

Panasonic

ideas for life

NEW

Control Category 4 PLe SIL3
SAFETY LIQUID LEAK SENSOR

SQ4 SERIES



Conforming to Machinery & EMC Directive



Certified



Certified by NRTL

Conforming to SEMI-S2



Industry first*

Improved productivity
Two-stage
detection

Industry first*

Compliance with international
safety standards

Safety
certification

*As of October 2010; according to research by Panasonic Electric Works SUNX.

A Safety Liquid Leak Sensor Offering Unparalleled Productivity and Safety

Introducing the SQ4 Series

Featuring a two-stage detection system for improved productivity and reliable safety performance that complies with international standards

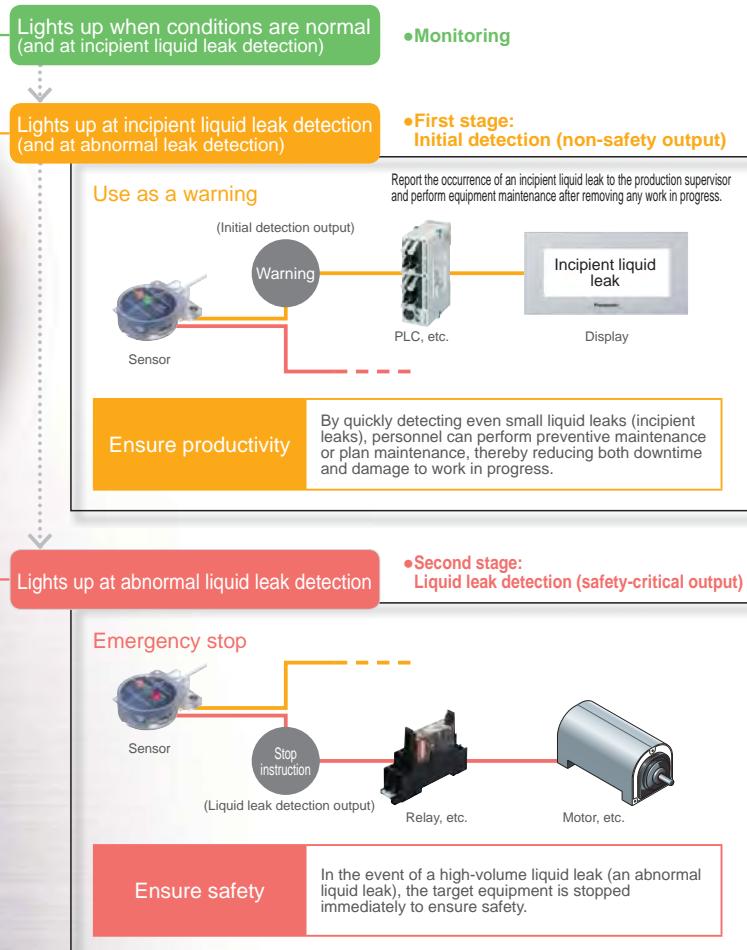


Improved productivity

Two-stage detection

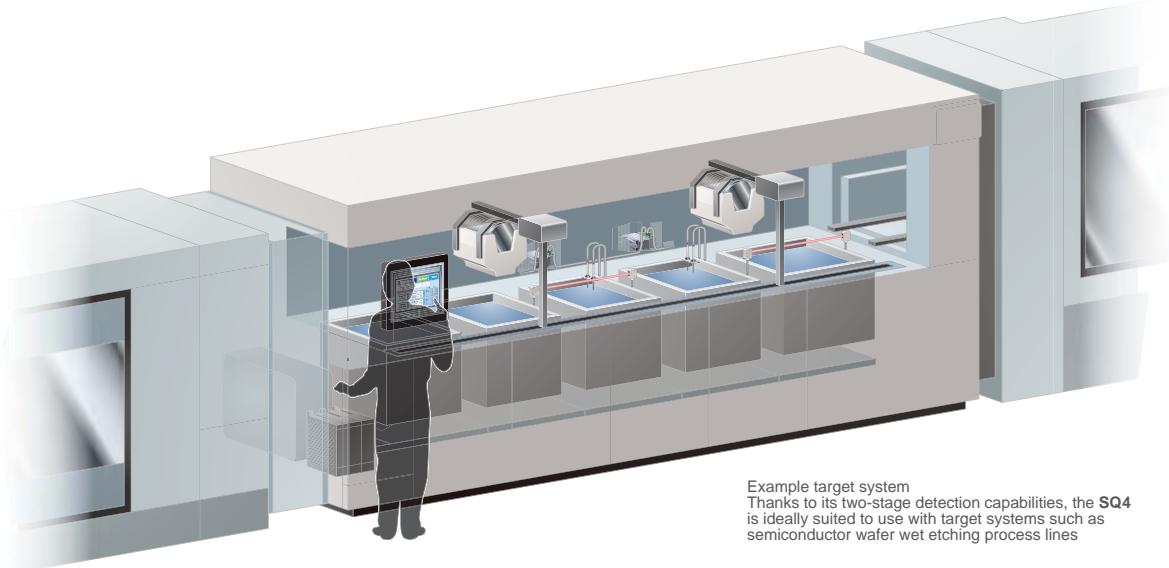
- Simplify preventive maintenance and maintenance planning
- Improve yields
- Reduce damage to work in progress in case of a leak
- Trigger an emergency stop in the event of a malfunction

*As of October 2010; according to research by Panasonic Electric Works SUNX.



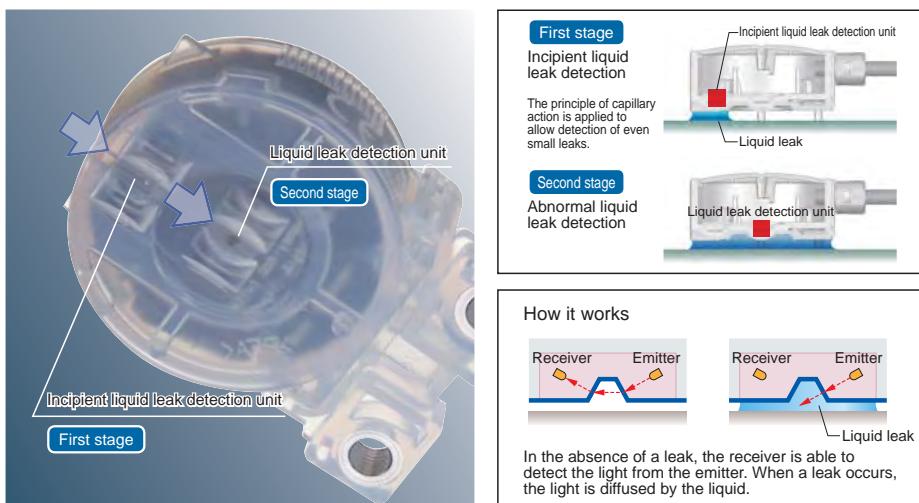
- The SQ4 can also be used alone.

The SQ4 can also be used without a controller, allowing the benefits of two-stage detection to be added to existing equipment by augmenting or replacing existing detection systems.



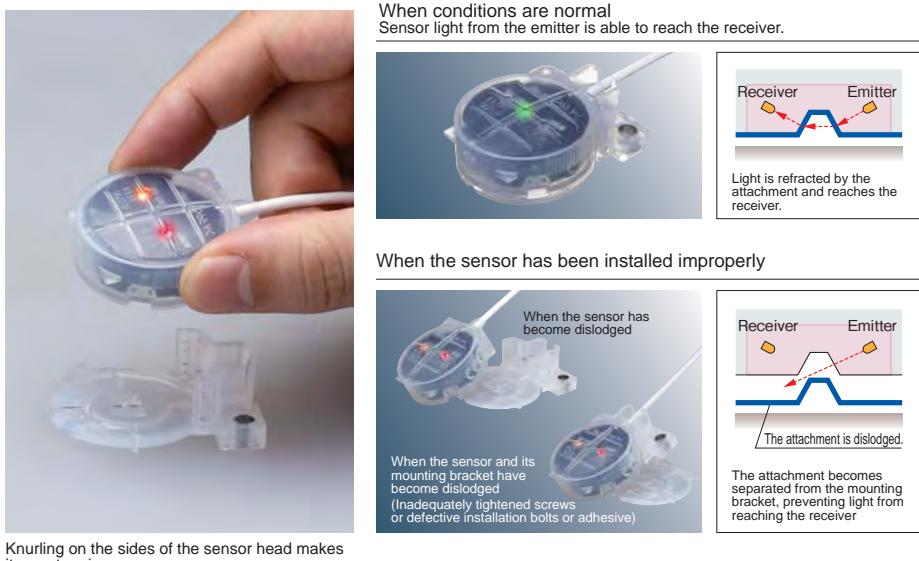
- Two-stage detection addresses both incipient liquid leaks (by generating a warning) and abnormal liquid leaks (by initiating an emergency stop).

On the bottom of the sensor are two detection units, one located at the front and one at the center. If a liquid leak occurs in front of the sensor, the front detection unit will detect even a small incipient leak. When the leak increases in volume and reaches the center of the sensor, it will be detected as an abnormal leak. While previous implementations of two-stage liquid leak detection have relied on two separate sensors installed at different heights, the **SQ4** delivers the same full-featured detection capability in a single sensor unit.



- The **SQ4** can also detect human error (improper installation).

In addition to detecting liquid leaks, the **SQ4** can detect both human error (such as a failure to install the sensor) and sensor malfunctions. If the sensor itself or the sensor and its mounting bracket have become dislodged, have been improperly installed, or are suffering from a broken cable connection, light from the emitter will not reach the receiver, causing the device to generate the same output as if a liquid leak had occurred.



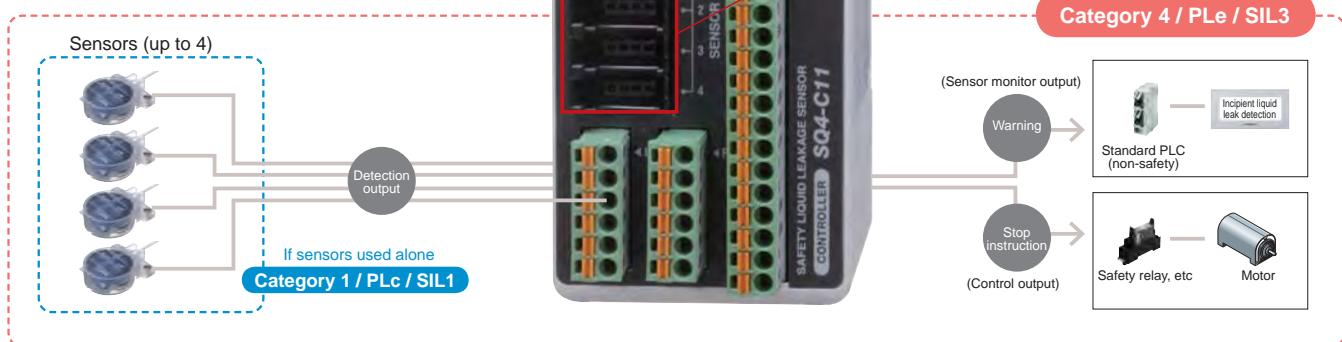
Knurling on the sides of the sensor head makes it easy to grip.

Industry first*

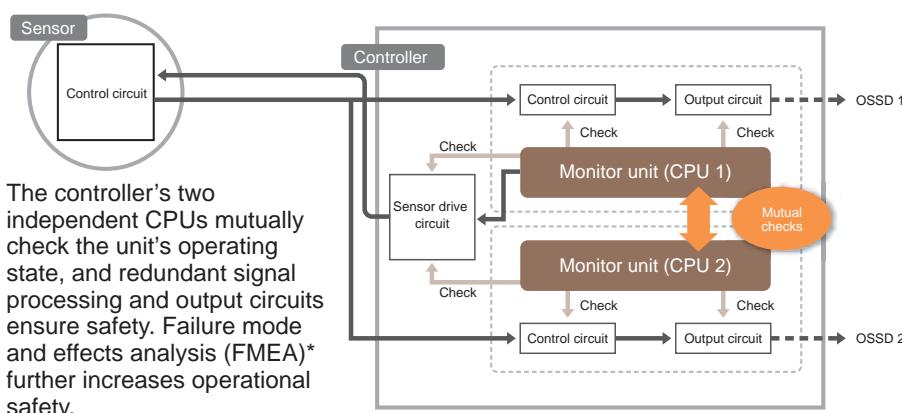
Reliable stop instructions Safety certification

- The **SQ4** is the first device of its kind in the industry* to earn safety certification, demonstrating that it delivers safety performance of the highest caliber.

The **SQ4** system is designed to fulfill safety requirements imposed by international standards. When used in combination, the **SQ4-A** sensor and **SQ4-C11** controller meet category 4 / PLe / SIL3 requirements under ISO 13849-1:2008, which has been updated to add probability criteria to the existing risk evaluation system (in the control category), allowing the functional safety of programmable electronic control systems and related devices to be evaluated. The sensor fulfills category 1 / PLc / SIL1 requirements when used in a standalone configuration.



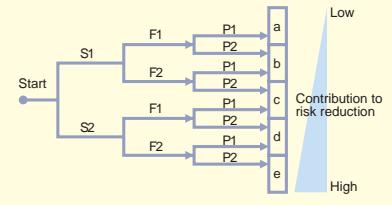
- Dual CPUs deliver an advanced level of safety control.



*FMEA comprises a systematic method for analyzing latent failures and defects so that they can be prevented from manifesting themselves.

ISO 13849-1: 2008

PL (Required performance level)
Performance level (PL) applied in order to achieve the required risk reduction



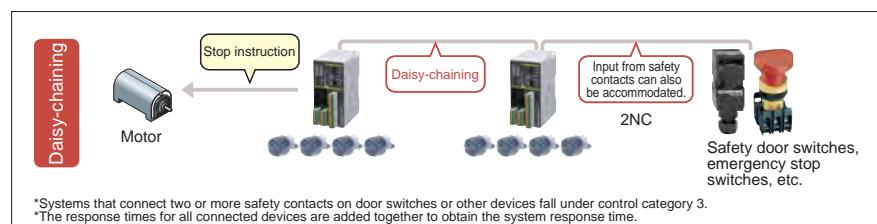
S: Severity of injury
S1: Slight (normally reversible injury)
S2: Serious (normally irreversible injury or death)

F: Frequency and/or exposure to hazard
F1: Seldom to less often and/or the exposure time is short
F2: Frequent to continuous and/or the exposure time is long

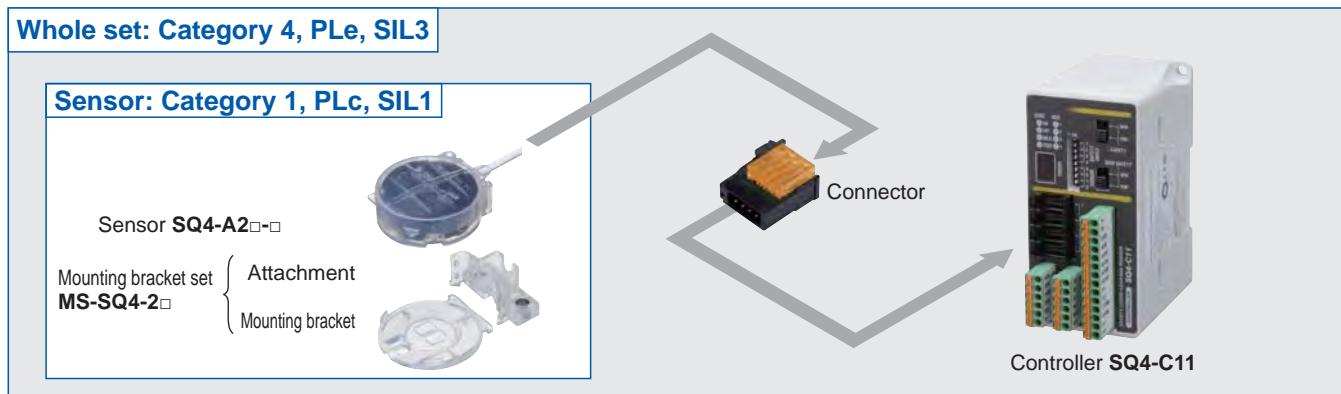
P: Possibility of avoiding hazard or limiting harm
P1: Possible under specific conditions
P2: Scarcely possible

- Reduce wiring and lower costs by daisy-chaining controllers and other safety equipment.

The controller's safety input function can be used to connect wiring used to daisy-chain controllers together as well as input from safety contacts (2NC) on emergency stop switches, safety door switches, and other devices. In this way, safety output can be aggregated onto a single line to reduce safety circuit wiring and lower costs.



■ PRODUCT CONFIGURATION



■ ORDER GUIDE

Sensors

Type	Appearance	Sensing object (Note 1)	Model No.	Output
For standard liquid	 Material: Polypropylene	Water etc.	SQ4-A21-P	PNP open-collector transistor
			SQ4-A21-N	NPN open-collector transistor
For chemical liquid	 Material: PFA	Sulfuric acid, Hydrochloric acid, Phosphoric acid, Ammonia, Fluorinert (Note 2), Galden (Note 2) or Fluorine etc.	SQ4-A22-P	PNP open-collector transistor
			SQ4-A22-N	NPN open-collector transistor

Notes: 1) The agents mentioned above are examples. It may not be detected depending on viscosity the agent. Before using this device, check the detecting liquid and installation condition.
2) Fluorinert™ is the world wide trademark of 3M. Galden is the world wide trademark of Solvay Solexis.

Mounting bracket set

Make sure to purchase the sensor and controller as a set.

Type	Appearance		Sensing object	Model No.
	Attachment	Mounting bracket		
For standard liquid	 Material: Polypropylene	 Material: PVC		MS-SQ4-21
		Water etc.		
For chemical liquid	 Material: PFA	 Material: PVC	Liquids with comparatively high surface tension such as Sulfuric acid, Hydrochloric acid, Phosphoric acid, and Ammonia	MS-SQ4-22
			Liquids with comparatively low surface tension such as Fluorinert (Note), Galden (Note), and Hydrogen fluoride	
			Liquids such as low-concentration hydrogen fluoride	MS-SQ4-23

Note: Fluorinert™ is the world wide trademark of 3M. Galden is the world wide trademark of Solvay Solexis.

Connectors

Make sure to purchase the connector when using the controller.

Designation	Model No.	Description
Hook-up connector (e-CON)	CN-EP2	For SQ4-A21-□ (PVC cable) It is used to connect to the controller. Yellow 5 pcs. per set
	CN-EP3	For SQ4-A22-□ (PFA cable) It is used to connect to the controller. Orange 5 pcs. per set

Hook-up connector

- **CN-EP2** 
- **CN-EP3** 

Controller

Type	Appearance	Model No.	Description
Safety controller		SQ4-C11	Up to 4 safety liquid leak sensors can be connected. Control catagory 4, PLe SIL3

SPECIFICATION

Sensors

Item	Type	For standard liquid	For chemical liquid
	Model No.	PNP output	SQ4-A21-P
Sensing object	Water (Standard liquid) (Note 2)		Sulfuric acid, Hydrochloric acid, Phosphoric acid, Ammonia, Fluorinert (Note 3), Galden (Note 3), Hydrofluoric acid etc. (Note 2)
Supply voltage	12 to 24 V DC ±10 % Ripple P-P 10 % or less		
Current consumption	30 mA or less		
Utilization category	DC-12, DC-13		
Leakage detection output (Abnormal leakage detection, Safety output)	<p><PNP output type> PNP open-collector transistor</p> <ul style="list-style-type: none"> • Maximum source current: 50 mA • Applied voltage: Same as the supply voltage (between detection output and +V) • Residual voltage: 2.5 V or less (at 50 mA source current) 		<p><NPN output type> NPN open-collector transistor</p> <ul style="list-style-type: none"> • Maximum sink current: 50 mA • Applied voltage: Same as the supply voltage (between detection output and 0 V) • Residual voltage: 2 V or less (at 50 mA sink current)
Response time	10 ms or less		
Output operation	ON when initial detection, OFF when detection leakage or wrong installation		
Initial leakage detection output (Initial leakage, Non-safety output)	<p><PNP output type> PNP open-collector transistor</p> <ul style="list-style-type: none"> • Maximum source current: 50 mA • Applied voltage: Same as the supply voltage (between detection auxiliary output and +V) • Residual voltage: 2.5 V or less (at 50 mA source current) 		<p><NPN output type> NPN open-collector transistor</p> <ul style="list-style-type: none"> • Maximum sink current: 50 mA • Applied voltage: Same as the supply voltage (between detection auxiliary output and 0 V) • Residual voltage: 2 V or less (at 50 mA sink current)
Response time	50 ms or less		
Output operation	ON when normal condition, OFF when initial detection or accidental leakage		
Protection	IP65 / IP67 (IEC)		
Ambient temperature / humidity	-10 to +55 °C +14 to +48.2 °F (No dew condensation or icing allowed) (Note 4), Storage: -10 to +55 °C +14 to +48.2 °F / 35 to 85 % RH, Storage: 35 to 85 % RH		
Emitting element	Infrared LED (modulated)		
Material	Enclosure: Polypropylene		Enclosure: PFA
Cable	0.18 mm ² 4-core PVC cabtire cable, 2 m 6.562 ft long		0.1 mm ² 4-core PFA cabtire cable, 2 m 6.562 ft long
Weight	Net weight: 45 g approx., Gross weight: 110 g approx.		

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +20 °C +68 °F.

2) The agents mentioned above are examples. It may not be detected depending on viscosity of the agent.

Before using this device, check the detecting liquid and installation condition.

3) Fluorinert™ is the world wide trademark of 3M. Galden is the world wide trademark of Solvay Solexis.

4) Liquid being detected should be also kept within the rated ambient temperature range.

Controller

Item	Model No.	SQ4-C11
Applicable standards	International standard	ISO 13849-1 (Category 4, PLe), IEC 60947-5-2, IEC 61508-1 to 7 (SIL3), IEC 62061 (SIL3)
	Japan	JIS B 9705-1 (Category 4), JIS C 0508-1 to 7 (SIL3)
	Europe (EU) (Note 2)	EN 60947-5-2, EN 55011 Class A, EN 61000-6-2, EN 50178, EN ISO 13849-1 (Category 4, PLe), EN 61508-1 to 7 (SIL3)
	North America (Note 3)	ANSI/UL 508, CAN/CSA C22.2 No.14
	South Korea	S1-G-1-2009, S2-W-5-2009
	SEMI	Conforming to SEMI-S2-0310a
Power voltage	24 V DC ⁺¹⁰ % ₋₁₅ Ripple P-P 10 % or less	
Consumption current	200 mA or less	
Control output (OSSD 1, OSSD 2)	<p>PNP open-collector transistor / NPN open-collector transistor (switch method)</p> <p><Selecting PNP output></p> <ul style="list-style-type: none"> • Maximum source current: 200 mA • Applied voltage: Same as power voltage (between control output to +V) • Residual voltage: 2.5 V or less (at 200 mA source current) <p><Selecting NPN output></p> <ul style="list-style-type: none"> • Maximum sink current: 200 mA • Applied voltage: Same as power voltage (between control output to 0 V) • Residual voltage: 2.0 V or less (at 200 mA sink current) 	
Response time	20 ms or less (excluding the response time of the sensor)	
Operation mode (Output operation)	ON when initial detection, OFF when detection leakage or wrong installation	
Utilization category	DC-12, DC-13	
Sensor monitor output (AUX1, 2, 3, 4, Non-safety output)	<p>PNP open-collector transistor / NPN open-collector transistor (switch method)</p> <p><Selecting PNP output></p> <ul style="list-style-type: none"> • Maximum source current: 60 mA • Applied voltage: Same as power voltage (between sensor monitor output to +V) • Residual voltage: 2.5 V or less (at 60 mA source current) <p><Selecting NPN output></p> <ul style="list-style-type: none"> • Maximum sink current: 60 mA • Applied voltage: Same as power voltage (between sensor monitor output to 0 V) • Residual voltage: 2.0 V or less (at 60 mA sink current) 	
Response time	100 ms or less (excluding the response time of the sensor)	
Operation mode (Output operation)	ON when normal condition, OFF when initial detection or accidental leakage	
Utilization category	DC-12, DC-13	
Lockout output	OFF for lockout (Rating: Same as sensor monitor output)	
Auxiliary output	Negative logic output of control output 1 / 2 (OSSD 1 / 2) (Rating: Same as sensor monitor output) [Auxiliary output ON when control output 1 / 2 (OSSD 1 / 2) is OFF]	
Functions	Interlock / lockout cancel / Test input / External device monitor / Safety input / Control output polarity selection / Non-safety output polarity selection / Sensor connection number setting	
Protection	IP20 (IEC) (However, it should be in IP54 protection structure of control panel)	
Ambient temperature / humidity	-10 to +55 °C +14 to +48.2 °F (No dew condensation or icing allowed), Storage: -10 to +55 °C +14 to +48.2 °F / 35 to 85 % RH, Storage: 35 to 85 % RH	
PFHd	2.55 × 10 ⁻⁹ (when connecting 4 safety liquid connecting sensors)	
MTTFd	100 years or more	
Material	Main unit case: PC / ABS (alloy)	
Weight	Net weight: 170 g approx., Gross weight: 440 g approx.	

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +20 °C +68 °F.

2) Regarding EU Machinery Directive, a Notified Body, TÜV SÜD, has certified with the type examination certificate.

3) With regards to the standards in the US, under the US regulation 29 CFR 1910.7, TÜV SÜD, a Nationally Recognized Testing Laboratory (NRTL) certified by OSHA, has certified with the safety certificate based on UL / ANSI standards.

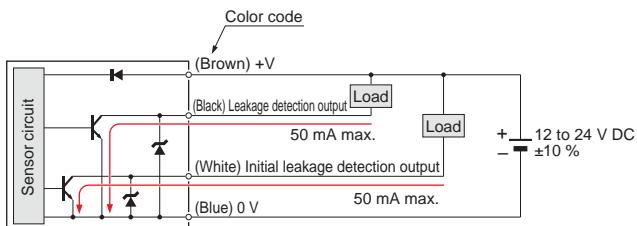
With regards to the standards in Canada, under the safety regulations based on CEC (Canadian Electric Code), TÜV SÜD, a Certification Body accredited by SCC, has certified with the safety certificate based on CSA standards.

I/O CIRCUIT AND WIRING DIAGRAMS

Sensors

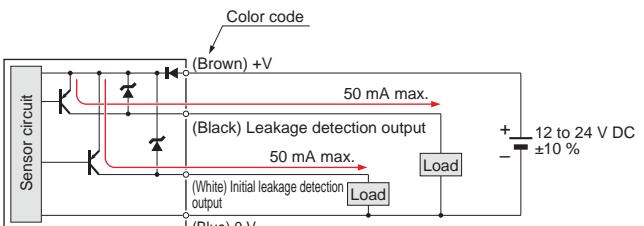
SQ4-A□-N

NPN output type



SQ4-A□-P

PNP output type

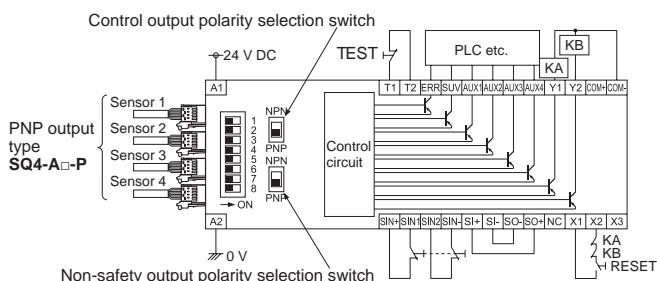


Controller

SQ4-C11

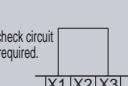
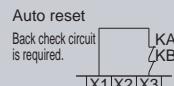
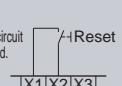
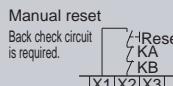
Controller

For operation with PNP output



*RESET

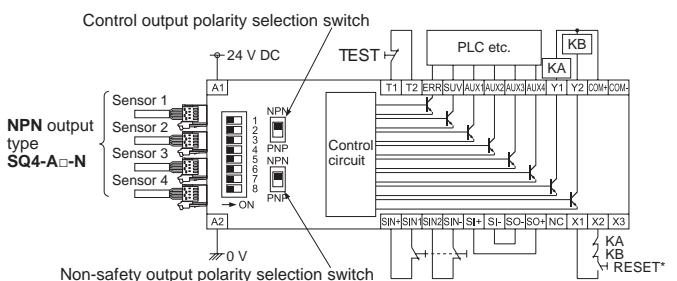
Manual / Auto reset can be selected by the wiring of the reset input terminals (X1, X2, and X3).



KA, KB: External devices

Forced guide relay,
magnet contactor or
monitored valve

For operation with NPN output



PRECAUTIONS FOR PROPER USE



- This product is a sensor for detecting leak of fluids.
- When this product is used with safety devices, construct the system such that the device itself.

- This device has been developed / produced for industrial use only.
- Before using this device, check whether the device performs properly with the functions and capabilities as per the design specifications.
- Avoid using this device in an explosive atmosphere because this product does not have an explosive-proof protective construction.

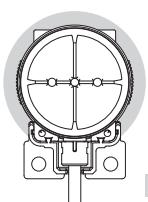
Installation



- There is the detection mount difference by directivity of a liquid leakage. When there are a direction from which a liquid leakage happens, and an inclination, please install the nose-of-cam side (opposite side of a cable) of a sensor towards a top.
- Use the mounting bracket MS-SQ4-□ (optional) which suits the liquid to detect.
- Periodical checking of operation is recommended with the liquids which are not dangerous (water, alcohol, etc.).
- The amount of detection may change with the conditions of the installation surface.
- Be sure to use the mounting bracket MS-SQ4-□ (optional) when installing this device to avoid human error, etc. Reliable detection cannot be guaranteed when this sensor is used alone.

Leakage detection condition and variation factor

- Leak detection part of this product properly detects the leakage in the following condition.
 - Detection range: Area except backward of this product (liquid must enter to the detection range)
 - Material of installation surface: Hard vinyl chloride or Stainless steel
 - Surface condition for installation: Glossy surface (surface roughness: corresponding 0.4 µmRa) and clean surface.
 - Installation surface angle: Horizontal



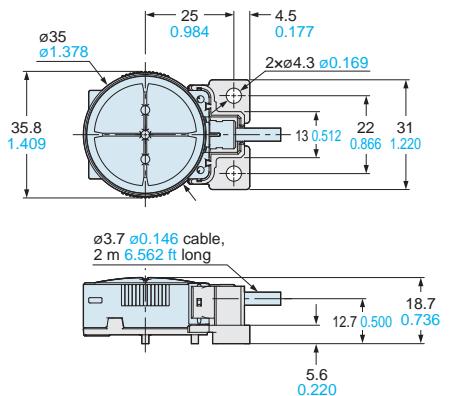
Detection range

- This product may not detect properly liquid in following element.
 - Liquid kind, consistency (surface tension) and air bubble incorporation.
 - Material, roughness, angle, dirtiness and liquid absorption of surface of installed surface of sensor.
 - Wrong selection of dedicated mounting bracket.
- Check the detecting liquid and the installation condition before use.

DIMENSIONS (Unit: mm in)

SQ4-A21-□

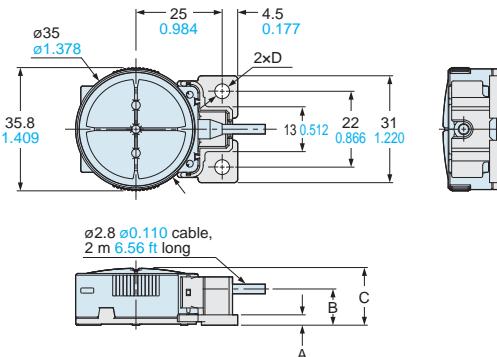
Assembly dimensions with mounting bracket for
MS-SQ4-21



Sensor

SQ4-A22-□

Assembly dimensions with mounting bracket



Sensor

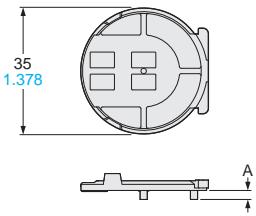
Mounting bracket set model No.	A	B	C	D
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MS-SQ4-22	5.4 0.213	12.7 0.500	18.7 0.736	2xø4.2 ø0.165
MS-SQ4-23	3.4 0.134	10.5 0.413	16.5 0.650	2xø4.3 ø0.169
MS-SQ4-24	5.6 0.220	12.7 0.500	18.7 0.736	2xø4.3 ø0.169

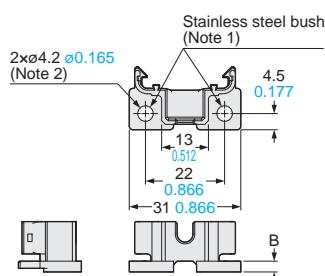
MS-SQ4-□

Mounting bracket set

Attachment



PVC / PFA mounting bracket

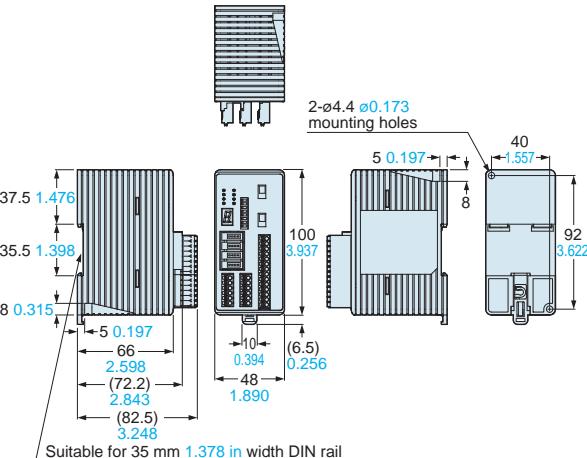


Model No.	A	B
MS-SQ4-21	2.5 0.098	5.6 0.220
MS-SQ4-22	2.5 0.098	5.4 0.213
MS-SQ4-23	0.3 0.012	3.4 0.134
MS-SQ4-24	2.5 0.098	5.6 0.220

Notes: 1) Drawing above is for PFA mounting bracket.
PVC mounting brackets do not incorporate stainless steel
bushes.
2) The size of mounting holes is ø4.3 mm ø0.169 in

SQ4-C11

Controller



Panasonic®