Introduction

Residual current devices (RCD) have always played an important role in circuit protection by detecting leakage to ground for equipment in many installations. RCD's are used in unison with a circuit protective device in industrial applications in the United States. The following guide will give an insight to the construction, mechanical operation, and applications of RCD's.

RCD Definitions

Important definitions:

Earth leakage current
Current that flows between line to line or line to earth.

Residual current
The sum of the values of the electric currents in all live conductors

Fault current
Current that flows between line to line or line to earth.

Earth fault
When a conductive path is accidentally induced between a line and the earth

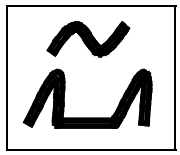
RCD Definition
RCD's provide ground fault protection to equipment by monitoring the leakage of current to ground. An RCD will trip when a ground fault is detected in excess of the trip rating of the device. An RCD is designed to disconnect a circuit whenever it detects that the electrical current is unbalanced between the phase conductor and the neutral conductor. An imbalance may be caused by phase leaking to ground.

Difference between type A and AC

Types of RCD's

Type AC
Must be used for protection against AC earth leakage current.

Type A
Must be used for protection against AC and pulsating DC (rectified AC) earth leakage current. The type A RCD must be installed in any circuit where the main supply is likely to be rectified. Some examples of applications where this would apply are motor speed controllers (drives) and power tools.



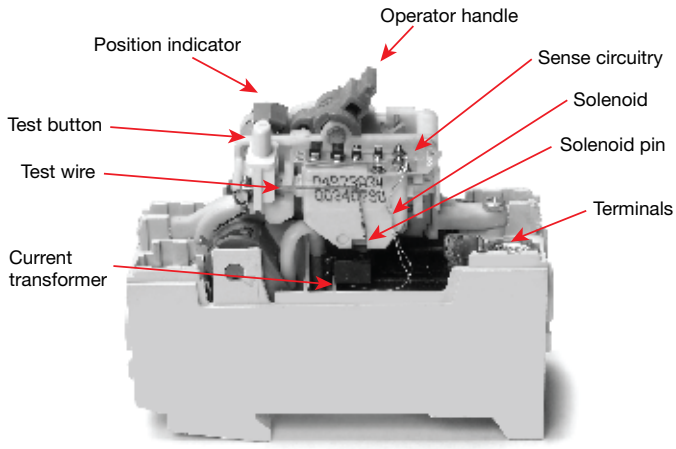
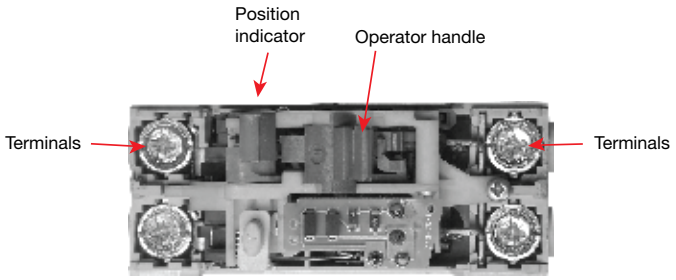


ABB Residual Current Device

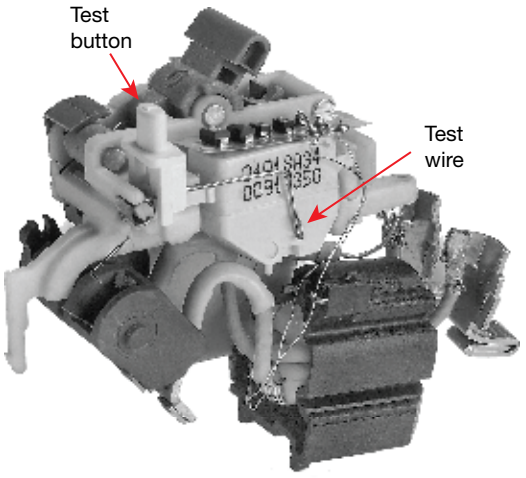
15

RCD Mechanical operation

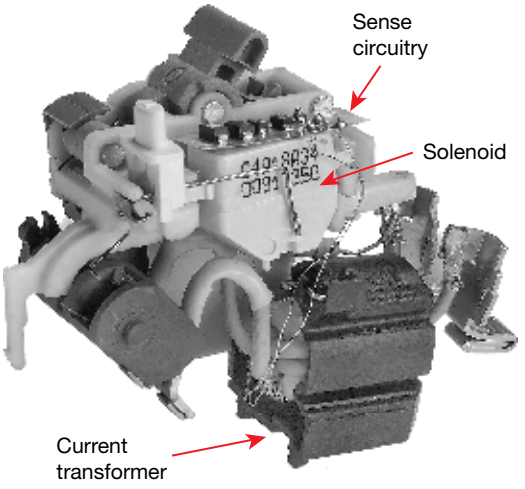
Main Incoming Supply and Terminals
The main incoming and the grounded neutrals are connected to the terminals. The operator handle places the RCD in the on and off position as the position indicator shows.



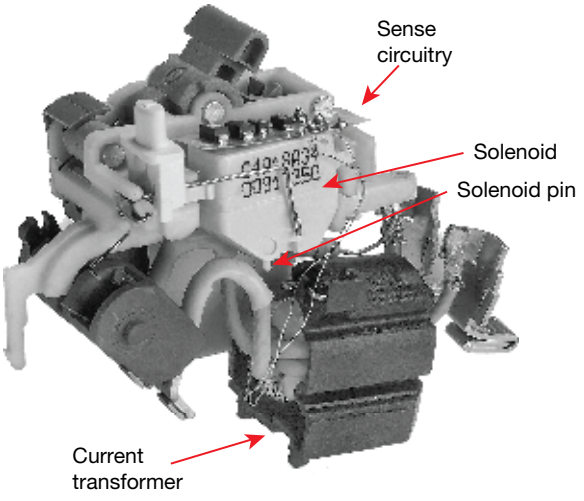
Test button and Test Wire
When the test button is pressed it allows the correct operation of the device to be verified by passing a small current through the test wire. This simulates a leakage to ground by creating an imbalance in the current transformer (CT).



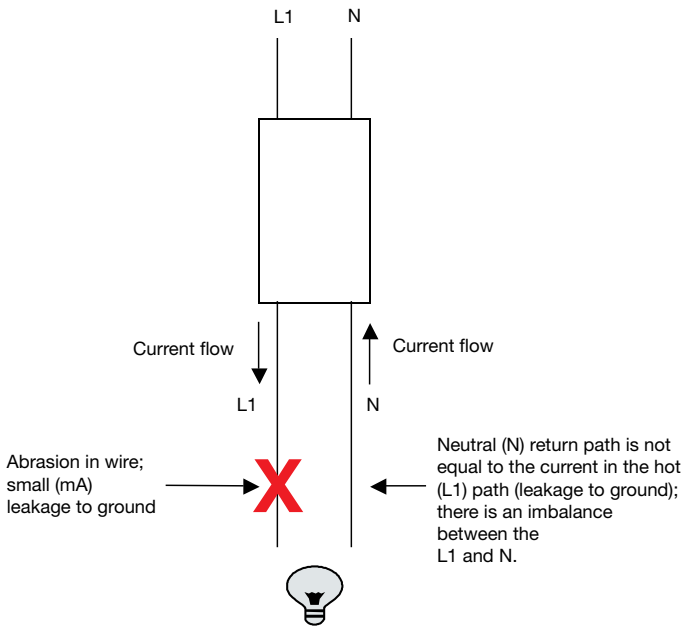
Current Transformer and Sense Circuitry
The current transformer surrounds the neutral and L1 conductors. During normal operation, all of the current being carried through the L1 conductor returns up through the neutral conductor. Therefore the currents in the two conductors are equal and opposite. When a leakage to ground occurs it causes some of the current to take a path to ground and creates an imbalance in the current between the two conductors. This imbalance in current induces a current in the current transformer (CT) which is then picked up by the sense circuitry. The sense circuitry then actuates the solenoid and the contacts are forced apart by a spring, terminating the electricity supply to the device.



Solenoid
Once an imbalance has been detected by the CT, there is voltage induced on the CT. The voltage travels through the connected copper wires to the sense circuitry and the solenoid is actuated. The plunger at the bottom of the solenoid is then pushed out to trip the breaker.



Example of current leakage to ground



Difference between RCD and MCB

Miniature Circuit Breaker (MCB)
A miniature circuit breaker (MCB) is a device designed to isolate a circuit during an overcurrent event without the use of a fusible element. A breaker is a resettable protective device that protects against two types of overcurrent situations; overload and short circuit.

Residual Current Device (RCD)
A residual current device (RCD) is a device designed to provide protection against voltage leakage to ground. *RCD's are sensitive to a 30-300mA. RCD's are mechanical devices that contain a CT and a solenoid.* RCD's are designed to protect equipment, not wires against overload and short circuit situations. For this reason, an RCD should always be used in conjunction with an MCB in order to provide full protection from overload and leakage to ground.

Ground Fault Interrupter (GFI)
GFI Definition (NEC): A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds the values established for a Class A device.

A ground fault interrupter (GFI) is a device designed to measure the current between the hot wire and neutral wire. Like the RCD, the GFI will open the closed contacts in order to protect against damage. A GFI is sensitive to 5mA and higher and is designed to protect people, not equipment.

A GFI is an electric device that contains a printed circuit board (PCB). GFI's have a "pigtail" wire at the end that carries a signal to the PCB that tells the contacts to open when a current imbalance is detected between the two conductors.

Technical data
F200AC, F200A

Item	F200AC	F200A
Approvals:		
UL	1053	1053
CSA	-	-
VDE	-	-
IEC	-	-
Number of Poles:	2,4	2,4
Rated Currents:	16,25,40,63,80,100,125	16,25,40,63,80,100,125
Operating Voltage:	480Y/277 VAC	480Y/277 VAC
Production Category:	IP20	IP20
Depth of Unit Per DIN 43880:	68mm/ 2.68 in.	68mm/ 2.68 in.
Mounting Position:	vertical, horizontal	vertical, horizontal
Standard Mounting:	35mm DIN rail	35mm DIN rail
Main and Shunt Trip Terminals:		
Wire Size	18-4 AWG/.82-21.2mm²	18-4 AWG/.82-21.2mm²
Torque	17.5 in-lbs./1.978 nm	17.5 in-lbs./1.978 nm
Tool	#2 Posidrive	#2 Posidrive
Accessory Terminals		
Wire Size	18-16 AWG/.82-1.3mm²	18-16 AWG/.82-1.3mm²
Torque	4.5 in-lbs./.51nm	4.5 in-lbs./.51nm
Tool	# 1 Posidrive	# 1 Posidrive
Service Life at Rated Load:	No Load 20,000 operations Full Load 10,000 operations	No Load 20,000 operations Full Load 10,000 operations
Shock Resistance:	30g minimum of 2 impacts, shock duration of 13ms	30g minimum of 2 impacts, shock duration of 13ms
Vibration Resistance:	5g, 20 cycles, 5 Hz, 150 Hz @ 0.8 ~ In	5g, 20 cycles, 5 Hz, 150 Hz