



# PTVupgrade SmartStart™

## Digital Video Recorder Power Supply Protection

### Introducing SmartStart

SmartStart™ is a power supply protection system designed exclusively for the TiVo® Digital Video Recorder (DVR). SmartStart effectively addresses concerns related to the concurrent startup of multiple disk drives and is implemented using the latest engineering and semiconductor technologies found in high-end disk arrays in enterprise computing environments.

Adding additional video storage capacity to your TiVo® DVR is a smart choice. However, the latest 40 and 80 hour TiVo® Series2 DVR systems are designed with power supplies intended for use with only a single disk drive. Although there are no known problems with adding additional drives, there are concerns related to the long-term reliability and life expectancy of the TiVo® power supply. Specifically, the concurrent startup of multiple disk drives requires more current than the TiVo power supply may be capable of delivering without long term damage or overheating.

One fact that is universally agreed upon is the that any TiVo® power supply can effectively sustain the operation of two disk drives during normal operation without cause for concern.

Figure 1. depicts the power supply current demand in single and dual-drive systems.

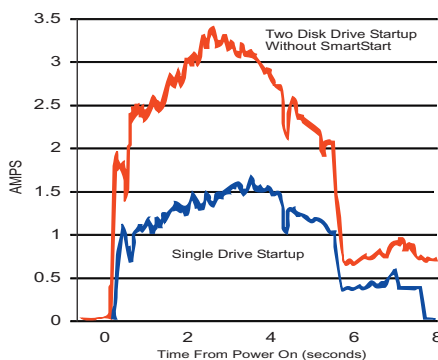


Figure 1. Single & Dual Disk Startup

### Smart Triple Protection with IntelliDesign™

SmartStart mitigates potential limitations of the TiVo® DVR power supply by performing three critical functions for the original DVR disk drive during the startup phase:

**One:** SmartStart offsets the startup of the original and expansion disk drive in the DVR. During the critical startup period, as much as 250% more current is demanded from the TiVo® power supply. This initial current draw is required to start the disk platters spinning. SmartStart IntelliDesign™ gently ramps power to the original disk drive as it completes its stressful startup phase. This is a proven technique for removable enterprise disk storage products.

**Two:** SmartStart sequences both supply voltages to the disk drive, separating the logic and motor power supply power into independent switching groups. Disk drive logic power is enabled first and followed several seconds later by motor power. Voltage sequencing further reduces the current surge to the power supply and results in overall lower startup stress.

**Three:** SmartStart gently ramps both logic and motor supply voltage to the disk drive. SmartStart's solid-state power electronics gradually ramps voltage to the original disk drive and prevents power spikes that can stress the TiVo® DVR power supply.

IntelliDesign triple startup protection provides a smooth SmartStart. Figure 2. graphically depicts the results.

### Smart Design for Smart People

SmartStart works with all TiVo® products and can easily and safely be added to any new or existing TiVo® DVR with dual disk drives. Installation is performed in just a few minutes and provides lasting power supply protection.

### SmartStart Product Highlights

- Offsets disk startup for dual drive TiVo's
- Sequences both 5 and 12 volt supplies
- Current regulation for disk drive power
- Solid-state design
- Integrated cable
- Compact design
- Easy installation
- Works with **all** TiVo® systems

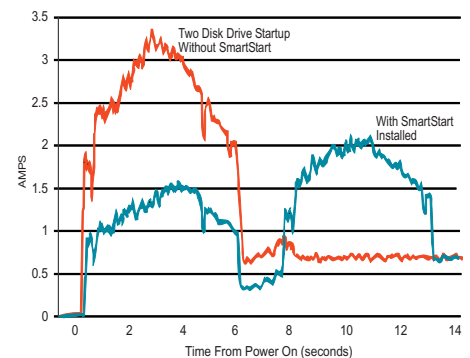


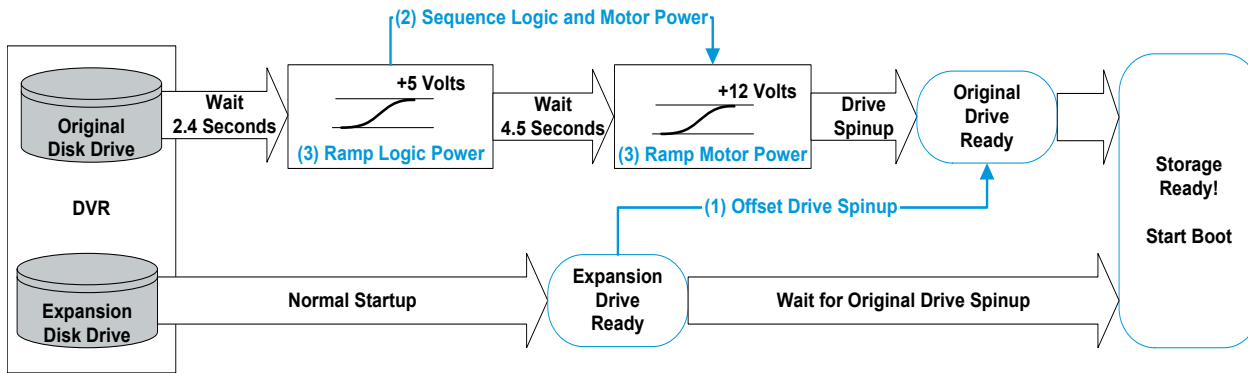
Figure 2. Dual Disk Current Draw with SmartStart Installed

The integrated cables provides a simple connection for the original disk drive while reducing cable clutter. Clutter that can be detrimental to efficient airflow and cooling. SmartStart uses all solid-state components for the highest reliability and trouble free operation.

### Smart Choice

There is no reason to stress your power supply when you make the choice to increase the storage capacity of your TiVo® DVR. The SmartStart is the **smart** choice for long term protection and enjoyment of your TiVo® digital video recorder.

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## IntelliDesign™ Triple Startup Protection

### SmartStart Specifications

Physical Dimensions (Including Cables)	9.75 inch L x 0.75 inch W x 0.375 inch D 24.8 cm L x 1.9 cm W x 0.95 cm D	
Input Connector	Molex 4-Pin 5.08mm (MALE)	
Output Connectors	Molex 4-Pin 5.08mm (FEMALE)	
Input Voltage 1	1.0V to 13.2V, 5.0 Volts Typical	
Input Voltage 2	1.0V to 13.2V, 12.0 Volts Typical	
Supply Current Combined (5V and 12V)	1.2 mA Typical, 2.3 mA Maximum	
Output Max Current	5 Volts - 3 Amps, 12 Volts - 3 Amps	
Operating Temperature	0° to 55° C	
Startup Time	5 Volts - 2.4 Seconds Typical 12 Volts - 6.9 Seconds Typical	
Supported Digital Video Recorders	<b>TiVo Series1</b> <b>Standalone</b> Sony SVR-2000 Philips HDR (all models)  <b>DirecTV DVR</b> Sony SAT-T60 Philips DSR6000 Hughes GXCEBOT	<b>TiVo Series2</b> <b>Standalone</b> AT&T TCD130040 TiVo TCD130040 TiVo TCD130060 TiVo TCD140060 Sony SVR-3000 TiVo TCD230040 TiVo TCD240040 TiVo TCD240080 <b>DirecTV DVR</b> Hughes HDVR2 Philips DSR7000
Package Contains	SmartStart Controller Unit Installation Instructions	
Warranty	6 months	

The PTVupgrade SmartStart can be purchased from:



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