



Resense
A Sense of Touch

Force/Torque Explorer Instruction Manual

Operating Manual



Revision history

Revision	Date	Comment	Chapter
01	2026-08-18	Layout changes	All

Technical support

If there are any questions about the software or the sensor, please contact us.

Resense GmbH
Alexander-Wiegand-Str. 30
D-63911 Klingenberg

Phone: +49 9372 132-0

Email: info@resense.io

Copyright

© Resense GmbH 2026

This documentation is copyright protected.

**Contents**

Technical support	1	9.3 Tare	10
Copyright	1	10 Sensor Data Panel	11
Contents	2	11 Recordings Tab	11
1 Introduction	3	11.1 Making a Recording	11
2 Conventions used in this manual	3	11.2 Managing Recordings	12
3 System Requirements & Installation	3	11.3 Exporting Recordings	12
4 First Launch – Overview of the Interface	3	12 Calibration Matrix Tab	12
5 Menu Reference	4	12.1 Loading a Matrix File	12
5.1 File Menu	4	12.2 Matrix Operations	13
5.2 Tools Menu	4	13 Configuration Tab	13
5.3 View Menu	4	13.1 Electronics Configuration & Debug Mode	13
5.4 Help Menu	4	13.2 Tare Button (Configuration Tab)	14
5.4.1 Changelog	4	13.3 Acquisition Mode	14
5.4.2 About	4	13.4 Matrix Calculation	14
5.4.3 Sample Scripts	4	13.5 Filter	15
6 Sensor selection	6	13.6 Temperature Compensation	15
6.1 Selecting a COM Port	6	13.7 MVpV Mode	15
6.2 Connection Status & Sensor Data Panel	6	13.8 Firmware Update	15
6.3 Downsampling	7	13.9 Flash Force/Torque Matrix	16
7 Working Without a Physical Sensor	7	13.10 Flash Temperature Matrix	16
8 Output Mode Selection	7	14 Serial Monitor Tab	17
9 Sensor Plots	9	14.1 Connecting the Serial Monitor	18
9.1 Graph Layout	9	14.2 Sending Commands	18
9.2 Time History & Force/Torque Plot Range	10	14.3 Command History	19
		14.4 Timestamp, Auto-scroll & Clear	19
		14.5 Baud Rate & Line Endings	20
		15 Diagnostics Tab	20
		15.1 Get Diagnostic Data	20
		15.2 Clear & Eject Drive	21



1 Introduction

Force/Torque Explorer is a desktop application for acquiring, visualizing, recording, and configuring Resense Force/Torque (FT) sensing electronics. It communicates with the measurement electronics over a standard USB-to-serial (COM) port, displays live 6-axis force and torque data in real time, and provides tools to view, record, and export measurement data.

Conventions used in this manual

Commands sent to electronics are shown in monospace, e.g. TARA.

File paths are shown with forward slashes.

NOTE boxes highlight useful tips; WARNING boxes highlight risks.

2 System Requirements & Installation

Requirement	Details
Operating System	Windows 10 / 11 (64-bit)
Java Runtime	Bundled OpenJRE 21 – no separate installation required
Connectivity	Available USB port for sensor connection
Display	Minimum 1280 × 768 recommended for full graph visibility
Storage	~500 MB for application + recordings

Table 1 System Requirements & Installation

To install Force/Torque Explorer:

1. Run the provided installer or extract the application archive to a folder of your choice.
2. Launch ForceTorqueExplorer.exe (or the provided desktop shortcut).
3. No additional Java installation is needed – the bundled OpenJRE 21 is used automatically.

	The application creates a log/ folder next to the executable and stores settings in config. json.
---	--

3 First Launch – Overview of the Interface

When you launch Force/Torque Explorer for the first time, the application window opens with six main tabs across the top:

Tab	Purpose
Sensor Plots	Live chart display of Force (Fx, Fy, Fz) and Torque (Tx, Ty, Tz) in real time
Recordings	Start/stop recordings, manage saved recordings, export data
Calibration Matrix	Load, edit, and manage the 6×6 calibration matrix applied to raw data
Configuration	Electronics settings – acquisition mode, filters, matrix flashing, firmware update
Serial Monitor	Send raw text commands to the electronics and view its text responses
Diagnostics	Retrieve the diagnostics report from the connected device

Table 2 Tabs and Purpose

On the right side of the window, a Sensor Data panel shows real-time values such as temperature from the connected electronics. This panel is always visible regardless of which tab is active.

At the very top is a menu bar (File, Tools, View, Help) for language/theme settings, view switching, changelog, and other global options.



4 Menu Reference

4.1 File Menu

Menu Item	Description
Language → English	Switch the application UI language to English.
Language → Deutsch	Switch the application UI language to German.
Color scheme → Light	Apply the light (FlatLaf Light) colour scheme.
Color scheme → Dark	Apply the dark (FlatLaf Dark) colour scheme.
Exit	Exit the application.

Table 3 *File Menu*

4.2 Tools Menu

Menu Item	Description
Temperature Display	Opens a real-time temperature display or temperature-specific analysis tool.
FPS Counter	Checkbox: Displays the chart rendering frame rate as an overlay — useful for assessing PC performance at high acquisition rates.
Show Frequency in Data Picker	Checkbox: Enables an advanced data-picker to overlay by showing frequency information in addition to time-domain values.
Developer Mode	Checkbox: enables developer-only UI elements only for Resense internal use.

Table 4 *Tool Menu*

4.3 View Menu

Menu Item	Description
Live view	Switch the main display to the live data view (View tab).
Recording view	Switch the main display to recording playback mode.

Table 5 *View Menu*

4.4 Help Menu

Menu Item	Description
Changelog	Displays the version history and release notes.
About	Shows the application version and license information.
Sample Scripts	Opens sample code/scripts to help with automation or integration.

Table 6 *Help Menu*

4.4.1 Changelog

Help → Changelog opens a dialog displaying the full version history of Force/Torque Explorer: every release, the published date, all new features, and bug fixes. The most recent version is shown at the top. Scroll down to review older releases. This is the same content as the CHANGELOG.txt file bundled with the application.

4.4.2 About

Help → About displays the application name, current version number, copyright notice, and third-party license acknowledgements. Individual license texts can be found in the license/ folder of the installation directory.

4.4.3 Sample Scripts

Help → Sample Scripts opens a built-in code viewer containing ready-to-use scripts that show how to read sensor data directly from the serial port in your own application, without going through Force/Torque Explorer. The dialog is non-modal — you can leave it open while using the rest of the application.



The dialog contains two top-level tabs:

Tab	Sub-tabs	Contents
Python	Legacy Mode / Protocol Mode	One .py file per sub-tab. Buttons: Copy to Clipboard, Save As.
C / C++	Legacy Mode / Protocol Mode	Three source files per sub-tab (header + implementation + main). Buttons: Copy (current file), Save As (current file), Save All Files (saves all 3 to a chosen folder).

Table 7 Help Menu – Sample Scripts

Legacy Mode scripts (Python and C/C++):

- Baud rate: 1 000 000 bps (fixed — do not change).
- Packet size: 28 bytes — 7 × IEEE 754 float32 little-endian.
- Fields: fX [N], fY [N], fZ [N], mX [mNm], mY [mNm], mZ [mNm], temperature [°C].
- No framing or checksum — reconnecting the port resets alignment.
- C/C++ files: HexFT_Legacy.h, HexFT_Legacy.cpp, main_legacy.cpp

Protocol Mode scripts (Python and C/C++) framed binary with CRC16-CCITT:

Frame Field	Size	Description
Start byte	1 byte	Always 0x7E — used for stream synchronization.
Version/Flags	1 byte	Upper 4 bits = protocol version (1); lower 4 bits = flags.
Message type	1 byte	0x00 = Measurement (7 floats) 0x02 = Diagnostic (11 floats)
Payload count	1 byte	Number of float32 values that follow.
Frame counter	1 byte	Rolling 0–255 counter; a gap means dropped frames.
Payload	count × 4 bytes	Measurement: fX,fY,fZ,mX,mY,mZ,temperature.
CRC16	2 bytes	CRC16-CCITT (polynomial 0x1021, init 0xFFFF) over header + payload.

Table 8 Protocol Mode Byte Description

- C/C++ files: HexFT_Protocol.h, HexFT_Protocol.cpp, main_protocol.cpp

	Install the Python dependency libraries in your global/virtual python environment, if not present.
---	---

	The COM port to use in your script is displayed as a hint at the bottom of the Sample Scripts dialog.
---	--



5 Sensor selection

Before any live data appears, you must connect the software to the evaluation of electronics via USB.

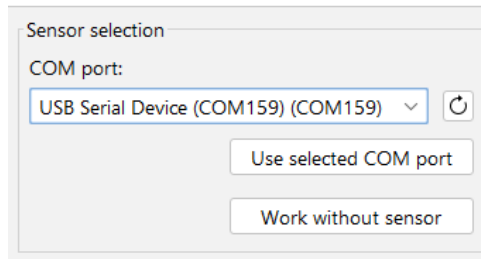


Figure 1 *COM Port selection*

5.1 Selecting a COM Port

Follow these steps to establish a connection:

1. Plug the FT electronics into your PC with the USB cable. Windows will assign a COM port number.
2. In the Sensor Select section, click the Refresh button (circular arrow icon) to scan for available COM ports.
3. Click on the desired COM port in the list to select it.
4. Click Connect. The application will open the serial port at the required baud rate and begin receiving data.



If no COM ports appear, check that the USB driver is installed and the cable is firmly connected. Try unplugging and re-plugging the device, then click Refresh again.

Once connected, the status label updates to show the selected port name. Live sensor data begins streaming and the charts in the Sensor Plots tab become active.



Ensure the electronics is not in debug mode to view live streaming of data.

5.2 Connection Status & Sensor Data Panel

After a successful connection the Sensor Data panel on the right populates with readings from the electronics. See Chapter 12 for a full explanation of every field.

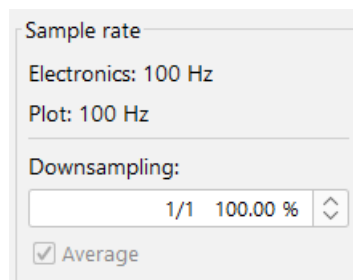


Figure 2 *Sample rate*



Two read-only labels under the “Sample rate” show the measured data rates:

- Electronics – the number of data packets received from the electronics per second (e.g. 1000 Hz).
- Plot – the number of samples rendered per second after downsampling (e.g. 100 Hz with ratio 10).

5.3 Downsampling

The Downsampling section allows you to reduce the plot update rate relative to the incoming data rate, when using very high acquisition rates (e.g. 1 kHz).

Control	Description
Downsampling Ratio	Integer spinner. • A ratio of 1 means every received sample is plotted. • A ratio of 10 means every 10th sample is plotted. Recorded data is always stored at the full incoming rate regardless of this setting.
Average checkbox	Visible and enabled only when the ratio is greater than 1. When checked, the point displayed is the average of the downsampled group rather than just the last sample, giving a smoother trace.

Table 9 Downsampling

6 Working Without a Physical Sensor

If no physical FT electronics is available, Force/Torque Explorer provides a No Sensor mode that allows you to use most application features with simulated data. This is useful for:

- Testing the recording, export, and matrix functions without hardware.
- Demonstrating the software interface offline.
- Verifying that a recorded data file imports and displays correctly.

To activate No Sensor mode:

1. In the Sensor Select section, click the No Sensor button (if present in your build).
2. The application enters a mock-connection state. Synthetic data is generated for display purposes.

	The No Sensor button is available in specific builds of Force/Torque Explorer. If the button is not visible in your installation, this feature is not enabled in your build. Contact Resense support for more information.
---	---

All recording, matrix, and export functions work normally in No Sensor mode. The serial monitors and diagnostics feature require an actual connected device.

7 Output Mode Selection

Located under the Output Values section, three mutually exclusive radio buttons control how the application displays measurement data:

Checkbox	Mode Name	Description
F/T calculation in software UI	SOFTWARE_MATRIX	Raw data from the electronics is multiplied by the calibration matrix loaded in the Calibration Matrix tab. The calculation is done entirely in software on the PC. Use this mode when the matrix calculation is turned “off” in the electronics.
F/T calculation on electronics	ELECTRONICS_MATRIX	Electronics performs matrix multiplication on-board and transmits already converted Force/Torque values. The matrix stored in the device's flash



		memory is used. Ideal for normal operation with a calibrated device and when matrix calculation is turned “on” the electronics
Raw values	RAW_DATA	No matrix is applied. The raw 6-channel ADC/sensor values are displayed and recorded. In this mode the chart automatically switches to the 6-axis layout and all six channels share the same Y-axis scale. It is helpful for debugging or verifying raw signal levels. Matrix calculation should be turned “off” on the electronics end.

Table 10 Three radio buttons

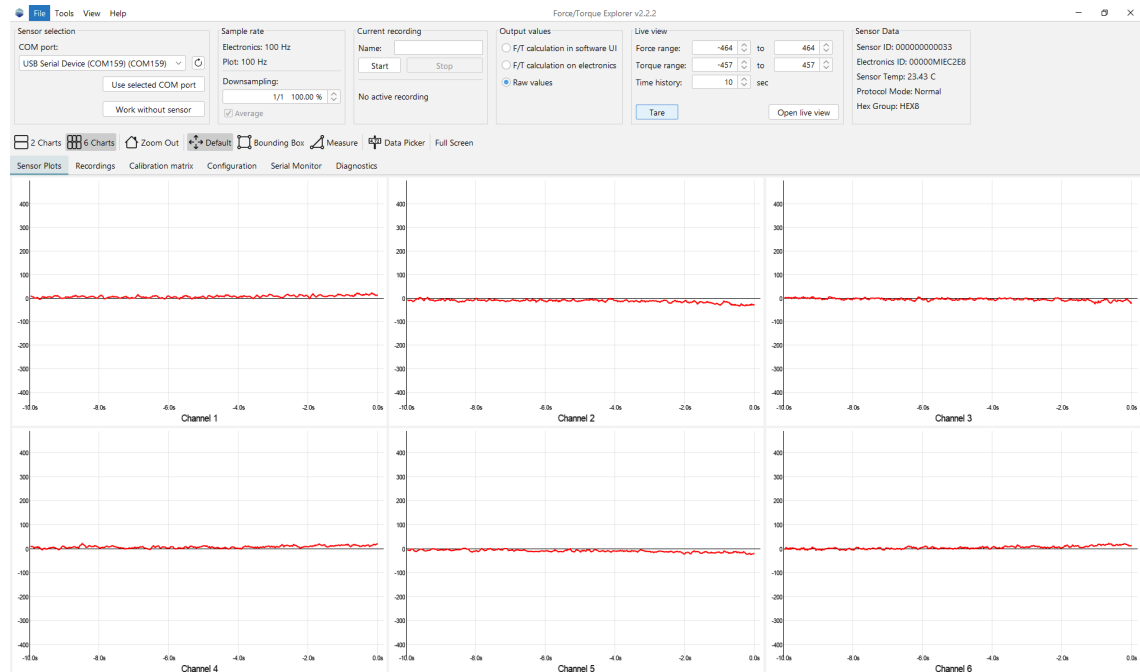


Figure 3 Time Series plot of Raw values of all channels



When Raw Data mode is selected, the force and torque range spinners are synchronized – changing one also changes the other, since both axes show the same raw value range.



8 Sensor Plots

The Sensor Plot is the primary display for real-time data (Figure 3). It shows scrolling time-series charts for Force (Fx, Fy, Fz in N) and Torque (Tx, Ty, Tz in mNm).

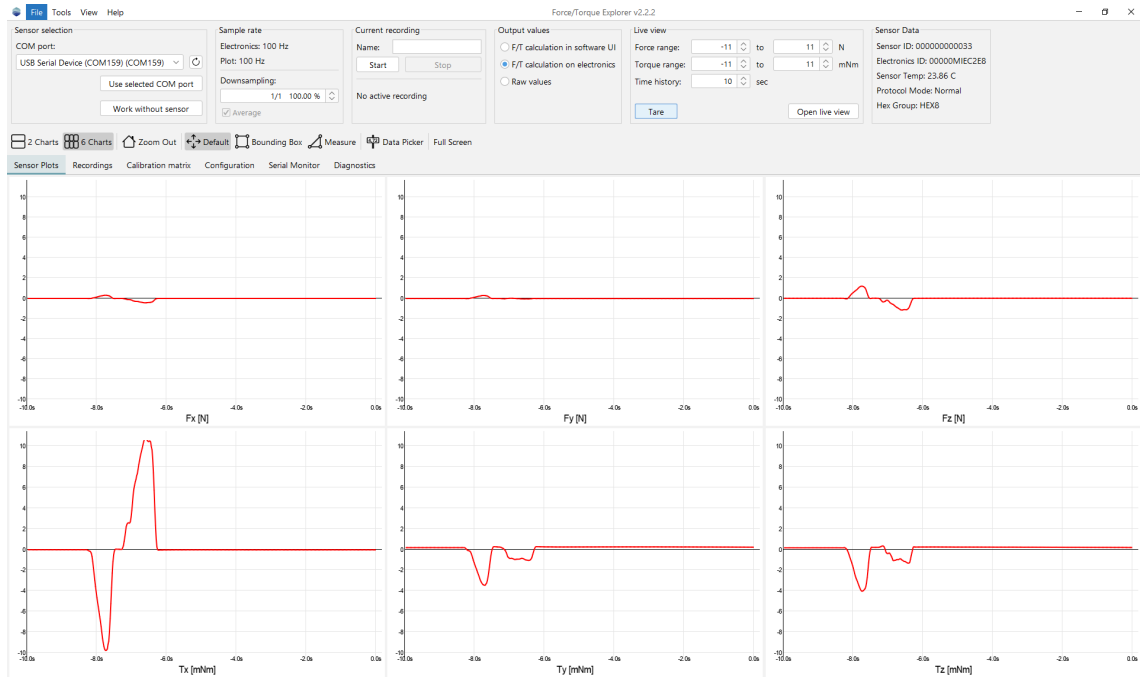


Figure 4 Time Series plot of F/T values of all channels

8.1 Graph Layout

Two toolbar buttons at the top left of the chart area switch between layout modes:

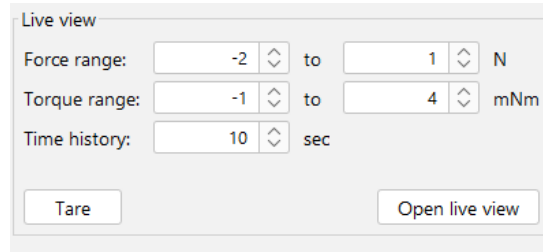
Button (icon)	Description
2 Charts	One combined Force chart (Fx, Fy, Fz) and one combined Torque chart (Tx, Ty, Tz). Switching to this layout doubles the time history to keep the same total time visible (half the update density).
6 Charts	Six individual charts – one per axis. Each channel is displayed separately for maximum detail. The time history is halved when switching from 2-chart layout.
Zoom Out	Zoom out will reset the plot chart Y axis to fit all the channels. This works only with viewing recorded data
Default	Default Span option tool helps to move across the plot in X and Y direction
Bounding Box	The tool can be used to visualize a particular area of interest zoomed in.
Measure	The force/torque value is overlayed across the plot in the selected region over the time series
Data Picker	To see the absolute value of one sample of the recorded data
Full Screen	Maximizes the plot window. To revert to normal view, simply click it back again.

Table 11 Toolbar buttons



	The Raw Data output mode forces the 6-chart layout and disables the 2-chart layout button.
---	---

8.2 Time History & Force/Torque Plot Range



Live view

Force range: to N

Torque range: to mNm

Time history: sec

Figure 5 Live view

Above the chart area, three spinners control the plot window:

Control	Unit	Range	What it does
Force Range	N	-2 000 000 to +2 000 000	Y-axis range of the Force chart(s). Adjust to match the expected measurement range of your sensor. In Raw Data mode, this also sets the Torque range.
Torque Range	Nm	-2 000 000 to +2 000 000	Y-axis range of the Torque chart(s). Independent of Force range in Software/Electronics Matrix modes.
Time History	seconds	1 – 600 s	How many seconds of historical data are shown in the scrolling chart. Increase for a longer trend view; decrease to zoom in on recent data.
Open Live View	-		Switches sensor plots to live streaming mode when viewing recorded data
Tare	-	-	Sensor a serial software command for Tare function

Table 12 Time History & Force/Torque Plot Range

8.3 Tare

The Tare button sends the command TARA to the electronics. This instructs the device to zero/offset all channels based on the current load — effectively treating the current measurement as the new baseline (zero point). It is equivalent to pressing the Tare button in the Configuration tab and directly on the mini electronics.

	 WARNING Tare is applied in the electronics firmware. Remove all external loads from the sensor before pressing Tare if you want a clean zero reference.
--	---



9 Sensor Data Panel

The Sensor Data panel is displayed on the right side of the application window and is always visible. It shows scalar live readings from the connected electronics.

Field	Unit	Description
Sensor ID	-	Displays the 12-character sensor id read from the electronics
Electronics ID	-	Displays the 12-character electronics id read from the electronics
Sensor Temp	°C	NTC temperature sensor reading from the FT sensor head.
Protocol Mode	—	Which protocol mode setting is running on the electronics.
HEX Group	—	A device grouping/identification identifier returned by the GET HEX_GROUP command. Shows only standard HEX models.

Table 13 *Sensor Data Panel*

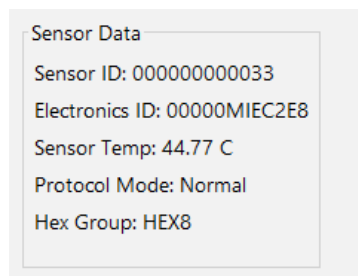


Figure 6 *Sensor Data*

10 Recordings Tab

The Recordings tab lets you capture measurement data to disk and manage, view, rename, delete, import, and export recordings.

10.1 Making a Recording

1. Make sure the electronics are connected and live data is streaming.
2. Optionally type a descriptive name in the 'Current recording' Name field.
3. Click Start Recording. The button label changes and data start accumulating.
4. Click Stop Recording to end the session. The recording is saved automatically.

While recording is active, the details panel shows:

- Duration elapsed.
- Number of measurements captured so far.
- Data size on disk.

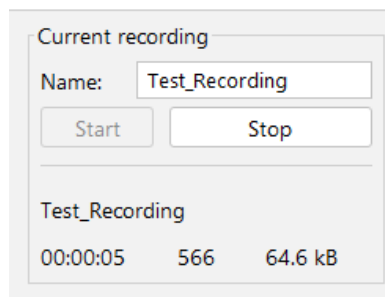


Figure 7 *Recording Panel details while recording*

10.2 Managing Recordings

“Previous Recordings” shows all saved recordings. Select one to activate the management buttons:

Button	Description
View	Opens the selected recording in the View tab for playback.
Rename	Renames the selected recording.
Delete	Permanently deletes the selected recording from disk.
Import	Import a recording file (.csv) previously exported from another PC.
Export	Export the selected recording to a shareable file.

Table 14 Managing Recordings

10.3 Exporting Recordings

Click Export Recording to save a recording in a portable format. Options include:

- Full Time Range – exports the complete recording.
- View Frame – exports only the time window currently visible in the recording viewer.

Select the desired export format from the Export Format drop-down before exporting.

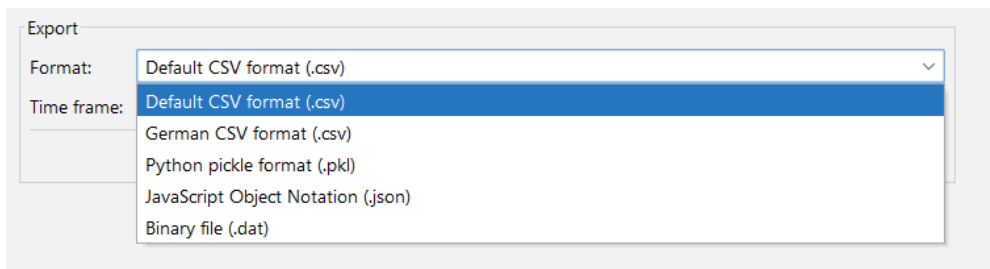


Figure 8 Different export formats for the recording sensor data

11 Calibration Matrix Tab

The Calibration Matrix tab manages the 6×6 calibration matrix used when Output Mode is set to ‘F/T calculation in software UI’ (Software Matrix). The matrix transforms the 6 raw sensor channels into the three force components (Fx, Fy, Fz in N) and three torque components (Tx, Ty, Tz in mNm).

11.1 Loading a Matrix File

The matrix is stored as a plain text (.txt) file. To load it:

1. Click Open Matrix File. A file browser opens.
2. Navigate to and select your .txt matrix file. The file must contain exactly 36 numeric values arranged as a 6×6 matrix.
3. The matrix values are displayed in the editable grid on screen.

	The matrix file may contain the values separated by commas and/or newlines, with optional surrounding square brackets [] — these are all handled automatically.
---	---



11.2 Matrix Operations

Button	Description
Open Matrix File	Load a 6×6 matrix from a .txt file. Each of the 36 values is read and shown in the on-screen grid.
Transpose	Swaps rows and columns of the current on-screen matrix (mathematical transpose).
Zero Matrix	Replace the current matrix with a null matrix
Identity Matrix	Replace the current matrix with the 6×6 identity matrix (1s on diagonal, 0s elsewhere). It is useful for testing raw channels directly.
Save as	Save the current matrix to a new file which can be viewed with a text editor
Apply matrix	The values on the matrix cells will be applied to live streamed data.

Table 15 Matrix Operations

	The matrix shown on screen in the Calibration Matrix tab is the software-side matrix. It has no effect unless Output Mode is set to Calc UI (Software Matrix). To write a matrix into the device so it can be used in hardware mode, use Flash FT Matrix (Section 9.8).
---	--

12 Configuration Tab

The Configuration tab provides access to electronic-level settings, firmware management, and calibration flashing. Most controls in the Electronics Configuration section become active only after enabling Debug Mode.

12.1 Electronics Configuration & Debug Mode

The Electronics Configuration section contains a Debug Mode checkbox at the top. This is the gateway to basic electronics settings.

What happens when Debug Mode is enabled:

1. The software sends SET CONFIG_MODE 1 to the device, switching it from binary streaming mode to text-command mode.
2. The software then queries the device for its current configuration: GET CONFIG, GET MATRIX, GET SENSOR_ID, GET ELECTRONICS_ID, and all checkbox states.
3. The Acquisition Mode, Matrix Calculation, Filter, Temperature Compensation, and MVpV controls are enabled so they can be changed.
4. Sensor ID and Electronics ID labels populate with the device's identifiers.

What happens when Debug Mode is disabled:

5. The software sends SET CONFIG_MODE 0, returning the device to binary streaming mode for normal data acquisition.
6. All electronics configuration controls are greyed out again.

	⚠ WARNING
	While Debug Mode is active, the device is in text mode and binary sensor data is NOT being received. The live charts will not update. Always disable Debug Mode after completing configuration changes to resume normal operation.

12.2 Tare Button (Configuration Tab)

Command sent: TARA

The Tare button in the Configuration tab performs the same action as the Tare button in the View tab (see Section 6.5). It instructs electronics to use the current sensor output as the new zero reference. This does not require Debug Mode — it works in normal binary streaming mode.

12.3 Acquisition Mode

The Acquisition Mode drop-down (enabled in Debug Mode) controls how the electronics samples measurement data. The command sent is SET MODE <index>

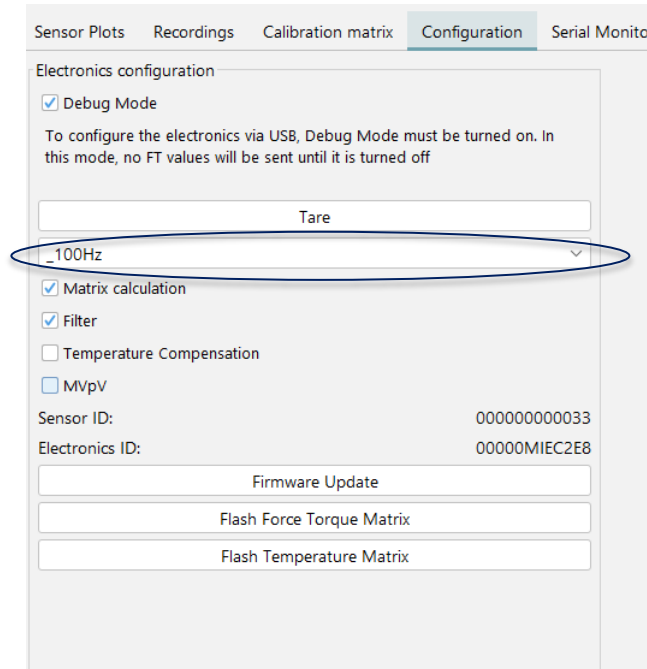


Figure 9 Basic Electronic Configuration Control using the UI

Mode Index	Mode Name	Description
0	100 Hz	Continuous acquisition at 100 samples per second.
1	500 Hz	Continuous acquisition at 500 samples per second.
2	1 kHz	Continuous acquisition at 1000 samples per second.
3	Trigger (External)	Hardware-triggered mode. Electronics acquires one sample per external trigger signal pulse. Use for synchronized multi-device setups.
4	Software Trigger	Each sample is triggered by a software command sent over the serial interface. Useful for controlled, on-demand sampling from the host PC.

Table 16 Acquisition Mode

	After changing the mode, disable Debug Mode to return to binary streaming so the new rate takes effect in the live charts.
---	--

12.4 Matrix Calculation

Checkbox: Matrix Calculation | Commands: SET MATRIX_CALC 1 / SET MATRIX_CALC 0



When enabled, the electronics applies its internally stored 6×6 calibration matrix to the raw sensor channels and outputs fully calibrated Force and Torque values. When disabled, the electronics outputs the uncalibrated raw channel values. This setting is stored in the device's non-volatile memory.



This checkbox is only meaningful in Calc Electronics (Hardware Matrix) output mode. In Calc UI (Software Matrix) mode, the PC always multiplies the received raw data by the software matrix regardless of this setting.

12.5 Filter

Checkbox: Moving Average Filter

When enabled, the electronics applies a moving average filter to the raw channel values before any matrix calculation.

12.6 Temperature Compensation

Checkbox: Temperature Compensation

When enabled, the electronics use the on-board temperature sensor reading together with a stored polynomial temperature matrix (see Section 9.9) to compensate for thermally induced zero level drift in the sensor output. This improves measurement accuracy over wide temperature variations (0-50 °C). The temperature compensation matrix must have been previously flashed to the device for this option to have any effect.



Temperature Compensation is automatically enabled when you flash a temperature matrix via Flash Temperature Matrix (Section 9.9).

12.7 MVpV Mode

Checkbox: MVpV

When enabled, the electronics outputs sensor values in millivolts per volt (mV/V) units instead of the standard ADC counts. The temperature value is also sent in mV/V but displayed in Celsius.

12.8 Firmware Update

Button: Firmware Update

WARNING

Firmware update restarts the device in bootloader mode. The COM port connection will be lost during the process. Only update firmware with the official RESENSE-provided. uf2 file.

Procedure:

1. Connect to the electronics (COM port must be open).
2. Click Firmware Update. A warning dialog is shown.
3. Click Yes. The software sends the BOOT command to the device.
4. The device reboots into bootloader mode. A drive labelled RPI-RP2 should appear in Windows Explorer.



5. An information dialog instructs you to wait, then click OK.
6. A file browser opens – select the firmware file with the .uf2 extension.
7. The software copies the .uf2 file to the RPI-RP2 drive. The device reboots automatically with new firmware.
8. After rebooting (~5 seconds), reconnect the COM port normally.



If the RPI-RP2 drive does not appear, try unplugging and re-plugging the USB cable and then holding the mini electronics logo button.

12.9 Flash Force/Torque Matrix

Button: Flash Force/Torque Matrix (also available in the Calibration Matrix tab)

This operation writes a 6×6 calibration matrix directly into the device's non-volatile flash memory. After flashing, the device will use this matrix for hardware matrix calculation (Calc Electronics mode) and the matrix persists across power cycles.

Procedure:

1. Ensure the electronics are connected (COM port open).
2. Click Flash FT Matrix.
3. A file browser opens. Select a .txt file containing exactly 36 values (the 6×6 matrix).
4. A confirmation dialog appears showing the file name. Click Yes to proceed or No to cancel.
5. The software switches the device to text mode (SET CONFIG_MODE 1), sends all 36 SET MATRIX <index> <value> commands, then returns to binary mode (SET CONFIG_MODE 0).
6. A successful dialog confirms the operation. The new matrix is now stored in the device.

File format for the FT matrix .txt file:

- 36 decimal numbers representing the 6×6 matrix in row-major order.
- Values can be separated by commas or newlines (or both).
- Optional surrounding square brackets [] are accepted.



Values are scaled internally by a factor of 10^{16} before being stored as integers in the device to preserve floating-point precision.

WARNING

Flashing the wrong matrix will cause incorrect Force/Torque readings. Always verify the file contents before proceeding.

12.10 Flash Temperature Matrix

Button: Flash Temperature Matrix

This operation writes 18 temperature compensation coefficients into the device's non-volatile flash memory. After flashing, the device uses these coefficients together with the live temperature reading to correct thermally induced drift.

Procedure:

1. Ensure the electronics is connected.
2. Click Flash Temperature Matrix.
3. Select a .csv file containing the 18 coefficients (see file format below).
4. Confirm the dialog that appears.
5. The software sends SET CONFIG_MODE 1, then sends all 18 SET TMATRIX <index> <value> commands, then automatically enables Temperature Compensation (SET TCOMPENSATION 1) then returns to binary mode.
6. A successful dialog confirms the operation and reminds you that temperature compensation is now enabled.

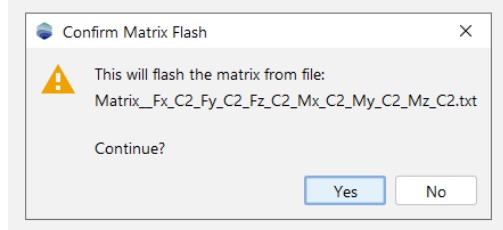


Figure 11 Confirmation window for flashing the correct matrix

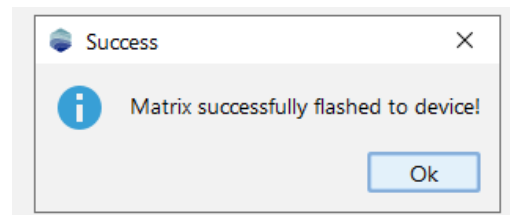


Figure 10 Success message window after flashing matrix

File format for the temperature matrix .csv file:

- 7 rows: 1 header row + 6 data rows (one per sensor channel: Fx, Fy, Fz, Tx, Ty, Tz).
- Header row: a, b, c (column labels – can use any text, it is skipped).
- Each data row contains 3 values: a, b, c – the polynomial coefficients for that channel.
- Polynomial applied: $\text{correction} = a \cdot T^2 + b \cdot T + c$ (T = temperature in °C).
- Total: 6 channels $\times$ 3 coefficients = 18 values.

	Coefficients are scaled internally by 10^{10} before being stored as integers.
---	--

13 Serial Monitor Tab

The Serial Monitor tab provides a direct text-based interface to the FT electronics. It allows you to send serial commands provided by Resense and view the device's text responses. This is useful for low-level configuration, testing individual commands, or obtaining raw device output.

**⚠ WARNING**

The Serial Monitor automatically enables Debug Mode on the device (sends SET CONFIG_MODE 1) when you connect it. While the Serial Monitor is connected, binary sensor data streaming is paused, and the live charts do not update. Disconnect the Serial Monitor to resume normal operation.

13.1 Connecting the Serial Monitor

Prerequisite: A device must already be connected via COM port in the Configuration tab.

1. Navigate to the Serial Monitor tab.
2. Optionally adjust the Baud Rate and Line Ending (see Section 10.3).
3. Click Connect. The output area shows:
 - === Connecting to serial monitor... ===
 - === Connected to serial monitor (Debug Mode ON) ===
 - === Note: Binary sensor data parsing is disabled ===
4. The input field and Send button become active.
5. Click Disconnect to return to binary mode and the charts resume.

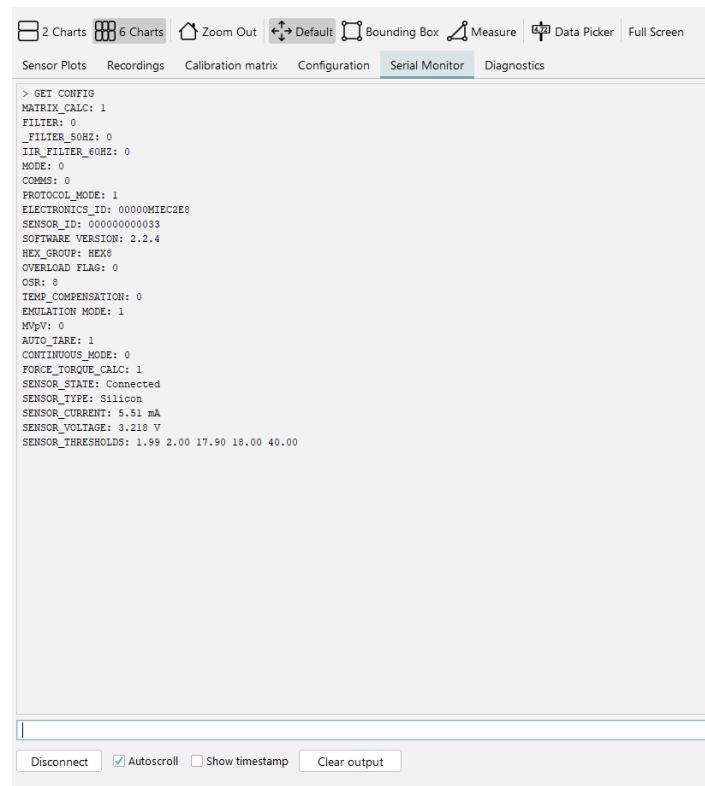


Figure 12 Serial Monitor Tab

13.2 Sending Commands

To send a command to the electronics:

1. Type the command in the input field at the bottom of the tab.



2. Press Enter or click Send.
3. The command is echoed in the output area prefixed with '>'. The device's response appears on subsequent lines.

Commonly used commands (for reference):

Command	Description
GET CONFIG	Retrieves the current electronics configuration.
GET MATRIX	Retrieves the stored calibration matrix.
GET SENSOR_ID	Returns the sensor identifier string.
GET ELECTRONICS_ID	Returns the electronics identifier string.
GET MATRIX_CALC	Returns current state of matrix calculation (0 or 1).
GET FILTER	Returns current state of moving average filter (0 or 1).
GET TCOMPENSATION	Returns current state of temperature compensation (0 or 1).
GET MVpV	Returns current state of MVpV mode (0 or 1).
GET HEX_GROUP	Returns the HEX group identifier.
GET DIAGNOSTICS	Triggers the device to write a diagnostics report to a removable drive.
TARA	Tares (zeroes) all sensor channels.
BOOT	Reboots the device into bootloader mode for firmware update.
SET CONFIG_MODE 0	Switches the device back to binary streaming mode.
SET MODE <0-4>	Sets acquisition mode (0=100Hz, 1=500Hz, 2=1kHz, 3=Trigger, 4=SW Trigger).

Table 17 *Commands*

13.3 Command History

The Serial Monitor remembers the last 100 unique commands you have sent. Use the scroll bar to navigate through previously sent commands — the same behaviour as a terminal application. Selecting a previous command and pressing Enter will resend it. Consecutive duplicate commands are not duplicated in history.

13.4 Timestamp, Auto-scroll & Clear

Control	Description
Auto-scroll	Checkbox: When checked, the output area automatically scrolls to the bottom whenever new text is appended. Uncheck to manually scroll and examine earlier output without being interrupted.
Timestamp	Checkbox: When checked, every line printed in the output area is prefixed with the current time in HH:mm:ss.SSS format. Applied both to sent commands and to incoming device responses.
Clear button	Clears all text from the output area. Does not affect the connection or command history.

Table 18 *Timestamp, Auto-scroll & Clear*



13.5 Baud Rate & Line Endings

Control	Options	Default	Notes
Baud Rate	9600 / 19200 / 38400 / 57600 / 115200 / 230400 / 250000 / 460800 / 500000 / 921600 / 1 000 000 / 1 500 000 / 2 000 000 / 2 500 000 / 3 000 000	115200	Must match the device baud rate. The FT electronics typically operates at 115200 baud. Only change this if instructed by Resense support.
Line Ending	None / LF (\n) / CR (\r) / CRLF (\r\n)	LF (\n)	The selected line ending is appended to every command before it is transmitted. LF is the default and works with the FT electronics. Use None if your command already includes the required terminator.

Table 19 Baud Rate & Line Endings

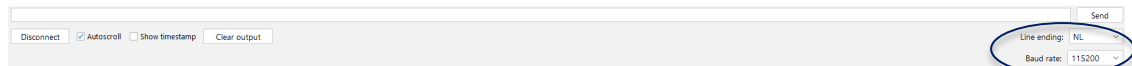


Figure 13 Serial Monitor Configuration Buttons

14 Diagnostics Tab

The Diagnostics tab retrieves a diagnostics report from the connected FT electronics. The device writes the report to a removable drive (a USB mass-storage partition exposed by the electronics), which the software then reads and displays in a two-column table.

14.1 Get Diagnostic Data

1. Connect the electronics via com port as described in section 5.1.
2. Navigate to the Diagnostics tab.
3. Click 'Get Diagnostics Data'.
4. The software sends GET DIAGNOSTICS to the device. The device saves a file named DIAG.txt (or DIAG_<NN>.txt) to its removable drive partition. The application waits up to 13 seconds for this file to appear on the PC.
5. Once found, the file is parsed and displayed as Field / Value rows in the table.

Sensor Plots Recordings Calibration matrix Configuration Serial Monitor Diagnostics	
Get diagnostic data Clear and Eject Drive	
Field	
=== ELECTRICAL DATA DIAGNOSTICS ===	
Timestamp	755510 ms
=== DEVICE INFORMATION ===	
Firmware Version	2.2.4
Sensor ID	000000000033
Electronics ID	00000MIEC2E8
IIR Filter 50Hz	0
IIR Filter 60Hz	0
Continuous mode	0
Emulation mode	1
Temperature Compensation	0
Force Torque Calculation	0
AUTO_TARE	1
mVpV mode	0
HEX_GROUP	HEX8
Supply Voltage	3.300 V
Half Supply Voltage	1.626 V
Sensor Current	36.443 mA
Sensor Voltage	3.275 V
Sensor Temperature	44.80 °C
Board Temperature	34.63 °C
ADC7 Internal Temperature	54.55 °C
Negative Channel Voltages [V]	1.621, 1.620, 1.620, 1.620, 1.620, 1.620
Positive Channel Voltages [V]	1.629, 1.620, 1.627, 1.628, 1.627, 1.627
Differential Voltages [mV/V]	-0.842, 28.121, -0.721, -0.665, -0.642, -0.611
Internal ADC Temperature [°C]	55.779, 55.03346, 55.901, 54.280, 55.758, 55.729
=== SENSOR STATUS ===	

Figure 14 Diagnostics Tab

The table columns are:



- Field – the diagnostic item name (e.g. firmware version, error count, sensor ID).
- Value – the corresponding value or measurement.



If no file appears within 13 seconds, a timeout warning is shown. Ensure the electronics is connected and the device supports the GET DIAGNOSTICS command.

14.2 Clear & Eject Drive

1. Clear all rows from the diagnostics table.
2. Find the removable drive that contains the DIAG file and safely eject it via the Windows Shell API.



A success dialog confirms which drive letter was ejected. This step is optional but recommended to allow the device to remount cleanly for the next diagnostics request.