Transfer switches provide an ideal location to monitor power sources and loads. To do so, transfer switches must communicate with other power and network devices. This document describes the electronic modules that provide key communication, monitoring, and control capabilities to transfer switches.

COMMUNICATIONS ENABLE MODERN POWER SYSTEM BENEFITS

Modern power management systems such as the ASCO Critical Power Management System provide comprehensive solutions for managing power equipment and systems. By recording and assessing data from engine-generators, transfer switches, power control switchgear, power meters, load banks, circuit breakers, and other power devices, these systems monitor power conditions and provide real-time notices about power events.

The information provided by these systems enables users to respond to power conditions, conduct forensic analyses of power events, and evaluate operating data to increase reliability, efficiency and compliance. These capabilities require intra-switch and extra-switch communications that provide feature-rich power information far beyond transfer switch status. Communication modules make the necessary data flows possible.

COMMUNICATION PATHWAYS PROVIDE FEATURE-RICH POWER DATA

To provide information-rich features, communications must occur between devices within and outside of transfer switches and send data to power equipment and power networks. These communications can be classified into the following types, which are presented with examples:

- **Direct Monitoring of Transfer Switch State**: Simple digital signaling to indicate transfer switch position.
- **Direct Monitoring and Control of Transfer Switch Operation**: Initiating load transfer after detecting a reduction in or absence of voltage.
- **Monitoring and Control of Accessory Devices**: Ancillary devices may be located inside or near transfer switches. Human-Machine Interfaces (HMI) and remote annunciators are two examples.
- **Monitoring of Conditions in Switches, Power Sources, and Equipment Loads**: Power meters and power quality meters can be used to monitor power source and load circuits. Communications can be used to monitor the status and settings of electronically controlled circuit breakers.
- **Monitoring and Control of Multiple Switches and Devices Using Linear Networks**: Multiple switches can be sequentially connected and remotely monitored through a chain of communication modules to provide a simple and effective power monitoring network.
- **Monitoring and Control of Multiple Switches and Devices Using Networks with Redundant Pathways**: Communication modules in transfer switches can be connected to ring or mesh networks of Remote Connectivity Units to provide redundant data pathways. Communication modules are needed to connect power equipment to these networks.

Using these configurations, power data can be used for purposes such as compiling event logs, automating compliance reporting, displaying real-time operating information on one-line diagrams, and visually replaying power events. These increasingly sophisticated capabilities are key to realizing the value-added benefits of modern power networks. However, communication ports must offer compatible protocols to accommodate specific technologies and configurations.
COMMUNICATION PATHWAYS UTILIZE MULTIPLE PROTOCOLS

The most common protocols used in critical power communications include digital input-output (digital IO); serial communications, including RS485; and IP-based communications over Ethernet.

Digital IO

The simplest inputs to power management systems are digital signals, which have two states: off and on. Remote indication of an alarm signal is an example of a digital communication – when a condition triggers an alarm, a switch closes contacts to complete a circuit and voltage becomes present. This voltage could be used to light an indicator lamp or operate a relay to initiate subsequent actions. Devices can use dry or Form C contacts to communicate with other devices such as signal lights, relays and annunciators.

Analog Signal

Analog devices send measured values by varying signal circuit voltage or current levels. For instance, a 4-20 milliamp (mA) circuit might be used to signal a measured value to another device. A signal for indicating the level of an engine-generator’s fuel tank is an example of this type of communication, where a 4mA current indicates the minimum sensible value (empty) and a 20mA current indicates the maximum value (full). In operation, the current would continuously scale with the parameter measured by the originating sensor.

Serial/RS485

Serial protocols transmit data sequentially along a single circuit, a process known as serial communication. Serial communication is often used in industrial settings because it is less affected by electrical noise, and because it can span relatively long distances. Serial communication can be deployed in half-duplex and full- configurations by using one or two pairs, respectively, of twisted copper wires. The type of data transmission requires electronic ports that can code and decode the serial data sent between originating and receiving devices.

Figure 1: Half-Duplex Communications
Internet Protocol-Based Data over Ethernet

Ethernet denotes Local or Wide Area Networks that use Transmission Control Protocol/Internet Protocol (TCP/IP) to send addressable data over copper wire or optical fiber. Multiple, uniquely addressed devices can be connected to one circuit and devices decode only the packets that contain their address. Ethernet can support the simultaneous use of multiple data protocols. Modbus TCP/IP, SNMP, and BACnet IP are examples of IP-based communication protocols used on Ethernet networks. These are the types of protocols needed to transmit data for feature-rich power systems and IoT applications. This requires electronic processors to convert and buffer data for transmission over Ethernet pathways.

COMMUNICATION MODULES STREAMLINE DEPLOYMENT

All but the simplest applications require transfer switch communication using multiple formats. In a typical ASCO 7000 SERIES ATS, controllers use Ethernet communications to connect to any advanced HMI that may be installed in a switch. Likewise, serial communications may also be used with legacy power devices.

For the above reasons, transfer switches are most often equipped with communication modules that provide the required connections and signaling capabilities. These modules streamline equipment deployment in the following ways:

- Placing communications hardware inside transfer switches enables inbound, outbound and intra-switch communications.
- Using a device that features multiple communication protocols and types of connectors simplifies overall design, requires less space inside a transfer switch, simplifies installation, and reduces overall installed cost.
- Installing a communication module provides a single location for landing communication leads.
- Installing a communication module provides ready-to-go communication interfaces that simplify integration with existing Ethernet networks and other systems.
COMMUNICATION MODULES OFFER APPLICATION FLEXIBILITY

Applications for communication modules begin with intra-device communications. For instance, an ATS may collect data for display on an HMI panel on the front of the switch (Figure 3). This type of accessory may require Ethernet communications to interact with the transfer mechanism and other accessories within the ATS. Because an HMI such as the ASCO Touch Display Interface can show feature-rich displays of power information, such as real-time values on one-line diagrams, a compatible communication module must be fitted to interact with the transfer switch controller.

An advanced HMI will commonly display information from additional transfer switches and power devices. In systems with more than one ATS, placing a communication module inside each switch enables the creation of linear networks of interconnected transfer switches. When equipped with power meters and/or power quality meters, this simple linear network can provide visibility into the power sources and loads served by each switch to a remote monitor, terminal, gateway, or third-party power or building monitoring system. An example of a linear network is shown in Figure 4.

Figure 3: Ethernet can be used to communicate with intra-switch devices such as an HMI.

Figure 4: Communication modules support linear ATS networks.
Notably, applications requiring redundant data pathways must connect communication modules to Remote Connectivity Units featuring managed Ethernet switches. These can be used to form ring or mesh networks that are required for data pathway redundancy. Figure 5 shows a simplified example. Readers should note that each managed Ethernet switch would typically serve more than one power device.

![Diagram](image)

**Figure 5:** Communication modules connect ATS to ring or mesh networks of Remote Connectivity Units with Managed Ethernet Switches (RCU-MES). These provide redundant communication paths.

For additional information about communication power devices, review our document entitled *Data Communications for Critical Power Management Systems*. For information regarding ASCO 516x Remote Connectivity Units, review information at [www.ascopower.com](http://www.ascopower.com).
COMMUNICATION MODULES OFFER SECURITY PROVISIONS

As stated, transfer switches provide a perfect location for monitoring power sources and loads. If left unprotected, they could also present a cybersecurity concern. For this reason, communication modules should provide security measures to reduce security risk. Specifiers should select communication modules that do the following:

- Encrypt data to provide end-to-end protection between a communication module and a monitoring system
- Use signed firmware to impede malicious files from residing in the communication module memory
- Disable open protocols to prevent detection and manipulation of a communication module
- Provide a resilient design for recovering from Denial of Service attacks
- Provide password protection to prevent interaction by unauthorized entities

ASCO COMMUNICATION MODULES MEET POWER COMMUNICATION NEEDS

Communication modules may be specified as accessories for new transfer switches and other power equipment. They may also be obtained to add communication capabilities to existing transfer switches. Their application flexibility is one of the reasons why communication modules are the most popular accessory in ASCO’s own power equipment offerings (Figure 6). Additional information about the communication modules can be obtained at www.ascopower.com.

Figure 6: The ASCO 5170 is an example of an Ethernet transfer switch communication module.
SUMMARY

Transfer switches offer a location for collecting information about power sources and loads. To obtain this information, communication modules are installed in transfer switches, which feed data the switch and ancillary devices to local or remote monitoring equipment. This data can enable users to gain insight into power conditions and equipment performance faster than ever before, and to access intelligent features that increase reliability, enhance efficiency, and ease regulatory compliance.

The key to accessing this information is equipping transfer switches with modules that can communicate with other devices. Digital IO, analog, and IP-enabled protocols are commonly used to communicate between different types of devices. By using models that offer the necessary protocols, communication modules unblock power data and streamline the specification, installation and use of transfer switches and critical power systems.