



PT2E-3730

Gas Detector with Signal Converter
SD-3 series
HART®Field Device Specification

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1. INTRODUCTION

1.1 Scope

RIKEN KEIKI Co., Ltd. smart transmitter/gas detector head, model SD-3, complies with HART Protocol Revision 7.0. This document specifies all the device specific features and documents HART Protocol implementation details (e.g., the Engineering Unit Codes supported). The functionality of this Field Device is described sufficiently to allow its proper application in a process and its complete support in HART capable Host Applications.

1.2 Purpose

This specification is designed to compliment other documentation (e.g., SD-3series Operation Manual) by providing a complete, unambiguous description of this Field Device from a HART Communication perspective

1.3 Who should use this document?

The specification is designed to be a technical reference for HART capable Host Application Developers, System Integrators and knowledgeable End Users. It also provides functional specifications (e.g., commands, enumerations and performance requirements) used during Field Device development, maintenance and testing. This document assumes the reader is familiar with HART Protocol requirements and terminology.

2. DEVICE IDENTIFICATION

| | | | |
|-----------------------------------|----------------------|--------------------------|------------|
| Manufacturer Name: | RIKEN KEIKI Co.,Ltd. | Model Name(s): | SD-3 |
| Manufacture ID Code: | 605B (Hex) | Device Type Code: | E481 (Hex) |
| HART Protocol Revision | 7.0 | Device Revision: | 1 |
| Number of Device Variables | 1 | | |
| Physical Layers Supported | FSK | | |
| Physical Device Category | Current output | | |

3. PRODUCT OVERVIEW

- The detector is a fixed type gas detector head that detects leak of gases and that performs the alarm activation when the gas concentration is over the setting value.
- This detector is a safety unit, not an analyzer or densitometer which performs quantitative/qualitative analysis/measurement for gases.
- The detector detects abnormalities in the air caused by presence of gases or other reasons (leak) with the built-in gas sensor. The concentrations of detected gases are displayed on the seven-segment LED.
- The detector outputs gas concentration in 4-20 mA.

4. PRODUCT INTERFACES

4.1 Process Interface

4.1.1 Power Input Terminal

Power input provides two terminals, marked 1 and 2 (+ and –) for connection.
Refer to the Operation Manual for connection details.

4.2 Host interface

4.2.1 Analog Output

4 to 20mA output current is loop current.
Refer to the Operation Manual for connection details.

| | |
|----------------------------|--|
| Detection Mode (No Alarm) | 4 - 20 mA (concentration output) |
| Detection Mode (Gas Alarm) | 4 - 20 mA (concentration output) |
| Initial Clear | 2.5 mA setting: 2.5 mA 4 mA, HOLD, 4 - 20 mA setting: 4 mA |
| Maintenance Mode | 2.5 mA setting: 2.5 mA 4 mA setting: 4 mA HOLD setting: The previous value retained 4-20 mA setting: 4 - 20 mA (concentration output) |
| Alarm Test | Output ON setting: 4 - 20 mA (concentration output) Output OFF setting: 4 mA |
| Fault Alarm | 0.5 mA (Fixed) |
| INHIBIT | 2.5 mA setting: 2.5 mA 4 mA, HOLD, 4 - 20 mA setting: 4 mA |
| Power Off | 0 mA |

In case of over scale, an output will not exceed 20.5 mA.

4.3 Local Switches And Displays

4.3.1 Local Control-switches And Displays

This device has local control-switches and displays.

4.3.2 Internal Jumpers And Switches

Use the supplied dedicated control key to operate the detector. If products other than these accessories are used, key operations cannot be accepted properly.
Refer to the Operation Manual.

5. DEVICE VARIABLES

There are no device variables exposed to the user.

6. DYNAMIC VARIABLES

There is only one Dynamic Variable exposed to the user.

| | Meaning | Units |
|----------|----------------|-----------------|
| PV | Gas Value | Depends on gas. |
| SV,TV,QV | Not Applicable | - |

7. STATUS INFORMATION

7.1 Device Status

Bit 4 ("More Status Available") is set whenever any failure is detected. Command #48 gives further detail. (See Section 7.3.)

7.2 Extended Device Status

The Field Device cannot predict, in advance, when the maintenance will be required. This bit is set if a sensor break is detected. "Device Variable Alert" is set if the PV is out of limit.

7.3 Additional Device Status (Command #48)

Command #48 returns 25 bytes of data, with the following status information:

| Byte | Bit | Meaning | class | Device Status |
|----------|--------------------------------------|---|---------|---------------|
| | | | | Bits Set |
| 1 | 1 | ROM error(SD-3) | Error | 4,7 |
| | 2 | EEPROM error(SD-3) | Error | 4,7 |
| | 3 | RAM error(SD-3) | Error | 4,7 |
| | 4 | Extra error(SD-3) | Error | 4,7 |
| | 5 | Reserve | Error | 4,7 |
| | 6 | Reserve | Error | 4,7 |
| | 7 | Reserve | Error | 4,7 |
| | 8 | Reserve | Error | 4,7 |
| 2~ 21 | 1 | Reserve | -(0) | - |
| 22 | 1 | E-6 Warning | Info | 4 |
| | 2 | E-27 Warning | Info | 4 |
| | 3 | E-9 Warning | Info | 4 |
| | 4 | E-8 Warning | Info | 4 |
| | 5 | E-1 Warning | Info | 4 |
| 23 | 1 | E-1 error | Error | 4 |
| | 2 | E-1A error | Error | 4 |
| 24 | 1 | 18:Device-Specific Status | Warning | 4 |
| | | (OVER RANGE) | | |
| | 2 | 18:Device-Specific Status(Locking over) | Warning | 4 |
| | 3 | 19:Device-Specific Status(1st ALARM) | Warning | 4 |
| 4 | 20:Device-Specific Status(2nd ALARM) | Warning | 4 | |
| 25 | 1 | 21:Device-Specific Status(INITIAL) | Info | 4 |
| | 2 | 22:Device-Specific Status(INHIBIT) | Info | 4 |
| | 3 | 23:Device-Specific Status(TEST) | Info | 4 |
| | 4 | 24:Device-Specific Status(ADJ) | Info | 4 |

All bits used in this transmitter indicate device or sensor failure, and therefore also set bit 7 and bit 4 of the Device Status byte.

These bits are set or cleared by the self-test executed at power up, or following a reset or self-test command. They are also set (but not cleared) by any failure detected during continuous background self-testing.

8. UNIVERSAL COMMANDS

Command #3 returns PV for a total of 14 bytes of response data. (See Section 6.)

Command #14: The unit of measurement for the minimum sensor limit and span depends on the gas.

9. COMMON-PRACTICE COMMANDS

9.1 Burst Mode

This Field Device does not support Burst Mode.

9.2 Catch Device Variable

This Field Device does not support Catch Device Variable.

10. DEVICE-SPECIFIC COMMANDS

The Device Specific commands are used strictly for the unique features of the SD-3

| Command# | Description |
|----------|--|
| 128 | Writes the execution status of alarm test. |
| 130 | Writes the execution status of zero calibration. |
| 131 | Writes the execution status of span calibration. |
| 196 | Writes the indicated value for alarm test. |
| 197 | Writes the indicated value for span calibration. |
| 198 | Write maintenance mode ON/OFF. |
| 227 | Read the results of zero calibration. |
| 228 | Read the results of span calibration. |
| 229 | Read the span calibration value readings. |
| 230 | Reads maintenance mode ON/OFF. |

11. PERFORMANCE

11.1 Sampling Rates

Typical sampling rates are shown in the following table.

| | |
|------------------------------|---------------|
| Primary Gas sensor sample | 10 per second |
| PV digital value calculation | 4 per second |
| Analog output update | 4 per second |

11.2 Power-Up

On power up, the transmitter goes through a self-test procedure, which takes approximately 10 seconds. During this period, the device will not respond to HART commands, and the analog output is set at 4.0mA.

When the self-test is satisfactorily completed, and the first measurement has been made, the PV values are set, and the analog output moves to a value representing the measurement. The slew rate of this movement is limited by the configured "damping time". Only after the PV are correctly set, will the device respond to HART commands.

If the self-test fails, all live measurement data (PV, current and percent of range) are set to "Not A Number", and the analog output is set to the configured malfunction-indicating current. The device will attempt to respond to HART commands.

Fixed-current mode is cancelled by power loss.

11.3 Command Response Times

| | |
|---------|---------|
| Minimum | 20ms |
| Typical | 50ms |
| Maximum | 100ms * |

* During self-test following a self-test command, the device may take up to 250ms to respond.

Busy and Delayed-Response

The transmitter may respond with "busy" status if a further command is received while self-test is underway.

Delayed-response is not used.

11.4 Long Messages

The largest data field used is in the response to Command 21: 34 bytes including the two status bytes.

11.5 Non-Volatile Memory

EEPROM is used to hold the device's configuration parameters. New data is written to this memory immediately on execution of a write command.

11.6 Damping

Damping is standard, affecting only the PV and the loop current signal.

Manual Log

| Rev. | Amendment | Issue data |
|------|-------------|------------|
| 0 | First issue | 2025/3/12 |