iCOMOX Data Acquisition Kit

User Manual

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1. Introduction

The iCOMOX Data Acquisition (DA) kit enables displaying all data acquired by the kit's sensors while performing a basic signal processing analysis. In addition, the kit displays data statistics and an acquisition plan.

The iCOMOX DA kit (refer to Figure 1) comprises the following four components:

1. iCOMOX (1) – Mounted on the monitored equipment.
2. iCOMOX Dongle (2) – Connects to a PC USB port, providing wireless communication with the iCOMOX.
3. USB Cable (3) – Connects the iCOMOX to one of the USB ports of a PC, allowing wired communication. In addition, the USB-C cable provides the iCOMOX with its power supply (the iCOMOX can also be powered by internal batteries).
4. The iCOMOX Monitor SW (4) – Installed and run on a PC, provides a Graphical User Interface (GUI) for communicating with the iCOMOX.

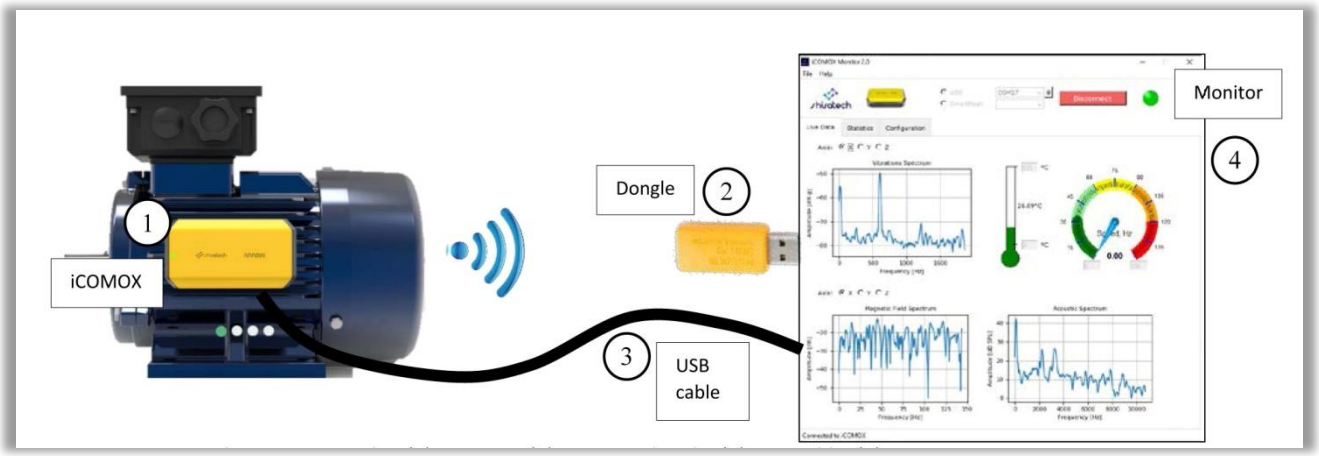


Figure 1: The iCOMOX DA Kit

After installing the iCOMOX DA Monitor and connecting the iCOMOX to the PC using the USB-C cable or the SmartMesh IP Dongle, live data from the sensors is processed, using Fast Fourier Transform, and presented on the screen.

In the Statistics view, the moving average of each sensor is computed together with its standard deviation and its maximal and minimal value.

In the Configuration view, you can select the sensors whose data require being displayed. In addition, you can schedule the acquisition as either continuous, or at a specified frequency.

2. Overview

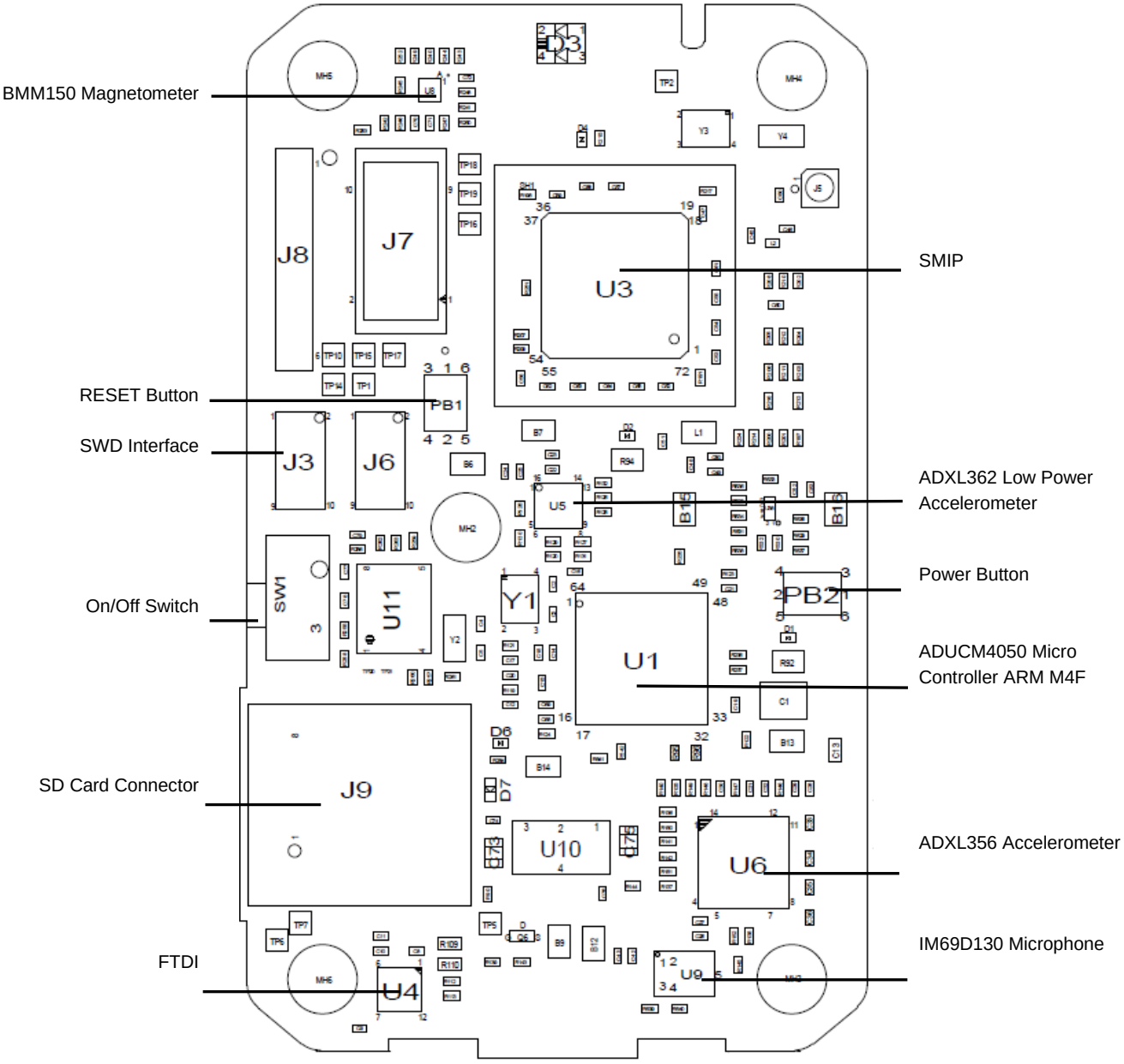


Figure 2: iCOMOX Board Layout

3. Quick Start

Before running the iCOMOX Data Acquisition Kit for the first time, perform the following steps:

1. To ensure that you are running the latest firmware version, start with downloading and flashing the latest firmware version.
2. Install the iCOMOX Monitor.

Note: For the PC to correctly recognize the iCOMOX, the FTDI driver must be installed. For FTDI driver installation instructions, refer to Appendix A: FTDI D2XX Driver.

3. Communication with the iCOMOX is enabled via both serial USB cable connection and through the SmartMesh connection. Choose your preferred communication method and follow the instructions in the corresponding section.

3.1 Connecting with the USB Cable

To connect with the USB cable, perform the following steps:

1. Turn on the iCOMOX by sliding the slide switch on the iCOMOX (see chapter 4 - Connecting the iCOMOX Kit).
2. Connect the iCOMOX to the Windows PC using the USB-C cable.
3. The iCOMOX LED will illuminate in orange and the board will vibrate for 2 seconds, indicating that the built-in test is in progress. Once completed, the iCOMOX LED will be illuminated in green, signaling that the iCOMOX has loaded successfully. If a hardware malfunction has been detected, the LED will illuminate in red (refer to the Troubleshooting section).
4. Launch the Device Manager and note which COM port represents the iCOMOX.
5. Launch the iCOMOX Monitor (when installation is required, refer to chapter 8.2 -Monitor Installation Instructions). Monitor Launch can take up to 40 seconds.
6. In the Communication panel, select the USB communication mode.
7. From the COM port drop-down menu, select the suitable COM port (refer to step 4).

Note: If the COM port drop-down menu is empty, close the iCOMOX Monitor window, turn the iCOMOX off and then on again, and repeat from Step 2.

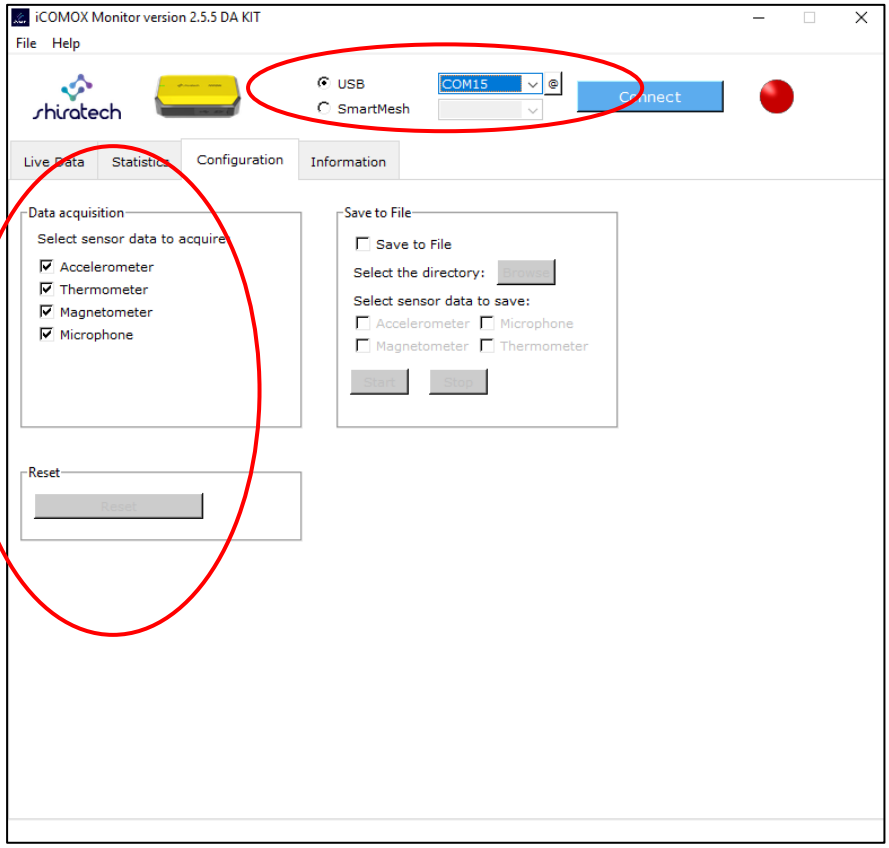


Figure 3: The Monitor Configuration Tab

8. Click the Configuration tab and from the Configuration view, select the sensor data to be acquired.
9. Click Connect.

Note: After clicking the blue Connect button, the Monitor establishes communication with the iCOMOX. The Colored Status Indicator color changes, as described in the following table.

Status Indicator Color	Significance
	Disconnected
	Trying to establish wired communication with the iCOMOX.
	Wired communication established.

Table 1: The Colored Status Indicator Color Table – USB Connection

Note: 5-10 seconds after the Colored Status Indicator in the iCOMOX Monitor Software turns green, the signals from the sensors appear on the plots. The green LED on the iCOMOX device blinks repeatedly when data is being transferred from the iCOMOX to the PC. When data is not being transferred, the green iCOMOX LED remains green during normal operation or red if the built-in self-test has failed indicating possible hardware malfunction.

10. Verify the following, which signifies that the connection has been established successfully:
    - The Colored Status Indicator is green.
    - The Status Bar displays the Connected to iCOMOX message.
    - The iCOMOX green LED should repeatedly toggle on and off.

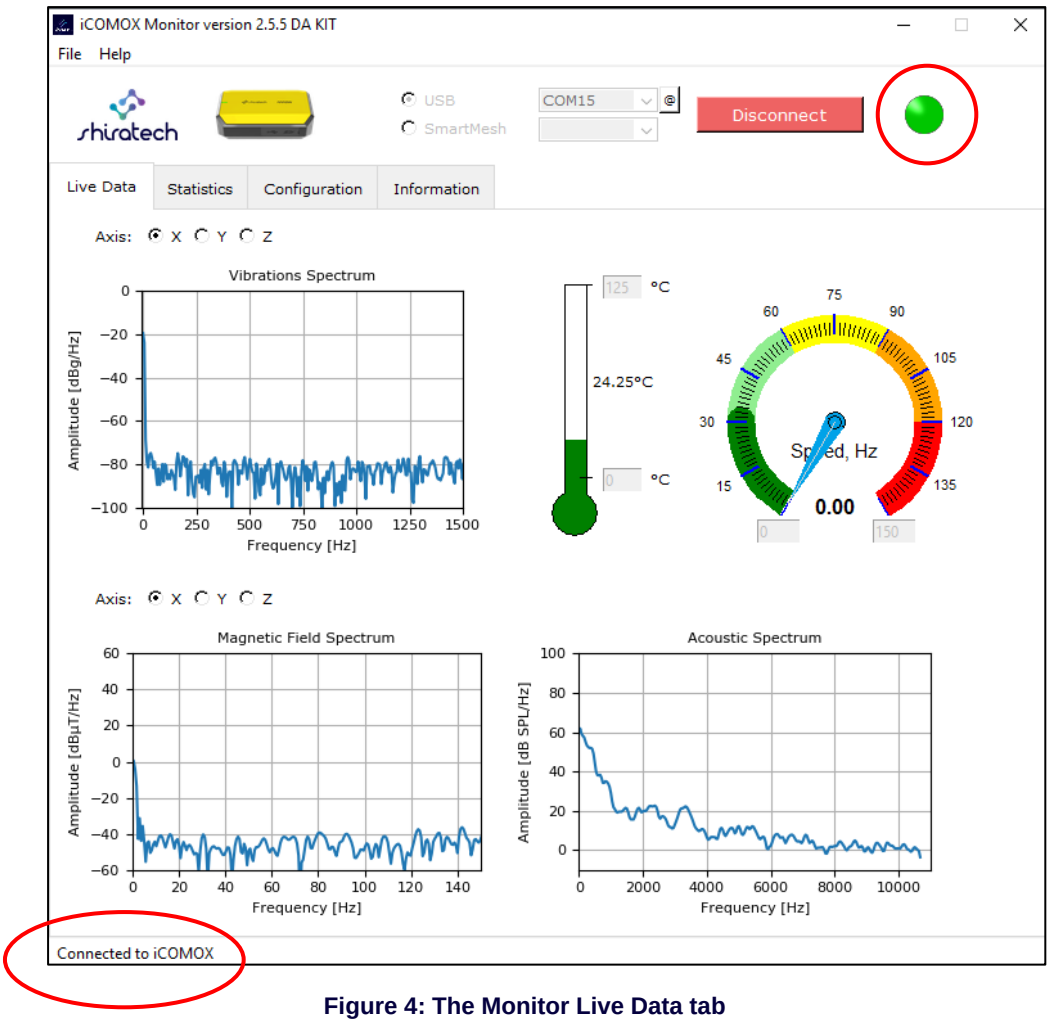


Figure 4: The Monitor Live Data tab

11. Verify that live data is displayed, in accordance with the sensors selected in Step 8.

3.2 Connecting with the SmartMesh

To connect with the SmartMesh, perform the following steps:

1. Connect the iCOMOX dongle to the PC to prepare for SmartMesh IP (SMIP) communications mode.
2. Turn on the iCOMOX by sliding the slide switch on the iCOMOX (see chapter 4 - Connecting the iCOMOX Kit).
3. The iCOMOX LED will illuminate in orange and the board will vibrate for 2 seconds, indicating that the built-in test is in progress. Once completed, the iCOMOX LED will be illuminated in green, signaling that the iCOMOX has loaded successfully. If a hardware malfunction has been detected, the LED will illuminate in red (refer to the Troubleshooting section).
4. Launch the Device Manager. You should note four different and consecutive COM ports which represent the dongle.
5. Launch the iCOMOX Monitor (when installation is required, refer to the chapter 8.2 - Monitor Installation Instructions). Monitor Launch can take up to 40 seconds.
6. In the Configuration view, select the sensor data to be acquired.

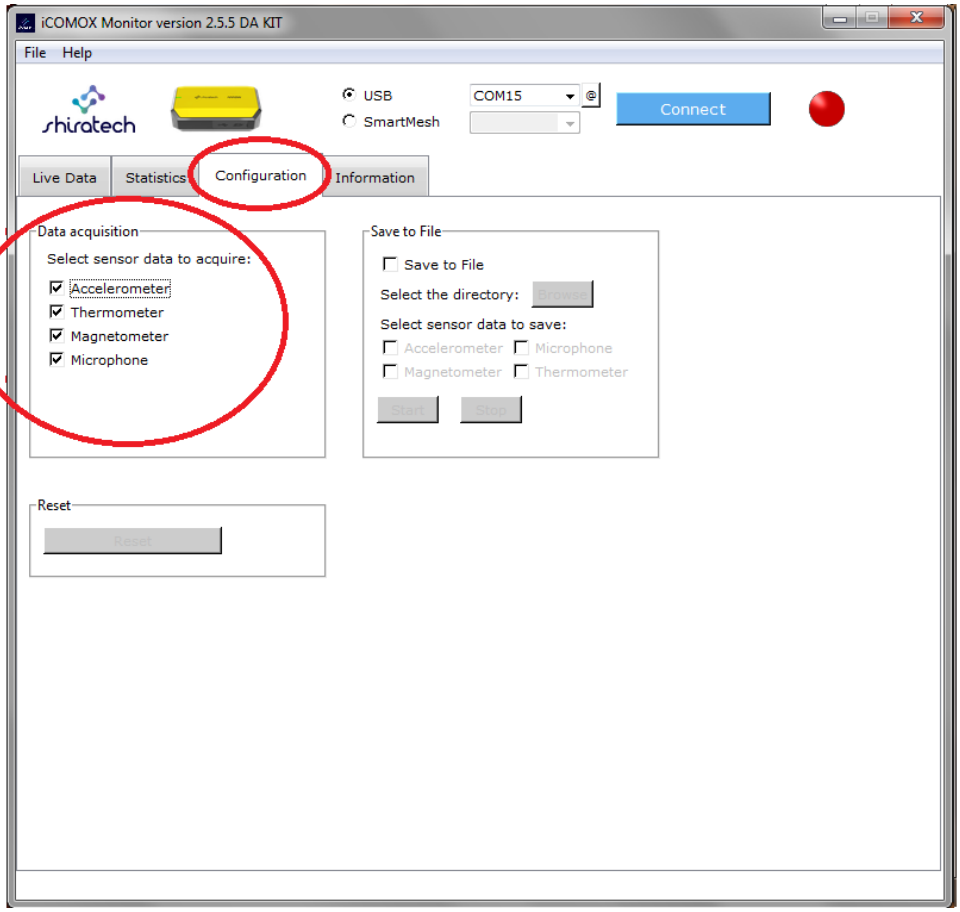


Figure 5: The Monitor Configuration Tab

7. In the Communication panel, select the USB communication mode.

8. Open the drop-down menu. Four different COM ports should appear. Select the highest numbered COM port.

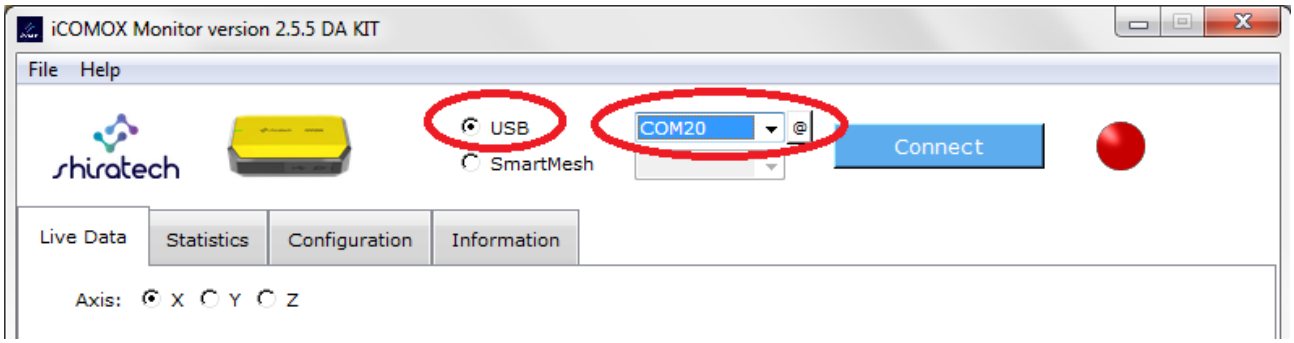


Figure 6: The Monitor Communication panel

9. In the Communication panel, select the SmartMesh option.

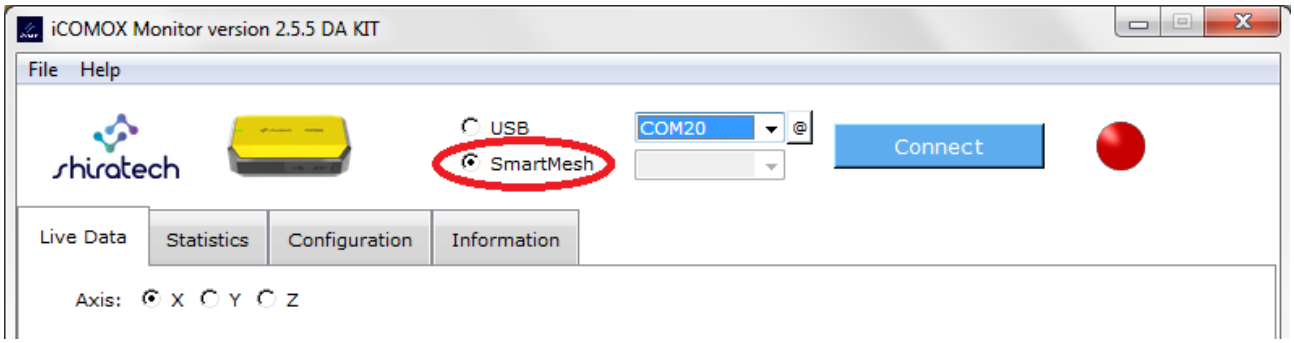


Figure 7

10. Click Connect.

Note: After clicking the blue Connect button, an attempt to establish communication between the PC and the dongle will be initiated, and the Colored Status Indicator should turn yellow. All colors are defined in the following table.

Status Indicator Color	Significance
	Disconnected
	Trying to establish wireless communication with the iCOMOX.
	Wireless communication established.

Table 2: The Colored Status Indicator Color Table – SMIP Connection

Note: 5-10 seconds after the Colored Status Indicator turns green, the signals from the sensors appear on the plots. The green iCOMOX LED blinks repeatedly when data is transferred from the iCOMOX to the PC. When data is not transferred, the green iCOMOX LED does not blink.

11. Verify that the Status Bar informs that the dongle list was updated. It is normal for this process to last 20 seconds. Please refer to the Troubleshooting section if it takes longer than two minutes. When the Status Bar displays “1 element”, click the drop-down menu next to the SmartMesh button, and select the mote.

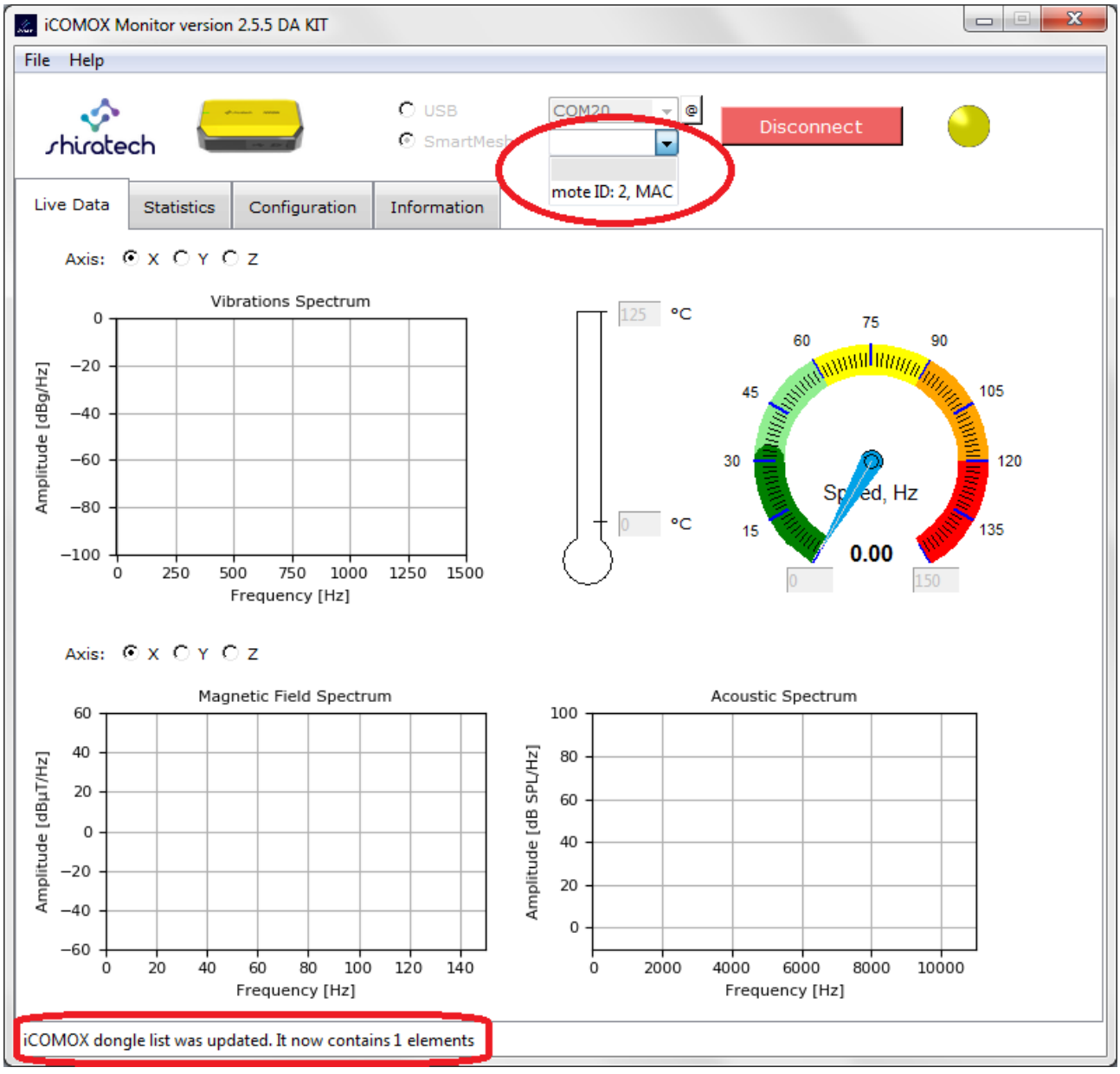


Figure 8: The Monitor’s Status Bar Indication of the Dongle Recognizing the iCOMOX

Note: After a dongle has been selected, data should start flowing to the Monitor. When a message from the iCOMOX is received by the dongle, the Colored Status Indicator turns green.

12. The Colored Status Indicator will turn green. Verify that Status Bar indicates that packets are being received. When all packets are received a full graph can be updated. It may take several minutes until all graphs are updated and the curves are drawn.

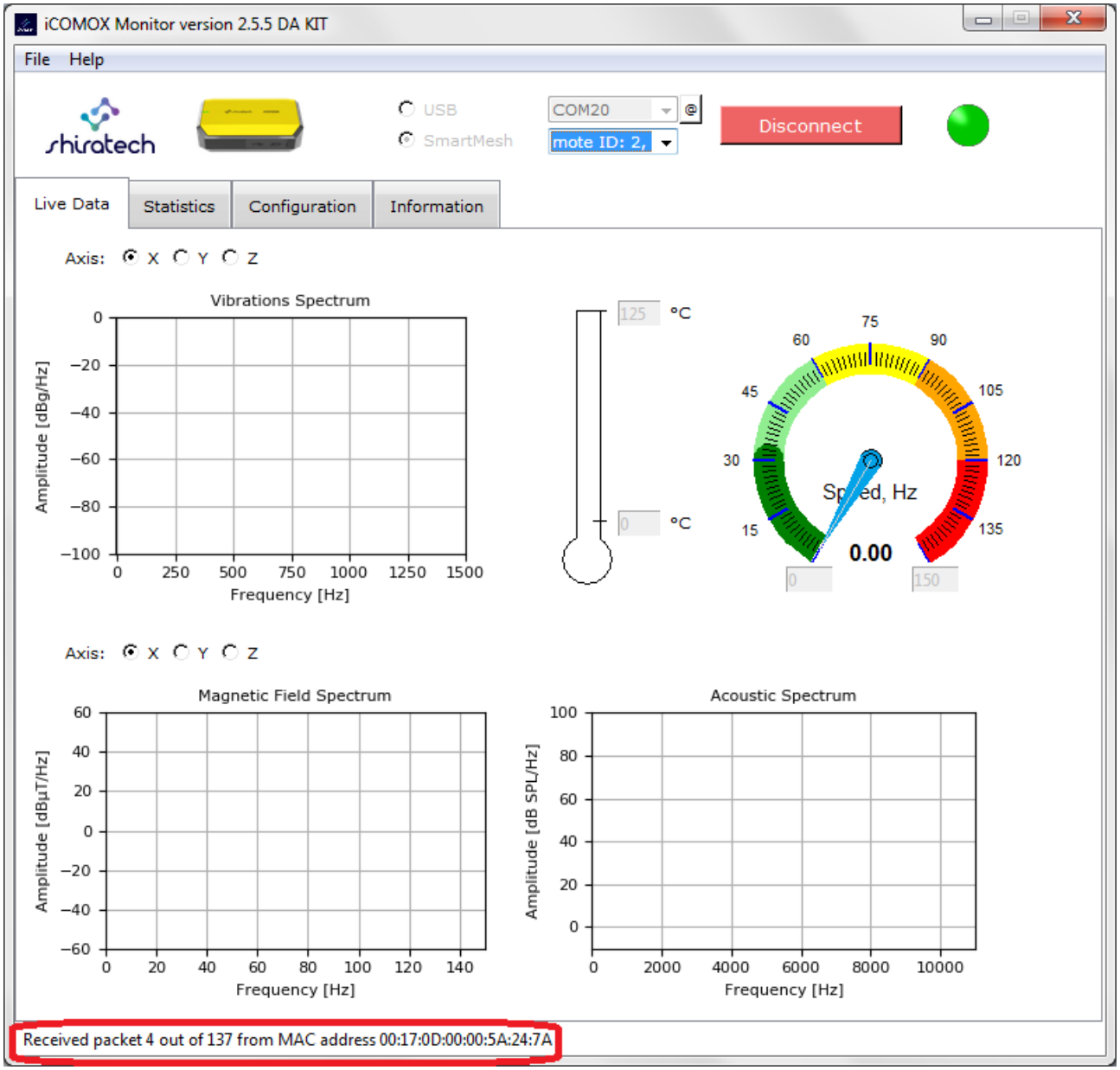


Figure 9: The Monitor Live Data tab

13. Verify that the panels selected in the Configuration tab display the received data and the Status Bar informs as to the received data packets. Every green iCOMOX LED blink represents a data packet which has been sent.

Figure 10: iCOMOX Monitor

Note: The LED's regular toggle rate can be as low as a single blink every 3 minutes, depending on the selected sensors configuration.

4. Connecting the iCOMOX Kit

4.1 Prerequisites

1. iCOMOX Kit
2. PC with Windows 10 installed

4.2 USB-C Cable connection

To connect the iCOMOX to the PC using the USB-C cable, perform the following steps.

1. Connect the iCOMOX to the PC using the USB-C cable.

Figure 11: USB-C Cable Connection

Note: It is recommended to fasten the screws of the USB-C cable to the iCOMOX.

2. Turn on the iCOMOX by sliding the slide switch on the iCOMOX in the direction of the LED (the opposite direction of the USB-C cable).

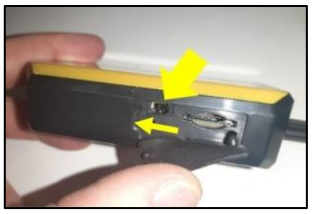


Figure 12: Switching the iCOMOX on

3. Verify that the green iCOMOX LED is illuminated.

Figure 13: The Green LED is illuminated

4.3 SMIP connection

To connect the iCOMOX to the PC using SMIP, perform the following steps.

1. Connect the Dongle (if SmartMesh communication is required) to one of the USB ports on the PC.

Figure 14: Connecting the Dongle

2. Turn on the iCOMOX by sliding the slide switch on the iCOMOX in the direction of the LED - the opposite direction of the USB-C cable (see figure 11).
3. Verify that the green iCOMOX LED is illuminated (see figure 12).

Note: The iCOMOX is equipped with batteries. When the USB cable is disconnected, the iCOMOX, when turned on, is powered by the batteries instead of by the USB-C cable. When not in use, make sure that the iCOMOX is off when the USB-C cable is disconnected.

5. Mechanical Structure

5.1 The Sensor Pack

The iCOMOX Sensor Pack comprises the following equipment:

- LED indicators (1)
- Case (2)
- SD and on/off switch cover (3)
- Gasket (4)
- Case cover (5)
- Electronic card (6)
- Case - Cover connection screws (7)
- Case – Electronic card connection screw (8)

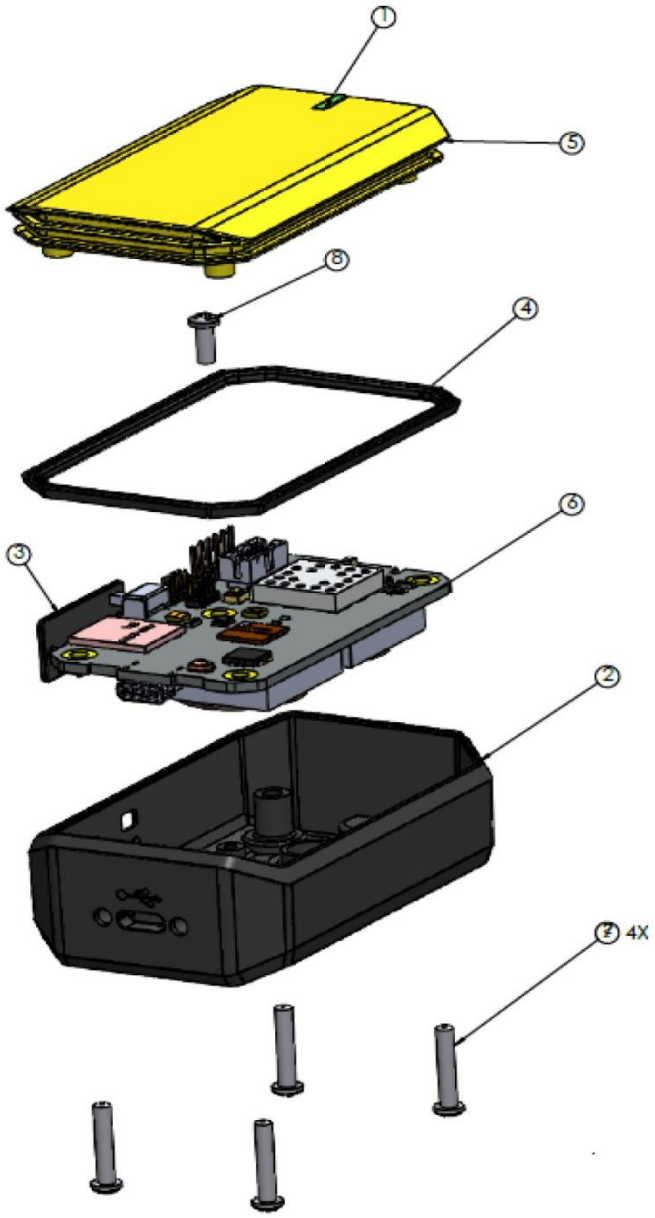


Figure 15: iCOMOX Mechanical Structure

5.2 The Mounting Kit

The Mounting Kit (Figure and Table) provides a versatile solution for mounting the iCOMOX sensor pack onto the monitored equipment.

The Mounting Kit includes the following two adaptors:

1. Two-screw Adaptor (3) – secures to the iCOMOX sensor pack with two screws (4). This adaptor has a hole at each end, which can enable fitting to such motors as the three-phase, Size 63 Induction Motor.
2. Slot Adaptor (1) – designed with slots instead of holes, providing additional versatility. If the Two-screw Adaptor (3) fits your equipment, you do not require the Slot Adaptor (1).

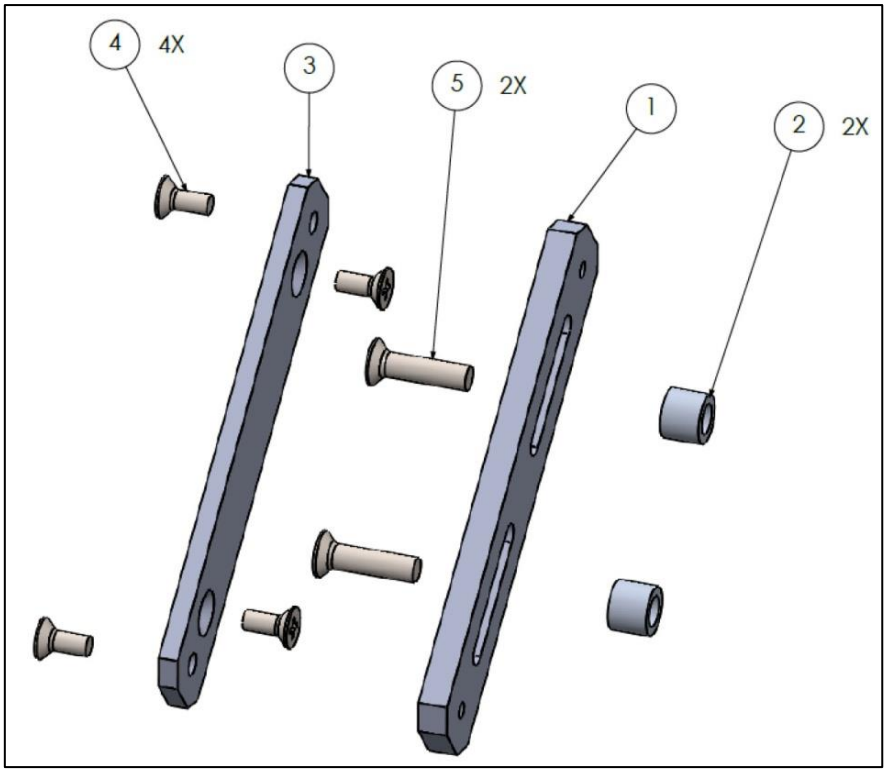


Figure 16: Mounting Kit Adaptors

Item No.	Part Number	Description	Qty
1	0009-00-00-0004		1
2	0009-00-00-0001		2
3	0009-00-00-0008		1
4	DIN EN ISO 7046-1-M4 x 10 - Z – 10N		4
5	DIN EN ISO 7046-1-M4 x 20 - Z – 20N		2

Table 3: Mounting Kit Components

5.3 Creating an Adaptor

When the supplied adaptors do not fit your equipment, you can produce an adaptor according to the dimensions of the supplied adaptor in Figure .

Note: Only the 73mm distance holes are to be considered during the design. These holes are made to accommodate m4 screws.

For more information/support, contact support@shiratech-solutions.com .

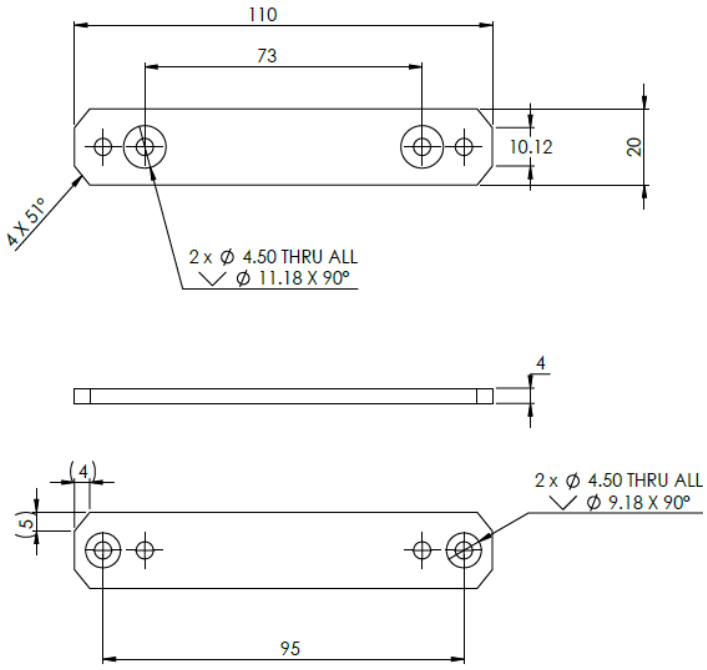


Figure 17: The Mounting Adaptor

6. Replacing the Batteries

The iCOMOX contains two CR2450N batteries. To replace the batteries, perform the following steps:

1. Disconnect the USB cable from the iCOMOX, in case it was connected.
2. Using a Phillips screwdriver, dismount the iCOMOX from the motor.

Figure 18: Loosen the Screws to Detach the iCOMOX

3. Carefully remove the thermal conductor.

Figure 19: Removing the Thermal Conductor

4. Remove the mounting element from the backside of the iCOMOX.

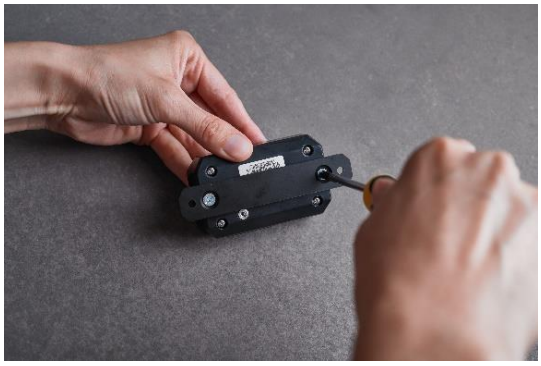


Figure 20: Removing the Mounting Adaptor

5. Remove the four screws at the back side of the iCOMOX.

Figure 21: Loosen the Screws to Open the iCOMOX

6. Remove the yellow cover.

Caution: Do not detach the SmartMesh antenna that is connected to the card.

Figure 22: Opening the iCOMOX Yellow Cover

7. Remove the screw at the middle of the electronic card to disconnect the electronic card from the cover.

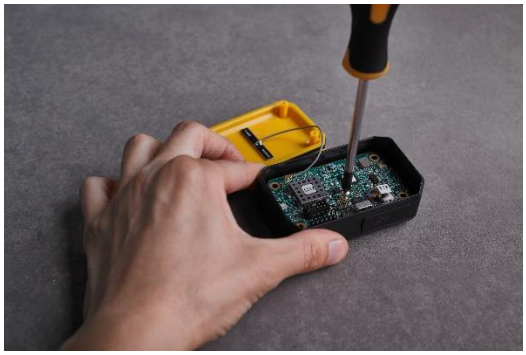


Figure 23: Removing the iCOMOX from the Cover

8. Replace the two batteries with new CR2450N batteries.

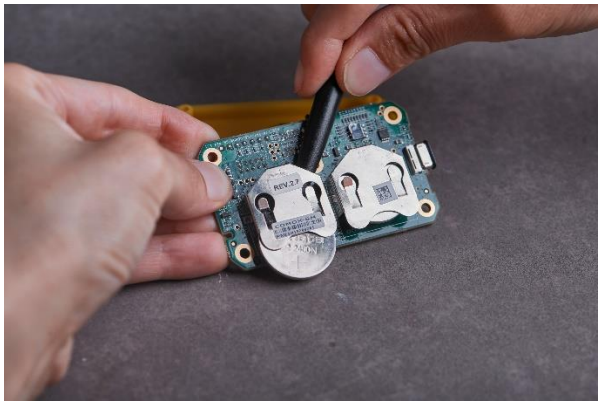


Figure 24: Removing the Datteries

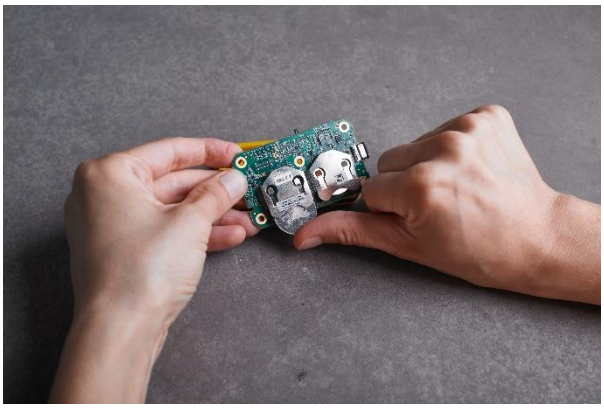


Figure 25: Inserting new Batteries

9. Assemble the iCOMOX and then reinstall the iCOMOX onto the motor.

7. Flash Programmer

The iCOMOX Flash Programmer is a Windows utility for programming the flash memory of the iCOMOX via the USB-C port. It is based on the Cross Core Serial Flash Programmer™ by Analog Devices.

7.1 Installing the iCOMOX Flash Programmer

To install the iCOMOX Flash Programmer, perform the following steps:

1. Download and run the latest version of the *iCOMOX Flash Programmer* from:
   https://www.shiratech-solutions.com/products/icomox/
   The iCOMOX Flash Programmer Setup Wizard opens.

Figure 26: iCOMOX Flash Programmer Installer

2. Click Next. The Setup Type window opens.

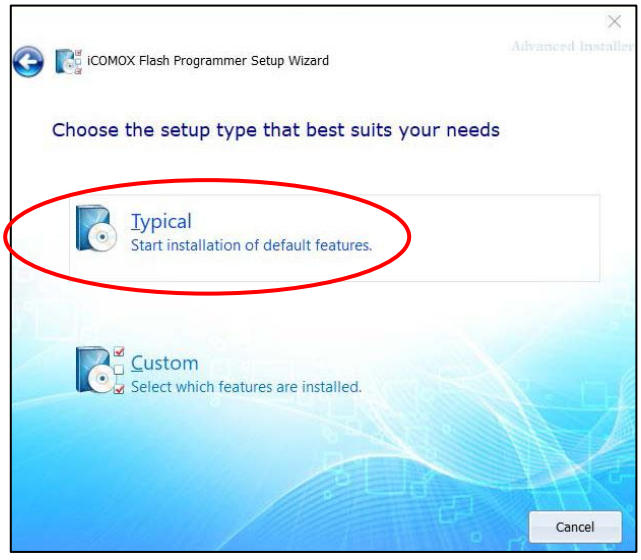


Figure 27: iCOMOX Flash Programmer Installer

3. Click Typical. The Select Installation Folder window opens.

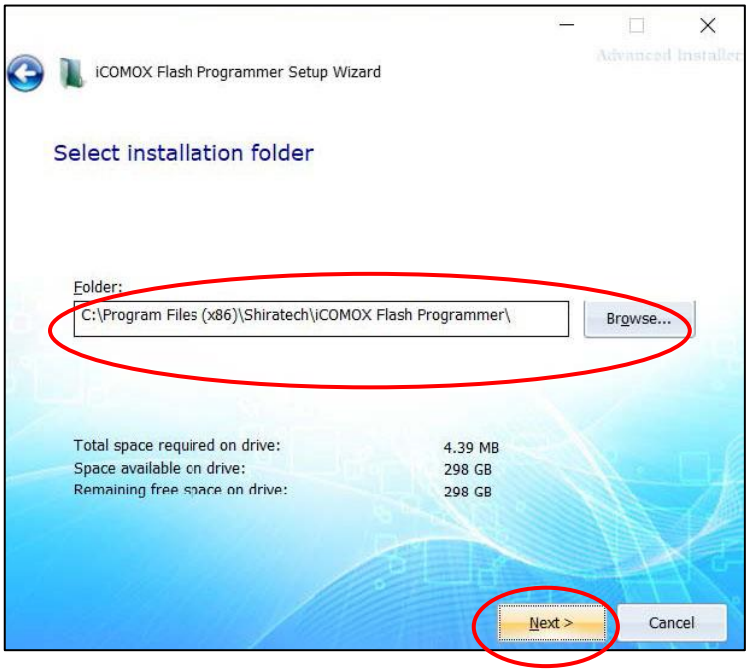


Figure 28: iCOMOX Flash Programmer Installer

4. Browse to the installation path on your PC and click Next. The Begin Installation window opens.

Figure 29: iCOMOX Flash Programmer Installer

5. Click Install to begin installation. The License Terms window appears.

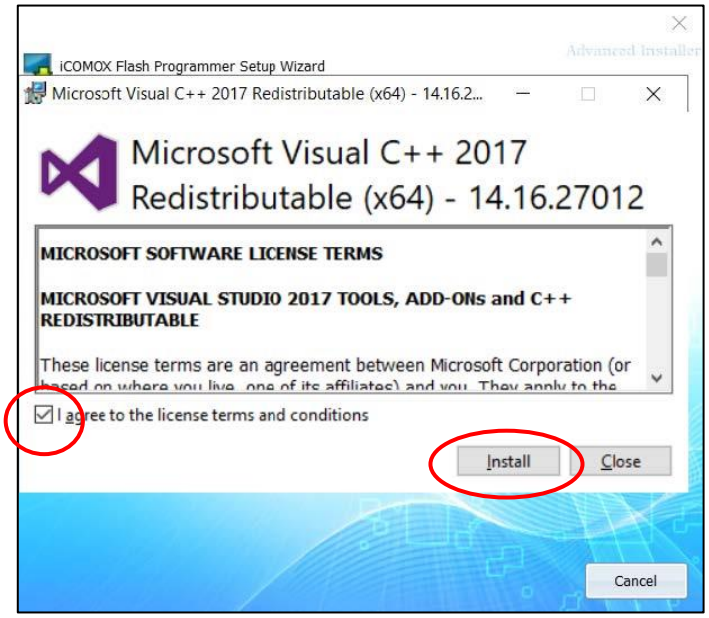


Figure 30: iCOMOX Flash Programmer Installer

6. When additional installations are required:
   - Follow the relevant instructions.
   - Select the 'I agree to the license terms and conditions' checkbox.
   - Click Install, restart the PC and repeat the installation process from Step 1.
7. When additional installations are **not** required:
   - Select the 'I agree to the license terms and conditions' checkbox.
   - Click Install. The Successfully Installed window appears.

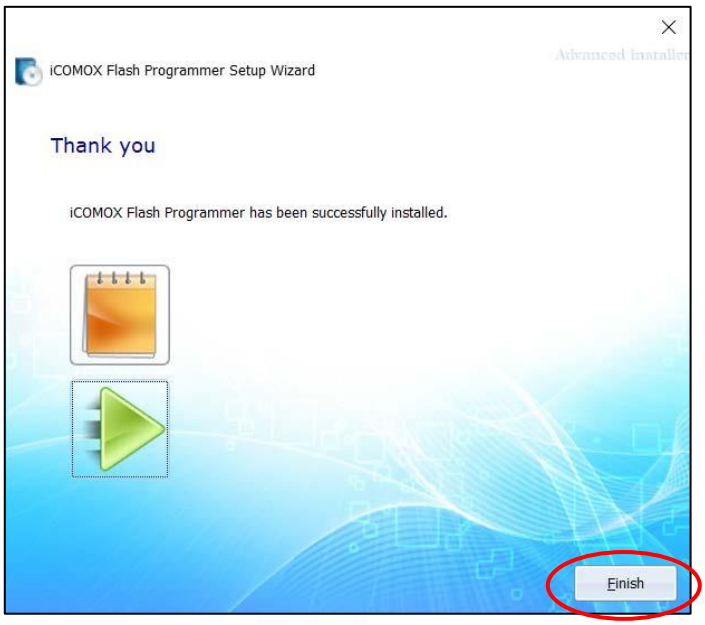


Figure 31: iCOMOX Flash Programmer Installer

8. Click Finish to complete the installation process.

7.2 Flashing

To program the Flash, perform the following steps:

1. Disconnect the USB cable from the iCOMOX.

Note: After disconnecting the USB cable, make sure that the switch is off, to prevent the iCOMOX from consuming the batteries.

2. Detach the iCOMOX from the motor, by removing the mounting element from the back side of the iCOMOX.
3. Remove the 4 screws on the back of the iCOMOX to remove the iCOMOX cover.

Note: For more detailed instructions regarding the unmounting and opening of the iCOMOX, refer to Section 6: Replacing the Batteries.

Figure 32: Removing the iCOMOX Cover

4. Launch the iCOMOX Flash Programmer.
5. Click the Browse button to select the .hex file to be programmed.

Figure 33: iCOMOX Flash Programmer

Note: For the PC to correctly recognize the iCOMOX, the FTDI driver must be installed. For installation instructions, refer to appendix A.

6. Connect the iCOMOX to the PC using the USB-C cable and turn the iCOMOX on by sliding the slide switch on the iCOMOX in the direction of the LED (the direction opposing the USB-C cable).

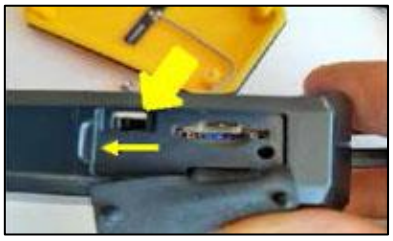


Figure 34: Switching the iCOMOX on.

7. Locate the BOOT and RESET buttons on the iCOMOX and perform the following sequence:
   - Hold down both the BOOT and the RESET buttons.
   - Release the RESET button
   - Release the BOOT button.

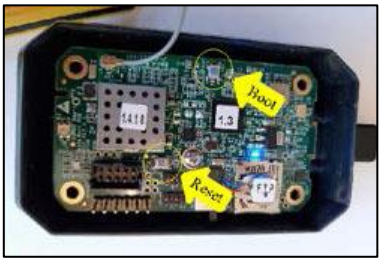


Figure 35: The BOOT and the RESET Buttons.

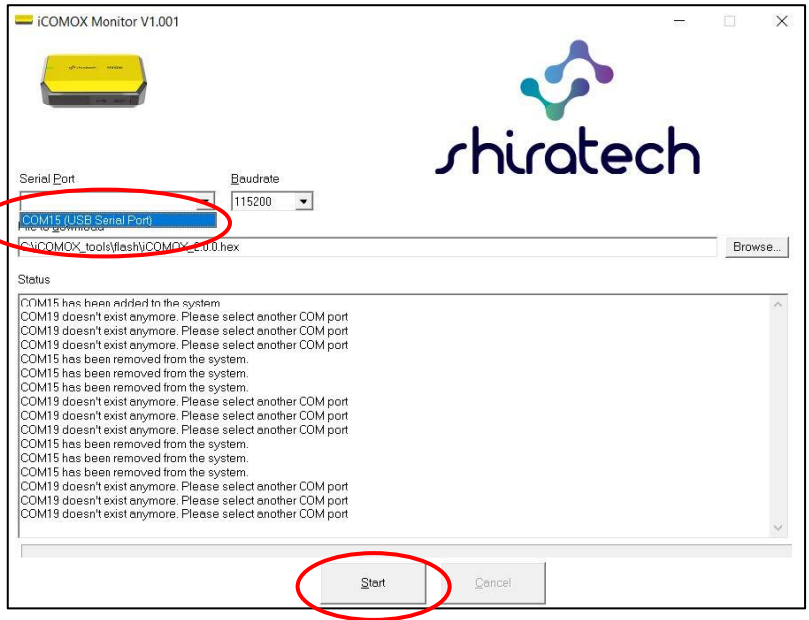


Figure 36: The Serial Port Drop-down menu.

8. Select the suitable COM port (USB Serial Port) from the drop-down menu and click Start. Flashing should begin.

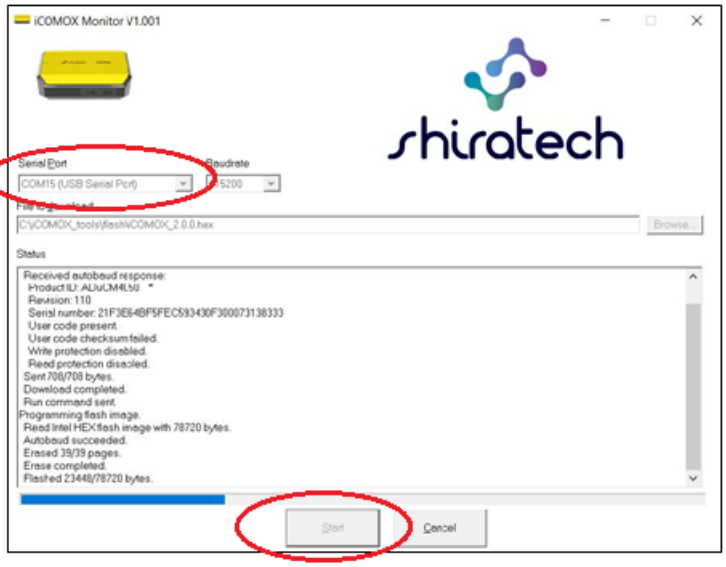


Figure 37: Start Flashing

Note: You can launch the Device Manager prior to performing this step, to verify which COM port to choose in later steps.

9. Verify that “Done” appears at the end of the status report, indicating that flashing was successful.

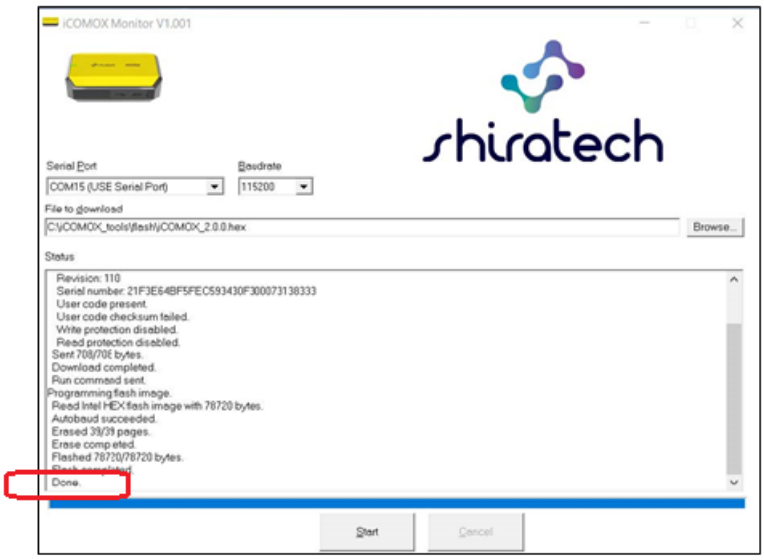


Figure 38: “Done”

Note: Section explains how to read the flash version. This method can be used to verify the flash has been successfully updated.

10. Close Flash Programmer to free up COM port before opening iCOMOX Monitor Software.

8. Monitor

8.1 Overview

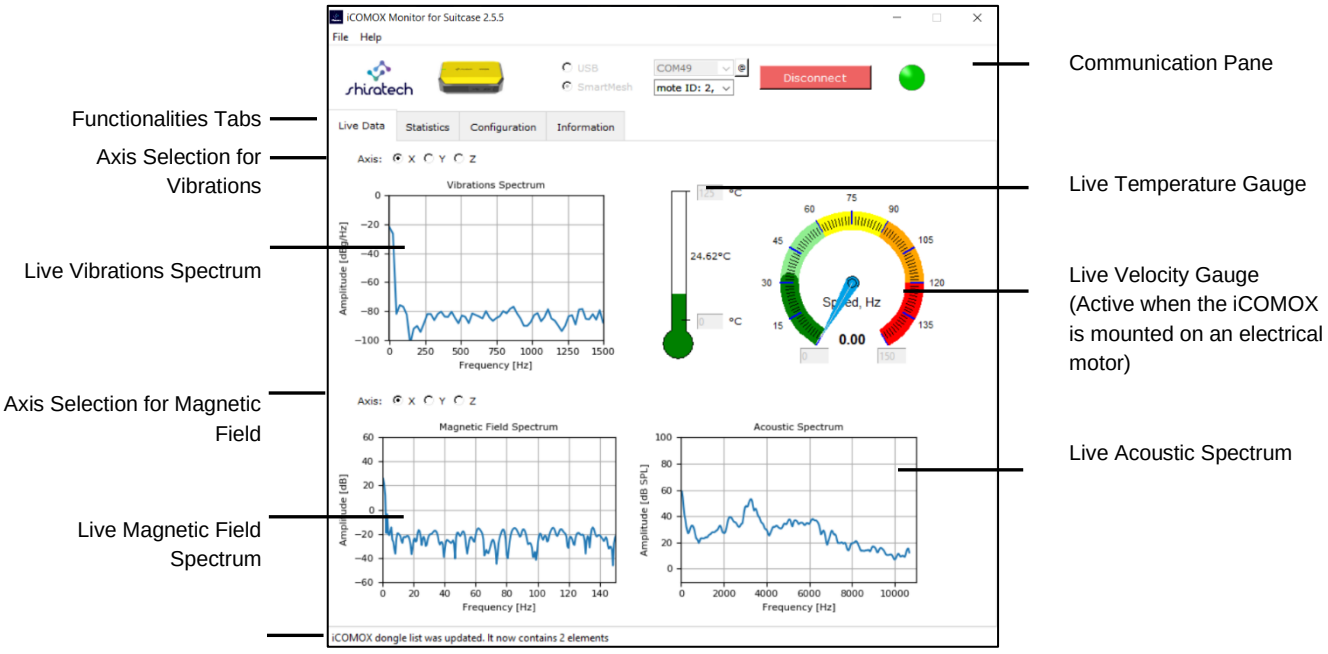


Figure 39: iCOMOX Monitor GUI

Figure 40: Monitor Overview

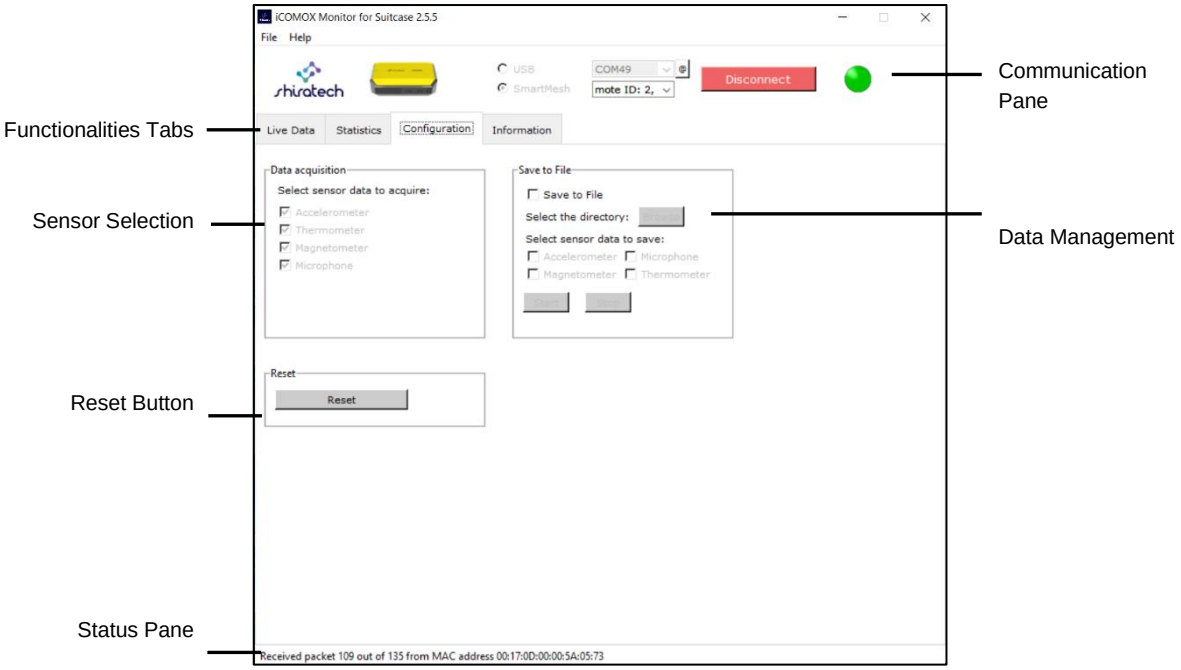


Figure 41: iCCOMOX Monitor

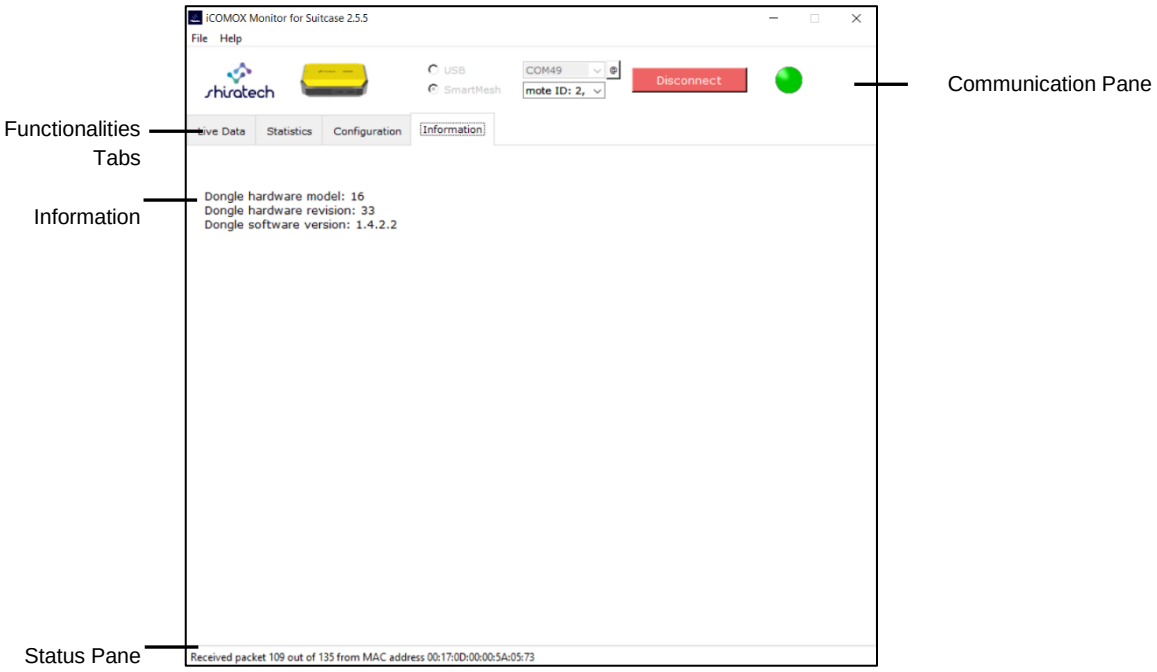


Figure 42: Monitor Overview

8.2 Main Window

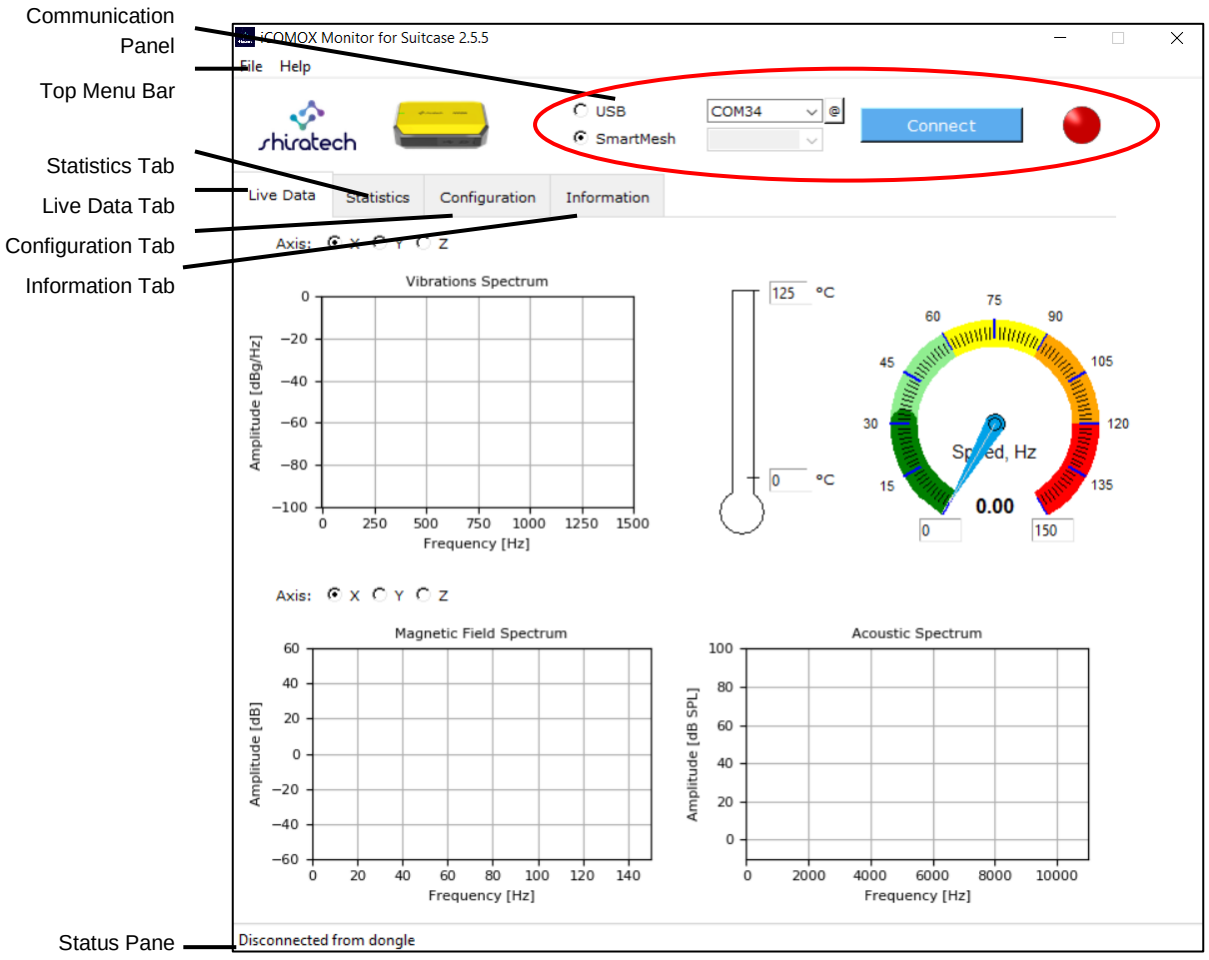


Figure 43: Monitor Main Window

Main Window comprises the following components:

1. Top Menu Bar – Displays the File – Exit and Help – About tabs.
2. Communication Panel - contains the following features:
3. Wireless or wired communication selection (1).
   - USB
   - SmartMesh (SMIP)
4. Drop down menu for the COM port selection of the iCOMOX USB Manager or SmartMesh (SMIP) mote selection (2).
5. Connect/Disconnect button to enable/disable communication (3).
6. Colored Status Indicator (4).

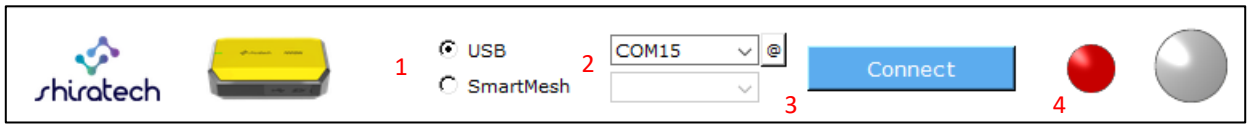


Figure 44: Communication Panel

7. Status Bar - Displays the following status information.

8. Incoming data packets number and status.
9. SmartMesh devices connection status.

8.2.1 Tab Views

The Main Window provides the following four-tab views:

1. Live Data
2. Statistic
3. Configuration
4. Information

8.2.1.1 Live Data View

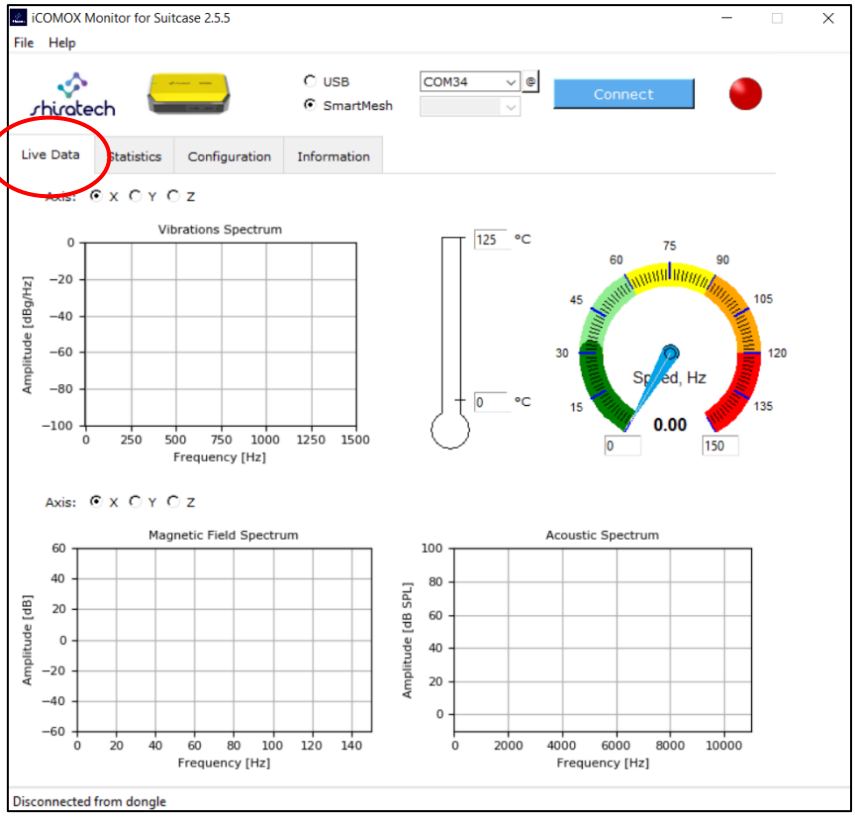


Figure 45: Monitor Live Data View

The Live Data view provides a live display of the following collected data:

1. Axis selection
2. Vibrations Spectrum
3. Magnetic Field Spectrum
4. Tachometer - Displays the motor speed, calculated by sensing the variations in the motor's magnetic field
5. Acoustic Spectrum

8.2.1.2 Statistics View

The Statistics view displays live statistical information extracted from the acquired sensor data. The information for each axis is presented separately.

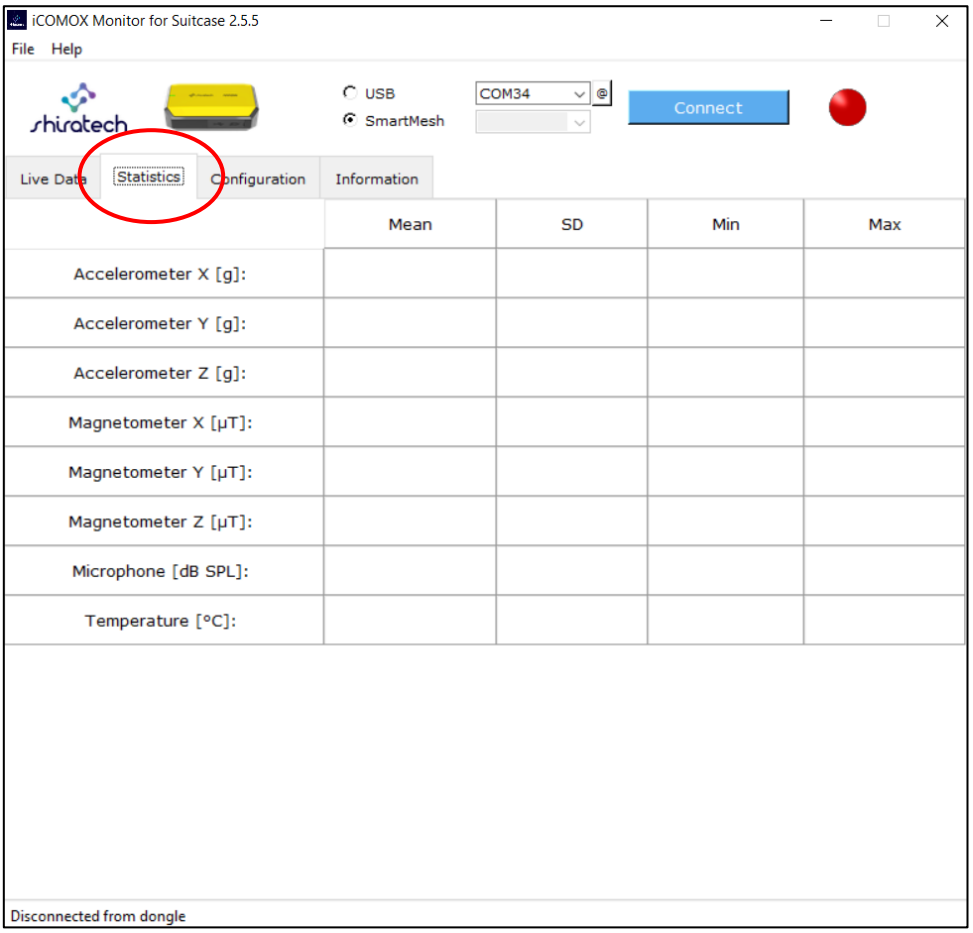


Figure 46: Monitor Statistics View

8.2.1.3 Configuration View

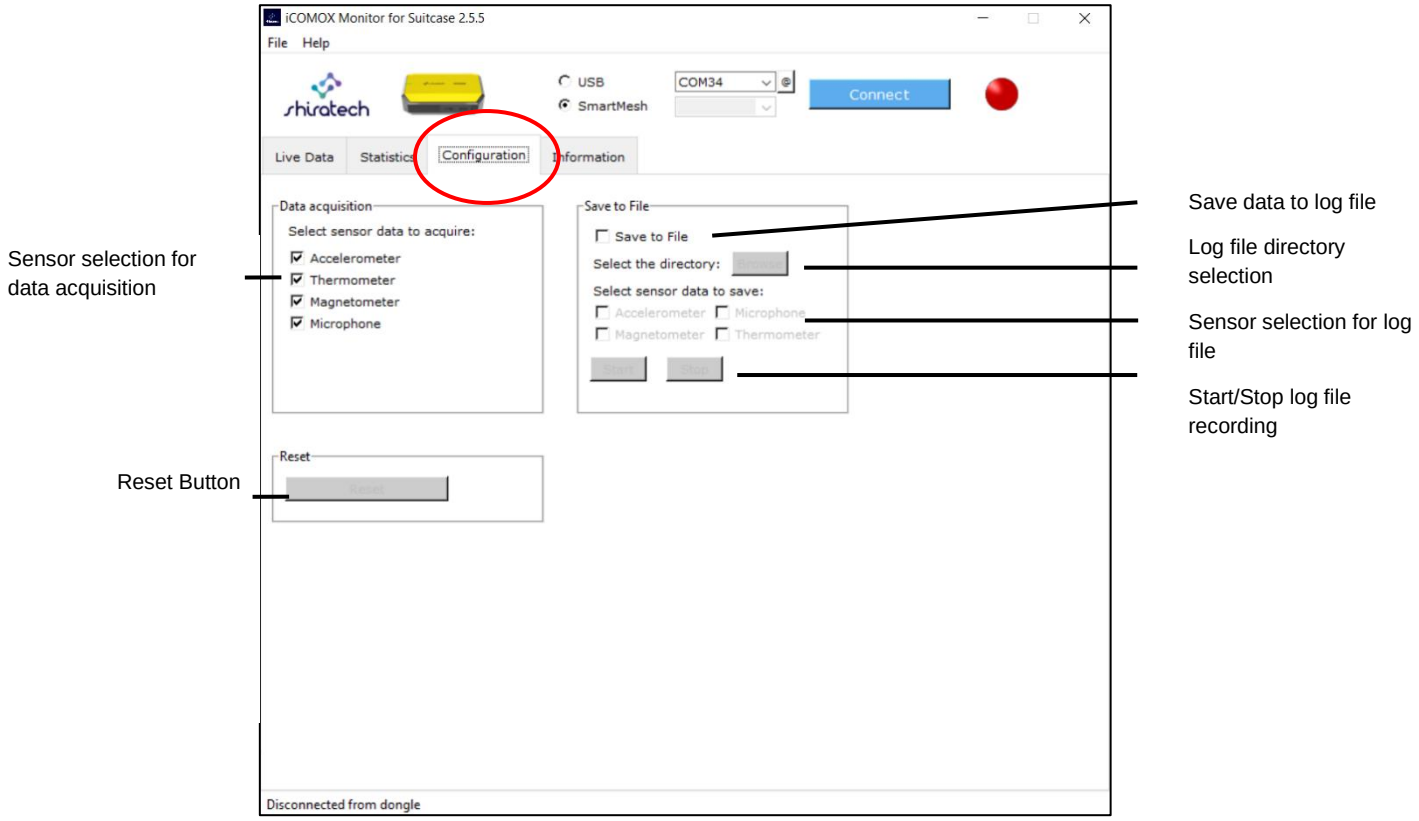


Figure 47: Monitor Configuration View

The Configuration View displays the following three main functional areas:

1. Data Acquisition - Sensor selection for data acquisition and display in the Main Window.
2. Save to File - Enables saving currently acquired live sensor data into a log “xlsx” file.

Note: After selecting the Save to File option, the directory for file storage must be specified by clicking Browse button. Afterwards, the required sensor data to be saved into the log file must be selected. Once this has been done, the user can click the “Start” button at any time, while the iCOMOX is connected, to start the data recording. When the user presses the “Stop” button, the system stops recording the data and saves the log file in the specified directory.

3. Reset Button – Resets the iCOMOX by performing a soft reset to the ADUCM4050 MCU.

Note: After resetting the iCOMOX using the Monitor Reset button, it is necessary to click ‘Disconnect’ and then ‘Connect’, to complete the reset action.

8.2.1.4 Information View

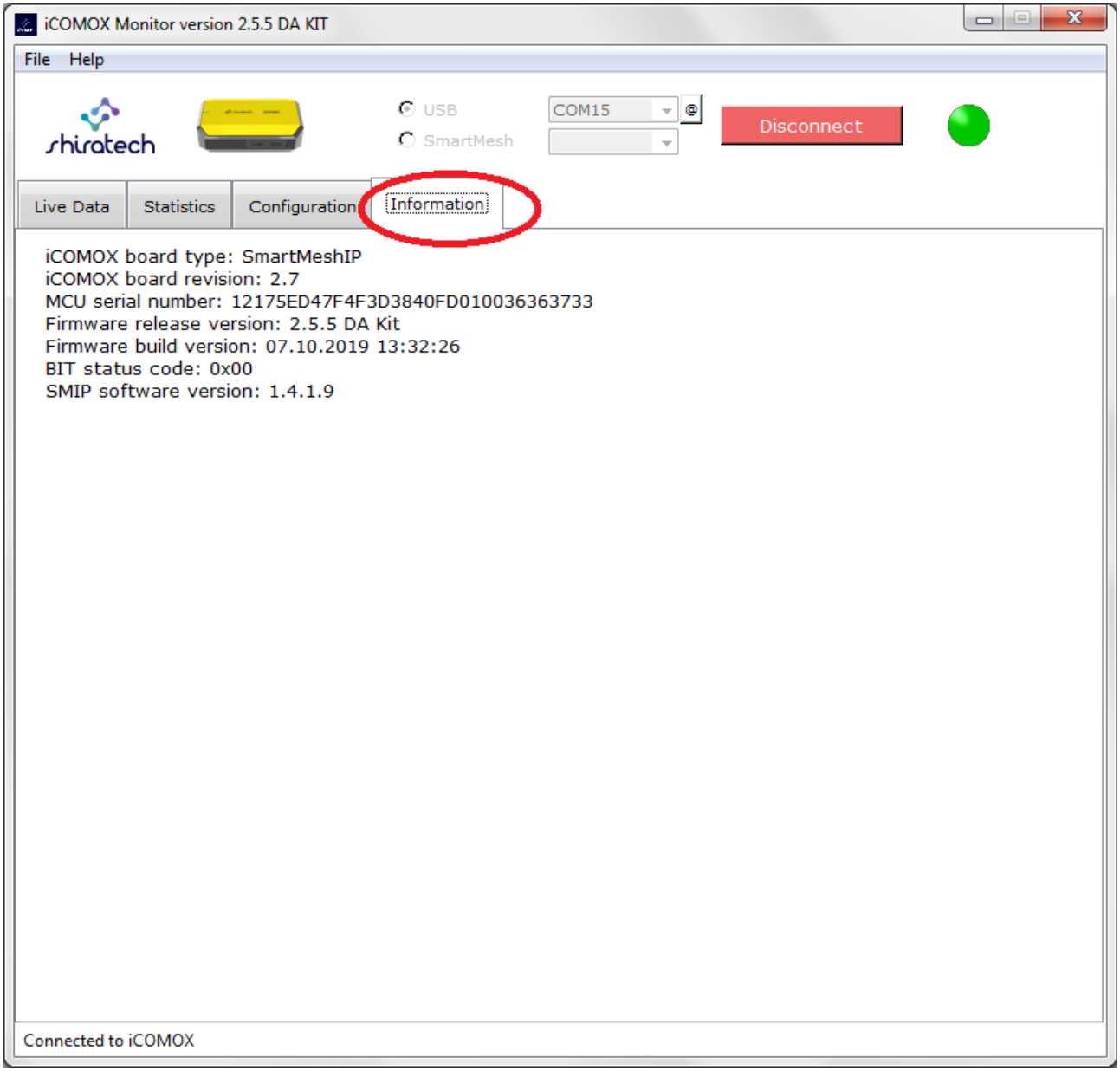


Figure 48: Monitor Information View

When in USB Mode, the Information View displays the following data:

1. iCOMOX hardware information:
   - Type/Edition.
   - Board revision.
   - MCU serial number.
2. iCOMOX firmware information:
   - Firmware release version.
   - Firmware build version.

- BIT status code – Built-in test result. 0x00 means that all components passed the test successfully. Other status codes represent sensors that did not pass the test (in such case, please refer to the Troubleshooting section).
- SMIP software version – describes the SMIP component firmware version.

Note: In rare cases the iCOMOX may start transmitting this information before connecting. Simply click 'Disconnect' and then 'Connect' in the iCOMOX Monitor software, to complete the reset action.

When in SmartMesh mode, information about the dongle is displayed.

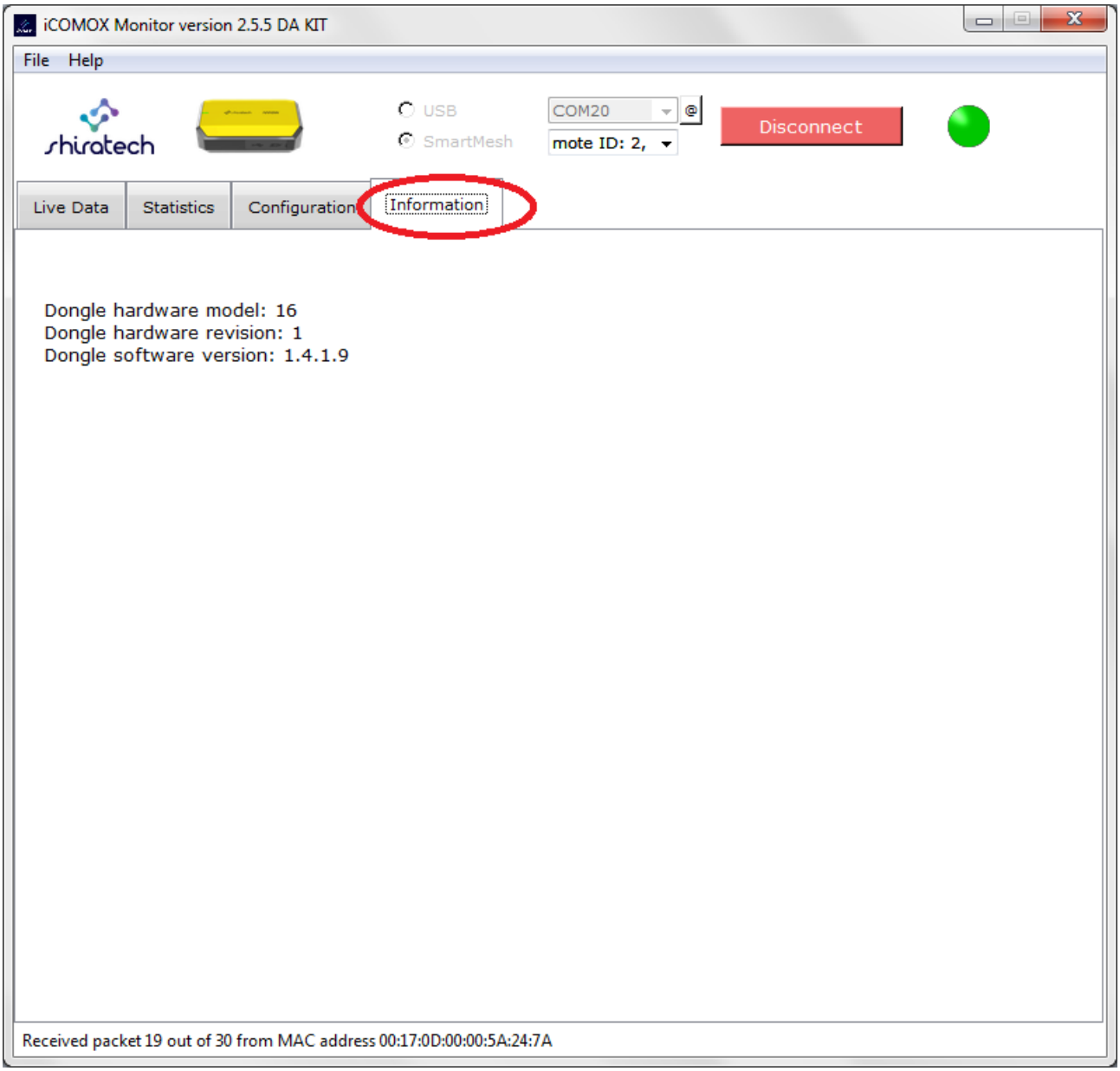


Figure 49: In SmartMesh Mode

8.3 Installing the iCOMOX Monitor

To install the iCOMOX Monitor, perform the following steps:

1. Download the iCOMOX installer file from: http://www.shiratech-solutions.com/products/icomox/.
2. Run the installer file to launch the installer. You may first need to uninstall an existing previous version. The Setup Wizard opens.

Figure 50: iCOMOX Monitor Installer

3. Click Next. The Create Application Shortcuts window opens.

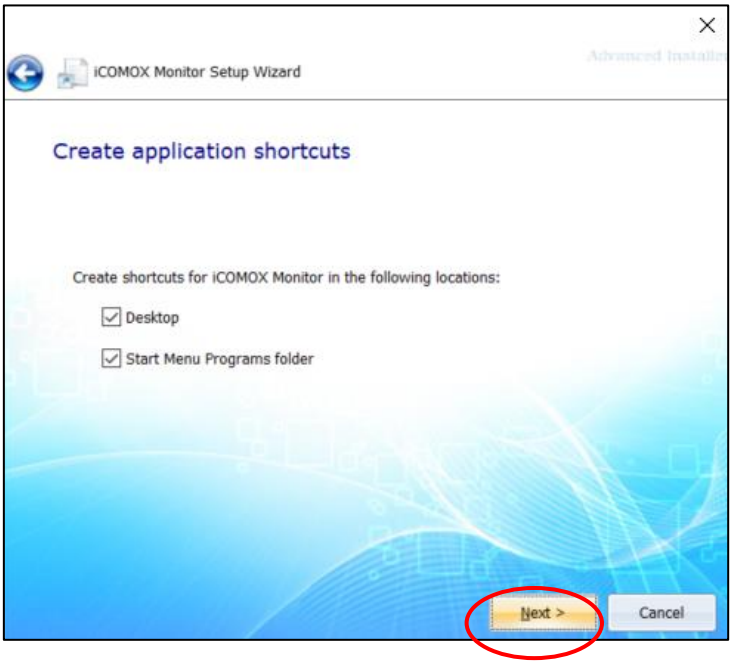


Figure 51: iCOMOX Monitor Installer

4. Select the required shortcuts and click Next. The Select Installation Folder window opens.

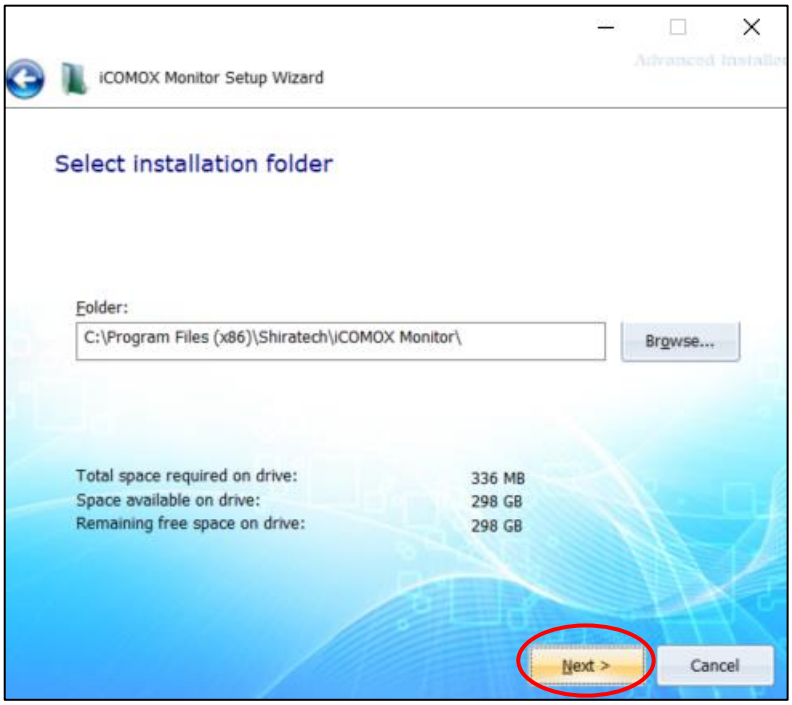


Figure 52: iCOMOX Monitor Installer

5. Browse to the installation path on PC and click Next. The Begin Installation window opens.

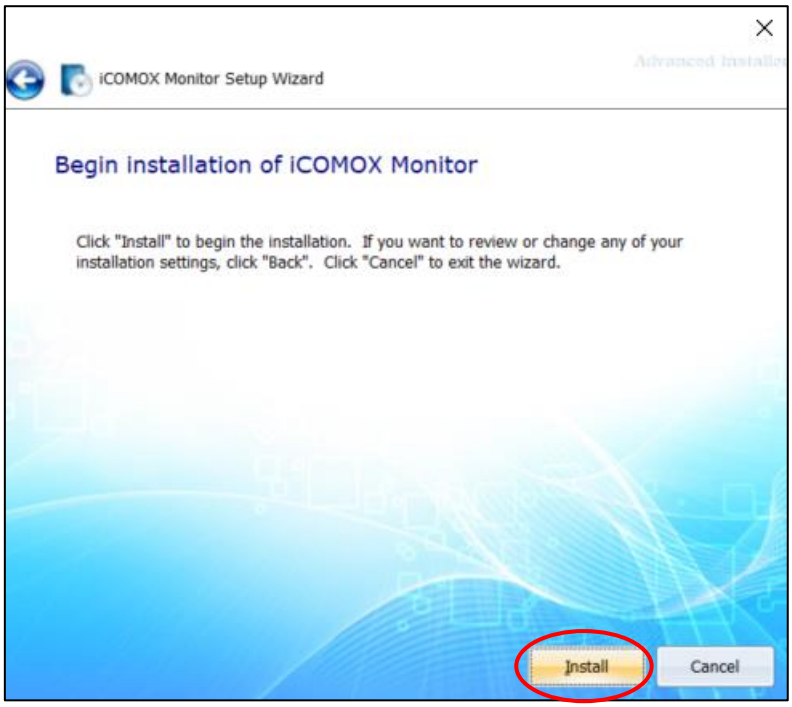


Figure 53: iCOMOX Monitor Installer

6. Click Install. The installation process begins.

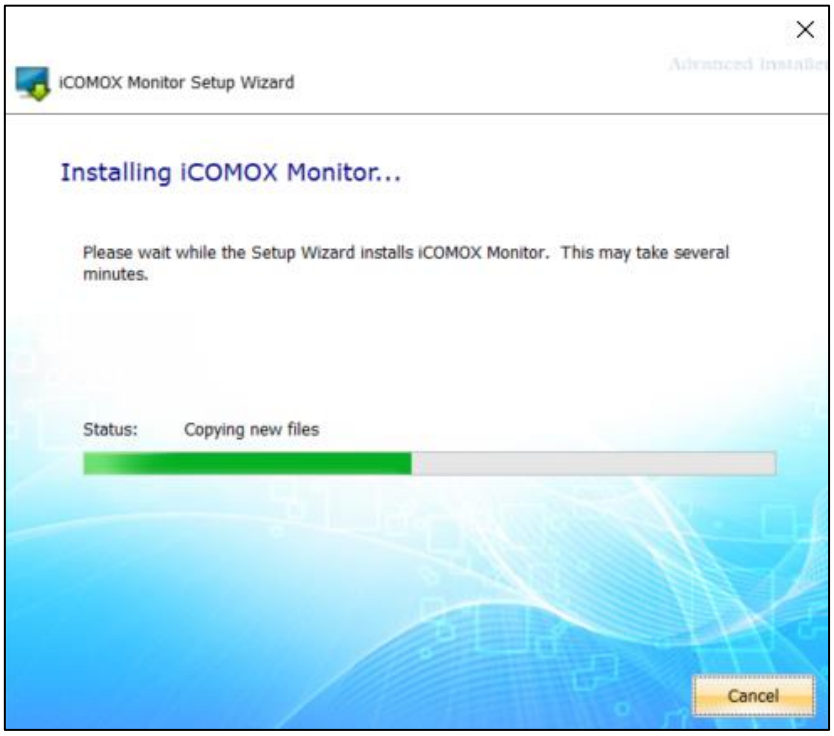


Figure 54: iCOMOX Monitor Installer

7. When installation is completed, click Finish to complete the installation process.

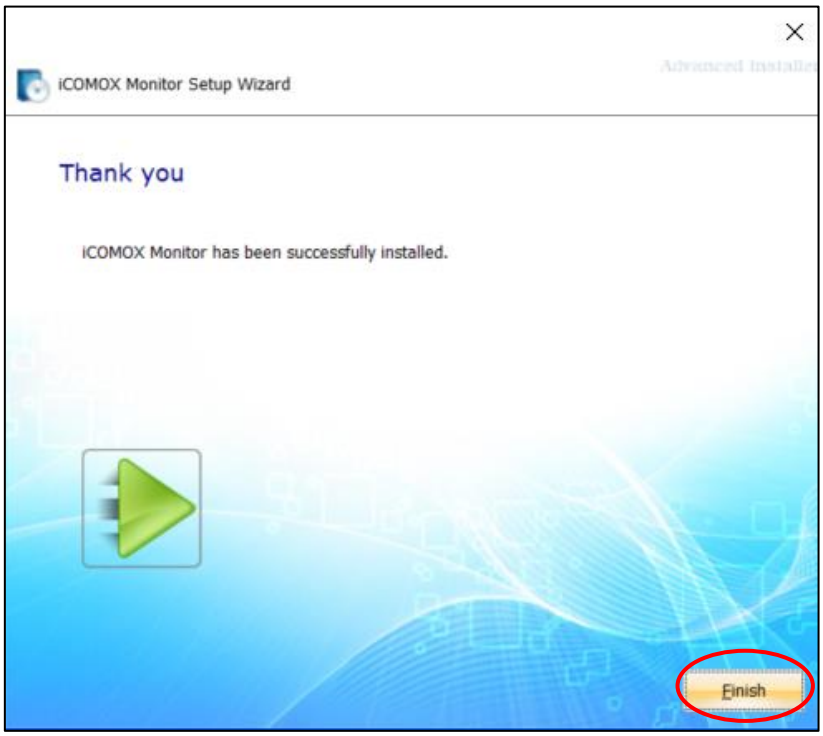


Figure 55: iCOMOX Monitor Installer

Note: You are now ready to run iCOMOX Monitor. Refer to Install the iCOMOX Monitor for more details.

Figure 56: iCOMOX Monitor Desktop icon

9. Troubleshooting

Problem	Possible Reason	Solution
PC does not recognize the iCOMOX	Missing driver for the FTDI.	Follow the instructions in Appendix A: FTDI D2XX Driver.
Monitor does not connect to the iCOMOX. The Colored Status Indicator on the Monitor appears red instead of green after clicking the Connect button.	iCOMOX is not operating.	1. Turn the iCOMOX off and on again. 2. Verify that the Colored Status Indicator on the Monitor is green.
	USB cable is not connected properly.	1. Verify that the USB is connected properly. 2. Close the Monitor, turn the iCOMOX off and on again. 3. Re-launch the Monitor.
	USB cable is damaged.	1. Replace the USB cable. 2. Close the Monitor and turn the iCOMOX off and on again. 3. Verify that the LED is flashing. 4. Re-launch the Monitor.
	Firmware version and Monitor version are not compatible.	1. Download and flash the latest firmware version to the iCOMOX. 2. Download and run the latest iCOMOX Monitor version.
The plots on the Monitor are not updated.	Communication is lost.	1. Try to reconnect by clicking the Disconnect button and then the Connect button on the Monitor. 2. Re-launch the Monitor. 3. If communication is still not re-established, close the Monitor and turn the iCOMOX off and on again.
Monitor does not appear on the screen.	The Monitor requires a great deal of memory.	Wait for the Monitor to appear. It can take up to 40 seconds to appear for the first time.
Monitor COM port drop-down menu is empty. (And the refresh button doesn't help)	USB connection was not recognized by the operating system.	Close the iCOMOX Monitor window, turn the iCOMOX off and then on again.

Monitor Reset button does not reset the connection.	Connection has to be reset manually.	Click the Monitor's 'Disconnect' button, then click 'Connect'.
iCOMOX LED illuminates in red.	Built-in test detected a hardware malfunction. Each bit in the status code represents a different sensor.	Contact technical support.
BIT status code different than 0x00		
iCOMOX version information is not displayed in Monitor	In rare cases the iCOMOX may start transmitting this information before connecting.	Click the Monitor's 'Disconnect' button, then click 'Connect'.

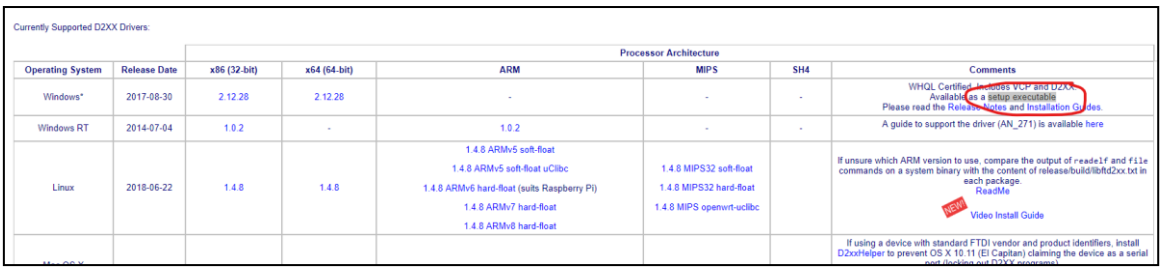
Table 4: Troubleshooting list

10. Appendix A: FTDI D2XX Driver

D2XX drivers allow the iCOMOX monitor (and other applications as well) direct access to the USB device through a DLL.

To install the driver from FTDI website:

1. Go to https://www.ftdichip.com/Drivers/D2XX.htm.
2. Press the setup executable which is often found on the top-right side of the table (see Figure


Currently Supported D2XX Drivers:

		Processor Architecture					
Operating System	Release Date	x86 (32-bit)	x64 (64-bit)	ARM	MIPS	SH4	Comments
Windows*	2017-08-30	2.12.28	2.12.28	-	-	-	WHQL Certified. Includes VCP and D2XX. Available as a setup executable Please read the Release Notes and Installation Guides.
Windows RT	2014-07-04	1.0.2	-	1.0.2	-	-	A guide to support the driver (AN_271) is available here
Linux	2018-06-22	1.4.8	1.4.8	1.4.8 ARMv5 soft-float 1.4.8 ARMv5 soft-float uClibc 1.4.8 ARMv6 hard-float (suits Raspberry Pi) 1.4.8 ARMv7 hard-float 1.4.8 ARMv8 hard-float	1.4.8 MIPS32 soft-float 1.4.8 MIPS32 hard-float 1.4.8 MIPS openwrt-uclibc		If unsure which ARM version to use, compare the output of `readelf` and `file` commands on a system binary with the content of release/build/libftd2xx.txt in each package. ReadMe NEW Video Install Guide
							If using a device with standard FTDI vendor and product identifiers, install D2xxHelper to prevent OS X 10.11 (El Capitan) claiming the device as a serial

Figure 57: Setup Executable FTDI D2XX Driver

11. Document Revision History

Revision	Date	Author	Status and Description
2.0	30.07.2019		Initial version
2.0	30.08.2019	M Elias	Revision
3.0	12.09.2019	Ori Makeover	Re-organization
3.0	15.09.2019	M Elias	Revision
3.1	06.10.2019	Ori Makeover	New software release - update

Table 5: Mounting Kit Components

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