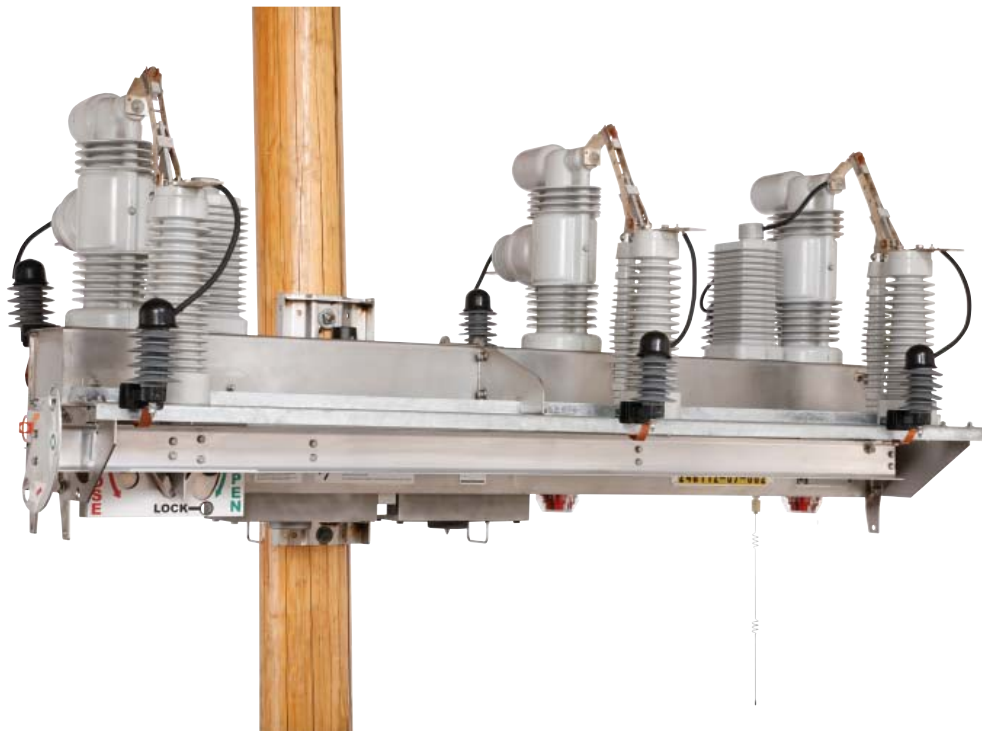


## Product Description

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# Introduction

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## Qualified Persons

### **WARNING**

The equipment covered by this publication must be installed, operated, and maintained by qualified persons who are knowledgeable in the installation, operation, and maintenance of overhead electric power distribution equipment along with the associated hazards. A qualified person is one who is trained and competent in:

- The skills and techniques necessary to distinguish exposed live parts from non-live parts of electrical equipment.
- The skills and techniques necessary to determine the proper approach distances corresponding to the voltages to which the qualified person will be exposed.
- The proper use of the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electrical equipment.

These instructions are intended only for such qualified persons. They are not intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

## Read this Instruction Sheet

Read this instruction sheet thoroughly and carefully before installing or operating your S&C IntelliRupter PulseCloser. The latest version of this publication is available online in PDF format at [www.sandc.com](http://www.sandc.com). Select: Support/Product Literature Library.

## Retain this Instruction Sheet

This instruction sheet is a permanent part of your S&C IntelliRupter PulseCloser. Designate a location where you can easily retrieve and refer to it.

## Replacement Instructions

If you need additional copies of this instruction sheet, contact your nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

**IntelliRupter PulseCloser**

S&C IntelliRupter PulseCloser is a unitized package of fault-interrupting and control components which provides fault isolation and circuit restoration functions on an overhead distribution system. IntelliRupter can operate as a standalone fault interrupter or, with appropriate options, can be integrated into a SCADA system and/or an S&C IntelliTEAM II® Automatic Restoration System.

IntelliRupter features PulseClosing Technology™—a unique means for verifying that the line is clear of faults before initiating a close operation. PulseClosing is a superior alternative to conventional reclosing. It significantly reduces stress on system components as well as voltage sags experienced by customers upstream of the fault.

IntelliRupter utilizes three-pole, electrically operated vacuum interrupters rated 630 amperes continuous, 12,500 amperes interrupting. A rating of 800 amperes continuous is assigned with a 2 ft./sec wind—similar to conductor ratings. IntelliRupter provides full live-switching performance under any and all ice conditions—circuit making, circuit breaking, and pulseclosing are accomplished within the interrupters; there are no external moving parts.

Each IntelliRupter is factory-assembled on a single base with:

- Unique magnetic latching actuators, which provide single-phase or three-phase tripping and lockout of the interrupters. The interrupters can also be manually tripped by means of a pull-ring, operable from the ground with an extendo stick.
- Sensors for three-phase monitoring of line current and three-phase monitoring of line voltage on both sides of each interrupter.
- One or two integral power modules, which derive the required operating energy directly from the distribution line. An optional external power supply allows the IntelliRupter to be powered from a dc battery, or ac service voltages.
- Open/close indicator for each phase.
- Manually actuated open/close/ready lever, operable from the ground with an extendo stick.
- Manually actuated lever, to enable or disable a hot line tag or disable an electronically set hot line tag. The lever is operable from the ground using an extendo stick. A hot line tag indicator on the protection and control module shows a “set” tag.
- Manually actuated lever, if provided, to block user configured elements. User selections are: ground/negative sequence overcurrent elements; sensitive earth overcurrent elements; circuit testing; or change to an alternate general profile. The lever is operable from the ground using an extendo stick. The control status indicator will light for 10 seconds to indicate the lever actuation was detected.
- A control group, featuring a hookstick-removable protection and control module and communication module mounted in the base. The control group is easily configured and operated from the safety and security of a vehicle parked near the base of the pole, by means of a secure WiFi communication link to a laptop computer.
- A unique multi-function status indicator on the protection and control module, which shows that the control group is operating normally. The blink rate changes if a WiFi connection has been made, control power has been lost, or the position of the open/close/ready operating lever has been changed.
- Integrated Global Positioning System, which provides 1-ms accurate time-stamping of events to speed post-event analysis, as well as IntelliRupter location data for entry in the user’s graphical information system.
- Provisions for mounting three surge arresters on each side of the IntelliRupter. Joslyn *Zforce* Type ZHP (Heavy Duty) polymer-housed metal-oxide surge arresters can be optionally factory-installed and wired.
- Single-point lifting means for convenient rigging and hoisting of IntelliRupter during installation.

## Description

IntelliRupter is available in the upright-crossarm mounting configuration, with or without an integral, hookstick-operated disconnect for visible air-gap isolation of switched-open circuits. The disconnect is interlocked with the interrupters to ensure that the pole-units are open prior to opening or closing the disconnect; a status point for remote monitoring of disconnect position is included. The interrupters may be operated with the disconnect in the open position.

IntelliRupter pole-units are molded of S&C Cypoxy®▲. The sensors are embedded, thus eliminating the cost, clutter, and complexity associated with separately mounted sensors. Total system accuracy, including sensing, control, and interrupting time is nominally  $\pm 2\%$  for both voltage and current.

▲ *Cypoxy* is the S&C trademark for S&C's cycloaliphatic epoxy resin system. Cypoxy is nontracking, self-scouring, nonweathering . . . there's never a compromise of insulation integrity.

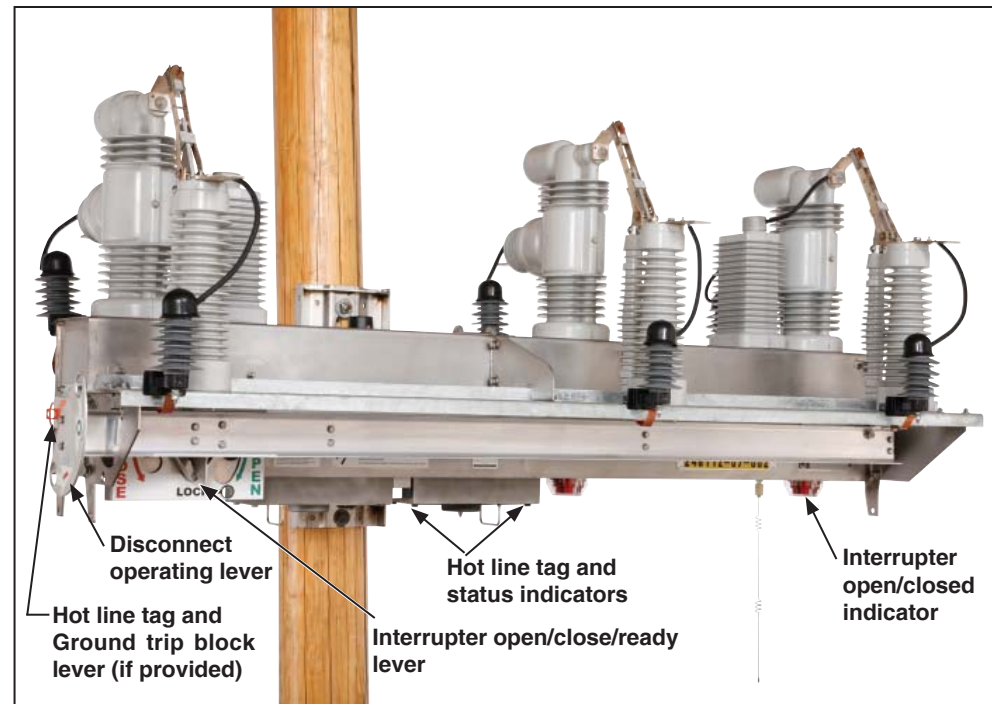


Figure 1. IntelliRupter controls and indicators.

## Control Groups

IntelliRupter is available with a variety of software control groups. Each features easy configuration and operation, using secure WiFi communication to a nearby laptop computer.

IntelliRupter operation is based on the installed Control Group, the communication system used, and real-time operating conditions. Protective relaying features are unique for each operating mode.

### Standard Control Group

Protection settings are configured by the user. This mode is applicable to traditional radial circuits where one or two fault interrupting points in the main line—or multiple branch points—are desired. SCADA communication is available, but not required for operation.

The Standard Control Group is ideally suited for standalone (non-communicating) applications. It can also provide wide-area network capability for SCADA applications when furnished with a user-specified radio. The radio permits configuration, operation, interrogation, and software maintenance of IntelliRupter to be performed at any location having access to the communication system, using optional IntelliLINK® Remote Setup Software.

The Standard Control Group consists of a hookstick-removable protection and control module and communication module. This flexible, low-maintenance arrangement offers excellent immunity to surges and noise induced by normal power line events such as faults and lightning strikes, and minimizes pole clutter.

The protection and control module provides point-on-wave closing to minimize asymmetrical fault current and inrush current. It features a complete set of protection and control functions, including:

- Simultaneous independent directional phase, ground, negative-sequence, and sensitive earth time-overcurrent, instantaneous-overcurrent, and definite-time elements
- Directional blocking of overcurrent elements
- Over/under voltage elements
- Over/under frequency elements
- Phase unbalance detection
- Synchronization check
- Cold-load pickup modifier

Comprehensive diagnostics are also included.

The communication module is powered from the distribution line, through the integral power module(s). A sophisticated 20-channel Global Positioning System chip set in the communication module provides 1-ms accurate time-stamping of events.

No batteries are required for standalone operation but ac line voltage must be available on the side of the IntelliRupter with the integral power module.

### Standard Control Group with Battery Backup

The Standard Control Group with Battery Backup includes batteries in the communication module. The batteries support operation for a minimum of four hours after loss of ac line voltage on both sides of IntelliRupter, permitting extended dead-line switching.

### **IntelliTEAM II® Control Group with SpeedNet™ Radio**

In addition to all the features of the Standard Control Group, this control group includes the IntelliTEAM II Automatic Restoration System, with team communication via S&C SpeedNet Radio, for high-speed network communication via DNP 3.0 protocol, at 900-MHz. This control group provides:

- Peer-to-peer communication and distributed intelligence to make operating decisions; no central processing or SCADA is required, but SCADA is fully supported.
- System restoration capability, enabling use of real-time data to maximize system asset capability.
- Automatic protection group selection, which responds to changes after distribution system reconfiguration, enhancing flexibility and optimizing protection.
- Sophisticated RTU functionality, including remote reporting of interrupter status points and operations, as well as current, voltage, watts, and VARs.

Using *adaptive coordination*, protection settings groups are set by the user, and are selected during circuit reconfiguration based upon user input and direction of current flow at the IntelliRupter. For example, on return to normal, IntelliRupter might select its alternate settings group to prevent operation during closed-transition switching. Batteries in the communication module support operation for up to four hours after loss of ac line voltage on both sides of IntelliRupter, permitting extended dead-line switching.

### **IntelliTEAM II® Control Group, Communication Device Ready**

In addition to all the features of the Standard Control Group, this control group includes the IntelliTEAM II Automatic Restoration System, with team communication via a user specified IntelliTEAM compatible communication device approved for installation in an IntelliRupter. This control group provides:

- Flexible communication choices.
- System restoration capability, enabling use of real-time data to maximize system asset capability.
- Automatic protection group selection, which responds to changes after distribution system reconfiguration, enhancing flexibility and optimizing protection.
- Sophisticated RTU functionality, including remote reporting of interrupter status points and operations, as well as current, voltage, watts, and VARs.

Using *adaptive coordination*, protection settings groups are set by the user, and are selected during circuit reconfiguration based upon user input and direction of current flow at the IntelliRupter. For example, on return to normal, IntelliRupter might select its alternate settings group to prevent operation during closed-transition switching. Batteries in the communication module support operation for up to four hours after loss of ac line voltage on both sides of IntelliRupter, permitting extended dead-line switching.

### **Source-Transfer Control Group with SpeedNet Radio**

This control group provides automatic source-transfer using two IntelliRupters, with peer-to-peer communication provided via S&C SpeedNet Radio, for high-speed network communication via DNP 3.0 protocol, at 900-MHz. The IntelliRupters ensure a high degree of critical-load continuity by minimizing interruptions resulting from the loss of one source.

### **Source-Transfer Control Group, Communication Device Ready**

This control group provides automatic source-transfer using two IntelliRupters, with peer-to-peer communication provided via a user specified IntelliTEAM compatible communication device approved for installation in an IntelliRupter. The IntelliRupters ensure a high degree of critical-load continuity by minimizing interruptions resulting from the loss of one source.

### Loop Restoration Control Group

This control group is specifically intended for standalone (non-communicating) loop applications comprised of normally-closed IntelliRupters or conventional reclosers, with a normally-open IntelliRupter switching point. It can also provide wide-area network capability for SCADA applications when furnished with a user-specified radio.

The control group enables the feeder on either side of the switching point to be fed from a different source. If a fault occurs on either feeder, the normally-closed IntelliRupters (or reclosers) in that feeder open on overcurrent protection, then pulseclose (or reclose) sequentially to sectionalize and isolate the fault. Service is automatically restored to unfaulted line segments by closing the IntelliRupter at the normally-open switching point.

## Fault Testing

After tripping on overcurrent, conventional reclosers test for the presence of a fault by reclosing several times. Conventional reclosing subjects the system to the same high-magnitude fault current during each reclose test. The effects are made even more severe when slower inverse curves are used, which subject the system to longer fault duration.

### Pulseclosing

Unlike conventional reclosers, IntelliRupter can be configured to fault test by pulseclosing—a precisely timed, quick close-and-open of each successive phase, with analysis of the resulting voltage and current waveforms to determine if a fault is present. Pulseclosing subjects the system to only a small fraction of the fault energy of conventional reclosing; IntelliRupter will close if no fault is detected on any phase. Pulseclosing can also be initiated before a regular closing operation, when IntelliRupter is open and locked-out.

### Conventional Closing

An IntelliRupter can alternately be configured to use conventional “hard” closing for each test after the initial trip. Such “hard” closing may be necessary to allow fuses to operate, after an initial very-fast-trip, fuse-saving operation.

## Profiles

### Closing Profiles

A Closing Profile is used when closing an open and locked-out IntelliRupter. Synchronization check prior to closing may be selected. Pulseclosing may be selected as well. Overcurrent, voltage, and frequency protection are set for one trip to lockout. The Closing Profile is time-limited, and will switch to the assigned General Profile after successfully closing. The Second Closing Profile can be configured with different parameters.

### Hot Line Tag Profile

A Hot Line Tag can be set locally or by SCADA. In such instances, the Hot Line Tag Profile is used. Overcurrent, voltage, and frequency protection are set for one trip to lockout.

### Cold Load Pickup

The Cold Load Pickup modifier can be configured to provide appropriate overcurrent protection after an extended outage.

## Overview

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### **IntelliTEAM II Automatic Restoration System**

IntelliRupters may be applied with S&C 5800 Series Automatic Switch Controls operating overhead and underground distribution switches, as well as Universal Interface Modules applied with protective relays and recloser controls not of S&C manufacture, in an IntelliTEAM II Automatic Restoration System. Using peer-to-peer communication with distributed intelligence, IntelliTEAM II tracks system conditions and quickly initiates service restoration. IntelliTEAM II requires no central monitoring or SCADA control, though SCADA is fully supported.

With IntelliTEAM II, restoration proceeds without the delays inherent in dispatcher-operated or centrally controlled systems. It monitors real-time current and voltage throughout the system and uses this data to make smart switching decisions, acting locally before breakers and reclosers lock out.

### **Module Service**

Should an error occur in the protection and control module, preventing normal operation of the IntelliRupter, the module can be removed and replaced from a bucket truck, using S&C Module Handling Fitting Catalog Number 4450 attached to a suitable hookstick. If automatic configuration is then selected, sensor calibration, site, and configuration information will be written into the new module; it will function exactly like the module which was replaced. This information is stored in auxiliary memory in the base of the IntelliRupter. The replaced module may then be returned to S&C for diagnosis and repair.

The communication module can also be removed and replaced from a bucket truck, using S&C Module Handling Fitting Catalog Number 4450 attached to a suitable hookstick. Battery condition is periodically tested by the temperature-compensated charging system, and an alarm is transmitted when battery voltage is low. Removal of the communication module allows easy field replacement of the battery.