This publication provides the data required for the user to design a support structure for the Trans-Rupter II Transformer Protector, the loading data necessary to properly construct foundations for a Trans-Rupter II unit to be installed on S&C Mounting Pedestals, the maximum-continuous and permissible-peak terminal-pad loading limits, pole-unit wiring requirements, external wiring and battery requirements for Model EX, and allowable current transformer ratios for Model SE.

Table of Contents

Loadings for Support Structures

TransRupter II Transformer Protector pole-units exert dynamic forces that are transferred to supporting structures. The supporting structures, therefore, must be designed to withstand apparatus loads, dead loads, wind loads, and ice loads. Structures should be designed to limit deflections as follows:

1. Horizontal deflections of the structural section to which a pole-unit is attached should not exceed 1% of the height of that section above ground.
2. Maximum deflections, under dynamic forces, of any supporting member for pole-units should not exceed 1 inch (25 mm) in any direction.

For purposes of support-structure design, it is assumed that the highest wind loads do not occur simultaneously with the most severe ice or terminal-pad loads. Generally, the bending moments produced by wind loads will dictate the design of the structure and the foundation.

Legend:

Mw = Static wind bending moment

MTi = Total in-line bending moment

MTp = Total perpendicular bending moment

Fw = Static wind force

FTi = Total in-line force

FTp = Total perpendicular force

Fo = Dynamic force accompanying opening operation

Y = Height from top mounting boss to pole-unit center of gravity

Table 1. Maximum Loading Data—Per Pole-Unit①

Rating, kV	Mw, ft.-lbs. (newton-meters)	Fw, lbs. (newton)	Fo, lbs. (newton)	Pole-Unit Weight, lbs. (kg)②	Connection Enclosure Weight, Model EX, lbs. (kg)	Control Cabinet Weight, Model SE, lbs. (kg)	Y, Inches (mm)
69	279 (378)	78 (347)	1000 (4448)	187 (85)	40 (18)	150 (68)	20⅝ (524)
115	551 (747)	110 (489)	1000 (4448)	231 (105)	40 (18)	150 (68)	35¾ (908)
138	705 (956)	128 (569)	1000 (4448)	234 (106)	40 (18)	150 (68)	38⅜ (975)

① Values shown are for wind speeds of 100 miles (169 kilometers) per hour.

② The motor operator option adds 35 lbs. (16 kg.) per pole-unit.

Dimensions in inches (mm)

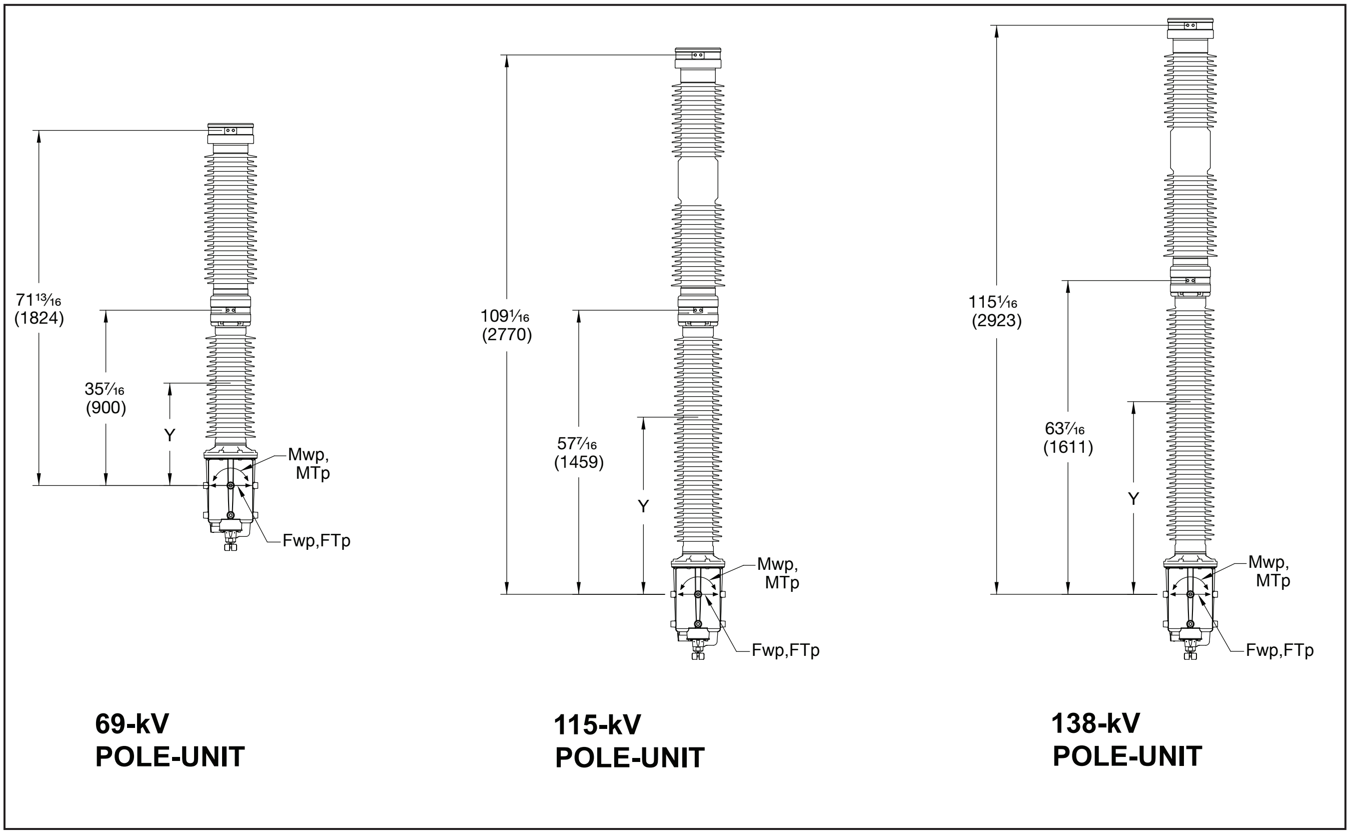


Figure 1. Pole Unit Dimensions

How to Determine Total Bending Moments and Total Forces

The total bending moments and forces exerted by each pole-unit at the support structure's foundation can be calculated as follows:

English Units:

MTi = Mw + (Ui 3 A) + (Li 3 B)

MTp = Mw + (Up 3 A) + (Lp 3 B)

FTi = Fw + Ui + Li

FTp = Fw + Up + Lp

Where:

Ui = Upper-terminal-pad in-line load (lbs.)

Up = Upper-terminal-pad perpendicular load (lbs.)

Li = Lower-terminal-pad in-line load (lbs.)

Lp = Lower-terminal-pad perpendicular load (lbs)

Metric Units:

MTi = Mw +(Ui 3 A) + (Li 3 B)

MTp = Mw + (Up 3 A) + (Lp 3 B)

FTi = Fw + Ui + Li

FTp = Fw + Up + Lp

Where:

Ui = Upper-terminal-pad in-line load (newtons)

Up = Upper-terminal-pad perpendicular load (newtons)

Li = Lower-terminal-pad in-line load (newtons)

Lp = Lower-terminal-pad perpendicular load (newtons)

① See Tables 2 and 3 on page 5 for maximum recommended terminal-pad loads. MTi = Mw +(Ui 3 A) + (Li 3 B)

Other Mounting Considerations

Additional requirements may affect the design of the support structures:

- Each pole-unit requires a minimum clearance of 6 feet (1829 mm) beneath and 36 inches (914 mm) around.
- The standard charging tool is designed for an 8-foot (2438-mm) structure. If pole-units are to be mounted more than 8 feet (2438 mm) above grade, extra section(s) for the tool are recommended. Extra 2-foot (610-mm) and 4-foot (1219 mm) extensions are available. See Specification Bulletin 731-31 for ordering information on extra charging-tool sections.
- S&C recommends that the total length of extra charging-tool sections should not exceed 8 feet (2438 mm). If the pole-units are to be mounted more than 16 feet (4877 mm) above grade, a platform may be required to close and charge the pole-units.
- There are no restrictions with regard to pole-unit phase spacing, apart from the usual dielectric considerations. The dielectric ratings requirements of the application, therefore, will determine minimum phase spacing.
- Pole-units should be mounted vertically upright, at 90° ±15°.

Pole-Unit Wiring Requirements

Pole-units are shipped with 12 inches (305 mm) of 20-gauge wire running from the electrical junction boxes, with butt splices on the ends for connection to user-furnished pole-unit wiring. (Wiring for the optional motor operators is connected to a terminal block inside the motor housing.) S&C recommends use of 18-gauge tinned stranded wire to connect the pole-units to the low-voltage connection enclosure for Model EX or the control cabinet for Model SE. Shielded wire is not required. The length of wire runs should be no more than 50 feet (1524 cm).

S&C Mounting Pedestals and the Trans-Rupter II Transformer Protector with Integral Disconnect include all necessary wiring and conduits to connect the pole-units to the low-voltage connection enclosure for Model EX or the control cabinet for Model SE. If the Trans-Rupter II Transformer Protector is to be installed on a user-furnished support structure, the user must furnish the appropriate wiring and conduit.

If the quick connect option(s) is specified, the Trans-Rupter II Transformer Protector will include:

- Catalog Number Suffix "-C2." Amphenol®● Tri-Start Connectors for connecting pole-units to terminal blocks in Model EX low-voltage enclosure or Model SE control cabinet.
- Catalog Number Suffix "-C3." Amphenol Tri-Start Connectors for connecting optional motor operators and pole-units to Model EX low-voltage enclosure.

Checklist for Required Installation Materials

The Trans-Rupter II Transformer Protector includes the hardware required to attach the pole-units to the mounting brackets. (Brackets and mounting hardware for installing the optional motor operators are included.) The following items are *not* included and must be furnished by the user:

- Mounting brackets for the pole-unit (Mounting brackets should be fabricated of at least ¼-inch-thick (6-mm-thick) steel.)
- Conduit and wiring to attach pole-units to the connection enclosure on Model EX or the control cabinet on Model SE
- Mounting hardware and/or brackets to mount the low-voltage connection enclosure for Model EX or the control cabinet for Model SE

S&C Mounting Pedestals and the Trans-Rupter II Transformer Protector with Integral Disconnect include all of the above items.

● Amphenol is a trademark of Amphenol Aerospace Division of the Amphenol Corporation.

Legend:
- L_U = Upper-terminal-pad in-line loads
- L_L = Lower-terminal-pad in-line loads
- P_U = Upper-terminal-pad perpendicular loads
- P_L = Lower-terminal-pad perpendicular loads
- V_U = Upper-terminal-pad vertical loads
- V_L = Lower-terminal-pad vertical loads

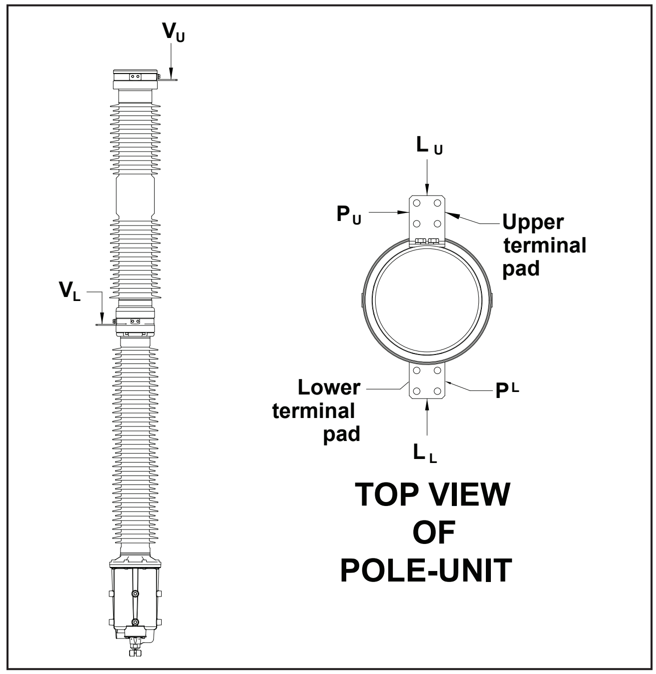


Figure 2. Terminal Pad Locations

Table 2. Terminal-Pad Loading Limits—In-line loads in opposing directions①②

Ratings, kV	In-Line with Terminal Pads				Perpendicular to Terminal Pads③				Vertical to Terminal Pads			
	Maximum Continuous		Permissible Peak④		Maximum Continuous		Permissible Peak④		Maximum Continuous		Permissible Peak④	
	L_U, lbs. (newtons)	L_L, lbs. (newtons)	L_U, lbs. (newtons)	L_L, lbs. (newtons)	P_U, lbs. (newtons)	P_L, lbs. (newtons)	P_U, lbs. (newtons)	P_L, lbs. (newtons)	V_U, lbs. (newtons)	V_L, lbs. (newtons)	V_U, lbs. (newtons)	V_L, lbs. (newtons)
69	140 (623)	230 (1023)	295 (1312)	530 (2358)	70 (311)	150 (667)	135 (601)	260 (1157)	250 (1112)	250 (1112)	250 (1112)	250 (1112)
115	75 (334)	120 (534)	120 (534)	140 (623)	40 (178)	75 (334)	55 (245)	100 (445)	250 (1112)	250 (1112)	250 (1112)	250 (1112)
138	70 (311)	120 (534)	115 (512)	120 (534)	35 (156)	75 (334)	55 (245)	80 (356)	250 (1112)	250 (1112)	250 (1112)	250 (1112)

① Higher terminal-pad loading combinations for the upper and lower terminal pads may be possible, depending on the loads each is required to carry. Contact the nearest S&C Sales Office for more information.

② The addition of optional motor operators has no effect on terminal-pad loading limits.

③ Perpendicular loads are calculated at a maximum pull-off angle of 30° from in-line. Contact the nearest S&C Sales Office if a more severe pull-off angle is required.

④ Permissible-peak loads are calculated at wind loads of 100 miles (161 kilometers) per hour. For terminal-pad loading limits at higher wind loads, contact the nearest S&C Sales Office.

Table 3. Terminal-Pad Loading Limits—In-line loads in the same direction①②

Ratings, kV	In-Line with Terminal Pads				Perpendicular to Terminal Pads③				Vertical to Terminal Pads			
	Maximum Continuous		Permissible Peak④		Maximum Continuous		Permissible Peak④		Maximum Continuous		Permissible Peak④	
	L_U, lbs. (newtons)	L_L, lbs. (newtons)	L_U, lbs. (newtons)	L_L, lbs. (newtons)	P_U, lbs. (newtons)	P_L, lbs. (newtons)	P_U, lbs. (newtons)	P_L, lbs. (newtons)	V_U, lbs. (newtons)	V_L, lbs. (newtons)	V_U, lbs. (newtons)	V_L, lbs. (newtons)
69	60 (267)	190 (845)	80 (356)	450 (2002)	40 (178)	70 (311)	60 (267)	170 (756)	250 (1112)	250 (1112)	250 (1112)	250 (1112)
115	40 (178)	70 (311)	65 (289)	140 (623)	20 (89)	35 (156)	30 (133)	75 (334)	250 (1112)	250 (1112)	250 (1112)	250 (1112)
138	35 (156)	65 (289)	50 (222)	130 (578)	20 (89)	30 (133)	30 (133)	60 (267)	250 (1112)	250 (1112)	250 (1112)	250 (1112)

① Higher terminal-pad loading combinations for the upper and lower terminal pads may be possible, depending on the loads each is required to carry. Contact the nearest S&C Sales Office for more information.

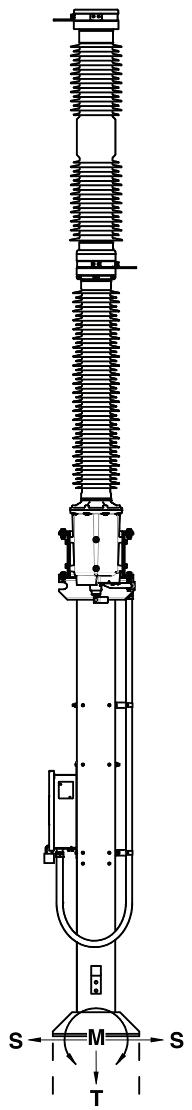
② The addition of optional motor operators has no effect on terminal-pad loading limits.

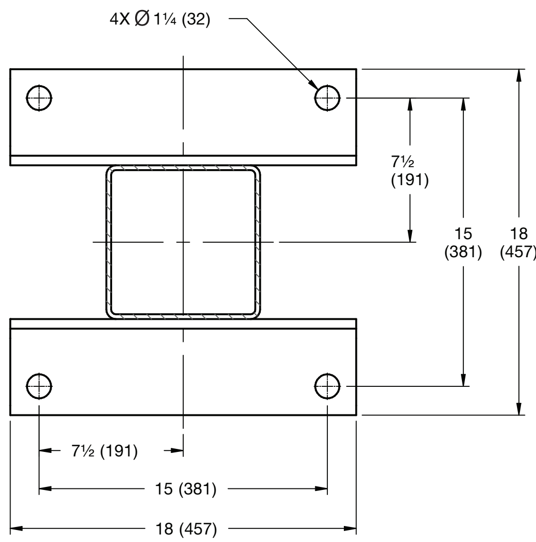
③ Perpendicular loads are calculated at a maximum pull-off angle of 30° from in-line. Contact the nearest S&C Sales Office if a more severe pull-off angle is required.

④ Permissible-peak loads are calculated at wind loads of 100 miles (161 kilometers) per hour. For terminal-pad loading limits at higher wind loads, contact the nearest S&C Sales Office.

The following tables provide the loading data necessary to properly construct foundations for Trans-Rupter II Transformer Protector pole-units installed on S&C Mounting Pedestals. This loading information is based on the most-adverse combination of maximum terminal-pad loading limits and accounts for the dead-weight contribution of the Trans-Rupter II Transformer Protector and mounting pedestal(s) along with wind loading of 100 miles (161 kilometers) per hour.

Trans-Rupter II Transformer Protectors, when installed with the recommended S&C anchor bolts and with flexible-conductor connections at all six terminal pads, are capable of withstanding seismic loading of 0.25 g ground acceleration in any direction as well as performing as intended during such loading and afterward.





MOUNTING PEDESTAL BASE DETAIL

Dimensions in inches (mm)

Table 4. Mounting-Pedestal Foundation Loading Data—Trans-Rupter II Transformer Protector①②

Rating, kV	Phase Spacing, Inches (mm)	Pedestal Height, Inches (mm)	Mounting Pedestal Suffix	Bending Moment, M, ft.-lbs. (newton-meters)	Shear Load, S, lbs. (newtons)	Thrust Load, T, lbs. (newtons)		
						Static	Dynamic	Total
69	48 (1219)	96 (2433)	-E84	24 500 (33 222)	2150 (9564)	2860 (12 722)	3000 (13 345)	5860 (26 067)
		120 (3048)	-E104	29 000 (39 324)	2150 (9564)	2860 (12 722)	3000 (13 345)	5860 (26 067)
		144 (3658)	-E124	34 000 (46 104)	2150 (9564)	2860 (12 722)	3000 (13 345)	5860 (26 067)
	84 (2134)	96 (2433)	-E88	13 500 (18 306)	1350 (6005)	1730 (7695)	1500 (6672)	3230 (14 367)
		120 (3048)	-E108	16 000 (21 696)	1350 (6005)	1730 (7695)	1500 (6672)	3230 (14 367)
		144 (3658)	-E128	18 500 (25 086)	1350 (6005)	1730 (7695)	1500 (6672)	3230 (14 367)
115	84 (2134)	96 (2433)	-E88	10 500 (14 238)	1050 (4670)	1780 (7918)	1500 (6672)	3280 (14 590)
		120 (3048)	-E108	12 500 (16 950)	1050 (4671)	1780 (7918)	1500 (6672)	3280 (14 590)
		144 (3658)	-E128	14 500 (19 662)	1050 (4671)	1780 (7918)	1500 (6672)	3280 (14 590)
	102 (2591)	96 (2433)	-E81	11 000 (14 916)	1100 (4893)	1805 (8029)	1500 (6672)	3305 (14 701)
		120 (3048)	-E101	13 000 (17 628)	1100 (4893)	1805 (8029)	1500 (6672)	3305 (14 701)
		144 (3658)	-E121	15 000 (20 340)	1100 (4893)	1805 (8029)	1500 (6672)	3305 (14 701)
138	84 (2134)	96 (2433)	-E88	10 500 (14 238)	1050 (4671)	1805 (8029)	1500 (6672)	3305 (14 701)
		120 (3048)	-E108	12 500 (16 950)	1050 (4671)	1805 (8029)	1500 (6672)	3305 (14 701)
		144 (3658)	-E128	14 500 (19 662)	1050 (4671)	1805 (8029)	1500 (6672)	3305 (14 701)
	102 (2591)	96 (2433)	-E81	11 000 (14 916)	1100 (4893)	1830 (8140)	1500 (6672)	3330 (14 813)
		120 (3048)	-E101	13 000 (17 628)	1100 (4893)	1830 (8140)	1500 (6672)	3330 (14 813)
		144 (3658)	-E121	15 000 (20 340)	1100 (4893)	1830 (8140)	1500 (6672)	3330 (14 813)

① A single column is used for 69-kV Trans-Rupter II Transformer Protector models with 48-inch (122-cm) phase spacing. All other models use two columns.

② The motor operator option includes three single-pole motor operators and associated mounting hardware. The motor operators weigh 35 lbs. (16 kg.) each.

One nonadjustable "a" contact (ac2) that follows the open-closed state of the pole-unit and two nonadjustable "b" contacts (bol, bo2) that are opposite to the open-closed state of the pole-unit are available for use in user-furnished remote indication applications.

When specified with optional catalog number suffix "-R," there are two normally closed remote gas-density indicating contacts included: one for alarm level one (LP) and the other for alarm level two (LLP).

Detailed information on the wiring of the Model EX low-voltage enclosure and the Model SE control cabinet can be found on the wiring diagram schematic for each device.

Table 5. Model EX — Schematic Wiring Diagram

Catalog Number	Optional Feature: Motor Operators①	Schematic Wiring Diagram
329016	—	CDR-7002
	A	CDR-7003
	B	CDR-7021
329018	—	CDR-7002
	A	CDR-7003
	B	CDR-7021
329019	—	CDR-7002
	A	CDR-7003
	B	CDR-7021

① Options that do not affect the wiring of the switch are not listed on the wiring diagram and/or schematic.

Table 6. Model SE — Schematic Wiring Diagram

Catalog Number	Optional Features①			Schematic Wiring Diagram	Detailed Wiring Diagram
	Relay Current Rating②	Test Switch	Fourth Overcurrent Relay		
319016	J1	—	—	CDR-6708	CDR-6708-1
	J1	H	—	CDR-6707	CDR-6707-1
	J1	H	U1	CDR-6705	CDR-6705-1
	J1	—	U1	CDR-6706	CDR-6706-1
	J5	—	—	CDR-6704	CDR-6704-1
	J5	H	—	CDR-6703	CDR-6703-1
	J5	H	U5	CDR-6701	CDR-6701-1
	J5	—	U5	CDR-6702	CDR-6702-1
319018	J1	—	—	CDR-6708	CDR-6708-1
	J1	H	—	CDR-6707	CDR-6707-1
	J1	H	U1	CDR-6705	CDR-6705-1
	J1	—	U1	CDR-6706	CDR-6706-1
	J5	—	—	CDR-6704	CDR-6704-1
	J5	H	—	CDR-6703	CDR-6703-1
	J5	H	U5	CDR-6701	CDR-6701-1
	J5	—	U5	CDR-6702	CDR-6702-1
319019	J1	—	—	CDR-6708	CDR-6708-1
	J1	H	—	CDR-6707	CDR-6707-1
	J1	H	U1	CDR-6705	CDR-6705-1
	J1	—	U1	CDR-6706	CDR-6706-1
	J5	—	—	CDR-6704	CDR-6704-1
	J5	H	—	CDR-6703	CDR-6703-1
	J5	H	U5	CDR-6701	CDR-6701-1
	J5	—	U5	CDR-6702	CDR-6702-1

① Options that do not affect the wiring of the switch are not listed on the wiring diagram and/or schematic.

② Required option: specify 1-ampere (-J1) or 5-ampere (-J5) rated relays for use with 1- or 5-ampere outputs from user-furnished current transformers.

Optional Remote Gas-Density Indicator

If furnished, the remote gas-density indicator provides contacts for each pole-unit that allow remote monitoring of two low-gas-pressure alarms:

- **Level 1 Alarm (Normally closed contact LP)** When a Level 1 alarm is issued, the pole-unit can be opened and closed as usual. The pole-unit still has full interrupting and dielectric ratings. However, the pole-unit has lost gas and should be replaced as soon as possible. The remote gas-density Level 1 alarm contact opens at 95% of normal density, or 70 psig at 68°F (20°C). Contacts are normally closed at normal operating gas-pressure.
- **Level 2 Alarm (Normally closed contact LLP)** When a Level 2 alarm is issued, the gas density in the pole-unit has dropped below the minimum functional level. The pole-unit will not maintain full interrupting or dielectric ratings. The pole-unit should be removed from service and replaced promptly. Do not operate this Trans-Rupter II Transformer Protector. Pole-units cannot be filled in the field. The remote gas-density Level 2 alarm contact opens at 88% of normal density, or 65 psig at 68°F (20°C). Contacts are normally closed at normal operating gas-pressure.

External wire should be 12-gauge or larger. There are no limitations on the length of wire runs for connection to user-furnished relays and/or control power.

The trip-coil current is 2½ amperes per pole-unit, or 7½ amperes for the complete Trans-Rupter II Transformer Protector. The coil current duration is 20 ms.

Control voltage polarity must be maintained as shown on the appropriate wiring diagram schematic. (See Tables 5 and 6 on pages 8 and 9.)

For Model EX with Optional Motor Operators

Each motor operator has a running-current of 1.7 A for the 48-Vdc motor and 0.8 A for the 125-Vdc motor. The running-current for all three motors is 5.1 A for 48-Vdc motors and 2.4 A for the 125-Vdc motors. The motor operators take approximately 2 minutes to reset the pole-units.

A source-side, group-operated series disconnect is required in series with Trans-Rupter II Transformer Protectors to isolate the transformer protector and to provide a visible air-gap after the pole-units have been tripped. The disconnect is always used to pick up transformer magnetizing inrush current after all three pole-units have been closed and charged. To allow remote closing of the circuit, the series disconnect must also be power operated.

When applying the motor operators with a power-operated disconnect, S&C recommends that users include electrical interlocks in their control scheme to coordinate the operation of the Trans-Rupter II Transformer Protector and series disconnect. A control scheme should be provided to ensure the disconnect cannot be opened unless the unit is open and the disconnect cannot be closed unless the Trans-Rupter II Transformer Protector is closed, charged, and the motor operators have stopped. Auxiliary and time-delay relays can be used to provide coordination.

Trans-Rupter II Transformer Protectors include interrupter-position contacts that can be used for this purpose. The wiring diagram in Figure 1 illustrates a segment of a possible control scheme for the Trans-Rupter II Transformer Protector applied with a high-voltage, gang-operated disconnect powered by the S&C LS-1 Switch Operator. To coordinate the Trans-Rupter II Transformer Protector with the disconnect, remove the jumper wire—represented by the dashed line—and connect the auxiliary pole-unit "a" and "b" terminal block contacts in series as shown:

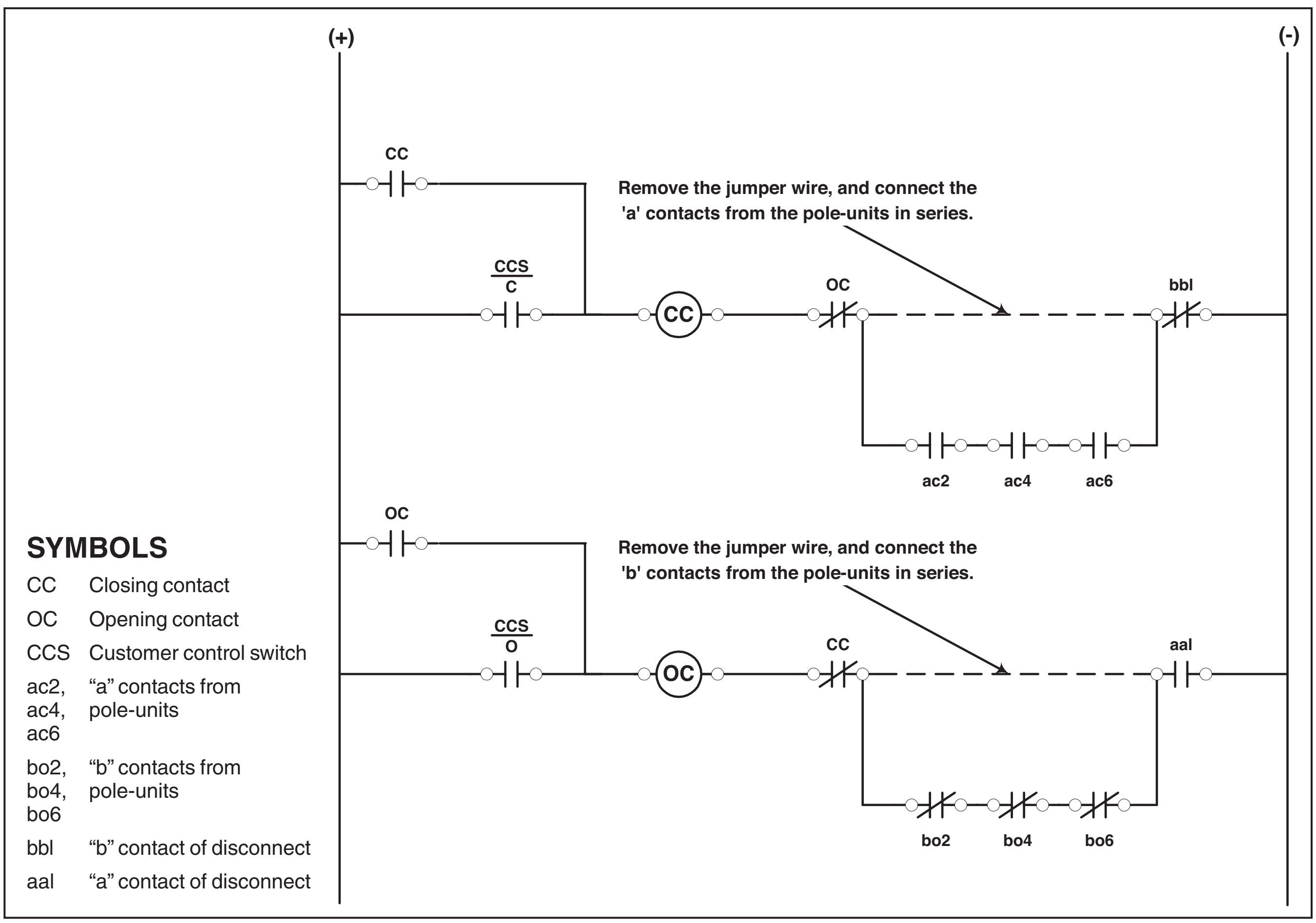


Figure 3. An example of a control schematic diagram showing the disconnect and the Trans-Rupter II Transformer Protector in the open position.

How to Determine Allowable Current-Transformer Ratios for Model SE

The allowable current-transformer (CT) ratios for Model SE are determined by the system voltage, the transformer base-rating, and the available fault-level current. Tables 7 through 12 on pages 13 and 14 provide the minimum and maximum acceptable CT ratios for use with Trans-Rupter II Transformer Protector Model SE. The ratios are based on a setting of 150% full-load pick-up and a 1-second fault-current withstand rating. If current transformers outside the recommended ratios are used, deratings may apply. Contact the nearest S&C Sales Office.

Current-Transformer Wiring Recommendations

The running distance of wiring between CTs and the Model SE control cabinet should be selected in accordance with the user's engineering practices. The wire gauge should meet standard wiring used to connect CTs to relays, and meet the burden of the relay.

Table 7. Allowable Current-Transformer Ratios for 69-kV Model SE—1-Ampere Output

Transformer Size, MVA	10-kA Max Fault Current		20-kA Max Fault Current		25-kA Max Fault Current		31.5-kA Max Fault Current	
	Allowable CT Ratio		Allowable CT Ratio		Allowable CT Ratio		Allowable CT Ratio	
	Min	Max	Min	Max	Min	Max	Min	Max
1.5	100:1	200:1	—	—	—	—	—	—
2	100:1	200:1	—	—	—	—	—	—
2.5	100:1	300:1	200:1	300:1	250:1	300:1	300:1	300:1
3.75	100:1	500:1	200:1	500:1	250:1	500:1	300:1	500:1
5	100:1	600:1	200:1	600:1	250:1	600:1	300:1	600:1
7.5	100:1	800:1	200:1	800:1	250:1	800:1	300:1	800:1
10	150:1	1200:1	200:1	1200:1	250:1	1200:1	300:1	1200:1
15	200:1	1200:1	200:1	1200:1	250:1	1200:1	300:1	1200:1
20	250:1	1200:1	250:1	1200:1	250:1	1200:1	300:1	1200:1
30	400:1	1200:1	400:1	1200:1	400:1	1200:1	400:1	1200:1
40	500:1	1200:1	500:1	1200:1	500:1	1200:1	500:1	1200:1
50	600:1	1200:1	600:1	1200:1	600:1	1200:1	600:1	1200:1

Table 8. Allowable Current-Transformer Ratios for 69-kV Model SE—5-Ampere Output

Transformer Size, MVA	10-kA Max Fault Current		20-kA Max Fault Current		25-kA Max Fault Current		31.5-kA Max Fault Current	
	Allowable CT Ratio		Allowable CT Ratio		Allowable CT Ratio		Allowable CT Ratio	
	Min	Max	Min	Max	Min	Max	Min	Max
1.5	100:5	200:5	—	—	—	—	—	—
2	100:5	200:5	—	—	—	—	—	—
2.5	100:5	300:5	200:5	300:5	250:5	300:5	300:5	300:5
3.75	100:5	500:5	200:5	500:5	250:5	500:5	300:5	500:5
5	100:5	600:5	200:5	600:5	250:5	600:5	300:5	600:5
7.5	100:5	800:5	200:5	800:5	250:5	800:5	300:5	800:5
10	150:5	1200:5	200:5	1200:5	250:5	1200:5	300:5	1200:5
15	200:5	1200:5	200:5	1200:5	250:5	1200:5	300:5	1200:5
20	250:5	1200:5	250:5	1200:5	250:5	1200:5	300:5	1200:5
30	400:5	1200:5	400:5	1200:5	400:5	1200:5	400:5	1200:5
40	500:5	1200:5	500:5	1200:5	500:5	1200:5	500:5	1200:5
50	600:5	1200:5	600:5	1200:5	600:5	1200:5	600:5	1200:5

Table 9. Allowable Current-Transformer Ratios for 115-kV Model SE—1-Ampere Output

Transformer Size, MVA	10-kA Max Fault Current		20-kA Max Fault Current		25-kA Max Fault Current		31.5-kA Max Fault Current	
	Allowable CT Ratio		Allowable CT Ratio		Allowable CT Ratio		Allowable CT Ratio	
	Min	Max	Min	Max	Min	Max	Min	Max
5	100:1	400:1	200:1	400:1	250:1	400:1	300:1	400:1
7.5	100:1	600:1	200:1	600:1	250:1	600:1	300:1	600:1
10	100:1	800:1	200:1	800:1	250:1	800:1	300:1	800:1
15	100:1	1200:1	200:1	1200:1	250:1	1200:1	300:1	1200:1
20	150:1	1200:1	200:1	1200:1	250:1	1200:1	300:1	1200:1
30	250:1	1200:1	250:1	1200:1	250:1	1200:1	300:1	1200:1
40	300:1	1200:1	300:1	1200:1	300:1	1200:1	300:1	1200:1
50	350:1	1200:1	350:1	1200:1	350:1	1200:1	350:1	1200:1

Table 10. Allowable Current-Transformer Ratios for 115-kV Model SE—5-Ampere Output

Transformer Size, MVA	10-kA Max Fault Current		20-kA Max Fault Current		25-kA Max Fault Current		31.5-kA Max Fault Current	
	Allowable CT Ratio		Allowable CT Ratio		Allowable CT Ratio		Allowable CT Ratio	
	Min	Max	Min	Max	Min	Max	Min	Max
5	100:5	400:5	200:5	400:5	250:5	400:5	300:5	400:5
7.5	100:5	600:5	200:5	600:5	250:5	600:5	300:5	600:5
10	100:5	800:5	200:5	800:5	250:5	800:5	300:5	800:5
15	100:5	1200:5	200:5	1200:5	250:5	1200:5	300:5	1200:5
20	150:5	1200:5	200:5	1200:5	250:5	1200:5	300:5	1200:5
30	250:5	1200:5	250:5	1200:5	250:5	1200:5	300:5	1200:5
40	300:5	1200:5	300:5	1200:5	300:5	1200:5	300:5	1200:5
50	350:5	1200:5	350:5	1200:5	350:5	1200:5	350:5	1200:5

Table 11. Allowable Current-Transformer Ratios for 138-kV Model SE—1-Ampere Output

Transformer Size, MVA	10-kA Max Fault Current		20-kA Max Fault Current		25-kA Max Fault Current		31.5-kA Max Fault Current	
	Allowable CT Ratio		Allowable CT Ratio		Allowable CT Ratio		Allowable CT Ratio	
	Min	Max	Min	Max	Min	Max	Min	Max
5	100:1	300:1	200:1	300:1	250:1	300:1	300:1	300:1
7.5	100:1	500:1	200:1	500:1	250:1	500:1	300:1	500:1
10	100:1	600:1	200:1	600:1	250:1	600:1	300:1	600:1
15	100:1	800:1	200:1	800:1	250:1	800:1	300:1	800:1
20	150:1	1200:1	200:1	1200:1	250:1	1200:1	300:1	1200:1
30	200:1	1200:1	200:1	1200:1	250:1	1200:1	300:1	1200:1
40	250:1	1200:1	250:1	1200:1	250:1	1200:1	300:1	1200:1
50	300:1	1200:1	300:1	1200:1	300:1	1200:1	300:1	1200:1

Table 12. Allowable Current-Transformer Ratios for 138-kV Model SE—5-ampere output

Transformer Size, MVA	10-kA Max Fault Current		20-kA Max Fault Current		25-kA Max Fault Current		31.5-kA Max Fault Current	
	Allowable CT Ratio		Allowable CT Ratio		Allowable CT Ratio		Allowable CT Ratio	
	Min	Max	Min	Max	Min	Max	Min	Max
5	100:5	300:5	200:5	300:5	250:5	300:5	300:5	300:5
7.5	100:5	500:5	200:5	500:5	250:5	500:5	300:5	500:5
10	100:5	600:5	200:5	600:5	250:5	600:5	300:5	600:5
15	100:5	800:5	200:5	800:5	250:5	800:5	300:5	800:5
20	150:5	1200:5	200:5	1200:5	250:5	1200:5	300:5	1200:5
30	200:5	1200:5	200:5	1200:5	250:5	1200:5	300:5	1200:5
40	250:5	1200:5	250:5	1200:5	250:5	1200:5	300:5	1200:5
50	300:5	1200:5	300:5	1200:5	300:5	1200:5	300:5	1200:5

Control power for the trip-energy supply is provided by the transformer primary-side bushing current transformers (CT). The standard overcurrent protection system is capable of sensing an overcurrent and providing a trip signal within 2 cycles at two times the pickup setting for either a steady-state condition where the protection system is continuously powered and a fault subsequently occurs, or for a fault-closing condition wherein the protection system has not been continuously powered.

This performance curve shown in Figure 4 illustrates the power-up time for the Model SE's trip-energy supply compared to the various CT output levels①. This chart can be used to compare the power-up time and signal timing of the self-powered relay in relation to the Model SE trip-energy supply power-up time. Monitoring devices cannot be connected to the Model SE trip circuit. For further information on the Model SE trip-energy supply, contact the nearest S&C Sales Office.

① Three-phase secondary current of 350 mA will power up the trip-energy supply in 10 seconds.

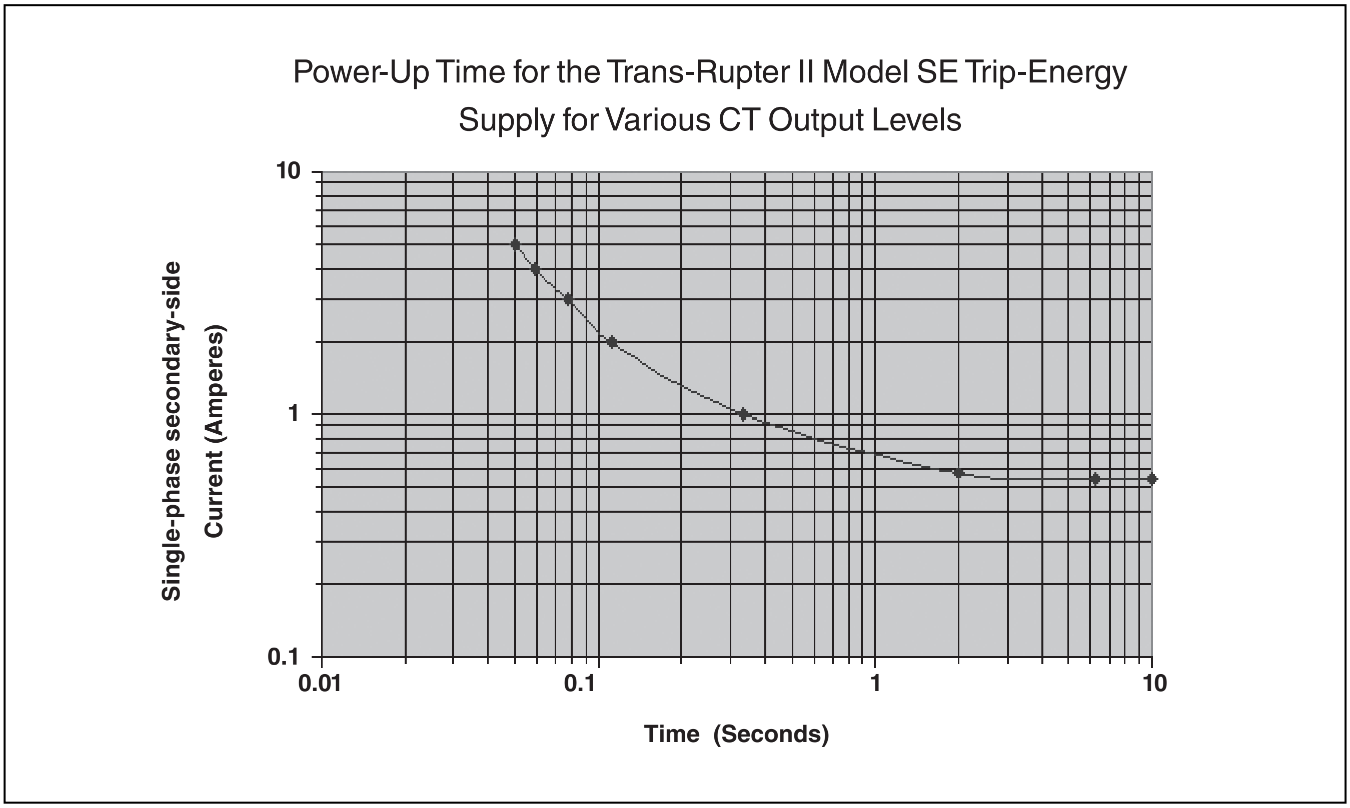


Figure 4. Performance curve illustrating the power-up time for the Model SE's trip-energy supply.