

# Honeywell Analytics Industrial Fixed Product Fundamentals

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# Typical Areas Requiring Gas Detection

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- Many different applications for flammable, toxic and Oxygen gas detection
  - Industrial processes increasingly involve use and manufacture of highly dangerous substances, particularly toxic and combustible gases
  - Occasional escapes of gas occur
    - Create potential hazards to industrial plant, employees and people living nearby
  - Worldwide incidents involving asphyxiation, explosions and loss of life, are a constant reminder of this problem

## Oil & Gas

- Industry covers large number of upstream activities
  - On and offshore exploration and production of oil and gas
  - Oil and gas transportation, storage and refining
- Large amount of highly flammable Hydrocarbon gases involved
  - Serious explosive risk
  - Toxic gases such as Hydrogen Sulfide are often present

## Typical Applications

- Exploration drillings rigs
- Production platforms
- Onshore oil and gas terminals
- Refineries

## Typical Gases

- Flammable: Hydrocarbon gases
- Toxic: Hydrogen Sulfide, Carbon Monoxide

## Semiconductor Manufacturing

- Involves use of highly toxic substances and flammable gas
- Phosphorus, Arsenic, Boron and Gallium commonly used as doping agents
- Hydrogen used as reactant and reducing atmosphere carrier gas
- Etching and cleaning gases include  $\text{NF}_3$  and other perfluorocompounds.

## Typical Applications

- Wafer reactor
- Wafer dryers
- Gas cabinets
- Chemical Vapour Deposition

## Typical Gases

- Flammable: Hydrogen, Isopropyl Alcohol, Methane
- Toxic:  $\text{HCl}$ ,  $\text{AsH}_3$ ,  $\text{BCl}_3$ ,  $\text{PH}_3$ ,  $\text{CO}$ ,  $\text{HF}$ ,  $\text{O}_3$ ,  $\text{H}_2\text{Cl}_2\text{Si}$ ,  $\text{TEOS}$ ,  $\text{C}_4\text{F}_6$ ,  $\text{C}_5\text{F}_8$ ,  $\text{GeH}_4$ ,  $\text{NH}_3$ ,  $\text{NO}_2$  and  $\text{O}_2$  Deficiency
- Pyrophoric: Silane

## Chemical Plants

- Large user of gas detection equipment
- Often use range of flammable and toxic gases in manufacturing processes
  - Or created as process by-products

## Typical Applications

- Raw material storage
- Process areas
- Laboratories
- Pump rooms
- Compressor stations
- Loading/unloading areas

## Typical Gases

- Flammable: General Hydrocarbons
- Toxic: Various including Hydrogen Sulfide, Hydrogen Fluoride and Ammonia

## Power Stations

- Traditionally coal and oil used as fuel for Power Stations
- Most are being converted to natural gas

## Typical Applications

- Around boiler pipe work and burners
- In and around turbine packages
- In coal silos and conveyor belts in older coal/oil fired stations

## Typical Gases

- Flammable: Natural Gas, Hydrogen
- Toxic: Carbon Monoxide, SOx, NOx and Oxygen deficiency

In most industries, one key part of a safety plan for reducing risks to personnel and plant is use of early warning devices such as gas detectors

- Can help provide more time to take remedial or protective action
- Can also be part of a total integrated monitoring and safety system for an industrial plant

## Waste Water Treatment Plants

- Familiar site around many cities and towns
- Sewage naturally gives off Methane and  $H_2S$ 
  - ‘Rotten egg’ smell of  $H_2S$  can often be noticed as human nose can detect at less than 0.1ppm

## Typical Applications

- Digesters
- Plant sumps
- $H_2S$  scrubbers
- Pumps

## Typical Gases

- Flammable: Methane, Solvent vapors
- Toxic: Hydrogen Sulfide, Carbon Dioxide, Chlorine, Sulfur Dioxide, Ozone

## Boiler Rooms

- Small buildings may have a single boiler
- Larger buildings often have large boiler rooms housing several large boilers

## Typical Applications

- Flammable gas leaks from incoming gas main
- Leaks from boiler and surrounding gas piping
- Carbon Monoxide given off badly maintained boiler

## Typical Gases

- Flammable: Methane
- Toxic: Carbon Monoxide



## Hospitals

- May use many different flammable and toxic substances
  - Particularly in laboratories
- Many are very large and have onsite utility supplies and back up power stations

## Typical Applications

- Laboratories
- Refrigeration plants
- Boiler rooms
- Generator Rooms

## Typical Gases

- Flammable: Methane, Hydrogen
- Toxic: Carbon Monoxide, Chlorine, Ammonia, Ethylene Oxide and Oxygen deficiency

## Tunnels/Parking Structures

- Need to be monitored for toxic gases from exhaust fumes
- Modern tunnels and parking structures use monitoring to control ventilation fans
- Tunnels may also need to be monitored for natural gas build-up

## Typical Applications

- Parking structures
- Underground and enclosed car parks
- Access tunnels
- Ventilation control

## Typical Gases

- Flammable: Methane (natural gas), LPG, LNG, Petroleum Vapor
- Toxic: Carbon Monoxide, Nitrogen Dioxide



## **mA Output 101 (Analog)**

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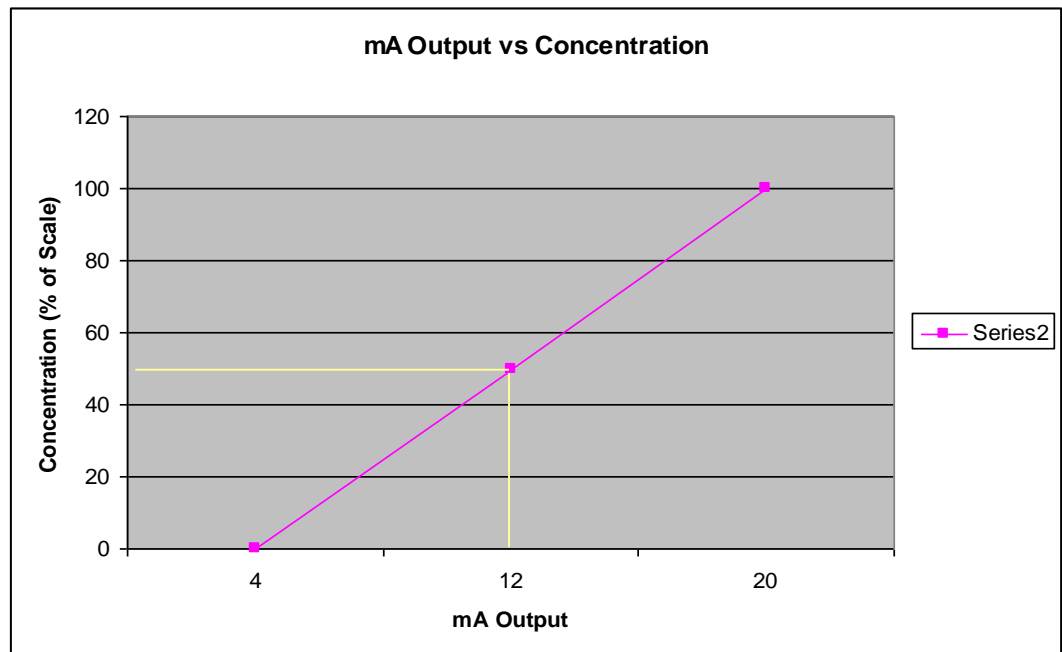
# 4-20mA Definition

- Definition of: **4-20 MA**

**(4 TO 20 MILLIAMP) A POINT-TO-POINT OR MULTI-DROP CIRCUIT MAINLY USED IN THE PROCESS AUTOMATION FIELD TO TRANSMIT SIGNALS FROM INSTRUMENTS AND SENSORS IN THE FIELD TO A CONTROLLER. IT SENDS AN ANALOG SIGNAL FROM 4 TO 20 MA THAT REPRESENTS 0 TO 100% OF SOME PROCESS VARIABLE.**

The 4-20mA is an electrical signal proportional to the gas detection (or other output device): As the concentration or device response increases the mA output will increase respectively.

4mA = 0% of range  
12mA = 50% of range  
20mA = 100% of range



# Electrical Current Analogy

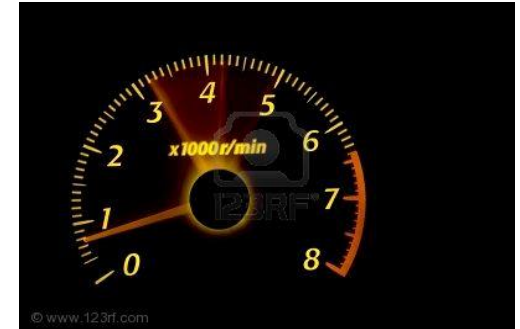
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## Tachometer

Car at no speed (idling)  
4 milliamps = 0% of range

Car at full speed  
20 milliamps = 100% of range

Car stalled  
0 milliamps = fault



# mA Output Forms

4 forms of mA output signals:

- Loop (2-Wire)
- Source (3-Wire)
- Sink (3-Wire)
- Isolated (4-Wire)

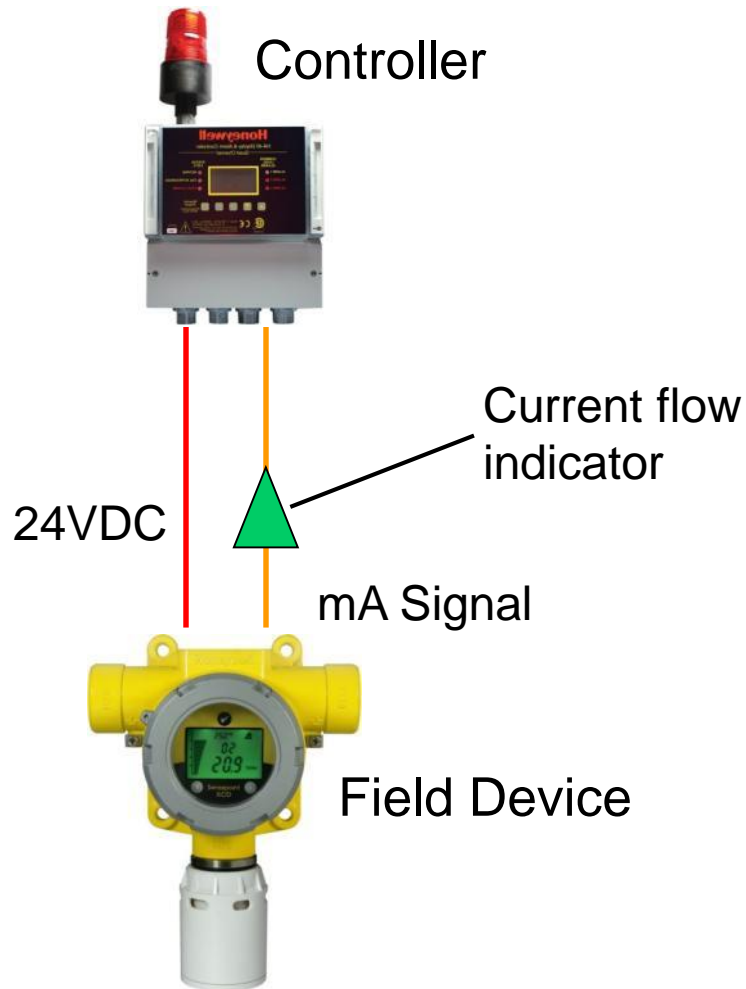
Type	# of Wires	% used
Loop	2	~3%
Source	3	~90%
Sink	3	<1%
Isolated	4	~5%

Each form uses a different reference path for the creation of the mA signals which is dependant on the controller or receiving device (i.e. PLC) that the field device is connected to.

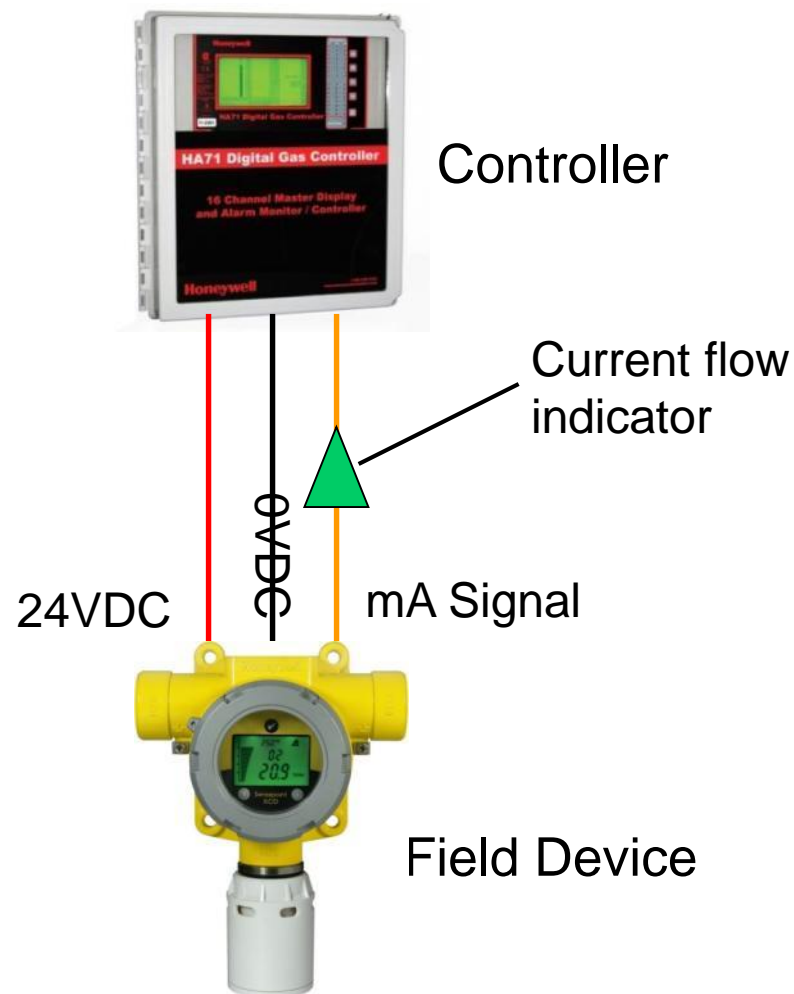
*Note: Controllers and PLCs (Programmable Logic Controller) are essentially the same from a basic operational stance*

# Field Device Output Configuration

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**Loop = 2-Wire**



**Source = 3-Wire**





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## Series 3000 MKII

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# Series 3000 MkII Overview

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- Gas detector 2 wire 4-20mA Output
  - Replaces other 2 wire 4-20mA toxic gas detectors
  - Cost effective way to update without pulling additional wire
- Factory calibrated sensors
  - O<sub>2</sub>, H<sub>2</sub>S, CO, SO<sub>2</sub>, NH<sub>3</sub>, HCL, HCN, HF, CL<sub>2</sub>, CLO<sub>2</sub>, NO<sub>2</sub>, H<sub>2</sub>, PH<sub>3</sub>, NO
  - Surecell™ sensors
  - Reflex™ sensor diagnostics
- Hazardous area certified
  - UL, cUL, Inmetro, and ATEX
  - IS sensor connection for 'Hot Swap' capability



# Series 3000 MkII Summary

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- Reduced installation costs
  - Common transmitter for all sensors
    - Same tools/installation methods reduces install costs
  - 2 wire loop powered
    - Low power reduces energy costs
    - Low cost cabling
- Reduced operation costs
  - Same user interface for all detectors
    - Less chance of incorrectly configuring/interpreting readings/messages increases detector up time
    - Reduced training time reduces training costs
- Reduced maintenance costs
  - Enhanced diagnostics with warning and fault codes
  - Replaceable intelligent hot swap plug in sensors
    - No hot work permit required
    - Less time and cost to maintain detectors
  - Common spare parts
    - Reduced maintenance/spares stock level and cost





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## Sensepoint XCD

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# Overview

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- Toxic and Flammable gas detector 3-wire Transmitter/Sensor combo
- Technologies
  - Catalytic or Infrared for Flammable gases
  - Electrochemical Cell for Oxygen and Toxic gases
  - Infrared for Carbon Dioxide
- Versatile Local Display
  - Simultaneous Bar-Graph and Numerical concentration display
  - Multi color LCD Status Back-Light
  - Icons provide additional information
- Worldwide certification
  - IEC Ex, ATEX and UL
  - CSA (cat bead)/cUL Toxics (Canada)
  - KTL (Korea), GB,CCCF (China)
  - Inmetro (Brazil)

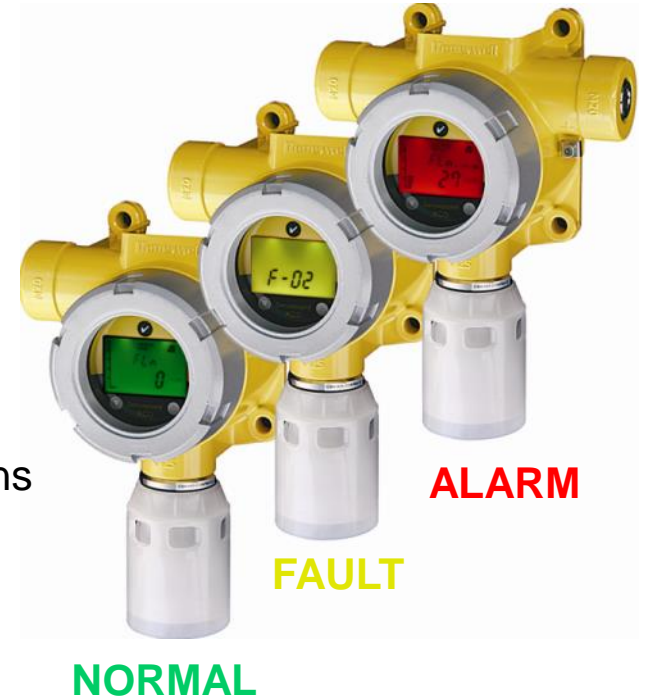




# Overview

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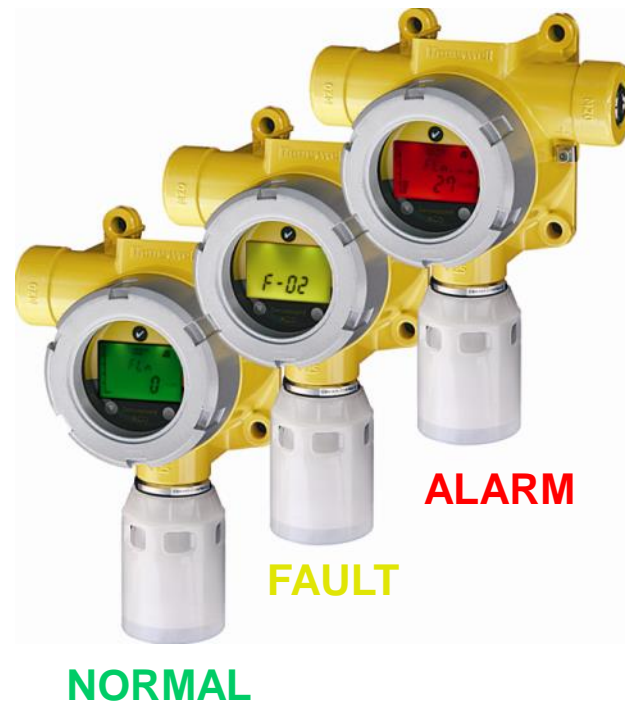
- One-Person, Non-Intrusive calibration and maintenance
- Standard Outputs:
  - 3-wire 4 to 20 mA analog signal (sink or source)
  - Relays, 2 Alarm and 1 Fault, fully configurable
- Clear and informative display
  - Tri-color backlight on LCD display
    - Instantly and clearly visible from a distance
    - Helps to clarify operation status in adverse situations



# Sensepoint XCD Status Outputs

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Display Status		
Status	Display	Backlight
Fault - Circuit or sensor error	F-XX Fault Number w/ blinking fault icon	Yellow - flashing
System Fault	N/A	
Warning	W-XX Warning number w/blinking fault icon	Green - steady
Normal	0.0 Gas Concentration	Green - steady
Alarm 1	Gas Concentration blinking 1st alarm icon	Red - flashing
Alarm 2	Gas Concentration blinking 2nd alarm icon	Red - flashing
Overrange	Full-scale icon and blinking gas reading	Red - flashing
Inhibit	Inhibit icon dependant on Menu command. If any relay is set to inhibit, then inhibit relay is activated	Green - steady



- Common Transmitter Identity

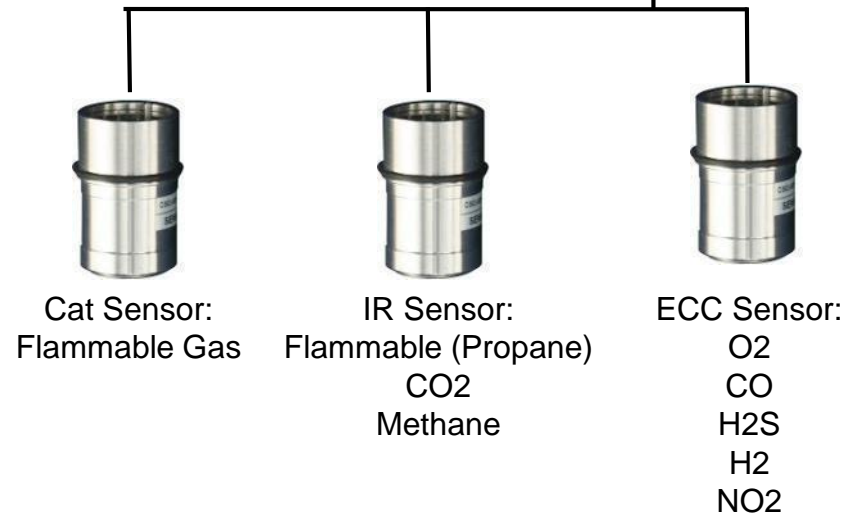
- Same transmitter electronics applicable to a variety of gas sensors within sensor technology families

- 3 different terminal PCB platforms

- Flammable
- O<sub>2</sub>
- Toxic

- Uses Electrochemical/Catalytic/IR sensing technology

- Transmitter reads sensor type and range



# Gases and Ranges

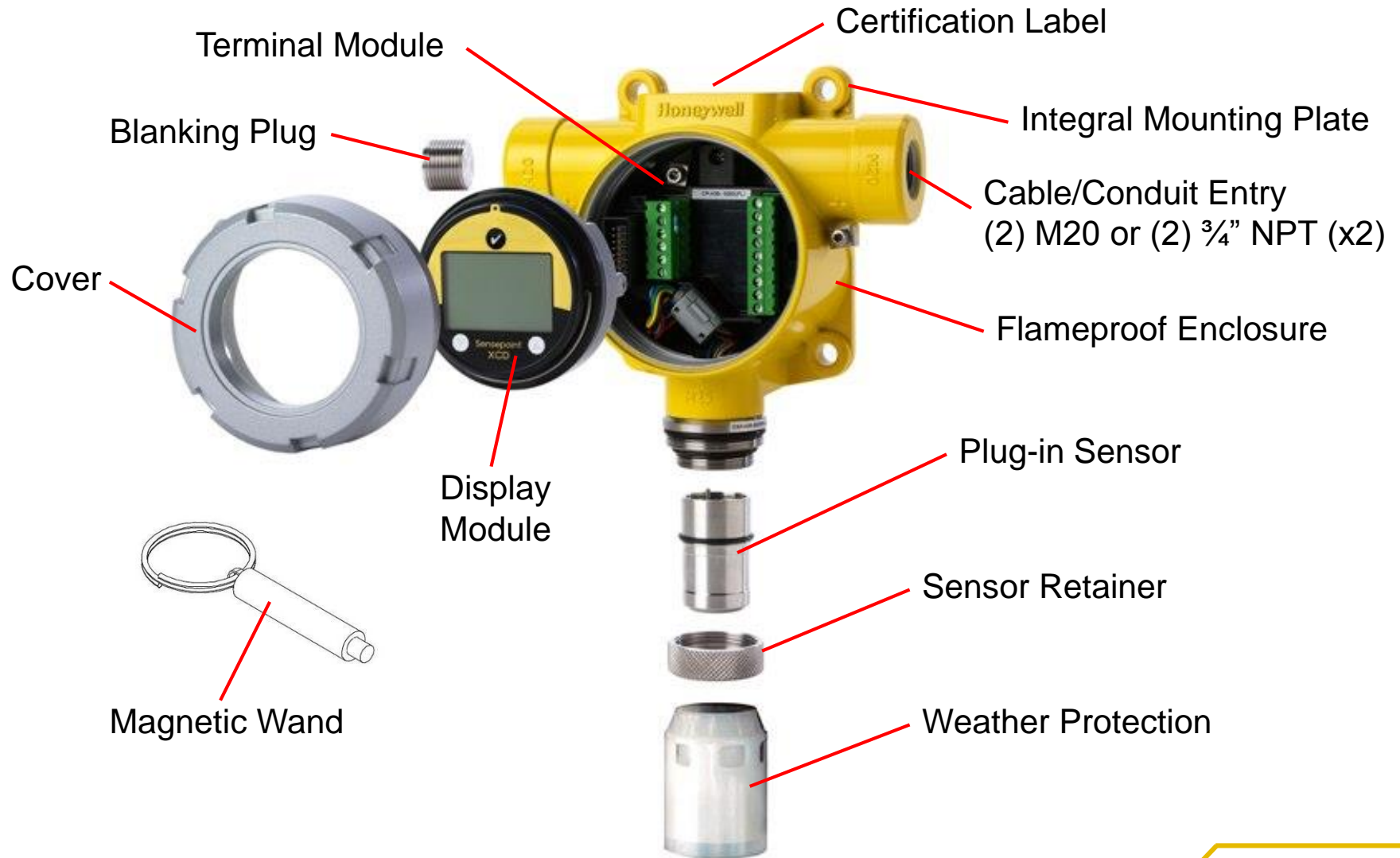
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Gas	User Selectable Full Scale Range	Default Range	Steps	Operating Temperature *		Default Alarm Points	
				Min	Max	A1	A2
Electrochemical Sensors				▲ - Rising Alarm ▼ - Falling Alarm			
Oxygen	25.0%Vol. only	25.0%Vol.	n/a	-20°C / -4°F	55°C / 131°F	19.5%Vol. ▼	23.5%Vol. ▲
Hydrogen Sulfide	10.0 to 100.0ppm	50.0ppm	0.1ppm	-20°C / -4°F	55°C / 131°F	10ppm ▲	20ppm ▲
Carbon Monoxide	100 to 1,000ppm	300ppm	100ppm	-20°C / -4°F	55°C / 131°F	30ppm ▲	100ppm ▲
Hydrogen	1,000ppm only	1,000ppm	n/a	-20°C / -4°F	55°C / 131°F	200ppm ▲	400ppm ▲
Nitrogen Dioxide	10.0 to 50.0ppm	10.0ppm	5.0ppm	-20°C / -4°F	55°C / 131°F	5.0ppm ▲	10.0ppm ▲
Catalytic Bead Sensors							
Flammable 1 to 8*	20.0 to 100.0%LEL	100%LEL	10%LEL	-20°C / -4°F	55°C / 131°F	20%LEL ▲	40%LEL ▲
Infrared Sensors							
Methane	20.0 to 100.0%LEL	100%LEL	10%LEL	-20°C / -4°F	50°C / 122°F	20%LEL ▲	40%LEL ▲
Propane	20.0 to 100.0%LEL	100%LEL	10%LEL	-20°C / -4°F	50°C / 122°F	20%LEL ▲	40%LEL ▲
Carbon Dioxide	2%Vol. only	2%Vol.	n/a	-20°C / -4°F	50°C / 122°F	0.4%Vol. ▲	0.8%Vol. ▲



# Overview

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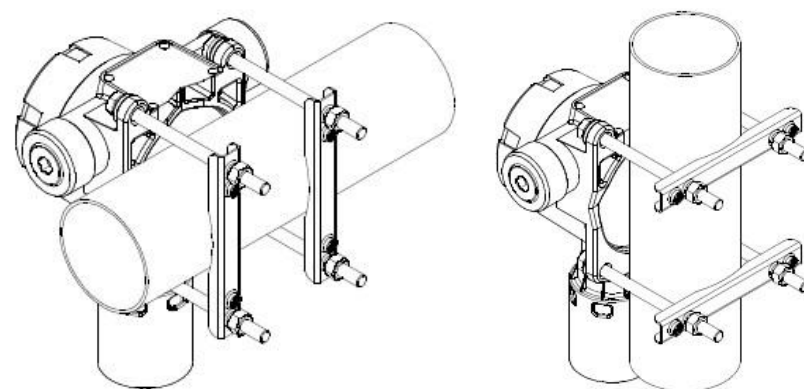


# Optional Accessories

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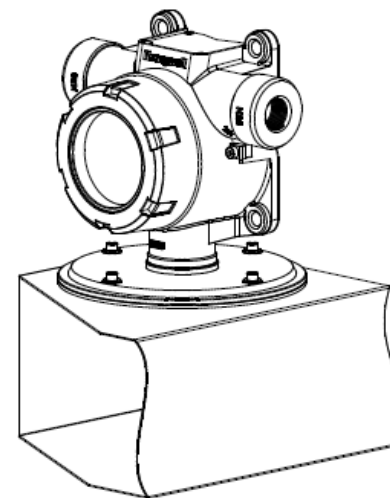
- **Pipe Mount Bracket**

- The transmitter may be fixed directly to a horizontal or vertical pipe/structure
- Suitable for pipes Ø40.0-80.0mm (Ø1.6 to 3.1").



- **Duct Mount Kit** (For CO, H2 and H2S gas sensors only)

- Enables detection within ventilation duct w/transmitter external to duct
- Square/rectangular ducts
  - Minimum 1mm (0.04") duct wall thickness
- External gas inlet port
  - Recommended for bump test only
  - Use calibration cup for calibration
  - Suitable for 6mm (¼") ID tubing

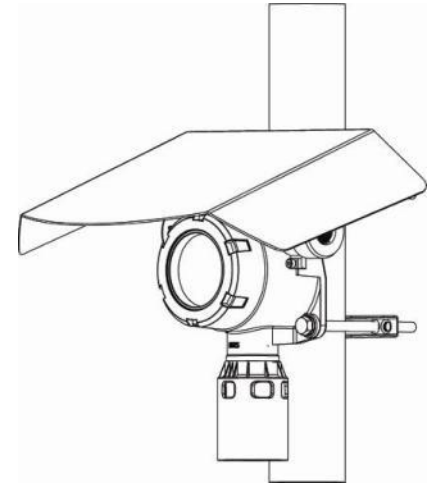


# Accessories

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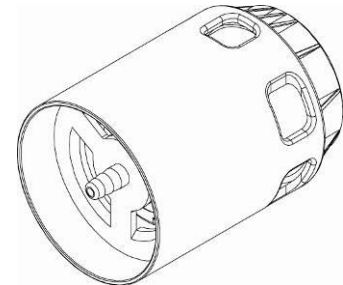
- **Sunshade/deluge cover**

- Designed to protect XCD from overheating in exposed hot and arid climates.
- Additional protection from thermal shock in Tropical Environments / water deluge conditions.
- Attaches to the integral mounting lugs



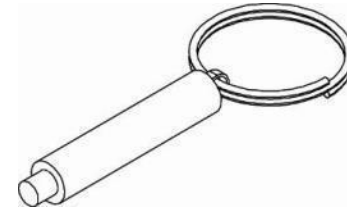
- **Weather protection w/gassing port** (supplied as standard)

- Recommended for outdoor exposed applications
- Gassing port
  - Recommended for bump testing only
  - Suitable for 6mm (1/4") ID tubing



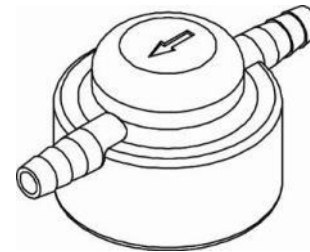
- **Magnetic Wand**

- For menu activation and changing settings



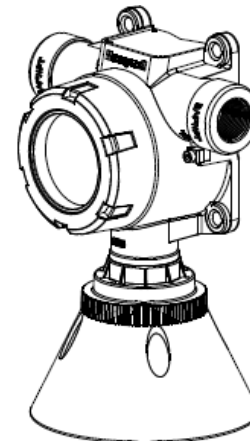
- **Gassing Cap**

- For applying calibration gases to sensor
- Use 6mm (1/4") ID tubing
  - 500ml/min for IR, toxic & O<sub>2</sub>
  - 1Ltr/min for catalytic



- **Collecting cone** (CO and H<sub>2</sub> only)

- To aid detection of lighter than air gases
- Stand off from wall required or ceiling mounting bracket



- Output
  - 3-wire 4-20mA
    - Sink or source switch selectable
  - Over range 22mA
  - Fault  $\geq 0.0 < 1.0$  mA
  - Inhibit (Selectable)
    - Flam/Toxic: 2mA or 4mA (Oxygen 2mA or 17.4mA)
- Supply voltage
  - 16 to 32 VDC (24 VDC nominal)
- Power consumption (max)
  - Cat: 4.9W, ECC: 3.7W, IR: 3.7W
- Wiring
  - Suitable mechanically protected cable/conduit and glands
  - 3 conductor plus shield
    - 90% coverage preferred
  - 20 to 14AWG cable
    - Ensure min required voltage at detector is 16 VDC

# Customer Value

Honeywell

- Reduced installation / commissioning costs
  - Factory configured sensors
    - 100% factory gas tested
  - Sensor recognition
    - Transmitter automatically recognizes sensors
  - Non-intrusive configuration
    - Removes need for hot work permit or “gas-free” certificate
    - On-line signal injector tool to save gas during commissioning
- Reduced routine maintenance costs
  - Long life sensing elements
    - Typical >2 years (CAT & EC type)
    - Proven Catalytic Sensor, poison resistant technology for flammable gas
    - Proven Electro-Chemical Cell (ECC) sensing technology for toxic gas
      - Surecell™ ECCs for hot and humid environments
      - Reflex™ automatic cell fault diagnostics
    - Hydrocarbon and CO2 Infrared sensing technology for greater durability and lifespan
  - User programmable calibration frequency
    - Provides reminder to enable proactive maintenance planning
  - Enhanced diagnostic software and display
    - Reduces need for additional service training
    - No additional interrogator device needed



# Technical Summary

Honeywell

- Cost effective gas detector
  - Alphanumeric & Bar-graph display
  - Status backlit LCD (Green, Red, Yellow)
  - 3 wire, 24V DC, 4~20mA output
  - 3 configurable relays
- Hazardous area certified
  - IECEx, ATEX, KTL (Korea), GB, CCCF (China),
  - CSA (Canada), UL (North America)
  - Performance approvals
- Robust design
  - Aluminium Alloy
  - Built in mounting plate
- Wide choice of sensors
  - Catalytic and Infrared flammable gas detector
  - 0-100% LEL
  - ECC for toxic gasses
  - O<sub>2</sub>, H<sub>2</sub>S, CO, H<sub>2</sub>,
  - Infrared CO<sub>2</sub>
- Designed for wide range of applications
  - Ambient monitoring, outdoor & indoor, arctic, temperate, arid and tropical
  - Suitable for HVAC and Sampling Systems







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## HA Series Controllers (HA-20, 40, 71)

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## HA20 2-Channel Controller

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# Overview

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- Mid-range controller product designed to monitor 1 to 2 transmitters or sensors



# Overview - Features

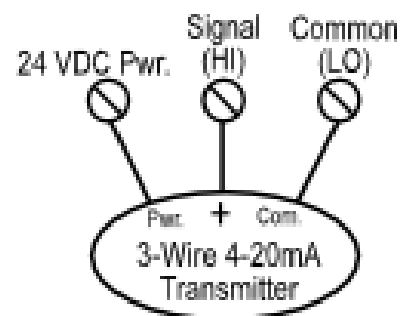
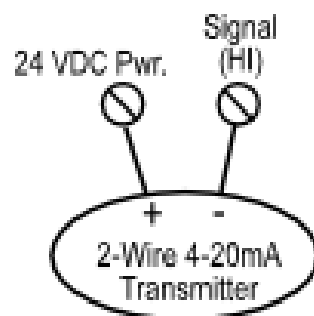
- Accepts up to two inputs
  - 4-20mA inputs
- AC input power supply generates 24 VDC @ 50 watts max for powering external devices
- 3 independent alarm levels per channel
  - *Relay Acknowledge* feature allows silencing of external audible devices during existing alarm conditions
- Graphic LCD readout displays monitored data as bar graphs, trends and engineering units
- Two standard SPDT common alarm relays are configurable for HORN, HIGH, WARN or FAULT alarm conditions
  - 6 discrete channel alarm relays also included
- Touch & magnetic keypad for nonintrusive operation in potentially hazardous locations
- Standard NEMA 4X polycarbonate enclosure
  - Certified to Class I, Div. 2, Groups A,B,C,D - CE mark

- Controllers accept both AC and DC Power
- Definitions:
  - AC (Alternating Current)
    - Common form of electricity from power plant to home/office
  - DC (Direct Current)
    - An electrical current that travels in one direction and used within circuits of electrical devices

# Inputs

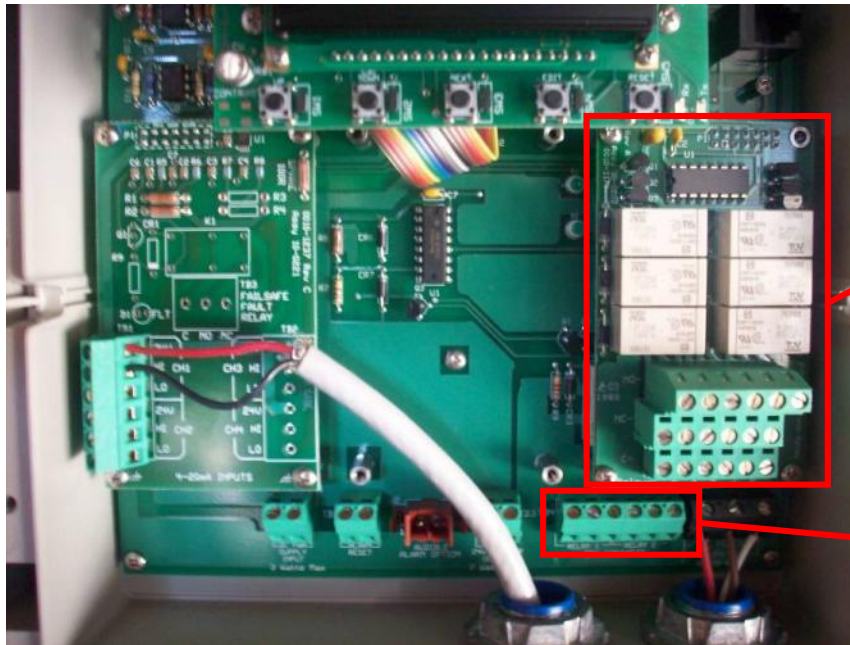
- Up to 2 channels of 4-20mA
  - 2 Wire
    - S3000
  - 3 Wire
    - XCD

Transmitter	Controller Terminal / Transmitter Wire		
XCD	24V - 24V	HI - 4-20mA	LO - 0V
S3K	24V - +	HI - -	LO - None



# Relays

- HA20 equipped standard with 2 onboard relays
  - 6 Additional discrete relays included



6 Additional Relays

2 Standard Relays

# Part Numbers

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## HA20 Digital Gas Controller

### Description

### Order Number

2 channel controller: UL/CSA approved, Class I, Division 2 - NEMA 4X enclosure with magnetic input for nonintrusive control, dual 4-20 mA analog input, 2 – 5 Amp common relays, 6 – 5 Amp discrete relays, and internal 50W power supply

HA20PY

2 channel controller: UL/CSA approved, Class I, Division 2 - NEMA 4X enclosure with magnetic input for nonintrusive control, dual 4-20 mA analog input, 2 – 5Amp common relays, 6 - 5Amp discrete relays, internal 50W power supply, and factory mounted Class I, Division 2 approved red xenon strobe light.

HA20PY-H

HA20PY - H



HA20PY





# Summary

- Easy to read Graphic LCD display
- Local strobe available as option
- 4-20mA communication
- Common and discrete alarm relays
- User customized alarm capabilities
  - Logic “Or” condition statement
- 3 Independent alarm levels plus Fault per channel
- Authorization Mode for security





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## HA40 4-Channel Controller

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# Overview of HA40

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- Mid-range controller product designed to monitor 1 to 4 transmitters or sensors



# Product Features

Honeywell

- Accepts up to four inputs
  - 4-20mA inputs
- AC input power supply generates 24 VDC @ 50 watts max for powering external devices
- 3 independent alarm levels per channel
  - *Relay Acknowledge* feature allows silencing of external audible devices during existing alarm conditions
- Graphic LCD readout displays monitored data as bar graphs, trends and engineering units
- Two standard SPDT common alarm relays are configurable for HORN, HIGH, WARN or FAULT alarm conditions
  - 6 discrete channel alarm relays also included
- Touch & magnetic keypad for nonintrusive operation in potentially hazardous locations
- Standard NEMA 4X polycarbonate enclosure
  - Certified to Class I, Div. 2, Groups A,B,C,D - CE mark

# Summary

- Easy to read Graphic LCD display
- Local strobe available as option
- 4-20mA communication
- Common and discrete alarm relays
- User customized alarm capabilities
  - Logic “And” & “Or” condition statements
- 3 Independent alarm levels plus Fault per channel
- Authorization Mode for security
- NEMA 4x polycarbonate





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## HA71 16-Channel Controller

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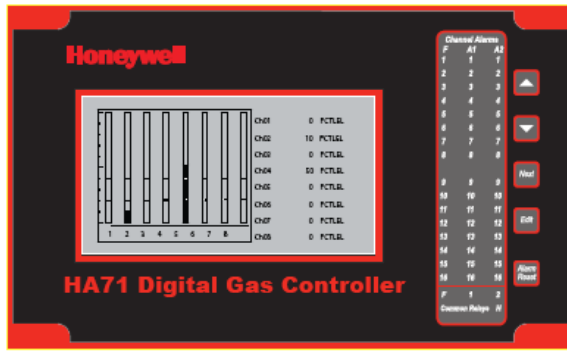
**Honeywell**

- 2 versions available
  - 8 Channel input with 3 common and 16 discrete relays
  - 16 Channel input with 3 common and 32 discrete relays
- User interface
  - Graphic LCD readout displays monitored data as:
    - Trends
    - Bar graphs
    - Engineering units
    - Alarm LED's flash when new and become steady after acknowledged
  - Push-button keypad
  - Magnetic keypad

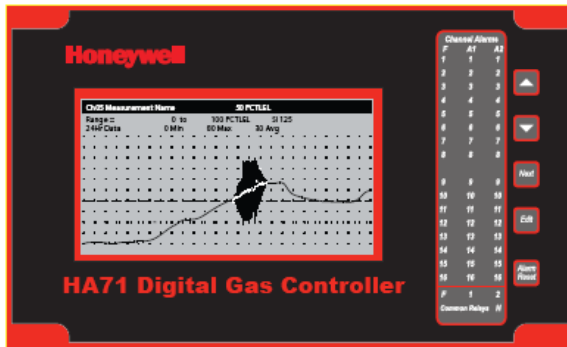


# Graphic Screens

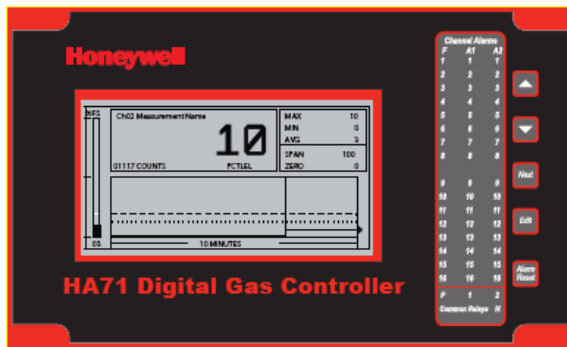
Honeywell



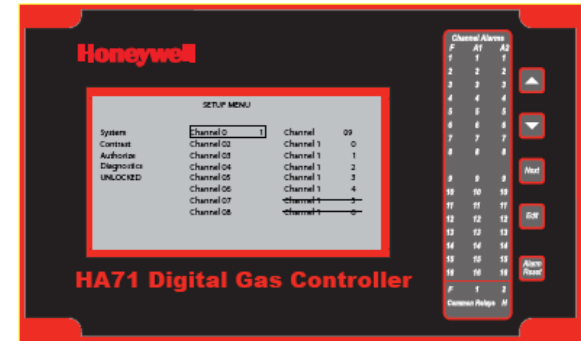
**Bar Graph**  
(Bar graph of each point with alarm level set points and live concentration)



**Trend Graph**  
(Trend Graph shows the 24 hour trend of the point selected)



**Combination**  
(The bar graph displayed is a 10 minute window used for viewing active conditions. The screen also supplies the units of measure numerical concentration level and minimum/maximum/average reading data)



**Setup Screen**  
(Enables the user to scroll to the desired channel or system setup for altering the operation of the selected item)

- Inputs
  - 8 or 16 channel inputs
    - 4-20mA
- Outputs
  - Common Relays (standard)
    - Horn, Alarm 1, Alarm 2 & Fault
  - Discrete Relays
    - Alarm 1, Alarm 2 or Alarm 3 - Switch selectable
- Relay Acknowledge feature allows silencing of external audible devices during existing alarm conditions
- Cal Mode offers pushbutton zero / span calibration for direct sensor interface applications. Authorization Mode allows locking of critical configuration variables

- 150 Watt AC – 24VDC Power Supply
  - 110-120 VAC @ 3.2A max
  - 220-240VAC @ 1.6A max
    - Voltage selectable via switch selection on internal power supply
  - Powers HA71 and up to 8 or 16 detectors
    - Maximum 5 watts per channel available for powering of external transmitters

# Part Numbers

**Honeywell**

## HA71 Digital Gas Controller

## Order Number

8 channel controller: UL/CSA approved, Class I, Division 2 - NEMA 4X enclosure with magnetic input for nonintrusive control, eight 4-20 mA analog inputs, 3 – 5 Amp common relays, 16 – 5 Amp discrete relays (Alarm 1 & Alarm 2 per channel), and an internal 150W power supply.

HA71N4-8

16 channel controller: UL/CSA approved, Class I, Division 2 - NEMA 4X enclosure with magnetic input for nonintrusive control, sixteen 4-20 mA analog inputs, 3 – 5 Amp common relays, 32 – 5 Amp discrete relays (Alarm 1 & Alarm 2 per channel), and an internal 150W power supply.

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