

# SA1Q Stainless Analog Laser Sensor

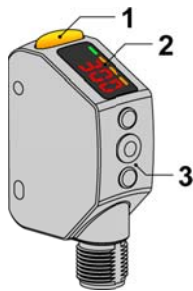
## Quick Start Guide

### Class 1 laser CMOS sensor with an analog output.

This guide is designed to help you set up and install the SA1Q Sensor. For complete information on programming, performance, troubleshooting, dimensions, and accessories, please refer to the Instruction Manual. Use of this document assumes familiarity with pertinent industry standards and practices.

	<p><b>WARNING: Not To Be Used for Personnel Protection</b>  <b>Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death.</b>          This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.</p>
--	--

## Features



1. Output indicator (Amber)
2. Display
3. Buttons

Figure1. Sensor Features

## Display and Indicators

The display is a 4-digit, 7-segment LED. The main screen is the Run mode screen, which shows the current distance to the target in millimeters\*<sup>1</sup>. (\*1. The display may differ from the actual distance due to operating environment, target and aging. The distance data is a reference value.)



1. Stability indicator (STB; Green)
2. Active TEACH indicators
  - 2-PT : Two-Point TEACH (Amber)
  - 1-PT : Two-Point TEACH (Amber)
3. Display Value indicator (MM; Amber)

Figure2. Display in Run Mode

### Output Indicator

- On : Displayed distance is within the taught analog output window
- Off : Displayed distance is outside of the taught analog output window

### Active TEACH Indicators (2-PT and 1-PT)

- 2-PT on : Two-point TEACH mode selected (default)
- 1-PT on : One-point TEACH mode selected

### Stability Indicator (STB)

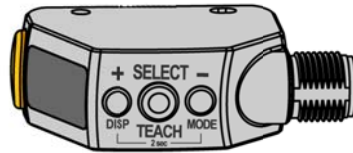
- On : Stable signal within the specified sensing range
- Flashing : Marginal signal, the target is outside the limits of the specified sensing range, or a multiple peak condition exists
- Off : No target detected within the specified sensing range

**Display Value Indicator (MM)**

- On : Display shows the distance in millimeters (default)
- Off : Display shows the analog output value

**Buttons**

Use the sensor buttons **[SELECT/TEACH]**, **[+/DISP]**, and **[-/MODE]** to program the sensor.

**[SELECT/TEACH]**

- Press to select menu items in Setup mode
- Press and hold for longer than 2 seconds to start the currently selected TEACH mode (the default is two-point TEACH)

**[-/MODE]**

- Press to navigate the sensor menu in Setup mode
- Press to change the distance setting for the 0 V (4 mA ) point; press and hold to decrease numeric values
- Press and hold for longer than 2 seconds to enter Setup mode

**[+/DISP]**

- Press to navigate the sensor menu in Setup mode
- Press to change the distance setting for the 10 V (20 mA) point; press and hold to increase numeric values
- Press and hold for longer than 2 seconds to toggle the display value between the distance and the analog output



**Note:** When navigating the menu, the menu items loop.

**Laser Description and Safety Information**

**CAUTION:** Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. Do not attempt to disassemble this sensor for repair. A defective unit must be returned to the manufacturer.

**Class 1 Lasers**

Class 1 lasers are lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

COMPLIES WITH 21 CFR 1040.10 AND 1040.11  
EXCEPT FOR DEVIATIONS PURSUANT TO  
LASER NOTICE No. 50, DATED JUNE 24, 2007.  
IDEC CORPORATION  
2-6-64, Nishimiyahara, Yodogawa-ku,  
Osaka 532-0004, Japan

CLASS 1  
LASER PRODUCT

COMPLIES WITH IEC 60825-1:2007

**Laser wavelength:** 655 nm


**Output:** < 0.20 mW

**Pulse Duration:** 7  $\mu$ s to 2 ms

**Installation**

### Install the Safety Label

The safety label must be installed on SA1Q sensors that are used in the United States.

	<b>Note:</b> Position the label on the cable in a location that has minimal chemical exposure.
---	--

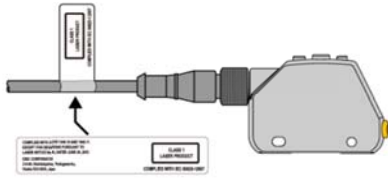


Figure 3. Safety Label Installation

1. Remove the protective cover from the adhesive on the label.
2. Wrap the label around the SA1Q cable, as shown.
3. Press the two halves of the label together.

### Sensor Orientation

Optimize detection reliability and minimum object separation performance with correct sensor-to-target orientation. To ensure reliable detection, orient the sensor as shown in relation to the target to be detected.

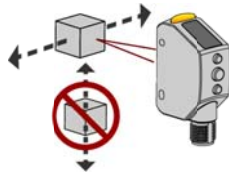


Figure 4. Optimal Orientation of Target to Sensor

See the following figures for examples of correct and incorrect sensor-to-target orientation as certain placements may pose problems for sensing some targets.

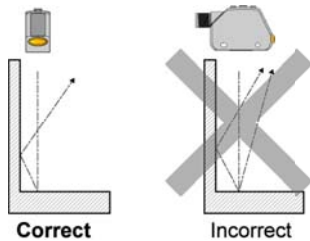


Figure 5. Orientation by a wall

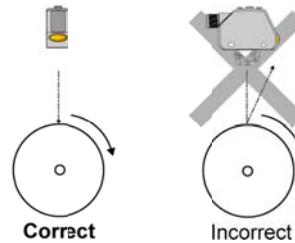


Figure 6. Orientation for a turning object

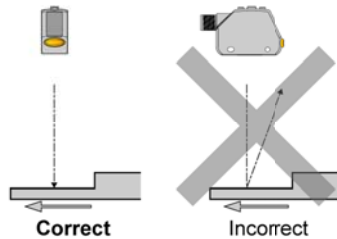


Figure 7. Orientation for a height difference difference

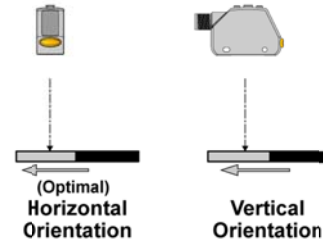


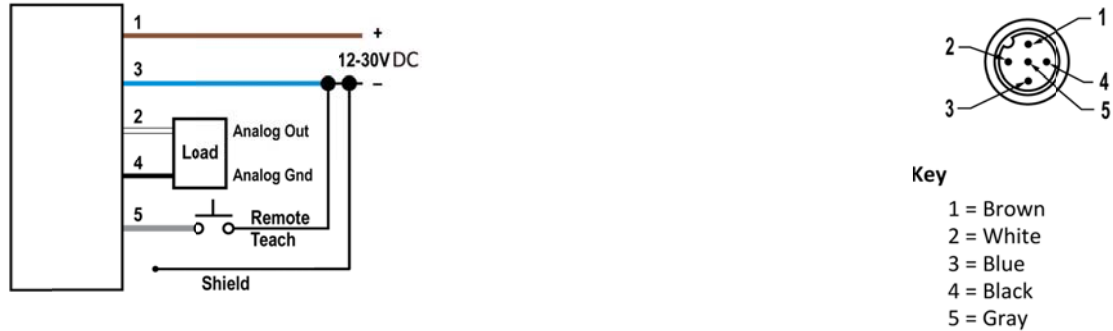
Figure 8. Orientation for a color or luster

### Mount the Sensor

1. If a bracket is needed, mount the sensor onto the bracket.
2. Mount the sensor (or the sensor and the bracket) to the machine or equipment at the desired

3. location. Do not tighten the mounting screws at this time.
3. Check the sensor alignment.
4. Tighten the mounting screws to secure the sensor (or the sensor and the bracket) in the aligned position.

## Wiring Diagram



- Note:** Open lead wires must be connected to a terminal block.
- Note:** The input wire function is user-selectable; see the Instruction Manual for details. The default for the input wire function is off (disabled).
- Note:** Shielded cordsets are recommended for all models with quick disconnect fittings. It is recommended that the shield wire be connected to -V DC (the blue wire).

## Cleaning and Maintenance

Handle the sensor with care during installation and operation. Sensor windows soiled by fingerprints, dust, water, oil, etc. may create stray light that may degrade the peak performance of the sensor. As the sensor may cause corrosion, please do not leave moisture adhering. Wipe clean plenty, use it for cleanliness. Blow the window clear using filtered, compressed air, then clean as necessary using water and a lint-free cloth.

## Sensor Programming

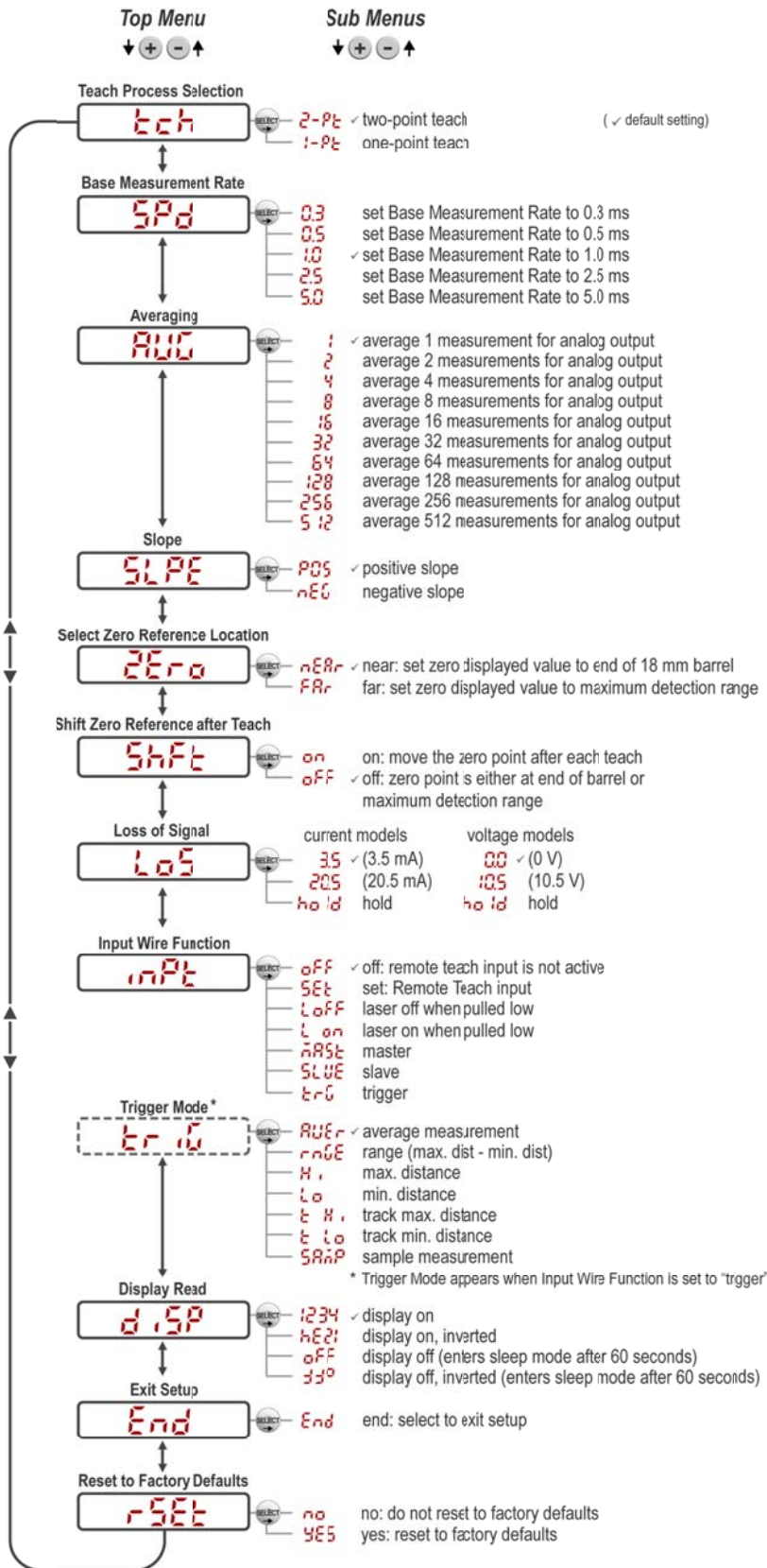
Program the sensor using the buttons on the sensor or the remote input (limited programming options). In addition to programming the sensor, use the remote input to disable the buttons for security, preventing unauthorized or accidental programming changes. See the Instruction Manual, for more information.

### Setup Mode

1. Access Setup mode and the sensor menu from Run mode by pressing and holding **MODE** for longer than 2 seconds.
2. Use **+** and **-** to navigate through the menu.
3. Press **SELECT** to select a menu option and access the submenus.
4. Use **+** and **-** to navigate through the submenus.
5. Select a submenu option.
  - Press **SELECT** to select a submenu option and return to the top menu.
  - Press and hold **SELECT** for longer than 2 seconds to select a submenu option and return immediately to Run mode.

To exit Setup mode and return to Run mode, navigate to **End** and press **SELECT**.

Figure 9. Sensor Menu Map





## Basic TEACH Instructions

Use the following instructions to teach the SA1Q sensor. The instructions provided on the sensor display vary depending on the type of TEACH mode selected. Two-point TEACH is the default TEACH mode.

1. Press and hold **TEACH** for longer than 2 seconds to start the selected TEACH mode.
2. Present the target.
3. Press **TEACH** to teach the target. The target is taught and the sensor waits for the second target, if required by the selected TEACH mode, or returns to Run mode.  
Complete steps 4 and 5 only if required for the selected TEACH mode:
4. Present the second target.
5. Press **TEACH** to teach the target. The target is taught and the sensor returns to Run mode.

## Manual Adjustments

Manually adjust the distance set for the 0 V (4 mA) and 10 V (20 mA) values using the  and  buttons. The available adjustments vary depending on the TEACH mode selected.







## Locking and Unlocking the Sensor Buttons

Use the lock and unlock feature to prevent unauthorized or accidental programming changes. Three settings are available:

- **wLoc**: The sensor is unlocked and all settings can be modified (default).
- **Loc**: The sensor is locked and no changes can be made.
- **OLoc**: The switch point value can be changed by teaching or manual adjustment, but no sensor settings can be changed through the menu.

When in **Loc** mode, **Loc** displays when the [**SELECT/TEACH**] button is pressed. The switch point displays when [**+DISP**] or [**-MODE**] are pressed, but **Loc** displays if the buttons are pressed and held.

When in **OLoc** mode, **Loc** displays when [**+DISP**] or [**-MODE**] are pressed and held. To access the manual adjust options, briefly press and release [**+DISP**] or [**-MODE**]. To enter TEACH mode, press the [**SELECT/TEACH**] button and hold for longer than 2 seconds.

To enter **Loc** mode, hold  and press  four times. To enter **OLoc** mode, hold  and press  seven times. Holding  and pressing  four times unlocks the sensor from either lock mode and the sensor displays **wLoc**.

## Specifications

### Sensing Beam

Visible red Class 1 laser, 655 nm

### Supply Voltage (Vcc)

12 to 30 V DC

### Power and Current Consumption, exclusive of load < 675 mW

### Sensing Range

**SA1Q-110\*** : 35 to 110 mm (1.38 to 4.33 in)

**SA1Q-310\*** : 35 to 310 mm (1.38 to 12.20 in)

### Analog Output Configuration

0 to 10V or 4 to 20mA, depending on model

### Output Rating

**Analog Voltage Outputs (SA1Q-\*\*V):**

2.5 kΩ minimum load resistance

**Analog Current Outputs (SA1Q-\*\*A):**

1 kΩ maximum load resistance at 24 V ;

maximum load resistance:  $[(V_{cc} - 4.5)/0.02 \Omega]$

### Remote Input

**Allowable Input Voltage Range:** 0 to Vcc

**Active Low (internal weak pullup-sinking current):**

Low State < 2.0 V at 1 mA max.

### Supply Protection Circuitry

Protected against reverse polarity and transient overvoltages

### Analog Resolution

**SA1Q-110\*** : 35 to 110 mm: < 0.15 mm

**SA1Q-310\*** : 35 to 110 mm: < 0.3 mm

110 to 310 mm: < 1 mm

### Beam Spot Size :

Table 1: SA1Q-110\*

Distance (mm)	Size (Horizontal × Vertical)
35	2.4 × 1.0
60	2.2 × 0.9
110	1.8 × 0.7

Table 2: SA1Q-310\*

Distance (mm)	Size (Horizontal × Vertical)
35	2.6 × 1.0
160	2.3 × 0.9
310	2.0 × 0.8

### Analog Linearity

Analog linearity performance matches accuracy performance curve (see [Performance Curves](#) on page 8).

### Response Speed

Total response speed varies from 0.5 to 2560 ms, depending on base measurement rate and averaging settings.

See Instruction Manual for more information.

### Connector

Integral 4-pin M12/Euro-style male quick disconnect

### Construction

**Housing:** 316 L stainless steel

**Lens cover:** PMMA acrylic

**Lightpipe and display window:** polysulfone

### Operating Conditions

Table 3: 35 to 95% relative humidity

Vcc	Min. Ambient Temp (°C)	Max. Ambient Temp (°C)	
	All Models	SA1Q-**V (0–10V)	SA1Q-**A (4–20 mA)*1
12	-10	50	50
24			45
30			40

\*1 For 4-20mA models only : Max.

Ambient Sensor Temp(°C) ; 50- (Vcc – 12)/2

### Storage Conditions

-10 °C to +50 °C (+14 °F to +122 °F)

### Delay at Power Up

< 750 ms

### Maximum Torque

**Side mounting:** 1 N · m (9 in · lbs)

### Ambient Light Immunity

< 5,000 lux at 300 mm

### Chemical Compatibility

Compatible with commonly used acidic or caustic cleaning and disinfecting chemicals used in equipment cleaning and sanitation. ECOLAB® certified.

Compatible with typical cutting fluids and lubricating fluids used in machining centers

### Application Note

- For optimum performance, allow 10 minutes for the sensor to warm up
- Since the detection distance may change due to the surrounding environment or aging, please perform correction and maintenance on a regular basis.
- In an operating environment with a temperature change, please set the sensor with sufficient margin.
- After the SA1Q housing, when transporting or storing under high temperature environment, please reconfirm the sensing range at startup.
- Depending on the use environment, the housing may be discolored, but performance of the sensor is not affected.

### Environmental Rating

IEC IP67 per IEC60529

IEC IP68 per IEC60529

IEC IP69K per DIN40050-9

### Vibration

MIL-STD-202G, Method 201A (10 to 60 Hz, 0.06 inch (1.52 mm) double amplitude, 2 hours each three mutually axes), with sensor operating

### Shock

MIL-STD-202G, Method 213B, Condition I (100G 6 shocks on each of three mutually perpendicular axes), with sensor operating

### Certifications



Industrial  
Control  
Equipment  
3TJJ

Class 2 power


UL Environmental Rating: Type 1



chemical compatibility certified

ECOLAB is a registered trademark of Ecolab USA Inc. All rights reserved.

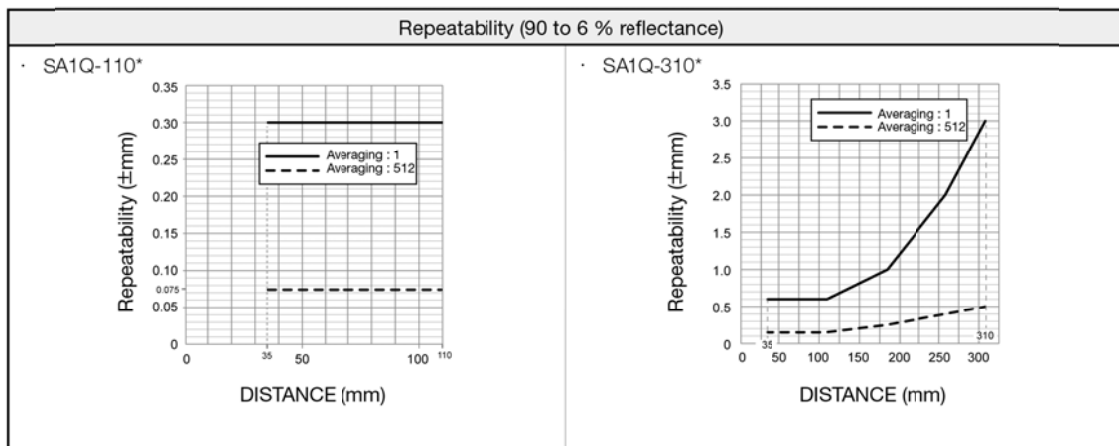
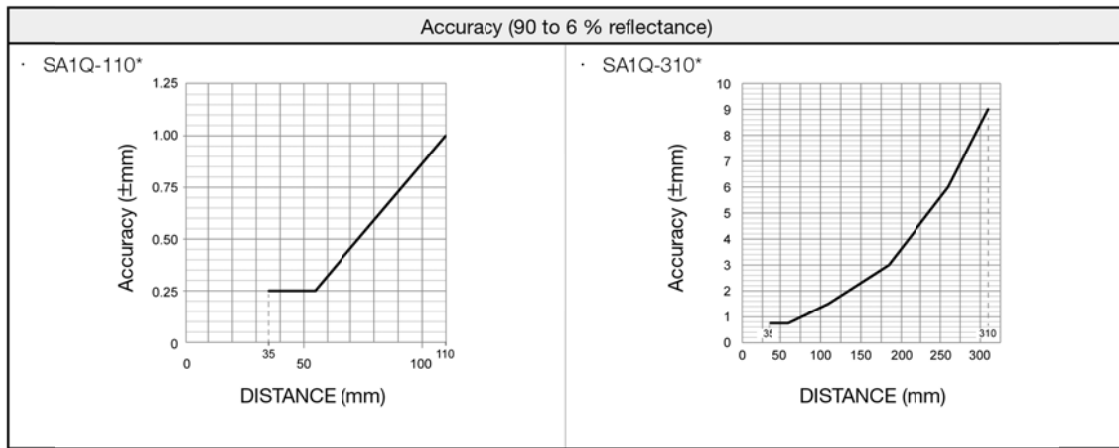
**Required Overcurrent Protection**

	<b>WARNING:</b> Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.
---	--

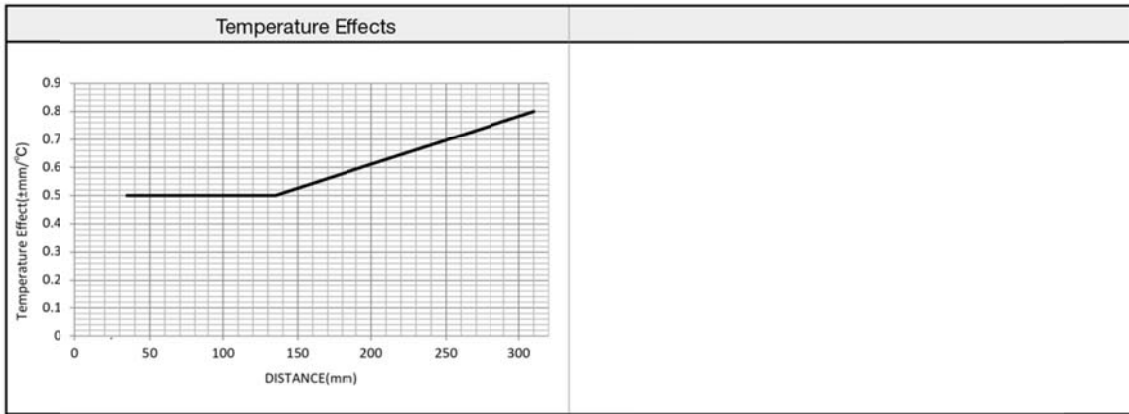
Overcurrent protection is required to be provided by end product application per the supplied table. Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply. Supply wiring leads < 24 AWG shall not be spliced.

Supply Wiring (AWG)	Required Overcurrent Protection (Amps)
20	5.0
22	3.0
24	2.0
26	1.0
28	0.8
30	0.5

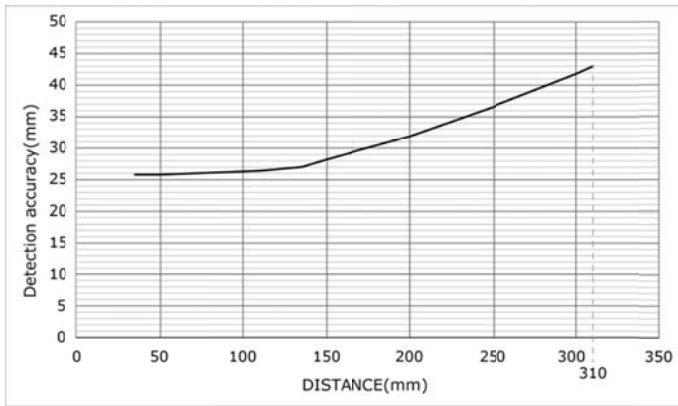
**Performance Curves**







**Detection error with operating distance**



Due to the operating environment and accuracy of SA1Q, errors may occur in detection distance. Please make a setting with sufficient margin with reference to [Detection error with operating Distance](#) on page 9\* when programming SA1Q.

\* Temperature change at 30°C

Figure 10. Detection error with operating distance

## IDEC Warranty

IDEC warrants its merchandise to be free from defects in material and workmanship under normal and proper use for a Period of one (1) year from date of shipment. Buyer's exclusive remedy for a non conformity in any item shall be repair or Replacement at seller's option. This warranty is in lieu of all other warranties whether expressed, implied or statutory, including implied warranties of merchantability and of fitness. IDEC shall not be liable for claims based on breach of warranty or negligence or any other damages including consequential, contingent or incidental damages. Warranty does not apply if the merchandise is altered or modified in any way after delivery by IDEC.

**Exclusion**

- The SA1Q is for general electronic equipment. Do not use SA1Q for the purpose that malfunction or failure may directly threaten the human body and life.
- The SA1Q is not intended to be used for applications which require high reliability and safety, such as medical equipment, nuclear equipment, railways, aircraft, and vehicles. The SA1Q cannot be used for these applications.
- Use the product within the environmental limits given in the Catalog and Quick Start Guide.