Westinghouse Electric Corporation
Distribution Apparatus Division
Bloomington, Indiana 47401

Application Data
38-723

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Relay and Static Control
2.3-14.4 Kv, 400-800 Amperes
110 Kv BIL

Three-Phase Automatic Oil Circuit Reclosers Type ES and ESM

Selection and Application

The Westinghouse automatic oil circuit recloser provides three-phase overcurrent protection for both substation and line application. This application data divides the complete recloser into three separate components for discussion:

1. The recloser which consists of the high voltage components and stored energy mechanism.

2. The control – Westinghouse type CO overcurrent relays or MTR static control.

3. The frame, either adjustable substation frame or pole-type mounting frame, and the tank lifting windlass.

Selection Step 1 – Recloser Continuous Current and Interrupting Rating

Select recloser catalog number from Table I below.

Description – The recloser high voltage components and mechanism consist of the following:

- Aluminum top casting – The top casting supports the bushings with the De-Ion interrupters. The top casting has integral lifting eyes.

- High-voltage oil-filled compartment – The high voltage compartment is segmented into three separate sections – one per phase. Each segment is electrically isolated to reduce the possibility of internal flashover during abnormal conditions. The tank is vented to the atmosphere to release gasses formed during interruption.

- Oil drain, sample valve, and visual floating ball oil level indicator.

- Stored energy trip and close mechanism.

- Operations counter and main contact position indicator.

- Manual close pushbutton – The stored energy mechanism permits the recloser to be closed into a faulted line without damage.

- External manual trip lever.

Common Ratings

The following data is applicable to all Westinghouse reclosers.

Temperature Range	−30° C to +70° C
Voltage Range	2.3 to 14.4 Kv RMS
Rated Maximum Voltage	15.5 Kv RMS
Basic Impulse Level 1.2 × 50 Microsecond Impulse Withstand	110 Kv
60 Hertz, One Minute Withstand, Dry	50 Kv RMS
60 Hertz, Ten Second Withstand, Wet	45 Kv RMS
Minimum Close Time	25 Cycles
Minimum Interrupting Time	3.5 Cycles

Duty Cycle

Type ES-400 Meets ANSI C37.60 1974 Table 2A Line 11
Type ES-560 Meets ANSI C37.60 1974 Table 2A Line 12
Type ES-800 Meets ANSI C37.60 1974 Table 2A Line 12
Type ESM-560 Meets ANSI C37.60 1974 Table 2A Line 13
Type ESM-800 Meets ANSI C37.60 1974 Table 2A Line 13
Type ES-105 Meets ANSI C37.60 1974 Table 2A Line 12
Type ES-108 Meets ANSI C37.60 1974 Table 2A Line 12

Table 1 – Specific Ratings and Catalog Number

Type	ES-400	ES-560	ES-800	ES-105	ES-108	ESM-560	ESM-800
Specific Ratings							
Continuous Current Range (Amps)	400	560	800①	560	800①	560	800①
Four-Second Rating RMS Symm. Amps	8000	12000	12000	12000	12000	16000	16000
Maximum Interrupting Capacity RMS Symm. Amps②							
4.8 Kv	6000	12000	12000	12000	12000	24000	24000
8.32 Kv	5000	10000	10000	10000	10000	20000	20000
14.4 Kv	4000	8000	8000	10000	10000	16000	16000
Catalog Number							
Recloser Top Casting Designed For Use With Pole Mounting Frame	ES40PG03	ES56PG03	ES80PG03	ES105PG03	ES108PG03	③	③
Recloser Top Casting Designed For Use With Substation Mounting Frame	ES40SG03	ES56SG03	ES80SG03	ES105SG03	ES108SG03	ESM56SG03	ESM80SG03

① Based upon a maximum temperature rise of 55° C.
② Interrupting capacity is not a function of phase or ground minimum trip selection.
③ ESM 560 and ESM 800 are not available for pole mounting.

Selection Step 2 – High Voltage Bushings and Terminals

Description
High voltage bushings for the type ES and ESM recloser are of bulk porcelain construction. Terminals supplied are either a NEMA 4-hole flat pad or a 4 bolt clamp type for 2/0 through 800 MCM conductor. All bushings are ASA 70 Grey.

Bushing Electrical Characteristics and Catalog Number

Ratings	Recloser Type	Outline Drawing	Terminal	Catalog Number
17 in. creep 7.5 in. strike	ES	5563A09	NEMA 4 hole pad	ES17PG02
17 in. creep 7.5 in. strike	ES	5563A10	Clamp #2 to 800 MCM	ES17CG02
17 in. creep 7.5 in. strike	ESM	5563A09	NEMA 4 hole pad	ESM17PG02
17 in. creep 7.5 in. strike	ESM	5563A10	Clamp #2 to 800 MCM	ESM17CG02

Selection Step 3 – Bushing Current Transformers and Auxiliary Switch

Description
Each relayed recloser uses a set of three (600/5 or 1200/5) multi-ratio (5 lead) bushing current transformers to provide overcurrent sensing and auxiliary functions such as driving thermal demand ammeters. The recloser with the MTR static control uses a set of three (1000/5) bushing current transformers to provide overcurrent sensing. Bushing current transformers (2 sets maximum) are mounted on bushings 1, 3 and 5. Both the type ES and ESM recloser use a stored energy mechanism. Leads from the BCT's are terminated in the low voltage mechanism compartment with Penn Union 6006-SC short circuiting type terminal blocks. Each recloser requires 3 "A" and 3 "B" contacts to operate the control circuit. One "A" and one "B" (field changeable) are provided for customer use. (For additional contacts see Selection Step 14.)

Bushing Current Transformer Technical Data and Catalog Number

600/5, Accuracy Class C100, Curve 511800

Current Ratio	600/5	500/5	450/5	400/5	300/5	250/5	200/5	150/5	100/5	50/5
Turns Ratio	120:1	100:1	90:1	80:1	60:1	50:1	40:1	30:1	20:1	10:1

1200/5, Accuracy Class C200, Curve 511801

Current Ratio	1200/5	1000/5	900/5	800/5	600/5	500/5	400/5	300/5	200/5	100/5
Turns Ratio	240:1	200:1	180:1	160:1	120:1	100:1	80:1	60:1	40:1	20:1
Secondary Trips	X2-X3	X1-X2	X1-X3	X4-X5	X3-X4	X2-X4	X1-X4	X3-X5	X2-X5	X1-X5

Catalog Number – Bushing Current Transformer

Quantity and Ratio	For Use with Control Shown	Mechanism Cabinet Connection Diagram	Catalog Number
3-600/5	Relay	1880B95	3CT6EG03
3-1200/5	Relay	1880B97	3CT12EG03
6-600/5	Relay	1880B96	6CT6EG03
6-1200/5	Relay	1880B98	6CT12EG03
3-600/5 and 3-1200/5	Relay	1880B99	6CT612EG03
3-1000/5	Static	1883B23	3CT10SG01
3-1000/5 and 3-600/5	Static	1883B24	6CT610SG01 ③
3-1000/5 and 3-1200/5	Static	1883B25	6CT112SG01 ③

Note 1: Maximum of 2 sets of BCT's may be specified (6 BCT's/recloser).

Note 2: By selecting catalog numbers for BCT's, the mechanism connection diagram is also selected. This diagram shows the BCT connections and compartment 25 watt, 240 VAC space heater.

Note 3: Required when ammeters or thermals from accessories, page 8, are specified. Size 2 (G03 or G04) cabinet is also required when ammeters or thermals are specified.

Selection Step 4 – Trip Coil Voltage and Trip Potential Source

Each recloser requires a shunt trip coil. Selection depends upon trip source specified by the user. The users trip control voltage and trip coil voltage must be the same (except when the capacitor trip device or battery trip device is specified). The trip coils will operate from the following sources:

- 24 VDC NiCad battery and battery charger – internal source
- Capacitor trip device – internal source
- 48 or 125 VDC – external source
- 240 VAC – external source

Trip Coil Technical Data and Catalog Number

Voltage	Trip Amps	Voltage Range	Catalog Number
24 VDC	4.0	14-28	TCE24G01
48 VDC	2.6	28-56	TCE48G01
125 VDC	5.0	70-140	TCE125G01
240 VAC	1.9	208-254	TCE230G01
Cap. Trip Device Coil	3.7	Ref. IL 38721-5	CTDEG02

Note 1: When internal battery trip device (Step 12) is selected specify TCE24G01 24 VDC trip coil.

Note 2: TCE230G01 is standard for static control; however, any tripping source can be used.

Selection Step 5 – Stored Energy Charging Motor

Description
Each recloser is supplied with a spring trip, spring close mechanism. The mechanism requires a 240 VAC motor to charge the closing springs.

Charge Motor Technical Data and Catalog Number

Catalog Number	Voltage	Locked Rotor Amps	Charge Amps
23ACEG01	Nominal 240 VAC Range 208-254 VAC	6	3

Selection Step 6 – Substation Type Mounting Frame and Control Cabinet Location

Description
All substation mounting frames are constructed from 3 in x 3 in x 3/16 in galvanized angle iron. All frames are adjustable height and include provisions for user grounding.

Note 1: A size 2, G03, frame and cabinet can be supplied on static controlled reclosers where a larger cabinet is required; however, the connection between the control cabinet and the recloser mechanism cabinet will be hard wiring.

Note 2: The size one cabinet (G05's) is the standard substation frame and cabinet for a static controlled recloser. If metering accessories from page 8 are specified, the size 2 cabinet (either the G03 or G04 frame) must be specified depending on whether or not the convenience of a plug connection is required.

Note 3: A size 3 cabinet may be required if several accessories are specified. No catalog numbers apply.

Catalog Number for ES	Catalog Number for ESM	Normally Used With Listed Control	Cabinet Size	Cabinet Position Bushing 1, 3, and 5 To Front	Wiring Method Between Control Cabinet and Mechanism Cabinet	Outline Drawing
PRSG03	PRMSG03	Relay	2	Front Recessed	Hard Wire	5562A90
PRSG04	PRMSG04	Static	2	Front Recessed	Amphenol plugs	5562A90
PRSG05	PRMSG05	Static	1	Front Recessed	Amphenol plugs	6474A01
PRSRG03	PRMSRG03	Relay	2	Rear Mounted	Hard Wire	5562A91
PRSRG04	PRMSRG04	Static	2	Rear Mounted	Amphenol plugs	5562A91
PRSRG05	PRMSRG05	Static	1	Rear Mounted	Amphenol plugs	6468A76
PRSLG03	PRMSLG03	Relay	2	Left Side	Hard wire	5562A92
PRSLG04	PRMSLG04	Static	2	Left Side	Amphenol plugs	5562A92
PRSLG05	PRMSLG05	Static	1	Left Side	Amphenol plugs	6468A19

Selection Step 7 – Tank Lifting Windlass For Substation Mounted Type ES or ESM Reclosers

Description
A winch type tank lifter and the necessary pulleys and cable are supplied so that the user may lower oil tank for inspection.

Catalog Number	For Use With Type Recloser	Outline Drawing
TLSG01	ES All Ratings	5554A73
TLMG01	ESM All Ratings	5556A73

① Pole mounting frames are not available for type ESM reclosers.
② Actual length of the cable is length shown plus 5 ft. for slack.

Selection Step 8 – Pole Type Mounting Frames For Direct Pole Monuting

Description
The direct pole mounting frame is constructed with 3 in x 3 in x 3/16 in galvanized angle iron.

Catalog Number	For Use With Type Recloser	Outline Drawing
PRPG03	Relayed ES All Ratings①	5562A93
PRPG04	Static ES All Ratings①	6474A02

Selection Step 9 – Tank Windlass For Pole Mounted Type ES Reclosers

Description
A winch type tank lifter and the necessary pulleys and cables are supplied so that the user may lower oil tank for inspection.

Catalog Number	For Use With Type Recloser	Outline Drawing
TLPG02	ES All Ratings①	5562A94

Selection Step 10 – Control Cable Assembly For Use With Pole Mounted Reclosers

Description
Each recloser and control cabinet are connected together via a multi-conductor control cable. For pole mounted type ES reclosers the user must specify the length of cable required. The control cable enters the recloser mechanism cabinet through a multi-conductor plug and jack. Control cable selection is not required for substation mounted units.

Catalog Number	Length of Control Cable (Feet)②
CA5G01	5
CA10G01	10
CA15G01	15
CA20G01	20
CA25G01	25
CA30G01	30
CA35G01	35
CA40G01	40

Selection Step 11 – Relay Control For Either Substation or Pole Mounted Reclosers

Description

Recloser applications may be simplified through use of Westinghouse Type CO overcurrent relays for phase and ground protection. Westinghouse type CO relays provide an infinite number of time delay trip curves and when combined with the multi-ratio bushing current transformer provide the user with many values of phase and ground minimum trip settings without the purchase of any other components. For complete curve shapes, time delay current ranges, and instantaneous current ranges refer to Westinghouse Performance Data 41-000 and DB 41-100A.

Control Cabinet Description

The relay size 2 control cabinet is mounted on the substation frame (See Selection Step 6 for location) or provided with pole mounting brackets in the case of a pole mounted unit. All relays and controls are mounted on a hinged front panel for easy access. Each relay control package is supplied with the following equipment as standard.

- Control switch with red and green indicating lights.
- Fuse for control circuit protection.
- Non-reclose switch.
- 25 watt, 230 VAC control cabinet heater.
- Necessary terminal blocks and control wiring.

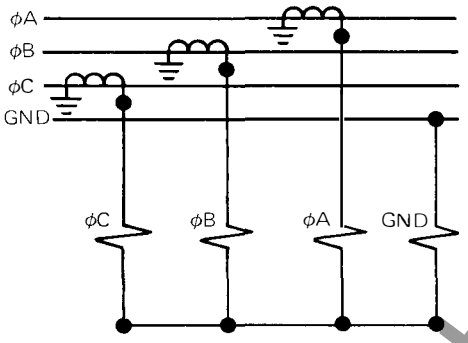
Relay Selection

The relay control package may be supplied with two phase and one ground relay, three phase relays and no ground relay, or three phase relays and one ground relay. The phase and ground relays may be supplied with or without a fast trip feature. Each relay and its associated fast trip relay contain "targets" to indicate which phase has "seen" a fault. Each relay is mounted in a Westinghouse Flexi-test case to permit quick removal for inspection and maintenance. The control scheme requires circuit closing (CC) type relays. Refer to DB 41-100 or Table 4, page 7, for style number selection.

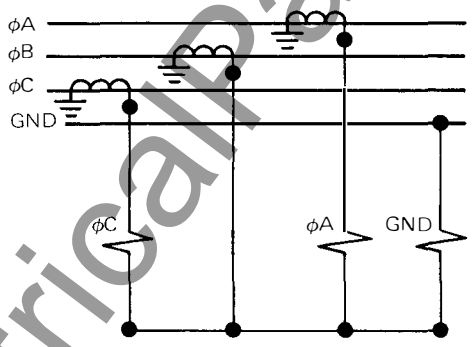
The use of two phase and one ground relays, three phase relays and no ground relay, or three phase relays and one ground relay depend upon the application and/or user preference. The following table is designed to show the tripping sequence for various combinations of fault conditions.

Typical BCT-Relay Connections For Grounded Wye Systems

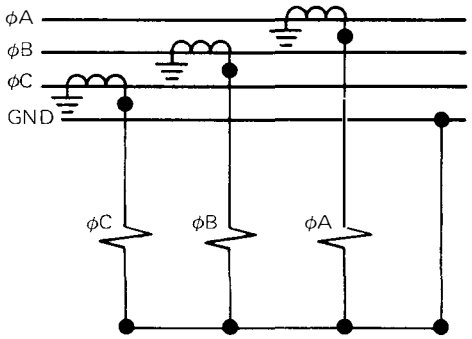
3 Phase Relays and 1 Ground Relay



2 Phase Relays and 1 Ground Relay



3 Phase Relays and No Ground Relay



Type of Fault	3 Phase Relays and 1 Ground Relay		2 Phase Relays and 1 Ground Relay		3 Phase Relays and No Ground Relay	
	Primary Trip Relay	Back-Up Trip Relay	Primary Trip Relay	Back-Up Trip Relay	Primary Trip Relay	Back-Up Trip Relay
ØA-GND	GND	ØA	GND	ØA	ØA	—
ØB-GND	GND	ØB	GND	—	ØB	—
ØC-GND	GND	ØC	GND	ØC	ØC	—
ØA-ØB	ØA or ØB	ØB or ØA	ØA	—	ØA or ØB	ØB or ØA
ØA-ØC	ØA or ØC	ØC or ØA	ØA or ØC	ØC or ØA	ØA or ØC	ØC or ØA
ØC-ØB	ØC or ØB	ØB or ØC	ØC	—	ØC or ØB	ØB or ØC
ØA & ØB-GND	GND	ØA or ØB	GND	ØA	ØA or ØB	ØB or ØA
ØA & ØC-GND	GND	ØA or ØC	GND	ØA or ØC	ØA or ØC	ØC or ØA
ØB & ØC-GND	GND	ØB or ØC	GND	ØC	ØB or ØC	ØC or ØB
ØA, ØB, ØC-GND	GND	ØA or ØB or ØC	GND	ØA or ØC	ØA or ØB or ØC	ØC or ØB or ØA

Note 1: The above table is designed to illustrate a general case. Actual primary and back-up tripping depend upon actual relay co-ordination, fault current magnitude, and symmetry.

Reclose Relay Selection

The relay control package may be supplied with either the Type RCS-II or Type EMI reclose relay. Selection depends upon application and/or user preference. The reclose relay (RCS-II or EMI) is the device that controls the following functions:

- Number of tripping operations to lock out.
- Number and sequence of fast and time delay trips.
- Reset time.

Figure 1 shows a typical sequence of tripping and reclosing of the recloser main contacts. In this example the control is set for four operations to lock out.

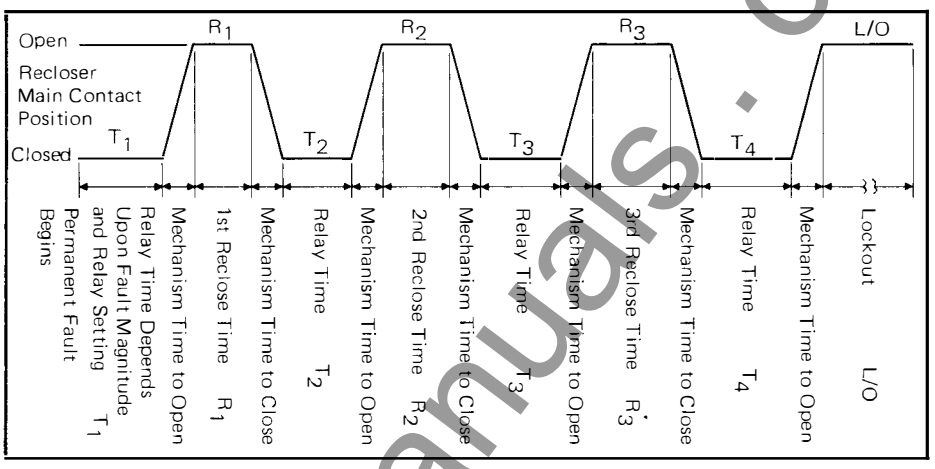


Figure 1

Reset Time

Both the RCS-II and EMI reclose relays have the reset after reclose feature. The reset timer begins upon reclose as shown in Figure 2. This feature allows a shorter reset time. Reset time need only be coordinated with maximum trip time at minimum trip setting.

To describe the operation, assume the recloser is locked out and the fault still exists. Operate control switch to close recloser. The recloser will operate on the last selected trip curve. In most cases this will be a time delay operation. After the reset time, the control will reset to its programmed operational sequence.

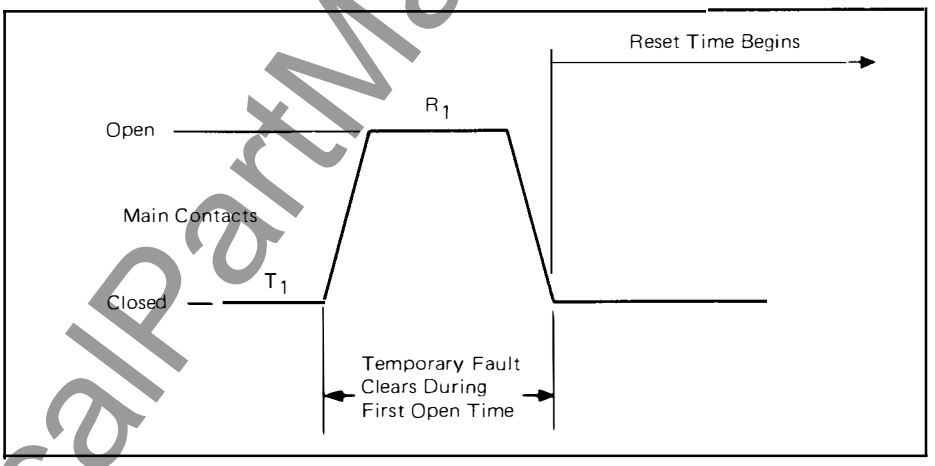


Figure 2

Load Current Metering

To aid the user in feeder loading, the relay control package may be supplied with Sangamo thermal demand meters or indicating ammeters. All relay control packages include panel knock out and terminals for easy installation of meters in the field or factory.

Capacitor Trip Device

The capacitor trip device consists of a capacitor and rectifier network to provide a DC potential to the trip coil. The capacitor trip device maintains a constant DC potential for tripping regardless of the main line voltage conditions. Refer to IL-38-721-5 for schematic. Style number of device is 804-B158G01.

Comparison of Type RCS-II and EMI Reclose Relay Features

Function	Relay and Catalog Number	
	RCS-II	EMI
Trips to lockout	1, 2, 3 or 4	1, 2, 3 or 4
Number of fast trips	0, 1, 2, 3 or 4	0, 1, 2, 3 or 4
Reset time	Adjustable 25-120 sec.	Adjustable 0-390 sec.
Reclose time range		
First reclose time R_1	Instantaneous or 5-60 sec.①	Instantaneous or 5-57 sec.②
Second reclose time R_2	5-60 sec.①	5-57 sec.②
Third reclose time R_3	5-60 sec.①	5-57 sec.②
Instruction Book Number	IL-38-721-4	IL-38-741
Schematic	237C164	3871A77

① Reclose times R_1, R_2 & R_3 are independent of each other in the RCS-II relay.

② Reclose times R_1, R_2 & R_3 are the same in the EMI relay unless R_1 is set for instantaneous reclose, then R_2 and R_3 must be identical times.

Note: 5 seconds is the minimum reclose time for the second and third reclose times on both the RCS-II and EMI relays. This time allows the motor to charge the close springs.

Relay Control Catalog Numbers, Schematics, and Connection Diagrams

The following tables have been prepared to aid the use in selecting a relay package. Every combination of relays, CTD, BTD and meters has been identified by a catalog number. This catalog number specifies the schematic and wiring diagram.

Table 1 – 2 Phase Relays and 1 Ground Relay

2 Phase Relays and 1 GND Relay	Provisions for Meters	Sangamo Triplex Thermal Demand Ammeters	Type GA 0-5 Amp Indicating Ammeters	RCS-II Reclose Relay	EMI Reclose Relay	Trip Circuit Voltage ● 48 VDC, 125 VDC External Source ● 24 VDC BTD Internal Source. Note: Battery trip device BTD must be specified as a separate item			Trip Circuit Voltage ● 230 VAC External Source			Trip Circuit Voltage ● Internal CTD		
						Catalog① Number	Schematic Diagram	Wiring Diagram	Catalog① Number	Schematic Diagram	Wiring Number	Catalog① Number	Schematic Diagram	Wiring Diagram
●	●			●		CC201	5963C01	5963C02	CC207	5963C03	5963C04	CC213	5963C05	5963C06
●		●		●		CC202②	5963C01	5963C02	CC208②	5963C03	5963C04	CC214②	5963C05	5963C06
●			●			CC203	5963C01	5963C02	CC209	5963C03	5963C04	CC215	5963C05	5963C06
●	●				●	CC204	5963C51	5963C52	CC210	5963C53	5963C54	CC216	5963C55	5963C56
●		●			●	CC205②	5963C51	5963C52	CC211②	5963C53	5963C54	CC217②	5963C55	5963C56
●			●		●	CC206	5963C51	5963C52	CC212	5963C53	5963C54	CC218	5963C55	5963C56

① When entering orders, the style number of the phase and ground relays must be specified as well as the catalog number of the control.

② The style number of the thermal demand ammeter must be specified: 402A869H04 ADH-2 without instantaneous attachment, or 402A869H09 ADH-2 with instantaneous attachment, 0-5 amp scale.

Table 2 – 3 Phase Relays and No Ground Relay

3 Phase Relays and No GND	Provisions for Meters	Sangamo Triplex Thermal Demand Ammeters	Type GA 0-5 Amp Indicating Ammeters	RCS-II Reclose Relay	EMI Reclose Relay	Trip Circuit Voltage ● 48 VDC, 125 VDC External Source ● 24 VDC BTD Internal Source. Note: Battery trip device must be specified as a separate item			Trip Circuit Voltage ● 230 VAC External Source			Trip Circuit Voltage ● Internal CTD		
						Catalog① Number	Schematic Diagram	Wiring Diagram	Catalog① Number	Schematic Diagram	Wiring Diagram	Catalog① Number	Schematic Diagram	Wiring Diagram
●	●			●		CC219	5963C07	5963C08	CC225	5963C09	5963C10	CC231	5963C11	5963C12
●		●		●		CC220②	5963C07	5963C08	CC226②	5963C09	5963C10	CC232②	5963C11	5963C12
●			●			CC221	5963C07	5963C08	CC227	5963C09	5963C10	CC233	5963C11	5963C12
●	●				●	CC222	5963C57	5963C58	CC228	5963C59	5963C60	CC234	5963C61	5963C62
●		●			●	CC223②	5963C57	5963C58	CC229②	5963C59	5963C60	CC235②	5963C61	5963C62
●			●		●	CC224	5963C57	5963C58	CC230	5963C59	5963C60	CC236	5963C61	5963C62

① When entering orders, the style number of the phase relays must be specified as well as the catalog number of the control.

② The style number of the thermal demand ammeter must be specified: 402A869H04 ADH-2 without instantaneous attachment, or 402A869H09 ADH-2 with instantaneous attachment, 0-5 amp scale.

Table 3 – 3 Phase Relays and 1 Ground Relay

3 Phase Relays and 1 GND Relay	Provisions for Meters	Sangamo Triplex Thermal Demand Ammeters	Type GA 0-5 Amp Indicating Ammeters	RCS-II Reclose Relay	Remote Trip and Close	EMI Reclose Relay	Trip Circuit Voltage ● 48 VDC, 125 VDC External Source ● 24 VDC BTD Internal Source. Note: Battery trip device must be specified as a separate item			Trip Circuit Voltage ● 230 VAC External Source			Trip Circuit Voltage ● Internal CTD		
							Catalog① Number	Schematic Diagram	Wiring Diagram	Catalog① Number	Schematic Diagram	Wiring Diagram	Catalog① Number	Schematic Diagram	Wiring Diagram
●	●			●			CC237	5963C13	5963C14	CC243	5963C15	5963C16	CC249	5963C17	5963C18
●		●		●			CC238②	5963C13	5963C14	CC244②	5963C15	5963C16	CC250②	5963C17	5963C18
●	●			●			CC239	5963C13	5963C14	CC245	5963C15	5963C16	CC251	5963C17	5963C18
●		●				●	CC240	5963C63	5963C64	CC246	5963C65	5963C66	CC252	5963C67	5963C68
●	●					●	CC241②	5963C63	5963C64	CC247②	5963C65	5963C66	CC253②	5963C67	5963C68
●		●				●	CC242	5963C63	5963C64	CC248	5963C65	5963C66	CC254	5963C67	5963C68
●	●			●	●					CC258	5963C19	5963C20	CC255	5963C21	5963C22
●		●		●	●					CC259②	5963C19	5963C20	CC256②	5963C21	5963C22
●			●	●	●					CC260	5963C19	5963C20	CC257	5963C21	5963C22

① When entering orders, the style number of the phase and ground relays must be specified as well as the catalog number of the control.

② The style number of the thermal demand ammeter must be specified: 402A869H04 ADH-2 without instantaneous attachment, or 402A869H09 ADH-2 with instantaneous attachment, 0-5 amp scale.

Stock Relays

In order to provide short shipment, certain overcurrent relays are stocked at Bloomington. A listing is provided to aid the purchaser in specifying a recloser using stock relays.

Table 4 – Over Current Relays

Type	Current Range Amps: AC		Time Curve	Contacts	Indicating Contact Switch	Style Number
	Time Unit	Instantaneous Unit IIT				
CO-8	0.5-2.5	2-48	Inverse	Spst	0.2/2.0 Amp dc	264C900A03
CO-8	1-12	None	Inverse	Spst	0.2/2.0 Amp dc	264C900A05
CO-8	1-12	6-144	Inverse	Spst	0.2/2.0 Amp dc	264C900A07
CO-9	4-12	16-32	Very Inverse	Spst	0.2/2.0 2 ICS units per relay	183A805A28
CO-9	0.5-2.5	None	Very Inverse	Spst	0.2/2.0 Amp dc	264C901A01
CO-9	0.5-2.5	2-48	Very Inverse	Spst	0.2/2.0 Amp dc	264C901A03
CO-9	1-12	None	Very Inverse	Spst	0.2/2.0 Amp dc	264C901A05
CO-9	1-12	6-144	Very Inverse	Spst	0.2/2.0 Amp dc	264C901A07
CO-11	0.5-2.5	10-40	Extremely Inverse	Spst	0.2/2.0 Amp dc	1875296
CO-11	1-12	6-144	Extremely Inverse	Spst	0.2/2.0 Amp dc	265C047A07

Selection Step 12 – Battery Trip Device

A battery trip device may be selected. The battery trip device consists of a 24 VDC Ni-CAD battery and a 230 VAC potential type battery charger.

Catalog Number	Description
BTDG01	Battery trip device for use with control catalog numbers CC201-CC206, CC219-CC224, and CC237-CC242.
	Connection Diagram 3889A99

Selection Step 13 – Remote Trip and Close

Description

All relayed control packages are wired for user addition of a remote trip and close function, except control catalogs CC-255-260 which are furnished with all the local equipment wired at the factory.

This accessory includes the following loose and unmounted material that the user must mount in the recloser control cabinet if a control other than CC255-260 is specified.

628A271H07 Latch Relay
161A833H07 Remote/Local Switch
158P987H01 Remote/Local N/P

In addition – a 505A714G01 Remote Switch is supplied for remote mounting by the user.

Note – this option requires 230 VAC power. If other voltages, see Accessory 10 and 11, page 4, of PL 38-720.

Catalog Number	Description
STCG01	Remote trip and close, loose and unmounted for 230 VAC remote power operation only on controls other than CC 255-260

Selection Step 14 – Extra Auxiliary Switches

Description

A total of four extra "A" or "B" contacts may be added for exclusive customer use. This accessory combined with the standard two extra "A" or "B" contacts (see Selection Step 3) will give the customer a total of six extra "A" or "B" contacts. All "A" or "B" switches are field changeable from "A" to "B" or "B" to "A". The contacts are terminated in the mechanism compartment.

Catalog Number	Description
AUX3G02	Westinghouse Style No. 46A5916G01 A total of 4 contacts either "A" or "B"

Selection Step 15 – Type MTR Static Control for Either Substation or Pole Mounted Reclosers

Description

Panel Construction

The front panel of the static control is neatly designed and clearly marked to afford ease in making changes in the coordination of the recloser as system demands vary.

The major components of the static control are:

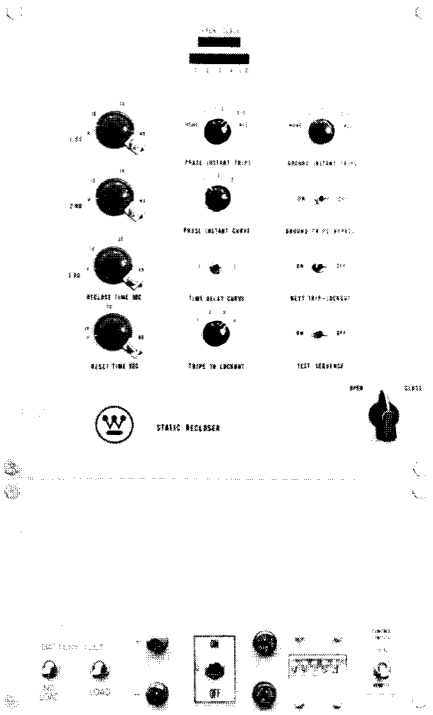
- **Static Phase Protection Unit**
- **Static Ground Fault Unit**
- **Faulted Phase Indicator Unit**
- **Ground Fault Indicator Unit**
- **Remote Trip and Close Unit**

The features of each major component are described below.

Static Phase Protection Unit

This unit provides conventional three phase overcurrent protection. By accepting the same minimum trip on ground faults, this unit can also be connected to provide phase plus ground overcurrent protection. This is accomplished by utilizing a two phase and one ground overcurrent relay scheme. If a different value of ground minimum trip is required, the static ground fault unit must also be purchased.

Curve shapes can be changed by substitution of the phase boards. Each of three phase boards provides two time-delay curves and three instantaneous curves. See Application Data 38-733A, and Table 1 on page 10.



1. Phase Time-Delay Curves
Either of the two time-delay curves may be selected by setting a two-position toggle switch on the control panel.

2. Phase Instantaneous Curve
Any one of the three instantaneous phase curves per board may be selected with the three-position rotary switch on the control panel.

3. Phase Instantaneous Trip Selector
The static control can operate on either the instantaneous or the time-delay curve. A rotary switch on the front panel is provided to select which of the tripping operations are to be controlled by the instantaneous curve.

4. Phase Minimum Trip
Selection of the phase minimum trip current is made from the following table.

A minimum trip resistor establishes the trip current for each phase. A total of three resistors are required and they are mounted on a panel in the rear of the cabinet. They can easily be removed by disconnecting two mounting screws.

Phase Minimum Trip Current	Resistor Style① Number
50	2586C02H13
70	2586C02H14
100	2586C02H15
140	2586C02H16
200	2586C02H17
280	2586C02H18
400	2586C02H19
560	2586C02H21
800	2586C02H22
1120	2586C02H23
1600	2586C02H24

① Three Resistors Required

5. Operations to Lockout
The number of operations to lockout can be set by turning the selector switch to the appropriate position from one to four.

6. Reset Time
Any reset time from six (6) to sixty (60) seconds is possible. The reset timer is not started until after the recloser closes in on the line. The use of fast reset times is made possible by a fault monitor circuit which prevents the reset timer from operating if the current flowing in the primary is above the minimum trip setting.

7. Reclose Time
A separate rotary switch is available for each reclosing operation allowing any combination of reclosing times. The following reclosing times are available:
1st Instantaneous to 60 seconds
2nd 6 to 60 seconds
3rd 6 to 60 seconds

8. Indicating Lights
A top set of lights indicates whether the recloser is open or closed. The lower array of indicator lights shows the sequence state of the static counter, including lockout.

9. Control and Cold Load Pickup Switch
The control switch permits the operator to electrically trip or close the recloser. Holding this switch in the closed position raises the minimum trip setting of the control 2½ times without changing the shape of the curve or the coordination. This allows the recloser to remain closed for the duration of inrush current. Inrush current occurs when load is restored after an extended outage and rapidly subsides to normal (full) load levels. Normal minimum trip settings return when the switch is released from the close position.

For those applications where 2½ times normal minimum trip is not desired, this value can be set to any value between 1.0 and 2.5 times by specifying the desired multiple.

10. Next Trip Lockout Switch
This switch sets the control to operate on the instantaneous curve, cancels the reclosing function of the control, and sets the recloser to lock out after one instantaneous operation.

11. Test Sequence Switch
This switch is used to check the operation of the control and recloser. If the control and recloser are operating properly this will cause the recloser to trip and close in its programmed operating sequence.

12. Battery Test Device
This feature provides the user with a convenient method to periodically check the condition of the 24 volt DC Ni-CAD battery. A panel mounted test jack, 10 ohm load resistor, and two test switches are included to permit load and no load testing.

13. Power Switch
Allows the battery to be disconnected from the control during service by moving the toggle switch to the "off" position.

14. Control Power Fuse
A fuse provides protection for the low voltage circuit.

15. Electric Operations Counter
A counter with a cyclometer dial records each recloser operation.

Static Ground Fault

Ground fault protection with a minimum trip value different than the phase minimum trip setting is available as an optional catalog control.

1. Ground Instantaneous Trip Selector
The ground unit of the type MTR static control will operate on either the instantaneous or the time-delay curve. To select the tripping operations that will be controlled by the instantaneous curve, rotate the selector switch to the appropriate position.

2. Ground Minimum Trip Amperes
Selection of the ground minimum trip is made from the following table. A minimum trip resistor establishes the trip current for each phase. One resistor is required and it is mounted on a panel in the rear of the cabinet. The resistor can easily be removed by disconnecting two mounting screws.

3. Ground Trip Bypass
This switch, when in the "on" position, blocks the ground tripping function, thus eliminating the ground trip operation.

Ground Minimum Trip Current	Resistor Style Number②
5.8①	
10.0①	
25.0	2586C02H01
50.0	2586C02H02
70.0	2586C02H03
100.0	2586C02H04
140.0	2586C02H05
200.0	2586C02H06
280.0	2586C02H07
400.0	2586C02H08
560.0	2586C02H09
800.0	2586C02H10

① Accessory required. See catalog number LGMTG01 page 9 and item 13.1, P.L. 38-720, page 4.
② One resistor required.

Faulted Phase Indicator Unit

This unit provides visual indication of which phase has been subjected to fault conditions by indicating which phase or phases last tripped the recloser. A subsequent reclose on a different phase resets the previous phase target or targets. The faulted phase indicators may also be reset manually by pushing the reset button. Counters are available as an option to indicate the number of times each phase has caused the recloser to operate.

Ground Fault Indicator Unit

A target indicates when a ground fault has tripped the recloser. The target can only be reset manually by pushing the reset button.

A counter is available as an option to indicate the number of times ground faults have caused the recloser to trip.

Remote Trip and Close

The remote trip and close unit enables the user to trip and close the recloser from a remote location. This unit blocks the reclose function when the recloser is tripped from the remote location. Note: This feature requires 230VAC power. If other voltage, see Accessory 10, page 4, PL 38-720.

Accessories (Optional)

• **Three Mini-Ammeters:** Type GA 0-5 Amp Indicating Ammeters can be provided to indicate the phase current value. This accessory requires the use of a separate set of bushing current transformers that are selected from Selection Step 3, page 2 and a size 2, G03.or G04 cabinet.

Cat. No. 3MAG01

• **Thermal Demand Ammeter:** Sangamo ADH-2 Triplex Thermal Demand Ammeters will be provided with or without an instantaneous attachment. This accessory requires the use of a separate set of bushing current transformers that are selected from Selection Step 3, page 2 and a size 2, G03 or G04 cabinet.

S # 402A869H04 w/o Inst.
S # 402A869H09 with Inst.

• **Zone Sequence Control Unit**
For applications with two static controlled reclosers in series, it is recommended that the recloser nearest the source (upline) be equipped with the zone sequence accessory to maintain the desired coordination sequence of the two reclosers.

To ensure coordination between the instantaneous curves of the two reclosers, the instantaneous curve of the upline recloser must be slower than the downline recloser. To permit coordination with various types of reclosers, the zone sequence control unit of the MTR control allows the instantaneous trip time to be increased by 3-12 cycles.

If the fault is cleared by the down line recloser, the zone sequence unit of the source recloser only steps the static counter thus keeping the pre-programmed cycle in the proper sequence.

This accessory is provided on a plug-in board that mounts directly in front of the phase time curve board when viewed from the rear of the front panel.

Cat. No. ZSCG02

• **Low Ground Minimum Trip**
In order to provide ground minimum trip values below 25 amps, this accessory is required in addition to the ground minimum trip resistor selected on page 8. This accessory includes one extra set of bushing current transformers.

Cat. No. LGMTG01

• **Counters for Phase and Ground Fault Indicators**
These counters are mounted on the front panel and indicate the number of times the recloser has operated.

Cat. No. PCTRG01, phase only.
Cat. No. GCTRG01, ground counter only.
Cat. No. PGCTRG01, phase and ground.

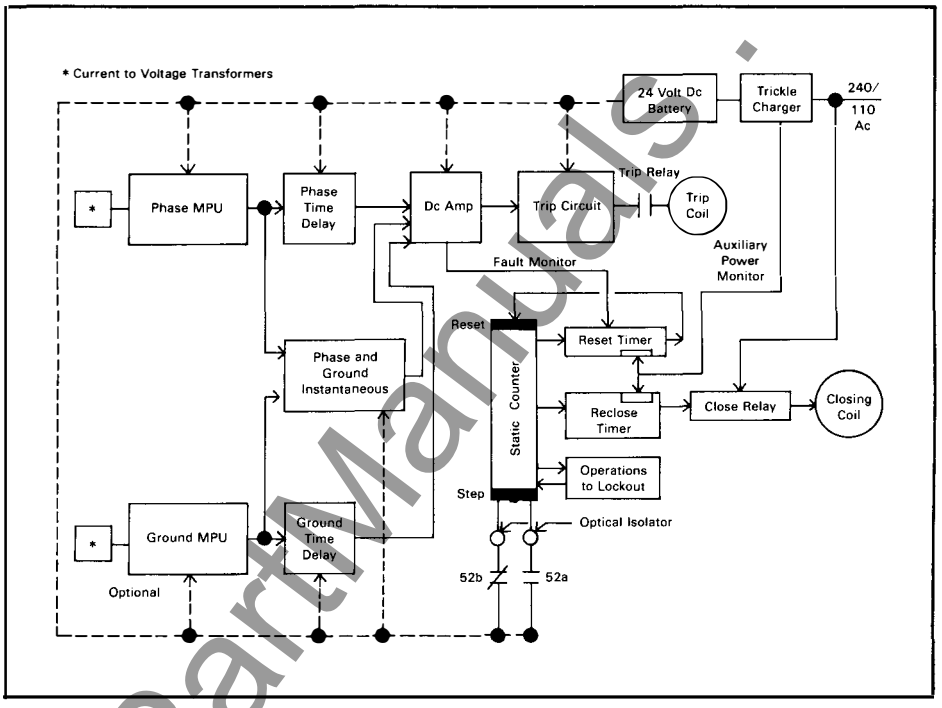
• **Cold Load Pickup Resistor**
This resistor raises the minimum pick-up by the value shown when the control switch is held in the close position.

Minimum Trip Multiplier	Resistor Catalog Number
1.5	CLP15G01
2.0	CLP20G01
2.5	Standard CLP25G01

• **Instantaneous Trip**
This accessory trips the recloser instantaneously at any fault current above a preset level of fault current on the phase time current curve only.

Cat. No. ITG__ __①

① Catalog number must contain 5 digits. The last 2 are variable from 01 to 99 which specify the multiple of minimum pickup that will instantaneously trip or lockout the recloser. Only the instantaneous trip or the instantaneous lockout may be specified since they cannot be combined.



• **Instantaneous Lockout**
This accessory trips and locks out the recloser instantaneously on the phase time current curve at any fault current above a preset value.

Cat. No. ILG__ __①

Description of Static Control Operation

Complete Adjustability and Flexibility Built In

The MTR Static Control has all of the necessary components required to give all of the timing values for reset and reclose operations outlined in this Application Data. In addition, the control has three-phase instantaneous curves and two-phase time delay curves built in. It is possible, therefore, to change these functions in the field without requiring additional parts.

Sequence of Operation (See Block Diagram)

Three 1000/5 bushing current transformers provide current sensing for the type MTR static control. The primaries of three current to voltage transformers for phase tripping are connected to the bushing current transformers. The secondary voltages are fed through full wave bridges connected in parallel. This paralleled connection of the bridges results in a "maximum voltage network," which feeds the minimum pick-up circuit. The voltage supplied to the phase curve shaping networks is proportional to the magnitude of the fault current on any phase.

After a time delay, determined by the fault magnitude, the curve shaping network sends a signal to the dc amplifier which in turn energizes the trip coil through the contacts of the trip relay.

The logic of the MTR static control is controlled by the static counter. The static counter is the static equivalent of a mechanical stepping relay that is set to allow the recloser to interrupt and automatically reclose a predetermined number of times. The position of the static counter in its cycle determines whether the tripping sequence will be instantaneous or time delayed and also determines the length of the reclosing time.

The reclosing timer circuit energizes the close coil through the contacts of the closing relay. The reclosing time delay circuit is a quick reset type allowing the same circuit to be used for all reclosing intervals. The reset timer is energized by a "B" contact of the auxiliary switch when the recloser closes and the current level is less than minimum trip.

When current flow is in excess of the minimum pick-up setting, a signal from the dc amplifier disables the reset timer preventing it from resetting the counter. This fault-monitor circuit makes possible reset times less than the maximum time delay trip without fear that the recloser may not lock out in the event of a low-current fault.

When optional ground tripping is supplied, an additional current to voltage transformer is connected to the bushing current transformer neutral to detect circuit unbalance.

The secondary voltage of this transformer is also applied to a full wave bridge. The output voltage is applied to the DC amplifier through the ground trip minimum pickup and curve shaping network.

Time Current Curves of the ES Recloser with Static Control

Each static controlled recloser has included as standard equipment three instantaneous curves and two time delay curves for phase tripping. Units with the optional ground trip unit also include one instantaneous and one time delay curve for ground tripping. The curves must be selected from the following table.

The curves remain consistent as set within an accuracy of plus or minus 5% throughout the temperature range of −30 degrees C to +70 degrees C (−22 degrees F to +158 degrees F).

Table 1. Available Time Curves.

Description	Style Number
Phase Time Curve	
CO-8 (Standard)	201C963G01
CO-9	202C040G01
CO-11	202C298G01
Ground Time Curve	
CO-8	203C221G01
CO-9 (Standard)	203C221G02
CO-11	203C223G01
CO-9	671B592G01

Ordering Information

The five major components of the type MTR static control listed on page 7 (excluding the accessories) have been combined into eight control packages. In addition, there are provisions for mounting and wiring the six optional accessory packages.

When ordering a static phase protection unit, the style number of the time curve must be selected and specified from Table 1. A time curve from the same Table 1 must also be selected and specified when ordering a static ground fault unit.

When ordering any of the six accessories described on pages 8 and 9, the appropriate catalog number or numbers and/or style number must be selected and specified.

Each of the package components contain all of the features described on pages 7 and 8 under each component.

Package Components

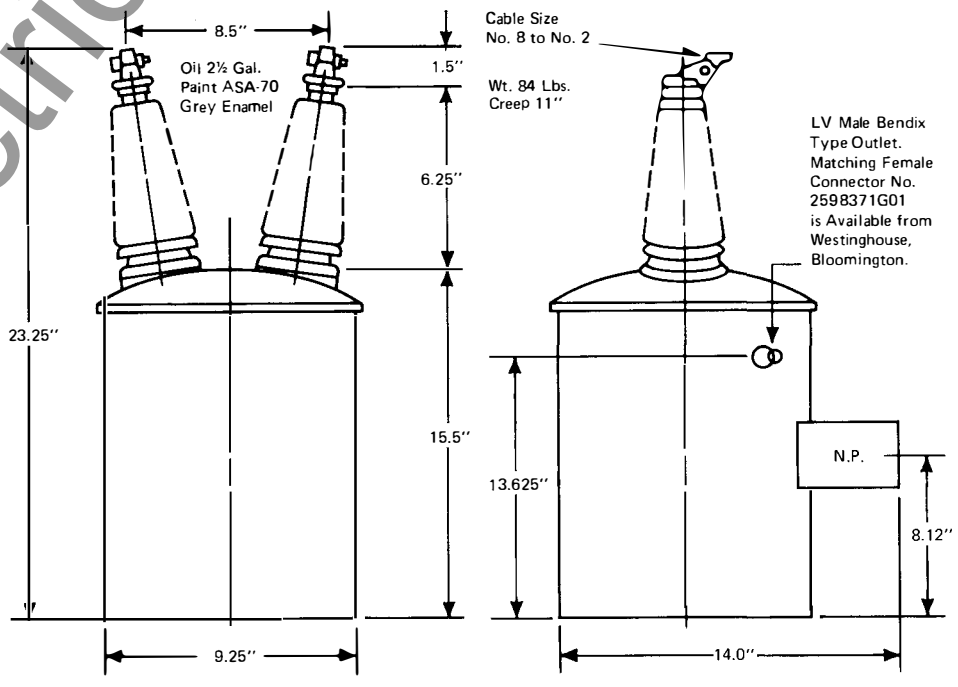
Package Control Catalog Number	Schematic Diagram 230 VAC Trip①	Wiring Diagram 230 VAC Trip①	Static Phase Protection Unit	Static Ground Fault Unit	Faulted Phase Indicator Unit	Ground Fault Indicator Unit	Remote Trip and Close Unit
SC101G02	5963C76	5963C77	●				
SC102G02	5963C78	5963C79	●				●
SC103G02	5963C80	5963C81	●		●		
SC104G02	5963C82	5963C83	●		●		●
SC105G02	5963C84	5963C85	●	●			
SC106G02	5963C86	5963C87	●	●			●
SC107G02	5963C88	5963C89	●	●	●	●	●
SC108G02	5963C90	5963C91	●	●	●	●	

① Any other trip source from Selection Step 4 is possible, if specified by proper selection of the trip coil.

Selection Step 16 – Potential Transformers CBT

The CBT transformer is designed for use where the user has one system voltage and one secondary voltage is desired. A Bendix plug on the secondary eliminates any exposed live parts in the control circuit. The CBT can be supplied with or without fuses in the H.V. bushings. All units have two H.V. bushings.

Dimensions In Inches – CBT Transformer



Ordering Information

Catalog numbers have been assigned to the connection equipment for CBT transformers that are to be mounted on substation mounting frames. Included in the catalog number is all the necessary connectors, cable, gasket, bracket, bolts, nuts, and lock washers to mount one CBT transformer. This transformer is mounted on the left as you look into the mechanism compartment. If a second CBT transformer is required, a quantity of two must be specified and the second unit will be mounted on the right side as you look into the mechanism compartment.

Connection Equipment

Catalog No.	Description
PETLLG01 ①	CBT Transformer Connection Equipment Line to Line – 1 unit substation frame
PETLGG01 ①	CBT Transformer Connection Equipment Line to ground – 1 unit sub. frame
803B825G01 ①	Same as PETLLG01 except for pole mounting frame
803B825G02 ①	Same as PETLGG01 except for pole mounting frame

① Catalog number of CBT Transformer must also be specified. See Table 1 this selection step for units available. If two transformers required, then quantity of two must be specified for both connection equipment and CBT transformer.

CBT Transformer Rating

As mentioned under ordering information, the catalog and quantity of CBT transformers must be specified. CBT transformers are available with or without fuses in one or both H.V. bushings. Table 1 lists all available transformer catalog numbers. Secondary voltage in all cases is 240 VAC.

Other Optional Accessories

A. **Ground Wire Monitoring Scheme**
Westinghouse has available a circuit that monitors the customer's ground circuit. The scheme trips and locks out the recloser after one operation should the customer's ground circuit open. Closing the recloser resets the circuit. The scheme can be modified to include one shot to lockout for overcurrent relay tripping.

Bill of Material includes:

- Signal transformer
- Auxiliary Current Transformer
- Ballast Resistor
- SC Relay
- GA-332 Ammeter (0-5A)
- Latching Relay
- 2-3000 ohm Resistors (if other than 24 VDC Trip)
- Special Capacitor Trip Device

The scheme will operate off any control power source; however, the preferred tripping source is a capacitor trip device. Select the proper control package from Step 11. The scheme is not applicable to static controlled reclosers.

B. See 38-720 P WE A for other optional assessories and description.

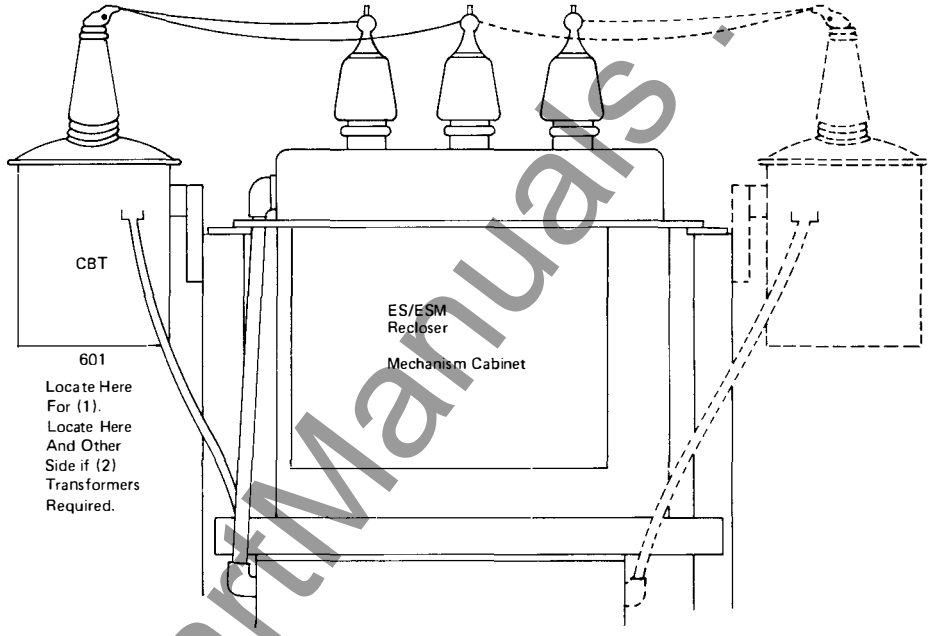


Figure 1 CBT Transformer Connected Phase-to-Phase

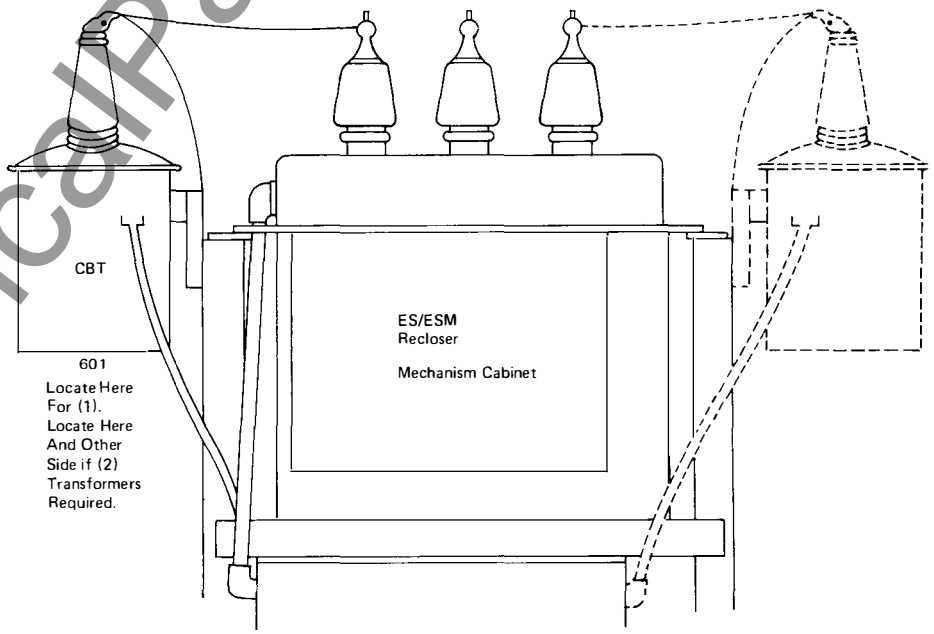


Figure 2 CBT Transformer Connected Line-to-Ground

Table 1 CBT Transformer Catalog Numbers

High Voltage	Outline Drawing	Catalog Numbers 15 Kv H.V. Bushings		
		Without Fuses	With 1 Fuse	With 2 Fuses
2400 volts	PT06	PT06PX01	PT06PX01F	PT06PX01FF
4160 volts	PT06	PT06PX02	PT06PX02F	PT06PX02FF
4800 volts	PT06	PT06PX03	PT06PX03F	PT06PX03FF
7200 volts	PT06	PT06PX04	PT06PX04F	PT06PX04FF
7600 volts	PT06	PT06PX05	PT06PX05F	PT06PX05FF
7960 volts	PT06	PT06PX06	PT06PX06F	PT06PX06FF
8300 volts	PT06	PT06PX07	PT06PX07F	PT06PX07FF
12000 volts	PT06	PT06PX08	PT06PX08F	PT06PX08FF
12470 volts	PT06	PT06PX09	PT06PX09F	PT06PX09FF

Typical Specifications

A. Relayed Reclosers

A.1. General. These specifications are applicable to outdoor power class automatic circuit reclosers, equipment, material, and accessories. Automatic oil circuit reclosers specified shall be furnished complete with all accessories, control cabinet, and interconnect wiring, factory installed and assembled, and upon receipt, ready for immediate service.

A.2. Codes and Standards. All equipment furnished under these specifications shall conform to the applicable standards of ANSI, NEMA, and IEEE. The automatic oil circuit recloser shall be designed, fabricated, and tested in accordance with ANSI C37.60, NEMA SG13, and these specifications.

A.3. Rating. The automatic oil circuit recloser shall meet the following requirements:

Number of phases	3
Rated Maximum Voltage	15.5 Kv
Nominal system voltage	14.4 Kv and below
Continuous current, amperes	400, 560 or 800
Basic insulation level	110 Kv
Operating voltage	14.4 Kv and below
Interrupting capacity, RMS amperes symmetrical @ 14.4 Kv	4,000, 8,000, 10,000 or 16,000
Minimum interrupting time, cycles	3.5
60 Hertz, one minute withstand, dry	50 Kv RMS
60 Hertz, ten second withstand, wet	45 Kv RMS

A.4. Mechanical Construction Details. The following paragraphs describe the general construction of the oil circuit reclosers.

A.4.1. Current Transformers. Each recloser shall be equipped with three 600/5 multi-ratio bushing current transformers, relay accuracy 10C100. These transformers may also be used by the purchaser for auxiliary functions not covered by this specification. The BCT secondary leads shall be terminated in the recloser control cabinet with shorting type terminal blocks.

A.4.2. Operating Mechanism. Each recloser shall be equipped with a stored energy mechanism that is spring closed, spring opened. Minimum operating sequence to be 0 – ½ sec. – CO – 5sec. – CO – 5 sec. – CO.

A.4.3. Manual Operation. Each recloser shall be provided with a means to manually close and trip the recloser while it is energized.

A.4.4. Insulating Oil. A sufficient quantity of suitable insulating oil shall be supplied with each recloser. Each recloser shall be shipped with the insulation oil in the recloser.① The insulating oil shall meet all requirements as defined by NEMA, and shall have a dielectric strength of at least 26 Kv. An oil drain, sample valve and visual floating ball oil level indicator are to be provided.

A.4.5. Substation Mounting Frame. Each recloser shall be mounted on a self-supporting, adjustable height, angle iron substation frame suitable for installation on a concrete base. The mounting frame shall be so designed that the recloser tank can be lowered to permit inspection and maintenance of the recloser contacts through the addition of the tank lifter accessory. Provisions for grounding by the user must also be provided.

A.4.6. Bushings. Bushings shall be made from bulk porcelain with 17 inches of creep and a minimum strike distance of 7.5 inches, line to ground. Terminals are to be either a NEMA 4 hole pad or a 4 bolt clamp type for conductor sizes #2 to 800 MCM.

A.5. Electrical and Recloser Control Details. The following paragraphs describe the control and general electrical details of the oil circuit recloser.

A.5.1. Control Switch and Indicating Lights. The recloser shall be provided with an electric trip-close switch to allow manual control of the recloser. Red and green indicating lights shall be supplied to indicate the position of the recloser main contacts at any time.

A.5.2. Control Fusing. The control shall be supplied to operate independently of line voltage variations.

A.5.3. Control Cabinet Heater. The recloser control cabinet shall be equipped with a heater to prevent condensation of moisture on the control components.

A.5.4. Interrupting Capacity. Interrupting capacity shall be as specified (Para. A.3.). The recloser and control shall provide full interrupting capacity independent of phase and ground minimum trip settings.

A.5.5. Phase Minimum Trip. The recloser relay control shall provide flexibility in selecting phase minimum trip amperes by changing tap settings of multi-ratio bushing current transformers and relay tap settings, in conformance with standard relay practices.

A.5.6. Phase Time Delay Curves. The recloser control is to be supplied with inverse phase time delay and instantaneous curves to be determined by the purchaser.

A.5.7. Trips to Lockout. The number of trips to lockout shall be adjustable from one to four operations, in the field, without entering the oil filled high voltage compartment.

A.5.8. Reclose Time. Reclosing time shall be adjustable based on the capability of the RCS-II or EMI reclose relay as shown on page 5. Sequence of operation to be specified when ordering.

A.5.9. Integrator Reset Time. Reset time shall be adjustable over the range specified for the RCS-II or the EMI reclose relay as shown on page 5.

A.5.11. Separately Adjustable Phase (or Ground) Instantaneous Unit. (optional) The recloser control shall be equipped with separately adjustable instantaneous overcurrent units to provide instantaneous overcurrent tripping.

A.5.12. Operations Counter. Each recloser shall be equipped with an operation counter and a main contact position indicator.

A.5.13 Ground Trip Unit. When specified, ground trip protection shall be provided by a Westinghouse CO relay in the common or neutral bushing current transformer circuit which will trip the recloser on phase unbalance or ground fault condition.

A.5.14. Recloser Control Mounting. The reclosers shall be provided with the following controls on the front control panel for manual operation of the recloser. Electric close and trip switch; red and green indicating lights for indicating contact position; fuse for low voltage control protection; ground trip bypass switch (optional); and one-shot-to-lockout switch.

A.5.15. Control Wiring. All control wiring shall conform to the best industry standards for quality and neatness. Wiring shall be bundled together in a wiring harness or loom. Unsupported, unbound wiring will not be accepted.

A.5.16. Auxiliary Contacts. Each recloser is to be supplied with a minimum of 2 extra auxiliary contacts up to a maximum of 6 that are field changeable to any combination of "A" or "B".

① Reclosers for export out of the continental U.S. are shipped without oil. Purchaser to buy WEMCO-C locally.

B. Static Reclosers

B.1. General. These specifications are applicable to outdoor power class automatic circuit reclosers, equipment, material, and accessories. Automatic oil circuit reclosers specified shall be furnished complete with all accessories, control cabinet, and interconnect wiring factory installed and assembled, and upon receipt, ready for immediate service.

B.2. Codes and Standards. All equipment furnished under these specifications shall conform to the applicable standards of NEMA, ANSI, and IEEE. The automatic oil circuit recloser shall be designed, fabricated, and tested in accordance with ANSI C37.60, NEMA SG13, and these specifications.

B.3. Rating. The automatic oil circuit recloser shall meet the following requirements:

Number of phases	3
Rated maximum voltage	15.5 Kv
Nominal system voltage	14.4 Kv and below
Continuous current, amperes	400, 560 or 800
Basic insulation level	110 Kv
Operating voltage	14.4 Kv and below
Interrupting capacity, RMS amperes symmetrical @ 14.4 Kv	4,000, 8,000, 10,000 or 16,000
Minimum interrupting time, cycles	3.5
60 Hertz, one minute withstand, dry	50 Kv RMS
60 Hertz, ten second withstand, wet	45 Kv RMS

B.4. Mechanical Construction Details. The following paragraphs describe the general construction of the oil circuit reclosers.

B.4.1. Current Transformers. Each recloser shall be equipped with three 1000/5 bushing current type transformers for current sensing. The BCT secondary leads shall be terminated in the recloser control cabinet with shorting type terminal blocks.

B.4.2. Operating Mechanism. Each recloser shall be equipped with a stored energy mechanism that is spring closed, spring opened. Minimum operating sequence to be 0-1/2 sec. – CO – 5 sec. – CO – 5 sec. – CO.

B.4.3. Manual Operation. Each recloser shall be provided with a means to manually close and trip the recloser while it is energized.

B.4.4. Insulating Oil. A sufficient quantity of suitable insulating oil shall be supplied with each recloser. Each recloser shall be shipped with the insulation oil in the recloser.① The insulating oil shall meet all requirements as defined by NEMA, and shall have a dielectric strength of at least 26 Kv. An oil drain, sample valve and visual floating ball oil level indicator are to be provided.

B.4.5. Substation Mounting Frame. Each recloser shall be mounted on a self-supporting, adjustable height, angle iron substation frame, suitable for installation on a concrete base. The mounting frame shall be so designed that the recloser tank can be lowered to permit inspection and maintenance of the recloser contacts through the addition of the tank lifter accessory. Provisions for grounding by the user must also be provided.

B.4.6. Bushings. Bushings shall be made from bulk porcelain with 17 inches of creep and a minimum strike distance of 7.5 inches, line to ground. Terminals to be either a NEMA 4 hole pad or a 4 bolt clamp type for conductor sizes #2 to 800 MCM. Purchaser to specify.

B.5. Electrical and Recloser Control Details. The following paragraphs describe the control and general electrical details of the oil circuit recloser.

B.5.1. Control Switch and Indicating Lights. The recloser shall be provided with an electric trip-close switch to allow manual control of the recloser. Indicating lights shall be supplied to indicate the position of the recloser main contacts at any time.

B.5.2. Control Fusing. The control shall be supplied to operate independently of line voltage variations.

B.5.3. Control Cabinet Heater. The recloser control cabinet shall be equipped with a heater to prevent condensation of moisture on the control components.

B.5.4. Interrupting Capacity. Interrupting capacity shall be as specified (Para. B.3.). The recloser and control shall provide full interrupting capacity independent of phase and ground minimum trip settings.

B.5.5. Phase Minimum Trip. The recloser static control shall provide flexibility in selecting phase minimum trip amperes.

B.5.6. Phase Time Delay and Instantaneous Curves. The recloser control is to be supplied with inverse phase time delay and instantaneous curves to be determined by purchaser.

B.5.7 Trips to Lockout. The number of trips to lockout shall be adjustable from one to four operations by a switch on the front panel.

B.5.8. Reclose Time. Reclose time is to be independently adjustable for each of the three reclose intervals.

B.5.9. Reset Time. Reset time shall be adjustable by a switch on the front panel. The reset time shall begin upon successful reclosing of the recloser main contacts.

B.5.10. Battery Charging. The battery charger shall be capable of supplying sufficient energy to the trip battery to maintain the battery at the proper operating voltage. The battery charger shall operate independently of load current through the recloser main contacts.

B.5.11. Recloser Operating Controls. The recloser static control shall be provided with the following functions:

Ground trip by-pass.
Next trip lockout.
Cold load pick-up.
Lockout indicating light
Test sequence switch.

B.5.12. (Optional) **Ground Trip Unit.** The ground trip unit supplied shall have an adjustable minimum pick-up setting variable over the current carrying range of the recloser. Interrupting capacity of the recloser shall not be limited by the ground minimum pick-up setting. The number of instantaneous trips shall be adjustable independent of the number of phase trips selected.

① Reclosers for export out of the continental U.S. are shipped without oil. Purchaser to buy WEMCO-C locally.

Static Control Calibrator

Style No. 633A819A01

The static control calibrator facilitates calibration and testing of the time-current curves and reclosing times of the MTR static control. Calibration of curves between the known and published maximum and minimum levels is easily accomplished.

The static control calibrator is enclosed in a heavy gauge metal case with special features for attachment to the recloser mounting frame. All metering is within the desired accuracy range. These features make the unit desirable for both field and shop testing.

The device will either supplement or take the place of standard relay test schemes. The MTR static control can be tested and calibrated using standard relay test equipment and procedures; or the static control calibrator can be used to test the static control complete with the ES recloser. This gives a true operating time for the complete equipment. The only factor not considered in time-current curve calibration is the arcing time involved when the device is interrupting an actual fault current; this arcing time is a maximum of one cycle.

A double plug arrangement eliminates possible errors in connection and speeds up the testing procedure. The arrangement consists of a male plug on the front of the calibrator to which is attached the control cable from the static control to the ES recloser. A self contained control cable with necessary weatherproof connectors is included with the static control calibrator and attaches directly to the ES recloser.

To test the static controlled ES recloser, it is necessary to bypass the device if it is in service, or to connect the 240 volt control power to the ES recloser if it is not in service. The static control calibrator can then be placed in the circuit. The 240 volts are carried through the connecting cable to the calibrator where it is stepped down to a nominal 5 volt level with a current output of 30 amperes.

Static Control Calibrator

(1) Trip Time Switch: This switch initiates the testing after all settings have been made and the recloser is ready for test by feeding current into the static control circuit.

(2) Function Selector Switch: This switch allows calibration or checking of either tripping time or reclosing time.

(3) Ammeter Range Selector: This switch allows the ammeter range to be varied by the scale multipliers of 1.0, 2.5, 5, 10, 25 and 50. This feature allows accurate values of test currents to be set and recorded.

(4) Ammeter: This meter measures the actual value of test current (or simulated fault current) to be applied to the static control.

(5) Male Plug Connector: The static control is connected to the ES recloser (at the ES recloser) with a detachable weatherproof plug. This plug is disengaged from the ES recloser and connected to the static control calibrator at this point.

(6) Cycle Counter: The cycle counter, calibrated in .01 seconds records the time to trip and reclose.

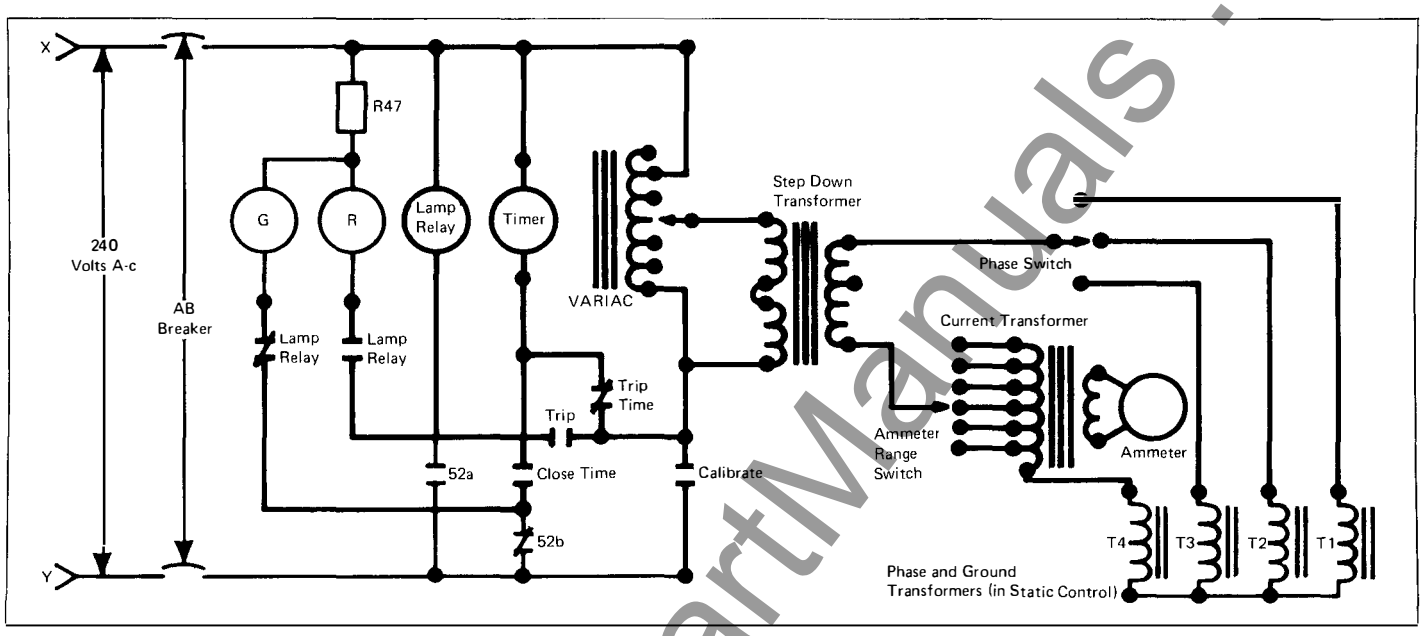
(7) Phase Selector: This switch allows testing of each of the three phases. Ground trip characteristics can also be calibrated.

(8) Current Adjuster: This variable source enables the value of test current to be varied from 0 to 30 amperes. This range of available test current allows full range testing of the static control.

(9) Calibration Switch: This switch allows the value of test current to be accurately set prior to the actual operation of the control and the recloser.

(10) Female Connector and Control Cable: This cable is plugged into the male plug at the ES recloser to complete the circuit (see schematic diagram on page 15).

Static Control Calibrator Schematic Diagram



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