Instruction

400 Series Crystal Calibration User Guide

Document No.:	INS11552
Version:	6
Description:	Guide for crystal calibration of the 400 Series single chip
Written By:	ANI;JFR
Date:	2012-05-29
Reviewed By:	JFR;PNI;ANI
Restrictions:	Partners Only

Approved by:

Date	CET	Initials	Name	Justification
2012-05-29	11:18:17	PNI	Peter Nielsen	

CONFIDENTIAL

REVISION RECORD

Doc. Rev	Date	By	Pages affected	Brief description of changes
1	20100520	ANI	ALL	Initial version
2	20100604	ANI	2+3	alternative enable pin connection changed to J9 pin 3
3	20110318	ANI	3	Fixed typo from MOSI to MISO
4	20110324	JFR	Section 3	Removed cable colors and introduced J6 connector instead of J14 and J15
5	20110517	ANI	ALL	Added calibration hardw are description and restructuring section 3
6	20120529	ANI	Section 3.2	Change enable on chip fromp00 to p22

Table of Contents

1 ABBREVIATIONS 1

2 INTRODUCTION 1

2.1 Purpose 1
2.2 Audience and prerequisites 1

3 CALIBRATION HARDWARE CONFIGURATION 2

3.1 Calibration of device connected to application connector on ZDP03A 3
3.2 Calibration of device connected to a programming connector on ZDP03A or other prog. hw. 3

4 CALIBRATION HARDWARE DESCRIPTION 5

4.1 Calibration box schematic 5
4.2 Calibration of calibration box 5
4.3 Calibration flow 5
4.4 Calibration box Bill of Material 5
4.5 Layout considerations 6

REFERENCES 7

INDEX 8

Table of Figures

Figure 1 Calibration box 2
Figure 2 Calibration and programming with Z-Wave Programmer 3
Figure 3 Calibration programmed devices 4

Table of Tables

Table 1, Which devices has to be calibrated 1
Table 2, Calibration box interface 3

1 ABBREVIATIONS

Abbreviation	Explanation
ZDP03A	Z-Wave Development Platform, which also supports Z-Wave 400 Series programming

2 INTRODUCTION

2.1 Purpose

The purpose of this document is to give a description of the crystal calibration of the Z-Wave 400 Series Single Chips.

Beware that as the calibration is relative to the system crystal, the calibration cannot be performed if the chip is not connected to the final system crystal.

Below it can be seen which devices are sold precalibrated, and which that must be calibrated in product.

Table 1, Which devices has to be calibrated

Device	Calibration
ZM4101	Calibrated during production. No further calibration needed by customer
ZM4102	Calibrated during production. No further calibration needed by customer
SD3402	Each chip must be calibrated after PCB assembly

Devices must be calibrated once, and the calibration is valid in the entire product lifetime.

2.2 Audience and prerequisites

The audience is Z-Wave partners and Sigma Designs.

3 CALIBRATION HARDWARE CONFIGURATION

Figure 1 shows the calibration hardware box.

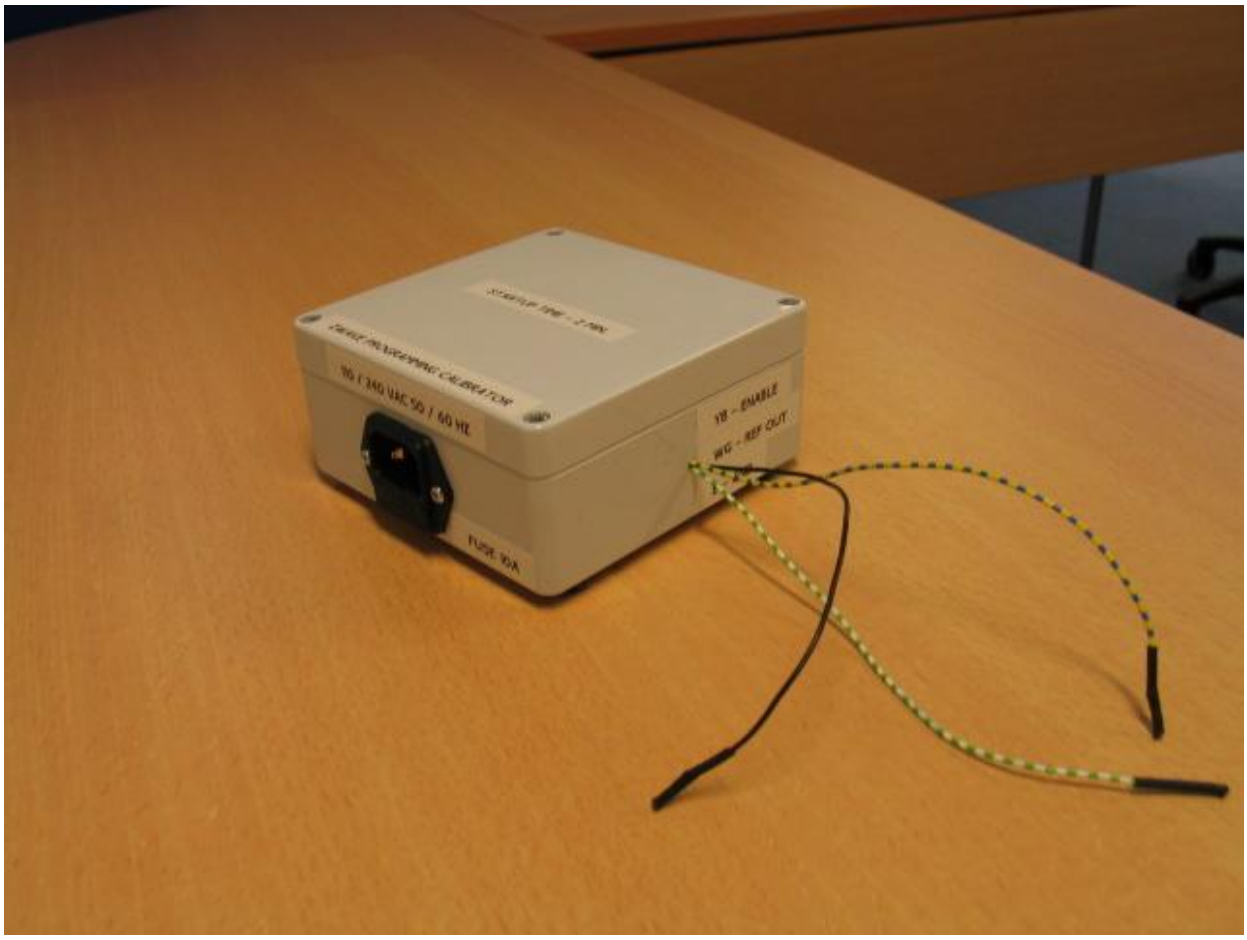

Figure 1 Calibration box

the calibration box must be supplied with 100VAC-240VAC, 50/60Hz. There are 3 flywires, which must be connected as shown in the following sections. The startup time of the calibration unit is 2 minutes before it is ready.

Calibration can be done either as a step in the programming process, or as a separate step on non-programmed/programmed devices. Anyway, the calibration step requires the same hardware setup.

3.1 Calibration of device connected to application connector on ZDP03A

Table 2, Calibration box interface

Calibration Box Cable Labeling	ZDP03A
REF_OUT	Pin 6 on J6 connector
ENABLE	Pin 3 on J9 connector
GND	Pin 9 on J6 connector

Figure 2 shows how the setup is for calibrating the 400 Series using the ZDP03A, or any similar programming hardware. Refer to [1] regarding how to operate the PC based Z-Wave Programmer in connection with the ZDP03A.

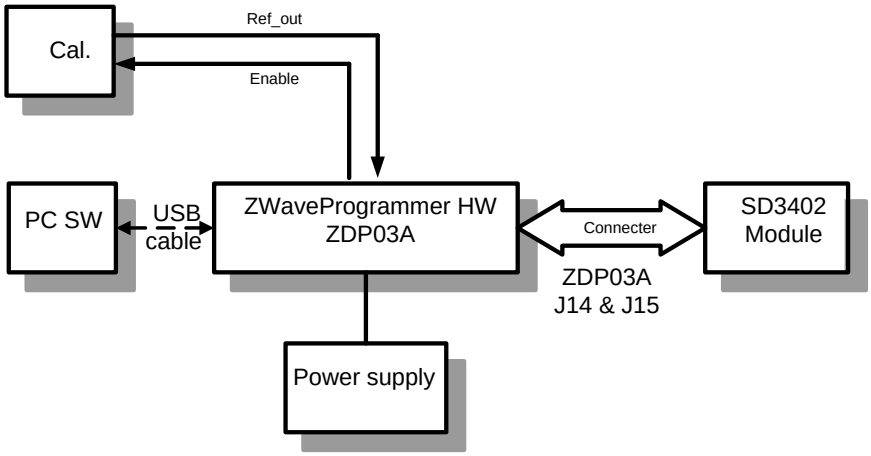

Figure 2 Calibration setup with the device connected on application connector (J14, J15)

3.2 Calibration of device connected to a programming connector on ZDP03A or other prog. hw.

Table 3, Calibration box interface

Calibration Box Cable Labeling	SD3402 Pin Name
REF_OUT	P23 (SPI1_MISO)
ENABLE	P22 (by default) or Pin 3 on J9 if ZDP03A is used
GND	VSS

The setup of that solution can be seen on Figure 3. The pin Ref_out must be connected to SPI1_MISO on the chip (which is already part of the programming interface), the programming connector (J6 on ZDP03A) must be connected to the SD3402 chip in the product during calibration as shown on figure 3.

The enable pin from the calibration box can be connected to J9 Pin 3 on the ZDP03A if this is used for programming. If another programming platform is used it must be checked if it supports “calibration

enable control". If "calibration enable control" is not supported by the programmer P0.0 of the chip must be connected to the enable signal from the calibration box.

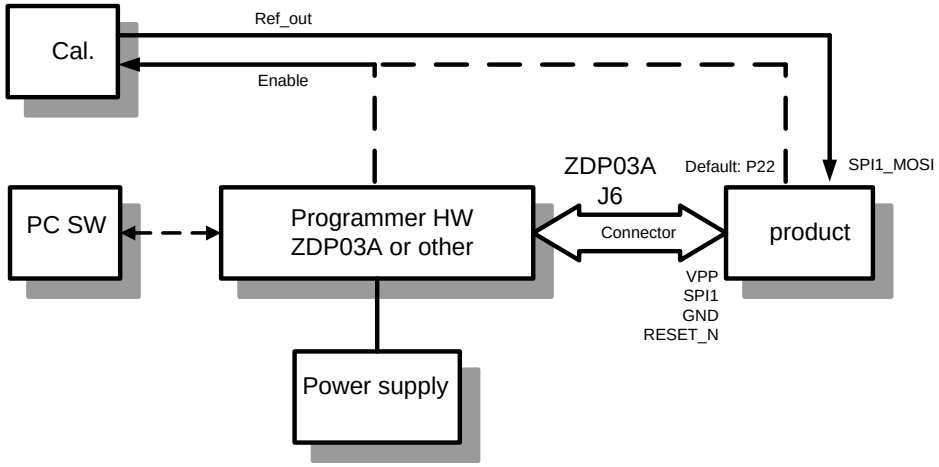

Figure 3 Calibration programmed devices

4 CALIBRATION HARDWARE DESCRIPTION

This section describes the internals of the calibration box and calibration sequence for developers that e.g. want to integrate it into their programming solution. Be aware that the leadtime on the OCXO can be long.

4.1 Calibration box schematic

A schematic for the calibration box can be found in [2].

4.2 Calibration of calibration box

After production the calibration box must be calibrated. It is done as shown below:

The enable pin must be shorted to ground. The frequency on the ref_out pin must be measured, and tuned on the multiturn potmeter until the frequency is 39.0625KHz +-0.04Hz.

4.3 Calibration flow

If it is needed to reimplement the calibration sequence (e.g. for implementing in custom programmer instead of the ZDP03A) The necessary sequence is shown below:

1. Disable the calibration box (enable = 0)
2. Download the calibration hex file to the chip in Execution out of SRAM mode (see [1]). The file is available in the Z-Wave SDK.
3. Tristate all IOs of the programming interface (SPI 1) (on the programming hardware)
4. Enable the calibration box (enable = 1)
5. Wait 1 seconds for the calibration to run.
6. Disable the calibration box (enable = 0)
7. Read the calibration result from SRAM address 0xFFF.
8. If the calibration value is 0x80 calibration has failed and nothing should be written to the OTP, otherwise write the calibration value to OTP address 0x0006
9. Remember to include the calibration value in the calculation of the codespace CRC[4]

4.4 Calibration box Bill of Material

A bill of material for the calibration box can be found in [3].

4.5 Layout considerations

The decoupling capacitors (100nF and 10nF) must be placed close to the IC they are shown next to in the schematic.

The OCXO can consume up to 800mA during warmup, and 300mA during normal operation, so the power supply wiring must be able to handle that.

If 3.3V 1.25A is available in the system the AC/DC converter can be removed.

REFERENCES

[1] Sigma Designs, INS10679, Instruction, Z-Wave Programmer User Guide.
[2] Sigma Designs, SCH11793, Schematic, 400 Series Frequency Calibration Box
[3] Sigma Designs, BOM11794, BOM, 400 Series Frequency Calibration Box
[4] Sigma Designs, INS11489, 400 Series Z-Wave Single Chip Programming Mode

INDEX

F

Flywires 2

S

Startup time of 2