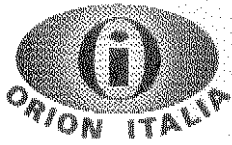




# CURRENT PROTECTION RELAY IPR-A

## IPR-A INSTRUCTION MANUAL TABLE OF CONTENTS

<b>SECTION 1 - INTRODUCTION</b>	
1.1 PRODUCT DESCRIPTION .....	1-1
1.2 SPECIFICATIONS .....	1-1
1.3 ORDER CODE .....	1-3
<b>SECTION 2 - INSTALLATION</b>	
2.1 UNPACKING .....	2-1
2.2 MOUNTING .....	2-1
2.3 PRODUCT IDENTIFICATION .....	2-1
2.4 WIRING .....	2-1
2.5 CURRENT TRANSFORMERS .....	2-1
2.6 OUTPUT RELAYS .....	2-3
2.7 BREAKER STATUS AND CONTROL CONNECTIONS .....	2-3
2.8 EXTERNAL SWITCHES .....	2-3
2.9 ACCESS PUSHBUTTON .....	2-3
2.10 COMMUNICATIONS .....	2-3
2.11 CONTROL POWER .....	2-4
2.12 SYSTEM GROUNDING .....	2-4
2.13 HIPOT TESTING .....	2-4
<b>SECTION 3 - PROTECTION APPLICATION INFORMATION</b>	
3.1 OVERCURRENT PROTECTION .....	3-1
<b>SECTION 4 - DISPLAY AND KEYBOARD</b>	
4.1 DISPLAY MODES .....	4-1
4.2 CONTROLS AND INDICATORS .....	4-1
ACTUAL VALUES key .....	4-1
PROG pushbutton .....	4-2
SET POINTS key .....	4-2
PAGE UP and PAGE DOWN keys .....	4-2
LINE key .....	4-2
VALUE UP and VALUE DOWN keys .....	4-3
STORE key .....	4-3
RESET key .....	4-4
TRIP, ALARM and SERVICE leds .....	4-4
BREAKER CLOSED, OPEN and EARTHED leds .....	4-4
SWITCH CURRENT, PICKUP I> (51), PICKUP I>> (50) leds .....	4-4
PICKUP I <sub>o</sub> > (51N/G), PICKUP I <sub>o</sub> >> (50N/G) leds .....	4-5
LCD display .....	4-5
<b>SECTION 5 - AUTOMATIC OPERATION MODE</b>	
<b>SECTION 6 - SETPOINTS MODE</b>	
PAGE 1: SETPOINT ACCESS .....	6-2
PAGE 2: PHASE CURRENT .....	6-3
PAGE 3: GROUND CURRENT .....	6-5
PAGE 4: CONFIGURATION .....	6-8
PAGE 5: COMMUNICATIONS .....	6-11
PAGE 6: CALIBRATION MODE .....	6-11
<b>SECTION 7 - ACTUAL VALUES MODE</b>	
PAGE 1: CURRENT .....	7-1
PAGE 2: MAINTENANCE DATA .....	7-2
PAGE 3: OPERATIONS DATA .....	7-3
PAGE 4: PRE-TRIP DATA .....	7-4
PAGE 5: EVENT DATA .....	7-5
PAGE 6: LOCAL OPERATION .....	7-6
<b>SECTION 8 - EVENT RECORDING INFORMATION</b>	
8.1 EVENT DEFINITION .....	8-1
8.2 TRIP EVENT .....	8-1
8.3 ALARM EVENT .....	8-1
8.4 EVENT STORAGE .....	8-1
8.5 EVENT FORMAT .....	8-1
8.6 EVENT DISPLAY FORMAT .....	8-1



# CURRENT PROTECTION RELAY IPR-A

---

## SECTION 9 - RELAY TESTING

9.1 PRIMARY INJECTION TESTING	9-1
9.2 SECONDARY INJECTION TESTING	9-1
9.3 PHASE CURRENT INPUT FUNCTION CHECK	9-1
9.4 PHASE INSTANTANEOUS PICKUP AND TRIP CHECK	9-2
9.5 PHASE OVERCURRENT CURVE VERIFICATION	9-2
9.6 GROUND CURRENT INPUT FUNCTION CHECK	9-2
9.7 GROUND INSTANTANEOUS PICKUP AND TRIP CHECK	9-3
9.8 GROUND OVERCURRENT CURVE VERIFICATION	9-3
9.9 OUTPUT RELAY FUNCTIONAL CHECK	9-3
9.10 POWER LOSS CHECK	9-4

## SECTION 10 - TEST REPORT

## SECTION 11 - WARRANTY

## APPENDIX A - TROUBLESHOOTING GUIDE

## APPENDIX B - CURVES AND CURVE TABLES

ANSI CURVES	B-2
IAC CURVES	B-10
IEC/BS142 CURVES	B-18
DEFINITE TIME CURVES	B-26

## APPENDIX C - RELAY SETTING SHEET

## APPENDIX D - SAMPLE CALCULATION

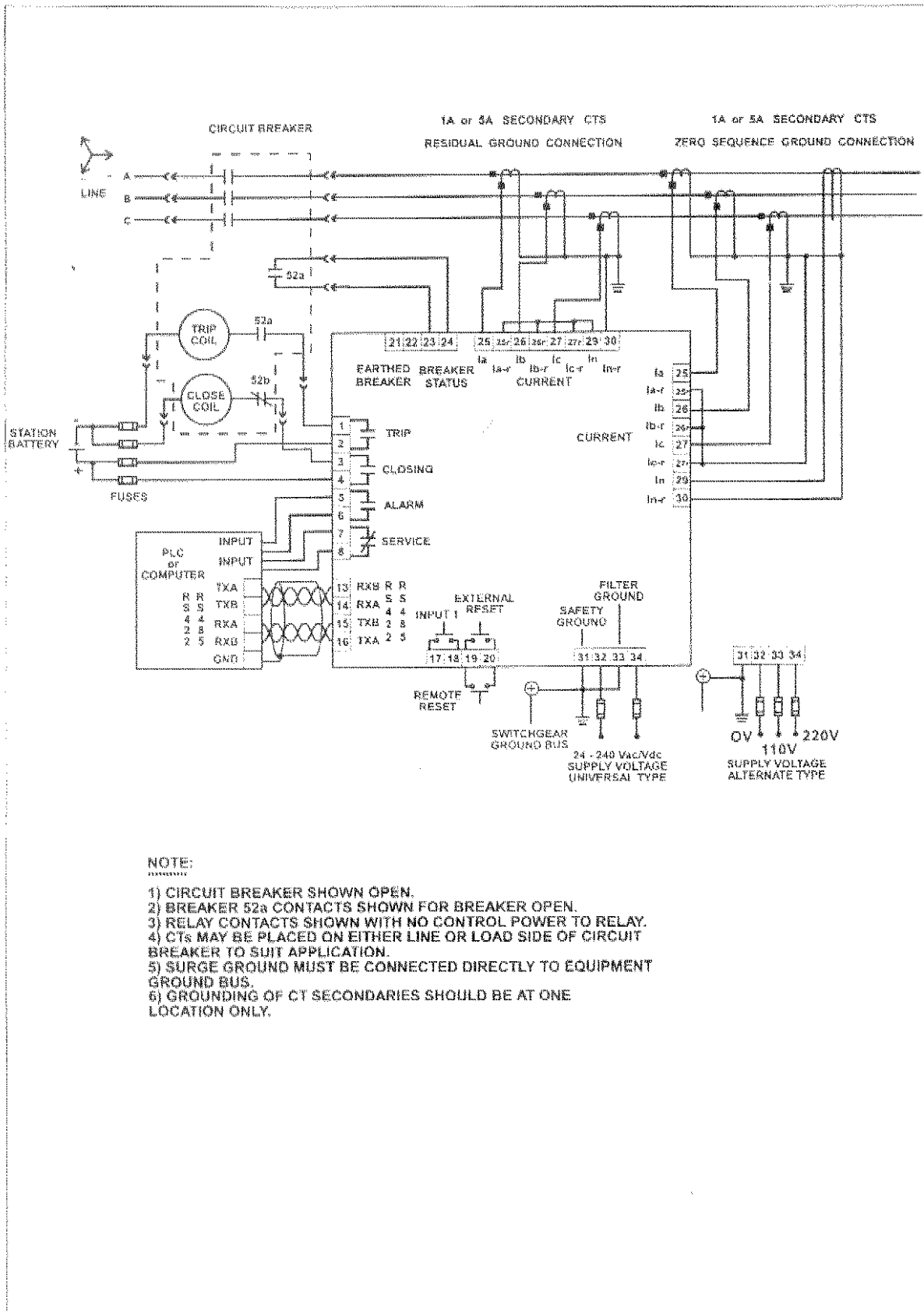


Figure 2-2 IPR-A Typical wiring diagram.

# CURRENT PROTECTION RELAY IPR-A

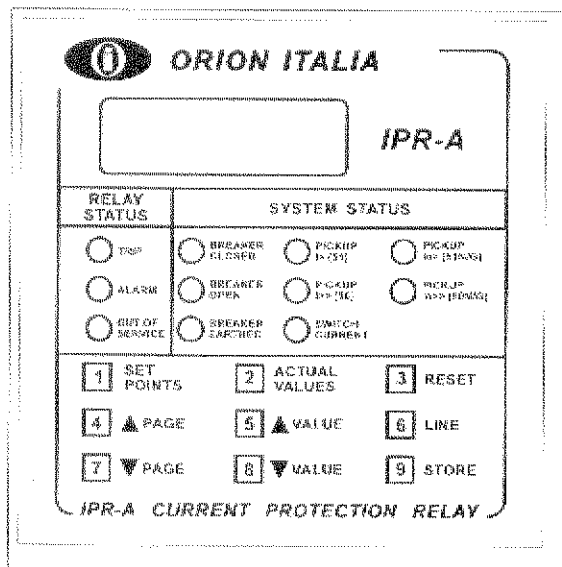
YES/NO questions, pressing either key will cause the answer to change. Any changed setpoint will not be used internally until the STORE key is pressed.

**USE:** These keys can be pressed any time a setpoint is displayed in SETPOINTS mode or when a YES/NO question is displayed in ACTUAL VALUE mode (see STORE key). When the desired setpoint value is reached the STORE key is used to save it. If an altered setpoints is not stored the previous value will still be in effect.

## STORE key

**FUNCTION:** The STORE key allows the user to store new setpoints into the IPR-A relay's internal memory.

**EFFECT:** When this key is pressed in SETPOINTS mode the currently displayed setpoint will be stored and will immediately come into effect. But if the access code was not entered or the PROG pushbutton was not pressed previously the IPR-A relay will ask the access code before to store the setpoint. To enter a three digit access code, the keyboard is organized as follows:



If the PROG pushbutton is pressed when the IPR-A relay ask for the access code the setpoint will be stored.

If the access code entered is wrong the IPR-A will not store the setpoint and the following message appear on the display:

ONLY VIEW  
WRONG CODE

When a setpoint is stored the message:

NEW SETPOINT  
STORED

will appear on the display.

The STORE key can be pressed in ACTUAL VALUES mode to clear the maintenance data or the operations data or pre-trip data or event data or to modify the status of the disconnecter or circuit breaker.

To clear the maintenance data the following message from page 2 of ACTUAL VALUE mode must be displayed after the "NO" value is altered to say "YES" by pressing the VALUE UP/VALUE DOWN key:

MAINTENANCE DATA  
CLEAR? YES

Then when the STORE key is pressed the following message will appear on the display

DATA CLEARED

The maintenance data will then be cleared.

To clear the operations data or pre-trip data or event data is accomplished using the same procedure previously described.

To modify the status of the disconnecter or circuit breaker the following message from page 6 of ACTUAL VALUE mode must be displayed after the "NO" value is altered to say "YES" by pressing the VALUE UP/VALUE DOWN key.

CLOSING DISCONN?  
YES

for closing of disconnecter or

CLOSING BREAKER?  
YES

for closing of circuit breaker or

OPENING DISCONN?  
YES

for opening of disconnecter or



## CURRENT PROTECTION RELAY IPR-A

### OPENING DISCONN?

YES

for opening of circuit breaker.

Then when the STORE key is pressed the following message will appear on the display

### ACTUAL VALUES

END OF PAGE

The status of disconnector or circuit breaker will then be modified.

**USE:** The STORE key can be used only in SETPOINTS mode to store new setpoints, or in ACTUAL VALUES mode to clear the maintenance data or the operations data or pre-trip data or event data or to modify the status of the disconnector or circuit breaker.

### RESET key

**FUNCTION:** The RESET key allows the user to reset the IPR-A after any of the latched output relays have become active so that a feeder closing can be attempted.

**EFFECT:** The RESET key returns the trip or alarm output relay to its inactive state and extinguishes the associated LED after a fault condition has caused it to become active. This key will only be effective if the fault condition has been removed. Otherwise, re-setting will not be possible and pressing the RESET key will have no effect.

**USE:** This key can be used at any time, in any mode to reset the IPR-A relay.

### TRIP led

The TRIP led indicates the state of the trip output relay which is used to trip the Feeder Breaker monitored by the IPR-A relay. When the LED is on, the TRIP relay is active (if previously it was programmed latched operation) with the cause of the trip condition shown on AUTOMATIC OPERATION mode. The LED will be extinguished by pressing the RESET key only if the fault condition causing the relay to be activated has been removed.

### ALARM led

The ALARM led indicates the state of the alarm output relay. When the LED is on, the ALARM relay is active (if previously it was programmed latched operation) with the cause of the alarm condition shown on AUTOMATIC OPERATION mode. The LED will be extinguished by pressing the RESET key only if the fault condition causing the alarm relay to be activated has been removed.

### OUT OF SERVICE led

The OUT OF SERVICE led is used to show the result of the IPR-A self-test feature. When the LED is on, the SERVICE relay is deactivated and service is required.

### BREAKER CLOSED led

The BREAKER CLOSED LED indicates the status of the Feeder Breaker being monitored by the IPR-A relay. The LED is on if the Feeder Breaker is closed.

### BREAKER OPEN led

The BREAKER OPEN LED indicates the status of the Feeder Breaker being monitored by the IPR-A relay. The LED is on if the Feeder Breaker is open.

### BREAKER EARTHED led

The BREAKER EARTHED LED indicates the status of the Feeder Breaker being monitored by the IPR-A relay. The LED is on if the Feeder Breaker is earthed.

### SWITCH CURRENT led

The SWITCH CURRENT led is on when the current of either phase has exceeded the normal current of the disconnector or fuses. With circuit breaker, this led is off.

### PICKUP I> (51) led

For the purpose of testing, for calibration verification, the PICKUP I> (51) indicator will come on when inverse time phase overcurrent protection feature has had its pickup threshold exceeded. The indicator will

## CURRENT PROTECTION RELAY IPR-A

---

remain on only as long as the measured phase current is above its pickup threshold.

### PICKUP I>> (50) led

For the purpose of testing, for calibration verification, the PICKUP I>> (50) indicator will come on when instantaneous overcurrent protection feature has had its pickup threshold exceeded. The indicator will remain on only as long as the measured phase current is above its pickup threshold.

### PICKUP Io> (51N/G) led

For the purpose of testing, for calibration verification, the PICKUP Io> (51N/G) indicator will come on when inverse time ground overcurrent protection feature has had its pickup threshold exceeded. The indicator will remain on only as long as the measured ground current is above its pickup threshold.

### PICKUP Io>> (50N/G) led

For the purpose of testing, for calibration verification, the PICKUP Io>> (50N/G) indicator will come on when instantaneous ground overcurrent protection feature has had its pickup threshold exceeded. The indicator will remain on only as long as the measured ground current is above its pickup threshold.

### LCD display

The display is a 32 character alphanumeric type. This display visually shows in english all values, setpoints and messages, through a series of lines within the pages of 3 display modes: Actual Values, Setpoints, and Automatic Operation.



# CURRENT PROTECTION RELAY IPR-A

## 6. SETPOINTS MODE

In SETPOINTS mode any or all of the feeder trip/a-farm setpoints may be either viewed or altered. This mode is divided into six separate pages of data each of which contains a different group of relay setpoints. The contents of which are as follows:

Page	Contents
1	Setpoint access
2	Phase current setpoints
3	Ground current setpoints
4	Configuration setpoints
5	Communications setpoints
6	Calibration mode setpoint

To enter SETPOINTS mode the SET POINTS key must be pressed. When in this mode, if no key is pressed for more than ten minutes, the display will automatically go into AUTOMATIC OPERATION mode. To return to SETPOINTS mode the SET POINTS key must be pressed. When this key is pressed the following message will appear on the display,

### SETPOINTS PAGE 1 SETPOINT ACCESS

which is the first line of the first page of SETPOINTS mode. Here the PROG pushbutton could be pressed or only pressing the STORE key and entering the access code, if it's desired to modify setpoints. Otherwise, the SETPOINTS can only be viewed.

The PAGE UP, PAGE DOWN, and LINE keys (see section 4.2) may then be used to view all of the SETPOINTS data.

When setpoints are to be changed, the VALUE UP, VALUE DOWN, and STORE keys (see section 4.2) are used.

The PAGE UP, PAGE DOWN, and LINE keys are used to display the setpoints that are to be changed. The setpoints themselves are changed by pressing the VALUE UP or VALUE DOWN keys until the desired setpoint value is reached. When the setpoint is adjusted to its proper value the STORE key should be pressed in order to store the setpoint into the IPR-A relay's internal memory. Once the STORE key is pressed the message,

### NEW SETPOINT STORED

will appear on the display and the new setpoint value will be used by the IPR-A relay.

If an attempt is made to store a new setpoint value without the PROG pushbutton pressing during the following message,

### SETPOINTS PAGE 1 SETPOINT ACCESS

and the access code entered is wrong, the new value will not be stored and the message,

### ILLEGAL ACCESS

will appear on the display.

Setpoints may be changed while the feeder breaker is closed; however it is not recommended to change important protection parameters without first opening the circuit breaker.

Setpoints will remain stored indefinitely in the IPR-A relay's internal non-volatile memory even when control power to the unit is removed.

All six pages of data and the lines in each page are as shown in Table 6-1. Also shown are the ranges and increments for each setpoint. It should be noted that the IPR-A relay's feeder protection parameters are based on the data entered by the user. Thus this data must be complete and accurate for the given system.

The following abbreviations are used in the messages in the setpoints pages:

A	Ampers
CT	Current transformer
CUR	Current
CYC	Cycles
DISCREP.	Discrepancy
ELEC.	Electrical
EXTREM	Extremely
Hz	Hertz
INST	Instantaneous
INV	Inverse
KA	Kiloamps
KV	Kilovolts
MECH.	Mechanical
MOD	Moderately
mS	Milliseconds
NOM	Nominal
O/C	Overcurrent
SEC	Secondary or second



# CURRENT PROTECTION RELAY IPR-A

x P/U Multiple of pickup level  
 ZERO SEQ Zero Sequence

Table 6-1 SETPOINTS

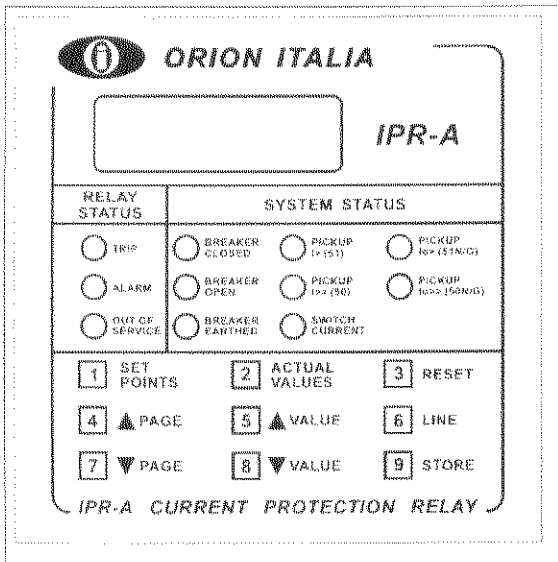
**SETPOINTS PAGE 1**  
**SETPOINT ACCESS**

Line Information Line

**1 SETPOINTS PAGE 1**  
**SETPOINT ACCESS**  
 Description: This page of setpoints contains messages for Setpoint Access. To altered the setpoints, the PROG pushbutton could be pressed during this message or pressing the STORE key and entering the access code.

*Message line 2 will appear if the LINE key was pressing during the message of the line 1.*

**2 ENTER ACCESS**  
**CODE:**  
 Description: Once this message is displayed, enter your three digit access code using the keyboard organized as follows:



Range: 111-999  
 Factory value: 111

Once the correct code is entered, setpoint access can be enabled.

Table 6-1 SETPOINTS

**SETPOINTS PAGE 1**  
**SETPOINT ACCESS**

Line Information Line

*Messages Line 3 to 7 will appear if the setpoints access is enabled. Otherwise, messages line 8 to 10 will appear.*

*Messages Line 3 to 7 will appear if the PROG pushbutton was pressing during the message of the line 1.*

**3 SETPOINT ACCESS**  
**ENABLED**  
 Description: This message indicates the access to setpoints to alter it.

**4 ENTER NEW ACCESS**  
**CODE NO**  
 Description: This message allows the user to enter their own personalized access code.  
 Range: YES, NO  
 Factory value: NO

*Messages lines 6 and 7 will only appear if NO is selected in message line 4.*

*Messages lines 5 to 7 will only appear if YES is selected in message line 4.*

**5 ENTER NEW ACCESS**  
**CODE:**  
 Description: Once this message is displayed, enter a three digit access code using the keyboard organized as explained before.

Once the new access code is entered, the following message appear on the display:

**NEW ACCESS CODE**  
**STORED**

**6 IPR-A RELAY**  
**IPR-A XXXXXXXX**  
 Description: This message identifies the IPR-A firmware revision.

**7 END OF PAGE**  
**SETPOINT VALUES**  
 Description: This is the last line of page 1, setpoints. Press PAGE UP or LINE keys to view page 2.





# CURRENT PROTECTION RELAY IPR-A

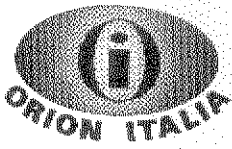
Table 6-1 SETPOINTS

SETPOINTS PAGE 1	
SETPOINT ACCESS	
Line	Information Line
8	<p><b>ONLY VIEW</b> <b>WRONG CODE</b></p> <p>Description: This message indicates the access to setpoints is only in view mode.</p>
9	<p><b>IPR-A RELAY</b> <b>IPR-A XXXXXXXX</b></p> <p>Description: This message identifies the IPR-A firmware revision.</p>
10	<p><b>END OF PAGE</b> <b>SETPOINT VALUES</b></p> <p>Description: This is the last line of page 1, setpoints. Press PAGE UP or LINE keys to view page 2.</p>

Table 6-1 SETPOINTS

SETPOINTS PAGE 2	
PHASE CURRENT	
Line	Information Line
1	<p><b>SETPOINTS PAGE 2</b> <b>PHASE CURRENT</b></p> <p>Description: The setpoints page 2 header. In this page you must enter information about the phase current transformer being used in your application. This allows the IPR-A relay to accurately sense the feeder currents. This page also allows you to set the levels for various overcurrent alarms and trips.</p>
2	<p><b>SAMPLING</b> <b>FREQUENCY 50 Hz</b></p> <p>Description: The frequency entered in this setpoint is used for internal sampling. The frequency entered here must match the line frequency, otherwise the current readings will be unstable.</p> <p>Range: 50 Hz, 60 Hz Factory value: 50 Hz</p>
3	<p><b>PHASE CT RATING</b> <b>PRIMARY 100 A</b></p> <p>Description: Enter the primary current rating of the phase current transformers being used. This value is found on the transformer nameplate. If your transformer has a rating outside this range contact ORION ITALIA for information. Note that all three phase CT's must have the same rating.</p> <p>Range: 10 to 5000 Amps, steps of 5 Amp. Factory value: 100 A</p>
4	<p><b>PHASE TIMED O/C</b> <b>PICKUP 25 %CT</b></p> <p>Description: The phase overcurrent pickup level is entered here. This is given as a percentage of the CT rating. This setting will determine the level of current which the IPR-A relay will identify as too high, and then initiate a timed overcurrent trip of the breaker, according to the selected curve shape. For example, if 50% is entered here, then the IPR-A relay initiate a timed trip of the feeder breaker when at least one of the phase currents reaches 50% of the full CT rating entered in message Pg. 2 line 3. Determine this value by referring to the feeder design specifications.</p>

*Note: Please refer to section "Protection Application Information" in regards to the maximum current capacity of the relay.*



# CURRENT PROTECTION RELAY IPR-A

Table 6-1 SETPOINTS

**SETPOINTS PAGE 2**  
**PHASE CURRENT**

Line Information Line

Range: 4% to 250%, steps of 1%  
Factory value: 25%

**5 PHASE O/C CURVE**  
**ANSI MOD INV**

Description: The shape of the required protection curve must be entered here. The curve names are shown below together with the shortened form of the name which is displayed in this message.

CURVE NAME	DISPLAYED NAME
1. Moderately inverse	MOD INV
2. Normal inverse	NORMAL INV
3. Very inverse	VERY INV
4. Extremely inverse	EXTREM INV
5. Short time	SHORT TIME
6. Inverse	INVERSE

One the four different curve types can be programmed: ANSI, IAC, IEC/BS142 or DEFINITE TIME. Once the correct curve has been chosen for your application press the VALUE UP or VALUE DOWN keys until the required curve is displayed and store the selected curve using the STORE key. The ANSI moderately inverse curve is shown in this example.

Range: ANSI MOD INV, ANSI NORMAL INV, ANSI VERY INV, ANSI EXTREM INV, IAC SHORT TIME, IAC INVERSE, IAC VERY INV, IAC EXTREM INV, IEC SHORT TIME, IEC-A NORMAL INV, IEC-B VERY INV, IEC-C EXTREM INV, DEFINITE TIME #1 and #2.  
Factory value: ANSI MOD INV

**6 PHASE TIMED O/C**  
**DIAL 10**

Description: The phase overcurrent time dial number is entered here. This allows the user to fit the selected curve to the system requirements. Select the curve number by referring to the Appendice B.

Range: 1 to 10, steps of 1  
Factory value: 10

Table 6-1 SETPOINTS

**SETPOINTS PAGE 2**  
**PHASE CURRENT**

Line Information Line

**7 PHASE TIMED O/C**  
**SHIFT 1.0**

Description: Although only 10 discrete curves can be selected for phase time overcurrent using the time multiplier dial, the trip times can be shifted to effectively create curves in between. This allows for more accurate coordination. To selected the correct shift value, plot the required curve for coordination and select the closest curve shape and curve number. Set the phase time multiplier dial to the closest curve number. Then select the best time overcurrent shift value to adjust the curve trip times. For example if the plotted curve falls exactly on normally inverse curve number 4, select CURVE SHAPE normal inverse and TIME DIAL 4. Then set the phase overcurrent shift of 1. If instead the plotted curve was between curve 3 and 4 about 80% below curve 4 then a multiplier shift of 0.8 would be chosen.

Range: 0.5 to 1.1, steps of 0.1  
Factory value: 1.0

**8 PHASE O/C ALARM**  
**ENABLED**

Description: This message allows the user to enable or disable the phase overcurrent alarm.

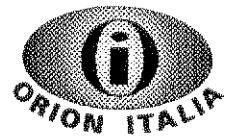
Range: ENABLED, DISABLED  
Factory value: ENABLED

*Messages lines 9 and 10 will only appear if ENABLED is selected in message line 8.*

**9 PHASE O/C ALARM**  
**LEVEL 1.0xP/U**

Description: This is the value of current flowing in any phase which will cause the relay to initiate an alarm. This value is entered as a multiple of the phase timed overcurrent pickup level chosen in message line 4. Choose alarm values lower than the trip pickup levels by an amount which will give adequate warning of impending problems. For example a value of 80% of the phase timed overcurrent level might be chosen, and 0.8 would be entered here.

Range: 0.5 to 3.0, steps of 0.1  
Factory value: 1.0



# CURRENT PROTECTION RELAY IPR-A

**Table 6-1 SETPOINTS**  
**SETPOINTS PAGE 2**  
**PHASE CURRENT**

Line	Information Line
10	<p><b>PHASE O/C ALARM</b>  <b>DELAY 1 SEC</b></p> <p>Description: The value of the timed overcurrent alarm delay is entered here. The purpose of the time delay is to prevent alarms due to momentary high currents which occur when large equipment is switched on or off the feeder. If the current drops below the alarm setting before the time delay which you select, no alarm will be initiated.</p> <p>Range: 1 to 254 sec, steps of 1 sec            Factory value: 1 sec</p>
11	<p><b>PHASE INST TRIP</b>  <b>ENABLED</b></p> <p>Description: This setpoint allows the user to enable or disable the phase instantaneous trip protection.</p> <p><i>NOTE: Please refer to section "Protection Application Information" in regard to the maximum current capacity of the relay.</i></p> <p>Range: ENABLED, DISABLED            Factory value: ENABLED</p>

*Messages lines 12 and 13 will only appear if ENABLED is selected in message line 11.*

12	<p><b>PHASE INST TRIP</b>  <b>LEVEL 10.0xP/U</b></p> <p>Description: The instantaneous overcurrent trip level for all phase is entered here as a multiple of the pickup level already set in message line 4. This feature protects the feeder from sudden very high current which cannot be tolerated without machine damage. For example, if the phase overcurrent pickup level was 100 Amps, and a setting of 5 was chosen here then a current of 500 or higher amps in any phase, for longer than the time specified in the next message will cause a trip signal to be produced by the IPR-A relay.</p> <p>Range: 1.0 to 18, steps of 0.5            Factory value: 10</p>
----	--

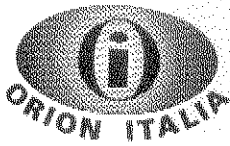
**Table 6-1 SETPOINTS**  
**SETPOINTS PAGE 2**  
**PHASE CURRENT**

Line	Information Line
13	<p><b>PHASE INST TRIP</b>  <b>DELAY 0 CYC</b></p> <p>Description: The intentional delay on the phase instantaneous trip is set here. If 0 is selected, there will be no intentional delay. There is, however, a one cycle delay which is necessary for the IPR-A relay to react to the fault condition. If any other value is entered within the above range, the trip will occur in this above reaction time plus the entered value. Thus, for an entered delay of 2 cycles on a 60 Hz system, the actual time to trip on phase instantaneous is <math>3 \times 16.6 \text{ msec} = 50 \text{ msec}</math>.</p> <p>Range: 0 to 40 cycles, steps of 1 cycle.            Factory value: 0 cycle.</p>
14	<p><b>END OF PAGE</b>  <b>SETPOINT VALUES</b></p> <p>Description: This is the last line of page 2, setpoints. Press PAGE UP or LINE keys to view page 3.</p>

**Table 6-1 SETPOINTS**  
**SETPOINTS PAGE 3**  
**GROUND CURRENT**

Line	Information Line
1	<p><b>SETPOINTS PAGE 3</b>  <b>GROUND CURRENT</b></p> <p>Description: The setpoint page 3 header. In this page the setpoints which determine the ground current protection are entered.</p>
2	<p><b>GROUND CURRENT</b>  <b>SENSING ENABLED</b></p> <p>Description: This message allows the user to enable or disable the ground current protection.</p> <p>Range: ENABLED, DISABLED            Factory value: ENABLED</p>

*Only message line 15 will appear if DISABLED is selected in message line 2.*



# CURRENT PROTECTION RELAY IPR-A

**Table 6-1 SETPOINTS**  
**SETPOINTS PAGE 3**  
**GROUND CURRENT**

Line	Information Line
3	<p><b>SENSING SYSTEM</b>  <b>RESIDUAL</b></p> <p>Description: This message is asking if your system uses a separate zero sequence CT or if the phase CT's are connected in a residual sensing configuration to detect ground current.</p> <p>Range: ZERO SEQUENCE, RESIDUAL            Factory value: RESIDUAL</p> <p><i>Message line 4 will only appear if ZERO SEQUENCE was selected in message line 3.</i></p>
4	<p><b>GROUND CT RATIO</b>  <b>PRIMARY 100 A</b></p> <p>Description: This message ask for the ratio of the zero sequence transformer being used in your application. This value will be on the transformer nameplate.</p> <p>Range: 10 to 5000 A, steps of 5 A            Factory value: 100 A</p>
5	<p><b>GROUND TIMED O/C</b>  <b>PICKUP 12 %CT</b></p> <p>Description: The ground overcurrent pickup level is entered here. This setpoint set the level of current at which the IPR-A relay initiates a timed trip of the feeder breaker, according to the curve selected in message line 6. For example, if 50% is entered here, then the IPR-A relay initiate a programmed trip of the feeder breaker when the ground current reaches 50% of the full CT rating. The CT rating used will be either:</p> <p>a) The phase CT primary rating entered in message page 2 line 2, if residual current sensing is chosen in line 3.            b) The zero sequence CT primary rating, if zero sequence sensing is chosen in message line 3.</p> <p>If the ground current exceeds the limits of the time/overcurrent curve in use, a feeder breaker trip will occur. Determine the ground current pickup level for your application according to the grounding system used.</p> <p><i>Note: Please refer to section "Protection Application Information" in regards to the maximum current capacity of the relay.</i></p> <p>Range: 4% to 150%, steps of 1%            Factory value: 12%</p>

**Table 6-1 SETPOINTS**  
**SETPOINTS PAGE 3**  
**GROUND CURRENT**

Line	Information Line														
6	<p><b>GROUND O/C CURVE</b>  <b>ANSI MOD INV</b></p> <p>Description: The shape of the required ground current protection curve must be entered here. The available curves are shown below, together with the shortened form of the name which is displayed in this message.</p> <table border="1"> <thead> <tr> <th>CURVE NAME</th> <th>DISPLAYED NAME</th> </tr> </thead> <tbody> <tr> <td>1. Moderately inverse</td> <td>MOD INV</td> </tr> <tr> <td>2. Normal inverse</td> <td>NORMAL INV</td> </tr> <tr> <td>3. Very inverse</td> <td>VERY INV</td> </tr> <tr> <td>4. Extremely inverse</td> <td>EXTREM INV</td> </tr> <tr> <td>5. Short time</td> <td>SHORT TIME</td> </tr> <tr> <td>6. Inverse</td> <td>INVERSE</td> </tr> </tbody> </table> <p>One the four different curve types can be programmed: ANSI, IAC, IEC/BS142 or DEFINITE TIME.</p> <p>Range: ANSI MOD INV, ANSI NORMAL INV, ANSI VERY INV, ANSI EXTREM INV, IAC SHORT TIME, IAC INVERSE, IAC VERY INV, IAC EXTREM INV, IEC SHORT TIME, IEC-A NORMAL INV, IEC-B VERY INV, and IEC-C EXTREM INV            Factory value: ANSI MOD INV</p>	CURVE NAME	DISPLAYED NAME	1. Moderately inverse	MOD INV	2. Normal inverse	NORMAL INV	3. Very inverse	VERY INV	4. Extremely inverse	EXTREM INV	5. Short time	SHORT TIME	6. Inverse	INVERSE
CURVE NAME	DISPLAYED NAME														
1. Moderately inverse	MOD INV														
2. Normal inverse	NORMAL INV														
3. Very inverse	VERY INV														
4. Extremely inverse	EXTREM INV														
5. Short time	SHORT TIME														
6. Inverse	INVERSE														
7	<p><b>GROUND O/C TIME</b>  <b>DIAL 10</b></p> <p>Description: The ground overcurrent time dial number is entered here. This allows the user to fit the selected curve to the system requirements. Select the curve number by referring to the Appendice B.</p> <p>Range: 1 to 10, steps of 1            Factory value: 10</p>														
8	<p><b>GROUND O/C TIME</b>  <b>SHIFT 1.0</b></p> <p>Description: Ground time multiplier shift works exactly the same way as the phase shift time multiplier except that it affects the selected ground curve. See setpoint page 2 line 6.</p> <p>Range: 0.5 to 1.1, steps of 0.1            Factory value: 1.0</p>														



# CURRENT PROTECTION RELAY IPR-A

Table 6-1 SETPOINTS

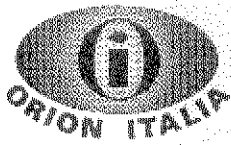
SETPOINTS PAGE 3  
GROUND CURRENT

Line	Information Line
9	<p><b>GROUND O/C ALARM</b> <b>ENABLED</b></p> <p>Description: This message allows the user to enable or disable the ground overcurrent alarm. Range: ENABLED, DISABLED Factory value: ENABLED</p> <p><i>Messages lines 10 and 11 will only appear if ENABLED is selected in message line 9.</i></p>
10	<p><b>GROUND O/C ALARM</b> <b>LEVEL 1.0xP/U</b></p> <p>Description: The ground overcurrent alarm level is entered as a multiple of the pickup level. This setpoint sets the level of ground current at which the IPR-A relay initiates an alarm. For example, if 0.5 is entered here, then the IPR-A relay will initiate an alarm when the ground current reaches 50% of the pickup level entered in message line 5. Determine the alarm level for your application by referring to the feeder design specifications. The alarm must be far enough below the trip setting to allow corrective action to be taken.</p> <p>Range: 0.5 to 3.0, steps of 0.1 Factory value: 1.0</p>
11	<p><b>GROUND O/C ALARM</b> <b>DELAY 1 SEC</b></p> <p>Description: The time delay for the ground alarm is entered here. This feature prevents the alarm for the timed period and stops nuisance alarms due to momentary high ground currents. When the alarm condition persist beyond the timed period the alarm will occur.</p> <p>Range: 1 to 254 sec, steps of 1 sec Factory value: 1 sec</p>
12	<p><b>GROUND INST TRIP</b> <b>ENABLED</b></p> <p>Description: This setpoint allows the user to enable or disable the ground instantaneous trip protection.</p> <p><i>NOTE: This setpoint must be enabled and a proper trip level must be selected if a pickup level has been selected greater than 100% of CT (5A tap only). See caution in section "Protection Application Information".</i></p> <p>Range: ENABLED, DISABLED Factory value: ENABLED</p>

Table 6-1 SETPOINTS

SETPOINTS PAGE 3  
GROUND CURRENT

Line	Information Line
	<p><i>Messages lines 13 and 14 will only appear if ENABLED is selected in message line 12.</i></p>
13	<p><b>GROUND INST TRIP</b> <b>LEVEL 10.0xP/U</b></p> <p>Description: The instantaneous ground current trip level is entered here as a multiple of the pickup level already chosen in message line 5. This feature protects the feeder from sudden very high ground current. For example, say the ground pickup level is 50 amp, and the setting of 2 was chosen here. If a current of 100 or more amps lasts for longer than the time delay set in message line 14, then a trip signal will be produced by the IPR-A relay.</p> <p>Range: 1.0 to 18, steps of 0.5 Factory value: 10</p>
14	<p><b>GROUND INST TRIP</b> <b>DELAY 0 CYC</b></p> <p>Description: An intentional delay on the ground instantaneous trip is entered here. This prevents nuisance trips due to momentary high ground currents. Should the condition persist beyond the timed period the trip will occur. If 0 is selected there will be no intentional delay on the trip. There is, however, a 1 cyc delay which is necessary for the IPR-A relay to react to the fault condition. If any other value is entered within the above range, the trip will occur in the above reaction time plus the entered value.</p> <p>Range: 0 to 40 cycles, steps of 1 cycle. Factory value: 0 cycle.</p>
15	<p><b>END OF PAGE</b> <b>SETPOINT VALUES</b></p> <p>Description: This is the last line of page 3, setpoints. Press PAGE UP or LINE keys to view page 4.</p>



# CURRENT PROTECTION RELAY IPR-A

Table 6-1 SETPOINTS

**SETPOINTS PAGE 4  
CONFIGURATION**

Line	Information Line
1	<p><b>SETPOINTS PAGE 4 CONFIGURATION</b></p> <p>Description: The setpoints page 4 header. In this page, relay characteristics are set up to suit the particular application. The breaker type and characteristics are selected here.</p>
2	<p><b>RESET TYPE LOCAL</b></p> <p>Description: The reset type is selected here. The LOCAL reset allows to reset the IPR-A relay only with the front RESET key. The LOCAL &amp; REMOTE reset allow to reset the IPR-A relay with the RESET key or with the EXTERNAL RESET input (terminals 19 and 20).</p> <p>Range: LOCAL, LOCAL &amp; REMOTE Factory value: LOCAL</p>
3	<p><b>TRIP RELAY PULSED</b></p> <p>Description: This display indicates that the trip relay is ready to have its mode of operation set up. This controls whether the relay will operate in pulsed or latched mode, as follows:</p> <p>a) Pulsed operation: If pulsed operation is selected the relay becomes energized when a trip condition occurs. When the 52a contacts of the breaker confirm that the breaker is open, the IPR-A seal-in timer is initiated and counting down of the programmed time delay starts. After this delay time elapses, the trip relay will become de-energized. This means that the relay will keep the trip signal on until feeder current has dropped by the opening of the breaker and the programmed time delay has expired.</p> <p><i>NOTE: The IPR-A relays are not designed to regularly break inductive current. Pulsed relay becomes latched to act as the seal-in contact as used in electromechanical relays.</i></p> <p>b) Latched operation: If latched operation is chosen for trip relay it will remain active once energized until it is reset. Pressing the RESET key on the front panel unlatches trip relay, if the fault condition has been removed.</p> <p>Range: PULSED, LATCHED Factory value: PULSED</p>

Message line 4 will only appear if PULSED operation is assigned to the trip relay

Table 6-1 SETPOINTS

**SETPOINTS PAGE 4  
CONFIGURATION**

Line	Information Line
4	<p><b>TRIP RELAY PULSE TIME 0.1 SEC</b></p> <p>Description: This message allows the user to set the length of the pulse for the trip relay when selected for pulse operation. The pulse time controls the length of time that the relay will seal-in once the 52a contacts react.</p> <p>Range: 0.1 to 0.6 secs, steps of 0.1 sec Factory value: 0.1 sec</p>
5	<p><b>ALARM RELAY PULSED</b></p> <p>Description: This display indicates that the alarm relay is ready to have its mode of operation set up. This controls whether the relay will operate in pulsed or latched mode, as is explained in message line 3. The latched operation may be convenient if the alarm relay is being used to annunciate a fault condition.</p> <p>Range: PULSED, LATCHED Factory value: PULSED</p> <p><i>Message line 6 will only appear if PULSED operation is assigned to the alarm relay</i></p>
6	<p><b>ALARM RELAY PUL. TIME 0.1 SEC</b></p> <p>Description: This message allows the user to set the length of the pulse for the alarm relay when selected for pulse operation. The pulse time controls the length of time that the IPR-A relay will react.</p> <p>Range: 0.1 to 0.6 secs, steps of 0.1 sec Factory value: 0.1 sec</p>
7	<p><b>BREAKER TYPE CIRCUIT BREAKER</b></p> <p>Description: This message allows to user to select the breaker type to suit the particular application. The DISCONNECTOR type is commonly named ON-LOAD SWITCH or LOAD-BREAK SWITCH.</p> <p>Range: CIRCUIT BREAKER, DISCONNECTOR Factory value: CIRCUIT BREAKER</p> <p><i>Messages lines 8 to 17 will only appear if DISCONNECTOR type is selected in message line 7. Messages lines 18 to 24 will only appear if CIRCUIT BREAKER type is selected in message line 7.</i></p>

# CURRENT PROTECTION RELAY IPR-A

Table 6-1 SETPOINTS

SETPOINTS PAGE 4 CONFIGURATION	
Line	Information Line
8	<p><b>DISCONNECTOR</b> <b>NOM CUR 100 A</b></p> <p>Description: The normal current of switch-disconnector is entered here. This current is utilized to allow opening or trip of disconnector only if the value of current flowing in all phase is below to the value which you enter here. If the switch-disconnector utilizes fuses, then is the normal current of fuses the limit value selected for analysis. The IPR-A relay allows the opening of the switch-disconnector within the limits of its capacity, those identifying the excess (e.g. straight shortcircuits), leaving the circuit interruption to the back-up fuses.</p> <p>Range: 10 to 5000 A, steps of 5 A. Factory value: 100 A</p>
9	<p><b>DISCONNECTOR</b> <b>WITH FUSES YES?</b></p> <p>Description: The message asks for the installation of fuses in the disconnector. There are two possible alternatives: 1) Only disconnector or 2) Disconnector with fuses.</p> <p>Range: NO, YES Factory value: YES</p> <p><i>Message line 10 will only appear if DISCONNECTOR WITH FUSES YES? is selected in message line 9.</i></p>
10	<p><b>FUSE NORMAL</b> <b>CURRENT 100 A</b></p> <p>Description: The normal current of fuses is entered here. This current is utilized to allow opening or trip of disconnector only if the value of current flowing in all phase is below to the value which you enter here.</p> <p><i>NOTE: Please control that the fuses current must be below that the disconnector current.</i></p> <p>Range: 5 to 70 A, steps of 1 A. 70 to 5000A, steps of 5 A. Factory value: 100 A</p>
11	<p><b>BREAKER DISCREP.</b> <b>ALARM DISABLED</b></p> <p>Description: This message asks if you want the breaker discrepancy alarm enabled or disabled.</p>

Table 6-1 SETPOINTS

SETPOINTS PAGE 4 CONFIGURATION	
Line	Information Line
	<p>Range: ENABLED, DISABLED Factory value: DISABLED</p> <p><i>Message line 12 will only appear if ENABLED is selected in message line 11</i></p>
12	<p><b>BREAKER DISCREP.</b> <b>DELAY 1000 mS</b></p> <p>Description: This setpoint defines the amount of time that the breaker auxiliary contacts have to react after a trip or close command. If the correct response is not detected in this time a breaker discrepancy alarm occurs and alarm output is activated.</p> <p>Range: 100 to 2500 mSEC, steps of 10 mS. Factory value: 1000 mSEC</p>
13	<p><b>ELEC. OPERATIONS</b> <b>MAXIMUM 100</b></p> <p>Description: The electrical operations maximum number is entered here. This number represents the quantity of guaranteed operations under rated voltage and current. Determine this number from the disconnector manufacturer's data. This number allows to calculate the accumulated KA alarm level from disconnector. The IPR-A relay utilizes the formula: Acc. KA= ELEC. OPERATIONS * DISCONNECTOR RATED CURRENT.</p> <p>Range: 5 to 9995, steps of 5 Factory value: 100</p>
14	<p><b>MECH. OPERATIONS</b> <b>ALARM DISABLED</b></p> <p>Description: This message allows the user to enable or disable the mechanical operations alarm.</p> <p>Range: ENABLED, DISABLED Factory value: DISABLED</p> <p><i>Message line 15 will only appear if ENABLED is selected in message line 14.</i></p>
15	<p><b>MECH. OPERATIONS</b> <b>MAXIMUM 3000</b></p> <p>Description: The mechanical operations maximum number is entered here. This number represents the quantity of guaranteed mechanical operations from the disconnector manufacturer's data.</p>



# CURRENT PROTECTION RELAY IPR-A

## 7. ACTUAL VALUES MODE

In ACTUAL VALUES mode, any of the parameters monitored or calculated by the IPR-A relay may be viewed or cleared by the user. This mode is divided into six separate pages of data each of which contains a different group of actual feeder values. The contents of which are as follows:

Page	Contents
1	Current data.
2	Maintenance data.
3	Operations data.
4	Pre-trip data.
5	Event-recording data.
6	Local operation.

To place the relay in ACTUAL VALUES mode the ACTUAL VALUES key must be pressed. When this is done the following message will appear on the display.

### ACTUAL VALUES CURRENT

which is the first line of the first page of ACTUAL VALUES mode. Here the PROG pushbutton could be pressed or only pressing the STORE key and entering the access code, if it's desired to clear datas. Otherwise, the datas are not altered and will appear the message.

### ILLEGAL ACCESS

If the relay is in ACTUAL VALUES mode and no key is pressed for more than ten minutes, the display will automatically go into AUTOMATIC OPERATION mode. To return to ACTUAL VALUES mode the ACTUAL VALUES key must be pressed.

The PAGE UP, PAGE DOWN, and LINE keys are used to examine all of the actual feeder data outlined above.

All six pages of data and the lines in each page are as shown in Table 7-1.

The following abbreviations are used in the messages in the actual values pages:

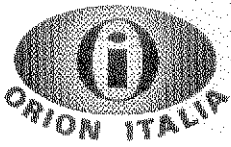
A	Ampers
BREAKER	Circuit breaker
DISCONN	Disconnecter
ELEC.	Electrical
INST	Instantaneous
INV	Inverse
KA	Kiloamps

MECH.	Mechanical
O/C	Overcurrent

**Table 7-1 ACTUAL VALUES  
ACTUAL VALUES PAGE 1  
CURRENT**

Line	Information Line
1	<b>ACTUAL VALUES CURRENT</b> Description: The actual values page 1 header. This page gives information on the feeder and ground currents being monitored by the IPR-A relay.
2	<b>PHASE A CURRENT 610 A</b> Description: This is the actual monitored RMS current following in phase A of the feeder.
3	<b>PHASE B CURRENT 615 A</b> Description: This is the actual monitored RMS current following in phase B of the feeder.
4	<b>PHASE C CURRENT 612 A</b> Description: This is the actual monitored RMS current following in phase C of the feeder.
	<i>Message line 5 will only appear if ground sensing has been enabled in setpoint.</i>
5	<b>GROUND CURRENT 8 A</b> Description: This is the actual leakage RMS current following to ground in the system.
6	<b>ACTUAL VALUES END OF PAGE</b> Description: The last line of page 1, actual values. Press the PAGE UP or LINE to view page 2.





# CURRENT PROTECTION RELAY IPR-A

Table 7-1 ACTUAL VALUES

ACTUAL VALUES PAGE 2 MAINTENANCE DATA	
Line	Information Line
1	<p><b>ACTUAL VALUES</b> <b>MAINTENANCE DATA</b></p> <p>Description: The actual values page 2 header. This page allows the maintenance related data, which the IPR-A relay has collected, to be viewed. This data remains in memory even if the control power is removed from the IPR-A relay. Information on the number of breaker or disconnecter trips, the number of breaker or disconnecter closure, the number of breaker or disconnecter opening and accumulated breaker or disconnecter trip current is stored on this page for use in scheduling breaker or disconnecter maintenance.</p> <p><i>Message line 2 will only appear if circuit breaker has been enabled in setpoints.</i></p>
2	<p><b>CIRCUIT BREAKER</b> <b>TRIPS 25</b></p> <p>Description: This is the total number of times that the feeder circuit breaker controlled by the IPR-A relay has been tripped since the breaker was put in service. The maximum number of trips displayable is 9999. If the maximum number of trips exceeds 9999, this value will be displayed. This figure may be useful for scheduling mechanical inspections of the breaker.</p> <p><i>Message line 3 will only appear if disconnecter has been enabled in setpoints.</i></p>
3	<p><b>DISCONNECTOR</b> <b>TRIPS 25</b></p> <p>Description: This is the total number of times that the feeder disconnecter controlled by the IPR-A relay has been tripped since the disconnecter was put in service. The maximum number of trips displayable is 9999. If the maximum number of trips exceeds 9999, this value will be displayed. This figure may be useful for scheduling mechanical inspections of the disconnecter.</p>
4	<p><b>ACCUMULATED AMP</b> <b>PH A 102 KA</b></p> <p>Description: This is the Kiloamps feeder current measurement right at the time when a trip or opening was last initiated by the IPR-A relay. This measurement is made at each trip or opening of the breaker or disconnecter and added to the previous accumulated value. This accumulated value gives an indication of disconnecter or breaker pole wear and be used to schedule inspections.</p>

Table 7-1 ACTUAL VALUES

ACTUAL VALUES PAGE 2 MAINTENANCE DATA	
Line	Information Line
5	<p><b>ACCUMULATED AMP</b> <b>PH B 104 KA</b></p> <p>Description: This is the accumulated sum of the Kiloamps phase B current.</p>
6	<p><b>ACCUMULATED AMP</b> <b>PH C 56 KA</b></p> <p>Description: This is the accumulated sum of the Kiloamps phase C current.</p>
7	<p><b>CLOSURE NUMBER</b> <b>5</b></p> <p>Description: This is the total number of times that the feeder circuit breaker or disconnecter controlled by the IPR-A relay has been closed. The IPR-A relay can closed the breaker or disconnecter, locally or remote via serial communications. The maximum number of closure displayable is 9,999.</p>
8	<p><b>OPENING NUMBER</b> <b>5</b></p> <p>Description: This is the total number of times that the feeder circuit breaker or disconnecter controlled by the IPR-A relay has been open. The IPR-A relay can opening the breaker or disconnecter, locally or remote via serial communications. The maximum number of opening displayable is 9,999.</p>
9	<p><b>MAINTENANCE DATA</b> <b>CLEAR? NO</b></p> <p>Description: This message asks if you want to clear the maintenance data which has been collected to date. Use the VALUE UP or VALUE DOWN keys to display YES or NO and then pressed STORE key and enter the access code, to store the condition. <b>NOTE:</b> If the PROG pushbutton was not pressed previously at this message or during message of the page 1, line 1 of ACTUAL VALUES, or the access code entered is wrong, the following message will appear: <b>ILLEGAL ACCESS</b></p> <p>If the access is authorized, the following message will appear: <b>DATA CLEARED</b></p>
10	<p><b>ACTUAL VALUES</b> <b>END OF PAGE</b></p> <p>Description: The last line of page 2, actual values. Press the PAGE UP or LINE to view page 3.</p>



# CURRENT PROTECTION RELAY IPR-A

Table 7-1 ACTUAL VALUES

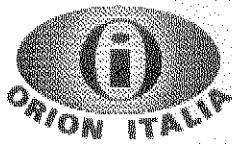
ACTUAL VALUES PAGE 3  
OPERATIONS DATA

Line	Information Line
1	<p><b>ACTUAL VALUES</b> <b>OPERATIONS DATA</b></p> <p>Description: The actual values page 3 header. This page allows the feeder operation related data, which the IPR-A relay has collected, to be viewed. Information on the number and types of trips issued by the IPR-A relay can be viewed in this page. This data remains in memory even if the control power is removed from the IPR-A relay. The maximum number of trips which can be displayed is 9,999. If the maximum number of the trips exceeds 9999, this value will be displayed.</p>
2	<p><b>PHASE TIMED O/C</b> <b>TRIPS            5</b></p> <p>Description: This is the number of times that the feeder breaker or disconnecter controlled by the IPR-A relay has been tripped due to the current flowing through it exceeding the timed phase overcurrent level set up in the setpoints mode.</p>
3	<p><b>PHASE INST O/C</b> <b>TRIPS            3</b></p> <p>Description: This is the number of times that the feeder breaker or disconnecter has been tripped by the IPR-A relay due to the current in the three phase system exceeding the phase instantaneous limits set up in the setpoints mode.</p>
4	<p><b>GROUND TIMED O/C</b> <b>TRIPS            6</b></p> <p>Description: This is the number of times that the feeder breaker or disconnecter has been tripped by the IPR-A relay due to ground current in the three phase system exceeding the programmed level set up in the setpoints mode.</p>
5	<p><b>GROUND INST O/C</b> <b>TRIPS            3</b></p> <p>Description: This is the number of times that the feeder breaker or disconnecter has been tripped by the IPR-A relay due to ground current exceeding the instantaneous limits set up in the setpoints mode.</p>

Table 7-1 ACTUAL VALUES

ACTUAL VALUES PAGE 3  
OPERATIONS DATA

Line	Information Line
6	<p><b>OPERATIONS DATA</b> <b>CLEAR?            NO</b></p> <p>Description: This message allows the user to clear the data in messages line 2 to line 7. Use the VALUE UP or VALUE DOWN keys to display YES or NO. To clear the data to select YES and then press the STORE key and enter the access code. YES should only be selected if you are prepared to lose the old data. The new data will be collected from the date that the clearing was done. Select NO to continue using the old data.</p> <p><b>NOTE:</b> If the PROG pushbutton was not pressed previously at this message or during message of the page 1, line 1 of ACTUAL VALUES, or the access code entered is wrong, the following message will appear:</p> <p><b>ILLEGAL ACCESS</b></p> <p>If the access is authorized, the following message will appear:</p> <p><b>DATA CLEARED</b></p>
7	<p><b>ACTUAL VALUES</b> <b>END OF PAGE</b></p> <p>Description: The last line of page 3, actual values. Press the PAGE UP or LINE to view page 4.</p>



# CURRENT PROTECTION RELAY IPR-A

Table 7-1 ACTUAL VALUES

**ACTUAL VALUES PAGE 4  
PRE-TRIP DATA**

Line	Information Line
1	<p><b>ACTUAL VALUES PRE-TRIP DATA</b></p> <p>Description: The actual value page 4 header. This page gives data on the condition of the feeder when a trip was last initiated by the IPR-A relay. This page can be viewed immediately after a trip to determine its cause. For example, if an overcurrent trip has occurred, then the phase currents can be inspected to check which phase or phases caused this. This page remains in memory even if the control power is removed from the IPR-A relay.</p>
2	<p><b>CAUSE OF LAST TRIP:</b></p> <p>Description: This message appears on the display to advise the user that the cause of the last trip will be displayed next. Pressed LINE key to view the next message which will give the reason for the last trip of the feeder breaker or disconnector.</p> <p><i>One of the messages lines 3 to 6 will then be displayed.</i></p>
3	<p><b>TIME OVERCURRENT PHASE A</b></p> <p>Description: This message indicates that the feeder breaker or disconnector trip was caused by the current in any or all of the phases A, B or C of the feeder exceeding the phase time/overcurrent limits programmed in the setpoints mode. Phase A is shown here.</p>
4	<p><b>TIME OVERCURRENT GROUND</b></p> <p>Description: This message indicates that the feeder breaker or disconnector trip was caused by the ground current sensed by the IPR-A relay exceeding the limits set by the timed/overcurrent curve which was programmed in the setpoints mode.</p>
5	<p><b>INST OVERCURRENT PHASE C</b></p> <p>Description: This message indicates that the feeder breaker or disconnector trip was caused by the current in any or all of the phases A, B or C of the feeder exceeding the instantaneous limit set up in setpoints mode. Phase C is shown here.</p>

Table 7-1 ACTUAL VALUES

**ACTUAL VALUES PAGE 4  
PRE-TRIP DATA**

Line	Information Line
6	<p><b>INST OVERCURRENT GROUND</b></p> <p>Description: This message indicates that the feeder breaker or disconnector was tripped due to the ground current exceeding the instantaneous limit set up in setpoints mode.</p>
7	<p><b>PHASE A PRE-TRIP 6100 A</b></p> <p>Description: This is the RMS current flowing in phase A measured over one cycle of feeder current, at the time that the IPR-A relay initiated the breaker or disconnector trip.</p>
8	<p><b>PHASE B PRE-TRIP 5900 A</b></p> <p>Description: This is the RMS current flowing in phase B measured over one cycle of feeder current, at the time that the IPR-A relay initiated the breaker or disconnector trip.</p>
9	<p><b>PHASE C PRE-TRIP 6200 A</b></p> <p>Description: This is the RMS current flowing in phase C measured over one cycle of feeder current, at the time that the IPR-A relay initiated the breaker or disconnector trip.</p> <p><i>Message line 10 will only appear if ground sensing is enabled in setpoints mode</i></p>
10	<p><b>GROUND PRE-TRIP 250 A</b></p> <p>Description: This is RMS ground current sensed by the IPR-A relay measured over one cycle of feeder current, at the time when the IPR-A relay initiated the breaker or disconnector trip.</p>



# CURRENT PROTECTION RELAY IPR-A

Table 7-1 ACTUAL VALUES

ACTUAL VALUES PAGE 4

PRE-TRIP DATA

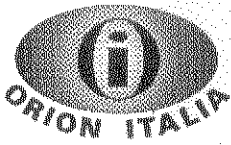
Line	Information Line
11	<p><b>PRE-TRIP DATA</b>  <b>CLEAR? NO</b></p> <p>Description: This message allows the user to clear the data of pre-trip. Use the VALUE UP or VALUE DOWN keys to display YES or NO. To clear the data to select YES and then press the STORE key and enter the access code. YES should only be selected if you are prepared to lose the old data. The new data will be collected from the date that the clearing was done. Select NO to continue using the old data.</p> <p><b>NOTE:</b> If the PROG pushbutton was not pressed previously at this message or during message of the page 1, line 1 of ACTUAL VALUES, or the access code entered is wrong, the following message will appear:</p> <p><b>ILLEGAL ACCESS</b></p> <p>If the access is authorized, the following message will appear:</p> <p><b>DATA CLEARED</b></p>
12	<p><b>ACTUAL VALUES</b>  <b>END OF PAGE</b></p> <p>Description: The last line of page 4, actual values. Press the PAGE UP or LINE to view page 5.</p>

Table 7-1 ACTUAL VALUES

ACTUAL VALUES PAGE 5

EVENT

Line	Information Line
1	<p><b>ACTUAL VALUES</b>  <b>EVENT</b></p> <p>Description: The actual values page 5 header. This page allows the recorded events to be viewed. If control power is removed, all currents and voltages of each events will be erased. Only the cause of event remains in memory if the control power is removed from the IPR-A relay.</p> <p><i>NOTE: See section 8 for more information on Event Recording.</i></p>
2	<p><b>No. OF EVENTS:</b>  <b>4</b></p> <p>Description: This message shows the number of recorded events.</p>
3	<p><b>VIEW EVENTS?</b>  <b>NO</b></p> <p>Description: This message asks if the user want to view events. Use the VALUE UP or VALUE DOWN keys to display YES or NO and press STORE to select the choice. If YES is selected, the following message will appear:</p> <p><b>EVENT CAUSE</b></p> <p><i>Pressing LINE key, the first event will be displayed.</i></p>
4	<p><b>PHASE O/C</b>  <b>ALARM</b></p> <p>Description: This message shows an example of a phase overcurrent alarm. Pressing LINE key everytime to see each of the 4 RMS currents associated to phase overcurrent alarm.</p> <p><i>All the causes, and currents of the events recorded will be displayed by pressing each time the LINE key.</i></p>
5	<p><b>EVENTS</b>  <b>CLEAR? NO</b></p> <p>Description: This message prompts the user to erase the event data displayed on this page. Use the VALUE UP or VALUE DOWN keys to display YES or NO. To clear the data to select YES and then press the STORE key and enter the access code.</p>



# CURRENT PROTECTION RELAY IPR-A

Table 7-1 ACTUAL VALUES

ACTUAL VALUES PAGE 5	
EVENT	
Line	Information Line
	<p><b>NOTE:</b> If the PROG pushbutton was not pressed previously at this message or during message of the page 1, line 1 of ACTUAL VALUES, or the access code entered is wrong, the following message will appear:</p> <p><b>ACTUAL VALUES</b> <b>END OF PAGE</b></p> <p>If the access is authorized, the following message will appear:</p> <p><b>DATA CLEARED</b></p>
6	<p><b>ACTUAL VALUES</b> <b>END OF PAGE</b></p> <p>Description: The last line of page 5, actual values. Press the PAGE UP or LINE keys to view page 6.</p>

Table 7-1 ACTUAL VALUES

ACTUAL VALUES PAGE 6	
LOCAL OPERATION	
Line	Information Line
1	<p><b>ACTUAL VALUES</b> <b>LOCAL OPERATION</b></p> <p>Description: The actual values page 6 header. This page allows the opening or closing of the circuit breaker or disconnecter via the IPR-A relay.</p> <p><i>Messages lines 2 or 3 will only appear if CIRCUIT BREAKER is selected in setpoints mode.</i></p> <p><i>Message line 2 will only appear if circuit breaker is open.</i></p>
2	<p><b>CLOSING BREAKER?</b> <b>NO</b></p> <p>Description: This message asks if the user wants to close the circuit breaker via the IPR-A relay. Use the VALUE UP or VALUE DOWN keys to display YES or NO. To close the circuit breaker to select YES and then press the STORE key and enter the access code.</p> <p><b>NOTE:</b> If the PROG pushbutton was not pressed previously at this message or during message of the page 1, line 1 of ACTUAL VALUES, or the access code entered is wrong, the following message will appear:</p> <p><b>ILLEGAL ACCESS</b></p> <p>If the access is authorized, the following message will appear:</p> <p><b>ACTUAL VALUES</b> <b>END OF PAGE</b></p> <p>Press PAGE UP or LINE keys to go AUTOMATIC OPERATION mode.</p> <p><i>Message line 3 will only appear if circuit breaker is closed.</i></p>
3	<p><b>OPENING BREAKER?</b> <b>NO</b></p> <p>Description: This message asks if the user wants to open the circuit breaker via the IPR-A relay. Use the VALUE UP or VALUE DOWN keys to display YES or NO. To open the circuit breaker to select YES and then press the STORE key and enter the access code.</p>

# CURRENT PROTECTION RELAY IPR-A

Table 7-1 ACTUAL VALUES

ACTUAL VALUES PAGE 6

LOCAL OPERATION

Line Information Line

**NOTE:** If the PROG pushbutton was not pressed previously at this message or during message of the page 1, line 1 of ACTUAL VALUES, or the access code entered is wrong, the following message will appear:  
**ILLEGAL ACCESS**

If the access is authorized, the following message will appear:

**ACTUAL VALUES**  
**END OF PAGE**

Press PAGE UP or LINE keys to go AUTOMATIC OPERATION mode.

*Messages lines 4 or 5 will only appear if DISCONNECTOR is selected in setpoints mode.*

*Message line 4 will only appear if disconnecter is open.*

4 CLOSING DISCONN?

NO

Description: This message asks if the user wants to close the disconnecter via the IPR-A relay. Use the VALUE UP, VALUE DOWN and STORE keys as explained in the message line 2.

*Message line 5 will only appear if the disconnecter is closed.*

5 OPENING DISCONN?

NO

Description: This message asks if the user wants to open the disconnecter via the IPR-A relay. Use the VALUE UP, VALUE DOWN and STORE keys as explained in the message line 3.

6 ACTUAL VALUES

END OF PAGE

Description: The last line of LOCAL OPERATION page. This is the last page of ACTUAL VALUES. Press PAGE UP or LINE keys to go AUTOMATIC OPERATION mode.

## CURRENT PROTECTION RELAY IPR-A

---

### 8. EVENT RECORDING INFORMATION

Event recording information is a feature of the IPR-A feeder relays. Data relating to one or more "events" is saved in memory and can be viewed by the operator through the front panel display or by a host computer through SICROI.

#### 8.1 EVENT DEFINITION

An "event" is defined as:

- a) occurrence of any set trip conditions or
- b) occurrence or disappearance of any set alarm condition.

#### 8.2 TRIP EVENT

Currently available trip events:

- a) any of the 4 timed overcurrent trips
- b) any of the 4 instantaneous overcurrent trips

#### 8.3 ALARM EVENT

Currently available alarm events:

- a) any of the overcurrent alarms
- b) accumulated KA alarm
- c) breaker discrepancy alarm
- d) mechanical operations alarm.

#### 8.4 EVENT STORAGE

All events will be stored in a memory buffer of the IPR-A unit, and up to 5 events will be accumulated. The buffer is operated in First-In-First-Out (FIFO) mode. In the buffer is full with 5 stored events, then as each new event occurs the oldest will be lost.

#### 8.5 EVENT FORMAT

Each event is characterized by cause and the magnitude of several measured feeder parameters, which are pertinent to the event at the time of occurrence. The parameters which will be saved are:

- a) the cause of the event; and
- b) each of the 4 RMS currents.

### 8.6 EVENT DISPLAY FORMAT

To view all the recorded events, users must press ACTUAL VALUES key, and select the EVENT page.

This Appendix lists the 4 possible curve types, and their corresponding curve shapes. They are listed as follows:

**ANSI CURVES**

Moderately Inverse  
Normal Inverse  
Very Inverse  
Extremely Inverse

**IAC CURVES**

IAC Short Time  
IAC Inverse  
IAC Very Inverse  
IAC Extremely Inverse

**IEC/BS142 CURVES**

IEC Short Time  
IEC A (Normal Inverse)  
IEC B (Very Inverse)  
IEC C (Extremely Inverse)

**DEFINITE TIME CURVES**

Definite Time #1 (Range: 0.025 to 0.550 sec)  
Definite Time #2 (Range: 0.25 to 5.50 sec)



**ANSI CURVES**  
**MODERATELY INVERSE TIMED O/C TRIP TIMES**

MODERATELY INVERSE

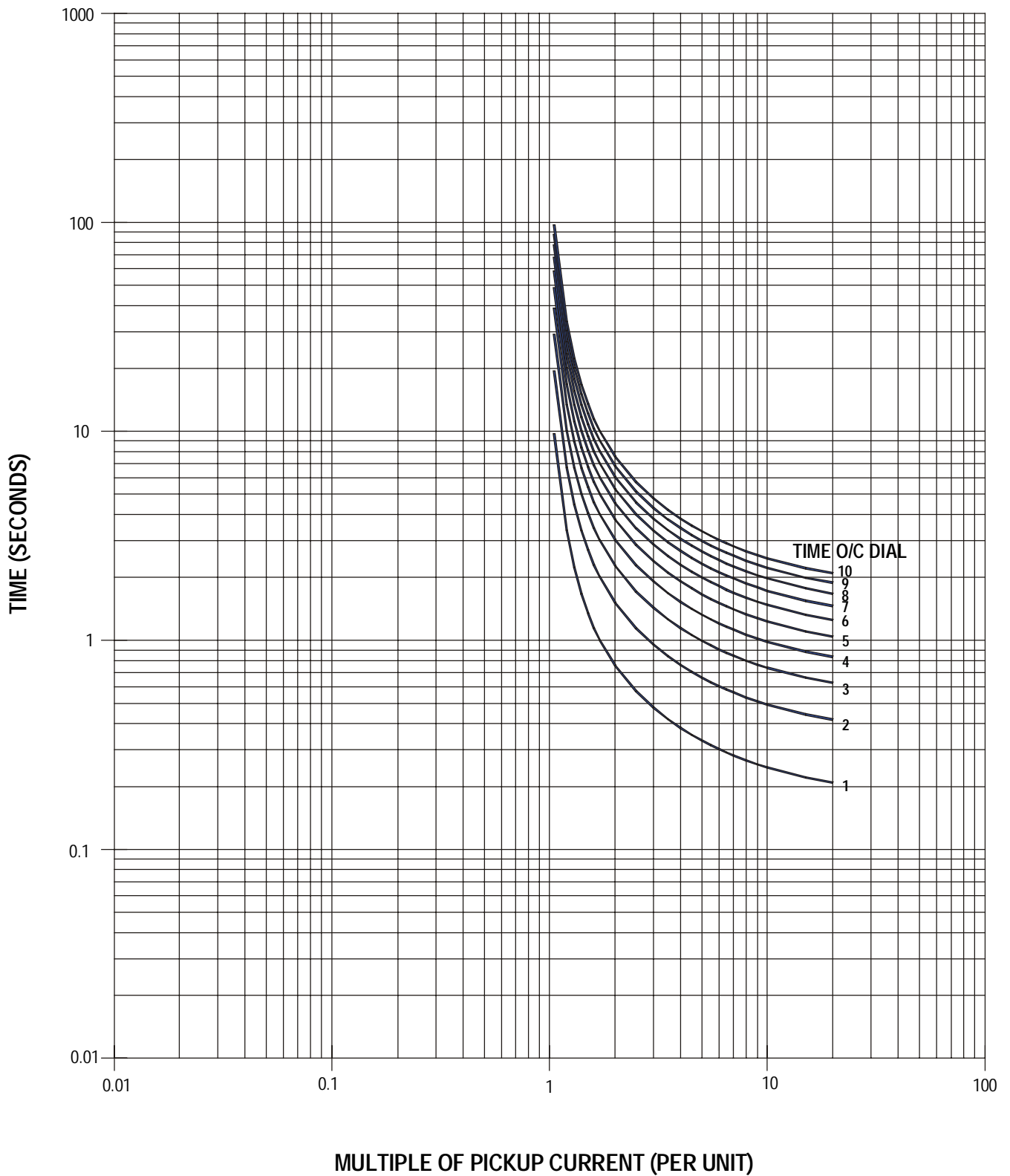
**Formula**  $T = S * M * (A + B / (I / I_{pu} - C) + D / (I / I_{pu} - C)^2 + E / (I / I_{pu} - C)^3)$

- |                           |                       |   |
|---------------------------|-----------------------|---|
| TRIP TIME (SEC)           | <b>T</b>              | CURVE SHAPE CONSTANT <b>A</b> = 0.1735  |
| CURVE SHIFT MULTIPLIER    | <b>S</b>              | CURVE SHAPE CONSTANT <b>B</b> = 0.6791  |
| CURVE MULTIPLIER SETPOINT | <b>M</b>              | CURVE SHAPE CONSTANT <b>C</b> = 0.8000  |
| INPUT CURRENT             | <b>I</b>              | CURVE SHAPE CONSTANT <b>D</b> = -0.0800 |
| PICKUP CURRENT SETPOINT   | <b>I<sub>pu</sub></b> | CURVE SHAPE CONSTANT <b>E</b> = 0.1271  |

(Per Unit I/I<sub>pu</sub>)

SHIFT (S)	CURVE (M)	1	1,5	2	3	4	5	6	7	8	9	10	15	20
1	1	17,457	1,351	0,757	0,478	0,382	0,332	0,302	0,281	0,267	0,255	0,247	0,221	0,209
1	2	34,913	2,702	1,515	0,955	0,764	0,665	0,604	0,563	0,533	0,511	0,493	0,442	0,417
1	3	52,37	4,053	2,272	1,433	1,145	0,997	0,906	0,844	0,8	0,766	0,74	0,663	0,626
1	4	69,826	5,404	3,03	1,91	1,527	1,329	1,208	1,126	1,066	1,021	0,986	0,884	0,835
1	5	87,283	6,755	3,787	2,388	1,909	1,662	1,51	1,407	1,333	1,277	1,233	1,105	1,043
1	6	104,739	8,106	4,544	2,866	2,291	1,994	1,812	1,689	1,6	1,532	1,479	1,326	1,252
1	7	122,196	9,457	5,302	3,343	2,673	2,327	2,114	1,97	1,866	1,788	1,726	1,547	1,461
1	8	139,652	10,807	6,059	3,821	3,054	2,659	2,416	2,252	2,133	2,043	1,972	1,768	1,669
1	9	157,109	12,158	6,817	4,298	3,436	2,991	2,718	2,533	2,4	2,298	2,219	1,989	1,878
1	10	174,565	13,509	7,574	4,776	3,818	3,324	3,02	2,815	2,666	2,554	2,465	2,21	2,087
0,5	1	8,728	0,675	0,379	0,239	0,191	0,166	0,151	0,141	0,133	0,128	0,123	0,11	0,104
0,5	2	17,457	1,351	0,757	0,478	0,382	0,332	0,302	0,281	0,267	0,255	0,247	0,221	0,209
0,5	3	26,185	2,026	1,136	0,716	0,573	0,499	0,453	0,422	0,401	0,383	0,371	0,331	0,313
0,5	4	34,913	2,702	1,515	0,955	0,764	0,665	0,604	0,563	0,533	0,511	0,493	0,442	0,417
0,5	5	43,641	3,377	1,894	1,194	0,954	0,831	0,755	0,704	0,667	0,638	0,616	0,552	0,522
0,5	6	52,37	4,053	2,272	1,433	1,145	0,997	0,906	0,844	0,801	0,766	0,741	0,663	0,626
0,5	7	61,098	4,728	2,651	1,672	1,336	1,163	1,057	0,985	0,933	0,894	0,863	0,773	0,731
0,5	8	69,826	5,404	3,031	1,911	1,527	1,329	1,208	1,126	1,066	1,021	0,986	0,884	0,835
0,5	9	78,554	6,079	3,408	2,149	1,718	1,496	1,359	1,267	1,201	1,149	1,109	0,994	0,939
0,5	10	87,283	6,755	3,787	2,388	1,909	1,662	1,511	1,407	1,333	1,277	1,233	1,105	1,043
0,8	1	13,965	1,081	0,606	0,382	0,305	0,266	0,242	0,225	0,213	0,204	0,197	0,177	0,167
0,8	2	27,93	2,161	1,212	0,764	0,611	0,532	0,483	0,451	0,427	0,409	0,394	0,354	0,334
0,8	3	41,896	3,242	1,818	1,146	0,916	0,798	0,725	0,676	0,641	0,613	0,592	0,531	0,501
0,8	4	55,861	4,323	2,424	1,528	1,222	1,064	0,967	0,901	0,853	0,817	0,789	0,707	0,668
0,8	5	69,826	5,404	3,031	1,911	1,527	1,329	1,208	1,126	1,066	1,021	0,986	0,884	0,835
0,8	6	83,791	6,484	3,636	2,292	1,833	1,595	1,451	1,351	1,281	1,226	1,183	1,061	1,002
0,8	7	97,756	7,565	4,242	2,675	2,138	1,861	1,691	1,576	1,493	1,431	1,381	1,237	1,169
0,8	8	111,722	8,646	4,847	3,057	2,443	2,127	1,933	1,802	1,706	1,634	1,578	1,414	1,335
0,8	9	125,687	9,727	5,453	3,439	2,749	2,393	2,175	2,027	1,921	1,839	1,775	1,591	1,502
0,8	10	139,652	10,807	6,059	3,821	3,054	2,659	2,416	2,252	2,133	2,043	1,972	1,768	1,669
1,1	1	19,202	1,486	0,833	0,525	0,421	0,366	0,332	0,311	0,293	0,281	0,271	0,243	0,231
1,1	2	38,404	2,972	1,666	1,051	0,841	0,731	0,664	0,619	0,587	0,562	0,542	0,486	0,459
1,1	3	57,606	4,458	2,499	1,576	1,261	1,097	0,997	0,929	0,881	0,843	0,814	0,729	0,689
1,1	4	76,809	5,944	3,333	2,101	1,681	1,462	1,329	1,239	1,173	1,124	1,085	0,972	0,918
1,1	5	96,011	7,431	4,166	2,627	2,101	1,828	1,661	1,548	1,466	1,404	1,356	1,215	1,148
1,1	6	115,213	8,916	4,999	3,152	2,521	2,194	1,993	1,858	1,761	1,685	1,627	1,458	1,377
1,1	7	134,415	10,402	5,832	3,677	2,941	2,559	2,326	2,167	2,053	1,966	1,898	1,701	1,607
1,1	8	153,617	11,888	6,665	4,203	3,361	2,925	2,658	2,477	2,346	2,247	2,169	1,945	1,836
1,1	9	172,819	13,374	7,498	4,728	3,781	3,291	2,991	2,787	2,641	2,528	2,441	2,188	2,066
1,1	10	192,022	14,861	8,332	5,253	4,201	3,656	3,322	3,096	2,933	2,809	2,712	2,431	2,295

## MODERATELY INVERSE



**ANSI CURVES**  
NORMAL INVERSE TIMED O/C TRIP TIMES

NORMAL INVERSE

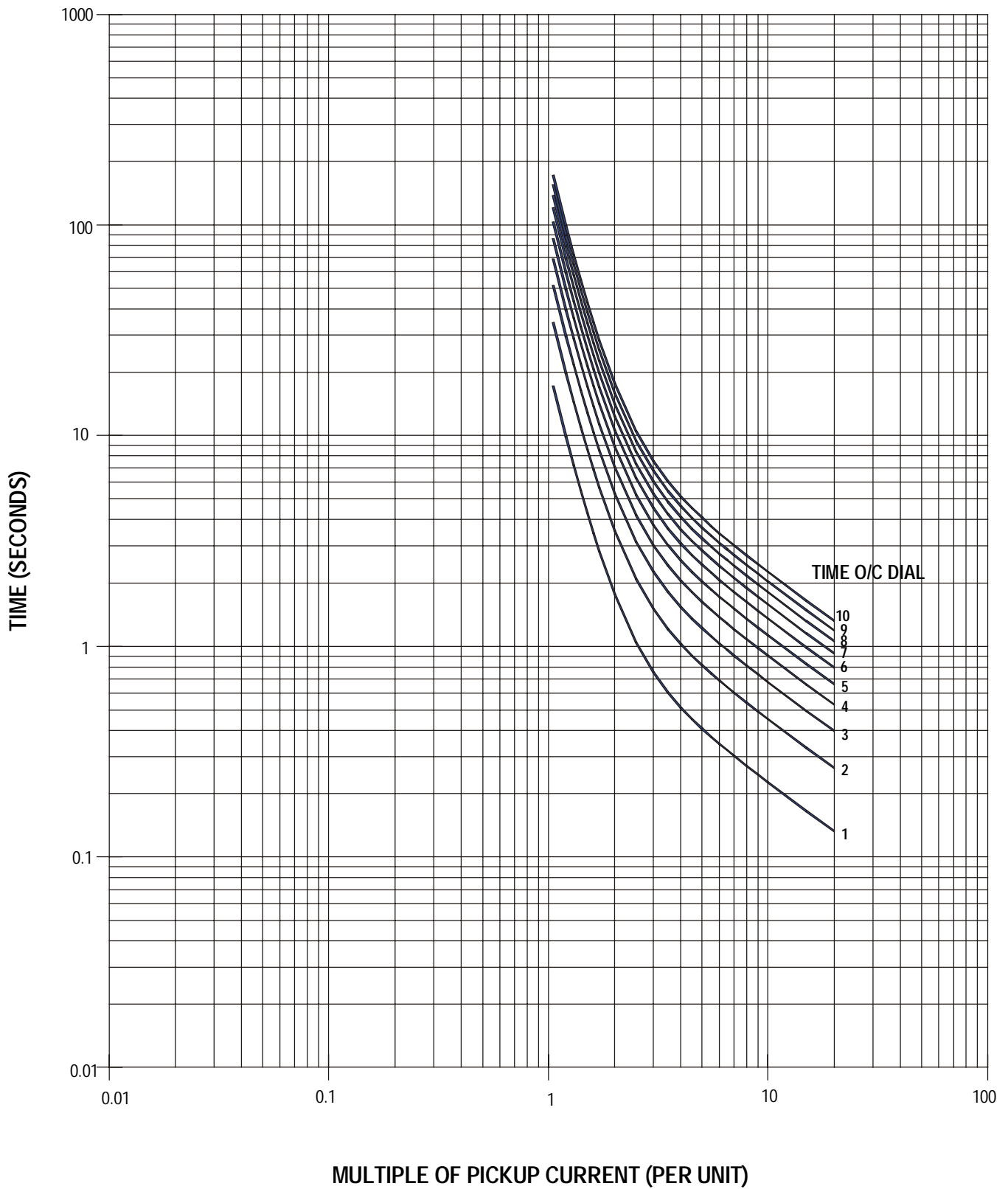
**Formula**  $T = S * M * (A + B / (I / I_{pu} - C) + D / (I / I_{pu} - C)^2 + E / (I / I_{pu} - C)^3)$

- TRIP TIME (SEC)                      **T**      CURVE SHAPE CONSTANT **A= 0.0274**
- CURVE SHIFT MULTIPLIER            **S**      CURVE SHAPE CONSTANT **B= 2.2614**
- CURVE MULTIPLIER SETPOINT        **M**      CURVE SHAPE CONSTANT **C= 0.3000**
- INPUT CURRENT                        **I**      CURVE SHAPE CONSTANT **D= -4.1899**
- PICKUP CURRENT SETPOINT          **I<sub>pu</sub>**    CURVE SHAPE CONSTANT **E= 9.1272**

(Per Unit I/I<sub>pu</sub>)

SHIFT (S)	CURVE (M)	1	1,5	2	3	4	5	6	7	8	9	10	15	20
1	1	21,317	4,284	1,766	0,754	0,513	0,407	0,344	0,302	0,27	0,246	0,226	0,165	0,133
1	2	42,634	8,568	3,531	1,508	1,025	0,814	0,689	0,604	0,541	0,492	0,452	0,329	0,265
1	3	63,951	12,853	5,297	2,262	1,538	1,22	1,033	0,906	0,811	0,738	0,678	0,494	0,398
1	4	85,268	17,137	7,062	3,016	2,051	1,627	1,378	1,208	1,082	0,983	0,904	0,659	0,53
1	5	106,585	21,421	8,828	3,77	2,564	2,034	1,722	1,51	1,352	1,229	1,13	0,824	0,663
1	6	127,902	25,705	10,594	4,524	3,076	2,441	2,067	1,812	1,622	1,475	1,356	0,988	0,796
1	7	149,219	29,989	12,359	5,277	3,589	2,848	2,411	2,114	1,893	1,721	1,582	1,153	0,928
1	8	170,537	34,274	14,125	6,031	4,102	3,254	2,756	2,415	2,163	1,967	1,808	1,318	1,061
1	9	191,854	38,558	15,89	6,785	4,615	3,661	3,1	2,717	2,434	2,213	2,034	1,482	1,193
1	10	213,171	42,842	17,656	7,539	5,127	4,068	3,445	3,019	2,704	2,458	2,26	1,647	1,326
0,5	1	10,659	2,142	0,883	0,377	0,256	0,203	0,172	0,151	0,135	0,123	0,113	0,082	0,066
0,5	2	21,317	4,284	1,766	0,754	0,513	0,407	0,344	0,302	0,27	0,246	0,226	0,165	0,133
0,5	3	31,976	6,426	2,648	1,131	0,769	0,61	0,517	0,453	0,406	0,369	0,339	0,247	0,199
0,5	4	42,634	8,568	3,531	1,508	1,025	0,814	0,689	0,604	0,541	0,492	0,452	0,329	0,265
0,5	5	53,293	10,71	4,414	1,885	1,282	1,017	0,861	0,755	0,676	0,615	0,565	0,412	0,331
0,5	6	63,951	12,853	5,297	2,262	1,538	1,22	1,033	0,906	0,811	0,738	0,678	0,494	0,398
0,5	7	74,61	14,995	6,18	2,639	1,795	1,424	1,206	1,057	0,946	0,86	0,791	0,577	0,464
0,5	8	85,268	17,137	7,062	3,016	2,051	1,627	1,378	1,208	1,082	0,983	0,904	0,659	0,53
0,5	9	95,927	19,279	7,945	3,393	2,307	1,831	1,55	1,359	1,217	1,106	1,017	0,741	0,597
0,5	10	106,585	21,421	8,828	3,77	2,564	2,034	1,722	1,51	1,352	1,229	1,13	0,824	0,663
0,8	1	17,054	3,427	1,412	0,603	0,41	0,325	0,276	0,242	0,216	0,197	0,181	0,132	0,106
0,8	2	34,107	6,855	2,825	1,206	0,82	0,651	0,551	0,483	0,433	0,393	0,362	0,264	0,212
0,8	3	51,161	10,282	4,237	1,809	1,231	0,976	0,827	0,725	0,649	0,59	0,542	0,395	0,318
0,8	4	68,215	13,709	5,65	2,413	1,641	1,302	1,102	0,966	0,865	0,787	0,723	0,527	0,424
0,8	5	85,268	17,137	7,062	3,016	2,051	1,627	1,378	1,208	1,082	0,983	0,904	0,659	0,53
0,8	6	102,322	20,564	8,475	3,619	2,461	1,953	1,653	1,449	1,298	1,18	1,085	0,791	0,636
0,8	7	119,376	23,991	9,887	4,222	2,871	2,278	1,929	1,691	1,514	1,377	1,266	0,922	0,743
0,8	8	136,429	27,419	11,3	4,825	3,281	2,603	2,205	1,932	1,731	1,573	1,446	1,054	0,849
0,8	9	153,483	30,846	12,712	5,428	3,692	2,929	2,48	2,174	1,947	1,77	1,627	1,186	0,955
0,8	10	170,537	34,274	14,125	6,031	4,102	3,254	2,756	2,415	2,163	1,967	1,808	1,318	1,061
1,1	1	23,449	4,713	1,942	0,829	0,564	0,447	0,379	0,332	0,297	0,27	0,249	0,181	0,146
1,1	2	46,898	9,425	3,884	1,659	1,128	0,895	0,758	0,664	0,595	0,541	0,497	0,362	0,292
1,1	3	70,346	14,138	5,827	2,488	1,692	1,342	1,137	0,996	0,892	0,811	0,746	0,544	0,438
1,1	4	93,795	18,85	7,769	3,317	2,256	1,79	1,516	1,329	1,19	1,082	0,994	0,725	0,583
1,1	5	117,244	23,563	9,711	4,147	2,82	2,237	1,895	1,661	1,487	1,352	1,243	0,906	0,729
1,1	6	140,693	28,276	11,653	4,976	3,384	2,685	2,273	1,993	1,785	1,623	1,492	1,087	0,875
1,1	7	164,141	32,988	13,595	5,805	3,948	3,132	2,652	2,325	2,082	1,893	1,74	1,268	1,021
1,1	8	187,59	37,701	15,537	6,634	4,512	3,58	3,031	2,657	2,38	2,163	1,989	1,45	1,167
1,1	9	211,039	42,413	17,48	7,464	5,076	4,027	3,41	2,989	2,677	2,434	2,237	1,631	1,313
1,1	10	234,488	47,126	19,422	8,293	5,64	4,475	3,789	3,321	2,975	2,704	2,486	1,812	1,458

# NORMAL INVERSE



**ANSI CURVES**  
**VERY INVERSE TIMED O/C TRIP TIMES**

VERY INVERSE

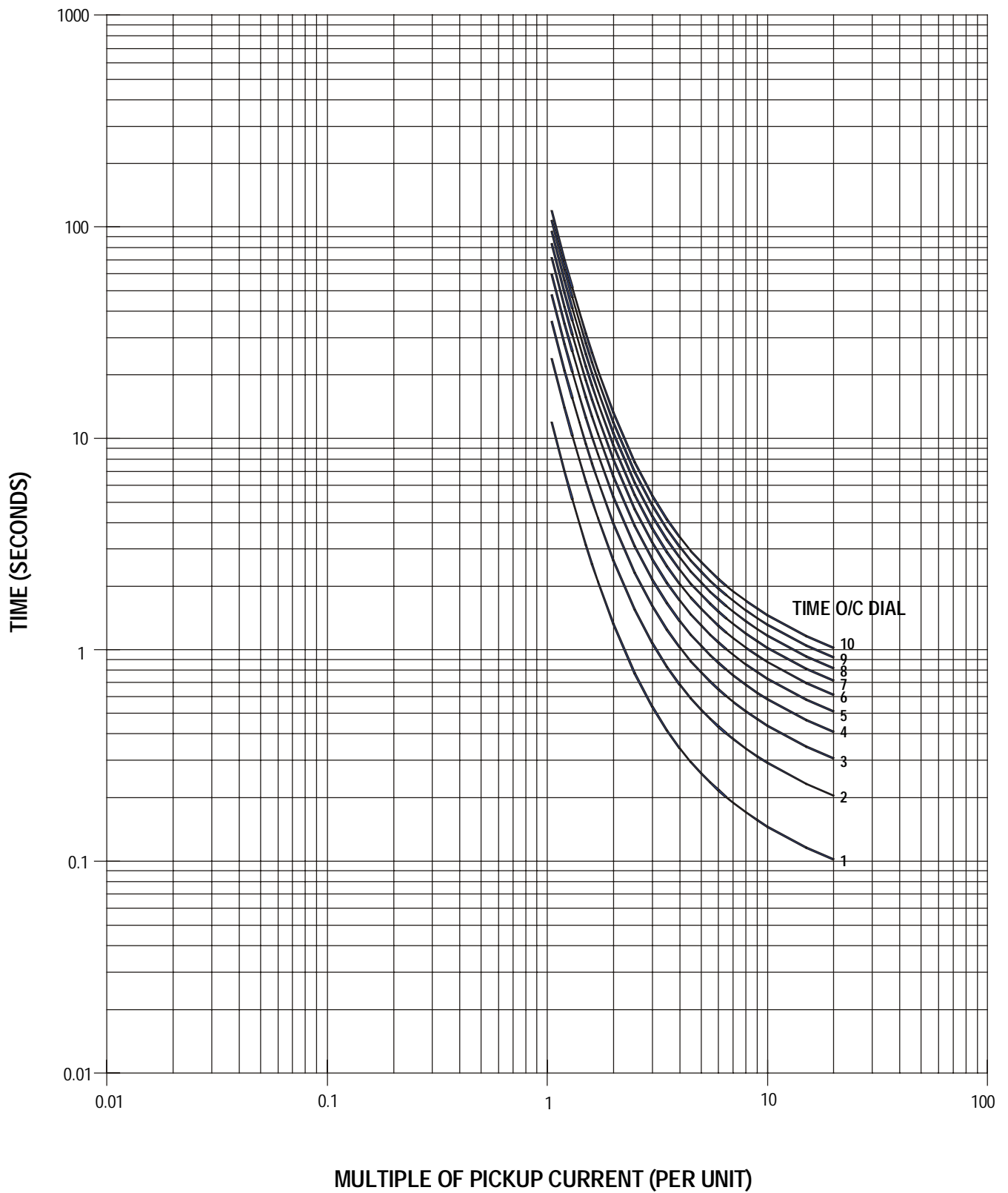
**Formula**  $T = S * M * (A + B / (I / I_{pu} - C) + D / (I / I_{pu} - C)^2 + E / (I / I_{pu} - C)^3)$

- |                           |                       |  |
|---------------------------|-----------------------|--|
| TRIP TIME (SEC)           | <b>T</b>              | CURVE SHAPE CONSTANT <b>A= 0.0615</b>  |
| CURVE SHIFT MULTIPLIER    | <b>S</b>              | CURVE SHAPE CONSTANT <b>B= 0.7989</b>  |
| CURVE MULTIPLIER SETPOINT | <b>M</b>              | CURVE SHAPE CONSTANT <b>C= 0.3400</b>  |
| INPUT CURRENT             | <b>I</b>              | CURVE SHAPE CONSTANT <b>D= -0.2840</b> |
| PICKUP CURRENT SETPOINT   | <b>I<sub>pu</sub></b> | CURVE SHAPE CONSTANT <b>E= 4.0505</b>  |

(Per Unit I/I<sub>pu</sub>)

SHIFT (S)	CURVE (M)	1	1,5	2	3	4	5	6	7	8	9	10	15	20
1	1	14,709	3,134	1,325	0,537	0,341	0,26	0,216	0,189	0,17	0,156	0,146	0,116	0,102
1	2	29,418	6,268	2,65	1,074	0,682	0,52	0,432	0,378	0,34	0,312	0,291	0,232	0,204
1	3	44,127	9,402	3,976	1,611	1,024	0,78	0,648	0,566	0,51	0,469	0,437	0,348	0,306
1	4	58,835	12,537	5,301	2,148	1,365	1,04	0,864	0,755	0,68	0,625	0,583	0,464	0,408
1	5	73,544	15,671	6,626	2,685	1,706	1,299	1,081	0,944	0,85	0,781	0,728	0,58	0,51
1	6	88,253	18,805	7,951	3,221	2,047	1,559	1,297	1,133	1,02	0,937	0,874	0,696	0,612
1	7	102,962	21,939	9,276	3,758	2,388	1,819	1,513	1,321	1,19	1,093	1,02	0,812	0,714
1	8	117,671	25,073	10,602	4,295	2,73	2,079	1,729	1,51	1,36	1,25	1,165	0,928	0,815
1	9	132,38	28,207	11,927	4,832	3,071	2,339	1,945	1,699	1,53	1,406	1,311	1,044	0,917
1	10	147,089	31,341	13,252	5,369	3,412	2,599	2,161	1,888	1,7	1,562	1,457	1,16	1,019
0,5	1	7,354	1,567	0,663	0,268	0,171	0,13	0,108	0,094	0,085	0,078	0,073	0,058	0,051
0,5	2	14,709	3,134	1,325	0,537	0,341	0,26	0,216	0,189	0,17	0,156	0,146	0,116	0,102
0,5	3	22,063	4,701	1,988	0,805	0,512	0,39	0,324	0,283	0,255	0,234	0,218	0,174	0,153
0,5	4	29,418	6,268	2,65	1,074	0,682	0,52	0,432	0,378	0,34	0,312	0,291	0,232	0,204
0,5	5	36,772	7,835	3,313	1,342	0,853	0,65	0,54	0,472	0,425	0,391	0,364	0,29	0,255
0,5	6	44,127	9,402	3,976	1,611	1,024	0,78	0,648	0,566	0,51	0,469	0,437	0,348	0,306
0,5	7	51,481	10,969	4,638	1,879	1,194	0,91	0,756	0,661	0,595	0,547	0,51	0,406	0,357
0,5	8	58,835	12,537	5,301	2,148	1,365	1,04	0,864	0,755	0,68	0,625	0,583	0,464	0,408
0,5	9	66,19	14,104	5,963	2,416	1,535	1,169	0,973	0,849	0,765	0,703	0,655	0,522	0,459
0,5	10	73,544	15,671	6,626	2,685	1,706	1,299	1,081	0,944	0,85	0,781	0,728	0,58	0,51
0,8	1	11,767	2,507	1,06	0,43	0,273	0,208	0,173	0,151	0,136	0,125	0,117	0,093	0,082
0,8	2	23,534	5,015	2,12	0,859	0,546	0,416	0,346	0,302	0,272	0,25	0,233	0,186	0,163
0,8	3	35,301	7,522	3,18	1,289	0,819	0,624	0,519	0,453	0,408	0,375	0,35	0,278	0,245
0,8	4	47,068	10,029	4,241	1,718	1,092	0,832	0,692	0,604	0,544	0,5	0,466	0,371	0,326
0,8	5	58,835	12,537	5,301	2,148	1,365	1,04	0,864	0,755	0,68	0,625	0,583	0,464	0,408
0,8	6	70,603	15,044	6,361	2,577	1,638	1,247	1,037	0,906	0,816	0,75	0,699	0,557	0,489
0,8	7	82,37	17,551	7,421	3,007	1,911	1,455	1,21	1,057	0,952	0,875	0,816	0,649	0,571
0,8	8	94,137	20,058	8,481	3,436	2,184	1,663	1,383	1,208	1,088	1	0,932	0,742	0,652
0,8	9	105,904	22,566	9,541	3,866	2,457	1,871	1,556	1,359	1,224	1,125	1,049	0,835	0,734
0,8	10	117,671	25,073	10,602	4,295	2,73	2,079	1,729	1,51	1,36	1,25	1,165	0,928	0,815
1,1	1	16,18	3,448	1,458	0,591	0,375	0,286	0,238	0,208	0,187	0,172	0,16	0,128	0,112
1,1	2	32,36	6,895	2,915	1,181	0,751	0,572	0,475	0,415	0,374	0,344	0,32	0,255	0,224
1,1	3	48,539	10,343	4,373	1,772	1,126	0,858	0,713	0,623	0,561	0,515	0,481	0,383	0,336
1,1	4	64,719	13,79	5,831	2,362	1,501	1,144	0,951	0,831	0,748	0,687	0,641	0,51	0,449
1,1	5	80,899	17,238	7,289	2,953	1,877	1,429	1,189	1,038	0,935	0,859	0,801	0,638	0,561
1,1	6	97,079	20,685	8,746	3,544	2,252	1,715	1,426	1,246	1,122	1,031	0,961	0,765	0,673
1,1	7	113,258	24,133	10,204	4,134	2,627	2,001	1,664	1,453	1,309	1,203	1,122	0,893	0,785
1,1	8	129,438	27,58	11,662	4,725	3,003	2,287	1,902	1,661	1,496	1,375	1,282	1,02	0,897
1,1	9	145,618	31,028	13,119	5,315	3,378	2,573	2,14	1,869	1,683	1,546	1,442	1,148	1,009
1,1	10	161,798	34,475	14,577	5,906	3,753	2,859	2,377	2,076	1,87	1,718	1,602	1,276	1,121

### VERY INVERSE



**ANSI CURVES**  
EXTREMELY INVERSE TIMED O/C TRIP TIMES

EXTREMELY INVERSE

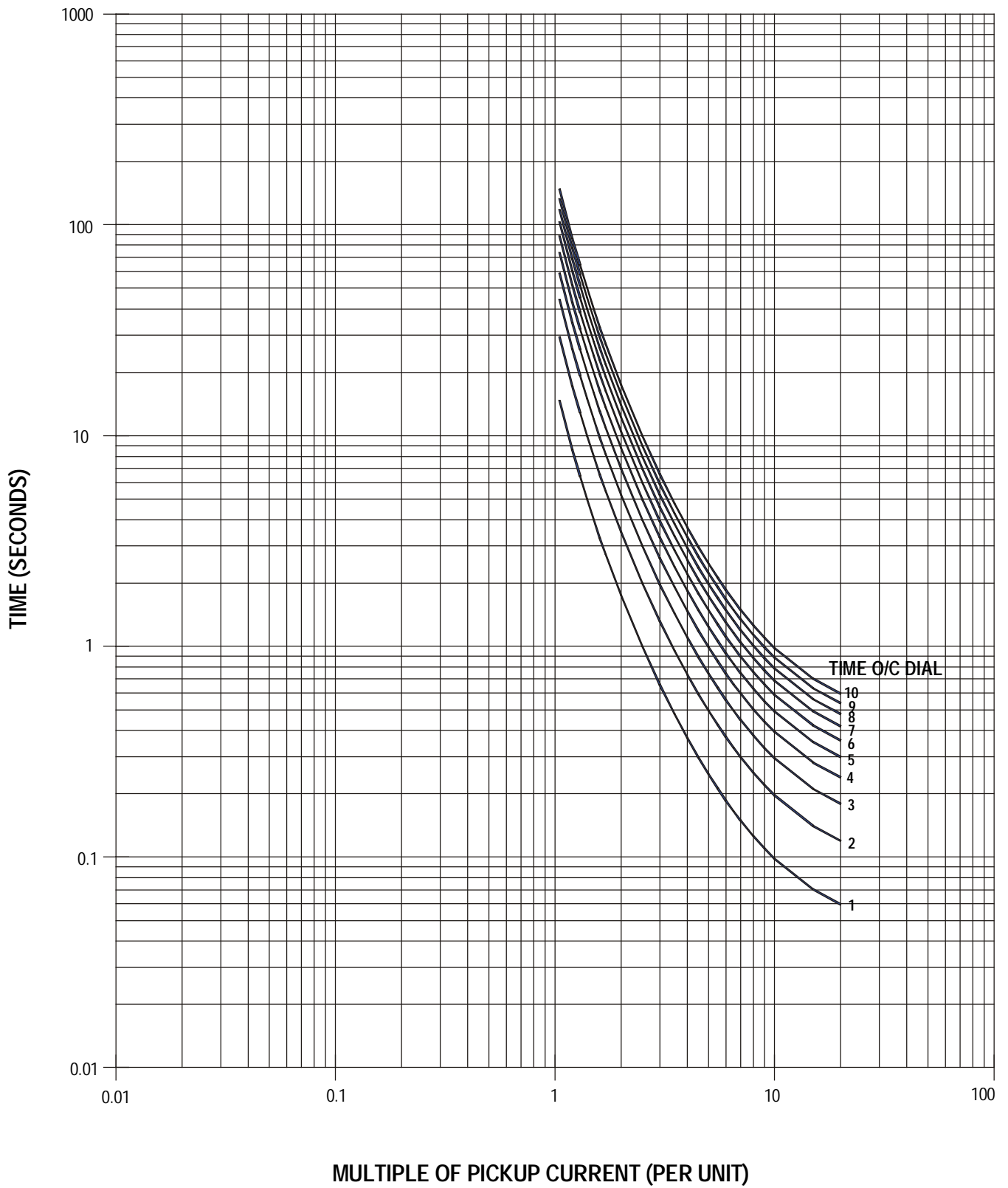
**Formula**  $T = S * M * (A + B / (I / Ipu - C) + D / (I / Ipu - C)^2 + E / (I / Ipu - C)^3)$

- |                           |            |  |
|---------------------------|------------|--|
| TRIP TIME (SEC)           | <b>T</b>   | CURVE SHAPE CONSTANT <b>A</b> = 0.0399 |
| CURVE SHIFT MULTIPLIER    | <b>S</b>   | CURVE SHAPE CONSTANT <b>B</b> = 0.2294 |
| CURVE MULTIPLIER SETPOINT | <b>M</b>   | CURVE SHAPE CONSTANT <b>C</b> = 0.5000 |
| INPUT CURRENT             | <b>I</b>   | CURVE SHAPE CONSTANT <b>D</b> = 3.0094 |
| PICKUP CURRENT SETPOINT   | <b>Ipu</b> | CURVE SHAPE CONSTANT <b>E</b> = 0.7222 |

(Per Unit I/Ipu)

SHIFT (S)	CURVE (M)	1	1,5	2	3	4	5	6	7	8	9	10	15	20
1	1	18,314	4,001	1,744	0,659	0,368	0,247	0,185	0,149	0,126	0,11	0,098	0,07	0,06
1	2	36,628	8,002	3,489	1,319	0,736	0,495	0,371	0,298	0,251	0,219	0,196	0,141	0,119
1	3	54,942	12,003	5,233	1,978	1,104	0,742	0,556	0,447	0,377	0,329	0,295	0,211	0,179
1	4	73,256	16,004	6,977	2,638	1,472	0,99	0,742	0,596	0,503	0,439	0,393	0,281	0,239
1	5	91,569	20,005	8,722	3,297	1,84	1,237	0,927	0,745	0,628	0,549	0,491	0,351	0,298
1	6	109,883	24,005	10,466	3,956	2,208	1,484	1,113	0,894	0,754	0,658	0,589	0,422	0,358
1	7	128,197	28,006	12,21	4,616	2,576	1,732	1,298	1,043	0,88	0,768	0,688	0,492	0,418
1	8	146,511	32,007	13,955	5,275	2,944	1,979	1,483	1,192	1,006	0,878	0,786	0,562	0,477
1	9	164,825	36,008	15,699	5,934	3,312	2,227	1,669	1,341	1,131	0,987	0,884	0,632	0,537
1	10	183,139	40,009	17,443	6,594	3,68	2,474	1,854	1,491	1,257	1,097	0,982	0,703	0,597
0,5	1	9,157	2	0,872	0,33	0,184	0,124	0,093	0,075	0,063	0,055	0,049	0,035	0,03
0,5	2	18,314	4,001	1,744	0,659	0,368	0,247	0,185	0,149	0,126	0,11	0,098	0,07	0,06
0,5	3	27,471	6,001	2,616	0,989	0,552	0,371	0,278	0,224	0,189	0,165	0,147	0,105	0,09
0,5	4	36,628	8,002	3,489	1,319	0,736	0,495	0,371	0,298	0,251	0,219	0,196	0,141	0,119
0,5	5	45,785	10,002	4,361	1,648	0,92	0,619	0,464	0,373	0,314	0,274	0,246	0,176	0,149
0,5	6	54,942	12,003	5,233	1,978	1,104	0,742	0,556	0,447	0,377	0,329	0,295	0,211	0,179
0,5	7	64,099	14,003	6,105	2,308	1,288	0,866	0,649	0,522	0,44	0,384	0,344	0,246	0,209
0,5	8	73,256	16,004	6,977	2,638	1,472	0,99	0,742	0,596	0,503	0,439	0,393	0,281	0,239
0,5	9	82,413	18,004	7,849	2,967	1,656	1,113	0,834	0,671	0,566	0,494	0,442	0,316	0,269
0,5	10	91,569	20,005	8,722	3,297	1,84	1,237	0,927	0,745	0,628	0,549	0,491	0,351	0,298
0,8	1	14,651	3,201	1,395	0,528	0,294	0,198	0,148	0,119	0,101	0,088	0,079	0,056	0,048
0,8	2	29,302	6,401	2,791	1,055	0,589	0,396	0,297	0,238	0,201	0,176	0,157	0,112	0,095
0,8	3	43,953	9,602	4,186	1,583	0,883	0,594	0,445	0,358	0,302	0,263	0,236	0,169	0,143
0,8	4	58,604	12,803	5,582	2,11	1,177	0,792	0,593	0,477	0,402	0,351	0,314	0,225	0,191
0,8	5	73,256	16,004	6,977	2,638	1,472	0,99	0,742	0,596	0,503	0,439	0,393	0,281	0,239
0,8	6	87,907	19,204	8,373	3,165	1,766	1,188	0,89	0,715	0,603	0,527	0,472	0,337	0,286
0,8	7	102,558	22,405	9,768	3,693	2,061	1,386	1,038	0,835	0,704	0,614	0,55	0,394	0,334
0,8	8	117,209	25,606	11,164	4,22	2,355	1,583	1,187	0,954	0,804	0,702	0,629	0,45	0,382
0,8	9	131,86	28,806	12,559	4,748	2,649	1,781	1,335	1,073	0,905	0,79	0,707	0,506	0,43
0,8	10	146,511	32,007	13,955	5,275	2,944	1,979	1,483	1,192	1,006	0,878	0,786	0,562	0,477
1,1	1	20,145	4,401	1,919	0,725	0,405	0,272	0,204	0,164	0,138	0,121	0,108	0,077	0,066
1,1	2	40,291	8,802	3,838	1,451	0,809	0,544	0,408	0,328	0,277	0,241	0,216	0,155	0,131
1,1	3	60,436	13,203	5,756	2,176	1,214	0,816	0,612	0,492	0,415	0,362	0,324	0,232	0,197
1,1	4	80,581	17,604	7,675	2,901	1,619	1,089	0,816	0,656	0,553	0,483	0,432	0,309	0,263
1,1	5	100,726	22,005	9,594	3,627	2,024	1,361	1,02	0,82	0,691	0,603	0,54	0,386	0,328
1,1	6	120,872	26,406	11,513	4,352	2,428	1,633	1,224	0,984	0,83	0,724	0,648	0,464	0,394
1,1	7	141,017	30,807	13,431	5,077	2,833	1,905	1,428	1,148	0,968	0,845	0,756	0,541	0,46
1,1	8	161,162	35,208	15,35	5,803	3,238	2,177	1,632	1,312	1,106	0,966	0,864	0,618	0,525
1,1	9	181,308	39,609	17,269	6,528	3,643	2,449	1,836	1,476	1,244	1,086	0,973	0,696	0,591
1,1	10	201,453	44,01	19,188	7,253	4,047	2,722	2,04	1,64	1,383	1,207	1,081	0,773	0,656

# EXTREMELY INVERSE





**IAC CURVES**  
IAC SHORT INVERSE TIMED O/C TRIP TIMES

IAC SHORT INVERSE

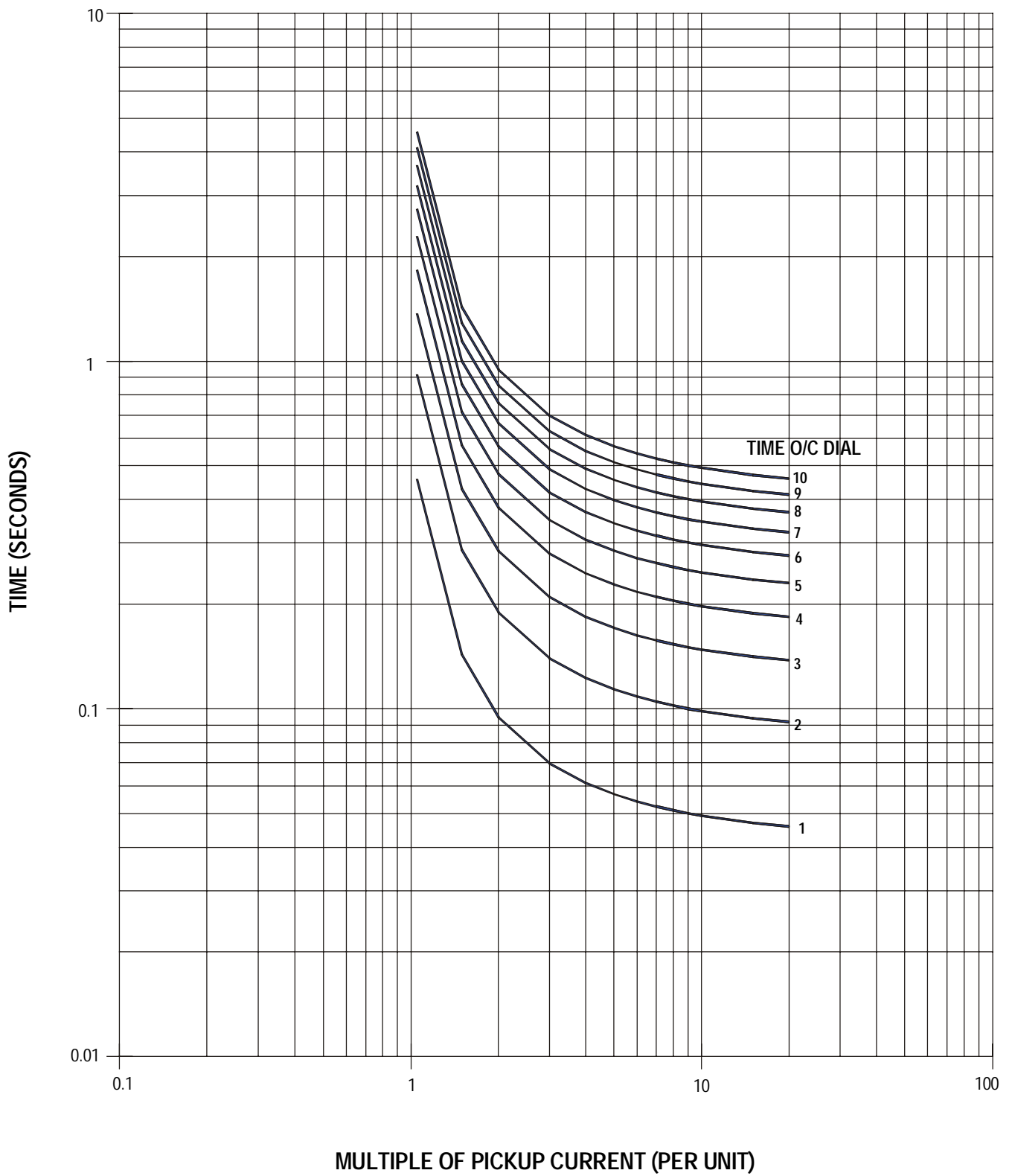
**Formula**  $T = S * M * (A + B / (I / I_{pu} - C) + D / (I / I_{pu} - C)^2 + E / (I / I_{pu} - C)^3)$

- TRIP TIME (SEC)                                    **T**      CURVE SHAPE CONSTANT **A= 0.043**
- CURVE SHIFT MULTIPLIER                        **S**      CURVE SHAPE CONSTANT **B= 0.061**
- CURVE MULTIPLIER SETPOINT                  **M**      CURVE SHAPE CONSTANT **C= 0.620**
- INPUT CURRENT                                    **I**      CURVE SHAPE CONSTANT **D= -0.001**
- PICKUP CURRENT SETPOINT                      **I<sub>pu</sub>**    CURVE SHAPE CONSTANT **E= 0.022**

(Per Unit I/I<sub>pu</sub>)

SHIFT (S)	CURVE (M)	1	1,5	2	3	4	5	6	7	8	9	10	15	20
1	1	0,598	0,143	0,095	0,07	0,062	0,057	0,054	0,053	0,051	0,05	0,05	0,047	0,046
1	2	1,195	0,287	0,19	0,14	0,123	0,114	0,109	0,105	0,103	0,101	0,099	0,094	0,092
1	3	1,793	0,43	0,285	0,21	0,185	0,171	0,163	0,158	0,154	0,151	0,149	0,142	0,138
1	4	2,39	0,573	0,38	0,28	0,246	0,229	0,218	0,21	0,205	0,201	0,198	0,189	0,185
1	5	2,988	0,717	0,475	0,35	0,308	0,286	0,272	0,263	0,257	0,252	0,248	0,236	0,231
1	6	3,585	0,86	0,57	0,421	0,369	0,343	0,327	0,316	0,308	0,302	0,297	0,283	0,277
1	7	4,183	1,003	0,665	0,491	0,431	0,4	0,381	0,368	0,359	0,352	0,347	0,331	0,323
1	8	4,78	1,146	0,76	0,561	0,492	0,457	0,436	0,421	0,41	0,402	0,396	0,378	0,369
1	9	5,378	1,29	0,855	0,631	0,554	0,514	0,49	0,474	0,462	0,453	0,446	0,425	0,415
1	10	5,975	1,433	0,95	0,701	0,615	0,571	0,544	0,526	0,513	0,503	0,495	0,472	0,461
0,5	1	0,299	0,072	0,048	0,035	0,031	0,029	0,027	0,026	0,026	0,025	0,025	0,024	0,023
0,5	2	0,598	0,143	0,095	0,07	0,062	0,057	0,054	0,053	0,051	0,05	0,05	0,047	0,046
0,5	3	0,896	0,215	0,143	0,105	0,092	0,086	0,082	0,079	0,077	0,075	0,074	0,071	0,069
0,5	4	1,195	0,287	0,19	0,14	0,123	0,114	0,109	0,105	0,103	0,101	0,099	0,094	0,092
0,5	5	1,494	0,358	0,238	0,175	0,154	0,143	0,136	0,132	0,128	0,126	0,124	0,118	0,115
0,5	6	1,793	0,43	0,285	0,21	0,185	0,171	0,163	0,158	0,154	0,151	0,149	0,142	0,138
0,5	7	2,091	0,502	0,333	0,245	0,215	0,2	0,191	0,184	0,18	0,176	0,173	0,165	0,162
0,5	8	2,39	0,573	0,38	0,28	0,246	0,229	0,218	0,21	0,205	0,201	0,198	0,189	0,185
0,5	9	2,689	0,645	0,428	0,315	0,277	0,257	0,245	0,237	0,231	0,226	0,223	0,213	0,208
0,5	10	2,988	0,717	0,475	0,35	0,308	0,286	0,272	0,263	0,257	0,252	0,248	0,236	0,231
0,8	1	0,478	0,115	0,076	0,056	0,049	0,046	0,044	0,042	0,041	0,04	0,04	0,038	0,037
0,8	2	0,956	0,229	0,152	0,112	0,098	0,091	0,087	0,084	0,082	0,08	0,079	0,076	0,074
0,8	3	1,434	0,344	0,228	0,168	0,148	0,137	0,131	0,126	0,123	0,121	0,119	0,113	0,111
0,8	4	1,912	0,459	0,304	0,224	0,197	0,183	0,174	0,168	0,164	0,161	0,158	0,151	0,148
0,8	5	2,39	0,573	0,38	0,28	0,246	0,229	0,218	0,21	0,205	0,201	0,198	0,189	0,185
0,8	6	2,868	0,688	0,456	0,336	0,295	0,274	0,261	0,253	0,246	0,241	0,238	0,227	0,222
0,8	7	3,346	0,803	0,532	0,392	0,345	0,32	0,305	0,295	0,287	0,282	0,277	0,265	0,258
0,8	8	3,824	0,917	0,608	0,449	0,394	0,366	0,348	0,337	0,328	0,322	0,317	0,302	0,295
0,8	9	4,302	1,032	0,684	0,505	0,443	0,411	0,392	0,379	0,369	0,362	0,357	0,34	0,332
0,8	10	4,78	1,146	0,76	0,561	0,492	0,457	0,436	0,421	0,41	0,402	0,396	0,378	0,369
1,1	1	0,657	0,158	0,105	0,077	0,068	0,063	0,06	0,058	0,056	0,055	0,054	0,052	0,051
1,1	2	1,315	0,315	0,209	0,154	0,135	0,126	0,12	0,116	0,113	0,111	0,109	0,104	0,102
1,1	3	1,972	0,473	0,314	0,231	0,203	0,189	0,18	0,174	0,169	0,166	0,163	0,156	0,152
1,1	4	2,629	0,631	0,418	0,308	0,271	0,251	0,24	0,232	0,226	0,221	0,218	0,208	0,203
1,1	5	3,286	0,788	0,523	0,385	0,338	0,314	0,299	0,289	0,282	0,277	0,272	0,26	0,254
1,1	6	3,944	0,946	0,627	0,463	0,406	0,377	0,359	0,347	0,339	0,332	0,327	0,312	0,305
1,1	7	4,601	1,103	0,732	0,54	0,474	0,44	0,419	0,405	0,395	0,387	0,381	0,364	0,355
1,1	8	5,258	1,261	0,836	0,617	0,541	0,503	0,479	0,463	0,451	0,443	0,436	0,416	0,406
1,1	9	5,916	1,419	0,941	0,694	0,609	0,566	0,539	0,521	0,508	0,498	0,49	0,468	0,457
1,1	10	6,573	1,576	1,046	0,771	0,677	0,629	0,599	0,579	0,564	0,553	0,545	0,52	0,508

### IAC SHORT INVERSE



**IAC CURVES**  
IAC INVERSE TIMED O/C TRIP TIMES

IAC INVERSE

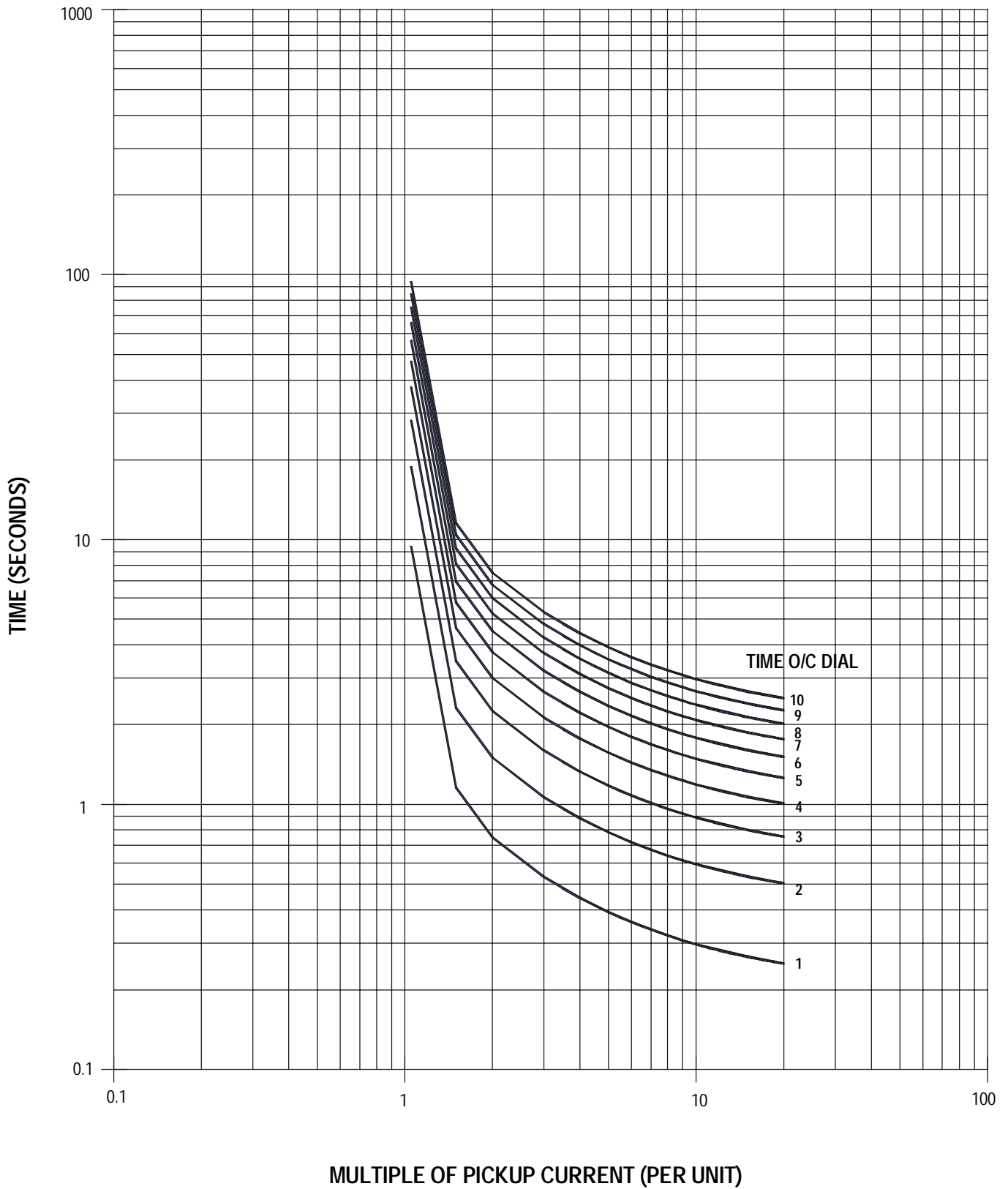
**Formula**  $T = S * M * (A + B / (I / I_{pu} - C) + D / (I / I_{pu} - C)^2 + E / (I / I_{pu} - C)^3)$

- TRIP TIME (SEC)                            **T**      CURVE SHAPE CONSTANT **A= 0.2078**
- CURVE SHIFT MULTIPLIER                **S**      CURVE SHAPE CONSTANT **B= 0.863**
- CURVE MULTIPLIER SETPOINT          **M**      CURVE SHAPE CONSTANT **C= 0.8000**
- INPUT CURRENT                            **I**      CURVE SHAPE CONSTANT **D= -0.418**
- PICKUP CURRENT SETPOINT              **I<sub>pu</sub>**    CURVE SHAPE CONSTANT **E= 0.1947**

(Per Unit I/I<sub>pu</sub>)

SHIFT (S)	CURVE (M)	1	1,5	2	3	4	5	6	7	8	9	10	15	20
1	1	18,41	1,155	0,749	0,532	0,443	0,392	0,36	0,337	0,32	0,307	0,297	0,267	0,252
1	2	36,821	2,31	1,499	1,064	0,885	0,784	0,719	0,674	0,64	0,614	0,594	0,533	0,503
1	3	55,231	3,466	2,248	1,596	1,328	1,177	1,079	1,011	0,96	0,922	0,891	0,8	0,755
1	4	73,641	4,621	2,997	2,128	1,77	1,569	1,439	1,348	1,28	1,229	1,188	1,066	1,007
1	5	92,052	5,776	3,747	2,66	2,213	1,961	1,798	1,685	1,601	1,536	1,485	1,333	1,258
1	6	110,462	6,931	4,496	3,192	2,656	2,353	2,158	2,022	1,921	1,843	1,781	1,599	1,51
1	7	128,872	8,087	5,246	3,724	3,098	2,745	2,518	2,359	2,241	2,15	2,078	1,866	1,761
1	8	147,282	9,242	5,995	4,256	3,541	3,138	2,878	2,695	2,561	2,457	2,375	2,133	2,013
1	9	165,693	10,397	6,744	4,788	3,983	3,53	3,237	3,032	2,881	2,765	2,672	2,399	2,265
1	10	184,103	11,552	7,494	5,32	4,426	3,922	3,597	3,369	3,201	3,072	2,969	2,666	2,516
0,5	1	9,205	0,578	0,375	0,266	0,221	0,196	0,18	0,168	0,16	0,154	0,148	0,133	0,126
0,5	2	18,41	1,155	0,749	0,532	0,443	0,392	0,36	0,337	0,32	0,307	0,297	0,267	0,252
0,5	3	27,615	1,733	1,124	0,798	0,664	0,588	0,54	0,505	0,48	0,461	0,445	0,4	0,377
0,5	4	36,821	2,31	1,499	1,064	0,885	0,784	0,719	0,674	0,64	0,614	0,594	0,533	0,503
0,5	5	46,026	2,888	1,873	1,33	1,107	0,981	0,899	0,842	0,8	0,768	0,742	0,666	0,629
0,5	6	55,231	3,466	2,248	1,596	1,328	1,177	1,079	1,011	0,96	0,922	0,891	0,8	0,755
0,5	7	64,436	4,043	2,623	1,862	1,549	1,373	1,259	1,179	1,12	1,075	1,039	0,933	0,881
0,5	8	73,641	4,621	2,997	2,128	1,77	1,569	1,439	1,348	1,28	1,229	1,188	1,066	1,007
0,5	9	82,846	5,199	3,372	2,394	1,992	1,765	1,619	1,516	1,441	1,382	1,336	1,2	1,132
0,5	10	92,052	5,776	3,747	2,66	2,213	1,961	1,798	1,685	1,601	1,536	1,485	1,333	1,258
0,8	1	14,728	0,924	0,599	0,426	0,354	0,314	0,288	0,27	0,256	0,246	0,238	0,213	0,201
0,8	2	29,456	1,848	1,199	0,851	0,708	0,628	0,576	0,539	0,512	0,491	0,475	0,427	0,403
0,8	3	44,185	2,773	1,798	1,277	1,062	0,941	0,863	0,809	0,768	0,737	0,713	0,64	0,604
0,8	4	58,913	3,697	2,398	1,702	1,416	1,255	1,151	1,078	1,024	0,983	0,95	0,853	0,805
0,8	5	73,641	4,621	2,997	2,128	1,77	1,569	1,439	1,348	1,28	1,229	1,188	1,066	1,007
0,8	6	88,369	5,545	3,597	2,554	2,125	1,883	1,727	1,617	1,537	1,474	1,425	1,28	1,208
0,8	7	103,098	6,469	4,196	2,979	2,479	2,196	2,014	1,887	1,793	1,72	1,663	1,493	1,409
0,8	8	117,826	7,394	4,796	3,405	2,833	2,51	2,302	2,156	2,049	1,966	1,9	1,706	1,611
0,8	9	132,554	8,318	5,395	3,83	3,187	2,824	2,59	2,426	2,305	2,212	2,138	1,919	1,812
0,8	10	147,282	9,242	5,995	4,256	3,541	3,138	2,878	2,695	2,561	2,457	2,375	2,133	2,013
1,1	1	20,251	1,271	0,824	0,585	0,487	0,431	0,396	0,371	0,352	0,338	0,327	0,293	0,277
1,1	2	40,503	2,542	1,649	1,17	0,974	0,863	0,791	0,741	0,704	0,676	0,653	0,586	0,554
1,1	3	60,754	3,812	2,473	1,756	1,461	1,294	1,187	1,112	1,056	1,014	0,98	0,88	0,83
1,1	4	81,005	5,083	3,297	2,341	1,947	1,726	1,583	1,483	1,409	1,352	1,306	1,173	1,107
1,1	5	101,257	6,354	4,121	2,926	2,434	2,157	1,978	1,853	1,761	1,689	1,633	1,466	1,384
1,1	6	121,508	7,625	4,946	3,511	2,921	2,589	2,374	2,224	2,113	2,027	1,96	1,759	1,661
1,1	7	141,759	8,895	5,77	4,096	3,408	3,02	2,77	2,594	2,465	2,365	2,286	2,053	1,938
1,1	8	162,011	10,166	6,594	4,682	3,895	3,451	3,165	2,965	2,817	2,703	2,613	2,346	2,214
1,1	9	182,262	11,437	7,419	5,267	4,382	3,883	3,561	3,336	3,169	3,041	2,939	2,639	2,491
1,1	10	202,513	12,708	8,243	5,852	4,869	4,314	3,957	3,706	3,521	3,379	3,266	2,932	2,768

### IAC INVERSE



**IAC CURVES**  
IAC VERY INVERSE TIMED O/C TRIP TIMES

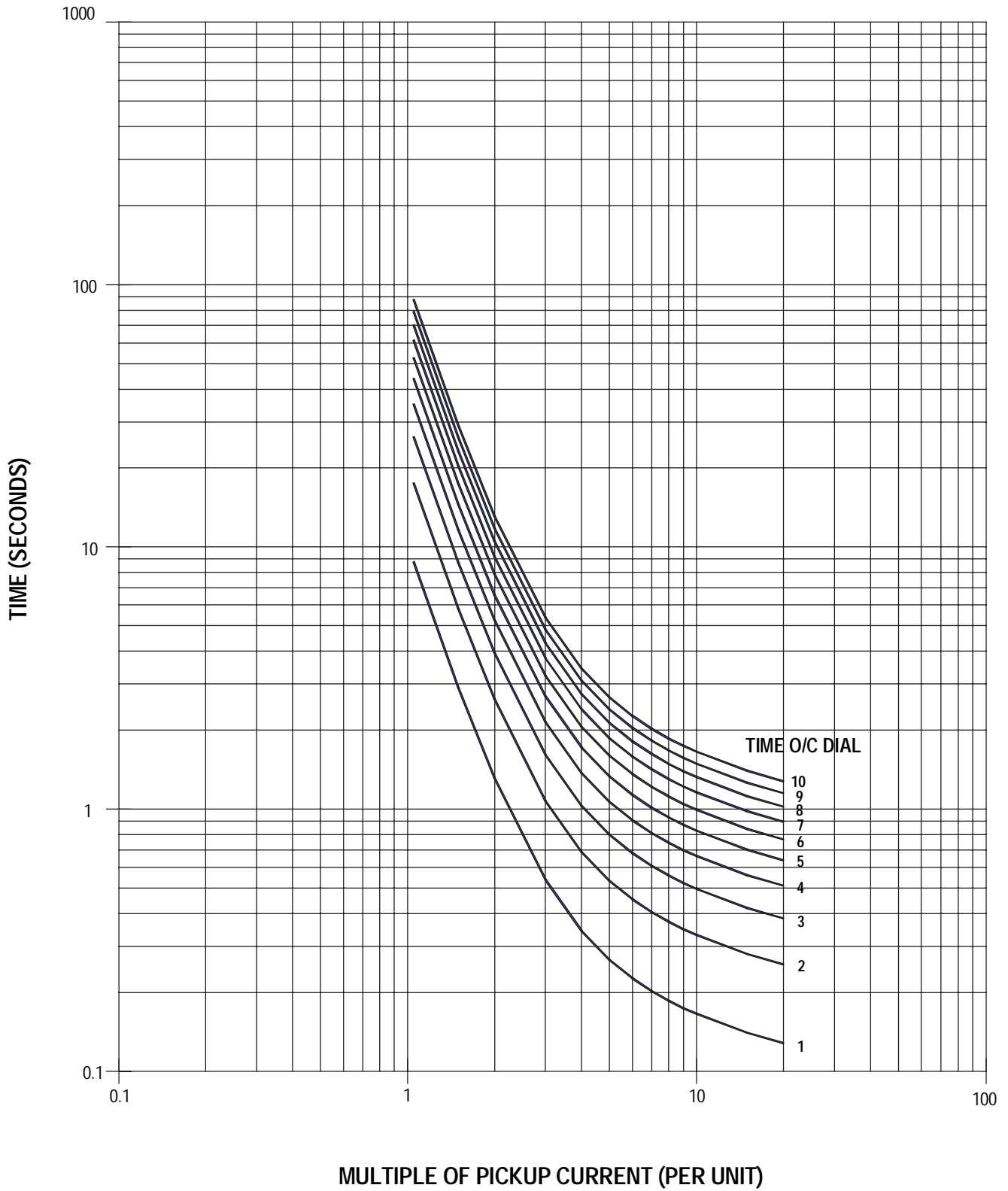
IAC VERY INVERSE

**Formula**  $T = S * M * (A + B / (I / I_{pu} - C) + D / (I / I_{pu} - C)^2 + E / (I / I_{pu} - C)^3)$

- TRIP TIME (SEC) **T** CURVE SHAPE CONSTANT **A= 0.090**
- CURVE SHIFT MULTIPLIER **S** CURVE SHAPE CONSTANT **B= 0.796**
- CURVE MULTIPLIER SETPOINT **M** CURVE SHAPE CONSTANT **C= 0.100**
- INPUT CURRENT **I** CURVE SHAPE CONSTANT **D= -1.289**
- PICKUP CURRENT SETPOINT **I<sub>pu</sub>** CURVE SHAPE CONSTANT **E= 7.959**

		(Per Unit I/I <sub>pu</sub> )													
SHIFT (S)	CURVE (M)	1	1,5	2	3	4	5	6	7	8	9	10	15	20	
1	1	10,301	2,901	1,312	0,538	0,344	0,266	0,227	0,203	0,186	0,174	0,165	0,14	0,128	
1	2	20,602	5,803	2,625	1,075	0,687	0,533	0,453	0,405	0,372	0,349	0,331	0,28	0,256	
1	3	30,902	8,704	3,937	1,613	1,031	0,799	0,68	0,608	0,559	0,523	0,496	0,42	0,383	
1	4	41,203	11,606	5,249	2,15	1,374	1,066	0,907	0,81	0,745	0,698	0,662	0,56	0,511	
1	5	51,504	14,507	6,561	2,688	1,718	1,332	1,133	1,013	0,931	0,872	0,827	0,7	0,639	
1	6	61,805	17,409	7,874	3,225	2,061	1,598	1,36	1,215	1,117	1,047	0,993	0,84	0,767	
1	7	72,105	20,31	9,186	3,763	2,405	1,865	1,586	1,418	1,304	1,221	1,158	0,98	0,894	
1	8	82,406	23,211	10,498	4,3	2,748	2,131	1,813	1,62	1,49	1,396	1,324	1,12	1,022	
1	9	92,707	26,113	11,81	4,838	3,092	2,398	2,04	1,823	1,676	1,57	1,489	1,26	1,15	
1	10	103,008	29,014	13,123	5,375	3,435	2,664	2,266	2,025	1,862	1,745	1,655	1,4	1,278	
0,5	1	5,15	1,451	0,656	0,269	0,172	0,133	0,113	0,101	0,093	0,087	0,083	0,07	0,064	
0,5	2	10,301	2,901	1,312	0,538	0,344	0,266	0,227	0,203	0,186	0,174	0,165	0,14	0,128	
0,5	3	15,451	4,352	1,968	0,806	0,515	0,4	0,34	0,304	0,279	0,262	0,248	0,21	0,192	
0,5	4	20,602	5,803	2,625	1,075	0,687	0,533	0,453	0,405	0,372	0,349	0,331	0,28	0,256	
0,5	5	25,752	7,254	3,281	1,344	0,859	0,666	0,567	0,506	0,466	0,436	0,414	0,35	0,319	
0,5	6	30,902	8,704	3,937	1,613	1,031	0,799	0,68	0,608	0,559	0,523	0,496	0,42	0,383	
0,5	7	36,053	10,155	4,593	1,881	1,202	0,932	0,793	0,709	0,652	0,611	0,579	0,49	0,447	
0,5	8	41,203	11,606	5,249	2,15	1,374	1,066	0,907	0,81	0,745	0,698	0,662	0,56	0,511	
0,5	9	46,354	13,056	5,905	2,419	1,546	1,199	1,02	0,911	0,838	0,785	0,745	0,63	0,575	
0,5	10	51,504	14,507	6,561	2,688	1,718	1,332	1,133	1,013	0,931	0,872	0,827	0,7	0,639	
0,8	1	8,241	2,321	1,05	0,43	0,275	0,213	0,181	0,162	0,149	0,14	0,132	0,112	0,102	
0,8	2	16,481	4,642	2,1	0,86	0,55	0,426	0,363	0,324	0,298	0,279	0,265	0,224	0,204	
0,8	3	24,722	6,963	3,149	1,29	0,824	0,639	0,544	0,486	0,447	0,419	0,397	0,336	0,307	
0,8	4	32,963	9,285	4,199	1,72	1,099	0,853	0,725	0,648	0,596	0,558	0,529	0,448	0,409	
0,8	5	41,203	11,606	5,249	2,15	1,374	1,066	0,907	0,81	0,745	0,698	0,662	0,56	0,511	
0,8	6	49,444	13,927	6,299	2,58	1,649	1,279	1,088	0,972	0,894	0,837	0,794	0,672	0,613	
0,8	7	57,684	16,248	7,349	3,01	1,924	1,492	1,269	1,134	1,043	0,977	0,927	0,784	0,715	
0,8	8	65,925	18,569	8,398	3,44	2,199	1,705	1,45	1,296	1,192	1,117	1,059	0,896	0,818	
0,8	9	74,166	20,89	9,448	3,87	2,473	1,918	1,632	1,458	1,341	1,256	1,191	1,008	0,92	
0,8	10	82,406	23,211	10,498	4,3	2,748	2,131	1,813	1,62	1,49	1,396	1,324	1,12	1,022	
1,1	1	11,331	3,192	1,443	0,591	0,378	0,293	0,249	0,223	0,205	0,192	0,182	0,154	0,141	
1,1	2	22,662	6,383	2,887	1,183	0,756	0,586	0,499	0,446	0,41	0,384	0,364	0,308	0,281	
1,1	3	33,993	9,575	4,33	1,774	1,134	0,879	0,748	0,668	0,615	0,576	0,546	0,462	0,422	
1,1	4	45,323	12,766	5,774	2,365	1,512	1,172	0,997	0,891	0,819	0,768	0,728	0,616	0,562	
1,1	5	56,654	15,958	7,217	2,957	1,889	1,465	1,247	1,114	1,024	0,96	0,91	0,77	0,703	
1,1	6	67,985	19,149	8,661	3,548	2,267	1,758	1,496	1,337	1,229	1,151	1,092	0,924	0,843	
1,1	7	79,316	22,341	10,104	4,139	2,645	2,051	1,745	1,559	1,434	1,343	1,274	1,078	0,984	
1,1	8	90,647	25,533	11,548	4,73	3,023	2,344	1,994	1,782	1,639	1,535	1,456	1,232	1,124	
1,1	9	101,978	28,724	12,991	5,322	3,401	2,637	2,244	2,005	1,844	1,727	1,638	1,386	1,265	
1,1	10	113,309	31,916	14,435	5,913	3,779	2,931	2,493	2,228	2,049	1,919	1,82	1,54	1,405	

### IAC VERY INVERSE



**IAC CURVES**  
IAC EXTREMELY INVERSE TIMED O/C TRIP TIMES

IAC EXTREMELY INVERSE

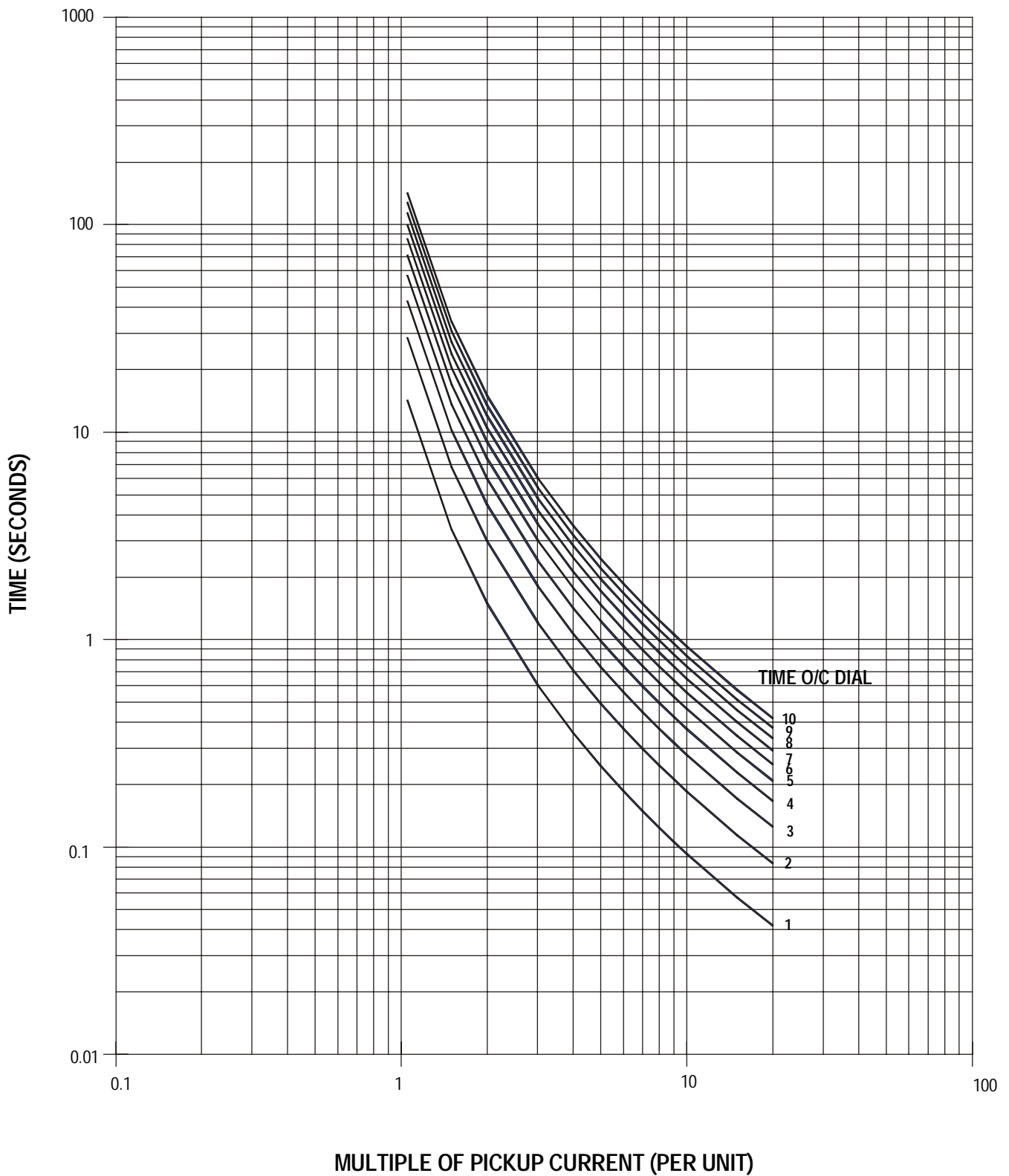
**Formula**  $T = S * M * (A + B / (I / I_{pu} - C) + D / (I / I_{pu} - C)^2 + E / (I / I_{pu} - C)^3)$

- TRIP TIME (SEC)                      **T**      CURVE SHAPE CONSTANT **A= 0.004**
- CURVE SHIFT MULTIPLIER            **S**      CURVE SHAPE CONSTANT **B= 0.638**
- CURVE MULTIPLIER SETPOINT        **M**      CURVE SHAPE CONSTANT **C= 0.620**
- INPUT CURRENT                        **I**      CURVE SHAPE CONSTANT **D= 1.787**
- PICKUP CURRENT SETPOINT          **I<sub>pu</sub>**    CURVE SHAPE CONSTANT **E= 0.246**

(Per Unit I/I<sub>pu</sub>)

SHIFT (S)	CURVE (M)	1	1,5	2	3	4	5	6	7	8	9	10	15	20
1	1	18,541	3,398	1,498	0,606	0,356	0,246	0,186	0,149	0,124	0,106	0,093	0,057	0,042
1	2	37,083	6,795	2,997	1,212	0,711	0,491	0,372	0,298	0,248	0,212	0,185	0,114	0,083
1	3	55,624	10,193	4,495	1,817	1,067	0,737	0,558	0,447	0,372	0,318	0,278	0,171	0,125
1	4	74,166	13,59	5,993	2,423	1,422	0,983	0,744	0,595	0,495	0,424	0,371	0,228	0,167
1	5	92,707	16,988	7,491	3,029	1,778	1,229	0,93	0,744	0,619	0,53	0,463	0,285	0,209
1	6	111,249	20,385	8,99	3,635	2,133	1,474	1,115	0,893	0,743	0,636	0,556	0,343	0,25
1	7	129,79	23,783	10,488	4,241	2,489	1,72	1,301	1,042	0,867	0,742	0,648	0,4	0,292
1	8	148,332	27,181	11,986	4,846	2,844	1,966	1,487	1,191	0,991	0,848	0,741	0,457	0,334
1	9	166,873	30,578	13,484	5,452	3,2	2,212	1,673	1,34	1,115	0,954	0,834	0,514	0,375
1	10	185,415	33,976	14,983	6,058	3,555	2,457	1,859	1,488	1,239	1,06	0,926	0,571	0,417
0,5	1	9,271	1,699	0,749	0,303	0,178	0,123	0,093	0,074	0,062	0,053	0,046	0,029	0,021
0,5	2	18,541	3,398	1,498	0,606	0,356	0,246	0,186	0,149	0,124	0,106	0,093	0,057	0,042
0,5	3	27,812	5,096	2,247	0,909	0,533	0,369	0,279	0,223	0,186	0,159	0,139	0,086	0,063
0,5	4	37,083	6,795	2,997	1,212	0,711	0,491	0,372	0,298	0,248	0,212	0,185	0,114	0,083
0,5	5	46,354	8,494	3,746	1,514	0,889	0,614	0,465	0,372	0,31	0,265	0,232	0,143	0,104
0,5	6	55,624	10,193	4,495	1,817	1,067	0,737	0,558	0,447	0,372	0,318	0,278	0,171	0,125
0,5	7	64,895	11,892	5,244	2,12	1,244	0,86	0,651	0,521	0,434	0,371	0,324	0,2	0,146
0,5	8	74,166	13,59	5,993	2,423	1,422	0,983	0,744	0,595	0,495	0,424	0,371	0,228	0,167
0,5	9	83,437	15,289	6,742	2,726	1,6	1,106	0,837	0,67	0,557	0,477	0,417	0,257	0,188
0,5	10	92,707	16,988	7,491	3,029	1,778	1,229	0,93	0,744	0,619	0,53	0,463	0,285	0,209
0,8	1	14,833	2,718	1,199	0,485	0,284	0,197	0,149	0,119	0,099	0,085	0,074	0,046	0,033
0,8	2	29,666	5,436	2,397	0,969	0,569	0,393	0,297	0,238	0,198	0,17	0,148	0,091	0,067
0,8	3	44,499	8,154	3,596	1,454	0,853	0,59	0,446	0,357	0,297	0,254	0,222	0,137	0,1
0,8	4	59,333	10,872	4,794	1,939	1,138	0,786	0,595	0,476	0,396	0,339	0,296	0,183	0,133
0,8	5	74,166	13,59	5,993	2,423	1,422	0,983	0,744	0,595	0,495	0,424	0,371	0,228	0,167
0,8	6	88,999	16,308	7,192	2,908	1,707	1,18	0,892	0,714	0,595	0,509	0,445	0,274	0,2
0,8	7	103,832	19,026	8,39	3,392	1,991	1,376	1,041	0,834	0,694	0,594	0,519	0,32	0,234
0,8	8	118,665	21,744	9,589	3,877	2,276	1,573	1,19	0,953	0,793	0,678	0,593	0,365	0,267
0,8	9	133,498	24,463	10,788	4,362	2,56	1,769	1,339	1,072	0,892	0,763	0,667	0,411	0,3
0,8	10	148,332	27,181	11,986	4,846	2,844	1,966	1,487	1,191	0,991	0,848	0,741	0,457	0,334
1,1	1	20,396	3,737	1,648	0,666	0,391	0,27	0,204	0,164	0,136	0,117	0,102	0,063	0,046
1,1	2	40,791	7,475	3,296	1,333	0,782	0,541	0,409	0,327	0,273	0,233	0,204	0,126	0,092
1,1	3	61,187	11,212	4,944	1,999	1,173	0,811	0,613	0,491	0,409	0,35	0,306	0,188	0,138
1,1	4	81,582	14,949	6,592	2,665	1,564	1,081	0,818	0,655	0,545	0,466	0,408	0,251	0,184
1,1	5	101,978	18,687	8,241	3,332	1,956	1,352	1,022	0,819	0,681	0,583	0,509	0,314	0,229
1,1	6	122,374	22,424	9,889	3,998	2,347	1,622	1,227	0,982	0,818	0,7	0,611	0,377	0,275
1,1	7	142,769	26,161	11,537	4,665	2,738	1,892	1,431	1,146	0,954	0,816	0,713	0,44	0,321
1,1	8	163,165	29,899	13,185	5,331	3,129	2,162	1,636	1,31	1,09	0,933	0,815	0,502	0,367
1,1	9	183,56	33,636	14,833	5,997	3,52	2,433	1,84	1,474	1,226	1,049	0,917	0,565	0,413
1,1	10	203,956	37,373	16,481	6,664	3,911	2,703	2,045	1,637	1,363	1,166	1,019	0,628	0,459

### IAC EXTREMELY INVERSE





**IEC/BS142 CURVES**  
IEC SHORT TIME O/C TRIP TIMES

IEC SHORT TIME

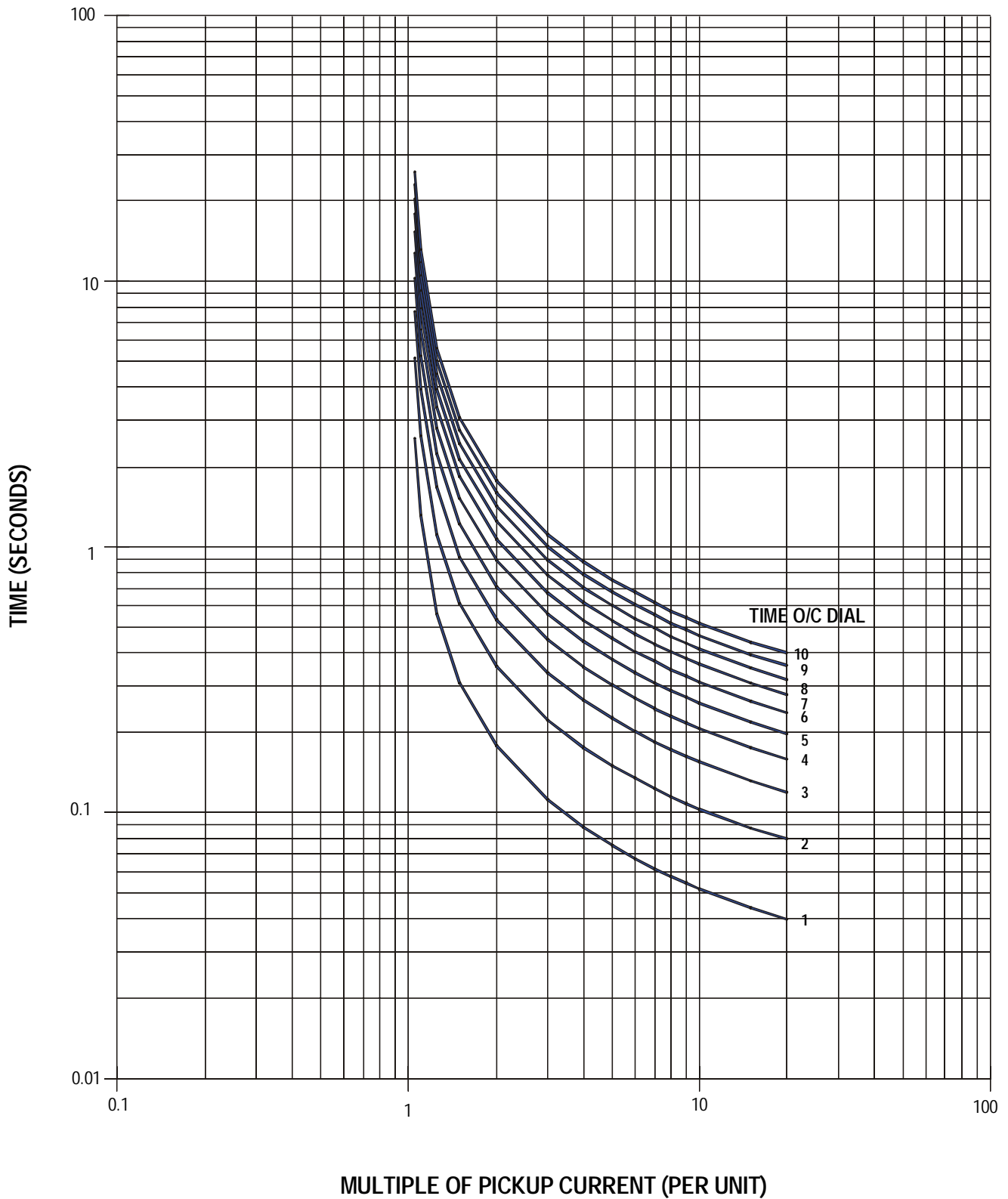
**Formula**  $T = S * M * (K / ((I / I_{pu}) ** E - 1))$

- TRIP TIME (SEC)                                    **T**      CURVE SHAPE CONSTANT **K=** 0.050
- CURVE SHIFT MULTIPLIER                        **S**      CURVE SHAPE CONSTANT **E=** 0.040
- CURVE MULTIPLIER SETPOINT                  **M**
- INPUT CURRENT                                    **I**      SMPR-1 MULT (M) = 10 \* IEC MULT
- PICKUP CURRENT SETPOINT                      **I<sub>pu</sub>**    IEC MULT: 0.1 to 1.0 , STEPS of 0.1

(Per Unit I/I<sub>pu</sub>)

SHIFT (S)	CURVE (M)	1,05	1,5	2	3	4	5	6	7	8	9	10	15	20
1	1	2,559	0,306	0,178	0,111	0,088	0,075	0,067	0,062	0,058	0,054	0,052	0,044	0,039
1	2	5,119	0,612	0,356	0,223	0,175	0,15	0,135	0,124	0,115	0,109	0,104	0,087	0,079
1	3	7,678	0,917	0,534	0,334	0,263	0,226	0,202	0,185	0,173	0,163	0,155	0,131	0,118
1	4	10,238	1,223	0,711	0,445	0,351	0,301	0,269	0,247	0,231	0,218	0,207	0,175	0,157
1	5	12,797	1,529	0,889	0,556	0,438	0,376	0,336	0,309	0,288	0,272	0,259	0,219	0,196
1	6	15,357	1,835	1,067	0,668	0,526	0,451	0,404	0,371	0,346	0,327	0,311	0,262	0,236
1	7	17,916	2,141	1,245	0,779	0,614	0,526	0,471	0,432	0,404	0,381	0,363	0,306	0,275
1	8	20,476	2,446	1,423	0,89	0,702	0,602	0,538	0,494	0,461	0,435	0,415	0,35	0,314
1	9	23,035	2,752	1,601	1,002	0,789	0,677	0,606	0,556	0,519	0,49	0,466	0,393	0,353
1	10	25,595	3,058	1,778	1,113	0,877	0,752	0,673	0,618	0,576	0,544	0,518	0,437	0,393
0,5	1	1,28	0,153	0,089	0,056	0,044	0,038	0,034	0,031	0,029	0,027	0,026	0,022	0,02
0,5	2	2,559	0,306	0,178	0,111	0,088	0,075	0,067	0,062	0,058	0,054	0,052	0,044	0,039
0,5	3	3,839	0,459	0,267	0,167	0,132	0,113	0,101	0,093	0,086	0,082	0,078	0,066	0,059
0,5	4	5,119	0,612	0,356	0,223	0,175	0,15	0,135	0,124	0,115	0,109	0,104	0,087	0,079
0,5	5	6,399	0,764	0,445	0,278	0,219	0,188	0,168	0,154	0,144	0,136	0,13	0,109	0,098
0,5	6	7,678	0,917	0,534	0,334	0,263	0,226	0,202	0,185	0,173	0,163	0,155	0,131	0,118
0,5	7	8,958	1,07	0,622	0,39	0,307	0,263	0,236	0,216	0,202	0,19	0,181	0,153	0,137
0,5	8	10,238	1,223	0,711	0,445	0,351	0,301	0,269	0,247	0,231	0,218	0,207	0,175	0,157
0,5	9	11,518	1,376	0,8	0,501	0,395	0,338	0,303	0,278	0,259	0,245	0,233	0,197	0,177
0,5	10	12,797	1,529	0,889	0,556	0,438	0,376	0,336	0,309	0,288	0,272	0,259	0,219	0,196
0,8	1	2,048	0,245	0,142	0,089	0,07	0,06	0,054	0,049	0,046	0,044	0,041	0,035	0,031
0,8	2	4,095	0,489	0,285	0,178	0,14	0,12	0,108	0,099	0,092	0,087	0,083	0,07	0,063
0,8	3	6,143	0,734	0,427	0,267	0,21	0,18	0,162	0,148	0,138	0,131	0,124	0,105	0,094
0,8	4	8,19	0,979	0,569	0,356	0,281	0,241	0,215	0,198	0,184	0,174	0,166	0,14	0,126
0,8	5	10,238	1,223	0,711	0,445	0,351	0,301	0,269	0,247	0,231	0,218	0,207	0,175	0,157
0,8	6	12,286	1,468	0,854	0,534	0,421	0,361	0,323	0,296	0,277	0,261	0,249	0,21	0,189
0,8	7	14,333	1,712	0,996	0,623	0,491	0,421	0,377	0,346	0,323	0,305	0,29	0,245	0,22
0,8	8	16,381	1,957	1,138	0,712	0,561	0,481	0,431	0,395	0,369	0,348	0,332	0,28	0,251
0,8	9	18,428	2,202	1,281	0,801	0,631	0,541	0,485	0,445	0,415	0,392	0,373	0,315	0,283
0,8	10	20,476	2,446	1,423	0,89	0,702	0,602	0,538	0,494	0,461	0,435	0,415	0,35	0,314
1,1	1	2,815	0,336	0,196	0,122	0,096	0,083	0,074	0,068	0,063	0,06	0,057	0,048	0,043
1,1	2	5,631	0,673	0,391	0,245	0,193	0,165	0,148	0,136	0,127	0,12	0,114	0,096	0,086
1,1	3	8,446	1,009	0,587	0,367	0,289	0,248	0,222	0,204	0,19	0,18	0,171	0,144	0,13
1,1	4	11,262	1,345	0,783	0,49	0,386	0,331	0,296	0,272	0,254	0,239	0,228	0,192	0,173
1,1	5	14,077	1,682	0,978	0,612	0,482	0,414	0,37	0,34	0,317	0,299	0,285	0,24	0,216
1,1	6	16,893	2,018	1,174	0,735	0,579	0,496	0,444	0,408	0,38	0,359	0,342	0,288	0,259
1,1	7	19,708	2,355	1,369	0,857	0,675	0,579	0,518	0,476	0,444	0,419	0,399	0,337	0,302
1,1	8	22,524	2,691	1,565	0,979	0,772	0,662	0,592	0,544	0,507	0,479	0,456	0,385	0,346
1,1	9	25,339	3,027	1,761	1,102	0,868	0,744	0,666	0,612	0,571	0,539	0,513	0,433	0,389
1,1	10	28,154	3,364	1,956	1,224	0,965	0,827	0,74	0,679	0,634	0,599	0,57	0,481	0,432

### IEC SHORT TIME



**IEC/BS142 CURVES**  
IEC -A (NORMAL INVERSE) O/C TRIP TIMES

IEC-A (NORMAL INVERSE)

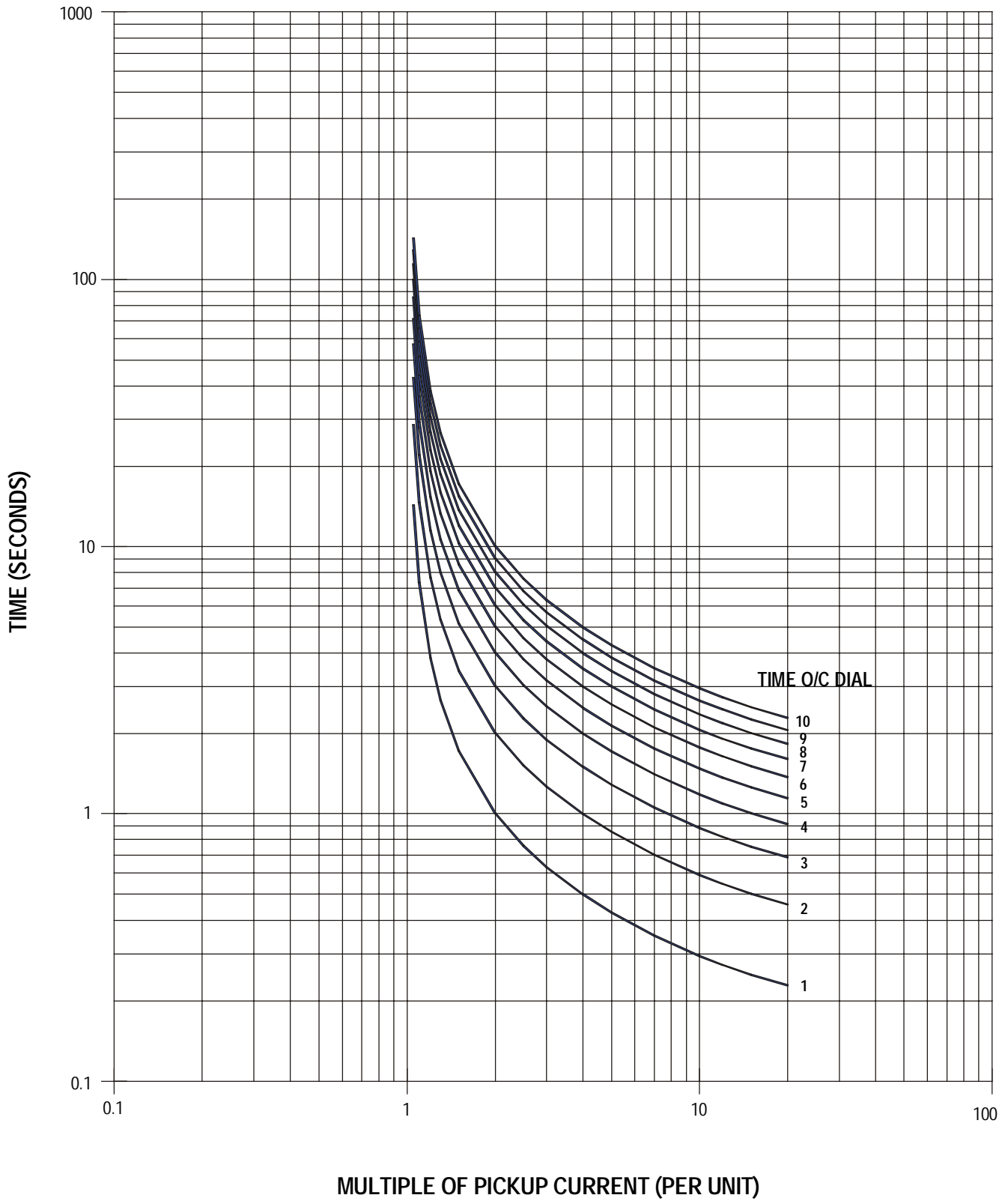
**Formula**  $T = S * M * (K / ((I / I_{pu})^{**} E - 1))$

- TRIP TIME (SEC)                                    **T**      CURVE SHAPE CONSTANT **K= 0.140**
- CURVE SHIFT MULTIPLIER                        **S**      CURVE SHAPE CONSTANT **E= 0.020**
- CURVE MULTIPLIER SETPOINT                   **M**
- INPUT CURRENT                                    **I**      SMPR-1 MULT (M) = 10 \* IEC MULT
- PICKUP CURRENT SETPOINT                     **I<sub>pu</sub>**    IEC MULT: 0.1 to 1.0 , STEPS of 0.1

(Per Unit I/I<sub>pu0</sub>)

SHIFT (S)	CURVE (M)	1,05	1,5	2	3	4	5	6	7	8	9	10	15	20
1	1	14,34	1,719	1,003	0,63	0,498	0,428	0,38	0,353	0,33	0,312	0,297	0,252	0,227
1	2	28,68	3,439	2,006	1,26	0,996	0,856	0,76	0,706	0,659	0,623	0,594	0,503	0,453
1	3	43,02	5,158	3,009	1,891	1,494	1,284	1,14	1,058	0,989	0,935	0,891	0,755	0,68
1	4	57,361	6,878	4,012	2,521	1,992	1,712	1,52	1,411	1,319	1,247	1,188	1,006	0,907
1	5	71,701	8,597	5,015	3,151	2,49	2,14	1,9	1,764	1,648	1,558	1,485	1,258	1,134
1	6	86,041	10,317	6,017	3,781	2,988	2,568	2,28	2,117	1,978	1,87	1,782	1,509	1,36
1	7	100,381	12,036	7,02	4,411	3,486	2,996	2,659	2,469	2,308	2,181	2,079	1,761	1,587
1	8	114,721	13,755	8,023	5,042	3,984	3,424	3,039	2,822	2,637	2,493	2,376	2,012	1,814
1	9	129,061	15,475	9,026	5,672	4,482	3,852	3,419	3,175	2,967	2,805	2,674	2,264	2,041
1	10	143,401	17,194	10,029	6,302	4,98	4,28	3,799	3,528	3,297	3,116	2,971	2,516	2,267
0,5	1	7,17	0,86	0,501	0,315	0,249	0,214	0,19	0,176	0,165	0,156	0,149	0,126	0,113
0,5	2	14,34	1,719	1,003	0,63	0,498	0,428	0,38	0,353	0,33	0,312	0,297	0,252	0,227
0,5	3	21,51	2,579	1,504	0,945	0,747	0,642	0,57	0,529	0,495	0,467	0,446	0,377	0,34
0,5	4	28,68	3,439	2,006	1,26	0,996	0,856	0,76	0,706	0,659	0,623	0,594	0,503	0,453
0,5	5	35,85	4,299	2,507	1,575	1,245	1,07	0,95	0,882	0,824	0,779	0,743	0,629	0,567
0,5	6	43,02	5,158	3,009	1,891	1,494	1,284	1,14	1,058	0,989	0,935	0,891	0,755	0,68
0,5	7	50,191	6,018	3,51	2,206	1,743	1,498	1,33	1,235	1,154	1,091	1,04	0,88	0,794
0,5	8	57,361	6,878	4,012	2,521	1,992	1,712	1,52	1,411	1,319	1,247	1,188	1,006	0,907
0,5	9	64,531	7,737	4,513	2,836	2,241	1,926	1,71	1,587	1,484	1,402	1,337	1,132	1,02
0,5	10	71,701	8,597	5,015	3,151	2,49	2,14	1,9	1,764	1,648	1,558	1,485	1,258	1,134
0,8	1	11,472	1,376	0,802	0,504	0,398	0,342	0,304	0,282	0,264	0,249	0,238	0,201	0,181
0,8	2	22,944	2,751	1,605	1,008	0,797	0,685	0,608	0,564	0,527	0,499	0,475	0,402	0,363
0,8	3	34,416	4,127	2,407	1,512	1,195	1,027	0,912	0,847	0,791	0,748	0,713	0,604	0,544
0,8	4	45,888	5,502	3,209	2,017	1,594	1,37	1,216	1,129	1,055	0,997	0,951	0,805	0,726
0,8	5	57,361	6,878	4,012	2,521	1,992	1,712	1,52	1,411	1,319	1,247	1,188	1,006	0,907
0,8	6	68,833	8,253	4,814	3,025	2,39	2,054	1,824	1,693	1,582	1,496	1,426	1,207	1,088
0,8	7	80,305	9,629	5,616	3,529	2,789	2,397	2,128	1,976	1,846	1,745	1,664	1,409	1,27
0,8	8	91,777	11,004	6,419	4,033	3,187	2,739	2,431	2,258	2,11	1,994	1,901	1,61	1,451
0,8	9	103,249	12,38	7,221	4,537	3,585	3,081	2,735	2,54	2,374	2,244	2,139	1,811	1,632
0,8	10	114,721	13,755	8,023	5,042	3,984	3,424	3,039	2,822	2,637	2,493	2,376	2,012	1,814
1,1	1	15,774	1,891	1,103	0,693	0,548	0,471	0,418	0,388	0,363	0,343	0,327	0,277	0,249
1,1	2	31,548	3,783	2,206	1,386	1,096	0,942	0,836	0,776	0,725	0,686	0,654	0,553	0,499
1,1	3	47,322	5,674	3,31	2,08	1,643	1,412	1,254	1,164	1,088	1,028	0,98	0,83	0,748
1,1	4	63,097	7,565	4,413	2,773	2,191	1,883	1,672	1,552	1,451	1,371	1,307	1,107	0,998
1,1	5	78,871	9,457	5,516	3,466	2,739	2,354	2,09	1,94	1,813	1,714	1,634	1,384	1,247
1,1	6	94,645	11,348	6,619	4,159	3,287	2,825	2,507	2,328	2,176	2,057	1,961	1,66	1,496
1,1	7	110,419	13,24	7,722	4,852	3,834	3,295	2,925	2,716	2,539	2,4	2,287	1,937	1,746
1,1	8	126,193	15,131	8,826	5,546	4,382	3,766	3,343	3,104	2,901	2,742	2,614	2,214	1,995
1,1	9	141,967	17,022	9,929	6,239	4,93	4,237	3,761	3,492	3,264	3,085	2,941	2,49	2,245
1,1	10	157,742	18,914	11,032	6,932	5,478	4,708	4,179	3,881	3,626	3,428	3,268	2,767	2,494

### IEC-A (NORMAL INVERSE)



**IEC/BS142 CURVES**  
IEC -B (VERY INVERSE) O/C TRIP TIMES

IEC-B (VERY INVERSE)

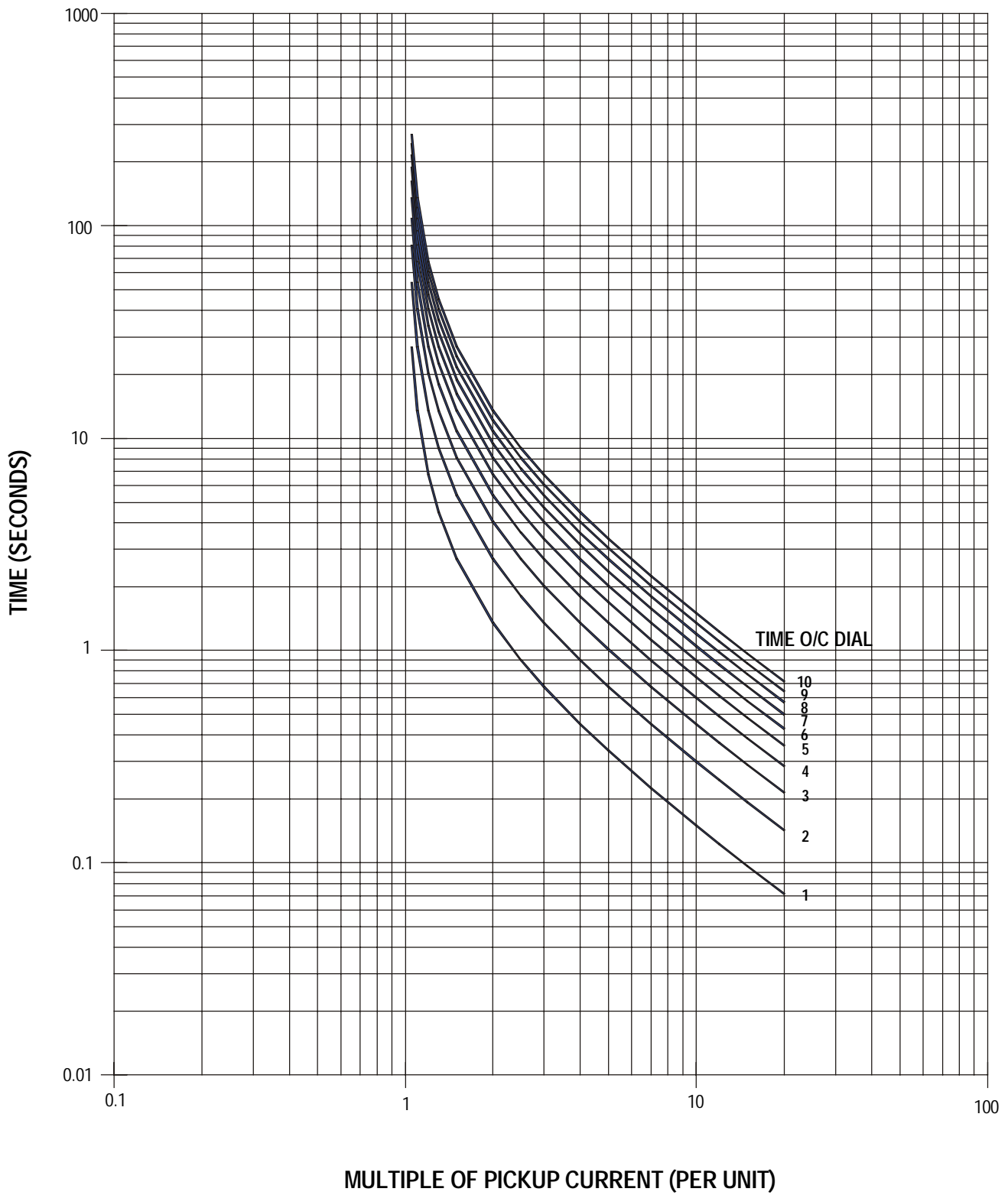
**Formula**  $T = S * M * (K / ((I / I_{pu}) ** E - 1))$

- TRIP TIME (SEC)                                    **T**      CURVE SHAPE CONSTANT **K= 13.500**
- CURVE SHIFT MULTIPLIER                        **S**      CURVE SHAPE CONSTANT **E= 1.000**
- CURVE MULTIPLIER SETPOINT                  **M**
- INPUT CURRENT                                    **I**      SMPR-1 MULT (M) = 10 \* IEC MULT
- PICKUP CURRENT SETPOINT                    **I<sub>pu</sub>**    IEC MULT: 0.1 to 1.0 , STEPS of 0.1

(Per Unit I/I<sub>pu</sub>)

SHIFT (S)	CURVE (M)	1,05	1,5	2	3	4	5	6	7	8	9	10	15	20
1	1	27	2,7	1,35	0,675	0,45	0,338	0,27	0,225	0,193	0,169	0,15	0,096	0,071
1	2	54	5,4	2,7	1,35	0,9	0,675	0,54	0,45	0,386	0,338	0,3	0,193	0,142
1	3	81	8,1	4,05	2,025	1,35	1,013	0,81	0,675	0,579	0,506	0,45	0,289	0,213
1	4	108	10,8	5,4	2,7	1,8	1,35	1,08	0,9	0,771	0,675	0,6	0,386	0,284
1	5	135	13,5	6,75	3,375	2,25	1,688	1,35	1,125	0,964	0,844	0,75	0,482	0,355
1	6	162	16,2	8,1	4,05	2,7	2,025	1,62	1,35	1,157	1,013	0,9	0,579	0,426
1	7	189	18,9	9,45	4,725	3,15	2,363	1,89	1,575	1,35	1,181	1,05	0,675	0,497
1	8	216	21,6	10,8	5,4	3,6	2,7	2,16	1,8	1,543	1,35	1,2	0,771	0,568
1	9	243	24,3	12,15	6,075	4,05	3,038	2,43	2,025	1,736	1,519	1,35	0,868	0,639
1	10	270	27	13,5	6,75	4,5	3,375	2,7	2,25	1,929	1,688	1,5	0,964	0,711
0,5	1	13,5	1,35	0,675	0,338	0,225	0,169	0,135	0,113	0,096	0,084	0,075	0,048	0,036
0,5	2	27	2,7	1,35	0,675	0,45	0,338	0,27	0,225	0,193	0,169	0,15	0,096	0,071
0,5	3	40,5	4,05	2,025	1,013	0,675	0,506	0,405	0,338	0,289	0,253	0,225	0,145	0,107
0,5	4	54	5,4	2,7	1,35	0,9	0,675	0,54	0,45	0,386	0,338	0,3	0,193	0,142
0,5	5	67,5	6,75	3,375	1,688	1,125	0,844	0,675	0,563	0,482	0,422	0,375	0,241	0,178
0,5	6	81	8,1	4,05	2,025	1,35	1,013	0,81	0,675	0,579	0,506	0,45	0,289	0,213
0,5	7	94,5	9,45	4,725	2,363	1,575	1,181	0,945	0,788	0,675	0,591	0,525	0,338	0,249
0,5	8	108	10,8	5,4	2,7	1,8	1,35	1,08	0,9	0,771	0,675	0,6	0,386	0,284
0,5	9	121,5	12,15	6,075	3,038	2,025	1,519	1,215	1,013	0,868	0,759	0,675	0,434	0,32
0,5	10	135	13,5	6,75	3,375	2,25	1,688	1,35	1,125	0,964	0,844	0,75	0,482	0,355
0,8	1	21,6	2,16	1,08	0,54	0,36	0,27	0,216	0,18	0,154	0,135	0,12	0,077	0,057
0,8	2	43,2	4,32	2,16	1,08	0,72	0,54	0,432	0,36	0,309	0,27	0,24	0,154	0,114
0,8	3	64,8	6,48	3,24	1,62	1,08	0,81	0,648	0,54	0,463	0,405	0,36	0,231	0,171
0,8	4	86,4	8,64	4,32	2,16	1,44	1,08	0,864	0,72	0,617	0,54	0,48	0,309	0,227
0,8	5	108	10,8	5,4	2,7	1,8	1,35	1,08	0,9	0,771	0,675	0,6	0,386	0,284
0,8	6	129,6	12,96	6,48	3,24	2,16	1,62	1,296	1,08	0,926	0,81	0,72	0,463	0,341
0,8	7	151,2	15,12	7,56	3,78	2,52	1,89	1,512	1,26	1,08	0,945	0,84	0,54	0,398
0,8	8	172,8	17,28	8,64	4,32	2,88	2,16	1,728	1,44	1,234	1,08	0,96	0,617	0,455
0,8	9	194,4	19,44	9,72	4,86	3,24	2,43	1,944	1,62	1,389	1,215	1,08	0,694	0,512
0,8	10	216	21,6	10,8	5,4	3,6	2,7	2,16	1,8	1,543	1,35	1,2	0,771	0,568
1,1	1	29,7	2,97	1,485	0,743	0,495	0,371	0,297	0,248	0,212	0,186	0,165	0,106	0,078
1,1	2	59,4	5,94	2,97	1,485	0,99	0,743	0,594	0,495	0,424	0,371	0,33	0,212	0,156
1,1	3	89,1	8,91	4,455	2,228	1,485	1,114	0,891	0,743	0,636	0,557	0,495	0,318	0,234
1,1	4	118,8	11,88	5,94	2,97	1,98	1,485	1,188	0,99	0,849	0,743	0,66	0,424	0,313
1,1	5	148,5	14,85	7,425	3,713	2,475	1,856	1,485	1,238	1,061	0,928	0,825	0,53	0,391
1,1	6	178,2	17,82	8,91	4,455	2,97	2,228	1,782	1,485	1,273	1,114	0,99	0,636	0,469
1,1	7	207,9	20,79	10,395	5,198	3,465	2,599	2,079	1,733	1,485	1,299	1,155	0,743	0,547
1,1	8	237,6	23,76	11,88	5,94	3,96	2,97	2,376	1,98	1,697	1,485	1,32	0,849	0,625
1,1	9	267,3	26,73	13,365	6,683	4,455	3,341	2,673	2,228	1,909	1,671	1,485	0,955	0,703
1,1	10	297	29,7	14,85	7,425	4,95	3,713	2,97	2,475	2,121	1,856	1,65	1,061	0,782

### IEC-B (VERY INVERSE)



**IEC/BS142 CURVES**  
**IEC -C (EXTREMELY INVERSE) O/C TRIP TIMES**

IEC-C (EXTREMELY INVERSE)

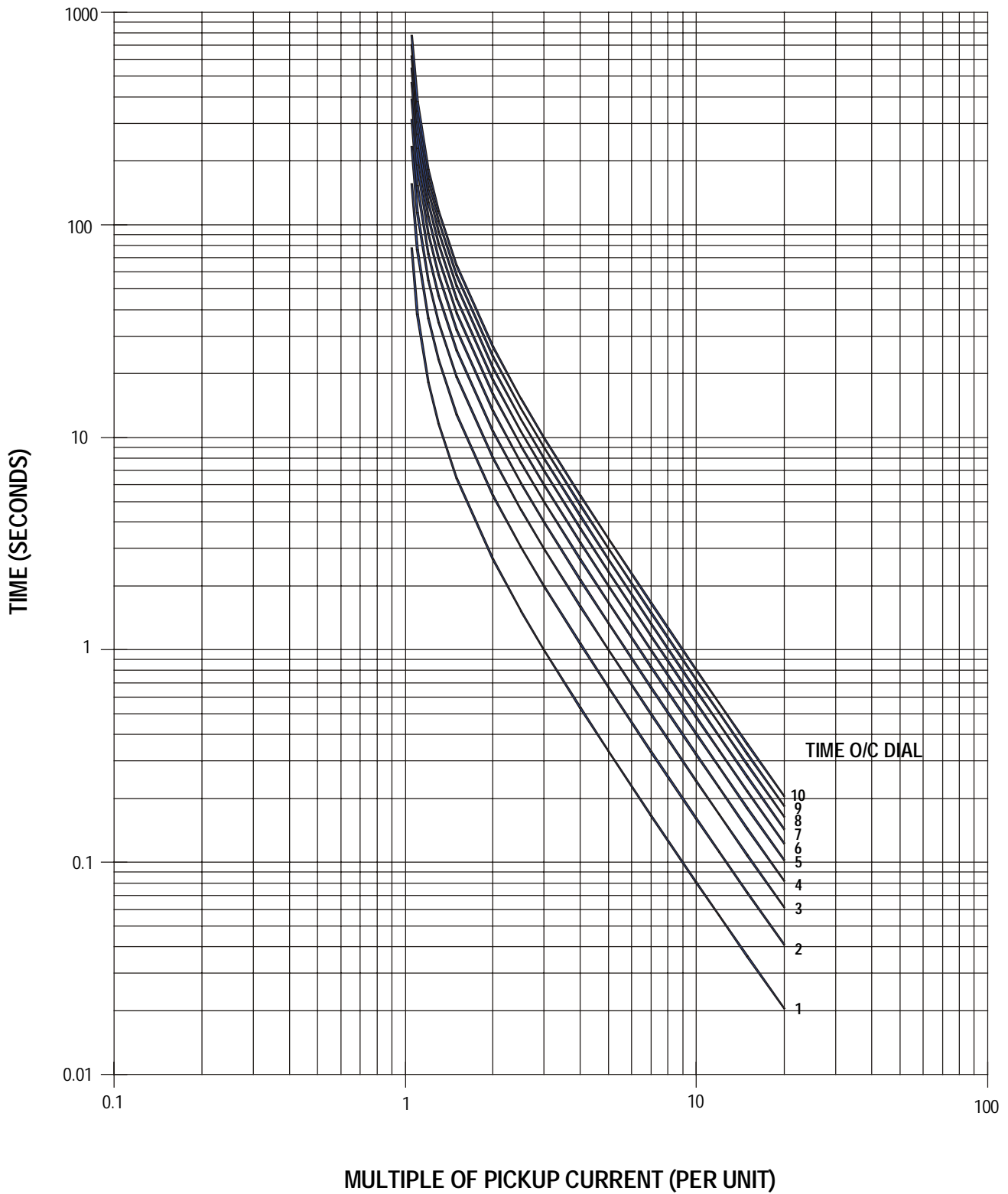
**Formula**  $T = S * M * (K / ((I / I_{pu})^{**} E - 1))$

- TRIP TIME (SEC)                                    **T**      CURVE SHAPE CONSTANT **K= 80.000**
- CURVE SHIFT MULTIPLIER                        **S**      CURVE SHAPE CONSTANT **E= 2.000**
- CURVE MULTIPLIER SETPOINT                  **M**
- INPUT CURRENT                                    **I**      SMPR-1 MULT (M) = 10 \* IEC MULT
- PICKUP CURRENT SETPOINT                    **I<sub>pu</sub>**    IEC MULT: 0.1 to 1.0 , STEPS of 0.1

(Per Unit I/I<sub>pu</sub>)

SHIFT (S)	CURVE (M)	1,05	1,5	2	3	4	5	6	7	8	9	10	15	20
1	1	78,049	6,4	2,667	1	0,533	0,333	0,229	0,167	0,127	0,1	0,081	0,036	0,02
1	2	156,098	12,8	5,333	2	1,067	0,667	0,457	0,333	0,254	0,2	0,162	0,071	0,04
1	3	234,146	19,2	8	3	1,6	1	0,686	0,5	0,381	0,3	0,242	0,107	0,06
1	4	312,195	25,6	10,667	4	2,133	1,333	0,914	0,667	0,508	0,4	0,323	0,143	0,08
1	5	390,244	32	13,333	5	2,667	1,667	1,143	0,833	0,635	0,5	0,404	0,179	0,1
1	6	468,293	38,4	16	6	3,2	2	1,371	1	0,762	0,6	0,485	0,214	0,12
1	7	546,341	44,8	18,667	7	3,733	2,333	1,6	1,167	0,889	0,7	0,566	0,25	0,14
1	8	624,39	51,2	21,333	8	4,267	2,667	1,829	1,333	1,016	0,8	0,646	0,286	0,16
1	9	702,439	57,6	24	9	4,8	3	2,057	1,5	1,143	0,9	0,727	0,321	0,18
1	10	780,488	64	26,667	10	5,333	3,333	2,286	1,667	1,27	1	0,808	0,357	0,201
0,5	1	39,024	3,2	1,333	0,5	0,267	0,167	0,114	0,083	0,063	0,05	0,04	0,018	0,01
0,5	2	78,049	6,4	2,667	1	0,533	0,333	0,229	0,167	0,127	0,1	0,081	0,036	0,02
0,5	3	117,073	9,6	4	1,5	0,8	0,5	0,343	0,25	0,19	0,15	0,121	0,054	0,03
0,5	4	156,098	12,8	5,333	2	1,067	0,667	0,457	0,333	0,254	0,2	0,162	0,071	0,04
0,5	5	195,122	16	6,667	2,5	1,333	0,833	0,571	0,417	0,317	0,25	0,202	0,089	0,05
0,5	6	234,146	19,2	8	3	1,6	1	0,686	0,5	0,381	0,3	0,242	0,107	0,06
0,5	7	273,171	22,4	9,333	3,5	1,867	1,167	0,8	0,583	0,444	0,35	0,283	0,125	0,07
0,5	8	312,195	25,6	10,667	4	2,133	1,333	0,914	0,667	0,508	0,4	0,323	0,143	0,08
0,5	9	351,22	28,8	12	4,5	2,4	1,5	1,029	0,75	0,571	0,45	0,364	0,161	0,09
0,5	10	390,244	32	13,333	5	2,667	1,667	1,143	0,833	0,635	0,5	0,404	0,179	0,1
0,8	1	62,439	5,12	2,133	0,8	0,427	0,267	0,183	0,133	0,102	0,08	0,065	0,029	0,016
0,8	2	124,878	10,24	4,267	1,6	0,853	0,533	0,366	0,267	0,203	0,16	0,129	0,057	0,032
0,8	3	187,317	15,36	6,4	2,4	1,28	0,8	0,549	0,4	0,305	0,24	0,194	0,086	0,048
0,8	4	249,756	20,48	8,533	3,2	1,707	1,067	0,731	0,533	0,406	0,32	0,259	0,114	0,064
0,8	5	312,195	25,6	10,667	4	2,133	1,333	0,914	0,667	0,508	0,4	0,323	0,143	0,08
0,8	6	374,634	30,72	12,8	4,8	2,56	1,6	1,097	0,8	0,61	0,48	0,388	0,171	0,096
0,8	7	437,073	35,84	14,933	5,6	2,987	1,867	1,28	0,933	0,711	0,56	0,453	0,2	0,112
0,8	8	499,512	40,96	17,067	6,4	3,413	2,133	1,463	1,067	0,813	0,64	0,517	0,229	0,128
0,8	9	561,951	46,08	19,2	7,2	3,84	2,4	1,646	1,2	0,914	0,72	0,582	0,257	0,144
0,8	10	624,39	51,2	21,333	8	4,267	2,667	1,829	1,333	1,016	0,8	0,646	0,286	0,16
1,1	1	85,854	7,04	2,933	1,1	0,587	0,367	0,251	0,183	0,14	0,11	0,089	0,039	0,022
1,1	2	171,707	14,08	5,867	2,2	1,173	0,733	0,503	0,367	0,279	0,22	0,178	0,079	0,044
1,1	3	257,561	21,12	8,8	3,3	1,76	1,1	0,754	0,55	0,419	0,33	0,267	0,118	0,066
1,1	4	343,415	28,16	11,733	4,4	2,347	1,467	1,006	0,733	0,559	0,44	0,356	0,157	0,088
1,1	5	429,268	35,2	14,667	5,5	2,933	1,833	1,257	0,917	0,698	0,55	0,444	0,196	0,11
1,1	6	515,122	42,24	17,6	6,6	3,52	2,2	1,509	1,1	0,838	0,66	0,533	0,236	0,132
1,1	7	600,976	49,28	20,533	7,7	4,107	2,567	1,76	1,283	0,978	0,77	0,622	0,275	0,154
1,1	8	686,829	56,32	23,467	8,8	4,693	2,933	2,011	1,467	1,117	0,88	0,711	0,314	0,176
1,1	9	772,683	63,36	26,4	9,9	5,28	3,3	2,263	1,65	1,257	0,99	0,8	0,354	0,198
1,1	10	858,537	70,4	29,333	11	5,867	3,667	2,514	1,833	1,397	1,1	0,889	0,393	0,221

### IEC-C (EXTREMELY INVERSE)





**DEFINITE TIME CURVES**  
**DEFINITE TIME #1 O/C TRIP TIMES**

DEFINITE TIME #1 (Range: 0.025 to 0.550 SEC)

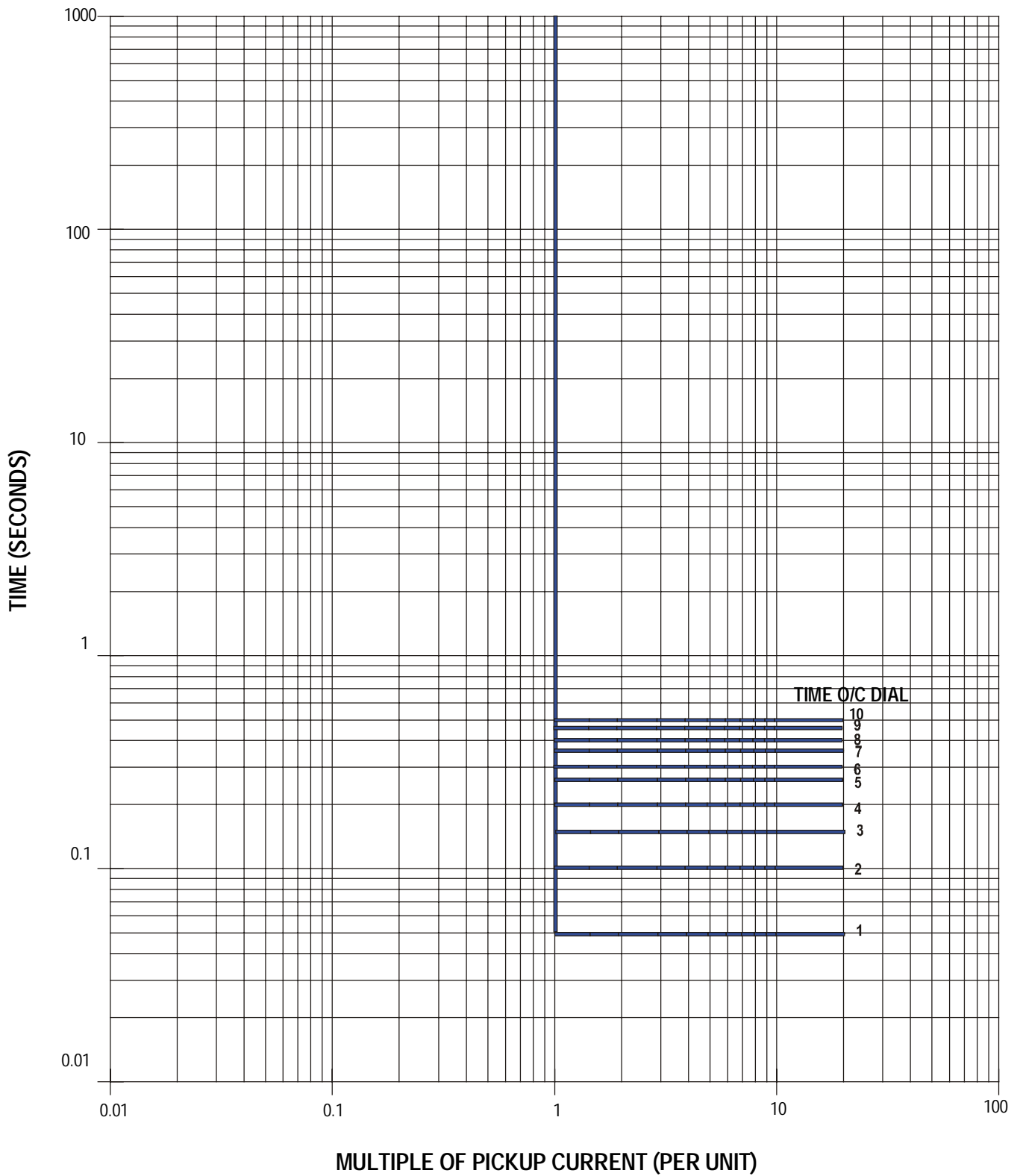
-----  
**Formula T= S \* M \* 0.050**

TRIP TIME (SEC)                    **T**  
 CURVE SHIFT MULTIPLIER        **S**  
 CURVE MULTIPLIER SETPOINT    **M**  
 INPUT CURRENT                    **I**  
 PICKUP CURRENT SETPOINT      **Ipu**

(Per Unit I/Ipu)

SHIFT (S)	CURVE (M)	1	1,5	2	3	4	5	6	7	8	9	10	15	20
1	1	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05
1	2	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
1	3	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15
1	4	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
1	5	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25
1	6	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3
1	7	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35
1	8	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4
1	9	0,45	0,45	0,45	0,45	0,45	0,45	0,45	0,45	0,45	0,45	0,45	0,45	0,45
1	10	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5
0,5	1	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025
0,5	2	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05
0,5	3	0,075	0,075	0,075	0,075	0,075	0,075	0,075	0,075	0,075	0,075	0,075	0,075	0,075
0,5	4	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
0,5	5	0,125	0,125	0,125	0,125	0,125	0,125	0,125	0,125	0,125	0,125	0,125	0,125	0,125
0,5	6	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15
0,5	7	0,175	0,175	0,175	0,175	0,175	0,175	0,175	0,175	0,175	0,175	0,175	0,175	0,175
0,5	8	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
0,5	9	0,225	0,225	0,225	0,225	0,225	0,225	0,225	0,225	0,225	0,225	0,225	0,225	0,225
0,5	10	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25
0,8	1	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04
0,8	2	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08
0,8	3	0,12	0,12	0,12	0,12	0,12	0,12	0,12	0,12	0,12	0,12	0,12	0,12	0,12
0,8	4	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16
0,8	5	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
0,8	6	0,24	0,24	0,24	0,24	0,24	0,24	0,24	0,24	0,24	0,24	0,24	0,24	0,24
0,8	7	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28
0,8	8	0,32	0,32	0,32	0,32	0,32	0,32	0,32	0,32	0,32	0,32	0,32	0,32	0,32
0,8	9	0,36	0,36	0,36	0,36	0,36	0,36	0,36	0,36	0,36	0,36	0,36	0,36	0,36
0,8	10	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4
1,1	1	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055
1,1	2	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11
1,1	3	0,165	0,165	0,165	0,165	0,165	0,165	0,165	0,165	0,165	0,165	0,165	0,165	0,165
1,1	4	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22
1,1	5	0,275	0,275	0,275	0,275	0,275	0,275	0,275	0,275	0,275	0,275	0,275	0,275	0,275
1,1	6	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33
1,1	7	0,385	0,385	0,385	0,385	0,385	0,385	0,385	0,385	0,385	0,385	0,385	0,385	0,385
1,1	8	0,44	0,44	0,44	0,44	0,44	0,44	0,44	0,44	0,44	0,44	0,44	0,44	0,44
1,1	9	0,495	0,495	0,495	0,495	0,495	0,495	0,495	0,495	0,495	0,495	0,495	0,495	0,495
1,1	10	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55

### DEFINITE TIME #1



**DEFINITE TIME CURVES**  
**DEFINITE TIME #2 O/C TRIP TIMES**

DEFINITE TIME #2 (Range: 0.25 to 5.50 SEC)

-----  
**Formula  $T = S * M * 0.50$**

TRIP TIME (SEC)                    **T**  
 CURVE SHIFT MULTIPLIER        **S**  
 CURVE MULTIPLIER SETPOINT    **M**  
 INPUT CURRENT                    **I**  
 PICKUP CURRENT SETPOINT      **I<sub>pu</sub>**

		(Per Unit I/I <sub>pu</sub> )													
SHIFT (S)	CURVE (M)	1	1,5	2	3	4	5	6	7	8	9	10	15	20	
1	1	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	
1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	
1	3	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	
1	4	2	2	2	2	2	2	2	2	2	2	2	2	2	
1	5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	
1	6	3	3	3	3	3	3	3	3	3	3	3	3	3	
1	7	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	
1	8	4	4	4	4	4	4	4	4	4	4	4	4	4	
1	9	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	
1	10	5	5	5	5	5	5	5	5	5	5	5	5	5	
0,5	1	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	
0,5	2	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	
0,5	3	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	
0,5	4	1	1	1	1	1	1	1	1	1	1	1	1	1	
0,5	5	1,25	1,25	1,25	1,25	1,25	1,25	1,25	1,25	1,25	1,25	1,25	1,25	1,25	
0,5	6	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	
0,5	7	1,75	1,75	1,75	1,75	1,75	1,75	1,75	1,75	1,75	1,75	1,75	1,75	1,75	
0,5	8	2	2	2	2	2	2	2	2	2	2	2	2	2	
0,5	9	2,25	2,25	2,25	2,25	2,25	2,25	2,25	2,25	2,25	2,25	2,25	2,25	2,25	
0,5	10	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	
0,8	1	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	
0,8	2	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	
0,8	3	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	
0,8	4	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6	
0,8	5	2	2	2	2	2	2	2	2	2	2	2	2	2	
0,8	6	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4	
0,8	7	2,8	2,8	2,8	2,8	2,8	2,8	2,8	2,8	2,8	2,8	2,8	2,8	2,8	
0,8	8	3,2	3,2	3,2	3,2	3,2	3,2	3,2	3,2	3,2	3,2	3,2	3,2	3,2	
0,8	9	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6	
0,8	10	4	4	4	4	4	4	4	4	4	4	4	4	4	
1,1	1	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	
1,1	2	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	
1,1	3	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	
1,1	4	2,2	2,2	2,2	2,2	2,2	2,2	2,2	2,2	2,2	2,2	2,2	2,2	2,2	
1,1	5	2,75	2,75	2,75	2,75	2,75	2,75	2,75	2,75	2,75	2,75	2,75	2,75	2,75	
1,1	6	3,3	3,3	3,3	3,3	3,3	3,3	3,3	3,3	3,3	3,3	3,3	3,3	3,3	
1,1	7	3,85	3,85	3,85	3,85	3,85	3,85	3,85	3,85	3,85	3,85	3,85	3,85	3,85	
1,1	8	4,4	4,4	4,4	4,4	4,4	4,4	4,4	4,4	4,4	4,4	4,4	4,4	4,4	
1,1	9	4,95	4,95	4,95	4,95	4,95	4,95	4,95	4,95	4,95	4,95	4,95	4,95	4,95	
1,1	10	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	

## DEFINITE TIME #2

