Sectionalizers

Cooper Power Systems

Service Information

Type GWC Installation Instructions

S270-21-1

Applicable to serial number 1088 and above

88973KMA

Figure 1.
Kyle® Type GWC Sectionalizer.

Contents

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SAFETY INFORMATION

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

Hazard Statements

This manual contains two types of hazard statements:

WARNING: Refers to hazards or unsafe practices which could result in severe personal injury, or death, and equipment damage.

CAUTION: Refers to hazards or unsafe practices which could result in damage to equipment or in personal injury.

Safety Instructions

Following are general caution and warning statements that apply to this equipment. Additional statements, related to specific tasks and procedures, are located throughout the manual.

WARNING: Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this manual. Improper operation, handling or maintenance can result in death, severe personal injury, and equipment damage. G101.0

WARNING: This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply may result in death, severe personal injury and/or equipment damage. G102.0

WARNING: High voltage. Contact with high voltage will cause severe personal injury or death. Follow all locally approved safety procedures when working around high voltage lines and equipment. G103.0

WARNING: Do not operate this equipment out of oil. Oil is the electrical insulating medium within this equipment; operation out of oil will result in flashovers that will damage the equipment and may cause severe personal injury. G104.0

WARNING: Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply may result in death, severe personal injury, and/or equipment damage. G111.0

CAUTION: This equipment requires routine inspection and maintenance to ensure proper operation. If it is not maintained it may fail to operate properly. Improper operation may cause equipment damage and possible personal injury. G105.0

CAUTION: Follow all locally approved safety practices when lifting and mounting the equipment. Use the lifting lugs provided. Lift the load smoothly and do not allow the load to shift. Improper lifting may result in equipment damage. G106.0

CAUTION: Radiation. At voltages up to the specified test voltages, the radiation emitted by the vacuum interrupter is negligible. However, above these voltages, radiation injurious to personnel may be emitted. See *Service Information S280-90-1, Vacuum Interrupter Radiation Warning*, for further information. G109.0

Additional Information

These instructions do not claim to cover all details or variations in the equipment, procedures, or process described, nor to provide directions for meeting every possible contingency during installation, operation, or maintenance. When additional information is desired to satisfy a problem not covered sufficiently for the user's purpose, please contact your Cooper Power Systems sales engineer.

SHIPMENT AND ACCEPTANCE

Each sectionalizer is completely assembled, inspected, tested, and adjusted at the factory and is filled to the correct level with insulating oil. It is in good condition when accepted by the carrier for shipment. Upon receipt of a sectionalizer:

1. Inspect the sectionalizer thoroughly for damage and loss of parts or oil incurred during shipment. If damage or loss is discovered, file a claim with the carrier immediately.
2. Check for oil leakage and tighten all bolts that may have been loosened during shipment, especially the bolts attaching the head to the tank.

HANDLING AND STORAGE

General

If the sectionalizer is to be stored for an appreciable time before installation, provide a clean, dry storage area. Locate the sectionalizer so as to minimize the possibility of mechanical damage. In particular, protect the bushings and keep the operator cabinet closed to protect the electronic control components.

Control Battery Charging and Storage

The control battery is fully charged just prior to shipment and is ready for use. However, storage for the length of time will cause the battery to gradually lose its storage. Loss of charge accelerates with increase in ambient temperature.

For trouble-free performance, it is highly recommended that the battery be kept on trickle charge (approximately 15mA) until the control is put into service, especially if it is to be in transit and/or storage for more than 30 days. The battery can tolerate a continuous trickle charge of 15mA indefinitely without damage.

Unless the battery is known to be fully charged, it is recommended that it be charged 50mA for 48 hours and then maintained at 15mA until the control is out of service.

Like the control cabinet heater, the battery can be kept charged by energizing the battery charger in the control with 120Vac applied to Terminals 5 and 6 of the input terminal strip.

NOTE: When shipped from the factory, the battery is disconnected and the output plug is taped to the side of the battery, Connect the battery plug into the mating receptacle below the battery to complete the battery circuit.

CAUTION: Electrical shock hazard. Be sure the grounded side of the 120 Vac auxiliary power circuit is connected to the terminal labeled COMMON AC GND (usually terminal 5). A 120 Vac short-to-ground will exist if the input connections are reversed. Failure to comply could result in personal injury and equipment damage. T219.0

If it is not convenient to apply 120Vac power to a stored control, the battery can be removed from the control cabinet and charged on the bench with a dc source which supplies approximately 15mA charging current to the battery. A dual-rate portable trickle charger, Catalog No. KA1142ME3, is available for this purpose. It provides a selectable output of either 15mA for maintaining a charged battery. This unit plugs into a standard 120Vac receptacle and has an output plug at the end of a 4-foot cord which mates with the battery plug.

DESCRIPTION

The sectionalizer is a self-contained, circuit-opening device used in conjunction with source-side protective devices such as reclosers or circuit breakers, to automatically isolate faulted sections of electrical distribution systems. The sectionalizer senses current flow above a preset level, and when the source-side protective device opens to de-energize the circuit, the sectionalizer counts the overcurrent interruption. Depending upon the coordination scheme, the sectionalizer will open during the first, second, and third open interval of the fault interrupting device to isolate permanent faults and confine outages to smaller sections of line.

The sectionalizer does not interrupt fault current but can be closed into a faulted line. It opens during the open interval of the backup device. For this reason, it must always be used in series with a fault-interrupting backup protective reclosing device. Also, it will reset counts that do not reach the counts-to-open setting within the selected reset time due to clearing of temporary faults.

A minimum of 0.5 amps of load current flowing through the sectionalizer will block the generation of a count pulse. This “count-restraint” feature prevents the sectionalizer from counting overcurrents interrupted by down-line devices.

The sectionalizers are also equipped with an inrush-current restraint feature which distinguishes between inrush currents and fault currents. If it is determined that the overcurrent through the sectionalizer is inrush current, the phase and ground current levels of the sectionalizer are blocked for a duration of 3 seconds upon current detection.

Ratings

Tables 1 and 2 show rating information for the Type GWC sectionalizer.

Table 1
Basic Sectionalizer Ratings

	Type GWC
Nominal Voltage (kV)	34.5
Rated Maximum Voltage (kV)	38.0
Impulse Withstand 1.2 x 5.0 microsecond wave BIL (kV)	150
60 hertz withstand	
Dry, 1 minute (kV)	70
Wet, 10 seconds (kV)	60
Continuous Current Rating (amps)	400
Rated symmetrical interrupting current (amps rms)	880
Rated making current, asymmetrical (amps rms)	15000
Short-time ratings (amps rms)	
10-seconds symmetrical	3500
1-second symmetrical	10000
Momentary maximum, asymmetrical (amps rms)	15000

Table 2
Operating Data

Phase-minimum-actuating current (amps)	16, 24, 40, 56, 80, 112, 160, 224, 256, 296, 320, 448, 480, 640
Ground-minimum-actuating current (amps)	3.5, 7, 16, 20, 28, 40, 56, 80 112, 160, 224, 320, BLOCK
Number of counts to open	1, 2, 3
Count reset (seconds)	15, 30, 60, 90, 120, 180

Dimensions and Weights

Figure 2 shows essential dimensional information for a Type GWC sectionalizer, along with its weight and oil capacity.

Operating Controls

The operating controls of the sectionalizer are located on the front panel, within the control cabinet, as shown in Figure 3.

Remote Control Switch

In the ON position, this switch permits the sectionalizer to be operated by remotely located “dry” contacts which are wired to a terminal block in the control cabinet. Separate normally-open contacts are required for the open and close operation.

In the OFF position, this switch disables remote control but *does not* prevent automatic operations (by means of the control panel switches).

An extra set of contacts on this switch can provide switch position information to the remote location.

115Vac - 5amp Breaker Switch

In the ON position, this switch energizes all 115Vac power to the control cabinet and the operating housing of the sectionalizer.

Manual Control Switch

While in the TRIP position, the sectionalizer main contacts are open and the closing circuit is disabled.

When placed in the CLOSE position, the sectionalizer closing circuit is energized, the closing solenoid will be momentarily energized and the sectionalizer will close.

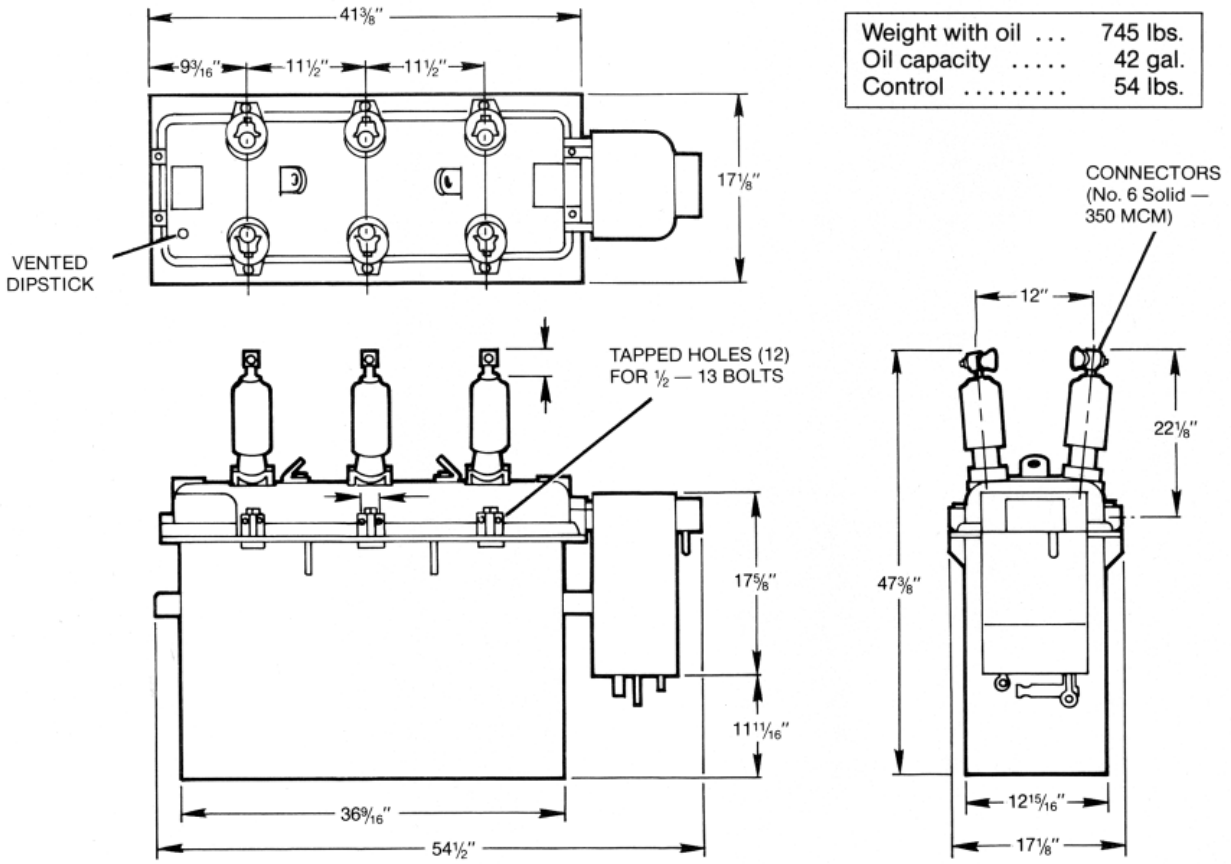


Figure 2.
Type GWC Sectionalizer.

One Count-to-Open Switch

When set to the ONE COUNT TO OPEN position, the sectionalizer will open on the completion of the first overcurrent count. This feature provides added safety during downline hot-line work. The operation of this switch also cancels out any accumulated memory time and resets the count to zero.

Lamp Test Contact Position Switch

When set to CONTACT POSITION, this momentary contact, center-off switch energizes the appropriate lamp to indicate the position of the main contacts in the sectionalizer; green lamp indicates open, the red lamp indicates closed.

In the LAMP TEST position, both lamps are energized to check their condition.

Battery Test Terminals

The battery test terminals enable convenient checking of the battery voltage, charging rate and battery quiescent drain current.

Battery Load Test

This switch is used in conjunction with the BATTERY TEST TERMINALS. While checking battery voltage, pressing this button connects a 10 ohm load resistor over the battery, allowing measurement of loaded battery voltage.

Manual Trip Lever

In addition to the controls described above, a manually operated trip lever is located on the underside of the operator cabinet. Capable of being operated with a hookstick, this lever will mechanically trip the operating mechanism to open the sectionalizer.

Once pulled down, the lever stays down and disables the closing circuit to block closing of the sectionalizer. The lever must be returned manually to its “UP” position to re-activate the closing circuit.

INDICATING DEVICES

In addition to the contact position indicator lamps on the control panel; a contact position indicator and an operations counter are located under the sleet hood, on the mechanism operator cabinet.

The yellow contact position indicator is pinned to the main operating shaft of the sectionalizer to indicate the OPEN and CLOSED condition of the main contacts.

The operations counter gives a visual indication of the cumulative number of openings of the unit.

SETTINGS

The operating characteristics are preset to customer specifications and tested prior to shipment from the factory. However, if the sectionalizer is relocated or the coordination scheme is modified, the operating characteristics can be easily changed in the field. The settings should be checked before the unit is put into service. All settings are located on the printed circuit board mounted on the control front panel. See Figure 3.

NOTE: Before changing the trip resistor settings, the sectionalizer must be bypassed and de-energized.

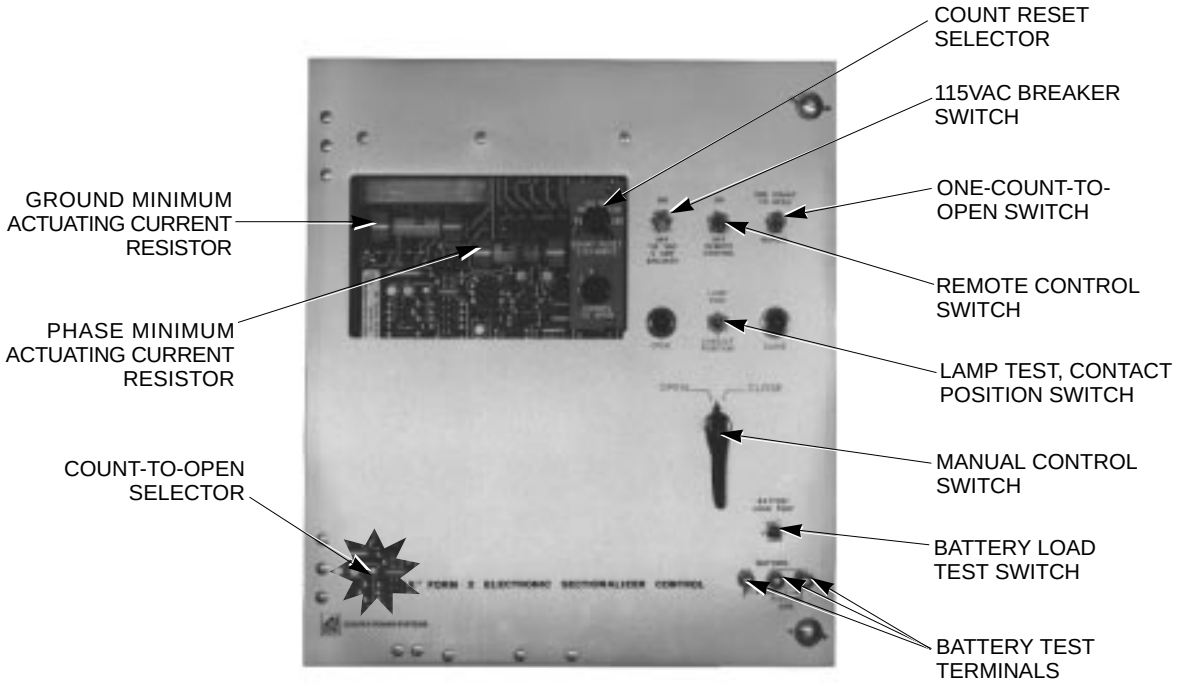


Figure 3.
Operator Control Panel.

Minimum Actuating Current

The minimum actuating current levels for both phase and ground are determined by the selection of the proper plug-in resistors. (Normally these settings are approximately 80 percent of the minimum trip settings of the backup protective device.)

NOTE: If the backup device is not equipped for ground fault sensing and tripping, the ground current sensing circuits of the sectionalizer can be de-activated by using a shorting resistor labeled "BLOCK".

Phase current resistors are identified with the phase symbol (ø) and the actuating current value in amps. Catalog numbers for the available phase current resistors are listed in Table 3.

Table 3
Minimum Actuating Resistor (Phase)

Label Value (amps)	Resistance (ohms)		Catalog Number
	Minimum	Maximum	
16	264	270	KA176GV16
24	172	176	KA176GV24
40	94.3	96.3	KA176GV40
56	66.3	67.7	KA176GV56
80	47	48	KA176GV80
112	32.6	33.4	KA176GV112
160	22.9	23.5	KA176GV160
224	16.3	16.7	KA176GV224
256	13.8	14.2	KA176GV256
296	11.9	12.3	KA176GV296
320	11.1	11.5	KA176GV320
448	8.1	8.3	KA176GV448
480	7.4	7.6	KA176GV480
640	5.5	5.7	KA176GV640

Table 4
Minimum Actuating Resistor (Ground)

Label Value (amps)	Resistance (ohms)		Catalog Number
	Minimum	Maximum	
3.5	6.91K	7.05K	KA177GV3
7	1.168K	1.192K	KA177GV7
16	379.0	387.0	KA177GV16
20	298.0	304.0	KA177GV20
28	200.0	204.0	KA177GV28
40	135.63	138.37	KA177GV40
56	94.3	96.3	KA177GV56
80	66.3	67.7	KA177GV80
112	47.0	48.0	KA177GV112
160	32.6	33.4	KA177GV160
224	22.9	23.5	KA177GV224
320	15.8	16.2	KA177GV320
BLOCK	0	0.1	KA177GVBLO

Ground current resistors are identified with the ground symbol (⏚) and the actuating current value in amps. Catalog numbers for the available ground current resistors are listed in Table 4.

The minimum actuating current of the sectionalizer for both phase and ground can be changed by merely changing the appropriate plug-in resistor.

Counts-to-Open

The counts-to-open setting is determined by the position of the COUNTS-TO-OPEN SELECTOR switch. Switch positions 1, 2, and 3 correspond to 1, 2, or 3 counts to open. Normally this setting is one less than the number of operations to lockout of the backup protective device. To change the number of counts-to-open setting, merely change the position of the rotary switch.

Count Reset

The reset setting is determined by the position of the COUNT RESET switch. Reset times of 15, 30, 60, 90, 120, and 180 seconds are available. This feature resets to zero, and any accumulated counts are cancelled whenever current, below the minimum actuation level, flows through the sectionalizer without interruption for longer than the time programmed.

The reset feature will operate with any current flow from minimum load (5 amps) to values below phase or ground pickup levels.

Count Restraint

The count-restraint feature blocks the sectionalizer from generating a count pulse as long as 0.5 amps of load current flows through the sectionalizer.

Inrush-Current Restraint

The inrush-current restraint feature blocks the phase and ground actuating levels for three seconds after current flow through the sectionalizer has been restored and the overcurrent has been determined to be inrush current.

The three-second time interval allows for system inrush parameters to stabilize prior to allowing the sensitivity of the sectionalizer to return to its programmed state.

Response Time

For backfed motor contribution and unsymmetrical clearing of upline faults, a response time is built into the sectionalizer control to eliminate unwanted counting of these situations. Upon detection of any current above the phase or ground actuating setting, the current must exceed the response time characteristics as illustrated in Figure 4. Total clearing time of reclosers and breakers must exceed the response time characteristics of the sectionalizer.

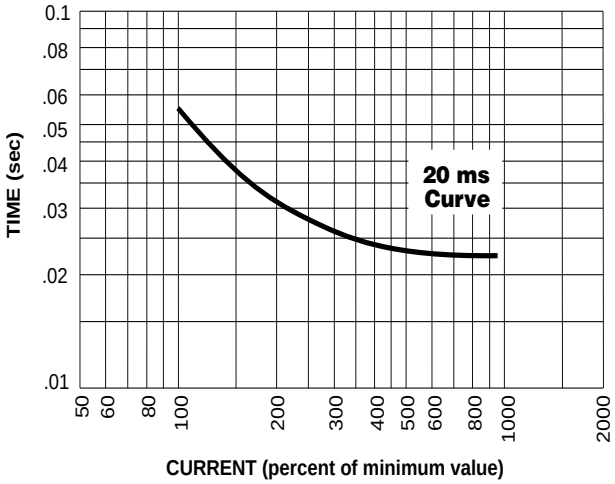


Figure 4.
Maximum Response-Time Characteristic.

INSTALLATION

WARNING: Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply may result in death, severe personal injury, and/or equipment damage. G111.0

Preliminary Checks

Make sure the oil in the tank is at the proper level by checking the vented dipstick in the head casting. Replenish any loss with new, dry transformer oil.

If the switch has been stored for any length of time or is being relocated, check the dielectric strength of the oil in accordance with ASTM-approved testing procedures. Physical properties of the oil used in Kyle® distribution switchgear is found in Reference Data R280-90-1.

1. In new equipment, the oil must have a minimum dielectric strength of 26kV. If less than 26kV, filter the oil to restore its dielectric strength to an acceptable level.
2. If the equipment has been in service and is being relocated, the minimum dielectric strength of the oil must be at least 22kV. If less than 22kV, or if the oil is contaminated with carbon or sludge, replace the oil.
3. Check that the actual settings agree with the sectionalizer nameplate and are correct for the planned installation.

Lifting the Sectionalizer

Follow all approved safety practices when making hitches and lifting the equipment. Lift the load smoothly and do not allow the load to shift.

This unit has two lifting lugs - **both must be used when lifting the sectionalizer**. Maximum strength is attained with a vertical lift attached to the lugs. Use a spreader bar with a fixed attachment point for the hook at the load center.

If a sling is used, it must have a fixed attachment point at the load center. Rig the load so that the sling height is equal to, or greater than the distance between lifting lugs. See Figure 4.

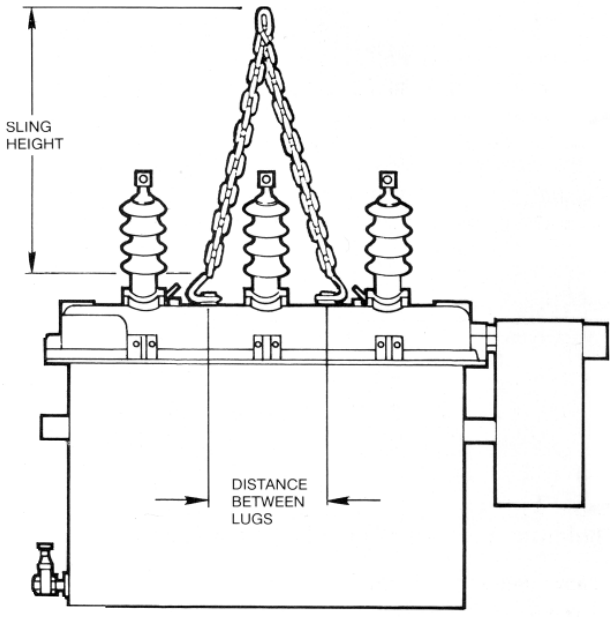


Figure 4.
Lifting the Sectionalizer.

Mounting the Sectionalizer

Figure 5 shows installation using a Kyle mounting frame. If other mounting means are used, support the sectionalizer with the twelve 1/2-13 threaded holes tapped into the sides of the casting.

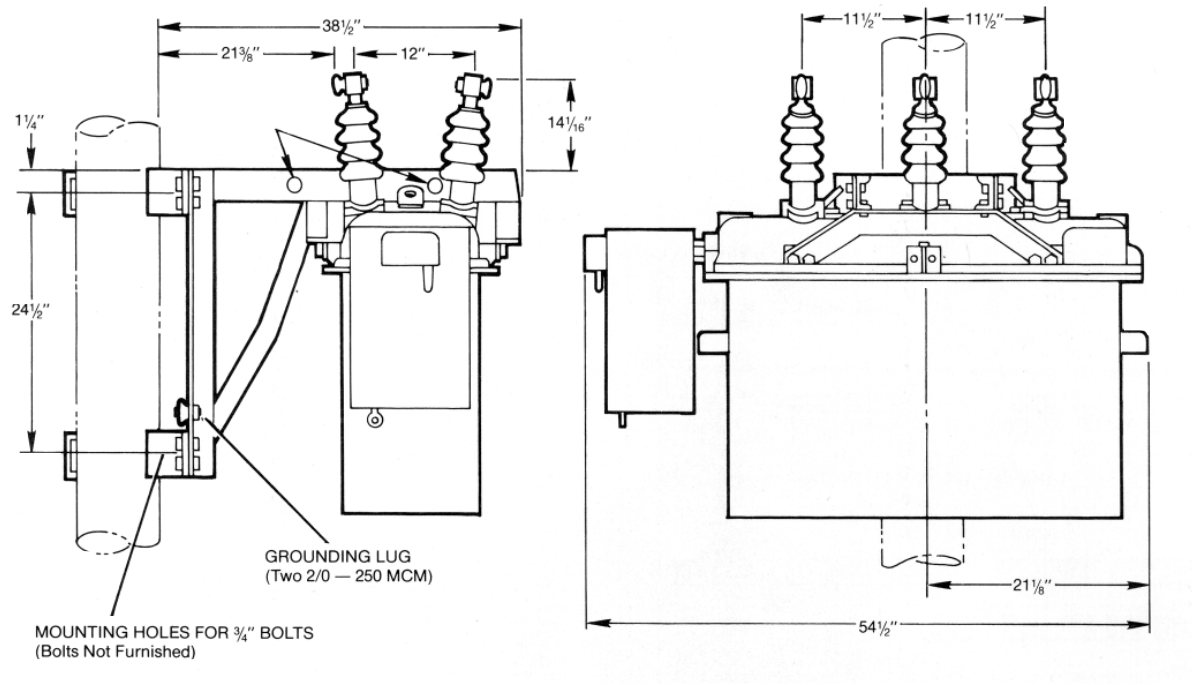


Figure 5.
Type GWC Sectionalizer in KA146W3 Pole-Mounting Hanger.

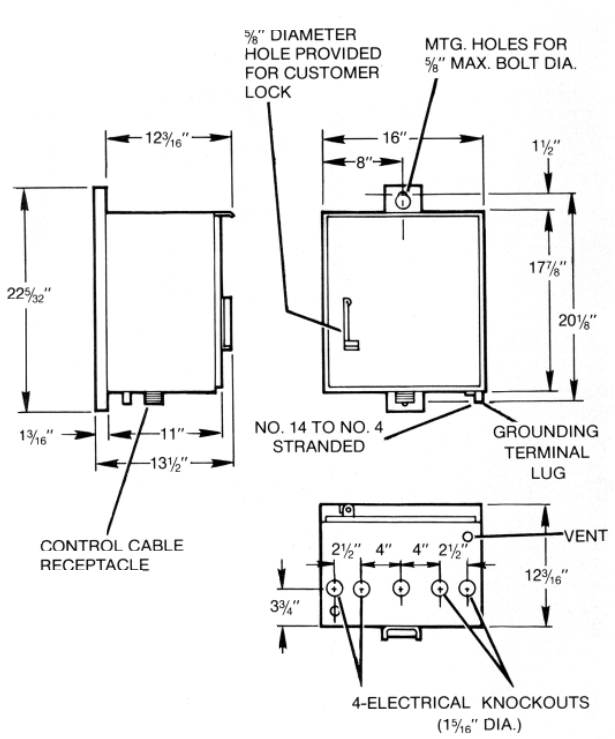


Figure 6.
Standard Cabinet Mounting Dimensions.

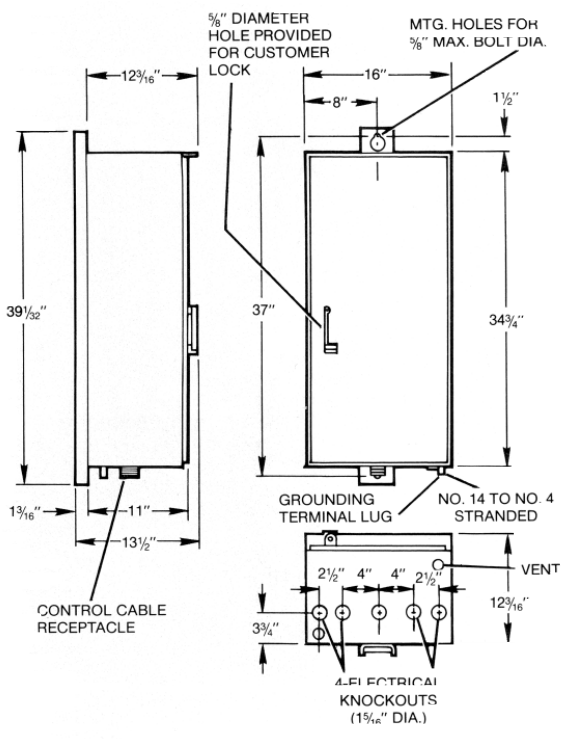


Figure 7.
Double-size Cabinet Mounting Dimensions.

Mounting the Control

Remotely mounted, the Electronic Sectionalizer Control can be located at any convenient, accessible location near the sectionalizer. The 35-foot control cable limit determines the maximum distance between the control and sectionalizer.

1. For pole mounted installations, the control is normally mounted near the base of the pole.
2. For substation installations, brackets are available as a mounting frame accessory for mounting the control to the substation frame.

Outline, mounting, and knockout dimensions are shown in Figure 6 for the standard control cabinet and Figure 7 for the double-size control cabinet.

Grounding the Control

The control cabinet **must** be grounded. A grounding connector on the underside of the cabinet will accommodate No. 14 solid through No. 4 stranded conductors (Figures 6 and 7). Be sure to follow all locally approved grounding procedures when installing the control.

NOTE: If the control is mounted on a sectionalizer frame, which itself is grounded, a separate lead from the cabinet to earth ground is not required, but may be added.

The installation must include the following:

1. Protect sectionalizer and transformer with lightning arresters.
2. Ground the transformer tank.
3. Ground the sectionalizer head.
4. Secondary cables must be Triplex or shielded cables.

Control Cable

A 7-foot cable is furnished as standard with the control sectionalizer package. This length is sufficient for most installations. For other installations, cable lengths, as specified on the order are provided.

The cable is fabricated with connectors which mate with the receptacles on the sectionalizer and the control.

NOTE: Adequately support the control cable along its length to prevent repeated movement due to wind or other outside forces which can damage the cable.

CAUTION: This control is equipped with a voltage restraint feature which prevents the control from counting overcurrent interruptions unless the auxiliary voltage is also interrupted. Therefore, the auxiliary power must be obtained from the load side of the upline backup protective device so that the control is energized only when the backup is closed. Failure to follow this precaution will prevent proper operation of the sectionalizer. T219.0

AUXILIARY POWER

All Type GWC sectionalizers require 120Vac auxiliary power to operate. The 120Vac supply operates the spring charging motor, the closing solenoid, the battery charger and the voltage restraint circuit.

Auxiliary power connections and connections from remote operation are made on a 19-point terminal strip mounted vertically on the back of the control. Figure 8 shows the customer connection terminals. However, deviations may occur to accommodate certain combinations of accessories. All terminals for required connections are clearly marked.

CAUTION: Electrical shock hazard. Be sure the grounded side of the 120 Vac auxiliary power circuit is connected to the terminal labeled COMMON AC GND (usually terminal 5). A 120 Vac short-to-ground will exist if the input connections are reversed. Failure to comply could result in personal injury and equipment damage. T219.0

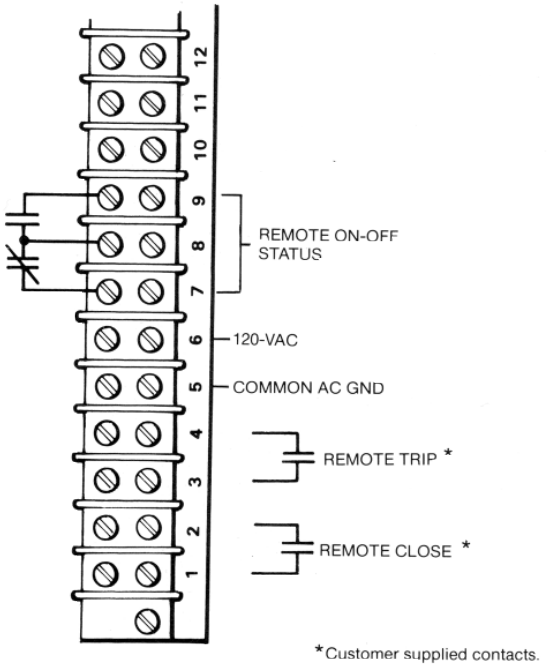


Figure 8.
Customer Connections Terminal Strip.

Main Wiring

It is desirable to provide the sectionalizer with switches and protection as shown in Figure 9. Surge protection on both sides of the sectionalizer is recommended.

The universal clamp-type terminals used for main line connections accept No. 2 solid through 350-mcm copper or aluminum cables.

The grounding clamp for the Type GWC sectionalizer is located on the mounting frame; it accommodates 2/0 through 250-mcm cable.

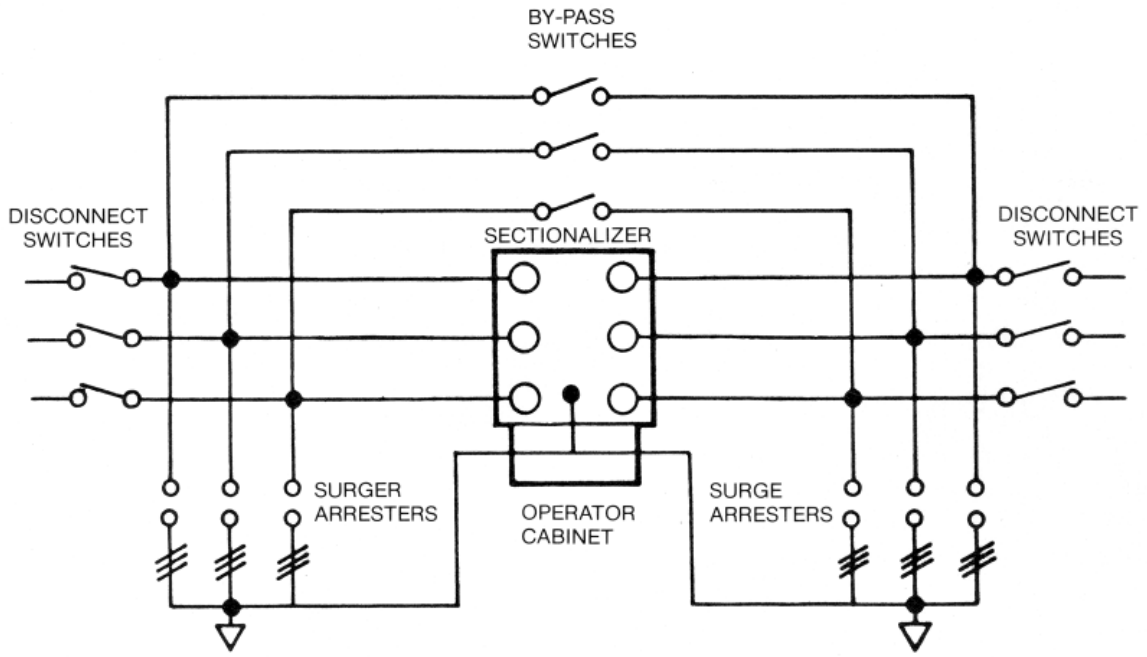


Figure 9.
Main Wiring connections.

INTERCONNECTION WIRING DIAGRAM

Figures 10 and 11 show the interconnection wiring of both the sectionalizer and the sectionalizer control.

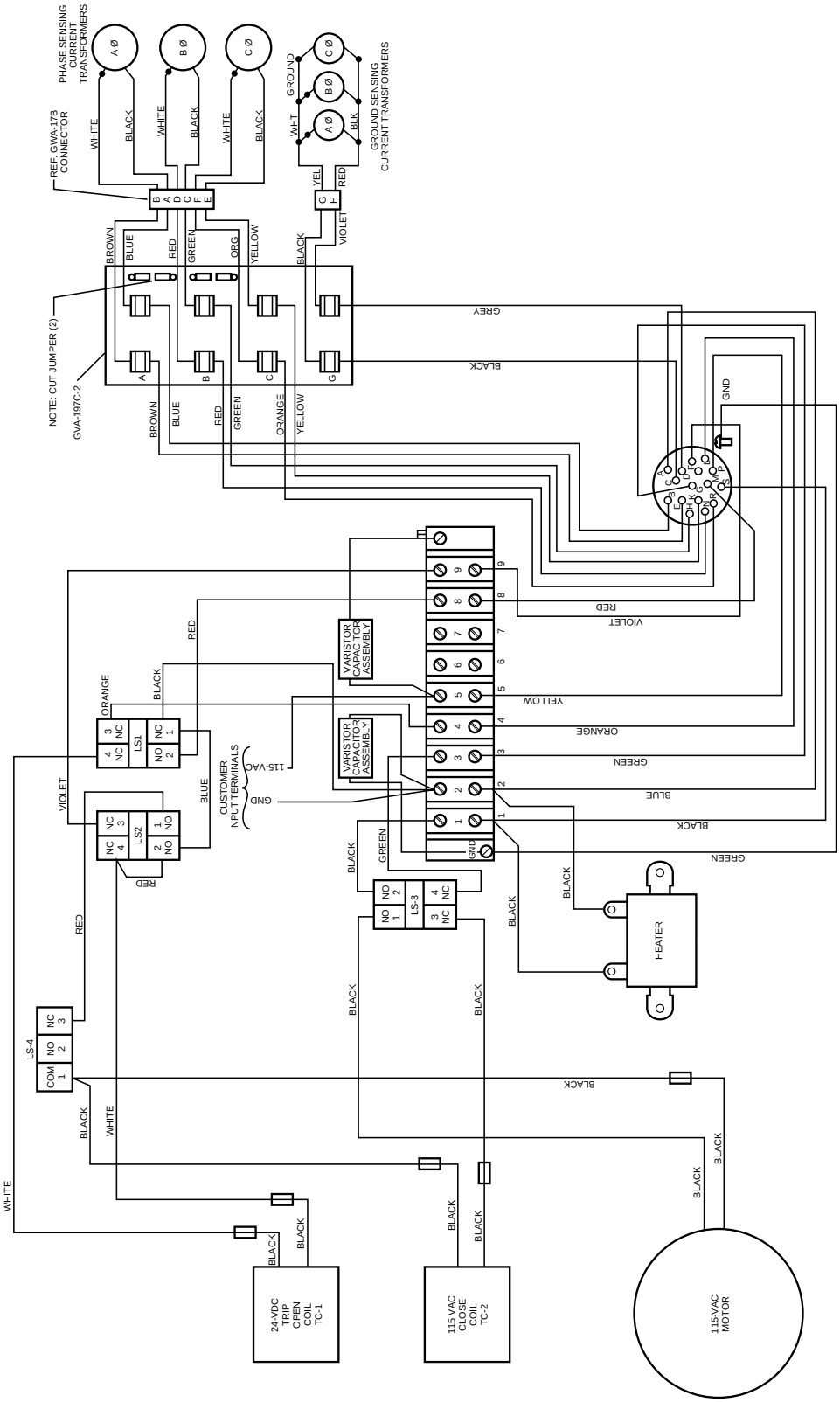


Figure 10.
Type GWC sectionalizer interconnection diagram.

"HTR" HEATER ASSEMBLY		
Term	To	Color
1	TB1-11	BRN
2	TB2-2	BRN

"BC" BATTERY CHARGER		
Term	To	Color
1	TB2-2	WHT
1	BC-4	WHT
2	TB1-17	RED
2	BP(+)	RED
3	TB1-10	BRN
3	X-3	BRN
4	BC-1	WHT
4	X-4	WHT

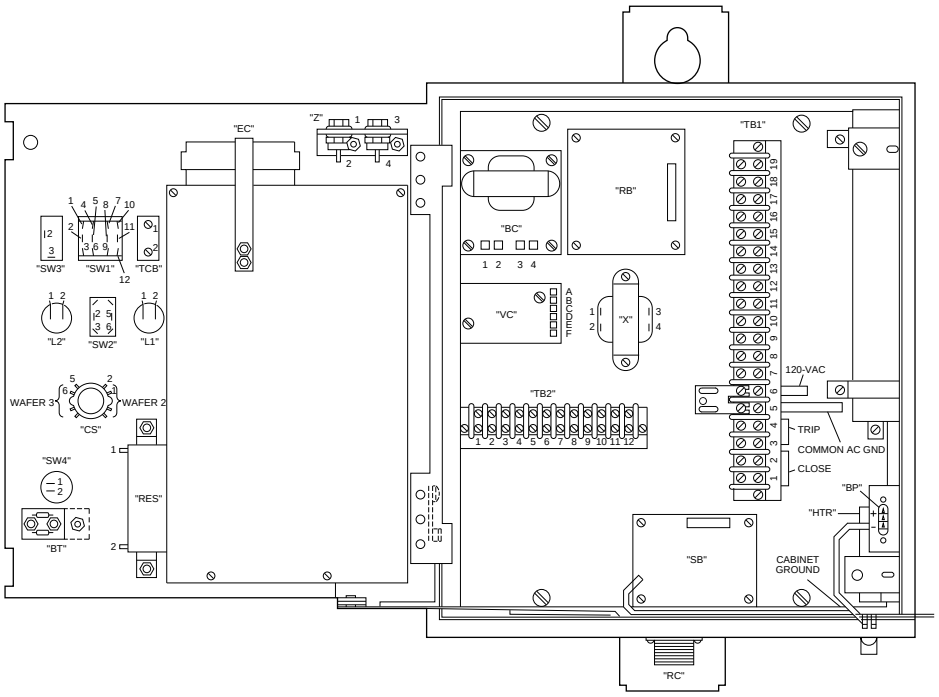
"X" TRANSFORMER 120/25 VAC		
Term	To	Color
1	VC-A	YEL
2	VC-B	GRN
3	BC-3	BRN
4	BC-4	WHT

"TCB" 5A CIRCUIT BREAKER		
Term	To	Color
1	TB1-6	RED
2	TB1-11	BRN

"RB" RELAY BOARD		
Term	To	Color
1	TB1-5	BRN
2	TB1-10	RED
3	TB1-14	ORG
4	TB1-13	YEL
5	TB1-17	GRN
6	TB1-2	BLU
7	TB1-15	VIO
8	TB1-12	GRY
9	TB1-16	WHT
10	TB1-18	BLK
11	TB2-10	WHT /BRN
12		
13	TB1-19	WHT /RED

"RC" RECEPTACLE		
Pin	To	Color
A	SB-1	BRN
B	SB-2	RED
C	SB-3	ORG
D	SB-4	YEL
E	SB-5	GRN
F	SB-16	BLU
G	SB-14	GRN
H	SB-6	BLU
K	SB-7	VIO
L	SB-13	YEL
M	SB-12	ORG
N	SB-8	GRY
P	SB-11	RED
R	SB-9	WHT
S	SB-10	BRN

"SW1" REMOTE ON/OFF		
Term	To	Color
2	CS-5	BRN
3	TB1-3	VIO
5	L2-1	RED
6	TB1-1	BLU
10	TB1-9	ORG
11	TB1-8	YEL
12	TB1-7	GRN



"VC" VOLTAGE CHARGING BOARD		
Term	To	Color
A	X-1	YEL
B	X-2	GRN
C	GND	WHT
D	EC-18	ORG

"BT" BATTERY TERMINALS		
Term	To	Color
1	Z-1	WHT
1	SW2-3	WHT
2	RES-2	BLK
3	SW4-2	RED
3	TB1-17	RED

"SW2" LMP. TEST and CONTACTOR POS.		
Term	To	Color
1	CS-6	BLK
2	L2-2	ORG
3	BT-1	WHT
3	SW2-6	WHT
4	TB1-12	GRY
5	L1-2	YEL
6	SW2-3	WHT
6	TB2-1	WHT

"CS" PISTOL GRIP SWITCH			
Term	Wafer	To	Color
1	2	L1-1	RED
1	2	SW4-2	RED
2	2	TB1-2	WHT /RED
5	3	TB1-16	WHT /BRN
5	3	SW1-2	BRN
6	3	TB1-4	BLK
6	3	SW2-1	BLK

"RES" BATTERY TEST RESISTOR		
Term	To	Color
1	SW4-1	BRN
2	BT-2	BLK
2	BP(-)	BLK

"EC" EDGE CONNECTOR		
Term	To	Color
2	Z-4	RED
3	Z-1	WHT
7	TB2-4	WHT
8	TB2-5	GRY
14	TB2-8	VIO
15	TB2-7	BLU
16	TB2-6	GRN
17	TB2-3	YEL
18	VC-D	ORG
19	TB1-18	RED
20	SW3-2	WHT
21	TB1-19	BRN
22	SW3-3	BLK

"BP" BATTERY PLUG		
Term	To	Color
+	BC-2	RED
—	RES-2	BLK

CABINET GROUND	
From	Color
Receptacle Mtg. Screw	GRN
SB-GND	GRN
Back Panel	GRN

"Z" ZENER DIODE ASSEMBLY		
Term	To	Color
1	EC-3	WHT
1	BT-1	WHT
2	Z-3	BLK
3	Z-2	BLK
4	EC-2	RED
4	TB2-10	RED

"SB" SURGE BOARD			
Term	From	To	Color
1	RC-A	TB2-1	BRN
2	RC-B	TB2-3	RED
3	RC-C	TB2-4	ORG
4	RC-D	TB2-5	YEL
5	RC-E	TB2-9	GRN
6	RC-H	TB2-6	BLU
7	RC-K	TB2-7	VIO
8	RC-N	TB2-8	GRY
9	RC-R	TB2-9	WHT
10	RC-S	TB1-10	BRN
11	RC-P	TB1-6	RED
12	RC-M	TB1-12	ORG
13	RC-L	TB1-13	YEL
14	RC-G	TB1-14	GRN
15			
16	RC-F	TB1-15	BLU
GND		CAB. GND	GRN

CUSTOMER CONNECTIONS		
Function	Term	Customer Supply
"SW1" T	TB1-9	REMOTE
	B1-8	ON-OFF
	TB1-7	STATUS
Motor, close Coil, Heater & Battery Charger	TB1-6	120 Vac
	TB1-5	Common AC GND
REMOTE TRIP	TB1-4	
	TB1-3	TRIP
REMOTE CLOSE	TB1-2	
	TB1-1	CLOSE

"TB2" TERMINAL BLOCK				
Color	Bottom	Term	Top	Color
BRN	SB-1	1	TB2-2	BLK
WHT	SW2-6	1	TB1-5	BRN
		2	TB2-1	BLK
BRN	HTR-2	2	BC-1	WHT
RED	SB-2	3	EC-17	YEL
ORG	SB-3	4	EC-7	WHT
YEL	SB-4	5	EC-8	GRY
BLU	SB-6	6	EC-16	GRN
VIO	SB-7	7	EC-15	BLU
GRY	SB-8	8	EC-14	VIO
		8	TB2-9	BLK
GRN	SB-5	9	TB2-8	BLK
WHT	SB-9	9		
RED	Z-4	10	RB-11	WHT /BRN

Figure 11.
Type GWC control interconnection diagram.

ACCESSORIES

Auxiliary Switch (KA102GV1)

The auxiliary switch, mounted to the top of the operator cabinet, in a weather-proof housing, is used for relaying or interlocking schemes and for remote contact indication.

Two switch stages are provided. Each stage consists of two independent contact assemblies with either “a” (normally open) or “b” (normally closed) contacts which can be easily changed in the field. A data plate attached to the switch cover shows the switch arrangement. Related switch contact positions are shown in Table 5.

The switch is permanently wired to a multi-pin receptacle in the bottom of the mechanism operator cabinet. Table 6 shows the pin arrangement of the the mating plug shown in Figure 12.

Table 5
Related Switch Contact Positions

When Sectionalizer Contacts Are	Closed	Open
Auxiliary “a” contacts are.....	Closed	Open
Auxiliary “b” contacts are.....	Open	Closed

The switch contacts are insulated for 600 volts and have a continuous current rating of 10 amps. Their interrupting ratings are shown in Table 7.

Switching positions can be changed from “a” or “b” operation by repositioning the cams inside each switch section. To change any cam position:

1. Remove the auxiliary switch cover.
2. Detach the switch from the switch link by removing the groove pin and C-rings.
3. Remove the machine screws attaching the assembly to the cabinet.
4. With the switch removed, unfasten the two hex nuts and lockwashers from the long machine screws that hold the switch sections together.
5. Starting with the rear switch section, lift the cams off the operating shaft, replacing the cams in one of the positions shown in Figure 13.
6. Reassemble the switch sections, as removed, and remount the switch on the sectionalizer.

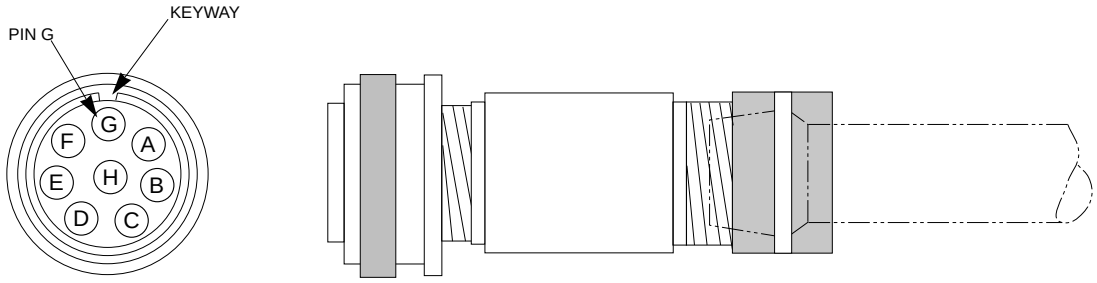


Figure 12.
Auxiliary Switch Connector Plug.

Table 6
Switch Leads to Receptacle Terminals

Switch Stages	Switch Terminal	Receptacle Pin	Switch Contact
Stage 1	1	A	“b”
	2	B	
	3	C	“a”
	4	D	
Stage 2	5	E	“b”
	6	F	
	7	G	“a”
	8	H	

Table 7
Interrupting Ratings - Switch Contacts

Volts	Inductive ac (amps)	Non-Inductive ac (amps)	Inductive dc (amps)	Non-Inductive dc (amps)
24dc	—	—	15	20
48dc	—	—	7.5	10
120ac	60	80	—	—
125dc	—	—	1.5	2
240ac	30	60	—	—
250dc	—	—	0.45	0.5

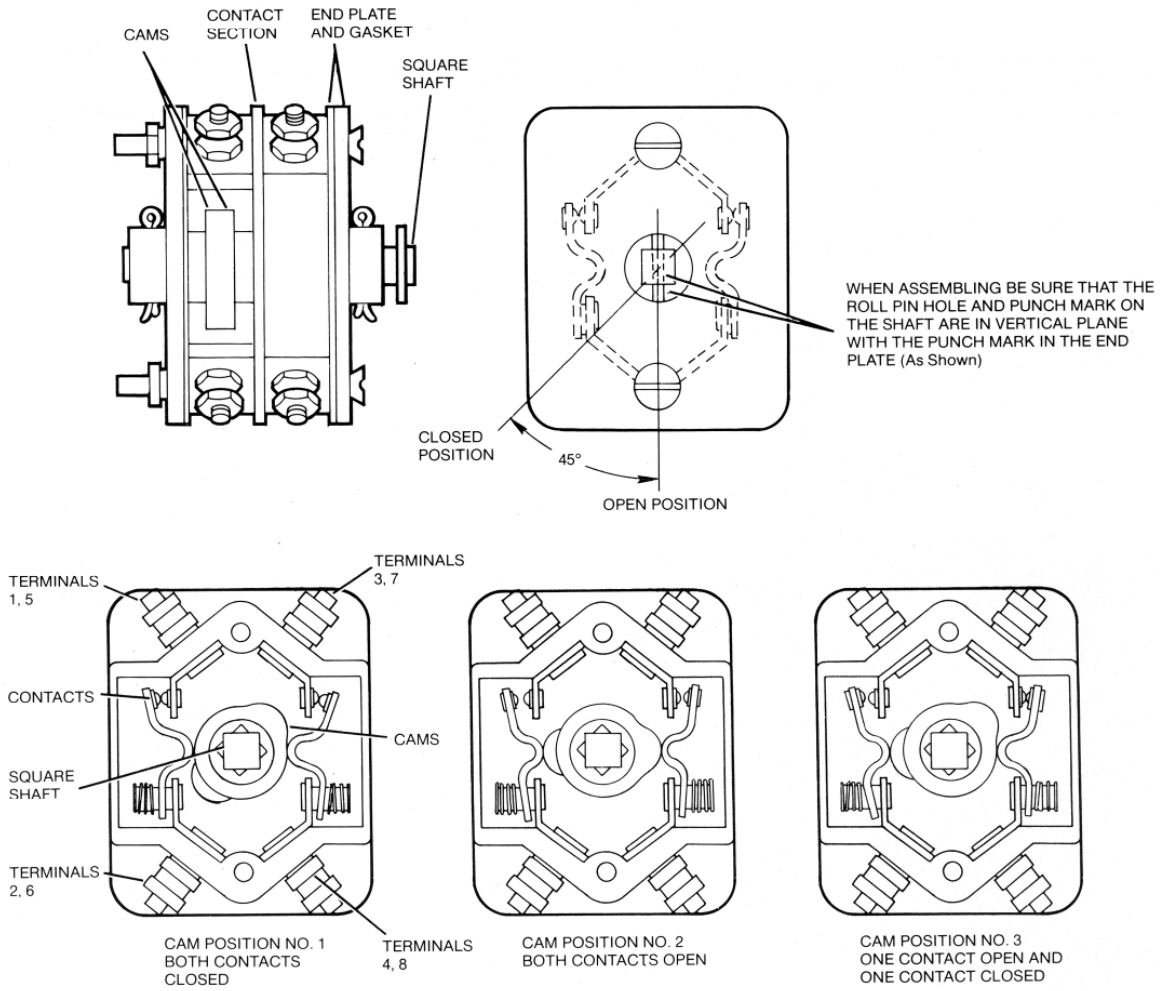


Figure 13.
Cam Positions inside the Auxiliary Switch.

Bushing-Type, Multi-Ratio Current Transformers

The multi-ratio current transformers have only one primary turn - the bushing rod. They are available with secondary windings that provide a primary/secondary-current ratio of 600:5. Different ratios can be obtained by connection to appropriate taps on the secondary windings. See Table 8.

OPERATING INSTRUCTIONS

Automatic Operation

Under normal operating conditions, the sectionalizer counts overcurrent interruptions. If the required number of counts are registered within the selected memory time, a relay contact closes, connecting the battery to a 24Vdc trip solenoid in the sectionalizer. The trip solenoid breaks the toggle latch mechanism, which releases the trip springs and opens the sectionalizer contacts.

Table 8
Bushing-Type, Multi-Ratio Current Transformer Ratios and Terminal Connection.

Ratio	Terminals
600:5	X1—X5
500:5	X2—X5
450:5	X3—X5
400:5	X1—X4
300:5	X2—X4
250:5	X3—X4
200:5	X4—X5
150:5	X1—X3
100:5	X1—X2
50:5	X2—X3

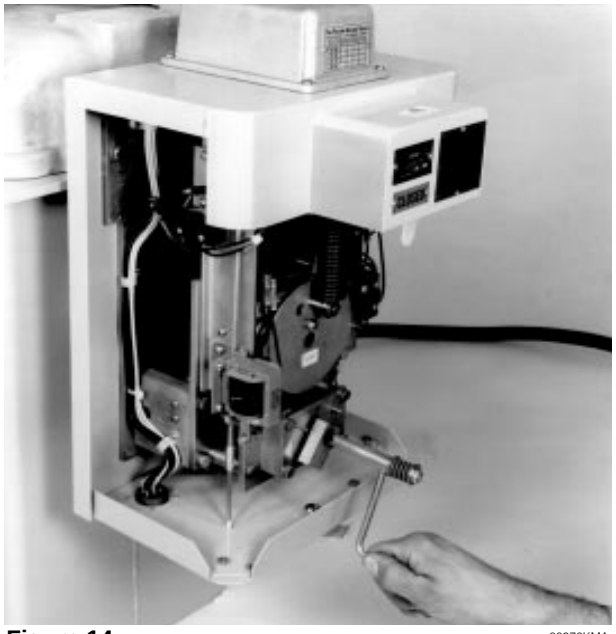
The sectionalizer's opening operation closes a switch which connects 115Vac power to the motor. The motor operates a gear reduction and lever mechanism to extend (charge) both the trip and closing springs and set the toggle latch.

Type GWC motor-operated sectionalizers do not close automatically. An electrical signal is required. The closing signal is initiated by moving the manual control switch to the “CLOSE” position, or closing a remotely located “dry” contact connected to Terminals 1 and 2 on the customer connection terminal strip.

The closing signal energizes a 115Vac solenoid which releases the charged closing springs to close the sectionalizer contacts.

Manual Electrical Operation

The sectionalizer can be electrically opened and closed by operating the manual control switch, in the control cabinet, to the “TRIP” or “CLOSE” position, or by closing remotely located “dry” contacts.



88972KMA

Figure 14.
Checking mechanism to manually charge the closing springs.

Manual Non-Electrical Operation

Manual non-electrical opening is accomplished by pulling down the manual trip lever located under the operator housing of the sectionalizer. Once pulled down, the manual trip lever stays down until manually returned. While the manual trip lever is down, manual and electrical closing is blocked.

Manual non-electrical closing is accomplished by cranking the operator shaft (Figure 14). Remove the cover from the operator housing, mount the crank handle (stored in the bottom of the housing) on the shaft and crank clockwise. When the closing spring drive stud reaches the 7 o’clock position, the closing spring will be fully extended and the mechanism will stop. Up to 42 cranking revolutions may be required. To close the sectionalizer, push the closing solenoid plunger up, into the solenoid, to release the closing spring.

CONTROL BATTERY

Power to operate the trip solenoid is provided by a 24-volt, nickel-cadmium battery located in the back, upper-right corner of the control cabinet. A 120Vac battery charger provides a constant trickle charge to the battery.

Battery Connections

When shipped from the factory, the battery is disconnected from the control and its output connector is taped to the side of the battery. Plug the connector into the mating receptacle located just below the battery to complete the battery circuit.

Battery Check

Three battery test terminals in the lower right corner of the panel (Figure 15) are used to check battery voltage and charging rate. If abnormal test readings are encountered, refer to the sectionalizer maintenance instructions.

NOTE: The control does not need to be connected to a sectionalizer for these battery check tests.

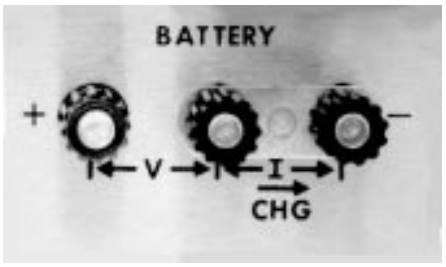


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Figure 15.
Battery Test Terminals.

The left hand pair of terminals (-V-) are connected directly across the battery output to check battery voltage. The red terminal (far left) is plus (+). The output voltage of a fully charged battery will normally be 26-28 volts. The BATTERY LOAD TEST switch on the control front panel places a 10 ohm resistor over the battery output. Press and hold this switch for approximately 5 seconds while observing battery voltage. Voltage must not drop by more than 3 volts from the no load voltage previously noted.

The right hand pair of terminals (-I-) are connected in series with the negative battery lead to check charging rate. Proceed as follows:

1. Make sure that the control is on by moving the manual control switch to “CLOSE”.
2. Plug-in a dc milliammeter into the current test terminals. Loosen both terminals slightly and disconnect the shorting link from between the terminals.
3. With the battery charger energized, current will flow in the direction shown by “CHG”. The charging rate will be approximately 17mA.

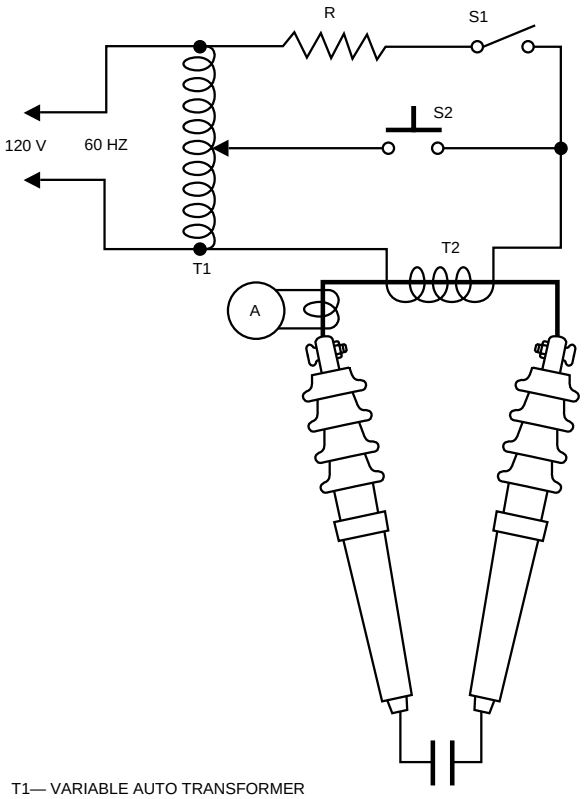
4. Replace and tighten the shorting link between the current terminals before removing the ammeter.

NOTE: Bypass diodes in the battery circuit prevent the control from being disabled if the link is inadvertently left open.

TESTING

Type GWC sectionalizers are carefully tested at the factory prior to shipment. Well-equipped test facilities, a detailed testing procedure, and trained test personnel assure that the unit will operate according to published data. Permanent records are kept of each sectionalizer's test performance.

Each sectionalizer leaves the factory ready for installation. Pre-installation testing is not necessary. However, should verification of operation prior to installation be desired, the following procedures should be used.



T1— VARIABLE AUTO TRANSFORMER
T2— 600:5 CURRENT TRANSFORMER
S1— SPST TOGGLE SWITCH
S2— SPST PUSHBUTTON SWITCH
R1— DROPPING RESISTOR, 2K-10 WATT
A — AMMETER

Figure 16.
Test Circuit Schematic.

Test Circuit and Equipment

A suggested test circuit is shown in Figure 16. In this test setup, the test current is obtained by back-feeding a 600:5 amp current transformer (located in the primary loop of one phase of the sectionalizer) from an adjustable 120Vac source. The ammeter scales should be selected to accommodate the appropriate range of test currents.

Pre-Test Procedures

Before performing any of the test procedures that follow, make sure the 120Vac power to the voltage charging board is disconnected to disable the voltage restraint feature. The sectionalizer will not count as long as the voltage restraint feature (part of the voltage charging board) is energized.

To disable the voltage charging board, disconnect X-3 and X-4 leads on the battery charger board.

Test Procedures

While performing the following tests, monitor the continuity between test points C and D, F and H. If no continuity exists between either set of test points upon closing of the sectionalizer, apply 6 amps of load current by closing switch S1 for 3.5 seconds. Once continuity has been restored, open S1 and proceed with the test procedures.

Minimum Actuating Current

The minimum actuating current can be verified by testing at the ± 10 percent values of the phase and ground actuating current ratings. For example, the minimum actuating resistor rated at 80 amps is tested at 72 amps (no count) and at 88 amps (count registered).

Phase Minimum Actuating Current

When checking the phase minimum actuating current, the ground fault sensing portion of the sectionalizer must be disabled. Testing an individual phase without disabling the ground sensing circuits will cause a false count.

The following procedure can be used:

1. Jumper the ground actuating current resistor with a short lead to disable the ground sensing circuit.
2. Jumper terminals P and D together.
3. Program the sectionalizer for one-count-to-open by setting the COUNTS-TO-OPEN selector switch to “1”.
4. Close the sectionalizer by operating the Manual Control Switch to “CLOSE”.
5. With the test circuit connected to phase A of the sectionalizer and S1 open, hold S2 closed and slowly raise the test current from zero to the appropriate value shown in Column A of Table 9. Hold S2 closed at this current for at least three seconds.
6. Release S2 to simulate a backup opening. The sectionalizer should not open.

7. Close S2 and adjust the test current to the appropriate value shown in Column B of Table 9.
8. Release S2 to simulate a backup opening. The sectionalizer should count the overcurrent interruption and open.
9. Repeat steps 3 through 7 for phases B and C.
10. Remove the jumper from terminals P and D.
11. Remove the jumper from across the ground actuating current resistor upon completion of this portion of the test.

Ground Minimum Actuating Current

To prevent the possibility of a false count, the phase sensing portion of the sectionalizer control circuit should be disabled when the ground minimum actuating current is being checked.

The following procedure should be used:

1. Jumper the phase actuating current resistor with a short lead to disable the phase sensing circuit.
2. Jumper terminals P and D together.
3. Check that the sectionalizer control is set for one-count-to-open.
4. Close the sectionalizer by operating the Manual Control Switch to “CLOSE”.
5. With the test circuit connected to phase A of the sectionalizer and S1 open, hold S2 closed and slowly raise the test current from zero to the appropriate value shown in Column A of Table 9. Hold S2 closed at this current for at least three seconds.

Table 9
Test Circuit Operating Limits for Actuating Current Settings

Actuating Current Setting (amps)	Column A Sectionalizer Must Not Count Below (amps)	Column B Sectionalizer Must Count At (amps)
3.5	3	4
7	6.3	7.7
16	14.4	17.6
20	18	22
24	21.6	26.4
28	25.2	30.8
40	36	44
56	50.4	61.6
80	72	88
112	101	124
160	144	176
224	201	247
256	230	282
296	266	326
320	288	352
448	403	483
480	432	528
640	576	704

6. Release S2 and simulate a backup opening. The sectionalizer should not open.
7. Close S2 and adjust the test current to the appropriate value shown in Column B of Table 9.
8. Release S2 to simulate a backup opening. The sectionalizer should count the overcurrent interruption and open.
9. Repeat steps 3 through 7 for Phases B and C.
10. Remove the jumper from terminals P and D.
10. Remove the jumper from across the phase actuating current resistor.

Count Restraint

The count restraint feature prevents erroneous counts of overcurrents interrupted by downline protective devices by blocking the counting operation as long as a minimum of 0.5 amps of uninterrupted line current flows through the sectionalizer.

The operation of the count restraint can be verified by superimposing an interruptible overcurrent on a constant minimum line current. The sectionalizer will not count or open on the interruption of the overcurrent as long as the minimum line current is not interrupted. To check the ground restraint feature, proceed as follows:

1. Jumper the ground actuating current resistor with a short lead to disable the phase sensing circuit.
2. Jumper terminals P and D together.
3. Check that the sectionalizer control is set for one-count-to-open.
4. Close the sectionalizer by operating the Manual Control Switch to “CLOSE”.
5. With the test circuit connected to phase A of the sectionalizer and S1 open, hold S2 closed (to simulate a constant load current of approximately 6 amps), hold S2 closed and raise the test current slightly above the appropriate value shown in Column B of Table 9. Hold S2 closed at this current for at least three seconds.
6. Release S2 and simulate a downline device clearing the overcurrent. The sectionalizer **should not** open, verifying the operation of the count restraint feature.
7. Open S1 and again close and adjust S2 to simulate a backup device clearing the fault. This time the sectionalizer should count the overcurrent interruption and open.
8. Remove the jumper from terminals P and D.

Voltage Restraint

When energized at 120Vac, the voltage charging board provides fast charging times for the trip energy storage capacitors. It also acts as a voltage restraint; the sectionalizer will not count an overcurrent interruption of the protective device unless the voltage at the control is also interrupted. To check the voltage restraint feature, proceed as follows:

1. Reconnect X-3 and X-4 leads to the battery charging board.
2. Jumper the ground actuating resistor with a short lead to disable the ground sensing circuit.
3. Jumper terminals P and D together.
4. Program the sectionalizer for one-count-to-open.
5. Close the sectionalizer by operating the Manual Control Switch to “CLOSE”.
6. With the test circuit connected to phase A of the sectionalizer and S1 open, close S2 and raise the current to slightly above the appropriate value shown in Column B of Table 9. Hold S2 closed at this current for at least three seconds.
7. Release S2 to simulate a downline device clearing the overcurrent. The sectionalizer **should not** open.
8. Disconnect X-3 and X-4 leads on battery charger boards.
9. Again close and release S2. The sectionalizer **should** open.
10. Remove the jumper from terminals P and D.

Number of Counts-to-Open

The number of counts-to-open can be verified by interrupting, the preset number of times, an overcurrent through the sectionalizer. For example, with the control set for three counts, the sectionalizer will open upon the third overcurrent interruption. Proceed as follows:

1. Jumper the ground actuating current resistor with a short lead to disable the ground sensing circuit.
2. Program the sectionalizer for three counts-to-open by setting the COUNTS-TO-OPEN SELECTOR switch to “3”
3. Close the sectionalizer by operating the Manual Control Switch to “CLOSE”.
4. With the test circuit connected to phase A of the sectionalizer and S1 open, close S2 and raise the test current to slightly above the appropriate value shown in Column B of Table 9. Hold S2 closed at this current for at least three seconds.
5. Open and close S2 a number of times. The sectionalizer should open upon the third opening of S2.
6. To verify the two-counts-to-open setting, set the COUNTS-TO-OPEN SELECTOR switch to “2” and repeat steps 3 through 5. The sectionalizer should open upon the second opening of S2.

Count Reset

The count reset feature resets the sectionalizer count to zero whenever current below the actuating level flows through the sectionalizer for longer than the programmed reset time without interruption. The reset time settings have a tolerance of ±10 percent.

It can be verified by interrupting an overcurrent flow through the sectionalizer one time less than the counts-to-open setting, then allowing load current to flow for periods just under and just over the reset setting. The sectionalizer should open if the overcurrent for the final count is interrupted within the reset time period (count has reset to zero). The following procedures is used to verify the count reset:

1. Jumper the ground actuating current resistor with a short lead to disable the ground-sensing circuit.
2. Jumper terminals P and D together.
3. Program the sectionalizer control for two counts-to-open and set the COUNT RESET SELECTOR to 15 seconds.
4. Close the sectionalizer by operating the Manual Control Switch to “CLOSE”.
5. With test circuit connected to phase A of the sectionalizer and S1 open, close S2 and raise the test current to slightly above the appropriate value shown in Column B of Table 9. Hold S2 closed at this current for at least three seconds.
6. Release S2 to simulate a backup protective device clearing the overcurrent. The sectionalizer will register a count.
7. Close S1 for 13.5 seconds.
8. Momentarily close and then release switch S2. The sectionalizer should open, verifying that the count reset has not been activated.
9. Reclose the sectionalizer. Close and release S2 once to register one overcurrent interruption count.
10. Close S1 for slightly more than 16.5 seconds.
11. Momentarily close and release switch S2. The sectionalizer should not open verifying that the count reset has been activated and the first count has been erased.
12. Again, close and release S2. The sectionalizer should open.
13. Remove the jumper from terminals P and D.

Inrush-Current Restraint

The inrush-current restraint feature distinguishes between fault currents and inrush currents. For fault current interruptions, the sectionalizer counts and opens normally. For an inrush-current condition, the phase and ground minimum actuating current detection is blocked for 3 seconds to prevent counting the inrush current.

The three-second time interval allows for system inrush parameters to stabilize prior to allowing the sensitivity of the sectionalizer to return to its programmed state.

The operation of the inrush-current restraint can be verified by simulating a fault condition (the overcurrent is preceded by an overcurrent interruption) and an inrush condition (the overcurrent is preceded by a load current interruption).

The following procedure is used to verify the inrush-current restraint feature.

1. Jumper the ground actuating current resistor with a short lead to disable the ground sensing circuit.
2. Set the COUNTS TO OPEN SELECTOR switch to “1”.
3. Close the sectionalizer by operating the Manual Control Switch to “CLOSE”.
4. With the test circuit connected to phase A of the sectionalizer and S1 open, hold S2 closed and raise the test current to slightly below the appropriate value shown in Column A of Table 9.
5. Release S2 to simulate a backup opening with only load current flowing through the sectionalizer when current was interrupted. The sectionalizer **should not** open.
6. Close S2 and, in **no more than three seconds**, adjust the test current to just below twice the appropriate value shown in Column A of Table 9 to simulate an inrush condition. Release S2. The sectionalizer **should not** open, verifying that the inrush restraint feature has been activated.
7. Reset the inrush restraint as follows:
   - **A.** Short test terminals D and P together.
   - **B.** Close S1 for 3.5 seconds.
   - **C.** Open S1 and remove short from test terminals D and P.
8. Close S2 and raise the test current to slightly above the appropriate value shown in Column B of Table 9.
9. Release S2 to simulate a backup opening with fault current flowing through the sectionalizer when current was interrupted. The sectionalizer **should** open.
10. Close the sectionalizer by operating the Manual Control Switch to “Close”.
11. Repeat step 9 to simulate a fault condition.
12. Release S2. The sectionalizer **should** open verifying that the inrush restraint has not been activated.

Post-Test Procedures

After testing has been completed, make sure that the control settings are programmed to the operating parameters as originally specified.

Reconnect X-3 and X-4 leads to battery charger board terminals 3 and 4 respectively.

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