IQS325 User Guide

The user guide introduces the development tools available for the product and guides the setup of certain key elements.

Contents

1 Introduction

This document provides an overview of the graphical user interface (GUI) for the IQS325 Debug and Display software. The GUI can be used to configure the IQS325 for a specific application and evaluate its performance in real time. This document uses the IQS325EV02 Evaluation (EV) kit, shown below in Figure 1.1, as an example and thus does not cover all applications. Instead, it aims to equip users with the knowledge needed for configuring, debugging, data logging, and header file export using the GUI software to address their unique applications. For guidelines on the hardware and electrode design, please refer to the appropriate application notes. For IC-specific information, operation, and memory map details, please refer to the IQS325 Datasheet.

Figure 1.1: IQS325EV02 EV kit

2 Getting Started

This section describes the process of initial device set-up prior to application-specific tuning.

2.1 Step 1: GUI Software Installation

Download and install the Azoteq IQS325 GUI PC Software from the Azoteq website under the Software and Tools page. Extract the downloaded zip file, follow the installation wizard procedure, and afterwards launch the software executable program. The following window should appear:

Figure 2.1: Main Window of the Azoteq IQS325 GUI

2.2 Step 2: Hardware Connections

Connect the DS200 to your PC, using a standard type-C cable. The device under test (DUT), being either an IQS325EV02 EV kit or an application PCBA, can be interfaced with a suitable 10-to-10 pin ribbon cable connection (or application-specific connections), as shown in Figure 2.2 below.

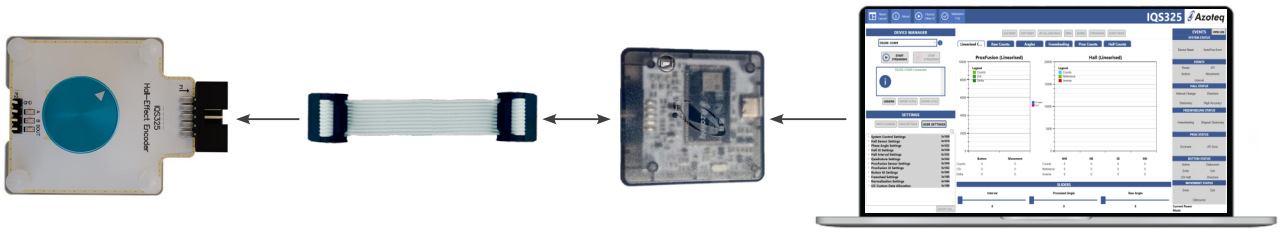


Figure 2.2: DS200 Connection for Streaming and Testing

Note: The CT210A can be used instead of the DS200, along with a standard USB-micro data cable and a suitable 20-to-10 pin ribbon cable connection, as shown in Figure 2.3 below.

Figure 2.3: CT210A Connection for Streaming and Testing

If a custom cable or hardware is used, the required connections are shown in Table 2.1 and Figure 2.4 below.

Table 2.1: DS200 Pin-out

IQS Pins	DS200 Pins
GND	Pin 1
VDD	Pin 3
SDA	Pin 7
SCL	Pin 9
RDY	Pin 10

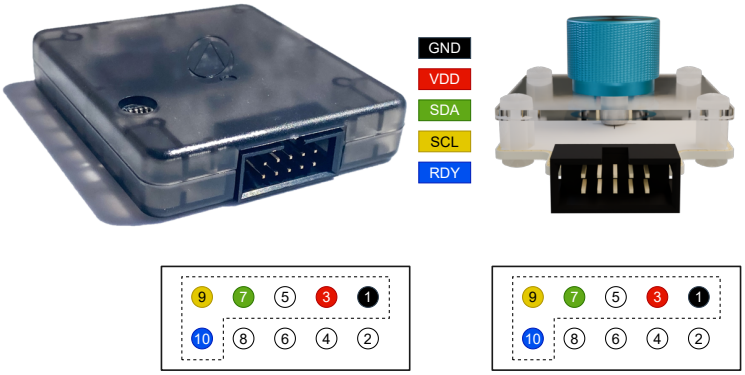


Figure 2.4: DS200 Power, I²C and RDY Connections

2.3 Step 3: PC Connection Verification

After connecting the DS200 device to the computer, the GUI software will automatically install any necessary drivers. It will then verify its connection and firmware, displaying a 'Device Connected' message in the configuration tool manager section, as shown in the red block in Figure 2.5.

Figure 2.5: DS200 Recognition and Connection

Note: If the connected DS200 device firmware is out of date, an 'Update available' button should automatically appear next to the device enumeration. Click this button to launch the Azoteq firmware upgrade tool and update the firmware, as shown in Figure 2.6.

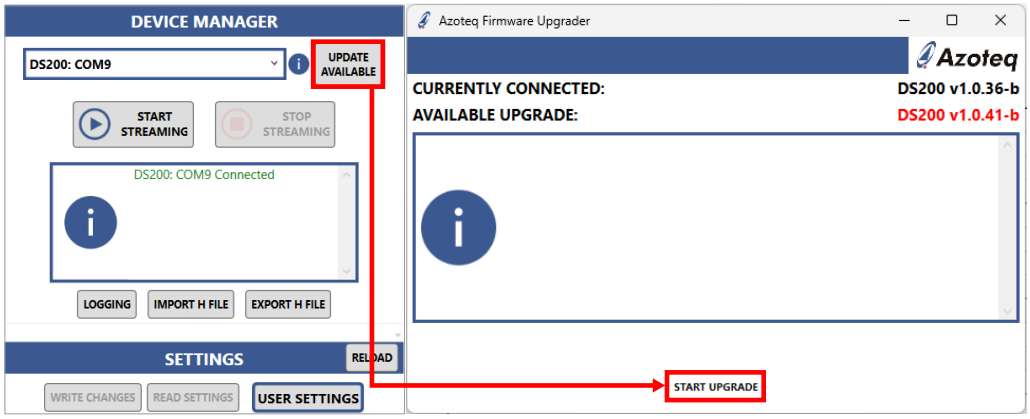


Figure 2.6: DS200 Firmware Upgrade

2.4 Step 4: Initiate IQS325 Communication (Streaming)

Click on 'START STREAMING' to initiate communications with the IQS325. Additional messages will appear and will provide the following information:

- Power status
- I^2C address
- Device version information
- Settings and streaming confirmations or errors, as applicable

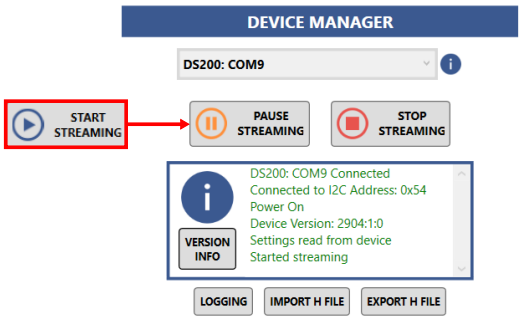


Figure 2.7: Message Dialogue Results from a Successful IQS325 Connection

If an error is displayed, please ensure that the device is properly connected and that the IQS325's product and version numbers were verified successfully.

2.5 Step 5: Acknowledge Reset and Streaming Mode

Click on the red text button 'ACK RESET' to clear the reset event flag. The text 'ACK RESET' should change colour to black, indicating successful reset acknowledgement, and should remain so thereafter.

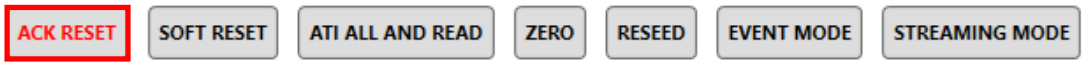


Figure 2.8: ACK Reset Button

Click the 'STREAMING MODE' to enter I^2C streaming mode.

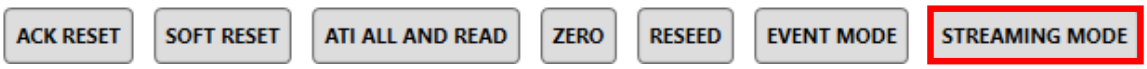


Figure 2.9: Enable Streaming Button

The IQS325 will now stream all sensor data, as shown in Figure 2.10. The counts for the various channels should change as the control knob is rotated.

Figure 2.10: IQS325 Streaming

2.6 Step 6: User Settings

When using the standard IQS325 EV kit hardware (AZP1484A2), one can simply open the ‘USER SETTINGS’ window, navigate to the first tab named ‘EV Kit Module’, and click on the image button of the kit to apply the predefined configuration settings for the demo. Refer to Figure 2.11.

The device may now be configured further by selecting the ‘USER SETTINGS’ button to open the pop-up window with settings organized in menu tabs.

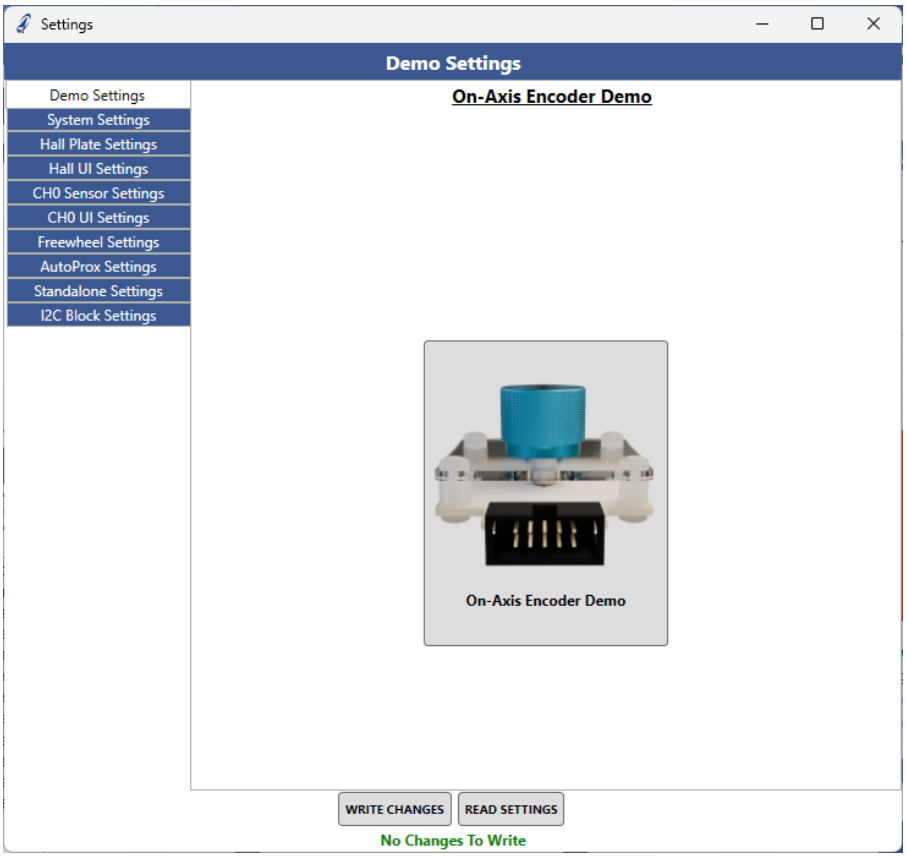


Figure 2.11: User Settings

3 IQS325 Debug and Display Software Overview

This section briefly explains the GUI elements such as the sensor graphs, device events, and commands, as well as some additional core functionality such as data logging and exporting of device settings.

3.1 IQS325 Streaming Data

The IQS325 GUI displays all the streaming data in the graph panel in the centre of the GUI. The default graph view is the bar graph, which plots the instantaneous counts of each channel. There are additional scope views that plot additional information over time. These are explained later in this document, where relevant.

Figure 3.1: Streaming Graphs

The graph views can be manipulated with the following controls:

- Scroll wheel to zoom in and out.
- Hold and drag middle-mouse button to zoom to a bounding box.
- Hold and drag right-mouse button to pan.
- Double left-click to reset the graph view.

3.1.1 Counts

The IQS325 has five channels in total; one ProxFusion® (or “touch”) channel with a “Button” UI and “Movement” UI, and four “Hall” channels, one for each of the Hall plates in the IC. The “counts” of a channel is a representation of the signal strength measured by the sensor. Specifically on the IQS325,

the counts displayed in the default bar graph view are not the raw charge transfer measurements, but are instead “Linearised Counts” which are derived from the Raw Counts as:

$$\text{Linearised Counts} = \frac{3276750}{\text{Raw Counts}}.$$

The raw counts of each channel may be viewed in the ‘Raw Counts’ tab. However, all on-chip processing makes use of the linearised counts.

Note: All the signals recorded in the graphs and sliders are read directly from the IC. For more information regarding the register map, please consult the IQS325 datasheet.

3.1.2 ProxFusion Channel

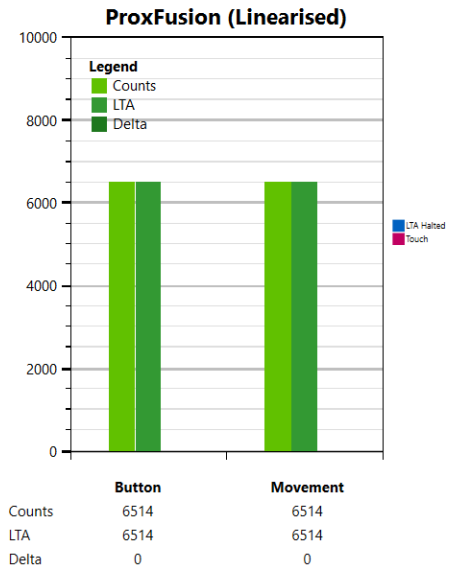


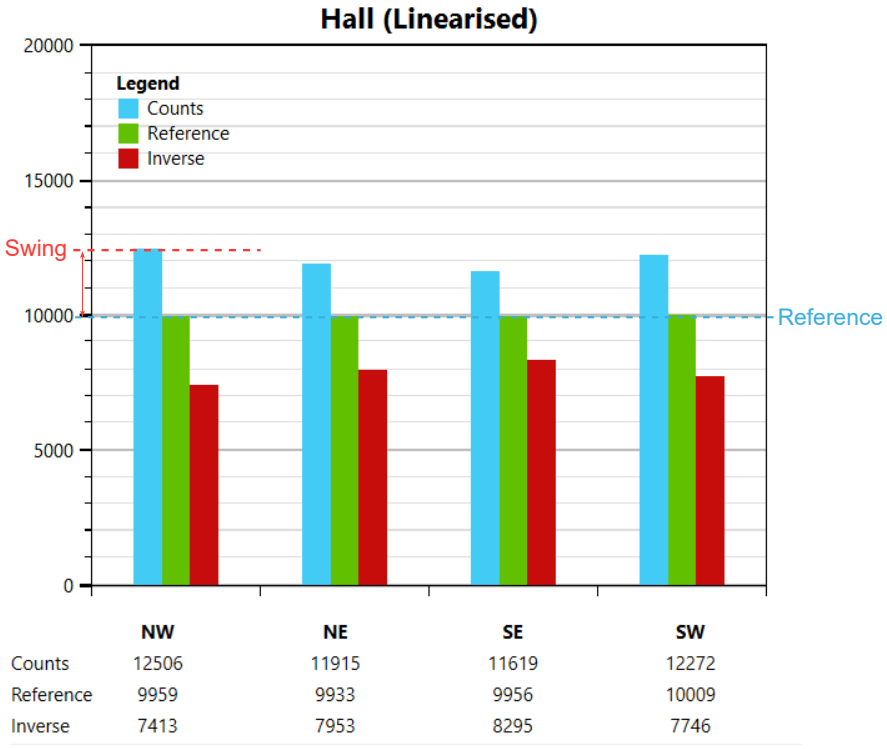
Figure 3.2: Button Channel Counts

The ProxFusion channel shows the counts of the capacitive/touch sensor. The **counts** value shows the raw measurement of the sensor, after linearisation and filtering. The **LTA** is the Long Term Average of the counts signal. It tracks slow variations in the environment, and is used as a reference to detect movement; refer to AZD004 for more details. The **delta** is simply the difference between the LTA and the counts, and is used to detect activity or movement.

In the default configuration of the sensor, a user touching the sensor causes the counts to increase. On the EV kit, a copper pad on the PCB acts as the capacitive-sensing electrode. This couples capacitively to the metal knob. Therefore, touching the knob results in an increase in overall capacitance of the pad to GND, causing the counts to increase on the channel. In this way, the IQS325 can detect the proximity of the user’s hand before the knob is rotated, allowing it to wake up and transition to a faster sampling rate to measure the rotation more accurately.

The ProxFusion channel detects two separate event types: button presses and movements. These two event types track their own LTA and delta values. The Button event compares the counts to a slow or static LTA to detect long-term presses. The Movement event uses a more dynamic LTA to detect brief changes in the rate of change of the counts.

3.1.3 Hall Channels



	NW	NE	SE	SW
Counts	12506	11915	11619	12272
Reference	9959	9933	9956	10009
Inverse	7413	7953	8295	7746

Figure 3.3: Hall Channel Counts

The four Hall plates are designated as **NW**, **NE**, **SE**, and **SW**. Each plate shows three sets of counts: **Counts**, **Reference**, and **Inverse**.

The counts value represents a raw measurement of the vertical (or Z-axis) magnetic field strength at each plate. The Inverted counts value represents a second measurement on the same Hall plate, but with the polarity of the measurement inverted. Finally, the Reference counts value represents the midpoint between the two measurements—a DC value around which the normal and inverted counts swing. This Hall reference effectively represents the counts of the Hall plate if there was *no external magnetic field*.

These four Hall plates are used to calculate the absolute angle of a nearby magnet.

3.1.4 Angle Measurements

Three sliders at the bottom of the GUI show the output of the Hall encoder.

- **Interval** shows the coarse angle output of the Interval UI, and is derived from the final angle. This is the value that would typically be used if a discrete number of positions per rotation is required, such as in a mouse scroll wheel that uses 24 intervals per rotation. The number of intervals per rotation is configurable.
- **Processed Angle** shows the output angle as a 16-bit value, after filtering and auto zero compensation. This value may be significantly different from the raw angle, as an offset is added whenever the Hall sensor is “zeroed”.
- **Raw Angle** shows the magnet angle calculated directly from the Hall counts.

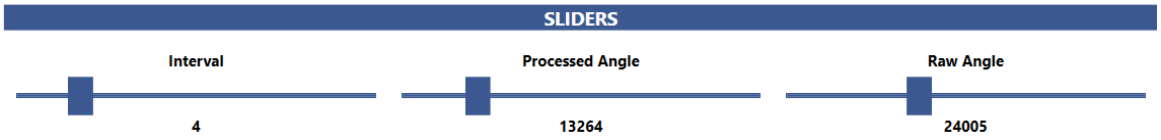


Figure 3.4: Angle Measurement Sliders

3.2 Data Logging

It may be necessary to save all the above streaming data to a file for debugging or testing purposes. The logging function allows the GUI to save all streaming data from the IQS325 to a CSV file. Click the “Logging” button in the Configuration Tool Manager panel to open the logging window.

Figure 3.5: Logging Function Using the Configuration Tool Manager

From here, the desired variables from the IQS325 can be enabled or disabled. To start logging, click the “Start Logging” button, and choose the destination of the CSV log file.

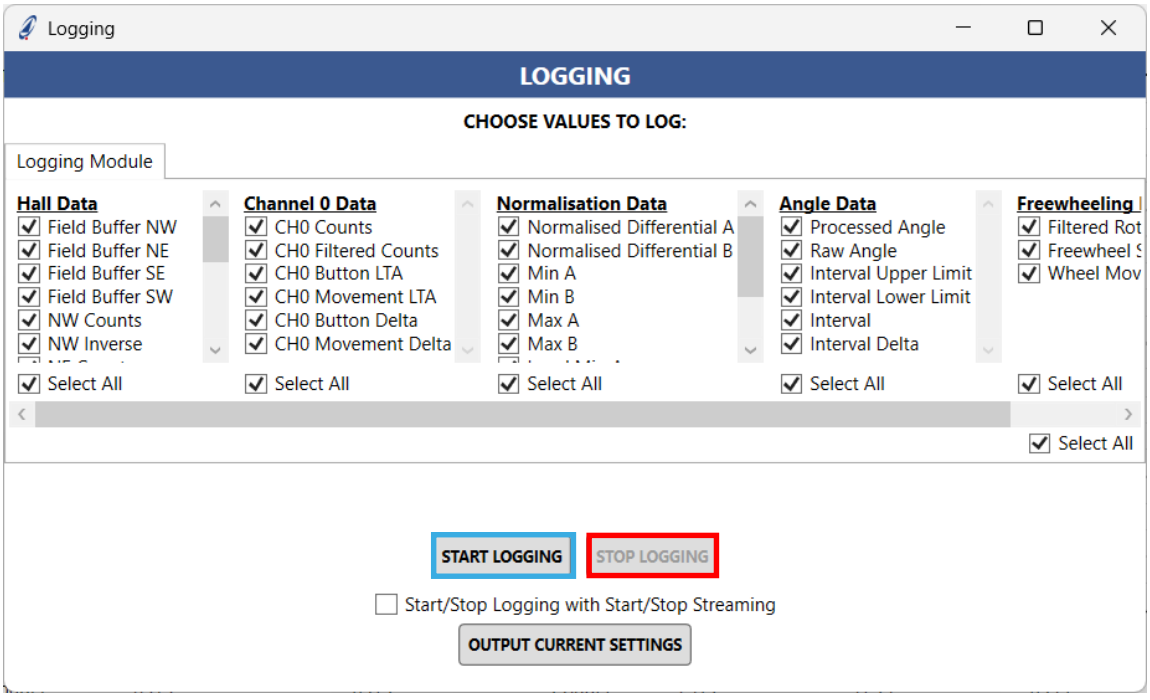


Figure 3.6: Logging Configuration Window

Once the file destination is confirmed, data logging will begin. To stop logging, click the “Stop Logging” button.

3.3 Export Device Configuration to H-File

After configuring the IQS325, you can export the new settings for safekeeping, sharing, or future use on the same or another device. The settings are exported as a *.h*-header file using the ‘EXPORT H FILE’ button.

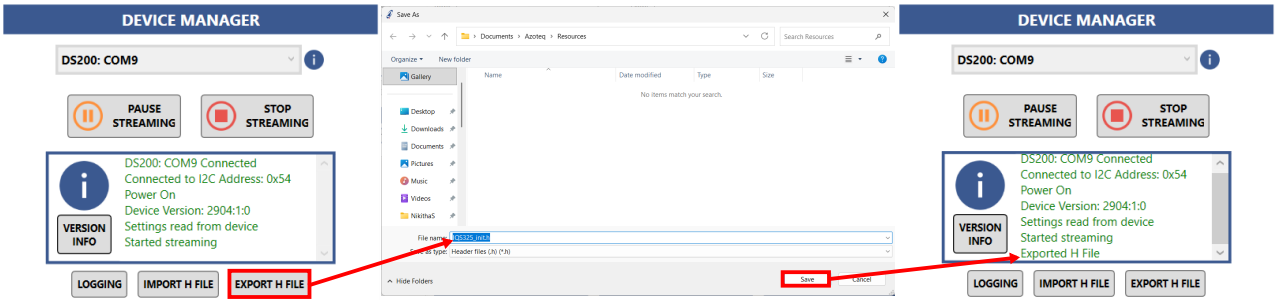


Figure 3.7: Exporting a Defined Configuration

3.4 Import Preconfigured H-File

If the device was previously configured and an associated .h-file was exported from the GUI, the file may now be imported into the GUI using the ‘IMPORT H FILE’ button.

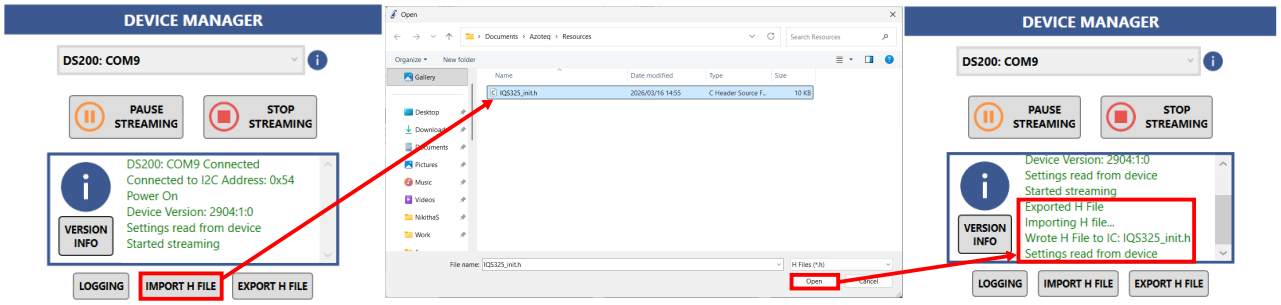


Figure 3.8: Importing a Predefined Configuration

3.5 Command Buttons

At the top centre of the GUI is a row of buttons that execute commonly-used commands.

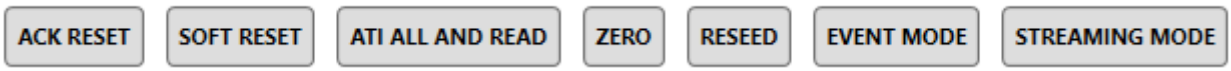


Figure 3.9: Command Buttons

3.5.1 Acknowledge Reset

The “Ack Reset” button clears the IQS325’s reset flag by writing the **Acknowledge Reset** bit to the IC. This should be the fist step after powering on any Azoteq IQS-device. On start-up, the IC will set its reset flag to indicate that a reset event has occurred.

The GUI will show that a reset has occurred by changing the Ack Reset button colour to red.

Note: After acknowledging a reset, it may sometimes appear that the device stops streaming. Since the IQS325 is an I²C-configurable chip, it always resets to I²C streaming mode at start-up, and will remain in streaming mode until the reset flag has been cleared. However, the IQS325 transitions into event mode as soon as the reset is acknowledged.

3.5.2 Soft Reset

The “Soft Reset” button issues a command to the IQS325 to perform a soft reset. This can be used to clear any configured settings back to their default values.

3.5.3 Streaming and Event Modes

The IQS325 has two communication modes:

- **I²C Streaming Mode**: The IQS325 regularly opens an I²C communications window, directly after it has performed a measurement. The “Streaming Mode” button places the IQS325 into I²C streaming mode.
- **I²C Event Mode**: The IQS325 only opens an I²C window if an event has occurred. The “Event Mode” button enables mode on the IQS325.

3.5.4 ATI All and Read

The “ATI All and Read” button writes the **Force CH0 ATI** and **Force Hall ATI** commands to the IQS325. The ATI routine is a calibration algorithm on the IC that will recalibrate all the sensors to their target or reference counts.

Once ATI is complete, the GUI reads all the IQS325 settings to update any parameters that the ATI routine may have changed.

3.5.5 Zero

The “Zero” button resets the current interval to 0. This is done by adjusting the offset between the raw angle and the processed angle so that the processed angle sits at the centre of interval 0.

The Hall encoder can be zeroed on-chip by setting the **Zero Now** bit in the System Commands register.

3.5.6 Reseed Touch

The “Reseed” command can be used to update the LTA of the ProxFusion channel by setting it equal to the counts. Note that the Reseed command may trigger an ATI routine if the resulting LTA is significantly different from the target.

3.6 Events

The panel on the right-hand side of the GUI shows the current event flags that are set on the IC. On the IQS325, these flags can be found at registers 0x2000 – 0x2005.

3.6.1 Device Status

- **Device Reset**: Indicates that a recent power-on event has occurred, and should be cleared by sending an Acknowledge Reset command (Ack Reset button). This flag also indicates that all registers and settings of the device have been restored to their default states, and must be reconfigured.
- **AutoProx Error**: Indicates that AutoProx mode was not entered correctly. This may imply that the AutoProx threshold is an invalid value.

3.6.2 Event Flags

- **Power**: The power mode of the device has changed.
- **ATI**: The touch channel or Hall channels have undergone an ATI routine. This would imply that the counts of the channels have changed, and some on-chip settings may have been altered.
- **Button**: The ProxFusion Button state changed.
- **Movement**: The ProxFusion channel detected a movement event.
- **Interval**: The Hall encoder has entered a new interval.

3.6.3 Hall Status

These flags relate specifically to the Hall angle measurements.

- **Interval Change**: The Hall encoder has entered a new interval.
- **Direction**: Set to '1' for a forward rotation (interval value increased), and '0' for a reverse rotation (interval value decreased).
- **Stationary**: Is set if the current interval has not changed for some period of time. The IQS325 will only transition into low power mode if this flag is set.
- **High Accuracy**: Indicates that the device is in high-accuracy power mode (a temporary high-report-rate mode that samples the Hall channels quickly to avoid potential rotation aliasing).

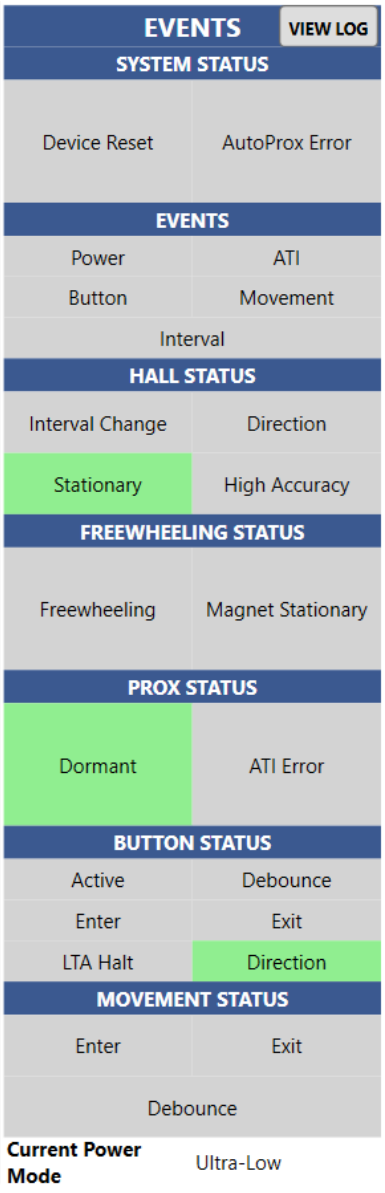


Figure 3.10: Events Panel

3.6.4 ProxFusion Status

These flags are specific to the touch channel.

- **Dormant**: The touch sensor has not been activated for some period of time. The IQS325 will only enter low power mode if this flag (along with the Hall Stationary flag) is set.
- **ATI Error**: Set if the touch channel fails to recalibrate correctly. This indicates that the current output of the touch channel may be invalid.

3.6.5 Button Status

- **Button**: The delta of the touch channel has exceeded the Button threshold. This flag indicates the user has touched or interacted with the touch sensor.
- **Debounce**: When crossing the Button threshold, the touch sensor will be sampled multiple times in rapid succession. This flag is set during this rapid sensing stage.

- **LTA Halt**: The delta of the touch channel has exceeded the LTA Halt threshold. In this state, the LTA kept fixed rather than tracking environmental changes. This aids in increasing sensitivity of the Button event detection.

3.6.6 Movement Status

- **Enter**: The delta of the touch channel exceeded the Movement threshold in a positive direction. This indicates that the user approached the sensor.
- **Exit**: The delta of the touch channel exceeded the Movement threshold in a negative direction. This indicates that the user approached the sensor.
- **Debounce**: When crossing the Button threshold, the touch sensor will be sampled multiple times in rapid succession. This flag is set during this rapid sensing stage.

3.6.7 Power Mode

Finally, the current **Power Mode** is displayed at the bottom of the events panel.

4 Reference Design

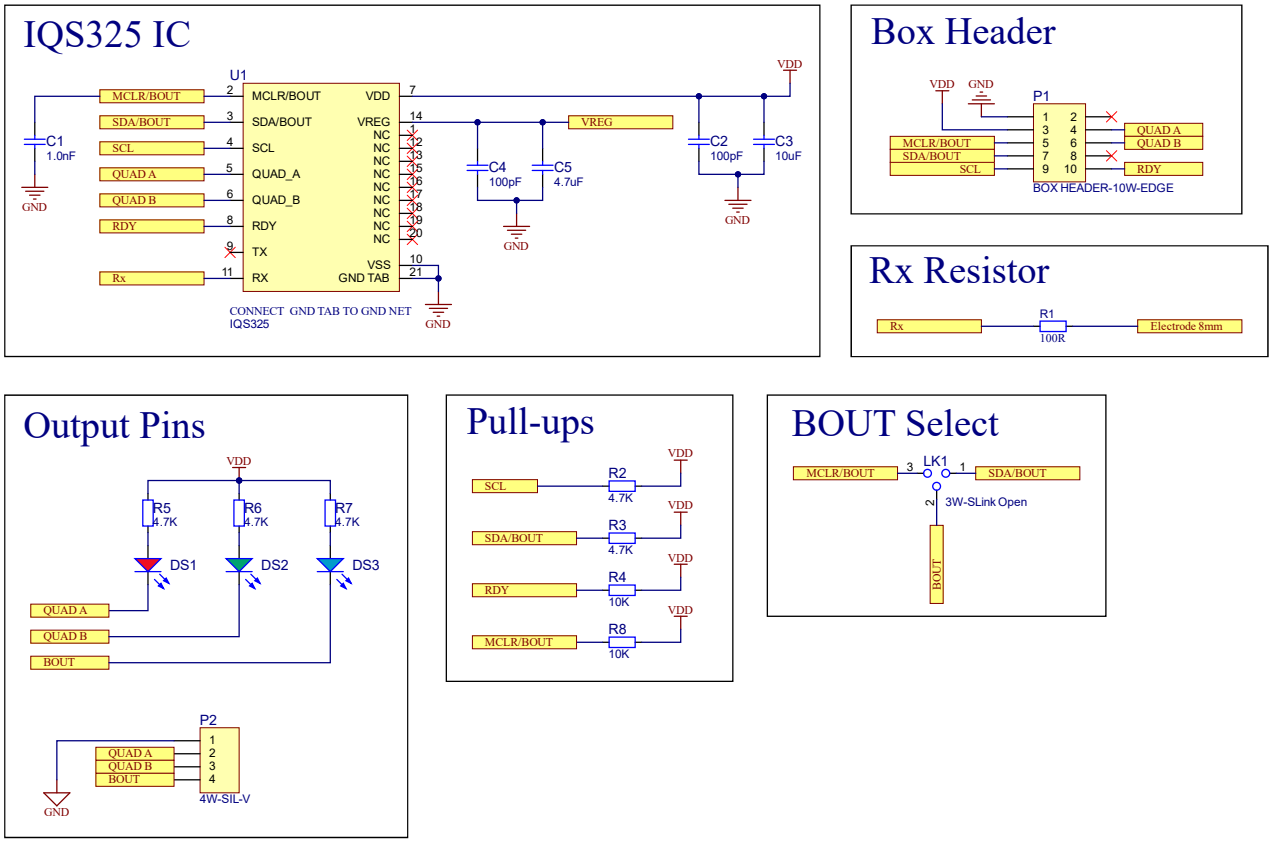


Figure 4.1: IQS325 Reference Schematic

5 Revision History

Release	Date	Changes
v1.0	April 2026	Initial release

Contact Information

	South Africa (Headquarters)	China
Physical Address	1 Bergsig Avenue Paarl 7646 South Africa	Room 501A, Block A T-Share International Centre Taoyuan Road, Nanshan District Shenzhen, Guangdong, PRC
Tel	+27 21 863 0033	+86 755 8303 5294 ext 808
Email	info@azoteq.com	info@azoteq.com

	USA	Taiwan
Physical Address	7000 North Mopac Expressway Suite 200 Austin TX 78731 USA	Xintai 5th Road, Sec. 1 No. 99, 9F-12C Xizhi District 221001 New Taipei City Taiwan
Tel	+1 512 538 1995	+886 932 219 444
Email	info@azoteq.com	info@azoteq.com

Visit www.azoteq.com
for a list of distributors and worldwide representation.

Patents as listed on www.azoteq.com/patents-trademarks/ may relate to the device or usage of the device.