KTH78 series

Evaluation Kit User Manual

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1 Product Overview

The KTH78 series evaluation kit is designed to be used alongside the EVM programmer software. This manual introduces the components of the evaluation kit and the primary features of the software, including register read/write, angle data reading, and firmware updates.

2 Evaluation Kit Components

2.1 Connection Diagram

The connection diagram of the KTH78 evaluation kit is shown below. It includes a USB cable, KTH78 Sensor Control Board (SCB), connection cables, adapter board and demo board. The KTH78 SCB evaluation box contains an MCU preloaded with the necessary firmware for communication and interaction with the software. The adapter board can connect either to the customer's PCB or the provided demo board. The demo board is equipped with the KTH78 series chip, and all the pins of the chip are exposed for easy connection and testing.

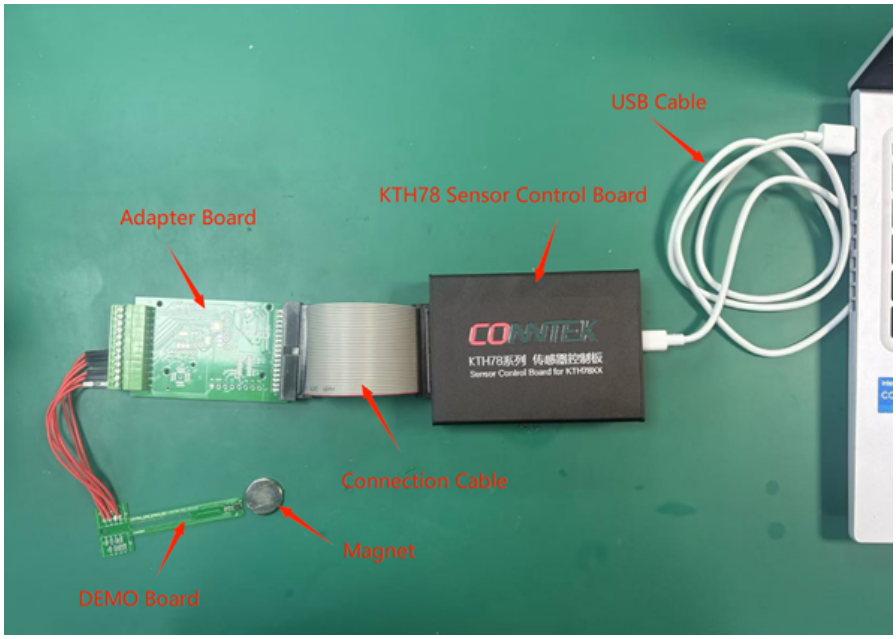


Figure 1: Connection diagram of the KTH78 evaluation kit.

2.2 Adapter Board

The adapter board connects the KTH78 SCB evaluation box on the left through a conntection cable. Its pin definitions are labeled in the diagram. On the right, it connects to the demo board with removable terminals, and the pin definitions are also labeled. If no demo board is available, the KTH78 series chip can be soldered directly onto the adapter board for evaluation.

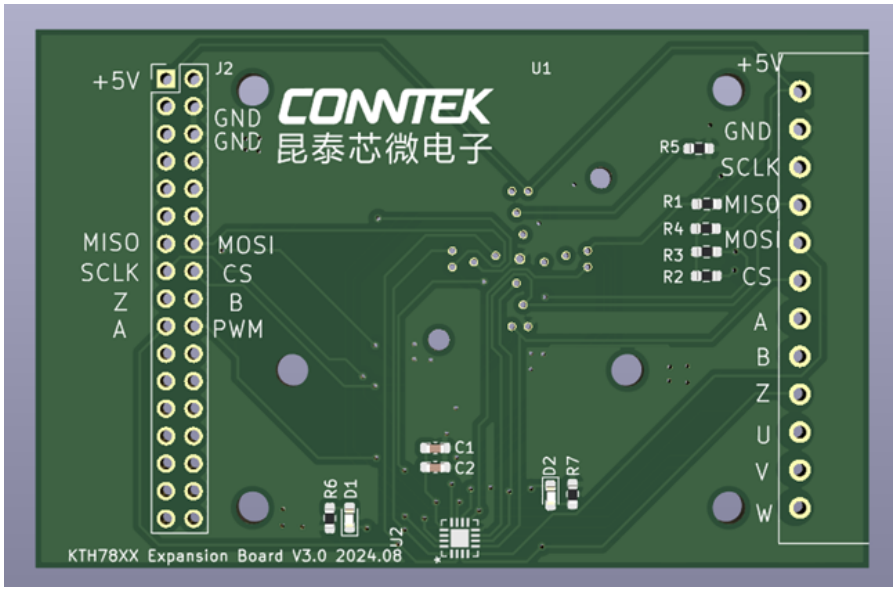


Figure 2: Adapter board for the KTH78 evaluation kit.

2.3 Demo Board

The demo board includes the KTH78 series chip and the necessary capacitors. It also connects essential chip pins to pads below through J1 and J2 connectors. The pad definitions for J1 and J2 are as follows:

Pad	Pin	Description
J1.1	VDD	Power Supply
J1.2	GND	Ground
J1.3	NC	Not Connected
J1.4	CS	SPI Chip Select
J1.5	SCLK	SPI Clock
J1.6	MISO	Master In Slave Out
J1.7	MOSI	Master Out Slave In
J1.8	TEST	Internal Testing
J2.1	IO6	PIN15
J2.2	IO1	PIN1
J2.3	IO5	PIN9
J2.4	IO4	PIN6
J2.5	IO2	PIN2
J2.6	IO3	PIN3
J2.7	MGL	Magnetic Field Low
J2.8	MGH	Magnetic Field High

Table 1: Pad Definitions for Demo Board Connectors

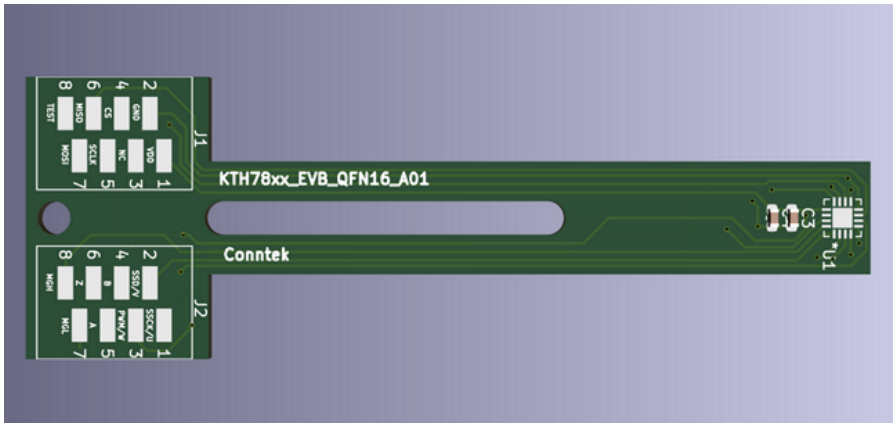


Figure 3: Demo board for the KTH78 series chip.

3 Software Interface and Features

3.1 Home Section

The home section includes several primary functionalities:

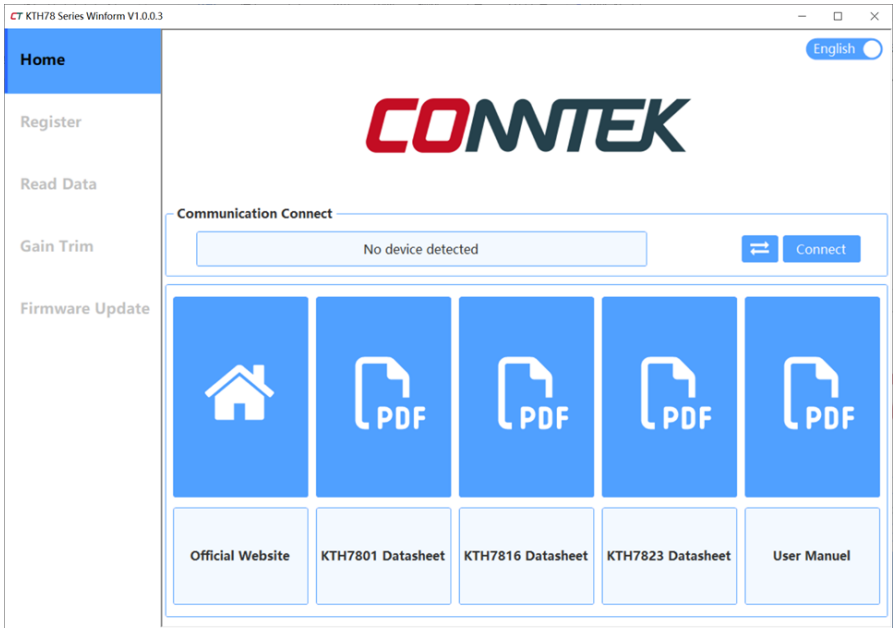
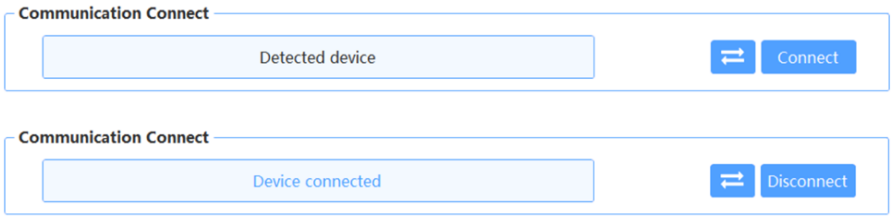


Figure 4: Home section interface.

3.1.1 Communication Connection

The default communication mode is USB. Users can switch between USB and serial communication by toggling the option. Once the hardware is connected via USB, a message will indicate detection. Clicking ”Connect” will establish the connection if the message confirms success. Otherwise, an error dialog will appear.

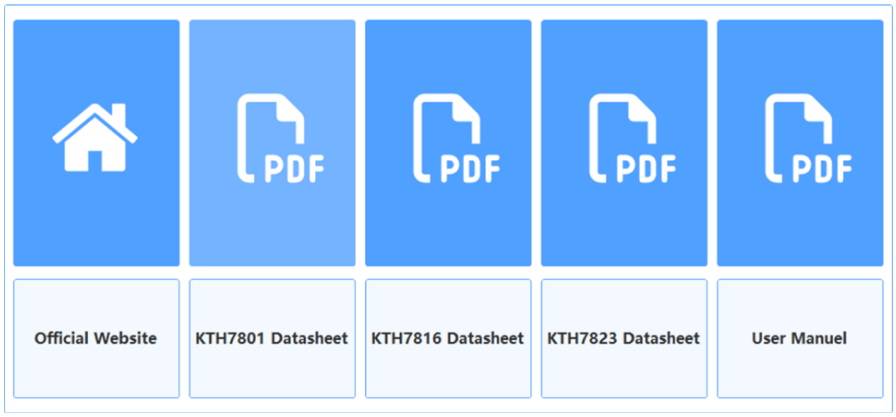


3.1.2 Language Switching

The default language is Chinese. Users can toggle the language setting to switch between Chinese and English.

3.1.3 Related Resources

This section provides access to relevant resources for further reference.



3.2 Register Read/Write Section

The register read/write section allows users to interact with the device's registers.

3.2.1 Register Table

Users can modify register values directly by entering values in the text fields and pressing Enter. Checkboxes enable or disable specific register settings.

Figure 5: Register table interface.

3.2.2 Functional Details

The "Read Registers" button updates all register values in the table. The "Write Registers" button writes all modified values to the chip, providing a dialog with feedback on success or errors. The result of the magnetic field strength detection is reflected by the indicator light on the interface. If the light is on, it indicates that the magnetic field strength has exceeded the threshold.

3.3 Data Reading Section

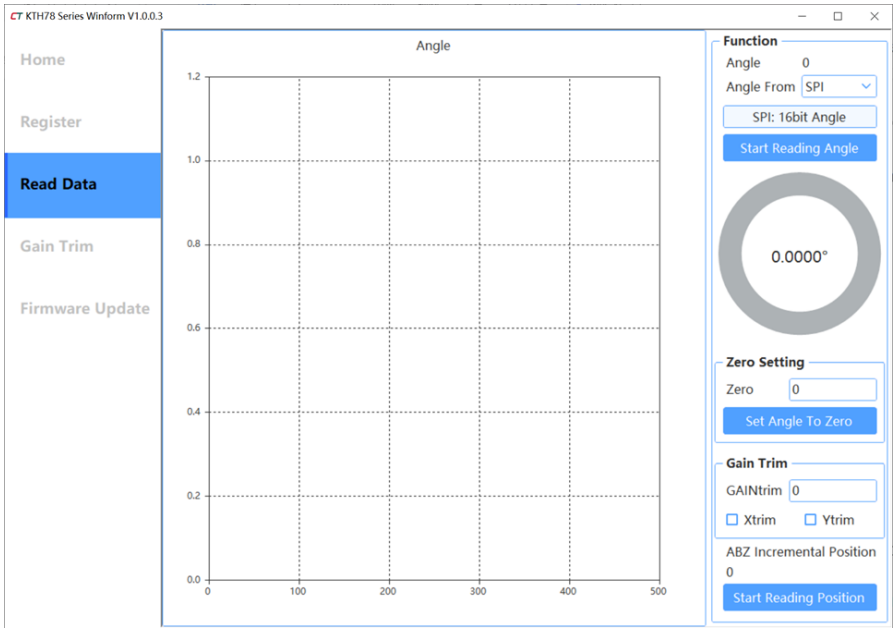


Figure 6: Data reading section interface.

The **Start Reading Angle** button continuously reads angle data and updates the real-time angle reading plot, the current angle value, and the degree display below.

The plot can be zoomed in by selecting an area with the mouse, and it can be restored to its original view by right-clicking.

The **Angle Source** dropdown menu provides two options: SPI and PWM, which allow switching between different angle acquisition methods.

Above the **Read Angle** button, there is a text prompt displaying the SPI angle output format: either 16-bit angle or 12-bit angle + CRC.

For **Zero Point Configuration**, users can modify the value in the **Zero** text box and press Enter to write the value into the zero-point setting register. Clicking the **Set Current Angle as Zero Point** button will write the current angle value displayed at the top into the zero-point setting register.

For **Off-Axis Calibration**, users can modify the value in the **GAINtrim** text box and press Enter to write the value into the off-axis trim register. By selecting the **Xtrim** or **Ytrim** checkboxes, users can choose to trim the X or Y axis.

The **Start Reading Position** button continuously reads position data and updates the ABZ incremental position text display in real time.

3.4 Gain Trim Section

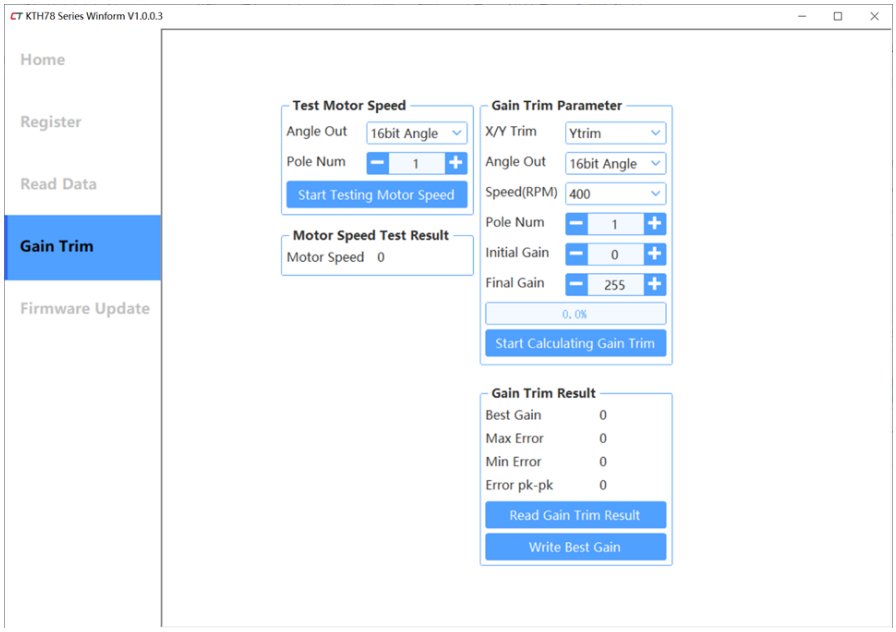


Figure 7: Gain Trim settings.

This function primarily enables the motor to rotate at a constant speed while the program periodically reads the SPI position data from the KTH78 chip. It then calculates the optimal **GainTrim** register value and writes it into the register to achieve off-axis correction.

Before use, ensure that the motor rotates at a constant speed. The speed can be selected from one of the following options: 50 rpm, 100 rpm, 400 rpm, 500 rpm, 1000 rpm, or 3000 rpm. Next, configure the off-axis parameters as described below:

- (1) **Trim Direction**: Refers to the selection of **Ytrim** or **Xtrim**, based on the physical position of PIN1 as defined in the datasheet.
- (2) **Angle Output**: Specifies the SPI angle format. Based on the chip's suffix model, choose between a 16-bit angle output or a 12-bit angle output with a 4-bit CRC.
- (3) **Motor Speed**: Refers to the current constant rotational speed of the motor.
- (4) **Pole Pairs**: Refers to the number of pole pairs of the magnet used with the KTH78 chip.
- (5) **Initial Gain and Final Gain**: Specifies the range of **GainTrim** register values to be tested.

After configuring the off-axis parameters, click the **Start Off-Axis Calculation** button. The program will begin calculating the off-axis parameters, and the progress bar will start moving. When the progress bar reaches 100%, the calculation is complete, and the results will be displayed in the off-axis calculation results area.

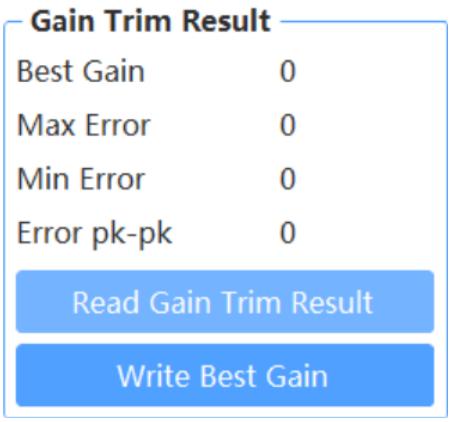


Figure 8: Gain Trim Results.

Clicking the **Write Optimal Gain Value** button will write the optimal **GainTrim** value into the **GainTrim** register and save it.

3.5 Firmware Update

The firmware update process includes the following steps:

1. Connect via USB communication. 2. Select the desired firmware binary file. 3. Click "Update" and wait for the progress bar to complete. If an error occurs, retry the process.

4 FAQs

Q: How do I set ABZ resolution and UVW pole pairs?

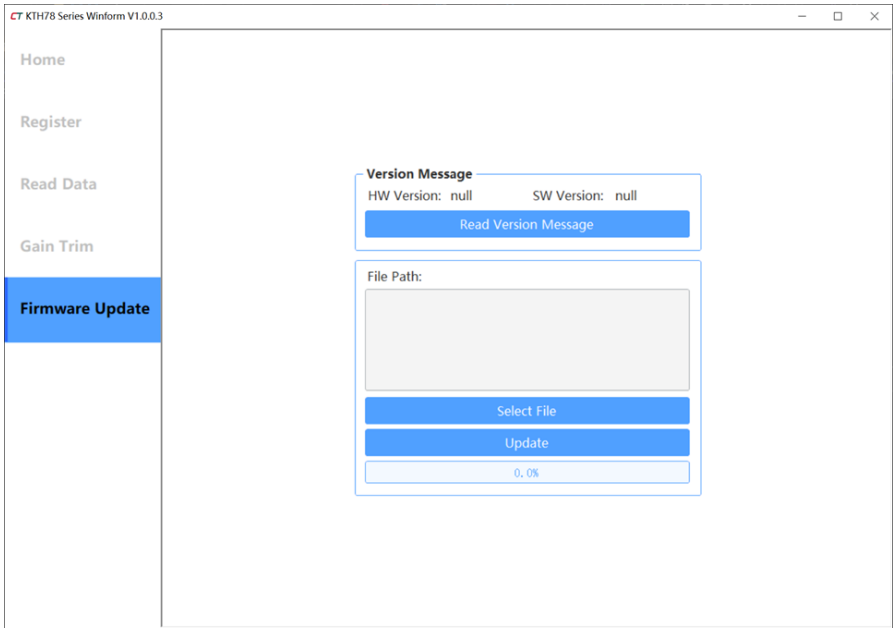


Figure 9: Firmware update interface.

- **ABZ Resolution**: Set by the PPT[9:0] register. The resolution equals $4 \times (\text{PPT}[9:0] + 1)$ lines. For example, PPT[9:0] = 1023 results in an ABZ resolution of 4096 lines.
- **UVW Pole Pairs**: Set by the NPP[2:0] register. The pole pair count equals NPP[2:0] $+ 1$. For example, NPP[2:0] = 0 corresponds to 1 pole pair.

Revision History

Version	Date	Author	Revision Summary
1.0	2024.06.18	Liu Junbo	Initial release.
1.1	2024.08.12	Hu Qinbin	Added description for automatic gain calculation.
1.2	2024.08.20	Liu Junbo	Added bilingual switching; updated angle reading and version information features.
1.3	2024.12.13	Zhang Kaixin	Updated evaluation board composition details.

Table 2: Revision History