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# H8SX Family Emulator E6000H

## Performance Measurement

#### Overview

This document describes how to measure the performance function in the full-specification emulator E6000H for the H8SX/1651.

The functions described in this document can be performed through the H8SX E6000H emulator in a stand-alone form. These functions are also available through all E6000H emulators for the H8SX family.

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### 1. Specifications

The E6000H emulator provides the performance measurement function to measure the rate of execution time.

The performance measurement function does not affect the realtime operation because it measures the rate of execution time in the specified range by using the circuit for measurement of hardware performance included in the emulator.

Select one of the following five modes according to the purpose of measurement.

Mode	Description	Purpose
a) Time Of Specified Range Measurement	Measures the execution time and execution count in the specified range.	Measurement of time taken for processing of functions except for that required for child functions called from the functions.
b) Start Point To End Point Measurement	Measures the execution time and execution count between the specified addresses.	Measurement of time taken for processing of functions.
c) Start Range To End Range Measurement	Measures the execution time from a specified range to another specified range.	Measurement of execution time spent from calling of any of sequential subroutines to calling of any of other sequential subroutines in a program that includes subroutines in sequence, such as an assembly program.
d) Access Count Of Specified Range Measurement	Measures the number of times a specified range is accessed from another specified range.	Measurement of the number of times a global variable is accessed from a specific function.
e) Called Count Of Specified Range Measurement	Measures the number of times a specified range has called another specified range.	Measurement of the number of times a function is called from a specific function.

Table 1.1	Available Measurement Modes

Use eight performance channels installed on the circuit for measurement of hardware performance in the emulator for setting of conditions for measurement. Up to eight points can be set.

## 2. Functional Descriptions

This document describes how to measure the performance function in the H8SX/1651 E6000H emulator.

It guides you through examples of the procedures for analyzing performance in the sample program provided in the CD-ROM of the H8SX E6000H emulator. Check the measurement result on the [Performance Analysis] window after program execution. For the performance measurement mode, the 'Time Of Specified Range Measurement' (see table 1.1) is specified here.



### 3. Software Preparation

#### 3.1 Introduction

Install the software provided in the CD-ROM of the H8SX E6000H emulator to expand the sample program (tutorial workspace) to be used in this document on your personal computer.

The software in the CD-ROM of the H8SX E6000H emulator can also be installed in a personal computer in which the High-performance Embedded Workshop has already been installed. In this case, some dialog boxes may be skipped in the installation process.

If the software has already been installed, go to section 4.

#### 3.2 Installing the H8SX E6000H Emulator Software

(1) Execute setup.exe from the CD-ROM of the H8SX E6000H emulator.

The whole screen is displayed and installation of [H8SX E6000H Emulator] is started. Click the [Next] button.





(2) The [License Agreement] dialog box will appear. Read the contents and click the [Yes] button.

High-performance Embedded Workshop Setup	×
License Agreement Please read the following license agreement carefully.	Ŷ
Press the PAGE DOWN key to see the rest of the agreement.	
Software User License Agreement This is a legal agreement between you, the purchaser of the license rights granted by this Agreement ("Licensee"or"You"), and Hitachi ULSI Systems Co.,Ltd. ("Licensor"). By installing or downloading the accompanying software ("Software"), or using the Software that is embedded in your computer, you agree to be bound by the terms of this Agreement. If you do not agree to these terms, promptly return all Software items (disks, written materials, and packaging) to your supplier.	
Do you accept all the terms of the preceding License Agreement? If you select No, the setup will close. To install Renesas C/C++ Compiler Package for H8, H8S and H8SX family, you must accept this agreement.	nt
	No

(3) The [Start Copying Files] dialog box will appear. Click the [Next] button.

High-performance Embedded Workshop Setup	
Start Copying Files Review settings before copying files.	Ŷ
Setup has enough information to start copying the program files. If you want to review change any settings, click Back. If you are satisfied with the settings, click Next to b copying files. Current Settings:	
<component> High-performance Embedded Workshop [C:\Program Files\Renesas\Hew] Toolchains [C:\Program Files\Renesas\Hew\Tools\Renesas] Simulator Debugger</component>	
[C:\Program Files\Renesas\Hew\Tools\Renesas]	>
InstallShield	Cancel



(4) The following progress bar will be displayed while the program files are being copied.

Installing Copying HEW Program Files C:\\H8\H8_6_1\support\2000\2126n.pgd
Cancel

(5) The [InstallShield Wizard Complete] dialog box will appear. Click the [Finish] button.



This is the end of software preparation.

#### 3.3 Installing Other Necessary Software

For the host interface board, which is an optional board for the H8SX E6000H emulator, install the necessary software according to the connection type (PCI card, PC card, LAN adaptor, or USB adaptor). The installation procedure is described in the manual supplied with the optional product; it is not described in this document.



#### 4. Operations

This section describes how to activate the High-performance Embedded Workshop (HEW) and how to use the performance measurement function in the following steps.



Figure 4.1 Procedures for Sample Program Execution

#### 4.1 Opening a Workspace

Activate the High-performance Embedded Workshop by opening the [Start] menu and selecting [All Programs], [Renesas], [High-performance Embedded Workshop], and [High-performance Embedded Workshop] in that order.





#### 4.2 Opening a Workspace

(1) The [Welcome!] dialog box will appear on the High-performance Embedded Workshop screen.



Select the [Browse to another project workspace] radio button in the [Welcome!] dialog box and click the [OK] button.





(2) The [Open Workspace] dialog box will appear.

Open Works	pace 🥐 🔀
Look jn: 🔎	1650 💌 🗢 🛍 🗰 🛛
🚞 Debug	
Tutorial.hv	
File <u>n</u> ame:	Tutorial.hws
Files of <u>t</u> ype:	HEW Workspaces (*.hws)

When the software from the CD-ROM of this product has been installed, workspace "Tutorial.hws" is stored in the folder structure shown below (standard location). Specify the correct location by opening the folders in order.

Select the workspace "Tutorial.hws" and click the [Open] button.

C:\WorkSpace\Tutorial\E6000H\1650\Tutorial.hws	
C:\WorkSpace └Tutorial └E6000H └1650 └Tutorial.hws	

Note: The above directory may not be specifiable depending on the software version. In this case, select the following directory.

<High-performance Embedded Workshop installation directory> \Tools\Renesas\DebugComp\Platform\E6000H\1650\Tutorial

Directory examples:

C:\hew3\Tools\Renesas\DebugComp\Platform\E6000H\1650\Tutorial C:\hew2\Tools\Renesas\DebugComp\Platform\E6000H\1650\Tutorial

(3) If the workspace version is old, the following dialog box will appear.

High-pe	erformance Embedded Workshop 🛛 🛛 🔀
1	The Workspace you are about to open was created with an earlier version of HEW. The data files for the workspace, projects and sessions will be updated. Once updated this workspace cannot be opened by an older version of HEW. Backup versions of your old files will be created in the workspace and project directories with the prefix 'old_version_xxx'. Do you wish to continue ?
	OK Cancel

To update it to the new version, click the [OK] button.



(4) If the [Toolchain missing] dialog box appears, select the target project name and click the [OK] button.



(5) If the [Changing Toolchain Version] dialog box appears, select the desired toolchain version and click the [OK] button.

Change Toolchai	in Version		? 🗙
Toolchain name: Current version: <u>C</u> PU Family:	Hitachi H8S,H8/300 St 6.0.0.0  H8S,H8/300	andard Toolchain	OK Cancel
<u>T</u> oolchain:	Hitachi H8S,H8/300 S	tandard Toolchain 💌	]
Toolchain <u>v</u> ersior	6.1.2.0	•	D
Toolchain <u>b</u> uild pha	ises:		
Build phase		Version	Information
H85,H8/300 Asse H85,H8/300 C/C+ H85,H8/300 C/C+ OptLinker		6.01.01 6.01.02 2.01.01 9.01.01	



(6) If the [Change Toolchain Version Summary] dialog box appears, just click the [OK] button.

Change Toolchain Version Summary				
<u>S</u> ummary :				
Project name : Tutorial	^			
Hitachi H8S,H8/300 Standard Toolchain was upgraded 6.0.0.0 -> 6.1.2.0.				
	~			
Generate Upgrade.txt as a summary file in the project directory				
ОК				

(7) After the workspace has been read, operation on the High-performance Embedded Workshop screen becomes available.





## 4.3 Connecting the E6000H Emulator

(1) Open [Debug Session] from the [Debug] menu.

🖗 Tutorial - High-performa	ince Embedded W	orkshop		
<u>File E</u> dit <u>V</u> iew <u>P</u> roject <u>B</u> uild	<u>D</u> ebug Set <u>u</u> p <u>T</u> ool	s Te <u>s</u> t <u>W</u> indow	Help	
🛛 🗅 🖨 🖬 🏉 🖉 <	De <u>b</u> ug Sessions		🗩 🕂 🖓 🎧 🖉 🏙 👗 🛛 Debug	-
<b>∥</b> *r	Debug Settings		000	
0 👿 16 10 8 2 9	≣ <b>†</b> Reset CP <u>U</u>		TOP IPC PC	
	≣↓ <u>G</u> o	F5		1
🖃 🖓 Tutorial	≣↓ R <u>e</u> set Go	Shift+F5		
E Tutorial	国t Go To <u>C</u> ursor			
⊡⊟ dbsct.c	I <sub>PC</sub> Set <u>P</u> C To Cursor			
± sbrk.c	<u>R</u> un			
🖻 🔄 C++ source file	™ <sub>PC</sub> Display PC	Ctrl+Shift+Y		
······································	} Step In	F11		
🔄 🔛 tutorial.cpp	A Step Over	F10		
🔄 🔄 Download modul	{} Step Out	Shift+F11		
🛛 🖂 🖂 Dependencies	<u>S</u> tep			
≣ sbrk.h ≣ sort.h	Step <u>M</u> ode	+		
🛄 stacksct.h	🔟 <u>H</u> alt Program			
	Initialize			
	🚰 Connect			
	Disconnect			
└ P	S <u>a</u> ve Memory			
Add/remove sessions	Veri <u>f</u> y Memory		2 🚉 Default1 desktop	

(2) The [Debug Session] dialog box will appear. Select [sessionh8sx\_1650\_e6000h\_emulator] for [Current Session] and click the [OK] button.

Debug Sessions	? 🗙	
Sessions Synchronized Debug		
Debug sessions:		
sessionh8sx_1527_e6000h_emulator sessionh8sx_1527R_e6000h_emulator	<u>A</u> dd	
sessionh8sx_1544_e6000h_emulator sessionh8sx_1650_e6000h_emulator	<u>R</u> emove	
sessionh8sx_1653_e6000h_emulator sessionh8sx_1663_e6000h_emulator	Save as	
	Properties	
Current session:		
Isessionh8sx_1527_e6000h_emulator		
ОК	Cancel	



(3) The [Change Session] dialog box will appear. Click the [Yes] button.



(4) The display of the session on the toolbar is changed as [sessionh8sx\_1650\_e6000h\_emulator].





(5) Turn on the E6000H emulator and click [Connect] from the [Debug] menu.



(6) The [Connecting] dialog box is displayed while the E6000H emulator is connected.



The [E6000H Driver Details] dialog box may be shown when connecting the E6000H emulator. In this case, select the driver in use and click the [Close] button.



(7) When the E6000H emulator is connected, [Connected] is displayed on the [Debug] tab.

Tutorial - High-performance Embedded Workshop	X
File Edit View Project Build Debug Setyp Tools Te <u>st W</u> indow <u>H</u> elp	
📗 🗅 😂 🗟 🕺 🛍 💼 🔂 🔛 🎇 🕢 🔛 🔽 🖂 📝 🖾 🔜 😥 🖾 🖾 Debug 💽 Sessionh8sx_1527R_e600	0 <b>-</b>
<b>™ </b> T	
- M M 15 12 8 2	
Intorial   Interview   Interview	
🕺 91 91 Al At 😫 2t 🖉 🖻 🖬 ?	
(firmware ID: H8SX E6000H 1.0.11). The memory map information have been initialized. Initialise bus monitor OK User Reset signal is Inactive User NMI signal is Inactive User Standby signal is Inactive	~
Connection to the emulator has been completed successfully. Connected	
	~
Build A Debug A Find in Files A Macro A Test A Version Control A	
Ready 📴 🔛 🔛 Default1 desktop INS	



#### 4.4 Downloading a Program

(1) Select [Download Modules] form the [Debug] menu to load the sample program. Select the file "Tutorial.abs" registered in the workspace.



(2) After downloading a program completes, a downward arrow is added to the icon left to the file name.





### 4.5 Opening a Source File

(1) Double-click the source file name "tutorial.cpp" on the workspace to open the source code. Here, select the file "tutorial.cpp".



(2) The contents of the file "Tutorial.cpp" are displayed in the [Source] window.





### 4.6 Setting a Breakpoint

(1) Scroll the source code display to show line 46 by using the scroll bar.



Here, double-click the [S/W Breakpoint] column on line 46 to set a breakpoint.

A red dot indicates that a software breakpoint has been set.

To clear a breakpoint previously set, double-click the red dot.

### 4.7 Setting a Performance Measurement Condition

RENESAS

(1) Select [Performance Analysis] from [Performance] of the [View] menu.



(2) The [Select Performance Analysis Type] dialog box will appear. Select [E6000H Performance Analysis] and click the [OK] button.

Select Performance	Analysis Type	? 🛛
Performance Analysis:	E6000H Performance Analysis	▼ <u>D</u> K <u>C</u> ancel



(3) The [Performance Analysis] window will be added.

Tutorial - High-performance Embedded Workshop - [T		
Eile Edit View Project Build Debug Setup Tools Test y		
	🔽 🐴 🙀 🖉 🕮 📇 👗 Debug 💽 sessionh8sx_1527R_e600 🔽	
🖑 💯 🔟 8 2 🛒 🚰 📧 🕇 🎎 🔤 📗 🖼	💭 🔟 🐺 💐 🗊 ET EL ET EL 🔁 🖓 🖓 🖤 🗸 🦕 💹 💹	
	1	
Tutorial		
E Source file	D. S. Source	
dbsct.c 33	long j;	
	int i; class Sample *p sam;	
resetprg.cpp 36		
	p_sam= new Sample;	
	<pre>for( i=0; i&lt;10; i++ )(</pre>	
Tutorial.abs - 0000000 40 0001044	$\frac{1}{if(j < 0)}$	
Dependencies 41 0001046	; = -;;	
stackset.h		
45 0001058	<pre>p_sam-&gt;sort(a);</pre>	
46 0001066	<pre>p_sam-&gt;change(a);</pre>	
48 0001068	n sam->sO=a[O]:	
🔁 P 🛃 T 🔍 N 🚺		
× • × · × · · · · · · · · · · · · · · ·		
No Name Condition Rate R	UN-TIME MAX-MIN-TIME Count 01020304 🔨	
1		
2		
3		
4		
Ži 0↓ 0↑ ▲↓ ▲↑ 🔽 &↑ 🖉 🗈 🖬 ?		
U ▲ Debug / Find in Files λ Macro λ Test λ Version Control /		
Ready	🖪 🔝 🔛 Default1 desktop Read-write 40/65 13 INS NUM	

(4) Select the line in the [Performance Analysis] window that has 1 in its [No.] column and click the right-hand mouse button to display a popup menu.



Select [Set...] from this popup menu.



(5) The [Performance Analysis Properties] dialog box will appear. Select [Time Of Specified Range Measurement] from the [Measurement Method PA1] combo box.

Performance Analysis Propert	ies 🔹 ? 🔀
Measurement Method PA1:	Time Of Specified Range Measurement
Bange Name :         PA1           Range         Start Address :         H'00000000           End Address :         H'000000000	
TASK ID	Common Settings of Performance(PA1-8)
C Others	Address Control Mode: PC
C TASK Selection <u>1</u> none	Time Measurement Unit: 20ns
C TASK Selection 2 none	
C TASK Selection <u>3</u> none	OK Cancel

Click the [...] button on the right of the [Start Address] edit box.

(6) The [Input Function Range] dialog box will appear.

Input Function Range	? 🔀
Eunction	ОК
H'00000000	Cancel

Enter 'Sample::sort(long\*)' in the [Function] edit box and then click the [OK] button.

Input Function Range	? 🔀
Eunction	ОК
Sample::sort(long*)	Cancel



(7) The addresses for the function entered in (6) above is automatically set in the [Start Address] and [End Address] edit boxes. Check addresses for [Range] and click the [OK] button.

Performance Analysis Proper	ties 🔹 💽 🔀
Measurement Method PA1:	Time Of Specified Range Measurement
Bange Name :     PA1       Range     Start Address :     H'00002046       End Address :     H'000020C4	
TASK ID	Common Settings of Performance(PA1-8)
C Others	Address Control Mode: PC
C TASK Selection 1 none	Time Measurement Unit: 20ns
C TASK Selection <u>2</u> none	Time Measurement Onit. 2015
C TASK Selection <u>3</u> none	OK Cancel

(8) The performance analysis condition is displayed on the [Performance Analysis] window.

🟟 Tutorial - Hish-performance Embedded Workshop - [Tutorial.cpp]
◇ ファイル(E) 編集(E) 表示(V) プロジェクト(E) ビルド(B) デバッグ(D) 基本設定(U) ツール(D) テスト(G) ウィンドウ(W) ヘルプ(H) _ B ×
🗅 😅 🖬 🕼 🕹 🖗 😜 🙀 🧛 💽 🦛 😒 🍂 😒 🕮 🖽 🗡 Debug 💽 (sessionh8sx_1650_e6000) 🗸
Tutorial I I I I I I I I I I I I I I I I I I I
□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □
dbsctc 31 000102e void tutorial(void)
Sprk
int i; □ ≌ resetpr∉.cpt 35 class Sample *p_sam;
- is sort.cpp 36
Mutorialcop         37         0001032         p_sam= new sample;           38         0001050         for(i=0;  (10; i++)]
□ □ Download mode 39 000103c j = rand(); □ □ Tutorialabs 40 0001044 if(j < 0){
= → Dependencies 41 0001046 j = -j;
■         sbrk.h         42         }           ■         sorth         43         0001048         a[i] = j;
■ sortn 44 } ■ stackscth 45 0001058 p sam->sort(a);
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
47 48 000106e p sam->s0=a[0];
49 0001072 p sam->s1=a[1]; ▼
Tutorial.cop
· · · · · · · · · · · · · · · · · · ·
No Name Condition Rate RUN-TIME Count 01020304050
1 FA1 Range H'00002046 H'00002054 0% 00h 00min 00s 000ms 000ms 0
2
3
🔄 OJ OT AL AT 😫 XT 🖉 🖻 🖬 ?
Connected
Klash λ Build λ Debug Λ Find in Files λ Macro λ Test λ Version Control /
レディ  区  図  図  D Default1 desktop Read-write 46/65 1 INS / 2

The measured value of data will become the initial value immediately after the performance analysis condition has been set.



## 4.8 Executing a Program

(1) Select [Reset Go] from the [Debug] menu to execute a program.

🖗 Tutorial - High-performance	Embedded Worksho	p - [Tutorial	.cpp]
🧈 File Edit View Project Build	Debug Setup Tools 1	fest Window	Help
] D 🛩 E 🕼   &   % h	De <u>b</u> ug Sessions		▼ 約 務
0 🕅 16 10 8 2 🛒 🖁	Debug Settings		70 🛱 💐
	≣¶ Reset CP <u>U</u>		
□ ⊡… 🖓 Tutorial ⊡… 🚯 Tutorial	≣↓ Go	F5	
📋 🚊 🔄 C source file <	Reset Go	Shift+F5	Source
black.c	'∐I Go To <u>C</u> ursor I <sub>PC</sub> Set <u>P</u> C To Cursor		void tutor {
resetprg.cpp	<u>R</u> un <sup>V</sup> ec Displa <u>y</u> PC Ct	rl+Shift+Y	long j int i;
🔛 tutorial.cpp ⊡ Download modules		F11	class
Tutorial.abs - 000		F10	p_sam=
🖻 💼 Dependencies	<b>{}</b> → Step <u>O</u> ut	Shift+F11	for(i
⊡≣ sbrk.h ⊡≣ sort.h	<u>S</u> tep		j if
📄 🗐 stacksct.h	Step <u>M</u> ode	· · · ·	
•	🐠 <u>H</u> alt Program		}
🔄 P 🗟 T 🔍 N 🚺	Initialize		
≚ <mark>♣ ₭ ₭</mark>	<sup>m</sup> Disconnec <u>t</u>		
No Name Conditi	S <u>a</u> ve Memory		te RUN-
1 PA1 Range H	Verify Memory		00h
2 <	Configure Overlay		
N 01 01 AL AT 21 21 0	Do <u>w</u> nload Modules		
Build Debug / Find in	Unioad Modules	Version Contr	
	Thes A Macro A test /	·	
Reset hardware and start execution			



#### 4.9 Performance Analysis Result

(1) When a break condition is satisfied, the source window shows the program stop position.

Tutorial - High-performance Embed     File Edit View Project Build Debug		
D 😅 🖬 🕼 🥵 🐰 🖻 🖻 😣	🖌 🔄 🛤 🛣 🖓 🔛 🍪 🛗 👗 🚺 Debug 💽 💽 sessionh8sx_	
	t+ XX   III     III     III     III     III	
Tutorial	II 6 4	
⊡… 🕞 Tutorial ⊡… 🔄 C source file	Line Source D., S., Source	
Gestation disct.c gestation disct.c gestation disct.c gestation disct.c gestation disct.c gestation disct.c gestation disct.c gestation disct.c	40         0001044         if(j < 0)(           41         0001046         j = -j;           42         )	
말 resetprg.cpp 말 sort.cpp 말 tutorial.cpp	43     0001048     a[i] = j;       44     >       45     0001058     p_sam->sort(a);	
<ul> <li>☐ ☐ Download modules</li> <li>☐ I Tutorial.abs - 0000000</li> <li>☐ Dependencies</li> <li>☐ sbrk.h</li> </ul>	46         0001066         p_sam->change(a);           47	
- E sort.h	50         0001076         p_sam->s2=a[2];           51         0001071         p_sam->s3=a[3];           52         000107F         p_sam->s4=a[4];	
P IT IN	Z Tutorial.cpp	
× • × ×		
No Name Condition	Rate RUN-TIME Count 0102030-	
1 PA1 Range H'00002046 H 2 <	'000020c4 15% OOh OOmin OOs OOOms O93us O8Ons 1 #######	
× OJ OT AJ AT 2J 2T 2 P		
Break = Software Break	🔝 🔝 🔝 Default1 desktop Read-write 46/65 1 INS NUM	

The yellow arrow points to the program counter location and the corresponding source line is highlighted in yellow.

"Software Break" is displayed as the program stop cause in the [Debug] tab and on the status bar.

When the program execution is halted, the results of measurement are displayed in the [Performance Analysis] window.

For details on the displayed contents and the customizing methods, refer to the H8SX E6000H Emulator User's Manual that is listed in section 5, Related Documents.

In addition, the performance measurement function of the H8SX E6000H emulator has other functions than 'Time Of Specified Range Measurement' used in this document. For details on these functions, the H8SX E6000H Emulator User's Manual is also available.



#### 5. Related Documents

The H8SX E6000H emulator and High-performance Embedded Workshop provide many other useful functions not mentioned in this document. Please refer to the following related documents for important information such as detailed specifications, technical information, or restrictions.

Documents Related to the H8SX/1651 E6000H Emulator:

• H8SX E6000H Emulator User's Manual

Debugger Part:

Section 3.7, Using the Event Points

Tutorial:

Section 4.17, Trace Functions

- Precautions on Using the H8SX E6000H Emulator
- PC Card Interface for E6000, E6000H and E8000 Emulators HS6000EIP02H User's Manual
- Emulator Options 1 (PC I/F-part) documents

Document Related to High-Performance Embedded Workshop:

• High-performance Embedded Workshop User's Manual

Documents Related to CPU:

- H8SX/1651 Group Hardware Manual
- H8SX Family Software Manual

Documents Related to H8S, H8/300 Series C/C++ Compiler Package:

- Notes on Usage of the C/C++ Compiler Package for H8SX, H8S, H8 Family V.6.01 Release 02 and Corrections in the User's Manual
- H8S, H8/300 Series C/C++ Compiler, Assembler, Optimizing Linkage Editor User's Manual

Visit the following Renesas websites for information on this product:

Japanese site:	http://japan.renesas.com/e6000h
Global site:	http://www.renesas.com/e6000h



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### **Revision History**

		Revisions	
Rev.	Publication date	Page	Description
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