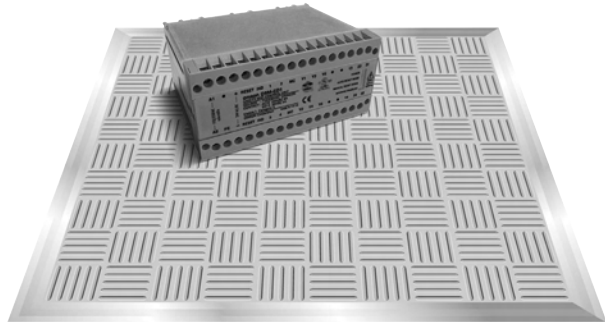


Safety Mat System D9M

Keeps Areas Safe by Detecting Workers' Presence

- Conforms to EN1760-1, EN954-1 (Category 3), and EN60204-1 standards.
- Failsafe operation ensured with Safety Mat and Controller combined.
- Safety Mats can be connected in series and controlled by a single Controller.
- Degree of protection: IP67. (Mats)

Note: Be sure to read the "Safety Precautions" on page F-11.



Ordering Information

Model Number Legend

D9M-□□□□□
1 2

1. Function

- M: Safety Mat
- T: Trim
- C: Controller
- P: Maintenance parts





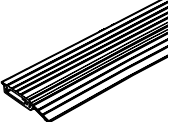
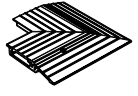

2. Size, length, and appearance

Safety Mat

Appearance	A (mm)	B (mm)	Model
	500	500	D9M-M1010
	750	500	D9M-M1510
	1,000	500	D9M-M2010
	750	750	D9M-M1515
	500	1,500	D9M-M1030
	1,000	750	D9M-M2015
	1,000	1,000	D9M-M2020
	750	1,500	D9M-M1530
	1,000	1,250	D9M-M2025
	1,000	1,500	D9M-M2030

Presence Detection Sensors
D9M

■ Trim

Appearance	Name	Model
	Perimeter Trim (2 m)	D9M-T3210
	Uniting Trim (4 m)	D9M-T3420
	External Corner Trim	D9M-T3012
	Internal Corner Trim	D9M-T3013
	Perimeter Trim with Cable Trunk (3.5 m)	D9M-T3311
	External Corner Trim with Cable Trunk	D9M-T3014
	Internal Corner Trim with Cable Trunk	D9M-T3015

Note: Refer to “Safety Precautions” on page F-11 for details on applications.

■ Controller

Name	Model
Controller	D9M-CD1

■ Maintenance Parts

Name	Model
Fuse	D9M-P1

Specifications

■ Safety Mat

Approved standards	EN1760-1, EN954-1 (Category 1) (See note.), UL508
Min. detection weight	35 kg
Max. permissible load	2,000 N
Max. permissible connected area	100 m ²
Max. number of connected Safety Mats	Unlimited
Max. connection lead length	200 m
Mechanical life	1,000,000 operations
Degree of protection	IP67
Ambient temperature	-10° to 55°C
Ambient humidity	100% max.
Surface material	Vinyl
Surface color	Yellow
Weight (per m ²)	Approx. 24 kg

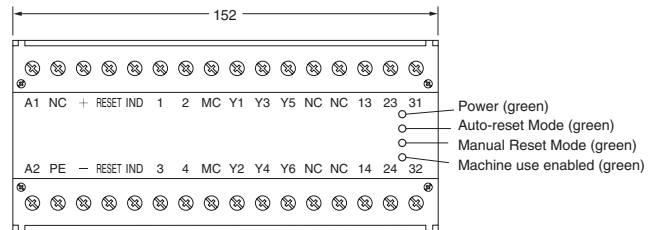
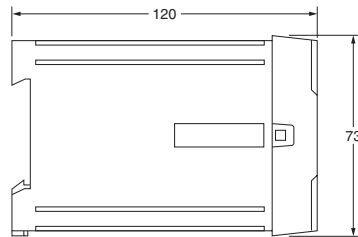
Note: Conforms to EN954-1 (Category 3) when used with the D9M-CD1 Controller.

■ Controller

Approved standards	EN1760-1, EN60204-1, EN954-1 (Category 3), UL508
Response time (from Safety Mat pressure to safety contact opening)	35 ms max.
Contact resistance	100 mΩ max.
Min. permissible load (reference value)	10 V, 10 mA
Supply voltage	110/230 VAC or 24 VAC/24 VDC (+10%/-15%; 100 VAC ±15% also applicable)
Power consumption	AC: 9 VA max.; DC: 6 W max.
Contact form	Main contact: DPST-NO, Sub contact: SPST-NC
Rated load	4 A at 250 VAC, AC15 2 A at 30 VDC, DC13
Max. contact voltage	250 VAC, 30 VDC
Max. contact current	4 A
External reset display	24 VDC/0.24 W
Input for external contactor monitoring	Contact: NC
Input for external reset switch	Contact: NO
Sensor input	4-wire Safety Mat
Operation indicators	LED 1: Power supply input (green) LED 2: Auto-reset (green) LED 3: Manual reset (green) LED 4: Output (green)
Internal control switches	110 VAC/230 VAC selectable, Auto-reset/Manual reset selectable
Internal input protective fuses	Replaceable fuse (D9M-P1): 500 mA, Auto-reset fuse: 500 mA
Vibration resistance	10 to 55 to 10 Hz, 0.15-mm single amplitude
Degree of protection	Terminals: IP20, Case: IP40
Ambient temperature	-10° to 45°C
Ambient humidity	35% to 85%
Case material	Polycarbonate
Installation	35-mm DIN Track
Weight	Approx. 920 g

Dimensions

D9M-CD1 Controller (Unit: mm)



Safety Precautions

Read the Instruction Sheet carefully before installing or using the Safety Mat System.

⚠ WARNING

The Safety Mat System is not suitable for machinery that cannot be quickly stopped by electrical control.

Position the Safety Mat so that the danger zone can only be reached by walking over the Safety Mat.

The Safety Mat System is not suitable for detecting children.

Do not route cables under the Uniting Trim. The Uniting Trim's sensitivity will be reduced and the cables may cause detection failures.

When using the Safety Mat for intrusion detection, refer to the equation below and calculate the minimum safe distance between the point where a person steps on the Safety Mat and the dangerous area.

A person may be injured if the machinery does not stop before that person reaches the dangerous area.

Calculation of the Minimum Safety Distance

The EN999 standards provide the following formula to calculate the minimum safety distance for floor-installed Safety Mats:

$$S = (1,600 \times T) + 1,200 \text{ mm}$$

In this equation, S is the minimum safety distance (unit: mm), the term 1,600 represents a standard approach speed of 1,600 mm/s, T is the overall stop time required for the machinery to stop, and the term 1,200 mm represents the length of a step and the length of an arm.

The overall stop time is comprised of two components:

$$T = t1 + t2$$

t1: Maximum response time from the activation of the detection device to the point that the control device's output goes OFF (35 ms for these Safety Mats).

t2: Response time of the machinery, i.e., the time required to stop the machine or remove the risk after receiving the output signal from the Safety Mat System.

The worst case scenario for the response time of the machinery (t2) must be used in the formula. The actual response time depends on various factors such as the machinery being used, the operating mode, the product being processed, and the point in the control cycle at which the stop signal is received. If there are other factors that may affect the response time, such as brake wear, these factors must be taken into account as well.

Example Calculation

In this example, the Safety Mats are used with machinery that has a measured worst-case response time of 0.485 s.

$$\begin{aligned} T &= t1 + t2 \\ &= 35 \text{ ms} + 485 \text{ ms} \\ &= 520 \text{ ms} = 0.520 \text{ s} \end{aligned}$$

$$\begin{aligned} S &= (1,600 \times 0.520) + 1,200 \text{ mm} \\ &= 832 + 1,200 \text{ mm} = 2,032 \text{ mm} \end{aligned}$$

Consequently, the Safety Mat must be installed at a minimum distance of 2,032 mm from the danger source.

Note: 1. Read the Instruction Sheet included with the Safety Mat System thoroughly for details on designing and installing the Safety Mat System to provide the minimum safety distance mentioned above.

2. The Safety Mat's Perimeter Trim and Corner Trim are not considered part of the Safety Mat's detecting area. Do not include the Perimeter Trim and Corner Trim in the safety distance.

■ Precautions for Safe Use

- Store the Safety Mat in a vertical (standing) condition prior to installing it.
- Turn OFF the power supply before wiring. Also, do not touch any terminals (current-carrying parts) while the power is ON.
- Install the Safety Mat only onto a flat floor surface.
- When moving the Safety Mat, do not use the attached cables to pull or lift it.
- Do not place any kind of cover on top of the Safety Mat.

■ Precautions for Correct Use

Installation

Using Trim Pieces

Perimeter Trim: D9M-T3210/T3310

Secures the edges of the Safety Mats to the floor. The Perimeter Trim is hollow, so cable can be routed through it.

External Corner Trim: D9M-T3012

Used together with the Perimeter Trim (D9M-T3210/T3310) to secure the external corners of the Safety Mats to the floor. The External Corner Trim is hollow, so cable can be routed through it.

Internal Corner Trim: D9M-T3013

Used together with the Perimeter Trim (D9M-T3210/T3310) to secure the internal corners of the Safety Mats to the floor. The Internal Corner Trim is hollow, so cable can be routed through it.

Perimeter Trim with Cable Trunk: D9M-T3311

Secures the edges of the Safety Mats to the floor. It is composed of two parts with a cable trunk for cable wiring and a top cover.

External Corner Trim with Cable Trunk: D9M-T3014

Used together with the Perimeter Trim with Cable Trunk (D9M-T3311) to secure the external corners of the Safety Mats to the floor. It is composed of two parts with a cable trunk for cable wiring and a top cover.

Internal Corner Trim with Cable Trunk: D9M-T3015

Used together with the Perimeter Trim with Cable Trunk (D9M-T3311) to secure the internal corners of the Safety Mats to the floor. It is composed of two parts with a cable trunk for cable wiring and a top cover.

Uniting Trim: D9M-T3420

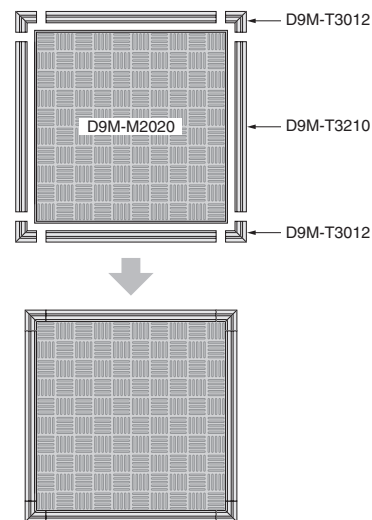
The Uniting Trims join the Safety Mats when two or more Safety Mats are being combined. In addition to joining the Safety Mats, the Uniting Trims preserve the Safety Mat's sensitivity at the joints.

- Note:**
1. The Perimeter Trim or Perimeter Trim with Cable Trunk must be cut to fit the size of the Safety Mats being used. Furthermore, when the Safety Mat's wiring is being routed through the Perimeter Trim and Corner Trim, it will be necessary to cut or notch the Perimeter Trim or a Corner Trim for cable access. Refer to the *Safety Mat Instruction Sheet* for details on cutting or notching the Perimeter Trim and Corner Trim.
 2. The Uniting Trim must be cut to fit the size of the Safety Mats being used.
 3. The Perimeter Trim and Corner Trim must be anchored to the floor to secure the Safety Mats. It is also necessary to drill holes in the Perimeter Trim to anchor it. Refer to the *Safety Mat Instruction Sheet* for details on drilling holes in the Perimeter Trim and Corner Trim and anchoring it to the floor.

Safety Mat Configuration

The Safety Mats are secured by anchoring the Perimeter Trim and Corner Trim to the floor. Before ordering, confirm the number of Perimeter Trim and Corner Trim pieces that will be needed.

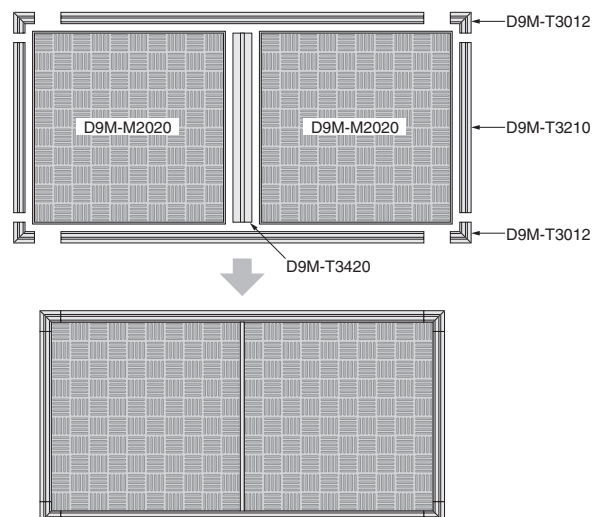
Example 1: Using a Single Safety Mat



In this case, the perimeter of the Safety Mat is about 4 m and the following pieces are required:

- D9M-M2020 Safety Mat: 1 piece
- D9M-T3210 Perimeter Trim (2 m): 2 pieces
- D9M-T3012 External Corner Trim: 4 pieces

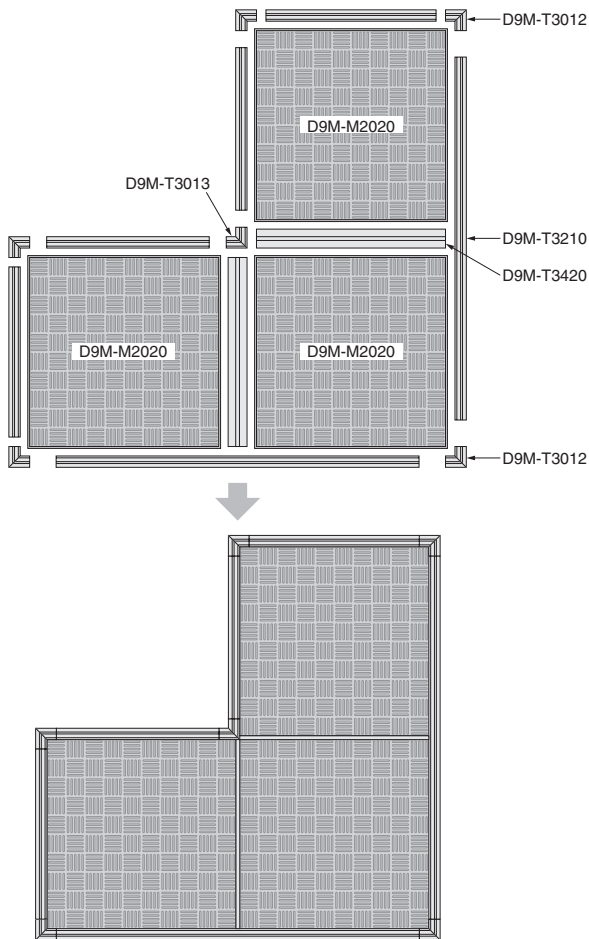
Example 2: Using Two Safety Mats



In this case, the perimeter of the Safety Mat is about 6 m, the joint between the Safety Mats is 1-m long, and the following pieces are required:

- D9M-M2020 Safety Mat: 2 pieces
- D9M-T3210 Perimeter Trim (2 m): 3 pieces
- D9M-T3420 Uniting Trim (4 m): 1 piece
- D9M-T3012 External Corner Trim: 4 pieces

Example 3: Using Three Safety Mats

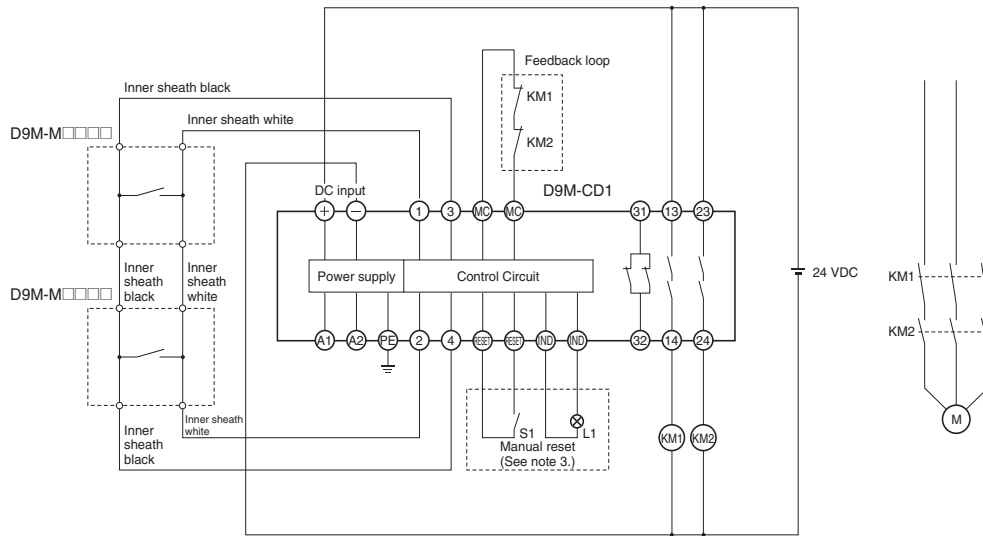


In this case, the perimeter of the Safety Mat is about 8 m, the joints between the Safety Mats are 2-m long, and the following pieces are required:

- D9M-M2020 Safety Mat: 3 pieces
- D9M-T3210 Perimeter Trim (2 m): 4 pieces
- D9M-T3420 Uniting Trim (4 m): 1 piece
- D9M-T3012 External Corner Trim: 5 pieces
- D9M-T3013 Internal Corner Trim: 1 piece

Application Examples

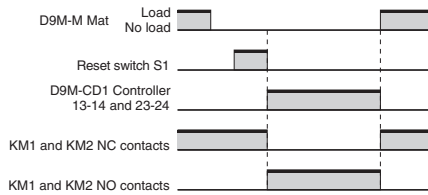
D9M (Intrusion Detection, Presence Detection, Manual Reset)



- S1: Reset Switch
- L1: External Reset Indicator
- KM1, KM2: Magnet Contactors
- M: 3-phase Motor

- Note:**
1. The circuit example shown above conforms to category 3 standards.
 2. Always consider the safety distance when deciding on the dimensions of the Safety Mat. Refer to "Safety Precautions" on page F-11 for the formulae used to calculate the minimum safety distance.
 3. Select Manual Reset Mode with the D9M-CD1's internal Selector Switch.

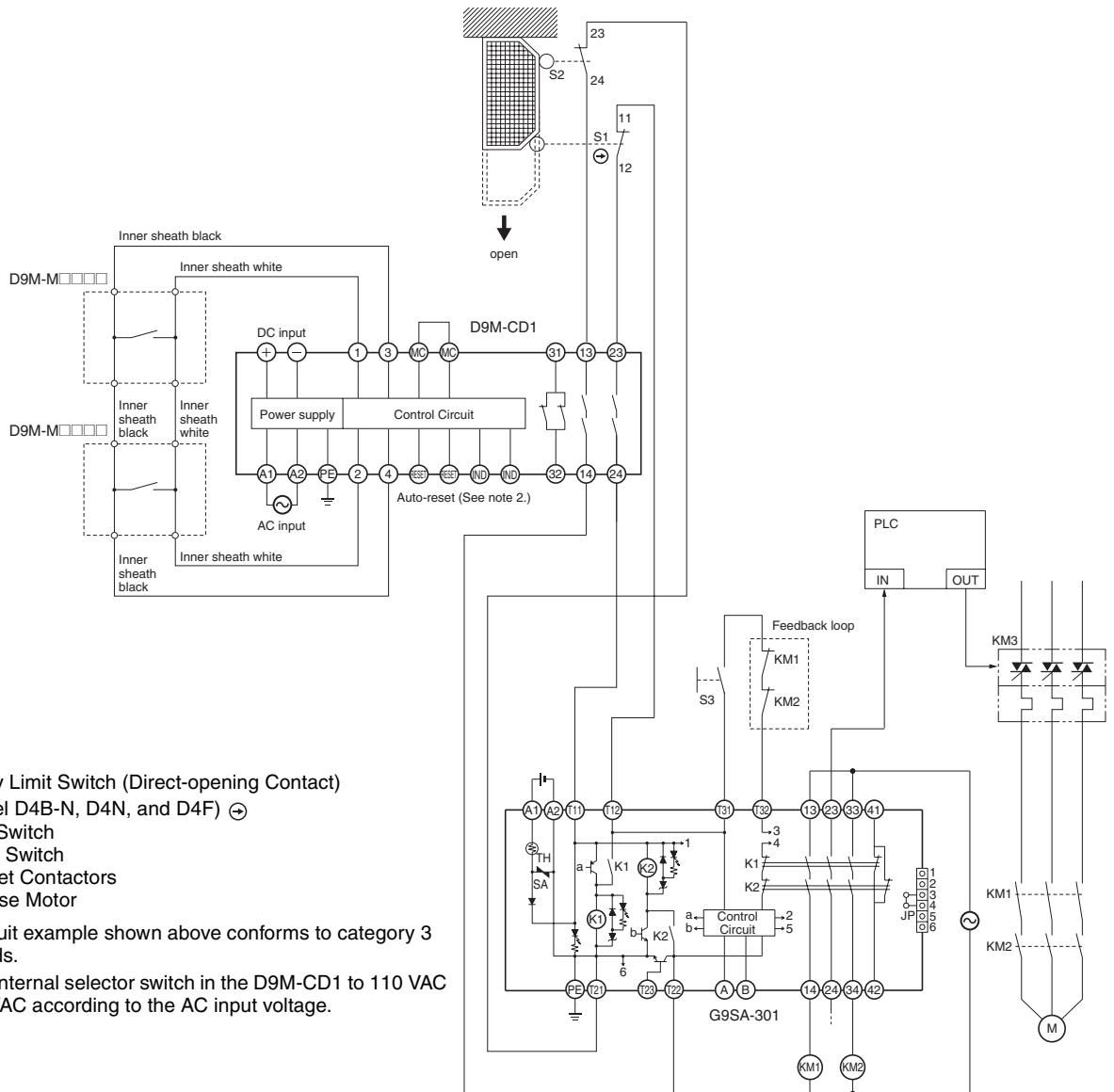
Timing Chart



Presence Detection Sensors

D9M

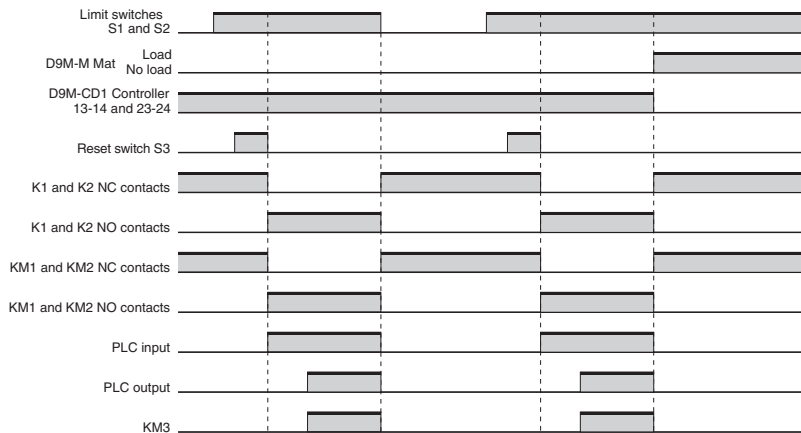
**D4B-N, D4N, and D4F (Open/Closed State Detection)
D9M (Presence Detection)
G9SA-301 (2-channel Input, Manual Reset)**



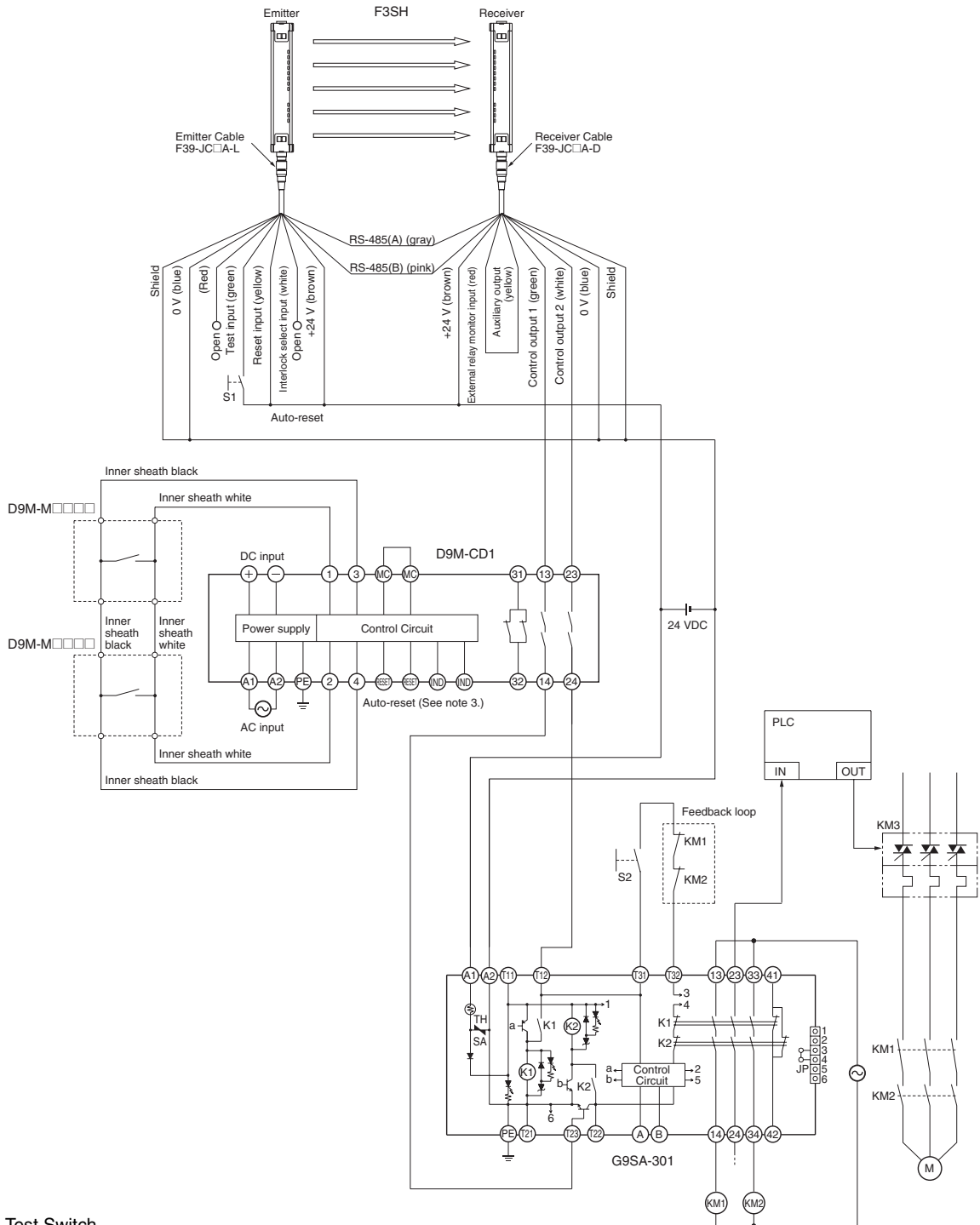
- S1: Safety Limit Switch (Direct-opening Contact) (Model D4B-N, D4N, and D4F) ⊕
- S2: Limit Switch
- S3: Reset Switch
- KM1, KM2: Magnet Contactors
- M: 3-phase Motor

- Note: 1.** The circuit example shown above conforms to category 3 standards.
- 2.** Set the internal selector switch in the D9M-CD1 to 110 VAC or 230 VAC according to the AC input voltage.

Timing Chart



F3SH (Intrusion Detection)
D9M (Presence Detection)
G9SA-301 (2-channel Input, Manual Reset)

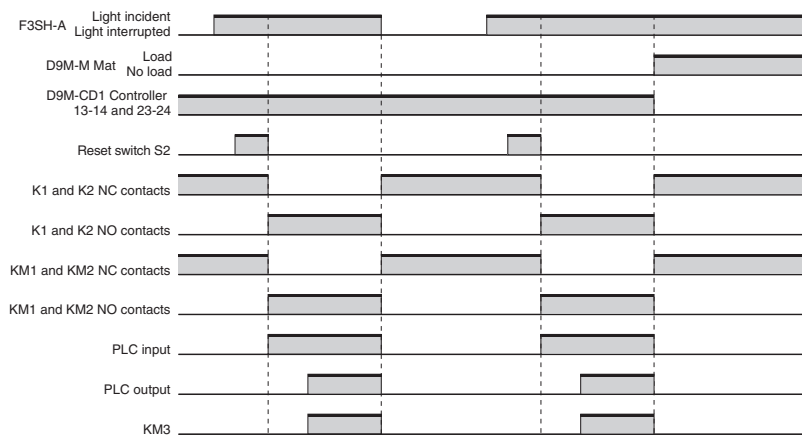


- S1: External Test Switch
- S2: Reset Switch
- KM1, KM2: Magnet Contactors
- KM3: Solid-state Contactor
- M: 3-phase Motor

- Note:**
1. The circuit example shown above conforms to category 3 standards.
 2. Use the safety distance described for the F3SH Safety Light Curtain to determine the Safety Mat size. Refer to page C-36 for information on calculating the safety distance.
 3. Set the internal selector switch in the D9M-CD1 to 110 VAC or 230 VAC according to the AC input voltage.

Presence Detection Sensors D9M

Timing Chart



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
 To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. Z163-E1-02

In the interest of product improvement, specifications are subject to change without notice.

Presence Detection Sensors
D9M