

# LPC315x Data Logger/Remote Data Acquisition Board Documentation

## Circuit board assembly description

- 1) Main LPC315x Data Logger board – This is the main Data Logger board.
- 2) RS232 transceiver board – is used for early s/w development, before Linux is running on the platform or before the GSM cellular module begins to use the only UART port on the LPC315x. This board is connected to P15 on the main board to connect the LPC315x UART to a PC serial port over RS-232.
- 3) uFL to SMA boards – is used to connect antenna (SMA) to the GSM cellular module (uFL) plugged in to the main board at J3.
- 4) LPC1343 VCOM board – is used to provide a SPI to USB virtual comm. Port for Linux debug. This is needed because there is only one UART port on the LPC315x chip, and it is used for interfacing to the GSM module. The India team will need to develop the s/w for LPC1343 SPI-to-USB Vcomm. This board connects to the main board at P7.
- 5) RS485 XCVR board – This board contains the RS485 transceiver so the LPC315x UART port can be used to drive the LPC1102 DMX512 Lighting board using standard DMX512 cables. The RS485 XCVR board connects to the main DL board at P15. The GSM cellular module is not useable when the RS485 XCVR board is attached to main board.
- 6) LPC31xx Audio board – this board is used with LPC315x internal I2S audio codec to support stereo headphone out, stereo line level out, stereo line level in, and Microphone input. This board connects to main board at P8.
- 7) LPC1102 DMX512 Lighting board – This board is used to demonstrate using the LPC315x as a DMX512 master lighting controller; while the LPC1102 DMX512 Lighting board is the DMX512 client. The LPC1102 DMX512 board has a 3-color LED at D300. This board requires a separate power supply (is not powered by main DL board). When power is applied to this board all 3 LEDs are on full brightness. Software to control LPC1102 PWM's is needed to dim LEDs.

## Associated Modules which can be used with the LPC315x Data Logger/Data Acquisition Board

- 1) 900/1800 Mhz ¼ wave antenna – used for GSM cellular module. Also requires uFL-to-SMA board and uFL-to-uFL RF cable to connect antenna to GSM module.
- 2) WUBR-170GN USB dongle – can add WiFi 802.11 BGN to the Data Logger when installed at J7 and the appropriate drivers have been installed.
- 3) JN5148-EK010 Evaluation Kit – contains the Jennic 2.4GHz IEEE802.15.4 & JenNet development kit. Main DL board has Jennic JN5148 module with on-board antenna for communication with other Jennic JN5148 modules. The intent is for the Main DL board to be the main controller.



## Power Indicator

There is no dedicated power LED indicator on the Data Logger main board. Check 3.3V at P6 pin 2. The 3.3V power is generated by the LPC315x.

## Data Logger boot

The Data Logger boot mode is controlled by the logic level latched at the LPC315x GPIO0, GPIO1 and GPIO2 pins on the rising edge of RSTIN\_N pin. The level of GPIO0 is always low by pull-down R93. The level on GPIO1 is determined by R89 and R92; GPIO2 is determined by R83 and R92. The level of GPIO1 is indicated by LED D17 (silkscreen MD1). The level of GPIO2 will be indicated by LED D18 (silkscreen MD2). The LED will be on when GPIOx is high and off when the corresponding GPIOx is low.

### Boot Mode Table

| Boot Mode  | R83           | R92           | R89           | R94           |
|------------|---------------|---------------|---------------|---------------|
| NAND flash | Not installed | installed     | Not installed | installed     |
| SPI        | Not installed | installed     | installed     | Not installed |
| DFU        | installed     | Not installed | Not installed | installed     |
| SD/MMC     | installed     | Not installed | installed     | Not installed |

## SD/MMC Boot

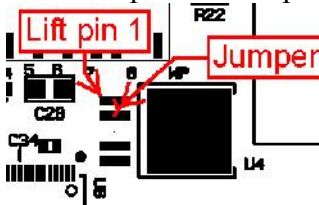
The SD/MMC power regulator U4 pin 1 must be high to enable the regulator. By default U4 pin 1 comes up low as it is driven by an external 8-bit register used to provide GPO's.

### Board rework required to boot from SD/MMC

SD/MMC regulator rework for booting from SD/MMC

Lift U4 pin 1 from the pcb to disconnect from U5 pin 5.

Short U4 pin 1 to U4 pin 2.



## List of on-board header style jumpers

| Header Designator | Description   | Default                                |
|-------------------|---|--|
| JP1               | Jennic 802.15.4 wireless module U1 nSPI_MEM_WP<br>Open – program flash<br>Closed – SPI Flash write protected  | open                                   |
| JP2               | GSM cellular module SERVICE mode select<br>Open – non-service mode; normal operation<br>Closed – service mode   | open                                   |
| JP3<br>JP4        | Route external power at J4 through on-board 5V regulator or bypass regulator.<br>JP3-2 shunted to JP4-2: 5V external power, bypass regulator.<br>JP3-1 shunted to JP3-2; JP4-1 shunted to JP4-2: 6V – 15V | 5V Ext Power<br>JP3-2 shunted to JP4-2 |

|     |  |        |
|-----|--|--------|
|     | external power goes to on-board 5v regulator   |        |
| JP5 | Nand flash Lock select<br>Open – Nand block lock command enabled, all blocks are protected or locked from program or erase.<br>Closed – Nand block lock disabled; program / erase enabled. | closed |

### List of on-board solder jumpers

| Jumper Designator | Description  | Default |
|-------------------|--|---------|
| JS1               | Jennic 802.15.4 wireless module U1 interrupt to LPC315x GPIO2<br>Open – disconnect Jennic 802.15.4 wireless interrupt from GPIO2<br>Closed - connect Jennic 802.15.4 wireless interrupt to GPIO2   | closed  |
| JS2               | Jennic 802.15.4 wireless module enable flash programming from LPC315x SPI<br>Open – disable Jennic 802.15.4 wireless flash programming from LPC315x SPI<br>Closed – enable Jennic flash programming from LPC315x SPI;<br>Jennic 802.15.4 wireless module must be held in reset while LPC315x programs flash over SPI | open    |
| JS3               | 3.3V connection at GSM Cellular UART trace port P4<br>Open – 3.3V is disconnected from P4 pin 2; used when FTDI cable is used to connect GSM UART trace to PC USB.<br>Closed – 3.3V is connected to P4 pin 2; use when RS232 XCVR board is used to connect trace port P4 to PC serial port.                          | open    |
| JS4               | Jennic 802.15.4 wireless module U1 Intelligent Peripheral interface select<br>Open – disable LPC315x SPI_nCS1 from Jennic 802.15.4 wireless module.<br>Closed – enable LPC315x SPI_nCS1 to Jennic 802.15.4 wireless IP select input.   | closed  |
| JS5               | D6 installed +PSU_VBUS to +VBAT voltage for GSM module<br>Open – +PSU_VBUS to +VBAT is 3.8V  | open    |

| <b>Jumper Designator</b> | <b>Description</b>  | <b>Default</b> |
|--------------------------|---|----------------|
|                          | Closed - +PSU_VBUS to +VBAT is 4.2V   |                |
| JS6                      | Hardware enable of USB_VBUS_B to +PSU_VBUS<br>Open – s/w must enable USB_VBUS_B to +PSU_VBUS<br>Closed – always enable USB_VBUS_B to power +PSU_VBUS  | open           |
| JS7                      | Disable 300mA load on external power<br>Open – 300mA load applied to external power; use only when board is powered from Li-Ion battery. The 300mA load is used to ensure external voltage source is capable of supplying 300mA of current before s/w switches from battery power to external dc power (i.e. solar panel).<br>Closed – hardware disable of 300mA load; use for tethered external power only (no battery) application. | closed         |
| JS8                      | External power (J4) enabled to power LPC315x +PSU_VBUS<br>Open – External power is s/w controlled to supply power to LPC315x. Used in battery powered application. S/W will check external power under 300mA load prior to switching external power on to +PSU_VBUS.<br>Closed - hardware always enable of external dc power to LPC315x; use for tethered applications with external power only (no battery).                         | closed         |
| JS9                      | 3.3V power to P7 SPI/I2C header for LPC1343 VCOM board<br>Open – no 3.3V supplied to P7 header; LPC1343 VCOM board is powered by the USB Device connector.<br>Closed – 3.3V supplied to P7  | open           |
| JS10<br>JS12<br>JS13     | SPI chip select for LPC1343 VCOM at P7 header; close only one of these solder jumpers.<br>Open – SPI chip select is not connected to P7<br>Closed – SPI chip select is connected to P7; close only one switch and be sure the selected SPI chip select is not being used for another device on the SPI bus.   | All open       |
| JS11                     | LPC315x 1.8V (+VSUP2) power supplies +VSUP4/8 (external memory bus) power rail<br>Open – LPC315x 1.8V not used to power +VSUP4/8; optional 1.8V power supply U23 used to power +VSUP4/8; JS15 must be closed when JS11 is open.<br>Closed – LPC315x 1.8V (+VSUP2) supplies +VSUP4/8; JS15 must be open when JS11 is closed.   | closed         |
| JS14                     | GSM module RING signal connection to LPC315x GPIO1<br>Open – GSM_RING signal is disconnected from GPIO1<br>Closed – GSM_RING signal is connected to GPIO1; this does not affect GPIO1 being used for LPC315x boot mode  | closed         |

| <b>Jumper Designator</b> | <b>Description</b>   | <b>Default</b> |
|--------------------------|--|----------------|
|                          | select.  |                |
| JS15                     | On-board 1.8V supply to +VSUP4/8 (external memory bus)<br>Open – on-board 1.8V not used to power +VSUP4/8; LPC315x 1.8V +VSUP2 used to power +VSUP4/8; JS11 must be closed when JS15 is open.<br>Closed – optional on-board 1.8V (U23) supplies +VSUP4/8; JS11 must be open when JS15 is closed.   | open           |
| JS16                     | On-board optional 1.8V power supply input voltage<br>Open – no voltage supplied to U23 input; 1.8V supplied by LPC315x +VSUP2<br>Closed – voltage supplied to U23; U23 may be used to supply 1.8V  | open           |
| JS17                     | 3.3V power to P15 LPC315x UART header<br>Open – no 3.3V supplied to P15 header pin 2; setting when using FTDI cable to interface LPC315x UART to PC USB.<br>Closed – 3.3v supplied to P15 header pin 2; setting when using RS232 XCVR baby board to interface LPC315x UART to PC serial port.  | closed         |
| JS18                     | GSM module C104/RXD signal connection to LPC315x UART RXD.<br>Open – GSM RXD signal is disconnected from LPC315x RXD. Use this setting anytime the LPC315x UART is being connected to the RS232 XCVR board or any other cable / device other than the GSM module.<br>Closed – GSM RXD signal is connected to LPC315x RXD; when GSM module is used this must be closed... | closed         |
| JS19                     | Board system reset source select<br>Open – System reset driven by simple RC; C122 must be installed for this mode.<br>Closed – System reset driven by reset supervisor.  | closed         |
| JS20                     | 3.3V to JTAG connector P14 pin 2; bottom side jumper on PCB.<br>Open – 3.3V disconnected from JTAG connector P14-2. Leave open when the JTAG dongle is self-powered.<br>Closed – 3.3V is connected to JTAG connector P14-2. Close this jumper when the JTAG dongle must be powered from the target.  | open           |

### **On board connectors & headers**

| <b>Reference Designator</b> | <b>Function</b>                                    |
|-----------------------------|--|
| J1                          | Ethernet interface                                 |
| J2                          | SD/MMC slot  |
| J3                          | GSM Cellular module connector; Telit GC864-QUAD_V2 |

| Reference Designator | Function  |
|----------------------|---|
| J4                   | External DC power; 5V power brick; 6V – 15Vdc<br><b>Caution: ensure JP3 and JP4 are set correctly for external voltage used otherwise damage could result to the board or LPC315x.</b>  |
| J5                   | Embedded Artists QVGA LCD panel SPI interface for touch screen  |
| J6                   | USB Device interface connector. The LPC315x can only support one USB Device or one USB Host but not both at the same time. The USB Device and Host connectors are multiplexed to the LPC315x. The mux is controlled by s/w. The default after power on is the Device connected to the LPC315x.                        |
| J7                   | USB Host interface connector. This connector is multiplexed with J6 for connection to the LPC315x. See J6 function for additional details.  |
| J8                   | ANA2_1 analog sensor input, 3-position screw terminal block. The LPC315x has 3 ADC channels. ADC10B_GPA1 and ADC10B_GPA2 are both connected to an external 4:1 multiplexer chip U15. Which channel of the multiplexer is connected to the LPC315x ADC is set by GPO at U5. Analog inputs must be between 0V – 3.3Vdc. |
| J9                   | ANA2_0 analog sensor input, 3-position screw terminal block.  |
| J10                  | ANA1_1 analog sensor input, 3-position screw terminal block.  |
| J11                  | ANA1_0 analog sensor input, 3-position screw terminal block.  |
| P1                   | Jennic 802.15.4 wireless module (U1) JTAG connector   |
| P2                   | Li-Ion battery JST 3-pin connector; this is optional connector for battery.   |
| P2A                  | Li-Ion battery JST 2-pin connector.   |
| P3                   | Jennic 802.15.4 wireless module serial interface connector. Used for programming the flash on the module. May be connected to either the RS232 XCVR board or FTDI cable to interface to a PC. Programming the module is required to use the Intelligent Peripheral interface for interfacing to LPC315x SPI.          |
| P4                   | GSM cellular module monitor serial interface connector. Used for reprogramming the module. May be connected to either the RS232 XCVR board or FTDI cable to interface to a PC. The GSM module responds to AT commands on serial interface to LPC315x UART. No reprogramming of the GSM module should be needed.       |
| P5                   | Embedded Artists QVGA LCD panel LCD data interface.   |
| P6                   | LPC315x I2C expansion interface; may be used for sensors with I2C.  |
| P7                   | LPC1343 VCOM interface (SPI)  |
| P8                   | LPC315x Audio Codec analog interface to LPC31xx Audio board.  |
| P9                   | LPC315x SPI expansion interface; may be used for sensors with SPI.  |
| P10                  | ANA2_3 analog sensor input, 3-position header.  |
| P11                  | ANA2_2 analog sensor input, 3-position header.  |
| P12                  | ANA1_3 analog sensor input, 3-position header.  |
| P13                  | ANA1_2 analog sensor input, 3-position header.  |
| P14                  | LPC315x JTAG interface 20-pin connector   |
| P15                  | LPC315x UART interface; used to connect RS232 XCVR board for early development debug. Can not be used when GSM module will be used.   |

## Board GPIO function

The GPIO used on the Data logger board are described in the following table. More GPIO was required than available from the LPC315x alone, so an external 8-bit D-type flip-flop U5 is used for additional GPO's. GPIO table column descriptions:

Column 1 – Function; brief name describing what the GPIO is used for.

Column 2 – defines which LPC315x pin name and pin number, or expansion GPO used.

Column 3 – defines how the LPC315x GPIO or expansion GPO comes up after power on / reset.

Column 4 – voltage rail the GPIO is powered by. The LPC315x GPIO's powered by VDD\_IOA (1.8V) use an external buffer U8 to translate to 3.3V.

Column 5 – GPIO function relative to the LPC315x or expansion GPO. The Data logger start up software must program the LPC315x GPIO according to this column. To implement an open-drain output OUT (OD), s/w must program GPIO as output to drive low, but program the same GPIO as input for open-drain state.

Column 6 – active level for GPIO

### GPIO function table

| Function                            | LPC315x or External GPO Expansion - pin           | Default I/O – PU/PD      | GPIO Vdd_IO     | Function In / Out | Active level |
|-------------------------------------|---|--------------------------|-----------------|-------------------|--------------|
| SPI-to-USB virtual comm chip select | mUART_CTS_N /SPI_CS_OUT1 - P11                    | In                       | VDD_I OC – 3.3v | Out               | low          |
| SPI to USB Vcom IRQ                 | I2SRX_WS0 – R9                                    | During RST high, then In | VDD_I OC – 3.3v | In                | low          |
| LCD TS SPI CS                       | SPI_CS_OUT0 – D8                                  | Out (high)               | VDD_I OC – 3.3v | Out               | low          |
| Jennic chip SPI CS                  | mUART_CTS_N /SPI_CS_OUT1 - P11 (shared with VCom) | In                       | VDD_I OC – 3.3v | Out               | low          |
| Sensor SPI CS                       | mUART_RTS_N /SPI_CS_OUT2 - R11                    | Out (high)               | VDD_I OC – 3.3v | Out               | low          |
| LCD_BL_INTENS/SHDN                  | PWM_DATA – D10                                    | In                       | VDD_I OC – 3.3v | Out               | Pwm/high     |
| ENET_IRQ                            | mI2STX_BCK0/PCM_FSC – T12                         | Out (clock)              | VDD_I OC – 3.3v | In                | low          |
| DevVBUS-2-PSU_EN                    | mNAND_RYBN1/MCI_DAT5 – C5                         | In                       | Vdd_IO A – 1.8V | Out               | low          |
| EXT_PWR 2 PSU Ena                   | NAND_NCS_1 – L3                                   | Out (high)               | Vdd_IO A –      | Out               | low          |



| Function  | LPC315x or External GPO Expansion - pin | Default I/O – PU/PD | GPIO Vdd_IO    | Function In / Out | Active level |
|---|---|---------------------|----------------|-------------------|--------------|
|   |   |                     | 1.8V           |                   |              |
| GSM_ON/OFF_PULSE  | mI2STX_DATA0/PCM_DATA – T13             | Out (low)           | VDD_IO – 3.3v  | Out               | high (3.3v)  |
| EXTPWR_400mA_Load_EN  | mNAND_RYBN3/MCI_DATA7 – D4              | In                  | Vdd_IOA – 1.8V | Out               | high         |
| GSM_PWRMON  | mNAND_RYBN2/MCI_DATA6 – D5              | In                  | Vdd_IOA – 1.8V | In                | high         |
| LPC315x Boot_Mod0 / Jennic 802.15.4 wireless module interrupt | GPIO0 – R13                             | In / PD             | VDD_IO – 3.3v  | In                |              |
| LPC315x Boot_Mod1 / GSM module RING indicator.                | GPIO1 – T14                             | In / PD             | VDD_IO – 3.3v  | In                |              |
| LPC315x Boot_Mod2 / GSM module DTR handshake.                 | GPIO2 – P12                             | In                  | VDD_IO – 3.3v  | In                |              |
| PSU_STOP  | GPIO3 – D12                             | In                  | VDD_IO – 3.3v  | In                | high         |
| LCD Touch screen Pen_IRQ                                      | GPIO4 – D11                             | In                  | VDD_IO – 3.3v  | In                | low          |
| SD/MMC nCD  | I2SRX_DATA0 – P9                        | In                  | VDD_IO – 3.3v  | In                | low          |
| SD/MMC WP   | I2SRX_BCK0 – T9                         | In                  | VDD_IO – 3.3v  | In                | high         |
| nUSB_Host_Pwr_Fault   | NAND_NCS_2 – L4                         | Out (high)          | Vdd_IOA – 1.8V | In                | Low (OD)     |
| LPC315x nChrg_250mA   | NAND_NCS_3 – M2                         | Out (high)          | Vdd_IOA – 1.8V | Out (OD)          | Low (OD)     |
| Stereo Audio Line-In2 detect from                             | mI2STX_CLK0/PCM_DB – T11                | Out (clock)         | VDD_IO – 3.3v  | In                | high         |

| Function   | LPC315x or External GPO Expansion - pin | Default I/O – PU/PD | GPIO Vdd_IO           | Function In / Out | Active level |
|--|---|---------------------|-----------------------|-------------------|--------------|
| LPC31xx Audio board at P8.                                   |   |                     | 3.3v                  |                   |              |
| Stereo Audio Line-In1 detect from LPC31xx Audio board at P8. | mI2STX_WS0/P<br>CM_DCK – R12            | Out (clock)         | VDD_I<br>OC –<br>3.3v | In                | high         |
| USB_Host Power ena   | GPO EXP – Q0                            | Out (low)           | 3.3v                  | Out               | high         |
| SD/MMC_PWR_EN  | GPO EXP – Q1                            | Out (low)           | 3.3v                  | Out               | high         |
| Analog Mux sel:<br>EXT_PWR_CHK /<br>nPSU_VBUS<br>monitor     | GPO EXP – Q2                            | Out (low)           | 3.3v                  | Out               |              |
| Analog port mux select S0                                    | GPO Exp – Q3                            | Out (low)           | 3.3v                  | Out               |              |
| Analog port mux select S1                                    | GPO Exp – Q4                            | Out (low)           | 3.3v                  | Out               |              |
| GSM_RESET  | GPO Exp – Q5                            | Out (low)           | 3.3v                  | Out               | high         |
| USB Mux SEL<br>nDEVICE/HOST                                  | GPO Exp – Q6                            | Out (low)           | 3.3v                  | Out               |              |
| Jennic 802.15.4 wireless module reset                        | GPO Exp – Q7                            | Out (low)           | 3.3v                  | Out               | low          |

## Key components on main board

### IC's / modules

| Reference Designator | Description  |
|----------------------|--|
| U2                   | Ethernet MAC + PHY; Micrel KSZ8851-16MLL.  |
| U1                   | NXP (Jennic) JN5148-001-M/00T,534 802.15.4 wireless module with on-module antenna.   |
| U4                   | SD/MMC 3.3V power regulator; Rohm BD33KA5WFP-E2.   |
| U5                   | Expansion GPO; NXP 74LVC273PW.   |
| U6                   | External memory bus 16-bit dual supply transceiver; TI 74AVCA164245GR  |
| U7                   | External dc power step-down 1.2A voltage regulator; used only when JP3, JP4 are strapped for 6v – 15v external power voltage range. Diodes Inc AP5100WG-7. |
| U10                  | Optional EEPROM for storage of Ethernet MAC address; not installed as default.   |
| U11                  | SDRAM 32M x 16, 1.8V; Micron MT48H32M16LFBF-75:B   |

| Reference Designator | Description  |
|----------------------|--|
| U12                  | Nand Flash 4Gbit, 2k page, configured 256M x 16, 1.8V; Micron MT29F4G16ABCHC:C.  |
| U13                  | LPC3152 MCU; NXP   |
| U15                  | Dual 4-chan analog mux/demux; used to multiplex two of the LPC315x ADC channels to analog sensors. Sensor voltage range must be between 0v – 3.3Vdc. NXP 74LV4052DB  |
| U16                  | USB high speed multiplexer chip; NXP NX3DV221GM. Allows single LPC315x USB controller to be used either as Device only or Host only. Default is for USB Device. S/W must write to USB Mux SEL nDEVICE/HOST GPO Exp – Q7.   |
| U18                  | External memory bus 8-bit dual supply transceiver; NXP 74AVC8T245PW  |
| U20                  | 1-of-2 decoder/demultiplexer; NXP 74LVC1G19GW; used to decode the LPC315x static memory chip select 1 (EBI_nSTCS1) in to two separate address spaces:<br>1) Ethernet MAC + Phy 0x20020000 – 0x20027FFF (data) or 0x20030xxx (command).<br>2) Expansion GPO at 0x20028xxx or 0x30038xxx |
| U23                  | Optional 1.8V power regulator for devices on external memory bus; National Semi LM3670MF-1.8. This regulator is not used as a default. The LPC315x +VSUP2 supplies 1.8V to external memory bus devices.  |
| U24                  | USB Host port VBUS power switch; Micrel MIC2005A-1YM5.   |
| U26                  | Board reset supervisor, 2.63V threshold; Diodes Inc. APX809-26SA.  |
| Y1                   | 25Mhz crystal; used for Ethernet MAC + Phy chip.   |
| Y2                   | 12Mhz crystal; used for LPC315x main oscillator.   |
| Y3                   | 32.768Khz crystal; used for LPC3156 RTC.   |

### Switches

| Reference Designator | Description   |
|----------------------|---|
| SW1                  | Jennic 802.15.4 wireless module manual reset; can be used along with SW2 to place the module in flash programming mode. Note: expansion GPO GPO_nRES_ZIG (GPO Exp – Q7) must be driven high before the Jennic module can be programmed or will respond to any serial communication. |
| SW2                  | Jennic 802.15.4 wireless module SPIMISO_Z; when pressed while SW1 is pressed then released will place the module in programming mode through the serial interface.  |
| SW3                  | When pressed supplies high level to LPC315x PSU_ON. Used to manually turn on LPC315x power supplies when LPC315x is in STOP mode.   |
| SW4                  | Manual Data Logger board system reset.  |

### LED's

| Reference Designator | Description   |
|----------------------|---|
| D17                  | “MD2” silkscreen; Reflects the state of LPC315x GPIO2; at power-on or reset will reflect boot mode bit-2. LED is on when GPIO2 is high; LED is off when GPIO2 is low. |
| D18                  | “MD1” silkscreen; Reflects the state of LPC315x GPIO1; at power-on or reset will reflect boot mode bit-1. LED is on when GPIO1 is high; LED is off when GPIO1 is low. |
| D1                   | SD/MMC power indicator  |
| D2                   | GSM Cellular module status LED; See Telit documentation:<br>1) Telit_GC864-QUAD_V2_Hardware_User_Guide_r3.pdf<br>2) Telit_AT_Commands_Reference_Guide_r9.pdf          |

## LCD

The Data Logger supports the Embedded Artists 3.2 inch QVGA color LCD display (EA-LCD-002) at P5 and J5.

# LPC1343 VCOM board

## Board Power

The LPC1343 VCOM board is typically powered from the USB Device VBUS connector J202. It is also possible to power the board from the LPC1343 UART connector P201. When the board is powered by P201 the USB Device connector J202 must be disconnected. P7-1 to P7A-1 must be open in both power configurations. See Table for LPC1343 VCOM board operation mode for how power jumpers are configured in each mode.

## Board / LPC1343 boot

To boot the LPC1343 in ISP mode for programming the internal flash add a jumper shunt at JP202. The LPC1343 UART is brought out to P201. The LPC1343 UART port can be connected to a PC through either the RS232 XCVR baby board to PC serial port, or with an FTDI cable to PC USB port. See LPC1343 Operation mode table for jumper connections for each mode and power source.

### LPC1343 VCOM board operation mode table

| Operational Mode                        | Power Source       | JP201       | JP202  | Notes   |
|---|--------------------|-------------|--------|---|
| LPC1343 ISP mode;<br>Use RS232 XCVR brd | J202<br>VBUS       | 2-3<br>3.3V | closed | RS232 XCVR board installed at P201 to program LPC1343 Flash from PC serial port. The RS232 XCVR board is powered from JP201.  |
| LPC1343 ISP mode;<br>Use FTDI cable     | P201<br>FTDI cable | 1-2<br>5V   | closed | FTDI cable installed at P201 to program LPC1343 Flash from PC virtual comm port. No USB Device installed at J202.   |
| LPCxxxx UART to USB VCP                 | J202<br>VBUS       | 2-3<br>3.3V | open   | RS232 XCVR board installed at P201 to interface with any LPCxxxx MCU UART port. RS232 XCVR board is powered from JP201.   |
| LPCxxxx SPI / I2C to USB VCP            | J202<br>VBUS       | open        | open   | P7A used to interface to SPI or I2C interface of any LPCxxxx MCU. For Data logger SPI-to-VCP debug port jumper P7A pins 2, 3, 4, 5, 6, 9, and 10 to the same pins on main board P7. |

### List of on-board header style jumpers

| Header Designator | Description  | Default | Notes   |
|-------------------|--|---------|---|
| P7A               | SPI / I2C interface to LPC315x on main Data logger brd | open    | For SPI to USB VCOM connect 2,3,4,5,6,9,and 10 to P7 on main brd. Also select one of three possible SPI chip selects on the DL main board by adding |

| Header Designator | Description           | Default | Notes   |
|-------------------|-----------------------|---------|---|
|                   |                       |         | solder to JS10, JS12 or JS13. When no LCD is used on Data Logger solder JS10.   |
| JP201             | Power select for P201 | open    | When RS232 XCVR board is installed at P201, jumper JP201_2-3 for 3.3V to XCVR board.<br>When FTDI cable is installed a P201, jumper JP201_1_2 for 5V to power LPC1343 VCOM board from FTDI cable. USB Device must not be installed at J202. |
| JP202             | LPC1343 ISP mode      | open    | Short before power-on or reset to bring up LPC1343 in ISP mode to program internal Flash.   |

### On board connectors & headers

| Reference Designator | Description                 | Notes  |
|----------------------|-----------------------------|--|
| P201                 | LPC1343 UART interface      | Connect either RS232 XCVR baby brd or FTDI cable to program LPC1343 Flash in ISP mode. See LPC1343 VCOM board operation mode table for VCOM board jumper settings. |
| J202                 | USB Device conn             | Board typically powered by this connector. USB device must be disconnected when the board is powered by the FTDI cable at P201.                                    |
| P202                 | LPC1343 SWD debug connector |  |

## RS485 XCVR board

### Board Power

The RS485 XCVR board is powered from the P200 pin 3; the LPC315x UART interface connector. The RS485 XCVR board is connected to the main DL board at P15. SJ17 must be shorted to get 3.3V power to P15. The RS485 transceiver has a separate power pin (VCC, pin 14) for the RS485 differential pair signals, which can be powered at 5V or 3.3V. To power the transceiver VCC from 3.3V install a shunt at JP200\_1-2. To power VCC from 5V install a shunt at JP200\_2-3 and attach the off-board 5V to TP1. The off-board 5V power supply also needs to be grounded to the RS485 brd at P200 pin 1 or other convenient location.

### List of on-board header style jumpers

| Header Designator | Description                   | Default | Notes  |
|-------------------|-------------------------------|---------|--|
| JP200             | RS485 transceiver VCC voltage | Open    | 3.3V – shunt 1 - 2<br>5V – shunt 2 – 3, add off-board 5V supply at TP1, and add off board gnd to P200 pin 1. |

### List of on-board solder jumpers

| Jumper Designator | Description              | Default | Notes  |
|-------------------|--------------------------|---------|--|
| JS200<br>JS201    | Pull-apart bias enable   | short   | DMX512 defines a simple resistor divider to bias the RS458 differential pair to ensure a known logic level is received at the master receiver when no clients are on the RS485 bus.                          |
| JS202             | 120 ohm termination      | Short   | 120 ohm termination across the RS485 differential pair when jumper is shorted. The master controller should be located at one far end to the RS485 bus and should have termination on.                       |
| JS203             | RS485 common tied to GND | Short   | RS485 is generally tied to gnd at one place on the RS485 bus. This is generally done at the master controller. Multiple connections to gnd are usually ok, but could also create gnd loops causing problems. |

### On board connectors & headers

| Reference Designator | Description            | Notes  |
|----------------------|------------------------|--|
| P200                 | LPC315x UART interface | P200 is connected to the LPC315x UART interface on the DL main board P15. The transceiver UART interface is powered from P200 pin 2. Ensure the Data logger main |

| Reference Designator | Description | Notes   |
|----------------------|-------------|---|
|                      |             | board has JS17 shorted to get 3.3V to P15. The GSM module on the DL main board must not be powered on to use the LPC315x UART port with the RS485 XCVR board. |
| J200                 | DMX512 Out  | XLR-5F connector used to connect standard DMX512 clients to the DL running a DMX512 lighting master controller application.                                   |
| J201                 | RS-485 bus  | 3-position screw terminal may also be used to wire up the RS485 bus to client lighting boards for simple wire demonstration.                                  |



## LPC31xx Audio board

### Board Power

The LPC31xx Audio board is powered from the P300 pin 9; the LPC315x audio interface connector. The LPC31xx Audio board is connected to the main DL board at P8.

External power supply Jumper settings:

There are no power supply jumpers for the LPC31xx audio board.

List of on-board header style jumpers:

There are no header style or solder style jumpers on the LPC31xx audio board.

### On board connectors & headers

| Reference Designator | Description   | Notes |
|----------------------|---|-------|
| P300                 | LPC315x analog audio signals, 3.3V power, gnd   |       |
| J302                 | Microphone mono input;  |       |
| J303                 | Stereo audio line level input1; signal VIN_DETECT high indicates a cable has been plugged in to J303. |       |
| J304                 | Stereo audio line level input2; signal TIN_DETECT high indicates a cable has been plugged in to J304. |       |
| J305                 | Stereo headphone output; supports 16 – 32 ohm load.   |       |

## S232 XCVR board

### Board power

The RS232 XCVR board is powered from the P15A pin 3; the uart interface connector.

The RS232 XCVR board is connected to the main DL board at P15.

External power supply Jumper settings:

Solder jumper JS17 must be shorted on the main DL board to supply 3.3v power to P15 pin 3.

List of on-board header style jumpers:

There are no header style or solder style jumpers on the RS232 XCVR board.

### On board connectors & headers

| Reference Designator | Description   | Notes |
|----------------------|---|-------|
| P15A                 | LPC315x UART interface  |       |
| P304                 | DB9 male connector wired as DTE; requires null-modem cable when connecting to a PC serial port. |       |

## LPC1102 DMX512 lighting board

The LPC1102 DMX512 lighting board makes use of three PWM outputs of the LPC1102 to drive the intensity of each color input of the tri-color LED at D300. The LPC1102 analog ADC inputs are connected to a light sensor (Q303) and a temperature sensor U304. The concept is the LPC1102 receives DMX512 lighting commands from the main DL board over RS485. The LPC1102 then programs the PWM according to the DMX512 commands and / or the light and temperature sensors.

### Board Power

The LPC1102 DMX512 board is powered from a 5V power brick attached to connector J306. Power may also be supplied by a 5V bench supply connected using TP2 (5V power) and TP3 (GND). When power is applied to an unprogrammed LPC1102 the PWM outputs come up as inputs with pull-up, causing each LED to be lit with maximum intensity. The LED at maximum intensity is quite bright; you may want to cover the LED while working with an unprogrammed LPC1102 DMX512 board.

External power supply Jumper settings:

There are no power supply jumpers on the LPC1102 DMX512 board.

### Board / LPC1102 boot

The LPC1102 has no dedicated ISP entry pin. Therefore, user code is required to invoke ISP functionality. Unprogrammed parts automatically boot into ISP mode. The LPC1102 UART is brought out to P302. The LPC1102 UART port can be connected to a PC through either the RS232 XCVR baby board to PC serial port, or with an FTDI cable to PC USB port. **Caution - when using an FTDI cable to program the LPC1102 it is necessary to disconnect the FTDI cable pin 3 from P302. This is because the FTDI cable will output 5V on pin 3.** See the LPC1102 User manual for details of booting the LPC1102.

### List of on-board header style jumpers

| Header Designator | Description                         | Default | Notes  |
|-------------------|-------------------------------------|---------|--|
| JP300             | RS-485 120 ohm terminations enable. | open    | Open – termination is disabled.<br>Shorted – termination is on across the RS485 + to – signal. Add termination when only the LPC1102 DMX512 board is the last board connected in the RS485 daisy chain, or if it's the only board on the RS485 bus to a DMX512 master. |
| JP301             | RS485 transceiver VCC voltage       | Open    | 3.3V – shunt 1 - 2<br>5V – shunt 2 – 3   |
|                   |                                     |         |  |

## List of on-board solder jumpers

| Jumper Designator | Description   | Default | Notes  |
|-------------------|---|---------|--|
| JS300             | LPC1102 P0_9 to UART connector CTS                            | open    | Leave open   |
| JS301             | LPC1102 P0_8 to UART connector RTS                            | Open    | Leave open   |
| JS302             | LPC1102 UART RXD connect to RS485 transceiver receive output. | short   | Open – when using LPC1102 ISP.<br>Short – to use RS485 transceiver for DMX512 interface.   |
| JS303             | RS485 common tied to GND                                      | Short   | RS485 is generally tied to gnd at one place on the RS485 bus. This is generally done at the master controller. Multiple connections to gnd are usually ok, but could also create gnd loops causing problems. |

## On board connectors & headers

| Reference Designator | Description                      | Notes   |
|----------------------|----------------------------------|---|
| P301                 | LPC1102 serial wire debug        |   |
| P302                 | LPC1102 UART port connector      | Used for LPC1102 ISP to program internal flash.   |
| P303                 | DMX512 In                        | 5-pin male XLR connector DMX512 input to the LPC1102 DMX512 board.  |
| J300                 | RS485 3-position terminal block. | This connector can be used to connect a small RS485 network between a main DL board (DMX512 master controller) and a LPC1102 DMX512 board (DMX512 slave).   |
| J301                 | DMX512 Out                       | 5-pin female XLR-5F connector used as the output connector when daisy chain to another DMX512 client (slave) board. When this connector is used the termination should be disabled by leaving JP300 open. |
| J306                 | 5V dc power input.               |   |
| TP2                  | +5V test point                   | Use to connect +5V bench top power supply to the LPC1102 Lighting board.  |
| TP3                  | GND test point                   | Use to connect bench top power supply to the LPC1102 Lighting board   |

## Key components on main board

| Reference Designator | Description  |
|----------------------|--|
| U300                 | MAX13432EETD+, Maxim. RS485 transceiver  |
| U302                 | SA57000-33D, NXP. 3.3v voltage regulator.  |
| U303                 | LPC1102 MCU; NXP   |
| U304                 | LM335M/NOPB, National Semi. Two-terminal zener Precision Temperature Sensor. The LM135 has a breakdown voltage directly proportional to absolute temperature at +10 mV/°K. |
| D300                 | CLV6A-FKB-CK1P1G1BB7R3R3; Cree. high performance tricolor (red, green, blue) SMT LED.  |
| SW300                | LPC1102 MCU reset  |