Using a Portland Tool & Die DCC-1448 or PQC-3048 with SoundCheck

Introduction
The Portland Tool & Die DCC-1448 and PQC-3048 provide a direct interface to digital MEMS microphones which can be used with SoundCheck to easily facilitate measurement of these devices. In this note we will outline the necessary physical connections between the microphone and the measurement instrument, between the measurement instrument and the computer and finally the hardware and calibration setup inside SoundCheck.

Microphone Connection
A typical digital MEMS microphone has five wires or pins:

Notes:
1. You can connect two microphones simultaneously. When two microphones are connected the microphone set as the left device will be mapped to the left output and the right to the right output.
2. When testing only a single microphone we recommend that it’s L/R select pin be connected to ground.
A direct USB connection provides the simplest interface between a DCC-1448 or PQC-3048 and SoundCheck. When connected via USB the instruments will appear as a standard USB audio device in the Windows Device Manager. The hardware setup parameters are:

**Audio Driver:** WDM/MME  
**Device Name:** PTD DCC-1448 or PTD PQC-3048  
**Select Channel:** Left (If testing a single microphone)  
**Latency:** 0  
**Sampling Rate:** 48 kHz  
**Alias Free Freq:** 22800 (default)  
**Digital:** Digital  
**Bit Depth:** 24 bit

**Notes:**

1. To test two microphones, simply create two hardware channels, Left and Right.  
2. Both the DCC-1448 and PQC-3048 operate at only 48 kHz output sample rate. Therefore you will need to configure your output device to 48 kHz as well. SoundCheck requires that input and output sample rates match.
System Diagram – USB Connection

MEMS mic
PDM

DCC-1448

Amplifier

USB

USB

Laptop
The DCC-1448, but not the PQC-3048, also has a SPDIF digital audio output which offers a second option for connecting the instrument to SoundCheck. In this configuration the instrument is connected to the digital audio input of an audio interface that is already configured for use in SoundCheck. With an RME Fireface UC(X) as an example the SoundCheck hardware configuration would appear as follows:

Audio Driver: ASIO
Device Name: ASIO Fireface USB
Select Channel: SPDIF coax. L (If testing a single microphone)
Latency: 0
Sampling Rate: 48 kHz
Alias Free Freq. 22800 (default)
Digital: Digital
Bit Depth: 24 bit

Notes:
1. To test two microphones, simply create two hardware channels, Left and Right.
2. Both the DCC-1448 and PQC-3048 operate at only 48 kHz output sample rate. Therefore you will need to configure your audio interface at 48 kHz as well. SoundCheck requires that input and output sample rates match.
When connecting the SPDIF output of the DCC-1448 to a 3rd party audio interface, we recommend setting that device to synchronize its internal sample clock to the instrument's SPDIF output. This insures that input and output sample rates will be the exactly the same and is further required for simultaneous microphone substitution measurements. On the RME Fireface series of interfaces it is selected by using the SPDIF coax. as the clock source.

Direct USB connection vs Audio Interface SPDIF connection notes

- USB offers the simplest connection between SoundCheck and a Portland Tool & Die digital MEMS microphone interface and is the only connection option for the PQC-3048.
- SPDIF can be used with an appropriate audio interface for simultaneous microphone substitution measurements. In addition a 3rd party interface with an ASIO driver will provide consistent delay, which is required for absolute phase measurements.
Unlike the familiar units of sound pressure, Pa and dBSPL, used when measuring an analog microphone, the output of a digital microphone is measured in units of FS (full-scale) and dBFS. Unfortunately there is no widespread agreement on what digital full scale means. By default, in SoundCheck, FS refers to an absolute peak level, +1 or -1 in the digital domain. However, many device manufacturers refer to full scale relative to a the RMS level of a sine wave whose peak level reaches +1 and -1 in the digital domain.

To reproduce the same measurement results as used by most manufacturers of MEMS devices you can create a calibrated input device which accounts for the difference between peak and RMS based reference levels.

As depicted, simply create a new Calibrated Input Device with a sensitivity of -3.01 dB and use this for your digital input signal paths.

Controlling a DCC-1448 or PQC-3048 from within SoundCheck

Portland Tool & Die supplies a command line utility, ptdutil.exe, which can be used to configure and control the digital MEMS microphone interfaces directly from inside SoundCheck. The System Custom step is used to invoke the command line utility and you can include any of the available parameters. This example enables the PSR impairment generator. You can just as easily control the Vdd supply or clock frequency.

Notes:
1. Make sure to use quotes when defining the path to the utility if it includes spaces or special characters.
2. Check the “Wait for completion” option to insure the command completes before the sequence proceeds to the next step.