

PD1 Power Sdac Basics

1. Digital Signal Processing Essentials

DSP refers to analyze analog signal in digital formats. Due to the rapidly development of digital computers (contrast to analog computers), DSP has become a very important field in modern technology. Analog-to-Digital conversion, numerical calculation and Digital-to-Analog conversion are three elements in DSP, while often DSP means only the numerical calculation part. The theories and algorithms behind the numerical calculation part of the DSP are so many that many books have need devoted to them. In TDT's System II User's Manual there is a section, namely "Digital Signal Processing Applications Using TDT System II" which provides entry-level reading material for TDT system users. This book is highly recommended for people who are new to DSP or to TDT products.

Sometimes DSP means Digital Signal Processors, which refers to a group of integrated chips which do basic digital signal processing numerical calculations. Filtering functions are very important functions in DSP calculations. Since the algorithms and programming of the Digital Signal Processors are complicated, most users use high-level language drivers to utilize those functions.

2. TDT's PD1

PD1 consists up to 29 DSP processors to perform tasks requiring speed. These DSPs are so arranged that the user can connect them in different network (or system). Listed below are some important parameters of PD1 and its DSPs:

Max number of DSPs (which can be programmed): 28

Processor speed: 20 MIP

Processor architecture: 16-bit integer

Filter type: FIR

DSP type	Static Operation		Dynamic Operation	
	Mono	Stereo	Mono	Stereo
Max filter length (taps)	480	240	255	127
	filter load time <10ms		filter update rate approx. 100Hz	

These DSPs with the delay processor and D/A, A/D converters in the PD1 make it possible to process audio signal in real time. It is especially useful in 3-D audio.

Note: PD1 comes with different configurations: Number of DSPs can vary from 2 to 28; delay processor is an option unit; and PD1 basic unit has two-channel D/A and two-channel A/D (user can add another 2-channel A/D and two-channel D/A IO card).

3. How to Use PD1

The main function of the PD1 is filtering. Every DSP is a filter, and once a set of FIR coefficients is loaded, it can use the coefficients to process numerical data sent to the DSP in a

continuous manner. The DSPs can be connected (routed) to form different system for different filtering purpose.

There are three programs provided with the PD1: AutoRoute, SoundStage and WKInterp. AutoRoute provides the user a visual representation of the DSPs and their connections. It is useful for beginners to understand the signal flow in the PD1, while for experienced users it is not necessary. SoundStage demonstrates that how PD1 can be used in a 3-D audio environment, and it manipulates an analog signal using PD1's real-time processing power.

WKInterp is for processing HRTF (Head-Related Transfer Function). The HRTFs provided with PD1 from University of Wisconsin should be converted into a TDT format to be used in PD1, and the filter taps can also be changed in this program.

PD1 DSP's operations consist of static and dynamic operations. In static operations, filter coefficients are loaded to DSPs only once, and in dynamic operations, filter coefficients are updated continuously. Necessary drivers are provided with PD1 for all of the operations.

It is highly recommended for all PD1 users to follow the manual "Programming the PD1 Power Dac", especially all the examples, to understand PD1. All the essential information is either in the text, or in the programming examples, or in both. There are also several example programs in the PD1 software to demonstrate typical applications of PD1.