Supplementary Instructions for Type DB Air Circuit Breakers Amptector® Solid-State Trip System

MB 3123-C

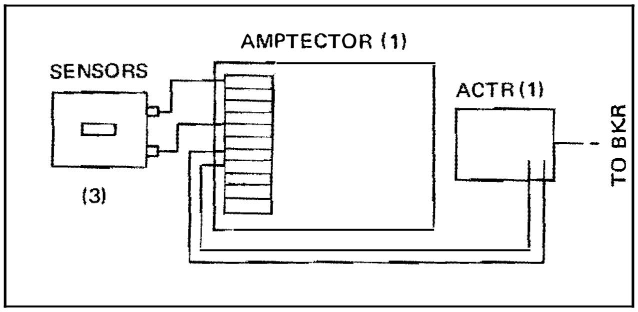

Figure 1

Introduction

1. The circuit breaker is tripped on overload and short circuit conditions by combined action of three components:

(1) The sensors
(2) The Amptector solid-state trip unit.
(3) The actuator (ACTR)

2. Schematically this may be represented as shown in Figure 1. This makes up a very flexible system covering a wide range of tripping characteristics. Not only is the Amptector adjustable but the sensors are available over a range of ratings. All necessary tripping energy is derived from the load current flowing through the sensors--no separate power supply is required.

3. The automatic overload and short circuit tripping characteristics for a specific breaker rating, as established by the sensor rating, are determined by the settings of the Amptector static trip unit. This unit also supplies a pulse of tripping current to the actuator. Thus, all tripping functions are performed by secondary control circuitry, with no mechanical or direct magnetic action between the primary current and the mechanical tripping parts of the breaker.

Sensors

4. The sensors produce an output proportional to the load current, so the breaker continuous current rating for any frame size can be changed simply by changing the sensors. The wide range of long delay current pick-up available on the Amptector makes one set of sensors suitable for a number of current ratings. The Amptector setting controls are standard and are usable with any standard sensors. If sensors are changed because of changing load conditions etc., it is only necessary to readjust the Amptector controls to the new desired values.

5. The standard available sensor ratings are listed below.

Bkr. Frame Rating	*Sensor Rating*
600 Amperes	200, 400, 600 Amp.
1600 Amperes	400, 800, 1200, 1600 Amp.
3000 Amperes	2500, 3000 Amp.
4000 Amperes	4000 Amp.

On the types DB-25 and DB-50 breakers the sensors are located at the bottom of each pole unit on the front of the breaker base. On the types DB-75 and DB-100 breakers the sensors are located around the lower studs on the back of the breaker base.

Amptector

Adjustments

6. There can be a total of six adjustable controls, with screwdriver adjustment made only through openings in the front coverplate. These are for setting the following adjustments:

(1) Long delay current pick-up
(2) Long delay
(3) Short delay current pick-up
(4) Short delay
(5) Instantaneous current pick-up
(6) Ground current time, with non-adjustable current pick-up

NOTE

The term "pick-up" as used here means the magnitude of current at which the Amptector timing function begins.

Ranges

7. The ranges of pick-up current settings (in multiples of sensor rating) and time delay are as follows:

(1) Long delay pick-up	.5 to 1.25 X sensor rating
(2) Long delay	4 to 36 seconds at 6X rating

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Over these ranges, tripping will always occur within the time band shown on the attached curve.

(3) Short delay pick-up — 4 to 10 X sensor rating
(4) Short delay — .18 seconds to .5 seconds or 11 to 30 cycles of 60 Hz, at 2.5 times pick-up setting.

Over these ranges, tripping will always occur within the time band shown on the attached curve. Although the time adjustment is continuous, three time bands are recommended and are marked as follows:

	Minimum	*Intermed*	*Maximum*
Top of band	.18 Sec.	.33 Sec.	.50 Sec.
	11 Cycles	20 Cycles	30 Cycles
Bottom of band	0.067 Sec.	.20 Sec.	0.37 Sec.
	4.0 Cycles	12 Cycles	22 Cycles

(5) Instantaneous pick-up — 4 to 12 times sensor rating
(6) Ground Current
Pick-up — Not adjustable
Delay — 13 to 30 Cycles at 60 Hz

Models

8. Any one of six combinations of the three pick-up ranges and the three time ranges listed above may be used. These combinations, with corresponding Amptector model numbers are as follows:

Elements	*Amptector Model*
(1) Long Delay and Instantaneous	LI
(2) Long Delay, Instantaneous and Ground	LIG
(3) Long Delay and Short Delay	LS
(4) Long Delay, Short Delay and Ground	LSG
(5) Long Delay, Short Delay, Instantaneous and Ground	LSIG
(6) Long Delay, Short Delay and Instantaneous	LSI

The Amptector is mounted on top of the breaker mechanism frame, and lies in front of the arc chutes.

Connections

9. Each Amptector has a terminal block equipped with test plug terminals accessible at the front. This permits convenient field checking of calibrations and operation with an external power supply. A specially designed power supply test kit, with plugs to match the Amptector test plug terminals is available. This test kit is made to plug into any standard 115V., 60 Hz outlet.

10. Figure 2 shows a typical standard connection diagram, which includes the Amptector terminal block. The following tabulation explains the markings of the terminals.

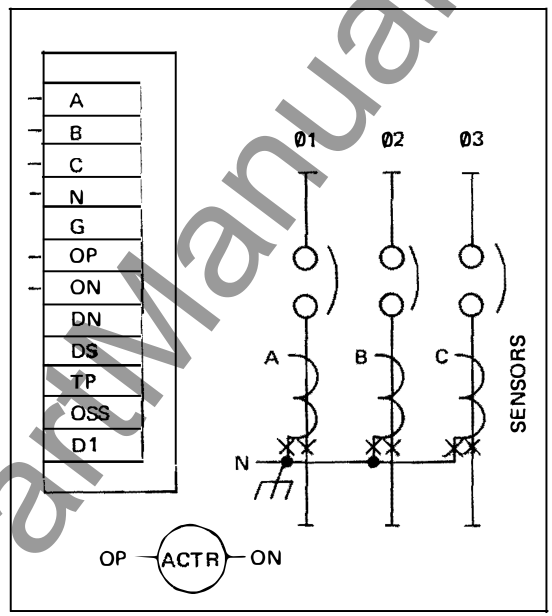


Figure 2

A	Sensor phase terminal
B	Sensor phase terminal
C	Sensor phase terminal
N	Neutral
G	Ground
OP	Output positive*
ON	Output negative*
DN	Discriminator negative
DS	Discr Switch Ø (Or Inst Defeat)
TP	Test Point, for checking long-delay pick-up with test kit only.
OSS	Overcurrent switch signal to accessory unit.
D1	Ø Short Delay Defeat

Ø - For Calibration and Test

*To Actuator Coil. THIS COIL HAS A POLARITY MARKING ON THE POSITIVE LEAD WHICH MUST BE OBSERVED.

Ground Protection

11. When the Amptector is supplied with a ground element, ground current protection is provided by energizing

this element with the sum of the currents in the three phase elements, or with a suitable source of ground current. The ground element thus acts in the same way as the coil of a protective relay. Tripping results from a pulse that is sent to the actuator from the Amptector, the same as for phase overcurrent protection. One ampere (or more) of current into the ground element will cause tripping. When the ground element is energized from an external current transformer, ground current sensitivity will depend on the ratio of the current transformer used. There is no adjustment for the ground current pickup; it is fixed at one value.

Discriminator

12. The discriminator feature is included with any Amptector that does not have an instantaneous element. This feature permits instantaneous tripping only while a breaker is being closed. After the breaker has closed, the discriminator inhibits the instantaneous feature in the Amptector, thus permitting the breaker to operate with the required tripping characteristics. Early models of the Amptector required the use of an external time delay switch to provide this feature.

Servicing

13. The Amptector is the intelligence of the overcurrent protection provided by the breaker. It is a device that has many solid-state components. Since the only moving parts are the adjustments, the Amptector will give long, trouble-free service. All components and connections, including the printed circuit board itself, are coated to give effective environmental protection.

14. If there is any reason to suspect that the Amptector is not operating correctly, it should not be tampered with; since tampering could result in loss of vital overcurrent protection. A specially designed tester is available for checking Amptector operation without using primary current. The tester can be plugged into any convenience outlet; and will pass enough current to check any pickup calibration. Time delay calibrations can also be checked.

15. Special handling and test equipment are required to service solid-state devices. If use of the tester shows that an Amptector is not operating correctly, it is strongly recommended that a spare Amptector be used and the questionable unit be returned to the factory for service.

Actuator

16. The actuator receives a tripping pulse from the Amptector and produces a mechanical force to trip the breaker. The actuator is made up of a permanent magnet, a disc held by the magnet, a rod acted on by a spring, a lever for tripping the breaker, and a lever for mechanically resetting the actuator. The magnet cannot pull and reset the disc against the force of the spring acting on the rod, but can overcome the spring force when the disc is in contact with the magnet. A tripping pulse from the Amptector counteracts the effect of the permanent magnet, allowing the spring to separate the disc from the magnet and move the rod to actuate the trip lever. The trip lever than moves the trip bar and trips the breaker. As the breaker opens, the cross bar strikes the spring finger attached to the reset lever; this furnishes the assistance required to move the disc so as to close the air gap between it and the permanent magnet against the spring force. The device is reset when the disc is in contact with the magnet. If the disc is not fully reset the trip lever will hold the breaker mechanism in the trip free condition and the breaker cannot be reclosed. Figure 3 shows a simplified sketch of the actuator.

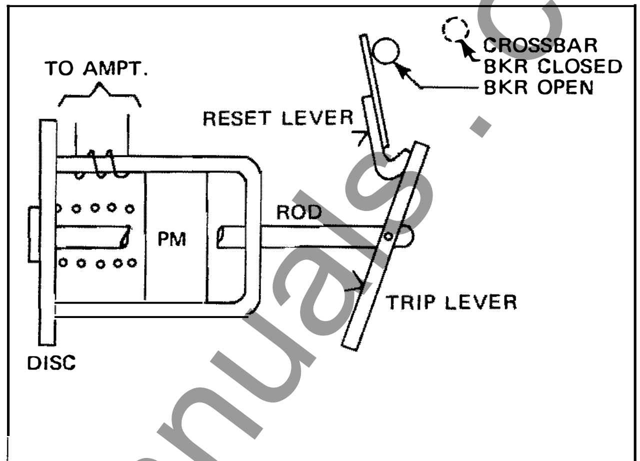
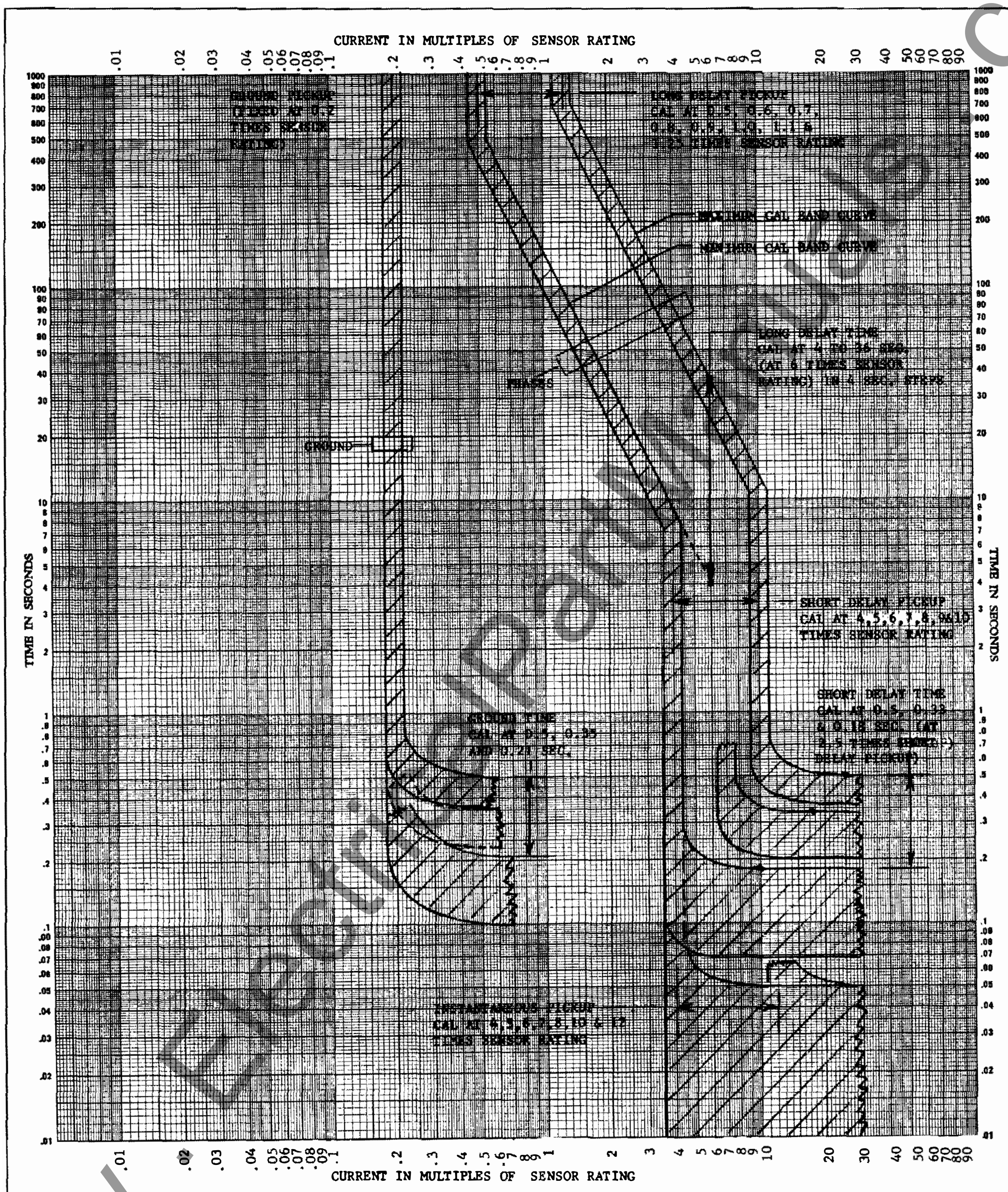


Figure 3

17. The actuator physically occupies the space normally reserved for the undervoltage device. This means that when the solid-state trip system is supplied, the standard electro-mechanical undervoltage device cannot be supplied. A solid-state undervoltage device is available.

Installation

18. On some type DB breakers the Amptector mounting plate is fastened to the mechanism frame with shock mounts. To limit the movement of these Amptectors during shipment, they are tied down. The tie-down material should be cut loose and removed before the breaker is placed in service. The only other consideration during installation is making or checking the setting for each adjustment of the Amptector. The most desirable settings for any breaker must be determined from the time-current characteristics of the connected load.



NOTE: Short delay and instantaneous pickup can be set down to approximately 2 times sensor rating by using test kit.

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