

Instructions for Digitrip RMS 500 Trip Unit



I.L. 29-851-A

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WARNING

DO NOT ATTEMPT TO INSTALL OR PERFORM MAINTENANCE ON EQUIPMENT WHILE IT IS ENERGIZED. DEATH OR SEVERE PERSONAL INJURY 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. THE WESTINGHOUSE ELECTRIC CORPORATION 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 Westinghouse 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 Westinghouse Electric Corporation for further information or instructions.

1.0 General Description

1.1 Protection

The Digitrip RMS 500 Trip Unit, illustrated in Fig. 1, is a micro-processor based type trip suitable for use in type SPB Systems Pow-R circuit breakers and types DS and DSL low voltage AC power circuit breakers and Series C® R-Frame molded case circuit breakers.

The trip unit 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 500 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.

The Digitrip RMS 500 Trip Unit is available in six optional protection models. Each trip unit may be equipped with a maximum of five phase and two ground (time-current) adjustments to meet specific application requirements. These protection models include the following types which are further illustrated in the nameplate examples shown in Fig. 2.

Figure	Type Protection	Identifier
2.1	Long Time/Instantaneous	(LI)
2.2	Long Time/Short Time	(LS)
2.3	Long Time/Short Time/Instantaneous	(LSI)
2.4	Long Time/Instantaneous/Ground	(LIG)
2.5	Long Time/Short Time/Ground	(LSG)
2.6	Long Time/Short Time/Instantaneous/ Ground	(LSIG)

1.2 Information

Red LED indicators are provided on the face of the trip unit to indicate the mode of an automatic trip operation. A battery is provided to maintain the mode of trip LED indication following an automatic trip operation.

Green LEDs are provided to indicate the operational status of the trip unit and the status of the back-up battery mounted in the rating plug.

1.3 Testing

An integral test panel, including a test selector switch and test and reset pushbuttons, is provided to test the circuit breaker in either a "Trip" or "No-Trip" test mode under qualified conditions.

2.0 UL Listed Devices

Digitrip RMS 500 Trip Units are listed by the Underwriters Laboratories, Inc. for use in types SPB, DS and DSL and Series C R-Frame circuit breakers under UL File E7819.

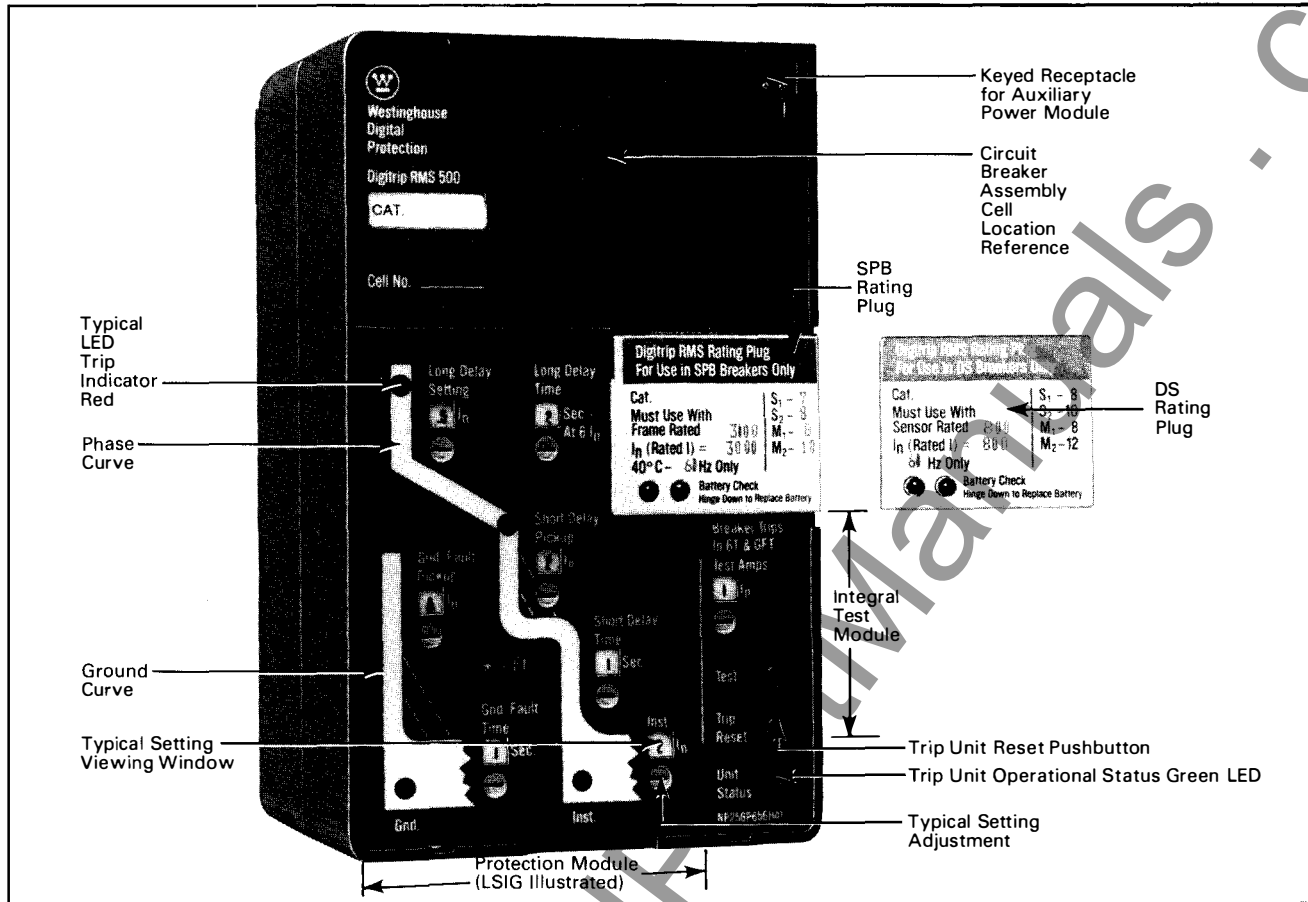


Fig. 1 Typical Digitrip RMS 500 Trip Unit with Rating Plug Installed

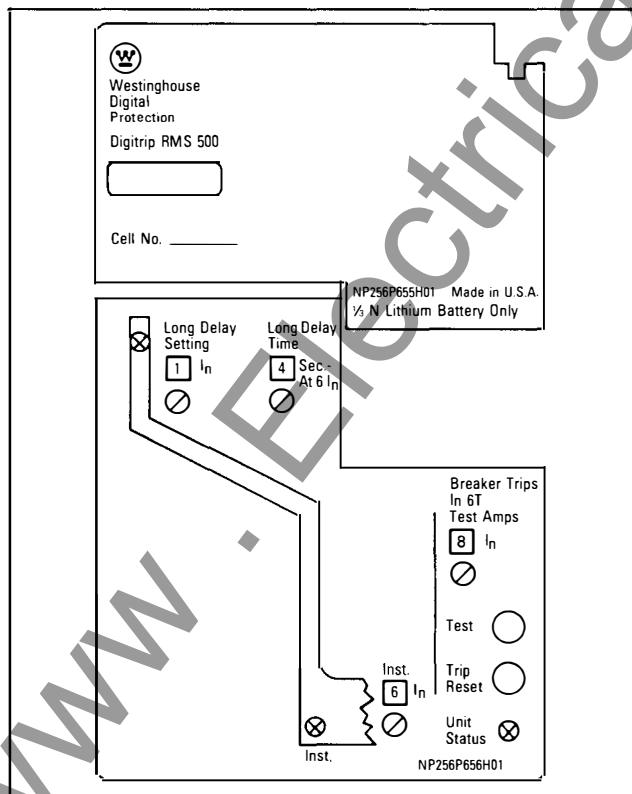


Fig. 2.1 Long Time/Instantaneous Protection (LI) Nameplate

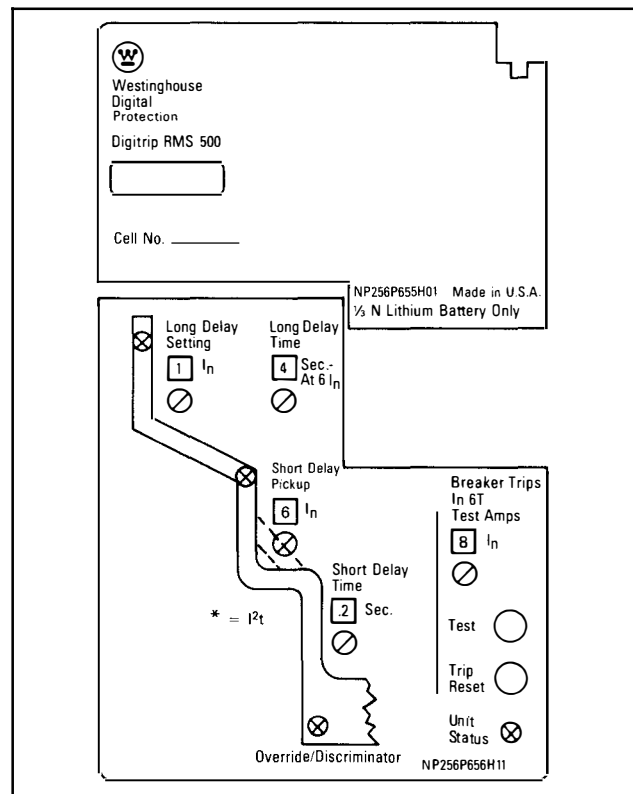


Fig. 2.2 Long Time/Short Time Protection (LS) Nameplate

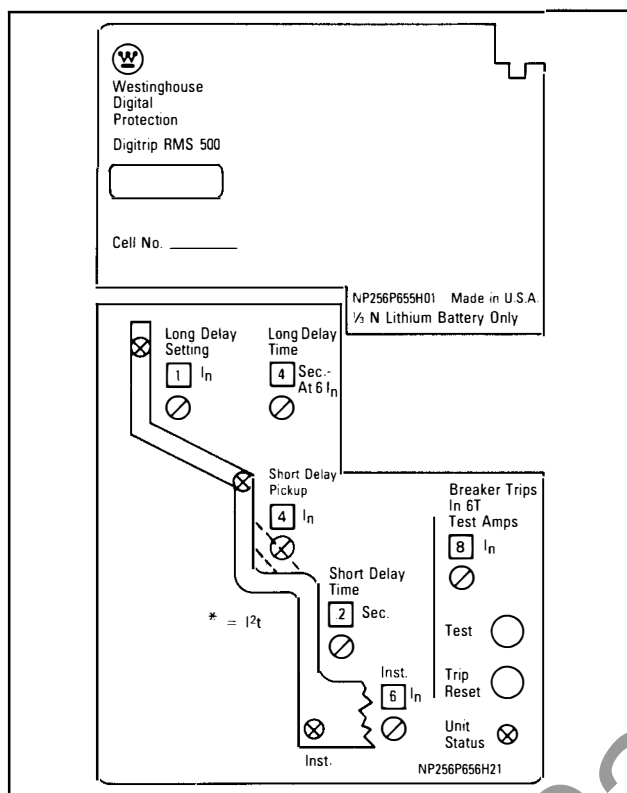


Fig. 2.3 Long Time/Short Time/Instantaneous Protection (LSI) Nameplate

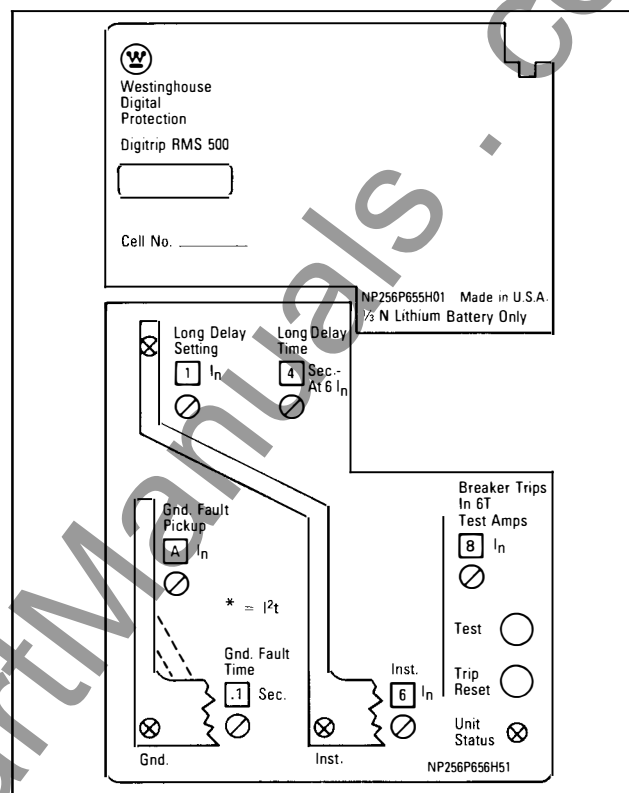


Fig. 2.4 Long Time/Instantaneous/Ground Protection (LIG) Nameplate

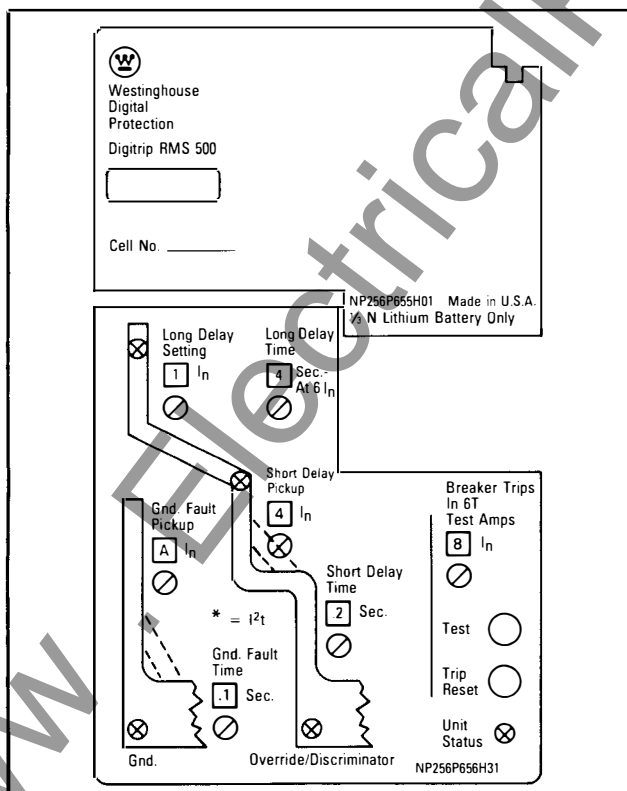


Fig. 2.5 Long Time/Short Time Protection (LSG) Nameplate

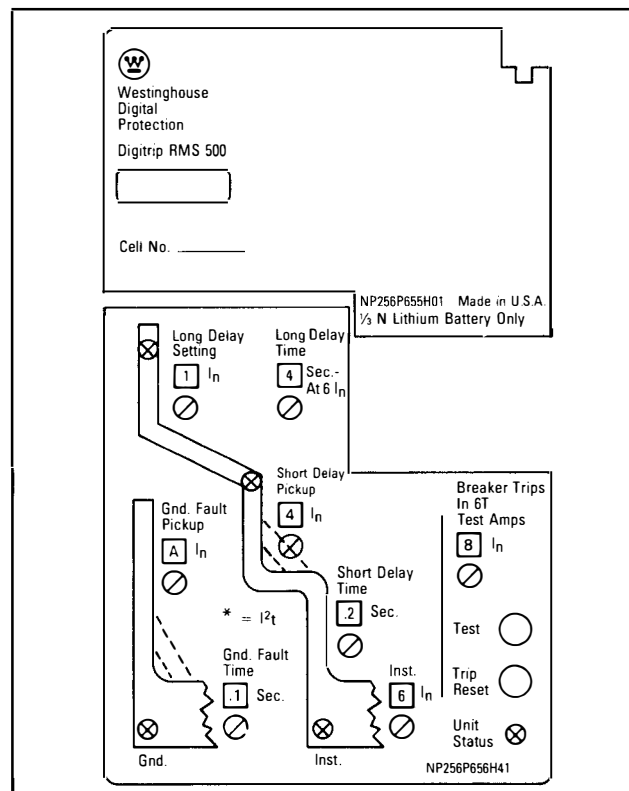


Fig. 2.6 Long Time/Short Time/Instantaneous/Ground Protection (LSIG) Nameplate

3.0 Principle of Operation

3.1 General

The Digitrip RMS 500 Trip Unit provides three basic functions: Protection, Information and Testing. A typical trip unit and rating plug are illustrated in Fig. 1. Individual product instruction leaflets referenced in Sections 9.1 and 9.2 illustrate typical Digitrip RMS Trip Units installed in specific breakers.

The trip unit uses the INTEL MCS-51 family of microcomputers to perform its numeric and logic functions. The principle of operation can best be described by referring to the block diagram shown in Fig. 3.

In the Digitrip RMS 500 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 current signals from these sensors provide the correct magnitude of current for protection functions as well as tripping power during normal circuit breaker operating periods. Using these current signals in the protection function, analog voltages are developed across various calibrating resistors including:

- 1) Phase current
- 2) Ground fault current (when supplied)
- 3) Rating plug

The resulting analog voltages are multiplexed into an analog-to-digital converter and the output data fed into the microcomputer chip along the data bus.

The microcomputer, in cyclic fashion, repeatedly scans the resultant voltage values across each calibrating resistor and

enters these values into its RAM or Read/Write Memory. This data, which is used to calculate true RMS current values, is repeatedly compared with the pre-set protection function pick-up settings and other operating data stored in the ROM or Read Only Memory. The microcomputer software program is then used, in decision tree fashion, to initiate protection functions including tripping actions through the low energy flux transfer trip coil in the circuit breaker.

3.2 Trip and Operation Indicators

Red colored LEDs, as shown in Figs. 1 and 2, indicate on the face of the trip unit the mode of trip of any automatic trip operation. As indicated in Fig. 2, each LED is strategically located in the related segment of the time-current curve depicted on the face of the trip unit. The mode of trip is identified by the segment of the time-current curve in which the LED is turned "On". Following an automatic trip operation, a back-up battery, as indicated in Figs. 3 and 6, is provided to supply power to the LEDs. A green colored battery check LED and a test pushbutton as shown in Figs. 1 and 6, are provided to check the status of the battery.

A trip reset pushbutton, as shown in Fig. 1, is provided to turn "Off" the LEDs following a trip operation.

A green colored LED, as shown in Fig. 1, indicates the operational status of the trip unit. Once the load current through the circuit breaker exceeds approximately 20% of the frame or sensor rating, the green LED will flash "On" and "Off" once each second. A flashing green LED is an indication of a properly operating trip unit.

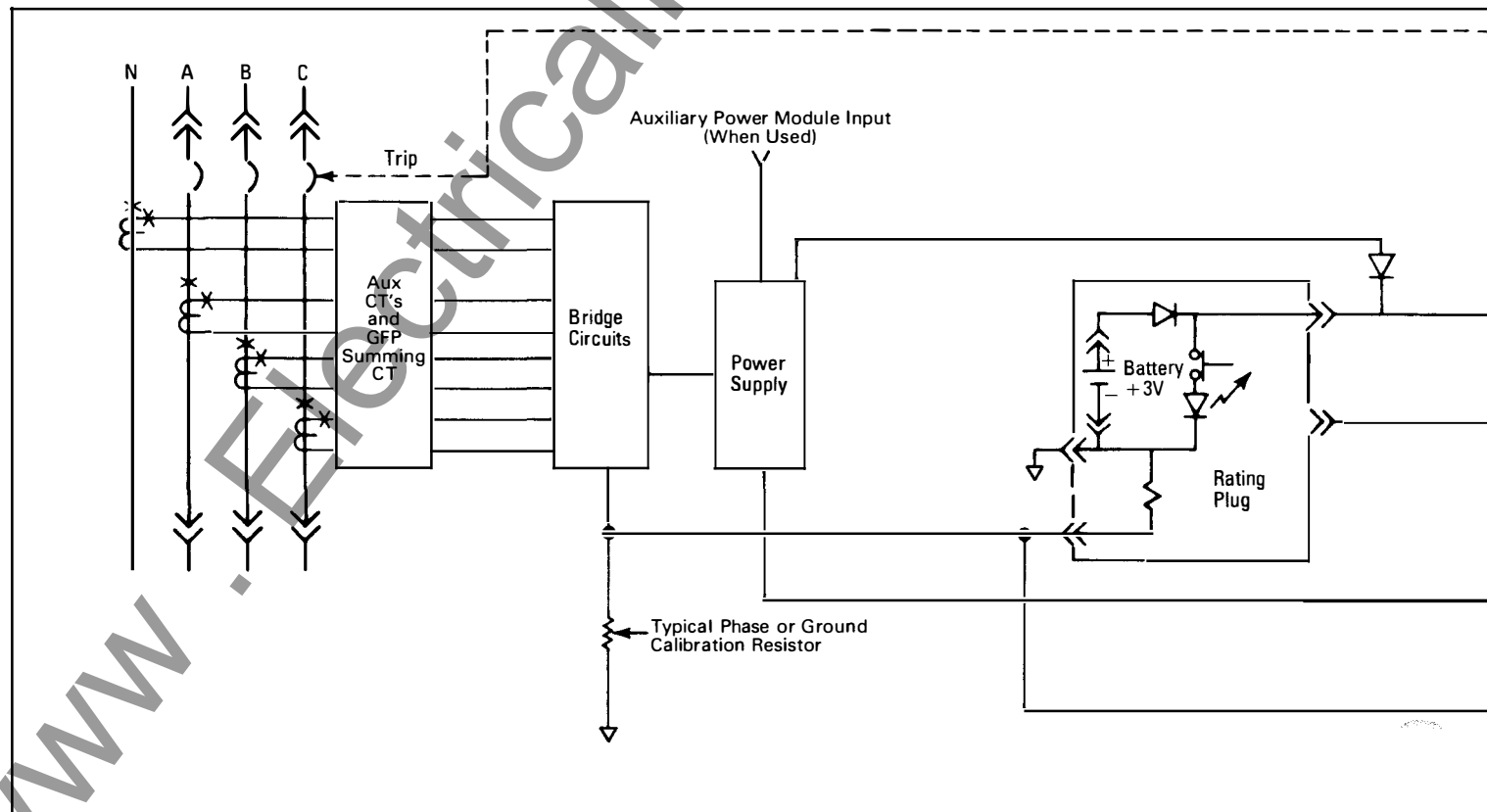


Fig. 3 Digitrip RMS 500 Block Diagram with Breaker Interface

3.3 Test Provisions

An integral test panel, including a test selector switch and test and reset pushbuttons, is provided to test the circuit breaker in either a TRIP or NO-TRIP test mode under qualified conditions. See Section 5.

For bench testing of the trip unit alone or of the trip unit while it is installed in the circuit breaker, an optional Auxiliary Power Module (Cat. No. PRTAAPM) as shown in Fig. 7 is available. This Auxiliary Power Module, which operates from a separate 120 Vac supply, may also be used when a drawout type circuit breaker is in any of its four cell positions, i.e., "Connected", "Test", "Disconnected" and "Withdrawn" (or "Removed.")

3.4 Making Current Release (Discriminator)

When the DIGITRIP RMS 500 Trip Unit is not equipped with an adjustable instantaneous protection setting, i.e., types LS or LSG, a making current release (or discriminator) circuit is provided. This circuit will prevent the circuit breaker from being closed and latched-in on a faulted circuit. The non-adjustable release is pre-set at eleven (11) times the installed rating plug ampere rating (I_n).

The making current release is armed only for the first ten (10) cycles following an initial circuit breaker closing operation with a load current exceeding approximately 20% of the circuit breaker frame or sensor rating. Should the load current through the circuit breaker drop to a value less than this, the release will re-arm. The release, once armed, will remain armed until the load current passing through the circuit breaker exceeds approximately 20% for 10 cycles. Any trip operation initiated by the making current release will trip the circuit breaker instantaneously.

3.5 Instantaneous Override

In addition, when the Digitrip RMS 500 Trip Unit is not equipped with an adjustable instantaneous setting, i.e., types LS or LSG, a high-set non-adjustable instantaneous override trip circuit is provided. This high level tripping action is pre-set to a specific value that reflects the short time withstand rating of the circuit breaker in which the trip unit is installed. Specific values vary between circuit breaker types and ratings. For specific information, refer to the supplementary leaflets and/or time-current curves referenced in Sections 9.1 and 9.2.

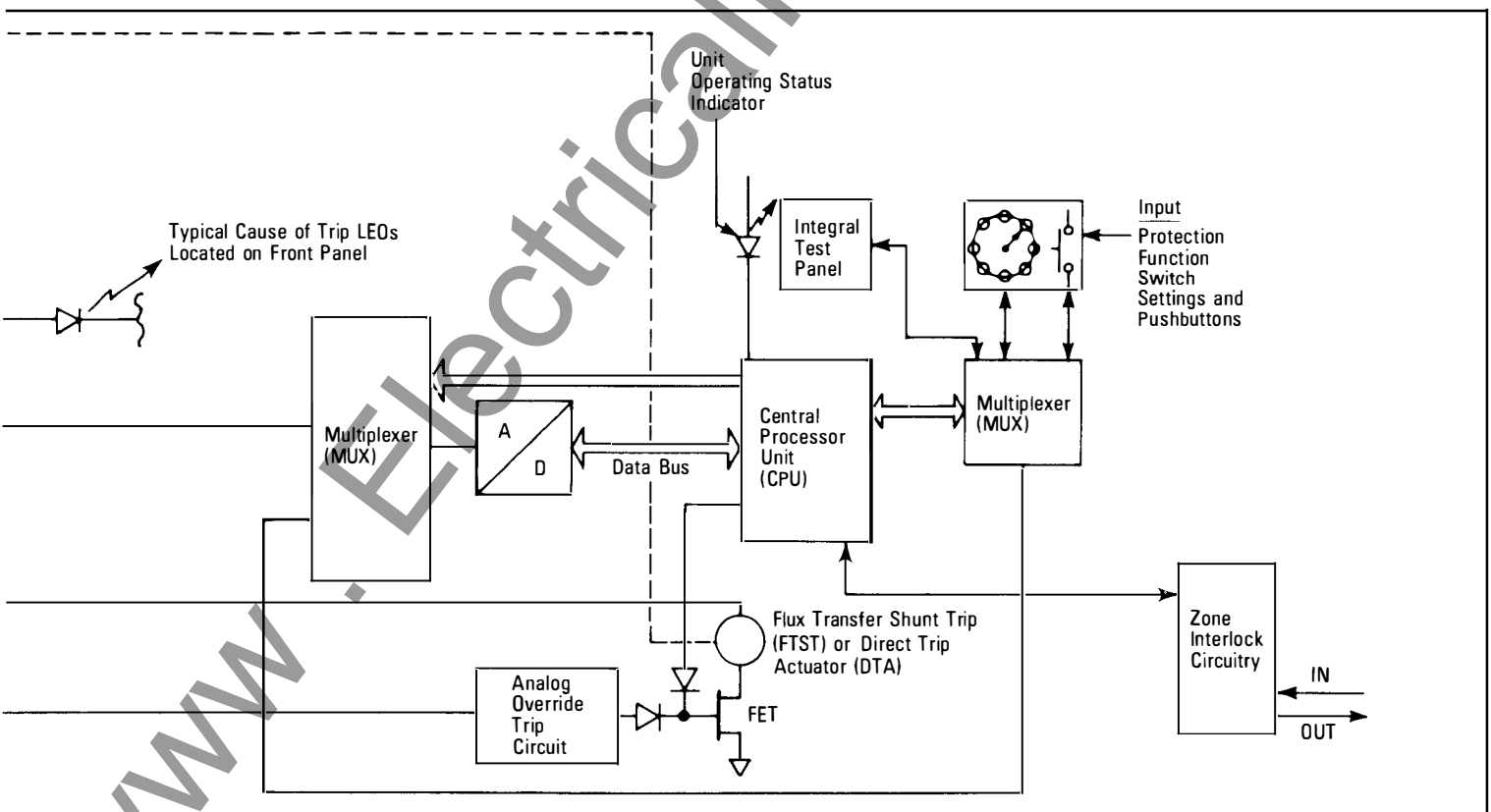
3.6 Zone Interlocking

As indicated in the block diagram in Fig. 3, zone interlock signals are provided. For Digitrip RMS 500 Trip Units equipped with either ground fault or short time protection functions or both, separate zone interlocking circuits are provided. When utilized, these input/output signals must be connected in the ultimate equipment assembly in line with details provided with the specific circuit breaker connection diagrams supplied with the circuit breaker and referenced in Sections 9.1 and 9.2. Similarly, if the zone interlocking function is chosen not to be used, defeater connections on each circuit must be added as illustrated in the same referenced diagrams.

4.0 Protection Settings

4.1 General

Prior to placing any circuit breaker in operation, all available protection settings should be set using values as recommended by the specifying engineer responsible for the installation. The number of settings that must be made will be a



factor of the protection model supplied as illustrated in Figs. 2.1 through 2.6. Each settings is made with an eight position rotary switch using a small screwdriver. The selected setting for each adjustment will appear in the small rectangular opening as illustrated in Fig. 1.

The installed rating plug establishes the maximum continuous current rating of the circuit breaker. All current pick-up settings in the protection module are defined in per unit multiples of the ampere rating (I_N) of the installed rating plug.

To illustrate the portion of the protection curve being adjusted, simulated Time-Current curves are pictured on the face of the trip unit. The particular setting to be adjusted is located in close proximity to its portion of the simulated Time-Current curve. Should an automatic trip occur as a result of a fault current exceeding the pre-selected value in this portion of the Time-Current curve, the red LED shown in this segment of the simulated Time-Current curve will turn "ON".

The available settings, along with the illustrated effect of changing the settings, are given in Figs. 4.1 through 4.7.

4.2 Long Delay Settings

Eight (8) available settings, as illustrated in Fig. 4.1, range from 0.5 to 1.0 (I_N). Each setting is expressed as a multiple of the maximum ampere rating (I_N) of the installed rating plug.

4.3 Long Delay Time Settings

Eight (8) available settings, as illustrated in Fig. 4.2, range from 2 to 24 seconds. These settings represent total clearing times at a current value equal to six (6) times the installed rating plug ampere rating (I_N).

4.4 Short Delay Pick-Up Settings

As illustrated in Fig. 4.3, eight (8) available settings range from 2 to 6 (I_N) with two variable settings of S1 and S2. These variable settings depend upon the type of circuit breaker in which the trip unit is installed. Specific information on these settings is given in the supplemental instruction leaflet referenced in Sections 9.1 and 9.2 that is supplied with the circuit breaker. Specific information is also shown on the rating plug and on the applicable time-current curve.

4.5 Short Delay Time Settings

As illustrated in Fig. 4.4, two different curve configurations are possible, i.e., flat or I^2t response. The configuration selected will be a factor of the type of selective coordination being developed. The I^2t response will provide a longer time delay in the low-end of the short delay pick-up range than will the flat response setting.

Five flat (0.1, 0.2, 0.3, 0.4, 0.5 sec.) and three I^2t (0.1, 0.3, 0.5 sec.) response time delay settings are provided. The I^2t response settings are identified by the suffix asterisk (*) that appears in the setting viewing window. The I^2t response is applicable only up to eight (8) times the ampere rating of the installed rating plug (I_N). After this value is exceeded, the I^2t response configuration reverts to a flat response.

4.6 Instantaneous Pick-up Settings

As illustrated in Fig. 4.5, eight (8) available settings range from 2 to 6 (I_N) with two variable settings M1 and M2. These variable settings depend upon the type of circuit breaker in which the trip unit is installed. Specific information on these settings is given in the supplemental instruction leaflet referenced in Sections 9.1 and 9.2 that is supplied with the circuit breaker. Spe-

cific information is also shown on the rating plug and on the applicable Time-Current curve.

4.7 Ground Fault Current Pick-up Settings

As illustrated in Fig. 4.6, eight (8) available settings are given in alphabetical notations from A to K. (There is no "G" notation). Specific setting values are a function of the installed rating plug. In general, the pick-up settings range from 0.25 to 1.0 times the ampere rating (I_N) of the installed rating plug up to a maximum pick-up value of 1200 A. However, in the lower ampere rating plug values, an error factor can occur in the Digitrip RMS 500 Trip Unit since it is completely self-powered using only the input from the installed current sensors. Refer to Table 1, Note 2 for additional information.

Specific current pick-up values are tabulated in Table 1 and on the ground fault Time-Current curve of the applicable circuit breaker. Under primary injection test conditions, when the external auxiliary power module shown in Fig. 7 is used, the tabulated values should be in effect. The tabulated values shown in Table 1 are based on the use of a residual current sensing scheme with the same rated current sensor in all phase and neutral conductors. Refer to the applicable supplemental circuit breaker instruction leaflet for values applicable to alternate sensing schemes.

4.8 Ground Fault Time Delay Settings

As illustrated in Fig. 4.7, two different curve configurations are possible, i.e., flat or I^2t response. The configuration selected will be a factor of the type of selective coordination being developed. The I^2t response will provide a longer time delay in the low-end of the ground fault pick-up range than will the flat response setting.

Table 1 – Ground Fault Current Pickup Settings

		PICKUP SETTINGS GROUND FAULT CURRENTS (AMPERES) ^①							
		A ^②	B ^②	C ^②	D ^②	E ^②	F	H	K
INSTALLED RATING PLUG (AMPERES) I_N ^③	100	25	30	35	40	50	60	75	100
	200	50	60	70	80	100	120	150	200
	250	63	75	88	100	125	150	188	250
	300	75	90	105	120	150	180	225	300
	400	100	120	140	160	200	240	300	400
	600	150	180	210	240	300	360	450	600
	800	200	240	280	320	400	480	600	800
	1000	250	300	350	400	500	600	750	1000
	1200	300	360	420	480	600	720	900	1200
	1600	400	480	560	640	800	960	1200	1200
	2000	500	600	700	800	1000	1200	1200	1200
	2400	600	720	840	960	1200	1200	1200	1200
	2500	625	750	875	1000	1200	1200	1200	1200
	3000	750	900	1050	1200	1200	1200	1200	1200
	3200	800	960	1120	1200	1200	1200	1200	1200
	4000	1000	1200	1200	1200	1200	1200	1200	1200
	5000	1200	1200	1200	1200	1200	1200	1200	1200

① Tolerances on pickup levels are $\pm 10\%$ of values shown in chart.

② Ground fault pickup levels shown are nominal values when tested with external control power present. Without external control power such as is the case with the Digitrip RMS 500, ground pickup levels may exceed these values up to the E setting of that particular rating plug.

③ Refer to Type DS, Type SPB or Series C R-Frame supplemental instruction leaflets given in Section 9 for list of available rating plugs with each type circuit breaker.

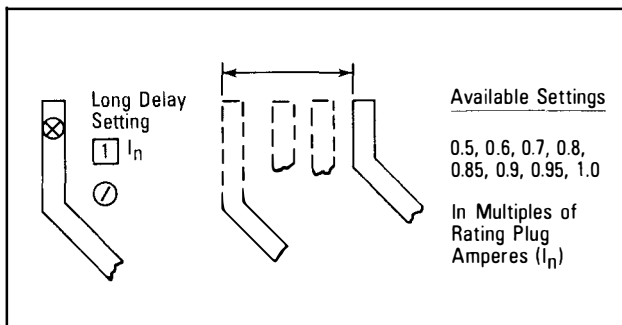


Fig. 4.1 Long Delay Ampere Pickup Settings

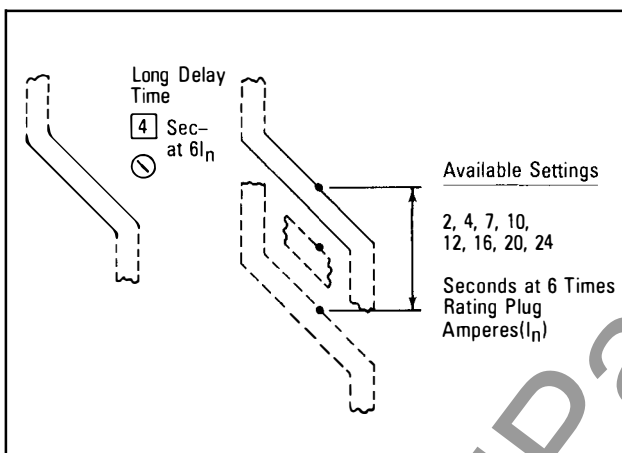


Fig. 4.2 Long Delay Time Settings

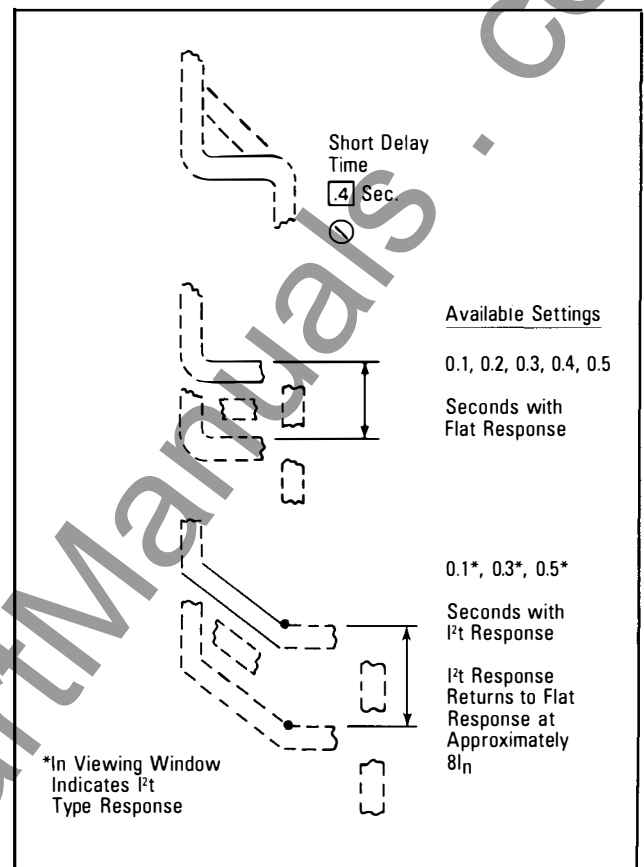


Fig. 4.4 Short Delay Time Settings

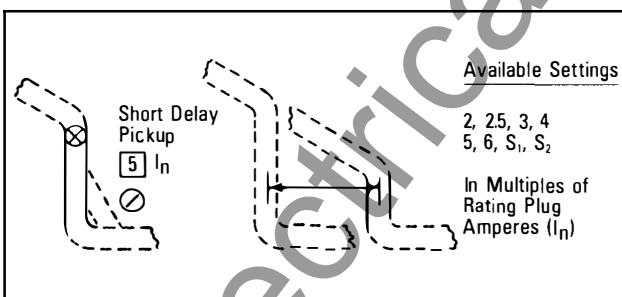


Fig. 4.3 Short Delay Current Pickup Settings

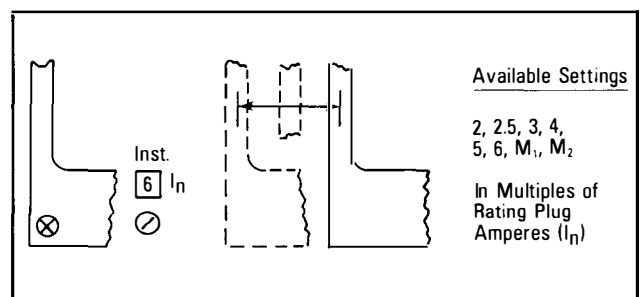


Fig. 4.5 Instantaneous Current Pickup Settings

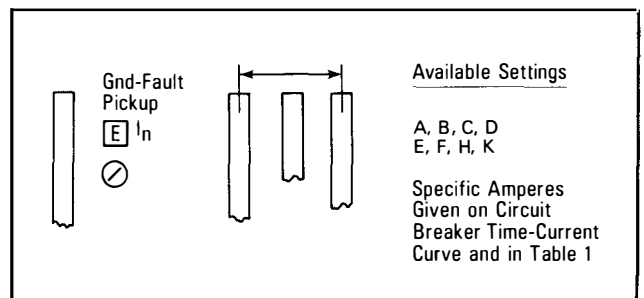


Fig. 4.6 Ground Fault Current Pickup Settings

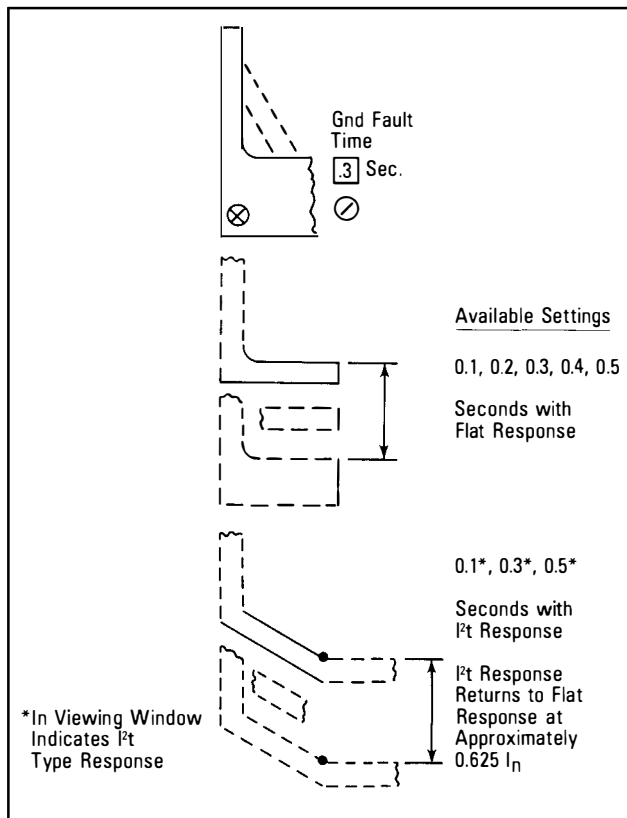


Fig. 4.7 Ground Fault Time Delay Settings

Five flat (0.1, 0.2, 0.3, 0.4, 0.5 sec.) and three I²t (0.1, 0.3, 0.5 sec.) response time delay settings are provided. The I²t response settings are identified by the suffix asterisk (*) that appears in the setting viewing window. The I²t response is applicable only up to 0.625 times the ampere rating of the installed rating plug (I_n). Beyond this value, the I²t response configuration reverts to a flat response.

5.0 Integral Test Panel — Test Procedure

5.1 General

As illustrated in Figs. 1 and 5, an integral test panel is provided to test the Digitrip RMS 500 Trip Unit.

Adequate no-trip settings are provided to insure that the trip unit is operational without tripping the circuit breaker.

CAUTION

THE TRIPPING OF A CIRCUIT BREAKER UNDER "TEST CONDITIONS" WHILE IT IS IN SERVICE AND CARRYING LOAD CURRENT, WHETHER DONE BY INTEGRAL OR EXTERNAL TEST MEANS, IS NOT RECOMMENDED.

ANY SUCH TRIPPING OPERATION WILL CAUSE DISRUPTION OF SERVICE AND POSSIBLE PERSONAL INJURY RESULTING FROM UNNECESSARY SWITCHING OF CONNECTED EQUIPMENT.

TESTING OF A CIRCUIT BREAKER THAT RESULTS IN THE TRIPPING OF THE CIRCUIT BREAKER SHOULD BE DONE ONLY WITH THE CIRCUIT BREAKER IN THE "TEST" OR "DISCONNECTED" CELL POSITIONS OR WHILE THE CIRCUIT BREAKER IS ON A TEST BENCH.

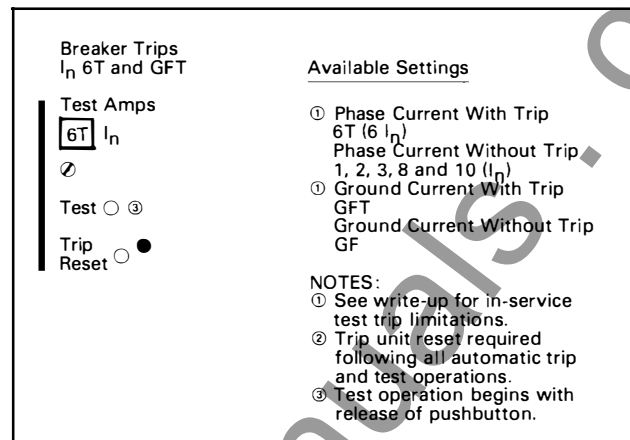


Fig. 5 Integral Test Panel

To preserve the primary protection function of the trip unit, all in-service testing under "Trip" or "No-Trip" conditions must be done at load current values no greater than 40% of the plug rating (I_n). Any attempt to conduct in-service testing above this value will be ***automatically aborted** by the trip unit.

Since the Digitrip RMS 500 Trip Unit is completely self-powered using energy derived from the current sensors installed in the circuit breaker, all in-service tests conducted should be conducted with the auxiliary control power module, shown in Fig. 7, plugged into the trip unit. This action will avoid operational difficulties caused by load current levels that are too low to operate the trip unit.

5.2 When To Test

Tests can be conducted with the breaker in the "connected" cell position while carrying load current. However, as stated in the caution note in Section 5.1, good practice will limit circuit breaker in-service "trip tests", where required, to maintenance periods during times of minimum load conditions. Testing, prior to start-up can best be accomplished with the breaker out of its cell or in the "Test", "Disconnected" or "Withdrawn" (or Removed) cell positions.

Note: Since time-current settings are based on desired system coordination and protection schemes, the protection settings selected and preset under Section 4.0 above should not be altered during or as a part of any routine test sequence.

5.3 Test Provision

As indicated in Fig. 5, six different test settings (1, 2, 3, 6T, 8 and 10X I_n) are available for testing the phase elements of the trip unit and two (GF, GFT) are provided for testing the ground elements. One setting under each test mode (6T and GFT) will initiate a tripping action of the circuit breaker.

With appropriate pre-set selections of the phase protection settings, an ample range of settings under the "No Trip" condition are available to test the long time, short time and instantaneous trip settings without tripping the circuit breaker.

In the "GF" test position, the amount of test current is adequate to prove the operating condition of the trip unit without tripping the circuit breaker. This is not to be construed as a calibration

*No abort signal will occur for tests conducted unless the current breaker is carrying load current.

test. The value of the simulated test current is 1.0 per unit of the rating plug value.

5.4 Mode of Conducting Tests

5.4.1 Control Power

Install the Auxiliary Power Module (Cat. No. PRTAAPM) to insure control power is available for testing.

5.4.2 By Not Tripping the Breaker

1. Should the circuit breaker be in the cell "Connected" position and carrying load current, make sure that the circuit breaker is carrying no more than 40% of the plug ampere rating (I_N).
2. Place the test selector switch in one of the six "No Trip" test settings, i.e., 1, 2, 3, 8, 10, or GF.
3. Depress the "Test" pushbutton and release it – the test is initiated when the pushbutton is released.
4. Should any of the various protection settings be less than the selected "No Trip" test value, then the LED related to that function will turn on signifying successful completion of the test action. Note: For long delay tests there will be some period of time between start of test and LED turn "ON".
5. Reset the trip unit by depressing and releasing the "Trip Reset" pushbutton. All LEDs turned "ON" by the "No Trip" test action should turn "OFF".

Should an actual overload or fault condition occur during an in-service, "No Trip Test" sequence, the protection function will override the test function, and the circuit breaker will trip automatically as pre-programmed with the various Time-Current settings.

Note: The "Trip Reset" pushbutton may be depressed at any time. However, should a test initiated via the integral test panel be in progress, it would be aborted.

A test initiated via the integral test panel may be aborted at any time by depressing the "Trip Reset" pushbutton.

5.4.3 By Tripping the Breaker

1. Make sure that the circuit breaker is carrying no more than 40% of the plug ampere rating (I_N).
2. Place the test selector switch in one of the two "Trip" test settings, i.e., 6T or GFT.
3. Depress the "Test" pushbutton and release it – the test is initiated when the pushbutton is released.
4. Should any of the various protection settings be less than the selected "Trip" test value, the circuit breaker will trip and the LED related to that function will turn "ON" following the test action.
5. Reset the trip unit by depressing and releasing the "Trip Reset" pushbutton. All LEDs turned "ON" resulting from the "Trip" test action should turn "OFF".

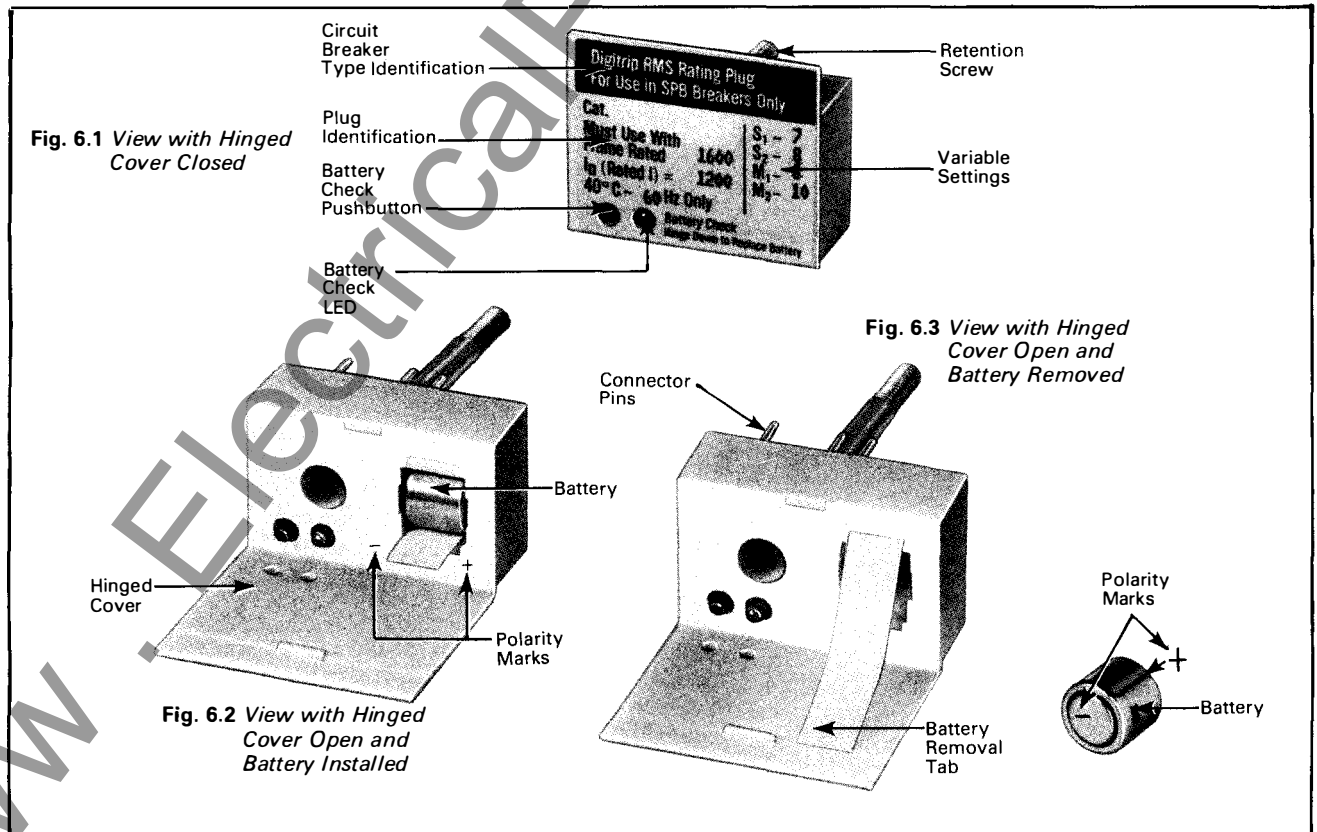


Fig. 6 Typical Rating Plug

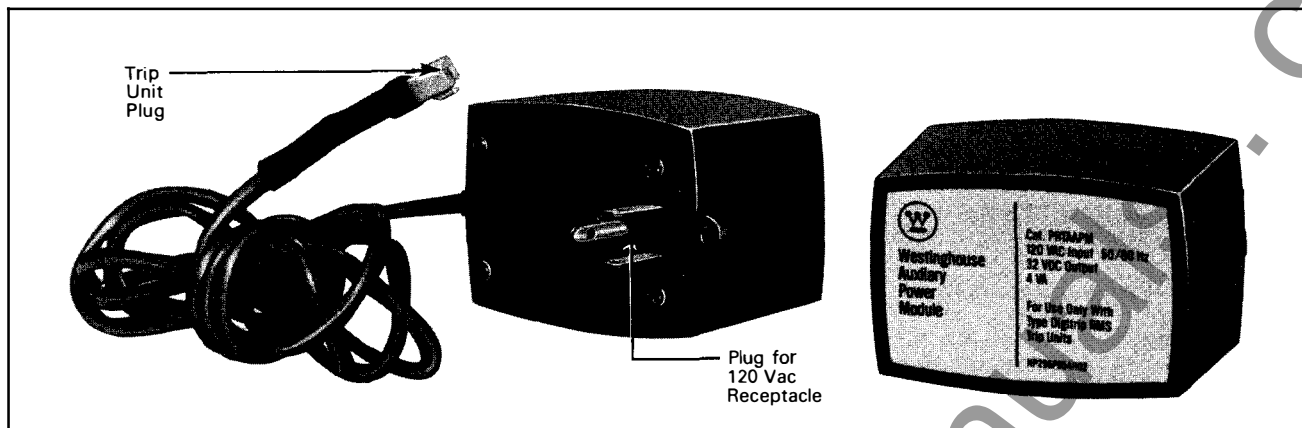


Fig. 7 Auxiliary Power Module

6. Reset and reclose the circuit breaker following established operating procedures.

6.0 Back-up Battery

6.1 General

As indicated in Figs. 3 and 6, a back-up battery is provided to maintain the mode of trip LED indication in the Digitrip RMS 500 Trip Unit. The back-up battery is located in the rating plug along with a battery check pushbutton and a green battery check LED.

6.2 Battery Check

The battery is a long life, lithium photo type unit. The ready status of the battery can be checked at any time by depressing the battery check pushbutton and observing the "On" condition of the battery check LED as shown in Fig. 6.1. If the battery check LED does not turn "ON", replace the battery.

6.3 Battery Replacement

Should the battery require replacement, it can be easily replaced from the front of the trip unit by lowering the hinged cover of the rating plug as shown in Fig. 6.2. The battery can then be removed by pulling the battery tab as shown in Fig. 6.3.

Note: The battery can be replaced at any time with the circuit breaker in service without affecting the operation of the circuit breaker and its protection function.

The replacement battery should be the same type or equivalent. Acceptable 3.0 volt lithium batteries may be obtained from the following companies under their type designation indicated:

Company	Model
Varta Batteries, Inc. 150 Clarbroom Road Elmsford, N.Y. 10523	CR 1/3N
Duracell South Broadway Tangtown, N.Y. 10591 (914) 591-7000	DL 1/3N
Union Carbide Corp. Battery Products Div. Eveready 39 Old Ridgebury Road Danbury, CT 06817-0001 (203) 794-7548	2L-76BP

CAUTION

CARE SHOULD BE EXERCISED WHEN REPLACING A BATTERY TO INSURE THAT THE CORRECT POLARITIES ARE OBSERVED. POLARITY MARKINGS ARE SHOWN ON THE RATING PLUG WHEN THE HINGED COVER IS OPEN AS INDICATED IN FIGS. 6.2 AND 6.3.

7.0 Auxiliary Power Module

The Auxiliary Power Module (Cat. No. PRTAAPM), illustrated in Fig. 7, is an encapsulated power supply that requires a 120 Vac input at either 50 or 60 Hz. It provides an output of 32 Vdc (nominal 40 Vdc open circuit) which can be used for testing a Digitrip RMS 500 Trip Unit.

When drawout construction is provided, any circuit breaker equipped with a Digitrip RMS 500 Trip Unit can be conveniently set and tested while the circuit breaker is out of its cell or in its cell in the "Disconnect" or "Withdrawn" positions using the Auxiliary Power Module.

The Auxiliary Power Module is equipped with a unique plug-in connector suitable only for plugging into the keyed receptacle of a Digitrip RMS Trip Unit. This prohibits the possible use of an incorrect, but similar, type power module. The location of the keyed receptacle for the auxiliary power module is shown in Fig. 1.

8.0 Rating Plug

The rating plugs, as illustrated in Figs. 1 and 6, are used to establish the continuous ampere rating of the related circuit breaker. All pick-up settings of the protection functions of the trip unit, i.e., long delay, short delay, instantaneous and ground fault are selected as a multiple of the rating plug rating (I_{R1}).

Different types and ratings are available to match the desired ampere rating and type of circuit breaker into which the trip unit is to be installed. Also, since the rating plugs are frequency sensitive, specific types are available for 50 or 60 Hz system applications.

Complete catalog descriptions of all available rating plugs are given in the applicable circuit breaker supplementary instruction leaflets. References to these documents are given in Sections 9.1 and 9.2.

9.0 References

9.1 Type DS Low Voltage AC Power Circuit Breakers

I.B. 33-790-IF	Instructions for Low-Voltage Power Circuit Breakers Types DS and DSL
I.B. 33-790-IF Supplement No. 1	Section 8A Supplement Circuit Breaker Automatic Tripping System When Using Digitrip RMS Trip Assembly
SC-4280-87	Typical Time-Current Characteristic Curve (LI) for Type DS Circuit Breakers
SC-4281-87	Typical Time-Current Characteristic Curve (LS) for Type DS Circuit Breakers
SC-4279-87	Typical Time-Current Characteristic Curve (G) for Type DS Circuit Breakers
508B508	Connection Diagram for Type DS Circuit Breakers

9.2 Type SPB Systems Pow-R Breakers

I.L. 29-801	Instruction for the Systems Pow-R Breaker and Drawout Mechanism
I.L. 29-855	Supplementary Instructions for the Systems Pow-R Breaker used with the Digitrip RMS Trip Assembly
SC-4283-87	Typical Time-Current Characteristic Curve (LI) for Type SPB Systems Pow-R Breaker
SC-4284-87	Typical Time-Current Characteristic Curve (LS) for Type SPB Systems Pow-R Breaker
SC-4282-87	Typical Time-Current Characteristic Curve (G) for Type SPB Systems Pow-R Breaker
I.S. 15545	SPB Master Connection Diagram using Digitrip RMS Trip Assemblies

9.3 Digitrip RMS Trip Assemblies

I.L. 29-851	Instructions for Digitrip RMS 500 Trip Unit
I.L. 29-852	Instructions for Digitrip RMS 600 Trip Unit
I.L. 29-853	Instructions for Digitrip RMS 700 Trip Unit
I.L. 29-854	Instructions for Digitrip RMS 800 Trip Unit

9.4 Series C R-Frame Molded Case Circuit Breakers

29-106	Frame Book
29-107	Frame Instruction Leaflet
29-707	Supplement Instructions for Series C R-Frame used with the Digitrip RMS Trip Assembly
SC-4582-89	Typical Time-Current Characteristic Curve (LI) for Type RD Circuit Breakers
SC-4583-89	Typical Time-Current Characteristic Curve (LS) for Type RD Circuit Breakers
SC-4584-89	Typical Time-Current Characteristic Curve (G) for Type RD Circuit Breakers
I.L. 29C709	Master Connection Diagram for Series C R-Frame Circuit Breaker with Digitrip RMS

Instructions for Digitrip RMS 500 Trip Unit



I.L. 29-851-A

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WARNING

DO NOT ATTEMPT TO INSTALL OR PERFORM MAINTENANCE ON EQUIPMENT WHILE IT IS ENERGIZED. DEATH OR SEVERE PERSONAL INJURY 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. THE WESTINGHOUSE ELECTRIC CORPORATION 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 Westinghouse 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 Westinghouse Electric Corporation for further information or instructions.

1.0 General Description

1.1 Protection

The Digitrip RMS 500 Trip Unit, illustrated in Fig. 1, is a micro-processor based type trip suitable for use in type SPB Systems Pow-R circuit breakers and types DS and DSL low voltage AC power circuit breakers and Series C® R-Frame molded case circuit breakers.

The trip unit 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 500 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.

The Digitrip RMS 500 Trip Unit is available in six optional protection models. Each trip unit may be equipped with a maximum of five phase and two ground (time-current) adjustments to meet specific application requirements. These protection models include the following types which are further illustrated in the nameplate examples shown in Fig. 2.

Figure	Type Protection	Identifier
2.1	Long Time/Instantaneous	(LI)
2.2	Long Time/Short Time	(LS)
2.3	Long Time/Short Time/Instantaneous	(LSI)
2.4	Long Time/Instantaneous/Ground	(LIG)
2.5	Long Time/Short Time/Ground	(LSG)
2.6	Long Time/Short Time/Instantaneous/Ground	(LSIG)

1.2 Information

Red LED indicators are provided on the face of the trip unit to indicate the mode of an automatic trip operation. A battery is provided to maintain the mode of trip LED indication following an automatic trip operation.

Green LEDs are provided to indicate the operational status of the trip unit and the status of the back-up battery mounted in the rating plug.

1.3 Testing

An integral test panel, including a test selector switch and test and reset pushbuttons, is provided to test the circuit breaker in either a "Trip" or "No-Trip" test mode under qualified conditions.

2.0 UL Listed Devices

Digitrip RMS 500 Trip Units are listed by the Underwriters Laboratories, Inc. for use in types SPB, DS and DSL and Series C R-Frame circuit breakers under UL File E7819.

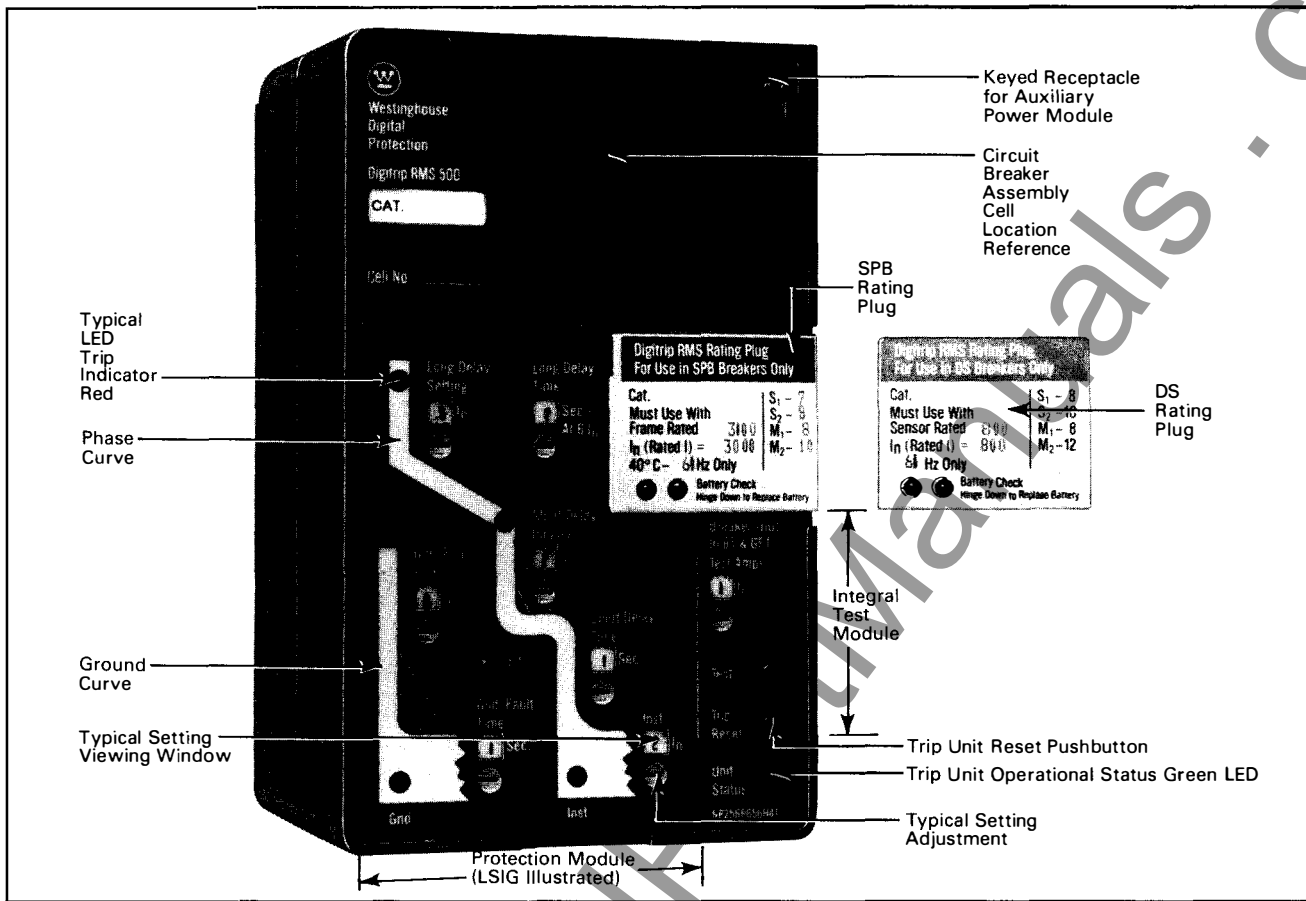


Fig. 1 Typical Digitrip RMS 500 Trip Unit with Rating Plug Installed

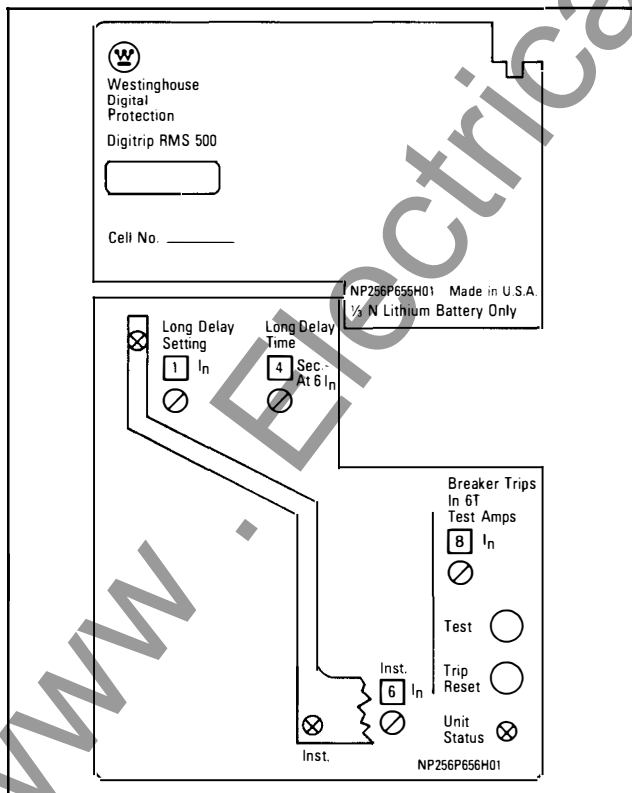


Fig. 2.1 Long Time/Instantaneous Protection (LI) Nameplate

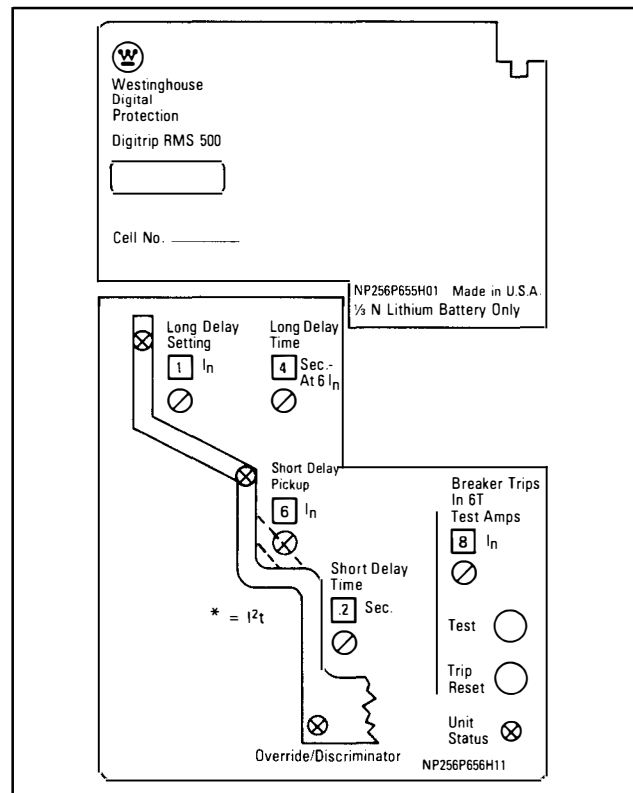


Fig. 2.2 Long Time/Short Time Protection (LS) Nameplate

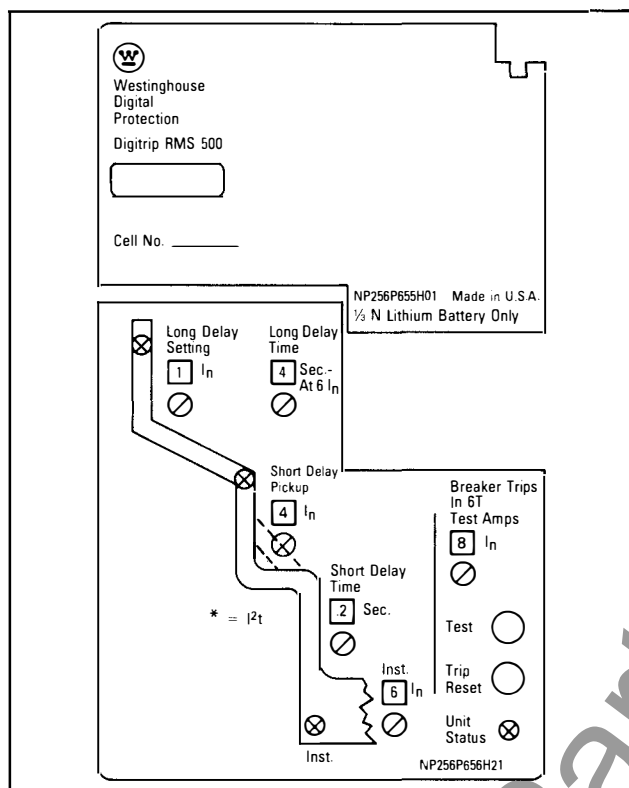


Fig. 2.3 Long Time/Short Time/Instantaneous Protection (LSI) Nameplate

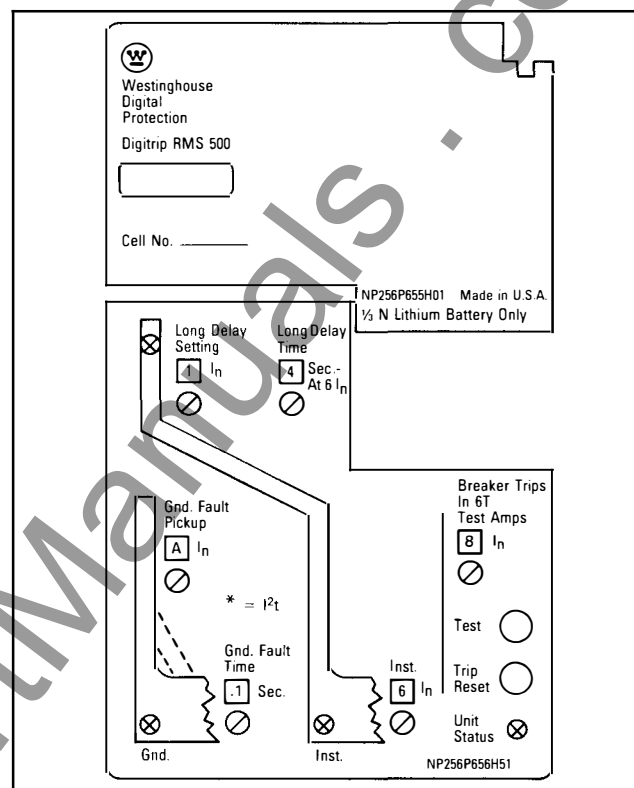


Fig. 2.4 Long Time/Instantaneous/Ground Protection (LIG) Nameplate

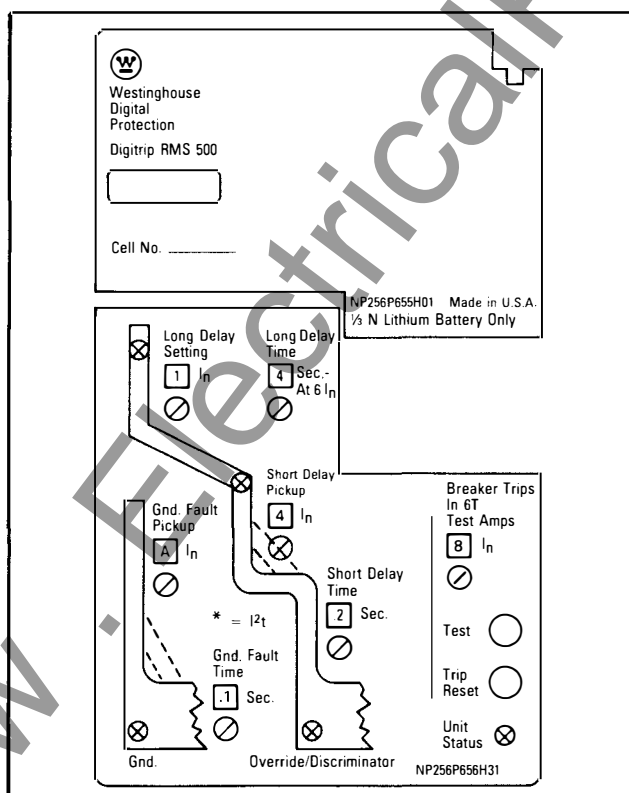


Fig. 2.5 Long Time/Short Time Protection (LSG) Nameplate

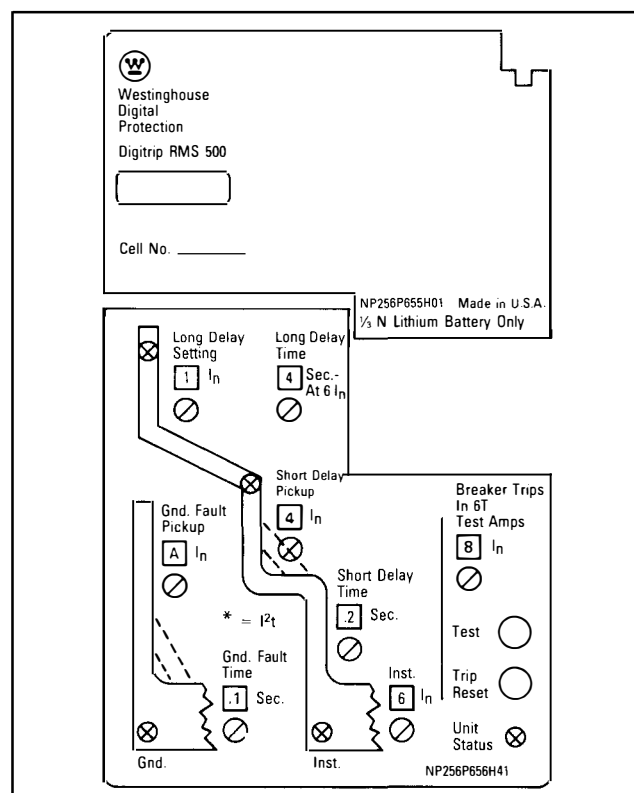


Fig. 2.6 Long Time/Short Time/Instantaneous/Ground Protection (LSIG) Nameplate

3.0 Principle of Operation

3.1 General

The Digitrip RMS 500 Trip Unit provides three basic functions: Protection, Information and Testing. A typical trip unit and rating plug are illustrated in Fig. 1. Individual product instruction leaflets referenced in Sections 9.1 and 9.2 illustrate typical Digitrip RMS Trip Units installed in specific breakers.

The trip unit uses the INTEL MCS-51 family of microcomputers to perform its numeric and logic functions. The principle of operation can best be described by referring to the block diagram shown in Fig. 3.

In the Digitrip RMS 500 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 current signals from these sensors provide the correct magnitude of current for protection functions as well as tripping power during normal circuit breaker operating periods. Using these current signals in the protection function, analog voltages are developed across various calibrating resistors including:

- 1) Phase current
- 2) Ground fault current (when supplied)
- 3) Rating plug

The resulting analog voltages are multiplexed into an analog-to-digital converter and the output data fed into the microcomputer chip along the data bus.

The microcomputer, in cyclic fashion, repeatedly scans the resultant voltage values across each calibrating resistor and

enters these values into its RAM or Read/Write Memory. This data, which is used to calculate true RMS current values, is repeatedly compared with the pre-set protection function pick-up settings and other operating data stored in the ROM or Read Only Memory. The microcomputer software program is then used, in decision tree fashion, to initiate protection functions including tripping actions through the low energy flux transfer trip coil in the circuit breaker.

3.2 Trip and Operation Indicators

Red colored LEDs, as shown in Figs. 1 and 2, indicate on the face of the trip unit the mode of trip of any automatic trip operation. As indicated in Fig. 2, each LED is strategically located in the related segment of the time-current curve depicted on the face of the trip unit. The mode of trip is identified by the segment of the time-current curve in which the LED is turned "On". Following an automatic trip operation, a back-up battery, as indicated in Figs. 3 and 6, is provided to supply power to the LEDs. A green colored battery check LED and a test pushbutton as shown in Figs. 1 and 6, are provided to check the status of the battery.

A trip reset pushbutton, as shown in Fig. 1, is provided to turn "Off" the LEDs following a trip operation.

A green colored LED, as shown in Fig. 1, indicates the operational status of the trip unit. Once the load current through the circuit breaker exceeds approximately 20% of the frame or sensor rating, the green LED will flash "On" and "Off" once each second. A flashing green LED is an indication of a properly operating trip unit.

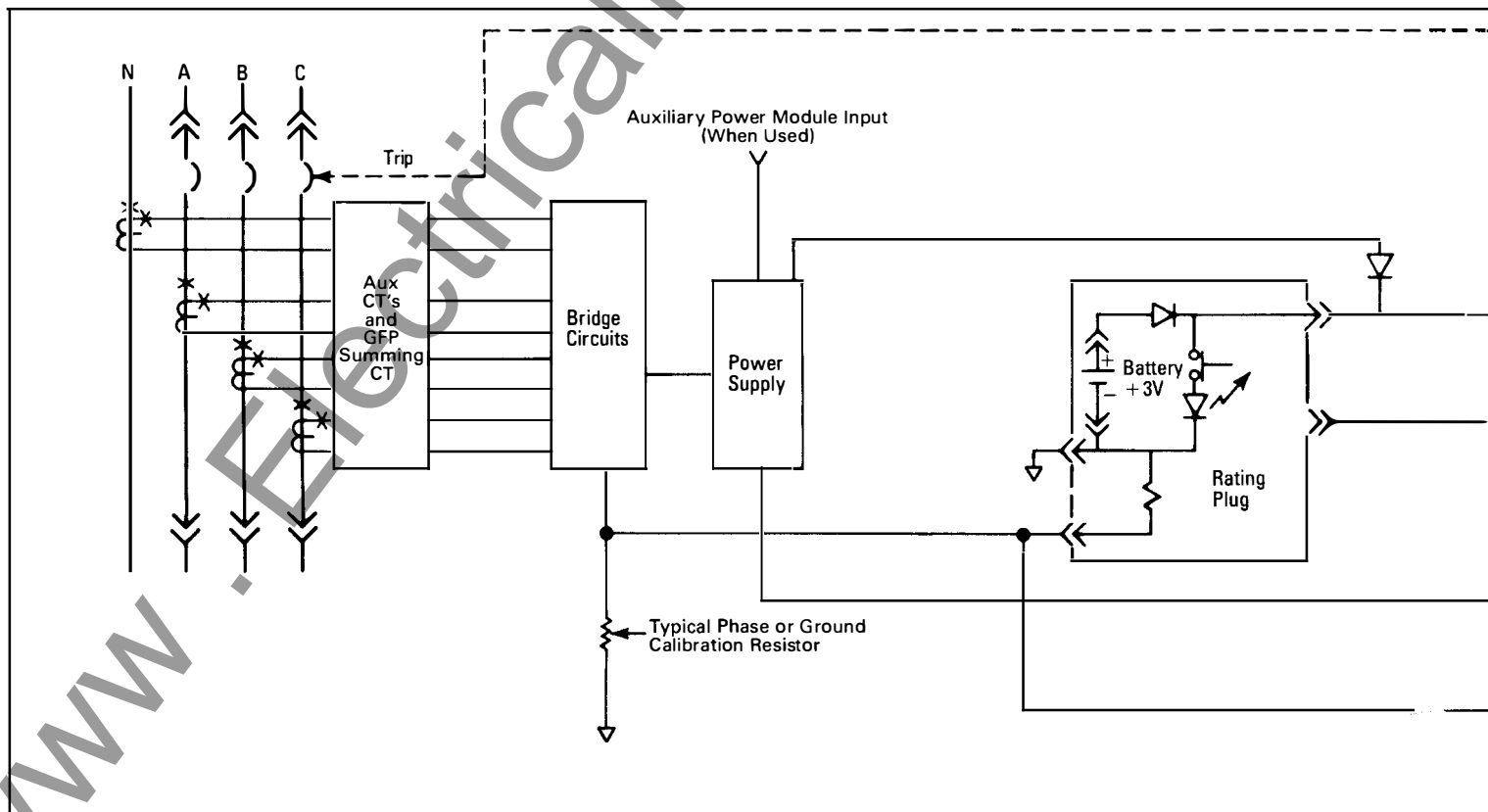


Fig. 3 Digitrip RMS 500 Block Diagram with Breaker Interface

3.3 Test Provisions

An integral test panel, including a test selector switch and test and reset pushbuttons, is provided to test the circuit breaker in either a TRIP or NO-TRIP test mode under qualified conditions. See Section 5.

For bench testing of the trip unit alone or of the trip unit while it is installed in the circuit breaker, an optional Auxiliary Power Module (Cat. No. PRTAAPM) as shown in Fig. 7 is available. This Auxiliary Power Module, which operates from a separate 120 Vac supply, may also be used when a drawout type circuit breaker is in any of its four cell positions, i.e., "Connected", "Test", "Disconnected" and "Withdrawn" (or "Removed.")

3.4 Making Current Release (Discriminator)

When the DIGITRIP RMS 500 Trip Unit is not equipped with an adjustable instantaneous protection setting, i.e., types LS or LSG, a making current release (or discriminator) circuit is provided. This circuit will prevent the circuit breaker from being closed and latched-in on a faulted circuit. The non-adjustable release is pre-set at eleven (11) times the installed rating plug ampere rating (I_N).

The making current release is armed only for the first ten (10) cycles following an initial circuit breaker closing operation with a load current exceeding approximately 20% of the circuit breaker frame or sensor rating. Should the load current through the circuit breaker drop to a value less than this, the release will re-arm. The release, once armed, will remain armed until the load current passing through the circuit breaker exceeds approximately 20% for 10 cycles. Any trip operation initiated by the making current release will trip the circuit breaker instantaneously.

3.5 Instantaneous Override

In addition, when the Digitrip RMS 500 Trip Unit is not equipped with an adjustable instantaneous setting, i.e., types LS or LSG, a high-set non-adjustable instantaneous override trip circuit is provided. This high level tripping action is pre-set to a specific value that reflects the short time withstand rating of the circuit breaker in which the trip unit is installed. Specific values vary between circuit breaker types and ratings. For specific information, refer to the supplementary leaflets and/or time-current curves referenced in Sections 9.1 and 9.2.

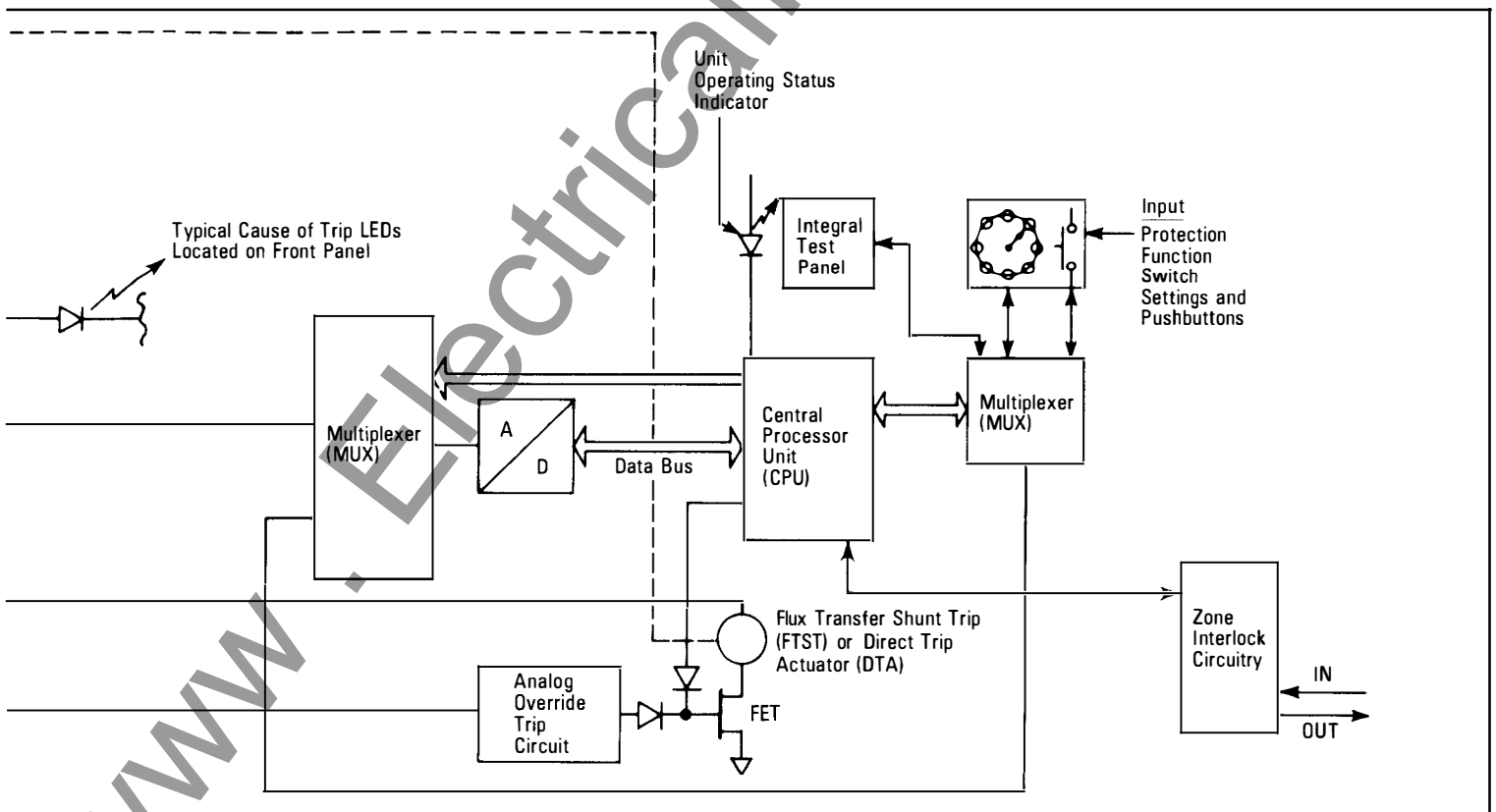
3.6 Zone Interlocking

As indicated in the block diagram in Fig. 3, zone interlock signals are provided. For Digitrip RMS 500 Trip Units equipped with either ground fault or short time protection functions or both, separate zone interlocking circuits are provided. When utilized, these input/output signals must be connected in the ultimate equipment assembly in line with details provided with the specific circuit breaker connection diagrams supplied with the circuit breaker and referenced in Sections 9.1 and 9.2. Similarly, if the zone interlocking function is chosen not to be used, defeater connections on each circuit must be added as illustrated in the same referenced diagrams.

4.0 Protection Settings

4.1 General

Prior to placing any circuit breaker in operation, all available protection settings should be set using values as recommended by the specifying engineer responsible for the installation. The number of settings that must be made will be a



factor of the protection model supplied as illustrated in Figs. 2.1 through 2.6. Each settings is made with an eight position rotary switch using a small screwdriver. The selected setting for each adjustment will appear in the small rectangular opening as illustrated in Fig. 1.

The installed rating plug establishes the maximum continuous current rating of the circuit breaker. All current pick-up settings in the protection module are defined in per unit multiples of the ampere rating (I_N) of the installed rating plug.

To illustrate the portion of the protection curve being adjusted, simulated Time-Current curves are pictured on the face of the trip unit. The particular setting to be adjusted is located in close proximity to its portion of the simulated Time-Current curve. Should an automatic trip occur as a result of a fault current exceeding the pre-selected value in this portion of the Time-Current curve, the red LED shown in this segment of the simulated Time-Current curve will turn "ON".

The available settings, along with the illustrated effect of changing the settings, are given in Figs. 4.1 through 4.7.

4.2 Long Delay Settings

Eight (8) available settings, as illustrated in Fig. 4.1, range from 0.5 to 1.0 (I_N). Each setting is expressed as a multiple of the maximum ampere rating (I_N) of the installed rating plug.

4.3 Long Delay Time Settings

Eight (8) available settings, as illustrated in Fig. 4.2, range from 2 to 24 seconds. These settings represent total clearing times at a current value equal to six (6) times the installed rating plug ampere rating (I_N).

4.4 Short Delay Pick-Up Settings

As illustrated in Fig. 4.3, eight (8) available settings range from 2 to 6 (I_N) with two variable settings of S1 and S2. These variable settings depend upon the type of circuit breaker in which the trip unit is installed. Specific information on these settings is given in the supplemental instruction leaflet referenced in Sections 9.1 and 9.2 that is supplied with the circuit breaker. Specific information is also shown on the rating plug and on the applicable time-current curve.

4.5 Short Delay Time Settings

As illustrated in Fig. 4.4, two different curve configurations are possible, i.e., flat or I^2t response. The configuration selected will be a factor of the type of selective coordination being developed. The I^2t response will provide a longer time delay in the low-end of the short delay pick-up range than will the flat response setting.

Five flat (0.1, 0.2, 0.3, 0.4, 0.5 sec.) and three I^2t (0.1, 0.3, 0.5 sec.) response time delay settings are provided. The I^2t response settings are identified by the suffix asterisk (*) that appears in the setting viewing window. The I^2t response is applicable only up to eight (8) times the ampere rating of the installed rating plug (I_N). After this value is exceeded, the I^2t response configuration reverts to a flat response.

4.6 Instantaneous Pick-up Settings

As illustrated in Fig. 4.5, eight (8) available settings range from 2 to 6 (I_N) with two variable settings M1 and M2. These variable settings depend upon the type of circuit breaker in which the trip unit is installed. Specific information on these settings is given in the supplemental instruction leaflet referenced in Sections 9.1 and 9.2 that is supplied with the circuit breaker. Spe-

cific information is also shown on the rating plug and on the applicable Time-Current curve.

4.7 Ground Fault Current Pick-up Settings

As illustrated in Fig. 4.6, eight (8) available settings are given in alphabetical notations from A to K. (There is no "G" notation). Specific setting values are a function of the installed rating plug. In general, the pick-up settings range from 0.25 to 1.0 times the ampere rating (I_N) of the installed rating plug up to a maximum pick-up value of 1200 A. However, in the lower ampere rating plug values, an error factor can occur in the Digitrip RMS 500 Trip Unit since it is completely self-powered using only the input from the installed current sensors. Refer to Table 1, Note 2 for additional information.

Specific current pick-up values are tabulated in Table 1 and on the ground fault Time-Current curve of the applicable circuit breaker. Under primary injection test conditions, when the external auxiliary power module shown in Fig. 7 is used, the tabulated values should be in effect. The tabulated values shown in Table 1 are based on the use of a residual current sensing scheme with the same rated current sensor in all phase and neutral conductors. Refer to the applicable supplemental circuit breaker instruction leaflet for values applicable to alternate sensing schemes.

4.8 Ground Fault Time Delay Settings

As illustrated in Fig. 4.7, two different curve configurations are possible, i.e., flat or I^2t response. The configuration selected will be a factor of the type of selective coordination being developed. The I^2t response will provide a longer time delay in the low-end of the ground fault pick-up range than will the flat response setting.

Table 1 – Ground Fault Current Pickup Settings

		PICKUP SETTINGS GROUND FAULT CURRENTS (AMPERES) ①							
INSTALLED RATING PLUG (AMPERES) I_N		A ②	B ②	C ②	D ②	E ②	F	H	K
	100	25	30	35	40	50	60	75	100
	200	50	60	70	80	100	120	150	200
	250	63	75	88	100	125	150	188	250
	300	75	90	105	120	150	180	225	300
	400	100	120	140	160	200	240	300	400
	600	150	180	210	240	300	360	450	600
	800	200	240	280	320	400	480	600	800
	1000	250	300	350	400	500	600	750	1000
	1200	300	360	420	480	600	720	900	1200
	1600	400	480	560	640	800	960	1200	1200
	2000	500	600	700	800	1000	1200	1200	1200
	2400	600	720	840	960	1200	1200	1200	1200

① Tolerances on pickup levels are $\pm 10\%$ of values shown in chart.

② Ground fault pickup levels shown are nominal values when tested with external control power present. Without external control power such as is the case with the Digitrip RMS 500, ground pickup levels may exceed these values up to the E setting of that particular rating plug.

③ Refer to Type DS, Type SPB or Series C R-Frame supplemental instruction leaflets given in Section 9 for list of available rating plugs with each type circuit breaker.

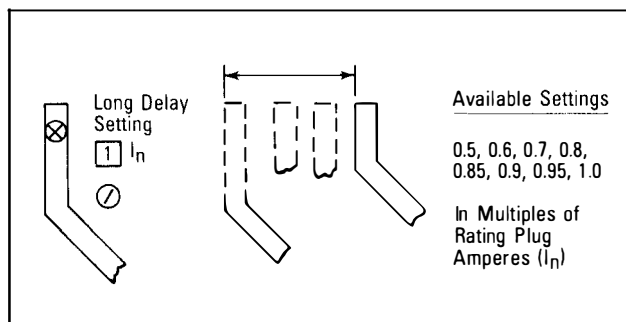


Fig. 4.1 Long Delay Ampere Pickup Settings

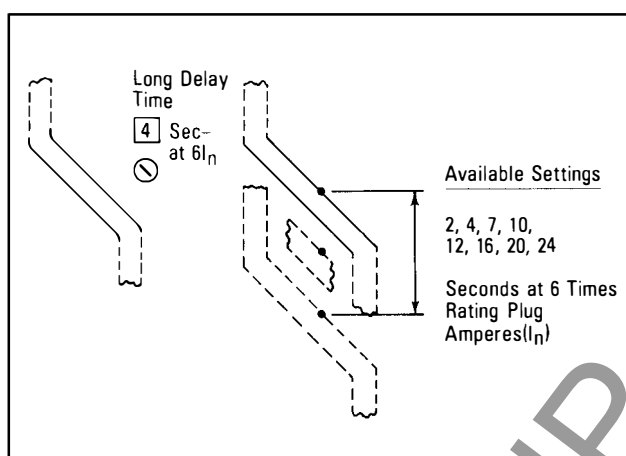


Fig. 4.2 Long Delay Time Settings

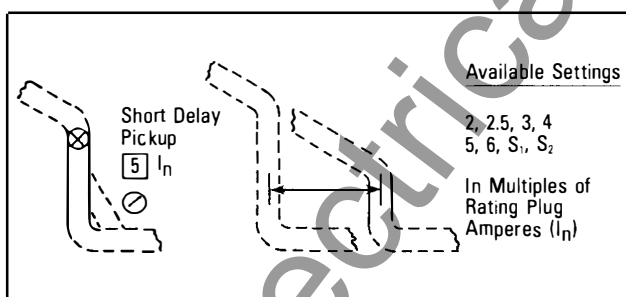


Fig. 4.3 Short Delay Current Pickup Settings

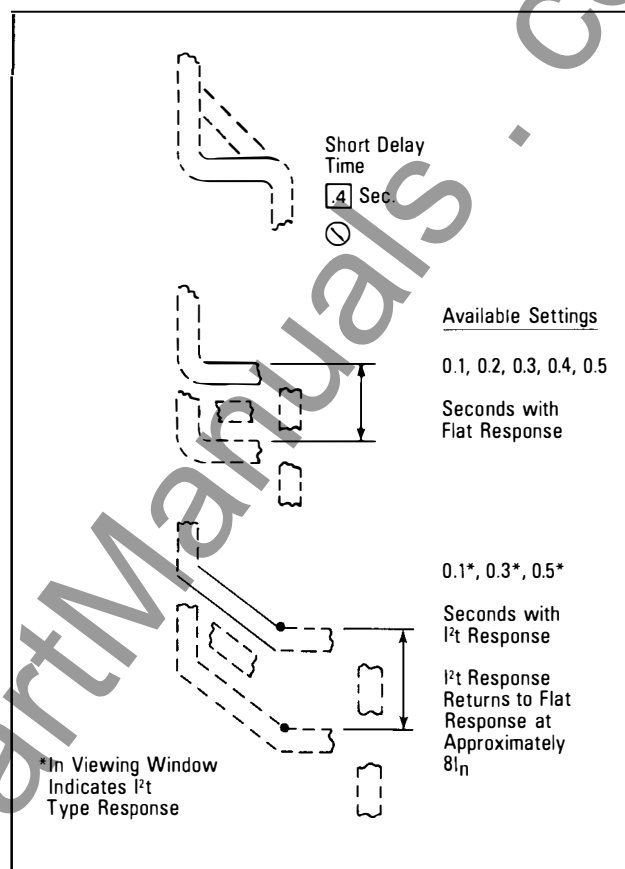


Fig. 4.4 Short Delay Time Settings

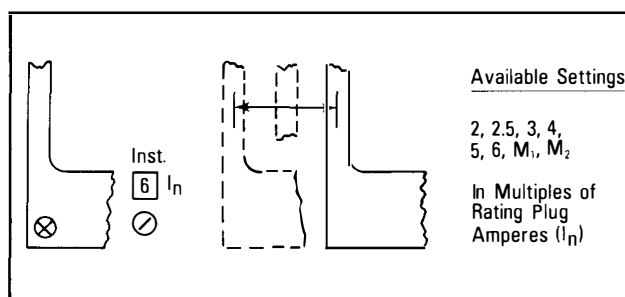


Fig. 4.5 Instantaneous Current Pickup Settings

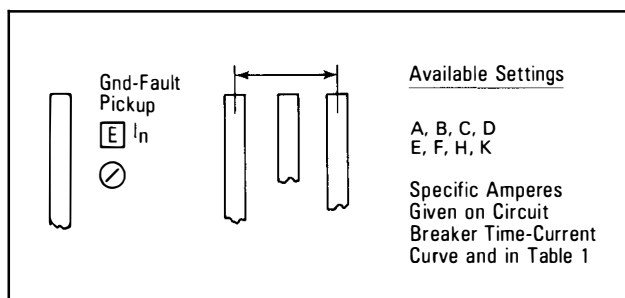


Fig. 4.6 Ground Fault Current Pickup Settings

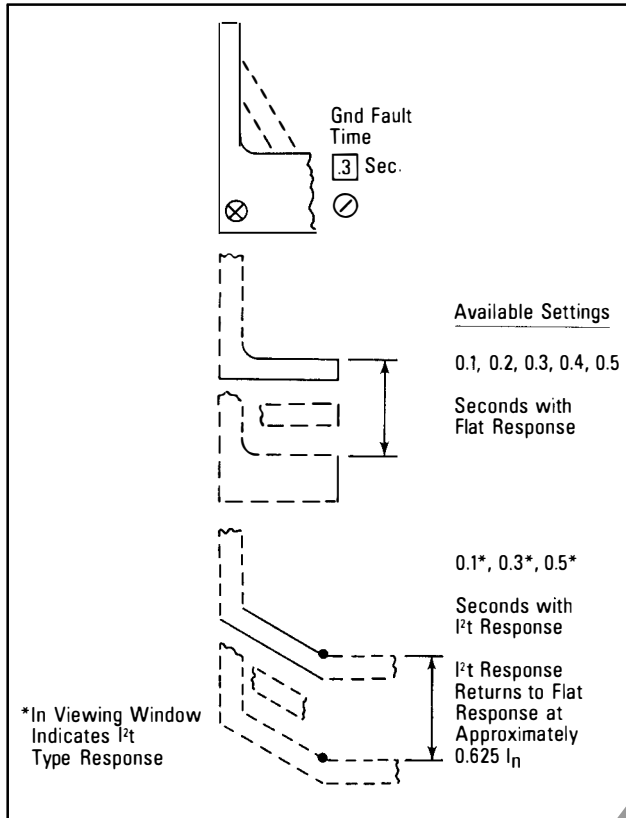


Fig. 4.7 Ground Fault Time Delay Settings

Five flat (0.1, 0.2, 0.3, 0.4, 0.5 sec.) and three I^2t (0.1, 0.3, 0.5 sec.) response time delay settings are provided. The I^2t response settings are identified by the suffix asterisk (*) that appears in the setting viewing window. The I^2t response is applicable only up to 0.625 times the ampere rating of the installed rating plug (I_n). Beyond this value, the I^2t response configuration reverts to a flat response.

5.0 Integral Test Panel — Test Procedure

5.1 General

As illustrated in Figs. 1 and 5, an integral test panel is provided to test the Digitrip RMS 500 Trip Unit.

Adequate no-trip settings are provided to insure that the trip unit is operational without tripping the circuit breaker.

CAUTION

THE TRIPPING OF A CIRCUIT BREAKER UNDER "TEST CONDITIONS" WHILE IT IS IN SERVICE AND CARRYING LOAD CURRENT, WHETHER DONE BY INTEGRAL OR EXTERNAL TEST MEANS, IS NOT RECOMMENDED.

ANY SUCH TRIPPING OPERATION WILL CAUSE DISRUPTION OF SERVICE AND POSSIBLE PERSONAL INJURY RESULTING FROM UNNECESSARY SWITCHING OF CONNECTED EQUIPMENT.

TESTING OF A CIRCUIT BREAKER THAT RESULTS IN THE TRIPPING OF THE CIRCUIT BREAKER SHOULD BE DONE ONLY WITH THE CIRCUIT BREAKER IN THE "TEST" OR "DISCONNECTED" CELL POSITIONS OR WHILE THE CIRCUIT BREAKER IS ON A TEST BENCH.

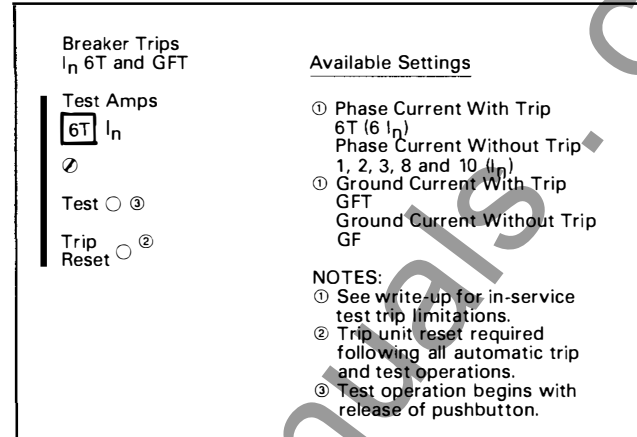


Fig. 5 Integral Test Panel

To preserve the primary protection function of the trip unit, all in-service testing under "Trip" or "No-Trip" conditions must be done at load current values no greater than 40% of the plug rating (I_n). Any attempt to conduct in-service testing above this value will be ***automatically aborted** by the trip unit.

Since the Digitrip RMS 500 Trip Unit is completely self-powered using energy derived from the current sensors installed in the circuit breaker, all in-service tests conducted should be conducted with the auxiliary control power module, shown in Fig. 7, plugged into the trip unit. This action will avoid operational difficulties caused by load current levels that are too low to operate the trip unit.

5.2 When To Test

Tests can be conducted with the breaker in the "connected" cell position while carrying load current. However, as stated in the caution note in Section 5.1, good practice will limit circuit breaker in-service "trip tests", where required, to maintenance periods during times of minimum load conditions. Testing, prior to start-up can best be accomplished with the breaker out of its cell or in the "Test", "Disconnected" or "Withdrawn" (or Removed) cell positions.

Note: Since time-current settings are based on desired system coordination and protection schemes, the protection settings selected and preset under Section 4.0 above should not be altered during or as a part of any routine test sequence.

5.3 Test Provision

As indicated in Fig. 5, six different test settings (1, 2, 3, 6T, 8 and $10 \times I_n$) are available for testing the phase elements of the trip unit and two (GF, GFT) are provided for testing the ground elements. One setting under each test mode (6T and GFT) will initiate a tripping action of the circuit breaker.

With appropriate pre-set selections of the phase protection settings, an ample range of settings under the "No Trip" condition are available to test the long time, short time and instantaneous trip settings without tripping the circuit breaker.

In the "GF" test position, the amount of test current is adequate to prove the operating condition of the trip unit without tripping the circuit breaker. This is not to be construed as a calibration

*No abort signal will occur for tests conducted unless the current breaker is carrying load current.

test. The value of the simulated test current is 1.0 per unit of the rating plug value.

5.4 Mode of Conducting Tests

5.4.1 Control Power

Install the Auxiliary Power Module (Cat. No. PRTAAPM) to insure control power is available for testing.

5.4.2 By Not Tripping the Breaker

1. Should the circuit breaker be in the cell "Connected" position and carrying load current, make sure that the circuit breaker is carrying no more than 40% of the plug ampere rating (I_N).
2. Place the test selector switch in one of the six "No Trip" test settings, i.e., 1, 2, 3, 8, 10, or GF.
3. Depress the "Test" pushbutton and release it – the test is initiated when the pushbutton is released.
4. Should any of the various protection settings be less than the selected "No Trip" test value, then the LED related to that function will turn on signifying successful completion of the test action. Note: For long delay tests there will be some period of time between start of test and LED turn "ON".
5. Reset the trip unit by depressing and releasing the "Trip Reset" pushbutton. All LEDs turned "ON" by the "No Trip" test action should turn "OFF".

Should an actual overload or fault condition occur during an in-service, "No Trip Test" sequence, the protection function will override the test function, and the circuit breaker will trip automatically as pre-programmed with the various Time-Current settings.

Note: The "Trip Reset" pushbutton may be depressed at any time. However, should a test initiated via the integral test panel be in progress, it would be aborted.

A test initiated via the integral test panel may be aborted at any time by depressing the "Trip Reset" pushbutton.

5.4.3 By Tripping the Breaker

1. Make sure that the circuit breaker is carrying no more than 40% of the plug ampere rating (I_N).
2. Place the test selector switch in one of the two "Trip" test settings, i.e., 6T or GFT.
3. Depress the "Test" pushbutton and release it – the test is initiated when the pushbutton is released.
4. Should any of the various protection settings be less than the selected "Trip" test value, the circuit breaker will trip and the LED related to that function will turn "ON" following the test action.
5. Reset the trip unit by depressing and releasing the "Trip Reset" pushbutton. All LEDs turned "ON" resulting from the "Trip" test action should turn "OFF".

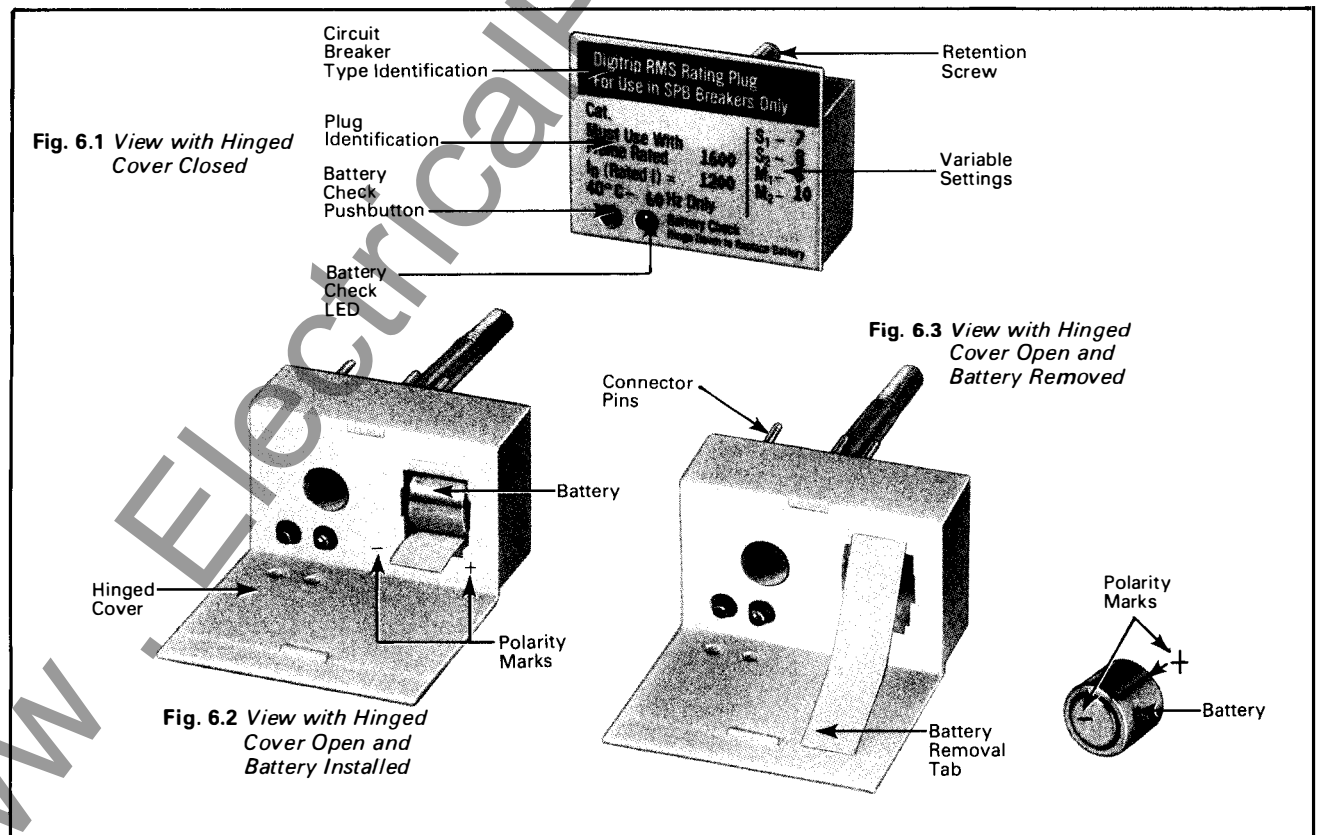


Fig. 6 Typical Rating Plug

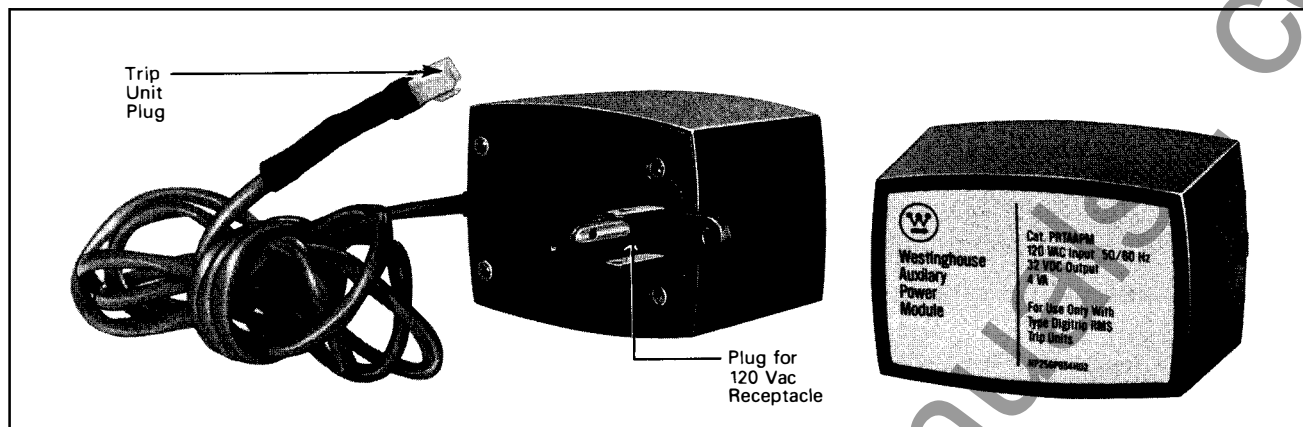


Fig. 7 Auxiliary Power Module

6. Reset and reclose the circuit breaker following established operating procedures.

6.0 Back-up Battery

6.1 General

As indicated in Figs. 3 and 6, a back-up battery is provided to maintain the mode of trip LED indication in the Digitrip RMS 500 Trip Unit. The back-up battery is located in the rating plug along with a battery check pushbutton and a green battery check LED.

6.2 Battery Check

The battery is a long life, lithium photo type unit. The ready status of the battery can be checked at any time by depressing the battery check pushbutton and observing the "On" condition of the battery check LED as shown in Fig. 6.1. If the battery check LED does not turn "ON", replace the battery.

6.3 Battery Replacement

Should the battery require replacement, it can be easily replaced from the front of the trip unit by lowering the hinged cover of the rating plug as shown in Fig. 6.2. The battery can then be removed by pulling the battery tab as shown in Fig. 6.3.

Note: The battery can be replaced at any time with the circuit breaker in service without affecting the operation of the circuit breaker and its protection function.

The replacement battery should be the same type or equivalent. Acceptable 3.0 volt lithium batteries may be obtained from the following companies under their type designation indicated:

Company	Model
Varta Batteries, Inc. 150 Clarbroom Road Elmsford, N.Y. 10523	CR 1/3N
Duracell South Broadway Tangtown, N.Y. 10591 (914) 591-7000	DL 1/3N
Union Carbide Corp. Battery Products Div. Eveready 39 Old Ridgebury Road Danbury, CT 06817-0001 (203) 794-7548	2L-76BP

CAUTION

CARE SHOULD BE EXERCISED WHEN REPLACING A BATTERY TO INSURE THAT THE CORRECT POLARITIES ARE OBSERVED. POLARITY MARKINGS ARE SHOWN ON THE RATING PLUG WHEN THE HINGED COVER IS OPEN AS INDICATED IN FIGS. 6.2 AND 6.3.

7.0 Auxiliary Power Module

The Auxiliary Power Module (Cat. No. PRTAAPM), illustrated in Fig. 7, is an encapsulated power supply that requires a 120 Vac input at either 50 or 60 Hz. It provides an output of 32 Vdc (nominal 40 Vdc open circuit) which can be used for testing a Digitrip RMS 500 Trip Unit.

When drawout construction is provided, any circuit breaker equipped with a Digitrip RMS 500 Trip Unit can be conveniently set and tested while the circuit breaker is out of its cell or in its cell in the "Disconnect" or "Withdrawn" positions using the Auxiliary Power Module.

The Auxiliary Power Module is equipped with a unique plug-in connector suitable only for plugging into the keyed receptacle of a Digitrip RMS Trip Unit. This prohibits the possible use of an incorrect, but similar, type power module. The location of the keyed receptacle for the auxiliary power module is shown in Fig. 1.

8.0 Rating Plug

The rating plugs, as illustrated in Figs. 1 and 6, are used to establish the continuous ampere rating of the related circuit breaker. All pick-up settings of the protection functions of the trip unit, i.e., long delay, short delay, instantaneous and ground fault are selected as a multiple of the rating plug rating (I_N).

Different types and ratings are available to match the desired ampere rating and type of circuit breaker into which the trip unit is to be installed. Also, since the rating plugs are frequency sensitive, specific types are available for 50 or 60 Hz system applications.

Complete catalog descriptions of all available rating plugs are given in the applicable circuit breaker supplementary instruction leaflets. References to these documents are given in Sections 9.1 and 9.2.

9.0 References

9.1 Type DS Low Voltage AC Power Circuit Breakers

I.B. 33-790-IF	Instructions for Low-Voltage Power Circuit Breakers Types DS and DSL
I.B. 33-790-IF Supplement No. 1	Section 8A Supplement Circuit Breaker Automatic Tripping System When Using Digitrip RMS Trip Assembly
SC-4280-87	Typical Time-Current Characteristic Curve (LI) for Type DS Circuit Breakers
SC-4281-87	Typical Time-Current Characteristic Curve (LS) for Type DS Circuit Breakers
SC-4279-87	Typical Time-Current Characteristic Curve (G) for Type DS Circuit Breakers
508B508	Connection Diagram for Type DS Circuit Breakers

9.2 Type SPB Systems Pow-R Breakers

I.L. 29-801	Instruction for the Systems Pow-R Breaker and Drawout Mechanism
I.L. 29-855	Supplementary Instructions for the Systems Pow-R Breaker used with the Digitrip RMS Trip Assembly
SC-4283-87	Typical Time-Current Characteristic Curve (LI) for Type SPB Systems Pow-R Breaker
SC-4284-87	Typical Time-Current Characteristic Curve (LS) for Type SPB Systems Pow-R Breaker
SC-4282-87	Typical Time-Current Characteristic Curve (G) for Type SPB Systems Pow-R Breaker
I.S. 15545	SPB Master Connection Diagram using Digitrip RMS Trip Assemblies

9.3 Digitrip RMS Trip Assemblies

I.L. 29-851	Instructions for Digitrip RMS 500 Trip Unit
I.L. 29-852	Instructions for Digitrip RMS 600 Trip Unit
I.L. 29-853	Instructions for Digitrip RMS 700 Trip Unit
I.L. 29-854	Instructions for Digitrip RMS 800 Trip Unit

9.4 Series C R-Frame Molded Case Circuit Breakers

29-106	Frame Book
29-107	Frame Instruction Leaflet
29-707	Supplement Instructions for Series C R-Frame used with the Digitrip RMS Trip Assembly
SC-4582-89	Typical Time-Current Characteristic Curve (LI) for Type RD Circuit Breakers
SC-4583-89	Typical Time-Current Characteristic Curve (LS) for Type RD Circuit Breakers
SC-4584-89	Typical Time-Current Characteristic Curve (G) for Type RD Circuit Breakers
I.L. 29C709	Master Connection Diagram for Series C R-Frame Circuit Breaker with Digitrip RMS

Instructions for Digitrip RMS 500 Trip Unit



I.L. 29-851-A

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WARNING

DO NOT ATTEMPT TO INSTALL OR PERFORM MAINTENANCE ON EQUIPMENT WHILE IT IS ENERGIZED. DEATH OR SEVERE PERSONAL INJURY 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. THE WESTINGHOUSE ELECTRIC CORPORATION 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 Westinghouse 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 Westinghouse Electric Corporation for further information or instructions.

1.0 General Description

1.1 Protection

The Digitrip RMS 500 Trip Unit, illustrated in Fig. 1, is a micro-processor based type trip suitable for use in type SPB Systems Pow-R circuit breakers and types DS and DSL low voltage AC power circuit breakers and Series C® R-Frame molded case circuit breakers.

The trip unit 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 500 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.

The Digitrip RMS 500 Trip Unit is available in six optional protection models. Each trip unit may be equipped with a maximum of five phase and two ground (time-current) adjustments to meet specific application requirements. These protection models include the following types which are further illustrated in the nameplate examples shown in Fig. 2.

Figure	Type Protection	Identifier
2.1	Long Time/Instantaneous	(LI)
2.2	Long Time/Short Time	(LS)
2.3	Long Time/Short Time/Instantaneous	(LSI)
2.4	Long Time/Instantaneous/Ground	(LIG)
2.5	Long Time/Short Time/Ground	(LSG)
2.6	Long Time/Short Time/Instantaneous/Ground	(LSIG)

1.2 Information

Red LED indicators are provided on the face of the trip unit to indicate the mode of an automatic trip operation. A battery is provided to maintain the mode of trip LED indication following an automatic trip operation.

Green LEDs are provided to indicate the operational status of the trip unit and the status of the back-up battery mounted in the rating plug.

1.3 Testing

An integral test panel, including a test selector switch and test and reset pushbuttons, is provided to test the circuit breaker in either a "Trip" or "No-Trip" test mode under qualified conditions.

2.0 UL Listed Devices

Digitrip RMS 500 Trip Units are listed by the Underwriters Laboratories, Inc. for use in types SPB, DS and DSL and Series C R-Frame circuit breakers under UL File E7819.

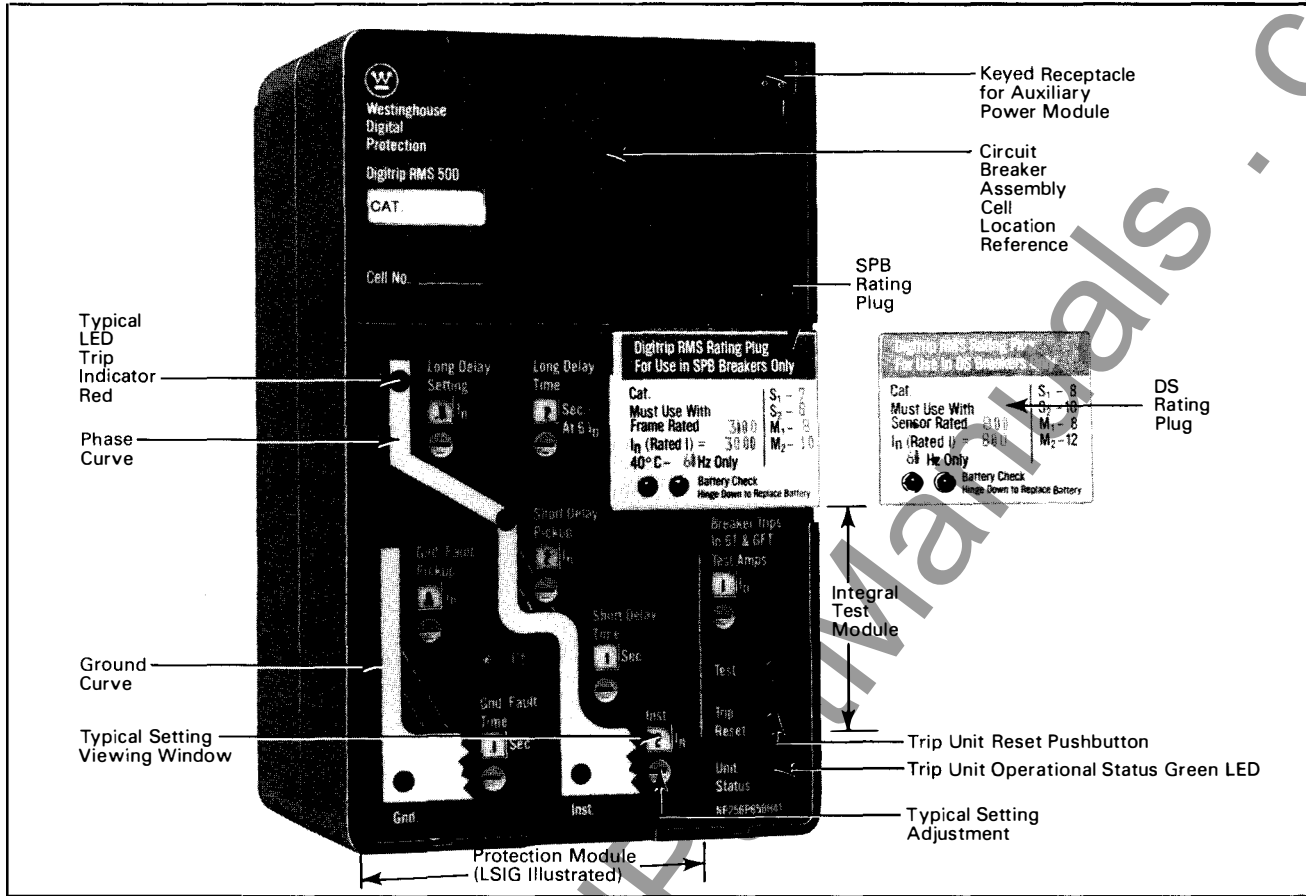


Fig. 1 Typical Digitrip RMS 500 Trip Unit with Rating Plug Installed

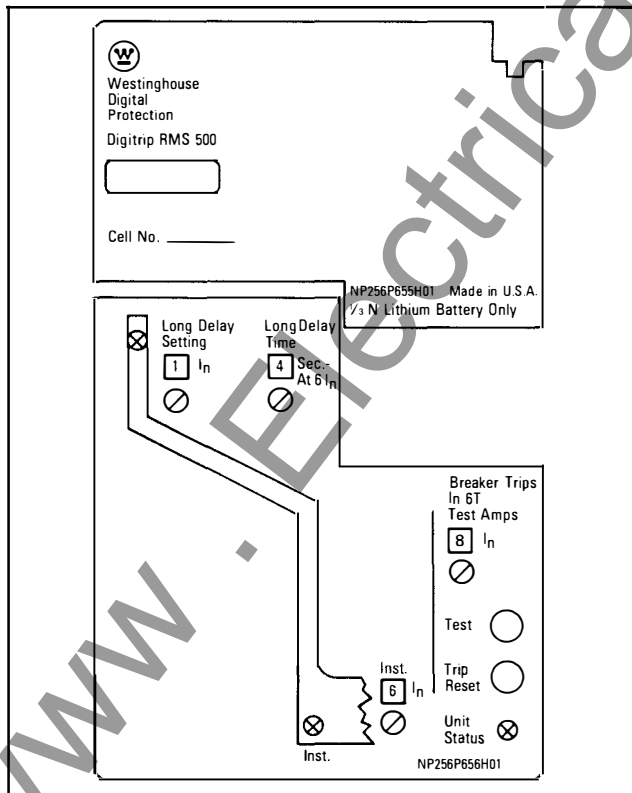


Fig. 2.1 Long Time/Instantaneous Protection (LI) Nameplate

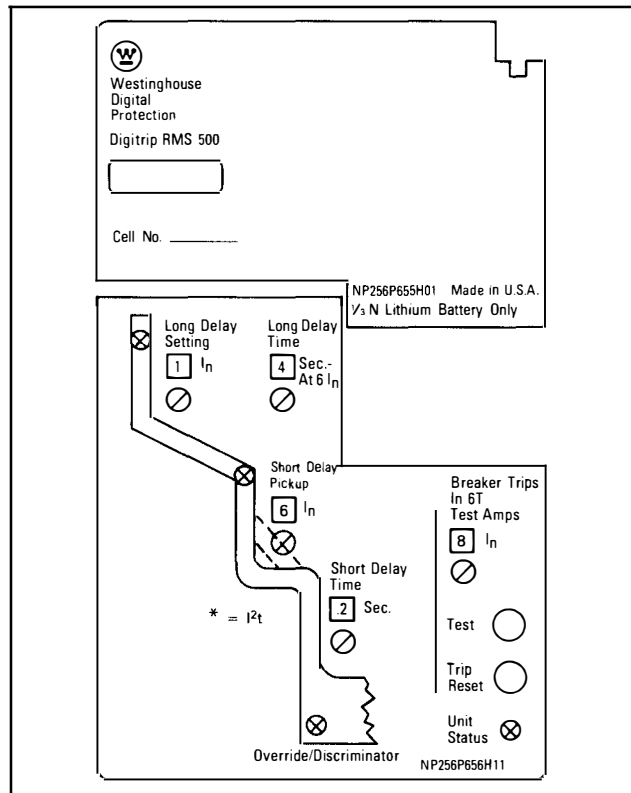


Fig. 2.2 Long Time/Short Time Protection (LS) Nameplate

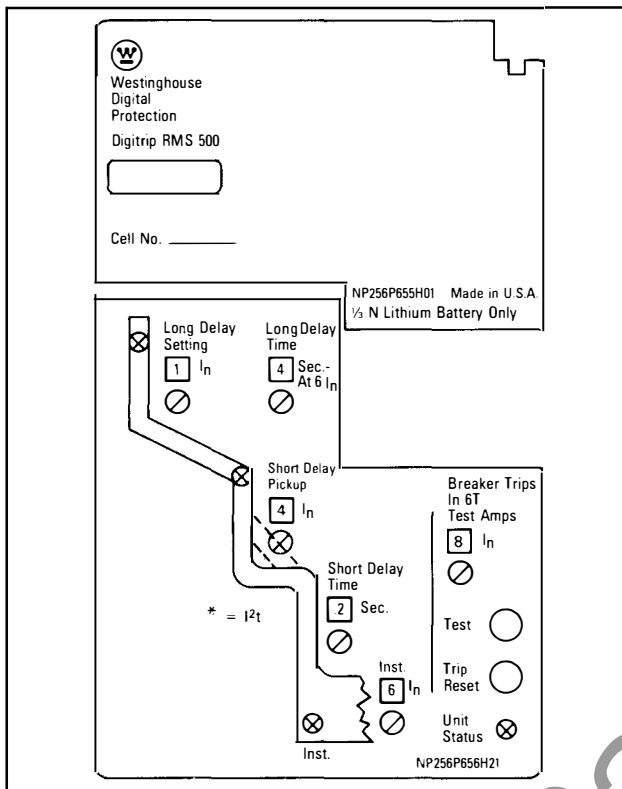


Fig. 2.3 Long Time/Short Time/Instantaneous Protection (LSI) Nameplate

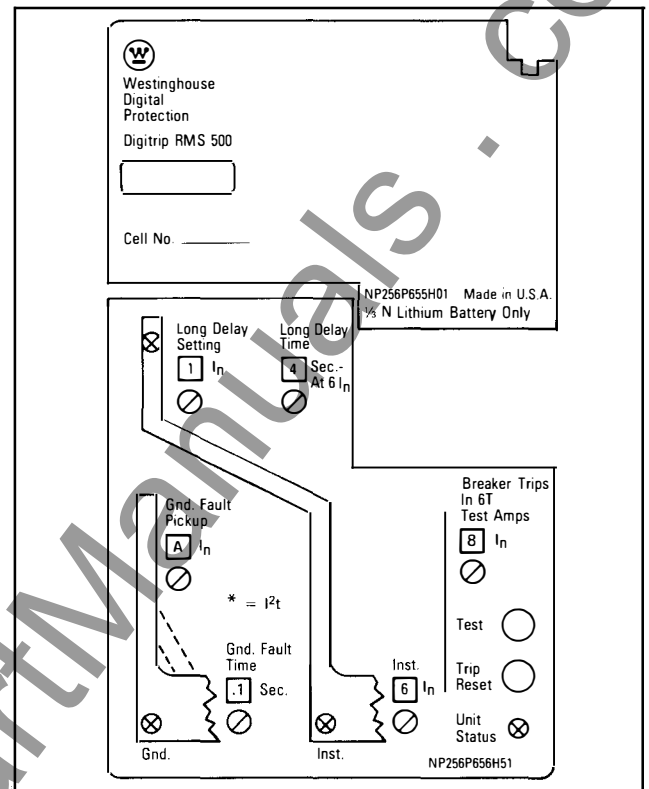


Fig. 2.4 Long Time/Instantaneous/Ground Protection (LIG) Nameplate

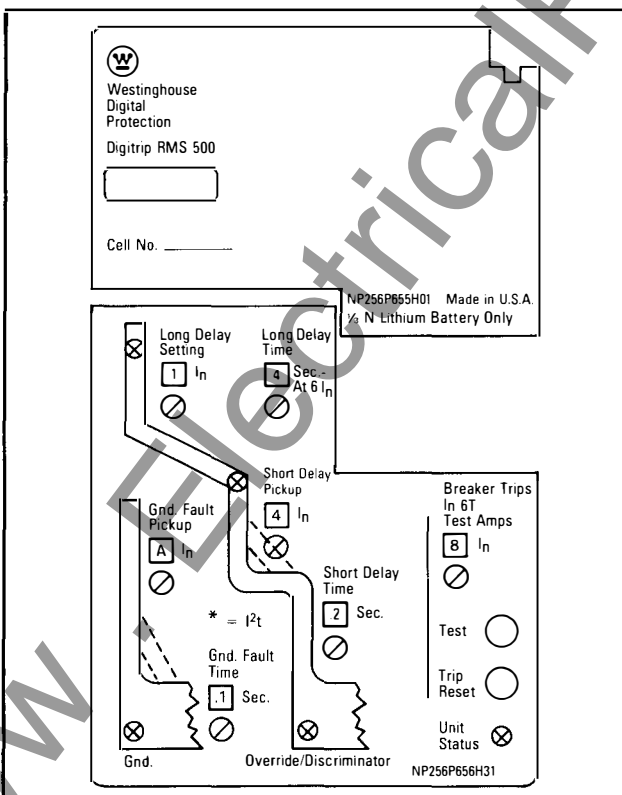


Fig. 2.5 Long Time/Short Time Protection (LSG) Nameplate

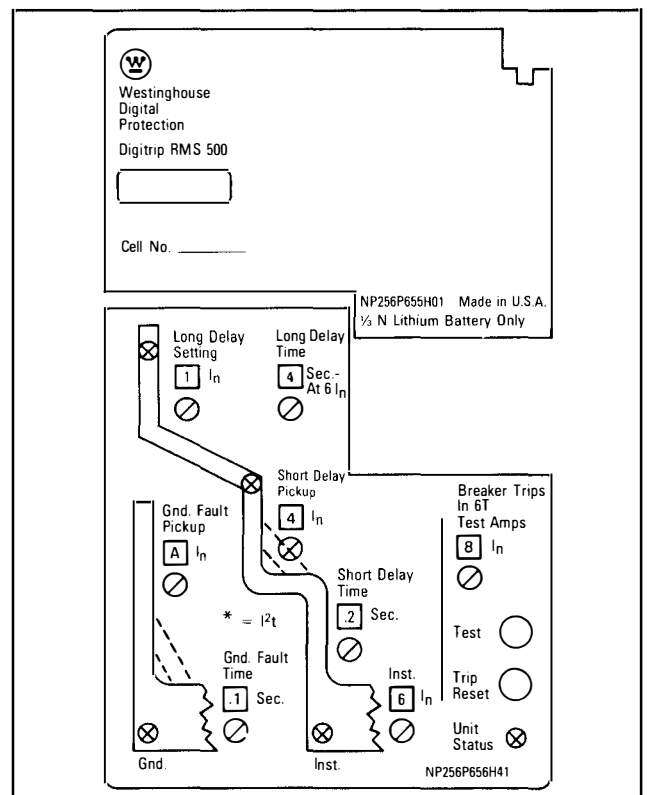


Fig. 2.6 Long Time/Short Time/Instantaneous/Ground Protection (LSIG) Nameplate

factor of the protection model supplied as illustrated in Figs. 2.1 through 2.6. Each settings is made with an eight position rotary switch using a small screwdriver. The selected setting for each adjustment will appear in the small rectangular opening as illustrated in Fig. 1.

The installed rating plug establishes the maximum continuous current rating of the circuit breaker. All current pick-up settings in the protection module are defined in per unit multiples of the ampere rating (I_N) of the installed rating plug.

To illustrate the portion of the protection curve being adjusted, simulated Time-Current curves are pictured on the face of the trip unit. The particular setting to be adjusted is located in close proximity to its portion of the simulated Time-Current curve. Should an automatic trip occur as a result of a fault current exceeding the pre-selected value in this portion of the Time-Current curve, the red LED shown in this segment of the simulated Time-Current curve will turn "ON".

The available settings, along with the illustrated effect of changing the settings, are given in Figs. 4.1 through 4.7.

4.2 Long Delay Settings

Eight (8) available settings, as illustrated in Fig. 4.1, range from 0.5 to 1.0 (I_N). Each setting is expressed as a multiple of the maximum ampere rating (I_N) of the installed rating plug.

4.3 Long Delay Time Settings

Eight (8) available settings, as illustrated in Fig. 4.2, range from 2 to 24 seconds. These settings represent total clearing times at a current value equal to six (6) times the installed rating plug ampere rating (I_N).

4.4 Short Delay Pick-Up Settings

As illustrated in Fig. 4.3, eight (8) available settings range from 2 to 6 (I_N) with two variable settings of S1 and S2. These variable settings depend upon the type of circuit breaker in which the trip unit is installed. Specific information on these settings is given in the supplemental instruction leaflet referenced in Sections 9.1 and 9.2 that is supplied with the circuit breaker. Specific information is also shown on the rating plug and on the applicable time-current curve.

4.5 Short Delay Time Settings

As illustrated in Fig. 4.4, two different curve configurations are possible, i.e., flat or I^2t response. The configuration selected will be a factor of the type of selective coordination being developed. The I^2t response will provide a longer time delay in the low-end of the short delay pick-up range than will the flat response setting.

Five flat (0.1, 0.2, 0.3, 0.4, 0.5 sec.) and three I^2t (0.1, 0.3, 0.5 sec.) response time delay settings are provided. The I^2t response settings are identified by the suffix asterisk (*) that appears in the setting viewing window. The I^2t response is applicable only up to eight (8) times the ampere rating of the installed rating plug (I_N). After this value is exceeded, the I^2t response configuration reverts to a flat response.

4.6 Instantaneous Pick-up Settings

As illustrated in Fig. 4.5, eight (8) available settings range from 2 to 6 (I_N) with two variable settings M1 and M2. These variable settings depend upon the type of circuit breaker in which the trip unit is installed. Specific information on these settings is given in the supplemental instruction leaflet referenced in Sections 9.1 and 9.2 that is supplied with the circuit breaker. Spe-

cific information is also shown on the rating plug and on the applicable Time-Current curve.

4.7 Ground Fault Current Pick-up Settings

As illustrated in Fig. 4.6, eight (8) available settings are given in alphabetical notations from A to K. (There is no "G" notation). Specific setting values are a function of the installed rating plug. In general, the pick-up settings range from 0.25 to 1.0 times the ampere rating (I_N) of the installed rating plug up to a maximum pick-up value of 1200 A. However, in the lower ampere rating plug values, an error factor can occur in the Digitrip RMS 500 Trip Unit since it is completely self-powered using only the input from the installed current sensors. Refer to Table 1, Note 2 for additional information.

Specific current pick-up values are tabulated in Table 1 and on the ground fault Time-Current curve of the applicable circuit breaker. Under primary injection test conditions, when the external auxiliary power module shown in Fig. 7 is used, the tabulated values should be in effect. The tabulated values shown in Table 1 are based on the use of a residual current sensing scheme with the same rated current sensor in all phase and neutral conductors. Refer to the applicable supplemental circuit breaker instruction leaflet for values applicable to alternate sensing schemes.

4.8 Ground Fault Time Delay Settings

As illustrated in Fig. 4.7, two different curve configurations are possible, i.e., flat or I^2t response. The configuration selected will be a factor of the type of selective coordination being developed. The I^2t response will provide a longer time delay in the low-end of the ground fault pick-up range than will the flat response setting.

Table 1 – Ground Fault Current Pickup Settings

		PICKUP SETTINGS GROUND FAULT CURRENTS (AMPERES)①							
INSTALLED RATING PLUG (AMPERES) I_N		A②	B②	C②	D②	E②	F	H	K
	100	25	30	35	40	50	60	75	100
	200	50	60	70	80	100	120	150	200
	250	63	75	88	100	125	150	188	250
	300	75	90	105	120	150	180	225	300
	400	100	120	140	160	200	240	300	400
	600	150	180	210	240	300	360	450	600
	800	200	240	280	320	400	480	600	800
	1000	250	300	350	400	500	600	750	1000
	1200	300	360	420	480	600	720	900	1200
	1600	400	480	560	640	800	960	1200	1200
	2000	500	600	700	800	1000	1200	1200	1200
	2400	600	720	840	960	1200	1200	1200	1200
	2500	625	750	875	1000	1200	1200	1200	1200
	3000	750	900	1050	1200	1200	1200	1200	1200
	3200	800	960	1120	1200	1200	1200	1200	1200
	4000	1000	1200	1200	1200	1200	1200	1200	1200
	5000	1200	1200	1200	1200	1200	1200	1200	1200

① Tolerances on pickup levels are $\pm 10\%$ of values shown in chart.

② Ground fault pickup levels shown are nominal values when tested with external control power present. Without external control power such as is the case with the Digitrip RMS 500, ground pickup levels may exceed these values up to the E setting of that particular rating plug.

③ Refer to Type DS, Type SPB or Series C R-Frame supplemental instruction leaflets given in Section 9 for list of available rating plugs with each type circuit breaker.

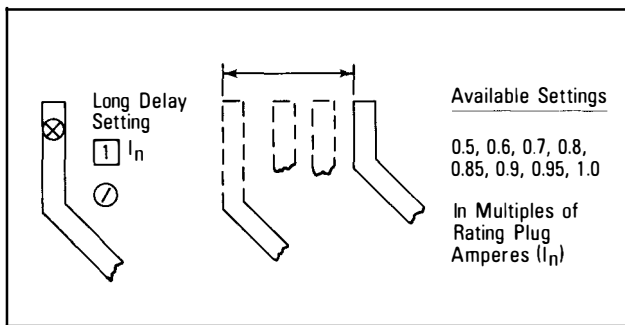


Fig. 4.1 Long Delay Ampere Pickup Settings

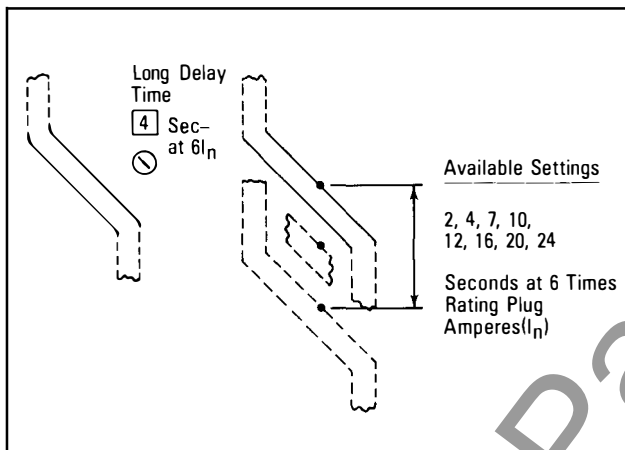


Fig. 4.2 Long Delay Time Settings

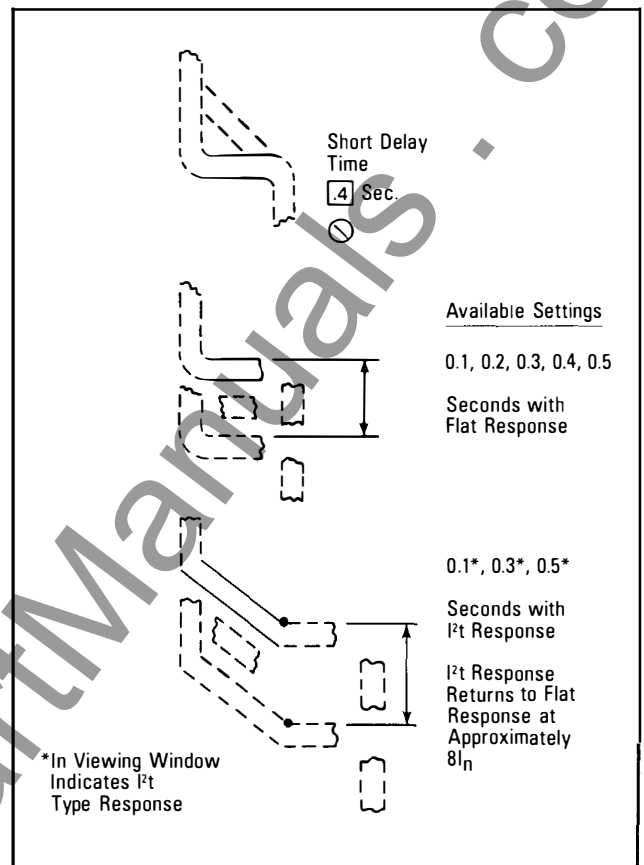


Fig. 4.4 Short Delay Time Settings

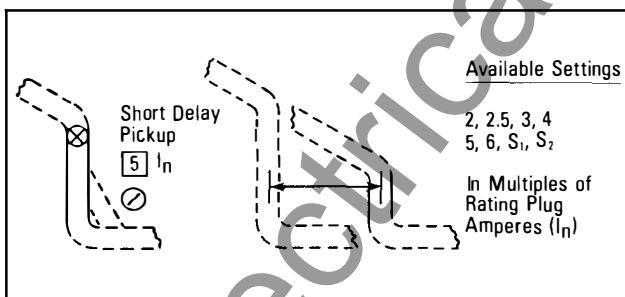


Fig. 4.3 Short Delay Current Pickup Settings

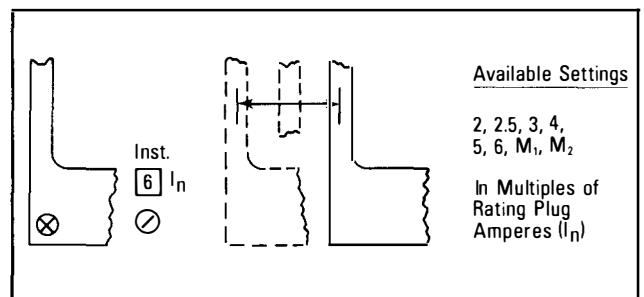


Fig. 4.5 Instantaneous Current Pickup Settings

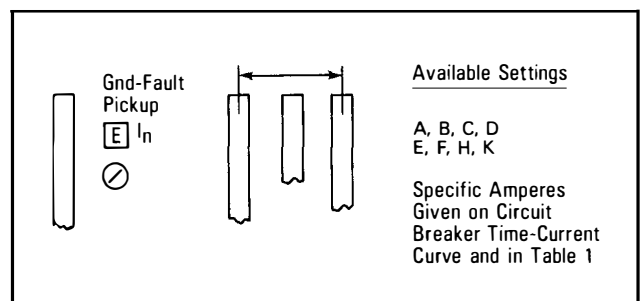


Fig. 4.6 Ground Fault Current Pickup Settings

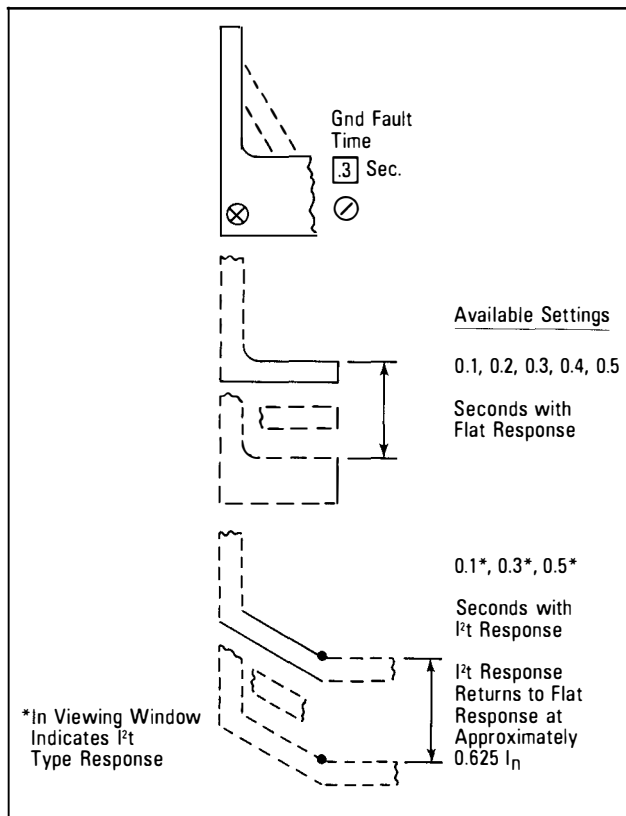


Fig. 4.7 Ground Fault Time Delay Settings

Five flat (0.1, 0.2, 0.3, 0.4, 0.5 sec.) and three I²t (0.1, 0.3, 0.5 sec.) response time delay settings are provided. The I²t response settings are identified by the suffix asterisk (*) that appears in the setting viewing window. The I²t response is applicable only up to 0.625 times the ampere rating of the installed rating plug (I_n). Beyond this value, the I²t response configuration reverts to a flat response.

5.0 Integral Test Panel — Test Procedure

5.1 General

As illustrated in Figs. 1 and 5, an integral test panel is provided to test the Digitrip RMS 500 Trip Unit.

Adequate no-trip settings are provided to insure that the trip unit is operational without tripping the circuit breaker.

CAUTION

THE TRIPPING OF A CIRCUIT BREAKER UNDER "TEST CONDITIONS" WHILE IT IS IN SERVICE AND CARRYING LOAD CURRENT, WHETHER DONE BY INTEGRAL OR EXTERNAL TEST MEANS, IS NOT RECOMMENDED.

ANY SUCH TRIPPING OPERATION WILL CAUSE DISRUPTION OF SERVICE AND POSSIBLE PERSONAL INJURY RESULTING FROM UNNECESSARY SWITCHING OF CONNECTED EQUIPMENT.

TESTING OF A CIRCUIT BREAKER THAT RESULTS IN THE TRIPPING OF THE CIRCUIT BREAKER SHOULD BE DONE ONLY WITH THE CIRCUIT BREAKER IN THE "TEST" OR "DISCONNECTED" CELL POSITIONS OR WHILE THE CIRCUIT BREAKER IS ON A TEST BENCH.

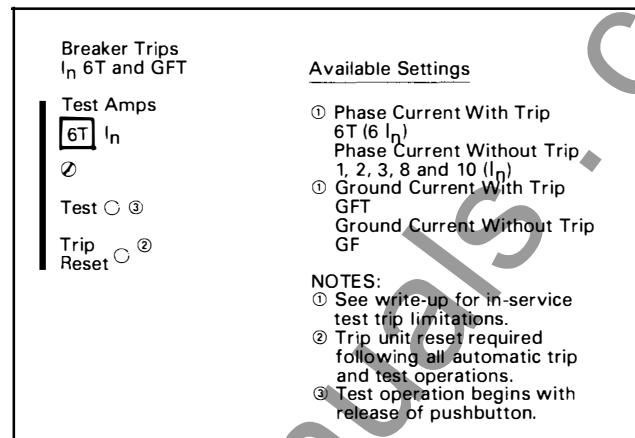


Fig. 5 Integral Test Panel

To preserve the primary protection function of the trip unit, all in-service testing under "Trip" or "No-Trip" conditions must be done at load current values no greater than 40% of the plug rating (I_n). Any attempt to conduct in-service testing above this value will be ***automatically aborted** by the trip unit.

Since the Digitrip RMS 500 Trip Unit is completely self-powered using energy derived from the current sensors installed in the circuit breaker, all in-service tests conducted should be conducted with the auxiliary control power module, shown in Fig. 7, plugged into the trip unit. This action will avoid operational difficulties caused by load current levels that are too low to operate the trip unit.

5.2 When To Test

Tests can be conducted with the breaker in the "connected" cell position while carrying load current. However, as stated in the caution note in Section 5.1, good practice will limit circuit breaker in-service "trip tests", where required, to maintenance periods during times of minimum load conditions. Testing, prior to start-up can best be accomplished with the breaker out of its cell or in the "Test", "Disconnected" or "Withdrawn" (or Removed) cell positions.

Note: Since time-current settings are based on desired system coordination and protection schemes, the protection settings selected and preset under Section 4.0 above should not be altered during or as a part of any routine test sequence.

5.3 Test Provision

As indicated in Fig. 5, six different test settings (1, 2, 3, 6T, 8 and 10X I_n) are available for testing the phase elements of the trip unit and two (GF, GFT) are provided for testing the ground elements. One setting under each test mode (6T and GFT) will initiate a tripping action of the circuit breaker.

With appropriate pre-set selections of the phase protection settings, an ample range of settings under the "No Trip" condition are available to test the long time, short time and instantaneous trip settings without tripping the circuit breaker.

In the "GF" test position, the amount of test current is adequate to prove the operating condition of the trip unit without tripping the circuit breaker. This is not to be construed as a calibration

*No abort signal will occur for tests conducted unless the current breaker is carrying load current.

test. The value of the simulated test current is 1.0 per unit of the rating plug value.

5.4 Mode of Conducting Tests

5.4.1 Control Power

Install the Auxiliary Power Module (Cat. No. PRTAAPM) to insure control power is available for testing.

5.4.2 By Not Tripping the Breaker

1. Should the circuit breaker be in the cell "Connected" position and carrying load current, make sure that the circuit breaker is carrying no more than 40% of the plug ampere rating (I_N).
2. Place the test selector switch in one of the six "No Trip" test settings, i.e., 1, 2, 3, 8, 10, or GF.
3. Depress the "Test" pushbutton and release it – the test is initiated when the pushbutton is released.
4. Should any of the various protection settings be less than the selected "No Trip" test value, then the LED related to that function will turn on signifying successful completion of the test action. Note: For long delay tests there will be some period of time between start of test and LED turn "ON".
5. Reset the trip unit by depressing and releasing the "Trip Reset" pushbutton. All LEDs turned "ON" by the "No Trip" test action should turn "OFF".

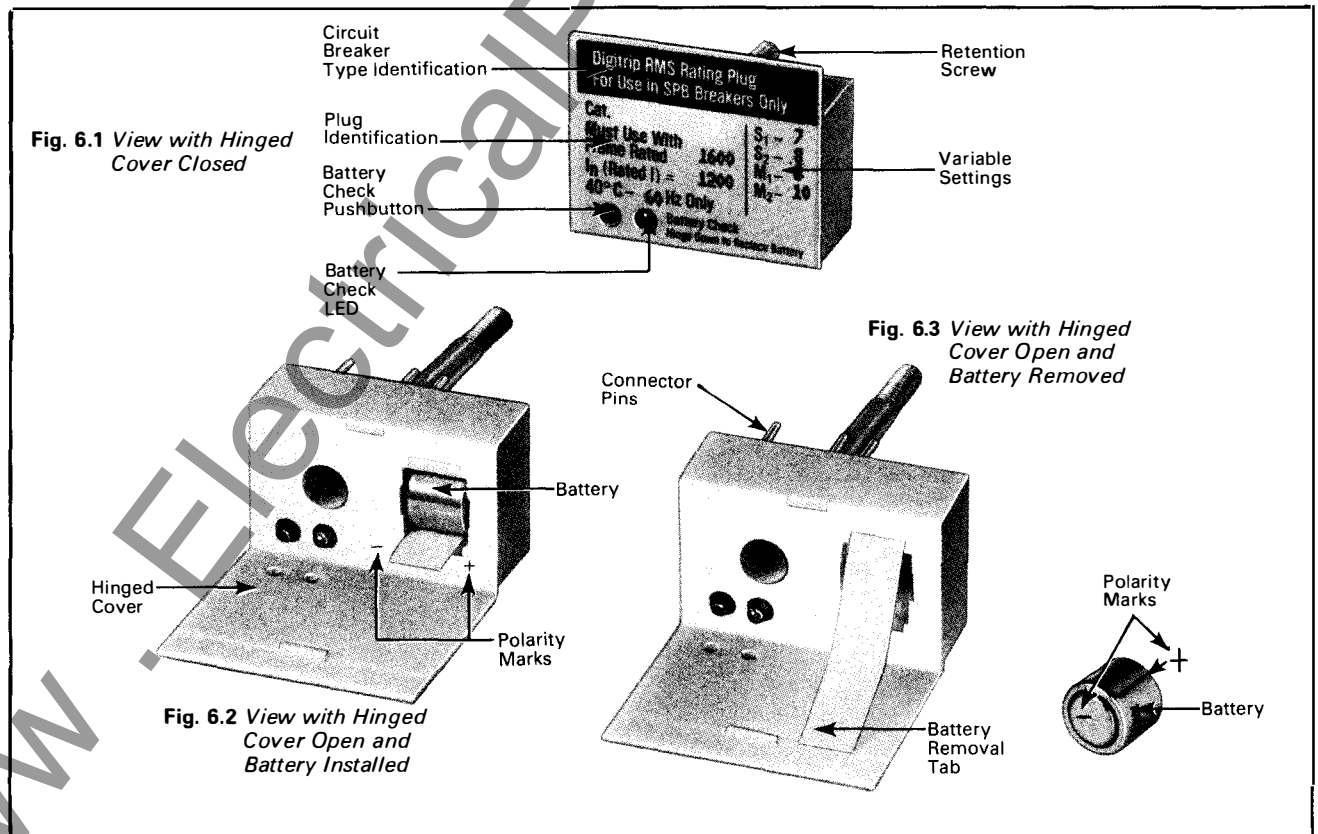
Should an actual overload or fault condition occur during an in-service, "No Trip Test" sequence, the protection function will override the test function, and the circuit breaker will trip automatically as pre-programmed with the various Time-Current settings.

Note: The "Trip Reset" pushbutton may be depressed at any time. However, should a test initiated via the integral test panel be in progress, it would be aborted.

A test initiated via the integral test panel may be aborted at any time by depressing the "Trip Reset" pushbutton.

5.4.3 By Tripping the Breaker

1. Make sure that the circuit breaker is carrying no more than 40% of the plug ampere rating (I_N).
2. Place the test selector switch in one of the two "Trip" test settings, i.e., 6T or GFT.
3. Depress the "Test" pushbutton and release it – the test is initiated when the pushbutton is released.
4. Should any of the various protection settings be less than the selected "Trip" test value, the circuit breaker will trip and the LED related to that function will turn "ON" following the test action.
5. Reset the trip unit by depressing and releasing the "Trip Reset" pushbutton. All LEDs turned "ON" resulting from the "Trip" test action should turn "OFF".



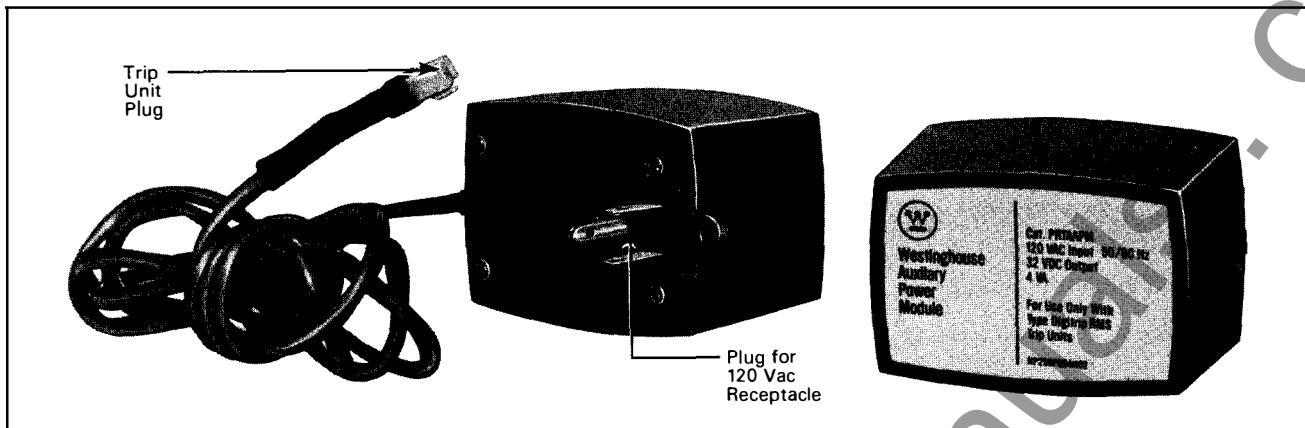


Fig. 7 Auxiliary Power Module

6. Reset and reclose the circuit breaker following established operating procedures.

6.0 Back-up Battery

6.1 General

As indicated in Figs. 3 and 6, a back-up battery is provided to maintain the mode of trip LED indication in the Digitrip RMS 500 Trip Unit. The back-up battery is located in the rating plug along with a battery check pushbutton and a green battery check LED.

6.2 Battery Check

The battery is a long life, lithium photo type unit. The ready status of the battery can be checked at any time by depressing the battery check pushbutton and observing the "On" condition of the battery check LED as shown in Fig. 6.1. If the battery check LED does not turn "ON", replace the battery.

6.3 Battery Replacement

Should the battery require replacement, it can be easily replaced from the front of the trip unit by lowering the hinged cover of the rating plug as shown in Fig. 6.2. The battery can then be removed by pulling the battery tab as shown in Fig. 6.3.

Note: The battery can be replaced at any time with the circuit breaker in service without affecting the operation of the circuit breaker and its protection function.

The replacement battery should be the same type or equivalent. Acceptable 3.0 volt lithium batteries may be obtained from the following companies under their type designation indicated:

Company	Model
Varta Batteries, Inc. 150 Clarbroom Road Elmsford, N.Y. 10523	CR 1/3N
Duracell South Broadway Tangtown, N.Y. 10591 (914) 591-7000	DL 1/3N
Union Carbide Corp. Battery Products Div. Eveready 39 Old Ridgebury Road Danbury, CT 06817-0001 (203) 794-7548	2L-76BP

CAUTION

CARE SHOULD BE EXERCISED WHEN REPLACING A BATTERY TO INSURE THAT THE CORRECT POLARITIES ARE OBSERVED. POLARITY MARKINGS ARE SHOWN ON THE RATING PLUG WHEN THE HINGED COVER IS OPEN AS INDICATED IN FIGS. 6.2 AND 6.3.

7.0 Auxiliary Power Module

The Auxiliary Power Module (Cat. No. PRTAAMP), illustrated in Fig. 7, is an encapsulated power supply that requires a 120 Vac input at either 50 or 60 Hz. It provides an output of 32 Vdc (nominal 40 Vdc open circuit) which can be used for testing a Digitrip RMS 500 Trip Unit.

When drawout construction is provided, any circuit breaker equipped with a Digitrip RMS 500 Trip Unit can be conveniently set and tested while the circuit breaker is out of its cell or in its cell in the "Disconnect" or "Withdrawn" positions using the Auxiliary Power Module.

The Auxiliary Power Module is equipped with a unique plug-in connector suitable only for plugging into the keyed receptacle of a Digitrip RMS Trip Unit. This prohibits the possible use of an incorrect, but similar, type power module. The location of the keyed receptacle for the auxiliary power module is shown in Fig. 1.

8.0 Rating Plug

The rating plugs, as illustrated in Figs. 1 and 6, are used to establish the continuous ampere rating of the related circuit breaker. All pick-up settings of the protection functions of the trip unit, i.e., long delay, short delay, instantaneous and ground fault are selected as a multiple of the rating plug rating (I_N).

Different types and ratings are available to match the desired ampere rating and type of circuit breaker into which the trip unit is to be installed. Also, since the rating plugs are frequency sensitive, specific types are available for 50 or 60 Hz system applications.

Complete catalog descriptions of all available rating plugs are given in the applicable circuit breaker supplementary instruction leaflets. References to these documents are given in Sections 9.1 and 9.2.

9.0 References

9.1 Type DS Low Voltage AC Power Circuit Breakers

I.B. 33-790-IF	Instructions for Low-Voltage Power Circuit Breakers Types DS and DSL
I.B. 33-790-IF Supplement No. 1	Section 8A Supplement Circuit Breaker Automatic Tripping System When Using Digitrip RMS Trip Assembly
SC-4280-87	Typical Time-Current Characteristic Curve (LI) for Type DS Circuit Breakers
SC-4281-87	Typical Time-Current Characteristic Curve (LS) for Type DS Circuit Breakers
SC-4279-87	Typical Time-Current Characteristic Curve (G) for Type DS Circuit Breakers
508B508	Connection Diagram for Type DS Circuit Breakers

9.2 Type SPB Systems Pow-R Breakers

I.L. 29-801	Instruction for the Systems Pow-R Breaker and Drawout Mechanism
I.L. 29-855	Supplementary Instructions for the Systems Pow-R Breaker used with the Digitrip RMS Trip Assembly
SC-4283-87	Typical Time-Current Characteristic Curve (LI) for Type SPB Systems Pow-R Breaker
SC-4284-87	Typical Time-Current Characteristic Curve (LS) for Type SPB Systems Pow-R Breaker
SC-4282-87	Typical Time-Current Characteristic Curve (G) for Type SPB Systems Pow-R Breaker
I.S. 15545	SPB Master Connection Diagram using Digitrip RMS Trip Assemblies

9.3 Digitrip RMS Trip Assemblies

I.L. 29-851	Instructions for Digitrip RMS 500 Trip Unit
I.L. 29-852	Instructions for Digitrip RMS 600 Trip Unit
I.L. 29-853	Instructions for Digitrip RMS 700 Trip Unit
I.L. 29-854	Instructions for Digitrip RMS 800 Trip Unit

9.4 Series C R-Frame Molded Case Circuit Breakers

29-106	Frame Book
29-107	Frame Instruction Leaflet
29-707	Supplement Instructions for Series C R-Frame used with the Digitrip RMS Trip Assembly
SC-4582-89	Typical Time-Current Characteristic Curve (LI) for Type RD Circuit Breakers
SC-4583-89	Typical Time-Current Characteristic Curve (LS) for Type RD Circuit Breakers
SC-4584-89	Typical Time-Current Characteristic Curve (G) for Type RD Circuit Breakers
I.L. 29C709	Master Connection Diagram for Series C R-Frame Circuit Breaker with Digitrip RMS

