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EPSIL5N

Portable ISP Programmer **MKII**

Portable ISP Programmer for Atmel, Atmel Wireless (Temic) and Philips FLASH Microcontrollers

User Guide

EQUINOX
TECHNOLOGIES
EQUINOX TECHNOLOGIES UK LIMITED

The Embedded Solutions Company

Contents

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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 '**EPSILON5**' is a CE Approved Product. It is designed for use in an ESD controlled environment i.e. 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 '**EPSILON5**' 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.

RoHS Compliance

The '**EPSILON5**' is a RoHS compliant product.

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

It is often the case that users experience problems when installing or using a product for the first time.

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

Manual

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.

Internet Web Site

The support page for all Equinox ISP Programmers can be found at:
http://www.equinox-tech.com/products/downloadsearch.asp

E-mail

Please e-mail any technical support questions about this product to:
support@equinox-tech.com

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

This manual provides an overview of the contents of the EPSILON5 Programming System 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/products/downloadsearch.asp

Software:	
	EQTools Script Builder – Manual This software is used to create and upload 'Programming Projects' to the programmer. The following sources of documentation are available for this software: • Installation and Getting Started Guide (pdf manual) • Help file
	Upload Wizard - Standalone Project Upload Utility This software utility is used to upload Programming Projects to any Equinox programmer. These projects can then be used in Standalone Mode, i.e. without a PC. • Please follow the on-screen instructions within the Upload Wizard utility itself.
	ASCII Text Communications Protocol – Application Note This protocol can be used to control the programmer from an external controller via RS-232. The following sources of documentation are available for this protocol: • Application Note – AN110 for a full description.
	ConsoleEDS Pro – Application note This software utility allows any Equinox programmer to be controlled via simple Command Line instructions from a Command Window within Windows. The following sources of documentation are available for this software: • Application Note 111 – ConsoleEDS Manual

ISP PRO	**ISP Pro – Manual** This software is used to control the programmer in a production environment. It is not supplied as standard with this programmer. The following sources of documentation are available for this software: • Installation and User Manual • Help File
CONFIGIT	• **Configit – Firmware Upgrade Utility** This utility is used to upgrade the firmware of the programmer. A firmware update may be required to add support for new devices and to correct any firmware issues.
LabMEW®	**Labview – Remote Application Control – Application Note** This upgrade allows a production facility to control a single programmer from a 'Labview for Windows' application. The Application note describes how to control the programmer using a custom Labview (from National Instruments) application. The following sources of documentation are available for this software: • Application Note - Remote Application Control of ISP-PRO
REMOTE APPLICATION Control	• **Remote Application Control – Application Note** Describes how to control the programmer using a custom Remote Application written in e.g. Visual Basic, C++, C Builder, Delphi etc.
ERROR MESSAGES	• **Error Message Descriptions** This document lists all the possible error messages which can be generated by the EQTools / ISP-PRO applications.

EPSILON5
Portable ISP Programmer

Downloading up-to-date documentation and software:

In line with our policy of continuous improvement, the software and associated documentation for this product are updated on a regular basis. Please refer to the 'Downloads Page' for this product on our website at http://www.equinox-tech.com/products/downloadsearch.asp for the most up-to-date information for this product.

Browse to http://www.equinox-tech.com

- Click / select the <Downloads> tab → the 'Downloads Search Page' will appear.
- Type in the name of the programmer e.g. EPSILON5 into the 'Product Name' field
- Click the <Search> button
  → a list of all the software and documentation available for this product are displayed.
- Click the <Info> button next to an individual item to see the details of the downloadable file
- Click the <Download> button to download the file

Please note:

You may be asked to register your programmer before downloading certain files. Equinox use the registration information to send you up-to-date information about new software releases etc.

1.0 Programmer Overview

1.1 System Contents

Hardware

- EPSILON5 MKII Programmer

- 2 x Jumper Links for internal jumpers

Cables

- DC Power Cable

- 9-way Female to 9-way Male Serial Cable

- 25-way Female to 9-way Male Serial Adaptor

- ISP Cables
  1 x 10-way IDC to 10-way IDC Ribbon Cable
  1 x 6-way IDC to 6-way IDC Ribbon Cable

Software

(Supplied on an Equinox CD-ROM)

- EQTools
  (Project Management Utility for Equinox
  Production ISP Programmers)

Documentation

- EPSILON5 - User Guide

1.2 Hardware Overview (external layout)

Top Panel

ISP Cable Slot
ISP cable plugs into relevant ISP Header internally and then exits the case through this slot.

Front Panel

<Target Vcc> LED
- Indicates when 'Target Vcc (Power)' is ON
- Does not indicate 'Programmer Power' unless Jumper J9 is fitted.

Status LED's:
<PASS> LED
<BUSY> LED
<FAIL> LED

<NO> Button
- Used to cancel a programming operation.

<YES> Button
- Used to start an 'autoprogram' operation.

Bottom Panel

1. RS-232 port (J5)
2. External DC Power Supply Input (CON1)

1.3 Hardware Overview (internal layout)
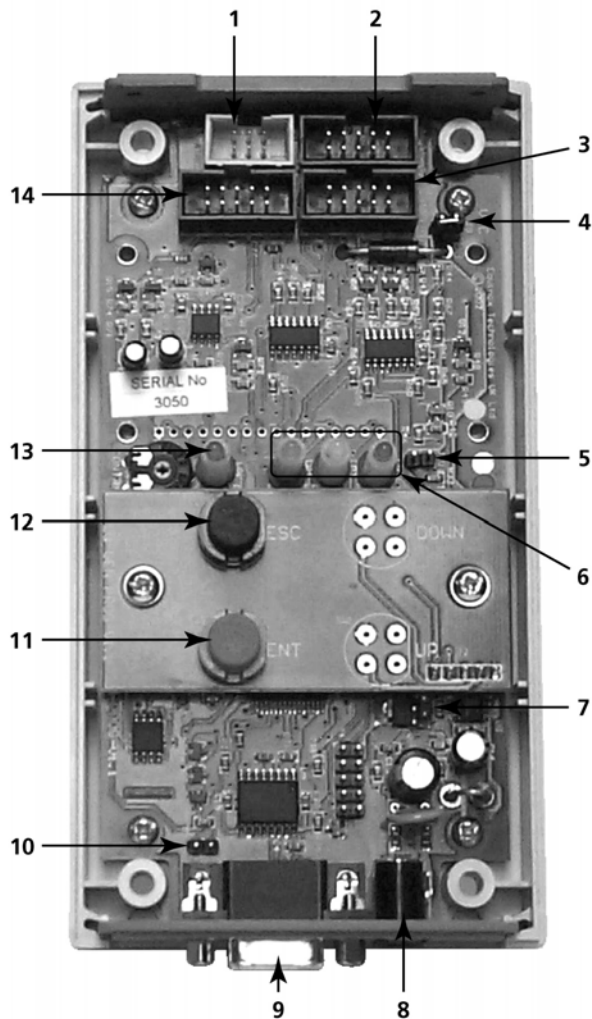
Hardware

1. Atmel 6-way ISP (SPI) Header
2. Equinox 10-way ISP (SPI / UART) Header
3. Atmel 10-way ISP (SPI) Header
4. Jumper (J9) – Vcc Link
5. Jumper (J10) – Enable Target Power LED
6. Status LED's
7. Firmware Update Jumper 2 (J11)
8. External DC Power Supply Input (CON1)
9. RS-232 port (J5)
10. Firmware Update Jumper 1 (J5)
11. <Yes> button
12. <No> button
13. Target Vcc Present – LED
14. Atmel 10-way JTAG Header

1.4 Push Button Functions
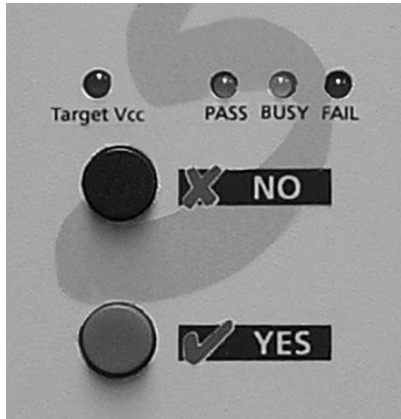
The EPSILON5 programmer features two push buttons, **<YES>** and **<NO>**, which are used to control the programmer when it is operating in 'Standalone Mode'.

The function of these buttons is described below.

Button	Function of button
	The **<No>** button has the following functions: i. To cancel a programming action ii. To return to the 'Standby' state
	The **<YES>** button has the following functions: i. To execute a programming project which has been pre-loaded into the programmer 'FLASH Memory Store'. ii. To return to the 'Standby' state

1.5 Programmer Specifications

1.5.1 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 section
1	Target Device Support	See Device Support List	1.6.1
2	Target Device Programming Interfaces	The programmer supports the following programming interfaces: • Atmel Low Voltage SPI • Atmel High Voltage SPI (+12V Vpp) • Atmel AVR JTAG (chargeable update) • Atmel (formerly Temic) 8051 Boot loader ISP NXP (Phillips) 8051 - Boot Loader ISP	1.6.2
3	Operating modes	The programmer supports the following operating modes: As standard: • Development Mode (PC controlled) • Project Upload Mode using Upload Wizard (PC controlled) • Standalone Mode - Keypad + LCD operation • Standalone Mode – Run Target • ConsoleEDS EVAL – Command Line control Optional chargeable upgrades: • Standalone Mode - Remote Controlled via 'ASCII Text Communications' RS-232 Serial Protocol • PC controlled via ISP-PRO software (chargeable upgrade) ConsoleEDS PRO – Command Line control	2.4
4	On-board FLASH Memory Store	2 Mbits (256 kBytes) FLASH Memory	
5	Project storage in Memory Store	1 x Programming Project or 2 x 'Chained Projects'	
6	Keypad entry	2 x Push Button - <YES> and <NO>	
7	Status LED's	3 x Status LED's - <PASS>, <BUSY>, <FAIL>	
8	Target Vcc Voltage Detection LED	• Target Vcc (POWER) LED will light when Target Vcc is detected. • Threshold detection voltage: approx 3.1V	

9	**PC Control Software**	The programmer can be controlled using: • EQTools (as standard) • ISP-PRO (chargeable upgrade) • Standalone Upload Wizard (chargeable upgrade) • ConsoleEDS Evaluation version • ConsoleEDS PRO (chargeable upgrade) • ASCII Text Mode (chargeable upgrade)	2.3
10	**PC requirements**	PC running Windows 95 / 98 / 2000 or ME / NT4 / XP	
11	**Power Supply Options**	There are 3 possible modes for powering the Programmer / Target System: • Programmer powers Target System • Target System powers the Programmer • Programmer and Target System are independently powered	3.0
12	**Voltage range**	See specified section	1.5.2
13	**Vpp Voltage Generator**	On Board +12.0V Vpp Voltage Generator (Applies +12.0V to RESET pin for ATtiny HV programming)	
14	**DC Power Connector (CON1)**	• DC Power Connector • 2.5 mm Jack Socket – Centre Positive • DC Power Lead supplied with programmer – white stripe is +ve.	1.5.2
15	**Programmer Current Consumption**	This refers to the current consumption of the actual programmer circuitry. See specified section.	1.5.3
16	**Max. current through programmer**	This refers to the maximum current which can be supplied through the programmer from CON1 (i.e. external power supply) to the Target System. Max current = 300 mA.	1.5.3
17	**Target SPI Frequency**	**Software SPI algorithm:** • SLOW SPI: 0 – 490.2 kHz (user selectable) • MEDIUM SPI: 0 – 490.2 kHz (user selectable) (SPI speeds are estimations only due to uneven mark/space ratio and non-continuous waveforms) **Hardware SPI algorithm (requires firmware 3.04 or greater):** • SLOW SPI: 115.2 kHz to 921.6 kHz (user selectable) • FAST SPI: 115.2 kHz to 921.6 kHz (user selectable)	
18	**Target UART Speed**	This is the Communications Speed (BAUD rate) from the programmer to the Target Device when communicating via a Boot Loader. The BAUD rate is configurable from 1,200 to 115 kBaud. This settings is completely independent from the BAUD rate settings for the PC communicating with the programmer.	
			4.0

19	ISP Headers	4 x ISP Headers (inside enclosure) i. Atmel 10-way (SPI) ii. Atmel 6-way (SPI) iii. Atmel 10-way (JTAG) iv. Equinox 10-way (SPI+UART)	
20	**Frequency generator output (SCK2)**	Programmer can output a configurable square wave frequency on the SCK2 pin. This is used to clock the Target Device in the absence of a Target Oscillator.	
21	**PC Connection (J5)**	• RS232 9-way Female D Connector • Connects to spare PC COM port • All 9 connections must be made in serial cable. • Baud rate: 38,400 (fixed)	1.5.6
22	**Temperature range**	0 to 50 deg. C	
23	**Size (enclosure)**	189H x 80L x 31D mm	
24	**Shipped Weight**	0.75 kg	

1.5.2 Voltage range

The programmer is designed to operate from a supply voltage in the range defined in the table below. Correct operation outside of these limits is not guaranteed. The programmer supply voltage can be derived from either the **CON1 connector** or the **Target Vcc** pin on any of the ISP Headers. The CON1 centre pin and the Target Vcc are physically joined together inside the programmer if the jumper J9 is fitted.

Fig. 1.5.2 Programmer voltage supply range for reliable operation

#	Programmer mode	Min Vcc	Max Vcc	Units
1	Programming a Target Device	3.05	5.00	V
2	Uploading Programming Projects to programmer FLASH	3.10	5.00	V

Important note:
The programmer electronics should operate reliably between the 'Min Vcc' and 'Max Vcc' voltage levels specified in the table above. This does NOT mean that every Target Device can also be programmed within this voltage range.

To verify that a particular device can be programmed at a certain Vcc voltage:
- Check the supply / programming voltage parameters for the actual device (IC) in the manufacturer's datasheet.
- Many devices have two different voltage range versions eg. 2.7 – 6.0V and 4.0 – 6.0V. Please ensure that you are programming the device within the stated voltage range.
- Ensure that you have selected the required Target Vcc Voltage in your EQTools – Programming Project (*.ppm).
  e.g. if you are programming at +3.3V, you must set up this voltage in your Programming Project. This can be found in the EQTools - Project Builder <Target Vcc> tab.
- For most Atmel AVR and AT89S devices, the FLASH and EEPROM Write Times increase as the Target Voltage decreases. The timings are automatically set for you in your project as long as you have declared the correct Target Vcc voltage in your project.
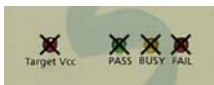
1.5.3 Current Consumption / Parameters

1.5.3.1 Current Consumption

The programmer can either be powered from the Target System via one of the ISP Headers or from an independent power supply via CON1. The table below details the programmer current consumption with a supply voltage of 5.0V and 3.3V for both 'Standby' mode and during a typical programming operation when the programmer is independently powered. If the programmer is to be powered from the Target System (typical of field use), then the Target System power supply must be capable of supplying the maximum current that can be drawn by the programmer during a programming operation.

Fig. 1.5.3.1 Programmer voltage supply range for reliable operation (independently powered)

#	Programmer mode	LED Status	CON1 Vcc (V)	Min	Typ	Max	Units
1	Standby Mode		5.0	-	28.0	35.0	mA
2	Standby Mode		3.3	-	28.0	35.0	mA
3	Programming (BUSY)		5.0	-	47.0	60.0	mA
4	Programming (BUSY)		3.3	-	44.0	60.0	mA

Status LED Key:

ON FLASHING OFF

Notes:

The above measurements were taken with the programmer and Target System independently powered (i.e. J9 removed). EPSILON BOM – 1.20/1.21. Target device – AT90S8515.

These measurements refer to the current taken by the programmer's internal circuitry.

Standby Mode – All LED's OFF (Target Vcc is OFF so the Target Vcc LED is also OFF)

1.5.3.2 Maximum Current handling of programmer

If the programmer is supplying power to the Target System, then the current drawn by the Target System must be below the maximum value stated in the table below.

Fig. 1.5.3.2 Programmer – maximum current ratings

#	Programmer mode	Comments	Typ	Max	Units
1	Programmer supplying power to the Target System	• Power is supplied from External Power Supply via CON1 • J9 is fitted connecting the CON1 Vcc to the Target Vcc	-	300	mA

1.5.4 DC Power Input Connector (CON1)

It is possible to power the programmer from an external power supply by plugging the DC Power Cable supplied with the programmer into CON1. This connector is a 2.5mm jack socket.

Fig. 1.5.4 CON1 – pin-out

Description	Voltage
Centre pin	+3.1V to +5.0V from external power supply
Outer	0V (Ground connection)

1.5.5 DC Power Cable Specification

The programmer is supplied with a DC power cable which plugs into CON1. The other end of this cable is supplied with bare wire ends for connecting to an external power supply. e.g. bench PSU.

Cable Specification:
- One end features a female 2.5mm DC jack plug
- The other end of the cable is supplied with bare wire ends for connecting to an external power supply. e.g. bench PSU.
- The black lead with the white stripe is the +VE cable.
- The all black lead is the GROUND cable.
- The external voltage applied to CON1 must be between 3.1 and 5.0V !
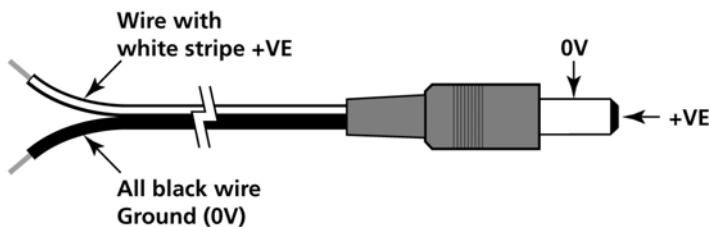
1.5.6 J5 – RS-232 Communications Port & Serial Cables

1.5.6.1 Connecting the programmer to the PC COM port

The EPSILON5 programmer communicates with a PC via the RS-232 Communications Port (J5). A suitable 9-way to 9-way serial cable is supplied with the programmer.

The programmer is supplied with the following PC Serial Cables / Adaptors:

1. 9-way D (female) to 9-way D (Male) Serial Cable

Programmer to 9-way PC Serial Port Connection

This cable should be connected between the 9-way D-connector on the programmer and a spare 9-way RS-232 COM port on your PC.
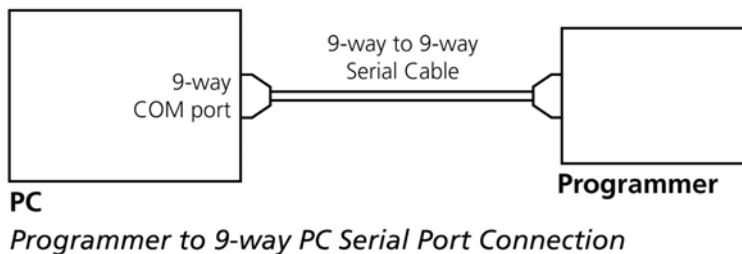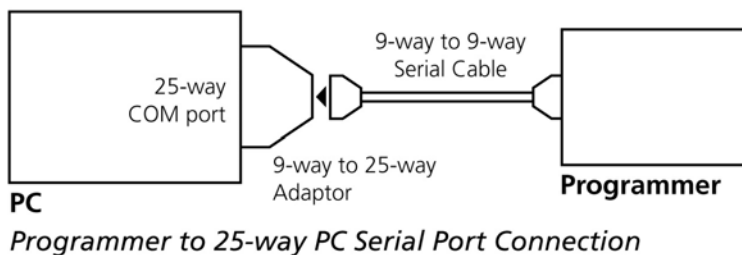
2. 9-way D (female) to 25-way D (Female) adaptor

Programmer to 25-way PC Serial Port Connection

If your PC has a 25-way D connector, you will need to plug the 9-25 way adaptor onto the end of the 9-9 way Serial Cable as shown in the diagram below.

1.5.6.2 Serial Cable Length

The serial cable supplied with the programmer is approximately 2m in length. If you wish to make your own longer cable, please ensure that you connect all 9 pins at each end in a straight-through pin-to-pin fashion. See fig. 1.5.6.2 for the pin-out specifications. The programmer features an ESD protected full RS-232 specification driver chipset and so should operate reliably when driving serial cables up to 10m in length. However, it is recommended to keep the serial cable as short as possible to enhance EMI immunity and reduce EMI emissions.

Important note:
The programmer uses ALL of the NINE pins of the COM port for different purposes. It is therefore imperative that the cable used to connect between the programmer and the PC COM port has all NINE cables connected. Failure to do this will result in the programmer not operating correctly.

1.5.6.3 Serial Cable Pin-outs

Fig. 1.5.6.1 Pin-out of J5 - RS-232 Communications Port

Pin No.	RS232 pin	Description
1	DCD	Not Connected
2	RXD	Receive
3	TXD	Transmit
4	DTR	Not Connected
5	0 Volt	0V
6	DSR	Not Connected
7	RTS	Not Connected
8	CTS	Not Connected
9	RING	Not Connected

Fig. 1.5.6.2 Connections for 9-way to 9-way Serial Cable (Straight through cable)

9-way (Male)	9-way (Female)
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

Fig. 1.5.6.3 Connections for 9-way to 25-way Adaptor

25-way (Female)	9-way (Male)
8	1
3	2
2	3
20	4
7	5
6	6
4	7
5	8
22	9

1.6 Device Support

1.6.1 Devices supported by the programmer

The programmer supports the following devices:

#	Silicon vendor	Family	Programming algorithm	Device support	
1	**Atmel**	AT89S	LV SPI	- AT89(L)S8252/53 - AT89(L)S51/52 (including 'L' versions) - AT89S 2051 / 4051 - AT89S8253	S
2	**Atmel**	AT90S (AVR)	LV SPI	- AT90(L)S1200(A) / 2313 / 2333 / 4433 / 2323 / 2343 / 4414 / 8515 / 4434 / 8535 (including 'L' versions)	S
3	**Atmel**	AT90CAN	LV SPI	AT90CAN128 / AT90CAN64 / AT90CAN32	S
4	**Atmel**	AT90CAN	JTAG (AVR)	AT90CAN128 / AT90CAN64 / AT90CAN32	U
5	**Atmel**	AT90USB	LV SPI	AT90USB1286/ AT90USB1287/ AT90USB162/ AT90USB646/ AT90USB647/ AT90USB82	S
6	**Atmel**	AT90USB	JTAG (AVR)	AT90USB1286, AT90USB1287, AT90USB646, AT90USB647	U
7	**Atmel**	ATmega (AVR)	LV SPI	- ATmega 8 / 16 / 32 / 48 / 88 / 64 / 103 / 128 / 1280 / 1281 / 168 / 169(V) / 169PV / 323 / 325 / 329 / 2560 / 2561 2561V / 8515 / 8535 (including 'L' versions)	S
8	**Atmel**	ATmega (AVR)	JTAG (AVR)	ATmega 8515 / 8535 / 32 / 64 / 128 / 1280 / 1281 / 161 / 162 / 163 / 169 / 323 / 325 / 329 / 3290(V) 406 / 640(V) / 2560 / 2561 (including 'L' versions)	U
9	**Atmel**	ATtiny (AVR)	LV SPI	ATtiny 12 / 13 / 15L / 22 / 24*/ 25 / 26 / 45 / 85 / 2313 (including 'L' versions)	S
10	**Atmel**	ATtiny (AVR)	HV SPI (+12V VPP)	ATtiny 11 / 12 / 15L (including 'L' versions – Vcc must be +5V with a +12V Vpp applied to the RESET pin) HV ISP support for the ATtiny13, 25, 45 etc is not currently available.	S
11	**Atmel (Temic)**	T89C51Rx2	UART Boot Loader	T89C51 RB2 / RC2 / RD2 T89C51 IB2 / IC2 T89C51CC01 (Support for the AT89Cxxxx devices is not currently available)	S
12	**NXP (Philips)**	T89C51Rx2	UART Boot Loader	P89C51 RB2 / RC2 / RD2 P89C 660 / 662 / 664 / 668	S
13	**Zensys**	ZW series	LV SPI	ZW0102 / ZW0201 / ZW0301	S