

# Instructions for Digitrip RMS 210 Trip Unit for use with Type SPB Systems Pow-R Breakers

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## WARNING

**DO NOT ATTEMPT TO INSTALL OR PERFORM MAINTENANCE ON EQUIPMENT WHILE IT IS ENERGIZED. DEATH, SEVERE PERSONAL INJURY, OR SUBSTANTIAL PROPERTY DAMAGE CAN RESULT FROM CONTACT WITH ENERGIZED EQUIPMENT. ALWAYS VERIFY THAT NO VOLTAGE IS PRESENT BEFORE PROCEEDING WITH THE TASK, AND ALWAYS FOLLOW GENERALLY ACCEPTED SAFETY PROCEDURES.**

**CUTLER-HAMMER IS NOT LIABLE FOR THE MISAPPLICATION OR MISINSTALLATION OF ITS PRODUCTS.**

The user is cautioned to observe all recommendations, warnings, and cautions relating to the safety of personnel and equipment as well as all general and local health and safety laws, codes, and procedures.

The recommendations and information contained herein are based on Cutler-Hammer experience and judgement, but should not be considered to be all-inclusive or covering every application or circumstance which may arise. If any questions arise, contact Cutler-Hammer for further information or instructions.

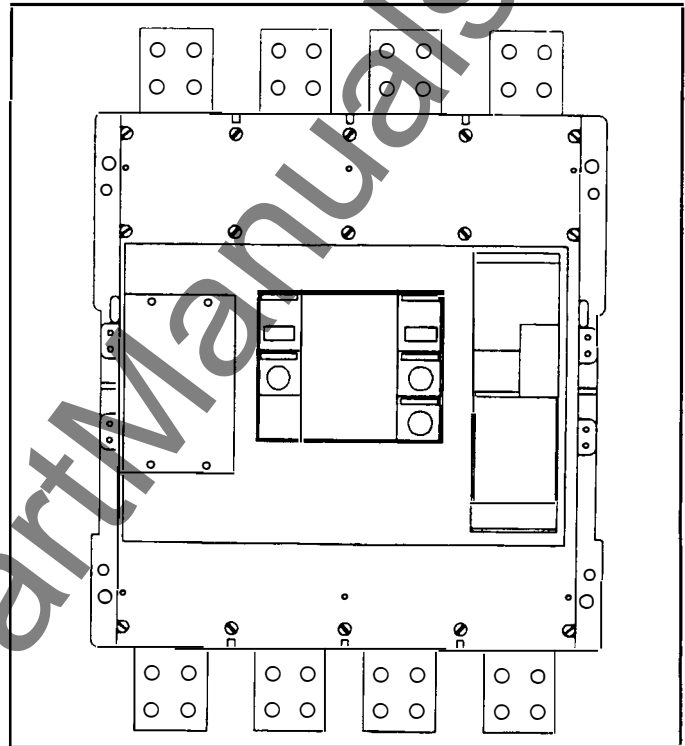


Fig. 1 Digitrip RMS 210 Trip Unit for use with SPB Systems Pow-R Breakers

## 1.0 GENERAL DESCRIPTION

### 1.1 Protection

The Digitrip RMS 210, illustrated in Figure 1, is a custom application specific integrated circuit based trip unit for use with SPB Systems Pow-R Breakers.

The Digitrip RMS 210 provides true RMS current sensing for proper correlation with thermal characteristics of conductors and equipment. Interchangeable rating plugs are provided to establish the continuous current rating of each circuit breaker.

The Digitrip RMS 210 Trip Unit is completely self-contained and when the circuit breaker is closed, requires no external control power to operate its protection systems. It operates from current signal levels and control power derived through current sensors integrally mounted in the circuit breaker.

Digitrip RMS 210 Trip Units are suitable for AC applications only.

The Digitrip RMS 210 Trip Unit is equipped with an instantaneous pick-up adjustment to meet specific application requirements as illustrated in Figure 3.

**1.2 Testing**

Test points are provided for functional field testing of the trip unit when connected to a test kit (Catalog No. STK2).

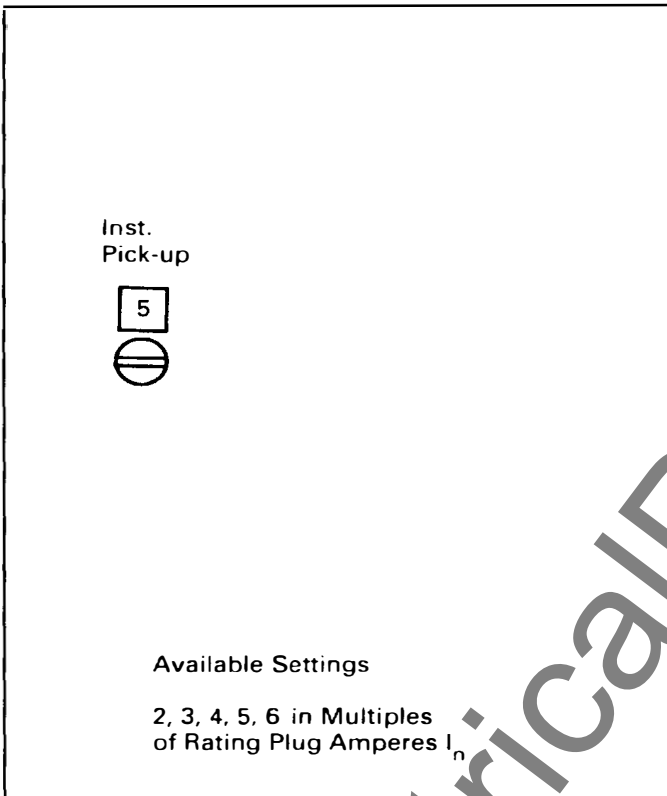


Fig. 2 Instantaneous Pick-Up Settings

**2.0 UL LISTED DEVICES**

The Digitrip RMS 210 Trip Unit is listed in accordance with Underwriters Laboratories, Inc. Standard UL 489, under file E7819 and satisfies the applicable requirements of the International Electrotechnical Commission (IEC) recommendations for molded case circuit breakers.

**3.0 PRINCIPLE OF OPERATION**

In open air at 40°C, an SPB circuit breaker with a Digitrip RMS 210 Trip Unit installed will carry continuously up to 5000 amperes without exceeding a 50°C rise at the terminals. The calibration of the trip unit is insensitive to ambient temperatures over a range of - 20° to +55°C. However, the trip unit contains thermal temperature pro-

TECTIVE circuitry that initiates a trip operation for self-protection if the internal ambient temperature at the printed circuit board (PCB) reaches approximately 100°C.

For ambient conditions above 40°C, derating of the circuit breaker frame should be considered to avoid exceeding a safe terminal temperature operating range. Consult Cutler-Hammer for recommendations.

**3.1 General**

The Digitrip RMS 210 Trip Unit provides a tripping signal to the flux transfer shunt trip when current and time delay settings are exceeded. This is accomplished by employing the Cutler-Hammer custom designed integrated circuit Sure™ chip, which includes a microcomputer to perform its numeric and logic functions.

In the Digitrip RMS 210 Trip Unit, all required sensing and tripping power to operate its protection function is derived from the current sensors in the circuit breaker. The secondary currents from these sensors provide the correct input information for the protection functions, as well as tripping power, whenever the circuit breaker is carrying current. These current signals develop voltages across the appropriate calibrating resistors.

The resulting analog voltages are digitized by the custom designed integrated circuits.

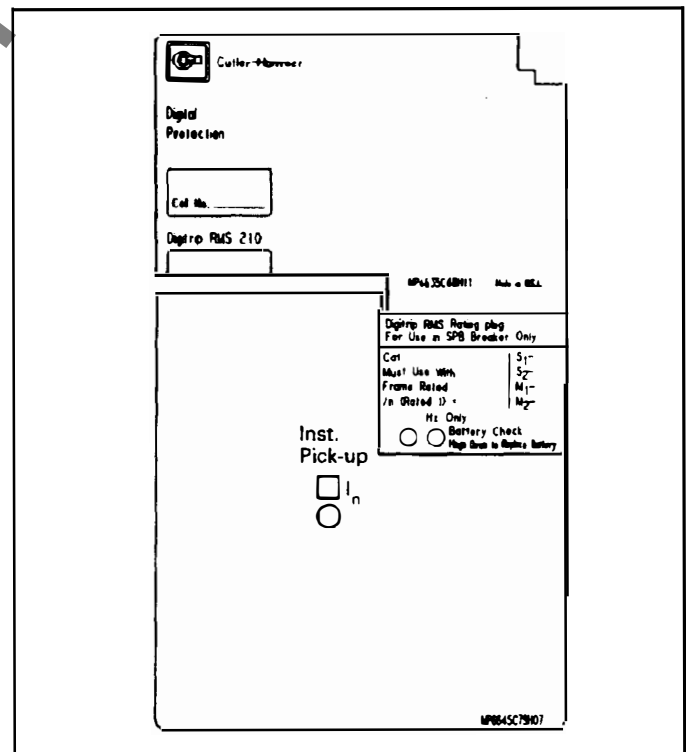


Fig. 3 Trip Unit Nameplate Catalog No. S21LI

The microcomputer, in cyclic fashion, repeatedly scans the voltage values across each calibrating resistor and enters these values into Random Access Memory (RAM). These data are used to calculate true RMS current values, which are then repeatedly compared with the protection function settings and other operating data stored in the Read Only Memory (ROM). The software program then determines whether to initiate protection functions, including tripping the breaker through the flux transfer shunt trip device in the circuit breaker.

### 3.2 Overload Trip

In accordance with standards requirements, the trip unit initiates a trip of the circuit breaker within two hours for an overload of 135 percent, and a trip in less time for higher overloads.

### 3.3 Instantaneous Trip

For short circuit conditions that exceed the instantaneous pickup settings, the trip unit initiates a trip with no intentional delay.

## 4.0 PROTECTION SETTINGS

### 4.1 General

Prior to placing any circuit breaker in operation, each trip unit protection setting must be set to the values specified by the engineer responsible for the installation. The available settings along with the effect of changing the settings are illustrated in Figure 2.

The installed rating plug establishes the maximum continuous current rating ( $I_n$ ) of the circuit breaker. Instantaneous current settings are defined in multiples of  $I_n$ .

### 4.2 Instantaneous Pick-up Setting

Seven settings are available that range from 2 to 6 ( $I_n$ ) as shown in Figure 2.1.

## 5.0 TESTING

A test receptacle is built into each trip unit to test the function of the trip unit using the STK2 Test Kit. Refer to Frame Book 29-106 for ordering information.

## 6.0 FRAME RATINGS AND RATING PLUGS

The **Frame Rating** of a circuit breaker is the maximum RMS current it can carry continuously. The maximum Short-Circuit Current Ratings of the circuit breaker are usually related to the Frame Rating as well.

It is often times desirable to be able to choose a current value ( $I_n$ ), less than the full frame rating, to be the basis for the coordination of the circuit breaker's protection functions, without affecting its short-circuit current capability. For the Digitrip 210 Trip Unit this is implemented by changing the **Rating Plug**.

The Rating Plug (See Fig. 4) fits into a special cavity to complete the trip units.

The Rating Plug current rating, ( $I_n$ ), is the basis for the trip unit current settings:

- 1) The long delay protection function of the trip unit is set at  $I_n$ .
- 2) The instantaneous pick-up setting is a multiple of  $I_n$ .

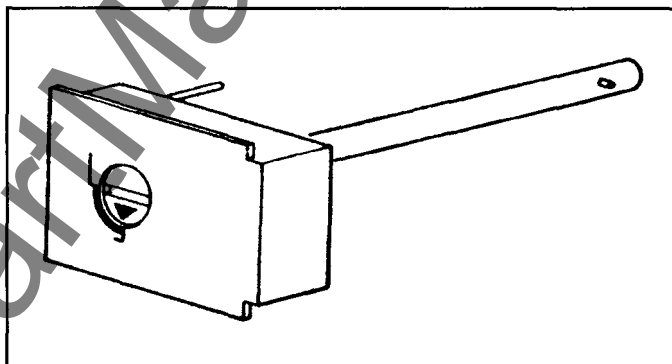


Fig. 4 Typical Rating Plug

Rating Plugs for the Digitrip RMS 210 Trip Units are marked for and may be applied on both 50 and 60 Hz Systems.



**DANGER**

**BEFORE YOU FIT THE RATING PLUG INTO THE TRIP UNIT, BE SURE TO CHECK THAT THE BREAKER TYPE AND FRAME RATING, MATCH THOSE PRINTED ON THE RATING PLUG COVER.**

**INSTALLING A RATING PLUG THAT DOES NOT MATCH THE BREAKER TYPE AND FRAME RATING, CAN PRODUCE SERIOUS MISCOORDINATION AND/OR FAILURE OF THE PROTECTION SYSTEM.**

Complete catalog descriptions of all available rating plugs are given in the applicable circuit breaker supplementary instruction leaflets (see Section 7.0).

**7.0 REFERENCES**

I.L. 29-801 Instructions for the Systems Pow-R Breaker and Drawout Mechanism

29-849 Supplementary Instructions for the Systems Pow-R Breaker used with a Digitrip RMS Trip Assembly

SC-5622-93 Typical Time-Current Characteristic Curves for Type SPB Systems Pow-R Breaker

IS 15545 SPB Master Connection Diagram using Digitrip RMS Trip Assemblies

**Table 1-1. Digitrip Rms 210 Trip Unit Types**

Frame Rating	Digitrip RMS 310 Trip Unit Type Catalog Numbers
1600 amps 2000 amps 2500 amps	RES1600LS RES2000LS RES2500LS
Trip Unit Functions: Long Delay	
Fixed Ampere Rating ① with Fixed Long Delay	●
Adjustable Ampere Setting with Fixed Long Delay ②	●
Instantaneous Delay	●
Adjustable Instantaneous Pick-up ③	●
Override	●
Fixed Instantaneous ④	●

① Fixed rating plugs available, see Table 1-2.

② Optional four-setting adjustable rating plugs available, see Table 1-2.

③ Using trip unit with adjustable short delay time (LSI, LSIG), instantaneous pick-up is achieved when the lowest time delay setting (I) is selected.

④ A nonadjustable override setting is set at the frame withstand rating.

**Table 1-2. Digitrip RMS 210 Trip Unit Trip Function and Rating Settings**

Trip Function	Rating/Setting Description	
Ampere Rating Fixed at 100%	Fixed rating plugs available:	
	Trip Unit Ampere Rating	Fixed Rating Plugs
	1600A	800A, 1000A, 1200A, 1250A①, 1400A, 1500A①, 1600A (I <sub>n</sub> )
	2000A	1000A, 1200A, 1250A①, 1400A, 1600A, 2000A (I <sub>n</sub> )
	2500A	1200A, 1250A①, 1600A, 2000A, 2500A (I <sub>n</sub> )
Adjustable Long Delay Pick-up	Adjustable rating plugs available:	
	Trip Unit Ampere Rating	Adjustable Rating Plugs
	1600A	800A, 1000A, 1200A, 1600A (I <sub>n</sub> )
		800A, 1000A, 1250A, 1600A① (I <sub>n</sub> )
	2000A	1000A, 1200A, 1600A, 2000A (I <sub>n</sub> )
1000A, 1250A, 1600A, 2000A① (I <sub>n</sub> )		
2500A	1200A, 1600A, 2000A, 2500A (I <sub>n</sub> ) 1250A, 1600A, 2000A, 2500A① (I <sub>n</sub> )	
Instantaneous Pick-up	In multiples of installed rating plug amperes (I <sub>n</sub> ) with marks at 2-3-4-5-6-7-8x ③	

① Not UL Listed

③ 7x and 8x settings not available for 2500A frame.