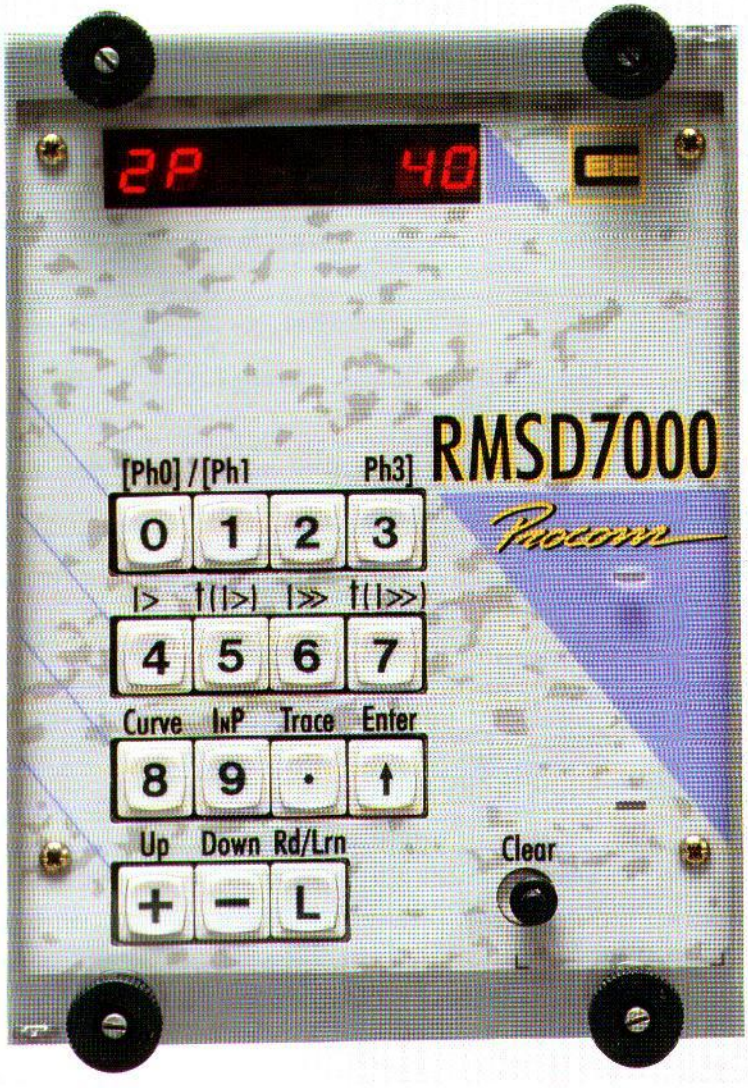
RMSD 7000

Procom



DIGITAL
MULTICURVE
DIRECTIONAL
PROTECTIONS

The ultimate in power network supervision

Communicating digital multicurve directional overcurrent relay RMSD 7900

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 fiels 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.

Principes and applications

The object of devices in the RMSD 7900 series is to provide directional protection of three-phase electrical networks.

They are modular in design and can be totally integrated into the PROCOM structure, or just as easily they may be used entirely independently in any other classical protection scheme.

Using microprocessors and digital technology, the RMSD 7900 devices operate on the principle of signal sampling and calculate the harmonic spectrum of the input currents (up to the seventh harmonic) and input voltages (fundamental only) using Fast Fourier Transforms (FFT).

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

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

Where: I_1 represents the amplitude of the fundamental. I_2 to I_7 are the amplitudes of the harmonics.

The user also has the possibility, by on-site programming, of choosing to eliminate one or more harmonics which he considers to be undesirable.

The RMSD 7900 range incorporates two different devices:

- *RMSD 7921 designed for protection of loops or the rapid separation or "islanding" of networks having several sources in parallel.*
  To perform this function they have two "rms" overcurrent units controlled by the phase angle between polarising voltage and current.
- *RMSD 7912 designed for directional earth fault protection on looped networks or those having multiple earthing points.*
  They can be extremely sensitive because they may be supplied from core balance CTs, and as they may reject completely any unwanted third harmonics, they may also be used for the protection of radial network where a setting below the capacitive current of the feeder in question is required (isolated neutral or high impedance neutral earthing).
  To achieve this the RMSD 7912 relays have an "rms" zero sequence overcurrent unit controlled by the phase angle between zero sequence polarising voltage and zero sequence current.

The overcurrent units have two operating levels with wide setting ranges:
— A low-set unit with a time/current characteristic, site programmable with a choice of inverse, very inverse, extremely inverse and definite time.
— A high-set unit with a definite time characteristic.

The polarising voltage, at the characteristic angle θc, is situated in the centre of a blocking zone covering 180°.

RMSD 7912 / RMSD 7921

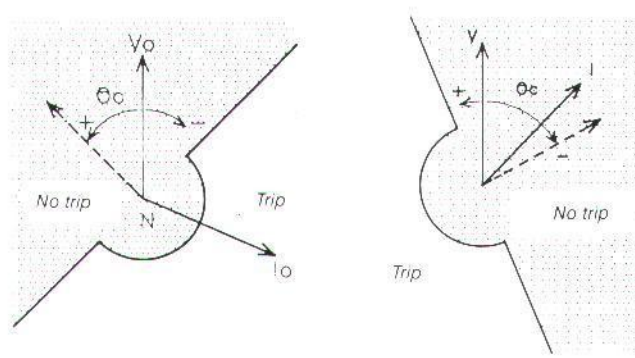


Figure 1

Adjustment of the characteristic angle may be carried out on site over range of +/−180° in steps of 5°, which will satisfy all possible applications.

Major advantages

The RMSD 7900 relays have three main series of advantages as follows:

RELIABILITY AND AVAILABILITY

The design and construction of equipment in the RMSD 7900 series respects the same standards of reliability and safety used by CEE for the manufacture of conventional static protection devices:

- Conforming to the recommendations and standards of IEC 255.
- Mechanical, fool-proof fouling pins preventing the insertion of an unsuitable type of relay into a base.
- 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.

In addition to these basic construction details, the RMSD 7900 devices incorporate an automatic self-supervision system which, together with the plug-in case facility, optimises their availability.

The automatic self-supervision system intervenes at three different levels:

- Detection of loss of auxiliary supply.
- Detection of a microprocessor failure using a "watchdog".
- Detection of a breakdown of a microprocessor periferal (such as RAM, EEPROM, etc.) by executing microdiagnostic programs.

The user is warned of the operation of the automatic self-supervision system by the closure of a dry contact brought out to terminals and/or as required by the interruption of the digital communication channels.

ADAPTIBILITY AND AUTONOMY

As they are mounted in modular, plug-in, metallic cases type R, relays in the RMSD 7900 series may be used either:
— as independent modules,
— as modules integrated into a rack cradle incorporating conventional static relays in the 7000 series,
— as modules integrated into a rack cradle as an element of the PROCOM structure.

This flexible presentation means that the RMSD 7900 relays may be easily adapted to the user's real technical and economic requirements and can, for example, be inserted into existing schemes and installations.

* Please consult us.

The RMSD 7900's autonomous and flexible nature is further reinforced by the fact that it can, without the use of special devices, be connected to a source of ac or dc auxiliary supply having a very wide range of tolerance (20 to 66V or 38 to 250V).

POWER AND FLEXIBILITY OF THE COMMUNICATIONS

The RMSD 7900 series of relays communicate with the external world in three major ways:

- **Local communication:** dialogue between the user and the equipment is ensured by means of a keyboard on the device itself, which may be used to set up and read back all of the quantities in memory, or those calculated or measured by the RMSD 7900. An easily readable LED display unit enables the user to have direct readout of the electrical quantities in true primary values.

- **Communication by digital channels:** The RMSD 7900 contain two digital serial communication channels of the RS-232-C/DB 25 or current loop (0 - 20mA) types. The choice is at the user's disgression, simply using a switch. The RS-232-C/DB 25 outlet can be used for direct connection (either by galvanomic connection or via fibre optics) to a PC (microcomputer)*. The current loop terminals (0 - 20mA) may be used to incorporate the relay into a communications network controlled by a PC or other device*. All data available locally, whether measured or introduced as an input, may be transmitted to a remote location. If the relay operates or when the operator presses on the "Trace" key the "rms" values of the phase or zero sequence currents and the operating zones, calculated over a period starting 2 seconds before the event and finishing 1 second after are made available to the centralised system.

- **Communication by "all or nothing" channels:** The RMSD 7900 relays are fitted with electromagnetic output units to provide alarm, trip or load shedding signals:
— Alarm: by a dry contact on the "watchgog" system, or by the operation of a unit which signals that a set-level has been exceeded.
— Trip or load shedding: two high-power output units A and B which can directly control the power circuit nreaker or contractor. Functions such as high-set or low-set are programmable to one or other unit by the user. The operation of the relay is automatically indicated by flashing of the LED display, and a mechanical (flag) operation indicator is fitted to the "b" output unit. The phase(s) involved in the fault are indicated by the display unit.

General characteristics

1 Input ant output quantities

• Nominal frequency (Fn)	50 or 60 Hz
• Nominal current (In)	1 or 5 A (RMSD 7921) 1 A, 5 A or core-balance CT (RMSD 7912)
• Nominal voltage (Un)	100/110/120 or 380 V (RMSD 7921)
• Nominal voltage (Vn)	100/$\sqrt{3}$ or 110/$\sqrt{3}$ V or CT polarising (RMSD 7912)
• Auxiliary supply	20 - 66 Vdc 38 - 250 Vdc or Vac 50/60 Hz
• Burden :	
– On current input circuit	< 0.2 VA at In (RMSD 7921) < 1 VA at In (RMSD 7912)
– On voltage input circuit	< 0.3 VA at Un (RMSD 7921) < 1 VA at Vn (RMSD 7912)
– On auxiliary supply	approx. 8W dc, 13 VA ac
• Recommended transformers :	
– Current transformers	5 VA 5P20
– Voltage transformers	10 VA class 1
• Output contacts :	
– Units A and B (operating levels)	2 NO or 1 NC + 1 NO or 2 NC
– Unit C (alarm - optional)	1 NO
– Unit W (watchdog)	1 NC (picked up in normal operation)

	Units A, B, W	Unit C
– Maximum operating voltage	600 V	250 V
– Maximum permanent current	5 A	2.5 A
– Closing current (0.2 sec)	10 A	5 A
– Rupturing capacity :		
on dc (L/R = 40 ms) at 48/110 Vdc	50 W (1 A/0.5 A)	25 W (0.5 A/0.25 A)
on ac (Cos φ = 0.4)	1250 VA; I < 3 A	625 VA; I < 1.5 A

– Mechanical operation indicator	hand-reset "flag" on the "B" unit
• Signalling and display	an 8 digit LED numerical display unit, giving visual output of the settings and measurements, as well as differentiation of the types of fault

2 Nominal ranges of the influencing factors

• Temperature	– 10° to + 55°C
• Frequency	+/– 10% Fn

3 Measurements

• Voltage elements U12 and U23 (RMSD 7921), Vo (RMSD 7912) :	
– Characteristic quantity	"rms" values
– Operating values :	
Polarising	5% of Un (RMSD 7921) 1% of 3 Vn (RMSD 7912)
• Current elements I1 and I3 (RMSD 7921), Io (RMSD 7912) :	
– Characteristic quantity	"rms" values
• Tripping conditions :	
– Polarising :	
Tripping zone	"1" on readout
Non-tripping zone	"0" or "–" on readout
– Operating levels :	
I > (definite time)	Io, I1 or I3 : 100% of I > setting
(dependent time)	Io, I1 or I3 : 110% of I > setting
I >>	Io, I1 or I3 : 100% of I >> setting
– Programming of output units :	
I > instantaneous	None, A, B, (A+B), C, (A+C), (B+C)
time-delayed	A, B or (A+B)
I >> instantaneous	None, A, B, (A+B), C, (A+C), (B+C)
time-delayed	None, A, B, or (A+B)

• Setting ranges :	RMSD 7921	RMSD 7912
– Primary current In	1 - 7500 A (1 A steps)	Same + 20 or 100 A (CBCT)
– I >	0.5 to 4 IN (0.1 IN steps)	0.05-0.4 IN (0.01 IN steps)
– I >>	2 to 25 IN (0.5 IN steps)	0.2-2.5 IN (0.05 IN steps)

– t (I >) :	
Definite time, curve type 0	0.1 - 3 sec (0.05 sec steps)
Definite time, curve type 1	1 - 30 sec (0.5 sec steps)
Dependent time, curves types 2, 3, 4	0.1 - 3 sec at 10 I > (0.05 sec steps)
– t (I >>) : **definite time**	0.1 - 3 sec (0.05 sec steps)
– Characteristic angle	– 180 to + 180° (5° steps)
– Fn	50 or 60 Hz
– Slave number	1 to 255 (unity steps)
– Resetting value	> 90% I > > 90% I >>
• Resetting time	< 80 ms
• Overshoot	< 40 ms

General characteristics (continued)

3 Measurements (continued)

- Overload withstand on inputs :
  - Current circuits ..... 80 In/ 1 sec - 20 In/3 sec - 3 In permanent (RMSD 7921)
    40 In/ 1 sec - In permanent (RMSD 7912)
  - Voltage circuits ..... 2 Un/10 sec - 1.3 Un permanent (RMSD 7921)
    2 Vn/10 sec - 1.3 Vn permanent (RMSD 7912)
- Precision :
  - Operating levels ..... 5% of setting (if > In) or 5% In
  - Time-delays ..... 5% or ± 30 ms
    7.5% or ± 30 ms for extremely inverse curve type 4
  - Characteristic angle ..... 5°

4 Curves and response times

- Response time :
  - I > instantaneous ..... < 100 ms
    definite time ..... $= t(I>)$
    dependent time ..... $= \frac{T}{(I/I>)^{\alpha} - 1} \times t(I>)$
    Inverse time (see figure 2) ..... $T = 0.0466$, $\alpha = 0.02$
    Very inverse time (see figure 3) ..... $T = 9$, $\alpha = 1$
    Extremely inverse time (see figure 4) ..... $T = 99$, $\alpha = 2$ to IEC 255-4
  - I >> instantaneous ..... < 100 ms
    Time-delayed ..... $= t(I>>)$

5 Digital communication

- Support ..... 2 switchable channels, each having output sockets : current loop/0-20 mA DB 25/RS-232-C
- Protocol ..... Master/Slave to J-BUS or other standard as required
- Operating speed ..... 1200, 2400 or 4800 baud, programmable

6 Insulation to IEC 255-5

- Dielectric withstand
  - All terminals together/frame and between galvanically isolated groups ..... 2kV – 50/60Hz – 1 min
  - DB 25 / RS 232 C socket ..... 500V – 50/60Hz – 1 min
  - Insulation resistance at 500 V ..... > 10 000 Megohms
  - Impulse voltage withstand (except DB 25/RS 232 C socket) ..... 5kV – 1.2/50 µs

7 High frequency disturbance withstand to IEC 255-22.1 (except DB 25/RS 232 C socket) ..... 2.5kV and 1kV – 1MHz class III

8 Case R3

9 Weight 3.9kg

10 Identifying drawings ..... 05A8 (RMSD 7921)
07A8 (RMSD 7912)

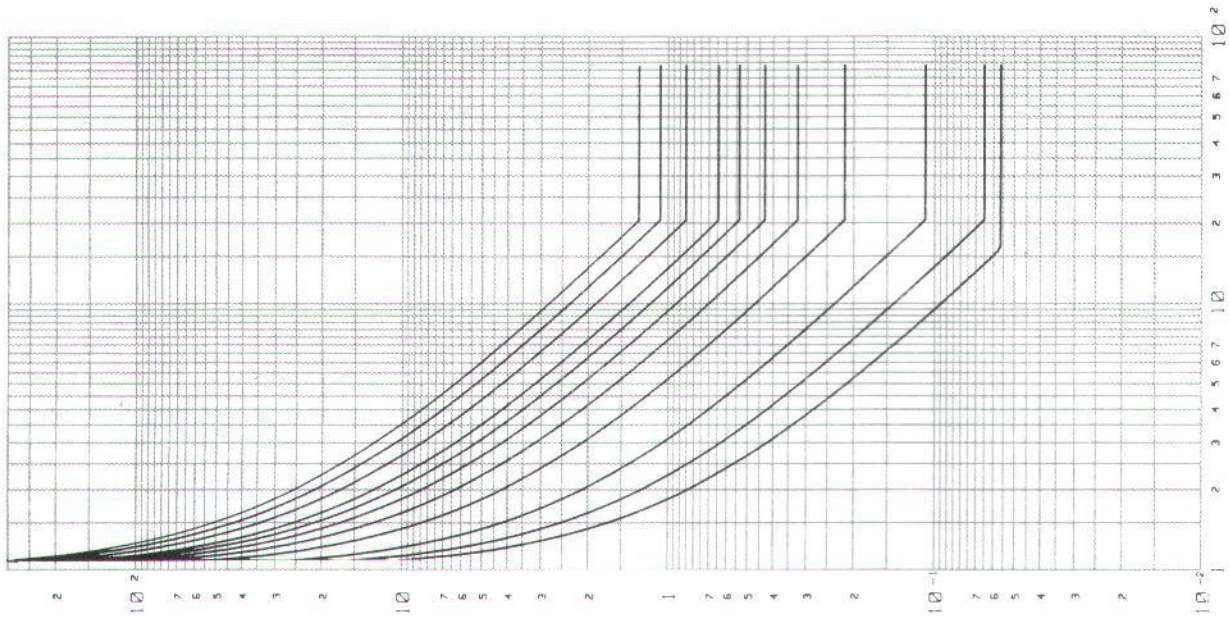


Fig. 3 - RMSD 7900 - Very inverse time curves to IEC 255-4

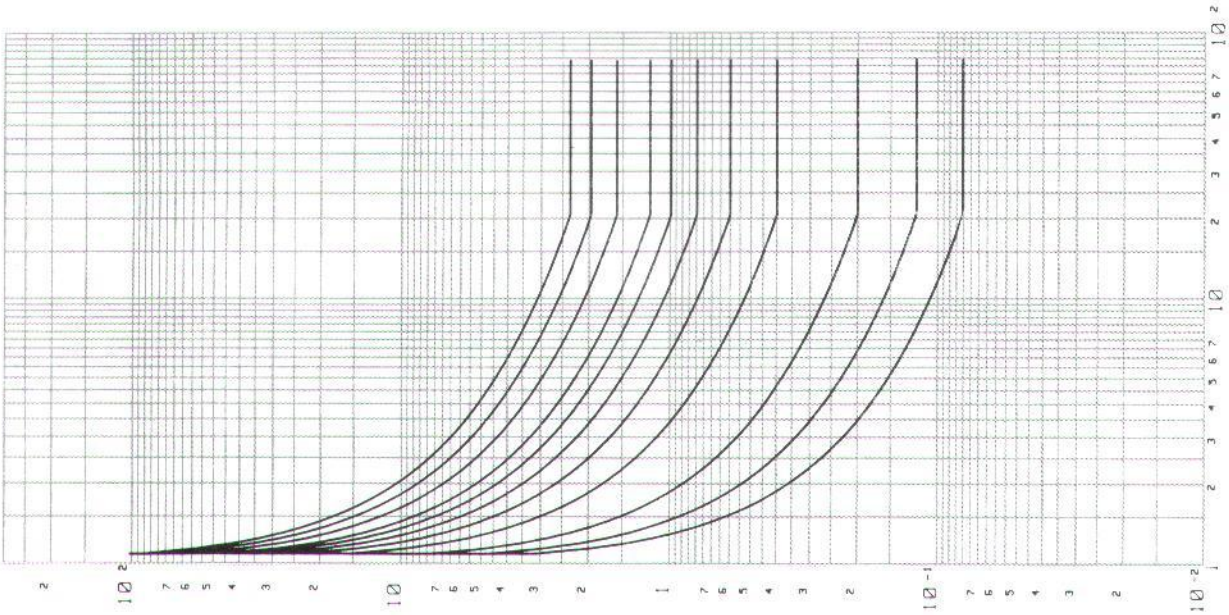


Fig. 2 - RMSD 7900 - Inverse time curves to IEC 255-4

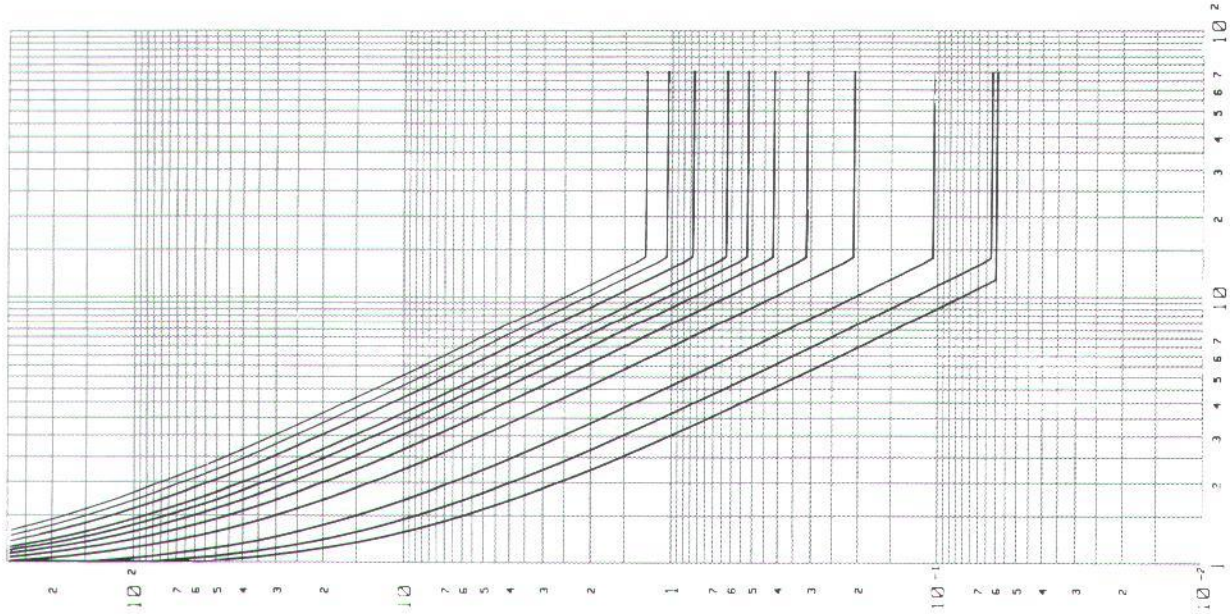
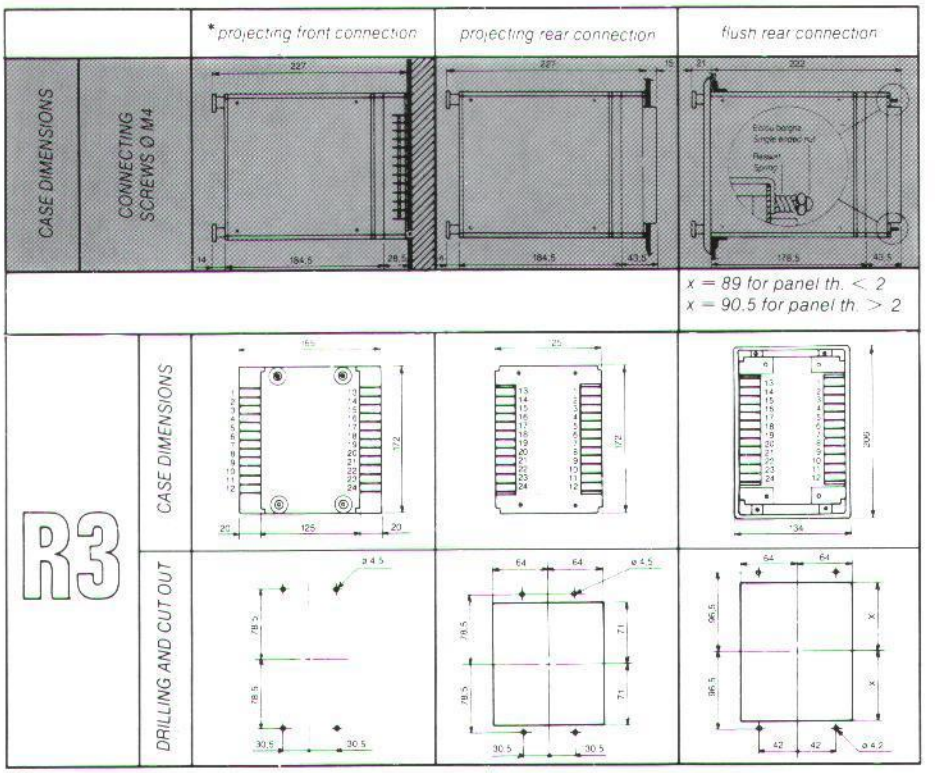


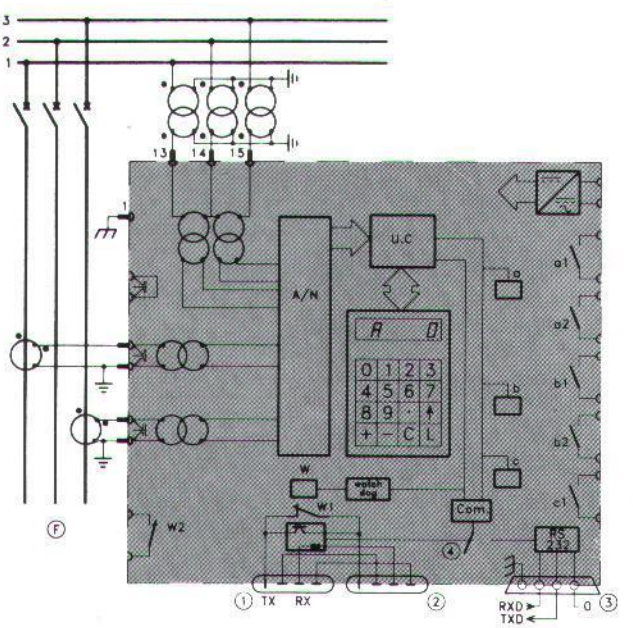
Fig. 4 - RMSD 7900 - Extremely inverse time curves to IEC 255-4

Case type R3



* Only without communication

Operation



RMSD 7921 - Simplified operation and connection diagram

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