



EASY SWAP

A NEW METHOD FOR REPLACING AMPLIFIERS AND MINIMISE DOWNTIMES
IN THE EVENT OF A CRITICAL HARDWARE FAILURE

Abstract

System Integrators spend considerable time and effort minimising system downtime for their customers due to audio equipment failure. Downtimes are critical for applications such as theme park attractions and venues hosting conferences and live events in general, where the failure of audio in an area, large or small, may result in show disruptions or cancelled events, with negative consequences for the business owners. Good design practices and service-level agreements are fundamental tools that the system integrators use to minimise the potential impact of downtimes in the unfortunate event of an amplifier failure. However, service calls may take a day or more to be answered, since a trained tech has to reach the installation, assess the problem, replace the faulty amplifier, program the replacement amp and test the result before the audio system's operation is restored to normal. To address this gap, we have developed a novel functionality for hot-swapping amplifiers, allowing users to replace a faulty amplifier with a new unit in minutes, without performing specific configuration or needing a product-specific skill set. This is possible thanks to the ability that each Unica series amplifier has to archive backups automatically on a flash memory drive installed on the rear panel. Feedback from the field highlights the overall simplicity of hot-swapping operation as the main strength of our approach, along with the fact that Easy Swap is applicable to installations of any scale and complexity, as it doesn't rely on a centralised processor to store backups. In this paper, we present this new functionality called "Easy Swap", discussing its benefits and applications, and highlighting how this feature contributes toward easing the everyday life of integrators and technicians, providing them with more time to focus on new business.



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INTRODUCTION

AV system integrators face the challenge of keeping their customers' audio systems running reliably and efficiently. Hardware equipment, no matter how reliable, may still fail and cause system downtime, resulting in event cancellations, lost business, and damage to the reputation of the business. To ensure reliable operation, system integrators typically rely on good design practices, as well as service level agreements to provide timely maintenance and repair services. However, even with these measures, unexpected failure of equipment can result in significant downtime while technicians travel to the site and replace or repair the equipment. To address this problem, Powersoft has developed a new feature, Easy Swap, available with Unica Series amplifiers. This feature simplifies and accelerates the process of replacing a faulty amplifier, reducing time and effort required, while providing peace of mind. Easy Swap is designed to enable technicians to quickly and easily replace a faulty amplifier, without requiring specific knowledge or skills, and without disrupting the project management schedules of system integrators.

EASY SWAP EXPLAINED

Easy Swap is a new tool for AV professionals that minimises system downtimes by allowing them to easily and almost effortlessly swap a defective amplifier with a replacement unit. Easy Swap is not just a product feature, but is made possible thanks to a series of individual functionalities unique to Unica series amplifiers, such as:

- Amplifier Backup
- Restore from USB operation

AMPLIFIER BACKUP

This section describes the automatic backup functionality present on all Unica series amplifiers, allowing users to store all parameters and firmware files on a USB drive plugged into the rear panel.

AMPLIFIER SETTINGS BACKUP

Powersoft's Easy Swap is underpinned by the amplifier-backup functionality. This is enabled by the advanced processing architecture of Unica amplifiers, which allows users to monitor and edit all parameters in real-time, while updating a local backup



file simultaneously. This backup file is stored on a dedicated USB flash memory drive, which is shipped with each amplifier and installed on the rear panel. The amplifier-backup functionality offers reliability, scalability, and ease of use.

BACKUP RELIABILITY

The backup process runs automatically, capturing changes to the amplifier settings in real-time as they happen. This creates a faithful snapshot of the amplifier, including speaker presets, input settings, routing, network settings, Dante/AES67 settings, and patching. Note that the backup file does not include hardware-specific parameters such as the serial number, events-history log, and network interface MAC address. The architecture of the file stored on the USB flash memory drive ensures a valid backup is always present, even if the operation is interrupted. The Powersoft-provided USB flash memory drive offers industrial-grade performance and reliability. Lastly, Unica amplifiers can monitor the status of the USB drive and alert the user if there is a failure to the drive or its backup file.

SCALABILITY

The amplifier-backup strategy based on a local USB flash memory drive provides scalability for installations of various sizes and complexities. In fact, any installation can benefit from the automatic amplifier-backup functionality, regardless of its size, as the backup storage facility is locally installed on the rear of each amplifier.

EASE OF USE

The amplifier-backup feature is easy to use; it activates automatically when a compatible USB flash drive is plugged into the USB Type-A connector on the rear panel. No additional configuration or central PC is required to store and update the backup files.

FIRMWARE BACKUP

The second feature that enables Easy Swap is the automatic firmware backup. This ensures that the USB flash drive connected to the amplifier's rear panel always contains a copy of the firmware running on the amplifier. Whenever a new firmware is installed on the amplifier (via ArmoníaPlus or remotely via the Cloud interface), the amplifier's processor also save a copy of the firmware to the USB drive, along with the entire amplifier's settings backup. The main advantage of backing up the firmware to



the USB flash drive is evident when performing a restore-from-USB operation. This allows updating the firmware of the replacement unit before loading the backup file. More details about firmware compatibility can be found in the next section.

RESTORE FROM USB

Easy Swap's user-friendly nature lies in its restore-from-USB feature. Unica's ability to retrieve all user parameters from a suitable backup file stored on a USB flash drive makes swapping Unica amplifiers a simple task. To install a replacement amplifier, simply insert the USB flash drive that was previously installed on the failed unit. This will load all its settings and restore the system functionality in minutes - no PC or product-specific training required. When a USB drive is inserted into the rear panel, the front panel will guide the user through the restore procedure if a suitable backup is found. This makes replacing a faulty unit and restoring the audio system to normal a breeze, requiring only a one-page instruction manual and a few screwdrivers.

EASY SWAP PROCEDURE

Replacing a faulty amplifier with a new one is made easy with Easy Swap. To complete the process, the first step is to locate the faulty unit and disconnect all cables from its rear panel. Then, the faulty amplifier is removed from the rack, and the USB drive is kept and inserted into the replacement amplifier. Following the on-screen instructions, the settings of the faulty unit will be loaded onto the replacement amplifier. When the "Restore completed" screen is shown, the input, output, and network cables can be connected and the result tested.

The procedure for replacing a faulty amplifier with a new one is simple and requires just a few steps, as detailed below:

1. **Locate** the faulty amplifier and **disconnect** all cables from its rear panel.
2. **Remove** the faulty amplifier from the rack.
3. **Keep hold** of the **USB drive** installed on the faulty amplifier.
4. **Install** the replacement amplifier, connecting **only** the **mains** cable.
5. **Insert the USB** drive from the faulty unit (step 3) into the **replacement amplifier**.
6. **Follow** the instructions on the **front display** to load the settings onto the replacement amplifier.
7. **Wait until** the procedure is completed and the "**Restore completed**" screen is shown.
8. **Connect** the input, output, and network cables to the replacement amplifier.
9. **Test** the result.



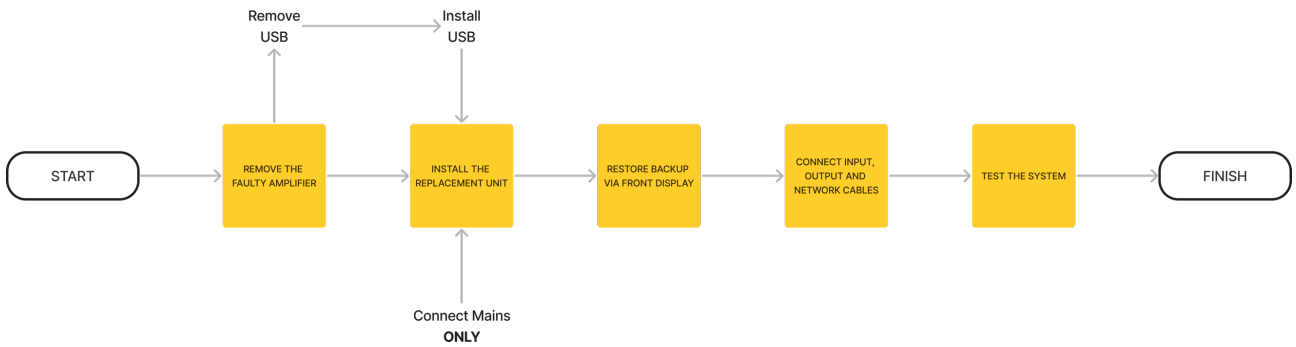


Figure 1 - Easy Swap Procedure Flowchart

ON-SCREEN INSTRUCTIONS

When the USB drive from the defective unit is plugged into the replacement amp, the on-screen instructions guide the user through the Easy Swap procedure. The images below provide a step-by-step guide to restoring a backup from a USB drive.

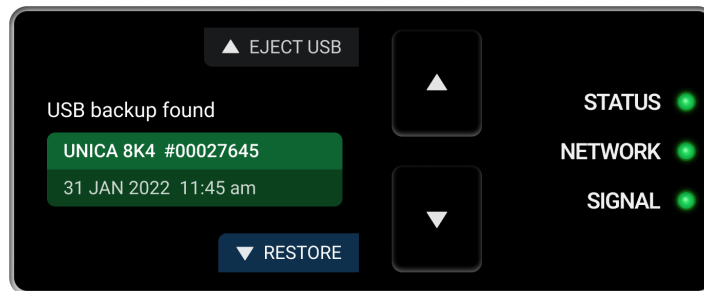


Figure 2 - Backup Found

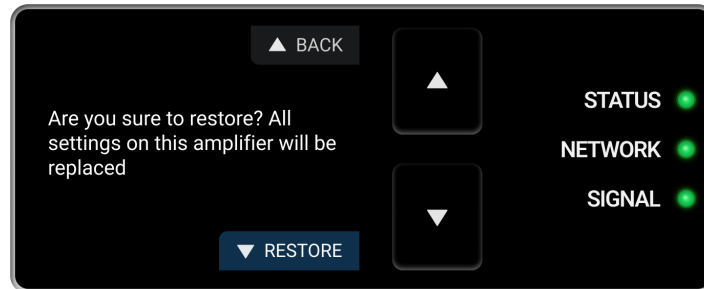


Figure 3 - Confirm Restore

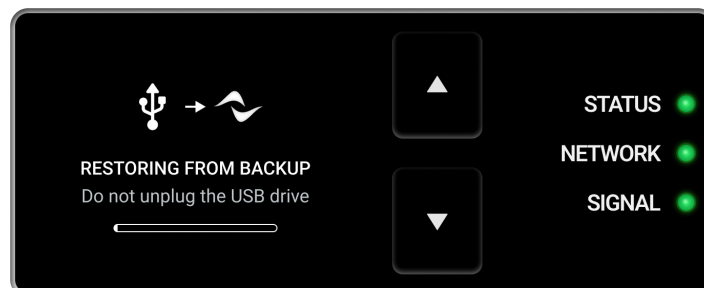


Figure 4 - Restoring From Backup



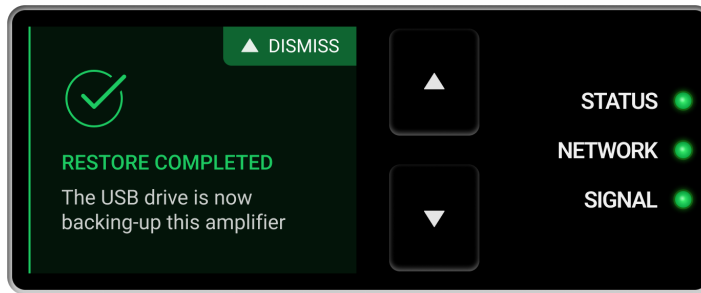


Figure 5 - Restore Succeeded

BACKUP FOUND

After inserting the USB drive, the front panel will display a message saying a valid backup file has been found (Figure 2). The display shows the amplifier model, serial number, and date and time of the backup file (*). The user can confirm (Figure 3) or cancel the operation. If the operation is canceled, the settings are not loaded to the new amplifier, and the USB drive stores the backup safely.

In case the USB drive contains a backup file that is not compatible (stored by an amplifier of a different model) or corrupted, the display shows a different screen (Figure 6). In this case it is not possible to proceed with the restore, so the user must eject the USB drive and perform the restore to a compatible amplifier.

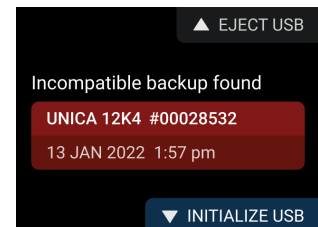


Figure 6 - Incompatible Backup Found

In case a USB drive is connected and a backup file is not found, the amplifier will use the USB drive to backup its own settings. The following confirmation page is shown; no other actions are possible (Figure 7).

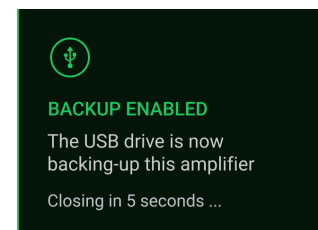


Figure 7 - Backup Enabled Confirmation

(*) Unica series amplifiers come with a perpetual clock that is programmed during manufacturing. However, this clock may not remain accurate over time. To ensure date and time accuracy, Unica series amplifiers must be connected to the internet.



CONFIRM RESTORE

After the user clicks "Restore" on the Backup Found page, a confirmation page is shown. This is the last chance to cancel the operation. To confirm, the user must press the "Restore" button on the front panel (Figure 8).

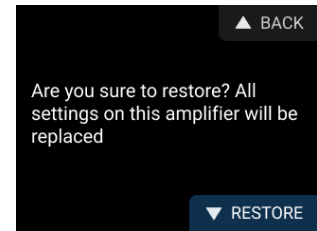


Figure 8 - Confirm Restore

RESTORING FROM BACKUP

After confirming the restore operation, the amplifier will begin restoring the backup file, displaying a progress bar. It is important not to remove the USB or mains power during the process (Figure 9).



Figure 9 – Restoring Backup

RESTORE SUCCEEDED

Once the restore procedure is complete, the amplifier will display a confirmation message (Figure 10). Dismissing the notification instructs the amplifier to initialize the USB drive, allowing it to store the amplifier's own backup automatically, without needing to be swapped out again (Figure 11).

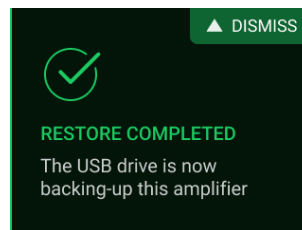


Figure 10 - Restore Succeeded

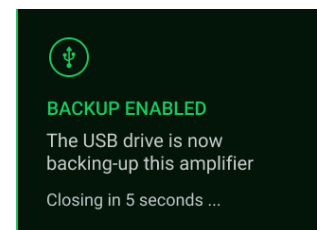


Figure 11 – Backup Enabled

Particular engineering care was taken to ensure the restore operation was reliable. The chances of failure are virtually nonexistent, but a dedicated screen (Figure 12) is displayed if it does occur. It is recommended to contact support in this case.

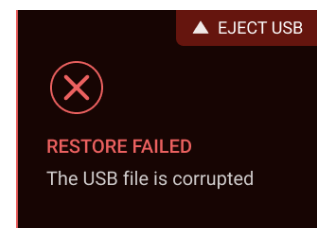


Figure 12 - Restore Failed



PARAMETERS RESTORED VIA EASY SWAP

When restoring a backup to a replacement amplifier, all user settings are transferred, including input, matrix, output, network, and other settings. The parameters that are not transferred include the serial number, MAC address, and events history log file, as these are tied to the physical hardware and cannot be transferred.

The Easy Swap procedure restores the following user settings:

- **Input settings**
 - Source selection strategy
 - Dante/AES67 input subscriptions (name and channel of the transmitter)
 - Global input settings (input gain and delay trim)

- **Matrix settings**
 - Mixing taps gain and mute
 - Advanced matrix settings (gain and mute)

- **Output settings**
 - Advanced EQ and Groups processing (EQ, gain, delay, polarity, mute)
 - Loudspeaker speaker configuration (bridge/split ways)
 - Loudspeaker processing (Speaker presets)
 - Loudspeaker diagnostic settings
 - Dante/AES67 transmitted channels (channel #, pick point, gain trim)

- **Network settings**
 - Dante/AES67 settings (Dante name, sample rate, AES67 mode, latency, encoding, unicast delay request mode, preferred clock leader mode, Dante device configuration lock mode).
 - Network security settings

- **Other settings**
 - Mains current limiter
 - GPIO configuration
 - Eco Mode settings



BACKUP COMPATIBILITY

The Unica amplifier series' Easy Swap functionality is designed to ensure maximum compatibility between backups and firmware versions. Backup files are automatically generated and backward compatible, meaning a backup file created with firmware version N can restore settings on an amplifier running firmware version N-1. This is possible because the USB drive contains a copy of the latest firmware, which is automatically updated during the restore procedure. This ensures the amplifier settings are restored correctly and the audio system is returned to normal operation without manual firmware updates. Needless to say, the backup files are also forward compatible. This means that a backup file created with firmware version N can be used to restore settings on an amplifier running firmware version N+1. This allows integrators to take advantage of the latest firmware features without worrying about compatibility issues.

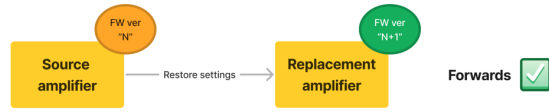


Figure 13 - Forward compatibility is guaranteed by default. New firmware can support older backups without additional configuration.

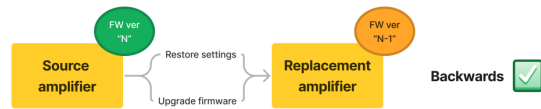


Figure 14 - Backup compatibility is ensured thanks to the automatic firmware upgrade process included in the restore operation. The firmware file is stored onboard the USB drive along with the backup file.



Figure 15 - It is not possible to restore a backup to an amplifier model that is different from the source.

The table below provides a summary of the compatibility of backups between different amplifier models and firmware versions.

Source Amp Model/Firmware	Destination Amp Model/Firmware	Compatibility
Unica Model M/Firmware N	Unica Model M/Firmware N-1	Compatible
Unica Model M/Firmware N	Unica Model M/Firmware N+1	Compatible
Unica Model M/Firmware N	Unica Model ≠M/Firmware N	Not Compatible



APPLICATION

Easy Swap is suitable for installations of any size and complexity. All Unica series amplifiers come with Easy Swap pre-installed; simply insert the USB drive included in the package into the dedicated USB port on the rear panel. Its amplifier-backup and restore-from-USB features make it possible to swap amplifiers in minutes, without any extra configuration or product-specific knowledge, regardless of system size or the presence of a central processor. This makes Easy Swap a great tool for system integrators and technicians, saving them time to focus on important tasks. Easy Swap's scalability helps system integrators reduce operational costs and provide better service to their customers.

SCENARIOS

The following application examples demonstrate the three primary scenarios in which Easy Swap can be used. In all cases, the goal of Easy Swap is to reduce downtime and restore the audio system to its normal operation as quickly as possible.

- Technician dispatching
- Express-shipping replacements
- Self-service maintenance

TECHNICIAN DISPATCHING

In the technician dispatching scenario, a service technician is dispatched to the site with a replacement amplifier and a one-page instruction manual. The technician can then swap the faulty amplifier with the replacement and restore the system to its prior performance in minutes. This allows integrators to provide fast and efficient service to their customers, without needing to send a trained technician to the site.

EXPRESS-SHIPPING REPLACEMENTS

In the express-shipping scenario, the integrator is responsible for shipping a replacement amplifier with a one-page instruction manual to the customer. This allows integrators to provide replacement hardware and instructions to their customers, while still being able to control the system maintenance process.

SELF-SERVICE MAINTENANCE

In the self-service maintenance scenario, local technicians can use the one-page instruction manual to self-service their audio systems in case of faults, without needing professional assistance or recurring maintenance contracts. This allows integrators to provide their customers with an easy and cost-effective way to maintain



their audio systems, while still gaining from selling the replacement hardware or providing quick action in case of complications. Spare amplifiers could be stowed in a rack or utility room since the commissioning specifically for replacement in case of faults. It is important to note that easy swap is only possible across amplifiers of the same model (e.g. 8K8 → 8K8). Therefore, there must be at least one spare unit for all amplifier models in the installation, or at least a subset of the most application-critical ones.

TYPICAL USE CASE

In a typical self-service maintenance scenario, consider a sports arena with a PA system installed. A few months after installation, one of the amplifiers driving a stack of subwoofers suffers a critical hardware failure. The amplifier displays the message "HW fault", and the local technicians are informed of the issue via a local monitoring system and/or the Powersoft remote cloud platform, possibly before the audience notices. Luckily, the integrator included spare amplifiers with the system during installation, allowing the local crew to quickly respond to critical failures with Easy Swap. The local technician can follow the one-page instruction manual to replace the faulty amplifier with a replacement unit. This will ensure the backup settings stored on the USB flash drive connected to the faulty amplifier can be used to configure the new amplifier. Once the new amplifier is installed, the technician will need to plug in the USB flash drive previously removed from the faulty unit. This will trigger the Easy Swap procedure, prompting the user to confirm the operation. The procedure will then begin automatically, updating the firmware of the new amplifier (if needed) and restoring the amplifier settings from the USB drive. This will restore the audio system to its prior performance in minutes. Easy Swap enabled the sports arena crew to quickly replace the faulty amplifier with a new one without needing professional help or having to learn specialized software or complex procedures. This tool is great for system integrators and technicians, saving them time and allowing them to focus on important tasks. It also provides business owners with an easy and cost-effective way to maintain their audio systems, while integrators can still profit from selling the replacement hardware or providing swift assistance in case of complications.



LIMITATIONS OF EASY SWAP

Easy Swap is designed to quickly replace a defective amplifier, reducing downtime and restoring the audio system to normal operation. However, there are some limitations to consider. Easy Swap only works with amplifiers of the same model, so a backup file created with one model can only be used to configure and restore settings on a replacement of the same model. Additionally, the Easy Swap procedure only restores user settings, not the amplifier's serial number, MAC address, or events history log file. Finally, the USB flash drive stores only the most recent backup, so restoring a backup from a different time or date is not possible.

EXCLUDED APPLICATIONS

Easy Swap does not cover all scenarios where an amplifier needs to be replaced. For instance, it is not suitable for replacing an amplifier with a different model or an older version of the same model without performing a firmware update. Additionally, Easy Swap cannot restore a backup file from a different time or date.

The following applications cannot be addressed by Easy Swap:

- Replace an existing amplifier with a different model.
- Restore a backup file from a different time or date to the same amplifier, or another.
- Downgrade the firmware of the replacement unit.
- Update the firmware of multiple amplifiers via USB in bulk.
- Program multiple amplifiers in bulk via USB.



CONCLUSION

In conclusion, Easy Swap is set out to be a revolutionary feature that will bring a dramatic change to the way audio system integrators and technicians replace defective amplifiers. Rather than needing to rely on a professional or specialized software, the Easy Swap feature allows local technicians to easily restore settings from a USB drive and perform the necessary repairs without the need for any professional assistance. This not only helps to reduce downtime, but it also allows integrators to control the maintenance process more effectively. The process of replacing amplifiers is made even easier with the one-page instruction manual that comes pre-installed with Easy Swap, allowing integrators to provide quick and efficient service to their customers and reduce operational costs. Moreover, Easy Swap is suitable for installations of any size and complexity, making it an invaluable tool for audio system integrators and technicians.



APPENDIX - DATA INTEGRITY, SECURITY, AND DURABILITY OF USB FLASH MEMORY DRIVES

USB flash memory drives have become increasingly popular in recent years due to their versatility and ease of use for transferring files across multiple devices.

However, there is a perception that USB drives are not a reliable data storage medium and are not suitable for mission critical applications. In reality, USB flash memory drives are just as reliable, if not more reliable, than other data and file archive methods. This appendix will discuss the technologies and key features that make USB flash memory drives a reliable option for storing amplifier backups, enabling Easy Swap capabilities.

DATA INTEGRITY

Data integrity is a key concern when it comes to storing data on any medium. Data integrity is the assurance that stored data has not been accidentally or maliciously altered or destroyed. USB flash memory drives rely on several technologies to ensure that the data stored on them is secure and reliable. The first is ECC (Error Correction Code) which is used to detect and correct errors that may occur during the reading and writing of data. ECC is used to protect data from corruption due to electrical interference, heat, or other environmental factors. The second is wear-leveling, which is used to prolong the life of the drive. Wear-leveling is a process that spreads out the writes across the entire drive in order to evenly distribute the wear and tear on the memory cells. This ensures that the drive will have a longer lifespan and will be able to retain data for a longer period of time. The third is secure erase, which is used to securely and permanently erase data from the drive. Secure erase ensures that data cannot be recovered from the drive, even if the drive is damaged or destroyed. These technologies, combined with the high-quality components used in modern USB flash memory drives and the robust construction of the drives, ensure the data stored on them is secure and reliable.

SECURITY

Data security is also a key concern when it comes to storing data on a USB flash memory drive. USB flash memory drives typically use encryption to protect the data stored on them. The most common type of encryption used is AES (Advanced Encryption Standard), which is a symmetric encryption algorithm that is highly secure and resistant to attack. AES is used to encrypt the data stored on the drive, ensuring



that it can only be accessed by the user with the correct encryption key. Additionally, USB flash memory drives may also feature built-in authentication methods, such as password protection or biometric authentication, to ensure that only authorized users can access the data stored on the drive. These security features ensure that the data stored on the USB drive is safe from unauthorized access or tampering.

THE BENEFITS OF USING THE NETWORK CABLE RETAINER ACCESSORY

The Network Cable Retainer accessory is a great way to protect USB drives from accidental tampering. This simple device secures the USB drive to the amplifier, preventing it from being removed or unplugged. It consists of two pieces: a latch attached to the amplifier's USB port and a retention bracket attached to the USB drive. This creates a secure connection, protecting the data stored on the drive. Integrators and technicians can benefit from this tool, ensuring the security and integrity of the data stored on the USB drive. It also takes full advantage of Easy Swap functionality, minimizing downtime in the event of a critical hardware failure.

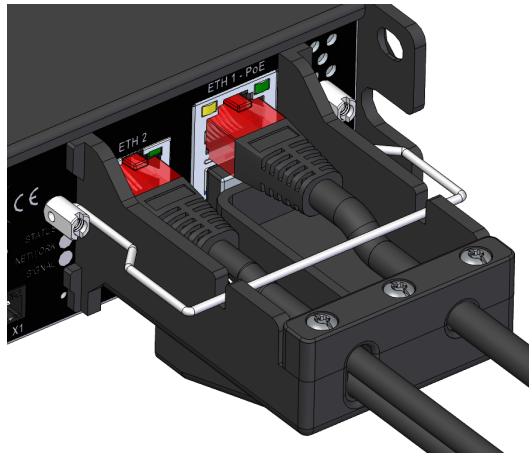


Figure 16 - This Network Cable Retainer Accessory is designed for Unica Series Amplifiers. It also serves as a security shield for the Easy Swap Flash Memory USB Drive, reducing the risk of accidental tampering or manipulation

DURABILITY

Durability is an important consideration when choosing a data storage medium, and USB flash memory drives are no exception. USB flash memory drives are designed to be durable and resistant to shock, vibration, temperature, and moisture. The drives are also designed to withstand a wide range of temperatures, from -10 to 85 degrees Celsius, and are rated to last for thousands of write/erase cycles. These features ensure that the data stored on the drive is safe and reliable, even in harsh environments. In conclusion, USB flash memory drives are a reliable and secure data storage medium, making them an excellent choice for critical applications such as amplifier backups. The data stored on the drive is secure, reliable, and durable, making it an ideal choice for mission-critical applications.



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