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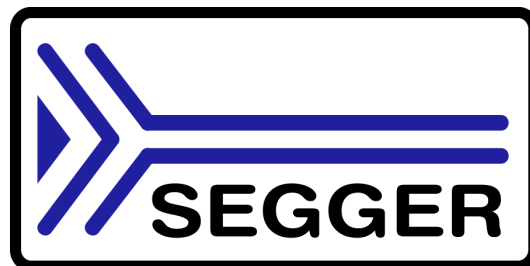
J-Link / J-Trace *User Guide*



Software Version V4.36
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Revisions

This manual describes the J-Link and J-Trace device.

For further information on topics or routines not yet specified, please contact us.

Revision	Date	By	Explanation
V4.36 Rev. 1	110927	EL	Chapter "Flash download" added. Chapter "Flash breakpoints" added. Chapter "Target interfaces and adapters" * Section "20-pin JTAG/SWD connector" updated. Chapter "RDI" added. Chapter "Setup" updated. Chapter "Device specifics" updated. Several corrections / updates.
V4.36 Rev. 0	110909	AG	Chapter "Working with J-Link" * Section "J-Link script files" updated.
V4.26 Rev. 1	110513	KN	Chapter "Introduction" * Section "J-Link / J-Trace models" corrected.
V4.26 Rev. 0	110427	KN	Several corrections.

Revision	Date	By	Explanation
V4.24 Rev. 1	110228	AG	Chapter "Introduction" * Section "J-Link / J-Trace models" corrected. Chapter "Device specifics" * Section "ST Microelectronics" updated.
V4.24 Rev. 0	110216	AG	Chapter "Device specifics" * Section "Samsung" added. Chapter "Working with J-Link" * Section "Reset strategies" updated. Chapter "Target interfaces and adapters" * Section "9-pin JTAG/SWD connector" added.
V4.23d	110202	AG	Chapter "J-Link and J-Trace related software" * Section "J-Link software and documentation package in detail" updated. Chapter "Introduction" * Section "Built-in intelligence for supported CPU-cores" added.
V4.21g	101130	AG	Chapter "Working with J-Link" * Section "Reset strategies" updated. Chapter "Device specifics" * Section "Freescale" updated. Chapter "Flash download and flash breakpoints" * Section "Supported devices" updated * Section "Setup for different debuggers (CFI flash)" updated.
V4.21	101025	AG	Chapter "Device specifics" * Section "Freescale" updated.
V4.20j	101019	AG	Chapter "Working with J-Link" * Section "Reset strategies" updated.
V4.20b	100923	AG	Chapter "Working with J-Link" * Section "Reset strategies" updated.
90	100818	AG	Chapter "Working with J-Link" * Section "J-Link script files" updated. * Section "Command strings" updated. Chapter "Target interfaces and adapters" * Section "19-pin JTAG/SWD and Trace connector" corrected. Chapter "Setup" * Section "J-Link configurator added."
89	100630	AG	Several corrections.
88	100622	AG	Chapter "J-Link and J-Trace related software" * Section "SWO Analyzer" added.
87	100617	AG	Several corrections.
86	100504	AG	Chapter "Introduction" * Section "J-Link / J-Trace models" updated. Chapter "Target interfaces and adapters" * Section "Adapters" updated.
85	100428	AG	Chapter "Introduction" * Section "J-Link / J-Trace models" updated.
84	100324	KN	Chapter "Working with J-Link and J-Trace" * Several corrections Chapter Flash download & flash breakpoints * Section "Supported devices" updated
83	100223	KN	Chapter "Introduction" * Section "J-Link / J-Trace models" updated.
82	100215	AG	Chapter "Working with J-Link" * Section "J-Link script files" added.

Revision	Date	By	Explanation
81	100202	KN	Chapter "Device Specifics" * Section "Luminary Micro" updated. Chapter "Flash download and flash breakpoints" * Section "Supported devices" updated.
80	100104	KN	Chapter "Flash download and flash breakpoints" * Section "Supported devices" updated
79	091201	AG	Chapter "Working with J-Link and J-Trace" * Section "Reset strategies" updated. Chapter "Licensing" * Section "J-Link OEM versions" updated.
78	091023	AG	Chapter "Licensing" * Section "J-Link OEM versions" updated.
77	090910	AG	Chapter "Introduction" * Section "J-Link / J-Trace models" updated.
76	090828	KN	Chapter "Introduction" * Section "Specifications" updated * Section "Hardware versions" updated * Section "Common features of the J-Link product family" updated Chapter "Target interfaces and adapters" * Section "5 Volt adapter" updated
75	090729	AG	Chapter "Introduction" * Section "J-Link / J-Trace models" updated. Chapter "Working with J-Link and J-Trace" * Section "SWD interface" updated.
74	090722	KN	Chapter "Introduction" * Section "Supported IDEs" added * Section "Supported CPU cores" updated * Section "Model comparison chart" renamed to "Model comparison" * Section "J-Link bundle comparison chart" removed
73	090701	KN	Chapter "Introduction" * Section "J-Link and J-Trace models" added * Sections "Model comparison chart" & "J-Link bundle comparison chart" added Chapter "J-Link and J-Trace models" removed Chapter "Hardware" renamed to "Target interfaces & adapters" * Section "JTAG Isolator" added Chapter "Target interfaces and adapters" * Section "Target board design" updated Several corrections
72	090618	AG	Chapter "Working with J-Link" * Section "J-Link control panel" updated. Chapter "Flash download and flash breakpoints" * Section "Supported devices" updated. Chapter "Device specifics" * Section "NXP" updated.
71	090616	AG	Chapter "Device specifics" * Section "NXP" updated.
70	090605	AG	Chapter "Introduction" * Section "Common features of the J-Link product family" updated.

Revision	Date	By	Explanation
69	090515	AG	Chapter "Working with J-Link" * Section "Reset strategies" updated. * Section "Indicators" updated. Chapter "Flash download and flash breakpoints" * Section "Supported devices" updated.
68	090428	AG	Chapter "J-Link and J-Trace related software" * Section "J-Link STM32 Commander" added. Chapter "Working with J-Link" * Section "Reset strategies" updated.
67	090402	AG	Chapter "Working with J-Link" * Section "Reset strategies" updated.
66	090327	AG	Chapter "Background information" * Section "Embedded Trace Macrocell (ETM)" updated. Chapter "J-Link and J-Trace related software" * Section "Dedicated flash programming utilities for J-Link" updated.
65	090320	AG	Several changes in the manual structure.
64	090313	AG	Chapter "Working with J-Link" * Section "Indicators" added.
63	090212	AG	Chapter "Hardware" * Several corrections. * Section "Hardware Versions" Version 8.0 added.
62	090211	AG	Chapter "Working with J-Link and J-Trace" * Section "Reset strategies" updated. Chapter J-Link and J-Trace related software * Section "J-Link STR91x Commander (Command line tool)" updated. Chapter "Device specifics" * Section "ST Microelectronics" updated. Chapter "Hardware" updated.
61	090120	TQ	Chapter "Working with J-Link" * Section "Cortex-M3 specific reset strategies"
60	090114	AG	Chapter "Working with J-Link" * Section "Cortex-M3 specific reset strategies"
59	090108	KN	Chapter Hardware * Section "Target board design for JTAG" updated. * Section "Target board design for SWD" added.
58	090105	AG	Chapter "Working with J-Link Pro" * Section "Connecting J-Link Pro the first time" updated.
57	081222	AG	Chapter "Working with J-Link Pro" * Section "Introduction" updated. * Section "Configuring J-Link Pro via web interface" updated. Chapter "Introduction" * Section "J-Link Pro overview" updated.
56	081219	AG	Chapter "Working with J-Link Pro" * Section "FAQs" added. Chapter "Support and FAQs" * Section "Frequently Asked Questions" updated.
55	081218	AG	Chapter "Hardware" updated.
54	081217	AG	Chapter "Working with J-Link and J-Trace" * Section "Command strings" updated.
53	081216	AG	Chapter "Working with J-Link Pro" updated.

Revision	Date	By	Explanation
52	081212	AG	Chapter "Working with J-Link Pro" added. Chapter "Licensing" * Section "Original SEGGER products" updated.
51	081202	KN	Several corrections.
50	081030	AG	Chapter "Flash download and flash breakpoints" * Section "Supported devices" corrected.
49	081029	AG	Several corrections.
48	080916	AG	Chapter "Working with J-Link and J-Trace" * Section "Connecting multiple J-Links / J-Traces to your PC" updated.
47	080910	AG	Chapter "Licensing" updated.
46	080904	AG	Chapter "Licensing" added. Chapter "Hardware" Section "J-Link OEM versions" moved to chapter "Licensing"
45	080902	AG	Chapter "Hardware" Section "JTAG+Trace connector" JTAG+Trace connector pinout corrected. Section "J-Link OEM versions" updated.
44	080827	AG	Chapter "J-Link control panel" moved to chapter "Working with J-Link". Several corrections.
43	080826	AG	Chapter "Flash download and flash breakpoints" Section "Supported devices" updated.
42	080820	AG	Chapter "Flash download and flash breakpoints" Section "Supported devices" updated.
41	080811	AG	Chapter "Flash download and flash breakpoints" updated. Chapter "Flash download and flash breakpoints", section "Supported devices" updated.
40	080630	AG	Chapter "Flash download and flash breakpoints" updated. Chapter "J-Link status window" renamed to "J-Link control panel" Various corrections.
39	080627	AG	Chapter "Flash download and flash breakpoints" Section "Licensing" updated. Section "Using flash download and flash breakpoints with different debuggers" updated. Chapter "J-Link status window" added.
38	080618	AG	Chapter "Support and FAQs" Section "Frequently Asked Questions" updated Chapter "Reset strategies" Section "Cortex-M3 specific reset strategies" updated.
37	080617	AG	Chapter "Reset strategies" Section "Cortex-M3 specific reset strategies" updated.
36	080530	AG	Chapter "Hardware" Section "Differences between different versions" updated. Chapter "Working with J-Link and J-Trace" Section "Cortex-M3 specific reset strategies" added.

Revision	Date	By	Explanation
35	080215	AG	Chapter "J-Link and J-Trace related software" Section "J-Link software and documentation package in detail" updated.
34	080212	AG	Chapter "J-Link and J-Trace related software" Section "J-Link TCP/IP Server (Remote J-Link / J-Trace use)" updated. Chapter "Working with J-Link and J-Trace" Section "Command strings" updated. Chapter "Flash download and flash breakpoints" Section "Introduction" updated. Section "Licensing" updated. Section "Using flash download and flash breakpoints with different debuggers" updated.
33	080207	AG	Chapter "Flash download and flash breakpoints" added Chapter "Device specifics": Section "ATMEL - AT91SAM7 - Recommended init sequence" added.
32	0080129	SK	Chapter "Device specifics": Section "NXP - LPC - Fast GPIO bug" list of device enhanced.
31	0080103	SK	Chapter "Device specifics": Section "NXP - LPC - Fast GPIO bug" updated.
30	071211	AG	Chapter "Device specifics": Section "Analog Devices" updated. Section "ATMEL" updated. Section "Freescale" added. Section "Luminary Micro" added. Section "NXP" updated. Section "OKI" added. Section "ST Microelectronics" updated. Section "Texas Instruments" updated. Chapter "Related software": Section "J-Link STR91x Commander" updated
29	070912	SK	Chapter "Hardware", section "Target board design" updated.
28	070912	SK	Chapter "Related software": Section "J-LinkSTR91x Commander" added. Chapter "Device specifics": Section "ST Microelectronics" added. Section "Texas Instruments" added. Subsection "AT91SAM9" added.
28	070912	AG	Chapter "Working with J-Link/J-Trace": Section "Command strings" updated.
27	070827	TQ	Chapter "Working with J-Link/J-Trace": Section "Command strings" updated.
26	070710	SK	Chapter "Introduction": Section "Features of J-Link" updated. Chapter "Background Information": Section "Embedded Trace Macrocell" added. Section "Embedded Trace Buffer" added.

Revision	Date	By	Explanation
25	070516	SK	Chapter "Working with J-Link/J-Trace": Section "Reset strategies in detail" - "Software, for Analog Devices ADuC7xxx MCUs" updated - "Software, for ATMEL AT91SAM7 MCUs" added. Chapter "Device specifics" Section "Analog Devices" added. Section "ATMEL" added.
24	070323	SK	Chapter "Setup": "Uninstalling the J-Link driver" updated. "Supported ARM cores" updated.
23	070320	SK	Chapter "Hardware": "Using the JTAG connector with SWD" updated.
22	070316	SK	Chapter "Hardware": "Using the JTAG connector with SWD" added.
21	070312	SK	Chapter "Hardware": "Differences between different versions" supplemented.
20	070307	SK	Chapter "J-Link / J-Trace related software": "J-Link GDB Server" licensing updated.
19	070226	SK	Chapter "J-Link / J-Trace related software" updated and reorganized. Chapter "Hardware" "List of OEM products" updated
18	070221	SK	Chapter "Device specifics" added Subchapter "Command strings" added
17	070131	SK	Chapter "Hardware": "Version 5.3": Current limits added "Version 5.4" added Chapter "Setup": "Installing the J-Link USB driver" removed. "Installing the J-Link software and documentation pack" added. Subchapter "List of OEM products" updated. "OS support" updated
16	061222	SK	Chapter "Preface": "Company description" added. J-Link picture changed.
15	060914	OO	Subchapter 1.5.1: Added target supply voltage and target supply current to specifications. Subchapter 5.2.1: Pictures of ways to connect J-Trace.
14	060818	TQ	Subchapter 4.7 "Using DCC for memory reads" added.
13	060711	OO	Subchapter 5.2.2: Corrected JTAG+Trace connector pinout table.
12	060628	OO	Subchapter 4.1: Added ARM966E-S to List of supported ARM cores.
11	060607	SK	Subchapter 5.5.2.2 changed. Subchapter 5.5.2.3 added.
10	060526	SK	ARM9 download speed updated. Subchapter 8.2.1: Screenshot "Start sequence" updated. Subchapter 8.2.2 "ID sequence" removed. Chapter "Support" and "FAQ" merged. Various improvements

Revision	Date	By	Explanation
9	060324	OO	Chapter "Literature and references" added. Chapter "Hardware": Added common information trace signals. Added timing diagram for trace. Chapter "Designing the target board for trace" added.
8	060117	OO	Chapter "Related Software": Added JLinkARM.dll. Screenshots updated.
7	051208	OO	Chapter Working with J-Link: Sketch added.
6	051118	OO	Chapter Working with J-Link: "Connecting multiple J-Links to your PC" added. Chapter Working with J-Link: "Multi core debugging" added. Chapter Background information: "J-Link firmware" added.
5	051103	TQ	Chapter Setup: "JTAG Speed" added.
4	051025	OO	Chapter Background information: "Flash programming" added. Chapter Setup: "Scan chain configuration" added. Some smaller changes.
3	051021	TQ	Performance values updated.
2	051011	TQ	Chapter "Working with J-Link" added.
1	050818	TW	Initial version.

About this document

This document describes J-Link and J-Trace. It provides an overview over the major features of J-Link and J-Trace, gives you some background information about JTAG, ARM and Tracing in general and describes J-Link and J-Trace related software packages available from Segger. Finally, the chapter *Support and FAQs* on page 255 helps to troubleshoot common problems.

For simplicity, we will refer to J-Link ARM as J-Link in this manual.

For simplicity, we will refer to J-Link ARM Pro as J-Link Pro in this manual.

Typographic conventions

This manual uses the following typographic conventions:

Style	Used for
Body	Body text.
Keyword	Text that you enter at the command-prompt or that appears on the display (that is system functions, file- or pathnames).
Reference	Reference to chapters, tables and figures or other documents.
GUIElement	Buttons, dialog boxes, menu names, menu commands.

Table 1.1: Typographic conventions



SEGGER Microcontroller GmbH & Co. KG develops and distributes software development tools and ANSI C software components (middleware) for embedded systems in several industries such as telecom, medical technology, consumer electronics, automotive industry and industrial automation.

SEGGER's intention is to cut software development time for embedded applications by offering compact flexible and easy to use middleware, allowing developers to concentrate on their application.

Our most popular products are emWin, a universal graphic software package for embedded applications, and embOS, a small yet efficient real-time kernel. emWin, written entirely in ANSI C, can easily be used on any CPU and most any display. It is complemented by the available PC tools: Bitmap Converter, Font Converter, Simulator and Viewer. embOS supports most 8/16/32-bit CPUs. Its small memory footprint makes it suitable for single-chip applications.

Apart from its main focus on software tools, SEGGER develops and produces programming tools for flash microcontrollers, as well as J-Link, a JTAG emulator to assist in development, debugging and production, which has rapidly become the industry standard for debug access to ARM cores.

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EMBEDDED SOFTWARE (Middleware)



emWin

Graphics software and GUI

emWin is designed to provide an efficient, processor- and display controller-independent graphical user interface (GUI) for any application that operates with a graphical display. Starterkits, eval- and trial-versions are available.



embOS

Real Time Operating System

embOS is an RTOS designed to offer the benefits of a complete multitasking system for hard real time applications with minimal resources. The profiling PC tool embOSView is included.



emFile

File system

emFile is an embedded file system with FAT12, FAT16 and FAT32 support. emFile has been optimized for minimum memory consumption in RAM and ROM while maintaining high speed. Various Device drivers, e.g. for NAND and NOR flashes, SD/MMC and CompactFlash cards, are available.



emUSB

USB device stack

A USB stack designed to work on any embedded system with a USB client controller. Bulk communication and most standard device classes are supported.

SEGGER TOOLS

Flasher

Flash programmer

Flash Programming tool primarily for microcontrollers.

J-Link

JTAG emulator for ARM cores

USB driven JTAG interface for ARM cores.

J-Trace

JTAG emulator with trace

USB driven JTAG interface for ARM cores with Trace memory. supporting the ARM ETM (Embedded Trace Macrocell).

J-Link / J-Trace Related Software

Add-on software to be used with SEGGER's industry standard JTAG emulator, this includes flash programming software and flash breakpoints.



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Chapter 1

Introduction

This chapter gives a short overview about J-Link and J-Trace.

1.1 Requirements

Host System

To use J-Link or J-Trace you need a host system running Windows 2000 or later. For a list of all operating systems which are supported by J-Link, please refer to *Supported OS* on page 21.

Target System

A target system with a supported CPU is required.

You should make sure that the emulator you are looking at supports your target CPU. For more information about which J-Link features are supported by each emulator, please refer to *Model comparison* on page 23.

1.2 Supported OS

J-Link/J-Trace can be used on the following operating systems:

- Microsoft Windows 2000
- Microsoft Windows XP
- Microsoft Windows XP x64
- Microsoft Windows Vista
- Microsoft Windows Vista x64
- Windows 7
- Windows 7 x64

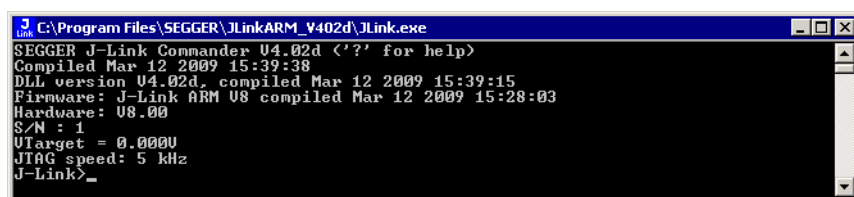
1.3 J-Link / J-Trace models

J-Link / J-Trace is available in different variations, each designed for different purposes / target devices. Currently, the following models of J-Link / J-Trace are available:

- J-Link ARM
- J-Link Ultra
- J-Link ARM Pro
- J-Trace ARM
- J-Trace for Cortex-M

In the following, the different J-Link / J-Trace models are described and the changes between the different hardware versions of each model are listed. To determine the hardware version of your J-Link / J-Trace, the first step should be to look at the label at the bottom side of the unit. J-Links / J-Traces have the hardware version printed on the back label.

If this is not the case with your J-Link / J-Trace, start `JLink.exe`. As part of the initial message, the hardware version is displayed.



```
C:\Program Files\SEGGER\JLinkARM_V402d\JLink.exe
SEGGER J-Link Commander V4.02d ('?' for help)
Compiled Mar 12 2009 15:39:38
DLL version V4.02d, compiled Mar 12 2009 15:39:15
Firmware: J-Link ARM V8 compiled Mar 12 2009 15:28:03
Hardware: V8.00
S/N : 1
VTarget = 0.000V
JTAG speed: 5 kHz
J-Link>_
```

1.3.1 Model comparison

The following tables show the features which are included in each J-Link / J-Trace model.

Hardware features

	J-Link	J-Link Pro	J-Trace for Cortex-M	J-Trace
USB	yes	yes	yes	yes
Ethernet	no	yes	no	no
Supported cores	ARM7/9/11, Cortex-A5/A8, Cortex-M0/M1/M3/M4, Cortex-A5/A8/A9/R4	ARM7/9/11, Cortex-A5/A8, Cortex-M0/M1/M3/M4, Cortex-A5/A8/A9/R4	ARM 7/9 (no tracing), Cortex-M0/M1/M3/M4	ARM 7/9
JTAG	yes	yes	yes	yes
SWD	yes	yes	yes	no
SWO	yes	yes	yes	no
ETM Trace	no	no	yes	yes

Software features

Software features are features implemented in the software primarily on the host. Software features can either come with the J-Link or be added later using a license string from Segger.

	J-Link	J-Link Pro	J-Trace for Cortex-M	J-Trace
J-Flash	yes(opt)	yes	yes(opt)	yes(opt)
Flash breakpoints ²	yes(opt)	yes	yes(opt)	yes(opt)
Flash download ¹	yes(opt)	yes	yes(opt)	yes(opt)
GDB Server	yes(opt)	yes	yes(opt)	yes(opt)
RDI	yes(opt)	yes	yes(opt)	yes(opt)

¹ Most IDEs come with its own flashloaders, so in most cases this feature is not essential for debugging your applications in flash. The J-Link flash download (FlashDL) feature is mainly used in debug environments where the debugger does not come with an own flashloader (for example, the GNU Debugger). For more information about how flash download via FlashDL works, please refer to *Flash download* on page 143.

² In order to use the flash breakpoints with J-Link no additional license for flash download is required. The flash breakpoint feature allows setting an unlimited number of breakpoints even if the application program is not located in RAM, but in flash memory. Without this feature, the number of breakpoints which can be set in flash is limited to the number of hardware breakpoints (typically two for ARM 7/9, up to six for Cortex-M) For more information about flash breakpoints, please refer to *Flash breakpoints* on page 155.

1.3.2 J-Link ARM

J-Link is a JTAG emulator designed for ARM cores. It connects via USB to a PC running Microsoft Windows 2000 or later. For a complete list of all operating systems which are supported, please refer to *Supported OS* on page 21. J-Link has a built-in 20-pin JTAG connector, which is compatible with the standard 20-pin connector defined by ARM.

1.3.2.1 Additional features

- Direct download into flash memory of most popular micro-controllers supported
- Full-speed USB 2.0 interface
- Serial Wire Debug supported *
- Serial Wire Viewer supported *
- Download speed up to 720 KBytes/second **
- JTAG speed up to 12 MHz
- RDI interface available, which allows using J-Link with RDI compliant software

* = Supported since J-Link hardware version 6

** = Measured with J-Link Rev.5, ARM7 @ 50 MHz, 12MHz JTAG speed.



1.3.2.2 Specifications

The following table gives an overview about the specifications (general, mechanical, electrical) for J-Link ARM. All values are valid for J-Link ARM hardware version 8.

General	
Supported OS	For a complete list of all operating systems which are supported, please refer to <i>Supported OS</i> on page 21.
Electromagnetic compatibility (EMC)	EN 55022, EN 55024
Operating temperature	+5°C ... +60°C
Storage temperature	-20°C ... +65 °C
Relative humidity (non-condensing)	Max. 90% rH
Mechanical	
Size (without cables)	100mm x 53mm x 27mm
Weight (without cables)	70g
Available interfaces	
USB interface	USB 2.0, full speed
Target interface	JTAG 20-pin (14-pin adapter available)
JTAG/SWD Interface, Electrical	
Power supply	USB powered Max. 50mA + Target Supply current.
Target interface voltage (V_{IF})	1.2V ... 5V
Target supply voltage	4.5V ... 5V (if powered with 5V on USB)
Target supply current	Max. 300mA
Reset Type	Open drain. Can be pulled low or tristated.
Reset low level output voltage (V_{OL})	$V_{OL} \leq 10\%$ of V_{IF}
For the whole target voltage range (1.2V \leq V_{IF} \leq 5V)	

Table 1.1: J-Link ARM specifications

LOW level input voltage (V_{IL})	$V_{IL} \leq 40\%$ of V_{IF}
HIGH level input voltage (V_{IH})	$V_{IH} \geq 60\%$ of V_{IF}
For 1.8V \leq $V_{IF} \leq$ 3.6V	
LOW level output voltage (V_{OL}) with a load of 10 kOhm	$V_{OL} \leq 10\%$ of V_{IF}
HIGH level output voltage (V_{OH}) with a load of 10 kOhm	$V_{OH} \geq 90\%$ of V_{IF}
For 3.6 \leq $V_{IF} \leq$ 5V	
LOW level output voltage (V_{OL}) with a load of 10 kOhm	$V_{OL} \leq 20\%$ of V_{IF}
HIGH level output voltage (V_{OH}) with a load of 10 kOhm	$V_{OH} \geq 80\%$ of V_{IF}
JTAG/SWD Interface, Timing	
SWO sampling frequency	Max. 6 MHz
Data input rise time (T_{rdi})	$T_{rdi} \leq 20$ ns
Data input fall time (T_{fdi})	$T_{fdi} \leq 20$ ns
Data output rise time (T_{rdo})	$T_{rdo} \leq 10$ ns
Data output fall time (T_{fdo})	$T_{fdo} \leq 10$ ns
Clock rise time (T_{rc})	$T_{rc} \leq 10$ ns
Clock fall time (T_{fc})	$T_{fc} \leq 10$ ns

Table 1.1: J-Link ARM specifications

1.3.2.3 Download speed

The following table lists performance values (Kbytes/s) for writing to memory (RAM):

Hardware	ARM7 via JTAG	ARM9 via JTAG	Cortex-M3 via SWD
J-Link Rev. 6 – 8	720 Kbytes/s (12MHz JTAG)	550 Kbytes/s (12MHz JTAG)	180 Kbytes/s (12 MHz SWD)

Table 1.2: Download speed differences between hardware revisions

All tests have been performed in the testing environment which is described on *Measuring download speed* on page 256.

The actual speed depends on various factors, such as JTAG/SWD, clock speed, host CPU core etc.

1.3.2.4 Hardware versions

Versions 1-4

Obsolete.

Version 5.0

Identical to version 4.0 with the following exception:

- Uses a 32-bit RISC CPU.
- Maximum download speed (using DCC) is over 700 Kbytes/second.
- JTAG speed: Maximum JTAG frequency is 12 MHz; possible JTAG speeds are: 48 MHz / n, where n is 4, 5, ..., resulting in speeds of:
 - 12.000 MHz (n = 4)
 - 9.600 MHz (n = 5)
 - 8.000 MHz (n = 6)
 - 6.857 MHz (n = 7)
 - 6.000 MHz (n = 8)