
SECD-7I0B-03 (H)

User Manual V1.0

Serial number	version number	content	Date
1	V1.0	New	2020.07.13

Preface

SECD-710B-03 (H) is a monitoring and control platform specially designed for construction machinery and agricultural machinery by Huaxing Digital Company. The display is based on the ARM platform and adopts a 7.0-inch, 800×480 resolution TFT industrial-grade liquid crystal display, which has good human-computer interaction performance.

In addition to the display function, it also integrates control and communication functions: support digital and analog signal input and output, motor control, CAN, LTE, GPS, and can seamlessly connect with the remote monitoring center.

The display adopts a flat-panel front panel design with a beautiful industrial appearance. Electromagnetic compatibility, IP protection, and high level of anti-vibration impact can meet the environmental index requirements of harsh working conditions.

It supports the LM Studio integrated development environment independently developed by Huaxing, and the configuration program and screen development are easy.

1、Functions and features

1. Integration of control, display and communication

- Display: Exquisite and practical industrial-grade TFT LCD screen, which can realize the display of various components
- Control: 5 channels of switch input, 6 channels of switch/PWM output, 8 channels of analog input, 1 channel of motor drive output
- Communication: support a variety of wired and wireless communication technologies, compatible with J1939/CANOpen/CAN2.0B protocol; support USB program and quick download of pictures
- The function overview is as follows:

Numbering	Features	Sub-number	Subfunction	description
1	display	1.1	Picture switch	Press the button to turn the page
		1.2	Variable display	Display variable value at specified position
		1.3	Icon display	Display a customized icon in the specified location
		1.4	Bar graph display	The progress bar shows the associated variable value
		1.5	Cut picture	Cut the picture to a custom target location
2	communication	2.1	CAN communication	Receive the CAN data of the Huaxing controller and send it to the configuration software after processing; receive the data of the configuration software and send it to the controller;
		2.2	LTE communication, GPS communication	Upload data to the remote monitoring center; receive data from the monitoring center; receive satellite latitude and longitude information
		2.4	GPRS remote debugging and update of LM configuration	The remote technical support center can perform remote LM debugging and brushing
		2.5	USB update program and pictures	After plugging in the USB with HMI configuration, the configuration and picture will be updated automatically after power on

3	control	3.1	Process control	Realize the sequence relationship, branch relationship, and cycle relationship in the task body software
		3.2	Parameter feature modification	Component parameter format definition
		3.3	Integer operations	Integer definition, assignment, extreme value, limiting, four arithmetic operations, logic operations, comparison and other functions
		3.4	Floating point arithmetic	Realize floating-point number definition, assignment, extreme value, limiting, four arithmetic operations, elementary function operations, comparison and other functions
		3.5	Data conversion processing	Realize normalization processing, data conversion processing between different types of data and different engineering quantities
		3.6	Selection function	Realize the choice relationship between number and number
		3.7	Approximation function	Provides approximate calculation methods such as the Taiwanese series approximation of the piecewise continuous function and the multi-segment straight line approximation of the curve
		3.8	Time function	Realize a class of functions that are used in discrete manufacturing and batch process industries, which are related to time and use switching and analog as output functions
		3.9	Process volume processing	Provides a class of functional functions for process industry automation (including specific calculation methods for engineering quantities such as flow and temperature)
		3.10	Control typical links	Provides typical links for controller design and control system simulation
		3.11	PID controller	Provides a PID controller that accounts for more than 90% of the total control

				loop
		3.12	Dedicated TSO controller	Provides the unique "transient-steady-state-overshoot" controller and two-position controller unique to LM measurement and control components
		3.13	filter	Provides Butterworth filters for process industry automation
4	Human-computer interaction	4.1	Keyboard scan	Support 5 buttons
		4.2	Power saving function	Screen brightness automatic/manual adjustment
5	input Output	5.1	Switch input	Support switch input
		5.2	Analog input	Support analog input
		5.3	Frequency input	Support TI input
		5.4	Switch output	Support switch output
		5.5	Analog output	Support analog output
		5.6	Motor output	Support stepper motor output

1. Dedicated display and control development environment

Huaxing's self-developed LM Studio display and control development environment, based on the IEC61149 standard, provides LM Studio-GUI screen preparation tools, and integrates a large number of function blocks to quickly develop screens and configuration programs.

2. Adapt to harsh environments

Can be used in severe cold and hot environments: -25 degrees low temperature, 65 degrees high temperature

Anti-reverse power supply design, self-protection greater than 37V to prevent burnout

Suitable for environments such as strong vibration, dusty rain and lightning strikes in field operations

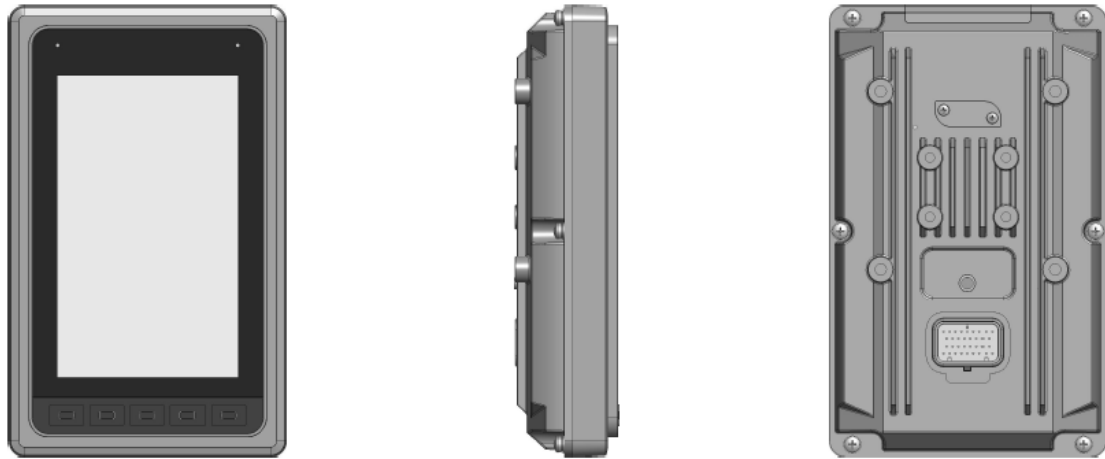
3. It can be seamlessly connected with Huaxing remote monitoring system

Support remote debugging and brush program, convenient for after-sales maintenance

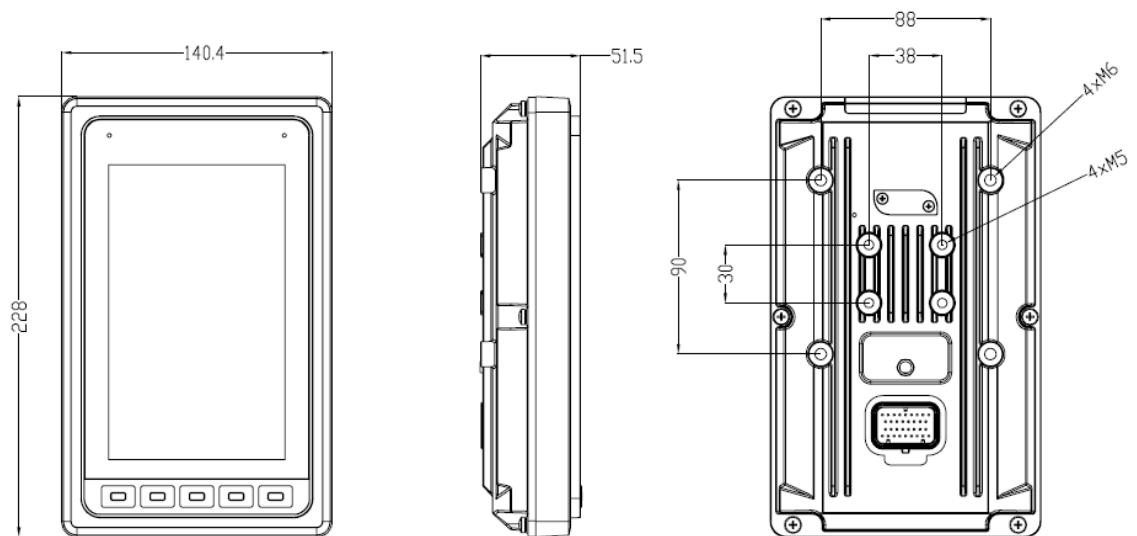
Support remote unlocking machine to facilitate credit management

2、external interface function description

1. External interface definition



2. Installation size



Can be fixed and installed with 4×M6 screws (including spring washers and flat washers)

1、Definition of connector port

classification	Port type	The port number	Corresponding to M4-MCU pin	Mode selection/feedback	Features
Voltage type analog input	AI_V_1	J1-21	PA1_ADC12_IN1		High-speed AD sampling: Input: 0~10V.DC, Accuracy: 0.5%, Resolution: 0.025%
	AI_V_2	J1-29	PA1_ADC12_IN2		
	AI_V_3	J1-30	PA1_ADC12_IN3		
	AI_V_4	J1-32	PA1_ADC12_IN4		
	AI_V_5	J1-4	PA1_ADC12_IN5		
	AI_V_6	J1-5	PA1_ADC12_IN6		
Resistive analog input	AI_R_1	J1-23	PA1_ADC12_IN7		The sampling range is set by the duty cycle, the sampling accuracy is 0.5%, and the resolution is 0.025%; 0~30KΩ
	AI_R_2	J1-31	PA1_ADC12_IN8		
Switch input (low effective)	DI_L_1	J1-12	PH4	PA9(DO) The default is DI_L, when PA9 is high, it is DI_H	High and low level switching is detected, Low level (0-4.55V) High level (4.55-36V) Frequency: 0~1KHz
	DI_L_2	J1-13	PH3		
	DI_L_3	J1-14	PH8		
	DI_L_4	J1-15	PF8		
	DI_L_5	J1-6	PE3		
Frequency input	TI_1	J1-3	PA8	PF7(DO) The default is TI_1 pull high, when PF7 is high, pull low	12-24V.DC Frequency:10Hz~70KHz, Accuracy: 0.1%
PWM/switch output	PWM_1/DO_1	J1-10	PB7	PB1_ADC12_IN9	Pulse width modulation output: Frequency: 50~2.55kHz, Current 0~1.5A, 1% accuracy, 0.025% resolution
	PWM_2/DO_2	J1-18	PB8	PC1_ADC123_IN11	
	PWM_3/DO_3	J1-26	PB9	PC2_ADC123_IN12	
	PWM_4/DO_4	J1-27	PB10	PC3_ADC123_IN13	
	PWM_5/DO_5	J1-28	PB11	PC4_ADC12_IN14	
	PWM_6/DO_6	J1-22	PF6	No feedback on this route	
Motor drive output	MO_A+	J1-11			Stepper motor control Contact capacity: 40V.DC 1.2A, Frequency: 0~130Hz, Features: overvoltage, short circuit protection
	MO_A-	J1-16			
	MO_B+	J1-19			
	MO_B-	J1-20			
Reset	Reset	J1-7			Short circuit with ground for more than 5 seconds to reset
Key switch	SMI Key switch	J1-17			Judge whether the key switch is turned on when input 24V or not
Ground	GND	J1-8,24,33			Ground
Power supply	+5VOUT	J1-9			Power supply for external devices, Maximum output 750mA

Power positive	Power positive	J1-25,34			Power supply 12-24V
CAN bus	CANA_H	J1-2			
	CANA_L	J1-1			

Internal control pin		
Features	Corresponding to M4-MCU pin	Remarks
Key scan	PG10 (DI), line scan	Key code 1-key S5
	PG13 (DI), line scan	Key code 3-key S1
	PG14 (DI), line scan	Key code 4--button S2
	PG2 (DI), column scan	Key code 5--button S3
	PG3 (DI), column scan	Key code 6-key S4
Two hours to trigger the reset port	PI3	Output
24VDRV start	PI11	Output
SMI signal detection	PI8	input
buzzer	PB12	Output
AUO screen backlight control	PE5	Output
AUO screen brightness adjustment	PC8	Output
ARM 24 signal detection	PA0_ADC123_IN0	input

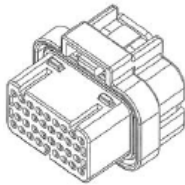


3、Development and debugging

1、Hardware development platform



Connect the PC to the LM USB emulator via USB, and connect the other end of the emulator to the SECD-710B-03 (H) display screen via CAN. Install Huaxing's dedicated integrated development environment LM Studio on the PC. Complete the construction of the hardware platform.

When purchasing products, relevant development and debugging accessories must be equipped at the same time, as shown in the following table:

Serial number	name	model	Icon	Vendor
1	AMP connector socket sheath	4-1437290-0		Tyco Electronics
2	AMP connector metal pin	3-1447221-3		Tyco Electronics
3	USB analog debugger	HX-USB-SIMULATOR		Shanghai Huaxing Digital Company

1. Software development platform

LM Studio supports application development based on Huaxing's special LM language, and provides a software platform integrating project management, code writing, compilation, and debugging functions for Huaxing's controller and display product application development, and improves application development efficiency and quality.

With the help of the GUI programming module of LM Studio, users can develop in a graphical manner. They only need to create some controls on the interface and associate these controls with the corresponding variables. At the same time, some LM script programs corresponding to the keys are added to realize what you see is what you get.

LM Studio integrates a large number of mature and easy-to-use component libraries, as follows:

Component number	Big category	Category description	Function introduction
1. 1	System kernel	System functions	Implement system definition
1. 2		Mission control	Realize the definition of task body
2. 1	Basic services	Process control	Realize the sequence relationship, branch relationship, and cycle relationship in the task body software
2. 2		Parameter feature modification	Component parameter format definition
2. 3		Integer operations	Integer definition, assignment, extreme value, limiting, four arithmetic operations, logic operations, comparison and other functions
2. 4		Floating point arithmetic	Realize floating-point number definition, assignment, extreme value, limiting, four arithmetic operations, elementary function operations, comparison and other functions
2. 5		Data conversion processing	Realize normalization processing, data conversion processing between different types of data and different engineering quantities
2. 6		Selection function	Realize the choice relationship between number and number
2. 7		Approximation function	Provides approximate calculation methods such as the Taiwanese series approximation of the piecewise continuous function and the multi-segment straight line approximation of the curve
3. 1	communication	CAN communication	Realize CAN data transmission
3. 2		GPRS/GPS communication	Realize GPRS/GPS data transmission
3. 3		Serial communication	Realize RS232 serial data transmission
4	input Output	Input and output drive	Realize digital input and output, analog input and output, pulse input, motor output, and real-time clock, keyboard, encoder and other peripheral communication

5.1	typical application	Time function	Realize a class of functions that are used in discrete manufacturing and batch process industries, which are related to time and use switching and analog as output functions
5.2		Process volume processing	Provides a class of functional functions for process industry automation (including specific calculation methods for engineering quantities such as flow and temperature)
5.3		Control typical links	Provides typical links for controller design and control system simulation
5.4		PID controller	Provides a PID controller that accounts for more than 90% of the total control loop
5.5		Dedicated TSO controller	Provides the unique "transient-steady-state-overshoot" controller and two-position controller unique to LM measurement and control components
5.6		filter	Provides Butterworth filters for process industry automation
6.1	GUI screen	GUI system	Build GUI system
6.2		GUI graphic control library	Create page, icon, text, bar graph, meter pointer and other controls
6.3		GUI script library	Dedicated to the process control, numerical calculation and timer function of the GUI system

For specific component applications, see "LM Reference Manual" under the "Help" menu of the LM Studio software.

3、Application examples

3.1 Screen compilation

The screen preparation adopts the graphical "what you see what you get" method for development. It includes the following steps:

- Create a new GUI project
- Add GUI controls
- Generate GUI code template

Create a new GUI project and add GUI controls → Edit control properties → Modify script based on background script template

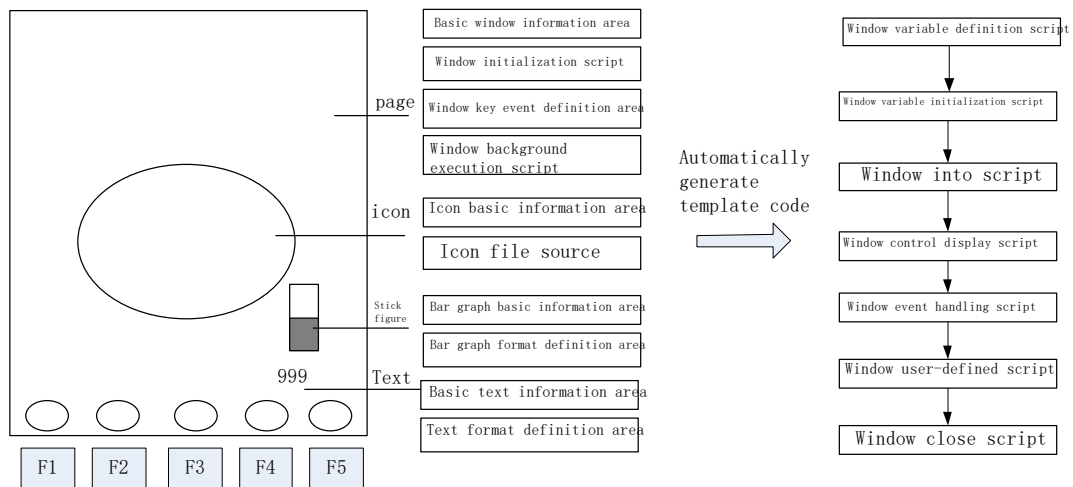


Figure 1 The basic process of LM Studio GUI development graphical interface

3.1.1 Create a new GUI project

For details, see "Help Content" under the "Help" menu of the LM Studio software.

3.1.2 Add GUI controls

- Page control definition

3.1.3 Generate background GUI script code

Double-click the page to automatically generate the background script code corresponding to the page.

3.2 Control and communication programming

3.2.1 IO input and output function

-
- 1-4.3 horizontal screen;
 - 2---5.0 vertical screen
 - 3—7.0 Portrait
 - After the first line is over, press Enter, and write GUILib: V. in the second line.
After the second line is over, press Enter to save and exit.

3) Create three folders, ICON, LIB, and PHOTO under the GUI folder

- LIB folder---used to place font files, the naming of font files conforms to XXXX.DZK (X is Arabic numerals)
- PHOTO folder---used to store picture files, the pictures are converted from the host computer download tool, and the name conforms to XXXX.bmp (X is Arabic numerals)
- ICON folder---used to place icon files



3.3.2 Burning steps

- 1) Before burning the picture font library, make sure that the bottom layer has been burned. You can open the configuration debugging interface to connect to the code file to observe whether it can communicate. If it fails to communicate, first reset the motherboard and try again.
- 2) After adding the files to be burned in the U disk according to the second step, connect it to the USB port of the motherboard, and then power on the motherboard.
- 3) Under normal circumstances, the display screen will start to flash and display burned pictures after a few seconds, and the U disk indicator light will start to flash.
- 4) If you cannot see the burning process, please make sure to unplug the U disk under the premise that the U disk indicator is not flashing.

4. Description of environmental indicators

- Working temperature: -20°C ~ $+65^{\circ}\text{C}$ Storage temperature: -25°C ~ $+80^{\circ}\text{C}$
Overvoltage protection: 37V
- Vibration resistance: 8.3~400Hz 10mm 6.8g Shock resistance: 50g, 6ms&11ms Relative humidity: 10%~90%
- Protection level: IP65

5. Connect with external controller

Connect with external controller device via CAN bus, support CAN2.0B, Canopen, J1939 protocol.

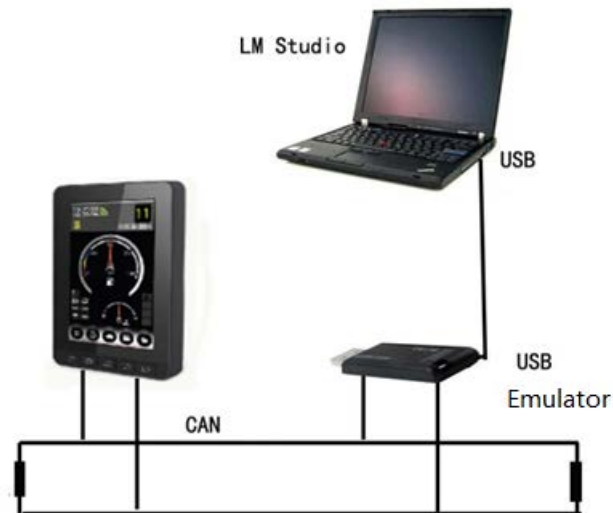


Figure 2 Schematic diagram of external controller connection

6. Common troubleshooting

1. The connection between the display case and the grounded metal part should have a low impedance value. It is qualified by the following test. When the transient interference is injected, the voltage drop is measured between the controller case and the grounded metal parts. It is required that the voltage U_{max} on the case should not be greater than 0.8V (TTL low level threshold) during the entire process of interference injection; According to some characteristic parameters during the interference injection, the required ground impedance range is calculated: in the 0-100MHz frequency band, the impedance value shall not exceed 60 milliohms;
2. In addition to the good grounding of the display shell, all input and output points of sensors, loads, etc. connected to the display must be connected in a closed loop, that is, all input and output grounds must be connected to the corresponding ground of the display.
3. The common reasons for unsuccessful burning of picture fonts are as follows:
 - The configuration file does not exist or the content is wrong
 - Wrong naming of the folder to be burned, no burned file or wrong file naming format
 - Problems with the USB flash drive or motherboard
 - The underlying program is not burned or the version is wrong

FCC Statement

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator& your body.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.