User Guide

Digital output transmitter with Insight PC
software USB-C interface

Indigo202

VAISALA

Table of contents

List of figures

List of tables

1. About this document

1.1 Version information

This document provides detailed instructions for using and maintaining the Vaisala Indigo202 digital output transmitter.

Table 1   Document versions (English)

Document code	Date	Description
M212843EN-B	November 2022	This document. Added information on temporary use of Insight PC software connection and USB device driver installation. Updated power supply accessory options.
M212843EN-A	September 2022	Previous version. First version of the manual.

1.2 Related manuals

For the latest versions of these documents, see docs.vaisala.com.

Document code	Name
M212816EN	Indigo202 Digital Transmitter Quick Guide
M212815EN	Indigo201 Analog Output Transmitter Quick Guide
M212842EN	Indigo201 Analog Output Transmitter User Guide
M211799EN	Vaisala CARBOCAP® Carbon Dioxide Probe GMP251 User Guide
M211897EN	Vaisala CARBOCAP® Carbon Dioxide Probe GMP252 User Guide
M211972EN	Vaisala PEROXCAP® Hydrogen Peroxide, Humidity and Temperature Probe HPP272 User Guide
M212022EN	Vaisala HUMICAP® HMP Series humidity and temperature probes with MMP8 and TMP1 User Guide

1.3 Documentation conventions

WARNING! alerts you to a serious hazard. If you do not read and follow instructions carefully at this point, there is a risk of injury or even death.

CAUTION! warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

Note highlights important information on using the product.

Tip gives information for using the product more efficiently.

1.4 Trademarks

Vaisala® is a registered trademark of Vaisala Oyj.

Microsoft® and Windows® are either registered trademarks or trademarks of Microsoft Corporation in the United States and other countries.

Modbus® is a registered trademark of Schneider Automation Inc.

All other product or company names that may be mentioned in this publication are trade names, trademarks, or registered trademarks of their respective owners.

2. Product overview

2.1 Introduction to Indigo200 transmitters
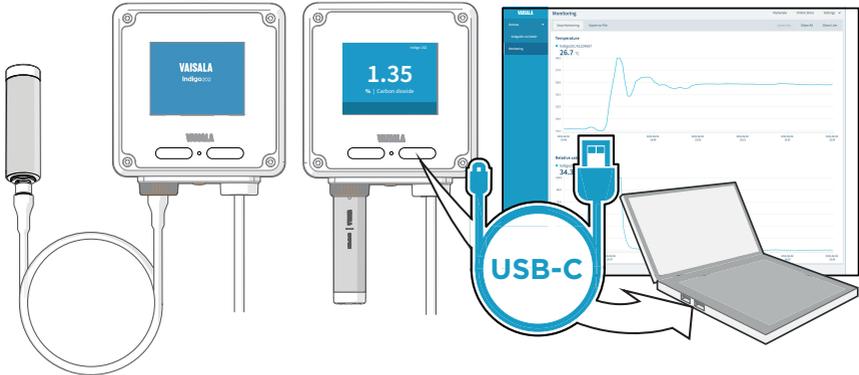
Figure 1   Probe connection options

Vaisala Indigo200 transmitters are a plug-and-play host device platform for Vaisala Indigo-compatible probes. Indigo transmitters extend the feature set of connected probes with a range of additional options for outputs, measurement viewing, status monitoring, and configuration interface access.

Depending on the Indigo200 transmitter model, a display is available as an optional selection or as a standard feature. In the non-display model, an LED indicator is used for notifications. Probes can be connected either directly on the transmitter from the probe's connector, or by using a cable between Indigo and the probe.

For easy access to configuration and additional monitoring options, the transmitter can be connected to Vaisala Insight PC software with a USB cable.

The Indigo202 transmitter is designed for digital output applications. The transmitter's output options include RS-485 Modbus RTU and 2 programmable relays.

For more information on Indigo transmitter models, see www.vaisala.com/indigo.

2.1.1 Indigo202 basic features and options

- All Vaisala Indigo-compatible probes can be connected to all Indigo transmitter models
- The transmitter can be connected to Vaisala Insight PC software with a generic USB-C cable for easy access to configuration and monitoring options
- Digital output: RS-485 Modbus RTU
- 2 configurable relays
- 3.5" TFT LCD color display
- Power supply input 15 ... 30 V DC (24 V AC ±10 % 50/60Hz)

• 1-m, 3-m, 5-m, and 10-m probe connection cables available as accessories

2.2 Indigo200 transmitter parts
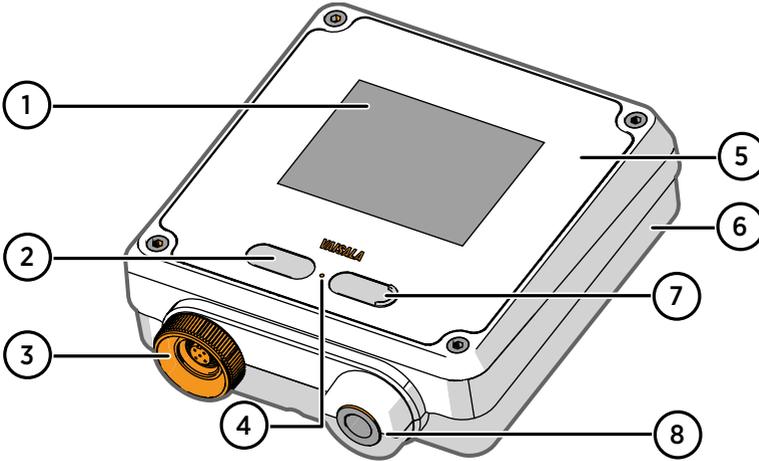
1   Display
2   Push button for transmitter display quick actions (switch between display views, display off and on)
3   Probe and probe cable connector, locking wheel
4   LED status indicator
5   Top cover of the transmitter: display, circuit board and connector pins
6   Transmitter base: input and output wiring (screw terminals), mounting base
7   USB-C port for connecting the transmitter to Insight PC software
8   Rubber lead-through with strain relief for input/output cable. See Wiring options (page 17) for instructions and the location of the alternative wiring route on the back of the transmitter.

> ⚠ **CAUTION!** Only use Vaisala Indigo-compatible probes with the transmitter. Attempting to connect incompatible probes or probe cables can damage the equipment.

2.3 Transmitter display
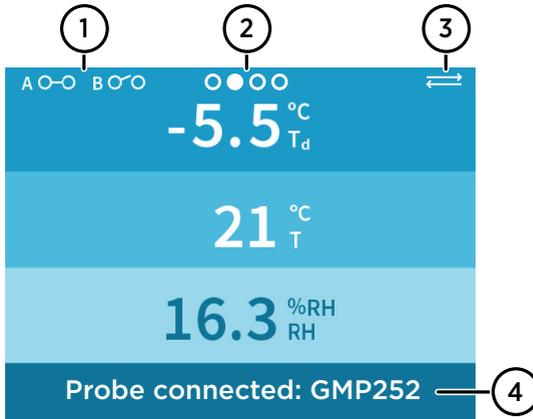
Figure 3   Indigo200 display with relays, three parameters and USB connection notification

1   Relay A and relay B status
2   Display view navigation icons
3   Active USB connection notification icon
4   Message field for notifications, warnings and errors

You can configure the transmitter display to show 1 to 3 measurement parameters in numeric and graph format. Information about the transmitter and connected probe (for example, notifications and warnings) is shown on a message row on the top part of the display.

Relay and USB connection status are also shown on the display as applicable.

The parameters shown, display brightness, and display mode (numeric or graph) can be configured with the Insight PC software.

Switching between display views and turning display off and on

To switch between different display views, push the left button on the front cover once.

To turn the display off and on, keep the left button pressed down for a few seconds.

2.3.1 Graph mode
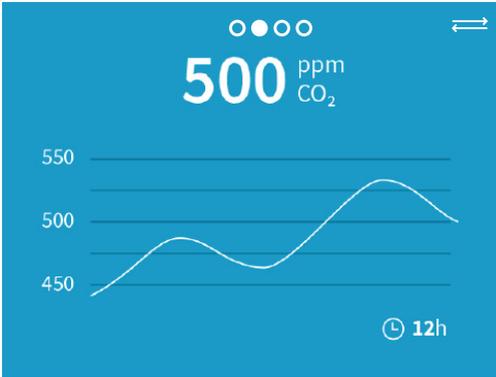
Figure 4   Transmitter display in graph mode

You can set the transmitter display to show the connected probe's measurement data as graphs. The measurement parameters can be configured with the Insight PC software.

You can switch between the numerical and graph views shown on the display with the push button on the front of the transmitter.

2.4 Configuration access with Insight PC software

Figure 5   Insight PC software configuration example: relay output A options

Indigo200 transmitters and the probes connected to the transmitters can be configured, monitored, and calibrated by connecting the transmitter to a PC that has Vaisala Insight PC software installed. To access the configuration options in Insight PC software, you need to connect a computer with Insight PC software to the transmitter front cover USB port with a USB-C (type C to A) cable. You can either use either a generic USB-C cable, or the Vaisala accessory cable (item code: 273956). Using Indigo200 transmitters with Insight software requires the Vaisala USB Device driver.

> **i** Note that a USB-C cable is not included in Indigo200 transmitter deliveries by default.

> **i** Note that the USB cable connection to Insight is only intended for temporary use during configuration, and must not be used for permanent installations. The IP rating and EMC properties of the transmitter can be affected when the USB port is open.

For an overview of using the Insight PC software, see Insight PC software overview (page 25).

2.5 Modbus communication

Indigo202 supports the Modbus RTU serial communication protocol (2-wire RS-485 interface).

For an overview of the Modbus implementation in Indigo202, see Modbus overview (page 29).

For information on the Modbus registers in Indigo202, see *Appendix A: Modbus reference*.

3. Installation

3.1 Opening and mounting
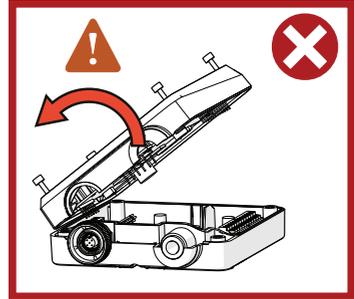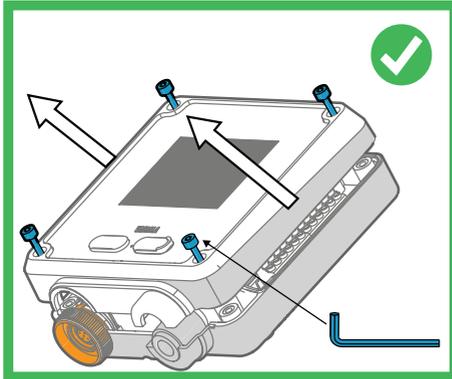
⚠ **CAUTION!** To avoid damaging the connector pins of the transmitter, pull the transmitter cover off the base in a straight angle. Do not twist or bend.

▶ 1. Loosen the 4 screws on the transmitter cover.

2. Carefully open the transmitter cover part of the way from both sides so it is easier to pull the cover off the base.

3. Pull the transmitter cover off the base in a straight angle. Do not twist or bend.

4. Lead the input/output cable inside the transmitter (see Wiring options (page 17)). If you are wiring through the lead-through on the bottom of the transmitter, test that the strain relief works with your cable.

5. Place the transmitter base on the installation surface and mount it with 3 screws. See the screw positions in Figure 6 (page 16).

6. Connect the input/output cable's wiring to the screw terminals (see Indigo200 transmitter base (page 16)) and reattach the cover when done.

3.2 Indigo200 transmitter base
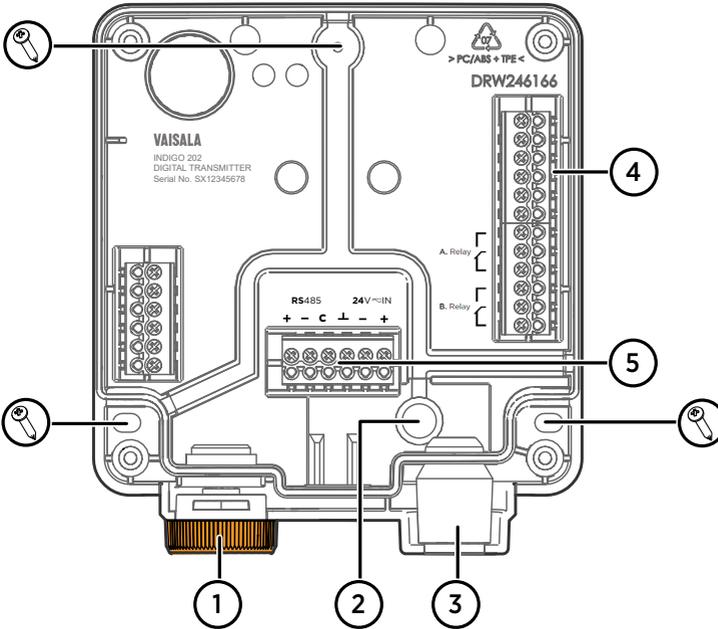
Figure 6   Indigo 202 transmitter base main parts and mounting screw positions

1   Probe and probe cable connector inside the locking wheel
2   Wiring from the back: cut open the seal
3   Rubber cable lead-through with strain relief
4   Screw terminals for relays A and B
5   Screw terminals for 24 V power supply input and RS-485 (Modbus) connection

CAUTION! Do not energize the power supply before the wiring has been connected.

3.3 Wiring options
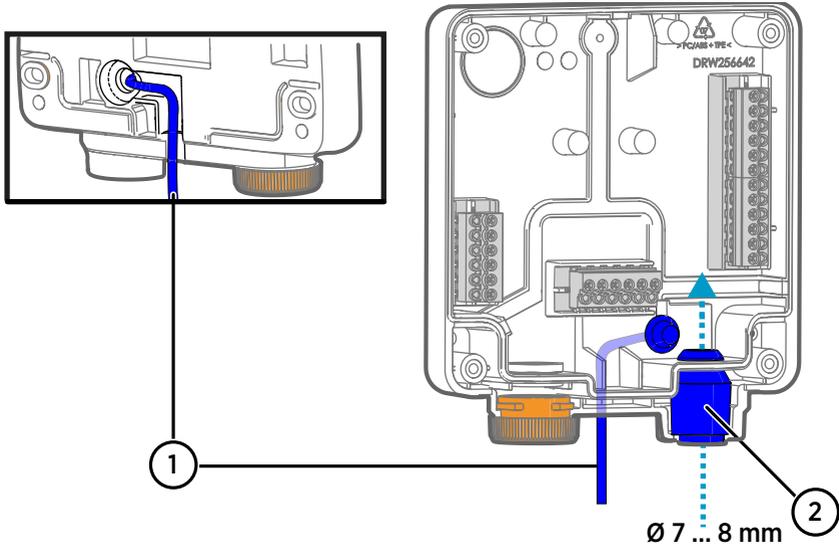
Figure 7   Indigo200 wiring options

1   Wiring from the back: cut the seal open and nest the cable in the groove on the back of the transmitter base
2   Wiring through the rubber lead-through on the bottom of the transmitter

▶   1. To wire the input/output cable through the back of the transmitter:

   a. Cut off as much of the seal on the transmitter base as is needed to fit your cable through the opening.

   b. Lead the cable through the cut in the seal.

   c. Nest the cable inside the groove on the back of the transmitter as shown in Figure 7 (page 17), and attach strain relief as needed.

   > ⚠ **CAUTION!** To preserve the IP rating of the transmitter, the back of the transmitter must rest flat on the installation surface. Always nest the cable inside the groove on the back, so that the cable does not push the back of the transmitter off the installation surface.

   d. If you wire only through the back, plug or seal the other lead-through on the bottom.

2. To wire the input/output cable through the rubber lead-through on the bottom:

    a. Push the input/output cable through the lead-through.

    b. The lead-through provides strain relief and holds the cable in place. Tightening is not required.

> The recommended cable diameter for wiring through the rubber lead-through is 7 … 8 mm. If you use a different cable size, test that the strain relief works as intended.

3.4 Inputs and outputs

Table 2   Inputs and Outputs

Property	Specification
Insight PC software [1] configuration access	USB-C port on transmitter (compatible with generic USB cables)
Digital output	RS-485 Modbus RTU
Relays	2 configurable relays (VAC/VDC)
	Device maximum specification (resistive load): • Max. switching power 30 W / 37.5 VA

	UL-rated maximum specification (resistive load):
	• AC: max. 28 V / 0.5 A
	• DC: max. 40 V / 0.24 A
	• Up to 30 VDC:
	  • max. switching current 1 A
	  • max. switching power 30 W

Power supply input [2]	15 … 30 VDC (24VAC ±10 % 50/60 Hz)
Maximum current	Transmitter and connected probe max. 1 A
Power consumption	Transmitter max. 3 W (+ connected probe, varies depending on probe type)
Probe connector	M12/5 connector for probe or probe cable connection (Vaisala Indigo-compatible probes)
Cable lead-throughs	2 options: rubber lead-through on the bottom of the transmitter, and opening with a seal at the back of the transmitter
Screw terminal wire size	0.2 … 1.5 mm^2

1)   *Vaisala Insight software for Windows® available at www.vaisala.com/insight.*
2)   *Using a power supply with overload protection is recommended for electrical safety.*

> ⚠️ **CAUTION!** Do not modify the unit or use it in ways not described in the documentation. Improper modification or use may lead to safety hazards, equipment damage, failure to perform according to specification, or decreased equipment lifetime.

3.5 Dimensions
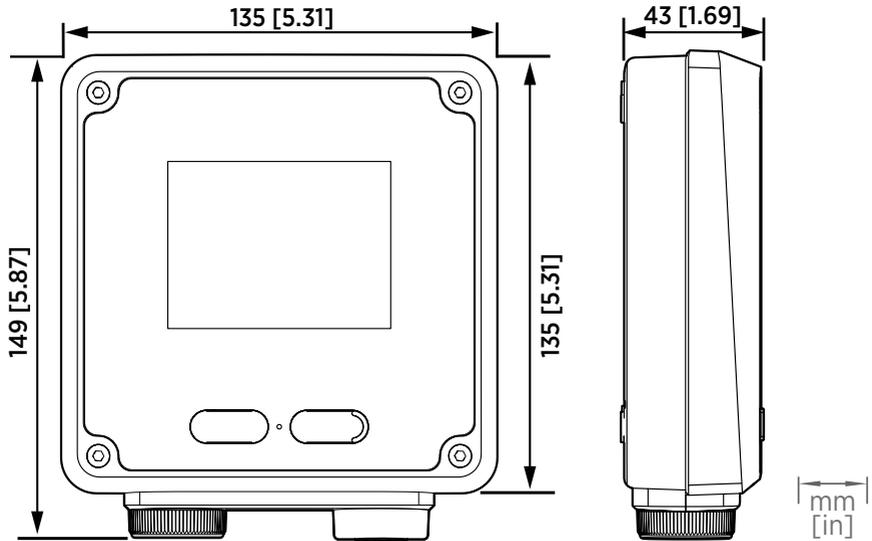
Figure 8   Indigo200 transmitter dimensions

3.6 Attaching probes and cables

> ⚠️ **CAUTION!** Only connect compatible measurement devices to the transmitter. Attempting to connect incompatible devices or cables can damage the equipment. Refer to transmitter specifications for compatibility information.

Figure 9   Attaching probes and cables to Indigo200

1   Probes are locked in place with the locking wheel. **Never turn from the probe body.**
2   Connect probe cables in the same way as probes: insert the cable in the connector and
     hold in place while turning the locking wheel.
3   Insert probes into the probe connector with the orientation mark facing out.

▶   1. Insert the probe into the probe connector with the orientation mark on the probe body
       facing out.

    2. Hold the probe in the probe connector and lock it in place by turning the locking wheel
       counterclockwise. Do not turn the probe body when attaching, only the locking wheel on
       the transmitter.

    3. When the transmitter recognizes the connected probe, it shows a notification message on
       the display (for example, **Probe Connected: GMP251**).

4. Using Indigo202 with Insight PC software

4.1 Vaisala Insight PC software

Vaisala Insight PC software is a configuration software for Vaisala Indigo-compatible probes and transmitters. Insight is available for the Windows operating system (64-bit only). For a full list of supported operating system versions, see http://www.vaisala.com/insight.

> ℹ️ To ensure support for your transmitter, download the latest version of Insight at www.vaisala.com/insight.

With the Insight PC software, you can:

- See real-time measurements and device and status information
- Configure outputs and relays
- Configure serial communication (for example, Modbus) settings
- Configure the transmitter settings (for example, display mode)
- Calibrate and adjust the probe connected to the transmitter

Indigo200 transmitters can be connected to Insight PC software with a standard USB-C cable (type C to A or type C to C). For instructions on connecting the transmitter to Insight, see Connecting to Insight PC software (page 23).

> ℹ️ Note that the USB cable connection to Insight is only intended for temporary use during configuration, and must not be used for permanent installations. The IP rating and EMC properties of the transmitter can be affected when the USB port is open.

> ℹ️ To connect the Indigo transmitter to Vaisala Insight PC software with a USB cable, you must have the Vaisala USB Device driver installed on your PC.

4.1.1 Installing Vaisala USB Device driver

> ℹ️ The Vaisala USB Device driver only supports Windows® operating systems.

▶ 1. Connect your USB-C cable to the Indigo transmitter USB port, and the connect the USB cable to a USB port on a PC that has Insight PC software installed. Windows® detects the new device and installs the appropriate driver.

2. Open **Device Manager** from the Windows® Start menu. Use search to find it if necessary (search for "device").
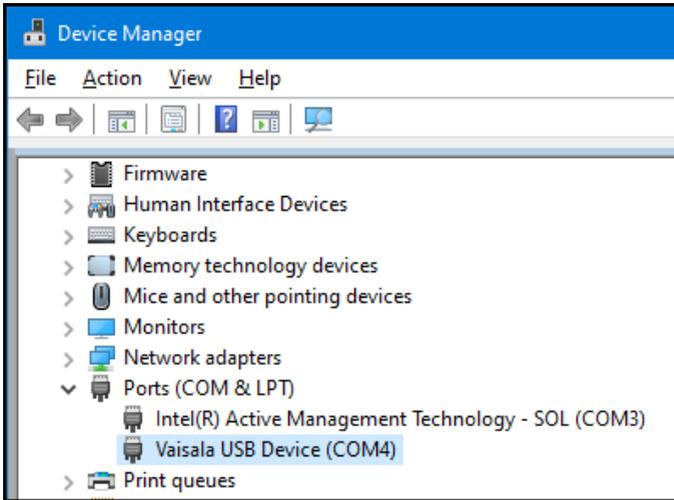
3. Locate the Vaisala USB device in the Device Manager list of devices :

   - If the device is listed as **Vaisala USB Device** with a COM port number in brackets, the driver is ready for use.
   - If the device is listed as **Vaisala USB Instrument Cable** without a COM port number listed, you must install the driver manually.

4. To install the driver manually:

   a. Disconnect the USB cable from the computer.

   b. Download the Vaisala USB device driver at http://www.vaisala.com/software (look for **USB Instrument Driver Setup** for cables).

   c. Extract the driver zip file and run the USB driver installation program *Vaisala USB Device Driver Setup.exe*. Accept the installation defaults.

   d. Go back to step 1 and verify that the driver installation works as expected.

4.2 Connecting to Insight PC software
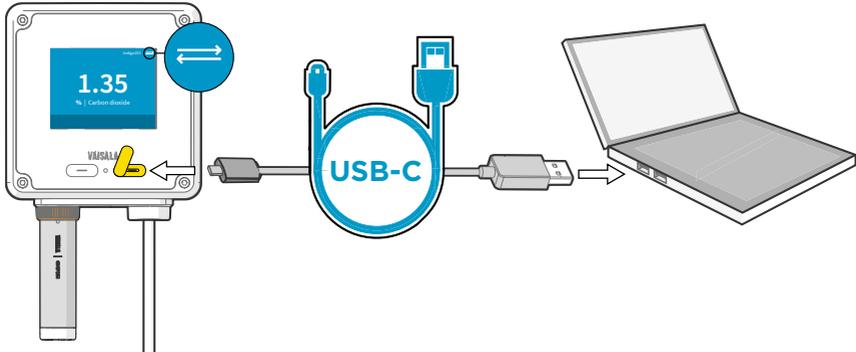
Figure 10   Connecting Indigo200 transmitter to Insight PC software with USB-C cable

Required tools:
- Computer with a Microsoft Windows® operating system (64-bit version), Vaisala Insight PC software, and Vaisala USB Device driver installed
- USB cable with a USB-C (type C to A or type C to C) connector (available as an accessory, a generic cable can also be used)

Note that the USB cable connection to Insight is only intended for temporary use during configuration, and must not be used for permanent installations. The IP rating and EMC properties of the transmitter can be affected when the USB port is open.

You can connect the Indigo200 transmitter to Vaisala Insight PC software with any generic USB cable that has a USB-C connector. The Insight software can be downloaded at www.vaisala.com/insight. Using Indigo200 transmitters with Insight software requires the Vaisala USB Device driver.

For an overview of the Insight PC software configuration and monitoring options for Indigo200, see Insight PC software overview (page 25).

To connect the transmitter to Insight PC software:

1. Verify that you have the Vaisala USB Device driver installed on your computer. For instructions, see Installing Vaisala USB Device driver (page 21).

2. Open the Insight software on your PC.

3. Connect the USB cable to a free USB port on the PC.

4. Open the protective cover of the right-hand port on the front of the transmitter, and connect the USB cable to the USB-C connector.

5. In transmitter models with a display, the USB connection icon (see Figure 10 (page 23)) appears on the top right corner of the transmitter display when the USB cable connection is active.

6. Wait for Insight software to detect the device.

You can also temporarily power the transmitter through your computer with the USB cable when using Insight. Note that certain probe functionalities that increase the power supply requirements, such as purge or heating, may affect the Insight connection when powering the transmitter only through the USB connection. If the probe connected to the transmitter has a purge or heating feature, do not use the temporary USB powering option.

4.3 Insight PC software overview
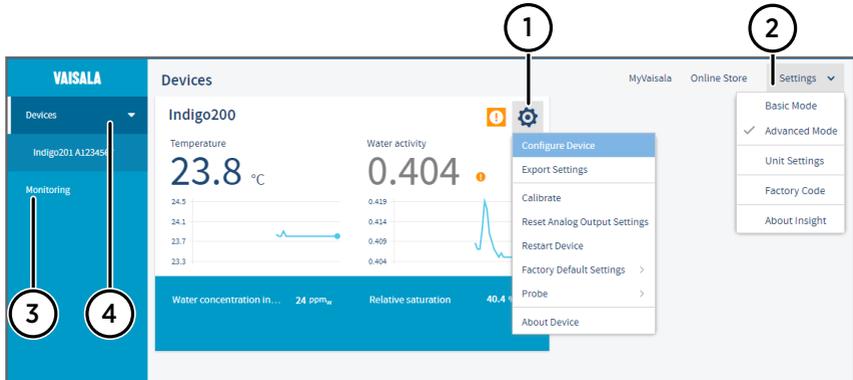
Figure 11   Insight software main menu view with Indigo200 transmitter and connected probe

1   Select ⚙ to access Insight main menu.
- **Configure Device**: display and graph options, output and relay settings, parameter and unit selection, environmental compensation settings, filtering factor, probe options, and general settings.
- **Export Settings**: creates a text file export of the device settings.
- **Calibrate**: options for calibrating and adjusting the measurement of the connected probe, adjusting outputs, viewing adjustment data, and restoring factory adjustments.
- Various reset, factory default settings, and restart options for transmitter and probe.
- **About Device**: general device information such as serial number and software version.

2   Select **Settings** to switch between the **Basic Mode** and **Advanced Mode** user modes, change the units of parameters (metric/non-metric), enter a factory code to access restricted functionalities, or view information about the Insight software.

3   **Monitoring** provides options for monitoring and recording selected parameters, and exporting the monitoring data as a CSV (comma-separated values) file.

4   Device information menu with the following tabs:
- **Measurements**: measurement graph view with parameter drop-down selection.
- **Calibration information**: read-only information about the latest stored calibration.
- **Diagnostics**: troubleshooting and administrative information about the device status. Also includes options for exporting the device error log and other diagnostics information as files (CSV/ZIP). When contacting Vaisala support, it is recommended to include an up-to-date export of the error log with the support request.

4.3.1 Unit settings
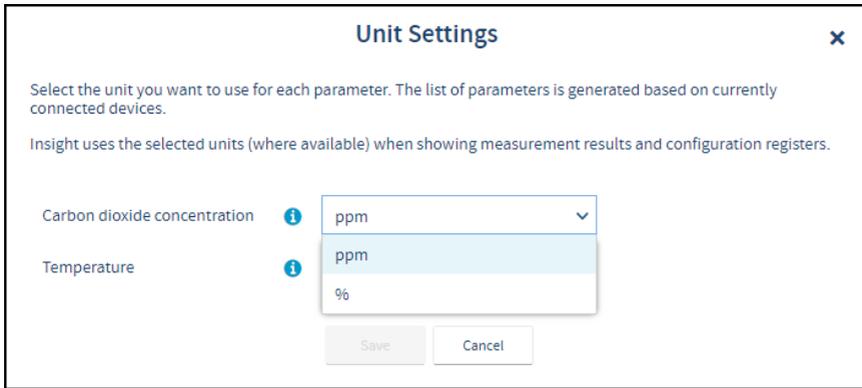
You can change the units of the measurement parameters in the Insight PC software main view **Settings** menu. For the location of the menu, see Figure 11 (page 25).

> The unit selection has an effect on entering configuration values (for example, whether you must enter relay activation limits as ppm or % values).

4.4 Disabling and enabling USB functionality and RS-485 termination with DIP switch

If you install the transmitter to a location where it is necessary to limit access to configuration, you can disable the USB functionality with a DIP switch on the Indigo202 front cover component board. RS-485 termination can also be switched on or off with a DIP switch.
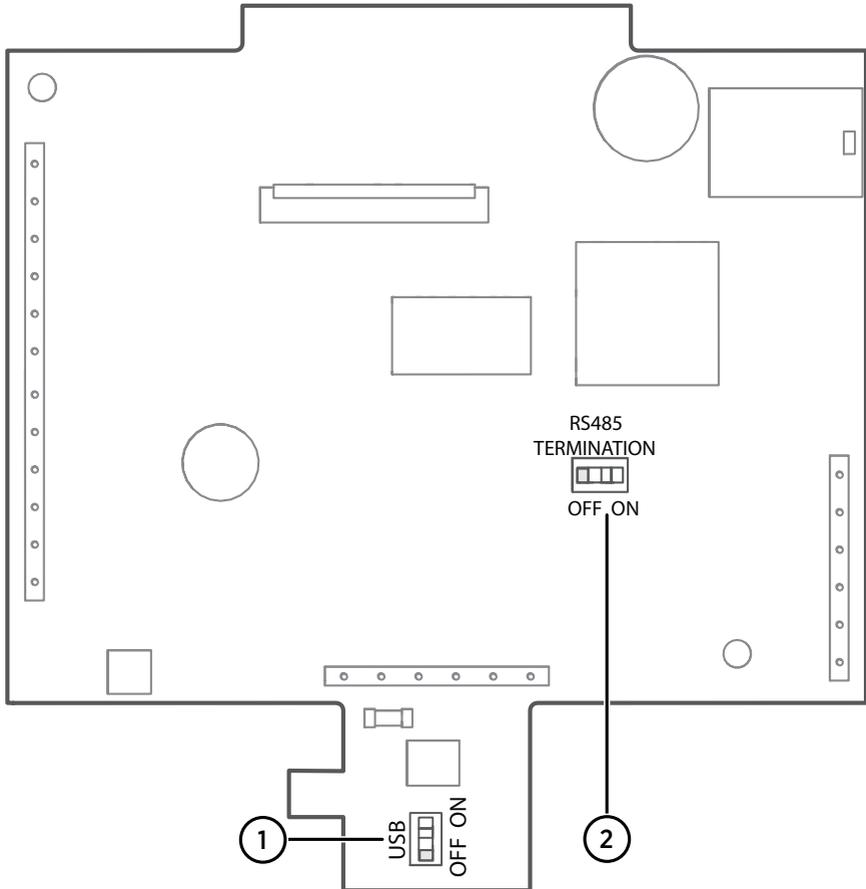
Figure 13   USB and RS-485 termination OFF/ON DIP switch locations

1   DIP switch for setting USB functionality OFF or ON

To switch USB communication or RS-485 termination OFF or ON with the DIP switches:

▶   1. Power off the transmitter.

2. Open the transmitter cover. See Opening and mounting (page 15).

> ℹ️ To avoid damaging the connector pins of the transmitter, pull the transmitter cover off the base in a straight angle. Do not twist or bend.

3. Use a small screwdriver or a similar tool to change the position of the DIP switch to OFF or ON.

4. When done, close the transmitter cover and power on Indigo. Note that when the USB DIP switch is in the OFF position, the transmitter USB port is inactive and it is not possible to connect Indigo202 to Insight PC software for configuration.

5. Modbus

5.1 Modbus overview

Indigo202 supports the Modbus RTU serial communication protocol (2-wire RS-485 interface).

There are 2 groups of Modbus register addresses in use in Indigo202: probe registers and Indigo registers. The probe registers are received from the connected probe, and are organized according to the probe's register map. Indigo registers include transmitter-specific information.

Table 3   Indigo202 Modbus registers

Address	Name	Data type
Probe registers (according to the connected probe's register map) [1]		
0000_{hex}	First measurement probe address	
$DFFF_{hex}$	Last measurement probe address	
Indigo registers		
$E000_{hex}$	Status	16-bit
$E001_{hex}$	Notification and error bits	16-bit
$E002_{hex}$	Connected probe	text [30]
$E011_{hex}$	Relay A status	enum
$E012_{hex}$	Relay B status	enum

1)   *See the connected probe's Modbus documentation for probe-specific register information*

Received Modbus requests for register operations are handled in two different ways, depending on whether the register is a probe register or an Indigo transmitter register. Addresses above $DFFF_{hex}$ (that is, Indigo registers) are handled as normal requests. Lower addresses (that is, probe registers 0000_{hex} ... $DFFF_{hex}$) are passed to the measurement probe, and the response from the probe is again passed to the original Modbus client. Indigo can also have a cache for commonly requested registers (Measurement registers).

The maximum response delay is 2 seconds (when the data content needs to be fetched from the probe). The minimum delay between requests is 10 ms.

5.1.1 Default communication settings
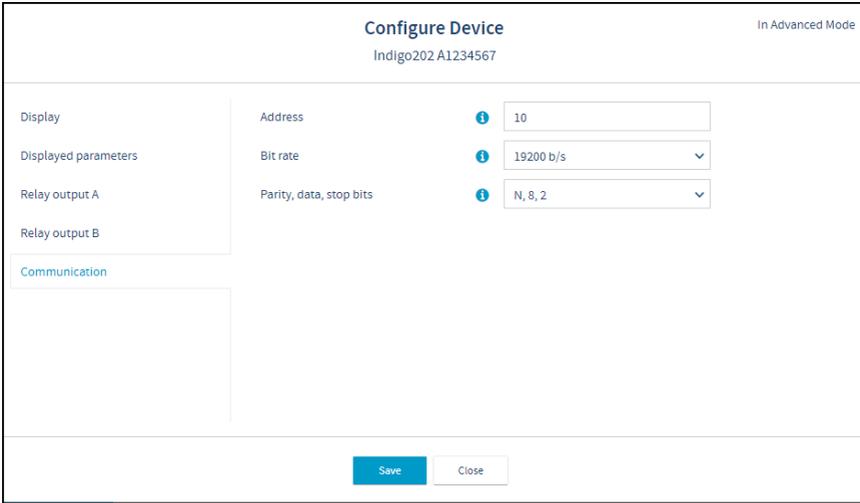
Figure 14   Insight PC software Communication menu view

Modbus communication settings can be configured in the Insight PC software **Configure Device > Communication** menu.

Table 4   Default Modbus serial communication settings

Description	Default value
Serial bit rate	19200
Parity	None
Number of data bits	8
Number of stop bits	2
Modbus device address	10

6. Configuring relays

6.1 Relay configuration overview

Indigo200 transmitters have 2 configurable relays (relay A and relay B). Both relays have configuration options for selecting the parameter that is used to control the relay, activation triggers, hysteresis, and error state behavior.

Figure 15   Relay configuration options (CO_2 probe example)

1   **Relay output on/off**: Set to **ON** to enable relay output.
2   **Output parameter**: The measurement that is used to control the relay. Options vary based on the type of the connected probe.
3   **Activate above**:
    When the measurement value exceeds the value set here, the relay activates.
    See the different relay activation options described in Figure 18 (page 34).
4   **Activate below**:
    When the measurement value falls below the value set here, the relay activates.
    See the different relay activation options described in Figure 18 (page 34).
5   **Hysteresis**: Define a buffer value for relay deactivation (set the value according to the parameter selected for the relay). With hysteresis, an activated relay switches off only when the measured value crosses the relay activation/deactivation limit and the additional buffer value.
6   **Error output state**: Select which state the relay is set to when an error occurs (on, off, or remains in its current state).

Relay state information

When one or both relays are enabled, the relay state (active/not active) is shown on the transmitter display. You can also view the status of the relays with Insight PC software.

Figure 16   Relay icons on display (relay A active, relay B not active)

6.1.1 Relay activation options

> **i** Note that the values given must match the parameter and unit selections.

Relay activation and deactivation can be configured to happen either when the measurement passes a single setpoint, or also when the measurement is within or outside a set range. The following options are available:
- The relay activates when the measurement rises above or falls below a single setpoint, and deactivates when the measurement returns to the other side of the setpoint value.
- When you set a higher value for **Activate above** and a lower value for **Activate below**, the relay is **passive** when the measured value is in between the setpoints.
- When you set a lower value for **Activate above** than for **Activate below**, the relay is **active** when the measured value is in between the setpoints.

For examples of different relay activation options, see Relay activation and hysteresis examples (page 33).

Note that the hysteresis configuration has an effect on relay activation and deactivation. For more information on hysteresis, see Relay hysteresis (page 32). The effect of hysteresis is also described in the examples in Relay activation and hysteresis examples (page 33).

6.1.2 Relay hysteresis

If the measurement you are using to control the relay is likely to move back and forth close to the activation setpoint, you can set a hysteresis that prevents the relay switching on and off too frequently.

When hysteresis is used, the relay activates at the defined limit, but does not switch off immediately when the measurement moves back to the other side of the activation limit. Instead, with hysteresis, the relay remains active until the measurement crosses the relay activation/deactivation limit and the additional buffer value.
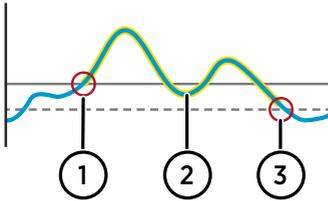
Figure 17   Behavior of relay that activates above limit, with hysteresis

1   Measurement goes above the relay activation limit (solid line —) and the relay activates.
2   Measurement falls below the activation limit, but stays above the hysteresis limit (dashed line - - -). The relay remains active.
3   Measurement falls below the hysteresis limit and the relay switches off.

6.1.3 Relay activation and hysteresis examples

Figure 18 (page 34) shows examples of different relay setpoint options, ranging from only one setpoint to different combinations of "above" and "below" setpoints. The effect of hysteresis is also described in the examples.
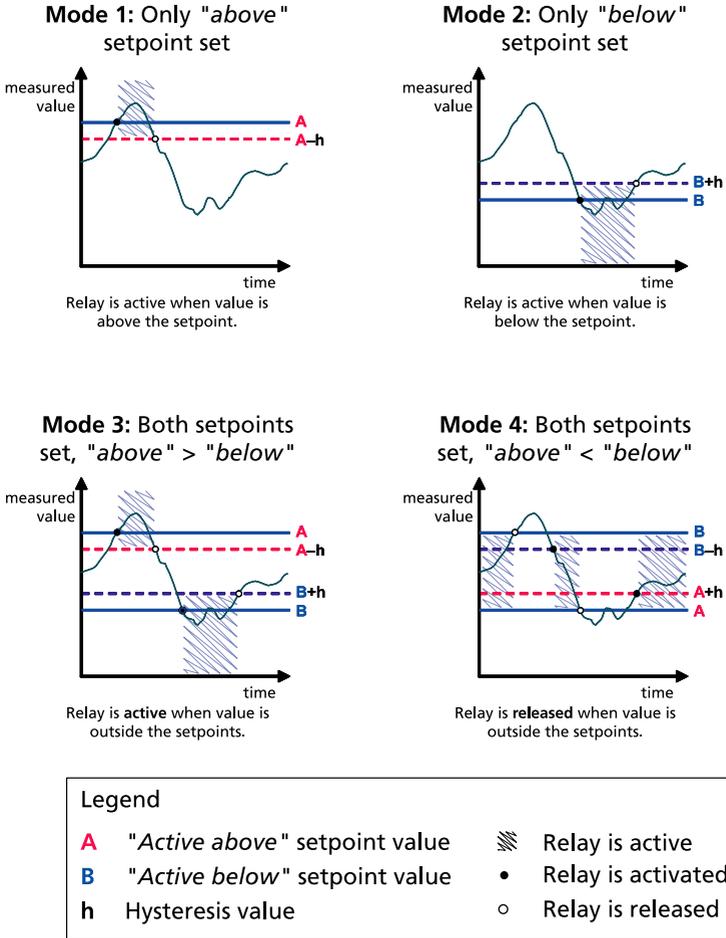
Figure 18   Relay activation and hysteresis examples

6.2 Setting relay activation limit without hysteresis

You can set the relay to activate when the probe measurement exceeds or falls below a set limit. When you configure a single setpoint for relay activation without hysteresis, the relay switches on or off immediately when the measurement moves over or below the setpoint.

Figure 19   Relay settings example: one setpoint without hysteresis

To define a single setpoint for relay activation when the measurement exceeds the defined activation limit (**Activate above**) without using hysteresis:

1. Select ⚙ to access Insight main menu.

2. In the **Configure Device** menu, select either relay A or relay B.

3. Enable the relay output by setting **Relay output on/off** to ON.

4. Select the measurement parameter that is used to control the relay with the **Output parameter** dropdown.

   The parameter options depend on the connected probe. Note that the parameter units are defined in the **Settings** menu: see Unit settings (page 26).

5. Enter the activation limit value in the **Activate above** field.

   > **ℹ** With this configuration, there is no hysteresis buffer. The relay activates or switches off immediately after passing this point.

6. Leave the **Activate below** field empty and set the **Hysteresis** field value as **0** (no hysteresis).

7. Select the **Error output state** for the relay.

8. Select **Save** to store the configuration.

6.3 Setting relay activation limit using hysteresis

If the measurement you are using to control the relay is likely to move back and forth close to the activation setpoint, you can set a hysteresis that prevents the relay switching on and off too frequently.

When hysteresis is used, the relay activates at the defined limit, but does not switch off immediately when the measurement moves back to the other side of the activation limit. Instead, with hysteresis, the relay remains active until the measurement reaches the defined tolerated variation limit.

Figure 20   Relay settings example: one setpoint with hysteresis

To define a single setpoint for relay activation when the measurement falls below the defined activation limit (**Activate below**) using hysteresis:

▶ 1. Select ⚙ to access Insight main menu.

2. In the **Configure Device** menu, select either relay A or relay B.

3. Enable the relay output by setting **Relay output on/off** to ON.

4. Select the measurement parameter that is used to control the relay with the **Output parameter** dropdown.

   The parameter options depend on the connected probe. Note that the parameter units are defined in the **Settings** menu: see .

5. Enter the activation limit value in the **Activate below** field.

6. Leave the **Activate above** field empty.

7. Enter the hysteresis value in the **Hysteresis** field.

8. Select the **Error output state** for the relay.

9. Select **Save** to store the configuration.

   With this configuration, the relay activates when measurement falls below the value entered in the **Activate below** field (100 ppm in this example). When the measurement returns above the **Activate below** limit, the relay does not switch off until it has reached the combined value of the activation limit and hysteresis buffer (120 ppm in this example). For further examples on the effect of hysteresis, see Figure 18 (page 34).

7. Calibration and adjustment

7.1 Calibration overview
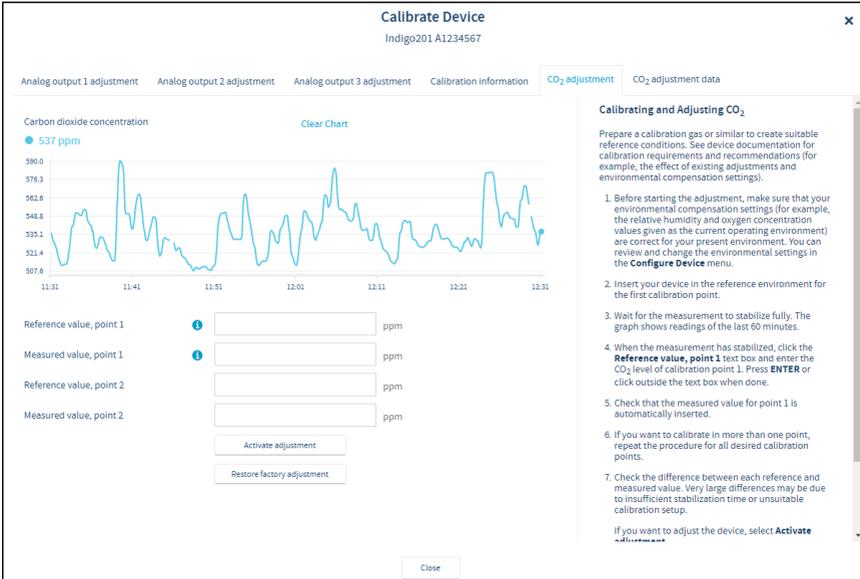
Figure 21   Calibration menu main view example (CO_2 probe)

The **Calibrate** menu in Insight PC software contains options for calibrating and adjusting the measurement of the probe you have connected to the transmitter. You can also view the current adjustment and restore the probe's factory adjustments.

> The range of available options (for example, environmental compensations and the number of adjustment points) varies depending on the features of the connected probe.
> The menu examples presented here are examples of calibration options that are available when a CO_2 probe is connected to the transmitter.

> **CAUTION!** Before adjusting a probe's measurement, make sure that you have familiarized yourself with the probe-specific calibration requirements such as possible adjustment limits and environmental compensation interdependencies. See the user documentation of the probe for probe-specific information.

Starting calibration

To open the calibration menu, select ⚙ to access Insight main menu. In the main menu, select **Calibrate**.

Figure 22   Calibration menu selection

Restoring factory adjustment

Before adjusting the probe measurement, remove any possible earlier adjustments with the **Restore factory adjustment** selection.

Figure 23   Restore factory adjustment selection

> ℹ️ Always restore factory adjustment before entering a new adjustment. This prevents any possible earlier adjustments having an effect on the new adjustment you make.

7.2 Environmental compensation

When making adjustments, you can enter information about the environment in which you perform the adjustment. This allows compensating for environmental factors that have an effect on the measurement (for example, temperature, pressure, or background gases).

The selection of environmental compensations available in the Indigo transmitter configuration menus depends on the features and configuration of the connected probe. If the probe you have connected to the transmitter supports environmental compensations, the configuration options are shown in the Insight PC software **Configure Device** menu. For information and instructions on the environmental compensation features of the probe, see the user documentation of the probe you are using.
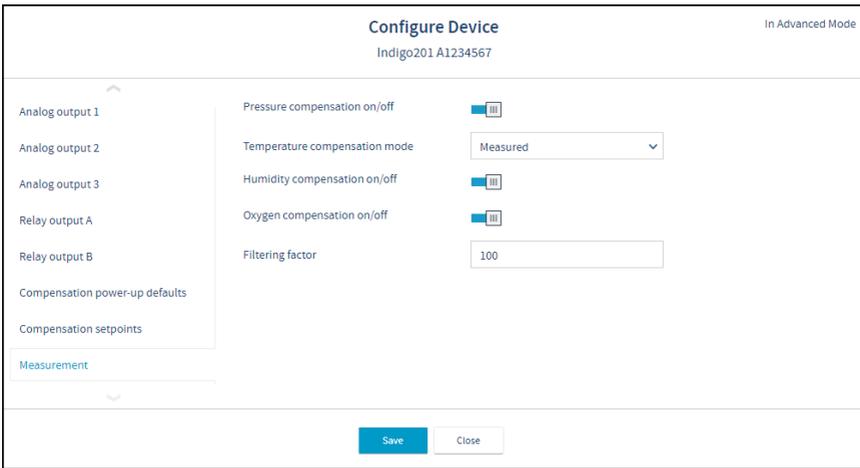
Figure 24   Enivironmental compensation configuration example with CO_2 probe

7.3 CO_2 probe adjustment example

Prepare a calibration gas or similar to create suitable reference conditions. See device documentation for calibration requirements and recommendations (for example, the effect of existing adjustments and environmental compensation settings).

To adjust the CO_2 measurement of the probe that is connected to the transmitter:

1. Before starting the adjustment, make sure that your environmental compensation settings (for example, the relative humidity and oxygen concentration values given as the current operating environment) are correct for your present environment. You can review and change the environmental settings in the **Configure Device** menu.

2. To open the Insight PC software calibration menu, select ⚙ to access Insight main menu. In the main menu, select **Calibrate**.

3. Select **CO_2 adjustment**.

4. Insert the probe in the reference environment for the first calibration point.

5. Wait for the measurement to stabilize fully. The graph shows readings of the last 60 minutes.

6. When the measurement has stabilized, click the **Reference value, point 1** text box and enter the CO_2 level of calibration point 1. Press **ENTER** or click outside the text box when done.

7. Check that the measured value for point 1 is automatically inserted.

8. If you want to calibrate in more than one point, repeat the procedure for all desired calibration points.

9. Check the difference between each reference and measured value. Very large differences may be due to insufficient stabilization time or unsuitable calibration setup.

   If you want to adjust the device, select **Activate adjustment**.
   To exit without taking the adjustment in use, select **Close**.

10. After calibrating your device, update the information in the **Calibration information** tab.

8. Maintenance and troubleshooting

8.1 Cleaning

You can clean the Indigo transmitter body by wiping it with a moist cloth. Standard cleaning agents can be used.

> **i** Refer to the probe-specific cleaning instructions when cleaning the probe connected to transmitter. Do not spray anything directly on the probe, since that may deposit impurities on the sensor.

Chemical tolerance

The following chemicals can be used to clean the transmitter:

- H_2O_2 (6000 ppm), non-condensing
- Alcohol-based cleaning agents such as ethanol and IPA (70 % Isopropyl Alcohol, 30 % water)
- $Ca(Clo)_2$ (calcium hypochlorite) max. 0.5 %
- QAC (quaternary ammonium cations) max. 0.5 %

> **i** Avoid exposing the transmitter to chemicals for unnecessarily long periods of time. Do not immerse it in a chemical, and wipe chemicals off the surfaces after cleaning.

8.2 Replacing probes

> ⚠️ **CAUTION!** Only connect compatible measurement devices to the transmitter. Attempting to connect incompatible devices or cables can damage the equipment. Refer to transmitter specifications for compatibility information.

> **i** If you want to configure the probe settings, such as purge interval, you must do that before attaching the probe to the transmitter. To configure the probe, you can use the free Vaisala Insight PC software. For more information, see your probe's user guide and visit www.vaisala.com/insight.

You can replace probes both when transmitter power is on and when it is off. There is no need to disconnect any wires from the transmitter; just detach the probe from the probe cable connector (5-pin M12).

The measurement parameters and outputs will behave differently depending on whether the new probe's parameters are the same as the parameters of the old probe:

- If you replace a probe with a new one that has the same measurement parameters as the removed probe, the transmitter will continue to show those measurements once it detects the new probe. Outputs will give an error notification, which will disappear when the new probe is detected.
- If you replace a probe with a new one that has different measurement parameters as the removed probe, you need to reconfigure the measurement parameters and outputs for the new probe.

8.3 Troubleshooting

Problem	Possible Cause	Remedy
USB connection to Insight PC software cannot be established	USB connection has been disabled with the DIP switch on the transmitter component board.	See the instructions in Disabling and enabling USB functionality and RS-485 termination with DIP switch (page 27).
Functionalities are not available in Insight PC software.	Insight PC software is in **Basic Mode**. Certain functionalities are only available in **Advanced Mode**.	Change the user mode from **Basic Mode** to **Advanced Mode** in the Insight PC software main view **Settings** menu.
Measurement performance affected after calibration.	Probe has not been switched from calibration mode to normal operating mode in the Insight PC software.	Open the calibration menu in the Insight PC software (**Configure Device > Calibrate**). Exit the calibration menu with the **Close** selection, and ensure that you confirm closing the calibration mode when exiting with the **Yes** selection.

8.4 Display messages

The following table lists the display messages that Indigo 202 uses to inform you about the transmitter's state.

In addition to the Indigo transmitter messages, the connected probes have probe-specific messages that are also shown on the display. Messages from the connected probe start with **Probe:**. For more information on the probe-specific messages, see the probe's documentation.

Table 5   Indigo transmitter messages shown on display

Display message	Description	Recommended action
Errors		

Display message	Description	Recommended action
Low supply voltage	The supply voltage is below the minimum (range: 15 ... 30 VDC or 24 VAC ±10 % 50/60 Hz).	The error clears when the supply voltage returns to the specified range. Check your power supply and restart Indigo if needed.
No legal measurement probe	The connected probe is not compatible with Indigo or a restriction (probe name or serial number) on allowed probes is in place.	Check your probe's Indigo compatibility and possible restrictions on allowed probes.
Warnings		
No measurement probe	The measurement probe is not connected, or the probe is connected poorly and cannot be recognized by Indigo.	Check that you have fastened the probe correctly with the locking wheel.
Notifications		
Probe connected:	Indigo displays the name of the connected probe.	
Waiting for measurements	The connected probe is preparing measurements (for example, at start-up or after a probe restart).	
Unable to measure all parameters	Some of the measurements you have configured to be displayed are currently not available. This can be caused, for example, by the probe heating feature: parameters that are affected by heating cannot be shown while the heating cycle is ongoing.	

9. Technical data

9.1 Specifications

Table 6   Indigo-compatible probes

Measurement type	Probe models
Humidity and temperature	HMP1, HMP3, HMP4, HMP5, HMP7, HMP8, HMP9
Temperature	TMP1
Dew point	DMP5, DMP6, DMP7, DMP8
Carbon dioxide	GMP251, GMP252
Vaporized hydrogen peroxide	HPP271, HPP272
Moisture in oil	MMP8

Table 7   Indigo202 inputs and outputs

Property	Description/value
Insight PC software configuration access [1]	USB-C port on transmitter (compatible with generic USB cables)
Power supply input	15 ... 30 V DC [2] 24 V AC ±10 % 50/60 Hz
Relay contacts x 2	Max. switching power 30 W Max. switching current 1 A Max. switching voltage 40 V DC / 28 V AC
Digital communications	RS-485, Modbus RTU

1)   *Vaisala Insight software for Windows® available at www.vaisala.com/insight*
2)   *When used with the HMP7 probe, the minimum required power supply input is 18 V DC.*

Table 8   Indigo200 operating environment

Property	Specification
Operating temperature	With display −20 ... +60 °C (−4 ... +140 °F) Without display −40 ... +60 °C (−40 ... +140 °F)
Storage temperature	−40 ... +70 °C (−40 ... +158 °F)

Property	Specification
Chemical tolerance	Temporary exposure during cleaning: • H_2O_2 (6000 ppm, non-condensing) • Alcohol-based cleaning agents such as ethanol and IPA (max. 70 % concentrate)
IP rating	IP65: Dust-tight. Protected from water jets from any direction.
Indoor/outdoor use	Indoor use

Table 9   Indigo200 compliance

Property	Specification
EMC compatibility	EN 61326-1, industrial environment
Compliance marks	CE, RCM

Table 10   Indigo200 mechanical specifications

Property	Specification
Housing material	PC/ABS plastic
Display window material	PMMA plastic
Connection screw terminals	26 AWG ... 20 AWG
Weight	402 g (14.2 oz)
Dimensions (H×W×D)	149 × 135 × 43 mm (5.87 × 5.31 × 1.7 in)

9.2 Dimensions
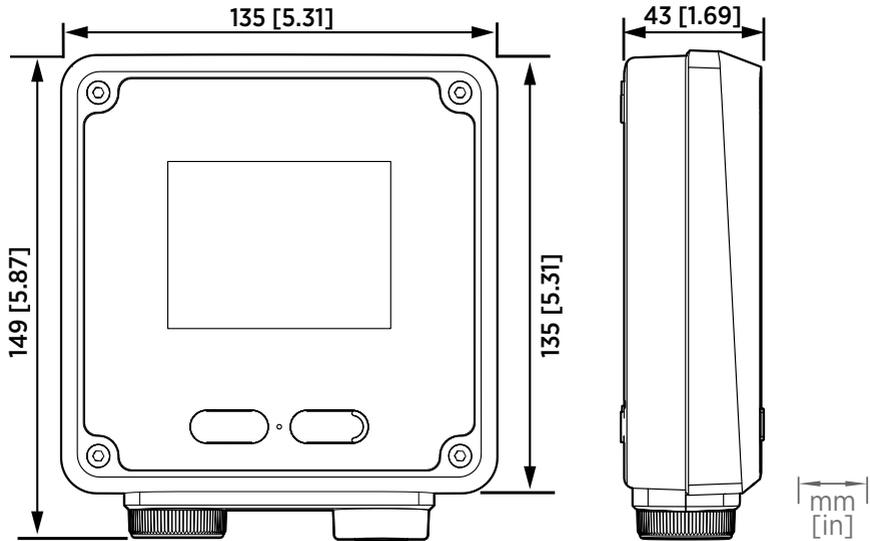
Figure 25   Indigo200 transmitter dimensions

9.3 Spare parts and accessories

> ℹ️ Information on spare parts, accessories, and calibration products is available online at www.vaisala.com and store.vaisala.com.

Table 11   Indigo200 spare parts and accessories

Description	Item code
USB-C connection cable (2 m, type C to A, for Insight PC software access) [1]	273956
Probe connection cable, 1 m (3 ft 3 in)	INDIGOCABLE1M
Probe connection cable, H_2O_2 compatible, 1 m (3 ft 3 in)	INDIGOCABLEHD1M5
Probe connection cable, 3 m (9 ft 11 in)	INDIGOCABLE3M
Probe connection cable, H_2O_2 compatible, 3 m (9 ft 11 in)	INDIGOCABLEHD3M

Description	Item code
Probe connection cable, 5 m (16 ft 5 in)	INDIGOCABLE5M
Probe connection cable, H_2O_2 compatible, 5 m (16 ft 5 in)	INDIGOCABLEHD5M
Probe connection cable, 10 m (32 ft 10 in)	INDIGOCABLE10M
Probe connection cable, H_2O_2 compatible, 10 m (32 ft 10 in)	INDIGOCABLEHD10M
Universal mains power supply with EU/US/UK/AUS plugs	INDIGOPOWER24V

1)   Note that a USB-C cable is not included in Indigo200 deliveries by default. A generic USB-C cable (type C to A) can also be used.

9.4 Recycling

Disposal of Vaisala products is to be done according to local laws and regulations. We encourage end-users to segregate the products from other waste at end-of-life and use best available recycling practices to minimize related environmental impacts.
Almost all of the parts in our products can be recovered as material or energy. If applicable, Vaisala recommends removing the battery unit before recycling the rest of the device as typical electronic waste. The battery unit can be recycled separately in accordance with local waste management practices and regulations. Integrated small sized batteries are typically left in place and removed by professionals at the recycling facilities.

Indigo200 series transmitter disposal

Do not disassemble Indigo200 series transmitters for recycling. Dispose of the entire transmitter as electrical and electronical waste.

Appendix A. Modbus reference

A.1 Function codes

Table 12   Supported function codes

Function code (decimal)	Function code (hexadecimal)	Name
03	03_{hex}	Read Holding Registers
16	10_{hex}	Write Multiple Registers
43 / 14	$2B_{hex}$ / $0E_{hex}$	Read Device Identification

A.1.1 Device identification objects

Table 13   Device identification objects

Object ID	Object ID (hexadecimal)	Object name	Example contents
0	00_{hex}	VendorName	"Vaisala"
1	01_{hex}	ProductCode	"Indigo 202"
2	02_{hex}	MajorMinorVersion	"1.2.3" Software version of the device.
3	03_{hex}	VendorUrl	"http://www.vaisala.com/"
4	04_{hex}	ProductName	"Indigo 202 Digital Transmitter"
128	80_{hex}	SerialNumber [1]	"K0710040"
129	81_{hex}	CalibrationDate [1]	"2020-01-31" Calibration date in YYYY-MM-DD format. Empty string if not set/valid.
130	82_{hex}	CalibrationText [1]	"Vaisala/HEL" Calibration information text. Empty string if not set/valid.

1)   Vaisala-specific device information.

A.2 Indigo status registers

The following table describes the status information provided in Indigo status registers (transmitter, probe, and relay statuses). For more details on the high-level transmitter and probe statuses reported in register E000$_{hex}$, see Notification and error bits (page 50).

Table 14   Modbus status registers (read-only)

Address (Hexadecimal)	Register description	Data format	Notes
E000$_{hex}$	Status	16-bit	0 = Status OK 1 = Info 2 = Warning 3 = Error
E001$_{hex}$	Notification and error bits	16-bit	Provides additional details on the high-level status reported in register E000$_{hex}$. See Notification and error bits (page 50).
E011$_{hex}$	Relay A status	enum	0 = Relay is not active 1 = Relay is activated
E012$_{hex}$	Relay B status	enum	0 = Relay is not active 1 = Relay is activated

A.2.1 Notification and error bits

The status register (E000$_{hex}$) can report that one of the following notification types is present:

0   No issues
1   Info
2   Warning
3   Error

Additional details about the status reported in the register E000$_{hex}$ can be provided in the 16-bit register E001$_{hex}$, as described in the following table.

Table 15   Bits in register E001$_{hex}$

Bit in E001$_{hex}$	Meaning	Notes
0 (0000$_{hex}$)	No errors	
2 (0002$_{hex}$)	Probe error	Connect to Insight PC software and review the error information in the **Diagnostics** menu. Check display messages.

Bit in E001$_{hex}$	Meaning	Notes
4 (0004$_{hex}$)	Low supply voltage	The supply voltage is not within the specified range (15 ... 30 VDC (24 VAC ±10 % 50/60 Hz)
16 (0010$_{hex}$)	No measurement probe	Probe not connected or Indigo cannot detect the probe.
32 (0020$_{hex}$)	Probe warning	Connect to Insight PC software and review the error information in the **Diagnostics** menu. Check display messages.

Maintenance and calibration services

Vaisala offers comprehensive customer care throughout the life cycle of our measurement instruments and systems. Our factory services are provided worldwide with fast deliveries. For more information, see www.vaisala.com/calibration.

- Vaisala Online Store at store.vaisala.com is available for most countries. You can browse the offering by product model and order the right accessories, spare parts, or maintenance and calibration services.
- To contact your local maintenance and calibration expert, see www.vaisala.com/contactus.

Warranty

For standard warranty terms and conditions, see www.vaisala.com/warranty.
Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.

Technical support

Contact Vaisala technical support at helpdesk@vaisala.com. Provide at least the following supporting information as applicable:

- Product name, model, and serial number
- Software/Firmware version
- Name and location of the installation site
- Name and contact information of a technical person who can provide further information on the problem

For more information, see www.vaisala.com/support.

Recycling

Recycle all applicable material according to local regulations.

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