Crystal Calibration - Oscillator Module

IOMOD14

ISPnano-IOMOD-14 V2.0

IOMOD14

Crystal (XTAL) Calibration-Oscillator Module V2.0
for the Silicon Labs Z-Wave 500 Series of ICs and modules

Hardware User Manual

Contents

IOMOD14

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Copyright Information

Information in this document is subject to change without notice and does not represent a commitment on the part of the manufacturer.

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 plus 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).

Exceptions to warranty

Over-voltage damage

This warranty does not cover damage to the **IOMOD14** module due to voltages beyond the specified voltage limits being applied to the 'DC Power Input' or any of the ISP Headers or connectors. The user must ensure that sufficient care is taken to avoid over-voltage and static conditions (ESD) on any of the **IOMOD14** I/O connector pins.

Over-current damage

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

IOMOD14 - 'Line Driver Circuitry' damage due to catastrophic ESD event

The **IOMOD14** module features **'Line Driver Circuitry'** which interfaces to the Target system (DUT). This circuitry is very well protected from ESD events. However, it can still be damaged by excessive current flowing through the **'analogue switch'** components in the event of a large electrostatic discharge. The user must ensure that the **IOMOD14** remains constantly powered at 9.0V and the target system must be OFF (discharged) before being connected or disconnected from the module.

Electromagnetic Compatibility (EMC) Compliance

The *'IOMOD14 - 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.

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 IOMOD14 module.

Warning!
Any damage caused to the programmer by Electrostatic Discharge (ESD) through incorrect earthing or power supply issues 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.**
- Silicon Labs Design document: *INS12524 - 500 Series Calibration User Guide*

► **Application Notes**
AN145 - AN145 Silicon Labs 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 IOMOD14 - Z-Wave Calibration Module (Fixed frequency version)

1.0 Overview

The *'IOMOD14'* module has been specially designed to support *'XTAL calibration'* of the **Z-Wave 500 series** ICs and modules from **Silicon Labs**.
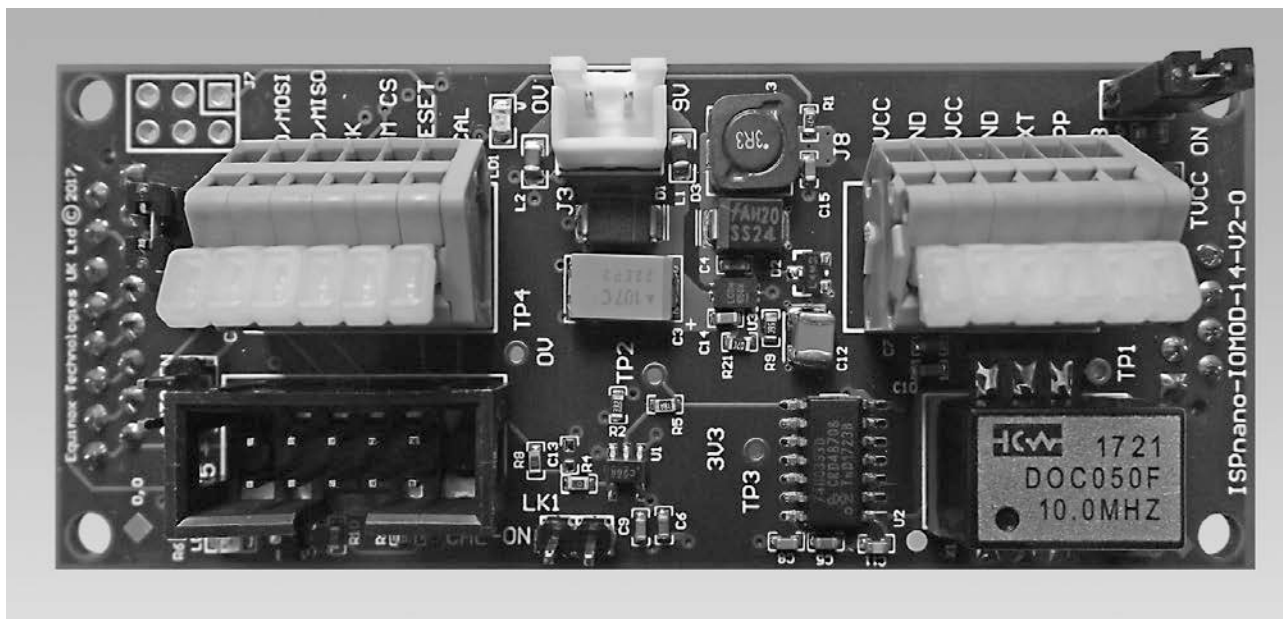
The module generates a very accurate **'Calibration frequency'** (Fcalbuf) of 39.0625 kHz which can be switched to the target **Z-Wave** device under programmer control.

1.1 IOMOD14 module - main features

The main features of the *'IOMOD14'* module are as follows….

- Generates a very accurate *'Calibration frequency'* (39.0625 kHz) for use during the *'XTAL calibration'* procedure of a **Silicon Labs Z-Wave 500 series** devices and modules.
- 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
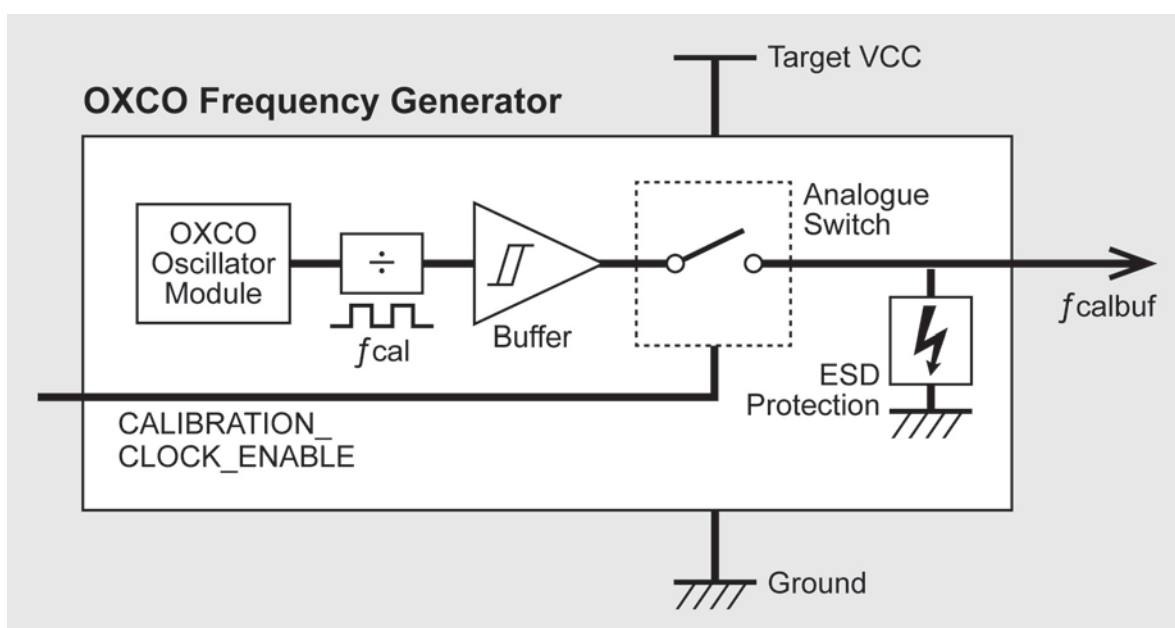- Quick-connect connector for connecting power signals TVCC, TVPP, E-VCC
- 10-way IDC connector (Equinox / Silicon Labs SPI pin-out) to allow direct connection to any Z-Wave evaluation board
- *'Target Power'* LED - illuminates when the programmer switches the TVCC supply on
- The *'Calibration frequency'* 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 IOMOD14 module - additional features compared to IOMOD10

The *'IOMOD14'* module has the following additional features compared to the older *'IOMOD10'* module....

- Integrated 9V to 3.3V switch-mode power supply - the module now powers from a standard Equinox 9.0V supply (same as ISPnano programmer)
- The *'Programmer - SPI - SCK'* signal is now fully buffered using a *'Clock buffer'* circuit on the IOMOD14 module.
- Supports programming of external *'SPI FLASH memory'* devices due to buffered *'Programmer - SPI - SCK'* signal.
- Programmable *'RESET_N'* frequency @ 500 Hz for keeping Z-Wave device in reset when programming an external *'SPI FLASH memory'* device.

1.3 Principle of operation of the IOMOD14 module

The *'IOMOD14 - Calibration Module'* is simply a hardware block which generates a very accurate / stable **'Calibration frequency'** for use with the **'Z-Wave calibration firmware'** from Silicon Labs.

The module must be controlled from an **'external system'** which could be an Equinox programmer, Silicon Labs 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 **IOMOD14** module.

IOMOD14
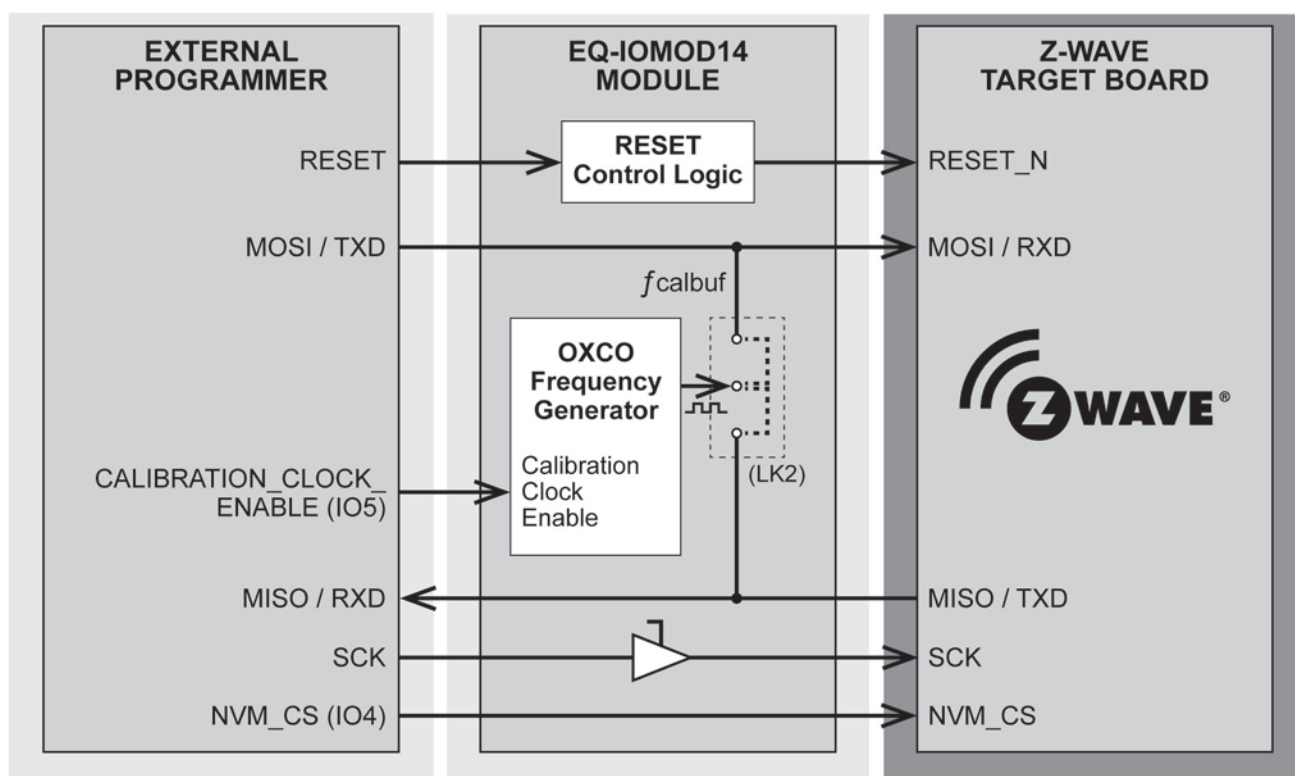
1.4 Explanation of Programming and Calibration modes

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'* is switched off.
Programming	**LOW**	• During normal *'programming operations'*, the **MOSI / TXD** signal from the *'external programmer'* passes unchanged through the **IOMOD14** module. • The *'Programmer SCK'* signal is buffered on the **IOMOD14** module and this buffer is enabled when the programmer is in 'programming' mode.
Calibrating	**HIGH**	• When the *'CAL_ENABLE'* pin is set to *'HIGH'* 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'.* • The *'Programmer SCK'* signal buffer is now automatically disabled so the SCK pin is not driven during the calibration mode.

1.5 OXCO - Frequency Generator block

The **'OXCO Frequency Generator'** block on the **IOMOD14** 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...
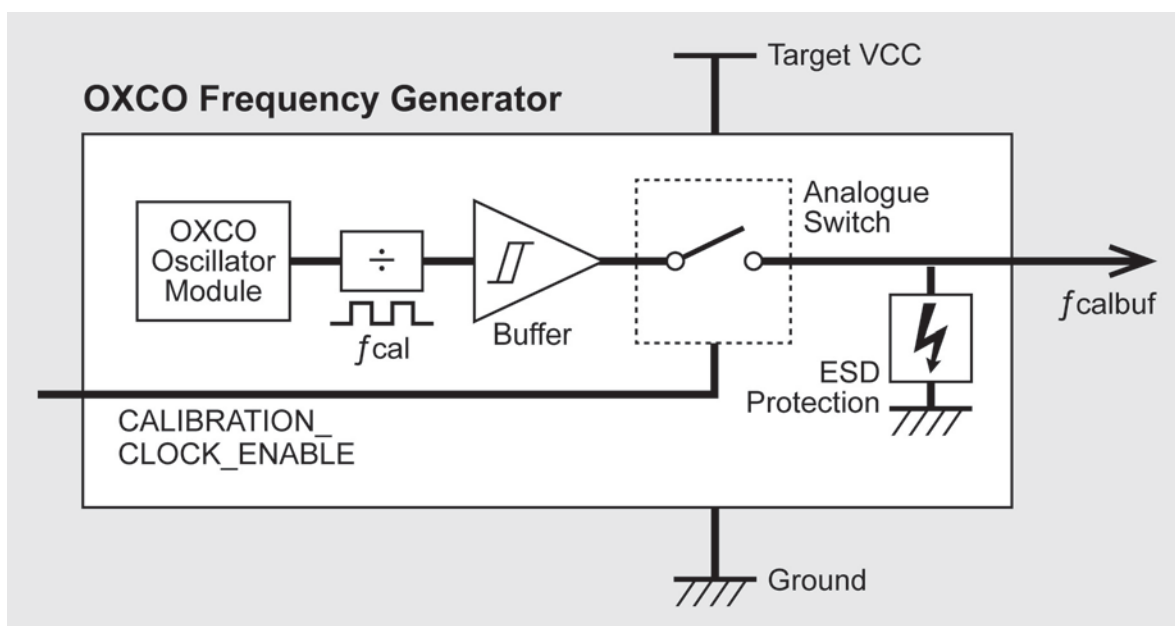
#	Functional block / signal	Further information
1	**OXCO Oscillator Module**	This is a totally self-contained OXCO module which generates a very accurate / stable fixed frequency of 10 MHz.
2	**Divider network**	The output frequency of the OXCO module is then divided down by 256 to give the required 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 IOMOD14 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

IOMOD14

1.6 IOMOD14 module - control methods

The table below outlines possible methods of controlling the *'IOMOD14'* 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	Silicon Labs - Evaluation board / programmer	A separate *'IOMOD14 - Carrier Board'* is required. Please contact Silicon Labs technical support for further information about this configuration.
3	Custom factory programming hardware	Please contact either Equinox Technologies or Silicon Labs to discuss your production requirements. A separate *'IOMOD14 - Carrier Board'* is required.

IMPORTANT NOTE!

The *'IOMOD14 - calibration module'* must be controlled by an *'external control system'*.
The module cannot be used standalone to perform the calibration process.

2.0 IOMOD14 - General Product Information

2.1 Ordering information
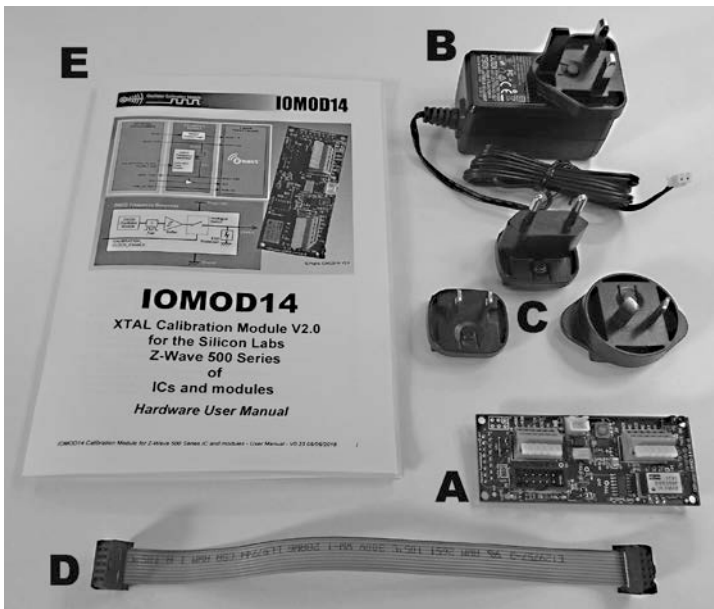
This table below details the order codes for the IOMOD14 calibration system....

See Section	Kit Order Code	Product Availability
2.2	EQ-IOMOD14-KIT	NOW

2.2 IOMOD14 kit (module only) - Kit contents

The *IOMOD14* module when ordered as an *'IOMOD14 kit'* (Order code: *EQ-IOMOD14-KIT*) comes with the following components.

Hardware:		
A	1 x IOMOD14 V2.0 module (actual *'Calibration Module'* hardware)	
B	1 x 9V Power Supply (mains power supply adaptor)	
C	1 x set of mains plug adaptors - UK, USA, European, Asia	
D	1 x 10-way 0.1" pitch IDC cable	
Documentation:		
E	1 x *IOMOD14* - User Manual (printed)	

3.0 IOMOD14 - Hardware layout

3.1 IOMOD14 module - Hardware layout overview

The illustration below shows the relevant hardware items on the *'IOMOD14'* module......
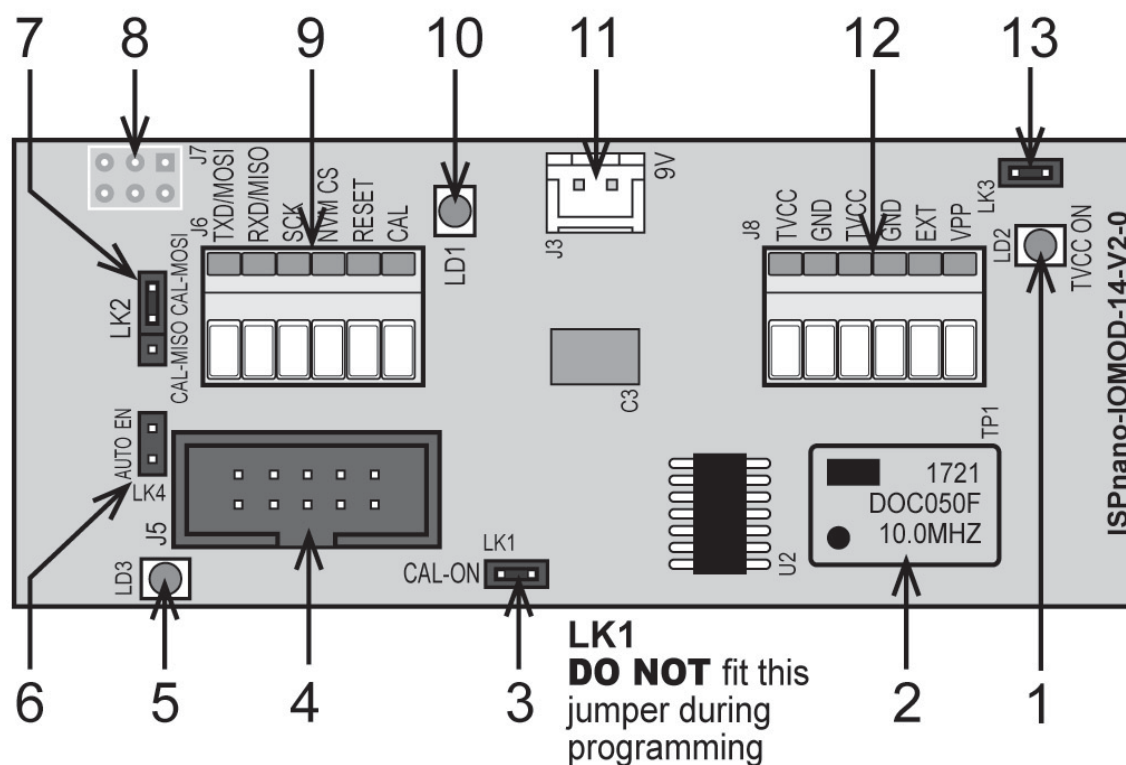
PCB Label	Diagram #	Functional description
CONNECTORS		
J3	11	**DC Power Input** (2-Pin JST Connector)
J5	4	**Programming / Calibration Signals** **Connector type:** 10-way IDC - Equinox / Silicon Labs pin-out **Purpose:** Connect to Z-Wave target board
J6	9	**Programming / Calibration Signals** (Quick connect connector) **Connector type:** Quick connect connector **Purpose:** Connect 'programming signals' to target Z-Wave device / fixture probe pins
J7	8	
J8	12	**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	13	**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.
Status indicators (LEDs)		
LD1	10	**Power supply status** - 3.3V Power Status LED (Green)
LD2	1	**Target VCC (TVCC) Power status LED (RED)**
LD3	5	**Calibrated Oscillator signal** - Enabled / Active (Yellow)
OSCILLATOR MODULE		
TPI	2	**OXCO - Oscillator Module**

3.2 IOMOD14 module - Connector overview

The connectors on the *IOMOD14* 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** 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 *Do NOT connect pin 2 (PROG_IO5) of the IDC connector to a Silicon Labs Target Board!
J5 UART	**Equinox standard 10-way 0.1" pitch IDC Box Header** **UART Interface pin-out**	**UART interface pin-out** PROG_TVCC (1) (2) PROG_IO5 PROG_IO4 (3) (4) PROG_TXD N/C (5) (6) PROG_RXD PROG_GND (7) (8) PROG_IO3 PROG_GND (9) (10) PROG_RESET *Do NOT connect pin 2 (PROG_IO5) of the IDC connector to a Silicon Labs Target Board!
J6	**Programming \ Calibration Signals** (Quick connect connector)	TXD/MOSI RXD/MISO SCK NVM CS RESET CAL
J8	**Power Connectors** (Quick connect connector)	TVCC GND TVCC GND EXT VPP

3.3 IOMOD14 module - Status indicator LEDs

The *IOMOD14* module features 3 x *'Status LEDs'* as shown in the illustration below....
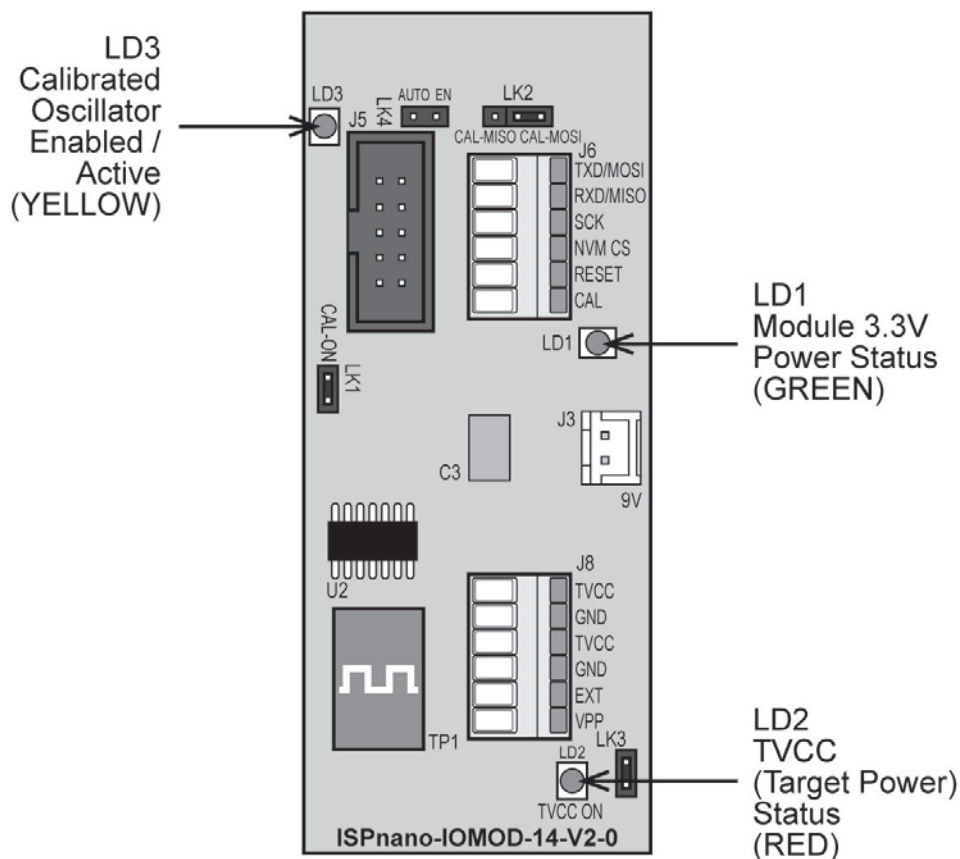
The function of each *'Status LED'* is explained in the table below....

LED	Colour	Description
LD1	GREEN	**IOMOD14 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.

3.4 OXCO - Oscillator Module (temperature compensated)

The *'OXCO Oscillator Module'* fitted to the *IOMOD14* 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.
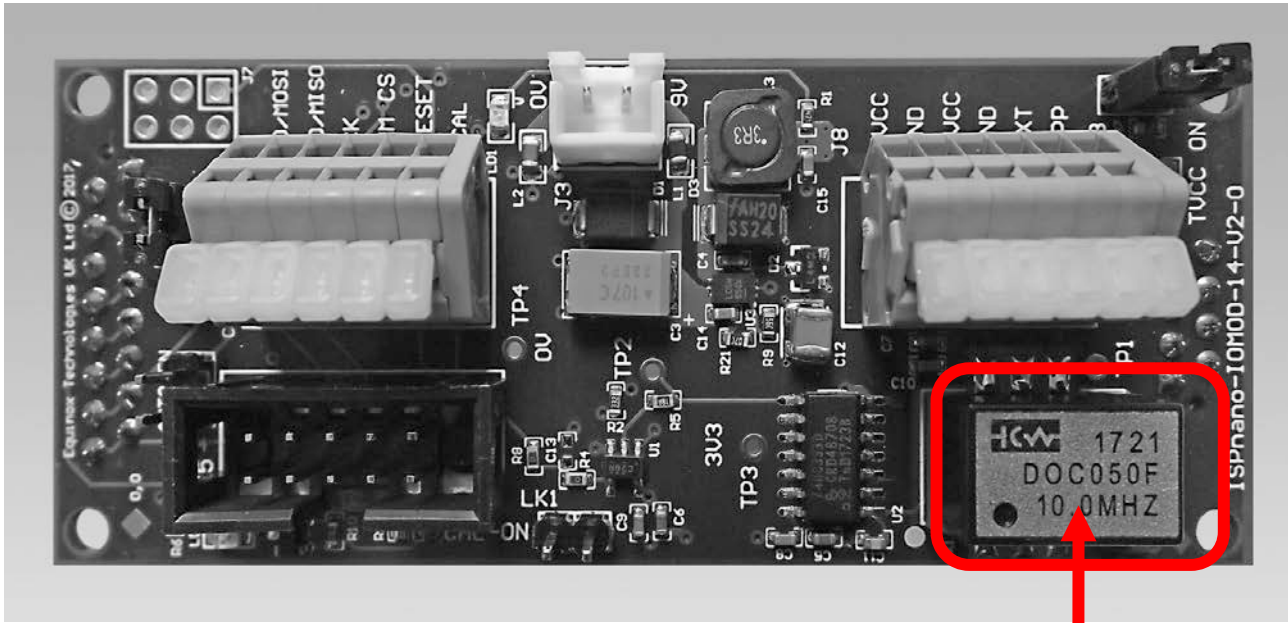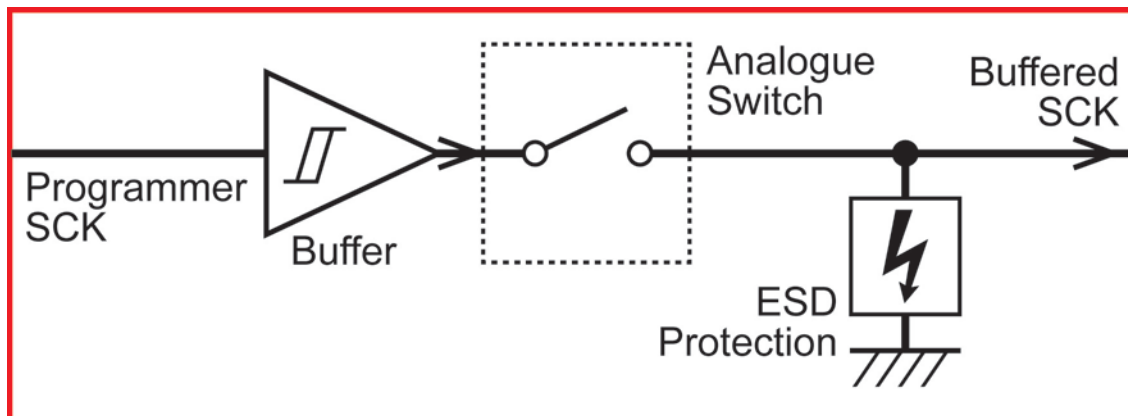

OXCO Module - Warning this component gets very hot!!!

3.4 Programmer SCK clock buffering

The **IOMOD14** module buffers the **'Programmer SCK'** signal from the programmer to the Z-Wave target system as shown in the diagram below.

This hardware feature has been introduced to clean up the **'SCK clock signal'** from the programmer so that is has fast enough signal edges to allow the programmer to work with modern external SPI FLASH / EEPROM memory devices.

This allows the **IOMOD14** module to program an NVM device (external SPI FLASH / EEPROM memory device) which is connected to the same SPI bus as a Z-Wave device. The older **IOMOD10** module does NOT support this feature.

3.5 IOMOD14 - Operating specifications

The table below details the main operating characteristics of the *IOMOD14* module.

Parameter	Minimum	Nominal	Maximum	Units	Notes
Temperature range	0	25	70	deg. C	
IOMOD10 Supply Voltage (via 2-pin JST connector)	8.8	9.0	9.5	V	
Supply current (at start-up from cold) taken from external 9.0V supply	TBD	300	TBD	mA	see Note 1
Supply current (steady-state) taken from external 9.0V supply	110	130	TBD	mA	see Note 2
OXCO Warm-up time	-	-	60	seconds	see Note 3
OXCO output frequency		10.00	-	MHz	see Note 4
Calibration output frequency (fcalbuf)	-	39.0625	-	kHz	see Note 5

Note 1:
When the *IOMOD14* module is first powered up from 'cold', it will take a very high current from the external 9.0V supply for an extended period of time known as the *'OXCO Warm-up time'*. This high current is due to the OXCO 'oven heater' switching on to heat up the OXCO module.

It is therefore very important that the correct 9.0V power supply capable of supplying the initial start-up current is used to power the IOMOD14 module.

Note 2:
Once the OXCO has been heated to the correct operating temperature, the OXCO module current will then decrease to the 'steady-state' value shown in the table. The current will then remain at this lower value as long as power remains switched on to the OXCO module.

Note 3:
The *'OXCO Warm-up time'* is the time taken from when the *IOMOD14* module is first powered up from 'cold' to when the OXCO module has reached its operating temperature. The datasheet for the OXCO module states 60 seconds, so it recommended that the programmer waits at least 90 seconds before using the *IOMOD14* module to perform the first calibration operation.

Note 4:
The *'OXCO output frequency'* if the frequency which comes out of the OXCO module BEFORE it is divided down to make the *'Calibration output frequency'*. This frequency is NOT used for calibration purposes.

Note 5:
The *'Calibration output frequency (fcalbuf)'* is the final signal waveform used for calibration purposes.

4.0 IOMOD14 - Configuration link settings

4.1 Overview

The *'IOMOD14'* 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.

4.2 Link 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)**

4.3 Link LK2 - Calibration Clock Output Pin selection

The *'LK2'* jumper link is used to select which output pin on the *IOMOD14* 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...
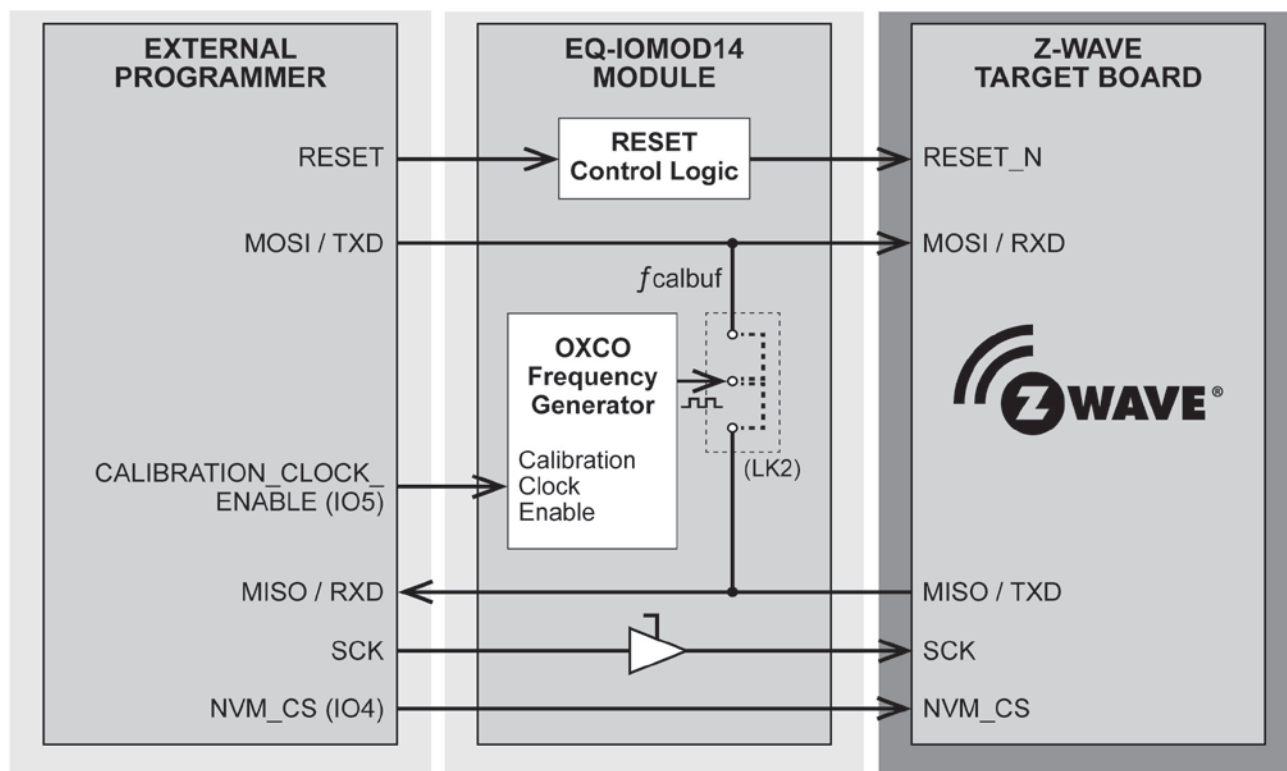
Please refer to the table below which shows the settings for the *LK2* jumper link.

Jumper position	Jumper setting	Calibration frequency output pin from the IOMOD14 module
1 - 2	1-2 CAL-MISO	SPI - MISO / programmer UART - RXD
2 - 3	2-3 CAL-MOSI	SPI - MOSI / programmer UART TXD* (default setting)

Notes:

* The *'UART - TXD'* is the programmer TRANSMIT pin which is connected to the target Z-Wave *'UART - RXD'* (RECEIVE) pin.

4.4 Link 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 **IOMOD14** circuitry is actually running from.
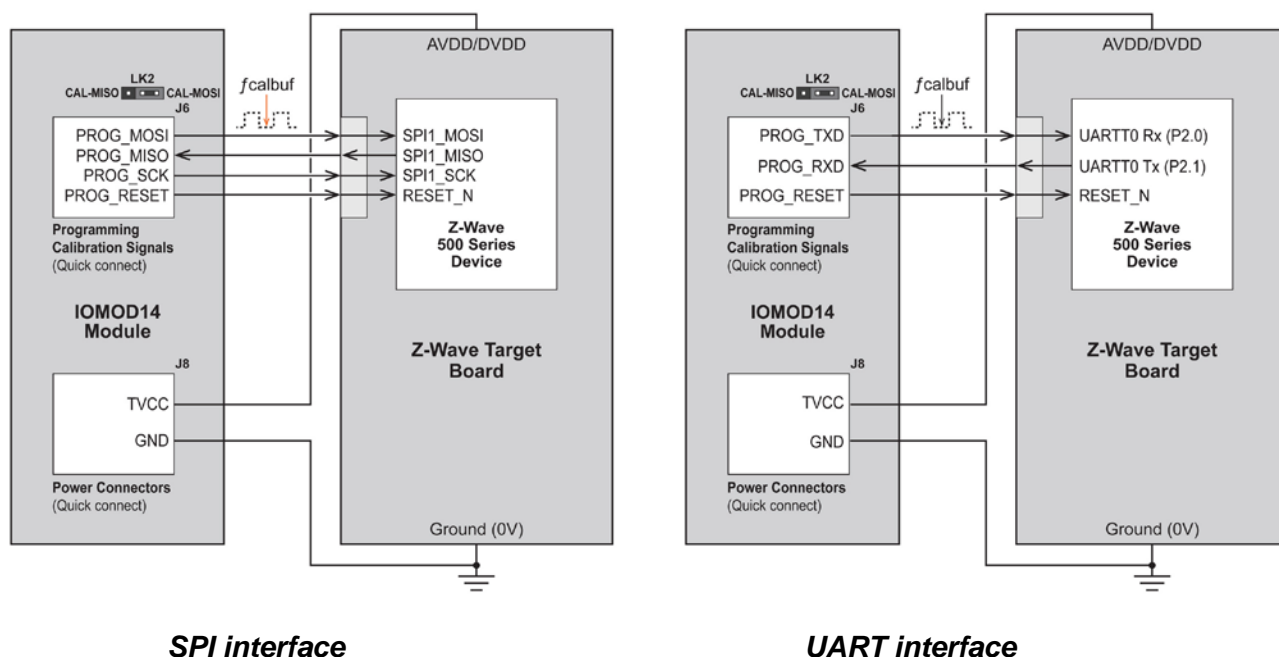
4.5 Link LK4 - Not fitted

The jumper link *'LK4'* must not be fitted on the **IOMOD14** module.

5.0 Connecting IOMOD14 module to a Z-Wave target system

5.1 Overview

The illustrations below detail the connections required between the *IOMOD14* module and the target 500 series Z-Wave device for both the *'SPI interface'* and *'UART interface'*.
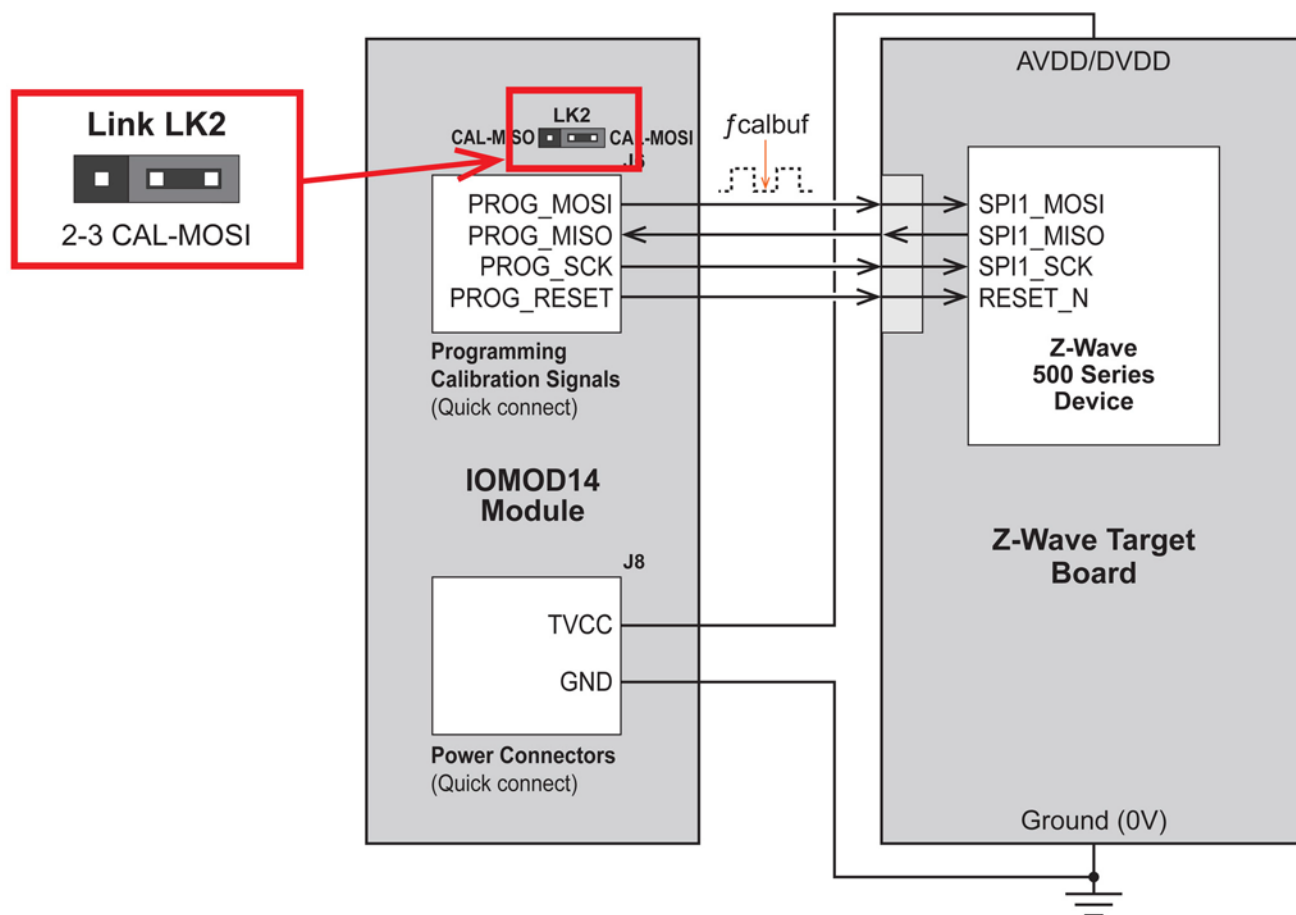

| SPI interface | UART interface |

The table below details the connections required between the *IOMOD14* module and the target Z-Wave device for both *'SPI'* and *'UART'* interfaces.

ISPnano Pin name	IOMOD14 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
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

5.2 Connecting to a Z-Wave device via the 'SPI Interface'

This section describes how to connect the IOMOD14 module to Z-Wave device using the *'SPI'* interface.

ISPnano Pin name	IOMOD14 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
I/O3	**SCK**	O	SCK	SPI - Serial Clock
I/O2	**MISO**	I	MISO	SPI - MISO
I/O1	**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

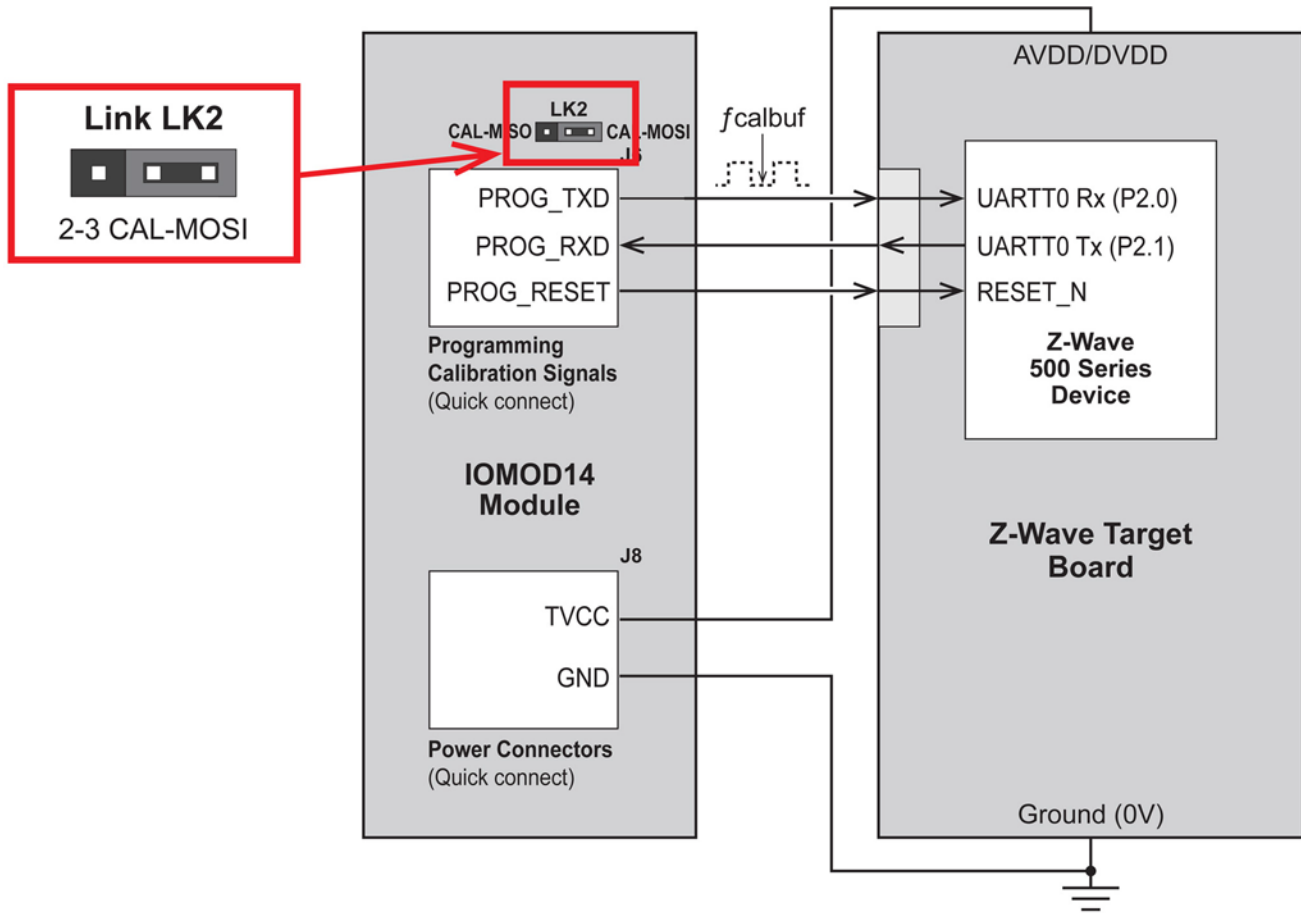## 5.3 Connecting to a Z-Wave device via the 'UART Interface'

This section describes how to connect the IOMOD14 module to Z-Wave device using the *'SPI'* interface.

ISPnano pin name	IOMOD14 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
I/O2	**RXD**	I	TXD	Z-Wave --> Programmer
I/O1	**TXD**	O	RXD	Programmer --> Z-Wave
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

* The *'UART - TXD'* is the programmer *TRANSMIT* pin which is connected to the target Z-Wave *'UART - RXD'* (RECEIVE) pin.

Crystal Calibration - Oscillator Module

Appendix 1 - Using IOMOD14 module with ISPnano Series 4 programmer

1.0 Overview

This appendix describes how to use the '*IOMOD14'* module with an Equinox '**ISPnano Series 4**' programmer.

Important note:
The '*IOMOD14'* module is NOT compatible with any other ISPnano programmer.

IOMOD14

Crystal Calibration - Oscillator Module

1.1 Fitting the IOMOD14 module to the ISPnano programmer

The *'IOMOD14'* module fits onto the *'ISPnano Series 4 ATE'* programmer as shown in the picture below.....
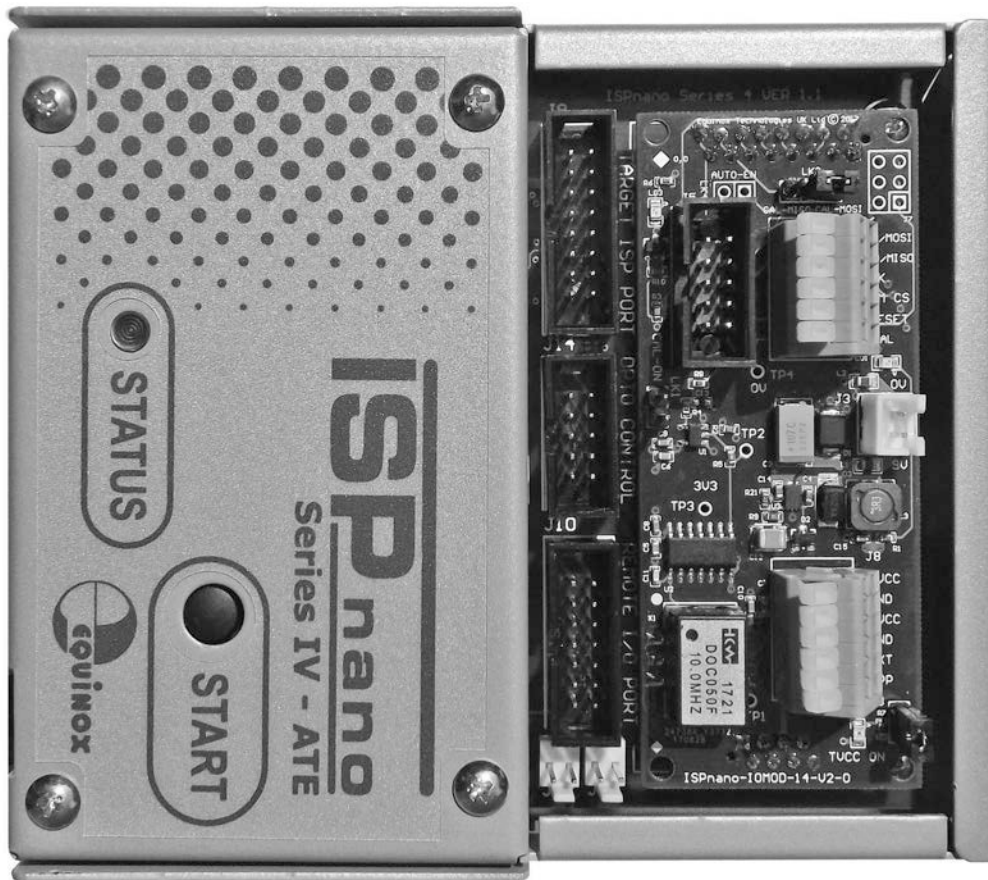

Instructions:

- Position the *'IOMOD14'* module over the IOMOD connectors on the programmer motherboard - see picture above.
- Gently push the *'IOMOD14'* module down at both ends at the same time.
- The module should lock into place on the programmer.

1.2 Powering the IOMOD14 module

A programming / calibration system using the *'ISPnano Series 4 ATE'* and the *'IOMOD14 - Oscillator Calibration Module'*, requires **TWO independent power supplies**. One power supply is for the ISPnano programmer and the other power supply is for the *IOMOD14* module.
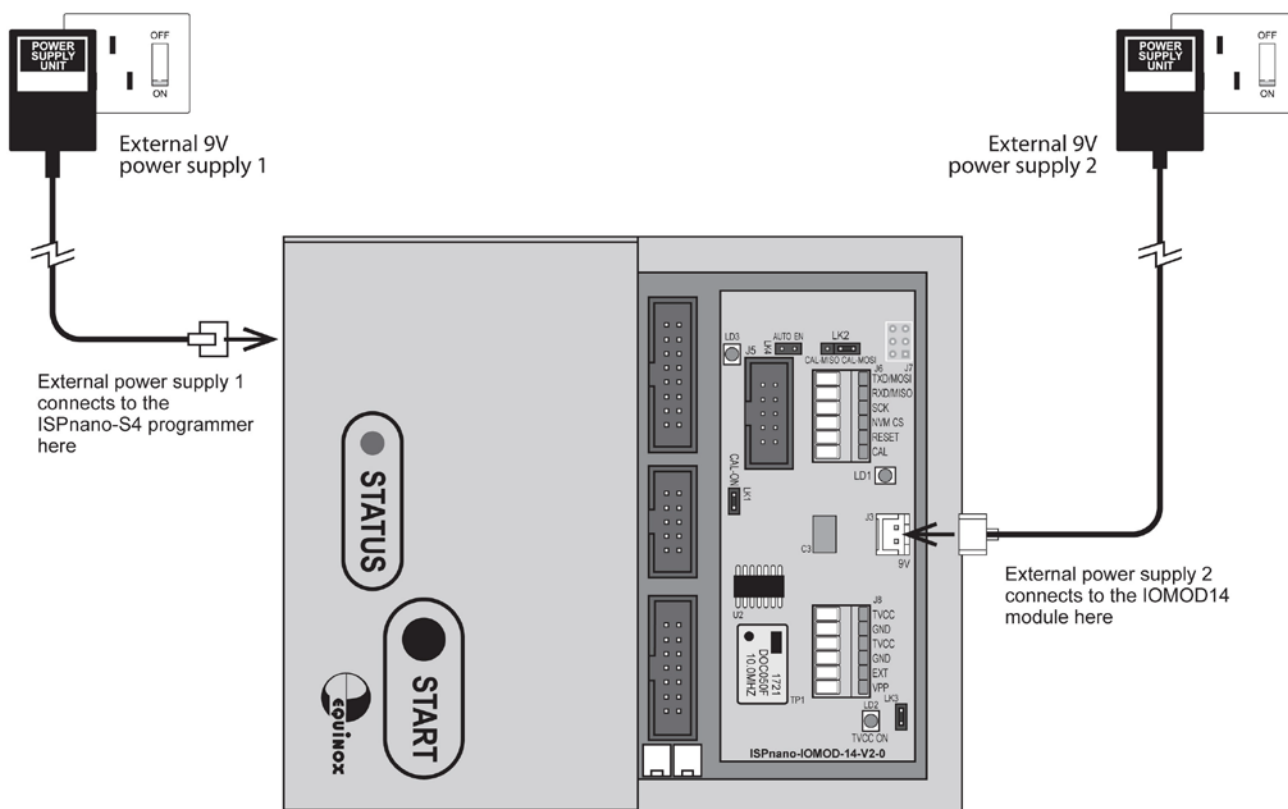
External Power supply #	Used to power:	Voltage / current ratings	Power supply DC connector
Power supply #1	ISPnano programmer	9.0V @1.3A	2-pin JST
Power supply #2	IOMOD14 module / OXCO module	9.0V @1.3A	2-pin JST

The *IOMOD14* connector module must be powered by an external 9.0V 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.

1.3 Setting up the IOMOD14 module ready for production

The *'IOMOD14 - 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 IOMOD14 module

It is very important to follow the power sequencing instructions below when setting up the *IOMOD14* module / programmer ready for a production run.....

Instructions:

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

2. Apply 9.0 V DC power to the *IOMOD14* module via the J3 2-pin JST connector
--> The GREEN LED should illuminate on the *IOMOD14* module

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 *IOMOD14* module should be left on throughout production.

2. If the power to the *IOMOD14* 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.