Matrix FSR 16x16 Matrix Thin-Film Pressure Sensor

Product Specification and User Manual

Model: Matrix FSR 16x16 | Version: V1.0 | Date: September 2026

1. Product Overview

The 16x16 Matrix FSR (Force Sensing Resistor) thin-film pressure sensor features 256 independent piezoresistive sensing points and is designed for full-surface pressure distribution acquisition. The sensor uses an ultra-thin flexible film substrate and an independently scanned row-and-column electrode matrix. It simultaneously captures the pressure value at each point of the contact surface and outputs a complete two-dimensional pressure heatmap in real time. With a fast response, ultra-thin profile and easy integration, it is suited to pressure-mapping applications such as gait analysis, seat pressure detection, tooling fit-pressure testing, and robotic tactile sensing.

The Matrix FSR circuit is formed by crossing row and column conductors: 16 row conductors and 16 column conductors intersect orthogonally to form 256 intersections, each of which is a sensing point, enabling a pressure map covering 256 sensing points to be drawn. The row and column conductors converge at the cable tail and lead out to two 1.0 mm-pitch FPC connectors. When pressure is applied to the sensing area, the force on each sensing point differs and so does its output voltage. Based on FSR characteristics, a more heavily loaded sensing point has a lower resistance and a higher output voltage, and vice versa. By acquiring and comparing the output voltage of each sensing point, the data-acquisition module calculates the location and distribution of force across all points; such sensors are therefore also commonly called "pressure distribution map sensors".

Features and advantages:

- Low actuation force, range covering 500 g ~ 50 kg
- Ultra-thin and flexible, thickness 0.3 mm, conformable to curved surfaces
- Convenient acquisition of pressure distribution area and relative value of each point
- Simple and easy to use, easy to integrate
- Cost-effective

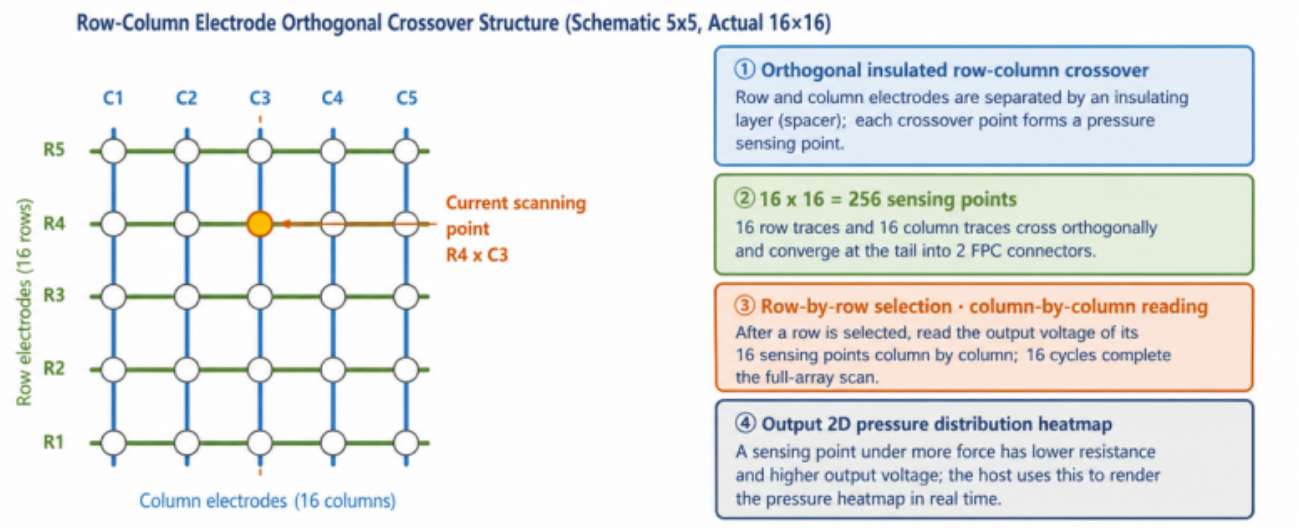


Figure 1 Row/column electrode orthogonal cross structure and scanning principle

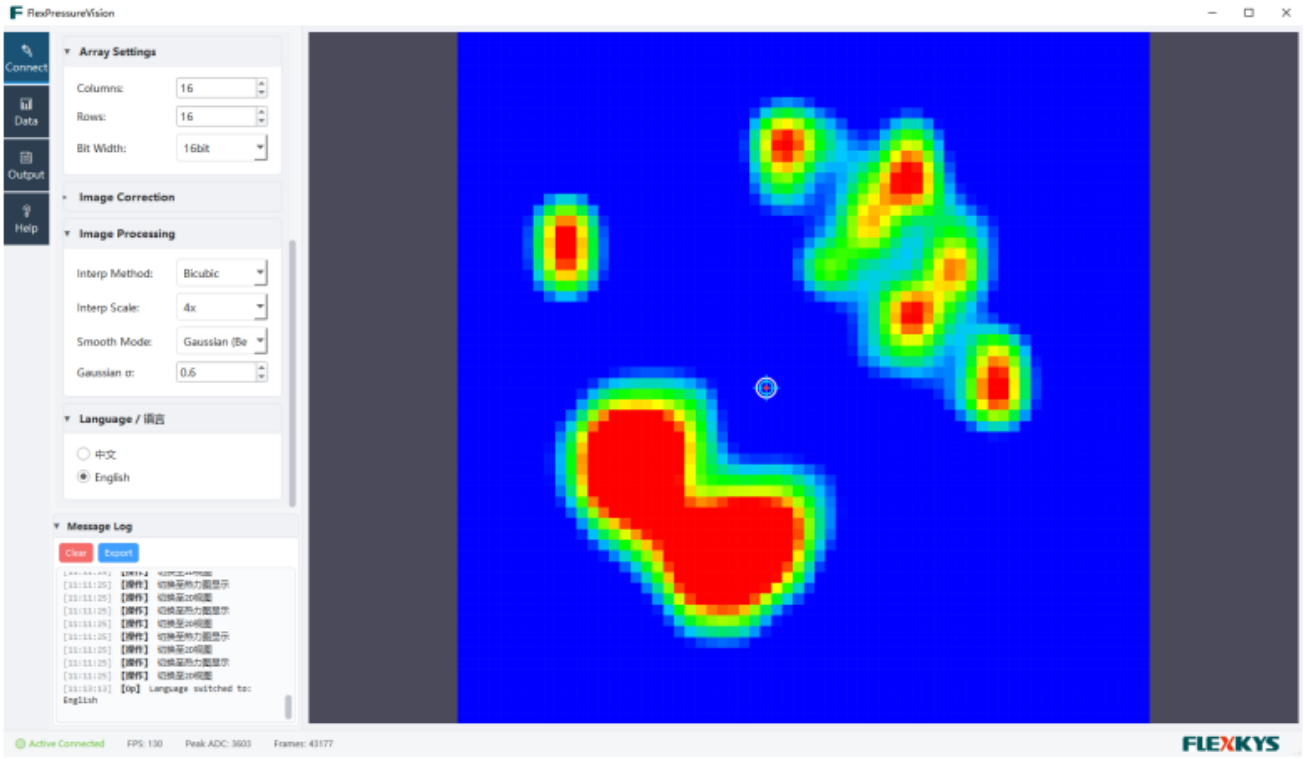


Figure 2 Real-time pressure distribution heatmap in the host software

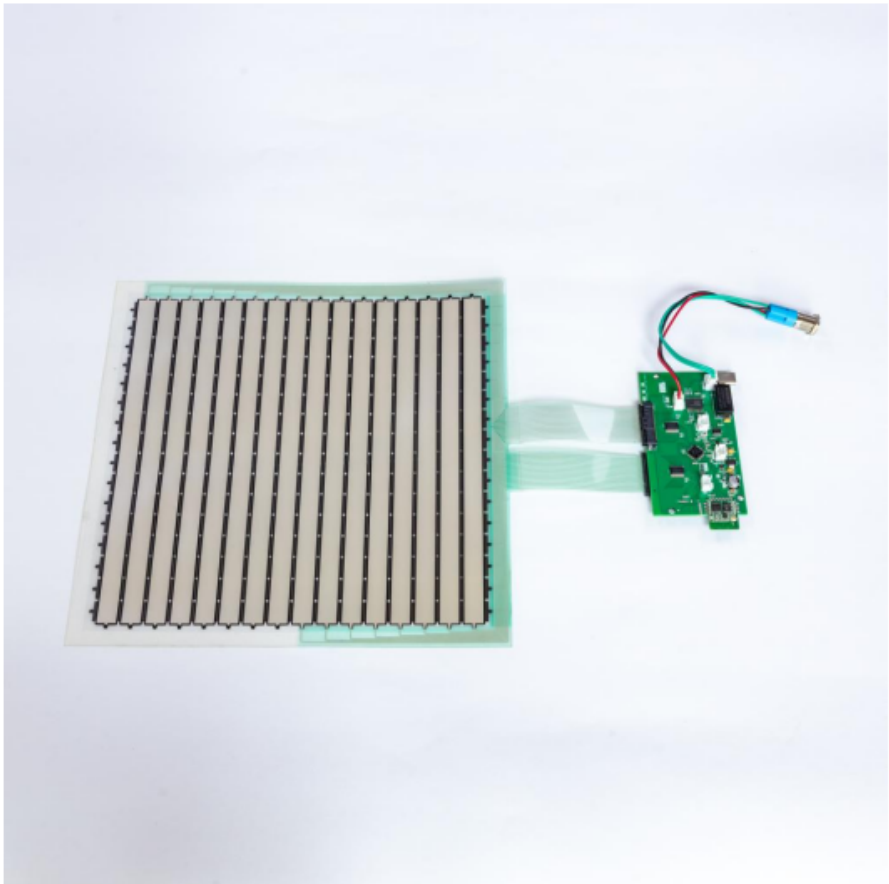
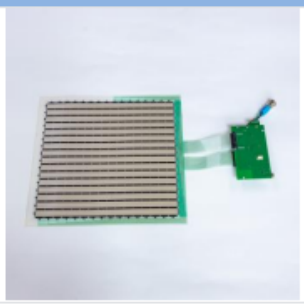


Figure 3 Product photo (FSR sensor and data acquisition module)

2. Product Components

2-1. FSR Sensor

Product Photo	Performance Parameters
	Electrode array: 16 rows x 16 columns Number of sensing points: 256 Overall dimensions: 324.36 x 248.15 mm Sensing area: 229.78 x 228.60 mm (approx. 528 cm²) Sensing point size: 11.17 x 12.35 mm Row/column pitch: 14.3 mm Connector: FPC, pitch 1.0 mm Sensor thickness: 0.3 mm Force measurement range: 500 g ~ 50 kg

Item	Parameter
Electrode array	16 rows x 16 columns
Number of sensing points	256
Overall dimensions (incl. tail lead area)	324.36 x 248.15 mm
Sensing area	229.78 x 228.60 mm (approx. 528 cm²)
Sensing point size	11.17 x 12.35 mm
Row/column pitch	14.3 mm
Substrate	PET
Sensor thickness	0.3 mm
Force measurement range	500 g ~ 50 kg
Force repeatability (single unit)	< ±5% (at 80% of max force)
Off resistance	> 1 MΩ
Response time	< 1 ms
Force resolution	Continuous
Operating temperature	-30 ℃ ~ 60 ℃
Operating voltage	3 ~ 5 V DC
Rated current	10 mA ~ 100 mA
Storage temperature	0 ~ 35 ℃
Storage humidity	< 70% RH
Service life	> 2 million cycles
Connector	FPC, pitch 1.0 mm (2, tail spacing 17.00 mm)

Table 2-1 FSR sensor specification parameters

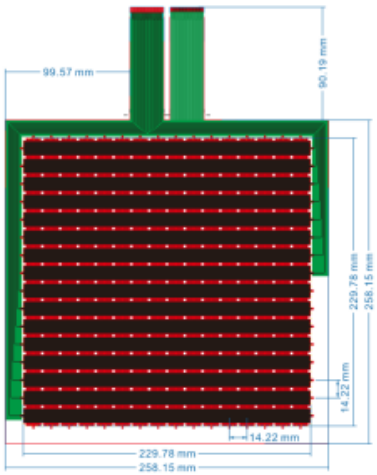


Figure 4 Product dimension drawing

Figure 5 Product structure (layer stack)

Note: the sensing area is a 16x16 matrix. The matrix FSR 16x16 shares the same data-acquisition platform and software as the larger matrix products, so the acquisition module, software and communication protocol described below follow the same configuration as that platform.

2-2. Data Acquisition Module

Product Photo	Electrical Performance Parameters
	Power supply: DC 5 V (Type-C interface) **Operating current:** standby 80 mA, full load 150 mA **ADC sampling resolution:** 16 bit, reference voltage 3.3 V **Communication:** USB virtual serial / WiFi wireless **Refresh rate:** USB 20 Hz; WiFi 5-12 Hz

3. Product Software

3-1. Software Operating Environment

Operating system: Windows 10 / 11 (64-bit);

Driver: a serial driver must be installed first, otherwise the COM port cannot be recognized.

3-2. Software Runing

The software is a green/portable version; double-click FlexPressureVision_boxed.exe to run.

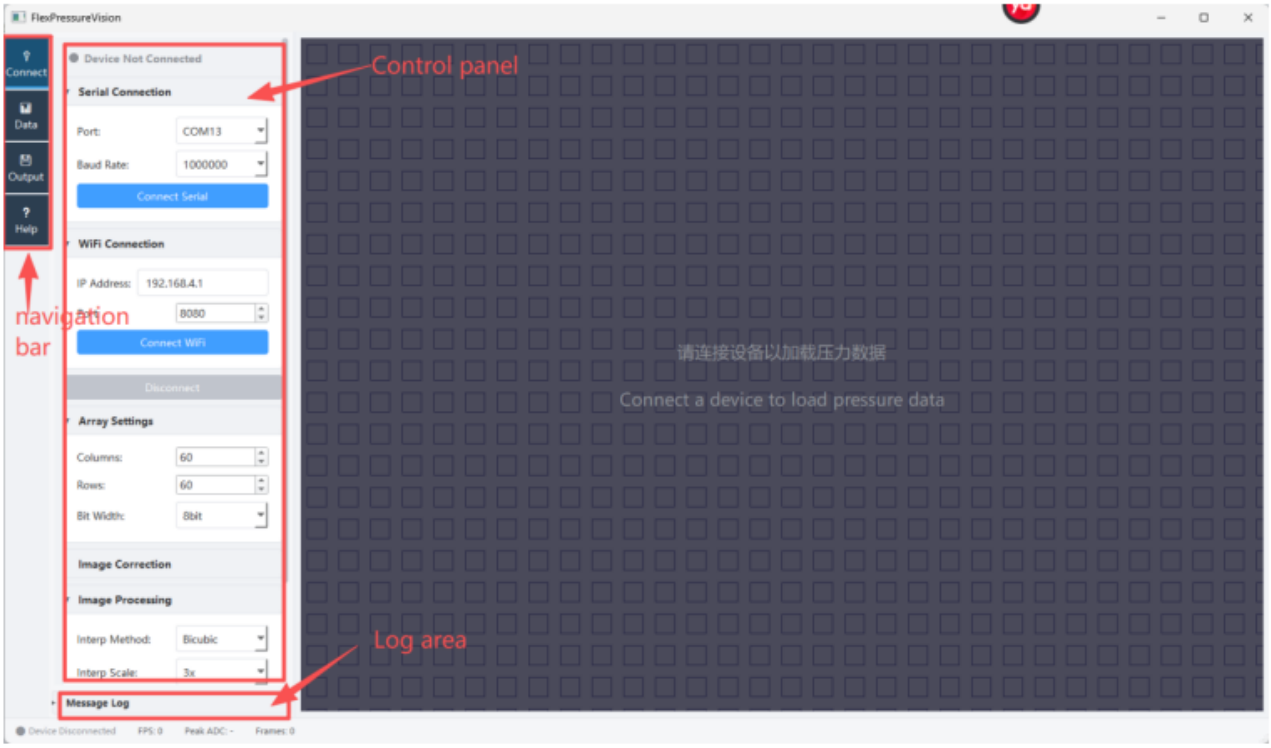


Figure 6: Description of the functional areas in the software interface

3-3. Software User Guide

The main window is divided into a left panel (navigation + control + log) and a right rendering area (2D/3D pressure map).

3-3-1. Connect Device

Connect the device power (Type-C, 5 V) and select a communication method:

(1) Select USB serial communication - connect the data cable to the computer and ensure the WiFi switch is off (press the power button; the WiFi indicator goes off).

(2) Select WiFi communication - Connect the data cable directly to the power adapter or mobile phone charger (5v 1a / 2a), turn on the WiFi red switch (then turn on the power switch, and the WiFi indicator light will be on). For the first use, connect the device to the WiFi hotspot matrix FSR using the password 123456789, and check "Automatic Connection".

Figure 7 Device buttons and interfaces

Figure 8 Connecting to the device WiFi hotspot

Open the software and click "Connect" to enter the connection page.

Note: *Before opening the software, make sure to turn on the device first. Otherwise, the software will not be able to recognize the COM port. Before powering on, you must select the communication mode and then press the power switch. To switch communication modes, first turn off the device power, then turn on or off the WiFi switch, and then press the device power to complete the switching process. The serial port and WiFi cannot work simultaneously; you can only choose one of the communication methods.*

1. Connect the device in the software:

- Serial: select the COM port and baud rate (default 1000000) and click "Connect Serial"
- WiFi: after confirming the computer is connected to the device WiFi, click "Connect WiFi"

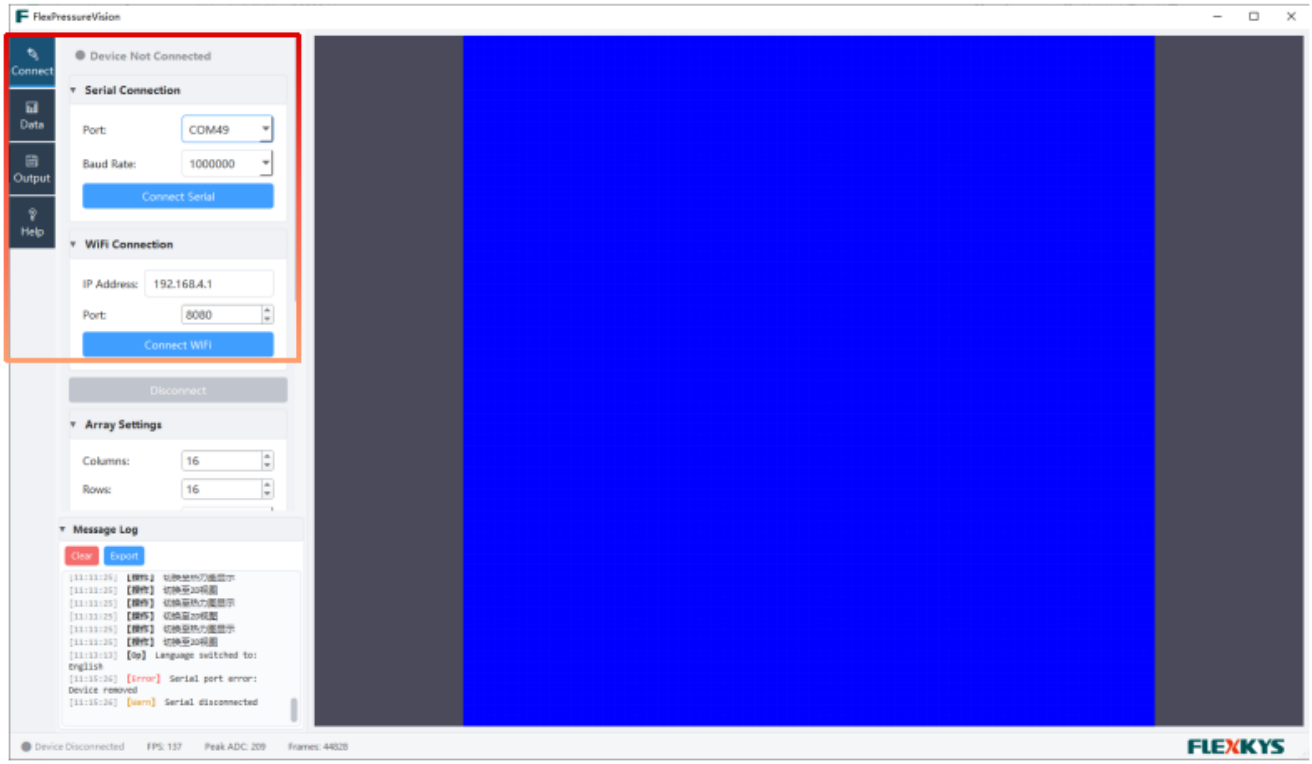


Figure 9 Software connection page

• Fill in 16 rows and 16 columns in the entire row/column setting. **If it is connected via USB, select 16bit. If you choose the WIFI connection method, set the bit rate to 8bit.**

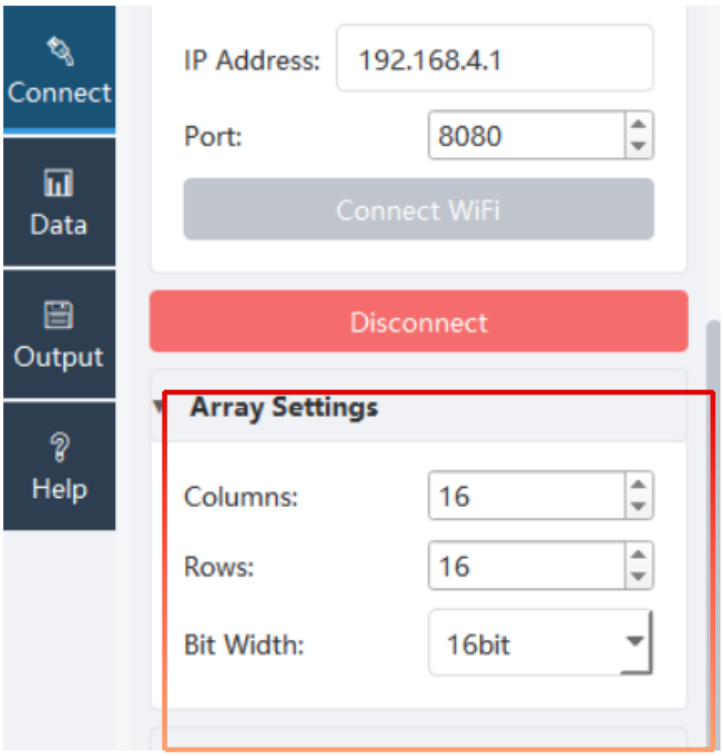


Figure10 Software connection page-Array Setting

2. On successful connection, the status bar shows the indicator and the log is output synchronously.

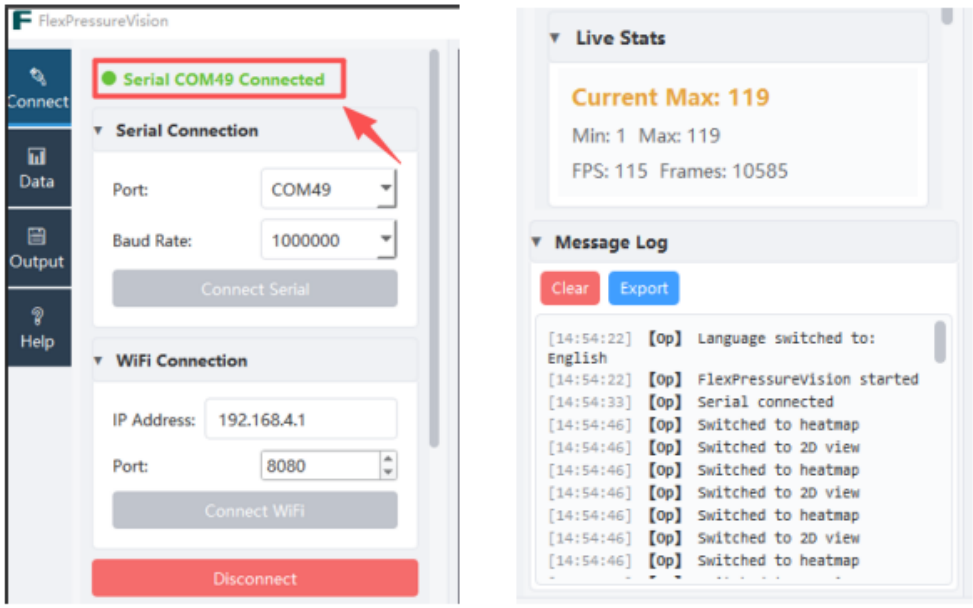


Figure 11 Successful connection status

3-3-2. Configuration Parameters

Configure at the bottom of the connection page:

Parameter	Description	Default
Columns / Rows	Sensor array rows and columns	16 x 16
Bit Width	ADC sampling depth, must match the slave device	16 bit
Horizontal / Vertical Mirror	Flip the image orientation	Off
Interpolation	Nearest / Bilinear / Bicubic	Bilinear
Interpolation Factor	Interpolation magnification	3x
Smoothing	Gaussian filter: Off / Pre-interpolation denoise / Post-interpolation blur	Off
Gaussian Sigma	Filter strength (0.5 ~ 3.0)	1.0

Table 3-1 Configuration parameters

3-3-3. Language Switching

Switch between Chinese / English interface at the bottom of the connection page.

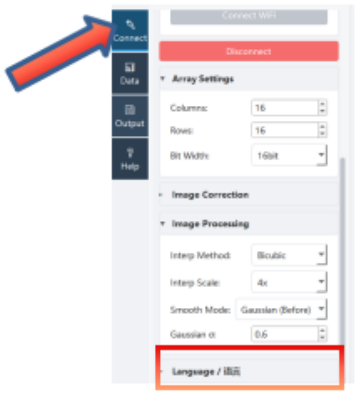


Figure 12 Parameter configuration interface

3-3-4. Data Display and Adjustment

Switch to the "Data" page:

- **Display Style:** grayscale / heatmap. Grayscale shows pressure intensity in black and white; heatmap shows a blue-to-red gradient.
- **View Mode:** 2D is a top-down plan view; 3D stretches the pressure into a 3D surface that can be dragged and rotated with the mouse.
- **Reference Voltage:** ADC reference voltage (default 3.30 V), used to convert the ADC count to an actual voltage value.
- **Gain:** 1.0 ~ 10.0x; increase the gain when the signal is too weak so that faint pressure can also be colored.
- **Range Adjustment:** the Min / Max sliders set the upper and lower bounds of the color mapping; below Min no color is shown, above Max is clipped. "Auto Range" adapts the range to the current data with one click.
- **Real-time Statistics:** current maximum, minimum / maximum, FPS, frame count.
- **COP Analysis:** It can display the position of the center of gravity of the force in the working area. By setting a noise threshold, the pressure noise below the threshold (such as the initial noise) can be filtered out.

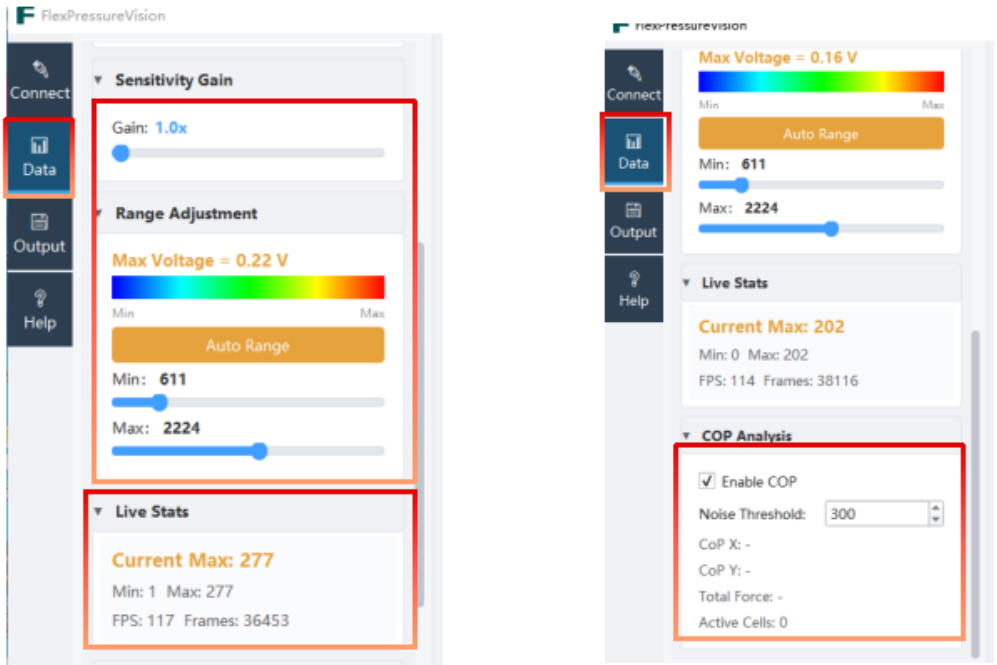


Figure 13 Range adjustment ,real-time statistics and COP Analysis

Switch to the "Connect" page:

In the image processing method, difference mode ,interp scale, smooth mode and Gaussian value can all be set.

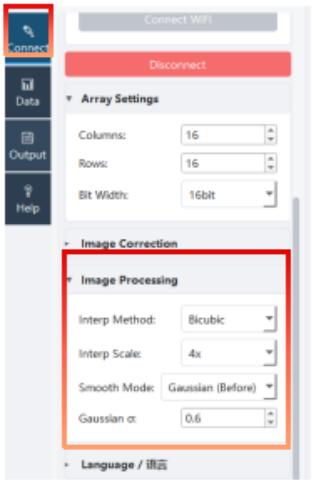


Figure 14 Image processing method

3-3-5. Data Export

Switch to the "Output" page:

Method	Description
TXT export	Raw ADC value text file
CSV export	Tabular format, openable in Excel
Screenshot	Save the current view as PNG
Display-area screenshot	Capture only the data rendering area
Full-screen screenshot	The whole main window
Batch image	Continuously save multiple frames

Table 3-2 Data export methods

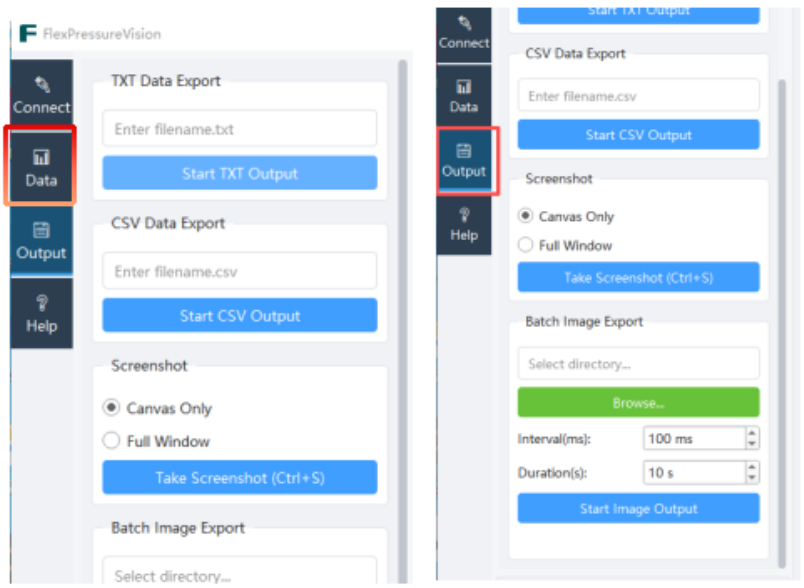


Figure 15 Data export interface

4. Interface Information

4-1. Serial Communication Protocol

4-1-1. Physical Link

The basic serial communication parameters are shown in the table below.

Item	Detailed Description
Communication interface	USB CDC virtual serial (Type-C hardware interface; the device has a built-in USB-to-serial controller)
Hardware flow control	None (RTS/CTS hardware handshake is not used; only two data lines are used for transmission)
Serial data format	8 data bits, 1 stop bit, no parity (8N1 standard serial mode)
Baud rate note	The USB virtual serial is based on the high-speed USB bus; the baud rate parameter is only a software placeholder and does not limit the actual transfer speed; the host serial tool can use any baud rate (recommended default 1000000) to transfer data normally
Communication logic	After power-on and sensor initialization, the device actively and cyclically reports the complete pressure array data packet; the host does not need to send any query or start command - data is received as soon as it is connected

The device connects to the PC via USB and, after the driver is installed, is recognized as a COM port (Windows). The baud rate does not affect the actual transfer speed; the default value (e.g. 1000000) can be used. Once connected, the host software receives the data packets from the acquisition device without sending any command.

4-1-2. Data Format

The frame structure is globally fixed; a single frame is fixed at 519 bytes (16-bit ADC sampling; this device outputs 16 bits by default). The data acquisition device reports the complete pressure sensor array data frame in the following format:

Frame header (3 bytes)	Reserved bytes (2 bytes)	Data payload	Frame tail (2 bytes)
Fixed 55 AA F1	00 00, reserved unused	16x16 ADC values	Fixed 00 5A

Table 4-1 Data frame structure

Frame length formula breakdown:

Formula: total = 3 + 2 + columns x rows x (bit width / 8) + 2.

This device defaults to 16 bit (2 bytes per point) -> 3 + 2 + 16x16x2 + 2 = 519 bytes

8-bit packet length -> 3 + 2 + 16x16x1 + 2 = 263 bytes

Example packet analysis:

55 AA F1 00 00 02 00 02 00 02 00 03 00 06 00 04 00 07 00 05 00 22 00 09 00

08 00 20 00 08 00 04 00 ... 00 04 00 05 00 04 00 03 00 03 00 02 00 02 00 5A

- 55 AA F1: frame header, marks the start of a frame
- 00 00: reserved padding bytes
- 00 02: ADC value of the 1st sample point = 0x0002 = 2; 02 00: ADC value of the 2nd sample point = 2; parse all 256 two-byte groups in order
- Frame tail 00 5A: end-of-frame flag, indicating that the current 16x16 array data transfer is complete, immediately followed by the next frame

Host parsing logic:

- Continuously buffer the data stream received over USB;

- Search the byte stream cyclically for the sync frame header 0x55 0xAA 0xF1;
- After finding the header, read the next 514 bytes (2 reserved bytes + 512 payload bytes), then the following 2 bytes should be 0x00 0x5A;
- After validation, extract the middle 512-byte payload and split it into 2-byte groups to reconstruct the 16x16 two-dimensional pressure matrix; on failure discard the current buffer and re-synchronize on the frame header.

4-2. WiFi Communication

4-2-1. Basic Communication Parameters

The basic WiFi communication parameters are shown in the table below.

Item	Detailed Description
Communication protocol	TCP socket (TCP server mode; the device builds a TCP server after power-on)
Default parameters	AP hotspot mode, device IP: 192.168.4.1, listening port: 8080
Data format	Binary stream, the same 55 AA F1 frame structure as the serial port
Connection method	After the PC / host device connects to the device WiFi hotspot, it acts as a TCP client and connects to 192.168.4.1:8080
Transport	TCP streaming binary stream, no additional TCP encapsulation layer; it only transparently transmits the same raw pressure frame as the serial port

The binary data packet transmitted over WiFi TCP has the same frame header, reserved bytes, ADC payload, frame tail, total length, byte order and matrix arrangement as the USB virtual serial; the host parsing code is common and does not need to distinguish between the serial / WiFi links.

Complete frame: 55 AA F1 + 00 00 + 256 two-byte ADC values + 00 5A, 519 bytes per frame.

TCP streaming: TCP is a boundary-free byte stream and does not packetize automatically. The host must follow the same logic as the serial port: rely on the frame header 55 AA F1 and the frame tail 00 5A for frame synchronization and de-framing, and must not parse data based on TCP packet boundaries.

4-2-2. WiFi Communication Workflow

1. After power-on, the WiFi module automatically creates an AP wireless hotspot (WiFi name: Matrix FSR / password: 123456789);

2. The internal firmware starts a TCP server and keeps listening on port 8080 for a client to connect;

3. After the PC / tablet connects to this WiFi hotspot, it uses a network debugging tool or host software to initiate a TCP client connection to 192.168.4.1:8080;

4. Once the connection is established, the device automatically and cyclically reports the complete pressure array data packet; the client does not need to send any start or query command;

5. After the client disconnects, the device continues to wait for a new client, and resumes data reporting once a client connects;

6. A single client connection is supported; when multiple clients connect simultaneously, only the first valid connection can receive data.

Appendix A Application Circuit Reference

The sensor consists of a 16-row, 16-column array with 256 pressure acquisition points total. The reserved connector consists of two 1.0 mm-pitch 16-pin FPC connectors (FPC_1 and FPC_2). The figure below shows an example circuit block diagram for reference; the user may adjust the circuit according to the actual application.

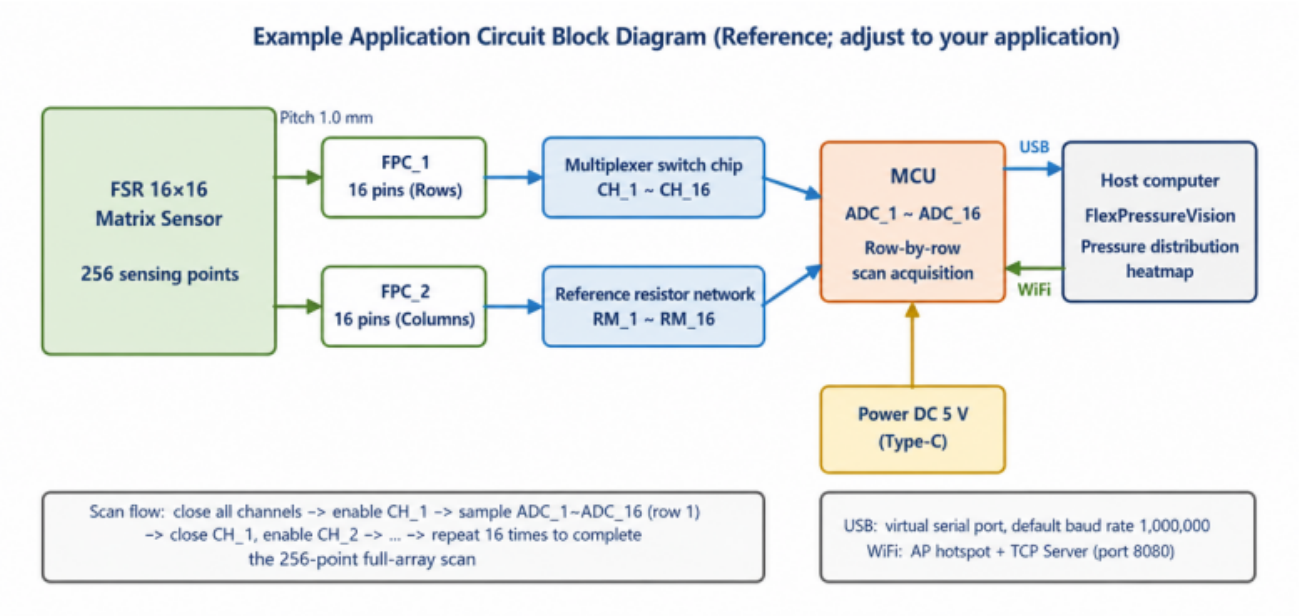


Figure A-1 Example application circuit block diagram

Example description: the FSR connector "FPC_1" connects to the CH_1 ~ CH_16 ports of the channel-switch chip; the FSR connector "FPC_2" connects to the RM_1 ~ RM_16 ports (the reference resistor RM value may be determined by the customer according to the actual use). The MCU measures the voltage across the reference resistors (RM) using 16 ADC channels: when all channel switches are off, turn on channel 1 (CH_1) and the MCU acquires the ADC_1 ~ ADC_16 voltage values, from which the R_FSR force value of row 1 is obtained; then turn off CH_1 and turn on CH_2, and the MCU acquires the ADC_1 ~ ADC_16 voltage values again to obtain the R_FSR force value of row 2, and so on. With the channel-switch chip and the MCU ADC channels cooperating, the 256 pressure acquisition points can be fully scanned, and the force distribution on the sensor surface can be obtained through data analysis.

The host software can simultaneously show which areas of the sensor are under load and which are unloaded, and can distinguish between heavily, moderately and lightly loaded areas within a loaded region. The sensor is highly sensitive to motion and force changes.