

F2MC-16 LX-Series Evaluation Board User's Guide (Rev 2.0)



Revision History

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1.0	02.25.02	New Document
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1. General Description

1.1 Overview

The “FFMC-16LX-Series Evaluation board” is a low cost multifunctional evaluation board for the Fujitsu MB90540/45, MB90550, MB90580, and MB90590/95 Flash Micro controller series. It can be used as a low cost target system for software development especially for MCU and Flash programming evaluation.

This board allows the designer to start software development before their own target system is available.

1.2 Features

- Supports 16-bit LX series MB90540/45, MB90550, MB90580, MB90590/95
- 7-12V unregulated external DC power supply
- On board regulator for 5V internal power
- Two high speed CAN drivers
- One RS-232 interface
- Optional sub clock
- RST, HST push button
- 8 user LEDs
- External reset via RS-232
- Prototyping area
- 4 Mhz main crystal
- Stepper motor
- 10 pin connector for evaluation of synchronous serial programming
- All MCU pins routed to connector for evaluation
- In circuit serial programming
- Key pad interface

1.2.1 Delivery Checklist

Check the evaluation Board kit for following items:

- F2MC 16LX series evaluation board with MB90F598
- Serial cable, 9 pin male to 9 pin female
- MCU product CD ROM with software and documentation
- Power adapter

1.3 Description of evaluation Board

The “FFMC-16LX-Series Evaluation board” is designed to support Flash Microcontrollers of MB90540/45, MB90550, MB90580, and MB90590/95 series. The evaluation board supports only QFP-100P (.64 mm pitch) package. This board is available in both socket and non-socket version. The socket enables this board to connect to an in circuit emulator by using the probe cable (MB2132-457).

By default the board uses a 4 MHz crystal as the main oscillator clock, Internal clock rate up to 16 MHz can be generated using the internal PLL of the Microcontroller. RS232 transceiver U2 can be used to connect directly to the on-chip UART1/UART0 by using the D-sub connectors. The transceiver generates the adequate voltage levels for receive and transmit lines. In the board the DTR line is hardwired to the DSR line.

All pins of the MCU are connected to edge connectors J1 and J2.

Note: The pin numbers of the J1, J2 connectors correspond to the pin numbers of the QFP socket only!

The on-board voltage regulator U5 allows connection of an unregulated DC input voltage between +7.5V to 12V. The heat sink on the board is capable of dissipating approximately 4 watts at room temperature.

There are three push buttons on the board; Reset button SW3, Demo button SW4 and HST button SW2.

Eight users LEDs D2 to D9 are connected via a 1K pull up resistor network to IO Port2.

The operating modes (Program (synchronous/asynchronous)/execution) of the MCU can be selected by the mode pin setting. The DIPswitch SW1 located on the board can be used to set the modes.

The 10-pin IDC connector J3 allows testing the Asynchronous/synchronous mode of programming. The pin layout is directly compatible with the "Fujitsu Flash kit", synchronous programmer. This pin layout is also compatible with the asynchronous programming adapter made by Fujitsu.

The edge connector J19 allows the user to connect an external 4x4 matrix Keypad.

One stepper motor x1 on the board can rotate 0 to 360 angles.

Note: This board is general evaluation board for QFP-100 pin device of 16LX series of Fujitsu Microcontroller. In this board stepper motor is connected directly to the Microcontroller pins 54,55,56,57. But the Microcontroller series such as MB90540/545 doesn't have built in stepper motor macro on the chip. So it is better to remove the stepper motor from the board to avoid any loading on the Microcontroller.

The stepper motor can be used only with the MB90590 and MB90595 series.

1.4 Supported Microcontroller series

The target Board is designed to work with many different Microcontrollers from the F2MC 16LX Family. The following Microcontroller series parts can be used with this board:

MB90595 series: MB90V595, MB90598/G, MB90F598/G, etc

MB90590 series: MB90V590, MB90F594A/G, MB90591/G, MB90F591/G, etc

MB90580 series: MB90V580, MB90F583, MB90583, etc

MB90550 series: MB90V550, MB90F553A, MB90553A, etc

MB90545 series: MB90V545, MB90F549/G, MB90549/G, etc

MB90540 series: MB90V540, MB90F543/G etc.

1.5 Jumpers and switches

This section describes all jumpers and switches that can be modified on the evaluation board to used with different series of MCUs. The default setting is shown with a gray shaded area. All jumpers and switches are named directly on the board by their function, so it is very easy to set jumpers according to the features.

1.5.1 Power supply voltage (J4, J11)

The jumper J4 connects Vcc supply voltage to the Microcontroller power supply pin Vcc. This jumper can be used to measure the Icc current of the Microcontroller.

Jumper name	Jumper setting	Description
J4	ON (Closed)	Power supply Vcc connected to the Microcontroller
	OFF (open)	Power supply Vcc disconnected to the Microcontroller

Jumper J11 connects Pin 58 on the 16LX series MCU to power supply. This pin is used for different functions depending on the MCU selection. Such as in MB90598, this pin is used for stepper motor power supply pin DVcc. This jumper gives the option to the user to treat either this pin as DVcc (Supply voltage for stepper motor) or to treat it as a general-purpose I/O pin, depending on the Microcontroller used on the board by user.

Jumper name	Jumper setting	Description
J11	ON (Closed)	Power supply DVcc connected to the Microcontroller
	OFF (open)	Power supply DVcc disconnected from the Microcontroller and the pin is available for general-purpose use. This jumper should leave open, if MB90580, MB550, MB90540/45 series MCU is used.

1.5.2 Power supply Ground (J10)

This jumper provides the digital ground signal to the stepper motor interface, if the MCU used on the board has one.

Jumper name	Jumper setting	Description
J10	ON (Closed)	DVss connected to the Microcontroller
	OFF (open)	DVss disconnected to the Microcontroller and pin is available for general-purpose use. This jumper should be open, if MB90580, MB550, MB90540/45 series MCU is used.

1.5.3 Configuration of RS232 Interface (J6, J7, J8, J9)

Jumpers J6, J7, J8, J9 allow the selection of the appropriate UART interface pins to program the Microcontroller on the board. The jumpers connect the TTL output of the serial driver to the

UART of the MCU. If the UART interface is not used then corresponding jumpers should be left open. The chart below shows the MCU pin no and the corresponding jumpers setting on the board used for the asynchronous boot-loader software.

Target device	UART	SIN	SOT	J6 (SIN)	J7 (SIN)	J8 (SOT)	J9 (SOT)
MB90F598	UART1	Pin no. 21	Pin no. 24	2-3	-	-	2-3
MB90F594A	UART0	Pin no. 16	Pin no. 14	-	2-3	2-3	-
MB90F591	UART0	Pin no. 16	Pin no. 14	-	2-3	2-3	-
MB90F583	UART0	Pin no. 18	Pin no. 19	-	1-2	1-2	-
MB90F553	UART0	Pin no. 20	Pin no. 19	1-2	-	1-2	-
MB90F549PF	UART1	Pin no. 21	Pin no. 24	2-3	-	-	2-3
MB90F543PF/MB90F548PF	UART1	Pin no. 21	Pin no. 24	2-3	-	-	2-3

1.5.4 Sub clock crystals (J16, J17)

Jumper J16 and J17 connects a sub-clock crystal to the Microcontroller on board (if MCU has sub-clock interface). These jumpers should be removed if the MB90595, MB90550A, series MCU is used, because no sub-clock is supported for these series MCUs.

Jumper name	Jumper setting	Description
J16	Open	X1A (Pin 79) disconnected
	Closed	Sub-clock crystal connected to X1A (Pin 79)
J17	Open	X0A (Pin 80) disconnected
	Closed	Sub-clock crystal connected to X0 (Pin 80)

1.5.5 Configuration of the CAN interface (J12, J13, J14, J15)

The jumpers J12, J13, J14, J15 connect the CAN interface high-speed driver to the Microcontroller on board. Jumpers J12 and J13 connects to CAN1 and J14, J15 connects to CAN0 interface of the MCU. J13, J15 connect the RX Line, and J12, J14 connect the TX line of the MCU. These jumpers should be removed if the MB90550A or MB90580 series MCU is used, because no CAN interface is supported on these series MCUs.

Target device	CAN0		CAN1	
	J14 (TX0)	J15 (RX0)	J12 (TX1)	J13 (RX1)
MB90F598	1-2	1-2	-	-
MB90F594A	1-2	1-2	1-2	1-2
MB90F591	1-2	1-2	1-2	1-2
MB90F583	-	-	-	-
MB90F553	-	-	-	-
MB90F549PF	2-3	2-3	2-3	2-3
MB90F543PF/MB90F548PF	2-3	2-3	2-3	2-3

1.5.6 Define synchronous serial interface jumper (J5)

This jumper connect a synchronous clock signal from the synchronous programmer to the Microcontroller. This board supports synchronous programming only for the MB90595,

MB90590A and MB90540 series MCUs. This jumper should be removed if the MB90550A or MB90580 series MCU is used.

Jumper name	Jumper setting	Description
J5	1-2 closed	SCK signal is connected to MB90540/545 and MB90595 series MCU
	2.3 closed	SCK signal is connected to MB90590/G
	Open	Pins are available for general purpose use

1.5.7 Reset generation (J18)

It is possible to use the DTR line of the UART interface to generate a reset for the evaluation board.

Jumper name	Jumper setting	Description
J18	2-3	DTR used to generate Reset
	1-2	DTR used to generate HST
	Open	Default

1.5.8 Define switches (SW1, SW2, SW3, SW4)

1.5.8.1 SW1 (Mode switch)

The DIPswitch SW1 set the operating mode of the Microcontroller and configures the serial interface for asynchronous or synchronous programming mode. SW1/1, SW1/2, and SW1/3 are used to set the three mode pins MD0, MD1, and MD2 of the Microcontroller. These pins define the operating mode of the Microcontroller. Make sure that the mode pin setting corresponds to the usage of the application. The default setting shown below is used for execution mode.

Mode Pins	DIP switch setting	Logical value
MD0 (SW1/1)	ON (Closed)	0 (low)
	OFF (open)	1 (high)
MD1 (SW2/2)	ON (Closed)	0 (low)
	OFF (open)	1 (high)
MD2 (SW1/3)	ON (Closed)	0 (low)
	OFF (open)	1 (high)

SW1/4 and SW1/5 set the port pins P00 and P01. These two port pins are used to define the serial programming mode as synchronous or asynchronous.

Description	DIP switch setting	Logical value
P00 (SW1/4)	ON (Closed)	0 (low)
	OFF (open)	1 (high)
P01 (SW1/5)	ON (Closed)	0 (low)
	OFF (open)	1 (high)

Note: The port pins P00 and P01 are connected to a 47k pull up resistor.

SW1/6 defines the configuration of serial interface signal CTS and RTS.

Description	DIP switch setting	Comments
CTS/RTS	ON (Closed)	CTS/RTS shorted
	OFF (open)	CTS/RTS open

The table below shows the configuration of SW1 in various operation Modes:

Operation Modes	SW1/1 (MD0)	SW1/2 (MD1)	SW1/3 (MD2)	SW1/4 (P00)	SW1/5 (P01)	SW1/6 (CTS/RTS)
Asynchronous Programming mode	ON (Closed)	OFF (open)	OFF (open)	ON (Closed)	ON (Closed)	ON (Closed)
Execution Mode	OFF (open)	OFF (open)	ON (Closed)	OFF (open)	OFF (open)	OFF (open)

1.5.8.2 Reset and hardware standby switch (SW2, SW3)

SW3 generates the RESET signal to the Microcontroller when pressed. SW2 holds the program execution at the current location when pressed.

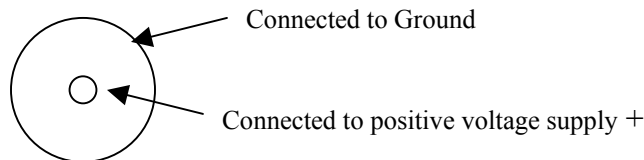
1.5.8.3 Demo Switch (SW4)

This switch generates the input capture interrupt signal if the interrupt is defined in the application software.

1.6 Connectors

1.6.1 Power connector x1

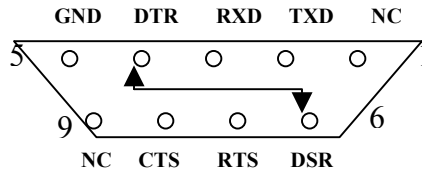
The following figure shows the power connection JACK X5. The connector is used to connect an external regulated DC power supply voltage (7.5v-12v DC) to the evaluation board. It is recommended to use 7.5V to keep the power dissipation to a minimum.



1.6.2 Serial interface connector x3

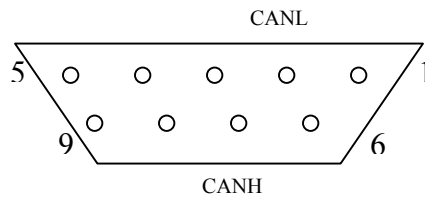
The 9 pins D sub female connector X3 is used for the serial interface. This can be used for in-circuit programming by configuring the jumpers (J6, J7, J8, J9, refer to section 1.5.2) for different

series of Microcontroller. The following diagram shows the connection of the 9-pin D-Sub female connector X3.



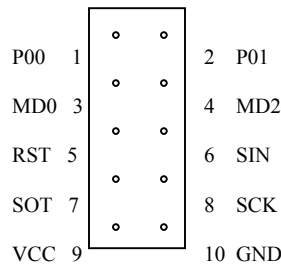
1.6.3 CAN interface connector x2, x4

The following diagram shows the connection of the 9-pin D-sub male connector X2 and X4, which is used for the CAN interface.



1.6.4 Edge connector J3

This connector can be used to program the Microcontroller in synchronous serial mode. The pin layout is compatible with the Fujitsu synchronous programmer.



1.6.5 Key pad connector J19

This connector can be used to connect to a 4x4 keypad matrix. This is connected to the Port 0 of the Microcontroller.

1.7 Configuration of the Board

Carefully remove the board from the shipping carton. Check, first if there is any damage before power on the evaluation board. In order to set up the board follow these steps.

- 1 After power-on, the green power-on LED should be ON. If the LED is not ON, switch off the power supply and check the default jumper setting. Check the jumper J4 connection. If it is open then connect jumper J4 to connect Vcc 5V to the MCU.

2. By default the Flash memory of the Microcontroller on the evaluation board has been pre programmed with a test program. So after power on the running light for the eight user LEDs can be seen. If the board is ordered with MB90595 or MB90590 series Microcontroller, the test program can be run by pressing the demo button on the board. At the first click of the demo button, it shows the different LEDs pattern for the eight user LEDs, on the second click it demos the stepper motor that rotates clockwise and counter-clockwise. These two demos will run alternatively at every time demo button is pressed.
3. To program the Microcontroller with the user application program, connect the serial cable from the board to the PC COM port.
4. Select the appropriate UART interface for the MCU by setting jumpers (J6 to J8) shown in the section 1.5.2.
5. Set all dip switches of SW1 to OFF except no. 1,4,5,6.
6. Set jumpers J16 and J17, if the application software is using the sub clock (if MCU has one).
7. If the board is used with CAN application. Set the appropriate jumpers for CAN0/CAN1 as shown in the section 1.5.4. Adjust the potentiometer clockwise to their end position.
8. Start the asynchronous programming utility software (Provided by Fujitsu or it can be download from the product CD) on the PC and download the program.
9. Set mode pin 3 of SW1 to ON position and all switches to OFF, to execute the program.
10. If board is used as an emulator target board (if the board has a socket), switch OFF the power supply and remove the Microcontroller from the socket. Now the probe cable can be mounted into the socket. Make sure to match the cable pin no. 1 to the socket on the board. Fix the probe cable with screws. Connect the other side of the probe cable now to the emulation POD. For the emulator set up please look at the corresponding user manuals for the emulator system.

Related product

- | | |
|-------------------------|---|
| 1. FLASH-CAN-100MP-MO6 | Evaluation board for MB90590/595/540/580 series |
| 2. FLASH-CAN2-100MP-MO6 | Evaluation board for MB90590/595/540/580 series |
| 3. MB2141A | Emulator debugger main unit |
| 4. MB2145-507 | Emulation Pod |
| 5. MB2132-457 | Probe cable for QFP package (Yamaichi socket) |
| 6. MB2132-464 | Probe cable for QFP package (Tokyo Eletech) |
| 7. NQPACK100RB179 | QFP-100 PIN Socket (Tokyo Eletech) |
| 8. HQ100RB179 | Socket cover |

Appendix

BILL OF MATERIAL

Serial no.	Name of the component	Part number	Symbol	Qty
1	IC (RS232 Driver)	MAX202CSE	U2	1
2	IC (CAN Driver)	PCA82C250TD	U4, U3	2
3	5V Regulator	NJM7805FA-ND	U5	1
4	MCU	MB90598/ MB90F543/ MB90F594AGPF-G/ MB90F591PF-G/ MB90F548GPF-G /MB90F553ABPF-G/ MB90F583CPF-G	U1	1
5	Stepper motor		X1	1
6	Heat sink (For regulator)	HS190-ND	For U5	1
7	4 Mhz Crystal	XC749CT-ND	Y1	1
8	32.7 kHz Crystal	300-1003-ND	Y2	1
9	50 K Potentiometer	3296W-503-ND	P1,P2	2
10	DC Power Jack	CP-002APJ-ND	X5	1
11	D sub 9 pin male connector	A2096-ND	X2, X4	2
12	D sub 9 pin female connector	A2100-ND	X3	1
13	LEDs	P501CT-ND	D2, D5, D8, D11	4
14	LEDs	P500CT-ND	D3, D6, D9	3
15	LEDs	P502CT-ND	D4, D7	2
16	Sip resistor	4609x-101-473	RN1	1
17	Resistors Pack (8 in 1)	742C163473JCT-ND	RP3	1
18	Resistors Pack (8 in 1)	742C163102JCT-ND	RP1	1
19	Resistor	P270ACT-ND	R1	1
20	Diode (1A,	DL4004MSCT-ND	D1	1
21	Diode/BAT 85)	SGL41-40GICT-ND	D10	1
22	Capacitor, 100uf	PCE3197CT-ND	C2	1
23	Capacitor, 27pf	PCC270CGCT-ND	C10, C11	2
24	Capacitor, 22pf	PCC220CGCT-ND	C8, C9	2
25	Capacitor, .1uf, 50v		C1, C3 to C7, C12 to C18	13
26	Header (8x1)		J19	1
27	RST/Hst push button Switch	P10887SCT-ND	SW2, SW3, SW4	3
28	Low profile SMT/ DIP switch	KAS1106E	SW1	1
29	Square Header (5x2)	S2012-36-ND	J3	1
30	Header (25x2)	S2012-36-ND	J1, J2	2
31	Header (3x1)	S1012-36-ND	J5 to J8, J9, J12 to J15, J18	10
32	Header (2x1)	S1012-36-ND	J4, J10, J11, J16, J17	5
33	Bump on, Square, .40X.10 Black	SJ5518-0-ND	For PCB Mount holes	4
34	PC Test Point Multi Purpose RED	5010K-ND	TP1	1
35	PC Test Point Multi Purpose black	5011K-ND	TP2	1
36	Hex Nut for U5	4CHNTS		1
37	Screws	4C31PPES		1
38	Shorting Jumpers	A26230-ND	For Jumper J4, J6, J9, J15, J14	5
39	Hex nut/Screws		For x2, x3, x4	6

Schematic and Drawings

