



# STAR-Dundee

## SpaceWire and SpaceFibre Expertise

### FMC SpaceWire/SpaceFibre Board Mk3

The FMC SpaceWire/SpaceFibre board is an FPGA Mezzanine Card which is designed to extend the capabilities of an FPGA development board by adding support for up to four SpaceWire interfaces and up to two SpaceFibre interfaces.

The FMC board is a partially populated High Pin Count (HPC) mezzanine card which implements the ANSI VITA 57.1 standard. The standard defines a 400-pin connector arranged in 10 columns with 40 pins in each column. The rows are labelled A to K and provide the following pins.

- 160 single-ended or 80 differential user signals
- 10 Gigabit Transceiver differential pairs
- 2 Gigabit Transceiver differential clock pairs
- 4 differential clocks pairs

The interfaces provided on the STAR-Dundee FMC board are listed below.

- 16 LVDS differential pairs used for SpaceWire
- 20 single ended signals used for GPIO
- 2 Gigabit Transceiver differential pairs used for SpaceFibre
- 2 Gigabit Transceiver differential clock pairs as LVDS clock inputs to the carrier board

The FMC interface is keyed to orientate the board away from the carrier board.



FMC SpaceWire/SpaceFibre Board Mk3

#### Key Features

**Four SpaceWire ports:** The FMC board has four SpaceWire ports which are connected through LVDS buffers to FMC pins. The ports are compliant with the ECSS-E-ST-50-12C and ECSS-E-ST-50-12C Rev.1 SpaceWire standards.

Each SpaceWire port has two differential input pairs and two differential output pairs, Data/Strobe in and Data/Strobe out. SpaceWire ports 1 and 2, and ports 3 and 4 are grouped together such that the input pairs from each port in the group can be swapped to match dedicated SpaceWire ports on the carrier board. DIP switches are used to configure the LVDS switch.

**Two SpaceFibre ports:** The FMC board has two SpaceFibre EGSE connectors which follow the Type-C electrical EGSE cable assembly connector specification defined in the SpaceFibre standard

document ECSS-E-ST-50-11C. The signal lines are AC-coupled in both directions.

**Gigabit Transceiver differential clock:** Two differential clocks are provided to the carrier board on GBTCLK0 and GBTCLK1. Three clock sources are available on the board including an SMA P/N pair, a fixed 125 MHz oscillator and a fixed 156.25 MHz oscillator. A set of switches is used to control the selection for each clock.

**Status LEDs:** The FMC board has two tri-colour LEDs per SpaceWire and SpaceFibre port. The LED state is programmable by I<sup>2</sup>C bus to display red, green, blue or a colour combination.

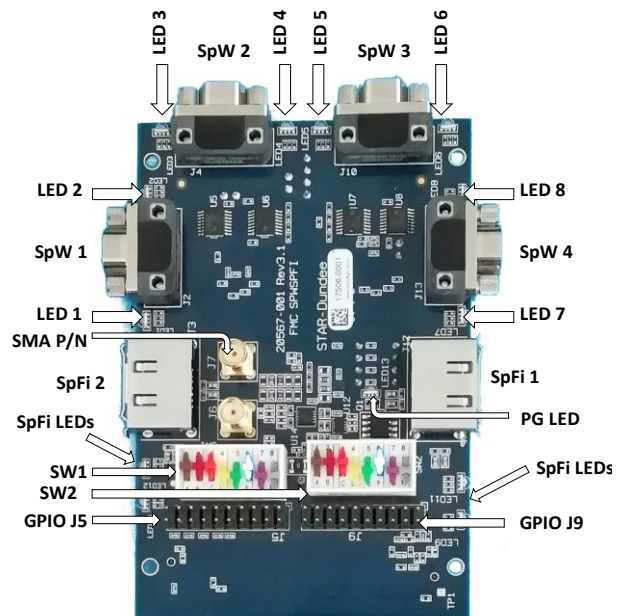
**GPIO headers:** Two header rows with 10-bits per header are available for general purpose connectivity or breakout.

**IPMI EEPROM:** The Mk3 board implements ANSI/VITA 57.1 IPMI support. A 2K-bit EEPROM is programmed with records defined in the IPMI Platform Management FRU Information Storage Definition v1.0 including connector type, pin connectivity and voltage rail DC output/load characteristics.

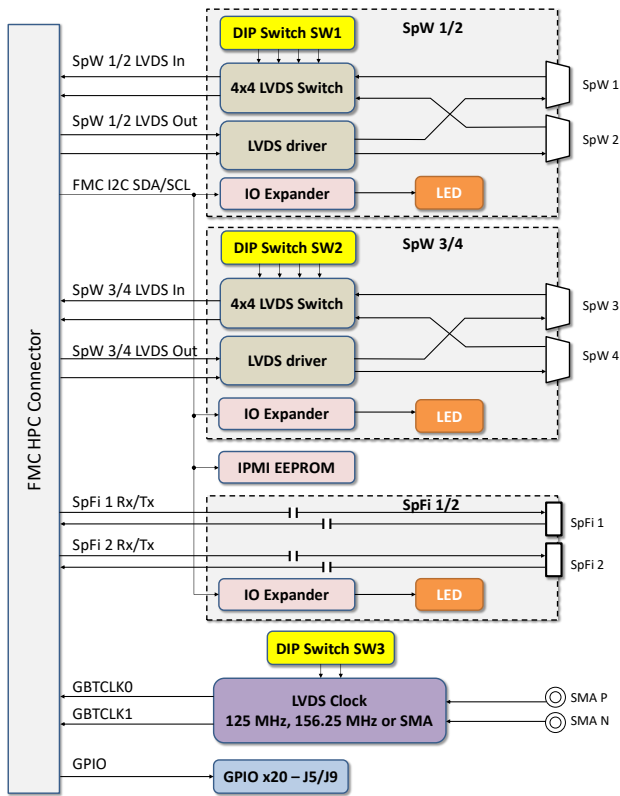
#### Hardware Overview

Four SpaceWire ports with accompanying status LEDs (two for each port); two SpaceFibre EGSE ports; a selectable 125 MHz, 156.25 MHz or SMA sourced LVDS clock; two DIP switch banks to configure the SpaceWire LVDS pinout; and an HPC connector are provided by the FMC board. An overview of the board layout is shown in the figure below.

SpaceWire (SpW) LVDS signals are connected to the FMC connector pins via LVDS buffers, while the SpaceFibre (SpFi) signals are AC-coupled. The LVDS drivers of the SpaceWire interfaces are always enabled.



FMC Board Hardware Layout



**FMC Board Architecture**

The board implements two LVDS clock sources on Gigabit Transceiver clock GBTCLK0 and GBTCLK1. The clock source can be configured by DIP switch to one of 125 MHz, 156.25 MHz or SMA. The clocks can be used as a reference clock for the SpaceFibre interface design or for general clocking resources dependent on the carrier board. Three clock sources are provided and selectable by switches.

Two LEDs per SpaceWire and SpaceFibre port are available for status indication. IO expander devices programmable through the FMC I<sup>2</sup>C bus set the value of each LED.

Two 10-pin header rows are connected to the FMC connector and are available for test purposes, breakout, GPIO or jumper expansion.

## Usability

**Ease of use:** The FMC SpaceWire/SpaceFibre board is easy to use and can be configured without software support.

**First class support:** As with all of STAR-Dundee's products, a year's support and maintenance is included with the FMC board. Support is provided directly from the team that developed the product allowing us to respond quickly with answers to customer questions, give assistance with application development, and resolve any problems quickly.

## Development Card Support

The FMC board is designed to be compatible with a wide range of development cards. The number of SpaceWire, SpaceFibre, GPIO and GBTCLK pins which can be connected is dependent on the carrier board. Please contact [enquiries@star-dundee.com](mailto:enquiries@star-dundee.com) for further information on the connector pinout or development card support.

The table below lists the SpaceWire and SpaceFibre pin connectivity which can be used as a quick reference for development card support.

### SpaceFibre Pinout

Port	Tx	Rx	CLK
SpFi 1	DP0_C2M_P/N	DP0_C2M_P/N	GBTCLK0_M2C
SpFi 2	DP1_C2M_P/N	DP1_C2M_P/N	GBTCLK1_M2C

### SpaceWire Pinout

Port	Dout (P/N)	Sout (P/N)	Din (P/N)	Sin (P/N)
SpW 1	LA09	LA14	LA01 <sup>(1)</sup>	LA18 <sup>(1)</sup>
SpW 2	LA10	LA13	LA00 <sup>(1)</sup>	LA17 <sup>(1)</sup>
SpW 3	LA08	LA12	HB00 <sup>(2)</sup>	HB06 <sup>(2)</sup>
SpW 4	LA22	LA25	HB04 <sup>(2)</sup>	HB17 <sup>(2)</sup>

- (1) Din/Sin pins of SpW 1 and 2 are swappable by 4x4 LVDS switch  
 (2) Din/Sin pins of SpW 3 and 4 are swappable by 4x4 LVDS switch

## Specifications

Part Number	311
Size	Single width PCB board 120 x 68 mm (approx.)
Power	<ul style="list-style-type: none"> <li>Powered by FPGA carrier card 3P3VAUX and 3P3V pins.</li> <li>1.8V, 2.5V and 3.3V VADJ bank voltage support</li> <li>Power monitoring circuit - indicates if 3P3V, 3P3VAUX and VADJ are within expected tolerances</li> </ul>
FMC	LPC, HPC and FMC+
VADJ range	1.8V to 3.3V
SpW Ports	<ul style="list-style-type: none"> <li>Compliant to ECSS-E50-12A, ECSS-E-ST-50-12C, ECSS-E-ST-50-12C Rev.1</li> <li>Number of SpaceWire Ports: 4</li> <li>Maximum Speed: 300 Mbit/s</li> <li>Connectors: 9-pin micro-miniature D-type</li> </ul>
SpFi Ports	<ul style="list-style-type: none"> <li>Compliant to ECSS-E-ST-50-11C</li> <li>Number of SpaceWire Ports: 2</li> <li>Data Signalling Rate: 1.88 – 3.2 Gbit/s</li> <li>Connectors: Type-C EGSE electrical connectors</li> </ul>

All information provided is believed to be accurate at time of publication. Please contact STAR-Dundee for the most recent details. © 2020 STAR-Dundee Ltd.



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