

**FR20/30 Series**  
**PGA401P EVALUATION BOARD FOR FR-DSU3**  
**MB2197-120**  
**HARDWARE MANUAL**



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# PREFACE

## ■ Safe Use of the MB2197-120 Evaluation Board

This manual contains important information required to use the MB2197-120 evaluation board safely. Be sure to read this manual thoroughly before using the evaluation board, and then use the evaluation board only as instructed in this manual.

In particular, read the safety precautions provided at the beginning of the manual, and conduct a safety check before using the MB2197-120.

Keep this manual handy so that you can refer to it anytime while using the MB2197-120.

## ■ Product Environment

The MB2197-120 evaluation board can operate in a temperature range from 0 to 35°C and a humidity range from 30 to 80%. Do not use the board in excessively hot or humid environments or in an environment that will allow condensation to form.

Since the MB2197-120 evaluation board is a printed circuit board without a cabinet, all the electronic parts are exposed. Do not put any object on the evaluation board or allow metallic parts to contact your body or electrically charged materials. While the power to the evaluation board is on, keep it away from any object that may short-circuit it or catch fire easily. While using the evaluation board, keep it as level as possible. Do not use the evaluation board in a location where it will be exposed to vibration, dust, or explosive gases.

If you use the evaluation board in an environment other than that described above, you or bystanders could be injured or property could be damaged.

We recommend that you keep the packing materials in which the evaluation board was delivered to use to repack the board if it has malfunctioned and needs repair.

## ■ Objectives of This Manual and Intended Readers

The MB2197-120 evaluation board is a development support tool used to develop and evaluate application products for the FR<sup>\*1</sup> 20/30 series.


This manual, intended for engineers who will use the MB2197-120 to develop application products for the FR<sup>\*1</sup> 20/30 series, describes the handling, functions, and setup of the MB2197-120 evaluation board (evaluation board hereafter).

\*1 FR, an abbreviation of Fujitsu RISC controller, is a product of Fujitsu Limited.

## ■ Pages Containing Safety Precautions

The following is a list of the pages containing important precautions.

To ensure safety, read these pages before using the evaluation board.

Symbol	Meaning	Item
	This symbol indicates that injury could result or the evaluation board or connected devices could be damaged if the evaluation board is not used correctly	P3, P5, P10, P17, P24, P29

## ■ Organization of This Manual

This manual consists of the following four chapters. Read this manual thoroughly before using the evaluation board.

### **CHAPTER 1 "OVERVIEW AND HANDLING"**

This chapter presents an overview of the MB2197-120 evaluation board and provides information on handling.

### **CHAPTER 2 "DESCRIPTION"**

This chapter describes the system configuration of the evaluation board, lists part names, and provides the specifications of the board.

### **CHAPTER 3 "FUNCTIONS"**

This chapter describes the functions of the evaluation board.

### **CHAPTER 4 "CONNECTION AND SETUP"**

This chapter describes how to connect, set up, and power on and off the evaluation board. Read this chapter before turning on the evaluation board.

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# READING THIS MANUAL

## ■ Page Layout of This Manual

In this manual, an entire section is presented on a single page or two-page spread whenever possible. The reader can thus view a section without having to flip pages. The content of each section is summarized immediately below the title. You can obtain a rough overview of the evaluation board by reading through these summaries. (The following shows an example of a two-page spread in this manual.)

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# CHAPTER 1 OVERVIEW AND HANDLING

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**This chapter presents an overview of the MB2197-120 evaluation board and provides information on handling.**

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- 1.1 "Overview"
- 1.2 "Checking Packed Components"
- 1.3 "Options"
- 1.4 "Precautions on Using This Product"

## 1.1 Overview

---

**The MB2197-120 evaluation board is a development support tool used to develop and evaluate hardware and software that uses the FR-DSU3 and PGA401 pin evaluation device manufactured by Fujitsu.**

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### ■ Overview

This product includes the QFP208P header (MB2197-127) for the MB2197-120 (header board hereafter). It is connected to a user system using the DSU-FR20/30 emulator (MB2197-01; emulator hereafter) and an FR-series device such as the MB91F361 (QFP208).

If you have any questions about whether a device is compatible with the evaluation board or which evaluation board is compatible with a device, contact a Fujitsu sales representative.

The evaluation board also contains external trace memory for an evaluation device (such as the MB91V360) as well as alternate user memory. This allows you to efficiently develop and evaluate a user system using the MB91F361 and other devices.

The evaluation board has the following major features:

- The evaluation board has an IC socket and a DSU connector for an evaluation device. You can connect it to the header board using the supplied header interface cables (a pair).
- Header board provided for connecting the emulator and user system
- Evaluation board power supplied from the user system via the header board
- Large-capacity trace memory and alternate user memory for an evaluation device

## 1.2 Checking Packed Components

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Before using the evaluation board, make sure you have received the following components in good condition.

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### ■ Checking Packed Components



Transporting the evaluation board may damage it. To prevent damage when transporting the board, keep the packing materials in which the board was delivered.

Before using the evaluation board, make sure that none of the following components are missing.

- Evaluation board.....1
- Header interface cables (standard).....2
- Header interface cables (long).....2
- Hardware manual.....1

## 1.3 Options

---

The evaluation board options listed in Table 1.3-1 "Options" are available. Please purchase the options as required.

---

### ■ Options

Table 1.3-1 Options

Name	Model
Evaluation device (PGA-401C-A02)	MB91V360
QFP208P header for MB2197-120 *1	MB2197-127
DSU-FR20/30 emulator *2	MB2197-01

\*1 Compatible with the MB91F361 (QFP208). For other compatible devices, contact a Fujitsu sales representative.

\*2 The emulator also requires debugging software and communication cables. For more information, contact a Fujitsu sales representative.

## 1.4 Precautions on Using This Product

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When using the evaluation board, observe the precautions described in this manual.

---

### ■ Precautions on Using the Evaluation Board

Observe the following precautions when using the evaluation board.



- Do not put any object on the evaluation board.
- Be sure to turn off the power before connecting or disconnecting a cable.
- When disconnecting a cable, hold the case or connector. Do not pull the cable.
- To prevent electrostatic damage, do not allow any metallic objects such as connector pins to contact your fingers or another object.
- The evaluation board has many exposed sharp parts such as monitor pins. To avoid injury, handle the evaluation board carefully.
- Set up and use the evaluation board only as instructed in this manual.

### ■ Storage

Observe the following precautions when storing the evaluation board.



- Do not put any object on the evaluation board. Since the board has no cabinet, we recommend that you store the board in the packing carton.
- Do not subject the evaluation board to any shocks.
- Do not expose the board to direct sunlight, high temperatures, or high humidity. Do not allow condensation to form.
- Do not store the evaluation board, which contains many electronic parts, in a strong electric or magnetic field for a long time.

Table 1.4-1 "Operating and Storage Environments" shows the temperature and humidity conditions for operation and storage.

**Table 1.4-1 Operating and Storage Environments**

	Temperature	Humidity
Operating	0 to 35 °C	30 to 80% (Condensation does not form.)
Storage	-20 to 70 °C	30 to 90% (Condensation does not form.)



## CHAPTER 2 DESCRIPTION

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**This chapter describes the system configuration of the evaluation board, lists part names, and provides the specifications of the board.**

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- 2.1 "System Configuration"
- 2.2 "Layout and Part Names"
- 2.3 "General Specification"

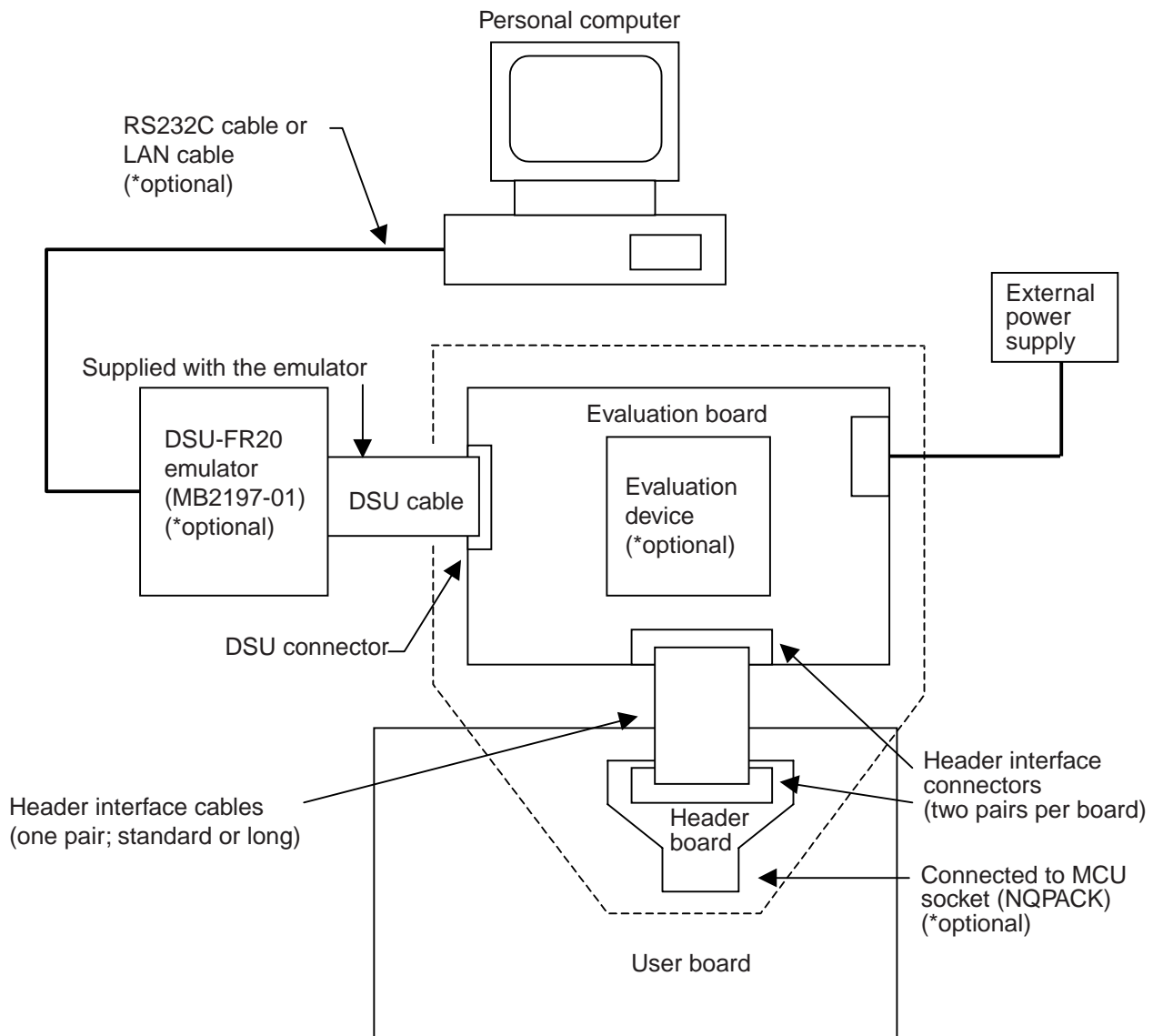
## 2.1 System Configuration

Before using the evaluation board, connect it to the emulator, header board, and user board.

### ■ System Configuration

Figure 2.1-1 "System Configuration" shows the system configuration of the evaluation board.

**Figure 2.1-1 System Configuration**



\* See the emulator manual for the emulator specifications.

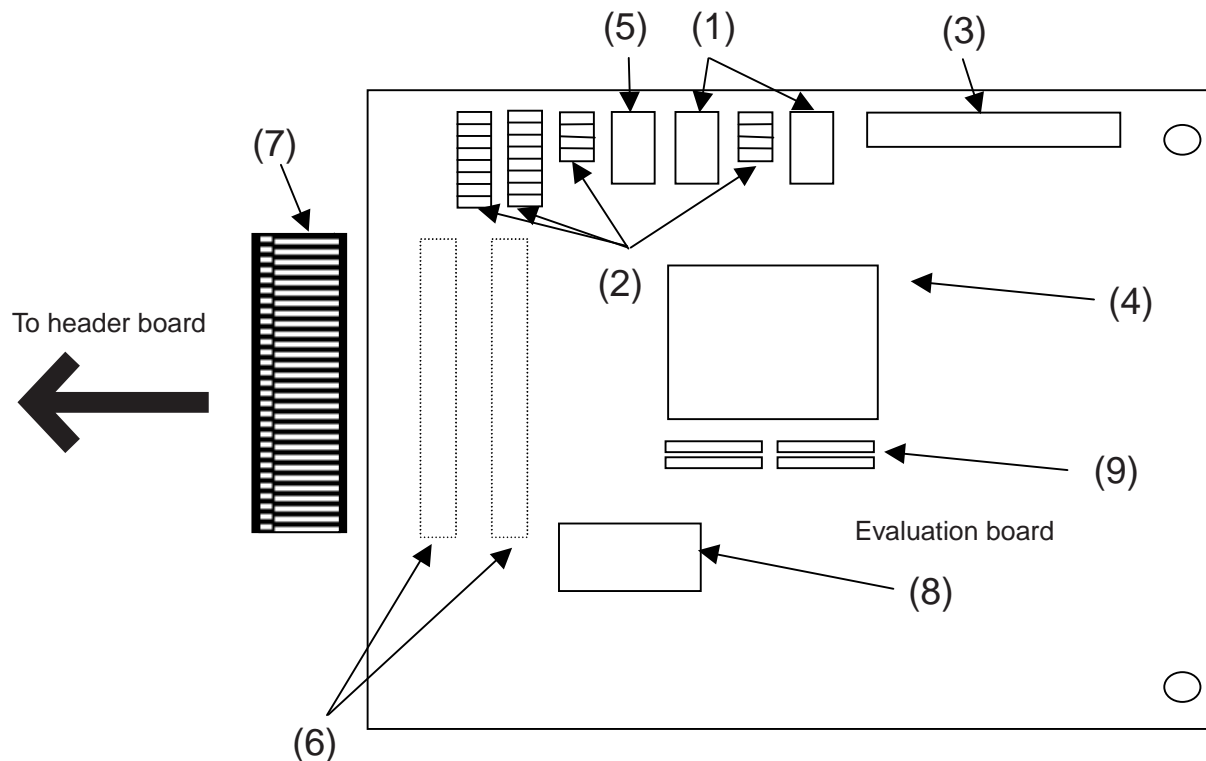
## 2.2 Layout and Part Names

This section shows the layout and part names of the evaluation board.

### ■ Layout and part names

Figure 2.2-1 "Layout of the Evaluation Board" shows the layout and part names of the evaluation board.

Figure 2.2-1 Layout of the Evaluation Board



- (1) IC socket for a crystal oscillator: Accepts a crystal oscillator that provides clock signals to the evaluation device on the evaluation board.
- (2) Jumper plugs: Selects various settings.
- (3) DSU connector: Accepts the DSU cable for the emulator.
- (4) IC socket for the emulation device: Accepts the evaluation device (package code: PGA-401C-A02).
- (5) IC socket for the lowpass filter: Accepts a resistor or capacitor for configuring a subclock lowpass filter on the evaluation board.
- (6) Header interface connector: Accepts a header interface cable supplied with the evaluation board (Mounted on the back side).
- (7) Header interface cables (pair): Connects the evaluation board and the header board.
- (8) Terminal strip: Accepts an external power supply (which shall be 5 V +/- 10%, 3A or higher).
- (9) IC socket for data line pull-up: Accepts a resistor assembly that pulls up a data line (D [31:0]) on the evaluation board.

\* The evaluation board has an insulator plate on the back.

## 2.3 General Specifications

Table 2.3-1 "General Specifications" lists the general specifications of the evaluation board.

### ■ General specifications



The evaluation board may malfunction if you use it outside the range of operating conditions listed in Table 2.3-1 "General Specifications". Be sure to use the evaluation board within the specified operating conditions.

Table 2.3-1 "General Specifications" lists the general specifications of the evaluation board.

**Table 2.3-1 General Specifications**

Item		Specification	Remarks
Power input *1		VCC1: 5 V $\pm$ 10%, 3A or higher	Supplied from the user board
		VCC3: 5 V $\pm$ 10%, 3A or higher	Supplied from the terminal strip
Unit dimensions *2	Evaluation board	150mm (W) $\times$ 180mm(D) $\times$ 25mm(H)	No cabinet. Has an insulator plate on the back.
Unit weight	Evaluation board	250g	
Header interface cable dimensions		Standard: 5 cm, long: 20 cm	Length of the cable only
Temperature environment *3		Operating: 0 to 35°C, storage: -20 to 70°C	No condensation shall form.
Humidity environment		Operating: 30 to 80%, storage: 30 to 90%	No condensation shall form.

\*1 VCC1 is the user power supplied from the user board.

VCC3 is the power supplied from the terminal strip.

\*2 W and D represent the dimensions of the printed circuit board. H represents the height from the connector on the back of the board to the top of the tallest part on the printed circuit board.

\*3 For the temperature environment of the evaluation device, see the data sheet supplied with the evaluation device.

# CHAPTER 3 DESCRIPTION

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**This chapter describes the functions of the evaluation board.**

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3.1 "Function Specifications"

3.2 "Connector Specifications"

3.3 "Signal Circuit Connection"

3.4 "Limitations"

## 3.1 Function Specifications

Table 3.1-1 "Function Specifications of the Evaluation Board" lists the function specifications of the evaluation board.

### ■ Function Specifications

Table 3.1-1 Function Specifications of the Evaluation Board

Item	Specification
Evaluation board function	Connects the emulator and the user board.
Trace memory	The evaluation board contains three large-capacity synchronous SRAM modules (MT58LC64K32D9LG-11, manufactured by Micron) for use as external trace memory for the evaluation device.
Alternate user memory	The evaluation board contains two flash memory modules (MBM29LV400T-10PFTN, manufactured by Fujitsu) and two high-speed SRAM modules (TC55V16256FT-12, manufactured by Toshiba) for use as alternate user memory for the evaluation device.
Jumper plug	Changes the clock that is supplied to the evaluation device as well as the lowpass filter and the xCS signal output destination.

\* For the specifications of each memory module, see the data sheet supplied with the memory module.

## 3.2 Connector Specifications

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Table 3.2-1 "Connector Specifications" lists the connector specifications of the evaluation board.

---

### ■ Connector Specifications

Table 3.2-1 Connector Specifications

Item	Specification
DSU connector	Accepts the DSU cable supplied with the emulator.
Terminal strip	Accepts external power and supplies power to the evaluation board.
Header interface connector	Accepts the supplied header interface cables (one pair) for connection of the evaluation board and the header board.

## 3.3 Signal Circuit Connection

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This section describes the input-output signals between the evaluation board and the user board.

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### ■ Clock Input Connection

The clock input from the user board (X0, X1 and X0A, and X1A) is connected to the evaluation device via a jumper plug on the evaluation board. This allows you to select, using a jumper plug, whether the clock signal (X0, X1 and X0A, and X1A) to be supplied to the evaluation device should come from the clock signal on the user board or from the crystal oscillator on the evaluation board. If you supply the clock signal from the user board, pay close attention to the items described in Section 3.4 "Limitations".

### ■ Analog Power Supply Terminal Connection

The analog power supply terminals (AVCC, AVRH, AVSS, and AVRL) are directly connected to the user board without any additional circuitry.

### ■ Port Terminal Connection

All port terminals other than the external data bus terminals of the evaluation device or the port terminals that also act as address output terminals are directly connected to the user board without any additional circuitry.

## 3.4 Limitations

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**This section contains the limitations on using the evaluation board. Be aware of these limitations when you use the evaluation board.**

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### ■ Limitations

(1) If you use the evaluation board, the MCU on the user board must be installed in a socket. Use the specified IC socket for the MCU.

(2) The RSTX terminal of the evaluation device is fixed at H level.

Since an INIT request from the user system is not directly tied to the evaluation device, but passes via the emulator, INIT arrives a few clock signals later than INIT from the user system.

You can also reset the user system using the reset command from the emulator.

Since the emulator has a reset input (\*RSTIN) terminal with low impedance, supply the user board reset circuit with sufficient driving capacity.

(For details, see the manual supplied with the emulator.)

(3) While the evaluation device is in user hold mode or low power consumption mode, the user path terminal is in the same state as that specified in the specifications of the evaluation device.

(4) To supply the CLK signal from the user board to the evaluation device, use the crystal oscillator as the source for supplying the CLK signal from the user board.

If, as a limitation of the evaluation device, the X1 terminal must be open in order to use the crystal oscillator, remove the jumper plug provided to switch the X1 signal on the evaluation board.

(5) You can use the header interface cable (long) only if the device has a low clock frequency or if an extremely low load is applied to the user terminal. Normally, use the header interface cable (standard).

(6) If the bus cycle has the following clock, insert the appropriate wait cycles for access to alternate user memory.

- 11.2 MHz or higher: One wait cycle or more for flash memory
- 18.7 MHz or higher: Two wait cycles or more for flash memory
- 26.2 MHz or higher: Three wait cycles or more for flash memory
- 26.3 MHz or higher: One wait cycle or more for high-speed SRAM

(7) Since A [19:0] must be supplied to alternate user memory, if used, regardless of the external bus width, this terminal cannot be used as a port.

(8) To select the chip for alternate user memory, switch the user xCS signal using the jumper plug. Thus, if alternate user memory is used, the xCS signal on the user board is fixed at H level using a pull-up 10KΩ resistor.



# CHAPTER 4 CONNECTION AND SETUP

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This chapter describes the procedures for setting up required devices before power-on, making basic settings, and turning the evaluation board on and off.



**Before performing any procedure described in this chapter, turn off all power in the system. Performing a procedure while the power is on may result in an electric shock or device malfunction.**

**Be sure to hold a cable by the connector when you connect or disconnect it. Pulling the cable may break the conductor in the cable.**

**Do not forcibly bend a cable, since the conductor in the cable may break.**

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4.1 "Setting Up the Evaluation Board"

4.2 "Connecting the Evaluation Board and the Header Board"

4.3 "Connecting the Evaluation Board and the User Board"

4.4 "Connecting the Evaluation Board and the Emulator"

4.5 "Ways of Using the Evaluation Board"

4.6 "Power-on and Power-off Procedures"

## 4.1 Setting Up the Evaluation Board

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This section describes how to make the jumper plug settings on the evaluation board and how to connect a crystal oscillator and a resistor installed in a socket.

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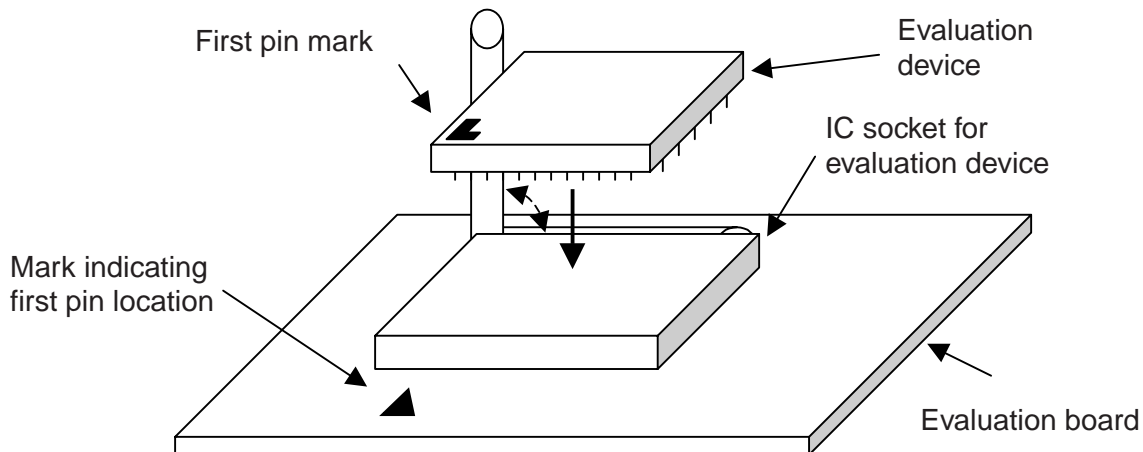
### ■ Mounting an Evaluation Device

Use the procedure below to mount the evaluation device in an IC socket on the evaluation board. Figure 4.1-1 "Mounting of the Evaluation Device" shows how to mount the evaluation device.

#### ○ Procedure for mounting the evaluation device

1. Raise the lever of the IC socket for the evaluation device to release the lock.
2. Insert the evaluation device in the IC socket for the evaluation device so that the mark indicating the first pin on the evaluation device is aligned with the mark indicating the location of the first pin of the evaluation device on the evaluation board.
3. Lower the lever of the IC socket for the evaluation device to lock the evaluation device.

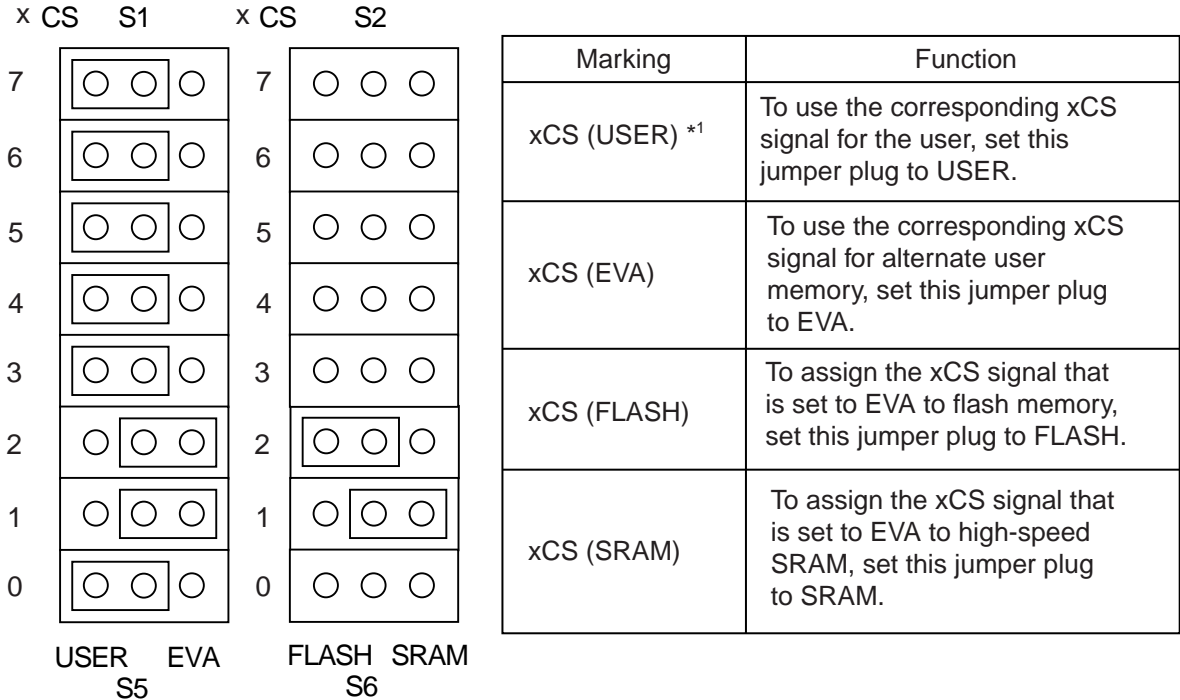
**Figure 4.1-1 Mounting of the Evaluation Device**



■ Jumper Plug Settings 1

Use the jumper plugs on the evaluation board to switch the output destination of a CS signal to be sent to the evaluation device. Figure 4.1-2 "Jumper Plug Settings 1" shows jumper plug settings 1.

Figure 4.1-2 Jumper Plug Settings 1

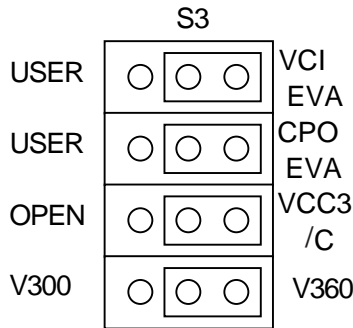


\*1 xCS7, which does not exist on the user side, is always H level unless the setting is EVA.  
 \*2 This figure shows the factory default settings.

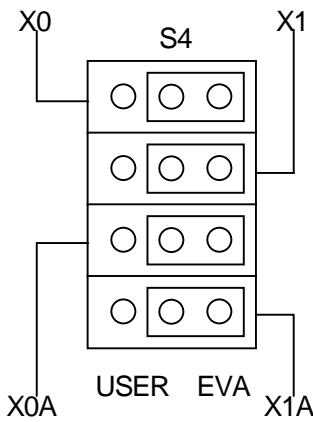
■ Jumper plug Settings 2

You can switch the lowpass filter to be used for the evaluation device as well as the VCC3/C terminal and clock supply. Figure 4.1-3 "Jumper Plug Settings 2" shows jumper plug settings 2.

Figure 4.1-3 Jumper Plug Settings 2



Marking	Function
VCI EVA, CPO EVA	To use the lowpass filter on the evaluation board or the user board, set this jumper plug to EVA or USER, respectively.
VCC3/C	To add a 0.1- $\mu$ F capacitor to the VCC3/C terminal, set this jumper plug to VCC3/C. Otherwise, set this jumper plug to OPEN.
V300, V360	Always set this jumper plug to V360.



Marking	Function
X0, X1	To supply the clock signal (X0, X1) from the crystal oscillator on the evaluation board, set this jumper plug to EVA. To supply the clock signal (X0, X1) from the user board, set this jumper plug to USER.
X0A, X1A	To supply the clock signal (X0A, X1A) from the crystal oscillator on the evaluation board, set this jumper plug to EVA. To supply the clock signal (X0A, X1A) from the user board, set this jumper plug to USER.

\*1 This figure shows the factory default settings.

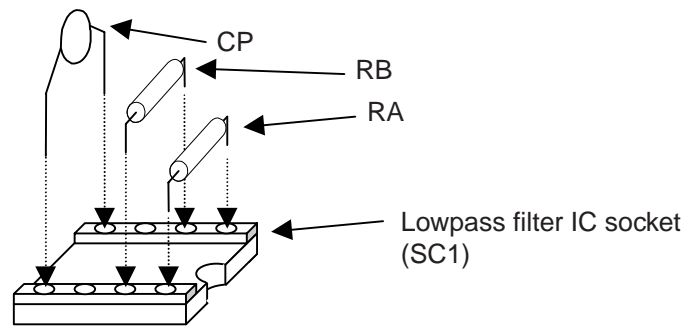
### ■ Lowpass Filter Configuration

To configure a lowpass filter on the evaluation board for the evaluation device, you must install a resistor and a capacitor in the lowpass filter IC socket (SC1) on the evaluation board. Figure 4.1-4 "Lowpass filter IC socket" shows how to install a resistor and a capacitor.

Neither a resistor nor a capacitor is factory-installed. Please purchase a resistor and a capacitor as required.

For the values of the lowpass filter, see the data sheet supplied with the evaluation device.

**Figure 4.1-4 Lowpass filter IC socket**



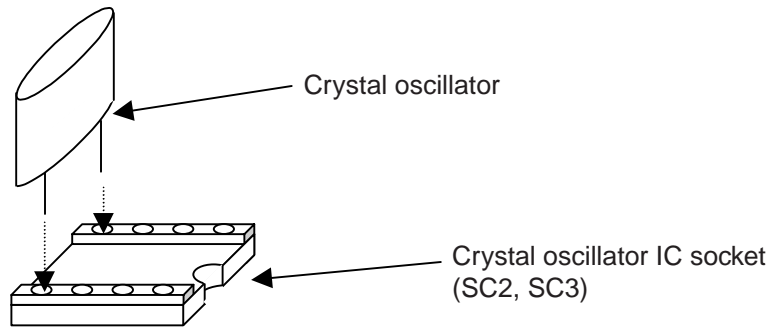
■ Installing a Crystal Oscillator

To supply the clock signal from the evaluation board to the evaluation device, you must install a crystal oscillator in the crystal oscillator IC socket (SC2 for X0 and X1 or SC3 for X0A and X1A) on the evaluation board. Figure 4.1-5 "Crystal Oscillator IC Socket" shows how to install a crystal oscillator.

A crystal oscillator is not factory-installed. Please purchase a crystal oscillator as required.

For the frequency and other data of the crystal oscillator, see the data sheet supplied with the evaluation device.

Figure 4.1-5 Crystal Oscillator IC Socket



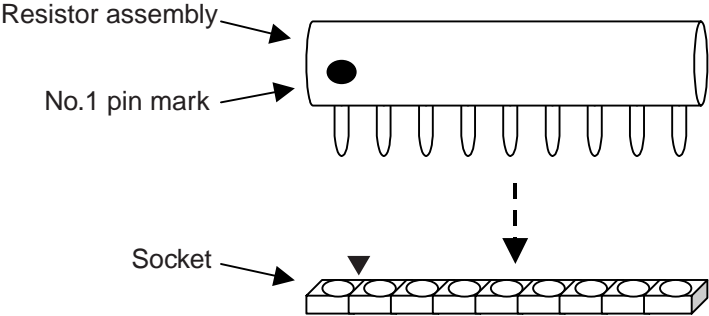
■ Resistors Installed in Sockets

Table 4.1-1 "Resistors Installed in Sockets" shows how to handle resistors installed in sockets on the evaluation board. Figure 4.1-6 "Installing Resistors" shows how to install resistors.

Table 4.1-1 Resistors Installed in Sockets

MCU signal name	Marking	Resistor	Connecting a resistor
D31-D24	RB1(SC5)	Eight-element resistor assembly	Since the resistor assemblies are factory-installed, remove them if the user board has already been equipped pull-up resistors on signal lines.
D23-D16	RB3(SC7)	Eight-element resistor assembly	
D15- D8	RB2(SC6)	Eight-element resistor assembly	
D7 - D0	RB4(SC8)	Eight-element resistor assembly	

Figure 4.1-6 Installing Resistors



\* All the resistors have a resistance of 100 kΩ.

Be careful when installing a resistor assembly, since it has polarities. To install a resistor assembly, with the marking on the evaluation board on your left, insert pin 1 of the resistor assembly in the socket indicated by the triangle.

## 4.2 Connecting the Evaluation Board and the Header Board

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This section describes how to connect the evaluation board and the header board.

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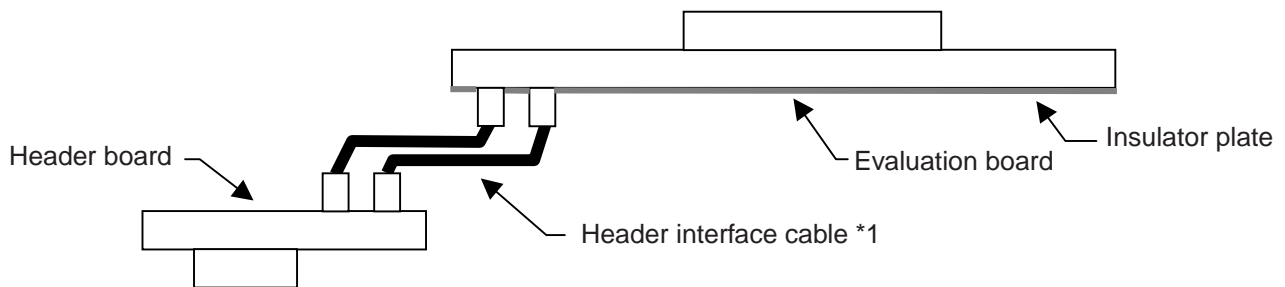
### ■ Connecting the Evaluation Board and the Header Board

Figure 4.2-1 "Connecting the Evaluation Board and the Header Board" shows how to connect the evaluation board and the header board.



The header interface connector has no locking mechanism. From time to time while using the evaluation board, check whether the header interface connector has become loose.

**Figure 4.2-1 Connecting the Evaluation Board and the Header Board**



\*1 You can use the header interface cable (long) only if the MCU operates with a low clock frequency or if the load applied to the user terminal is extremely light. Normally, use the header interface cable (standard).

## 4.3 Connecting the Evaluation Board and the User Board

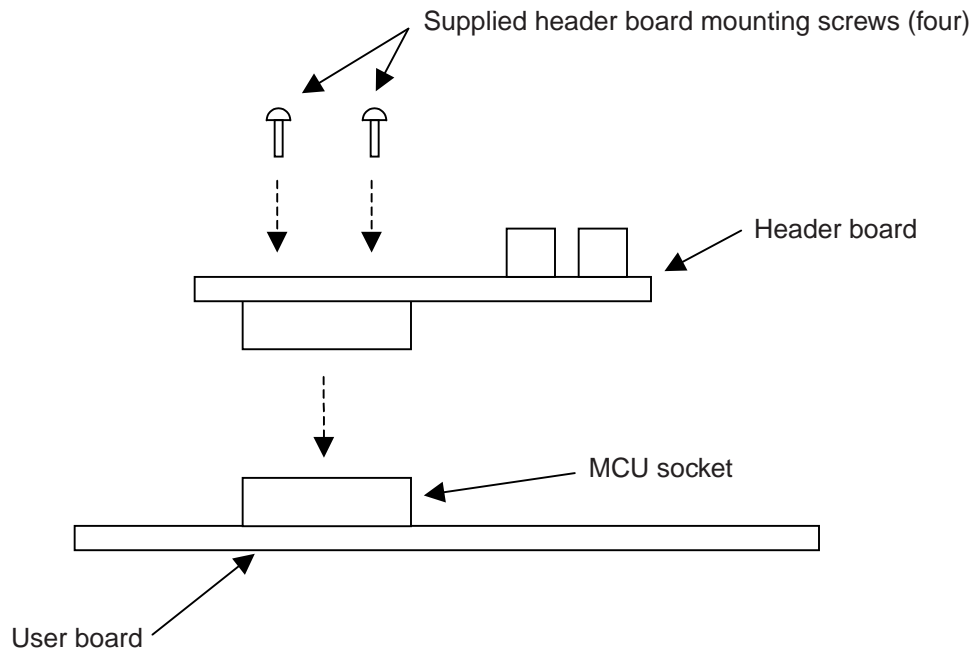
This section describes how to connect the evaluation board and the user board.

### ■ Connecting the Evaluation Board and the User Board

To connect the evaluation board to the user board, you must install on the user board the MCU IC socket supplied with the header board. For information on the MCU IC board, see the instruction manual supplied with each header board.

Connect the evaluation board and the user board as shown in Figure 4.3-1 "Connecting the Evaluation Board and the User Board". Connect the header board to the MCU IC socket on the user board and secure it using the header board mounting screws (four) supplied with the header board.

**Figure 4.3-1 Connecting the Evaluation Board and the User Board**



Note: The header board and the MCU socket engage precisely. Be sure to install or remove the header board vertically. Furthermore, be careful not to exert excessive force on the header board while it is connected.

## 4.4 Connecting the Evaluation Board and the Emulator

---

This section describes how to connect the evaluation board and the emulator.

---

### ■ Connecting the Evaluation Board and the Emulator

For information on connecting the evaluation board and the emulator, see the hardware manual supplied with the emulator.

## 4.5 Ways of Using the Evaluation Board

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This section describes the typical ways in which the evaluation board can be used.

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### ■ Ways of Using the Evaluation Board

Figure 4.5-1 "Sample Use of the Evaluation Board 1" and Figure 4.5-2 "Sample Use of the Evaluation Board 2" show two ways the evaluation board can be used.

**Figure 4.5-1 Sample Use of the Evaluation Board 1**

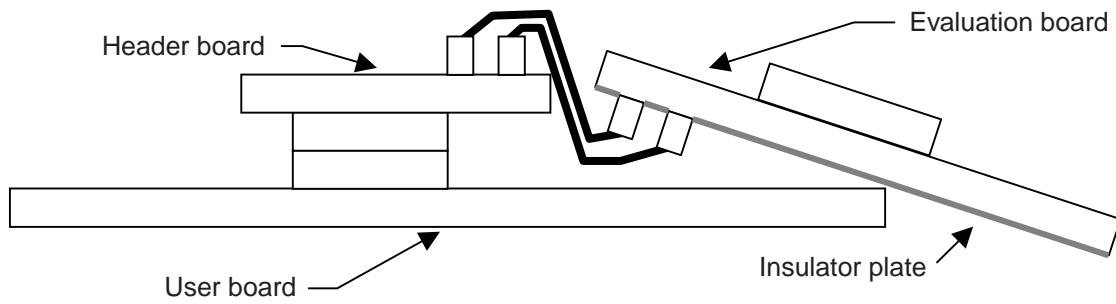
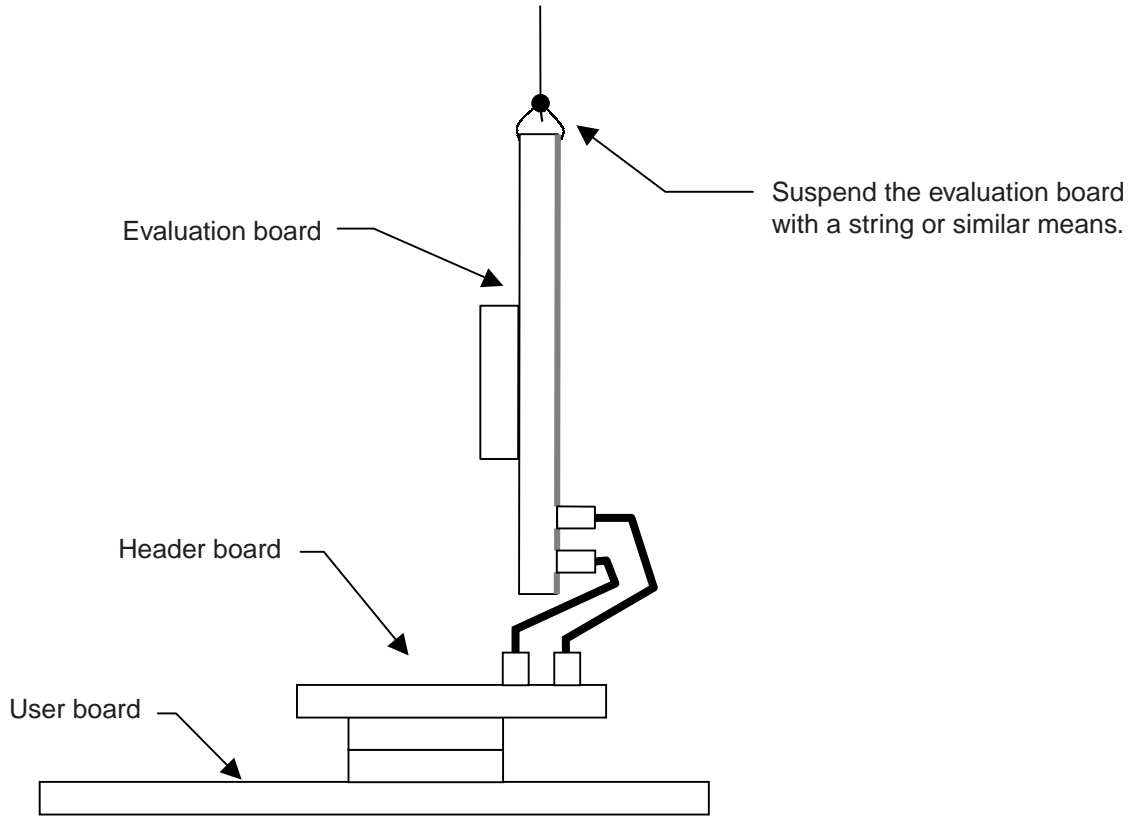


Figure 4.5-2 Sample Use of the Evaluation Board 2



Notes:

1. Secure the DSU cable on the evaluation board with adhesive tape or similar material.
2. To connect the evaluation board as shown above, bend the header interface cable to the extent that it maintains a shape required before connecting it to the user board.

## 4.6 Power-on and Power-off Procedures

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This section describes power-on and power-off procedures for the evaluation board.

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### ■ Power-on and power-off procedures for the evaluation board



Use the following power-on and power-off procedures for the evaluation board. Performing a procedure incorrectly may damage the user system or other components.

(1) Power-on procedure

- Turn on the emulator power.
- Turn on the user power.
- Turn on the evaluation board power.

(2) Power-off procedure

- Turn off the evaluation board power.
- Turn off the user power.
- Turn off the emulator power.



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This is listed in alphabetic order.**

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FR 20/30 Series

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MB2197-120

HARDWARE MANUAL

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