

Honeywell

Indoor Air Quality Sensor

TR50



User Guide

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Reference documents

TR50 Indoor Air Quality Sensor Datasheet	31-00565M
TR50 Indoor Air Quality Sensor Mounting Instructions	31-00566M

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INTRODUCTION TO TR50

1.1 Introduction

The TR50 IAQ (Indoor Air Quality) Sensor is an advanced, configurable device for commercial buildings. It monitors 5 parameters

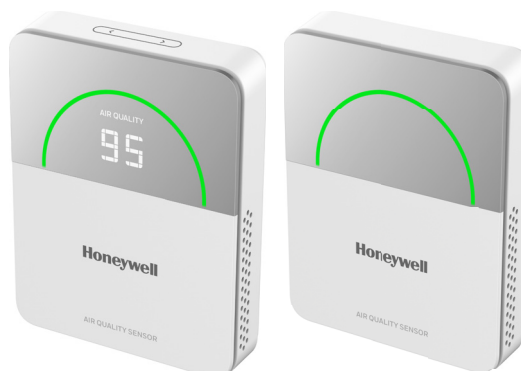
- Temperature (T)
- Relative Humidity (RH)
- Carbon Dioxide (CO₂)
- Particular Matter (PM1.0, PM2.5 and PM10)
- Total Volatile Organic Compound (TVOC)

This TR50 IAQ Sensor device communicates using the Modbus, BACnet MS/TP, or Sylk™ Bus protocol and easily integrates with the building management system.

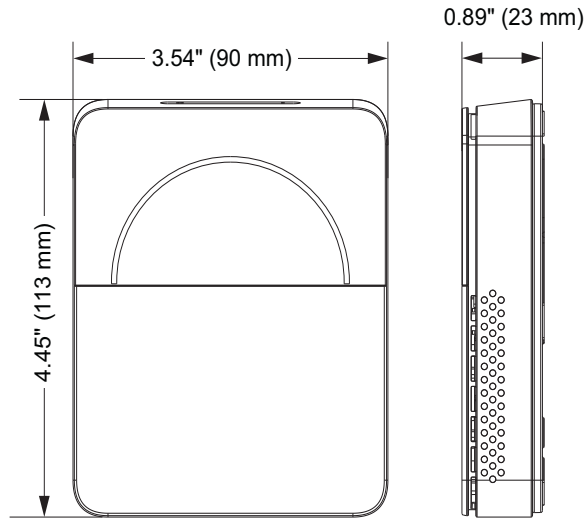
The algorithm built into the device can calculate comprehensive air quality level and display AQI (Air Quality Index) number in LCD and corresponding color with LED ring. The device is packaged with numerous presets suitable for most commercial building requirements, enabling a quick and easy initial setup.

The TR50 IAQ Sensor device has two display modes:

- With Display (With Touch Button)
- Without Display (Without Touch Button)



1.2 Dimensions



All the dimensions shown are in inches (mm).

1.3 Intended audience and assumed knowledge

This User Guide provides information about the Getting Started, Configuration details, and Operations of the TR50 IAQ Sensor to the system integrator, technicians, and end-users. All the electrical engineers and technicians working with the product must have basic training on HVAC Sensors, Smart sensors, and Room Controllers and its application.

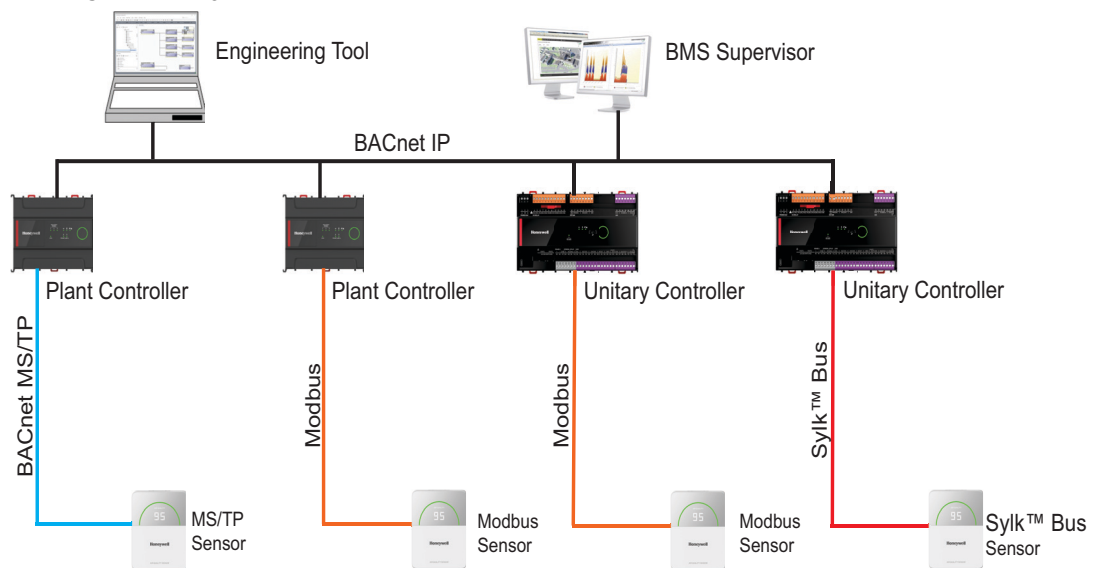
1.4 Specification

Parameter	Description
Detection Parameters	- Temperature (T) - Relative Humidity (RH) - Carbon Dioxide (CO₂) - Particular Matter (PM1.0, PM2.5 and PM10) - Total Volatile Organic Compound (TVOC)
Power Supply	Direct : 24 VAC/VDC $\pm$ 20 % Sylk™ Bus : Honeywell Sylk™ Bus Technology
Operating Temperature	32 to 122 °F (0 to 50 °C)
Operating Humidity	0-95 % RH, non-condensing
Storage Temperature	-40 to 150 °F (-40 to 65.5 °C)

Parameter	Description
Communication	BACnet MSTP, Modbus over RS-485, or Sylk™ Bus
Net weight	189 grams (0.42 lbs.)
Power Consumption	TR50-5D : 24 VAC 3.8 VA, 24 VDC, 1.5 W TR50-5N : 24 VAC 3.8 VA, 24 VDC, 1.4 W TR50-3D : 24 VAC 3.2 VA, 24 VDC/Sylk™ Bus, 0.9 W TR50-3N : 24 VAC 3.2 VA, 24 VDC/Sylk™ Bus, 0.8 W
Dimensions	3.54 inches (90 mm) x 4.45 inches (113 mm) x 0.89 inches (23 mm)

1.5 System Architecture

There are many flexible ways IAQ Sensor TR50 can be integrated into a building management system (BMS), as shown below:



1.6 Ordering Information

Part Number	Sensors	Communication Protocol	Display	Power
TR50-5D	Temperature, Humidity, CO ₂ , PM2.5 and TVOC	Modbus + BACnet + Sylk™ Bus	Yes	24 VAC/VDC
TR50-5N	Temperature, Humidity, CO ₂ , PM2.5 and TVOC	Modbus + BACnet + Sylk™ Bus	No	24 VAC/VDC
TR50-3D	Temperature, Humidity and CO ₂	Modbus + BACnet + Sylk™ Bus	Yes	24 VAC/VDC or Sylk™ Bus
TR50-3N	Temperature, Humidity and CO ₂	Modbus + BACnet + Sylk™ Bus	No	24 VAC/VDC or Sylk™ Bus

2.1 Important Safety Information and Installation Precautions

Read the below instructions carefully for safety and installation.

Local codes and practices

Always install equipment in accordance with the National Electric Code and a in manner acceptable to the local authority having jurisdiction.



Electrostatic sensitivity

This product and its components may be susceptible to Electrostatic Discharge (ESD). Use appropriate ESD grounding techniques while handling the product. When possible, always run the product by its non-electrical components.

High voltage safety test

Experienced electricians, at first contact, always assume that hazardous voltages may exist in any wiring system. A safety check using a known, reliable voltage measurement or detection device should be made immediately before starting work and when work resumes.



Lightning and high-voltage danger

Most electrical injuries involving low-voltage wiring result from sudden, unexpected high voltages on usually low-voltage wiring. Low-voltage wiring can carry hazardous high voltages under unsafe conditions. Never install or connect wiring or equipment during electrical storms. Improperly protected wiring can have a fatal lightning surge for many miles. All outdoor wiring must be equipped with adequately grounded and listed signal circuit protectors, which must comply with local, applicable codes. Never install wiring or equipment while standing in water.



Wiring and equipment separations

Install all the wiring and controllers to minimize the possibility of accidental contact with other potentially hazardous and disruptive power and lighting wiring. Never place 24 VAC or communications wiring near other bare power wires, lightning rods, antennas, transformers, or steam or hot water pipes. Never place the wire in any conduit, box, channel, duct, or other enclosure containing power or lighting circuits. Always provide adequate separation of communications and another electrical wiring according to code. Keep wiring and controllers at least six feet from large inductive loads (power distribution panels, lighting ballasts, motors, etc.). Failure to follow these guidelines can introduce electrical interference and cause the system to operate erratically.



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2.1.1 Before Installation

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and the product to ensure the product is suitable for your application.
3. TR50 IAQ Sensor must be installed and mounted only by authorized and trained personnel.
4. When performing any work (installation, mounting, start-up), all manufacturer instructions, particularly the Mounting Instructions (31-00566M-01), are to be observed.
5. It is recommended to keep the device at room temperature for at least 24 hours before applying power. This allows any condensation resulting from low shipping/storage temperatures to evaporate.
6. After installation is complete, check out product operation as provided in these instructions.

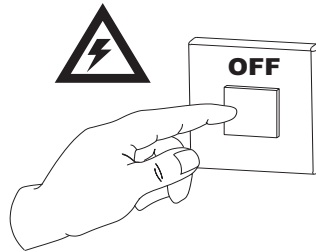
Note: All wiring must agree with applicable codes, ordinances, and regulations as specified in installation wiring diagrams.

2.1.2 Restricting Access to Network

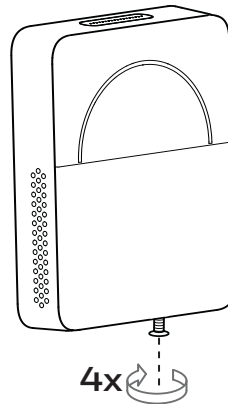
Prevent unauthorised access to the network (e.g., BACnet MSTP, Modbus, or Sylk™ bus) that the Smart Sensor uses. With any system, preventing physical access to the network and equipment reduces the risk of unauthorised interference. When using open protocols such as Modbus or BACnet MSTP, care should be taken to ensure that the physical network is protected from unauthorised access.

2.2 Steps to Install TR50 Sensor

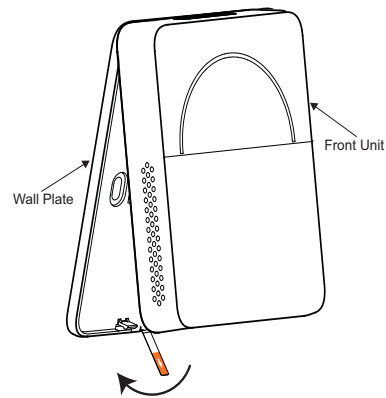
1. Switch OFF the power supply before initiating the TR50 IAQ Sensor installation.



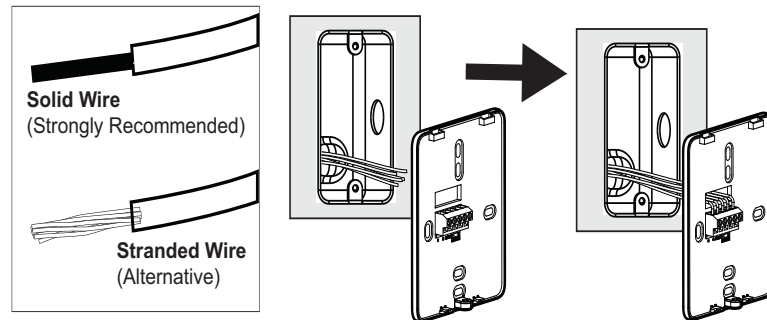
2. Loosen the bottom screw by turning it anticlockwise with the help of a screwdriver.



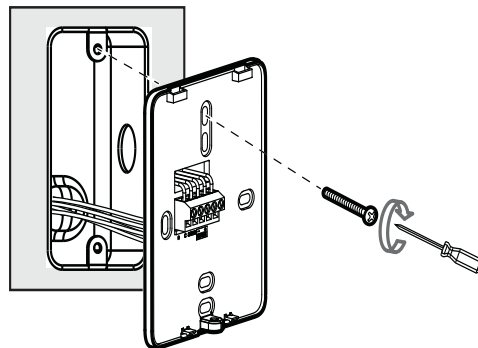
3. Separate the front unit and wall plate by pulling out the tape from the bottom to do the wiring.



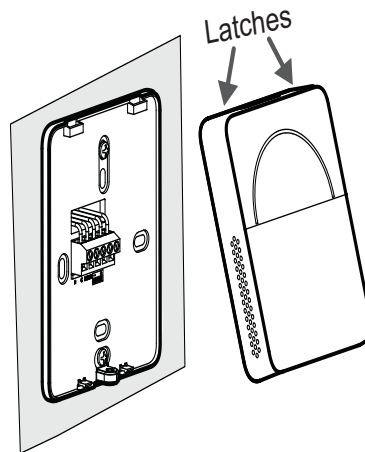
4. Pull the cables through the junction box and do wiring. Refer [Wiring Connections](#) section for wiring details.



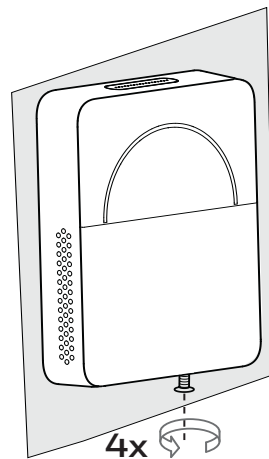
5. Fix the wall plate with the help of two screws to the Junction box.



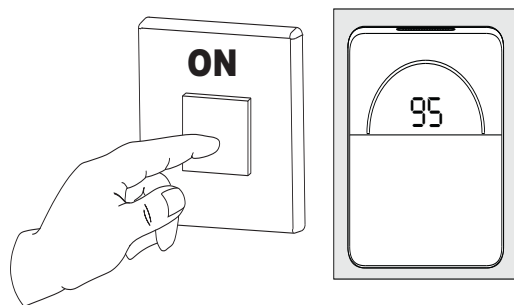
6. Attach the front unit to the wall plate, making sure the latches on each side are well matched.



7. Tighten the bottom screw to fix the front unit and wall plate.

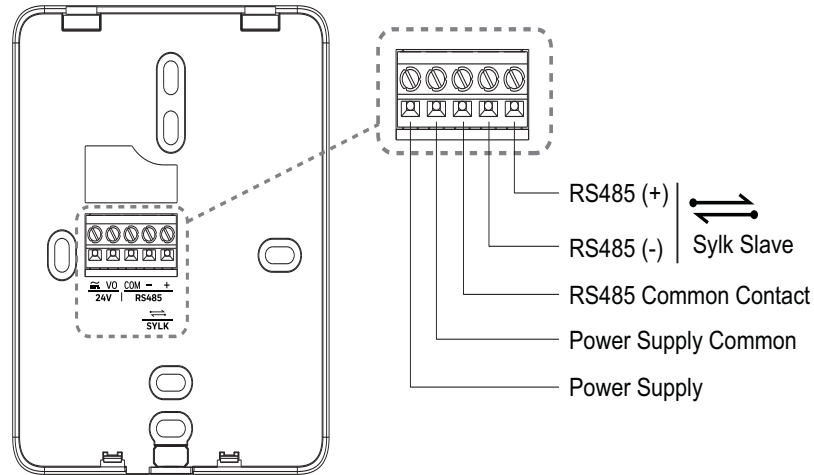


8. Switch ON the power supply to start IAQ TR50 Sensor device.



2.3 Wiring Connections

Below are the wiring details of RS-485 via communication BACnet, Modbus and Sylk™ Bus through plant or unitary controller.



2.3.1 Wiring Terminals

Legends/Label	Description
	Power supply (24 V AC/DC)
VO	Power supply common
COM	COM contact for RS485 interface
-	(-) for RS485 interface
+	(+) for RS485 interface
	Sylk slave, Power input

Follow the below steps to do wiring for two wires into one terminal:

- Step 1. Strip 1/2 inch (13 mm) from the wires to be attached at one terminal.
- Step 2. Twist the wires together with plier. (A minimum of 3 turns).
- Step 3. Cut the twisted end of wires to 3/16 inch (5 mm) before inserting into terminal and tightening screw. Then pull on each wire in all terminals to check for mechanical connection.

2.3.2 Sylk™ Bus Wiring

Recommended maximum distance from controller to any Slyk device			
Quality and type of device ^a	Single twisted pair, non-shielded, stranded or solid ^b		Standard thermostat wire, (non-twisted), shielded or non-shielded, stranded or solid ^{c,d}
	18-22 AWG	24 AWG	18-24 AWG
TR50-5D 1.5 W TR50-5N 1.4 W TR50-3D 0.9 W TR50-3N 0.8 W	500 ft (150 m)	400 ft (120 m)	100 ft (30 m)

^a For Spyders, use the Resource Usage View in the Spyder Tool to determine maximum number of devices. For Comfort-Point™ Open controllers, there is a maximum power consumption 1.6 W

Note: When the Sylk™ Bus load is above 1 W, the interval report time must be specified carefully.

^b As a rule of thumb, single twisted pair (2 wires per cable only), thicker gauge, non-shielded cable yields best results for longer runs.

^c The 30 m distance for standard thermostat wire is conservative, but meant to reduce the impact of any sources of electrical noise (including but no limited VFDs, electronic ballasts, etc). Shielded cable recommended only if there is a need to reduce the effect of electrical noise.

^d These distances also apply for shielded twisted pair.

2.3 Power Up the Sensor Device

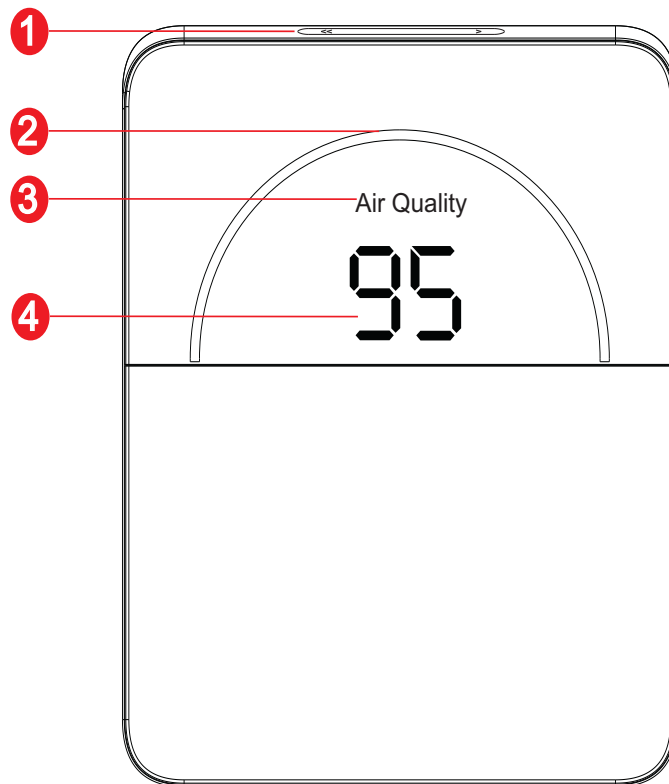
Once the TR50 IAQ Sensor device is installed and powered, the device gets started and shows firmware version number “x.x.x.x” as per the latest updated firmware and the parameter values are displayed on the LCD.

Note: The current firmware version number is 0.1.1.0. It can be updated if there is any firmware update in the device.

3.1 Home Screen - User Interface

The TR50 IAQ Sensor user interface contains

1. Touch Button
2. LED Status Color Ring
3. Parameter Description
4. Mono display



3.1.1 Touch Button

A Touch Button is available on the top of the TR50 IAQ Sensor device to change the parameters. Swipe the touch button or click left/right button to change the parameters.



3.1.2 LED Ring Behavior / Indication

The LED light behavior can be configured into two modes:

- Color Mode
- Neutral Mode

These two modes indicates LED behavior, air quality, sensor reading, or sensor health.

Color Mode:



LED Behavior	Air Quality Level	Sensor Reading Level	Sensor Health
Green	Good	Good	-
Yellow	Medium	Medium	-
Red	Poor	Poor (For CO ₂ , PM2.5 and TVOC)	Sensor Failure

Neutral Mode: With Display/ Without Display

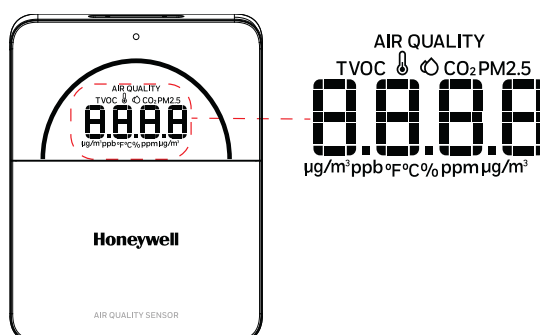
The LED behavior of Neutral mode Temperature readings are shown below:



LED Behavior	Air Quality Level	Sensor Reading Level	Sensor Health
White on	Good	Good	-
White Breath	Medium	Medium	-
White Blink	Poor	Poor (For CO2, PM2.5 and TVOC)	Sensor Failure

3.1.3 Parameter Description

The TR50 IAQ Sensor device will show 5 different parameter readings on the LCD display.



The following table provide an overview of all the available segments of the TR50 IAQ Sensor device with its parameter names and units.

Segments	Parameter Name	Units
	Temperature	°C (°F)
	Humidity	%
	Carbon Dioxide	PPM
	Particular Matter	µg/m ³
	Total Volatile Organic Compound	PPB

3.1.4 Mono Display

The Mono segment display on the TR50 IAQ Sensor is used to show the air quality sensor parameter values.

3.2 Display Parameter

The Display Parameter of TR50 IAQ Sensor have 2 different modes

- Auto Mode
- Manual Mode

3.2.1 Auto Mode

After the installation and configuration, the display will show the parameter values per cycle time. The default time for the cycle to change the parameter is 5 seconds. If the SKU don't have PM2.5 and TVOC in the device, or installer configure to hide the parameters, the display will jump to next parameters.

When the TR50 device is powered on, the LCD display brightness will be in normal mode and the LCD display will be changed to dim/dark mode in seconds that is pre-setting.

3.2.2 Manual Mode

Under the manual mode the installer will configure the required parameters. The cycle time to display the parameters can be set manually from the range of 3-10 seconds or swipe the touch button to change the parameters.

When the TR50 device is powered on, the LCD display brightness will be in normal mode and the LCD display will be changed to dim/dark mode in seconds that is pre-setting.

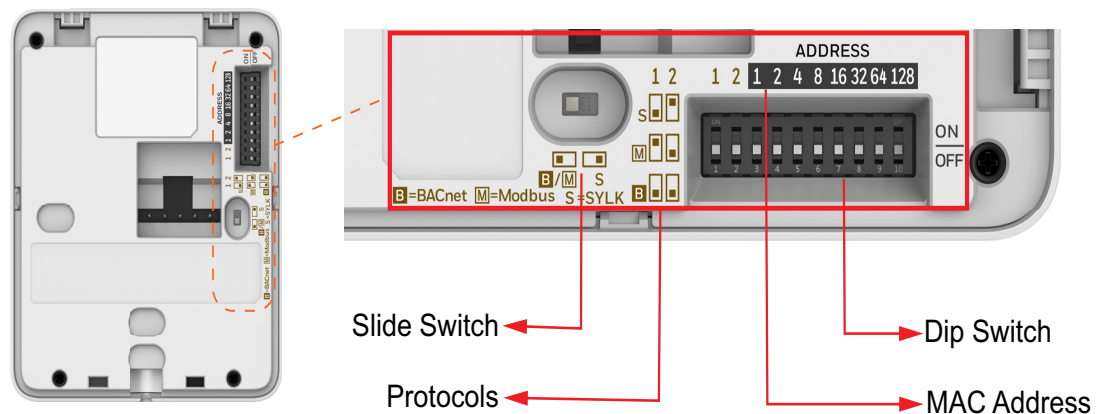
4.1 Topologies used to connect TR50 IAQ Sensor

To configure the TR50 IAQ Sensor, the device must be connected to plant or unitary controller. Before configuring the device, complete the dip switch configuration and connect the device to plant controller or unitary controller through RS-485 cables and connect your supervisor's workstation (Laptop or PC) to the same network. For more details refer [System Architecture](#) on page 3 and Niagara/CPO Engineering Guide, Smart Sensor configuration section.

4.2 Dip Switch Configuration

The Dip switch is used to change the communication protocols as per the selected networks.

The below figure describes the different switch how to communicate the networks:

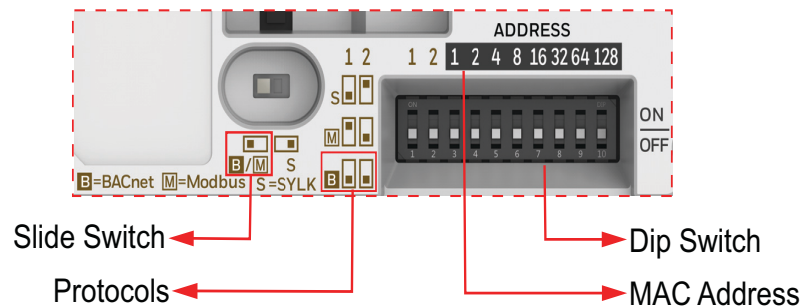


4.2.1 BACnet Mode

Slide Switch : The slide switch is set to LEFT to work in BACnet network mode.

DIP Switch (Protocol selection) : The BACnet protocol switch is set to OFF for both 1 and 2 address.

DIP Switch (Address settings) : The Auto MAC address for the BACnet mode is all ON/OFF.

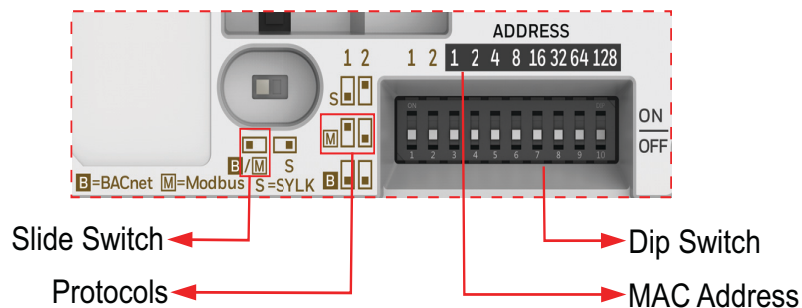


4.2.2 Modbus Mode

Slide Switch : The slide switch is set to LEFT to work in Modbus network mode.

DIP Switch (Protocol selection) : The Modbus protocol switch is set to ON/OFF or 1/2 address.

DIP Switch (Address settings) : The Modbus mode does not have auto MAC address.



4.2.3 Slyk™ Bus Mode

Slide Switch : The slide switch is set to RIGHT to work in Slyk™ Bus network mode.

DIP Switch (Protocol selection) : The Slyk™ Bus protocol switch is set to OFF/ON for 1/2 address.

DIP Switch (Address settings) : For the Sylk™ Bus device address always configure “1,2,4 and 8” address. Do not configure “16 to 128” address.

Default Address = 1	1	2	4	8		1	2	4	8
Default: 1									
Address: 1					Address: 9				
Address: 2					Address:10				
Address: 3					Address:11				
Address: 4					Address:12				
Address: 5					Address:13				
Address: 6					Address:14				
Address: 7					Address:15				
Address: 8									

4.3 RS-485 Configuration

4.3.1 Pre-Requisites:

- Power Source (24 VAC/VDC) to connect TR50 device and Plant controller/ Unitary controller
- RS-485 cables
- Plant controller/ Unitary controller

Before configuring the device make sure the power supply is Switch OFF.

Refer [Wiring Connections](#) section on page 9 for details about RS-485 wiring.

4.4 BACnet Configuration

4.4.1 Pre-Requisties

Adjust the switches on the back of the device to enable the device to operate in BACnet mode. Refer [Dip Switch Configuration](#) for more details.

4.4.2 Automatic MAC Address

The TR50 IAQ Sensor device support automatic MAC address when DIP switch address is put to all OFF or all ON.

By default, all the DIP switch address are OFF, so the MAC address will be assigned automatically.

Below are the default MAC address details. Engineers can assign MAC address manually via DIP address switch.

- **Default MAX Master:** 35
- **Default Min MAC:** 1
- **Default Max MAC:** 30

4.4.3 BACnet Serial Port Settings

- **Data Bits:** 8
- **Stop Bits:** 1
- **Parity:** None

4.4.4 BACnet Device Instance ID

By default, the TR50 IAQ Sensor device will use MAC address as BACnet device instance to benefit initial device discovery process for TR50 commissioning.

After TR50 device is discovered, commissioning engineer take the responsibility to assign a unique BACnet device instance across inter-network. For more details about device discovery and device ID refer Niagara Engineering Guide Smart Sensor section.

4.4.5 Auto Baud Rate

The TR50 IAQ Sensor device will be running in adaptive baud rate mode.

The adaptive baud rate will work in the first 4 minutes after the device is power ON. Choose a valid baud rate (9600, 38400, 19200, 57600, 76800, 115200). If the valid baud rate can not be found in this period, device will look in flash for the baud rate found last time, if failed again, use default 38400.

4.4.6 BACnet Points

Use the BACnet MSTP network to discover and add the TR50 IAQ Sensor device.

Refer Niagara/CPO Engineering Guide Smart Sensor device discovery section for more details.

After the device is discovered, different BACnet points will be created as per SKUs. These points are used to configure below sections as desired.

- Changing Parameter values
- Out of Range reading
- Alarm set values
- LCD Brightness

4.4.6.1 Input Points

Point Name	BACnet Instance	Read/Write	Type
SS_AI_SensorReading_Temp	1	Read	Analog Input
SS_AI_SensorReading_Humi	2	Read	Analog Input
SS_AI_SensorReading_CO ₂	3	Read	Analog Input
SS_AI_SensorReading_PM2.5	4	Read	Analog Input
SS_AI_SensorReading_TVOC	5	Read	Analog Input
SS_AI_AIR_QUALITY_SCORE	6	Read	Analog Input
SS_AI_SensorReading_PM1.0	7	Read	Analog Input
SS_AI_SensorReading_PM10	8	Read	Analog Input

4.4.6.2 Temperature Configuration Points

Point Name	BACnet Instance	Read/Write	Type	Default Value
CfgAlarmTempLowLimit	1	R/W	Analog Value	65
CfgAlarmTempHighLimit	2	R/W	Analog Value	86
CfgAlarmTempDeadband	3	R/W	Analog Value	2
CfgAlarmTempTimeDelay	4	R/W	Analog Value	300
SS_MV_OutofRange_Temp	1	R/W	Multi State Value	1
CfgTempSensorOffset	281	R/W	Analog Value	0
CfgAlarmTempLimitEnable	21	R/W	Multi State Value	4

4.4.6.3 Humidity Configuration Points

Point Name	BACnet Instance	Read/Write	Type	Default Value
CfgAlarmHumiLowLimit	51	R/W	Analog Value	10
CfgAlarmHumiHighLimit	52	R/W	Analog Value	80
CfgAlarmHumiDeadband	53	R/W	Analog Value	5
CfgAlarmHumiTimeDelay	54	R/W	Analog Value	300
SS_MV_OutofRange_Humi	2	R/W	Multi State Value	1
cfgAlarmHumiLimitEnable	22	R/W	Multi State Value	4
cfgHumiSensorOffset	282	R/W	Analog Value	0

4.4.6.4 CO₂ Configuration Points

Point Name	BACnet Instance	Read/Write	Type	Default Value
CfgAlarmCO ₂ HighLimit	101	R/W	Analog Value	1000
CfgAlarmCO ₂ HighhighLimit	102	R/W	Analog Value	1400
CfgAlarmCO ₂ Deadband	103	R/W	Analog Value	100
CfgAlarmCO ₂ TimeDelay	104	R/W	Analog Value	300
CfgCO ₂ SensorCalibrationBase	283	R/W	Analog Value	0
SS_MV_OutOfRange_CO ₂	3	R/W	Multi State Value	1
CfgAlarmCO ₂ LimitEnabled	23	R/W	Multi State Value	4

4.4.6.5 PM2.5 Configuration Points

Point Name	BACnet Instance	Read/Write	Type	Default Value
CfgAlarmPM2.5HighLimit	151	R/W	Analog Value	35
CfgAlarmPM2.5HighhighLimit	152	R/W	Analog Value	55
CfgAlarmPM2.5Deadband	153	R/W	Analog Value	5
CfgAlarmPM2.5TimeDelay	154	R/W	Analog Value	300
CfgPM2.5SensorOffset	284	R/W	Analog Value	0
SS_MV_OutOfRange_PM2.5	4	R/W	Multi State Value	1
CfgAlarmPM2.5LimitEnabled	24	R/W	Multi State Value	4
CfgPM1.0SensorOffset	287	R/W	Analog Value	0
CfgPM10SensorOffset	288	R/W	Analog Value	0

4.4.6.6 TVOC Configuration Points

Point Name	BACnet Instance	Read/Write	Type	Default Value
CfgAlarmTVOCHighLimit	201	R/W	Analog Value	250
CfgAlarmTVOCHighhighLimit	202	R/W	Analog Value	350
CfgAlarmTVOCDeadband	203	R/W	Analog Value	10
CfgAlarmTVOCTimeDelay	204	R/W	Analog Value	300
CfgTVOCSensorOffset	285	R/W	Analog Value	0
SS_MV_OutOfRange_TVOC	5	R/W	Multi State Value	1
CfgAlarmTVOCLimitEnabled	25	R/W	Multi State Value	4

4.4.6.7 Configuration Points

Point Name	BACnet Instance	Read/Write	Type	Default Value
SS_MV_AQI_Level	6	R/W	Multi State Value	1
CfgAlarmAQIUnhealthyLimit	251	R/W	Analog Value	40
CfgAlarmAQIModerateLimit	252	R/W	Analog Value	80
CfgAlarmAQIDeadband	253	R/W	Analog Value	5
CfgAlarmAQITimeDelay	254	R/W	Analog Value	300
CfgAlarmAQILimitEnable	26	R/W	Multi State Value	4

4.4.6.8 User Interface Configuration

Point Name	BACnet Instance	Read/Write	Type	Default Value
CfgLedBrightness	301	R/W	Analog Value	50
CfgLedDimBrightness	302	R/W	Analog Value	10
CfgLcdBrightness	321	R/W	Analog Value	80
CfgLcdDimBrightness	322	R/W	Analog Value	40
CfgLcdAutoCycleTime	341	R/W	Analog Value	5
CfgLedLcdTimeoutTime	361	R/W	Analog Value	0
CfgLedLcdDimTime	362	R/W	Analog Value	10
CfgIsParaDisplayed	381	R/W	Analog Value	TR50-5D: 63 TR50-3D: 15
CfgIsLedLcd	21	R/W	Binary Value	1
CfgLedColorOption	61	R/W	Multi State Value	1
CfgLcdParameterSwitch	81	R/W	Multi State Value	1
CfgAlarmIndicatorEnable	41	R/W	Multi State Value	4

4.4.6.9 BACnet Configuration Points

Point Name	BACnet Instance	Read/Write	Type	Default Value
MstpHeaderCrcErrCount	500	R	Analog Value	-
MstpDataCrcErrCount	501	R	Analog Value	-
CfgIsMstpBadCrcClear	41	R/W	Binary Value	1

4.4.6.10 Alarm Points

Point Name	BACnet Instance	Read/Write	Type	Default Value
CfgAlarmLocalDetectionEnable	1	R/W	Binary Value	1

4.5 Modbus Configuration

4.5.1 Baud Rate

Modbus supports automatic baud rate and manual baud rate configuration, It can support the following baudrate : 1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200.

4.5.1.1 Auto Baud Rate

The default for the first startup is Auto Baud rate. This detection process will last 5 minutes after TR50 start to detect there is data communication from Modbus master. If there is no right baud rate matched during this 5 minutes, TR50 will work as the last-detected baud rate, or default to 19200 bps

4.5.1.2 Manual Baud Rate

After the default Auto Baud rate matches, please configure `cfgModbusAutoBaudrate` Enable register to false, this will make TR50 work as Manual Baud rate, then configure desired Baud rate

4.5.2 Modbus Serial Port Settings

- **Data Bits:** 8
- **Stop Bits:** 1
- **Parity:** None/Even/odd (**Default:** Even)

4.5.3 Modbus Configuration Register Table

Setup/ Runtime	Addr	Dir	Non- Volatile	Name	SKU	Type/Unit	Bits Num	Range	Default
Setup	112	R/W	V	cfgHandling Command	3N/ 3D/ 5N/5D	int16	16	0-3	0
Setup	2000	R/W	NV	cfgBaudrate	3N/ 3D/ 5N/5D	enum/ int16	16	0: 1200 baud 1: 2400 baud 2: 4800 baud 3: 9600 baud 4: 14400 baud 5: 19200 baud 6: 38400 baud 7: 57600 baud 8: 115200 baud	5

Setup/ Runtime	Addr	Dir	Non- Volatile	Name	SKU	Type/Unit	Bits Num	Range	Default
Setup	2001	R/W	NV	cfgParity	3N/ 3D/ 5N/5D	enum/ int16	16	0: none 1: odd 2: even	2
Setup	2002	R/W	NV	cfgStopBits	3N/ 3D/ 5N/5D	int16	16	1-2	1
Setup	2010	R/W	NV	cfgTemperature- Offset	3N/ 3D/ 5N/5D	signed/ int16	16	-	0
Setup	2011	R/W	NV	cfgHumidityOff- set	3N/ 3D/ 5N/5D	signed/ int16	16	-	0
Setup	2012	R/W	NV	cfgCO ₂ Calibra- tion	3N/ 3D/ 5N/5D	signed/ int16	16	>=400	0
Setup	2013	R/W	NV	cfgPM2.5Offset	5N/5D	signed/ int16	16	-	0
Setup	2014	R/W	NV	cfgTVOCOffset	5N/5D	signed/ int16	16	-	0
Setup	2015	R/W	NV	cfgPM1Offset	5N/5D	signed/ int16	16	-	0
Setup	2016	R/W	NV	cfgPM10Offset	5N/5D	signed/ int16	16	-	0
Setup	2030	R/W	NV	cfgTemperature- LowLimit	3N/ 3D/ 5N/5D	signed/ int16	16	32°F<=TemperateLow- Limit <= TemperateHigh- Limit	65°F
Setup	2031	R/W	NV	cfgHumidityLow- Limit	3N/ 3D/ 5N/5D	int16	16	0<=HumidityLowLimit <= HumidityHighLimit	10
Setup	2032	R/W	NV	cfgCO ₂ HighLimit	3N/ 3D/ 5N/5D	int16	16	0<=CO ₂ HighLimit <= CO ₂ HighHighLimit	1000
Setup	2033	R/W	NV	cfgPM2.5High- Limit	5N/5D	int16	16	0<=PM2.5HighLimit <=PM2.5HighHighLimit	35
Setup	2034	R/W	NV	cfgTVOCHigh- Limit	5N/5D	int16	16	8<=TVOCHighLimit<= TVOCHighHighLimit	250 ppb
Setup	2035	R/W	NV	cfgModerateLimit	3N/ 3D/ 5N/5D	int16	16	cfgUnhealthyLimit<=cfg- ModerateLimit<=100	80
Setup	2050	R/W	NV	cfgTemperature- HighLimit	3N/ 3D/ 5N/5D	signed/ int16	16	TemperateLow- Limit<=TemperateHigh- Limit <=122°F	86°F
Setup	2051	R/W	NV	cfgHumidityHigh- Limit	3N/ 3D/ 5N/5D	int16	16	HumidityLowLimit<= HumidityHighLimit<=100	80
Setup	2052	R/W	NV	cfgCO ₂ HighHigh- Limit	3N/ 3D/ 5N/5D	int16	16	CO ₂ HighLimit<= CO ₂ High- HighLimit<=9999	1400
Setup	2053	R/W	NV	cfgPM2.5High- HighLimit	5N/5D	int16	16	PM2.5HighLimit<= PM2.5HighHigh- Limit<=5000	55
Setup	2054	R/W	NV	cfgTVOCHigHigh- Limit	5N/5D	int16	16	TVOCHighLimit<= TVOCHighHigh- Limit<=9999	350 ppb

Setup/ Runtime	Addr	Dir	Non- Volatile	Name	SKU	Type/Unit	Bits Num	Range	Default
Setup	2055	R/W	NV	cfgUnheathyLimit	3N/ 3D/ 5N/5D	int16	16	0<= cfgUnhealthyLimit <= cfgModerateLimit <= 100	40
Setup	2070	R/W	NV	cfgTempera- turedeadband	3N/ 3D/ 5N/5D	int16	16	0 <= deadband	2
Setup	2071	R/W	NV	cfgHumidi- tydeadband	3N/ 3D/ 5N/5D	int16	16	0 <= deadband	5
Setup	2072	R/W	NV	cfgCO ₂ deadband	3N/ 3D/ 5N/5D	int16	16	0 <= deadband	100
Setup	2073	R/W	NV	cfgPM2.5dead- band	5N/5D	int16	16	0 <= deadband	5
Setup	2074	R/W	NV	cfgTVOCdead- band	5N/5D	int16	16	0 <= deadband	10 ppb
Setup	2075	R/W	NV	cfgAQIdeadband	3N/ 3D/ 5N/5D	int16	16	0 <= deadband	5
Setup	2090	R/W	NV	cfgTemperature time delay	3N/ 3D/ 5N/5D	int16	16	0 <= time delay	300
Setup	2091	R/W	NV	cfgHumidity time delay	3N/ 3D/ 5N/5D	int16	16	0 <= time delay	300
Setup	2092	R/W	NV	cfgCO ₂ time delay	3N/ 3D/ 5N/5D	int16	16	0 <= time delay	300
Setup	2093	R/W	NV	cfgPM2.5 time delay	5N/5D	int16	16	0 <= time delay	300
Setup	2094	R/W	NV	cfgTVOC time delay	5N/5D	int16	16	0 <= time delay	300
Setup	2095	R/W	NV	cfgAQI time delay	3N/ 3D/ 5N/5D	int16	16	0 <= time delay	300
Setup	2110	R/W	NV	Cfg_OORSensor- FailAlarmIndica- torEn	3D/5D	enum/ int16	16	1:Disable 2:cfgOutOfRangeAlarm- IndicatorEnable 3:cfgSensorFailureAlarm- IndicatorEnable 4:cfgOutOfRangeAlarm- IndicatorEnable && cfg- SensorFailureAlarmIndicat orEnable	4
Setup	2130	R/W	NV	cfgSensorRead- ingDisplayEnable	3D/5D	int16	16	cfgIsDisplayed_AQI-bit0 cfgIsDisplayed_Temp-bit1 cfgIsDisplayed_Humi-bit2 cfgIsDisplayed_CO ₂ -bit3 cfgIsDisplayed_PM2.5-bit4 cfgIsDisplayed_TVOC-bit5	15/63
Setup	2150	R/W	NV	cfgTempAlarm- LimitEnable	3N/ 3D/ 5N/5D	enum/ int16	16	1:Temp Low Limit And High Limit Disable 2:Temp Low Limit Enable 3:Temp High Limit Enable 4:Temp Low Limit And High Limit Enable	4

Setup/ Runtime	Addr	Dir	Non- Volatile	Name	SKU	Type/Unit	Bits Num	Range	Default
Setup	2151	R/W	NV	cfgHumiAlarm-LimitEnable	3N/ 3D/ 5N/5D	enum/ int16	16	1:Humidity Low Limit And High Limit Disable 2:Humidity Low Limit Enable 3:Humidity High Limit Enable 4:Humidity Low Limit And High Limit Enable	4
Setup	2152	R/W	NV	cfgCO ₂ AlarmLimitEnable	3N/ 3D/ 5N/5D	enum/ int16	16	1:CO ₂ High Limit And High High Limit Disable 2:CO ₂ High Limit Enable 3:CO ₂ High High Limit Enable 4:CO ₂ High Limit And High High Limit Enable	4
Setup	2153	R/W	NV	cfgPM25Alarm-LimitEnable	5N/5D	enum/ int16	16	1:PM2.5 High Limit And High High Limit Disable 2:PM2.5 High Limit Enable 3:PM2.5 High High Limit Enable 4:PM2.5 High Limit And High High Limit Enable	4
Setup	2154	R/W	NV	cfgTVOCAlarm-LimitEnable	5N/5D	enum/ int16	16	1:TVOC High Limit And High High Limit Disable 2:TVOC High Limit Enable 3:TVOC High High Limit Enable 4:TVOC High Limit And High High Limit Enable	4
Setup	2155	R/W	NV	cfgAQIAlarmLimitEnable	3N/ 3D/ 5N/5D	enum/ int16	1	1: AQI Moderate Limit And Unhealthy Limit Disable 2: AQI Moderate Limit Enable 3: AQI Unhealthy Limit Enable 4: AQI Moderate And Unhealthy Limit Enable	4
Setup	3000	R/W	NV	cfgLED Ring Color Option	3N/ 3D/ 5N/5D	int16	16	1-2	1
Setup	3001	R/W	NV	cfgLEDRing brightness	3N/ 3D/ 5N/5D	int16	16	40-100	50
Setup	3002	R/W	NV	cfgLEDDim-Brightness	3D/5D	int16	16	10-40	10
Setup	3020	R/W	NV	cfgLCD_AUTO_-CYCLE_TIME	3D/5D	int16	16	3-10	5
Setup	3021	R/W	NV	cfgLCD backlight brightness	3D/5D	int16	16	40-100	80

Setup/ Runtime	Addr	Dir	Non- Volatile	Name	SKU	Type/Unit	Bits Num	Range	Default
Setup	3022	R/W	NV	3	3D/5D	enum/ int16	16	1: Auto (default) 2: Manual + AQI(as the static page) 3: Manual + Temperature (as the static page) 4: Manual + Humidity (as the static page) 5: Manual + CO ₂ (as the static page) 6: Manual + PM2.5 (as the static page) 7: Manual + TVOC (as the static page) 8: Manual + no static page	1
Setup	3023	R/W	NV	cfgLCDDim-Brightness	3D/5D	int16	16	10-40	40
Setup	3030	R/W	NV	cfgLCD DIM Time	3D/5D	int16	16	3-10	10
Setup	3031	R/W	NV	cfgLCD OFF time	3D/5D	int16	16	0, 10-30	0
Setup	4000	R/W	NV	cfgTemperature-Unit	3N/ 3D/ 5N/5D	bit/boolean	1	-Fahrenheit: 0 -Celsius: 1	Fahrenheit
Setup	4004	R/W	NV	cfgTVOCUnit	5N/5D	bit/boolean	1	-ppb: 0 -ug/m3: 1	ppb
Setup	4020	R/W	NV	cfgLEDAndLCD-Enable	3D/5D	bit/boolean	1	ON or OFF	ON/1
Setup	5000	R/W	NV	cfgModbusAuto-BaudrateEnable	3N/ 3D/ 5N/5D	bool	1	TRUE or FALSE	TRUE
Setup	5001	R/W	V	cfgModbusFrameCntClear	3N/ 3D/ 5N/5D	bool	1	TRUE or FALSE	TRUE
Setup	5040	R/W	NV	cfgLocalDetectionEnable	3N/ 3D/ 5N/5D	bool	1	TRUE or FALSE	TRUE

4.5.4 Modbus Sensor Reading Status Register Table

Category	Reg type	Setup /Run time	Addr	Dir	Non-Volatile	Name	SKU	Type/ Unit	Default Unit	Bits Num	Range	Scale	Default
DispValues	Input	run-time	1	R	V	Temperature	3N/3D/5N/5D	int16	°F	16	32-122(°F) 0-50(°C)	0.1	0
DispValues	Input	run-time	2	R	V	Humidity	3N/3D/5N/5D	int16	%RH	16	0-100	0.1	
DispValues	Input	run-time	3	R	V	Carbon dioxide	3N/3D/5N/5D	int16	ppm	16	0-9999	0.1	
DispValues	Input	run-time	4	R	V	Particulates PM2.5	5N/5D	int16	ug/m ³	16	0-5000	1	
DispValues	Input	run-time	5	R	V	TVOC	5N/5D	int16	ppb	16	8-9999	1	
DispValues	Input	run-time	14	R	V	Particulates PM1	5N/5D	int16	ug/m ³	16	0-5000	1	
DispValues	Input	run-time	24	R	V	Particulates PM10	5N/5D	int16	ug/m ³	16	0-5000	1	
DispValues	Input	run-time	30	R	V	Air-quality score	3N/3D/5N/5D	int16	signed	16	0-100	1	
Device	Input	run-time	80	R	V	TAG Identifier Data	3N/3D/5N/5D	string	string	64	"SS-TR50"	-	
Device	Input	run-time	96	R	V	Renasa Firmware version	3N/3D/5N/5D	int32	signed/ int32	32	00 00 00 01 99 99 99 99	-	
Device	Input	run-time	98	R	V	Nordic Firmware version	3N/3D/5N/5D	int32	signed/ int32	32	00 00 00 01 99 99 99 99	-	

Category	Reg type	Setup /Run time	Addr	Dir	Non-Volatile	Name	SKU	Type/ Unit	Default Unit	Bits Num	Range	Scale	Default
Device	Input	run-time	114	R	V	Renesas Firmware File download status identifier	3N/3D/5N/5D	int16	enum/int16	16	0:OTA provision_OK 1:firmware Signature verification failed 2:firmware update failed. 3:firmware update in progress.(After recv Handling cmd 02) 4:reserved. 5:signature validation failed. 6:flash access failed. 9:OTA Provisional status. 90:OTA downloading status. 91:OTA downloaded status.	-	
Device	Input	run-time	115	R	V	Nordic Firmware File download status identifier	3N/3D/5N/5D	int16	enum/int16	16	0:OTA provision_OK 1:firmware Signature verification failed 2:firmware update failed. 3:firmware update in progress.(After recv Handling cmd 02) 4:reserved. 5:signature validation failed. 6:flash access failed. 90:OTA downloading status. 91:OTA downloaded status.	-	
Device	Input	run-time	200	R	V	Modbus Bad Frame Count	3N/3D/5N/5D	int32	int32	32		-	0
Device	Input	run-time	202	R	V	Modbus Received Frame Count	3N/3D/5N/5D	int32	int32	32		-	0
Device	Input	run-time	210	R	V	Data-BaseRevision	3N/3D/5N/5D	int32	int32	32		-	0

Category	Reg type	Setup /Run time	Addr	Dir	Non-Volatile	Name	SKU	Type/ Unit	Default Unit	Bits Num	Range	Scale	Default
Device	Input	run-time	1000	R	V	SS_-Model Name	3N/3D/5N/5D	string	string	128	"TR50-3N", "TR50-3D", "TR50-5N", "TR50-5D"	-	
Device	Input	run-time	1030	R	V	SS_Serial Number	3N/3D/5N/5D	string	string	128	"0000000000000000"	-	

4.5.5 Modbus Runtime Register Table

Category	Reg type	Setup /Run time	Addr	Dir	Non-Volatile	Name	SKU	Type / Unit	Default Unit	Bits Num	Range	Scale	Default
Device	Input	run-time	100	R	V	Temperature_FailureAlarm	3N/3D/5N/5D	signed/ int16	-	16	Error code: 64: fail_ntc_short_0 65: fail_ntc_open_0 66: fail_ntc_short_1 67: fail_ntc_open_1 68: fail_ntc_short_2 69: fail_ntc_open_2	1	0
Device	Input	run-time	101	R	V	Humidity_FailureAlarm	3N/3D/5N/5D	signed/ int16	-	16	Error code: 12: communication_failure	1	0
Device	Input	run-time	102	R	V	CO2_FailureAlarm	3N/3D/5N/5D	signed/ int16	-	16	Error code: 12: communication_failure 70: fail_storage	1	0
Device	Input	run-time	103	R	V	PM2.5_FailureAlarm	5N/5D	signed/ int16	-	16	Error code: 12: communication_failure 71: fail_low_fan_speed 72: fail_high_fan_speed 73: fail_pd 74: fail_ld	1	0

Category	Reg type	Setup /Run time	Addr	Dir	Non-Volatile	Name	SKU	Type / Unit	Default Unit	Bits Num	Range	Scale	Default
Device	Input	run-time	104	R	V	TVOC_Failure-Alarm	5N/5D	signed/int16	-	16	Error code: 12: communication_failure	1	0
Device	Holding	run-time	2200	R/W	V	TempOutOf-Range	3N/3D/5N/5D	enum/int16	-	16	1: For normal 2: For off normal	-	1
Device	Holding	run-time	2201	R/W	V	Humi-OutOf-Range	3N/3D/5N/5D	enum/int16	-	16	1: For normal 2: For off normal	-	1
Device	Holding	run-time	2202	R/W	V	CO2OutOfRange	3N/3D/5N/5D	enum/int16	-	16	1: For normal 2: For high limit 3: For high high limit	-	1
Device	Holding	run-time	2203	R/W	V	PM25OutOf-Range	5N/5D	enum/int16	-	16	1: For normal 2: For high limit 3: For high high limit	-	1
Device	Holding	run-time	2204	R/W	V	TVO-COOutOf-Range	5N/5D	enum/int16	-	16	1: For normal 2: For high limit 3: For high high limit	-	1
Device	Holding	run-time	2205	R/W	V	AQILevel	3N/3D/5N/5D	enum/int16	-	16	1 = For normal 2 = For Moderate limit 3 = For Unhelthy limit	-	1

4.6 Sylk™ Bus Configuration

For MVO phase1 release there are no additional TR50 features. TR50-3N, TR50-3D can be emulated as TR40 to work with controllers that currently support TR40.

In the near future, complete Sylk features for TR50 device will be available working with Honeywell Optimizer Controllers.

5.1 About Status LED Ring

The LED status ring colors are configured for data points to indicate the conditions of the parameters that may require control. IAQ Sensor TR50 device helps to view and manage the parameter readings through LED ring. This LED ring is available in both with display and without display modes. Refer [LED Ring Behavior / Indication](#) section on page 11 for more details.

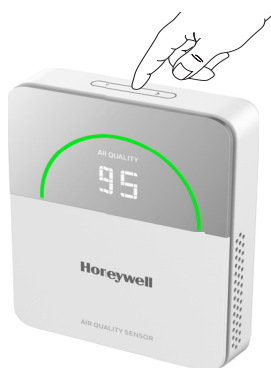
5.2 TVOC Sensor Reading

- When the TR50 device is powered up out of the box, it takes at least 48 hours to stabilize the TVOC sensor without power interruption,
- In addition, whenever the device is powered off, the TVOC sensor needs some time to baseline its data. The long if the device is powered off, the more time is needed to complete this baseline process. Normally it can complete between a couple of minutes to 2 hours.

So only after this stabilization and baseline time the TVOC reading is effective.

5.3 Temperature Unit Change

Temperature units from °F to °C can be changed by long pressing the middle of the touch button for 5 seconds. (This change applies only to TR50-3D and TR50-5D).



5.4 Factory Reset

1. Power up the sensor device.
2. Wait for 5 seconds, LED halo ring indicate Air quality level.
3. Hold whole button area for 10 seconds by your 3 or more fingers.
4. LED ring will blink quickly with the cycle of Green-Red-Green-Red-Green-Red-...
5. Remove your finger from button area.
6. LED ring will stay with White ON.
7. Click middle button once within 5 seconds.
8. LED ring will be White ON and LCD display "0000" (Only for TR50-5D and TR50-3D)
9. Wait until the device run "Reset to Factory Default" and then reboot.
10. Wait a moment, Smart Sensor will light LED.
11. Complete "Reset".

CORRECTION AND CALIBRATION

6.1 Regular Correction

To ensure the accuracy of the measured value, the TR50 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 requirements needed on the user's site; Honeywell can perform the correction via Niagara software tool at the factory if the following environmental conditions are required for field correction.

6.2 Correction Environment

- Temperature: 32 to 122 °F (0 to 50 °C)
- Humidity: 0-95% RH, non-condensing
- The TR50 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 m² (325 ft²).

6.3 Calibration Standards Needed for Factory Correction

6.3.1 Temperature and Humidity

Temperature and Humidity Calibration Standard:

After the temperature and humidity calibration standard and TR50 IAQ Sensor that needs to be corrected are powered on continuously and synchronously for more than 60 minutes, start to record the temperature and humidity value for 10 minutes, use the synchronous average value within 10 minutes overcorrection.

6.3.2 CO₂

CO₂ Calibration Standard:

The CO₂ sensor has an auto-calibration feature inbuilt which will occur automatic when the CO₂ value is below 400 ppm. The outdoor CO₂ reference value is about 380 ppm - 420 ppm. After the CO₂ calibration standard and TR50 IAQ Sensor that needs to be corrected are powered continuously and synchronously, the CO₂ value shall be continuously recorded for 30 minutes, using the synchronous average value over 30 minutes for correction.

6.3.3 TVOC

TVOC Calibration Standard (According to Alcohol Volatilization):

TVOC sensor has auto calibration feature inbuilt. Since, each TVOC uses different sensors and sensitive substances, it is recommended to use the new TR50 IAQ Sensor machine as the TVOC calibration standard.

After the TVOC and TR50 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 48 hours power-on.

6.3.4 PM1.0, PM2.5, and PM10

PM1.0, PM2.5, and PM10 Calibration Standard (According to GRIMM Technology):

After the new IAQ Sensor and old IAQ Sensor that needs to be corrected are powered on continuously and synchronously for more than 10 minutes, record the PM1.0, PM2.5 and PM10 value for 30 minutes, and synchronous average value over 30 minutes can be applied for correction.

MAINTENANCE AND TROUBLESHOOTING

7.1 Maintenance

Regular maintenance is required in everyday use environments to ensure accurate IAQ Sensor data. Depending on the environment, maintenance is done every 3 to 6 months. Public places with a high concentration of dust, dry seasons, pollen seasons, and poor environmental cleanliness can shorten maintenance.

General maintenance includes: Cleaning the TR50 IAQ Sensor using a vacuum cleaner to remove dust inside.

7.2 Troubleshooting

If a fault occurs in a typical use environment, see the below troubleshooting table. Contact the dealer or manufacturer if the defect cannot be fixed.

Fault Condition	Troubleshooting
PM1.0, PM2.5, and PM10 data are abnormal; the deviation is too large, and the value is too high or too low.	Check whether debris or dust is in the sensor housing or the air inlet and 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 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 large within a short time after power is ON. TVOC baseline 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.

Fault Condition	Troubleshooting
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.	The sensor can be powered off and back on to see if the reading returns to normal. Contact the dealer or manufacturer if the sensor value cannot be recovered.
Communication interruption RS-485 (MODBUS RTU)	Check if the power supply is normal and 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.
RS-485/Sylk™ Bus communication abnormal	Check the slide switch is in correct position, check the DIP switch protocol is also correct.
LCD doesn't display any information	Check the power supply is normal, check the device SKU is LCD display modes.
LCD display 9999	Check the sensor value is more than 9999.
LCD display Err.	Check the sensor is working correct.
LED ring dark	Check the power supply is normal
LED ring blink	Check the sensor is working correct.
Touch button no any feedback	Check the touch area is clean and dry. Check the finger is dry and no any ESD risk.
Noise or smell or fire from device	Check the power supply is normal.
Device reboot automatic	Check the software revision is updated, check the Sylk™ Bus load is normal.
No TVOC and PM sensor data	Check the device SKU only have Temperature Humidity and CO ₂ .

7.3 Error Code

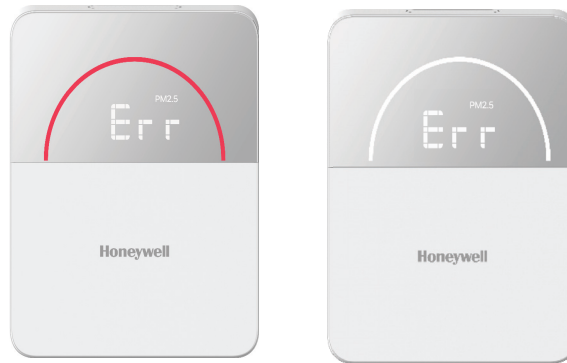
7.3.1 Error Code With Display

In case of any sensor failure alarm for **TR50-5D** and **TR50-3D**, the display will show the sensor name and Err, until the user change it manually. For example, in case of PM2.5 sensor failure, the display will show the error code as Err^{PM2.5}. If more than one sensor fails, the display will switch among those failure sensors.

The below figure indicates the Error Code for Color mode and Neutral Mode.

- **Color Mode:** Indicates Red LED ring with Error Code.

- **Neutral Mode:** Indicates White LED ring (Blink) with Error Code.



7.3.2 Error Code Without Display

In case of any sensor failure alarm for **TR50-5N** and **TR50-3N**, LED ring will blink as per color and neutral modes.

The below figure indicates the Error Code for Color mode and Neutral Mode.

- **Color Mode:** Indicates Red LED ring.
- **Neutral Mode:** Indicates White LED ring (Blink).



CERTIFICATION AND REGULATION

8.1 Waste Electrical and Electronic Equipment (WEEE)

WEEE: Waste Electrical and Electronic Equipment Directive	
	• 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.

8.2 FCC Part 15 compliant

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference caused by undesired operation.

8.3 Power Supply Guidelines and Requirements

TR50 IAQ Sensor uses 24 VAC/VDC power from a UL Listed Class- 2 transformer or IEC 61558 listed transformer.



WARNING:

TR50 is a half-wave rectifier device. If we connect it with another half-wave rectifier device or use the same transformer, TR50 risks being damaged by short with "C COM GND" or other equivalent connections.

8.4 Standards and Compliances

RoHS	IEC63000
CE	EN 60730-1 EN 60730-2-9
UL	UL 60730-1 UL 60730-2-9
ISED	ICES-003 issue 7

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