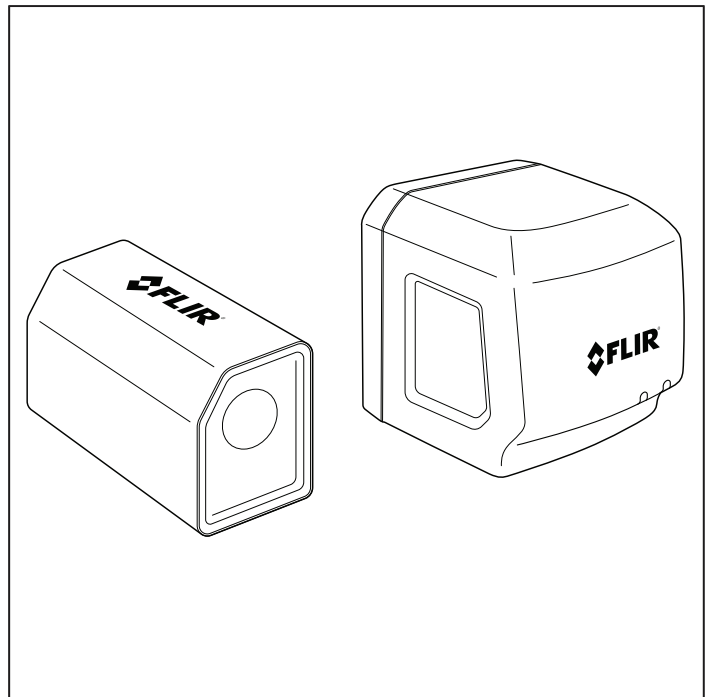![FLIR logo]

User Manual
Vibration Monitoring Solution

SV87–KIT (GW65 Remote Monitoring Gateway and SV87 Vibration / Temperature Remote Sensors)

User Manual
Vibration Monitoring
Solution

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1 Advisories

1.1 Copyright

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1.2 Quality Assurance

The Quality Management System under which these products are developed and manufactured has been certified in accordance with the ISO 9001 standard. FLIR Systems is committed to a policy of continuous development; therefore, we reserve the right to make changes and improvements on any of the products without prior notice.

1.3 Documentation

To access the latest manuals and notifications, go to the Download tab at: https://support.flir.com. It only takes a few minutes to register online. In the download area you will also find the latest releases of manuals for our other products, as well as manuals for our historical and obsolete products.

1.4 Disposal of Electronic Waste

As with most electronic products, this equipment must be disposed of in an environmentally friendly way, and in accordance with existing regulations for electronic waste. Please contact your FLIR Systems representative for more details.

2 Introduction

The FLIR Vibration Monitoring Solution allows you to monitor machinery for excessive vibration and over-temperature conditions using a mobile device exclusively (stand-alone) or a combination of Windows PC and mobile device. Accelerometers in the Remote Sensors measure changes in vibration. Thermometers in the Remote Sensors measure surface Temperature.

This product can check for balance issues, eccentricity, misalignment, and looseness. Examples of equipment that can be monitored are shown below.
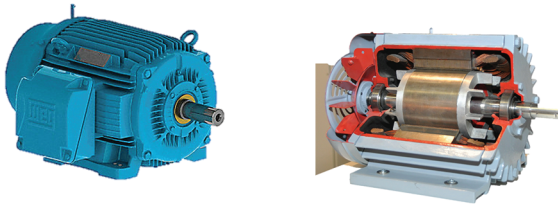

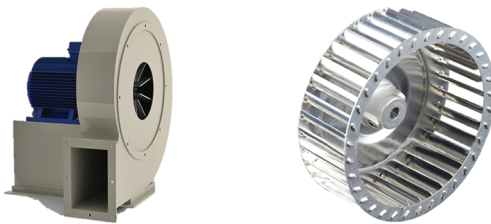**Figure 2.1** Monitoring vibration and temperature in motors.

Figure 2.2 Monitoring vibration and temperature in fans.

Figure 2.3 Monitoring vibration and temperature in conveyors.

Figure 2.4 Monitoring vibration and temperature in chillers.

Vibration measurements look at the frequency (velocity), amplitude (strength), and acceleration (intensity) of the vibration.
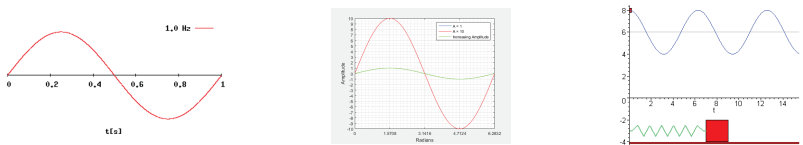
Figure 2.5 Vibration frequency (left), amplitude (centre), and acceleration (right)

Vibration measurements provide insight into potential mechanical issues. This device is well suited for identifying imbalances, eccentricity, loose parts, and misalignment. In addition, Remote Sensors include a surface temperature thermometer that identifies potential over-heating issues. Excessive vibration and over-temperature conditions can shorten the life of machinery and components, pose safety hazards, and create excessive noise.

Acceleration is measured in 'g' units (gravitational constant). Velocity is represented in mm/s (millimeters per second) and in/s (inches per second) units and is derived from FFT (Fast Fourier Transform) analysis of Acceleration measurements. Temperature measurements are presented in ℃ and ℉ units.

The Remote Sensors attach directly to machinery, using the supplied double-sided tape, and transmit data to the Remote Monitoring Gateway via Bluetooth which in turn communicates to a mobile device and Windows PC. Adhesive alternatives are available commercially that could be more reliable on some machinery (see the *Specifications* section for details). The system consists of the following components:

- **GW65 Remote Monitoring Gateway**. Communicates with Remote Sensors over Bluetooth and transmits measurement data over Wi-Fi. Multiple Gateways can be used for optimum coverage of large test sites.
- **SV87 Remote Sensors**. Attach to machinery and transmit measurement data and battery status via Bluetooth to the Remote Monitoring Gateway.
- **Mobile application (app) for iOS and Android devices**. Communicates with the Remote Monitoring Gateway on a Wi-Fi network.
- **Windows PC application**. Communicates with Remote Monitoring Gateways and mobile devices on a Wi-Fi network.

3 Safety

Warnings identify conditions that expose the user to danger. For safe operation, and to avoid the potential for electrical shock and fire, read and understand all operational instructions and safety warnings and cautions. Failure to do so can cause personal injury and damage to equipment.

- Please read all safety information and user manual instructions before using these devices.
- No user serviceable equipment. Please contact FLIR for all service and repair inquiries.
- Use these devices only as described in the provided documentation. Failure to do so can impair the devices' built-in protections.
- These devices are intended for indoor use only.
- Do not use any of these devices if they appear damaged or if they do not function normally. Contact FLIR for service.
- Avoid wet or overly damp locations for installation or when using these devices.

⚠	WARNING! Hazardous conditions.
▣	Double Insulation.
(ETL)	Certified by ETL to North America safety standards.
CE	Conforms to European Union directives.
	Conforms to Australian Safety and EMC standards.
	Complies with WEEE Directives.

3   Safety

<table>
<tr><td>⚠   **WARNING**</td></tr>
<tr><td>

Applicability: Class B digital devices.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced Radio / TV technician for help.

</td></tr>
</table>

4 Product Descriptions

4.1 Product Call-Out Description
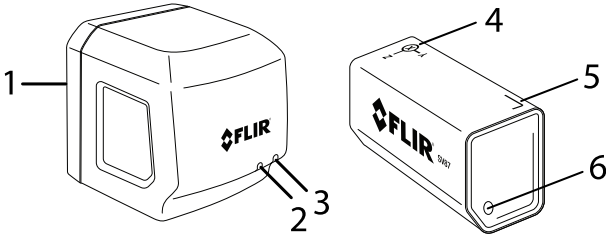
Figure 4.1 Remote Monitoring Gateway GW65 (left) and SV87 Remote Sensor (right).

1. GW65 AC plug side
2. GW65 Power LED (blue light when powered)
3. GW65 Communications LED (green for active communications; amber for inactive communications)
4. SV87 'xyz' axes graphic
5. SV87 serial number label
6. Low battery LED (glows red when battery is low)

4.2 Remote Monitoring Gateway GW65 Overview

Gateways communicate with sensors over Bluetooth and transmit measurement data over a Wi-Fi network. Gateways are AC powered and can be plugged directly into an AC receptacle (100 V to 240 V AC 50 / 60 Hz).

4.3 SV87 Remote Sensor Overview

SV87 sensors attach to machinery using the supplied double-sided tape. Adhesive alternatives are available that could be more reliable on some machinery (see the *Specifications* section for details). When attached, sensors measure Acceleration in gravitational units (g) and surface temperature in ℃ or ℉ units.

Velocity data is derived from the Acceleration measurements using FFT (Fast Fourier Transform) and displayed in mm/s or in/s units (millimeters or inches per second).

Measurement data is transmitted from the sensors to Gateways over Bluetooth. Sensors also transmit battery status data. Coordinates (x, y, z) for vibration axes and serial number are printed on the sensor housing.

4.4   Mobile App Overview

The mobile app is available from the FLIR website (link below), the App Store (iOS devices), or Google Play (Android devices). With the mobile app you can communicate with Gateways over a Wi-Fi network.

The mobile app allows you to configure and organize Gateways and sensors into complete test systems, link sensors into groups, document asset types and classifications, monitor readings digitally and graphically, set alarms, and more.

Web link: https://support.flir.com/product/RemoteMonitoring.

4.5   Windows PC App Overview

The Windows PC app (link below) allows you to monitor and control test systems from your PC. Communication takes place over a Wi-Fi network. The app displays measurement data in trend graphs and digitally. The app can send email alerts when alarm thresholds have been exceeded and can export measurement data as .csv files for use in spreadsheets.

Web link: https://support.flir.com/product/RemoteMonitoring.

5   Quick Steps

The Vibration Monitoring Solution is a powerful set of tools that require careful attention and a fair number of steps, even for a quick start, to setup. Once setup is complete, however, the tools are automated and do not require adjustment unless changes to the setup are needed.

Follow the quick steps in Section 5.1, below, for Stand-Alone operation (mobile device use only), or Section 5.2 if you are using a Windows PC and a mobile device. Refer to Section 8.2, *Choosing PC-based or Stand-Alone Control*, to help you decide which route to take.

These steps will take you through the process of establishing communication with the devices in your system. Once communication is established you can continue with the remaining sections of this manual to setup sensors and explore the other capabilities of the monitoring system.

NOTE

- The mobile device must be within 12 inches (30 cm) of the Gateway during setup.
- The sensors must be kept within 5 feet (1.5 m) of the Gateway during setup.

5.1   Quick Steps for Stand-Alone Operation

1. Plug the Gateway into an AC outlet. The blue power LED and amber communication LED will light. The communication LED turns green when communication is established with the Wi-Fi network.
2. Download the FLIR Remote Monitoring app for Android (Google Play) or iOS device (App Store).

3. Open the app on your mobile device and tap '**STAND-ALONE**' on the opening app screen.
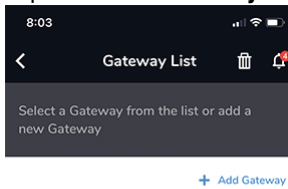
4. Tap the **+ Add Gateway** command.

5. A three-step information screen will appear. Tap **START**.
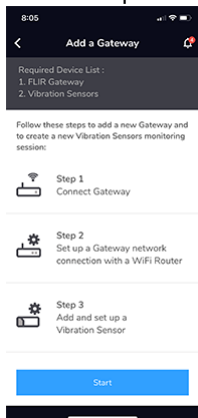
6. The STEP 1 screen will appear. Tap **CONNECT**.
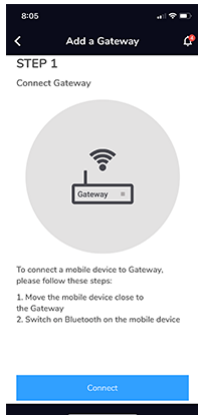
7. The Gateway name should appear on the Gateway List.
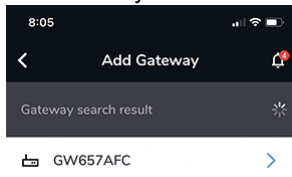
8. Tap the displayed Gateway name. The STEP 2 screen will appear. Note that STEP 3 is the Sensor activation step (not covered in these quick steps). See Section 9, *Mobile App*, for instructions.

9. Tap **CONTINUE**.
10. Tap the name of your network in the Wi-Fi Router List.
11. Type the network password when prompted.
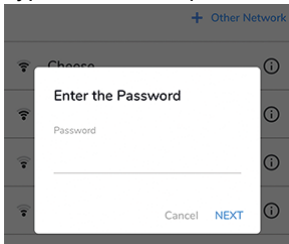
12. Tap **NEXT** when communication is successful. If not successful, repeat the above steps; contact FLIR if issues persist.
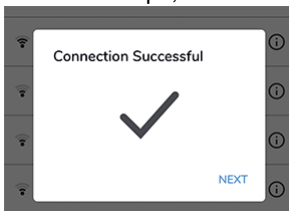
13. The Stand-Alone communication is now operational, and the system is ready for adding sensors; see Section 9, *Mobile App*.

5.2   Quick Steps for Windows PC Operation

1. Connect the Windows PC to the local Wi-Fi server network.
2. Download, install and open the FLIR Gateway Windows app.
   Link to app: https://support.flir.com/remote monitoring.

3. The user name, password, IP address, and port number are shown on the app's opening screen.
4. If Gateways have been connected before, you'll see them on the Gateway List in the app. If Gateways have been archived, you'll see the ARCHIVED box (red) next to the archived Gateway. To export data in .csv format from an archived or active Gateway, click the Export button on the opening app screen.
5. Plug the GW65 into an AC power source.
6. The blue (power) LED and amber (communications) LED will light. The communications LED is amber when not communicating to the Wi-Fi network. When communication is established, the LED will turn green.
7. Download , install, and open the **mobile app** on your smart device, and select **Local Server** from the opening screen. For Android devices use the Google Play store and for iOS devices go to the App Store to obtain the mobile app.
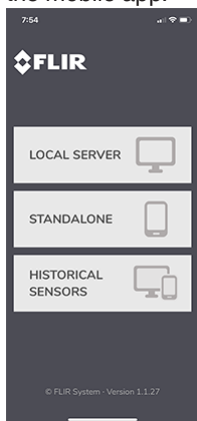
8. Tap **+Add Server** to begin the process of connecting to the Wi-Fi network, unless you see the PC machine name already on the Server List (as shown in the image below). If so, tap the machine name and continue with step 14.
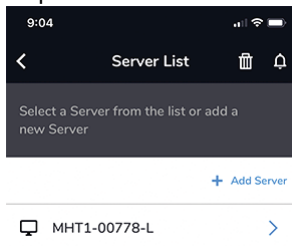
9. In the mobile app, tap on the Server IP field and type the IP address that matches the address on the Windows app screen.
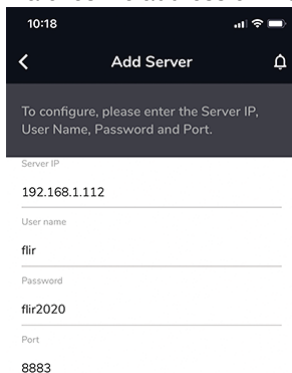
10. Tap the User name field and type the user name that matches the user name in the Windows app screen.
11. Tap the Password field and type the password that matches the password in the Windows app screen.
12. If necessary, tap the Port field and enter the number that matches the number in the Windows app screen.

13. Tap Continue in the mobile app. After several seconds your PC machine name should appear on the mobile app.
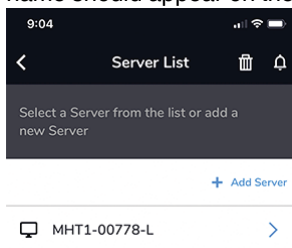
14. Tap the PC name on the mobile app and tap the **+Add Gateway** command when prompted. A three-step information screen will appear.
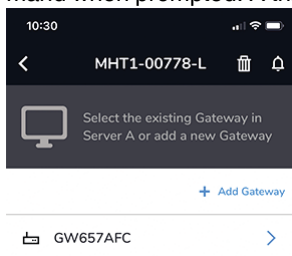
15. Tap **Start**. The STEP 1 screen will appear. Tap **Connect**.

16. The STEP 2 screen will appear, tap **Continue**. Note that STEP 3 is the Sensors activation step, not covered in these quick steps. See Section 9, *Mobile App*, for instructions.

17. The Gateway that was powered up earlier in this procedure will appear in the mobile app. Tap the Gateway name.
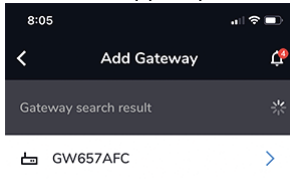
18. A list of Wi-Fi networks will appear, tap your network's name.
19. When prompted, type the Wi-Fi network password and then tap **NEXT**. When communication is successful, press **NEXT** again to continue.
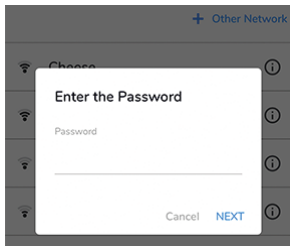
20. The Gateway that you plugged in earlier should now appear on the Windows app Gateway list. Click the Refresh button and repeat these steps if you do not see the Gateway on the list. Contact FLIR if issues persist.
21. When the Gateway appears on the list you are ready to add sensors as explained in Section 9, *Mobile App*.

6 Sensor Installation

NOTE
Do not permanently affix sensors to assets until you've allowed sufficient time to ensure stable communication between sensors and Gateways in their temporary positions.

6.1 Sensor Placement Considerations

When considering test point sensor locations, the individual parts of the equipment and its operation should be well understood. Basic rotating equipment will have a combination of bearings, shafts, shaft coupling equipment, fans, pumps, compressors, etc. Note that this unit is not suitable for monitoring bearing or gearbox vibration as this would require a higher frequency range (this product has a maximum frequency of 1 kHz).

For personal and equipment safety, do not affix sensors where they can interfere with machine operation. Affix sensors to solid metal. Refer to the dedicated section below for a list of areas where sensors should not be affixed.

6.2 Mounting the Sensors

Sensors should be placed on structural parts of the equipment that significantly respond to the overall vibration and dynamic forces (example photos below).

For best results, clean the area where the sensor is to be attached.

Confirm stable communication between sensors and Gateways before committing to a permanent installation. Move the Gateway closer to the sensors if necessary and use multiple Gateways if greater coverage is required.

Although the maximum distance between sensors and Gateway is 213 ft. (65 m), the range is affected by concrete, metal, etc. in the line-of-sight. Multiple Gateways can be used for wider coverage.

Sensors must be installed where they cannot interfere with the operation of the machinery under test or where they will interfere with machine operators. Attach the sensors to the equipment using the supplied double-sided tape. Adhesive alternatives are available commercially that could be more reliable on some machinery (see the *Specifications* section for details).
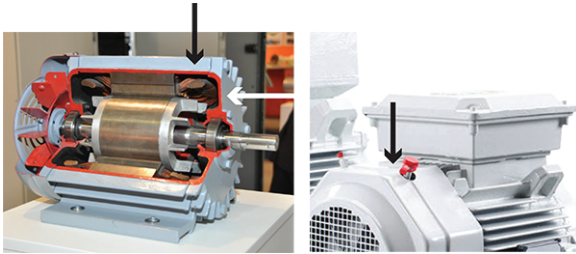
Figure 6.1 Examples of areas to place sensors.

Figure 6.2 SV87 Sensors shown mounted on machinery.

6.3   Where Sensors should not be placed

⚠️ **CAUTION**
Do not mount sensors on the following locations: • Motor winding areas   • Middle of motor   • Pump casing   • Cooling fan fins/covers   • Coupling belt guards, gearboxes   • Seal locations

Figure 6.3 Examples of places you should not mount sensors.

6.4   Determining the Number of Sensors to Place on Equipment

The larger the equipment under test, the greater the number of sensors required; this is because vibrations can go undetected if the sensors are positioned too far from the source of vibration. Vibration is absorbed by the equipment after travelling approximately 3.3 ft. (1 m), so you'll want to situate sensors to maximize coverage.

Ensure that coverage of equipment is sufficient regarding the number of sensors. Ten (10) sensor will work in most circumstances, given no obstruction between Gateway and sensor. The key factor is obstruction since, with no obstruction, it is possible to have more than ten sensors operating normally. Use multiple Gateways to accommodate more sensors and to ensure proper coverage of a test site.

For larger equipment, more sensors may be needed, as discussed earlier. Use a sufficient number of sensors to provide good surface-area coverage of assets.

6.5   Documenting Sensor Locations

It is important to document the sensor and test point locations for all equipment in a test system, as discussed in Section 7, *Mapping a Test Site*. A spreadsheet is ideal for documenting Gateways, test points, sensors, sensor groups, etc.

Having accurate documentation helps locate, track, and assess equipment easily for preventive maintenance programs and servicing.

7 Mapping a Test Site

To best maintain a test site, it is important to keep a list of asset (equipment) names and their types, classifications, and locations. Depending on the size of the operation, a site map may also be needed to show machine locations and the test points where sensors are attached to assets.

7.1 Assets

The term 'asset' is used when referring to a piece of equipment under test.

Log as much information as possible for each asset so that maintenance and configuration can be handled quickly and accurately. Keep track of locations, names, categories, and test points/sensors.

7.2 Sensor Groups

When using the mobile and Windows apps, sensors are grouped for easy tracking and monitoring. Groups should be appropriately named for clarity and easy identification.

7.3 Test Points

A test point is a location on an asset where a sensor is attached. Test point location is a critical part of the vibration monitoring strategy. Refer to Section 6, *Sensor Installation*, for important information and instructions.

7.4 Sensor Identification

Sensor serial numbers are printed on their housings. The mobile and Windows apps will show the serial number of sensors and Gateway hardware when communication is established. Names of sensors and other components in the system can be customized.

8 Communication Preparation

8.1 Communication Basics

As discussed below, the first decision you'll make is whether to use the stand-alone method (mobile smart device exclusively) or a combination of Windows PC and mobile device.

If you'll be communicating exclusively from a mobile device, you'll need only the mobile remote monitoring app. If you'll be communicating using a Windows PC, you'll need the Windows PC app and the mobile app.

The mobile app is available from the App Store, Google Play, or FLIR website (link below). The Windows app is available from the FLIR website.

Web link: https://support.flir.com/product/RemoteMonitoring.

8.2 Choosing PC-based or Stand-Alone Control

8.2.1 How To Decide

As mentioned, the first decision to be made when planning and configuring a test system is whether to run a stand-alone system or a system that incorporates a Windows PC for monitoring and control. The table below lists the advantages for each method. Block diagrams are provided later in this section showing how the system components, Wi-Fi, Bluetooth, and direct connections interact.

STAND-ALONE METHOD	WINDOWS PC METHOD
Simple setup and portability.	Convenient, comprehensive dashboard and monitoring console.
View measurements, trends, alarms, and FFT directly on a smart phone.	Text files (.csv) of measurement data can be exported for data analysis.
Easy updating of firmware and app.	Automatically sends email alert when alarm set points are exceeded.
Data is easily transportable and retrievable.	Unlimited data storage on PC.

8.2.2 Stand-Alone System Block Diagram

The diagram below provides an overview of the Stand-Alone system. Subsequent sections of the manual provide details and specifics regarding test systems that will be controlled by a smart device only.

This diagram shows how a test system is configured using a smart device. The sensor, on a monitored asset, automatically sends vibration and temperature data to the gateway every 90 seconds (via Bluetooth).

The Gateway transmits sensor data to the smart phone using Wi-Fi. The smart device alerts the user to abnormal vibration or temperature readings.

Ten (10) or more sensors can pair with one Gateway system depending on the severity of obstructions that exist between sensors and Gateway.
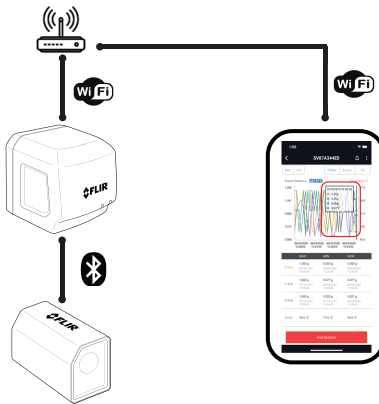
Figure 8.1 The Gateway (GW65) is shown communicating with a Wi-Fi network and a smart phone. The SV87 sensor is shown communicating with the Gateway via Bluetooth.

8.2.3   Windows PC Operation Block Diagram

This diagram below shows how a test system can be configured using a PC. The PC provides up-to-the-minute measurement status (digitally and graphically) and alerts the user to abnormal vibration or temperature readings.

The Windows app can automatically send email when an abnormal reading is registered. The PC can also export sensor data as .csv formatted files for use in spreadsheets.

Figure 8.2   Block diagram of a system controlled by a Windows PC. The GW65 Gateway communicates with the SV87 Sensor using Bluetooth and with the smart phone through a Wi-Fi router. The PC is shown communicating with the network using a direct Ethernet connection.

8.3   Preparing a Communications System

During setup, the Gateways, sensors, and mobile devices must be in close proximity. As detailed below:

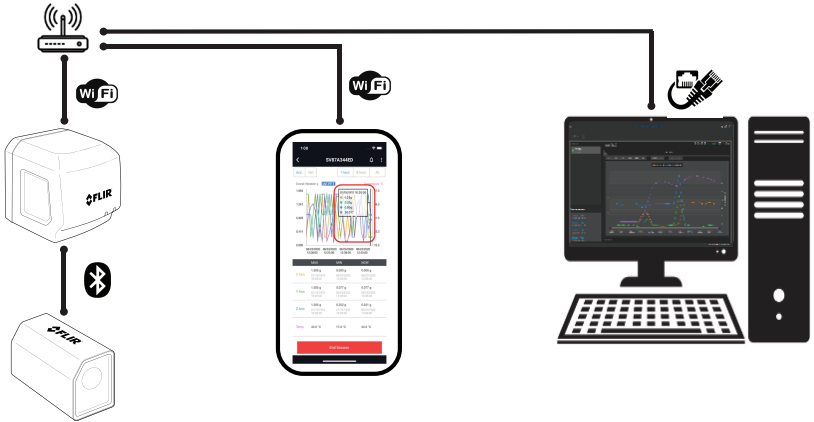- The mobile device must be within 12 inches (30 cm) of the Gateway during setup.
- The sensors must be kept within 5 feet (1.5 m) of the Gateway during setup.

When planning a test configuration it is useful to understand the equipment hierarchy, as you will be prompted in the applications for equipment names, classifications, types, etc. The hierarchy and definitions are as follows:

- Group: Sensor groups are collections of sensors in a test area.
- Assets: Machinery under test. Assets require names, types (pump, for example), and ISO 2372 classification (see chart in the mobile app). Photos of assets can be added by mobile device during configuration.
- Test Points: Location and position of sensors on an asset.

With the information covered in this section, a site map and equipment list should be created and maintained. This will ensure that you know where all Gateways, sensors, and other equipment are located when performing

preventive maintenance and if you need to locate equipment quickly in an emergency. See Section 7, *Mapping a Test Site*, for more information.

8.4 Preparing the Mobile App
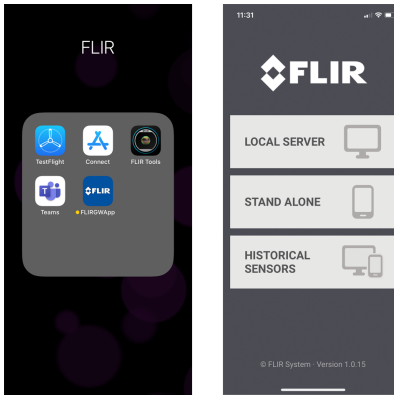
Figure 8.3   FLIR mobile app installed on mobile device (above, left) and opening screen (above, right).
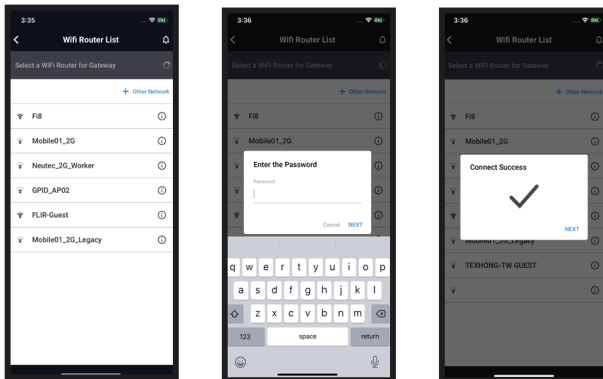

Figure 8.4   Adding a new network or selecting an existing one.

1. After downloading the mobile app, as described earlier, you'll see the FLIR app on your mobile device, as shown in Figure 8.3 above.
2. When you open the app you'll see a start-up screen (*Section 5*, Figure 5.1). Select the option for stand-alone operation.

3. Select a Wi-Fi network from the list or tap **+ Other Network** to add a new network (see Figure 8.4 above).
4. The next screen prompts for a network password. Enter the password and tap **NEXT**.
5. Communication to the network should now be established.
6. If you are unable to connect to the Wi-Fi network, please verify that the credentials are correct. Contact FLIR support if connection issues persist.
7. Once the setup and preparation are complete, follow the detailed instructions in Section 9, *Mobile App*.
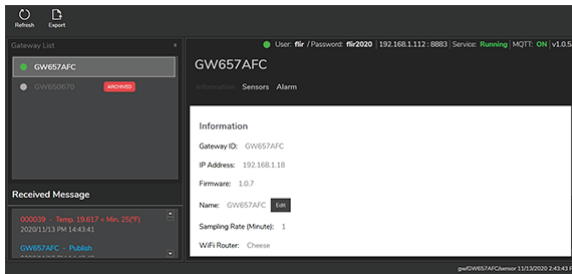
8.5 Preparing the Windows PC App

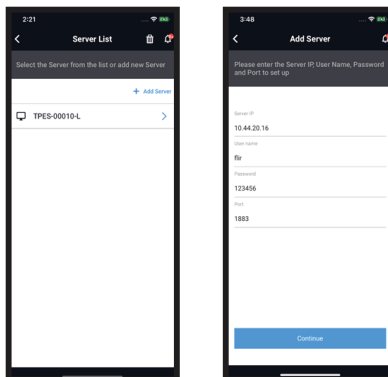**Figure 8.5** Windows PC app opening screen.

Figure 8.6 Add a new server or select an existing one. Note that references to a server indicate that the Windows PC app is being used.

To maintain a test site using a Windows PC, download the Windows app and mobile app (for iOS or Android) from the FLIR support site shown below. Follow the preparation steps below and then continue with the instructions in Section 10, *Windows App*.

Web link: https://support.flir.com/product/RemoteMonitoring.

1. Open the Windows app on your PC. The opening screen is shown in Figure 8.5 above (shown with the Information tab selected).
2. Open the mobile app on your mobile device, as described earlier.
3. Tap **+ Add Server** in the mobile app to setup a new network or select an existing one from the list as shown in Figure 8.4 above.
4. The next screen prompts for the network user name and password. Tap **Continue** when done.
5. Network connection should now be established.
6. For connection issues, verify that the credentials are correct. Contact FLIR support if connection issues persist.
7. Refer to the dedicated instructions in Section 9, *Mobile App* and Section 10, *Windows PC App*.

8.6   'Historical Sensors' Option

Select the 'Historical Sensors' option from the opening screen in the mobile app to view previous sensor configurations. You can also select archived, historical sensor configurations in the Windows PC app.

8.7   Preparation for Sensor Placement

1. Once communication between all components in the system (Gateways, sensors, PC and mobile devices) is established, the sensors can be moved into position temporarily. Do not permanently affix the sensors at this point.
2. With the sensors in their desired locations, allow time to ensure that the communications between all system components is stable. If you notice intermittent problems you may have to move the Gateway closer to the sensors.
3. When stable communication is verified, follow the instructions in Section 6, *Sensor Installation*, for details on permanently attaching sensors to equipment. To verify stable communications, ensure that there are no connection drop-outs, weak signals, or connection display errors.
    Evidence of spotty communications would be Gateway communication light toggling amber and green colors, alarm set points false triggering, and displayed data and graphs on mobile device or PC showing no data.

9   Mobile App

9.1   FLIR Mobile App Screens

Once communication between all devices in the test system is verified, follow the instructions below. **The numbered steps below correspond to the numbered screen shots.**
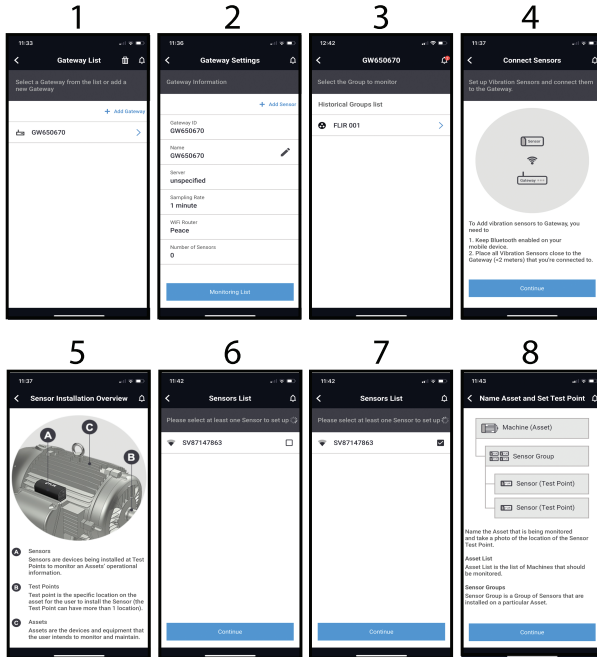
1. Tap an existing Gateway from the list or tap **+ Add Gateway** to add a new Gateway.
2. Tap **+ Add Sensor** to configure a new sensor or tap **Monitoring List** to view existing configurations.
3. List of existing sensor groups.
4. Informational page. Tap **Continue**.
5. Sensor installation definitions page.
6. Connected sensors. Tap a sensor on the list to continue.
7. Selected sensor indicated by checked box.

8. Naming Assets and Setting Test Points (informational page). Tap
    Continue.
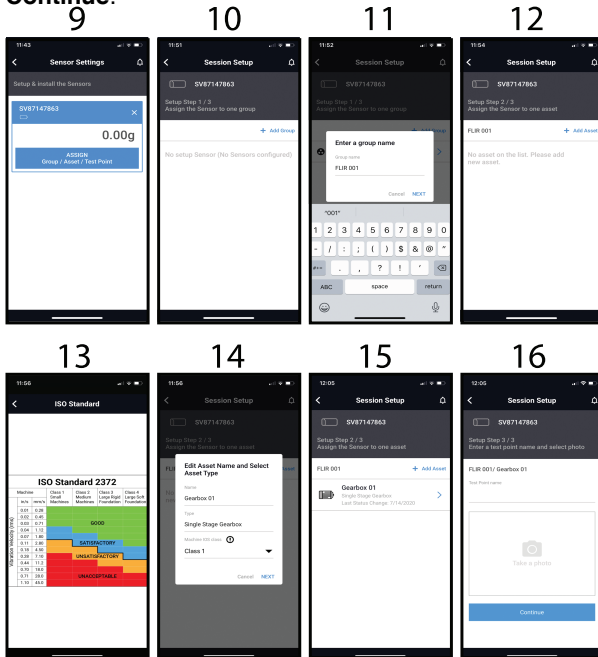
9. Sensor Settings. The top blue box shows the selected sensor and its cur-
    rent reading, tap the **X** to remove it. Tap the lower blue box to continue with
    the sensor group, asset, and test point setup.
10. Tap **+ Add Group** to add a new sensor group.
11. Type a group name and tap **NEXT**.
12. Tap **+ Add Asset** to add a new asset or tap an existing asset.
13. ISO Standard 2372 machine classification table.
14. Name the asset, describe its type, and select its class. Tap **NEXT**.
15. Assign the selected sensor to an asset. Tap **+ Add Asset** to create a new
    asset or tap an existing one.

16. Name the test point, take a photo, and tap **Continue** when done.
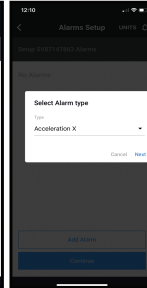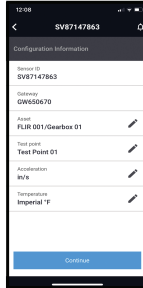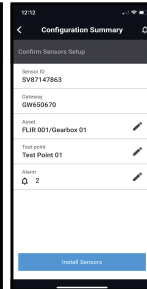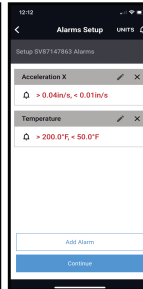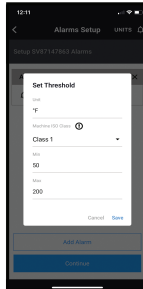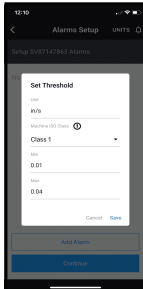
17. View the test point name and photo. When satisfied, tap **Save**.
18. Configuration screen. View the sensor ID, Gateway name, asset/group names, test point name, and vibration/temperature units of measure. Tap a pencil icon to edit a field.
19. Tap **Add Alarm** to program an alarm, or tap **Continue** to bypass.
20. Select an alarm type and tap **NEXT** or tap **Cancel**.
21. Select the low and high alarm thresholds. Tap **Save** to continue.
22. Select a threshold for another Alarm. Tap **Save** to continue.
23. Edit an existing alarm (pencil icon), delete an alarm (**X**), or add an alarm. Tap **Continue**.

24. Tap a pencil icon to edit a field. Tap **Install Sensors** to complete the setup.

25. For a successful installation, tap **Finish Setup**. If there is an error, retry the setup steps.
26. List of installed sensors. Tap **Finish Setup**.
27. Tap the Local Server (for Windows PC mode) or Stand-alone tab to switch between configurations. You will need to follow a process, however, as explained in Section 12, *Toggling Stand-Alone and Local Server Modes*, to switch from one mode to the other.
28. View the trend chart, change measurement units, and edit the alarm setup.
29. Continue as with the previous trend screen. Tap **End Session** to stop the test. Tap the alarm bell icon to view alarm activity.
30. Tap the **Recent** or **Expired** tab to view recent or historical alarms.

9.2   Trend Charts

As shown in screens 28 and 29 above. The mobile app shows a representation of logged data on a trend chart and in a MAX/MIN data table (below the graph). Additional trend chart details are provided below. **The numbered steps below correspond to the accompanying numbered screen shots.**

1. Tap an installed sensor as shown in screen 1 (below), to open the trend chart.
2. Tap the **Acc.** tab to view acceleration measurement data. Note that you can tap the three dots or the alarm icon, on the upper right corner of the app screen, to see other options.
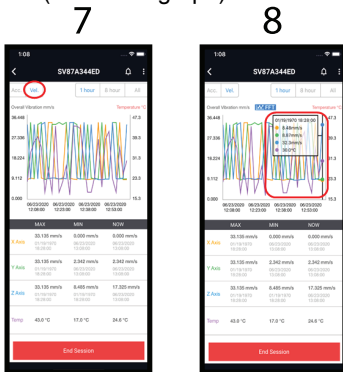3. Tap the **FFT** icon to view the Fast Fourier Transform screens.
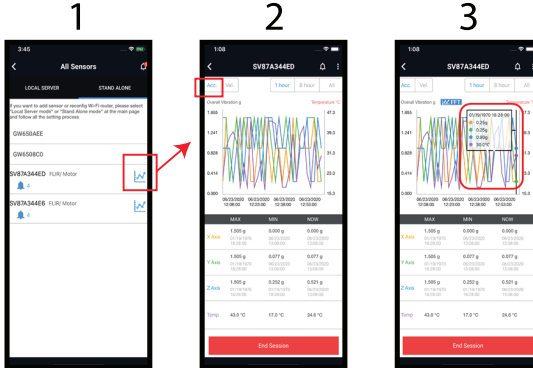
4. Tap any area of a chart to select a region, the measurement and time stamp for the region will appear. To add and remove measurement data from the graph, tap a measurement type in the MAX/MIN table (below the graph).
5. FFT data screen. See *FFT* Section 11 for technical FFT information.

6. FFT data screen. See *FFT* Section 11 for technical FFT information.

7. Select Velocity measurement data by tapping the **Vel.** tab as shown.
8. Velocity data is shown on the trend chart. Tap a region of the chart to open its measurement and time stamp information. To add and remove measurement data from the graph, tap a measurement type in the MAX/MIN table (below the graph).

9. Tap the FFT icon to view the Fast Fourier Transform screens.
10. FFT data screen. See *FFT* Section 11 for technical FFT information.

11. FFT data screen. See *FFT* Section 11 for technical FFT information.

10 Windows PC App

To monitor a test site using a Windows PC, download the Windows application from the FLIR support site (link below). Open the application and follow the instructions below.

Ensure that all devices (mobile device, Gateway, and sensors) reside on the same IP sub-network, assigned from the shared router or AP (access point). The mobile device configuration, when identifying the PC, must match the IP address shown in the Windows screen.

Web link: https://support.flir.com/product/RemoteMonitoring.

Note that you may need to obtain system information and credentials from your IT department to connect to a network.

10.1 Windows App Opening Screen

Refer to the call-out numbers in Figure 10.1, below, for this numbered list.

1. Click **REFRESH** to initiate or refresh a connection.
2. Click **EXPORT** to export data as a .csv file.
3. User name, password, IP address, port and other information. Click the user name to open the credentials setup screen.
4. Information, Sensors, and Alarm tabs. Click a tab to open. The Information tab is selected in Figure 10.1 below.
5. Click to edit the Gateway name.
6. Alarm and other messaging appear here.
7. Archived Gateway. Click the red ARCHIVE tab to open the data window for the archived Gateway.
8. Active Gateway.
9. Sampling rate (how often readings are taken).
10. Wi-Fi network name.
11. Email alerts setup.
12. Click to archive the selected Gateway.

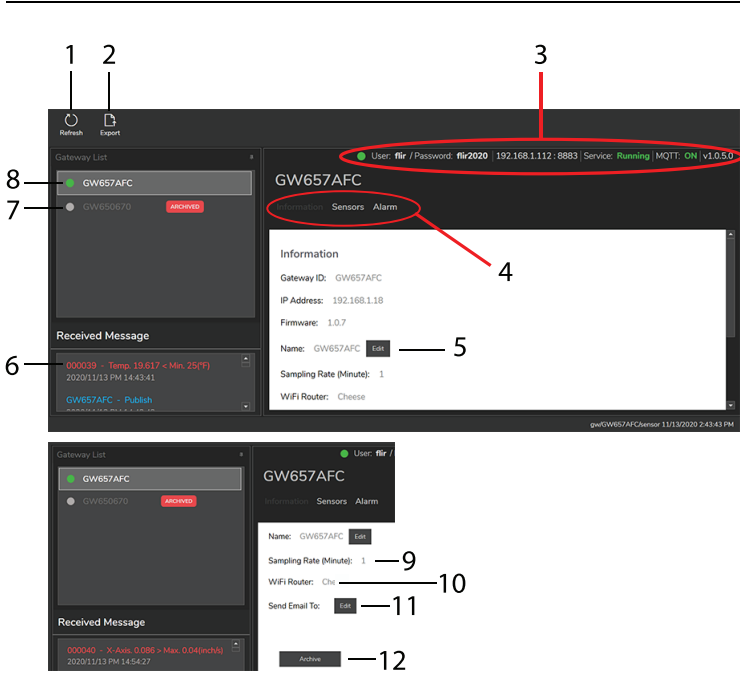**Figure 10.1** Windows App opening screen with Information tab selected.

10.2   Exporting Measurement Data as .csv Formatted File

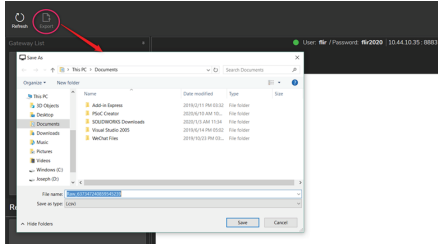Export data as .csv file for use in a spreadsheet.

Figure 10.2 Exporting measurement data as .csv file.

Time	Sensor ID	X g-rms(g's)	X V-rms(mm/s)	Y g-rms(g's)	Y V-rms(mm/s)	Z g-rms(g's)	Z V-rms(mm/s)	Temp(°C)	Voltage(V)
2020/9/25 PM 05:17:09	SV8700005E	0.184836937	0.12559096	0.076889611	0.06938247	0.92912876	0.67134715	24.38	3.6
2020/9/25 PM 05:18:12	SV8700005E	0.18025163	0.19053948	0.088860591	0.05896583	0.937171382	0.64610478	24.3	3.6
2020/9/25 PM 05:19:16	SV8700005E	0.184926902	0.13871879	0.087668997	0.16526489	0.927675863	0.62633032	24.33	3.6
2020/9/25 PM 05:20:24	SV8700005E	0.182764515	0.17646503	0.083108608	0.10937588	0.932971391	0.61176226	24.34	3.6
2020/9/25 PM 05:21:29	SV8700005E	0.182335594	0.10722014	0.091496036	0.11124672	0.930220103	0.61550753	24.37	3.6
2020/9/25 PM 05:22:32	SV8700005E	0.185345261	0.14341034	0.078138563	0.0845235	0.930804905	0.62889653	24.36	3.6
2020/9/25 PM 05:23:35	SV8700005E	0.194625092	0.23391894	0.074083074	0.11052909	0.928836783	0.64351775	24.42	3.6
2020/9/25 PM 05:24:38	SV8700005E	0.184027767	0.16738066	0.078440606	0.10541068	0.93003336	0.59459527	24.45	3.6

Figure 10.3 Example .csv data file.

10.3   Sensors Tab

Click the Sensors tab to view sensor information and battery status. Refer to Figure 10.4, below, for this numbered list.

1. List of alarm types.
2. Click to open the alarm threshold editing utility.
3. Click to open the Trend Chart.
4. Click to update (refresh) the displayed data.
5. Click to toggle inch/s and mm/s units.
6. Click to toggle temperature units (°C/°F).
7. Click to close this window.
8. Current maximum and minimum alarm threshold settings.
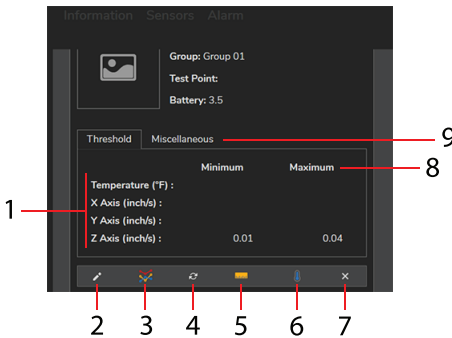9. Click the Miscellaneous tab to view test start date and display update rate.

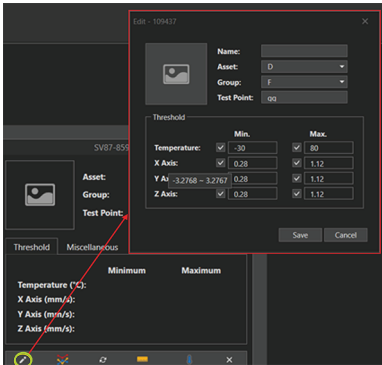
Figure 10.4 Sensors tab screen.

Figure 10.5 Using the edit tool to configure sensor alarms.
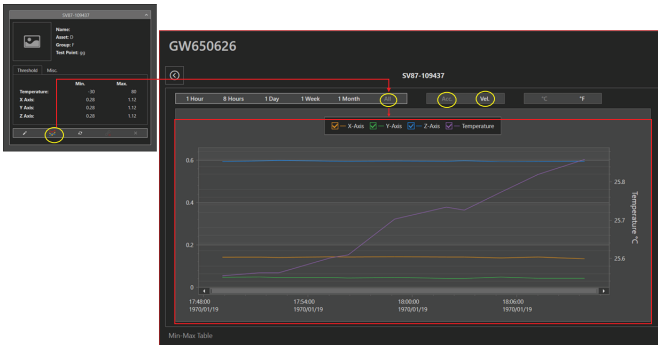

Figure 10.6 Opening a Trend Chart. Click on a point on a graph line to see instantaneous date/time and measurement values.
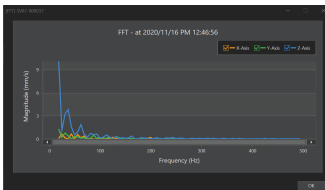

Figure 10.7 To open an FFT graph, as shown in this figure, double-click on any measurement point from a Trend Chart (shown in Figure 10.5).
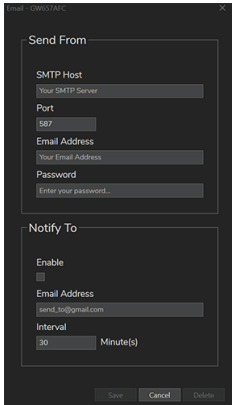
Figure 10.8 Configuring the system to send automatic alarm email alerts.

10.4   Alarm Status Tab

Click the Alarm tab to view alarm activity. Refer to Figure 10.9, below, for this numbered list.

1. Refresh the screen.
2. Mark the selected alarm as 'read'.
3. Mark alarm as 'unread'.
4. Delete alarm instance.
5. Click a check box to select one or more alarm instances.
6. Time of alarm instance.
7. Alarm details.
8. Sensor where alarm occurred.
9. Sensor group name.
10. Name of asset where sensor is mounted.
11. Test point name.

Figure 10.9 Alarm Status tab screen.

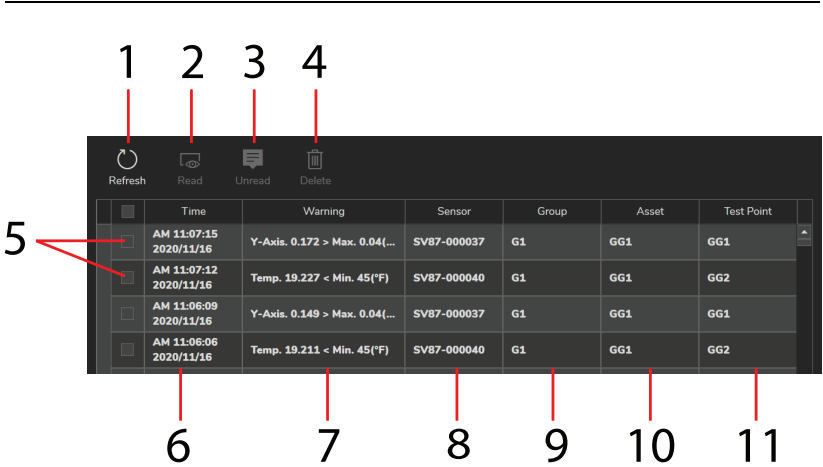### 10.5   Archived Sensors

Configurations can be archived for future reference by clicking on ARCHIVE in the Information tab as shown at the start of this section in Figure 10.1. In Figure 10.10, below, the archive screen is shown when an archived configuration is selected.

1. Click the Archive to see the archived information.
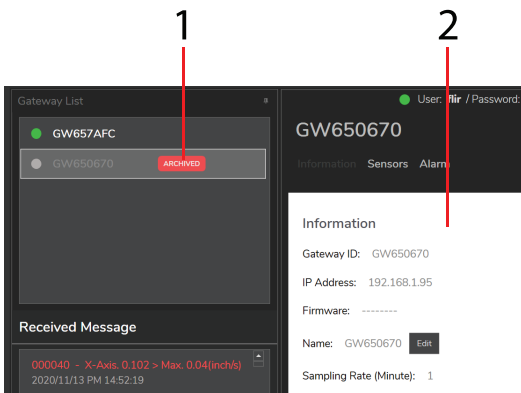2. Archived information.

Figure 10.10 Archived Gateway screen.

11 Fast Fourier Transform (FFT)

11.1 Background

In simple terms, FFT is a mathematical algorithm that converts a data presentation (graph, for example), shown as a function of time, into a data presentation shown as a function of frequency and vice versa.

This is useful in the representation of vibration measurements. For example, Velocity graphs, in the FLIR mobile and Windows apps, are derived from FFT analysis of Acceleration measurements.

11.2 Time-Domain and Frequency-Domain Methods

Time and frequency domain vibration measurement methods can both be employed to study vibration measurements.

The time domain method provides a glimpse into the source of vibration but not ideal for analyzing multiple frequency vibration signals.

The frequency domain method is more effective; especially when evaluating amplitude and phase characteristics of vibration signals. The frequency domain method is effective finding bearing defects and identifying shock pulses and friction activity.

11.3 Determining Machine Defects by Vibration Characteristics

Each defect causes vibrations having unique characteristics. You can determine, more easily, the root cause of a problem if you understand these characteristics, and that's where FFT comes in handy.

You can determine a lot about an asset, even when it is working normally, by looking at FFT data graphs. For example, in normal operation, the shaft rotation frequency (fundamental) will be represented on the graph on the left followed by a series of harmonics whose amplitude will be approximately a third the amplitude of the fundamental.

Additional signals are present in a normal system representing the vibrations of the structure that the machine is mounted on.

For faulty systems, the following changes in FFT graphs may appear.

- Shaft balance issues cause large radial variations and marked increase in amplitude of the fundamental frequency.
- Misalignments are shown as an increase in frequency amplitude at the 2nd harmonic.

- Looseness is evidenced by a marked increase in the number of harmonics. If there is looseness in the main support of the asset, an increase in the fundamental frequency amplitude will also be noticed.
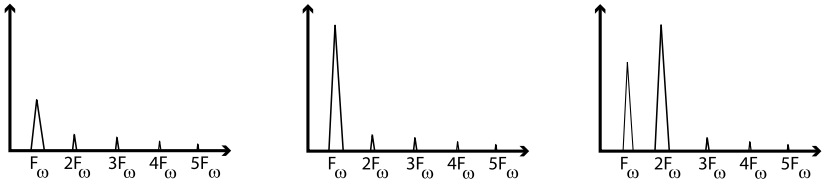

Figure 11.1 Graph on left shows a normal system; Centre graph shows a balance issue; Graph on right shows a misalignment issue.
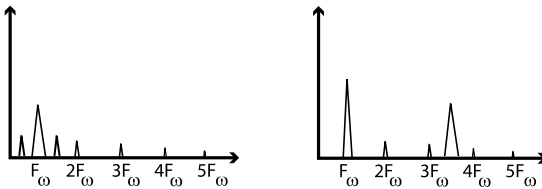

Figure 11.2 Graph on left shows a loose equipment issue (additional frequencies near the fundamental); Graph on right shows an impulse vibration (between 3rd and 4th harmonic) . Frequency of the impulse will vary from machine to machine (speed, size, etc.).

12 Toggling Stand-Alone and Local Server Modes

Once you set up your test system as either a 'Stand-Alone' or 'Local Server' configuration, switching to the opposite mode requires a few steps preparation. If you attempt to setup in Local Server mode, after you've setup in Stand-Alone mode, for example, you'll receive an error message on the mobile app.

To switch from the Local Server mode to the Stand-Alone mode, follow these steps and view the screens below.

1. Navigate to the opening mobile app screen and select Local Server mode.
2. Step to the **+ Add Server** screen, where your PC's machine name will be shown.
3. Check the box next to the PC name.
4. Tap the **DELETE** command at the top of the screen.
5. Confirm the deletion, when prompted.
6. Now return to the mobile app opening screen, select the Stand-Alone mode, and follow the instructions for configuring a test system in Stand-Alone mode as previously described.
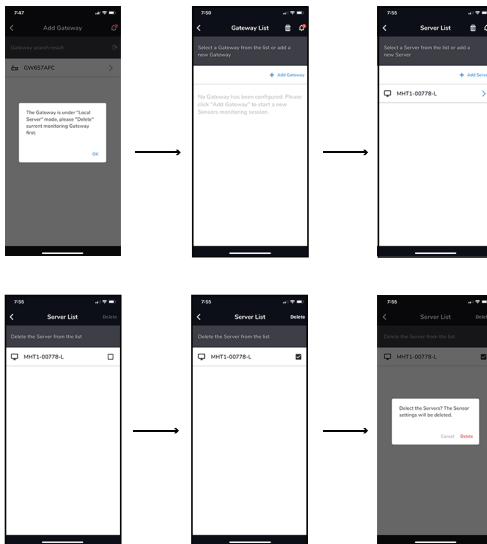

Figure 12.1 Switch from the Local Server mode to the Stand-Alone mode.

To switch from the Stand-Alone mode to the Local Server mode, follow these steps.

1. Navigate to the opening mobile app screen and select Stand-Alone mode.
2. Step to the **+ Add Gateway** screen, where the currently connected Gateway name will be shown.
3. Tap the trash icon at the top of the screen.
4. Confirm the deletion, when prompted.
5. Now return to the mobile app opening screen, select the Local Server mode, and follow the instructions for configuring a test system in Local Server mode as previously described.
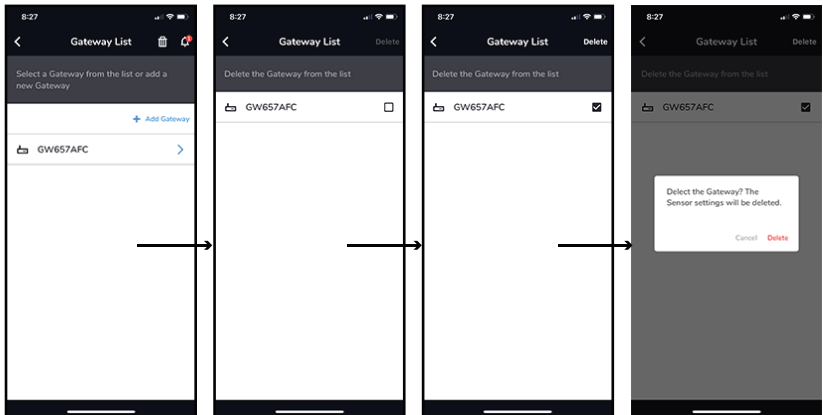

Figure 12.2 Switch from the Stand-Alone mode to the Local Server mode.

13 GW65 Field Firmware Updates

13.1 Firmware Update Procedure using the Mobile App

To update the GW65 Gateway firmware, connect to the network with the mobile app, and then follow the steps below:

1. Select 'Local' or 'Stand-Alone' mode in the app and connect to the same network as the GW65.
2. Navigate to the 'Gateway Settings' screen in the app and tap the 'FW Update' box.
3. When prompted, tap on an available update file and tap 'UPDATE'.
4. The app will show the 'Update Complete' message when done.
5. The GW65 will reboot and operation will continue normally. If you have questions or update issues, please contact FLIR.
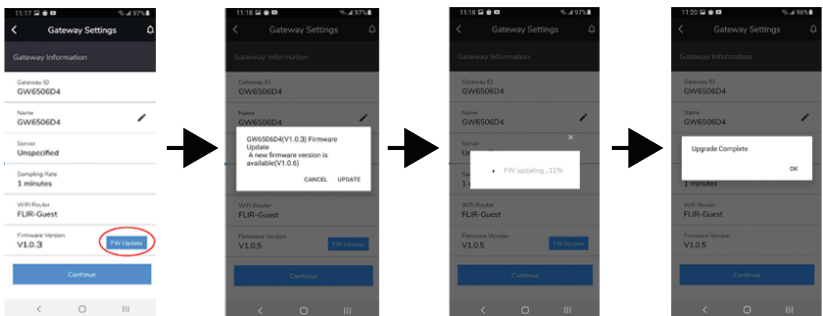

Figure 13.1 GW65 Gateway Firmware Update Using Mobile App.

14 Three-Year Limited Warranty

This product is protected by FLIR's 3-Year Limited Warranty. Visit
www.flir.com/testwarranty to read the 3-Year Limited Warranty document.

15 CUSTOMER SUPPORT

Customer Support Telephone List:	https://support.flir.com/contact
Repair, Calibration, and Technical Support	https://support.flir.com

16 Specifications

16.1 GW65 Remote Monitoring Gateway Specifications

Operating and Storage Temperature	-13 ℉ ~ +149 ℉ (-25 ℃ ~ +65 ℃)	
Operating Relative Humidity	10 ~ 95% non-condensing	
Altitude	6562 ft. (2000 m)	
Data back-up	32 MB flash memory available for power outages. 5 days of data for 4 sensors or 20 days of data for one sensor can be stored maximum.	
Power	100 ~ 240 V AC 50/60 Hz	
Bluetooth	Type:	BLE 4.2
	Gateway-to-Sensor Range:	213 ft. (65 m) line-of-sight
	Antenna:	-3 dBm, single antenna, omni-directional
Wi-Fi	Type:	IEEE 802.11 b/g/n
	Frequency Range:	2.4 GHz
	Output power:	< 100 mW
	Antenna:	0 dBm, single antenna, omni-directional
	Signal strength:	-65 ~ –70 dBm
IP Rating	IP 40	
Drop-proof	3.3 ft. (1 m)	
Safety	Certifications: ETL / IC / FCC / CE / RCM	
Dimensions	2.26 in x 1.55 in x 1.82 in. (57.3 mm x 39.3 mm x 46.1 mm)	
Weight	1.2 oz. (35 g)	

16.2   SV87 Remote Sensor Specifications

Measurements	Acceleration: ± 32 g (gravitational constant)
	Velocity data (mm/s or in/s) displayed in the mobile and Windows apps, derived from FFT.
	Contact temperature trend range: −22°F ~ +176°F (−30℃ ~ +80℃)
Frequency Range	10 Hz ~ 1 kHz
Sampling rate	One data point captured / 90 seconds
Sensor attachment method	Double-sided tape (supplied). Order Tesa® 4957 double-sided general purpose PE-foam tape from your local supplier for additional tape.
	Adhesive alternatives are available on the market that could be more reliable on some machinery. Epoxy (Loctite AA 330 + Loctite SF 7387/8) may give a more rigid and long lasting bond.
Number of sensors per Gateway	Ten (10) sensors will work in most circumstances, given no obstruction between Gateway and sensor. The key factor is obstruction since, with no obstruction, it is possible to have more than ten sensors operating normally.
Operating Temperature	-22 °F ~ +176 °F (-30 °C ~ +80 °C)
Operating altitude	6562 ft. (2000 m)
Battery	3.6 V 2400 mAh Lithium battery (battery life: 4 years, nominal)
Bluetooth	Type: BLE 4.2
	Sensor-to-Gateway Range: 213 ft. (65 m) line-of-sight
	Output power: < 10 mW
IP Rating	IP 67
Drop-proof	3.3 ft. (1 m)
Safety	Certifications: ETL / IC / FCC / CE / RCM
Dimensions	2.42 in x 0.95 in. (61.5 mm x 24 mm)
Weight	1.4 oz. (28 g)

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