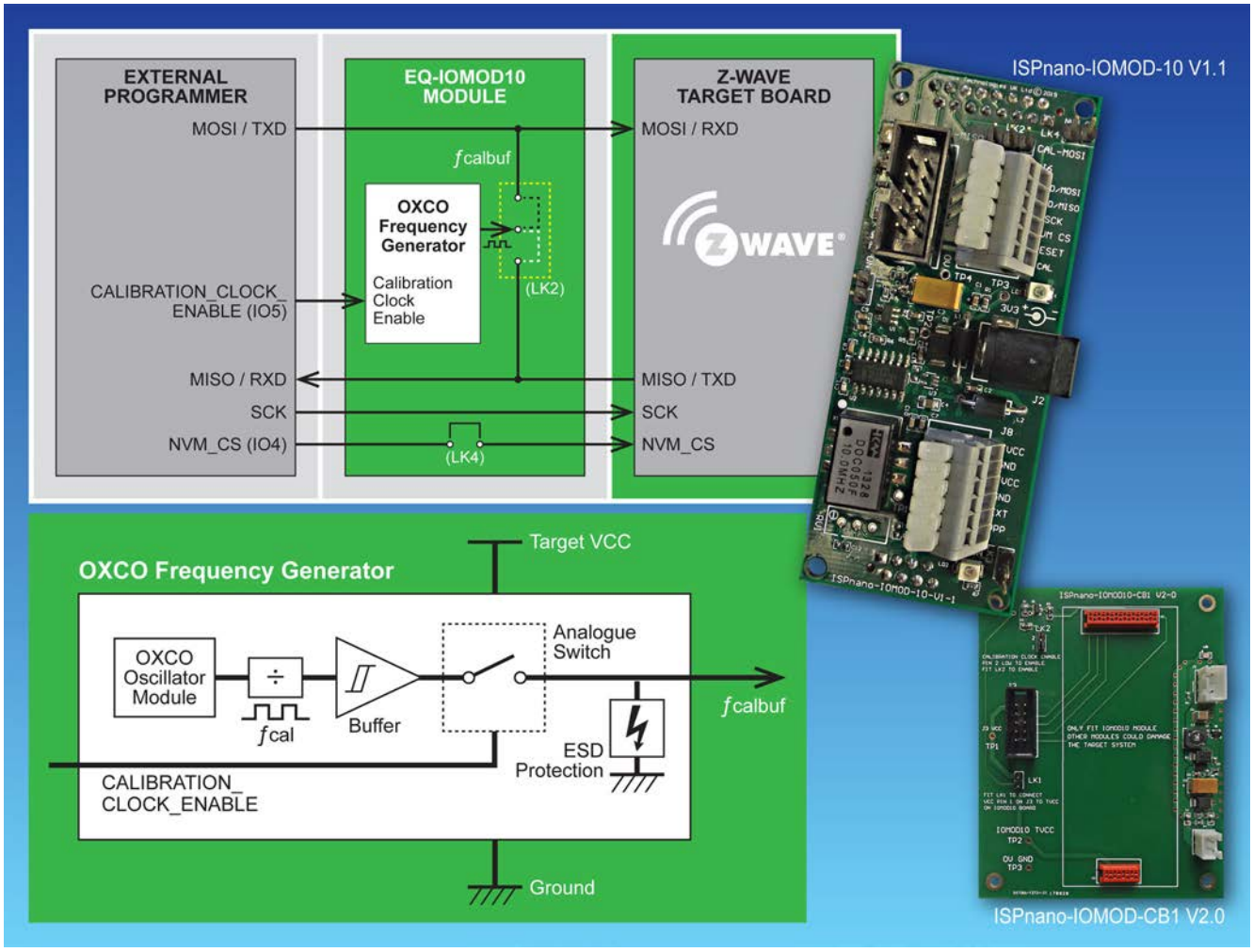

IOMOD10F

XTAL Calibration Module V1.1 and Carrier Board for the SIGMA Z-Wave 500 Series of ICs and modules

Hardware User Manual

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Equinox guarantees that its products will be free from defects of material and workmanship under normal use and service, and these products will perform to current specifications in accordance with, and subject to, the Company's standard warranty which is detailed in Equinox's Purchase Order Acknowledgment.

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.

IOMOD10 - 'Line Driver Circuitry' damage.

The ***IOMOD10*** module 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 ***'IOMOD10 - Z-Wave Calibration module'*** is a CE Approved Product but only when used in conjunction with an Equinox **'ISPnano Programming Module'**. 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 ***'IOMOD10F - Z-Wave Calibration 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 or IOMOD10F module.

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 Manuals**

- **This manual.**
- Sigma Design document: ***INS12524 - 500 Series Calibration User Guide***

► **Application Notes**
AN145 - AN145 Sigma Z-Wave 500 Series ISP programming

► **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 ***'500 series Z-Wave programming tools'*** can be found at:
http://www.equinox-tech.com/products/details.asp?ID=1732

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

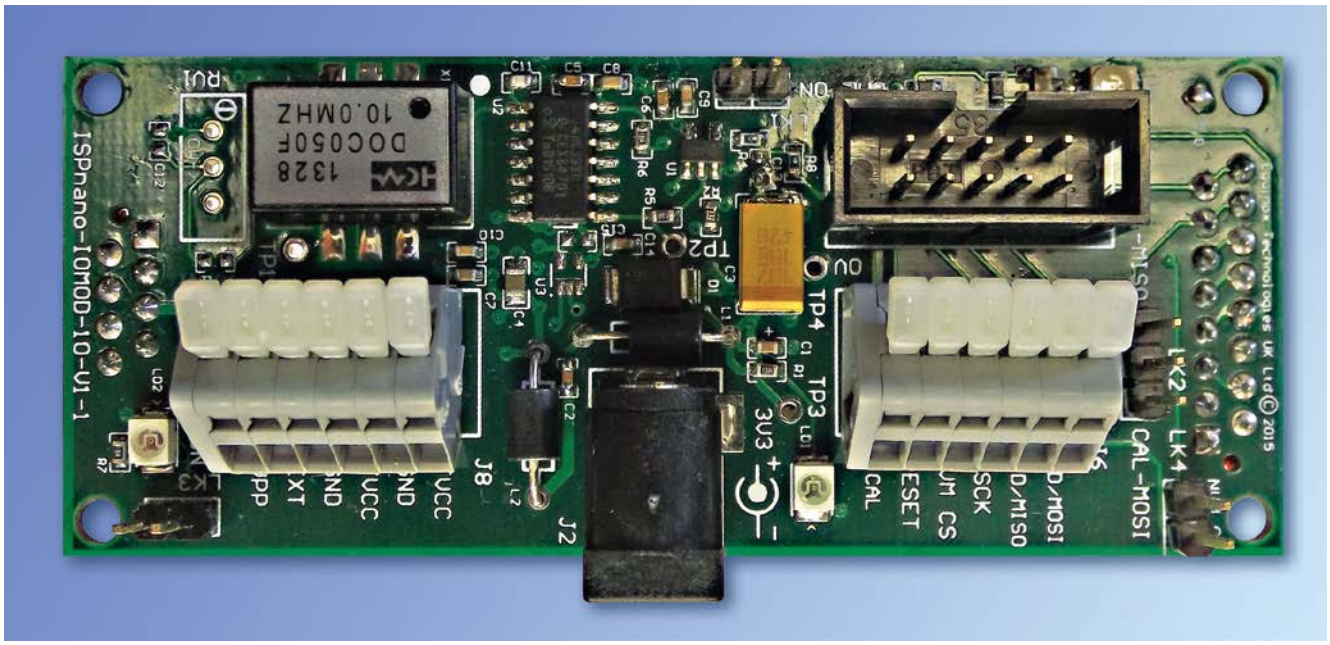
► **Fax**
Please fax any technical support questions about this product to: +44 (0) 1942 844181

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

1.0 IOMOD10F - Z-Wave Calibration Module (Fixed frequency version)

1.0 Overview

The ***'IOMOD10F'*** module has been specially designed to support ***'XTAL calibration'*** of the ***Z-Wave 500 series*** ICs and modules from ***Sigma Designs***. The module generates a very accurate ***'Calibration frequency'*** of 39.0625 kHz which can be switched to the target **Z-Wave** device under programmer control.



1.1 IOMOD10F module - main features

The main features of the ***'IOMOD10F'*** module are as follows….

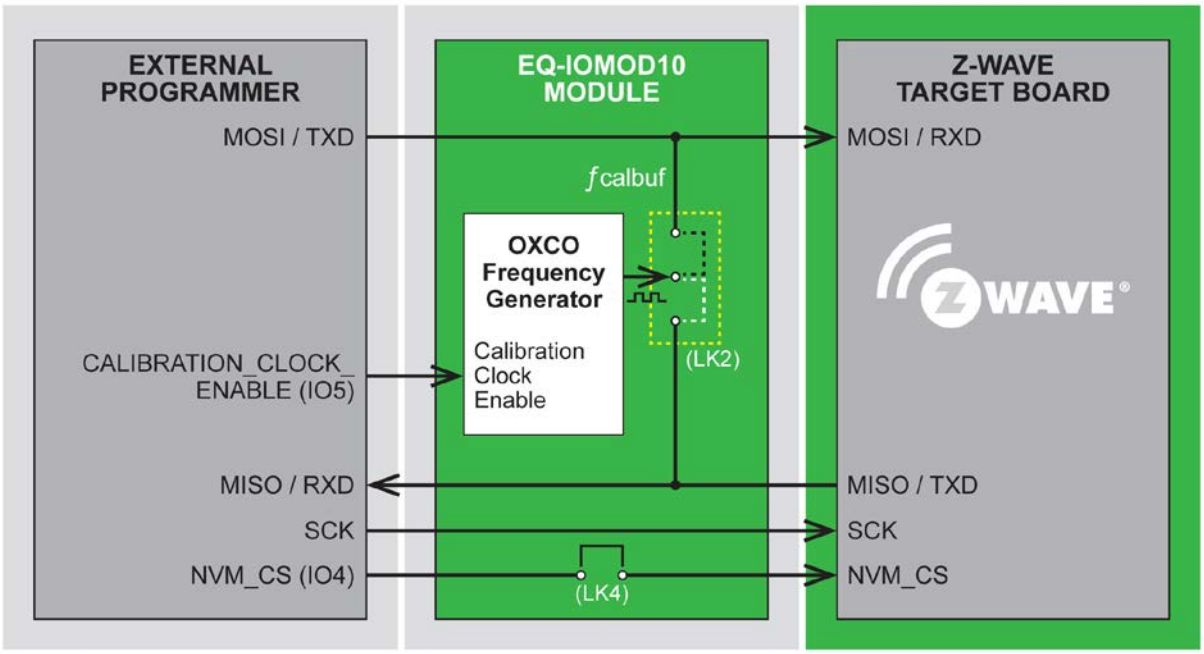
- Generates a very accurate ***'Calibration frequency'*** (39.0625 kHz) for use during the ***'XTAL calibration'*** procedure of a ***Sigma Z-Wave 500 series*** device.
- The ***'Calibration frequency'*** can be switched to the target device under programmer control
- Very high accuracy temperature-compensated **OXCO module** guarantees correct frequency for calibration.
- Quick-connect connector for connecting programmer I/O pins to target board / DUT
- Quick-connect connector for connecting power signals TVCC, TVPP, E-VCC
- 10-way IDC connector (Equinox / Sigma SPI 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 (SPI interface) or ***TXD*** or ***RXD*** pin (UART interface) - jumper selectable
- ***Chip Select (CS)*** control line available for interfacing to external ***NVM serial memory*** device.
- Full ESD protection on ***'Calibration frequency'*** output pin

1.2 Principle of operation of the IOMOD10F module

The ***'IOMOD10F - Calibration Module'*** is simply a hardware block which generates a very accurate / stable ***'Calibration frequency'*** for use with the ***'Z-Wave calibration firmware'*** from Sigma.

The module must be controlled from an ***'external system'*** which could be an Equinox programmer, Sigma Designs evaluation board or even a customer's own programming system.

The illustration below shows how the ***'programming signals'*** connect between the ***'External programmer'*** and the ***'Z-Wave target Board'*** through the ***IOMOD10F*** module.



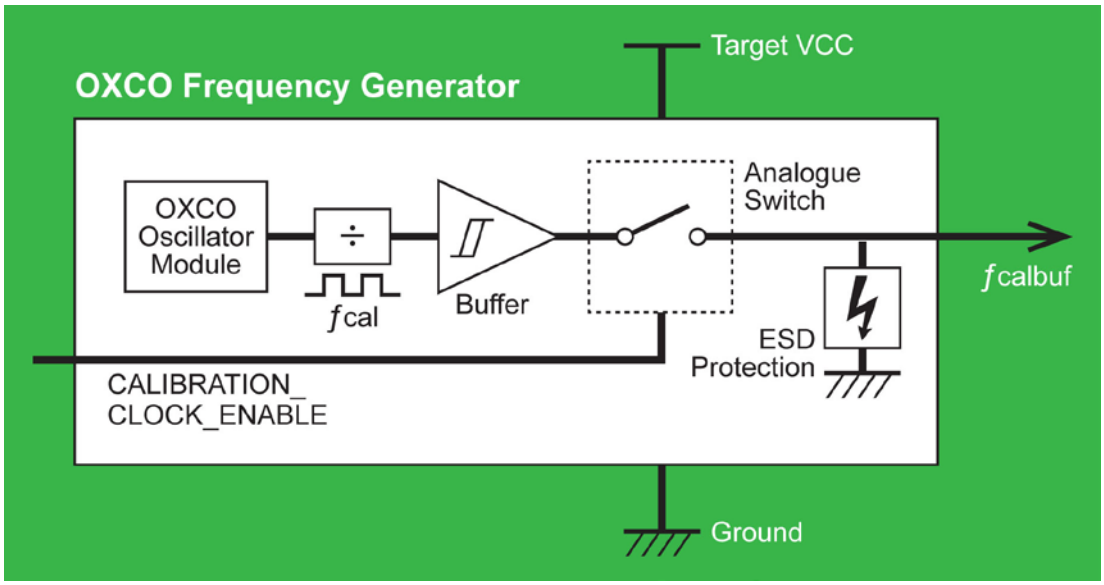
The table below explains the different states of the ***'Calibration frequency'*** during the ***'programming'*** and ***'calibration'*** stages....

Status	CAL ENABLE pin	Explanation
No action	**LOW**	When the programmer / calibration is dormant, then the 'Calibration frequency' must be switched off.
Programming	**LOW**	During normal ***'programming operations'***, the ***MOSI / TXD*** signal from the ***'external programmer'*** passes unchanged through the ***IOMOD10F*** module.
Calibrating	**HIGH**	When the ***'CAL_ENABLE'*** pin is enabled by the ***'External programmer'***, then the ***'calibration frequency'*** from the ***'OXCO frequency generator'*** block is switched to the ***MOSI / RXD*** output pin so the module will now output the ***'calibration frequency'***. to the ***'Z-Wave target Board'.***

1.3 OXCO - Frequency Generator block

The ***'OXCO Frequency Generator'*** block on the ***IOMOD10F*** module generates a very accurate ***'Calibration frequency'*** which is used during the ***'XTAL calibration procedure'*** of a Z-Wave 500 Series IC or module.

The illustration below shows the internal functionality of the ***'OXCO Frequency Generator'*** block...



#	Functional block / signal	Further information
1	**OXCO Oscillator Module**	This is a totally self-contained OXCO module which generates a very accurate / stable fixed frequency of 10 MHz.
2	**Divider network**	The output frequency of the OXCO module is then divided down by 256 to give the required 39.0625 kHz frequency used for the Z-Wave XTAL calibration procedure.
3	**Buffer**	The output of the divider is then buffered before going into an analogue switch.
4	**Analogue switch**	This switch is used to 'gate' the ***'Calibration frequency'*** onto the selected output signal of the IOMOD10F module.
5	**ESD protection**	The analogue switch features ESD protection on its output.
6	**Fcal (OXCO)**	This is the output frequency of the OXCO module which is a fixed frequency 10 MHz.
7	**Fcalbuf**	This is the final 'calibration frequency' waveform of 39.0625 kHz

1.4 IOMOD10F module - control methods

The table below outlines possible methods of controlling the ***'IOMOD10F'*** module.....

#	Control Method	Further information / instructions
1	Equinox ISPnano programmer control	See appendix 1 of this manual for an overview. See application note AN145 for more in-depth information.
2	Sigma Designs - Evaluation board / programmer	A separate ***'IOMOD10F - Carrier Board'*** is required. See appendix 3 of this manual. Please contact Sigma Designs technical support for further information about this configuration.
3	Custom factory programming hardware	Please contact either Equinox Technologies or Sigma Designs to discuss your production requirements. A separate ***'IOMOD10F - Carrier Board'*** is required.

IMPORTANT NOTE!

The ***'IOMOD10F - calibration module'*** must be controlled by an ***'external control system'***.
The module cannot be used standalone to perform the calibration process.

2.0 IOMOD10F - General Product Information

2.1 Ordering information

This table below details the order codes for the various IOMOD calibration systems....

See section	Kit Order Code	Further information
2.2	**IOMOD10F-KIT**	This is the legacy IOMOD10 kit which included an ***IOMOD10F*** module + 3.3V power supply. **Availability:** Discontinued due to obsolescence of the 3.3V power supply used to power the IOMOD10F module
2.3	**EQ-RBK-ZWAVECALIBOX-3**	This is a new ***IOMOD10 kit*** which includes an ***IOMOD10F*** module plus a re-designed ***'Carrier Board'*** which features an integrated 3.3V power supply on the ***'Carrier Board'***. Availability: current product

2.2 IOMOD10F kit (module only) - System Contents

The ***IOMOD10F*** module when ordered as an ***'IOMOD10F kit'*** (Order code: EQ-IOMOD10F-KIT) comes with the following components...

Hardware:

- 1 x IOMOD10F V1.1 module (actual ***'Calibration Module'*** hardware)
- 1 x 9V Power Supply
- 1 x Set of mains plug adaptors - UK, USA, European, Asia
- 1 x 10-way 0.1" pitch IDC cable

Software:

- The ***IOMOD10F*** module does NOT come with any software.
- Please see application note AN145 for details of how to control the ***IOMOD10F*** module.

Documentation:

- 1 x ***IOMOD10F*** - User Manual (printed)

PLEASE NOTE:

This ***EQ-IOMOD10F-KIT*** is no longer available due to the obsolescence of the 3.3V power supply used with the IOMOD10F module.

The replacement product is the ***EQ-IOMOD14-KIT*** which features the new IOMOD14 calibration

module with an on-board 3.3V power supply

If you are using the IOMOD10F module with an external programmer from Sigma, then please refer to the new ***EQ-RBK-ZWAVECALIBOX-3*** kit.

2.3 Sigma EQ-RBK-ZWAVECALIBOX-3 kit - System Contents

The ***IOMOD10F*** module is also available with a ***'Carrier Board'*** which allows it to be connected to an ***'external programming system'*** e.g. Sigma's own development programmer.

Kit order code: ***EQ-RBK-ZWAVECALIBOX-3***

System contents:

Hardware:

- 1 x ***ISPnano-IOMOD-10-V1.1*** (actual ***'Calibration Module'*** hardware)
- 1 x ***ISPnano-IOMOD10-CB1-V2.0*** (actual ***'Carrier Board'*** hardware)
- 1 x 9V Power Supply
- 1 x Set of mains plug adaptors - UK, USA, European, Asia
- 1 x 10-way Ribbon Cable
- 1 x Screw Pack
  Contents:
  - 4 x 16mm M3 Pozi Pan Head Screws
  - 4 x M3 Metal Plain Washers
  - 4 x M3 Full Hexagonal Nuts
  - 4 x Stick On Rubber Feet, Round
  - 4 x Jumper Links
  - 4 x 7mm Round Nylon Spacers

Software:

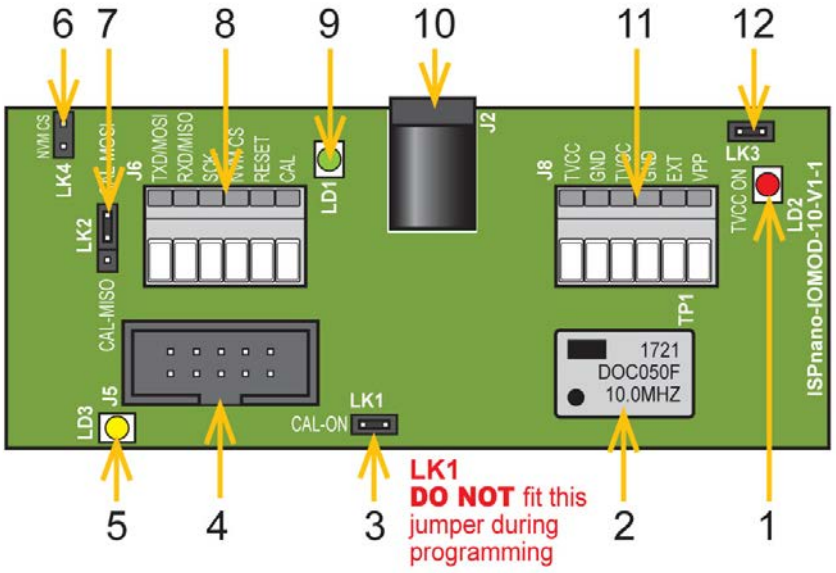
- The ***IOMOD10F*** module does NOT come with any software.
- Please see application note AN145 for details of how to control the ***IOMOD10F*** module.

Documentation:

- 1 x *IOMOD10F* - User Manual (printed)

2.4 IOMOD10F module - Hardware layout

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

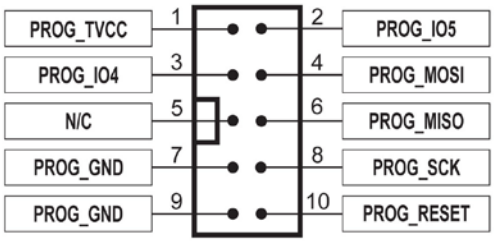
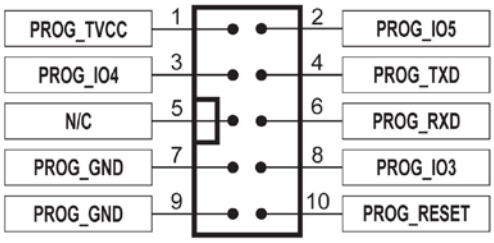
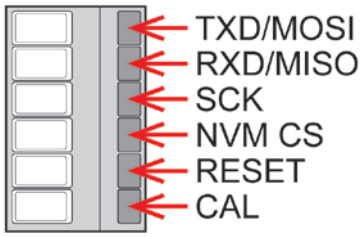
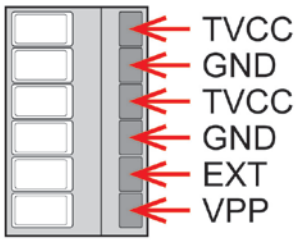


PCB Label	Diagram #	Functional description
CONNECTORS		
J2	10	**DC Power Input** (2.1mm Jack Socket - centre positive)
J5	4	**Programming / Calibration Signals** **Connector type:** 10-way IDC - Equinox / Sigma pin-out **Purpose:** Connect to 'external programmer' e.g. Sigma eval board
J6	8	**Programming / Calibration Signals** (Quick connect connector) **Connector type:** Quick connect connector **Purpose:** Connect 'programming signals' to target Z-Wave device / fixture probe pins
J8	11	**Power Connectors** **Connector type:** Quick connect connector **Purpose:** Connect 'power signals' to target Z-Wave device / fixture probe pins
JUMPER LINKS		
LK1	3	**Enable Calibration Output (Manual Test only)** *For test purposes only.* *DO NOT* ***fit this jumper during normal operation.***
LK2	7	**Calibration Clock - Output Pin Select** 1-2 CAL-MISO 2-3 CAL-MOSI

LK3	12	**TVCC (Target Power) Status LED - Enable** (fit jumper to enable LED)
LK4	6	**External NVM SPI memory device - 'Chip Select (CS)' - enable** Fit jumper link to connect programmer '***IO4'*** pin to the target ***'NVM CS (Chip Select)'*** pin.
LED's		
LD1	9	**IOMOD10F module** - 3.3V Power Status LED (Green)
LD2	1	**Target VCC (TVCC) Power status LED (RED)**
LD3	3	**Calibrated Oscillator signal** - Enabled / Active (Yellow)
OSCILLATOR MODULE		
TPI	2	**OXCO - Oscillator Module**

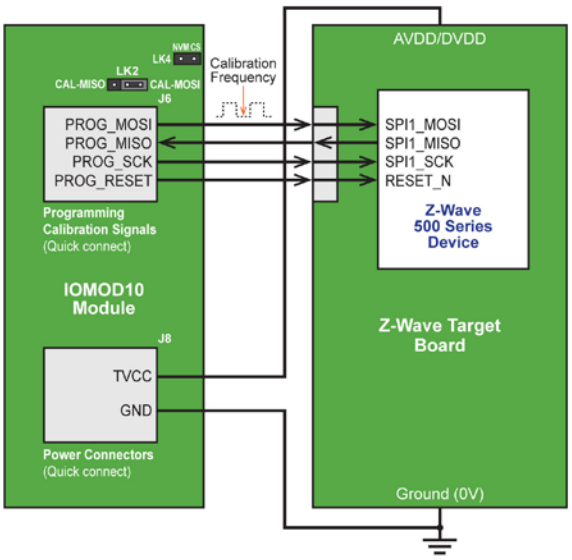
2.5 IOMOD10F module - connector overview

The connectors on the ***IOMOD10F*** module are detailed in the table below.

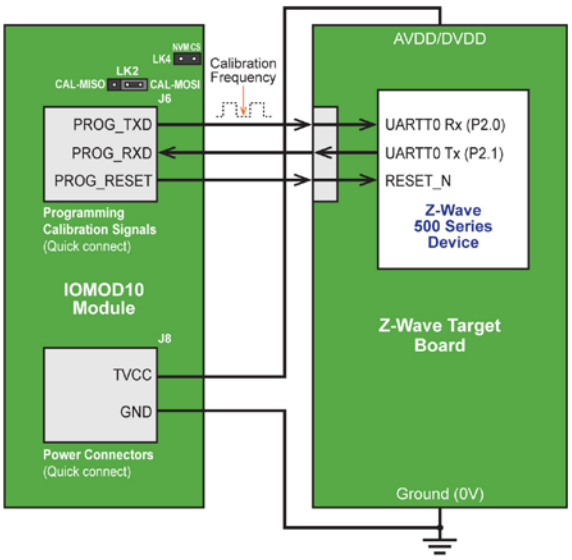
J5 **SPI**	**Equinox standard** **10-way 0.1" pitch IDC** **Box Header** **SPI Interface pin-out**	**SPI Interface pin-out**  *Do NOT connect pin 2 (PROG_IO5) of the IDC connector to a Sigma Target Board!
J5 **UART**	**Equinox standard** **10-way 0.1" pitch IDC** **Box Header** **UART Interface pin-out**	**UART interface pin-out**  *Do NOT connect pin 2 (PROG_IO5) of the IDC connector to a Sigma Target Board!
J6	**Programming ** **Calibration Signals** (Quick connect connector)	
J8	**Power Connectors** (Quick connect connector)	

2.6 IOMOD10F - connecting to a Z-Wave target system

The illustrations below detail the connections required between the ***IOMOD10F*** module and the target 500 series Z-Wave device for both the ***'SPI interface'*** and ***'UART interface'***.



SPI interface



UART interface

The table below details the connections required between the ***IOMOD10F*** module and the target Z-Wave device.

ISPnano Pin name	IOMOD10F module pin label	ISPnano Input / Output	Connect to pin on target Z-Wave device	Notes
I/O4	**NVM CS**	O	NVM CS (Chip Select) *Optional connection	**Chip Select (CS)** pin for external NVM device (optional - fit jumper link LK4)
I/O3	**SCK**	O	SCK	SPI - Serial Clock
I/O2	**RXD / MISO**	I	MISO or TXD	SPI - MISO
I/O1	**TXD / MOSI**	O	MOSI or RXD	SPI - MOSI
RESET	**RESET**	O	RESET_N	RESET for Z-Wave device
GND	**GND**	P	Signal GROUND (0V)	Signal Ground Connection
TVCC	**TVCC**	P	Target VCC	Connect to Z-Wave VCC power rail
TVPP	**VPP**	-	N/C	Not Connected
EXT-VCC	**EXT**	-	N/C	Not Connected

Please refer to appendix 4 for detailed examples of how to connect the ***IOMOD10F*** module to different Z-Wave target systems via the ***'SPI interface'*** and ***'UART interface'***.

2.7 IOMOD10F - Configuration jumper link settings

The ***'IOMOD10F'*** module features 4 x ***'Configuration jumper links'*** which are used to configure the module for the programming application.

PCB Label	Diagram #	Description
LK1	3	**Enable Calibration Output (Manual)** ***For test purposes only.*** ***DO NOT fit this jumper during programming.***
LK2	7	**Calibration Clock - Output Pin Select**  1-2 CAL-MISO 2-3 CAL-MOSI
LK3	12	**TVCC (Target Power) Status LED - Enable** (fit jumper to enabled LED)
LK4	6	**External NVM SPI memory device - 'Chip Select (CS)' - enable** Fit jumper link to connect programmer '***IO4'*** pin to the target ***'NVM CS (Chip Select)'*** pin.

2.7.1 Configuration Jumper LK1 - Enable Calibration Output

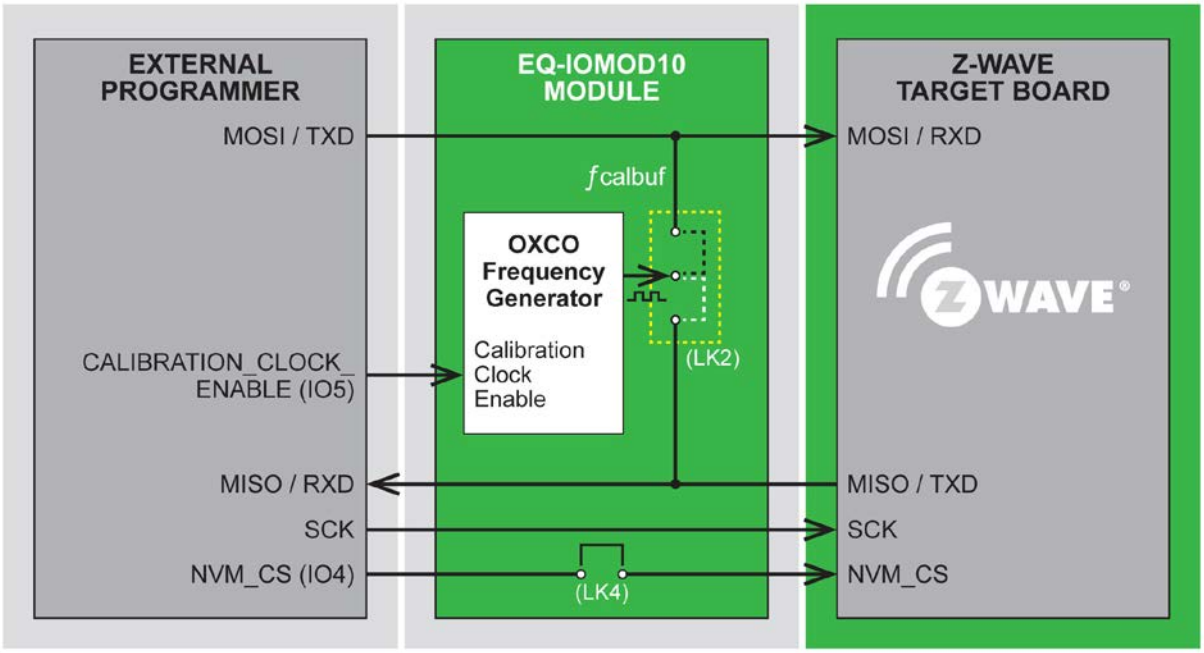
The jumper link ***'LK1'*** is used to manually force the ***'Calibration frequency'*** to be output from the module. This bypasses the programmer control and can be used to manually test the output frequency of the module.

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

LK1 Jumper position	Selected function	
Not fitted	Calibration frequency output is controlled by the programmer (via OP5 pin)	Default setting
Fitted	Calibration frequency is permanently output	**(ONLY USE THIS SETTING FOR TEST PURPOSES)**

2.7.2 Configuration Jumper LK2 - Calibration Clock Output Pin selection

The ***'LK2'*** jumper link is used to select which output pin on the ***IOMOD10F*** module the ***'Calibration frequency'*** will be output on. The ***'Calibration frequency'*** (Fcalbuf) is output to the centre pin of the 3-way jumper link LK2 - see illustration below...



Please refer to the table below which shows the settings for the ***LK2*** jumper link.

Jumper position	Jumper setting	Calibration frequency output pin from the IOMOD10F module
1 - 2		MISO / RXD
2 - 3		MOSI / TXD (default setting)

2.7.3 Configuration Jumper LK3 - TVCC (Target Power) Status LED - Enable

The ***'LK3'*** jumper link is used to enable an LED when ***'Target Power'*** is switched on.

Jumper position	Selected function
Not fitted	TVCC LED will be permanently off
Fitted	TVCC LED will illuminate when the programmer TVCC (power from external programmer) supply is enabled

Important note:
The ***'Target Power'*** is independent of the 3.3V supply which the ***IOMOD10F*** circuitry is actually running from.

2.7.4 Configuration Jumper LK4 - NVM CS (Chip Select)

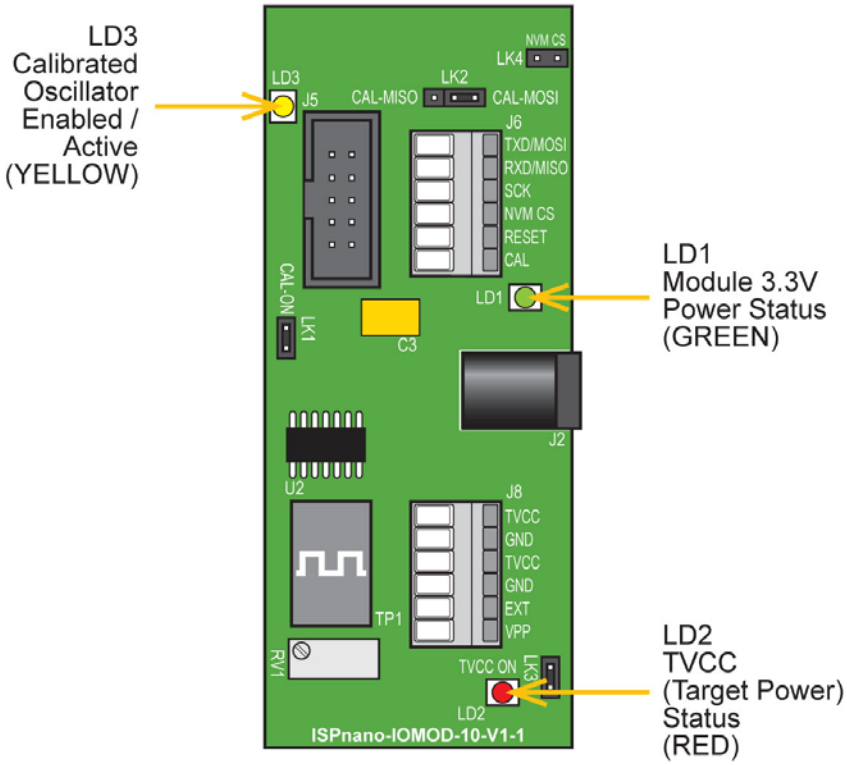
The jumper link ***LK4*** connects the external ISPnano programmer '***IO4'*** pin to the ***'NVM CS (Chip Select)'*** pin on the Z-Wave Target Board

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

LK4 Jumper position	Selected function
Not fitted	Target ***NVM CS (Chip Select)*** pin is left floating. It is NOT connected to the external programmer.
Fitted	Target ***NVM CS (Chip Select)*** pin is connected to the external ISPnano ***IO4*** output pin. This allows the external programmer to control the Chip Select of the NVM memory device connected to the Z-Wave device on the shared SPI bus. If the programmer needs to disable the NVM memory via the ***'Chip Select'*** pin, then this jumper must be fitted.

2.8 IOMOD10F module - Status LED's

The ***IOMOD10F*** module features 3 x ***'Status LEDs'*** as shown in the illustration below....

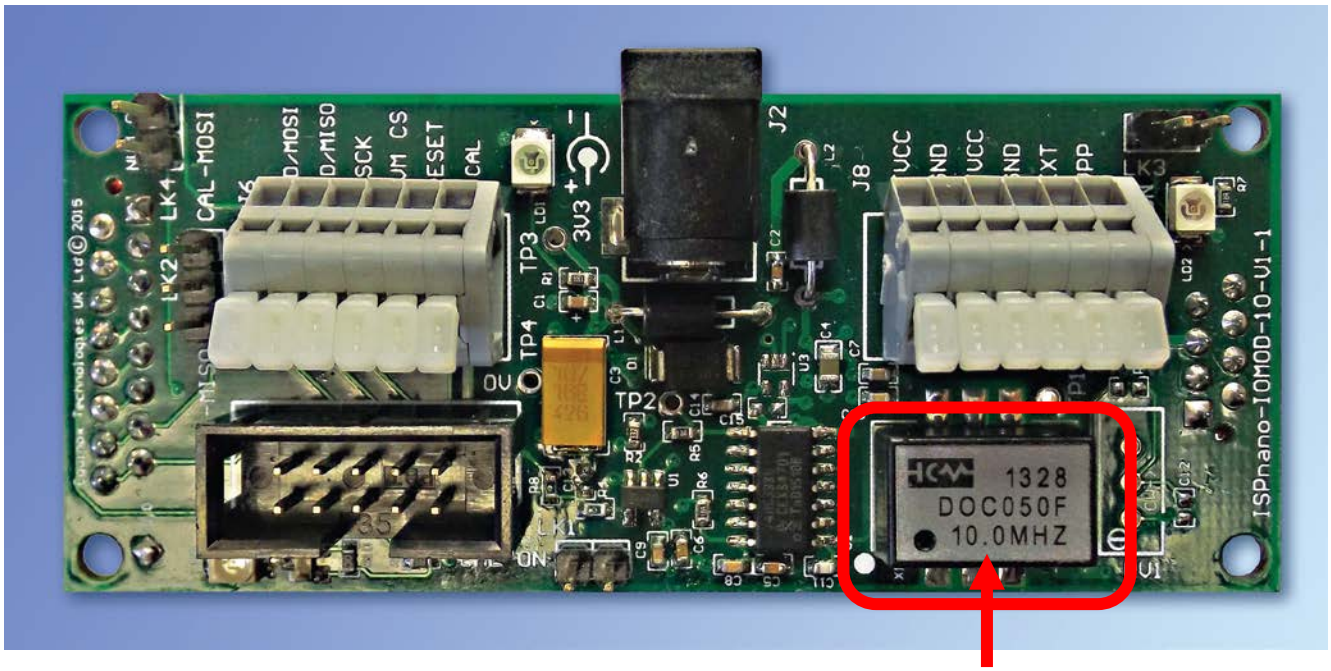


The function of each ***'Status LED'*** is explained in the table below....

LED	Colour	Description
LD1	GREEN	**IOMOD10F module +3.3V DC Power Status** This LED will illuminate as soon as the +3.3V power supply to the module is switched on. The LED should then remain permanently on.
LD2	RED	**TVCC - Target Power Status** This LED will only illuminate when the 'target power supply' (either from the programmer or target board) is switched on.
LD3	YELLOW	**Calibrated Oscillator enabled / active** This LED will only illuminate when the ***'Calibration oscillator'*** has been enabled via the programmer IO5 signal being driven HIGH.

2.9 OXCO - Oscillator Module (temperature compensated)

The ***'OXCO Oscillator Module'*** fitted to the ***IOMOD10F*** module is a temperature-compensated component. It requires a **minimum of 90 seconds** to come up to temperature before the ***'Calibration Frequency'*** output will stabilise to the nominal calibrated value. It is therefore very important to **wait at least 90 seconds** after applying the 3.3V power supply to the module **BEFORE** attempting any programming / calibration operation.



OXCO Module - Warning this component gets very hot!!!

2.10 Operating specifications

The table below details the main operating characteristics of the ***IOMOD10F*** module.

Parameter	Minimum	Nominal	Maximum	Units	Notes
Temperature range	0	25	70	deg. C	
Supply Voltage (via DC jack socket)	3.13	3.30	3.47	V	
Supply current (at start-up)	N/A	680	800	mA	
Supply current (steady-state)	-	330	-	mA	
OXCO Warm-up time	-	-	60	seconds	
OXCO output frequency		10.00	-	MHz	
Calibration output frequency	-	39.0625	-	kHz	

Appendix 1 - Using IOMOD10F module with ISPnano Series 4 programmer

1.0 Overview

This appendix describes how to use the '***IOMOD10F'*** module with an Equinox **'ISPnano Series 4'** programmer.

Important note:
The '***IOMOD10F'*** module is NOT compatible with any other ISPnano programmer.

1.1 Fitting the IOMOD10F module to the ISPnano programmer

The ***'IOMOD10F'*** module fits onto the ***'ISPnano Series 4 ATE'*** programmer as shown in the picture below.....

Instructions:

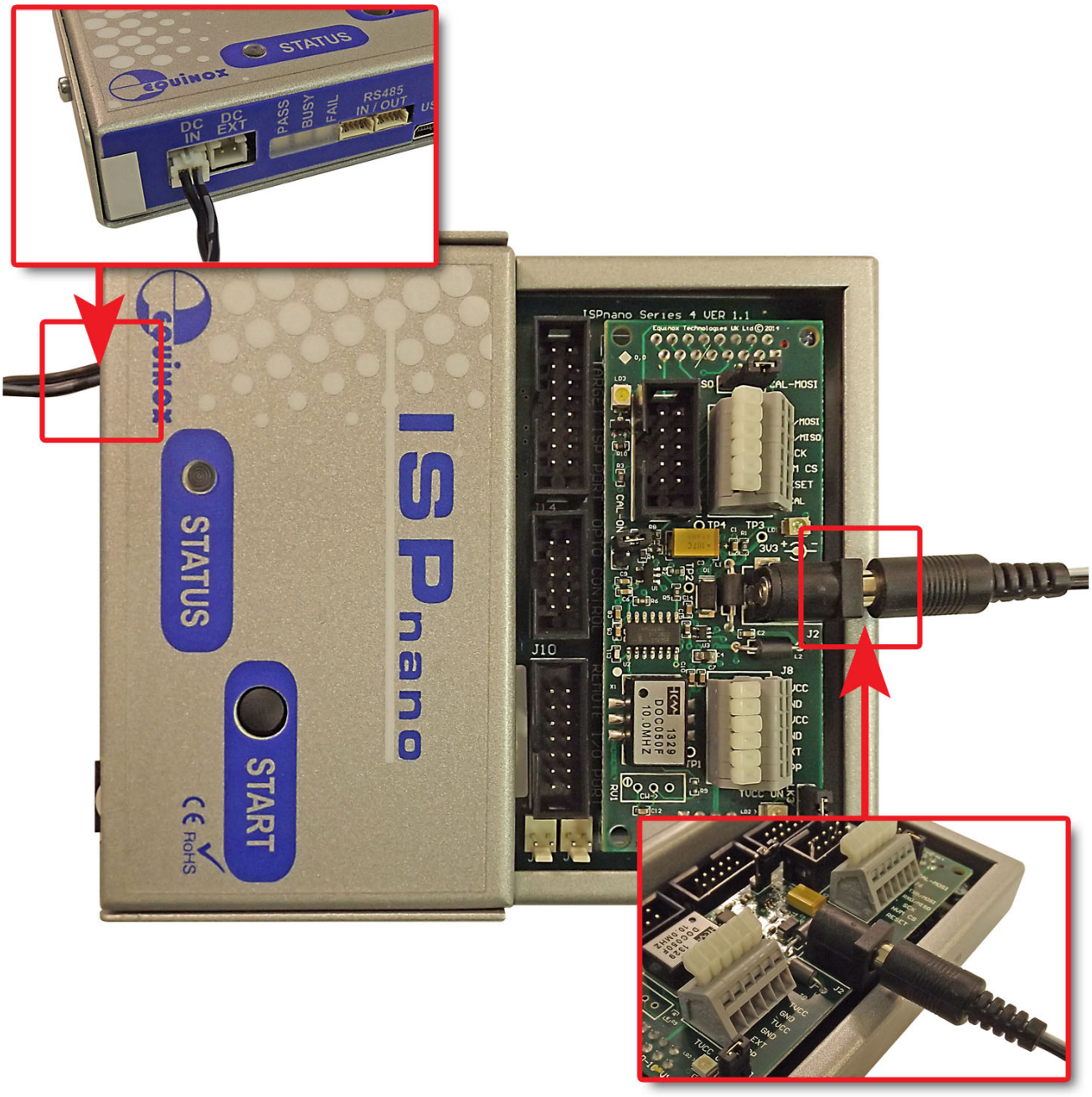
- Position the ***'IOMOD10F'*** module over the IOMOD connectors on the programmer motherboard - see picture above.
- Gently push the ***'IOMOD10F'*** module down at both ends at the same time.
- The module should lock into place on the programmer.

1.2 Powering the IOMOD10F module

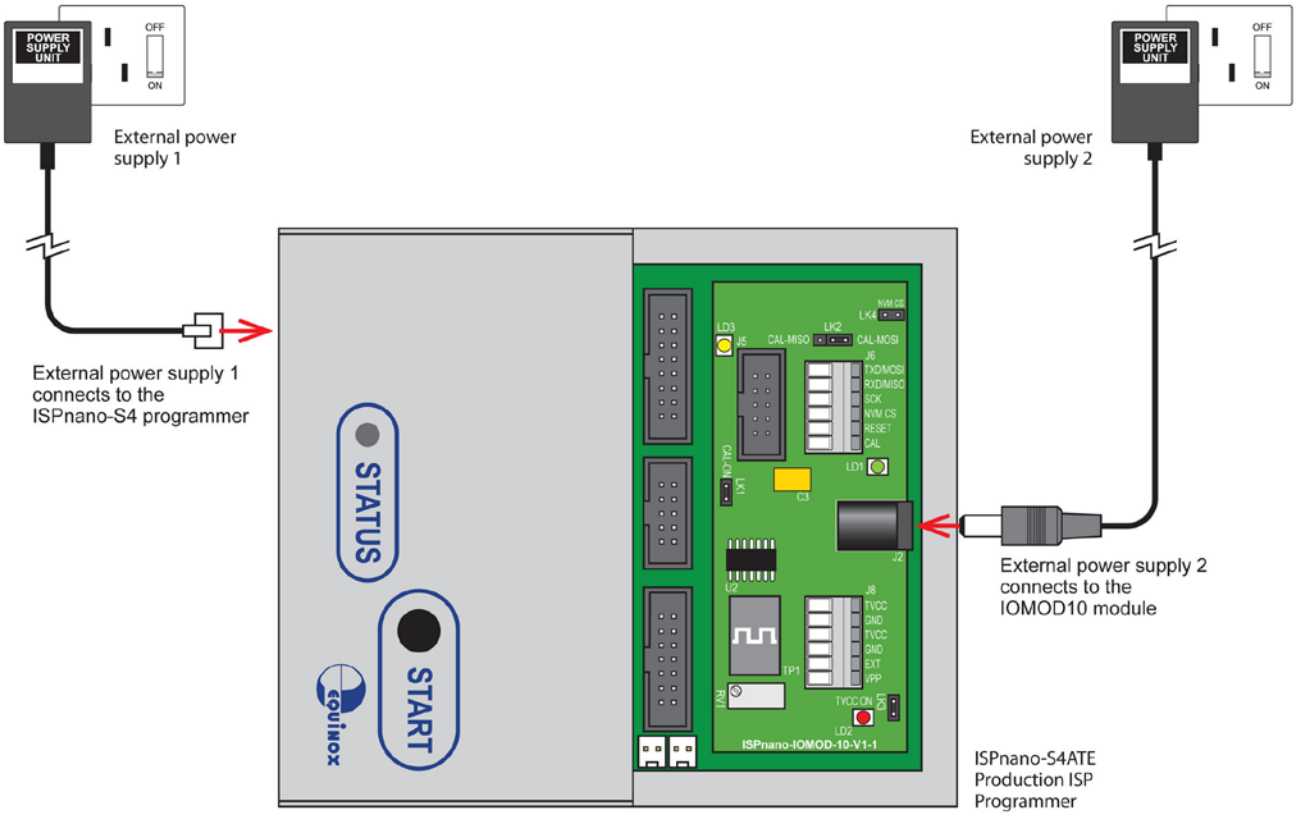
A programming / calibration system using the ***'ISPnano Series 4 ATE'*** and the ***'IOMOD10F - Oscillator Calibration Module'***, requires TWO independent power supplies. One power supply is for the ISPanno programmer and the other power supply is for the ***IOMOD10F*** module.

The ***IOMOD10F*** 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 an accurate current-limited supply.

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



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 @ 1.8A power supply for use with this module is supplied as standard by Equinox with the ***IOMOD10F*** module kit. Please use the Equinox power supply as this has been checked for use with the ***IOMOD10F*** module.

1.3 Setting up the IOMOD10F module ready for production

The ***'IOMOD10F - Z-Wave calibration module'*** is designed to be used with an Equinox **'ISPnano Series 4'** programmer.

Instructions:

- Plug the module into an Equinox **'ISPnano Series 4'** 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 jumper to select which pin the ***'Calibration frequency'*** is output on.
- Run a ***'Calibration script'*** using the Equinox ***ISP-PRO*** software utility in order to perform the ***'XTAL calibration'*** function.

1.4 Power sequencing instructions for the IOMOD10F module

It is very important to follow the power sequencing instructions below when setting up the ***IOMOD10F*** module / programmer ready for a production run.....

Instructions:

1. Apply 9.0 - 24.0V DC power to the ***ISPnano*** programmer

2. Apply 3.3V power to the ***IOMOD10F*** module via the 2.1mm jack connector

3. Wait at least 90 seconds for the OXCO module to come up to temperature.

4. It is now safe to start the programming / calibration sequence.

Important notes:

1. The power to the ***IOMOD10F*** module should be left on throughout production.

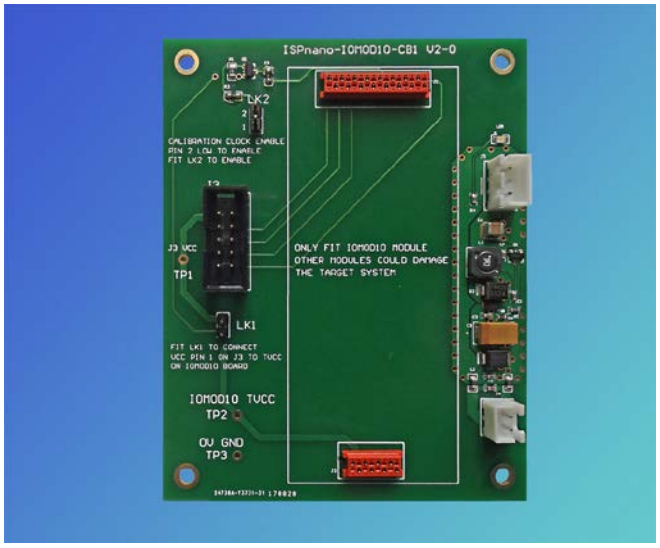
2. If the power to the ***IOMOD10F*** module is switched off (even momentarily) for any reason, you must wait at least 90 seconds before attempting any further calibrations. Failure to wait 90 seconds could result in incorrect calibration values being calculated.

Appendix 2 - IOMOD10F 'Carrier Board'

1.0 Overview

It is possible to use the ***IOMOD10F - Sigma calibration module*** without using an Equinox ***ISPnano*** programmer. This allows the module to be used for performing ***'XTAL calibration'*** when connected to a customer's own in-house ***'programming system'*** or the ***'Sigma evaluation board'***.

To use the ***IOMOD10F*** module without an ***ISPnano*** programmer, it is necessary to fit the ***IOMOD10F*** module into the ***'IOMOD10F - Carrier Board'*** - see illustrations below.....



IOMOD10 Carrier Board V2 on its own

IOMOD10 module V1.1 fitted to the IOMOD10 Carrier Board V2

The ***'IOMOD10F - Carrier Board'*** is simply a ***'base board'*** which the standard ***'IOMOD10F module'*** plugs into. The carrier board then allows an ***'external programmer'*** to connect to the ***'IOMOD10F module'*** via a 10-way IDC connector.

Important note:
The new ***V2.00 PCB*** version of the ***'Carrier Board'*** features an integrated 3.3V power supply which is used to power the ***IOMOD10F*** module.

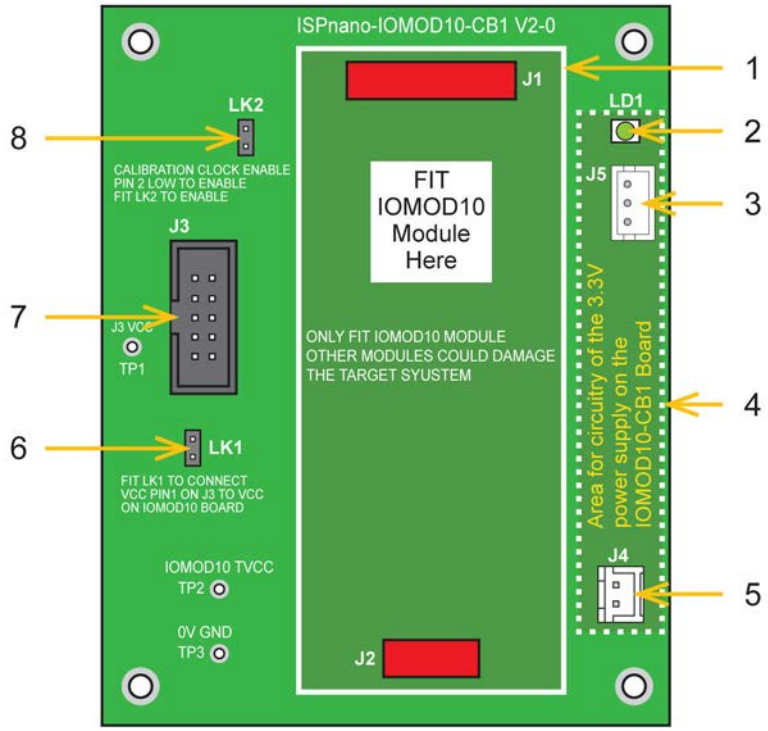
1.1 IOMOD10F - Carrier Board - features

The main features of the ***'IOMOD10F carrier board'*** are as follows:

- Simple ***'carrier board'*** which allows the ***'IOMOD10F - Sigma Calibration Module'*** to be used with an external programming system.
- Allows the ***'IOMOD10F module'*** to plug in via Micromatch mating connectors
- 10-way IDC connector (standard Equinox / Sigma SPI pin-out) to allow external programmer to plug into the carrier board.
- Connector pin for ***'Oscillator Output Enable'*** signal from external
- External power connector (2-way Molex) to allow the ***'Target VCC (TVCC)'*** to be externally powered if required.
- The actual IOMOD10F module circuitry is powered from an external 3.3V supply which is plugged into the jack socket on the IOMOD10F module itself.
- The new ***V2.00 PCB*** version of the ***'Carrier Board'*** features an integrated 3.3V power supply which is used to power the IOMOD10F module.
- All other signal and power connections are available on the ***'IOMOD10F module'*** itself.
- 4 x mounting holes to allow the ***'carrier board'*** to be mounted inside a test / programming fixture

Important note:
The ***'IOMOD10F carrier board'*** simply allows the routing of an external programmer to the ***'IOMOD10 module'***. The ***'IOMOD10F module'*** must be controlled from the external programming system.

1.2 IOMOD10F - Carrier Board - Hardware Layout



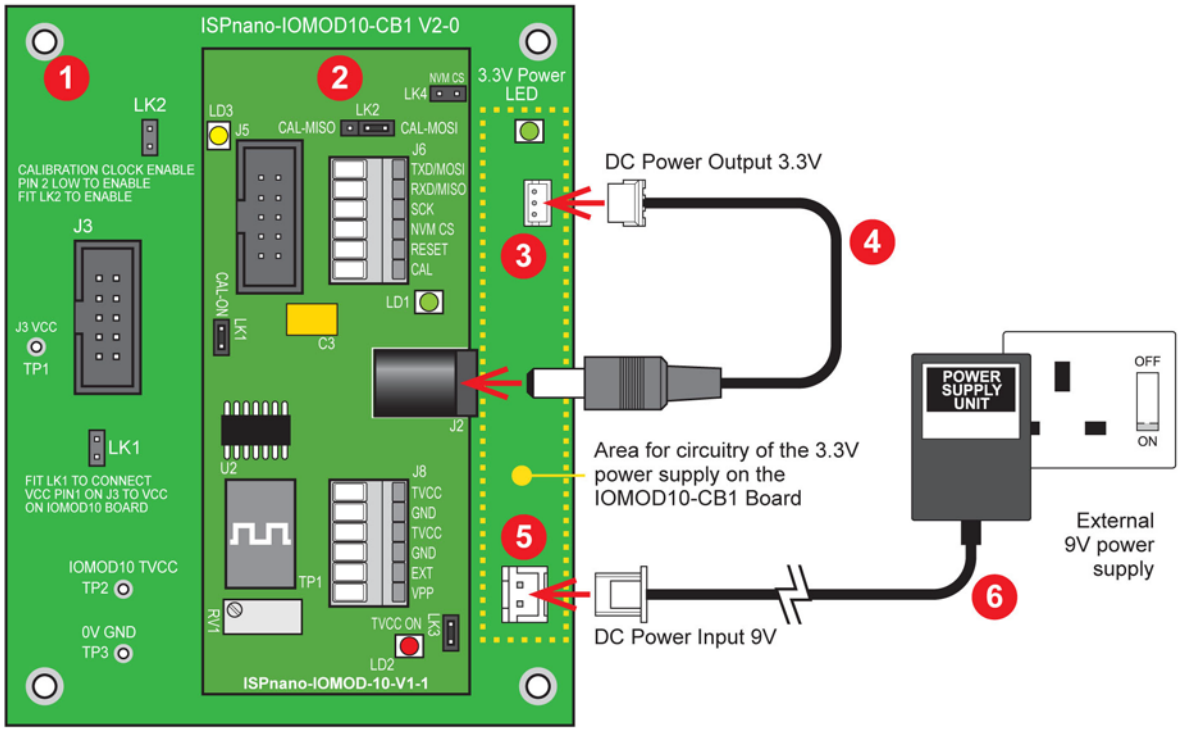
PCB Label	Diagram #	Description
CONNECTORS		
J3	7	**Programming / Calibration Signals** **Connector type:** 10-way IDC - Equinox / Sigma pin-out **Purpose:** Connect to 'external programmer' e.g. Sigma eval board
J4	5	**DC 3.3V Power Output Connector** (3-pin JST ZH Series Connector Vertical)
J5	3	**DC 9V Power Input Connector** (2-pin JST XH Series Connector Vertical)
JUMPER LINKS		
LK1	6	**Jumper Link** (Fit LK1 to connect VCC Pin 1 on J3 to TVCC on IOMOD10F Board)
LK2	8	**Calibration Clock Enable Jumper Link** (Pin 2 LOW to enable fit LK2 to enable)
LED's		
LD1	2	**Carrier Board Status LED** 3V Power Status LED (Green)

MISCELLANEOUS		
-	2	This is where the IOMOD10F module is located when fitted.
-	4	This is where the circuitry for the 3.3V power supply is located on the IOMOD10-CB1 V2.0 Board.

1.3 Powering the IOMOD10F module via the Carrier Board

The new ***version 2.0*** of the ***'Carrier Board'*** now has an on-board 3.3V power supply which generates a very accurate and stable 3.3V supply to power the ***IOMOD10F*** module circuitry. It is now possible to power the ***'Carrier Board'*** via a 9V DC supply which then generates the 3.3V supply required to power the ***IOMOD10F*** module.

The illustration below shows how to connect up the power supply to the ***'Carrier Board'*** and ***IOMOD10F*** module combination....



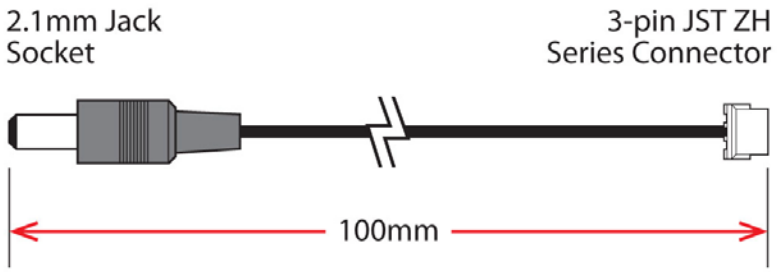
Number	PCB label	Description
1	rev 2.0	IOMOD10F ***'Carrier Board'***
2	rev V1.1	IOMOD10F - Z-Wave - XTAL calibration module
3	J5	DC 3.3V Power Output Connector J5 (3-pin JST ZH Series Connector Vertical)
4		Power Cable (3-pin JST ZH Series Connector to 2.1mm Jack Socket)
5	J4	DC 9V Power Input Connector
6		External 9V Power Supply (fitted with 2-pin JST XH Series Connector)

Instructions:
The instructions detailed below explain how to connect power to the ***IOMOD10F*** / ***Carrier Board*** combination. Steps 1 - 3 should already have been carried out by Equinox so you can start at step 4.

1. Place the ***'Carrier Board'*** on a flat surface.

2. Carefully plug the ***IOMOD10F*** module into the ***'Carrier Board'***.

3. Connect the power cable shown below between the ***'Carrier Board'*** and the ***IOMOD10F*** module



4. Plug the external 9V Power supply into the 2-pin ***'Power input'*** on the ***'Carrier Board'***.

5. Switch on the external 9V Power supply

--> The ***'Power LED'*** on the ***'Carrier Board'*** should illuminate.
--> The power supply on the ***'Carrier Board'*** then feeds 3.3V to the ***IOMOD10F*** module via the jack socket.
--> The ***'Power LED'*** on the ***IOMOD10F*** module should illuminate.

6. Wait at least 90 seconds for the OXCO module on the IOMOD10F to come up to temperature.

7. It is now safe to start the programming / calibration sequence.

Warnings!
1. The power to the Z-Wave Target System must be switched **OFF BEFORE** connecting it to the IOMOD10F module. **Do NOT connect when the target board is live!**

2. The power to the Z-Wave Target System must be switched OFF and any residual energy stored in the system **must be fully discharged BEFORE the Target System is disconnected** from the IOMOD10F module.

Appendix 3 - Interfacing the IOMOD10F carrier board to the Sigma eval module

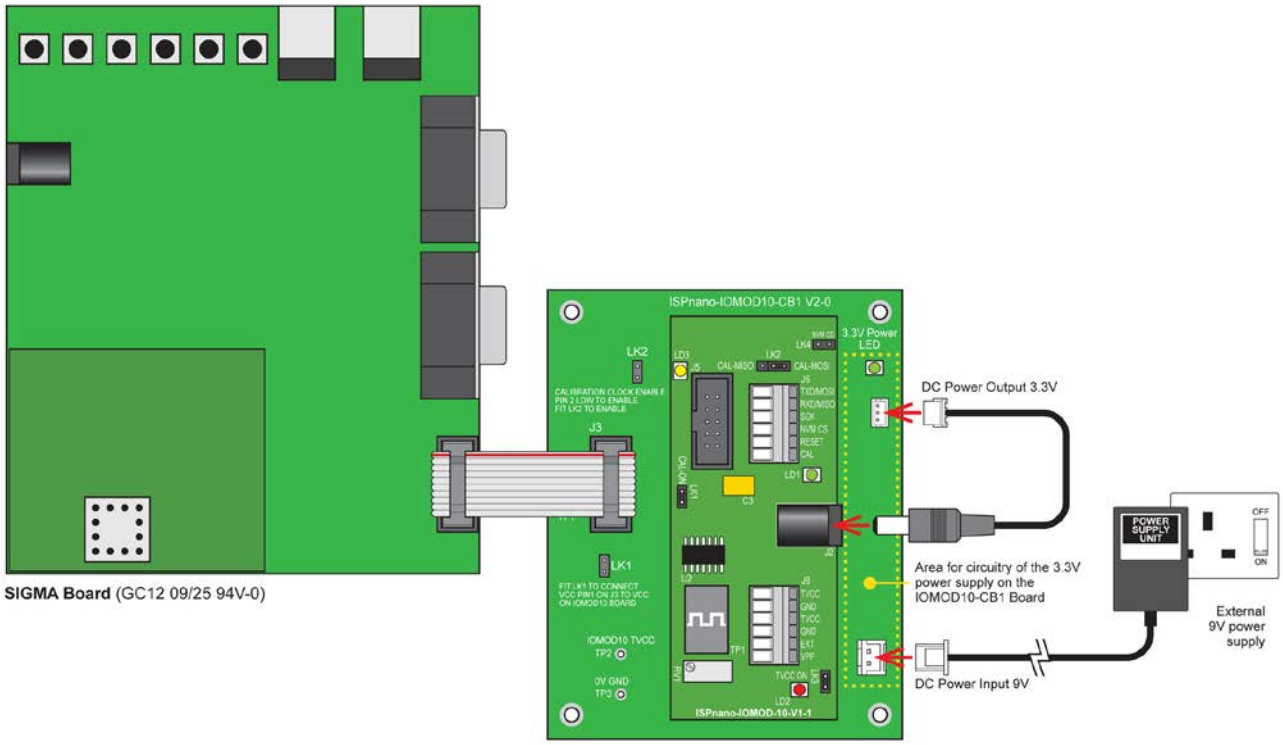
1.1 Overview

The ***'IOMOD10F module'*** can be interfaced to the ***'Sigma Eval Module / programmer'*** by using the ***'IOMOD10 carrier board'***. The ***'Carrier board'*** features a 10-way IDC connector with the standard Equinox / Sigma pin-out allowing the external programmer to connect to the ***'IOMOD10F module'***.

For detailed instructions for setting up this configuration, please refer to the Sigma Design document: ***INS12524 - 500 Series Calibration User Guide***

1.2 Connecting the IOMOD10F to the Sigma Eval Module

The illustration below shows how the ***'Sigma evaluation module'*** connects to the ***'IOMOD10F carrier board'*** via a 10-way IDC cable.....



Important note:
The actual control of the ***'Calibration Frequency'*** signal must be implemented manually.
Please contact Sigma Designs for instructions and technical support for this mode of operation.

Appendix 4 - Interfacing the IOMOD10F module to a Z-Wave target system

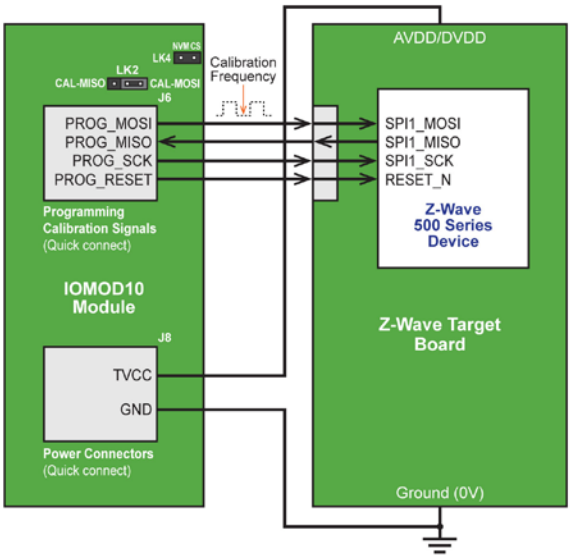
1.0 Overview

This section details how to connect the ***IOMOD10F*** module to a Z-Wave target system.

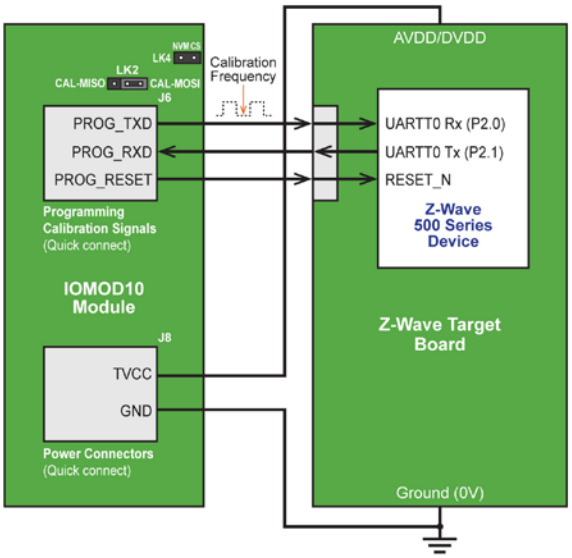
The ***IOMOD10F*** module supports the following Z-Wave device ***'programming interfaces'***.....

Interface		Comment
SPI	SPI programming Port	Uses an ***SPI Port + RESET_N*** pin as an In-System Programming (ISP) interface.
UART	UART programming port	Uses a ***2-pin UART interface + RESET_N*** pin as an In-System Programming (ISP) interface.

The illustrations below detail the connections required between the ***IOMOD10F*** module and the target 500 series Z-Wave device for both the ***'SPI interface'*** and ***'UART interface'***.



SPI interface



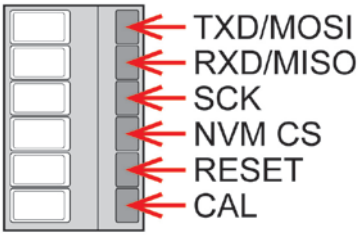
UART interface

The next sections give detailed examples of how to connect the ***IOMOD10F*** module to a Z-Wave target system via either the ***'SPI'*** or ***'UART'*** interface.

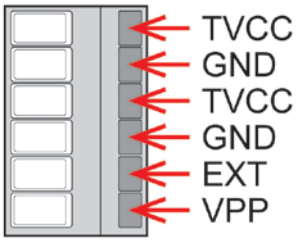
1.1 IOMOD10F - SPI interface via separate wired signal connections

The illustration below shows how to connect the **IOMOD10F** module to a 500 series Z-Wave **Target Board (DUT)** via the ***'SPI programming interface'*** using the ***'Quick Connect'*** connectors J6 and J8.

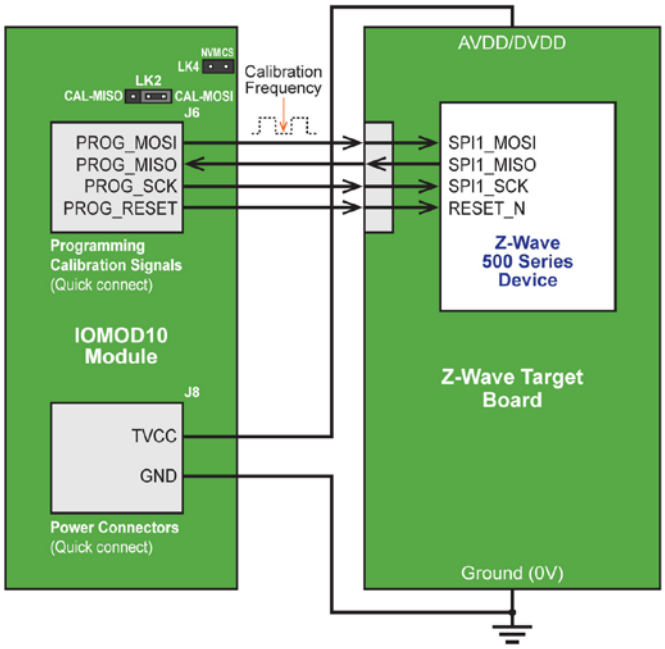
Quick Connect - J6



Quick Connect - J8



SPI Interface pin-out

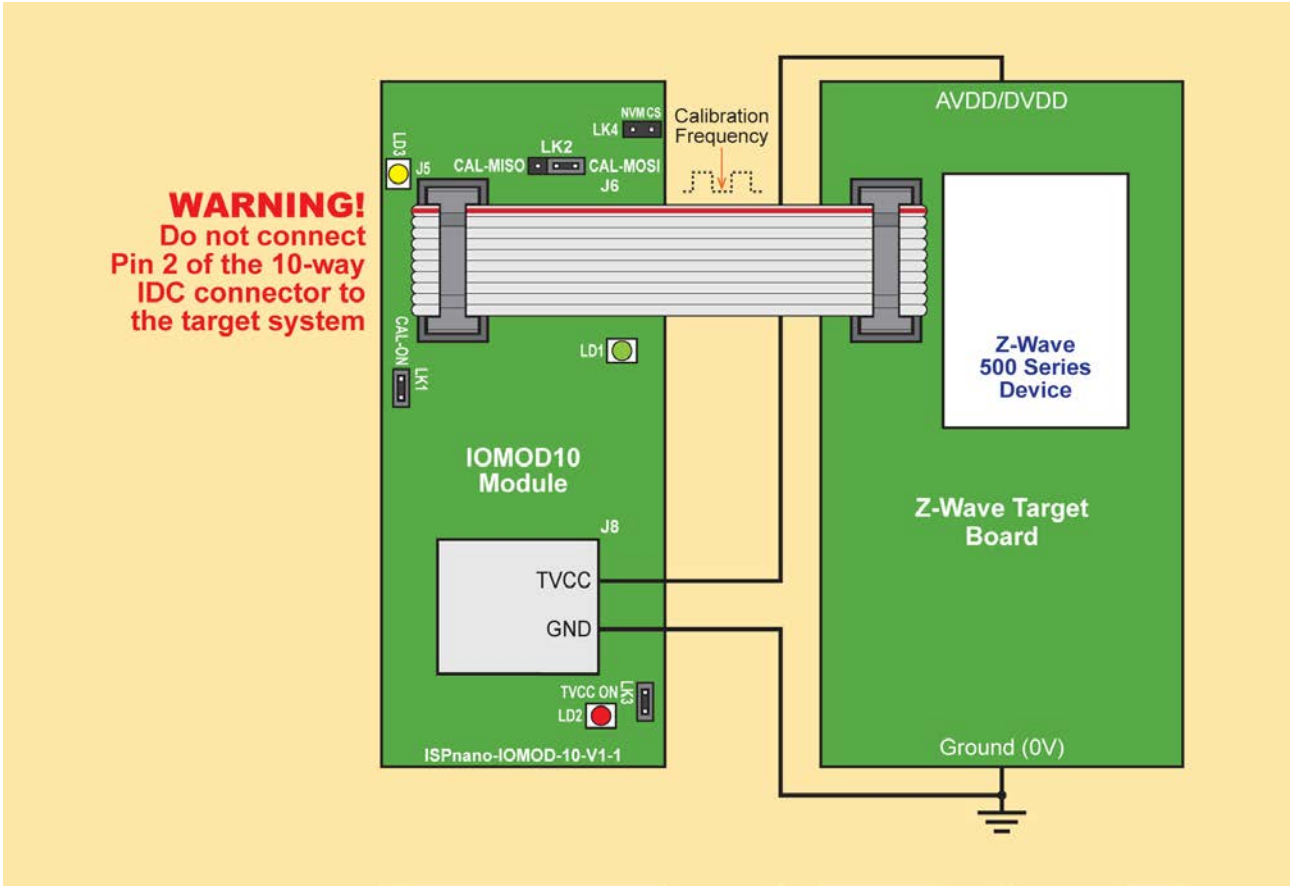


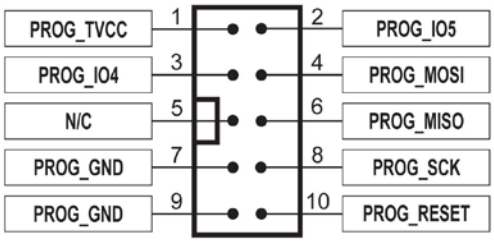
The table below details the connections required between the ***IOMOD10F*** module and Z-Wave device.

ISPnano Pin name	IOMOD10F module pin label	ISPnano Input / Output	Connect to pin on target Z-Wave device	Notes
I/O4	**NVM CS**	O	NVM CS (Chip Select) *Optional connection	**Chip Select (CS)** pin for external NVM device (optional - fit jumper link LK4)
I/O3	**SCK**	O	SCK	SPI - Serial Clock
I/O2	**RXD / MISO**	I	MISO	SPI - MISO
I/O1	**TXD / MOSI**	O	MOSI	SPI - MOSI
RESET	**RESET**	O	RESET_N	RESET for Z-Wave device
GND	**GND**	P	Signal GROUND (0V)	Signal Ground Connection
TVCC	**TVCC**	P	Target VCC	Connect to Z-Wave VCC power rail
EXT-VCC	**EXT**	-	N/C	Not Connected

1.2 IOMOD10F - SPI interface via 10-way IDC connector

The illustration below shows how to connect the **IOMOD10F** module to a 500 series Z-Wave **Target Board (DUT)** via the ***'SPI programming interface'*** using the ***'10-way IDC'*** connector (J5) on the **IOMOD10F** module.



J5 SPI	**Equinox standard 10-way 0.1" pitch IDC Box Header** **SPI Interface pin-out**	**SPI Interface pin-out**  *Do NOT connect pin 2 (PROG_IO5) of the IDC connector to a Sigma Target Board!

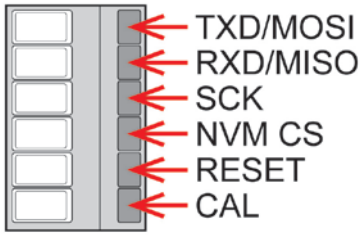
Notes:

1. The ***'Z-Wave target board'*** must be fitted with a 10-way IDC connector with the identical pin-out to the connector on the ***IOMOD10F*** module - see pin-out description above.
2. A 10-way IDC ribbon cable should then be connected between the ***IOMOD10F*** module and the ***'Z-Wave target board'***.
3. Power connections - always use separate wired connections for GROUND (0V) and TVCC.

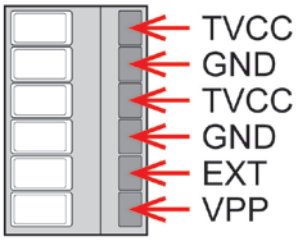
1.3 IOMOD10F - UART interface via separate wired signal connections

The illustration below shows how to connect the ***IOMOD10F*** module to a 500 series Z-Wave Target Board (DUT) via the ***'UART programming interface'***.

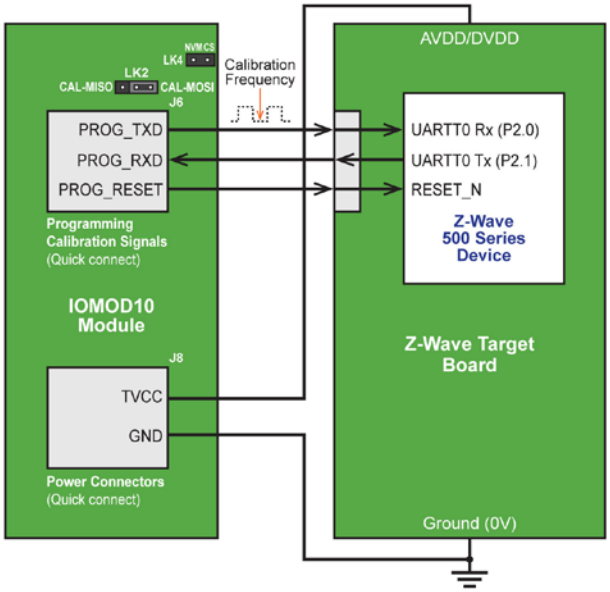
Quick Connect - J6



Quick Connect - J8



UART Interface pin-out



The table below details the connections required between the ***IOMOD10F*** module and Z-Wave device.

ISPnano Pin name	IOMOD10F module pin label	ISPnano Input / Output	Connect to pin on target Z-Wave device	Notes
I/O4	**NVM CS**	O	No connection	**Chip Select (CS)** pin for external NVM device (optional - fit jumper link LK4)
I/O3	**SCK**	O	No connection	
I/O2	**RXD / MISO**	I	TXD	Programmer UART receive
I/O1	**TXD / MOSI**	O	RXD	Programmer UART transmit
RESET	**RESET**	O	RESET_N	RESET for Z-Wave device
GND	**GND**	P	Signal GROUND (0V)	Signal Ground Connection
TVCC	**TVCC**	P	Target VCC	Connect to Z-Wave VCC power rail
EXT-VCC	**EXT**	-	No connection	Not Connected

Notes:

1. The programmer UART ***TXD*** TRANSMIT pin connects to the Z-Wave device ***RXD*** RECEIVE pin.
2. The programmer UART ***RXD*** RECEIVE pin connects to the Z-Wave device ***TXD*** TRANSMIT pin.
3. There is no ***'external NVM memory'*** device accessible via the ***'UART interface'***.