Power Disable Feature

The "Power Disable" feature is a new industry standard feature defined for both SATA and SAS devices. This new feature allows the host system to perform a hard reset to the hard drive (HDD). The new feature can be found on newer SAS Ultrastar® HDDs (beginning with Ultrastar He[8] and 7K6000), and now the feature is optionally available on Ultrastar SATA HDDs starting with the Ultrastar DC HC510. This article focuses on the SATA implementation.

What You Need to Know

The Power Disable feature introduces a new HDD management capability to electronically provide a hard "power on reset" to the HDD. Regardless of whether you implement the feature, there are three important things to know about the feature.

- First, it requires a unique circuit board (PCBA) on the SATA HDD. If you want the feature, you must specifically order it.
- Second, if you put a new SATA HDD with this feature into a legacy chassis or enclosure, the drive may not spin up! The HDD is not defective. Some legacy power supplies provide 3.3V power on P3 (Pin 3), and this forces the HDD to get stuck in a hard reset condition preventing the HDD from spinning up.
- Third, if you are a chassis vendor or developer, you should begin making the required changes to be compatible with the new feature.

Specifically, the chassis should support the new definition of Pin 3 and not tie Pin 3 to Power as was done in legacy chassis. For Ultrastar DC HC510 and DC HC520 HDDs, Western Digital offers specific part numbers (with or without this feature) to support each type of chassis. The SATA models of Ultrastar DC HC530 do not offer this feature, but future generations may require chassis that are compatible with the Power Disable feature.

If you plug a new SATA HDD with this feature into a legacy chassis or enclosure, the drive may not spin up!

Unless you specifically require the new feature, which is included in the SATA 3.3 industry standard specification (published 2/2/2016), we recommend that you use HDDs without the feature, especially if the HDD will be going into an unknown or untested chassis.

Ultrastar SATA Part Numbers – Without Power Disable Feature

512e Format

SATA		ISE		SE		SED	
Capacity	Product	Part #	Model #	Part #	Model #	Part #	Model #
14TB	DC HC530	—	—	0F31284	WUH721414ALE6L4	—	—
12TB	DC HC520	0F30144	HUH721212ALE600	0F30146	HUH721212ALE604	—	—
10TB	DC HC510	0F27604	HUH721010ALE600	0F27606	HUH721010ALE604	0F27605	HUH721010ALE601
8TB	DC HC510	0F27610	HUH721008ALE600	0F27612	HUH721008ALE604	0F27611	HUH721008ALE601
8TB	DC HC320	—	—	0B36404	HUS728T8TALE6L4	—	—
6TB	DC HC310	—	—	0B36039	HUS726T6TALE6L4	—	—
4TB	DC HC310	—	—	0B36040	HUS726T4TALE6L4	—	—

4Kn Format

SATA		ISE		SE		SED	
Capacity	Product	Part #	Model #	Part #	Model #	Part #	Model #
14TB	DC HC530	—	—	0F31278	WUH721414ALN6L4	—	—
12TB	DC HC520	0F30141	HUH721212ALN600	—	—	—	—
10TB	DC HC510	0F27607	HUH721010ALN600	0F27609	HUH721010ALN604	0F27608	HUH721010ALN601
8TB	DC HC510	0F27613	HUH721008ALN600	0F27615	HUH721008ALN604	0F27614	HUH721008ALN601
8TB	DC HC320	—	—	0B36402	HUS728T8TALN6L4	—	—
8TB	DC HC320	—	—	0B36404	HUS728T8TALE6L4	—	—
6TB	DC HC310	—	—	0B35946	HUS726T6TALN6L4	—	—
6TB	DC HC310	—	—	0B36039	HUS726T6TALE6L4	—	—
4TB	DC HC310	—	—	0B35948	HUS726T4TALN6L4	—	—
4TB	DC HC310	—	—	0B36040	HUS726T4TALE6L4	—	—
		ISE = Instant Secure Erase		*SE = Secure Erase*		*SED = Self-Encrypting Drive*	

Table 1: Available Ultrastar SATA hard drives that do not support the Power Disable feature.

Ultrastar SATA Part Numbers – With Power Disable Feature

512e Format – With New Power Disable Feature

SATA		ISE		SE		SED	
Capacity	Product	Part #	Model #	Part #	Model #	Part #	Model #
12TB	DC HC520	0F29590	HUH721212ALE600	0F29592	HUH721212ALE604	—	—
10TB	DC HC510	0F27452	HUH721010ALE600	0F27454	HUH721010ALE604	0F27453	HUH721010ALE601
8TB	DC HC510	0F27455	HUH721008ALE600	0F27457	HUH721008ALE604	0F27456	HUH721008ALE601

4Kn Format – With New Power Disable Pin Feature

SATA		ISE		SE		SED	
Capacity	Product	Part #	Model #	Part #	Model #	Part #	Model #
12TB	DC HC520	0F29620	HUH721212ALN600	0F29622	HUH721212ALE604	—	—
10TB	DC HC510	0F27502	HUH721010ALN600	0F27504	HUH721010ALN604	0F27503	HUH721010ALN601
8TB	DC HC510	0F27505	HUH721008ALN600	0F27507	HUH721008ALN604	0F27506	HUH721008ALN601
		ISE = Instant Secure Erase		*SE = Secure Erase*		*SED = Self-Encrypting Drive*	

Table 2: Available Ultrastar SATA hard drives that support the Power Disable feature

SAS HDDs are not affected by this legacy concern. The Power Disable feature is supported on all Ultrastar SAS HDDs beginning with the Ultrastar He8 and 7K6000, and continuing with the DC HC510. The Ultrastar DC HC510 is the first Western Digital product to offer the feature on SATA HDDs.

Available SATA part numbers are shown in the table below. Selecting HDDs without the feature (Table 1) will minimize the risk of the HDD not powering on. If you desire HDDs that support this new feature, then you should choose HDDs with Power Disable feature (Table 2). Drives with 512 emulation format are shown in the green rows, 4Kn format are in blue.

There is a simple fix if you find yourself in a situation where an Ultrastar SATA HDD is not spinning up. By using a simple "Molex to SATA" power connector (Figure 1) to supply power to the HDD, you can usually eliminate the problem. Changing the power connector effectively removes power from P3 (Pin 3) and allows the drive to spin up normally.



Figure 1: Molex to SATA cable

Frequently Asked Questions

Q: Why would you want this feature?

A: The Power Disable feature provides an easy way to power cycle a drive in order to perform a hard reset. This can be useful if a drive locks up for some reason, and you don't want to send a technician to the physical rack and manually "unplug the drive" and then "plug it back in" in order to power cycle the drive. Now, a smart chassis can provide a management tool to do this function automatically.

Q: Why would you want this feature on SATA?

A: Since many SATA storage devices are deployed in storage systems that use SAS backplanes, this SATA feature is compatible with the SAS implementation, and will work properly when used on a SAS backplane that supports this feature.

Q: If I am using SAS HDDs, should I be concerned?

A: No. This feature is available for use on newer SAS chassis. Older SAS chassis will ignore this feature. Specifically, SAS HDDs never defined an alternate usage to P3 (Pin 3), and therefore legacy systems will have it as a "no-connect". With SATA, the story is different. Some legacy SATA power supplies tied P1 (Pin 1), P2 (Pin 2) and P3 (Pin 3) together to 3.3V resulting in P3 (Pin 3) being permanently powered "high", thus sending a permanent "hard reset" signal to the HDD.

Q: If I am using SATA HDDs, should I be concerned?

A: Yes. Educate yourself about the feature to determine if you require it. The "safe" bet is to order SATA HDDs that do not include this feature.

Q: How will I know if there is a problem?

A: The HDD will not spin up / power up.

Q: If I install a drive with the feature into a system that does not support it (or vice versa), can I damage the HDD?

A: No. You can safely plug an HDD either with or without the feature into a new or legacy system.

If the legacy system is providing power to P3 (Pin 3), the only side effect is that the HDD will not spin up.

Likewise, if you have a new chassis that supports the Power Disable feature, an HDD without the feature will just ignore the Hard Reset request and remain powered up.

Q: If I want this feature, is there any reason I should be convinced otherwise?

A: No. If you prefer or require this feature, then we can easily provide it. Our goal is to raise awareness that the HDD will not spin up if a legacy chassis provides 3.3V power to P3 (Pin 3). We don't want customers returning drives that they believe are defective when the problem is with the legacy chassis. A smart customer will be aware of this potential issue, and be prepared to take either version for maximum supply flexibility.

Q: If I order the HDD without the feature, can I somehow enable it?

A: No. This feature is hard wired. By sending a "high level" signal to P3 (Pin 3), special circuitry on the HDD physically removes power to the SoC (System on Chip...the brains of the HDD). This external circuitry cannot be configured by firmware.

Q: When was this feature introduced on SAS HDDs?

A: With the introduction of 12G SAS, a new SAS standard, SAS-3, redefined P3 (Pin 3) from "3.3V Power" to "POWER DISABLE", i.e. "Reset". At that time, the STA (SCSI Trade Association) researched the marketplace and determined that there were no conflicting legacy concerns. The Ultrastar 7K6000 SAS and Ultrastar He8 SAS were the first Western Digital HDDs to support this feature. Ultrastar DC HC510 introduced the optional feature with SATA for the first time.

Q: What if I have a legacy system using an HDD that has this new feature, and the drive doesn't spin up?

A: You can easily fix the problem by using a "Molex to SATA" power connector. See figure 1.

Q: What exactly is the problem and how does the "Molex to SATA" connector solve it?

A: Legacy SATA power cables used P3 (Pin 3) to supply 3.3V power to the HDD. The new feature uses P3 (Pin 3) to perform a hard reset. So if you plug a new drive into an old system... P3 (Pin 3) may be hard wired to keep the drive in "Hard Reset" mode, so that the drive will never spin up. Changing the power connector effectively removes power from P3 (Pin 3), and allows the drive to spin up normally.

Q: Do I lose any other benefit when choosing an HDD without this feature?

A: No. The drive behaves the same. And P3 (Pin 3) is ignored.

Q: With the concerns about legacy products, why did we introduce this new feature? Is this an industry issue or unique to Western Digital?

A: This is an industry issue. The Power Disable feature was originally introduced to the T10 standards body as a new SAS feature. The feature enables the initiator or SAS expander to disable power to the SAS device. If the storage device has encountered a "hung" interface condition, this feature provides the host system a way to "power-off" the device without having to support independent power switches for every power connector, or require physical removal and insertion of the device at the physical connector. SATA HDDs are often deployed in storage enclosures that use SAS backplanes, so it is important that this feature be implemented on SATA devices as well. In a SAS system that supports the Power Disable feature, the host can now remotely power-off and then power-on the HDD to reset a "device hung" condition.

SATA Revision	Power Disable feature support status	Western Digital SATA Products
Serial ATA Rev 3.3	Feature **is** supported	Future products
Serial ATA Rev 3.2+	Feature **is** supported	Ultrastar DC HC510 / HC520 Option
Serial ATA Rev 3.2	Feature **is not** supported	Ultrastar DC HC510 / HC520 Standard
Serial ATA Rev 3.1	Feature **is not** supported	Earlier Ultrastar products

Table 3: SATA Specifications and their support of the Power Disable feature

Q: Are there SATA specifications that explain this?

A: Yes. See table 3. The Ultrastar DC HC510 has two configurations. One complies with SATA Rev 3.2. The other also complies with SATA Rev 3.2 plus supports the Power Disable feature defined in SATA Rev 3.3.

1) SATA Rev 3.2 (with no Power Disable feature)
2) SATA Rev 3.2 with the Power Disable feature defined in SATA Rev 3.3 (option)

Q: Are there Western Digital specifications that explain this?

A: Yes. You will find the P3 (Pin 3) definition within the Western Digital SATA OEM Specifications on the Western Digital website under Resources.

A typical SATA connector is shown in figure 2, and contains a SIGNAL connector, and a POWER connector. The Power Disable feature is controlled by P3 (Pin 3) on the Power Connector. The definition of each pin is shown in table 4. P1 (Pin 1), P2 (Pin 2) and P3 (Pin 3) are the focal point of the Power Disable feature.

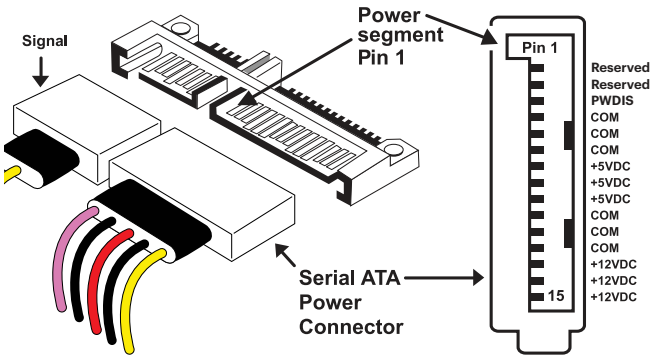


Figure 2: A typical SATA connector that supports Power Disable (PWDIS)

Ultrastar DC HC510 SATA OEM Specification

The Ultrastar SATA OEM Specification defines the SATA Power Connector pins as shown in the table below. Individual product specifications can be found on the www.westerndigital.com website.

In the power connector, you will notice that P1 and P2 are both reserved, and tied together internally, and it was expected that power (3.3V) would be applied. P3 is now reserved or defined as PWDIS, and is used to enter and exit the POWER DISABLE mode.

In previous versions of the SATA specification, P3 was tied to P1 and P2.

More Information

Learn more about the Power Disable feature from the SCSI Trade Association (STA) website, where Dan Reno, a member of the HDD Technical Marketing team at Western Digital, explains the benefit of the new feature. Although he is describing the feature on 12Gb/s SAS drives, it works the same on SATA drives that include this feature from the SATA 3.3 specification. http://www.scsita.org/serial-storage-wire/2014/04/power-disable-pin-pin-3.html

Ultrastar DC HC510 SATA Connector Pin Definitions

	No.	Plug Connector Pin Definition		Signal	I/O
Signal	S4	Gnd	2nd mate	Gnd	
	S2	A+	Differential signal A from Phy	RX+	Input
	S3	A-		RX-	Input
	S4	Gnd	2nd mate	Gnd	
	S5	B-	Differential signal A from Phy	TX-	Output
	S6	B+		TX+	Output
	S7	Gnd	2nd Mate	Gnd	
Key and spacing separate signal and power segments					
Power	P1	Reserved*	NOT USED (P1 and P2 tied internally)	Reserve	
	P2	Reserved*	NOT USED (P1 and P2 tied internally)	Reserve	
	P3	Reserved* or PWDIS* (option)	NOT USED (P1, P2 and P3 tied internally)) or Enter/Exit Power Disable (option)	Reserve or PWDIS	
	P4	Gnd	1st Mate	Gnd	
	P5	Gnd	2nd Mate	Gnd	
	P6	Gnd	2nd Mate	Gnd	
	P7	V5	5V power, pre-charge, 2nd Mate	5V	
	P8	V5	5V power	5V	
	P9	V5	5V power	5V	
	P10	Gnd	2nd mate	Gnd	
	P11	Reserved	Support staggered spin-up and LED activity Vih max=3.3V	Reserve	
	P12	Gnd	1st Mate	Gnd	
	P13	V12	12V power, pre-charge, 2nd Mate	V12	
	P14	V12	12V power	V12	
	P15	V12	12V power	V12	

Table 4: SATA Connector Pin Definitions

* SATA Specification Revision 3.1 and prior revisions assigned 3.3V to pins P1, P2 and P3. In addition, device plug pins P1, P2, and P3 were required to be bused together. In the standard configuration of this product, P3 is connected with P1 and P2 and this product behaves as a SATA version 3.1 or prior device. For product with the optional SATA 3.3 Power Disable Feature supported, P3 is now assigned as the POWER DISABLE CONTROL PIN. If P3 is driven HIGH (2.1V-3.6V max), power to the drive circuitry will be disabled. Drives with this optional feature WILL NOT POWER UP in systems designed to SATA Spec Revision 3.1 or earlier. This is because P3 driven HIGH will prevent the drive from powering up.

Western Digital.

5601 Great Oaks Parkway
San Jose, CA 95119, USA
US (Toll-Free): 800.801.4618
International: 408.717.6000

www.westerndigital.com

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