Protección de sobrecorriente y coordinación de la protección

Referencias Electrónicas

- http://en.wikipedia.org/wiki/Circuit_breaker
- http://hyperphysics.phy-astr.gsu.edu/hbase/electric/bregnd.html
- http://www.memonline.com/guide05.html
- http://www.bussmann.com/library/techspec/TechSpec19.pdf
- www.bussmann.com/library/ topics/EDP_2%20P%2014-22%20Example.pdf
- http://www.geindustrial.com/solutions/engineers/time_current_curves.html
- http://www.cutler-hammer.eaton.com/unsecure/html/101basics/Module05/Output/
- http://www.sea.siemens.com/step/pdfs/mccb_1.pdf
- http://www.sea.siemens.com/step/pdfs/mccb_2.pdf
- http://www.sea.siemens.com/step/pdfs/mccb_3.pdf
- http://www.sea.siemens.com/step/pdfs/mccb_4.pdf
- http://www.sandc.com/webzine/111102_1.asp

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Protección de conductores

Referencia http://www.bussmann.com/library/techspec/TechSpec19.pdf

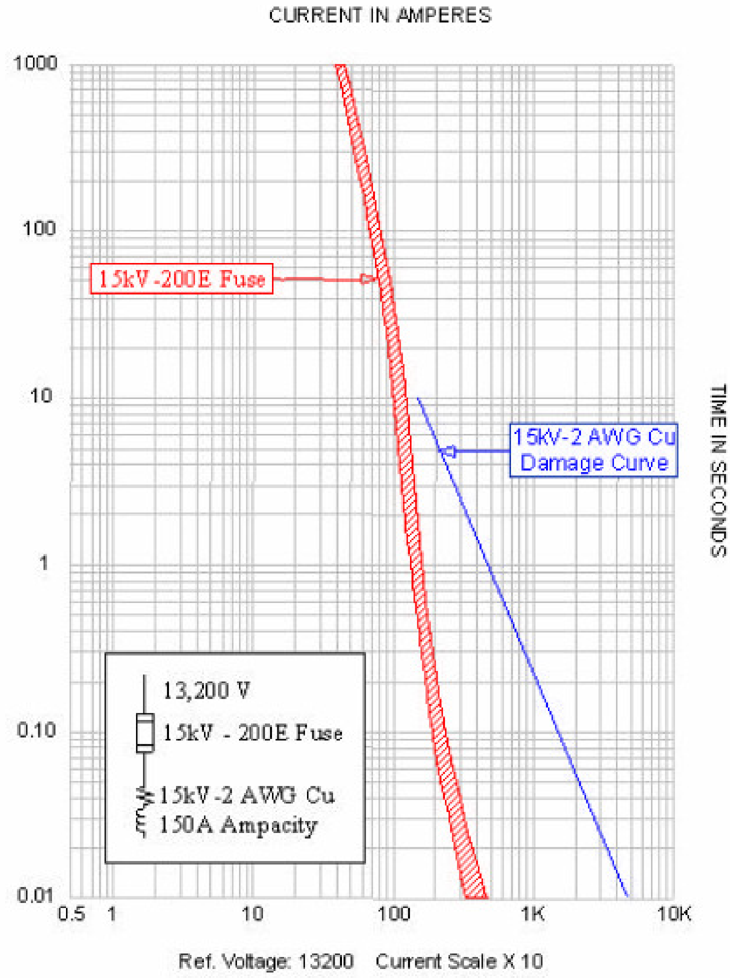


Figure 1

When analyzing the protection of conductors against short-circuit conditions, several methods can be used, but all methods are based upon a standard physics formula. This formula, published by ICEA (Insulated Cable Engineers Association), IEEE, CEC (Canadian Electrical Code), and IEC, gives the amount of current and time required to damage the insulation of conductors.

The formula, as shown by ICEA, IEEE and CEC, for copper with XLP insulation is as follows.

$$[I/A]^2 t = 0.0297 \log [(T_2 + 234)/(T_1 + 234)]$$

The formula for aluminum with XLP insulation is:

$$[I/A]^2 t = 0.0125 \log [(T_2 + 228)/(T_1 + 228)]$$

Note that "T_1" is the initial operating temperature (90° C for XLP) and the "T_2" is the temperature at which the insulation begins to be damaged (250° C for XLP). "I" is the short-circuit current in amperes and "t" is the time of the short-circuit current. "A" is the conductor area in circular mils (see Table 8 in the 2002 NEC for the circular mils of conductors). The formula simply determines the amount of current and time it takes to raise the temperature of a specific cross sectional area of copper or aluminum from T_1 to T_2.

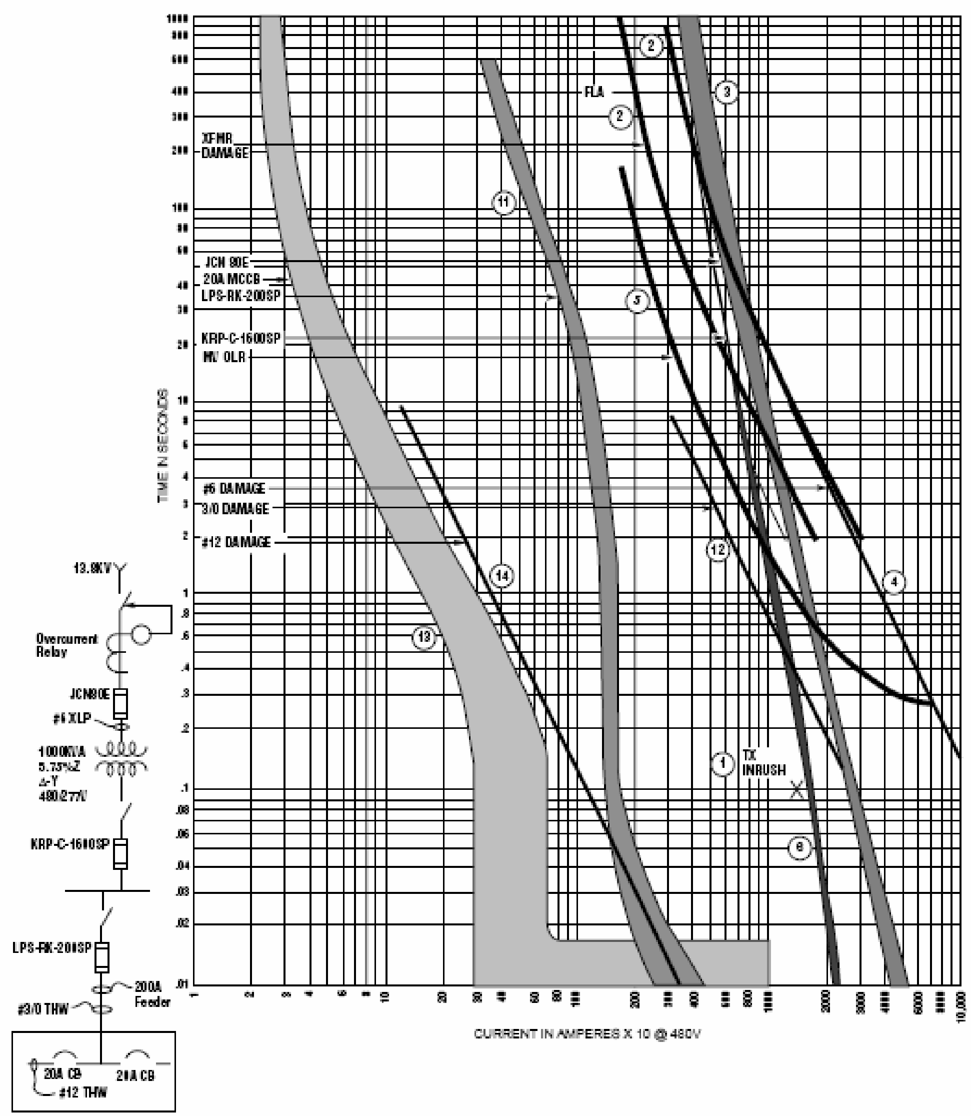
The results of the formula can be plotted on a time-current curve, along with the fuse or overcurrent relay curves. Provided the overcurrent device clears the short circuit before the conductor damage curve is reached, the conductor insulation is not damaged.

Referencia: www.bussmann.com/library/ topics/EDP_2%20P%2014-22%20Example.pdf

Time Current Curve #1 (TCC1)

Device ID	Description	Comments
(1)	1000KVA XFMR Inrush Point	12 x FLA @ .1 Seconds
(2)	1000KVA XFMR Damage Curves	5.75%Z, liquid filled (Footnote 1) (Footnote 2)
(3)	JCN 80E	E-Rated Fuse
(4)	#6 Conductor Damage Curve	Copper, XLP Insulation
(5)	Medium Voltage Relay	Needed for XFMR Primary Overload Protection
(6)	KRP-C-1600SP	Class L Fuse
(11)	LPS-RK-200SP	Class RK1 Fuse
(12)	3/0 Conductor Damage Curve	Copper THW Insulation
(13)	20A CB	Thermal Magnetic Circuit Breaker
(14)	#12 Conductor Damage Curve	Copper THW Insulation

Footnote 1: Transformer damage curves indicate when it will be damagec thermally and/or mechanically, under overcurrent conditions.



Coordinación de las protecciones

Coordinación incorrecta

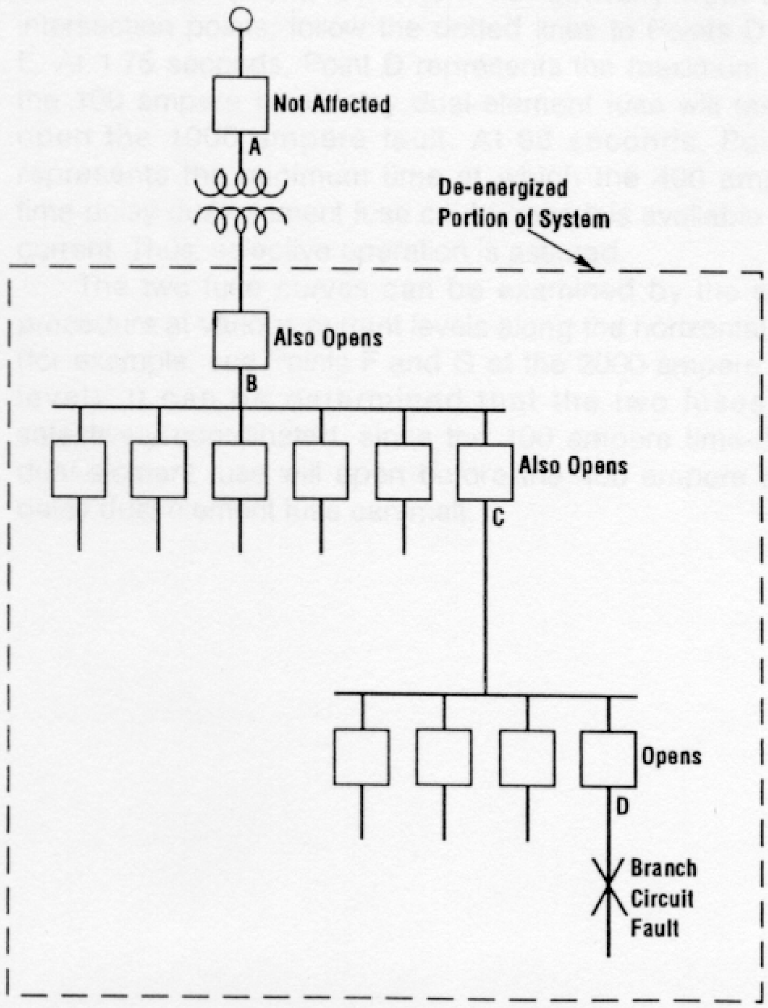


Figure 1

Coordinación correcta

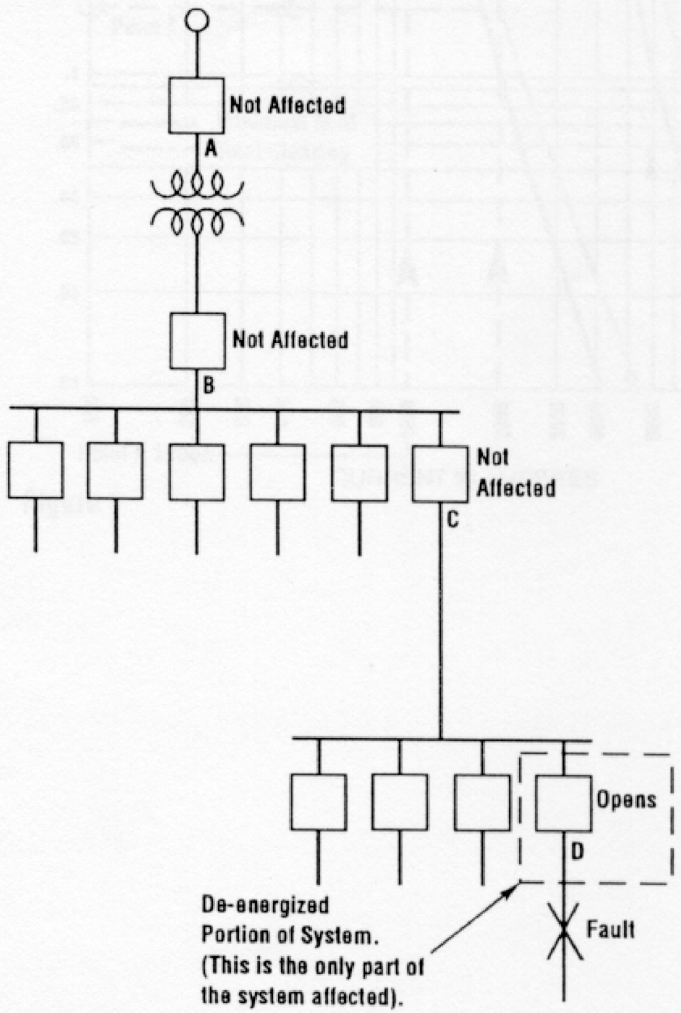
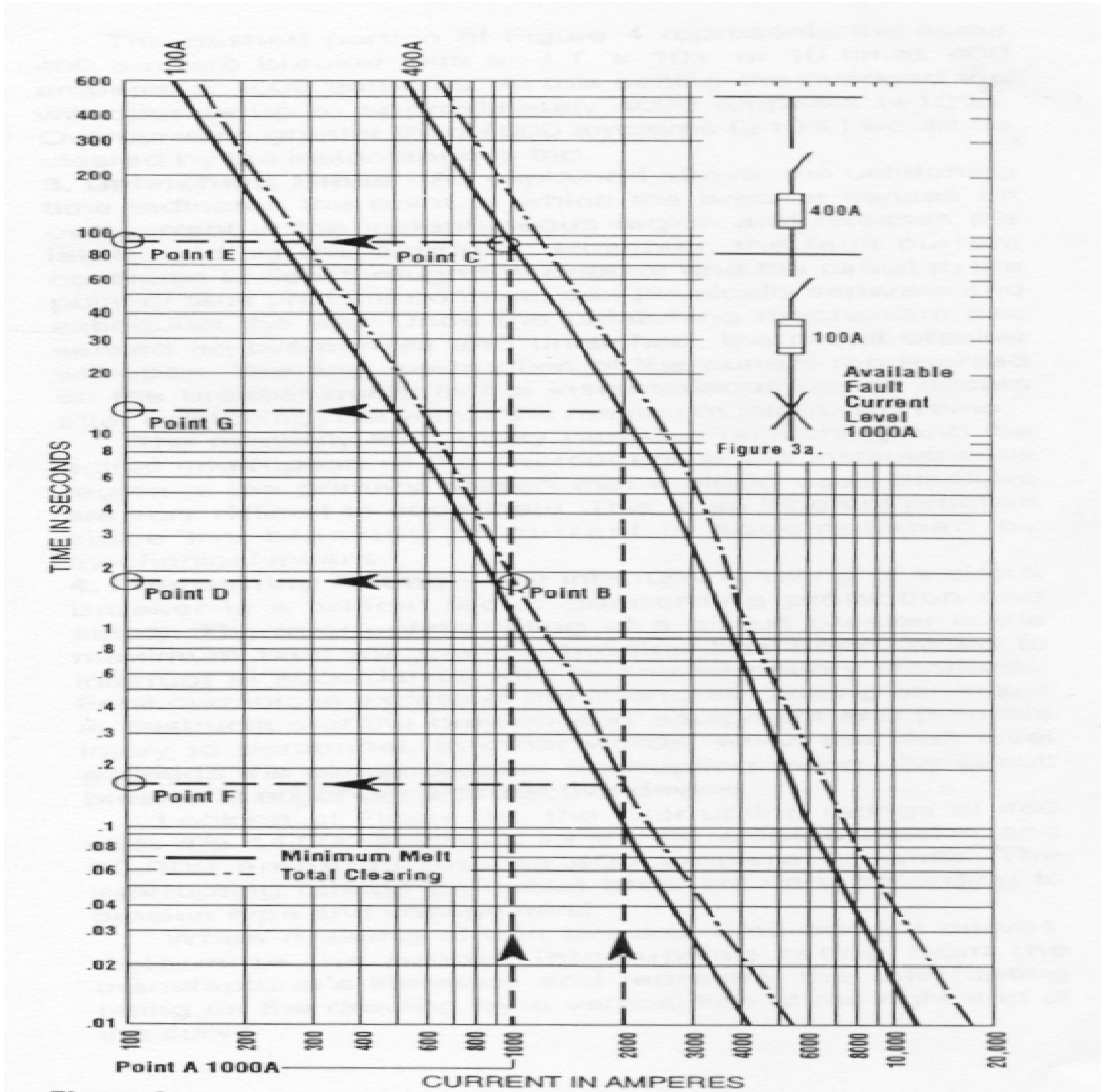
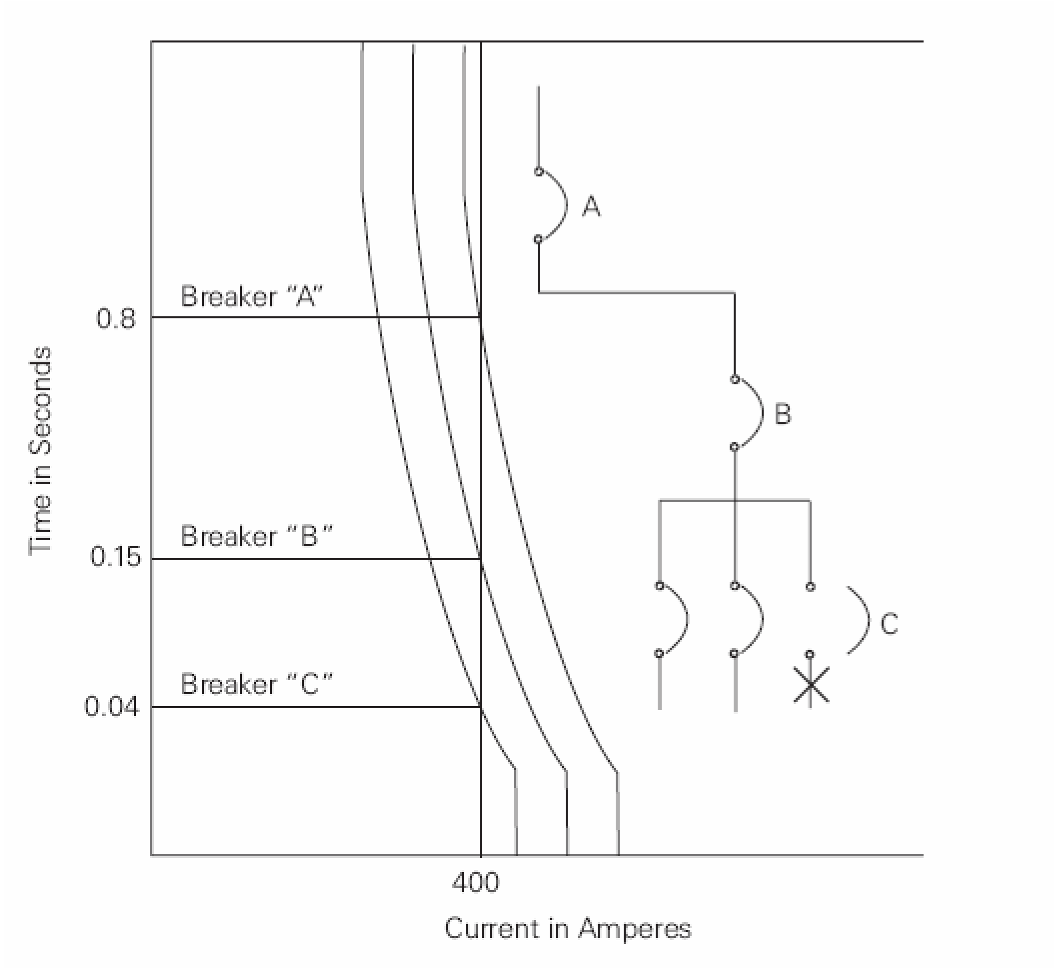


Figure 2

Característica tiempo- corriente y coordinación entre fusibles

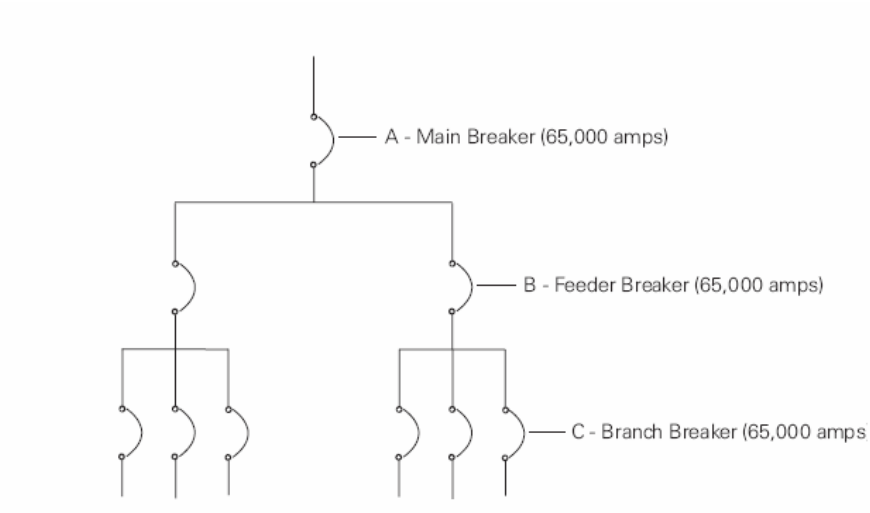


Coordinación entre interruptores



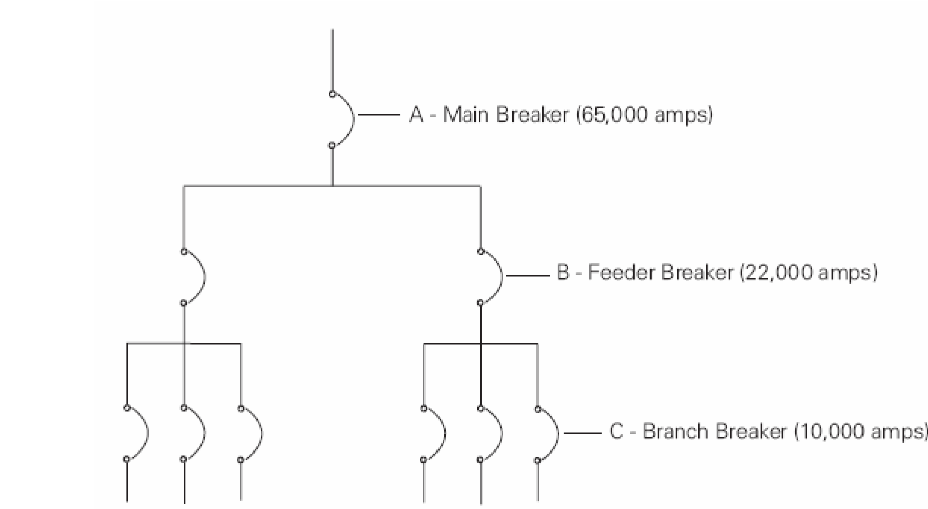
Capacidad interruptiva
*Referencia:*http://www.sea.siemens.com/step/pdfs/mccb_2.pdf

Alternativa 1: Todos los elementos con la misma capacidad interruptiva, la cual Debe ser mayor o igual que el nivel de corto Circuito disponible



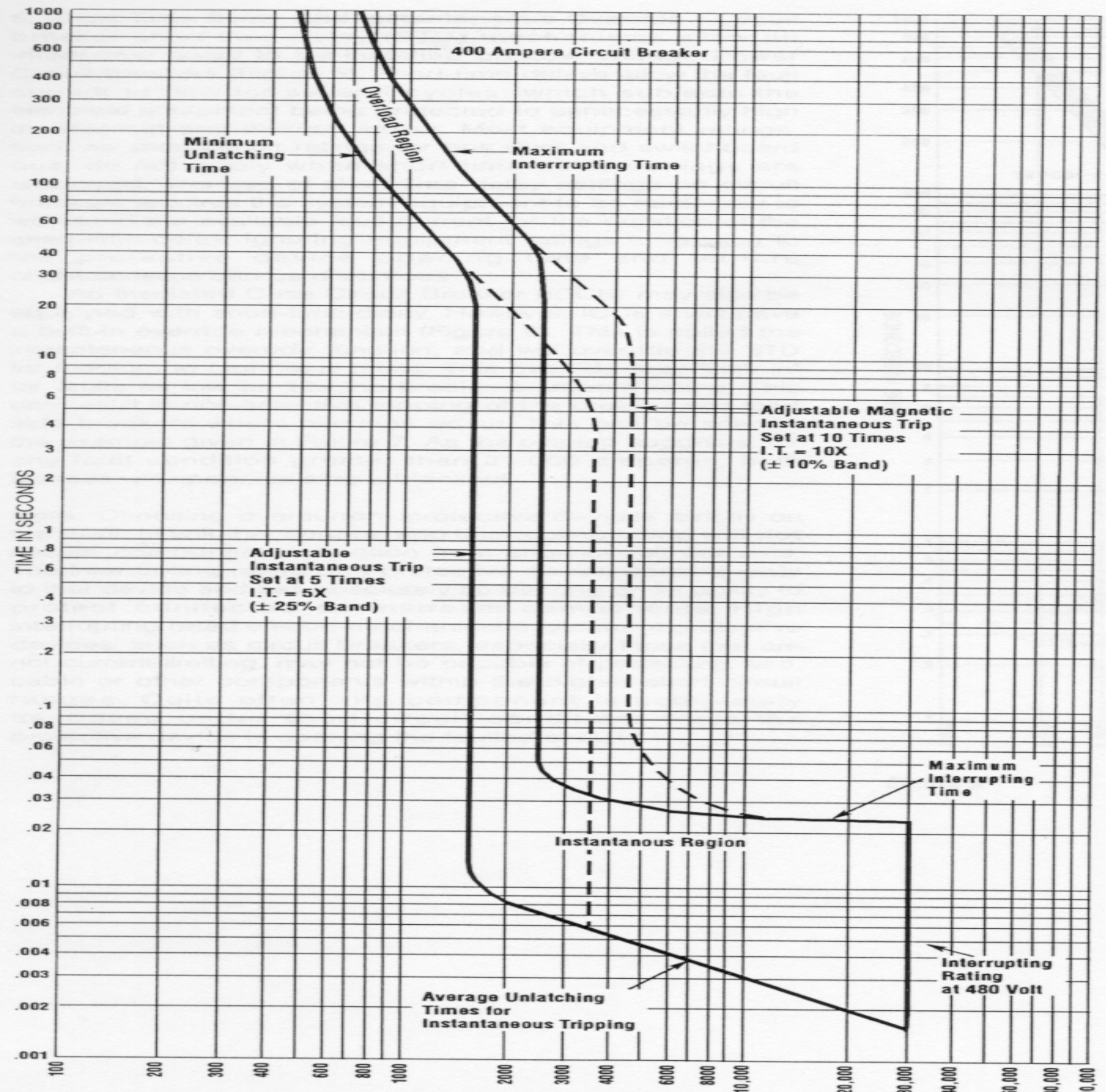
"The first method is to select circuit breakers with individual ratings equal to or greater than the available fault current. This means that, in the case of a building with 65,000 amperes of fault current available at the service entrance, every circuit breaker must be rated at 65,000 amperes interrupting capacity (AIC)."

Alternativa 2: Interruptor "aguas arriba" debe tener Una capacidad interruptiva mayor o igual que el nivel de corto circuito disponible en el sistema, pero los Interruptores "aguas abajo" pueden tener capacidades Interruptivas inferiores



"The second method is to select circuit breakers with a series combination rating equal to or greater than the available fault current at the service entrance. The series-rated concept is that the main upstream breaker must have an interrupting rating equal to or greater than the available fault current of the system, but subsequent downstream breakers connected in series can be rated at lower values. For example, a building with 65,000 amperes of available fault current might only need the breaker at the service entrance to be rated at 65,000 AIC. Additional downstream breakers can be rated at lower values. The series combination must be tested and listed by UL."

Característica tiempo-corriente de interruptores termomagnéticos



Average Unlatching Times Breaker Tripping Magnetically

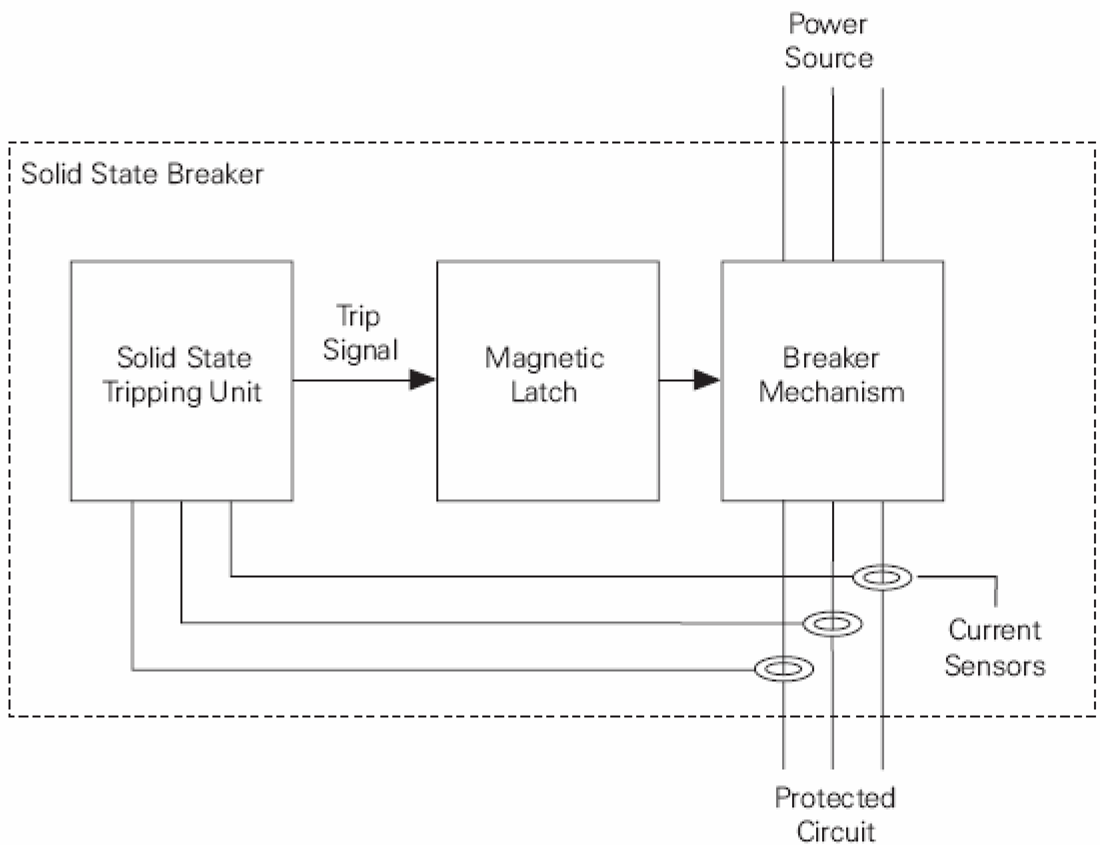
Current in RMS Amps	Time in Seconds
5,000	.0045
10,000	.0029
15,000	.0024
20,000	.0020
25,000	.0017

Interrupting Rating

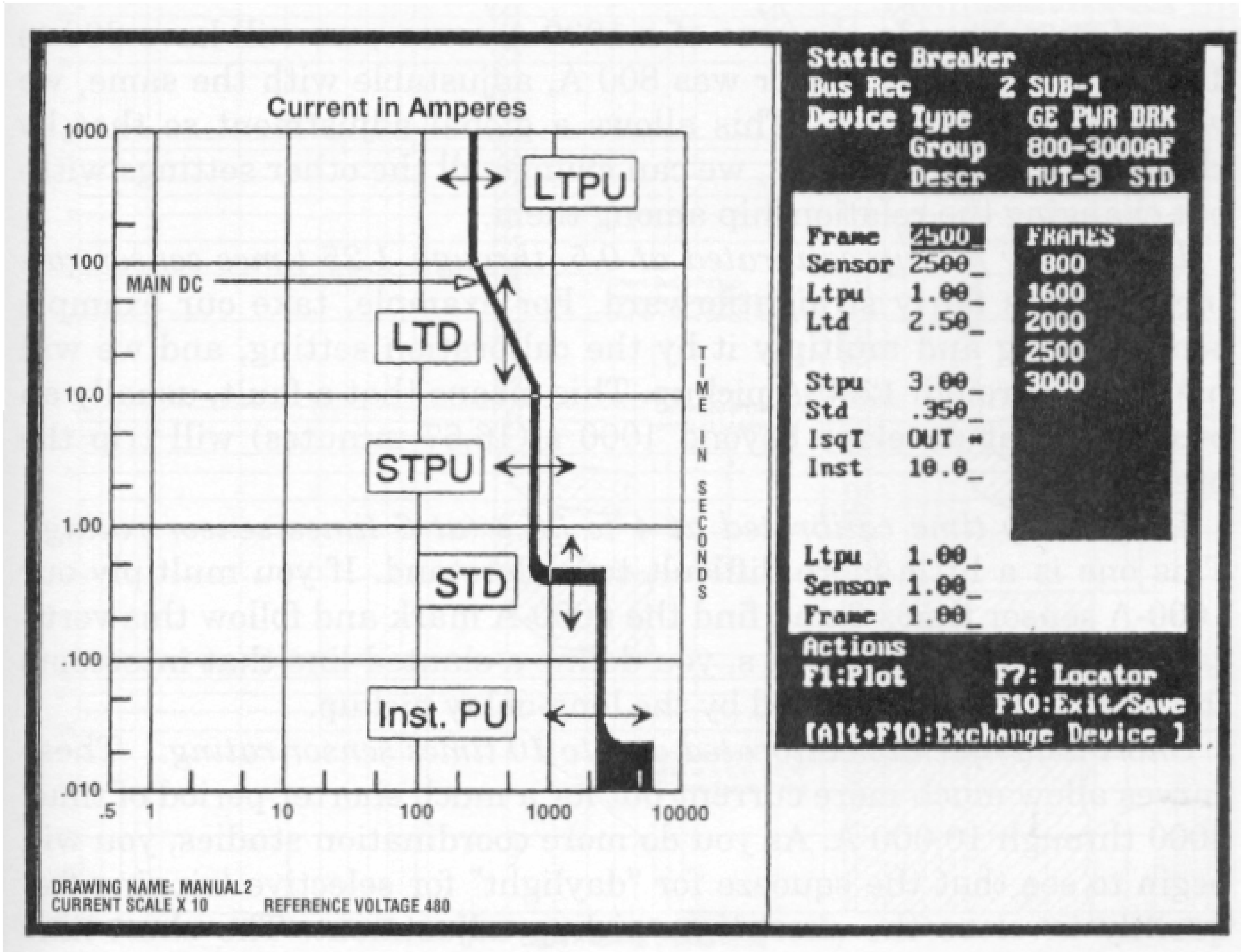
RMS Sym.	Amps
240V	42,000
480V	30,000
600V	22,000

Figure 4. Typical Circuit Breaker Time-Current Characteristic Curve

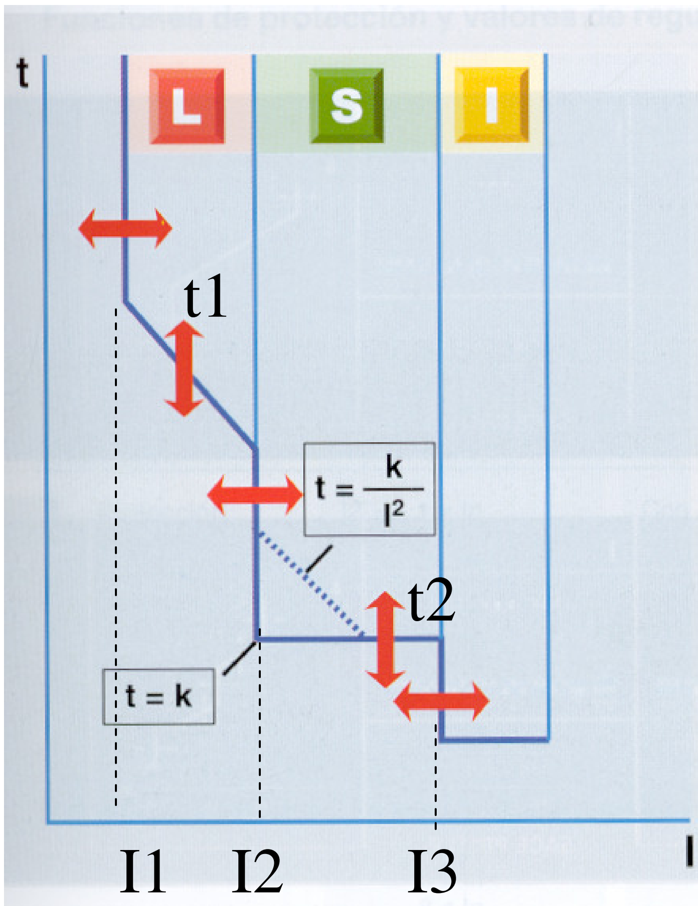
Solid State Circuit Breakers



Ajustes disponibles en Interruptores (relé basado en microprocesador)



Ejemplo de interruptor automático (Relé con microprocesador)



Funciones de protección

El relé SACE PR111 está dotado con las siguientes funciones de protección:

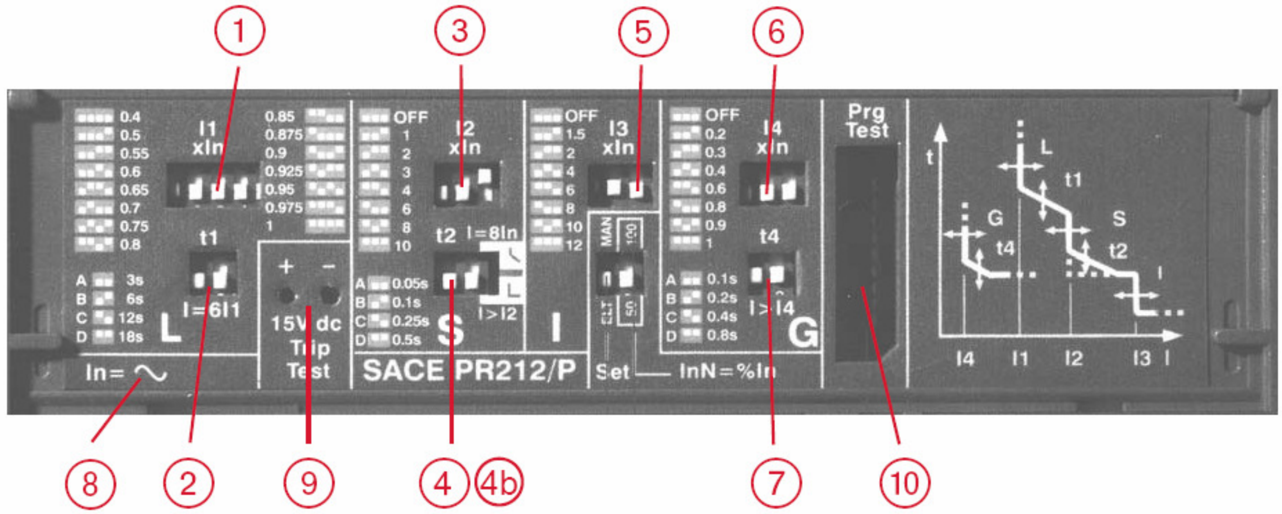
- sobrecarga (L)
- cortocircuito selectivo (S)
- cortocircuito instantáneo (I)
- defecto a tierra (G)

Para la gama de regulaciones, véase el parágrafo sucesivo.

Funciones de protección y valores de regulación del relé SACE PR111

Función		Umbrales de corriente	Tiempo de actuación	Posibilidad de exclusión	Relación t = f (I)
L	Protección contra el sobrecarga	I1 = 0,4 x In 0,5 x In 0,6 x In 0,7 x In 0,8 x In 0,9 x In 0,95 x In 1 x In	Con la corriente I = 6 x I1 t1 = 3 s (curva A) 6 s (curva B) 12 s (curva C) 18 s (curva D)	NO	$t = k/I^2$
S	Protección selectiva contra cortocircuito	I2 = 1 x In 2 x In 3 x In 4 x In 6 x In 8 x In 10 x In	Con la corriente I = 8 x In t2 = 0,05 s (curva A) 0,10 s (curva B) 0,25 s (curva C) 0,5 s (curva D)	SI	$t = k/I^2$ (curva tiempo/corr. I^2t ON)
		I2 = 1 x In 2 x In 3 x In 4 x In 6 x In 8 x In 10 x In	Con la corriente I > I2 t2 = 0,05 s (curva A) 0,10 s (curva B) 0,25 s (curva C) 0,5 s (curva D)	SI	t = k (curva tiempo/corr. I^2t OFF)
I	Protección instantánea contra cortocircuito	I3 = 1,5 x In 2 x In 4 x In 6 x In 8 x In 10 x In 12 x In	Intervención instantánea	SI	t = k
G	Protección contra defecto a tierra	I4 = 0,2 x In 0,3 x In 0,4 x In 0,6 x In 0,8 x In 0,9 x In 1 x In	Con la corriente I = 4 x I4 t4 = 0,1 s (curva A) 0,2 s (curva B) 0,4 s (curva C) 0,8 s (curva D)	SI	$t = k/I^2$

PR212



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

Referencia:Catálogo de Siemens

Molded Case Circuit Breakers

Digital Solid State Sentron Sensitrip III Series

Technical

The Sentron Sensitrip III circuit breaker is a true RMS current sensing device. Digital microprocessor circuitry within the electronic trip unit provides more precise control over the circuit breaker functions. This control allows circuit coordination flexibility not available with thermal magnetic circuit breakers.

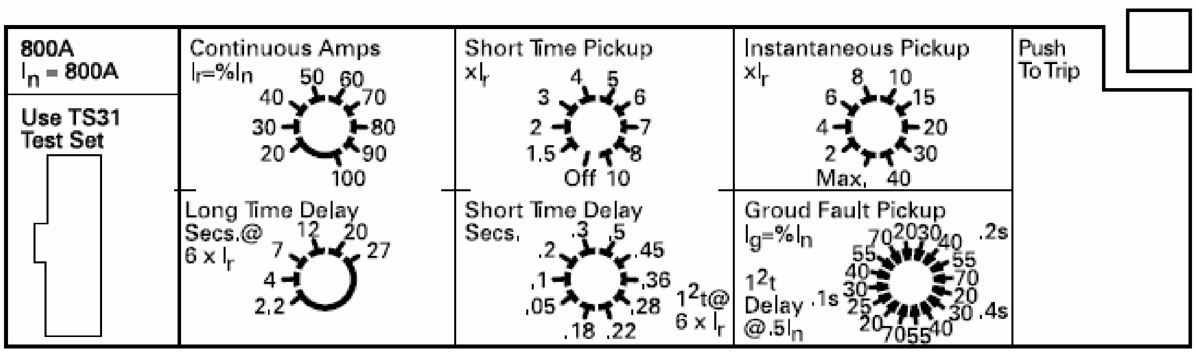
Functions available in Sentron Sensitrip circuit breakers.

Catalog Number (Description + Suffix)	Trip Type	Cont Current Setting	Long Time Delay	Instantaneous Setting	Short Time Pick Up	Short Time Delay	Short Time I^2t Pick Up	Ground Fault Pick Up	Ground Fault Delay
Basic Unit + (A)	LI	√	√	√					
Basic Unit + (A)G	LIG	√	√	√				√	√
Basic Unit + (A)NT	LSI	√	√	√	√	√	√		
Basic Unit + (A)NGT	LSIG	√	√	√	√	√	√	√	√

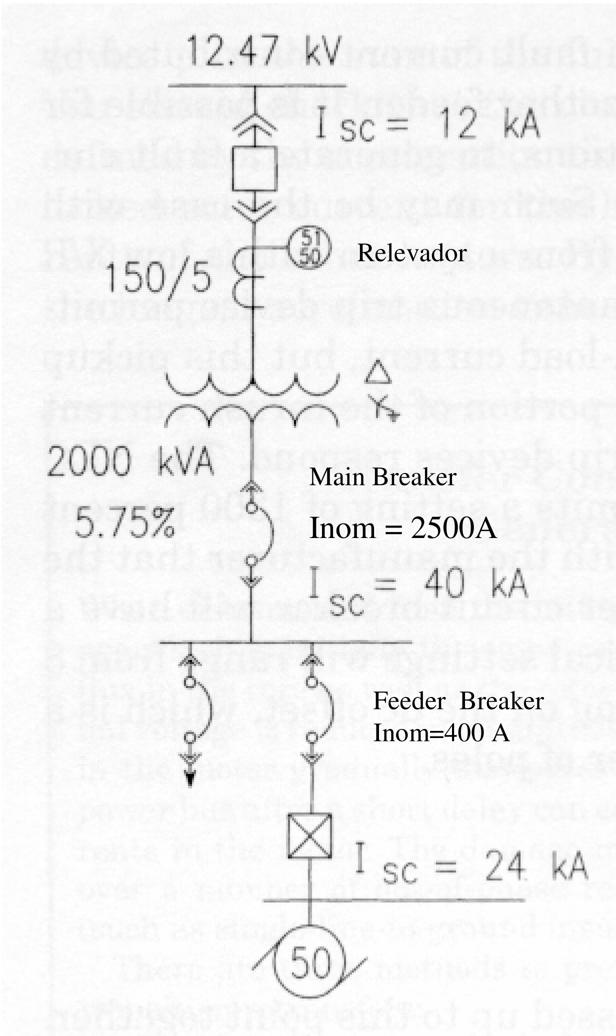
Letter "A" is used for MD and ND Solid State frame types only.

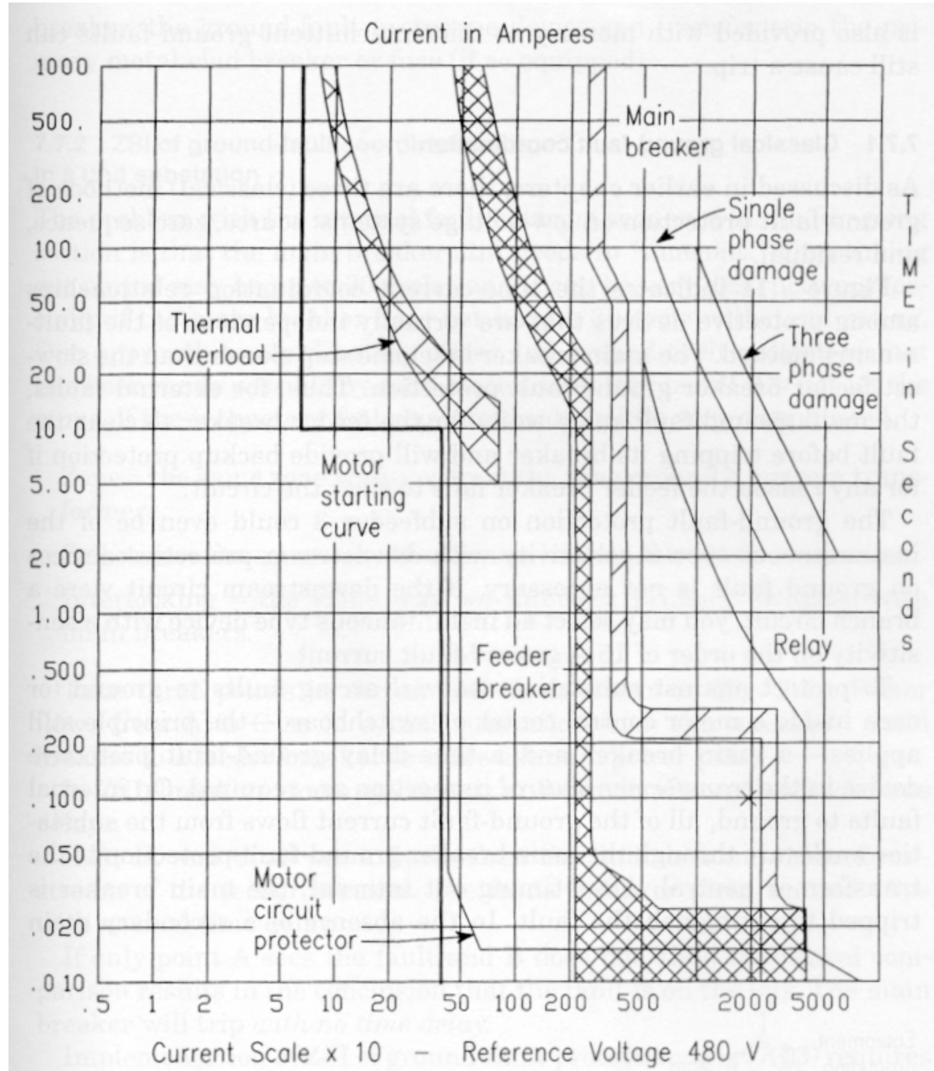
Typical Trip Unit Labeling and Adjustment Positions for the Sentron Sensitrip Circuit Breaker.

SMD6, SHMD6, SCMD6, SND6, SHND6, SCND6, SPD6, SHPD6



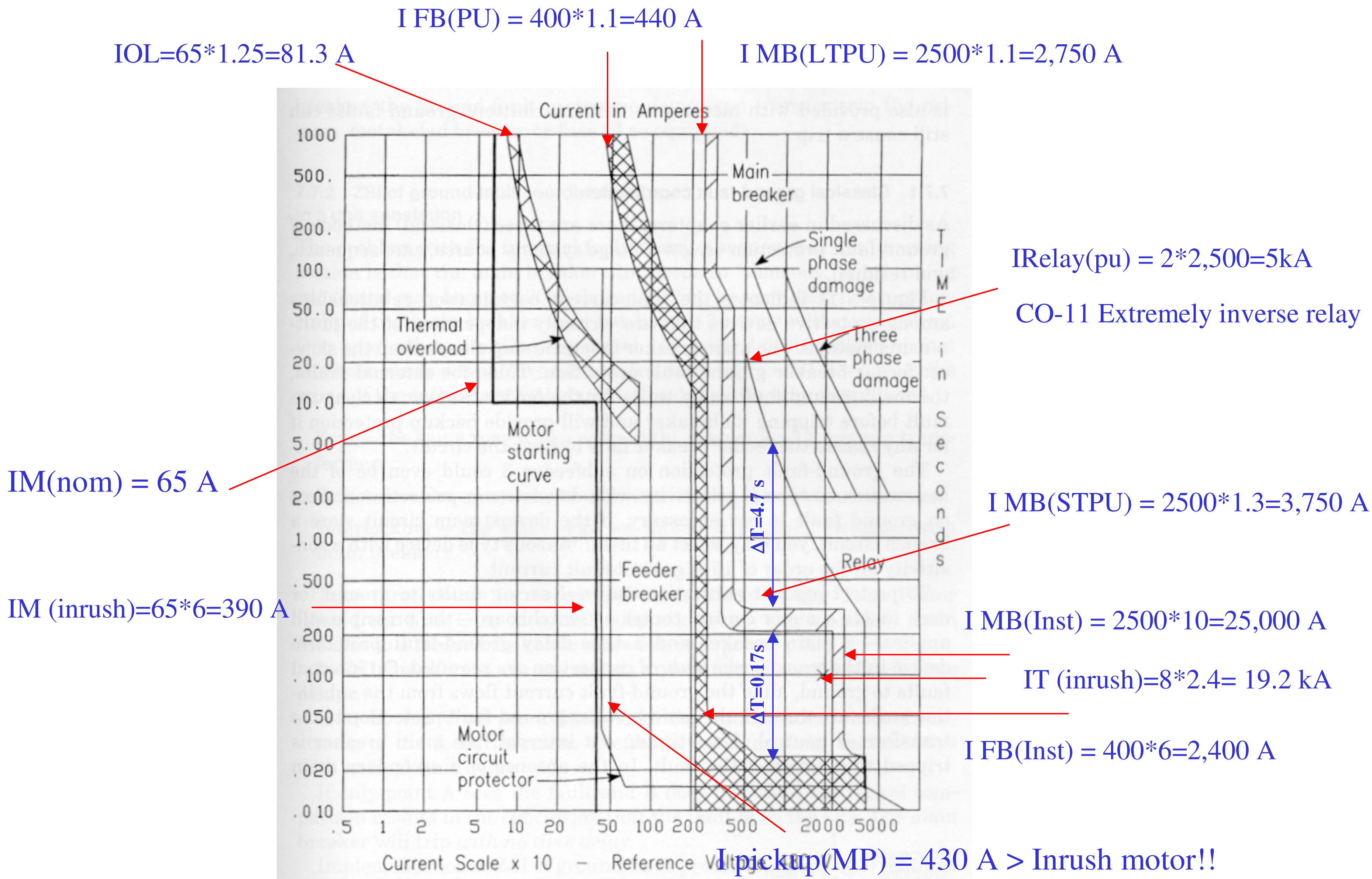
Coordinación de las protecciones





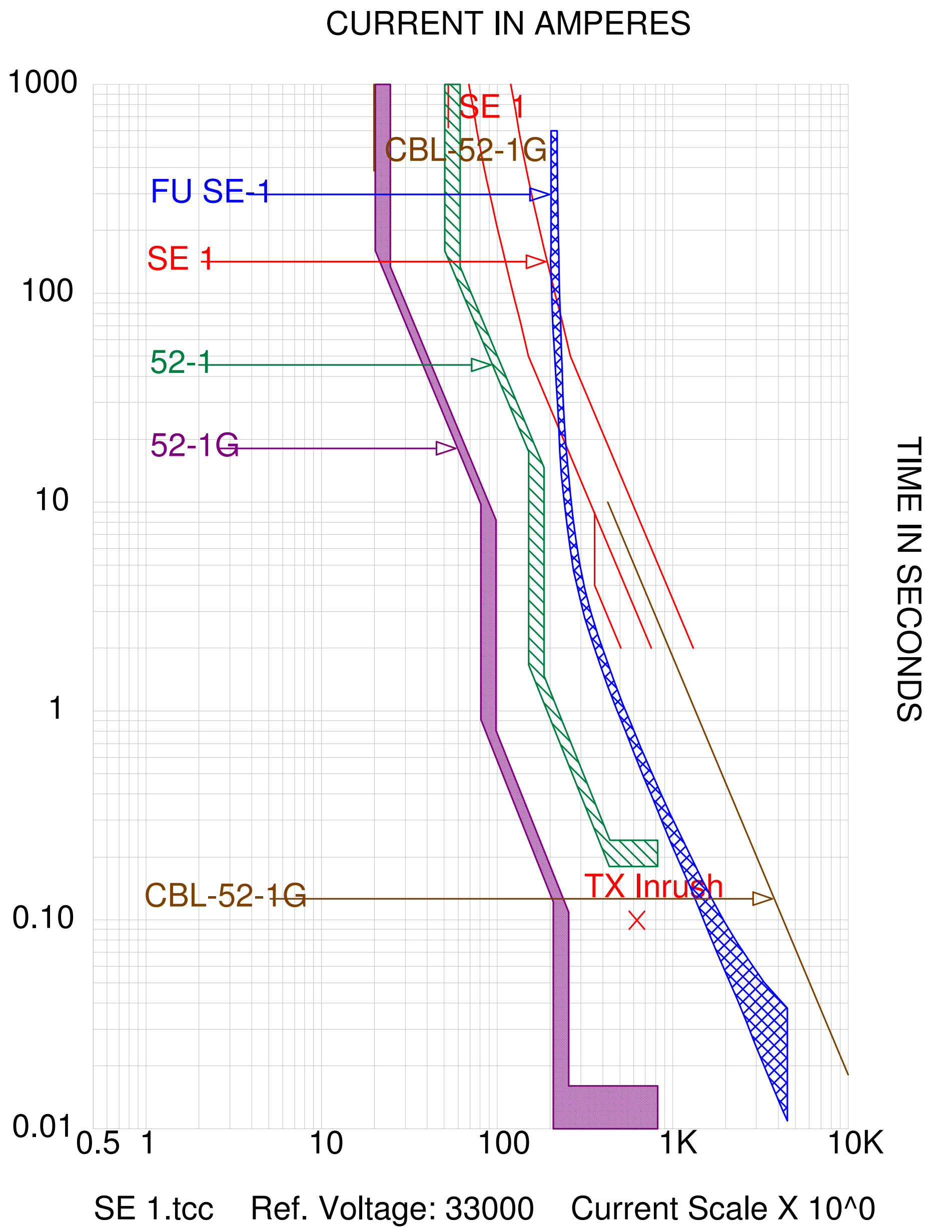
$$InomT = \frac{2000E3}{\sqrt{3}(480)} = 2405A \qquad Inom_M \approx 65A$$

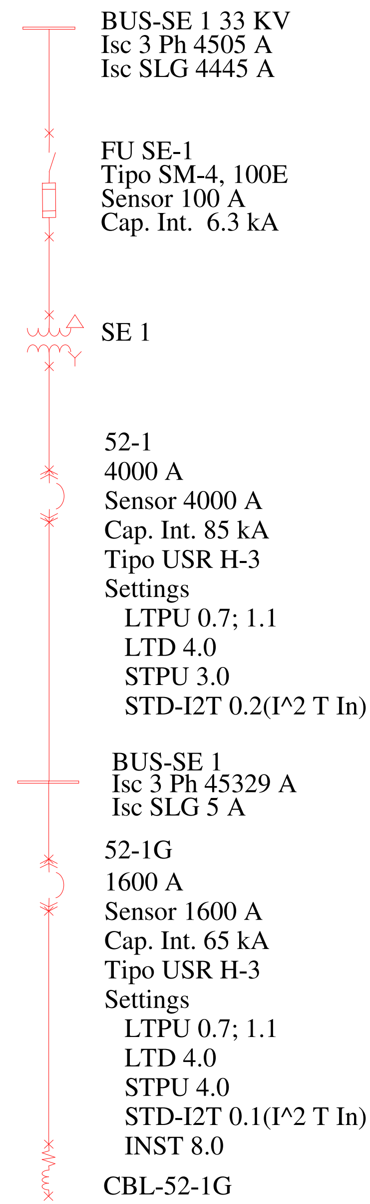
Coordinación de las protecciones (Corrientes referidas al lado de 480 V)



Los elementos deberán contar con la capacidad interruptiva adecuada de acuerdo a los resultados del estudio de CC

Ejemplo coordinación planta industrial





Ejemplo coordinación planta industrial