Overview of SPI command protocols
Differences between the OPC-N2 and OPC-N3

Introduction

The OPC-N3 has recently been introduced into the Alphasense product range. This offers advantages over the current OPC-N2 and in time the OPC-N3 will replace the OPC-N2. We advise that new customers should start with the OPC-N3 and that existing customers should transition to the OPC-N3.
The OPC-N2 and OPC-N3 have the same current and voltage requirements. The SPI pin outs are also identical. There are differences however in the SPI communication protocol. This means that coding developed for the OPC-N2 will not work with the OPC-N3. It should be possible to modify the coding to adjust for these changes.
This document outlines the main differences. Full information can be found in the following documents:

072-0502 OPC-N3 Manual
072-0503 Supplemental SPI Information for the OPC-N3

These documents are supplied on the built in SD cards of all OPC-N3s and are also available on request from Alphasense.

It is also hoped that the popular GitHub-OPC library will be updated to allow use of the OPC-N3 and also the OPC-R1.

A coding example for running the OPC-N3 using an Arduino-Uno is also available on request from Alphasense.

Key differences and general guidelines

The mode of sending commands to the OPC has changed from the OPC-N2 to the OPC-N3. This means that:
In response to any initial command byte, the OPC-N3 should return a byte of value 0x31, indicating it is busy.
Upon receiving a command byte OPC-N3 will stop its activities and prepare data for a response if required.
During this period, until the response data is ready, if further bytes are sent to the OPC-N3, the returned byte will continue to be 0x31 (busy). When the OPC-N3 has prepared its response data it will load the SPI buffer with a byte value 0xF3 to indicate it is ready to transfer data. The command byte value must remain consistent with the original command byte value sent for the command to be validated by the OPC-N3. If it is not, the OPC-N3 will load the SPI buffer with 0x31 (busy) value and return to its normal mode of operation. THE SAMPLING TRIGGER WILL NOT BE ARMED IF THIS OCCURS. Rearming of the trigger can be achieved by a successful histogram or PM data request.
To communicate with the OPC-N3, the SPI master should poll the OPC-N3 with the command byte value, checking the returned byte for the value 0x31 (busy) or 0xF3 (ready). The first returned byte should always be 0x31 (busy). Subsequent returned bytes will either be 0x31 (busy) or 0xF3 (ready) depending on the status of the OPC-N3. If another byte value is received by the SPI master at this stage, an error has occurred and communication should cease for > 2s to allow the OPC-N3 to realise the error and clear its buffered data. The SPI master should also clear any buffered data.

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In general, it is suggested that the command byte polling interval is 10 ms and the delay between byte transfers following a receipt of byte value 0xF3 (ready) is 10 µs.

Switching on fan and laser and reading Histograms or PM data

Please note that both the fan and the laser must be switched on independently on the OPC-N3, unlike the OPC-N2, commands are listed below:

0x02 is SPI byte following 0x03 to turn fan OFF.
0x03 is SPI byte following 0x03 to turn fan ON.
0x06 is SPI byte following 0x03 to turn laser OFF.
0x07 is SPI byte following 0x03 to turn laser ON.

The Flow charts give examples of switching the OPC fan and laser on and off and reading histogram data or PM data only.
Only one peripheral ON/OFF value can follow a 0x03 power SPI command byte. If it is desired to switch multiple peripherals, each one must be switched with a separate 0x03 byte –> option byte sequence.
The interval after a 'Switch Peripherals/Fan on' sequence should be > 600 ms (< 2 s) to allow the firmware to run through the fan start up routine.

Please note that the OPC-N3 histogram now contains more data than the histogram of the OPC-N2 and that the locations have changed of some of the parameters from the OPC-N2.

Revision Control

Version	Comment	Release Date	Released by
A	**First Draft**	**December 2018**	**Mark Giles**

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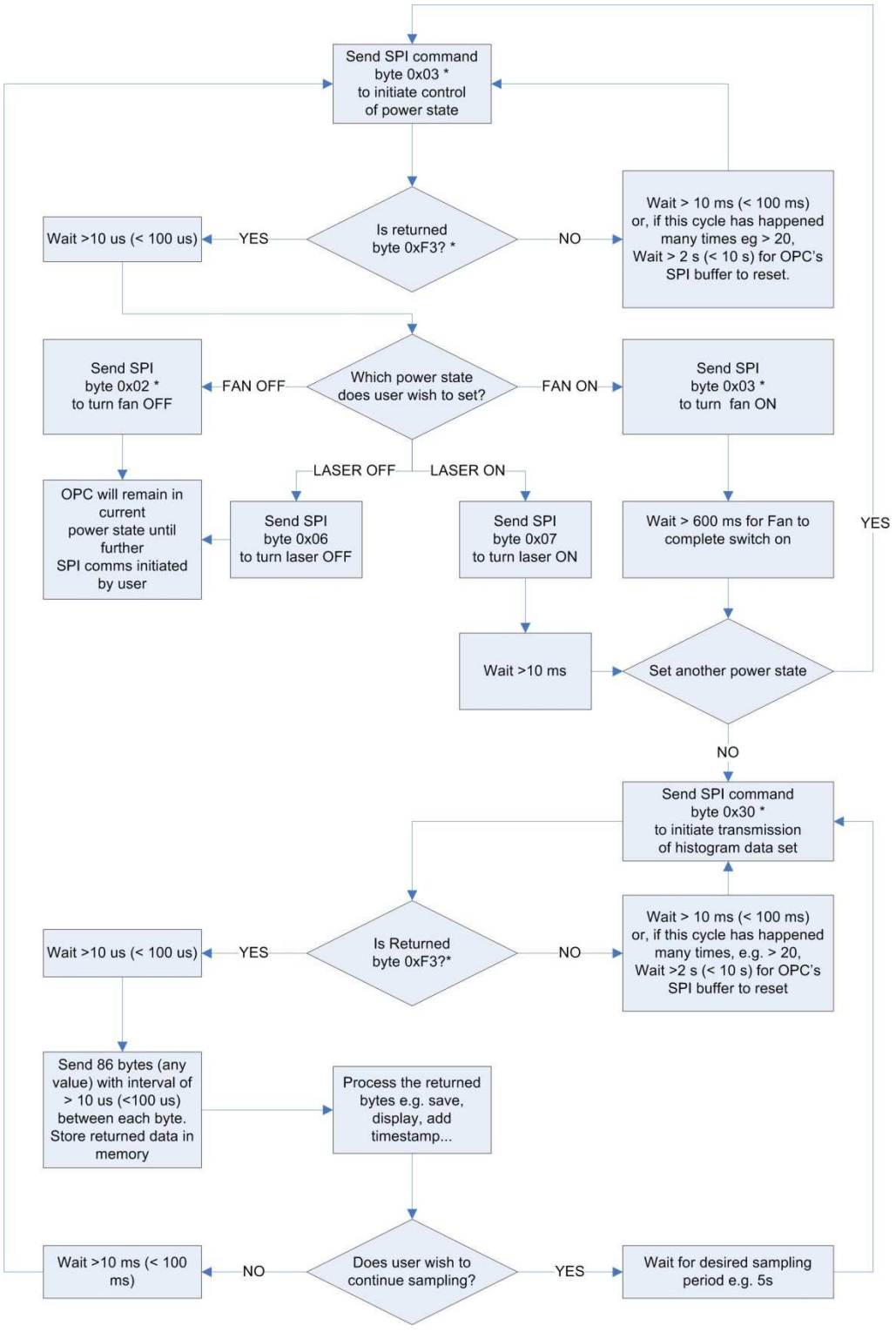

Figure 1: Flow chart depicting a typical sequence of commands and delays to run an OPC-N3 histogram sampling session.

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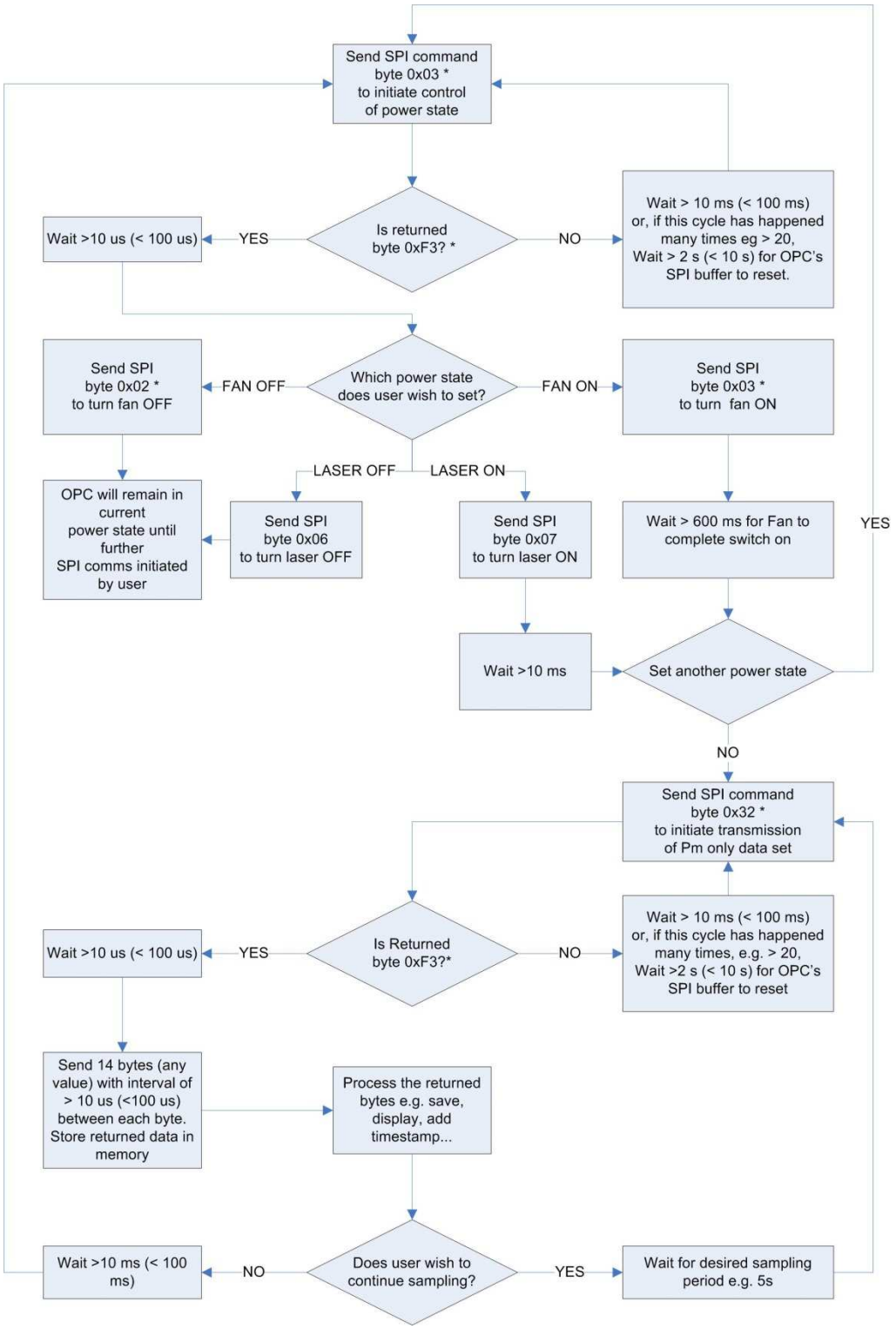

Figure 2: Flow chart depicting a typical sequence of commands and delays to run an OPC-N3 and collect PM data only.

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