

FMC-MCM-1000

Evaluation and Product Development Platform

Instruction Sheet

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Revision History

The following table shows the revision history for this document.

Date	Version	Notes
1/10/2013	SOC initial Release	
20/10/2013	Version 1.00	--
10/01/2014	Version 1.10	--
20/07/2014	Version 2.00	--
30/07/2014	Version 2.10	--
29/06/2015	Version 2.11	Rev. 4
26/07/2016	Version 2.20	Multiple IP Targets supported

1. Preloaded Evaluation Cores

SOC provides the FMC-MCM-1000 with a configuration image programmed in the SPI Flash for either Encoder or Decoder evaluation. Upon powering the flash will program the FPGA on the FMC-MCM-1000 in less than 1 second (Spartan6 LX45).

Decoder Evaluation Image

The decoder evaluation image configures the HDMI Output Chip by Analog Devices and configures the Network MAC. SOC has integrated a fully operational UDP/IP stack capable of DHCP. The network core can be configured to 100Mbps or 1Gbps operation. The USB UART is connected to API registers within the system. The API can also be forwarded to the module cards.

Encoder Evaluation Image

The encoder evaluation image configures the HDMI Input and Output Chip by Analog Devices. The Network MAC is configured and SOC has integrated a fully operational UDP/IP stack capable of DHCP within the FPGA. The network core can be configured to 100Mbps or 1Gbps operation. The USB UART is connected to API registers within the system. The API can also be forwarded to the module cards.

Source Code

Source code for the FMC-MCM-1000 is available for purchase; however specific modules may be limited to Encrypted Netlists. SOC also provides a wide range of other IP cores that can be used to speed up product development. For any inquiries please contact sales@soctechnologies.com

2. Carrier Board Interfaces

The FMC_MCM_1000board requires a 12V/3A power adapter or ATX power when the ATX power connector is requested. This 12V/3A adapted is typically supplied by SOC.

A single Module interface connector is located on the top edge of the FMC_MCM_1000. The connector is a DDR3 SODIMM style connector (not pin compatible with DDR3 memory).

3. SOC API Interface

The API interface is a critical component to properly setting up and running the evaluation platforms. It is used to set up the network stack, read status registers, and customized cores running on the module cards.

Connect a Mini-USB cable from a PC to the FMC-MCM-1000. Open a terminal/serial program and connect to the UART using the following settings:

- baud rate : 115200
- Data Bit: 8
- Parity: None
- Stop bits: 1
- Flow Control: None

On power-up or reset the terminal window will display the prompt shown in Figure 1. At any time the 'Escape' key can be pressed to bring up a prompt.

```
-----  
|| SOC Technologies UART Interface ||  
-----
```

```
Note: Changing Register Values may cause unintended/unexpected  
results. Please make sure you are using the correct register  
programming guide for your system.  
Remember you may press 'Esc' when asked for a new Data Value  
to keep the current setting.
```

```
Enter a HEX Address (00-FF) to Modify:
```

Figure 1. UART Start-up Prompt

When entering an address to modify or read, the address must be entered in Hexadecimal. 0x00 – 0xFF. When changing the Data value of the register, the value may be entered in decimal, or it may be entered in hexadecimal by starting the number with an ‘h’.

```
Enter a HEX Address (00-FF) to Modify: a4
Current Value(HEX): 000004D2 | New Value(DEC): 100

Enter a HEX Address (00-FF) to Modify: a4
Current Value(HEX): 00000064 | New Value(DEC): hABC

Enter a HEX Address (00-FF) to Modify: a4
Current Value(HEX): 00000ABC | New Value(DEC): |
```

Figure 2. UART Data Entry

Figure 2 shows an example of reading and changing register 0xA4. On the first line 0xA4 is entered as the address to read/write. After entering the address the current value of the register is returned (0x4D2=1234). The new value 100 is then written to the register.

In the next line 0xA4 is read again and the new value ‘100’ can be seen in the register. Next a Hexadecimal value of 0xABC is written to the register using ‘hABC’ to specify ABC as Hexadecimal. The successful write can be seen when reading the register in the third line.

The Module and FMC-MCM-1000 board share the same UART interface. Thus to communicate with the module cards the FMC-MCM-1000 has to forward the UART signals to the module. In the example systems this is toggled by pressing Pushbutton ‘S6’ and checking the status of LED ‘D11’.

LED ‘D11’ STATUS	MEANING
OFF	FMC_MCM_1000 UART Interface Active
ON	MCM_1000 UART Interface Active

Table 1 – LED ‘D11’ Meaning

For more information on API registers that can be read or modified please request the corresponding API register document for your IP Core / Module / Interface Board.

4. Setting up the Network

The most critical part of setting up the evaluation platform is correctly configuring the network core. When both an Encoder and Decoder platform is purchased the boards will be set up to directly communicate with one another on power up.

Network Speed

The FMC-MCM-1000 is capable of both 100Mbps and 1Gbps operation. Note that the board will negotiate to the fastest available link speed, and can NOT be forced to use a lower speed.

The link speed should be known prior to powering on the FPGA. SOC provides a jumper on the PMOD connector (J9) to select the network speed for the logic on power up or reset. This mode must match the link speed for proper operation. Figure 3 Shows the Power-up configuration mode.

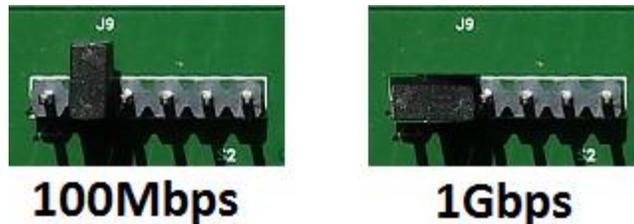


Figure 3. Network Power-up Configuration

Board IP Address / DHCP

On power-up and the presence of an active network, SOC's network IP core will attempt to obtain an IP address via DHCP. If DHCP is not available the network core will assign itself an initial IP address after the DHCP times out (approx. 10 seconds). The board's IP address can be read via the API register 0xAA. If the board is currently attempting to obtain an IP address via DHCP the board's IP address will not be readable and will return 255.255.255.255 (0xFFFFFFFF) via the API when read.

When DHCP is not present the FMC-MCM-1000 will initialize to an IP address such as 192.168.1.xxx. This IP address is customizable upon request, and to the discretion of SOC.

When using a static IP the IP address may be changed via the API. Consult the documentation for the API registers responsible for setting the Board IP Address.

Network RX

The network is capable of receiving user UDP packets. In the default configuration these packets are only for the Decoder Module. The decoder module expects Transport Stream data transmitted via UDP on port 1234. The network core is capable of receiving UDP packets on all ports from any IP address, this can be changed using the API registers.

Network TX

The network is capable of sending user UDP packets. The default application for network transmission is the Encoder Modules. The default transmission UDP port is 1234, however this can be changed via the API interface. The default Target/Transmission IP can be changed and read via the API interface.

5. Sending / Receiving Transport Streams

Receiving Transport Streams (Encoder)

Encoder modules are capable of sending transport stream via UDP. By default the Encoder image is set to target the Static IP address of the Decoder image. If a different IP or Target port is required it must be set using the API registers.

Various Encoder configurations are supported from one encoder channel up to multiple encoder channels. The number of transport stream channels output from a module is also dependent on the configuration. Because of this the FMC_MCM_1000 supports multiple target IP addresses and or UDP ports for each transports stream. Consult the SOC API documentation for setting each target IP address, and the FMC_MCM_1000-Module configuration being used to determine which target IP corresponds to each transport stream present in the system.

In addition to sending the encoded stream to a decoder FMC_MCM_1000 system (for the best real-time/low-latency demo), it is also possible to receive the transport stream using a computer as the decoding solution. SOC recommends (but not limited to) two options for receiving the encoded streams.

VLC Media Player

The simplest Method for playing the received transport stream is via VLC media player.

- Open VLC media player
- Media → Open Network Stream
- Enter the following the field 'udp://@:1234'
 - The UDP port can be set via API interface. The default UDP port is 1234. Refer to the corresponding SOC API documents for details.
- Click Play

If the board is set up properly VLC will begin playing the transport stream.

SOC's UDP Receiver

SOC's UDP receiver is capable of receiving UDP data on any specified port. By default the receiver will save the file as a transport stream file (.ts). Once the receiver is closed the file may be played back using many popular media players such as VLC. The UDP receiver is a single Windows executable (.exe) file which is launched via a batch (.bat) file. The receiving port may be changed by editing the .bat file, simply change the number after '-p' to the desired port.

Note that SOC does not provide the UDP receiver with the FMC-MCM-1000. It is intended for more advanced application/debugging and must be requested. Contact support@soctechnologies.com

Sending Transport Streams (Decoder)

A single Decoder module is capable of decoding a single PID of one transport stream at a time. The FMC_MCM_1000 carrier board is set up to receive a transport stream over UDP on a specific port. (default is 1234). The receiving port can be changed when required (Multiple UDP streams on various UDP ports are being received). The decoder modules also have the ability to select specific PIDs for decoding from the transport stream. Consult the API documentation for setting the receiving port on the VTR carrier board and the API documentation for the module for setting a specific PID. Note when a specific PID is not set the Decoder will default to the first PID in the transport stream program map table.

In addition to decoding a transport stream from a FMC_MCM_1000 encoder it is also possible to send a pre-encoded transport stream from a computer. SOC Suggest only one method for sending Transport stream files to the FMC_MCM_1000 running a Decoder Module. Upon request SOC will provide a TS_Sender program. This simple program sends the Transport Stream file to the FMC_MCM_1000.

To set up the TS_Sender edit and save the Batch file so that the IP address and Port match the configuration of the FMC_MCM_1000.

To use simply drag the '.ts' file onto the batch file of the program. If the settings are configured and the board is properly connected a window showing the status of the transport stream transmission will look similar to Figure 4. If the IP address is not reachable the 'Sent Present', 'Sent Size', and 'Stream time' will remain at 0. If this occurs please check the network configuration.

```

C:\Windows\system32\cmd.exe
System-On-Chip Technologies

File      : D:\SOC_Technologies\Streams\MPEG2\Wanted720p.ts
To       : 192.168.1.110:1234
PacketSize: 20000

Keyboard:
'b' to send from beginning
'c' to continue and switch loop sending file.
'x' to exit.

Space key to pause.

File length: 117MB

Curr      Max      Bit-Rate      Sent      Sent      Seg      Stream      Real      Time
seg      seg      curr  peak  percent  size  inter  time      time      error
(Byte)   (Byte)   (Mbps) (Mbps)
1000    85728    0.2- 6.7    0%     0    100  000:05.300-000:05.201  79ms

```

Figure 4. TS Sending Status Window

6. Updating the Carrier board Image

SOC releases updated firmware from time to time which provides added features and bug fixes. To update the firmware on the FMC_MCM_1000 a Xilinx iMPACT Cable is required for reprogramming. The update process is described in the reconfiguration guides (separate document).

7. Additional Resources

- API Manual(s) – Encoder Module
- API Manual(s) – Decoder Module
- API Manual – FMC_MCM_1000_Encoder
- API Manual – FMC_MCM_1000_Decoder
- Reconfiguration Guide for FMC_MCM_1000

