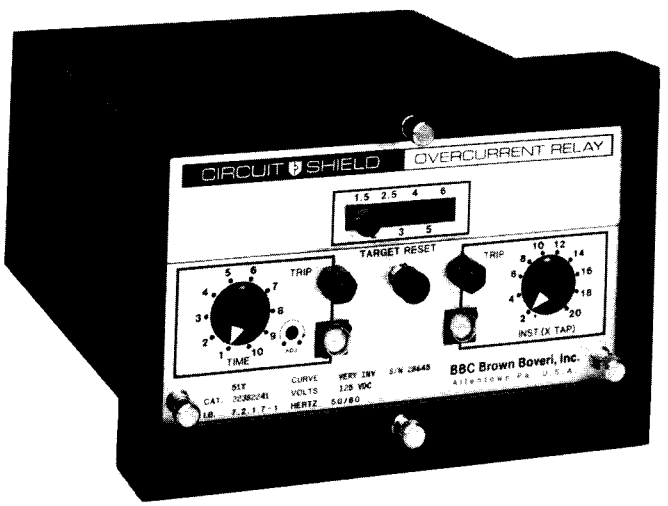
IB 7.2.1.7-1
Issue C

Instructions

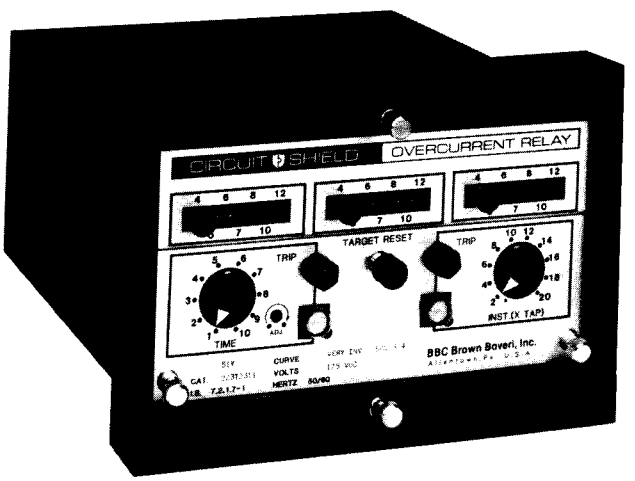
Overcurrent Relays

CATALOG SERIES 223/423
DRAWOUT SEMI-FLUSH MOUNTED
SINGLE PHASE, TWO PHASE, AND THREE-PHASE RELAYS

INVERSE	TYPE 51I
VERY INVERSE	TYPE 51Y
EXTREMELY INVERSE	TYPE 51E
DEFINITE TIME	TYPE 51D
SHORT TIME	TYPE 51S
LONG TIME	TYPE 51L
LONG TIME INVERSE	TYPE 51IM
LONG TIME VERY INVERSE	TYPE 51YM



SINGLE PHASE
FOR RESIDUAL GROUND PROTECTION



THREE PHASE
FOR PHASE PROTECTION

INSTRUCTIONS FOR CIRCUIT-SHIELD™ SOLID-STATE RELAYS
DRAWOUT SEMI-FLUSH MOUNTED
SINGLE PHASE, TWO PHASE, AND THREE PHASE

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INTRODUCTION

These instructions contain the information required to properly install, operate, and test the complete line of Type 51 solid-state overcurrent relays.

The CIRCUIT-SHIELD overcurrent relay is housed in a semi-flush drawout relay case suitable for conventional panel mounting.

All connections to the relay are made at terminals located on the rear of the case and clearly numbered, one (1) through twelve (12).

CURRENT, TIME, and INST. pickup controls are located on the front panel behind a removable clear plastic cover.

TIME and INST. target indicators are also mounted on the front panel. Both targets are reset by means of a pushbutton extending through the relay cover.

PRECAUTIONS

The following precautions should be taken when applying solid-state relays:

1. Incorrect wiring may result in damage to solid-state relays. Be sure wiring agrees with the connection diagram for the particular relay before the relay is energized. Be sure control power is applied in the correct polarity before applying control power.

2. Apply only the rated control voltage marked on the relay front panel. Unlike conventional relay contacts, solid-state outputs are rated for a particular control voltage. If rectified AC voltage is used in place of a battery, proper filtering will be required to insure SCR "Holding Current".

3. Be sure the trip circuit is interrupted by an "a" contact to remove high currents from solid-state output circuits. Solid-state output circuits have inherently high momentary current ratings and low continuous current ratings. Never exceed the ratings.

4. When applying input current to protective relays, be sure to interrupt the input current immediately after the relay operates.

5. Load (trip coils or auxiliary relays) must draw at least 0.10 amps to insure operation. SCR's require a minimum current to remain conducting after triggering. Parallel a resistance with a low current coil to guarantee the holding current, if necessary.

6. Do not attempt to manually operate target vanes on CIRCUIT-SHIELD overcurrent relays. Although the targets return their indication under shock, they can be damaged by manual operation with a pencil or pointed object.

7. Do not apply high voltage tests to solid-state relays. If a control wiring insulation test is required, bond all terminals together and disconnect ground wire before applying test voltage.

8. Be sure to note the connections to terminals 9, 10, and 11 (described under CONNECTIONS on page 3) required for the proper operation of the TIME and INSTANTANEOUS elements. Jumper links are supplied with all relays.

9. Only the lower circuit board of the CIRCUIT-SHIELD overcurrent relay is removable. This board should insert smoothly. Do not use force.

10. Note that removal of the tap block pin is equivalent to setting the highest tap.

11. Follow test instructions to verify that the relay is in proper working order.

CAUTION: Since troubleshooting entails working with energized equipment, caution should be taken to avoid personal shock. Only competent technicians familiar with good safety practices should service these devices.

PLACING THE RELAY INTO SERVICE

1. RECEIVING, HANDLING, STORAGE

Upon receipt of the CIRCUIT-SHIELD relay (when not included as part of a switchboard) examine for shipping damage. If damage or loss is evident, file a claim at once and promptly notify the nearest Asea Brown Boveri Office. Use normal care in handling to avoid mechanical damage. The CIRCUIT-SHIELD system has no vital moving parts and if kept reasonably clean and dry, has no practical limit to its operating life.

2. INSTALLATION

Mounting

The outline dimensions and panel drilling and cutout information is given in Figure 2.

Connections

External connection diagram is shown in Figure 1.

For the instantaneous function to be operable Terminals 9 and 10 must be externally shorted. Instantaneous relay operation can be cancelled for reclosing applications by using an external supervisory contact connected to these terminals.

For the TIME function to be operable terminals 10 and 11 must be externally shorted. The TIME function can be cancelled for directional or voltage control by using an external supervisory contact connected to these terminals.

All CIRCUIT-SHIELD relays have metal front panels which are connected through printed circuit board runs and connector wiring to a terminal at the rear of the relay case. The terminal is marked "G" and is located as shown in Fig. 2 below. In all applications this terminal should be wired to ground.

Special care must be taken to connect control power in the proper polarity. Reversing plus (+) and minus (−) will cause SCR A and SCR B to block the flow of trip current and the relay will not function. For capacitor trip applications, the plus (+) output of the capacitor trip device must be connected to terminal 7 of the relay, the negative (−) to terminal 8.

3. SETTINGS

Current Pickup Taps

A tap block for each phase is located on the relay front panel. Each tap block provides for seven (7) pickup settings which are marked in CT secondary amperes. When a pin is pulled out, that phase switches to the maximum tap setting. The pin may be moved with the relay in service.

Time Dial

One of ten (10) time-current curves is selected by a two-element control labeled TIME on the left side of the relay front panel.

a) A ten position SWITCH giving discrete steps 1 through 10.

b) A screwdriver adjusted VERNIER providing continuous time adjustment between steps.

When the vernier, marked "ADJ", is turned to the extreme counterclockwise position, the time-current curve shown on the switch has been selected. The vernier provides a continuous time adjustment between the switch selected curve and the curve indicated by the next higher number. Intermediate positions can be verified by test.

Instantaneous

Instantaneous pickup is selected by the potentiometer dial on the right side of the relay front panel. The dial is labeled "INST." The markings indicate multiples of the pickup tap setting.

For example, if the phase one (1) tap is set at six (6) amperes and the INST dial is set at eight (8), the INST. setting is:

6 amps X 8 = 48 amps

Consequently, an instantaneous trip will occur at 48 amps in phase one (1) of the relay.

TESTING IN SERVICE

In general, it is not necessary to schedule periodic maintenance of this relay. However, if a trip test is desired to confirm the proper functioning of the system, the following procedure can be used.

Mounted in Switchgear

Tests should be made on a de-energized main circuit. If tests are to be made on an energized circuit, be sure to take all necessary precautions.

It is customary to test the trip circuit of electro-mechanical overcurrent relays by manually closing the trip contacts to trip their associated circuit breakers. If the contacts are allowed to part before the seal-in contact closes, the relay contacts are eroded by the arc. Also, high transient voltages will appear from trip bus to positive.

This problem is avoided in the CIRCUIT-SHIELD overcurrent relay by the operational test feature. Separate pushbuttons labeled "TRIP" are provided for the TIME and INST. functions. The pushbuttons, recessed to prevent accidental operations, will cause the breaker to trip.

A portion of the control voltage is applied to the time circuit when the TIME pushbutton is depressed. The time delay circuit then produces a trip signal, in a time corresponding to approximately two (2) multiples of current tap setting, (at nominal control voltage), and the TIME target operates. For this test the INST. pickup must be set above (2) multiples or the INST. element will trip first.

Similarly, a portion of the control voltage is applied to the INST. circuit when the INST. pushbutton is depressed, producing a trip signal and operating the INST. target.

On special three phase relays with individual phase targets, the tests described will cause the middle phase target to operate in addition to the TIME or INST. target.

Test Accessory

A test accessory which can be used to quickly check the primary C.T.'s, the upper non-drawout input section of the relay, control power, and the continuity of the trip circuit is available from the factory. This drawout test accessory is plugged into the relay in place of the drawout element to make the checks. See IB-7.2.1.7-2 for details.

APPLICATION DATA

The Type 51 series of overcurrent relays provide overcurrent protection phase-to-phase or phase-to-ground. They are designed to be operated by standard five (5) ampere secondary current transformers. The output circuit (trip circuit) will operate conventional circuit breaker trip coils at the DC voltage specified on the relay nameplate.

These relays can be used for all applications where conventional electromechanical relays are used. They come in seven different time-current curve families, INVERSE (51I), VERY INVERSE (51Y), EXTREMELY INVERSE (51E), SHORT TIME (51S), LONG TIME (51L), DEFINITE TIME (51D), LONG TIME INVERSE (51IM), and LONG TIME VERY INVERSE (51YM). A standard INSTANTANEOUS function or a special INVERSE INSTANTANEOUS function can be furnished as an option with any of the time families.

Any one of seven control voltages can be obtained: 24Vdc, 32Vdc, 48Vdc, 125Vdc, 250Vdc, 175Vdc (120Vac capacitor trip), 350Vdc (240Vac capacitor trip).

These overcurrent relays are offered with the following pickup ranges:

Range	Taps ‡
0.1-0.5	0.1, 0.15, 0.2, 0.25, 0.3, 0.4, 0.5
0.5-2.0	0.5, 0.6, 0.8, 1.0, 1.2, 1.5, 2.0
1.5-6.0	1.5, 2.0, 2.5, 3, 4, 5, 6
2.5-5	2,5, 2.8, 3.1, 3.5, 4.0, 4.5, 5.0
2.5-10	2.5, 3.75, 5, 6.3, 7.5, 8.6, 10
4-12	4, 5, 6, 7, 8, 10, 12

‡ When tap plug is removed, affected phase reverts to the maximum pickup.

TOLERANCES

TIME PICKUP ..... ±5% of tap setting

TIME DELAY

dial #10 (2-20 multiples) ..... ±5%
dial #1 (2-20 multiples) ..... 10 ms or ±10% (whichever is larger)

INST. PICKUP ..... ±10% of pickup amps (tap x dial setting)

RATINGS

TEMPERATURE

Nominal ..... 25°C ambient
Additional ±5% tolerance ..... −15°C to +55°C
Must operate ..... −30°C to +70°C

FREQUENCY

Nominal ..... 60 Hertz
Additional ±5% tolerance ..... +1 to −3 Hertz

INPUT CIRCUIT

Phase one (1) current — terminals 1 and 2.
Phase two (2) current — terminals 3 and 4.
Phase three (3) current — terminals 5 and 6.

The current input for single-phase relays is made at terminals 3 and 4.

Each input current is fed to a tapped transformer primary. The secondary winding produces a voltage across a burden resistor. This voltage is rectified and supplied to the static circuitry.

The pickup of the static circuit is adjusted to the desired pickup current by tap selection of the transformer primary turns.

INPUT CURRENT RATINGS

Time	Tap Range, A	Input Current, 1 Ø or 3 Ø (CT Secondary Amperes)
1 Second	0.1 - 0.5 0.5 - 2.0 1.5 - 6.0 2.5 - 5.0 2.5 - 10	300 multiples of pickup tap setting or 235 A rms, whichever is less.
	4 - 12	390 A rms
Continuous	All Ranges	1.5 multiples of pickup tap setting.

BURDEN

The burden of the Circuit Shield overcurrent relay is very low, allowing the use of current transformers which would give unsatisfactory performance if they were driving electro-mechanical relays.

Because the input characteristic of the Circuit Shield relay is nonlinear, an impedance cannot be specified, however, the burden voltage across the relay current input terminals can be readily calculated for any given value of current transformer secondary current:

TAP (AMPS)	R_{DC} OHMS
0.5	.092
0.6	.078
0.8	.065
1.0	.055
1.2	.048
1.5	.040
2.0	.032
1.5	.042
2.0	.034
2.5	.038
3.0	.026
4.0	.022
5.0	.020
6.0	.0185
4	.020
5	.020
6	.0185
7	.0175
8	.017
10	.0165
12	.0165

$$V = \frac{1.0}{I_T} + I_S \times R$$

V = burden voltage (volts)
I_S = current transformer secondary current (amperes)
I_T = relay pickup current tap setting (amperes)
R = D.C. resistance of relay input circuit (ohms) (select from table)

NOTES:

1. for units with 0.1 to 0.5A tap range, the Is x R term is negligible.
2. for units with 2 to 5A tap range, use values shown for 1.5 to 6A unit.

OUTPUT CIRCUIT

The CIRCUIT-SHIELD overcurrent relay energizes the breaker trip coil by means of an output SCR. Two SCR's are provided, one for the time delay and one for the instantaneous circuit as indicated in the wiring diagram shown in Figure 1.

As shown, relay terminal 7 is connected to the control power positive, with the trip coil connected to relay terminal 12 through a 52/a contact.

SCR A is gated by the time delay circuit, while SCR B is gated by the instantaneous circuit.

Note that once an SCR is gated (turned on), it will remain in conduction until its anode current falls below its holding current which typically is 5 to 20 milliamperes. Consequently, the trip coil current must be interrupted with the 52/a contact.

OUTPUT TRIP CIRCUIT RATINGS

Nominal Voltage	Range of Operation	Max. Current, Amps DC		
		6 Cycles	1 Second	Continuous
24 Vdc	18 - 30			
32 Vdc	24 - 40			
48 Vdc	28 - 60			
125 Vdc	70 - 140			
250 Vdc	140 - 280	30	15	1
175 Vdc	100 - 195			
350 Vdc	200 - 385			

* Capacitor Trip Applications

TARGET CIRCUITS

The target indicators for the TIME and INST. circuits are polarity sensitive devices which are set by current flow through the corresponding trip SCR.

Target reset is accomplished by the control power connection (terminals 7 and 8 of Figure 1) through the TARGET RESET pushbutton.

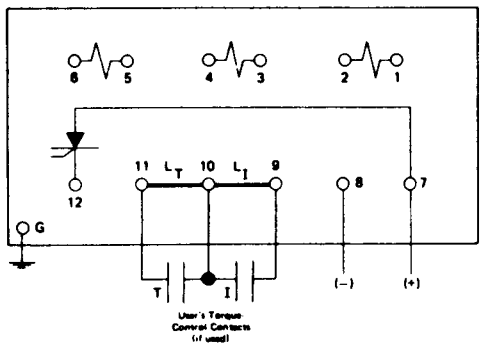
Standard relays have 2 targets TIME and INST. Three phase relays may be specially ordered with 5 targets — TIME, INST. and PHASE targets. These 3 additional targets wil indicate which phase currents are in excess of tap setting when the relay trips the breaker.

FREQUENCY RATING

See page 17.

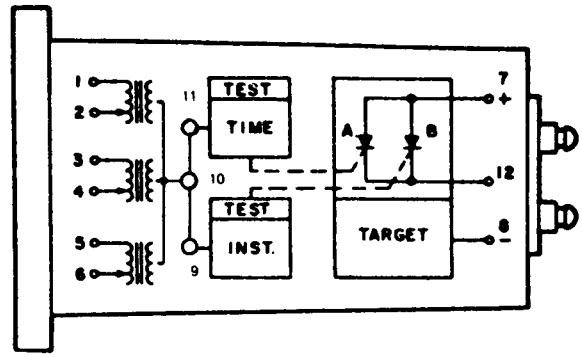
Internal Connection Diagrams

12D223A
TIME-OVERCURRENT RELAYS
Type 51 (with or without Instantaneous)
Single Phase Relays — omit coils 1-2 and 5-6)
(Two Phase Relays — omit coil 3-4)



Note:
User to remove links L_T or L_I only if torque-control contacts are to be used:

1. Remove only L_T for torque-control of 51. (Time element)
2. Remove only L_I for torque control of 50. (Instantaneous element)



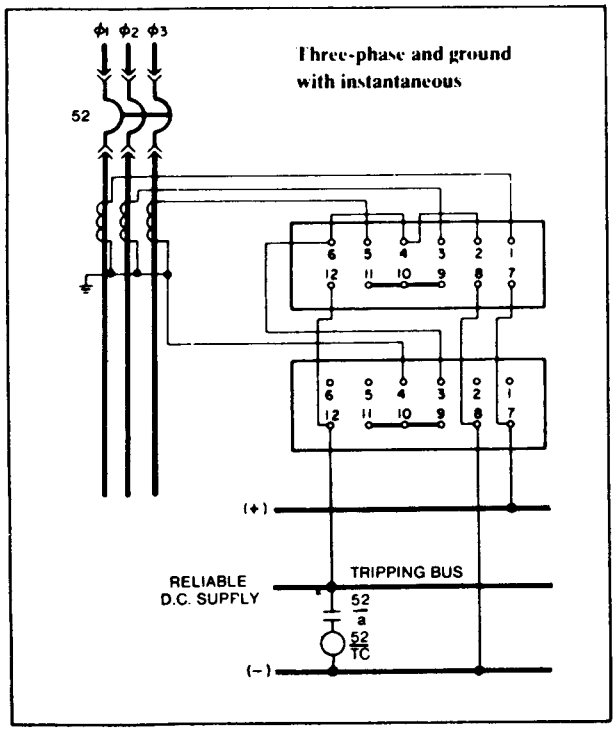
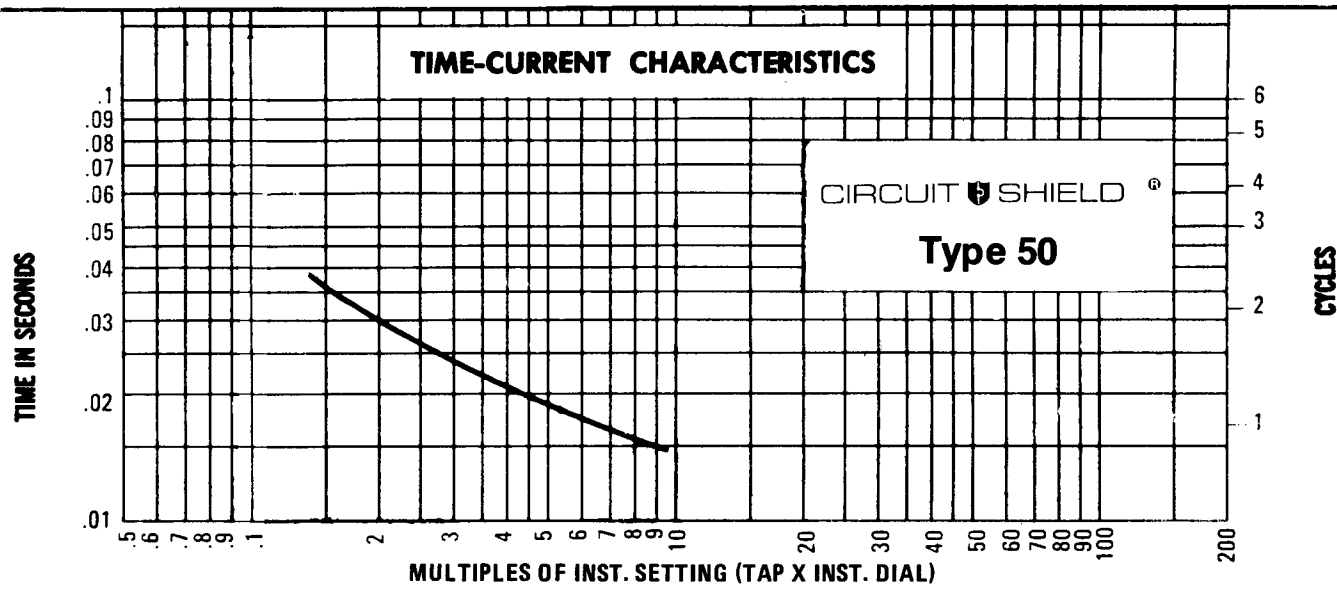


FIGURE 1

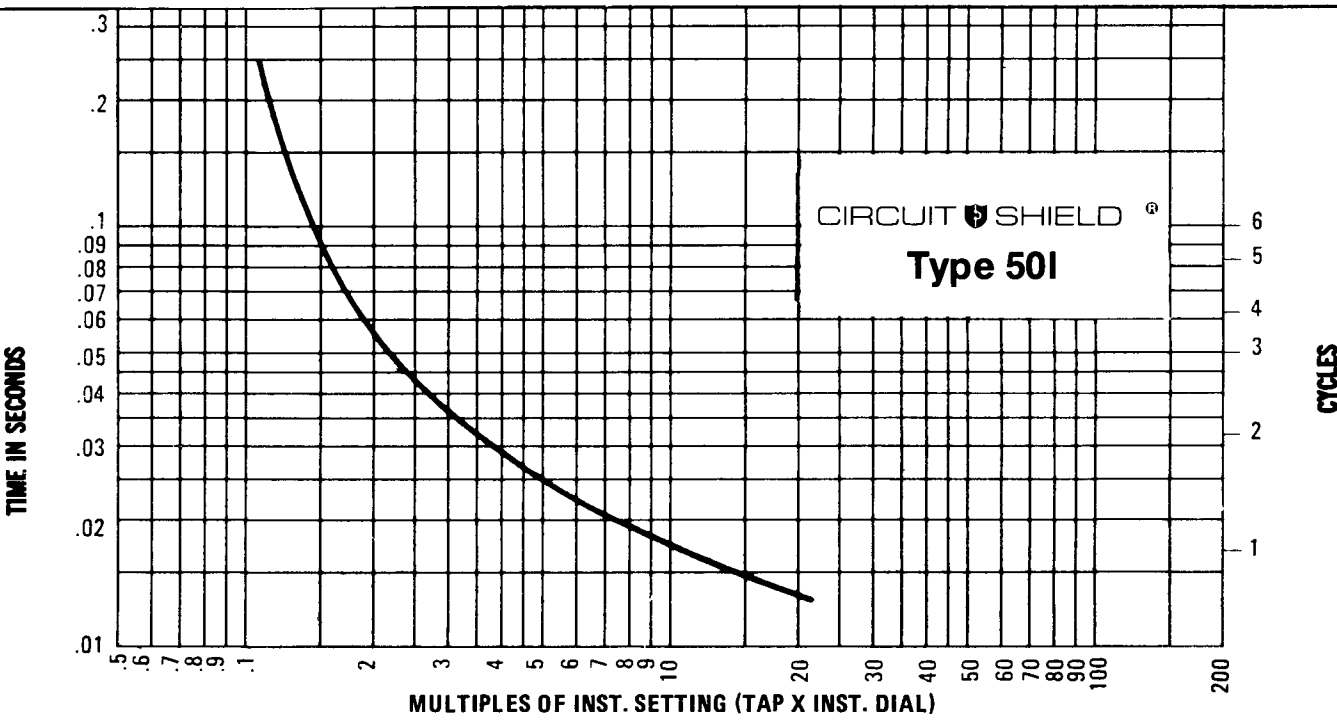
Internal Connections and Typical External Connection Diagram



TYPE 50 INSTANTANEOUS

Oct. 19, 1971

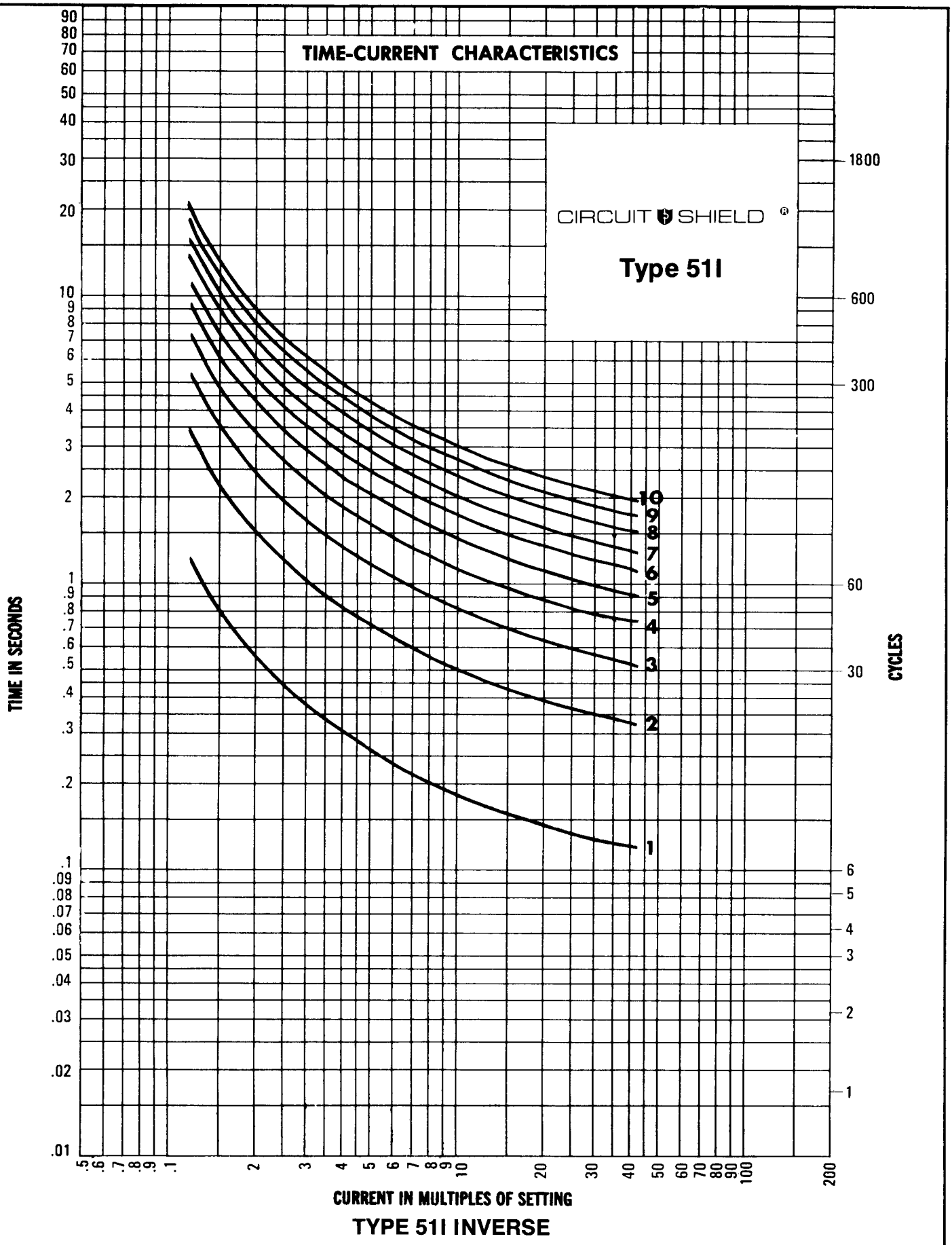
TCC605807



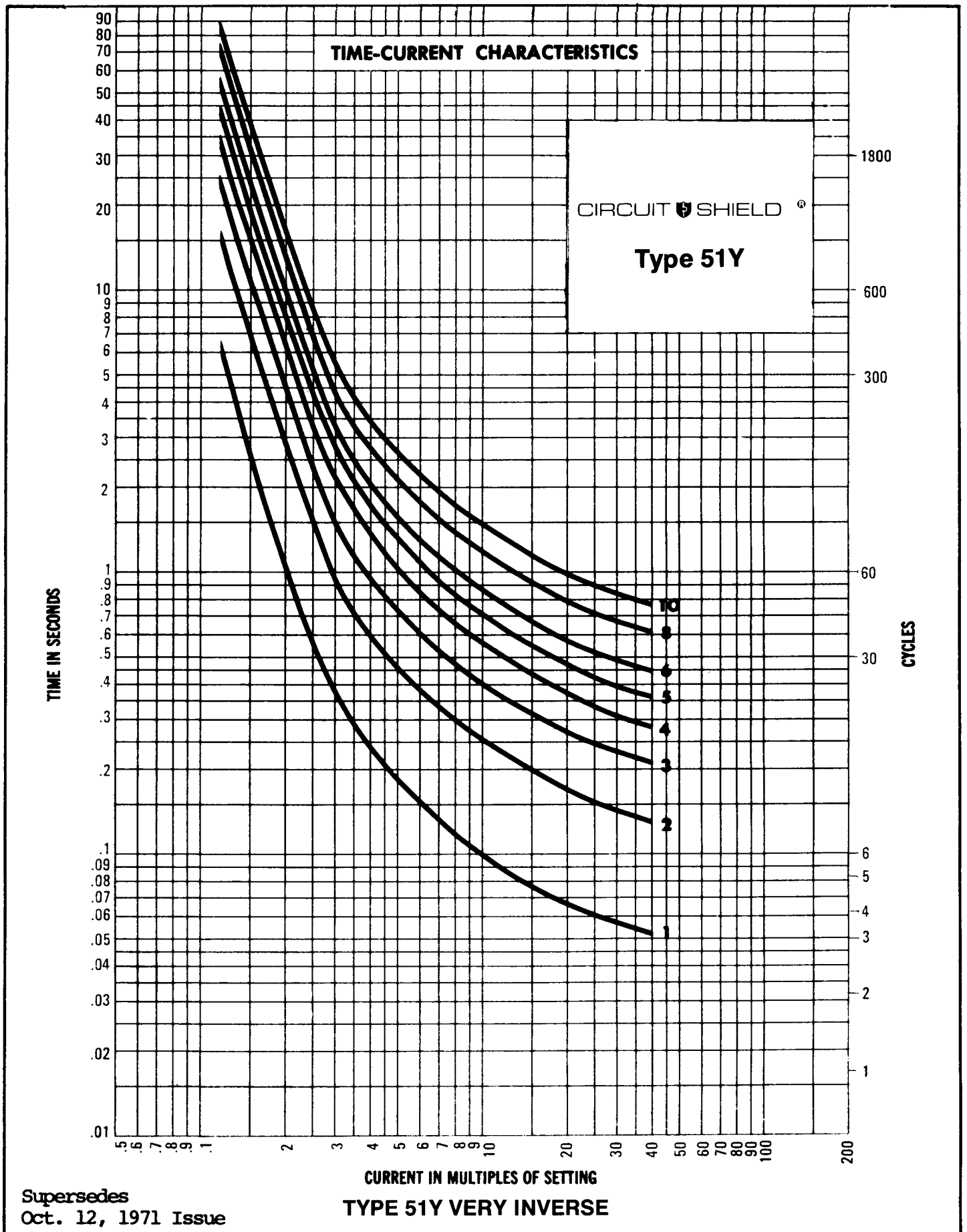
TYPE 50I INVERSE INSTANTANEOUS

Aug 29, 1972

TCC605812



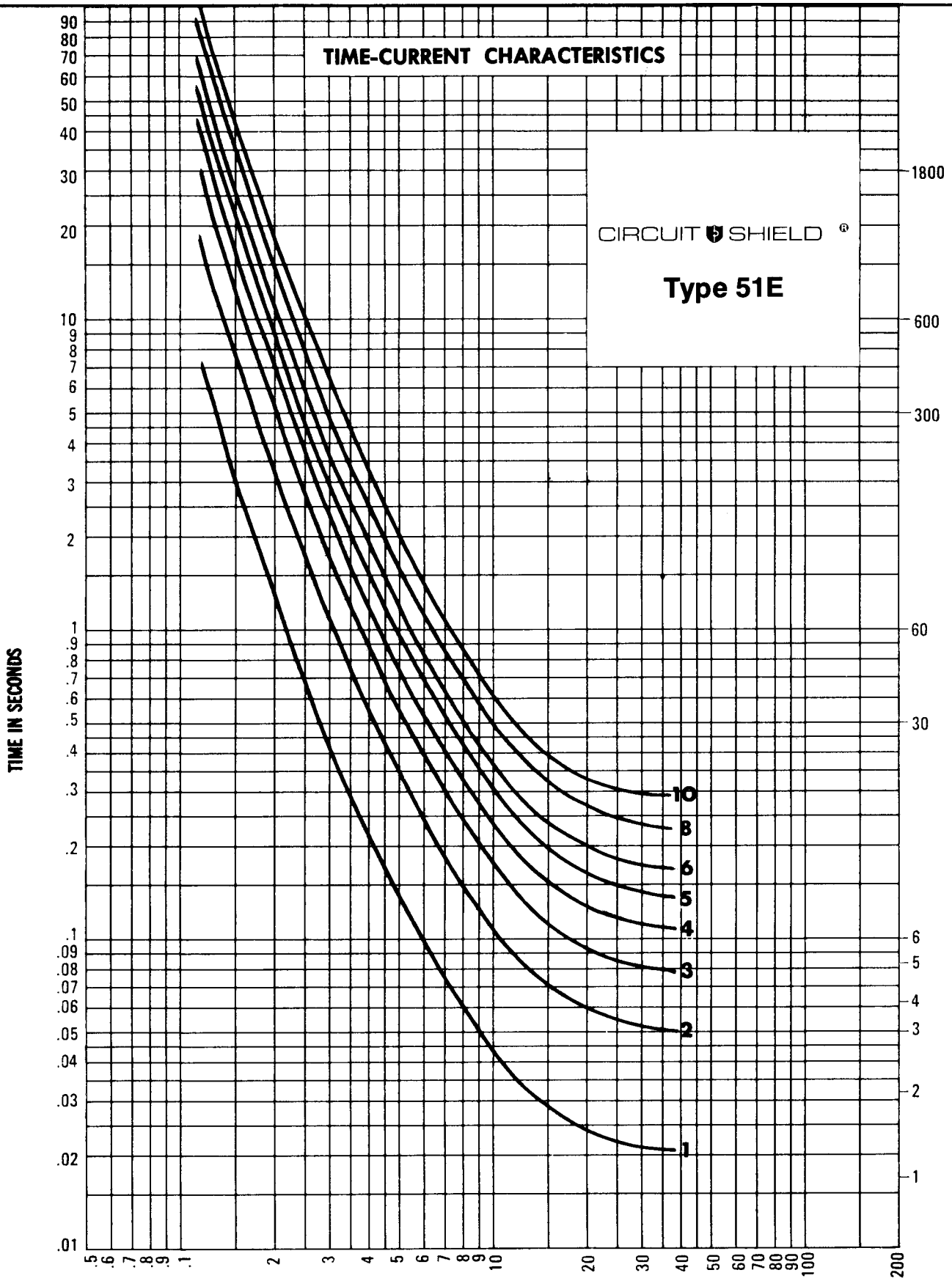
TYPE 51I INVERSE



Supersedes
Oct. 12, 1971 Issue

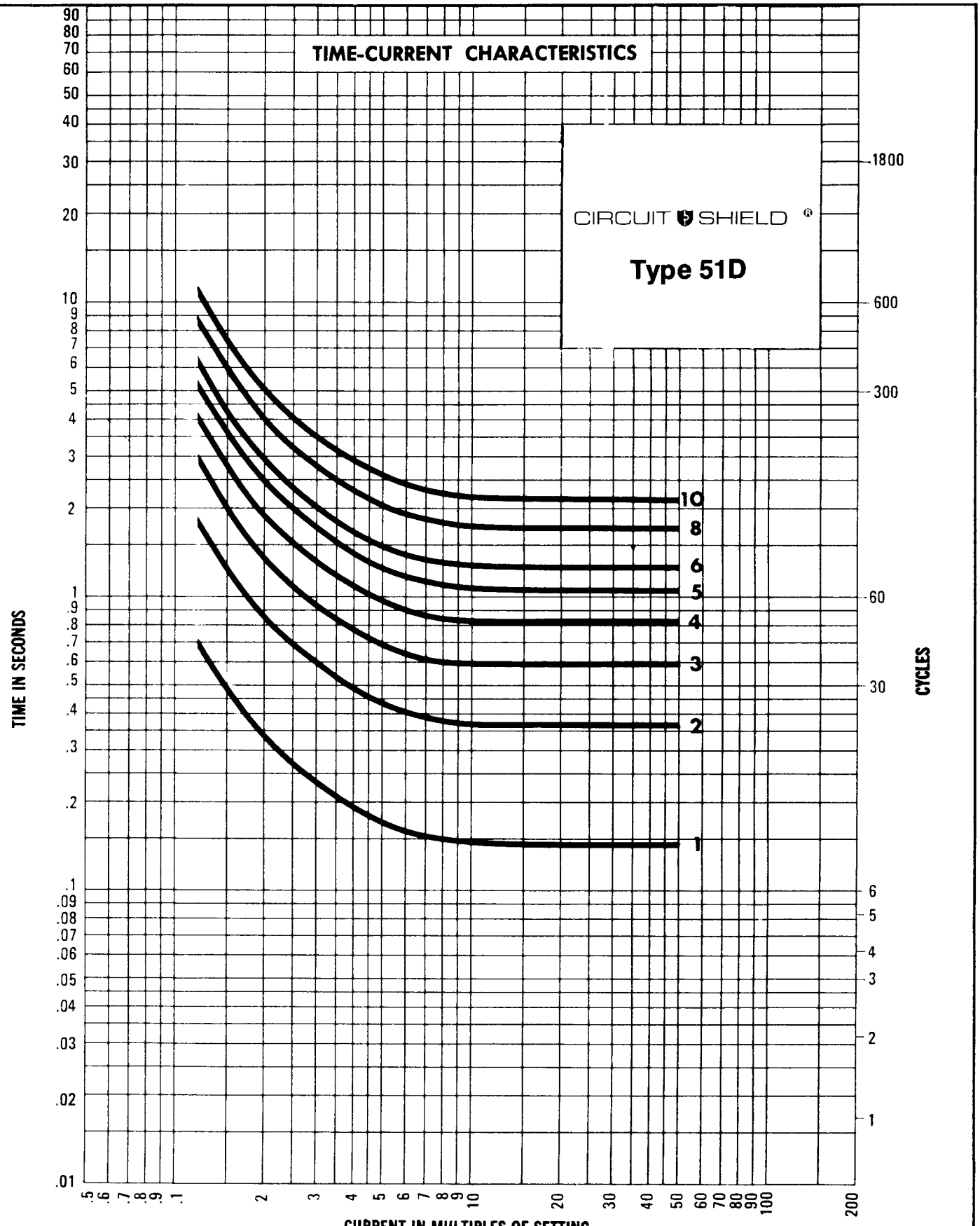
TYPE 51Y VERY INVERSE

SOLID-STATE OVERCURRENT RELAYS



TYPE 51E EXTREMELY INVERSE

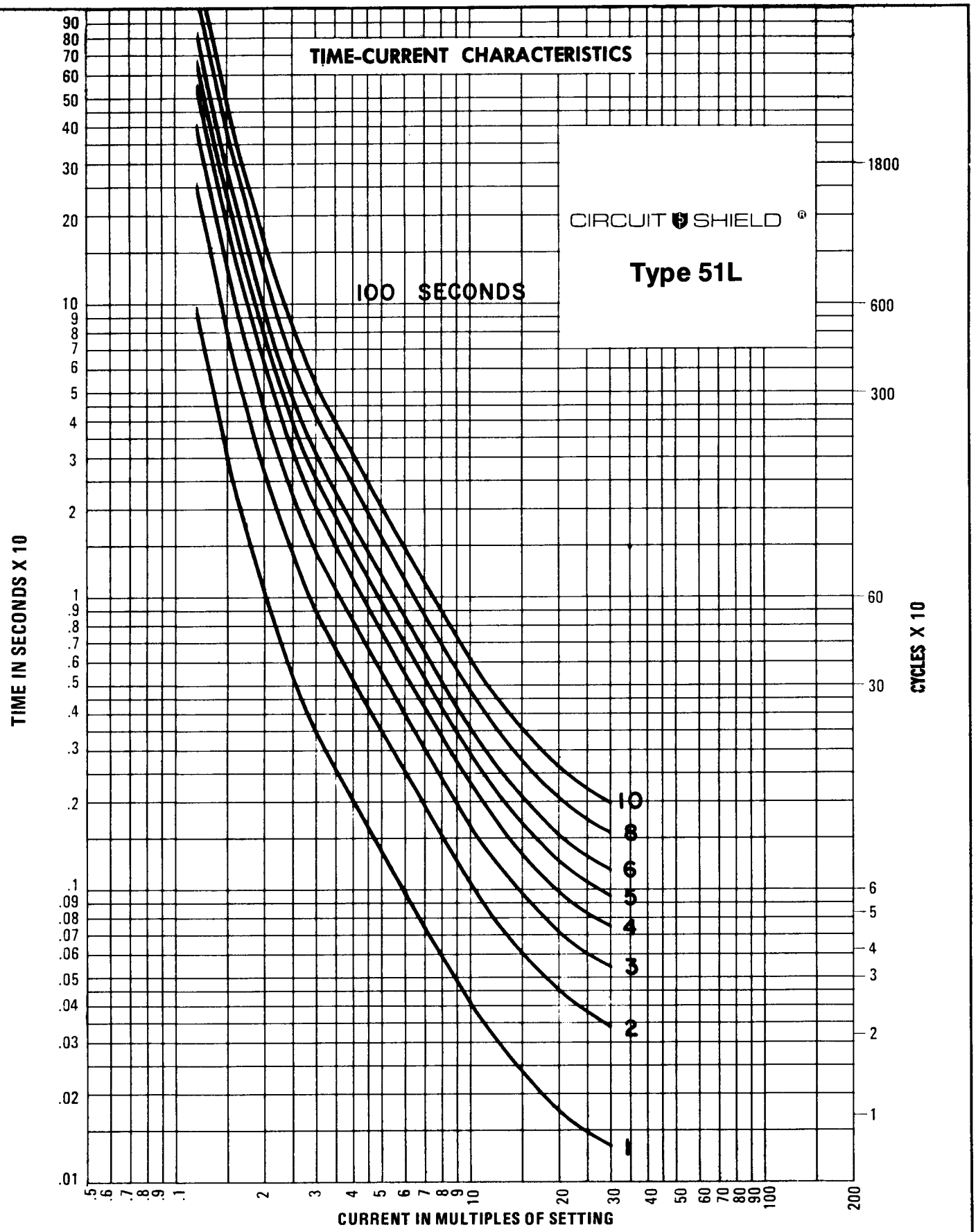
OCT. 12, 1971	TCC605803



TYPE 51D DEFINITE TIME

MAR. 26, 1974

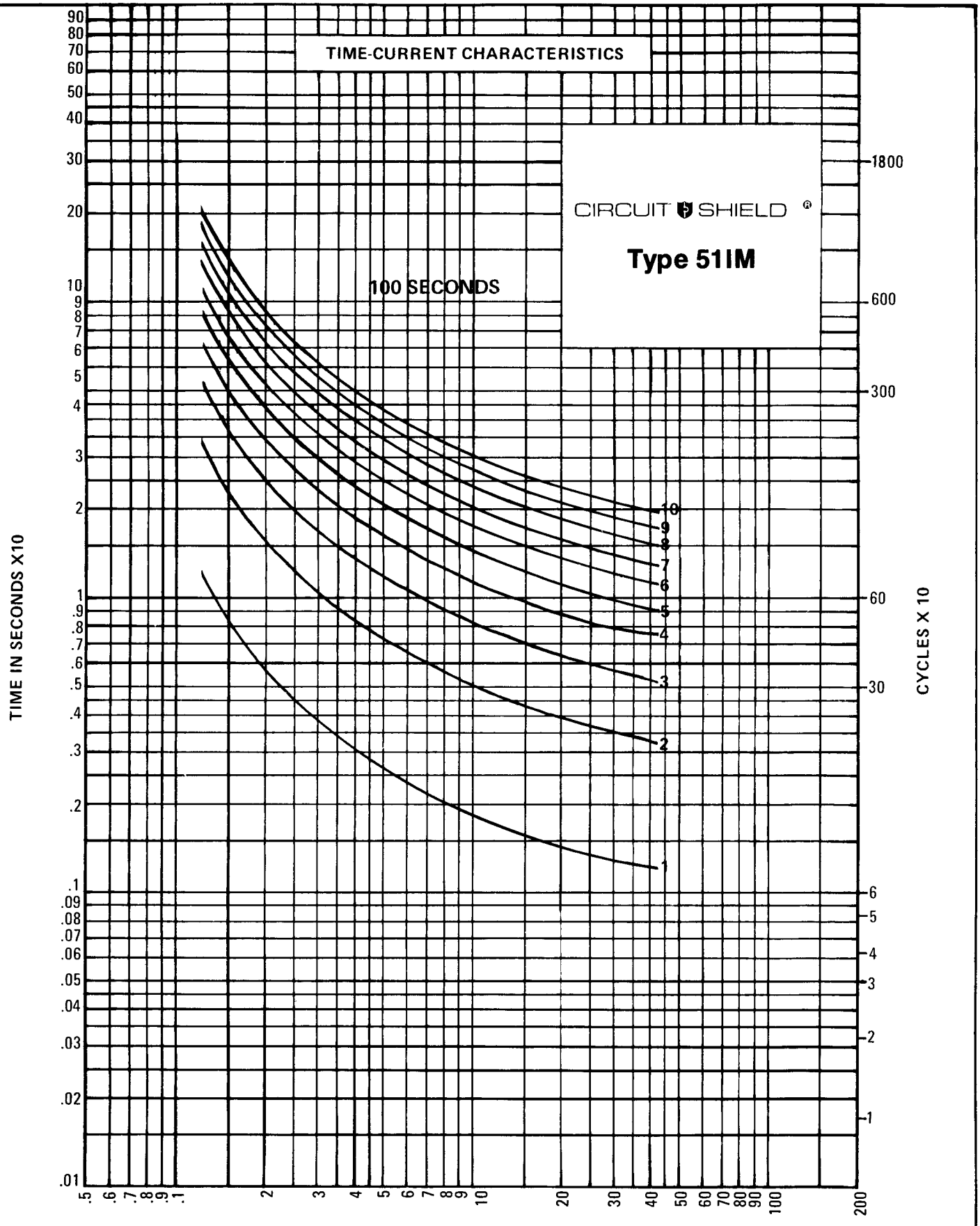
TCC605806



TYPE 51L LONG TIME, EXTREMELY INVERSE

MAR. 9, 1973

TCC605805

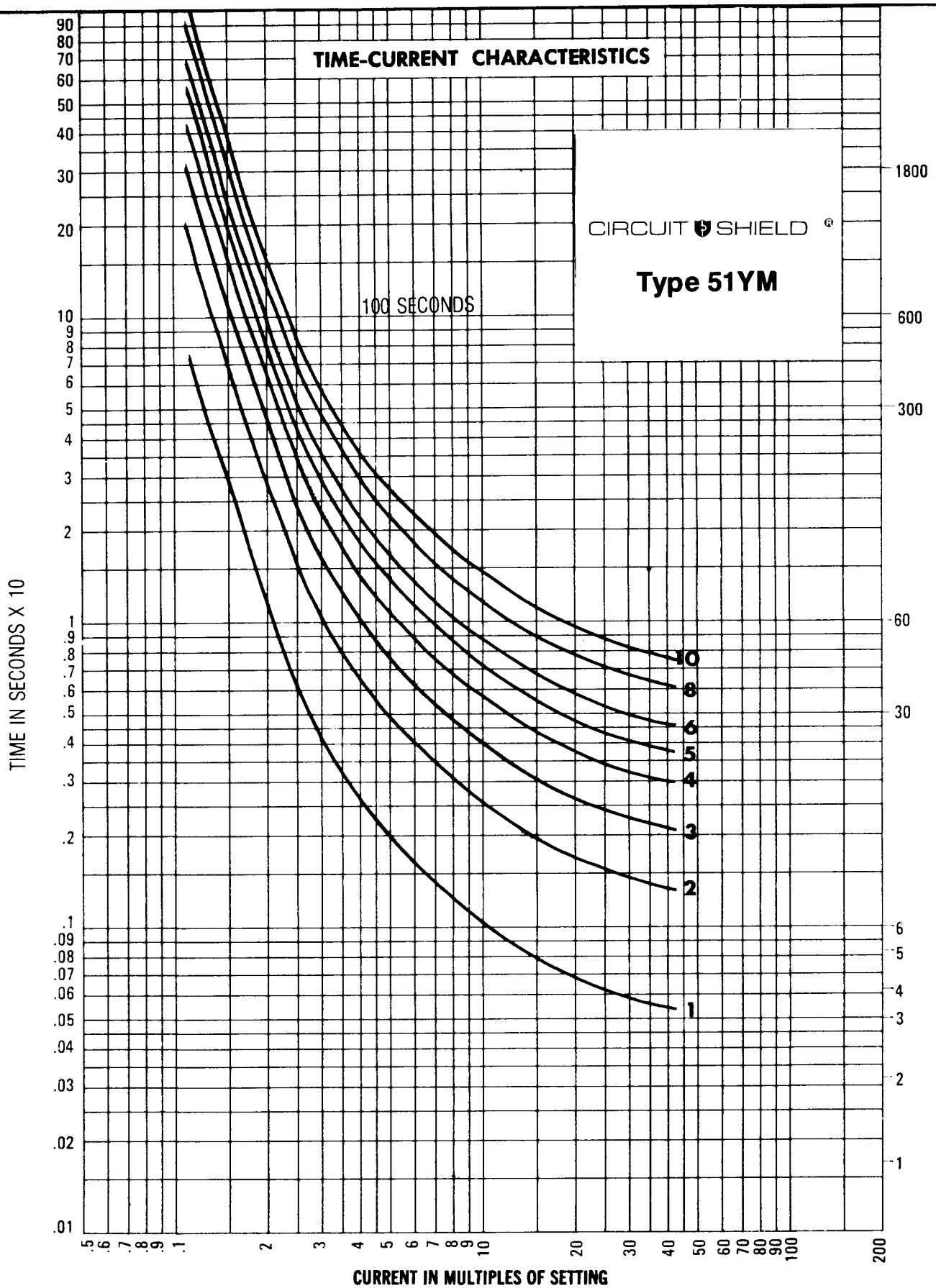


TYPE 51IM LONG TIME, INVERSE

MAR. 26, 1974

TCC605813

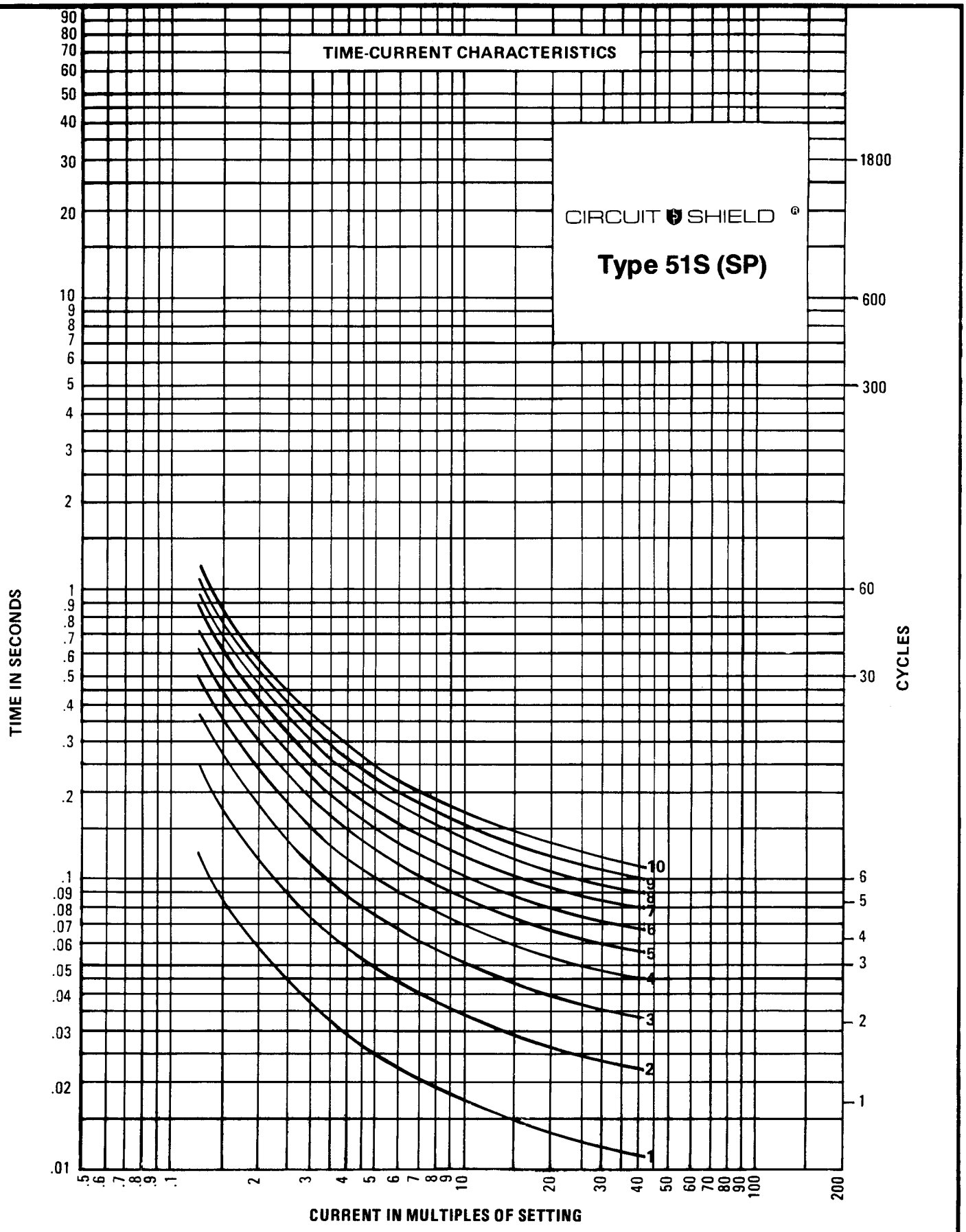
SOLID-STATE OVERCURRENT RELAYS



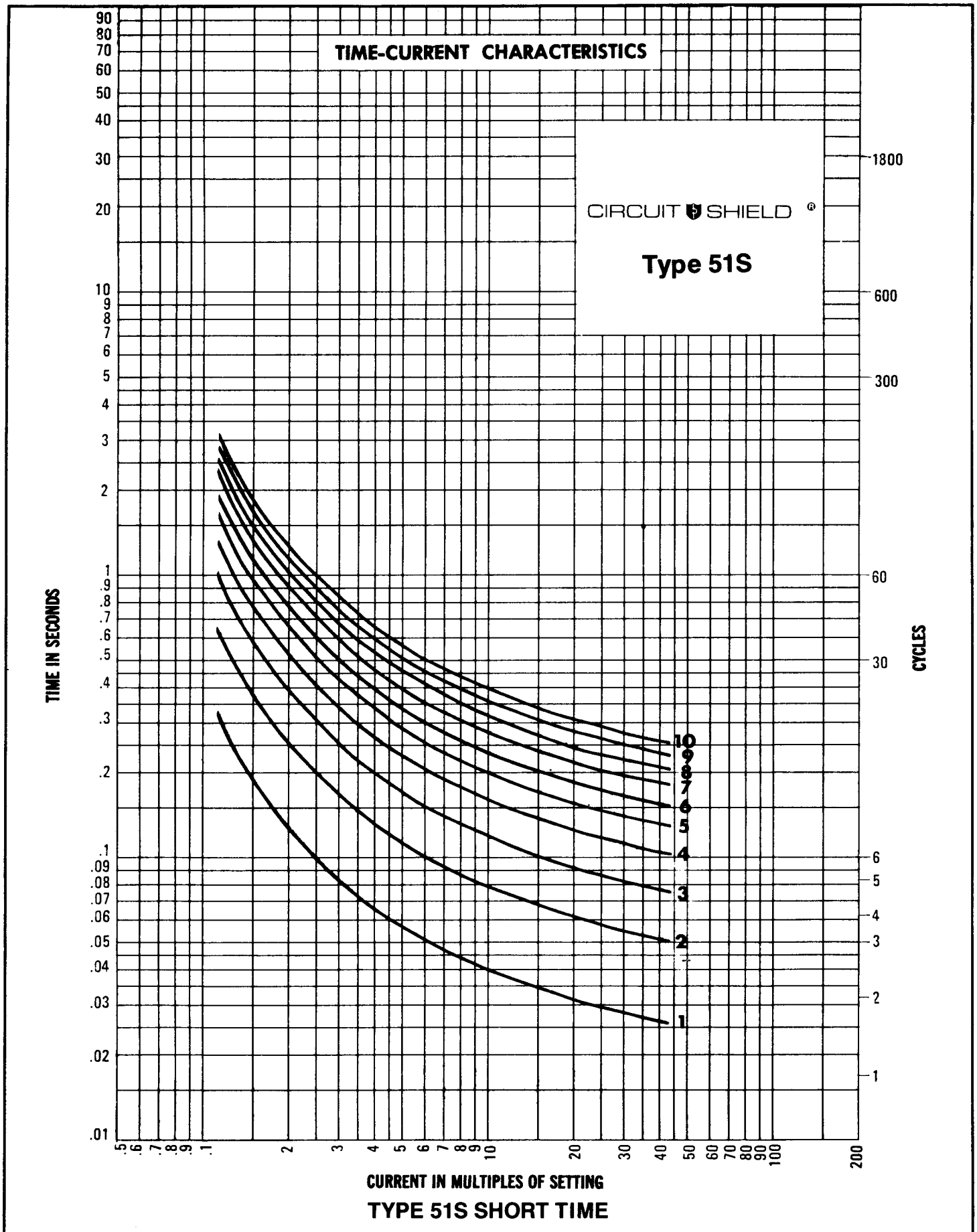
TYPE 51YM LONG TIME, VERY INVERSE

JULY 6, 1972

TCC605811



TYPE 51S (SP) SHORT TIME



TYPE 51S SHORT TIME

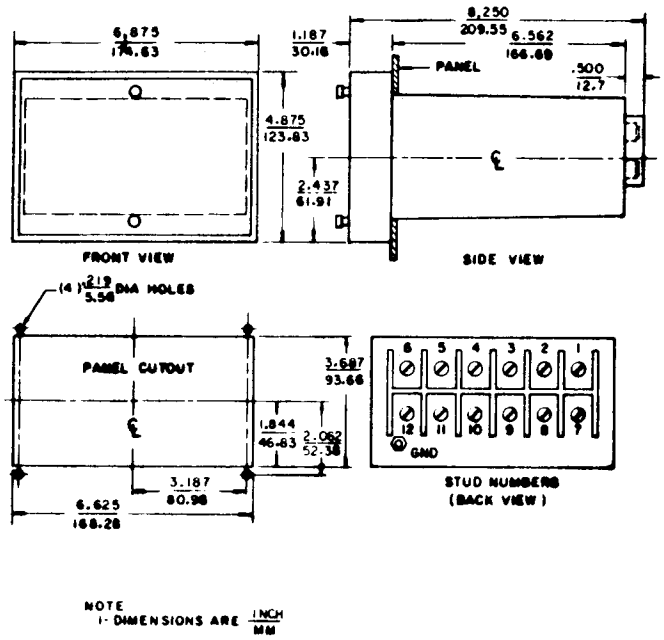
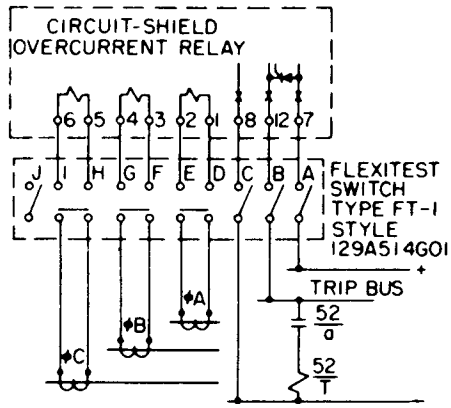


Fig. 2 — Overcurrent Relay Outline and Drilling



Suggested arrangement for drawout type test facilities to be used by those wishing to maintain their conventional test procedures when checking solid-state overcurrent relays.

This sketch shows Westinghouse's Flexitest Switch. However, G.E., States, Meter Devices, or other types can be used.

Fig. 3 — Typical Test Switch Connections

FREQUENCY RATING

Type 51 series relays with a nameplate rating of 50/60 Hz are suitable for operation at either frequency; however, the time current curves shown on pages 7-16 apply only to 60 Hz operation. To determine the operating time for 50 Hz applications use the correction factors shown here.

Type 51I inverse relays with a nameplate rating of 50 Hz (only) will perform per curve TCC605801 when operated at 50 Hz. The correction factors should NOT be used.

Use the following conversion table to convert 60 Hz curves to 50 Hz operation. This conversion applies only to relays rated 50/60 Hz.

60 HZ MULTIPLE	50 HZ MULTIPLE
1	1
2	2
3	3.18
4	4.38
5	5.58
6	6.78
8	9.18
10	11.58
15	17.58
20	23.58
40	48.42

Plot the time corresponding to a multiple of current in the 60 Hz column against the multiple in the 50 Hz column.

EXAMPLE:

Find the time corresponding to 4 multiples of current on the 60 Hz curve in the instruction book. Plot this value of time for 4.38 multiples of current for 50 Hz.

TESTING

1. MAINTENANCE AND RENEWAL PARTS

CAUTION: Since troubleshooting entails working with energized equipment, caution should be taken to avoid personal shock. Only competent technicians familiar with good safety practices should service these devices.

No routine maintenance is required on these relays. Follow test instructions to verify that the relay is in proper working order. We recommend that an inoperative relay be returned to the factory for repair; however, a circuit description and/or a schematic diagram are available for those who wish to attempt repairs. Contact your local sales engineer or contact the factory. These relays have an SCR (thyristor) as the output stage. This output SCR may be ordered from the factory (part no. 605211-006). Replacement target head assembly may be ordered should the target be mechanically damaged.

Also available from the factory are circuit card extenders. All these relays use the 10 point extender, catalog 200X0010.

Drawout Element

Lower drawout circuit boards of the same catalog number are interchangeable. The board is removed by using the metal pull knobs on its front panel. Removing the board will not cause an open C.T. secondary or a false trip, therefore, the board may be changed while the relay is in service.

Note that the relay is identified by a serial number on the underside of the circuit board.

The relay time-current characteristic and control voltage rating is determined by the drawout element. This nameplate data will be found on the front panel of the drawout element.

Replacement of Target Head Assembly

The relay target is an electrically operated, magnetically held device.

Should the orange/black target disk be damaged, it can easily be replaced. Order target head assembly part 609283-102 from the factory.

Replacement procedure:

1. From the front of the relay, pull the existing plastic holder straight off using needle nose pliers.
2. Carefully place the new target assembly on the pole pieces with disk end closest to you.
3. With control power applied, press the target reset button. If the target shows orange, remove the assembly, rotate 180 degrees, and reinstall. Actuate target reset. Target should turn to black.

2. HIGH POTENTIAL TESTS

Do not apply high voltage tests to solid-state relay circuits. If a control wiring insulation test is required, bond all terminals together and disconnect grounding wire before applying test voltage.

3. ACCEPTANCE TESTS

Follow calibration test procedure under paragraph 4. Check the following points: time dial 1, current 5-times pickup; time dial 10, current 10 times pickup; time dial 10, current 5 times pickup. Operating times should be within $\pm 5\%$ of the times shown on the time-current characteristic curve.

4. CALIBRATION TESTS (Also see Appendix A)

Connect the CIRCUIT-SHIELD relay to the test source, proper DC control voltage (to match relay), and synchronous timer as shown in Figure 4. Also, set pickup tap to desired value.

TIME — Pickup

1) Set TIME dial to required value.
2) With DC source off, preset test current to 95% of pickup value.
3) With DC on, apply test current. No trip should occur.
4) With DC off, preset test current to 105% of pickup value.
5) With DC on, apply test current. The relay should trip and operate the TIME target. (Allow sufficient time)
6) Reset target by pressing the RESET pushbutton.

TIME — Delay Curve

1) Set INST. dial to maximum position (20X).
2) Set TIME dial to required value, per time-current curves.
3) With DC off, preset test current to 300% of pickup value.
4) With DC on, apply test current. The relay should trip in a time within the tolerances shown on page 4.
5) Reset target by pressing the RESET pushbutton.

INST. — Pickup

1) Set INST. dial to required value.
2) With DC off, preset current to 90% of required value (TAP X INST. DIAL).
3) With DC on, apply test current. Relay should not trip on INST. (i.e. no INST. target indication).
4) With DC off, preset test current to 110% of required value.
5) With DC on, apply test current. Relay should trip giving INST. target.
6) Reset target by pressing the RESET pushbutton.

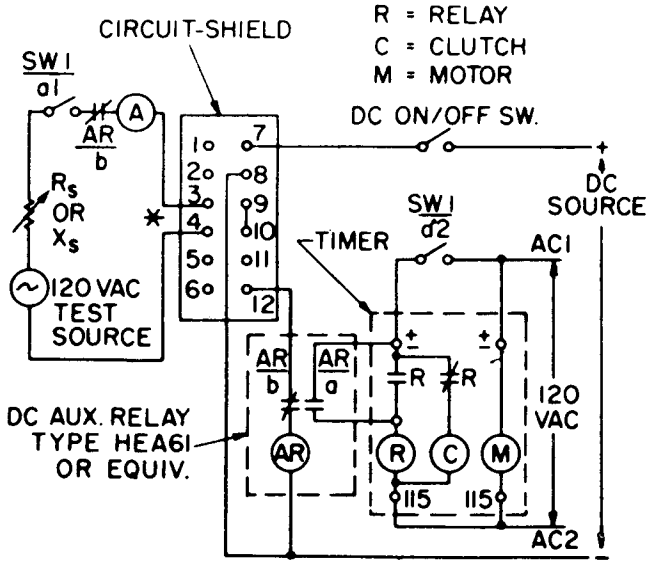


Fig. 4 — Calibration Test Circuit

NOTE: If a rectifier is to be used as the DC source for testing, the filter capacitor should be at least 250 ufd.

***NOTE:** FOR 3-PHASE RELAYS, PHASES A & C CAN BE SIMILARLY TESTED BY ALTERNATELY CONNECTING THE TEST SOURCE TO 1—2 and 5—6.

NOTE: Auxiliary relays with coil resistances greater than 10 ohms/volt must have a parallel resistor added across the relay coil. Size resistor to draw 100 ma current from DC source

APPENDIX A

CIRCUIT-SHIELD TEST TABLES

NOTE: You need not use these tables if you desire to make the standard receiving calibration check described under calibration testing.

When testing protective relays with test sources of limited capacity the accuracy of test results is affected by the wave shape of the test current. Where extremely accurate calibration test are desired, the attached test Tables prepared under laboratory conditions with standard CIRCUIT-SHIELD relays can be used:

Table 1 — Resistance Testing
("STATES" resistance bank #33560.R)

Table 2 — Reactance Testing
("G.E." reactor, #6054975)

Table 3 — MULTI-AMP Unit (SR-51 test set)

Note that the test current wave distortion is more apparent at the low current tap setting (highest relay burden) and at high current multiples (lowest test source impedances).

CIRCUIT-SHIELD solid-state overcurrent relays have been designed with a low burden characteristic. This relay burden is such that the primary current transformer will not saturate at high fault current values if the CT is selected so that its saturation point is above one multiple of the relay pickup setting. This is accomplished by a specially designed input transformer in the relay which saturates at just above pickup current. In addition to improving the accuracy performance of the primary current transformer, this feature also effectively prevents internal solid-state components from being subjected to high currents and voltages under fault conditions.

CONSULT FACTORY FOR TEST CURRENT CORRECTIONS TO BE USED FOR TEST SETS NOT LISTED IN THIS APPENDIX.

TABLE 1
CIRCUIT-SHIELD OVERCURRENT RELAY
TEST CURRENT CORRECTION — RESISTANCE TESTING
120 VOLT SOURCE (FIXED)

(STATES #33560.R)

TEST CURRENT MULT.	0.5-2 AMP TAP RANGE							1.5-6 AMP TAP RANGE			4-12 AMP TAP RANGE				
	0.5	0.6	0.8	1.0	1.2	1.5	2.0	2.5	3	4	5	6	7	8	10	12
PICKUP	0.50	0.60	0.80	1.00	1.20	1.50	2.00	2.50	3.00	4.00	5.00	6.00	7.00	8.00	10.00	12.00
2X	1.02	1.22	1.62	2.02	2.42	3.02	4.02	5.02	6.02	8.02	10.00	12.00	14.00	16.00	20.00	24.00
3X	1.56	1.86	2.46	3.06	3.65	4.55	6.05	7.55	9.05	12.10	15.10	18.10	21.10	24.10	30.10	36.10
4X	2.12	2.51	3.31	4.11	4.91	6.11	8.11	10.10	12.10	16.10	20.10	24.10	28.10	32.11	40.10	48.10
5X	2.70	3.19	4.19	5.19	6.19	7.68	10.20	12.70	15.20	20.20	25.20	30.20	35.20	40.20	50.20	60.18
6X	3.30	3.89	5.09	6.28	7.48	9.28	12.30	15.30	18.30	24.30	30.30	36.30	42.30	48.30		
8X	4.57	5.36	6.94	8.53	10.10	12.50	16.50	20.50	24.50	32.50	40.50	48.50	56.50			
10X	5.95	6.92	8.88	10.90	12.90	15.80	20.80	25.80	30.80	40.81	50.80					
15X	9.94	11.30	14.20	17.10	20.00	24.50	31.90	39.40	46.90							
20X	14.90	16.50	20.10	23.90	27.80	33.70	43.60	53.50								

This table lists corrected test currents for one (1) to twenty (20) multiples of each tap setting available on CIRCUIT-SHIELD relays. These test currents cause the relay to produce the trip time corresponding to current transformer (CT) operation, as will be encountered in actual service.

TABLE 2

CIRCUIT-SHIELD OVERCURRENT RELAY
TEST CURRENT CORRECTION — REACTANCE TESTING
120 VOLT SOURCE (ADJUSTABLE)

(G.E. REACTOR #6054975)

TEST CURRENT MULT.	0.5	0.6	X_S=24 Ω 0.8	1.0	1.2	1.5	2.0	X_S=12 Ω 2.5	3	4	5	X_S=6 Ω 6	7	8	X_S=3 Ω 10	12
PICKUP	0.50	0.60	0.80	1.00	1.20	1.50	2.00	2.50	3.00	4.00	5.00	6.00	7.00	8.00	10.00	12.00
2X	1.08	1.21	1.61	2.00	2.40	3.00	4.00	5.00	6.00	8.00	10.00	12.00	14.00	16.00	20.00	24.00
3X	1.52	1.81	2.41	3.00	3.60	4.50	6.00	7.50	9.00	12.00	15.00	18.00	21.00	24.00	30.00	36.00
4X	2.05	2.41	3.20	4.00	4.80	6.00	8.00	10.00	12.00	16.00	20.00	24.00	28.00	32.00	40.00	48.00
5X	2.55	3.04	4.00	5.00	6.01	7.50	10.00	12.50	15.00	20.00	25.00	30.00	35.00	40.00	50.00	60.00
6X	3.06	3.64	4.90	6.00	7.20	9.05	12.05	15.00	18.00	24.00	30.25	36.00	42.00	48.00	60.00	72.00
8X	4.06	4.90	6.55	8.05	9.75	12.15	16.05	20.10	24.30	32.40	41.00	49.00	56.00	64.00	80.00	
10X	5.35	6.35	8.25	10.40	12.30	15.25	20.50	25.50	31.00	41.50	51.50	62.50	71.50	80.00		
15X	7.85	9.55	12.40	15.50	18.90	22.70	30.45	40.00	47.00	61.80	78.00				X_S=0.5 Ω	
20X	10.70	13.20	16.60	22.00	25.00	31.25	46.50	63.00	67.00							
	0.5-2 AMP TAP RANGE							1.5-6 AMP TAP RANGE				4-12 AMP TAP RANGE				

This table lists corrected test currents for one (1) to twenty (20) multiples of each tap setting available on CIRCUIT-SHIELD relays. These test currents cause the relay to produce the trip time corresponding to current transformer (CT) operation, as will be encountered in actual service.

When using a tapped reactance in series with a variable voltage source to test CIRCUIT-SHIELD relays, the desired test current should be set using the largest possible reactance, as indicated in the chart above for a 120 Vac source.

TABLE 3

For specific test instructions using MULTI-AMP SR-51 Test Set see page 15.

CIRCUIT-SHIELD OVERCURRENT RELAY
TEST CURRENT CORRECTION — MULTI-AMP TEST SET

(MULTI-AMP SR-51, SR-76)

80 VOLT TAP: use data to left of bold line.
40 VOLT TAP: use data to right of bold line.

TEST CURRENT MULT.	0.5	0.6	0.8	1.0	1.2	1.5	2.0	2.5	3	4	5	6	7	8	10	12
			0.5-2 AMP TAP RANGE					1.5-6 AMP TAP RANGE				4-12 AMP TAP RANGE				
PICKUP	0.50	0.60	0.80	1.00	1.20	1.50	2.00	2.50	3.00	4.00	5.00	6.00	7.00	8.00	10.00	12.00
2X	1.55	1.58	1.87	2.25	2.59	3.15	4.10	5.05	6.10	8.10	10.00	12.00	14.20	16.00	20.00	24.30
3X	3.35	3.34	3.49	3.85	4.29	5.01	6.40	7.80	9.40	12.30	15.30	18.30	21.30	24.30	30.20	36.50
4X	5.10	4.89	5.09	5.45	6.00	6.90	8.70	10.40	12.30	16.50	20.40	24.50	28.50	32.00	40.50	48.80
5X	6.78	6.50	6.60	7.00	7.70	8.81	11.00	13.30	16.00	20.80	25.50	30.80	35.60	41.20	51.00	62.00
6X	8.10	7.90	7.95	8.50	9.30	10.50	13.30	16.00	19.00	25.00	30.60	37.00	44.20	49.50	61.80	74.00
8X	10.80	10.40	10.60	11.30	12.40	14.30	17.80	21.80	25.20	33.00	41.50	51.50	59.50	65.50		
10X	13.30	12.90	13.30	14.00	15.60	18.00	22.30	27.00	31.00	40.90	55.00	65.00	75.00	82.00		
15X	18.80	18.70	18.60	20.50	22.50	25.00	32.00	39.00	52.00	65.00	79.00				40 VOLT TAP	
20X	24.00	24.30	24.00	26.00	29.50	32.50	42.00	61.00	70.00	85.00						

This table lists corrected test currents for one (1) to twenty (20) multiples of each tap setting available on CIRCUIT-SHIELD relays. These test currents cause the relay to produce the trip time corresponding to current transformer (CT) operation, as will be encountered in actual service.

The SR-51, which operates from a 120 Vac source, uses a transformer with step down taps to produce a wide range of currents useful in general relay testing. Since the series impedance of the transformer provides a fixed source impedance, a variable autotransformer is used to adjust the level of input current. This fixed source impedance is in general not large enough compared to the non-linear relay impedance to guarantee sine wave test current.

Type 51 Catalog Series 423 Time-Overcurrent Relays (with Thyristor Output)

INTRODUCTION

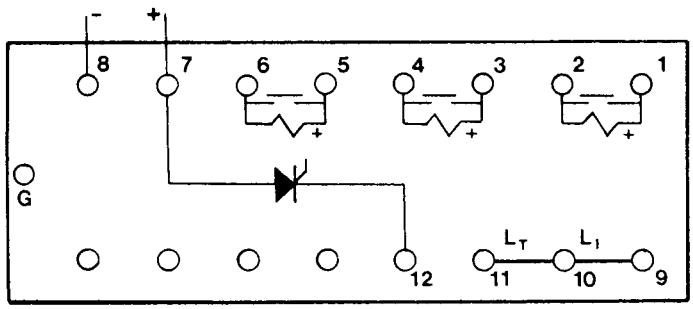
Type 51 Time-Overcurrent Relays with catalog numbers starting with 423 are similar to relays of the 223 series, but offer totally drawout construction with integral test facilities. Current transformer shorting is accomplished by a direct-acting spring and blade assembly upon removal of the relay from its case. Sequenced disconnects eliminate any possibility of nuisance tripping during withdrawal or insertion of the relay.

Basic operation, external connections, and electrical specifications for the 423 series are the same as for the 223 series. OBSERVE ALL PRECAUTIONS listed in the basic instruction book, IB 7.2.1.7-1A, page 2. Precaution #9 as applicable to the 423 series should read: "9. The entire assembly of the overcurrent relay is removable. This assembly should insert smoothly. Do not use excessive force."

CONNECTIONS

Typical external connections are as shown in Fig.1, page 6 of IB 7.2.1.7-1A. NOTE that while the same numbered connection points are used in the 423 series units, their relative position on the rear terminal block of the relay is NOT the same. See internal connection diagram shown below.

External test devices as shown in Fig. 3, page 17 are generally not required with the 423 series units.



INTERNAL CONNECTIONS: Type 51 Catalog Series 423

NOTE: User to remove links LT or LI only if external contact to be used to torque-control the relay. Remove LT for control of 51 element. Remove LI for control of 50 element.

For single phase units omit coil 1-2 and 5-6.
For two phase units omit coil 3-4.

Type 51 Time-Overcurrent Relays

TESTING

Test connections are readily made to the drawout relay unit by means of standard banana plugs. Current connections are made to the vertical posts at the blade assemblies. Control power and output connections are made at the rear vertical printed circuit board. This rear board is marked for easier identification of the connection points. A typical calibration test circuit is shown in Fig. 4, pg. 19 of IB 7.2.1.7-1.

Note: when testing Series 423 relays, jumpers must be installed between terminals 9-10-11 on the rear circuit board to complete the torque control circuits for proper operation. The jumpers must be removed before re-inserting the relay in its case.

TEST PLUG

A test plug assembly, catalog number 400X0001 is available for use with the 423 series units. This device plugs into the relay case on the switchboard and allows access to all external circuits wired to the case. See Instruction Book IB 7.7.1.7-8 for details on the use of this device.

Note: the X51C Overcurrent Relay Test Accessory is not compatible with 423 series units.

MAINTENANCE

Should separation of the upper and lower circuit boards be necessary, remove (2) screws that attach the left and right handle assemblies to the upper printed circuit board. The lower board may then be withdrawn forward from the printed circuit connector. A ten point extender board is available from the factory if access to the lower circuit board is required during testing or troubleshooting.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to Asea Brown Boveri.