Liquid detection in the semiconductor and FPD manufacturing processes
Sensor Selection by Process and Equipment

Liquid detection and measurement sensors & switches play key roles in a variety of equipment and processes.
## Sensor Selection by Chemical and Application

Liquid detection and measurement sensors & switches for a variety of chemicals and uses

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<th>Liquid Level Detection</th>
<th>Temperature Measurement</th>
<th>Object Detection</th>
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<td>Chemical-resistant fiber-optic sensors Model HPF-T029/HPF-T035/HPF-D014</td>
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<td>Pipe-mounted liquid level switches with built-in amplifier Model HPQ-T1</td>
<td>Chemical temperature sensors Model YYQZ01</td>
<td>Chemical-resistant fiber-optic sensors Model HPF-T029/HPF-T035/HPF-D014</td>
<td>Micro flow rate liquid flow meter Model F7M</td>
</tr>
</tbody>
</table>

### Precautions for Handling

PFA Chemical Resistance

Note: Models for use with a standard SUS (etc.) sheath are also available.
**CLEANING**

- Chemical temperature measurement
- IPA liquid level detection
- IPA liquid leak detection
- Acid/alkali chemical liquid leak detection
- Chemical flow rate measurement

---

**Application**

**IPA liquid level detection**

Pipe-mounted fiber-optic liquid-level sensor

Model HPF-T032E/HPF-T034E

<table>
<thead>
<tr>
<th>Material</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>switch: PFA</td>
</tr>
<tr>
<td>B</td>
<td>Mounting base: PVC</td>
</tr>
</tbody>
</table>

**Acid/alkali chemical liquid leak detection**

Liquid leak switches with built-in amplifier

Model HPQ-D1

Sensor: PFA

Mounting base: PVC

**IPA liquid leak detection**

Liquid leak detection fiber-optic sensors

Model HPF-D040

Sensor: PFA

Mounting base: PVC

**Chemical temperature measurement**

Chemical-resistant temperature sensors

Model YG0201

**Acidic/alkaline chemical flow rate measurement**

Thermal Micro Flow Meter

Micro flow rate liquid flow meter

Model F7M

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**Hazardous location**

Fiber-optic switch Amplifier

**Non-hazardous location**

This micro flow meter has an IP65 protective structure with a surface that is completely metal-free, so it can be used in environments where it is exposed to splashing liquid.

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**Cleaning**

- Single wafer cleaning system
- Batch type cleaning machine
- Etcher

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**Chemical**

- IPA liquid level detection
- IPA liquid leak detection
- Acidic/alkaline chemical liquid leak detection

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**Chemical temperature measurement**

- Chemical-resistant temperature sensors

**Chemical flow rate measurement**

**IPA liquid level detection**

**IPA liquid leak detection**

**Acid/alkali chemical liquid leak detection**

**Liquid leak switches with built-in amplifier**

Model HPQ-D1

Sensor: PFA

Mounting base: PVC

**Chemical temperature measurement**

Chemical-resistant temperature sensors

Model YG0201

**Acidic/alkaline chemical flow rate measurement**

Thermal Micro Flow Meter

Micro flow rate liquid flow meter

Model F7M

---

**Fail-safe detection for upper and lower limits**

Upper limit detection

if liquid present

Upper limit detection

if liquid present

**Quick turnaround after a leak, with no need for absorbent paper**

Easy maintenance

After leak detection, simply wipe the detector surface—a much easier process than with detection tape or a liquid-absorbing model.

**Suitable for liquid leak detection in explosive atmospheres.**

PFA protects the sensor and cable.

**Less element failure by condensation**

Two models with different materials are available.

Temperature measurement ranges

0 to 200°C (FEP) 0 to 250°C (PFA)

**To resist corrosive fluids, liquid-contacting areas are made of fused quartz and fluororesin**

This micro flow meter has an IP65 protective structure with a surface that is completely metal-free, so it can be used in environments where it is exposed to splashing liquid.

---

**Material**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
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<tbody>
<tr>
<td>A</td>
<td>Sensor tube</td>
</tr>
<tr>
<td>B</td>
<td>Fitting</td>
</tr>
</tbody>
</table>

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**Notes**

- RTD element is embedded in Teflon resin to greatly reduce element failure caused by condensation.
- PFA protection for switch and cable PVC bracket is available for acid/alkali detection, and PFA (with some SUS) for organic solvent detection.
Diluent flow rate measurement

Heater surface temperature is constantly controlled so that it stays at a fixed value that is slightly higher than the fluid temperature. Heat dissipation from the heater changes depending on the flow rate. As the flow rate rises, the amount of heat transferred to the fluid increases, and the power consumption of the heater increases. By measuring the heater’s power consumption, the flow rate can be calculated.

- Heat dissipation from the heater is quite small, so it does not heat the fluid.

**Equipment examples**

- CMP
- Chemical supply system
- Diluent flow rate measurement
- Slurry/diluted chemical liquid level detection
- Resist liquid level detection
- Acid/alkaline liquids leak detection
- Acidic/alkaline chemical flow rate measurement

**Slurry/diluted chemical liquid level detection**
Pipe-mounted fiber-optic liquid level sensors Model HPF-T034E

**Resist solution leak detection**
Liquid leak switch with built-in amplifier Model HPQ-D2

**Resist solution level detection**
Pipe-mounted liquid level switches with built-in amplifier Model HPQ-T

**Diluent/cleaning solution flow rate measurement**
Micro flowrate liquid flow meter Model F7M

**Suitable for detection of cloudy liquids such as slurry**
Regardless of whether the target liquid is cloudy or transparent, light refracts in the same way, so there is no reversal of the sensor’s operation. As a result, the same settings can be used for level detection of the slurry and of washing water.

**Secure installation in tight spaces**
Equipped with locking mechanism Secure installation is ensured by using the support lever on the switch.

**Space-saving and gang-mountable**
Indicator and operation selector switch are on the side, so even when switches are gang-mounted, it is easy to make adjustments while viewing the indicator.

**Measurement of 30 ml/min and lower flow rates**
This flowmeter employs a thermal measurement principle and MEMS sensing technology, making it possible to measure micro flow rates (30 ml/min and less), which is difficult to accomplish with conventional measurement methods.

**Note:** Remember that the support lever requires space to move up and down.
HEAT TREATMENT

Application

- Chillers
- Scrubbers
- VMBs

Detection of chiller circulation fluid level
Pipe-mounted liquid level switches with built-in amplifier
Model HPQ-T

Circulation fluid level

Circulation fluid leak detection

Leak detection for chiller circulation fluid
Liquid leak switches with built-in amplifier
Model HPQ-DP11
HPQ-DP12
Switch: PP
Mounting base: PP

Detection of scrubber liquid level in tank
Tank-inserted fiber-optic sensors
Model HPF-D027
HPF-D033

Detection of scrubbing liquid leak

Scrubbing liquid temperature measurement

Temperature measurement for scrubber liquid
Chemical-resistant temperature sensors
Model YYQZ01

Easy liquid level detection without tuning
Refractive detection ensures sufficient gain between light-ON and dark-ON light levels. This switch is also suitable for liquids with poor light transmission (such as resist liquid and waste fluids).

Operation panel located on the side
With the indicator and operation selector switch located on the side, even when switches are gang-mounted, it is easy to make adjustments while checking the indicators.

Accurate detection regardless of liquid conductivity
The switch detects liquid leaks optically, so it does not rely on liquid conductivity.
Accessories for indirect detection of liquid leaks, such as liquid-absorbing paper, are unnecessary.

Easy maintenance
After leak detection, simply wipe the detector surface—a much easier process than with detection tape or a liquid-absorbing model.

Detection of tank liquid level for scrubbers — all-resin structure means no chance of metallic contamination
No metal is used in Model HPF-D027 or HPF-D033, even on the inside, thanks to PFA tube structure.

4 mm dia. model for easy routing
Model HPF-D033’s PFA tube has a space-saving outer diameter of 4 mm. Its structure also facilitates routing.

Stray drop protection for reliable detection
The sensor shape is designed so that drops accumulate at the tip, reducing malfunctions.

Less element failure by condensation
Two models with different materials are available.
Temperature measurement ranges
0 to 200˚C (FEP) 0 to 250˚C (PFA)

RTD element is embedded in Teflon resin to greatly reduce element failure caused by condensation.
### Liquid leak detectors with built-in amplifier

**Model HPQ-D1_/HPQ-D2_/HPQ-D3_/HPQ-D2_**

**Optical type**

- **Built-in amplifier, no absorbent paper required, usable with various liquids.**

**Acids or alkaline liquids, IPA (isopropyl) alcohol, pure water, Fluorinert, Galden, etc.**

**Notes:**
- For explosion-proof applications, be sure to select a suitable fiber type.
- Fluorinert and Galden are registered trademarks of 3M and Solvay Solexis respectively.
- Solvay Solexis respectively.
- For product details, contact one of our sales representatives or our Abbott dealer.
- For Model HPQ-D11/12/21 models, a switch with 5m cable (2m PFA tube) is also available.

**PFA protection for switch and cable**

- PVC bracket is available for acid/alkali detection,
- PFA protection for switch and cable
- PFA (SUS) bracket (10 units)

**Easy maintenance**

- After leak detection, simply wipe the detector surface—a much easier process than with detection tape or a liquid-absorbing model.

**Operation indicator**

- Switch status can be checked from the body side.
- Normal status (green LED lit)
- Liquid leakage (red LED lit)

**Suitable for export equipment**

- CE marking, UL certified
- Wide variety of output modes and types are available.
- Normally open type: no UL certification.
- Normally open type: no UL certification.

**Acid resistance**

- 50% IPA to 100% HNO₃ (without freezing)

**Shock resistance**

- 3,000 g/s²

**IP67**

- The cable exits the detector through a PFA tube fused to the case. Therefore, liquid cannot enter the detector.

**PFA protection**

- Floating mechanism attached

---

**DETECTION PRINCIPLE**

*This switch is not explosion-proof. Do not use it where the use of an explosion-proof product is specified.*

**Notes:**
- For Model HPQ-D11/12/21 models, a switch with a 5m cable (2m PFA tube) is also available.
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---

**SPECIFICATIONS**

**Catalog**

<table>
<thead>
<tr>
<th>Detection method &amp; shape</th>
<th>Operation mode</th>
<th>Output mode</th>
<th>Catalog listing</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC</td>
<td>NC</td>
<td>Open collector NPN</td>
<td>HPQ-D11</td>
</tr>
<tr>
<td>NO</td>
<td>Closed collector NPN</td>
<td>HPQ-D12</td>
<td></td>
</tr>
<tr>
<td>PFA</td>
<td>NC</td>
<td>Open collector NPN</td>
<td>HPQ-D21</td>
</tr>
<tr>
<td>NO</td>
<td>Closed collector NPN</td>
<td>HPQ-D22</td>
<td></td>
</tr>
</tbody>
</table>

**Detection method**

- Built-in reverse connection protection, malfunction prevention at power ON (approx. 20 ms), output short-circuit protection

**Protection circuits**

- Built-in reverse connection protection, malfunction prevention at power ON (approx. 20 ms), output short-circuit protection

**External dimensions**

**External dimensions**

<table>
<thead>
<tr>
<th>Model HPQ-D1_</th>
<th>Model HPQ-D2_</th>
</tr>
</thead>
<tbody>
<tr>
<td>External dim.</td>
<td>External dim.</td>
</tr>
<tr>
<td>200x28x44</td>
<td>200x28x44</td>
</tr>
</tbody>
</table>

**Output circuit diagram**

**Liquid Leak Detection**

**WHG**

- CE marking, UL certified
- Wide variety of output modes and types are available.
- Normally open type: no UL certification.
- Normally open type: no UL certification.

**Acid resistance**

- 50% IPA to 100% HNO₃ (without freezing)

**Shock resistance**

- 3,000 g/s²

**Operation indicator**

- Switch status can be checked from the body side.
- Normal status (green LED lit)
- Liquid leakage (red LED lit)

---

**Acids or alkaline liquids, IPA (isopropyl) alcohol, pure water, Fluorinert, Galden, etc.**

**Notes:**
- For explosion-proof applications, be sure to select a suitable fiber type.
- Fluorinert and Galden are registered trademarks of 3M and Solvay Solexis respectively.
- Solvay Solexis respectively.
- For product details, contact one of our sales representatives or our Abbott dealer.
- For Model HPQ-D11/12/21 models, a switch with 5m cable (2m PFA tube) is also available.

**PFA protection for switch and cable**

- PVC bracket is available for acid/alkali detection,
- PFA protection for switch and cable
- PFA (SUS) bracket (10 units)

**Easy maintenance**

- After leak detection, simply wipe the detector surface—a much easier process than with detection tape or a liquid-absorbing model.

**Operation indicator**

- Switch status can be checked from the body side.
- Normal status (green LED lit)
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- Wide variety of output modes and types are available.
- Normally open type: no UL certification.
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**Shock resistance**

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**IP67**

- The cable exits the detector through a PFA tube fused to the case. Therefore, liquid cannot enter the detector.

**PFA protection**

- Floating mechanism attached

---

**DETECTION PRINCIPLE**

*This switch is not explosion-proof. Do not use it where the use of an explosion-proof product is specified.*

**Notes:**
- For Model HPQ-D11/12/21 models, a switch with a 5m cable (2m PFA tube) is also available.
- Normally open type: no certification.
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**Operation indicator**

- Switch status can be checked from the body side.
- Normal status (green LED lit)
- Liquid leakage (red LED lit)
Liquid leak detectors with built-in amplifier

Model HPQ-DP11/HPQ-DP12

Built-in amplifier, no absorbent paper required, usable with various liquids.

For pure water, industrial water, Fluorinert, Galden, etc.

Notes: For explosion-proof applications, be sure to select a suitable fiber type. Fluorinert™ is a registered trademark of 3M and Galden™ is a registered trademark of Solvay Solexis.

Optical method detects liquid leakage directly

Detection is possible immediately after installation even without sensitivity adjustment. Accessories used in indirect detection of leaks, such as absorbent paper, are unnecessary. Detection performance does not depend on the conductivity of the target liquid.

Fast and easy maintenance

After leak detection, simply wipe off the detector’s surface—a much easier process than with detection tape or a liquid-absorbing model.

DETECTION PRINCIPLE

Normal: no liquid (light received)
Abnormal: leak (light blocked)

For explosion-proof applications, be sure to select a suitable fiber type. Fluorinert™ is a registered trademark of 3M and Galden™ is a registered trademark of Solvay Solexis.

Optical method detects liquid leakage directly

Detection is possible immediately after installation even without sensitivity adjustment. Accessories used in indirect detection of leaks, such as absorbent paper, are unnecessary. Detection performance does not depend on the conductivity of the target liquid.

Fast and easy maintenance

After leak detection, simply wipe off the detector’s surface—a much easier process than with detection tape or a liquid-absorbing model.
Liquid leak detection fiber-optic sensors

Model HPF-D040

Inherently safe product. PFA protects sensor and cable. Saves space.

PFA protects sensor and cable.

Usable in an atmosphere with organic solvents such as IPA.

Notes: SUS is partially used on the mounting bracket.

Saves space

Sensor head has a height of only 9.9 mm.

DETECTION PRINCIPLE

When a leak is detected, no light reaches the receiver. Since the same is true in a fiber cable break or disconnection, operation is fail-safe. Install in the pan with a stud.

CATALOG LISTING

Diffuse scan

<table>
<thead>
<tr>
<th>Shape (mm)</th>
<th>Bend radius</th>
<th>Cable Length</th>
<th>Catalog listing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round</td>
<td>R20</td>
<td>5m</td>
<td>HPF-D040</td>
</tr>
</tbody>
</table>

SPECIFICATIONS

<table>
<thead>
<tr>
<th>Catalog listing</th>
<th>HPF-D040</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td></td>
</tr>
<tr>
<td>Detection method</td>
<td>Reflective (contact type)</td>
</tr>
<tr>
<td>Compatible amplifier (Model No.)</td>
<td>HPX-EG</td>
</tr>
<tr>
<td>Standard target liquid</td>
<td>IPA (isopropyl alcohol)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>−30 to +70 °C</td>
</tr>
<tr>
<td>Material</td>
<td>Sensor: PFA. Cable: polyethylene (PFA coated). Bracket: PFA (and SUS)</td>
</tr>
</tbody>
</table>

Note: Use of sensor in explosive atmosphere

The fiber unit can be used in a hazardous location by installing the amplifier unit in a non-hazardous location. However, before using the fiber optic sensor, carefully check the explosive proof regulations for the facility and equipment.

EXTERNAL DIMENSIONS

Unit: mm

Model HPF-D040

- Installation base (main unit)
- Installation base (bushing SUS)
- 2.3 dia. PFA covering
- 30.9 x 19.1 x 20 x 24 x 9.9
- Hole 3.3
**Tank-inserted fiber-optic sensors**

**Model HPF-D027/HPF-D033**

All-resin structure ensures no metal contamination.

- 4mm diameter allows easy running of cables.
- Reliable detection by preventing liquid cling!

Reliable detection by preventing liquid cling!

Proprietary tip structure prevents liquid from clinging to the tip, eliminating a cause of faulty operation.

**Detection Principle**

The principle uses the difference in the reflective index due to the presence of liquid.

- No liquid (light received)
- Liquid present (no light received)
- Other companies' models

**Detected liquid type:**

- Water
- Other liquids

**CATALOG LISTING**

<table>
<thead>
<tr>
<th>Type</th>
<th>Shape</th>
<th>Cable Length</th>
<th>Catalog Listing</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 dia</td>
<td>4 dia</td>
<td>2m</td>
<td>HPF-D027</td>
</tr>
<tr>
<td>6 dia</td>
<td>6 dia</td>
<td>2m</td>
<td>HPF-D033</td>
</tr>
</tbody>
</table>

**SPECIFICATIONS**

- **Model HPF-D027**
  - Resin head: Heat shrunk fluorine-resin (PFA) tube, dia. 4 dia.
  - Pressure resistance: -49 to 490 kPa
  - Operating temperature: -30 to +105 °C
  - Material: Polyethylene (PFA coated)

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**Recommended compatible amplifier unit**

Model HPX-EG

Auto sensitivity switch function

This function automatically optimizes the sensitivity setting during auto tuning, affording easy operation while delivering the highest detection performance.

**Detection method**

- Reflection type (Model HPF)
- Transmission type (Model HPX)

**Detection accuracy (Model HPF)**

1 mm or less (for water)

**Detection accuracy (Model HPX)**

Liquid*

**Material:**

Polyethylene (PFA coated)

**Notes:**

- In some cases of saturation, it may not be possible to adjust the setting.
- If the saturation point is reached for incoming light when no liquid is present, change the setting type.

*Depending on the color and viscosity of the liquid, detection may not be possible.

**Liquid Level Detection**

- Suitable for various applications:
  - Liquid Leak Detection
  - Temperature Measurement
  - Object Detection
  - Flow Rate Measurement

**Cleaning**

- CMP
- Heat Treatment

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**Liquid Level Detection Products**

All-resin structure ensures no metal contamination.

**Tank-inserted fiber-optic sensors**

Model HPF-D027/HPF-D033

Reliable detection by preventing liquid cling!

Proprietary tip structure prevents liquid from clinging to the tip, eliminating a cause of faulty operation.

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**Detection accuracy (Model HPX)**

Liquid*

**Material:**

Polyethylene (PFA coated)

**Notes:**

- In some cases of saturation, it may not be possible to adjust the setting.
- If the saturation point is reached for incoming light when no liquid is present, change the setting type.

*Depending on the color and viscosity of the liquid, detection may not be possible.
Pipe-mounted fiber-optic liquid level sensors

Model HPF-T032/HPF-T032E
HPF-T034/HPF-T034E

Fail-safe detection of tank upper and lower liquid level limits

- An array of 16 optical axes eliminates the effects of air bubbles and water droplets
- PFA-jacketed fiber
- Fits a wide range of pipe diameters.
- Location of the optical axes is clearly marked.

Array of 16 optical axes eliminates the effects of air bubbles and water droplets
Adverse effects from air bubbles and water droplets are reduced, resulting in reliable detection.

Fits a variety of pipe diameters.
Designed for pipes 3 to 19 mm in dia.

Position of optical axes is marked
Position of the optical axis array is easily visible.

PFA-jacketed optical fiber
Fiber-optic cables protected by chemical-resistant resin can be run through machines and equipment safely (Model HPF-T032 and T032E only).

Array of 16 optical axes eliminates

DETECTION PRINCIPLE

When used with Model HPX-EG amplifier
Easy setup is done without the process liquid.

Setting the sensitivity
When used with model HPX-EG amplifier
Tuning does not require liquid.

Fail-safe detection for upper and lower limits
Required optical system
Light circuit closed when no liquid.

Light circuit closed when no liquid
Required optical system

Setting the sensitivity
When used with model HPX-EG amplifier
Easy setup is done without the process liquid.

Setting the sensitivity
When used with model HPX-EG amplifier
Easy setup is done without the process liquid.

Catalog listing
Thru scan (Attached to pipe)

<table>
<thead>
<tr>
<th>Type</th>
<th>Compatible pipe dia.</th>
<th>Shape</th>
<th>Cable dia.</th>
<th>Cable length</th>
<th>Catalog listing</th>
</tr>
</thead>
<tbody>
<tr>
<td>LP 2</td>
<td>3 to 13 mm dia.</td>
<td>3 to 13 mm dia.</td>
<td>2×2.2 mm dia.</td>
<td>5 m</td>
<td>HPF-T032</td>
</tr>
<tr>
<td>LP 2</td>
<td>8 to 19 mm dia.</td>
<td>8 to 19 mm dia.</td>
<td>2×2.3 mm dia.</td>
<td>5 m</td>
<td>HPF-T034</td>
</tr>
</tbody>
</table>

*1 Use with PFA-Jacketed pipe with wall thickness of 1 mm.
*2 Depending on the pipe used, as well as the liquid through scan and refractive ratios, fiber unit detection may not be reliable, so be sure to test the operation before use.
*3 If the fiber unit is used with other than the recommended pipe, material, or wall thickness, please test before use or consult our sales staff.

EXTERNAL DIMENSIONS

Unit: mm

Model HPF-T032/HPF-T032E/HPF-T032E-L02
Model HPF-T034/HPF-T034E/HPF-T034E-L02
Pipe-mounted liquid level switches with built-in amplifier

Model HPQ-T1_/HPQ-T2_

Just by mounting the switch on a pipe, the surface of the liquid can be easily detected.

- Reliable detection
- Operation panel is located on the side.
- Fits various pipe diameters
- The same model can be used for upper or lower limit detection.

Reliable detection
Refraction-based detection ensures sufficient gain between light-ON and dark-ON light levels. This switch is also suitable for liquids with poor light transmission (such as photoresist liquid and waste fluids).

Fits various pipe diameters
Switches fit on pipes with diameters of 1/16 inch, 3 to 7 mm, and 8 to 13 mm. They can be mounted using a cable tie or M3 screw.

Same model handles upper or lower limit detection
Note: For pipe diameters of 8 mm or less, please contact us, switches with adjustable sensitivity are also available.

Fits various pipe diameters
- The same model can be used for upper or lower limit detection.

Operation panel on the side
Indicator and operation selector switch are located on the side. Even when switches are gang-mounted, they can be adjusted individually.

Same model handles upper or lower limit detection
Note: For pipe diameters of 8 mm or less, please contact us, switches with adjustable sensitivity are also available.

Optical axis position
Note: The slit width is 1 mm, and therefore repetitive detection is possible at an accuracy of that width or less. This varies depending on the condition of the liquid.

Example of fail-safe setup

Example of recommended settings

CATALOG LISTINGS

<table>
<thead>
<tr>
<th>Detection method, shape</th>
<th>Bracket</th>
<th>Sensitivity adjustment</th>
<th>Output mode</th>
<th>Catalog listing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thru-scan</td>
<td>HPQ-T1</td>
<td>-</td>
<td>Open collector PNP transistor</td>
<td>HPQ-T1</td>
</tr>
<tr>
<td>HPQ-T1-002</td>
<td>-</td>
<td>-</td>
<td>Open collector NPN transistor</td>
<td>HPQ-T2</td>
</tr>
<tr>
<td>HPQ-T1-003</td>
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<td>Open collector NPN transistor</td>
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<tr>
<td>HPQ-T1-004</td>
<td>-</td>
<td>-</td>
<td>Open collector PNP transistor</td>
<td>HPQ-T2</td>
</tr>
<tr>
<td>HPQ-T2</td>
<td>-</td>
<td>-</td>
<td>Open collector NPN transistor</td>
<td>HPQ-T2-005</td>
</tr>
</tbody>
</table>

Model HPQ-T1/T2 models are also available with a 5 m cable. For models that fit 1/16 inch diameter pipes, please contact a sales representative.

SPECSIFICATIONS

- Applicability
- Pipe diameter: 1/16 inch, 3 to 7 mm, 8 to 13 mm.
- Switches fit on pipes with diameters of 1/16 inch, 3 to 7 mm, and 8 to 13 mm.
- Operation panel on the side
- Fits various pipe diameters
- Reliability detection
- The same model can be used for upper or lower limit detection.

EXTERNAL DIMENSIONS

Model HPQ-T

OUTPUT CIRCUIT DIAGRAM

Model HPQ-T1

Model HPQ-T2

Model HPQ-T1

Model HPQ-T2
Ideal for temperature control in wet process treatment tanks and piping!

Two models with different temperature ranges of 0 to 200 °C (FEP) and 0 to 250 °C (PFA) are available.

**RTD element is embedded in Teflon resin to greatly reduce element failure caused by condensation.**

<table>
<thead>
<tr>
<th>Protection tube</th>
<th>Material</th>
<th>Length</th>
<th>3-wire method</th>
<th>Temperature measurement range</th>
<th>Rated current</th>
<th>Tolerance</th>
<th>Terminal size</th>
<th>Casing listing</th>
</tr>
</thead>
<tbody>
<tr>
<td>inner dia.</td>
<td>FEP</td>
<td>200mm</td>
<td></td>
<td>0 to 200 °C</td>
<td>1mA</td>
<td>Class B</td>
<td>M3.5</td>
<td>YYQZ01BF420010B0</td>
</tr>
<tr>
<td>inner dia.</td>
<td>PFA</td>
<td>200mm</td>
<td></td>
<td>0 to 250 °C</td>
<td>1mA</td>
<td>Class B</td>
<td>M3.5</td>
<td>YYQZ01BP420010B0</td>
</tr>
<tr>
<td>outer dia.</td>
<td>FEP</td>
<td>6mm</td>
<td></td>
<td>0 to 250 °C</td>
<td>1mA</td>
<td>Class B</td>
<td>M3.5</td>
<td>YYQZ01BF620010B0</td>
</tr>
<tr>
<td>outer dia.</td>
<td>PFA</td>
<td>6mm</td>
<td></td>
<td>0 to 250 °C</td>
<td>1mA</td>
<td>Class B</td>
<td>M3.5</td>
<td>YYQZ01BP620010B0</td>
</tr>
</tbody>
</table>

**EXTERNAL DIMENSIONS**

- **4 mm dia. type**
  - Material: oxygen-free copper (with electroplated tin)
  - Length: 200mm
  - Core (mm): 0.1
  - Scanning distance (mm): 1000
  - Catalog listing: YYQZ01B

- **6 mm dia. type**
  - Material: oxygen-free copper (with electroplated tin)
  - Length: 200mm
  - Core (mm): 0.1
  - Scanning distance (mm): 1000
  - Catalog listing: YYQZ01 SHP

**SPECIFICATIONS**

- **Thru scan**
  - Type: E7 mm dia.
  - Size: 200mm
  - Shape: Top/Side
  - Cable: 2-wire method
  - Amp: 1mA
  - Distance: 1300mm
  - Core: 1.0
  - Catalog listing: HPF-T029

- **Diffuse scan**
  - Type: E7 mm dia.
  - Size: 200mm
  - Shape: Top/Side
  - Cable: 2-wire method
  - Amp: 1mA
  - Distance: 1300mm
  - Core: 1.0
  - Catalog listing: HPF-T035

**CUSTOMIZING SERVICE**

We offer customized cables with protection tube lengths of 100 to 1000 mm and lead lengths of 1 to 10 m. Please contact a sales representative for details.
Micro flow rate liquid flow meter

Model F7M

Thermal micro flow rate liquid flow meter, achieving high-functionality measurement and usability

Features & Merits of the F7M

Combining a thermal MEMS sensor that is commonly used for gas flow meters and a flow path that is made of highly corrosion-resistant fused quartz glass, the product can measure both instantaneous and total-flow values of micro flow rates under 30 mL/min, which is difficult to do with a high degree of reproducibility using traditional measurement methods. Compared with conventional methods, the measurement method used by this new product is less susceptible to changes in the fluid state (e.g., bubbles, pulsations, and fluid temperature) (although it may be necessary to change the settings parameters), and micro flow rates can be measured easily. Measuring the flow rates allows for more reliable data management by replacing alternative measures, such as managing the pump rotation speed, measuring the weight, and managing the fluid supply time. In addition, with the event function it is possible to detect empty pipes and the presence of bubbles, and to monitor the status of pulsation.

Measures 30 mL/min or lower

Features the thermal measurement principle using MEMS sensing technology. Measuring micro flow rates under 30 mL/min, which traditionally has been difficult, is now possible. (Measurement range: 0.1 to 10 mL/min, 0.3 to 30 mL/min)

Flexible installation and wide range of fluids

- Compliant with IP65 protection rating.
- Exterior contains no metal, providing improved resistance to corrosion fluids, allowing use in environments with liquid spray.
- Can be used for a variety of fluids, so long as they do not corrode fused quartz glass (the material of the flow path) or fluororesin (the material of the fitting), allowing use in environments with liquid spray.
- The sensor does not come into contact with any fluids.

Detected Fluids

Water, liquid A, liquid B

Straight flow path

The straight flow channel means pressure loss is lower and cleaning is easier, with no puddles of liquid.

Compact, light-weight, and easy to install

- This model is more compact and lighter than its predecessors.
- By using the included mounting bracket, it can be easily installed on a surface (for horizontal pipe connection).
- It can also be installed for vertical pipe connection.
- A separate converter (amplifier) is not required.

Specifications

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Model F7M</th>
<th>F7M9520</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction accuracy</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
</tr>
<tr>
<td>Measurable flow range (for water (H2O))</td>
<td>0.1 to 10 mL/min</td>
<td>0.3 to 30 mL/min</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
</tr>
<tr>
<td>Measurement range</td>
<td>0.2 to 10 mL/min</td>
<td>0.6 to 30 mL/min</td>
</tr>
<tr>
<td>Measurable flow range (for water (H2O))</td>
<td>0.2 to 10 mL/min</td>
<td>0.6 to 30 mL/min</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
</tr>
<tr>
<td>Measurement range</td>
<td>0.6 to 30 mL/min</td>
<td>2.0 to 60 mL/min</td>
</tr>
<tr>
<td>Measurable flow range (for water (H2O))</td>
<td>0.6 to 30 mL/min</td>
<td>2.0 to 60 mL/min</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
</tr>
<tr>
<td>Measurement range</td>
<td>2.0 to 60 mL/min</td>
<td>8.0 to 150 mL/min</td>
</tr>
<tr>
<td>Measurable flow range (for water (H2O))</td>
<td>2.0 to 60 mL/min</td>
<td>8.0 to 150 mL/min</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
</tr>
<tr>
<td>Measurement range</td>
<td>8.0 to 150 mL/min</td>
<td>30.0 to 600 mL/min</td>
</tr>
<tr>
<td>Measurable flow range (for water (H2O))</td>
<td>8.0 to 150 mL/min</td>
<td>30.0 to 600 mL/min</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
</tr>
<tr>
<td>Measurement range</td>
<td>30.0 to 600 mL/min</td>
<td>100.0 to 1500 mL/min</td>
</tr>
<tr>
<td>Measurable flow range (for water (H2O))</td>
<td>30.0 to 600 mL/min</td>
<td>100.0 to 1500 mL/min</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
</tr>
<tr>
<td>Measurement range</td>
<td>100.0 to 1500 mL/min</td>
<td>300.0 to 4500 mL/min</td>
</tr>
<tr>
<td>Measurable flow range (for water (H2O))</td>
<td>100.0 to 1500 mL/min</td>
<td>300.0 to 4500 mL/min</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
</tr>
<tr>
<td>Measurement range</td>
<td>300.0 to 4500 mL/min</td>
<td>600.0 to 7500 mL/min</td>
</tr>
<tr>
<td>Measurable flow range (for water (H2O))</td>
<td>300.0 to 4500 mL/min</td>
<td>600.0 to 7500 mL/min</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
</tr>
<tr>
<td>Measurement range</td>
<td>600.0 to 7500 mL/min</td>
<td>1200.0 to 15000 mL/min</td>
</tr>
<tr>
<td>Measurable flow range (for water (H2O))</td>
<td>600.0 to 7500 mL/min</td>
<td>1200.0 to 15000 mL/min</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
</tr>
<tr>
<td>Measurement range</td>
<td>1200.0 to 15000 mL/min</td>
<td>3000.0 to 37500 mL/min</td>
</tr>
<tr>
<td>Measurable flow range (for water (H2O))</td>
<td>1200.0 to 15000 mL/min</td>
<td>3000.0 to 37500 mL/min</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
<td>±0.5 % rdg. (at 20 % or more of the flow rate range)</td>
</tr>
</tbody>
</table>

External contact input

- Non-voltage contacts or open collector
- Maximum output voltage: 5.6 V
- Maximum output current: 5 mA
- Maximum output resistance: 100 kΩ min.
- External load resistance: 250 kΩ min.
- Allowable ON residual voltage: 0.8 V max.
- Allowable OFF resistance: 100 kΩ min.
- Allowable OFF residual voltage: 0.8 V max.
- Off terminal current: 0.5 mA before contact resistance (250Ω)

External contact output

- Non-voltage contacts or open collector
- Maximum output voltage: 5 V max.
- Maximum output current: 5.6 mA
- Maximum output resistance: 100 kΩ min.
- External load resistance: 250 kΩ min.
- Allowable ON residual voltage: 0.8 V max.
- Allowable OFF residual voltage: 0.8 V max.
- Allowable OFF resistance: 100 kΩ min.
- Allowable OFF residual voltage: 0.8 V max.
- Off terminal current: 0.5 mA before contact resistance (250Ω)

Environmental specifications

- Ambient temperature range (operation-guaranteed range): 0 to 50 °C
- Humidity range: 10 to 90 % RH (without condensation)
- Height: 63 mm
- Width: 26 mm
- Length: 122 mm

<table>
<thead>
<tr>
<th>EXTERNAL DIMENSIONS</th>
<th>Unit mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>63</td>
</tr>
<tr>
<td>Width</td>
<td>26</td>
</tr>
<tr>
<td>Length</td>
<td>122</td>
</tr>
</tbody>
</table>

For detailed specifications, refer to the user’s manual (CP-SP-1421E).
PRECAUTIONS FOR HANDLING (Installation)

**Model HPF-T032/T034**

**Mounting method**

- The switch should be mounted to a metal plate using the included cable ties and anti-slip tubes. Fixing tightly the two upper and lower cable ties and then pull off the rubber band ensures the switch is firmly mounted. When for additional cable ties or rubber bands are required, use one or more than 2.0 mm diameter wire. Recommended wire materials are SUS, PTFE, Type 316, Type 304. For the internal parts, use our HPF-T032/T034 in this instruction.

- **Model HPQ-D1_/HPQ-D2_**

**Installation**

- **Mounting method**

  - **Removing the switch from the mounting base**
  
  - Push the switch until the detector through the holes, and secure the switch with two M4 nuts. For a PFA mounting base, insert in the same manner but with a single M3 stud bolt.

  - **Mounting with adhesive**
  
  - This PVA type bracket can also be adhesive mounted. If the switch is mounted to a metallic object, it is the same mat after the mounting base, we recommend a monomer-based adhesive. However, regardless of the type of surface material, be sure to check the specifications of the adhesive to make sure that it is appropriate. *For use in explosion-proof environment, since this product is not explosion-proof type, it cannot be used as an explosion-proof environment.*

- **Model HPQ-DP**

**Mounting method**

- **Installing the mounting base**

  - Use two M4 screws or stud bolts to fix the mounting base so that it does not wobble. The recommended tightening torque is 0.5 N·m or less. For details, refer to the instruction manual.

**Model HPF-T029/HPF-T035/HPF-D014**

**Mounting method**

- **Installing the fiber-optic switch**

  - Use a commercially available flaxmade wire joint that matches the outside diameter of the PFA tube.

**Model HPF-D027/HPF-D033**

**Mounting method**

- **Installing the fiber-optic sensor**

  - When installing the fiber-optic sensor, use a commercially available flaxmade wire joint that matches the outside diameter of the PFA tube.

**Characteristics of Sensing Distance by Combination with Fiber Extender (typical values)**

**PFA Chemical Proof**

<table>
<thead>
<tr>
<th>Product name</th>
<th>Code</th>
<th>Substances</th>
<th>OK</th>
<th>Substance PFA chemical proof</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Acrylonitrile</td>
<td></td>
<td>C2H3CN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Barium chloride</td>
<td></td>
<td>BaCl2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Calcium chloride</td>
<td></td>
<td>CaCl2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chlorine</td>
<td></td>
<td>Cl2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chloroform</td>
<td></td>
<td>CH3Cl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cyclohexane</td>
<td></td>
<td>C6H12</td>
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<tr>
<td></td>
<td></td>
<td>Benzene</td>
<td></td>
<td>C6H6</td>
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<tr>
<td></td>
<td></td>
<td>Glycerin</td>
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<td>C3H8(OH)2</td>
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<tr>
<td></td>
<td></td>
<td>Hydrofluoric acid</td>
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<td>Hydrochloric acid</td>
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<td>HCl</td>
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<td></td>
<td></td>
<td>Hydrogen fluoride</td>
<td></td>
<td>HF</td>
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<tr>
<td></td>
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<td>Isopropyl alcohol</td>
<td></td>
<td>CH3(OH)2</td>
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<td>Isopropyl methyl ketone</td>
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<td>CH3(OH)CH3</td>
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<td>Isobutyl methyl ketone</td>
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<td>C3H7(OH)2</td>
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<td>Methanol</td>
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<td>Methanol (anhydride)</td>
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<td>C2H5OH</td>
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<tr>
<td></td>
<td></td>
<td>Nitric acid</td>
<td></td>
<td>HNO3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sodium chloride</td>
<td></td>
<td>NaCl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sodium dichromate</td>
<td></td>
<td>Na2Cr2O7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sodium hydroxide</td>
<td></td>
<td>NaOH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sodium carbonate</td>
<td></td>
<td>Na2CO3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sodium nitrate</td>
<td></td>
<td>NaNO3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sulfuric acid</td>
<td></td>
<td>H2SO4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thallium</td>
<td></td>
<td>Tl</td>
</tr>
</tbody>
</table>

Additional Notes:

- Use above tables to list that the product can be used with the indicated substances. *Substances such as strong acids and ammonia may penetrate PFA (Fluororin).*
GLOBAL STANDARDS AND APPROVALS

International standards, including safety standards, are established by two international organizations: the IEC for electricity and the ISO for other fields.

1. IEC (International Electrotechnical Commission)

The IEC is an international organization that was founded in October 1906 following discussions that began at the International Electrical Congress in 1881. It has its headquarters in Geneva, Switzerland, and works with the ISO and other international organizations to coordinate the preparation of international standards in fields other than electricity. The ISO also works with the IEC in developing international standards, with the total amount of work being handled by the two organizations. The IEC and the ISO have developed an inter-communication system called the BSI (British Standards Institution) for the unified standardization of products. The organization issues standards for the latest electrical technologies based on discussions between representatives of participating countries, which have signed an international agreement to develop national standards based on the IEC standards.

2. ISO (International Organization For Standardization)

The ISO started activities in 1947 and has its headquarters in Geneva, Switzerland. The organization works for standardization in fields other than the electrical field and has about 90 participating countries. Japan has joined the ISO since 1952. The ISO 9000 quality management system family of standards and ISO 14000 (environmental management system) family of standards are well known in Japan.

UL standards (region: United States of America)

1. About UL standards

In the United States, since states and local governments have the right to make safety regulations, some safety regulations are locally adopted, as in the case of the principal cities such as New York, Los Angeles, Chicago, and San Francisco. However, in some cases, although all approval is required not only locally but also at the state and federal level, manufacturers generally pursue UL certification only in order to verify product safety to individual state or local government authorities. Additionally, in recent years, due to increased standardization with the Canadian Standards Association (CSA), there is a movement to harmonize UL and CSA standards.

2. About UL

UL (Underwriters Laboratories Inc.) is a private nonprofit organization that promotes public safety by protecting human life and property from fire and other risks. Its standards and approvals include testing, studying, inspection, and certification. UL was organized as a result of fires that occurred at that time, using lighters. In 1894, fire occurred frequently in major cities, and their cause was almost always new outdoor or electrical devices that were used without having been tested. The accidents were a cause of concern in the insurance business, and a dedicated investigative group was organized, followed by the Underwriters Electric Bureau, a nonprofit organization and the predecessor of UL, in 1894. This became Underwriters Laboratories Inc. in 1901. Since then its function has expanded to areas other than electricity.

UL stands for the Factory Mutual Insurance Company. It is a private insurance company founded in 1895 to provide insurance for factories and commercial facilities. In addition to insurance services, it provides risk management services for factories and commercial facilities, developing business not only in North America but also in South America, Europe, the Middle East, Asia, and the African region.

An affiliated company, FM Approvals, is a third-party certification body that offers certification and testing services for products for industrial and commercial property loss prevention. It grants FM Approvals to products that have been tested to comply with the requirements of FM standards.

FM standards (region: United States of America)

3. CSA mark

This mark is used for independently functioning final products that are to be shipped to Canada. It certifies that the products have been tested by UL based on Canada’s CSA standards.

UL listing mark

This mark is used for independently functioning final products that are to be shipped to Canada. It certifies that the products have been tested by UL based on Canada’s CSA standards.

S-mark

This new listing mark was introduced in 1996 to certify that products comply with the safety requirements of both Canada and the U.S.

Recognized component mark for shipment to Canada

This mark is used for parts/materials (components) for shipment to the Canadian market. It certifies that the products have been verified by UL to satisfy safety's safety requirements.

Recognized component mark for shipment to the U.S. and Canada

This mark is used for parts/materials (components) that comply with the safety requirements of both Canada and the U.S.

FM standards (region: United States of America)

3. CSA mark

This mark certifies that the product has been verified by the CSA to satisfy Canadian standards for a product for the Canadian market.

CSA mark for use in Canada and the U.S.

This mark certifies that the product has been verified by the CSA to satisfy both Canadian standards and U.S. standards as a product for the Canadian market.

S-mark (region: Korea)

1. About the S-mark

The S-mark is a voluntary certification system established in November 1987 by the Korean Occupational Safety and Health Agency (KOSHA) to reduce accidents and injuries. It is also closely related to CE marking (Europe), which is a mandatory conformity assessment procedure established by the EU and all EU member states. The KOSHA issues the S-mark certification for products conforming to the Korean standards, which differ from the EU standards. The S-mark was established with the aim of promoting the health and safety of workers and to encourage employers to take accident prevention measures.

Radio Waves Act (KC mark) (region: Korea)

KC mark (Korean certification mark)

S-mark (region: Korea)

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Radio Waves Act (KC mark) (region: Korea)

KC mark (Korean certification mark)

Products such as computers, peripherals, and communication equipment require the KC mark under the Electrical Appliance Safety Control Act. The Radio Waves Act defines the procedures for testing and communication equipment. The EMC (electromagnetic compatibility) testing becomes mandatory for radio equipment on July 1, 2011, and safety testing becomes mandatory for radio equipment and all information processing equipment on January 1, 2012.

WHG certificate (region: Germany and part of Benelux)

WHG (Wasserwirtschaftsrecht) Act, a German law that provides the legal basis for the protection of surface water and ground water. WHG prescribes water protection for sources of water pollution. The product is also approved by the German Institutes for Building Research (Deutsches Institut für Bautechnik) according to WHG regulations.

1. GB standards (region: China)

Following China's accession to the World Trade Organization (WTO) in 2001, a new safety certification system was established by the Certification and Accreditation Administration of the People's Republic of China. The product's safety standards became unified and consistent in commodities requiring certification, in standards, technical regulations, testing procedures, certification marking, and certification fees.

This new system is called China Compulsory Certification (CCC). Whether a product is subject to CCC is determined by the GB Standards (Guojia Fahuan, or Chinese National Standards) and by the product’s HS code (Harmonized Commodity Description and Coding System).

About GB standards

The Chinese National Standards (GB Standards) are based on IEC Standards. The range of items subject to CCC was announced by the CNCA on July 1, 2002, categorized by HS codes, commodity descriptions and comments, and caráter, with each product having an HS code that is not among those subject to CCC does not need a CCC mark. Even if the HS code is on the list, the product might not be subject to the GB Standards. Therefore, obtaining CCC marking is required only if both the HS code and GB standards are applicable.

About GB standards

In order to make the best use of the advantages obtained by European unification, the European Union (EU) Commission modified the safety regulations of the member states to produce unified regulations by product category, such as machinery, tools, and medical devices. This was done in the European Communities Directives (EC Directives) officially announced in 1993. Documents such as the Machine Directive, EMC Directive, (regulations on the compatibility of electromagnetic waves generated by electrical products), Low Voltage Directive, and Medical Device Directive were issued. At the same time, the system of grouping CE marking by product category began. * The CE Directives must directly refer to the EC product standards and the Low Voltage Directive and the EMC Directive. The Machinery Directive is also relevant indirectly.

About EN standards

EC directives such as those mentioned above are laws that must be observed. However, they contain only basic requirements written in general terms, making it difficult in concrete understanding. Therefore, many manufacturers now design products based on what are known as EN standards. In parallel with unifying the regulations (EC directives) in the EU area, the industrial standards and safety standards of each country are also being unified. This unification of standards is being carried out by two methods: the CE marking (EC mark) and the European Committee for Standardization (CEN).*

Unlike the national standards of each country, which are mutually recognized within the EU, mutual recognition of national standards is not allowed in this case. The CE marking is used as a substitute for the national certification and approval of each country, and is abbreviated as the CE mark. The CE marking must be affixed to products to indicate conformity with the CE marking system.

* The CE Directives must directly refer to the EC product standards and the Low Voltage Directive and the EMC Directive. The Machinery Directive is also relevant indirectly.

About VDE

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