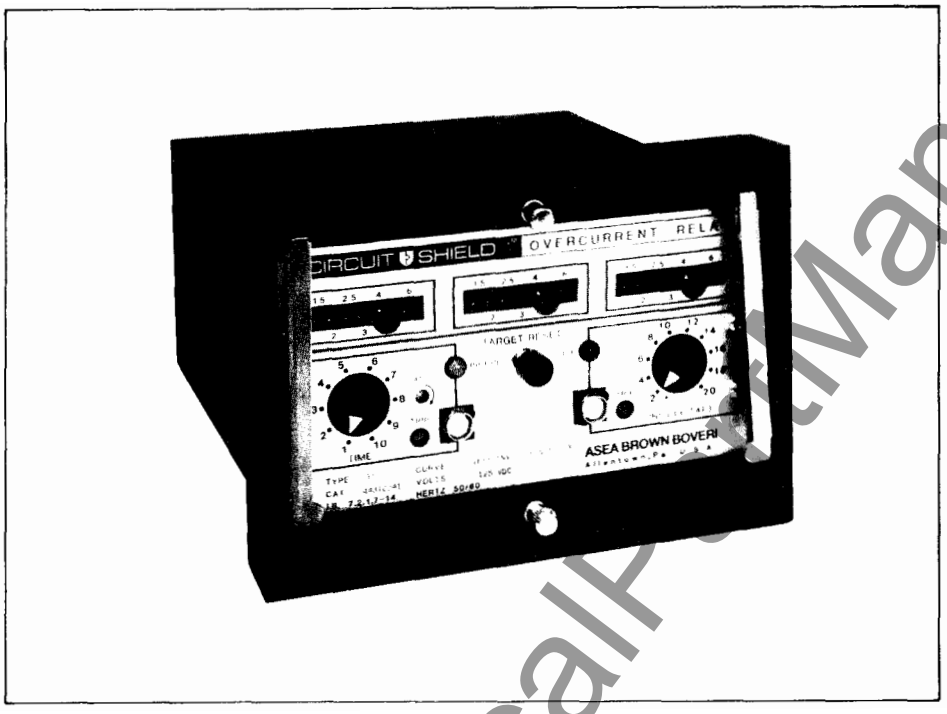
ABB Power T&D Company Inc.
Relay Division
Coral Springs, FL
Allentown, PA

October 1993
Supersedes Descriptive Bulletin 41-1135
pages 1-4, 5-6
dated September 1990
Mailed to: E, D, C/41-000B

Three Phase and Single Phase
Device Number: 51, 50/51, 51N, 50/51N

CIRCUIT SHIELD®

Type 51 Time-Overcurrent Relays



Features

- Improved dynamic performance
  - Fast reset
  - No overtravel
- Low burden
- Precise instantaneous
- Low maintenance
- Built-in test
- Seismic capability to 6g ZPA
- Transient immunity
- 2 year warranty

Application

Type 51 overcurrent relays are used for phase and ground overcurrent protection in utility, industrial and commercial electrical power systems. Common applications consist of a three phase relay for protection against phase faults and a single phase relay (with low tap range) for gound fault protection.

These solid state relays allow closer coordination than electromagnetic types due to improved dynamic performance: no overtravel and fast reset. Low burden improves current transformer performance and allows the use of low ratio bushing mounted C.T.'s in switchgear applications.

Type 51 overcurrent relays are designed to match the time current characteristic curves of conventional induction disk overcurrent relays for easy coordination with upstream and downstream electromechanical relays and fuses. They are operated from standard current transformers with 5 ampere secondary ratings. The output (tripping) circuit will operate a conventional circuit breaker trip or auxiliary relay. Eight time current characteristic curve families are available:

Inverse — **Type 51I**
Very Inverse — **Type 51Y**
Extremely Inverse — **Type 51E**
Definite Time — **Type 51D**
Short Time — **Type 51S**
Long Time, Extremely Inverse — **Type 51L**
Long Time, Very Inverse — **Type 51YM**
Long Time, Inverse — **Type 51IM**

A universal instantaneous function can be furnished on any Type 51 overcurrent relay. The instantaneous is precise, easy to set and has excellent dynamic response (minimal overreach or response to d.c. offset).

For motor protection, the three different long time characteristics (51L, 51IM, 51YM) are offered to allow optimum selection of the relay based on the starting time of motor. In addition, a special "inverse" instantaneous feature is offered. In motor applications it can be used to supply sufficient delay to override the inrush current on starting.

All type 51 overcurrent relays include provisions to allow external control of the TIME and INSTANTANEOUS elements of the relay. For example, directionally controlled overcurrent protection is easily implemented by using a Type 32 phase directional relay to control a Type 51 overcurrent relay.

Type 51 overcurrent relays can be provided with contact outputs or thyrister (SCR) output. Both types are available in Totally Drawout cases and offer integral test facilities.

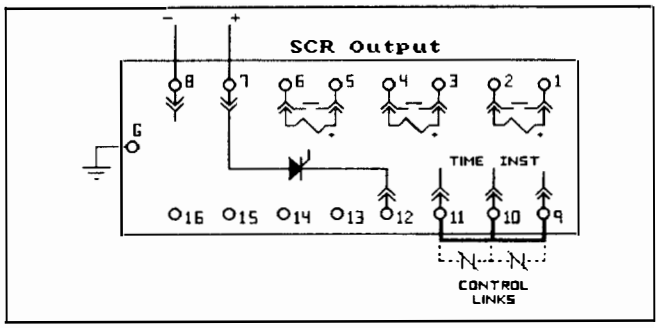


Figure 1. Internal Connections for SCR Output Model

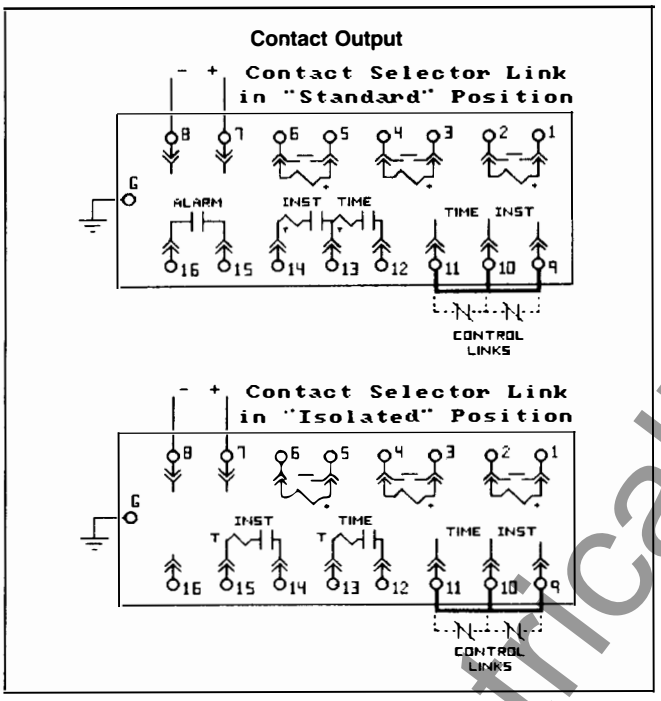


Figure 2. Internal Connections for Contact Output Model

Notes:

A. 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)

B. Single Phase Relays – omit coils 1-2 and 5-6.

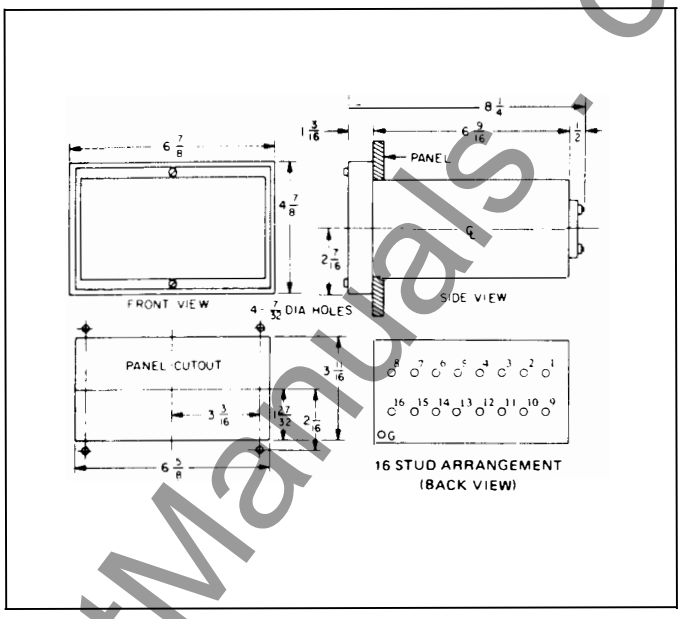


Figure 3. Outline and Drilling

Burden

Unlike induction-disk types, the burden of the Type 51 series of relays does not depend on the curve shape. All time-current characteristics (inverse, very inverse, long-time, etc.) have the same burden for the same tap range. In addition, the burden is the same whether the relay is provided with an instantaneous element or not. Finally, the burden is independent of frequency. The saturation voltage characteristics are plotted in Figure 4, for the lowest tap of the 5 available tap ranges. The very low burden of the solid state relay is a distinct advantage, especially when applied with lower ratio current transformers.

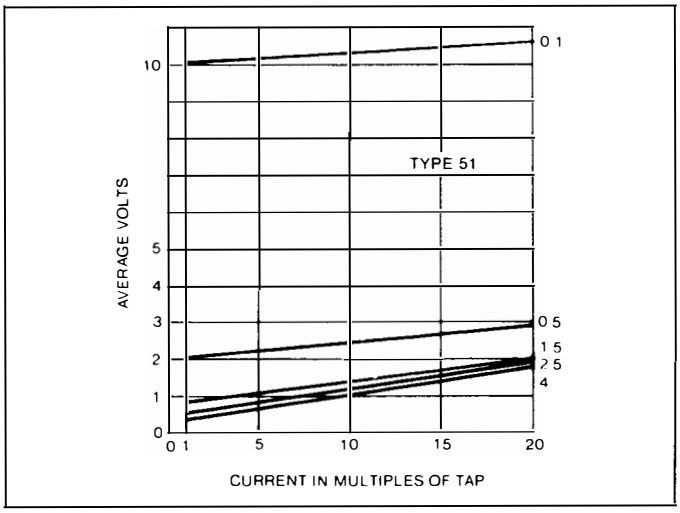


Figure 4. Saturation Voltage Characteristics for Minimum Tap Setting

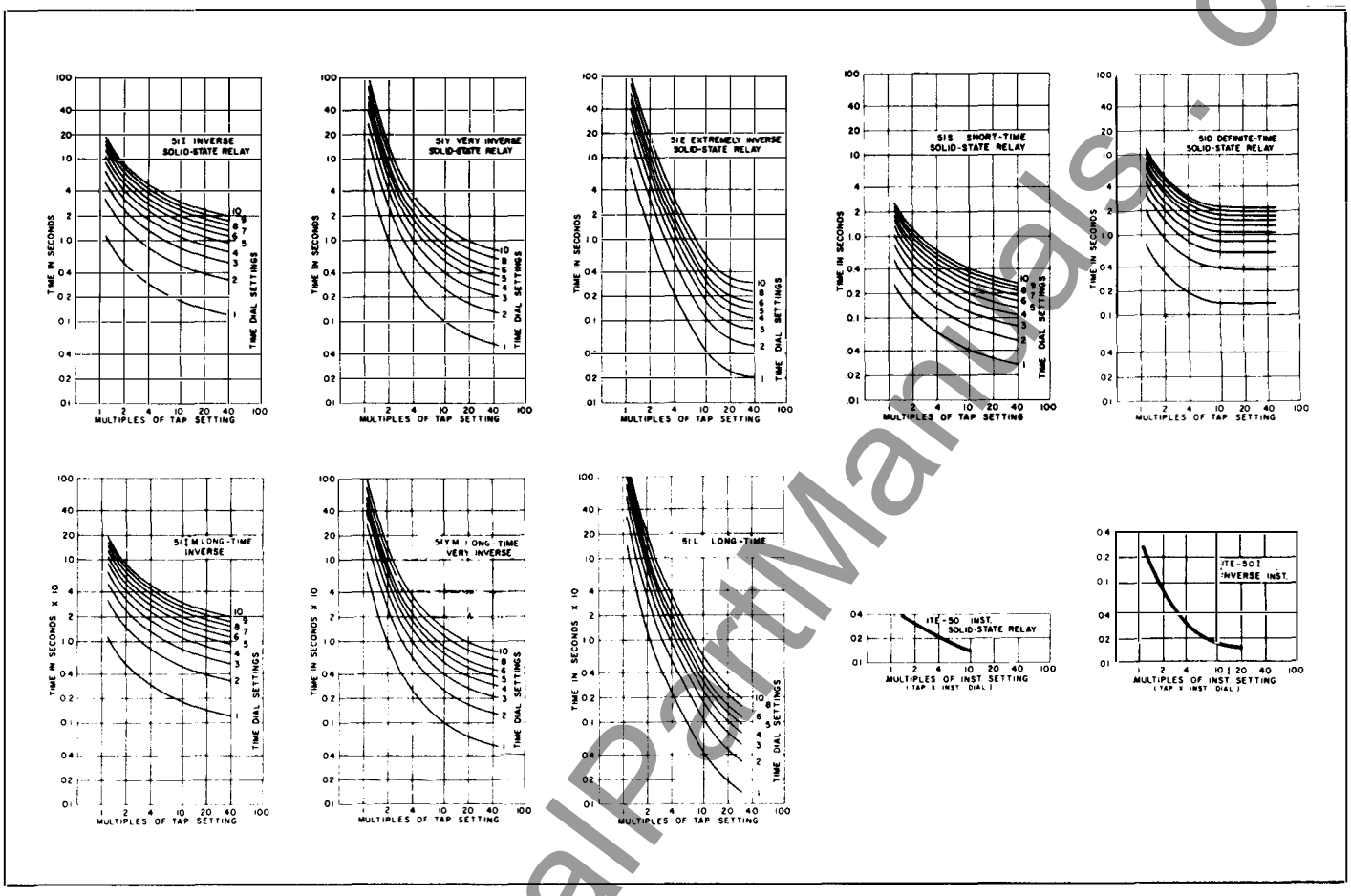


Figure 5. Time Current Characteristics

Table 1. Selection Guide

Time-Current Characteristic	Relay Type	Basic Application
Inverse	Type 51I	Provides phase or ground overcurrent protection on Utility and Industrial circuits. Especially applicable where the fault magnitude is mainly dependent on the system fault capacity. Relay slope approaches a flat characteristic at high currents, giving a small change in operating time over a broad change in fault current magnitude.
Very Inverse	Type 51Y	Provides phase or ground overcurrent protection on Utility and Industrial circuits. Especially applicable on subtransmission and distribution lines, where the fault magnitude is mostly a function of the relative location of the fault to the relay. In addition, provides better coordination with low-voltage breakers or a back-up to other relays.
Extremely Inverse	Type 51E	Used on Utility primary distribution feeders to coordinate with main and branch fuses and reclosers. Good for cold load pick-up on distribution feeders.
Short-Time	Type 51S	Designed to provide overcurrent protection where fast operation is needed such as in residual ground relaying or where system stability is involved. Also used in some bus or generator differential applications where restraint windings are not required.
Long-Time	Type 51L Type 51YM Type 51IM	Applied in motor circuit applications, to over-ride motor starting circuits. Choose relay type based on starting time of motor.
Definite-Time	Type 51D	For use where fault currents and generating capacity vary over a wide range. Relay has fixed operating time (per time dial setting) above approximately 10 times tap current, thus providing definite time selective operation for coordination.

Specifications

Pickup: Suitable for 50/60 Hz.
For other frequency ranges, consult factory.
See Table 2 for tap ranges.

Input Circuit Rating: See Table 3

Burden: See Figure 4 (unity power factor)

Control Drain:
Thyristor (SCR) Models
No continuous drain; suitable for use with capacitor trip device.

Contact output models
0.6 watts nominal drain.
2.5 watts maximum drain.

Output Circuit Rating:
Thyristor (SCR) Models
30 amperes, 6 cycles
15 amperes, 1 second
1 ampere, continuous

Contact Output Models
at 125 Vdc: 30A Tripping Duty
5A Continuous
1A Opening Resistive
0.3A Opening Inductive

Series Target Coil Rating: 30A. tripping (1 amp minimum trip circuit current req'd to set targets).
For trip circuit currents below 1 amp, .25 amps minimum, add "-ST" to catalog number for sensitive target coil.

Temperature Range: Minus 20°C to Plus 70°C

Seismic Capability: More than 6g ZPA biaxial multifrequency vibration without damage or malfunction ANSI/IEEE C37.98.

Transient Immunity: More than 2500V, 1 Mhz, bursts at 400 Hz, repetition rate continuous, (ANSI C37.90.1 SWC); Fast transient test; EMI test.

Weight: Unboxed — 5.1 lbs. (2.3 kg)
Boxed — 5.4 lbs. (2.3 kg)
— 0.26 cubic feet

Table 2. Pickup Tap 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 – 5.0	2.5, 2.8, 3.1, 3.5, 4.0, 4.5, 5.0
4 – 12	4, 5, 6, 7, 8, 10, 12

1. When tap plug is removed, affected phase automatically switches to the highest setting. C.T. secondary is not opened.

Table 3. Input Circuit Withstand 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	300 multiples of pickup tap setting or 235 A rms, whichever is less.
	4 – 12	300 multiples of pickup tap setting or 390 A rms, whichever is less.
Continuous	All Ranges	1.5 multiples of pickup tap setting.

Testing

Conventional overcurrent relay test procedures using commercially available test sets may be used.

In addition each relay includes built-in operational test pushbuttons (guarded to preclude accidental operation) to permit functional testing of the relay and breaker without additional test equipment.

A test plug is available for Total Drawout relays.

How To Order

For a complete listing of available overcurrent relays, including the Type 51 series see TD 41-025. To place an order, or for further information contact the nearest ABB Representative.

How To Specify

Time-overcurrent relays shall be Asea Brown Boveri Type 51 or approved equal. Relay shall be of solid-state low burden construction, with either Thyristor (SCR) or contact output.

Relay shall be capable of withstanding 6g ZPA seismic stress at minimum settings without malfunction. Built-in means shall be provided to allow operational tests without additional equipment. Relay shall have one target for time function and one target for instantaneous function. As an option, the relay can be supplied with three additional targets for individual phase identification.

Further Information

List Prices: PL 41-020
Technical Data: TD 41-025
Instruction Book (Thyristor, SCR, models): 7.2.1.7-1
Instruction Book (Contact output models): 7.2.1.7-14
Test Accessory: 7.2.3-1
Test Plug: 7.7.1.7-8
Application Note-Torque Control: AN-2
Application Note-Burden: AN-3
Application Note-O.C. Relays for Motor Protection: AN-4
Motor Protection Paper: TP 18.0.3
Generator Protection Paper: TP 18.6-1
Other Protective Relays: Application Selector Guide, TD 41-016

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Three Phase and Single Phase
Suitable for 50/60 Hz

CIRCUIT SHIELD®

Type 51 Time-Overcurrent Relays

Type	Curve	Time Unit Pickup Range (amperes)	Instantaneous Attachment② Pickup Range (in multiples of tap setting)		Thyristor Output (SCR) Catalog Number①		Contact Output Catalog Number①	
			Standard (50)	Inverse (50 I)	Single Phase	Three③ Phase	Single Phase	Three③ Phase
51 I	Inverse	.1-.5A			423S14X0		443S14X0	
		.5-2A			423S11X0	423T11X0	443S11X0	443T11X0
		1.5-6A			423S12X0	423T12X0	443S12X0	443T12X0
		4-12A			423S13X0	423T13X0	443S13X0	443T13X0
		.1-.5A	2-20		423S14X1		443S14X1	
				4-16	423S14X2		443S14X2	
		.5-2A	2-20		423S11X1	423T11X1	443S11X1	443T11X1
			1-10		423S11X4	423T11X4	443S11X4	443T11X4
				4-16	423S11X2	423T11X2	443S11X2	443T11X2
				1.4-5.6	423S11X3	423T11X3	443S11X3	443T11X3
		1.5-6A	2-20		423S12X1	423T12X1	443S12X1	443T12X1
			1-10		423S12X4	423T12X4	443S12X4	443T12X4
				4-16	423S12X2	423T12X2	443S12X2	443T12X2
				1.4-5.6	423S12X3	423T12X3	443S12X3	443T12X3
		4-12A	2-20		423S13X1	423T13X1	443S13X1	443T13X1
			1-10		423S13X4	423T13X4	443S13X4	443T13X4
				4-16	423S13X2	423T13X2	443S13X2	443T13X2
				1.4-5.6	423S13X3	423T13X3	443S13X3	443T13X3
51 Y	Very Inverse	.1-.5A			423S24X0		443S24X0	
		.5-2A			423S21X0	423T21X0	443S21X0	443T21X0
		1.5-6A			423S22X0	423T22X0	443S22X0	443T22X0
		4-12A			423S23X0	423T23X0	443S23X0	443T23X0
		.1-.5A	2-20		423S24X1		443S24X1	
				4-16	423S24X2		443S24X2	
		.5-2A	2-20		423S21X1	423T21X1	443S21X1	443T21X1
			1-10		423S21X4	423T21X4	443S21X4	443T21X4
				4-16	423S21X2	423T21X2	443S21X2	443T21X2
				1.4-5.6	423S21X3	423T21X3	443S21X3	443T21X3
		1.5-6A	2-20		423S22X1	423T22X1	443S22X1	443T22X1
			1-10		423S22X4	423T22X4	443S22X4	443T22X4
				4-16	423S22X2	423T22X2	443S22X2	443T22X2
				1.4-5.6	423S22X3	423T22X3	443S22X3	443T22X3
		4-12A	2-20		423S23X1	423T23X1	443S23X1	443T23X1
			1-10		423S23X4	423T23X4	443S23X4	443T23X4
				4-16	423S23X2	423T23X2	443S23X2	443T23X2
				1.4-5.6	423S23X3	423T23X3	443S23X3	443T23X3
51 E	Extremely Inverse	.1-.5A			423S34X0		443S34X0	
		.5-2A			423S31X0	423T31X0	443S31X0	443T31X0
		1.5-6A			423S32X0	423T32X0	443S32X0	443T32X0
		4-12A			423S33X0	423T33X0	443S33X0	443T33X0
		.1-.5A	2-20		423S34X1		443S34X1	
				4-16	423S34X2		443S34X2	
		.5-2A	2-20		423S31X1	423T31X1	443S31X1	443T31X1
			1-10		423S31X4	423T31X4	443S31X4	443T31X4
				4-16	423S31X2	423T31X2	443S31X2	443T31X2
				1.4-5.6	423S31X3	423T31X3	443S31X3	443T31X3
		1.5-6A	2-20		423S32X1	423T32X1	443S32X1	443T32X1
			1-10		423S32X4	423T32X4	443S32X4	443T32X4
				4-16	423S32X2	423T32X2	443S32X2	443T32X2
				1.4-5.6	423S32X3	423T32X3	443S32X3	443T32X3
		4-12A	2-20		423S33X1	423T33X1	443S33X1	443T33X1
			1-10		423S33X4	423T33X4	443S33X4	443T33X4
				4-16	423S33X2	423T33X2	443S33X2	443T33X2
				1.4-5.6	423S33X3	423T33X3	443S33X3	443T33X3

① Each of the listed catalog numbers contains an X for the control voltage designation.
To complete the catalog number replace the X with the proper control voltage code digit:

175 Vdc (120 Vac Capacitor Trip) Type 423 only	1
350 Vdc (240 Vac Capacitor Trip) Type 423 only	2
220 Vdc Type 443 only	2
48 Vdc	3
125 Vdc	4
250 Vdc	5
120 Vac Type 443 only	6
32 Vdc	8
24 Vdc	9
20-150 Vdc/30-150 Vac Type 443 only	0

② Instantaneous attachment pickup ranges are listed as multiples of the selected time unit tap setting. For example: Catalog Number 423T11X1 describes a Type 51 I, with a 0.5-2A tap range and instantaneous pickup range of 2-20 multiples of the (.5-2A) tap. This provides the total instantaneous range of 1-40 amperes.

③ For individual phase targets (total of five targets), replace the letter "T" with the letter "P" in the catalog number.

To place an order, or for further information, contact the nearest ABB Representative.

Type	Curve	Time Unit Pickup Range (amperes)	Instantaneous Attachment② Pickup Range (in multiples of tap setting)		Thyristor Output (SCR) Catalog Number①		Contact Output Catalog Number①	
			Standard (50)	Inverse (50 I)	Single Phase	Three③ Phase	Single Phase	Three③ Phase
51 S	Short Time	.1-.5A			423S44X0		443S44X0	
		.5-2A			423S41X0	423T41X0	443S41X0	443T41X0
		1.5-6A			423S42X0	423T42X0	443S42X0	443T42X0
		4-12A			423S43X0	423T43X0	443S43X0	443T43X0
		.1-.5A	2-20		423S44X1		443S44X1	
				4-16	423S44X2		443S44X2	
		.5-2A	2-20		423S41X1	423T41X1	443S41X1	443T41X1
				4-16	423S41X2	423T41X2	443S41X2	443T41X2
		1.5-6A	2-20		423S42X1	423T42X1	443S42X1	443T42X1
				4-16	423S42X2	423T42X2	443S42X2	443T42X2
		4-12A	2-20		423S43X1	423T43X1	443S43X1	443T43X1
				4-16	423S43X2	423T43X2	443S43X2	443T43X2
51 D	Definite Time	.1-.5A			423S64X0		443S64X0	
		.5-2A			423S61X0	423T61X0	443S61X0	443T61X0
		1.5-6A			423S62X0	423T62X0	443S62X0	443T62X0
		4-12A			423S63X0	423T63X0	443S63X0	443T63X0
		.1-.5A	2-20		423S64X1		443S64X1	
				4-16	423S64X2		443S64X2	
		.5-2A	2-20		423S61X1	423T61X1	443S61X1	443T61X1
				4-16	423S61X2	423T61X2	443S61X2	443T61X2
		1.5-6A	2-20		423S62X1	423T62X1	443S62X1	443T62X1
				4-16	423S62X2	423T62X2	443S62X2	443T62X2
		4-12A	2-20		423S63X1	423T63X1	443S63X1	443T63X1
				4-16	423S63X2	423T63X2	443S63X2	443T63X2
51 M	Long Time, Inverse	2.5-5A			423S85X0	423T85X0	443S85X0	443T85X0
		4-12A			423S83X0	423T83X0	443S83X0	443T83X0
	④	2.5-5A	2-20		423S85X1	423T85X1	443S85X1	443T85X1
				4-16	423S85X2	423T85X2	443S85X2	443T85X2
		4-12A	2-20		423S83X1	423T83X1	443S83X1	443T83X1
				4-16	423S83X2	423T83X2	443S83X2	443T83X2
51 YM	Long Time, Very Inverse	2.5-5A			423S95X0	423T95X0	443S95X0	443T95X0
		4-12A			423S93X0	423T93X0	443S93X0	443T93X0
	④	2.5-5A	2-20		423S95X1	423T95X1	443S95X1	443T95X1
				4-16	423S95X2	423T95X2	443S95X2	443T95X2
		4-12A	2-20		423S93X1	423T93X1	443S93X1	443T93X1
				4-16	423S93X2	423T93X2	443S93X2	443T93X2
51 L	Long Time, Extremely Inverse	2.5-5A			423S55X0	423T55X0	443S55X0	443T55X0
		4-12A			423S53X0	423T53X0	443S53X0	443T53X0
	④	2.5-5A	2-20		423S55X1	423T55X1	443S55X1	443T55X1
				4-16	423S55X2	423T55X2	443S55X2	443T55X2
		4-12A	2-20		423S53X1	423T53X1	443S53X1	443T53X1
				4-16	423S53X2	423T53X2	443S53X2	443T53X2
51 SP	Fast Curve	.5-2A			423S71X0	423T71X0	443S71X0	443T71X0
		1.5-6A			423S72X0	423T72X0	443S72X0	443T72X0
		4-12A			423S73X0	423T73X0	443S73X0	443T73X0

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② Instantaneous attachment pickup ranges are listed as multiples of the selected time unit tap setting.
For example: Catalog Number 423T11X1 describes a Type 51 I, with a 0.5-2A tap range and instantaneous pickup range of 2-20 multiples of the (.5-2A) tap. This provides the total instantaneous range of 1-40 amperes.

③ For individual phase targets (total of five targets), replace the letter "T" with the letter "P" in the catalog number.

④ For 0.5-2A tap ranges, consult factory.

To place an order, or for further information, contact the nearest ABB Representative.

Printed in U.S.A.

September, 1990
Supersedes Section 7.2.0.3, Type 51 on page 7, dated January 1, 1990.
Mailed to: E, D, C/41-100B

Type 51, Suitable for 50/60 Hz

CIRCUIT SHIELD ®

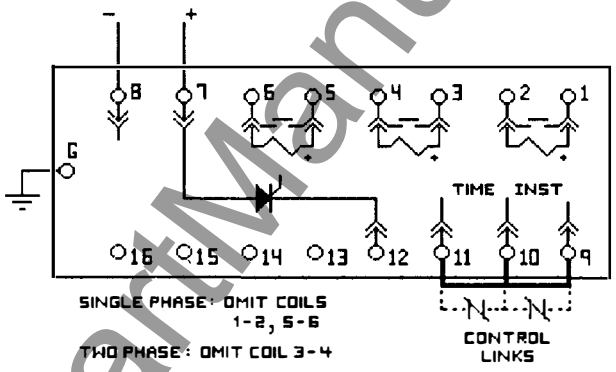
Type 51 Time-Overcurrent Relays

Internal Connection Diagrams

Test Case with SCR output 16D423A
Test Case with contact output 16D443A

Note: Control Links must be in place for normal operation. Remove a link only when wiring an external contact to control the relay function. See the particular relay's instruction book for additional information on the use of the control links.

16D423A Type 51 Time-Overcurrent Relay Thyristor Output Drawout Test Case



16D443A Type 51 Time-Overcurrent Relay Contact Output Drawout Test Case