### Production In-System Programming (ISP) Module





# IO-MOD Connector Modules for the ISPnano Programmer Range

(ISPnano-S3, ISPnano-S4-ATE and ISPnano-MUX)

# Hardware User Manual





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## **Equinox Warranty Information**

This product is guaranteed by Equinox Technologies UK Limited for a period of **24 months (2 years)** after the date of purchase against defects due to faulty workmanship or materials. The guarantee covers both parts and labour. This is a **'Return to manufacturer'** warranty. The customer is responsible for all shipping + customs clearance costs for returning the programmer to Equinox and for Equinox returning the programmer back to the customer. 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.

#### Programmer 'Line Driver Circuitry' damage.

The programmer features '*Line Driver Circuitry*' which interfaces to the Target system (DUT). This circuitry is protected via ESD protection diodes. If these diodes become damaged during operation of the programmer then it is likely that the programmer driver circuitry is also damaged. This warranty does not cover damage to the programmer '*Line Driver Circuitry*'.

#### 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 '**ISPnano Programming Module**' 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 '**ISPnano Programming Module**' with the same care as you would these types of devices. Always ensure that you are not carrying a static charge yourself before handling the product. Wearing an earthed anti-static wrist strap is recommended.

Equinox has 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.
- Ensure than any residual charge stored in capacitors on the Target System has been discharged BEFORE connecting or disconnecting the programmer.

### 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:

- User Manual
- Application Notes

### 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 / download page for the '*ISPnano programmer range*' can be found at: <u>http://www.equinox-tech.com/products/details.asp?ID=1440&displ=tl</u>

#### E-mail

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

### ► 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 and Software**

### **Overview**

This manual provides an overview of the contents of the '**ISPnano Programming Range'** 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 <a href="http://www.equinox-tech.com/products/details.asp?ID=1440&displ=tl">http://www.equinox-tech.com/products/details.asp?ID=1440&displ=tl</a>

Software:	
	EQTools Script Builder – Manual
EQTools	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
	Help file
	ASCII Text Communications Protocol – Application Note
	This protocol can be used to control the programmer from an external controller via RS-232.
ABCOEFGHIMME TEXT MODE	The following sources of documentation are available for this protocol:
	Application Note – AN110
	ISP Pro – Manual
	This software is used to control the programmer in a production environment. It is not supplied as standard with this programmer.
<b>ISP</b> PRO	The following sources of documentation are available for this software:
	Installation and User 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.
Upload Wizard	• Please follow the on-screen instructions within the Upload Wizard utility itself.
	Application Note – AN117
LabNEW <sup>®</sup>	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 – AN109
REMOTE APPLICATION (1) 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. The following sources of documentation are available for this software:
	Application Note – AN109
	ConsoleEDS Pro – Application note
Console <b>EDS</b>	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 - AN111
	JTAG In-System (ISP) Upgrade – Application Note
ATmega ISP	This license upgrade enables the programmer to support high-speed In-System Programming (ISP) of the Atmel ATmega microcontroller family using the JTAG algorithm. Support is offered for both single and multiple JTAG devices in a JTAG Chain.
	The following sources of documentation are available for this software:
	Application Note – AN105



### Documentation and software for the ISPnano 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 ISPnano programmer from the following page on the Equinox website:

http://www.equinox-tech.com/products/details.asp?ID=1440&displ=tl

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

### **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	12C
AN122	Atmel - AT91SAM7 ARM7 FLASH microcontrollers	JTAG
AN127	Atmel – XMEGA AVR FLASH microcontrollers via the 2-wire PDI interface	PDI
AN128	NXP – LPCxxx ARM7 FLASH microcontrollers	JTAG
AN130	Zensys – ZWxxx – Z-WAVE Series	SPI
AN132	Atmel ATtiny AVR microcontrollers via the TPI interface	ТРІ
AN133	Atmel AT45D Serial DataFlash programming	SPI
AN134	Austriamicrosystems – magnetic encoder programming	AMS 1-wire SPI I2C
AN135	Xilinx Spartan FPGA – external Serial DataFLASH programming method	SPI

These application notes can be found in PDF format on the CD-ROM which was supplied with the programmer. You can also find the very latest versions on the *"ISPnano Download Page"* on the Equinox website.

### **Programmer related - Application notes**

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

Application Note	Description
AN109	Remote Application Control of Equinox ISP Programmers using ISP-PRO Utility
AN110	ASCII Text Control (ATC) Protocol for Remote Control of Equinox Programmers
AN111	ConsoleEDS Protocol for Remote Control of Equinox Programmers
AN112	Firmware Update instructions for Equinox ISP Programmers
AN114	Accurate on-chip Oscillator Calibration for Atmel AVR microcontrollers
AN121	Equinox EQTools – Release Notes
AN123	Controlling an Equinox ISP Programmer from a Remote System via the Remote 4-wire TTL Port
AN126	USB Driver Installation instructions for PPM4-MK1 and ISPnano programmers

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



## 1.0 Overview

This manual describes the family of *'IO-MOD - I/O Connector Modules'* which are available for use with the Equinox *'ISPnano'* family of production ISP device programmers. Each module is designed to suit different signal connection type, routing or signal buffering requirements.

# 2.0 IO Connector Module Overview

### 2.1 Overview

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A range of different **'I/O Connector Modules'** are available which are designed to suit different signal routing requirements. The table below shows the range of **'I/O Connector Module'** which are currently available....

Module name	Module description	Module Picture	Overview of module signal routing
IO-MOD1	I/O Connector Module 1	THE ACTION OF TH	<ul> <li>Only TVCC, TVPP, EXT-VCC power signals signals + RESET are switched (isolated) through relays.</li> <li>All other signals are routed via analogue switches from the programmer to the DUT.</li> <li>Programming interfaces supported: All</li> </ul>
IO-MOD2	I/O Connector Module2	Се2-84-580 т Се2-84-580 т	<ul> <li>All programming and power signals are routed through relays.</li> <li>The DUT is routed to the 'ATE Port' by default and only routed to the programmer when a programming operation is in progress.</li> <li>Programming interfaces supported: All</li> </ul>
IO-MOD3	I/O Connector Module 3	CLOCK BUFFER J- LC-QA SCOT SCOT SCOT SCOT SCOT SCOT SCOT SCOT	<ul> <li>Supports direction connection of a remote 'Serial Clock Buffer' module which buffers the serial clock signal at the target end of the ISP cabling.</li> <li>Can be used to buffer the clock for XMEGA PDI, ATtiny TPI, AT45D SPI and AVR / ARM JTAG devices.</li> </ul>

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IO-MOD4	I/O Connector Module 4		<ul> <li>Supports direction connection of a remote <i>'Serial Clock Buffer'</i> module which buffers the serial clock signal at the target end of the ISP cabling.</li> <li>Can be used to buffer the clock for XMEGA PDI, ATtiny TPI, AT45D SPI and AVR / ARM JTAG devices.</li> </ul>
IO-MOD5	l/O Connector Module5	Soo Cook	<ul> <li>Supports direct connection of a remote <i>'Serial Clock Buffer'</i> module which buffers the serial clock signal at the target end of the ISP cabling.</li> <li>Can be used to buffer the clock for XMEGA PDI, ATtiny TPI, AT45D SPI and AVR / ARM JTAG devices.</li> <li>Only TVCC, TVPP, E-VCC power signals + RESET are switched (isolated) through relays.</li> </ul>
IO-MOD6	I/O Connector Module6	eerse are an	<ul> <li>Programmer compatibility: Series IV + MUX</li> <li>Atmel 6-pin IDC SPI programming header</li> <li>Atmel 10-way IDC AVR JTAG programming header</li> <li>Equinox 10-way IDC generic programming header</li> <li>Only the RESET, TVCC, TVPP and EXT-VCC signals are switched (isolated) through relays.</li> <li>Quick-connect connectors for GROUND and POWER signals</li> </ul>
IO-MOD7	I/O Connector Module7		<ul> <li>Programmer compatibility: ISPnano Series 3</li> <li>Atmel 6-pin IDC SPI programming header</li> <li>Atmel 10-way IDC AVR JTAG programming header</li> <li>Equinox 10-way IDC generic programming header</li> <li>Quick-connect connectors for GROUND and POWER signals</li> </ul>

ISP	nano		(ISP) Module
IO-MOD8	I/O Connector Module 8	ресси и о сул и о	<ul> <li>ARM Cortex miniature 10-way 0.05" JTAG / SWD programming / debug header</li> <li>Programmer compatibility: ISPnano Series IV, ISPnano-MUX</li> <li>The RESET, TVCC, TVPP and EXT-VCC signals are switched (isolated) through relays.</li> <li>Quick-connect connectors for GROUND and POWER signals</li> </ul>
IO-MOD9	I/O Connector Module 9	ССА	<ul> <li>ARM standard 20-way 0.1" JTAG / SWD programming / debug header</li> <li>Programmer compatibility: ISPnano Series IV, ISPnano-MUX</li> <li>The RESET, TVCC, TVPP and EXT-VCC signals are switched (isolated) through relays.</li> <li>Quick-connect connectors for GROUND and POWER signals</li> </ul>
IO-MOD10F	I/O Connector Module 10F		<ul> <li>Z-Wave 500 series - Oscillator Calibration module</li> <li>Programmer compatibility: ISPnano Series IV</li> <li>Quick-connect connectors for SPI / UART programming signals</li> <li>Quick-connect connectors for GROUND and POWER signals</li> </ul>
IO-MODINT	l/O Connector Module		<ul> <li>This is a specially designed 'Interface module' which allows any 'IO-MOD' module to connect to an 'ISPnano Series III' programmer.</li> </ul>

Production In-System Programming



### 2.2 Programmer compatibility

The table below details which IO-MOD module is compatible with which programmer...

Module name	Module description	Module Picture	Series III	Series III ATE	Series IV ATE	MUX2 MUX4 MUX8
IO-MOD1	I/O Connector Module 1	THE SECOND STATES SECOND STATE	No	No	Yes	Yes
IO-MOD2	I/O Connector Module2	Сса. «лу сса. со сса. «лу сса. «лу сса	No	No	Yes	Yes
IO-MOD3	l/O Connector Module 3	CLOCK BUFFR J- LOS BUFFR J- LOS BUFFR J- LOS BUFFR BUF	Yes (See note 1)	No	Yes	No
IO-MOD4	I/O Connector Module 4	DO DO DA GET DO DO DA GET CLOCK BUFFER J J J J J J J J J J J J J	Yes (See note 1)	No	Yes	No



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IO-MOD5	I/O Connector Module5	A Constant of the second secon	No	No	Yes	Yes
IO-MOD6	I/O Connector Module6	Coch war coch and coc	No	No	Yes	Yes
IO-MOD7	l/O Connector Module7		Yes (See note 1)	No	Yes	No
IO-MOD8	I/O Connector Module5		No	No	Yes	Yes

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IO-MOD9	I/O Connector Module 9	No	No	Yes	Yes
IO-MOD10F	I/O Connector Module 10	No	No	Yes	No
IO-MODINT	l/O Connector Module	Yes	No	No	No

#### Note 1

The use of any *IO-MOD* module with the *'ISPnano Series 3'* programmer requires the use of the mating *IO-MODINT* interface module.

## 3.0 Inserting an 'I/O Connector Module'

## 3.1 ISPnano Series IV programmer

The *'ISPnano Series IV'* programmer is capable of accepting a single *'IO-MOD'* connector module. The illustration below shows how to insert an *'IO-MOD'* module into the programmer.





### 3.2 ISPnano-MUX Multiplexed programmers

The '*ISPnano-MUX*' range of programmer are capable of accepting 2, 4 or 4 x '*IO-MOD*' connector modules depending on the programmer model

The illustration below shows how to insert an *'IO-MOD'* module into an ISPnano MUX2, MUX4 or MUX8 programmer.

## 4.0 ISPnano Series III programmer

### 4.1 Overview

It is now possible to use certain '*IO-MOD*' connector modules with the '*ISPnano Series III*' programmer. This requires the '*IOMOD-INT*' interface module to be attached to the programmer. The chosen '*IO-MOD*' connector module can then be plugged into the '*IOMOD-INT*' interface module.

The pictura below shows how an 'IO-MOD' connector module can be interfaced to the programmer.







### 4.2 Assembling the IO-MOD module to the programmer

The illustration below shows how the 'IOMOD-INT' module is fixed to the 'ISPnano Series III' main programmer body. The chosen 'IOMOD-INT' module is the plugged into the 'IOMOD-INT' module.





The picture below demonstrates how the 'IOMOD-INT' module fits to the programmer...



## 4.3 Picture of IOMOD-INT Interface Module

The picture below shows the IOMODINT Interface Module.





### 4.4 Example of using the IO-MOD5 module

The picture below demonstrates how to use the *'IO-MOD5'* module with the 'ISPnano Series III' programmer. The remote *'Serial Clock Buffer Module'* is connected to the *'IO-MOD5'* module via a 10-way ISP cable.



# Appendix 1 – IOMOD1 Module

### 1.0 Overview

The **'IOMOD1'** module is designed to allow any ISPnano programmer to interface to a Target system (DUT). The module features the standard ISPnano 16-way IDC 'Target ISP Port' connector plus a wire-wrap version of the same port. All power signals are switched via relays making this IMOD module suitable for use on the ISPnano Series 4 ATE and ISPnano-MUX programmers only.



### 1.1 Module main features

The main features of the 'IOMOD1' module are as follows....

- Standard ISPnano 16-way IDC 'Target ISP Port' connector (not switched via relays)
- Wire-wrap version of ISPnano 16-way IDC 'Target ISP Port' connector (not switched via relays)
- User-configurable pull-up resistors for I2C and Atmel XMEGA PDI / ATtiny TPI programming algorithms
- 'Target Power' status LED (TVCC signal)
- Relay isolation of all power signals (TVCC, TVPP and EXT-VCC supplies)



## Appendix 2 – IOMOD2 Module

### 1.0 Overview

The **'IOMOD2'** module is designed to allow an ISPnano programmer to automatically switch the signals from a Device Under Test (DUT) between the programmer and an external ATE or ICT (In-Circuit Test) system.



### 1.1 Module main features

The main features of the 'IOMOD2' module are as follows....

- Supports routing of external ATE or ICT or measurement equipment to a Target System / DUT (Device Under Test) under programmer control
- The programmer electronics are only connected to the programmer when the programmer is in 'programming mode'.
- Relay isolation of all programming signals
- Relay isolation of all power signals (TVCC, TVPP and EXT-VCC supplies)
- All signals connected to the '*ATE Connector*' are routed to the '*Target Connector*' by default when the relays are OFF.
- The programmer electronics are routed to the 'Target Connector' when the relays are ON.

### Warning:

The *'relay isolation'* is only designed to isolate <u>'low voltage signals' (<50V DC)</u>. It is not designed and must not be used for isolation of mains 110 / 230 - 240 V AC signals.



## **1.2 Principle of operation**

The 'IOMOD2' module is designed to operate as follows:

#### 1. During functional test (default configuration)

- All signals on the 'ATE Connector' are routed to the 'Target Connector'
- This allows an external 'ATE System' or 'In-Circuit Test (ICT)' system to be routed to the Target System or Device under Test (DUT)



#### 2. During device programming

- The programmer isolates the signals connected to the 'ATE Connector'
- The internal 'programmer electronics' are now routed to the *Target System* or *Device under Test (DUT)*





## 1.3 Relay signal routing

The signal routing depends on whether the relays on the IOMOD2 module are energised (ON) or deenergised (OFF) – see table below.

Relay position	Relays ON Indicator	Signal routing
OFF (default)	OFF	'Target Connector' signals are routed to the 'ATE Connector'
ON	ON	<i>'Target Connector '</i> signals are routed to the 'Internal Programmer Power and I/O Driver Circuitry'

#### Please note:

The relays are automatically controlled by the programmer. When the programmer performs any *'programming action'*, it will automatically energise the relays thereby disconnecting *the 'ATE Connector'* signals and routing the 'programmer electronics' to the *Target System (DUT)*.

### 1.4 IOMOD2 module overview diagram

The diagram below shows the relevant components of the 'IOMOD2' module.

Picture	Annotation number	Description	
4-	1	<b>DIP-Switch</b> Configures pull-up resistors for I2C, PDI and TPI	
3 - Connector	2	<b>Target Connector</b> Connect to Target System (DUT) Target System signals and power connections	
	3	ATE Connector Connect to external ATE or ICT External ATE / ICT signals and power connections	
	4	Relay Power indicator Illuminates when the relay coils are energised	
	5	<b>Relays</b> These relays route the Target System signals between the external ATE / ICT or the programmer	

## 1.5 Connecting the DUT to the 'I/O Connector Module'

The *Target Board (DUT)* which is to be programmed must be connected to the *'TARGET CONNECTOR'* on the IOMOD2 connector module. See picture below.....



ATE connector rarget connector

The **'Target Connector'** is a 16-way 0.1" pitch IDC connector. The illustration below shows where pin 1 of the connector is located.....



### Instructions:

• Connect the 'Target System' (UUT) to the 16-way 'Target Connector' port.

The programmer is only connected to the *Target System (DUT)* when the relays are energised when the programmer is in 'programming mode'.



# **1.6 Connecting external ICT / ATE equipment to the 'I/O Connector Module'**

It is possible to connect external *ATE / ICT / measurement equipment* to the ISPnano programmer by using the '*ATE Connector*' on the *IOMOD2* module. See picture below.....



The '*ATE Connector*' is a 16-way 0.1" pitch IDC connector. The illustration below shows where pin 1 of the connector is located.....





When the programmer is idle (not in programming mode), then any signals connected to the 'ATE **Connector'** on the **IOMOD2** module are routed to the **Target system (DUT)**. The programmer electronics is completely out of circuit at this point so the programmer does not load the **Target System (DUT)** in any way.



Instructions:

• Connect the external 'ATE System' or ICT equipment or measurement equipment to the 'ATE Connector' port of the IOMOD2 module



## **1.7 DUT routed to External ATE System (default)**

When the programmer is powered up but not running a *'Programming Project'*, the relay coils are <u>not</u> energised so the *'Target System (UUT)'* connections are routed via the *'Target ISP Port'*, through the relays to the *'ATE Port'* where they then connect to the *'External ATE / ICT System'*. The signal direction depends on the particular signal I/O line, GROUND or power line being routed.

The path of a single signal or passive power / GROUND line is shown in the schematic below.



#### Please note:

• When the relays are not energised, the programmer electronics are completely isolated from both the *'Target System'* and the *'External ATE System'*.



## 1.8 DUT routed to External ATE System – Pin routing

By default the RELAYs are **<u>OFF</u>** and the '**ATE Port**' signals are routed to the '**Target Connector**' pins as detailed in the table below.

Target ISP Port Pin Number	ATE Port Pin Number	Programmer Pin name	Notes		
1 + 2	1 + 2	TARGET_VCC	<b>Target VCC</b> This pin should be connected to the Target System Vcc.		
3 + 4	3+4	EXT_VCC	<b>Target External VCC</b> No connection required as EXT-VCC is being used to control the RELAY coils.		
5 + 6	5+6	PROG_GND	<b>Signal Ground Connection (1)</b> 0V to which the programmer JTAG, SPI, I2C, PDI, TPI signal lines are referenced to.		
7a 7b 7c	7a 7b 7c	<ul><li>I2C SCL</li><li>PDI_CLK</li><li>TPI_CLK</li></ul>	<ul> <li>I2C SCL clock signal</li> <li>XMEGA PDI CLOCK Signal</li> <li>ATtiny TPI CLOCK Signal</li> </ul>		
8a 8b 8c	8a 8b 8c	<ul> <li>I2C_SDA</li> <li>XMEGA_PDI_DAT</li> <li>ATTINY_TPI_DATA</li> </ul>	<ul> <li>I2C SDA data signal</li> <li>XMEGA PDI DATA Signal</li> <li>ATtiny TPI DATA Signal</li> </ul>		
9	N/C	OP6	Spare Output (used for PDI / TPI)		
10	N/C	Programmer I/O5	Not available		
11	11	Programmer I/O4	<ul><li>SPI – SCK2</li><li>JTAG – TMS</li></ul>		
12	12	Programmer I/O3	<ul> <li>SPI – SCK</li> <li>JTAG – TCK</li> </ul>		
13	13	Programmer I/O2	<ul> <li>SPI – MISO</li> <li>JTAG – TDO</li> <li>UART - RXD</li> </ul>		
14	14	Programmer I/O1	<ul> <li>SPI – MOSI</li> <li>JTAG – TDI</li> <li>UART - TXD</li> </ul>		
15	15	PROG_VPP	Vpp Voltage		
16	16	PROG_RESET	Target RESET control pin		


## 1.9 DUT routed to internal programmer (RELAYs ON)

When the relay coils are energised, the 'Target System (DUT)' connections are routed to the 'Internal Programmer'. The 'External ATE / ICT System' is at this point completely disconnected (out of circuit). This allows the programmer to power up and program the 'Target Device' without any problems related to the external system loading the power or programmer signal lines.

The path of a single signal or passive power / GROUND line is shown in the schematic below.



#### Please note:

- When the relays are in this state, the '*External ATE System*' is completely isolated from both the '*Target System*' and the '*Internal Programmer electronics*'.
- All 'Target System' I/O signals, power and GROUND are now routed to the internal 'Programmer Driver / Power Circuitry'.
- The relays are automatically energised (switched ON) by the programmer when a programming operation is started.
- It is also possible to control the relay switching from an external system if required.



#### **1.10 DIP switch - pull-up resistor configuration**

The *IOMOD2* module features a 4-way '*DIP switch*' which is used to configure pull-up resistors on certain 'programmer signal lines'. These pull-up resistors are required for the I2C and Atmel XMEGA PDI / ATtiny TPI programming algorithms only.

Algorithm	DIP Switch position	DIP Switch illustration
I2C	1+2 = ON 3+4 = OFF	BCEA CERTS BCEA CERTS
XMEGA PDI ATtiny TPI	1+2 = OFF 3+4 = ON	AMBdddd DC2-HS-S0 DC2A AMB CODD2KA AMB CODD2KA C C C C C C C C C C C C C C C C C C C
All other algorithms	1+2 = OFF 3+4 = OFF	CODRAKA BCC-H-SOC AN-SOC AN-SOC AND CONTRACTOR CONTRACT

#### Please note:

For all other algorithms, the '*DIP switches*' should be all set to the '**OFF**' position (i.e. no pull-ups connected).



## Appendix 3 – IOMOD3 Module

#### 1.0 Overview

The 'IOMOD3' module is designed to allow a remote 'Clock Buffer Module' to be connected to an 'ISPnano Series III' programmer. The module features a 10-way 'Clock Buffer' IDC connector which is used to directly connect to a remote 'Clock Buffer Module' via any length of 10-way ribbon cable.



### 1.1 Module main features

The main features of the 'IOMOD3' module are as follows....

- Supports direct connection of a remote 'Clock Buffer Module' via a 10-way IDC plug
- Supports buffering of SPI, JTAG, XMEGA PDI and ATtiny TPI 'Serial Clock' signals
- The remote 'Clock Buffer Module' can be connected via any suitable length of ribbon cable to the 10-way IDC plug.
- User configurable clock signal routing a simple jumper selection allows either the 'SPI SCK', 'JTAG TCK' or 'XMEGA PDI CLK' serial clock signal to be routed from the programmer to the 'Buffered clock input' on the remote 'Clock Buffer Module'.
- Quick-connect connector for connecting programmer I/O pins 1..4 and RESET
- Quick-connect connector for connecting power signals TVCC, TVPP, E-VCC
- 'Target Power' LED illuminates when the programmer switches the TVCC supply on



## **1.2 Principle of operation**

The 'IOMOD3' module is designed to operate as follows:

- Plug the module into the programmer
- Connect a remote 'Clock Buffer Module' via the 10-way IDC plug labelled 'Clock Buffer'
- Manually connect any power and GROUND signals required between the programmer and the DUT
- Set the 'Configuration jumpers' to select the correct 'Serial clock source' to match the target programming interface ie. SPI, JTAG, PDI / TPI

#### 1.3 Hardware layout

The table below shows the relevant hardware items on the 'IOMOD3' module.

Picture	Annotation number	Description
	1	10-way Header
	2	Configuration jumper
5 - File Contract of Contract	3	TVCC LED Indicator
4	4	Quick connect connector (J5) for programmer POWER signals
3 - 2	5	Quick connect connector (J6) for programmer I/O signals



#### **1.5 Quick Connect - Power Connections**

The 'Quick connect - POWER signals' connector (J6) is designed to allow separate wires to be connected between the programmer and the Target System (DUT). The illustration below shows the pin-out of this connector.



#### J3 Quick Connect - Power Connections

Pin No	Connector	Description
1	TVCC	
2	GND	
3	TVCC	
4	VPP	
5	EXT-VCC	
6	GND	

### **1.6 Quick Connect - Programming signals**

The 'Quick connect - Programming Signals' connectors are designed to allow separate wires to be connected between the programmer and the Target System (DUT). The illustration below shows the pin-out of this connector.





#### J6 Quick Connect - Programming Signals

Pin No	Connector	Description
1	I/O 3	
2	GND	
3	I/O 4	
4	GND	
5	RESET	
6	GND	



### 1.4 Configuration jumpers

The **'IOMOD3'** module features 2 x **'Configuration jumpers'** which are used to configure the module for a selected target programming interface.

#### 1.4.1 Configuration Jumper J2

**'Configuration Jumper J2'** is used to configure which **'Serial Clock'** source is routed to the 10-way **'Clock Buffer'** IDC connector from the programmer.

Jumper position	Function selection	Explanation of routing	Supported programming interfaces
1 - 2	JTAG / SPI Clock	Routes the JTAG - TCK / SPI - SCK clock signal to the <b>'Clock Buffer'</b> IDC connector	<ul> <li>JTAG - AVR, ARM etc</li> <li>SPI - AVR, AT45D Serial DataFLASH</li> </ul>
2 - 3	PDI / TPI Clock	Routes the XMEGA PDI CLK / ATtiny TPI CLK clock signal to the 'Clock Buffer' IDC connector	<ul><li> XMEGA PDI</li><li> ATtiny TPI</li></ul>

The table below illustrates the settings of 'Configuration Jumper J2'.

#### 1.4.2 Configuration Jumper J7

**'Configuration Jumper J7'** is used to configure the connector board for use with Atmel XMEGA PDI or ATtiny TPI target devices. The jumper connects the programmer UART TRANSMIT and RECEIVE pins together via a 470 ohm resistor to allow bi-direction communications on a single pin. mmer.

The table below illustrates the settings of 'Configuration Jumper J7'.

Jumper position	Function selection	Explanation of function	Supported programming interfaces
1 - 2	Programmer UART TRANSMIT and RECEIVE Shorted together	Routes the JTAG - TCK / SPI - SCK clock signal to the <b>'Clock Buffer'</b> IDC connector	<ul><li>XMEGA PDI</li><li>ATtiny TPI</li></ul>
NOT FITTED	None	Use this selection for all devices except XMEGA PDI and ATtiny TPI	<ul> <li>Suitable for use with all devices except for XMEGA PDI and ATtiny TPI</li> </ul>

## Appendix 4 – IOMOD4 Module

#### 1.0 Overview

The 'IOMOD4' module is designed to allow a remote 'Clock Buffer Module' to be connected to an 'ISPnano Series III' or 'ISPnano Series IV' programmer. The module features a 10-way 'Clock Buffer' IDC connector which is used to directly connect to a remote 'Clock Buffer Module' via any length of 10-way ribbon cable.



#### 1.1 Module main features

The main features of the 'IOMOD4' module are as follows....

- Supports direct connection of a remote 'Clock Buffer Module' via a 10-way IDC plug
- Supports buffering of SPI, JTAG, XMEGA PDI and ATtiny TPI 'Serial Clock' signals
- The remote 'Clock Buffer Module' can be connected via any suitable length of ribbon cable to the 10-way IDC plug.
- User configurable clock signal routing a simple jumper selection allows either the 'SPI SCK', 'JTAG - TCK' or 'XMEGA PDI CLK' serial clock signal to be routed from the programmer to the 'Buffered clock input' on the remote 'Clock Buffer Module'.
- Quick-connect connector for connecting programmer I/O pins 1..4 and RESET
- Quick-connect connector for connecting power signals TVCC, TVPP, E-VCC
- 'Target Power' LED illuminates when the programmer switches the TVCC supply on



### **1.2 Principle of operation**

The 'IOMOD4' module is designed to operate as follows:

- Plug the module into the programmer
- Connect a remote 'Clock Buffer Module' via the 10-way IDC plug labelled 'Clock Buffer'
- Manually connect any power and GROUND signals required between the programmer and the DUT
- Set the 'Configuration jumpers' to select the correct 'Serial clock source' to match the target programming interface ie. SPI, JTAG, PDI / TPI

#### 1.3 Hardware layout

The table below shows the relevant hardware items on the 'IOMOD4' module.

Picture	Annotation number	Description
	1	TVCC LED Indicator
	2	Quick connect connector (J3) for programmer POWER signals
BUFFER 6	3	Quick connect connector (J6) for programmer I/O programming signals
3	4	Configuration jumper (J7)
	5	Configuration jumper (J8)
	6	Remote 'Clock Buffer' connector (J4)
	7	Configuration jumper (J2)



#### 1.4 Clock Buffer 10-way IDC connector

The '*Remote Clock Buffer Module*' connects to the *IOMOD4* module via a 10-way IDC cable which plugs into the '*Clock Buffer*' connector (J4) on the *IOMOD4* module.



The pin-out of the 'Clock Buffer' connector (J4) is detailed in the table below.....

10- way IDC pin #	Signal name	Signal description	Direction from programmer	Pin name on target device
1	TVCC	Target / Programmer VCC supply	Passive	VCC / VDD
2, 4, 6,8,10	GND	Target / Programmer Signal GROUND	Passive	GND
3	CLOCK_BUFF_ENABLE	Clock Buffer ENABLE signal	Output	No connect
5	PROG_PDI_CLK	XMEGA PDI / ATtiny TPI Clock signal from the programmer (not buffered)	Output	XMEGA - RESET
9	PROG_PDI_DATA	XMEGA PDI Bi-directional DATA signal	Passive	PDI_DATA



#### **1.5 Quick Connect - Power Connections**

The 'Quick connect - POWER signals' connector (J6) is designed to allow separate wires to be connected between the programmer and the Target System (DUT). The illustration below shows the pin-out of this connector.



#### J3 Quick Connect - Power Connections

Pin No	Connector	Description
1	TVCC	
2	GND	
3	TVCC	
4	VPP	
5	EXT-VCC	
6	GND	

### **1.6 Quick Connect - Programming signals**

The 'Quick connect - Programming Signals' connectors are designed to allow separate wires to be connected between the programmer and the Target System (DUT). The illustration below shows the pin-out of this connector.





#### J6 Quick Connect - Programming Signals

Pin No	Connector	Description
1	I/O 4	
2	I/O 3	
3	I/O 2	
4	I/O 1	
5	RESET	
6	GND	

### 1.7 Configuration jumpers

The **'IOMOD5'** module features 2 x **'Configuration jumpers'** which are used to configure the module for a selected target programming interface.

#### 1.7.1 Configuration Jumper J2

**'Configuration Jumper J2'** is used to configure which **'Serial Clock'** source is routed to the 10-way **'Clock Buffer'** IDC connector from the programmer.

The table below illustrates the settings of 'Configuration Jumper J2'.

Jumper position	Function selection	Explanation of routing	Supported programming interfaces
1 - 2	JTAG / SPI Clock	Routes the JTAG - TCK / SPI - SCK clock signal to the <i>'Clock Buffer'</i> IDC connector	<ul> <li>JTAG - AVR, ARM etc</li> <li>SPI - AVR, AT45D Serial DataFLASH</li> </ul>
2 - 3	PDI / TPI Clock	Routes the XMEGA PDI CLK / ATtiny TPI CLK clock signal to the <b>'Clock Buffer'</b> IDC connector	<ul><li> XMEGA PDI</li><li> ATtiny TPI</li></ul>

#### 1.7.2 Configuration Jumper J7

**'Configuration Jumper J7'** is used to configure the connector board for use with Atmel XMEGA PDI or ATtiny TPI target devices. The jumper connects the programmer UART TRANSMIT and RECEIVE pins together via a 470 ohm resistor to allow bi-direction communications on a single pin. mmer.

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The table below illustrates the settings of 'Configuration Jumper J7'.

Jumper position	Function selection	Explanation of function	Supported programming interfaces
1 - 2	Programmer UART TRANSMIT and RECEIVE Shorted together	Routes the JTAG - TCK / SPI - SCK clock signal to the ' <i>Clock Buffer</i> ' IDC connector	<ul><li>XMEGA PDI</li><li>ATtiny TPI</li></ul>
NOT FITTED	None	Use this selection for all devices except XMEGA PDI and ATtiny TPI	Suitable for use with all devices except for XMEGA PDI and ATtiny TPI

# Appendix 5 – IOMOD5 Module

#### 1.0 Overview

The 'IOMOD5' module is designed to allow a remote 'Clock Buffer Module' to be connected to an 'ISPnano Series 4' or 'ISPnano-MUX' programmer. The module features a 10-way 'Clock Buffer' IDC connector which is used to directly connect to a remote 'Clock Buffer Module' via any length of 10-way ribbon cable.



#### 1.1 Module main features

The main features of the 'IOMOD5' module are as follows....

- Supports direct connection of a remote 'Clock Buffer Module' via a 10-way IDC plug
- Supports buffering of SPI, JTAG, XMEGA PDI and ATtiny TPI 'Serial Clock' signals
- The remote 'Clock Buffer Module' can be connected via any suitable length of ribbon cable to the 10-way IDC plug.
- User configurable clock signal routing a simple jumper selection allows either the 'SPI SCK', 'JTAG - TCK' or 'XMEGA PDI CLK' serial clock signal to be routed from the programmer to the 'Buffered clock input' on the remote 'Clock Buffer Module'.
- Power signals TVCC, TVPP, EVCC are switched via relays
- Quick-connect connector for connecting programmer I/O pins 1..4 and RESET
- Quick-connect connector for connecting power signals TVCC, TVPP, E-VCC
- 'Target Power' LED illuminates when the programmer switches the TVCC supply on



#### **1.2 Principle of operation**

The 'IOMOD5' module is designed to operate as follows:

- Plug the module into the programmer
- Connect a remote 'Clock Buffer Module' via the 10-way IDC plug labelled 'Clock Buffer'
- Manually connect any power and GROUND signals required between the programmer and the DUT
- Set the 'Configuration jumpers' to select the correct 'Serial clock source' to match the target programming interface ie. SPI, JTAG, PDI / TPI

#### 1.3 Hardware layout

The table below shows the relevant hardware items on the 'IOMOD5' module.

Picture	Annotation number	Description
	1	Quick connect connector (J6) for programmer I/O signals
3 4 5 5 7 7 7 7 7 7 7 7 7 7 7 7 7	2	Quick connect connector (J5) for programmer POWER signals
	3	TVCC LED Indicator
	4	Relays (for switching TVCC, TVPP, E-VCC)
	5	Remote 'Clock Buffer' connector
	6	Configuration jumper
	7	Configuration jumper

#### **1.4 Quick Connect - Power Connections**

The 'Quick connect - POWER signals' connector (J6) is designed to allow separate wires to be connected between the programmer and the Target System (DUT). The illustration below shows the pin-out of this connector.



#### J6 Quick Connect - Power Connections

Pin No	Connector	Description
1	TVCC	
2	GND	
3	TVCC	
4	GND	
5	E-VCC	
6	GND	

## 1.5 Quick Connect - Programming signals

The 'Quick connect - Programming Signals' connectors are designed to allow separate wires to be connected between the programmer and the Target System (DUT). The illustration below shows the pin-out of this connector.





#### J6 Quick Connect - Programming Signals

Pin No	Connector	Description
1	I/O 4	
2	I/O 3	
3	I/O 2	
4	I/O 1	
5	RESET	
6	GND	

#### **1.6 Configuration jumpers**

The **'IOMOD5'** module features 2 x **'Configuration jumpers'** which are used to configure the module for a selected target programming interface.

#### 1.6.1 Configuration Jumper J2

**'Configuration Jumper J2'** is used to configure which **'Serial Clock'** source is routed to the 10-way **'Clock Buffer'** IDC connector from the programmer.

Jumper position	Function selection	Explanation of routing	Supported programming interfaces
1 - 2	JTAG / SPI Clock	Routes the JTAG - TCK / SPI - SCK clock signal to the <b>'Clock Buffer'</b> IDC connector	<ul> <li>JTAG - AVR, ARM etc</li> <li>SPI - AVR, AT45D Serial DataFLASH</li> </ul>
2 - 3	PDI / TPI Clock	Routes the XMEGA PDI CLK / ATtiny TPI CLK clock signal to the 'Clock Buffer' IDC connector	<ul><li> XMEGA PDI</li><li> ATtiny TPI</li></ul>

The table below illustrates the settings of 'Configuration Jumper J2'.

#### 1.6.2 Configuration Jumper J7

**'Configuration Jumper J7'** is used to configure the connector board for use with Atmel XMEGA PDI or ATtiny TPI target devices. The jumper connects the programmer UART TRANSMIT and RECEIVE pins together via a 470 ohm resistor to allow bi-direction communications on a single pin. mmer.

The table below illustrates the settings of 'Configuration Jumper J7'.

Jumper position	Function selection	Explanation of function	Supported programming interfaces
1 - 2	Programmer UART TRANSMIT and RECEIVE Shorted together	Routes the JTAG - TCK / SPI - SCK clock signal to the <b>'Clock Buffer'</b> IDC connector	<ul><li>XMEGA PDI</li><li>ATtiny TPI</li></ul>
NOT FITTED	None	Use this selection for all devices except XMEGA PDI and ATtiny TPI	<ul> <li>Suitable for use with all devices except for XMEGA PDI and ATtiny TPI</li> </ul>



# Appendix 6 – IOMOD6 Module

#### 1.0 Overview

The **'IOMOD6'** module is designed to allow simple interfacing to any **'Target boards'** or **'PCBAs'** which feature standard ISP connectors from Atmel, Equinox or Sigma Designs. This module features the standard Atmel AVR 6-way SPI and 10-way JTAG IDC connectors making it ideal for quick and simple interfacing to most AVR based **'Target boards'**.



#### 1.1 Module main features

The main features of the 'IOMOD6' module are as follows....

- Standard Atmel AVR 6-way 0.1" IDC SPI (ISP) connector
- Standard Atmel AVR 10-way 0.1" IDC JTAG connector
- Standard Equinox Generic 10-way 0.1" SPI / UART IDC connector
- Power signals TVCC, TVPP, EVCC are switched via relays
- Quick-connect connector for connecting power signals TVCC, TVPP, E-VCC
- 'Target Power' LED illuminates when the programmer switches the TVCC supply on
- ESD and over-voltage protection on programmer I/O pins IO1...IO4

#### 1.2 Programmer compatibility

The 'IOMOD6' module is compatible with the following programmers....

- ISPnano Series IV ATE
- ISPnano-MUX 2 / 4 / 8



### 1.3 Typical application / use

The 'IOMOD6' module is typical used to....

- Connect a programmer to an Atmel AVR 'Target Board' which features the Atmel 6-way IDC connector
- Connect a programmer to an Atmel AVR 'Target Board' which features the Atmel 10-way IDC JTAG connector (same connector as used on the Atmel JTAG ICE MK2 / 3 / 4)
- Connect a programmer to any Sigma Designs (Zensys) ZW100 / 200 / 300 'Target Board' which features the Equinox 10-way 0.1" IDC SPI connector

### **1.4 Principle of operation**

The 'IOMOD6' module is designed to operate as follows:

- Plug the module into the programmer
- Connect a suitable 6-way or 10-way 'IDC cable' to the relevant 'IDC Header' on the module
- Manually connect any power and GROUND signals required between the programmer and the DUT to the 'Quick Connect' connector block.

#### 1.5 Hardware layout

The table below shows the relevant hardware items on the 'IOMOD5' module.

Picture	Annotation number	Description
	1	Atmel 6-way SPI Header (J6)
3	2	Quick connect connector (J5) for programmer I/O signals
2 AT ME	3	TVCC LED Indicator
	4	Relays (for switching TVCC, TVPP, E-VCC)
	5	Equinox 10-way Header (J3)
	6	Atmel 10-way JTAG Header (J2)



### 1.6 IOMOD6 Header Pin-outs

10-way Equinox Header (J3)	10-way Atmel JTAG Header (J2)	6-way Atmel SPI Header (ISP) (J6)
PROG_VCC         1         2         PROG_SPARE           PROG_TSCK2         3         4         PROG_MOSI           N/C         5         6         PROG_MOSI           PROG_GND         7         8         PROG_SCK1           PROG_GND         9         10         PROG_RESET/VPP	PROG_TCK       1       2       PROG_GND         PROG_TDO       3       4       PROG_VCC         PROG_TMS       5       6       PROG_RESET         PROG_VCC       7       8       N/C         PROG_TDI       9       10       PROG_GND	PROG_MISO     1     2     PROG_VCC       PROG_SCK     3     4     PROG_MOSI       PROG_RESET     5     6     PROG_GND

## **1.7 ISP Cable considerations**

The programmer is supplied with a single 10-way ISP Cable as standard. This cable is terminated with a 10-way IDC 0.1" female polarised plug at each end. The cable is wired as a so-called 'straigh-through' cable with pin 1-1, 2-2 etc. The polarised ISP Header ensures that the ISP Cable cannot be plugged in the wrong way around by mistake. If you are planning to design such a header onto your Target System, it is strongly recommended that a similar polarised header is used. This will help to prevent accidental damage to both the programmer and the Target System.



Pin 1 of the ISP cable can be determined by looking for a small arrow on the plastic part of the ISP female plug. If the cable has a RED stripe on one cable, this usually also indicates pin 1.

If you are using the programmer in a production environment and constantly plugging / unplugging the ISP cable into/from the Target System, you may find that the cable eventually fails. Spare ISP cables can be ordered from Equinox in this eventuality.



#### **1.8 Quick Connect Connections**

The '*Quick connect*' connectors are designed to allow separate wires to be connected between the programmer and the Target System (DUT). The illustration below shows the pin-out of this connector.



#### J5 Quick Connect - Power Connectors

Pin No	Connector	Description
1	TVCC	
2	GND	
3	TVCC	
4	VPP	
5	E-VCC	
6	GND	

# Appendix 7 – IOMOD7 Module

#### 1.0 Overview

The **'IOMOD7'** module is designed to allow simple interfacing to any **'Target boards'** or **'PCBAs'** which feature standard ISP connectors from Atmel, Equinox or Sigma Designs. This module features the standard Atmel AVR 6-way SPI and 10-way JTAG IDC connectors making it ideal for quick and simple interfacing to most AVR based **'Target boards'**.



### 1.1 Module main features

The main features of the 'IOMOD7' module are as follows....

- Standard Atmel AVR 6-way 0.1" IDC SPI (ISP) connector
- Standard Atmel AVR 10-way 0.1" IDC JTAG connector
- Standard Equinox Generic 10-way 0.1" SPI / UART IDC connector
- Quick-connect connector for connecting power signals TVCC, TVPP, E-VCC
- 'Target Power' LED illuminates when the programmer switches the TVCC supply on
- ESD and over-voltage protection on programmer I/O pins IO1...IO4

#### 1.2 Programmer compatibility

The 'IOMOD7' module is compatible with the following programmers....

ISPnano Series III

### 1.3 Typical application / use

The 'IOMOD7' module is typical used to....

• Connect a programmer to an Atmel AVR '*Target Board*' which features the Atmel 6-way IDC connector

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- Connect a programmer to an Atmel AVR 'Target Board' which features the Atmel 10-way IDC JTAG connector (same connector as used on the Atmel JTAG ICE MK2 / 3 / 4)
- Connect a programmer to any Sigma Designs (Zensys) ZW100 / 200 / 300 'Target Board' which features the Equinox 10-way 0.1" IDC SPI connector

### **1.4 Principle of operation**

The 'IOMOD7' module is designed to operate as follows:

- Plug the module into the programmer
- Connect a suitable 6-way or 10-way 'IDC cable' to the relevant 'IDC Header' on the module
- Manually connect any power and GROUND signals required between the programmer and the DUT to the 'Quick Connect' connector block.

#### 1.5 Hardware layout

The table below shows the relevant hardware items on the 'IOMOD7' module.

Picture	Annotation number	Description
	1	Quick connect connector (J5) for programmer I/O signals
	2	Configuration jumper (J7)
	3	TVCC LED Indicator
	4	Equinox 10-way Header (J3)
	5	Atmel 10-way JTAG Header (J2)
	6	Atmel 6-way SPI Header (J6)



### **1.6 IOMOD6 Header Pinouts**

10-way Equinox Header (J3)	10-way Atmel JTAG Header (J2)	6-way Atmel SPI Header (ISP) (J6)
PROG_VCC         1         2         PROG_SPARE           PROG_TSCK2         3         4         PROG_MOSI           N/C         5         6         PROG_MOSI           PROG_GND         7         8         PROG_SCK1           PROG_GND         9         10         PROG_RESET/VPP	PROG_TCK       1       2       PROG_GND         PROG_TDO       3       4       PROG_VCC         PROG_TMS       5       6       PROG_RESET         PROG_VCC       7       8       N/C         PROG_TDI       9       10       PROG_GND	PROG_MISO     1     2     PROG_VCC       PROG_SCK     3     4     PROG_MOSI       PROG_RESET     5     6     PROG_GND

## 1.7 ISP Cable considerations

The programmer is supplied with a single 10-way ISP Cable as standard. This cable is terminated with a 10-way IDC 0.1" female polarised plug at each end. The cable is wired as a so-called 'straigh-through' cable with pin 1-1, 2-2 etc. The polarised ISP Header ensures that the ISP Cable cannot be plugged in the wrong way around by mistake. If you are planning to design such a header onto your Target System, it is strongly recommended that a similar polarised header is used. This will help to prevent accidental damage to both the programmer and the Target System.



Pin 1 of the ISP cable can be determined by looking for a small arrow on the plastic part of the ISP female plug. If the cable has a RED stripe on one cable, this usually also indicates pin 1.

If you are using the programmer in a production environment and constantly plugging / unplugging the ISP cable into/from the Target System, you may find that the cable eventually fails. Spare ISP cables can be ordered from Equinox in this eventuality.



#### **1.8 Quick Connect Connections**

The '*Quick connect*' connectors are designed to allow separate wires to be connected between the programmer and the Target System (DUT). The illustration below shows the pin-out of this connector.



#### J5 Quick Connect - Power Connectors

Pin No	Connector	Description
1	TVCC	
2	GND	
3	TVCC	
4	VPP	
5	E-VCC	
6	GND	

# Appendix 8 – IOMOD8 Module

#### 1.0 Overview

The **'IOMOD8'** module is designed to allow any ARM Target System with a 10-way 0.05" connector to be interfaced to an ISPnano programmer. The module also features a Quick Connect connector allowing all the power signals to be connected to the programmer.



#### 1.1 Module main features

The main features of the 'IOMOD8' module are as follows....

- Features 10-way 0.05" ARM connector
- Configuration jumper J2 to select either 'SWD' or 'JTAG' interface
- Power signals TVCC, TVPP, EVCC are switched via relays
- Quick-connect connector for connecting power signals TVCC, TVPP, E-VCC
- 'Target Power' LED illuminates when the programmer switches the TVCC supply on



#### **1.2 Principle of operation**

The 'IOMOD8' module is designed to operate as follows:

- Plug the module into the programmer
- Connect an ARM Target System (DUT) to the 10-way connector
- Set the configuration jumper J2 to select either 'SWD' or 'JTAG' interface
- Manually connect any power and GROUND signals required between the programmer and the DUT

#### 1.3 Hardware layout

The table below shows the relevant hardware items on the 'IOMOD8' module.

Picture	Annotation number	Description
3 4 4 4 5 5 5 5 5 5 5 5 5 5 5 5 5	1	SWD / JTAG Configuration jumper (J2)
	2	Quick connect connector (J5) for programmer POWER signals
	3	TVCC Power Status - LED Indicator
	4	Relays (for switching TVCC, TVPP, E-VCC)
	5	10-way ARM 0.05" Header (J3)

#### **1.4 Quick Connect Connections (Power signals)**

The '*Quick connect*' connectors are designed to allow separate wires to be connected between the programmer and the Target System (DUT). The illustration below shows the pin-out of this connector.





## 1.5 10-way ARM 0.05" Header (J3)

The

		JTAG			
J3	10-way ARM 0.05" Header	VCC12TMSGND34TCKGND56TDON/C78TDIGND910RESET			
		SWD			
		VCCIIIGND34SWCLKGND56SWON/C78N/CGND910RESET			



## Appendix 9 – IOMOD9 Module

#### 1.0 Overview

The **'IOMOD9'** module is designed to interface an ISPnano programmer to any ARM Target System (DUT) which features the generic ARM 20-way IDC connector.



### 1.1 Module main features

The main features of the 'IOMOD9' module are as follows....

- Features 20-way 0.1" generic ARM debug header / connector
- Configuration jumper J2 to select either 'SWD' or 'JTAG' interface
- Power signals TVCC, TVPP, EVCC are switched via relays
- Quick-connect connector for connecting power signals TVCC, TVPP, E-VCC
- 'Target Power' LED illuminates when the programmer switches the TVCC supply on



## **1.2 Principle of operation**

The 'IOMOD9' module is designed to operate as follows:

- Plug the module into the programmer
- Connect an ARM Target System (DUT) to the 20-way connector
- Set the configuration jumper J2 to select either 'SWD' or 'JTAG' interface
- Manually connect any power and GROUND signals required between the programmer and the DUT

#### 1.3 Hardware layout

The table below shows the relevant hardware items on the 'IOMOD9' module.

Picture	Annotation number	Description	
3-	1	SWD / JTAG - configuration jumper (J2)	
4	2	Quick connect connector (J5) for programmer POWER signals	
	3	TVCC Power Status - LED Indicator	
1	4	Relays (for switching TVCC, TVPP, E-VCC)	
	5	20-way ARM 0.1" IDC Header (J3)	

### **1.4 Quick Connect Connections (Power signals)**

The '*Quick connect*' connectors are designed to allow separate wires to be connected between the programmer and the Target System (DUT). The illustration below shows the pin-out of this connector.





## 1.5 20-way ARM 0.1" IDC Header (J3)

The

		JTAG			
			VTref 1	• • 2	Vsupply
			nTRST 3	<b>-• •</b> 4	GND
			TDI 5	• • 6	GND
			TMS 7	• • 8	GND
			TCK 9	<b></b>	- GND
			RTCK 11	<b>1</b> 2	- GND
			TD0 13	• • 14	- GND
			RESET 15	-• • 16	GND
			N/C 17	• • 18	- GND
10			N/C	• • 20	- GND
J3	10-way ARM 0.05" Header	0.475			
		SWD			
					- VCC (optional)
			N/C 5	-• • <del> </del>	GND
			N/C 7		- GND
			SWDIO 9	10	- GND
			SWCLK		- GND
			11	12	
			N/C 11 SW0 13		- GND
			N/C 11 SWO 13 RESET 15		- GND - GND - GND
			N/C 11 SWO 13 RESET 15 N/C 17	12 14 16 18	- GND - GND - GND - GND
			N/C         11           SWO         13           RESET         15           N/C         17           N/C         19	12 14 16 18 20	- GND - GND - GND - GND - GND

# Appendix 10 – IOMOD10F - Sigma Calibration Module (Fixed frequency)

#### 1.0 Overview

The 'IOMOD10' module has been specially designed to support 'XTAL calibration' of Sigma Designs Z-Wave 500 series ICs and modules. The module generates a very accurate 'Calibration frequency' which can be switched to the target Z-Wave device under programmer control.



#### **1.1 Module main features**

The main features of the 'IOMOD10' module are as follows....

- Generates a very accurate 'Calibration frequency' for use during the 'XTAL calibration' process of a Sigma Z-Wave 500 series device
- The 'Calibration frequency' can be switched to the target device under programmer control
- Quick-connect connector for connecting programmer I/O pins 1..4 (SPI or UART pins) and RESET
- Quick-connect connector for connecting power signals TVCC, TVPP, E-VCC
- 10-way IDC connector (Equinox pin-out) to allow direct connection to any Z-Wave evaluation board
- 'Target Power' LED illuminates when the programmer switches the TVCC supply on
- The 'Calibration frequency' can be output on either the programmer MOSI or MISO pin (jumper selectable)



#### **1.2 Principle of operation**

The 'IOMOD10' module is designed to operate as follows:

- Plug the module into the programmer
- Connect the 'Z-Wave Target System (DUT)' to either the 'Quick connect' connector (via wires) or to the 10-way IDC connector via a 10-way ribbon cable.
- Manually connect any power and GROUND signals required between the programmer and the Target Board (DUT)
- Set the 'Calibration Clock Output Pin Select' (LK2) configuration jumpers to select which pin the 'Calibration frequency' is output on.

#### **1.3 Fitting the IOMOD10 module to the programmer**

The 'IOMOD10' module fits onto the 'ISPnano Series 4 ATE' programmer as shown in the picture below.....



## 1.4 Powering the IOMOD10 module

A programming / calibration system using the 'ISPnano Series 4 ATE' and the 'IOMOD10 -Oscillator Calibration Module', requires TWO independent power supplies. One power supply is for the ISPanno programmer and the other power supply is for the IOMOD10 module.

The *IOMOD10* connector module must be powered by an external 3.3V DC power supply. The external supply is required because the '*OXCO - Oscillator Module*' on the *IOMOD10* module takes around 600mA at 3.3V and must have a accurate current-limited supply.

The illustration below shows the two independent power supply connections......


## Production In-System Programming (ISP) Module



The illustration below shows how to connect an external power supply to the *IOMOD10* module via a 2.1 mm centre positive jack socket.



#### Please note:

A suitable 3.3V DC regulated @ 1A power supply for use with this module is available from Equinox.



#### 1.5 Hardware layout

The table below shows the relevant hardware items on the 'IOMOD10' module.

Picture	Annotation number	Description
CAL-MISO CAL-MI	1	TVCC Target Power Status
	2	Enable Calibration Output (Manual)
	3	<b>Programming Calibration Signals</b> (Equinox 10-way 0.1" IDC Connector)
	4	Calibration Clock Output Pin Select 1-2 CAL-MISO 2-3 CAL-MOSI
	5	Programming Calibration Signals (Quick connect)
	6	<b>DC Power Input</b> (2-way Molex or 2.5mm Jack Socket)
	7	Power Connectors (Quick connect)
	8	TVCC Status LED Enable



#### **1.6 IOMOD10 module connector overview**

The connectors on the IOMOD10 module are detailed in the table below.

		SPI Interface pin-out
		PROG_TVCC 1 2 PROG_IO5   PROG_IO4 3 4 PROG_MOSI   N/C 5 6 PROG_MISO   PROG_GND 7 8 PROG_SCK   PROG_GND 9 10 PROG_RESET
J5	Equinox Standard	LIART interface nin-out
		PROG_IVCC 1 2 PROG_IO5   PROG_IO4 3 4 PROG_ID5   N/C 5 6 PROG_RXD   PROG_GND 7 8 PROG_IO3   PROG_GND 9 10 PROG_RESET
J6	Programming Calibration Signals (Quick connect)	TXD/MOSI RXD/MISO SCK NVM CS RESET CAL
J8	<b>Power Connectors</b> (Quick connect)	TVCC GND TVCC GND EXT VPP



#### 1.7 Configuration jumpers

The '*IOMOD10*' module features 2 x '*Configuration jumpers*' which are used to configure the module for the programming application.

#### 1.7.1 Configuration Jumper LK1 - Enable Calibration Output

The jumper link LK1 is used to manually force the **'Calibration frequency'** to be output from the module. This bypasses the programmer control and can be used to manually test the output frequency of the module.

Please refer to the table below which shows the settings for this jumper link.

Jumper position	Selected function
Not fitted	Calibration frequency output is controlled by the programmer (via OP5 pin)
Fitted	Calibration frequency is permanently output (only use this settings for test purposes)

#### 1.7.2 Configuration Jumper LK2 - Calibration Clock Output Pin Select

The LK2 jumper link is used to select which pin the *'Calibration frequency'* will be output on. Please refer to the table below which shows the settings for this jumper link.

Jumper position	Jumper setting	Calibration frequency output pin
1 - 2	1-2 CAL-MISO	MISO / RXD
2 - 3	2-3 CAL-MOSI	MOSI / TXD (default setting)



#### 1.7.3 Configuration Jumper LK3 - TVCC ON - Status LED

The jumper link LK3 enables the 'TVCC Status LED'. When the programmer switches on the target power supply (TVCC), the 'TVCC ON' LED will switch on.

Please refer to the table below which shows the settings for this jumper link.

Jumper position	Selected function
Not fitted	TVCC LED will be permanently off
Fitted	TVCC LED will be switch on when the programmer TVCC supply is enabled



#### 1.8 Connecting to a Target Board via the SPI interface

The illustration below shows how to connect the IOMOD10 module to a Target Board (DUT) via the SPI interface.





#### 1.9 Connecting to a Target Board via the UART interface

The illustration below shows how to connect the IOMOD10 module to a Target Board (DUT) via the UART interface.



# **ISP**nano

### **Appendix 11 - ISP Cable considerations**

The programmer is supplied with a single 10-way ISP Cable as standard. This cable is terminated with a 10-way IDC 0.1" female polarised plug at each end. The cable is wired as a so-called 'straigh-through' cable with pin 1-1, 2-2 etc. The polarised ISP Header ensures that the ISP Cable cannot be plugged in the wrong way around by mistake. If you are planning to design such a header onto your Target System, it is strongly recommended that a similar polarised header is used. This will help to prevent accidental damage to both the programmer and the Target System.



Pin 1 of the ISP cable can be determined by looking for a small arrow on the plastic part of the ISP female plug. If the cable has a RED stripe on one cable, this usually also indicates pin 1.

If you are using the programmer in a production environment and constantly plugging / unplugging the ISP cable into/from the Target System, you may find that the cable eventually fails. Spare ISP cables can be ordered from Equinox in this eventuality.