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User's Manual

RX850 Pro Ver. 3.30

Real-Time Operating System

Debug for CubeSuite

Target Tool
RX850 Pro Ver.3.30

Document No. U19431EJ1V0UM00 (1st edition)
Date Published December 2008

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[MEMO]

SUMMARY OF CONTENTS

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INTRODUCTION

Readers

This manual is intended for users who design and develop application systems using V850 microcontrollers products.

Purpose

This manual is intended for users to understand the functions of the RX850 Pro described the organization listed below.

Organization

This manual consists of the following major sections.

- GENERAL
- FUNCTIONS

How to read this manual

It is assumed that the readers of this manual have general knowledge in the fields of electrical engineering, logic circuits, microcontrollers, C language, and assemblers.

To understand the hardware functions of the V850 microcontrollers
→ Refer to the **User's Manual Hardware** of each product.

To understand the instruction functions of the V850 microcontrollers
→ Refer to the **V850ES Architecture User's Manual (U15943E) or V850E1 Architecture User's Manual (U14559E)**.

Conventions

Data significance:	Higher digits on the left and lower digits on the right
Note:	Footnote for item marked with **Note** in the text
Caution:	Information requiring particular attention
Remark:	Supplementary information
Numerical representation:	Binary...XXXX or XXXXB
	Decimal...XXXX
	Hexadecimal...0xXXXX

Prefixes indicating power of 2 (address space and memory capacity):

K (kilo)	$2^{10} = 1024$
M (mega)	$2^{20} = 1024^2$

Related Documents Read this manual together with the following documents.
The related documents indicated in this publication may include preliminary versions.
However, preliminary versions are not marked as such.

Documents related to development tools (user's manuals)

Document Name		Document No.
RX Series	Start for CubeSuite	U19428E
	Message for CubeSuite	U19433E
RX850 Pro Ver.3.30	Coding for CubeSuite	U19429E
	Debug for CubeSuite	This document
	Analysis for CubeSuite	U19432E
	Internal Structure for CubeSuite	U19434E
CubeSuite Integrated Development Environment	Start	U19549E
	Programming	U19390E
	Message	U19550E
	V850 Coding	U19383E
	V850 Build	U19386E
	V850 Debug	U19389E
	V850 Design	U19380E

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CHAPTER 1 GENERAL

This chapter describes an overview of task debug tool (RD850 Pro) that CubeSuite provides.

1. 1 Summary

RD850 Pro provides powerful debugging functions for a program in which the real-time operating system "RX850 Pro" is embedded.

RD850 Pro provides the following functions.

- **The real-time OS status display function**

CHAPTER 2 FUNCTIONS

This chapter describes main functions of RD850 Pro.

2. 1 Real-time OS Status Display Function

This is a function that acquires the all of the statuses of the generated/registered resources managed by RX850 Pro and displays their information when a break occurs at a certain point of a program running in CubeSuite.

In RD850 Pro, the following resource information can be displayed:

- Task information
- Eventflag information
- Semaphore information
- Mailbox information
- Memory pool information
- Cyclic startup handler information
- Queue information (timer queue or ready queue)
- Operating system management table information

[Caution] To display the resource information, the following conditions are required.

- A load module in which RX850 Pro has been linked must be loaded to debug tool connected to CubeSuite.
- RX850 Pro system initialization processing must be completed (the control must be transferred to a task which is the first to operate).

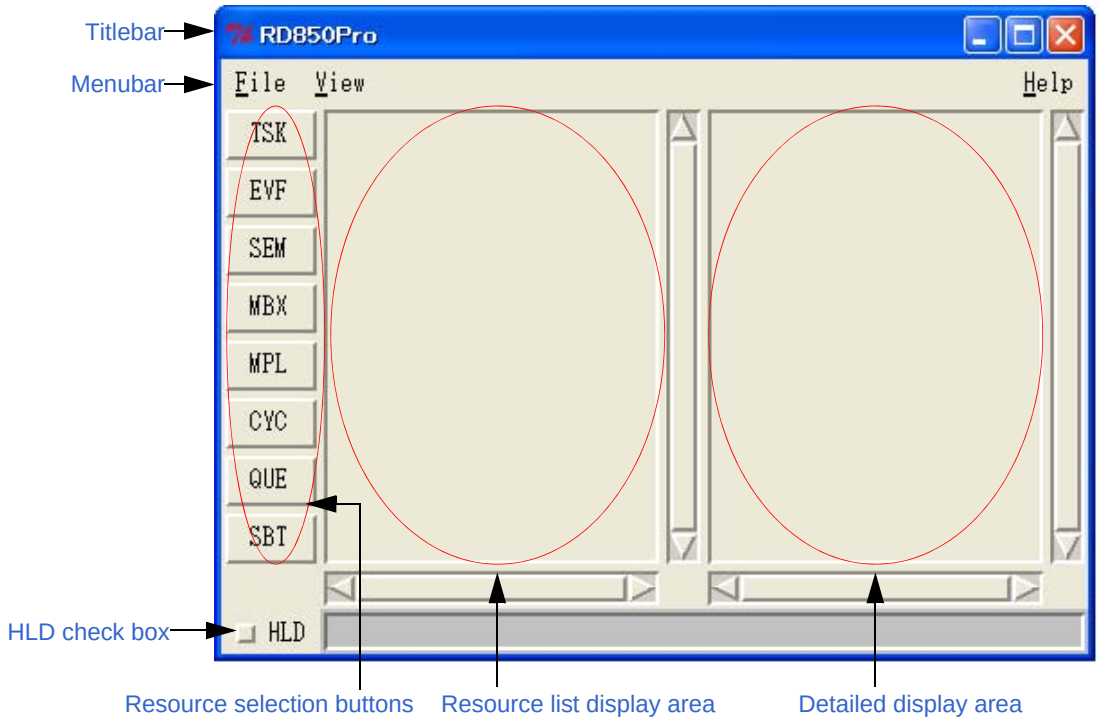
APPENDIX A WINDOW REFERENCE

Appendix A provides detailed explanations of window for RD850 Pro.

A. 1 Description

The window of RD850 Pro is one shown below (multiple windows can be opened at the same time, however).

Figure A-1. RD850Pro Window (When Startup)



A. 1. 1 Resource selection buttons

This button is used to select the resource to be displayed on the Resource list display area.

By clicking the button, the list of information of all the resources generated/registered within the selected resource is displayed on the Resource list display area.

Table A-1. Resource Selection Buttons

Button	Function
TSK	Displays Task information.
EVF	Displays Eventflag information.
SEM	Displays Semaphore information.
MBX	Displays Mailbox information.
MPL	Displays Memory pool information.
CYC	Displays Cyclic startup handler information.
QUE	Displays Queue information (timer queue or ready queue).
SBT	Displays Operating system management table information.

A. 1. 2 Resource list display area

This area is used to display the list of the resource selected with the Resource selection buttons.

All of the generated/registered resources are displayed in the list ("NONE" is displayed if no relevant resources exist).

For details on the contents of this area, refer to the "A. 2 Display Contents".

[Caution] To display the resource information, the following conditions are required.

The operation is not guaranteed if the Resource selection buttons is clicked while the conditions below are not satisfied.

- A load module in which RX850 Pro has been linked must be loaded to debug tool connected to CubeSuite.
- RX850 Pro system initialization processing must be completed (the control must be transferred to a task which is the first to operate).

A. 1. 3 Detailed display area

This area is used to display the detailed information of a resource selected with the Resource list display area.

For details on the contents of this area, refer to the "A. 2 Display Contents".

A. 1. 4 HLD check box

This box is used to fix the status (hold status) currently displayed.

When this check box is checked, the display information is not updated until the check box is unchecked, regardless of whether program execution or breaks occur thereafter. This check box is not checked in the default condition.

By using this function, statuses at different times can easily be compared by starting up several RD850 Pro.

A. 1. 5 Titlebar

The titlebar shows the type (task, eventflag, etc.) of resource currently selected. The title format is as follows:

- RD850Pro [*Resource type*]

A. 1. 6 Menubar

(1) [File] menu

Quit	Terminates RD850 Pro.

(2) [View] menu

Task	Displays Task information.
Eventflag	Displays Eventflag information.
Semaphore	Displays Semaphore information.
Mailbox	Displays Mailbox information.
Variable-size memorypool	Displays Memory pool information.
Cyclic handler	Display Cyclic startup handler information.
System queue	Displays Queue information (timer queue or ready queue).
System base table	Displays Operating system management table information.

(3) [Help] menu

Contents	Opens the help window for RD850 Pro.
About RD850 Pro	Displays the version information of RD850 Pro.

A. 2 Display Contents

This section is described the contents of the resource information selected with the Resource selection buttons.

A. 2. 1 Task information

Task information is displayed by clicking the [TSK] button.
The following contents are displayed in the Resource list display area and the Detailed display area.

Figure A-2. Task Information Display

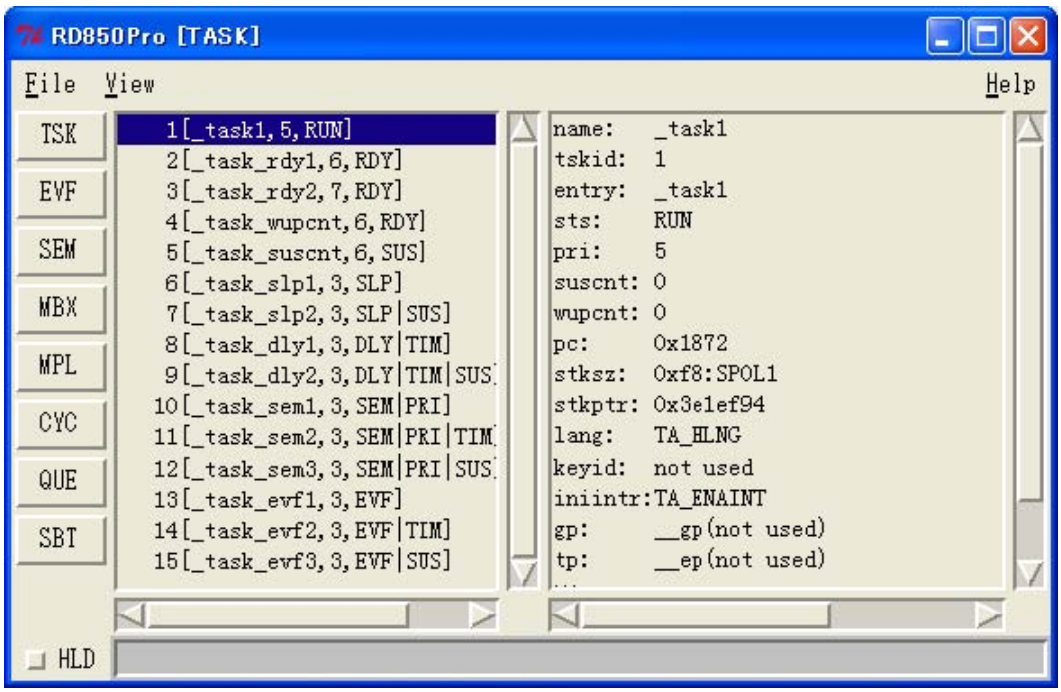


Table A-2. Resource List Display Area: Task Information

Item	Contents
1st item	Task ID number
2nd item	Task symbol **[Note]**
3rd item	Current task priority
4th item	Task state (refer to the "Table A-4. Task States")

[Note] A symbol of startup address is displayed as a symbol.
However, the startup address is displayed in hexadecimal notation if symbol information dose not exist.

[Remark] Tasks are displayed in the order of the ID number.

Table A-3. Detailed Display Area: Task Information

Item	Contents
name	Task symbol **[Note]**
tskid	Task ID number
entry	Task start address Format: *file name#line number* (*symbol* **[Note]**) **[Remark]** The task source can be opened in the Editor panel of CubeSuite by double-clicking this line. Refer to the "Task source program display".
sts	Task state (refer to the "Table A-4. Task States")
pri	Current priority
suscnt	Number of suspend requests
wupcnt	Number of wake-up requests
pc	Current pc register value If the internal symbol information is not obtained, this cannot be displayed. The display format is the same as the [entry] line. **[Remark]** The task source can be opened in the Editor panel of CubeSuite by double-clicking this line. Refer to the "Task source program display".
stksz	Stack size for task and the type of the system memory area to be allocated to that stack SPOL0: System Memory Pool 0 SPOL1: System Memory Pool 1
stkptr	sp register value of task
lang	Task language TA_ASM: Assembly language TA_HLNG: C language
keyid	Key ID number of task If key ID number is not specified, "(not used)" is displayed.
iniintr	Interrupt status at task activation TA_DISINT: Disables all interrupts TA_ENAINT: Enables all interrupts
gp	gp register-specific value of task If there is no gp register-specific value specification and the value is not used, "(not used)" is indicated following the label.
tp	tp register-specific value of task If there is no tp register-specific value specification and the value is not used, "(not used)" is indicated following the label.

[Note] A symbol of startup address is displayed as a symbol.
However, the startup address is displayed in hexadecimal notation if symbol information dose not exist.

The states of the tasks are as follows:

Table A-4. Task States

State	Description
RUN	Run state
RDY	Ready state
DMT	Dormant state
SUS	Suspend state
SLP	Wake-up wait state
DLY	Timeout wait state
EVF	Eventflag wait state
SEM	Semaphore wait state
MBX	Message wait state
MPL	Memory block wait state

There may be several of the above-described task states. In this case, these states are displayed separated by "|". The following information additional to the state is displayed depending on a task state.

Table A-5. Additional Task Information

State	Description
TIM	Wait state with time limit
PRI	Wait state of wait queue processed according to the priority

Moreover, if a task is in the wait state for resources (eventflag, semaphore, mailbox, memory pool), the ID of these resources are displayed in addition to the state.

- **Task source program display**

  When there is the debug information, by double-clicking the [entry] line on the Detailed display area, the source text of the task can be displayed in the Editor panel of CubeSuite, and by double-clicking the [pc] line, the source text at the pc register location can be displayed.

  Note that the corresponding disassemble text is displayed in the Disassemble panel of CubeSuite when there is no debug information.

A. 2. 2 Eventflag information

Eventflag information is displayed by clicking the [EVF] button.
The following contents are displayed in the Resource list display area and the Detailed display area.

Figure A-3. Eventflag Information Display

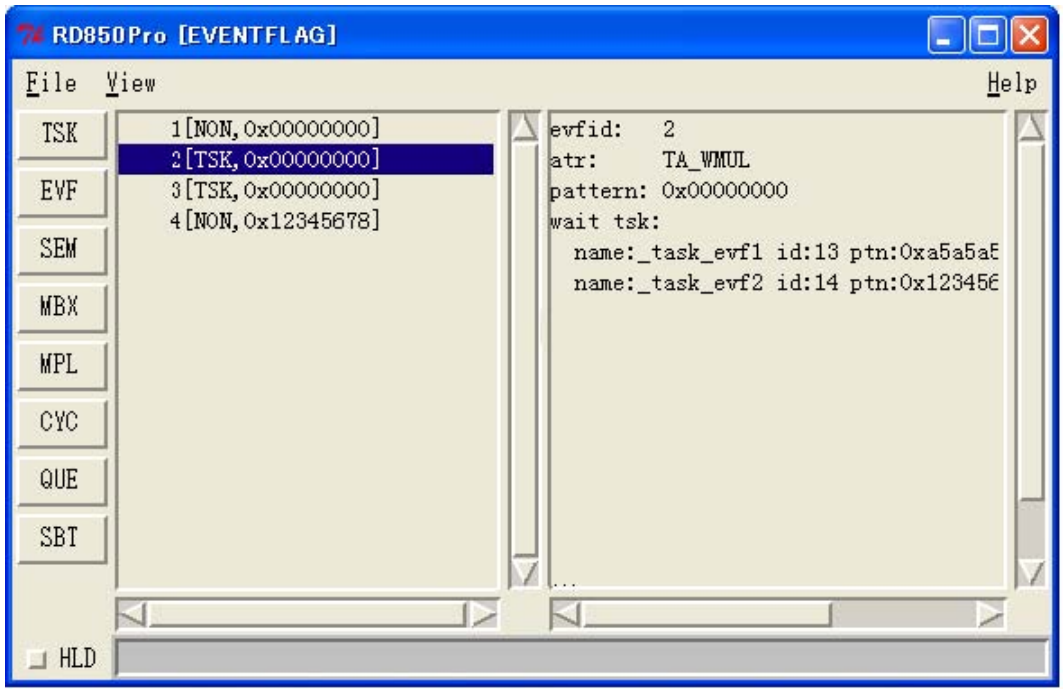


Table A-6. Resource List Display Area: Eventflag Information

Item	Contents
1st item	Eventflag ID number
2nd item	Existence of waiting task TSK: Waiting task exists NON: No task is waiting
3rd item	Current bit pattern

Table A-7. Detailed Display Area: Eventflag Information

Item	Contents	
evfid	Eventflag ID number	
atr	Number of tasks that can be queued into a wait queue TA_WMUL: 2 or more tasks TA_WSGL: 1 task only	
pattern	Current bit pattern	
wait tsk	This item is displayed when a task waiting for an eventflag exists.	
	name	Symbol of the first task in wait queue
	id	ID number of the first task in wait queue
	ptn	Request bit pattern
	opt	Wait condition TWF_ORW: OR wait TWF_ANDW: AND wait
	clr	Specification at the time of the condition satisfaction ON: Bit pattern is cleared OFF: Bit pattern is not cleared

A. 2. 3 Semaphore information

Semaphore information is displayed by clicking the [SEM] button.
The following contents are displayed in the Resource list display area and the Detailed display area.

Figure A-4. Semaphore Information Display

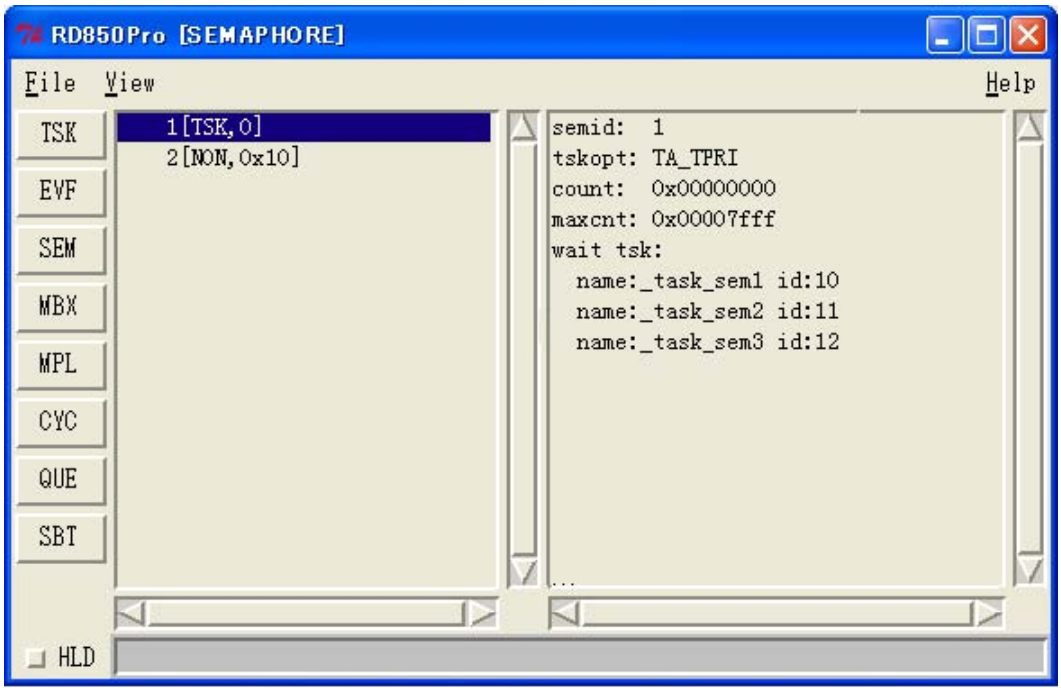


Table A-8. Resource List Display Area: Semaphore Information

Item	Contents
1st item	Semaphore ID number
2nd item	Existence of waiting task TSK: Waiting task exists NON: No task is waiting
3rd item	Current resource count

Table A-9. Detailed Display Area: Semaphore Information

Item	Contents	
semid	Semaphore ID number	
tskopt	Queuing method of task TA_TFIFO: According to FIFO TA_TPRI: According to priority	
count	Current resource count	
maxcnt	Maximum resource count	
wait tsk	This item is displayed when a task waiting for a resource of semaphore exists.	
	name	Symbol of the first task in wait queue
	id	ID number of the first task in wait queue

A. 2. 4 Mailbox information

Mailbox information is displayed by clicking the [MBX] button.
The following contents are displayed in the Resource list display area and the Detailed display area.

Figure A-5. Mailbox Information Display: 1

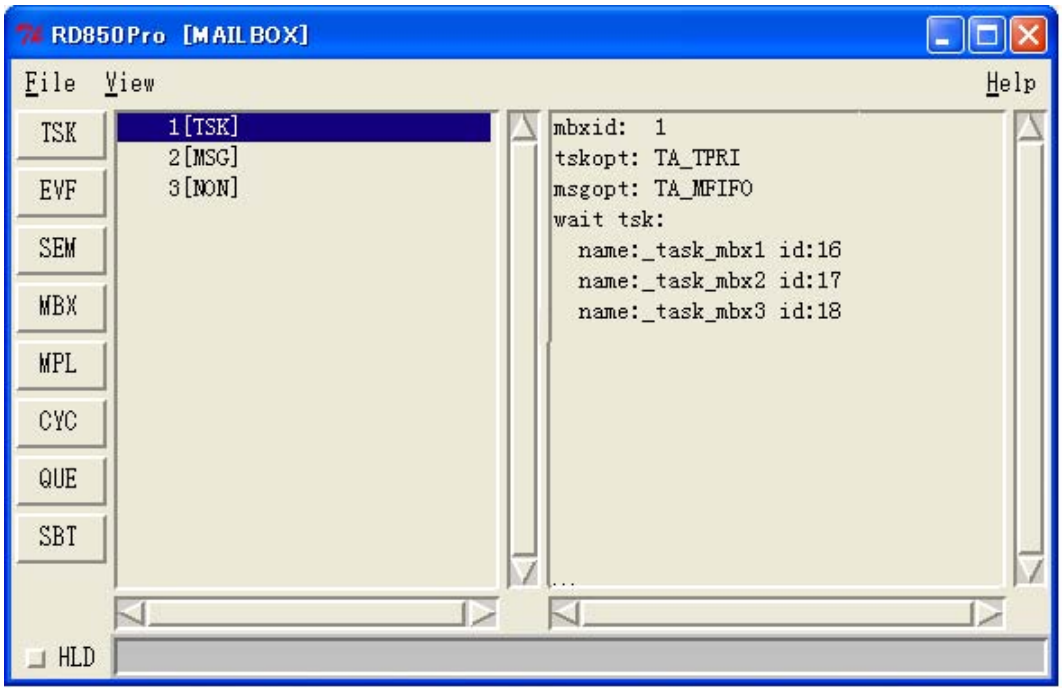


Figure A-6. Mailbox Information Display: 2

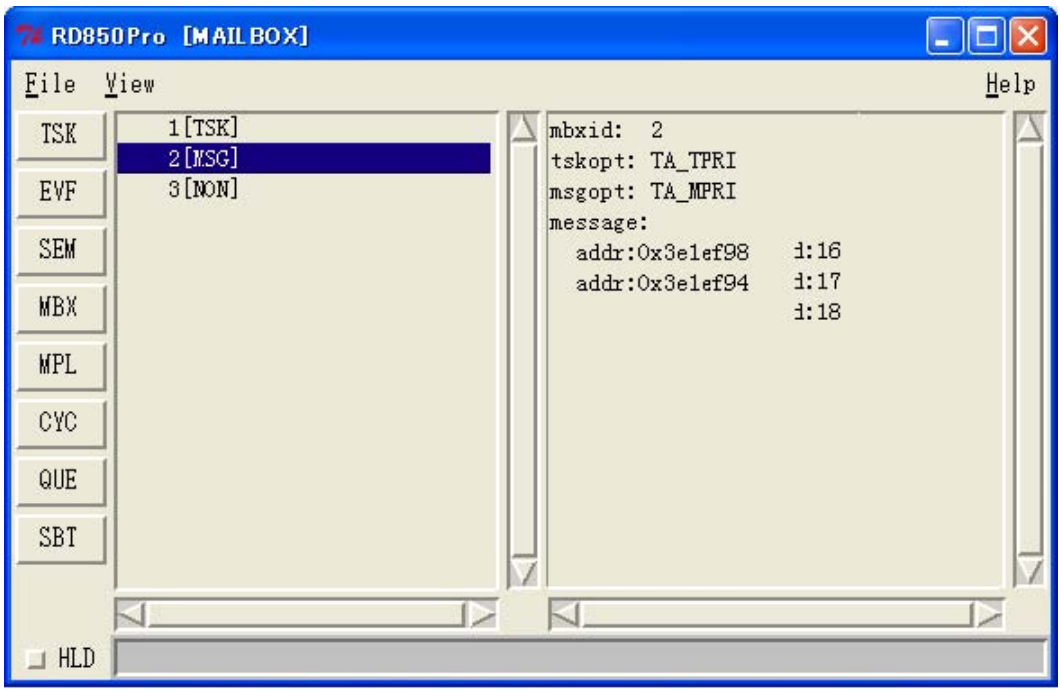


Table A-10. Resource List Display Area: Mailbox Information

Item	Contents
1st item	Mailbox ID number
2nd item	Existence of waiting task TSK: Waiting task exists MSG: Message waiting for receiving exists NON: Neither waiting task nor message waiting for receiving exists

Table A-11. Detailed Display Area: Mailbox Information

Item	Contents	
mbxid	Mailbox ID number	
tskopt	Queuing method of task TA_TFIFO: According to FIFO TA_TPRI: According to priority	
msgopt	Message queuing method TA_MFIFO: According to FIFO TA_MPRI: According to priority	
wait tsk	This item is displayed when a task waiting for transmitting a message exists.	
	name	Symbol of the first task in wait queue
	id	ID number of the first task in wait queue
message	This item is displayed when a message waiting for receiving a message exists.	
	addr	Address of the first message in wait queue **[Remark]** The memory list can be opened in the Memory panel of CubeSuite by double-clicking this line. Refer to the "Message memory display".

- Message memory display

By double-clicking the [adr] line within the [message] item on the Detailed display area, the contents of the address of the first message in wait queue can be displayed in the Memory panel of CubeSuite.

A. 2. 5 Memory pool information

Memory pool information is displayed by clicking the [MPL] button.
The following contents are displayed in the Resource list display area and the Detailed display area.

Figure A-7. Memory Pool Information Display

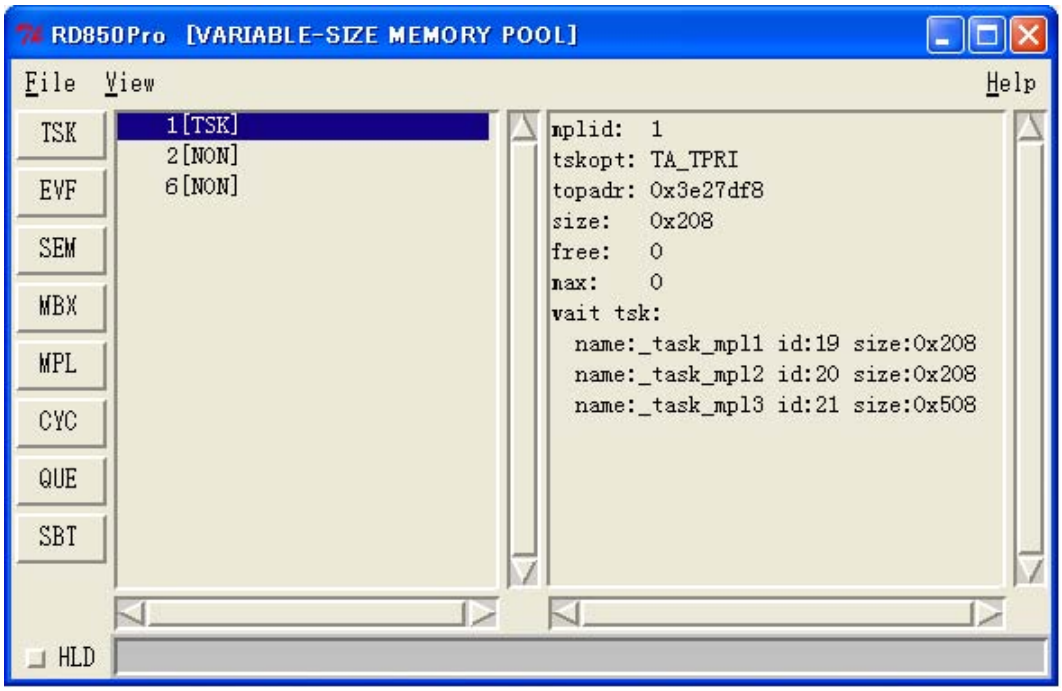


Table A-12. Resource List Display Area: Memory Pool Information

Item	Contents
1st item	Memory pool ID number
2nd item	Existence of waiting task TSK: Waiting task exists NON: No task is waiting

Table A-13. Detailed Display Area: Memory Pool Information

Item	Contents	
mplid	Memory pool ID number	
tskopt	Queuing method of task TA_TFIFO: According to FIFO TA_TPRI: According to priority	
topadr	Memory pool start address	
size	Memory pool size (Unit: byte) align4 (user specified size +8) is displayed	
free	Total size of free area (Unit: byte)	
max	Maximum memory block size that can acquired (Unit: byte)	
wait tsk	This item is displayed when a task waiting for release of a memory block exists.	
	name	Symbol of the first task in wait queue
	id	ID number of the first task in wait queue
	size	Requested block size (Unit: byte) (The result of adding 4-byte required by RX850 Pro to the value requested by get_blk, pget_blk, or tget_blk is displayed.)

A. 2. 6 Cyclic startup handler information

Cyclic startup handler information is displayed by clicking the [CYC] button.
The following contents are displayed in the Resource list display area and the Detailed display area.

Figure A-8. Cyclic Startup Handler Information Display

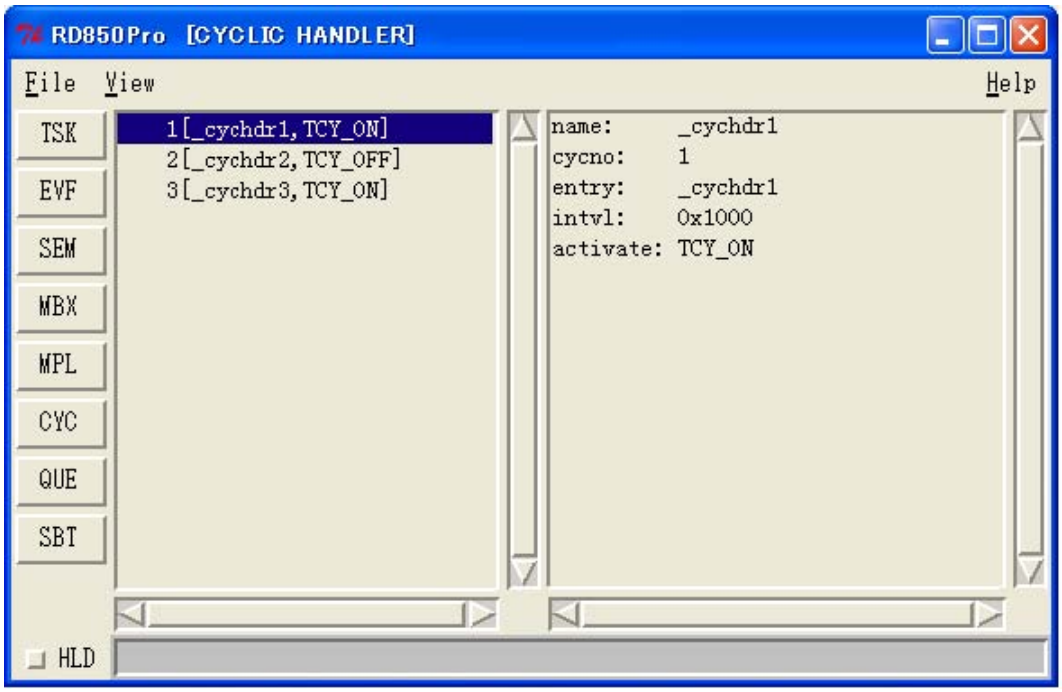


Table A-14. Resource List Display Area: Cyclic Startup Handler Information

Item	Contents
1st item	Cyclic startup handler ID number
2nd item	Cyclic startup handler symbol **[Note]**
3rd item	Activation status TCY_ON: Activated TCY_OFF: Not activated

[Note] A symbol of startup address is displayed as a symbol.
However, the startup address is displayed in hexadecimal notation if symbol information dose not exist.

Table A-15. Detailed Display Area: Cyclic Startup Handler Information

Item	Contents
name	Cyclic startup handler symbol **[Note]**
cycno	Specification number of cyclic startup handler
entry	Cyclic startup handler start address Format: *file name#line number* (*symbol* **[Note]**) **[Remark]** The task source can be opened in the Editor panel of CubeSuite by double-clicking this line. Refer to the "Cyclic startup handler source display".
intvl	Activation time interval of cyclic startup handler (Unit: basic clock cycles)
activate	Activation status TCY_ON: Activated TCY_OFF: Not activated

[Note] A symbol of startup address is displayed as a symbol.
However, the startup address is displayed in hexadecimal notation if symbol information dose not exist.

- Cyclic startup handler source display

When there is the debug information, by double-clicking the [entry] line on the Detailed display area, the source text of the cyclic startup handler can be displayed in the Editor panel of CubeSuite.
Note that the corresponding disassemble text is displayed in the Disassemble panel of CubeSuite when there is no debug information.

A. 2. 7 Queue information

Queue information is displayed by clicking the [QUE] button.

Queue information includes timer queue information and ready queue information.

The following contents are displayed in the Resource list display area and the Detailed display area.

Figure A-9. Queue Information Display: Timer Queue

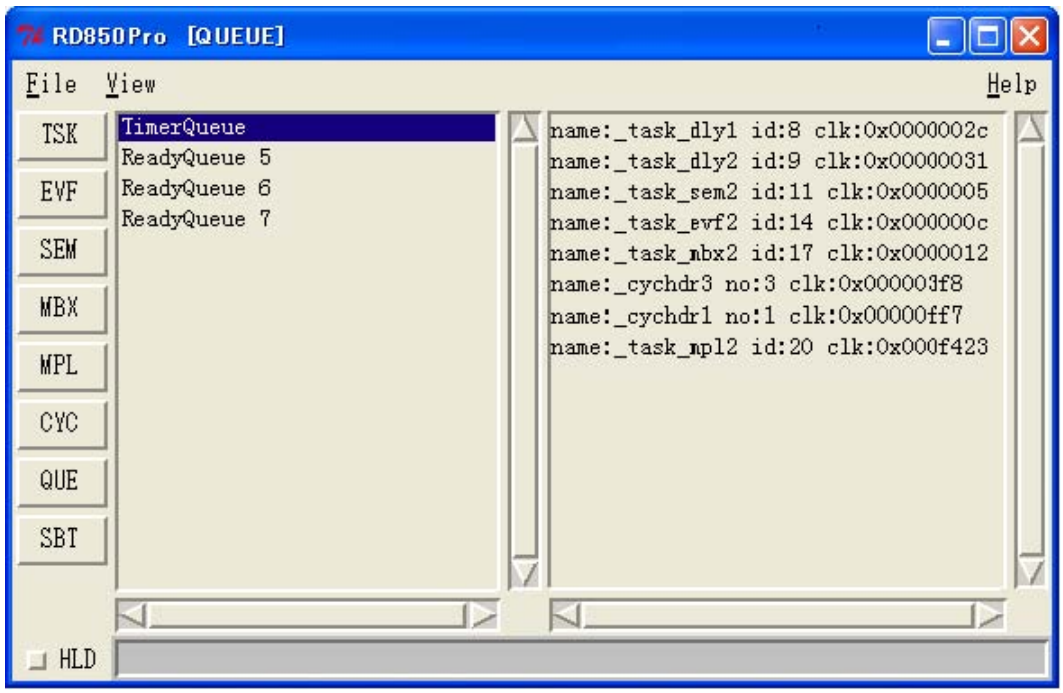


Figure A-10. Queue Information Display: Ready Queue

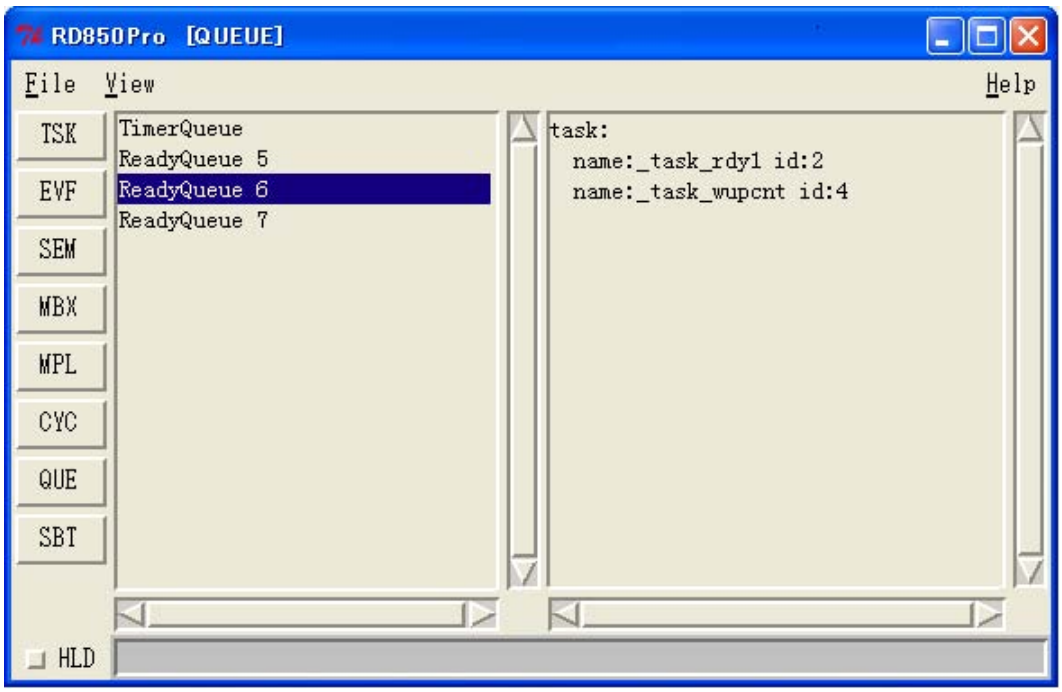


Table A-16. Resource List Display Area: Queue Information

Item	Contents
1st item	Type of queue TimerQueue: Timer queue ReadyQueue: Ready queue
2nd item	Priority (None in the case of timer queue)

Table A-17. Detailed Display Area: Timer Queue Information

Selected Resource	Item	Contents
Task	name	Task symbol **[Note]**
	id	Task ID number
	clk	Time remaining until the timeout wait state is released (Unit: basic clock cycles)
Cyclic startup handler	name	Cyclic startup handler symbol **[Note]**
	no	Specification number of cyclic startup handler
	clk	Time remaining until the cyclic handler is next activated (Unit: basic clock cycles)

[Note] A symbol of startup address is displayed as a symbol.
However, the startup address is displayed in hexadecimal notation if symbol information dose not exist.

Table A-18. Detailed Display Area: Ready Queue Information

Item	Contents	
task	name	Task symbol **[Note]**
	id	Task ID number

[Note] A symbol of startup address is displayed as a symbol.
However, the startup address is displayed in hexadecimal notation if symbol information dose not exist.

A. 2. 8 Operating system management table information

Operating system management table information is displayed by clicking the [SBT] button.

"System Base Table" is displayed in the Resource list display area and the following contents are displayed in the Detailed display area.

Figure A-11. Operating System Management Table Information Display

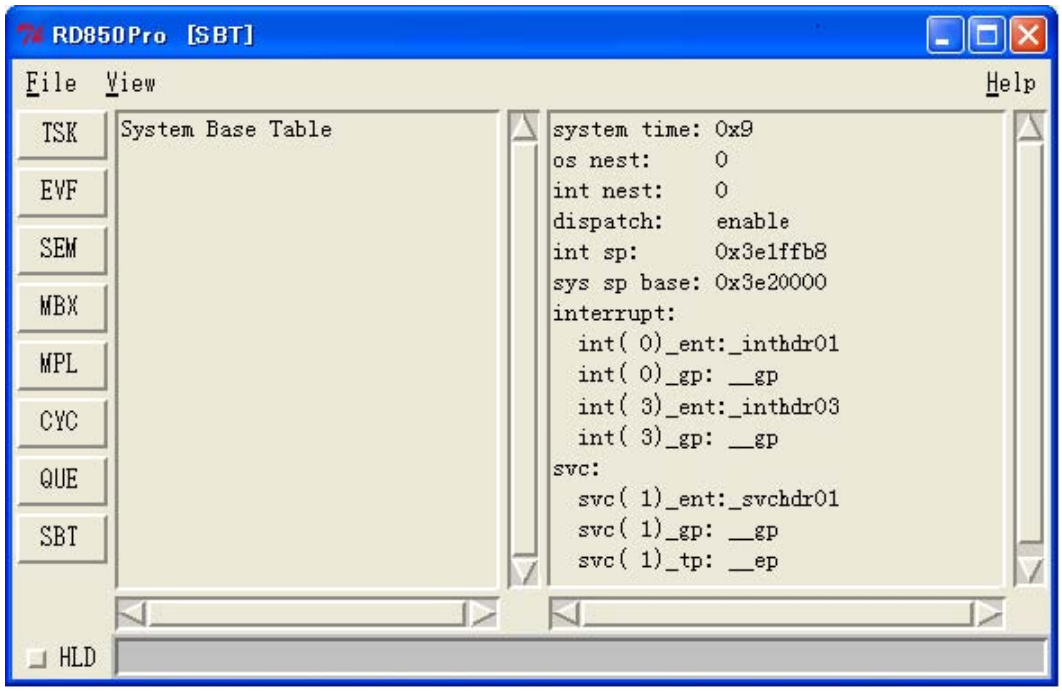


Table A-19. Detailed Display Area: Operating System Management Table Information

Item	Contents	
system time	System time (Unit: basic clock cycle)	
os nest	Nest count of system processing	
int nest	Nest count of interrupt processing	
dispatch	Dispatch restrain flag enable: Enable dispatch disable: Disable dispatch	
int sp	Stack pointer for handler The system fixed stack value that is when the control shifts from OS to indirectly startup interrupt handler (initial stack value is used in case of multiple interrupts). The stack pointer is placed where space for interrupt frames is reserved from [sys sp base].	
sys sp base	Start address of stack pointer for handler	
interrupt	This item is displayed when an indirectly activated interrupt handler exists.	
	Int (*interrupt source number*)_ent	Start address of indirectly activated interrupt handler Format: *file name#line number* (*symbol* **[Note]**)
	Int (*interrupt source number*)_gp	gp register-specific value of indirectly activated interrupt handler (This item is displayed only when the gp register-specific value is specified)
	Int (*interrupt source number*)_tp	tp register-specific value of indirectly activated interrupt handler (This item is displayed only when the tp register-specific value is specified)
svc	This item is displayed when a expanded SVC handler exists.	
	svc (*system call number*)_ent	Start address of expanded SVC handler Format: *file name#line number* (*symbol* **[Note]**)
	svc (*system call number*)_gp	gp register-specific value of expanded SVC handler (This item is displayed only when the gp register-specific value is specified)
	svc (*system call number*)_tp	tp register-specific value of expanded SVC handler (This item is displayed only when the tp register-specific value is specified)

[Note] A symbol of startup address is displayed as a symbol.
However, the startup address is displayed in hexadecimal notation if symbol information dose not exist.

- Handler source display

When there is the debug information, by double-clicking the [int (*interrupt source number*)_ent] or [svc (*system call number*)_ent] line on the Detailed display area, the source text of the handler can be displayed in the Editor panel of CubeSuite.

Note that the corresponding disassemble text is displayed in the Disassemble panel of CubeSuite when there is no debug information.

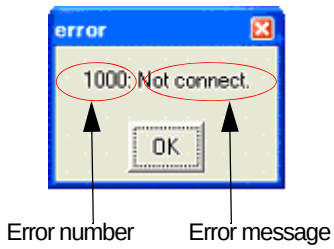
APPENDIX B MESSAGES

Appendix B provides the error information output from RD850 Pro.

B. 1 Overview

If an error occurs during an operation, the error information is displayed with the following format.

Figure B-12. Error Information Output Format



B. 2 Error Massages

The error information output from RD850 Pro is shown below.

Table B-20. Error Information List

Error Number	Description	
1000	Message	Not connect.
	Cause	RD850 Pro is not connected with CubeSuite.
	Action by User	Start CubeSuite.
1100	Message	Debugger running.
	Cause	An attempt was made to change the state of resource when the debug tool is not in the break status.
	Action by User	Operate it in the break status.
1200	Message	RX not loaded.
	Cause	RX850 Pro is not loaded.
	Action by User	Load the load module to which RX850 Pro has been linked.
1600	Message	Maybe link is broken.
	Cause	The queue search process ended abnormally due to a time out.
	Action by User	The queue information may be destroyed.

APPENDIX C INDEX

[MEMO]

For further information, please contact:

NEC Electronics Corporation
1753, Shimonumabe, Nakahara-ku,
Kawasaki, Kanagawa 211-8668,
Japan
Tel: 044-435-5111
http://www.necel.com/

[America]

NEC Electronics America, Inc.
2880 Scott Blvd.
Santa Clara, CA 95050-2554, U.S.A.
Tel: 408-588-6000
800-366-9782
http://www.am.necel.com/

[Europe]

NEC Electronics (Europe) GmbH
Arcadiastrasse 10
40472 Düsseldorf, Germany
Tel: 0211-65030
http://www.eu.necel.com/

Hanover Office
Podbielskistrasse 166 B
30177 Hannover
Tel: 0 511 33 40 2-0

Munich Office
Werner-Eckert-Strasse 9
81829 München
Tel: 0 89 92 10 03-0

Stuttgart Office
Industriestrasse 3
70565 Stuttgart
Tel: 0 711 99 01 0-0

United Kingdom Branch
Cygnus House, Sunrise Parkway
Linford Wood, Milton Keynes
MK14 6NP, U.K.
Tel: 01908-691-133

Succursale Française
9, rue Paul Dautier, B.P. 52
78142 Velizy-Villacoublay Cédex
France
Tel: 01-3067-5800

Sucursal en España
Juan Esplandiu, 15
28007 Madrid, Spain
Tel: 091-504-2787

Tyskland Filial
Täby Centrum
Entrance S (7th floor)
18322 Täby, Sweden
Tel: 08 638 72 00

Filiale Italiana
Via Fabio Filzi, 25/A
20124 Milano, Italy
Tel: 02-667541

Branch The Netherlands
Steijgerweg 6
5616 HS Eindhoven
The Netherlands
Tel: 040 265 40 10

[Asia & Oceania]

NEC Electronics (China) Co., Ltd
7th Floor, Quantum Plaza, No. 27 ZhiChunLu Haidian
District, Beijing 100083, P.R.China
Tel: 010-8235-1155
http://www.cn.necel.com/

Shanghai Branch
Room 2509-2510, Bank of China Tower,
200 Yincheng Road Central,
Pudong New Area, Shanghai, P.R.China P.C:200120
Tel:021-5888-5400
http://www.cn.necel.com/

Shenzhen Branch
Unit 01, 39/F, Excellence Times Square Building,
No. 4068 Yi Tian Road, Futian District, Shenzhen,
P.R.China P.C:518048
Tel:0755-8282-9800
http://www.cn.necel.com/

NEC Electronics Hong Kong Ltd.
Unit 1601-1613, 16/F., Tower 2, Grand Century Place,
193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: 2886-9318
http://www.hk.necel.com/

NEC Electronics Taiwan Ltd.
7F, No. 363 Fu Shing North Road
Taipei, Taiwan, R. O. C.
Tel: 02-8175-9600
http://www.tw.necel.com/

NEC Electronics Singapore Pte. Ltd.
238A Thomson Road,
#12-08 Novena Square,
Singapore 307684
Tel: 6253-8311
http://www.sg.necel.com/

NEC Electronics Korea Ltd.
11F., Samik Lavied'or Bldg., 720-2,
Yeoksam-Dong, Kangnam-Ku,
Seoul, 135-080, Korea
Tel: 02-558-3737
http://www.kr.necel.com/

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