

F²MC-16L/16LX EMULATOR
PGA-299P ADAPTER BOARD
MB2147-20-E
OPERATION MANUAL

PREFACE

The MB2147-20-E*1 is an optional tool of the MB2147-01-E, which is a development support tool used to develop and evaluate application products based on the FUJITSU MICROELECTRONICS F²MC*2-16L/16LX microcontroller.

This manual is intended for engineers who use the MB2147-20-E (called the adapter board in this manual) to develop F²MC-16LX application products. The manual explains how to handle and connect the adapter board.

*1 : Referred to as "adapter board"

*2 : F²MC is the abbreviation of FUJITSU Flexible Microcontroller.

■ Using the product safely

This manual provides important information for using this product safely. Be sure to read this manual carefully before using the product to ensure correct use. In particular, read carefully "■ Caution of the products described in this document" in this "PREFACE" before using the product so that you comprehend the requirements for safe use of the product.

After reading this manual, keep it handy for reference.

■ Caution of the products described in this document

The specifications of this product may be changed without prior notice. The publisher assumes no liability for any loss or damage whatsoever directly or indirectly arising out of the use of the product.

■ Related manuals

Along with manual, also read the following manuals:

- Emulator OPERATION MANUAL
- Evaluation MCU HARDWARE MANUAL
- Probe cable OPERATION MANUAL
- Probe header OPERATION MANUAL
- "SOFTUNE Workbench OPERATION MANUAL"

■ European RoHS compliance

Products with a -E suffix on the part number are European RoHS compliant products.

■ Notice on this document

All information included in this document is current as of the date it is issued. Such information is subject to change without any prior notice.

Please confirm the latest relevant information with the sales representatives.

■ **Caution of the products described in this document**

The following precautions apply to the product described in this manual.



Indicates a potentially hazardous situation which could result in death or serious injury and/or a fault in the user's system if the product is not used correctly.

Electric shock, Damage	Before performing any operation described in this manual, turn off all the power supplies to the system. Performing such an operation with the power on may cause an electric shock or device fault.
Electric shock, Damage	Once the product has been turned on, do not touch any metal part of it. Doing so may cause an electric shock or device fault.



Indicates the presence of a hazard that may cause a minor or moderate injury, damages to this product or devices connected to it, or may cause to loose software resources and other properties such as data, if the device is not used appropriately.

Cuts, Damage	Before moving the product, be sure to turn off all the power supplies and unplug the cables. Watch your step when carrying the product. Do not use the product in an unstable location such as a place exposed to strong vibration or a sloping surface. Doing so may cause the product to fall, resulting in an injury or fault.
Cuts	The product contains sharp edges that are left unavoidably exposed, such as jumper plugs. Handle the product with due care not to get injured with such pointed parts.
Damage	Do not place anything on the product or expose the product to physical shocks. Do not carry the product after the power has been turned on. Doing so may cause a malfunction due to overloading or shock.
Damage	Since the product contains many electronic components, keep it away from direct sunlight, high temperature, and high humidity to prevent condensation. Do not use or store the product where it is exposed to much dust or a strong magnetic or electric field for an extended period of time. Inappropriate operating or storage environments may cause a fault.
Damage	Use the product within the ranges given in the specifications. Operation over the specified ranges may cause a fault.
Damage	To prevent electrostatic breakdown, do not let your finger or other object come into contact with the metal parts of any of the connectors. Before handling the product, touch a metal object (such as a door knob) to discharge any static electricity from your body.
Damage	Before turning the power on, in particular, be sure to finish making all the required connections. Furthermore, be sure to configure and use the product by following the instructions given in this document. Using the product incorrectly or inappropriately may cause a fault.
Damage	Always turn the power off before connecting or disconnecting any cables from the product. When unplugging a cable, unplug the cable by holding the connector part without pulling on the cable itself. Pulling the cable itself or bending it may expose or disconnect the cable core, resulting in a fault.
Damage	Because the structure of the MCU socket does not allow an evaluation MCU to be mounted in the incorrect orientation, be very careful of the orientation of the evaluation MCU when mounting it. Inserting the evaluation MCU in the wrong orientation may damage the MCU, causing the MCU to become faulty.
Damage	Because the product has no casing, it is recommended that it be stored in the original packaging. Transporting the product may cause a damage or fault. Therefore, keep the packaging materials and use them when re-shipping the product.

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1. PRODUCT OUTLINE

■ Checking the items packaged

Check that the package contains all of the following items before using the product.

- Adapter board : 1
- Operation manual (Japanese version) : 1
- Operation manual (English version: this manual) : 1

■ Optional parts

The adapter board itself cannot operate alone. As required, purchase the options listed in Table 1 to build an emulator system for the evaluation MCU being used.

Table 1 Options

Name	Part number
Evaluation MCU*1	MB90Vxxx
Emulator unit	MB2147-01-E
Probe cable*2	MB2132-xxx
Probe header*2	MB2147-xxx-E

*1 : The part number varies depends on the evaluation MCU used. For details, contact the sales dept. or support dept.

*2 : An FPC probe cable is used for connecting the user system to the emulator.

A probe header is a board that uses a flat cable to connect the user system to the emulator.

Select a probe cable and probe header that are suitable for the package of the mass-production MCU to be used. Contact the sales or support representative for information on how to select a suitable probe cable and probe header.

See the probe cable operation manual and probe header operation manual of the relevant products for information on how to handle and safely use the probe cable and probe header.

■ Appearance and part names

Figure 1 shows the adapter board and gives the names of all of its parts.

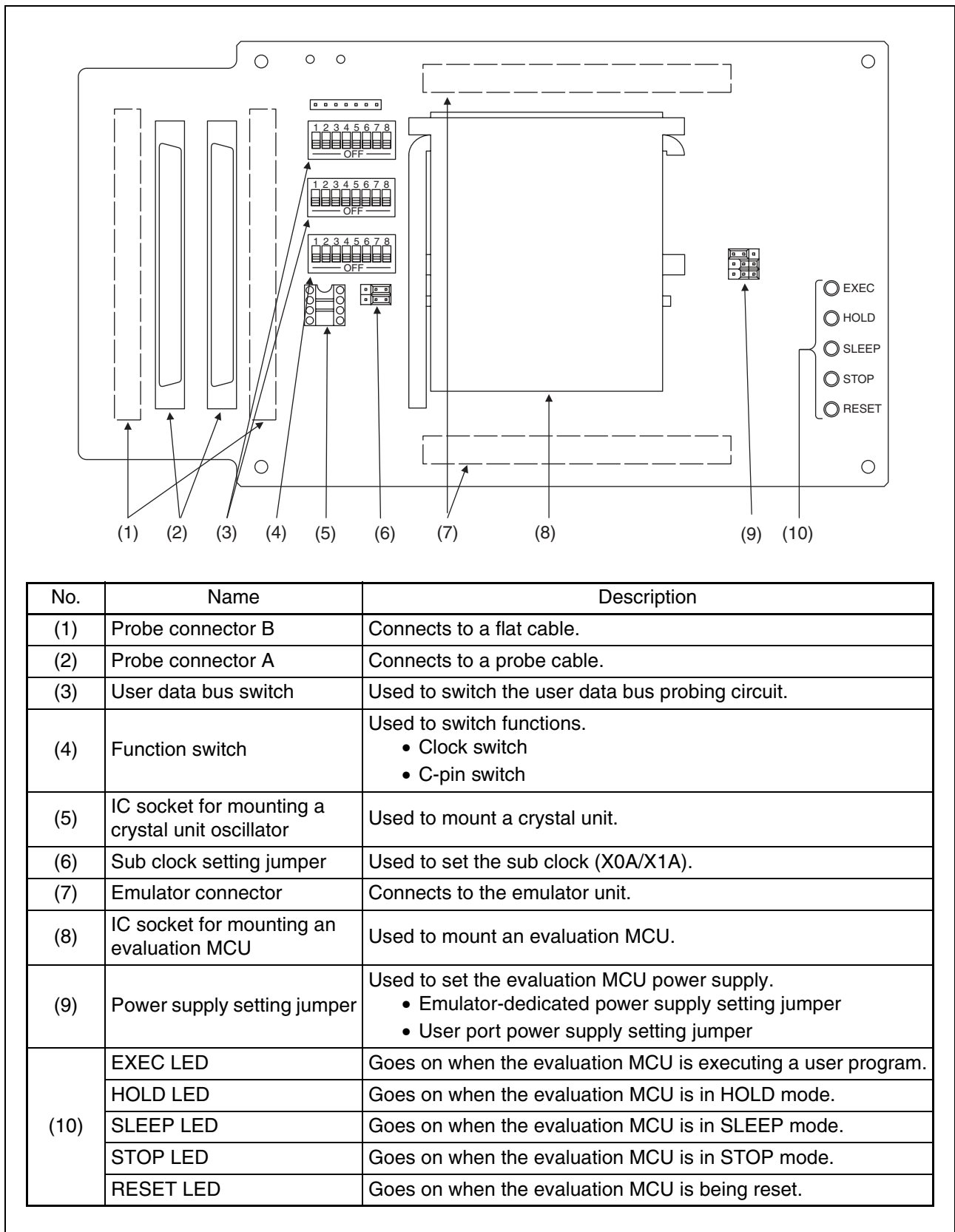


Figure 1 Appearance of the adapter board (top view)

2. CONNECTING THE PRODUCT

2.1 System Configuration

The adapter board can be used as an emulator when it is connected to the emulator unit.
Figure 2 shows the emulator system configuration.

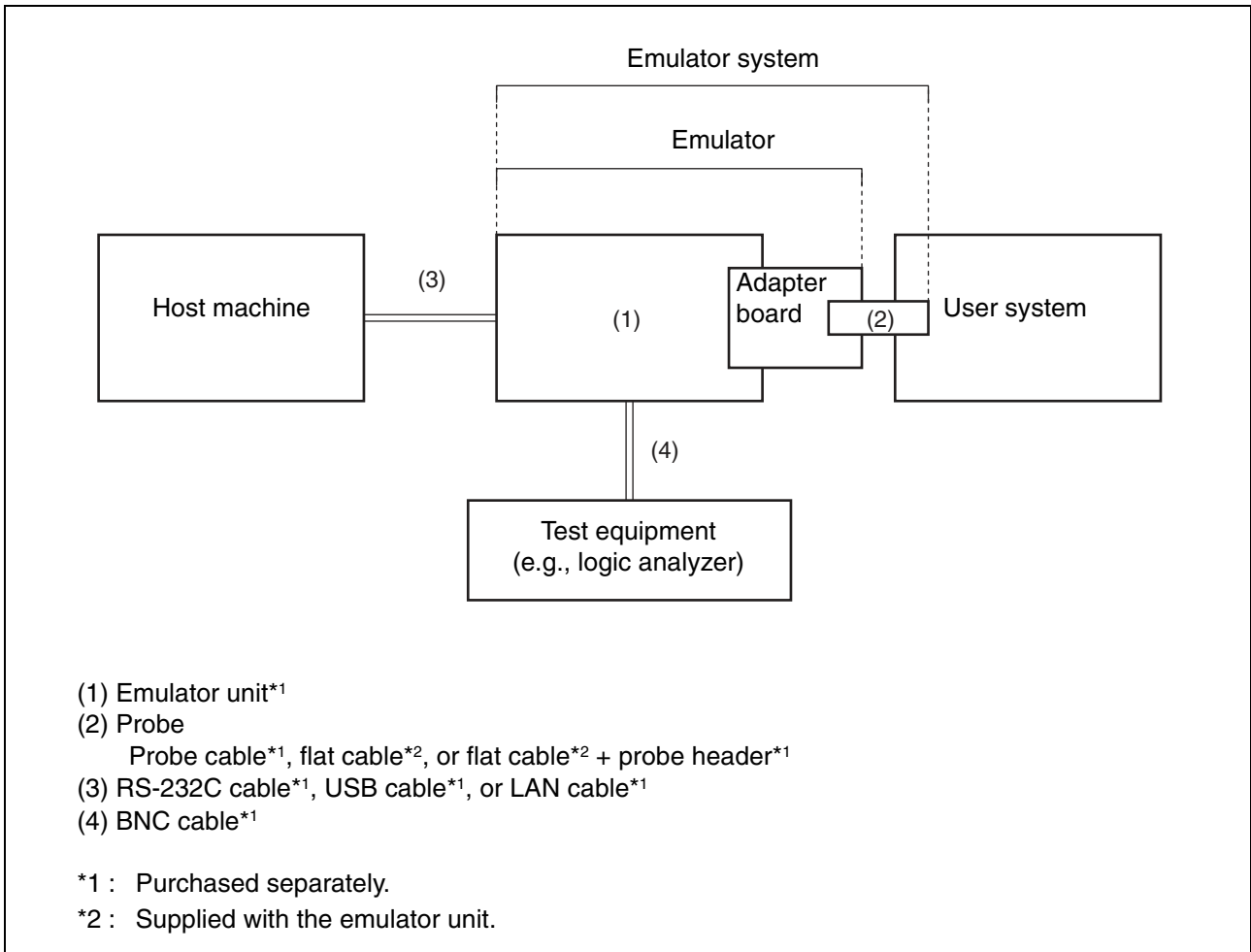


Figure 2 System configuration

2.2 Connecting the Adapter Board to the Emulator Unit

Connect the adapter board to the adapter board connector in the emulator unit, as shown in Figure 3.

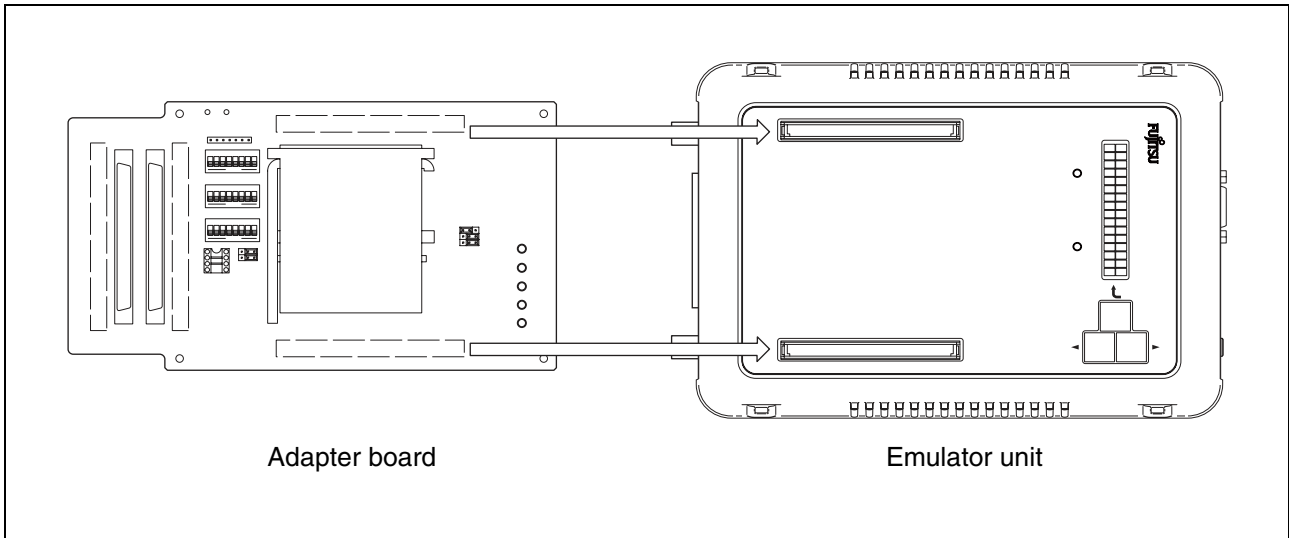


Figure 3 Connecting the adapter board to the emulator unit

2.3 Connecting a Probe to the User System

Connect a probe to the user system.

The type of connection between a probe and the user system varies depending on the configuration of the probe to be used. Table 2 summarizes the applicable probe configurations.

Table 2 Probe configurations

Cable used	Probe configuration	Method of connecting to the user system
Probe cable	Probe cable	Connect the connector* of the probe cable header to the connector* of the user system.
Flat cable	Flat cable + probe header	Connect the connector* of the probe header to the connector* of the user system.
	Flat cable	Connect the connector of the flat cable to the connector of the user system.

* : The shape of the header connector varies depending on the product.

Example: IC socket, connector (NQPACk)

Note : Before connecting the adapter board to the user system using a probe, remove the mass-production MCU from the user system.

■ **Connecting to the user system (using a probe cable)**

Connect the corresponding probe cable of the mass-production MCU package to be used to the connector of the user system, as shown in Figure 4.
See the probe cable operation manual of the relevant product for information on how to connect the connector of the probe cable header.

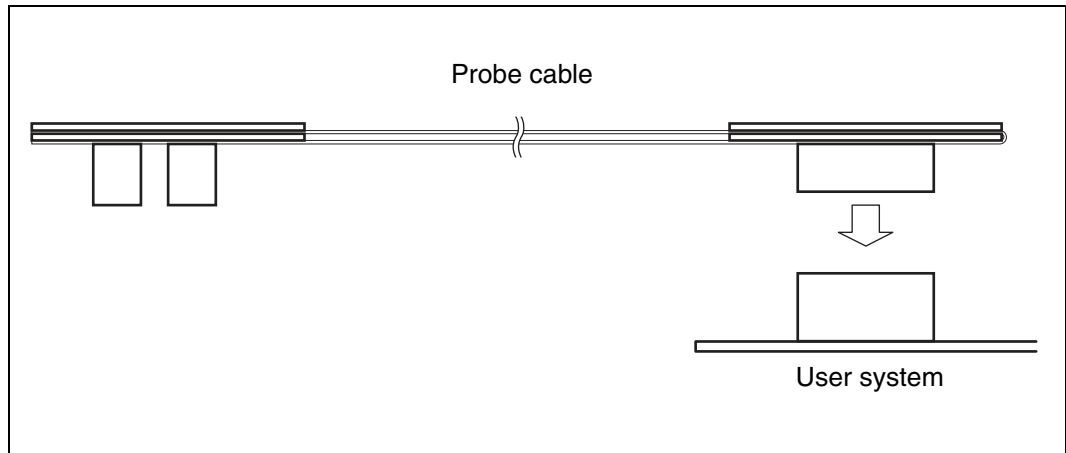


Figure 4 Connecting to the user system (using a probe cable)

■ **Connecting to the user system (using flat cables and a probe header)**

Connect the corresponding probe header of the mass-production MCU package to be used to the connector of the user system, as shown in Figure 5.
See the probe cable operation manual of the relevant product for information on how to connect the connector of the probe header.

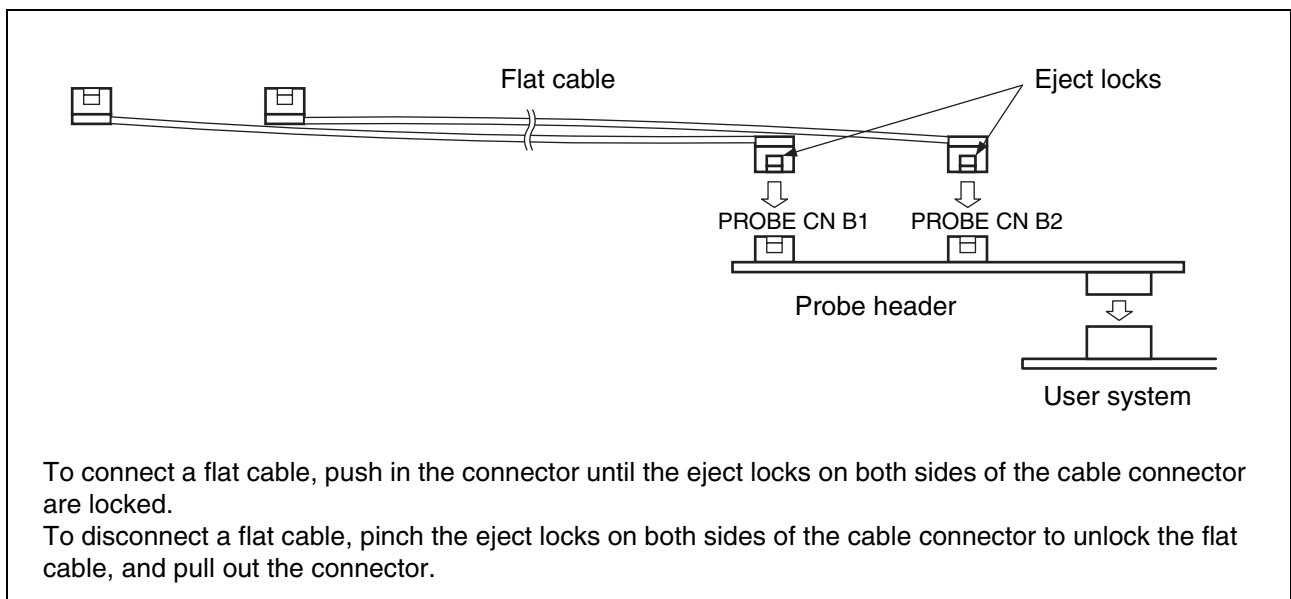


Figure 5 Connecting to the user system (using flat cables and a probe header)

■ **Using a flat cable to connect a probe to the user system**

If the same connectors as probe connector B1/B2 of the adapter board are mounted on the user system, the adapter board can be connected to the user system via a flat cable.

See “4. SPECIFICATIONS ■ User I/F specifications”, for details on the I/F specifications of probe connector B1/B2.

Connect a flat cable to probe connector B1/B2 of the user system, as shown in Figure 6.

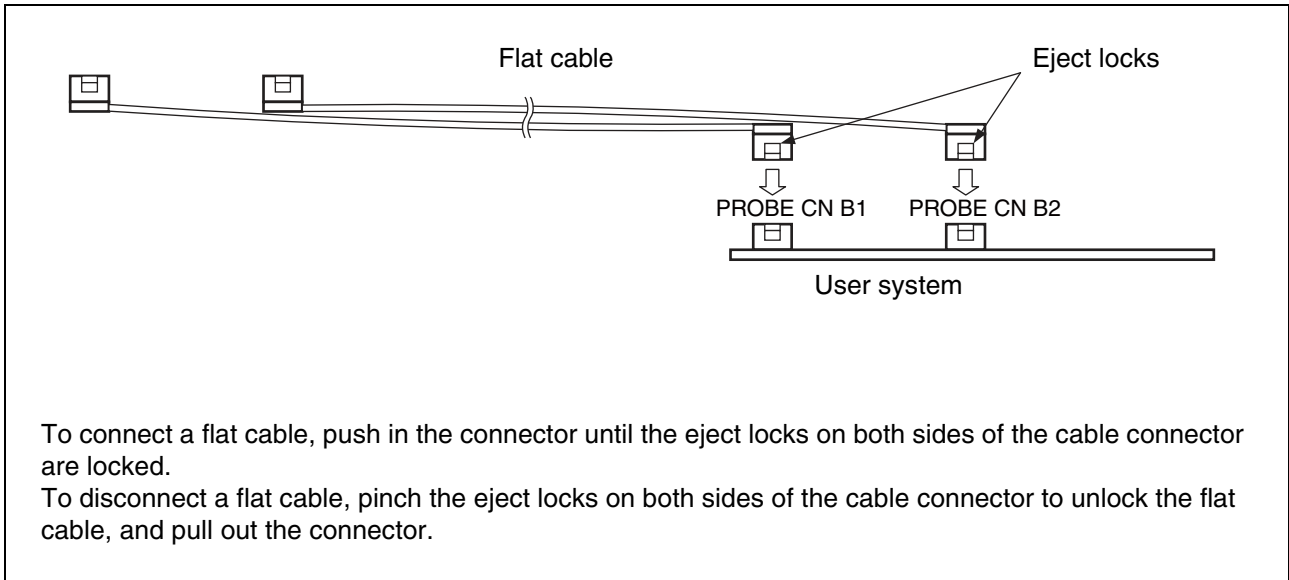


Figure 6 Using a flat cable to connect a probe to the user system

2.4 Connecting a Probe to the Adapter Board

Connect a probe to the adapter board.

Note : Two pairs (A1/A2 and B1/B2) of connectors are mounted on the adapter board.

Please use only one pair of probe connector when you debug it, and do not use both pairs simultaneously.

■ Connecting a probe to the adapter board (using a probe cable)

Connect a probe cable to probe connector A1/A2 of the adapter board, as shown in Figure 7.

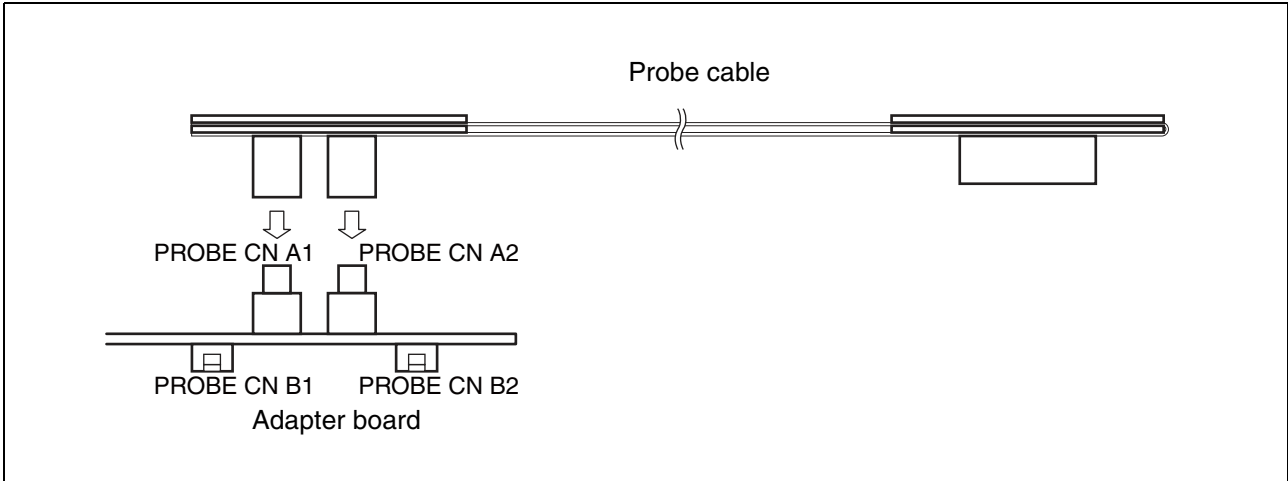
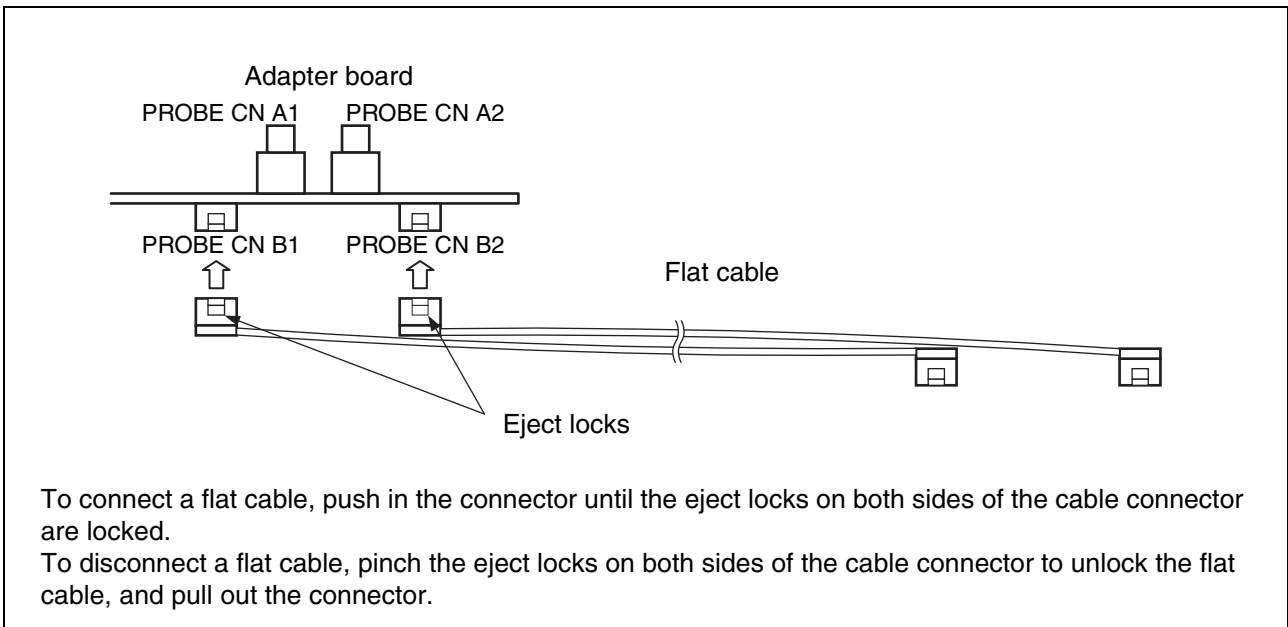


Figure 7 Connecting a probe to the adapter board (using a probe cable)

■ Connecting a probe to the adapter board (using a flat cable)

Connect a flat cable to probe connector B1/B2 of the adapter board, as shown in Figure 8.



To connect a flat cable, push in the connector until the eject locks on both sides of the cable connector are locked.

To disconnect a flat cable, pinch the eject locks on both sides of the cable connector to unlock the flat cable, and pull out the connector.

Figure 8 Connecting a probe to the adapter board (using a flat cable)

3. OPERATING THE PRODUCT

■ Mounting an evaluation MCU

Pull up the lever of an IC socket (SC1) to mount an evaluation MCU on the adapter board. Align the No. 1 pin index (□ or ○) of the evaluation MCU with that (△) of the IC socket. Place the lever of the IC socket back to its original position.

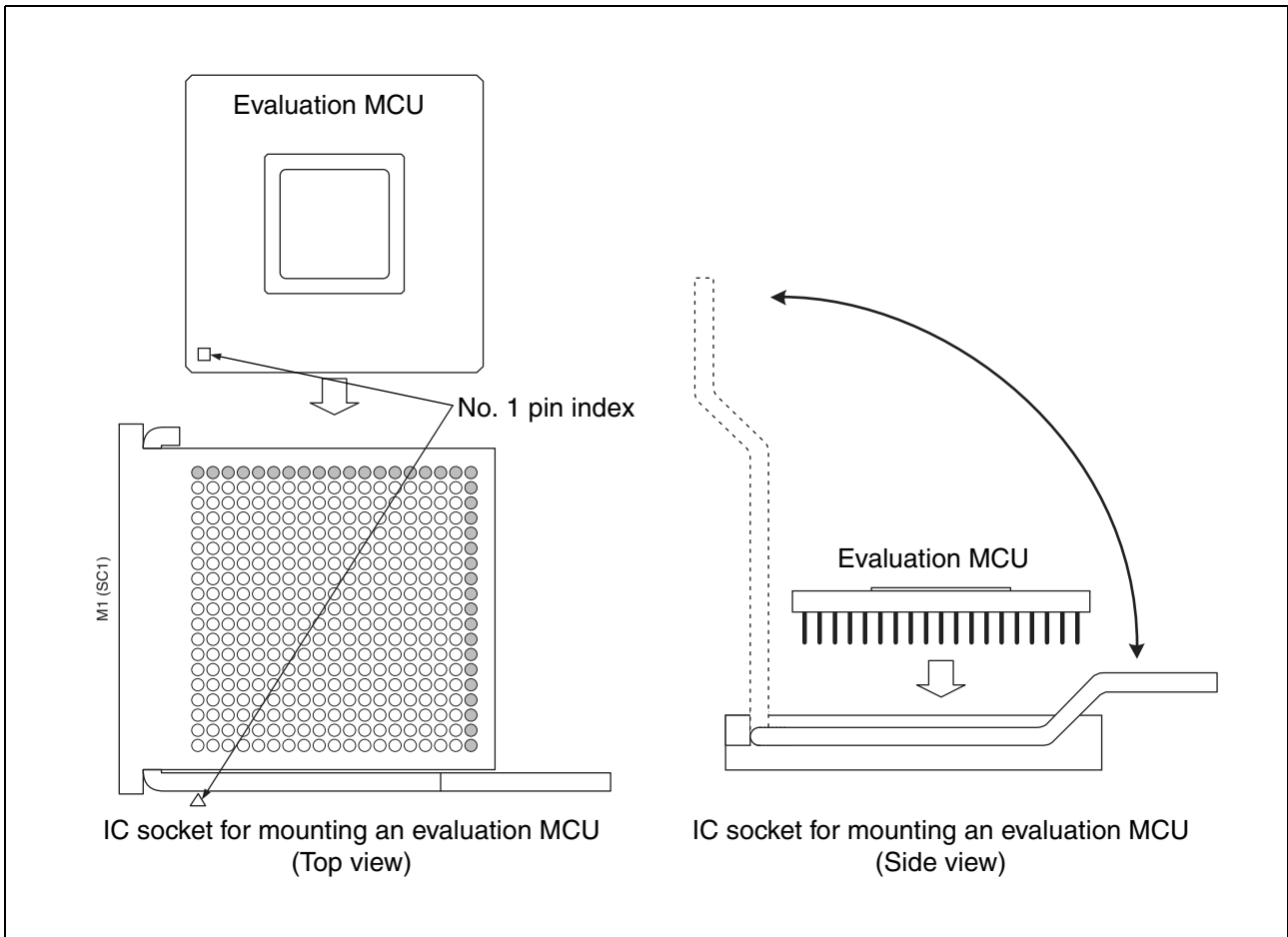


Figure 9 Mounting an evaluation MCU

Note : Do not use the shaded IC socket holes (●) shown in the figure. If the pins of an evaluation MCU are forcibly inserted into the shaded holes, the pins will be damaged.

■ Clock supply

Clock is supplied to the evaluation MCU.

Figure 10 shows how to mount a crystal oscillator unit in an IC socket (SC2) on the adapter board. Figure 11 shows the clock peripheral circuit configuration. Figure 12 shows examples of sub clock setting jumper settings. Table 3 lists the settings of the main clock switch. Table 4 lists the settings of the sub clock switch.

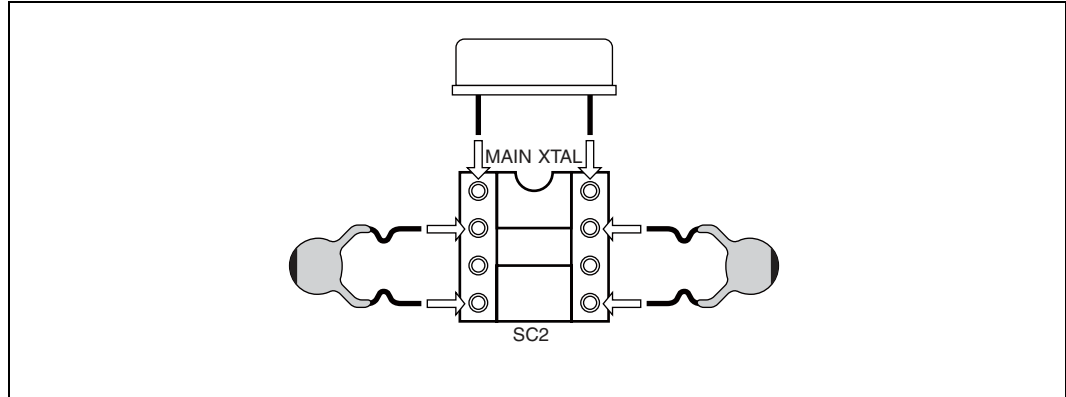


Figure 10 Mounting a crystal oscillator unit

Note : For a capacitor that is mounted with the oscillator, use a capacitor about 10pF smaller than the recommended value of the oscillator.

When a capacitor of the recommended value of the oscillator is mounted, an oscillator stabilization time becomes longer than the standard time due to the parasitic capacitance of a socket and the influence of an interconnect load and that may cause a failure such as instability of clock switching operation etc.

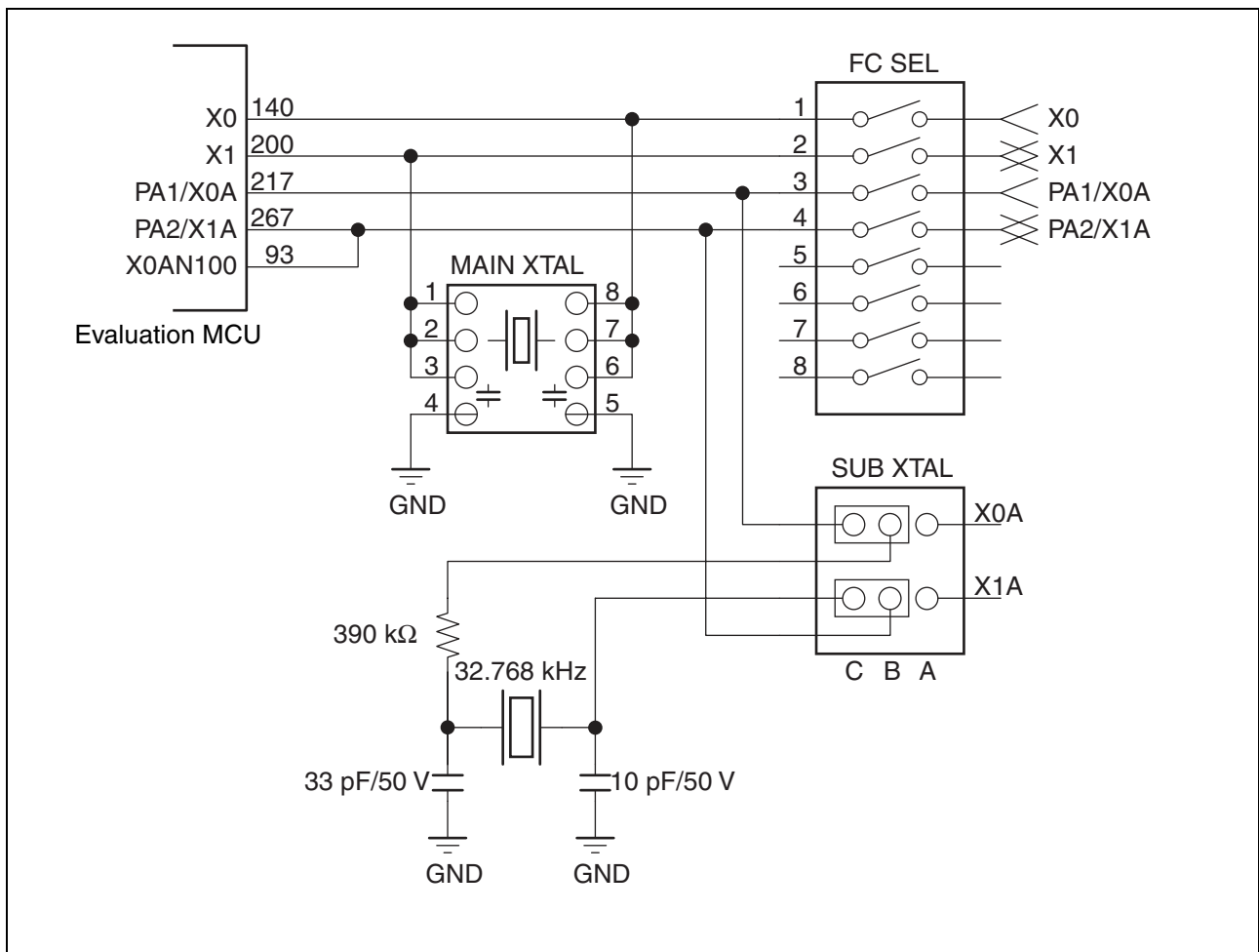


Figure 11 Clock peripheral circuit configuration

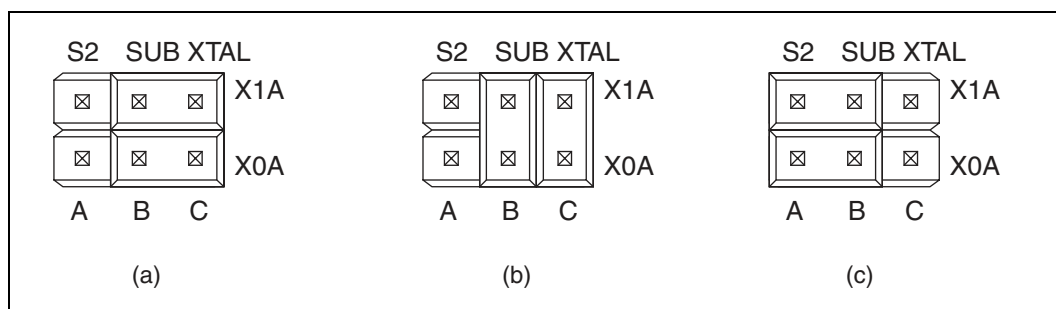


Figure 12 Examples of sub clock setting jumper settings

Table 3 Settings of the main clock switch

Main clock supply source	Setting of FC SEL (SW3)	
	1	2
Clock area	OFF	OFF
User system	ON	ON

Table 4 Settings of the sub clock switch

Sub clock			Setting of FC SEL (SW3)		Setting of SUB XTAL (S2)	
Availability	Supply source*1	Corresponding pin on the evaluation MCU*2	3	4		
Available	Clock area	X1A: Pin 267 X0A: Pin 217	OFF	OFF	X1A:B-X1A:C connected Figure 12 (a)	X0A:B-X0A:C connected Figure 12 (a)
		X1A: Pin 217 X0A: Pin 267	OFF	OFF	X1A:B-X0A:B connected Figure 12 (b)	X1A:C-X0A:C connected Figure 12(b)
Not available	-	-	ON	ON	X1A:A-X1A:B connected Figure 12 (c)	X0A:A-X0A:B connected Figure 12 (c)

*1 : Oscillation with a crystal unit mounted on the user system is not supported.

*2 : The correspondence between the number of the evaluation MCU pins and the sub clock signal (X0A, X1A) varies depending on the evaluation MCU used. Note that the correct pins must be used for the setting.

Contact the sales or support representative for number of the evaluation MCU pin that provides the sub clock signal.

Note : To supply the main clock from the user system, add an oscillator to the user system and have the main clock supplied after buffering using COMS or another type of buffer.

■ Setting of the emulator-dedicated power supply

Using the emulator-dedicated power supply setting jumper on the adapter board, set the tool interface power supply on the evaluation MCU to operate with the user power supply (UV_{cc1}) or the development tool power supply (+5 V).

On an evaluation MCU that has an emulator-dedicated power supply, the development tool power supply must supply power to the evaluation MCU as a tool interface power supply.

For an evaluation MCU that has an emulator-dedicated power supply, set the development tool power supply (+5 V). For an evaluation MCU that does not have an emulator-dedicated power supply, set the user power supply (UV_{cc1}).

For details on an evaluation MCU with a emulator-dedicated power supply, see the Evaluation MCU hardware manual of the relevant product, or contact the sales or support representative.

Figure 13 shows the emulator-dedicated power supply setting jumper. Table 5 lists the settings of the jumper.

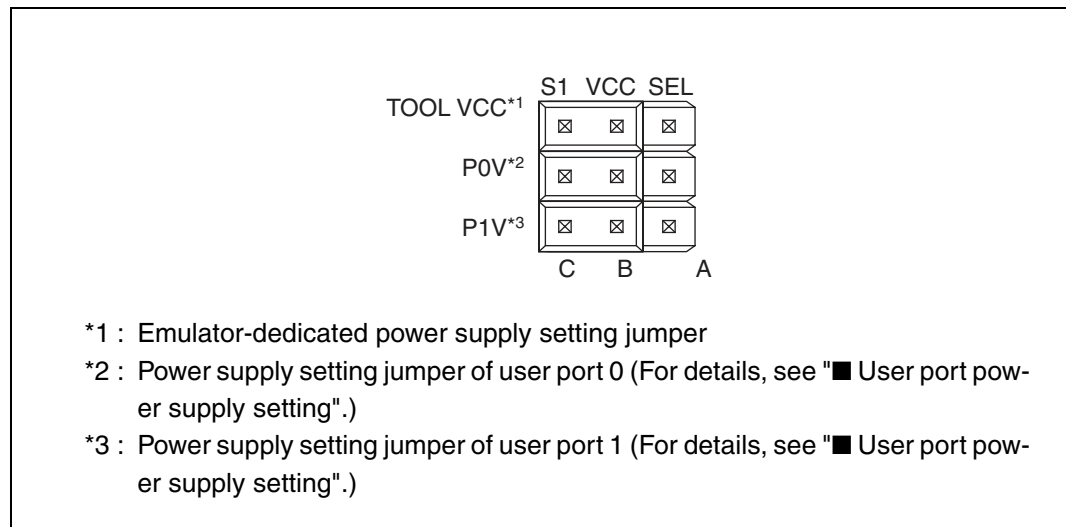


Figure 13 Emulator-dedicated power supply setting jumper

Table 5 Settings of the emulator-dedicated power supply setting jumper

Emulator-dedicated power supply pin	Setting of VCC SEL (S1)
Available	TOOL VCC: B-C connected (+5 V)
Not available	TOOL VCC: A-B connected (UV _{cc1})

■ Setting of the user port power supply

Use the user port power supply setting jumper on the adapter board to set the reference voltage of the user data bus probing circuit.

The user data bus for which the reference voltage is set corresponds to user port 0 or 1. Set the user port reference voltage for each user port power supply.

See "■ User data bus setting," for details on the user data bus probing circuit.

UVcc1: Main power of the evaluation MCU

UVcc2: Secondary power of the evaluation MCU

Table 6 lists the settings of the user port power supply setting jumper.

Table 6 Settings of the user port power supply setting jumper

User power supply source	Setting of VCC SEL (S1)			
	User port 0 power supply setting jumper (P0V)*1		User port 1 power supply setting jumper (P1V)*1	
Single source	A-B connected (UVcc1)		A-B connected (UVcc1)	
Dual source	Target power supply circuit with jumper connected*2		Target power supply circuit with jumper connected*2	
	A-B connected (UVcc1)	B-C connected (UVcc2)	A-B connected (UVcc1)	B-C connected (UVcc2)

*1 : See Figure 13 for the position of the user port power supply setting jumper.

*2 : Short-circuit the Vcc that corresponds to the user port power supply.

Example: When UVcc1 corresponds to user port 0 and UVcc2 corresponds to user port 1:

User port 0 power supply setting jumper (P0V): A-B connected (UVcc1)

User port 1 power supply setting jumper (P1V): B-C connected (UVcc2)

■ Settings of the C-pin switch

Use the C-pin switch on the adapter board to switch the C-pin setting.

Figure 14 shows the peripheral circuit configuration of the C-pin switch. Table 7 lists the settings of the switch.

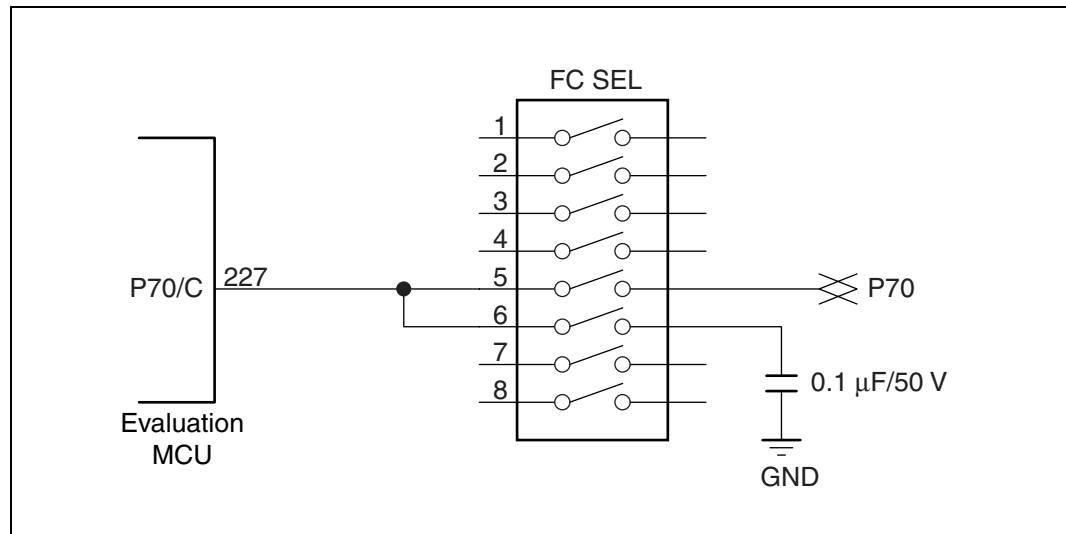


Figure 14 Peripheral circuit configuration of the C-pin switch

Table 7 Settings of the C-pin switch

C-pin	Setting of FC SEL (SW3)	
	5	6
Available	OFF	ON
Not available	ON	OFF

■ Settings of the user data bus switch

If the probing target pins (P00 to P07, P10 to P17) have a special specification, such as for a high-voltage port, set the user data bus probing circuit to "Disconnect."

When the external bus of the evaluation MCU is not used, "Disconnect" is the recommended setting for the user data bus probing circuit.

Using the user data bus switch on the adapter board, set the user data bus probing circuit to "Connect" or "Disconnect."

Figure 15 shows the peripheral circuit configuration of the user data bus switch. Table 8 lists the settings of the switch.

Table 8 Settings of the user data bus switch

Probing target pin		1	2	3	4	5	6	7	8
P00 to P07 (Setting of P0 SENSE (SW2))	Connect	ON	ON	ON	ON	ON	ON	ON	ON
	Disconnect	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
P10 to P17 (Setting of P1 SENSE (SW1))	Connect	ON	ON	ON	ON	ON	ON	ON	ON
	Disconnect	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

Note : This circuit has a function equivalent to that of a high-resistance pull-up resistor.

When all buses of the evaluation MCU and user system are in the Hi-Z state, approximately 3.0V appears on the bus.

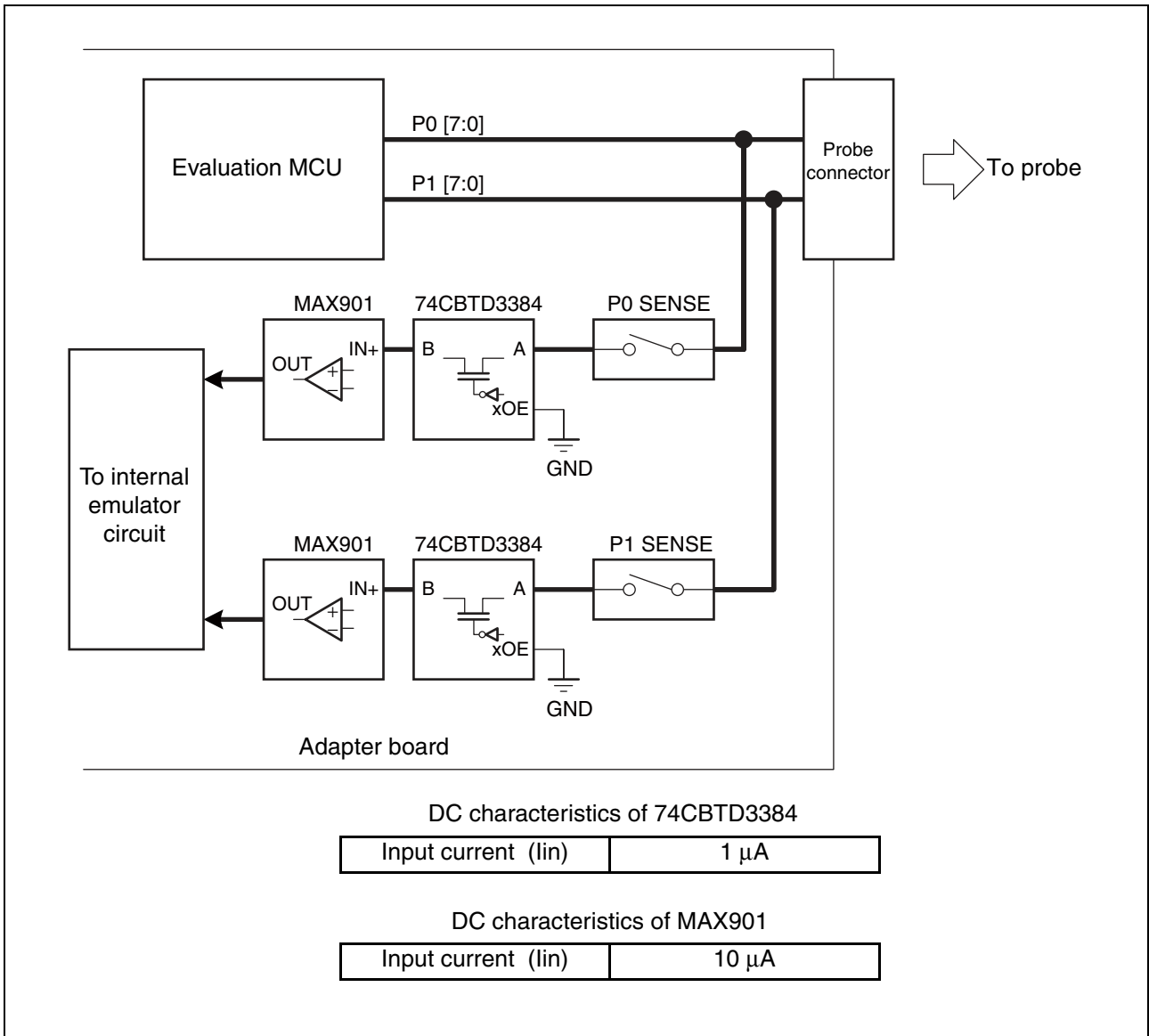


Figure 15 Peripheral circuit configuration of the user data bus switch

4. SPECIFICATIONS

■ General specifications

Table 9 lists the general specifications of the adapter board.

The following names used in this manual have the following definitions:

- Emulator: Emulator unit + adapter board
- Emulator system: Emulator unit + adapter board + probe

Table 9 General specifications

Item	Specification
Name	F ² MC-16L/16LX emulator PGA-299P adapter board
Part number	MB2147-20-E
Evaluation MCU power supply	Emulator interface power supply output: +3.3V or +5.0V (supplied from the emulator)
	User power supply input: +1.8V to +5.5V* ¹ 10mA or less* ² Dual source power supply supported: Supplied from the user system
Operating frequency	High-speed I/F: 8kHz to 33MHz* ³
Temperature	Operation: +5 °C to +35 °C Storage: 0 °C to +70 °C
Humidity	Operation: 30% to 80% (No condensation) Storage: 20% to 90% (No condensation)
External dimensions	(W) 110mm × (D) 199mm (protruding sections are not included.)
Weight	200g

*1 : The upper and lower voltage limits vary depending on the evaluation MCU used. For details, contact the sales or support representative.

*2 : The current consumption of the evaluation MCU is not included.

*3 : The upper and lower frequency limits vary depending on the evaluation MCU used.

The upper and lower frequency limits may vary depending on the operating voltage of the evaluation MCU used.

For details, contact the sales or support representative.

■ User I/F specifications

Table 10 and Table 11 summarize the correspondence between pin numbers of probe connector A/B and the evaluation MCU.

The evaluation MCU signal names in the tables are temporary names. Note that the actual signal names vary depending on the model. Evaluation MCU signal names can be determined from evaluation MCU pin numbers. For details, contact the sales or support representative.

Descriptions of evaluation MCU signal names and relevant precautions are given below:

- **PIDA:** Probe connection detection signal of probe connector A. This signal is connected to GND on the probe cable. When connecting a flat cable to probe connector B, leave this pin open (NC) on the user system.
- **PIDB:** Probe connection detection signal of probe connector B. When connecting a flat cable, connect this pin on the user system to GND.
- **UVcc1:** Main power supply of the evaluation MCU.
- **UVcc2:** Secondary power supply of the evaluation MCU. This power supply is connected to Vcc2 (Pin 228) of the evaluation MCU.
- **GND:** Ground of the evaluation MCU.

Notes:

- To control the evaluation MCU, additional circuits are added to the pins whose evaluation MCU signal names are underlined. Therefore, its electrical characteristics differ from those of an actual MCU. See the following sections for details on an additional circuit for each signal:
 - X0/X1 : “3. OPERATING THE PRODUCT ■ Clock supply”
 - PA1/PA2 (X0A/X1A) : “3. OPERATING THE PRODUCT ■ Clock supply”
 - P70 (C-pin) : “3. OPERATING THE PRODUCT ■ Settings of the C-pin switch”
 - P00 to P07/P10 to P17 : “3. OPERATING THE PRODUCT ■ Settings of the user data bus”
- On the emulator, UVcc1 and UVcc2 are mainly used as evaluation MCU power supplies. On other devices, they are used only for detecting voltage, no circuits consume a large amount of power.
- Use of the flat cable (standard) supplied with the emulator unit is recommended in order to prevent noise problems. Probe connector B1/B2 and the flat cable connector have the following part numbers:
 - Probe connector B1/B2 : 8930E-100-178MS-F (KEL company product)
 - Flat cable connector : 8925E-100-179-F (KEL company product)
- Regarding mounting of probe connector B1/B2 on the user system, note the layout of pin numbers of probe connector B1/B2 on the user system. Figure 16 shows the correspondence between probe connector B1/B2 pin numbers on the adapter board and those on the user system when a flat cable is used.

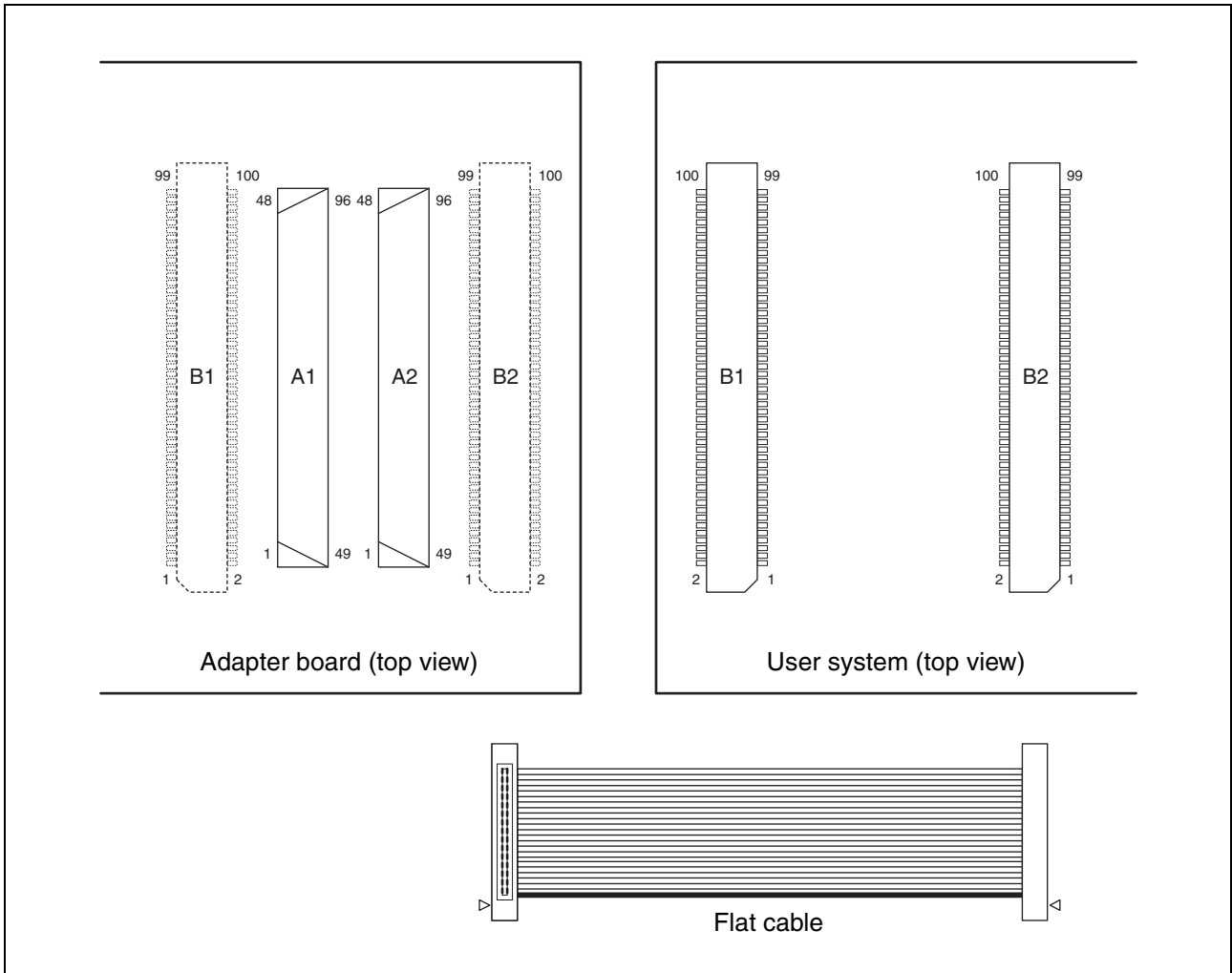


Figure 16 Correspondence between probe connector B1/B2 pin numbers on the adapter board and user system

Table 10 Probe connector A1/B1 pin array

Connector A1 pin number	Connector B1 pin number	Evaluation MCU signal name	Evaluation MCU pin number	Connector A1 pin number	Connector B1 pin number	Evaluation MCU signal name	Evaluation MCU pin number
-	100	GND	-	-	99	GND	-
96	98	GND	-	48	97	AN6	80
95	96	AN7	208	47	95	AN5	148
94	94	AN4	259	46	93	GND	-
93	92	AN3	79	45	91	AN2	207
92	90	AN1	147	44	89	AVss	258
91	88	AN0	78	43	87	AVR-	206
90	86	GND	-	42	85	AVcc	77
89	84	AVR+	146	41	83	P97	160
88	82	P96	223	40	81	GND	-
87	80	P95	26	39	79	P94	268
86	78	P93	94	38	77	P91	269
85	76	P92	219	37	75	P90	95
84	74	GND	-	36	73	P87	33
83	72	UVcc1	-	35	71	P86	169
82	70	P85	226	34	69	GND	-
81	68	P84	275	33	67	P83	34
80	66	P82	105	32	65	P80	167
79	64	P81	224	31	63	P77	35
78	62	GND	-	30	61	P75	225
77	60	P76	274	29	59	P74	32
76	58	P73	104	28	57	GND	-
75	56	P72	170	27	55	P71	106
74	54	P70	227	26	53	P67	163
73	52	GND	-	25	51	P66	162
72	50	GND	-	24	49	P64	96
71	48	P65	220	23	47	P63	270
70	46	P62	100	22	45	GND	-
69	44	P61	97	21	43	P60	221
68	42	P57	164	20	41	P55	273
67	40	P56	98	19	39	P54	271
66	38	GND	-	18	37	P52	222
65	36	P53	23	17	35	P51	99
64	34	P50	165	16	33	GND	-
63	32	P47	276	15	31	P46	107
62	30	P45	108	14	29	P43	277
61	28	P44	172	13	27	P42	109
60	26	GND	-	12	25	P40	173
59	24	P41	229	11	23	UVcc2	(228)
58	22	P37	130	10	21	GND	-
57	20	P36	292	9	19	P35	193
56	18	P34	131	8	17	P32	194
55	16	P33	247	7	15	P31	132
54	14	GND	-	6	13	GND	-
53	12	P30	293	5	11	P27	61
52	10	P26	248	4	9	GND	-
51	8	P25	133	3	7	P24	195
50	6	P23	62	2	5	P21	63
49	4	P22	134	1	3	P20	294
-	2	GND	-	-	1	GND	-

Table 11 Probe connector A2/B2 pin array

Connector A2 pin number	Connector B2 pin number	Evaluation MCU signal name	Evaluation MCU pin number	Connector A2 pin number	Connector B2 pin number	Evaluation MCU signal name	Evaluation MCU pin number
-	100	PIDB	-	-	99	GND	-
96	98	PIDA	-	48	97	PA0	159
95	96	GND	-	47	95	PA1	217
94	94	PA2	267	46	93	GND	-
93	92	PA3	149	45	91	PA4	81
92	90	PA5	260	44	89	PA7	82
91	88	PA6	209	43	87	PB0	83
90	86	GND	-	42	85	PB2	87
89	84	PB1	218	41	83	PB3	212
88	82	PB4	263	40	81	GND	-
87	80	PB5	153	39	79	PB6	86
86	78	PB7	8	38	77	PC0	150
85	76	UVcc1	-	37	75	PC1	84
84	74	GND	-	36	73	PC3	272
83	72	PC2	5	35	71	PC4	168
82	70	PC5	103	34	69	GND	-
81	68	PC6	166	33	67	PC7	7
80	66	GND	-	32	65	PD1	210
79	64	PD0	151	31	63	PD2	261
78	62	GND	-	30	61	PD4	158
77	60	PD3	6	29	59	PD5	216
76	58	PD6	92	28	57	GND	-
75	56	PD7	266	27	55	PE0	157
74	54	PE1	91	26	53	PE3	156
73	52	PE2	215	25	51	PE4	155
72	50	GND	-	24	49	PE6	88
71	48	PE5	16	23	47	PE7	15
70	46	PG0	264	22	45	GND	-
69	44	PG1	213	21	43	PG2	154
68	42	PG3	14	20	41	PG5	255
67	40	PG4	203	19	39	PG6	143
66	38	GND	-	18	37	PH0	202
65	36	PG7	299	17	35	PH1	142
64	34	PH2	201	16	33	GND	-
63	32	PH3	141	15	31	MD3	101
62	30	MD2	110	14	29	MD0	230
61	28	MD1	278	13	27	RST	262
60	26	GND	-	12	25	X0	140
59	24	GND	-	11	23	X1	200
58	22	UVcc1	-	10	21	GND	-
57	20	P00	252	9	19	P01	199
56	18	P02	71	8	17	P04	70
55	16	P03	138	7	15	P05	251
54	14	GND	-	6	13	P07	198
53	12	P06	296	5	11	P10	137
52	10	P11	136	4	9	GND	-
51	8	P12	197	3	7	P13	295
50	6	P14	250	2	5	P16	64
49	4	P15	135	1	3	P17	196
-	2	GND	-	-	1	GND	-

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