User Manual

PyrIQ Evaluation KIT

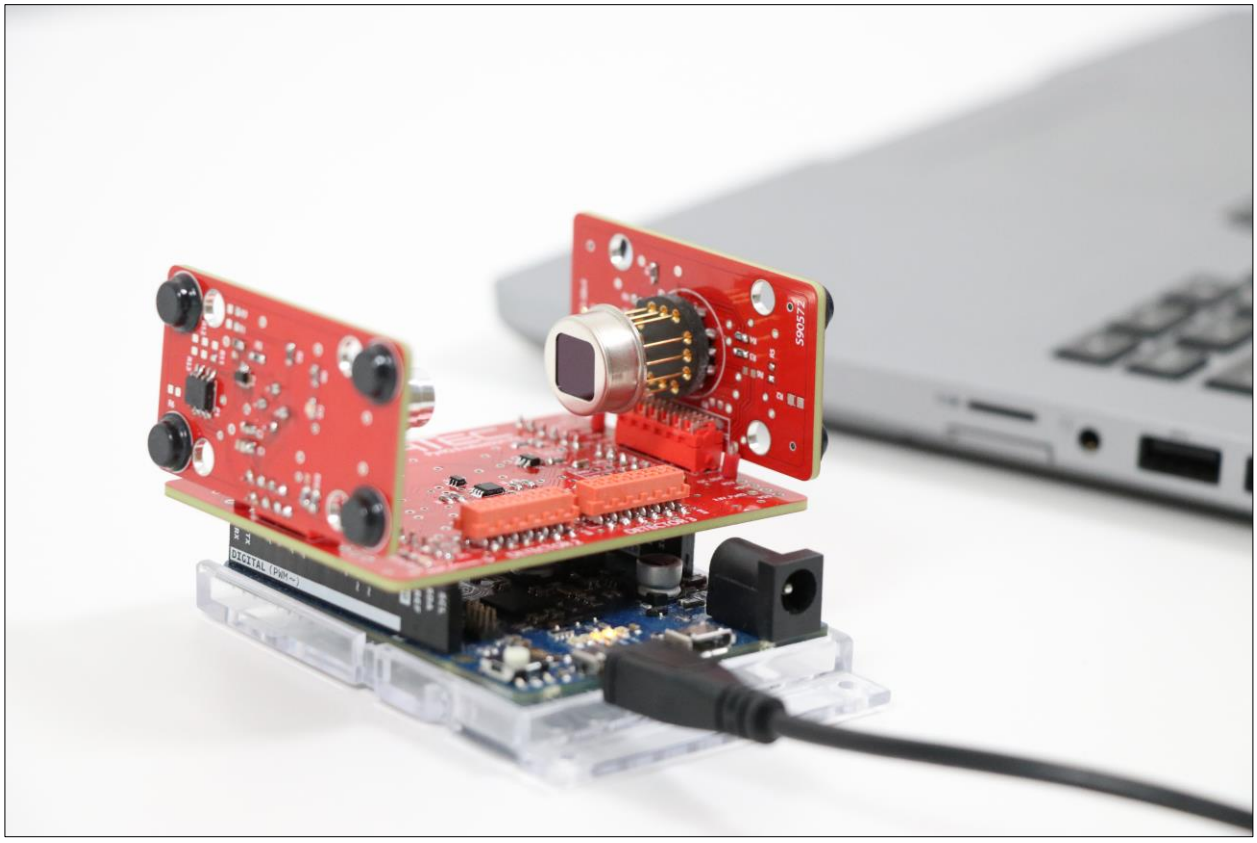

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Table of Contents

1 Introduction

This evaluation kit is intended to support customers in initial testing of InfraTec's PyrIQ detectors without having to develop test circuitry, firmware and software themselves.

The corresponding PyrIQ Evaluation Kit software allows for easy control of the detector and IR source parameters via an intuitive graphical user interface. With the help of this kit a quick and easy configuration of PyrIQ detectors is possible. The kit itself is not intended for industrial or commercial use.

All listed product names and trademarks remain the property of their respective owners.

This manual has been prepared with due care. Nevertheless, errors and omissions cannot be completely excluded.

Further developments in the sense of technical progress are reserved.

No liability is assumed for damages resulting from non-observance of the information contained in this manual.

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2 Important Information

2.1 Product Summary

This evaluation kit is intended to support customers in initial testing of InfraTec's PyrIQ detectors without having to develop test circuitry, firmware and software themselves.

The corresponding PyrIQ Evaluation Kit software (download at bit.ly/3Y8jpl5) allows for easy control of the detector and IR source parameters via an intuitive graphical user interface. With the help of this kit a quick and easy configuration of PyrIQ detectors is possible.

2.2 Warnings

The evaluation kit is dispatched from InfraTec in a safe condition. Any unauthorized modifications may compromise safety and invalidate the warranty.

The product is not intended for industrial usage. Especially in safety or emergency stop devices or in any other application where failure of the device could result in personal injury. The evaluation kit is not certified as intrinsically safe and therefore must not be operated in potentially flammable or explosive atmospheres.

Neglecting the above may result in injury or death.

2.3 Compliance

InfraTec hereby declares that the PyrIQ Evaluation Kit is in conformity with the essential requirements of the EU.

2.4 Handling

When making any adjustments on the electrical assembly of the evaluation kit the Arduino must be unpowered. To ensure that, please always connect the PCB boards, emitter and PyrIQ detectors *before* powering the Arduino.

Please, do not place the electronic components on electrically conductive parts.

2.5 Packaging

The PyrIQ Evaluation Kit comes in an antistatic packaging to protect the device during shipment. During unboxing and handling please make sure to follow the common ESD guidelines to prevent electrostatic discharge on the device.

3 Overview

With the PyrIQ Evaluation Kit, you can quickly and intuitively grasp an understanding of the various adjustable parameters and their impact. This kit is designed to help you explore and analyze the functionalities, providing valuable insights on how to pick the best parameter set for your specific application.

The evaluation kit offers the following key features:

- Intuitive graphical user interface (GUI) that can be installed onto your computer.
- Direct access to all available detector parameters (e.g., feedback path of the analog frontend, additional amplification stages, bandpass filter frequencies or the sampling frequency).
- Live view of the received data.
- Data storage for further processing.
- Control of the integrated IR source during data acquisition.
- Operation of up to three PyrIQ detectors in parallel with full bandwidth.

This manual can be divided into four parts:

- This chapter introduces the basic structure of the evaluation kit.
- Chapter 4 serves as the quick start guide.
- Chapter 5 demonstrates how the hardware is setup.
- Chapter 6 describes the software.

3.1 Working Principle

A key element of InfraTec's PyrIQ detectors is an application-specific integrated circuit (ASIC). This ASIC integrates the signal processing in the analog frontend and the digitization into one component. Furthermore, the ASIC offers a wide range of flexibility in the configuration of the detector parameters. Fig. 1 shows the working principle of the ASIC.

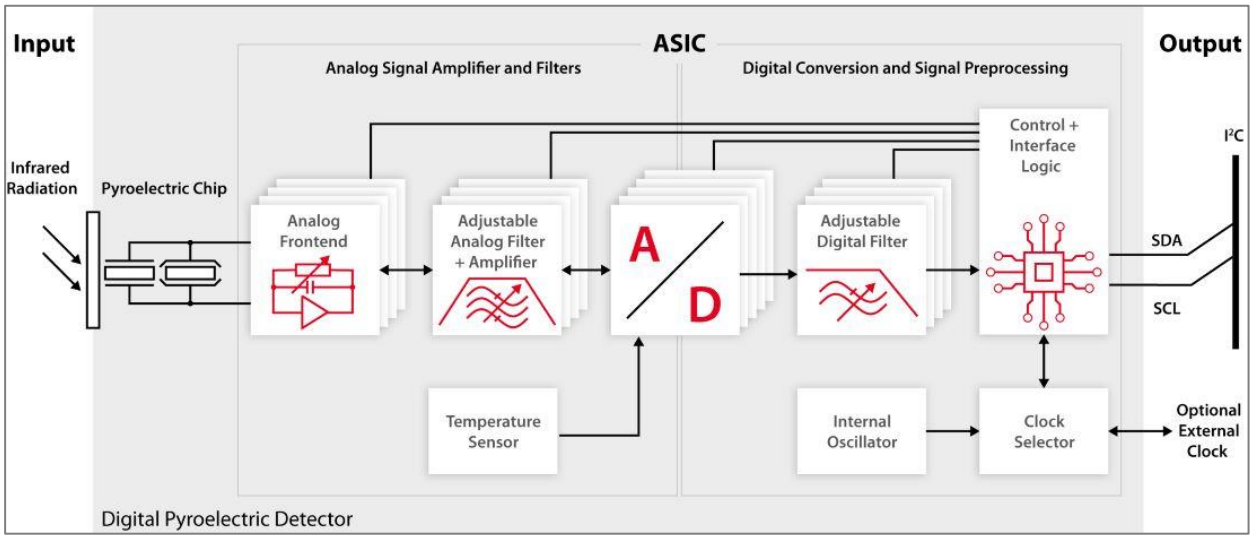


Fig. 1 Integrated components of the ASIC.

A detailed description of each ASIC function block can be found in the *PyrIQ Interface Desciption* which can be found at the same website (bit.ly/3Y8jpl5) as the software.

The PyrIQ Evaluation Kit is based on the Arduino Zero which has a Microchip SAMD21 microcontroller on board. The Arduino Zero serves as interface between the computer with the corresponding software and the PyrIQ detector. The basic working principle of the PyrIQ Evaluation Kit is outlined in Fig. 2.

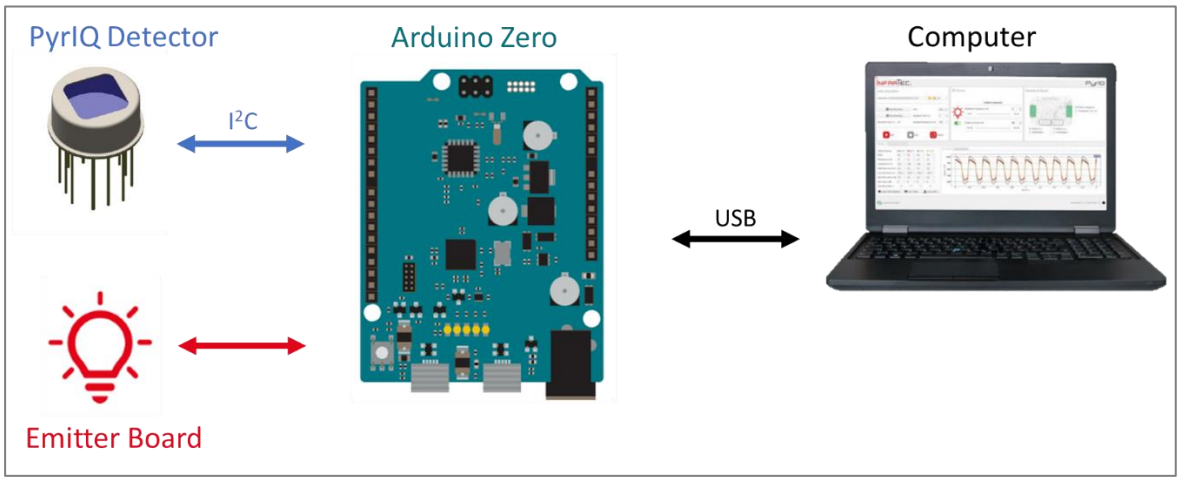
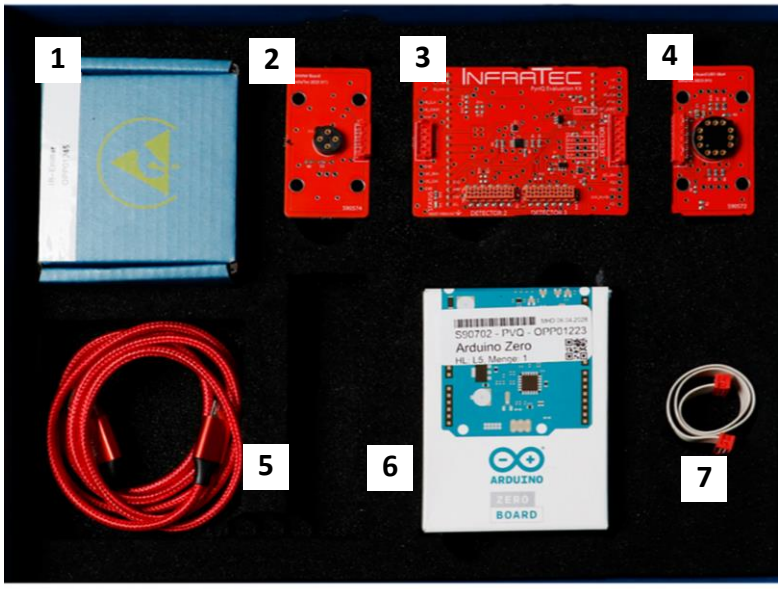


Fig. 2 Working principle of the PyrIQ Evaluation Kit

Due to the digital interface of the PyrIQ detector the Arduino Zero can directly read out the digitalized data via the I²C interface. The evaluation kit facilitates easy adjustment of all possible detector configuration options through the same I²C interface.

In addition to the wide range of detector parameters, the evaluation kit provides control of an IR source. Users can vary the modulation frequency or adjust the emitter current.

3.2 Scope of Delivery



1 IR Source
2 Emitter Board
3 Main Shield
4 Detector Board
5 USB Cable
6 Arduino Zero
7 Ribbon Cable

Fig. 3 Components of the PyrIQ Evaluation Kit

A detector is not included in the PyrIQ Evaluation Kit and needs to be obtained additionally, as costumers typically have specific preferences for an IR-filter combination.

4 Quick Start Guide

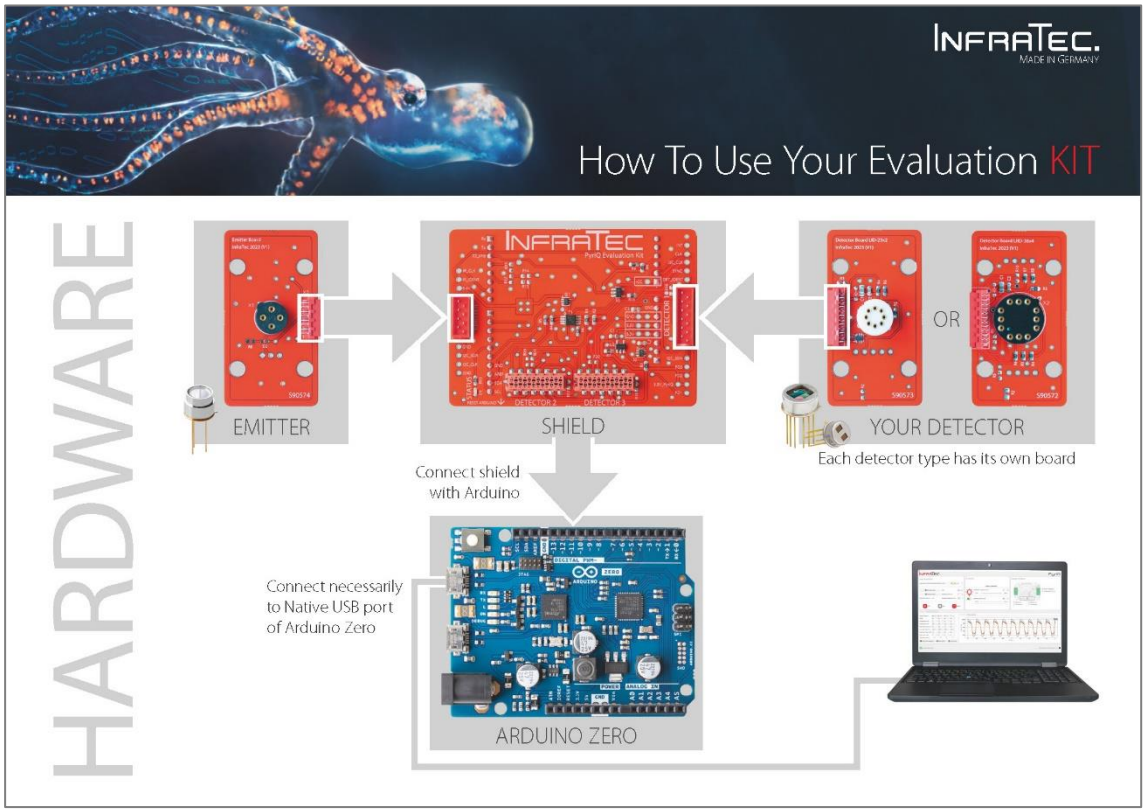


Fig. 4 Quick start guide – Page 1

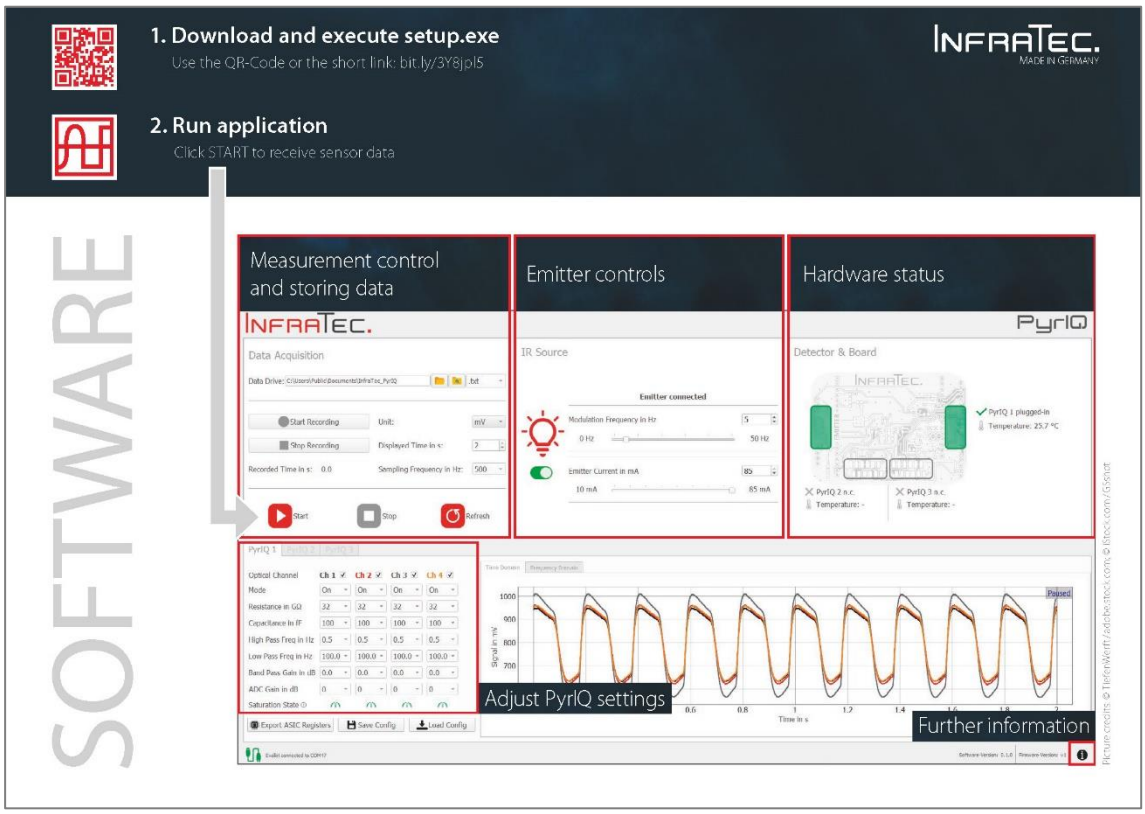


Fig. 5 Quick start guide – Page 2

5 Hardware

The evaluation kit can operate up to three PyrIQ detectors in parallel with the full bandwidth of 1,000 Hz sampling frequency.

The slot named *DETECTOR 1* is placed with a plug onto the main shield. In this way a PyrIQ detector in slot *DETECTOR 1* directly faces the IR source on the opposite side.

Fig. 6 shows how to assemble the PyrIQ Evaluation Kit under the use of slot *DETECTOR 1*.

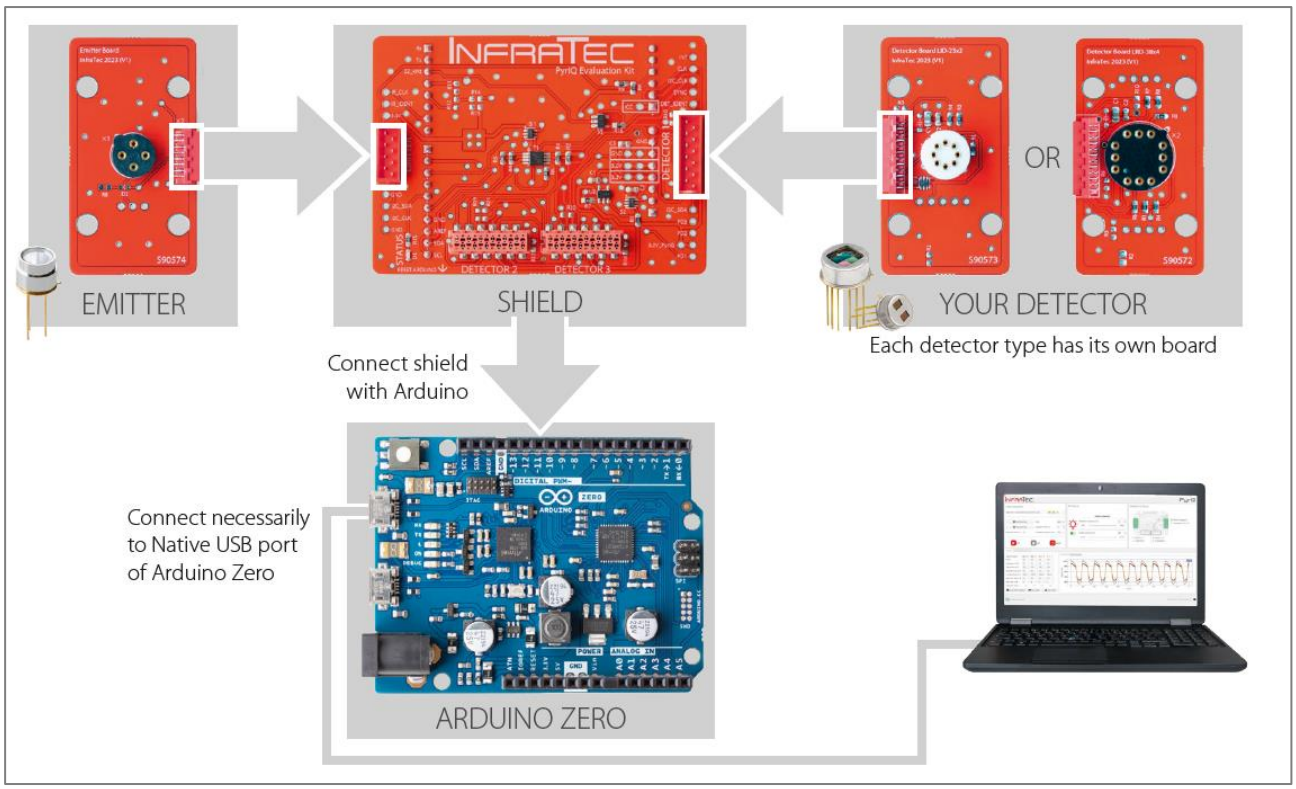


Fig. 6 Assembly of the PyrIQ Evaluation Kit

First you plug the IR source into the emitter board and the PyrIQ detector into the detector board. Please note that the PyrIQ detector itself is not part of the evaluation kit. Each PyrIQ detector type has its specific detector board. If you need a different detector board, you do not need to order a whole new evaluation kit. Instead, please order the respective detector board.

The next step is to plug the two boards into the corresponding connectors of the main shield which then is connected to the Arduino. Finally, you can connect the Arduino Zero to your computer. It is **important** to use the mini-USB connecter next to the reset button as described in the next chapter.

5.1 Arduino Zero - Used Port

The Arduino Zero offers two mini-USB ports as shown in Fig. 7. The ***Native USB Port*** next to the reset button is used to communicate with the evaluation kit software.

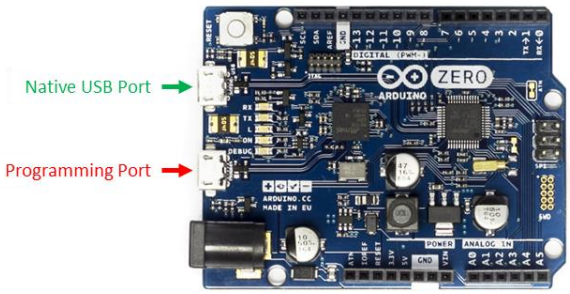


Fig. 7 Ports of the Arduino Zero

The *Programming Port* is used to flash the Arduino. The PyrIQ Evaluation Kit on the other hand uses the *Native USB Port*. This port is a real USB interface and offers a much higher bandwidth in comparison to the *Programming Port*.

If you connect the *Programming Port* instead of the *Native USB Port*, the software gives you the message shown in Fig. 8.

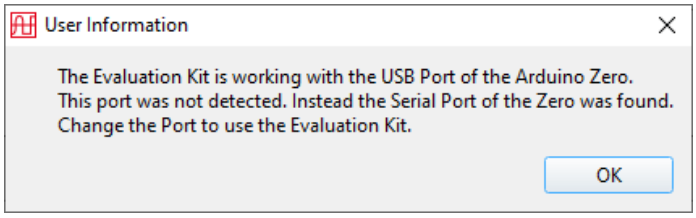


Fig. 8 Change port request when the Programming Port is connected instead of the Native USB Port

5.2 Ribbon Cable

The slots *DETECTOR 2* and *DETECTOR 3* offer a detector board connection via the included ribbon cable. By this, detector boards can be placed in a measurement system in a more flexible way (e.g., mounted to a gas cell, aligned on an optical bench facing an external/alternative IR source). An example setup is shown in Fig. 9.

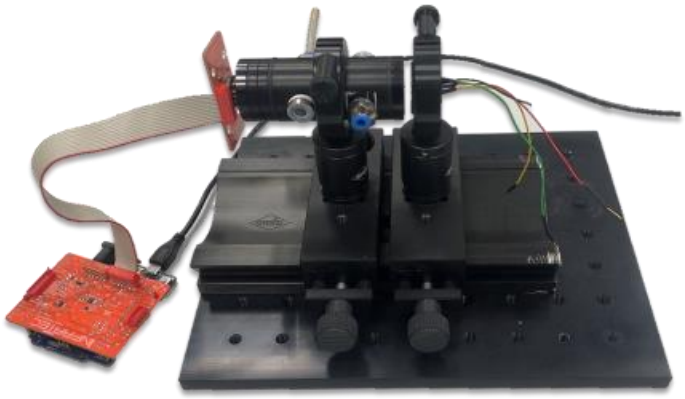


Fig. 9 Assembly with ribbon cable

5.3 Status LED

When you open the PyrIQ Evaluation Kit software and the evaluation kit is connected with the correct USB-connector to the computer the green status LED is lit as indicated in Fig. 10. This picture also shows the reset button of the Arduino which can be used to reset the whole hardware. Another reset option is the Refresh button of the software.

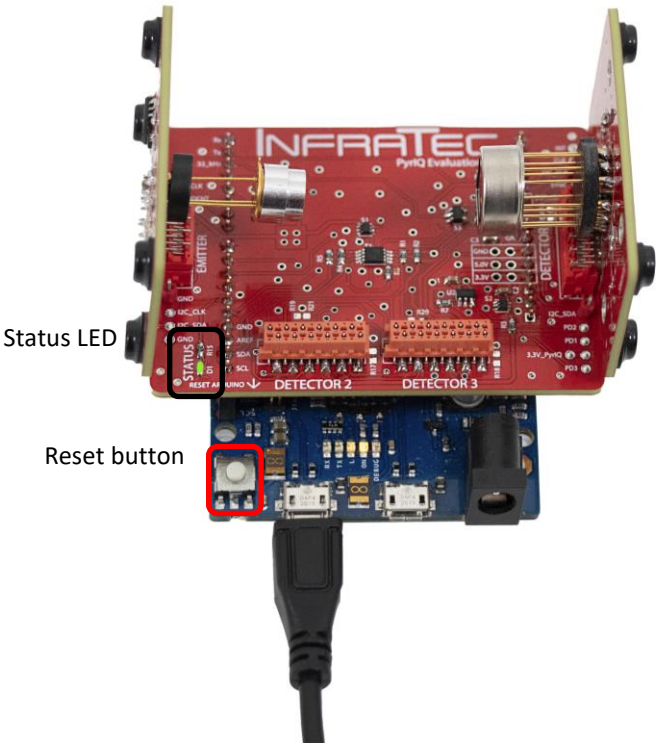


Fig. 10 Green status LED and reset button

5.4 Test Points

The main shield offers several test points at the sides of the PCB as shown in Fig. 11.

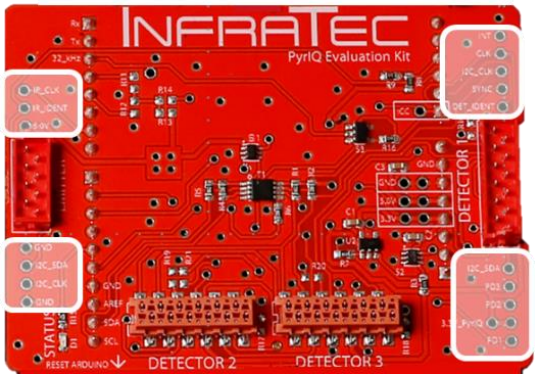


Fig. 11 Location of the test points at the main shield

The function of each test point is described in Table 1.

Pin Label	Description
IR_CLK	Clock of the IR source (see chapter 6.4.1 for more information)
IR_IDENT	Identification voltage of the emitter board
5.0V	Arduino Zero 5 V
GND	Ground
I2C_CLK	Clock line of the I^2C communication interface
I2C_SDA	Data line of the I^2C communication interface
INT	Interrupt pin of the PyrIQ detector
CLK	Clock pin of the PyrIQ detector (32 kHz)
SYNC	Sync pin of the PyrIQ detector
DET_IDENT	Identification voltage of detector board at slot *DETECTOR 1*
PD1	Power down pin of PyrIQ detector at slot *DETECTOR 1*
PD2	Power down pin of PyrIQ detector at slot *DETECTOR 2*
PD3	Power down pin of PyrIQ detector at slot *DETECTOR 3*
3.3V_PyrIQ	3.3 V supply the PyrIQ detector(s) operate with

Table 1: Test points and their function

5.5 Header Assignment

To attach the Detector- and Emitter-Board to the Main Shield the evaluation kit uses connectors from *TE Connectivity*. Fig. 12 and Fig. 13 show the assignment of these connectors and the manufacturer number.

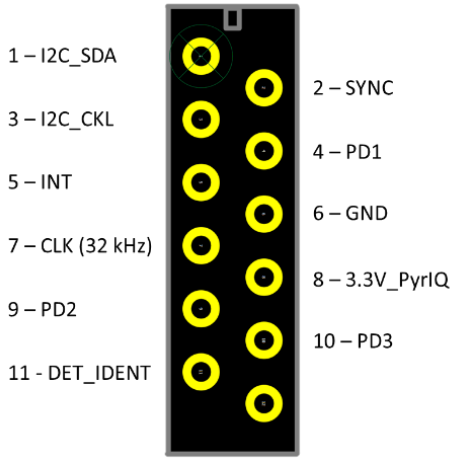


Fig. 12 Pin assignment of detector connector (manufacturer number *1-215464-2* from *TE Connectivity*)

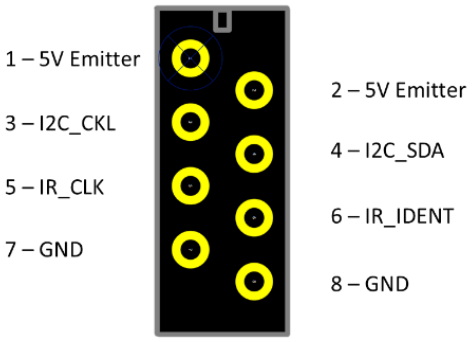


Fig. 13 Pin assignment emitter connector (manufacturer number *7-215464-8* from *TE Connectivity*)

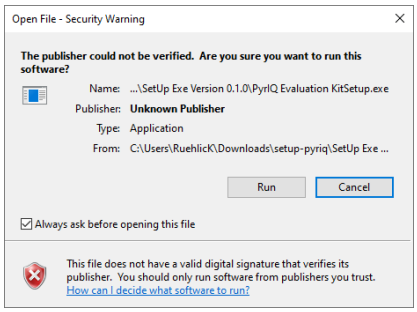
6 Software

After you have successfully assembled your PyrIQ Evaluation Kit, it is time to install the corresponding software which gives you direct and easy access to all PyrIQ parameters via an intuitive Graphical User Interface (GUI). In this chapter we explain where to download and how to install the PyrIQ Evaluation Kit software and walk you through the feature set of the GUI.

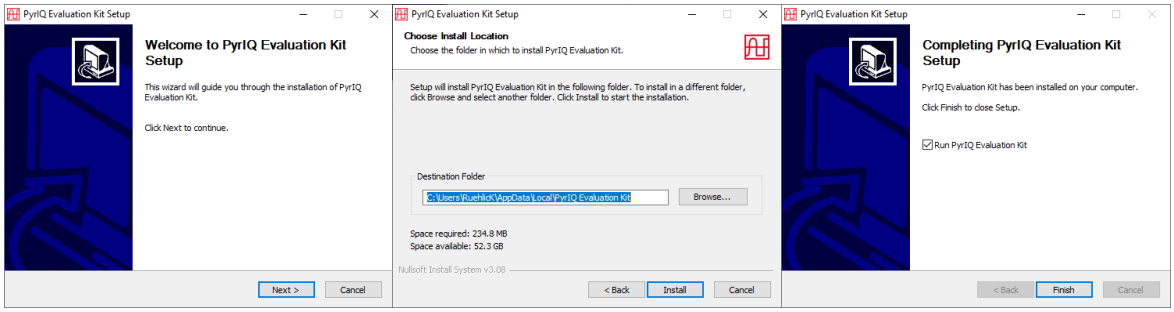
Our general advice on how to approach the software is: “Just try it out!”. You cannot choose a configuration where you damage the board or detector. In the worst case you might need to reset the hardware (e.g., via the restart button of the Arduino) and restart the PyrIQ Evaluation Kit software. **Tinkering is encouraged!**

6.1 Requirements, Installation & Launch

- The software is running on windows 10 and 11.
- Download the software from https://www.infratec.eu/sensor-division/pyriq-evaluation-kit-software/ (Short Link bit.ly/3Y8jpl5)
- Run the setup executable pyriq-evaluation-kitsetup.exe[1]



- After Clicking Run the Installation Wizard will guide you through the installation as shown below:



- Run the Software *PyrIQ Evaluation Kit*

[1] *Note:* The software of the evaluation kit is not code-signed. This means you get a notification when executing the setup exe. Click Run to proceed.

6.2 Overview of Graphical User Interface

In Fig. 14 you can see how the PyrIQ Evaluation Kit Graphical User Interface looks like.

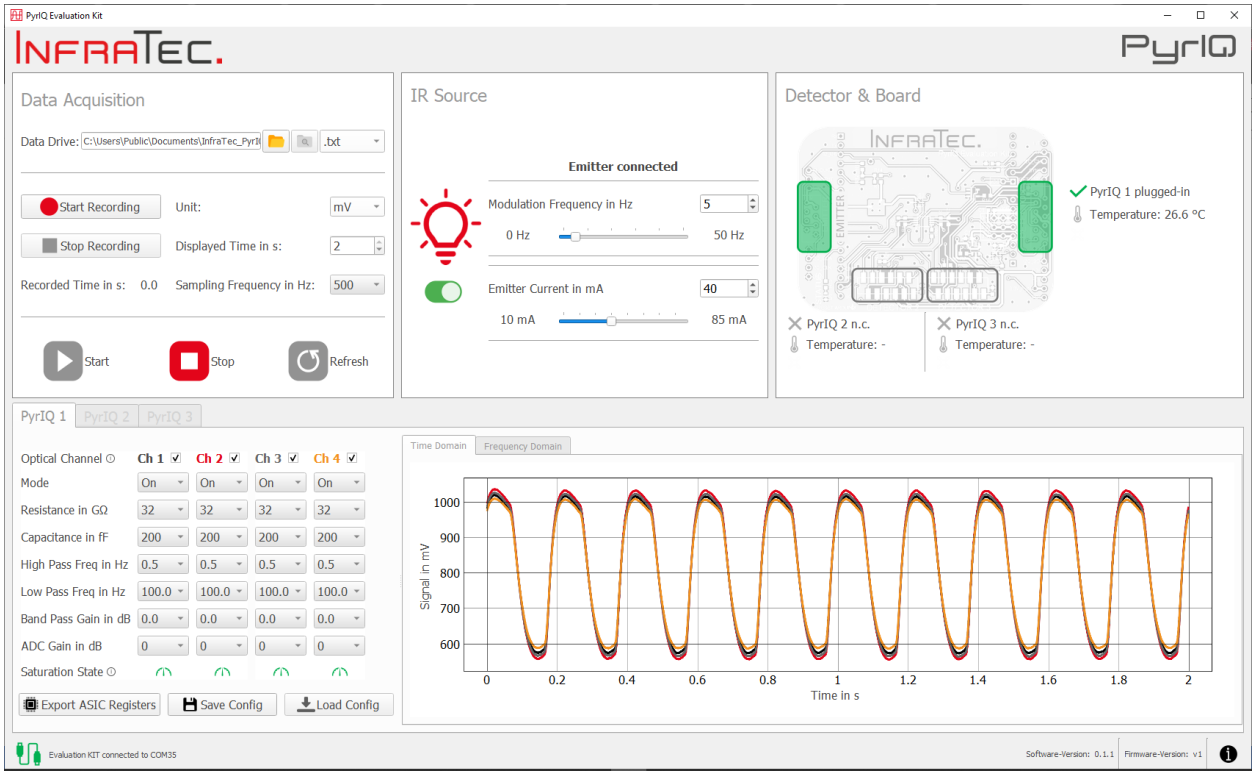


Fig. 14 GUI when data acquisition was started via Start-button in the “Data Acquisition” section

The GUI can be divided into the following blocks:

- Data Acquisition — Chapter 6.3 Measurement Control and Recording Data – page 14
- IR Source — Chapter 6.4 Emitter Controls for modulation frequency and current – page 16
- Detector & Board — Chapter 6.5 Hardware Status of connected emitter and detector boards – page 17
- PyrIQ 1/2/3 — Chapter 6.6 PyrIQ Configuration & Signals in time and frequency domain – page 20
- Status bar — Chapter 6.7 Evaluation KIT connection status and software/firmware version – page 24

6.3 Measurement Control and Recording Data

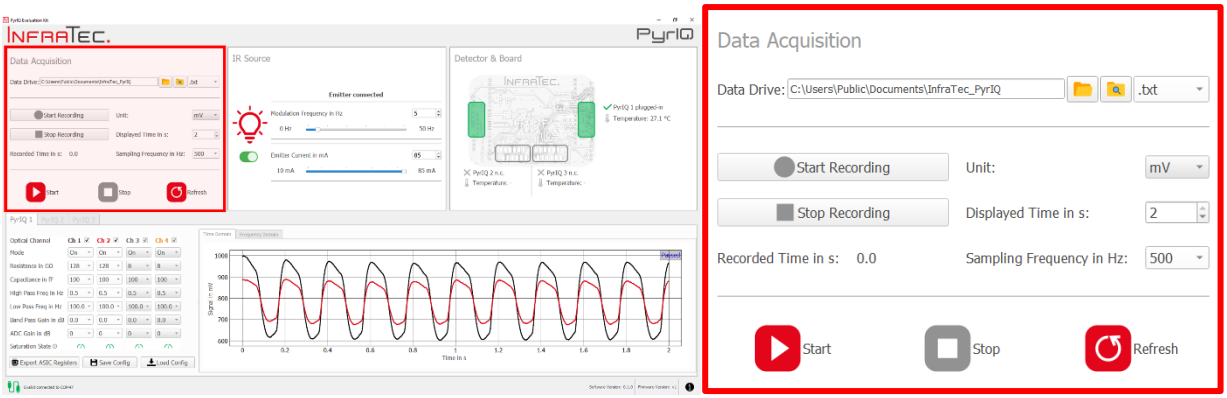


Fig. 15 GUI with highlighted “Data Acquisition” block

With the block shown in Fig. 15 you can start and stop the data acquisition, save the received data and adjust the sampling frequency as well as the displayed unit and time.

6.3.1 Data Acquisition

The Start button is only enabled when at least one detector is detected during the initialization phase (refer to chapter 6.5.1 for more information). To enforce a new initialization (e.g., when a new detector is connected to the main board), you can use the Refresh button or alternatively the reset button of the Arduino.

After pressing Start the received data are displayed in the plot area of the GUI (see chapter 6.6.6). To stop the measurement, you can use the Stop button.

6.3.2 Storage Location and Data File

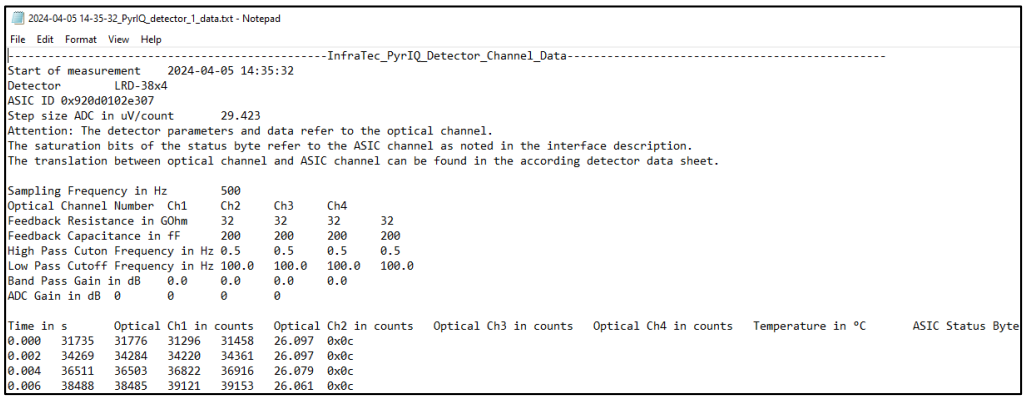
You can open an explorer window of the displayed data drive path by using the following button . If you want to change the default file location, click here .

You can also specify the file format in which the received detector data is saved via a drop-down list box .txt .

- In the *.txt-format you can record detector data for up to two hours.
- The *.parquet-format on the other hand has a maximum recording time of 24 hours.

If you want to record the received detector data, you can click Start Recording. During data acquisition, the GUI displays the recorded time in seconds. Every second the according new data is appended to the data file. To end the data acquisition use Stop Recording.

The data file is generated when the Start Recording button is pressed. Fig. 16 shows a typical data file.



2024-04-05 14-35-32_PyrIQ_detector_1_data.txt - Notepad

File Edit Format View Help

```
----------InfraTec_PyrIQ_Detector_Channel_Data----------
Start of measurement    2024-04-05 14:35:32
Detector        LRD-38x4
ASIC ID 0x920d0102e307
Step size ADC in uV/count       29.423
Attention: The detector parameters and data refer to the optical channel.
The saturation bits of the status byte refer to the ASIC channel as noted in the interface description.
The translation between optical channel and ASIC channel can be found in the according detector data sheet.

Sampling Frequency in Hz        500
Optical Channel Number  Ch1     Ch2     Ch3     Ch4
Feedback Resistance in GOhm     32      32      32      32
Feedback Capacitance in fF      200     200     200     200
High Pass Cuton Frequency in Hz 0.5     0.5     0.5     0.5
Low Pass Cutoff Frequency in Hz 100.0   100.0   100.0   100.0
Band Pass Gain in dB    0.0     0.0     0.0     0.0
ADC Gain in dB  0       0       0       0

Time in s       Optical Ch1 in counts   Optical Ch2 in counts   Optical Ch3 in counts   Optical Ch4 in counts   Temperature in °C       ASIC Status Byte
0.000   31735   31776   31296   31458   26.097  0x0c
0.002   34269   34284   34220   34361   26.097  0x0c
0.004   36511   36503   36822   36916   26.079  0x0c
0.006   38488   38485   39121   39153   26.061  0x0c
```

Fig. 16 Typical data file

As mentioned before, it is possible that the ASIC channel numbering and optical channel numbering differ. The channel listed in the data file refers to the optical channel. If the software detects a two-channel detector board only the two used optical channel will be output in the file. When building your own set-up, keep in mind that the used ASIC has four input channels and therefore you can also readout data from four channels.

The status byte provides four bits which are set when the according ASIC channel is saturated. The bits SAT1…4 refer to the ASIC channel as underlined by the snippet from the register map in Fig. 17.

Register-ID	Address	Mode	Bit position							
			Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
STATUS	0x00	R	SAT4	SAT3	SAT2	SAT1	OTP_SEQ [3:2]		OVW	INT

Fig. 17 Status byte from the register map

These saturation bits are not ordered by the software and still refer to the ASIC channel

Here a short example:
Status byte = 0x8c = 0b 1000 1100
This means that ASIC channel four fulfills the saturation condition. With the default LID-23x2 detector ASIC channel four refers to optical channel one (refer to Fig. 1). This means that the signal of optical channel one is saturated.

6.3.3 Sampling Frequency, Displayed Unit and Time

PyrIQ detectors offer four different sampling rates as shown in Table 2. You can adjust the sampling frequency of the PyrIQ detector and consequently the data acquisition rate by using the according box. The default value is 500 Hz.

Sampling Rate	**Output** {x} = Value of Frame x							
@1 kHz	{1}	{2}	{3}	{4}	{5}	{6}	{7}	{8}
@ 500 Hz	avg ({1}, {2})		avg ({3}, {4})		avg ({5}, {6})		avg ({7}, {8})	
@ 250 Hz	avg ({1}, {2}, {3}, {4})				avg ({5}, {6}, {7}, {8})			
@ 125 Hz	avg ({1}, {2}, {3}, {4}, {5}, {6}, {7}, {8})							

Table 2: Effect of the selected sampling rate to the output value

In PyrIQ detectors the analog signal conditioning is followed by digitization. Signal levels are presented as dimensionless counts. With formula (1) the digital signal values can be converted back to the corresponding voltages.

$$U_{Volt} = 0.8\,V - (32{,}768 - Counts) \cdot U_{LSB} \qquad (1)$$

Here, U_{Volt} represents the signal in volts, Counts is the digital signal and U_{LSB} denotes the least significant bit voltage, which is 29.423 µV. The internal reference voltage of the analog front-end is 1.6 V. This yields in the offset of 0.8 V.

The displayed unit of the received data can be changed during data acquisition with this box mV (the default setting is mV).

You can alter the displayed time span of the visualized live data between one and two seconds 2. The live signal is also displayed in the frequency domain in the according tab (see chapter 6.6.6 for more). Keep in mind that the frequency resolution is affected by the length of the signal used for the transformation into the frequency domain. With 1 s you get a resolution of Δf = 1/1 s = 1 Hz whereas with 2 s you get a finer resolution of Δf = 1/2 s = 0.5 Hz.

6.4 Emitter Controls

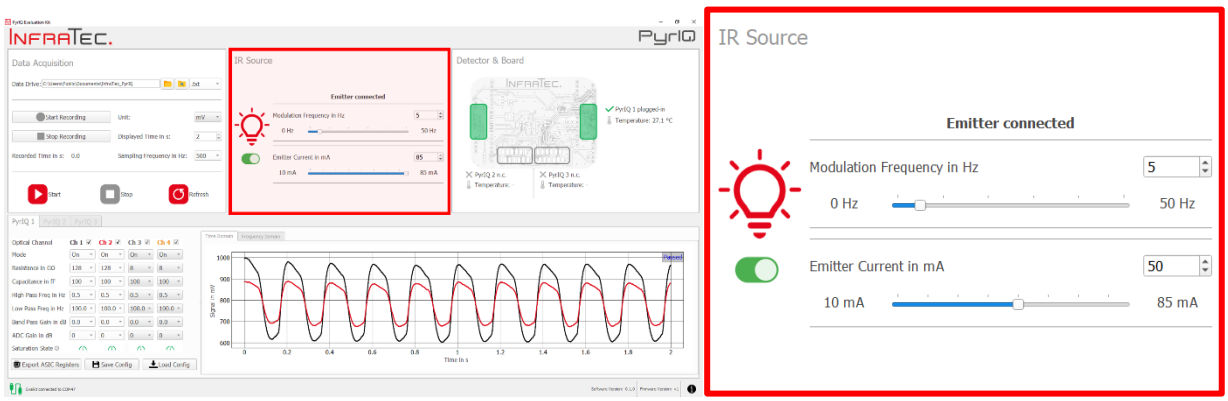


Fig. 18 GUI with highlighted “IR Source” block

The PyrIQ Evaluation Kit is shipped with an IR source. The kit automatically detects if an emitter board is connected. When the IR source is connected you can adjust the modulation frequency, the emitter current and turn the emitter on & off with this button. The modulation frequency and the emitter current can be changed at any time – either before/after or even during data acquisition (when the data recording is not running).

6.4.1 Modulation Frequency

The modulation frequency of the emitter can be set via a slider or spinbox 5 from 0 Hz, i.e., unmodulated permanently turned-on operation up to 50 Hz. To directly switch to the minimum (0 Hz) or maximum (50 Hz) modulation frequency you can click the respective labels next to the slider.

6.4.2 Emitter Current

With a disconnected emitter as shown in Fig. 19 the IR source current cannot be changed. The frequency can still be adjusted because you may want to use the TTL output at the pin *IR_CLK* as a trigger signal, e.g., for external choppers or IR sources.

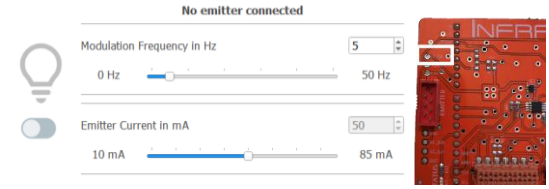


Fig. 19 GUI – IR source block when no emitter is connected (left). Highlighted IR_CLK pin at evaluation kit (right).

The emitter current is supplied at 5 V.[2] Therefore, at 85 mA a maximum resistance of 5 V / 85 mA = 60 Ω is feasible for the IR source. For higher resistances the selected 85 mA cannot be provided.

6.5 Hardware Status

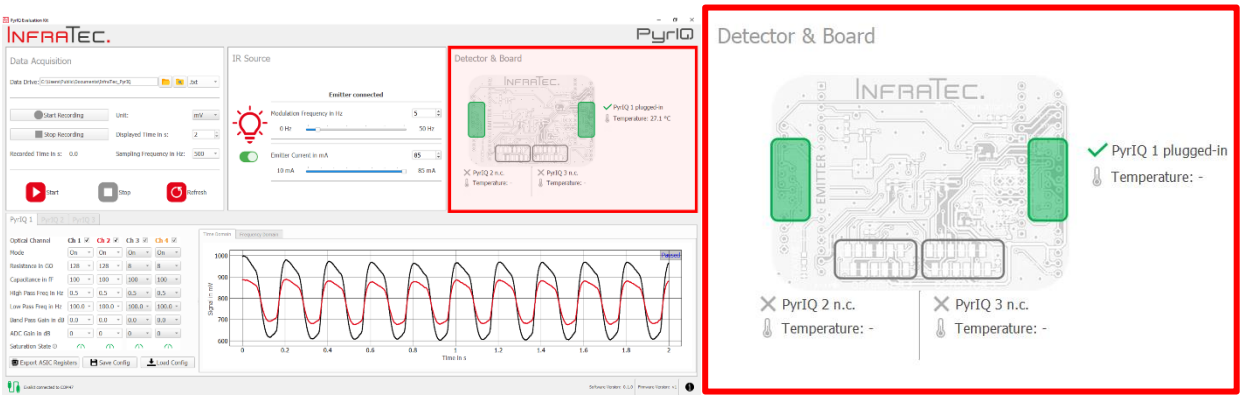


Fig. 20 GUI with highlighted “Detector & Board” block

When properly connected, the evaluation kit is identified automatically by the software. During hardware detection, the software enters an initialization phase as shown in the popup window in Fig. 21.

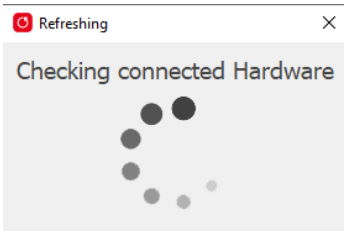


Fig. 21 Popup window during initialization phase

6.5.1 Initialization

A new initialization may be necessary when you disconnected the emitter or one of the detectors. In this case, please use either the Refresh button or the reset button of the Arduino.

During the initialization phase the following is checked:

- Is an emitter board connected?[3]
- Is a detector connected?
- What type of PyrIQ detector is connected?
  - e.g.: LID-23x2 or LRD-38x4

[2] The evaluation kit is powered via the USB connection. The supply voltage for the emitter is dependent on the voltage of the USB connection which is 5 V ± 5%.

[3] The system only detects the board, but not the IR source itself.

The results are displayed in the “Detector & Board” block. Two examples are shown below:

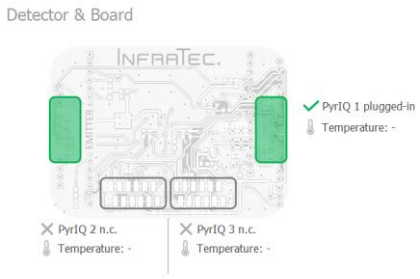


Fig. 22 Connected detector at slot PyrIQ 1 and connected emitter board

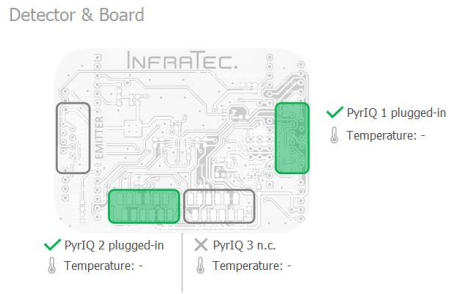


Fig. 23 Connected detector at slot PyrIQ 1 & PyrIQ 2 and disconnected emitter board

6.5.2 Hardware Changes

It is recommended to make any adjustments on the electrical assembly of the evaluation kit only if the Arduino Zero is unpowered. This precaution ensures that, following hardware changes, the software automatically triggers a new initialization phase, thereby ensuring that the software accurately reflects the connected hardware.

Unexpected behavior may occur if hardware changes are made after the software has been initialized. For instance, if the emitter is disconnected after being detected during initialization, no critical issues will arise. The only noticeable effect will be that the detector signals will not respond to modified emitter parameters, such as changes in current or frequency.

When the detector state changes the following implications can arise:

- If an additional detector is connected to the main shield, the signals of the already connected detectors will be distorted as show in Fig. 24[4].

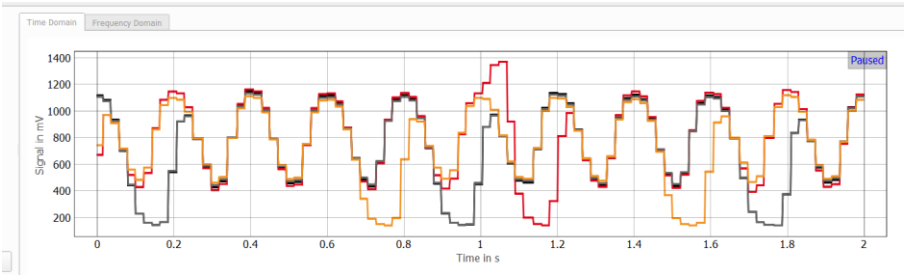


Fig. 24 Distorted signals due to additional connected detector after initialization

- If a detector is disconnected after being recognized during the initialization phase, pressing the Start button will prompt the software to display the error message shown in Fig. 25.

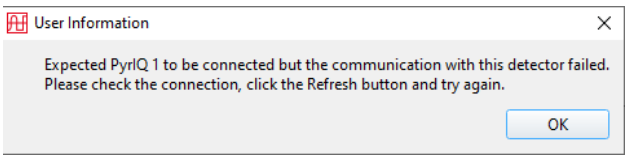


Fig. 25 Message when connection to PyrIQ Detector 1 is lost before DAQ

[4] This occurs because the newly connected detector operates with the default system configuration, causing it to output the internal 32 kHz clock. Consequently, the clock of this detector conflicts with the 32 kHz clock provided by the microcontroller for the correctly initialized detectors.

- A similar scenario occurs if a previously initialized detector is disconnected during the data acquisition. In this case, the user information shown Fig. 26 will appear.

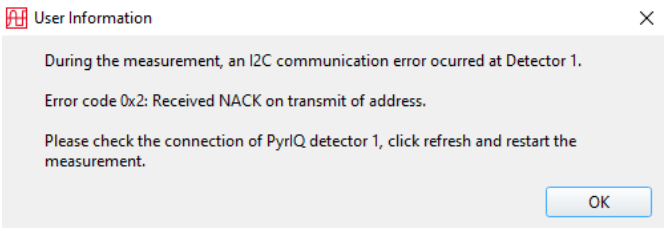


Fig. 26 Message when connection to PyrIQ Detector 1 is lost during DAQ

To resolve unexpected hardware changes as described above, simply click the Refresh button or restart the software.

6.5.3 Temperature

PyrIQ detectors feature a built-in temperature sensor which samples the temperature synchronous with the pyroelectric signal. This temperature data is transmitted to the software, which calculates and displays the one-second averaged temperature value for each individual PyrIQ detector as shown in Fig. 27.

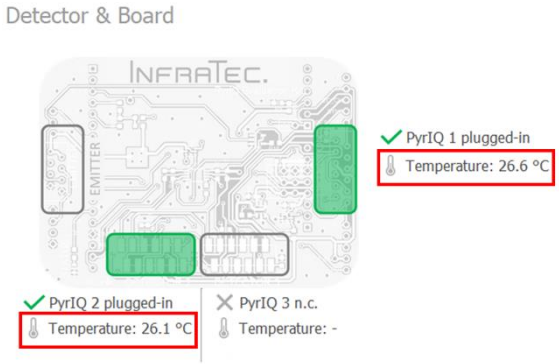


Fig. 27 Temperature value of the detectors in the GUI

6.5.4 ASIC-ID

Each PyrIQ detector is assigned a unique ASIC serial identification number, a six-byte-long ASIC-ID that can be retrieved from the software. Simply hover over the corresponding PyrIQ slot in the GUI, as shown in Fig. 28.

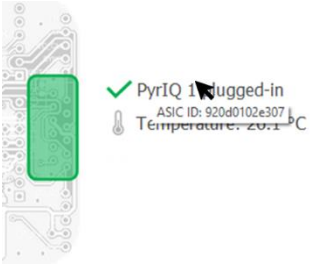


Fig. 28 Hex ASIC-ID (here 0x920d0102e307)

6.6 PyrIQ Configuration & Signals

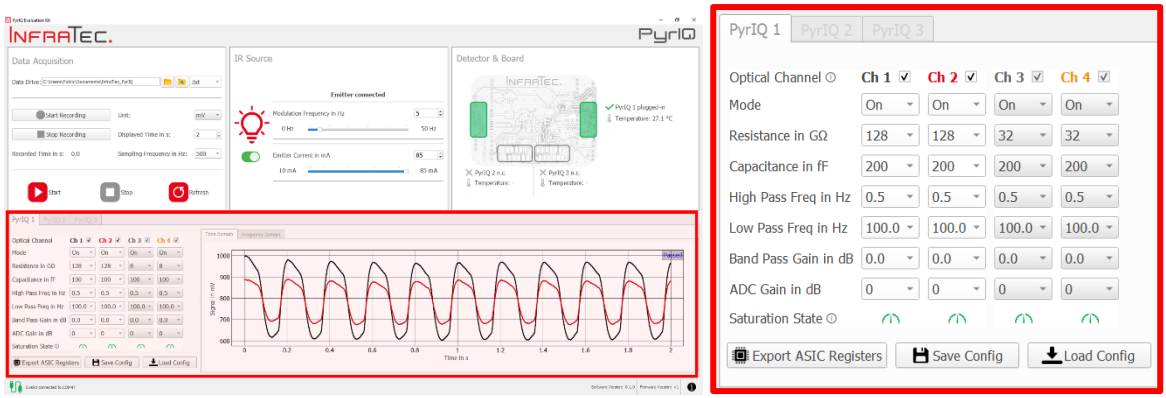


Fig. 29 GUI with highlighted “PyrIQ Configuration & Signals” block

One main advantage of InfraTec’s PyrIQ detectors is the flexible signal conditioning. The electrical amplification and filtering can be adjusted per channel affecting key sensor performance parameters such as responsivity, noise and signal-to-noise ratio.

6.6.1 Parameters

The left part of Fig. 30 shows all parameters which can be adjusted according to your needs. Simply click on a parameter and the GUI will show all available values, as demonstrated in Fig. 30 for the feedback resistance.

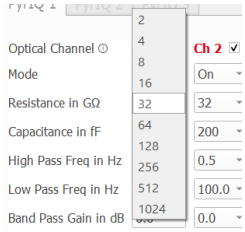


Fig. 30 Available feedback resistances for PyrIQ detectors

If you want to learn more about the effect of each individual PyrIQ parameter and general best-practice strategies, check out the PyrIQ website (bit.ly/3Y8jpl5) where you can receive the white paper “Configuration of Your PyrIQ Detector” upon request.

As mentioned in the previous chapter 6.5, the evaluation kit does check the PyrIQ detector type connected to the main shield. If a two-channel detector such as the LID-23x2 is identified, only the active optical channel 1 & 2 can be adjusted. Moreover, the GUI only enables the tab with the corresponding PyrIQ number when the respective detector slot is recognized during the initialization phase (see chapter 6.5 for more information).

Please note that all adjustable parameters can be changed even when the data acquisition is running. This feature makes it very easy to explore the effect of each detector parameter. However, once the received detector data are stored via the Start Recording button, the detector parameter boxes are disabled, and PyrIQ parameters cannot be altered.

6.6.2 Optical Channel vs. ASIC Channel

If you hover with your mouse over the Optical Channel label, the translation between optical channel and ASIC channel is displayed, as shown in Table 3.

ASIC Channel	ASIC Register Address	Optical Channel	
		LID-23x2	LRD-38x4
1	0x01 – 0x02	2	4
2	0x03 – 0x04	-	1
3	0x05 – 0x06	-	2
4	0x07 – 0x08	1	3

Table 3: Mapping between ASIC- and optical channel for default LID-23x2 and LRD-38x4 detectors

The displayed channel numbers (Ch1…Ch4) within the GUI refer to the optical channel of the detector. When integrating the PyrIQ detector into your own measurement system, it is important to note that the ASIC channel numbering and optical channel numbering can differ. The evaluation kit software assumes – based on its automatic PyrIQ detector recognition step – that your detector has the default mapping of optical and ASIC channel as shown in Table 3. This mapping is retrieved by the software after startup from the according JSON file inside the installation folder (e.g., …*PyrIQ Evaluation Kit**config*).[5]

The channel assignment of your PyrIQ detector can be found on the detector's data sheet.

6.6.3 Saturation

Due to conditions such as external mechanical or thermal shocks, the generated current of the pyroelectric material can significant, leading to saturation of the transimpedance amplifier (TIA) in the analog frontend. With an unfavorable filter configuration, the recovery time may take seconds. To address this, a fast reset circuit is implemented in the ASIC to shorten the recovery time.

When the output of the TIA is saturated, or the ADC is outside its usual operating range (~0.15…1.4 V) for a minimum of 128 clock cycles (4 ms), the fast reset circuit is triggered. It remains active for 2048 clock cycles (64 ms) after the saturation event has ended.

The Saturation State is indicated as follows in the GUI: (saturated) (unsaturated)

6.6.4 Export ASIC Register

To apply the different available detector parameters, the microcontroller needs to write the according byte(s) to the register map of the ASIC. The register map is part of the *Interface Description* of our PyrIQ detectors and can be downloaded from the same website (bit.ly/3Y8jpl5) as the software.

The feature Export ASIC Registers can help you to understand how the configured parameters from the GUI translate to the bytes written to the register map.

By clicking the button, you save the register map with the currently selected detector parameters of the according PyrIQ to the data drive specified in the Data Acquisition block (see chapter 6.3 for more information). You will receive a similar message as shown in Fig. 31, depending on your specified data path (see chapter 6.3.2).

[5] For LID-23x2 detectors the file *LID-23x2.json* is used and for LRD-38x4 detectors the file *LRD-38x4.json*.

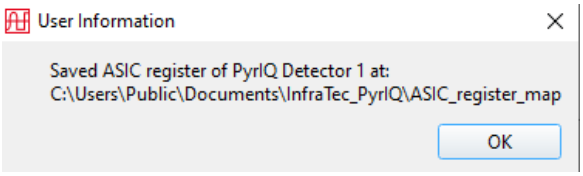


Fig. 31 Message after saving the register map of PyrIQ Detector 1

Inside the shown folder, you can find a text file containing the hex values of the different registers. It is important to note that the register map refers to the ASIC channel, which may differ from the optical channel of the detector (see section 6.6.2).

For instance, considering the default mapping between ASIC- and optical channel of the LRD-38x4 detectors, ASIC channel one corresponds with optical channel four (see Table 3). Table 4 provides an example of how the register *S1_CFGa* of ASIC channel one behaves for two different parameter sets of optical channel four.

Register-ID	Address	Register value	Meaning
S1_CFGa	0x0b	0x22 = 0b0010 0010	Optical Channel ⓘ Ch 4 ☑ Mode On Resistance in GΩ 32 Capacitance in fF 200
S1_CFGa	0x0b	0x06 = 0b000 0110	Optical Channel ⓘ Ch 4 ☑ Mode On Resistance in GΩ 2 Capacitance in fF 3200

Table 4: Register value of S1_CFGa for LRD-38x4 detectors when optical Ch4 is configured with 32GΩ||200fF and 2GΩ||3200fF

6.6.5 Save and Load Configuration

If you have found a parameter set that works for your PyrIQ detector and application, it can be useful to save this configuration. Therefore, you can use the option Save Config. This saves the current configuration in the according folder, which is shown after the button is pressed:

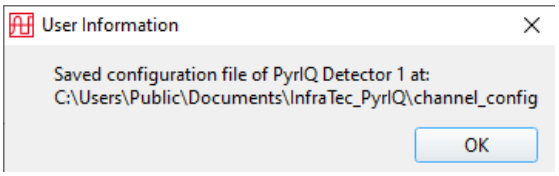


Fig. 32 Message after saving the parameter set of PyrIQ Detector 1

You can use the saved configuration later by clicking the button Load Config. Please note that this option is only available when the data acquisition is not running. After pressing the button, you can choose a saved configuration file in the opened windows explorer. Upon confirming the load process (Fig. 33) the corresponding configuration is adopted.

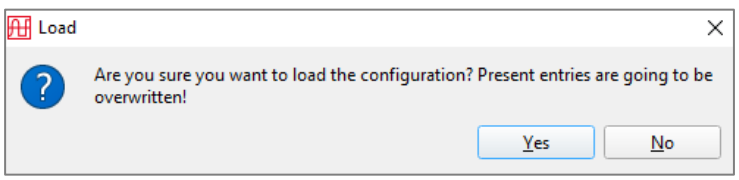


Fig. 33 Message after loading and selecting a specific configuration

6.6.6 Live Signal and Graph Options

When the data acquisition is running, the retrieved sensor data are displayed next to the parameter block. The displayed live graph is automatically adjusted to the data. Using the mouse, you can modify the diagram boundaries by scrolling or by pressed right click or pressed left click. If you want to go back to the default automatic mode, you can use the small automatic symbol A that appears when you hover your mouse over the graph area, as highlighted in Fig. 34.

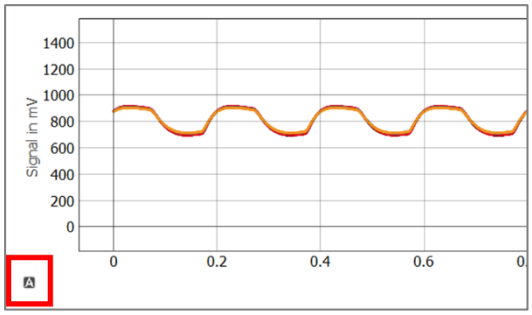


Fig. 34 Live graph with highlighted automatic button

As described in chapter 6.5.1, the evaluation kit automatically identifies the connected detector type. The graph correspondingly shows only the active optical channels of the according detector. You can hide and show the different sensor signals by using the checkboxes next to the channel number as shown in Fig. 35.

Fig. 35 Optical Ch1 is hidden and Ch2 is displayed.

When using pyroelectric detectors, it must be noted that they only provide a signal in the event of temperature changes. In gas sensing applications, this can be ensured by modulating the incident IR radiation. The modulated IR radiation causes the modulation frequency to be imprinted on the electrical measuring signal. The characterization of the measured values can be carried out particularly easily and clearly in the frequency domain. Therefore, the frequency domain is also displayed in the corresponding tab.

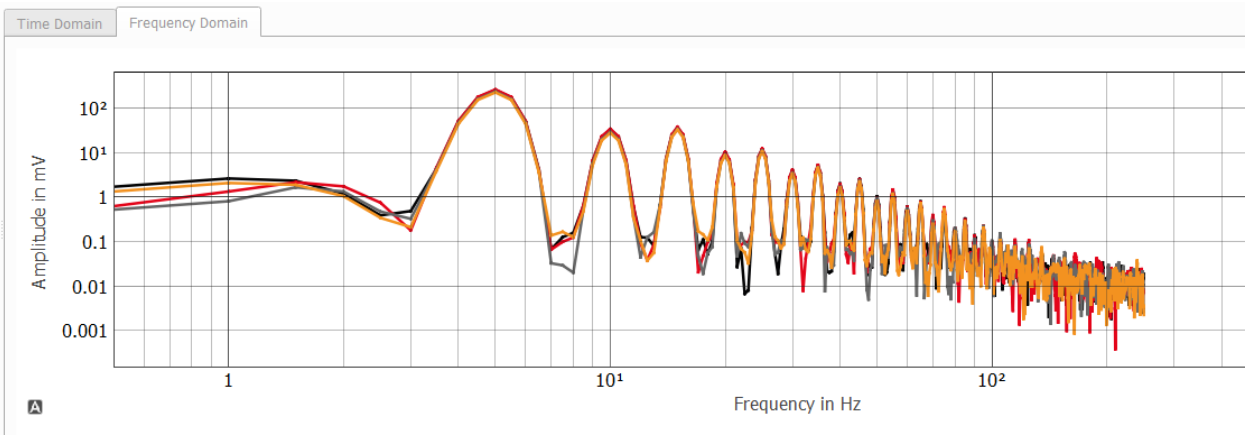


Fig. 36 Signal displayed in the frequency domain with a modulation frequency of 5 Hz

6.7 Status Bar

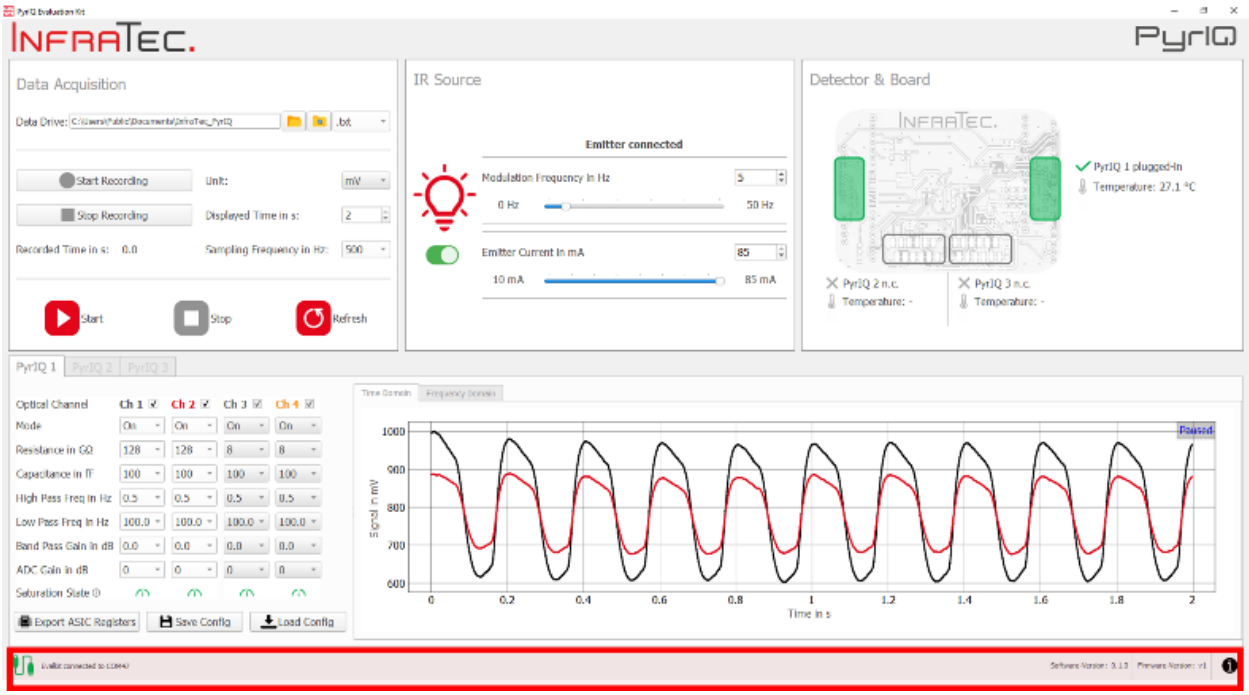


Fig. 37 GUI with highlighted status bar

Table 5 explains the different items which can be found in the status bar.

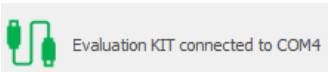
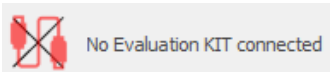
Connection Status	Shows if an evaluation kit is connected or not	 
Software Version	Version of the current software	
Firmware Version	Firmware version of the connected evaluation kit	
Further Information	Button to open a window with additional information	

Table 5: Items from the status bar

6.8 Further Information Window

Clicking on the ❶ icon opens the window shown in Fig. 38.

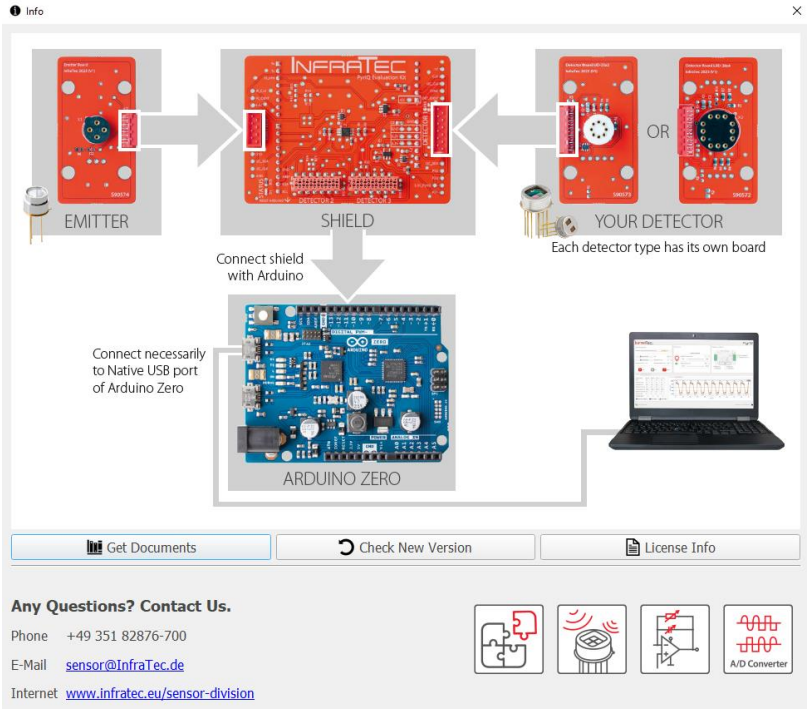


Fig. 38 Further information window

The information window instructs on how to assemble the PyrIQ Evaluation Kit under the use of slot *DETECTOR 1*. Moreover, you can click on the Get Documents or Check New Version button to visit our website. Here you can download the latest software version or find additional documents as the *PyrIQ Interface Description*. The button License Info allows you to access the license file of the software.

For further questions, please use the provided contact data!

6.9 New Software Version

As mentioned in chapter 6.8, you can download the latest software version from the corresponding website. Check out the Release Notes to review changes or enhancements of the different software versions. Before installing a new software version, ensure that your firmware version (see section 6.7) is compatible with the according software version.

Description	Type	Version	Download	Further Information
PyrIQ Evaluation Kit (exe)	PC Software	0.1.1	Download current version	Release notes

Fig. 39 Release Notes