GENERATION & NETWORK

Digital Multicurve Overcurrent Protections

RMSA7992

MULTICURVE DIGITAL R.M.S. OVERCURRENT PROTECTIONS INDEPENDENT OF AUXILIARY SUPPLY

PROCOM

The optimum operation of an electrical network depends particularly on the reliability and the availability of the protection, measuring and automation devices, and the manner in which these devices can communicate the information in their possession.

PROCOM, CEE's new modular system, satisfies these criteria by providing the possibility of using either separately or in an integrated system all of the intelligent functions of an electrical cubicle: protection, measurement, automation, communication.

CEE's exceptional experience in the field of network protection using static relays (more than 400,000 units in operation throughout the world) enabled our engineers to define, develop and manufacture PROCOM, to the standards of quality and concepts of technical innovation which have been the foundation of CEE's reputation over the past 30 years.

PRINCIPLES AND APPLICATIONS

The RMSA7992 is a microprocessor-based device independent of auxiliary supply. The relay is normally used to protect the 3-phase electrical networks against any type of short-circuit and earth fault. Fully autonomous, the relay can directly replace any electromechanical O.C. relay.

Used together with an auxiliary tripping module of the BAT7001 (consult us) type, the RMSA7992, allows to obtain an overall protective chain including a signal detection and processing and also the line circuit breakers or switches tripping, independent from any auxiliary voltage source.

Using microprocessor and digital technology, the RMSA7992 device operate on the principal of signal sampling and calculate the harmonic spectrum of the input currents up to the seventh harmonic using a Fast Fourier Transform (FFT).

These powerful principles and methods of measurement provide the possibility of evaluating phase by phase the harmonic "pollution" of currents in three-phase networks and establishing operating criteria on the basis of the true "rms" or root - mean - square value of the input quantities recreated by a quadratic combination of the harmonics:

$$I_{(rms)} = \frac{1}{\sqrt{2}} \sqrt{I_1^2 + I_2^2 + \ldots\ldots + I_7^2}$$

where: I_{H1} represents the amplitude of the fundamental,
I_{H2} to I_{H7} are the amplitude of the harmonics.

The RMS7992 relays have been designed for the protection of all types of electrical power equipment, but most specifically transformers and plain feeders. For this reason they carry out 4 distinct measurements of current, the three phases and the residual.

They incorporate two current operating levels with wide setting ranges:

- the "low-set" level with a multicurve type of operating characteristic, which can be programmed on site, choosing between the slightly inverse time, the inverse time, very inverse time, extremely inverse time and definite (or independent) time types.
- the "high-set" level, which has an independent time characteristic. Settings and choice of characteristic can each be programmed independently, both on the earth-fault detection unit and on that uses for phase faults.

The 3rd harmonic currents, which are of the zero-sequence type, can be rejected from the evaluation of the earth fault current magnitude by means of a front face located selector switch.

MAJOR ADVANTAGES

Reliability

The design and construction of these equipments respect the same standards of reliability and safety used by CEE for the manufacture of conventional static protection devices:

- conforming to the recommendations and standards I.E.C. 255.
- mechanical, fool-proof fouling pins on cases and bases.
- debugging and individual testing of certain critical components.
- component selection as a function not only of the thermal withstand but also of the withstand to overvoltages, etc.
- withstand to severe environmental conditions: heat/humidity -56 days, 40°C, 93% relative humidity.

Fault indication

6 electromagnetic hand-reset flags, located on the relay front face, enable the fault type indication:

- 4 flags, energized at the same time as the "a" or "b", output units, indicate the phases affected by a fault.
- 2 flags indicate the "a" and "b" output units operation.

The resetting of the 6 flags is made, while the relay front cover is in place, by a push button to be continuously depressed for 1 second.

The required energy is delivered:

- either, by a lithium battery set, located within the relay (10000 resetting operations, battery life expectancy: 10 years)
- or, by an external 9 volts Alcaline battery, connected to a special relay front face plug.

Flexibility and ease of settings

The O.C. low-set and high-set unit (I> and I>>) as well as earth fault unit (Io > and I >>) settings are adjusted by potentiometers. This facility also holds tor the associated time settings (t (I>), t (I>>), t (Io>), t (Io>>)).

The time/current characteristic selection for O.C. and earth fault units, is made by means of a 6-position selector switch, called "f (t)".

The protective functions are assigned to the output units by a 6-position selector switch, called "a/b/c" selection".

Adaptability and autonomy

As they are mounted in modular, plug-in, metallic cases type R, devices in the RMSA7992 series may be used either:

- as independent modules,
- as modules integrated into a rack cradle incorporating conventional static relays in the 7000 series.

This flexible presentation means that the RMSA7992 devices may be easily adapted to the user's real technical and economic requirements and can, for example, be inserted into existing schemes and installations.

Output units

The RMSA7992 are fitted with 3 attracted armature units:

- 2 output units ("a" and "b") with high making capacity to control the line contactors and circuit breakers.
- 1 starting unit ("c") to initiate an "alarm" when the O.C. or the earth fault thresholds are reached.

The 6-position selector switch ("a/b/c selection") located on the relay front, enables the protective functions to be assigned to the output units as described in the table of paragraph 5 of the "General Characteristics".

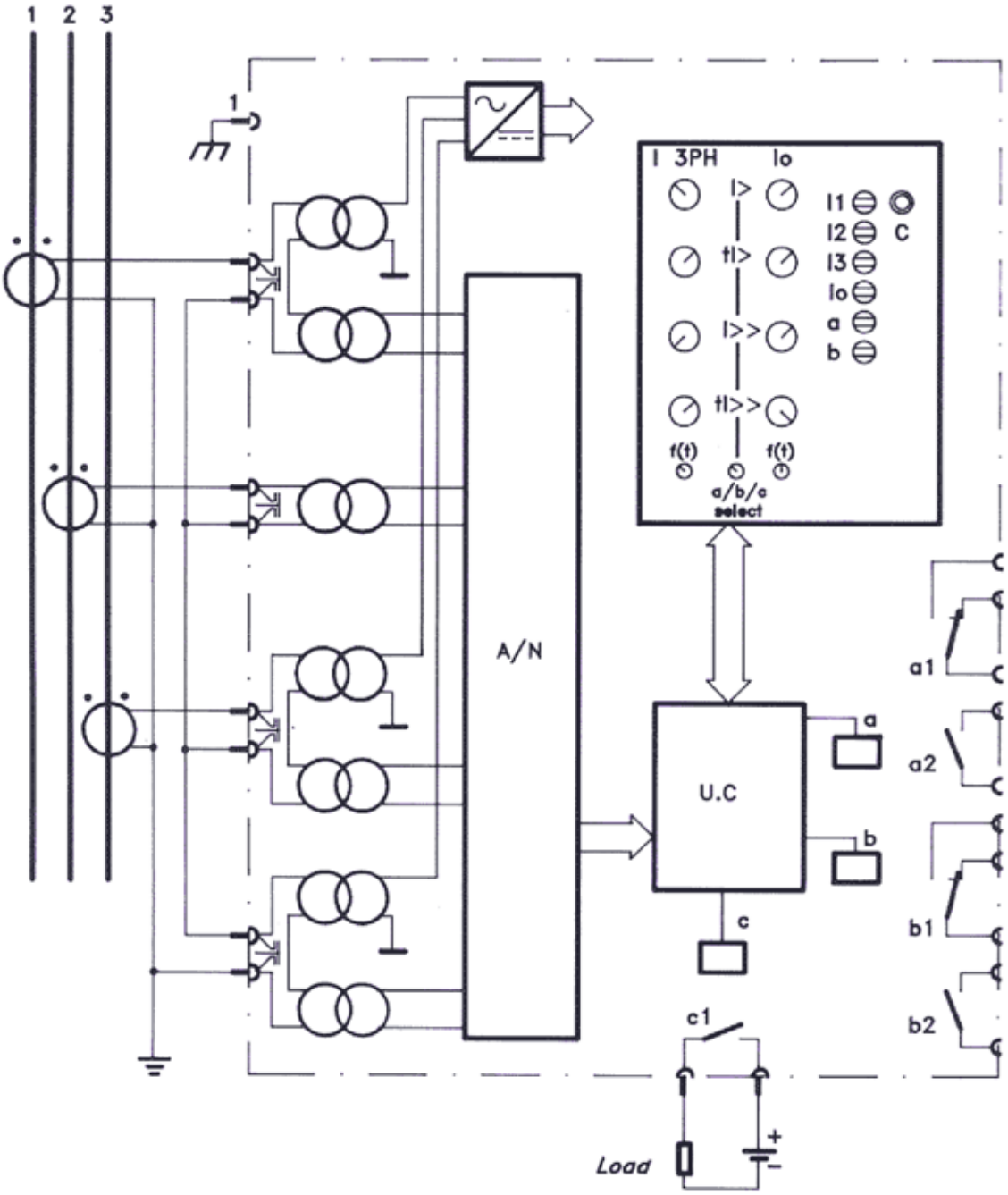


Fig. 1 - RMSA7992 - Example of simplified operation and connection diagram

GENERAL CHARACTERISTICS

1. Input and output quantities	
· Nominal current	In = 1 or 5 A
· Rated frequency	Fn = 50 or 60 Hz
· Burden:	
- on phase input circuit	about 7.5 VA at In
- on earth-fault input circuit	about 23 VA at In
· Recommended line (CTs) with a total secondary loop resistance (including CTs) <2 Ω for In = 1 A <0.5 Ω for In = 5 A	5 VA 5P20
· Output contacts	
- Output contacts "a" and "b"	2 NO or 1 NO + 1 NC or 2 NC
· Maximum operating voltage	600 V
· Maximum permanent current	5 A
· Closing current (0.2 s)	10 A
· Rupturing capacity on DC (L/R = 40 ms) on AC (Cos φ) = 0.4)	 50 W (1 A / 48 Vdc - 0.5 A / 110 Vdc) 1250 VA; I < 3A
- Alarm unit "c"	1 NO
· Use with DC voltages only (polarized output, + : Terminal 9; - : Terminal 8)	
· Maximum values for switching with a resistive load or an inductive load fitted with frankeel protection diode	
Power Voltage Current	10 W 250 V 300 mA
· Maximum values for switching with an inductive load	(L/R = 40 ms)
Power Voltage Current	5 W 250 V 150 mA
· Signalling	6 flags for indication of: phase and/or earth faults and "a" and "b" output units operation (hand reset)
2. Nominal ranges of the influencing factors	
· Temperature	-10° / +55°C
· Frequency	Fn ± 5 Hz
3. Measurements	
· Characteristic quantity	"rms" values of the phase and earth fault currents
· Operating values	110% of setting (dependent line low-set unit) 100% of setting (other units)
· Current ranges	
phases low-set I>	0.5 to 4 In
high-set I>>	1 to 25 In (with "off" position)
zero sequence low-set Io>	0.2 - 1 In
high-set Io>>	0.5 - 5 In (with "off" position)
· Time-delay settings	
low-sets t I>	0.1 - 3 s or 1 to 30 s (independent time) "F(t)" only = 0.1 0.1 - 3 s F(t) = 2, 3, 4 or 5
high-sets t I>> - t Io>>	0.1 - 3 s
· Rejection of 3rd harmonic current influence of zero sequence current evaluation	by a front accessible switch
· Resetting value	approx. 92%
· Overshoot	approx. 30 ms
· Overload withstand on inputs	
- phases	80 In / 1 s - 20 In / 3 s - 1.5 In permanent
- zero sequence	40 In / 1 s - 0.2 In permanent

GENERAL CHARACTERISTICS

· Precision	
- operating level	5% of level value with 5% of In
- time-delay	
"F(t)" = 2, 3, 5 (Curves A, B et FI)	5% or ± 30 ms
"F(t)" = 4 (Curve C)	7.5% or ± 30 ms
· Fidelity	
- Operating levels	1%
- Time delays	1% or ± 30 ms
- "C" unit response time with pre-fault 3 phase current I :	
I = 0	approx. 75 ms at 5 times the setting
I = 0.25 In	approx. 55 ms at 5 times the setting
· Resetting time for a value of (I from 5 times the setting) to 0	
"a" and "b" units	approx. 50 ms
"c" unit	approx. 35 ms

4. Time/current curves

Dependent time

· A, B, C curves (see figures 2-3-4) according to IEC 255-4 "F(t)" = 2, 3, 4

$$t\,(s) = \frac{T}{(I / Ir >)^{\alpha} - 1} \times \text{setting } (tI > \text{ or } t\,Io >)$$

- inverse time	T = 0.0466 α = 0.02
- very inverse	T = 9 α = 1
- extremely inverse	T = 100 α = 2

· Other curve (see figure 5)

- slightly inverse (FI)

$$t\,(s) = \frac{T}{0.339 - \frac{0.236}{(I / Ir >)}} \times \text{setting } (t\,I > \text{ or } t\,Io >)$$

"F(t) = 5" T = 0.3153

· Relationship between the "F(t)" selector switch and the time/current curves

F(t)	t	
0	X1	independent time
1	X10	independent time
2	A	dependent time
3	B	dependent time
4	C	dependent time
5	F1	dependent time

5. Output units ("a/b/c selector switch")

Selector position	"a" unit	"b" unit	«c» unit
1	t I> t I>>	t Io> t Io>>	I>
2	t I > t Io>	t I>> t Io>>	I>
3	t I> t I>>	t Io> t Io>>	Io>
4	t I> t Io>	t I>> t Io>>	Io>
5	t I> t I>>	t Io> t Io>>	I> Io>
6	t I> t Io>	t I>> t Io>>	I> Io>

6. Insulation to IEC 255-5	
· Dielectric withstand all terminals together/frame and between galvanically isolated groups	2 kV - 50 / 60 Hz - 1 min
· Insulation resistance at 500V	> 10.000 MΩ
· Impulse voltage withstand (except "c" unit in the transversal mode)	5 kV - 1.2/50 µS
7. High frequency disturbance withstand	
· to IEC 255-22-1	2.5 kV and 1 kV, 1 MHz class III
8. Case	R4
9. Weight	5.5 kg
10. Identifying drawing	07A9

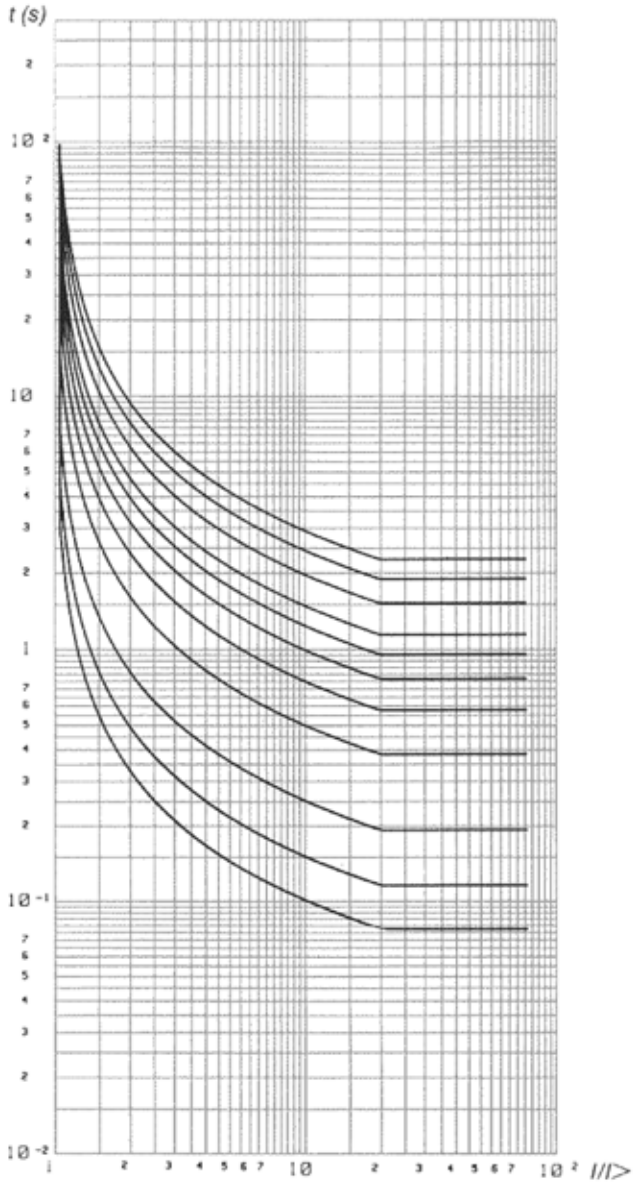


Fig. 2 - RMSA7992 - Inverse time curves to IEC 255-4

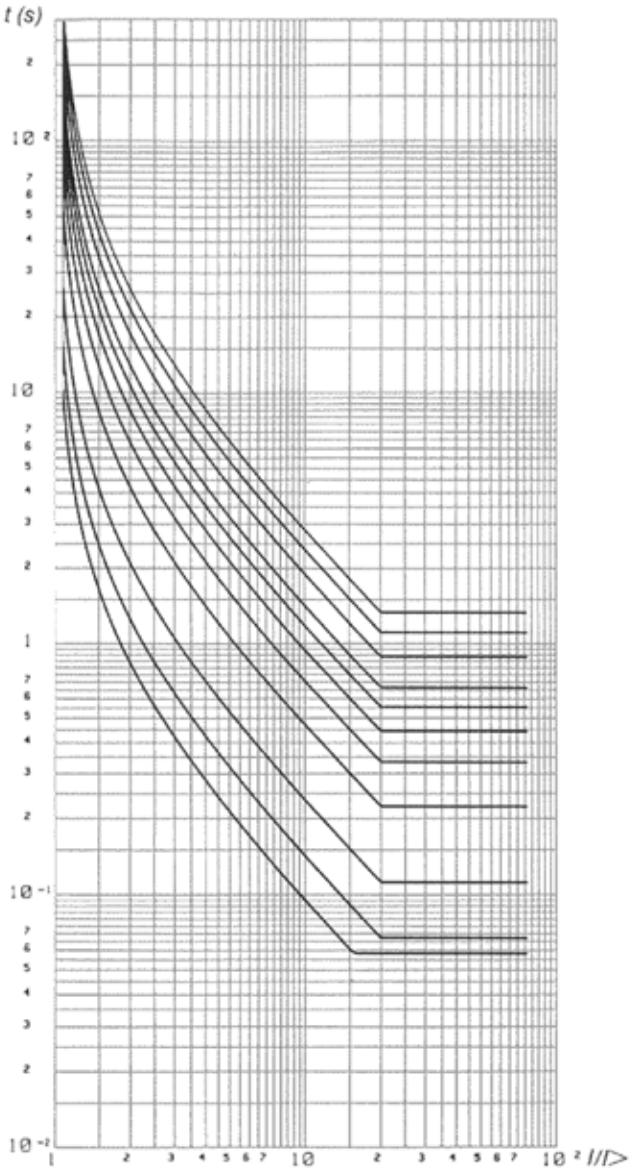


Fig. 3 - RMSA7992 - Very inverse time curves to IEC 255-4

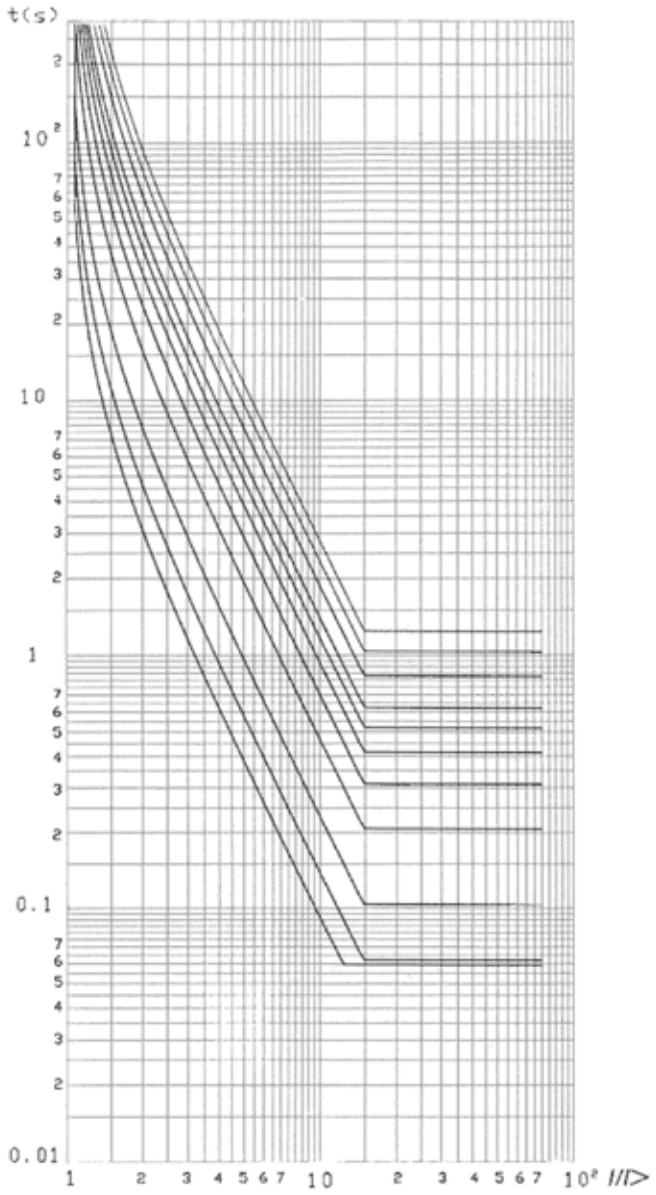


Fig. 4 - RMSA7992 - Extremely inverse time curves to IEC 255-4

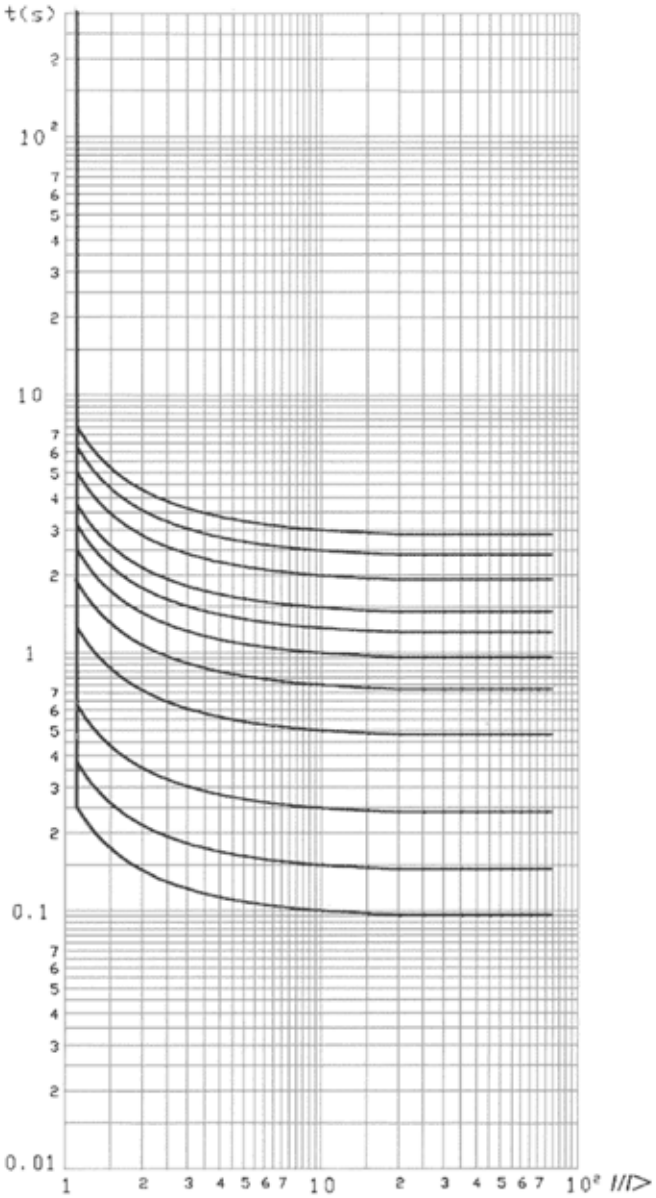
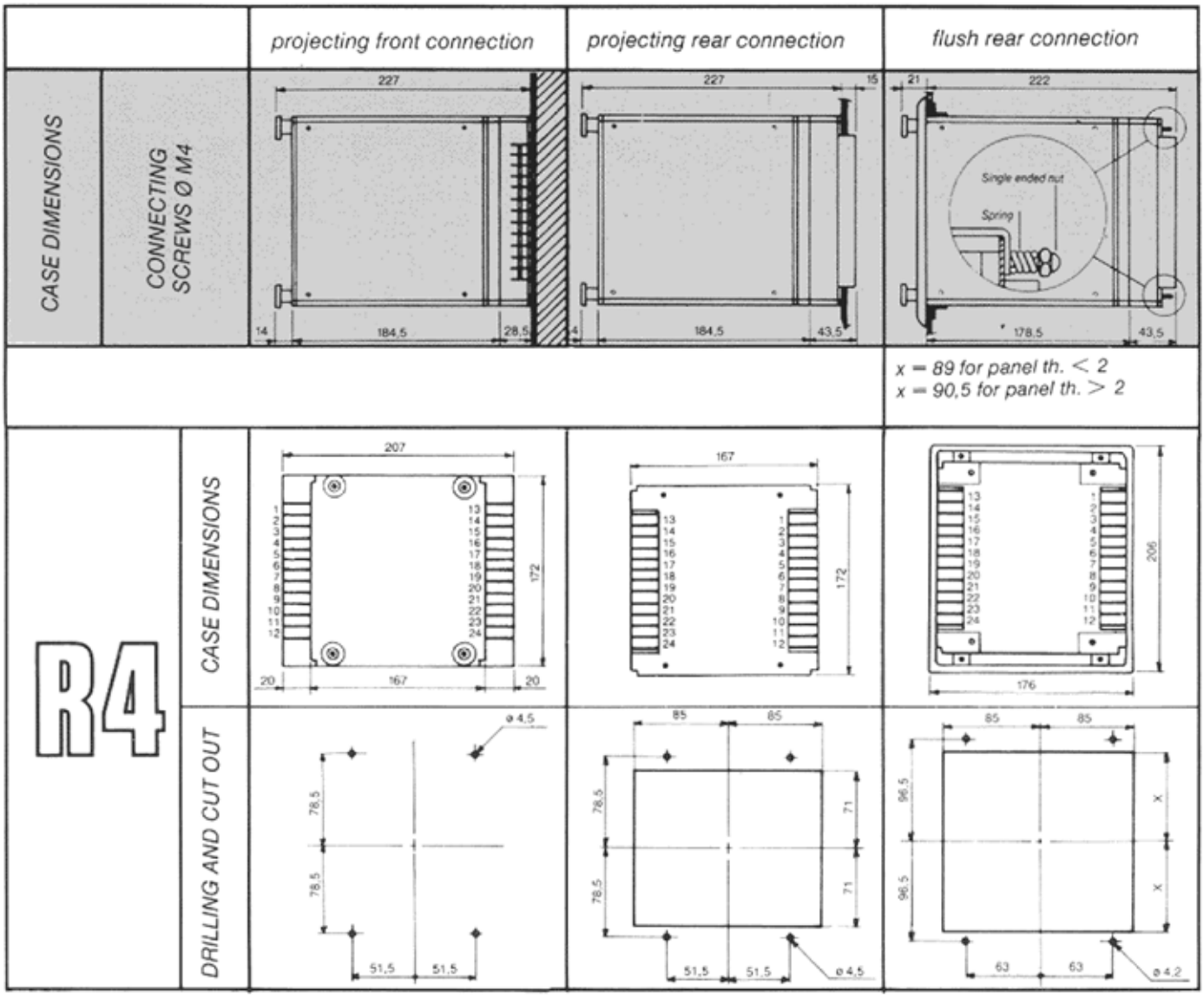


Fig. 5 - RMSA7992 - Slightly inverse curves to IEC 255-4

CASE TYPE R4



11, rue Marcel Sembat - 94146 Alfortville cedex - FRANCE
www.icelec.com - export@icelec.com
Tel: +33 (0)1 41 79 76 00 - Fax: +33 (0)1 41 79 76 01