



# TWR-SER2

## User's Manual

Rev. 1.2

# Contents

|   |           |
|---|-----------|
| <b>1 Overview</b> .....                   | <b>3</b>  |
| <b>2 Reference Documents</b> .....        | <b>5</b>  |
| <b>3 Hardware Features</b> .....          | <b>5</b>  |
| 3.1 Power Supply .....                    | 6         |
| 3.2 Dual Ethernet PHYs .....              | 6         |
| 3.3 Hi-Speed Dual Role USB.....           | 6         |
| 3.4 Low/Full-Speed Host USB.....          | 7         |
| 3.5 Serial Communications Interface ..... | 7         |
| 3.5.1 RS-232/485 Interface.....           | 7         |
| 3.5.2 Serial-to-USB .....                 | 8         |
| 3.5.3 Additional RS232 Interfaces .....   | 8         |
| 3.6 CAN Bus .....                         | 9         |
| 3.7 Elevator Connections .....            | 10        |
| <b>4 Configuration Settings</b> .....     | <b>15</b> |
| 4.1 Switch Settings .....                 | 15        |
| 4.2 Jumper Settings .....                 | 16        |
| <b>5 Mechanical Form Factor</b> .....     | <b>17</b> |

## 1 Overview

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The Serial2 Tower Board (TWR-SER2) is a peripheral Tower System Module designed to be used with a compatible MCU/MPU Tower Card. The TWR-SER2 provides additional interfaces that are common to feature rich MPU's.

The TWR-SER2 features the following:

- Industrial-grade Dual Ethernet PHY Transceiver w/ dual RJ-45 Ethernet Jacks, with integrated magnetics and LED's
- Industrial-grade High Speed Dual Role USB PHY (utilizes MPU's ULPI interface)
- Full Speed / Low Speed Host only USB (utilizes USB Host controller interface)
- Four Serial Ports
  - Serial-to-USB (MC9S08JS16) w/ USB mini-B connector
  - RS-232 / RS-485 Transceivers on shared DB9 connector
  - 2x RS-232 Transceivers with option for full flow control on 2x5 Headers

A block diagram for the TWR-SER2 is shown in the figure below.

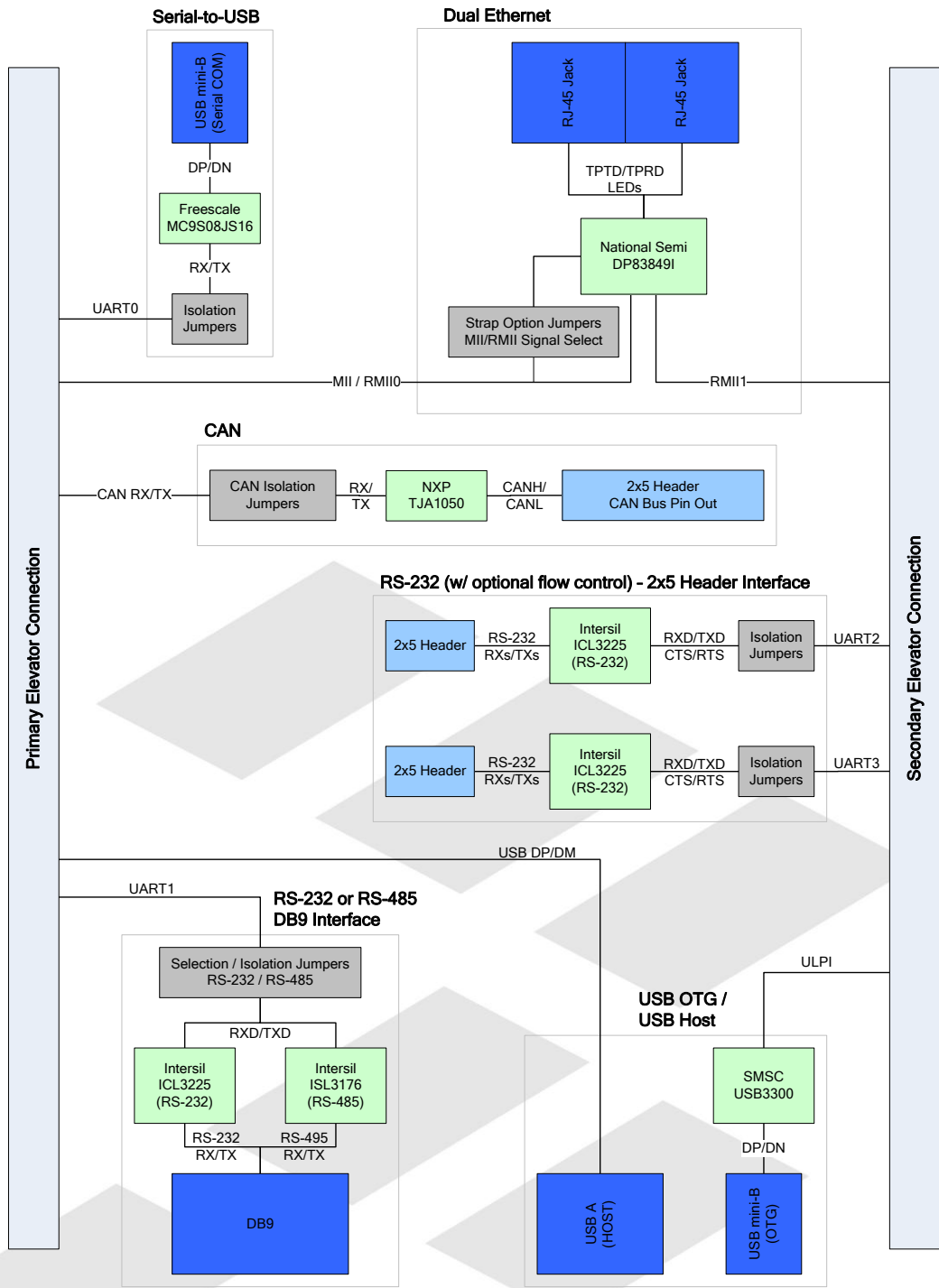


Figure 1 - TWR-SER2 Block Diagram

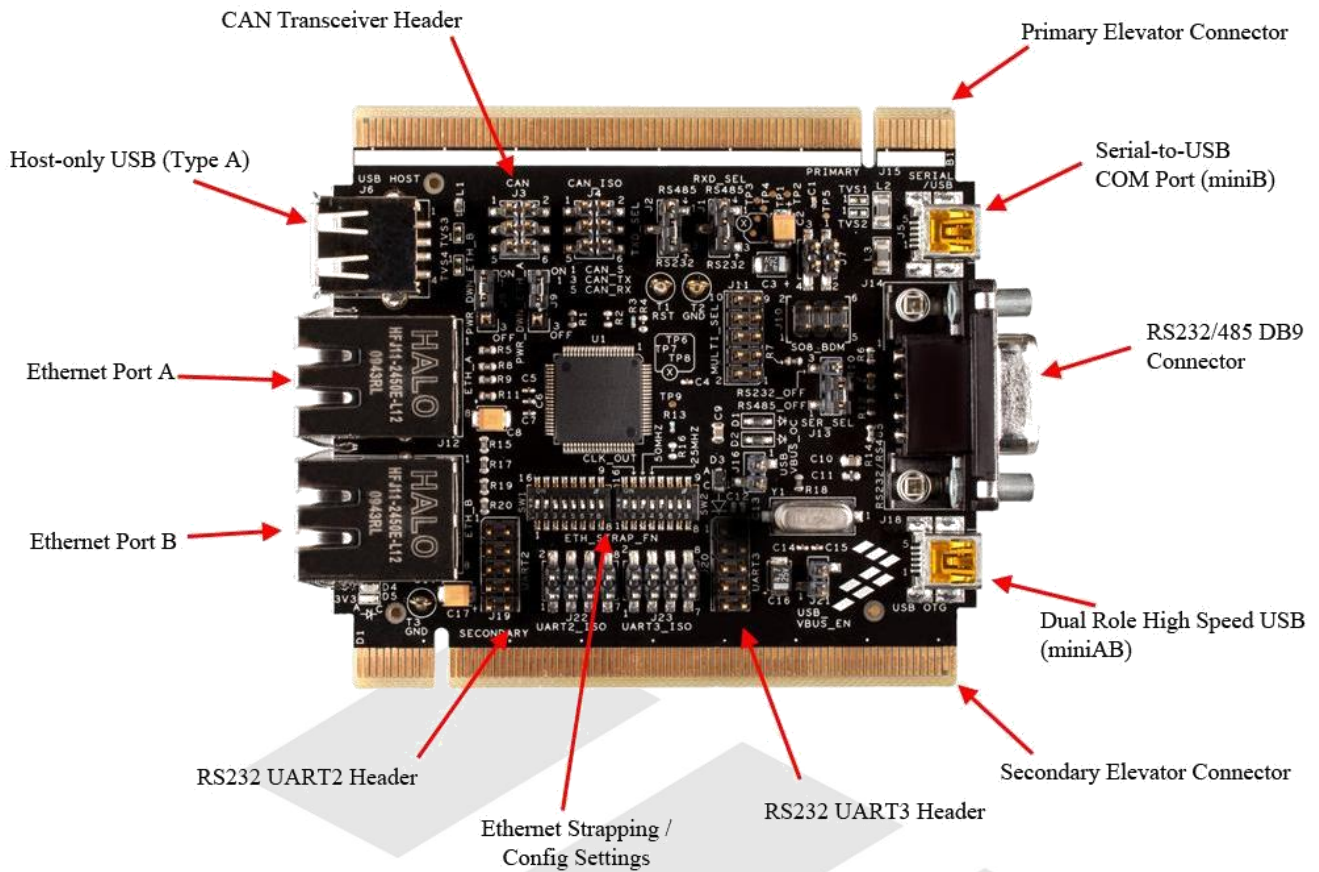


Figure 2 - TWR-SER2 Image

## 2 Reference Documents

The documents listed below should be referenced for more information on the Freescale Tower system and the TWR-SER2. Refer to <http://www.freescale.com/tower> for the latest revision of all released Tower documentation.

- *TWR-SER2 Schematics*
- *TWR-SER2 Quick Start Guide*
- *Freescale MC9S08JS16 Microcontroller with integrated USB Transceiver*
- *DP83849I PHYTER DUAL Industrial Temp Ethernet PHY Transceiver*
- *USB3300 Industrial Temp Hi-Speed USB PHY with ULPI Interface*
- *TJA1051T/3 High-Speed CAN Transceiver*

## 3 Hardware Features

This section provides more details about the features and functionality of the TWR-SER2.

## 3.1 Power Supply

It is intended that the TWR-SER2 be powered from a source in an assembled Tower System via the 5.0V and 3.3V supplies on the TWR-ELEV. This includes the functional Tower Elevator USB power connector, a capable MCU/MPU controller module, or other Tower System module capable of providing power to the entire Tower System. The TWR-SER2 is can also provide power to the Tower System when configured and used as a USB device through the Hi-Speed USB connection (Jumper J24).

## 3.2 Dual Ethernet PHYs

The TWR-SER2 module utilizes an industrial applicable National Semiconductor Dual Ethernet PHY Transceiver (DP83849I). The DP83849I features two fully independent 10/100 ports for multi-port applications. The TWR-SER2 is capable of supporting a single MII interface, a single RMII interface, or dual RMII interfaces.

The Ethernet PHY is configurable via two sets of micro dip switches (SW1 and SW2).

Refer to these settings for typical Ethernet setting. For specific setting details refer to the TWR-SER2 Jumper Options section.

- **10/100 Dual RMII**
  - J8 and J9 should be un-shunted
  - Configure SW1 (1-8) as 11000000
  - Configure SW2 (1-8) as 10100000
- **10/100 Signal Port RMII**
  - J9 should be un-shunted
  - Configure SW1 (1-8) as 11000000
  - Configure SW2 (1-8) as 10100000
- **10/100 Signal Port MII**
  - J9 should be un-shunted
  - Configure SW1 (1-8) as 00110000
  - Configure SW2 (1-8) as 00010000

## 3.3 Hi-Speed Dual Role USB

The TWR-SER2 features Hi-Speed Dual Role USB. This feature is implemented using the SMSC USB3300 USB Transceiver with ULPI interface. The ULPI interface is connected to the TWR-SER2 PCI edge connector connect to a Tower MCU module.

Refer to these settings to configure the High Speed USB ULPI Transceiver.

- **Host Mode** – TWR-SER2 will be connected to a device, such as a USB Memory Stick using the appropriate mini USB adaptor.
  - J24 should be un-shunted

- **Device Mode** – TWR-SER2 will be connected to a host, such as a host PC.
  - J24 should be shunted, if it is desired that the entire Tower system be powered via this connection.

### 3.4 Low/Full-Speed Host USB

The TWR-SER2 features a Host Type-A USB receptacle. The USB differential signals are connected directly to the Tower Elevator USB Signals and will be connected to a compatible Tower System MCU/MPU module’s USB Host controller. In addition to the differential data pair, the MCU should provide the VBUS\_EN signal and respond to the VBUS\_OC signals. J16 and J21 should be shunted to connect VBUS enable/over-current control to the MCU signals.

### 3.5 Serial Communications Interface

The TWR-SER2 is capable of providing up to four additional SCI’s. The number of accessible SCI’s on the TWR-SER2 will depend on the capabilities and Tower Elevator signals connections of the MCU/MPU Module.

#### 3.5.1 RS-232/485 Interface

UART1 (RXD/TXD) is connected to both an RS-232 transceiver and an RS-485 transceiver, selectable by a series of selection jumpers (J1, J2, & J13). The RS-232 and RS-485 transceivers are terminated at a common DB9 connector (J11). This SCI does not feature any type of flow control capabilities. Additional configurations related to the RS485 interface can be made using the MULTI\_SEL jumper (J2). Refer to the following tables for jumper setting details.

| Jumper | Pin | Description  |
|--------|-----|--|
| J1     | 2-3 | RXD_SEL – Specifies the SCI RX signal is routed to the RS232 Transceiver |
| J2     | 2-3 | TXD_SEL – Specifies the SCI TX signal is routed to the RS232 Transceiver |
| J13    | 1-2 | SER_SEL – Disables communication to and from the RS485 Transceiver       |

| Jumper | Pin | Description  |
|--------|-----|--|
| J1     | 1-2 | RXD_SEL – Specifies the SCI RX signal is routed to the RS485 Transceiver |
| J2     | 1-2 | TXD_SEL – Specifies the SCI TX signal is routed to the RS485 Transceiver |
| J13    | 2-3 | SER_SEL – Disables communication to and from the RS232 Transceiver       |

| MULTI_SEL<br>(J2) | Pin  | Description                             |
|-------------------|------|---|
|                   | 1-2  | Connects RS485 Receive EN and Driver EN |
|                   | 3-4  | Connects RS485 RX+ to TX+; Loopback     |
|                   | 5-6  | Connects RS485 RX- to TX-; Loopback     |
|                   | 7-8  | NC                                      |
|                   | 9-10 | Connects 5V supply to DB9 pin 6         |

### 3.5.2 Serial-to-USB

UART0 (RXD/TXD) is connected to a Freescale MC9S08JS16. The MC9S08JS16 provides a Serial-to-USB conversion that will transmit/receive external data via its USB transceiver connected to an USB mini-B connector. When this USB receptacle is connected to a host PC it will enumerate as a USB CDC. The driver required for the CDC device is located on the included CD and is also available on the TWR-SER2 webpage found at [www.freescale.com/tower](http://www.freescale.com/tower).

If needed the UART0 transceiver signals can be isolated from the Tower Elevator using J7.

| Pins | Description                |
|------|----------------------------|
| 1-2  | Remove to Isolate UART0_TX |
| 3-4  | Remove to Isolate UART0_RX |

### 3.5.3 Additional RS232 Interfaces

UART2 and UART3 (RXD/TXD/RTS/CTS) are connected to additional RS-232 transceivers. The RS-232 transceivers are terminated to 2x5 headers (refer to table for pinout).

These interfaces are capable of utilizing the optional RTS/CTS signals for flow control.

| J19 & J20 |             |
|-----------|-------------|
| Pin #     | Signal Name |
| 1         | NC          |
| 2         | NC          |
| 3         | RXD         |
| 4         | RTS         |
| 5         | TXD         |
| 6         | CTS         |
| 7         | NC          |
| 8         | NC          |
| 9         | GND         |
| 10        | NC          |



The 2x5 header is intended to be used with a DB-9 Male to 10 PIN IDC socket adaptor cable. The cable should conform to the following pin assignments.

| 10 Pin IDC<br>0.1" 2x5 | DB-9 Male | Function |
|------------------------|-----------|----------|
| 1                      | 1         | DCD      |
| 2                      | 6         | DSR      |
| 3                      | 2         | RX       |
| 4                      | 7         | RTS      |
| 5                      | 3         | TX       |
| 6                      | 8         | CTS      |
| 7                      | 4         | DTR      |
| 8                      | 9         | RI       |
| 9                      | 5         | GND      |
| 10                     | NC        | NC       |

By default the UART2 and UART3 transceiver signals are isolated from the Tower Elevator. The signals can be connected to the Tower Elevator connector using J22 and J23 respectively.

| Pins | Description                 |
|------|-----------------------------|
| 1-2  | Remove to Isolate UARTx_TX  |
| 3-4  | Remove to Isolate UARTx_RX  |
| 5-6  | Remove to Isolate UARTx_RTS |
| 7-8  | Remove to Isolate UARTx_CTS |

### 3.6 CAN Bus

The TWR-SER2 features a Controller Area Network interface using an NXP TJA1051T/3 CAN transceiver. The signals from the transceiver are connected to a 6-pin (2x3) header using the following CAN Bus Pin Out.

| Pin # | Signal Names | Signal Description |
|-------|--------------|--------------------|
| 1     | Not Used     |                    |
| 2     | CAN_V+       | Power              |
| 3     | CAN_GND      | Ground             |
| 4     | CAN_L        | Dominant Low       |
| 5     | CAN_H        | Dominant High      |
| 6     | Not Used     |                    |

**Table 1 – 2x3 Header CAN Bus Pin Out**

If needed the CAN transceiver signals can be isolated from the Tower Elevator using J4.

| Pins | Description              |
|------|--------------------------|
| 1-2  | Remove to Isolate CAN_S  |
| 3-4  | Remove to Isolate CAN_TX |
| 5-6  | Remove to Isolate CAN_RX |

### 3.7 Elevator Connections

The TWR-SER2 features two expansion card-edge connectors that interface to Elevator boards in a Tower System: the Primary and Secondary Elevator connectors. Table 2 provides the pinout for the Primary and Secondary Elevator Connector. An “X” in the “Used” column indicated that there is a connection from the TWR-MEM to that pin on the Elevator connector. An “X” in the “Jmp” column indicates that a jumper is available that can configure or isolate the connection from the Elevator connector.

**Table 2 - TWR-SER2 Primary Elevator Connector Pinout**

| TWR-SER2 Primary Connector |                      |                       |      |     |     |                   |                         |      |     |
|----------------------------|----------------------|-----------------------|------|-----|-----|-------------------|-------------------------|------|-----|
| Pin                        | Name                 | Usage                 | Used | Jmp | Pin | Name              | Usage                   | Used | Jmp |
| B1                         | 5V                   | 5.0V Power            | X    |     | A1  | 5V                | 5.0V Power              | X    |     |
| B2                         | GND                  | Ground                | X    |     | A2  | GND               | Ground                  | X    |     |
| B3                         | 3.3V                 | 3.3V Power            | X    |     | A3  | 3.3V              | 3.3V Power              | X    |     |
| B4                         | ELE_PS_SENSE         | Elevator Power Sense  | X    |     | A4  | 3.3V              | 3.3V Power              | X    |     |
| B5                         | GND                  | Ground                | X    |     | A5  | GND               | Ground                  | X    |     |
| B6                         | GND                  | Ground                | X    |     | A6  | GND               | Ground                  | X    |     |
| B7                         | SDHC_CLK / SPI1_CLK  |                       |      |     | A7  | I2C0_SCL          |                         |      |     |
| B8                         | SDHC_D3 / SPI1_CS1_b |                       |      |     | A8  | I2C0_SDA          |                         |      |     |
| B9                         | SDHC_D3 / SPI1_CS0_b |                       |      |     | A9  | GPIO9 / UART1_CTS |                         |      |     |
| B10                        | SDHC_CMD / SPI1_MOSI |                       |      |     | A10 | GPIO8 / SDHC_D2   |                         |      |     |
| B11                        | SDHC_D0 / SPI1_MISO  |                       |      |     | A11 | GPIO7 / SD_WP_DET |                         |      |     |
| B12                        | ETH_COL              | MII_COL               | X    |     | A12 | ETH_CRS           | MII_CRS                 | X    |     |
| B13                        | ETH_RXER             | MII_RXER / RMII0_RXER | X    |     | A13 | ETH_MDC           | MII_MDC / RMII0_MDC     | X    |     |
| B14                        | ETH_TXCLK            | MII_TXCLK             | X    |     | A14 | ETH_MDIO          | MII_MDIO / RMII0_MDIO   | X    |     |
| B15                        | ETH_TXEN             | MII_TXEN / RMII0_TXEN | X    |     | A15 | ETH_RXCLK         | MII_RXCLK               | X    |     |
| B16                        | ETH_TXER             |                       |      |     | A16 | ETH_RXDV          | MII_RXDV / RMII0_CRS_DV | X    |     |
| B17                        | ETH_TXD3             | MII_TXD3              | X    |     | A17 | ETH_RXD3          | MII_RXD3                | X    |     |
| B18                        | ETH_TXD2             | MII_TXD2              | X    |     | A18 | ETH_RXD2          | MII_RXD2                | X    |     |
| B19                        | ETH_TXD1             | MII_TXD1 / RMII0_TXD1 | X    |     | A19 | ETH_RXD1          | MII_RXD1 / RMII0_RXD1   | X    |     |
| B20                        | ETH_TXD0             | MII_TXD0 / RMII0_TXD0 | X    |     | A20 | ETH_RXD0          | MII_RXD0 / RMII0_RXD0   | X    |     |
| B21                        | GPIO1 / UART1_RTS    |                       | X    |     | A21 | I2S0_MCLK         |                         |      |     |

TWR-SER2 Primary Connector

| Pin | Name                    | Usage                   | Used     | Jmp | Pin | Name                   | Usage                       | Used     | Jmp |
|-----|-------------------------|-------------------------|----------|-----|-----|------------------------|-----------------------------|----------|-----|
| B22 | GPIO2 / SDHC_D1         |                         | X        |     | A22 | I2S0_DOUT_SCK          |                             |          |     |
| B23 | GPIO3                   |                         |          |     | A23 | I2S0_DOUT_WS           |                             |          |     |
| B24 | CLKIN0                  | RMII_REF_CLK            | X        | X   | A24 | I2S0_DIN0              |                             |          |     |
| B25 | CLKOUT1                 |                         |          |     | A25 | I2S0_DOUT0             |                             |          |     |
| B26 | <b>GND</b>              | <b>Ground</b>           | <b>X</b> |     | A26 | <b>GND</b>             | <b>Ground</b>               | <b>X</b> |     |
| B27 | AN7                     |                         |          |     | A27 | AN3                    |                             |          |     |
| B28 | AN6                     |                         |          |     | A28 | AN2                    |                             |          |     |
| B29 | AN5                     |                         |          |     | A29 | AN1                    |                             |          |     |
| B30 | AN4                     |                         |          |     | A30 | AN0                    |                             |          |     |
| B31 | <b>GND</b>              | <b>Ground</b>           | <b>X</b> |     | A31 | <b>GND</b>             | <b>Ground</b>               | <b>X</b> |     |
| B32 | DAC1                    |                         |          |     | A32 | DAC0                   |                             |          |     |
| B33 | TMR3                    |                         |          |     | A33 | TMR1                   |                             |          |     |
| B34 | TMR2                    |                         |          |     | A34 | TMR0                   |                             |          |     |
| B35 | GPIO4                   | USB_VBUS_EN             | X        | X   | A35 | GPIO6                  | USB_VBUS_OC                 | X        | X   |
| B36 | <b>3.3V</b>             | <b>3.3V Power</b>       | <b>X</b> |     | A36 | <b>3.3V</b>            | <b>3.3V Power</b>           | <b>X</b> |     |
| B37 | PWM7                    |                         |          |     | A37 | PWM3                   |                             | X        |     |
| B38 | PWM6                    |                         |          |     | A38 | PWM2                   |                             | X        |     |
| B39 | PWM5                    |                         | X        |     | A39 | PWM1                   |                             | X        |     |
| B40 | PWM4                    |                         | X        |     | A40 | PWM0                   |                             | X        |     |
| B41 | CAN0_RX                 | CAN_RX                  | X        | X   | A41 | UART0_RX               | UART0_RX                    | X        | X   |
| B42 | CAN0_TX                 | CAN_TX                  | X        | X   | A42 | UART0_TX               | UART0_TX                    | X        | X   |
| B43 | 1WIRE                   | CAN_S                   | X        | X   | A43 | UART1_RX               | UART1_RX                    | X        | X   |
| B44 | SPI0_MISO (IO1)         |                         | X        |     | A44 | UART1_TX               | UART1_TX                    | X        | X   |
| B45 | SPI0_MOSI (IO0)         |                         | X        |     | A45 | VSSA                   |                             |          |     |
| B46 | SPI0_CS0_b              |                         | X        |     | A46 | VDDA                   |                             |          |     |
| B47 | SPI0_CS1_b              |                         | X        |     | A47 | CAN1_RX                |                             |          |     |
| B48 | SPI0_CLK                |                         | X        |     | A48 | CAN1_TX                |                             |          |     |
| B49 | <b>GND</b>              | <b>Ground</b>           | <b>X</b> |     | A49 | <b>GND</b>             | <b>Ground</b>               | <b>X</b> |     |
| B50 | I2C1_SCL                |                         |          |     | A50 | GPIO14                 |                             |          |     |
| B51 | I2C1_SDA                |                         |          |     | A51 | GPIO15                 |                             |          |     |
| B52 | GPIO5 / SPI0_HOLD (IO3) |                         | X        |     | A52 | GPIO16 / SPI0_WP (IO2) |                             |          |     |
| B53 |                         | USB D+ Pulldown Control | X        |     | A53 | GPIO17                 |                             |          |     |
| B54 |                         | USB D- Pulldown Control | X        |     | A54 | USB0_DM                | USB D-                      | X        |     |
| B55 | IRQ_H                   |                         |          |     | A55 | USB0_DP                | USB D+                      | X        |     |
| B56 | IRQ_G                   |                         |          |     | A56 | USB0_ID                |                             |          |     |
| B57 | IRQ_F                   |                         |          |     | A57 | USB0_VBUS              | USB VBUS HST                | X        |     |
| B58 | IRQ_E                   |                         |          |     | A58 | I2S0_DIN_SCK           |                             |          |     |
| B59 | IRQ_D                   |                         |          |     | A59 | I2S0_DIN_WS            |                             |          |     |
| B60 | IRQ_C                   |                         |          |     | A60 | I2S0_DIN1              |                             |          |     |
| B61 | IRQ_B                   |                         |          |     | A61 | I2S0_DOUT1             |                             |          |     |
| B62 | IRQ_A                   |                         |          |     | A62 | RSTIN_b                |                             |          |     |
| B63 | EBI_ALE / EBI_CS1_b     |                         |          |     | A63 | RSTOUT_b               | Reset to Ethernet PHY / SPI | X        |     |
| B64 | EBI_CS0_b               |                         |          |     | A64 | CLKOUT0                | CLOCKOUT0                   | X        |     |
| B65 | <b>GND</b>              | <b>Ground</b>           | <b>X</b> |     | A65 | <b>GND</b>             | <b>Ground</b>               | <b>X</b> |     |

TWR-SER2 Primary Connector

| Pin | Name        | Usage             | Used     | Jmp | Pin | Name        | Usage             | Used     | Jmp |
|-----|-------------|-------------------|----------|-----|-----|-------------|-------------------|----------|-----|
| B66 | EBI_AD15    |                   |          |     | A66 | EBI_AD14    |                   |          |     |
| B67 | EBI_AD16    |                   |          |     | A67 | EBI_AD13    |                   |          |     |
| B68 | EBI_AD17    |                   |          |     | A68 | EBI_AD12    |                   |          |     |
| B69 | EBI_AD18    |                   |          |     | A69 | EBI_AD11    |                   |          |     |
| B70 | EBI_AD19    |                   |          |     | A70 | EBI_AD10    |                   |          |     |
| B71 | EBI_R/W_b   |                   |          |     | A71 | EBI_AD9     |                   |          |     |
| B72 | EBI_OE_b    |                   |          |     | A72 | EBI_AD8     |                   |          |     |
| B73 | EBI_D7      |                   |          |     | A73 | EBI_AD7     |                   |          |     |
| B74 | EBI_D6      |                   |          |     | A74 | EBI_AD6     |                   |          |     |
| B75 | EBI_D5      |                   |          |     | A75 | EBI_AD5     |                   |          |     |
| B76 | EBI_D4      |                   |          |     | A76 | EBI_AD4     |                   |          |     |
| B77 | EBI_D3      |                   |          |     | A77 | EBI_AD3     |                   |          |     |
| B78 | EBI_D2      |                   |          |     | A78 | EBI_AD2     |                   |          |     |
| B79 | EBI_D1      |                   |          |     | A79 | EBI_AD1     |                   |          |     |
| B80 | EBI_D0      |                   |          |     | A80 | EBI_AD0     |                   |          |     |
| B81 | <b>GND</b>  | <b>Ground</b>     | <b>X</b> |     | A81 | <b>GND</b>  | <b>Ground</b>     | <b>X</b> |     |
| B82 | <b>3.3V</b> | <b>3.3V Power</b> | <b>X</b> |     | A82 | <b>3.3V</b> | <b>3.3V Power</b> | <b>X</b> |     |

**Table 3 - TWR-SER2 Secondary Elevator Connector Pinout**

| TWR-SER2 Secondary Connector |                          |                      |      |     |     |                            |              |      |     |
|------------------------------|--------------------------|----------------------|------|-----|-----|----------------------------|--------------|------|-----|
| Pin                          | Name                     | Usage                | Used | Jmp | Pin | Name                       | Usage        | Used | Jmp |
| D1                           | 5V                       | 5.0V Power           | X    |     | C1  | 5V                         | 5.0V Power   | X    |     |
| D2                           | GND                      | Ground               | X    |     | C2  | GND                        | Ground       | X    |     |
| D3                           | 3.3V                     | 3.3V Power           | X    |     | C3  | 3.3V                       | 3.3V Power   | X    |     |
| D4                           | ELE_PS_SENSE             | Elevator Power Sense |      |     | C4  | 3.3V                       | 3.3V Power   | X    |     |
| D5                           | GND                      | Ground               | X    |     | C5  | GND                        | Ground       | X    |     |
| D6                           | GND                      | Ground               | X    |     | C6  | GND                        | Ground       | X    |     |
| D7                           | SPI2_CLK                 |                      |      |     | C7  | I2C2_SCL                   |              |      |     |
| D8                           | SPI2_CS1_b               |                      |      |     | C8  | I2C2_SDA                   |              |      |     |
| D9                           | SPI2_CS0_b               |                      |      |     | C9  | GPIO25                     |              |      |     |
| D10                          | SPI2_MOSI                |                      |      |     | C10 | ULPI_STOP                  | ULPI_STP     | X    |     |
| D11                          | SPI2_MISO                |                      |      |     | C11 | ULPI_CLK                   | ULPI_USB_CLK | X    |     |
| D12                          | ETH_COL                  |                      |      |     | C12 | GPIO26                     |              |      |     |
| D13                          | ETH_RXER                 | RMII1_RXER           | X    |     | C13 | ETH_MDC                    |              |      |     |
| D14                          | ETH_TXCLK                |                      |      |     | C14 | ETH_MDIO                   |              |      |     |
| D15                          | ETH_TXEN                 | RMII1_TXEN           | X    |     | C15 | ETH_RXCLK                  |              |      |     |
| D16                          | GPIO18                   |                      |      |     | C16 | ETH_RXDV                   | RMII1_CRSDV  | X    |     |
| D17                          | GPIO19 / SDHC_D4         |                      |      |     | C17 | GPIO27 / SDHC_D6           |              |      |     |
| D18                          | GPIO20 / SDHC_D5         |                      |      |     | C18 | GPIO28 / SDHC_D7           |              |      |     |
| D19                          | ETH_TXD1                 | RMII1_TXD1           | X    |     | C19 | ETH_RXD1                   | RMII1_RXD1   | X    |     |
| D20                          | ETH_TXD0                 | RMII1_TXD0           | X    |     | C20 | ETH_RXD0                   | RMII1_RXD0   | X    |     |
| D21                          | ULPI_NEXT / USB_HS_DM    | ULPI_NXT             | X    |     | C21 | ULPI_DATA0 / I2S1_MCLK     | ULPI_DATA0   | X    |     |
| D22                          | ULPI_DIR / USB_HS_DP     | ULPI_DIR             | X    |     | C22 | ULPI_DATA1 / I2S1_DOUT_SCK | ULPI_DATA1   | X    |     |
| D23                          | UPLI_DATA5 / USB_HS_VBUS | ULPI_DATA5           | X    |     | C23 | ULPI_DATA2 / I2S1_DOUT_WS  | ULPI_DATA2   | X    |     |
| D24                          | ULPI_DATA6 / USB_HS_ID   | ULPI_DATA6           | X    |     | C24 | ULPI_DATA3 / I2S1_DIN0     | ULPI_DATA3   | X    |     |
| D25                          | ULPI_DATA7               | ULPI_DATA7           | X    |     | C25 | ULPI_DATA4 / I2S1_DOUT0    | ULPI_DATA4   | X    |     |
| D26                          | GND                      | Ground               | X    |     | C26 | GND                        | Ground       | X    |     |
| D27                          | LCD_HSYNC / LCD_P24      |                      |      |     | C27 | AN11                       |              |      |     |
| D28                          | LCD_VSYNC / LCD_P25      |                      |      |     | C28 | AN10                       |              |      |     |
| D29                          | AN13                     |                      |      |     | C29 | AN9                        |              |      |     |
| D30                          | AN12                     |                      |      |     | C30 | AN8                        |              |      |     |
| D31                          | GND                      | Ground               | X    |     | C31 | GND                        | Ground       | X    |     |
| D32                          | LCD_CLK / LCD_P26        |                      |      |     | C32 | GPIO29 / UART2_DCD         |              |      |     |
| D33                          | TMR11                    |                      |      |     | C33 | TMR9                       |              |      |     |
| D34                          | TMR10                    |                      |      |     | C34 | TMR8                       |              |      |     |
| D35                          | GPIO21                   |                      |      |     | C35 | GPIO30 / UART3_DCD         |              |      |     |
| D36                          | 3.3V                     | 3.3V Power           |      |     | C36 | 3.3V                       | 3.3V Power   | X    |     |
| D37                          | PWM15                    |                      |      |     | C37 | PWM11                      |              |      |     |
| D38                          | PWM14                    |                      |      |     | C38 | PWM10                      |              |      |     |
| D39                          | PWM13                    |                      |      |     | C39 | PWM9                       |              |      |     |
| D40                          | PWM12                    |                      |      |     | C40 | PWM8                       |              |      |     |
| D41                          | CAN2_RX                  |                      |      |     | C41 | UART2_RXD / TSIO           | UART2_RX     | X    | X   |
| D42                          | CAN2_TX                  |                      |      |     | C42 | UART2_TXD / TS11           | UART2_TX     | X    | X   |

TWR-SER2 Secondary Connector

| Pin | Name                           | Usage             | Used     | Jmp | Pin | Name                                | Usage             | Used     | Jmp |
|-----|--------------------------------|-------------------|----------|-----|-----|-------------------------------------|-------------------|----------|-----|
| D43 | LCD_CONTRAST                   |                   |          |     | C43 | UART2_RTS / TSI2                    | UART2_RTS         | X        | X   |
| D44 | LCD_OE / LCD_P27               |                   |          |     | C44 | UART2_CTS / TSI3                    | UART2_CTS         | X        | X   |
| D45 | LCD_D0 / LCD_P0                |                   |          |     | C45 | UART3_RXD / TSI4                    | UART3_RX          | X        | X   |
| D46 | LCD_D1 / LCD_P1                |                   |          |     | C46 | UART3_TXD / TSI5                    | UART3_TX          | X        | X   |
| D47 | LCD_D2 / LCD_P2                |                   |          |     | C47 | UART3_RTS / CAN3_RX                 | UART3_RTS         | X        | X   |
| D48 | LCD_D3 / LCD_P3                |                   |          |     | C48 | UART3_CTS / CAN3_TX                 | UART3_CTS         | X        | X   |
| D49 | <b>GND</b>                     | <b>Ground</b>     | <b>X</b> |     | C49 | <b>GND</b>                          | <b>Ground</b>     | <b>X</b> |     |
| D50 | GPIO23                         |                   |          |     | C50 | LCD_D4 / LCD_P4                     |                   |          |     |
| D51 | GPIO24                         |                   |          |     | C51 | LCD_D5 / LCD_P5                     |                   |          |     |
| D52 | LCD_D12 / LCD_P12              |                   |          |     | C52 | LCD_D6 / LCD_P6                     |                   |          |     |
| D53 | LCD_D13 / LCD_P13              |                   |          |     | C53 | LCD_D7 / LCD_P7                     |                   |          |     |
| D54 | LCD_D14 / LCD_P14              |                   |          |     | C54 | LCD_D8 / LCD_P8                     |                   |          |     |
| D55 | IRQ_P / SPI2_CS2_b             |                   |          |     | C55 | LCD_D9 / LCD_P9                     |                   |          |     |
| D56 | IRQ_O / SPI2_CS3_b             |                   |          |     | C56 | LCD_D10 / LCD_P10                   |                   |          |     |
| D57 | IRQ_N                          |                   |          |     | C57 | LCD_D11 / LCD_P11                   |                   |          |     |
| D58 | IRQ_M                          |                   |          |     | C58 | I2S1_DIN_SCK                        |                   |          |     |
| D59 | IRQ_L                          |                   |          |     | C59 | I2S1_DIN_WS                         |                   |          |     |
| D60 | IRQ_K                          |                   |          |     | C60 | I2S1_DIN1                           |                   |          |     |
| D61 | IRQ_J                          |                   |          |     | C61 | I2S1_DOUT1                          |                   |          |     |
| D62 | IRQ_I                          |                   |          |     | C62 | LCD_D15 / LCD_P15                   |                   |          |     |
| D63 | LCD_D18 / LCD_P18 / SD_RX_0    |                   |          |     | C63 | LCD_D16 / LCD_P16 / SD_GND          |                   |          |     |
| D64 | LCD_D19 / LCD_P19 / SD_RXb_0   |                   |          |     | C64 | LCD_D17 / LCD_P17 / SD_GND          |                   |          |     |
| D65 | <b>GND</b>                     | <b>Ground</b>     | <b>X</b> |     | C65 | <b>GND</b>                          | <b>Ground</b>     | <b>X</b> |     |
| D66 | EBI_AD20 / LCD_P42 / SD_GND    |                   |          |     | C66 | EBI_BE_32_24_b / LCD_P28 / SD_TX_0  |                   |          |     |
| D67 | EBI_AD21 / LCD_P43 / SD_GND    |                   |          |     | C67 | EBI_BE_23_16_b / LCD_P29 / SD_TXb_0 |                   |          |     |
| D68 | EBI_AD22 / LCD_P44 / SD_RX_1   |                   |          |     | C68 | EBI_BE_15_8_b / LCD_P30 / SD_GND    |                   |          |     |
| D69 | EBI_AD23 / LCD_P45 / SD_RXb_1  |                   |          |     | C69 | EBI_BE_7_0_b / LCD_P31 / SD_GND     |                   |          |     |
| D70 | EBI_AD24 / LCD_P46 / SD_GND    |                   |          |     | C70 | EBI_TSIZE0 / LCD_P32 / SD_TX_1      |                   |          |     |
| D71 | EBI_AD25 / LCD_P47 / SD_GND    |                   |          |     | C71 | EBI_TSIZE1 / LCD_P33 / SD_TXb_1     |                   |          |     |
| D72 | EBI_AD26 / LCD_P48 / SD_RX_2   |                   |          |     | C72 | EBI_TS_b / LCD_P34 / SD_GND         |                   |          |     |
| D73 | EBI_AD27 / LCD_P49 / SD_RXb_2  |                   |          |     | C73 | EBI_TBST_b / LCD_P35 / SD_GND       |                   |          |     |
| D74 | EBI_AD28 / LCD_P50 / SD_GND    |                   |          |     | C74 | EBI_TA_b / LCD_P36 / SD_TX_2        |                   |          |     |
| D75 | EBI_AD29 / LCD_P51 / SD_GND    |                   |          |     | C75 | EBI_CS4_b / LCD_P37 / SD_TXb_2      |                   |          |     |
| D76 | EBI_AD30 / LCD_P52 / SD_RX_3   |                   |          |     | C76 | EBI_CS3_b / LCD_P38 / SD_GND        |                   |          |     |
| D77 | EBI_AD31 / LCD_P53 / SD_RXb_3  |                   |          |     | C77 | EBI_CS2_b / LCD_P39 / SD_GND        |                   |          |     |
| D78 | LCD_D20 / LCD_P20 / SD_GND     |                   |          |     | C78 | EBI_CS1_b / LCD_P40 / SD_TX_3       |                   |          |     |
| D79 | LCD_D21 / LCD_P21 / SD_REFCLK  |                   |          |     | C79 | GPIO31 / LCD_P41 / SD_TXb_3         |                   |          |     |
| D80 | LCD_D22 / LCD_P22 / SD_REFCLKb |                   |          |     | C80 | LCD_D23 / LCD_P23 / SD_GND          |                   |          |     |
| D81 | <b>GND</b>                     | <b>Ground</b>     | <b>X</b> |     | C81 | <b>GND</b>                          | <b>Ground</b>     | <b>X</b> |     |
| D82 | <b>3.3V</b>                    | <b>3.3V Power</b> | <b>X</b> |     | C82 | <b>3.3V</b>                         | <b>3.3V Power</b> | <b>X</b> |     |

## 4 Configuration Settings

There are several jumpers provided for isolation, configuration, and feature selection. Refer to the following table for details. The default installed jumper settings are shown in **\*bold\***.

### 4.1 Switch Settings

| Switch Options |   | Setting |              | Description   |
|----------------|---|---------|--------------|---|
| SW1            | Ethernet Strapping Functions / Settings | Dip 1   | <b>*On*</b>  | Enables RMI mode for Ethernet PHY A                               |
|                |   |         | Off          | Enables MII mode for Ethernet PHY A                               |
|                |   | Dip 2   | <b>*On*</b>  | Connects RX_CRS to RMII0_CRS_DV (required for RMI operation)      |
|                |   |         | Off          | Disconnects RX_CRS from RMII0_CRS_DV (required for MII operation) |
|                |   | Dip 3   | On           | Connects RX_CRS to MII_CRS (required for MII operation)           |
|                |   |         | <b>*Off*</b> | Disconnects RX_CRS from MII_CRS (required for RMI operation)      |
|                |   | Dip 4   | On           | Connects RX_DV to MII_RXDV (required for MII operation)           |
|                |   |         | <b>*Off*</b> | Disconnects RX_DV from MII_RXDV (required for RMI operation)      |
|                |   | Dip 5   | On           | Enables Dual PHY Extender Mode                                    |
|                |   |         | <b>*Off*</b> | Disables Extender Mode  |
|                |   | Dip 6   | On           | PHY A - Auto Negotiation (Use AN0/AN1 to set highest capability)  |
|                |   |         | <b>*Off*</b> | PHY A - Forced Mode (Use AN0/AN1 to set forced mode)              |
|                |   | Dip 7   | On           | AN0_A - Full-Duplex on PHY A                                      |
|                |   |         | <b>*Off*</b> | AN0_A - Half-Duplex on PHY A                                      |
|                |   | Dip 8   | On           | AN1_A - 100Base-TX on PHY A                                       |
|                |   |         | <b>*Off*</b> | AN1_A - 10Base-T on PHY A   |
| SW2            | Ethernet Strapping Functions / Settings | Dip 1   | <b>*On*</b>  | Enables RMI mode for Ethernet PHY B                               |
|                |   |         | Off          | Enables MII mode for Ethernet PHY B                               |
|                |   | Dip 2   | On           | Connects CLOCKOUT0 to Ethernet PHY Clock                          |
|                |   |         | <b>*Off*</b> | Isolates CLOCKOUT0 from Ethernet PHY Clock                        |
|                |   | Dip 3   | <b>*On*</b>  | Connects onboard 50MHz clock to Ethernet PHY Clock                |
|                |   |         | Off          | Isolates onboard 50MHz clock from Ethernet PHY Clock              |
|                |   | Dip 4   | On           | Connects onboard 25MHz clock to Ethernet PHY Clock                |
|                |   |         | <b>*Off*</b> | Isolates onboard 25MHz clock from Ethernet PHY Clock              |
|                |   | Dip 5   | On           | Disables onboard 25MHz / 50MHz clock                              |
|                |   |         | <b>*Off*</b> | Enables onboard 25MHz / 50MHz clock                               |
|                |   | Dip 6   | On           | PHY B - Auto Negotiation (Use AN0/AN1 to set highest capability)  |
|                |   |         | <b>*Off*</b> | PHY B - Forced Mode (Use AN0/AN1 to set forced mode)              |
|                |   | Dip 7   | On           | AN0_B - Full-Duplex on PHY B                                      |
|                |   |         | <b>*Off*</b> | AN0_B - Half-Duplex on PHY B                                      |
|                |   | Dip 8   | On           | AN1_B - 100Base-TX on PHY B                                       |
|                |   |         | <b>*Off*</b> | AN1_B - 10Base-T on PHY B   |

Figure 3 - TWR-SER2 Switch Settings

## 4.2 Jumper Settings

| Jumper Options |                               | Setting | Description                                    |
|----------------|-------------------------------|---------|--|
| J1             | RS232/485 RX Select (UART 1)  | 1-2     | RS485 Mode (connects RX to RO)                 |
|                |                               | *2-3*   | RS232 Mode (connects RX to R1OUT)              |
| J2             | RS232/485 TX Select (UART 1)  | 1-2     | RS485 Mode (connects TX to DI)                 |
|                |                               | *2-3*   | RS232 Mode (connects TX to T1IN)               |
| J4             | CAN Isolation                 | 1-2     | Connects CAN_S to S                            |
|                |                               | 3-4     | Connects CAN_TX to TXD                         |
|                |                               | 5-6     | Connects CAN_RX to RXD                         |
| J7             | JS16 RS232 Isolation (UART 0) | *1-2*   | Connects RX to S08JS16 RXD                     |
|                |                               | *3-4*   | Connects TX to S08JS16 TXD                     |
| J8             | Power Down Port B             | 1-2     | Disables Ethernet PHY B                        |
| J9             | Power Down Port A             | 1-2     | Disables Ethernet PHY A                        |
| J11            | RS485 Config (UART 1)         | 1-2     | Loopback Mode (connects RE to DE)              |
|                |                               | 3-4     | Loopback Mode (connects TX0_P to RX0_P)        |
|                |                               | 5-6     | Loopback Mode (connects TX0_N to RX0_N)        |
|                |                               | 7-8     | NC   |
|                |                               | 9-10    | 5V Supply to DB9                               |
| J13            | RS232/485 Disable (UART 1)    | *1-2*   | Disables RS485                                 |
|                |                               | 2-3     | Disables RS232                                 |
| J16            | VBUS OC Isolation             | 1-2     | Connects USB VBUS OC to Elevator               |
| J21            | VBUS EN Isolation             | 1-2     | Connects USB VBUS EN to Elevator               |
| J22            | RS232 (UART2) Isolation       | 1-2     | Connects TX to T1IN                            |
|                |                               | 3-4     | Connects RX to R1OUT                           |
|                |                               | 5-6     | Connects RTS to T2IN                           |
|                |                               | 7-8     | Connect CTS to R2OUT                           |
| J23            | RS232 (UART3) Isolation       | 1-2     | Connects TX to T1IN                            |
|                |                               | 3-4     | Connects RX to R1OUT                           |
|                |                               | 5-6     | Connects RTS to T2IN                           |
|                |                               | 7-8     | Connects CTS to R2OUT                          |
| J24            | USB Device Mode               | 1-2     | Device Mode (capable of powering Tower System) |

Figure 4 - TWR-SER2 Jumper Settings



## 5 Mechanical Form Factor

The TWR-SER2 is designed for the Freescale Tower System as a side mounting peripheral and complies with the electrical and mechanical specification as described in *Freescale Tower Electromechanical Specification*.

