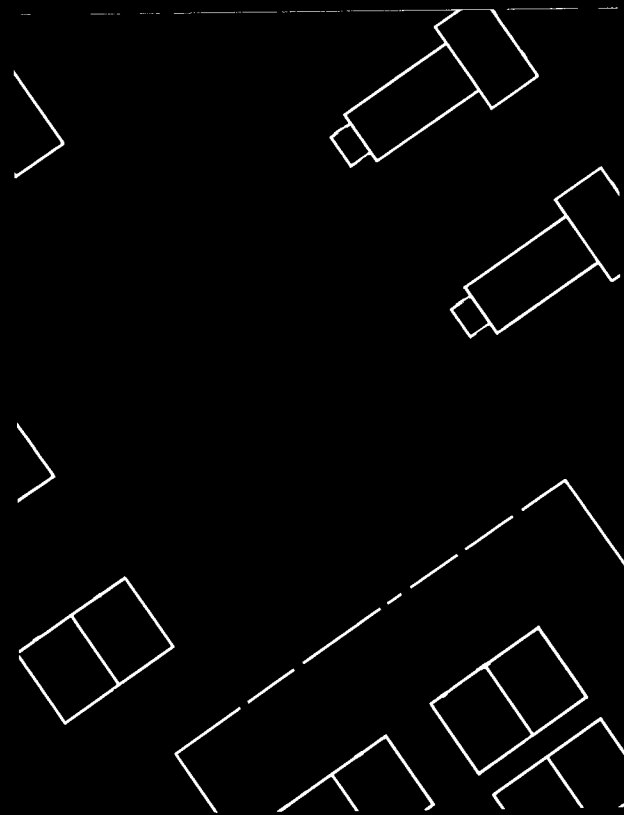
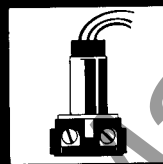




Remote Control Low Voltage Switching

Components
and Applications



GENERAL  ELECTRIC



Remote Control Low Voltage Switching

Components and Applications

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Overview

Remote Control components provide the basic building blocks for a flexible lighting control system. The standard components are assembled to provide the specific control functions required by the building. The new "EZ" electronic controls and components simplify both design and installation. The new preassembled "EZ-Panels" provide the most common panel control configurations in economical standard assemblies

which simplify design and installation. The low voltage latching relay which is the heart of the system is common to all General Electric lighting controls ... standard Remote Control Components, Smart Remote Control, and Programmable Lighting Control. Thus, installing a Remote Control component system not only provides the building's basic control needs, it ensures that the lighting controls can be upgraded in the future.

Feature/Benefit Summary

Low Voltage Wiring (Figure 1)

Multiple Switch Control of a Single Relay

- .. Simplifies central and local control of lighting and makes it possible to readily control lighting from several locations.

Pilot Light Status Indication

- .. Provides visual indication of lighting status at remote switching location.

Relay Grouping for Common Control

- .. Simple, low cost "multi-pole lighting contactor function". Circuits can be grouped for common control and reconfigured as the building layout changes without affecting the line-voltage wiring.

Reduced Wiring Costs

- .. Small low-voltage cables replace costly line voltage wiring and conduit. Particularly important for long switchlegs.

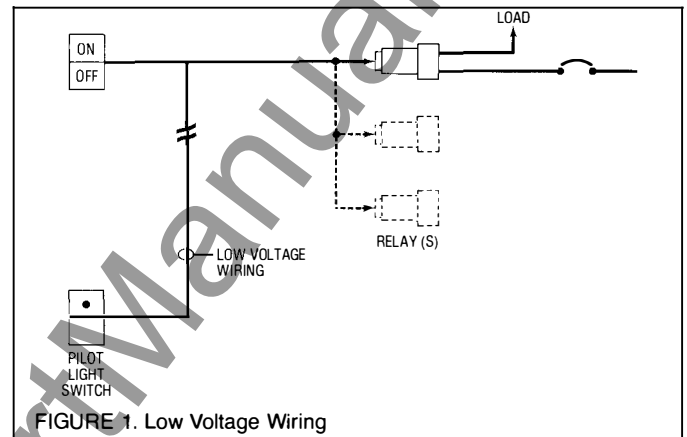


FIGURE 1. Low Voltage Wiring

Simple Lighting Automation

Manual or Automatic Master Control with Local Switch Override (Figure 2)

- .. Local and Remote Master Switches make it possible to manually control a floor or department and still allow an individual to override his local lighting.
- .. Timeclocks or the building automation system can readily control the lighting automatically. Local switch override makes the system responsive to the unpredictable needs of occupants.

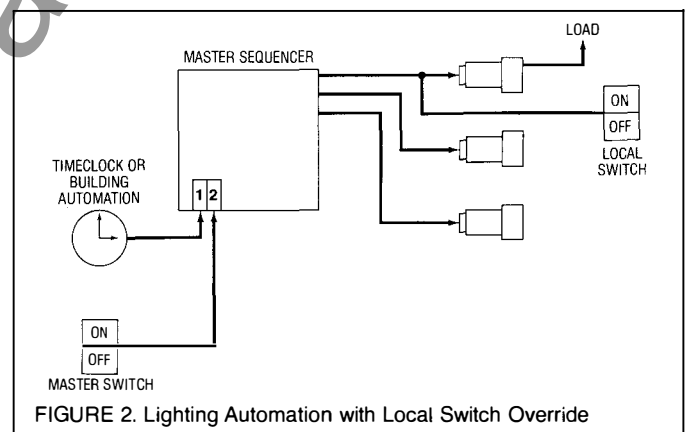


FIGURE 2. Lighting Automation with Local Switch Override

Manual or Automatic Master Control with Telephone Override (Figure 3)

- .. Similar to above except the existing Touchtone™ phones may be used instead of hardwired switches. Saves installation labor while providing a convenient switching method for occupants ... particularly effective in open office areas or for the control of remote loads or buildings.

Note: Figures 1, 2, and 3 are one line drawings illustrating the control concepts. Refer to the next section for more detail.

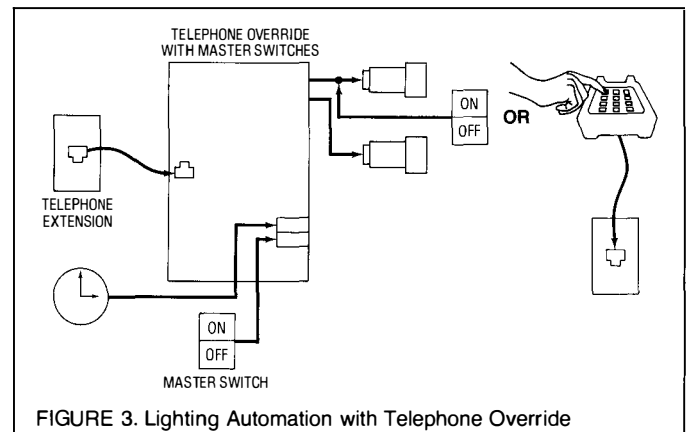


FIGURE 3. Lighting Automation with Telephone Override

Principles of Operation

Relays ... the Heart of the System *(pages 4-5)*

RR7 Operation

The relay employs a split low-voltage coil to move the line voltage contact armature to the ON (OFF) latched position. As illustrated, the ON coil moves the armature to the right when a 24 VAC control signal is impressed across its leads. This is analogous to a magnet attracting the handle of a standard single pole switch to the ON position when energized. The armature (handle) latches in the ON position and will remain there until the OFF coil is energized, drawing the armature into the OFF position.

This control operation provides several key control features:

- 1. Positive action**
The relay always goes to the state commanded. For example, multiple OFF commands will simply keep the contacts in the OFF position.
- 2. Stable operation**
Since the relay latches in the ON or OFF position, power outages do not result in a change-of-state.
- 3. Minimal power consumption**
Control power is only required when the relay changes state.
- 4. Additive control functions**
Pulse control signals coupled with latching allows any number of switches or electronic control devices to operate the same relay. The relay position is always dictated by the last signal.

RR8 and RR9

The RR8 and RR9 each include an auxiliary contact on the low-voltage side to provide status indication. The auxiliary contact in the RR8 is internally wired to provide 24VAC power to the status lead for direct wiring to pilot switches or indicator lights. The RR9 contact is isolated.

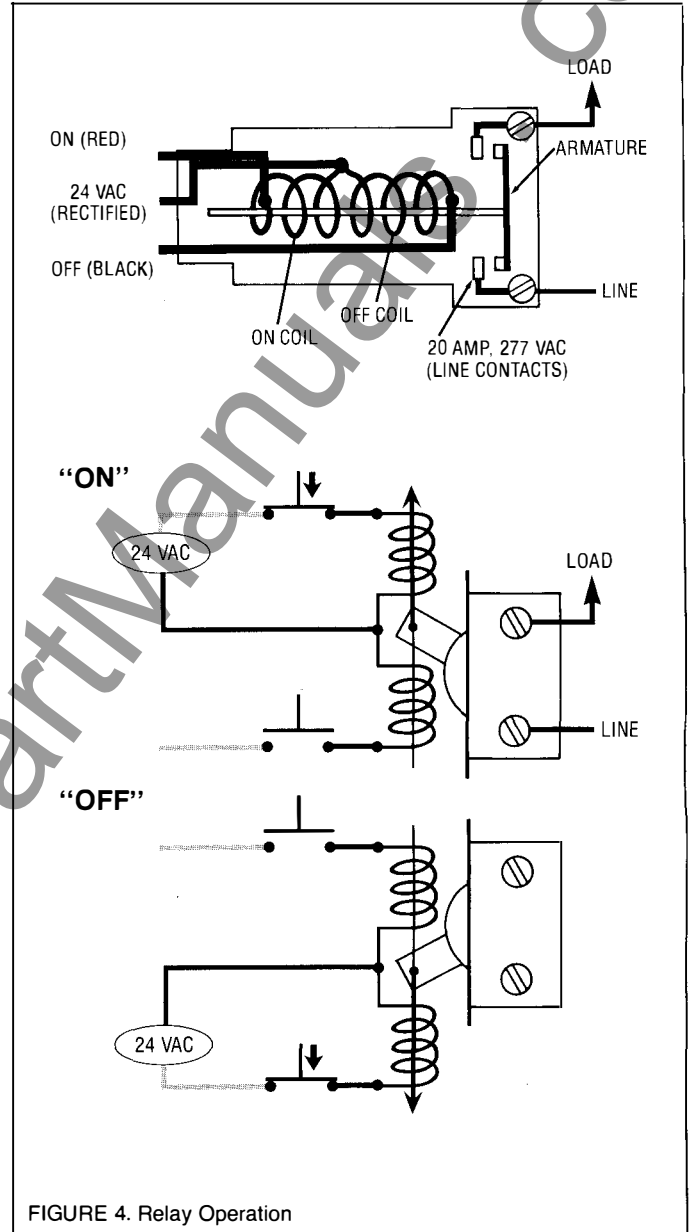


FIGURE 4. Relay Operation

Power Supplies ... Transformers/Rectifiers *(pages 6-7)*

The RT1 (RT2) transformer supplies 24 VAC power to operate the relays and their controls. The relay and pilot switch power is rectified to extend their life; electronic control component power is not rectified.

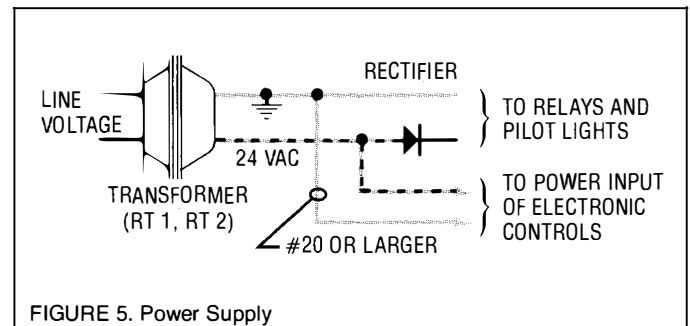


FIGURE 5. Power Supply

Switches (pages 8-11)

Standard

The standard low-voltage switch uses a rocker or two-button configuration to provide a momentary single-pole, double throw action. Pushing the ON (OFF) button completes the circuit to the ON (OFF) coil of the relay shifting the contact armature to the corresponding position. When the button is released, the relay remains in that position.

The pulse operation allows any number of switches to be wired in parallel as shown. A group of relays could also be wired for common switch control by paralleling their control leads. Those relays would then operate as a group.

Pilot

Pilot switches include a lamp wired between the switch common (white) and a pilot terminal. The auxiliary contact in the RR8 relay provides power to drive this lamp when the relay is ON.

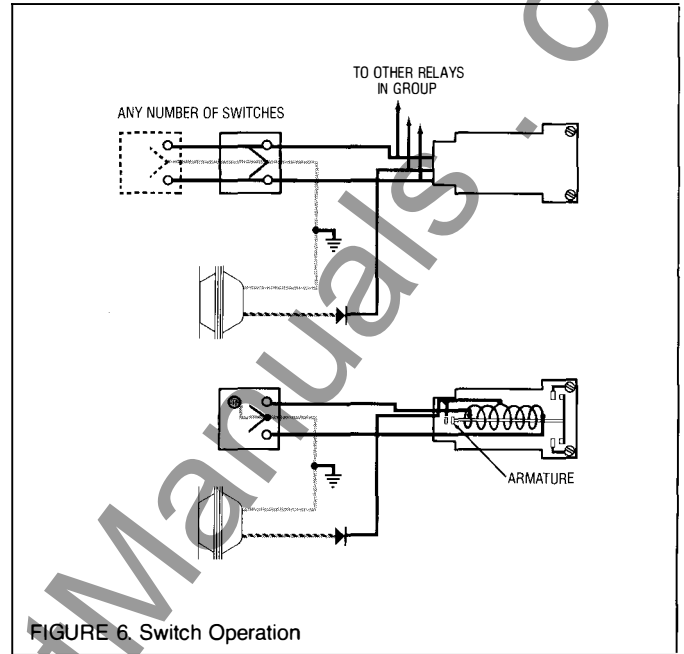


FIGURE 6. Switch Operation

Controls (pages 12-13)

Master Sequencer

The Master Sequencer allows relays to be controlled as a group while still allowing individual switch control of each. When the Master Switch is turned ON (OFF), the Sequencer pulses each of its ON (OFF) relay outputs sequentially. A local switch can control an individual relay without affecting any others.

A second input channel allows timeclocks, building automation system outputs, photocells or other maintained contact devices to also control the Sequencer. This provides simple automation coupled with local override of individual loads.

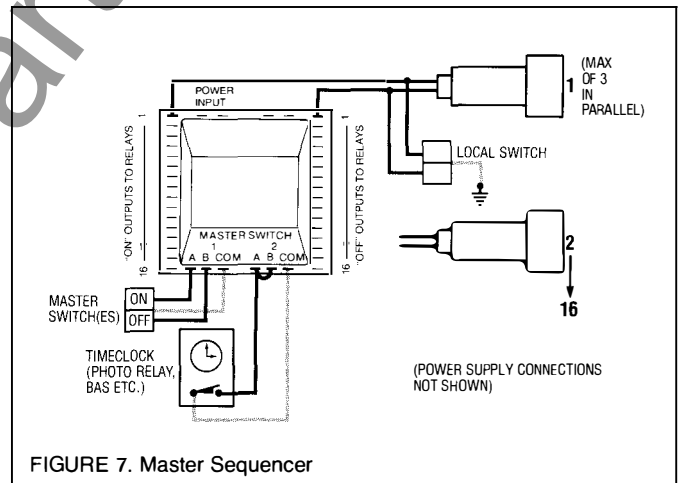


FIGURE 7. Master Sequencer

Telephone Override with Master Switches

The Telephone Override (RTEL) provides the same control functions as the Sequencer, but in addition, it allows the occupant's Touchtone™ phone to be used in lieu of (or in addition to) hardwired switches as illustrated below. "Special Function" switches on the RTEL also allow the phone override function to be disabled or to be limited to "ON" overrides only.

"Touchtone" is a registered trademark of AT&T.

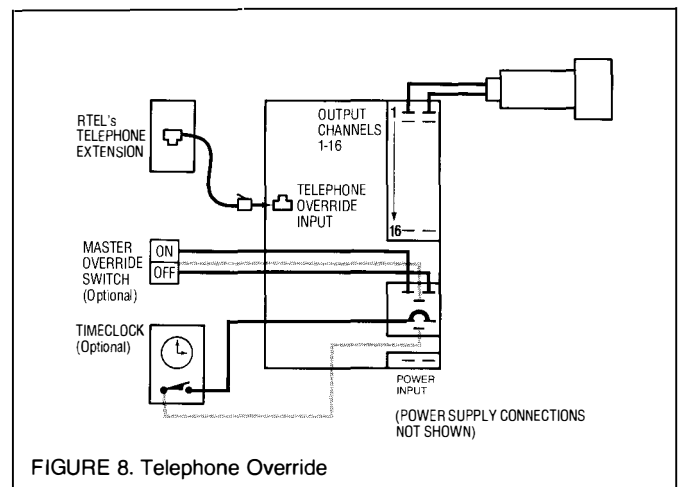
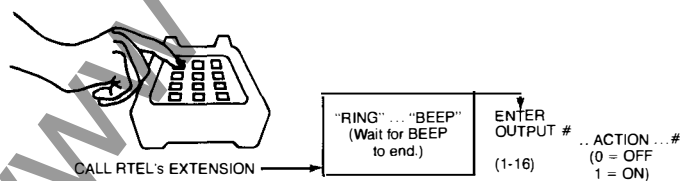
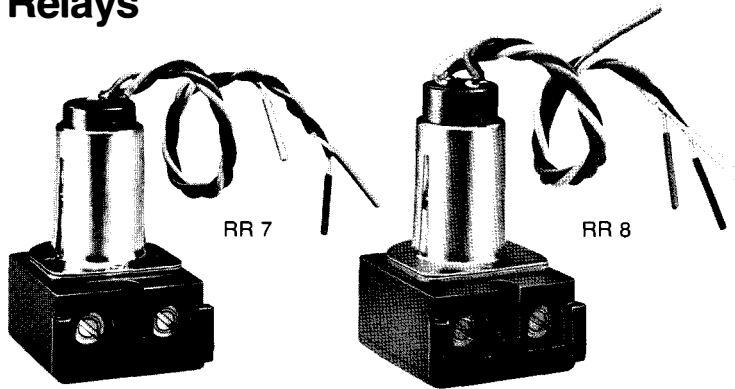


FIGURE 8. Telephone Override

Components

Relays



GE relays (RR 7, RR 8, RR 9) are mechanical latching-type units requiring only momentary 24 volt rectified AC switch circuit pulses to open or close line-voltage circuits. Coil design resists burnout that could occur if equipment or operational failure energized the relay for an extended period of time. All GE low-voltage relays may be used to full-rated capacity for tungsten filament, ballast, or resistive loads.

General Information

- UL Listed, CSA Certified
- Maximum ambient temperature 60°C (140°F)
- Mounts in standard ½" K.O. — .865"-.875" (nominal 22mm) diam. — in 14 or 16 gage material
- Operates in any position.

Standard Component Cat. No.	"EZ" Component Cat. No.	Description
RR 7	RR 7 EZ†	(3 low voltage leads)
RR 8	RR 8 EZ†	with internally energizing Pilot Contact (4 low voltage leads)
RR 9*	RR 9 EZ†	with isolated Pilot Contact (5 low voltage leads)

*For isolation of pilot circuit from control circuit for special applications, such as computer tie-in or to permit separate sourcing of pilot light power.

†Low-voltage wire leads have female Quick Disconnect (QD) terminals for .187" x .020" standard male tabs.

Specifications: RR 7, RR 8 and RR 9 Relays

Rated Capacity:

Lamp Load — 20 amp Tungsten Filament 125 VAC
20 amp Ballast 277 VAC

Resistive Load — 20 amp 277 VAC

Motor Load — ½ Hp @ 110-125 VAC
1½ Hp @ 220-277 VAC

Operating Environment:

Temperature — 0-60°C (32-140°F)

Relative Humidity — 10-95% RH,
Non-condensing

Atmosphere — Non-explosive
Non-corrosive

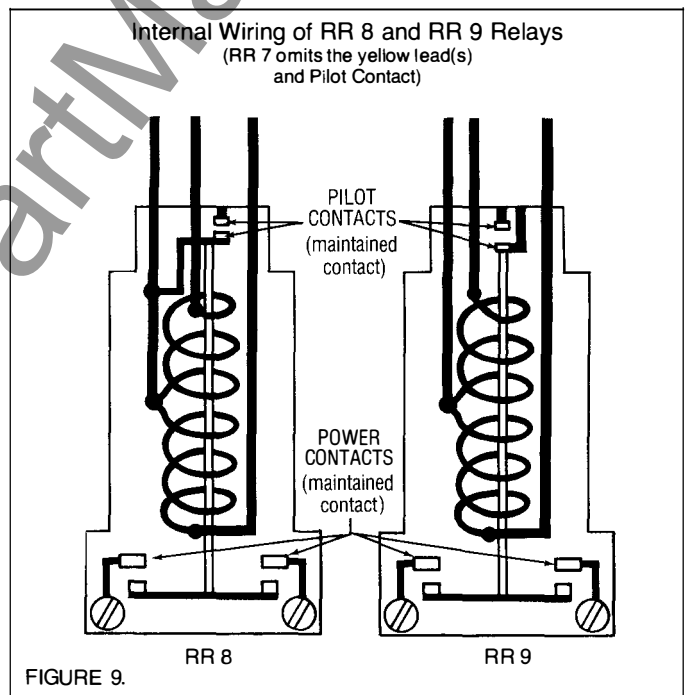
Vibration — Stationary applications
NEMA Level A
(.003 inch amplitude,
1G acceleration)

Endurance:

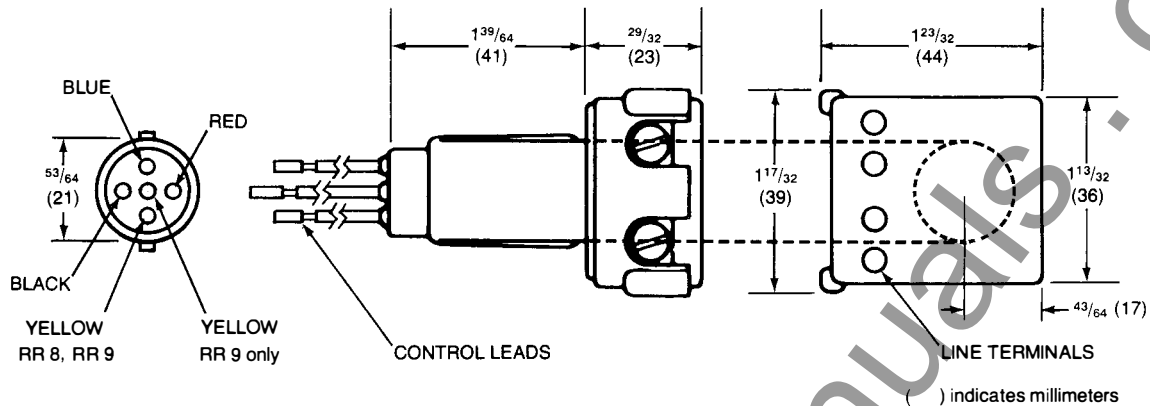
50,000 cycles, full load
100,000 cycles, no load

Line Voltage Characteristics

- Contacts — SPST maintained (mechanical latching)
- Terminals — 2 terminals, 2 back wiring holes per terminal for feed-through wiring, screw-actuated clamps for use with #14-10 AWG solid or stranded wire, copper wire only.



Cat. No.	Lead Length	Pilot Contact (Maintained Contact) Rating
RR 7	6"	N/A
RR 7 EZ	7½" QD	N/A
RR 8	6"	1 amp, 24 VAC
RR 8 EZ	7½" QD	1 amp, 24 VAC
RR 9	6"	1 amp, 24 VAC ISOLATED
RR 9 EZ	7½" QD	1 amp, 24 VAC ISOLATED



Low Voltage Coil Characteristics

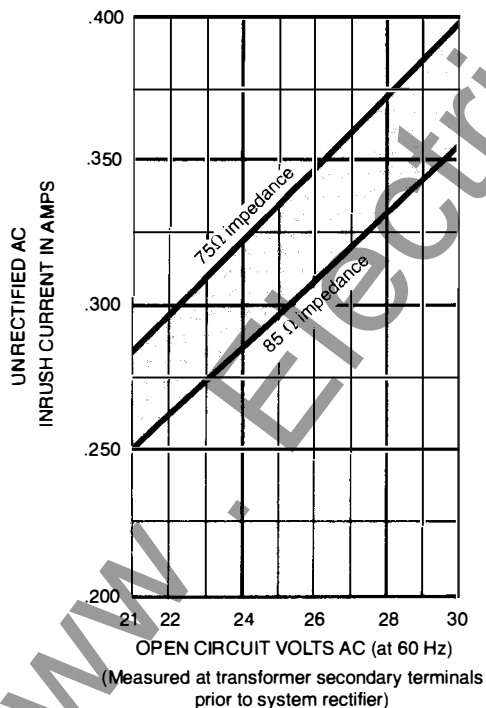
- Split Coil — ½ for "ON", ½ for "OFF"
- Compatible with standard interface/drivers, ULN-2003A Darlington transistor arrays.
- Operating Voltage —
 Nominal: 24-29 VAC ($\pm 10\%$) rectified
 (Minimum at relay = 21 VAC rectified)
 30-38 VDC ($\pm 10\%$) filtered

Note: DO NOT USE DC WITH PILOT OR LOCATOR LIGHTS.

- Duty rating: Momentary
- Minimum activating pulse time: 50 milliseconds
- Coil impedance: 75-85 Ω at 60 Hz unrectified
 55-60 Ω DC Resistance

(See Note 2: Important Considerations and Restrictions)

Relay Coil Inrush Current Vs. Transformer Voltage



Important Considerations and Restrictions

Relays Connected in Parallel — Two or more relays connected in parallel will operate together.

Pilot Light Contacts On RR 8 Relays May Be Connected in Parallel — When RR 8 relays are controlled by a Master Sequencer or Telephone Override unit, the relay pilot light contacts are sometimes connected in parallel by connecting all relay yellow wires together and then connecting them to either a separate pilot light or to the yellow wire of the switch which operates the Master Sequencer. If any one of the RR 8 relays is ON, the pilot light will indicate a circuit is ON. When the OFF master switch is actuated, all circuits will go OFF and the pilot light will go OFF also.

- Note:**
1. Do not use these relays to switch DC loads as doing so will damage the power contacts.
 2. For proper operation, use only half-wave rectified AC voltage for relay control.

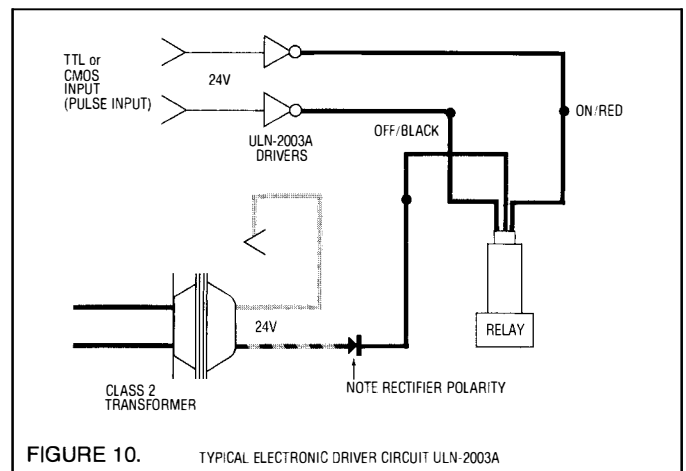
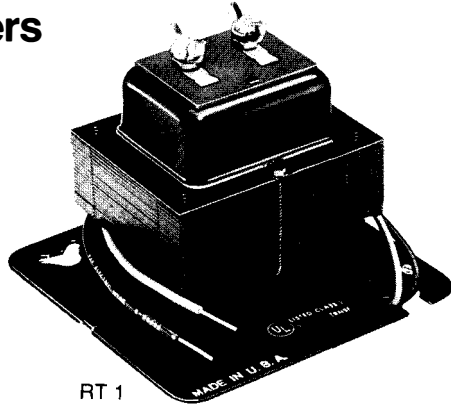


FIGURE 10. TYPICAL ELECTRONIC DRIVER CIRCUIT ULN-2003A

Power Supplies

Transformers



RT 1

The transformers provide the low-voltage power (29 VAC open circuit) for relay actuation and for low-voltage accessories. Because individual relay coils are only energized for a very short period of time, the demand factor is extremely low and one transformer can supply a large number of relays.

Component Cat. No.	Description
RT 1	118 VAC 60Hz transformer primary, 75 volt-amp momentary, 40 volt-amp continuous for 24 volt systems
RT 2	277 VAC 60Hz transformer primary, 75 volt-amp momentary, 40 volt-amp continuous for 24 volt systems

General Information

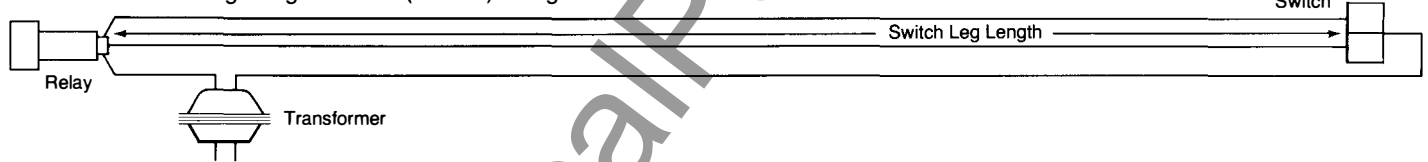
- Suitable for Class 2 signal systems (U.S. National Electric Code – Article 725, and Canadian Electric Code – Section 16)
- UL Listed, CSA Certified
- Overload Protected

Switch Runs and Voltage Drops

Under normal operating conditions using RA 16 rectifier and RT 1 transformer with 118 VAC primary or RT 2 transformer with 277 VAC primary, the following table is useful in determining wire size, permissible length of run, and number of relays that can satisfactorily operate in parallel.

Note: The figures have been calculated based on least ideal operating conditions likely to be encountered.

Maximum Switch Leg Length in Feet (Meters) using one RT 1 or RT 2 Transformer



Number of Relays* or Equivalent † in Parallel	RR 7 RR 8 and RR 9 Relays				
	WIRE SIZE				
	# 12 AWG	# 14 AWG	# 16 AWG	# 18 AWG	# 20 AWG
1	10000 (3048)	6500 (1981)	4000 (1219)	2550 (777)	1600 (488)
2	4850 (1478)	3000 (914)	1900 (579)	1200 (366)	750 (229)
3	3000 (914)	1900 (579)	1200 (366)	750 (229)	450 (137)
4	2100 (640)	1300 (396)	825 (251)	500 (152)	325 (99)
5	1550 (472)	950 (290)	600 (183)	375 (114)	240 (73)
6	1150 (350)	725 (221)	450 (137)	300 (91)	180 (55)
7	900 (274)	650 (198)	350 (107)	225 (69)	140 (43)
8	700 (213)	450 (137)	275 (84)	175 (53)	110 (34)
9	550 (168)	350 (107)	225 (69)	135 (41)	85 (26)
10	425 (130)	250 (76)	160 (49)	100 (50)	65 (20)
11	325 (99)	200 (61)	125 (38)	80 (24)	50 (15)
12	240 (73)	150 (46)	90 (27)	60 (18)	35 (11)
13	175 (53)	100 (30)	60 (18)	40 (12)	
14	110 (34)	65 (20)*	40 (12)		
15	55 (17)	35 (11)			

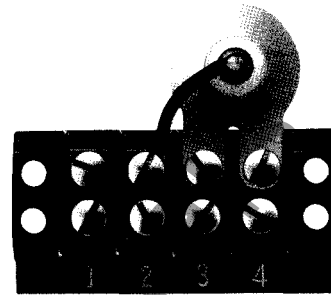
*If the application approaches the maximum switching length, a Master Sequencer may be advisable. (See page 13.)

†For applications with five or more relays in parallel, the use of Master Sequencers may be advisable. (See page 13.)

‡Count each Pilot Light Switch or Accessory as 1/8 relay, Locator Light Switch or Accessory as 1/2 relay, Master Sequencer or Telephone Controller as 1 Relay.

Note: If a Remote Control Blocking Diode Assembly RCBD 1 (or RCBD 12) is used, reduce the above distances by 40%. Do not use smaller than #20 AWG control wires in this system. If there are questions about a particular circuit, please contact your local GE Wiring Device Representative.

Rectifiers



RA 16

Important Considerations and Restrictions

When more than one transformer is used in accordance with U.S. National Electric Code Section 725-32 and Table 725-31 (a) and control devices are operated by a common switch, connect the WHITE low voltage secondary commons of both transformers by a common wire. Transformer primaries must be wired identically (correct polarity) to the same phase. Such installations are not permitted in Canada by Canadian Electric Code C22.1 Subrule 16-200 (4).

Factors that influence the calculation of power requirements are:

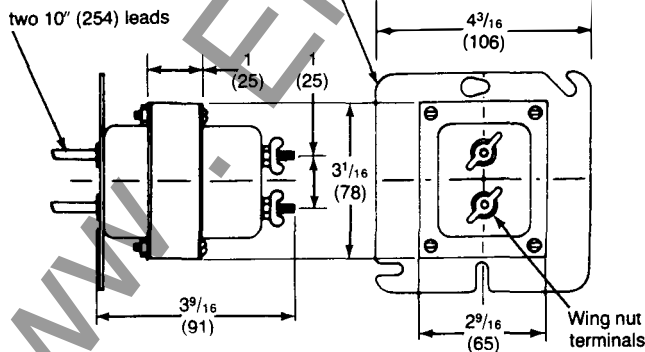
- a) maximum number of relays connected in parallel in any one circuit
- b) length of switch leg
- c) wire size
- d) number of electronic controls and low-voltage accessories that might be operated simultaneously
- e) number of pilot lights and locator lights in the switching circuits

Current draw of these components is given in each component description.

RT 1, RT 2

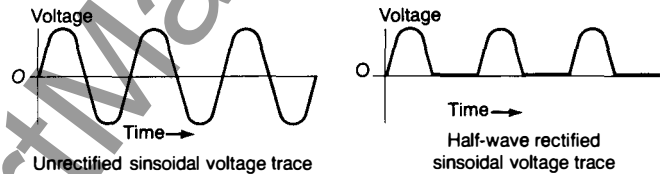
two 10" (254) leads

Flange fits 3 1/2" and 4" octagon box or 4" square box.



() indicates millimeters

The RA 16 rectifier is recommended for longer life of GE relays, pilot lamps and locator lamps.



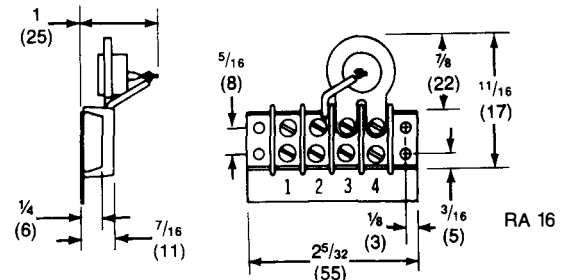
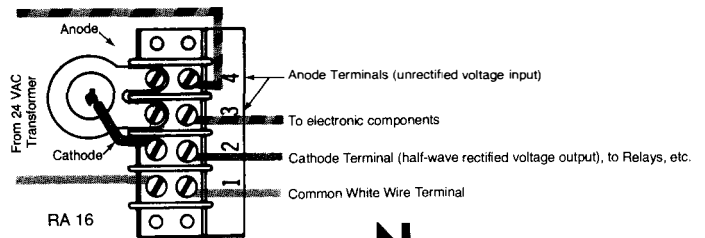
General Information

- Heavy duty silicon rectifier
- Affords protection to the switching system
- Provided in GE "EZ" component cabinets.

Rating

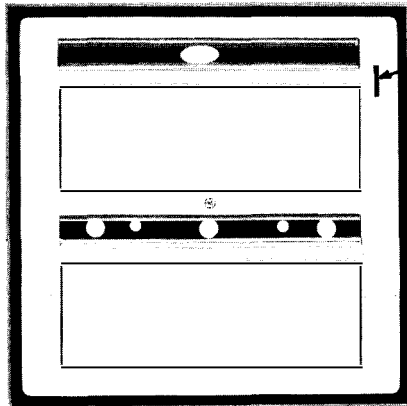
- 20A 30 VAC intermittent duty
- 7.5A 30 VAC continuous duty

Component Cat. No.	Description
RA 16	Silicon rectifier assembly



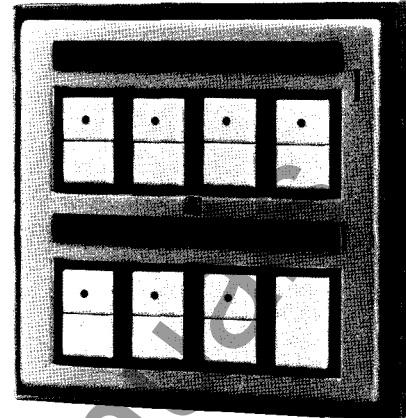
() indicates millimeters

Specifier Series Master Plate



Key opening for Frame Mounted Lockout Switch

RMP 2-35



RMP 2-35 shown with switches (purchase switches and accessories separately).

The master plate is used for convenient ganging of 8 switches or accessories.

One key-operated lock-out switch is provided in the frame which may be used to electrically deactivate any or all of the switches in the plate. The lock-out switch must not be used when two or more lighted switches are connected in parallel because feedback will occur in the pilot light circuit, causing the lamps to remain "ON" dimly. The lock-out switch will cut out indicator lamps on lighted switches and accessories using the white (common) wire on this plate.

General Information

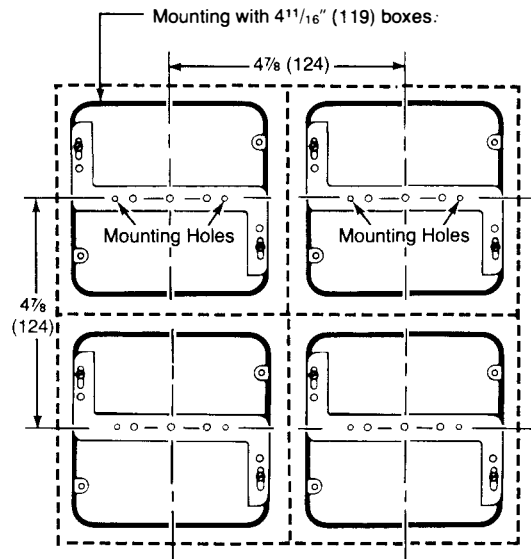
- Master plate accepts eight RS 2 series switches and/or RA 2 series accessories.
- Satin finish, anodized aluminum frame on zinc diecast base.
- Built-in locking switch, with one RK 1 key.
- Directory for identifying individual circuits holds typed elite size letters or 1/4" embossing tape such as Dymo®.
- Mounts directly on 4 11/16" square boxes using "S" bracket packed with unit. (May **NOT** be mounted on 4" square box).

Cat. No.	Description	Color
RMP 2-35	8-switch opening master plate	aluminum with black trim
RK 1	Key, replacement (1 furnished with master plate)	—

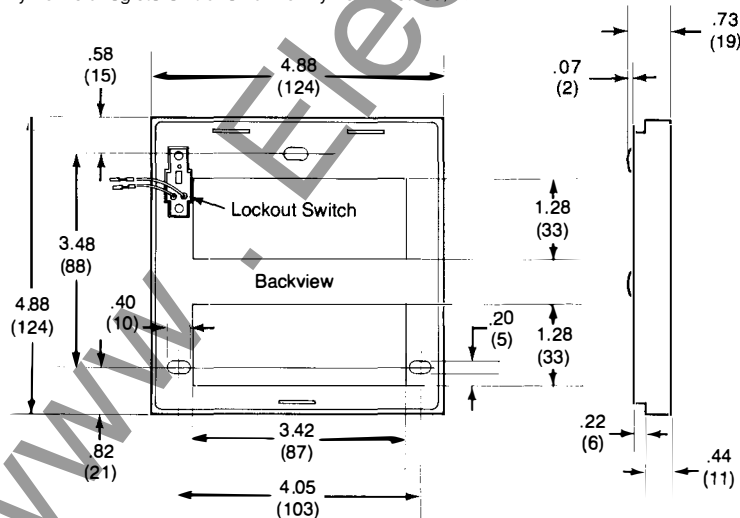
Dymo® is a registered trademark of Dymo Industries, Inc.

Installing Master Selector Switches

Four Master Plates are shown below in gang mounting. Note positioning of boxes to permit horizontal installation of mounting brackets. For multi-switch applications, the master plate is ideal for small, neat appearing installations. These plates mount directly on 4 11/16" square boxes without plaster rings. The boxes must be mounted so that the two mounting-screw tabs are on the sides of the box — not at top and bottom.



() indicates millimeters

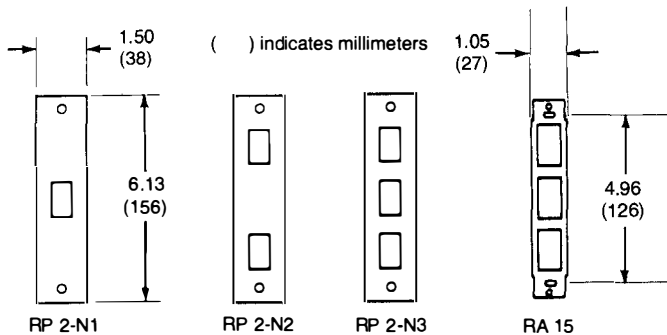


Specifier Series Narrow Wallplates

Switch Opening — .76" (19) x 1.89" (48)
Bracket Opening — .76" (19) x 1.26" (32)
Type 430 stainless, furnished with RA 15 brackets

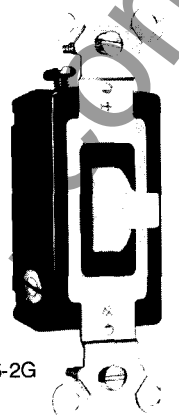
Cat. No.	Description
RP 2-N1	1 switch
RP 2-N2	2 switches
RP 2-N3	3 switches
RA 15	Bracket

RP 2-N1



Heavy Duty Toggle Switches

Where switches are desired to match the appearance of conventional switches, the use of GE single-pole, double-throw, center-OFF, momentary-contact toggle switches is recommended. For standard wall box mounting. Available in brown, ivory, gray and locking.



GE 5935-2G

Single-pole, double-throw, normally-open

Cat. No.	Color	Amp Rating at 277 VAC
GE 5935-1G	Brown	15
GE 5935-2G	Ivory	15
GE 5935-9G	Gray	15
GE 5935-0LG	Locking switch with 2 keys	15
GE 5099-0	Replacement key for GE 5935-0LG	

Single-pole, single-throw, normally-open

Cat. No.	Color	Amp Rating at 277 VAC
GE 5931-NO-1G	Brown	15

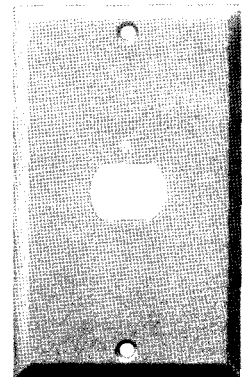
Interchangeable Line Switches and Plates



RTS 4

Switch opening for interchangeable devices. Plate A is furnished with 281V979 Bracket. Plates B-F are furnished with GE 7690-0 Bracket(s)

71011



Where switches are desired to match and fit into interchangeable line mounting brackets, the RTS 4, RTS 5, or RTS 5-9 should be used.

Heavy-duty, for interchangeable line brackets and wallplates.

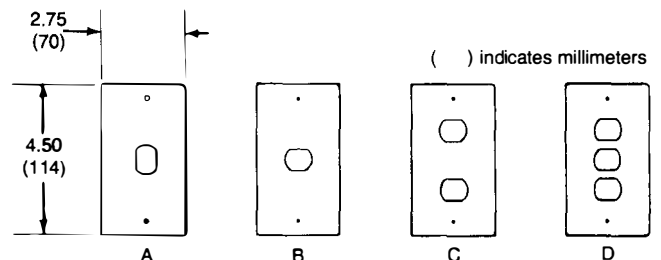
General Information

- SPDT: momentary-contact, normally-open, center-OFF
- Leads: 4" red, white, black
- Contacts: silver cadmium oxide
- Plates: use standard interchangeable line wallplates, such as 72031 which are furnished with GE 7690-0 mounting bracket.

Cat. No.	Description	Amp Rating at 25 VAC
RTS 4	Brown, fits interchangeable mounting bracket and plate, flush	15
RTS 5	Same, ivory	15

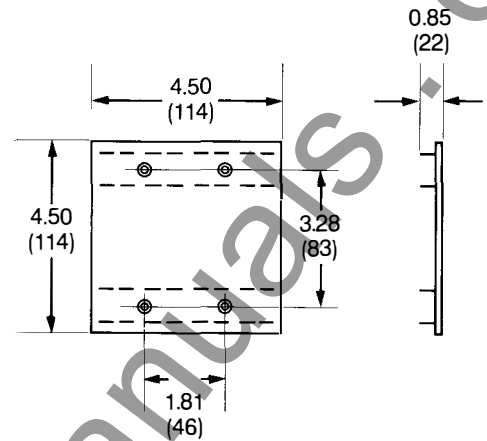
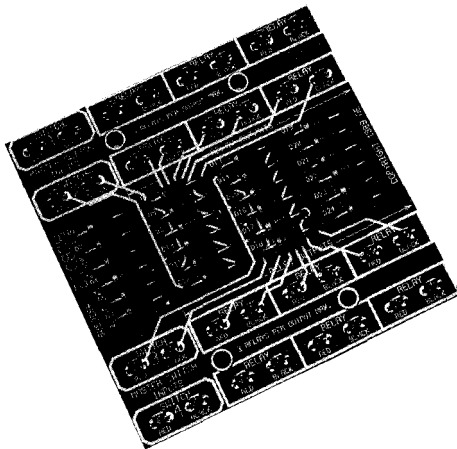
Drawing	Description	Brown Cat. No.	Ivory Cat. No.	Type 430 Stainless Cat. No.
A	1 gang, 1 switch			97041
B	1 gang, 1 switch	71011	72011	97011
C	1 gang, 2 switch	71021	72021	97021
D	1 gang, 3 switch	71031	72031	97031

Bracket GE 7690-0 (replacement)



Controls

Master Grouper (Blocking Diode Assembly)



() indicates millimeters

Master Group Control

The Master Grouper provides a simple means for providing Master Switch control of a small group of relays while still maintaining individual control of each.

The RCBD12 has four Master Switch Inputs; each associated with a bank of three relay outputs. The Master inputs can be paralleled to provide master control of up to 6 relay outputs. For larger groups, you should use the RMS8 (16 or 32) Master Sequencer.

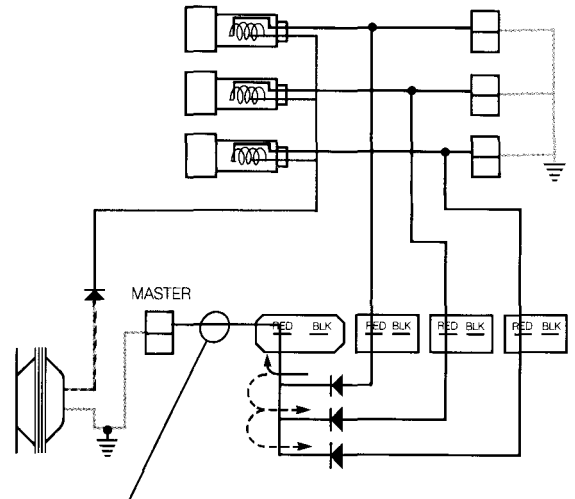
The RCBD12 provides the relay isolation through a simple array of blocking diodes shown in the diagram. The Master Switch controls all relays simultaneously since the current is free to flow from the transformer diode through each relay and then through the diodes in the RCBD12 to the common (ground).

From a design standpoint, it's not necessary to show the diodes. Simply indicate the Master Switches and their associated relay group. Relay groups may overlap. However, the number of relays in the switched group will limit the length of the Master Switchleg as shown in the diagram. The power supply rectifier in all GE relay component cabinets is configured for direct connection to the RCBD12. The RCBD12 is also compatible with the Master Sequencer and Telephone Override.

Environment: 0-55°C (32-131°F)
10-95% Relative Humidity
Stationary Applications

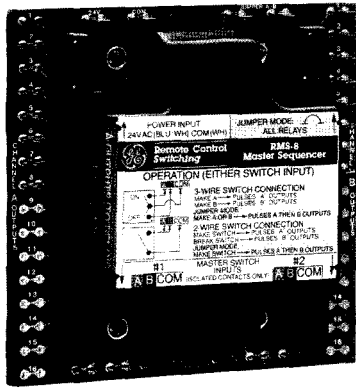
Mounting: Non-sensitive to orientation. Mounts in standard GE component panels

Power Supply: 24VAC rectified



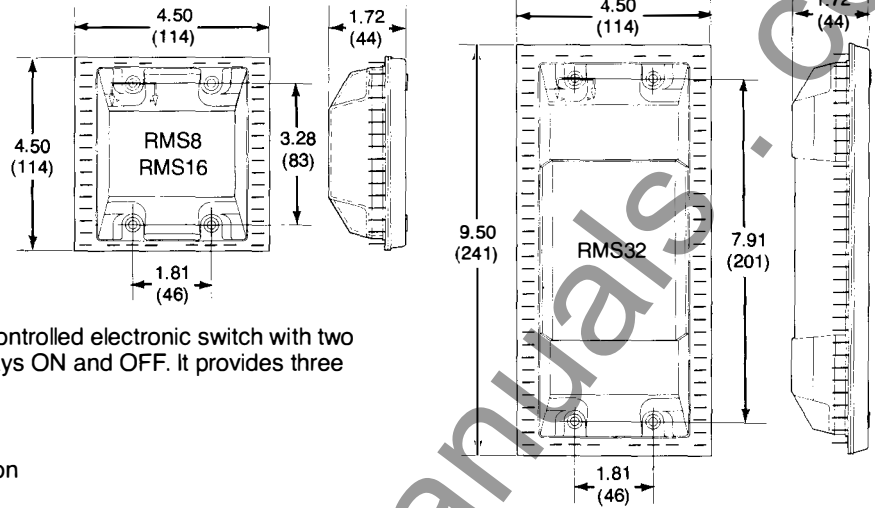
RELAYS IN PARALLEL	DISTANCE (FT.)
2	450
4	200
6	110

*For each of the three relay channels, rectifiers block current flow in direction shown by dotted line; permit it in direction shown by the solid lines. For simplicity, only the ON (Red) diodes and wiring are illustrated.



RMS8

Master Sequencer



() indicates millimeters

The Master Sequencer is a microprocessor controlled electronic switch with two independent inputs controlling 8, 16, or 32 relays ON and OFF. It provides three functions:

1. Master Group Control
2. Master Switchleg Extension
3. Maintained to Momentary Input Conversion

Master Group Control

The RMS turns each of its associated relays ON or OFF one at a time when it detects a change of state on an input. For example, when the ON side of a master switch input is actuated, the RMS senses this action and provides a pulse to each of its ON output terminals in rapid succession (2-4 seconds). Since each relay output is pulsed individually, there is practically no limit to the number of relays that can be controlled as part of a master group while still maintaining individual switch control of each.

In addition, each output may drive up to three relays in parallel or drive the master input to an RCBD12 group of three relays.

Master Switchleg Extension

The RMS does not have the same switchleg length limitation as the RCBD12. The master switchleg can be up to 1000 feet long regardless of the number of relays controlled.

Maintained to Momentary Input Conversion

Each input channel on the RMS will accept either 3-wire momentary contact switches, a single 3-wire maintained (form C) switch, or a single 2-wire SPST switch. This allows it to interface directly with typical control devices such as timeclocks while still providing local master switch override.

Cat. No.	Master Switch Inputs	"A" Bank Relay Outputs	"B" Bank Relay Outputs
RMS8	2	8	8
RMS16	2	16	16
RMS32	2	32	32

Environment: 0-55°C (32-131°F)
10-95% Relative Humidity
Stationary Applications

Mounting: Non-sensitive to orientation.
Mounts in standard
GE component panels

Power Supply: 24VAC unrectified
2 watts

Two Operating Modes ... ON/OFF or ON(OFF) only

A mode jumper allows the RMS to be used as an "ON"/"OFF" master controller or as an "ON" ("OFF") only device similar to the GE Motor Master.

"Two-Bank" ... Mode Jumper Removed

In the ON/OFF mode, either master switch controls the relays both ON and OFF. The ON (red) relay control leads are connected to the "A" bank of outputs; the OFF (black) leads to the "B" bank. Up to 8 relays may be controlled independently by the RMS8 (16 by the RMS16; 32 by the RMS32).

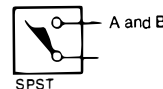
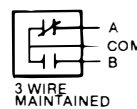
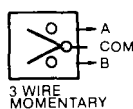
"One-Bank" ... Mode Jumper Installed

In the ON(OFF) mode, actuating either master switch pulses both the "A" and "B" banks of relay outputs. This doubles the relay output capacity. For example, the RMS8 will control up to 16 relays in the "One-Bank" mode.

The master switch action/RMS response for the two modes are summarized in the table to the right.

ON/OFF MODE

Master Switch Type*

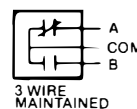
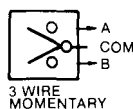


Master Action	Output Action
Close "A" Contact	Pulse "A" outputs
Open "A" contact	None
Close "B" contact	Pulse "B" outputs
Open "B" contact	None

Close switch	Pulse "A" outputs
Open switch	Pulse "B" outputs

ON(OFF) ONLY MODE

Master Switch Type*



Master Action	Output Action
Close "A" contact	Pulse "A" then "B" outputs
Open "A" contact	None
Close "B" contact	Pulse "A" then "B" outputs
Open "B" contact	None

Close switch	Pulse "A" then "B" outputs
Open switch	None

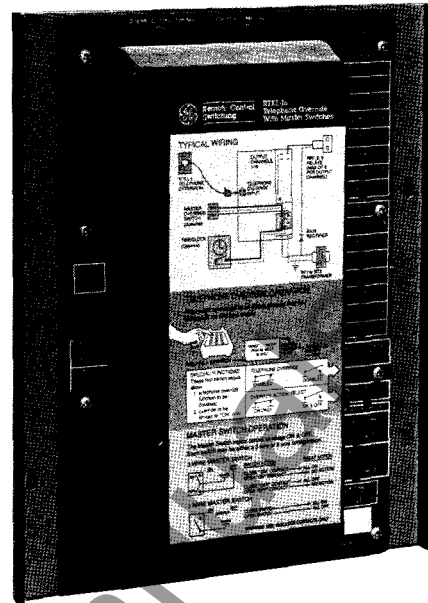
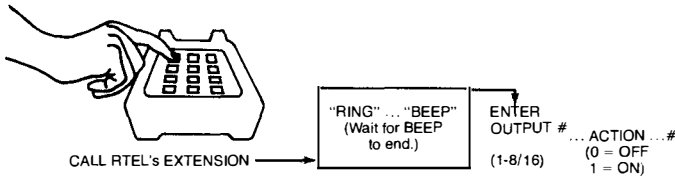
*WARNING: USE ISOLATED CONTACTS ONLY

Telephone Override with Master Switches

Telephone Override

The Telephone Override (RTEL) allows any Touchtone™ (dual tone multiple frequency) phone to override an individual relay or group of relays. Each relay output channel can control up to six relays in parallel. If even greater capacity is required, the output can drive an RMS Master Sequencer.

The RTEL plugs into a standard RJ11 telephone extension. To override an individual relay output channel, the user would:



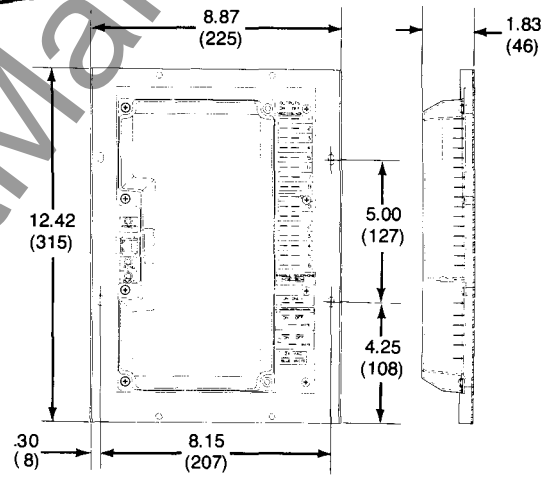
RTEL 16

Special Telephone Control Functions

The RTEL has two switch inputs which allow the operation of the phone override to be limited.

The first input, "Telephone Enable", disallows all telephone overrides when the switch is opened. This allows a pilot relay (RR9) to be used to control the time-of-day during which telephone overrides will be allowed. When this contact is open, the RTEL will not answer the incoming call (the telephone rings but there is no response).

The second input, "On Only", limits the phone overrides to ON only when the contact is closed. This eliminates the problem of "prank" switching of areas during work hours.



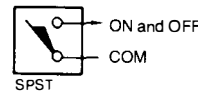
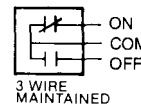
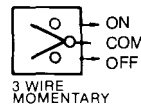
() indicates millimeters

Master Switches

The RTEL includes two ON/OFF Master Switches which operate identically to those on the Master Sequencer. Either master switch input supports 3-wire momentary, 3-wire maintained, or single pole, single throw switches as illustrated.

ON/OFF MODE

Master Switch Type*



Master Action	Output Action
Close ON contact	Pulse ON outputs
Open contact	None
Close OFF contact	Pulse OFF outputs
Open contact	None
Close switch	Pulse ON outputs
Open switch	Pulse OFF outputs

*WARNING: USE ISOLATED CONTACTS ONLY

Cat. No.	Master Switch Inputs	Output Channels	Relays/Output
RTEL8	2	8 (ON/OFF)	6
RTEL 16	2	16	6

Environment: 0-55°C (32-131°F)
10-95% Relative Humidity
Stationary Applications

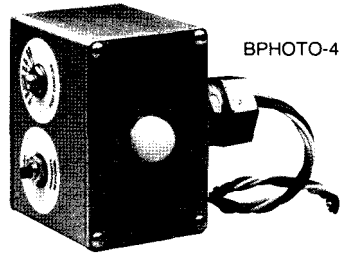
Mounting: Nonsensitive to orientation. Mounts in RB3EZ or RBS2 (RBF2) panels.

Telephone: RJ11 jack.
Dual-tone multiple frequency push-button phones only (no rotary)

Power Supply: 24 VAC unrectified
4 watts

Photo Switches

BPHOTO-4 This unit is used to shed artificial lighting in interior daylight spaces. It monitors **outside** light levels through a perimeter window or skylight to provide the switching signal to the input of a Master Sequencer or Telephone Override. The photo switch will turn loads OFF when the exterior light level reaches the set footcandle level and remains there for 15 minutes. When the light level decreases to approximately 15% less than this setting and remains there for 15 minutes, loads will be turned ON. (See the wiring diagram on page 25.)



BPHOTO-5 This unit is designed to shed exterior lighting.

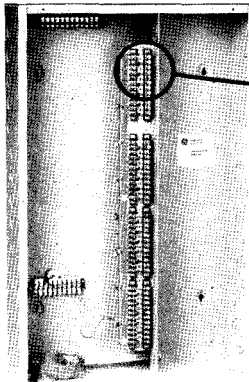
Specifications

Catalog Number	BPHOTO-4 (indoor use only) BPHOTO-5 (indoor/outdoor use)
Foot Candle Range	BPHOTO-4, 50-500 fc adjustable BPHOTO-5, 5-10 fc fixed
Power Requirement	No external source needed
Environment	18 to 55°C (0 to 131°F), non-corrosive atmosphere 0-85% RH non-condensing (BPHOTO-4) 0-100% RH (BPHOTO-5)
RFI Environment	Less than 15 v/m
Immediate Response	
Feature	BPHOTO-4 — Yes BPHOTO-5 — No
Hysteresis	15% typ. @ 100 fc 20% typ. @ 300 fc 25% typ. @ 500 fc

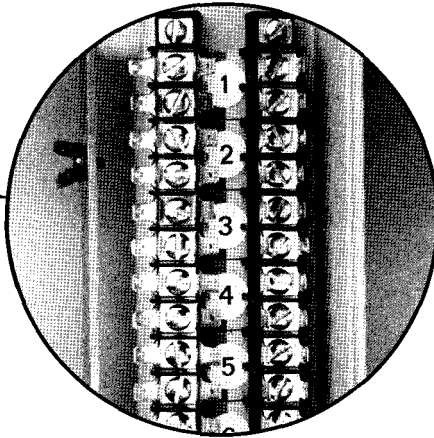
www.ElectricalPartManuals.com

Component Cabinets

Large Cabinets



RB3EZ



The RB3EZ is designed for simple assembly of low voltage control components.

The steel barrier separating the high and low-voltage sections provides 1/2" knockouts for up to 24 relays. The low-voltage section will accept any of the following combinations:

- 3 RMS8(16) or 3 RCBD12
- 1 RMS8(16) or 1 RCBD12 and 1 RMS32
- 1 RTEL8(16) and 1 RMS8(16) or 1 RCBD12

Available for surface or flush mounting. Gray enamel finish. Quick-turn cover screws. UL listed.

Cat. No.	Description
RB3EZ	Cabinet for 24 relays and associated controls. Includes RA16 rectifier prewired to bus bar. Cover supplied separately.
RB3-CFEZ	Flush cover for RB3EZ
RB3-CSEZ	Surface cover for RB3EZ

Low-Voltage Wiring

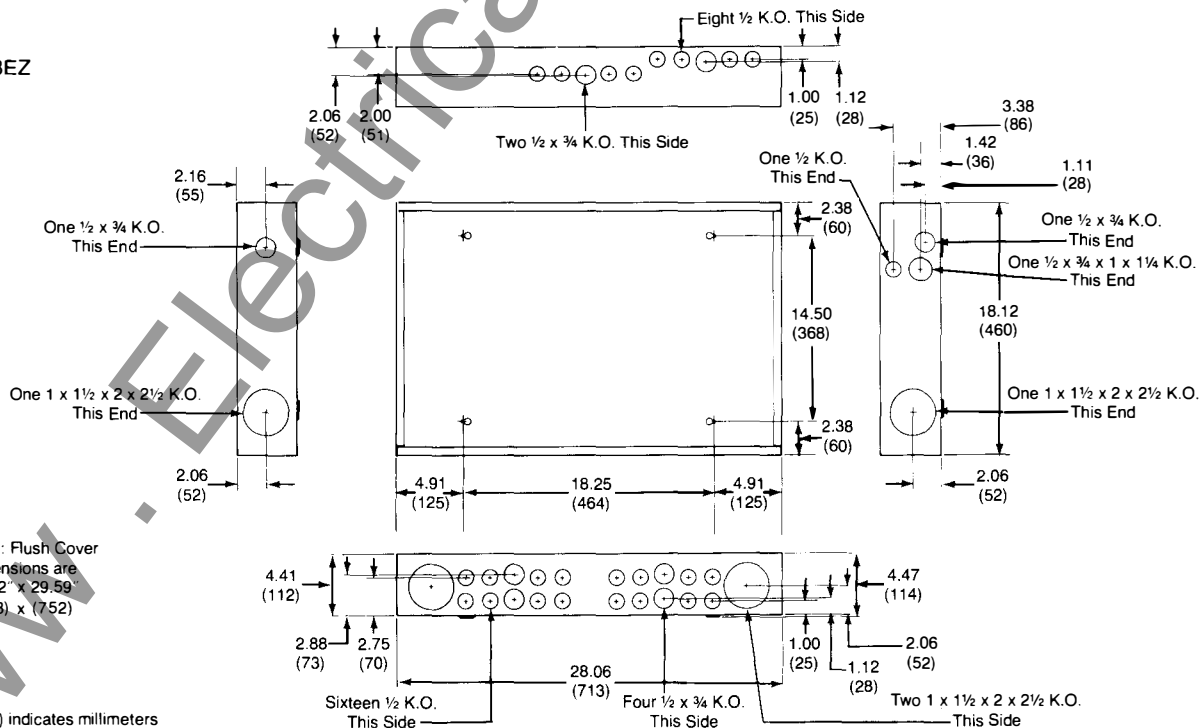
The color-coded, numbered low-voltage termination strips provide flexible push-on terminations for the relays and associated controls. An RA16 rectifier is prewired to a solid brass bus-bar providing power to all relays. This integrated design approach simplifies installation:

1. Plug the relay into the barrier and push its leads on to the color-coded terminations.
2. Parallel the Red/Black control leads to form relay groups as required.
3. Wire from the RMS or RTEL outputs to the relay groups.
4. Connect local switches to the relay terminations.
5. Connect Master Switches to the RMS or RTEL inputs.

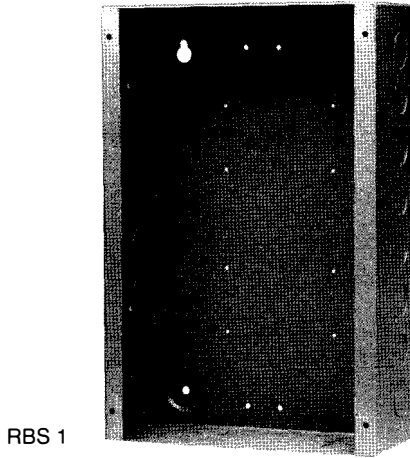
Mounting

The panel and all components are insensitive to mounting orientation. The panel would normally be mounted on either side of a lighting distribution panel.

RB3EZ



Small Cabinets



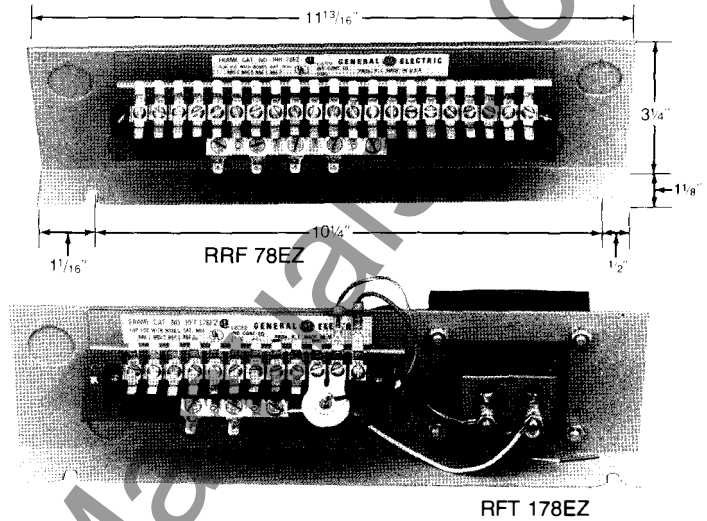
RBS 1

General Information

- Covers supplied with cabinets
- Listed by Underwriters' Laboratories, Inc.
- Accepts frames for relay mounting

Cat. No.	Description
RBS 1	Surface cabinet for one frame or two RMS8(16) or one RMS32 or two RCBD12
RBF 1	Same, flush
RBS 2	Surface cabinet for two frames or four RSM8(16) or 4 RCBD12 or two RMS32, or one RTEL
RBF 2	Same, flush

Frames for Component Cabinets



RFT 178EZ

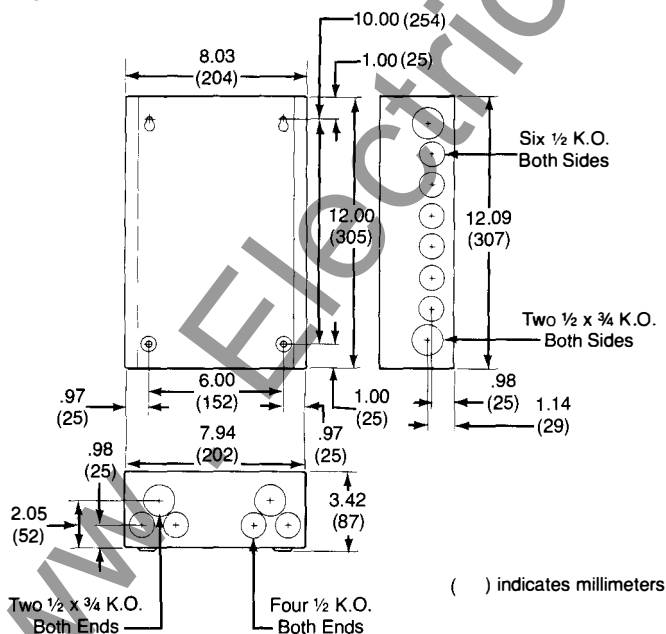
General Information

- Includes necessary low-voltage quick disconnect terminals
- Serves as separator of low and high-voltage sections.
- Listed by Underwriters' Laboratories, Inc.
- For use with RBS 1, RBS 2, RBF 1 RBF 2 cabinets

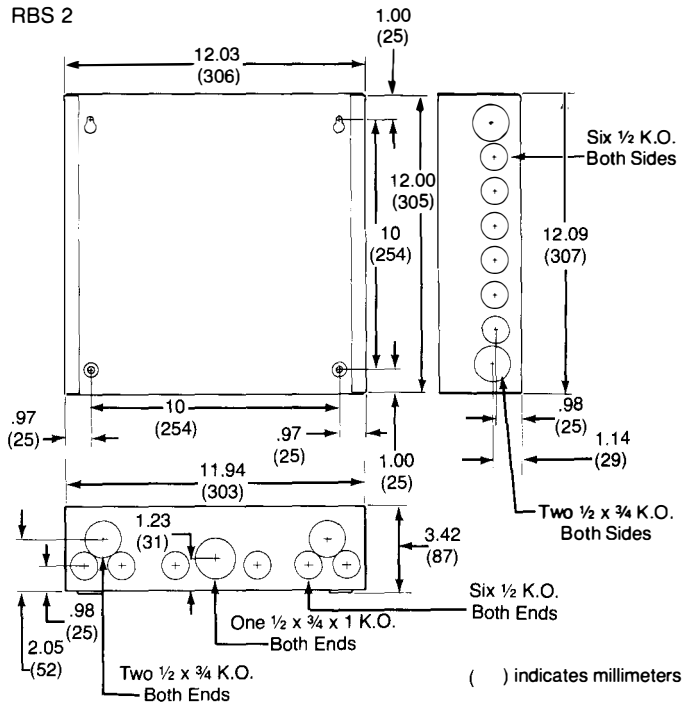
Cat. No.	Description
RRF 78EZ	Frame to hold 1 to 6 relays
RFT 178EZ	Frame with 118 VAC transformer* wired to RA 16 rectifier to hold 1 to 3 relays.
RFT 278EZ	Frame with 277 VAC transformer* wired to RA 16 rectifier to hold 1 to 3 relays

*75VA momentary, 40VA continuous for 24 VAC systems (same characteristics as RT 1 and RT 2 pages 6 and 7).

RBS 1



RBS 2



Color Coded Low Voltage Wire

Color coded to match switch/relay connections for simplified installation.
Class 2 or Class 2P to meet new NEC requirements.



Switch Wire

Standard Low Voltage Switches

Cat No.	Max. Diameter	Description
RSWIRE-3	(.210)	3-conductor, stranded, No. 20 AWG, Red/Black/White with jacket. Not for use in risers or air handling plenums.
RSWIRE-3P	(.150)	Same as above except rated for use in risers and air handling plenums.

Pilot/Locator Light Low Voltage Switches

RSWIRE-4	(.230)	4-conductor, stranded, No. 20 AWG, Red/Black/Yellow/White with jacket. Not for use in risers and air handling plenums.
RSWIRE-4P	(.175)	Same as above except rated for use in risers and air handling plenums.

Standard or Pilot Light 8-Gang Master Switches

RSWIRE-25	(.540)	8 individually identified sets of 3 No. 20 AWG, stranded. Each set contains a Red/Black/Yellow conductor. Single No. 18 AWG White common. Not for use in risers and air handling plenums.
RSWIRE-25P	(.435)	Same as above except rated for use in risers and air handling plenums.

Relay Wire

Relay Wire (for remote mounted RR7, RR8, or RR9 relays)

Cat. No.	Max. Diameter	Description
RRWIRE-5	(.255)	5-conductor, stranded, No. 20 AWG, Red/Black/Yellow/Yellow/Blue with jacket. Not for use in risers or air handling plenums.
RRWIRE-5P	(.200)	Same as above except rated for use in air handling plenums.

Panel Wire

Individual No. 18 AWG, stranded copper wires with the following color codes are recommended:

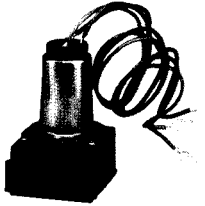
Black	OFF leads from RMS or RTEL to relays or jumpers
Red	ON leads
Blue	Rectified power to relays and pilot lights
Blue/White	Unrectified power to RMS and RTEL electronic controls
White	Common

These may be purchased from your regular wire supplier.

Replacement Parts

Relays

Relays for PAL Panels



PRR7L

Cat. No.	Description
PRR7L	Similar to RR7(8,9)EZ except 13" leads
PRR8L	
PRR9L	

Switches and Plates

RCS Series



RCS 2PL

Cat. No.	Description
Switches	
RCS 2PL	Pilot light, ivory
RCS 9PL	Pilot light, gray
Plates (302 Stainless, horizontal mount)	
RP311	1 gang, 1 switch
RP312	1 gang, 2 switches
RP313	1 gang, 3 switches
RP324	2 gang, 4 switches

RFS/RKS Series



RFS 6



RK 0

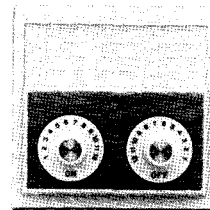
Cat. No.	Description
Switches	
RFS6	Unlighted, ivory
RKS6	Unlighted, key operated, ivory
RK 0	Key
Plates (302 Stainless, horizontal mount)	
RP211	1 gang, 1 switch
RP212	1 gang, 2 switches
RP213	1 gang, 3 switches
RP224	2 gang, 4 switches
Plates (Ivory Urea, horizontal mount)	
RP1	1 gang, 1 switch
RP2	1 gang, 2 switches
RP3	1 gang, 3 switches
RP24	2 gang, 4 switches
Surface Mounting Frame (Urea)	
RA 13	Base and cover, ivory



Frame with Switch. Switch purchased separately.

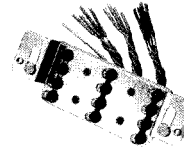
Switches and Plates (cont.)

12 Position Master Switch



RMS 4A

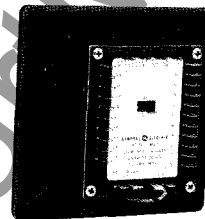
Cat. No.	Description
RMS 4A	12-position master selector switch. Furnished with ivory plate.
RP229	Stainless steel plate for above.
RA 12	Pilot light assembly for RMS 4A
RA 14	Replacement pilot lamp



RA 12

Controls

Motor Masters*

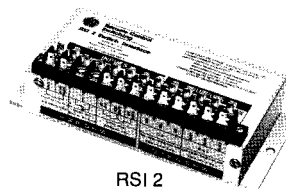


RMS 5BL

Cat. No.	Description
RMS 5BL	1 master switch input, 2 ON/OFF relay outputs
RMS 8BL	1 master switch input, 25 ON/OFF relay outputs

Note: RMS8(16,32) provides direct substitute.

Switch Interface*

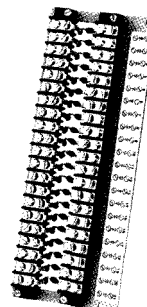


RSI 2

Cat. No.	Description
RSI 2	1 maintained, and one momentary ON/OFF master switch input; 3 ON/OFF relay outputs or 1 ON/OFF Motor Master output.

Note: RMS8(16,32) provides functional substitute.

Blocking Diode Assembly*



RCBD 1

Cat. No.	Description
RCBD 1	21 high capacity diodes with numbered termination strip
RA 20	Single replacement diode for RCBD.

Note: The RMS8(16,32) is recommended when grouping more than 5 relays. For large number of small groups, the Smart Remote Control panel is recommended.

*These items will be discontinued when the present stock is exhausted.

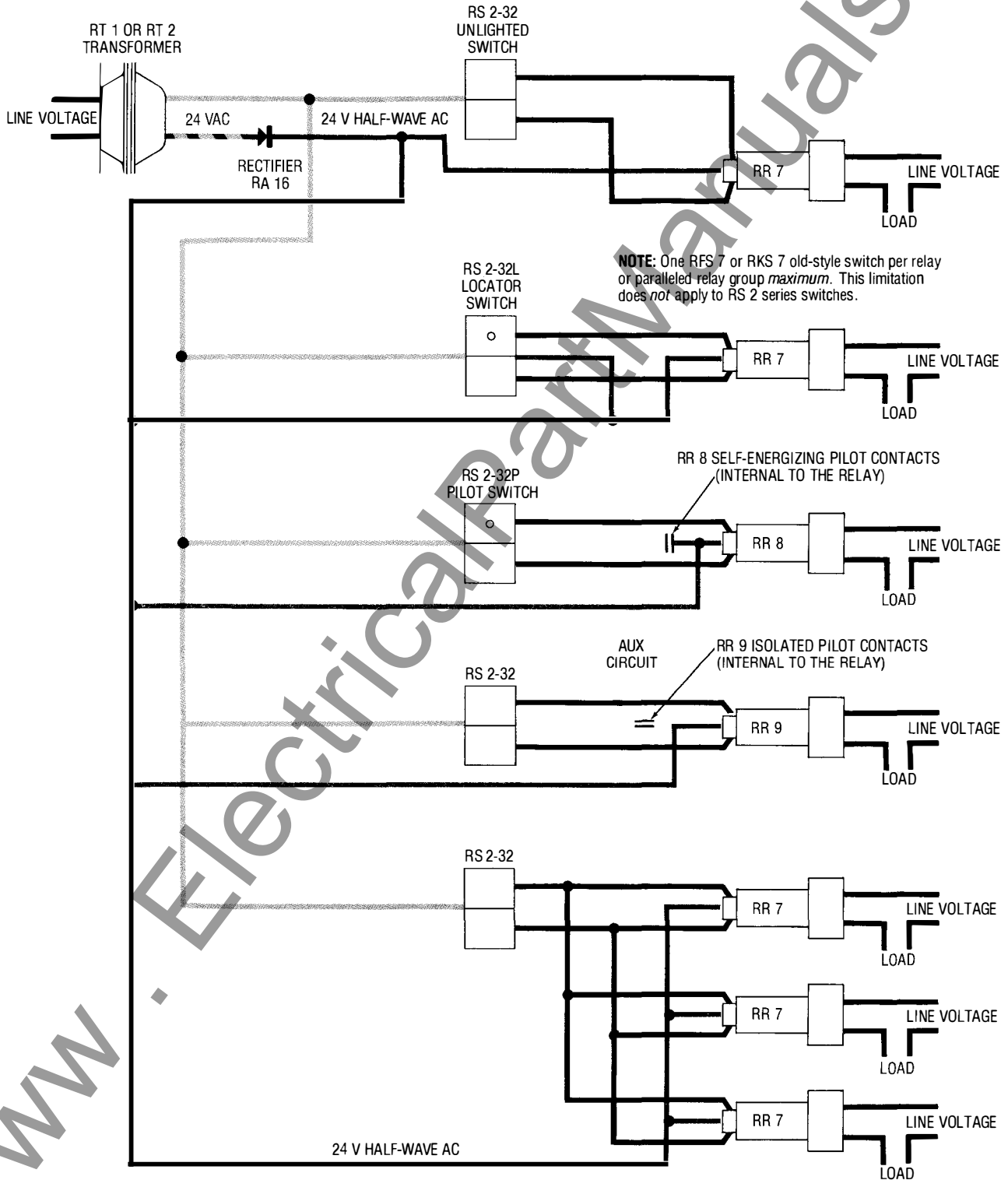
Basic Circuits and Applications

Standard Low-Voltage Wiring

Connecting Switches/Relays/Power Supply

Caution: Connecting relays in parallel is the same as connecting lamps in parallel. When so connected, they cannot be individually controlled. See table on page 6 for the maximum number of relays that can be operated at one time with given transformer capacity.

Note: RR 8 and RR 9 pilot contacts are located internal to the relay. For the clarity of the wiring diagram only, these pilot contact symbols have been figuratively located externally adjacent to the relay.

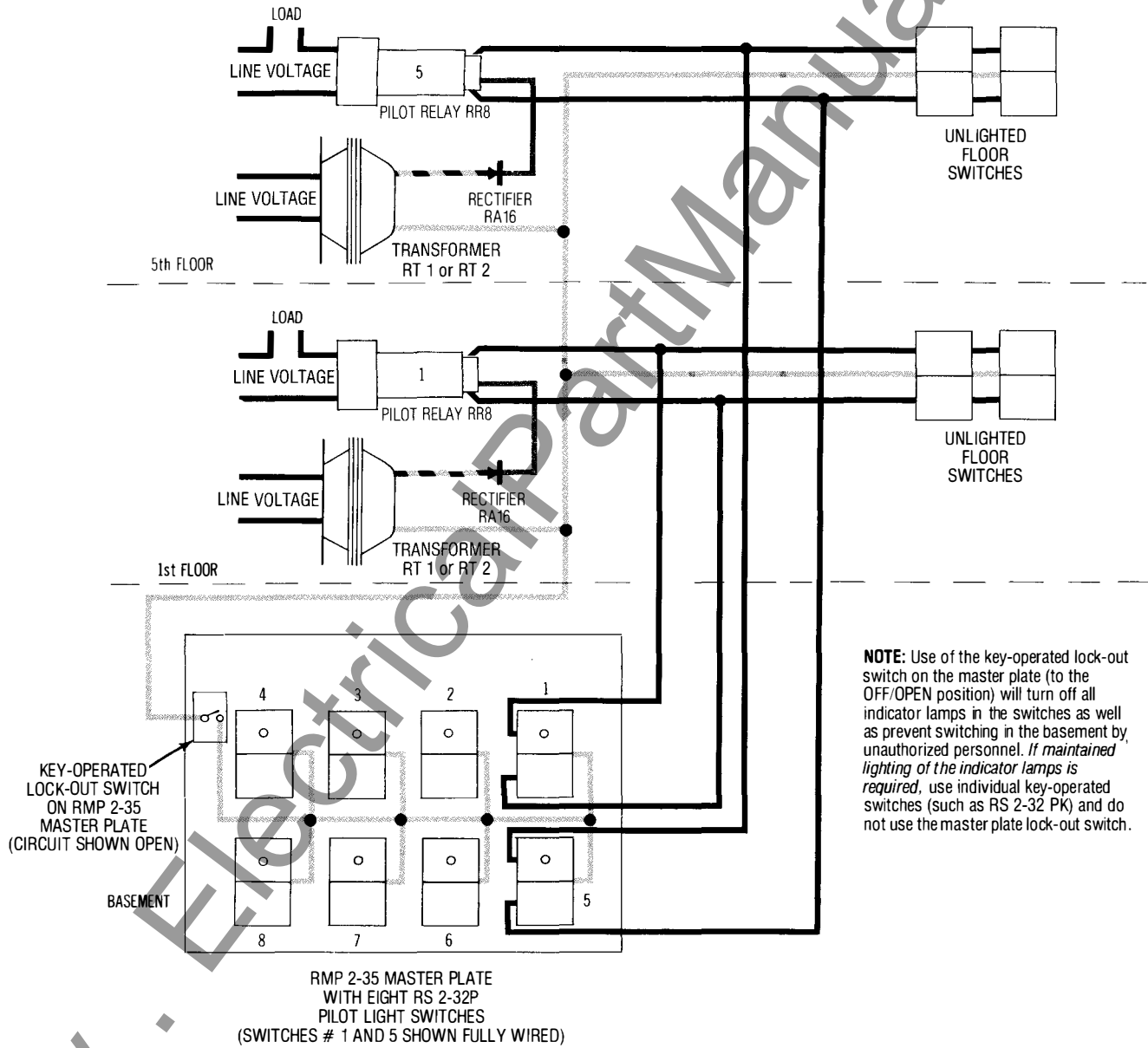


Central/Local Switch Control of Relays

For master control of individual relays on different floors where separate floor transformers and switches are also used, this circuit diagram explains the necessary wiring requirements.

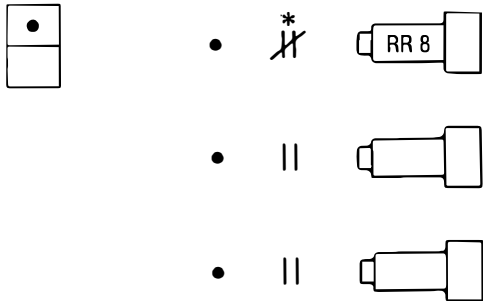
Note: White wires shown in gray.

This circuit is especially useful for watchman lights controlled from watchman station, or for control of corridor lights from superintendent's office.

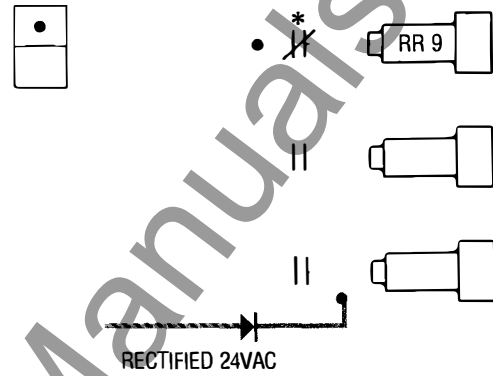


Pilot Light Status Indication for a Group of Relays

Any Relay in Group "ON" Lights Pilot



All Relays in Group "ON" to Light Pilot



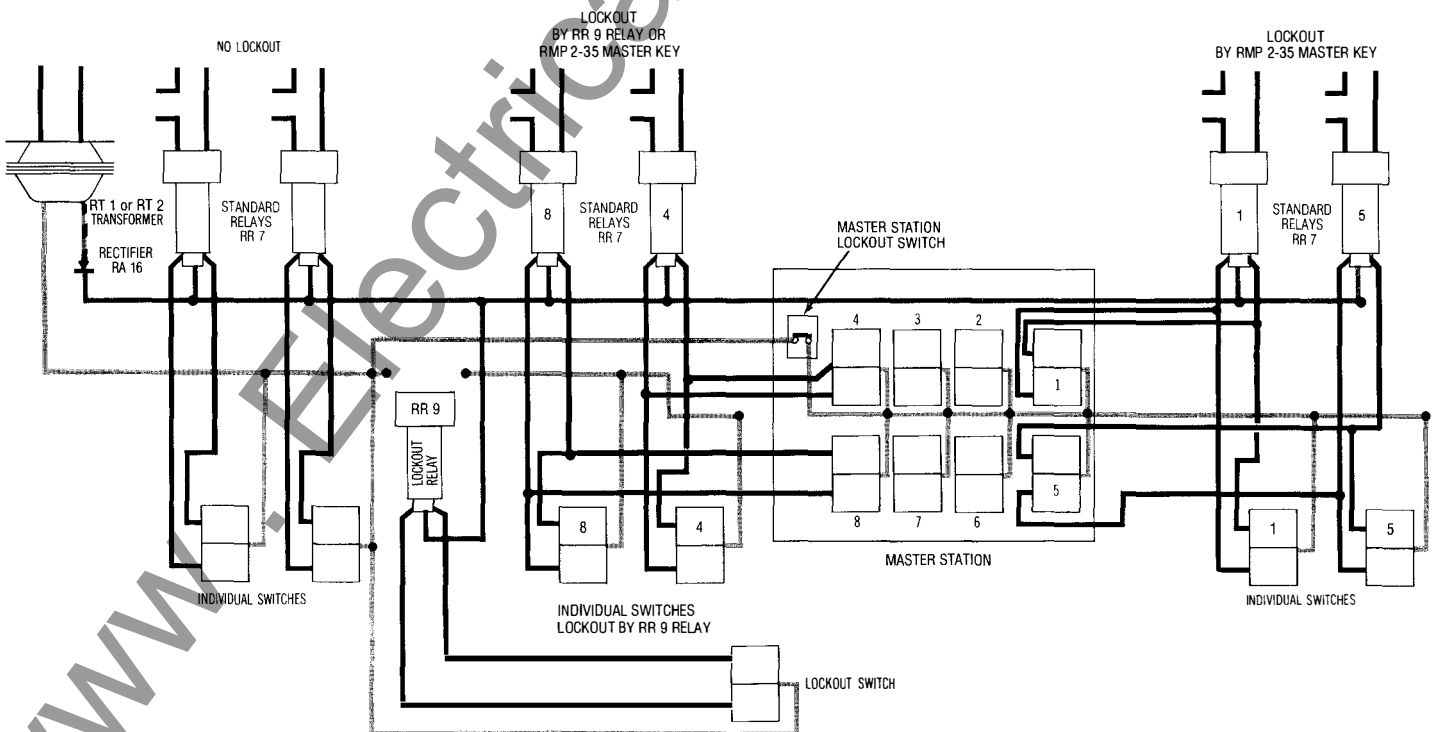
*Pilot light contact is internal to relays. (For simplicity, red, blue, and black wires are not shown).

Switch Lockout

The diagram illustrates suggested methods of locking out switches to prevent unauthorized control. The two individual switches at the left represent that part of the switching system not to be locked out. The two individual switches in the center can be locked out of control with the single "lock-out" switch at the bottom while the relays they normally control can be

operated from the master switch provided this is not locked out with its key switch. The two switches at the right are locked out along with the Master Station switches by the Master Station lockout switch.

Note: White wires shown in gray.



Master Control of Group Using RCBD12

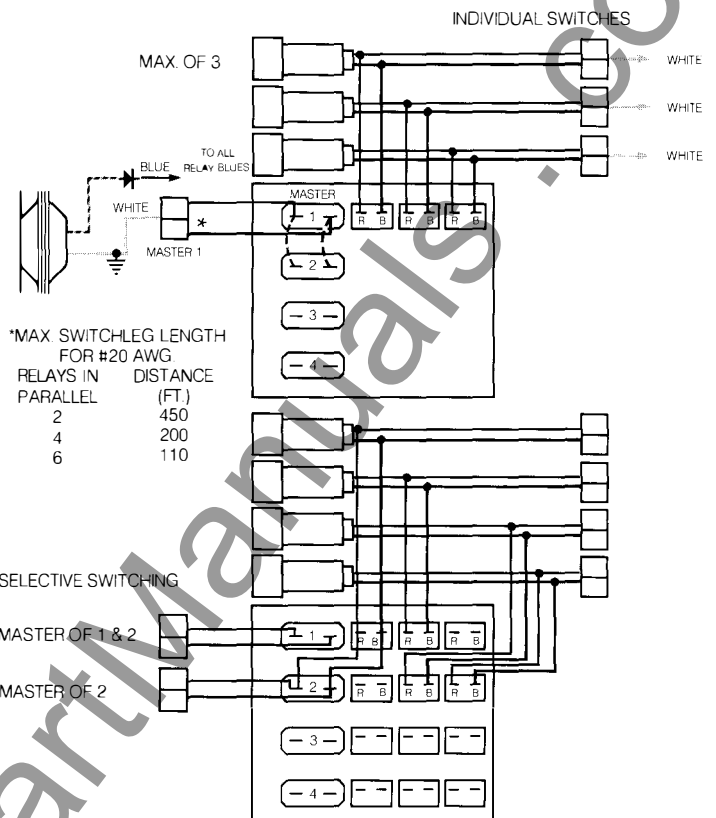
The RCBD12 provides economical switching of small groups of relays while maintaining individual control of each. Simply connect the master switch to one of the four inputs and then connect the relays associated with it to the three outputs. If there are more than 3 relays in the master group, you may parallel the inputs as shown. Use the RMS8(16 or 32) for more than 6 relays in parallel.

Selective Switching Using RCBD12

The diagram to the right shows how to obtain selective control over a group of relays. The first master switch is wired as the master for both inputs 1 and 2, the second for 2 only. You can increase the number of "master levels" by simply extending the wiring approach to more inputs.

Compatibility With Other Controls

The RCBD12 can be used in conjunction with an RMS Master Sequencer or RTEL Telephone Control module. Simply connect an output of these devices to a master input on the RCBD12 to control a group of up to 3 relays.



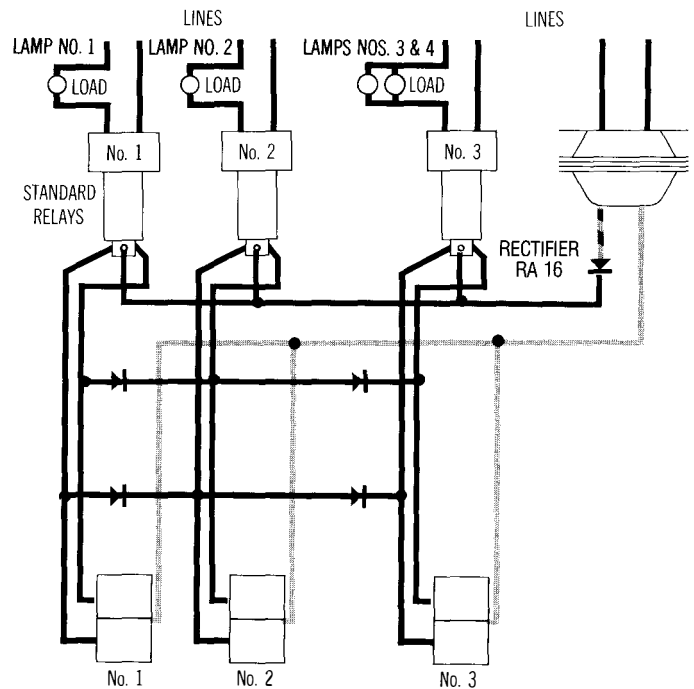
Selective Switching using Rectifiers

This circuit shows how to obtain selective control over a group of lights. Assume the wiring shown runs to a four-lamp fixture. Then:

- Switch #1 controls relay #1 and first lamp.
- Switch #2 controls relay #1 and #2 and first two lamps.
- Switch #3 controls all three relays and all four lamps.

Switch #3, then, functions as a master control device for that fixture. Note polarity of rectifiers.

Note: White wires shown in gray.

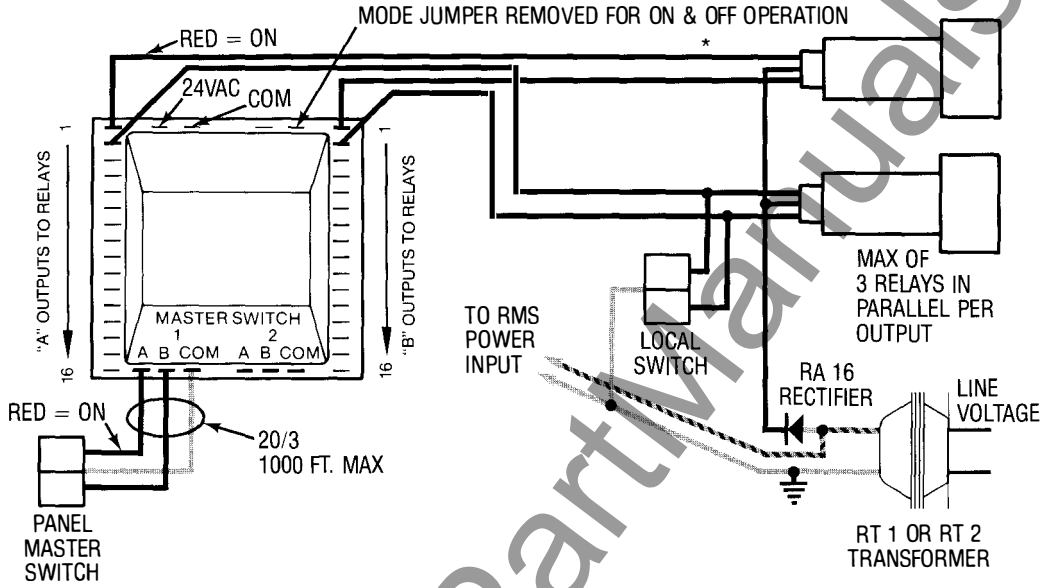


Simple Automation

Master Control of Group of Relays with Local Switch Override

This circuit shows the wiring of an RMS16 Master Sequencer to provide master ON/OFF control of a group of relays while still allowing individual control of each. Up to 3 relays may be connected in parallel on each RMS output. (Again, connecting relays in parallel means that they will always operate as a group.)

All of the applications illustrated for the Master Sequencer show it for ON/OFF operation (2-bank mode). For ON(OFF) only operation, the mode jumper would be installed and only the ON(OFF) relay leads would be connected to the outputs. In this mode, an RMS16 would drive 32 individual relays.



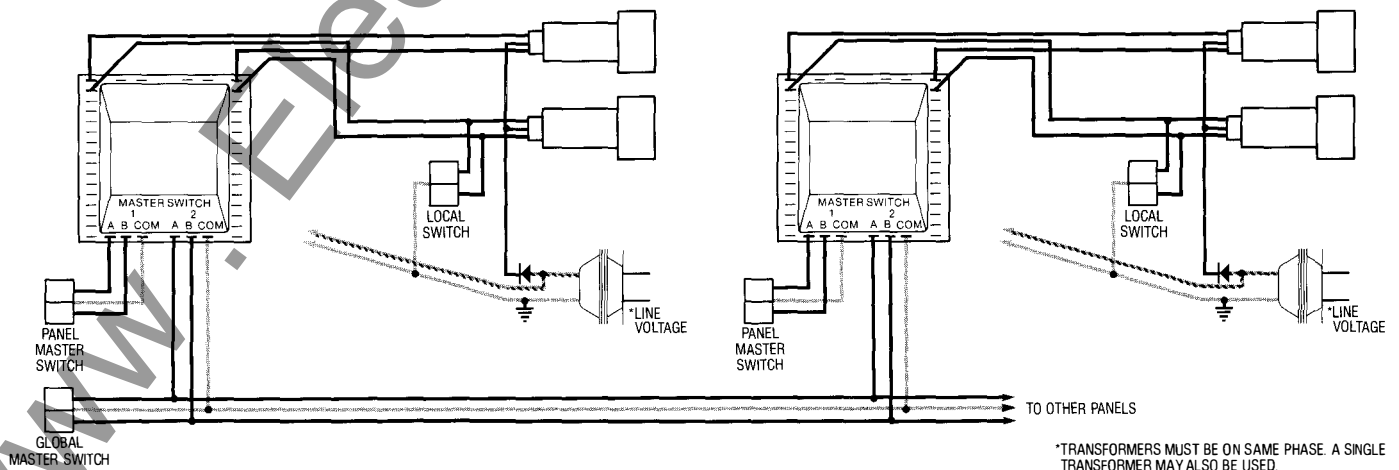
*Any output may also be connected to a Master Input (1-4) on the RCBD12

Global Master Switch with Local Panel Masters

The master switch inputs on Master Sequencers can be paralleled **provided the supply transformers are wired to the same phase**. The two independent master switch inputs on each RMS allow a local master switch to control each individual RMS independent of the other units.

The master switches may also be wired for pilot indication using the RR8 (any relay in group "ON" lights pilot) or RR9 (all relays

in group "ON" to light pilot) wiring illustrated on page 22. Another alternative is to allow a spare output on each RMS to drive an RR8 relay giving a pilot indication of the Master Sequencer's operation. In this case, however, the pilot indicates the operation of the RMS only; it doesn't reflect changes to individual relays by the occupant switches.

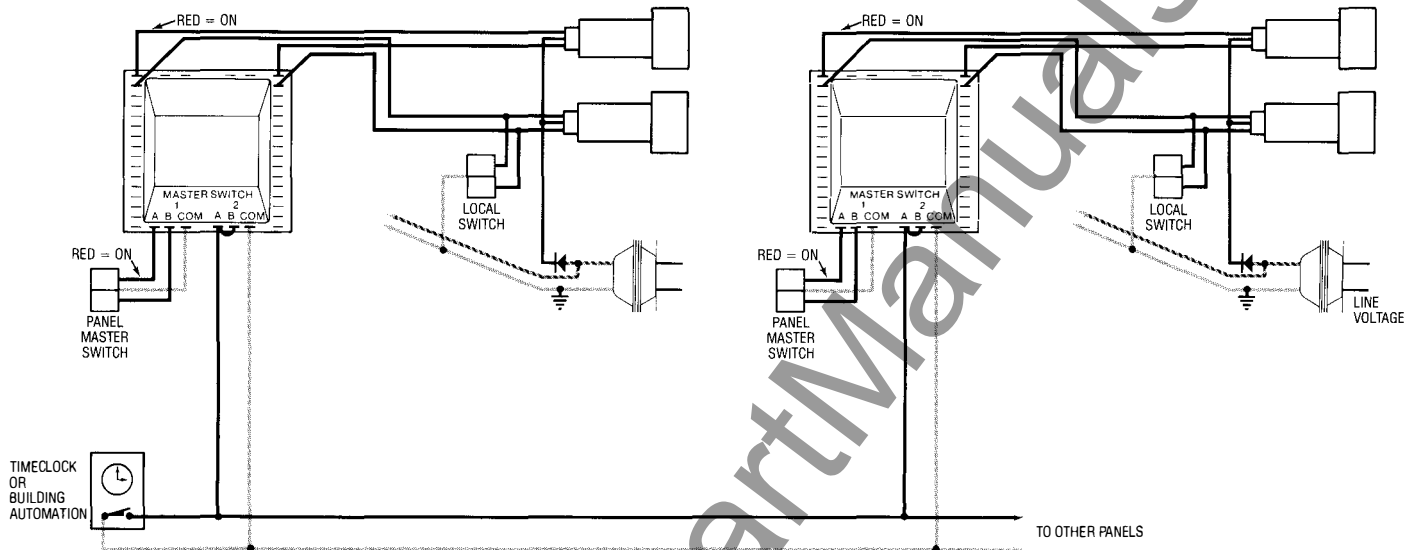


*TRANSFORMERS MUST BE ON SAME PHASE. A SINGLE TRANSFORMER MAY ALSO BE USED.

Timeclock/Building Automation System Control

The master switch inputs on a Master Sequencer will also accept the SPST or SPDT (form C) contacts typically provided by a timeclock, electronic timeclock, or building automation system. **((Use isolated contacts only!))**

The circuit below shows a timeclock with single pole, single throw contacts used in lieu of the global master switch to provide automatic ON/OFF operation for the building. To provide manual ON with multiple automatic OFF sweeps, the timeclock would simply be wired to the OFF(B) input only.



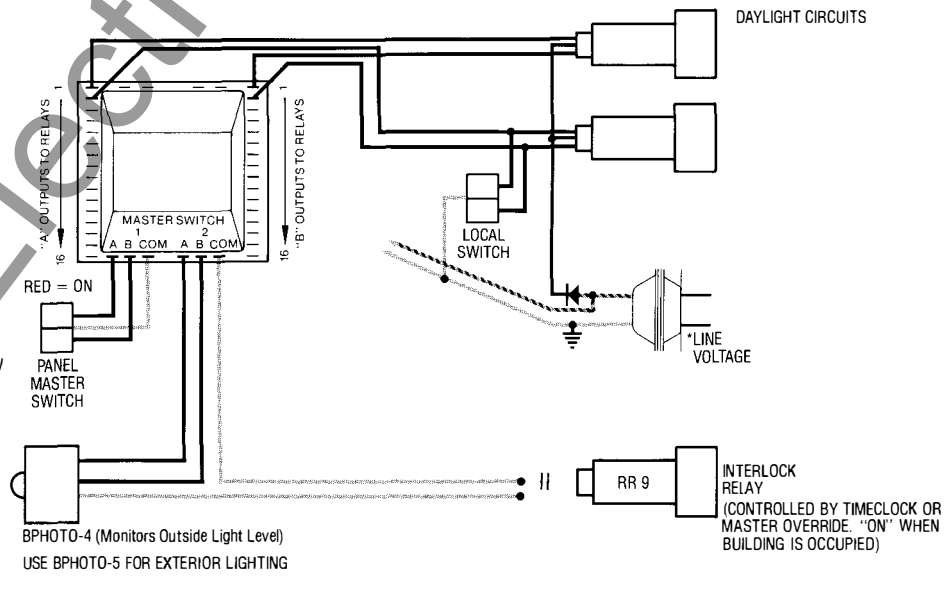
Daylighting Control

In a typical daylighting application, a BPHOTO-4 photoswitch would monitor exterior light levels. Its switched contacts would drive the "daylighting" Master Sequencer to shed/restore daylight circuits based on the amount of available daylight.

The daylighting function is deactivated whenever the RR9 "Interlock" relay is OFF. This stops the photoswitch from turning

ON the daylight circuits when the building is unoccupied. The local occupant switch can always override the daylighting function for that particular area.

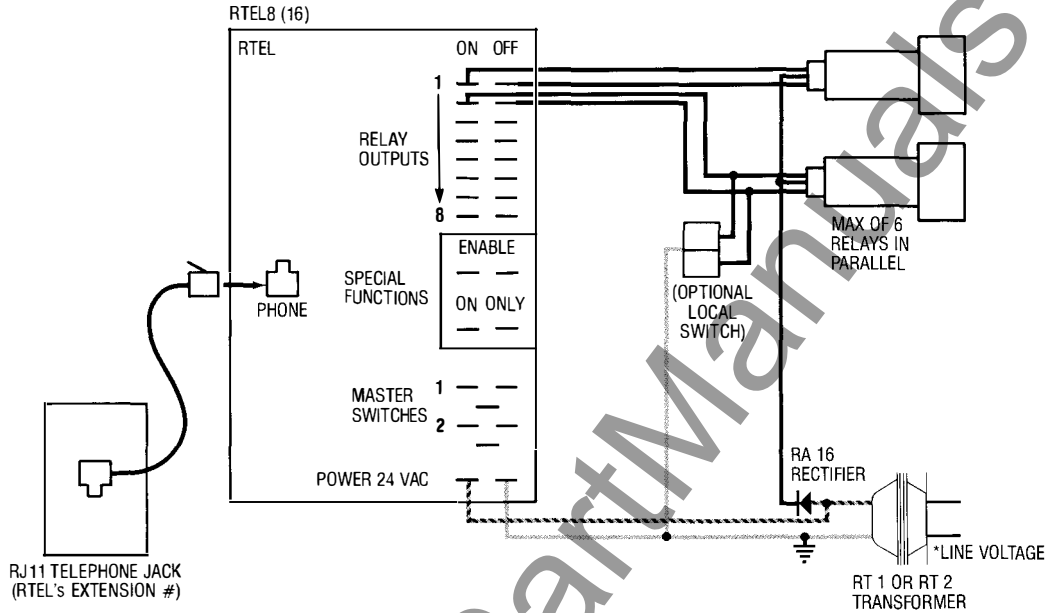
Note: A timeclock could replace the Panel Master Switch to provide a timed OFF for the exterior lighting.



Telephone Override with Master Switch Control

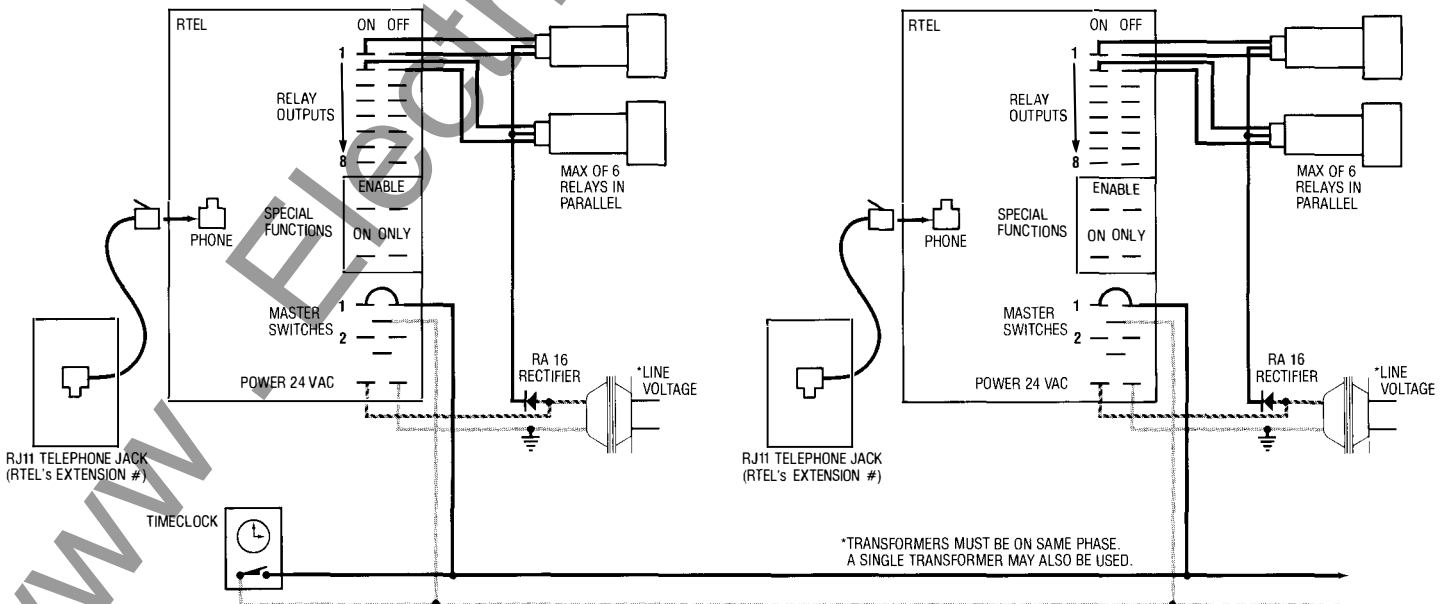
Telephone Override of Individual Relays

The Telephone Override (RTEL) allows existing Touchtone™ phones to control individual relays. Each RTEL output can control up to six relays in parallel.



Master Switch Control ... Global/Local Master Switches ... Timeclock/Building Automation System Control ... Daylighting

The RTEL includes two master switch inputs which operate identically to the ON/OFF master switch inputs on the Master Sequencer as illustrated below for the global Timeclock function.

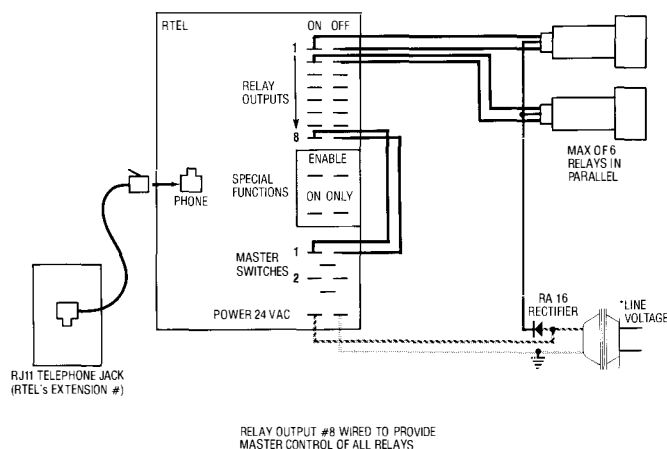


*TRANSFORMERS MUST BE ON SAME PHASE.
A SINGLE TRANSFORMER MAY ALSO BE USED.

Telephone Master Control

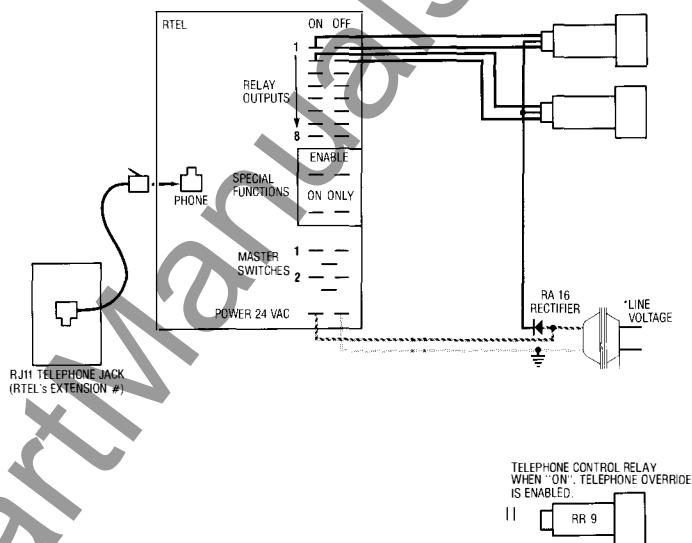
All Outputs

To control all outputs, connect any relay output to either of the master switch inputs. A telephone override of that specific relay output will then trigger all relay outputs.



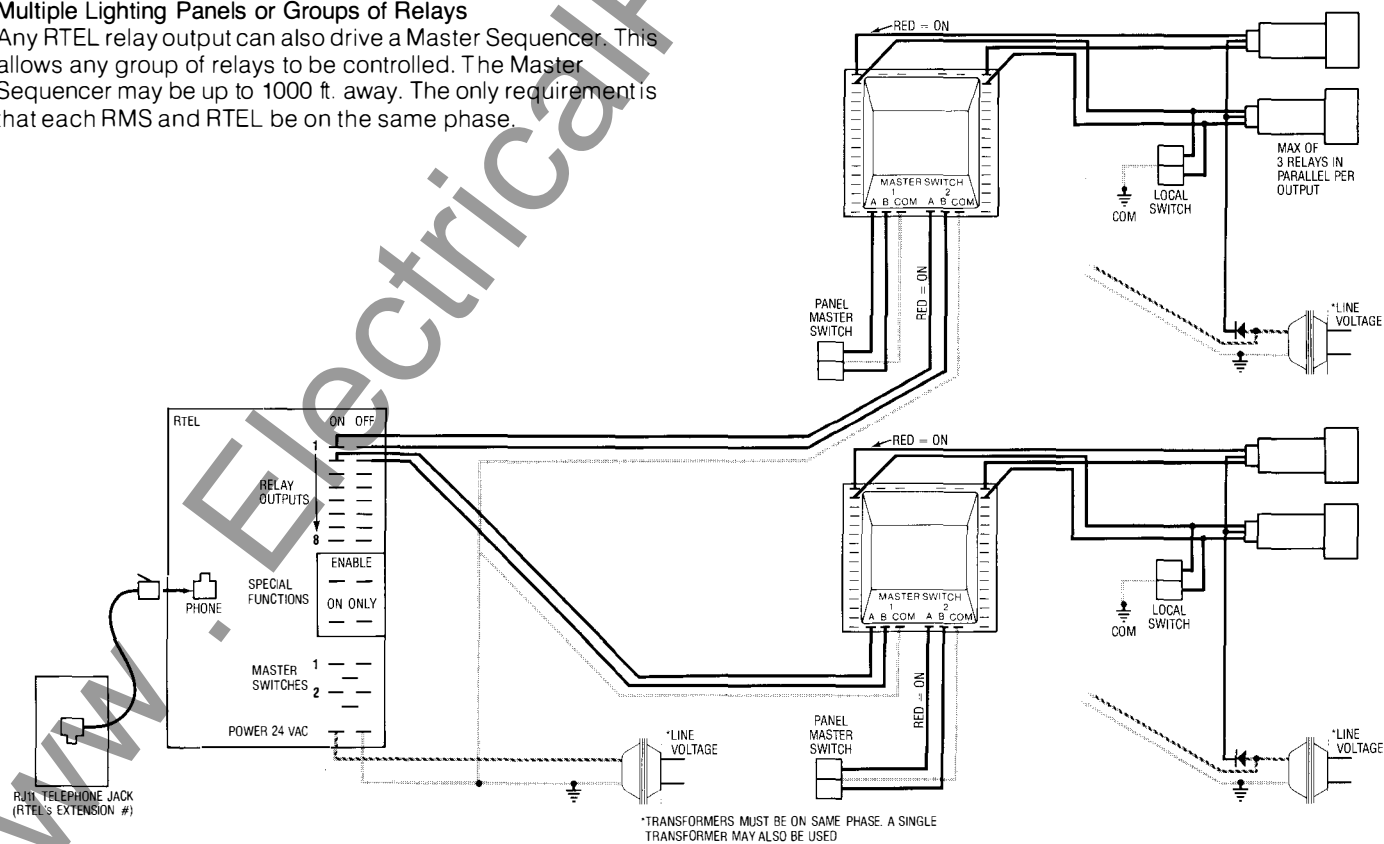
Limiting the Operation of the Telephone Overrides

The RTEL includes two special function inputs: one to limit the telephone overrides to ON only when the contact is closed, the other disables the phone altogether when its contact is opened. The operation can be dictated by simply installing jumpers on these inputs as required. If the operation changes throughout the day, the pilot contacts of an RR9 relay can be used as control inputs.

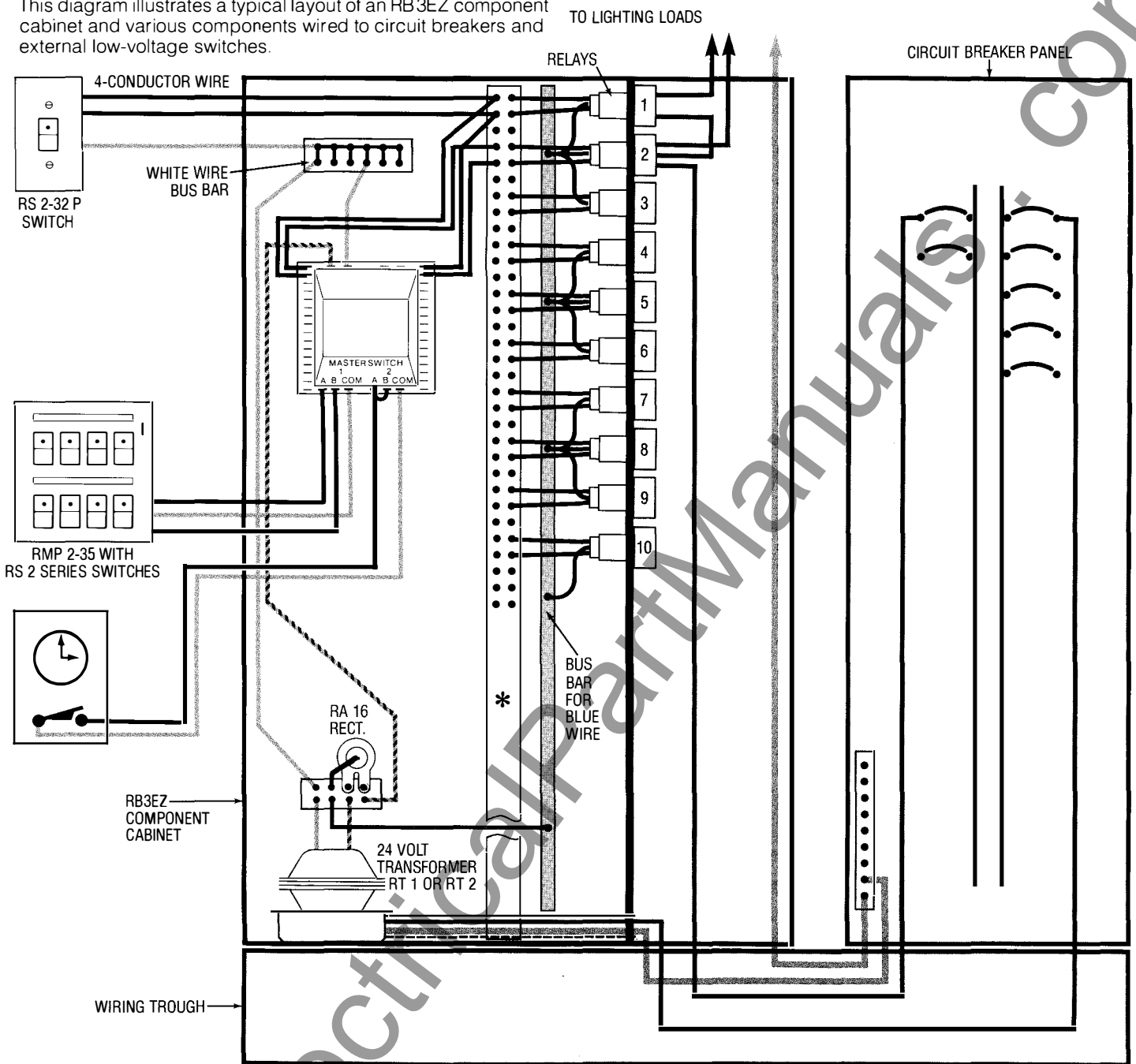


Multiple Lighting Panels or Groups of Relays

Any RTEL relay output can also drive a Master Sequencer. This allows any group of relays to be controlled. The Master Sequencer may be up to 1000 ft. away. The only requirement is that each RMS and RTEL be on the same phase.



This diagram illustrates a typical layout of an RB3EZ component cabinet and various components wired to circuit breakers and external low-voltage switches.



White wires shown in grey.

Indicates Line Voltage Wiring Compartments

*Termination strip uses numbered, color-code 3/16" push-on terminal strips. The multiple tabs are illustrated here as a single point for simplicity.

Simple Guideform Specification*

Furnish and install complete remote control wiring system for control of lighting, receptacles and other equipment as indicated on drawings, diagrams and schedules. System shall be complete with transformers, rectifiers, relays, switches, master-selector switches, pilot lights, electronic controls, wall plates and wiring. All remote-control wiring components shall be of same manufacture and installed in accordance with the

recommendations of the manufacturer. Remote-control equipment shall be as manufactured by General Electric Company or of equal quality, as approved by the design engineer.

Except where otherwise indicated, all such remote-control wiring shall be in accordance with Article 725, Class 2, of the National Electrical Code.

*Consult your GE representative for a more complete specification.

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TOUCH 1-800-877-8000, wait for tone. ENTER 6611193.
Make your call from any tone-generating phone
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