

ABB Protective releases

Thermal-magnetic S1, S3, S5, S6

The S1 – S3 Isomax series uses a non-interchangeable tripping mechanism with a fixed thermal and magnetic trip. These breakers utilize a heat sensitive bimetal for protection against overload currents. The magnetic element is an instantaneous acting device for protection against short circuit faults. The S5, S6 Isomax series with thermal-magnetic tripping mechanism are adjustable from .7 to 1.



S3 150 – S3 225

L

Fixed thermal

I_{th} = 15 – 150A

I_{th} = 175 – 225A

+

L

Fixed magnetic

I₃ = 10 x I_{th}

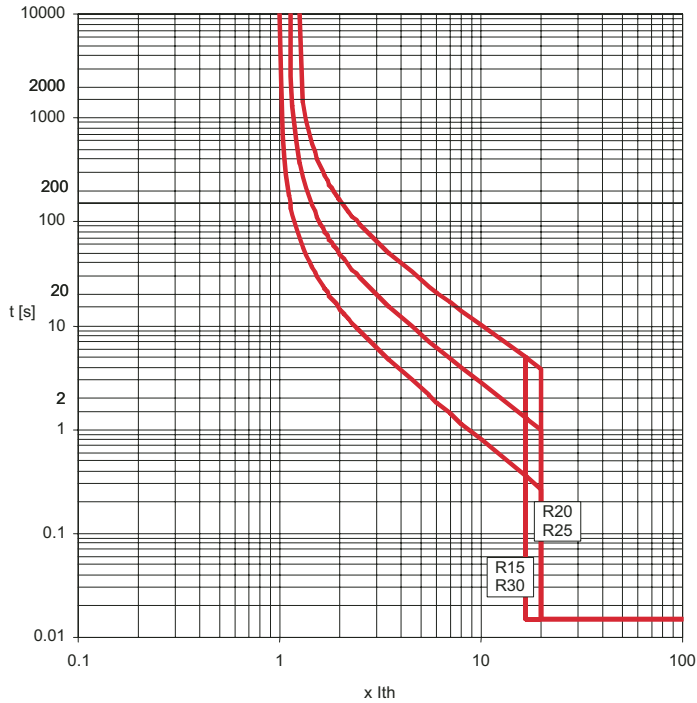
500A min.

Variation in thermal element setting currents according to ambient temperature

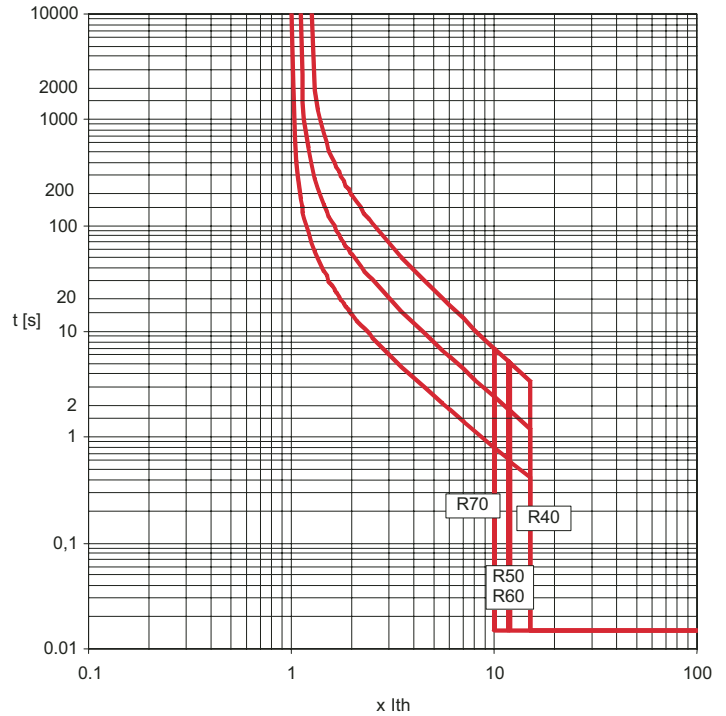
Circuit breaker frame	Trip release	Variation in current					
		10°C	20°C	30°C	40°C	50°C	60°C
S1 100, S3 100	R15	18	17	16	15	14	13
	R20	24	22	21	20	19	17
	R25	30	28	27	25	23	21
	R30	35	33	32	30	28	26
	R35	41	39	37	35	33	30
	R40	47	44	42	40	37	34
	R45	53	50	48	45	42	38
	R50	59	56	53	50	47	43
	R60	71	67	64	60	56	51
	R70	83	78	74	70	66	60
	R80	94	90	85	80	75	68
R90	106	101	95	90	85	77	
R100	118	112	106	100	95	85	
S3 150	R125	148	140	133	125	119	106
	R150	177	168	159	150	143	127
S3 225	R175	207	196	186	175	166	149
	R200	236	224	212	200	190	170
	R225	266	252	239	225	214	191
S5 400	R300	345	328	314	300	286	267
	R400	465	442	420	400	380	355
S6 600	R600	690	656	628	600	572	534
	R800	965	90	855	800	740	670

Protective releases
Thermal magnetic overcurrent release
Time current curves, S1

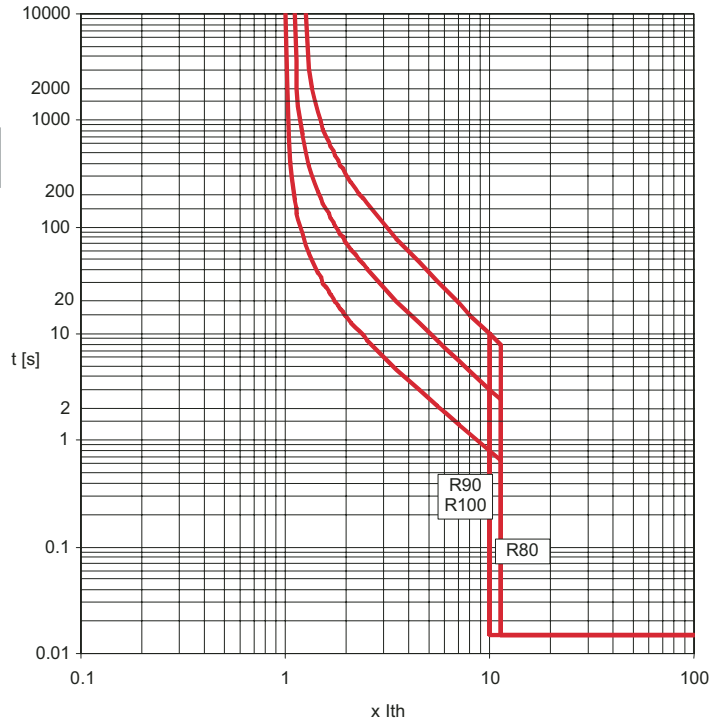
S1, 100 R15-R30



S1, 100 R40-R70



S1, 100 R80-R100



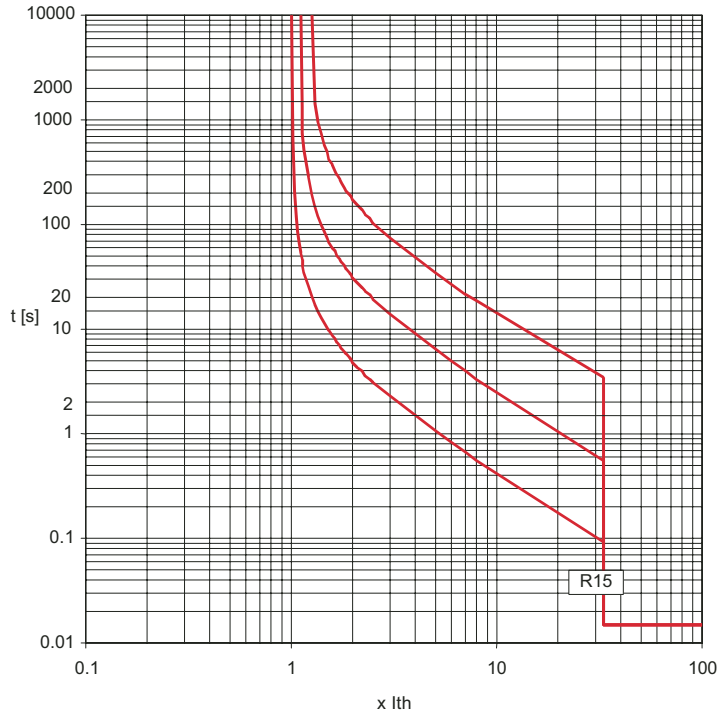
Protective releases

Thermal-magnetic overcurrent release

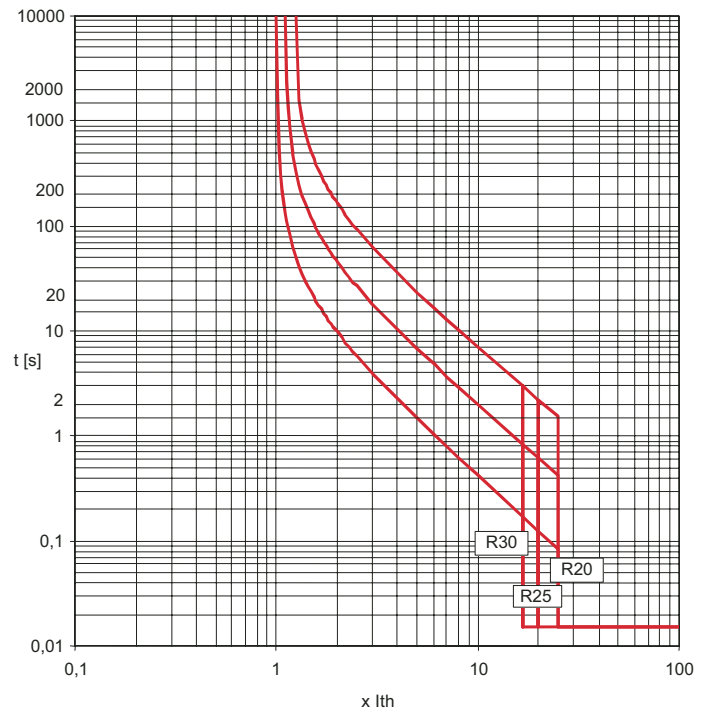
Time-current curves, S3



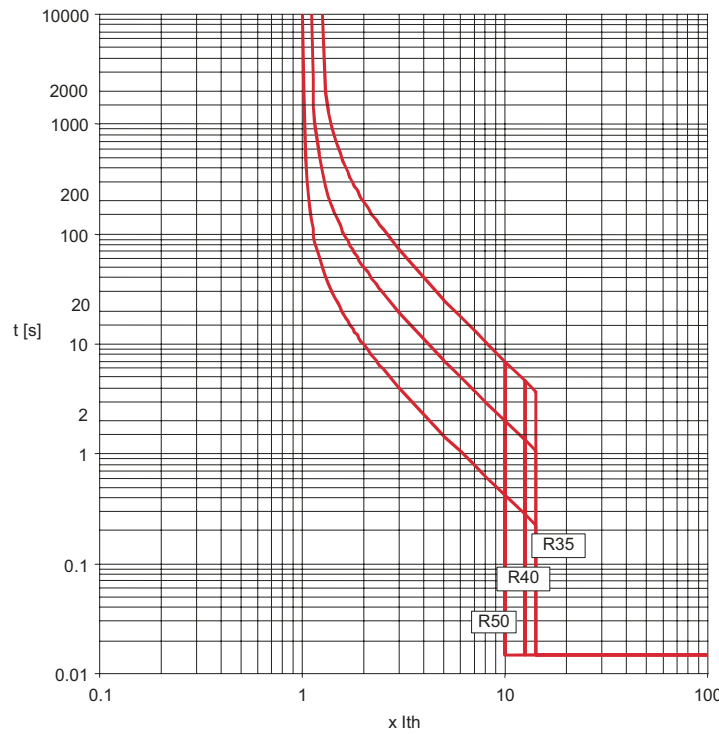
S3, R15



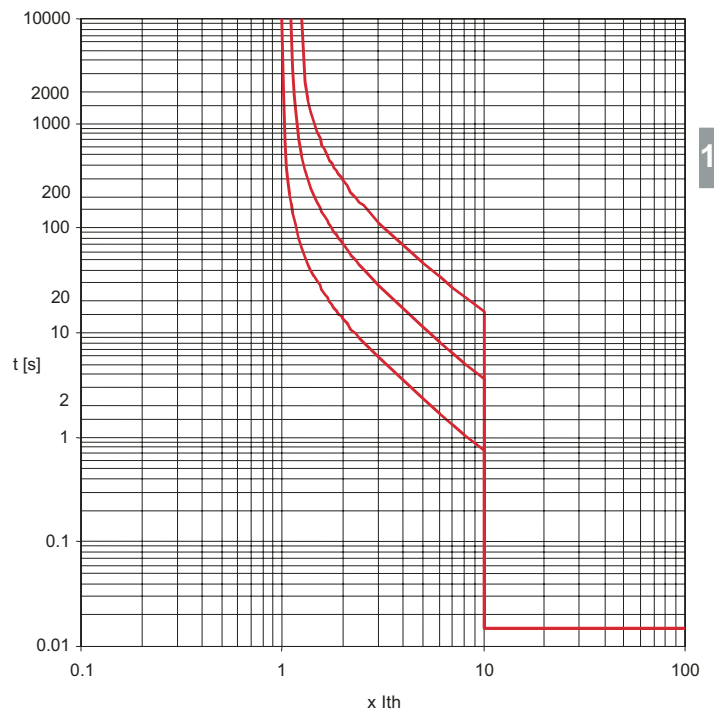
S3, R20-R30



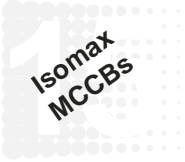
S3, R35-R50



S3, R50-R100



Ⓢ Direct current may shift tripping characteristic. Consult ABB.

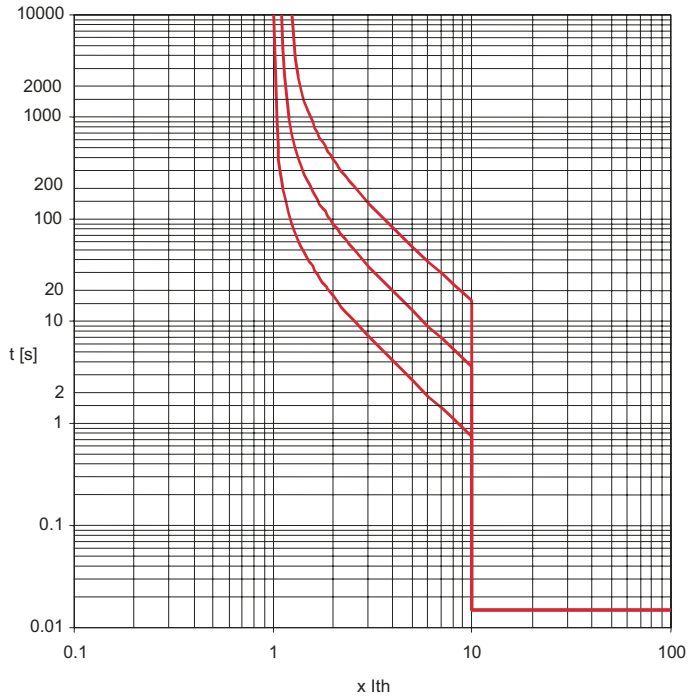


Protective releases

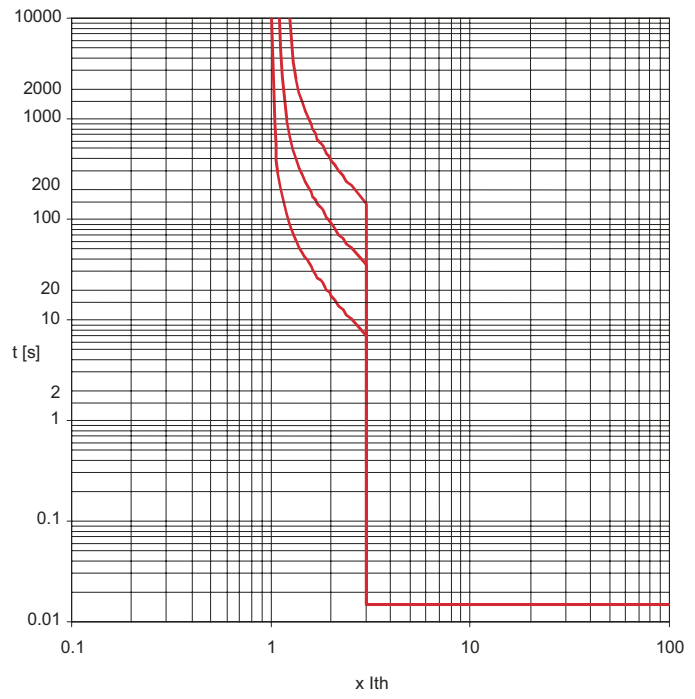
Thermal-magnetic overcurrent release

Time-current curves, S3

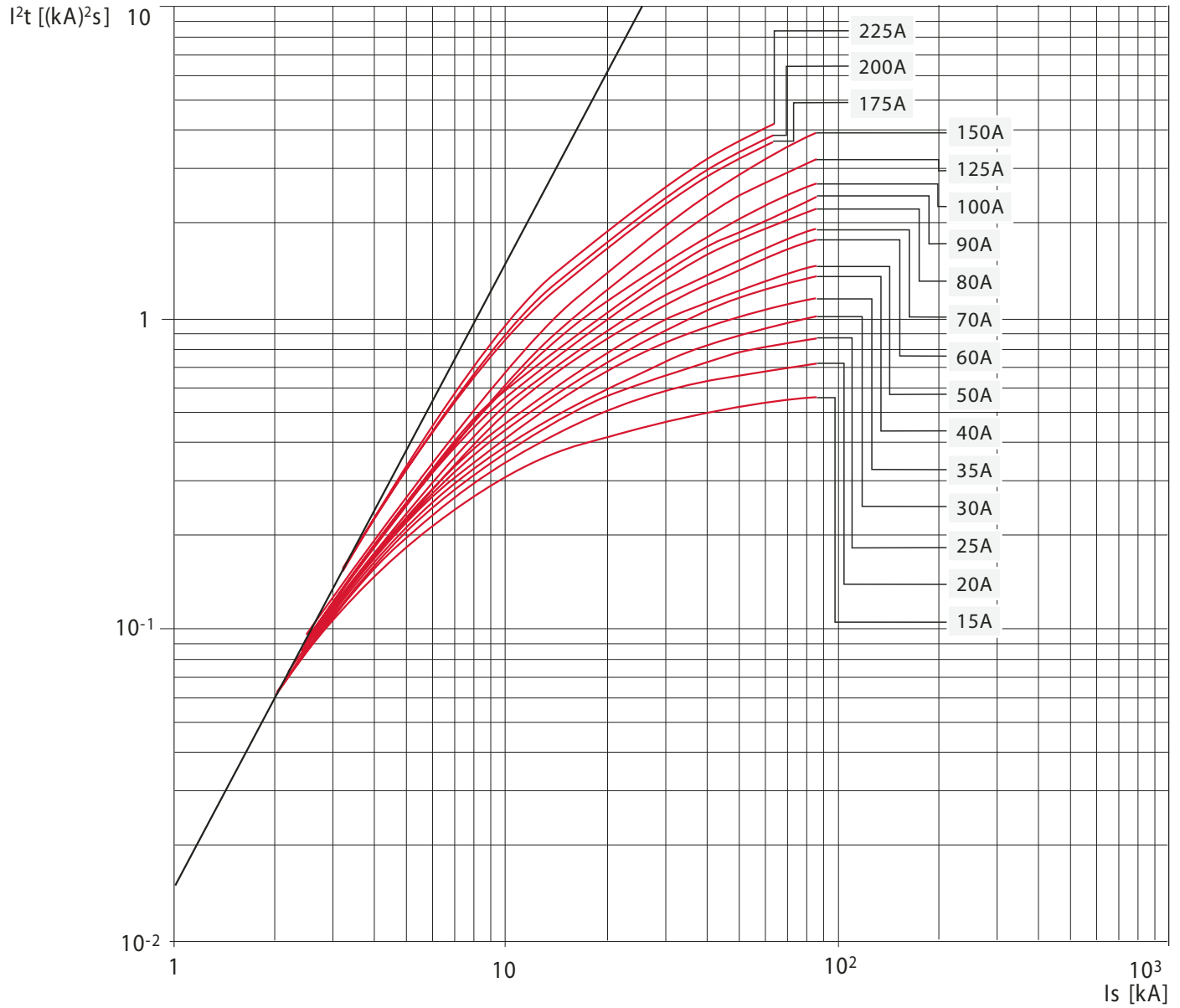
S3, R125-R225 – 10X I_m



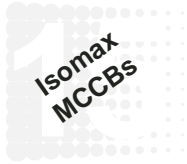
S3, R150-R225 – 3X I_m



Protective releases
 Specific let-through energy I^2t curves
 S3— TM - $I_{th} = 15A - 225A, 480VAC$



Key
 I_s = Prospective short-circuit symmetrical current
 I^2t = Specific let-through energy at the voltages shown



Protective releases

Microprocessor trip release

S4, S5, S6, S7, S8

Microprocessor based overcurrent relays for alternating current for S4, S5, S6 and S7 circuit-breakers

The microprocessor based overcurrent relays (actual RMS) for Isomax S circuit-breakers offer a wide range of current and trip time settings.

They are available in two versions:

PR211/P with overcurrent protection «L» and instant short circuit protection «I». Available with functions «L+S+I» or «L+S+I+G». Functions «S», «I» and «G» can be excluded manually by means of the trip current threshold selector (OFF position). In its most complete configuration, i.e. with functions «L+S+I+G», the PR212/P relay can be combined, on request, with the following units:

PR212/P with overcurrent protection «L», selective short circuit protection «S», instant short circuit protection «I» and ground fault protection «G». Available with functions «L+S+I» or «L+S+I+G». Functions «S», «I» and «G» can be excluded manually by means of the trip current threshold selector (OFF position). In its most complete configuration, i.e. with functions «L+S+I+G», the PR212/P relay can be combined, on request, with the following units:

PR212/D — dialog unit

Essential for two-way communication with electrical plant management systems. When the unit is present, it is possible to choose between the manually set parameters (LOC), and the parameters set by the electrical plant control system (REM) by means of the appropriate selector. The dialog unit must be supplied with an auxiliary voltage of 24 V d.c.

The following information is made available through the dialog unit on the field bus:

- protection parameters
- current values of phases, neutral and ground
- circuit-breaker state
- number of operations of circuit-breaker
- interrupted currents
- state of the overcurrent relay with indication of:
 - normal operation
 - pre-alarm (0.9 x I₁)
 - overcurrent function «L»
 - trip function «S»
 - trip function «I»
 - trip function «G».

It is possible to provide and/or modify the protection parameters and the circuit-breaker opening/closing controls. In the event of a serial communication error, the overcurrent relay operates in accordance with the last parameters set and in any event always in accordance with the manually programmed setting. The same occurs in the event of a dialog unit fault, and in the absence of auxiliary supply.

The dialog unit is external for circuit breakers S4 and S5 and is located inside the relay box for circuit breakers S6 and S7.

The external dialog unit is connected by means of a cable for supply and communication with the PR212/P protection relay.

The standard version of the dialog interface has the following specifications:

- hardware: EIA RS485 serial transmission line
- communication protocol: ABB Modbus
- transmission speed: 150 – 19200 baud (bit/s).

PR212/K — signalling unit

Can be connected directly to the PR212/P protection relay and provides contacts for the protection unit trip and alarm signals: pre-alarm, overcurrent function «L», trip functions «S», «I» and «G», trip by relay and internal communication error with PR212/P.

PR212/T — actuator unit

Can be installed only if the dialog unit is present, and by means of suitable relays, controls the opening and closing of the circuit-breaker. In order that opening and closing can be actuated, the circuit-breaker must be equipped with a motor operator (direct-acting for S4 and S5; stored energy type for S6 and S7).

Note

The K and T units are always external.

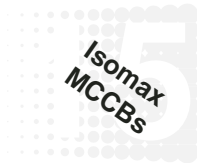
Other important features of the microprocessor based relays are as follows:

- protection of neutral with programmable automatic adjustment, executed by the manufacturer, to 50% (standard) or 100% (on request) of the current value selected for the phases. The optional version has no code in this catalog;
- reliable operation also when one phase only is live;
- individual and simultaneous adjustment on the three phases and neutral;
- no need for auxiliary supply;
- trip specifications not affected by the ambient temperature;
- consistency of specifications and reliability including in contaminated environments;
- signalling of tripped relay (available for all versions) by means of voltage-free contact for 24 V d.c. or a.c. circuits maximum 3 W.

Circuit-breaker rated current change according to ambient temperature. The tripping characteristics of Isomax S4 – S8 with electronic trip units are unaffected by ambient temperatures from -25°C to +70°C.

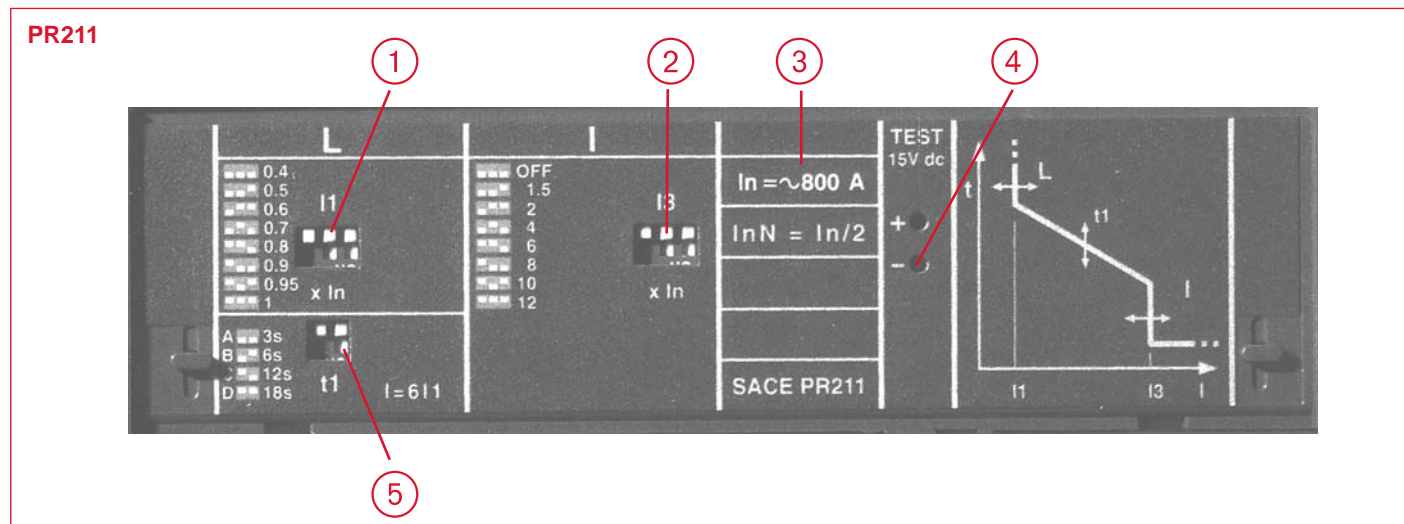
Protective releases

Microprocessor based overcurrent relays, PR211 for S4, S5, S6 & S7 breakers



Protective functions and set values

Protection against	Trip	Symbol	Set values (manual adjustment in steps)
Overload	Long delay	L	$I_1 = 0.4-0.5-0.6-0.7-0.8-0.9-0.95-1 \times I_n$ $t_1 = 4 \text{ curves A,B,C,D}$
Short-circuit	Instantaneous adjustment	I	$I_3 = 1.5-2-4-6-8-10-12 \times I_n$



Key

- 1 Dip-switch for function L setting (I1)
- 2 Dip-switch for function I setting (I3)
- 3 Rated current of current transformers
- 4 15 V d.c. input for release functioning check
- 5 Function L trip time setting dip switch (T1)

Rated and setting currents

Circuit-breaker	Current transformer	Functions	
		L (I1) A (0.4 – 1 x In)	I (I3) A (1.5 – 12 x In)
S4	250	100	40 – 100
			150 – 1200
S5	400	300	100 – 250
			375 – 3000
S6	600/800	600	120 – 300
			450 – 3600
S7	1200	1000	160 – 400
			600 – 4800
		800	240 – 600
		1000	320 – 800
		1200	400 – 1000
			480 – 1200
			900 – 7200
			1200 – 9600
			1000 – 12,000
			1800 – 14,400

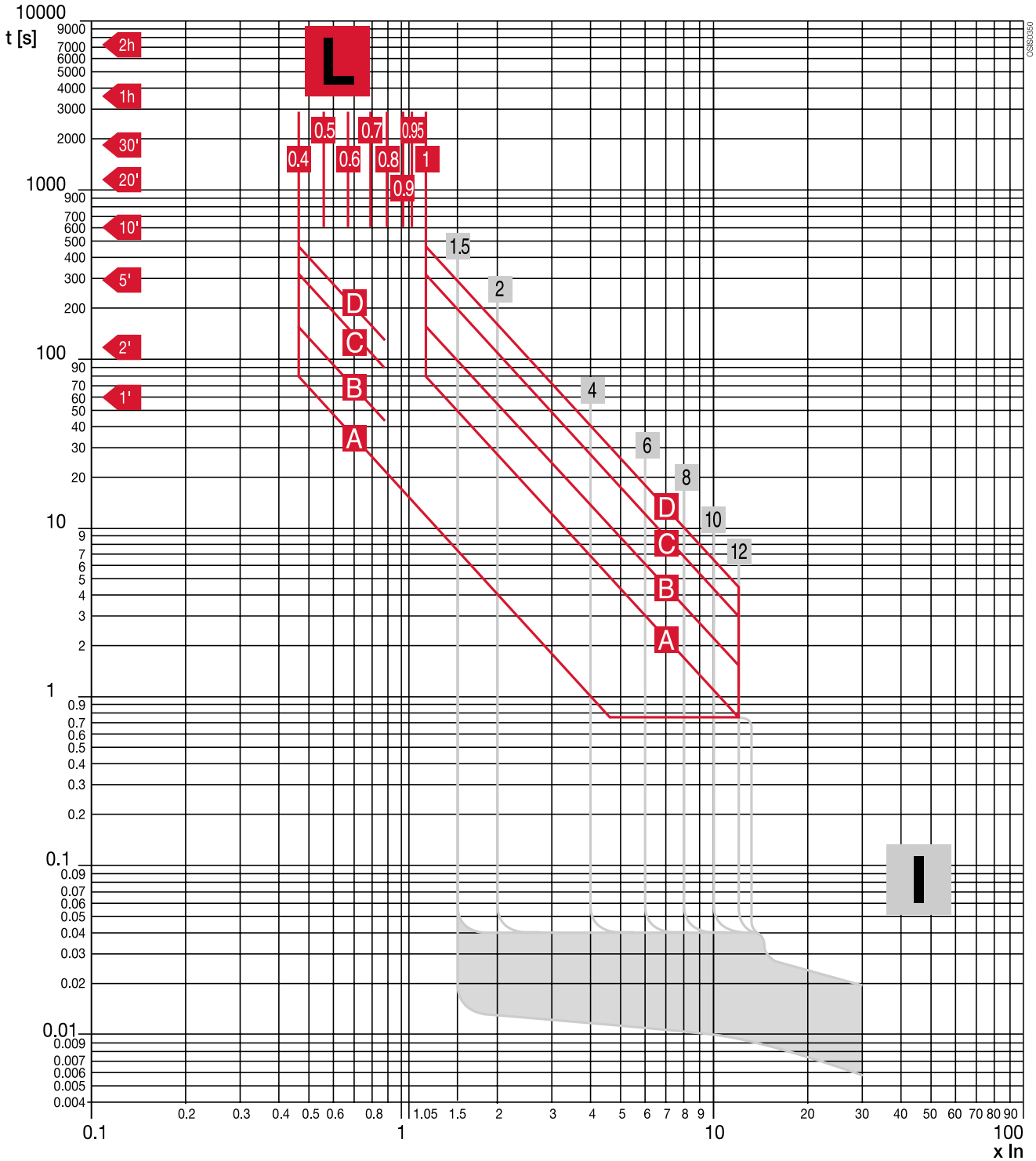


Protective releases

Microprocessor based overcurrent relays, PR211

Time-current curves, S4 – S7

Function L - I



Key
 I_n = Rated current of current transformers
 t = Tripping time

Protective releases

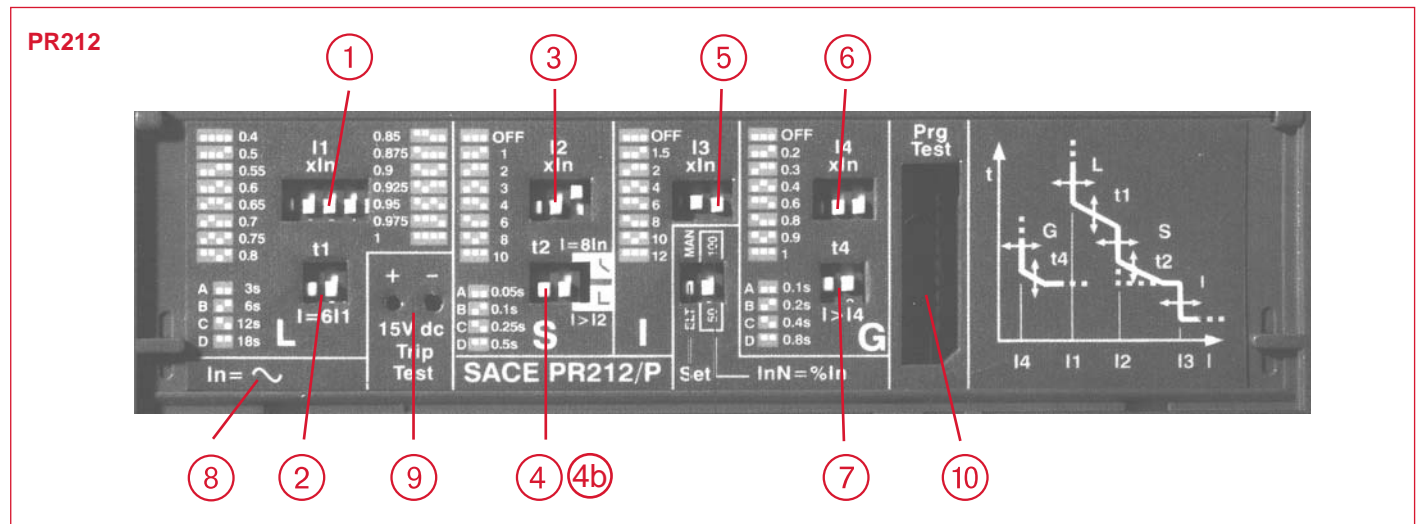
Microprocessor based overcurrent relays, PR212

Protection functions and set values, S4 – S8

Isomax
MCCBs

Protection functions and set values

Protection against	Overload	Short-circuit	Short circuit	Earth fault
Trip	Long delay	Inverse or definite short delay	Instantaneous adjustable	Inverse short delay
Symbol	L	S	I	G ⊕
Set values (manual adjustment in steps)	$I1 = 0.4-0.5-0.55-0.6-0.65-0.7-0.75-0.8-0.85-0.875-0.9-0.925-0.95-0.975-1 \times I_n$ $t1 = 4 \text{ curves A - D}$	$I2 = 1-2-3-4-6-8-10$ OFF $\times I_n$ $t2 = 4 \text{ curves A - D}$	$I3 = 1.5-2-4-6-8-10-12$	$I4 = 0.2-0.3-0.4-0.7-0.8-0.9-1$ $t4 = 4 \text{ curves A - D}$
Set values (electronic adjustment)	$I1 = 0.4 - 1 \times I_n$ $t1 = 3 - 18s$	$I2 = 1 \dots 10 \text{ OFF} \times I_n$ $t2 = 0.05 - 0.5$	$I3 = 1.5-12 \text{ OFF} \times I_n$	$I4 = 0.2 - 1 \text{ OFF} \times I_n$ $t4 = 0.1 - 0.8s$



Key

- 1 Function L setting dip-switch (I1)
- 2 Function L trip time setting dip-switch (t1)
- 3 Function S setting dip-switch (I2)
- 4 Function S trip time setting dip-switch (t2)
- 4b Fixed/variable trip time selection dip-switch
- 5 Function I setting dip-switch (I3)
- 6 Function G setting dip-switch (I4)
- 7 Function G trip time setting dip-switch (t4)
- 8 Rated current of current transformers
- 9 15 V d.c. input for release functioning check
- 10 Socket for connecting SACE PR010/T test unit

⊕ S8 it = 0.2 - 0.4



Protective releases

Rated and setting currents, PR212

S4 – S8

Rated and setting currents

Circuit breaker		Current transformer	Functions			
			L (I1) A (0.4 – 1.0 x In)	S (I1) A (1 – 10 x In)	I (I3) A (1.5 – 12 x In)	G (I4) A (0.2 – 1 x In) / S8 (0.2 – 0.4)
S4	250	100	40 – 100	100 – .1000	150 – 1200	20 – 100
		250	100 – 250	250 – .2500	375 – 3000	50 – 250
S5	400	300	120 – 300	300 – .3000	450 – 3600	60 – 300
		400	160 – 400	400 – .4000	600 – 4800	80 – 400
S6	600	600	240 – 600	600 – .6000	900 – 7200	120 – 600
		800	320 – 800	800 – .8000	1200 – 9600	160 – 800
S7	1200	1000	400 – 1000	1000 – .10,000	1500 – 12,000	200 – 1000
		1200	480 – 1200	1200 – .12,000	1800 – 14,400	240 – 1200
		1600	640 – 1600	1600 – .16,000	2400 – 19,200	320 – 640
S8	1600 – 2500	2000	800 – 2000	2000 – .20,000	3000 – 24,000	400 – 800
		2500	1000 – 2500	2500 – .25,000	3750 – 30,000	500 – 1000

Key

- I_u** = Rated uninterrupted current of circuit-breaker
- I_n** = Rated current of current transformers
- I1** = Current setting value for relay overload protection
- I2** = Current setting value for relay short-circuit selective protection
- I3** = Current setting value for relay instantaneous short-circuit protection
- I4** = Current setting value for earth fault protection

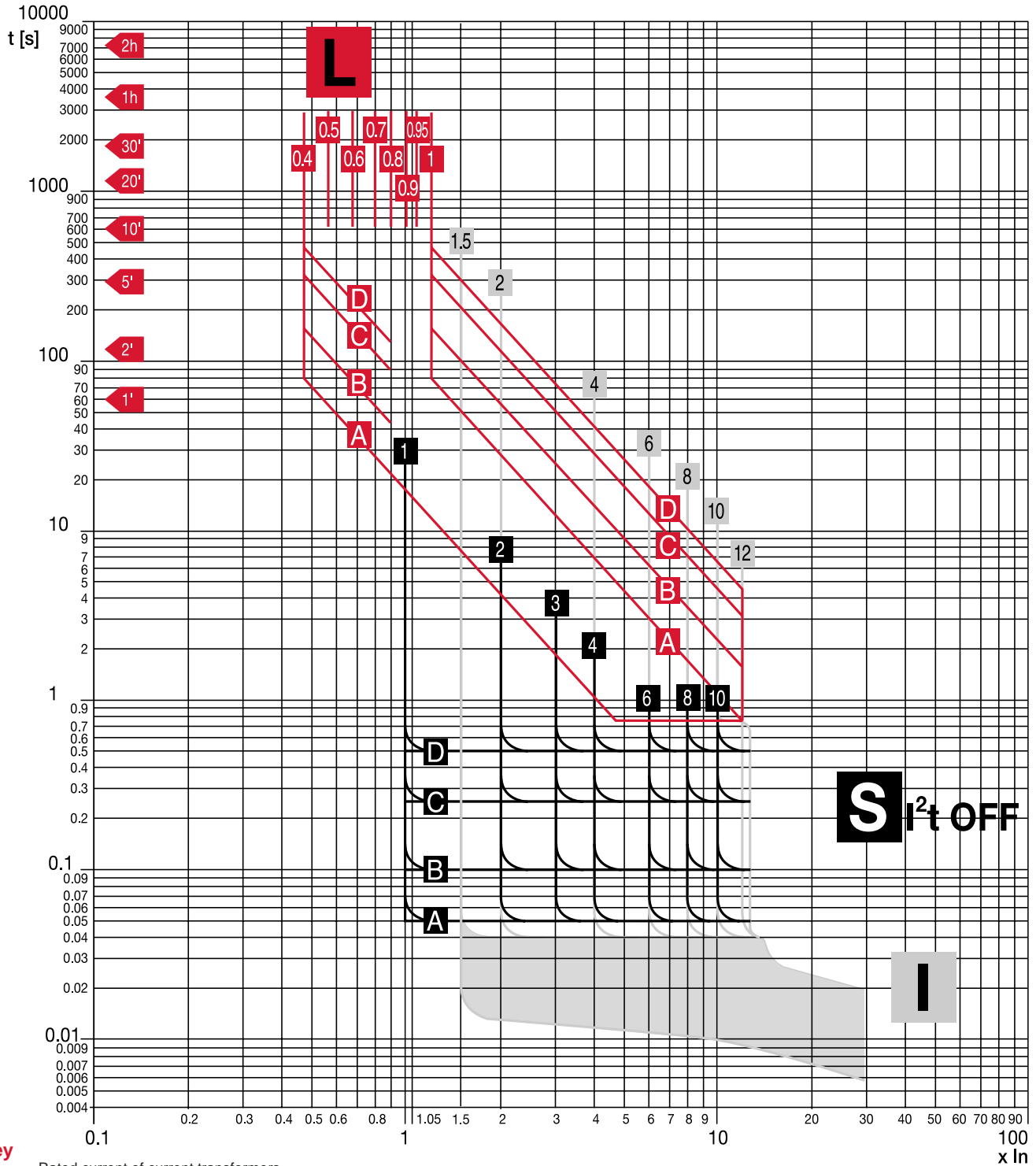
Protective releases

Microprocessor based overcurrent relays, PR212

Time-current curves, S4 – S8



Function L - S - I



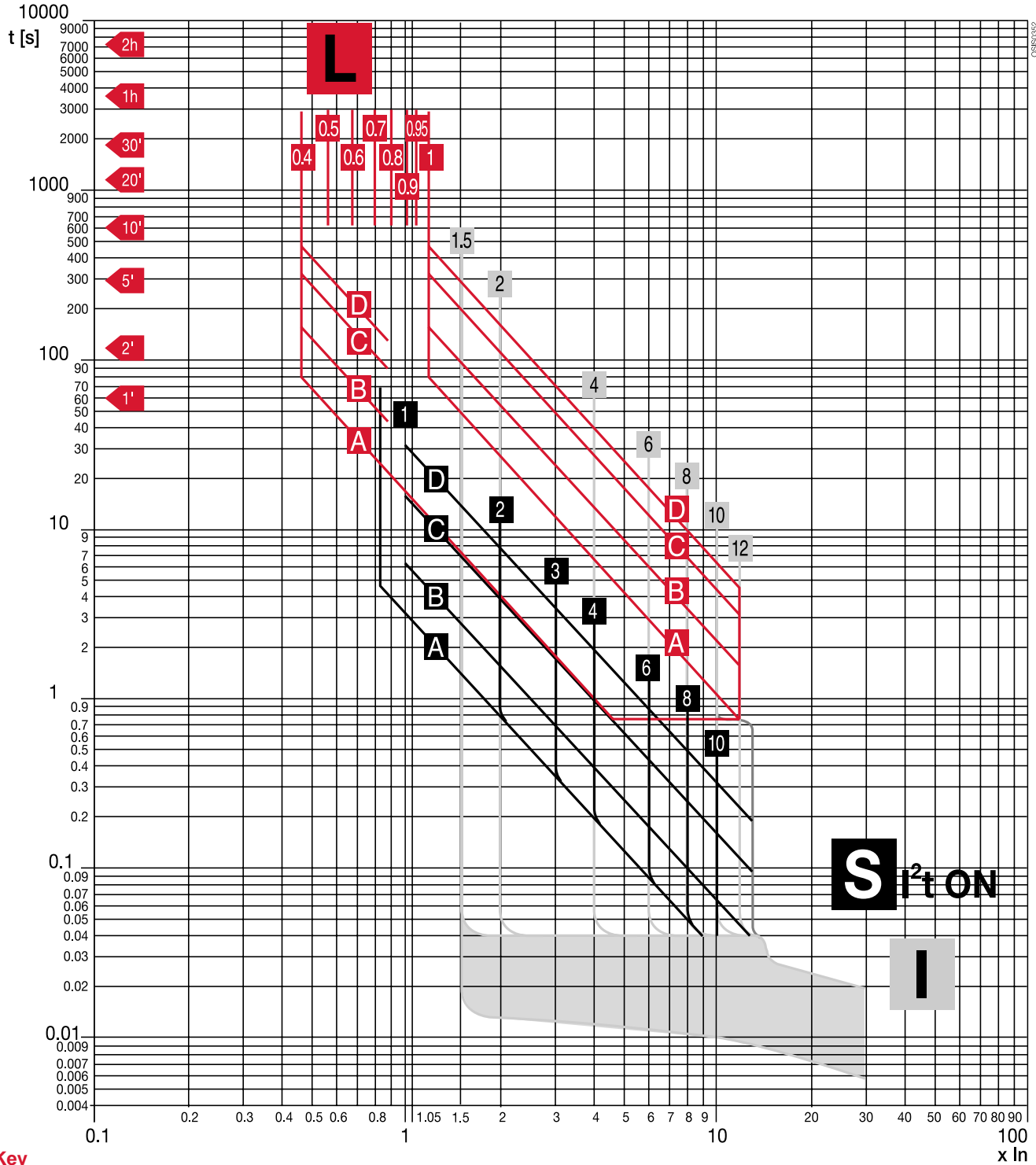


Protective releases

Microprocessor based overcurrent relays, PR212

Time-current curves, S4 – S8

Function L - S - I



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Key
 I_n = Rated current of current transformers
 t = Tripping time

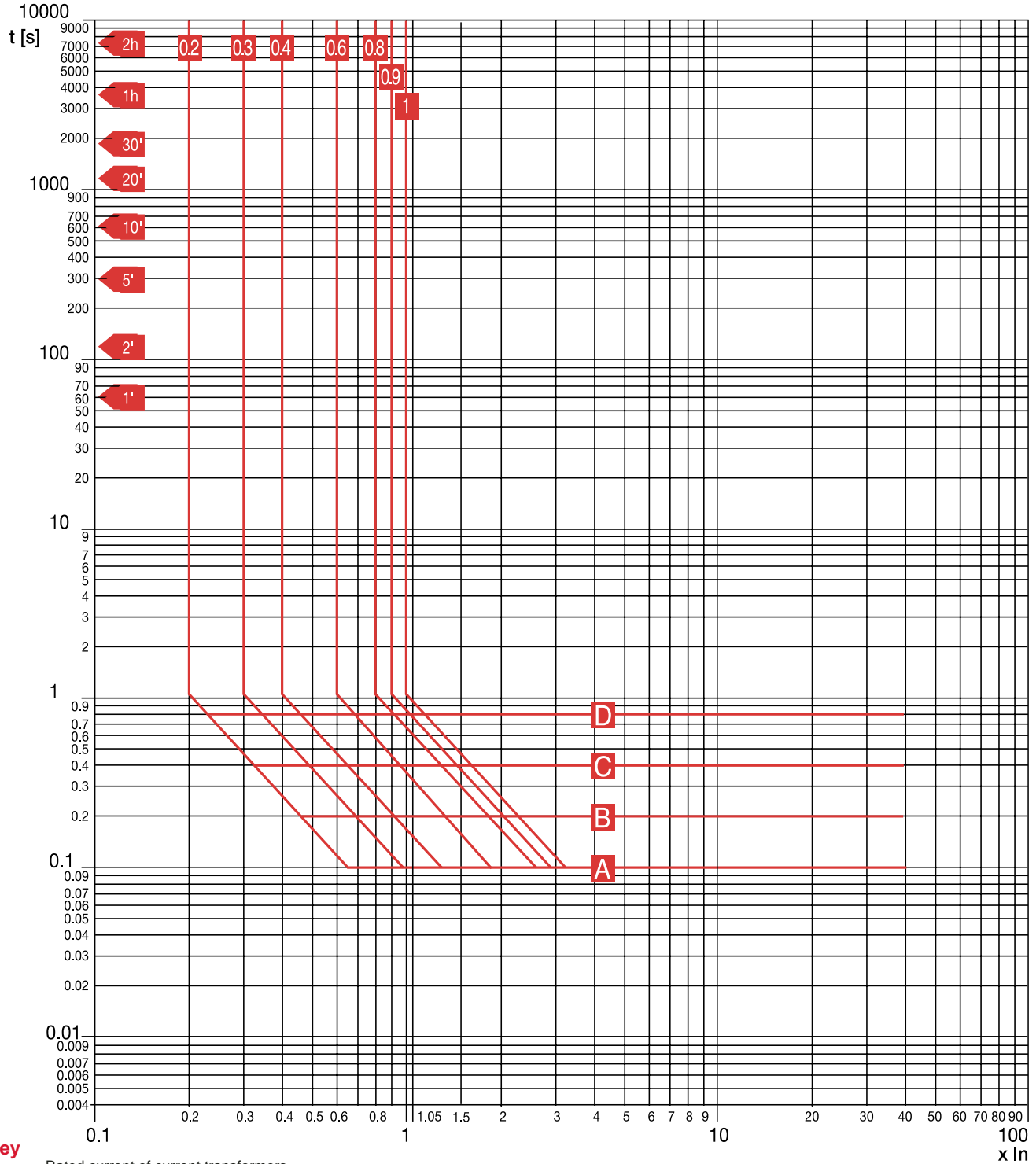
Protective releases

Microprocessor based overcurrent relays, PR212

Time-current curves, S4 – S8



Function G[®]



Key
 I_n = Rated current of current transformers
 t = Tripping time

© S8 maximum setting is 0.4 per NEC guidelines.



Motor horsepower ratings

Magnetic trip

1/2HP @ 575V to 100HP @ 575V

Horsepower per NEC 430-50				Motor full Load amps	Isomax Type	MCP Rating	Approximate trip setting % of MFLA						
208V	230V	460V	575V				1.5X	2X	4X	6X	8X	10X	12X
						Magnetic trip							
						%	%	%	%	%	%	%	
			1/2	0.9	S3	3	—	—	1300	2000	2700	3400	4000
		1/2		1.1	S3	3	—	—	1100	1600	2200	3700	3300
			3/4	1.3	S3	3	—	—	900	1400	1800	2300	2800
		3/4		1.6	S3	3	—	—	800	1100	1500	1900	2300
			1	1.7	S3	3	—	—	700	1100	1400	1800	2100
		1		2.1	S3	5	—	—	1000	1400	1900	2400	2900
	1/2			2.2	S3	5	—	—	900	1400	1800	2300	2700
1/2			1 1/2	2.4	S3	5	—	—	800	1300	1700	2100	2500
			2	2.7	S3	5	—	—	700	1100	1500	1900	2200
		1 1/2		3	S3	5	—	—	700	1000	1300	1700	2000
	3/4			3.2	S3	5	—	—	600	900	1300	1600	1900
		2		3.4	S3	5	—	—	600	900	1200	1500	1800
3/4				3.5	S3	10	—	—	1100	1700	2300	2900	3400
			3	3.9	S3	10	—	—	1000	1500	2100	2600	3100
	1			4.2	S3	10	—	—	1000	1400	1900	2400	2900
1				4.6	S3	10	—	—	900	1300	1700	2200	2600
		3		4.8	S3	10	—	—	800	1300	1700	2100	2500
	1 1/2			6	S3	10	—	—	700	1000	1300	1700	2000
			5	6.1	S3	10	—	—	700	1000	1300	1600	2000
1 1/2				6.6	S3	10	—	—	600	900	1200	1500	1800
	2			6.8	S3	10	—	—	600	900	1200	1500	1800
				7.5	S3	25	—	—	1300	2000	2700	3300	4000
2		5		7.6	S3	25	—	—	1300	2000	2600	3300	3900
			7 1/2	9	S3	25	—	—	1100	1700	2200	2800	3300
	3			9.6	S3	25	—	—	1000	1600	2100	2600	3100
3				10.6	S3	25	—	—	900	1400	1900	2400	2800
		7 1/2	10	11	S3	25	—	—	900	1400	1800	2300	2700
		10		14	S3	25	—	—	700	1000	1400	1800	2100
	5			15.2	S3	25	—	—	700	1000	1300	1600	2000
5				16.7	S3	25	—	—	600	900	1200	1500	1800
			15	17	S3	25	—	—	600	900	1200	1500	1800
		15		21	S3	50	—	—	1000	1400	1900	2400	2800
7 1/2	7 1/2		20	22	S3	50	—	—	900	1400	1800	2300	2700
				24.2	S3	50	—	—	800	1200	1700	2100	2500
		20	25	27	S3	50	—	—	700	1100	1500	1900	2200
	10			28	S3	50	—	—	700	1100	1400	1800	2100
10				30.8	S3	50	—	—	600	1000	1300	1600	1900
			30	32	S3	50	—	—	600	900	1300	1600	1900
		25		34	S3	50	—	—	600	900	1200	1500	1800
		30		40	S3	100	—	—	1000	1500	2000	2500	3000
			40	41	S3	100	—	—	1000	1500	2000	2400	2900
	15			42	S3	100	—	—	1000	1400	1900	2400	2900
15				46.2	S3	100	—	—	900	1300	1700	2200	2600
		40	50	52	S3	100	—	—	800	1200	1500	1200	2300
	20			54	S3	100	—	—	700	1100	1500	1900	2200
20				59.4	S3	100	—	—	700	1000	1300	1700	2000
			60	62	S3	100	—	—	600	100	1300	1600	1900
		50		65	S3	100	—	—	600	900	1200	1500	1800
	25			68	S3	100	—	—	600	900	1200	1500	1800
25				74.8	S3	150	—	—	800	1200	1600	2000	—
		60	75	77	S3	150	—	—	800	1200	1600	1900	—
	30			80	S3	150	—	—	800	1100	1500	1900	—
30				88	S3	150	—	—	700	1000	1400	1700	—
		75		96	S3	150	—	—	600	900	1300	1600	—
			100	99	S3	150	—	—	600	900	1200	1500	—

Motor horsepower ratings

Electronic trip

40HP @ 230V to 500HP @ 460V



208V	Horsepower per NEC 430-50			Motor full Load amps	Isomax Type	MCP Rating	Approximate trip setting % of MFLA						
	230V	460V	575V				1.5X	2X	4X	6X	8X	10X	12X
							Electronic trip						
							%	%	%	%	%	%	%
	40			104	S4	250	350	500	1000	1400	1900	2400	2900
40				114	S4	250	350	450	900	1300	1800	2200	2600
		100		124	S4	250	300	400	800	1200	1600	2000	2400
			125	125	S4	250	300	400	800	1200	1600	2000	2400
	50			130	S4	250	300	400	800	1200	1500	1900	2300
50				143	S4	250	250	350	700	1000	1400	1700	2100
			150	144	S4	250	250	350	700	1000	1400	1700	2100
	60			154	S4	250	250	300	600	1000	1300	1600	1900
		125		156	S4	250	250	300	600	1000	1300	1600	1900
60				169	S4	250	200	300	600	900	1200	1500	1800
		150		180	S5	400	350	450	900	1300	1800	2200	2700
	75			192	S5	400	300	400	800	1300	1700	2100	2500
75				211	S5	400	300	400	800	1100	1500	1900	2300
		200		240	S5	400	250	350	700	1000	1300	1700	2000
			250	242	S5	400	250	350	700	1000	1300	1700	2000
	100			248	S5	400	250	300	600	1000	1300	1600	1900
100				273	S6	600	350	450	900	1300	1800	2200	2600
			300	289	S6	600	300	400	800	1200	1700	2100	2500
		250		302	S6	600	300	400	800	1200	1600	2000	2400
	125			312	S6	600	300	400	800	1200	1500	1900	2300
			350	336	S6	600	250	350	700	1100	1400	1800	2100
125				343	S6	600	250	350	700	1100	1400	1700	2100
	150			360	S6	600	250	350	700	1000	1300	1700	2000
		300		361	S6	600	250	350	700	1000	1300	1700	2000
			400	362	S6	600	250	300	600	900	1300	1600	1900
150				396	S6	600	250	300	600	900	1200	1500	1800
			450	412	S6	800	300	400	800	1200	1600	1900	2300
		350		414	S6	800	300	400	800	1200	1600	1900	2300
			500	472	S6	800	250	350	700	1000	1400	1700	2000
		400		477	S6	800	250	350	700	1000	1300	1700	2000
	200			480	S6	800	250	350	700	1000	1300	1700	2000
		450		515	S6	800	250	300	600	900	1200	1600	1900
200				528	S6	800	250	300	600	900	1200	1500	1800
		500		590	S7	1000	250	350	700	1000	1400	1700	2000



Notes
