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FS2009 USB

Portable ISP Programmer
for Field-Service
and Production
applications



User Guide



The Embedded Solutions Company

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Equinox Warranty Information

This product is guaranteed by Equinox Technologies (UK) Limited for a period of 12 months (1 year) after the date of purchase against defects due to faulty workmanship or materials. One guarantee covers both parts and labour. Service under the guarantee is only provided upon presentation of reasonable evidence that the date of the claim is within the guarantee period (e.g. completed registration/guarantee card or a purchase receipt).

The guarantee is not valid if the defect is due to accidental damage, misuse or neglect and in the case of alterations or repair carried out by unauthorised persons. A number of exceptions to the warranty are listed in the 'Exceptions to warranty' section below. Service (during and after guarantee period) is available in all countries where the product is distributed by Equinox Technologies UK Limited.

Exceptions to warranty

Over-voltage damage

This warranty does not cover damage to the programmer due to voltages beyond the specified voltage limits being applied to the '**DC Power Input**' (CON1) or any of the ISP Headers. The user must ensure that sufficient care is taken to avoid over-voltage and static conditions on any of the 'ISP Header' I/O pins.

Over-current damage

This warranty does not cover damage to the programmer due to excessive current being drawn from the programmer power supply. The user must ensure that there is sufficient over-current protection within the test fixture to protect against short circuit loads.

Short-circuit damage

This warranty does not cover damage to the programmer due to short-circuit loads being placed across programmer I/O lines.

Damage to the Programmer Line Driver Circuitry

This warranty does not cover damage to the programmer 'Line Driver Circuitry' due to over-voltage, over-current or short-circuit of any of the programmer I/O lines. It is the responsibility of the user to make sure that sufficient precautions are taken before plugging the ISP Cable into a Target System.

Warning!

Any damage caused to the programmer by Electrostatic Discharge (ESD) through inadequate earthing is not covered under the warranty of the product.

Disclaimer

Whilst every effort has been made to ensure that programming algorithms are correct at the time of their release, it is always possible that programming problems may be encountered, especially when new devices and their associated algorithms are initially released. It is Equinox's Company Policy to endeavour to rectify any programming issues as quickly as possible after a validated fault report is received.

It is recommended that high-volume users always validate that a sample of a devices has been programmed correctly, before programming a large batch. Equinox Technologies UK Ltd. can not be held responsible for any third party claims which arise out of the use of this programmer including 'consequential loss' and 'loss of profit'.

Equinox Technologies UK Ltd. cannot be held responsible for any programming problems which are 'out of our control'. This type of problem is usually listed in the 'Errata Sheet' for the particular device being programmed and is available from the silicon vendor.

Information contained in this manual is for guidance purposes only and is subject to change. E&OE.

Electromagnetic Compatibility (EMC) Compliance

The 'FS2003 Programmer', 'FS2009 Programmer' and 'FS2009USB Programmer' are CE Approved Products. They are designed for use in an ESD controlled environment i.e. in development or production. This means, therefore, that the user must ensure that there is no possibility of damage from electrostatic discharge (ESD). Since the devices and equipment to which this product is likely to be connected may well themselves be susceptible to ESD, this should not pose any difficulty.

For example, if you are handling microcontrollers and EEPROMS etc. then you will already be used to appropriate precautions, such as the use of anti-static mats, wrist straps and so on. You should treat your programmer with the same care as you would these types of devices. Always ensure that you are not yourself carrying a static charge before handling the product. Wearing an earthed anti-static wrist strap is recommended.

Equinox have taken great care in designing this product to be compliant with the European EMC directive. When using the equipment be sure to follow the instructions provided. Although RF emissions are within prescribed limits, care should be taken if you are using the product near to sensitive apparatus. If you experience any difficulty please refer to Equinox Technical Support.



ESD Points to remember

- Work in a static-free environment.
- Wear an earthed wrist strap when handling either the programmer and/or any programmable device.
- Ensure that the PC, programmer and Target system are connected to the same EARTH (0V) potential.
- Do NOT plug the ISP cable of the programmer into a Target System when the Target power is ON.

Warning!

Any damage caused to the programmer by Electrostatic Discharge (ESD) through inadequate earthing is not covered under the warranty of the product.

Technical Support

If you have a technical support problem regarding this product, please consult the following list for help:

i. User Manual

ii. On-line help

Press **<F1>** for help at any time when running EQTools or ISP-PRO.

The help system is context-sensitive. Simply press **<F1>** on any error message and the possible causes of the error should be listed. This help system is updated on a regular basis. Please see software update details for information on keeping up-to-date with software revisions.

iii. Internet Web Site

The support page for all Equinox ISP Programmers can be found at:

<http://www.equinox-tech.com/products/downloadsearch.asp>

iv. E-mail

Please e-mail any technical support questions about this product to:

support@equinox-tech.com

v. Fax

Please fax any technical support questions about this product to: +44 (0) 1942 844181





Equinox will try our best to answer your questions about this product as quickly as possible. However, we cannot promise an immediate reply. Please consult our web site for new software updates as the problem that you are enquiring about may have already been fixed in a new version.

Product Documentation

i. Overview

This manual provides an overview of the contents of the FS2009USB / FS2003 Programming Systems plus associated hardware and software. References may be made to other hardware and software products which are not covered in detail in this manual. Please refer to the table below for a list of sources of documentation and/or browse to <http://www.equinox-tech.com>

Software:	
	<p>EQTools Script Builder – Manual</p> <p>This software is used to create and upload ‘Standalone Programming Projects’ to the programmer.</p> <p>The following sources of documentation are available for this software:</p> <ul style="list-style-type: none"> • Installation and Getting Started Guide (pdf manual) • Help file
	<p>ASCII Text Communications Protocol – Application Note</p> <p>This protocol can be used to control the programmer from an external controller via RS-232.</p> <p>The following sources of documentation are available for this protocol:</p> <ul style="list-style-type: none"> • Application Note – AN110.
	<p>Upload Wizard - Standalone Project Upload Utility</p> <p>This software utility is used to upload ‘Standalone Programming Projects’ to any Equinox programmer. These projects can then be used in Standalone Mode, i.e. without a PC.</p> <ul style="list-style-type: none"> • Please follow the on-screen instructions within the Upload Wizard utility itself. • Application Note - AN117
	<p>SPI In-System Programming (ISP) – Application Note</p> <p>This application note describes how to develop and implement ISP support for the Atmel AVR microcontroller family. This is a standard feature with the FS2009USB programmer.</p> <p>The following sources of documentation are available for this software:</p> <ul style="list-style-type: none"> • Application Note – AN101 • Device Support List

	<p>JTAG In-System (ISP) Upgrade – Application Note</p> <p>This license upgrade enables the FS2009USB Programmer to support high-speed In-System Programming (ISP) of the Atmel ATmega microcontroller family using the JTAG algorithm.</p> <p>The following sources of documentation are available for this software:</p> <ul style="list-style-type: none"> • Application Note – AN105 • Device Support List
	<p>Atmel AT91SAM7 In-System (ISP) Upgrade – Application Note</p> <p>This license upgrade enables the FS2009USB Programmer to support high-speed In-System Programming (ISP) of the AT91SAM7 FLASH microcontroller family using the JTAG algorithm.</p> <p>The following sources of documentation are available for this software:</p> <ul style="list-style-type: none"> • Application Note – AN122 • Device Support List
	<p>I2C Serial EEPROM In-System (ISP) Upgrade – Application Note</p> <p>This license upgrade enables the FS2009USB Programmer to support In-System Programming (ISP) of I2C Serial EEPROM devices from many manufacturers</p> <p>The following sources of documentation are available for this software:</p> <ul style="list-style-type: none"> • Application Note – AN118 • Device Support List
	<p>Error Message Descriptions</p> <p>This document lists all the possible error messages which can be generated by the EQTools / ISP-PRO applications.</p>

ii. Documentation and software for the FS2009USB programmer

In line with our policy of continuous improvement, the software and associated documentation for this product are updated on a regular basis. You can download the latest software, firmware, User Manuals and application notes for the FS2009USB, FS2009 & FS2003 programmers from the following pages on the Equinox website:

1. FS2009USB programmer

See <http://www.equinox-tech.com/products/details.asp?ID=1561&displ=tl>

2. FS2009USB programmer

See <http://www.equinox-tech.com/products/details.asp?ID=1303&displ=tl>

3. FS2003 programmer

See <http://www.equinox-tech.com/products/details.asp?ID=370&displ=tl>

You may be asked to register / log in to download some of these files.

iii. Device algorithm - Application notes

The table below lists the Application Notes available for helping to create ‘*Programming Projects*’ for different device families.

Application Note	Device Family	Programming Interface
AN100	Atmel - AT89Sxxxx FLASH microcontrollers	SPI
AN101	Atmel - AVR FLASH microcontrollers via the SPI Interface	SPI
AN105	Atmel - AVR FLASH microcontrollers via the JTAG Interface	JTAG
AN118	Generic I2C 24xxx Serial EEPROM memories	I2C
AN122	Atmel - AT91SAM7 ARM7 FLASH microcontrollers	JTAG
AN128	NXP – LPCxxx ARM7 FLASH microcontrollers	JTAG
AN130	Zensys – ZWxxx – Z-WAVE Series devices	SPI

These application notes can be found in PDF format on the CD-ROM which was supplied with the programmer. You can also find the very latest versions on the “*FS2009USB, FS2009 & FS2003 Download Page*” on the Equinox website.

iv. Programmer related - Application notes

The table below lists the Application Notes available for the FS2009USB, FS2009 & FS2003 programmer range which describe the USB driver installation, the different control methods available, firmware update procedure and Oscillator Calibration procedure.

Application Note	Description
AN109	Remote Application Control of Equinox ISP Programmers using ISP-PRO Utility
AN110	ASCII Text Control (ATC) Protocol for Remote Control of Equinox Programmers
AN111	ConsoleEDS Protocol for Remote Control of Equinox Programmers
AN112	Firmware Update instructions for Equinox ISP Programmers
AN114	Accurate on-chip Oscillator Calibration for Atmel AVR microcontrollers
AN121	Equinox EQTools – Release Notes

These application notes can be found in PDF format on the CD-ROM which was supplied with the programmer. You can also find the very latest versions on “**FS2009USB, FS2009 & FS2003 Download Page**” on the Equinox website.

1.0 Programmer Overview / Specifications

1.1 Programmers covered in this manual

This manual covers the following Equinox programmers:

- FS2009USB
- FS2009

1.2 Comparison of the FS2009USB and FS2009 programmers

The FS2009USB programmer is exactly the same hardware as the FS2009 programmer except that the **RS232 COM port** on the FS2009 has been replaced by a **USB port** on the FS2009USB. This allows the FS2009 programmer to support high-speed USB communications with a host PC. In most circumstances, it is also possible to power the FS2009USB programmer internal electronics from the PC USB port. It is NOT possible to power an attached target board when powering the programmer from the PC USB port.

The FS2009USB programmer will load and execute exactly the same '**Standalone Programming Projects**' as the FS2009 programmer. It is also backwards compatible with the FS2003 programmer.

1.3 Comparison of the FS2009 & FS2003 programmers

The FS2009 & FS2003 programmers are based on exactly the same hardware design. The only difference is that the FS2009USB features a more up-to-date microcontroller which has more on-chip firmware space and more RAM. This allows the FS2009 to hold more algorithms in memory and thus support more devices compared to the FS2003 programmer. It also makes many of the algorithms significantly faster as the extra RAM allows the algorithm to be optimised.

The advantages of the FS2009 programmer are as follows:

Programming speed:

- Faster AVR algorithms in PC controlled modes (EDS, ConsoleEDS and ISP-PRO)
- Faster AT91SAM7 algorithms in PC controlled modes (EDS, ConsoleEDS and ISP-PRO)

Additional device support (only available on FS2009USB):

- Atmel AT91SAM7 – ARM7 FLASH microcontrollers
- NXP LPC21xx - ARM7 FLASH microcontrollers
- I2C Serial EEPROMs

Availability:

- The FS2009USB programmer is available from stock.
- The FS2009 programmer has been replaced by the FS2009 programmer.
- The FS2003 is only available by special order and is subject to an MOQ.

1.4 FS2009USB, FS2009 & FS2003 Project Compatibility

As the FS2003 and FS2009 / FS2009USB programmers are based on the same hardware design, any '**Standalone Programming Projects**' developed for use on the FS2003 programmer can also be used on the FS2009 / FS2009USB programmer without requiring any modifications.

- Projects designed for the FS2003 programmer can be uploaded to the FS2009 / FS2009USB programmer without any modifications.
- Projects designed for the FS2009 / FS2009USB programmer can be uploaded to the FS2003 programmer as long as they are not for any of the device families which are only supported on the FS2009 / FS2009USB programmer.
- The latest version of EQTools / ConsoleEDS or ISP-PRO is required which supports the newer FS2009 / FS2009USB programmer.

1.5 FS2009USB - Main Features

Wide ranging Device Support capability

- Supports In-System Programming (ISP) of many popular FLASH Microcontrollers, Serial EEPROM and serial FLASH Memories

High-speed Programming

- Optimised algorithms, on-board project data storage and high-speed line-driver circuitry delivers the fastest possible programming times

Supports most ISP Protocols

- SPI, JTAG, I2C (2-wire). ATtiny HV SCI

High-speed JTAG port

- Supports high-speed JTAG programming of Atmel AVR and AT91SAM7 microcontrollers

High-speed SPI port

- Supports full range of SPI speeds from 10 Hz up to 4 MHz

Fully ESD and Over-voltage protected I/O

- All Target I/O pins feature both ESD and over-voltage protection

Supports programming at Target Voltages down to 3.0V

- An optimised driver circuit delivers fast clean programming waveforms from 3.0 to 5.0V.

Excellent Host Control connectivity

- 1 x USB Port (mini-USB connector)

Standalone Operation

- Programmer can operate in '**Standalone Mode**' i.e. without PC Control.
- Programmer can be controlled via 4-button Keypad / Display.

Supports up to 64 independent 'Standalone Programming Projects'

- Each project supports programming of a complete device including FLASH, EEPROM, Fuses etc.

Firmware upgradeable

- New algorithms and features can be added via a simple firmware upgrade

Compact physical size ideal for held-held production or field use

- The programmer is designed to be portable so it can be used for production or field use.

1.6 FS2003 - Programmer versions

The FS2003 programmer is only available as a single version – the FS2003(UN).

Programmer version	Description
FS2003(UN)	<ul style="list-style-type: none"> • Supports programming of Atmel AVR devices <u>via the SPI interface only.</u> • Supports programming of Atmel ATtiny devices via the ‘High-voltage Serial Programming Mode’. • Supports Atmel AT89S, AT89C51Rxx, AT89Sxxxx microcontrollers. • Supports NXP P89X51Rx2 devices • Supports Zensys 100 / 200 / 300 series devices.

Please note:

- The FS2003 is now a discontinued product. Please use the FS2009USB programmer as the replacement programmer.
- Equinox will continue to add new devices to the FS2003 programmer where possible.

1.7 FS2009USB - Programmer versions

The FS2009USB programmer is now available in three different versions, each offering different device support. Please refer to the table below for an overview of each version.

Programmer version	Description
FS2009USB(UN)	<ul style="list-style-type: none"> • Supports programming of Atmel AVR devices <u>via the SPI interface only.</u> • Supports programming of Atmel ATtiny devices via the ‘High-voltage Serial Programming Mode’. • Supports Atmel AT89S, AT89C51Rxx, AT89Sxxxx microcontrollers. • Supports NXP P89X51Rx2 devices • Supports Zensys 100 / 200 / 300 series devices.
FS2009USB(AVR-JTAG)	<ul style="list-style-type: none"> • Dedicated programmer supporting programming of the Atmel AVR family <u>via the JTAG interface only.</u>
FS2009USB(ARM)	<ul style="list-style-type: none"> • Dedicated programmer supporting many ARM microcontroller devices. • Atmel ARM7 microcontroller family including AT91 SAM7S SAM7SE / SAM7A / SAM7L / SAM7X / SAM7XC ARM7 families • NXP LPC21xx ARM7 families • ST STM32F100Rx Cortex-M3 ARM family • Includes a special 20-way IDC connector cable for interfacing to AT91SAM7 Target Boards.

Please note:

It is possible to upgrade any version of the FS2009USB programmer so it supports other devices as well.

1.8 FS2009USB – Device support for each Programmer version

The table below details which device families are supported by each version of the programmer.

Device Family	Programming Interface	FS2009USB (UN)	FS2009USB (AVR-JTAG)	FS2009USB (ARM)
Atmel AVR (SPI): - AT90S - AT90USB - AT90CAN - ATmega - ATmegaRF - ATtiny LV	LV SPI	YES YES YES YES YES YES	- - - - - -	- - - - - -
Atmel AVR (HV): - ATtiny HV	HV Serial (+12V)	YES	-	-
Atmel AVR (JTAG): - AT90USB - AT90CAN - ATmega - ATmegaRF	AVR JTAG	- - - - -	YES YES YES YES	- - - - -
Atmel AT91SAM7 - AT91SAM7A - AT91SAM7L - AT91SAM7S - AT91SAM7SE - AT91SAM7X - AT91SAM7XC	ARM JTAG	- - - - - -	- - - - - -	YES YES YES YES YES YES
Atmel 8051 - T89C51Rx2 - AT89C51xxx	UART Boot Loader	YES YES	- -	- -
Atmel 89S 8051 - AT89S82xx - AT89Sx051	LV SPI	YES YES	- -	- -
NXP 8051 - P89X51Rx2	UART Boot Loader	YES		-
NXP LPC ARM7 - LPC210x - LPC213x - LPC214x	ARM JTAG	UPGRADE	UPGRADE	YES YES YES
ST - STM32F100Rx	ARM JTAG	UPGRADE	UPGRADE	YES
Zensys - ZW100 / 200 / 300 series	LV SPI	YES		-
All manufacturers 24xxx Serial EEPROM Memories	I2C	UPGRADE	UPGRADE	UPGRADE

1.9 Programming Interface to Target Device

The programmer supports the following programming interfaces to the Target Device:


#	Programming Interface	Device Family	Description / Comment
1	LV SPI	AT89S AT90S AT90USB AT90CAN ATmega ATmegaRF ATtiny Zensys	Atmel Low Voltage Serial Programming Mode <ul style="list-style-type: none"> • Atmel 3-wire SPI interface (SCK, MOSI, MISO) • Target Device RESET • Works at target voltage (no Vpp required)
2	HV SPI (+12V Vpp)	ATtiny	Atmel High Voltage Serial Programming Mode <ul style="list-style-type: none"> • Atmel 4-wire SPI Interface (SCK, MOSI, MISO, MOSI2) • +12V Vpp is applied to the RESET pin to enter High Voltage Serial Programming Mode • Requires different connections to Target Device compared with LV SPI. • Requires all pins of target device to be accessible by the programmer.
3	UART Boot Loader	T89C51Rx2 P89X51Rx2	Atmel / Philips UART Boot Loader Interface <ul style="list-style-type: none"> • Uses RXD, TXD, PSEN, and Target Device RESET pin • TTL Levels from programmer to Target System
4	JTAG (Atmel AVR)	ATmega ATmegaRF AT90USB AT90CAN	Atmel ATmega AVR – JTAG ISP Interface <ul style="list-style-type: none"> • Uses same connector as Atmel JTAG ICE • A chargeable license upgrade is required to enable the ATmega JTAG ISP libraries.
5	JTAG (Atmel AT91SAM7)	AT91SAM7A AT91SAM7L AT91SAM7S AT91SAM7SE AT91SAM7X AT91SAM7XC	Atmel AT91SAM7 ARM – JTAG ISP Interface <ul style="list-style-type: none"> • Programming of Atmel AT91SAM7 devices requires a chargeable license upgrade (FS2009USB-UPG15) • This upgrade includes a special 20-way ISP Connector Cable compatible with the 20-way IDC connector found on ARM Target Systems.
6	JTAG (NXP ARM7)	LPC21xx	NXP LPX21xx ARM7 – JTAG ISP Interface <ul style="list-style-type: none"> • Programming of NXP LPC21xx ARM7 microcontrollers requires a chargeable license upgrade (FS2009USB-UPG27) • This upgrade includes a special 20-way ISP Connector Cable compatible with the 20-way IDC connector found on ARM Target Systems.

Please note:

The FS2009USB is available as various different versions which support different devices as standard. Not all device libraries may be enabled as standard with the programmer you have purchased.

1.10 System Contents


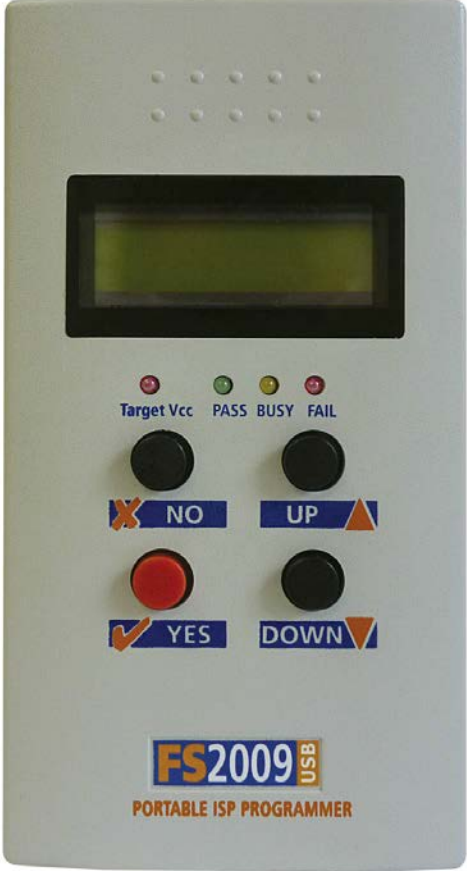




The FS2009USB programmer comes complete with an external mains power supply, PC Driver Software and cables. Please see the full contents list detailed below.

	Hardware
	<ul style="list-style-type: none"> • FS2009USB ISP Programmer • External Power Supply Adaptor (9V DC regulated @ 1.7A)
	Cables
	<ul style="list-style-type: none"> • USB connection cable (mini-USB to USB-A) • 6-way IDC ISP cable • 10-way IDC ISP cable • DC Power Cable (2.5mm jack plug to bare wire ends)
	Miscellaneous
	<ul style="list-style-type: none"> • 2 x Jumper Links
	Software
<p>(Supplied on an Equinox CD-ROM)</p> <ul style="list-style-type: none"> • EQTools (Project Management Utility for Equinox Production ISP Programmers) 	
Documentation	
<ul style="list-style-type: none"> • User Guide (printed) 	

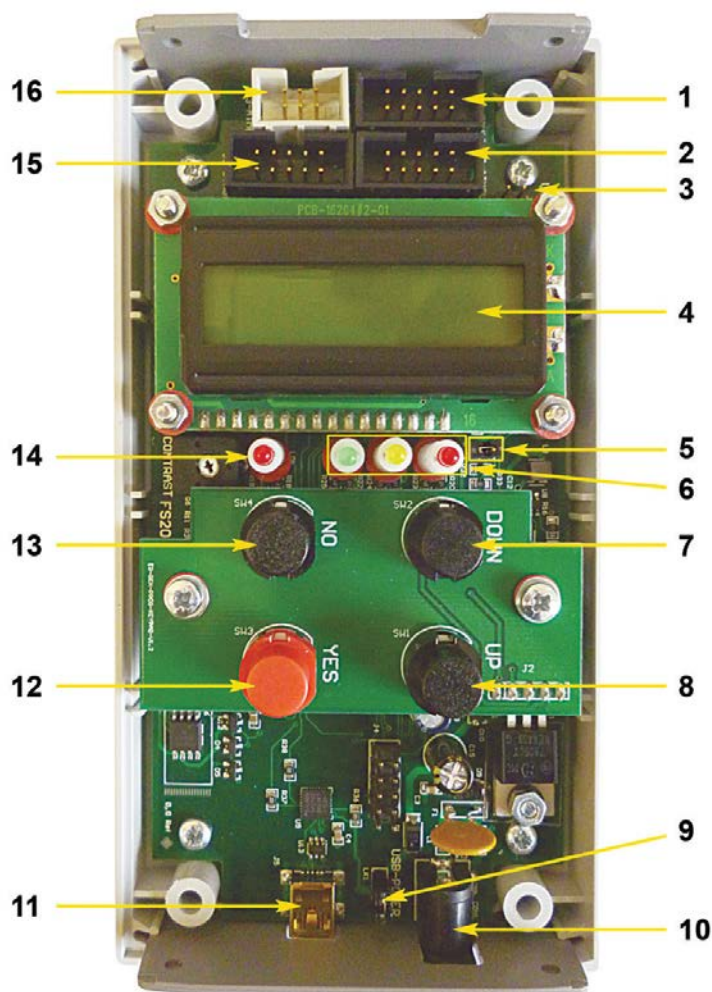
Please note:

The FS2009USB(ARM) version of the FS2009USB programmer comes with a special cable assembly which allows the programmer to connect to any ARM Target Board which is fitted with a 20-way IDC connector. See Appendix 1 for details of this cable.

1.11 Hardware Overview (external layout)

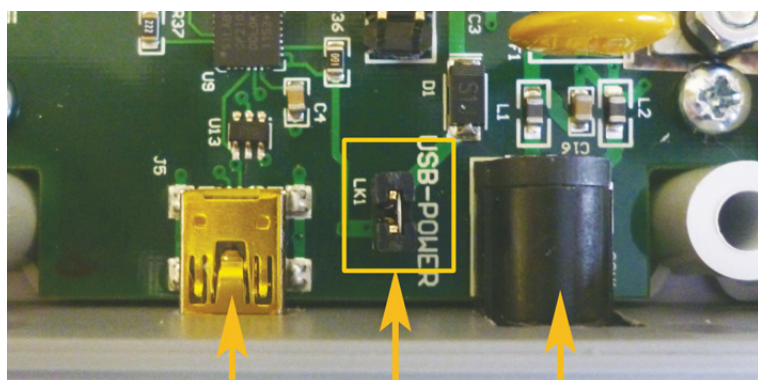
	<h3>Top Panel</h3>	
	<h3>ISP Cable Slot</h3>	<p>The ISP cable plugs into relevant 'ISP Header' internally and then exits the case through this slot.</p>
	<h3>Front Panel</h3>	
		<p><Target Vcc> LED - Indicates when 'Target Vcc' is ON - Does not indicate 'Programmer Power' unless Jumper J9 is fitted.</p> <p>Status LED's: <PASS> LED <BUSY> LED <FAIL> LED</p>
		<p><NO> Button - Used to cancel a programming operation.</p>
		<p><YES> Button - Used to start an 'autoprogram' operation.</p>
	<h3>Bottom Panel</h3>	
	<ol style="list-style-type: none"> 1. mini-USB Connector Port 2. External DC Power Supply Input (CON1) 	

1.12 Hardware Overview (internal layout)



Hardware

1. Equinox 10-way ISP (SPI / UART) Header (J6)
2. Atmel 10-way ISP (SPI) Header (J7)
3. Jumper (J9) – Vcc Link
4. Liquid Crystal Display (LCD)
5. Enable LCD Backlight Jumper (J10)
6. Status LED's
7. <Down> Key (SW2)
8. <Up> Key (SW1)
9. USB Power select Jumper (LK1)
10. External DC Power Supply Input (CON1)
11. mini-USB Connector port (J5)
12. <YES> Key (SW3)
13. <No> Key (SW4)
14. Target Vcc Present – LED
15. Atmel 10-way JTAG Header (J8)
16. Atmel 6-way ISP (SPI) Header (J3)



USB Connector Port

External DC Power Supply input

USB Power Select Jumper

USB Power Selection Jumper

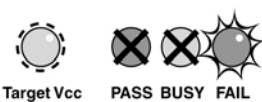
If the 'USB-POWER' link is fitted, this allows the programmer to be powered from the PC USB port.

Important notes

- It is not possible to power the Target System via the PC USB port.
- Some PC USB ports may not have sufficient power to supply the programmer.

1.13 Programmer Specifications Overview

The table below details the hardware specifications for the programmer. Please refer to the stated section for further information about any specific parameter.

#	Parameter	Description / comment	Refer to sect
1	Target Device Support	See Device Support List . For the latest version please see website.	
2	Target Device Programming Interfaces	The FS2009USB programmer supports the following programming interfaces: <ul style="list-style-type: none"> • Atmel Low Voltage SPI • Atmel High Voltage SPI (+12V Vpp) • Atmel 8051 Boot loader ISP • NXP 8051 - Boot loader ISP • Zensys 3-wire SPI Interface • Atmel AVR JTAG (chargeable update) The FS2009USB programmer supports the following additional programming interfaces: <ul style="list-style-type: none"> • Atmel AT91SAM7 JTAG (requires additional cable) • NXP LPC21xx LPC ARM JTAG • ST STM32 – ARM JTAG • I2C for programming Serial EEPROMs (chargeable upgrade) 	1.8
3	Operating modes	The programmer supports the following operating modes: As standard: <ul style="list-style-type: none"> • EDS Development Mode (PC controlled) • Project Upload Mode using Upload Wizard (PC controlled) • Standalone Mode - Keypad + LCD operation • Standalone Mode – Run Target 	3.4
4	On-board FLASH Memory Store	32 Mbits (4 MBytes) FLASH Memory	
5	Project storage in Memory Store	64 x Independent Programming Projects	
6	Keypad entry	4 x Push Button - <YES>, <NO>, <UP>, <Down>	
7	Status LED's  Target Vcc PASS BUSY FAIL	3 x Status LED's located on the programmer: <PASS>, <BUSY>, <FAIL> These LED's indicate the current status of the programmer.	
8	Programmer Display	2 x 16 character Back-lit LCD (backlight configurable)	