comunicating through generations

GE L90 Current Differential Relay over the RFL eXmux 3500 IP Access Multiplexer

The RFL eXmux 3500 is a hardened IP Access Multiplexer engineered for mission critical infrastructures that seamlessly transport voice, serial, video and Ethernet data communications over Ethernet/IP or MPLS networks. The eXmux 3500 is a Layer 2 device with an integrated managed Ethernet switch which allows the eXmux 3500 to be used either in a private network with other eXmux 3500's or as part of a larger Ethernet/IP/MPLS network. Both fiber (using SFPs) and RJ-45 connections are available for the eXmux 3500; uplink speeds of up to a Gigabit are possible.

Figure 1 below depicts the eXmux 3500 as the communications system providing a point-to-point communications circuit between a pair of L90 Current Differential Relays. The network cloud is a general representation of an IP network and does not imply a direct point-to-point connection. The communications protocol interface for this application note for the GE L90 over the eXmux 3500 is C37.94 Short Haul Fiber. Refer to the following table for the correct eXmux 3500 Interface Unit (IU) required for the appropriate GE L90 protocol interface.

GE L90 Communications Interface	eXmux 3500 Interface Unit (IU)
C37.94 SHF	4-Port C37.94 IU

Figure 1
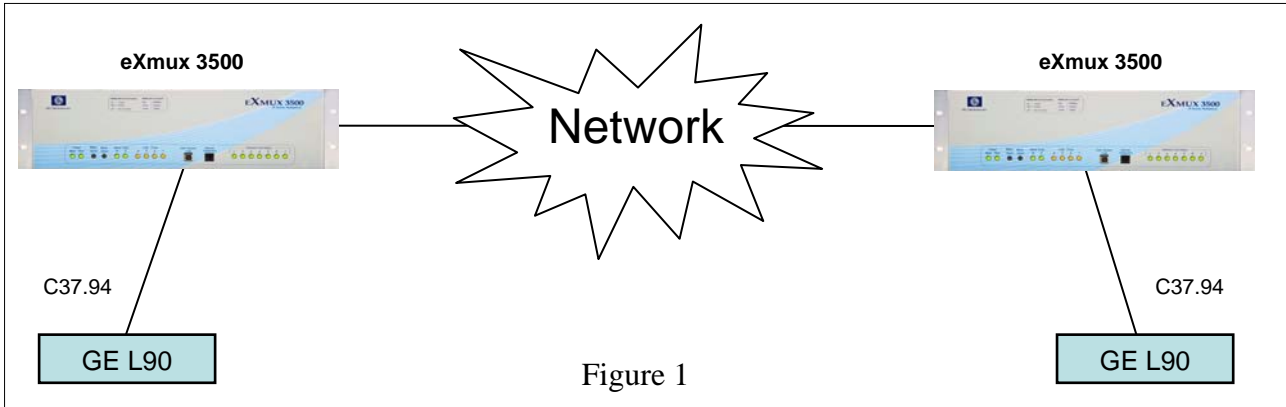
Network Performance Consideration

Current Differential Relays by nature are sensitive to communication channel delays which affects performance. Latency issues should always be considered when installing a current differential relay over any kind of multiplexer. The eXmux 3500 when applied over direct fiber connection with minimum jitter buffer delay settings (also referred to as Packet Delay Variation (PDV)) of 1-2ms, will yield a back-to-back communication channel delay of <5ms. In addition to the low latency, when setup in a redundant path configuration the eXmux 3500 has a unique Hitless Switching feature that guarantees no data is lost during any single path failure. For a network with anticipated traffic usage beyond 90% of bandwidth capacity, Quality of Service (QoS) features can always be used to ensure that TDM data has the highest priority.

When connecting eXmux 3500's over an IP network, the following information can be used as part of the overall network design to determine communication channel delays. The network topology should be designed with a minimum number of nodes between the two ends of any current differential relay channel to minimize the packet-delay variation (PDV) settings; this will minimize the overall latency. By using the VLAN capability of the eXmux 3500, a secure and direct bidirectional communications channel can be created for the GE L90 circuit.

Product Latency:
- eXmux 3500 C37.94 and RS-422 interface inherent back to back channel delay – 2.5ms
- eXmux 3500 C37.94 and RS-422 asymmetric back to back channel delay – 0.2ms
- eXmux 3500 through node delay – 0.02ms
- eXmux 3500 programmable packet-delay variation (PDV) settings – 1 to 500ms

eXmux 3500 Interface Unit Settings:
This application note assumes familiarity with the operation of the eXmux 3500 and the GE L90. The appropriate eXmux 3500 Interface Unit to be used for this circuit should be programmed before mapping. Refer to the eXmux 3500 manual for mapping procedures and specific interface wiring information for each of these IU's.

eXmux 3500 C37.94 IU settings
1. On desired Port tab, set RX Data-Out Polarity and TX Data-In Polarity to **NORMAL**.
2. On Bandwidth tab, set desired Port Bandwidth to **1** (64kbps).
   A multimode fiber cable with ST connector is used to connect the GE L90 C37.94 I/O to the eXmux 3500 C37.94 IU.

This application note may not apply to other vendors of Current Different Relays as some settings may be different. Check with the vendor of the relay you are using to determine the required eXmux 3500 settings. Contact RFL Electronics at 973-334-3100 for further assistance.