

## Fujifilm 13.56 MHz LTO Cartridge Memory (LTO-CM)

LTO Cartridge Memory (LTO-CM) uses Inductive Coupling. An inductive coil in the drive, library picker or external LTO CM-Reader powers and communicates with the LTO CM electronic module (EEPROM/antenna) inside the data cartridge shell.

This passive RF interface has a range of up to 20mm from the reader-coil to the cartridge CM (the closer the better). The CM stores 4 KB of information as 128 X 32 byte blocks and data transfers to and from the CM in 32 byte blocks.

CM for Ultrium2 is the same as Ultrium1; however, it is factory programmed with new Ultrium2 parameters. As a tape is loaded, the drive's CM-Reader reads the CM and the tape is identified. If an Ultrium2 tape is inserted into an Ultrium1 drive it immediately ejects without threading.



Both Ultrium1 and Ultrium2 cartridges can be used in Ultrium2 drives. Ultrium2 drives identify the tape from the CM while the cartridge is being loaded and the drive programs itself to the appropriate format. Likewise, Ultrium3 cartridges have the CM programmed with Ultrium3 information and Ultrium3 drives will recognize all Ultrium data cartridges accordingly. LTO cleaning cartridges also have CM, which the drives use to identify the cleaning cartridge and keep a tally of cleaning uses.

The LTO CM-Reader communicates by a contactless radio frequency interface. An RF (Radio Frequency) Operating Field is generated by the CM-Reader. The Operating Field supplies power transfer to the CM and is amplitude modulated by both the CM-Reader and the CM for communication between these two devices.

The Operating Field generated by the CM-Reader and measured at the CM antenna must be as follows:

- Frequency (fc) 13,560 kHz  $\pm$  7 kHz
- Minimum field (H min) 5 A/m
- Maximum field (H max) 15 A/m

The CM will operate as intended when the field is between 5 and 15 A/m. The CM-Reader should not generate a field higher than 25 A/m (ampere/meter).

The CM-Reader communicates to the CM by amplitude modulating the Operating Field. The bit coding for commands and data sent from the CM-Reader to the CM is Modified Miller encoding.

The CM communicates to the CM-Reader by amplitude modulating the Operating Field with a subcarrier of  $f_c/16$ . The bit coding for commands and data sent from the CM to the CM-Reader is Manchester encoding of the subcarrier.

Note: LTO Ultrium 4 data cartridges, introduced in 2007, have an increased cartridge memory capacity of 8 KB.

For More Data Storage Tape Technical Support Documents and Product Information, go to: [www.fujifilmusa.com/tapestorage](http://www.fujifilmusa.com/tapestorage) → Resource Center → Technical Center.

For questions or comments, go to “Ask the Expert” in the Technical Center.

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