DNE TECHNOLOGIES

White Paper

CV-MCU2: Working with Single and Multimode Fiber

15 February 2009

Types of Fiber

Multimode:

Light waves are dispersed into numerous paths, or modes, as they travel through the cable's core - typically 850 or 1300nm. Typical multimode fiber core diameters are 50, 62.5, and 100 micrometers.

Total internal reflection confines light within optical fibers (similar to looking down a mirror made in the shape of a long paper towel tube). Because the cladding has a lower refractive index, light rays reflect back into the core if they encounter the cladding at a shallow angle (red lines). A ray that exceeds a certain "critical" angle escapes from the fiber (yellow line).

Note: Do not "kink" any fiber optic cable – you will lose drive distance

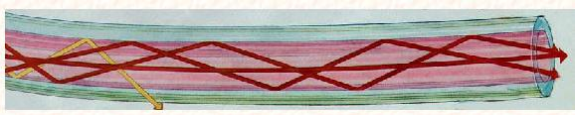

Figure 1: Multimode Fiber

Graded Index Multimode Fiber:

Graded index multimode fiber contains a core in which the refractive index diminishes gradually from the center axis out toward the cladding. The higher refractive index at the center makes the light rays moving down the axis advance more slowly than those near the cladding. Also, rather than zigzagging off the cladding, light in the core curves helically because of the graded index, reducing its travel distance. The shortened path and the higher speed allow light at the periphery to arrive at a receiver at about the same time as the slow but

straight rays in the core axis. The result: a digital pulse suffers less dispersion.

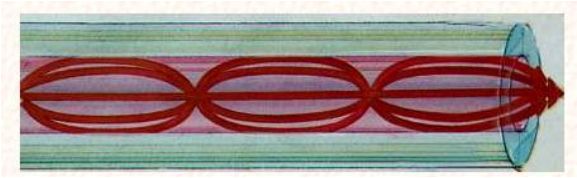

Figure 2: Graded Index Multimode Fiber

Note: TFOCA is made with Graded index multimode fiber

Singlemode:

Single Mode cable is a single stand of glass fiber with a diameter of 8.3 to 10 microns that has one mode of transmission. Single-mode fiber gives you a higher transmission rate and more distance than multimode, but it also costs more. Single-mode fiber has a much smaller core than multimode. The small core and single light-wave virtually eliminate any distortion that could result from overlapping light pulses, providing the least signal attenuation and the highest transmission speeds of any fiber cable type. Single-mode optical fiber is an optical fiber in which only the lowest order bound mode can propagate at the wavelength of interest typically 1300 to 1320nm.

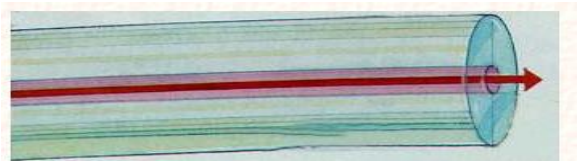

Figure 3: Singlemode Fiber

How can the CV-MCU2 drive both Single and Multimode Fiber?

CV-MCU2 Universal Module Transmitter

The transmit side of the CV-MCU2 Universal Module has a Singlemode (9µm/125µm) fiber internal to it, connected to the ST bulkhead.

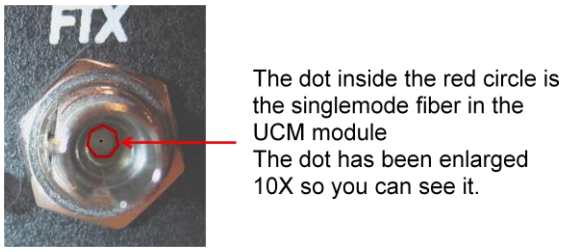

Figure 4: SM fiber in ST

When connected to a multimode fiber (50µm/125µm or 62.5µm/125µm) at the ST junction or at a SEP connecting to tactical fiber, the beam off Singlemode fiber fills the Multimode pipe. There is no loss; all light enters the Multimode pipe.

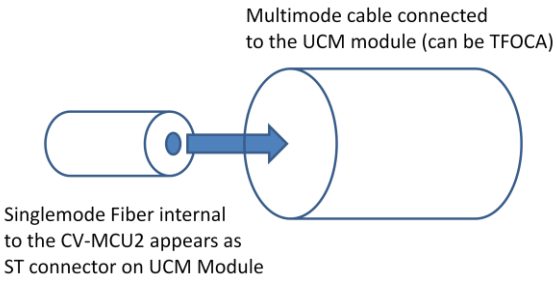

Figure 5: Transmitting from SM to MM

Note: Transmitting from Singlemode to Multimode results in no loss due to the mismatch

CV-MCU2 Universal Module Receiver

The receive side of the CV-MCU2 Universal Module CV-MCU2 Universal Module is connected directly to the receiver on the UCM circuit board. The receiver surface area is many times larger than the diameter of the Multimode or Singlemode fiber coming in on the ST connector; therefore there is no loss in incoming light power.

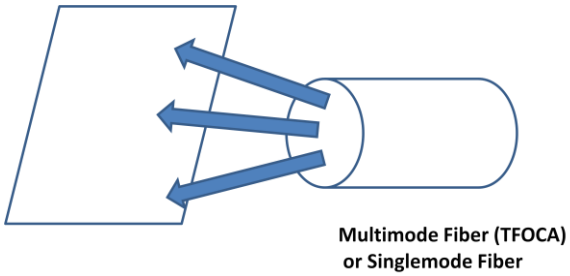

Figure 6: Receiving from SM or MM

This can be observed by comparing the diameter of the receiver opening to the transmitter opening.

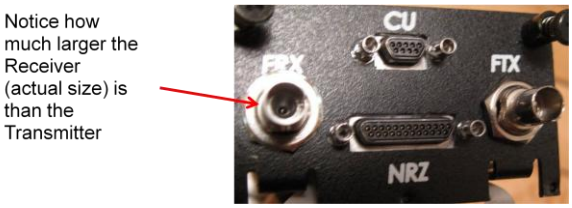

Figure 7: Receiver in ST

Note: Receiving from Singlemode or Multimode results in no loss due to the mismatch

Summary

The CV-MCU2 has been designed to operate with singlemode (9µm/125µm) or multimode fiber (50µm/125µm or 62.5µm/125µm) without changing physical modules or adjusting software settings.

About Ultra Electronics DNE Technologies

For over fifty years, Ultra Electronics DNE Technologies has provided communications devices to the US Department of Defense, Homeland Security and other government agencies. Ultra Electronics DNE Technologies manufactures networking equipment that economizes bandwidth and extends the drive distances of tactical communications devices. This equipment is used throughout the US Department of Defense and other government agencies to support the transition to IP networking, particularly in areas where bandwidth-intense network traffic is restricted by a single satellite or radio signal. Ultra Electronics DNE Technologies manufactures the AN/FCC-100, the TAC Multiservice Access Concentrator series, PacketAssure Service Delivery Managers and NRZ/CDI/FOM converters, including the CV-MCU2 converter/multiplexer.

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