

# K9+

Receiving Card

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Specification



## Overview

K9+ is a high-end receiving card developed for fine-pitch LED screens featuring large load capacity and up to 32 parallel data groups or 64 serial data groups. Due to its small form factor, K9+ is best fit into concise cabinets. With high-density connectors, it can achieve dustproof and shockproof effect, result in its high stability and reliability.

K9+ not only has all the functions of mainstream receiving cards, but also a series of practical and powerful features helping high-end displays to maximize video performance with stunning clarity. K9+ can be perfectly used in high-end rentals as well as fine-pitch fix-installed LED screens.

## Features

### Display effect

- 8bit/10bit video source input.
- HDR10 and HLG.
- Full gamma independent adjustment.
- Infi-bit color extension.
- Low latency.
- Color temperature adjustment.
- Grayscale refinement.
- Better gray at low brightness.

### Calibration

- Low-grayscale calibration.
- Double-layer calibration.
- High precise per-pixel calibration in brightness and chromaticity.

### Easy maintenance

- Seam correction.
- Highlight and OSD.
- Color gamut adjustment.
- Screen rotation.
- Up to 16 intelligent modules.
- Quick firmware upgrade and calibration coefficients download.
- Cabinet temperature, humidity, voltage and power monitoring.

### Stable and reliable

- Loop redundancy.

- Dual receiving card hot backup.
- PSU redundancy.
- Firmware redundancy and readback.
- Ethernet cable status monitoring.
- 7×24h uninterrupted work.

## Feature details

Display effect	
10bit	Maximum 10bit color depth video input and output, it presents a grayscale 16 times the normal 8bit video source, which offers smoother screen grayscale transition.
HDR	Presenting images with high dynamic range, high contrast and wide color gamut.
High frame rate	Supports not only conventional and non-integer frame rates such as 23.98/24/29.97/30/50/59.94/60Hz, but also outputs and displays 120/144/240Hz high frame rate images, greatly improving picture smoothness and reducing smearing.(this feature affects the load capacity).
Better grayscale at low brightness	Through the optimization of the brightness algorithm, the screen can maintain the integrity of grayscale at low brightness, presenting a high grayscale level display effect at low brightness.
14bit calibration	Supports the storage and processing of multiple copies of the calibration coefficient for different brightness levels, and real-time processing of the calibration coefficient according to the actual playback content to improve the uniformity and consistency of the screen body at different gray levels.
Double-layer calibration	Storage and processing of double correction coefficients under different brightness, real-time dynamic adjustment of the correction coefficients according to the actual playback content, and improve the uniformity and consistency of the screen under different gray levels.
Infi-bit	Grayscale dynamic compensation technology, it can significantly improve the grayscale of the LED screen, which is at least 64 times higher than the original level, effectively improving the details of low-gray pictures, making the grayscale transition smoother and presenting more vivid colors.
Low-grayscale calibration	The low gray level of the fine-pitch cabinet is independently calibrated, to solve the problem that such cabinet is prone to presenting low gray color bands and level unevenness with conventional calibration.
Grayscale refinement	With the use of a luminance meter, the actual screen display conditions are measured, and the screen grayscale can be accurately calibrated, which perfectly solves the gray level jitters and low gray color cast caused by the hardware.
Shortcuts	
Cabinet highlight	Mark quickly a target cabinet, by displaying a flashing rectangle indicator on the cabinet screen, which greatly facilitates front and rear maintenance.
Quick OSD	Mark quickly the index of a receiving card corresponding to a specific Ethernet port, allow for setting up the connection relationship of the screen easily.

Seam correction	Quickly and efficiently eliminate the perceptible bright and dark lines caused by physical screen splicing. It can be used repeatedly in rental scenarios, thanks to its advanced one-click reset feature.
Color adjustment	Quickly and easily adjust the color gamut of individual cabinet or screen. Support customized adjustment and one-click restore. Achieve high-precision color reproduction in combination with the use of the photometer.
Image rotation	Support the rotation of the cabinet image at an angle of 90°/180°/270°. Any angle rotation is also available in combination with supported LED sender models from Colorlight.
<b>Hardware monitoring</b>	
Bit error rate detection	Quickly identify the cabinet with abnormal connection, thanks to the feature of data transmission quality detection between receiving card and LED sender.
Humidity monitoring	Monitor the cabinet (need the support from the cabinet design), and send to the computer in real-time the running cabinet humidity.
Temperature monitoring	Monitor the cabinet (need the support from the cabinet design), and send to the computer in real-time the running cabinet temperature. With the software, users can monitor current temperature and be alerted on any abnormal condition.
Power supply monitoring	Support 2-way power fault monitoring of the cabinet (need the support from the cabinet design), and send to the computer in real-time the running power status. From the software, users can monitor current power status and be alerted on any abnormal condition.
Smoke monitoring	Monitoring cabinet pixel health (need the support from the cabinet design), and send to the computer in real-time smoke status. From the software, users can monitor current smoke status and be alerted on any abnormal condition.
Pixel-by-pixel monitoring	Monitoring cabinet pixel health (need the support from the cabinet design), and send to the computer in real-time each pixel status. With the software, users can check current pixels status and be alerted on the amount of bad pixels above a predefined threshold.
Fan control	Control the fan (requires support from the cabinet design) manually from the software, even allow automatic fan switching on current cabinet temperature status (requires support from the cabinet design).
LCD monitoring	Display on the cabinet LCD screen the temperature, voltage, running time and other status, support one-click self-test.
<b>Redundancy</b>	
Loop redundancy	The receiving card switches signal source to the other Ethernet port, when one receiving channel fail, maintaining the normal display of the LED screen.
Receiving card hot backup	Two receiving cards connect to the HUB board to control a single cabinet at the same time. When the main receiving card is abnormal, the backup card will take over the display immediately.
Firmware redundancy	Users can safely upgrade firmware without worrying about losing firmware due to cable disconnections or power failure during the upgrade process.

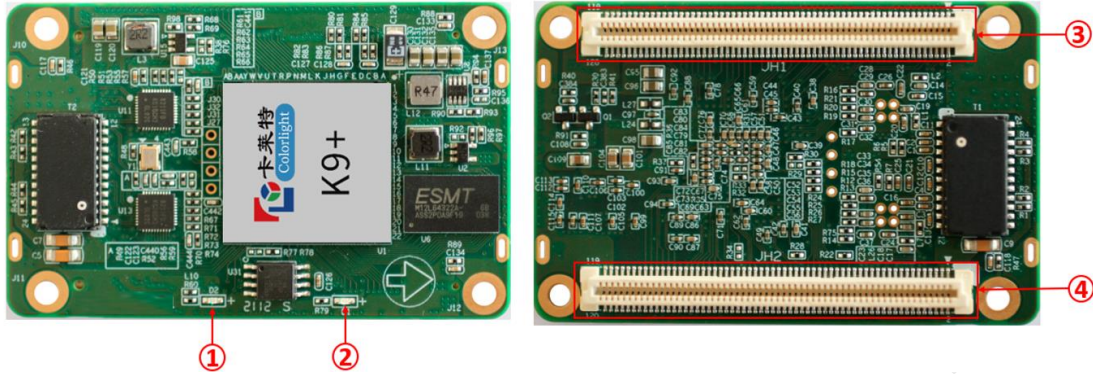
## Basic parameters

<b>Control System Parameters</b>	
Load capacity	Maximum 256x1024 pixels. <sup>1</sup>
Ethernet port exchange	Ethernet port changeable.
Grayscale	Up to 65536 grayscale.
<b>Display Module Compatibility</b>	
Chip Support	PWM chips, Shixin chips.
Scan Type	Up to 1/128 scan.
Module Supported	Up to 16384 pixels per data group.
Cable Direction	Route from left to right, from right to left, from top to bottom, from bottom to top.
Data Group	32 groups of parallel RGB data and 64 groups of serial RGB data, the later can be extended to 128 groups. Data groups can be exchanged freely.
Data Folded	Horizontal or vertical 2~8 folds.
<b>Monitoring Function (work with the module with corresponding sensor)</b>	
Temperature Monitoring	Monitoring temperature range:-25°C~75°C.
Humidity Monitoring	Monitoring humidity range: between 25%~95%RH.
Power Supply Monitoring	Monitoring power supply status, 2 monitoring ports available each card.
Net cable Monitoring	Operating total number of packets, error packets and network quality.
Cabinet monitoring	With M3, support monitoring such as cabinet door open, fan, smoke, etc.
<b>Pixel-by-Pixel Calibration</b>	
Brightness Calibration	Up to 14bit calibration accuracy.
Chromaticity Calibration	Up to 14bit calibration accuracy.
<b>Other features</b>	
Redundancy	Loop redundancy, receiving card redundancy, PSU redundancy, firmware redundancy.
Optional functions	Cabinet LCD display, temperature control relay, module hot swap, prestore picture, irregular screen design, etc.

<sup>1</sup> The load capacity may vary on some feature enabled. Please contact Colorlight technical for support.

## Hardware

### Appearance



### Interface

S/N	Name	Function	
1	Signal indicator	Flash once per second	Receiving card: normal. Ethernet cable connection: normal.
		Flash 10 times per second	Receiving card: normal. Cabinet: Highlight.
		Flash 4 times per second	Receiving card: working with back up channel (Loop redundancy status).
2	Power indicator	Constant red: normal.	
3	High-density connector JH1	Connect with the display's HUB or module. See below for pin definition.	
4	High-density connector JH2	Connect with the display's HUB or module. See below for pin definition.	

\* K9+ uses high-density connectors, please refer to the connector specification for details. The product photos in this article are for reference only.

### Equipment Specifications

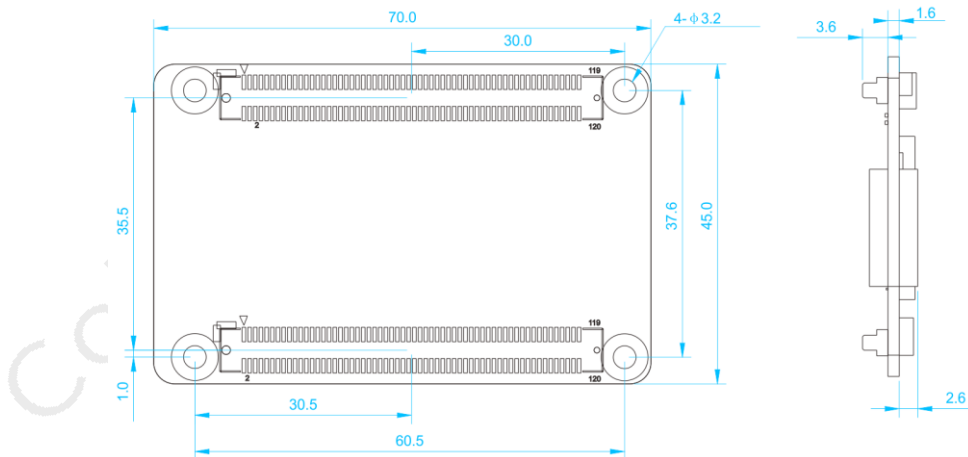
Physical Specifications	
Hardware interface	High-density connectors
Ethernet port transmission rate	1Gb/s
Communication Distance	Recommended: CAT5e cable ≤ 100m
Compatible with Transmission Equipment	Gigabit switch, Gigabit fiber converter, Gigabit fiber switch

Size <sup>2</sup>	L×W×H / 70.0mm(2.8")×45.0mm(1.8")×7.8mm(0.3")
Weight	21g / 0.05lbs
<b>Electrical specification</b>	
Power input	DC 3.8~5.5V, 0.6A
Rated power consumption	3.0W
ESD Resistance (HBM)	2KV
<b>Operating environment</b>	
Temperature	-25°C~75°C (-13°F~167°F)
Humidity	0%RH-80%RH, no condensation
<b>Storage and transport environment</b>	
Temperature	-40°C~125°C (-40°F~257°F)
Humidity	0%RH-90%RH, no condensation
<b>Packing information</b>	
Packing	Standard blister box, 4 cards per box, 400 cards per carton
Packing size	L×W×H / 550.0mm(21.9")×398.0mm(15.7")×180.0mm(7.1")
<b>Certification</b>	
* RoHS certification, EMC Class B certification, EMC needs to work with the cabinet design, please contact technical support for assistance.	

## Reference dimensions

Unit: mm

Tolerance: ±0.3mm

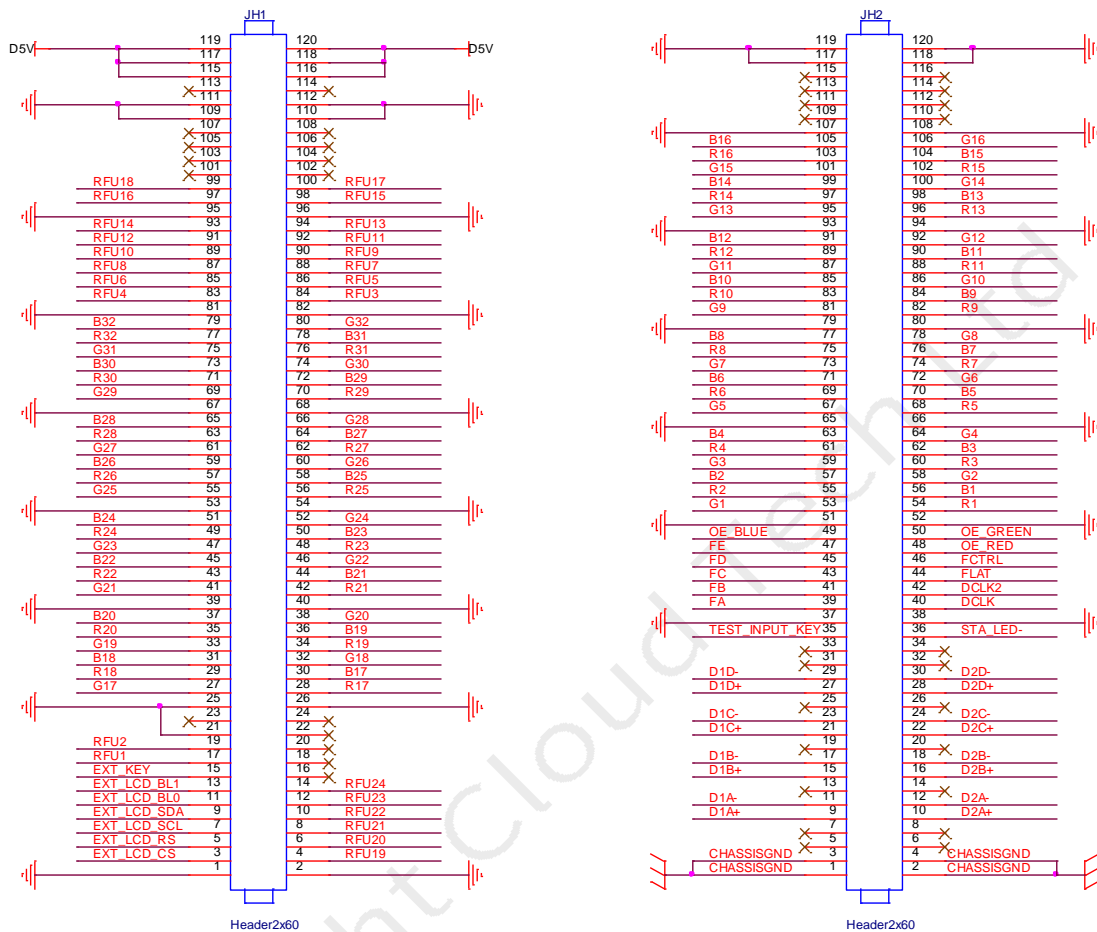


\* The distance between outer surfaces of the K9+ and HUB boards after their high-density connectors fit together is 5.0mm. A 5-mm copper pillar is recommended.

<sup>2</sup> Size and weight vary by manufacturing process.

## Definition of Pins

### 32 groups of parallel data interfaces



JH1					
Instructions	Definition	Pin No.		Definition	Instructions
Ground connection	GND	1	2	GND	Ground connection
LCD screen interface	EXT_LCD_CS	3	4	RFU19	Reserved
	EXT_LCD_RS	5	6	RFU20	
	EXT_LCD_SCL	7	8	RFU21	
	EXT_LCD_SDA	9	10	RFU22	
	EXT_LCD_BL0	11	12	RFU23	
	EXT_LCD_BL1	13	14	RFU24	
Reserved	EXT_KEY	15	16	NC	Empty
	RFU1	17	18	NC	
	RFU2	19	20	NC	
Ground connection	GND	21	22	NC	
Empty	NC	23	24	NC	



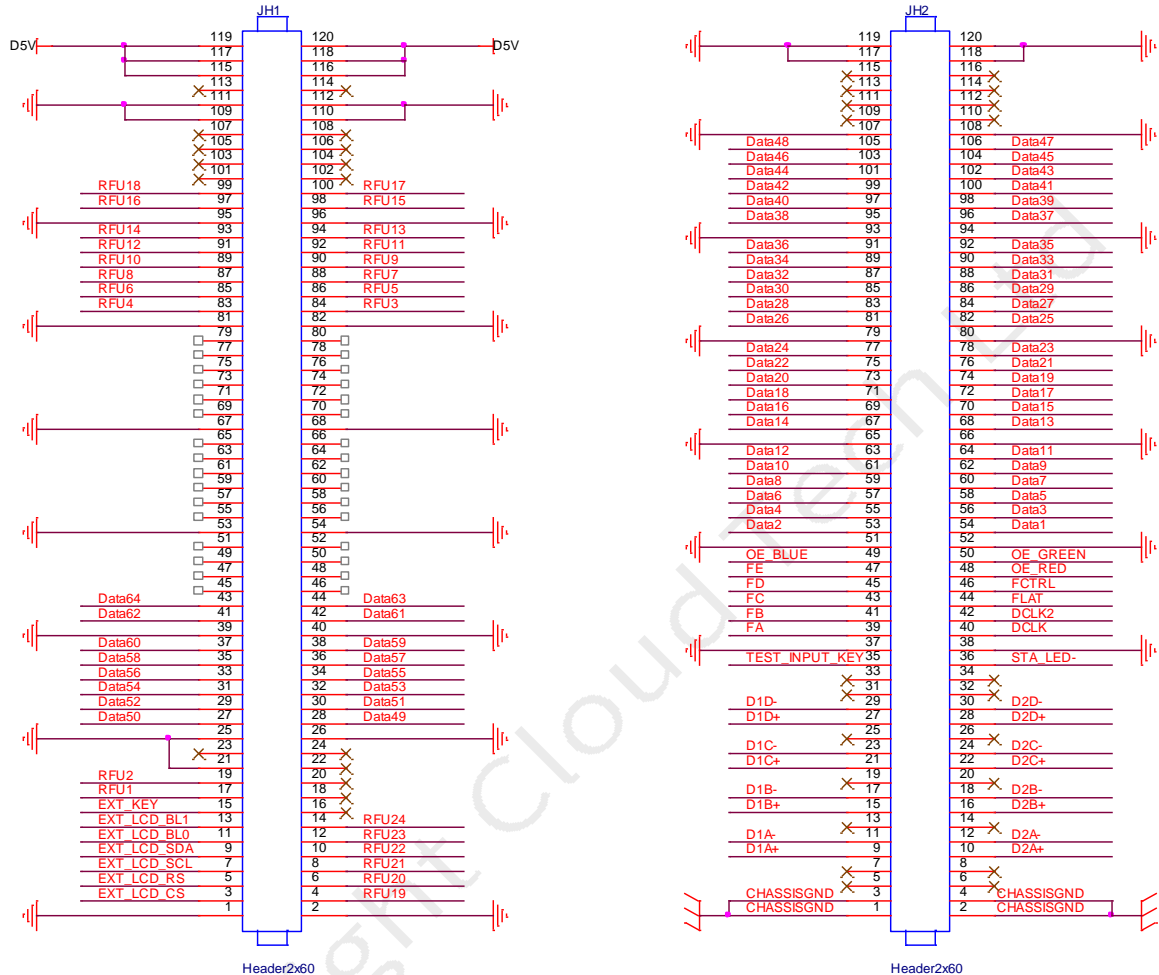
Ground connection	GND	25	26	GND	Ground connection
RGB OUTPUT	G17	27	28	R17	RGB OUTPUT
	R18	29	30	B17	
	B18	31	32	G18	
	G19	33	34	R19	
	R20	35	36	B19	
	B20	37	38	G20	
Ground connection	GND	39	40	GND	Ground connection
RGB OUTPUT	G21	41	42	R21	RGB OUTPUT
	R22	43	44	B21	
	B22	45	46	G22	
	G23	47	48	R23	
	R24	49	50	B23	
	B24	51	52	G24	
Ground connection	GND	53	54	GND	Ground connection
RGB OUTPUT	G25	55	56	R25	RGB OUTPUT
	R26	57	58	B25	
	B26	59	60	G26	
	G27	61	62	R27	
	R28	63	64	B27	
	B28	65	66	G28	
Ground connection	GND	67	68	GND	Ground connection
RGB OUTPUT	G29	69	70	R29	RGB OUTPUT
	R30	71	72	B29	
	B30	73	74	G30	
	G31	75	76	R31	
	R32	77	78	B31	
	B32	79	80	G32	
Ground connection	GND	81	82	GND	Ground connection
Reserved	RFU4	83	84	RFU3	Reserved
	RFU6	85	86	RFU5	
	RFU8	87	88	RFU7	
	RFU10	89	90	RFU9	
	RFU12	91	92	RFU11	
	RFU14	93	94	RFU13	

Ground connection	GND	95	96	GND	Ground connection
Reserved	RFU16	97	98	RFU15	Reserved
	RFU18	99	100	RFU17	
Empty	NC	101	102	NC	Empty
	NC	103	104	NC	
	NC	105	106	NC	
	NC	107	108	NC	
Ground connection	GND	109	110	GND	Ground connection
	GND	111	112	GND	
Empty	NC	113	114	NC	Empty
Power supply	D5V	115	116	D5V	Power supply
	D5V	117	118	D5V	
	D5V	119	120	D5V	
<b>JH2</b>					
<b>Instructions</b>	<b>Definition</b>	<b>Pin No.</b>		<b>Definition</b>	<b>Instructions</b>
Chassis ground	CHASSISGND	1	2	CHASSISGND	Chassis ground
	CHASSISGND	3	4	CHASSISGND	
Empty	NC	5	6	NC	Empty
	NC	7	8	NC	
Ethernet port 1 signal pin	D1A+	9	10	D2A+	Ethernet port 2 signal pin
	D1A-	11	12	D2A-	
	NC	13	14	NC	
	D1B+	15	16	D2B+	
	D1B-	17	18	D2B-	
	NC	19	20	NC	
	D1C+	21	22	D2C+	
	D1C-	23	24	D2C-	
	NC	25	26	NC	
	D1D+	27	28	D2D+	
D1D-	29	30	D2D-		
Empty	NC	31	32	NC	Empty
	NC	33	34	NC	
Test button	TEST_INPUT_KEY	35	36	STA_LED-	Status LED
Ground connection	GND	37	38	GND	Ground connection
Row decoding signal	FA	39	40	DCLK	First data serial clock
	FB	41	42	DCLK2	Second data serial clock
	FC	43	44	FLAT	Latch

	FD	45	46	FCTRL	Blanking
	FE	47	48	OE_RED	Display enable
Display enable	OE_BLUE	49	50	OE_GREEN	
Ground connection	GND	51	52	GND	Ground connection
RGB OUTPUT	G1	53	54	R1	RGB OUTPUT
	R2	55	56	B1	
	B2	57	58	G2	
	G3	59	60	R3	
	R4	61	62	B3	
	B4	63	64	G4	
Ground connection	GND	65	66	GND	Ground connection
RGB OUTPUT	G5	67	68	R5	RGB OUTPUT
	R6	69	70	B5	
	B6	71	72	G6	
	G7	73	74	R7	
	R8	75	76	B7	
	B8	77	78	G8	
Ground connection	GND	79	80	GND	Ground connection
RGB OUTPUT	G9	81	82	R9	RGB OUTPUT
	R10	83	84	B9	
	B10	85	86	G10	
	G11	87	88	R11	
	R12	89	90	B11	
	B12	91	92	G12	
Ground connection	GND	93	94	GND	Ground connection
RGB OUTPUT	G13	95	96	R13	RGB OUTPUT
	R14	97	98	B13	
	B14	99	100	G14	
	G15	101	102	R15	
	R16	103	104	B15	
	B16	105	106	G16	
Ground connection	GND	107	108	GND	Ground connection
Empty	NC	109	110	NC	Empty
	NC	111	112	NC	
	NC	113	114	NC	
	NC	115	116	NC	

Ground connection	GND	117	118	GND	Ground connection
	GND	119	120	GND	

### 64 groups of serial data interfaces



JH1					
Instructions	Definition	Pin No.		Definition	Instructions
LCD screen interface	GND	1	2	GND	Ground connection
	EXT_LCD_CS	3	4	RFU19	Reserved
	EXT_LCD_RS	5	6	RFU20	
	EXT_LCD_SCL	7	8	RFU21	
	EXT_LCD_SDA	9	10	RFU22	
	EXT_LCD_BL0	11	12	RFU23	
	EXT_LCD_BL1	13	14	RFU24	
Reserved	EXT_KEY	15	16	NC	Empty
	RFU1	17	18	NC	

	RFU2	19	20	NC	
Ground connection	GND	21	22	NC	
Empty	NC	23	24	NC	
Ground connection	GND	25	26	GND	Ground connection
RGB OUTPUT	Data50	27	28	Data49	RGB OUTPUT
	Data52	29	30	Data51	
	Data54	31	32	Data53	
	Data56	33	34	Data55	
	Data58	35	36	Data57	
	Data60	37	38	Data59	
Ground connection	GND	39	40	GND	Ground connection
RGB OUTPUT	Data62	41	42	Data61	RGB OUTPUT
	Data64	43	44	Data63	
Empty	NC	45	46	NC	Empty
	NC	47	48	NC	
	NC	49	50	NC	
	NC	51	52	NC	
Ground connection	GND	53	54	GND	Ground connection
Empty	NC	55	56	NC	Empty
	NC	57	58	NC	
	NC	59	60	NC	
	NC	61	62	NC	
	NC	63	64	NC	
	NC	65	66	NC	
Ground connection	GND	67	68	GND	Ground connection
Empty	NC	69	70	NC	Empty
	NC	71	72	NC	
	NC	73	74	NC	
	NC	75	76	NC	
	NC	77	78	NC	
	NC	79	80	NC	
Ground	GND	81	82	GND	Ground

connection					connection
Reserved	RFU4	83	84	RFU3	Reserved
	RFU6	85	86	RFU5	
	RFU8	87	88	RFU7	
	RFU10	89	90	RFU9	
	RFU12	91	92	RFU11	
	RFU14	93	94	RFU13	
Ground connection	GND	95	96	GND	Ground connection
Reserved	RFU16	97	98	RFU15	Reserved
	RFU18	99	100	RFU17	
Empty	NC	101	102	NC	Empty
	NC	103	104	NC	
	NC	105	106	NC	
	NC	107	108	NC	
Ground connection	GND	109	110	GND	Ground connection
	GND	111	112	GND	
Empty	NC	113	114	NC	Empty
Power supply	D5V	115	116	D5V	Power supply
	D5V	117	118	D5V	
	D5V	119	120	D5V	
<b>JH2</b>					
<b>Instructions</b>	<b>Definition</b>	<b>Pin No.</b>		<b>Definition</b>	<b>Instructions</b>
Chassis ground	CHASSISGND	1	2	CHASSISGND	Chassis ground
	CHASSISGND	3	4	CHASSISGND	
Empty	NC	5	6	NC	Empty
	NC	7	8	NC	
Ethernet port 1 signal pin	D1A+	9	10	D2A+	Ethernet port 2 signal pin
	D1A-	11	12	D2A-	
	NC	13	14	NC	
	D1B+	15	16	D2B+	
	D1B-	17	18	D2B-	
	NC	19	20	NC	
	D1C+	21	22	D2C+	
	D1C-	23	24	D2C-	
	NC	25	26	NC	
	D1D+	27	28	D2D+	

	D1D-	29	30	D2D-	
Empty	NC	31	32	NC	Empty
	NC	33	34	NC	
Test button	TEST_ INPUT_KEY	35	36	STA_LED-	Status LED
Ground connection	GND	37	38	GND	Ground connection
Row decoding signal	FA	39	40	DCLK	First data serial clock
	FB	41	42	DCLK2	Second data serial clock
	FC	43	44	FLAT	Latch
	FD	45	46	FCTRL	Blanking
	FE	47	48	OE_RED	Display enable
Display enable	OE_BLUE	49	50	OE_GREEN	
Ground connection	GND	51	52	GND	Ground connection
RGB OUTPUT	Data2	53	54	Data1	RGB OUTPUT
	Data4	55	56	Data3	
	Data6	57	58	Data5	
	Data8	59	60	Data7	
	Data10	61	62	Data9	
	Data12	63	64	Data11	
Ground connection	GND	65	66	GND	Ground connection
RGB OUTPUT	Data14	67	68	Data13	RGB OUTPUT
	Data16	69	70	Data15	
	Data18	71	72	Data17	
	Data20	73	74	Data19	
	Data22	75	76	Data21	
	Data24	77	78	Data23	
Ground connection	GND	79	80	GND	Ground connection
RGB OUTPUT	Data26	81	82	Data25	RGB OUTPUT
	Data28	83	84	Data27	
	Data30	85	86	Data29	
	Data32	87	88	Data31	

	Data34	89	90	Data33	
	Data36	91	92	Data35	
Ground connection	GND	93	94	GND	Ground connection
RGB OUTPUT	Data38	95	96	Data37	RGB OUTPUT
	Data40	97	98	Data39	
	Data42	99	100	Data41	
	Data44	101	102	Data43	
	Data46	103	104	Data45	
	Data48	105	106	Data47	
Ground connection	GND	107	108	GND	Ground connection
Empty	NC	109	110	NC	Empty
	NC	111	112	NC	
	NC	113	114	NC	
	NC	115	116	NC	
Ground connection	GND	117	118	GND	Ground connection
	GND	119	120	GND	

\* FE and LED\_SCLK2 are signal multiplexing pins, which are used as row decoding signals in parallel data and as the second serial clock in serial data.



## Expanded Functions


Descriptions			
Reserved pin	Smart module pin	Module Flash pin	Description
RFU1	Reserved	Reserved	Reserved
RFU2	Reserved	Reserved	Reserved
RFU3	HUB_CODE0	HUB_CODE0	Flash 1
RFU4	HUB_SPI_CLK	HUB_SPI_CLK	Clock signal of serial pin
RFU5	HUB_CODE1	HUB_CODE1	Flash 2
RFU6	HUB_SPI_CS	HUB_SPI_CS	CS Signal of serial pin
RFU7	HUB_CODE2	HUB_CODE2	Flash 3
RFU8	/	HUB_SPI_MOSI	Flash storage data input
	HUB_UART_TX	/	TX signal of smart module
RFU9	HUB_CODE3	HUB_CODE3	Flash 4
RFU10	/	HUB_SPI_MISO	Flash storage RGB output
	HUB_UART_RX	/	RX signal of smart module
RFU11	HUB_H164_CSD	HUB_H164_CSD	Data signal of 74HC164
RFU12	Reserved	Reserved	Reserved
RFU13	HUB_H164_CLK	HUB_H164_CLK	Clock signal of 74HC164
RFU14	POWER_STA1	POWER_STA1	Dual power detection signal 1
RFU15	MS_DATA	MS_DATA	Dual card backup connection signal
RFU16	POWER_STA2	POWER_STA2	Dual power detection signal 2
RFU17	MS_ID	MS_ID	Dual card backup identification signal
RFU18	HUB_CODE4	HUB_CODE4	Flash 5
RFU19	HUM	HUM	Humidity monitoring
RFU20	Reserved	Reserved	Reserved
RFU21	Reserved	Reserved	Reserved
RFU22	TEMP	TEMP	Temperature monitoring
RFU23	Reserved	Reserved	Reserved
RFU24	Reserved	Reserved	Reserved

\* RFU8 and RFU10 are signal multiplex extension pins. Only one pin from either the ARM Smart Module Pin or the Module Flash Pin can be selected at the same time.

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