# SEL Time-Domain Link (TiDL®) Technology

## A simple point-to-point digital secondary system solution

- Replace copper with fiber to increase personnel safety, reduce costs, and improve reliability.
- Implement an architecture that requires no network engineering or external time reference.
- Share merging unit data with as many as four SEL-400 series TiDL relays for increased design flexibility.
- Achieve strong cybersecurity by using isolated point-to-point connections.

# Technology Overview

SEL TiDL technology is a point-to-point digital secondary system solution engineered with simplicity in mind. It reduces substation construction and expansion costs, improves personnel safety, and increases flexibility by replacing copper with fiber. TiDL requires no external time source, has strong cybersecurity, and is easy to implement with no network engineering required.

### Simple Architecture

SEL-TMU TiDL Merging Units are placed in the yard close to the primary equipment and digitize discrete I/O signals and analog data, such as voltages and currents. These data are then transported over fiber-optic cables to an SEL TiDL relay in the control house. With this point-to-point architecture, implementation is simple and requires zero network engineering.

### Data-Sharing Capabilities

Each SEL-TMU can be paired with up to four SEL-400 series TiDL relays via independent point-to-point connections. This data-sharing capability gives you flexibility on how to best design protection for your system and makes installations more economical by reducing the device count.

### Built-In Time Synchronization

TiDL maintains relative time synchronization among all connected TiDL devices regardless of the number of units or length of fiber. Consequently, it does not rely on an external time reference for protection.

### Strong Cybersecurity Posture

The dedicated, deterministic TiDL system uses the SEL T-Protocol to help secure mission-critical applications. The isolated point-to-point connections and the absence of switches and routers reduce the electronic security perimeter and limit attack points. This security-minded architecture helps prevent remote access, and its simplicity mitigates the need for managing port access.

### Minimal Training Required

TiDL relay settings are the same as those in the popular SEL-400 series models, providing consistency and simplicity. You can use the same protection schemes and applications for complete distance, feeder, bus, and transformer protection.

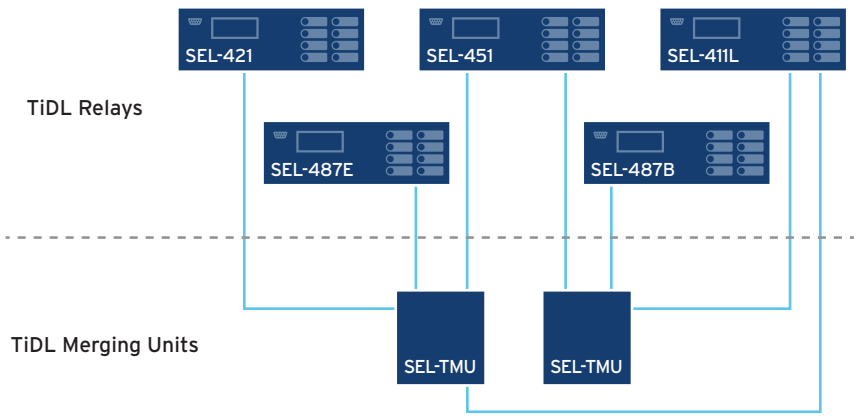
# TiDL Devices

### TiDL Merging Unit

The SEL-TMU is a purpose-built remote data acquisition device. It can communicate with as many as four TiDL relays over direct fiber-optic connections without the need for a network switch and an external time reference. With no user settings and simple hardware, the SEL-TMU is easy to deploy and manage long-term. Pluggable, self-shorting CT connections increase personnel safety by providing an additional layer of protection and make swapping connections between SEL-TMU devices quick and easy.

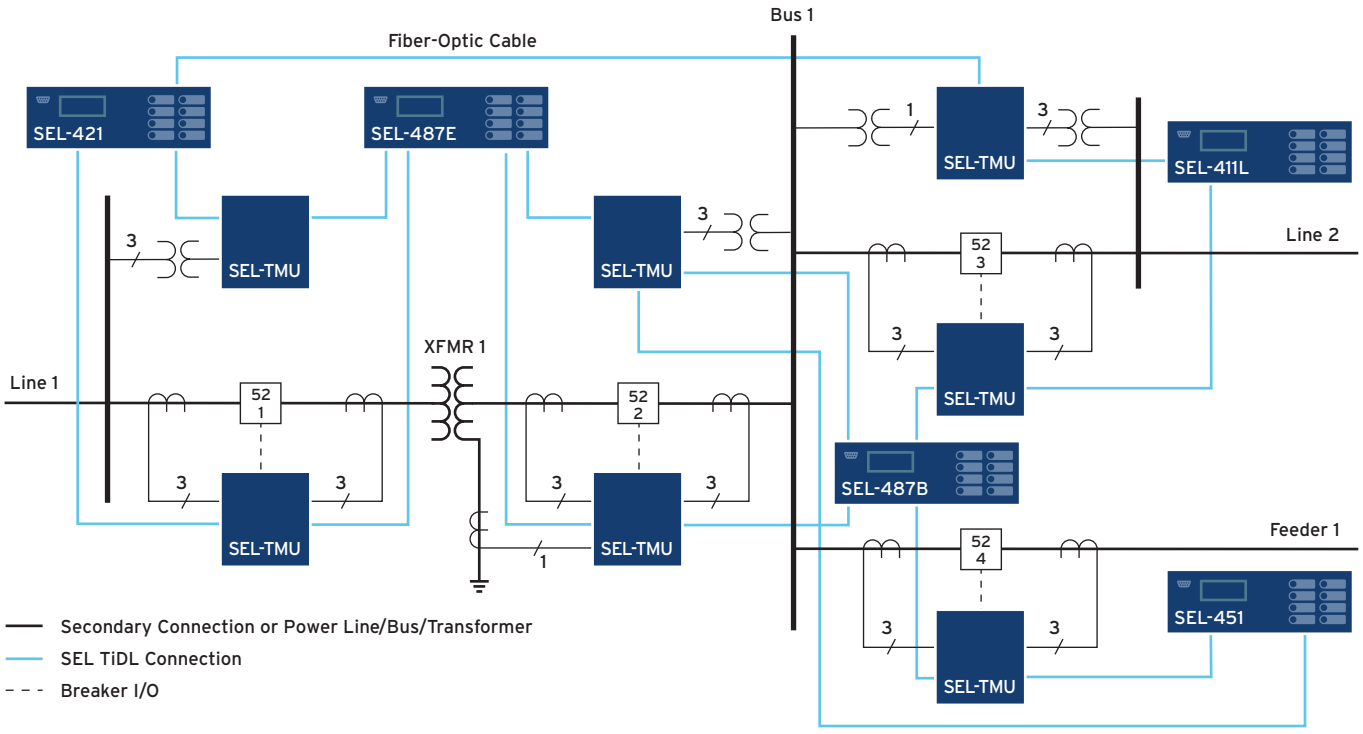
### TiDL Relays

Five models of SEL-400 series relays are enabled with TiDL technology, with settings and applications that are identical to relays with conventional secondary inputs. Instead of standard copper wiring connections, the relays have eight 100BASE-FX fiber ports for acquiring digitized analog and binary data. In addition, the relays have a traditional I/O board for local use in the control house with the rest of the inputs and outputs allocated to the remote SEL-TMU devices.



# Applications

TiDL technology can be applied throughout a substation, as shown in this high-level overview drawing. For more application information, refer to the SEL-400 Series TiDL Quick-Start Guide available at **selinc.com**.




# Data Transfer Using Point-to-Point Fiber

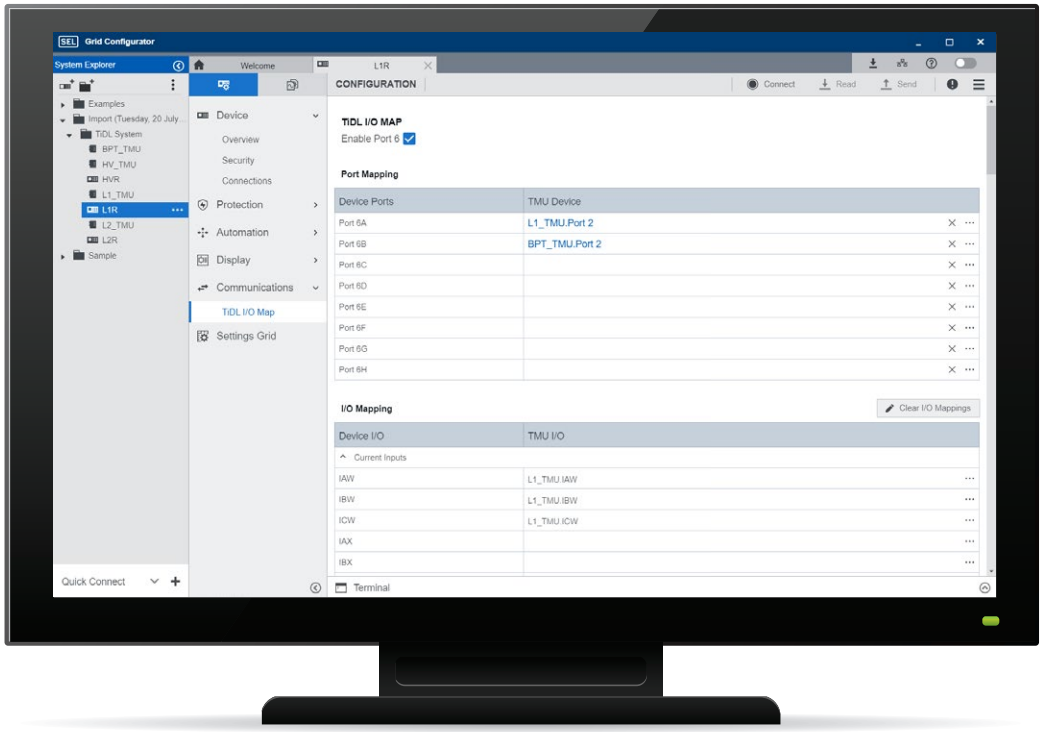
SEL's TiDL technology uses point-to-point fiber to send analog and digital data between an SEL-TMU and a TiDL relay.

### Low Latency and Low Jitter

Using point-to-point connections without switches and time-synchronization clocks between the SEL-TMU and TiDL relays leads to low latency and low jitter.

### Local Time Synchronization

Synchronize the entire TiDL system locally using point-to-point connections. Relative local time can be maintained between the relays and all of the connected SEL-TMU devices without the need for an external time signal, such as that from a GPS clock.




# TiDL System Configuration

### Customized Topologies

Quickly create, manage, and deploy TiDL devices using SEL Grid Configurator. The software allows you to configure and commission custom TiDL topologies to fit each application. It maps SEL-TMU analog signals and I/O to the local analog channels and I/O of the TiDL relay and verifies all connections and hardware, making commissioning quick and easy.

### Custom Aliases

While programming your topologies, you can give customized names to SEL-TMU I/O quantities (e.g., the physical location of the unit or company nomenclature) to make the mapping configuration more intuitive.

### Robust Self-Monitoring

Find communication link issues without the need for network analysis by using the built-in status tools in the TiDL system. Each TiDL relay port has individual diagnostics and LED indicators to speed up troubleshooting if communications are disrupted, and the relays display the errors on the front panel.

The SEL-TMU provides robust self-monitoring to detect an out-of-tolerance condition within the device. If an out-of-tolerance condition occurs, the SEL-TMU takes appropriate action (e.g., disables outputs on a detected failure to avoid spuriously tripping a breaker) and then alerts the connected TiDL relays.

### Tools for Testing and Commissioning

Preconfigure and commission a TiDL relay in a test environment, and then use the status LEDs to indicate wiring errors at the installation site. The relay stores the last valid configuration in memory to ensure the SEL-TMU devices are connected identically to when it was commissioned in the test environment. A commissioning report is available to help verify that the relay and SEL-TMU are properly configured.

### Centralized Field Upgrades

Upgrading an SEL-TMU is easy and does not require you to physically access each unit individually. Simply access the TiDL relay in the control house to provide upgrades to all remote SEL-TMU devices.

# Specifications

| | SEL-TMU | SEL-411L | SEL-421 | SEL-451 | SEL-487B | SEL-487E |
|---|---|---|---|---|---|---|
| **Analog Inputs** | 4 CT/4 PT or 8 CT | 6 CT/6 PT* | | | 21 CT/3 PT* | 18 CT/6 PT* |
| **Binary Inputs** | 16 universal (24–250 Vdc) | Up to 24 local, 72 distributed to connected SEL-TMU devices | | | | |
| **Binary Outputs** | 7 (standard Form A and Form C; high-speed, high-current interrupting) | Up to 15 local, 48 distributed to connected SEL-TMU devices | | | | |
| **Fiber-Optic Ports** | 4** | 8 | | | | |
| **Communications Protocol** | SEL T-Protocol | | | | | |
| **Power Supply** | 48–250 Vdc/ 100–240 Vrms | 24–48 Vdc, 48–125 Vdc or 110–120 Vac, or 125–250 Vdc or 110–240 Vac | | | | |
| **Operating Temperature** | –40° to +85°C (–40° to +185°F)<br>Note: LCD contrast is impaired for temperatures below –20°C (–4°F) and above +70°C (+158°F). | | | | | |

*The TiDL relay analog inputs are distributed to connected SEL-TMU devices.

**SEL-8103-01 small form-factor pluggable (SFP) transceivers must be purchased separately from an SEL-TMU to ensure correct fit for your application.

SEL SCHWEITZER ENGINEERING LABORATORIES

Making Electric Power Safer, More Reliable, and More Economical
+1.509.332.1890 | info@selinc.com | selinc.com


PF00550 • 20210729