

EMB-2230

Technical Specification Manual

Version: R1.00

Revisions

Version	Description of Version	Date Completed
R0.01	Draft release	6/12/2017
R1.00	Release	11/06/2017

Preface

This Technical Specification Manual (TSM) specifies the board layout, components, connectors, and the I/O connection ports, motherboards features.

Intended Audience

The TSM is intended to provide detailed, technical information about the EMB-2230 and its components to the vendors, system integrators, and other engineers and technicians who need this level of information. It is specifically not intended for general audiences.

What This Document Contains

Chapter	Description
1	Introduction
2	Product Description
3	Technical Reference
4	Operating System

1. Introduction

1.1 Product introduction

The EMB-2230 is a Pico-ITX (100x 72mm) industrial motherboard based on NXP i.MX6 ARM application processor. The board features a Power over Ethernet (PoE) ready Gigabit Ethernet port, on-board WiFi/BT, multiple LCD panel display interfaces support, and full set of I/Os including RS-232/485, CAN bus, digital IO and more..

1.2 Form Factor

The EMB-2230 is based on Pico-ITX .It is a small Single Board Computer Form factor with 100 x 72 mm (3.9" x 2,8").

2. Product Description

2.1 Specification

Table 1 summarizes the major features of the board.

Table 1. Specification

Platform	NXP i.MX6
Form Factor	Pico-ITX
Processor	NXP i.MX6DL (default) or i.MX6Q at 1GHz
Core	Cortex-A9 Dual core (i.MX6DL) or Cortex-A9 Quad core (i.MX6Q)
System Memory	64-bit 1GB DDR3 SDRAM 400MHz(i.MX6DL) or 528MHz(i.MX6Q)
Ethernet	Onboard Gigabit Ethernet with POE power option
Wireless	1 x 802.11 b/g/n ,2.4GHz Ch1~Ch14, 1 x Bluetooth V4.1
Audio	2 (R/L) x Speak out ,2.1W(1.4W) /Channel stereo ,Class D AMP, 2 (R/L) x Line out or Headphone out header, 1 x Mic in header
Storage	8GB iNand Flash, up to 32GB, 512K EEPROM (Option)
Graphic Controller	Vivante GC 880 + Vivante GC 320 (i.MX6DL) Vivante GC 2000 + Vivante GC 355 + Vivante GC 320 (i.MX6Q)
Display Interface	1x micro HDMI
LCD Interface	1 x 2 channel 24bit LVDS + I2C 40-pin FPC header, 1 x MIPI DSI up 2 lane + I2C 40-pin FPC header, shared with 1 x MIPI CSI
Display Resolution	HDMI - 1920 x 1080
SD Card Socket	1 x micro SD Socket (not support hot plug)
USB	2 x 4-pin 2.0 mm pitch USB 2.0 pin header, 2 x USB 2.0 Type A
Boot Switch	1 x 2-bit DIP switch for iNAND and micro SD boot selection 1 x bootloader button for USB and board boot
Power Switch	1 x on-board power switch
I/O Terminal Block	5-pin header with two combination of RS-232, RS-485, CAN Bus, and 2 x GPIO
RTC	1 x RTC input, 2-pin wafe heder,1.25mm
Power Input	1 x 5V/2A DC power input, 5.5mm OD, 2.5mm ID or 3-pin 2.54 header
OTG	1 x OTG
Expansion	2x 20-pin 2.0mm expansion header offers: x1 PCIe PHY, 1 x RS-232 (Rx, Tx) , IOMUX outputs: up to 1x UART, 1x CAN, 1x SPI, 1x I2C and configurable GPIOs. 40-pin FPC shared with MIPI CSI: 1x I2S digital audio channel with Line-out/detect, Line-out, Mic-in/detect
Operating Temperature	-10 ~ 50° C (14 ~ 122° F)
Storage Temperature	-40 ~ 85° C (-40 ~ 185° F)
Operating Humidity	5% ~ 95%, 40°C, non-condensing
Dimensions	100 x 72 mm (3.94" x 2.84")

2.2 Board Layout

Figure 1 shows the location of the major components on the top and bottom-side of the EMB-2230.

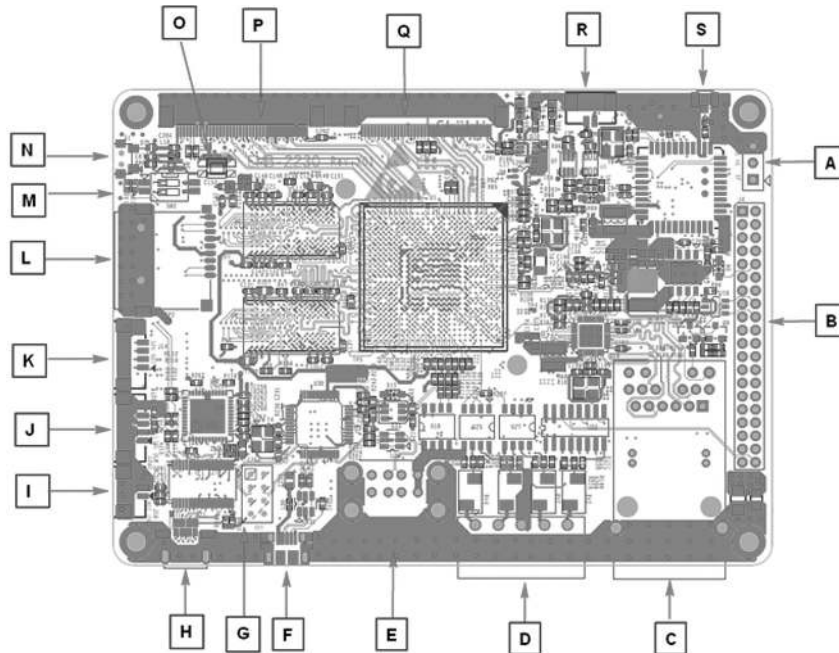


Table 2 lists the components identified in Figure 1

Table 2. Components Show in Figure 1

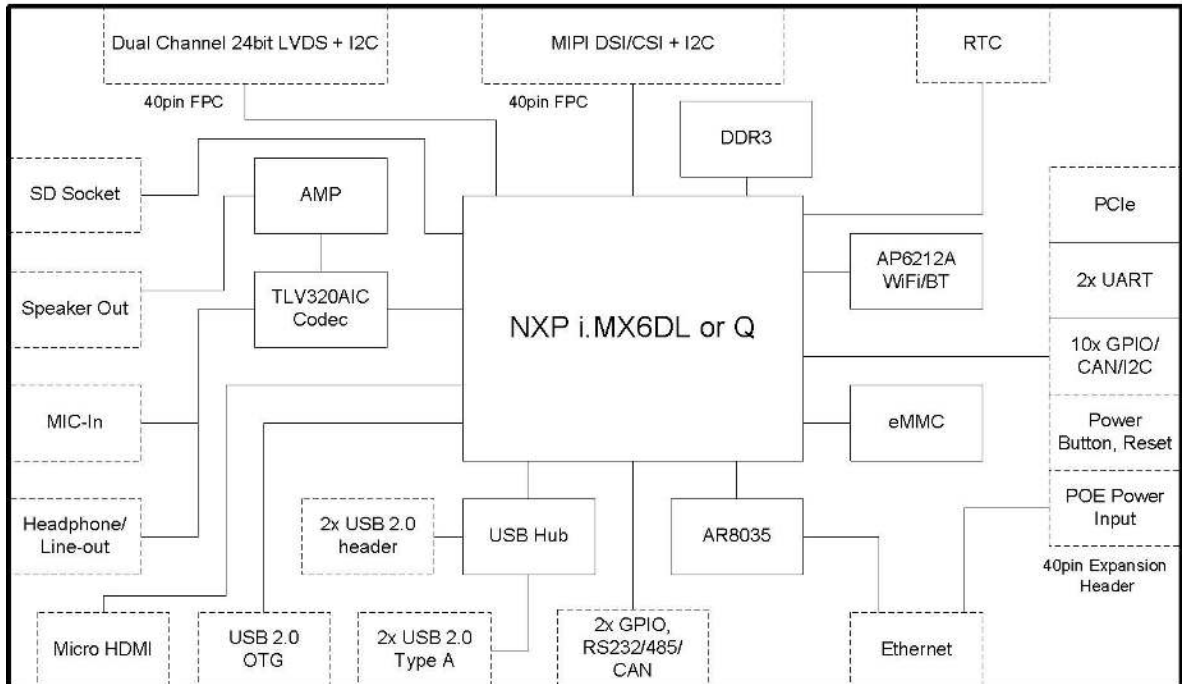
Item from Figure 1	Connector	Description
A	J1	5V DC Input
B	J4	5V DC in, 3.3V out, PCIe signals, GPIOs, POE power signals
C	U20	RJ45 connector for 1000M Ethernet with POE
D	J9	Modbus for RS232 or CAN or RS485 or GPIOs
E	J11	USB Type A for 2x Host USB 2.0
F	J12	Micro USB B for 1 x OTG USB
G	J10	2x USB 2.0 headers
H	J6	Micro HDMI connector for HDMI port
I	J16	Mic in
J	J15	L/R Line out or L/R Headphone out with mic in
K	J14	L/R Speaker out
L	J9	micro SD socket
M	SW2	2-bit switch for boot selection TF/eMMC
N	S1	Bootload Button for boot selection USB or board
O	SW1	System Power On/Off
P	J7	FPC connector for LVDS signals I2C GPIOs VCC
Q	J8	FPC connector for MIPI signals I2C I2S GPIOs VCC
R	J2	RTC Battery input
S	J3	2.4G antenna for Wifi/BTE
LED	D5	Green LED flashing for system working status
LED	D3	Green LED on for system power OK
LED	D1	Red LED light for power over voltage

2.3 Block Diagram

Figure 4 is a block diagram of the major functional areas of the board.

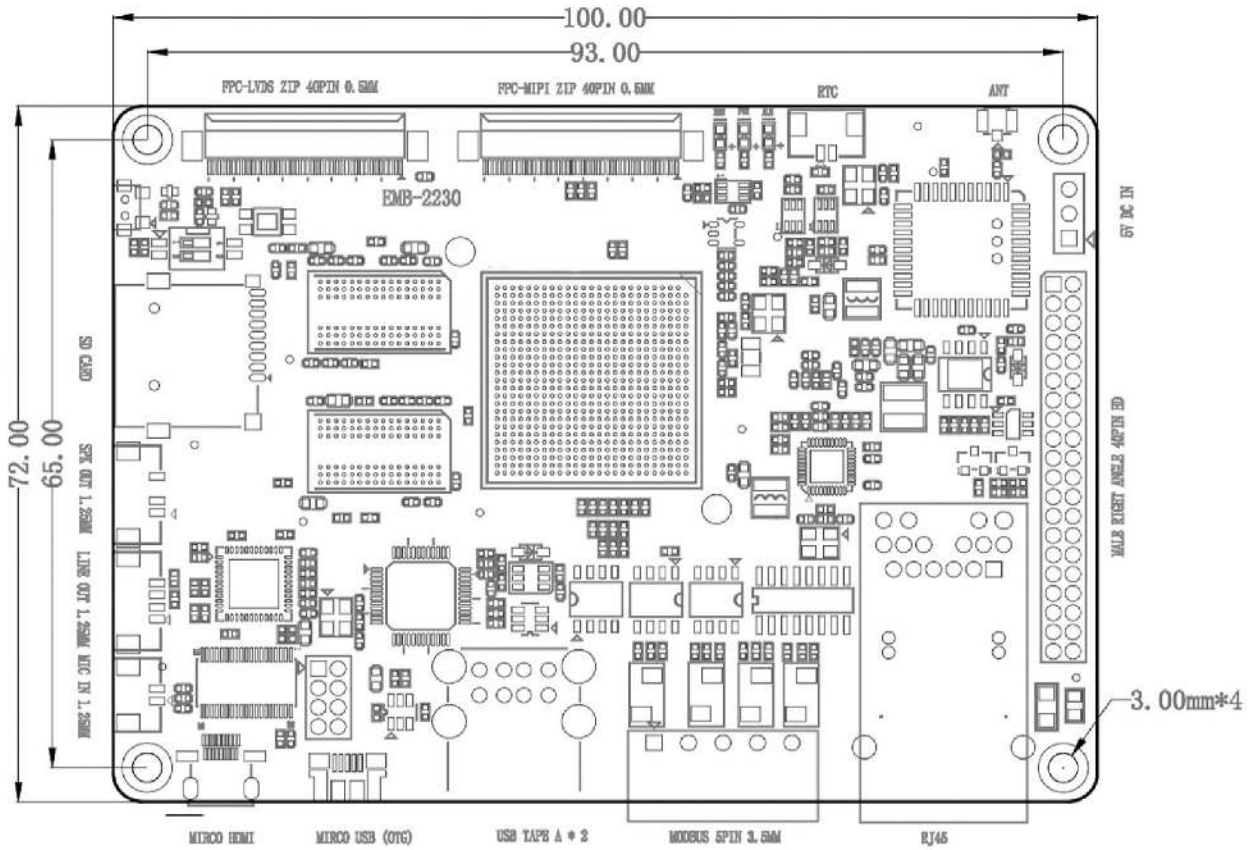
Figure 4. Block Diagram

EMB-2230



2.4 Dimensions

Figure 5 is board layout dimensions (unit: mm).



3. Technical Reference

3.1 Connectors and Headers

Table 4. J1 Header (Figure. 1. A)

Pin	Signal Name
1	+5V DC power input
2	+5V DC power input
3	GND

Table 5. J4 40-pin Expansion Header (Figure. 1. B)

Pin	Signal Name	Pin	Signal Name
1	GND	21	GPIO/SPI_CK (3.3V)
2	+5V IN	22	GPIO/SPI_SS1/Uart2_RTS (3.3V)
3	PCIeCLK_N (2.5V)	23	GPIO/SPI_MO (3.3V)
4	+5V IN	24	GPIO/I2C3_SC (3.3V)
5	PCIeCLK_P (2.5V)	25	GPIO/SPI_MI (3.3V)
6	+5V_IN	26	GPIO/I2C3_SDA (3.3V)
7	GND	27	GPIO/SPI_SS0 (3.3V)
8	+3.3V OUT	28	GPIO/CAN2_RX (3.3V)
9	PCIeTX_N (2.5V)	29	GPIO/Uart2_CTS (3.3V)
10	MCUIO for PWR_BTN	30	GPIO/CAN2_TX (3.3V)
11	PCIeTX_P (2.5V)	31	GND
12	MCUIO for Boot_BTN	32	GND
13	GND	33	VC1+ (POE Power In)
14	GND	34	VC2+ (POE Power In)
15	PCIeRX_N (2.5V)	35	VC1- (POE Power In)
16	GPIO/Uart2_TX (Console)	36	VC2- (POE Power In)
17	PCIeRX_P (2.5V)	37	GND
18	GPIO/Uart2_RX (Console)	38	GND
19	GND	39	RS232_TXD
20	GND	40	RS232_RXD

Table 6. J9 Modbus Port (Figure. 1. D)

Zero ohm resistor populated option	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5
1: R203, R206, R199, R200 (default)	GPIO_A	GPIO_B	GND	RS232_TX	RS232_RX
2: R203, R206, R209, R212	GPIO_A	GPIO_B	GND	RS485_A	RS485_B
3: R203, R206, R216, R220	GPIO_A	GPIO_B	GND	CAN_H	CAN_L
4: R210, R214, R199, R200	RS485_A	RS485_B	GND	RS232_TX	RS232_RX
5: R218, R221, R199, R200	CAN_H	CAN_L	GND	RS232_TX	RS232_RX
6: R218, R221, R209, R212	CAN_H	CAN_L	GND	RS485_A	RS485_B

Table 7. J12 OTG Port (Figure. 1. F)

Pin	Signal Name
1	USB_OTG_VBUS
2	USB_OTG_DM
3	USB_OTG_DP
4	USB_OTG_ID
5	GND

Table 8. J10 USB Header (Figure. 1. G)

Pin	Signal Name
1	USB_HOST_VBUS
3	USB_HUB_DM4
5	USB_HUB_DP4
7	GND
2	USB_HOST_VBUS
4	USB_HUB_DM3
6	USB_HUB_DP3
8	GND

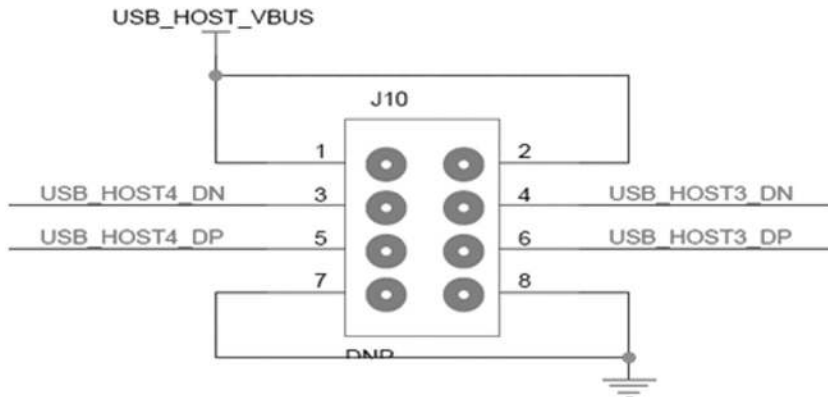


Table 9. J6 Micro HDMI Port (Figure. 1. H)

Pin	Signal Name
1	HPD_OUT
2	Utility
3	HDMI_D2P
4	GND
5	HDMI_D2N
6	HDMI_D1P
7	GND
8	HDMI_D1N
9	HDMI_D0P
10	GND
11	HDMI_D0N
12	HDMI_CLKP

13	GND
14	HDMI_CLKN
15	HDMI_CEC_OUT
16	GND
17	HDMI_DDC_CLK_OUT
18	HDMI_DDC_DAT_OUT
19	HDMI_5V_OUT

Table 10. J16 MIC In Header (Figure. 1. I)

Pin	Signal Name	Pin	Signal Name
1	Mic +	2	GND

Table 11. J15 Line Out or Headphone Out (Figure. 1. J)

Pin	Signal Name (Default)	Signal Name (Option)
1	Mic +	Mic +
2	GND	GND
3	Headphone_out (R)	Line-out (R)
4	Headphone_out (L)	Line-out (L)

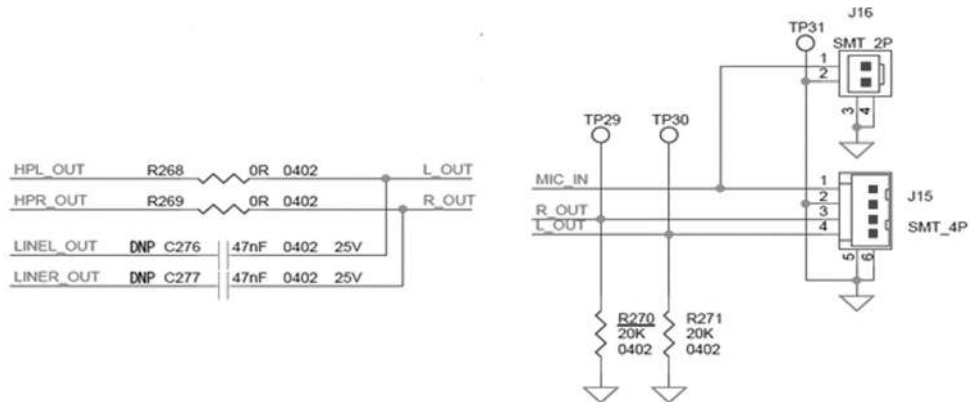


Table 12. J14 Speaker out (Figure. 1. K)

Pin	Signal Name
1	Speaker_out L-
2	Speaker_out L+
3	Speaker_out R-
4	Speaker_out R+

Table 13. J7 LVDS and TP Header (Figure. 1. P)

Pin	Signal Name	Pin	Signal Name
1	+5V_LCD	21	LVDS1_TX0_N
2	5V_LCD	22	GND
3	GPIO_LVDS_1/PWM (3.3V)	23	LVDS1_TX1_P
4	GND	24	LVDS1_TX1_N
5	LVDS0_TX0_P	25	GND
6	LVDS0_TX0_N	26	LVDS1_TX2_P
7	GND	27	LVDS1_TX2_N
8	LVDS0_TX1_P	28	GND
9	LVDS0_TX1_N	29	LVDS1_CLK_P
10	GND	30	LVDS1_CLK_N
11	LVDS0_TX2_P	31	GND
12	LVDS0_TX2_N	32	LVDS1_TX3_P
13	GND	33	LVDS1_TX3_N
14	LVDS0_CLK_P	34	GND
15	LVDS0_CLK_N	35	GPIO/I2C2_SCL (3.3V)
16	GND	36	GPIO/I2C2_SDA (3.3V)
17	LVDS0_TX3_P	37	GPIO_LVDS_2 (3.3V)
18	LVDS0_TX3_N	38	GPIO_LVDS_3 (3.3V)
19	GND	39	GPIO_LVDS_4 (3.3V)
20	LVDS1_TX0_P	40	3.3V_VDDIO

Table 14. J8 MIPI CSI DSI Header (Figure. 1. Q)

Pin	Signal Name	Pin	Signal Name
1	+5V_LCD	21	I2C1_SCL (3.3V)
2	5V_LCD	22	I2C1_SDA (3.3V)
3	GPIO_MIPI_1/REF_CLK (3.3V)	23	GPIO_MIPI_3 (3.3V)
4	GPIO_MIPI_2/PWM (3.3V)	24	GPIO_MIPI_4 (3.3V)
5	GND	25	GPIO_MIPI_5 (3.3V)
6	CSI_CLK_P	26	GND
7	CSI_CLK_N	27	DSI_CLK_P
8	GND	28	DSI_CLK_M
9	CSI_DP0	29	GND
10	CSI_DM0	30	DSI_DP0
11	GND	31	DSI_DM0
12	CSI_DP1	32	GND
13	CSI_DM1	33	DSI_DP1
14	GND	34	DSI_DM1
15	CSI_DP2	35	GND
16	CSI_DM2	36	GPIO_MIPI_6/AUD3_TXC (3.3V)
17	GND	37	GPIO_MIPI_7/AUD3_RXD (3.3V)
18	CSI_DP3	38	GPIO_MIPI_8/AUD3_FS (3.3V)
19	CSI_DM3	39	GPIO_MIPI_9/AUD3_TXD (3.3V)
20	GND	40	3.3V_VDDIO

Table 15. J2 RTC Battery Header (Figure. 1. R)

Pin	Signal Name	Pin	Signal Name
1	RTC Battery +	2	RTC Battery -

Table 16. Test Pads

Pin	Signal Name	Pin	Signal Name
TP1	+5V System Power	TP23	Speaker_out L-
TP2-7	GND	TP24	Speaker_out R-
TP9	GND	TP25	Speaker_out L+
TP10	3.3V For MCU	TP26	Mute Test
TP11	Bootload_key Test	TP27,28, 31	GND For Audio
TP12	WDT Test	TP29	Head_Phone_Out_R
TP13	JTAG_TCK	TP30	Head_Phone_Out_L
TP14	JTAG_TMS	TP32	RS485_A
TP15	JTAG_TDI	TP33	RS485_B
TP16	JTAG_TDO	TP34	CAN_H
TP17	JTAG_TRSTB	TP35	CAN_L
TP18	JTAG_MOD	J3-1	MCU_SCK
TP20	+1.8V For Audio Codec	J3-2	MCU_RST
TP21	Mic_In	J3-3	MCU_MOSI
TP22	Speaker_out R+	J3-4	MCU_MISO

3.2 Signal and Power Considerations

1. When providing power from the extension board via the expansion 40pin headers, not required connect the 5V DC power input header(J1) on the mainboard at the same time.
2. The VCC_5V output current from the expansion headers output has a limit of 1A
3. The USB_5V output current from the USB headers has a limit of 1A
4. When providing power from the expansion board via the expansion 40-pin headers, make sure to provide enough current (2A or more) to the mainboard
5. Speaker amplifier output: 2.1W/CH Into 4ohm 1.4W /CH Into 8ohm .

3.3 Boot Options

The board can be selected to boot up from on-board iNAND or micro-SD card. See Table 17.

Table 17. SW2 2bit Switch (Figure. 1. M)

Bit 1	Bit 2	Description
OFF	ON	Boot from micro SD Card
ON	OFF	Boot from eMMC
ON	OFF	No Boot
OFF	OFF	No Boot

3.4 GPIO Configuration Table

Table 18. J4 40-pin Expansion Header (Figure. 1. B/Table 5)

Pad	Pin	MUX MODE						
		ALT6	ALT5	ALT4	ALT3	ALT2	ALT1	ALT0
DISP0_DAT0	21		GPIO4_IO21			ECSPI3_SCLK		
DISP0_DAT1	23		GPIO4_IO22			ECSPI3_MOSI		
DISP0_DAT2	25		GPIO4_IO23			ECSPI3_MISO		
DISP0_DAT3	27		GPIO4_IO24			ECSPI3_SS0		
EIM_DATA28	29		GPIO3_IO28	UART2_CTS				
EIM_DATA26	16		GPIO3_IO26	UART2_TX				
EIM_DATA27	18		GPIO3_IO27	UART2_RX				
EIM_DATA29	22		GPIO3_IO29	UART2_RTS				
GPIO_5	24	I2C3_SCL	GPIO1_IO05					
GPIO_6	26	I2C3_SDA	GPIO1_IO06					
KEY_ROW4	28		GPIO4_IO15					FLEXCAN2_RX
KEY_COL4	30		GPIO4_IO14					FLEXCAN2_TX
CSI0_DAT10	39				UART1_TX to RS-232_TXD			
CSI0_DAT11	40				UART1_RX to RS-232_RXD			

Table 19. J9 Modbus Port (Figure. 1. D/Table 6)

Pad	Pin	MUX MODE						
		ALT6	ALT5	ALT4	ALT3	ALT2	ALT1	ALT0
CSI0_DAT12	4				UART4_TX to RS-232_TXD			
CSI0_DAT13	5				UART4_RX to RS-232_RXD			
DI0_PIN4	1		GPIO4_IO20					
DI0_PIN2	2		GPIO4_IO18					
CSI0_DAT14	1,2 /4,5				UART5_TX	To RS485_A, RS485_B		
CSI0_DAT15					UART5_RX			
CSI0_DAT18					UART5_RTS			
CSI0_DAT19					UART5_CTS			
KEY_COL2	1,2 /4,5					FLEXCAN1_TX	To CANH, CANL	
KEY_ROW2						FLEXCAN1_RX		
KEY_ROW1							GPIO4_IO09	To CAN_STB

Table 20. J7 LVDS and TP Header (Figure. 1. P/Table 13)

Pad	Pin	MUX MODE						
		ALT6	ALT5	ALT4	ALT3	ALT2	ALT1	ALT0
KEY_COL3	35		GPIO4_IO12	I2C2_SCL				
KEY_ROW3	36		GPIO4_IO13	I2C2_SDA				
DISP0_DAT8	1		GPIO4_IO29			PWM1_OUT		
DISP0_DAT7	37		GPIO4_IO28					
DISP0_DAT6	38		GPIO4_IO27					
DISP0_DAT5	39		GPIO4_IO26					

Table 21. J8 MIPI CSI DSI Header (Figure. 1. Q/Table 14)

Pad	Pin	MUX MODE						
		ALT6	ALT5	ALT4	ALT3	ALT2	ALT1	ALT0
GPIO_3	3		GPIO1_IO03					
DISP0_DAT9	4		GPIO4_IO30			PWM2_OUT		
CSI0_DAT8	22		GPIO5_IO26	I2C1_SDA		ECSPI2_SCLK		
CSI0_DAT9	21		GPIO5_IO27	I2C1_SCL		ECSPI2_MOSI		
DISP0_DAT15	23		GPIO5_IO09			ECSPI1_SS1		
DISP0_DAT18	24		GPIO5_IO12			ECSPI2_SS0		
DISP0_DAT17	25		GPIO5_IO11			ECSPI2_MISO		
CSI0_DAT4	36		GPIO5_IO22	AUD3_TXC		ECSPI1_SCLK		
CSI0_DAT7	37		GPIO5_IO25	AUD3_RXD		ECSPI1_SS0		
CSI0_DAT6	38		GPIO5_IO24	AUD3_TXFS		ECSPI1_MISO		
CSI0_DAT5	39		GPIO5_IO23	AUD3_TXD		ECSPI1_MOSI		

4. Operating System

4.1 Host Operating System

- a. Host OS: Ubuntu 12.04 64-bit or newer
- b. Host Build System: Yocto Embedded Linux

4.2 Target Operating System

- a. Board u-boot version: based on NXP u-boot-fslc-2015.04
- b. Board kernel version: based on NXP linux-imx-3.14.52_1.1.0_ga
- c. UI framework: Qt version 5.8
- d. Embedded Linux Distribution: Krogoth 2.1
- e. BSP: <http://wiki.habeyusa.com/wiki/EMB-2230>

4.3 U-boot Features

- a. Support 7", 10" LCD panel option (models: INNOLUX P070BAG-CM1, INNOLUX EJ101IA-01G, AUO G101EVN01.0)
- b. Support external USB drive image update via u-boot
- c. Support micro-SD card image update via u-boot
- d. Support HDMI display

4.4 Kernel Features

- a. Based on NXP linux-imx-3.14.52_1.1.0_ga
- b. Support HDMI and LCD dual display
- c. Support analog speaker, line out and HDMI audio selection
- d. USB to SATA support (Genesys Logic GL830)
- e. WiFi/BT support (AP6212A)

4.5 Other OS Support

- a. Android 6.0.1
- b. Linux Debian 8

Refer to <http://wiki.habeyusa.com/wiki/EMB-2230> for instructions of building the file systems.