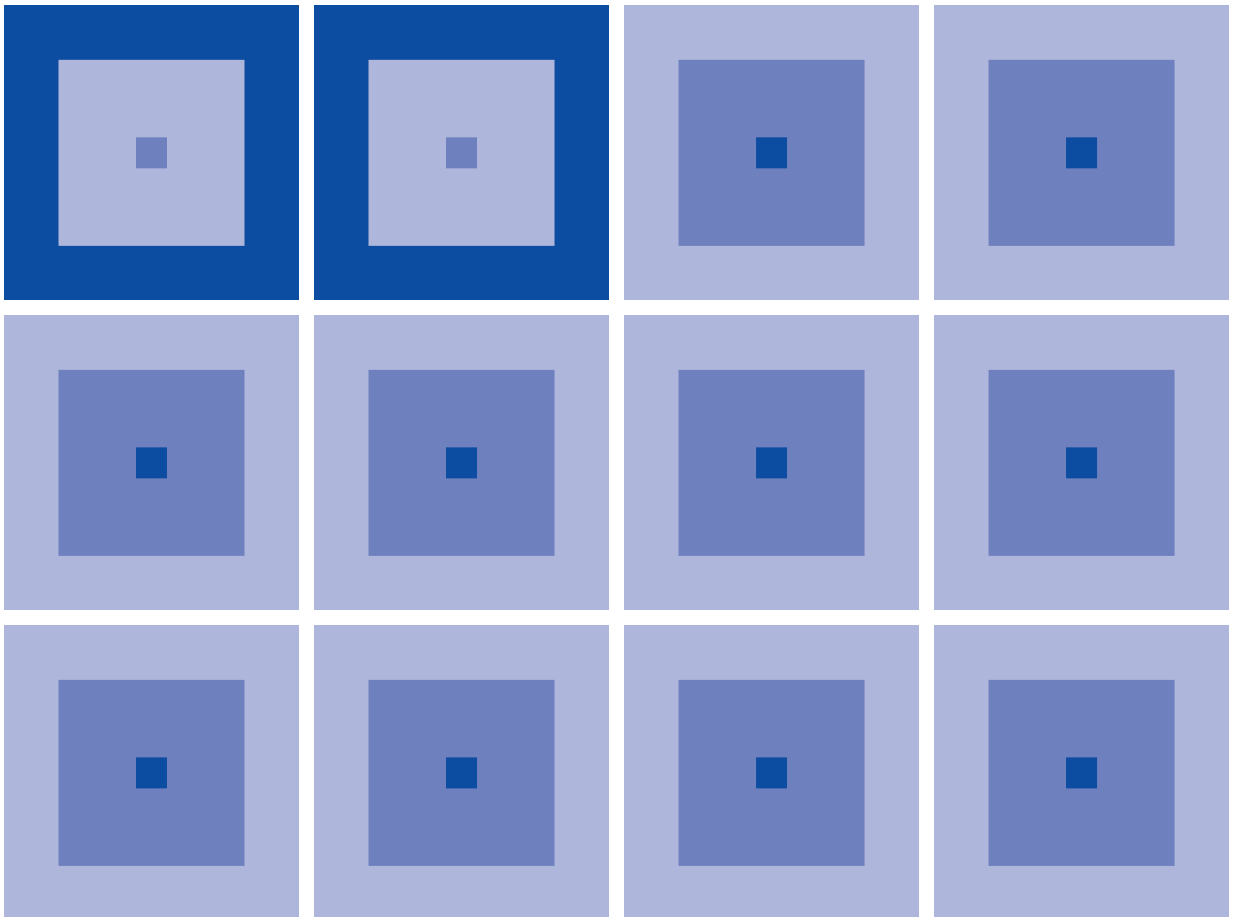


CMOS 8-BIT SINGLE CHIP MICROCOMPUTER

S5U1C88000H5 Manual

(S1C88 Family In-Circuit Emulator)



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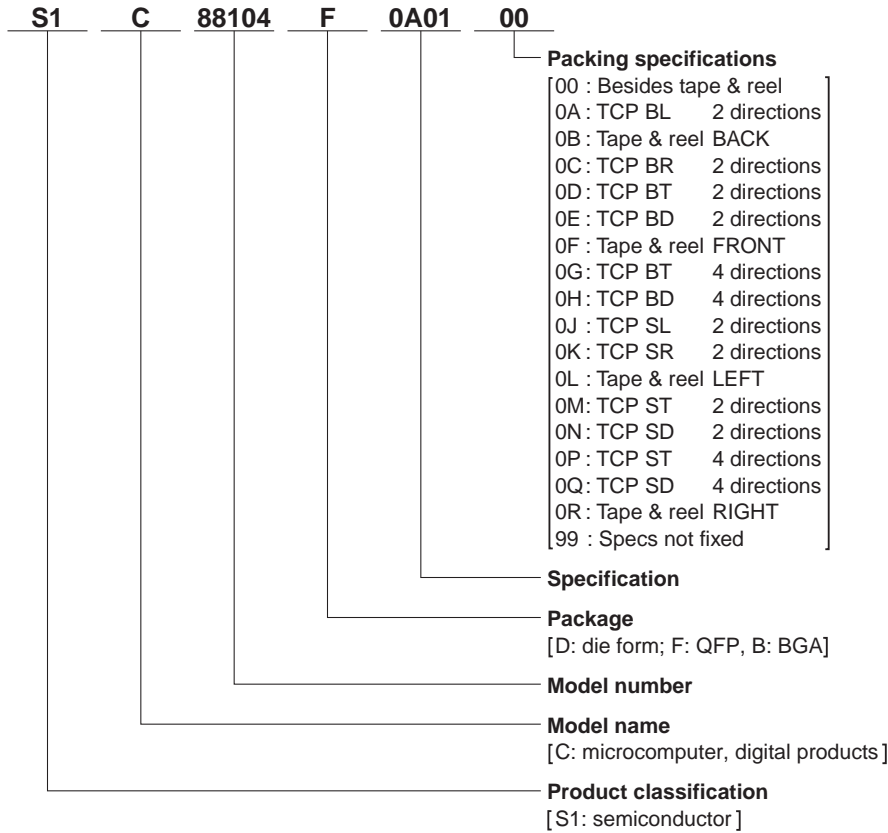
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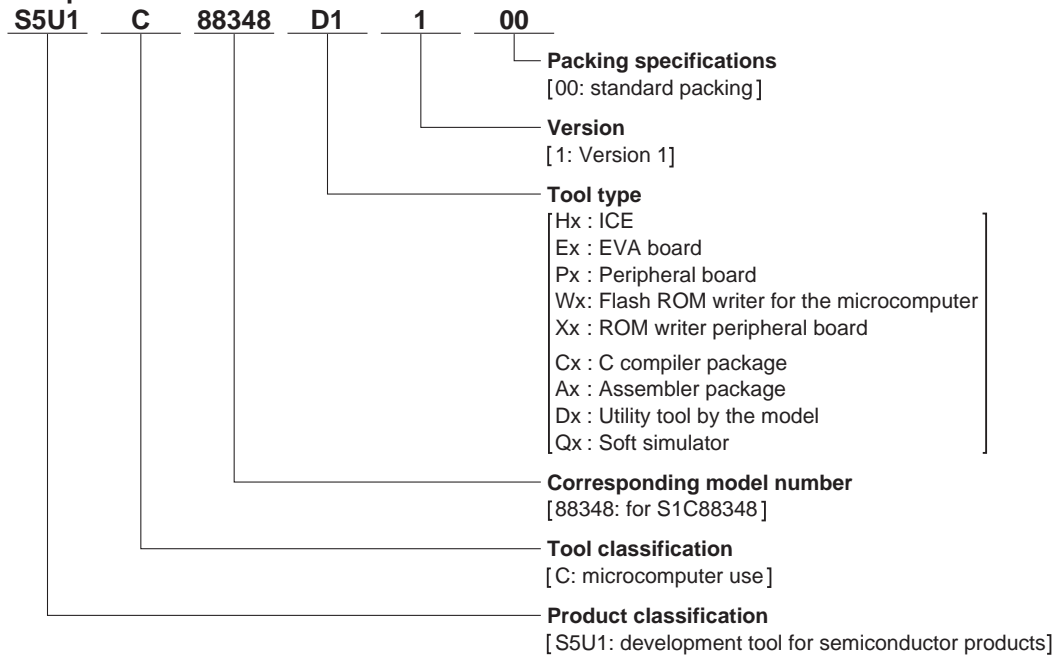
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Configuration of product number

Devices



Development tools



S5U1C88000H5 Manual (S1C88 Family In-Circuit Emulator)

This manual explains the use of the in-circuit emulator (S5U1C88000H5), setting up the system and starting up the debugger.

For the functions and operations of the debugger, see the help topics displayed in the debugger.

See also the tool manuals below which are provided for each model.

- S5U1C88xxxP Manual

- S5U1C88xxxD Manual or S1C88 Family Development Tool Manual

CONTENTS

| | | |
|------------------|--|-----------|
| CHAPTER 1 | PREFACE | 1 |
| 1.1 | Outline | 1 |
| 1.2 | Operating Environment | 1 |
| CHAPTER 2 | S5U1C88000H5 PACKAGE | 2 |
| 2.1 | Components | 2 |
| 2.2 | Component Specifications | 2 |
| CHAPTER 3 | IN-CIRCUIT EMULATOR (S5U1C88000H5) | 3 |
| 3.1 | Outline | 3 |
| 3.2 | Operating Environmental Conditions | 3 |
| 3.3 | Specifications of Operation Panel | 4 |
| CHAPTER 4 | SETTING UP EQUIPMENT | 5 |
| CHAPTER 5 | INSTALLING SOFTWARE | 6 |
| CHAPTER 6 | OPERATION | 8 |
| 6.1 | Starting up S5U1C88000H5 for Windows | 8 |
| 6.2 | End Procedure | 9 |
| 6.3 | Initial Setup File (ICE88UR.INI) and Parameter File (.PAR) | 9 |
| 6.4 | Debugging | 9 |
| CHAPTER 7 | PRECAUTIONS | 10 |
| APPENDIX | LIST OF MENUS, SHORTCUT KEYS AND DEBUG COMMANDS | 11 |

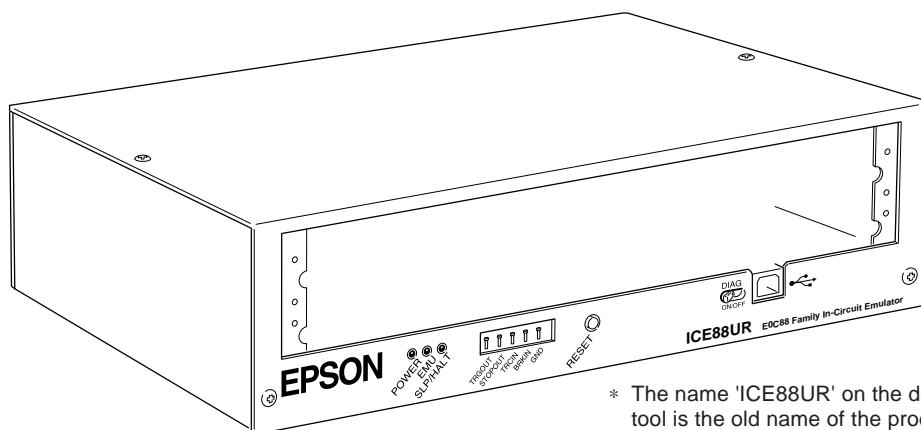
CHAPTER 1 PREFACE

1.1 Outline

The S5U1C88000H5 package, one of the software development tool packages for the 8-bit single chip microcomputer S1C88 Family, consists of an in-circuit emulator (S5U1C88000H5) and a debugger (S5U1C88000H5 for Windows). It allows the programmer to efficiently debug the target system and the target program.

This system can be used for all the S1C88 Family models. The S5U1C88000H5 in-circuit is compatible with each model of the S1C88 Family by installing the Peripheral Circuit Board (S5U1C88xxxP) that is provided for each model.

The S5U1C88000H5 system provides an advanced software developing environment that uses a personal computer as the host computer.



* The name 'ICE88UR' on the development tool is the old name of the product.

Fig. 1.1.1 S5U1C88000H5 external view

1.2 Operating Environment

To construct an S5U1C88000H5 system, the following equipment is necessary in addition to this package:

Personal computer

- IBM-PC/AT or compatible model with Windows 2000 or Windows XP installed.
- 80486DX2 66 MHz CPU or higher and 24MB RAM are recommended.
- A USB port is required in the personal computer.
- A hard disk drive, a 3.5" floppy disk drive (1.44MB) and a mouse are required.

Display unit

- A 16 or more color display.
- 1024 × 768 dot display is recommended.

Peripheral Circuit Board, other development tools

- Prepare the Peripheral Circuit Board and development tools (software) for the model to be developed.

Basic software

- The S5U1C88000H5 system is compatible with Windows 2000 or Windows XP. Note that it is not guaranteed to work with other versions.

CHAPTER 2 S5U1C88000H5 PACKAGE

2.1 Components

After unpacking the S5U1C88000H5 package, check to see that all the following components are included. Figure 2.1.1 shows the package drawing.

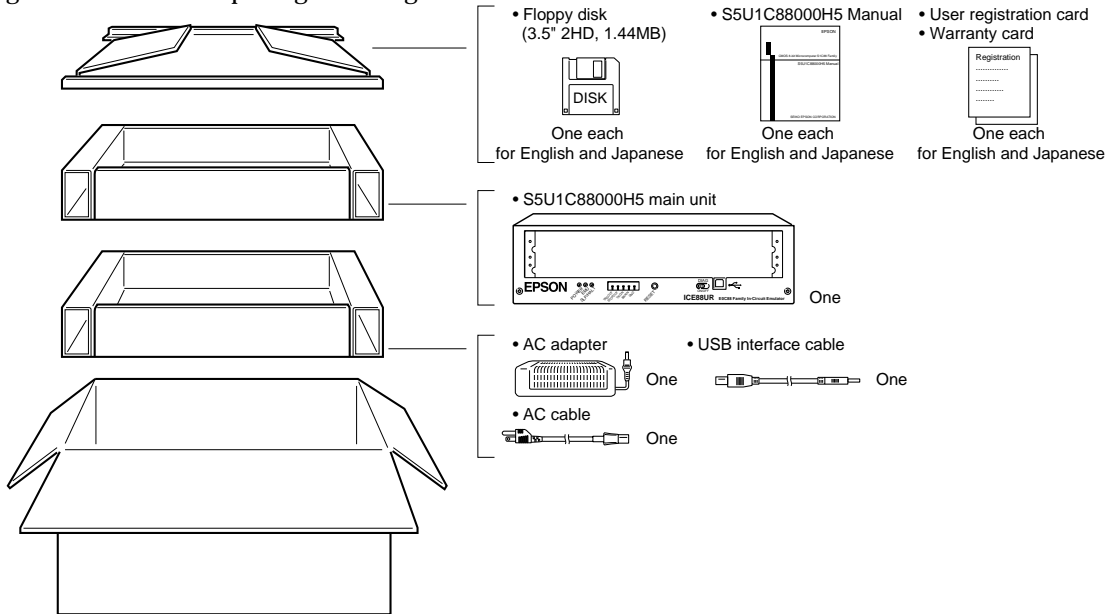


Fig. 2.1.1 S5U1C88000H5 package

2.2 Component Specifications

Table 2.2.1 shows the component specifications in the S5U1C88000H5 package.

Table 2.2.1 S5U1C88000H5 component specifications

| Components | Items | Specifications | Remarks |
|------------------------|-------------------------|---|---|
| S5U1C88000H5 main unit | Dimensions | 270 (W) × 192 (D) × 79 (H) mm | Rubber feet included |
| | Weight | Approx. 2.5 kg (main body) | |
| | External color | Cygnus white | |
| | Input voltage | DC 5 V | |
| | Current consumption | 2 A, max. | |
| | Board mounted | ICE board (one) | Peripheral Circuit board is sold separately |
| USB I/F cable | Length | 2 m | |
| AC adapter | Dimensions | 160 × 80 × 60 mm | Rubber feet excluded |
| | Input voltage | AC 90 V to 264 V | |
| | Input frequency | 47 Hz to 63 Hz | |
| | Power consumption | 25 W, max. (in ICE system load) | |
| | Output voltage/current | DC 5 V/5 A, with overcurrent protection | Outside: 5 V, Inside: 0 V |
| AC cable | Length | 1.8 m | |
| | Plug type | Bipolar with ground | |
| Accessories | System disk | 3.5" 2HD, 1.44MB (two) | One each for English and Japanese |
| | Manual | S5U1C88000H5 Manual | |
| | Warranty card | | |
| | User registration card | | |
| Package | Dimensions | 380 (W) × 260 (D) × 225 (H) | |
| | Materials | W carton, cardboard | |
| | Total weight of package | Approx. 4 kg | |

CHAPTER 3 *IN-CIRCUIT EMULATOR (S5U1C88000H5)*

3.1 *Outline*

The S5U1C88000H5 emulates the functions of the S1C88 core CPU and is used by installing a Peripheral Circuit Board for each model. The S5U1C88000H5 is connected to a personal computer via the USB port. The following shows the features of the S5U1C88000H5:

- Supports all the S1C88 Core CPU models
- 576KB of emulation memory built-in
- Advanced emulation functions (continuous execution, step execution, trace, break, coverage, etc...)
- On-the-fly function for real time monitoring memory.

See help topics of the debugger for details of the debugging functions.

Emulation Memory

The S5U1C88000H5 built-in emulation memory consists of the following two parts:

(1) 64KB emulation memory

This part corresponds to a 64KB area from address 000000H to address 00FFFFH in the accessible memory space of the S1C88 core CPU.

(2) 512KB emulation memory

This part can be allocated to a 512KB area within address 010000H to address FFFFFFFH. To allocate the emulation memory to a 512KB area to be used, specify the address in a parameter file that is read at the S5U1C88000H5 system start-up.

Thus the emulation memory can be used as an external memory that is generally prepared on the target board if the capacity of the external memory is 512KB or less. It is especially useful for debugging systems that have ROMs as the external memories.

Further, external RAM on the target board can also be debugged like the emulation memory.

See the development tool manual of the model to be developed or the "S1C88 Family Development Tool Manual" for specifying memory configuration.

3.2 *Operating Environmental Conditions*

Table 3.2.1 shows the environmental conditions that have to be used to operate the S5U1C88000H5.

Table 3.2.1 Environmental conditions

| Items | Specifications | Remarks |
|-------------------------|--|-----------------|
| Operating temperature | 5 to 40 °C | |
| Storage temperature | -10 to 60 °C | |
| Operating humidity | 35 to 80% | |
| Storage humidity | 20 to 90% | No condensation |
| Resistance to vibration | Operating: 0.25 m/S ² Transportation: 1 m/S ² | |

3.3 Specifications of Operation Panel

Figure 3.3.1 shows the external view of the panels and Table 3.3.1 shows the function of each part of the panels.

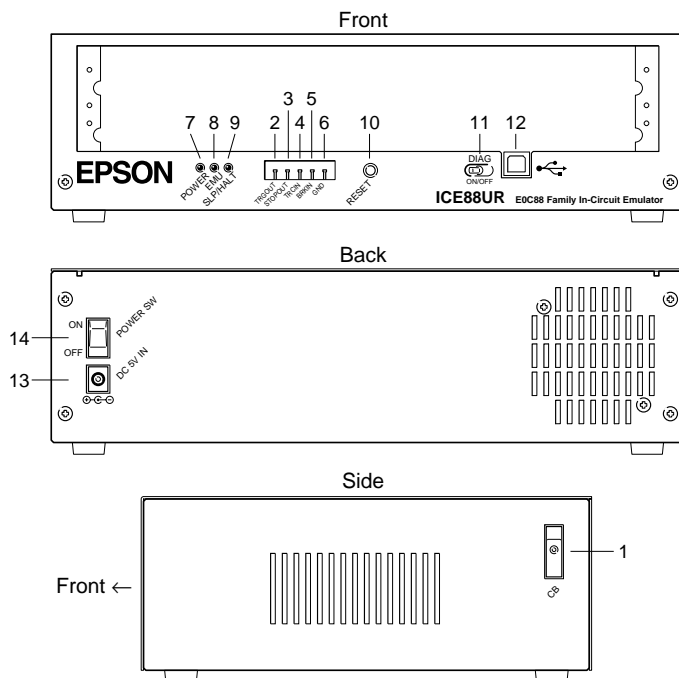


Fig. 3.3.1 External view of S5U1C88000H5 panels

Table 3.3.1 Function list of operation parts

| No. | Position | Indicated symbol | Name | Function |
|-----|----------|------------------|--|---|
| 1 | Side | CB | Circuit breaker | The breaker cuts off the power of the S5U1C88000H5 system (ICE board, Peripheral Circuit board and target board) at consumption current of 4 A or more. A small staff of the breaker comes up at the shut-off. The staff should be at the recessed position for normal operating status. The breaker does not work at the normal operation. |
| 2 | Front | TRGOUT | Tracing trigger output terminal | Upon coincidence of trigger conditions with a tracing trigger point, a pulse is output from this terminal. |
| 3 | Front | STOPOUT | HALT/SLEEP status output terminal | When the S1C88 CPU is in HALT or SLEEP status, low level signal is output from this terminal. This is used to measure execution rate of the CPU. At the break mode, low level signal is also output. |
| 4 | Front | TRCIN | Trace input terminal | Information is stored in the trace memory by connection with a signal of the target system. |
| 5 | Front | BRKIN | Break input terminal | A running program enters in break status by input a low level signal from the target system. |
| 6 | Front | GND | Ground terminal for above | In case the above terminal is monitored with such an oscilloscope, the GND line of the oscilloscope is connected to this terminal. This is also used as a GND in case the signals are input to the above terminals. |
| 7 | Front | POWER | Power-on LED | This green LED lights upon power-on of S5U1C88000H5. |
| 8 | Front | EMU | Emulation LED | This red LED lights when the target program is in running status. |
| 9 | Front | SLP/HLT | Halt LED | This yellow LED lights when the S1C88 CPU stops executing the program. |
| 10 | Front | RESET | Reset switch | This switch reset S5U1C88000H5. (for maintenance) |
| 11 | Front | DIAG | Diagnostic switch | Setting up when the S5U1C88000H5 power on, execute the self diagnostic test or not |
| 12 | Front | | Connector for connecting USB interface cable | This is a connector to connect the USB interface cable. |
| 13 | Back | DC 5V | DC input connector | This is a connector to connect the DC cable of the AC adapter dedicated for S5U1C88000H5. |
| 14 | Back | POWER SW | Power switch | Turns the S5U1C88000H5 power on and off. |

Note: In case of change the mode by the diagnostic switch, be sure to shift it at power off the S5U1C88000H5.

CHAPTER 4 SETTING UP EQUIPMENT

Connect the equipment as shown in Figure 4.1.

Note: Be sure to turn all the system equipment off before installation and connection.

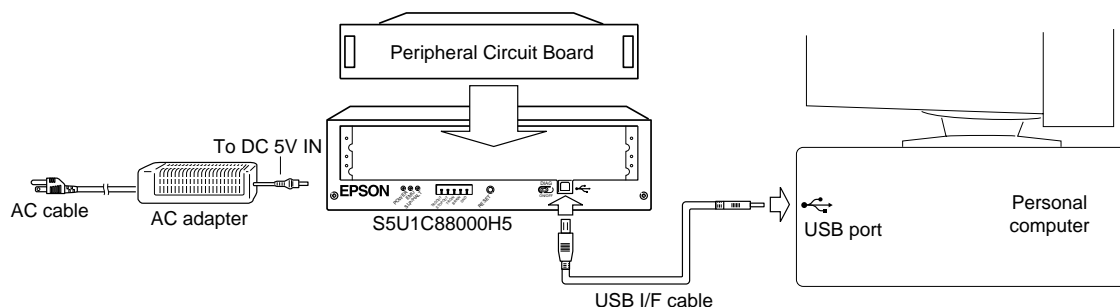


Fig. 4.1 Connection of S5U1C88000H5 system

(1) Installing the Peripheral Circuit Board

Install the Peripheral Circuit Board for the model to be developed to the S5U1C88000H5. The target board is connected to the Peripheral Circuit Board. Refer to the Peripheral Circuit Board manual of each model for how to install the Peripheral Circuit and target boards.

(2) Connecting the USB interface cable

Connect the S5U1C88000H5 to the personal computer using the USB interface cable supplied in this package.

(3) Connecting the AC adapter

Be sure to use the AC adapter supplied in this package for supplying power to the S5U1C88000H5. Connect the DC cord plug of the AC adapter to the DC 5V IN connector of the S5U1C88000H5. For the AC adapter, connect the AC cable supplied in this package. Use the same ground line between the S5U1C88000H5 and the host computer.

Note: Make sure that the equipment is installed and/or connected properly before turning the power on. The USB interface cable can be hot plugged.

CHAPTER 5 *INSTALLING SOFTWARE*

This package contains two 3.5" floppy disks (English and Japanese). Make backup copies before installing the software.

!! Read the Readme.txt file recorded in the disk !!

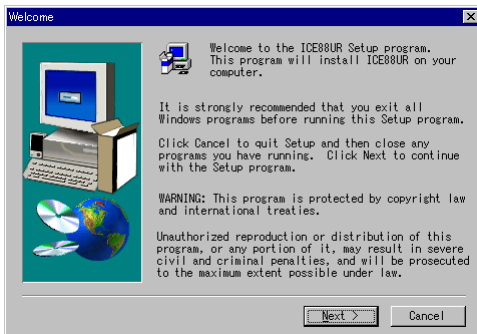
The Readme.txt file contains precautions. Be sure to read it before installing the software.

To install the tools

The debugger software should be installed in the host computer's hard disk using the dedicated installer. Follow the installing procedure described below. The explanation uses mouse operation, i.e. click, but key operation is also available. When using the keyboard, enter the underlined letter on the buttons.



- (1) Start Windows. If the OS is already active, close active programs.
- (2) Insert the supplied disk into the drive.
- (3) Double-click Setup.exe.



Welcome

- (4) Click on the [Next>] button to proceed.



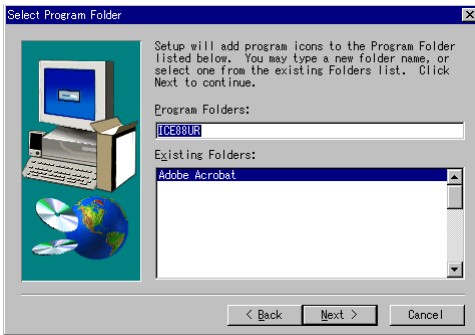
Choose Destination Location

A dialog box for specifying the folder in which to install the tools appears.

- (5) If you do not wish to change the default settings, simply click the [Next>] button to execute installation.

To install in another folder

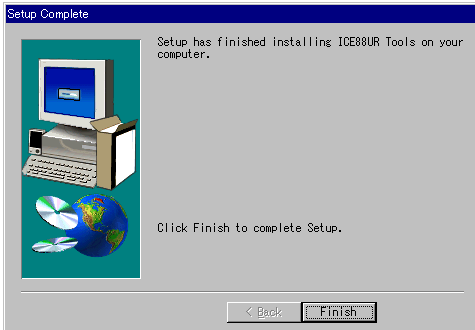
Click [Browse...] to bring up the [Choose Folder] dialog box. From this dialog box, enter the path or select the folder in which to install the tools. Click the [OK] button to finish folder selection and then click the [Next>] button.



Select Program Folder

- (6) Enter the desired program folder name and click the [Next>] button. To use the default folder name, simply click the [Next>] button.

The installer will start installing the tools.



Setup Complete

- (7) Click [Finish] to terminate the installer.

Program menu

The folder of tools is registered to the program menu by the installer.

To end installation

All dialog boxes that appear during installation have a [Cancel] button. To prematurely terminate installation, click [Cancel] in the dialog box when it is displayed.

To uninstall

To uninstall the installed tools, use "Add/Remove Programs" on the Control Panel.

CHAPTER 6 OPERATION

6.1 Starting up S5U1C88000H5 for Windows

The following shows the start-up procedure of the S5U1C88000H5 system.

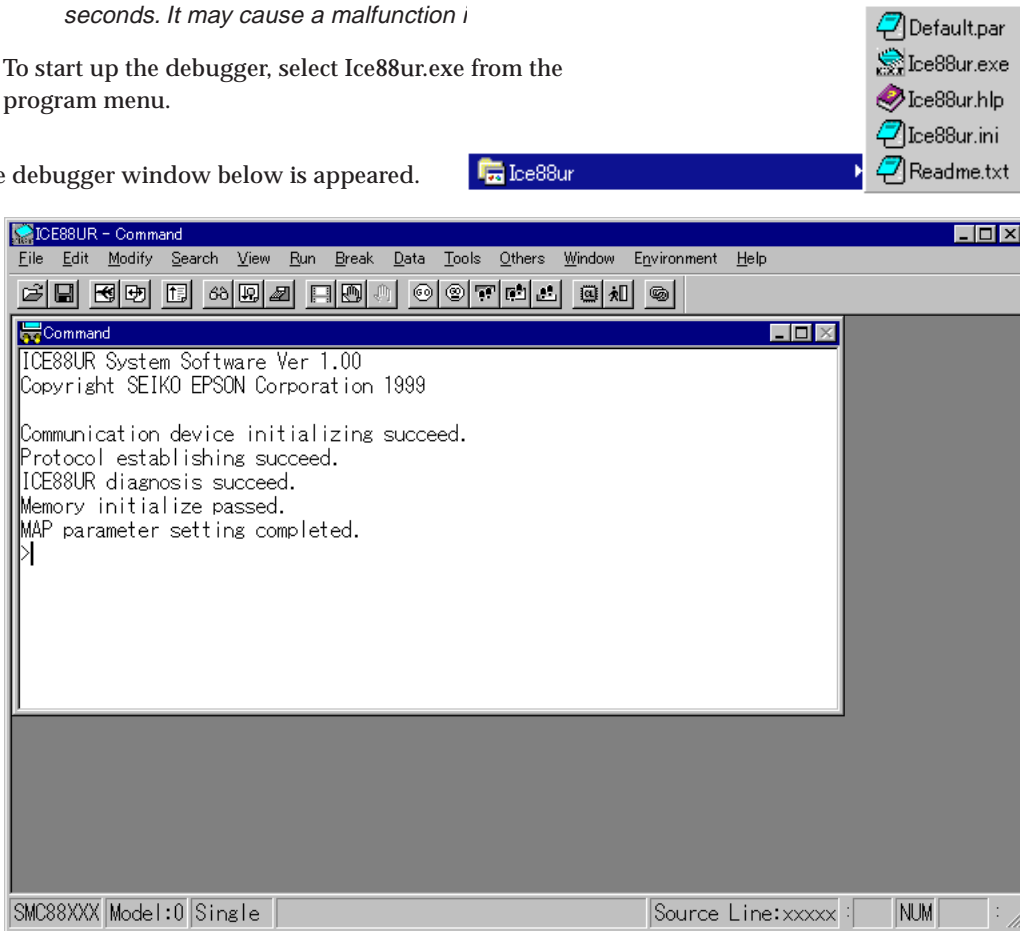
(1) Turn the S5U1C88000H5 in-circuit emulator on.

Note:

- After connecting the S5U1C88000H5 system, make sure that the equipment is installed and connected correctly before turning the power on.
- After the S5U1C88000H5 is turned off, do not turn the S5U1C88000H5 on for at least 10 seconds. It may cause a malfunction i

(2) To start up the debugger, select Ice88ur.exe from the program menu.

The debugger window below is appeared.



The S5U1C88000H5 debugger checks the S5U1C88000H5 hardware and files required. The check result is displayed in the [Command] window. If any error message appears and the debugger does not start up normally, terminate the debugger (choose [Exit] command from the [File] menu), then check the following points.

- Is the Peripheral Circuit Board installed in the S5U1C88000H5 properly?
- Is the S5U1C88000H5 connected to the personal computer with the USB interface cable properly?
- Is the S5U1C88000H5 turned on?
- Is the appropriate parameter file prepared? (see Section 6.3)

6.2 End Procedure

To terminate S5U1C88000H5 for Windows, choose the [Exit] command from the [File] menu. Do not turn the S5U1C88000H5 off until the debugger is terminated.

6.3 Initial Setup File (ICE88UR.INI) and Parameter File (.PAR)

The Ice88ur.ini file installed in the Windows system folder (\windows) contains the following initial setup information for the S5U1C88000H5 debugger.

Model=

A model name to be developed is specified. The model name described here will appear on the S5U1C88000H5 status bar.

Example: Model=E0C88316

Path=

A parameter file is specified.

The parameter file (.PAR) contains the memory mapping information for the model to be developed and information for allocating an external memory area to the S5U1C88000H5 emulation memory. It is read into the debugger (S5U1C88000H5 for Windows) at start-up. The development tool package for each model includes a parameter file that contains a basic memory configuration. It is necessary to customize the contents if the system to be developed has an external memory. Refer to the development tool manual of each model or the "S1C88 Family Development Tool Manual" for the contents of the parameter file and how to customize it.

The installer in this package installs the parameter file "Default.par" for starting up the debugger in the same folder as the debugger program and sets it as the default parameter file so that the debugger will read the file at start-up. To set the debugger to read an actual parameter file used for development, it is necessary to rewrite this Path= specification so that the necessary parameter file will be read in.

Example: Path=DEFAULT.PAR → Path=C:\E0C88\DEV88316\88316.PAR

When specifying a parameter file existing in the same folder as the debugger program (Ice88ur.exe), rewrite the file name only. When specifying a parameter file existing in another folder, the path should be described.

CCFile=

A command chain file is specified. When a command chain file name is entered here, the S5U1C88000H5 debugger will automatically execute the commands described in the specified file after it starts up. Use the command chain file for the S5U1C88000H5 environment configuration and loading program and option files after starting up.

Example: CCFile=C:\E0C88\DEV88316\test.com

When specifying a command chain file existing in the same folder as the debugger program (Ice88ur.exe), rewrite the file name only. When specifying a command chain file existing in another folder, the path should be described.

6.4 Debugging

To read a target program and to debug the program, choose the command from the menu, click the tool bar button, or enter the debug command directly in the [Command] window.

See Help in the debugger for debugging functions, operations and details of the debug commands.

To open the help window, choose the [Index...] command from the [Help] menu. The contents of the help topics appear. Clicking an underlined item jumps to the topic.

CHAPTER 7 PRECAUTIONS

(1) Connecting and disconnecting the equipment

Be sure to turn the personal computer and the S5U1C88000H5 off when installing the Peripheral Circuit Board or connecting cables and disconnecting them. Otherwise, the internal circuits of the equipment may be destroyed.

(2) Turning the power on and off

Do not turn the S5U1C88000H5 on for at least 10 seconds after it is turned off. Turning the power on without the interval may result in abnormal operation of the S5U1C88000H5 or in the circuit breaker cutting off. It may also cause a malfunction.

(3) Overcurrent protection

When the S5U1C88000H5 is turned on under the condition that V_{DD} and V_{SS} are short-circuited on the target system, the AC adapter cuts off the output current due to the overcurrent protection function.

In this case, the Power LED on the S5U1C88000H5 does not light up.

3 A or a more steady-state current on the target system cuts off the circuit breaker of the S5U1C88000H5.

(4) Difference between the emulation memory and the RAM in the actual IC

Both the S5U1C88000H5 emulation memory and the RAM in the actual IC are undefined at power-on. The set values are not same, therefore be sure to initialize the memory with the program.

(5) Difference between memory operations by the debugging commands and memory access by programs














Memory dump and other memory operations by the debugging commands use the firmware clock (default: 4 MHz) in the S5U1C88000H5. Memory access by the target program uses an emulation clock similar to the actual IC. Therefore, the read data may differ between the program and the debug command when low-speed devices or devices that delay outputting data are used on the target board. In such cases, use a low-frequency firmware clock set by the debugging command (CLK command).

(6) Setting up USB port









USB functions may be disabled in some personal computers by default. Make sure that the USB port is enabled and setup the BIOS configuration of the personal computer if necessary.

Do not connect the plural S5U1C88000H5 to the USB port. One personal computer can be connected only one S5U1C88000H5.

APPENDIX LIST OF MENUS, SHORTCUT KEYS AND DEBUG COMMANDS

| | Menu | Shortcut key | Button | Function | Command |
|----------|------------------------|-----------------------|---|---|---------|
| [File] | [Open...] | Ctrl + O |  | Loading program | LF |
| | [Save...] | Ctrl + S |  | Saving program | SF |
| | [Options...] | Ctrl + Shift + O | --- | Loading options | LO |
| | [Symbol] | --- | --- | Loading/saving symbols | LS, SS |
| | [Condition] | --- | --- | Loading/saving conditions | LC, SC |
| | [Log...] | Ctrl + L | --- | Logging | LOG |
| | [Exit] | Alt + F4 | --- | Terminating debugger | Q |
| [Edit] | [Copy] | Ctrl + C, Ctrl + INS | --- | Copy to clip board | --- |
| | [Paste] | Ctrl + V, Shift + INS | --- | Paste from clip board | --- |
| [Modify] | [Assemble...] | Ctrl + A | --- | Assembly | A |
| | [Edit...] | Ctrl + E | --- | Editing memory contents | E |
| | [Fill...] | Ctrl + F | --- | Filling memory area | F |
| | [Move...] | --- | --- | Copy memory | M |
| | [Move to em...] | --- | --- | Copy target memory to emulation memory | MVE |
| | [Register...] | Ctrl + R |  | Modifying registers | R |
| [Search] | [Data...] | Shift + F3 | --- | Data search | DS |
| | [Symbol...] | F3 | --- | Symbol search | SYS |
| | [Trace...] | Ctrl + F3 | --- | Trace memory search | TS |
| [View] | [Source-Source level] | Ctrl + 1 |  | C source display | SET |
| | [Source-ASM Mix] | Ctrl + 2 |  | C source & disassembly display | SET |
| | [Source-ASM] | Ctrl + 3 |  | Disassembly display | SET |
| | [Dump...] | Ctrl + D | --- | Memory dump | D |
| | [Trace...] | Ctrl + T |  | Trace data dump | TD |
| | [Coverage] | --- | --- | Coverage display | CV |
| | [List...] | Alt + F3 |  | Specifying program display location | LI |
| | [Map] | --- | --- | Memory mapping information display | MA |
| [Run] | [Go] | F5 |  | Program execution | G |
| | [Go from Reset] | Shift + F5 |  | Program execution after resetting | G |
| | [Go with Options...] | Ctrl + F5 | --- | Program execution from specified location | G |
| | [Step Into] | F8 |  | Step into | SI |
| | [Step Over] | F10 |  | Step over | SO |
| | [Step Exit] | Shift + F7 |  | Step exit | SE |
| | [Animate-Step Into...] | Alt + F8 | --- | Step into with step count | SI |
| | [Animate-Step Over...] | Alt + F10 | --- | Step over with step count | SI |

APPENDIX LIST OF MENUS, SHORTCUT KEYS AND DEBUG COMMANDS

| Menu | Shortcut key | Button | Function | Command | |
|---------------|--------------------|-------------------|---|--|-----------|
| [Break] | [Full Area...] | Shift + F9 | --- | Setting break points for full area | BA, BAR |
| | [1MB Area...] | F9 |  | Setting break points with area specification | BP, BPR |
| | [Sequence...] | Ctrl + Shift + F9 | --- | Setting sequential break mode | BAS |
| | [Data...] | Ctrl + F9 | --- | Setting data break condition | BD, BDR |
| | [List] | Alt + F9 |  | List of break conditions | BL |
| [Data] | [Symbol...] | Shift + F2 |  | Registering/deleting symbols | SY, SYR |
| | [Parallel Dump...] | Ctrl + F2 |  | Setting parallel dump points | PD, PDR |
| | [Watch...] | F2 |  | Setting watch points | W, WR |
| [Tools] | [Tool bar] | --- | --- | Tool bar on/off | --- |
| | [Status bar] | --- | --- | Status bar on/off | --- |
| [Others] | [Macro] | --- | --- | Macro | MC, MCR |
| | [Stub] | --- | --- | Stub | STB, STBR |
| | [Scope] | --- | --- | Function name display | SCP |
| | [Calculation...] | --- | --- | Calculation | CAL |
| | [Command Chain...] | Ctrl + G |  | Command chain | COM |
| | [Variables...] | Ctrl + Shift + F2 | --- | Variable display | VAR |
| | [History...] | Ctrl + H | --- | Command history | --- |
| [Window] | [Cascade] | --- | --- | Arrangement of windows | --- |
| | [Tile Horizon] | --- | --- | Arrangement of windows | --- |
| | [Tile Vertical] | --- | --- | Arrangement of windows | --- |
| | [Arrange Icons] | --- | --- | Arrangement of icons | --- |
| | [1 Source] | Alt + 1 | --- | Opening [Source] window | OW |
| | [2 Dump] | Alt + 2 | --- | Opening [Dump] window | OW |
| | [3 Register] | Alt + 3 | --- | Opening [Register] window | OW |
| | [4 Parallel dump] | Alt + 4 | --- | Opening [Parallel dump] window | OW |
| | [5 Local] | Alt + 5 | --- | Opening [Local] window | OW |
| | [6 Watch] | Alt + 6 | --- | Opening [Watch] window | OW |
| | [7 Break] | Alt + 7 | --- | Opening [Break] window | OW |
| | [8 Trace] | Alt + 8 | --- | Opening [Trace] window | OW |
| | [9 Coverage] | Alt + 9 | --- | Opening [Coverage] window | OW |
| | [10 Map] | Alt + 0 | --- | Opening [Map] window | OW |
| | [11 Search result] | Alt + Shift + 1 | --- | Opening [Search result] window | OW |
| [12 Stdout] | Alt + Shift + 2 | --- | Opening [STDOUT] window | OW | |
| [Environment] | [Clock Select...] | Shift + F4 | --- | Clock selection | CLK |
| | [CPU Reset] | Ctrl + I |  | CPU reset | RST |
| | [Set...] | F4 | --- | Environment settings | SET |
| | [Trace Mode] | --- | --- | Setting trace mode | TM |
| | [Trace Trigger] | --- | --- | Setting trace trigger point | TP, TPR |
| [Help] | [Index...] | --- | --- | Contents of help | --- |
| | [Using Help...] | --- | --- | How to use help | --- |
| | [About...] | --- | --- | Version display | --- |
| --- | --- | Esc |  | Stop execution | --- |

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