

MIRRORED BITS® COMMUNICATIONS

SIMPLE. POWERFUL. FIELD-PROVEN.



OVERVIEW

Use patented SEL MIRRORRED BITS communications to implement advanced protection, control, and monitoring.

Economical

Eliminate expensive external communications equipment, wiring, and maintenance.

Simple

Operate directly through a serial digital channel.

Secure

Exchange up to eight bits of information with protection-level security, dependability, and speed.

Flexible

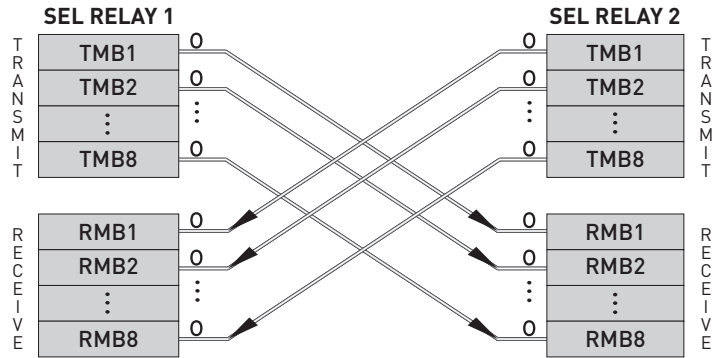
Use common communications channels, including dedicated optical fiber, multiplexed digital networks, analog microwave, and spread-spectrum radio.

Monitored

Report time-stamped sequence of events, communications disturbances, event type and duration, and channel availability in a detailed communications log available in each relay or logic processor.

TECHNOLOGY OVERVIEW

MIRRORRED BITS communications is an innovative, low-cost, relay-to-relay communications technology that sends internal logic status, encoded in a digital message, from one device to another. This technology opens the door to numerous protection, control, and monitoring applications that would otherwise require more expensive external communications equipment wired through contacts and control inputs. Applications for MIRRORRED BITS communications include line protection pilot schemes, remote device control and monitoring, relay cross tripping, and more.



OPERATIONAL OVERVIEW

The Received MIRRORRED BITS (RMBs) of one relay follow the status of the respective Transmit MIRRORRED BITS (TMBs) sent from the other relay. Use the RMBs in programmable logic to implement transfer tripping, blocking, interlocking, permissive schemes, direct control, or any function that can normally be performed with a programmable contact input. Each of the relays in the scheme repeatedly sends and receives the digital logic message while continually monitoring and checking the received message integrity. An internal monitoring point asserts when a good signal is received and deasserts immediately upon detection of a bad message. Other elements are available for channel alarming and availability as well.

KNOW THE STATUS OF YOUR COMMUNICATIONS LINK

The MIRRORRED BITS communications log takes the guesswork out of the performance of your communications system. The communications log example below demonstrates the type of data available for communications event analysis.

```
=>com a
SEL-311L 87L          Date: 05/28/03   Time: 15:26:56.250
EXAMPLE: BUS B, BREAKER 3
FID=SEL-311L-R108-V0-Z003002-D20030329 CID=E097
Summary for Mirrored Bits channel A
For 01/22/03 18:06:11.003 to 05/28/03 15:26:56.249
Total failures      1      Last error  Relay Disabled
Relay Disabled     1
Data error         0      Longest Failure 0.000 sec.
Re-Sync           0
Underrun          0      Unavailability 000000
Overrun           0
Parity error       0
Framing error      0      Loop-back      0
Bad Re-Sync        0
=>
```

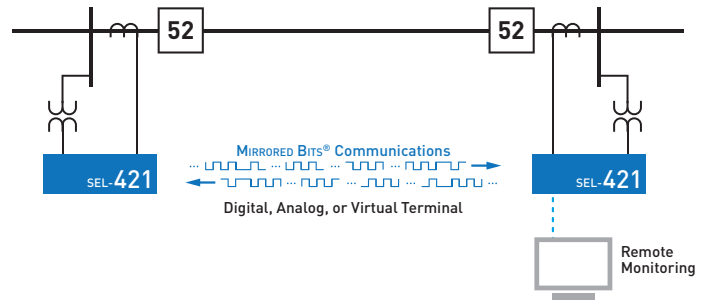
In addition to the communications log, a separate communications Sequence of Events report is available. This report contains time tags for the assertion and deassertion of any of the reported communications failures.

APPLICATIONS

ENHANCED MIRRORED BITS COMMUNICATIONS

Available in the SEL-400 Series Relays

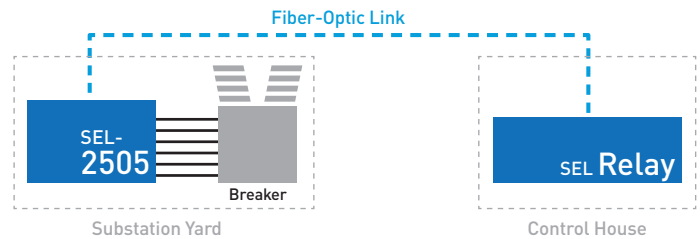
- Transmit analog and digital values.
- Establish an engineering connection with the remote relay via virtual terminal MIRRORED BITS communications.
- Synchronize the relay internal clock with MIRRORED BITS communications.



BREAKER CONTROL AND MONITORING

Use Fiber Optics in Place of Control Wiring

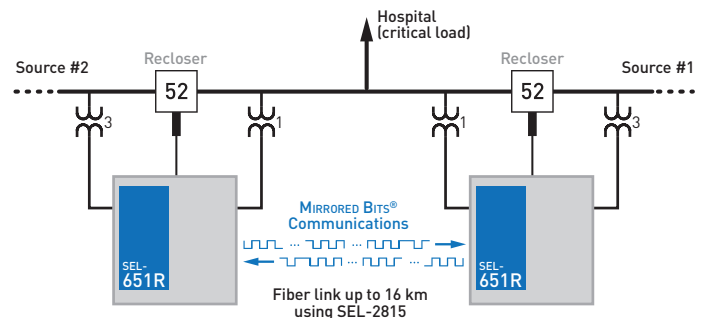
Use the SEL-2505 Remote I/O Module to eliminate control wiring between a circuit breaker and its associated relay. MIRRORED BITS communications can also be used to provide breaker position and monitoring. Fiber optics eliminate dc signal ground loops and hazardous induced voltages caused by ground potential rise.



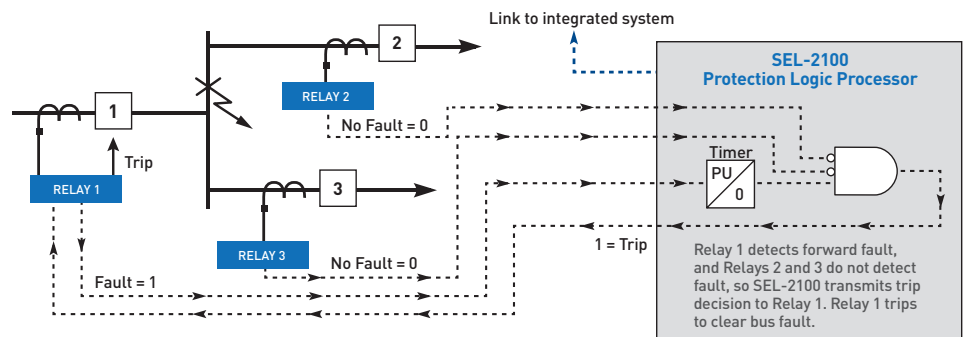
AUTOMATE YOUR DISTRIBUTION SYSTEM

Transfer Sources; Keep Load in Service During Outage

- Use SEL MIRRORED BITS communications to securely share recloser status, source status, and other logic information between SEL-651R Advanced Recloser Controls.
- Check voltage or synchronism check on closing.
- Use 12 Vdc auxiliary power available for modem or radio.



FAST BUS TRIP APPLICATION WITH THE SEL-2100 PROTECTION LOGIC PROCESSOR



PRODUCT AVAILABILITY

MIRRORED BITS COMMUNICATIONS IS A STANDARD FEATURE IN THESE PRODUCTS

Line Protection, Automation, and Monitoring

Legacy SEL-311A Phase and Ground Distance Relay
Legacy SEL-311B Distance Relay With Recloser
SEL-311C Transmission Protection System
SEL-311L Line Current Differential System
SEL-321 Phase and Ground Distance Relay
SEL-411L Advanced Line Differential Protection, Automation, and Control System
SEL-421 Protection, Automation, and Control System

Distribution and Feeders

SEL-351 Protection System
SEL-351R Recloser Control
SEL-351R Falcon™ Recloser Control
SEL-351RS Kestrel® Single-Phase Recloser Control
SEL-351S Protection System
SEL-451 Protection, Automation, and Bay Control System
SEL-651R Advanced Recloser Control
SEL-751 Feeder Protection Relay
SEL-751A Feeder Protection Relay

Substations

SEL-487B Bus Differential and Breaker Failure Relay
SEL-487E Transformer Protection Relay
SEL-487V Capacitor Bank Protection and Control System
SEL-787 Transformer Protection Relay
SEL-2414 Transformer Monitor

Generators and Distributed Generation Interconnections

SEL-700G Generator Protection Relay
SEL-700GT Intertie Protection Relay
SEL-700GW Wind Generator Relay

Motors

SEL-710 Motor Protection Relay
SEL-710-5 Motor Protection Relay

Metering

SEL-734 Advanced Metering System
SEL-735 Power Quality and Revenue Meter

Automation and SCADA

SEL-2100 Logic Processor
SEL-2240 Axion®
SEL-2411 Programmable Automation Controller
SEL-2440 DPAC Discrete Programmable Automation Controller
SEL-2505 Remote I/O Module
SEL-2506 Rack-Mount Remote I/O Module
SEL-2523 Annunciator Panel
SEL-2533 Annunciator
SEL-3505 Automation Controller
SEL-3530 Real-Time Automation Controller (RTAC)

Testing

SEL-4388 MIRRORRED BITS Tester
SEL-2505PB MIRRORRED BITS Interface

SEL Products That Aid in MIRRORRED BITS Implementation

SEL-2126 Fiber-Optic Transfer Switch
SEL-2800 Fiber-Optic Transceivers
SEL-2810 Fiber-Optic Transceivers With IRIG-B
SEL-2812 Fiber-Optic Transceivers With IRIG-B
SEL-2814 Fiber-Optic Transceivers With Hardware Flow Control
SEL-2815 Fiber-Optic Transceivers
SEL-2829 Fiber-Optic Transceivers
SEL-2830 Fiber-Optic Transceivers
SEL-2831 Fiber-Optic Transceivers
SEL-2894 Interface Converter
SEL-3094 Interface Converter
SEL-9220 Fiber-Optic Adapter for SEL-300 Series Relays

FIELD-PROVEN TECHNOLOGY

Join other SEL customers who have used MIRRORRED BITS communications since 1996 for fast, secure, and dependable communications. Contact SEL for papers, application guides, and other information to learn more about field-proven MIRRORRED BITS communications applications.

RELATED INFORMATION

Visit www.selinc.com to download SEL MIRRORRED BITS communications information:

- Application Guide: AG2001-12 Implementing MIRRORRED BITS Technology Over Various Communications Media
- Technical Paper: International Drive—Distribution Automation and Protection



**MAKING ELECTRIC POWER SAFER,
MORE RELIABLE, AND MORE ECONOMICAL**

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