Firefly Workshop CEK8902-S905D3
Open Source Hardware Specification

Version	Date	Revision History	Approval
3.0	2022.12.06	Modification based on the V3 hardware.	

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1. Product Introduction

Firefly Workshop CEK8902 - S905D3 system board, a kind of intelligent hardware, is widely applicable to educational suite, face recognition, smart display terminal, video terminals, industrial automation terminal products, etc., including advertising machine, digital signage, intelligent self-service terminals, intelligent retail terminals, smart home devices, O2O intelligent equipment, industrial control hosts, and robots.

CEK8902-S905D3 open source hardware adopts Amlogic® S905D3, quad core ARM Cortex-A55 CPU, with built-in Buildroot Linux, Ubuntu20.04, Android9.0 system. The core frequency is up to 1.9GHz. Its ARM G31 MP2 GPU supports 1080P video encoding and H.264 hard decoding. It has multi-channel video output. There is a specific interface on the board , which supports a number of peripheral expansion. It is your best choice regarding human-computer interaction and industrial control projects.

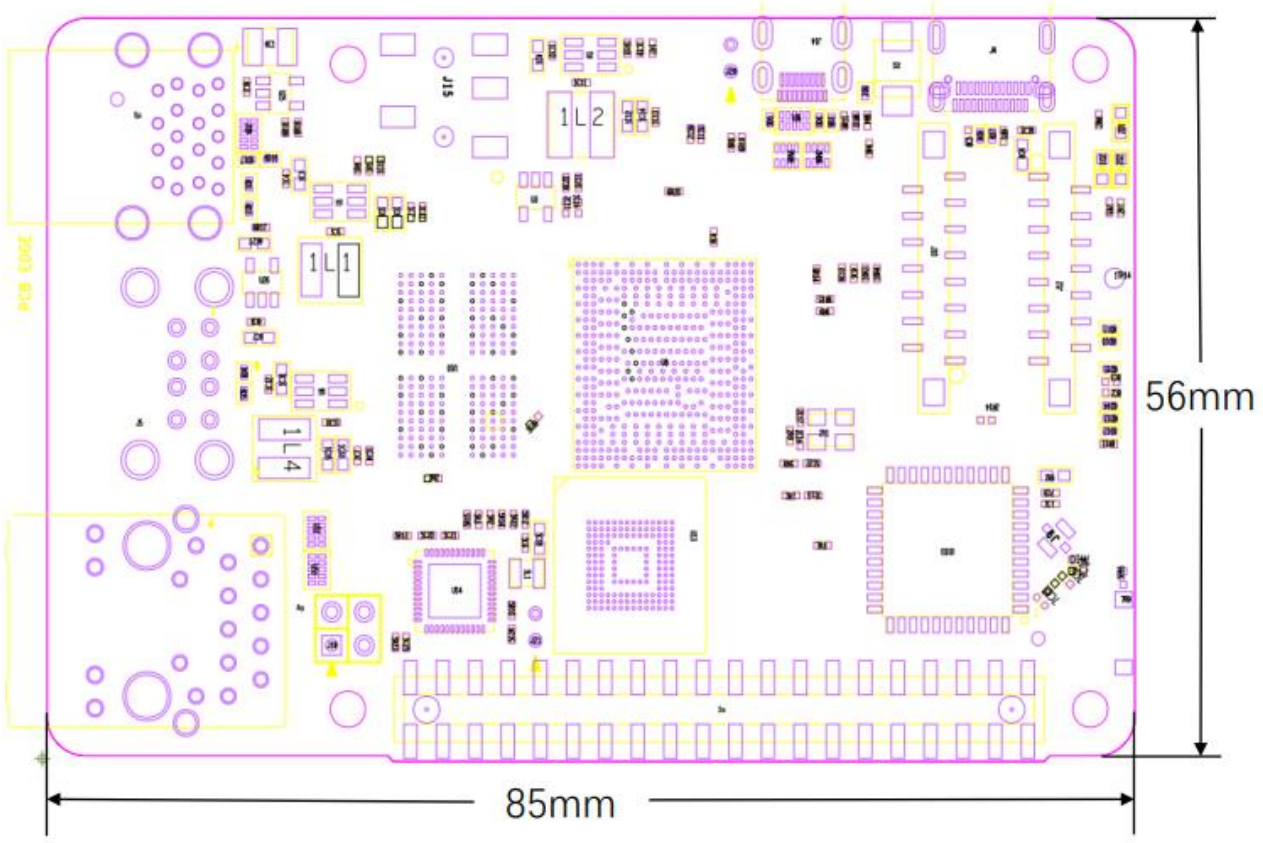
2. Product Features

- Compatible with most Raspberry PI 4B peripherals.
- Supports dual screen display, dual screen co-display.
- Supports customization for Linux and Android systems.
- The System API reference code is provided.
- Perfectly supports the development of client application programs. 3. Physical Specifications

3.1. Physical Product

3.2. Product Size

CEK8902-S905D3 open source main board adopts 6-layer PCB design, and the dimensions are shown below. The screw hole specifications are as follows: Φ2.5mm x 4.



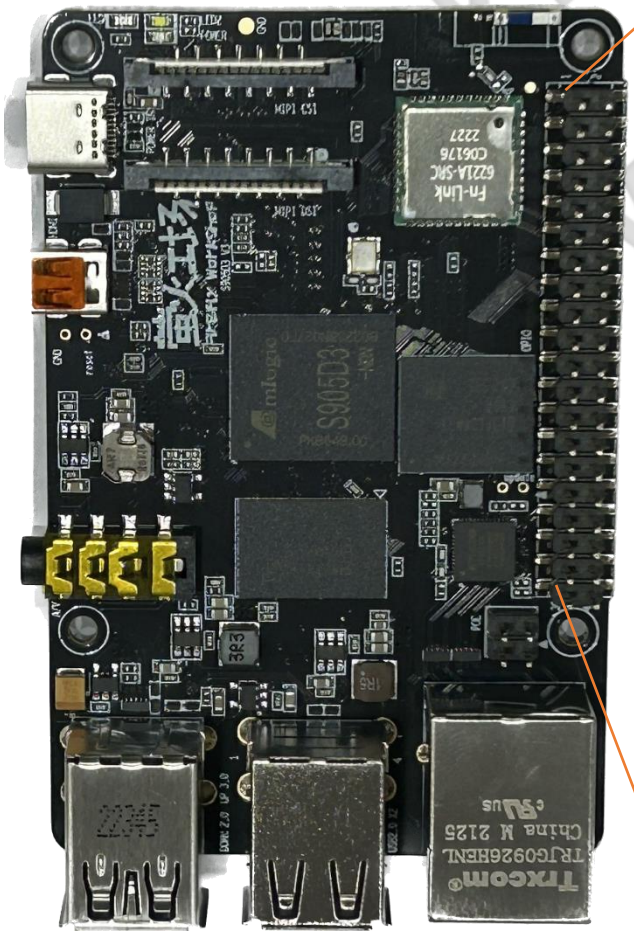
4. The Performance Parameters

Parameters	Description
CPU	Amlogic® S905D3 A55*4
NPU	1.2 TOPS
GPU	Mali G31 MP2
Memory	LPDDR4 2GB（2/4GB optional）
Storage	EMMC 5.1 16GB（8/16/32GB optional）
Power Management	Discrete power supply design
Keys	N/A
Working Voltage	5V 3A or above
Supported Systems	Ubuntu20.04/Android9.0/Buildroot Linux
Operating Temperature	0 ~ 70 ℃

5. Interface Description

Interface	Description
USB HOST	5 x USB interface: (1 x Type-C OTG, 3 x USB2.0, 1 x USB3.0)
UART	1 x TTL UART
MIPI DSI display	2 lane, Compatible with raspberry pie 4.3 inch capacitive touch screen
MIPI CSI input	2 lane MIPI-CSI camera interface
HDMI display output	1 x Micro HDMI2.1 port，supports up to 4K x 2K @60fps
Eth	1 x 10M/100M/1000M
Audio & Video	1 x 3.5mm headset interface + 1 x CVBS
WIFI	1T1R 2.4G + 5G WIFI
Bluetooth	1 x 2.4G BT4.2
The output power	2 extension connector pins, one for 3.3V, the other for 5V
40-Pins Header	2.54mm spacing, compatible with Raspberry PI
TF Card	Supports TF Card
System upgrade	Supports local USB upgrade

6. Schematic Diagram of 40 Extension Pins



3.3V PWR	1	2	5V PWR
I2C_SDA	3	4	5V PWR
I2C_SCL	5	6	GND
GPIOA_8	7	8	UART-TX
GND	9	10	UART-RX
GPIOAO_7	11	12	GPIOA_5
GPIOAO_9	13	14	GND
GPIOAO_8	15	16	GPIOH_8
3.3V PWR	17	18	GPIOA_3
SPI_B_MOSI	19	20	GND
SPI_B_MISO	21	22	ADC_CH3
SPI_B_SCLK	23	24	SPI_B_SS0
GND	25	26	GPIOE_2
I2C_SDA1	27	28	I2C_SCL1
GPIOA_2	29	30	GND
ADC_CH2	31	32	GPIOA_4
GPIOAO_5	33	34	GND
GPIOAO_10	35	36	ADC_CH0
GPIOA_7	37	38	GPIOA_0
GND	39	40	GPIOC_7

7. PRECAUTIONS FOR USE

During usage, in order to avoid failure or causing damage to the product, please pay attention to the following (including but not limited to):

- ✧ Do not expose the bare board to water, moisture, or short circuit with peripherals during operation.
- ✧ During installation and mounting, avoid deformation of the bare board caused by mounting.
- ✧ Handle with care to avoid mechanical or electrical damage to the circuit board and connectors.
- ✧ When installing peripherals (USB/IO/UART), pay attention to peripheral IO level and current output.
- ✧ When installing the serial port, do not directly connect to the RS232 or RS485 device. Check whether the TX or RX connection setup is correct.
- ✧ Check whether the input power supply is connected to the Type-C port for power input. Check whether the input voltage and current meet the requirements, considering all the peripherals presently running on the board.

Appendix: Product Comparison

	Firefly Workshop CEK8902-S905D3	Raspberry PI 4B	
Main chip	Amlogic S905D3	Broadcom BCM2711	Domestic chip, no supply issue
Process	12nm	28nm	👍👍
CPU	Quad core Arm Cortex-A55, 1.9GHz	Quad core ARM Cortex-A72, 1.5GHz	👍
GPU	ARM Mali G31 MP2 800MHz	VideoCore VI 500MHz	👍
NPU	1.2 TOPS INT8	--	👍👍
Decode	4Kx2K@60fps H.265	H.265 4K 60fps	
Encode	H.265 1080P@60fps H.264 1080P@30fps	H.264 1080P@30fps	👍
RAM	2GB，32bit	2GB，32bit	
ROM	16GB	-	👍👍
MIPI-CSI	2 lane	2 lane	
MIPI-DSI	2 lane	2 lane	👍
WIFI	1T1R 802.11 ac	1T1R 802.11 ac	
BT	V4.2	V5.0	
SD Card	x1	x1	
HDMI	x1	micro x2	
USB2.0	x3 + x1 USB-C OTG	x2	👍
USB3.0	x1	x2	
GigabitEth	x1	x1	
GPIOs	28	28	
OS	Linux & Android	Linux	👍

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.

Caution: Any changes or modifications to this device not explicitly approved by manufacturer could void your authority to operate this 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.

The device has been evaluated to meet general RF exposure requirement. 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.