

Digital Video Storage Array

Logical Drive Rebuild Procedures for Subsystems



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Preface

This troubleshooting guide covers the following topics:

- Answers to the following questions:
 - What Causes a Data Loss?
 - How Do I Know a Hard Drive Has Failed?
 - How to Locate a Failed Hard Drive?
 - How to Replace a Failed Drive?
 - How to Bring a New Drive Online?
 - How to Rebuild a Logical Drive?
- The procedures to recover from hard drive failure.
- Notices and working theories behind the rebuild operation.
- Addition information concerning miscellaneous drive errors.



CAUTION! Before attempting to rebuild a logical drive, make sure a missing drive or malfunctioning situation is not caused by the following:

1. A faulty cable
2. Temporary power loss
3. RAID LUNs not visible to the host
4. Host or drive-side timeout problems
5. Other causes of hardware failure affecting disk drive operation

Document Conventions

Convention	Meaning
Bold	Denotes a part, item, or assembly.
<i>Italic</i>	Denotes a reference to another paragraph, figure or table.
<u>Underline</u>	Used to emphasize a point.
<code>courier</code>	Denotes the actual name of an object, the exact code that should be typed or a message returned from a system.

Symbols

You may encounter these symbols within the document. Explanatory text accompanies each symbol, which provides additional information detailing the operation or highlighting safety information.



NOTICE! Notices inform you of essential but non-critical information. Read these messages carefully as any directions or instructions contained therein can help you avoid making mistakes.



CAUTION! Cautionary messages provide critical information that help you reduce the chance of losing data or damaging the system. Please heed these messages.



WARNING! Warnings highlight information, that if overlooked may cause damage to the system or result in personal injury. Take warnings seriously.



DANGER! Danger messages denote the presence of electrical equipment that may cause electric shock or electrocution. Take care when you see this symbol to avoid serious injury or death.

Related Publications

Refer to the latest Bosch Security Systems, Inc. Databook for the most up-to-date datasheets. To obtain a copy of the Databook, please contact your local Bosch representative.

You can also visit the Bosch Security Systems World Wide Web site at: <http://www.boschsecurity.com> to view a current listings of our publications.

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1 Identifying a Disk Drive Failure

1.1 What Causes a Data Loss?

1.1.1 A Logical Drive Has More Hard Drives Failed than the RAID Level Allows.

Although RAID technology aims to protect data from disk drive failure, a RAID3 or RAID5 array can only sustain a single disk drive failure. If two of its members fail, the array data is lost. The fault tolerance features of different RAID levels are listed below:

RAID Level	Number of Failed Drive(s) Allowed
RAID0	0: any will fail a RAID0 logical drive
RAID0+1	Multiple, if no two of them are in a mirrored pair
RAID3	1
RAID5	1

1.1.2 One of the Members of a Logical Volume, a Logical Drive, has Fatally Failed.

A logical drive is a logical configuration of two or more physical disk drives using one of the RAID configuration levels (0, 1, 0+1, 3, or 5) listed above. A logical volume combines several logical drives by striping them together. If one of the members of a logical volume fails, e.g., a logical drive has irrecoverably failed, the logical volume also fails.

1.1.3 Accidental Loss of Data

It is extremely rare for two or more disk drives to fail at the same time. However, in the case of a single drive failure you may accidentally remove the wrong drive when trying to replace a failed drive. Replacing the wrong drive means failing two drives together and results in data loss.

1.2 How Do I Know a Hard Drive Has Failed?

There are various ways to be notified of the events occurring on a Bosch RAID subsystem, including:

- LCD keypad panel display
- Event notification via the Bosch RAIDWatch Server or NPC sub-modules through the following methods:
 - email, SNMP traps, fax, LAN broadcast, MSN, ICQ, and SMS
- The graphical representation of enclosure elements in the Bosch RAIDWatch GUI
- RS-232C terminal screen
- LED indicators on the drive trays
- Audible alarm

Before replacing a disk drive, follow the steps in each notification method below to ensure that you can identify the exact failed drive for removal.

1.2.1 Hard Drive Failure Event Messages

You may receive disk drive failure messages through any of the management interfaces including: 1). LCD screen, 2). terminal/RAIDWatch GUI session, 3). or any of the event notification methods.

Disk Drive Failure Events

A disk drive failure is indicated by one of the following messages:

1.	CHL:_ ID:_ Drive ALERT: Drive HW Error (__)
2.	CHL:_ ID:_ Unexpected Drive Not Ready (__)
3.	LG=_ Logical Drive ALERT: Slot_ Drive Missing
4.	LG=_ Logical Drive ALERT: Slot_ Drive Failure
5.	LG=_ Logical Drive ALERT: CHL:_ ID:_ Drive Missing
6.	LG=_ Logical Drive ALERT: CHL:_ ID:_ Drive Failure

Event Description

Event Message	Description
1. HW Error	A hard drive returns "hardware failure." Possible remedy to the hardware failure: Stop I/O access to the array if host access can be stopped. Install a drive "known to be good" to verify that the hard drive has failed. If you have a similar RAID subsystem, you may power down the array and then install the original hard drives to another subsystem and check if it can be correctly recognized. NOTE: there is imminent danger when handling hard drives. The verification methods mentioned above are only recommended for qualified engineers.
2. Unexpected Drive Not Ready	A hard drive returns "Not Ready." A disk drive may exhibit connectivity problems or unsteady behavior before the firmware considers it as a failed drive. If a drive was removed and then reinstalled, the drive may not be immediately brought online.
3. Drive Missing	A member drive of an array is considered as non-existing; could be a failed drive before I/Os can be distributed to it.
4. Drive Failure	A drive determined as a failed drive by the firmware.

What to Do?

1. Jot down the failed drive's channel number, ID, or slot number. Refer to your *Installation and Administrator's Manual* for the ID/slot locations. ID/slot locations information is crucial for finding the exact failed drive.
2. Refer to the following discussions on status-checking methods for more details on how to guarantee safe handling of hard drives.
The same messages displayed on the LCD screen appear in an abbreviated format.

1.2.2

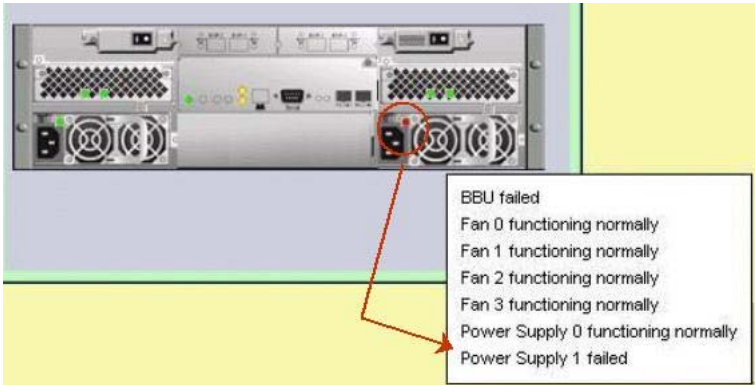
Physically Verify Hard Drive Failure

A missing drive in an array may simply be the result of improper handling; for example, when a drive tray is not properly installed. Check carefully that all the disk drives are firmly seated in the array. Also check the firmware configuration utility under the "View and Edit Logical Drives" sub-menu for "Failed Drv." You may also select the logical drive, press ENTER and select "View SCSI Drives" to see if the fault has been corrected.

												Cache Status: Clean			
												e Cache: Enable			
LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME	
P0	477F9A88	0	RAID5	9999	GOOD				5		3	0	0		
P	View scsi drives			999	GOOD				5		2	-	0		
P	Delete Parti- logi- Expa- add reGe- copy Medi- Writ-	Slot	Chl	ID	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID						
			2	0	9999	80MB	0	ON-LINE							
			2	1	9999	80MB	0	ON-LINE							
			2	2	9999	80MB	0	ON-LINE							
7			NONE												
Arrow Keys:Move Cursor Enter:Select Esc:Exit Ctrl+L:Refresh Screen															

1.2.4 Verify Disk Drive Status Using the RAIDWatch GUI Manager

GUI Screen Elements

	Drive status is "good"
	Drive is missing or bad
	Global spare
	Any drive icon shown in a color other than "black" represents a member of a logical drive or a dedicated spare. Black is the default color of a new or used drive. A used drive is a drive that had been chosen as a member of a logical drive.
	An empty tray; disk drive not installed.
	
	Fig. 1.2 Disk Drive Status and GUI Representation RAIDWatch recognizes each subsystem by its board serial number, and displays an exact replica of it in its panel view. LEDs shown on the enclosure view correspond to the real LEDs on the subsystem's rear panel. As shown in the diagram, if an LED corresponding to a failed component is lit red, you can move your cursor to the enclosure panel, and after holding the cursor there for a second, a summary of the enclosure status will be displayed.

1.2.5 "Temporary" Failure Status and Related Handling Procedure

Fatal failure of a logical drive can result from a temporary misidentification of drive status. For instance, if one hard drive is stated as BAD and another as MISSING, one of them might have a "Temporary" failed status.

It is highly recommended that you contact technical support and immediately stop host I/O access to the array. Below is the procedure for handling the situation:

1. Select System Functions in the terminal utility's Main Menu, select Reset Controller and then choose Yes to confirm.
2. Power off your subsystem. Wait for five seconds and power on the subsystem again.
3. Access the "View and Edit Logical Drives" sub-menu in your terminal utility and verify the hard drives' status.
4. If the array is already supported by a spare drive (Dedicated or Global), the rebuild process should start automatically.
5. If no spare is available or the rebuild does not start with an available spare, you may check the status under "View and Edit Logical Drives."
6. If the status is still stated as "FATAL FAIL," you have lost all data in the array.
7. If the array status returns to the "One-Drive-Failed" condition with no available spare drive, you may start rebuilding the array manually.

1.3 How to Locate a Failed Hard Drive?

1.3.1 RAIDWatch Enclosure View

- Although disk drive problems can only be solved onsite, an administrator can use the Bosch RAIDWatch to remotely identify a problem and then contact the engineer at the array site.
- To read more information about enclosure devices such as a disk drive, place your cursor either over the front or rear view graphic. An information text field displays as shown below.
- To access the screen, click on the Enclosure View icon in the navigation tree, and then click on the tabbed panel to access the display window of a cascaded enclosure.

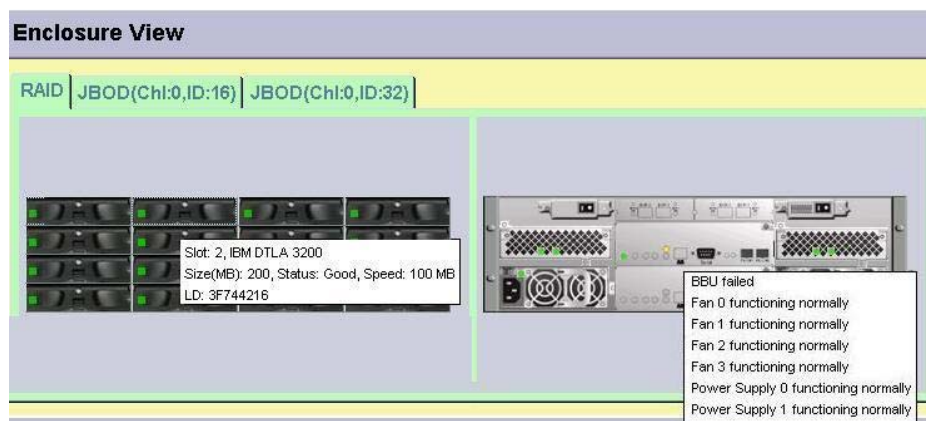


Fig. 1.3 Displaying Enclosure Device Information

1.3.2 Use the "Flash Drive" Function

1. First, find out the slot ID or channel ID of the failed drive, and then use the "Flash Drive" function to physically locate the failed drive. You can find the failed drive's ID in the following places:
 - a. The "View and Edit Logical Drives" sub-menu
 - b. The "View and Edit Drives" sub-menu
 - c. The event notification message
 - d. The RAIDWatch Event Log panel view

Access to the drive status menus is found in Section 1.2: *How do You Know a Hard Drive has Failed?*

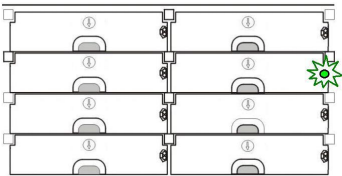
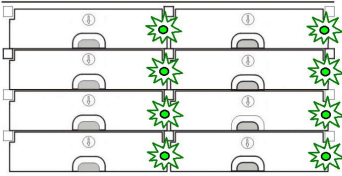
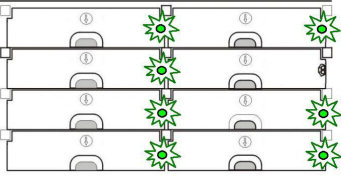
Quick view view view view view view view view view view	Slot	Chl	ID	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID	
		2	0	9999	40MB	0	ON-LINE	IBM	DDRS-34560D
			View drive information Scan scsi drive set slot Number add drive Entry Identify scsi drive clone Failing drive			0	ON-LINE	IBM	DDRS-34560D
						0	ON-LINE	IBM	DDRS-34560D
						0	ON-LINE	IBM	DDRS-34560D
						0	ON-LINE	IBM	DDRS-34560D
						0	ON-LINE	IBM	DDRS-34560D
								IBM	DDRS-34560D
		2						IBM	DDRS-34560D
		2						IBM	DDRS-34560D
		2	8	9999	40MB	NONE	NEW DRV	IBM	DDRS-34560D

Fig. 1.4 Drive Status Menu

In a configuration consisting of many arrays and hard drives, the Flash Drive function can help precisely locate a faulty drive.

2. Access the function through the RS-232C terminal screen Main Menu, "View and Edit Drives." Select the faulty drive by pressing ENTER, select Identify Drive, and then select one of the Flash Drive options.

Following are descriptions of the Flash Drive options:

 Fig. 1.5 Flash Selected Drive	The Read/Write LED of the drive you selected will light steadily for a configurable period of time, from 1 to 999 seconds.
 Fig. 1.6 Flash All Drives	The Read/Write LEDs of all connected drives will light for a configurable period of time. If the LED of the defective drive did not light on the "Flash Selected SCSI Drive" function, use "Flash All SCSI Drives" to verify the fault. If the "Flash All SCSI Drives" function is executed, and the defective drive's LED still does not respond, there could be a drive tray problem or the drive is dead.
 Fig. 1.7 Flash All but Selected Drives	Except for the selected drive, the Read/Write LEDs of all other connected drives will light for a configurable period of time ranging from 1 to 999 seconds. If you cannot be sure of the exact location of a specific drive, this function will help indicate where it is. This can prevent removal of the wrong drive when a drive fails and is about to be replaced.

1.3.3

Physically Locate the Failed Drive

- 1. Refer to the Installation and Hardware Reference Manual for descriptions of ID locations. For example, the tray numbering sequence of a DVA-16K is diagrammed below:

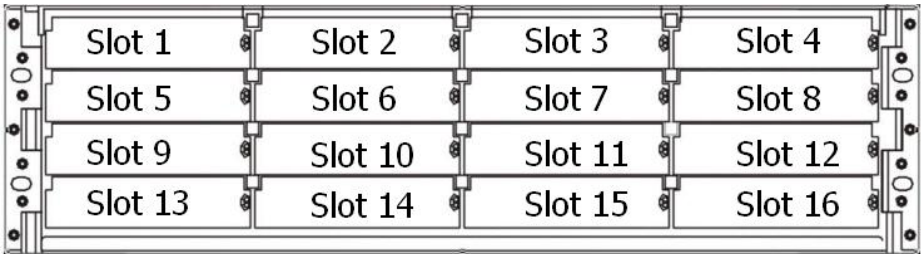


Fig. 1.8 Figure 6: Drive Tray Numbering Sequence

- 2. Locate the failed drive by referring to the drive status information previously collected.

3. Verify the display of the fault indicator on the drive tray's front bezel.

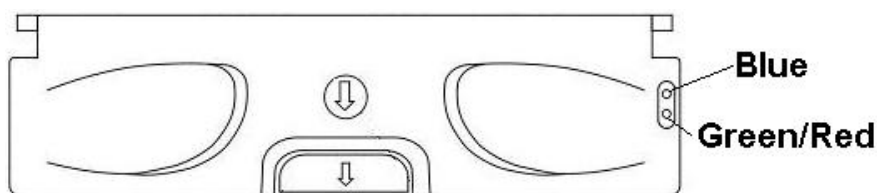


Fig. 1.9 Drive Tray LEDs

LED Name	Color	Status
Drive Busy	Blue	FLASHING indicates there is read/write activity on the drive. OFF indicates there is no read/write activity on the drive.
Power/ Status	Green/Red	GREEN indicates that power is being supplied to the drive. RED indicates that there is no power being supplied to the drive or the drive is stated as a failed drive.

4. The Power/Status LED on a hard disk drive considered as "Failed" should be lit red. You may now proceed with replacing the failed drive.

2 Logical Drive Rebuild Procedures

2.1 How to Replace a Failed Drive?



CAUTION! Do not remove a faulty drive module unless you have a replacement in hand and you can immediately replace the failed drive. If you leave a drive tray open, you could alter the airflow within the enclosure and eventually overheat the subsystem.

1. Be sure that you have identified the correct failed drive following the procedures described in the previous sections.
2. Open the front flap by pushing the release button at the front of the drive tray. The drive tray front flap will automatically be lifted and the drive tray will be dislodged from the chassis.

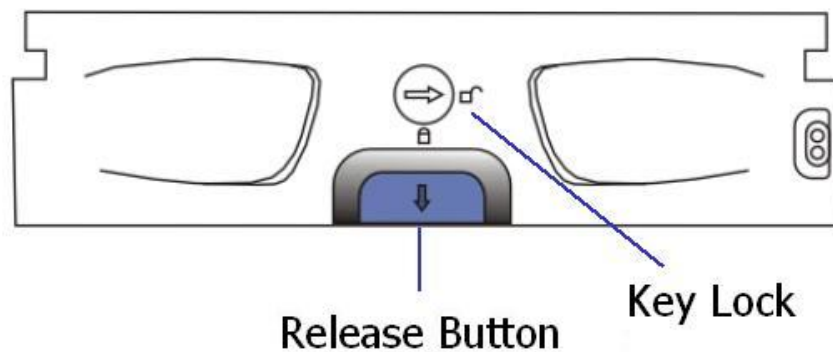


Fig. 2.1 Front View of an Individual Drive Tray

3. Remove the drive tray. Wait for 20 seconds if the drive has not spun down. To remove the drive tray from the enclosure, the key-lock must be unlocked. To do this, turn the key-lock on the front of the drive tray until the groove on its face is in a horizontal orientation and points to the right.

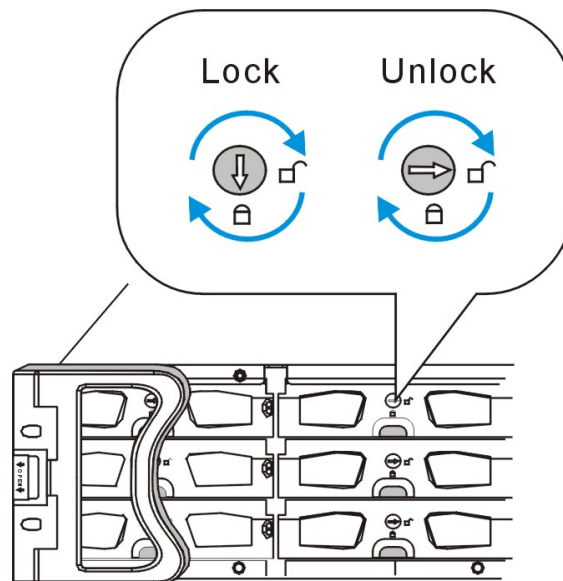


Fig. 2.2 Drive Tray Key-lock Rotation

4. Gently and carefully remove the drive tray with the hard drive from the chassis.

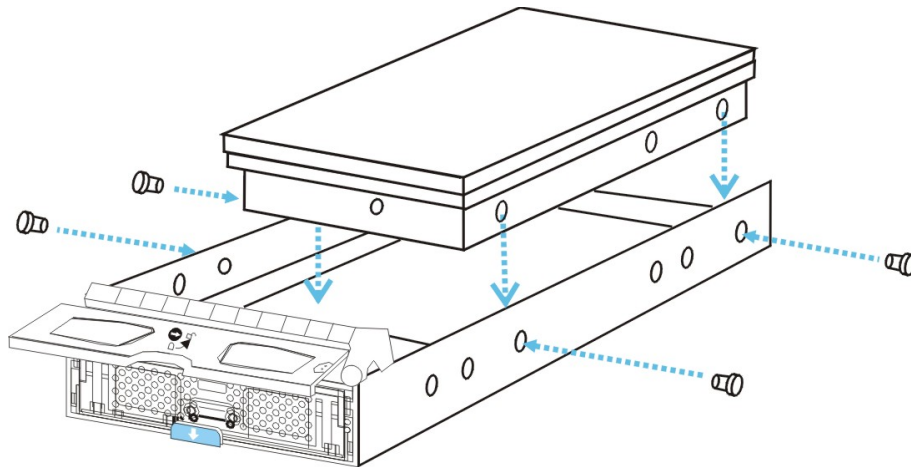


Fig. 2.3 Installing the Hard Drive

5. Open the front flap on the new drive tray (part number DVA-ADTK-050A, by pushing the release button on the front of the drive tray. The front flap will open in an upward direction.

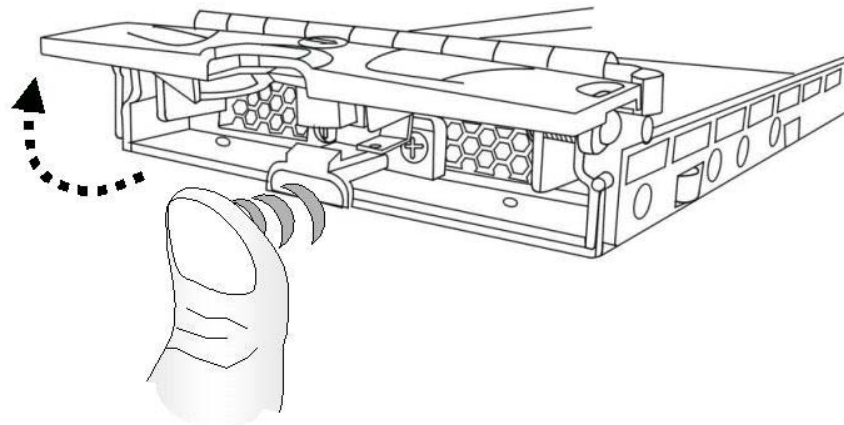


Fig. 2.4 Open Front Flap

6. Align the drive tray with the slot in which you wish to insert it. Make sure that it is resting on the rails inside the enclosure. Once the drive tray is lined up with the slot, gently slide it in. This should be done smoothly and gently. DO NOT SLAM the drive tray into place! Doing so can damage the connectors.

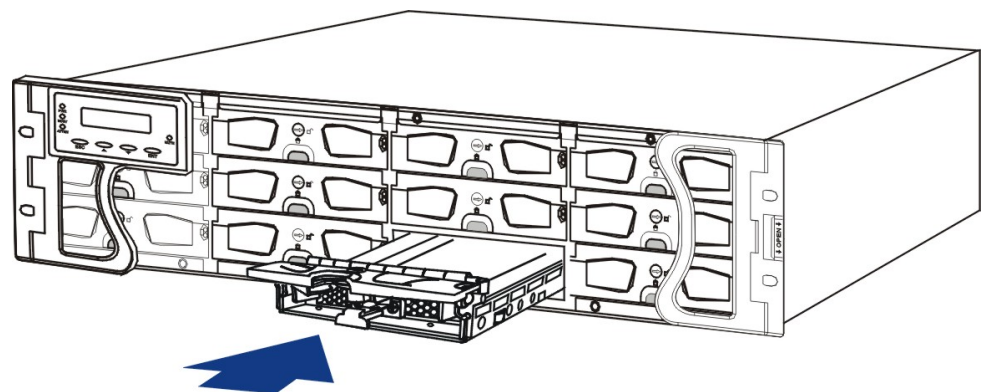


Fig. 2.5 Installing a Drive Tray

- 7. Close the front flap on the drive tray. Make sure the front flap is closed properly to ensure that the SATA connector at the back of the drive tray is firmly connected to the corresponding connector on the backplane board. If the front flap is not closed properly, the connection between the hard drive and the subsystem will not be secure.
- 8. Lock the flap into place by turning the key-lock until the groove on its face is pointing down (vertical orientation).
Once the drive tray is inserted, the RAID subsystem will recognize the drive and scan it in automatically. If your subsystem does not recognize a replacement drive, proceed to the next section for handling procedures.

2.2 How to Bring a New Drive Online?

A new drive should be automatically detected by a RAID subsystem once it is inserted. If either a Global or a Dedicated Spare drive is available, rebuild starts automatically. If no spare drives are available, and a new drive is inserted as a replacement but is not detected, the reason could be one of the following:

2.2.1 Periodic Auto-Detect Failure Drive Swap Check Time

The "Periodic Auto-Detect Failure Drive Swap Check Time" has been disabled.

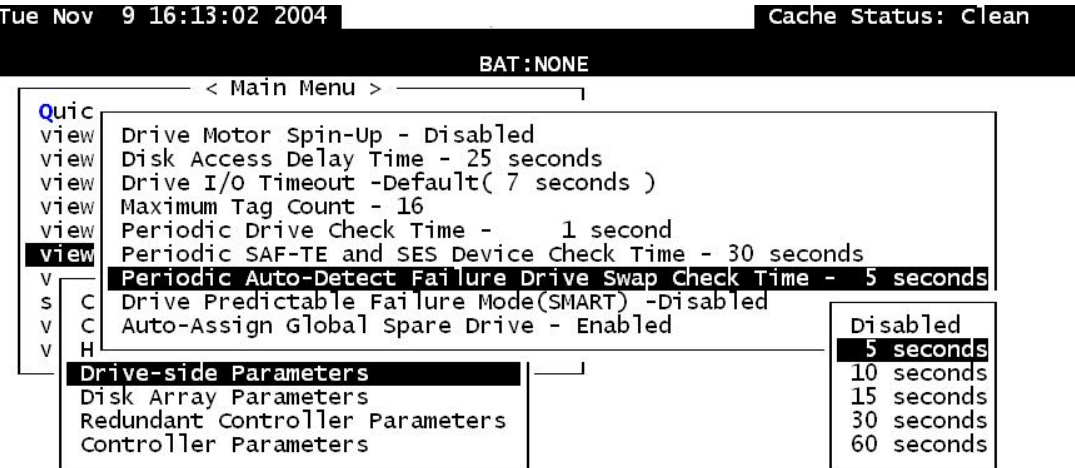


Fig. 2.6 Periodic Auto-detect Failure Option

Access this option through "Main Menu," "View and Edit Configuration Parameters," "Drive-side Parameters," and then "Periodic Auto-Detect Failure Drive Swap Check Time." Press Enter on it to see the options.

2.2.2

Periodic Drive Check Time

The "Periodic Drive Check Time" has been disabled.

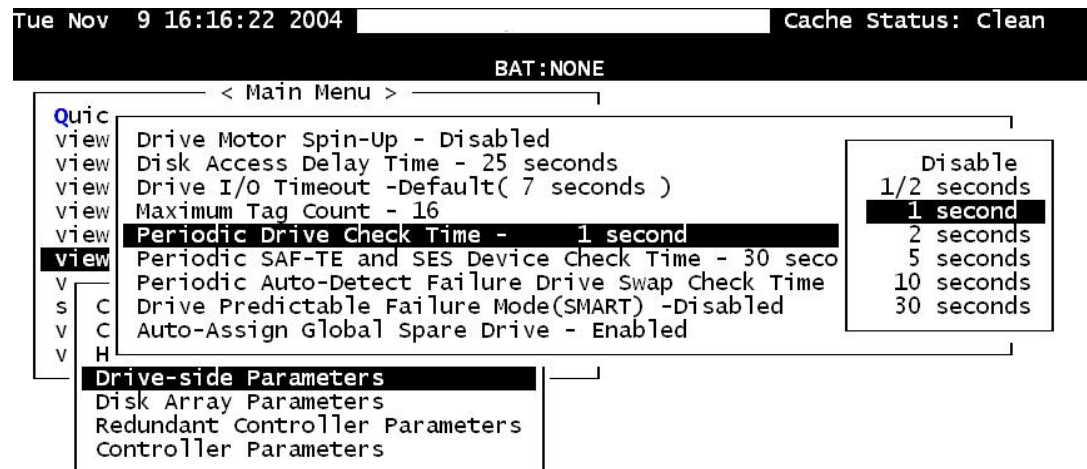


Fig. 2.7 Periodic Drive Check Time Option

Access the option through "Main Menu," "View and Edit Configuration Parameters," "Drive-side Parameters," and then "Periodic Drive Check Time." Press Enter on it to see the options. A periodic drive check time of 30 seconds is recommended.

2.2.3

Manual Scan In

Both SATA- and Fibre-based subsystems automatically scan in a new hard drive. A "LIP" is issued on a drive loop and a SATA drive has a dedicated channel. If neither of the above steps (check time settings) is preferred, you may either reset a SCSI-based subsystem or perform a manual scan-in to bring the new drive online.

Scan the replacement drive into the configuration by following the steps below:

1. From the Main Menu, choose "View and Edit Drives." Select any disk drive in the list and press Enter to proceed.
2. Choose "Scan SCSI Drive" and press Enter. Select the channel number and then the ID number of the replacement drive, and select Yes on the confirm box.
3. Verify the scan is successful. A successful scan is followed by the message "Scan SCSI drive successfully!"

Once the replacement drive is detected, the subsystem should immediately begin data rebuild.

2.3

How to Rebuild a Logical Drive?



CAUTION! The disk drive rebuild process reconstructs the data and parity information that was on the failed drive onto a replacement drive. If you prefer saving the array configuration data onto the array hard drives, you need to execute the "Restore NVRAM" command again so that a copy of the configuration data can be saved to the replacement drive.

1. Choose "View and Edit Logical Drives" from the terminal screen's Main Menu to reconfirm the status of a logical drive which has a failed member. See the table below for status diagnosis and the tasks to perform.

Logical Drive Status	Task(s) to Perform
If the status is "GOOD" after the occurrence of a failed drive, the spare drive might have been used to rebuild the logical drive. Because rebuilding takes time, it is more likely to see the status indicated as "REBUILDING."	Verify the correct location of the failed drive, replace it, and then configure the replacement drive as a spare. Configure the replacement into a spare drive to reduce the risk of failing more than one drive.
If the logical drive status is stated as "FATAL FAIL," two or more drives have failed. Data is lost. Check the status of its members. If the condition complies with the Temporary Failure status, stop host I/Os and proceed with the steps listed in Section 2.5.	Replace the failed drives, rebuild the logical drive, and restore backup data onto the logical drive.
If the array status is stated as "DRV ABSENT" or "INCOMPLETE," and this only occurs at power up, it is possible that your power up sequence is wrong or that a cabling failure has occurred.	Power down the subsystem and power up the subsystems, host computer(s) and peripherals in the correct sequence and see if it corrects the logical drive status. If the logical drive status is "FATAL FAIL," data is lost. If one drive is absent and any of the drive-check mechanisms have been activated, the drive status should change to "FAILED" after the reset. The difference between "ABSENT" and "FAILED" is whether I/O access has been directed to the target drive. If the "DRV ABSENT" status is cleared after reset, it is recommended to replace the target drive as the drive might have been showing symptoms of defects. If the status is "DRV FAILED," and there is no spare available, proceed with the manual rebuild process.
If the status still displays "DRV FAILED" after the faulty drive is replaced.	With no spare available and a member drive fails, verify and replace the faulty drive to begin rebuild. Check Section 5 to see if the subsystem has failed to bring a new drive online for some particular reason. If all related configurations have been corrected and the situation doesn't improve, you may try powering down the subsystem and reinstalling disk drives on an enclosure known to be good.



WARNING! Wait for the rebuild process to complete before replacing the failed drive. This eliminates the possibility of removing the wrong drive.

If spare drive configuration is preferred, remember to replace the failed drive, and configure the replacement into a spare drive. By the time the rebuild is completed, the original spare drive has become a member of the target logical drive.

2. There are two ways to rebuild a logical drive, Manual Rebuild and Automatic Rebuild, depending on whether spare drives were configured with the array.

Automatic Rebuild

If a member of a logical drive fails, the subsystem firmware first determines if there is a Dedicated Spare assigned to the logical drive. If yes, the rebuild process is automatically initiated.

If no Dedicated Spare is available, the subsystem firmware searches for a Global Spare. If a Global Spare is available, it automatically starts rebuilding the logical drive.

Manual Rebuild

If neither a Dedicated nor a Global Spare is available, and no drive-check mechanisms have been activated, the subsystem will not attempt to rebuild until the process is manually initiated. See Section 5 for descriptions of the drive-check mechanisms.

What to Do?

With Automatic Rebuild, a spare is automatically used as a replacement drive. Wait for the rebuild process to complete, replace the failed drive, and then configure the replacement drive as either a Dedicated or Global Spare drive.

With Manual Rebuild, replace the failed drive so that the subsystem can initiate the rebuild process. After the failed drive is replaced, check to see if the new drive has been recognized. If not, refer to Section 5 to change the related parameter settings.

Once any of the drive-check mechanisms have been activated or a replacement drive (SCSI drive) has been successfully scanned, the rebuild begins.

Wait for the rebuild process to complete. Do not reset or power down the subsystem during the process.



NOTICE! Only use Bosch qualified replacement drives DVA-ADTK.

2.4

Additional Information on Miscellaneous Errors

Some of the events more directly related to disk drives, such as "Drive Failure" and "Drive Missing," have been described in Section 1.2 in its sub-section: Event Description.

Error Messages	Description & Task(s) to Perform
LG:_ Logical Drive ALERT: Rebuild Aborted	Rebuild was canceled by a user or system is shut down.
LG:_ Logical Drive ALERT: Rebuild Failed	Rebuild has been interrupted, e.g., power outage, bad sectors or inconsistent parity found on another member drive, or the replacement drive is defective. Be aware that there are different situations that can cause interruptions to a rebuild. Situations and possible remedies are listed below: 1. It is always recommended to carefully check on all system events before taking further actions. For example, if a hard drive failure event occurred before the "Rebuild Failed" event, it is more likely the replacement drive is faulty. 2. If you mistakenly removed the wrong drive, under the condition when host I/Os have been stopped, you may try installing the original member drive. The array may be successfully restored. A system reset may also bring the array member back online. 3. If the rebuild is manually cancelled, the "Rebuild Failed" event is also displayed.
CHL:_ ID:_ Target ALERT: Unexpected Select Timeout	A "Select Timeout" message may not be resulted by drive failure. It could result from channel bus problems such as signal quality issues.
LG:_ Logical Drive ALERT: Parity Regeneration Failed	System faults or integrity problems forced the system to abandon the operation.
LG:_ Logical Drive ALERT: Creation Aborted	The logical drive creation process has been manually interrupted.
LG:_ Logical Drive ALERT: Creation Failed	The system was forced to abort the logical drive creation process. The subsystem may have discovered a selected drive is defective, a drive has been accidentally removed, etc.

LG:_ Logical Drive ALERT: Expansion Failed	Logical drive expansion failed. It could result from one of the following reasons: 1. A user canceled the expansion. 2. The drive used for expansion may be defective. 3. Bad blocks were encountered on another member drive during the process. 4. One of the member drives has failed.
LG:_ ALERT: CHL:_ ID:_ Media Scan Failed	Media Scan failed for certain reasons, e.g., logical drive has fatally failed.
LG:_ Logical Drive ALERT: CHL:_ ID:_ Clone Failed	Drive cloning failed. It could result from one of the following reasons: 1. Cloning was canceled by a user. 2. The drive used for cloning might have failed during rebuild or the drive is defective. 3. Bad blocks were encountered on another member drive during the process. 4. Serious system faults have occurred.

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