Honeywell

Indoor Air Quality Monitor

INTRODUCTION

About This Sensor

The Honeywell IAQ monitor is a configurable, connected, comprehensive array of multi sensors to measure various air quality parameter such as Particulate Matter (PM2.5 and PM10), Carbon Dioxide (CO_2), Total Organic Volatile compound (TVOC), Temperature (T), and Relative humidity (Rh).

It is suitable for intelligent building and systems, air quality data collection systems, green building evaluation systems and ventilation systems. It provides a RS-485 interface for communication using MODBUS RTU protocol.

The device is packaged with five sensors suitable for most commercial building requirements that enable quick and easy initial setup. In addition to the standard sensors, two additional sensors can be added from wide array of sensor options such as HCHO, Ozone**, NO_x, and SO_x.

The sensor module in the IAQ sensor is specifically designed for detection and stability to ensure better and accurate output. The intelligent control algorithms built into the device helps to minimize the influence of ambient temperature and relative humidity on the measured values.

The IAQ sensor is available in multiple variants in Black and White colors. It has variants with or without on-board Display. The simple structure and installation make wall-mounting and ceiling mounting easy and convenient.

Intended audience and assumed knowledge

This document provides information about installing and commissioning of the IAQ sensor.

It is assumed that the user is trained and familiar with HVAC concepts.

IMPORTANT: Always install equipment in accordance with the National Electric Code and in a manner acceptable to the local authority having jurisdiction. No guidelines, instructions, installation practices, or other information presented in this guide may be interpreted to supersede or modify the local codes and practices.

Reference documents

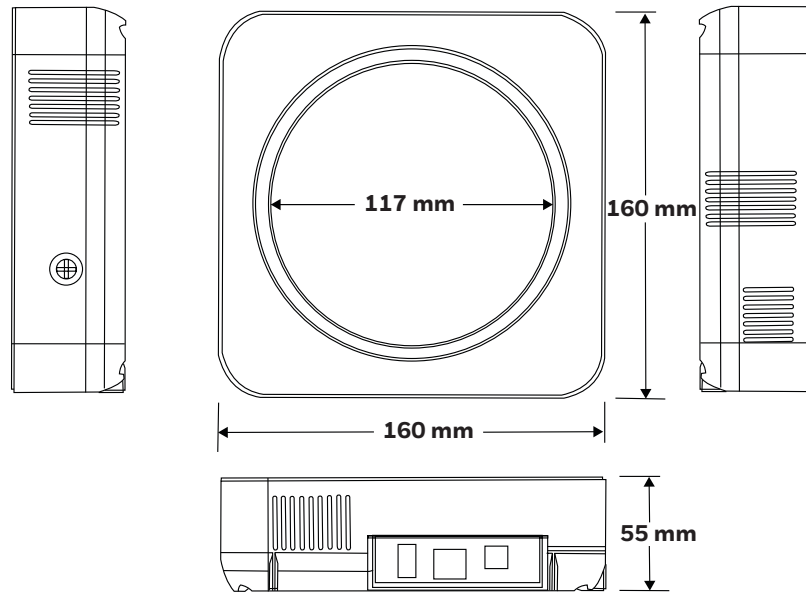• IAQ Sensor Datasheet – 31-00510: Describes IAQ sensor and its features.

Dimensions

Fig. 1. Dimensions.

SPECIFICATIONS

| Part Number	HN/HD INDOOR AIR QUALITY SENSOR SERIES
Detection Parameters	**5 standard sensors**: Temperature, Relative Humidity, Particulate Matter (PM2.5 and PM10), Total Organic Volatile compound (TVOC), Carbon Dioxide (CO_2) **2 customer selectable optional sensors**: Formaldehyde (HCHO), Ozone** (O_3), NO_2**, and SO_2**
Operating Environment Temperature	0 °C to 70 °C (32 °F to 158 °F)
Humidity	0–90% Rh (non-condensing)
Storage Conditions	-10 °C to 50 °C (14 °F to 122 °F)
Overall Dimensions	160 mm × 160 mm × 55 mm (without rear mounting plate) 6 1/4 in. × 6 1/4 in. × 2 1/8 in.
Net weight	520 g (1.15 lbs.)
** For future release	

INSTALLATION

⚠ WARNING

- To reduce the risk of electrical shock do not open the sensor. There are no user serviceable parts inside. Refer service to a qualified service personnel only.
- Cleaning — Use a dry cloth to clean the product. Do not use liquid cleaners or aerosol cleaners
- Water and moisture — Do not use the product near water. Do not install the product in a place where water may splash onto it.
- Do not operate the sensor with a hard, sharp or pointed object such as a fingernail or pen.

Mount the IAQ sensor on an inside wall approximately 1.4 m (4-½ ft) from the floor (or in the specified location), to allow exposure to the average zone temperature. Do not mount the IAQ sensor on an outside wall, on a wall containing water pipes, or near air ducts. Avoid locations that are exposed to discharge air from registers or radiation from appliances, lights, or the sun.

When mounting directly on a wall, use the type of screws appropriate for the wall material.
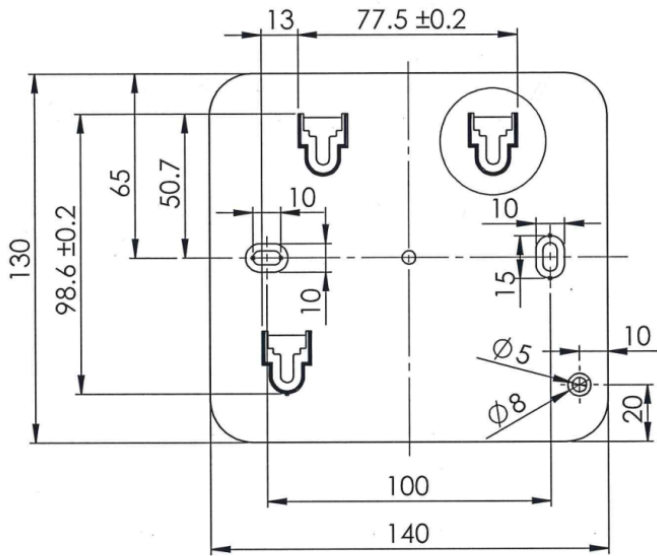
ALL DIMENSIONS ARE IN MM
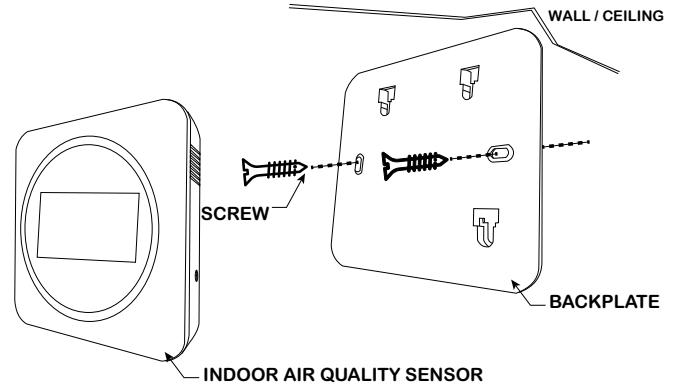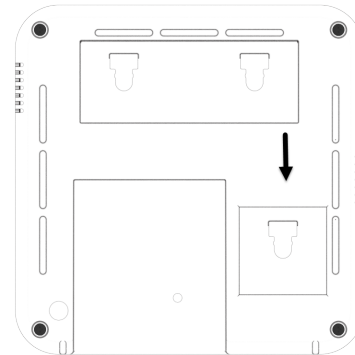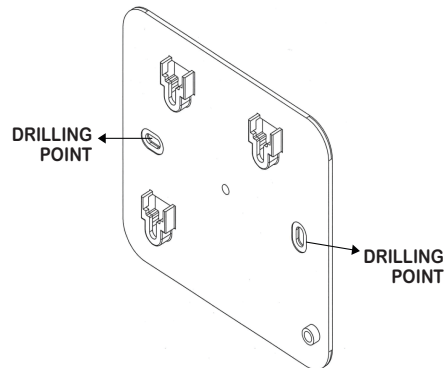
Fig. 2. Backplate mounting holes

Fig. 3. Mounting on a Wall

1. To separate the backplate from the sensor, slide the backplate downward according to the direction of the arrow.

2. Drill holes, to fix the backplate on a wall or ceiling.

3. Connect power cable, three wire RS-485 terminal connector to the sensor.
4. Mount IAQ sensor on backplate.
5. Power up the device.

RS–485 CONFIGURATION

Prerequisites

Before going through RS-485 configuration, ensure the sensor is installed and wired up according to the installation Instructions below.

After installing the sensor and powering it up for initial use or re-use, the device should be continuously powered to ensure stable output of all measured values. Complete these steps to configure the detector and connect it to the BMS.

Wiring

USB ←

RS 485 INTERFACE FOR
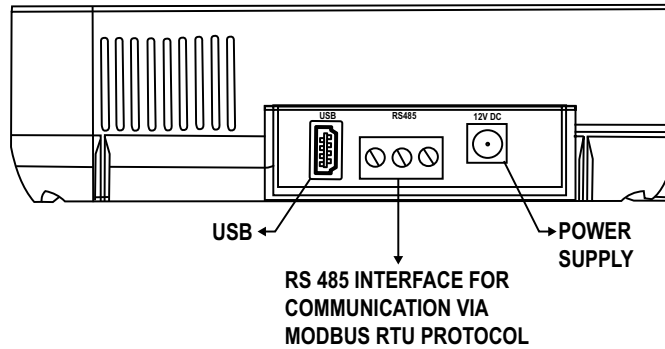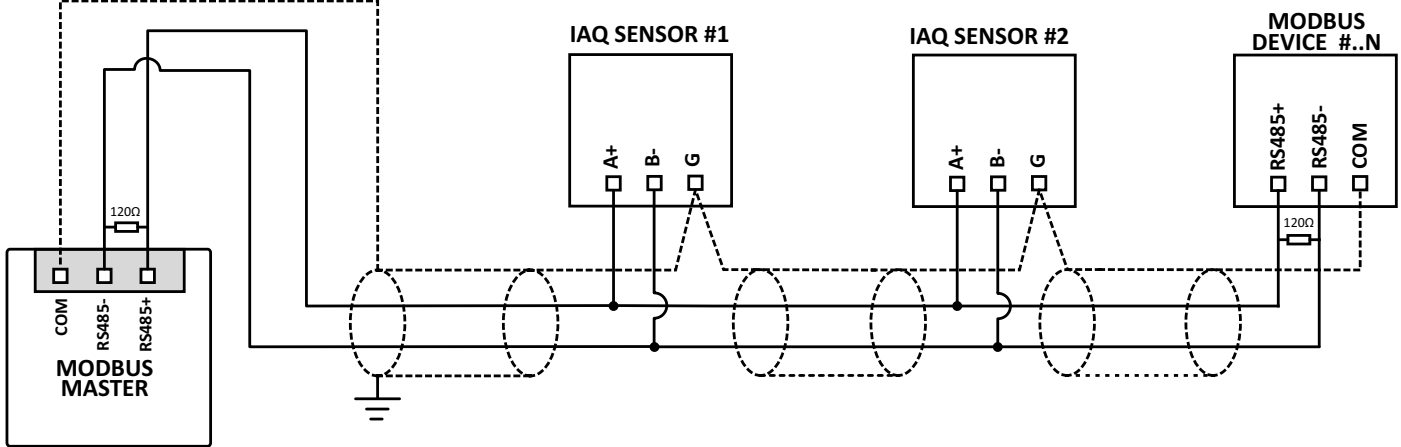COMMUNICATION VIA
MODBUS RTU PROTOCOL

→ POWER
SUPPLY

Fig. 4. Terminal Overview

NOTE:
1) If any of the devices are not electrically isolated, it is recommended that those devices be connected to the ground terminal.
2) The 120-Ohm termination resistor must be inserted directly into the terminals of both end devices.
3) If shielding is used, the shielding of each individual bus segment should be separately connected at one end to earth.
4) Always power each device and the connected slaves via separate transformers.
5) Between devices equipped with non-isolated RS485 bus interfaces, potential differences of max. ±7 V are allowed. Further, this bus should not extend beyond a single building.

Fig. 5. MODBUS System wiring

Table 1. MODBUS Register Table.

Starting Register Decimal	Data Description	Function	Read/ Write	Quantity of Registers (2Bytes/16bit)	Format	Decimals	Data Range, Data Description
40001	Temperature measurement	3	R	1	INT16	0	–10 °C – 70 °C
40002	Temperature (with decimal point) x 100	3	R	1	INT16	2	–10 °C – 70 °C
40003 / 40004	Temperature measurement (MSB)	3	R	2	Float	2	–10 °C – 70 °C
40005	Humidity measurement	3	R	1	INT16	0	0–100 % Rh
40006	TVOC measurement	3	R	1	INT16	0	$0 – 45000 \ \mu g/m^3$
40007	CO_2 measurement	3	R	1	INT16	0	0 – 5000 PPM
40008	PM 2.5 measurement	3	R	1	INT16	0	$0 – 1000 \ \mu g/m^3$
40009	PM 10 measurement	3	R	1	INT16	0	$0 – 1000 \ \mu g/m^3$
40010	AQI value	3	R	1	INT16	0	0 – 100
40011	HCHO measurement	3	R	1	INT16	0	0 – 50000 PPB
40012	Ozone (O_3) measurement	3	R	1	INT16	0	0 – 1000 PPB
40013	SO_2 measurement	3	R	1	INT16	0	0 – 20000 PPB
40014	NO_2 measurement	3	R	1	INT16	0	0 – 10000 PPB
40015	UVC measurement	3		1	INT16	0	$0 – 5 \ mW/cm^2$
40016	EMR measurement	3	R	1	INT16	0	TBD
40017	PM 1 measurement	3	R	1	INT16	0	$0 – 100 \ \mu g/m^3$
40018	Noise measurement	3	R	1	INT16	0	
40019	OS-1 (Optional place holder for future use)	3	R/W	1	INT16	0	
40020	OS-2 (Optional place holder for future use)	3	R/W	1	INT16	0	
40021	OS-3 (Optional place holder for future use)	3	R/W	1	INT16	0	
40022	OS-4 (Optional place holder for future use)	3	R/W	1	INT16	0	

NOTE: In order to reserve the decimal part, the measuring value with decimal will be magnified 100 times, marked as x100.

For example: function 3 of 40002 – Temperature (with decimal point) is marked with x100

if 40002 have 2333 value, then 2333/100 = 23.3 °C as output in system.

NOTE: MSB first Bit for temperature register 40003/40004 (floating point).

Table 2. MODBUS Register Table

Mode	RTU
Baud Rate	110, 300, 600, 1200, 2400, 4800, **9600**, 14400, 19200, 38400, 56000, 57600, 115200 (default: 9600bps)
Start Bits	1
Data Bits	8
Stop Bits	1
Parity	None / Even / Odd (default: None)
Register Map	**Support Function code:** 3 – Read Holding Registers
NOTE: MODBUS Port configuration is by software tool.	

MANAGING INDICATOR LIGHTS

NOTE: This section is applicable for sensors without on–board display.

About Indicator Lights

IAQ sensor has Power and AQI LED to indicate the conditions that may require control.

Indicator Lights Notification Signs

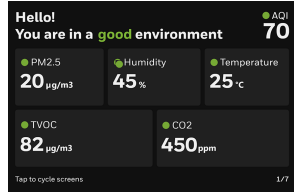The indicator light notification has different color codes to indicate the severity of the IAQ. The following table describes the available signs with color codes of the indicator lights pages.
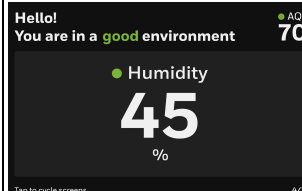
Table 3. Indicator Lights for IAQ

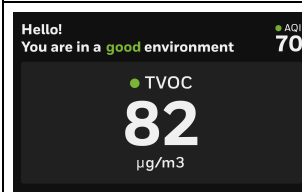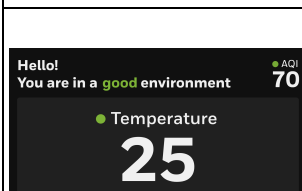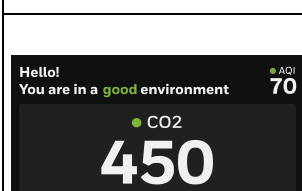| Indicator Color	Description
Green	Good: 100 to 70, indicated as green
Yellow	Moderate: 69 to 40, indicated as yellow
Red	Unhealthy: If less than 40, indicated as red

DISPLAY AND OPERATION

NOTE: This section is applicable for sensors with on-board display.

The IAQ sensor with digital display displays the values as in table below. Slide left or right to navigate between the screens.

Screen	Description
Hello! You are in a good environment ● AQI 70 — PM2.5 20 µg/m3 — Humidity 45% — Temperature 25°C — TVOC 82 µg/m3 — CO2 450 ppm — Tap to cycle screens 1/7	This is the Home screen of IAQ sensor. It contains widgets for all parameter displaying the values and status at a glance.
Hello! You are in a good environment — ● Air Quality Index 70 — Tap to cycle screens 2/7	This screen displays Air Quality Index value and status. AQI status is defined based on it's value. — **Good**: 100 to 70, indicated as green — **Moderate**: 69 to 40, indicated as yellow — **Unhealthy**: If less than 40, indicated as red This value is computed every 15 minutes.
Hello! You are in a good environment ● AQI 70 — ● PM2.5 20 µg/m3 — Tap to cycle screens 3/7	This screen displays PM2.5 value and status. PM 2.5 status is defined on it's value. — **Good**: 0 to 20, indicated as green — **Moderate**: 21 to 70, indicated as yellow — **Unhealthy**: If more than 70, indicated as red
Hello! You are in a good environment ● AQI 70 — ● Humidity 45 % — Tap to cycle screens 4/7	This screen displays Humidity value and status. Humidity status is defined on it's value. — **Good**: 40 to 60, indicated as green — **Moderate**: 35 to 40 or 60 to70, indicated as yellow — **Unhealthy**: 0 to 35 or 70 to 100 indicated as red
Hello! You are in a good environment ● AQI 70 — ● TVOC 82 µg/m3 — Tap to cycle screens 6/7	This screen displays TVOC value and status. TVOC status is defined on it's value. — **Good**: 0 to 3150, indicated as green — **Moderate**: 3151 to 27000, indicated as yellow — **Unhealthy**: If more than 27000, indicated as red
Hello! You are in a good environment ● AQI 70 — ● Temperature 25 °C — Tap to cycle screens 5/7	This screen displays Temperature value and status. Temperature status is defined on it's value. — **Good**: 24 to 26 °C, indicated as green — **Moderate**: 22 to 23 °C or 27 to 28 °C, indicated as yellow — **Unhealthy**: 0 to 21 °C or more than 28 °C, indicated as red
Hello! You are in a good environment ● AQI 70 — ● CO2 450 ppm — Tap to cycle screens 7/7	This screen displays CO_2 value and status. CO_2 status is defined on it's value. — **Good**: 300 to 600, indicated as green — **Moderate**: 600 to 1200, indicated as yellow — **Unhealthy**: If more than 1200, indicated as red

CORRECTION AND CALIBRATION

Regular Correction

In order to ensure the accuracy of the measured value, the IAQ sensor should be corrected every year. The correction should be carried out when a large deviation in the measured value occurs even if it has been used for less than one year.

This chapter describes the correction environment and requirement needed on user's site, the correction can be carried out by Honeywell via calibration software tool at factory.

If the following environment conditions are required for field correction.

CORRECTION ENVIRONMENT:
— Temperature: 20 °C ~ 25 °C (68 °F ~ 77 °F)
— Humidity: 40% ~ 50% Rh
— The IAQ sensor needs to be placed in the indoor natural environment within the above temperature and humidity range.
— There should be windows and no human interference with good air circulation.
— The room area for correction should not be less than 30 m^2 (325 ft^2).

CALIBRATION STANDARDS NEEDED FOR FACTORY CORRECTION.

PM2.5 and PM10
PM2.5 and PM10 calibration standard: A new IAQ sensor as a reference device.

After the new IAQ sensor and the old IAQ sensor that needs to be corrected are powered on continuously and synchronously for more than 10 minutes, record the PM2.5 and PM10 value for 30 minutes, and synchronous average value over 30 minutes can be applied for correction.

Temperature and humidity
Temperature and humidity calibration standard: commercial or industrial temperature and humidity calibration standard.

After the temperature and humidity calibration standard and IAQ sensor that needs to be corrected are powered on continuously and synchronously for more than 60 minutes, start to record the value of temperature and humidity for 10 minutes, use the synchronous average value within 10 minutes over correction.

CO$_2$
CO$_2$ calibration standard: CO$_2$ sensor has auto calibration feature inbuilt. If the user wants to perform manual calibration, follow the steps suggested below. Outdoor CO$_2$ reference value is about 380 ppm - 420 ppm.
After the CO$_2$ calibration standard and IAQ sensor that needs to be corrected are powered on continuously and synchronously, the CO$_2$ value shall be continuously recorded for 30 minutes, use the synchronous average value over 30 minutes for correction.

TVOC
TVOC calibration standard: TVOC sensor has auto calibration feature inbuilt. If the user wants to perform manual calibration, then follow the steps as suggested below. since, each TVOC uses different sensors and sensitive substances, it is recommended to use the new IAQ sensor machine as the TVOC calibration standard.

After the TVOC and IAQ sensor that needs to be corrected are powered on continuously and synchronously, record the TVOC value continuously for 30 minutes and use the synchronous average value over 30 minutes for correction, TVOC value will be stable only after correction and at least 24 hours power-on.

MAINTENANCE & FAULT CHECK

Maintenance

To ensure accurate IAQ sensor data, regular maintenance is required in normal use environments. Depending on the environment in which it is used, maintenance is usually required once every 3 to 6 months. Public places with high concentration of dust, dry seasons, pollen seasons, and poor environmental cleanliness can shorten the maintenance period.

General maintenance includes: cleaning the IAQ sensor using a vacuum cleaner to remove dust inside the IAQ sensor.

Fault Check

If a fault occurs in a normal use environment, see Table 4 to troubleshoot. If the fault cannot be eliminated, contact the dealer or the manufacturer.

Table 4. Fault Check-out.

Fault condition	Troubleshooting
PM2.5 and PM10 data abnormal, deviation is too large, the value is too high or too low	Check whether there is debris or a lot of dust in the IAQ sensor housing or on the air inlet and air outlet.
The CO_2 data is abnormal, the value is too high or too low	The CO_2 sensor has a self-calibration function inside. Usually the self-calibration will return CO_2 values to normal. Self-calibration conditions: The CO_2 concentration is around 400 ppm for at least 4 hours in every 24 periods. The self-calibration environment should last for one week.
TVOC's deviation is too large (high or low)	TVOC in the environment needs to be stabilized for at least 48 hours after the sensor is powered on. TVOC data deviation may be a little large within a short time after power is on. TVOC base line deviation may result in large data deviation.The equipment can be placed outside the window or outdoors for at least 24 hours when the outdoor air is good and clear, allowing TVOC to retrace its baseline.
Temperature and humidity deviation is too large, the value is too high or low	Check whether the environmental factors surrounding the IAQ sensor have any influence, such as direct sunlight, close to the heating or air conditioning air outlets, etc.
Temperature and humidity deviation is too large; value does not change for a long time	Sensor can be powered off and back on to see if the reading returns to normal. If value cannot be recovered, contact the dealer or manufacturer.
Communication interruption RS-485 (MODBUS RTU)	Check if the power supply is normal and if the RS-485 terminal is loose. Check whether the RS-485 communication line is accidentally cut. Check for an inductive load with electromagnetic interference near the equipment or RS-485 communication line, such as a water pump.

Waste Electrical and Electronic Equipment (WEEE)

- At the end of the product life, dispose of the packaging and product in an appropriate recycling center.
- Do not dispose of the device with the usual domestic refuse.
- Do not burn the device.

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