

FMR-20/BSW-20 Operation Manual



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1 Overview and system requirements

The ICC-4C is an industrial current controller with four channels. It can drive most of Optotune's products, particularly the electrically tunable lenses (EL), the beam shifters (BSW) and the fine steering mirrors (FMR). This manual focuses on how to drive the BSW and FMR with the ICC-4C.

System requirements:

- Windows 10 or later
- USB Driver: USB 2.0 port
- Optotune Cockpit Control Software <https://www.optotune.com/registration-for-software-download>
- Latest ICC-4C firmware <https://www.optotune.com/registration-for-software-download>

2 Mechanical mounting

Please refer to the respective datasheet for technical drawings:

<https://www.optotune.com/s/Optotune-FMR-20-Datasheet.pdf>

<https://www.optotune.com/s/Optotune-BSW-20-Datasheet.pdf>

<https://www.optotune.com/s/Optotune-ICC-4C-2000-datasheet.pdf>

3 Hardware

3.1 Overview

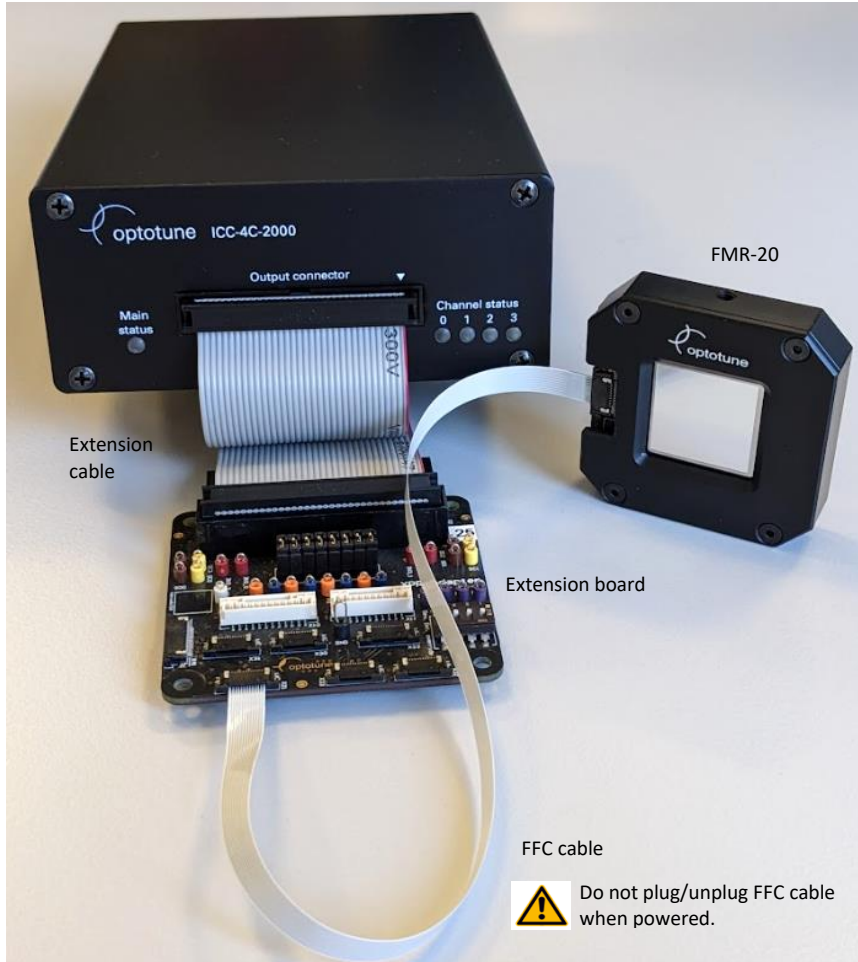


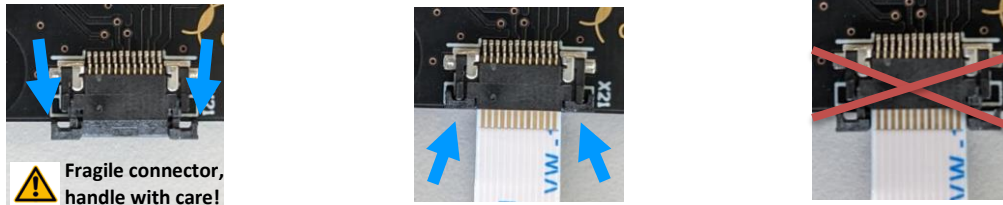
Figure 1: Picture of FMR-20 connected to the ICC-4C-2000 controller.

- FMR-20 or BSW-20 (incl. FFC cable)
- ICC-4C-2000 controller
- ICC-4C-2000 extension kit
 - Extension board for FMR-20 / BSW-20
 - Extension cable (15 cm, optional)
 - DIN rail clamp kit (included, not shown)
 - The FMR-20 / BSW-20 is connected via adapter board and standard FFC cable (12 pin, 0.5mm pitch). Also included is a power supply and a USB cable.
- ICC-4C power adapter and power cable (not shown, available plug types: EU, CH, US, UK, CN)

3.2 Hardware connections

The FFC cable can be plugged directly into the connector of the adaptor board. Open the connector clamp with tweezers. Insert the flex cable fully with the copper pads facing upwards. Close the black clamp by pushing both sides simultaneously.

IMPORTANT: Unlock the connector before making a new connection:



WARNING: Do not connect or disconnect the FMR-20 device with the FFC cable when powered. EEPROM corruption or permanent electronics damage may result.

Use connector X21 on the extension board to connect the device. A second device can be connected on connector X22:

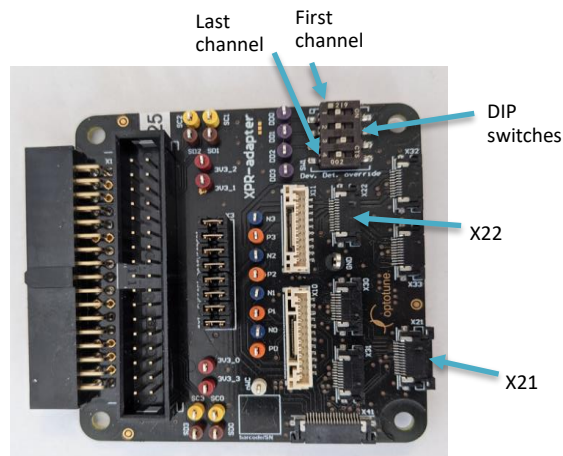


Figure 2: Connectors on ICC-4C-2000 extension board.

The default setting of DIP switches, i.e. all switches in OFF position, shall be used with the FMR-20. Using a different setting will disable automatic device detection, which is not recommended.

4 Software

Please install the latest software and firmware from our [website](#):

- Optotune Cockpit (GUI)
- ICC-4C-2000 Firmware
- ICC-4C SDK in Python or C#

4.1 Optotune Cockpit

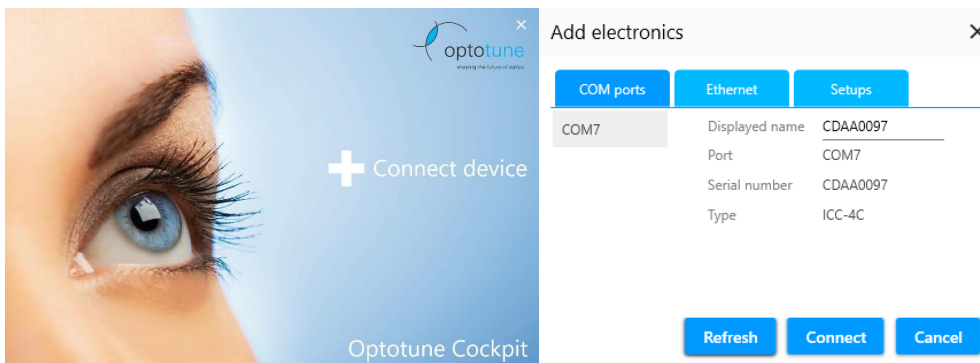
This section provides a short overview of the Optotune Cockpit software. It describes the main functions to control the FMR-20.

Please also refer to the more general manual on Optotune Cockpit:

<https://www.optotune.com/s/Optotune-Cockpit-manual.pdf>

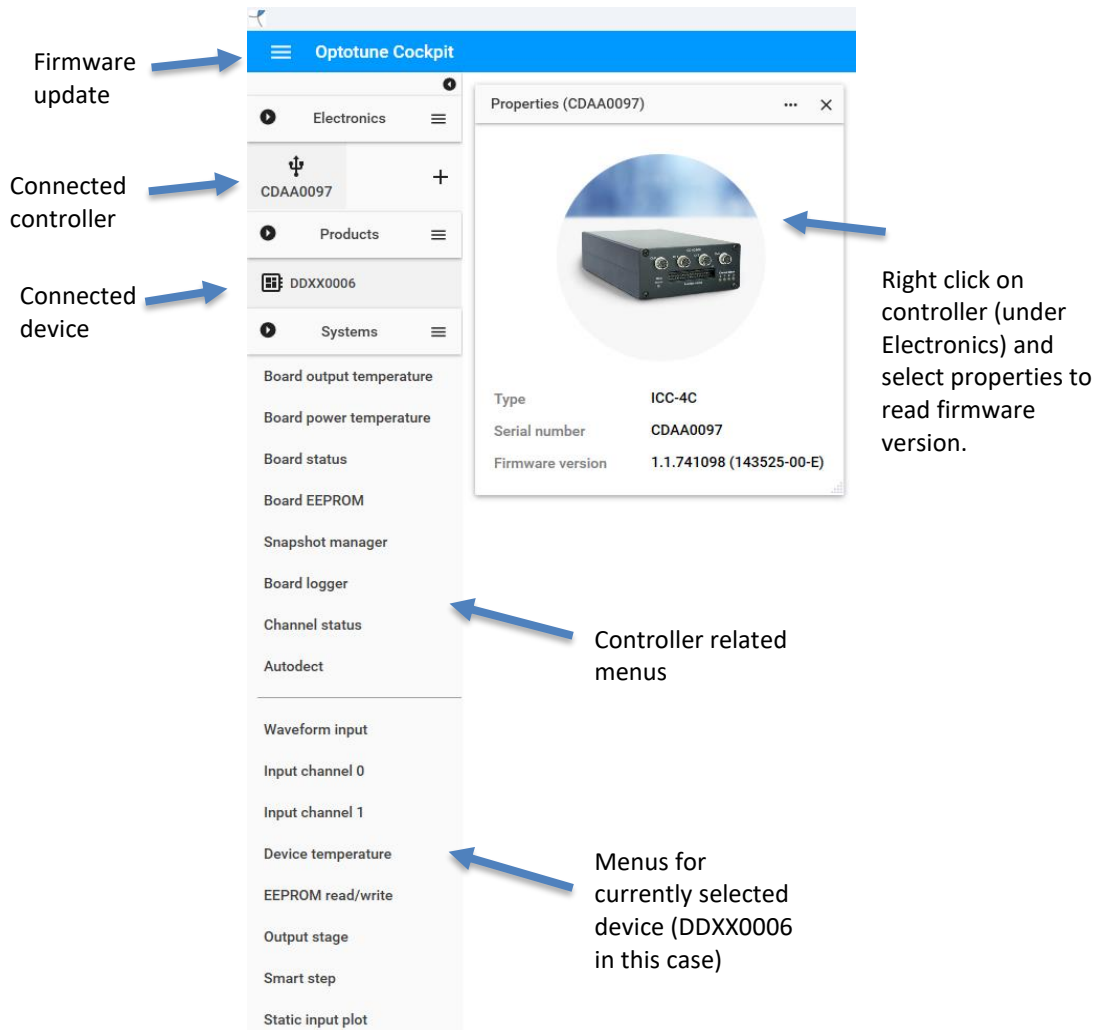
4.2 Connecting to hardware

Make sure that the ICC-4C is connected via USB to the computer and powered. Alternatively, connecting via Ethernet (incl. PoE) is possible. Open Optotune Cockpit and click on *Connect device*.



A window will appear, allowing you to select the controller. The COM port is detected automatically.

After clicking connect, the device will appear on the left-hand side of the Optotune Cockpit window.



Firmware update

Connected controller

Connected device

Right click on controller (under Electronics) and select properties to read firmware version.

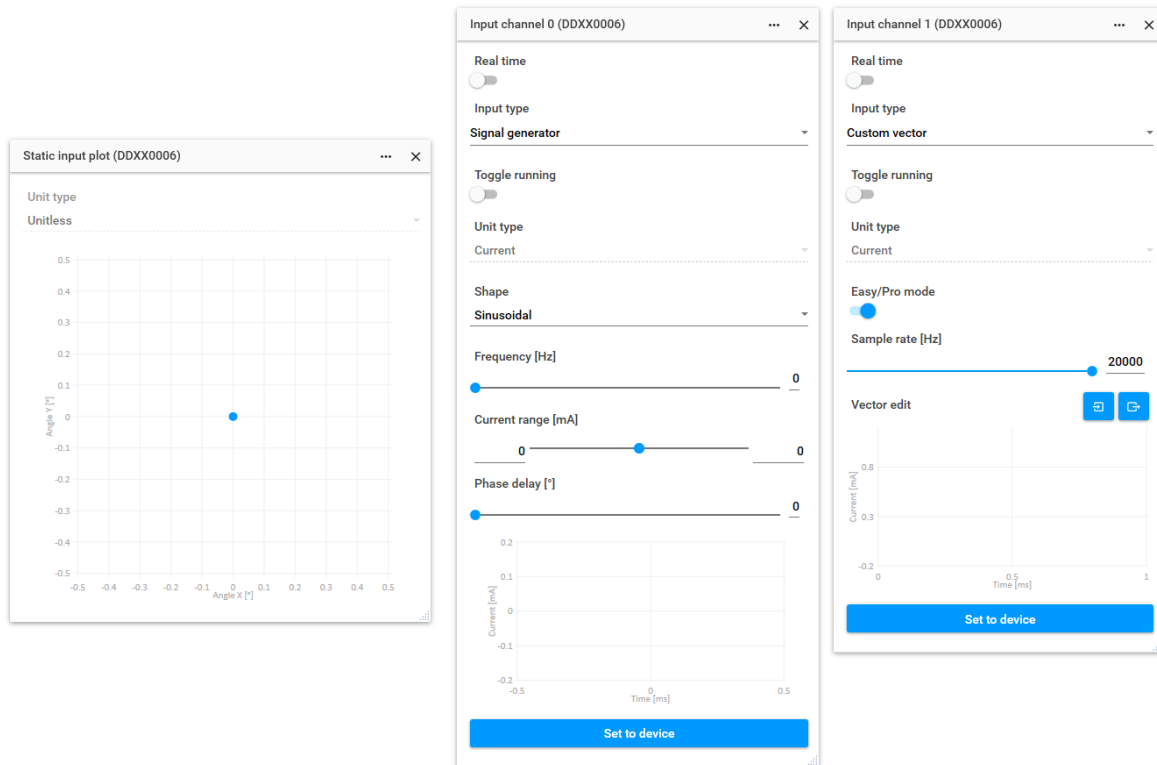
Controller related menus

Menus for currently selected device (DDXX0006 in this case)

Properties (CDAA0097)	
Type	ICC-4C
Serial number	CDAA0097
Firmware version	1.1.741098 (143525-00-E)

4.3 Device control

The main panels for controlling the FMR are the *Static input plot* and the more general *Input channel 0* and *Input channel 1* menus.



The *Static input plot* is a graphical representation of the pointing direction of the mirror. It can be clicked to make the mirror move to a desired position.

The *Input channel 0* and *Input channel 1* menus provide access to the following device control modes:

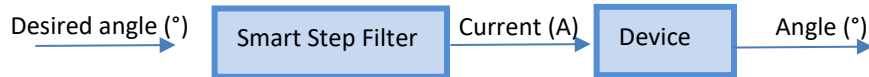
- **Static value:** Optotune Cockpit sends a static current value to the driver.
- **Signal generator:** The internal signal generator within the driver sends a time-dependent stream of position or current values until it is interrupted. Available signal generating functions are Sinusoidal, Rectangular, Sawtooth, Triangular and Staircase. These signals stay in sync over different channels, independently of the starting time, i.e. when you press *Set to device*.
- **Arbitrary vector:** The driver reads a set of user-defined positions or currents one after another and sends them to the mirror. Two modes are possible, simple mode with user defined sequence of points directly in the GUI. Import of a csv-table describing the sequence of values to be scanned.
- **Analog input:** The driver switches to Analog input mode.

There are two ways to control the mirror through this Panel, either with *Real Time Input* on or off. If *Real Time Input* is on, any changes in the panel are transferred directly to the driver and take effect immediately. If it is turned off, you need to press *Set to device* after making changes for them to be sent to the driver.

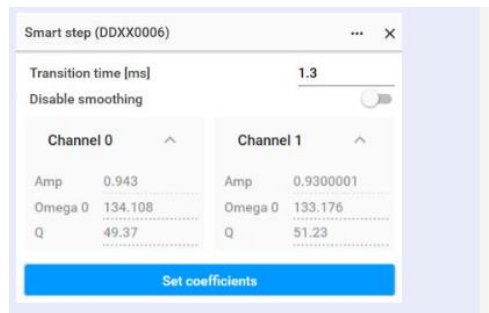
By default, the Unit type is *Current*. Due to the linear response of the device, the angular position control is straightforward for quasistatic applications.



For more dynamic waveforms, the dynamics of the device (FMR / BSW) need to be considered. The ICC-4C provides a *Smart Step* functionality for this purpose:



This filter uses a model that is based on the calibration parameters that are specific to every device:



The transition time of 1.3 ms should only be changed, if speed is crucial. Reducing the value can increase ringing and increase power consumption.

With *Smart Step* on, all input systems will automatically change to angle units (°) instead of current (A).