

Datasheet & programming guide

v1.2 January 2024

MicroCoder

Small-format programmer for coding:
SFP, SFP+, SFP28, CWDM, DWDM, GPON, BiDi etc.



MiniCoder

Small-format programmer for coding:
SFP, SFP+, SFP28, CWDM, DWDM, GPON, BiDi etc.
and QSFP, QSFP28, QSFP-DD, DAC etc.

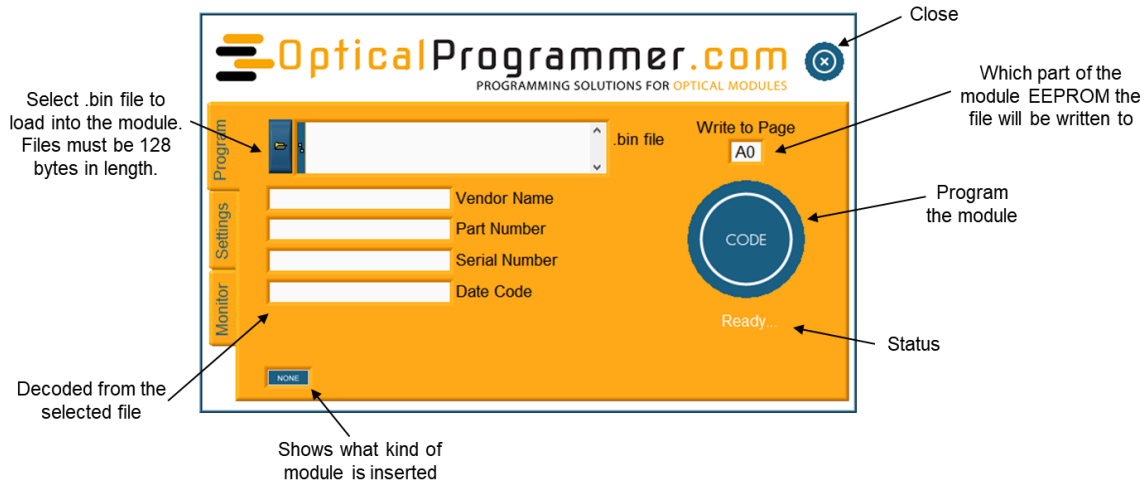
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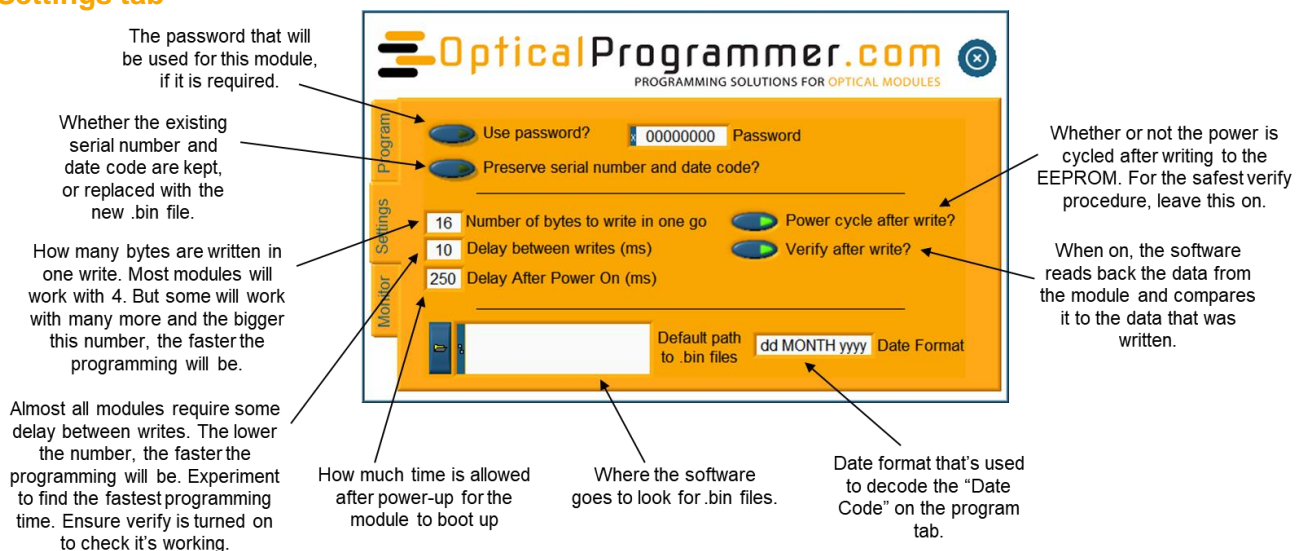
Software

The software we provide is designed to demonstrate the abilities of the coders, and to perform basic coding functions. We will also support you writing your own software.

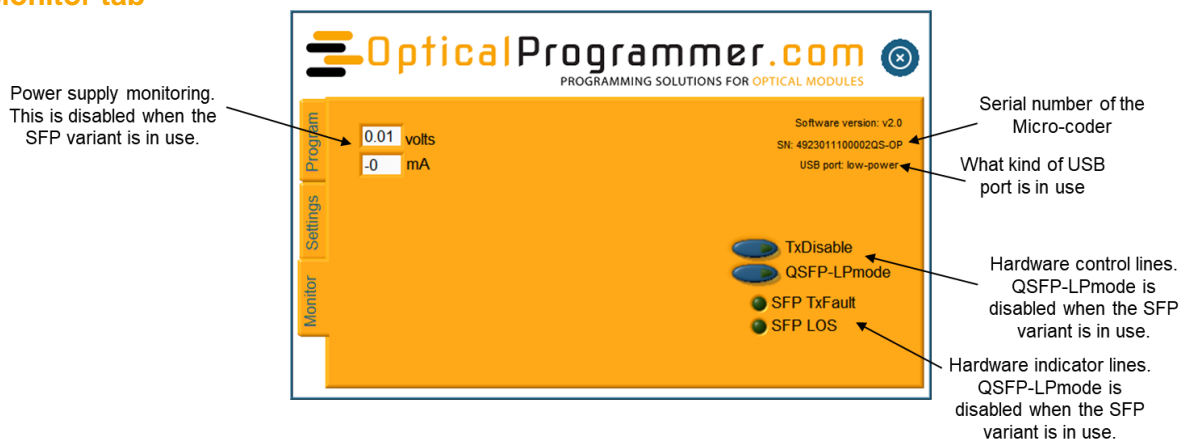
Program tab



Settings tab

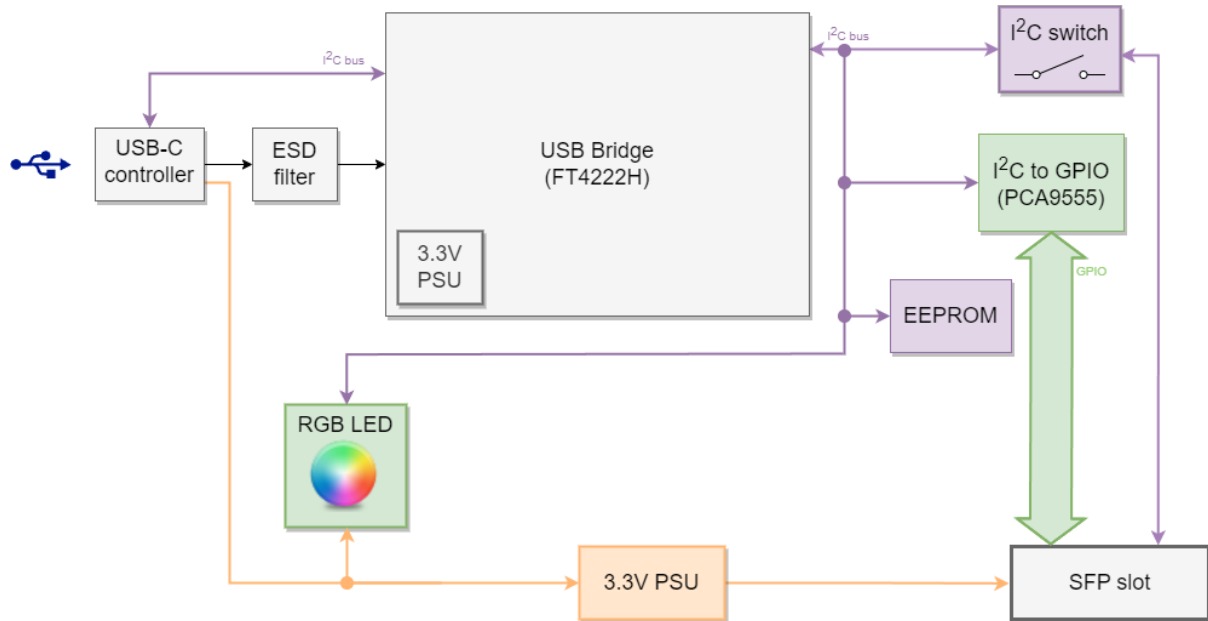


Monitor tab

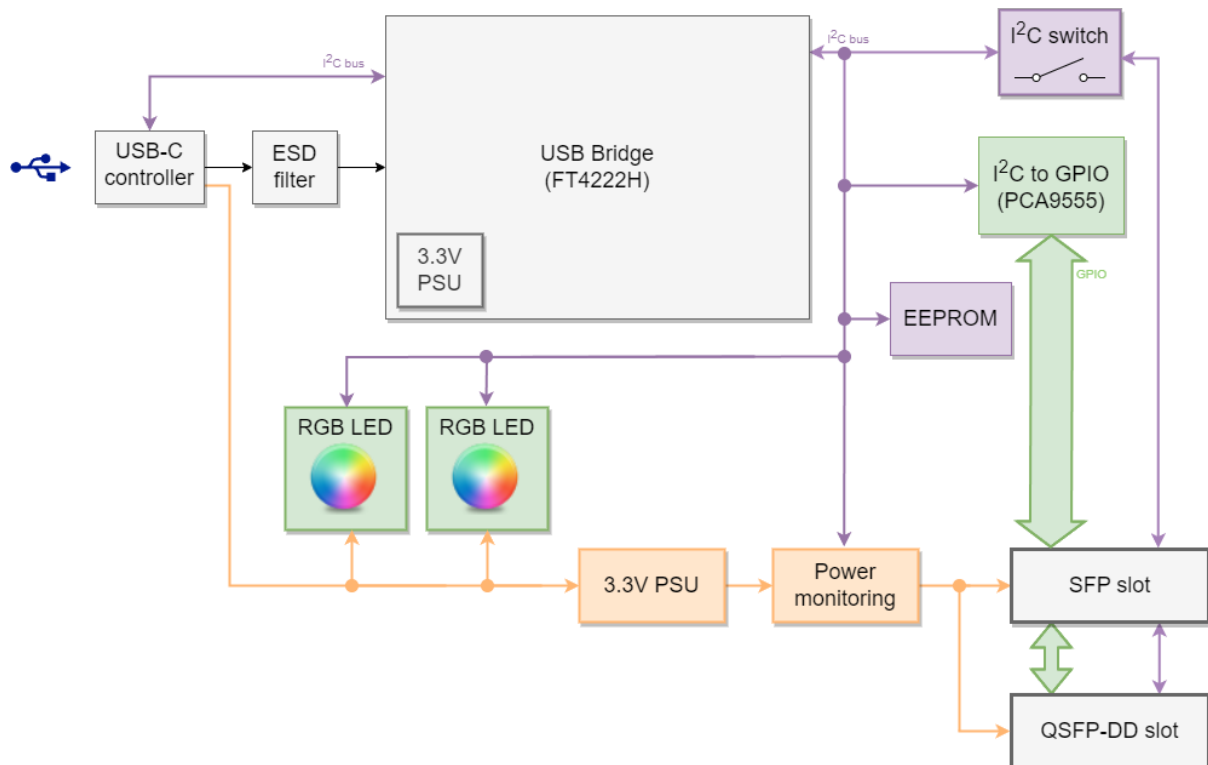


Hardware Overview

MicroCoder (SFP)



MiniCoder (SFP & QSFP-DD)



Hardware specifications

All parameters are with $T_A = 0$ to 30°C .

PARAMETER	TEST CONDITIONS	MINIMUM	TYPICAL	MAXIMUM	UNIT
Input voltage		4.5 ¹	5.0	6.0	V
Output voltage to transceivers	$P_{OUT} = 1.5\text{W}^2$	3.25	3.3	3.35	V
Output voltage to transceivers	$P_{OUT} = 7\text{W}^3$	3.15	3.3	3.45	V
Output power to transceivers	-	0	-	10^4	W
Quiescent current	Power to SFP is off LEDs are off Clock = 24MHz	45	52	54	mA
Power monitor accuracy ⁵	$P_{SFP} = 0$ to 5W	-	$\pm 1\%$	$\pm 5\%$	-

PARAMETER	TEST CONDITIONS	TYPICAL	UNIT
ESD protection – contact discharge	Standard IEC 61000-4-2	± 8	kV
ESD protection – air discharge	Standard IEC 61000-4-2	± 15	kV

A note about inserting multiple transceivers (MiniCoder only)

If an SFP and a QSFP transceiver are inserted at the same time, the MiniCoder's logic will prevent power from turning on to either transceiver.

The board is fitted with a USB-C socket. In the language of USB-C, the Coders are configured as UFP (upstream facing ports). All communications use the USB 2.0 standard.

¹ According to the USB standard, input voltage should never drop below 4.75V. In reality however, loaded ports can sometimes drop well below this, especially with long or poor quality cables.

² This represents QSFP-DD power class 1.

³ This represents QSFP-DD power class 3. In reality, the transceiver will quickly overheat at these power levels. The MicroCoder case is not designed to dissipate that much heat.

⁴ This is limited by the USB-C architecture and may not be available depending on the host implementation. The voltage at the transceiver is not guaranteed at maximum power.

⁵ For the MiniCoder only.

Programming Guide

If you want to create your own software for your MicroCoder, we will support you in doing so. This section contains all the information you need to get started.

SDK installation

The programmer has at its core an FTDI FT4222H USB to I²C converter chip. A USB driver is required, which provides two DLLs for the software to communicate with.

Where the function name starts with FT, it refers to the ftd2xx.dll

Where the function name starts with FT4222, it refers to the LibFT4222.dll

[Go to drivers for Windows/Android/Linux/OS X.](#)

[Programmers guide is here.](#)

[Software examples.](#)

After installing the driver, plug in the USB lead. Windows should automatically find the correct drivers and complete the installation

A note about I2C addresses

All I2C addresses in this document are in the 7-bit format. The eighth bit determines the read/write status of the command.

Various devices communicate via a single I²C bus:

MODULE	SLAVE/MASTER	I ² C ADDRESS
USB to I ² C bridge (FT4222H)	MASTER	-
USB-C controller	SLAVE	0x1D
LED (MicroCoder)	SLAVE	0x68
SFP LED (MiniCoder)	SLAVE	0x69
QSFP-DD LED (MiniCoder)	SLAVE	0x68
EEPROM	SLAVE	0x57
GPIO controller	SLAVE	0x38
Power monitor (MiniCoder)	SLAVE	0x41
Transceiver	SLAVE	0x50, 0x51

The I²C switch enables the I²C bus to the transceiver(s), but only when the power is applied. This arrangement prevents unpowered transceivers from locking up the bus.

Open

The first operation is to find the programmer and open a handle to it.

Use **FT_Open** to open *iDevice* = 0. This will open one USB interface for I²C data streaming.

If more than one programmer is connected to the same PC, another way will have to be used. There are several ways listed in the D2XX Programmer Guide.

ftHandle is returned from each FT_Open which is then used for all subsequent commands.

Configure Processor Clock Rate

Use **FT4222_SetClock** with *ClockRate* set to 1 (24MHz). This is a lower speed than the default and saves power.

Configure I²C

Use **FT4222_I2CMaster_Init** with *kbps = 100* to set internal I²C communication to 100kb/sec.

Port Expander

The port expander allows various parameters to be read and controlled via the I²C bus. Before attempting to read or write, the port expander must be configured:

To configure the the port expander:

Use **FT4222_I2CMaster_Write** with
deviceAddress = 0x38
buffer (Microcoder) = 0x03, 0x0E
buffer (Minicoder) = 0x03, 0x2E

Microcoder:

GPIO	NAME	R/W	OPERATION
P0	PWR-ON	WRITE	0 = power to SFP is off, 1 = power on
P1	SFP-ABSENT	READ	0 = SFP inserted, 1 = SFP slot is empty
P2	SFP-TxFault	READ	0 = SFP is OK, 1 = SFP is in fault
P3	SFP-LOS	READ	0 = SFP is OK, 1 = SFP in LOS
P4	-	WRITE	-
P5	SFP-TxDis	WRITE	0 = SFP Tx enabled. 1 = Tx disabled
P6	-	WRITE	-
P7	LED-RED-ONLY	WRITE	1 = Red LED forced on. 0 = RGB ready to use

Minicoder:

GPIO	NAME	R/W	OPERATION
P0	PWR-ON	WRITE	0 = power to SFP is off, 1 = power on
P1	SFP-ABSENT	READ	0 = SFP inserted, 1 = SFP slot is empty
P2	QSFP-TYPE	READ	0 = QSFP-DD inserted, 1 = QSFP or nothing inserted
P3	SFP-LOS	READ	0 = SFP is OK, 1 = SFP in LOS
P4	SFP-TxDis	WRITE	0 = SFP Tx enabled. 1 = Tx disabled
P5	QSFP-ABSENT	READ	0 = QSFP inserted, 1 = QSFP slot is empty
P6	QSFP-LPMode	WRITE	0 = QSFP inserted, 1 = QSFP slot is empty
P7	LED-RED-ONLY	WRITE	1 = Red LED forced on. 0 = RGB ready to use

To write to the port expander:

Use **FT4222_I2CMaster_Write** with
deviceAddress = 0x38
buffer = 0x01 0xYY, where YY represents P0-P7 (P7 is MSB).

To read the port expander:

Use **FT4222_I2CMaster_Write** with
deviceAddress = 0x38
buffer = 0x00

then,

Use **FT4222_I2CMaster_Read** with
deviceAddress = 0x38
bufferSize = 1
 The first byte returned is P0-P7 (P7 is MSB).

Get serial number, date code, hardware version

An EEPROM is provided on the I²C bus, at address 0x57. The first 23 bytes are reserved for the serial number of the board. The rest of the EEPROM is available for read/write.

Use **FT4222_I2CMaster_Write** with
deviceAddress = 0x57
buffer = 0x00

Use **FT4222_I2CMaster_Read** with
deviceAddress = 0x57
bufferSize = 23

A 23-character hex-encoded ASCII string is returned: **wwyyvmbnnnnppppppppppp**, where:

- ww** is week number of manufacture
- yy** is year of manufacture
- vv** is major hardware version
- m** is minor hardware version
- b** is hardware build number
- nnnnn** is the serial number
- ppppppppppp** is the product name, left justified with spaces
- MicroCoder: "S-OP□□□□□□"
- MiniCoder: "QS-OP□□□□□□"

RGB LED drivers

The MicroCoder has one RGB LED. The MiniCoder has two. Each is a constant current device, ensuring long and consistent LED life. Each colour LED can be turned on or off independently, and the brightness set. The driver is also capable of setting a wide variety of pulsating modes.

The RGB LED shows red when the USB port is powered up but before the software is running. When P7 is configured as an output, LED-RED-ONLY can be set to "0", which makes the RGB LED ready for normal functionality.

The LED driver can be complicated to set up. This simplified guide is a starting point for accessing the main features. Some settings could potentially damage the LEDs, so proceed with caution. Please ask if you are unsure.

RGB LED driver address:
 MicroCoder: 0x68
 MiniCoder: 0x68 (QSFP), 0x69 (SFP)

The following table shows how to set up the LEDs. Five typical setups are shown. The LED driver chip is write-only.

Address	Function	Green steady	Red steady	Blue steady	Blue slow pulse	Blue fast pulse
0x2F	Reset	0x00	0x00	0x00	0x00	0x00
0x00	Shutdown	0x20	0x20	0x20	0x20	0x20
0x02	Mode	0x00	0x00	0x00	0x20	0x20
0x03	Current limit (17.5mA – do not change)	0x10	0x10	0x10	0x10	0x10

0x04	Green brightness (00 to FF)	0x40 ⁶	0x00	0x00	0x00	0x00
0x05	Red brightness (00 to FF)	0x00	0x60	0x00	0x00	0x00
0x06	Blue brightness (00 to FF)	0x00	0x00	0x80	0x80	0x80
0x07	Load brightness data	0x00	0x00	0x00	0x00	0x00
0x10	Pulse setting	0x00	0x00	0x00	0x84	0x40
0x11	Pulse setting	0x00	0x00	0x00	0x84	0x40
0x12	Pulse setting	0x00	0x00	0x00	0x84	0x40
0x16	Pulse setting	0x00	0x00	0x00	0x64	0x20
0x17	Pulse setting	0x00	0x00	0x00	0x64	0x20
0x18	Pulse setting	0x00	0x00	0x00	0x64	0x20
0x1C	Load pulse data	0x00	0x00	0x00	0x00	0x00

Example

To set the LED to “Blue slow pulse”:

Do 15 separate I²C writes as follows...

```

deviceAddress = 0x68, buffer = 0x2F, 0x00
deviceAddress = 0x68, buffer = 0x00, 0x20
deviceAddress = 0x68, buffer = 0x02, 0x20
deviceAddress = 0x68, buffer = 0x03, 0x10
deviceAddress = 0x68, buffer = 0x04, 0x00
deviceAddress = 0x68, buffer = 0x05, 0x00
deviceAddress = 0x68, buffer = 0x06, 0x80
deviceAddress = 0x68, buffer = 0x07, 0x00
deviceAddress = 0x68, buffer = 0x10, 0x84
deviceAddress = 0x68, buffer = 0x11, 0x84
deviceAddress = 0x68, buffer = 0x12, 0x84
deviceAddress = 0x68, buffer = 0x16, 0x64
deviceAddress = 0x68, buffer = 0x17, 0x64
deviceAddress = 0x68, buffer = 0x18, 0x64
deviceAddress = 0x68, buffer = 0x1C, 0x00
    
```

Communication with Transceiver

Write:

Use **FT4222_I2CMaster_Write** with

deviceAddress = 0x50 (to access the “A0” area)

buffer = 0xYY 0xZZ, where YY is the memory location; ZZ is the data to write

Read:

Use **FT4222_I2CMaster_Write** with

deviceAddress = 0x50 (to access the “A0” area)

buffer = 0xYY, where YY is the desired memory location

then,

Use **FT4222_I2CMaster_Read** with

deviceAddress = 0x50 (to access the “A0” area)

bufferSize = as required

⁶ The green, red and blue LEDs are not all the same brightness for the same current. The numbers in this table give a reasonably equal brightness for all three colours.

Close

Use **FT4222_UnInitialize** and **FT_Close** to turn off and close communication with the programmer. This must be done before closing the software else the programmer will not be found next time the software is run.

Mechanical Properties

MicroCoder

Approximate dimensions: 44mm x 30mm x 14mm

Approximate weight: 13g

MiniCoder

Approximate dimensions: 80mm x 39mm x 14mm

Approximate weight: 31g

Both types are supplied with rubber feet.

Customization

Branding

Both the MicroCoder and MiniCoder labels can easily be customized to your branding. This is normally free of charge, subject to a minimum order quantity.

Software

If you have your own software team, we can work with them to achieve your desired outcome, providing all the support they need.

Alternatively, we offer a full turnkey solution, with software customized to your needs. We can even integrate into your SQL database systems if necessary. We will work with you to define how you would like the software to work, and how you would like it to appear. The target OS can be Windows, macOS, iOS, or Android. Just ask.

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OpticalProgrammer.com Ltd, registered number 13470035



EU Declaration of Conformity

OpticalProgrammer.com Ltd
14 Brandon Grove
Stoke-on-Trent. ST4 8EW.
UNITED KINGDOM

declare, under our sole responsibility, that the products:

SFP MicroCoder (S-OP)
SFP-QSFP MiniCoder (QS-OP)

conform with the provisions of the following EU Directives:

EMC Directive 2014/30/EU
Restrictions on Hazardous Substances Directive 2011/65/EU (RoHS2)

Place
Stoke-on-Trent, UK

Signature

Date
12/09/2023

Jon Mason
Director



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Email: jon@opticalprogrammer.com Web: www.opticalprogrammer.com
UK VAT: GB395023396 EORI: GB395023396000
OpticalProgrammer.com Ltd, registered number 13470035

**UK
CA**

UK Declaration of Conformity

OpticalProgrammer.com Ltd
14 Brandon Grove
Stoke-on-Trent. ST4 8EW.
UNITED KINGDOM

declare, under our sole responsibility, that the products:
SFP MicroCoder (S-OP)
SFP-QSFP MiniCoder (QS-OP)

conform with the provisions of the following UK Directives:
Electromagnetic Compatibility Regulations 2016
**The Restriction of the Use of Certain Hazardous Substances in Electrical and
Electronic Equipment Regulations 2012**

Place
Stoke-on-Trent, UK

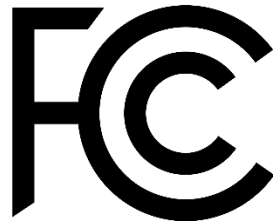
Signature

Date
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Statement of FCC Exemption

OpticalProgrammer.com Ltd
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Stoke-on-Trent. ST4 8EW.
UNITED KINGDOM

declare, under our sole responsibility, that the products:

SFP MicroCoder (S-OP)
SFP-QSFP MiniCoder (QS-OP)

are class-A unintentional radiators, exempt from the provisions of FCC Part 15 Subpart B (CFR 47), under the rule 15.103(c) "a digital device used exclusively as industrial...test equipment".

In addition, these devices are marketed only to industrial users, and is intended to be used by qualified engineers and technicians in an industrial environment.

Place
Stoke-on-Trent, UK

Signature

Date
12/09/2023

Jon Mason
Owner



Small print

Terms and Conditions of Sale:

In these conditions, "we" and "us" refers OpticalProgrammer.com Ltd. In placing an order with us, you agree to be bound by the terms and conditions stated herein. The provisions set forth herein are for the sole benefit of the parties hereto, and confer no rights benefits or claims upon any person or entity not a party hereto.

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Specifications, availability and pricing are subject to change without notice. Orders are not binding upon us until accepted by us, and until any specified initial payments are received. Prices listed are in British Pounds (GBP). We reserve the right to refuse service, terminate accounts, or cancel orders at our sole discretion.

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In placing an order with us, you agree to comply with all applicable export laws, restrictions and regulations of the United Kingdom or foreign agencies or authorities, and shall not export, or transfer for the purpose of re-export, any product to any prohibited or embargoed country or to any denied, blocked, or designated person or entity as mentioned in any United Kingdom or foreign law or regulation. You warrant that you are not prohibited by law from purchasing the products or services hereunder. You shall be responsible to obtain any license to export, re-export or import as may be required.

Cancellation

In the event of you cancelling an order, we reserve the right to invoice you for a reasonable proportion of the total order value that was originally quoted.

If we cancel an order, we will refund the payment within 5 days of cancellation.

If we fail to ship an off-the-shelf (non-custom) item within 7 days of payment, we will refund the payment within 5 days of the estimated shipment date.

Return and refund policy

Off-the-shelf (non-custom) products may be returned within 60 days of purchase for a full refund of the purchase price minus any shipping, taxes and duties we have paid. Unless agreed, you will be responsible for return shipping to us.

Warranty

Our products are covered by a one year warranty; this covers parts and labour based on the goods being returned to our address, below.

Privacy Policy

We may ask you to provide us with certain personal data including (but not limited to) your name, email address, phone number and mailing address. We will not share that data with any other company or individual without your permission. We will keep your data safe and we will use your data only in the context of our business relationship with you.

Intellectual Property

For "off the shelf" goods, we retain all intellectual property rights associated with the design and manufacture of any goods or equipment supplied under this agreement. For custom designs, you own the intellectual property rights including PCB designs, schematics, bills of material and any software supplied, unless otherwise agreed.

Liability

We will not be liable for any loss or damage to any goods or equipment on loan to us. We specifically disclaim any and all warranties, either express or implied, with regards to any licensed products. No warranty will apply if products supplied hereunder are in any way altered or modified after delivery. In no event shall we be liable for any damages, including but not limited to loss of profits, revenues, business, goodwill, data, injury, interruption of business, nor for incidental or consequential loss or fitness of purpose damages related to this agreement.

If we provide you with advice, training, applications support, or other assistance which concern any products supplied hereunder, or any equipment, system or the like in which the product may be installed, our giving of such advice or assistance will not subject us to any liability, whether based on contract, warranty, tort (including negligence) or other grounds.

Revision History

v1.2

- Complete update, added MiniCoder information.

v1.1

- Changed unused GPIOs to OUTPUTS, which changes the configuration bytes.

v1.1

- Added Micro-coder branding
- Added outline instructions and process flow for demo software
- Formatting changes

v1.0

- Original version