

Report No:

AN115

Title:

Special Function Module Instructions for PPM3-MK2 and PPM4-MK1 Programmers

Author:

John Marriott

Date:

21st January 2015

Version Number:

1.06

Abstract:

This application note describes the various 'Special Function Modules' which are available for the Equinox PPM3-MK2 and PPM4-MK1 programmers. The 'Special Function Module' contains all the 'I/O Driver Circuitry' which interfaces the programmer electronics to the user Target System. Instructions are also included which detail how to swap a 'Special Function Module'.

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without prior notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent or other industrial or intellectual property rights.

Contents

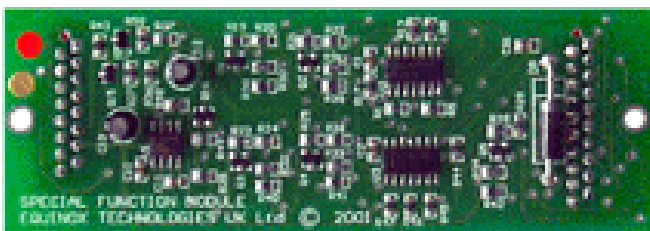
1.0 Special Function Modules (SFM)	5
1.1 Special Function Module - Overview.....	5
1.2 Special Function Module – Selection Guide.....	6
1.3 EQ-SFM-1 – Standard Special Function Module	7
1.4 EQ-SFM-MAX-V1.2 – High Speed / ESD Protected	7
1.5 EQ-SFM-MAX-V1.3 – High Speed / ESD Protected + 32 kHz	8
1.6 EQ-SFM-MAX – Differences between V1.2 and V1.3	8
2.0 How to fit a new Special Function Module	9
2.1 Overview	9
2.2 Equipment required	9
2.3 Fitting the new SFM Module	9
3.0 Declaring a Special Function Module in a Programming Project	11
3.1 Overview	11
3.2 Specifying the correct SFM Module in a Programming Project	11
3.3 In EDS (Development Mode)	11
3.4 In Project Builder (Standalone Mode)	12
3.5 Testing your Programming Project.....	13
4.0 EQ-SFM-MAX-V1.3 – AVR Oscillator Calibration	15
4.1 Overview	15
4.2 Hardware enabling of the 32.768 kHz oscillator circuitry	15
4.3 Switching the 32.768 kHz signal OFF / ON from a Programming Project.....	15
4.4 AVR RC Oscillator Calibration - SPI Interface.....	16
4.5 AVR RC Oscillator Calibration - JTAG Interface	18
5.0 Replacing the EQ-CALCON module with EQ-SFM-MAXV1.3 module	21
5.1 Overview	21
5.2 Replacing the EQ-CALCON Module	21
5.3 Changes to Statemachine settings	22
6.0 Documentation and Technical Support	23
6.1 Further Documentation	23
6.2 Technical Support.....	23

1.0 Special Function Modules (SFM)

1.1 Special Function Module - Overview

The PPM3-MK2 and PPM4-MK1 programmers feature an interchangeable '**Special Function Module**' or '**SFM**' (also referred to as '**I/O Driver Module**'). This module contains all the '**I/O Driver Circuitry**' which interfaces the electronics inside the programmer to the remote Target System.

The PPM3-MK2 and PPM4-MK1 programmers are fitted with the '**EQ-SFM-1**' module as standard – see photograph below.



In the event of damage to the programmer driver circuitry, it is possible to remove the complete '**Special Function Module**' and replace it with a new one. This allows the programmer to be repaired in-situ without the need to send it back to Equinox, thereby avoiding production down time.

There are also other '**Special Function Modules**' available which offer faster SPI / JTAG programming speeds and better ESD / Over-voltage protection. See section 1.2 for further details.

1.2 Special Function Module – Selection Guide

The Special Function Modules which are currently available are listed in the table below:

Special Function Module Order Code	Description
EQ-SFM-1	<p>Standard Special Function Module V1.0</p> <ul style="list-style-type: none"> Fitted to all PPM3-MK2 / PPM4-MK1 programmers as standard (from new) Supports JTAG speeds up to approx 900 kHz Supports SPI speeds up to approx 500 kHz Limited ESD and over-voltage protection Not recommended for driving capacitive or inductive loads Not recommended if the Target System power is not supplied / controlled from the programmer.
EQ-SFM-MAX-1.2	<p>High-speed High Current SFM Module V1.2</p> <ul style="list-style-type: none"> Supports JTAG speeds up to approx 4 MHz Supports SPI speeds up to approx 4 MHz Enhanced ESD protection Enhanced over-voltage / fault protection Safe to use when Target System is independently powered Better at driving capacitive or inductive loads Requires programmer firmware 3.04 or above
EQ-SFM-MAX-1.3	<p>High-speed High Current SFM Module with 32kHz Oscillator V1.3</p> <ul style="list-style-type: none"> Supports JTAG speeds up to approx 4 MHz Supports SPI speeds up to approx 4 MHz Integrated 32 kHz Oscillator for performing accurate calibration of Atmel AVR on-chip oscillators (replaces the CALCON module) Can be used as a replacement for the EQ-CALCON module Enhanced ESD protection Enhanced over-voltage / fault protection Safe to use when Target System is independently powered Better at driving capacitive or inductive loads Requires programmer firmware 3.04 or above

Please note:

- The '**EQ-SFM-1**' module is fitted in a PPM3-MK2 and PPM4-MK1 programmer as standard.
- The '**EQ-SFM-MAX-1.2**' and '**EQ-SFM-MAX-1.3**' modules are functionally identical except that the 'V1.3' module has a '32 kHz on-board precision oscillator' which can be used for 'AVR RC Oscillator Calibration'.
- The '**EQ-SFM-MAX-1.3**' module can be used a direct replacement for the '**EQ-SFM-MAX-1.2**' module as long as the '**Link LK1**' on the V1.3 module is not fitted (standard setting).
- The '**Special Function Module**' which is physically fitted inside the programmer must also be declared in each '**Programming Project**'.

1.3 EQ-SFM-1 – Standard Special Function Module

The '**EQ-SFM-1**' module is the standard '**Special Function Module**' which is fitted to the PPM3-MK2 and PPM4-MK1 programmer when it leaves the factory. This module supports SPI frequencies up to e.g. 500 kHz and JTAG waveforms up to e.g. 900 kHz.

This module is OK for use in the following circumstances:

- When the SPI Frequency specified in the '**Programming Project**' is < 500 kHz.
- When the JTAG Frequency specified in the '**Programming Project**' is < 900 kHz.
- When the programmer powers the Target System

This module should NOT be used in the following circumstances:

- When the Target System is powered from a different Power Supply to the Programmer (independently powered).
The Line Driver circuitry can be damaged if the Line Drivers are not powered and an ESD discharge is applied to any of the programmer Target I/O pins.
- When very fast SPI programming is required.
Please use either the **EQ-SFM-MAX-V1.2** or **V1.3** module which supports SPI frequencies up to 4MHz.
- When very fast JTAG programming is required.
Please use either the **EQ-SFM-MAX-V1.2** or **V1.3** module which supports JTAG frequencies up to 4MHz.

1.4 EQ-SFM-MAX-V1.2 – High Speed / ESD Protected

The '**EQ-SFM-MAX-V1.2**' module is designed to support high-speed SPI or JTAG programming of a Target System. The enhanced Line Driver circuitry on this module supports very fast waveforms and so SPI and JTAG frequencies up to 4 MHz can be used. This can significantly reduce the overall programming time for many high memory capacity devices.

The advantages of the EQ-SFM-MAX-V1.2 module compared to the standard EQ-SFM-1 module are as follows:

- Supports much faster SPI and JTAG frequencies
- Supports faster programming of Target IC
- Enhanced ESD and Over-voltage protection on each Programmer I/O pin
- Line Driver circuitry is permanently powered so is always protected from ESD and over-voltage conditions even if the Target System is independently powered.
- Safe to use when the Target System is independently powered.

1.5 EQ-SFM-MAX-V1.3 – High Speed / ESD Protected + 32 kHz

The '*EQ-SFM-MAX-V1.2*' module features the exactly the same Line Driver circuitry as the '*EQ-SFM-MAX-V1.2*' module. The only difference is that the 'V1.3' version features a '32 kHz precision Oscillator Module' which can be used for calibrating the 'Internal RC Oscillator' of an Atmel AVR microcontroller.

The advantages of the EQ-SFM-MAX-V1.2 module compared to the standard EQ-SFM-1 module are as follows:

- Supports much faster SPI and JTAG frequencies
- Supports faster programming of Target IC
- Enhanced ESD and Over-voltage protection on each Programmer I/O pin
- Line Driver circuitry is permanently powered so is always protected from ESD and over-voltage conditions even if the Target System is independently powered.
- Safe to use when the Target System is independently powered.
- Features an on-board precision 32.768 kHz oscillator which can be used for calibrating the '*Internal RC Oscillator*' of an Atmel AVR microcontroller.

1.6 EQ-SFM-MAX – Differences between V1.2 and V1.3

The '*EQ-SFM-MAX-1.2*' and '*EQ-SFM-MAX-1.3*' modules are functionally identical except that the 'V1.3' module has a '*32 kHz on-board precision oscillator*' which can be used for '*AVR RC Oscillator Calibration*'. When the '*EQ-SFM-MAX-1.3*' is shipped from Equinox, the '*32 kHz Oscillator Circuit*' is disabled so the 1.3 module will behave exactly the same as a V1.2 module. The V1.3 module can therefore be used as a direct replacement for the V1.2 module. It is not necessary to change any project settings but it is a good idea to change the '*Special Function Module*' selection in the project to '*EQ-SFM-MAX-1.3*'.

The '*32 kHz Oscillator Circuit*' can be enabled on the '*EQ-SFM-MAX-1.3*' module by soldering a link across the link **LK1** on the module.

2.0 How to fit a new Special Function Module

2.1 Overview

Swapping of the 'Special Function Module' is a very straightforward process. It can be carried out by any technician with basic electronics skills.

2.2 Equipment required

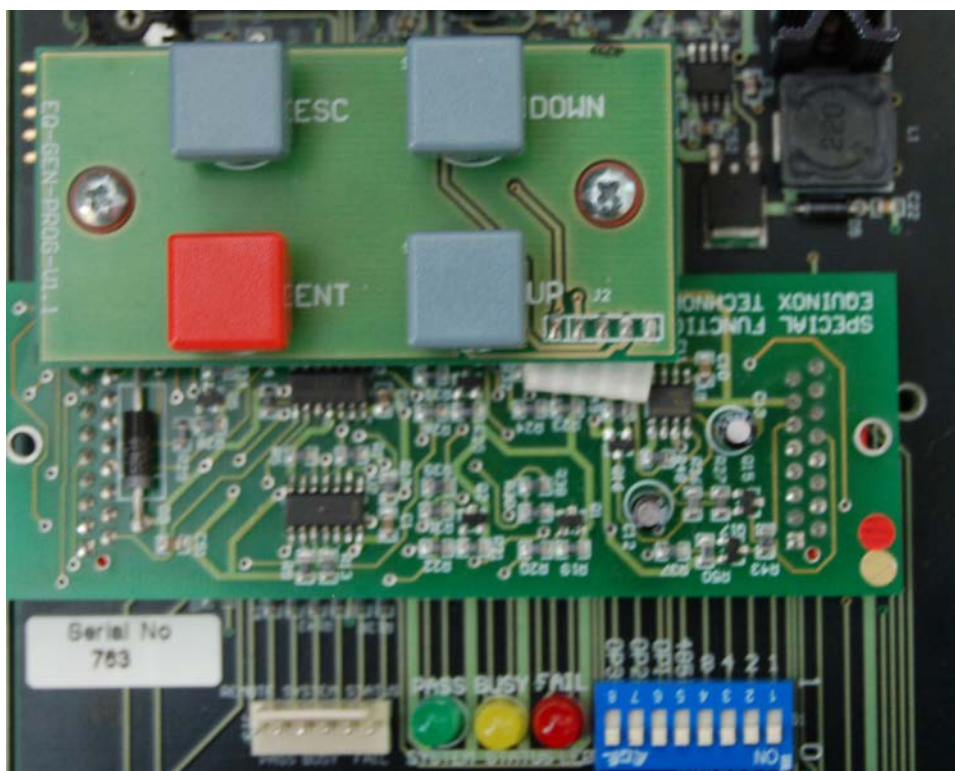
The following items are required to swap the '*Special Function Module*':

- PPM3-MK2 / PPM4-MK1 Programmer
- New 'Special Function Module'
- Philips screwdriver
- ESD wrist-strap (if available)

2.3 Fitting the new SFM Module

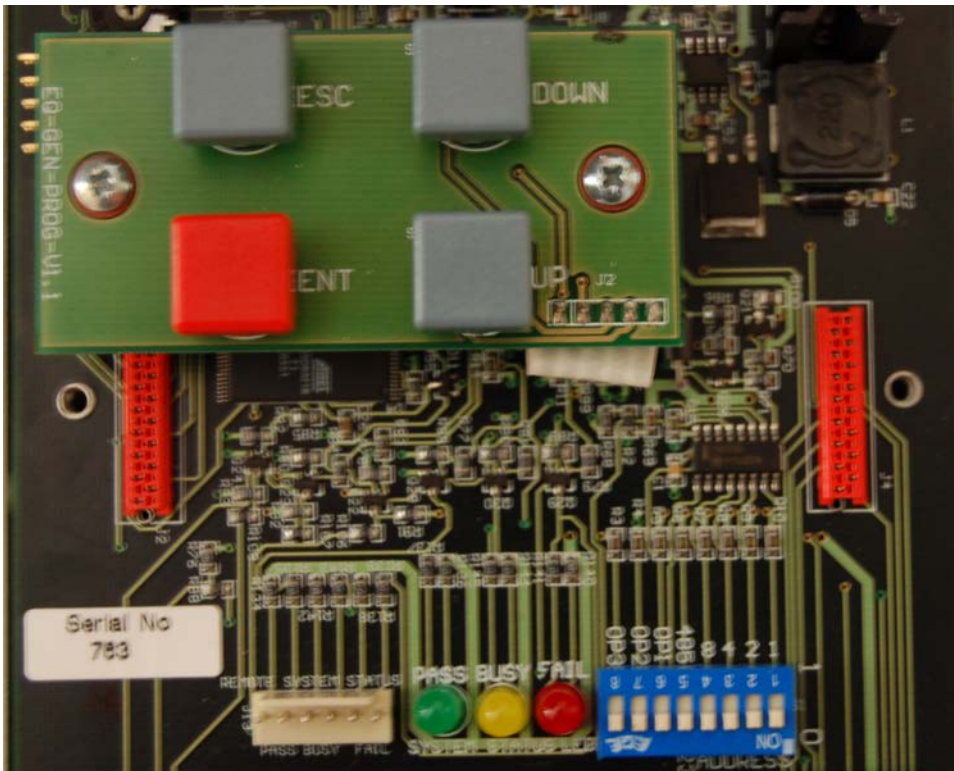
To fit a new SFM Module to the programmer:

- Make sure the programmer is powered off
- Remove all cables from the programmer
- Remove the four fixing screws in the side of the programmer case
- Carefully slide the lid of the programmer upwards and then off
- You can find the existing SFM Module underneath the keypad PCB – see picture below



- Carefully remove the existing SFM Module by applying pressure from underneath at both sides of the circuit board

→ The SFM module should pop out of the red connectors – see picture below.



- Fit the new SFM Module in the same position and orientation as the one you have just taken out (make sure to line up the long red connector on the main PCB to the long red connector on the SFM module)
- Push the new SFM Module down gently until it locks into place
- Replace the programmer lid
- Replace the programmer screws
- You may now want to test the programmer to make sure that the new module is working OK.

3.0 Declaring a Special Function Module in a Programming Project

3.1 Overview

The **'EQ-SFM-1'** and **'EQ-SFM-V1.2 / V1.3'** modules actually use slightly different firmware in the programmer. It is therefore necessary to specify which SFM Module is fitted inside the programmer in each individual Programming Project. The **'EQ-SFM-V1.2 / V1.3'** modules also require that programmer firmware 3.04 or above is installed. Please see the Application Note AN112 for detailed instructions to upgrade the programmer firmware.

Warning!

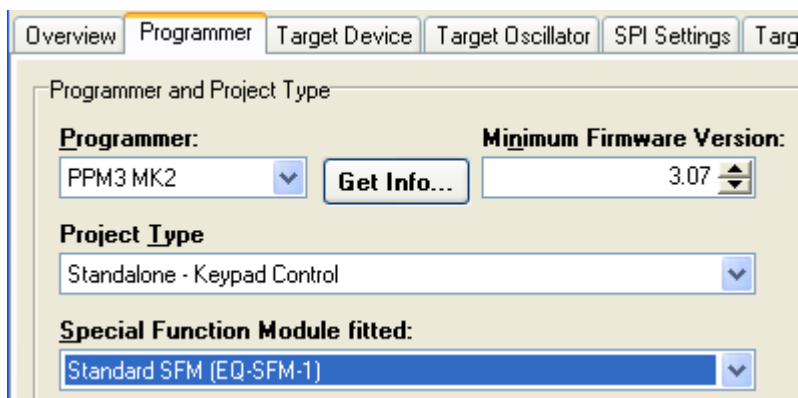
Failure to specify the correct module in each programming project can cause a DC voltage to be constantly output from the TVCC pin of the programmer.

3.2 Specifying the correct SFM Module in a Programming Project

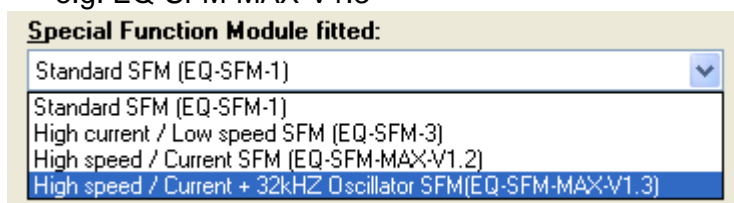
To specify the correct SFM Module in a Programming Project:

3.3 In EDS (Development Mode)

- Open your EDS (*.eds) development project
- Select the **<Programmer>** tab



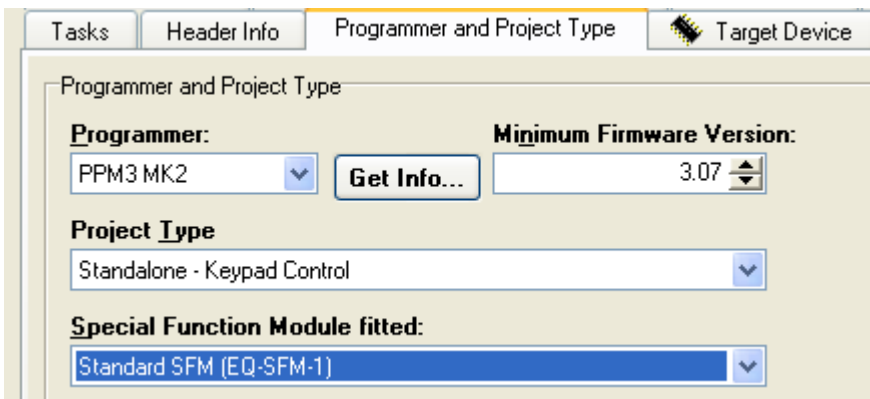
- Locate the **'Special Function Module fitted'** list box
- Select the relevant SFM Module which you have fitted to your programmer
e.g. EQ-SFM-MAX-V1.3



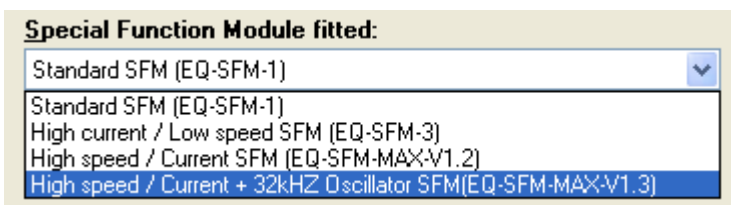
- If you now try the EDS project by performing any programming action, it will automatically re-compile the new **'Special Function Module'** settings into your project.

3.4 In Project Builder (Standalone Mode)

- Launch EQTools
- To modify an existing project:
From the left-hand pane, select **<Project Builder>** , **<Open Project>** and then browse to and select your Project File (*.ppm)
- To create a new Programming Project:
From the left-hand pane, select **<Project Builder>** , **<New Project>** and then follow the 'Project Builder' wizard on-screen instructions.
- Select the **<Programmer and Project Type>** tab



- Locate the '**Special Function Module fitted**' list box
- Click the down arrow to list all possible modules:



- Select the relevant '**Special Function Module**' which you have fitted to your programmer
- Re-compile your project to save the changes

Important notes:

- Failure to specify the correct SFM Module can result in erratic operation of the programmer.
- If you have existing projects which use the standard **EQ-SFM** module, these projects will need to be recompiled for the new SFM Module.

3.5 Testing your Programming Project

The simplest way to test whether your new 'Special Function Module' is operating correctly is to try your new / revised Programming Project in Development Mode (EDS).

- Open your EDS (*.eds) development project
- Select e.g. the **<Target Device>** tab
- Make sure you have a Target System connected to the programmer
- Click the **<Check ID>** button
 - The programmer should now try to communicate with the 'Target IC' on the Target System
 - If the 'ID Check' is a PASS then the 'Special Function Module' is functioning OK.
 - If the 'ID Check' is a FAIL then there may be a problem with the 'Special Function Module' or the 'Programming Project'.

4.0 EQ-SFM-MAX-V1.3 – AVR Oscillator Calibration

4.1 Overview

The **EQ-SFM-MAX-V1.3** module features an on-board 32.768 kHz oscillator which is used during the ‘Calibration Procedure’ for the Internal RC Oscillator of an Atmel AVR microcontrollers. This 32.768 kHz signal is DISABLED as standard so the V1.3 module behaves in the same way as the V1.2 module. If the oscillator is to be enabled, a physical solder link must be made on the **EQ-SFM-MAX-V1.3** circuit board.

4.2 Hardware enabling of the 32.768 kHz oscillator circuitry

To enable the 32.768 kHz oscillator:

- Make sure you take full ESD precautions so as not to damage the internal electronics of the programmer. e.g. wear an anti-static wrist band.
- Remove the **EQ-SFM-MAX-V1.3** module from the programmer
- Locate the ‘**Blob Link**’ solder pads marked ‘**BL1**’. If you find the text “CALCON” by following upwards from the “©” symbol, the two solder pads are immediately next to the “C” of the word “CALCON”.
- Link these two pads by my making a solder joint across them.
→ The 32.768 kHz oscillator signal is now enabled.

4.3 Switching the 32.768 kHz signal OFF / ON from a Programming Project

Once the 32.768 kHz hardware circuitry has been enabled by soldering blob link LK1, the actual 32.768 kHz oscillator signal is then switched on/off to the Target System using the programmer ‘**OP5**’ I/O pin.

- To switch the oscillator signal OFF, take **OP5** HIGH
- To switch the oscillator signal ON, take **OP5** HIGH
- The oscillator signal will appear on the **OP4 I/O pin** of the programmer.
- This corresponds to the **MOSI** pin in **SPI** programming mode.
- This corresponds to the **TDI** pin in **JTAG** programming mode.
- **OP5** is the ‘Spare’ programmer I/O pin in the ‘**Pre-programming State Machine**’

Please note:

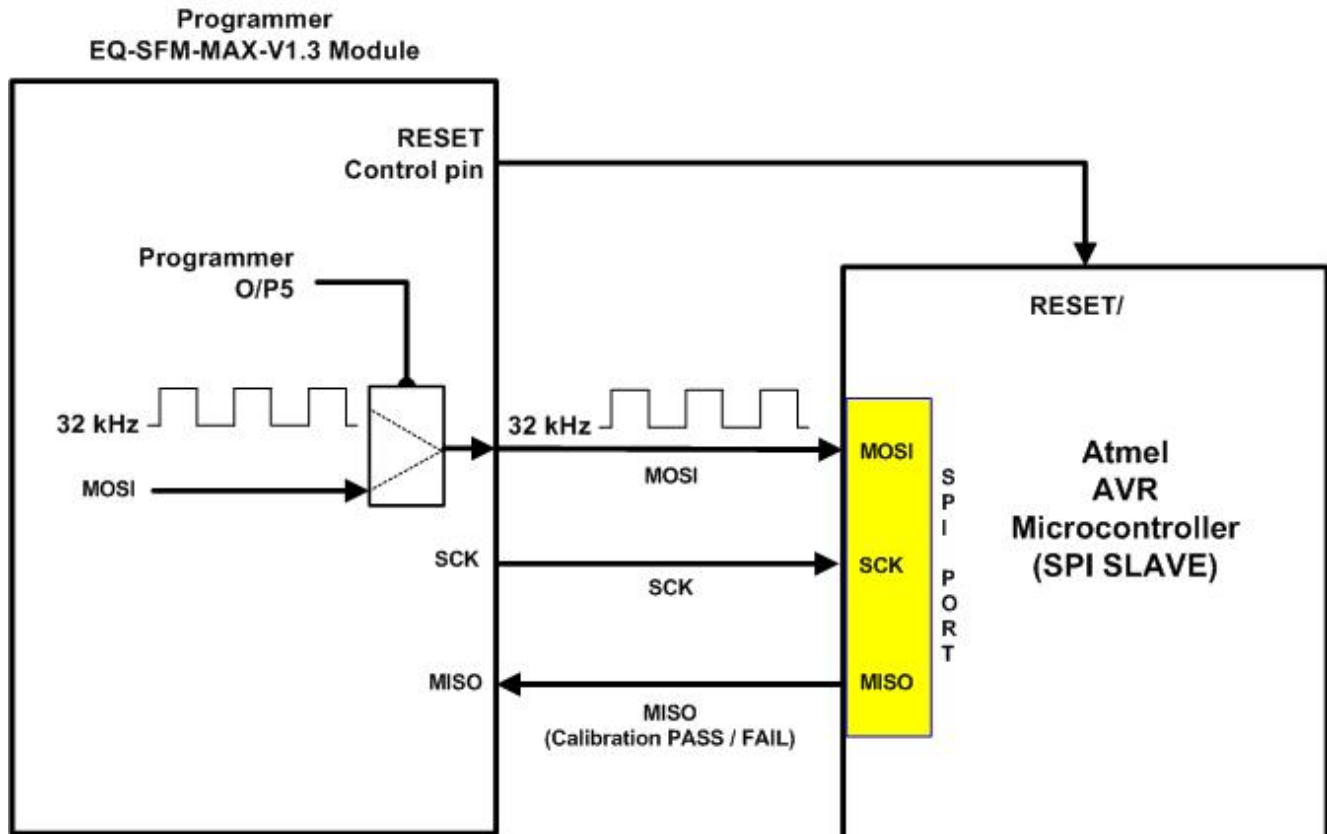
- The oscillator signal is **OFF** by default as the **OP5** pin will float HIGH by default.

Warning!

- To avoid contention between the **MOSI / TDI pin** and the 32 kHz oscillator signal, you should not enable the 32 kHz oscillator signal and drive the **MOSI / TDI** pin at the same time.

4.4 AVR RC Oscillator Calibration - SPI Interface

It is possible to use the PPM3-MK2 programmer in conjunction with the **EQ-SFM-MAX-V1.3** module to implement an '**Oscillator Calibration Procedure**' for the on-chip RC Oscillator of an Atmel AVR microcontroller. The same pins which make up the SPI programming interface (MOSI, MISO, SCK) can also be used for the calibration procedure. The diagram below shows the interface between the programmer and the target AVR microcontroller.



The **MOSI** pin of the programmer can either be:

- **MOSI** SPI signal
- or
- 32.768 kHz oscillator signal

Please note:

- The **32.768 kHz oscillator** is switched to the SPI **MOSI** pin by driving the programmer pin **O/P5** LOW.
- If the **O/P5** pin is driven HIGH, then the normal MOSI signal (O/P1) is routed to the MOSI pin.
- The **MISO** pin is used by the target AVR microcontroller to indicate a PASS / FAIL result for the 'Oscillator Calibration Procedure'.

Warning!

To avoid contention between the **MOSI** pin and the **32.768 kHz oscillator signal**, you should not

enable the 32 kHz oscillator signal and drive the **MOSI** pin at the same time. The **MOSI** pin should be set to '**TRI**' (tri-state) when the **32.768 kHz oscillator signal** is enabled.

To enable / disable the 32.768 kHz oscillator in an SPI project, the '**Pre-programming State Machine**' in the Programming Project should be set up as follows:

1. To switch the 32 kHz oscillator signal **OFF**, set '**O/P5**' to '**ODH**' (output driven HIGH) in active states:

Target Power Supply									Pre-Program State Machine									Erase									Post Erase Fuse									Flash									EEPROM									Security Settings								
State machine description:																																																														
SPI - 32kHz signal OFF																																																														
State.	Cycle Delay (ms)	RESET	O/P1	O/P2	O/P3	O/P4	O/P5	Value																																																						
Pin Name		RESET	MOSI	MISO	SCK	SPARE/SCK2																																																								
0 (Initial)	50	TRI	TRI	TRI	TRI	TRI	ODH	0x0DD0																																																						
1	50	LAH	ODL	TRI	ODL	TRI	ODH	0x2C95																																																						
2	50	LAL	ODL	TRI	ODL	TRI	ODH	0x1C95																																																						
3	0	TRI	TRI	TRI	TRI	TRI	TRI	0x0DC0																																																						
4	0	TRI	TRI	TRI	TRI	TRI	TRI	0x0DC0																																																						

→ There is no oscillator signal on the **MOSI** pin.

→ The **MOSI** pin can be used as the standard SPI **MOSI** pin at this point in time and can be drive HIGH / LOW by the programming algorithm.

2. To switch the 32 kHz oscillator signal **ON**:

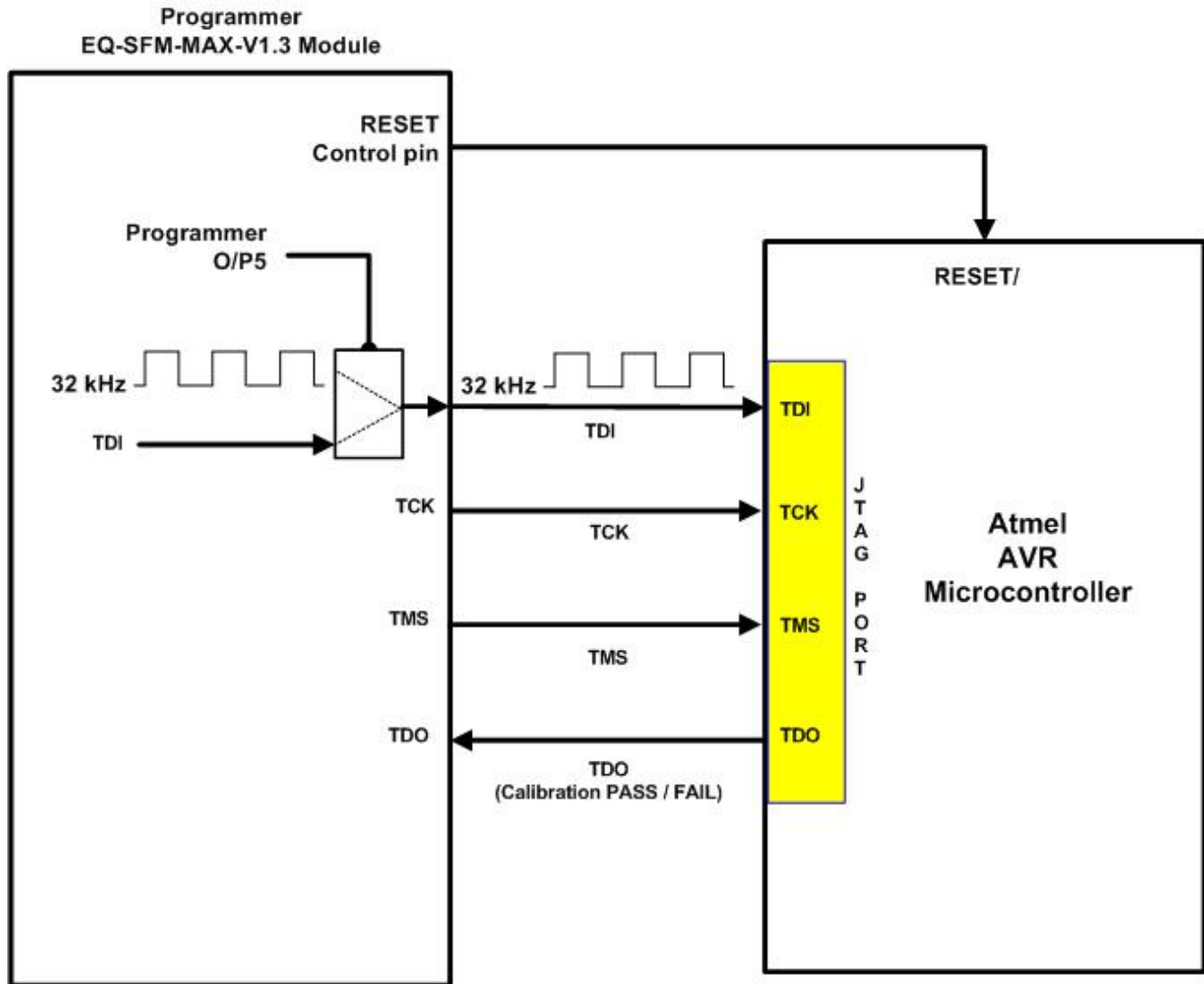
- Set the '**O/P5**' pin to '**ODL**' (output driven LOW) in all active states
- Set **MOSI pin** to 'TRI' (tri-state) so that the MOSI signal and oscillator signal are not in contention.

Tasks									Header Info									Programmer and Project Type									Target Device									Target Oscillator									SPI Settings																																																																																																																																																																																																																																																																																																																																												
Target Power Supply																																																						Pre-Program State Machine																																																						Erase																																																						Post Erase Fuse																																																						Flash																																																						EEPROM																																																						Security Settings																																																					
State machine description:																																																																																																																																																																																																																																																																																																																																																																																									
SFM-MAX-V1.3 - SPI interface - 32 kHz ENABLED - MOSI pin TRI-STATED																																																																																																																																																																																																																																																																																																																																																																																									
State.	Cycle Delay (ms)	RESET	O/P1	O/P2	O/P3	O/P4	O/P5	Value																																																																																																																																																																																																																																																																																																																																																																																	
Pin Name		RESET	MOSI	MISO	SCK	SPARE/SCK2	SPARE																																																																																																																																																																																																																																																																																																																																																																																		
0 (Initial)	20	LAH	TRI	TRI	TRI	TRI	ODL	0x25D0																																																																																																																																																																																																																																																																																																																																																																																	
1	500	LAH	TRI	TRI	TRI	TRI	ODL	0x25D0																																																																																																																																																																																																																																																																																																																																																																																	
2	0	TRI	TRI	TRI	TRI	TRI	TRI	0x0DC0																																																																																																																																																																																																																																																																																																																																																																																	
3	0	TRI	TRI	TRI	TRI	TRI	TRI	0x0DC0																																																																																																																																																																																																																																																																																																																																																																																	
4	0	TRI	TRI	TRI	TRI	TRI	TRI	0x0DC0																																																																																																																																																																																																																																																																																																																																																																																	

→ the 32 KHz signal will be output on the **MOSI (O/P1) pin** of the programmer.

4.5 AVR RC Oscillator Calibration - JTAG Interface

It is possible to use the PPM3-MK2 and PPM4-MK1 programmer in conjunction with the **EQ-SFM-MAX-V1.3** module to implement an '**Oscillator Calibration Procedure**' for the on-chip RC Oscillator of an Atmel AVR microcontroller. The same pins which make up the JTAG programming interface (TDI, TDO, TMS, TCK) can also be used for calibration procedure. The diagram below shows the interface between the programmer and the target AVR microcontroller.



The **TDI** pin of the programmer can either be:

- **TDI** JTAG signal
- or
- 32.768 kHz oscillator signal

Please note:

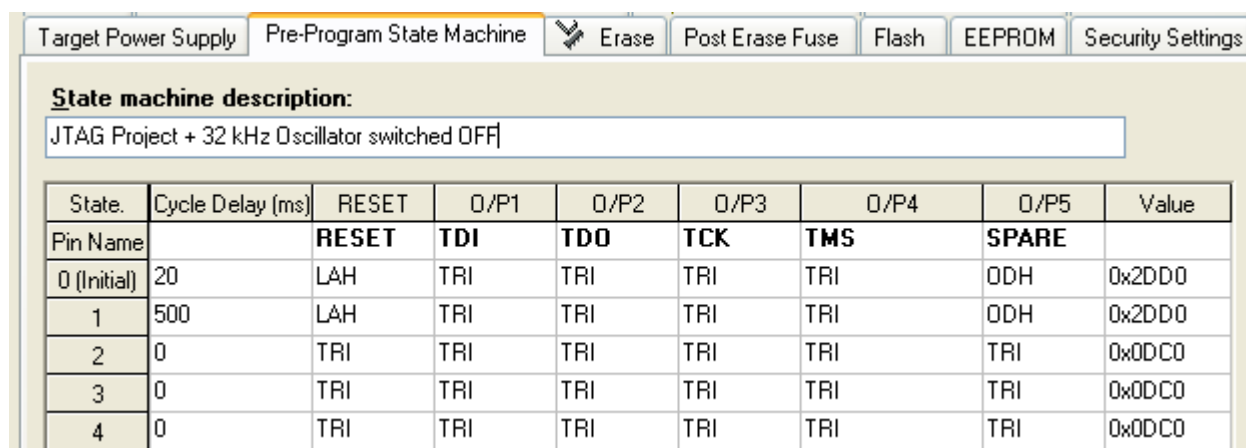
- The **32.768 kHz oscillator** is switched to the JTAG **TDI** pin by driving the programmer pin **O/P5** LOW.
- If the **O/P5** pin is driven HIGH, then the normal **TDI** signal (O/P1) is routed to the **TDI** pin.
- The **TDI** pin is used by the target AVR microcontroller to indicate a PASS / FAIL result for the 'Oscillator Calibration Procedure'.

Warning!

To avoid contention between the **TDI** pin and the **32.768 kHz oscillator signal**, you should not enable the 32 kHz oscillator signal and drive the **TDI** pin at the same time. The **TDI** pin should be set to '**TRI**' (tri-state) when the **32.768 kHz oscillator signal** is enabled.

To enable / disable the 32.768 kHz oscillator in a **JTAG** project, the '**Pre-programming State Machine**' in the Programming Project should be set up as follows:

1. To switch the 32 kHz oscillator signal **OFF**, set '**O/P5**' to '**ODH**' (output driven HIGH):



The screenshot shows the 'Pre-Program State Machine' configuration window. The state machine description is 'JTAG Project + 32 kHz Oscillator switched OFF'. Below it is a table with the following data:

State.	Cycle Delay (ms)	RESET	O/P1	O/P2	O/P3	O/P4	O/P5	Value
Pin Name		RESET	TDI	TDO	TCK	TMS	SPARE	
0 (Initial)	20	LAH	TRI	TRI	TRI	TRI	ODH	0x2DD0
1	500	LAH	TRI	TRI	TRI	TRI	ODH	0x2DD0
2	0	TRI	TRI	TRI	TRI	TRI	TRI	0x0DC0
3	0	TRI	TRI	TRI	TRI	TRI	TRI	0x0DC0
4	0	TRI	TRI	TRI	TRI	TRI	TRI	0x0DC0

→ There is no oscillator signal on the **TDI** pin. The **TDI** pin can be used as the standard JTAG TDI pin at this point in time.

2. To switch the 32 kHz oscillator signal **ON**:

- Set the '**O/P5**' pin to '**ODL**' (output driven LOW) for every active state in the State Machine.
- Set the **TDI** pin (O/P1) to '**TRI**' to avoid contention between the programmer **TDI** output and the oscillator signal

Target Power Supply Pre-Program State Machine Erase Post Erase Fuse Flash EEPROM Security Settings

State machine description:

State.	Cycle Delay (ms)	RESET	O/P1	O/P2	O/P3	O/P4	O/P5	Value
Pin Name		RESET	TDI	TDO	TCK	TMS	SPARE	
0 (Initial)	20	LAH	TRI	TRI	TRI	TRI	ODL	0x25D0
1	500	LAH	TRI	TRI	TRI	TRI	ODL	0x25D0
2	0	TRI	TRI	TRI	TRI	TRI	TRI	0x0DC0
3	0	TRI	TRI	TRI	TRI	TRI	TRI	0x0DC0
4	0	TRI	TRI	TRI	TRI	TRI	TRI	0x0DC0

→ The 32 kHz signal will be output on the **TDI pin** of the programmer.

5.0 Replacing the EQ-CALCON module with EQ-SFM-MAXV1.3 module

5.1 Overview

The '**EQ-CALCON**' module is an I/O Connector Module which plugs into the PPM3-MK2 or PPM4-MK1 programmer. It features an on-board 32 kHz oscillator module which is used for the '**AVR On-chip oscillator**' calibration process. The '**EQ-SFM-MAX-1.3**' module can be used to replace the older '**EQ-CALCON**' module which is prone to ESD damage as the analogue switch which controls the 32kHz oscillator is on the target-side of the programmer and hence has limited ESD protection. The newer '**EQ-SFM-MAX-1.3**' module integrates the '**Line Driver Circuitry**' plus the 32 kHz oscillator on one module and so the '**EQ-CALCON**' module is no longer required.

Advantages of EQ-SFM-MAX-V1.3 module

- Faster Line Driver Circuitry supporting faster SPI and JTAG programming
- The 32 kHz oscillator analogue switch is now on the programmer-side of the module and so is now fully ESD protected.
- One module supports both the '**Line Driver Circuitry**' and the '**32 kHz oscillator**' module

Disadvantages of EQ-SFM-MAX-V1.3 module

- The sense of the control pin '**O/P5**' which controls the 32 kHz oscillator is the **EXACT OPPOSITE** to the settings for the EQ-CALCON module.
- This means that the Statemachine settings must be changed in any programming projects which originally used the CALCON module.

5.2 Replacing the EQ-CALCON Module

This section details how to replace an '**EQ-CALCON**' module with an '**EQ-SFM-MAX-1.3**' module.

Instructions

- Remove the '**EQ-CALCON**' module from the programmer.
- Solder the link LK1 on the '**EQ-SFM-MAX-1.3**' module. This enables the 32 kHz oscillator functionality.
- Follow the instructions in section 2 to fit the '**EQ-SFM-MAX-1.3**' module to the programmer.
- Insert the relevant '**I/O Connector Module**' into the programmer – IO-CON 1 / 2 / 3 etc.
- Change your each '**programming project**' as detailed in section 5.3 to change the sense of the control pin '**O/P5**' which controls the 32 kHz oscillator – see section 5.3.

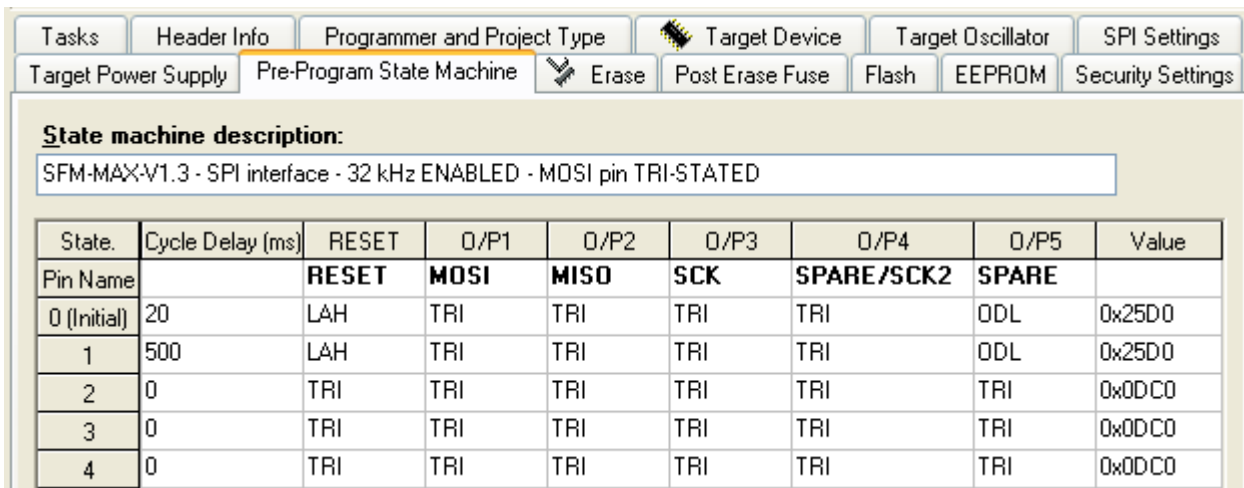
5.3 Changes to Statemachine settings

- If the '**EQ-SFM-MAX-1.3**' module is to be used to replace the '**EQ-CALCON**' module, then it is necessary to make a small change to the '**statemachine settings**' in each '**programming project**' as detailed below. The setting of the '**O/P5**' pin to enabled / disable the 32 kHz oscillator is the **EXACT OPPOSITE** to the settings for the EQ-CALCON module.

Instructions

- Open each '**programming project**' and select the **<Statemachine tab>**
- Set the '**O/P5**' pin to '**ODL**' (output driven LOW) for every active state in the State Machine where the 32 kHz oscillator is to be enabled.
- Set the '**O/P5**' pin to '**ODH**' (output driven HIGH) for every active state in the State Machine where the 32 kHz oscillator is to be disabled.
- This is the **EXACT OPPOSITE** to the settings for the EQ-CALCON module.
- Please see section 4.0 for full instructions on how to set up the '**EQ-SFM-MAX-1.3**' module for oscillator calibration.

Example...



State machine description:
SFM-MAX-V1.3 - SPI interface - 32 kHz ENABLED - MOSI pin TRI-STATED

State.	Cycle Delay (ms)	RESET	O/P1	O/P2	O/P3	O/P4	O/P5	Value
Pin Name		RESET	MOSI	MISO	SCK	SPARE/SCK2	SPARE	
0 (Initial)	20	LAH	TRI	TRI	TRI	TRI	ODL	0x25D0
1	500	LAH	TRI	TRI	TRI	TRI	ODL	0x25D0
2	0	TRI	TRI	TRI	TRI	TRI	TRI	0x0DC0
3	0	TRI	TRI	TRI	TRI	TRI	TRI	0x0DC0
4	0	TRI	TRI	TRI	TRI	TRI	TRI	0x0DC0

6.0 Documentation and Technical Support

6.1 Further Documentation

For further documentation about the use of the '*Special Function Module*', please refer to the following manuals and application notes.

Manuals

- EQTools – Getting Started Guide and User Manual
- PPM3-MK2 Programmer User Manual
- PPM4-MK1 Programmer User Manual

Application Notes:

- AN105 – In-System Programming (ISP) of the Atmel AVR FLASH Microcontroller Family using the JTAG Programming Interface.
- AN114 – Internal RC Oscillator Calibration Procedure for Atmel AVR microcontrollers

The manuals and application notes detailed above can be downloaded from our website at www.equinox-tech.com.

6.2 Technical Support

If you have any questions about the products or information covered in this application note, please email your questions to support@equinox-tech.com.