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April 1, 2003

Cautions

SH7018 Series TFP-100B User System Interface Cable (HS7018EWN61H) for E6000 Emulator

User's Manual

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Cautions

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IMPORTANT INFORMATION

READ FIRST

• READ this user's manual before using this user system interface cable.

• <u>KEEP the user's manual handy for future reference.</u>

Do not attempt to use the user system interface cable until you fully understand its mechanism.

User System Interface Cable:

Throughout this document, the term "user system interface cable" shall be defined as the following product produced only by Hitachi, Ltd. excluding all subsidiary products.

• User system interface cable (HS7018EWN61H)

The user system or a host computer is not included in this definition.

Purpose of the User System Interface Cable:

This user system interface cable is for connecting the emulator station and user system. This user system interface cable must only be used for the above purpose.

Improvement Policy:

Hitachi, Ltd. (including its subsidiaries, hereafter collectively referred to as Hitachi) pursues a policy of continuing improvement in design, performance, functions, and safety of the user system interface cable. Hitachi reserves the right to change, wholly or partially, the specifications, design, user's manual, and other documentation at any time without notice.

Target User of the User System Interface Cable:

This user system interface cable should only be used by those who have carefully read and thoroughly understood the information and restrictions contained in the user's manual. Do not attempt to use the user system interface cable until you fully understand its mechanism.

It is highly recommended that first-time users be instructed by users that are well versed in the operation of the user system interface cable.

LIMITED WARRANTY

Hitachi warrants its user system interface cables to be manufactured in accordance with published specifications and free from defects in material and/or workmanship. Hitachi will repair or replace any user system interface cables determined to be defective in material and/or workmanship. User system interface cables are wearing parts which Hitachi will not repair or replace if damaged and/or worn through use. The foregoing shall constitute the sole remedy for any breach of Hitachi's warranty. This warranty extends only to you, the original Purchaser. It is not transferable to anyone who subsequently purchases the user system interface cable from you. Hitachi is not liable for any claim made by a third party or made by you for a third party.

DISCLAIMER

HITACHI MAKES NO WARRANTIES, EITHER EXPRESS OR IMPLIED, ORAL OR WRITTEN, EXCEPT AS PROVIDED HEREIN, INCLUDING WITHOUT LIMITATION THEREOF, WARRANTIES AS TO MARKETABILITY, MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE OR USE, OR AGAINST INFRINGEMENT OF ANY PATENT. IN NO EVENT SHALL HITACHI BE LIABLE FOR ANY DIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE, OR LOSSES OR EXPENSES RESULTING FROM ANY DEFECTIVE USER SYSTEM INTERFACE CABLE, THE USE OF ANY USER SYSTEM INTERFACE CABLE, OR ITS DOCUMENTATION, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCEPT AS EXPRESSLY STATED OTHERWISE IN THIS WARRANTY, THIS USER SYSTEM INTERFACE CABLE IS SOLD "AS IS ", AND YOU MUST ASSUME ALL RISK FOR THE USE AND RESULTS OBTAINED FROM THE USER SYSTEM INTERFACE CABLE.

State Law:

Some states do not allow the exclusion or limitation of implied warranties or liability for incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may have other rights which may vary from state to state.

The Warranty is Void in the Following Cases:

Hitachi shall have no liability or legal responsibility for any problems caused by misuse, abuse, misapplication, neglect, improper handling, installation, repair or modifications of the user system interface cable without Hitachi's prior written consent or any problems caused by the user system.

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2. No license is granted by implication or otherwise under any patents or other rights of any third party or Hitachi.

Figures:

Some figures in this user's manual may show items different from your actual system.

Limited Anticipation of Danger:

Hitachi cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this user's manual and on the user system interface cable are therefore not all inclusive. Therefore, you must use the user system interface cable safely at your own risk.

SAFETY PAGE

READ FIRST

• **READ this user's manual before using this user system interface cable.**

• <u>**KEEP the user's manual handy for future reference.**</u>

Do not attempt to use the user system interface cable until you fully understand its mechanism.

DEFINITION OF SIGNAL WORDS

⚠ **This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.**

⚠ **DANGER**   **DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ **WARNING**   **WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ **CAUTION**   **CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION   **CAUTION** used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTE emphasizes essential information.

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⚠ WARNING

   Observe the precautions listed below. Failure to do so will result in a FIRE HAZARD and will damage the user system and the emulator product or will result in PERSONAL INJURY. The USER PROGRAM will be LOST.

1. **Do not repair or remodel the emulator product by yourself for electric shock prevention and quality assurance.**

2. **Always switch OFF the E6000 emulator and user system before connecting or disconnecting any CABLES or PARTS.**

3. **Always before connecting any CABLES, make sure that pin 1 on both sides are correctly aligned.**

4. **If cables are connected incorrectly, the power pins will be short circuited in the following way:**

90˚ rotation	180˚ rotation	270˚ rotation
25 (Vss) ⸺ 100 (Vcc)	15 (Vcc) ⸺ 65 (Vss)	30 (Vcc) ⸺ 55 (Pvcc)
55 (PVcc) ⸺ 30 (Vcc)	39 (Vcc) ⸺ 89 (Vss)	74 (Vcc) ⸺ 99 (Avcc)
99 (Avcc) ⸺ 74 (Vcc)		100 (Vcc) ⸺ 25 (Vss)

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Preface

Thank you for purchasing this user system interface cable (HS7018EWN61H) for the Hitachi's original microcomputer SH7018 series.

The HS7018EWN61H is a user system interface cable that connects an SH7010 series E6000 emulator (HS7010EPI60H; hereinafter referred to as the emulator) to the IC socket for a TFP-100B package for the SH7018 series MCU on the user system.

Contents

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Section 1 Configuration

CAUTION

Use an IC149-100-054-B51 socket (manufactured by YAMAICHI ELECTRONICS Co., Ltd.) for the TFP-100B package IC socket on the user system.

Figure 1 shows the configuration of the HS7018EWN61H user system interface cable for the TFP-100B package.
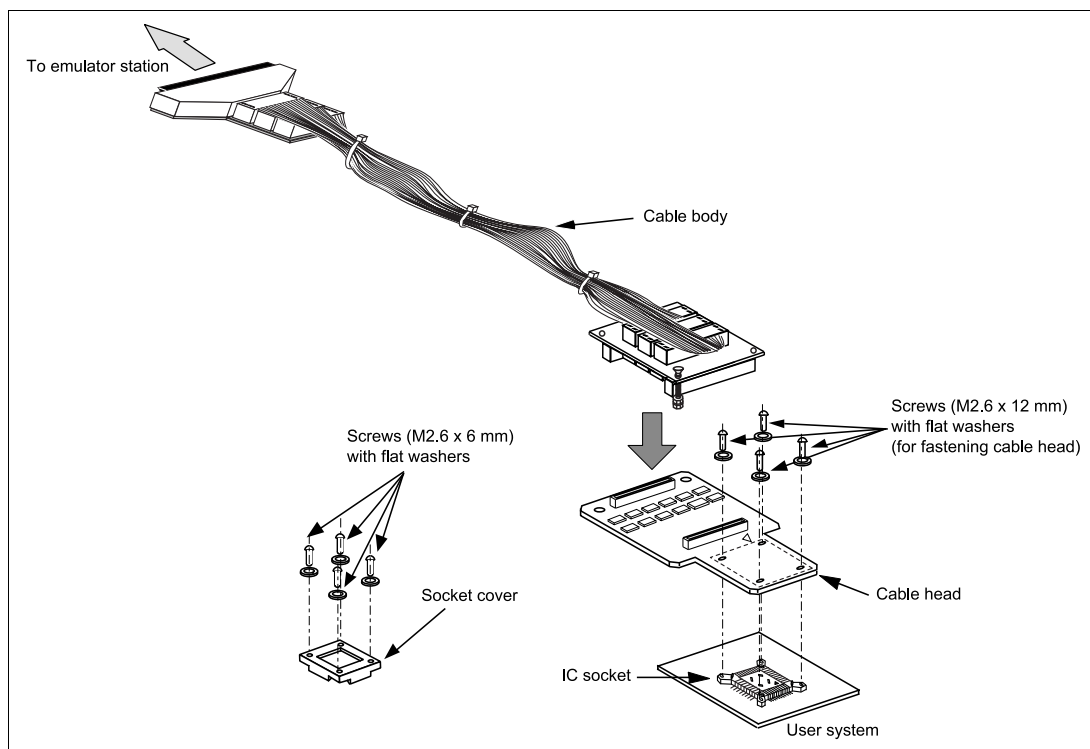
Figure 1   HS7018EWN61H User System Interface Cable

Table 1 lists the HS7018EWN61H components. Please make sure you have all of these
components when unpacking.

Table 1   HS7018EWN61H Components

No.	Component	Quantity	Remarks
1	Cable body	1	
2	Cable head	1	
3	IC socket	1	For the TFP-100B package
4	Socket cover	1	For installing a TFP-100B-packaged MCU
5	Screws (M2.6 x 12 mm)	4	For fastening cable head (with four flat washers)
6	Screws (M2.6 x 6 mm)	4	For installing a TFP-100B-packaged MCU (with four flat washers)
7	Documentation	1	User's manual for HS7018EWN61H (this manual)

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Section 2   Environmental Conditions

Maintain the conditions in table 2 when using the emulator.

Table 2   Environmental Conditions

Item	Specifications
Temperature	Operating: +10 to +35°C Storage: -10 to +35°C
Humidity	Operating: 35 to 80% RH, no condensation Storage: 35 to 80% RH, no condensation
Vibration	Operating: 2.45 m/s max. Storage: 4.9 m/s max. Transportation: 14.7 m/s max.
Ambient gases	There must be no corrosive gases present.

2.1   Setting Operating Voltage and Operating Frequency

Connecting the user system interface cable to the SH7010 series E6000 emulator enables emulation to be done using the user system operating voltage (Vcc: 3.0 to 3.6 V) Before determining the operating voltage and frequency of the user system, confirm the allowable range.
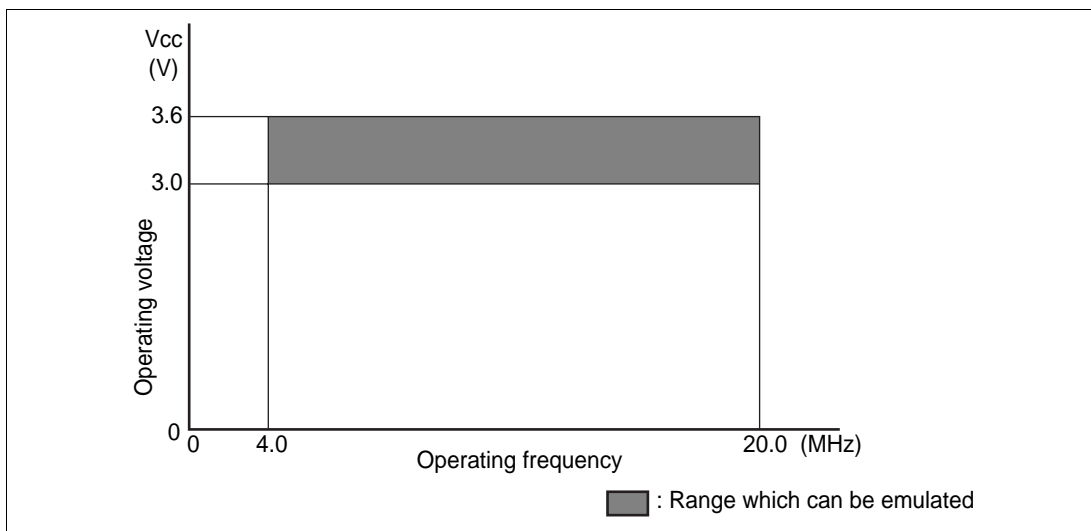
Figure 2   Allowable Operating Range

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Section 3   Product Specifications

The specifications of this product are shown in table 3.

Table 3   Product Specifications

Item	Specifications
Target processor	SH7018F
Package	TFP-100B
Function	Level limitation: This function keeps the output signal from 5-V emulator system equal to or less than power supply voltage of the user system (Vcc).
User-system operating conditions	Power supply voltage Vcc: 3.0 to 3.6 V, Pvcc: 4.5 to 5.5 V A drop in the Vcc level of the user system is detected when the power supply voltage drops to 2.5 V or less.
Current consumption	Maximum of 50 mA.

Drop in Vcc Level Detection Function:

When the user system interface cable is used, a drop is detected as follows:
When the power supply voltage (UVcc) of the user system is 2.5 V or less or when the power supply voltage (PVcc) for I/O circuits is 4.1 V or less, the Hitachi Debugging Interface (HDI) will detect a Vcc drop. In this case, a sufficient voltage may not be supplied to the user system; ensure that the specified voltage is supplied.

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Section 4   User Interface Specifications

The user system interface cable incorporates a level conversion circuit supporting a low-voltage circuit. Accordingly, when connecting the user system to the emulator, pay attention to the signal delays and the number of FANINs and FANOUTs.

4.1   User System Interface Circuit

The user system interface circuit of the user system interface cable is shown below.

(1) NMI and $\overline{\text{RES}}$
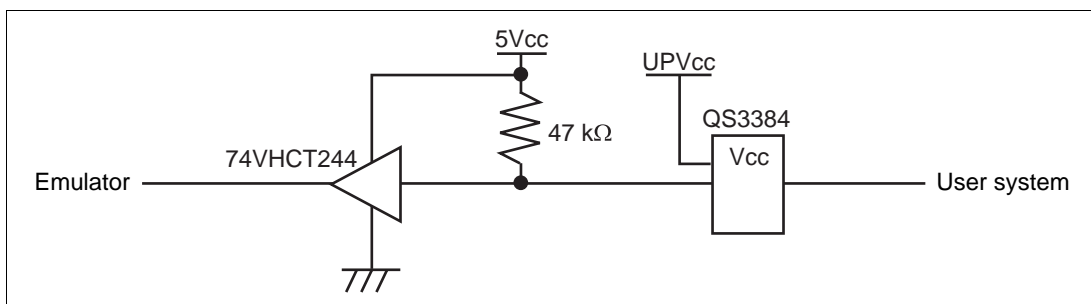
Figure 3   User System Interface Circuit for NMI and $\overline{\text{RES}}$

(2) PB8, PA5 to PA2, PD7 to PDØ, PE2, and PEØ
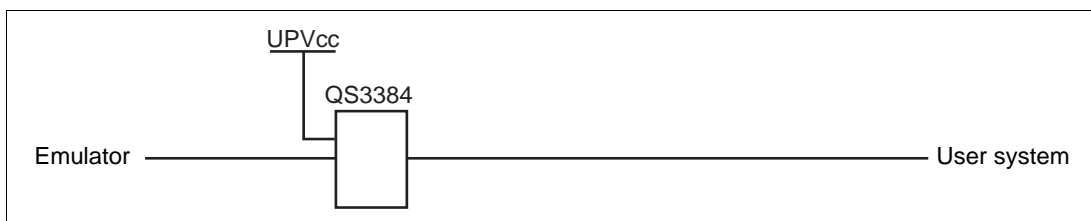
Figure 4   User System Interface Circuit for PB8, PA5 to PA2, PD7 to PDØ, PE2, and PEØ

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(3) AVcc, AVss, and AN7 to AN0
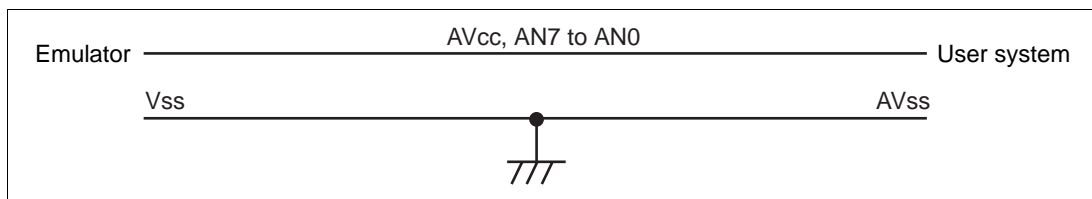
Figure 5   User System Interface Circuit for AVcc, AVss, and AN7 to AN0

(4) PVcc, Vcc and Vss
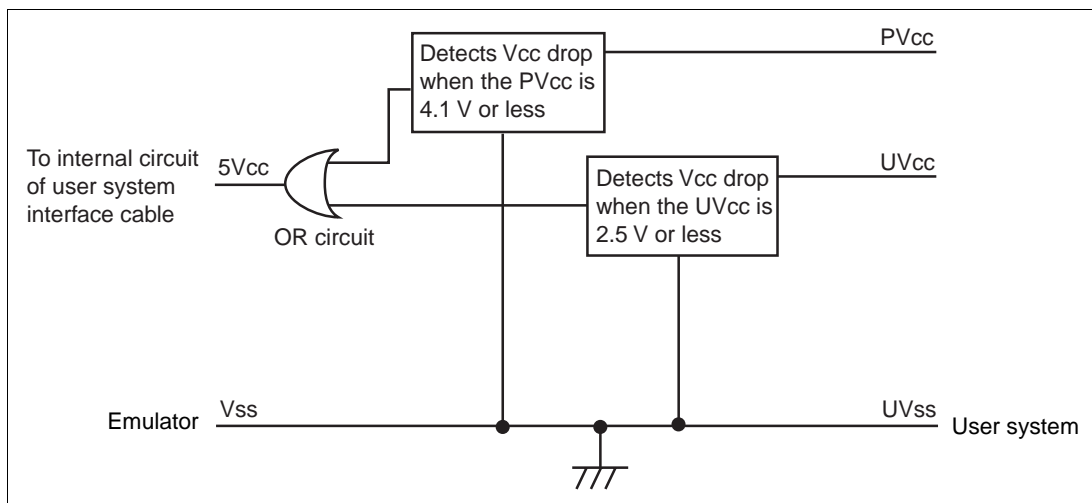
Figure 6   User System Interface Circuit for Vcc and Vss

(5) Other digital signals
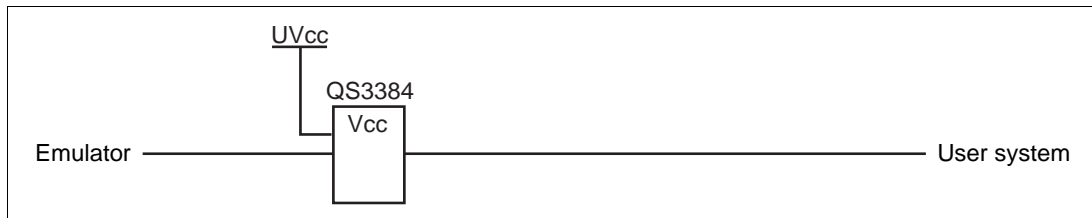
Figure 7   User System Interface Circuit for Other Digital Signals

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Note: 5Vcc, Uvcc, and Uvss represent Vcc and Vss on a user system. 5Vcc represents Vcc (5 V) generated in the user system interface cable.

Section 5   Notes on Emulation

This user system interface cable supports the SH7018F. The following settings must be made prior to emulation.

5.1   Setting Internal ROM

Set 32 kbytes for internal ROM size. Even when 32 kbytes is set for this emulator, a 256-kbytes area is effective. However, since the flash memory capacity of the SH7018 is 160 kbytes, programming must be performed so that the 160-kbytes capacity is not exceeded.

5.2   Setting Pin Function Controller

Since the initial register values when the emulator is used differ from those of the SH7018F, as shown in table 4, the initial settings must be made by the user program.

Table 4   Pin Function Controller Settings

| Register name	Symbol	Address	Initial Value when Emulator is Used	Initial Value for SH7018F
Port A control register L2	PACRL2	H'FFFF838E H'FFFF838F	H'0140	H'0000
Port B control register 1	PBCR1	H'FFFF8398 H'FFFF8399	H'000A	H'0000
Port B control register 2	PBCR2	H'FFFF839A H'FFFF839B	H'A000	H'0000

Note that the initial values of the pin function for the emulator differ from those of the SH7018F, as shown in table 5 (initial values are shaded).

Table 4   Pin Function Controller Settings

Pin No.	Emulator	SH7018F
28	PB6/IRQ4/A18/BACK	PB6/A18
29	PB7/IRQ5/A19/BREQ	PB7/A19
31	PB9/IRQ7/A21/ADTRQ	PB9/IRQ7/A21
46	PB8/IRQ6/A20/WAIT	PB8/IRQ6/A20/WAIT
48	PA4/ TXD1	PA4/TXD1
49	PA3/ RXD1	PA3/RXD1

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Section 6   Connection Procedures

6.1   Connecting User System Interface Cable to Emulator Station

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⚠ WARNING

Observe the precautions listed below. Failure to do so will result in a FIRE HAZARD and will damage the user system and the emulator product or will result in PERSONAL INJURY. The USER PROGRAM will be LOST.

1. Always switch OFF the user system and the emulator product before the USER SYSTEM INTERFACE CABLE is connected to or removed from any part. Before connecting, make sure that pin 1 on both sides are correctly aligned.
2. The user system interface cable dedicated to the emulator must be used.

To connect the cable body to the emulator station, follow the instructions below.

1. Make sure the user system and emulator station are turned off.

CAUTION

When connecting or removing the user system interface cable, apply force only in the direction suitable for connection or removal, while making sure not to bend or twist the cable or connectors. Otherwise, the connectors will be damaged.

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2. After making sure the direction of the cable body connector is correct, firmly insert the cable body connector into the emulator station socket (figure 8).

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Emulator station

Cable body connector

User system interface cable
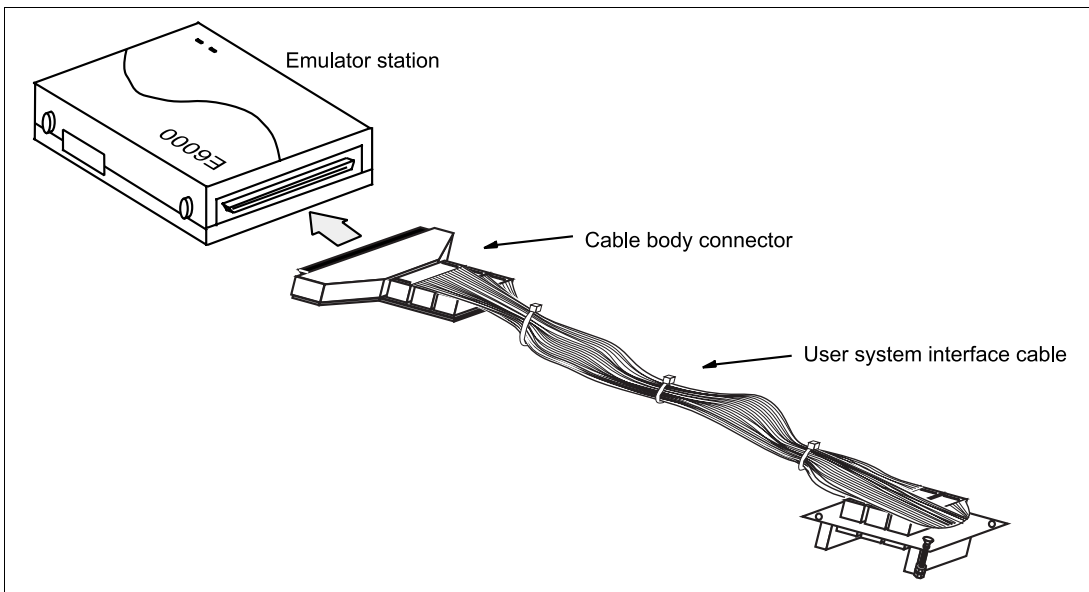
Figure 8   Connecting User System Interface Cable to Emulator Station

6.2   Connecting User System Interface Cable to User System

⚠ WARNING

Always switch OFF the user system and the emulator product before the USER SYSTEM INTERFACE CABLE is connected to or removed from any part. Before connecting, make sure that pin 1 on both sides are correctly aligned. Failure to do so will result in a FIRE HAZARD and will damage the user system and the emulator product or will result in PERSONAL INJURY. The USER PROGRAM will be LOST.

To connect the cable head to the user system, follow the instructions below.

6.2.1   Installing IC Socket

After checking the location of pin 1 on the IC socket, apply epoxy resin adhesive to the bottom of the IC socket for a TFP-100B package, and fasten it to the user system before soldering.

6.2.2   Soldering IC Socket

After fastening, solder the IC socket for a TFP-100B package to the user system. Be sure to completely solder the leads so that the solder slops gently over the leads and forms solder fillets. (Use slightly more solder than the MCU.)

6.2.3 Inserting Cable Head

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CAUTION

Check the location of pin 1 before inserting.
If the IC socket is not connected properly, the power-supply
pins will be shorted as shown below.

| 90° rotation	180° rotation	270° rotation
25 (Vss) —— 100 (Vcc)	15 (Vcc) —— 65 (Vss)	30 (Vcc) —— 55 (Pvcc)
55 (PVcc) —— 30 (Vcc)	39 (Vcc) —— 89 (Vss)	74 (Vcc) —— 99 (Avcc)
99 (Avcc) —— 74 (Vcc)		100 (Vcc) —— 25 (Vss)

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Align pin 1 on the IC socket for a TFP-100B package on the user system with pin 1 on the user system interface cable head, and insert the user system interface cable head into the IC socket on the user system, as shown in figure 9.

6.2.4 Fastening Cable Head

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CAUTION

1. **Use a Philips-type screwdriver whose head matches the screw head.**

2. **The tightening torque must be 0.294 N•m or less. If the applied torque cannot be accurately measured, stop tightening when the force required to turn the screw becomes significantly greater than that needed when first tightening. If a screw is tightened too much, the screw head may break or an IC socket contact error may be caused by a crack in the IC socket solder.**

3. **If the emulator does not operate correctly, cracks might have occurred in the solder. Check conduction with a tester and re-solder the IC socket if necessary.**

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Fasten the user system interface cable head to the IC socket for a TFP-100B package on the user system with the four screws (M2.6 x 12 mm; with four flat washers) provided. Each screw should be tightened a little at a time, alternating between screws on opposing corners. Take special care, such as manually securing the IC socket soldered area, to prevent the soldered IC socket from being damaged by overtightening the screws or twisting the components.
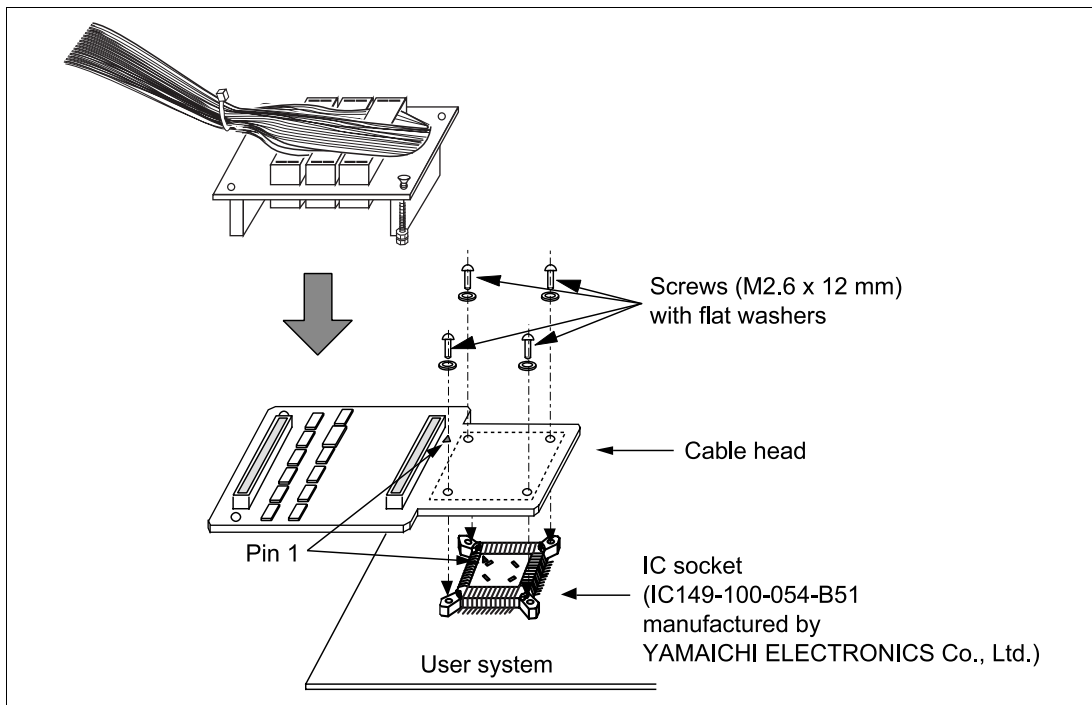
Figure 9   Connecting User System Interface Cable to User System

6.2.5   Fastening Cable Body

Connect the cable body to the cable head.
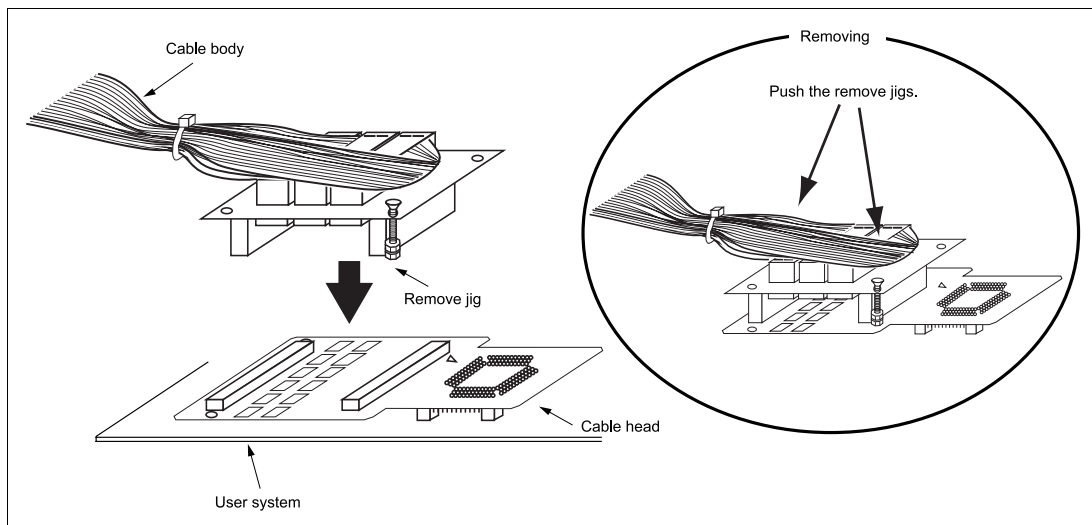
Figure 10   Fastening Cable Body

6.3   Recommended Dimensions for User System Mount Pad

Figure 6 shows the recommended dimensions for the mount pad (footprint) for the user system with an IC socket for a TFP-100B package (IC149-100-054-B51: manufactured by YAMAICHI ELECTRONICS Co., Ltd.). Note that the dimensions in figure 5 are somewhat different from those of the actual chip's mount pad.
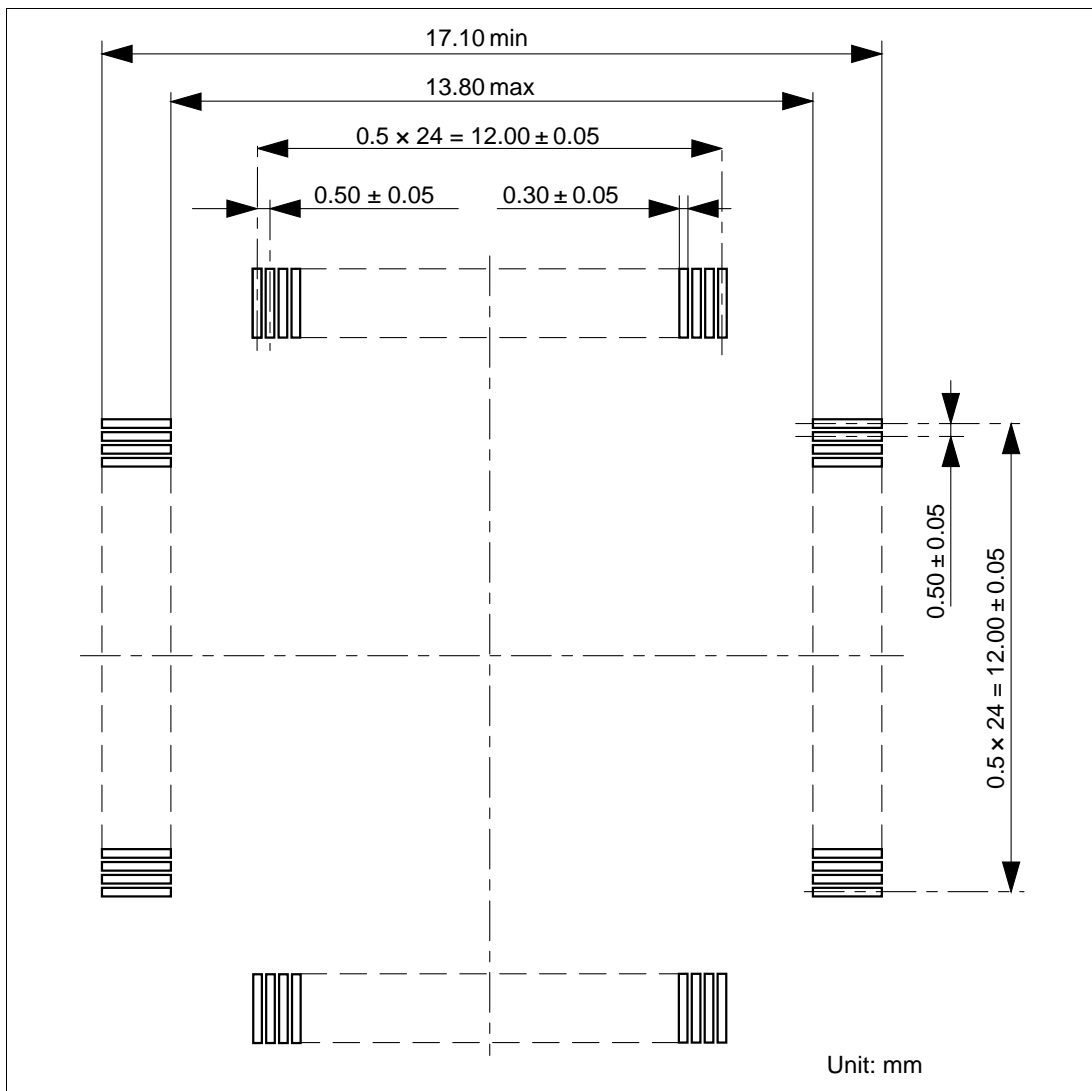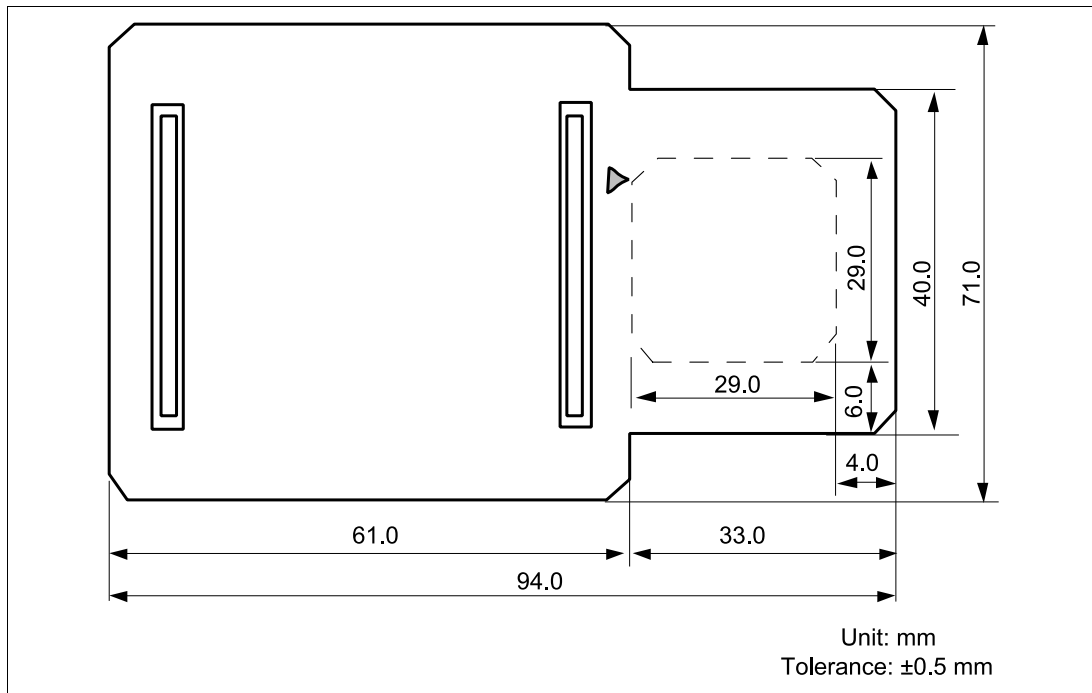

Figure 11   Recommended Dimensions for Mount Pad

6.4　Dimensions for User System Interface Cable Head

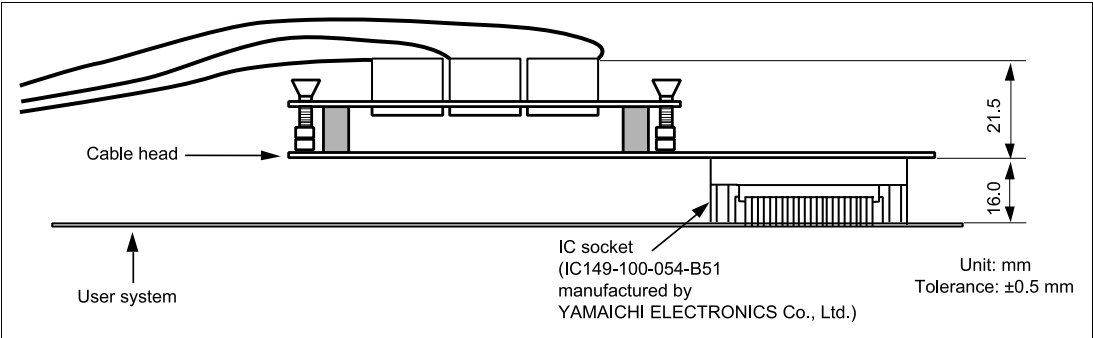The dimensions for the user system interface cable head are shown in figure 12.

Figure 12　Dimensions for User System Interface Cable Head

6.5 Resulting Dimensions after Connecting User System Interface Cable

The resulting dimensions, after connecting the user system interface cable head to the user system, are shown in figure 13.
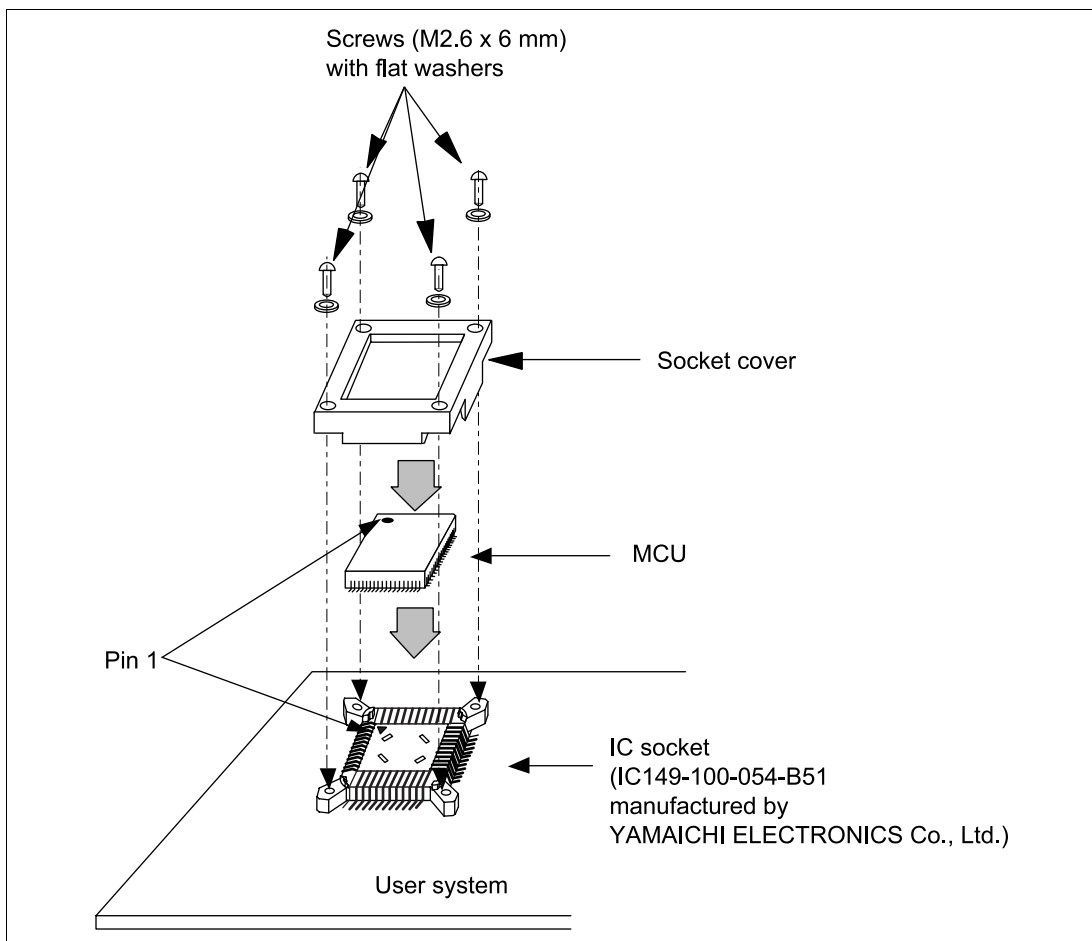

Figure 13   Resulting Dimensions after Connecting User System Interface Cable

Section 7   Installing the MCU to the User System

CAUTION

1. **Check the location of pin 1 before inserting.**

2. **Use a Philips-type screwdriver whose head matches the screw head.**

3. **The tightening torque must be 0.294 N•m or less. If the applied torque cannot be accurately measured, stop tightening when the force required to turn the screw becomes significantly greater than that needed when first tightening. If a screw is tightened too much, the screw head may break or an IC socket contact error may be caused by a crack in the IC socket solder.**

4. **If the MCU does not operate correctly, cracks might have occurred in the solder. Check conduction with a tester and re-solder the IC socket if necessary.**

Check the location of pin 1 before inserting the MCU into the IC socket on the user system, as shown in figure 14. After inserting the MCU, fasten the socket cover with the provided four screws (M2.6 x 6 mm; with four flat washers). Take special care, such as manually securing the IC socket soldered area, to prevent the IC socket from being damaged by overtightening the screws or twisting the components.

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Screws (M2.6 x 6 mm)
with flat washers

Socket cover

MCU

Pin 1

IC socket
(IC149-100-054-B51
manufactured by
YAMAICHI ELECTRONICS Co., Ltd.)

User system

Figure 14   Installing MCU to User System

Section 8 Verifying Operation

1. When using the E6000 emulator for the SH series, turn on the emulator according to the procedures described in the SH Series E6000 Emulator User's Manual (HS7000EPI60HE).

2. Verify the user system interface cable connections by accessing the external memory and ports to check the bus states of the pins with the MEMORY_FILL command (emulator command). If an error is detected, recheck the soldered IC socket and the location of pin 1.

3. The emulator connected to this user system interface cable supports two kinds of clock sources as the MCU clock: an emulator internal clock and an external clock on the user system. For details, refer to the Emulator Supplementary Information (HS7010EPI60HE).

   — To use the emulator internal clock
   Select the clock in the emulator station as the system clock (φ), by using the CLOCK command (emulator command).

   — To use the external clock on the user system
   Select the target clock (Target) as the system clock (φ), by using the CLOCK command (emulator command). Supply the external clock from the user system to the emulator by inputting the external clock from the EXTAL terminal (pin 68) on the cable head (operates at 4 to 20 MHz) or connecting a crystal oscillator to the EXTAL and XTAL terminals (the frequency must be 4 to 20 MHz). For details, refer to section 4, Clock Pulse Generator (CPG), in the SH7010 Series Hardware Manual.

   Figure 15 shows the oscillator circuit on the user system interface cable.
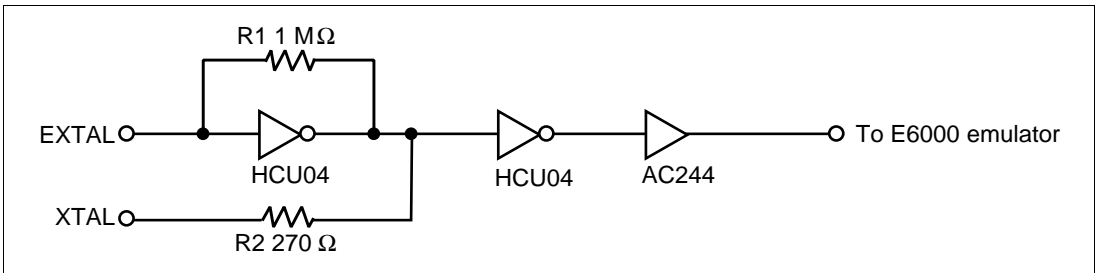
Figure 15   System Clock Oscillator

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Section 9   Notice

1. Make sure that pin 1 on the user system IC socket is correctly aligned with pin 1 on the cable head before inserting the cable head into the user system IC socket.

2. The dimensions of the recommended mount pad for the user system IC socket are different from those of the MCU.

3. This user system interface cable is specifically designed for the HS7010EPI60H emulator. Do not use this cable with any other emulator station.

4. To prevent breaking of wires in the cable body, do not place heavy or sharp metal objects on the user system interface cable.

5. While the emulator station is connected to the user system with the user system interface cable, force must not be applied to the cable head. Place the emulator station, user system interface cable, and user system as shown in the example in figure 15.
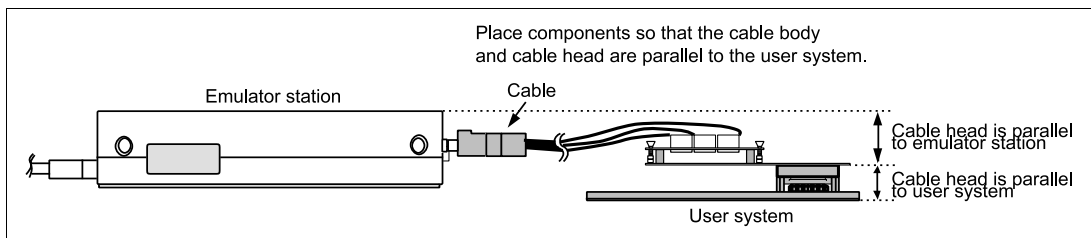
Figure 16   User System Interface Cable Location Example