S&C PMX™ Modular Metal-Enclosed Switchgear

Outdoor Distribution (13.8 kV and 25 kV)

Instructions for Operation

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S&C ELECTRIC COMPANY

Specialists in Electric Power Switching and Protection

Instruction Sheet 627-501
April 11, 2005 ©2005
Supersedes Instruction Sheet 627-501 dated 1-19-04

INTRODUCTION

General

The following instructions are for operation of manual or power-operated S&C PMX Modular Metal-Enclosed Switchgear rated 13.8 kV and 25 kV.

An assembly of PMX Switchgear may incorporate many types of components, such as interrupter switches, power fuses, switch operators, source-transfer controls, voltage sensors, current sensors, meters, etc., depending on user requirements.

Instructions for operation of each S&C component are provided in separate S&C instruction sheets. For each switchgear assembly, the applicable instruction sheets, drawings, and wiring diagrams are bound in a folder entitled "Instruction Manual." This instruction manual is located in a holder inside the appropriately marked switchgear-module door.

Qualified Persons

⚠ CAUTION

The equipment covered by this publication must be selected for a specific application and it must be installed, operated, and maintained by qualified persons who are thoroughly trained and who understand any hazards that may be involved. This publication is written only for such qualified persons and is not intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

Each assembly of S&C PMX Modular Metal-Enclosed Switchgear is provided with an "INSTALLATION AND OPERATION INFORMATION KIT" located in the holder inside the switchgear-module door on which the label "Installation and Operation Information Kit Inside This Bay" is affixed. The "INSTALLATION AND OPERATION INFORMATION KIT" includes applicable instruction sheets covering installation of the switchgear assembly and operation of components, plus drawings and wiring diagrams. All personnel involved with installation and operation of the switchgear assembly should be thoroughly familiar with the contents of the "INSTALLATION AND OPERATION INFORMATION KIT."

This equipment has been provided with comprehensive access control and operating features to minimize hazards. **However, since this equipment contains high voltage, there are hazards inherently present such that the following precautions should be observed at all times. FAILURE TO OBSERVE THESE PRECAUTIONS MAY RESULT IN SERIOUS INJURY OR DEATH.**

1. Padlocks must be installed and secured on all door handles and manual switch operating handles at all times unless a switch is being operated.
2. Snaplocks must be in place and the keys must be removed.
3. Key interlocks (if applicable) must be in place. Check the operating sequence of key interlocks to verify proper sequencing. After the switchgear is installed, destroy all duplicate keys or make them accessible *only* to authorized persons so that the key interlock scheme will not be compromised. Key interlocks are not security locks.
4. Mechanical cable interlocks are provided to prevent access to fuses unless the switch is open and to prevent operation of stored-energy switch operators when the module door is open. Do not attempt to operate any switch when the enclosure door is open. Periodically, verify that these interlocks are functional. Refer to the instructions under "MECHANICAL INTERLOCK" on page 13.
5. Do not apply any undue force to any handle when attempting to open or close a door or cover. The use of undue force may damage the handle or latching mechanism, or an interlock mechanism may be jammed. Do not attempt to close doors in an effort to reset interlocks. Instead, follow the instructions under "MECHANICAL INTERLOCK" on page 13.

Qualified Persons—continued

⚠ CAUTION

6. Do not remove or obscure any of the "CAUTION," "DANGER," or other precautionary signs and lables.
7. Make certain hanging barriers are in place unless work is being performed inside the enclosure.
8. Make certain all switchgear enclosures are properly grounded.
9. Make certain fuses are disconnected from all power sources (including backfeed) before being inspected or repaired.
10. Test for voltage and install suitable grounding equipment before touching any device that is to be inspected, serviced, or repaired.
11. Always assume both sets of power terminals on switch, fuse, or terminal connections to be energized unless proved otherwise by test or visual evidence.
12. Disconnet all voltage transformers and voltage sensors when external voltage is used to test any secondary-side wiring or when heaters are energized for temporary storage.

Read this Instruction Sheet

Read this instruction sheet thoroughly and carefully before operating your S&C PMX Modular Metal-Enclosed Switchgear. Familiarize yourself with "SAFETY INFORMATION" on pages 4 through 6.

Retain this Instruction Sheet

This instruction sheet is a permanent part of your S&C PMX Modular Metal-Enclosed Switchgear. Designate a location where you can easily retrieve and refer to this publication.

Proper Application

⚠ CAUTION

The equipment in this publication must be selected for a specific application. The application must be within the ratings furnished for the equipment. Ratings for this gear are listed on a ratings label located on the outside of the switchgear.

Warranty

The warranty and/or obligations described in S&C's standard conditions of sale, as set forth in Price Sheet 150, plus any special warranty provisions, as set forth in the applicable product-line specification bulletin, are exclusive. The remedies provided in the former for breach of these warranties shall constitute immediate purchaser's or end user's exclusive remedy and a fulfillment of all seller's liability. In no event shall seller's liability to immediate purchaser or end user exceed the price of the specific product which gives rise to immediate purchaser's or end user's claim. All other warranties whether express or implied or arising by operation of law, course of dealing, usage of trade or otherwise, are excluded. The only warranties are those stated in Price Sheet 150, and THERE ARE NO EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ANY EXPRESS WARRANTY OR OTHER OBLIGATION PROVIDED IN PRICE SHEET 150 IS GRANTED ONLY TO THE IMMEDIATE PURCHASER AND END USER, AS DEFINED THEREIN. OTHER THAN AN END USER, NO REMOTE PURCHASER MAY RELY ON ANY AFFIRMATION OF FACT OR PROMISE THAT RELATES TO THE GOODS DESCRIBED HEREIN, ANY DESCRIPTION THAT RELATES TO THE GOODS, OR ANY REMEDIAL PROMISE INCLUDED IN PRICE SHEET 150.

The seller's warranties do not apply to major components not of S&C manufacture, such as surge arresters, current-limiting fuses, instrument transformers, relays and meters, low-voltage circuit breakers, remote terminal units, and terminators. However, seller will assign to immediate purchaser or end user all manufacturers' warranties that apply to such components.

SAFETY INFORMATION

Understanding Safety-Alert Messages

There are several types of safety-alert messages which may appear throughout this instruction sheet as well as on labels and tags attached to the PMX Switchgear. Familiarize yourself with these types of messages and the importance of the various signal words, as explained below.

⚠ DANGER

"DANGER" identifies the most serious and immediate hazards which *will likely* result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ WARNING

"WARNING" identifies hazards or unsafe practices which *can* result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ CAUTION

"CAUTION" identifies hazards or unsafe practices which *can* result in minor personal injury or product or property damage if instructions, including recommended precautions, are not followed.

NOTICE

"NOTICE" identifies important procedures or requirements that, if not followed, *can* result in product or property damage if instructions are not followed.

Following Safety Instructions

If you do not understand any portion of this instruction sheet and need assistance, contact your nearest S&C Sales Office or S&C Authorized Distributor. Their telephone numbers are listed on S&C's website www.sandc.com. Or call S&C Headquarters at (773) 338-1000; in Canada, call S&C Electric Canada Ltd. at (416) 249-9171.

NOTICE

Thoroughly and carefully read this instruction sheet before operating your S&C PMX Modular Metal-Enclosed Switchgear.

Replacement Instructions and Labels

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.

It is important that any missing, damaged, or faded labels on the equipment be replaced immediately. Replacement labels are available by contacting your nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

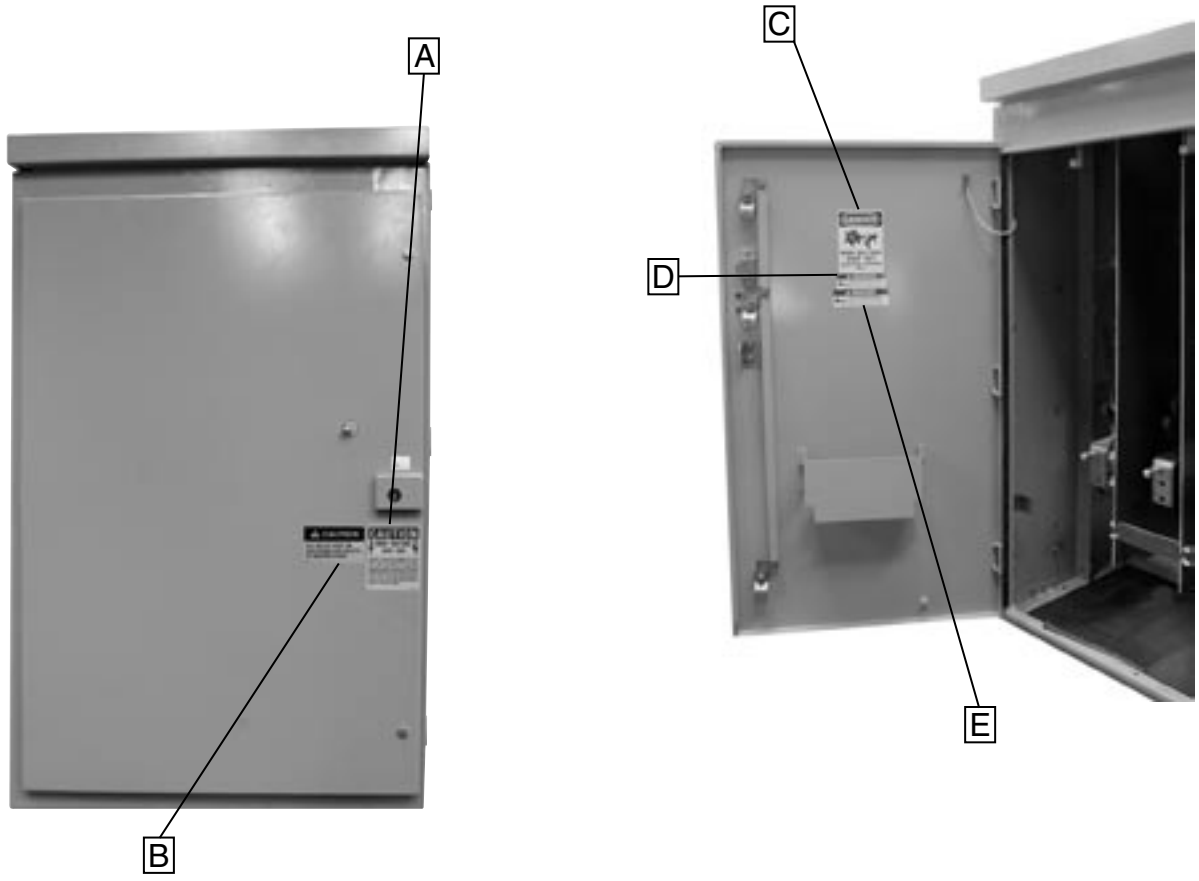
⚠ DANGER

PMX Switchgear contains high voltage. Failure to observe the precautions below will result in serious injury or death.

Some of these precautions may differ from company operating procedures and rules. Where a discrepancy exists, users should follow their company's operating procedures and rules.

1. **QUALIFIED PERSONS.** Access to metal-enclosed switchgear must be restricted only to qualified persons. See "Qualified Persons" on page 2.
2. **SAFETY PROCEDURES.** Always follow safe operating procedures and rules.
3. **PERSONAL PROTECTIVE EQUIPMENT.** Always use suitable protective equipment such as rubber gloves, rubber mats, hard hats, safety glasses, and flash clothing in accordance with safe operating procedures and rules.
4. **SAFETY LABELS.** Do not remove or obscure any of the "CAUTION," "WARNING," or "DANGER" labels.
5. **KEY INTERLOCKS.**
   - If optional key interlocks were furnished, they must be in place.
   - Check the operating sequence of key interlocks to verify proper sequencing.
   - After the metal-enclosed switchgear is installed, either: (1) destroy the extra set of keys or (2) make them accessible only to qualified persons. This will maintain the integrity of the key-interlock scheme.
   - Key interlocks are not security locks and are not substitutes for padlocks.
6. **MECHANICAL INTERLOCKS.** Periodically verify that these interlocks are functional. These interlocks prevent operation of the Mini-Rupter Switch when the associated switch-compartment door is open.
7. **OPENING DOORS.** Do not force doors open. Forcing a door open can damage the latching mechanism. If optional key interlocks are furnished, correctly position the interlocks so the doors can be opened.
8. **CLOSING AND LOCKING DOORS.**
   - Doors must be securely closed and latched, with padlocks in place at all times unless work is being performed inside the enclosure.
   - Do not close a door on a fuse in the open position. The door will strike the fuse pull-ring which will interfere with door closing. The door may be closed if the fuse is removed from the mounting.
9. **ENERGIZED TERMINALS.** Always assume that both sets of power terminals on any Mini-Rupter Switch or fuse are energized unless proved otherwise by test, by visual evidence of open-circuit conditions on both sets of terminals, or by observing that both sets of terminals are grounded.
10. **BACKFEED.** Mini-Rupter Switches switch terminals, fuses, and fuse mountings may be energized by backfeed.
11. **DE-ENERGIZING.** Before touching any device that is to be inspected, replaced, serviced, or repaired in the high-voltage compartments, always disconnect Mini-Rupter Switches, fuses, and other devices such as voltage sensors from all power sources (including backfeed) and control sources, test for voltage, and properly ground.
12. **TESTING.** Test for voltage on both sets of power terminals of any Mini-Rupter Switch or fuse using proper high-voltage test equipment before touching any device that is to be inspected, replaced, serviced, or repaired in the high-voltage compartments.
13. **GROUNDING.**
   - Make sure that the PMX Switchgear module(s) is properly grounded to the station or facility ground.
   - After the gear has been completely disconnected from all sources of power and tested for voltage, install suitable grounding cables in all compartments before touching any device that is to be inspected, replaced, serviced, or repaired in the high-voltage compartments.
14. **SWITCH POSITION.**
   - Always confirm the open/close position of the Mini-Rupter Switches by visually observing the position of the switch blades.
   - Switches and switch terminals may be energized by backfeed.
   - Switches and switch terminals may be energized in any position.
15. **FUSE POSITION.** Fuses and fuse mountings may be energized by backfeed even when the fuse is in the fully open position.

Location of Safety Labels



Reorder Information for Safety Labels

Location	Safety Alert Message	Description	Number
A	⚠ CAUTION	High Voltage—Keep Out	G-4900R2
B	⚠ CAUTION	All Bolts Must Be Tightened	G-9055
C	⚠ DANGER	Danger—High Voltage—Keep Out	G-6500
D	⚠ DANGER	Danger—Switches May Be Energized By Backfeed	G-6501
E	⚠ DANGER	Danger—Fuses May Be Energized By Backfeed	G-6502

Figures 1 and 2 illustrate many of the basic components and features of PMX Switchgear. Before proceeding with the remainder of the instructions, it is recommended that these figures be reviewed to gain familiarity with the various components and locations.

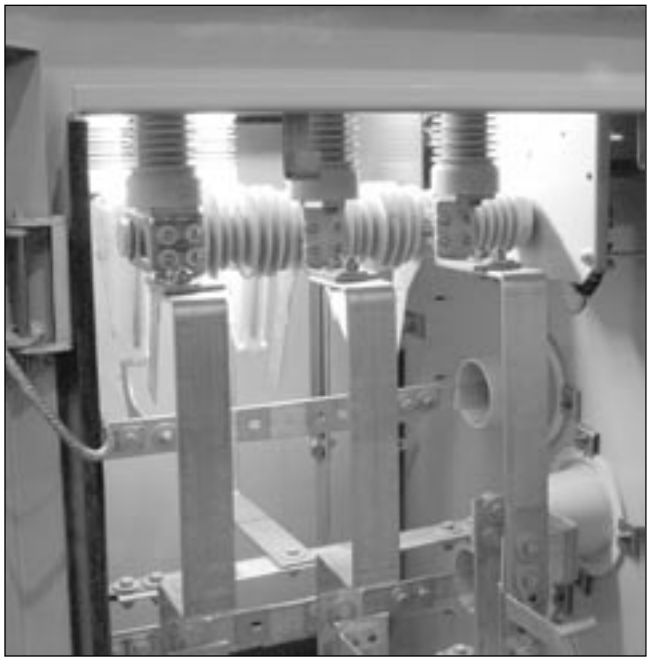


Figure 1. Switch compartment.

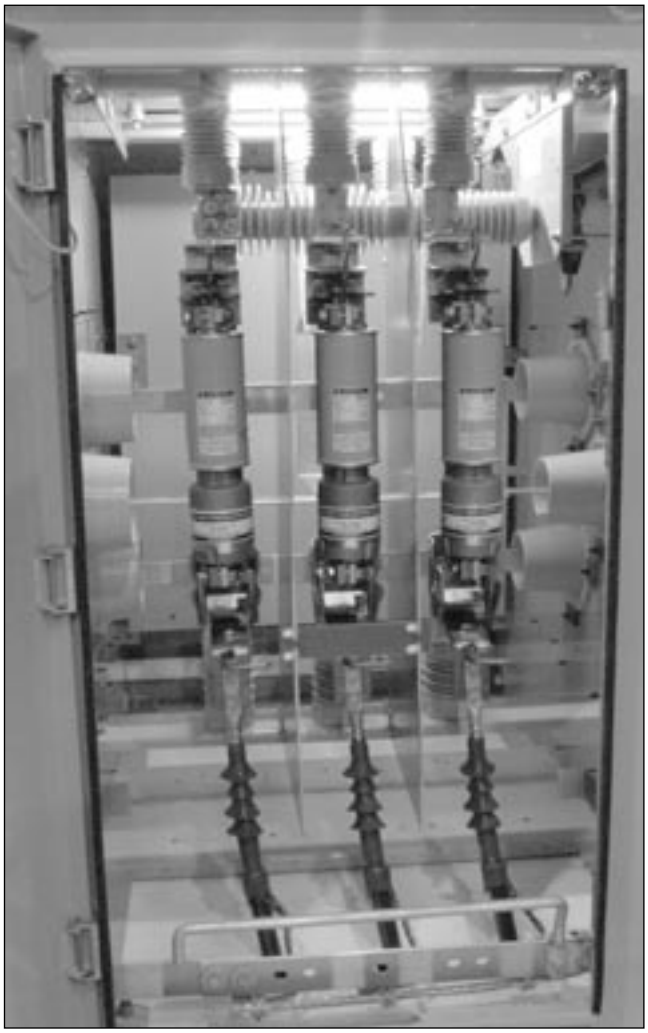


Figure 2. Fuse compartment.

Fusing—Standard Construction

Step 1

To insert the fuse (i.e., the fuse unit with its end fittings attached) in its hinge, use a universal pole★ equipped with an S&C Grapp1er™◆. Position the Grappler cone in the fuse pull-ring and cradle the fuse tube in the Grappler prongs (see Figure 3).

Step 2

Grasp the universal pole with both hands (approximately 2 feet apart) with one hand at the end of the pole opposite from the Grappler. Lift the fuse and lower it into its hinge. Make sure that the fuse is seated securely in the hinge; then disengage the Grappler from the fuse.

Step 3

Use a universal pole equipped with an S&C Grappler to move the fuse to the closed and latched position. Position the Grappler with the prongs downward and insert the longest prong into the pull-ring of the fuse.

Remove the temporary grounds (if applicable).

Fault Fiter Electronic Power Fuses

For information regarding the installation and operation of Fault Fiter Electronic Power Fuses, see the installation guide (if applicable) provided with the gear.

Figure 3. Installing or removing fuse using Grappler.

★ A 1¼″ diameter universal pole, at least 6 feet long, is recommended (S&C Catalog Number 4202R2-E, or equivalent).

◆ S&C Catalog Number 4423.

Refusing

Preparatory Procedures

Follow the same procedures as outlined under "Fusing—Standard Construction" on page 8.

How to Detect a Blown Fuse—SM-20, SM-40, and Fault Fiter

From a safe distance, observe the blown-fuse target. The upper end fitting features a brilliant-red blown-fuse target which projects from the top of the upper end fitting when the fuse unit has operated . . . making it easy to check the fuse condition with the fuse in the closed position. The blown-fuse target retracts within the end fitting when the blown fuse unit is replaced.

NOTE ON HANDLING: The current-design upper end fitting employs a free-floating blown-fuse target which can move (by force of gravity) into the "blown-fuse" position should the fuse unit be inverted during handling. Fuse condition can be verified by returning the fuse unit to the upright position. If the fuse unit is blown, the target will remain in the extended (projecting) position.

How to Detect a Blown Fuse—SM-4Z and SM-5S

From a safe distance, observe the blown-fuse target. The holders for S&C Type SM-4 and SM-5S Power Fuses feature a fluorescent fire-orange target on the spring-and-cable assembly, visible through the translucent glass-epoxy fuse tube, which moves to the "Blown" indicator window when the fuse operates, permitting a positive visual check of fuse condition without removing the holder from its mounting. The target fluoresces in the dark when illuminated with a flashlight.

Removing the Fuse from the Mounting★

1. Use a universal pole equipped with an S&C Grappler to unlatch the fuse. Position the Grappler with the prongs downward, insert the longest prong of the Grappler into the fuse pull-ring, and pull outward. Bring the fuse to the fully open position so that the tip rests against its stop, and disengage the Grappler.
2. Using the universal pole with the S&C Grappler, remove the fuse from its hinge as follows:
   a. Grasp the universal pole with both hands (approximately 2 feet apart) with one hand at the end of the pole opposite from the Grappler.
   b. Position the Grappler cone in the fuse pull-ring and cradle the fuse in the Grappler prongs (see Figure 3).
   c. Stand in a normal, upright position facing the universal pole. Move the pole forward until resistance between the Grappler and the fuse is felt (approximately 2 inches). Then, remove the fuse from its hinge with a *forward and upward* lifting motion. Alternately, the fuse-mounting contacts may be tested for voltage and then grounded by means of grounding leads properly connected to both source- and load-side fuse-mounting contacts, after which the fuse may be removed from the hinge by hand, using insulating rubber gloves.

Replacing the Fuse Unit

Complete instructions for removing blown (or unblown) fuse units from their end fittings, and for insertion of new fuse units, are described in the instruction sheet furnished with each fuse unit.

Installing the Fuse in its Mounting

Follow the same procedures as outlined under "Fusing" on page 11.

★ Applies to all fuses except Fault Fiter. For Fault Fiter directions, see the instructions included with each Fault Fiter unit.

Fusing—Enhanced Fuse Handling Construction

PMX Switchgear may be equipped with an adaptation of the unique TransFuser™ Mounting. This permits access to the fuse for quick and easy replacement of blown fuses with a shotgun stick. The fuse is accessible only when it is de-energized and isolated.

Opening the Fuse Access Panel

Step 1

Open the appropriate fuse termination-compartment door and secure it with the door holder.

Step 2

Secure the shotgun stick to the pull-ring at the lower end of the fuse access panel. See Figure 4. With an outward pull, pivot the fuse access panel end-for-end to expose the fuse. See Figure 5. Make certain that the mounting is latched before removing the shotgun stick. Then disengage the shotgun stick from the pull-ring. Using the shotgun stick, push against the top of the mounting to verify that it has securely latched. With the fuse access panel latched in the open position, the fuse is de-energized, isolated from high voltage, and accessible for removal from the mounting. See Figure 6.

NOTICE

Do *not* close a door on the fuse access panel in the open position with a fuse in the mounting. **The door will strike the fuse pull-ring which will interfere with door closing.** The door may be closed if the fuse is removed from the mounting.

Figure 4. To replace the fuses, pull the ring at the bottom of the TransFuser panel.

Figure 5. The panel pivots around and latches.

Figure 6. The fuse, now in full view and completely separate from the bus, can be easily removed from the mounting.

Fusing

Fault Fiter Electronic Power Fuses rated 25 kV should be installed in their mountings by hand using suitable protective equipment. Install all other fuses as follows:

Step 1

Secure a shotgun stick tightly to the fuse pull-ring with the fuse oriented so that the body of the fuse is below the stick. Grasp the shotgun stick with both hands (approximately 2 feet apart), placing one hand on the shotgun-stick latch mechanism.

Step 2

Lift the fuse and lower it into the cradle of the fuse mounting. See Figures 7 and 8.

Step 3

With the fuse securely seated in the cradle, push the fuse forward to latch it in the closed position. See Figure 8. Disengage the shotgun stick from the fuse. Use the shotgun stick to push against the fuse to verify that it is securely latched in the fuse mounting.

Closing the Fuse Access Panel

After the fuse has been installed or replaced, close the fuse access panel (energize the fuse) as follows:

Step 1

Secure a shotgun stick to the pull-ring at the top of the fuse access panel. With an outward pull, rotate the fuse access panel end-for-end to return the fuse to the component compartment. Make certain that the mounting latches in this position before removing the shotgun stick. Then disengage the shotgun stick from the pull-ring. Using the shotgun stick, push against the bottom of the mounting to verify that it has securely latched.

Step 2

Using the shotgun stick, lower the mechanical interlock to lock the fuse access panel.

Figure 7. Installing (or removing) fuse using shotgun stick.

Figure 8. Fuse lowered into the cradle in preparation for latching to fuse access panel.

Refusing

Preparatory Procedures

Follow the same procedures as outlined under "Fusing" on page 11.

How to Detect a Blown Fuse—SM-20, SM-40, and Fault Fiter

Pivot fuse access panel and observe the blown-fuse target. The upper end fitting features a brilliant-red blown-fuse target which projects from the top of the upper end fitting when the fuse unit has operated . . . making it easy to check the fuse condition with the fuse in the closed position. The blown-fuse target retracts within the end fitting when the blown fuse unit is replaced.

NOTE ON HANDLING: The current-design upper end fitting employs a free floating blown-fuse target which can move (by force of gravity) into the "blown-fuse" position should the fuse unit be inverted during handling. Fuse condition can be verified by returning the fuse unit to the upright position. If the fuse unit is blown, the target will remain in the extended (projecting) position.

How to Detect a Blown Fuse—SM-4Z and SM-5S

Pivot fuse access panel and observe the blown-fuse target. The holders for S&C Type SM-4 and SM-5S Power Fuses feature a fluorescent fire-orange target on the spring-and-cable assembly, visible through the translucent glass-epoxy fuse tube, which moves to the "Blown" indicator window when the fuse operates, permitting a positive visual check of fuse condition without removing the holder from its mounting. The target fluoresces in the dark when illuminated with a flashlight.

Removing the Fuse from the Mounting

1. Gain access to the blown S&C Power Fuse following the instructions found under "Opening the Fuse Access Panel" on page 10.
2. Fault Fiter Electronic Power Fuses rated 25 kV should be removed from their mountings by hand using suitable protective equipment. Remove all other fuses as follows:
   a. Grasp a shotgun stick with both hands (approximately 2 feet apart), placing one hand on the shotgun-stick latch mechanism.
   b. Secure the shotgun stick tightly to the fuse pull-ring. Always store fuses in a clean, dry location.
   c. Stand in a normal, upright position facing the shotgun stick. Unlatch the fuse with a short, outward pull on the fuse pull-ring. Then, remove the fuse from its mounting with an upward and outward lifting motion. Once the fuse has been removed from the mounting, the fuse access panel may be left with the live parts in the termination compartment and the doors may be closed.

Replacing the Fuse Unit

Complete instructions for removing blown (or unblown) fuse units from their end fittings, and for insertion of new fuse units, are described in the instruction sheet furnished with each fuse unit.

Installing the Fuse in its Mounting

Follow the same procedures as outlined under "Fusing" on page 11.

Modules containing power fuses have their front doors interlocked to prevent access to the fuses until the switch is open. The door on the front of the enclosure utilizes a locking lever and a cam interlock. The interlock works as described below:

Interlock for the Front Door: When the switch is closed, the locking lever engages a bracket on the door so the door can't be opened. See Figure 9a. When the switch has been opened, the interlock will release automatically when the door is opened and will engage a bracket on the switch, thus, preventing the switch from being closed. See Figure 9b.

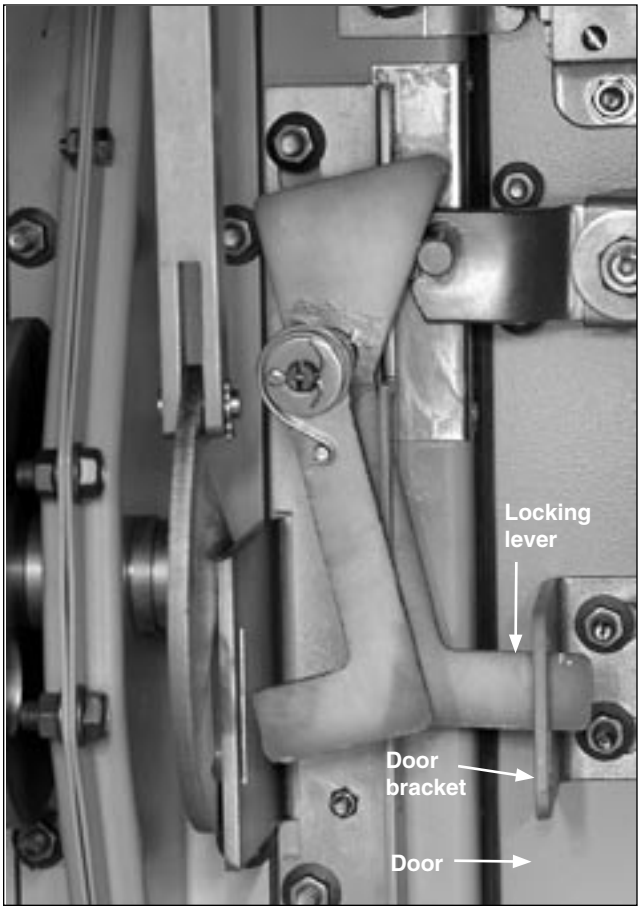


Figure 9a. Enclosure door closed—interlock unengaged from the switch.

Figure 9b. Enclosure door opened—interlock engaged to the switch.

Components

Figure 10 illustrates many of the basic components and features of Type PM Switch Operators, which are utilized in remote supervisory modules. It is recommended that this figure be reviewed to gain familiarity with the various components and their locations within the switch operators.

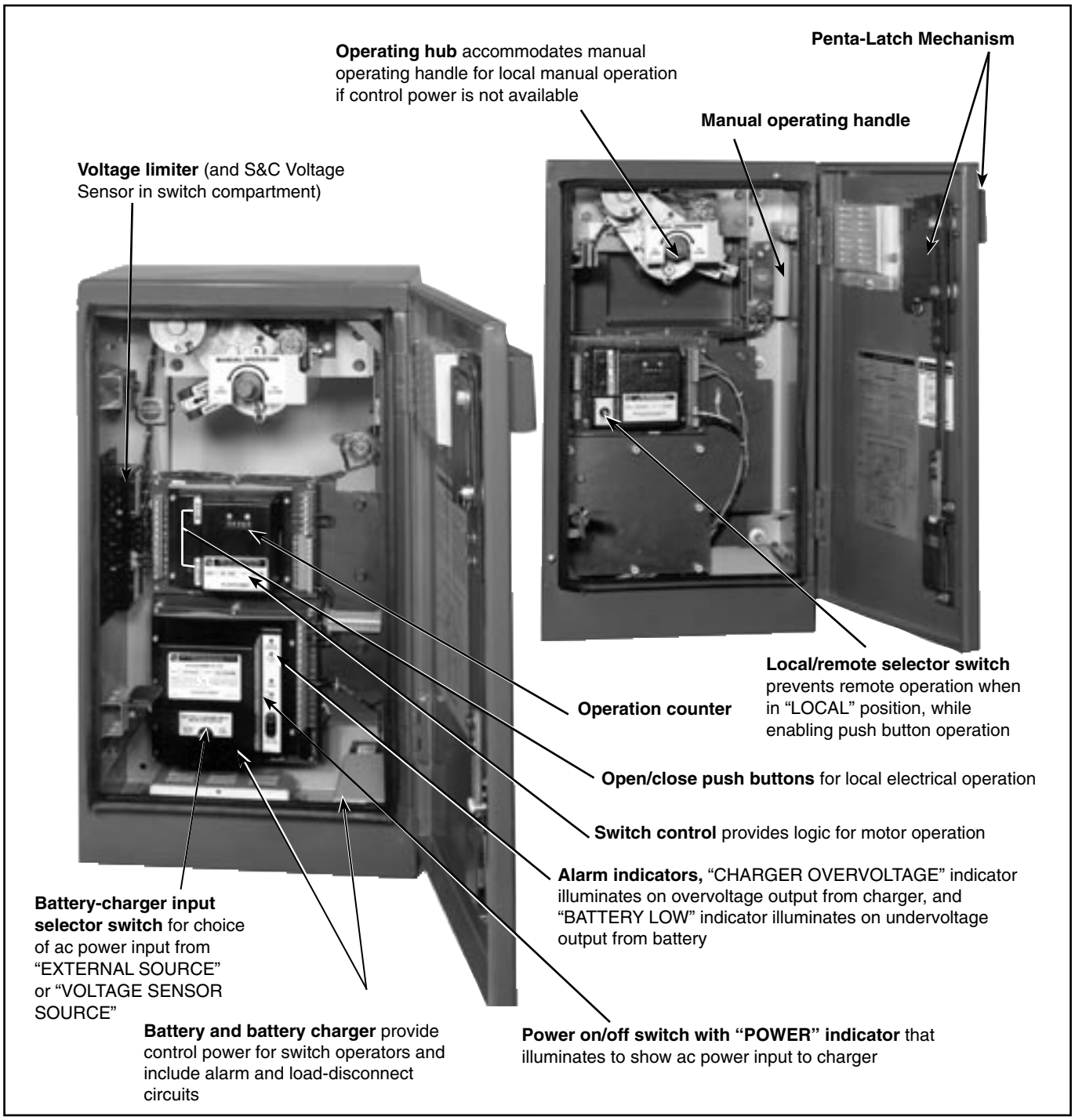


Figure 10. Interior view of Type PM Switch Operator showing switch control, battery, and battery charger. Inset shows Type PM Switch Operator that is not equipped with a control power source.

Operation

⚠ CAUTION

To prevent remote operation of a Type PM Switch Operator during local operation, or when decoupling or coupling a switch operator to a Mini-Rupter Switch, place the associated local/remote selector switch in the "LOCAL" position. Refer to Figure 10.

If the PMX Switchgear is energized, to avoid temporary service interruptions when test operating a switch operator, decouple the switch operator from its associated Mini-Rupter Switch. Refer to "Decoupling" on page 16. Switching operations will result in temporary service interruptions if the switch operator is coupled to the switch.

A local/remote selector switch is provided on the switch control of each switch operator for selection of its operating mode. A contact is also provided for remote indication of the selector-switch position. During normal operations, the local/remote selector switch will be in the "REMOTE" position. In remote, the selector switch prevents local electrical push button operation while permitting remote operation. If the switch operator is being operated using the open/close push buttons or manual operating handle, the selector switch should be in the "LOCAL" position. When in local, the selector switch prevents remote operation of the switch operator while allowing local electrical push button operation.

Local Operation

If Control Power Is Available—Place the local/remote selector switch of the switch operator in the "LOCAL" position. If the Mini-Rupter Switch is coupled to the switch operator, the switch may be opened or closed by pressing the appropriate open/close push button. If the Mini-Rupter Switch is decoupled from the switch operator, only the switch operator will move to the open or closed position when the open/close push buttons are pressed.

If Control Power Is Not Available—Place the local/remote selector switch of the switch operator in the "LOCAL" position. Then place the manual operating handle on the operating hub of the switch operator, see Figure 11, and rotate the handle approximately 155° in the appropriate direction, as indicated by the arrows on the "MANUAL OPERATION" label (counter-clockwise to open, clockwise to close).

Figure 11. Manual operation using manual operating handle if control power is not available.

Remote Operation

For remote operation of a switch operator, place the associated local/remote selector switch in the "REMOTE" position. The switch operator motor will now respond to opening and closing signals initiated from a remote location—provided that control power is available. When the selector switch is in remote, the open/close push buttons of the switch operator will not operate.

Decoupling

To decouple a switch operator from the Mini-Rupter Switch, first place the local/remote selector switch of the switch operator in the "LOCAL" position. Then slide the decoupler-latch knob of the switch operator in the direction indicated by the arrow on the decoupler latch, and pivot the latch to a position perpendicular to the drive levers. See Figure 12. This unlatches the switch drive lever from the switch operator drive lever. When thus decoupled, the switch operator can be exercised without affecting the position of the Mini-Rupter Switch.

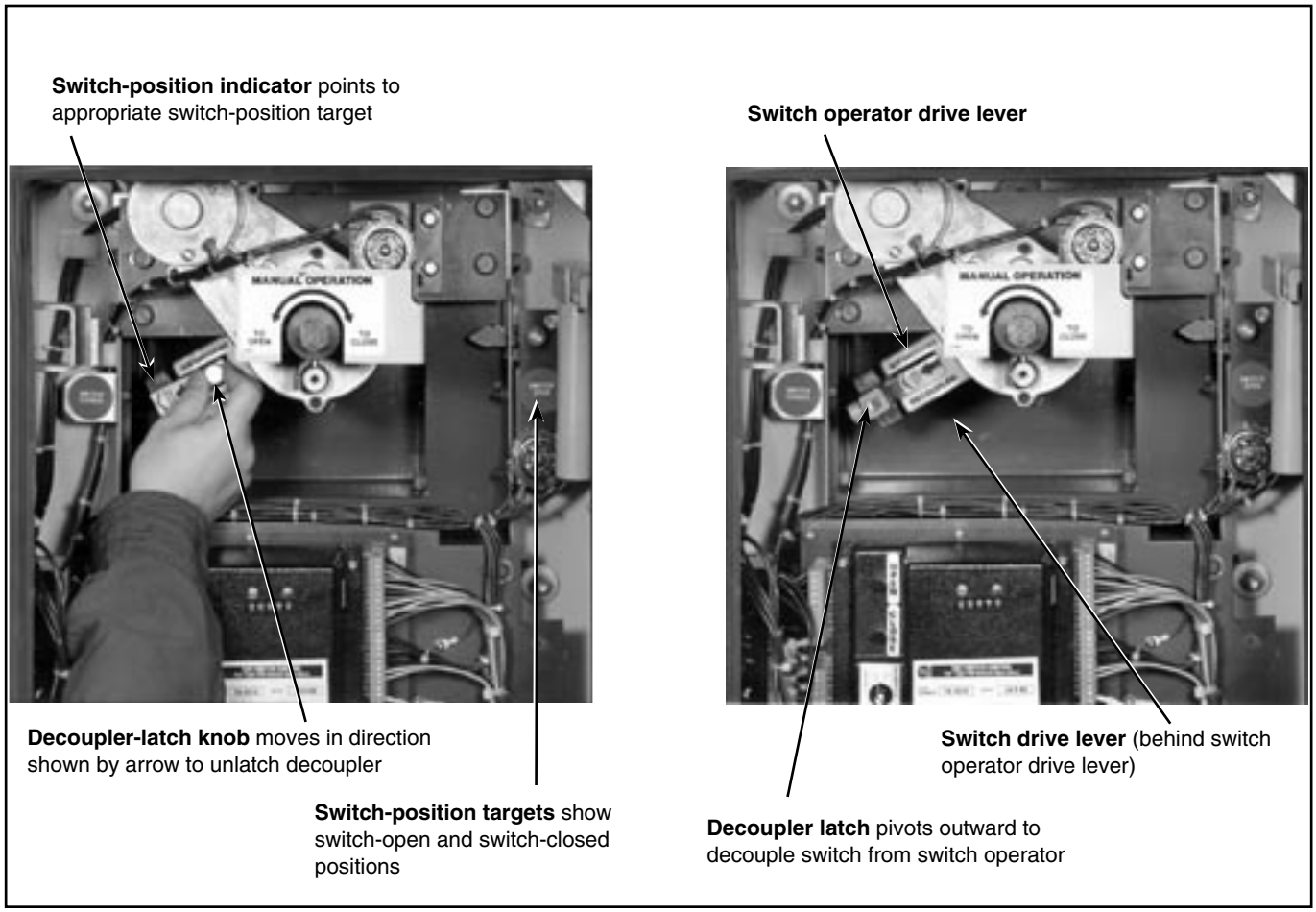


Figure 12. Decouple switch operator by sliding decoupler-latch knob in direction of arrow (left), and pivoting decoupler latch to position perpendicular to drive levers (right).

Coupling

To couple a switch operator to the Mini-Rupter Switch, first make certain that the local/remote selector switch of the switch operator is in the "LOCAL" position. Then move the switch operator drive lever into alignment with the switch drive lever using the appropriate open/close push button. See Figure 13. If necessary, bring the drive levers into exact alignment by placing the manual operating handle on the operating hub of the switch operator and slowly turning the handle until the drive levers are aligned. Latch the switch drive lever to the switch operator drive lever by pivoting the decoupler latch until it snaps into place between the arms of the switch operator drive lever.

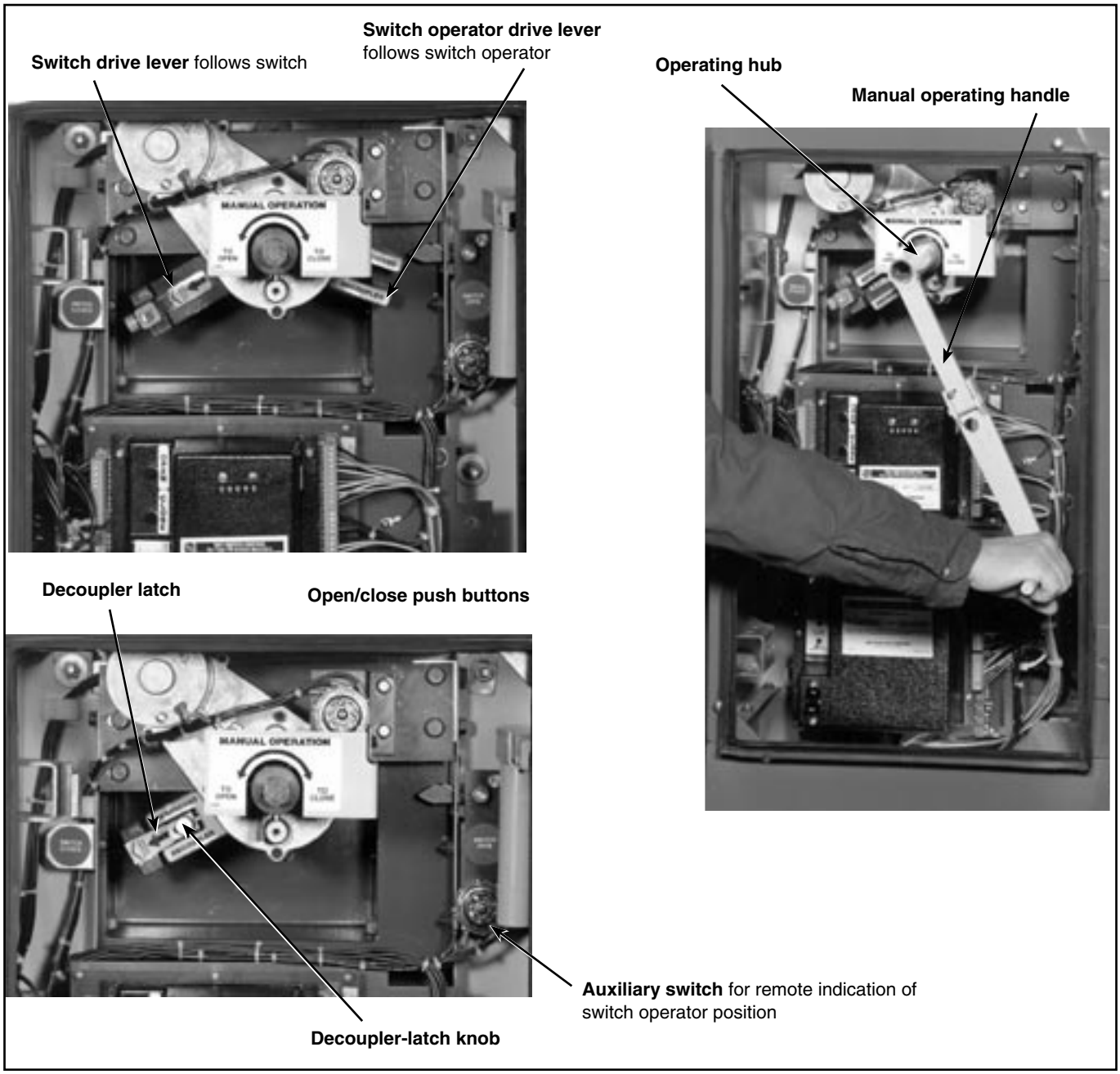


Figure 13. Couple switch operator by using open/close push buttons and manual operating handle to bring drive levers into alignment (upper left and right), and snapping decoupler latch into place (bottom left).

Final Checks Before Walking Away . . .

To ensure that a Type PM Switch Operator is ready for normal power operation of the Mini-Rupter Switch by remote supervisory control, be sure that the following conditions exist:

1. Switch operator is coupled to its associated switch with drive levers latched together.
2. Local/remote selector switch is in the "REMOTE" position.
3. For Type PM Switch Operators utilizing an external user-supplied 24-volt dc power source, the power source is connected to the switch control. If necessary, refer to the wiring diagrams in the "INSTALLATION AND OPERATION KIT."
4. For Type PM Switch Operators with battery and battery charger:
   a. Power on/off switch on the battery charger is in the "ON" position, and "POWER" indicator is illuminated.
   b. "CHARGER OVERVOLTAGE" and "BATTERY LOW" indicators are not illuminated.
   c. Battery-charger input selector switch is in the "EXTERNAL SOURCE" position if ac power input to the battery charger is provided by an external user-supplied 120-volt ac power source, and the power source is connected to the battery charger. If necessary, refer to the wiring diagrams in the "INSTALLATION AND OPERATION KIT."
   d. Battery-charger input selector switch is in the "VOLTAGE-SENSOR SOURCE" position if ac power input to the battery charger is provided by an internal S&C-supplied (voltage sensor) power source.
5. For Type PM Switch Operators with the ac power supply:
   a. Power on/off switch for ac power supply is in the "ON" position, and "POWER" indicator is illuminated.
   b. External user-supplied 120-volt ac power source is connected to the ac power supply. If necessary, refer to the wiring diagrams in the "INSTALLATION AND OPERATION KIT."
   c. Input fuse is installed in the fuse receptacle on the ac power supply.
6. Switch operator door is latched and secured with a padlock.

Exercising and Maintenance

⚠ CAUTION

Before inspecting, exercising or performing any maintenance on a Type PM Switch Operator, place the associated local/remote selector switch in the "LOCAL" position to ensure that the operator cannot be operated remotely. Also decouple the switch operator from the Mini-Rupter Switch. Refer to "Decoupling" on page 16. Decoupling the switch operator from the Mini-Rupter Switch will ensure that the switch does not change position.

Exercising

Occasional exercising of the Mini-Rupter Switches is recommended. In addition, Type PM Switch Operators should be given an exercising consisting of five or more operations at least once every year, unless normal operating duty provides equal or greater exercise. With the switch operator decoupled from the Mini-Rupter Switch, exercising of the operator can be accomplished at any convenient time without requiring that the switch itself be operated and, therefore, without requiring an interruption of service.

Battery Replacement

No routine maintenance is required for the battery packs. Refer to S&C Data Bulletin 669-97 (included when battery and charger are furnished) for information concerning the life expectancy of the battery packs. Evidence that the batteries are reaching end-of-life will be the illumination of the battery low indicator and remote alarm indication from the battery charger. Further, a measured open-circuit voltage across either battery pack of 10 volts or less indicates that *both* battery packs should be replaced.

To replace the battery, first place the power on/off switch on the battery charger in the "OFF" position and the local/remote selector switch in the "LOCAL" position. Then remove the two nuts holding down the bracket over the battery packs and remove the bracket. See Figure 14. Also remove the connectors from the terminals of the battery packs, and remove and properly dispose of the old battery packs. Attach the connectors to the terminals of the new battery packs—making sure that the positive and negative terminals are hooked-up according to the wiring diagram provided for the switch operator. Replace the bracket holding down the new battery packs and tighten the two nuts.

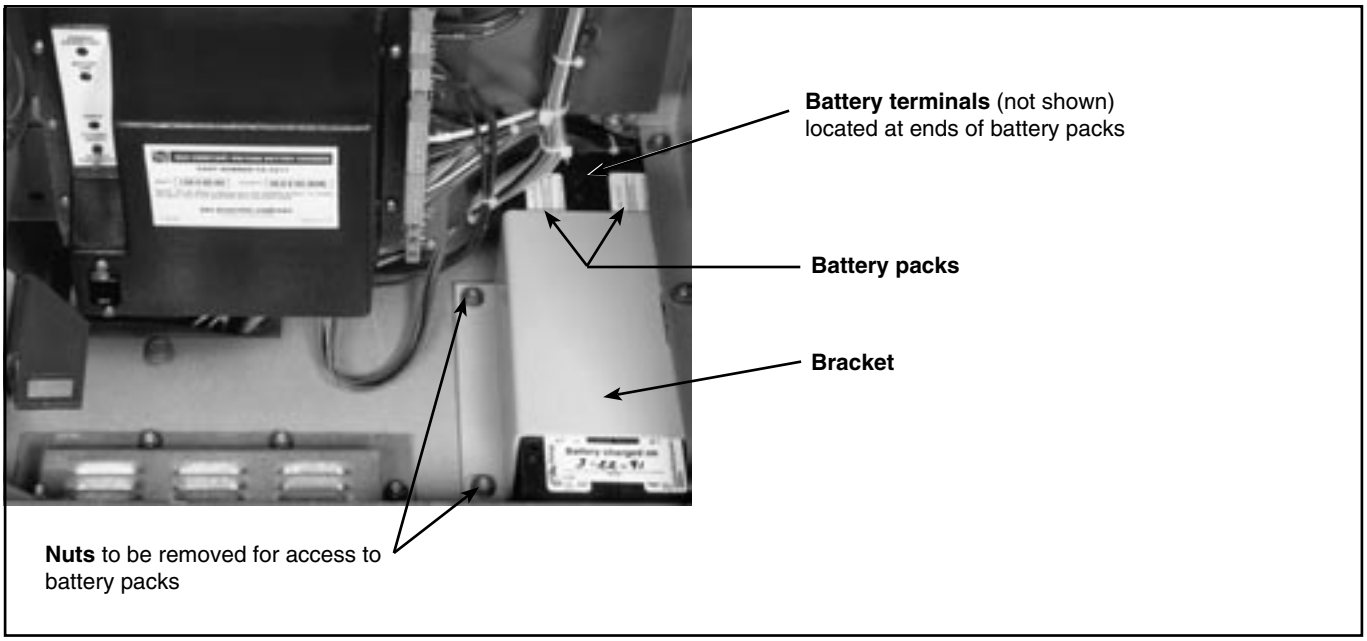


Figure 14. For battery replacement, remove nuts that secure hold-down bracket over battery.

Components

Figures 15 through 17 illustrate many of the basic components and features of source-transfer modules. Before proceeding with the remainder of the instructions, it is recommended that these figures be reviewed to gain familiarity with the various components and locations.

Figure 15. Low-voltage control compartment.

Figure 16. S&C Micro-AT® Source-Transfer Control.

Figure 17. Access panel removed showing input plug, input receptacle, and shorting receptacle of S&C Micro-AT Source-Transfer Control.

Mini-Rupter® Switches

⚠ WARNING

1. To prevent an automatic operation when decoupling or coupling an operator to a switch, during manual charging of an operator, or when manually operating a switch, place the manual/automatic operation selector switch located on the faceplate of the Micro-AT Source-Transfer Control in "MANUAL."
2. Do not perform any switching operations if the source-transfer control is in the lockout mode as indicated by illumination of the "LOCKOUT" lamp. See Figure 9. For such cases, see "Overcurrent- Lockout Condition" under the "OPERATING DESCRIPTION" in S&C Instruction Sheet 515-500.
3. If the gear is energized and paralleling of sources is not permitted, *decouple both stored-energy operators* (see "Decoupling" below) *to avoid temporary service interruptions when manually operating the gear. Switching operations will result in temporary service interruptions if stored-energy operators are coupled.*
4. Due to operating errors, the stored-energy operator's quick-make quick-break mechanism may stall in a partially discharged state. The conditions which will cause this mechanism to stall, as well as instructions for restoring the operator to the normal latched-open condition after a stall, are listed under "IF OPERATOR STALLS . . ." on page 25.
5. Do not assume that the operator position necessarily indicates the open or closed position of the Mini-Rupter Switch. Upon completion of an opening or closing operation, check to be sure that the following conditions exist:
   - The operator target (see Figure 15) signals "OPERATOR IN SWITCH-OPEN POSITION" or "OPERATOR IN SWITCH-CLOSED POSITION" to indicate that the switch operator has moved through a complete operation.
   - The switch-position target (see Figure 15) which signals "SWITCH OPEN" or "SWITCH CLOSED," is in agreement with the operator target.
   - The switch position, as verified by visual check of the switch-blade position, is in agreement with the switch-position target. A viewing window is provided in the switch compartment to allow positive visual verification of switch-blade position.
   - The operator target (see Figure 15) signals "OPERATOR CHARGED" to indicate that the operator is ready for the next operation.
6. To prevent all electrical and mechanical operations, padlock the operation selector in the "LOCK POSITION." This will also prevent motor charging of the stored-energy operator if system operating procedures require that the quick-make quick-break mechanism remain discharged—and source voltage is present.

Decoupling

Decoupling is accomplished using the decoupler handle. See Figure 13. When decoupled, the stored-energy operator may be operated without affecting the position of the associated Mini-Rupter Switch. Moreover, when decoupled, the Mini-Rupter Switch is prevented from moving by a mechanical device which locks the switch drive-shaft.

To decouple the stored-energy operators, first place the manual/automatic operation selector switch on the faceplate of the S&C Micro-AT Source-Transfer Control in "MANUAL." For each stored-energy operator, grasp the decoupler handle and press down on the coupled position latch to release the handle. Then move the handle upward to the "DECOUPLED" position. Make sure that the handle is fully latched in the decoupled position. While an operator is decoupled, the automatic transfer "ready" indicating lamp on the faceplate of the Micro-AT control will not light—a reminder of the decoupled condition. See Figure 16.

Coupling

To couple the stored-energy operators, first place the manual/automatic operation selector switch on the faceplate of the Micro-AT control in "MANUAL." *Then make sure that the stored-energy operators are in the same position (open or closed) as their associated Mini- Rupter Switches* by observing the switch-position and operator targets. See Figure 15. If required, use the open/close push buttons (provided control power is available) to reposition the operator(s).

For each operator, grasp the decoupler handle and press down on the decoupled-position latch to release the handle. Then move the handle downward to the "COUPLED" position. Make sure that the handle is fully latched in the coupled position. An attempt to operate a switch that is not completely coupled (or decoupled) will cause the operator mechanism to stall.

Automatic Switch Operation

High-speed quick-make quick-break operation is provided by stored-energy operators which, when solenoid tripped in response to control signals from the S&C Micro-AT Source-Transfer Control, automatically open and close the Mini-Rupter Switches. After each trip operation, the operators automatically charge when voltage is present on the associated source—ready for the next operation. For automatic switch operation, the manual/automatic operation selector switch on the Micro-AT control must be in "AUTOMATIC." See Figure 16. The Micro-AT control *will not* function automatically if one operator is coupled and the other is decoupled. Field programming and operation of the Micro-AT control is covered in S&C Instruction Sheet 515-500.

Non-automatic Switch Operation

If Control Power Is Available: To manually operate the stored-energy operator's quick-make quick-break mechanism —and (if coupled) to open or close a Mini-Rupter Switch—place the manual/automatic operation selector switch in "MANUAL" and press the associated open/close push button. See Figure 20. After each trip operation, the quick-make quick-break mechanism automatically charges when voltage is present on the associated source. The charging operation takes approximately 25 seconds.

If Control Power Is Lost and Operator Is Charged: To manually operate the stored-energy operator's quick-make quick-break mechanism —and (if coupled) to open or close a Mini-Rupter Switch—insert the small keyed end of the dual-purpose manual handle into the groove of the tripping shaft, behind the cover labeled "EMERGENCY TRIP," and turn in the direction indicated to effect desired operation. See Figure 19.

If Control Power Is Lost and Operator Is Discharged: Manually charge the stored-energy operator's quick-make quick-break mechanism as described under "Charging Operator (Non-electrical)" below. Then proceed as just described under "If Control Power Is Lost and Operator Is Charged."

Charging Operator (Non-electrical): The dual-purpose manual handle is used to manually charge the stored-energy operator's quick-make quick-break mechanism (required only in the event that control power has been lost). See Figure 20. Keep the charging shaft access port open by holding the operation selector in the "CHARGING POSITION." While the operation selector is in the "CHARGING POSITION," the control circuit is disconnected to prevent manual or automatic electrical operation (charging or tripping) in the event that control power is restored; and the emergency-trip port is mechanically blocked to prevent a manual mechanical trip operation.

While holding the port open, insert the large notched end (with recessed bolt) of the dual-purpose manual handle and secure it to the end of the charging shaft by turning the knurled knob clockwise 8 to 9 turns until firm resistance is felt. To charge the mechanism, grasp the tubular portion of the handle and, while pivoting the handle a few degrees, push in to engage the charging shaft. At the same time, rotate the handle as far as it will go (approximately 120°) in the appropriate direction. The "OPERATOR CHARGED" target will appear in the indicator window.

After the charging operation, loosen the knurled knob and remove the handle. The operation selector will spring return to the "OPERATING POSITION."

Figure 18. Decoupler handle being moved upward to decouple switch from associated switch operator.

Figure 19. Dual purpose manual handle inserted in the groove of shaft for emergency manual switching.

Figure 20. Dual purpose manual handle on the charging shaft.

Final Checks Before Walking Away . . .

So that the S&C Micro-AT Source-Transfer Control is ready for automatic operation, make sure that both source voltage indicating lamps and the automatic-transfer "ready" indicating lamp are illuminated. If the "READY" lamp is not lighted, refer to the liquid-crystal display on the faceplate of the Micro-AT control. When not being used to show menu information, this display shows messages explaining why the lamp is not lighted.

NOTE: A lighted "READY" lamp indicates that the status of associated components is normal, but an absence of illumination does not necessarily mean that the control is inoperative. For example, when transfer to the alternate source occurs, the lamp extinguishes but the control is ready for any subsequent programmed automatic operation required by a change in source conditions. Likewise, if the stored-energy operators are decoupled, the "READY" lamp is extinguished—and the switches will not operate—but the control is fully operative.

Close and padlock the access doors to the low-voltage control compartment and high-voltage compartments.

If Operator Stalls

The stored-energy operator's quick-make quick-break mechanism will stall in a partially discharged state if the operator is inadvertently tripped while its associated Mini-Rupter Switch is prevented from closing by any of the following conditions:

- Switch not completely coupled (or decoupled) to switch operator.
- Switch blocked open by mechanical interlock.
- Switch locked open by key interlock (applicable when that option, Catalog Number Suffix "-C1," is included).

To determine if the quick-make quick-break mechanism has stalled, observe the switch-position indicator target. If the words "SWITCH OPEN" on the target appear slightly off-center and one or more letters are partially hidden from view in the target opening, then the mechanism is in a stalled condition. See Figure 21.

Restore the stored-energy operator to a normal latched-open condition after such an occurrence as follows:

1. Make sure that the manual/automatic operation selector switch is in "MANUAL."

⚠ WARNING

To guard against handle kickback during performance of this step, do not release grip on handle until latching has occured.

2. Place the large notched end (with recessed bolt) of the dual-purpose manual handle in the center of the decoupler. See Figure 22. (The handle's knurled knob performs no function in this application.) While pivoting the handle, push it in to engage the reverse-drive hub. Then rotate the handle counterclockwise for the left-hand switch (clockwise for the right-hand switch) to back drive the switch and the quick-make quick-break mechanism—against the tension of the stored-energy spring—until the mechanism latches in its open position. A slight click may be heard when the mechanism latches.
3. Verify that the latched-open condition has been achieved by observing that the switch-position target reads "SWITCH OPEN" and the operator targets read "OPERATOR IN SWITCH-OPEN POSITION" and "OPERATOR CHARGED."

Figure 21. Switch position indicator target appears slightly off-centered if operator is stalled.

Figure 22. Dual-purpose manual handle reverse-driving the Mini-Rupter Switch and Operator's quick-make quick-break mechanism to recover from a stalled condition.

Maintenance

Components

No routine maintenance is required for the S&C Micro-AT Source-Transfer Control. However, operational testing once per year is recommended to verify proper functioning of the system.

Minimal mechanical maintenance is required for PMX Switchgear. Occasional inspection of the gear and exercising of the Mini-Rupter Switches is recommended. In addition, inspection and cleaning—of insulators and cable terminators in particular—should be performed periodically, at intervals based on environmental conditions.

⚠ WARNING

Before cleaning, completely de-energize, test, and ground the PMX Switchgear. Never use pressure-sprayed abrasives to clean PMX Switchgear. **Pressure-sprayed abrasives will damage switch and fuse components.**

The stored-energy operators should be given an exercising consisting of five or more operations at least once every year, unless normal operating duty provides equal or greater exercise. With the switches decoupled from the operators, exercising can be accomplished at any convenient time without requiring that the switches themselves be operated and, therefore, without requiring an interruption of service.

The nominal operating life of the stored-energy operators is 1500 operations (complete close-open cycles), provided that no more than 500 of such operations are performed while decoupled.

Returning Equipment to Service

When returning the equipment to service, the following procedures should be observed:

1. Make sure that switch and fuse grounding means are removed and that dual-purpose front barriers are removed from the "slide-in" position before closing the associated Mini-Rupter Switch or power fuses.
2. Make certain that the Mini-Rupter Switches are in the correct position (open or closed) as dictated by system circumstances.
3. Close each door permitting access to high voltage. Make sure that the associated Penta-Latch® Mechanisms are securely latched and padlocked before energizing the circuit or operating any switching device.
4. Make certain that the input plug is on the input receptacle.
5. Refer to "FINAL CHECKS BEFORE WALKING AWAY . . ." on page 24.
6. Close both low-voltage compartment doors and make sure that the associated Penta-Latch Mechanism is completely latched and padlocked.
7. Padlock all doors before leaving the installation site, even momentarily. Observe this procedure even in those cases where the gear is accessible only to qualified persons.

OPTIONAL FEATURES

Description		Applicable to Modules	Suffix to be Added to Module Number
Finish Color①	Light Gray Outdoor (Standard)	All Modules	-A1
	Olive Green Outdoor		-A2
Stainless-Steel Enclosure①		All 13.8-kV modules	-A10
		All 25-kV modules	-A11
Key Interlock②		All modules except Duplex, Remote Supervisory, and Source-Transfer	-C1
Mechanical Cable Interlock between Switch and Door		Manually operated switch	-C6
Auxiliary Switch, 4-PST		All manual modules containing a switch	-C7
		All Source-Transfer Modules	-C9
		All Remote Supervisory Modules	-C10
Compartmentalization		All 13.8-kV modules with incoming or outgoing cables except Source-Transfer and Duplex	-CP1
		All 25-kV modules with incoming or outgoing cables except Source-Transfer and Duplex	-CP2
Fuse Storage		All Fuse and Metering Modules	-E1
Base Spacer①	Mild Steel, 6 inches	All 13.8-kV modules	-K1
	Stainless steel, 6 inches		-K11
	Mild Steel, 12 inches		-K2
	Stainless steel, 12 inches		-K12
	Mild Steel, 6 inches	All 25-kV modules	-B1
	Stainless steel, 6 inches		-B11
	Mild Steel, 12 inches		-B2
	Stainless steel, 12 inches		-B12
Copper Bus①	Main and ground bus	All modules	-L1
	Main and ground bus plus terminal and switch pads		-L2
Power Measurement ION® 6200 Digital Multimeter③		All Metering Modules	-DMM
Fused Voltage Transformers④	Two transformers rated 7.2, 7.62, or 8.4 kV, phase to ground⑤	All 13.8-kV Metering Modules	-DB1
	Three transformers rated 7.2, 7.62, or 8.4 kV, phase to ground⑤		-DC1
	Two transformers rated 12, 13.2, or 14.4 kV, phase to phase⑤		-DE1
	Two transformers rated 14.4 kV, phase to ground⑥	All 25-kV Metering Modules	-DB2
	Three transformers rated 14.4 kV, phase to ground⑥		-DC2
	Two transformers rated 24 or 28 kV, phase to phase⑥		-DE2

① Applies to all modules in the assembly.

② Lock location and coordination scheme must be specified at time of order.

③ External 120-volt ac power source required.

④ Contact your nearest S&C Sales Office for voltages other than 13.8 kV or 25 kV.

⑤ Designed for ABB VIZ-11 transformers.

⑥ Designed for ABB VIZ-20 transformers.

TABLE CONTINUED ►

OPTIONAL FEATURES—Continued

Description		Applicable to Modules	Suffix to be Added to Module Number
Compete Provisions for Fused Voltage Transformers①②	Two transformers, phase to phase	All Metering Modules	-DF2
	Three transformers, phase to ground		-DF3
	Two transformers, phase to phase		-DF5
Mounting Provisions for Fused Voltage Transformers①②	Two transformers, phase to ground		-DF7
	Three transformers, phase to ground		-DF8
	Two transformers, phase to phase		-DF10
Two Window-Type Current Transformers	100/5	All Bus-Tap Metering Modules	-GA1
	200/5		-GA2
	400/5		-GA4
	600/5		-GA6
	800/5		-GA8
	1200/5		-GA12
Three Window-Type Current Transformers	100/5		-GB1
	200/5		-GB2
	400/5		-GB4
	600/5		-GB6
	800/5		-GB8
	1200/5		-GB12
Complete Provisions for Two Window-Type Current Transformers③			-GF1
Complete Provisions for Three Window-Type Current Transformers③			-GF2
Mounting Provisions for Two Window-Type Current Transformers③			-GF3
Mounting Provisions for Three Window-Type Current Transformers③			-GF4
Two Wound-Type (Bar-Type) Current Transformers④	100/5	All 13.8-kV Metering Modules	-GC1
	200/5		-GC2
	400/5		-GC4
	600/5		-GC6
	800/5◆		-GC8
	1200/5◆		-GC12

① Designed for ABB VIZ-11 and VIZ-20 transformers.

② To also include installation of customer-supplied voltage transformers, change the first two letters of the option suffix from "DF" to "-DG."

③ Designed for ABB KIR-11 and KOR-15C transformers.

④ Designed for ABB KIR-11 transformer.

◆ Main bus is rated 600 amperes.

TABLE CONTINUED ►

OPTIONAL FEATURES—Continued

Description		Applicable to Modules	Suffix to be Added to Module Number
Three Wound-Type (Bar-Type) Current Transformers①	100/5	All 13.8-kV Metering Modules	-GD1
	200/5		-GD2
	400/5		-GD4
	600/5		-GD6
	800/5◆		-GD8
	1200/5◆		-GD12
Two Wound-Type (Bar-Type) Current Transformers②	100/5	All 25-kV Metering Modules	-GC21
	200/5		-GC22
	400/5		-GC24
	600/5		-GC26
	800/5◆		-GC28
	1200/5◆		-GC212
Three Wound-Type (Bar-Type) Current Transformers②	100/5	All 25-kV Metering Modules	-GD21
	200/5		-GD22
	400/5		-GD24
	600/5		-GD26
	800/5◆		-GD28
	1200/5◆		-GD212
Complete Provisions for Two Wound-Type (Bar-Type) Current Transformers③④	All ratios except 1200/5	All Metering Modules	-GG1
	1200/5 radios only		-GG2
Complete Provisions for Three Wound-Type (Bar-Type) Current Transformers③④	All ratios except 1200/5		-GG3
	1200/5 radios only		-GG4
Mounting Provisions for Two Wound-Type (Bar-Type) Current Transformers③④	All ratios except 1200/5		-GG5
	1200/5 radios only		-GG6
Mounting Provisions for Three Wound-Type (Bar-Type) Current Transformers③④	All ratios except 1200/5		-GG7
	1200/5 radios only		-GG8
Aluminum Terminal Adapter for Two Cables per Phase, through 750 kc Mil		All Entrance and Cable Enrance Modules	-M1

① Designed for ABB KIR-11 transformer.

② Designed for ABB KOR-15C transformer.

③ Designed for ABB KIR-11 and KOR-15C transformers.

④ To also include installation of customer-supplied wound-type (bar type) current transformers, change the first two letters of the option suffix from "GG" to "-GH."

◆ Main bus is rated 600 amperes.

TABLE CONTINUED ►

OPTIONAL FEATURES—Continued

Description		Applicable to Modules	Suffix to be Added to Module Number
Surge Arresters, Set of Three	3-kV distribution class, 4.16-kV applications only	All Entrance and Cable Entrance Modules	-NA3
	6-kV distribution class, 4.16-kV applications only		-NA6
	9-kV distribution class, 13.8-kV applications only		-NA9
	10-kV distribution class, 13.8-kV applications only		-NA10
	12-kV distribution class		-NA12
	15-kV distribution class		-NA15
	18-kV distribution class, 25-kV applications only		-NA18
Provisions for Distribution-Class Surge Arresters Rated 3, 6, 10, 12, 15, or 18 kV, Bracket-Mounted			-PA
Viewing Window in Enclosure Door. Includes see-through barrier		All Entrance and Feeder Modules containing a switch	-VW
See-through Barrier. Hangs behind module door		All modules	-LB
Custom Designed Side Sheet on Side Coupled to Transformers—matches Transformer Throat Flange		Transformer Throat Modules	-S
Remote Indication①		All Source-Transfer Modules	-Y4
Test Panel②③			-Y5
Supervisory Control for Common-Bus Applications			-Y6
Communications Card④⑤			-Y8
Overcurrent Lockout⑥⑦	Six sensors, for one conductor per phase on both sources⑧		-Y21
	Nine sensors, for two conductor per phase on one sources⑨		-Y22
	Twelve sensors, for one conductor per phase both sources⑩		-Y23

① Includes a terminal block for user's connections.

② If a three-phase test source is not available, limited testing may be performed using an external, adjustable single-phase source.

③ In instances where a three-phase test source is to be used, an S&C Voltage Limiter—Three-Phase, Catalog Number TA-1741, must be furnished for the test circuit.

④ Requires an IBM PC AT or compatible computer using Intel's 80386 microprocessor, or higher. The computer must have a minimum of 2 Mb of memory, one 3.5-inch 1.44-Mb floppy disk drive, and a hard disk drive with at least 2 Mb of free space. The computer must operate under Microsoft Windows™, Version 3.1.

⑤ Requires Micro-AT Communication Cable, Catalog Number TA-2320 or TA-2321.

⑥ For applications where load feeders are connected to transformers with wye-grounded primary windings, contact your nearest S&C Sales Office.

⑦ Current sensors must not be installed on unshielded cables or on cables where the insulation is exposed but ungrounded (for example, where dielectric tape or heat-shrink tubing is used). These sensors are intended for application at ground potential and may be damaged by the voltage gradient between the cable insulation and ground.

⑧ Six S&C Closed-Gap Current Sensors, Catalog Number TA-1758, are furnished. Each current sensor accommodates a single conductor up to 2½ inches in diameter.

⑨ Three S&C Closed-Gap Current Sensors, Catalog Number TA-1758, and six S&C Closed-Gap Current Sensors, Catalog Number TA-2264, are furnished. Each current sensor accommodates a single conductor up to 2½ inches in diameter.

⑩ Twelve S&C Closed-Gap Current Sensors, Catalog Number TA-2264, are furnished. Each current sensor accommodates a single conductor up to 2½ inches in diameter.

TABLE CONTINUED ►

OPTIONAL FEATURES—Continued

Item		Applicable to Modules	Suffix to be Added to Module Number
Communication and Control Equipment Group①②—includes user-specified remote terminal unit (RTU); user-specified communication device; battery charger; battery packs; voltage sensor for power input to battery charger and single-phase voltage sensing; and current sensors for three-phase current sensing on each power-operated switch③		All Remote Supervisory Modules	Contact your nearest S&C Sales Office
Switch-Control Equipment Group for use with RTU by others②④—includes provisions for mounting of user-furnished and installed RTU, communication device, etc. in low-voltage compartment; current sensors (5-ampere ac output) for three-phase current sensing on each power-operated switch; and voltage sensor (user-selectable 5-volt ac or 69-volt ac output) for single-phase voltage sensing, with power for the switch operators supplied by	User-furnished 24-volt dc source or EnergyLine 5800 Series Switch Control		-Y12
	External control power—user-furnished 120-volt ac source to an S&C Battery Charger and battery packs⑤		-Y13
	Internal control power—S&C-furnished voltage sensor (20 volt-ampere) source to an S&C Battery Charger and battery packs①⑤		-Y14
Switch-Control Equipment Group for use without RTU④⑥—includes provisions in low-voltage compartment for connection of switch operators to user's wiring; with power for the switch operators supplied by	External control power—user-furnished 120-volt ac source to an S&C-furnished ac power supply		-Y15
	External control power—user-furnished 120-volt ac source to an S&C-furnished Battery Charger and battery packs		-Y16
	Internal control power—S&C-furnished voltage sensor 20 volt-ampere) source to an S&C Battery Charger and battery packs①		-Y17

① The S&C Voltage Sensor is mounted on the jaw-contact side of the switch, on the center phase.

② Current sensors must not be installed on unshielded cables or on cables where the insulation is exposed but ungrounded (for example, where dielectric tape or heat-shrink tubing is used). These sensors are intended for application at ground potential and may be damaged by the voltage gradient between the cable insulation and ground.

③ The S&C Battery Charger is factory-calibrated to accommodate the loads furnished in the Communication and Control Equipment Group at the time of shipment. If additional loads are subsequently added. S&C recommends recalibration of the charging output to the batteries to ensure optimal battery life. Refer to your nearest S&C Sales Office.

④ Includes provisions in low-voltage compartment for connection of switch operator to user's wiring.

⑤ The battery charger and a battery packs are not intended to provide power to any user-furnished and installed equipment.

⑥ Current and voltage sensing are not included and cannot be provided.