ISP juno

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 **'ISPjuno Programmer'** is a 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 ISPjuno 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:	
EQTools	**EQTools Script Builder – Manual** This software is used to create and upload ***'Standalone 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	**Upload Wizard - Standalone Project Upload Utility** 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. • Please follow the on-screen instructions within the Upload Wizard utility itself. • Application Note - AN117
ERROR MESSAGES	**Error Message Descriptions** This document lists all the possible error messages which can be generated by the EQTools / ISP-PRO applications.

ii. **Documentation and software for the ISPJUNO 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 ISPJUNO programmer from the following pages on the Equinox website:

1. ISPJUNO programmer
See http://www.equinox-tech.com/products/details.asp?ID=1543&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 / SWD
AN128	NXP – LPCxxx ARM7 FLASH microcontrollers	JTAG / SWD
AN140	ST STM32 Fxxx - ARM Cortex FLASH microcontrollers	JTAG / SWD
AN146	In-System Programming (ISP) of Silicon Labs - Gecko - ARM FLASH microcontroller families	SWD

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 ***"ISPJUNO Download Page***" on the Equinox website.

iv. Programmer related - Application notes

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

Application Note	Description
AN112	Firmware Update instructions for Equinox ISP Programmers
AN114	Accurate on-chip Oscillator Calibration for Atmel AVR microcontrollers
AN121	Equinox EQTools – Release Notes
AN126	Equinox USB Driver installation instructions

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 ***"ISPJUNO Download Page"*** on the Equinox website.

1.0 Introduction

The ISPjuno is a portable ISP programmer designed for field-service and production In-System Programming (ISP) applications. The programmer is capable of operating in 'Standalone Mode' (without PC) allowing an operator to select from 1 of 64 'Standalone Programming Projects' using the display and keypad. A single 'Autoprogram' key is then used to repetitively program the selected project.

- Professional grade Portable In-System (ISP) Programming system
- Ideal for Field-service or Production programming applications
- Supports 'Standalone' operation - no PC required after programmer has been configured with user projects
- Capable of storing up to 64 completely independent 'Standalone Programming Projects'.
- Supports In-system Programming (ISP) of many different programmable microcontrollers, serial EEPROM / FLASH memory devices and other custom devices (relevant Device libraries are required – chargeable upgrades)
- Supports the following programming interfaces: AVR - SPI, AVR - JTAG, 8051 - UART, AVR - XMEGA PDI, AVR - ATtiny TPI, AVR - ATtiny UPDI, Z-Wave – SPI, Z-Wave UART, ARM – JTAG, ARM - SWD
- Supports programming of devices between 3.0V and 5.0V
- Programmer controlled target power supply capable of powering the target system at 3.0V, 3.3V, 4.7V and 5.0V
- Interchangeable ***'Target Interface Modules (TIMs)'*** available to cater for many different Target ISP connector types
- High-speed USB connection to the PC
- Legacy RS232 COM port connection to the PC
- Programmer can be powered from an ***'External power supply'*** or ***'External USB Power Pack'*** via the ***'DC jack socket'***

2.0 Programmer Overview / Specifications

2.1 Programmers covered in this manual

This manual describes the configuration and use of the Equinox ISPjuno device programmer...

2.2 ISPjuno programmer - 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

- Supports the following programming interfaces: AVR - SPI, AVR - JTAG, 8051 - UART, AVR - XMEGA PDI, AVR - ATtiny TPI, AVR - ATtiny UPDI, Z-Wave – SPI, Z-Wave UART, ARM – JTAG, ARM - SWD

High-speed JTAG / SWD port

- Supports high-speed JTAG programming of AVR and ARM microcontrollers
- Capable of supporting high-speed programming of ARM microcontrollers via the SWD interface

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)
- 1 x legacy RS232 port (9-way D 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.

Multiple powering options

- Programmer can be powered from an external power supply or USB power pack (via DC jack socket only)

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.

2.3 ISPjuno - System Contents

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

Hardware

- ISPjuno Programmer
- 9V Power Supply- Universal adaptor
  Input: 230V AC, Output: 9V DC reg.@1.33A Fitted with 2.1mm centre +ve jack connector
- 1 x Set of mains plug adaptors - UK, USA, European, Asia

Cables

- USB connection cable (mini-USB to USB-A)
- 16-way IDC ISP cable
- 10-way IDC ISP cable
- DC Power Cable (2.1mm jack plug to bare wire ends)

Miscellaneous

- 2 x Jumper Links
- 4 x Rubber feet

Software

(Supplied on an Equinox CD-ROM)

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

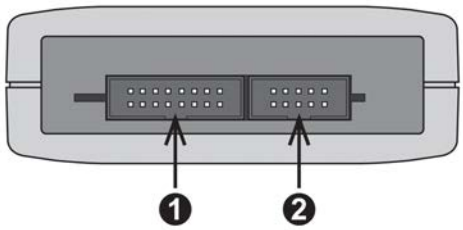
Documentation

- User Guide (printed)

Please note:

The ISPJUNO(ARM) version of the ISPJUNO 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.

2.4 Hardware Overview (external layout)



Top Panel

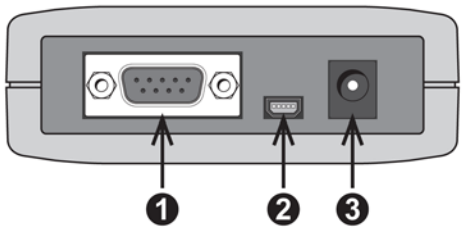
1. Target ISP Connector 16-Way
2. Target ISP Connector 10-Way

Front Panel

Status LEDs:
- PASS
- BUSY
- FAIL

Other LEDs:
- Comms status
- Target Vcc

4-button keypad
- RED Tick: OK
- Green cross: Cancel
- Up / Down for project selection



Bottom Panel

1. RS232 Connector Port
2. mini-USB Connector Port
3. External DC Power Supply Input

2.5 Programmer Status LEDs

The current status of the programmer is displayed on the programmer Status LED's as detailed in the table below.

Fig. 2.6.5 Programmer Status LED's – state descriptions

Status LED Display	State	State Description
	**WAITING**	• Programmer is now waiting to start an 'Autoprogram' operation.
	**BUSY**	• Programmer is 'BUSY' performing a programming operation. • If the programmer is controlled from EDS, the BUSY LED will remain on after a programming operation until a 'RESET programmer' command is executed.
	**FAIL**	• Programming operation has FAILED. • See programmer LCD for diagnostics • Programmer will automatically switch off target power if it is controlling power.
	**PASS**	• Programming operation was successful.

Status LED key:

Please note:

- There are also two special modes called ***'Waiting Target Connection'*** or ***'Waiting Target Disconnection'*** where the yellow ***'BUSY'*** LED will FLASH.
- These modes are enabled when ***'Target Connection Sense'*** is enabled in the Programming Project.

2.6 Programmer – Controlled Power Supplies

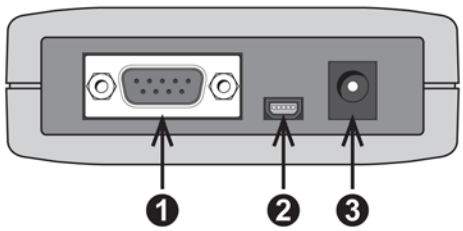
Programmer Power Supplies	Value
Programmable Vcc voltage (TVCC)	Yes Only 4 x pre-defined voltage levels: 3.0V, 3.3V, 4.7V and 5.0V @ 250mA Tolerance: +/- 5%
Programmable Vpp Voltage (TVPP)	No - fixed VPP voltage: 12.0V @ 100mA
External Switched Vcc supply	Not supported
Analogue voltage measurement	Yes Target (TVCC)
Target current measurement	Not supported
Target over-current detection	Not supported
Target controlled discharge circuit	Yes

2.7 Communication / Control Ports

The ISPjuno programmer features the following communications ports...

Communications ports	ISPjuno
RS232 port	1
USB port	1

These ports can be found on the bottom end panel of the programmer....



Bottom Panel

1. RS232 Connector Port
2. mini-USB Connector Port
3. External DC Power Supply Input

3.0 Powering the ISPjuno programmer

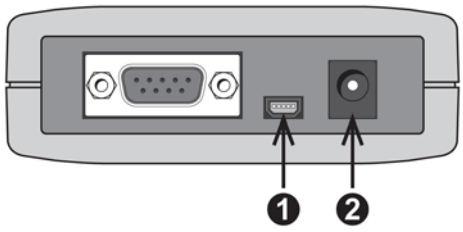
3.1 Overview

The ISPjuno programmer can be powered using one of the methods detailed in the table below.

#	Powering method	Section
1	External mains power adaptor via DC jack socket	3.3
2	External DC supply via DC jack socket	3.4
3	PC USB port power via programmer USB port	3.5
4	External USB 'Power bank' via programmer DC jack socket	3.6
5	Customer Target System / Target Supply	3.7

3.2 Programmer power connectors

The programmer can be powered from either the ***'DC jack power connector'*** or the ***'mini-USB port'*** connector which are located on the bottom end panel of the programmer as shown in the illustration below…



Bottom Panel

1. mini-USB Connector Port
2. DC Power Connector (Jack socket)

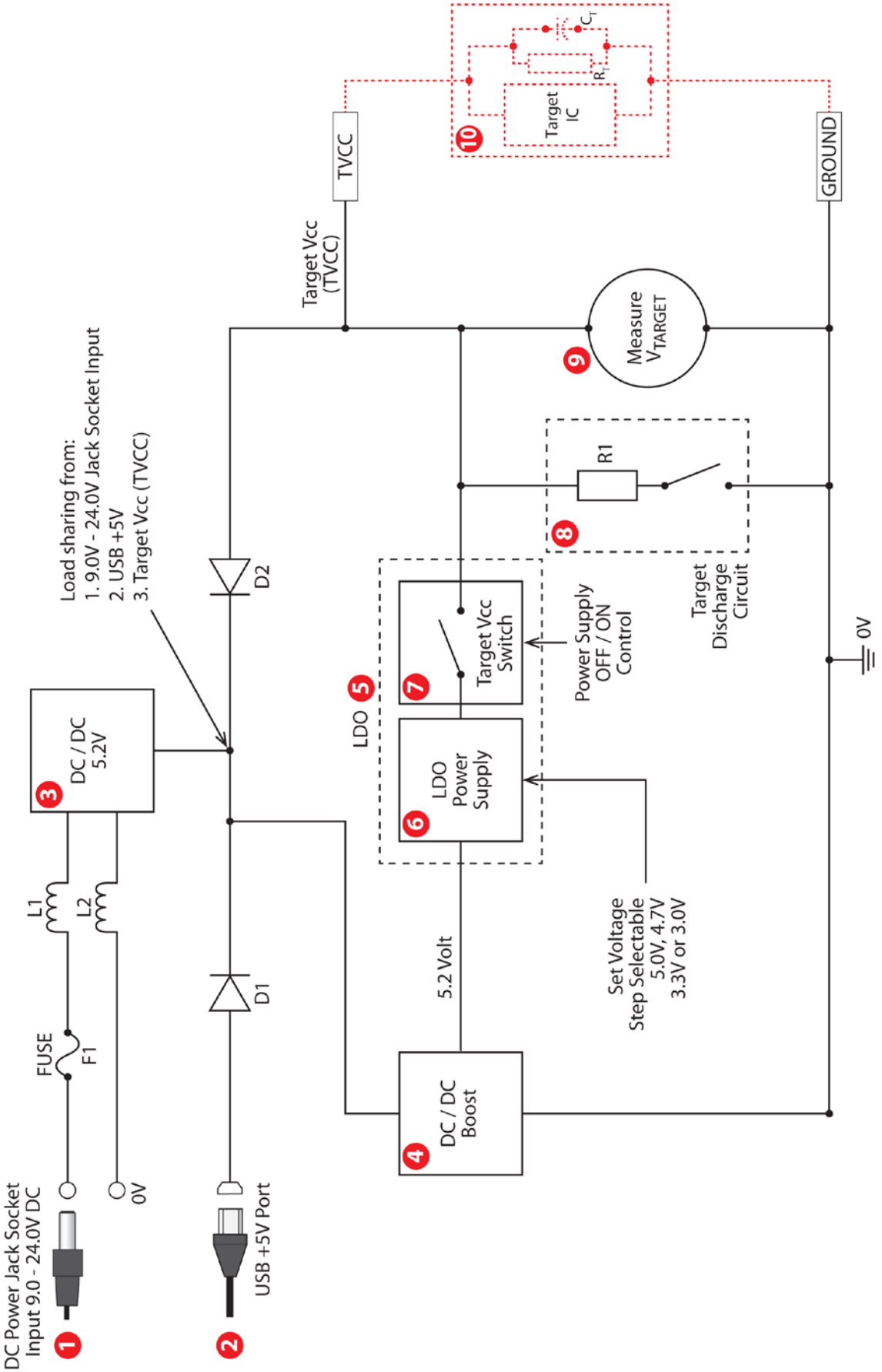
Connector	Description	Connector type	Input voltage range
J10	USB Port	mini-USB Connector	4.2 - 5.0V via PC USB port or USB 'Power pack'
J12	DC power connector	2.1mm Jack Socket, centre +ve	9.0 - 12.0V Via mains power adaptor or external power supply

3.3 ISPjuno - Power Supply overview

The ISPjuno programmer internal power supply configuration is shown in the overview diagram on the next page.

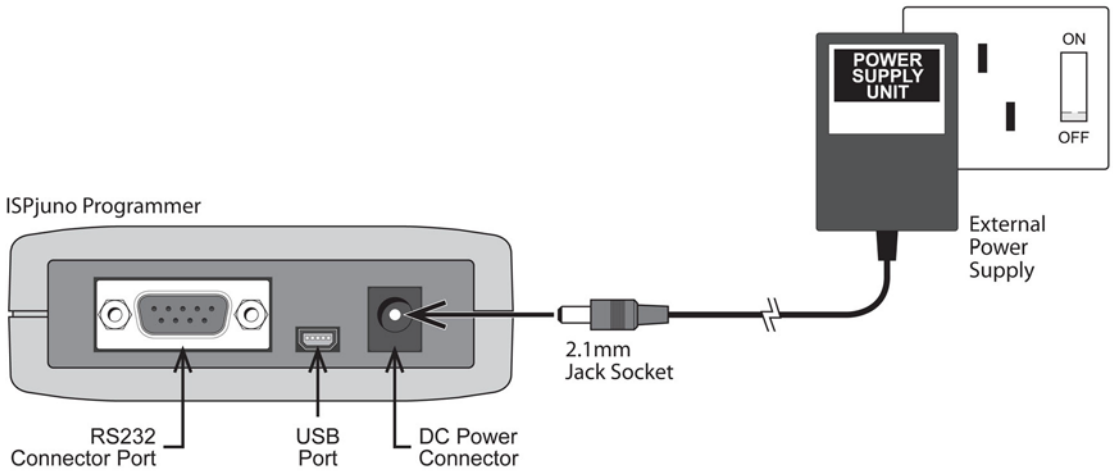
The table below refers to the diagram on the next page…

Key #	Description	Comments
1	DC Power Jack Socket	2.1mm centre positive jack socket Input 9.0 - 24.0V DC
2	USB +5V Port	Connect to PC USB Port
3	DC / DC Converter	Converts 9.0 – 24.0V input voltage to 5.2V
4	DC / DC Boost Circuit	Boosts the input voltage to ensure it is 5.2V
5	LDO	Low drop-out regulated power supply block
6	LDO Power Supply	Low drop-out regulated power supply with pre-set voltage steps
7	Target Vcc Switch	Switch controlling the output of the LDO power supply.
8	Target Discharge Circuit	When enabled, this circuit provides a discharge path for any energy contained in the target system power supply.
9	Measure V_Target	Analogue measurement of Target TVCC voltage
10	Customer Target PCBA	PCBA / DUT under test / being programmed


10
Target IC
TVCC
GROUND
Target Vcc (TVCC)
9
Measure V_{TARGET}
R1
8
Target Discharge Circuit
0V
Load sharing from:
1. 9.0V - 24.0V Jack Socket Input
2. USB +5V
3. Target Vcc (TVCC)
D2
LDO
5
7
Target Vcc Switch
Power Supply OFF / ON Control
6
LDO Power Supply
3
DC / DC 5.2V
L1
L2
FUSE
F1
D1
5.2 Volt
Set Voltage Step Selectable 5.0V, 4.7V 3.3V or 3.0V
4
DC / DC Boost
DC Power Jack Socket Input 9.0 - 24.0V DC
0V
USB +5V Port
1
2

3.4 External mains power adaptor via DC jack socket

The ISPjuno programmer 'kit' includes a mains power supply adaptor which can be used to power the programmer via the DC jack socket.



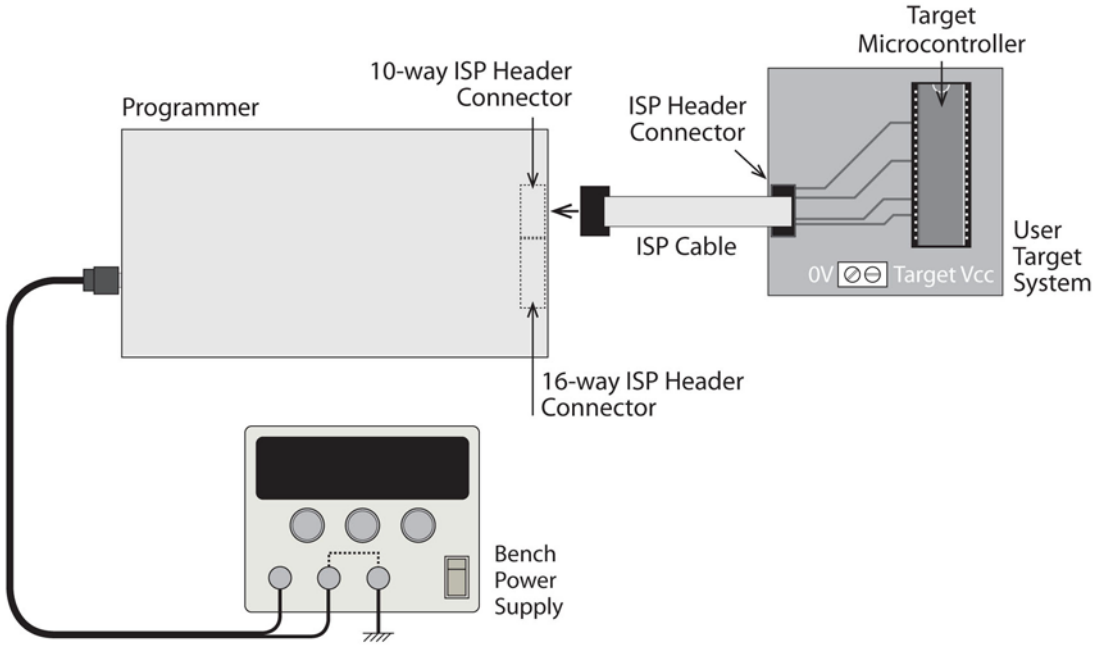
Important note:
The jack socket on the programmer is a 2.1mm centre-positive socket.

Instructions:

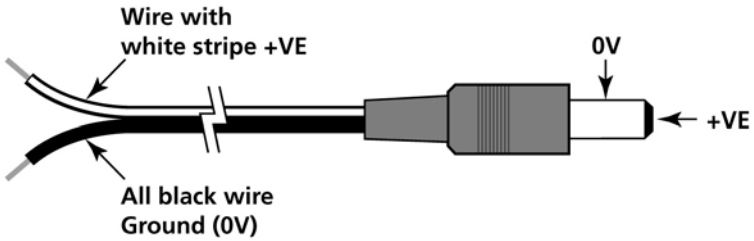
- Ensure the the ISP cable from the programmer is disconnected from any target system.
- Plug the 2.1mm jack plug end of the power supply cable into the ***programmer 'DC Power connector'*** socket as shown in the illustration above.
- Plug the mains power supply into a suitable mains socket.
- Switch on mains power --> the programmer should power up and show text on the display.

3.5 External DC supply via DC jack socket

The ISPjuno programmer can be powered via an ***'External DC supply'*** e.g. bench power supply via the programmer ***'DC jack socket '***.



The ISPjuno 'kit' includes a ***'DC power cable'*** which features a ***2.1mm centre positive jack plug*** on



one end and bare tinned wire ends on the other end.
This cable can be used to power the programmer from any external power supply.

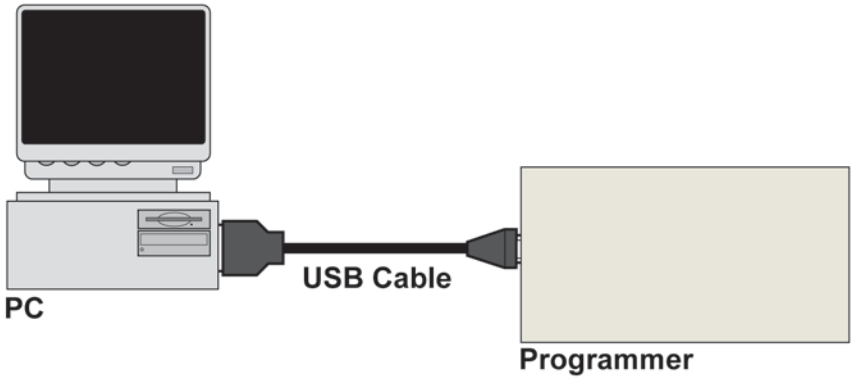
- One end features a female 2.1mm DC jack plug
- The other end of the cable is supplied with bare wire ends for connecting to an external power supply e.g. bench PSU.
- The black lead with the white stripe is the +VE cable.
- The all black lead is the GROUND cable.
- The external voltage applied to the programmer ***'Jack socket'*** must be between 9.0 and 12.0V!

Instructions:

- Ensure the the ISP cable from the programmer is disconnected from any target system.
- Plug the 2.1mm jack plug end of the power cable into the programmer ***'DC Power'*** jack socket as shown in the illustration above.
- Connect the wire ends of the power cable to a suitable external power supply e.g. bench supply as shown above.
- Switch on the external power supply --> the programmer should power up and show text on the display.

3.6 PC USB port power via programmer USB port

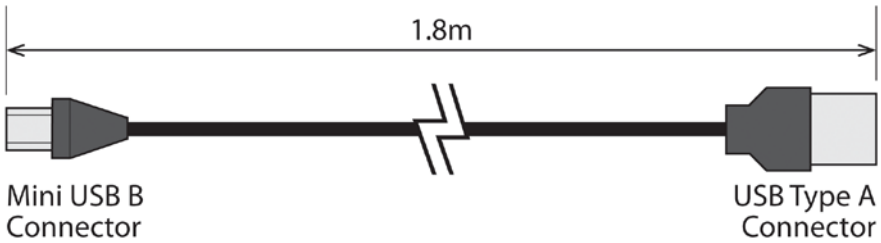
It is possible (but not recommended) to power the programmer via the USB port of a PC.



Instructions:

- Ensure the the ISP cable from the programmer is disconnected from any target system.
- Plug the ***'USB Type A'*** connector end of the USB cable into a spare USB port on the host PC (or powered USB hub)
- Plug the ***'mini-USB connector'*** end of the USB cable into programmer.
- The programmer should power up and show text on the display.

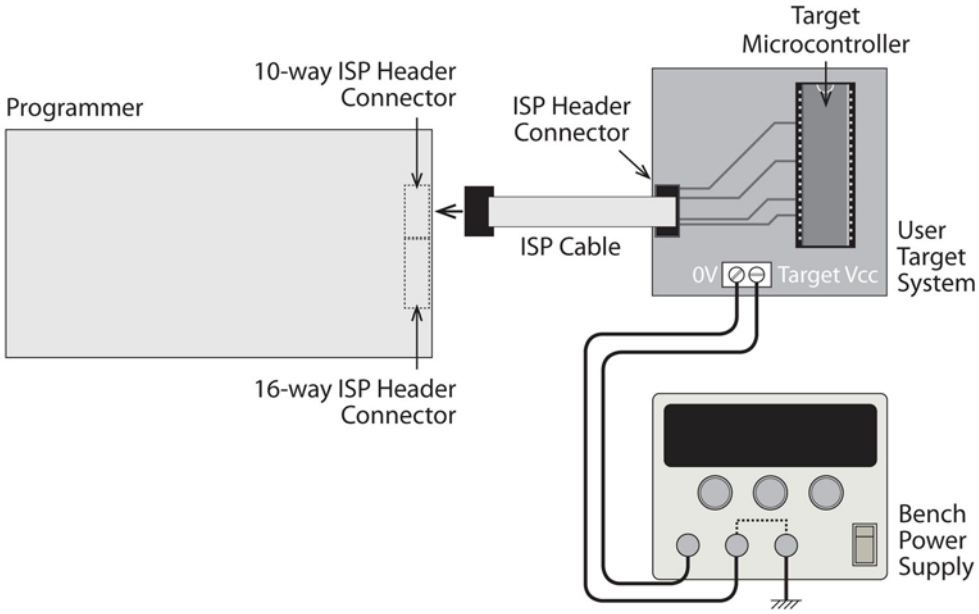
The USB cable specification is shown below….



Important note:
This method of powering the programmer may prove to be unreliable on many PCs due to the high current drawn from the USB port from the programmer. It is therefore recommended that this method of powering the programmer is only used for uploading projects and not for actual target device programming.

3.7 Customer Target System / Target Supply

It is possible to power the ISPjuno programmer from the customer's target system / PCA.
The programmer takes it power from the Target Board supply via the TVCC and GROUND wires of the 'ISP cable' which connects between the programmer ***'Target ISP Port'*** and the ***Target System***.



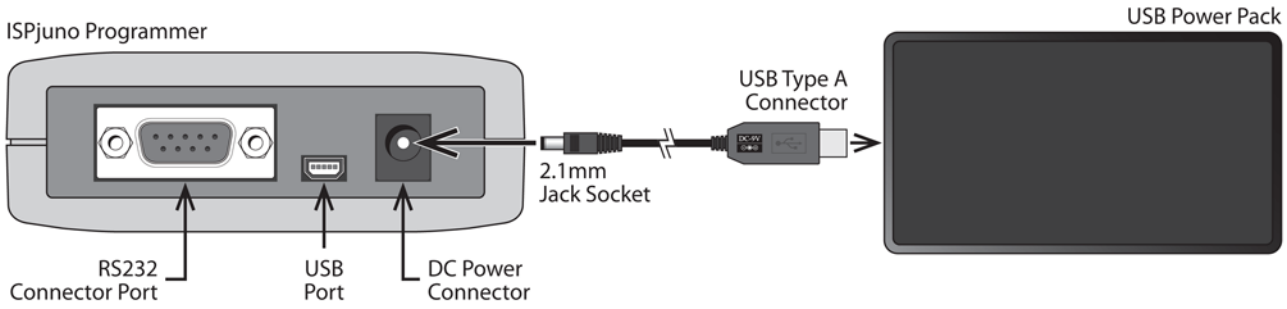
Important note:
This method of powering the programmer is not recommended due to the high current required by the programmer during the programming process. The target supply must have enough headroom to supply at least 200mA to the programmer.

Instructions:

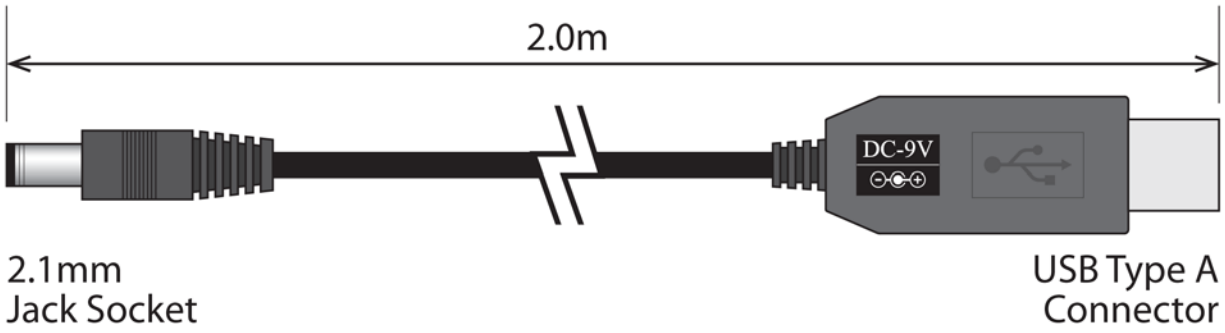
- Connect a suitable ***'ISP cable'*** between the programmer ***'Target ISP Port'*** and the ***Target System***
- Connect an ***'external power supply'*** to the ***Target System*** .
- Set the 'current limit' on the ***'external power supply'*** to a suitable value which can power both the programmer and ***Target System*** .
- Switch on the ***'external power supply'***
- The programmer should power up and show text on the display.

3.8 Power the Juno with an External USB 'Power bank'

The ISPjuno programmer can be powered via an external ***'USB Power bank'*** as shown in the illustration below.



This method of powering the programmer uses a dedicated ***'USB to 2.1mm Jack - 9V – DC to DC adaptor cable'*** which is available from Equinox Technologies.



This cable plugs into a PC USB port or USB ***'Power Bank'*** via a standard USB Type A connector. The other end of the cable features a 2.1mm jack plug which plugs into the mating 2.1mm jack 'power socket' on the ISPjuno programmer. The cable features a ***'DC to DC converter'*** which steps up the voltage from the USB power source to +9V which is suitable for powering the ISPjuno programmer.

Instructions (follow the order below):

1. Ensure the the ISP cable from the programmer is disconnected from any target system.
2. Plug the USB Type A connector end of the cable into the USB socket on the USB ***'Power Bank'***.
   → The USB ***'Power Bank'*** should auto-sense the load of the ***'DC to DC converter'*** and power up the converter circuitry.
3. Then Plug the 2.1mm jack plug end of the ***'USB to 2.1mm Jack - 9V – DC to DC adaptor cable'*** into the programmer ***'DC Power'*** jack socket of the programmer as shown in the illustration above.
   --> the programmer should power up and show text on the display.

Important note

Ensure that the the ***'USB to 2.1mm Jack - 9V – DC to DC adaptor cable'*** is plugged into the programmer ***'DC Power'*** jack socket **first and then plug the jack plug into the programmer.** This makes sure that the 9V power supply ral has settled before powering the programmer.

4.0 Powering the Target System

4.1 Overview

This section explains the different options available for powering the ***'Target System'***.

It is possible to power the ***'Target System'***. either from an ***'external power supply'*** or by utilising the ***'Programmer Controlled Target Power Supply'***.

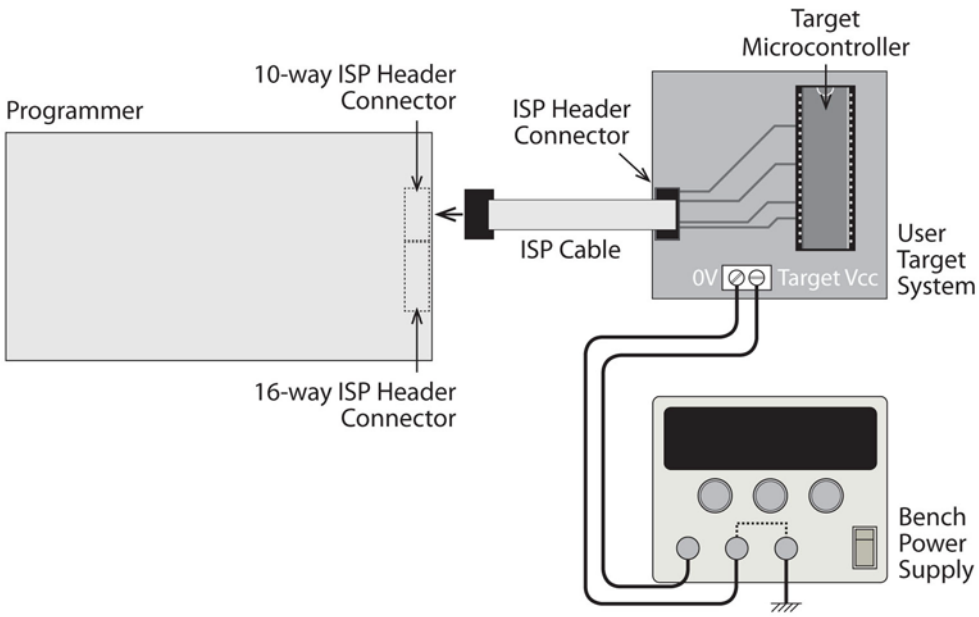
#	Target System powering method	Voltage range (V)	Power supply used to power the Target System
1	Independently powered	3.0 – 5.0	External Power Supply e.g. bench supply
2	Powered from the programmer	Pre-set voltages: 3.0V, 3.3V, 4.7V or 5.0V	Programmer Controlled Target Power Supply

The programmer is only capable of generating 4 different pre-set target voltages: 3.0V, 3.3V, 4.7V or 5.0V.

4.2 Target System – independently powered

4.2.1 Overview of external powering

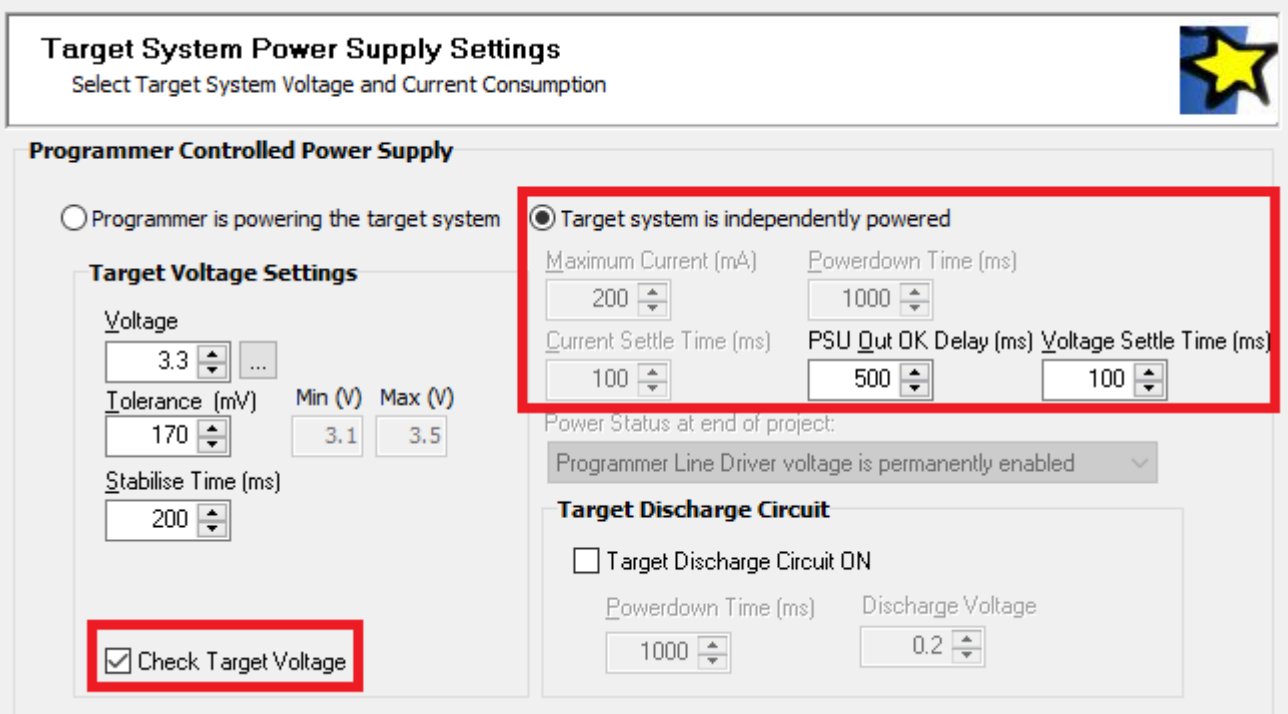
This section explains how to configure the programmer so the ***'Target System'*** is independently powered. This means that the ***'Target System'*** is powered by an ***'external power supply'*** and NOT by the programmer.



Important note:
In this scenario, the 'Target System' supplies the ***'Target voltage'*** to the programmer ***'Line Driver'*** circuity. This means that the ***'programming signals'*** will swing between 0V and ***'Target voltage'***.

4.2.2 Instructions for target independent powering

The default setting when creating a new ***'programming project'*** for the programmer using EQTools is that the ***'Target System is independently powered'***……



This means that an ***'external power supply'*** is being used to provide power to the ***'Target System'***.

1. If not already selected, select the ***'Target System is independently powered'*** radio button.

2. Set the ***'Voltage'*** under the ***'Target Voltage Settings'*** section to match the I/O voltage of the target IC / device which is being programmed.

Example:
If the target IC / device is being powered at 3.3V, then set the ***'Voltage'*** to be ***'3.3V'***.
The programmer IO signals will then swing between 0V and 3.3V.

3. Tick the ***'Check Target voltage'*** box
- Enabling this option forces the programmer to physically measure the actual voltage being fed from the ***'Target System'*** into the ***TVCC*** pin on the programmer.
- If the programmer measures the ***'Target voltage'*** and it is OFF (0V) or not within the voltage tolerance specified, the programmer will display a ***'Voltage error'***.

4.3 Target System – powered by the programmer

4.3.1 Overview

This section explains how the ***'Programmer Controlled Target Power Supply'***.can be used to power the ***'customer target system'***.

4.3.2 Pre-set Output voltages

The programmer is capable of powering a customer ***'target system'*** at one of four pre-defined ***'TVCC output voltages'*** as defined in the table below…

Programmer TVCC output voltage (V)	Voltage tolerance (%)	Min output voltage (V)	Max output voltage (V)	Max Allowed Current (mA)
3.0	5%			250
3.3	5%			250
4.7	5%			250
5.0	5%			250

Please note:
The ***'programmer controlled – target power supply'*** has a tolerance of approximately +/- 5%, so the generated voltage may not be the precise value of 3.0V, 3.3V, 4.7V or 5.0V specified in the ***'Target voltage settings'*** in your project. It could be any voltage between the ***'Min'*** and ***'Max'*** voltages show in the table.

4.3.3 Programmer signal IO (line driver) voltage range

The programmer ***'signal IO (line driver) voltage range'*** defines the voltage swing of the programmer ***'IO signals'***.

When the programmer is set to ***'Programmer is powering the target system'***, then the programmer ***'Line Driver voltage'*** will be set to the same value as specified in the project. This means that the IO signals used to actually program the target device / IC will now swing between 0V and the selected 'Target Voltage' as shown in the table below….

Programmer TVCC output voltage (V)	Logic 0 voltage (V)	Logic 1 voltage (V)
3.0	0	3.0
3.3	0	3.3
4.7	0	4.7
5.0	0	5.0

Warning!
It is possible to damage the Target Device / IC by setting the ***'Programmer TVCC voltage'*** to a value higher than the recommended voltage for the Target IC / Device.

If programming a device with a ***'Maximum allowed voltage'*** of 3.3V, do NOT set the ***'Programmer TVCC voltage'*** to a value higher than 3.3V.

4.3.4 Programmer power supply - current limit

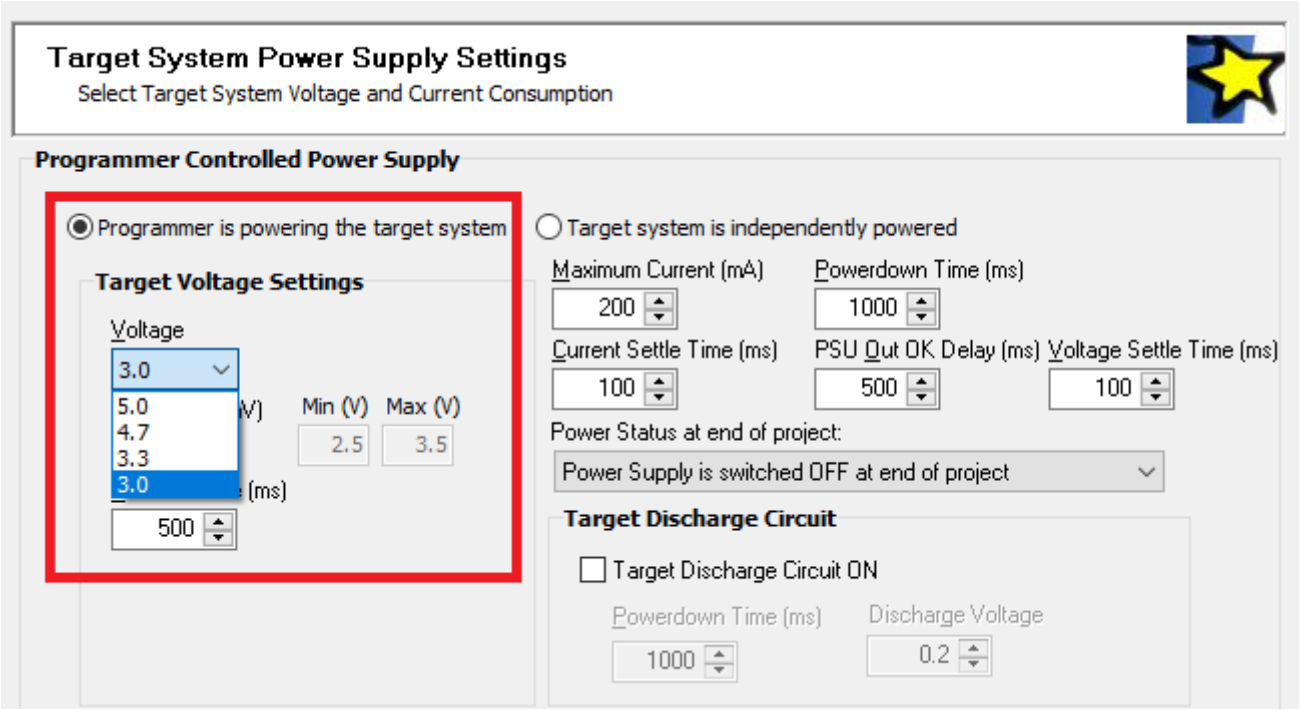
There is no ***'current measurement'*** on this programmer.
The ***'programmer controlled – target power supply'*** will automatically start to current-limit at approximately 250 mA to prevent damage to the programmer.

4.3.5 Configuring the programmer to power the Target System

This section explains how to configure the programmer so the programmer powers the ***'Target System'***.

In the ***'Power supply settings'*** tab in the ***'programming project'***…

1. Select the radio-button ***'Programmer is powering the target system'***….



2. Select the required ***'TVCC – Target output voltage'***…
   - Click the ***'Voltage'*** field
   - Now select the required voltage from the list displayed: 3.0V, 3.3V, 4.7V or 5.0V.
   - The ***'Voltage'*** field will default to the lowest voltage allowed for the selected ***'Target device / IC'***.

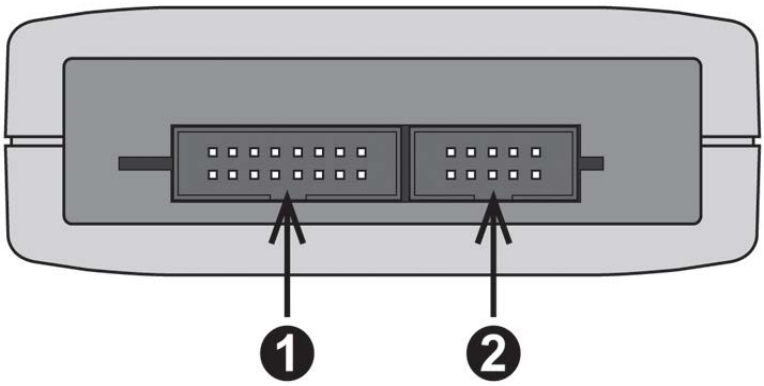
When the ***'programming project'*** is executed, the programmer will generate the selected voltage and this voltage will be output from the programmer ***'TVCC'*** pin.

Important note:
The selected ***'Target voltage'*** also sets the programmer ***'Line driver'*** voltage.
So the ***'programming signals'*** will now swing between 0V and the specified voltage.
e.g. If you select 3.3V, then the programmer ***'programming signals'*** will swing between 0V and 3.3V.

5.0 Target ISP connection – Selection Guide

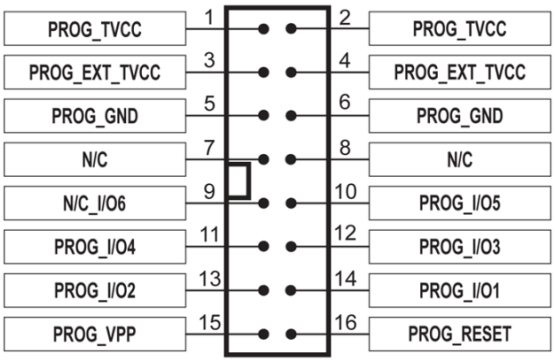
5.1 Overview of ISP connectors

The ISPjuno programmer features two ***'Target ISP Connectors'*** which are used to interface the programmer to the target board / device to be programmed. These connectors are located in the bottom end panel of the programmer as shown in the illustration below....

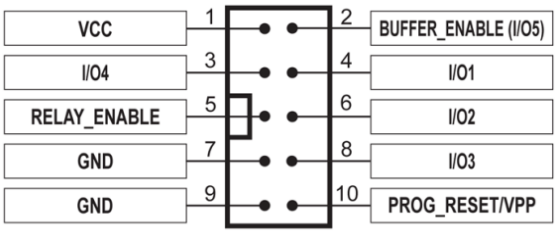


The pin-out of these IDC connectors are shown below....

1



2



A full explanation of each pin-out is available in the relevant chapters referred to in the table below...

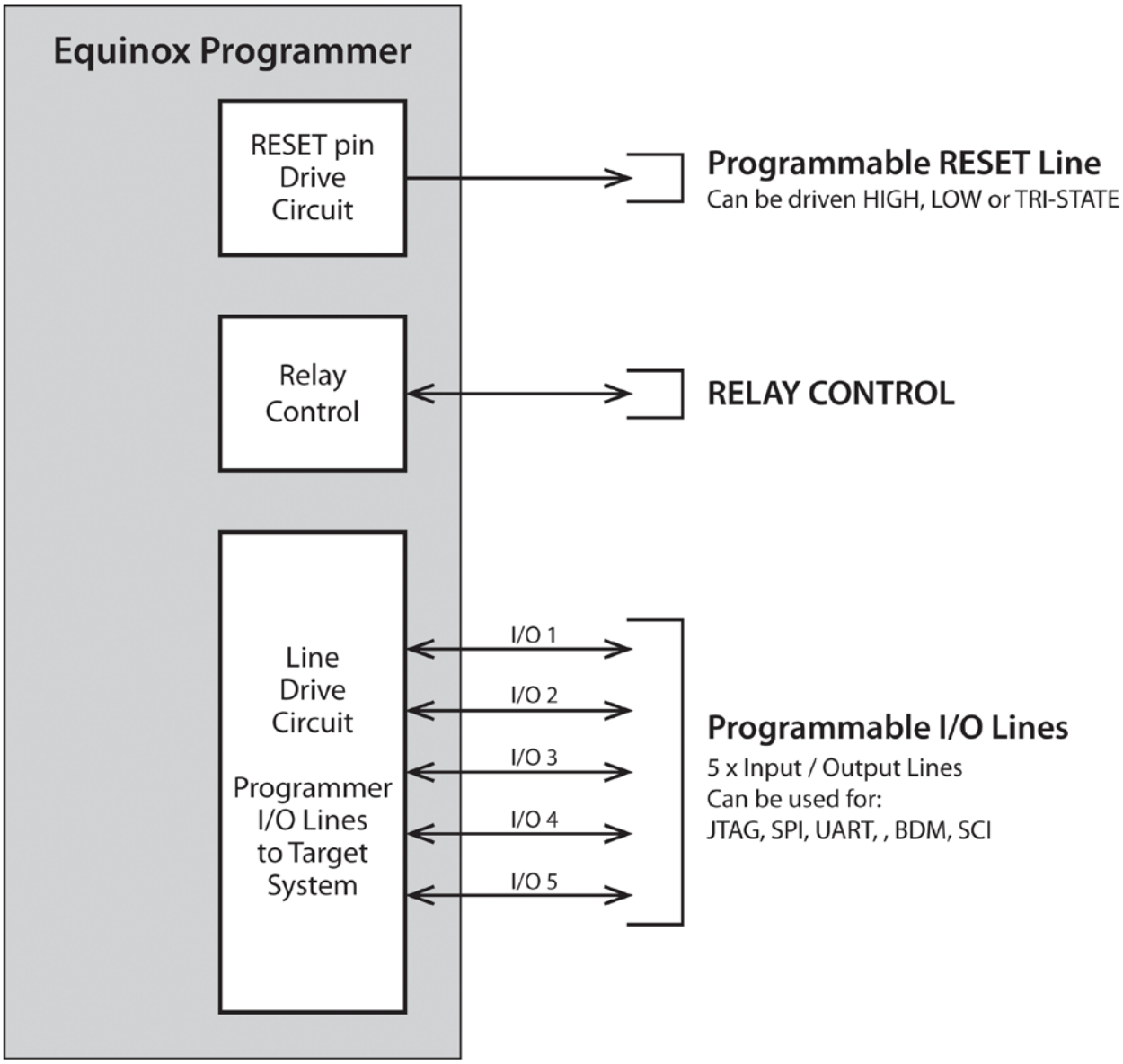
#	Target ISP connector	Connector type	Comment	Further information
1	Target ISP Connector #1	16-way 0.1" IDC female (bump polarised)	Same as ISPnano 16-way connector	See section 3.3
2	Target ISP Connector #2	10-way 0.1" IDC female (bump polarised)	Same as standard Equinox 10-way connector with a few exceptions	See section 3.4

5.2 Programmer – Target I/O Signals

The ISPjuno programmer features the following programmable signal lines which interface the programmer and the Target IC(s) to be programmed on the Target System:

- 5 x Programmable **Input / Output** lines
- 1 x Programmable **Output only** line
- 1 x Dedicated **RESET** pin

The diagram below shows the available programmer I/O lines:



Please note:

- These I/O signals are all available on the 16-way IDC connector but only a selection of the signals are available on the 10-way IDC connector.

5.3 Supported programming interfaces

The ISPjuno programmer is capable of supporting the following ***'programming interfaces'***...

Programming Interface	ISPjuno
SPI	Yes*
JTAG	Yes*
I2C	No
UART	Yes*
AVR XMEGA PDI	Yes
AVR ATtiny TPI (LV)	Yes
ATtiny TPI Port (HV +12V VPP)	Yes
AVR UPDI (LV)	Yes
AVR UPDI (HV +12V VPP)	Yes
Programmable clock output	Yes - 32 kHz

Please note:

- *The 'SPI interface', 'JTAG interface' and 'UART interface' signals all share the same physical programmer I/O lines.
- This means that the programmer can only be connected to a target device via one of these programming interfaces at any one time.

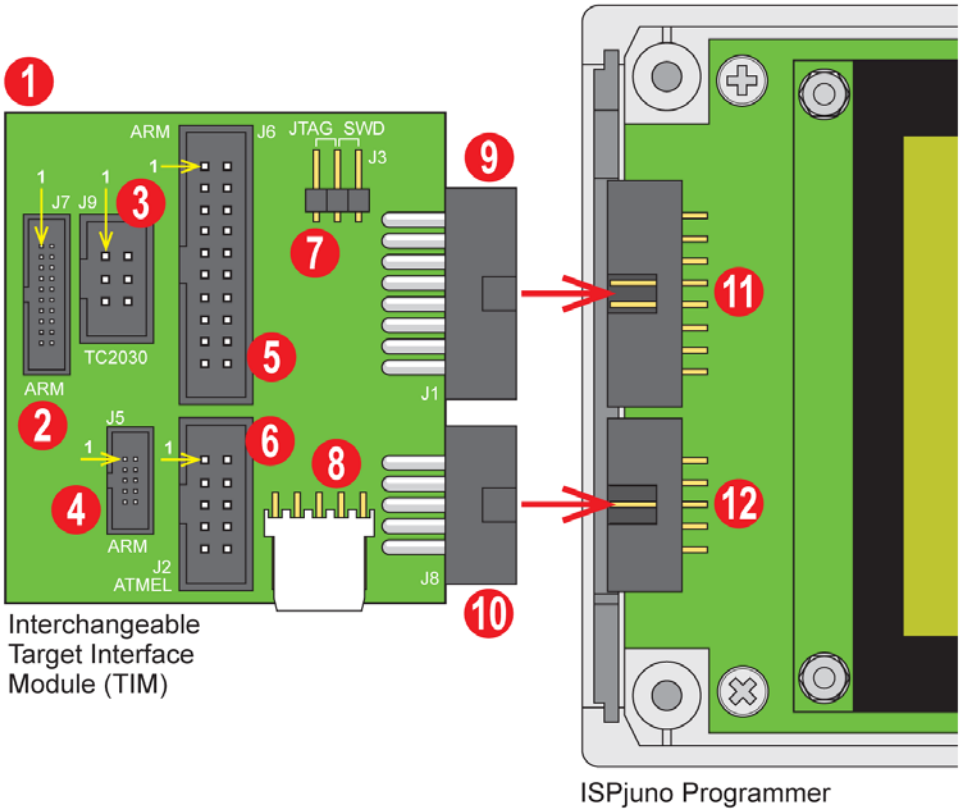
5.4 Programmer Target I/O Capability

Target I/O Capability	ISPjuno
Programmable Target I/O	5 x I/O 1 x O
I/O Voltage Range	1.8 – 5.0V
I/O Isolation	-
ESD protection on Target I/O lines	IEC61000-4-2, air discharge: 15 kV IEC61000-4-2, contact discharge: 8kV
Over-voltage protection on Target I/O lines	YES Voltages over 9V are clamped.

5.5 Overview of Target Interface Connector Modules (TIMs)

As it is impossible to cater for all the possible 'connector types' and 'connector pin-outs' which can be used to program electronics devices, Equinox have instead developed a range of ***'Target Interface Modules' (TIMs)*** which plug into the ISPjuno programmer and feature the most popular connector systems for e.g. AVR and ARM microcontrollers. These TIMs also feature dedicated 'Clock buffer circuitry' which buffers the clock signal for SPI, JTAG and SWD programming interfaces.

The illustration below shows how the ***'ARM - Target Interface Module'*** plugs into the end of the ISPjuno programmer....



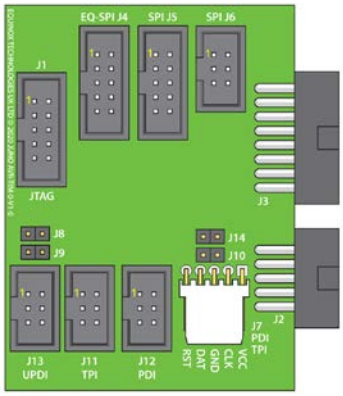
- Pluggable connector modules which feature the popular 'connector types' and 'connector pin-outs' for a designated family of devices.
- TIM module simply plugs into the 'Target ISP connector' end of the programmer.
- TIM modules currently available for 'ARM microcontroller devices' and 'AVR microcontroller devices'
- Each target connector on the TIM modules features an independent 'Clock buffer circuit' on the clock signal to guarantee good signal integrity.

Please note:
The TIM modules are designed for development programming use only. This is due to the size and form factory of the plug-in modules. Equinox recommends that ***'custom ISP cables'*** are used for production programming use.

There are currently two ***Target Interface Modules (TIMs)*** available....

ARM TIM Module

- Connects to ISPjuno programmer
- Features most of the popular connector types / pin-out's used for programming ARM microcontroller devices.
- 20-way 0.1" IDC connector - standard ARM pin-out
- 10-way 0.1" IDC connector - standard ARM pin-out
- 20-way 0.05" ARM Cortex connector - standard ARM pin-out
- 10-way 0.05" ARM Cortex connector - standard ARM pin-out
- Molex 5-pin SWD connector
- Each connector features an independently buffered 'Clock output' guaranteeing good signal integrity.
- See Appendix 2 for further information



AVR TIM Module (AVR-TIM-01-V1.0)

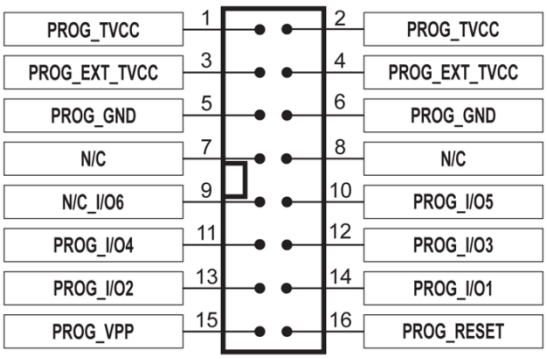
- Connects to ISPjuno programmer
- Features most of the popular connector types / pin-out's used for programming Microchip (formerly Atmel) AVR microcontroller devices.
- 10-way 0.1" IDC connector - standard Equinox pin-out
- 10-way 0.1" IDC connector - standard AVR JTAG pin-out
- 6-way 0.1" IDC connectors for:
  - standard AVR SPI (ISP) pin-out
  - AVR XMEGA PDI pin-out
  - AVR TPI pin-out
  - AVR UPDI pin-out
- Each connector features an independently buffered ***'Clock output'*** guaranteeing good signal integrity.
- See Appendix 3 for further information

Please note:
Unless otherwise specified, these ***'TIM modules'*** do NOT come as standard with the ISPjuno programmer. They must be ordered separately from the programmer.

5.6 Target ISP Port – 16-way connector pin-out

The ***'Target ISP Connector'*** port features all the signals required to implement In-System Programming (ISP) of a Target IC using the SPI, JTAG, I2C, XMEGA PDI, ATtiny TPI or UART interface. This connector also features the programmable ***"Target Vcc"*** and ***"Target Vpp"*** voltages plus a switched ***"EXTERNAL Vcc"*** supply.

The illustration below shows the location of the ***'Target ISP Connector'*** port on the rear panel of the programmer.



'Target ISP Connector' port

The connector is a 16-pin bump-polarised IDC connector with 0.1" pin spacing.

Pin 1 is the top right pin as shown in the diagram opposite.

The pin-out of this connector is detailed in the table below.

Pin No	Programmer Pin name	I/O	Connect to pin on Target System	Notes
1 + 2	TARGET_VCC	P	TARGET_VCC	**Target VCC** This pin should be connected to the Target System Vcc.
3 + 4	TARGET_EXT_VCC	P	See notes.	**Target External VCC** This pin should be connected to the Target System Vcc. Only use this pin if the ***"External Target Vcc"*** is to be switched to the ***"Target Vcc"***
5 + 6	PROG_GND	P	**Signal GROUND (0V)**	**Signal Ground Connection (1)** 0V to which the programmer JTAG, SPI, I2C signal lines are referenced to.
7a 7b 7c	I2C_SCL XMEGA_PDI_CLK ATTINY_TPI_CLK	I/O O O	• I2C SCL • RESET • TPI_CLK	• I2C SCL clock signal • XMEGA CLOCK Signal • ATtiny CLOCK Signal
8a 8b 8c	I2C_SDA XMEGA_PDI_DATA ATTINY_TPI_DATA	I/O I/O I/O	• I2C SDA • TEST (PDI_DATA) • TPI_DATA	• I2C SDA data signal • XMEGA DATA Signal • ATtiny DATA Signal
9	OP6	O	Algorithm specific	**Spare Output**
10	Programmer I/O5	I/O	• Spare I/O	

11	Programmer I/O4	I/O	• JTAG – TMS	This pin is used for JTAG Target Systems only.
12	Programmer I/O3	I/O	• JTAG – TCK • SPI - SCK	This pin can be used for JTAG or SPI Target Systems.
13	Programmer I/O2	I/O	• JTAG – TDO • SPI – MISO • UART – RXD • PDI_RXD	This pin can be used for JTAG, SPI, UART, XMEGA PDI and ATtiny TPI Target Systems.
14	Programmer I/O1	I/O	• JTAG – TDI • SPI – MOSI • UART - TXD	This pin can be used for JTAG, SPI or UART Target Systems.
15	PROG_VPP	P	See note	**Vpp Voltage** The programmer can output a "Vpp" voltage on this pin between 6.5V and 13.8V. This pin should not be connected unless a Vpp voltage is required by the Target IC.
16	PROG_RESET	O	**RESET**	**Target RESET control pin** This pin controls the Target Device RESET pin. It will driven HIGH/LOW according to the device type and settings in the <Pre-program State Machine> tab in the EQtools project.

Key
O - Output from programmer to Target Device
I - Input to programmer from Target Device
P - Passive e.g. GROUND and power rails
N/C - Not connected

Please note:

Signal GROUND (0V)

The ***'Signal GROUND (0V)'*** connection is the 0V to which the programming lines (JTAG, SPI, I2C, UART, PDI, TPI) are referenced to. This 0V line should be connected directly to the Target System (UUT) 0V connection via the shortest possible wire link.

Target Vcc

The ***'Target Vcc'*** is the output of the ***'Controlled Power Supply'*** from the programmer. The power supply has a range of 1.8 to 5.0V and can be switched ON / OFF to the Target System under programmer control.

External Target Vcc

The ***'External Target Vcc'*** is the voltage which is applied to the ***'DC EXT'*** connector of the programmer. It is electronically switched to pins 3+4 inside the programmer. This allows an external voltage from 1.8 – 24.0V to be switched to the Target System.

5.6 Equinox 10-way Header - Generic pin-out

This connection method is suitable for interfacing the programmer to a Target System which features the following:

- Equinox 10-way IDC ISP Header
- An Atmel device which features the 3-wire SPI + RESET Programming Interface

This is the favoured ISP connector as it allows the following additional functions:

- Application of +12V Vpp for ATtiny High Voltage Serial Programming
- ***'SCK2 Oscillator'*** for clocking devices during programming
- Spare I/O pin which could be used for ***'SPI SLAVE SELECT'*** or to drive an LED on the Target System

To implement this connection, simply plug the 10-way ISP cable into the ***Programmer J6 header*** and plug the other end of the cable into the matching header on the Target System.

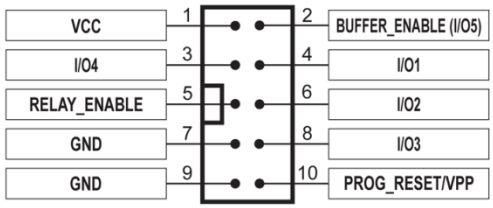


Figure 4.7.1 – Equinox 10-way IDC Header (J8) viewed from above

Warning!

1. It is possible for +12V to be output on pin 10 of this connector when programming ATtiny11/12/15 devices.
2. Connecting to the wrong ISP Header may cause catastrophic damage to the Programmer & Target System

Pin No	Programmer Pin name	I/O	Connect to pin on Target System	Notes
1	TARGET_VCC	P	TARGET_VCC	**Target VCC** This pin should be connected to the Target System Vcc.
2	BUFFER_ENABLE	IO5	Connect to Clock Buffer circuit Buffer Enable pin	This pin is used to enable the output of a remote Clock Buffer.
3	Programmer I/O4	IO4	• JTAG – TMS	This pin is used for JTAG Target Systems only.
4	Programmer I/O1	IO1	• JTAG – TDI • SPI – MOSI • UART - TXD	This pin can be used for JTAG, SPI or UART Target Systems.
5	RELAY ENABLE	O	Controlled output used to switch external relay	Direct programmer output with 470 ohm resistor in series. Requires external transistor to drive relay.
6	Programmer I/O2	IO2	• JTAG – TDO • SPI – MISO • UART – RXD • PDI_RXD	This pin can be used for JTAG, SPI, UART, XMEGA PDI and ATtiny TPI Target Systems.
7 + 9	PROG_GND	P	**Signal GROUND (0V)**	**Signal Ground Connection (1)** 0V to which the programmer JTAG,

				SPI, I2C signal lines are referenced to.
8	Programmer I/O3	IO3	• JTAG – TCK • SPI - SCK	This pin can be used for JTAG or SPI Target Systems.
10	PROG_RESET/VPP	O	**RESET**	**Target RESET control pin** This pin controls the Target Device RESET pin. It will driven HIGH/LOW according to the device type and settings in the <Pre-program State Machine> tab in the EQtools project. It is also used to apply a +12V VPP voltage for some algorithms.

Key
O - Output from programmer to Target Device
I - Input to programmer from Target Device
P - Passive e.g. GROUND and power rails
N/C - Not connected

6.0 ISPjuno - Standalone Mode Operation

6.1 Overview

The ISPjuno programmer is capable of operating in so-called ***'Standalone mode'*** where it can be used without being connected to a PC.

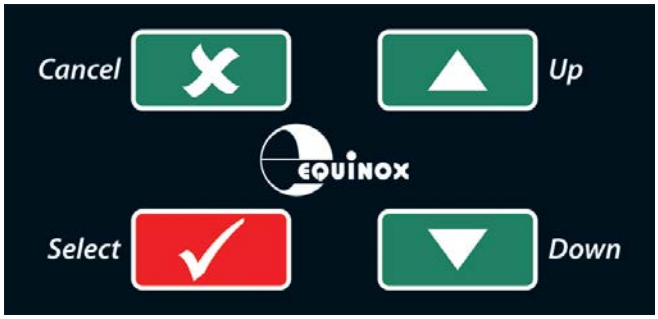
When the programmer is being operated in ***'Standalone mode'***, the user simply selects the required ***'Standalone programming project'*** from the list of projects which have been pre-stored in the programmer ***'Internal FLASH Memory Store'***.

6.2 Standalone Programming Project

A ***'Standalone programming project'*** is a special kind of project which contains all the information required to program the target DUT (IC).

6.3 Keypad functions

The ISPjuno programmer is operated in ***'Standalone mode'*** by using the 4-key keypad and display (LCD)….

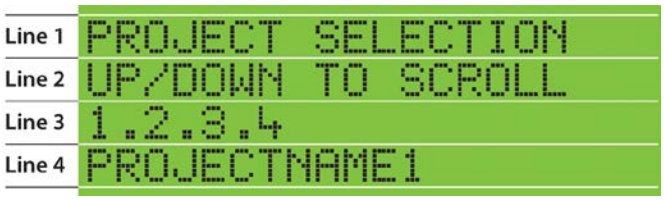
Keypad	LCD display message
	

The function of each ***'programmer key'*** is explained in the table below….

Programmer key	Function	Explanation
	UP	This key is used to scroll ***'Up'*** the ***'project list'*** if there is more than one project stored in the programmer.
	DOWN	This key is used to scroll ***'Down'*** the ***'project list'*** if there is more than one project stored in the programmer.
	Select or Go / Start	This key has 2 functions: 1. To select a project from the ***'Project List'*** 2. To start the execution of a pre-selected ***'standalone programming project'***
	Deselect or Back or Cancel	This key has 2 functions: 1. To cancel the current operation. 2. To 'go back' to the previous screen / programmer mode.

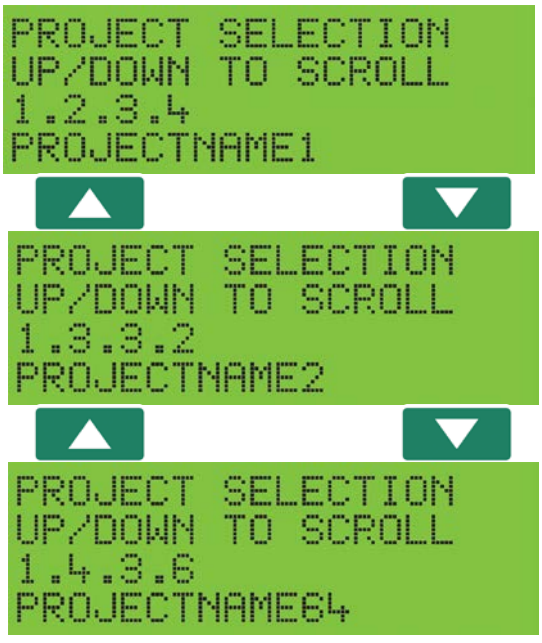
6.4 Entering ‘Project selection’ mode

The programmer will display the ***‘Project Selection’*** screen if either the  **'UP'** or  **'DOWN'** keys is pressed…

	LCD Message
When the ISPjuno programmer is in ***‘Project Selection’*** mode, the first ***‘Project Name’*** in the Project Collection will be displayed as follows....	
Lines 1 & 2 – Operator instructions **Line 3** – Project “version number” e.g. 1.2.3.4 **Line 4** – Project name / Project ID	

6.5 Selecting a project from the ‘Project List’

If there are multiple projects in the uploaded ***‘Project Collection’***, then it is possible to scroll through the list of all projects by using the programmer  **'UP'** and  **'DOWN'** keys…

	LCD Display message
 The projects are displayed by the programmer in the same order that they are displayed in the Project Collection in EQTools. The  **'DOWN'** key on the programmer will scroll down the list of projects as displayed in EQTools. When the last project in the Project Collection is reached, then the programmer will loop back up to the first project in the collection.	

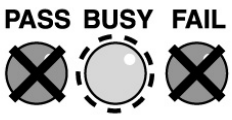
6.6 Selecting a project to execute

Once you have located the ***'standalone programming project'*** which you wish to execute, it is necessary to press the ✓ key 3 times in order to execute the project as shown in the table below….

	LCD Display message
Press the ✓ key to select displayed project. e.g. PROJECTNAME1	PROJECT SELECTION UP/DOWN TO SCROLL 1.2.3.4 PROJECTNAME1 ✓
The programmer will then perform a ***'Project Image check'***. This checks that the project data is valid (not corrupt).	CHECKING IMAGE ✓
Press the ✓ key to execute the selected ***'Standalone programming project'***.	PRESS YES TO PROGRAM TARGET ✓

6.7 Project execution mode - sequence

Once you press the to start the ✓ key, then programmer will commence the execution of the selected ***'standalone programming project'***.

	LCD Display message
When the programmer is in ***'project execution mode'***… 1. The ***'BUSY'*** LED will illuminate. 2. The LCD display will update with the progress of the project.	Programming… 

6.8 Project - PASS

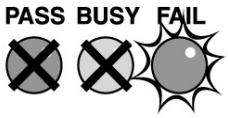
If the selected ***'standalone programming project'*** executes all the way through without any errors, then the programmer will display the following….

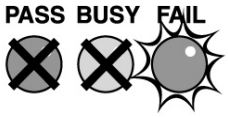
	LCD Display message
1. The ***'PASS'*** LED will illuminate. 2. The display will update with the progress of the project.	TARGET OPERATION HAS BEEN COMPLETED SUCCESSFULLY 

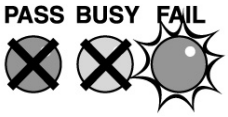
6.9 Project – FAIL – error messages

If the selected ***'standalone programming project'*** executes but an error is encountered during the programming process, then the programmer will display the relevant ***'Error message'*** and the ***'FAIL'*** LED will flash.

The most typical error message is:
'Cannot enter initial device communication Target Connection or Clock Speed Problem'…

Error 40 – Cannot enter programming mode	LCD Display message
This error corresponds to programmer error: Error 40 – Cannot enter programming mode This error can be due to and of the following reasons: • Incorrect connections between programmer and target IC / device. • No power / incorrect powering of target IC / device • Programmer 'clock speed' too fast for target IC / device	CANNOT ENTER INITIAL DEVICE COMMUNICATION TARGET CONNECTIOR OR CLOCK SPEED PROBLEM 

Error 41 – Incorrect Target Signature / Device ID	LCD Display message
This error corresponds to programmer error: Error 41 – Incorrect Target Signature / Device ID This error can be due to and of the following reasons: • The ***'signature (Device ID)'*** read back from the target IC / device does not match the ***'signature'*** declared in the programming project.	BAD SIGNATURE! 1E9702 

Error 41 – Incorrect Target Signature or JTAG ID	LCD Display message
This error corresponds to programmer error: Error 41 – Incorrect Target Signature / Device ID This error can be due to and of the following reasons: • For JTAG or SWD programming interface only. • The ***'signature (Device ID)'*** or ***'JTAG ID'*** read back from the target IC / device does not match the ***'signature'*** and / or ***'JTAG ID'*** declared in the programming project.	BAD SIGNATURE! 1E9702 5970203F 

6.10 Repeatedly executing the same project

If you are batch programming and simply want to execute the same ***'standalone programming project'*** over and over again, then you need to perform the following steps...

	LCD Display message
Wait for the project to pass or fail Press the  'YES' button	TARGET OPERATION HAS BEEN COMPLETED SUCCESSFULLY 
The 'Project selection' screen is displayed with shows the 'currently selected' project. Press the  key to select displayed project. e.g. PROJECTNAME1	PROJECT SELECTION UP/DOWN TO SCROLL 1.2.3.4 PROJECTNAME1 
The programmer will then perform a 'Project Image check'. This checks that the project data is valid (not corrupt).	CHECKING IMAGE 
Press the  'YES' button a third time. The ***'currently selected'*** project will then execute again.	PRESS YES TO PROGRAM TARGET 

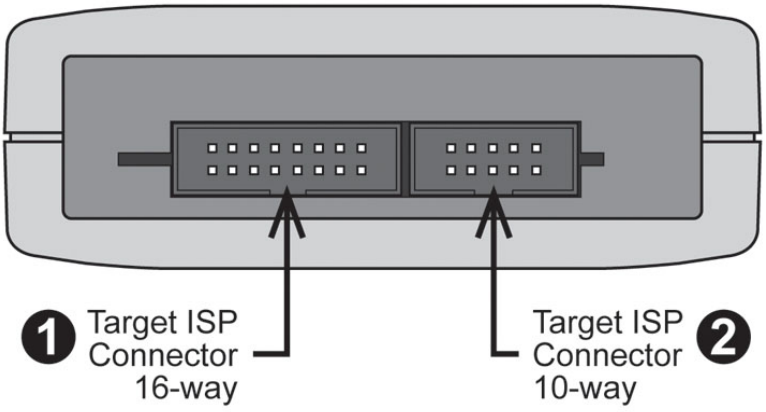
6.11 Programmer power-up – auto-selection of project

When the programmer if first powered up, it checks to see what the ***'last project'*** executed was before power was removed. This ***'last project'*** is then automatically pre-selected on initial power-up of the programmer.

Appendix 1 - 10-way ISP Header - Selection Guide

1.0 Overview

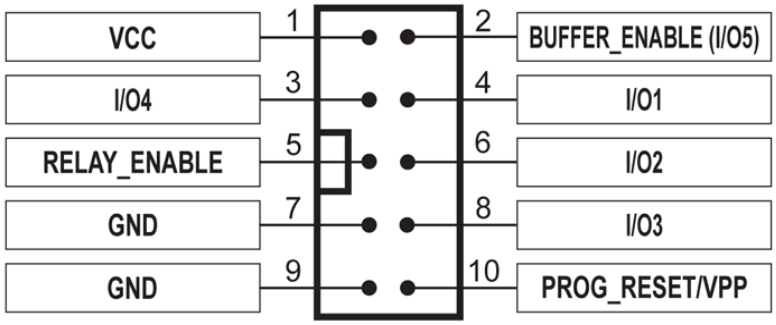
It is possible to use the ***'10-way – Target ISP' IDC connector*** (shown as #2 in the diagram below) on the ISPjuno programmer to connect to many different target device types.



The same pins on this connector are re-used for different functions depending on the target device being programmed.

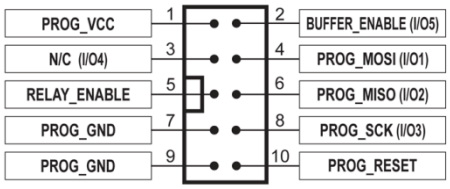
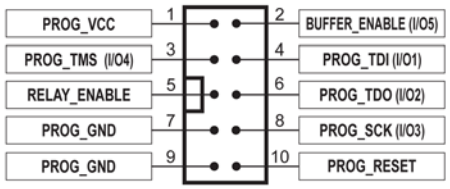
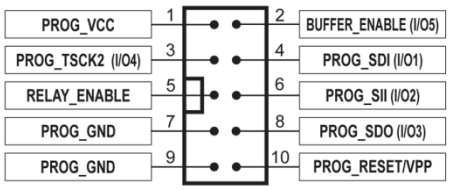
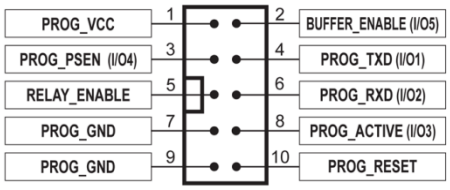
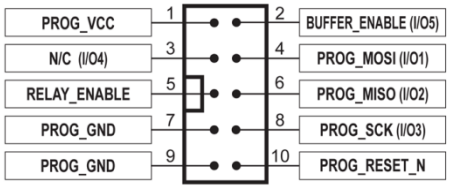
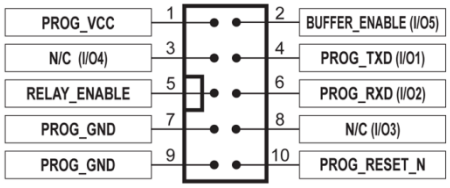
2.0 10-way IDC connector – Equinox generic pin-out

The generic pin-out of the 10-way IDC connector is shown in the diagram below...



3.0 10-way IDC connector - header selection chart

The table below shows the various pin-out permutations for the 10-way IDC connector depending on the target device / algorithm....

#	ISP Header	Description / Function	Refer to section	ISP Header Pin-out
1		Equinox 10-way IDC AVR SPI	3.1	
2		10-way JTAG IDC (non-standard pin-out)	3.2	
2	J3	Equinox-10-way_IDC-ATtiny_HV-pin-out	3.2	
3	J3	Equinox-10-way_UART_ Bootloader-pin-out	3.3	
4	J3	Equinox-10-way_Z-Wave_ SPI_pin-out	3.4	
5	J3	Equinox-10-way_Z-Wave- UART_pin-out	3.5	

3.1 Equinox 10-way Header - AVR SPI Interface

This connection method is suitable for interfacing the programmer to a Target System which features an 'Equinox 10-way' IDC connector with the Equinox pin-out.

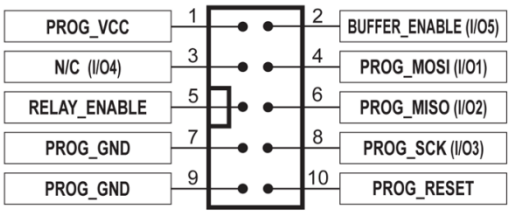


Figure 3.1- Equinox 10-way IDC Header (J7) viewed from above

Warning!
Connecting to the wrong ISP Header may cause catastrophic damage to the Programmer & Target System

Pin No	Programmer Pin name	I/O	Connect to pin on Target System	Notes
1	TARGET_VCC	P	TARGET_VCC	**Target VCC** This pin should be connected to the Target System Vcc.
2	BUFFER_ENABLE	IO5	Connect to Clock Buffer circuit Buffer Enable pin	This pin is used to enable the output of a remote Clock Buffer.
3	Programmer I/O4	IO4	No connect (N/C)	No connection for SPI
4	Programmer I/O1	IO1	SPI – MOSI	
5	RELAY ENABLE	O	Controlled output used to switch external relay	Direct programmer output with 470 ohm resistor in series. Requires external transistor to drive relay.
6	Programmer I/O2	IO2	SPI – MISO	
7 + 9	PROG_GND	P	**Signal GROUND (0V)**	**Signal Ground Connection (1)** 0V to which the programmer JTAG, SPI, I2C signal lines are referenced to.
8	Programmer I/O3	IO3	SPI - SCK	SPI Clock
10	PROG_RESET/VPP	O	**RESET**	**Target RESET control pin** This pin controls the Target Device RESET pin.

Key
O - Output from programmer to Target Device
I - Input to programmer from Target Device
P - Passive e.g. GROUND and power rails
N/C - Not connected

3.2 10-way JTAG header - non-standard pin-out

This connection method is suitable for interfacing the programmer to a Target System which is programmed via the 'JTAG' interface.

Important note:
This is a non-standard pin-out and so is not directly compatible with any standard JTAG connector for e.g AVR or ARM devices. A custom wired cable will be required.

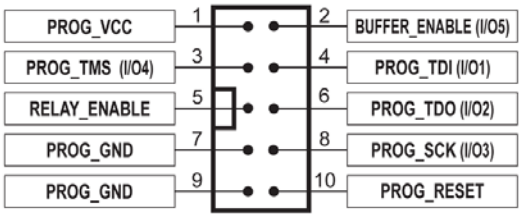


Figure 3.1- Equinox 10-way IDC Header (J7) viewed from above

Warning!
Connecting to the wrong ISP Header may cause catastrophic damage to the Programmer & Target System

Pin No	Programmer Pin name	I/O	Connect to pin on Target System	Notes
1	TARGET_VCC	P	TARGET_VCC	**Target VCC** This pin should be connected to the Target System Vcc.
2	BUFFER_ENABLE	IO5	Connect to Clock Buffer circuit Buffer Enable pin	This pin is used to enable the output of a remote Clock Buffer.
3	Programmer I/O4	IO4 - O	JTAG – TMS	JTAG - Test Mode Select
4	Programmer I/O1	IO1 - I	JTAG – TDI	JTAG - Test Data IN
5	RELAY ENABLE	O	Controlled output used to switch external relay	Direct programmer output with 470 ohm resistor in series. Requires external transistor to drive relay.
6	Programmer I/O2	IO2 - O	JTAG - TDO	JTAG - Test Data OUT
7 + 9	PROG_GND	P	**Signal GROUND (0V)**	**Signal Ground Connection (1)** 0V to which the programmer JTAG, SPI, I2C signal lines are referenced to.
8	Programmer I/O3	IO3 - O	JTAG - SCK	SPI Clock
10	PROG_RESET/VPP	O	**RESET**	**Target RESET control pin** This pin controls the Target Device RESET pin.

Key
O - Output from programmer to Target Device
I - Input to programmer from Target Device
P - Passive e.g. GROUND and power rails
N/C - Not connected

3.3 Equinox 10-way Header (ATtiny11/12/15 HV Interface)

This connection method is suitable for interfacing the programmer to a Target System which features the following:

- Equinox 10-way IDC ISP Header
- An Atmel ATtiny microcontroller eg. ATtiny11/12/15
- Suitable connections to implement 'High Voltage Serial Programming Mode'.

The connector supports programming of the Atmel ATtiny11/12/15 microcontrollers in 'High Voltage Serial Programming Mode'. This mode requires that a +12.0V Vpp voltage is applied to the RESET pin of the target device in order to enter programming mode.

To implement this connection, simply plug the 10-way ISP cable into the ***Programmer J6 header*** and plug the other end of the cable into the matching header on the Target System. Please ensure that you have made the correct connections from the ISP Header to your Target Device.

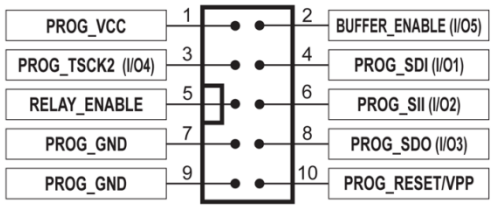


Figure 3.3 – Equinox 10-way IDC Header (J8) viewed from above

Warning!

- It is possible for +12V to be output on pin 10 of this connector when programming ATtiny11/12/15 devices.
- Connecting to the wrong ISP Header may cause catastrophic damage to the Programmer & Target System

Pin No	Programmer Pin name	Programmer Input / Output	Connect to pin on Target Device	Description
1	PROG_VCC	P	TARGET_VCC	**Target VCC** This pin should be connected to the Target System Vcc. This voltage could be used to power the programmer depending on the settings of the power switch/jumper on the programmer.
2	PROG_SPARE	-	No connect	**Spare Programmer I/O pin** This pin is currently a I/O spare pin which is not used during SPI programming. In order to use this pin, the pin state must be setup in the EQTools <Pre-programming State Machine> tab.
3	PROG_TSCK2	O	XTAL1	**SCK2 Clock Output** This output pin is used to supply an external clock signal (SCK2) to the target microcontroller.

4	PROG_SDI	O	SDI	**Serial Data Input** This is the serial data output pin from the programmer. This pin should be connected to the Serial Data Input (SDI) pin on the Target Microcontroller.
5	N/C	O	N/C	Not connected
6	PROG_SII	O	SII	**SII (Serial Instruction Input)** This is the serial data input pin to the programmer from the Target Device. This pin should be connected to the SII pin on the Target Microcontroller.
7	PROG_GND	P	GROUND	**Ground Connection** Common ground connection between PROGRAMMER and Target System.
8	PROG_SDO	I	SDO	**SDO (Serial Data Output)** This is the serial data output signal from the Target Device to the programmer. It is an INPUT pin to the programmer.
9	PROG_GND	P	GROUND	**Ground Connection** Common ground connection between PROGRAMMER and Target System.
10	PROG_RESET/VPP	O	RESET	**Target RESET control pin** This pin controls the Target Device RESET pin. A +12.0V Vpp voltage will be applied to this pin during programming. **Warning!** During 'High Voltage Serial Programming' of the Atmel ATtiny11/12/15 microcontrollers, a +12V Vpp voltage is generated by the programmer on this pin.

Key
O - Output from programmer to Target Device
I - Input to programmer from Target Device
P - Passive eg. GROUND and power rails
N/C - Not connected

3.4 Equinox 10-way Header (UART Boot Loader)

This connection method is suitable for interfacing the ISPJUNO programmer to a Target System which features the following:

- Equinox 10-way IDC ISP Header
- An Atmel Wireless T89C51Rx2 / CC01 microcontroller
- A Philips P89C51Rx2 or P89C66x microcontroller
- The relevant connections for in-system programming via the Boot Loader.

To implement this connection, simply plug the 10-way ISP cable into the ***Programmer J6 header*** and plug the other end of the cable into the matching header on the Target System.

Please note:
The programmer interfaces to the Target System at TTL voltage levels. If the serial port to your Target System is RS-232, you will need to convert the TTL levels from the programmer to RS-232 using an external convertor.

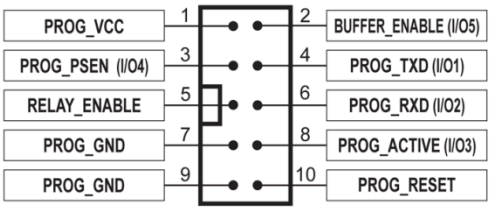


Figure 3.4 – Equinox 10-way IDC Header (J8) viewed from above

Warning!

1. It is possible for +12V to be output on pin 10 of this connector when programming ATtiny11/12/15 devices.
2. Connecting to the wrong ISP Header may cause catastrophic damage to the Programmer & Target System

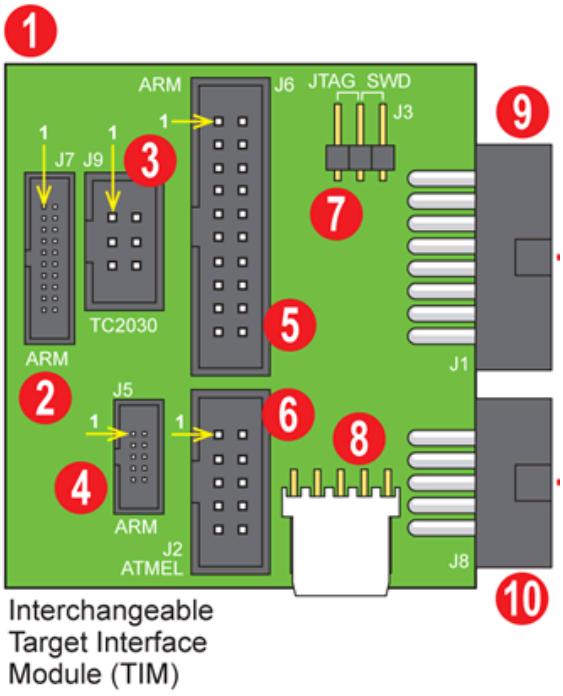
Pin No	Programmer Pin name	Programmer Input / Output	Connect to pin on Target Device	Description
1	PROG_VCC	P	TARGET_VCC	**Target Vcc** This pin should be connected to the Target System Vcc. This voltage could be used to power the programmer depending on the settings of the power switch/jumper on the programmer.
2	N/C	-	N/C	**Not connected**
3	PROG_PSEN	O	PSEN	**PSEN pin** This pin is driven LOW by the programmer to enter 'Boot Loader' programming mode.
4	PROG_TXD	O	RXD	**Programmer RXD (Transmit) pin** The programmer transmits serial data on this pin to the Target Device RXD (Receive) pin.
5	N/C	-	N/C	**Not Connected**
6	PROG_RXD	I	TXD	**Programmer RXD (Transmit) pin**

				The programmer receives serial data on this pin from the Target Device TXD (Transmit) pin.
7	PROG_GND	P	Ground Connection	**Target / Programmer GROUND connection** Common ground connection between PROGRAMMER and Target System.
8	PROG_ACTIVE	O	LED or Interrupt pin	**Programmer ACTIVE LED** This pin can be driven LOW when a programming action is taking place. The signal can be used to illuminate an LED or trigger an interrupt on the Target Microcontroller.
9	PROG_GND	P	Ground Connection	**Target / Programmer GROUND connection** Common ground connection between PROGRAMMER and Target System.
10	PROG_RESET	O	RESET	**Target RESET control pin** This pin controls the Target Device RESET pin. It will driven HIGH/LOW according to the device type and settings in the 'Pre-program State Machine' tab in the Eqtools project. **Warning!** During 'High Voltage Serial Programming' of the Atmel ATtiny11/12/15 microcontrollers, a +12V Vpp voltage is generated by the programmer on this pin.

Key
O - Output from programmer to Target Device
I - Input to programmer from Target Device
P - Passive eg. GROUND and power rails
N/C - Not connected

Appendix 2 – ARM Target Interface Module (TIM)

The diagram below shows the various ***'ISP connectors'*** which are available on ***the 'ARM – Target Interface Module (TIM)'***….

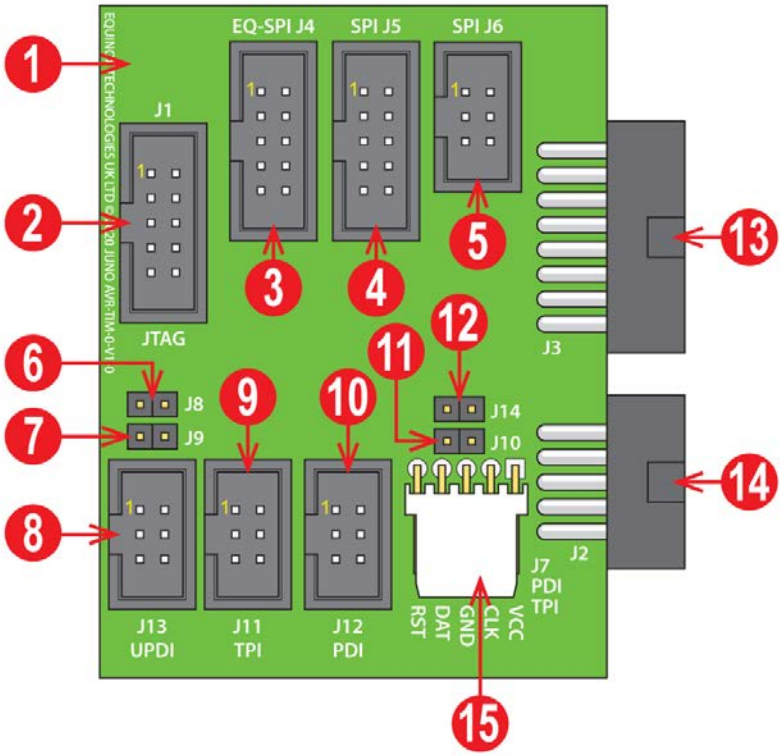


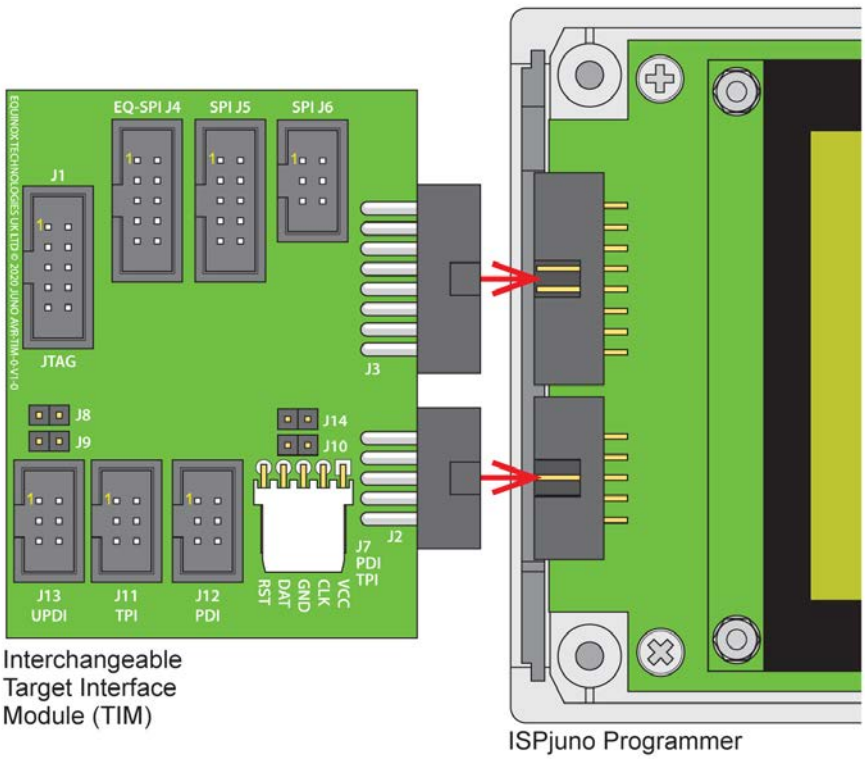
Interchangeable Target Interface Module (TIM)

#	PCB label	Description	Pin-out	Type	Pitch	Ways
1	-	ARM Target Interface Module (TIM) PCB	-	-	-	-
2	J7	20-way 0.05" Samtec connector - standard ARM pin-out	Generic ARM 20-way	Samtec	0.05"	20
3	J9	Tag Connect - TC2030-IDC PLUG-OF-NAILS(TM) CABLE 6-way IDC header	Custom	IDC	0.1"	6
4	J5	10-way 0.05" Samtec connector - standard ARM pin-out	10-way ARM Cortex	Samtec	0.05"	10
5	J6	20-way 0.1" IDC connector - standard ARM pin-out	20-way ARM Cortex	IDC	0.1"	20
6	J2	10-way 0.1" IDC connector – Atmel AVR JTAG pin-out	Atmel AVR JTAG	IDC	0.1"	10
7	J3	JTAG / SWD - Selection Jumper	-	Jumper link	-	-
8	J1	Molex 5-pin SWD connector	Custom	Molex	0.1"	5
9	J4	Programmer to Target ISP Connector 16-Way	Equinox ISPnano	IDC Plug	0.1"	16
10	J8	Programmer to Target ISP Connector 10-Way	Equinox generic	IDC Plug	0.1"	10

Appendix 3 – AVR Target Interface Module (TIM)

The diagram below shows the various ***'ISP connectors'*** which are available on the ***'AVR – Target Interface Module (TIM)'***….





The table below explains the pin-out and function the various ***'ISP connectors'*** on the ***'AVR – Target Interface Module (TIM)'***.

#	PCB label	Description	Pin-out	Type	Pitch	Ways
1	-	AVR - Target Interface Module (TIM) PCB	-	-	-	-
2	J1	Atmel AVR – JTAG pin-out	AVR JTAG	IDC	0.1"	10
3	J4	Equinox - 10-way IDC SPI pin-out (same as AVR ISP)	Equinox SPI	IDC	0.1"	10
4	J5	Atmel AVR - 10-way IDC SPI pin-out	AVR SPI 10-way	IDC	0.1"	10
5	J6	Atmel AVR - 6-way IDC SPI pin-out	AVR SPI 6-way	IDC	0.1"	6
6	J8	Configuration - Jumper link				
7	J9	Configuration - Jumper link				
8	J13	Atmel AVR – ATtiny UPDI - 6-way IDC	AVR UPDI	IDC	0.1"	6
9	J11	Atmel AVR – ATtiny TPI - 6-way IDC	ATtiny TPI	IDC	0.1"	6
10	J12	Atmel AVR – XMEGA PDI - 6-way IDC	XMEGA PDI	IDC	0.1"	6
11	J10	Configuration - Jumper link				
12	J14	Configuration - Jumper link				
13	J3	Programmer to Target ISP Connector 16-Way	Equinox ISPnano	IDC Plug	0.1"	16
14	J2	Programmer to Target ISP Connector 10-Way	Equinox ISPnano	IDC Plug	0.1"	10
15	J7	Atmel AVR PDI / TPI - 5-way Molex cable connector	Custom 5-way	Molex	0.1"	5