Using FonaDyn with RME digital audio interfaces
Sten Ternström

General

The RME series of digital audio interfaces are highly sophisticated devices of professional caliber. While their large range of built-in functions can seem overwhelming, their high performance warrants the extra effort to learn. The interfaces contain not only A/D-D/A converters, but also a complete mixing desk and a signal router, with which you can connect many signal sources and destinations at the same time. An RME interface can be used e.g. for setting up loudspeaker and/or headphone feeds to the subject, establishing a talkback from a control room, mixing in self-monitoring into headphones, bringing in a synthesizer or background accompaniment, to name a few examples. This guide gives some suggestions for getting started with FonaDyn on RME devices. To use the full potential of your device, be sure to study the RME User Guide carefully.

Configuring the hardware

Connect your Fireface to the computer and turn it on. In the on-screen task bar, find the icon shown here, and click it. (In Windows 10, this icon should appear when you click the ^ symbol in the Task Bar.)

This opens a dialog box with hardware settings for the device. Find the field **Sample Rate** and select 44100 Hz. For **Clock Source**, select **Internal**. Find also the field **DSP** and *un*check the box **EQ+D for Record**. Then choose **OK**.

Controlling the Fireface

All functions of the interface are controlled through the software app TotalMix FX. To start this app, find the (FX) icon and click it. (In Windows 10, this icon should appear when you click the ^ symbol in the Task Bar.) The app will start only if the device is connected and switched on. Once TotalMix FX is running, you can reach it through this icon in the Task Bar.

The TotalMix architecture

An ordinary mixing desk typically has a large number of inputs and a small number of outputs. For instance, a small 8→2 console has 8 inputs that can be mixed together to 2 output 'buses' (main left and main right). There is also a "tape return" route for listening to recordings instead of the inputs, which can have just 2 input channels on a small console, hence (8 or 2)→2; or more when doing multitrack work. Nowadays, "tape return" has been replaced by "software playback", since the recordings reside not on tape, but in the computer.

With RME hardware and the TotalMix software, you have a much larger domain. For instance, even on a small model such as the UCX, you have a console that is (18+18)→18. That is, each one of the 18 output buses receives its own independent mix of up to 36 inputs, of which 18 are from external sources and 18 come from the computer software. The channels are usually paired for stereo, but that still gives 9 control stripes each, for inputs, playbacks and outputs.

So, and this is important: to direct sound to a given output, *first* click on the stripe for that output, on the *lowest* row, "HARDWARE OUTPUTS". This moves all the input and playback faders into their positions *for that output. Then* pull up only the fader(s) for the HARDWARE INPUTS or SOFTWARE PLAYBACK signal source(s) that you want to hear.

For recording, all inputs go unchanged directly to the computer. So to record using hardware inputs AN1/2, you have to select the corresponding audio device in your recording software.

The TotalMix layout makes no difference between output buses and AUX buses; they are all equivalent. The only 'special' buses are the internal FX Send and FX Return, which go to/from the built-in effects unit.

Configuring SuperCollider

In SuperCollider you can easily open the startup file for editing, from the File menu.
Edit the file `startup.scd` to contain these lines:

```
Server.local.options.device = "ASIO Fireface";
Server.local.options.numOutputBusChannels = 2;
Server.local.options.numInputBusChannels = 2;
Server.local.options.sampleRate = nil;    // use the hardware-selected rate
```

FonaDyn (and any other code in SuperCollider) will now record on the first two input channels, AN1/2, and play on the first two playback channels, AN1/2.

Saving your setups

The TotalMix software has a number of options for saving and restoring its many settings. Please read the manual carefully on this point, because it can save you a lot of time. Briefly,

- There are eight Snapshot memories, each of which contains all settings and layout. Save/Load Snapshot... saves/loads one snapshot file.
- Save/Load Workspace... saves/loads the entire configuration of the device and of TotalMix itself, in a workspace file. This includes all Snapshots currently in the Workspace. Loading a Workspace file will overwrite the active Snapshots with the ones in the Workspace file.
- The Fireface device has an internal flash memory that stores the most recently used Workspace, even when the device is switched off. (This can make it possible to use the device stand-alone, without a computer.) When you connect the Fireface to a computer, TotalMix will ask if you want to use the settings stored in the device, or replace them with the settings in the current TotalMix workspace.

When you have finished setting up the device, always choose File | Save Snapshot or File | Save Workspace. If one configuration is enough for your project, a Snapshot will suffice. If your project uses up to eight Snapshots, save them all in one Workspace file.

Setting up the microphone and EGG signals

Models Fireface 400, UC, UCX, and Babyface

These models all have their microphone preamps on inputs 1 and 2. This is what FonaDyn expects. Connect your microphone to input 1 using an XLR connector, and your EGG device to input 2 using a ¼" jack plug connector (XLR on the Babyface).

In TotalMix, for each channel strip, there are three extra control panels, which appear when you press the corresponding button: Settings (spanner icon 🔧), Equalizer (EQ) and Dynamics (D). Now, for the channel Mic 1,

- Turn the pan knob fully left (L100)
- Press the spanner 🔧 to open the Settings.
- Turn *off* the Stereo button
- If the microphone requires phantom power (+48v), then turn on the button 48V .
- Set the Gain control knob to about -12 dB
- Check that AutoLevel is off.

The control knob called **Gain**, by default, is the only point at which the input gain can be controlled before the A/D converter. We will use this knob for gain calibration, as described in the *FonaDyn Handbook* section 3.2.4. Turn off the AutoLevel feature for the microphone, as it will break the calibration of sound level.

> Actually, there *is* a another Gain control, in the **Dynamics** panel. To use it when recording, you need (1) to go to the separate RME applet for hardware configuration, and there check the option "EQ+D for Record", and (2) to turn on Dynamics processing with the round button at the top left of the Dynamics panel. We discourage this, because you might accidentally introduce other Dynamics processing as well.

Now we will configure the EGG input. For the channel Mic 2,

- Turn the pan knob fully right (R100).
- Press the spanner 🔧 to open the Settings.
- Leave the Stereo button in the off state.
- Make sure that the phantom power is off.
- Turn on Inst (or Pad) if present, to select low gain for channel 2.
- Turn AutoLevel on.

For the EGG signal, the AutoLevel feature is quite useful, for preventing clipping. FonaDyn does not require the gain for the EGG signal to be calibrated.

Models Fireface 800, 802, UFX, UFX II and UFX+

These models all have their microphone preamps on inputs 9-12 (Fireface 800: inputs 7-10). FonaDyn uses only the inputs 1-2, and so will not see the microphone signals. To solve this, you can either use a separate mic preamp connected to analog line input 1 (easy), or use the built-in routing capabilities of the Fireface. The latter is a little trickier, but you don't need a separate pre-amp. The description below includes this re-routing alternative.

On the Fireface models 800 and 802, TotalMix has no Gain control here. Instead, on the front panel of the device, each of the four XLR inputs (7-10 or 9-12) has a physical gain or 'volume' control knob, next to its connector. We will use this physical knob for the gain calibration, as

described in the *FonaDyn Handbook* section 3.2.4. For the following example, we will use inputs 9 and 10, since both models have mic preamps on these inputs.

Connect your microphone to input 9 using an XLR connector, and your EGG device to input 10 using a ¼" jack plug connector.

In TotalMix, for the channel Mic 9,
- turn the pan knob fully left (L100),
- Press the spanner 🖉 to open the Settings
- turn *off* the Stereo button,
- if the microphone requires phantom power (+48v), then press the button 48V .

Now we will configure the EGG input. For the channel Mic 10,
- Turn the pan knob fully right (R100).
- Press the spanner 🖉 to open the Settings.
- Turn on Inst, to select the jack input instead of XLR.
- Leave the Stereo button in the off state.
- Turn the phantom power off (although it does not affect the jack input).

In TotalMix, it is possible to **loop back** internally the signals at the hardware outputs to the inputs, but only to those with the same number. In other words, only the hardware outputs AN1/2 can be looped back to hardware inputs AN1/2, which is where we want the Mic signal. To activate the loopback, follow these steps, in the given order:

- Pull down the fader on the output CONTROL ROOM AN1/2 (or "Main"). This is to prevent howling feedback, since AN1/2 is usually also the speaker output.
- Pull up the fader on HARDWARE INPUTS Mic 9 to 0 dB. This routes Mic 9 to the CONTROL ROOM AN1/2.
- Open the Settings for CONTROL ROOM output AN1/2 and press Loopback.

Now the signals on CONTROL ROOM outputs AN1/2 are invisibly looped back to HARDWARE INPUTS AN1/2 (unaffected by all the AN1/2 Settings, EQ and Dynamics). This is what we want. Now, the gain of the recorded signal is affected also by the fader for HARDWARE INPUTS Mic 9. The CONTROL ROOM AN1/2 fader affects only the gain to the analog outputs.

EQ settings

The EQ (equalizer) settings allow you to insert filters that change the frequency response of the channel. Normally, you should make sure that the EQ section is completely disabled on both input channels. Each 'EQ' indicator should be dark, not lit up in orange.

FonaDyn always applies a fixed high-pass filter of its own to the microphone signal. FonaDyn has no phase issues with the microphone signal. If you have a very good microphone *and* a great deal of low-frequency background noise in the room, you may still face problems with low-frequency rumble. If so, then in TotalMix, on the microphone channel, you might want to activate the built-in low-cut (LC) filter. In the EQ panel, turn on the LC switch and adjust the slope and cutoff of the low-cut (high-pass) filter as desired.

Do not apply any EQ to the EGG signal. If you do, the EGG pulse shapes may be distorted, or change in an undesired way with the fundamental frequency.

Setting up for playback

For listening to recordings, and for live monitoring of the microphone, FonaDyn will play back the Voice signal on the first two channels of Software Playback. When recording, the second output can optionally be used to play a tone for level calibration (Handbook section 3.2.4.2).

Default playback device

To avoid disturbances and accidental recording of alert sounds from your operating system, make sure that the Fireface outputs AN1/2 (sometimes called "Main" or "Speakers") are *not* configured as the **default playback sound device** for your computer. This is done in your computer's system control panel. This recommendation is especially important if you are using loopback on AN1/2, as described in the previous section.

If you do want to hear alert sounds, or if you want to play sounds from the same computer to the subject, you can set the Fireface outputs AN3/4 as the default playback device, and, using TotalMix, route Software Playback AN3/4 to the Fireface's headphone output.

Using extra DC-coupled A/D converters

Audio devices, by design, will block low frequencies and DC, making them useless for slow physiological signals such as flow, pressure and volume measurements. However, there are A/D converters that do pass DC and that can be connected via the ADAT lightpipe interface on your RME device. These converters come from the analog music synthesizer community, where they are used for control voltages.
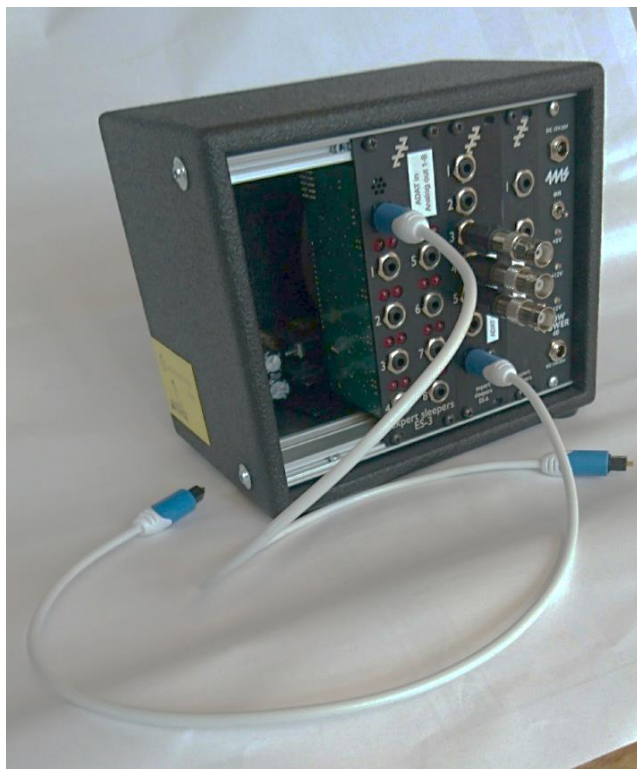
Mini rack-mount case with 8 A/D and 8 D/A channels with DC response. These connect to the ADAT ports of your high end digital audio interface, using the lightpipe cables (blue connctors).

The photo shows a rackmount case with A/D and D/A converters from ExpertSleepers: models ES-3, ES-6 and ES-7. These connect in synchrony to the ADAT port of the Fireface via two TosLink lightpipes. This provide 8 extra inputs and 8 extra outputs with a voltage swing of ±10V at 48kHz or 44.1 kHz, with DC coupling and 24-bit resolution. You will need also a small box for the rack-mounting and maybe an extra power supply module. The photo shows a case from Doepfer. The power supply that comes with this case is a bit too weak for the modules, so an extra one has been mounted at the far right. The outputs on the ES-3 module are not used, but the module is necessary anyway to obtain the sample synchronization clock signal from the Fireface.

This combination can be used to acquire respiratory signals as well as intraoral pressure and the larynx height signal from an EGG device. The total price should be less than 600€. Note that this equipment is designed for analog music synthesizer applications and is not certified for clinical use. In principle, also the voice and EGG signals could be acquired on the first 2 inputs of the ES-6.

For how to record these signals with FonaDyn, see the Handbook, section 3.2.7.