Description

The Bently Nevada* Hazardous Gas Detection System consists of the 350800 Hazardous Gas Sensor (with or without a housing) and the 6-channel 3500/63 Hazardous Gas Monitor. The Hazardous Gas Detection System is particularly suited for applications in enclosed or confined spaces that handle, pump, or compress combustible gases or use combustible gases as fuels. If a leak occurs, these gases may accumulate and reach a potentially explosive concentration. Detection of and alarming on hazardous gas concentrations is critical for the protection of both personnel and equipment in the area. Housings around natural gas fired industrial gas turbines, hydrogen pipeline compressors, or compressor doghouses are all examples of confined spaces where combustible gases could accumulate.

The 350800 Hazardous Gas Sensor is a continuous diffusion, catalytic bead technology. When used with the 3500/63 Hazardous Gas Monitor this sensor provides reliable and stable detection of either methane or hydrogen, depending on the gas used during calibration. The monitor indicates hazardous gas concentrations as a percentage of lower explosive limits (LEL). Configurable alarm setpoints are used to indicate that the gas concentration presents potential safety hazards of explosion.

The monitor is suitable for both simplex and redundant (TMR) 3500 Rack configurations. Additionally, the system provides 4 to 20mA outputs or can include relay module(s) that the user can program to change state, enabling shutdown of machines or processes and audible and/or visible alarms to protect both human life and machine assets.

The optional 350810 Remote Haz Gas Calibrator is designed and certified for use with the 350800 Hazardous Gas Sensor. When the sensor is located in a hazardous area, or any area that is difficult to access, the 350810 Remote Haz Gas Calibrator will allow calibration of the sensor from a remote location away from the hazardous or confined area.

The 350810 Remote Haz Gas Calibrator is operated pneumatically. The line pressure from the calibration gas is used to operate a slide that when closed blocks ambient air from reaching the 350800 Sensor. The trapped air in front of the sensor is then purged with a metered flow of calibration gas. Turning off the flow of calibration gas allows the slide to return to its original position allowing ambient air to reach the sensor.

The user must determine the ideal location for the sensors and consider many factors when doing so. These factors may include, location of potential leak points, gas characteristics, and ventilation. Companies that specialize in computerized fluid dynamic analysis can help you determine the best location for hazardous gas sensor placement based on your application.
Features

- Sensor certified to international flameproof standards, with or without housing
- Sensor and remote calibrator continuous high temperature operation (up to 200 °C)
- Remote calibrator pneumatically controlled
- Performance certified to CSA 22.2 no. 152, FM 3620, ANSI / ISA—12.13.01, and IEC/EN60079-29-1

Sensor Specifications:

Specified at +25 °C (+77 °F) unless otherwise noted, and when interfaced to the 3500/63 Hazardous Gas Detection Monitor. The sensor may be screwed directly into conduit, or used with the flameproof housing for ease of sensor replacement.

Sensor Type
Flameproof, continuous diffusion; catalytic bead; CH₄ & H₂ sensor

Sensor Life
Minimum
2 years
Normal Service
5 years, normal service

Initial Sensitivity
(as seen in the 3500 Verification Screen)
>15 mV / %LEL

Sensor Long-Term Zero Drift
(20 °C, 50%RH, 101kPa)
< ±2.5% LEL, per month

Sensor Long-Term Sensitivity Drift
(20 °C, 50%RH, 101kPa)
< -2.5% Signal, per month

Shift Due to Temperature (zero gas)
< ±5% LEL, -40 °C to +200 °C (-40 °F to +392 °F)

Response to Step Change
< 10 s to reach 50% LEL (T₅₀ time) reading when 100% LEL gas applied
< 12 s to reach 60% LEL (T₆₀ time) reading when 100% LEL gas applied
< 30 s to reach 90% LEL (T₉₀ time) reading when 100% LEL gas applied

Sensor Poison Resistance
T₅₀ to 20ppm HMDS (hexamethyldisiloxane) in 2.5% CH₄ > 75 minutes

Shock
250 g

Vibration
5 g from 10 Hz to 3200 Hz

Calibration Interval
90 days, recommended (3500/63 monitor reminder)

Operating Temperature
-40 °C to +200 °C (-40 °F to +392 °F)

Storage Temperature
0 °C to +40 °C (+32 °F to +104 °F)

Humidity
90%, non-condensing

Materials
Stainless steel body with integral sintered flame arrestor
## Monitor Specifications

Specified at +25 °C (+77 °F) unless otherwise noted

### Proportional Output Values

#### Hazardous Gas Concentration

% LEL

#### Calibration Status

Days since last calibration

### Monitor (alone) Accuracy

Within ±0.33% of full-scale typical, ±1% maximum

### Full Scale Range

0 - 100% LEL units

### Monitor Resolution

0.0015%

### Constant Current Supplied by Monitor to Sensor

290 to 312 mA @ +23 °C (+73 °F)
289 to 313 mA @ -30 °C to +65 °C (-22 °F to +149 °F)

### OK Range

Monitor detects sensor and field wiring faults.

### Sensor Cable Resistance

20 Ω per bridge leg maximum

### Monitor Input Impedance

200 kΩ

### Monitor Power Consumption (not including external power supply)

7.0 watts, typical

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### External Transducer Power Required

+22 to +30 Vdc (+24Vdc nominal) @ 1.8 A nominal per monitor (300 mA per channel)

Must be able to provide 4.9 Ln (x) + 6.5 A in-rush current, where x is the number of monitors

Strongly urge at least dual redundancy for safety system

### Monitor Alarm Inhibit

Contact closure on I/O inhibits monitor alarms

### Voltage

+5 Vdc, typical

### Current

0.4 mA, typical; 4 mA, peak

### Monitor Front Panel LEDs:

#### OK LED

Indicates when the Hazardous Gas Monitor is operating properly.

#### TX/RX LED

Indicates when the Hazardous Gas Monitor is communicating with other modules in the 3500 Rack.

#### Bypass LED

Indicates when the Hazardous Gas Monitor or a channel in the monitor is in Bypass Mode.

#### Cal LED

Indicates that a channel of the Hazardous Gas Monitor is in either Over Range or in Calibration.

### Recorder Analog Output

Applicable to each channel
Current Output
+4 to +20 mA representing 0 to 100% of monitor channel full scale, i.e., 0 to 100% LEL
< +4 mA indicative of linear response in the negative % LEL range, until clamped at user-selected Not OK current

Not OK / Bypass Current
User selectable as +3.5, +3.0, +2.5, or +2.0 mA

Over Range Current
20.5 mA, minimum, always latching

Compliance Voltage
0 to +12 Vdc, maximum

Load Impedance:
600 Ω, maximum

Alarms
Alarm Setpoints
Alert/Alarm1 and Danger/Alarm2 setpoints can be set for the direct proportional value of % LEL. The Alert/Alarm 1 setpoint can be set for the Cal Status proportional value but cannot be set for the Cal Status Danger/Alarm 2 setpoint. This setpoint value is determined by, and set to, the recommended calibration interval of 90 days. Alarms are adjustable and can be set from 0 to 60% of full-scale for each measured value. This Monitor only has over alarm setpoints. Alarm setpoints are only valid when enabled.

Alarm Accuracy
Within 0.13% of the desired value.

Alarm Hysteresis
Fixed @ 0.5% full scale.

Alarm Time Delays
Will not exceed 2 seconds with all channels in alarm and the minimum time delay configured. The user can use software to program alarm delays as follows:

Alert
From 1 to 60 seconds in 1 second intervals

Danger
From 1 to 60 seconds in 0.5 second intervals or to the minimum alarm time delay

Remote Calibrator Specifications
Specified at +25 °C (+77 °F) unless otherwise noted

Type
Continuous diffusion, pneumatic slide

Actuation Flow Rate
2 L/min minimum

Regulator Set Pressure (dead head)
10 ±1 psi

Environmental Limits
Monitor
Operating Temperature
-20 °C to +65 °C
(-4 °F to +149 °F)

Storage Temperature
-40 °C to +85 °C
(-40 °F to +185 °F)

Humidity
95%, non-condensing
Sensor (with or without housing) and Remote Calibrator

**Operating Temperature**
-40 °C to +200 °C
(-40 °F to +392 °F)

**Storage Temperature**
0 °C to +40 °C
(+32 °F to +104 °F)

**Effect of Humidity from 10% to 90% RH**
< ±5% LEL from baseline (baseline-room temperature, 50% RH)

**Housing**
Flameproof and IP66

**Physical**

**Monitor Module**

*Dimensions (Height x Width x Depth)*
241.3 mm x 24.4 mm x 241.8 mm
(9.50 in x 0.96 in x 9.52 in)

*Weight*
0.82 kg (1.8 lbm)

**Monitor I/O Module**

*Dimensions (Height x Width x Depth)*
241.3 mm x 24.4 mm x 99.1 mm
(9.50 in x 0.96 in x 3.90 in)

*Weight*
0.20 kg (0.44 lbm)

Sensor (without housing and without remote calibrator)

**Dimensions**

*Body Diameter x Body Length*
34.9 mm x 60 mm
(1.37 in x 2.36 in)

Length includes 3/4” NPT at rear of body

*Weight with 180° lead length*
0.34 kg (0.75 lbm)

**Materials**
Stainless steel body with integral sintered flame arrestor

Flameproof housing with sensor

**Remote Calibrator**

See Figure 4

*Dimensions* (Body Diameter x Body Length)
50.3 mm x 85.1 mm
(1.98 in x 3.35 in)

*Weight*
0.285 kg (0.63 lbm)

*Inlet thread*
¼ NPT

**Materials**
Housing, Cap, Slide
Hard anodized aluminum
Spring
Zinc plated spring steel

Cap o-ring
Fluorocarbon

Slide Seal
PTFE (spring energized)

3500 Rack Space Requirements
Monitor Module:
1 full-height front slot

I/O Modules:
1 full-height rear slot

CE Mark Directives
EMC
Standards:
EN61000-6-2 Immunity for Industrial Environments
EN 55011/22 CISPR 11/22 ISM Equipment
EN61000-6-4 Emissions for Industrial Environments

European Community Directives:
EMC Directive 2004/108/EC

Maritime
Standards:
IEC 60533 Electrical and Electronic Installations in Ships - EMC
DNV Std for Cert 2.4 (3.14 & 3.15)
ClassNK, Part 7, Chapter 1 (1.3)

Electrical Safety
IEC/EN 61010-1

System Performance Approvals:
Certified to:
FM 6320
CSA C22.2 No. 152
ANSI / ISA—12.13.01
IEC 61179-1, -4
IEC 60079-29-1

Hazardous Area Approvals:
Monitor:
North America:
AEx nA IIC
Class I, Zone 2
Class I, Div 2, Groups A, B, C, D
T4 @ -20 °C ≤ Ta ≤ +65 °C
(-4 °F to +150 °F)

Sensor (with or without housing):
ATEX
II 2 G Ex d IIB+H2 T2
-40 °C ≤ Ta ≤ +200 °C
(-40 °F ≤ Ta ≤ +392 °F)

IEC
II 2 G Ex d IIB+H2 T2
-40 °C ≤ Ta ≤ +200 °C
(-40 °F ≤ Ta ≤ +392 °F)

North America
CLASS 1, ZONE 1
AEx d IIB+H2 T2
-40 °C ≤ Ta ≤ +200 °C
(-40 °F ≤ Ta ≤ +392 °F)
Remote Calibrator:
ATEX

**Ex**

II 2 G c Ex II B+H2 T2
-40 °C ≤ Ta ≤ +200 °C
(-40 °F ≤ Ta ≤ +392 °F)

IEC

II 2 G c II B+H2 T2
-40 °C ≤ Ta ≤ +200 °C
(-40 °F ≤ Ta ≤ +392 °F)

**North America**
Not Required

For further certification and approvals information please visit the following website: [www.ge-mcs.com/bently](http://www.ge-mcs.com/bently)

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### Ordering Considerations

**General**

3500/63 Hazardous Gas Detection Monitors added to an existing 3500 Monitoring System, require the following (or later) firmware and software versions:

**3500/63 Haz Gas Detection Firmware**

Version 3.20, or later, for approvals certification

**3500/20 RIM Firmware**

Revision L or later,
3500/22M Rev 1.07 or later when used in TMR configuration

**3500 Rack Configuration Software**

Version 3.90 or later

**3500/01 Data Acquisition Software**

Version 2.42 or later

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### 3500/02 Operator Display Software

Version 1.42 or later

**System 1™ Software**

Version 5.0 or later

### External Termination Blocks

Applications cannot use External Termination Blocks with Internal Termination I/O modules.

When ordering I/O Modules with External Terminations, the External Termination Blocks and Cables must be ordered separately.

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**Remote Calibrator**

Requires the following (or later) firmware and software versions:

- **3500/63 Haz Gas Monitor Firmware**: Version 3.50
- **3500 Configuration Software**: Version 3.94

### Ordering Information

**Sensor**

350800-01-BXXX-CXX

- **B**: Lead Length
  - 006 6 Inch Lead
  - 096 96 Inch Lead
  - 144 144 Inch Lead
  - 180 180 Inch Lead
  - 240 240 Inch Lead

- **C**: Housing
  - 00 None
  - 01 Flameproof Housing

**Monitor**

3500/63-AXX-BXX

- **A**: Input/Output Module
  - 0 1 Internal Termination Catalytic Bead
  - 0 2 External Termination Catalytic Bead

- **B**: Agency Approvals
  - 0 1 North America (Div2, Zone2)
## External Termination Blocks

**165902-01**

3500/63 External Termination Block (Transducer, Terminal Strip Connectors).

**165901-01**

3500/63 External Termination Block (Transducer, Euro Style Connectors).

**133892-01**

3500/63 External Termination Block (Recorder, Terminal Strip Connectors).

**133900-01**

3500/63 External Termination Block (Recorder, Euro Style Connectors).

**00580440**

Connector Header, Internal Termination, 3-Position.

**00580445**

Connector Header, Internal Termination, 9-Position.

**00580446**

Connector Header, Internal Termination, 12-Position

## CABLES

### 3500/63 Transducer (XDCR) Signal to External Termination (ET) Block Cable

**134544-AXXXX-BXX**

**A:** Cable Length

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>0005</td>
<td>5 feet (1.5 metres)</td>
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<tr>
<td>0007</td>
<td>7 feet (2.1 metres)</td>
</tr>
<tr>
<td>0010</td>
<td>10 feet (3.0 metres)</td>
</tr>
<tr>
<td>0025</td>
<td>25 feet (7.6 metres)</td>
</tr>
<tr>
<td>0050</td>
<td>50 feet (15.2 metres)</td>
</tr>
<tr>
<td>0100</td>
<td>100 feet (30.5 metres)</td>
</tr>
</tbody>
</table>

**B:** Assembly Instructions

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>01</td>
<td>Not Assembled</td>
</tr>
<tr>
<td>02</td>
<td>Assembled</td>
</tr>
</tbody>
</table>

### 3500/63 Recorder Signal to External Termination (ET) Block Cable

**134543-AXXXX-BXX**

**A:** Cable Length

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</tbody>
</table>

## External Transducer Power Supply

(See specifications section above for requirements. One possible supply option that may be purchased through Bently Nevada, Inc. shown here.)

**164374**

Pepperl+Fuchs PS, 115 VDC input, +24 VDC output, 15 A max, plugs into a 3-position chassis, can be up to 3 times redundant when more than 1 are ordered. Strongly recommend at least dual redundancy for a safety system.

**164376**

Chassis for 164374 power supply, can accommodate up to 3 redundant power supplies

## Adapter Items for Retrofit Sensor Installations

**178706-01**

Stainless steel mounting plate adapter for housing (see Figure 2), if needed

**178441**

Aluminum conduit adapter; 1/2” conduit to 3/4” NPT connection at flameproof housing, if needed

SIRA99ATEX1115U Exde IIc AExde CL I DIV1 ABCD
Remote Calibration

Remote Calibrator

350810

Mount one remote calibrator on each sensor to enable ability for remote calibration

Regulator

284357-01

10 psi 2-stage regulator with CGA600 connection and 2 ft of clear Tygon® tubing.

Supply Line Kit

286642

Includes 100 ft of 1/8" OD coiled stainless tubing and two 1/4 NPT to 1/8" tube fittings; for interface between remote calibrator and panel location from where gas will be remotely applied.

Spare Individual Tube Fitting for Supply Lines

284833

¼ NPT to 1/8" tube fitting

Cylinders of Pressurized Gas

Requires zero air and cal gas (see below)

Calibration Kit for Non-remote Calibrations

168868-01

Includes cal boot & tube assembly, regulator, instruction sheet, in a carrying case that can hold two gas cylinders (gas cylinders sold separately; see below)

It is important to use the regulator and calibration boot that is supplied with the kit as it provides the correct flow to the sensor face that is critical to achieving accurate calibration. The regulator supplied with the calibration kit regulates the flow to ½ L/min and has a maximum inlet pressure of 500psig/35bar.

Cylinders of Pressurized Gas

For use with calibration kit or remote calibrator

Service Pressure: 500 psig (35 bar)

Cylinder to regulator connection: CGA 600

Gas volume: 34L

Bottle height: 10.5 inches

Bottle diameter: 2.85 inches

169038

CH₄ (methane) 2.5% by volume (50% LEL)

175974

H₂ (hydrogen) 2.0% by volume (50% LEL)

284219

Zero air

Gas Sensor Simulator Kit

For use in verifying wiring and voting logic. Not to take the place of calibration with actual sensors.

Refer to data sheet 285166-01

Spares

163179-04

3500/63 Monitor

164578-01

I/O Module with Internal Terminations

164895-01

I/O Module with External Terminations

166848-01

3500/63 Manual

166730-01

CD, Calibration Procedure Training

168957-01

Cal boot & tube assembly for non-remote calibrations

169039

Regulator for Calibration Kit (NOT FOR USE WITH REMOTE CALIBRATOR)

0.5 L/min

Maximum inlet pressure: 500 psig (35 bar)

Inlet fitting: CGA 600

350801-02

Flameproof housing assembly approved for use with BN sensor only
Graphs and Figures

Note: All dimensions shown in millimetres (inches) except as noted.

1) Main Module Front View
2) Internal Terminations I/O Module
3) External Terminations I/O Module
4) Status LEDs

Figure 1: Front and rear views of the Hazardous Gas Monitor
Plate thickness is 12.7 (0.5)

1) 9.00 mm diameter through, 16.00 mm diameter x 90° CSK, 4 places
2) 0.250 mm diameter through, 2 places

_Figure 2: Mounting Adapter Plate for Housing Retrofits_
Figure 3: Flameproof Housing with Sensor
Figure 4: Housing with Sensor and Remote Calibrator
Figure 8: 3500/63 Haz Gas Monitor Field Wiring Diagram 4

Specifications and Ordering Information

Part Number: 165853-01
Rev: M (03/11)
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NOTES: See Sheet 1
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