RIKEN KEIKI

Smart transmitter/Gas Detector Head

SD-1OX

(TYPE HS)

Safety Manual

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[Note] SD-1OX (TYPE HS) is certificated by the functional safety (IEC 61508:2010 Part2 and Part3). To maintain the function described in the certificate, manage the detector head according to this manual.

RIKEN KEIKI Co.,Ltd.

2-7-6 Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan
Phone : +81-3-3966-1113
Fax : +81-3-3558-9110
E-mail : intdept@rikenkeiki.co.jp
Web site : http://www.rikenkeiki.co.jp/

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Purpose

This safety manual describes the following information, for which users are responsible, when SD-1OX (TYPE HS) (hereinafter referred to as the detector head), a device certified by IEC 61508:2010 Part2 SIL 2 capable and IEC 61508:2010 Part3 SIL 3 capable, is used as part of the safety instrumented function: Proof test, repair and replacement, reliability data, product service life, environmental and usage restrictions, setting parameters, etc. To use the detector head safely, read this safety manual and all related documents.

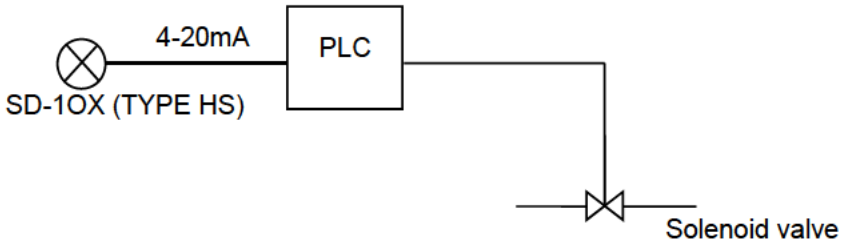
2

How to Use

2-1. Safety function

The safety function of the detector head includes the following:
• Monitoring oxygen concentration at sampling points.
• Outputting a current according to monitored gas concentration to the upper system side. The output function of the detector head is 4-20 mA output and HART communication output (*).
• About 4-20 mA output
Measured toxic gas concentration and 4-20 mA output are in a proportional relationship. For example, 4 mA is output when concentration is 0vol%, and 20 mA is output when concentration is full scale. During a failure, a current of 3.6 mA or less or 21 mA or more is output.
* HART communication output is not included in the safety function.

System example
The following example shows a system where the solenoid valve is controlled and blocked through PLC.



2-2 Safety accuracy

Safety accuracy: 10%
* An internal part failure that causes a difference exceeding this accuracy is counted in the FMEDA failure rate.

2-3 Diagnosis response

Maximum response time for self-diagnosis results: 15 seconds
* It means that a part failure detected in self-diagnosis is notified within this time limit. This is a total time of a self-diagnosis test interval and a failure response time.
* The maximum response time is 24 hours because of self-diagnosis of ROM / RAM check is performed once in only one day.

2-4 Setup

See the separate document "Operating Manual". Never fail to inspect parameters that are set.

2-5 Proof test

For a proof test interval, recommends one year.

Proof test procedure
(1) Never fail to bypass the safety function.
(2) Confirm that the gas concentration reading on the detector head is zero.
(3) Introduce a gas for calibration gas.
(4) Check the gas response time and 4-20 mA output value.
(5) Finish the procedure by resetting the bypass for the safety function.

* A proof test must be run by a trained service man because performing it incorrectly may cause a malfunction of the detector head.

2-6 Repair and replacement

See the separate document "Operating Manual".

2-7 Startup time (initial clear time)

About the first 25 seconds after turning on the detector head is the initial clear time. During that period, a gas cannot be detected correctly.

2-8 Firmware update

To update firmware, the detector head must be returned to the RIKEN KEIKI factory.

2-9 Reliability data

Information such as the failure rate, failure mode, etc. is described in the FMEDA report (No.RK 15/06-015 R001). See the separate document "FMEDA Report".
To meet SIL2, use with 1oo1 (HFT=0). To meet SIL3, use with 1oo2 (HFT=1).

2-10 Product service life

Product service life: 10 years from the date of manufacture
Reliability data in the FMEDA report are valid only during this period.

2-11 Required parameter settings

- During a burnout (failure), 4-20 mA output value becomes 3.6 mA or less or 21 mA or more.
- For security reasons, use the write protection function, which does not allow setting changes through HART communication.
- To use the detector head as the functional safety, never fail to follow the above item.

2-12 Environmental restrictions

For environmental restrictions, see the separate document "Operating Manual".

2-13 Application restrictions

For application restrictions, see the separate document "Operating Manual".

2-14 Configuration of the hardware / software

・Hardware Version：V1.1
・Software Version：V1.1

2-15. Definition of terms and abbreviations

Terms

Safety	Freedom from unacceptable risk of harm
Functional Safety	The ability of a system to carry out the actions necessary to achieve or to maintain a defined safe state for the equipment under control of the system
Basic Safety	The equipment must be designed and manufactured such that it protects against resulting fire and explosion under explosive atmosphere.
Safety Assessment	The investigation to arrive at a judgment - based on evidence - of the safety achieved by safety-related systems
Fail-Safe State	State that the defined fail-safe
Fail Safe	Failure that go to the defined fail-safe state without a demand from the process
Fail Dangerous	Failure that does not respond to a demand from the process (i.e. being unable to go to the defined fail-safe state). Failure that deviates the process signal or the actual output by more than 20% of span, drifts away from the user defined threshold (Trip Point) and that leaves the output within active scale.
Fail Dangerous Undetected	Failure that is dangerous and that is not being diagnosed by automatic stroke testing.
Fail Dangerous Detected	Failure that is dangerous but is detected by automatic stroke testing.
Fail Annunciation Undetected	Failure that does not cause a false trip or prevent the safety function but does cause loss of an automatic diagnostic and is not detected by another diagnostic.
Fail Annunciation Detected	Failure that does not cause a false trip or prevent the safety function but does cause loss of an automatic diagnostic or false diagnostic indication.
Fail No Effect	Failure of a component that is part of the safety function but that has no effect on the safety function.
Low demand mode	Mode, where the frequency of demands for operation made on a safety-related system is no greater than twice the proof test frequency.

Abbreviations

FMEDA	Failure Modes, Effects and Diagnostic Analysis
HFT	Hardware Fault Tolerance Tolerance that to keep executing the function requested under the hardware fault and error condition
MOC	Management of Change Management of change the hardware or software elements, and keep traceability
PFDavg	Average Probability of Failure on Demand
SFF	Safe Failure Fraction The fraction of the overall failure rate of a device that results in either a safe fault or a diagnosed unsafe fault.
SIF	Safety Instrumented Function A set of equipment intended to reduce the risk due to a specific hazard.
SIL	Safety Integrity Level Discrete level (one out of a possible four) for specifying the safety integrity requirements of the safety functions to be allocated to the E/E/PE safety-related systems where Safety Integrity Level 4 has the highest level of safety integrity and Safety Integrity Level 1 has the lowest.
SIS	Safety Instrumented System Implementation of one or more Safety Instrumented Functions. A SIS is composed of any combination of sensor(s), logic solver(s), and final element(s).

End of the manual