ALLIS-CHALMERS CONTROLS

INSTRUCTIONS

PORTABLE TEST SET FOR

STATIC OVERCURRENT TRIP DEVICES

BWX-6660-1

18X4589

INDEX

ILLUSTRATIONS

PRINTED IN U.S.A.

SGM & Co., Inc.

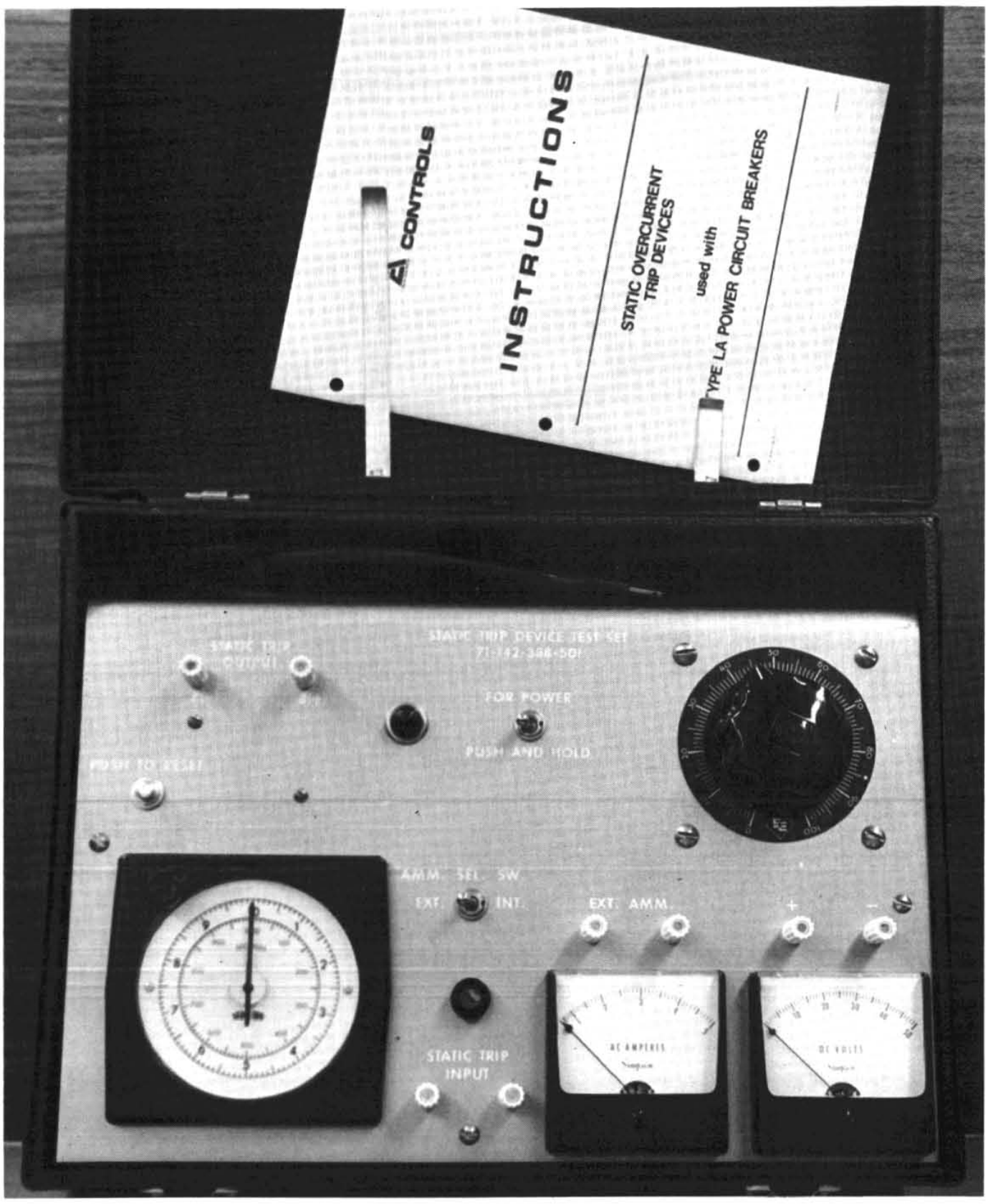


Figure 1. – Portable Test Set for Static Overcurrent Trip Devices

INTRODUCTION

This instruction is intended to describe the details of operation for Allis-Chalmers Portable Test Set shown in Figs. 1 and 2. For a complete description of the operation, settings, and application of static overcurrent trip devices, as well as further comments on the testing and on test results, reference should be made to the following instruction book for static trip devices.

BWX-6678-1 (18X4392) – Models A1, A2, A3, AG, AG1, AG2, D, D1, D2, DG, DG1, 4WAG, 4WDG

The tests described here are adequate for all practical purposes since if the static trip device functions as tested it is very unlikely to have malfunctions in the untested portions of the curve.

If the static trip device passes the tests described, but does not trip the circuit breaker or if the circuit breaker trips for unknown reasons, the trouble is most likely in the circuit breaker itself, or in the latching mechanism.

Generally speaking, it is desirable to perform routine maintenance on the circuit breaker prior to testing the static trip device. The static trip device can be tested last, and the breaker returned to service with the assurance that all settings are as intended.

When tests are made under field conditions there are a number of factors that could result in apparent minor deviations from expected results. These include instrument error, voltage variations, human error, etc. Such minor variations can be safely ignored.

Large deviations and improper functions should not occur. If such is the case, it is recommended that the local office of Allis-Chalmers be contacted for advice. The nature of electronic devices of this type, using special quality components and closely controlled selection and adjustment techniques, precludes reliable repair of static overcurrent trip devices in the field.

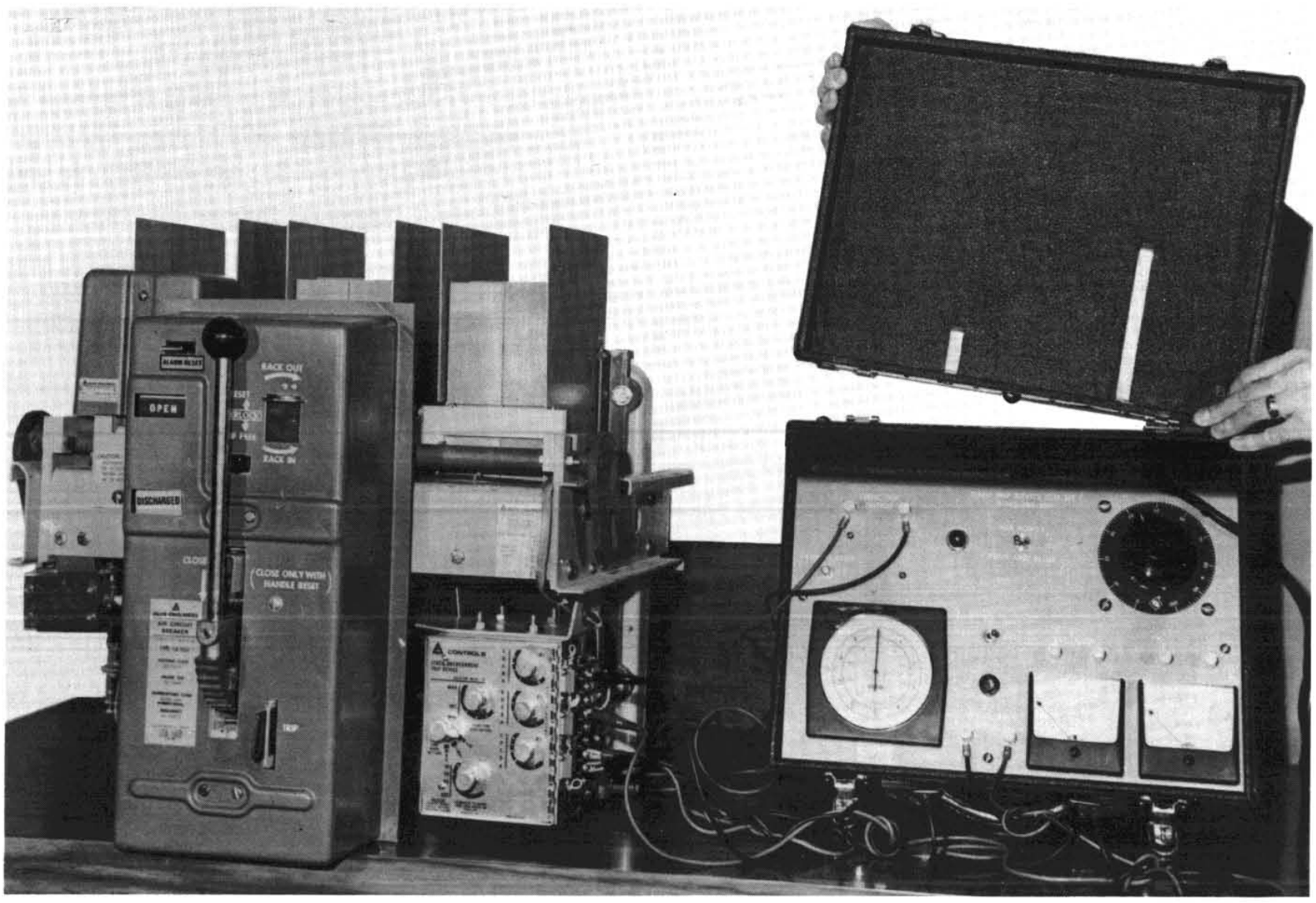


Figure 2. – Typical Test Arrangement

EQUIPMENT

The Test Set enables function and timing tests to be made easily and conveniently under field conditions with a minimum of preparation and no prior training or experience. It is not intended for use in calibrating static overcurrent trip devices.

It is suitable for testing all Selective Static and Dual Static Overcurrent Trip Devices as commonly used on Type "LA" circuit breakers. This includes the Models A, A1, A2, A3, AG, AG1 and AG2 Dual Static and Models C, C1, C2, C3, D, D1, D2, DG and DG1 Selective Static Trip Devices.

It can be used, without modification, to test a complete circuit breaker assembly, or an individual static trip device by itself.

The Test Set is completely self-contained.

Power requirements are low, well within the capability of ordinary 115 volt A.C. lighting circuits.

BASIS OF TEST

The Test Set enables circuit breakers and static overcurrent trip devices to be tested with no need for high primary circuit currents. It delivers to the static trip device a small, controllable current which is the functional equivalent of the secondary current from the bushing current transformer mounted on a primary stud of the circuit breaker.

The circuits of the static overcurrent trip device are used during test exactly as in normal service.

Although the low power test set does not enable tests to be made at the high current (fast) end of the time-current curve, this is not objectionable since the shape of the curves is determined by components in the static trip device, and tests at the low current end satisfactorily establish total performance.

Since tests of this nature are subject to slight errors, exact agreement with curves will not always be obtained. The tendency will be to show timing slightly faster (approximately 10%) than the typical time-current curves indicate. These factors do not apply in factory tests which are more elaborate in both facilities and procedures.

DESCRIPTION OF TESTS

A number of tests can be made on static overcurrent trip devices in order to verify proper operation or to establish the accuracy of the various functions. The user will normally establish test routines to suit the particular application and his standard operation procedures. The following are brief descriptions of available tests and their purposes.

Function Test

In many cases this is the only test that need be done to determine that the static trip device is operating. It supplies the static trip device with an input above the pickup setting and establishes that an output (tripping of the circuit breaker) is produced. This test does not check calibration, although it will show that timing is generally in the right area.

Power Supply Test

This test verifies that the internal power supply of the static device is functioning normally and is regulating itself properly to changes in input.

Pickup Test

This test shows that the pickup current properly corresponds to the pickup dial setting. It checks the turn-on of the trigger circuit to assure that a timing operation will start when the input signal has reached the proper magnitude.

Time Delay Test

In this test the actual time-to-trip is measured to assure that the selected settings will produce time delay as specified on the current-time characteristic curve. It is also useful in establishing time delay for nonstandard settings between the calibrated pickup points if such settings are desired. However, the test set is not intended for use in calibrating static trip devices.

Transfer Test

This test verifies that the circuits used to transfer from the long time delay curve to the instantaneous trip (Models A, A1, A2, A3, C, C1, C2, C3, AG, AG1 and AG2) and to the short time delay curve (Models D, D1, D2, DG and DG1) are functioning properly

Trip Signal Test

This test determines that the static overcurrent trip device produces a proper output for tripping the circuit breaker. It is usually used as a simple test to isolate the cause of unknown tripping trouble, since if a proper trip signal is obtained, the trouble is limited to the latching system on the circuit breaker.

TEST PROCEDURE

Preliminary (Refer to Fig. 3)

Connect the Test Set to a source of 115 volts A.C. The red pilot light indicates that the set is connected to the power source.

Connect the Test Set terminals marked STATIC TRIP INPUT to appropriate terminals on the static overcurrent trip device.

Also connect the terminals marked STATIC TRIP OUTPUT to the static overcurrent trip device if timing tests are to be made, or if a circuit breaker is not used as a tripping indication.

NOTE

Circuit breakers should be moved to the DISCONNECT position in the cubicle for testing, or moved to a convenient work area. When a complete circuit breaker is being tested, it is not necessary to remove any of the permanent wiring connections, with one exception – on breakers that have a bell alarm relay it is advisable to disconnect this relay if timing tests are to be made (it can, of course, be left in during normal function tests). This is because the Test Set time-measuring circuit uses a relay the same as a bell alarm relay, and two such relays might give an erroneous no-trip indication.

An ammeter is provided in the Test Set. Provision is also made for use of an external ammeter if desired.

The Test Set is now ready for use.

CAUTION

Always loosen shaft locks before moving the knobs on a static overcurrent trip device. Retighten the shaft locks after testing is completed and the desired permanent settings have been made.

The following table of test currents is provided as a convenience in selecting some currents for test. (Test Set capability is approximately 5 Amps.)

TABLE 1

Pickup Setting	Pickup Current (Amps.)	Multiples of Pickup (Amps.)		
		3X	5X	10X
A	0.5	1.5	2.5	5.0
B	0.625	1.875	3.125	(6.25)
C	0.75	2.25	3.75	(7.5)
D	0.875	2.625	4.375	(8.75)
E	1.0	3.0	5.0	(10.0)

Tests

Function Test

In many instances this is the only test that need be made on a static overcurrent trip device. Set its pickup knobs at "A," set instantaneous (or transfer) knob at 10X or higher, and close the circuit breaker (if used).

Push and hold the test set's toggle switch for power. Quickly increase the current to 1.5 Amps. (3X pickup) by adjusting variable voltage transformer. The circuit breaker should trip (and the timer stop) in approximately 10 to 45 seconds, depending on the time band used. (See Current-Time curve for the appropriate static trip device.) Release the power toggle switch. Reset timer and push reset button to ready the device for the next test. Repeat as desired, using same or different settings and test currents.

Change the instantaneous (or transfer) knob to the 5X setting with pickup knobs at "A." Quickly increase the current to 2.5 Amps. (5X pickup). The circuit breaker should trip instantly at approximately 2.5 Amps. and the timer stop. Shut off power. Repeat as desired.

This test proves that both the long time and short time or instantaneous circuits are functioning properly, and provides a general indication of the timing.

Power Supply Test

With the Test Set connected as shown in Fig. 3, connect its voltmeter as follows:

Models A, A1, A2, A3, D, D1, D2, C3	– Terminals 8-4 (8 is positive)
Models AG, AG1, AG2, DG, DG1	– Terminals 8-2 (8 is positive)
Models C, C1, C2	– Terminals 8-6 (8 is positive)
Models 4WAG, 4WDG	– Terminals 8-9 (8 is positive)

Adjust the variable voltage transformer on the Test Set for an ammeter indication of about 0.5 Amps. The voltmeter should read as follows:

Models A, C, C1, C2	– Between 12 and 18 volts
Models A1, A2, A3, AG, AG1, AG2, D, D1, D2, DG, DG1, 4WAG, 4WDG	– Between 20 and 24 volts

Increase the current briefly to about one Amp. and note that the voltage does not change significantly. This indicates that the power supply is normal.

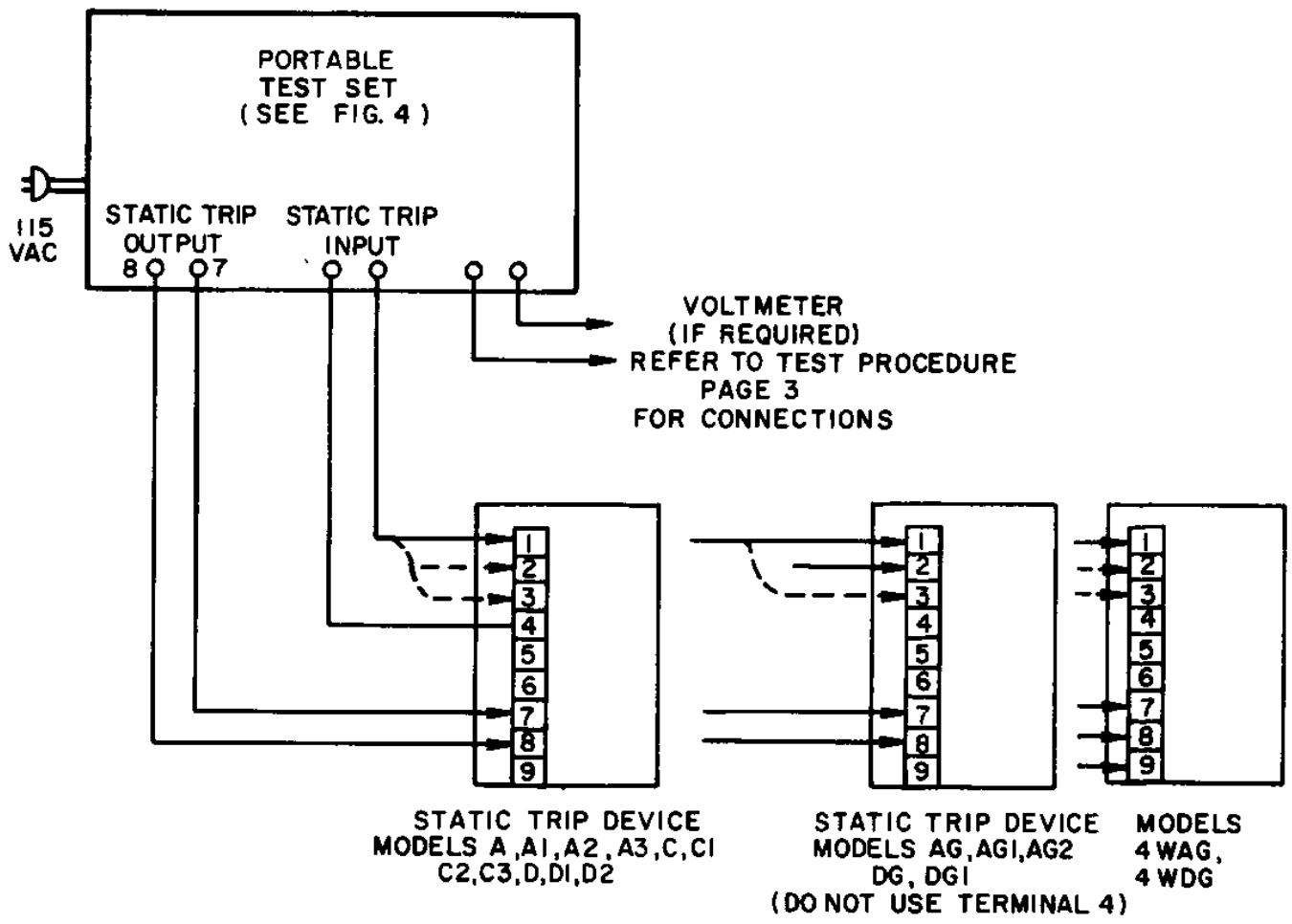


Figure 3. – Test Connection Diagram

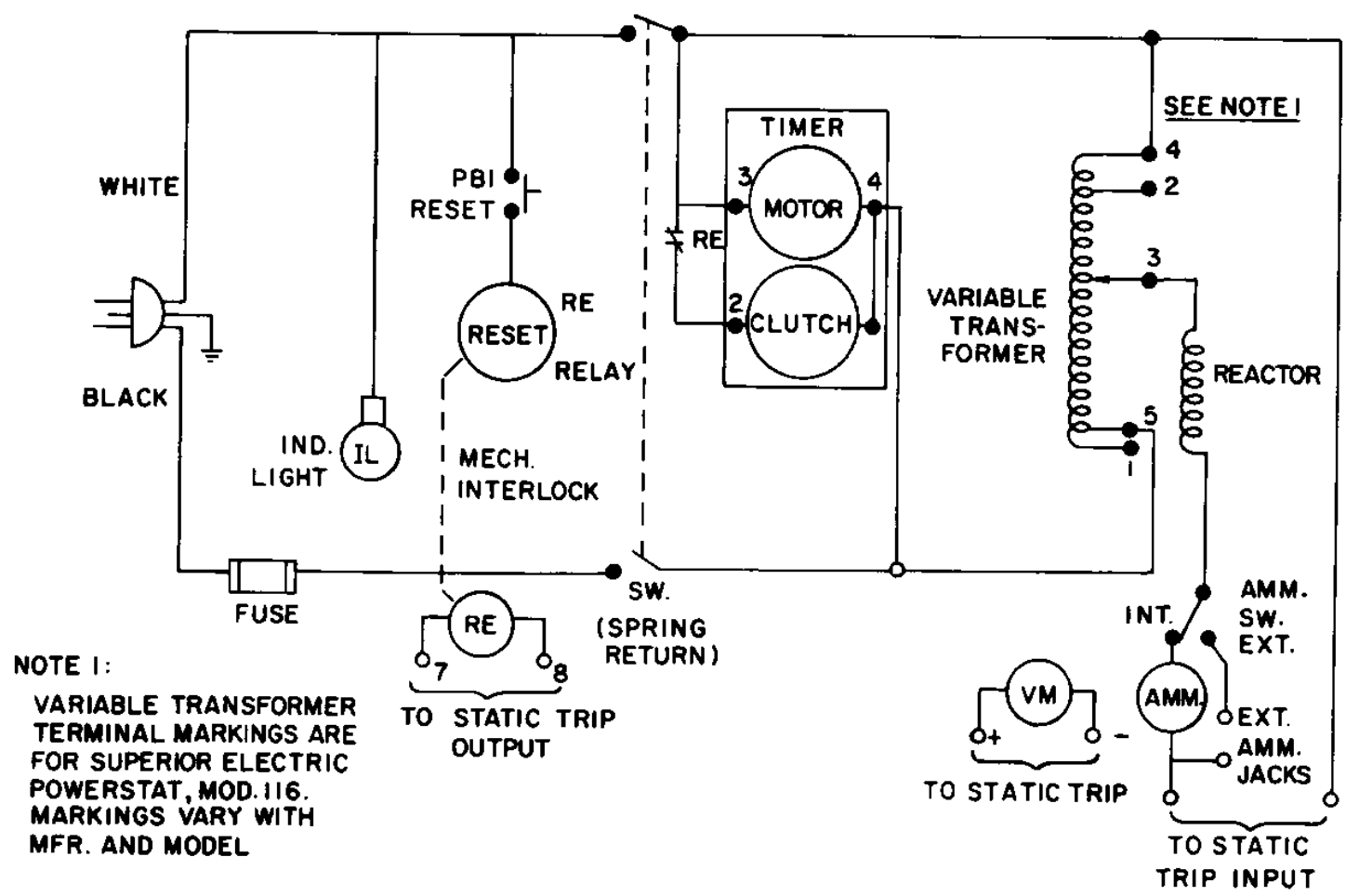


Figure 4. – Portable Test Set Schematic Diagram

Pickup Test

With the Test Set connected as shown in Fig. 3, connect its voltmeter as follows:

Models C, C1, C2	– Terminals 5-6 (5 is positive)
Models A, A1, A2, A3, D, D1, D2	– Terminals 5-4 (5 is positive)
Models AG, AG1, AG2, DG, DG1	– Terminals 5-2 (5 is positive)
Models 4WAG, 4WDG	– Terminals 5-9 (5 is positive)

Set pickup knobs at "A". Increase the current slowly until the voltmeter suddenly jumps from a very low value to 6 volts or more. This is the pickup point and the ammeter should read 0.5 Amps. The test currents for other pickup settings are given in Table 1. The pickup test is quite sensitive to the wave shape of the test current, which is not quite sinusoidal. This may cause an apparent low reading in the order of up to 10%, in addition to the production tolerance of plus or minus 10%. Thus, if the test shows that pickup is within these limits, the pickup calibration marks can be relied upon.

Time Delay Test

With the Test Set connected as shown in Fig. 3, set the pickup knobs at "A," and the instantaneous (or transfer) knob at 15X. Close the circuit breaker (if used).

Close and hold the power switch and set the desired test current. Open the switch, reset the timer dial and the timer circuit without changing the variable voltage transformer setting. Now, when the power switch is closed, the timing operation will start and continue until the circuit breaker opens and the timer stops. The measured time can be compared with the current-time curve for the appropriate static overcurrent trip device.

Other settings and/or multiples of pickup can be similarly tested within the limits of the Test Set (approximately 4-1/2 Amps.).

On the Models D, D1, D2, DG and DG1 static overcurrent trip device, it is also possible to test the time delay on the short-time bands. The procedure is as above, except set the TRANSFER knob at 5X, and the test current at 4 Amps. (approximate). The time to trip will be very short, as shown on the current-time curve. Each time-band may be tested by selecting the desired short-time band.

On the Models AG, AG1, AG2, DG, and DG1 static overcurrent trip device, it is not practical to test for time delay or pickup on the ground pickup circuit because of the high saturated reactance in that circuit. However, that is not a detriment since tests on the phase circuits (terminals 1-2 and 3-2) also prove the timing and pickup of the ground pickup circuit.

Transfer Test

With the Test Set connected as shown in Fig. 3, set pickup at "A" and instantaneous (or transfer) at 5X. Increase the current rapidly until the circuit breaker trips, which should be at 2.5 Amps. Other combinations of current and setting may also be tried.

On the Models D, D1, D2, DG, DG1 and 4WDG, the above procedure will not give a completely accurate result since there is time delay associated with the short-time bands. In this case, connect the voltmeter to terminals 4 and 6, and as the current is increased, the voltmeter will suddenly shift to a reading of 6 volts or more at 2.5 Amps. This indicates that transfer to the short-time band has occurred.

Trip Signal Test

This test may be used in conjunction with any of the previous tests that produce a circuit breaker tripping signal.

Connect the voltmeter to terminals 7 and 8 (8 is positive). When the test being conducted produces a trip signal, the voltmeter will suddenly jump to a reading of approximately 6 to 10 volts. This voltage will disappear when the test current is shut off.

It is apparent that the time delay before obtaining a trip signal can easily be predicted from the known static trip device settings, the known test current, and the appropriate current-time curve.

Trip Rating Table

Breaker Type	Models A3, AG2, 4WAG, D2, DG1, 4WDG — Long Time Delay Elements Available Pickup Settings (Amperes)					Tripping Transformer Group No.	Models AG2 and DG1 — Long Time Delay Element Available Ground Fault Settings (Amperes) — Percent of "A" Pickup				Models 4WAG and 4WDG — Inst. or Short Time Delay Available Ground Fault Settings (Amperes) — Percent of "A" Pickup			
	A	B	C	D	E		20%	40%	60%	80%	20%	40%	60%	80%
LA-600	40	50	60	70	80	I	–	–	–	–	–	–	–	–
LA-600	75	95	110	130	150	II	–	–	–	–	–	30	45	60
LA-600 LA-1600	125	155	175	220	250	III	–	–	–	–	25	50	75	100
LA-600 LA-1600	200	250	300	350	400	IV	40	80	120	160	40	80	120	160
LA-600 LA-1600	300	375	450	525	600	V	60	120	180	240	60	120	180	240
LA-600 LA-1600	400	500	600*	700	800	V-x	80	160	240	320	80	160	240	320
LA-1600	500	625	750	875	1000	VI	100	200	300	400	100	200	300	400
LA-1600	800	1000	1200	1400	1600	VII	160	320	480	640	160	320	480	640
LA-1600	1000	1250	1500*	1750	2000	VII-x	200	400	600	800	200	400	600	800
LA-3000	1200	1500	1800	2100	2400	VIII	240	480	720	960	240	480	720	960
LA-3000 LA-4000	2000	2500	3000			IX	400	800	1200	1600	400	800	1200	1600
LA-3000	2000	2500	3000	3500*	4000*	IX-x	400	800	1200	1600	400	800	1200	1600
LA-4000	2000	2500	3000	3500	4000	X	400	800	1200	1600	400	800	1200	1600

* Maximum continuous current for LA-600 is 600A, LA-1600 is 1600A, LA-3000 is 3000A and LA-4000 is 4000A.

GENERAL NOTES

1. Types
   - A – Dual Static (long time and instantaneous elements).
   - D – Selective Static (long time and short time elements).
   - AG – Dual Static with ground fault element for 3-wire circuits.
   - DG – Selective Static with ground fault element for 3-wire circuits.
   - 4WAG – Dual Static with ground fault element for 4-wire or 3-wire circuits.
   - 4WDG – Selective Static with ground fault element for 4-wire or 3-wire circuits.
2. The pickup settings of the instantaneous and short time delay elements are calibrated at 3, 5, 8 and 12 multiples of the long time delay pickup setting.
3. The maximum interrupting time is the maximum length of time that fault current flows, including arcing time.
4. Instantaneous maximum interrupting time may be greater when breakers are closed in on a fault depending on actual fault conditions. The maximum potential increase for a 3-phase fault is 0.01 seconds and for a single-phase ground fault is 0.02 seconds.
5. The lower limit of ground fault recognition is 25 amperes for an LA-600 breaker. For an LA-1600 breaker the lower limit is 40 amperes. Application of Models 4WAG and 4WDG is not recommended for LA-600 breakers having a minimum continuous current setting of less than 75 amperes or an LA-1600 breaker with a minimum continuous current setting of less than 200 amperes.

DUAL DEVICE

Model A – a general purpose device normally used for phase overcurrent protection. The pickup range is selected from the trip rating table and is continuously adjustable from "A" through "E" in the field. The instantaneous element is continuously field adjustable from 3 to 12 multiples of the long time delay pickup settings selected. The time delay band is selected and set at the factory – it is not field adjustable. Available time delays are minimum, intermediate and maximum.

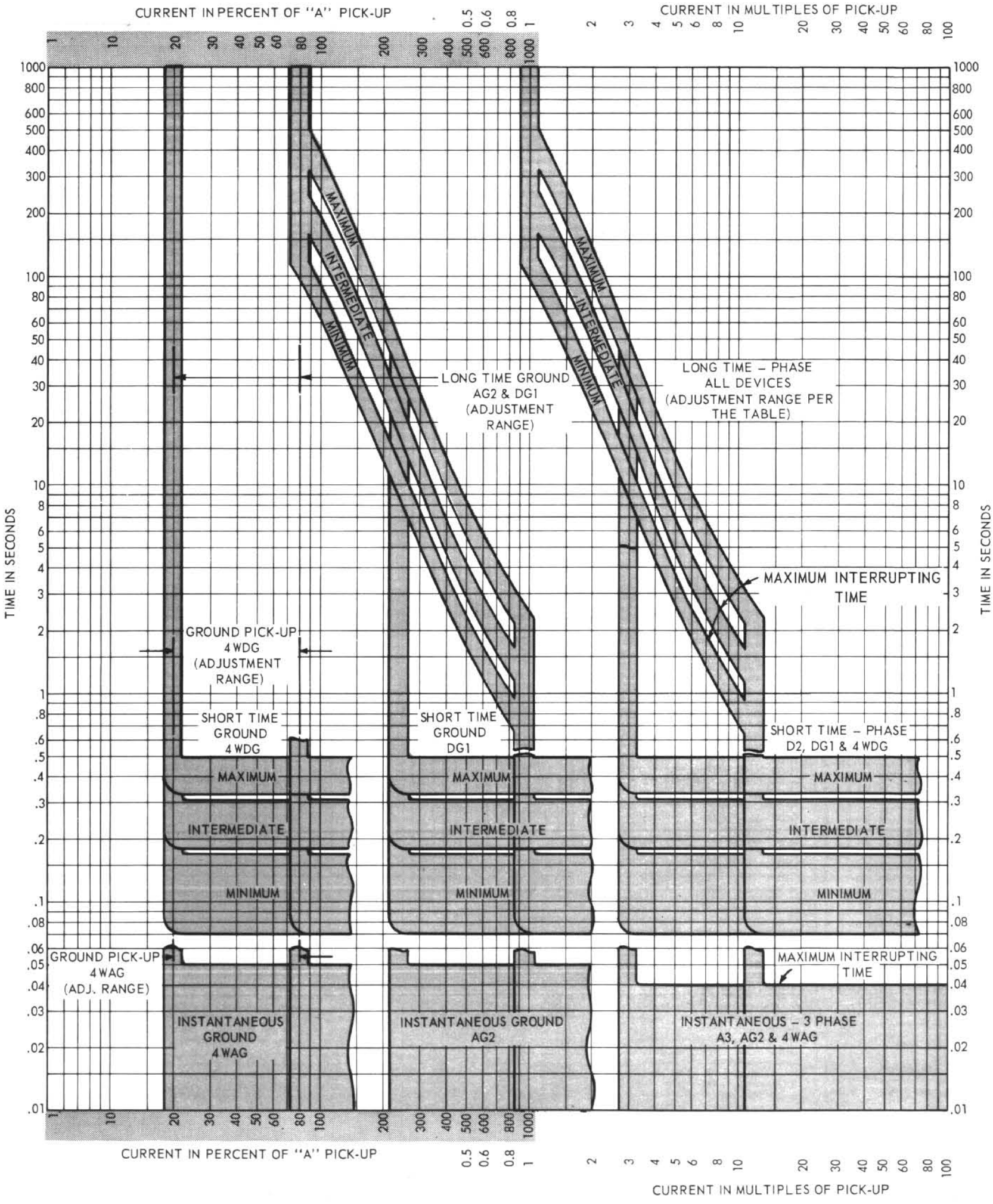
Model AG (optional) – provides phase overcurrent protection plus sensitive ground fault overcurrent protection for systems with phase-to-phase loading. Ground current pickup settings are independent of the phase pickup settings, and continuously adjustable in the field from 20% through 80% of the minimum phase pickup setting shown in column "A."

Model 4WAG (optional) – provides phase overcurrent protection plus sensitive ground fault overcurrent protection for 3-wire and 4-wire circuits for systems with phase-to-neutral loading. Ground current pickup settings are independent of the phase pickup settings, and continuously adjustable in the field from 20% through 80% of the minimum phase pickup setting in column "A."

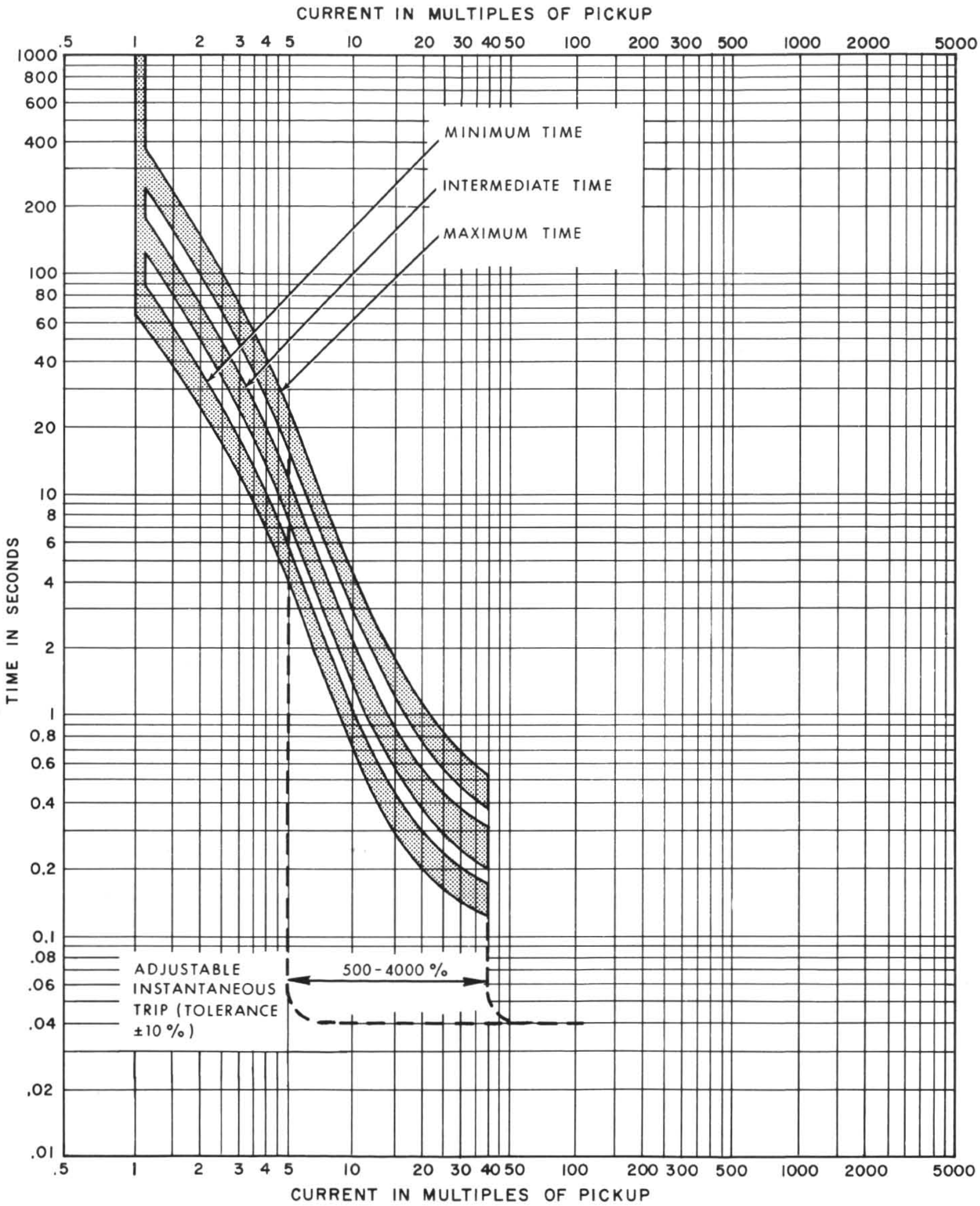
Model D (optional) – an overcurrent trip device which provides time delay tripping only. It allows field adjustment of long time delay and pickup and short time delay and pickup. The continuous adjustment feature allows a setting selection anywhere within calibrated points. The user can adjust the current at which the device transfers from long time to short time delay between these limits. Any one of the three short time delay curves can be chosen to be used with any of the three long time delay curves.

Model DG (optional) – provides phase overcurrent protection plus sensitive ground fault overcurrent protection for systems with phase-to-phase loading. Ground current pickup settings are independent of the phase pickup settings, and continuously adjustable in the field from 20% through 80% of the minimum phase pickup setting shown in column "A."

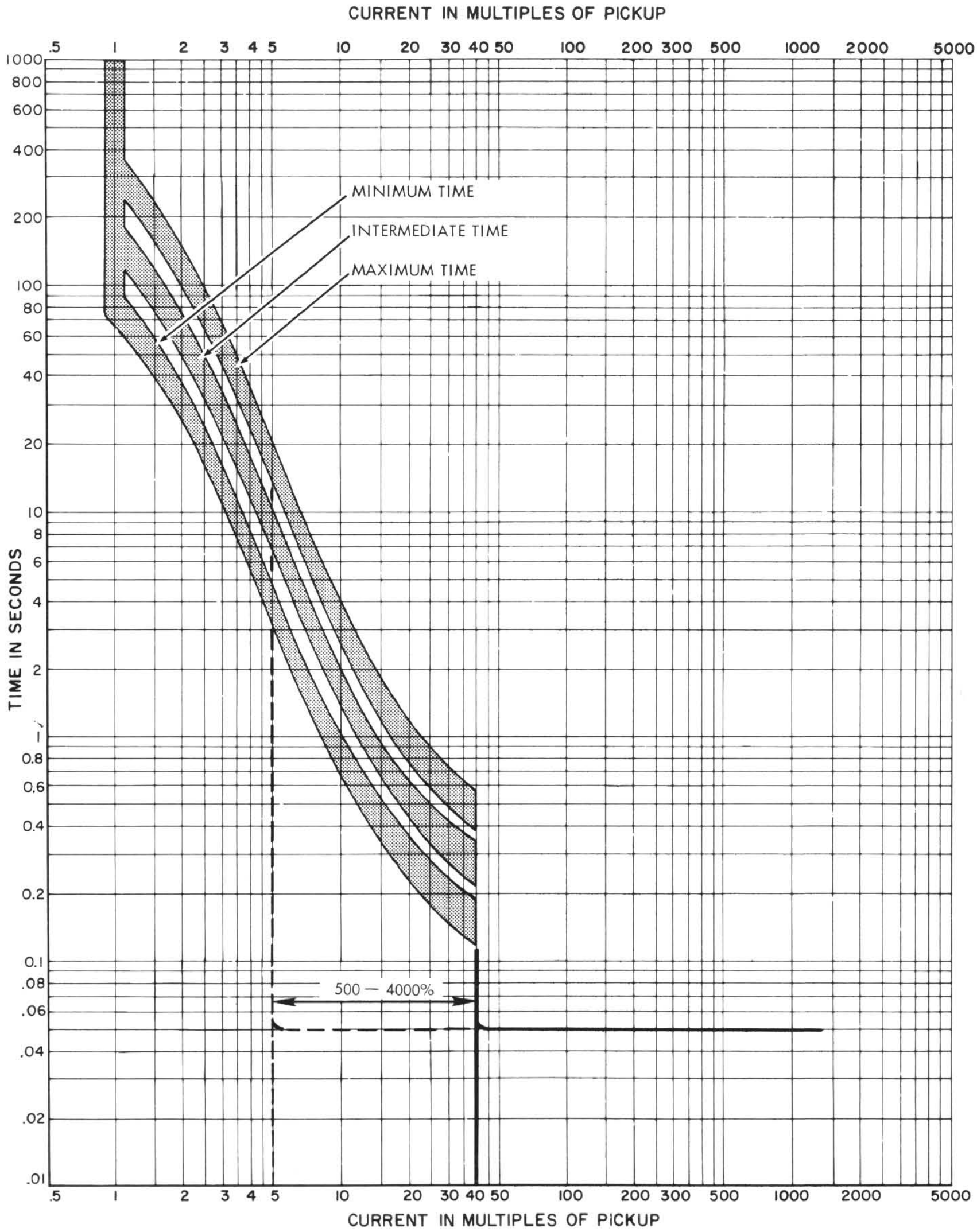
Model 4WDG (optional) – provides phase overcurrent protection plus sensitive ground fault overcurrent protection for 3-wire and 4-wire circuits for systems with phase-to-neutral loading. Ground current pickup settings are independent of the phase pickup settings and continuously adjustable in the field from 20% through 80% of the minimum phase pickup setting in column "A."



Current-Time Curves Models A, A1, A2, AG, AG1, AG2, D, D1, D2, DG, DG1, 4WAG, 4WDG



Current-Time Curves Models C, C1



Current-Time Curves Model C3