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# Schweitzer Mirrored Bits 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 Schweitzer protection relays using SEL Mirrored Bits. The network cloud is a general representation of an IP network and does not imply a direct point-to-point connection. The eXmux 3500 communications protocol interface for the Schweitzer protection relay using Mirrored Bits over the eXmux 3500 is the Asynchronous Interface Unit (IU). Refer to the following table for the correct eXmux 3500 Interface Unit (IU) required.

| Schweitzer relay | eXmux 3500 Interface Unit (IU) |
|---|---|
| Mirrored Bits | 8-Port Asynch IU |



Figure 1
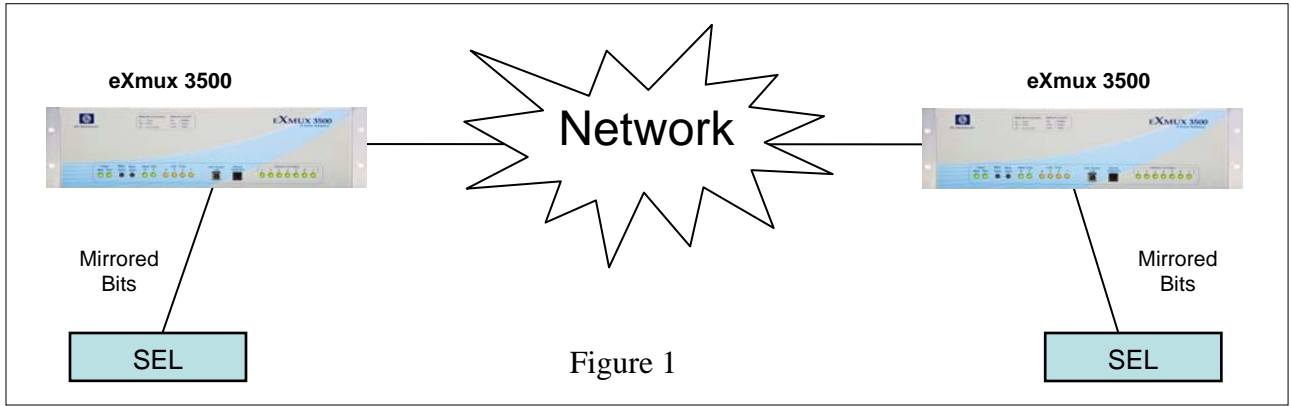
**Network Performance Consideration**

Latency issues should always be considered when installing a relaying channel over any kind of multiplexer. The eXmux 3500 Asych IU 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 <10ms. 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 relaying 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 Schweitzer Mirrored Bits circuit.

**Product Latency:**
- eXmux 3500 Asynch interface inherent back to back channel delay – 5ms
- eXmux 3500 through node delay – 0.003ms
- 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 Schweitzer protection relay. 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 this IU.

*eXmux 3500 Asynch IU settings*
1. On desired Port tab **ENABLE** port, set Baud Rate to desired speed, set Character length to **9**, DTR **DISABLE**, RTS **DISABLE,** Loopback to **NONE**.

A DB-9M to DB-9M cable is used to connect the Mirrored Bits port of the Schweitzer protection relay to the eXmux 3500 Asynch IU. Refer to the chart below and the SEL relay/eXmux 3500 manuals for cabling pin out information. RFL can provide the following cable if desired.

| SEL Mirrored Bits DB-9M | eXmux 3500 Async IU DB-9M | SEL Relay Asynch Signal |
|:---:|:---:|:---:|
| 2 | 2 | RX Data IN |
| 3 | 3 | TX Data OUT |
| 5 | 5 | Signal Gnd |

This application note applies only to Schweitzer protection relays using Mirrored Bits communications.  Contact RFL at 973-334-3100 for further assistance.

Mirrored Bits is a registered trademark of Schweitzer Engineering Labs, Inc