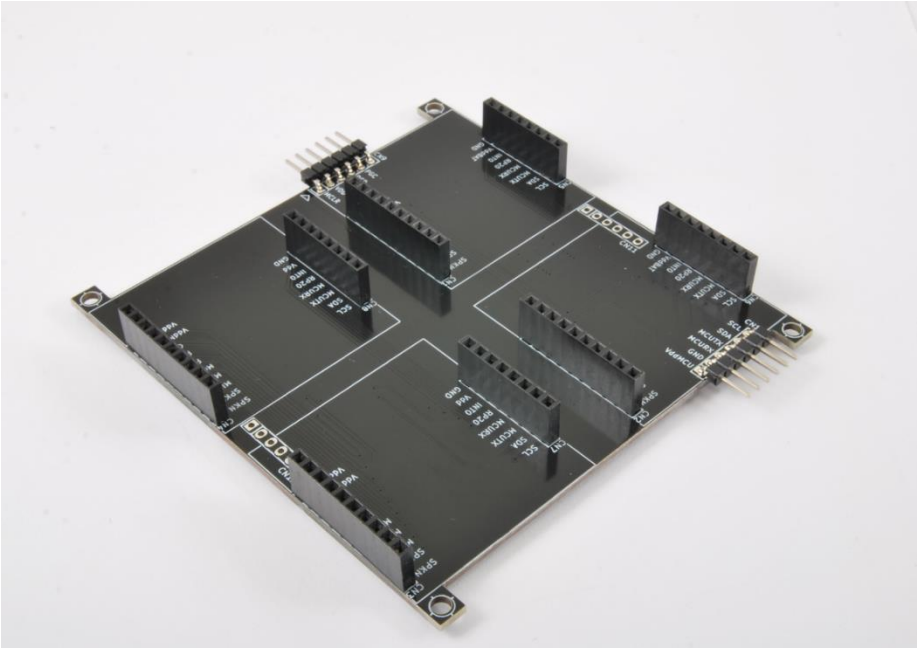
Mercury System

EB111



Expansion Board Quad - Product Datasheet

Author	Francesco Ficili
Date	01/11/2018
Status	Released

Revision History			
Version	Date	Author	Changes
1.0	01/11/2018	Francesco Ficili	Initial Release.

SUMMARY

1. Introduction

The Mercury System (MS in short) is a modular system for the development of connectivity and IoT applications. The system uses various type of electronic boards (logic unit, modems, slave board equipped with sensors and actuators, power boards...) and a complete SW framework to allow the realization of complex applications. Scalability, ease of use and modularity are key factors and are granted by the use of a heterogeneous set of components that allow to assemble the system like a construction made with LEGO© bricks.

The board set which composes the system is made up by the following "families":

- **Base Board (BB):** It's the "brain" of the system and contains the main logic unit as well as different communication buses and connector to interfaces the slaves. It also contains a simple power supply system and a recharge unit for a single LiPo cell (it can satisfy the power requirements of simpler systems). It can exist in different variants, depending on the employed microcontroller unit.
- **Modem Board (MB):** this one is the board that allow network connectivity. It can exist in different variant, depending on the network interface (GSM/GPRS, Wi-Fi, BT, Radio…). It's interfaced to the Base Board with a dedicated serial line.
- **Power Board (PB):** it's the board that allow to satisfy the particular power requirement of the system, when it's necessary. They can be vary depending on the particular power requirement to satisfy (high power, solar harvesting, piezo harvesting, etc.).
- **Slave Board (SB):** these are the system's peripherals, and they vary depending on the specific mounted sensor or actuator. Typical examples are SB with relay, temperature sensors, RGB LED controller, servo controller, accelerometer, etc. They communicate with the BB with I2C or UART and a dedicated command set.
- **Expansion Board (EB):** these are the board that allow planar connection of Mercury boards. There are variants which can contains Displays, battery socket, etc.
- **Brain-Less Board (BL):** these are the controller-less boards. They in general contain really simple sensor or actuators that don't need the bus interface. There are meant as an alternative to slave boards for cost-sensitive applications.

Slave Boards and Modem Board are provided pre-programmed with a FW which implements a dedicated command set for a high-level management of the boards, while the Base Boards are provided with a SW framework which provides all the low-level services (operative system, device drivers, system services, etc.), leaving to the user only the development of application level logic. Moreover, the Base Board comes with an USB bootloader, so it can be programmed without the need of a flashing device.

Figure 1 shows a typical system connection:

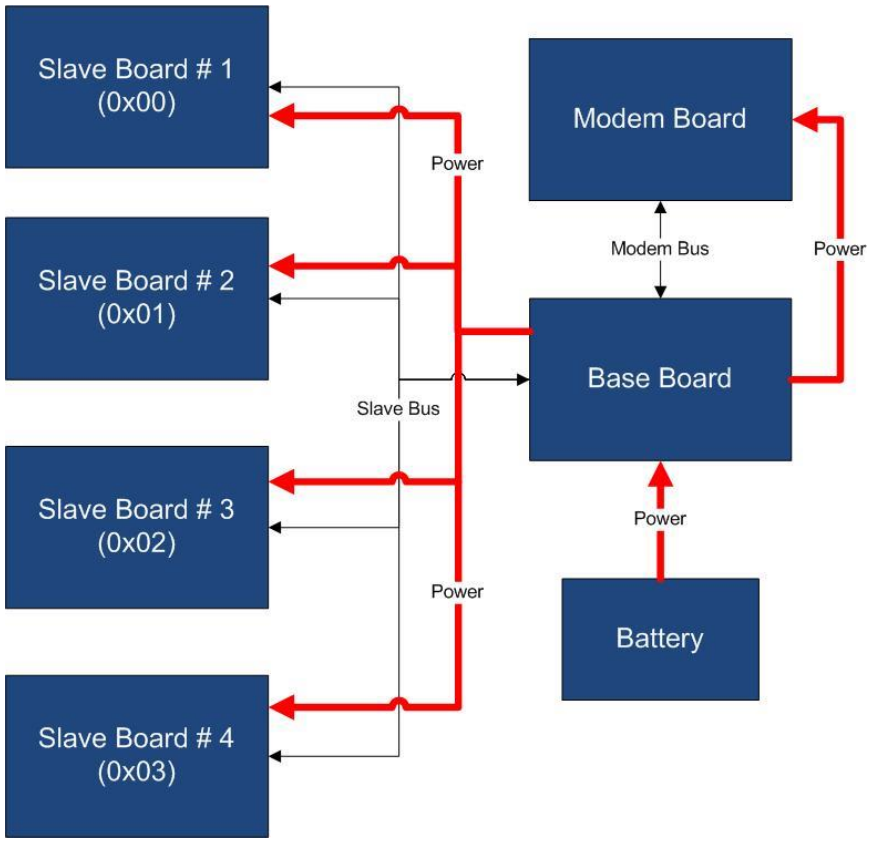


Figure 1 - Typical System Connection

Examples of application fields of MS are:

- Home automation System,
- IoT applications,
- Connectivity Applications,
- Monitoring and control Systems,
- Remote Control,
- Industrial Process control,
- Robotics applications,
- Test benches,
- Etc…

2. Block Diagram

The EB111 is a Mercury System expansion board with two Mercury System Sockets. The board allows to connect Mercury System BB with SBs, PBs and BLs in planar configuration. Figure 2 shows the EB111 block diagram.

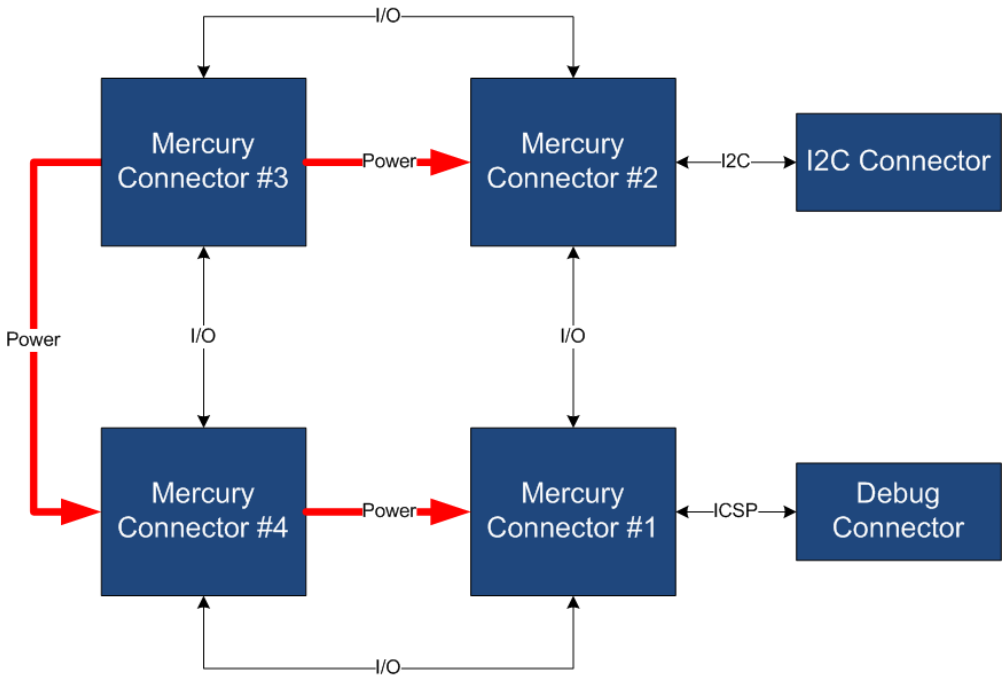


Figure 2 - Block Diagram

Table 1 resumes the EB111 board main characteristics:

Table 1 – Board Characteristics

Parameter	Description	Notes
Board Type	Expansion Board (EB)	
Supported Bus	I2C, UART	
# Mercury Connectors	4	

3. Hardware

This section goes deeper in the HW details of EB111. Figure 3 depicts the most important components of the board:

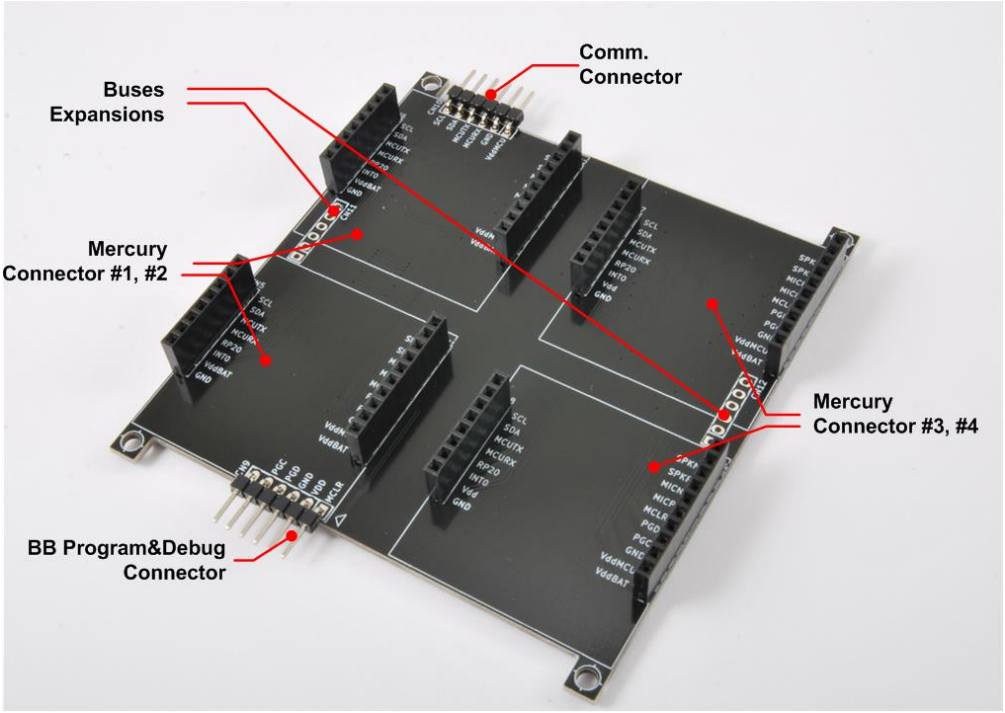


Figure 3 – Hardware Highlight

Table 2 provides a description of board's main components:

Table 2 – Hardware characteristics

Name	Description
Mercury Connectors #1 #2 #3 and #4	Mercury connector used to interface the board with the others MS boards.
BB Program&Debug Connector	PicKit 3 Microchip Programmer/debugger connector. It is directly connected to the BB (Base Board) MCU debug port, in order to allow advanced debugging and programming features, if needed.
Buses Expansion	Expansions connectors that carry power as well as I2C and UART connection.
Comm. Connector	Connector containing I2C and UART communication buses (for communication expansion).

4. Pinouts

This section highlights the pinouts of EB111 connectors.

Mercury Connector

The Mercury Connector is the connector which allows the interconnection of the various Mercury System Boards. The connector's pinout is depicted in Figure 4 and Table 3 explains the meaning of each single pin (NC stands for "Not Connected").

Table 3 - Mercury Connector Pinout

Pin Name	Pin Number	Description
VddBat	CN1,2,3,4 – 1	This pin is connected to the main power source.
VddMcu	CN1,2,3,4 – 2	This pin is connected to MCU regulated positive voltage reference (3,3V).
GND	CN1,2,3,4 – 3	This pin is connected to the board reference voltage.
IO11/PGC	CN1,2,3,4 – 4	This pin is connected to BB PGC (Program Clock) line, for advanced debugging features, and can be alternatively be used as generic IO (IO11).
IO10/PGD	CN1,2,3,4 – 5	This pin is connected to BB PGD (Program Data) line, for advanced debugging features, and can be alternatively be used as generic IO (IO10).
MCLR	CN1,2,3,4 – 6	This pin is connected to BB MCLR (Reset) line.
IO9	CN1,2,3,4 – 7	This pin is connected to BB generic IO6 line.
IO8	CN1,2,3,4 – 8	This pin is connected to BB generic IO7 line.
IO7	CN1,2,3,4 – 9	This pin is connected to BB generic IO8 line.
IO6	CN1,2,3,4 – 10	This pin is connected to BB generic IO9 line.
GND	CN5,6,7,8 – 1	This pin is connected to the board reference voltage.
VddBat	CN5,6,7,8 – 2	This pin is connected to the main power source.
IO5/INT0	CN5,6,7,8 – 3	This pin is connected to BB INT0 line and can be alternatively be used as generic IO (IO5).
IO4/INT1	CN5,6,7,8 – 4	This pin is connected to BB INT1 line and can be alternatively be used as generic IO (IO4).
McuRx/IO3	CN5,6,7,8 – 5	This pin is connected to BB UART Rx line and can be alternatively be used as generic IO (IO3).
McuTx/IO2	CN5,6,7,8 – 6	This pin is connected to BB UART Tx line and can be alternatively be used as generic IO (IO2).
SDA/IO1	CN5,6,7,8 – 7	This pin is connected to BB I2C SDA line (Data Line) and can be alternatively be used as generic IO (IO1).
SCL/IO0	CN5,6,7,8 – 8	This pin is connected to BB I2C SCL line (Clock Line) and can be alternatively be used as generic IO (IO0).

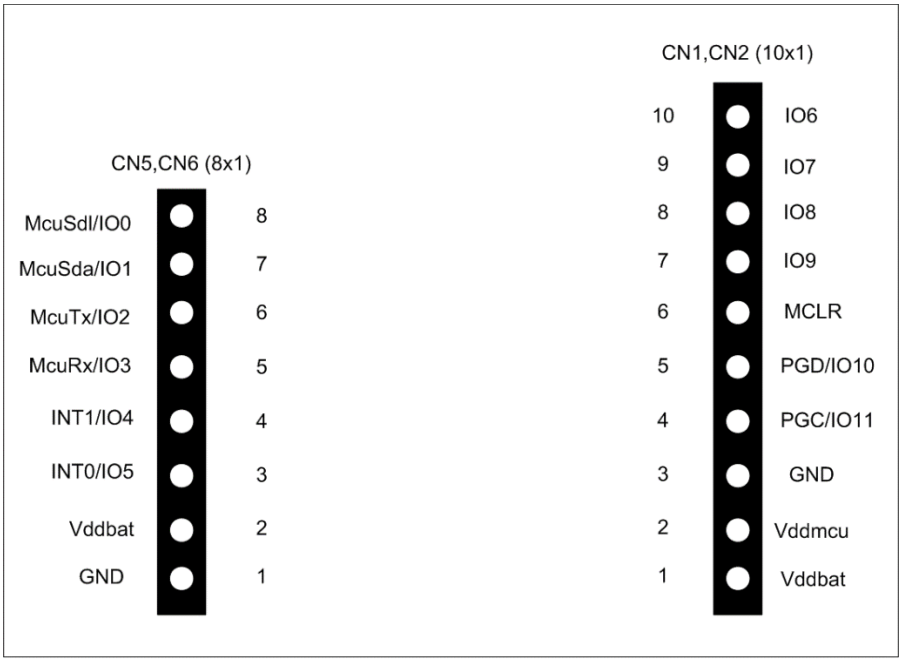


Figure 4 - Mercury Connector Pinout

BB Programmer Connector

The BB Programmer Connector is the connector which allows to re-program the BB (Base Board) using Microchip Technology ICSP (In-Circuit Serial Programming) interface. The connector's pinout is depicted in Figure 5 and Table 4 explains the meaning of each single pin (NC stands for "Not Connected").

Table 4 – BB Programmer Connector Pinout

Pin Name	Pin Number	Description
MCLR	CN9 – 1	Microcontroller Master Clear (RESET) pin.
Vdd	CN9 – 2	Positive power supply reference.
GND	CN9 – 3	Negative power supply reference.
PGD	CN9 – 4	Program Data pin.
PGC	CN9 – 5	Program Clock pin.

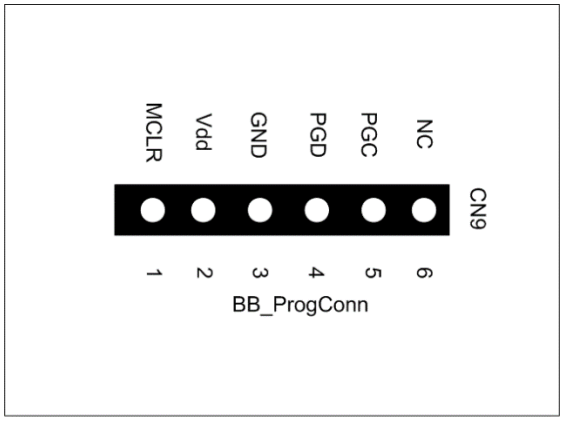


Figure 5 - BB Programmer Connector Pinout

Communication Connector

The Communcation Connector allow the connection of the communication buses (UART and I2C) to other boards. The connector's pinout is depicted in Figure 6 and Table 5 explains the meaning of each single pin (NC stands for "Not Connected").

Table 5 – Comm Connector Pinout

Pin Name	Pin Number	Description
VddMcu	CN10 – 1	This pin is connected to MCU regulated positive voltage reference (3,3V).
GND	CN10 – 2	Negative power supply reference.
McuTx	CN10 – 3	BB UART Tx Line.
McuRx	CN10 – 4	BB UART Rx Line.
McuSDA	CN10 – 5	BB I2C SDA Line.
McuSDL	CN10 – 6	BB I2C SCL Line.

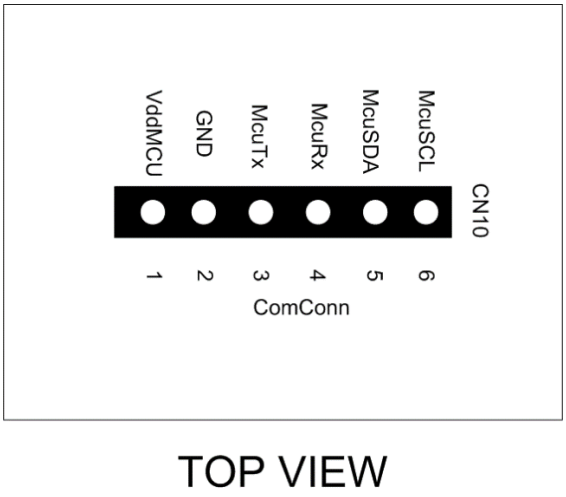


Figure 6 - Comm Connector Pinout

Expansion Connector

The Expansion Connector allow to connect the EB111 with another Expansion Board. The connector's pinout is depicted in Figure 7 and Table 6 explains the meaning of each single pin (NC stands for "Not Connected").

Table 6 – Expansion Connector Pinout

Pin Name	Pin Number	Description
VddMcu	CN11,12 – 1	This pin is connected to MCU regulated positive voltage reference (3,3V).
GND	CN11,12 – 2	Negative power supply reference.
VddBat	CN11,12 – 3	This pin is connected to the main power source.
INT0	CN11,12 – 4	BB INT0 Line.
McuSDA	CN11,12 – 5	BB I2C SDA Line.
McuSDL	CN11,12 – 6	BB I2C SCL Line.

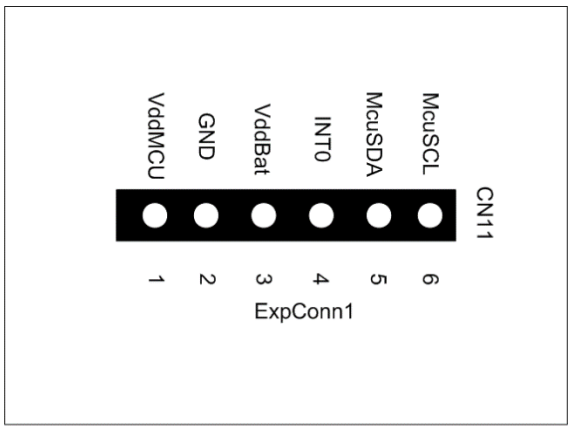


Figure 7 - Expansion Connector Pinout