SIEMENS

7 SK 88 . . - . . A

IDMTL OVERCURRENT RELAY

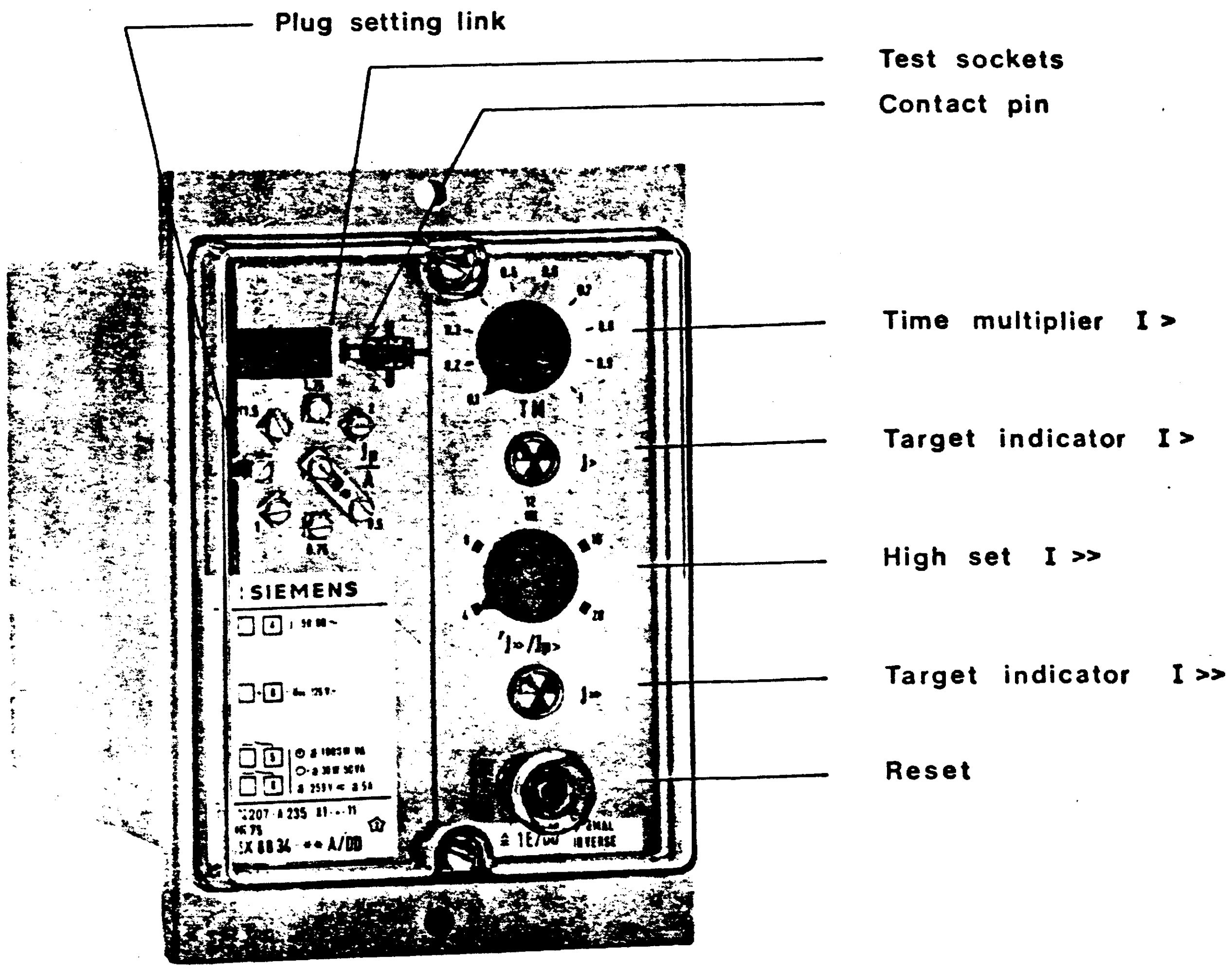
Installation and maintenance instructions

Protective relays

Static single phase, IDMTL overcurrent relay

7 SK 88. . - . . A

Installation and maintenance instructions



Contents Page

1. Survey of Types (ordering codes)

Inverse-time overcurrent relay system 7SK88 in a compact case

For current transformer rated current A	Setting range of 7SK88 A	Supply voltage U_V 60 V d.c. Order No. (for the Order No. suffix see below)	110 V d.c. Order No.	125 V d.c Order No.	220 V d.c. Order No.	Supply from current transformer	Weight, approx kg
1	0.1 to 0.4	7SK88 12–..	7SK88 13–..	7SK88 14–..	7SK88 15–..	7SK88 18–..	1,5 (C.T. powerd version 1,8)
1	0.2 to 0.8	22–..	23–..	24–..	25–..	28–..	
1 or 5 *	0.5 to 2	32–..	33–..	34–..	35–..	38–..	
1 or 5 *	1 to 4	42–..	43–..	44–..	45–..	48–..	
5	2.5 to 10	52–..	53–..	54–..	55–..	58–..	
5	4 to 16	62–..	63–..	64–..	65–..	68–..	

* In this case, the 5 A c.t. shall be in the earth fault circuit. Thus a higher sensitivity is achieved.

Order No. suffix for 7SK88

Characteristic and optional element I≫

Characteristic	Short-circuit instantaneous trip I≫ not fitted	 fitted
	Order No. suffix 7SK88..-	
Inverse	1DA	1EA
Very inverse	3DA	3EA
Extremely inverse	4DA	4EA

Continuous technological progress and modernisation of components may necessitate production modifications. These modifications do not affect relay performance and are recorded, for internal purposes only, by two letters after the code (MLFB) number (e.g. 7SK8818-1DA/DD).

Test adapter for 7SK88

7XV8110 Test adapter cable with banana plugs
7XV8120 Test adapter cable with Harting plug for testing with 7VP461

2. Description

Relay 7SK88 is a self contained, single phase overcurrent protection device with inverse definite minimum time characteristics. Its applications include primary protection of radial networks in distribution and industrial installations and back-up protection for distance relays and similar schemes.

The 7SK88 can be supplemented by the directional relay 7SP88. This combination provides a directional inverse time protection system for the protection of ring mains and parallel lines or transformers.

It can be equipped with a high set instantaneous element. Although designed principally for operation from an auxiliary d.c. power source, a version is available for current transformer derived auxiliary power, allowing use in installations where separate d.c. power is not provided.

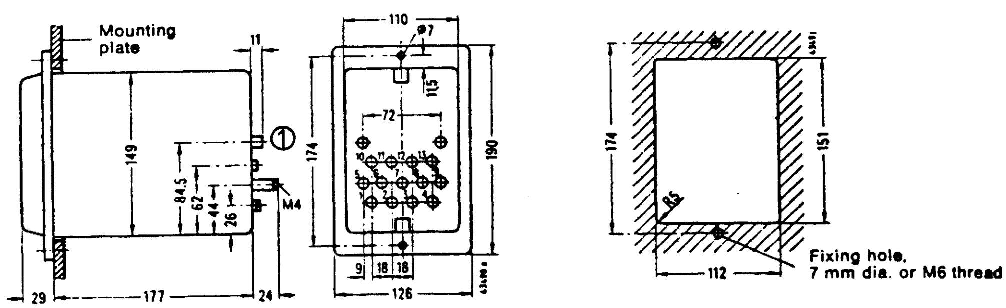
3. Acceptance Check

On unpacking the relay, check the nameplate to ensure that the model number and rating agree with the requirements. Check that there are no signs of physical damage. The relay has been thoroughly works-tested and calibrated. It contains no moving parts and is therefore ready for installation without adjustment. If the target indicator shows "tripped" (red) when delivered, this is unimportant since it can be reset as soon as the auxiliary supply voltage is connected or, with the C.T. powered version, when at least 20 % load current flows in the primary circuit.

4. Installation

The case is designed for flush mounting in a panel or support plate of any convenient thickness (fig. 1) and at any convenient angle in a location reasonable free from excessive heat, dust and moisture. It can be secured by two machine screws (M6), with nuts, top and bottom of the front bezel.

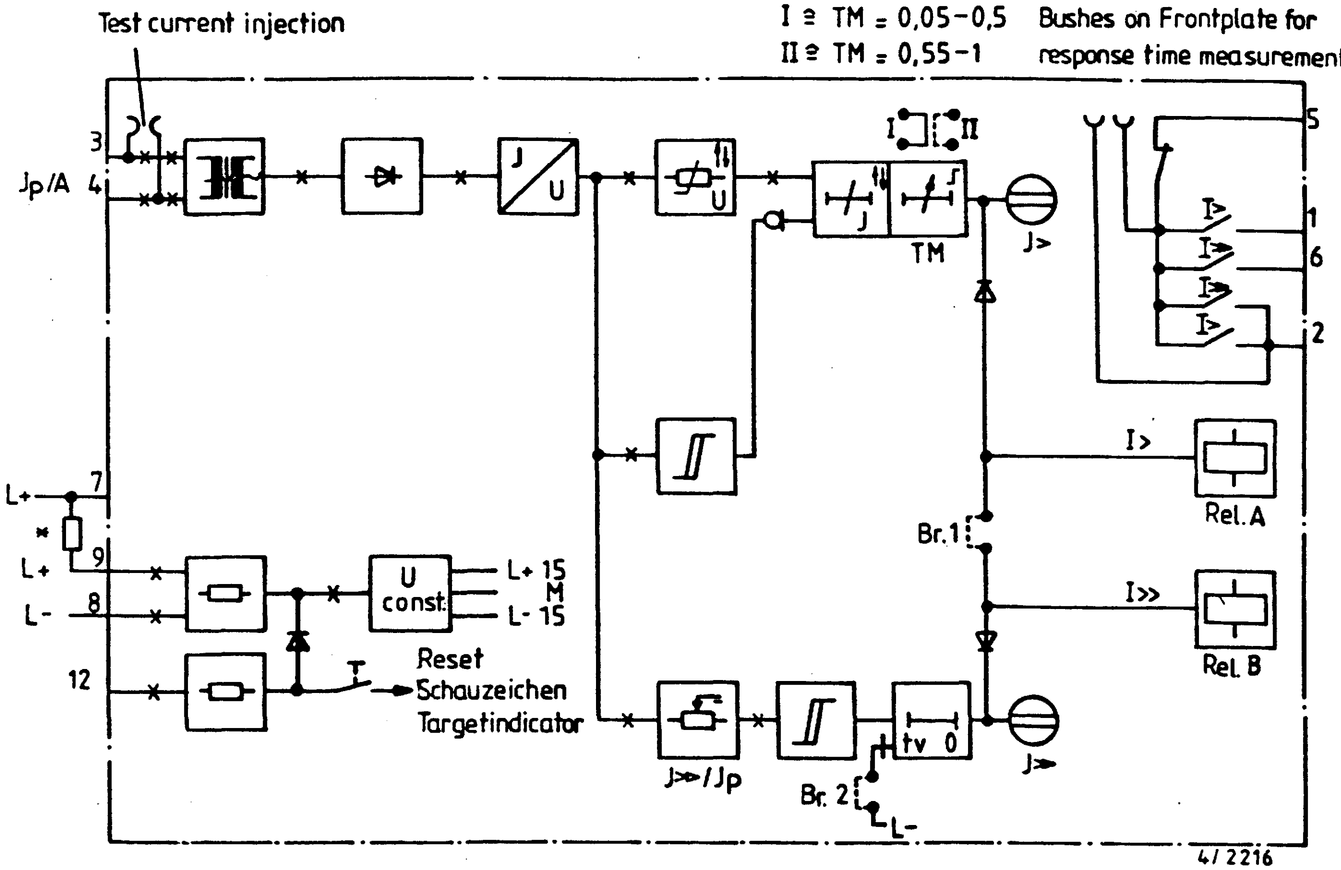
External connections are at the rear. These are post type terminals fitted with slotted head screws and clamps. Flexible or stranded conductors must be fitted with crimped ferrules. All terminals are permanently numbered. For front-access-only cabinets, the relays can be mounted on hinged plates or frames for access to the terminals. The units are not sensitive to shock. (Tested to withstand 2 G). The internal carrier is secured by screws from the back and supports the plug-in printed circuit board on the right hand side which carries the static component circuitry.



1 fixing screws for internal carrier

Fig. 1: Inverse-time overcurrent relay 7SK88; compact case for switchboard panel flush mounting

With the current transformer short-circuited and the auxiliary supply de-energised, connect the C.T. leads to terminals 3 and 4 and the auxiliary supply to terminal 9 (+ ve) or terminal 7 (if 220 V model is used) and terminal 8 and 12 (- ve). The 220 V model is fitted with a dropper resistance which is located at the main terminals for good heat dissipation. This resistance can attain a surface over-temperature of 200 °C - it must be ensured that the resultant heat can properly dissipate and is not obstructed by adjacent wiring or other restrictions.



* "dropper" resistance. 220 V model only.

Fig. 2: Internal Schematic 7SK88xx-xxA

If the target indicator shows "tripped", it can now be reset on application of the auxiliary supply or, with the C.T. powered version, when at least 20 % load current flows in the primary circuit.

With the C.T. powered version terminals 8 and 9 remain free.

In planning the tripping circuits, ensure that the rating of the output relay contacts are not exceeded.

Fig. 3a
current connections

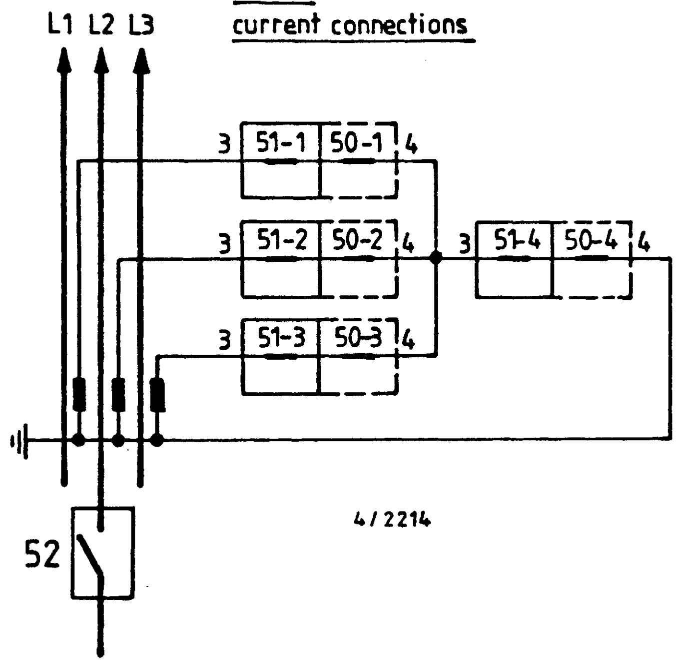
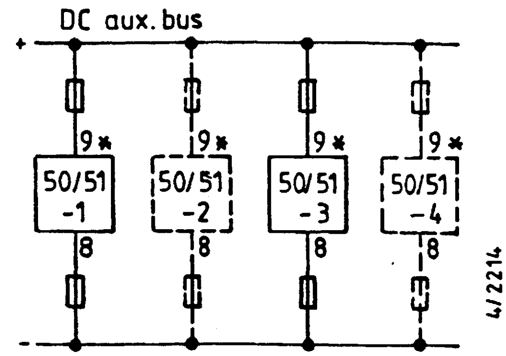


Fig. 3b
auxiliary supply connections
(not applicable to C.T. powered version)



* terminal 7 for 220V model

Legend:
51-1 o/c-relay 7SK 88
51-2 o/c-relay 7SK 88 optional
51-3 o/c-relay 7SK 88
51-4 o/c-relay 7SK 88 optional
52 Circuit breaker
50-1 high set element, optional
50-2 high set element, optional
50-3 high set element, optional
50-4 high set element, optional

Fig. 3c
output contact connections

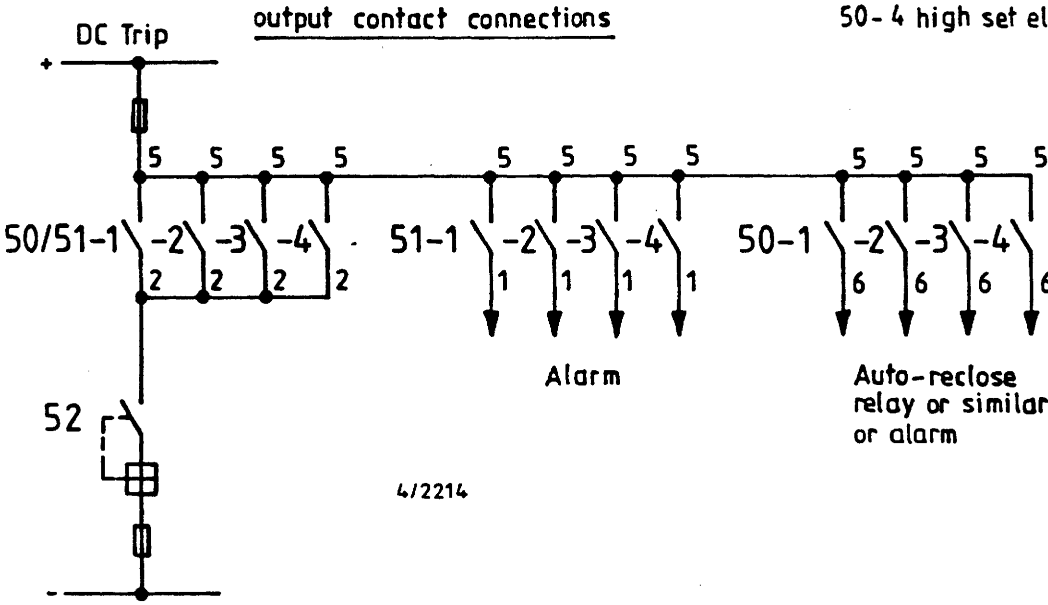


Fig. 3: External Schematic - 7SK88 Relay
d.c. powered or C.T. powered version

5. Setting the Relay

5.1 Overcurrent Element

Remove front cover by releasing captive screws top and buttom. Removal of the cover automatically short circuits the input from the associated current transformer and disconnects it from the internal circuits. Thus the accessible components on the relay front are entirely volt-free. When used for phase overcurrent protection, one or two further 7SK88 relays are installed in the remaining phases. These remain operative.

The overcurrent element (I) has two settings:
Current setting (Ip) (Plug setting)
10 - 40 %, 20 - 80 %, 50 - 200 % or 100 - 400 % in 7 equal steps selected by rotary link on the front plate. This setting values on the front plate are given in amps secondary. The two screws must be re-tightened carefully. The link must not be left in an open position. This setting allows the overcurrent pick-up value to be selected with respect to circuit rated load and current transformer ratio

e.g.	C.T. ratio	200/5 A
	circuit full load current	120 A
	required pick-up value (for example)	1.25 x full load current
	relay range	50 - 200 % (i.e. 2.5 to 10 A)

$$I_p = \frac{120}{200} \times 5 \times 1.25 = 3.75 \text{ A.}$$

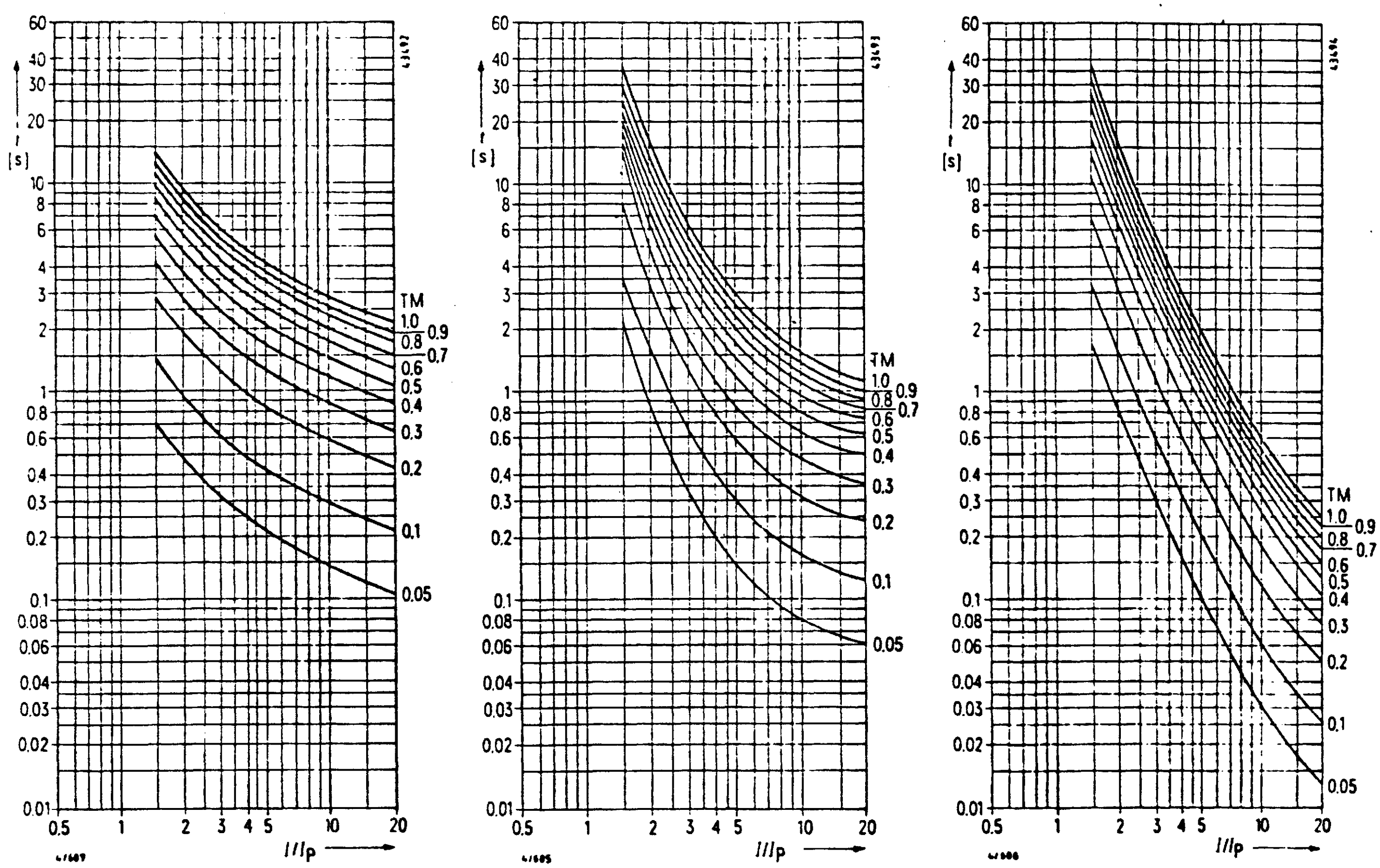
Nearest setting = 3.75 A (75 %).

5.2 Time Multiplier (TM)

Set by slotted rotary dial on the front plate; two ranges are available: 0.05 to 0.5 in steps of 0.05 (with selector plug on PCB in position I - as set in the factory), alt. 0.55 to 1 in steps of 0.05 (with selector plug on PCB in position II). The adhesive strip for the T.M. scale situated on the rear of the front plate must also be removed and fixed on the front to cover the printed letters TM (see fig. 6). Thus the alteration of the TM-setting range is made visible.

The TM-setting allows selection of the time scale against which the inverse characteristic is set (see fig. 4). The intermediate curves given by the 0.05 steps lie between the curves shown.

The recommended grading time between successive relays is 0.3 to 0.4 secs.



inverse (to B.S. 142) — very inverse — extremely inverse

I: Current in A
I_p: Pick-up setting in A
TM: Time multiplier adjustable on front panel, to B.S. 142

Fig. 4: Overcurrent time characteristics: $t = f\ /I/I_p)$ for the inverse-time overcurrent relay 7SK88

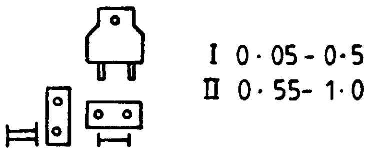


Fig. 5: TM range selector plug

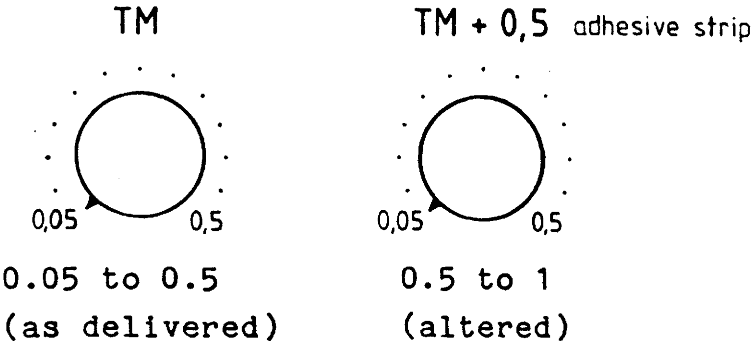


Fig. 6: TM setting range

5.3 <u>Instantaneous Element</u> (I >>)

When fitted, is set by slotted rotary dial on the front plate:
Range: 4 to 20 times I_p. The setting is continuous

i.e. if I_p set at 3.75 A = 125 % circuit f.l.c. (as in current setting example) and I >> set on 10, then instantaneous element operates at 37.5 A (12.5 x f.l.c.) within approx. 15 ms.

If the operating time proves to be too short, it can be extended by inserting a capacitor, on the solder tags marked C12 on the printed circuit board. A dry type tantalum capacitance is recommended (e.g. Siemens UBB-B45178). The required capacitance for a particular time delay is given in fig. 7; a 30 V device is adequate.

If the solder bridge 2 is inserted on the p.c.b. then the trip from the high set element I is blocked (as delivered the bridge 2 is <u>not</u> inserted).

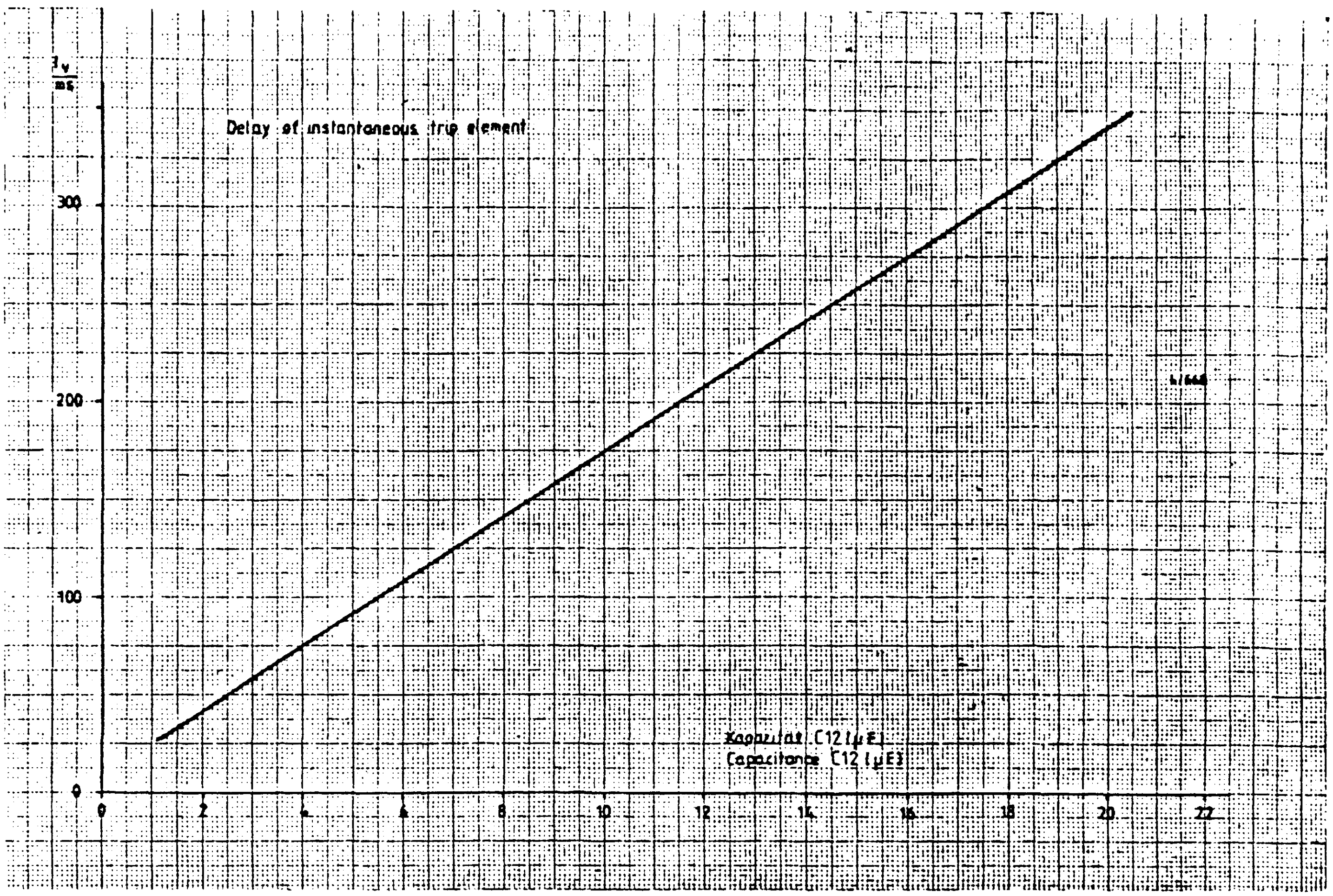


Fig. 7: Instantaneous element time delay related to value of capacitance C12.

6.1 Auxiliary Supply

The relay measuring element requires auxiliary power (see survey of types).

In the current transformer powered version, an additional internal circuit powers the measuring element from the C.T. secondary current. The output relay (tripping relay) contacts remain volt free, an auxiliary supply is still required for the circuit breaker trip coil.

As a further alternative, the power circuit breaker trip coil, for example Siemens type 3AS1102 (H86w), can also be operated directly from the C.T. secondary current when an auxiliary supply is not available. An auxiliary C.T., with saturation characteristic, type 4AM5070-8AB, connected in the C.T. circuit as in figure 8, gives the required power (up to 20 VA at 0.5 or 1 A). For reliable operation adequate primary current (greater than full load) is necessary, thus this method is not suitable for earth fault tripping if the earth fault current is less than full load current. In such cases an auxiliary supply is essential.

6.2 Current Transformer Selection

The phase overcurrent relay has a very low burden. Thus, as a general rule, a 15 VA 10P10 (knee point voltage > 190 V for 1 A resp. 38 V for 5 A transf. second. rating) transformer is sufficient. In many cases, a lower output will suffice. This can easily be checked by the general principles applying to the calculation of C.T. burdens.

When used as a ground fault protection relay, the low burden characteristic allows the relay to be set at the very sensitive current level of 10 - 40 % I_N even when used with C.T.'s of standard output.

If the trip coil has to be operated by aux. C.T. 4AM5070-8AB a minimum C.T. output of 30 VA, 10P10 is required.

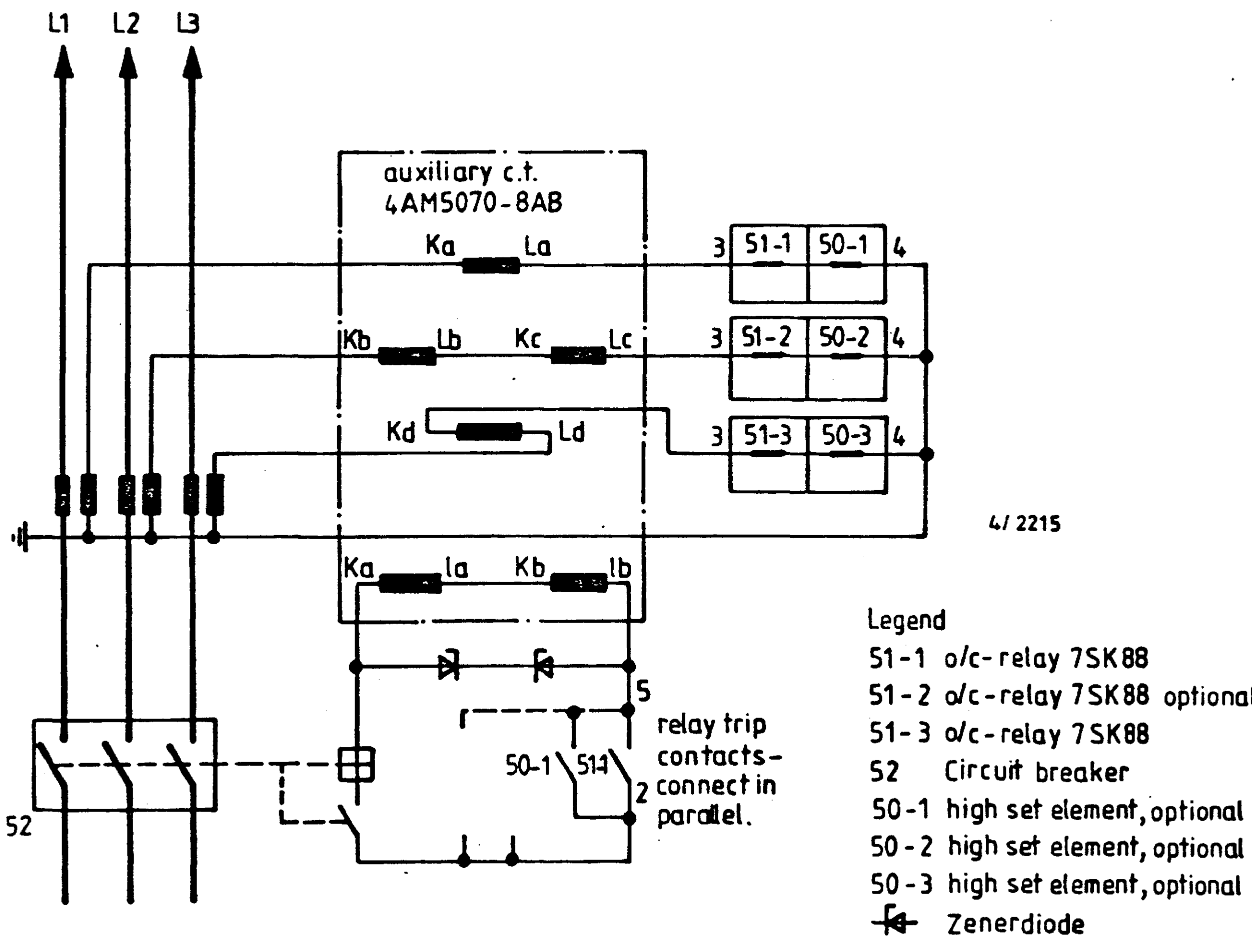


Fig. 8: External Schematic of 7SK88 relay -
C.T. powered version with tripping from C.T. supply

7. Commissioning

Firstly, check that the connections of current transformers, tripping and alarm connections as well as the polarity of the auxiliary supply are correct:

1. Check ratio and connections of C.T.s
   Check auxiliary supply voltage and polarity } (fig. 3 or 8)

2. Check response of relay at your settings:

CAUTION: When removing or restoring connections, the accepted safety practices and regulations must be observed. During all measurements take care that the thermal capacity is not exceeded (see fig. 10).

a) Remove transparent front cover. The external C.T. is automatically short-circuited and disconnected from relay.

b) Using test plug with the associated cable 7XV81 (which includes the trip circuit output - see figure 9) check the operating time at one or two points on the characteristic, one with a test current of approximately four times plug setting and one at a higher value if possible (Siemens test sets 7VP44 or 7VP461 may be used for this purpose). The permissible tolerance should not exceed ± 20 % (according to BS 142).

Should larger tolerances exist then, as a first step, the test set-up should be checked:

- superimposed load current } not possible if 7XV81
- shunt circuit for test current } is used for testing
- test current not constant during relay delay time
- test current not injected (in particular for C.T.-powered relays).

If after checking the above points an excessive tolerance exists then the complete relay should be returned for repair. Do not attempt recalibration.

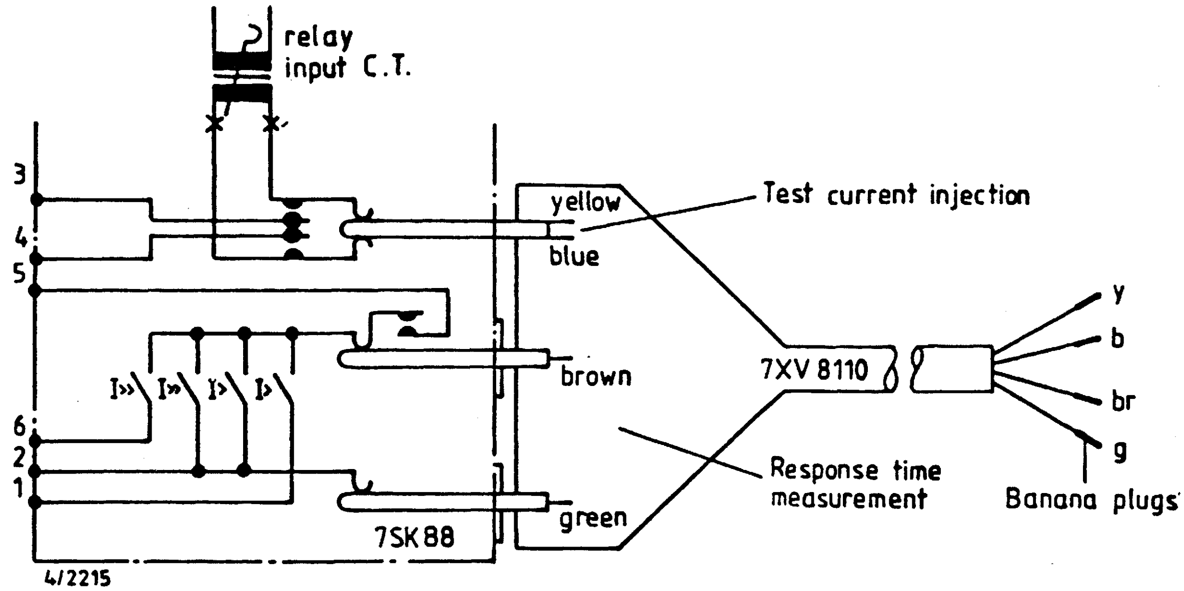


Fig. 9: Diagrammatic representation of effect of inserted test plug 7XV8110

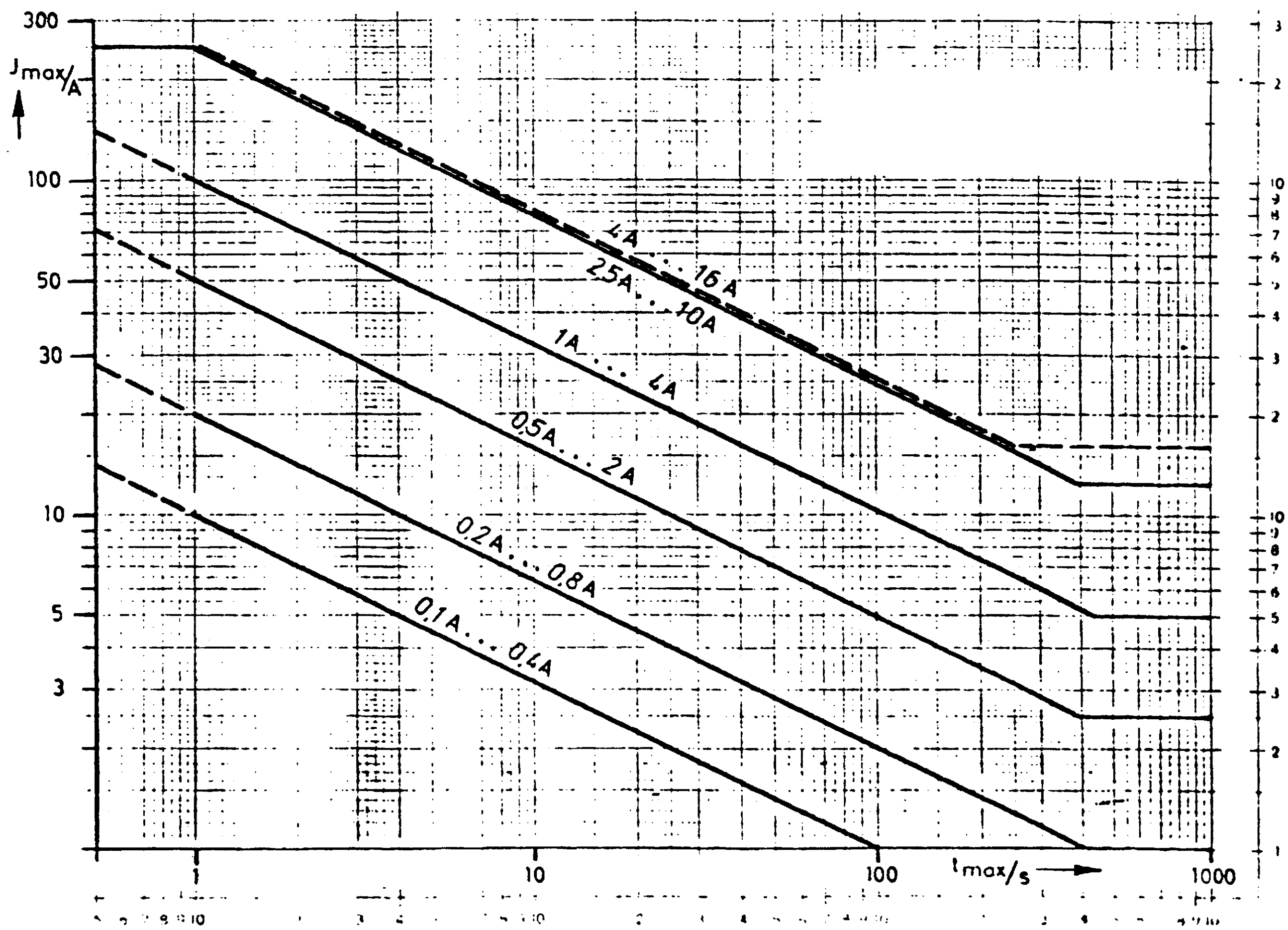


Fig. 10: Thermal withstand of current circuit 7SK88

c) The response of the high set element may be similarly checked. The permissible pick up tolerance should not exceed ± 10 %.

3. Check correct functioning of tripping circuit (with circuit breaker if possible) and indicating circuits all in conjunction with directional relay 7SP88 if fitted.

4. Restore equipment to proper operating condition.

Important:

After testing the relay it is essential that the correct type of plastic front cover is refitted. Check that the cover has the engraved type designation 7SK88..-..A.

8. Maintenance

The unit has no particular maintenance requirements. All measurement circuits are static and maintenance free. The output relay is covered with a transparent plastic wrap (cover).

An occasional functional test is recommended. The tripping circuit and power circuit breaker should be included in the test, together with any associated elements (e.g. 7SP88 directional element).

In the event that a component becomes damaged or unservicable the complete PCB or assembly can be easily replaced without recalibration.

The following standard replacement parts are available:

Description		Ordering Code
Transparent front cover		C73207-A235-B66
Printed circuit board (complete)		
Measuring element	inverse	C73207-A235-B221
	very inverse	C73207-A235-B225
	extremely inverse	C73207-A235-B227
with high set element	inverse	C73207-A235-B222
	very inverse	C73207-A235-B226
	extremely inverse	C73207-A235-B228

Important:

These replacement parts only apply for the relay type 7SK88..-..A. In the case of relays of an earlier series the complete relay must be returned for repair.

Technical Data

Auxiliary voltage U_N	V d.c.	60, 110, 125, 220 (preferred values)
Operating range	%	80 - 115) (for preferred
Max. perm. residual ripple	%	10) values)
Current demand. operated, including output relay		
at U_N = 110-220 V	mA	ca. 60
at U_N = 60 V	mA	ca. 75
Test voltage at 50 Hz for 60 s	kV	2
Impulse voltage test to IEC 225-4	kV	5
High-frequency test 1 MHz, 400/s	kV	2.5
Limiting temperature		
for operation		- 5 °C to +50 °C
for storage and transport		-25 °C to +65 °C
Case		
Weight (approx.)	kg	1.5 (CT powered version 1.8)
Material		Makrolon, fibreglass reinforced
Colour		Stone grey, RAL 7032
Degree of protection (IEC 144)		IP 54 (terminals IP 04)
Humidity class acc. DIN 40040		class F, i.e. 75 % average 95 % for max. 3 months p.a.
Mechanical withstand acc. DIN 60046		
for operation		10....60 Hz: 0.035 mm extentricity 60...500 Hz: 0.5 g
for storage and transport		5.....8 Hz: 7.5 mm extentricity 8...500 Hz: 2 g
Specifications or recommendations		IEC 225-4, VDE 0435, BS 142

Connection to current transformer	1 A or 5 A 50 or 60 Hz
Rated Burden (c.t.), typical values,	
based on min. setting	0.5 VA
c.t. powered version	5 VA
c.t. powered version plus c.t. operated	
trip coil	30 VA minimum
Limiting withstand values	
for 1 sec	100 x $I_{P\ min}$ (max. 250 A)
for 10 sec	30 x $I_{P\ min}$ (max. 75 A)
continuous	5 x $I_{P\ min}$ (max. 16 A)

Overcurrent element I

Plug settings		7 positions at equal intervals
Setting ranges	I_p in A	0.1 - 0.4
	A	0.2 - 0.8 *)
	A	0.5 - 2.0 *)
	A	1 - 4
	A	2.5 - 10 *)
	A	4 - 16
Pick-up tolerance	%	+ 15 - 0
Drop-out to pick-up ratio, typical		0.95
Drop-out time, typical	ms	≤ 30
Overshoot time	ms	≤ 2

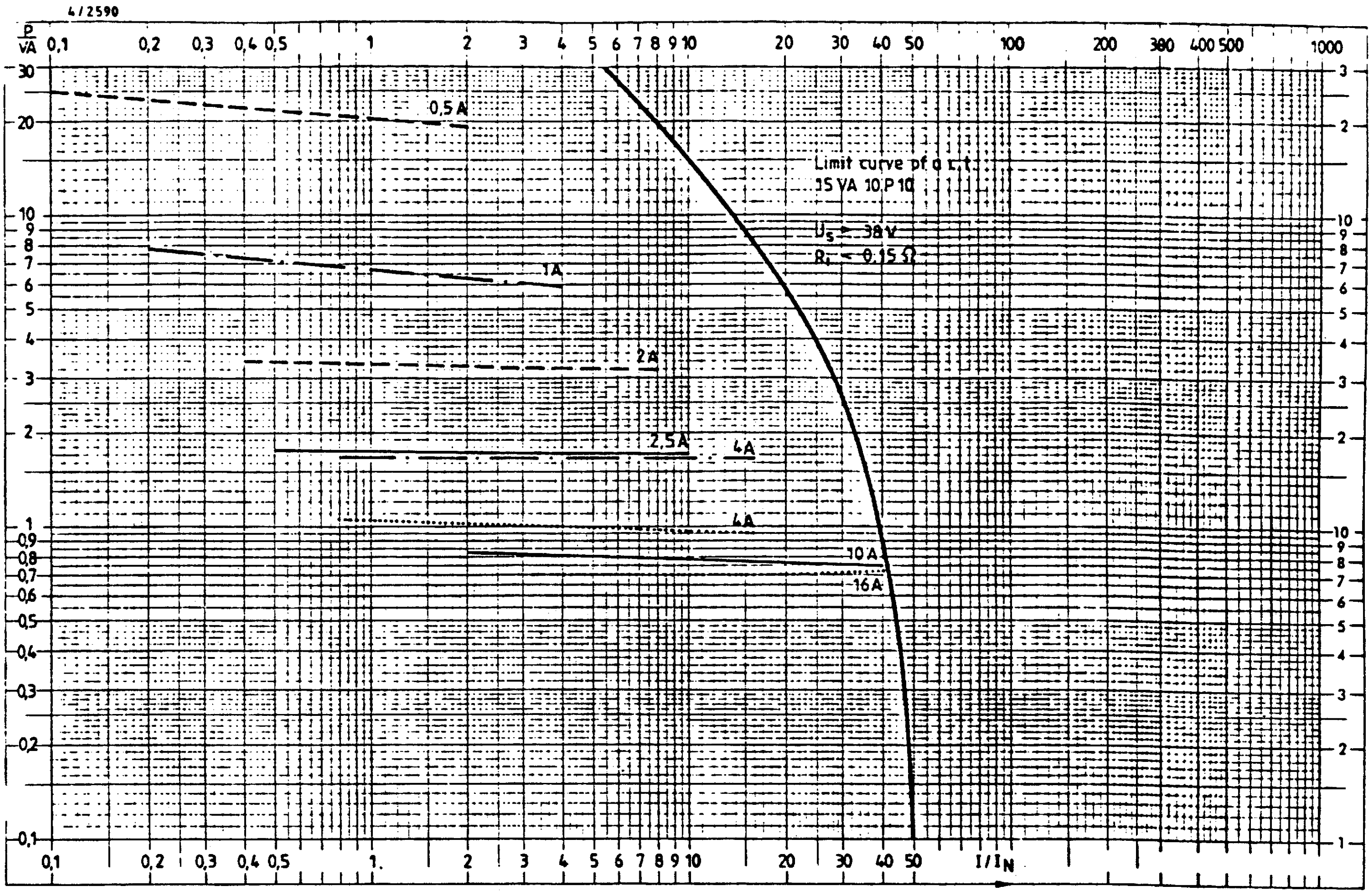
Time multiplier TM	0.05 to 1 in steps of 0.05
Characteristics	normal invese (BS 142) very inverse extremely inverse curve according to characteristic (see Fig. 4)

* preferred values

Instantaneous (high set) element I >>		
setting range		4 x to 20 x I_P (stepless)
pick-up time (typical values)		
at 1.1 I_P	ms	20
at 2 I_P	ms	15
with time delay (with additional capacitor C12 on PCB)	ms	50 - 400
pick-up tolerance		10 % of setting
drop-out to pick-up ratio, typical		0.95
drop-out time	ms	40
transient overreach (if C12 $\geqq$ 1 µF)	%	less than 10

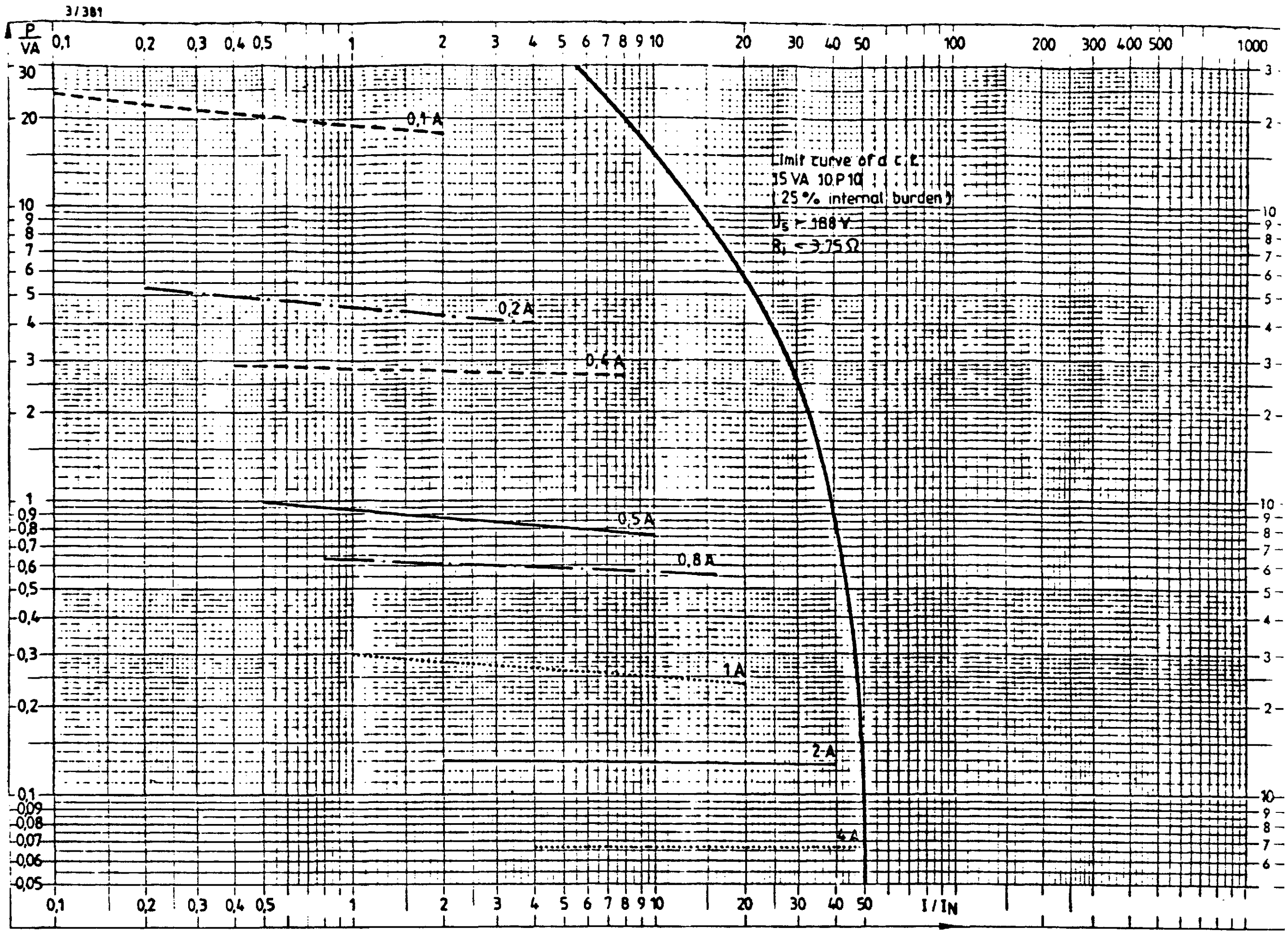
Output relays (2) each with:

Number and type of contacts		2 N/O; silver-cadmium oxide
Make capacity ⊙	W or VA	1000
Break capacity ○·	W or VA	30
Switching current, continuous	A	5
for 0.5 s	A	30
Switching voltage (a.c. or d.c.)	V	250



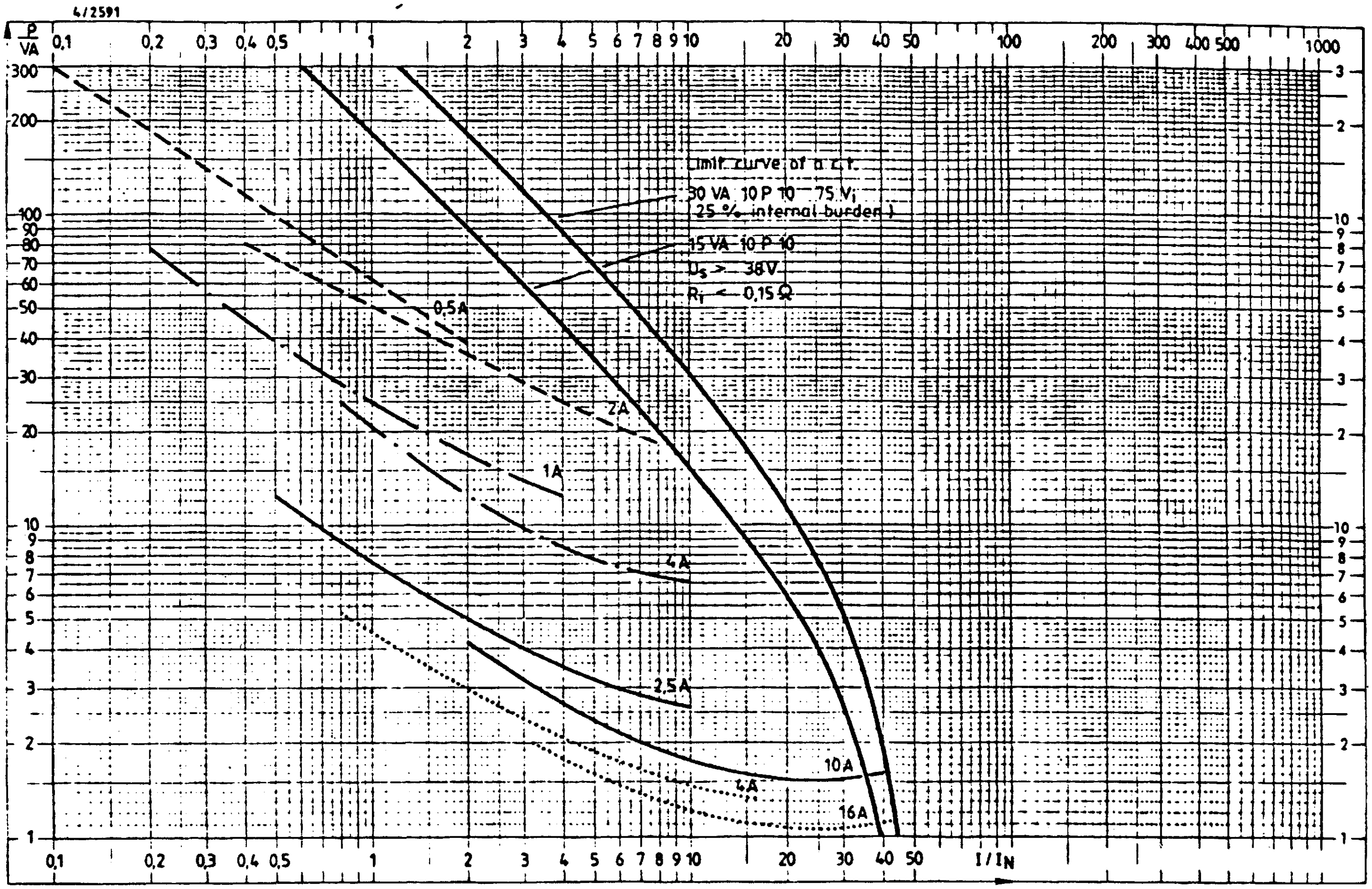
Burden of 5A, d.c. powered version, dependent on fault current, where I_N = 5A nominal current.

– – – –	Setting range	0,5 ... 2 A
—— · ——	Setting range	1 ... 4 A
————	Setting range	2,5 ... 10 A
············	Setting range	4 ... 16 A



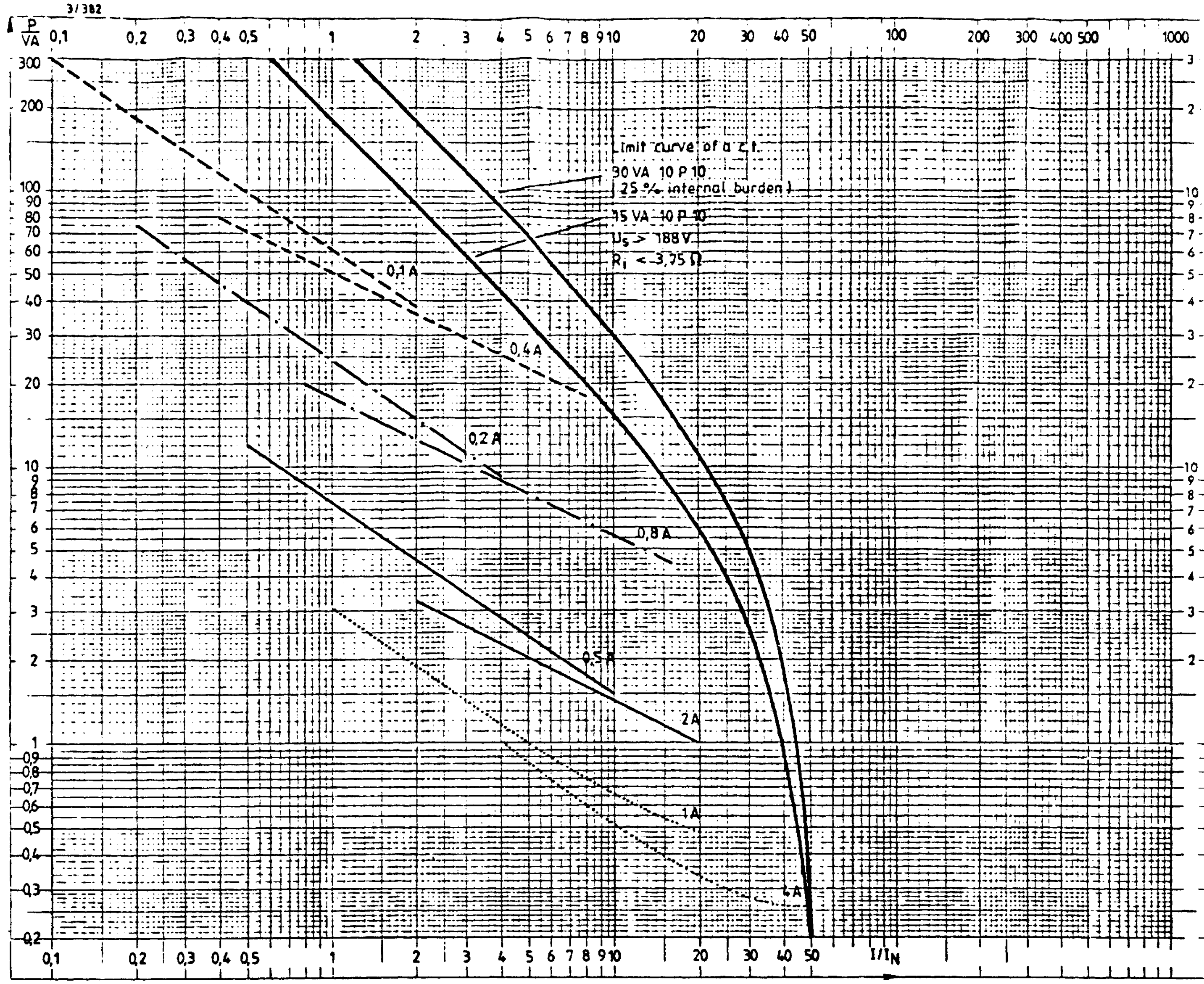
Burden of 1 A , d.c. powered version, dependent on fault current, where I_N = 1 A nominal current.

– – – –	Setting range	0,1 . . . 0,4 A
—— · —	Setting range	0,2 . . . 0,8 A
————	Setting range	0,5 . . . 2 A
··········	Setting range	1 . . . 4 A



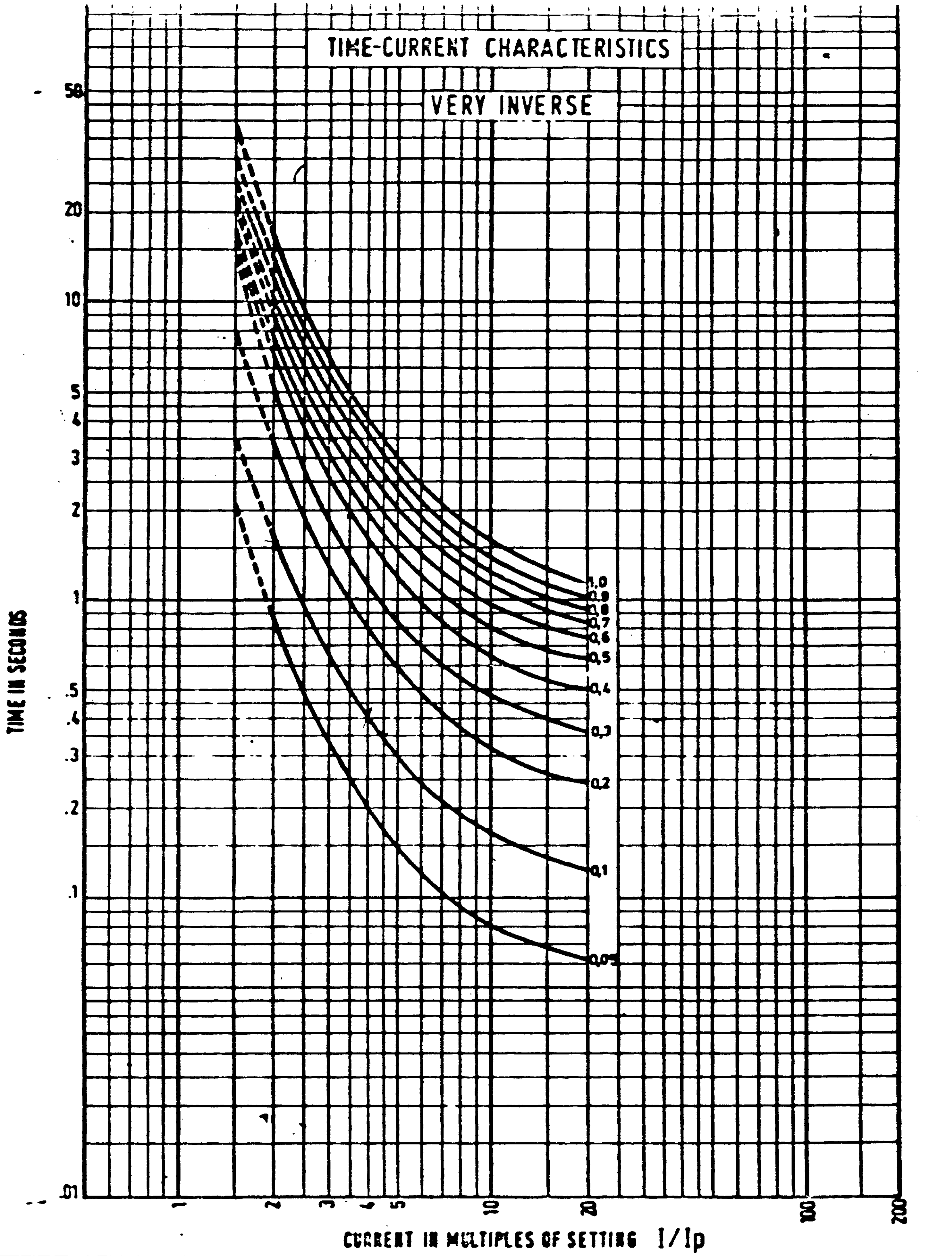
Burden of 5A, c.t. powered version, dependent on fault current, where I_N = 5A nominal current.

– – – –	Setting range	0,5	... 2 A
—·—	Setting range	1	... 4 A
———	Setting range	2,5	... 10 A
....	Setting range	4	... 16 A



Burden of 1A, c.t. powered version, dependent on fault current, where I_N = 1A nominal current.

– – – –	Setting range	0,1 . . . 0,4 A
—— · ——	Setting range	0,2 . . . 0,8 A
————	Setting range	0,5 . . . 2 A
··········	Setting range	1 . . . 4 A



	Tag	Name
Bearb	4 5 76	La/Strohm
Gepr		
Norm		
Abt		Ges

Module
VERY INVERSE

Anl.-Kennz.
Orts-Kennz.

SIEMENS

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Blätter