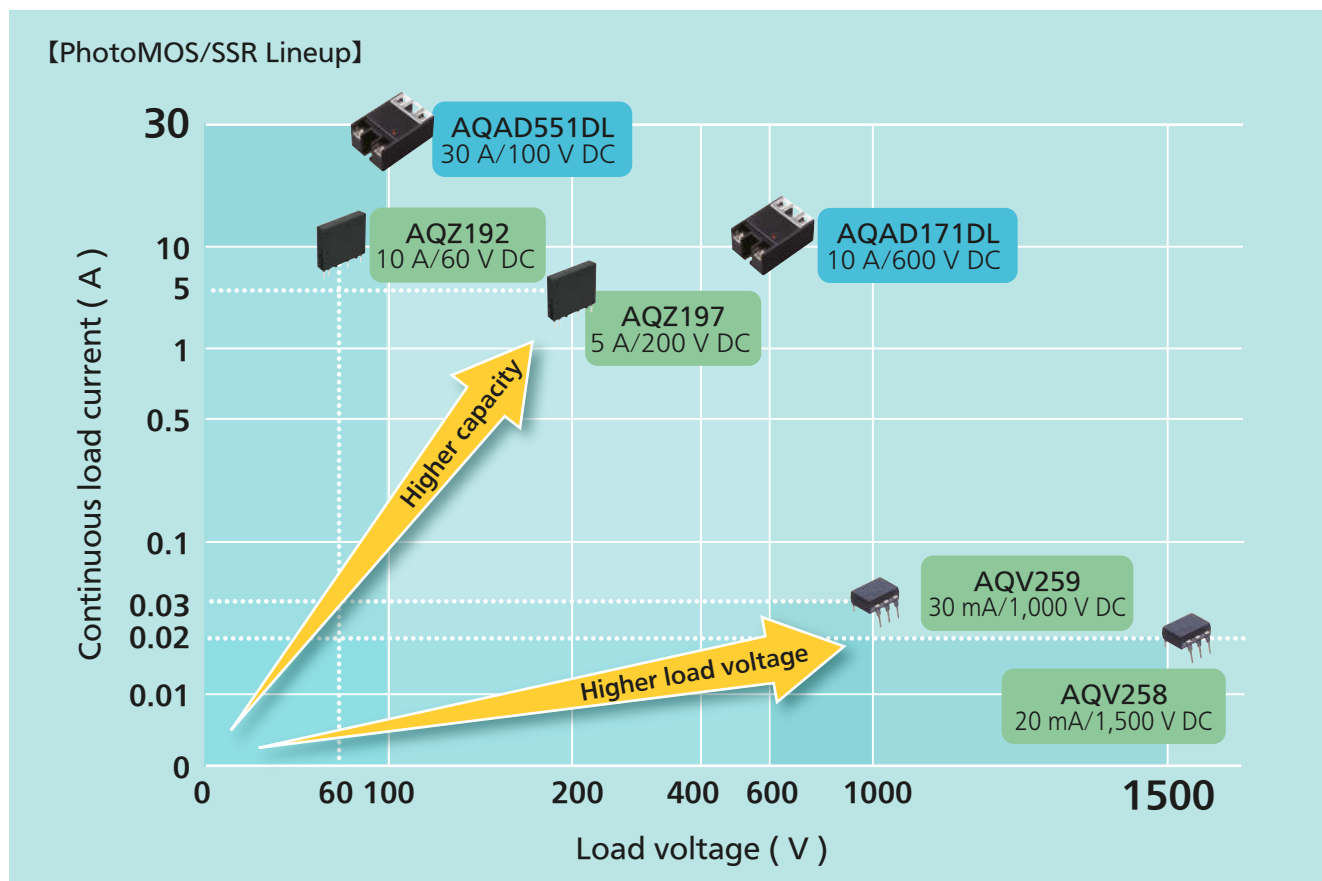### [NEC2014 690.12 definition (summary)]

- Emergency cutoff device (controlled by relay) shall install in less than 1.5 m (5 ft) in length inside a building, or less than 3 m (10 ft) in length outside a building from a PV array.
- Controlled conductors shall be limited to less than 30 V and 240 VA within 10 seconds of rapid shutdown initiation.
- The use of UL standard certified components is a requirement in system configurations.

PhotoMOS/SSR AQ-A

MOSFET, phototriac coupler, etc., is used inside internal element.
This facilitates customer needs for "High load voltage", "High capacity", and "Long life".

【PhotoMOS/SSR Lineup】

Continuous load current (A)

AQAD551DL
30 A/100 V DC

AQZ192
10 A/60 V DC

AQAD171DL
10 A/600 V DC

AQZ197
5 A/200 V DC

Higher capacity

AQV259
30 mA/1,000 V DC

Higher load voltage

AQV258
20 mA/1,500 V DC

Load voltage (V)

High load voltage

Compared to other markets, there is a need for high load voltage products in the energy management market. Therefore PhotoMOS/SSRs can handle maximum load voltages up to 1,500 V.

Typical Part No. AQV258 (1,500V load voltage), AQV259 (1,000V load voltage)

High capacity

It supports large current control of DC loads, a need that has been increasing in recent years. It is also effective for frequent contact switching and reducing of power consumption.

Typical Part No. AQZ192 (10 A/60 V DC), AQZ197 (5 A/200 V DC), AQAD551DL (30 A/100 V DC) and AQAD171DL (10 A/600 V DC)

Long life

Problems such as switching life are solved by using semiconductors in contacts. Cut of device running cost is possible because they are maintenance free.

Please note ① Standard specification products are shown in this catalog. For additional specifications, please contact our sales representative.
② If you are considering applications that involve energy management, please contact our sales representative at the planning stage.

LF-G/HE-S/HE PV

Relays

■Suitable for European photovoltaic generation standard IEC62109 and VDE0126
(Maintain a contact gap of at over 1.8 mm.)

Over 1.8 mm contact gap is required for the AC circuit side on photovoltaic generation equipment in the European market.

Background that contact gap over 1.8 mm is required in Europe market

The condition of the altitude stipulation (2,000 m or more) was added to the current demand of contact gap over 1.8 mm [over 2.5 kV surge breakdown voltage (between contacts)].

Contact gap over 1.8 mm is required for power relays.
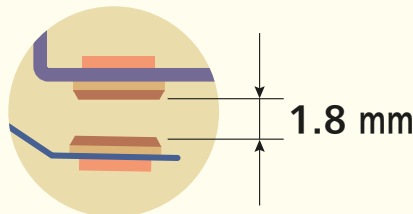
1.8 mm

LF-G (22 A/31 A/33 A)

Min. 1.8 mm

HE PV (35 A/48 A/90 A)

Min. 2.5 mm *90 A type: Min. 3.0 mm

HE-S (35 A)

Min. 3.2 mm

HE-S relays

HE-S Relays
2 Form A/
2 Form A 1 Form B type

The HE-S relay is a 2 Form A and 2 Form A 1 Form B relay that is miniature and features high capacity, built-in auxiliary contacts. In particular, the 2 Form A 1 Form B contact type supports mirror contact mechanisms and can be used to create safety circuits.

2 Form A 1 Form B contact type supports the mirror contact mechanisms. Detect welding of main contact and create safety circuit. Contact gap of 3.2 mm or higher.

Safety construction
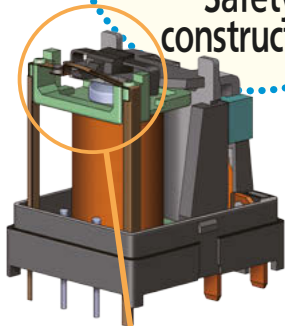
Miniature size attained compared to using two 1 Form A contact relays. Enhanced freedom of design

Space saving

Reduction of power consumption is achieved by reducing the coil holding voltage after applying rated coil voltage for at least 100 ms during relay operation.

Energy-saving

■ When using 1 Form A/2 Form A relay

For failsafe applications, use four 1 Form A type or two 2 Form A type.
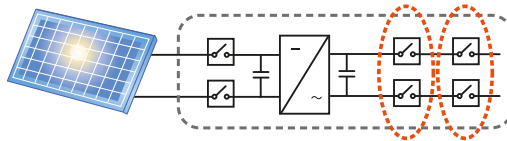
Rated operating power	Ratio in which coil holding voltage can be decreased	Power consumption when coil holding voltage decreases
1,880 mW	30 %V of rated coil voltage	approx. 170 mW

■ When using HE-S (2 Form A 1 Form B contact)

Use one 2 Form A 1 Form B type
(creation of contact welding monitoring circuit is possible).
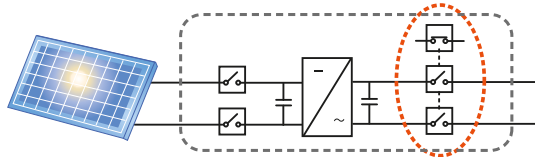
Enlarged view
(Form B contact)
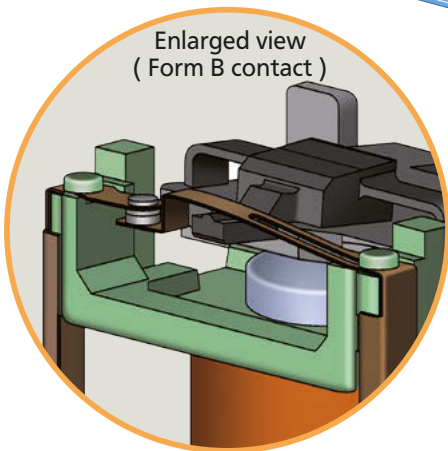
Explanation of mirror contact mechanism (2 Form A 1 Form B type)

Compliant with EN60947-4-1 mirror contact

• Designed so that Form A contact and Form B contact will not close at the same time.
• When From A contact welded, Form B contact gap of at least 0.5 mm is maintained.
*Form B contact, when used to monitor the condition of Form A contact, can be used exclusively as an auxiliary contact.

Normal operation		Malfunction
1 De-energize (Normal operation)	**2** Excitation (Normal operation)	**3** De-energize (When main contact welded)
Form A contact Form B contact	Form A contact Form B contact	Form A contact Form B contact
		Welding Min. 0.5 mm

HE-V relays

HE-V Relays

The HE-V relay is a miniature power relay that can conduct and cut off high DC voltage or high currents. Using a 2 Form A contact, it is capable of both plus and minus line cutoff on the DC side.

Using a blow-out magnet mechanism and serial contact connection, the required arc and gap length is maintained for high DC voltage cutoff. Over 3.8 mm contact gap (for each 1 Form A contact)
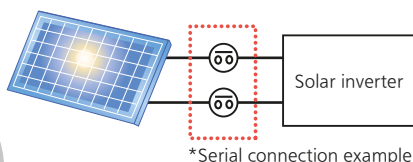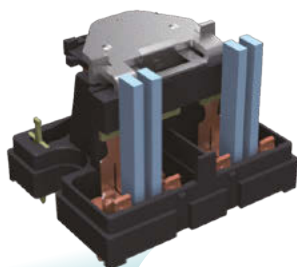
▼

Safety Construction
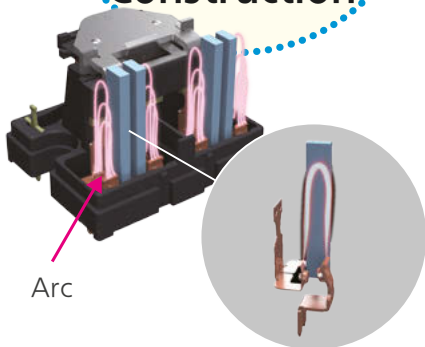
Arc

Miniature size attained compared to using two 1 Form A contact relays. Enhanced freedom of design

▼

Small

Solar inverter

*Serial connection example

Reduction of power consumption is achieved by reducing the coil holding voltage after applying rated coil voltage for at least 100 ms during relay operation.

▼

Energy-saving

Rated operating power	Ratio in which coil holding voltage can be decreased	Power consumption when coil holding voltage decreases
1,920 mW	33 %V of rated coil voltage	approx. 210 mW

Operation explanation (interception mechanism)

1 Power to relay is ON.

4 The arc extends inside the arc extinction space and completes cutoff. The arc does not get out.

2 Arc is generated when power to relay contact is cut.

**3** The arc extends by applying transverse field.

Inside arc extinction space

■Contribute to energy saving with reduced coil holding voltage

In existing products, rated coil voltage had to be applied to the coil side. However LF-G Relays, HE-S Relays, HE Relays PV and HE-V Relays will be operated with reduced coil voltage (coil holding voltage *1), so that lower power consumption could be achieved.
Reduce the coil holding voltage after applying the rated coil voltage for 100 ms or longer in that way you could reduce the energy consumption.

Condition: Max. contact carrying current (LF-G, HE, HE-S and HE-V)

Product	Rated operating power	Ratio in which coil holding voltage can be decreased at 20℃	Power consumption when coil holding voltage decreases at 20℃	Ratio in which coil holding voltage can be decreased at 85℃	Power consumption when coil holding voltage decreases at 85℃
LF-G Relays	1,400 mW	35 %V of rated coil voltage	approx. 170 mW	45 %V of rated coil voltage	approx. 280 mW
HE Relays PV	1,920 mW	40 %V of rated coil voltage	approx. 310 mW	50 %V of rated coil voltage	approx. 480 mW
HE-S Relays	1,880 mW	30 %V of rated coil voltage	approx. 170 mW	30 %V of rated coil voltage	approx. 170 mW
HE-V Relays	1,920 mW	33 %V of rated coil voltage	approx. 210 mW	33 %V of rated coil voltage	approx. 210 mW
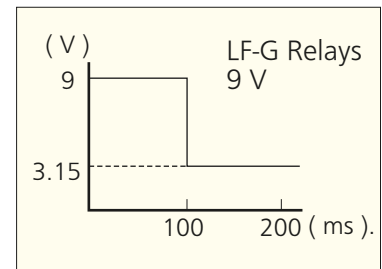
*1: Coil holding voltage is the coil voltage after 100 ms following application of the rated coil voltage.

LF-G Relays 9 V

■How to reduce coil holding Voltage

Please refer to the circuit examples below for reducing the coil holding voltage of AC load relays.
Please note, that the methods shown below are just examples and do not constitute any guarantee. Be sure to verify operation in your actual device.
Also, please contact our sales representative if you are considering a holding voltage reduction circuit using DC load relays (HE-V relay and EP relay).
(Please note that for switching DC loads, if a diode is used in the coil surge absorbing element in the relay, the contact opening velocity will slow down and sufficient cutoff performance cannot be guaranteed.)

1. Example of CR circuit method

Coil impress voltage (130 %V)

R   C
Regeneration diode   Relay coil
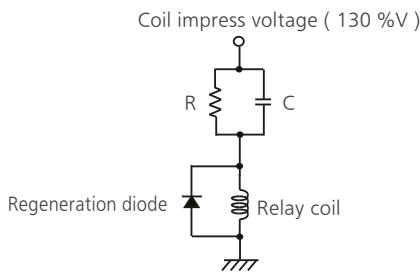
【Operation explanation】
① Apply voltage of over rated coil voltage (around 130 %V).
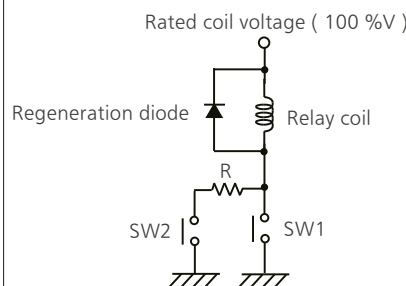② Power consumption when relay is ON is controlled using the values of relay coil resistance, C, and R.

*For application time of voltages over the rated voltage, please set value of capacitor C to 50 ms or greater.
*Set the coil holding voltage using resistance R, and the relay coil resistance to reach the voltage you are aiming for (around 50 %V).

[Depiction of coil voltage/current waveform]

Coil voltage   Coil current
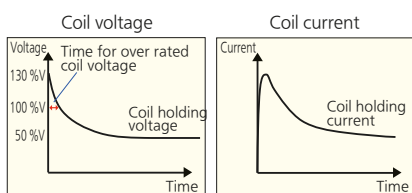
2. Example of switch method

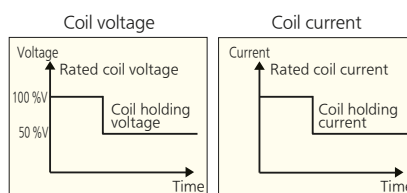Rated coil voltage (100 %V)

Regeneration diode   Relay coil
R
SW2   SW1

【Operation explanation】
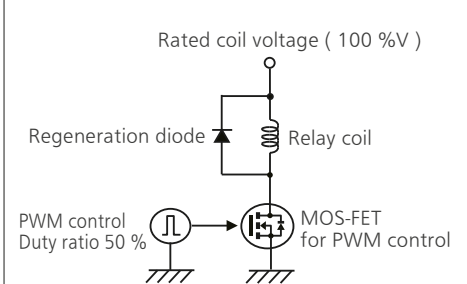① Operate by turning SW1 ON and applying rated voltage (100 %V) to relay coil.
② After at least 0.1 s in ①, turn SW2 ON, turn SW1 OFF and control the power consumption when the relay is ON using the value of resistance R.

*Set the coil holding voltage using resistance R, and the relay coil resistance to reach the voltage you are aiming for (around 50 %V).

[Depiction of coil voltage/current waveform]

Coil voltage   Coil current

3. Example of PWM method

Rated coil voltage (100 %V)

Regeneration diode   Relay coil
PWM control Duty ratio 50 %   MOS-FET for PWM control

【Operation explanation】
① MOS-FET→ON (Voltage supplied to relay coil)
   Make sure MOS-FET is completely ON (Duty ratio 100 %)
② After at least 0.1 s of ①, start PWM control with MOS-FET (Duty ratio 50 %), and control the power consumption when the relay is ON.

*We recommend a PWM control frequency of 20 kHz to 100 kHz.

[Depiction of coil voltage/current waveform]

Coil voltage   Coil current
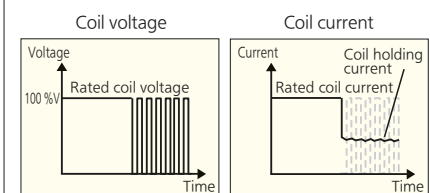
DJ-H relays

DJ-H Relays

This is a 1a 50A high capacity latching relay that can handle lighting and motor loads.
Manual operation verification is possible with the manual switch type.

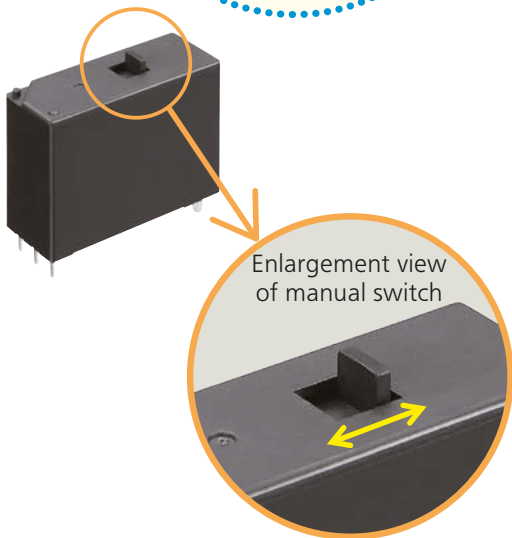**Supports anti-inrush and all types of lighting loads Equipped with manual switch for operation verification**

▼

Safety construction

**Low power consumption:
1 coil latching: 1.0 W
2 coil latching: 2.0 W**

▼

Energy-saving

Compliant with safety standards for inrush resistance and all types of lighting loads. (UL and VDE)

▼

Safety standard

■ Manual switch

Equipped with manual switch for operation verification
Manual relay on/off is possible (when there is De-energize).

Manual ON・OFF

Enlargement view of manual switch

■ Application examples
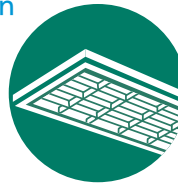
Lighting control

Smart homes (shutters and blinds)

Supports inrush current loads

● Supports all types of inrush loads such as tungsten loads (TV-20 equivalent), electric ballast loads (NEMA410), and capacitor loads (IEC60669-1), etc.

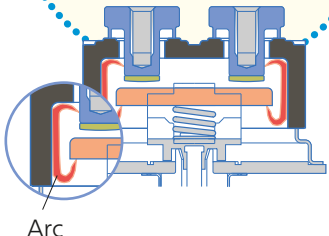| Load	Tungsten load	Electronic ballast load	Capacitive load
Switching capacity	2,400 W 120 V AC	20 A 277 V AC	20 A 250 V AC 200 µF
Electrical life	Min. 25×10^3 ope.	Min. 6×10^3 ope.	Min. 30×10^3 ope.
Surge current waveform	Tek ⬚ ℝ Relay M Pos: 3.800 ms 100 A/div 5 ms/div CH1 100 A M 5.00 ms CH1	Tek ⬚ ●Acq Complete M Pos: 11.52 ms 200 A/div 500 µs/div CH2 200 A M 500 µs CH1	Tek ⬚ ●Acq Complete M Pos: 6.480 ms 200 A/div 250 µs/div CH1 200 A CH2 200 A M 250 µs CH1

EP relays

EP Relays

The EP relay is a power relay that enables DC high voltage and a high current interruption in small size. Below listed are features compared to DC contactor of existing products generally used in the DC high voltage area.

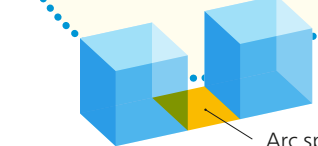**Sealed construction keeps the arc inside**
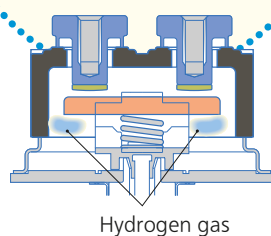
▼

Safety Construction

Arc

Free arc space

▼

Space saving

Arc space is necessary for existing products and cannot use adjacent mounting.

The capsule contact construction is filled with H$_2$ gas which provides a large cutoff capacity with a small contact gap.

▼

Small
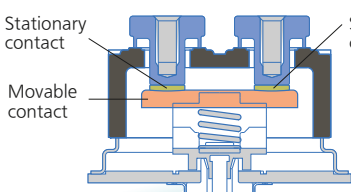
Hydrogen gas
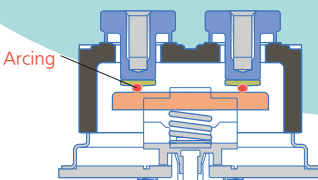
The arc is cooled and intercepted rapidly by the hydrogen mixed gas in the capsule contact.
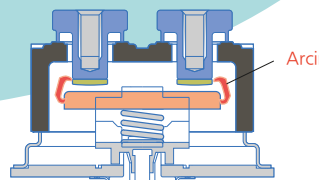
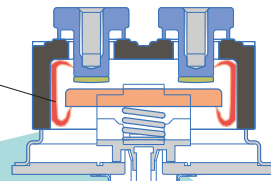## Operation explanation (interception mechanism)

1 Power to relay is ON.

Stationary contact

Stationary contact

Movable contact

4 Arc is attracted to the inner wall of sealed capsule contact, preventing arc from running side.

Arcing

2 Arc is generated when power to relay is cut.
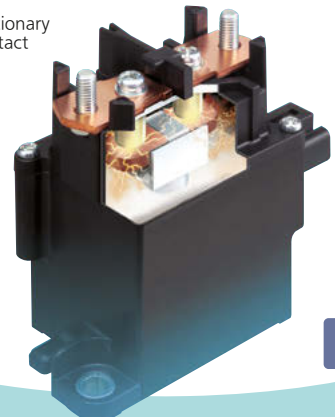
Arcing

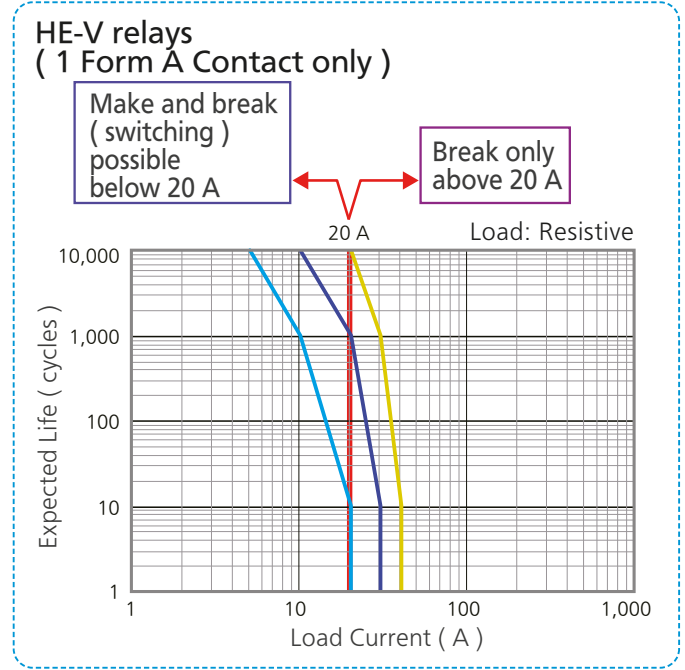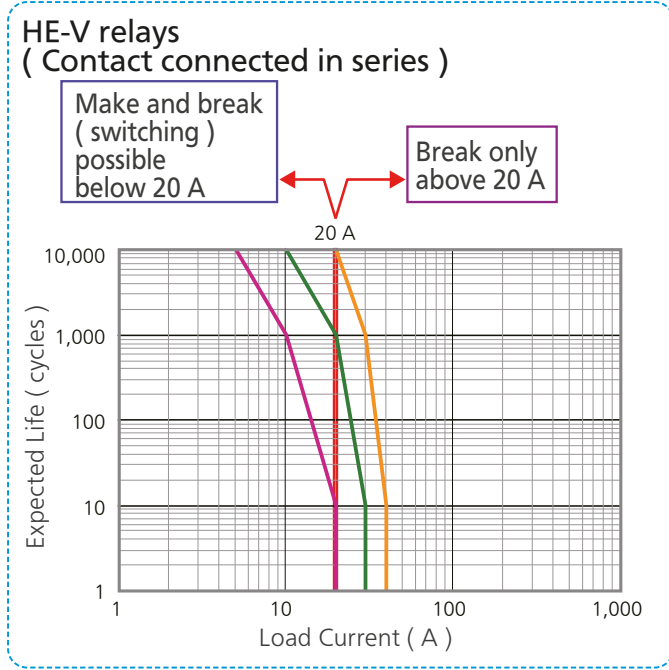**3** Due to external magnetic force, arc runs horizontally over contact surface.

Arcing

HE-V relays/EP relays expected life (cycles)

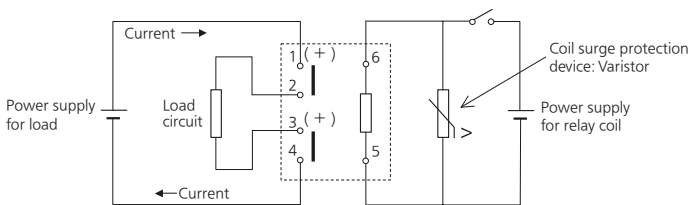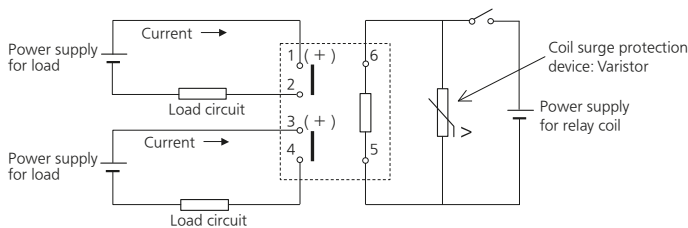Notes:In case of using over the rating, the data is only reference use. please test the actual condition before use.

── 1,000 VDC	── 800 VDC
── 600 VDC	── 500 VDC
── 400 VDC	── 300 VDC

HE-V relays (Contact connected in series)

Make and break (switching) possible below 20 A

Break only above 20 A

20 A

HE-V relays (1 Form A Contact only)

Make and break (switching) possible below 20 A

Break only above 20 A

20 A   Load: Resistive

HE-V relays Recommended circuit
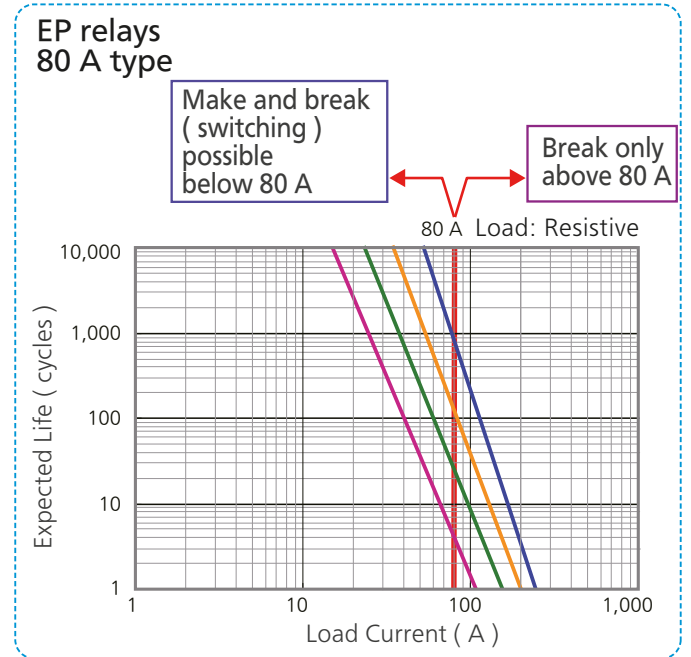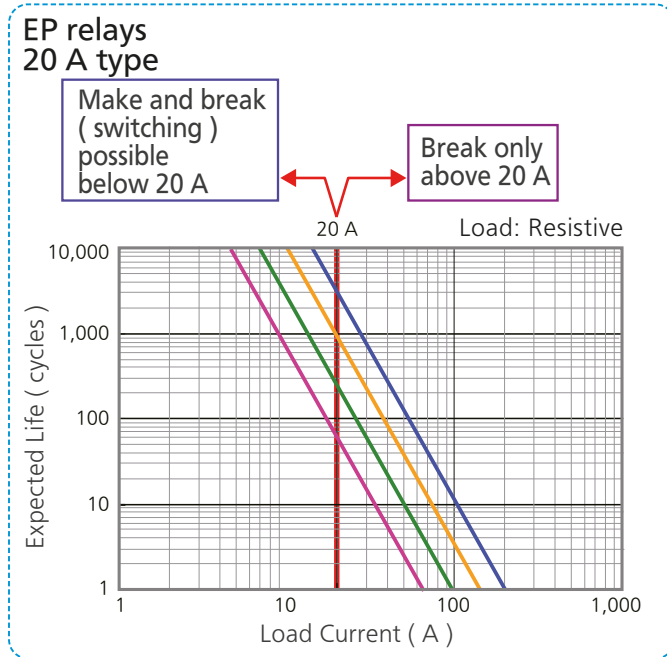Positive polarity of load should be connected to pin 1 and pin 3, refer to the following circuit schematics.

1. Each 1 Form A contact connected in series (Bottom view)

2. 1 Form A contact only (Bottom view)

Notes:In case of using over the rating, the data is only reference use. please test the actual condition before use.

━━━ 1,000 VDC ━━━ 800 VDC
━━━ 600 VDC ━━━ 400 VDC

EP relays 20 A type

Make and break
(switching)
possible
below 20 A

Break only
above 20 A

20 A   Load: Resistive

Expected Life (cycles)

Load Current (A)

EP relays 80 A type

Make and break
(switching)
possible
below 80 A

Break only
above 80 A

80 A   Load: Resistive

Expected Life (cycles)

Load Current (A)

The application examples in this document are for reference. Be sure to verify safety on the actual device before using.
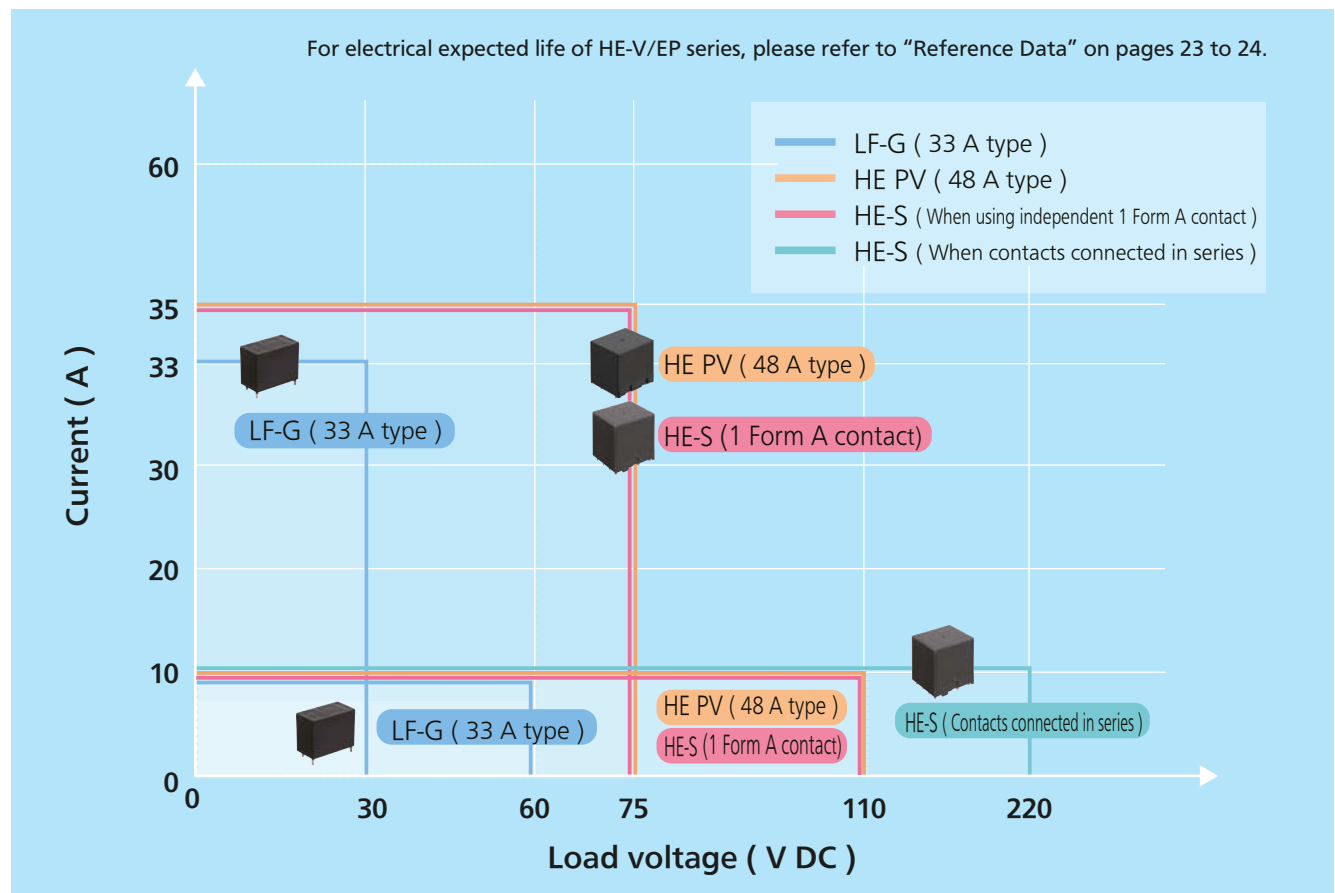
DC load switching capacity on AC load relay

Even on some AC load relays, support for DC loads is possible.
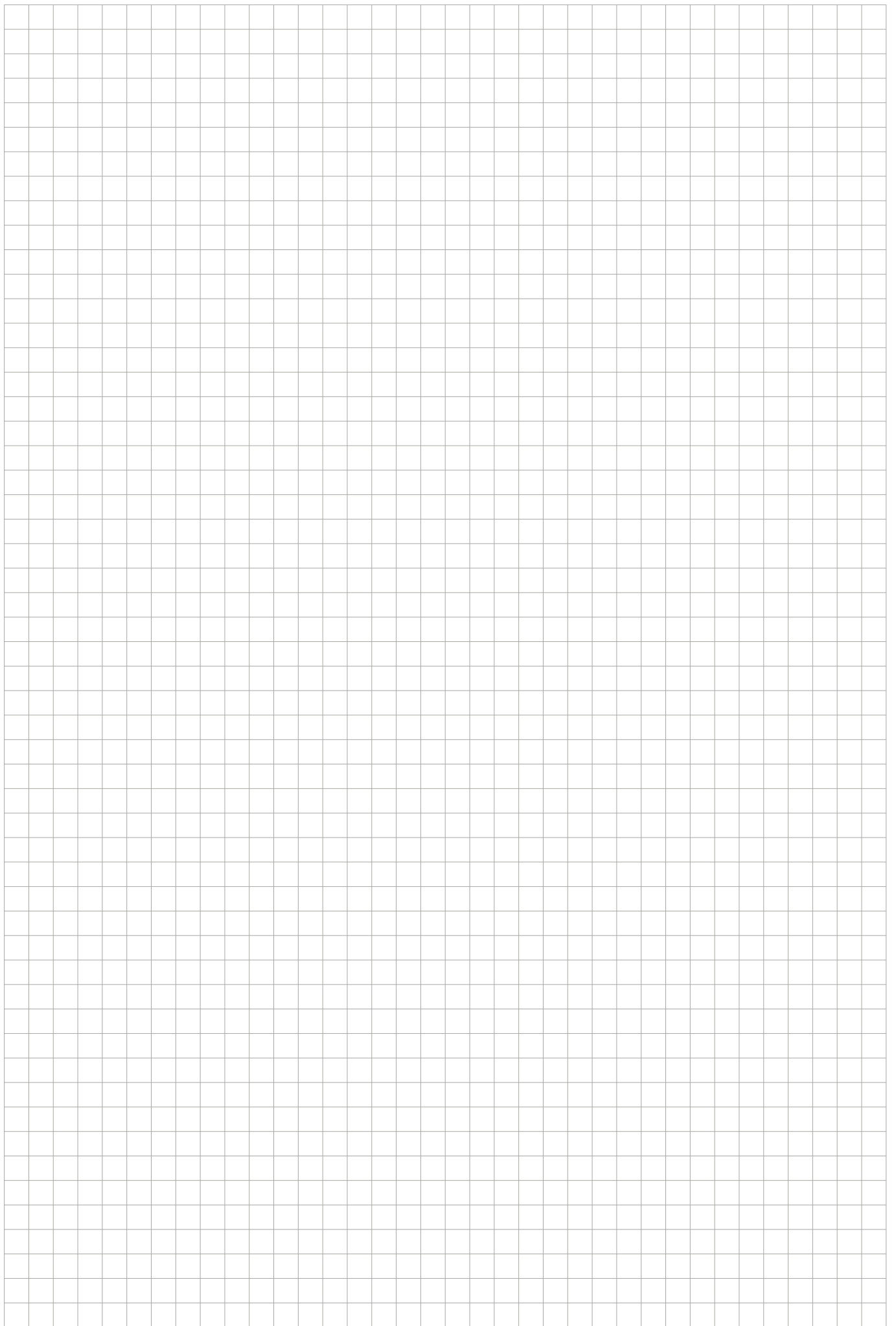*Guideline for when using DC loads. Please test the actual condition before use.

■ DC load switching capacity that is possible on AC load relay (reference value)

Appearance	Product name	Contact	Load voltage	Current	Electrical expected life (resistive load)	Remark
	LF-G (33 A type)	1 Form A	30 V DC	33 A		–
	HE PV (48 A type)	1 Form A	75 V DC	35 A		–
			110 V DC	10 A	10×10^3 ope.	–
	HE-S (35 A type)	2 Form A	75 V DC	35 A		When using independent 1 Form A contact
			110 V DC	10 A		When using independent 1 Form A contact
			220 V DC	10 A		When contacts connected in series

■ Maximum value of DC load switching capacity that is possible on AC load relay
(Conditions: resistive load, electrical expected life of 10,000 times) (reference value)

For electrical expected life of HE-V/EP series, please refer to "Reference Data" on pages 23 to 24.

- LF-G (33 A type)
- HE PV (48 A type)
- HE-S (When using independent 1 Form A contact)
- HE-S (When contacts connected in series)

Current (A)

Load voltage (V DC)

Specifications are subject to change without notice.

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2022.12