



Hewlett Packard
Enterprise

Technical white paper

Barcode and RFID labels for HPE StoreEver tape automation

HPE barcode labels in a highly effective tape management system



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Abstract

The barcode labels on tape cartridges provide both human-readable and machine-readable identifiers. Machine-readable identifiers enable the tape library system to manage the tape cartridges correctly. Any failure in the barcode label system with the label and format, the library reader, or the application might cause data to be inaccessible. Backup and restore failures are often caused by misuse or misunderstanding of barcode technology.

In 2010, HP, now Hewlett Packard Enterprise (HPE), added a radio frequency ID (RFID) technology option to barcode labels, now available with LTO-4, LTO-5, LTO-6, and LTO-7 media. These labels contain an RFID chip system as well as the printed barcode in order to streamline and simplify asset management for large data centers looking to reduce inventory times dramatically by using machine-readable identifiable technologies.

This paper discusses the many factors required to use barcode labels successfully in the tape backup environment.

Technical requirements of barcode labels

History of barcodes

Barcode label technology patents go back to 1934. While the idea of encoding information in a series of bars and spaces is not new, the application in the world of tape automation has added significant value to users of tape technology, enabling them to track their media both within automation products and at offsite locations. Many third parties use additional labeling for offsite tape storage, typically on the tape storage case. Application software is also evolving to use the barcode information to track where the data cartridge is located, verify the correct media type, and confirm the identity of the exact piece of media being accessed.

Barcode technology, like other languages, has evolved in to many symbologies suited for different applications. More than 200 different barcode symbologies have been developed. The most familiar symbology is the Universal Product Code (UPC) used on consumer merchandise such as food products. UPC labels are simple, strictly formatted, and designed to allow low-quality labels to be read by highly sophisticated readers. UPC codes on merchandise have the benefit of being used in an environment where a hand-held reader or multiple beam scanner can be moved to many locations on the label. It possibly scans hundreds of times to determine a good scan. Checksums are included in the coding scheme to verify the scan. As a last resort, the UPC label usually has a human readable portion that can be typed in to the terminal by an operator.

Barcode technology in tape libraries

Barcode labels for tape media use the Code 39 (sometimes referred to as Code 3-of-9) symbology—a widely used industrial standard. As the name implies, there are three wide elements (and six narrow elements) for every nine elements. An element can either be a bar (black, non-reflective) or a space (white, reflective). This format provides verification that a valid code is present. For example, a character with four wide elements and five narrow elements would be considered invalid because it must contain exactly three of nine wide elements.

The Code 39 specification allows for the addition of a checksum digit. However, for most tape media, a checksum digit is not used (with the exception of the barcode label for AIT products). Code 39 uses an asterisk as the stop-and-start characters. These are not printed as part of the human-readable portion of the label.

A barcode reader can determine the start character and the stop character. It can determine the intended direction of the characters regardless of which direction they are read. The reader is able to analyze the direction of the start or stop character relative to the lead-in white space on the label. This assures the reader that the system understands the intended direction of the characters. With tape libraries and tape autoloaders, the ability of the reader to reposition itself with respect to the label is much more restricted than the hand held or multiple beam scanners used for reading UPC codes. Often, the reader is at a fixed distance and angle from the barcode label.

The only variable position typically available to the barcode reader in a tape library is to scan in different vertical positions across the label. While these restrictions allow for a more cost-effective reader to be used compared to scanners in a retail environment, they put a greater emphasis on the quality of the label. Because of the physical constraints of the reader and the inability to have an operator standing by to enter the human-readable portion of the label manually, the quality of the label must be much higher than that of the common UPC label. Failure to read a label properly carries greater consequences given the importance of the cartridge data in today's computing environment. The importance of using a high-quality label cannot be overstated.

RFID technology in tape libraries

RFID technology represents the most significant advancement in inventory management since the barcode. An RFID scanner can potentially read the contents of a master carton or library case in seconds—even if the container is closed and sealed. Real-time visibility and asset tracking also enhances security, making it easier to comply with regulations such as HIPAA and Sarbanes-Oxley.

Additionally, HPE LTO-Labeled RFID media provides customers with an avenue to protect the company from the negative consequences of data breaches. Data breaches often result in lost confidence among customers and stakeholders, as well as possible legal and financial penalties to the company.



Label quality

Many factors contribute to the quality of a label. Some factors are obvious and observable to the human eye, but most factors require specialized optical measurement equipment to qualify them. The following are some of the factors which determine label quality:

- **Lead-in white space** before the first character and after the last character must have a minimum width of 10 narrow elements. This allows the reader to verify when to start looking for the first character and when to validate the last character. Without this, the reader might have difficulty determining the start of the barcode label. Avoid labels that use insufficient white space for these quiet zones. Additional information characters are separated by an inter-character gap, which is the same width as a narrow bar. The ratio of wide to narrow bar width may be in the range of 1.8 to 3.4. Barcodes with a narrow bar width of less than 0.020 inches (0.508 mm) must have a ratio of at least 2.5. A ratio of 3.0 is recommended. Every Code 39 barcode must be preceded and followed by a quiet zone with a width of at least 10 narrow bars.
- **Paper stock for labels is IMPORTANT:** Optimal reflectivity for both the white and black areas on the label is dictated by the ink and the paper used. Paper stock is a critical component in labels. A paper stock which does not optimally absorb the black ink will result in a reflective black surface and cause incorrect reading. Even though a label might be an American National Standards Institute (ANSI) grade A grading, that is not sufficient to ensure a quality label for library use. Ideally, use only labels which have been thoroughly tested and qualified in HPE libraries.
- **The white space must be very reflective** and contain a spatial distribution attribute. A very reflective, shiny surface (like a mirror) might actually appear black to the reader because the angle of reflection does not return sufficient light to the receiver of the reader. A white surface that reflects the light in many directions (spatial distribution) enables the barcode reader to detect white areas accurately. The paper stock used for the barcode label plays an important role in determining reflectivity of the label, and thus it is strongly recommended that only HPE preferred labels are used.
- **The black space must not be reflective.** Again, the factor of spatial distribution of the reflected light comes in to play. Even though the area might appear black to the human eye, if the surface is highly reflective along an angle aligned back to the receiver, the reader will read the black area as white. The paper stock used for the barcode label plays an important role in determining reflectivity of the label, and thus it is strongly recommended that only HPE preferred labels are used.
- **The ratio of narrow to wide elements** is crucial to the ability of the reader to distinguish wide elements from narrow elements. If the narrow and wide elements begin to appear too similar to the reader, it will result in incorrect reads. The edge definition between the black and white elements can appear different to the reader than to the human eye, if that transition is not crisp. Edge definition and edge location are common faults when personal printers are used to create barcode labels.
- **The size of narrow elements** must not be too small. If the element is too narrow it does not carry enough information for the reader to process it accurately, or it might not be detected. The element width, ratio specification, label size, and the lead-in white space combine to create a physical limit on the number of characters that a label can contain. Exceeding this number might cause read problems.
- **The quality rating** of the label must be high. All verified manufacturers use the standard ANSI X3.182 Barcode Print Quality Guideline, which considers each factor, to rate barcode labels. All HPE libraries require the highest quality rating of "A." This standard rating includes measurements of voids or white areas within the black bars, and specks or dark areas within the white bars. Either of those might be very detrimental to successfully reading a label.
- **Miscellaneous other factors** affect the quality of the label such as if the ink on the label is waterproof, how well the adhesive properties of the label are maintained over time, and if the label material can resist the wear from both human and machine handling. These factors are important to protect the integrity of the data cartridge.

Label manufacturing processes

There are two processes commonly used for manufacturing quality tape media and barcode labels. One uses a thermal transfer process and the other uses industrial-quality laser printers with a laminate overlay.

- **Thermal transfer printers** use a fixed-width thermal print head pressing onto a paper or plastic label, over a driven rubber roller called a platen, which produces a label with very good white-to-black transitions. Because of the high print speeds, such label printers have become very sophisticated, by using powerful processors and large memory capacities which allow them to produce the label images at the same speed as the print mechanism. If controlled well, this process has an acceptable level of voids in the black regions and specks in the white regions. The label from this process has a more shiny appearance, both to the human eye and to the barcode reader. Consequently, some readers, such as charge coupled device (CCD) readers, experience difficulty in distinguishing black from white. Generally, laser readers tend to work somewhat better with thermal transfer labels.
- **Industrial-quality laser printers** can print very good quality labels. The transition from white to black is not quite as sharp as the thermal transfer process but can still have the quality to achieve grade "A" classification. The laminate overlay protects the label from environmental factors such as water and abrasion. It also helps to scatter the light, which is beneficial to some readers, particularly CCD scanners. However, this same scattering might be detrimental to some laser scanners.



Labels printed on other types of printers, such as ink jet printers or office-quality laser printers, generally lack the high quality required to provide reliable reads in a tape library. Additionally, these types of labels might work in one library at one time but might not read on that library in the future. A label that reads in one library may not be interchangeable with other libraries of the same model, or with different models of libraries. The ink and stock material are also subject to water damage, smearing, wear, abrasion, and possible fading over time, which could be a problem while attempting to recover data from a cartridge. Similarly, labels made with adhesive strip label makers or low-quality thermal transfer printers will cause problems with interchange and reliable reading.

Label types

Tape labels are of two types: non-adhesive and adhesive. The non-adhesive labels are used in the DLT family of tape cartridges. The adhesive labels are used in LTO, AIT, 3480, 9840, and other tape formats.

- **Non-adhesive labels** The slide-in label for the DLT and SDLT formats has the advantage of being automatically oriented on the cartridge by the nature of the slot. Labels can be placed in the slot in either orientation, although the convention is to place the human-readable part of the label away from the hub side of the tape. This would be consistent with how one would want the label on the cartridge to appear if using a stand-alone drive and inserting the tape with the hub down. The slot length for DLT cartridges is not as long as other tape cartridge types, so it is suggested that no more than seven characters be present on the label (not counting the start and stop characters).

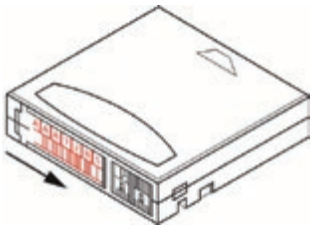


Figure 1. Inserting a non-adhesive label

- **Adhesive labels.** The LTO cartridge (as well as AIT, 9840, 3480, and others) uses a label with an adhesive backing that the user applies. The label must be applied within the recess of the cartridge. Labels applied outside of the recess can cause reading inconsistencies.

The less common HPE LTO-1 and LTO-2 label formats contain a short barcode and a long barcode (known as the dual barcode label) as shown in Figure 2. This dual barcode label was used in some older HP (now Hewlett Packard Enterprise) tape libraries. LTO label formats (with a single barcode) work with all newer HPE tape libraries from LTO-3 onwards. The single barcode is now the most widely used, owing to the prevalence of LTO-3, LTO-4, LTO-5, LTO-6, LTO-7, and LTO-8 tape automation devices. HPE LTO-1 and LTO-2 labels, with the short and long barcodes, must be oriented correctly on the tape. These labels have a note indicating which side must be applied toward the hub of the tape. Other LTO generations, with only one barcode, may be applied in either direction, although it is most common for the human readable text of the barcode to be near the side of the tape without the hub. Failure to apply the label correctly on LTO-1 and LTO-2 might make the label unreadable or not interchangeable with any of the HPE tape libraries.



HPE LTO-1 or LTO-2 dual barcode label



HPE LTO-6 single barcode

Figure 2. LTO label formats

Caution

Never use a label for a different media type, with LTO cartridges. The barcode could be unreadable and the label might get jammed in the drive or library robotics. Additionally, the label might be readable, but the library could misinterpret the type of cartridge and proceed to insert the cartridge into an incompatible drive, possibly damaging the drive and tape.

- * **RFID labels.** HPE LTO-4, LTO-5, LTO-6, and LTO-7 cartridges have the option of being labeled with RFID technology. The RFID chip and antenna are placed on the back of the label where the label adheres to the cartridge. With this technology, scanners can read a single cartridge from up to six feet away and a master carton or library case containing 20 cartridges from two feet away. The read rate for 20 cartridges equates to less than two seconds. The technology supports worldwide RFID frequencies and meets the RFID protocols of EPC Global Standard (version 2.0.1 or later) and the RFID transmission standard of ETSI EN 302 208-1 (version 2.1.1 or later).



HPE LTO-7 single barcode RFID label



Reverse of HPE LTO-7 single barcode RFID label

Figure 3. RFID label formats



Technical aspects of barcode readers

There are two main types of barcode readers: one type uses scanning lasers and the other type uses CCD technology. Each type has benefits and drawbacks. Both are used in tape automation products.

- **Scanning laser readers**—the scanning laser is a concentrated beam of light that is mechanically scanned across the surface of the barcode, usually by sweeping a mirror internal to the barcode reader device. When the beam passes over the barcode, a receiver analyzes the returning light to determine how much of the laser light is being reflected back into the receiver. A threshold is determined that separates the white areas of the label from the black areas. Because the speed with which the beam is being scanned across the label is known, the apparent width of the narrow and wide elements can be determined. This information is then processed to determine the information on the label. To reduce the possibility of errors, a laser scanner may perform up to 500 scans per second. Precaution must be taken with laser scanners so that the laser is not directed into the eyes of the user or service technicians.
- **CCD readers**—the CCD scanner consists of a light source, usually an array of LEDs that illuminates the entire label. A CCD then reads the entire image of the field of view at once. The CCD is a single line scan with each pixel representing one part of that line across the entire barcode. The amount of light received by each pixel is correlated to either a black area or a white area. The number of pixels each element contains is used to distinguish wide from narrow elements. A label surface that uniformly scatters the light from the LEDs in many directions (such as a high-quality HPE label) is the best for these types of scanners. Each time the barcode is scanned, several readings are taken to reduce the possibility of errors.
- **RFID scanners and readers**—HPE RFID labels can be read by any scanners or readers that meet the ETSI EN 302 208-1 and EPC Class 1 Gen 2 tags specifications. Readers are either fixed and strategically located throughout the facility or they are mobile. RFID scanners and readers have the unique capability to alert supervisors of any attempt to move a tagged item from an authorized area; hence, providing protection against security breaches and asset loss.

Higher quality readers are able to read labels more precisely, but this greater precision and sensitivity can cause more read issues with poor-quality labels. The same precise reading capability that allows a greater margin for reading quality labels also emphasizes voids and specks in low-quality labels. These voids and specks can result in read errors. However, regarding other label quality criteria such as the narrow to wide ratio and reflectivity, a high-quality scanner provides a greater margin of error to allow for lower ratios and worse reflectivity than a low-quality reader does. A high-quality label is the best way to ensure total compatibility across reader types and quality.

Format conventions for barcode labels

In addition to the technical details of how the information is encoded on the label and read by the scanner, the information for tape media barcode labels is governed by format conventions. For this paper, the formats for both DLT and LTO tapes will be reviewed, including the formats for data, cleaning, and diagnostic cartridges of each technology. Some of the format criteria are conventions used to standardize (as much as possible) among automation and tape manufacturers. Other format criteria are required by some tape automation products, some application software products, or both. Those elements will be discussed in more detail in sections of this paper devoted explicitly to automation and software requirements.



LTO type formats

The LTO Ultrium tape format now includes generation 1 to 8 as described in Table 1. The only difference is the format of the information on the label.

Table 1: HPE Media Product Numbers

Products	Product number
HPE LTO-8 Ultrium 30 TB RW Data Cartridge	Q2078A
HPE LTO-8 Ultrium 30 TB RW Custom Labeled No Case Library Pack (20 pack)	Q2078AC
HPE LTO-8 Ultrium 30TB RW 20 Data Cartridges Library Pack without Cases	Q2078AH
HPE LTO-8 Ultrium 30 TB RW Custom Labeled Data Cartridge (20 pack)	Q2078AL
HPE LTO-8 Ultrium 30 TB RW Non-Custom Labeled Data Cartridge (20 pack)	Q2078AN
HPE LTO-8 Ultrium 30 TB WORM Data Cartridge	Q2078W
HPE LTO-8 Ultrium 30 TB WORM Custom Labeled Data Cartridge (20 pack)	Q2078WL
HPE LTO-7 Ultrium Type M 22.5 TB RW Custom Labeled No Case Library Pack (20 pack)	Q2078MC
HPE LTO-7 Ultrium Type M 22.5 TB RW Custom Labeled Data Cartridges (20 pack)	Q2078ML
HPE LTO-7 Ultrium Type M 22.5 TB RW Non-Custom Labeled Data Cartridges (20 pack)	Q2078MN
HPE LTO-7 Ultrium 15 TB RW Data Cartridge	C7977A
HPE LTO-7 Ultrium 15 TB RW Custom Labeled No Case Library Pack (20 pack)	C7977AC
HPE LTO-7 Ultrium 15 TB RW RFID Custom Labeled Data Cartridge (20 pack)	C7977AF
HPE LTO-7 Ultrium 15 TB RW Eco Pack (20 Pack)	C7977AH
HPE LTO-7 Ultrium 15 TB RW Custom Labeled Data Cartridge (20 pack)	C7977AL
HPE LTO-7 Ultrium 15 TB RW Non-Custom Labeled Data Cartridge (20 pack)	C7977AN
HPE LTO-7 Ultrium 15 TB WORM Data Cartridge	C7977W
HPE LTO-7 Ultrium 15 TB WORM Custom Labeled Data Cartridge (20 pack)	C7977WL
HPE LTO-6 Ultrium 6.25 TB MP RW Data Cartridge	C7976A
HPE LTO-6 Ultrium 6.25 TB MP RW Custom Labeled Data Cartridge (20 pack)	C7976AL
HPE LTO-6 Ultrium 6.25 TB MP RW Eco Pack Custom Labeled Data Cartridge (20 pack)	C7976AC
HPE LTO-6 Ultrium 6.25 TB MP RW Eco Pack UnLabeled Data Cartridge (20 pack)	C7976AH
HPE LTO-6 Ultrium 6.25 TB MP RW Non-Custom Labeled Data Cartridge (20 pack)	C7976AN
HPE LTO-6 Ultrium 6.25 TB MP RW RFID Custom Labeled Data Cartridge (20 pack)	C7976AF
HPE LTO-6 Ultrium 6.25 TB MP WORM Data Cartridge	C7976W
HPE LTO-6 Ultrium 6.25 TB MP WORM Custom Labeled Data Cartridge (20 pack)	C7976WL
HPE LTO-6 Ultrium 6.25 TB BaFe RW Data Cartridge	C7976B
HPE LTO-6 Ultrium 6.25 TB BaFe RW Custom Labeled Data Cartridge (20 pack)	C7976BL
HPE LTO-6 Ultrium 6.25 TB BaFe RW Eco Pack UnLabeled Data Cartridge (20 pack)	C7976BH
HPE LTO-6 Ultrium 6.25 TB BaFe RW Non-Custom Labeled Data Cartridge (20 pack)	C7976BN
HPE LTO-6 Ultrium 6.25 TB BaFe WORM Data Cartridge	C7976BW
HPE LTO-5 Ultrium 3 TB RW Data Cartridge	C7975A
HPE LTO-5 Ultrium 3 TB RW Custom Labeled Data Cartridge (20 pack)	C7975AL
HPE LTO-5 Ultrium 3 TB RW Eco Pack Custom Labeled Data Cartridge (20 pack)	C7975AC
HPE LTO-5 Ultrium 3 TB RW Eco Pack UnLabeled Data Cartridge (20 pack)	C7975AH
HPE LTO-5 Ultrium 3 TB RW Non-Custom Labeled Data Cartridge (20 pack)	C7975AN
HPE LTO-5 Ultrium 3 TB RW RFID Custom Labeled Data Cartridge (20 pack)	C7975AF
HPE LTO-5 Ultrium 3 TB RW RFID Non-Custom Labeled Data Cartridge (20 pack)	C7975AJ
HPE LTO-5 Ultrium 3 TB WORM Data Cartridge	C7975W
HPE LTO-5 Ultrium 3 TB WORM Custom Labeled Data Cartridge (20 pack)	C7975WL
HPE LTO-4 Ultrium 1.6 TB RW Data Cartridge	C7974A
HPE LTO-4 Ultrium 1.6 TB RW Custom Labeled Data Cartridge (20 pack)	C7974AL
HPE LTO-4 Ultrium 1.6 TB RW Eco Pack Custom Labeled Data Cartridge (20 pack)	C7974AC
HPE LTO-4 Ultrium 1.6 TB RW Eco Pack UnLabeled Data Cartridge (20 pack)	C7974AH
HPE LTO-4 Ultrium 1.6 TB RW Non-Custom Labeled Data Cartridge (20 pack)	C7974AN
HPE LTO-4 Ultrium 1.6 TB RW RFID Custom Labeled Data Cartridge (20 pack)	C7974AF
HPE LTO-4 Ultrium 1.6 TB RW RFID Non-Custom Labeled Data Cartridge (20 pack)	C7974AJ
HPE LTO-4 Ultrium 1.6 TB WORM Data Cartridge	C7974W
HPE LTO-4 Ultrium 1.6 TB WORM Custom Labeled Data Cartridge (20 pack)	C7974WL
HPE LTO-3 Ultrium 800 GB RW Data Cartridge	C7973A
HPE LTO-3 Ultrium 800 GB RW Custom Labeled Data Cartridge (20 pack)	C7973AL
HPE LTO-3 Ultrium 800 GB RW Eco Pack Custom Labeled Data Cartridge (20 pack)	C7973AC

Products	Product number
HPE LTO-3 Ultrium 800 GB RW Eco Pack UnLabeled Data Cartridge (20 pack)	C7973AH
HPE LTO-3 Ultrium 800 GB RW Non-Custom Labeled Data Cartridge (20 pack)	C7973AN
HPE LTO-3 Ultrium 800 GB RW RFID Custom Labeled Data Cartridge (20 pack)	C7973AF
HPE LTO-3 Ultrium 800 GB RW RFID Non-Custom Labeled Data Cartridge (20 pack)	C7973AJ
HPE LTO-3 Ultrium 800 GB WORM Data Cartridge	C7973W
HPE LTO-3 Ultrium 800 GB WORM Custom Labeled Data Cartridge (20 pack)	C7973WL
HPE LTO-2 Ultrium 400 GB Data Cartridge	C7972A
HPE LTO-2 Ultrium 400 GB Custom Labeled Data Cartridge (20 pack)	C7972AL
HPE LTO-2 Ultrium 400 GB Non-Custom Labeled Data Cartridge (20 pack)	C7972AN
HPE LTO-1 Ultrium 200 GB Data Cartridge	C7971A
HPE LTO-1 Ultrium 200 GB Custom Labeled Data Cartridge (20 pack)	C7971AL
HPE LTO-1 Ultrium 200 GB Non-Custom Labeled Data Cartridge (20 pack)	C7971AN
HPE LTO Ultrium Universal Cleaning Cartridge	C7978A
HPE LTO-7 Ultrium RW Barcode Label Pack	Q2014A
HPE LTO-6 Ultrium RW Barcode Labels	Q2013A
HPE LTO-5 Ultrium WORM Barcode Labels	Q2012A
HPE LTO-5 Ultrium RW Barcode Labels	Q2011A
HPE LTO-4 Ultrium WORM Barcode Labels	Q2010A
HPE LTO-4 Ultrium RW Barcode Labels	Q2009A
HPE LTO-3 Ultrium WORM Barcode Labels	Q2008A
HPE LTO-3 Ultrium RW Barcode Labels	Q2007A
HPE LTO-2 Ultrium Barcode Labels	Q2002A
HPE LTO-1 Ultrium Barcode Labels	Q2001A

MP = Metal Particle BaFe = Barium Ferrite

LTO Label Format Specification

The full specification of the label format is as follows:

1. The label will most typically contain exactly eight total characters. These will consist of six volume identifier characters followed by two media generation identifier characters (i.e. ABC123L7). The volume identifier characters will be limited to the use of ASCII characters A–Z (41h–5Ah), 0–9 (30h–39h) in any order, with the exception that the special combinations of “CLN” and “DG (space)”, as described in note 3, must not be used as normal volume identifiers.
2. The two media ID characters must be included and must follow the volume identifier. The media characters must consist of two ASCII characters limited to A–Z (41h–5Ah) and 0–9 (30h–39h), defining the type of cartridge being used. Currently, the character string “Lg” is used, where “L” is the LTO type of cartridge and “g” (alphanumeric) is a generation of the LTO cartridge. For Type M media, the character string “Mg” is used, where “M” is the Type M designation and “g” (alphanumeric) is the generation of the LTO cartridge. Other designations for this field will be created with future media types.
3. This note applies to cleaning and diagnostic cartridges only. The first three alphanumeric characters in the sequence will determine a special type of cartridge. Diagnostic cartridges will be [DG{space}vnn], where “DG{space}” is the diagnostic cartridge identifier, “v” is the drive type identifier, and “nn” is a sequence of numbers (example: DG 100). Currently, Hewlett Packard Enterprise does not support the use of LTO diagnostic cartridges.

The cleaning cartridges will be [CLNvnn], where “CLN” is the cleaning cartridge identifier, “v” is the drive type identifier, and “nn” is a sequence of numbers (example: CLNH99L1). The cleaning cartridge identifier for LTO is L1 for the Ultrium universal cleaning cartridge used in all LTO drive generations.

Only ASCII characters A–Z (41h–5Ah) and 0–9 (30h–39h) may be used. Lower case characters and special characters are not allowed. These strings are most typically six characters.

The following sections give a more detailed description of the known possible and allowed media identifiers for LTO cartridges.



LTO data cartridge label format: nnnnnnXY

- nnnnnn is the volume serial number (when color coded, it is called VOLSER). The volume serial number is most typically exactly six alphanumeric (A–Z; 0–9) characters.

Note

The industry standard length of barcode labels is eight total characters; six volume identifier characters followed by two media generation identifier characters (i.e. ABC123L7). Hewlett Packard Enterprise extensively tests HPE tape libraries and associated application software (such as HPE CVTL and other backup applications) using 8-character barcode labels. The HPE-supported standard is 8-character barcode labels. Although the libraries might be able to read labels with more than eight characters, it is not assured that every application will operate correctly with these labels. For compatibility with other libraries and applications, it is highly recommended that the 8-character barcode labels are used. When labels with more than eight characters are used, it is critical to use high quality labels and to understand the restrictions of your applications.

- “XY” is the media ID. These must be alphanumeric. The following table lists the valid media ID combinations:

Table 2: Media ID description

X	Y	Description
L	1	LTO 1st Gen Data Tape
L	2	LTO 2nd Gen Data Tape
L	3	LTO 3rd Gen Data Tape
L	4	LTO 4th Gen Data Tape
L	5	LTO 5th Gen Data Tape
L	6	LTO 6th Gen Data Tape
L	7	LTO 7th Gen Data Tape
M	8	LTO 7th Gen Type M Data Tape
L	8	LTO 8th Gen Data Tape
L	9	LTO 9th Gen Data Tape
L	R	LTO 1st Gen WORM Data Tape
L	S	LTO 2nd Gen WORM Data Tape
L	T	LTO 3rd Gen WORM Data Tape
L	U	LTO 4th Gen WORM Data Tape
L	V	LTO 5th Gen WORM Data Tape
L	W	LTO 6th Gen WORM Data Tape
L	X	LTO 7th Gen WORM Data Tape
L	Y	LTO 8th Gen WORM Data Tape
L	Z	LTO 9th Gen WORM Data Tape

LTO universal cleaning cartridge: CLNvnnXY

- “CLN” denotes that this is a cleaning cartridge.
- “v” is the drive type identifier (drive manufacturer or universal; alpha only A–Z). If a drive type identifier is not required, this may also be numeric (0-9).
- “nn” is the volume serial number (numeric only 0–9).
- “XY” is the media ID (or VolID = Volume ID).

All manufacturers prefer and use the universal cleaning cartridge. For Hewlett Packard Enterprise, all cleaning cartridges are labeled with a media ID as “L1”.



DLT type formats

DLT tape and drive types are divided into three versions: DLT, DLT1, and SDLT. The first of these versions to be developed was DLT. The media was known as Type III media and was used with the first DLT 2000 drives. With the advent of the DLT 4000 drive, the Type IV media (also referred to as Compact 4 media) was developed. Type IV media is still used in the DLT 8000 drive.

The DLT1 and VS80 drives, developed by Benchmark (now part of Quantum), use Type IV media, but the format is not fully compatible with the other DLT drive types. Also, the DLT1 and VS80 drives require a cleaning cartridge that is unique to them. Quantum also developed DLTtape VS1 media specifically for the DLT VS160 drive. SDLT 600 can read the DLTtape VS1 media, thus providing a long-term upgrade solution when customers outgrow the DLT VS160. The DLT VS160 tape drive requires a unique DLTtape VS1 cleaning cartridge. The SDLT 1 and SDLT 2 drives use Type 1 SDLT media (also referred to as Compact 5 media) and cleaning cartridges. The SDLT 600 drives have been introduced with Type II SDLT media and use the same cleaning cartridges as Type 1 media.

DLT type barcode labels are six or seven characters long. In either case, the first six characters are referred to as the volume identifier. If present, the seventh character is referred to as the media identifier. Few 8-character DLT labels might be encountered for SDLT media. In this case, there are two media identifier characters. Only the capital letters A to Z are allowed, along with the numbers 0 to 9. All other conventions of the ANSI specification are used, including the asterisk for start and stop characters. No checksum digit is used.

DLT1 and VS80 barcode label format

Barcode labels for Type IV media used in DLT1 and VS80 drives typically use seven characters. The Hewlett Packard Enterprise convention calls for the first two characters to be alpha characters and the next four characters to be numeric. The seventh character must be a "B." The full description of the format for these cartridges is as follows:

- The six volume characters consist of alphanumeric characters (A–Z; 0–9) and in any order with the exception that the combinations of "CLN" and "DG(space)" shall not be used as normal volume identifiers.

Note

This applies to cleaning and diagnostic cartridges only. The first three alphanumeric characters in the sequence determine the type of cartridge being used. Diagnostic cartridges start with "DG(space)" followed by some sequence of characters. Cleaning cartridges start with "CLN" followed by some sequence of characters.

- The seventh character shall be a "B".

DLT barcode label format

Type IV media used in DLT drives typically use either 6- or 7-character labels. Much of the early media used only six characters consisting of any combination of alpha and numeric characters. Later, some automation manufacturers added the seventh character "D" as a descriptor to distinguish it from the media used in DLT1 and VS80 drives. Furthermore, some automation vendors added an "E" as an additional seventh character. One vendor uses the "E" to distinguish Type III media (without respect to the format) from Type IV media. Another vendor uses the "E" to distinguish Type IV media (without respect to the format) from Type III media. These two conventions conflict with each other. For cleaning cartridges and diagnostic cartridges, some libraries use a "C" as the seventh character. For most HPE libraries, the 6-character label format is used. Some exceptions for the compatibility are noted in the section "Interchange Compatibility of Labels" of this paper.

The full description for DLT cartridges format is as follows:

- The six volume characters consist of alphanumeric characters (A–Z) and (0–9) in any order, with the exception that the combinations of "CLN" and "DG(space)" shall not be used as normal volume identifiers.

Note

This applies to cleaning and diagnostic cartridges only. The first three alphanumeric characters in the sequence determine the type of cartridge being used. Diagnostic cartridges start with "DG(space)" followed by some sequence of characters. Cleaning cartridges start with "CLN" followed by some sequence of characters.

- The seventh character shall be non-existent, "D", "C", or "E".

SDLT barcode label format

SDLT media used in both SDLT 1 (220 GB and 320 GB) and SDLT 2 (600 GB) drives typically use either 7- or 8-character labels. The label format is the same as other DLT media types, with the exception that the media identifier may be either "S", "S1", "S2", or "S3". Hewlett Packard Enterprise and other automation vendors use only the "S" identifier, whereas Quantum recommends the use of "S1", "S2", and "S3" identifiers. Because of the limited size of the label, the use of 8-character labels is discouraged for interchange with multiple types of libraries.



Interchange compatibility of labels

There are some known issues of compatibility with label types not related to the label format. While good quality labels are a necessary first step in assuring reliable barcode reading, there are other factors. Also, one needs to be aware that just because a label works in one library, there is no guarantee that label will work in that library the next time. It also does not guarantee that the label will work in another library of the same model, or that the label can be interchanged with other library types. Only through the diligent use of labels from approved suppliers with the correct format for the library will barcode reading be successful and reliable.

The following are some guidelines to follow with respect to label compatibility:

- DLT labels with more than seven characters might have problems in some libraries due to the increased density of the bars and spaces. It is suggested that no more than seven characters be used for DLT labels to ensure compatibility.
- LTO labels that have only one barcode might not be readable in some older HP (now Hewlett Packard Enterprise) libraries. Always use the Hewlett Packard Enterprise dual barcode label from an approved vendor for LTO generation 1 and 2 type media.
- LTO labels with more or fewer than eight characters might have problems in some libraries. The length of the label and the location of the media identifiers are critical. It is suggested that exactly 8-character barcodes be used for LTO to ensure compatibility across library types. If barcode labels with more than eight total characters are used, they must be high-quality labels. Barcode reporting structures can be modified on most HPE libraries.
- Some older libraries such as the Compaq ESL 9198 and ESL 9326 with laser scanners might, in rare occurrences, operate thermal transfer labels more reliably than by using laser or laminate labels. All other current libraries have been qualified with the laser or laminate label.
- Newer libraries are capable of reading and using labels with more than eight characters. Eight characters is the industry standard and the most tested version of label. It is critical that labels with more than eight characters are created using a very high quality process.
- The industry standard length of barcode labels is eight total characters. Hewlett Packard Enterprise extensively tests the HPE tape libraries and associated application software (such as HPE CVTL, HPE Data Protector, and other backup applications) extensively for using 8-character barcode labels. The HPE-supported standard is 8-character barcode labels. Although the libraries may be able to read labels with more than eight characters, it is not assured that every application will operate correctly by using these labels. For compatibility with other libraries and applications, it is highly recommended that 8-character barcode labels be used.

Tape library and tape autoloader usage of barcode label information

Most HPE libraries interpret the format of the barcode label media identifier and may not load tapes to drives that are incompatible. Other HPE libraries simply pass the barcode information on to the application software and allow the application to determine whether a move command is issued. This section describes the operation of pre-merger HP (now Hewlett Packard Enterprise) and Compaq tape libraries, obsolete tape libraries, and current HPE tape libraries. Where appropriate, both Compaq and HP (now Hewlett Packard Enterprise) model numbers are given. Model numbers for HP (now Hewlett Packard Enterprise) and HPE branded libraries are the same.

Note

The following discussion assumes tapes are labeled correctly. For example, a cleaning cartridge label is not applied to a data cartridge, or an LTO label is not applied to a DLT cartridge. Such mislabeling can lead to possible damage to the cartridge, drives, or library robotics and cause application problems. The industry standard length of barcode labels is eight total characters. Hewlett Packard Enterprise tests HPE tape libraries and associated application software (such as HPE CVTL, HPE Data Protector, and other backup applications) extensively using 8-character barcode labels. The HPE-supported standard is 8-character barcode labels (eight total characters, which includes the media identifier, example: ABC123L7).

Although the libraries might be able to read labels with more than eight total character barcode labels, it is not assured that every application will operate correctly with these labels. For compatibility with other libraries and applications, it is highly recommended that 8-character barcode labels be used.



HPE current products

HPE StoreEver MSL3040 and MSL6480 Tape Libraries

A barcode label is recommended on all tapes in the library. The default configuration is to require barcode labels. MSL6480 firmware versions 4.60 and newer allow a configuration option to allow unlabeled media. When configured to use unlabeled media, the inventory time might be much greater if the library uses unlabeled tape cartridges. The HPE MSL3040 and MSL6480 Tape Libraries will interpret the barcode label media ID information by default. There is an option to configure the library to not interpret the media ID but caution must be used if this is selected.

Tapes without readable barcode labels will not be detected unless so configured, the slot will be shown as empty and will lead to errors. The MSL3040 and MSL6480 both report all barcode characters to the host. Eight is the default. The user can change the number of characters reported to the host using the partition wizard through the Remote Management Interface (RMI). Also, the user may change the left or right justification of the barcode. For example, a library set for six characters and right justification would report a label of ABC123L1 as C123L1 to the host. This example is not typical. Most applications examine all the characters.

By using library firmware 5.50 and later, the MSL6480 supports the initialization of LTO-7 Type M media. By using library firmware 3020 and later, the MSL3040 supports the initialization of LTO-7 Type M media.

HPE MSL G3 Series Tape Libraries (MSL 2024, 4048, 8048, 8096) and HPE 1/8 G2 Series Tape Autoloader

The HPE MSL G3 Series Tape Libraries require use of labels from Hewlett Packard Enterprise or HPE Authorized Resellers. Using self-printed labels with the HPE MSL G3 Series Tape Libraries is not supported, unless the labels are self-printed using the HPE preferred vendor's Tri-Optic ToGo printing solution (for more information, contact EDP Tri-Optic at tri-optic.com or by email at support@tri-optic.com).

A barcode label is not required on all tapes in the library, however labels are strongly recommended. The HPE MSL G3 series of libraries will interpret the barcode label media ID information by default. There is an option to configure the library to not interpret the media ID but caution must be used if this is selected. The MSL G3 libraries report eight barcode characters by default to the host. The user can alter this number using the configuration section of the Operator Control Panel (OCP) or through the RMI.

The user can configure how many characters display on the OCP. If there are more than eight characters, the MSL2024 OCP will display the eight characters on the left, the OCP for 4048, 8048, or 8096 will show it as seven characters (on the left) followed by a "+" symbol. The RMI will show all characters read by the barcode scanner. If a label is detected but cannot be read, or there is no label, the slot will be labeled as "full." Also, the user may change the left or right justification of the barcode. For example, a library set for six characters and right justification would report a label of ABC123L1 as C123L1 to the host. This example is not typical. Most applications examine all the characters.

By using firmware versions 5.10, 7.00, and 9.50 and later, respectively, the 1/8 G2 Autoloader, MSL2024, and MSL4048 support the initialization of LTO-7 Type M media.

Obsolete products

HPE StoreEver ESL G3 Tape Libraries

A barcode label is required on all tapes within the library. Cartridges must have an external barcode label that is machine-readable to identify the volume serial number. A barcode must use only uppercase letters A to Z and numeric values 0 to 9. The library supports Code 39 (3-of-9) type barcode labels. For LTO media barcodes, the library dynamically supports 1 to 13 characters for the volume serial number and a 2-character media type identifier. Tapes without readable barcode labels will not be detected so those slots will be shown as empty, possibly leading to errors. HPE-supplied barcode labels will provide the best results.

The ESL G3 also allows the user to configure the Return Media Identifier using the partitioning configuration screen, which provides the ability for right or left justification of the barcode label while being reported to hosts. The front panel and remote management interface will display all the characters of the barcode label.

HP StorageWorks ESL E-Series Tape Libraries¹

The HP StorageWorks ESL E-Series libraries¹ (ESL 712e/322e and ESL 630e/286e), as well as the ESL 9322 and ESL 9595 (also sold as Compaq models of the same names), do interpret the barcode information. The seventh character, the media identifier, is interpreted as follows:

- "S" indicates an SDLT tape.
- "L" indicates an LTO tape.
- Any other identifier, or no identifier, indicates a DLT tape.

A problem occurs if the seventh character is a "C" as required for some LTO libraries. The "C" is interpreted as a DLT cartridge even though it is an LTO cartridge. LTO cleaning cartridges for ESL libraries must use the "L" media identifier as the seventh character.

The use model for ESL libraries is that only data tapes with labels that contain media identifiers compatible with the target drive are allowed library access to that drive. For example, an LTO cartridge with a media identifier of L6 is not allowed to be moved into a DLT drive. In general, the drive that is the target of the move must be able to perform a valid operation on that tape—a read, write, or clean. An exception is if the media identifier for an SDLT tape is "S" only, it is allowed to be moved into either an SDLT 1 or an SDLT 2 drive. If the tape was actually written in an SDLT-2 drive and the target is an SDLT-1 drive, an error occurs at the application level. No damage will occur to the tape or the drive.

¹ These are obsolete HP (now Hewlett Packard Enterprise) offerings, so it will not change from HP to HPE.

By default, the ESL libraries display only the first six characters of the barcode label on the user GUI screen. Only service personnel may alter this. As a default, the ESL libraries report only the first six characters to the application. The number of characters reported on the screen can be changed using the front panel interface. The number of characters reported to the host can only be changed using the serial port and software. In all cases, the leading or left justified characters are displayed or reported. This justification cannot be altered.

HP StorageWorks Enterprise Modular Library (EML) E-Series Tape Libraries¹

The EML Tape Libraries barcode reporting can be configured as six to eight characters and left or right aligned. If six characters with left alignment are chosen, any characters after the sixth are truncated. By using six characters and right alignment, only the last six characters are shown with the beginning characters truncated. The length and justification of the barcode reporting format, as sent to the host and as viewed on the front panel, may be configured through the front panel configuration section.

- **HP¹ models 4215, 4228, 4248, 4448, 7215, 7228, 7248, and 7448** do not interpret the barcode label information. These are DLT-only libraries. The label contents are passed on to the host application as they are read. A maximum of six characters are passed to the host. These are the first six characters (as a human would read them, left to right) of the label.
- **HP¹ models A4825-252/400/588 and A4846-100** do interpret the contents of the barcode label. These DLT-based libraries require the seventh character of the cleaning cartridge to be a “C” when a cleaning operation is initiated with that cartridge.
- **HP¹ SureStore models 1/20 to 10/100 and HP¹ SureStore 1/9** models do not interpret the contents of the barcode label. However, these models have a setting that determines how many characters the library sends to the host. The possible settings are for six, seven, or eight maximum characters to be sent to the host. For example, an LTO library that is set to six characters maximum, reading an 8-character label of AB1234L1 would not send the L1 media identifier. It would send only the volume label of the first six characters: AB1234. For some host applications, this setting is significant. See the “Data protection and archiving software application requirements” section. These models require the use of the HP dual barcode LTO-1 and LTO-2 labels. LTO-3 and newer generations were not available on these libraries.
- **HP¹ SureStore 3/30, 6/100 and 10/588** libraries do not interpret the barcode label information. These libraries were only available with DLT 4000 or DLT 7000 drives. The interpretation of the barcode information is the same as described for the 10/180 and 20/700 models for the identifiers “C”, “D”, “E”, and “R”. Other identifiers are unknown to these libraries.
- **HP¹ SureStore models 10/180 and 20/700** do interpret the information on the barcode label. The media identifier, the seventh barcode character, is interpreted as follows:
 - “C” indicates a DLT CompacTape III or a DLT cleaning cartridge.
 - “D” indicates a DLT CompacTape IV cartridge.
 - “E” indicates a DLT CompacTape III XT cartridge.
 - “R” indicates a standard 9840 cartridge.
 - “L” indicates an LTO cartridge.
- **Compaq model TL891** series libraries do not interpret the barcode label information. Barcode reporting format length and justification can be set through the front panel.
- **Compaq model TL895** series libraries do not interpret the barcode label information. Barcode reporting format length and justification can be set through the front panel.
- **Compaq model SSL2020** AIT libraries do not interpret the barcode label information. The label for this product that is shipped with the library contains a checksum digit.
- **HP¹ StorageWorks AIT 35 GB** autoloader does not have a barcode reader. The label for this product that is shipped with the library contains a checksum digit.
- **The HP¹ StorageWorks 1/16 Tape Superloader** has an optional barcode reader. The Superloader does not interpret the barcode reader information.
- **The HP¹ StorageWorks 1/8 G1** Tape Autoloader does not have a barcode reader.
- **The HP¹ MSL5000 and 6000** series of libraries, also sold as Compaq MSL models, do not interpret the barcode label information. The magazine identifies the type of cartridge, DLT or LTO, and where it resides. If the magazine type is of the same class as the drive, the move will be attempted, independent of the barcode information. For example, if an SDLT cartridge is placed in a DLT library, the robot will attempt to place the cartridge in the drive. When the move fails (SDLT tapes do not fit into DLT drives), the cartridge is returned to the magazine slot it came from and an error message is reported.

The 5000 and 6000 series MSL reports all barcode characters (up to eight) to the host. Eight is the default. The user can reduce this number using the service level of the front panel, or by using the MSL5000util.exe utility and the serial port that is shipped with the library. Also, the user may change the left or right justification of the barcode. For example, a library set for six characters and right justification would report a label of ABC123L1 as C123L1 to the host. This example is not typical. Most applications examine either all the characters or the first six characters.

¹ These are obsolete HP (now Hewlett Packard Enterprise) offerings, so it will not change from HP to HPE.

HPE StorageWorks Virtual Library System (VLS) HPE Virtual Library System (VLS)

By using the HPE VLS, barcode templates are created for use with the virtual cartridges on which data is stored. These barcodes can have as few as two characters or as many as 99, and they are completely configurable by the administrator. While configuring the barcode templates, care must be taken to follow the requirements (if any) for barcode prefixes and length per the backup application. In addition, it is a good practice to use a barcode prefix that differs from any physical cartridge barcodes in a tape library to which data might be migrated behind the VLS. In this manner, physical and virtual cartridges can be easily recognized from within the backup application.

Data protection and archiving software application requirements

Each data protection and archiving software application has different barcode label requirements. Hewlett Packard Enterprise recommends referring to the vendor's current documentation for any application specific requirements.

HPE OpenView Storage Data Protector

- The application interprets all characters returned by the library.
- The number of characters interpreted by the application cannot be configured.
- The application ignores the media identifiers (for example, L1) on LTO generation 1 labels.
- Data Protector assumes that a tape beginning with "CLN" is a cleaning tape.
- Data Protector views the barcode label as a soft reference to the tape. If the barcodes of two tapes are swapped, Data Protector does not know the difference until the tapes are used and the header is read (scan, back up, restore, etc.). When Data Protector identifies each tape, it also associates the proper barcode with each tape.

Symantec/Veritas NetBackup

- NetBackup reads the full barcode (up to 16 characters) and create a six-character media ID. The media ID defaults to the last six characters of the barcode unless a media generation rule is set to choose the desired characters for the media ID.
- Any six characters can be configured for the media ID, but the default is the last six characters. Be aware, however, that this approach might cause problems if left in this mode for LTO. In the case of LTO, the first six characters are unique, and the last two are the media identifiers.
- Using media ID generation rules allows you to override the default media ID naming method used by Media Manager. To set these rules via the GUI, select Robot Inventory > Advanced Options > Media ID Generation, or add the following line to the [install_path]/volmgr/vm.conf file:
MEDIA_ID_BARCODE_CHARS = <robotnum> <barcode_length> <c1>:<c2>:<c3>:<c4>:<c5>:<c6>

Where:

- <robotnum> is typically always 0.
- <barcode_length> is the barcode length.
- <c1>:<c2>:<c3>:<c4>:<c5>:<c6> are the six characters to use for the Media ID.
For example, the following line sets a rule for robot 0 to use the first six characters of an eight-character barcode as the Media ID:
MEDIA_ID_BARCODE_CHARS = 0 8 1:2:3:4:5:6.
- LTO drives use eight-character barcodes. The last two digits identify the generation of the drive ("L1, L2", etc.). NetBackup can only read six-character barcodes. If you choose to read the right six characters (the default setting), you could potentially have duplicate media IDs. If you choose to read the left six characters, the characters that identify the generation are truncated. In this case, the only solution is to purchase labels and apply them to the cartridges in such a way that the first character or characters are unique to each generation of tape.

Symantec/Veritas Backup Exec

- All characters are interpreted from the library.
- The number of characters interpreted cannot be configured.
- If the application is configured to use barcode rules, the media identifier (barcode) can be used to select the correct type of media to be mounted into a drive in a mixed media library.
- The application only uses the barcode for the purpose of locating the media within the library. The media header is always read when the media is mounted into a drive.



Computer Associates BrightStor ARCserve

- 32 bytes can be read from the library.
- No configuration of the number of bytes read by the application is possible.
- 32 bytes are always allocated, but ending space characters are ignored.
- The media identifier is treated as a string of characters. If the leading character is a space character or \0, the slot is considered full, but to have no barcode. If it is a space, ARCserve assumes it has a barcode that is a blank. If the first character is a NULL character, ARCserve assumes that there is no barcode. However, ARCserve does not depend on the barcode to determine whether a slot is full or not. ARCserve looks at the information from the read element stat to determine whether the slot is full or not.
- The medium label has to be unique and cannot be reused. For example, if a user reuses or moves a used barcode to a new cleaning tape, ARCserve considers the new cleaning tape to be an old one and rejects it.

EMC Legato Networker

- Networker collects and saves up to 35 characters of a volume tag. Networker does not currently use the barcode as anything other than a text-string identifier for a tape.
- No configuration of the number of bytes read by the application is possible.
- Networker does not interpret the barcode information.
- Barcodes are used simply as machine readable labels. The content is not examined in any manner. NetWorker only performs string comparisons to see if the volume is the desired one.

IBM Tivoli Storage Manager

- Tivoli Storage Manager (TSM) interprets all the characters sent by the library.
- The number of characters interpreted cannot be configured.
- TSM interprets characters as an internal name and uses them as a volume name.
- TSM does not interpret media identifier characters.
- If TSM cannot read the barcode, it will not perform the labeling.

Hewlett Packard Enterprise-recommended barcode labels, formats, and usage

Hewlett Packard Enterprise recommends that barcode labels be purchased from only HPE or HPE Authorized Resellers. For more information on HPE product offerings, go to hpe.com/storage/storagemedia.

Email Hewlett Packard Enterprise if you have any questions about how to order custom sequenced barcode labels, use the email address na-prelabeled.media@hpe.com. Hewlett Packard Enterprise recommends custom labels be ordered directly from EDP Tri-Optic at tri-optic.com or by email at support@tri-optic.com.

Non-custom labels that are shipped with HPE libraries and labels bought through Hewlett Packard Enterprise after the initial purchase are uniquely sequenced labels. The sequence from the manufacturer only repeats when all possible combinations are exhausted. For LTO, it will take more than five million labels to begin at AA0001L6 again. Different generations of LTO labels are unique to each other in this same manner.

Note

Some applications only utilize the first six characters of the barcode label. In this case, the LTO generation identifier is ignored, which can result in duplicate barcode labels. Customers who are concerned about receiving unique labels can feel secure in ordering labels through Hewlett Packard Enterprise and do not have to order custom label sequences to ensure unique labels.

Potential issues caused by the improper use of barcode labels

- Labels of the wrong media can potentially cause damage to the cartridge, the drive, or the library. Some cartridges do not fit into drives of a different type. For example, damage might occur if an LTO cartridge is labeled as a DLT cartridge and a command is sent to insert that cartridge into a DLT drive.
- Tapes labeled with the wrong media identifier might be prevented from being inserted into a drive by the library or the ISV application.
- Cleaning cartridges that are not labeled as cleaning cartridges might be prevented from being used in a cleaning operation.
- Data cartridges labeled as cleaning cartridges may be inserted in a drive for a cleaning operation, but the cleaning will not be possible.
- Incorrectly oriented labels, or poorly applied labels, might become detached from the cartridge and jam the drive. Detached labels can cause a drive or library failure.
- Incorrectly oriented labels may be read by some libraries in some locations but not by all libraries or in all slot locations.
- Labels placed anywhere but the location of the cartridge specifically designed for them might jam in the drive and cause a drive or library failure.
- Labels with more characters than recommended might lead to an inconsistent ability to read the label.



Do's and Don'ts of barcode labels

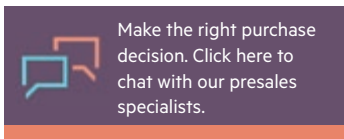
- Do email Hewlett Packard Enterprise if you have any questions about how to order custom sequenced barcode labels, use the email address na-prelabeled.media@hpe.com. Hewlett Packard Enterprise recommends custom labels be ordered directly from EDP Tri-Optic at tri-optic.com or by email at support@tri-optic.com.
- Do purchase labels and label solutions from only Hewlett Packard Enterprise or HPE Authorized Resellers.
- Do use LTO labels within one year of receiving them. The adhesive loses effectiveness while on the shipping paper. After being placed on the LTO cartridge, there is no degradation of the adhesive properties.
- Do replace damaged labels on tapes. If the exact character sequence is required, email Hewlett Packard Enterprise at na-prelabeled.media@hpe.com.
- Do orient labels correctly, especially LTO labels.
- Do understand the requirements of your software application for barcode labels.
- Do configure your library to work most effectively with your labels and your software application.
- Do use only the recommended format for the tape label information.
- Do use the HPE-supported standard of 8-character barcode labels (eight total characters, which includes the media identifier, example: ABC123L7).
- Do use the proper barcode label for the appropriate type of media. For example, use AIT labels on AIT cartridges and LTO labels on LTO cartridges.
- Do use unique barcode identifiers for virtual cartridges in a virtual library unit to distinguish them from physical media.
- Don't print labels on personal printers. The only self-printed labels supported are ones printed using the HPE preferred vendor's Tri-Optic ToGo printing solution (for more information, contact EDP Tri-Optic at tri-optic.com or by email at support@tri-optic.com).
- Don't place the label anywhere except in the approved area of the cartridge.
- Don't write on the barcode label.
- Don't apply new labels over existing labels on a cartridge. Remove the existing label before adding a new label.
- Don't re-use LTO labels. When an LTO label is removed from a cartridge, the adhesive is not capable of reliably holding the label to a cartridge again.

Don't use other adhesives, such as tape, to attach a label to a cartridge. The reflectivity of the tape will interfere with the ability of the scanner to read the label.

Conclusion

Using barcode labels on tape cartridges can increase the productivity of an overall tape management system. Tracking cartridges by barcode information within the library and outside the library has many benefits. Taking a few simple steps enables the user to realize the advantages of the barcode system. The labels must be of high quality, preferably purchased through Hewlett Packard Enterprise or Hewlett Packard Enterprise-qualified sources. The format of the label must be correct for the tape technology and library systems being used. The library must be configured in conjunction with the requirements of the data protection and archiving software application. Finally, the software application must be configured for the barcode labels being used. By following these guidelines, the barcode system will operate effectively and reliably, resulting in a highly successful tape management system.

Learn more at
hpe.com/storage/storagemedia



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