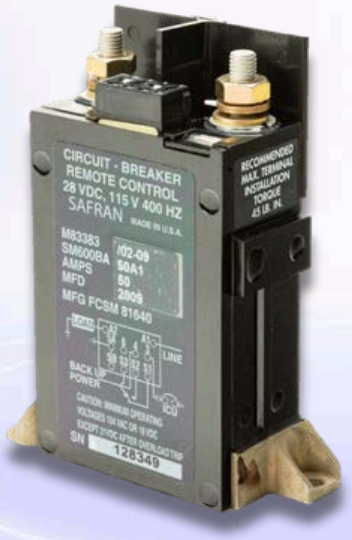
REMOTE CONTROL CIRCUIT BREAKER



COCKPIT CONTROL
Reliable remote switching and circuit protection from a safe location



POWER DISTRIBUTION
Simplifies system architecture while reducing wiring complexity







ELECTRICAL SYSTEMS
Protects critical electrical circuits across demanding applications



PROVEN RELIABILITY
Engineered for harsh environments and mission-critical performance

SAFRAN

ABOUT SAFRAN ELECTRICAL & POWER RCCBs

Safran Electrical & Power designs and manufactures Remote Control Circuit Breakers (RCCBs) for demanding aerospace applications. Combining circuit protection and remote switching capabilities, our RCCBs are engineered to deliver reliable performance while meeting stringent industry requirements.

Our products are integrated into a wide variety of aircraft electrical systems, supporting customers with dependable solutions developed through decades of experience in **aerospace power management and distribution.**

Building on a strong heritage in electrical systems, Safran Electrical & Power continues to develop **innovative RCCB solutions** that address evolving aircraft requirements while maintaining the highest standards of quality and reliability.



The purpose of this catalogue is to showcase the **Remote Control Circuit Breaker** product range offered by Safran Electrical & Power. The products presented have been selected to provide an overview of the available configurations and capabilities within our RCCB portfolio.

This catalog serves as a practical guide for product selection and is intended to support customers in identifying solutions that best meet their application requirements. Should you have any questions or specific requests, **our team is available to assist you.**

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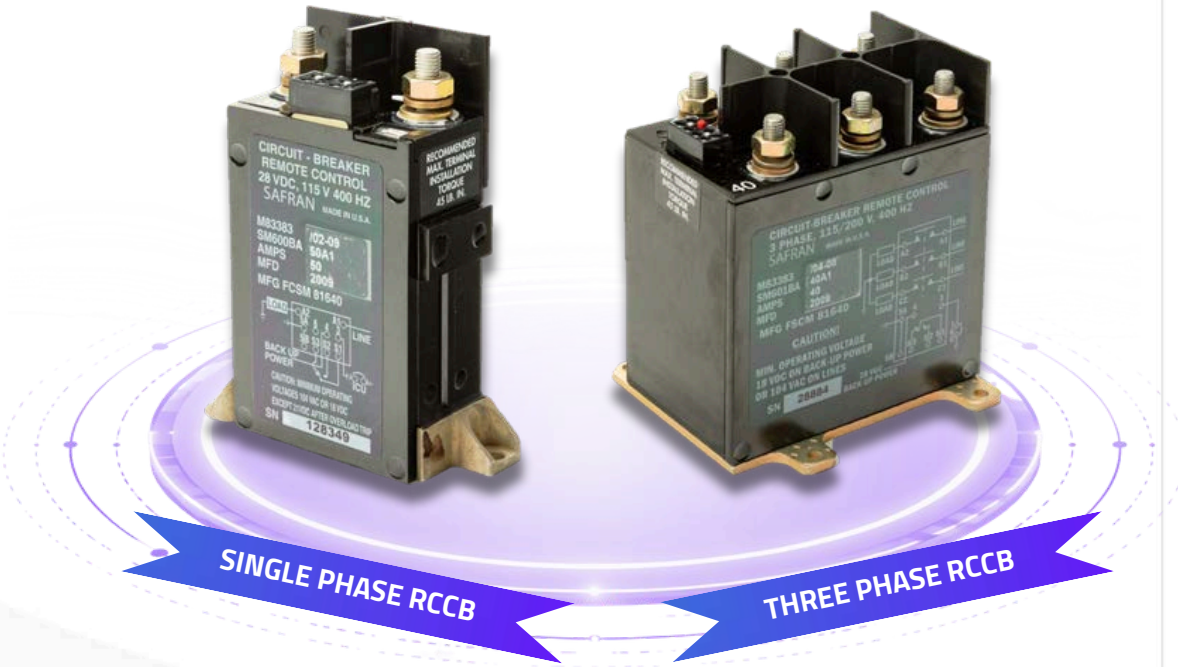
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RELIABLE. PROVEN. PROTECTED.

Safran Electrical & Power's Remote Control Circuit Breakers (RCCB) delivers reliable protection, reduced wiring, and remote control for demanding aerospace applications.



SINGLE PHASE RCCB

SINGLE PHASE RCCB (PERFORMANCE DATA)

THREE PHASE RCCB

THREE PHASE RCCB (PERFORMANCE DATA)

ORDERING INFORMATION

ENGINEERING DATA

SINGLE PHASE RCCB



CONFIGURATION	Single Phase
VOLTAGE RATING	28 VDC / 115-120 VAC 400 Hz
CURRENT RATING	5A - 100A
RUPTURE LEVEL	3600 A
ELECTRICAL ENDURANCE	5,000 Cycles
MECHANICAL ENDURANCE	25,000-50,000 Cycles
INSULATION RESISTANCE	100 MΩ Min
OPERATING TEMPERATURE	-54°C to +71°C
ALTITUDE RATING	50,000 ft
WEIGHT	318 - 339 g (0.701-0.747 lbs)

ADVANTAGES

RELAY, CIRCUIT BREAKER, OR BOTH

RCCBs combine the best attributes of a circuit breaker and a relay. Automatically protects the wires and the load device during circuit/load breakdown, but allows the flight deck control of the load during normal operation.

WEIGHT & COST SAVINGS

In distributed-load applications, RCCBs are a more efficient power distribution solution promoting cost and weight savings through the elimination of long runs of heavy cables associated with the conventional relay - flight deck circuit protector method. Control of the RCCB requires only one #22 AWG control wire from the ICU on the flight deck to the RCCB.

COCKPIT SPACE SAVINGS

An RCCB system removes the presence of large circuit breakers from the cockpit while permitting remote On/Off operation from the flight deck. Combine Safran Electrical & Power RCCB with Indicator Control Unit (ICU) model #1500-052-05.

SINGLE PHASE RCCB

PERFORMANCE DATA

Rupture Levels	3600 A (115 VAC or 28 VDC for 1 Pole)
Endurance (Resistive & Inductive Motor)	50,000 Cycles
Endurance (Motor)	5-50A: 50,000 cycles; 60-100A: 25,000 cycles
Endurance (Lamp)	5-25A: 50,000 cycles; 35-50A: 25,000 cycles; 60-100A: no rating
Dielectric Strength	1500V, 60 Hz, MIL-STD-202, method 301, 0.5 MA max
Insulation Resistance	100 mega ohm min, MIL-STD-202, method 302
Thermal Temperature Range	-54ºC to 71ºC (-65ºF to 160ºF). MIL-STD-202, Method 107
Vibration	10G's to 2000 Hz. Exceeds MIL-STD-202, Method 204, Condition C, 10 microseconds max. chatter
Shock	25G's. MIL-STD-202, Method 213, 10 microseconds max. chatter
Altitude	50,000 ft.
EMI Requirements	MIL-STD-461, Requirements CS114 and RE102 over the frequency range of 14 kHz to 400 MHz and RE102 limits for Aircraft and Space Systems.
EMI/RFI Susceptibility and Generation	MIL-STD-461, Class 1D
Moisture Resistance	MIL-STD-202, method 106
Salt Spray Resistance	MIL-STD-202, method 101, Condition B
Sand and Dust Resistance	MIL-STD-202, method 110, Condition A
Fungus Resistance	MIL-HDBK-454, Guideline 4
Explosion Proof	MIL-STD-202, method 109
Weight (Single Pole)	5-25A: 318 grams (0.703 lbs.); 35-50A: 325 grams (0.719 lbs.); 60-100A: 332 grams (0.734 lbs.)
Weight (w/ Auxiliary Contacts)	5-25A: 332 grams (0.734 lbs.); 35-50A: 339 grams (0.750 lbs.); 60-100A: 346 grams (0.766 lbs.)



OVERLOAD CALIBRATION DATA - SINGLE PHASE

AMPERE RATING	200% TRIP TIMES -54°C to +71°C		400% TRIP TIMES -54°C to +71°C		1000% TRIP TIMES -54°C to +71°C	
	MIN (SECONDS)	MAX (SECONDS)	MIN (SECONDS)	MAX (SECONDS)	MIN (SECONDS)	MAX (SECONDS)
5	7	40	1.2	6.4	0.3	1.2
10	12	42	2.8	8.5	0.42	1.05
15	13	45	1.7	8.3	0.35	1.2
20	14	46	2.9	7.6	0.4	1.15
25	15	50	2.6	8.7	0.4	1.3
35	16	55	2.8	8.3	0.35	1.3
40	11	55	2.9	9.2	0.36	1.3
50	13	55	2.4	10	0.4	1.25
60	13	60	2.6	13	0.26	1.8
75	13	60	2.5	13	0.26	1.8
80	14	60	2.7	12.5	0.3	20
100	17	63	3.5	13	0.38	1.9

OVERLOAD CALIBRATION DATA

RATING	PERCENT RATED CURRENT	AMBIENT TEMPERATURE Degrees C. ± 5°	TRIPPING TIME
ALL	115%	25ºC & 71ºC	NO TRIP
	138%		1 HOUR MAX*
	115%	-54ºC	NO TRIP
	150%		1 HOUR MAX*

- MUST TRIP IN ONE HOUR

SINGLE PHASE RCCB

SINGLE PHASE RCCB (PERFORMANCE DATA)

THREE PHASE RCCB

THREE PHASE RCCB (PERFORMANCE DATA)

ORDERING INFORMATION

ENGINEERING DATA

THREE PHASE RCCB



CONFIGURATION	Three Phase
VOLTAGE RATING	28 VDC / 115-120 VAC 400 Hz
CURRENT RATING	10A - 60A
RUPTURE LEVEL	3600 A
ELECTRICAL ENDURANCE	5,000 Cycles
MECHANICAL ENDURANCE	25,000-50,000 Cycles
INSULATION RESISTANCE	100 MΩ Min
OPERATING TEMPERATURE	-54°C to +71°C
ALTITUDE RATING	50,000 ft
WEIGHT	907.18 g (2.0 lbs) Max

ADVANTAGES

RELAY, CIRCUIT BREAKER, OR BOTH

RCCBs combine the best attributes of a circuit breaker and a relay. Automatically protects the wires and the load device during circuit/load breakdown, but allows the flight deck control of the load during normal operation.

WEIGHT & COST SAVINGS

In distributed-load applications, RCCBs are a more efficient power distribution solution promoting cost and weight savings through the elimination of long runs of heavy cables associated with the conventional relay - flight deck circuit protector method. Control of the RCCB requires only one #22 AWG control wire from the ICU on the flight deck to the RCCB.

COCKPIT SPACE SAVINGS

An RCCB system removes the presence of large circuit breakers from the cockpit while permitting remote On/Off operation from the flight deck. Combine Safran Electrical & Power RCCB with Indicator Control Unit (ICU) model #1500-052-05.

THREE PHASE RCCB

PERFORMANCE DATA



Rupture Levels	3600 A (115 VAC for 3 Pole)
Endurance (Resistive & Inductive Motor)	50,000 Cycles
Endurance (Motor)	10-50A: 50,000 cycles; 60A: 25,000 cycles
Endurance (Lamp)	10-25A: 50,000 cycles; 35-50A: 25,000 cycles; 60A: no rating
Dielectric Strength	1500V, 60 Hz, MIL-STD-202, method 301, 0.5 MA max
Insulation Resistance	100 mega ohm min, MIL-STD-202, method 302
Thermal Temperature Range	-54ºC to 71ºC (-65ºF to 160ºF). MIL-STD-202, Method 107
Vibration	10G's to 2000 Hz. Exceeds MIL-STD-202, Method 204, Condition C, 10 microseconds max. chatter
Shock	25G's. MIL-STD-202, Method 213, 10 microseconds max. chatter
Altitude	50,000 ft.
EMI Requirements	MIL-STD-461, Requirements CS114 and RE102 over the frequency range of 14 kHz to 400 MHz and RE102 limits for Aircraft and Space Systems.
EMI/RFI Susceptibility and Generation	MIL-STD-461, Class 1D
Moisture Resistance	MIL-STD-202, method 106
Salt Spray Resistance	MIL-STD-202, method 101, Condition B
Sand and Dust Resistance	MIL-STD-202, method 110, Condition A
Fungus Resistance	MIL-HDBK-454, Guideline 4
Explosion Proof	MIL-STD-202, method 109
Weight (Three Phase)	907.14 grams (2.0 lbs.) max.

OVERLOAD CALIBRATION DATA - THREE PHASE

AMPERE RATING	200% TRIP TIMES -54°C to +71°C		400% TRIP TIMES -54°C to +71°C		1000% TRIP TIMES -54°C to +71°C	
	MIN (SECONDS)	MAX (SECONDS)	MIN (SECONDS)	MAX (SECONDS)	MIN (SECONDS)	MAX (SECONDS)
10	12	80	2.8	11	0.42	1.3
15	13	80	1.7	10	0.35	1.2
20	14	80	2.9	9.6	0.4	1.15
25	15	80	2.6	10	0.4	1.3
35	16	80	2.8	11	0.35	1.3
40	16	80	2.6	10	0.36	1.3
50	13	80	2.9	10	0.4	1.25
60	13	80	2.4	16	0.26	1.8

OVERLOAD CALIBRATION DATA

RATING	PERCENT RATED CURRENT	AMBIENT TEMPERATURE Degrees C. ± 5°	TRIPPING TIME
ALL	115%	25ºC & 71ºC	NO TRIP
	138%		1 HOUR MAX.*
	115%	-54ºC	NO TRIP
	150%		1 HOUR MAX.*

- MUST TRIP IN ONE HOUR

ORDERING INFORMATION

Select the appropriate RCCB configuration based on phase, current rating, and auxiliary contact requirements



SINGLE PHASE RCCB

SINGLE PHASE RCCB (PERFORMANCE DATA)

THREE PHASE RCCB

THREE PHASE RCCB (PERFORMANCE DATA)

ORDERING INFORMATION

ENGINEERING DATA

SINGLE PHASE RCCB
Double Break Contacts

THREE PHASE RCCB
Double Break Contacts

AMP RATING	STANDARD	WITH AUXILIARY CONTACTS	WITH AUXILIARY CONTACTS
	SAFRAN ELECTRICAL & POWER P/N		
5A	SM600BA5N1-2	SM600BA5A1-2	**
10A	SM600BA10N1-2	SM600BA10A1-2	SM601BA10A1-2
15A	SM600BA15N1-2	SM600BA15A1-2	SM601BA15A1-2
20A	SM600BA20N1-2	SM600BA20A1-2	SM601BA20A1-2
25A	SM600BA25N1-2	SM600BA25A1-2	SM601BA25A1-2
35A	SM600BA35N1-2	SM600BA35A1-2	SM601BA35A1-2
40A	SM600BA40N1-2	SM600BA40A1-2	SM601BA40A1-2
50A	SM600BA50N1-2	SM600BA50A1-2	SM601BA50A1-2
60A *	SM600BA60N1-2	SM600BA60A1-2	SM601BA60A1-2
75A *	SM600BA75N1-2	SM600BA75A1-2	**
80A *	**	SM600BA80A1-2	**
100A*	SM600BA100N1-2	SM600BA100A1-2	**

NOTES

All ampere ratings equal to rated contact loads (resistive, inductive, motor, and lamp) except as noted.

* No Lamp Load Rating

Contact factory on alternate amperage, trip times, control configurations, grounding, auxiliary switches, mounting systems, etc.

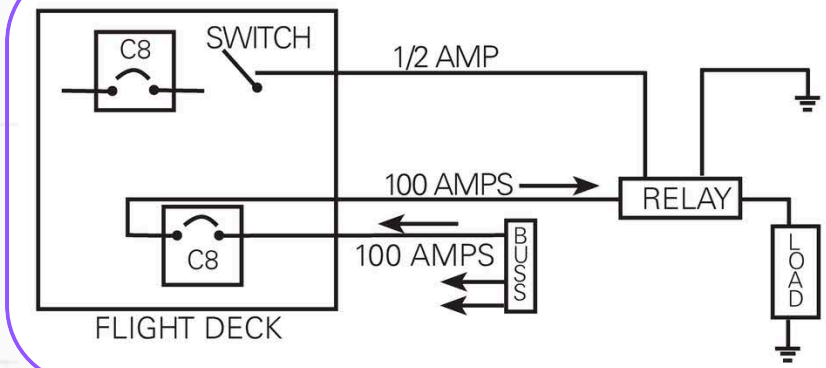
ENGINEERING DATA

APPLICATION NOTE

SINGLE PHASE RCCB
SINGLE PHASE RCCB (PERFORMANCE DATA)
THREE PHASE RCCB
THREE PHASE RCCB (PERFORMANCE DATA)
ORDERING INFORMATION
ENGINEERING DATA

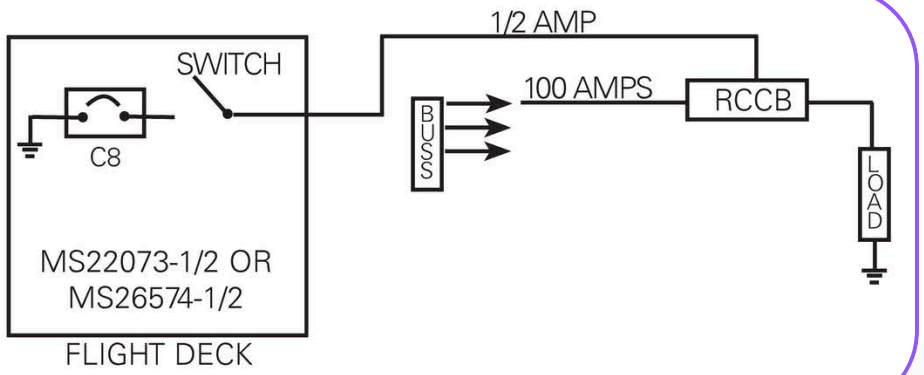


WITHOUT RCCB



WITH RCCB

DISTRIBUTED LOAD CONCEPT



ENGINEERING DATA

TYPICAL WIRING NOTE

SINGLE PHASE RCCB

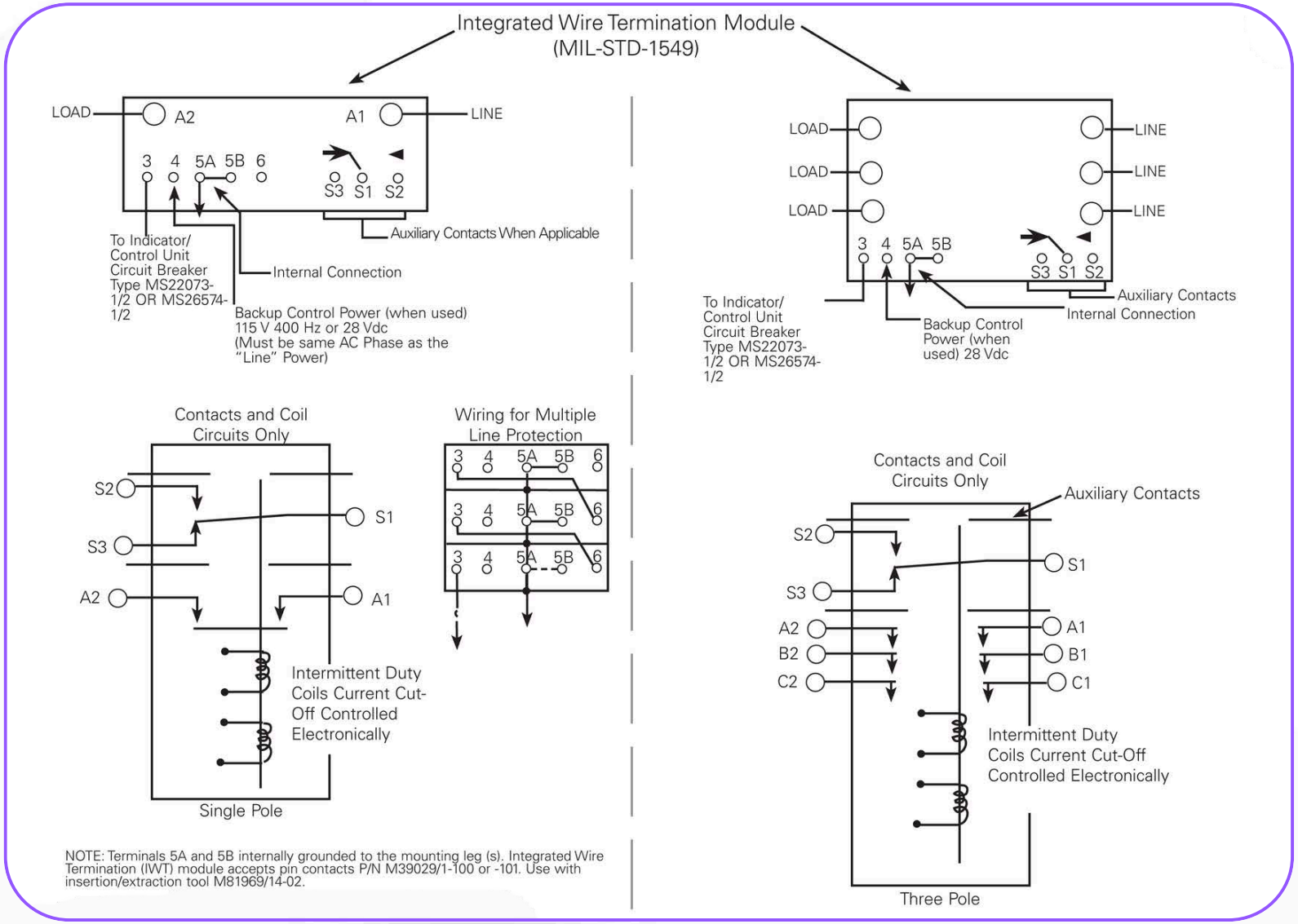
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THREE PHASE RCCB

THREE PHASE RCCB (PERFORMANCE DATA)

ORDERING INFORMATION

ENGINEERING DATA



ENGINEERING DATA

APPROXIMATE DIMENSIONS - SINGLE PHASE

SINGLE PHASE RCCB

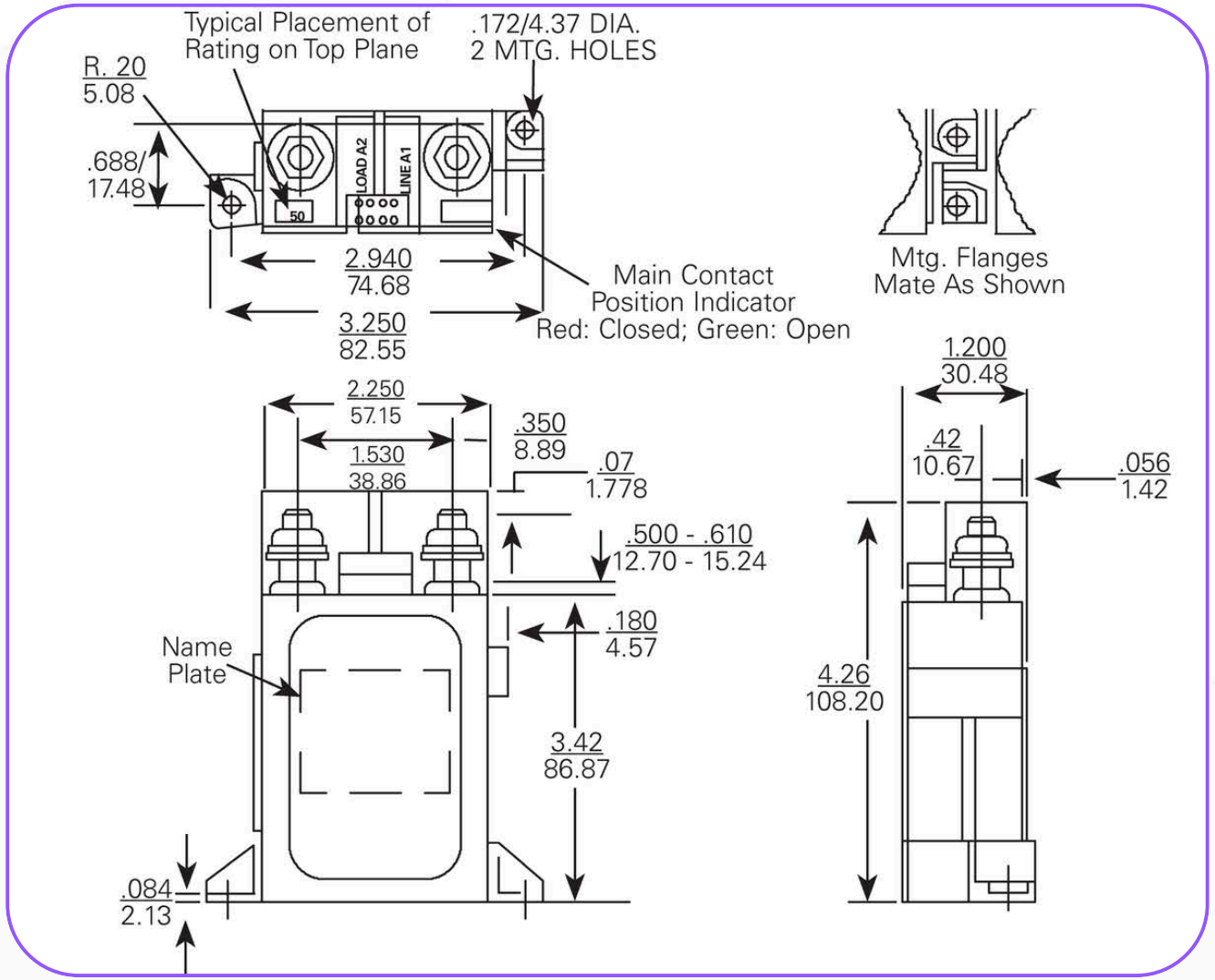
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THREE PHASE RCCB

THREE PHASE RCCB (PERFORMANCE DATA)

ORDERING INFORMATION

ENGINEERING DATA





ENGINEERING DATA

APPROXIMATE DIMENSIONS - THREE PHASE

SINGLE PHASE RCCB

SINGLE PHASE RCCB (PERFORMANCE DATA)

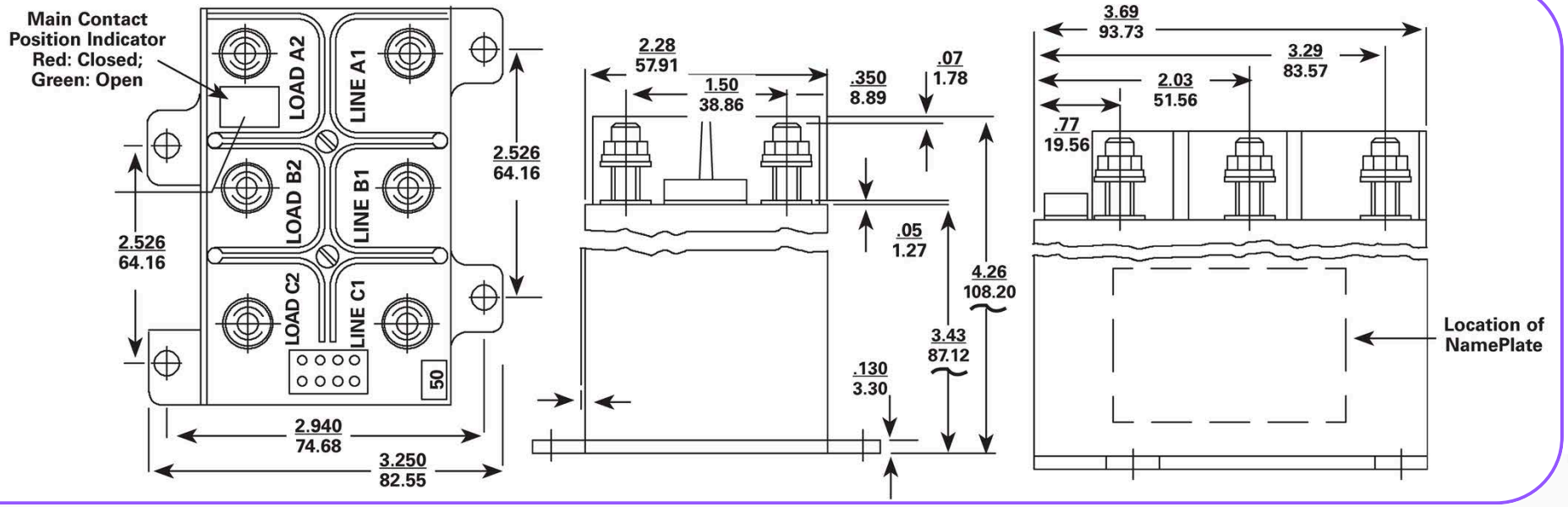
THREE PHASE RCCB

THREE PHASE RCCB (PERFORMANCE DATA)

ORDERING INFORMATION

ENGINEERING DATA





SINGLE PHASE RCCB

SINGLE PHASE RCCB (PERFORMANCE DATA)

THREE PHASE RCCB

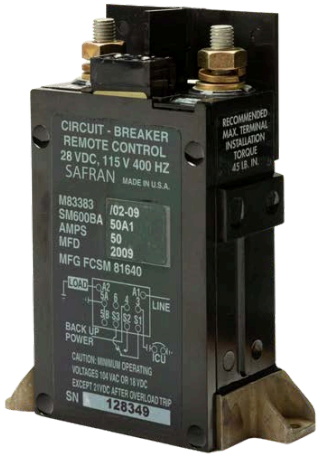
THREE PHASE RCCB (PERFORMANCE DATA)

ORDERING INFORMATION

ENGINEERING DATA

ENGINEERING DATA

COIL OPERATE CURRENT/ SET AND TRIP TIME RCCB





Circuits	Nominal System Voltage	I/CU Set Current @ Nom Voltage (Mulliamp)	Set Coil Current @ Nom Voltage Pulse	MAX. Set Time		*I/CU. Trip Current Nominal					MAX. Standby Current Milliamp
				Nominal Voltage & Room Temp.	Most Adverse Condition - MIN. Voltage 71°C. Ambient	71°C & Nominal Voltage	-54°C & Nominal Voltage	Room Temp. Nominal Voltage	71°C & Nominal Voltage	-54°C & Nominal Voltage	
Single Phase	28 Vdc (18 volts MIN.)	2	3.0 AMP MAX	20 Millisec	35 Millisec	1.4 AMP	1.4 AMP	1.4 AMP	0.9 AMP **	2.1 AMP	10
	115 Vac 400 Hz (104 V. MIN.)	2	10 AMP MAX	15 Millisec	30 Millisec	6.8 AMP **	6.3 AMP **	8.6 AMP **	6.1 AMP **	7.0 AMP **	10
Three Phase	28 Vdc (18 volts MIN.) 115 Vac	2	7.0 AMP MAX	20 Millisec	35 Millisec	1.5 AMP	1.4 AMP	1.7 AMP	0.9 AMP **	2.2 AMP	10
	400 Hz (104 V. MIN.)	2	13.0 AMP MAX	15 Millisec	30 Millisec	4.3 AMP **	3.3 AMP **	4.5 AMP **	4.0 AMP **	3.1 AMP **	10

* MAX. I/CU. Line Impedance 7.5

Current Decreases w/Time so that I^2t

** Average Half-Wave Rectified DC Current

***Absolute Min. Value from -54° to +71°C

ENGINEERING DATA

RCCB OVERVIEW & APPLICATION

SINGLE PHASE RCCB

SINGLE PHASE RCCB (PERFORMANCE DATA)

THREE PHASE RCCB

THREE PHASE RCCB (PERFORMANCE DATA)

ORDERING INFORMATION

ENGINEERING DATA

DESCRIPTION

The Remote Control Circuit Breakers (RCCB) concept, as load controllers in distributed-load applications, provides for a more efficient power distribution system with less line loss at a lower cost and with less weight than the conventional relay-flight deck circuit protector method.

Designed to meet the requirements of MIL-PRF-83383, the RCCB's capability and advantages include:

- Fusible link fail safe
- Remote on/off operation from the flight deck
- Visual indicators for open (green) and closed (red) on top surface
- Substantial reduction in weight and size
- Most direct route from power source to load
- Single wire control line from I/CU to RCCB
- Double-break power contact assembly
- Indication of trip or set by position of the ½ ampere circuit breaker on the flight deck
- Elimination of long runs of heavy and costly cables
- Magnetically latched coils (low power consumption)
- Use as a relay or circuit breaker or both
- Flanges mate for in-line or side-by-side mounting
- 1PST for DC or single phase AC
- 3PST for three phase AC only



APPLICATION

The Remote Control Circuit Breaker (RCCB) is a combination relay and circuit breaker which can be released or set by applying a release or set coil current electronically controlled by a command from the Indicator/Control Unit (I/CU) (a ½ ampere fast trip, thermal circuit breaker).

With power available to terminal #4 and/or terminal A1 (28 Vdc or 115 V 400 Hz) on 1PST RCCB: to terminal #4 (28 Vdc) and/ or both terminals B1 and C1 (115 V 400 Hz) on 3PST RCCB, the RCCB will assume the state requested/indicated by the I/CU. If power is removed from terminal #4 and A1 on 1PST or from terminal #4 and both B1 and C1 on 3PST, the RCCB will remain in the state it was in prior to power removal. When power is reapplied to the terminals, the RCCB will assume the state indicated by the I/CU.

With the RCCB closed, an overload or fault current on any line or lines will cause the RCCB to trip and in turn will cause a controlled overload of the I/CU, causing it to trip also. A fault or overload on any power contact will cause the RCCB to trip open within the time limits specified regardless of the availability of coil power. To reclose the RCCB, the I/CU line (line 3 to ground) must be opened by the I/CU or series switch and reconnected to ground.

ENGINEERING DATA

PERFORMANCE PARAMETERS & DESIGN CONCEPT

SINGLE PHASE RCCB

SINGLE PHASE RCCB (PERFORMANCE DATA)

THREE PHASE RCCB

THREE PHASE RCCB (PERFORMANCE DATA)

ORDERING INFORMATION

ENGINEERING DATA

OTHER PERFORMANCE PARAMETERS

- Coordination. An overload applied to two devices in series with a 2 to 1 current rating will result in only the lower rated device opening.
- Rupture capability to 3600A (115 Vac rms or 28 Vdc for SM600BA and 115 Vac rms for SM601BA series)
- Dielectric. 1500 V, 60 Hz, MIL-STD-202, Test Method 301, 0.5 MA maximum
- Explosion-proof. MILSTD- 202, Test Method 109
- Thermal Temperature Range. -54°C to 71°C (-65°F to 160°F). MIL-STD-202, Test Method 107
- Insulation Resistance. MILSTD- 202, Test Method 302, 100 Megohms minimum
- Aircraft Electrical Power. MILSTD- 704
- Vibration. 10 g's to 2000 Hz. MIL-STD-202, Test Method 204. Condition C (-54°C, 25°C, and 71°C). Maximum duration of contact transfer to uncommanded state: 10x10-6 seconds.
- Shock. 25 g's. MIL-TD-202, Test Method 213. Maximum duration of contact transfer to uncommanded state: 10x10-6 seconds.
- Altitude. 50,000 feet
- EMI, MIL-STD-461, Class 1D
- Moisture Resistance. MILSTD- 202, Test Method 106
- Fungus Resistance. MIL-STD- 454, Guideline 4
- Sand and Dust Resistance. MIL-STD-202, Test Method 110, Test Condition A
- Salt Spray Resistance. MILSTD- 202, Test Method 101, Test Condition B



INTRODUCTION

Part of the weight of the modern jet aircraft comes from the electrical wires and power control systems needed to distribute the electrical energy. As these aircraft increase their passenger carrying capability, the electrical power management system becomes more complex and could become heavier. Wire runs of more than 300 feet from the flight deck circuit breakers to the load become common.

Utilization of Safran Electrical & Power's Remote Controlled Circuit Breakers (RCCB) close to the load or power source will eliminate much of these long, heavy, and expensive wire/ cable. Control of the RCCB requires only one #22 AWG control wire from the flight deck to the RCCB.

Weight reduction, directly from wire use and indirectly from (generator) line heat loss, and installation and maintenance cost reductions becomes significant.

The RCCB combines the best attributes of a circuit breaker and a relay. The RCCB automatically protects the wires and the load device during circuit/load breakdown, but allows flight deck control of the load during normal operation.

OPERATION

The RCCB is basically a relay and a circuit breaker and allows the utilization of each identity singularly or in combination, depending upon the application.

All of the RCCB's capabilities apply in either application. It can be employed s a relay located adjacent to its load and remotely operated much like relays are today through control wiring and a switching device in the flight deck.

It can also be utilized as a circuit breaker and mounted adjacent to the load, the power source, or even the flight deck.

ENGINEERING DATA

DESIGN CONCEPT

SINGLE PHASE RCCB

SINGLE PHASE RCCB (PERFORMANCE DATA)

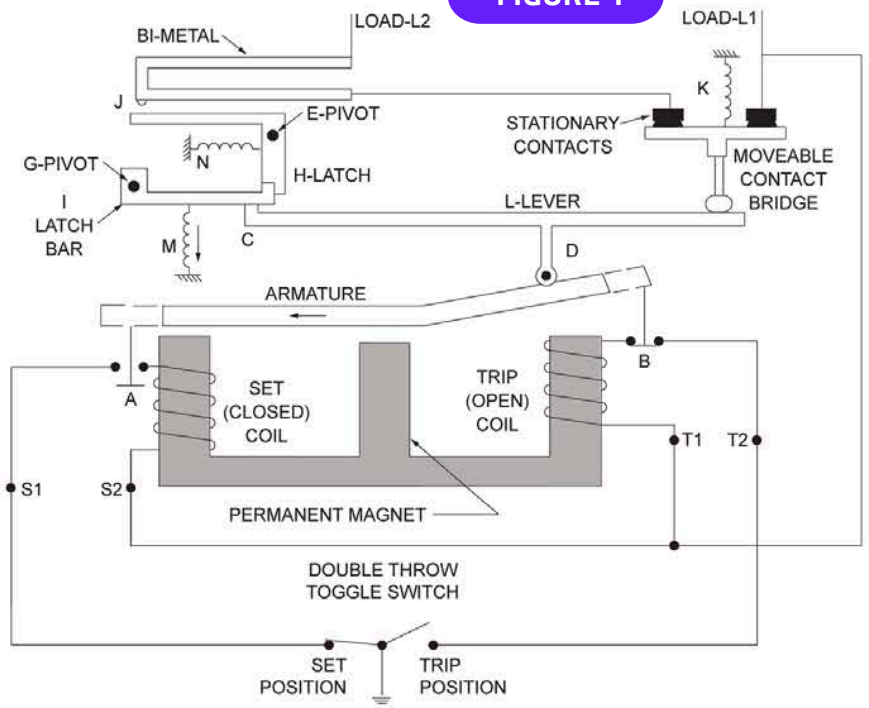
THREE PHASE RCCB

THREE PHASE RCCB (PERFORMANCE DATA)

ORDERING INFORMATION

ENGINEERING DATA

FIGURE 1



SINGLE PHASE RCCB

MOTOR OPERATION

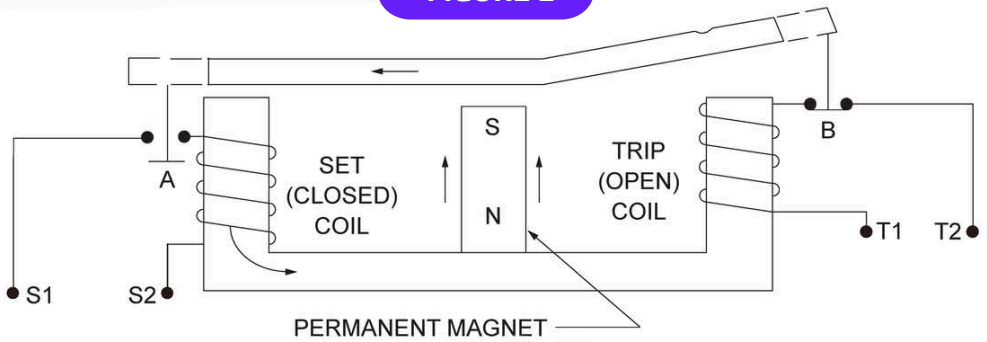
Figure 1 depicts a simplified presentation of the RCCB.
Figure 2 describes the "motor", which when "energized", will result in typical armature transfer operation.

The magnetic circuit utilizes a permanent magnet as a fulcrum and latch for the rocking armature and uses electromagnets (coils) at each end of the armature stroke for transfer purpose. In the set position **(Figure 2)**, the flux generated by the permanent magnet follows a patch from the top of the permanent magnet through the armature, through the left leg of the electro-magnet and back to the permanent magnet.

When the coil T1 -T2 is energized, the flux generated is such that it "flows" through the permanent magnet in the same direction as the flux generated by the permanent magnet itself. Its path now, however, is through the right leg of the electro-magnet. The flux generated by the electro-magnet increases in magnitude as power is applied, and as the flux builds up in the path through the right leg of the electromagnet, the flux tending to latch the armature in the left leg of the electro-magnet becomes very small in comparison. The armature then "transfers" and seals at the pole face of the right leg of the electro-magnet.

The cutthroat contact B in series with coil T1 -T2 is opened by mechanical actuation due to the armature movement. In **Figure 2**, a "dotted extension" of the armature represents the mechanical actuator of the cutthroat contacts. In actual design, this is accomplished more conveniently through only one armature extension and an appropriate actuator which drives both contacts B and A.

FIGURE 2



ENGINEERING DATA

DESIGN CONCEPT

SINGLE PHASE RCCB

SINGLE PHASE RCCB (PERFORMANCE DATA)

THREE PHASE RCCB

THREE PHASE RCCB (PERFORMANCE DATA)

ORDERING INFORMATION

ENGINEERING DATA

FIGURE 1

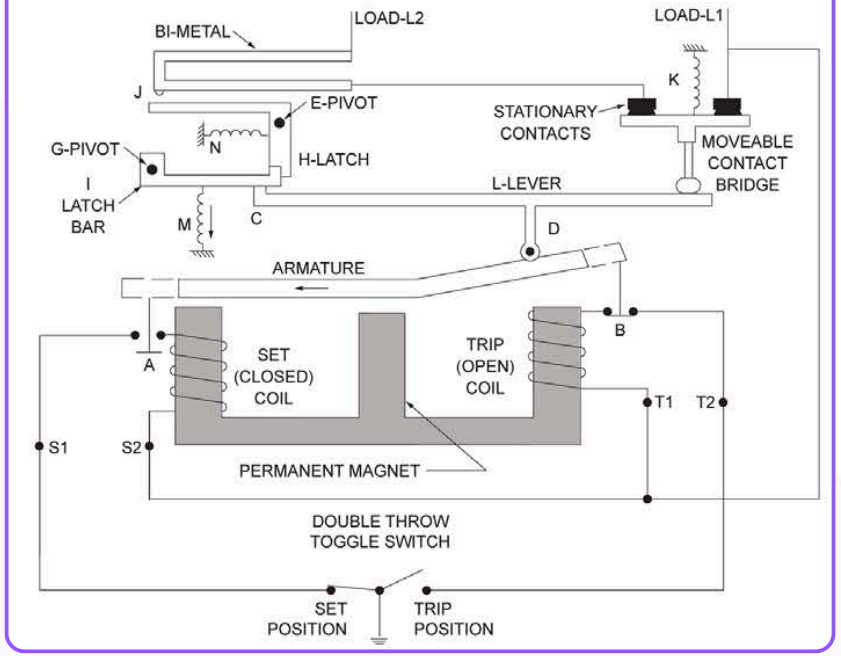
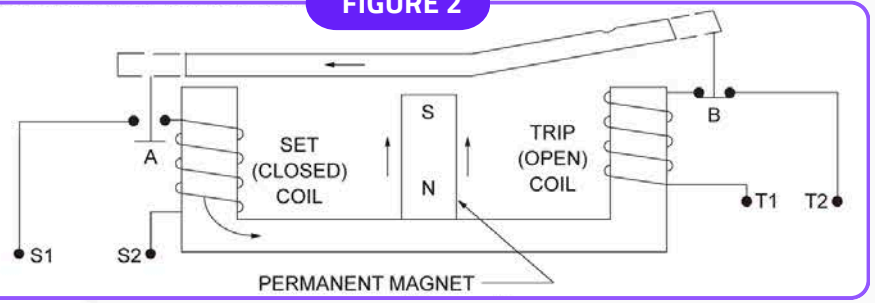


FIGURE 2



MOTOR OPERATION (CONTINUED)

The opening of contact B occurs in the last several thousandths of an inch travel of the armature movement. After coil opening, the armature movement continues (until it seats i.e. seals), due in some degree to the inertia of the armature, but mostly due to the magnetomotive force of the permanent magnet in conjunction with the decreasing air gap at the right pole face.

The device now is again in a stable position, but the armature has transferred and the following conditions exist:

Contact A is closed and contact B is open, and the armature is sealed and latched at the right leg of the electro-magnet. To transfer the armature to its original position, energizing the coil S1-S 2 allows the process described above to occur in the opposite direction.

There are a number of advantages to this design approach of the "motor."
1. The coils open upon transfer of the armature; hence, the actual "on time" or duty cycle approximately equals the operate time of the relay. Accordingly, the coil can be driven hard without fear of burnout. The "hot coil" with the low timer constant results, in turn, in fast operate times.

2. Using intermittent duty coils (smaller coils with less copper) results in less weight and smaller sizes.

3. Power is conserved. This is important for two reasons. If a relay is to use power, it must be available. In some of the present day and future vehicles, power remains an expensive commodity, and elimination of coil power drawing (10-35 watts) in power devices can add up especially when vehicles sophistication requires use of a significant number of these devices. Also, it
must be remembered that power utilized by relay coils generate heat which must be dissipated. The necessary elimination of this heat, in turn, requires the use of additional energy from the main power source.

4. As indicated, the cutthroat contacts are opened by the armature mechanically during the last several thousandths of an inch travel of armature movement. Note: In actual RCCB, the cutthroat contacts function is replaced by electronic control of coil on time.

SINGLE PHASE RCCB

SINGLE PHASE RCCB (PERFORMANCE DATA)

THREE PHASE RCCB

THREE PHASE RCCB (PERFORMANCE DATA)

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DESIGN CONCEPT

FIGURE 3

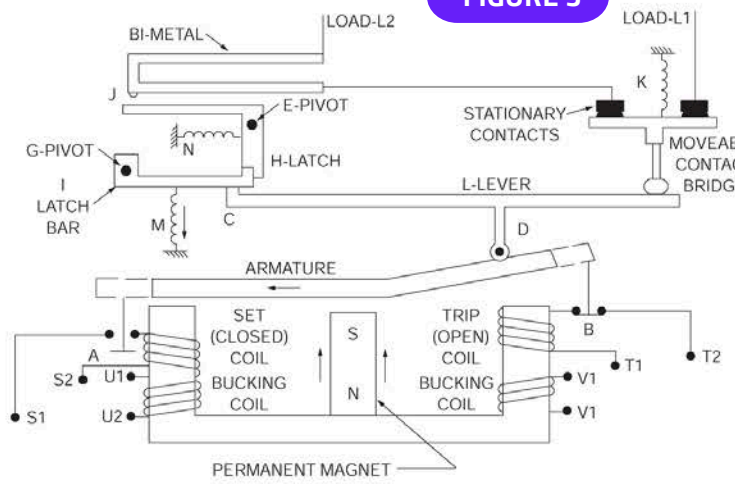
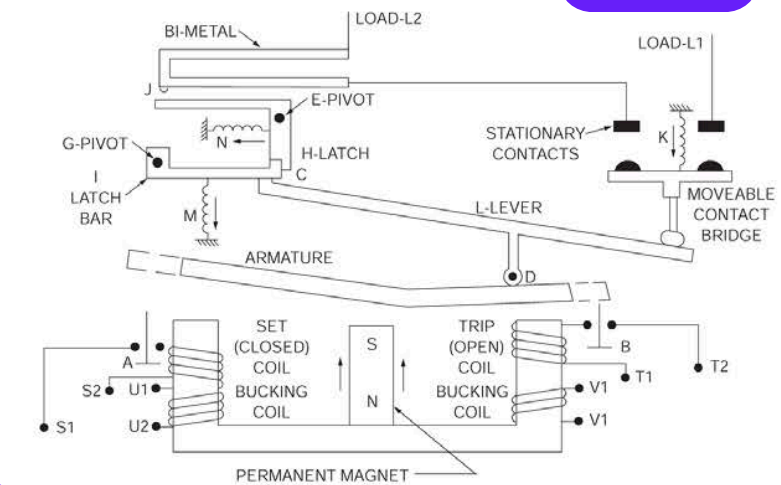


FIGURE 4



RCCB OPERATION AS A RELAY

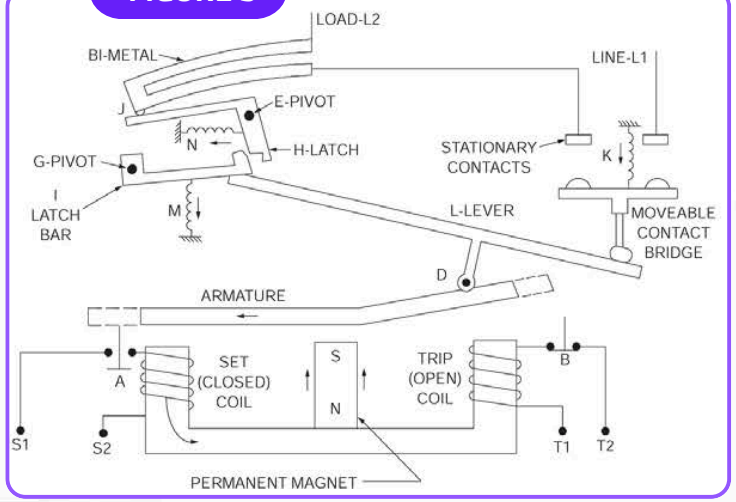
To examine the RCCB operation as a relay, refer to **Figure 3** and **4**. The device is shown in the set position in **Figure 3** and in the tripped position in **Figure 4**. The circuit path is from L2, through the bimetal to one of the stationary contacts. L1 is connected directly to the other stationary contact.

The movable bridge closes the circuit by bridging between the two stationary contacts. As can be seen, movement of the armature about its fulcrum will determine the position of the contacts. When coil S1-S2 has been energized such that the armature seals on the left-hand pole face (**Figure 3**), the mechanical linkage system
closes the contacts. Conversely, when coil T1-T 2 has been energized, such that the armature seals on the righthand pole face (**Figure 4**), the relay contacts will open due to the spring forces exerted by compression spring K.

Note that the coil U1-U2 is connected in parallel with T1-T2. It is wound on the left-hand core of the electro-magnet such that when energized along with T1-T2, the force it generates will be in a direction opposing the latching force generated in that core by the permanent magnet.

The utilization of a permanent magnet and intermittent duty coils, in conjunction with cutthroat contacts, allows a considerable reduction in copper and iron from that normally required in electro-magnets for continuous duty operation

FIGURE 5



NOTE

There is an "upward force" directed on the lever L through the linkage tying into the armature at point D. During operation as a relay, point C (interface between lever L and latch bar I) is "fixed" in place, and the lever L actually rotates about point C when moving the contact structure from the opening to the closed, and from the closed to the open position.

ENGINEERING DATA

DESIGN CONCEPT

SINGLE PHASE RCCB

SINGLE PHASE RCCB (PERFORMANCE DATA)

THREE PHASE RCCB

THREE PHASE RCCB (PERFORMANCE DATA)

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RCCB OPERATION AS A CIRCUIT BREAKER

To examine the operation of the device as a breaker, refer to **Figures 3**, **4**, and **5**.

In **Figure 3**, the device is shown in the closed contact position (presumably) carrying rated current. Should an overload occur, currents greater than rated currents now "flow" through the device "entering" through L2, passing through the bimetal, through the connection of the bimetal to one stationary contact, through the bridging moveable contact structure, to the other stationary contact, and "out" through L1.

Depending upon the size of the overload, the bimetal will begin to deflect as shown in **Figure 5** until the actuating end of the bimetal engages latch H at point J.

Motion and force due to the deflection of the bimetal moves latch H such that it rotates in a counter-clockwise direction around its pivot point E.

When latch H has moved an adequate distance, the upward force of lever L, applied at point C to latch bar I, will rotate latch bar I counter-clockwise around its pivot point G. This allows the main lever L to rotate clockwise around point D (where it is engaged with the armature) due to the "contact return" spring (compression spring) force K acting upon the moveable contact bridge.

Note that when this overload occurs, the armature is not transferred to the "off" (tripped) position, but instead remains in the latched position normally associated with the "on" (set) position of the device.

To "reset" the device after the fault or overload clears could be readily accomplished by energizing the "trip" coil (T1-T2) through a toggle or pushbutton switch (**see Figure 1**) located in the flight deck. The armature would then transfer and seal on the right-hand core of the electro-magnet, which is the "open" position shown in **Figure 4**. At that time, springs M and N (tension springs) would reposition latch bar I and latch H to the position shown in **Figure 4**, providing that the bimetal has now cooled sufficiently and returned to its original position as shown in **Figure 4**. At this stage, the RCCB is still in an "open position" i.e. (the contacts are open), but as outlined above, the fault or overload has been cleared through action and operation of the device through bimetallic activity, i.e. "Circuit Breaker" operation.

To re-close the contacts, it is now only necessary to energize coils S1-S2 and re-establish a mechanism position similar to that shown in **Figure 3**. If the fault of overload condition is still in existence, the device would again trip through bimetallic activity as just described.



ENGINEERING DATA
DESIGN CONCEPT

SINGLE PHASE RCCB

SINGLE PHASE RCCB (PERFORMANCE DATA)

THREE PHASE RCCB

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ENGINEERING DATA

THREE PHASE RCCB

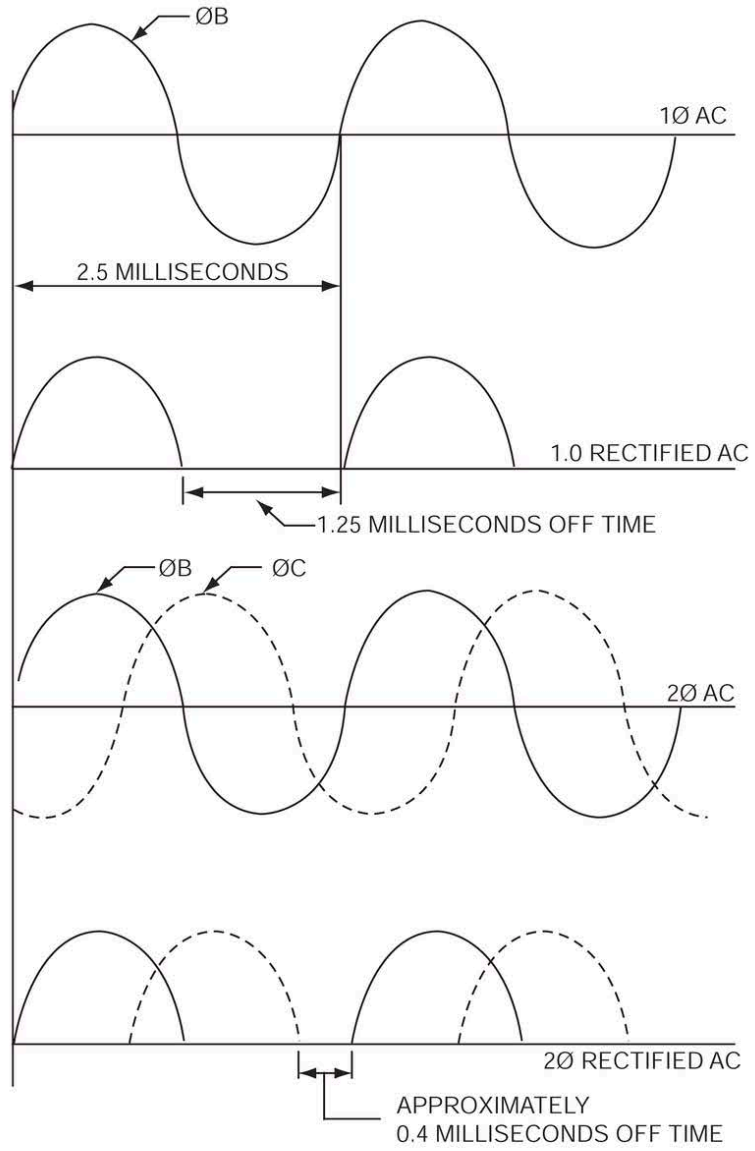
The design principles employed in the 3-pole RCCB have followed many of the same paths utilized in the 1-pole RCCB. Differences other than the obvious, such as size, weight, shape, etc., are explained below.

MOTOR OPERATION

The principles of motor operation and construction of the three pole devices are similar to those employed in the single pole RCCB.
In the 3-pole device, the AC operating power is drawn from two of the three phases.
The "off" time between current pulses during coil energization is approximately 0.4 milliseconds.
In comparison, the "off" time for single-phase power is approximately 1.25 milliseconds.
See **Figure 6**.

The timing circuit establishes a coil "on" time longer than the actual transfer time of the armature. The operation of the 3-pole RCCB is identical to the 1-pole.

FIGURE 6



ENGINEERING DATA
DESIGN CONCEPT

SINGLE PHASE RCCB

SINGLE PHASE RCCB (PERFORMANCE DATA)

THREE PHASE RCCB

THREE PHASE RCCB (PERFORMANCE DATA)

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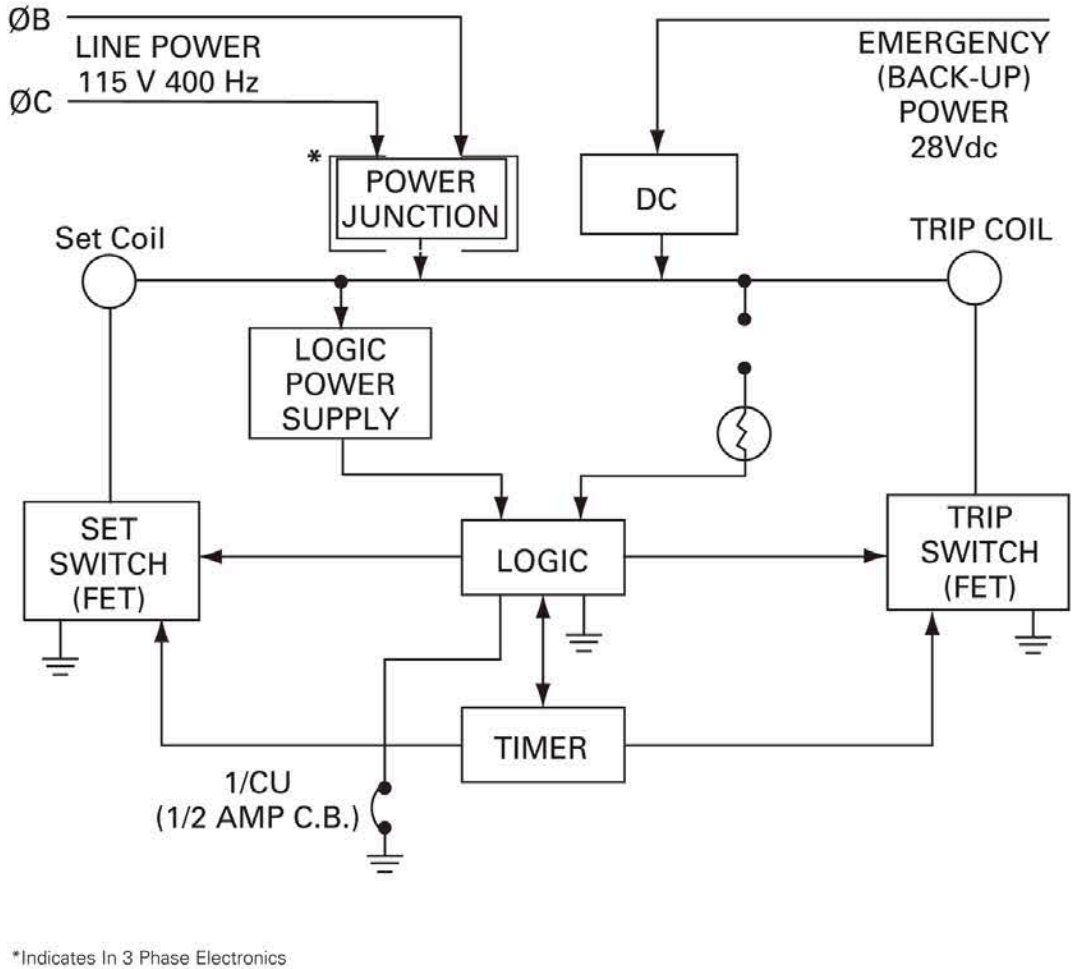
CONTROL CIRCUIT

Refer to **Figure 7**. There is one minor difference in operating principles and parameters from the single pole devices.
The difference is the addition of a power junction area in the electronics (see **Figure 7**). The 3-pole RCCB is designed for use in 3-phase circuits and is a 400 Hz AC load controller. The power junction is designed to use AC power only. DC operate (coil) power may be used even though AC loads are to be controlled. This connection is made at terminal 4 of the IWTS connector.

In **Figure 7**, two separate power junctions are shown: one for AC and one for DC. In the event both AC and DC are connected to the RCCB, only AC would be utilized by the logic circuit. Should AC power be lost, the DC connection would automatically take over the control function.

The other differences between 1-phase and 3-phase control circuitry, i.e. timer addition, is directly related as described in the above Motor Operation section.

FIGURE 7



*Indicates In 3 Phase Electronics

CONTACT

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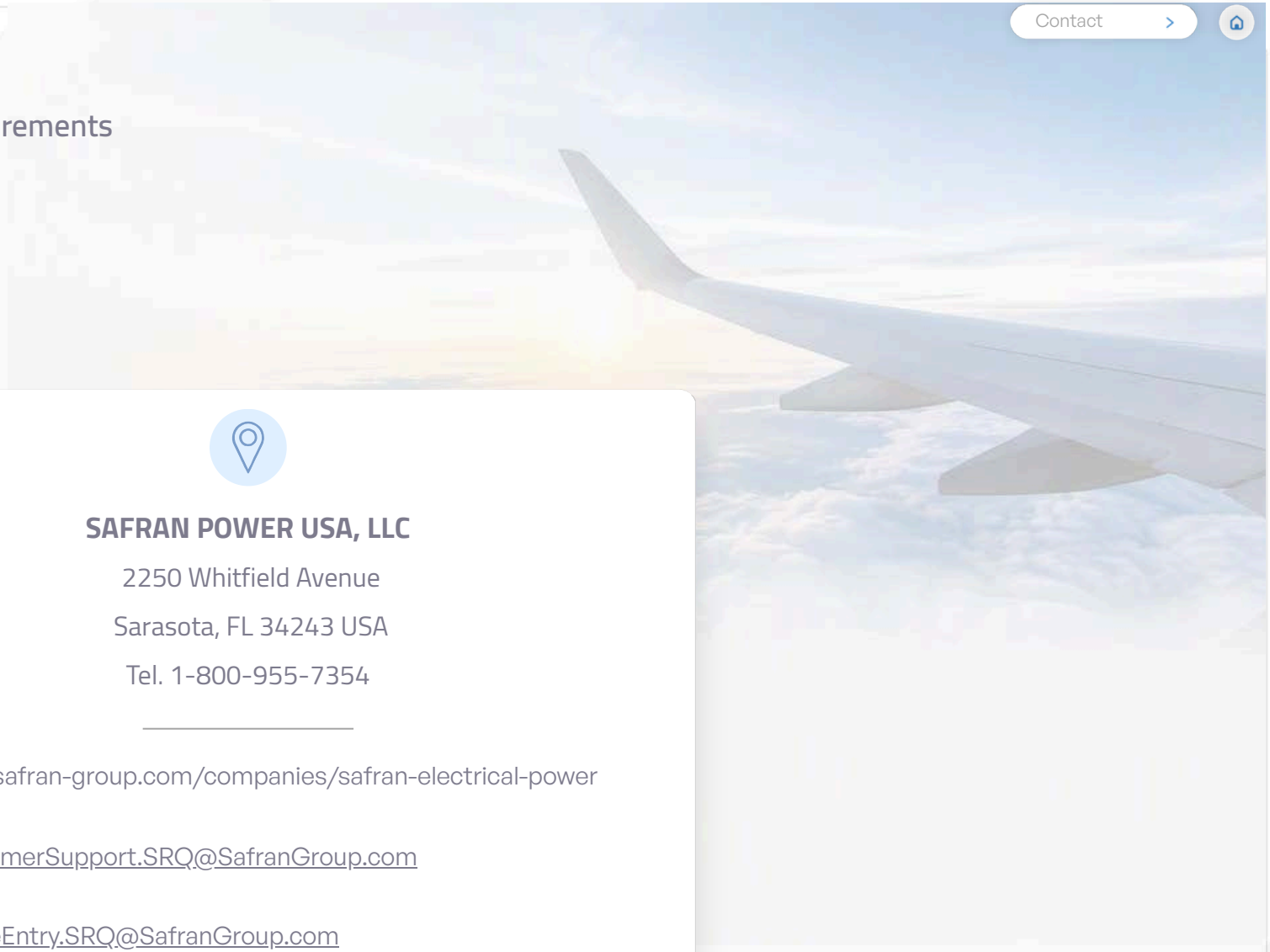
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