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Renesas Electronics Corporation

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User's Manual

H8S/2628, H8S/2615 Series
E6000 Emulator HS2628EPI61H
Supplementary Information

Renesas Electronics
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Rev.3.0 2003.03

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• KEEP the user's manual handy for future reference.

Do not attempt to use the emulator product until you fully understand its mechanism.

Emulator Product:

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

- Emulator station
- User system interface cables
- PC interface boards
- Optional SIMM memory module

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

Purpose of the Emulator Product:

This emulator product is a software and hardware development tool for systems employing the Hitachi microcomputers H8S/2628, H8S/2615 series (hereafter referred to as the MCU). This emulator product must only be used for the above purpose.

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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 emulator product are therefore not all inclusive. Therefore, you must use the emulator product safely at your own risk.

SAFETY PAGE

READ FIRST

• READ this user's manual before using this emulator product.

• KEEP the user's manual handy for future reference.

Do not attempt to use the emulator product 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.

⚠ 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. **Supply power according to the power specifications and do not apply an incorrect power voltage. Use only the provided power cable.**

CAUTION

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Preface

Thank you for purchasing the H8S/2628, H8S/2615 series E6000 emulator.

The H8S/2628, H8S/2615 series E6000 emulator (hereafter referred to as the E6000) was designed as a software and hardware development tool for systems based on Hitachi's original microcomputers HD64F2628 and HD64F2615.

The E6000 provides a CD-R that contains the Hitachi Debugging Interface (HDI) system program, test program, and the user's manual.

There are three manuals for the E6000: the H8S series E6000 Emulator User's Manual, this Supplementary Information, and the Hitachi Debugging Interface User's Manual. The E6000 Emulator User's Manual describes E6000 functions common to all H8S series microcomputers. This Supplementary Information describes the functions specialized for each microcomputer supported by the H8S/2628, H8S/2615 series E6000 emulator. Please read this manual before using the E6000.

To connect the E6000 to the user system, a user system interface cable for each package type is available. For details on the user system interface cable, refer to the User System Interface Cable User's Manual.

The following shows the related manuals:

- H8S Series E6000 Emulator User's Manual (HS2000EPI61HE)
- Hitachi Debugging Interface User's Manual (HS6400DIIW5SE)
- User System Interface Cable User's Manual (HS2628ECH61HE, HS2615ECH61HE)
- The PC interface board user's manual which will be the following manuals:
  - USB Adapter User's Manual (HS6000EIU01HE)
  - PCI Bus Interface Board User's Manual (HS6000EIC01HE, HS6000EIC02HE)
  - PCMCIA Interface Card User's Manual (HS6000EIP01HE)
  - LAN Adapter (HS6000ELN01HE)

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Section 1 Overview

The H8S/2628, H8S/2615 series E6000 emulator (hereafter referred to as the E6000) is an efficient software and hardware development support tool for application systems using Hitachi's original microcomputers H8S/2628, H8S/2615 series.

1.1 Environment Conditions

Table 1.1 Environment Conditions

Item	Specifications	
Temperature	Operating: +10 to +35°C	
	Storage: –10 to +50°C	
Humidity	Operating: 35 to 80% RH; no condensation	
	Storage: 35 to 80% RH; no condensation	
Ambient gases	No corrosive gases	
AC Power supply voltage	100 V to 240 V AC ±5% 50/60 Hz 0.6 A max.	
AC input cable*	HS2628EPI61H	HS2628EPI61HB
	100 V-120 V (UL)	200 V-240 V (BS)
User system voltage (UVcc)	Depends on the target MCU within the range 4.5 V to 5.5 V	

Note: HS2628EPI61H must be used at AC100 V-120 V input voltage.
HS2628EPI61HB must be used at AC200 V-240 V input voltage.

1.2 Supported MCUs and User System Interface Cables

Tables 1.2 to 1.5 show the correspondence between the MCUs and the user system interface cables supported by the E6000.

Table 1.2 H8S/2628 Series MCU and User System Interface Cable

No.	MCU Type Number	Package	E6000 User System Interface Cable
1	HD64F2628	100-pin QFP (FP-100M)	HS2628ECH61H

Table 1.3 H8S/2615 Series MCU and User System Interface Cable

No.	MCU Type Number	Package	E6000 User System Interface Cable
1	HD64F2615	80-pin QFP (FP-80Q)	HS2615ECH61H

1.3 Operating Voltage and Frequency Specifications

Table 1.4 shows the MCU operating voltage and frequency specifications supported by the E6000. If the E6000 is used in an environment that exceeds the operating voltage range and operating frequency range guaranteed for the MCU operation, normal emulator operation is not guaranteed.

Table 1.4 Operating Voltage and Frequency Specifications

MCU Types	Operating Voltage (V)	Operating Frequency (ϕ) (MHz)
H8S/2628, H8S/2615 series	4.5-5.5	4-24

NOTE

For details on the operating voltage and frequency specifications, refer to the MCU hardware manual.

In the E6000, the clock can be selected by using the Configuration window or the Clock command.

Table 1.5 Clock Selections

Clock Command Parameter	Configuration Window Setting	Notes
Main clock	Main clock	
10	10MHz internal clock	Default
20	20 MHz internal clock	
24	24 MHz internal clock	
t	Target	
t2	Target/2	

Section 2 User System Interface

All user system interface signals are directly connected to the MCU in the E6000 with no buffering except for those listed below which are connected to the MCU through control circuits:

- NMI
- RESET
- MD2, MD1, MD0
- XTAL
- EXTAL
- STBY
- WAIT

2.1 Signal Protection

All user system interface signals are protected from over- or under-voltage by use of diode arrays except for the AVcc and Vref.

The Vcc pins (except for the AVcc pin) at the head of the user system interface cable are connected together. The E6000 monitors the voltage level of the Vcc pins and displays the power-supply status in the Status Window.

2.2 User System Interface Circuits

The interface circuit between the MCU in the E6000 emulator and the user system has a signal delay of about 8 ns due to the user system interface cable. And high-impedance signals will be pulled up to the high level by pull-up resistors. When connecting the E6000 emulator to a user system, adjust the user system hardware to compensate for propagation delays.

The following diagrams show the interface signal circuits.

Default:

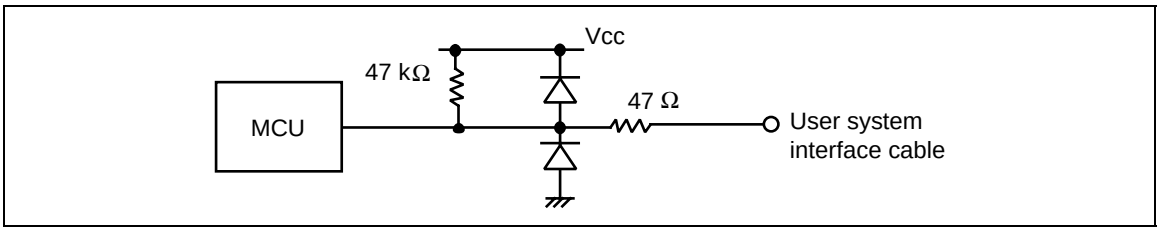

Figure 2.1 Default User System Interface Circuit

Mode Pins (MD2, MD1 and MD0), NMI, STBY and RESET: The NMI signal is input to the MCU through the emulator control circuit. The rising/falling time of the NMI signal must be 8 ns/V or less. The mode pins are only monitored. The CPU mode depends on the HDI Configuration settings.

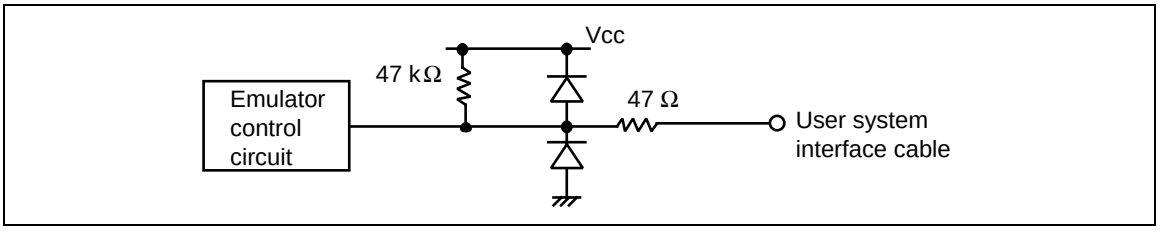

Figure 2.2 User System Interface Circuit for MD2, MD1, MD0, NMI, STBY, and RESET

PF0:

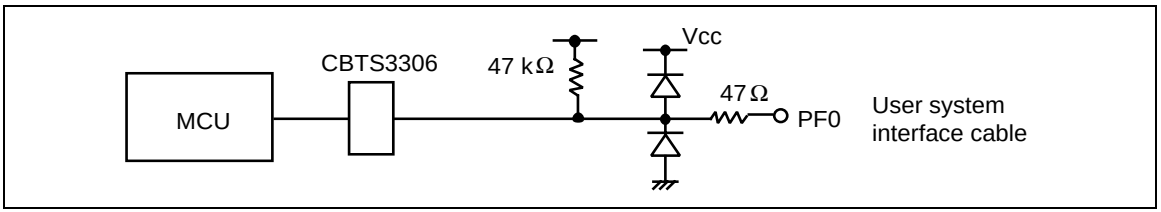

Figure 2.3 User System Interface Circuit for PF0

PC0-PC7:

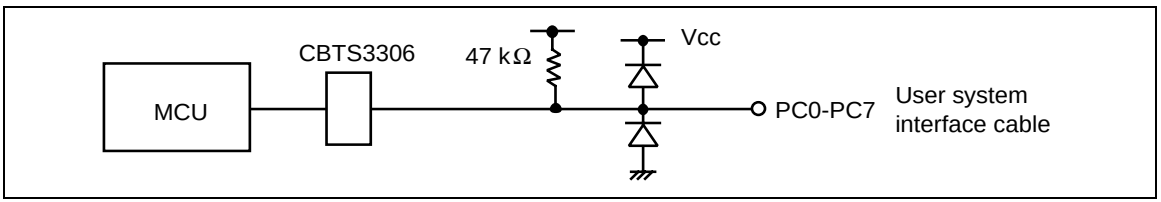

Figure 2.4 User System Interface Circuit for PC0-PC7

AN0-AN15, AVcc, AVss and Vref:

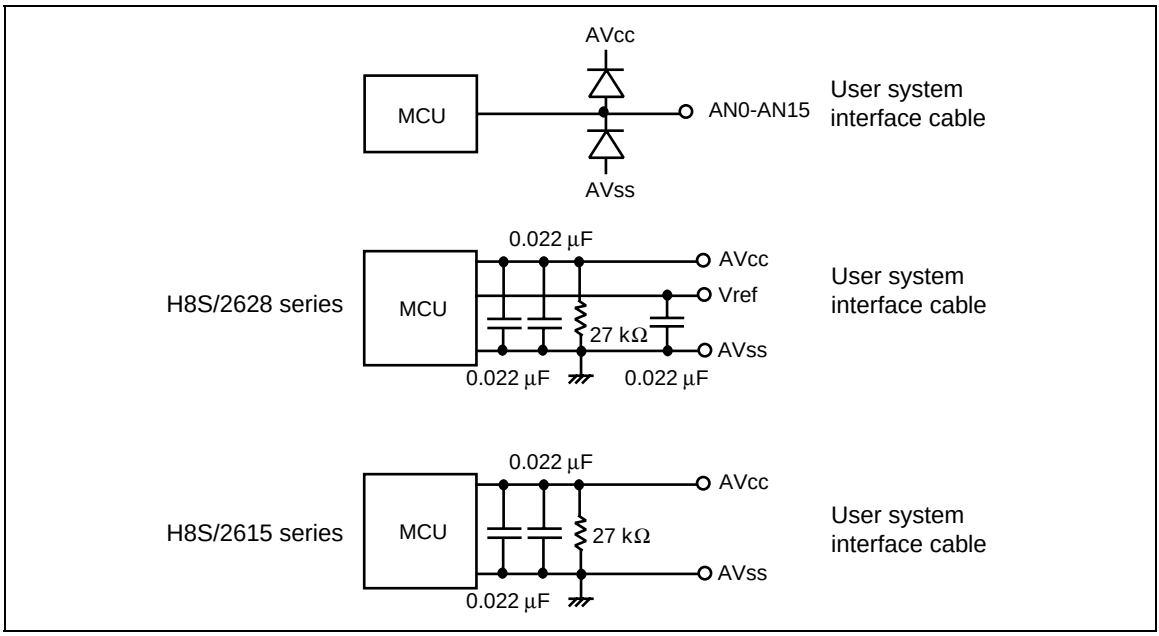

Figure 2.5 User System Interface Circuit for AN0-AN15, AVcc, AVss and Vref Signals

Section 3 Notes on Use

3.1 I/O Register Differences between Actual MCU and E6000

In the E6000, one evaluation chip emulates several types of MCU. Therefore, there are some differences in I/O registers between an actual MCU and the E6000. Note these differences when accessing the I/O registers.

I/O port is in the input state at default. The I/O register contents indicate the emulator port status. When the user system interface cable is not connected, the read value is 1 due to the emulator's pull-up resistors.

In the E6000, accesses to the following registers for controlling the flash memory are invalid.

- RAM emulation register (RAMER: H'FEDB)
- Flash memory control register 1 (FLMCR1: H'FFA8)
- Flash memory control register 2 (FLMCR2: H'FFA9)
- Erase block register 1 (EBR1: H'FFAA)
- Erase block register 2 (EBR2: H'FFAB)

3.2 Access to the Reserved Area

When accessing the reserved area, note the following:

If the reserved area is used, the operation in the actual MCU cannot be guaranteed. If the user program extends to the reserved area during debugging, select the MCU having the largest ROM capacity.

3.3 Support of Flash Memory

The E6000 does not emulate the flash memory control operation in the MCU.

3.4 Hardware Standby

The E6000 does not support hardware standby function. Therefore, the User Standby enable check box in the Configuration window will be disabled.

3.5 HCAN

When the CPU accesses the HCAN register and the operating frequency is 20 MHz or lower, the access counts are the same as those of the MCU. However, when the operating frequency is more than 20 MHz, one more clock is required for the CPU’s access counts.

3.6 Procedure for Applying the Power

When the user system is connected to the emulator, apply the power of the user system and then start the emulator. However, depending on the user system, the emulator may not operate normally due to the leakage current. In such a case, turn off the power switch of the emulator with the user system on, and restart the emulator.

Section 4 HDI Parameters

4.1 Address Areas

Table 4.1 lists the parameters for address areas (Area) that can be specified with HDI command line interface or displayed as trace results.

Table 4.1 Address Area Parameters

HDI Parameter (Trace Display)	Address Area	Description
rom (ROM)	On-chip ROM	MCU's on-chip ROM, which can be read but cannot be written to.
ram (RAM)	On-chip RAM	MCU's on-chip RAM (except for DTC RAM), which can be read and written to.
IO16 (I/O-16)	Internal I/O registers (16-bit bus)	MCU's internal I/O registers for the 16-bit bus.
IO8 (I/O-8)	Internal I/O registers (8-bit bus)	MCU's internal I/O registers for the 8-bit bus.
IO (I/O-16 or I/O-8)	Internal I/O registers	MCU's internal I/O registers for the 8-bit bus and 16-bit bus.
ext16 (EXT-16)	External area (16-bit bus)	External area for the 16-bit bus, which can be allocated to the user system memory or the optional SIMM memory module in the E6000.
ext8 (EXT-8)	External area (8-bit bus)	External area for the 8-bit bus, which can be allocated to the user system memory or the optional SIMM memory module in the E6000.
ext (EXT-16 or EXT-8)	External area	External area for the 8-bit bus and 16-bit bus, which can be allocated to the user system memory or optional SIMM memory module in the E6000.
Dtcram (RAM/DTC)	DTC RAM	MCU's on-chip RAM for DTC.

4.2 Access Status

Table 4.2 lists the parameters for access status (Status) that can be specified with HDI command line interface or displayed as trace results.

Table 4.2 Access Status Parameters

HDI Parameter (Trace Display)	Access Status	Description
dmac (DMAC)	On-chip DMAC	Access by the MCU's DMAC (Cannot be accessed by the EXDMA controller.)
dtc (DTC)	On-chip DTC	Access by the MCU's DTC
refresh (REFRESH)	Refresh	Refresh cycle by the MCU's refresh controller
prefetch (PROG)	CPU prefetch	Instruction prefetch cycle by the CPU
data (DATA)	CPU data access	Data access for instruction execution by the CPU

4.3 I/O Modules

Table 4.3 lists the parameters for I/O module selection in the custom setting of the HDI Configuration window.

Table 4.3 I/O Modules

HDI Parameter	I/O Module
PWM14	MCU's 14-bit PWM.
D/A	MCU's D/A.
TMR2-3	MCU's 8-bit timer (TMR2-3).
WDT1	MCU's WDT (WDT1).
IIC1	MCU's I2C bus (IIC1).
IIC0	MCU's I2C bus (IIC0).
IrDA	MCU's IrDA.
DTC	MCU's DTC.
TPU3-5	MCU's 16-bit timer pulse unit (TPU3-5).
MULT	Set SCI0 and SCI1 to support the multiprocessor communication/smart card interface. SCI2 is always enabled.
DMAC	MCU's DMAC.
REFRESH	MCU's refresh controller.
a/d (4 | 8)	A/D converter. Four or eight data registers can be selected.
sci (1 | 2 | 3 | 4)	Serial communication interface. The number of channels can be selected as follows: 1: SCI0, 1 2: SCI0, 1, 2 3: SCI0, 1, 2, 3 4: SCI0, 1, 2, 3, 4

Section 5 Diagnostic Test Procedure

This section describes the diagnostic test procedure using the E6000 test program.

5.1 System Set-Up for Test Program Execution

To execute the test program, use the following hardware; do not connect the user system interface cable and user system.

- E6000 (HS2628EPI61H)
- Host computer
- The E6000 PC interface board which will be one of the following boards or card:
  Select one interface board from the following depending on the PC interface specifications. (Please install HDI once to set up Interface board driver software)
  PCI bus interface board (HS6000EIC01H or HS6000EIC02H)
  PCMCIA interface card (HS6000EIP01H)
  USB adapter (HS6000EIU01H)
  LAN adapter (HS6000ELN01H)

1. Install the E6000 PC interface board in the host computer and connect the supplied PC interface cable to the board.
2. Connect the PC interface cable to the E6000.
3. Connect the supplied AC adapter to the E6000.
4. Initiate the host computer to make it enter DOS prompt command input wait state.
5. Turn on the E6000 switch.

5.2 Diagnostic Test Procedure Using the Test Program

Insert the CD-R (HS2628EPI61SR supplied with the E6000) into the CD-ROM drive of the host computer by pressing the Shift key, move the current directory to <Drive>:\Diag with a command prompt, and enter one of the following commands according to the PC interface board used to initiate the test program:

1. PCI bus interface board (HS6000EIC01H or HS6000EIC02H)
   > TM2628 –PCI (RET)

2. PCMCIA interface card (HS6000EIP01H)
   > TM2628 –PCCD (RET)

3. USB adapter (HS6000EIU01H)
   > TM2628 –USB

4. LAN adapter (HS6000ELN01H)
   > TM2628 –ELN

The HDI must be installed before the test program is executed.

Be sure to initiate the test program from <Drive>:\Diag. Do not initiate it from a directory other than <Drive>:\Diag, such as > <Drive>:\Diag\TM2628 –PCI (RET). If the test program is initiated when the current directory is not <Drive>:\Diag, the test program will not operate correctly.

When –S is added to the command line such as > TM2628 –PCI –S (RET), steps 1 to 19 will be repeatedly executed. To stop the execution, enter Q.

Notes: 1. When the CD-R is inserted into the CD-ROM drive without pressing the Shift key, the HDI installation wizard is automatically started.
   In such a case, exit the HDI installation wizard.
2. <Drive> is a drive name for the CD-ROM drive.
3. Do not remove the CD-R from the CD-ROM drive during test program execution.

The following messages are displayed during the test. There are 19 steps in this test. The following messages are displayed during the test.

Message	Description
E6000 H8S/2628 Emulator Tests Vx.x Copyright (c) 2002 Hitachi Ltd.	Test program startTest program start message. x.x shows the version number.
`Option memory board fitted? ( 1. None  2. 1MB  3. 4MB ): 1`	Enter 1 and press the Enter key because the SIMM memory module is not installed in this example.
`Loading driver .....OK (Use PC Card)`	Shows that driver software has been correctly loaded.
`Initializing driver .....OK`	Shows that driver software has been correctly initialized.
`Searching for interface card .....OK`	Shows that the PC interface board is correctly installed in the host computer.
`Checking emulator is connected .....OK`	Shows that the E6000 is correctly connected to the host computer.
`Emulator board information:` `Main board ID: H'5 Emulation board ID: H'0d`	Shows the ID number of the lower board of the E6000 (always 5) and the middle board of the E6000 (always D).
`SUB board ID: H'8`	Shows the ID number of the upper board of the E6000 (always 8) and whether the SIMM memory board is installed.

```
1) Test Register
   A) IDR0 Register ..................................OK
   B) PAGE Register ..................................OK
   C) TRACE G/A Register .............................OK
   D) PERFM G/A Register .............................OK
   E) CES G/A Register ...............................OK
   F) IDR1 Register ..................................OK
   G) IDR2 Register ..................................OK
```

Shows the check results for the registers in the E6000 (normal completion).

```
2) Test DPRAM
   A) Decode Test ....................................OK
   B) Marching Test ..................................OK
```

Shows the results of decoding test and step test for the dual-port RAM in the E6000(normal completion).

```
3) Test Firmware RAM
   A) Decode Test    page[H'700 - H'71f] ..............OK
```

Shows the results of decoding test for the firmware RAM in the E6000 (normal completion).

```
   B) Marching test  page[H'700 - H'71f] ..............OK
```

Shows the results of step test for the firmware RAM in the E6000 (normal completion).

```
4) Test Trace memory
   A) Decode Test    page[H'000 - H'04f](Lower 32K) ....OK
```

Shows the results of decoding test for the trace RAM (first half) in the E6000 (normal completion).

```
   B) Marching test  page[H'000 - H'04f](Lower 32K) ....OK
```

Shows the results of step test for the trace RAM (first half) in the E6000 (normal completion).

```
   C) Decode Test    page[H'000 - H'04f](Upper 32 K) ...OK
```

Shows the results of decoding test for the trace RAM (last half) in the E6000 (normal completion).

```
   D) Marching test  page[H'000 - H'04f](Upper 32 K) ...OK
```

Shows the results of step test for the trace RAM (last half) in the E6000 (normal completion).

```
5) Test Map control memory
   A) Decode Test    page[H'200 - H'27f] ..............OK
```

Shows the results of decoding test for the mapping RAM in the E6000 (normal completion).

```
   B) Marching test  page[H'200 - H'27f] ..............OK
```

Shows the results of step test for the mapping RAM in the E6000 (normal completion).

```
6) Test Internal ROM and RAM
   A) Decode Test   (Internal ROM) .....................OK
   B) Marching test (Internal ROM) .....................OK
   C) Decode Test   (Internal RAM) .....................OK
   D) Marching Test (Internal RAM) .....................OK
```

Shows the results of decoding test and step test for internal ROM and RAM in the E6000(normal completion).

```
7) Test Option RAM
   No option memory board fitted - test skipped
```

Shows the check results for the optional SIMM memory module in the E6000 (not installed).

```
8) Test Emulation RAM STEP Operation
   A) Step Operation ..................................OK
```

Shows the check results for the step execution controlling circuits in the E6000 (normal completion).

```
9) Test Keybreak
   A) Key Break .....................................OK
```

Shows the check results for the forced break controlling circuits in the E6000 (normal completion).

```
10) Test Emulation RAM Hardware Break
   A) GRD Break .....................................OK
   B) WPT Break .....................................OK
   C) WPT(ROM) Break ................................OK
```

Shows the check results for the illegal access break controlling circuits in the E6000 (normal completion).

```
11) Test Internal ROM Write-Protect
   A) Write-Protect .................................OK
```

Shows the check results for the internal ROM write-protection controlling circuits in the E6000 (normal completion).

```
12) Test Hardware Break
   A) Break Point Initialized .......................OK
   B) Event Detectors CES channel 1-12 ..............OK
   C) Test Sequencing 1 .............................OK
   D) Check Range Break .............................OK
   E) Range Break Test for Data .....................OK
   F) Check Compare Either ..........................OK
```

Shows the check results for the hardware break control circuits in the E6000 (normal completion).

```
13) Test Emulation RAM Trace
   A) Free Trace ....................................OK
   B) Range Trace ...................................OK
   C) Point to Point Trace ..........................OK
   D) Start and Stop Event Trace ....................OK
   E) Trace memory Overflow .........................OK
   F) Time STAMP Trace (24 MHz) .....................OK
   G) Time STAMP Trace (10 MHz) .....................OK
```

Shows the check results for the trace controlling circuits in the E6000(normal completion).

```
14) Test Runtime Counter
   A) Runtime Counter (24.0 MHz) ....................OK
   B) Runtime Counter (10.0 MHz) ....................OK
   C) Runtime Counter (SUB:187.5 kHz) ...............OK
   D) Runtime Counter (SUB:32.768 kHz) ..............OK
```

Shows the check results for the run-time counter in the E6000 (normal completion).

```
15) Test Emulation Monitor
   A) EMA23-EMA0 .....................................OK
   B) ACST2-ACST0 ....................................OK
   C) ASEST3-ASEST0 ..................................OK
   D) ASEBRKACK ......................................OK
   E) CNN ............................................OK
   F) NOCLK, NOCLK2 ..................................OK
   G) WINDOW .........................................OK
   H) SUBACT .........................................OK
   I) OTHER ..........................................OK
```

Shows the check results for the emulation monitor controlling circuits in the E6000 (normal completion).

```
16) Test PERFM G/A
   A) Time Measurement ...............................OK
   B) RESERVED
   C) Subroutine Count Measurement ...................OK
   D) Timeout Function (TIMOT Bit) ...................OK
   E) Timeout Function (TIMOP Bit) ...................OK
```

Shows the check results for the performance analysis controlling circuits in the E6000(nomal completion).

```
17) Test Bus Monitor
   A) Register .......................................OK
   B) Parallel RAM ...................................OK
   C) SPRSEL2 ........................................OK
   D) RAM Monitor ....................................OK
```

Shows the check results for the bus monitor controlling circuits in the E6000 (normal completion).

```
18) Test Parallel Access
   A) Internal ROM Parallel Read Access(WORD) ..........OK
   B) Internal ROM Parallel Write Access(WORD) .........OK
   C) Internal ROM Parallel Write Access(High Byte) ....OK
   D) Internal ROM Parallel Write Access(Low Byte) .....OK
   E) Internal RAM Parallel Read Access(WORD) ..........OK
   F) Internal RAM Parallel Write Access(WORD) .........OK
   G) Internal RAM Parallel Write Access(High Byte) ....OK
   H) Internal RAM Parallel Write Access(Low Byte) .....OK
   I) Option RAM Parallel Read Access(WORD) ..........SKIP
   J) Option RAM Parallel Write Access(WORD) .........SKIP
   K) Option RAM Parallel Write Access(High Byte) ....SKIP
   L) Option RAM Parallel Write Access(Low Byte) .....SKIP
```

Shows the check results for the parallel access controlling circuits in the E6000 (normal completion).

```
19) Test H8S/2628 Register Read/Write
   A) Register Read ..................................OK
   B) Register Read/Write Test .......................OK

Tests run for 0h:3min:11s

Tests passed, emulator functioning correctly
```

Shows the check results for the I/O-register access.

Shows the check time.

Shows that the E6000 is correctly operating.

When –S is added to the command line, step 1 will be executed again after step 19.