

Figure 1.  
Kyle® Form 4C microprocessor-based recloser control and personal computer.

931176KM

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## INTRODUCTION

**CAUTION:** Equipment misoperation. Do not connect this control to an energized recloser until all control settings have been properly programmed and verified. Failure to comply can result in control and recloser misoperation, equipment damage, and personal injury.

This guide is designed to assist engineers and qualified technicians with programming of the Form 4C control. These individuals must be familiar with the functions and programming parameters required for specific recloser installations.

This guide contains a listing of all access codes, program settings, and detailed operating descriptions of the code parameters. The codes, settings, and parameter descriptions are also listed on the control information label located inside the cabinet door.

**CAUTION:** Recloser misoperation. The control must be removed from service prior to performing any maintenance or testing. Failure to comply may result in mis-operation (unintentional operation) of the recloser.

## CONTROL SECURITY

The Form 4C control's three-level security system limits personnel access to only those control functions appropriate to their responsibilities. The four-digit security code prohibits unauthorized keyboard access to programming and operating parameters. No programming commands are accepted by the control unless the operator enters the appropriate four-digit security code. Be sure the necessary security codes are available to programming personnel.

Interrogation of the control to display all operating parameters and read-only functions of the control panel does not require entering a security code.

**NOTE:** Turning off the display at the keyboard removes any security code previously entered via the keyboard.

Any security level entered is disabled 10 minutes after keying in the last instruction or interrogation.

During programming, if identical codes are selected for different security levels, the higher security level code is recognized by the control.

### First Level Security

First level security authorizes changes to these operating parameters:

- Minimum trip values
- Number of operations to lockout
- Time-current curves
- Reclose time
- Current-transformer selection
- Supervisory close reset time
- Phase identification
- Feature ON/OFF commands
- Selection of metering integration intervals
- Access to TCC timing groups
- Activation of Sensitive Ground/Earth Fault, High Current Trip, and High Current Lockout
- Event Recorder
- Duty Cycle Monitor

### Second Level Security

The second level allows modification of these parameters:

- Set control identification number
- Close retry time and number of attempts
- Operations counter

### Third Level Security

The third level allows changes to these parameters:

- Security codes for levels 1, 2, and 3
- Line frequency

**IMPORTANT:** These security levels are designed to be accessible only to personnel completely familiar with the operation of these functions. Faulty programming could lead to unintentional control performance.

### Factory Programmed Security Codes

The Form 4C is programmed at the factory with standard security codes for first (1111), second (2222), and third (3333) level security. These codes are changeable to any 4-digit number using the third level security.

## KEYBOARD FUNCTIONS

Prior to interrogation and programming, the operator should be familiar with the control's keyboard. Figure 2 shows each key and its description of operation.

<table border="1"> <tr><td><b>MINIMUM TRIP</b></td></tr> <tr><td><b>1</b></td></tr> </table> <p>Interrogates or programs minimum trip (Phase and Ground)</p> <hr/> <p>"1" numeric value</p>	<b>MINIMUM TRIP</b>	<b>1</b>	<table border="1"> <tr><td><b>TCC 1</b></td></tr> <tr><td><b>2</b></td></tr> </table> <p>Interrogates or programs 1st TCC (Phase and Ground)</p> <hr/> <p>"2" numeric value</p>	<b>TCC 1</b>	<b>2</b>	<table border="1"> <tr><td><b>TCC 2</b></td></tr> <tr><td><b>3</b></td></tr> </table> <p>Interrogates or programs 2nd TCC (Phase and Ground)</p> <hr/> <p>"3" numeric value</p>	<b>TCC 2</b>	<b>3</b>	<table border="1"> <tr><td><b>TARGETS</b></td></tr> <tr><td><b>TARGET COUNTERS</b></td></tr> </table> <p>Displays fault target information.</p> <hr/> <p>Displays cumulative total of fault current trip operations for each phase and ground. (Used with SELECT LOWER FUNCTION key)</p>	<b>TARGETS</b>	<b>TARGET COUNTERS</b>	<table border="1"> <tr><td><b>CURRENT METERING</b></td></tr> </table> <p>Displays Phase and Ground load current and demand meter readings.</p>	<b>CURRENT METERING</b>	<table border="1"> <tr><td><b>DISPLAY ON</b></td></tr> <tr><td><b>OFF</b></td></tr> </table> <p>Turns keyboard and display ON and OFF.</p>	<b>DISPLAY ON</b>	<b>OFF</b>
<b>MINIMUM TRIP</b>																
<b>1</b>																
<b>TCC 1</b>																
<b>2</b>																
<b>TCC 2</b>																
<b>3</b>																
<b>TARGETS</b>																
<b>TARGET COUNTERS</b>																
<b>CURRENT METERING</b>																
<b>DISPLAY ON</b>																
<b>OFF</b>																
<table border="1"> <tr><td><b>OPER 1ST.TCC</b></td></tr> <tr><td><b>4</b></td></tr> </table> <p>Interrogates or programs number of trip operations on 1st TCC (Phase and Ground)</p> <hr/> <p>"4" numeric value</p>	<b>OPER 1ST.TCC</b>	<b>4</b>	<table border="1"> <tr><td><b>OPER. TO L.O.</b></td></tr> <tr><td><b>5</b></td></tr> </table> <p>Interrogates or programs number of operations to lock-out (Phase and Ground)</p> <hr/> <p>"5" numeric value</p>	<b>OPER. TO L.O.</b>	<b>5</b>	<table border="1"> <tr><td><b>RESET TIME</b></td></tr> <tr><td><b>6</b></td></tr> </table> <p>Interrogates or programs reset after successful reclose delay time.</p> <hr/> <p>"6" numeric value</p>	<b>RESET TIME</b>	<b>6</b>	<table border="1"> <tr><td><b>OPER. COUNTER</b></td></tr> <tr><td><b>SEQUENCE POSITION</b></td></tr> </table> <p>Displays total number of control trip operations.</p> <hr/> <p>Displays control operating sequence position. (Used with SELECT LOWER FUNCTION key)</p>	<b>OPER. COUNTER</b>	<b>SEQUENCE POSITION</b>	<table border="1"> <tr><td><b>CODE</b></td></tr> </table> <p>Provides direct entry of access codes</p>	<b>CODE</b>	<table border="1"> <tr><td><b>CLEAR</b></td></tr> </table> <p>Clears pending keyboard entries; resets targets, counters and demand drag hand.</p>	<b>CLEAR</b>	
<b>OPER 1ST.TCC</b>																
<b>4</b>																
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<b>CODE</b>																
<b>CLEAR</b>																
<table border="1"> <tr><td><b>RECLOSE 1</b></td></tr> <tr><td><b>7</b></td></tr> </table> <p>Interrogates or programs reclosing time after 1st trip operation.</p> <hr/> <p>"7" numeric value</p>	<b>RECLOSE 1</b>	<b>7</b>	<table border="1"> <tr><td><b>RECLOSE 2</b></td></tr> <tr><td><b>8</b></td></tr> </table> <p>Interrogates or programs reclosing time after 2nd trip operation.</p> <hr/> <p>"8" numeric value</p>	<b>RECLOSE 2</b>	<b>8</b>	<table border="1"> <tr><td><b>RECLOSE 3</b></td></tr> <tr><td><b>9</b></td></tr> </table> <p>Interrogates or programs reclosing time after 3rd trip operation.</p> <hr/> <p>"9" numeric value</p>	<b>RECLOSE 3</b>	<b>9</b>	<table border="1"> <tr><td><b>SELECT ACCESSORY</b></td></tr> </table> <p>Displays status of individual control features with programmable values.</p>	<b>SELECT ACCESSORY</b>	<table border="1"> <tr><td><b>ACCESSORY SCROLL</b></td></tr> </table> <p>Displays individual parameters of programmable control features and accessories.</p>	<b>ACCESSORY SCROLL</b>	<table border="1"> <tr><td><b>CHANGE</b></td></tr> </table> <p>Initiates change to programmed parameter.</p>	<b>CHANGE</b>		
<b>RECLOSE 1</b>																
<b>7</b>																
<b>RECLOSE 2</b>																
<b>8</b>																
<b>RECLOSE 3</b>																
<b>9</b>																
<b>SELECT ACCESSORY</b>																
<b>ACCESSORY SCROLL</b>																
<b>CHANGE</b>																
<table border="1"> <tr><td><b>PHASE</b></td></tr> <tr><td><b>GROUND</b></td></tr> </table> <p>Toggles between Phase and Ground Display</p>	<b>PHASE</b>	<b>GROUND</b>	<table border="1"> <tr><td><b>DISPLAY TEST</b></td></tr> <tr><td><b>0</b></td></tr> </table> <p>Checks LCD operation by displaying all numeric segments and messages.</p> <hr/> <p>"0" numeric value</p>	<b>DISPLAY TEST</b>	<b>0</b>	<table border="1"> <tr><td><b>SCROLL</b></td></tr> </table> <p>Permits display of the programmed values of most common control operating features.</p>	<b>SCROLL</b>	<table border="1"> <tr><td><b>SELECT LOWER FUNCTION</b></td></tr> </table> <p>Provides access to Target Counters and Sequence Position</p>	<b>SELECT LOWER FUNCTION</b>	<table border="1"> <tr><td><b>ESCAPE</b></td></tr> </table> <p>Escape key ignores recent keystroke and returns to ready (rdY) prompt.</p>	<b>ESCAPE</b>	<table border="1"> <tr><td><b>ENTER</b></td></tr> </table> <p>Enters changed parameter into program.</p>	<b>ENTER</b>			
<b>PHASE</b>																
<b>GROUND</b>																
<b>DISPLAY TEST</b>																
<b>0</b>																
<b>SCROLL</b>																
<b>SELECT LOWER FUNCTION</b>																
<b>ESCAPE</b>																
<b>ENTER</b>																

**Figure 2.**  
**Keyboard Functions.**

## SETTING THE CONTROL CLOCK

(Access Codes 153 -- 156)

The Form 4C control is equipped with a 24 hour notation time clock that records the year, month, day, hour, minute, and seconds of recorded events. The clock begins operation upon connection to the control's ac power or backup power supply.

The clock must be set at the time the control is installed, and reset whenever control power is disconnected. When the control is first energized, the clock default month and day are 1/1, and the year is 2001. The clock must be set prior to programming or interrogation for the recorded events to be logged to the proper day and time.

The clock is used in conjunction with the event recorder and load profile monitor to store events recorded in the control. No security code is required to set the clock or change clock settings.

To set, examine, or change clock settings, refer to Access Codes 153 through 156.

1. Connect the ac supply and the control battery. Four dashes (----) will appear on the LCD display to indicate that the clock needs to be set.
2. From the keyboard, press DISPLAY ON. The Ready (rdY) prompt appears indicating the control is ready for programming.

To set the year:

1. Press the CODE key and the numbers 1-5-3 (for access code 153). Then press ENTER.
2. Press the CHANGE key. Enter the four digits of the current year. Press ENTER.

To set the date:

1. Press the SCROLL key to advance the control to Access Code 154. Code 154 can also be entered manually.
2. Press CHANGE. Enter four digits for the month (01 to 12) and day (01 to 31). Single-digit months and days are preceded by a zero. Press ENTER.

To set hour and minute:

1. Press SCROLL to advance the control to Access Code 155. Code 155 can also be entered manually.
2. Press CHANGE and enter four digits for the hour (01 to 24) and minute (01 to 59). Press ENTER.

To set seconds:

1. Press SCROLL to advance the control to Access Code 156. Code 156 can also be entered manually.
2. Press CHANGE and enter two digits for the seconds (01 to 59) and press ENTER.

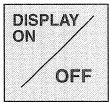
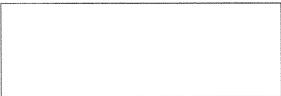
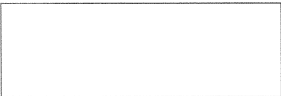


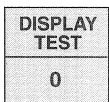
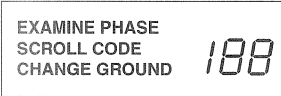
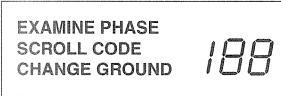


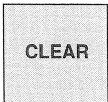
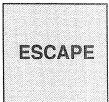




Use the SCROLL key to review the new calendar and clock settings. Press ESCAPE to return to the Ready (rdY) prompt.

## USING THE KEYBOARD

The following example of a Display Test illustrates the use of the keyboard for interrogation. The same basic step-by-step descriptive procedure is used for all keyboard interrogation and program change operations.

Each step of the procedure is numbered, the appropriate key to be pressed is illustrated, and the resulting keyboard display is shown.

### DISPLAY TEST

Step No.	Touch Key	Display Message	Access Code	Complex TCC	Parameter Value
1.					
			CODE		VALUE
2.					
			CODE		VALUE
3.	 OR 				
			CODE		VALUE

## Interrogation of Program Settings

The keyboard of the Form 4C control can be used to interrogate and display all programmed parameter settings. The most commonly used parameters have dedicated function keys.

Use the following procedures for interrogation of control parameters. Be sure the display is ON and the rdY prompt is displayed.

### Interrogation Of Minimum Trip

Step No.	Touch Key	Display Message	Access Code	Complex TCC	Parameter Value		
1.	<table border="1"> <tr><td>MINIMUM TRIP</td></tr> <tr><td>1</td></tr> </table>	MINIMUM TRIP	1	EXAMINE PHASE	01		<i>displays the latest recorded value of the appropriate parameter</i>
MINIMUM TRIP							
1							
			CODE		VALUE		
2.	<table border="1"> <tr><td>PHASE</td></tr> <tr><td>GROUND</td></tr> </table>	PHASE	GROUND	EXAMINE GROUND	01		<i>displays the latest recorded value of the appropriate parameter</i>
PHASE							
GROUND							
			CODE		VALUE		

To interrogate other dedicated control parameters or status information, press any of the function keys, listed below, at Step 1. Repeat Step 2 for any parameter with a phase and ground function. When pressed, the PHASE/GROUND key will alternately display the phase and ground values of the appropriate parameters. (If the PHASE/GROUND key is inadvertently pressed for a parameter without a phase and ground value, the control will ignore the command.)

### Interrogation Of Other Control Parameters

TCC 1	TCC 2	OPER 1ST. TCC	OPER. TO L.O.	RESET TIME	RECLOSE 1
2	3	4	5	6	7
RECLOSE 2	RECLOSE 3	TARGETS	CURRENT METERING	OPER. COUNTER	
8	9	TARGET COUNTERS		SEQUENCE POSITION	

Step No.	Touch Key	Display Message	Access Code	Complex TCC	Parameter Value
3.	ESCAPE				rdY
			CODE		VALUE

## Changing and Verifying Control Program Settings

Before making changes to control parameters, the operator must enter a security code that qualifies him to make changes to control settings.

The security code must be re-entered if the display is turned off (or shuts off automatically after 10 minutes with no further keyboard entry). This feature ensures that the Form 4C control returns to the read-only security access mode, after the programming operator leaves the control.

The control can be programmed via the keyboard, independent of the position of the Supervisory ON/OFF switch.

The Supervisory ON/OFF switch must be ON when programming via the data port or through the digital communications accessory.

The following example illustrates how the control's phase and ground minimum trip levels are changed and verified, using the keyboard. Phase minimum trip is changed from 100 amps to 200 amps. Ground minimum trip is changed from 50 amps to 100 amps.

**Change Phase Minimum Trip Value**

Step No.	Touch Key	Display Message	Display Message Code	Display Reading Value
1.				rdy
2.			CODE	- - -
3.			CODE	- 99
4.			99	- - - -
5.			99	<i>As the security code is entered, the dashes disappear. The security code will not appear in the display.</i>
6.				rdy
7.		EXAMINE PHASE	01	100
8.		PHASE CHANGE	01	- - - -
9.		PHASE CHANGE	01	- 200
10.		EXAMINE PHASE	01	200

Change Ground Minimum Trip Value

Step No.	Touch Key	Display Message	Access Code	Complex TCC	Parameter Value
11.	PHASE GROUND	EXAMINE GROUND	01 CODE		50 VALUE
12.	CHANGE	CHANGE GROUND	01 CODE		--- VALUE
13.	ENTER NEW VALUE	CHANGE GROUND	01 CODE		100 VALUE
14.	ENTER	EXAMINE GROUND	01 CODE		100 VALUE

To change the other control parameters, press any of the following keys after step 6. Repeat Steps 11 through 14 for any parameter with a phase and ground function. When pressed, the PHASE/GROUND key will alternately display the phase and ground values of the appropriate parameters. (If the PHASE/GROUND key is inadvertently pressed for a parameter without a phase and ground value, the control will ignore the command.)

TCC 1 2	TCC 2 3	OPER 1ST. TCC 4	OPER. TO L.O. 5
RESET TIME 6	RECLOSE 1 7	RECLOSE 2 8	RECLOSE 3 9

## Changing Control Settings Using Access Codes

Use the following procedure to interrogate or change any control settings of parameters without dedicated keys. Refer to Table 1 or to the control information label located inside the cabinet door to locate the desired parameter and appropriate access code. Enter the desired access code at Step 8.

### CHANGE ALTERNATE PHASE MINIMUM TRIP VALUE:

(Steps 2 through 6 are required to enter security code. If already in security, omit steps 2 through 6.)

Alternate phase minimum trip is changed from 120 amps to 240 amps.

Alternate ground minimum trip is changed from 60 amps to 120 amps.

Step No.	Touch Key	Display Message	Access Code	Complex TCC	Parameter Value
1.				rdy	rdy
2.		CODE	CODE	---	---
3.		CODE	CODE	-99	-99
4.			99	---	---
5.			99	<i>As the security code is entered, the dashes disappear. The security code will not appear in the display.</i>	
6.				rdy	rdy
7.		CODE	CODE	---	---
8.		CODE	CODE	-11	-11
9.		EXAMINE PHASE	11	120	120

Step No.	Touch Key	Display Message	Access Code	Complex TCC	Parameter Value
10.	CHANGE	PHASE CHANGE	11 CODE		---
11.	ENTER NEW VALUE	PHASE CHANGE	11 CODE		240
12.	ENTER	EXAMINE PHASE	11 CODE		240
13.	PHASE GROUND	EXAMINE GROUND	11 CODE		60
14.	CHANGE	CHANGE GROUND	11 CODE		---
15.	ENTER NEW VALUE	CHANGE GROUND	11 CODE		120
16.	ENTER	EXAMINE GROUND	11 CODE		120

### Control Interrogation Using The SCROLL Key

The SCROLL key provides parameters and status of the following access codes in numerical sequence; offering the convenience of obtaining basic parameter and control status information without selecting individual access codes. The code groups are:

- Basic programming settings (Codes 01 through 09)
- Alternate minimum trip (Code 11)
- Supervisory close reset time (Code 12)
- Features ON/OFF (Codes 20 through 26)

In the *Access Code Description* section of this manual, a YES in the Scroll column indicates that the SCROLL key can be used for interrogation; a NO indicates that the scroll function is not accessible.

### Control Interrogation Using The SELECT ACCESSORY Key

The SELECT ACCESSORY key provides ON/OFF status information of enhanced features:

- Complex TCC Setup (Codes 100 and 110)
- Sensitive Ground/Earth Fault (Code 120)
- High Current Trip (Code 130)
- High Current Lockout (Code 140)

This allows the operator a quick overview of modifications to the control parameters without individual code selection.

### Control Interrogation Using The ACCESSORY SCROLL Key

Some features on the Form 4C control contain multiple settings. These features are:

- Complex TCC1 Code 100 through 104
- Complex TCC2 Setup Code 110 through 114
- Sensitive Ground/Earth Fault Code 120 through 124
- High Current Trip Code 130 through 134
- High Current Lockout Code 140 through 143

The ACCESSORY SCROLL key provides the specific parameters of the features obtained with the SELECT ACCESSORY key.

## DOWNLOADING TO A DATA READER

The Data Reader (Figure 2) can be used with the Cooper Power Systems Form 4C recloser control and CL-4C regulator controls. Data gathered from recloser and regulator controls is stored in the Data Reader for later downloading into a personal computer for system analysis. A single Data Reader can collect and store data from 20 Form 4C controls or 100 regulator controls, or any equivalent combination of readings from the two types of controls. The Form 4C control is compatible with Data Reader Software Version 3.1 or above.

To operate the Data Reader:

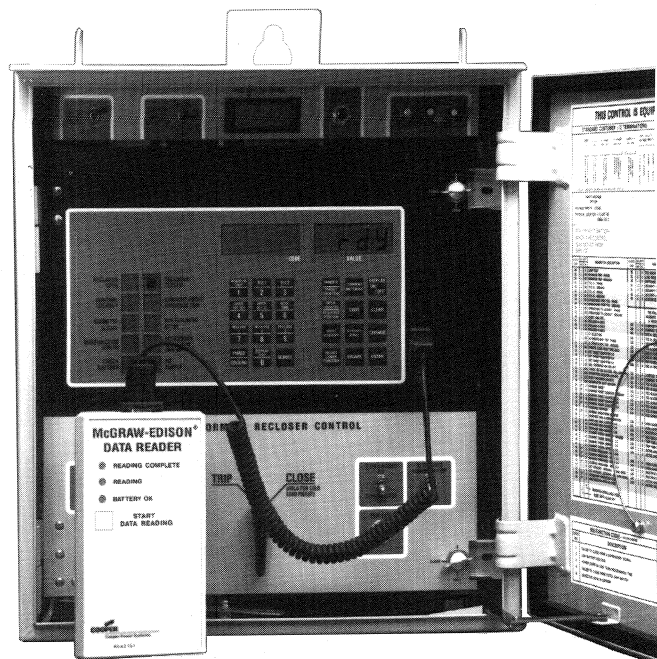
1. Connect the Data Reader to the data port (Figure 2).
2. Press and hold the START DATA READING button. All three LED lights will illuminate.
3. When the READING and READING COMPLETE lights go out., release the START DATA READING button. The BATTERY OK light will remain illuminated.

The READING light will illuminate and remain on while the data reader obtains data from the control.

When the data has been recorded, the READING COMPLETE light will illuminate.

4. Disconnect the Data Reader from the data port.

For additional information on the operation of the Data Reader, refer to *Service Information S225-10-7*.



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**Figure 2.**  
Data Reader plugs into data port on the Form 4C Control Panel.

## CONTROL INTERFACE SOFTWARE PROGRAM

An optional Form 4C INTERFACE™ software program is available to enable the control to be programmed and operated with a personal computer. It is used to send and receive data from the control and to provide access to the Data Reader's data files.

Form 4C INTERFACE software permits complete uploading and downloading of all data stored in the control. It includes a database manager that allows the operator to import, export, or delete data, such as control settings and data records from the database.

The software enables the user to print various reports and provides organized menus of data including:

- all control programming parameters
- event recorder information
- load profile records
- demand metering records
- duty cycle monitor data

The software also allows the user to operate the control directly. Form 4C controls with the Sensitive Ground/Earth Fault feature must use KSPS2 software version 2.0 or later.

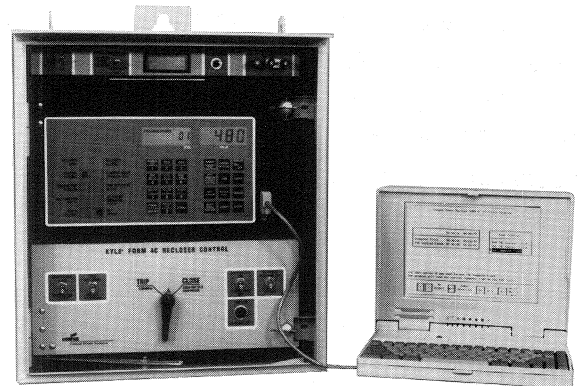
The Form 4C INTERFACE program (catalog number KSPS2) can be used on any IBM PC (XT, AT, PS/2)® or fully compatible computer with at least 640K of RAM memory.

## CONTROL OPERATION WITH A PERSONAL COMPUTER

A Data Port-to-Computer Interface Cable is available to permit connection of a personal computer to the data port on the front panel of the Form 4C control. The interface cable consists of an EIA232-connector on one end and a data port 9-pin connector on the other end.

The cable includes an adapter that converts low power Form 4C control data-port signals to an EIA232 interface. This will connect directly to personal computers with a 25-pin serial port and allows downloading of data from the control into the computer (Figure 3).

The personal computer can also be used to upload all control parameter settings into the control for convenient programming. The complete set of control operating parameters can be programmed and verified at the headquarters location or installation site. Programming data for each control is stored in the computer and can be printed out and archived for future reference. A printout of each control's program settings can also be kept at the installation site for reference during future inspections.



**Figure 3.**  
The Form 4C Control can be programmed directly from a personal computer.

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## ACCESS CODES AND PARAMETERS

Table 1 is a list of the Access Codes and their functions for the Form 4C control. A detailed list of program settings, parameter descriptions, and keyboard access codes follows this listing. Access codes and parameter descriptions can also be found on the control information label located inside the cabinet door.

\* **NOTE:** Programming of these access codes is required for basic control operation.

**Table 1**  
**Form 4C Control Program Access Codes and functions.**

ACCESS CODE	PARAMETER	ACCESS CODE	PARAMETER
<b>PROGRAMMING</b>		<b>OPERATIONS COUNTER</b>	
* 01	Minimum Trip - Phase and Ground	39	Operations Counter
* 02	TCC1 - Phase and Ground	<b>METERING</b>	
* 03	TCC2 - Phase and Ground	40	Instantaneous Current - Ground
* 04	TCC1 Operations - Phase and Ground	41	Instantaneous Current - Phase 1-2
* 05	Operations to Lockout - Phase and Ground	42	Instantaneous Current - Phase 3-4
* 06	Reset Time	43	Instantaneous Current - Phase 5-6
* 07	Reclose #1	44	Demand Current- Ground
* 08	Reclose #2	45	Demand Current- Phase 1-2
* 09	Reclose #3	46	Demand Current- Phase 3-4
* 10	CT Selection	47	Demand Current- Phase 5-6
* 11	Alternate Minimum Trip - Phase and Ground	48	Maximum Demand Current - Ground
12	Supervisory Close Reset Time	49	Maximum Demand Current - Phase 1-2
<b>PHASE IDENTIFICATION</b>		50	Maximum Demand Current- Phase 3-4
17	Bushings 1-2 Phase Identifier	51	Maximum Demand Current - Phase 5-6
18	Bushings 3-4 Phase Identifier	57	Select Integration Intervals - Phase and Ground
19	Bushings 5-6 Phase Identifier	<b>STATUS CODES</b>	
<b>FEATURE ON/OFF</b>		65	Accessory Status Code
20	Sequence Coordination	67	Alternate Minimum Trip Status
21	Target Reset After Successful Reclose	<b>MALFUNCTION CODES</b>	
22	Operations Counter	66	Malfunction Status Code
23	Event Recorder	<b>TCC GROUP</b>	
* 24	Recloser Duty Monitor	* 70	TCC Group
25	Ground Trip Precedence	<b>LINE FREQUENCY</b>	
26	Supervisory Via Momentary Contact	* 71	Line Frequency
<b>TARGETS</b>		<b>SOFTWARE VERSION/CONTROL ID</b>	
30	Target Status/Reset	72	CPU Software Version Number
32	Target Counter - Ground	76	Control Identification Number
33	Target Counter - Phase 1-2	78	Display/Communication Software Version Number
34	Target Counter - Phase 3-4	<b>CLOSE/RETRY</b>	
35	Target Counter - Phase 5-6	74	Close Retry Time
36	Target Counter - Sensitive Ground Fault	79	Number of Close Retry Attempts
<b>SEQUENCE POSITION</b>			
38	Sequence Position		

**Table 1 (cont'd)**  
**Form 4C Control Access Codes and functions.**

ACCESS CODE	PARAMETER	ACCESS CODE	PARAMETER
<b>DIGITAL COMMUNICATIONS</b>		<b>HIGH CURRENT LOCKOUT</b>	
80	Data Port Baud Rate Code	140	High Current Lockout - Phase (ON/OFF)
81	Real-Time Digital Communications Port Baud Rate Code	141	High Current Lockout - Ground (ON/OFF)
82	Control Communications Address	142	High Current Lockout (Multiple of Minimum Trip) - Phase and Ground
83	Real-Time Digital Communications Port Handshake Mode Code	143	High Current Lockout (Active Shot Number) - Phase and Ground
84	Number of Line-Sync Characters		
85	Real-Time Communications Port Transmit Enable Delay		
<b>SECURITY CODES</b>		<b>CLOCK</b>	
90	Security Code for Level 1	* 153	Time Clock - Year
91	Security Code for Level 2	* 154	Time Clock - Month and Day
93	Security Code for Level 3	* 155	Time Clock - Hour and Minute
99	Enter System Security	* 156	Time Clock - Second
<b>TIME-CURRENT CURVE MODIFIERS</b>		<b>EVENT RECORDER</b>	
100	Complex TCC1 (ON/OFF) - Phase and Ground	160	Number of Events Since Last Reset
101	TCC1 Selection - Phase and Ground	161	Event Number
102	TCC1 Constant Time Adder - Phase and Ground	162	Event Type
103	TCC1 Multiplier Value - Phase and Ground	163	Month and Day
104	TCC1 Minimum Response Time - Phase and Ground	164	Hour and Minute
110	Complex TCC2 (ON/OFF) - Phase and Ground	165	Second
111	TCC2 Selection - Phase and Ground	166	Ground Current
112	TCC2 Constant Time Adder - Phase and Ground	167	Phase 1-2 Current
113	TCC2 Multiplier Value - Phase and Ground	168	Phase 3-4 Current
114	TCC2 Minimum Response Time - Phase and Ground	169	Phase 5-6 Current
<b>SENSITIVE GROUND/EARTH FAULT</b>		<b>DUTY CYCLE MONITOR</b>	
120	Sensitive Ground/Earth Fault (ON/OFF)	* 170	100% Duty Factor
121	Percent of Ground Minimum Trip	171	Phase 1-2 Duty Cycle
122	Percent of Alternate Ground Minimum Trip	172	Phase 3-4 Duty Cycle
123	Sensitive Ground/Earth Trip Time	173	Phase 5-6 Duty Cycle
124	Operations to Lockout		
<b>HIGH CURRENT TRIP</b>		<b>LOAD PROFILE MONITOR</b>	
130	High Current Trip - Phase (ON/OFF)	180	Reading Number
131	High Current Trip - Ground (ON/OFF)	181	Time - Hour and Minute
132	High Current Trip (Multiple of Minimum Trip) - Phase and Ground	182	Ground Current
133	High Current Trip (Trip Time Delay) - Phase and Ground	183	Phase 1-2 Current
134	High Current Trip (Active Shot Number) - Phase and Ground	184	Phase 3-4 Current
		185	Phase 5-6 Current

## Access Code Descriptions

Access codes, parameter descriptions and security levels used in programming the Form 4C control are listed in this section of the programming guide. The high and low limits and increments of the code parameter values are also specified.

The control is furnished with indicated factory settings. These settings are not recommended for customer use. The control must be programmed with applicable settings prior to installation.

## Programming

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
01	1	0	YES	1600	50	1	Minimum Trip - Phase	100
01	1	0	YES	800	5	1	Minimum Trip - Ground	50

- Minimum trip is a threshold value at which a system overcurrent is detected.
- Minimum Trip is set for both phase and ground through a range of settings based on the recloser's CT ratio.  
**CT ratio 500:1** allows a range from 25 to 800 Amps phase and 2 to 400 Amps ground.  
**CT ratio 1000:1** allows a range from 50 to 1600 Amps phase and 5 to 800 Amps ground.  
**CT ratio 2000:1** allows a range from 100 to 2400 Amps phase and 10 to 1600 Amps ground.

- All values are adjusted in increments of one.
- The control accepts only the values within the limits preset in the control. Attempts to enter other values results in an LO/HI message.
- Use the PHASE/GROUND key to select phase and ground.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
02	1	0	YES	--	--	--	TCC1 - Phase	104
02	1	0	YES	--	--	--	TCC1 - Ground	106

- TCC is an abbreviation for time-current curve. A TCC is used as a protective response to initiate a trip signal when the minimum trip value (phase or ground) is exceeded.
- Identifies the programmed TCC1 - phase and ground curves selected from the TCC timing groups of the Form 4C control. (Reference Access Code 70). In most situations, TCC1 is designated as the fast curve.
- Time-current characteristics for TCC1 - phase are independent of time-current characteristics for TCC1 ground.

- Time-current characteristics of TCC1 - phase and ground are independent of time-current characteristics of TCC2 - phase and ground).
- When TCC characteristics are modified, the control readout indicates a modified curve by prefixing the TCC number with a lower-case "c" (Access codes 100-114).

**Programming (cont'd)**

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>03</b>	<b>1</b>	<b>0</b>	<b>YES</b>	--	--	--	<b>TCC2 - Phase</b>	<b>117</b>
<b>03</b>	<b>1</b>	<b>0</b>	<b>YES</b>	--	--	--	<b>TCC2 - Ground</b>	<b>135</b>
<ul style="list-style-type: none"> <li>TCC is an abbreviation for time-current curve. A TCC is used as a protective response to initiate a trip signal when the minimum trip value (phase or ground) is exceeded.</li> <li>Identifies the programmed TCC2 - phase and ground curves selected from the TCC timing groups of the Form 4C control. (Reference Access Code 70). In most situations, TCC2 is designated as the slow or delayed curve.</li> <li>Time-current characteristics for TCC2 - phase are independent of time-current characteristics for TCC2 ground.</li> <li>Time-current characteristics of TCC2 - phase and ground are independent of time-current characteristics of TCC1 - phase and ground.</li> <li>When TCC characteristics are modified, the control readout indicates a modified curve by prefixing the TCC number with a lower-case "c" (Access Codes 100-114).</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>04</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>4</b>	<b>0</b>	<b>1</b>	<b>Operations on TCC1 - Phase</b>	<b>2</b>
<b>04</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>4</b>	<b>0</b>	<b>1</b>	<b>Operations on TCC1 - Ground</b>	<b>2</b>
<ul style="list-style-type: none"> <li>Selection of zero to four trip operations on TCC1.</li> <li>Time-current characteristics for phase are independent of TCC characteristics for ground. The number of phase and ground TCC1 operations do not have to match.</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>05</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>4</b>	<b>1</b>	<b>1</b>	<b>Operations to Lockout - Phase</b>	<b>4</b>
<b>05</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>4</b>	<b>1</b>	<b>1</b>	<b>Operations to Lockout - Ground</b>	<b>4</b>
<ul style="list-style-type: none"> <li>Lockout is a control state with no further automatic recloses.</li> <li>Selection of one to four trip operations before the control locks out.</li> <li>The number of operations to lockout for phase and ground do not have to match.</li> <li>Use PHASE/GROUND key to select phase or ground.</li> </ul>								

### Programming (cont'd)

		Security			Limits				
Access Code	Write	Read	Scroll	High	Low	Incr	Parameter	Factory Settings	
<b>06</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>180</b>	<b>3</b>	<b>1</b>	<b>Reset Time (seconds)</b>	<b>30</b>	
<ul style="list-style-type: none"> <li>Reset timing begins after a successful reclose operation.</li> <li>Successful reclose is determined when the recloser is closed and the current sensed is below the minimum trip values (phase and ground).</li> </ul>									
		Security			Limits				
Access Code	Write	Read	Scroll	High	Low	Incr	Parameter	Factory Settings	
<b>07</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>45.0</b>	<b>0.3</b>	<b>0.1</b>	<b>Reclose #1 (seconds)</b>	<b>2</b>	
<ul style="list-style-type: none"> <li>Reclose#1 is the open time duration after the first trip operation prior to automatic reclosing.</li> <li>Selects the reclose interval after the first trip operation.</li> </ul>									
		Security			Limits				
Access Code	Write	Read	Scroll	High	Low	Incr	Parameter	Factory Settings	
<b>08</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>45.0</b>	<b>1.8</b>	<b>0.1</b>	<b>Reclose #2 (seconds)</b>	<b>2</b>	
<ul style="list-style-type: none"> <li>Reclose#2 is the open time duration after the second trip operation prior to automatic reclosing.</li> <li>Selects the reclose interval after the second trip operation.</li> </ul>									
		Security			Limits				
Access Code	Write	Read	Scroll	High	Low	Incr	Parameter	Factory Settings	
<b>09</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>45.0</b>	<b>1.8</b>	<b>0.1</b>	<b>Reclose #3 (seconds)</b>	<b>5</b>	
<ul style="list-style-type: none"> <li>Reclose#3 is the open time duration after the third trip operation prior to automatic reclosing.</li> <li>Selects the reclose interval after the third trip operation.</li> </ul>									
<p><b>Figure A.</b>  <b>Typical four trips to lockout operation. Fault current initiated with recloser closed.</b></p>									

**Programming (cont'd)**

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>10</b>	<b>1</b>	<b>0</b>	<b>NO</b>	<b>2000</b>	<b>500</b>	<b>--</b>	<b>CT Selection</b>	<b>1000</b>
<ul style="list-style-type: none"> <li>Programs the control to operate with a recloser current transformer ratio of 500:1, 1000:1, or 2000:1.</li> <li>Select 500 / 1000 / 2000 using the CHANGE key.</li> <li>Verify recloser current transformer ratio matches programmed setting.</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>11</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>1600</b>	<b>50</b>	<b>1</b>	<b>Alternate Minimum Trip (Amps) - Phase</b>	<b>120</b>
<b>11</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>800</b>	<b>5</b>	<b>1</b>	<b>Alternate Minimum Trip (Amps) - Ground</b>	<b>60</b>
<ul style="list-style-type: none"> <li>Sets an alternate minimum trip value for both phase and ground through a range of settings based on programmed CT selection (Access Code 10).  <b>CT ratio 500:1</b> allows a range from 25 to 800 Amps phase and 2 to 400 Amps ground.  <b>CT ratio 1000:1</b> allows a range from 50 to 1600 Amps phase and 5 to 800 Amps ground.  <b>CT ratio 2000:1</b> allows a range from 100 to 2400 Amps phase and 10 to 1600 Amps ground.</li> <li>Alternate Minimum Trip is turned on and off via the ALTERNATE MINIMUM TRIP switch on the front panel.</li> <li>Alternate Minimum Trip is available using the ALTERNATE MINIMUM TRIP front panel switch or through supervisory control.</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>12</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>60</b>	<b>0</b>	<b>1</b>	<b>Supervisory Close Reset Time (seconds)</b>	<b>30</b>
<ul style="list-style-type: none"> <li>Programs the time interval during which the control is set for one trip to lockout on TCC2. This occurs following a supervisory close signal (discrete SCADA or digital communications).</li> <li>If programmed for zero seconds, the control performs the normal programmed sequence.</li> <li>At the end of this time interval, the control returns to its normal programmed sequence.</li> </ul>								

## Phase Identification

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
17	1	0	NO	--	--	--	Bushings 1-2 Phase Identifier	A
18	1	0	NO	--	--	--	Bushings 3-4 Phase Identifier	B
19	1	0	NO	--	--	--	Bushings 5-6 Phase Identifier	C
<ul style="list-style-type: none"> <li>Select phase target identification as A, B, C, or 1, 2, 3 using the CHANGE key.</li> <li>Targets are examined via Access Code 30.</li> </ul>								

## Feature ON/OFF

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
20	1	0	YES	--	--	--	Sequence Coordination (ON/OFF)	ON
<ul style="list-style-type: none"> <li>Select Sequence Coordination ON and OFF using the CHANGE key.</li> <li>Sequence Coordination automatically advances the control sequence one step if both of the following conditions are met:                             <ol style="list-style-type: none"> <li>Line current exceeds the programmed minimum trip value for a time duration shorter than the programmed control response time. No trip signal is issued.</li> <li>The control is programmed for at least one operation on TCC1.</li> </ol> </li> <li>Sequence Coordination will not advance the control for those operations programmed for TCC2.</li> <li>The Sequence Coordination feature operates for both phase and ground faults; however, its program of advancing the sequence position is controlled only by the setting of Phase TCC1. If the control is programmed for all operations on TCC1, the sequence coordination feature is not operative on the last operation. The feature will not advance the control if advancing produces lockout.</li> <li>If non-reclosing is activated, the Sequence Coordination feature is disabled.</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
21	1	0	YES	--	--	--	Target Reset After Successful Reclose (ON/OFF)	ON
<ul style="list-style-type: none"> <li>Select the Target Reset feature ON and OFF via the CHANGE key.</li> <li>Fault targets may be reset automatically after a successful reclose (see Access Code 06) or manually reset via the CLEAR key.</li> <li>With the feature ON, targets are displayed only when the control is in the lockout position.</li> <li>With the feature OFF, targets are displayed only after the control has initiated a trip signal independent of any reclosing.</li> </ul>								

**Features ON/OFF (cont'd)**

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>22</b>	<b>1</b>	<b>0</b>	<b>YES</b>	--	--	--	<b>Operations Counter (ON/OFF)</b>	<b>ON</b>
<ul style="list-style-type: none"> <li>• With the feature ON, the total number of control trip operations is recorded.</li> <li>• Select Operations Counter ON or OFF using the CHANGE key.</li> <li>• Control trip operations are initiated via manual operation of the pistol-grip switch on the front panel or through automatic or supervisory operation (Access Code 39).</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>23</b>	<b>1</b>	<b>0</b>	<b>YES</b>	--	--	--	<b>Event Recorder (ON/OFF)</b>	<b>ON</b>
<ul style="list-style-type: none"> <li>• With the feature ON, the event recorder records event history information of up to 50 events, including time, date, and current levels on all three phases and ground (Access Codes 160 through 169).</li> <li>• Select Event Recorder ON or OFF using the CHANGE key.</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>24</b>	<b>1</b>	<b>0</b>	<b>YES</b>	--	--	--	<b>Recloser Duty Monitor (ON/OFF)</b>	<b>ON</b>
<ul style="list-style-type: none"> <li>• With feature ON, the recloser duty is recorded for each individual phase (Access Codes 170 through 173).</li> <li>• Select Recloser Duty Monitor ON or OFF using the CHANGE key.</li> </ul>								

### Features ON/OFF (cont'd)

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
25	1	0	YES	--	--	--	Ground Trip Precedence (ON/OFF)	ON

- **Ground Trip Precedence ON:** For all faults above the programmed ground minimum trip level, the number of operations to lockout equals the programmed number of ground operations to lockout.
- Select Ground Trip Precedence ON or OFF using the CHANGE key.

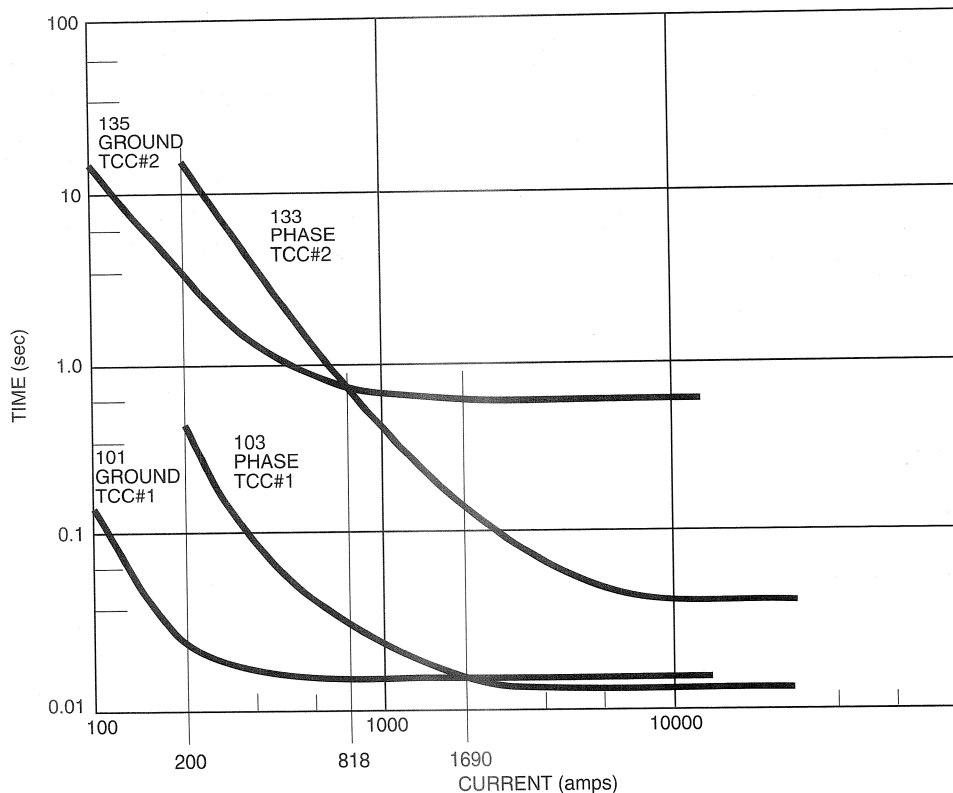
- **Ground Trip Precedence OFF:** For all faults between the programmed ground minimum trip level and the programmed phase minimum trip level, the number of operations to lockout equals the programmed number of ground operations to lockout. For all faults above the programmed phase minimum trip level, the number of operations to lockout equals the programmed number of phase operations to lockout.

**Sample application utilizing the Ground Trip Precedence feature. The table and curves reference the following settings.**

- Minimum Trip - Phase (Access Code 01P) .....200A
- Minimum Trip - Ground (Access Code 01G) .....100A
- TCC1 - Phase (Access Code 02P).....103
- TCC1 - Ground (Access Code 02G) .....101
- TCC2 - Phase (Access Code 03P).....133
- TCC2 - Ground (Access Code 03G) .....135
- Operations on TCC1 - Phase (Access Code 04P) .....2
- Operations on TCC1 - Ground (Access Code 04G) ....1
- Operations to Lockout - Phase (Access Code 05P) ....4
- Operations to Lockout - Ground (Access Code 05G)..2

**Trip sequence to lockout for a ground fault.**

Fault Current Level	Ground Trip Precedence ON	Ground Trip Precedence OFF
100 - 200A	101, 135	101, 135
200 - 818A	101, 103	101, 103, 135, 135
818 - 1690A	101, 103	101, 103, 133, 133
1690A and above	103, 103	103, 103, 133, 133



**Features ON/OFF (cont'd)**

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>26</b>	<b>1</b>	<b>0</b>	<b>YES</b>	--	--	--	<b>Supervisory Via Momentary Contact (ON/OFF)</b>	<b>OFF</b>
<ul style="list-style-type: none"> <li>With feature ON, supervisory operation is provided with a momentary-pulse contact instead of a maintained contact. If maintained contacts are used with the feature ON, the maintained contacts must be pulsed to obtain the appropriate supervisory function.</li> <li>Select Supervisory Via Momentary Contact ON/OFF using the CHANGE key.</li> </ul>								

**Targets**

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>30</b>	<b>Reset 0</b>	<b>0</b>	<b>NO</b>	--	--	--	<b>Examine Targets</b>	--
<b>32</b>	<b>Reset 0</b>	<b>0</b>	<b>NO</b>	--	--	--	<b>Examine Target Counter - Ground</b>	--
<b>33</b>	<b>Reset 0</b>	<b>0</b>	<b>NO</b>	--	--	--	<b>Examine Target Counter - Phase 1-2</b>	--
<b>34</b>	<b>Reset 0</b>	<b>0</b>	<b>NO</b>	--	--	--	<b>Examine Target Counter - Phase 3-4</b>	--
<b>35</b>	<b>Reset 0</b>	<b>0</b>	<b>NO</b>	--	--	--	<b>Examine Target Counter - Phase 5-6</b>	--
<b>36</b>	<b>Reset 0</b>	<b>0</b>	<b>NO</b>	--	--	--	<b>Examine Target Counter - Sensitive Ground/Earth Fault</b>	--
<ul style="list-style-type: none"> <li>Targets indicate which phase(s)/ground was above minimum trip when tripping occurred.</li> <li>Press the TARGET key to display the faulted phase(s)/ground.</li> <li>Pressing the TARGET COUNTER key the first time displays the cumulative number of ground trip operations. Continuous scrolling with the TARGET COUNTER key advances the display to show the cumulative number of trip operations for each phase and Sensitive Ground/Earth Fault.</li> <li>When the Sensitive Ground/Earth Fault feature is ON, the Target Display is altered to distinguish between sensitive ground/earth fault trips and normal ground fault trips. The ground fault portions of the display shows an "E" for sensitive earth fault operation and "G" for normal ground fault operation.</li> <li>Reset with CLEAR key.</li> </ul>								

**Sequence Position**

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>38</b>	--	<b>0</b>	<b>NO</b>	--	--	--	<b>Sequence Position</b>	--
<ul style="list-style-type: none"> <li>Sequence position is used to verify proper sequencing of the control.</li> <li>Displays a readout of the control position in the operations-to-lockout sequence.</li> <li>Accessible from the keyboard with the SELECT LOWER FUNCTION and SEQUENCE POSITION key.</li> </ul>								

## Operations Counter

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>39</b>	<b>Reset 2</b>	<b>0</b>	<b>NO</b>	--	--	--	<b>Operations Counter</b>	--
<ul style="list-style-type: none"> <li>This key displays the total number of control trip operations.</li> <li>Accessible from the keyboard with OPERATIONS COUNTER key.</li> <li>Reset with CLEAR key.</li> <li>Control trip operations are initiated via manual operation of the pistol-grip switch on the front panel or through automatic or supervisory operation.</li> </ul>								

## Metering

Using standard sensing current transformers mounted within Kyle electronically-controlled reclosers, current metering data is shown on the control panel LCD display, eliminating the need for separate meters and bushing current transformers.

Current metering in the Form 4C control monitors (in RMS Amps):

- Instantaneous current values.
- Phase demand current values integrated over a programmable time interval of 5 to 15 minutes.
- Ground demand current values integrated over a programmable time interval of 1 to 5 minutes.
- Maximum demand current (drag-hand function) values for phase and ground.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>40</b>	--	<b>0</b>	<b>NO</b>	--	--	--	<b>Instantaneous Current - Ground</b>	--
<b>41</b>	--	<b>0</b>	<b>NO</b>	--	--	--	<b>Instantaneous Current - Phase 1-2</b>	--
<b>42</b>	--	<b>0</b>	<b>NO</b>	--	--	--	<b>Instantaneous Current - Phase 3-4</b>	--
<b>43</b>	--	<b>0</b>	<b>NO</b>	--	--	--	<b>Instantaneous Current - Phase 5-6</b>	--
<ul style="list-style-type: none"> <li>Indicates the instantaneous line currents for all phases and ground.</li> <li>After interrogating any of these four access codes, use the CURRENT METERING key to scroll to the other current parameters.</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>44</b>	--	<b>0</b>	<b>NO</b>	--	--	--	<b>Demand Current- Ground (Amps)</b>	--
<b>45</b>	--	<b>0</b>	<b>NO</b>	--	--	--	<b>Demand Current- Phase 1-2</b>	--
<b>46</b>	--	<b>0</b>	<b>NO</b>	--	--	--	<b>Demand Current- Phase 3-4</b>	--
<b>47</b>	--	<b>0</b>	<b>NO</b>	--	--	--	<b>Demand Current- Phase 5-6</b>	--
<ul style="list-style-type: none"> <li>Indicates the demand currents for all phases and ground.</li> </ul>								

**Metering (cont'd)**

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
48	Reset 0	0	NO	--	--	--	Maximum Demand Current - Gnd (Amps)	--
49	Reset 0	0	NO	--	--	--	Maximum Demand Current - Phase 1-2	--
50	Reset 0	0	NO	--	--	--	Maximum Demand Current - Phase 3-4	--
51	Reset 0	0	NO	--	--	--	Maximum Demand Current - Phase 5-6	--

- Indicates the maximum demand current for all phases and ground.
- Reset with CLEAR key.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
57	1	0	NO	15	5	--	Select Integration Interval - Phase (5 to 15 minutes)	5
57	1	0	NO	5	1	--	Select Integration Interval - Ground (1 to 5 minutes)	1

- Changes integration time value of demand metering.
- Use PHASE/GROUND key to select phase or ground integration intervals.
- Select Integration Interval using the CHANGE key.

**Status Codes**

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
65	Reset 0	0	NO	--	--	--	<b>Accessory Status Codes</b> 1 - High Current Lockout 2 - Remote Trip and Lockout 3 - Supervisory Trip and Lockout	--

- Identifies the specific operation as indicated by the Accessory Operation LCD indicator on the control panel.
- Reset with CLEAR key.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
67	--	0	NO	--	--	--	Alternate Minimum Trip Status	--

- Indicates ON or OFF status of Alternate Minimum Trip.
- Alternate Minimum Trip can be selected either by the front panel ALTERNATE MINIMUM TRIP switch, or from supervisory control.

## Malfunction Code

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>66</b>	<b>Reset 0</b>	<b>0</b>	<b>NO</b>	--	--	--	<b>Malfunction Status</b> 1 - Failure to close from a supervisory signal 2 - Low or high battery voltage 3 - Power down in less than 48 hours on battery power 4 - Failed to close from the manual control switch 5 - Internal diagnostic alarm	--
<ul style="list-style-type: none"> <li>Identifies the specific malfunction as indicated by the Malfunction LCD indicator on the control panel.</li> </ul>				<ul style="list-style-type: none"> <li>Reset with CLEAR key.</li> </ul>				

## TCC Group

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>70</b>	<b>1</b>	<b>0</b>	<b>NO</b>	<b>4</b>	<b>1</b>	<b>1</b>	<b>TCC Group</b>	<b>1</b>

- Selects any one of four time-current-curve groups.
  - TCC's in only one timing group are available for programming at a time.
  - Select TCC group using the CHANGE key.
  - Display will shut off after a TCC group change.
- The table below lists the TCC's for the Form 4C control and provides a cross-reference to the Form 3A control equivalents. The curves are arranged in four keyboard-

accessible timing groups. Each timing group contains a selection of 21 TCC's.

Curves 200, 201, and 202 in timing group 4 match IEC curves normally described as inverse, very inverse, and extremely inverse respectively. Time-current curves can also be selected and programmed via the data port or remotely through the digital communications accessory.

Form 4C Timing Group†				Form 3A Time-Current Curves	
1	2	3	4	Ground MEA216	Phase MEA217
101	101	101	101		A
102	102	102	102	1	
111	111	111	111	8	
135	135	135	135	2	
105	105	105	105		R
117	117	117	117		B
133	133	133	133		C
140	140	140	140	3	
116	116	116	116		D
132	132	132	132		E
104	104	104	104		N
142				13	
162					K
165				K	
106	106	106	106	4	
141			141	11	
131			131	9	
114			114	5	
136			136	6	
119			119	14	

Form 4C Timing Group†				Form 3A Time Current Curves	
1	2	3	4	Ground MEA216	Phase MEA217
138	138		138		W
	164				J
	118				M
	113			8	
	161				T
	152			7	
	163				F
	112			15	
	107				L
		103		17	
		115			P
		121			G
		122			H
		151		18	
		139		16	
		137			V
		134			Z
		120			Y
			200		
			201		
			202		

† All curves in groups are interchangeable for phase and ground.

**Line Frequency**

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
71	3	0	NO	60	50	10	Line Frequency	60
<ul style="list-style-type: none"> <li>Change the operating frequency from 50 to 60 Hz</li> <li>Select Line Frequency (50/60) using the CHANGE key.</li> </ul>								

**Software Version / Control Identification**

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
72	--	0	NO	--	--	--	CPU Software Version Number	X.YY*
<p>* X represents the latest version of the CPU software: .YY represents the protocol used. EXAMPLE: X.04 represents CPU software with Protocol 2200. X.05 represents CPU software with Protocol 2179.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> <p><b>IMPORTANT:</b> The version number suffix of the CPU and the Display software must be identical.</p> </div>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
76	2	0	NO	9999	0	--	Control Identification Number	#
<p># Factory setting is the last four digits of the control serial number.</p> <ul style="list-style-type: none"> <li>If the identification number is changed, a record must be kept of the original serial number of the control.</li> </ul> <p>The serial number is required for any authorized service or repair work. The complete serial number appears on the nameplate located on the control cabinet.</p>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
78	--	0	NO	--	--	--	Display / Communications Software Version	X.YY
<p>* X represents the latest version of the display board: .YY represents the protocol used. EXAMPLE: X.04 represents display board software with Protocol 2200. X.05 represents display board software with Protocol 2179.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> <p><b>IMPORTANT:</b> The version number suffix of the CPU and the Display software must be identical.</p> </div>								

## Close / Retry

The Close/Retry feature is used to interrupt the closing signal to the recloser when closing power is lost.

If the recloser has not responded with a close operation, the control will turn off the reclose signal and go into the close/retry mode. The number of attempts is programmable from 1 to 5000 in increments of 1 via Access Code 79. In this mode, a close signal is initiated every 15 to 60 seconds via Access Code 74 for a duration of 100 cycles as long as the control is energized. If and when the recloser closes, it will continue to follow the programmed sequence of operations to lockout.

If the control is completely de-energized (no ac or dc power), while in the close/retry mode, it does not remember that it is in the close/retry mode upon re-energization. When the control is re-energized, it goes to the same state as the recloser. If the recloser is open, the control goes to lockout.

When the control and recloser are locked-out and the operator attempts to close the recloser either with the Manual Control Switch or via Supervisory Close, and the recloser closing power is not available, the control makes

one attempt to close the recloser and then locks open. The control does not go into the close/retry mode. The front panel Malfunction LCD indicator is displayed. Access Code 66 can be interrogated to determine the malfunction.

The Close/Retry feature is only activated during reclose attempts after a trip operation. If closing power is lost after a trip operation, preventing a reclose operation, the control goes into the close/retry mode.

Operating the manual control switch to the trip position takes the control out of the close/retry mode and locks out the control.

With Close/Retry, the Block-of-Close feature is not required to provide device protection during low voltage or loss of voltage conditions.

If closing power is not restored before the number of close/retry attempts (programmed through Access Code 79) are depleted, the control will lock out.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>74</b>	<b>2</b>	<b>0</b>	<b>NO</b>	<b>60</b>	<b>15</b>	<b>1</b>	<b>Close Retry Time (seconds)</b>	<b>--</b>
<ul style="list-style-type: none"> <li>Set the interval of time between close-retry attempts from 15 to 60 seconds in increments of 1 second.</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>79</b>	<b>2</b>	<b>0</b>	<b>NO</b>	<b>5000</b>	<b>1</b>	<b>1</b>	<b>Number of Close Retry Attempts</b>	<b>2500</b>
<ul style="list-style-type: none"> <li>Set the number of attempts the control will make to close the recloser before the control locks out.</li> <li>Up to 5000 attempts can be selected.</li> </ul>								

## Digital Communications

Codes 81 through 85 establish control communication parameters for digital communications. The values vary based on the system application.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
80	0	0	NO	4	1	1	<b>Data Reader Port Baud Rate</b> 1 = 300 2 = 1200 3 = 2400 4 = 4800*	--

- Baud rate is the number of bits per second of data that can be transferred.
- Baud rates are selectable through the keyboard.
- Shows the baud rate of the Data Reader Port.
- \* Baud rate must be at 4 to communicate with the hand-held Data Reader.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
81	0	0	NO	6	1	1	<b>Real-Time Digital Communications Port Baud Rate :</b> 1 = 300 2 = 1200 3 = 2400 4 = 4800 5 = 9600 6 = 19200	--

- Shows the baud rate of the Real-Time digital communications port.
- Transmit speed always equals receive speed.
- The baud rate code (1-6) must correspond to the baud rate of the system.
- Changes to the baud rate require re-energizing the control by first disconnecting the battery and ac power, followed by energizing the ac power and battery.
- Baud rates are selectable through the keyboard.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
82	0	0	NO	200	0	1	<b>Control Communications Address Protocol (2200)</b>	--
82	0	0	NO	2046	0	1	<b>Control Communications Address Protocol (2179)</b>	--

- Protocol 2200 permits up to 200 unique addresses on each party line and provisions are also made for broadcasting messages to all controls simultaneously. Refer to *Reference Information R280-90-9* and *R280-90-10* for more information on Protocol 2200.
- Protocol 2179 permits unique address on each party line and provisions are also made for broadcasting messages to all controls simultaneously. Refer to *Reference Information R280-90-11* and *R280-90-12* for more information on Protocol 2179.

## Digital Communications (cont'd)

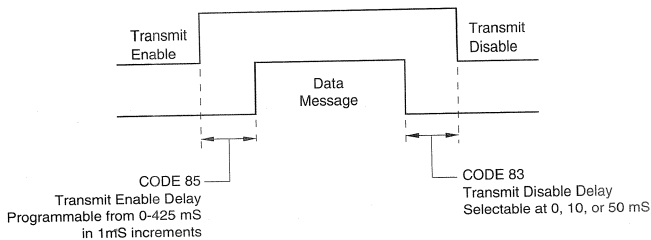
Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
83	0	0	NO	2	0	1	<b>Real-Time Digital Communications Port Handshake (Transmit Disable Delay)</b> <b>Mode Code:</b> 0 = None 1 = Not Applicable 2 = Modem Control (50 mS OFF) 3 = Modem Control (0 mS OFF) 4 = Modem Control (10 mS OFF)	--

- The transmit/receive handshaking method allows adaptability of different types of communication system interfaces with the Form 4C control. When using modes 2 through 4, the handshake out signal is used as the transmit enable. The handshaking input signal is ignored.
- Code 83 and Code 85 affect the bandwidth and efficiency of the communication system. Adjusting Codes 83 through 85 to the minimum operable delays, maximizes the efficiency of the communication system.
- **Mode 0:** No handshaking signals. This mode is used for direct connection between the Form 4C and a personal computer. It may also be used with an RTU for point-to-point applications.
- **Mode 1:** Not applicable. Used for internal purposes only.

- **Mode 2:** Transmit Enable with 50 millisecond transmit disable delay. This is applicable to the three available interface cards: fiber optic, user-powered EIA-232, and 202T modem interface. Mode 2 is used where a transmit enable (push-to-talk) is required as part of the handshaking.  
Applications include using the transmit enable to key a radio along with using a fiber-optic ring. Transmit enable is required for control of the fiber-optic ring.
- **Mode 3:** Transmit Enable with 0 millisecond transmit disable delay. This application is identical to Mode 2 without transmit disable delay. Mode 3 is used for fiber optic applications where radio squelching is not a concern.
- **Mode 4:** Transmit Enable with 10 millisecond transmit disable delay. This application is identical to Mode 2 but with a 10 millisecond transmit disable delay. Depending on the communication equipment, a 10 millisecond transmit disable is adequate compared to 50 milliseconds in Mode 2 and results in a shorter bandwidth and improved efficiency.

### Handshaking and Transmit Disable Delay Summary applicable to Access Code 83.

Access Code 83 Handshake Mode	Handshaking	Transmit Disable Delay
0	No	Not Applicable
1	Not Applicable	Not Applicable
2	Yes	50 mS
3	Yes	0mS
4	Yes	10ms



**Figure A.** Data transmission from the Form 4C control to the communication system for handshaking applications.

**Digital Communications (cont'd)**

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>84</b>	<b>0</b>	<b>0</b>	<b>NO</b>	<b>10</b>	<b>0</b>	<b>1</b>	<b>Number of Line Sync Characters</b>	<b>--</b>

- Defines the period of time the receive must idle to assume the start of a request message. Dead-line sync is used to determine the start of the request message. When used on a ring-configured or broadcast communication system, the control "hears" messages for devices at other nodes on the received data line. By reading the address, the control determines if the message is intended for it and ignores the remaining bytes if it is not.

A period of time during which the received data line is inactive, defines the end of the previous message. This inactive time is the dead-line sync period. The control is now synchronized so that the next byte received is considered the beginning of a new message.

The value programmed is the equivalent number of characters that the receive line must remain inactive, to be considered the end of a message. The control determines the actual time delay internally, taking into account baud rate and the number of bits in the character.

For example:

Baud = 4800

Dead-line sync character = 5 characters

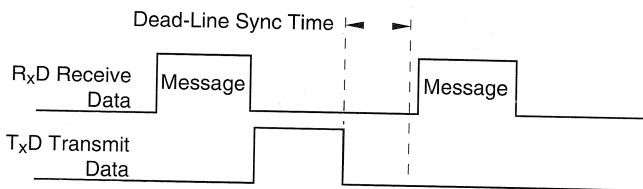
Dead time = 5 characters x 10 bits/character\* = 50 bits

50 bits ÷ 4800 bits/second = 10.4 mS dead-line sync time

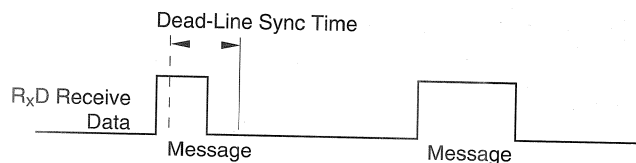
\* 10 bits/character applies to Protocol 2179, 8 data bits, 1 start bit, 1 stop bit.

11 bits/character applies to protocol 2200, 8 data bits, 1 start bit, 1 stop bit, 1 parity bit.

See Figures A and B.



**Figure A.**  
Message received at Form 4C control; message is for the Form 4C control.



**Figure B.**  
Message received at Form 4C control; message is not for the Form 4C control.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>85</b>	<b>0</b>	<b>0</b>	<b>NO</b>	<b>425</b>	<b>0</b>	<b>1</b>	<b>Communications Port Transmit Enable Delay (mS)</b>	<b>--</b>

- Defines the delay after the Transmit Enable signal is sent by the Form 4C control and before the transmission of the message. This allows for stabilization of the transmitter hardware before the message is actually sent.

- The value entered specifies the number of milliseconds that elapse (in the range of 425 mS, in 1 mS increments) before transmission begins. When a modem interface is used, a delay of 50 milliseconds is recommended. See Figure A under access Code 83.

## Security Codes

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>90</b>	<b>3</b>	<b>3</b>	<b>NO</b>	<b>9999</b>	<b>0</b>	<b>1</b>	<b>Level 1 Security Access</b>	<b>1111</b>
<ul style="list-style-type: none"> <li>Level 1 permits modifications of standard operating parameters (those addressable on the keyboard) and most feature parameters.</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>91</b>	<b>3</b>	<b>3</b>	<b>NO</b>	<b>9999</b>	<b>0</b>	<b>1</b>	<b>Level 2 Security Access</b>	<b>2222</b>
<ul style="list-style-type: none"> <li>Level 2 permits modifications of special features.</li> <li>Level 2 permits change of Security Level 1 only.</li> </ul>								
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <b>IMPORTANT:</b> Level 2 must only be accessible to personnel completely familiar with the special features.                 </div>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>92</b>	<b>3</b>	<b>3</b>	<b>NO</b>	<b>9999</b>	<b>0</b>	<b>1</b>	<b>Level 3 Security Access</b>	<b>3333</b>
<ul style="list-style-type: none"> <li>Level 3 permits changes of Security Levels 1, 2, and 3.</li> <li>Level 3 allows access to special operating features.</li> </ul>								
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <b>IMPORTANT:</b> Level 3 must only be accessible to personnel completely familiar with the special features.                 </div>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>99</b>	<b>0</b>	<b>0</b>	<b>NO</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>Enter Security System</b>	<b>--</b>
<ul style="list-style-type: none"> <li>Permits entry into the security system.</li> <li>The security access number does not appear in the display.</li> </ul>								

## Time-Current Curve Modifiers

The Form 4C control is equipped with 41 standard keyboard-selectable time-current curves, interchangeable for phase and ground TCC1 and TCC2.

Access codes 100 through 114 apply modifiers to the standard curves to assist in system coordination. A time-current curve modifier example is presented at the end of this section to illustrate the modifier options.

The methods of modification include:

- Constant Time Adder: Add a specific time to the selected TCC.
- Multiplier Value: Multiply the entire curve by a programmed value.
- Minimum Response Time Adder: Establish a minimum control response time independent of the selected TCC.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
100	1	0	YES	--	--	--	Complex TCC1 Setup-Phase (ON/OFF)	OFF*
100	1	0	YES	--	--	--	Complex TCC1 Setup-Ground (ON/OFF)	OFF*

- Allows for modification of TCC1.
- Use the PHASE/GROUND key to examine phase and ground.

\* Default setting when TCC1 is changed from Access Code 02 (key 2).

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
101	1	0	YES	--	--	--	TCC1 Selection-Phase	117
101	1	0	YES	--	--	--	TCC1 Selection-Ground	135

- Allows the selection of a programmed, fast or delayed time-current curve to be modified. In most situations, TCC1 is designated as a fast curve.
- Use the PHASE/GROUND key to select phase or ground TCC1.
- When TCC characteristics are modified, the readout of Code 02 will indicate a modified curve by prefixing the TCC with a lower case "c".

- Access codes 101 or 02 can be used to examine TCC1.
- Changes to Access Code 101 automatically update Access Code 02.
- Changes to Access Code 02 automatically update Access Code 101.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
102	1	0	YES	0.20	0.00	0.01	TCC1 Constant Time Adder-Phase (seconds)	0.00*
102	1	0	YES	0.20	0.00	0.01	TCC1 Constant Time Adder-Phase (seconds)	0.00*

- Modifies the programmed TCC1 to delay the time of overcurrent trip.
- Use with the PHASE/GROUND key to modify phase or ground TCC1.

\* Default setting when TCC1 is changed from Access Code 02 (key 2).

### Time-Current Curve Modifiers (cont'd)

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
103	1	0	YES	2.00	0.10	0.01	TCC1 Multiplier Value-Phase	1.00*
103	1	0	YES	2.00	0.10	0.01	TCC1 Multiplier Value-Ground	1.00*

- Vertically shifts programmed TCC1 by applying a desired multiplier.
- Use with the PHASE/GROUND key to modify phase or ground TCC1.

\* Default setting when TCC1 is changed from Access Code 02 (key 2).

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
104	1	0	YES	42	0	1	TCC1 Minimum Response Time-Phase (cycles)	0*
104	1	0	YES	42	0	1	TCC1 Minimum Response Time-Ground (cycles)	0*

- Allows modification of the programmed TCC1 by selecting a minimum response time in a range from 0 to 42 cycles.
- Use with the PHASE/GROUND key to modify phase or ground TCC1.

\* Default setting when TCC1 is changed from Access Code 02 (key 2).

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
110	1	0	YES	--	--	--	Complex TCC2 Setup-Phase (ON/OFF)	OFF*
110	1	0	YES	--	--	--	Complex TCC2 Setup-Ground (ON/OFF)	OFF*

- Allows for modification of TCC2.
- Use the PHASE/GROUND key to examine phase and ground.

\* Default setting when TCC2 is changed from Access Code 03 (key 3).

**Time-Current Curve Modifiers (cont'd)**

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
111	1	0	YES	--	--	--	TCC2 Selection-Phase	117
111	1	0	YES	--	--	--	TCC2 Selection-Ground	135

- Allows the selection of a programmed, fast or delayed time-current curve to be modified. In most situations, TCC2 is designated as a delayed or slow curve.
- Use the PHASE/GROUND key to select phase or ground TCC2.
- When TCC characteristics are modified, the readout of Code 111 will indicate a modified curve by prefixing the TCC with a lower case "c".

- Access Codes 111 or 03 can be used to examine TCC2.
- Changes to Access Code 111 automatically update Access Code 03.
- Changes to Access Code 03 automatically update Access Code 111.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
112	1	0	YES	0.20	0.00	0.01	TCC2 Constant Time Adder-Phase (seconds)	0.00*
112	1	0	YES	0.20	0.00	0.01	TCC2 Constant Time Adder-Phase (seconds)	0.00*

- Modifies the programmed TCC2 to delay the time of overcurrent trip.
- Use with the PHASE/GROUND key to modify phase or ground TCC2.

\* Default setting when TCC2 is changed from Access Code 03 (key 3).

**Time-Current Curve Modifiers (cont'd)**

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
113	1	0	YES	2.00	0.10	0.01	TCC2 Multiplier Value-Phase	1.00*
113	1	0	YES	2.00	0.10	0.01	TCC2 Multiplier Value-Ground	1.00*

- Vertically shifts programmed TCC2 by applying a desired multiplier.
- Use with the PHASE/GROUND key to modify phase or ground TCC2.

\* Default setting when TCC2 is changed from Access Code 03 (key 3).

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
114	1	0	YES	42	0	1	TCC2 Minimum Response Time-Phase (cycles)	0*
114	1	0	YES	42	0	1	TCC2 Minimum Response Time-Ground (cycles)	0*

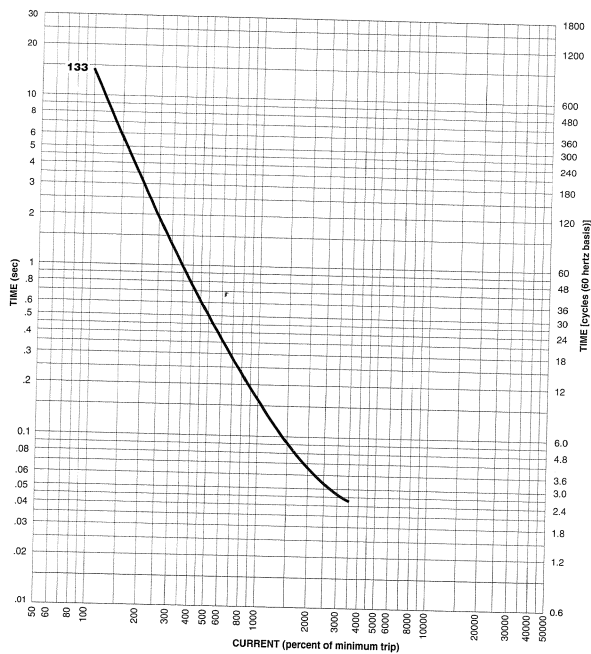
- Allows modification of the programmed TCC2 by selecting a minimum response time in a range from 0 to 42 cycles.
- Use with the PHASE/GROUND key to modify phase or ground TCC2.

\* Default setting when TCC2 is changed from Access Code 03 (key 3).

## Time-Current Curve Modifiers (cont'd)

### Modifications

In order to further enhance control flexibility and to offer an almost unlimited number of time-current curve selections, each TCC programmed into the Form 4C control can be modified vertically, with a constant time adder (Access Codes 102 or 112), a multiplier value (Access Codes 103 or 113), or a minimum response time adder (Access Codes 104 or 114). By simple programming, the basic TCC shape can be designed to meet coordination requirements. Modified TCC's display a "c" prefix code when interrogated to let the operator know that the standard TCC is modified. The figures below provide examples of modification to the basic #133 curve.



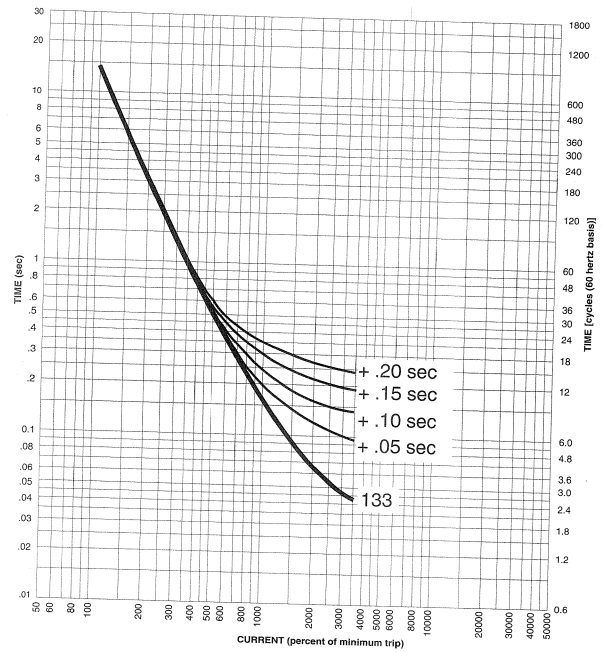
**Basic No. 133 Time-Current Curve (Control Response Time).**

### Constant Time Adders

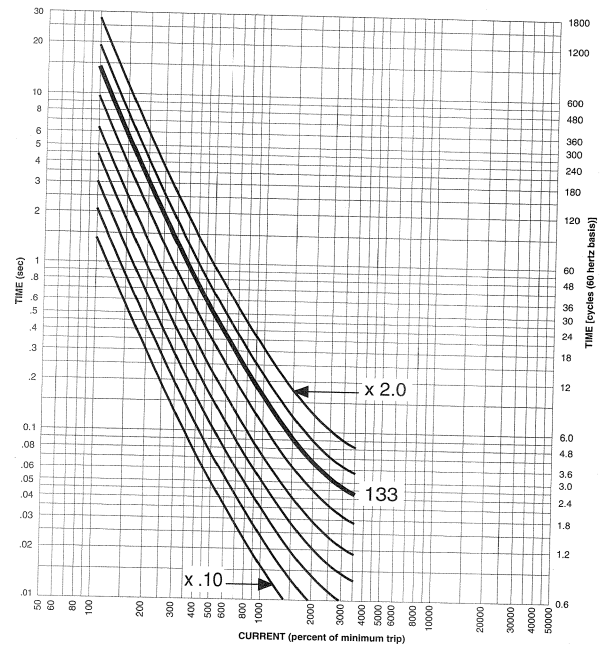
Constant time adders can be used to modify TCC characteristics. Programmable constant time adders are available from 0 to 0.2 seconds in 0.01 second increments. Refer to Access Codes 102 and 112 for interrogation and programming.

### Vertical Translation Multiplier

Each phase and ground TCC can be shifted vertically using vertical multipliers. The available multipliers are 0.10 to 2.0 in increments of 0.01. Refer to Access Code 103 and 113 for interrogation and programming.



**TCC modification with Constant Time Adder (Control Response Time).**



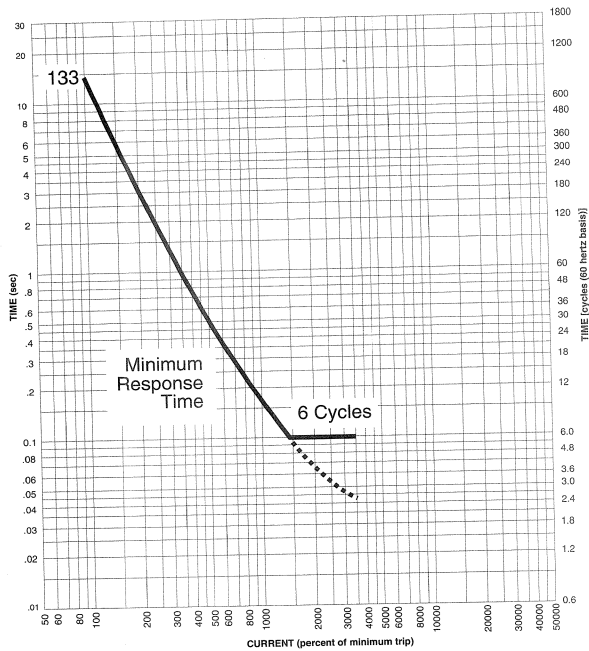
**TCC modification with Vertical Translation Multiplier (Control Response Time).**

## Time-Current Curve Modifiers (cont'd)

### Modifications (cont'd)

#### Minimum Response Time

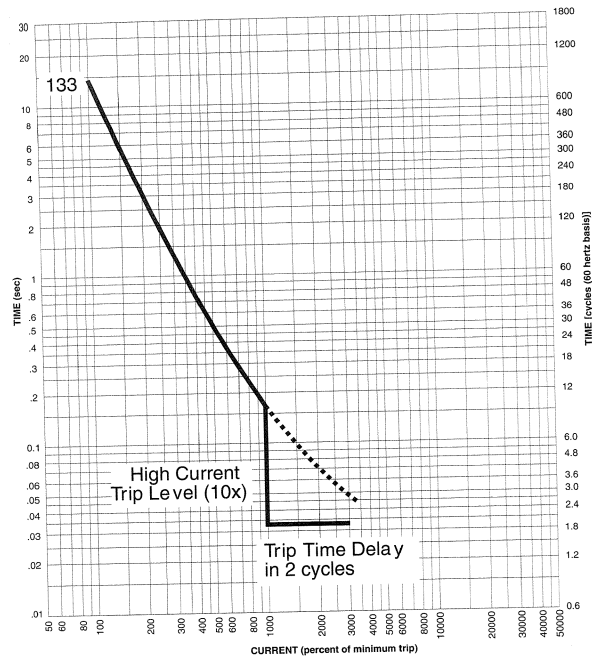
The #133 time-current curve can be modified by using a minimum response time setting as shown in the figure below. The available range of programming minimum time settings is 0 through 42 cycles in 1 cycle increments. Refer to Access Codes 104 and 114 for interrogation and programming.



**TCC modification with Minimum Response Time (control response time).**

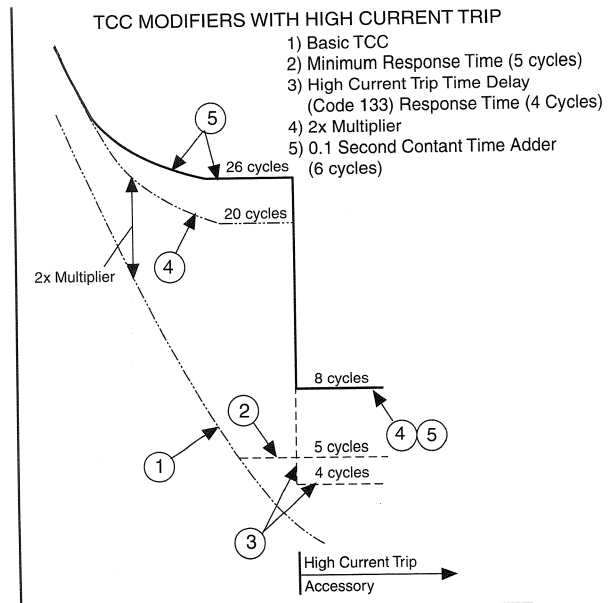
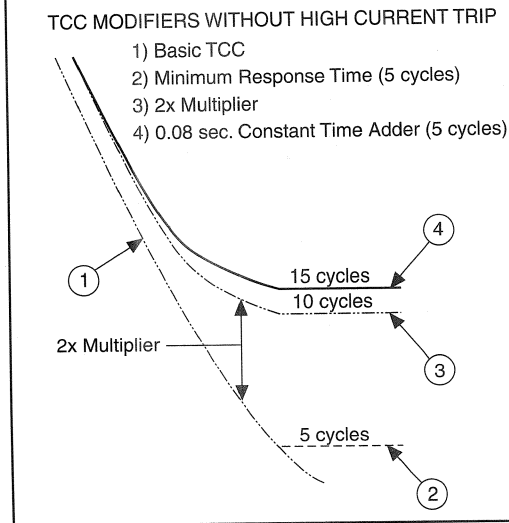
#### High Current Trip

A basic TCC can be modified for high current trip as shown below. The available range of programmable multipliers is from 1 through 30 times minimum trip in increments of one. High current trip also includes trip time delay with an available range of programmable delay times of 1 through 9 cycles in 1 cycle increments. Refer to Access Codes 130 and 134 for interrogation and programming.



**TCC modification with High Current Trip (control response time).**

The figures below show modified TCC's with and without the effects of high current trip and show precedence when more than one modifier is used.

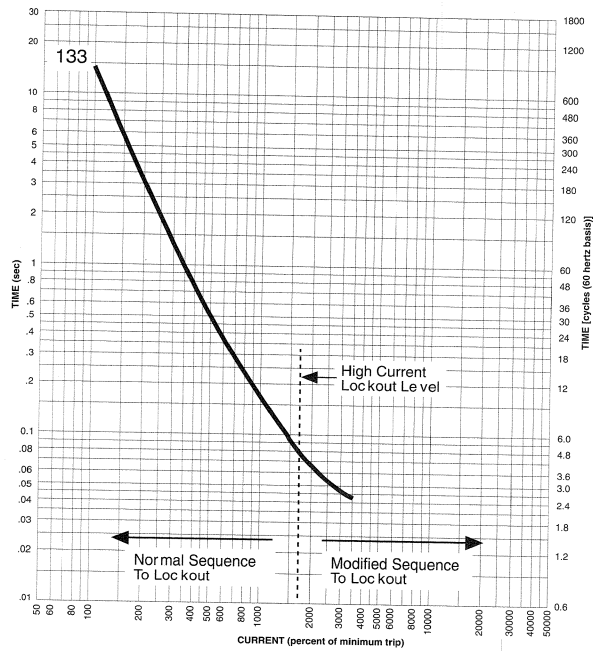


# Time-Current Curves (cont'd)

## Modifications (cont'd)

### High Current Lockout

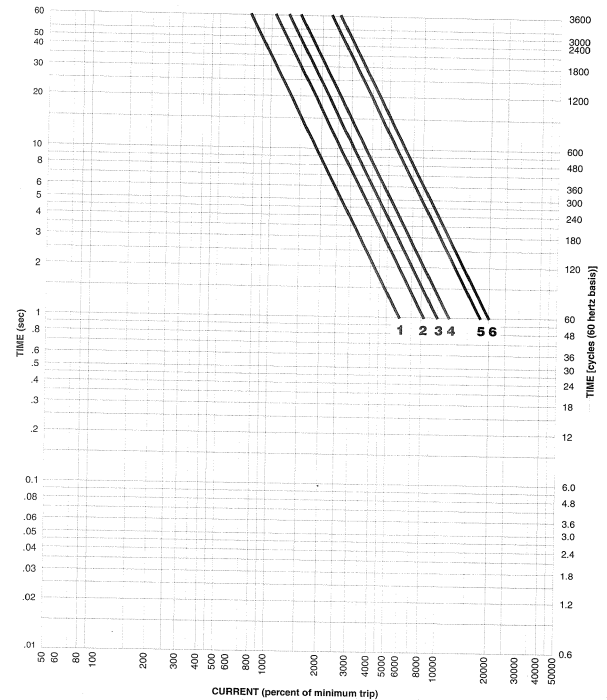
The figure below shows an example of sequence modification as a result of High Current Lockout. High Current Lockout is available in multipliers of 1 to 30 in increments of 1. Refer to Access Codes 140 and 143 for interrogation and programming.



TCC modification for High Current Lockout.

### TCC Modification Limits

When modifying time-current curves, caution must be exercised so that the modified curve does not exceed the short-time current limits of the recloser. Consideration should be given to the High Current Trip and Lockout features when programming very long timing curves with very high minimum trip values.



Maximum recloser limits for TCC modification.

### MAXIMUM SHORT TIME RECLOSER LIMITS

Recloser Type	Maximum Interrupting Rating (sym Amps)	Curve*
RXE, RVE	6000	1
WVE27, WVE38X	8000	2
WE	10000	3
VVE, VWVE27, VWVE38X	12000	4
VSA12, VSO12	12000	5
VSA16, VSO16	16000	5
VSA20, VSA20A, VSA20B	20000	6

\*Curves are recloser short time currents for a single trip operation.

### Maximum short-time recloser limits.

## Sensitive Ground/Earth Fault

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>120</b>	<b>1</b>	<b>0</b>	<b>YES</b>	--	--	--	<b>Sensitive Ground/Earth Fault (ON/OFF)</b>	<b>OFF</b>
<ul style="list-style-type: none"> <li>The Sensitive Ground/Earth Fault feature allows the Form 4C control to detect and have the recloser trip after a selectable, definite time, for ground (zero sequence) currents below normal ground minimum trip currents set with Access Code 01 Ground.</li> <li>When the Sensitive Ground/Earth Fault feature is ON, the target display (Access Code 30) is altered to distinguish between Sensitive Ground/Earth Fault trips and normal ground fault trips. The ground fault portion of the display will show an "E" for Sensitive Earth Fault operation and "G" for normal ground fault operation.</li> <li>Remote indication of targets is also altered when the Sensitive Ground/Earth Fault feature is ON. The remote targets normally indicate phase A, B, or C (alternatively 1, 2, or 3 - see access codes 17, 18, and 19); but with the Sensitive Ground/Earth Fault feature ON, the remote indications are phase, ground and sensitive ground in place of A, B, C (1, 2, or 3) respectively.</li> <li>The Sensitive Ground/Earth Fault feature is fully accessible and independently programmable by a digital communication link. Controls with the Sensitive Ground/Earth Fault feature must use <i>Form 4C Interface™ Program (KSPS2), Version 2.0</i> or later.</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>121</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>100</b>	<b>10</b>	<b>1</b>	<b>Sensitive Ground/Earth Trip Level</b>	<b>100</b>
<ul style="list-style-type: none"> <li>Sensitive Ground/Earth Trip Level is set as a percentage of programmed ground minimum trip in the range of 10 to 100% in 1% increments with 3 Amps* as the minimum allowable trip value.</li> <li>Form 4C control logic will prevent changes in the percent settings that will give a trip value below 3 Amps. Under this condition, a LO message will appear in the display. Subsequent changes to the Ground/Earth Minimum Trip setting (Access Code 01 Ground) that cause the Sensitive Ground/Earth Trip to be less than 3 Amps, are not accepted by the control and a LO message is displayed.</li> <li>* The minimum allowable trip value is dependent on the CT ratio (Access Code 10):                      2000:1 ratio, the minimum trip value is 6 Amps                      1000:1 ratio, the minimum trip value is 3 Amps                      500:1 ratio, the minimum trip value is 2 Amps</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>122</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>100</b>	<b>10</b>	<b>1</b>	<b>Alternate Sensitive Trip Level</b>	<b>100</b>
<ul style="list-style-type: none"> <li>Alternate Sensitive Trip Level has the same 3 amp limitation as the normal Sensitive Trip Level. By programming the Alternate Sensitive Ground/Earth Trip to 100%, the Sensitive Ground/Earth Trip feature is disabled by the Alternate Minimum Trip Switch on the control front panel or by selecting supervisory alternate minimum trip on the Supervisory I/O accessory or through digital communications.</li> <li>Form 4C control logic will prevent changes in the percent settings that will give a trip value below 3 Amps. Under this condition, a LO message appears in the display. Subsequent changes to the Ground/Earth Minimum Trip setting (Access Code 01 Ground) that cause the Sensitive Ground/Earth Trip to be less than 3 Amps, are not accepted by the control, and a LO message is displayed.</li> </ul>								

**Sensitive Ground/Earth Fault (cont'd)**

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>123</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>120</b>	<b>2</b>	<b>1</b>	<b>Definite Time to Trip (seconds)</b>	<b>120</b>
<ul style="list-style-type: none"> <li>This is the actual time at which the Sensitive Ground/Earth Fault feature will trip.</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>124</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>4</b>	<b>1</b>	<b>1</b>	<b>Operations to Lockout</b>	<b>4</b>
<ul style="list-style-type: none"> <li>This is the number of trip operations to lockout caused by the Sensitive Ground/Earth Fault feature.</li> <li>The setting is independent of the Number of Operations to Lockout (Access Code 05) set for normal phase and earth trip operations.</li> </ul>								
<div style="border: 1px solid black; padding: 5px;"> <p><b>IMPORTANT:</b> Any combination of Sensitive Ground/Earth Fault and phase and ground operations cannot exceed four operations to lockout.</p> </div>								

**High Current Trip**

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>130</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>High Current Trip - Phase (ON/OFF)</b>	<b>OFF</b>
<ul style="list-style-type: none"> <li>High Current Tripping allows for tripping the recloser with a programmable constant time whenever fault current exceeds a programmed level.</li> <li>High Current Tripping is used to modify the time current curve to allow for increased coordination with primary substation transformer protection or coordination with load side fusing.</li> <li>Trips a recloser at any current above the selected fault current level. Levels are set as multiples of the minimum trip (see Access Code 132).</li> <li>High-Current Trip-Phase is operable for phase, or phase and ground combined.</li> <li>Select High Current Trip-Phase ON and OFF using the CHANGE key.</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>131</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>High Current Trip - Ground (ON/OFF)</b>	<b>OFF</b>
<ul style="list-style-type: none"> <li>High Current Tripping allows for tripping the recloser with a programmable constant time whenever fault current exceeds a programmed level.</li> <li>High Current Tripping is used to modify the time current curve to allow for increased coordination with primary substation transformer protection or coordination with load side fusing.</li> <li>Trips a recloser at any current above the selected fault current level. Levels are set as multiples of the minimum trip (see Access Code 132).</li> <li>High-Current Trip-Ground is operable for phase and ground combined. It does not operate for ground only.</li> <li>Select High Current Trip-Ground ON and OFF using the CHANGE key.</li> </ul>								

### High Current Trip (cont'd)

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
132	1	0	YES	30	1	--	High Current Trip - Phase (Multiples of Minimum Trip)	30
132	1	0	YES	30	1	--	High Current Trip - Ground (Multiples of Minimum Trip)	30

- Sets the operating level (in multiples of minimum trip) at which the recloser will trip when the fault current is above the programmed level.
- Operating levels are separately selectable from 1 to 30, in increments of 1, for phase and ground trip.
- Use the PHASE/GROUND key to examine phase or ground.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
133	1	0	YES	9	1	--	High Current Trip - Phase (cycles) (Trip Time Delay)	1
133	1	0	YES	9	1	--	High Current Trip - Ground (cycles) (Trip Time Delay)	1

- Time delays are selectable from 1 to 9 cycles, in increments of 1 cycle, based on 60 Hertz. For 50 Hz systems, multiply the number of cycles by 0.83.
- The high current trip time delay should be set faster than the normal time current curve. If the high current trip is set slower, actual timings will be faster than the high current trip time programmed.
- Use the PHASE/GROUND key to examine phase or ground.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
134	1	0	YES	1-2-3-4	1	--	High Current Trip - Phase (cycles) (Active Trip Number)	0
134	1	0	YES	1-2-3-4	1	--	High Current Trip - Ground (cycles) (Active Trip Number)	0

- Indicates on which trip operation High current Trip is active.
- Trip operations, on which High Current Trip is active, are customer selectable, via the keyboard, for any combination in sequence (i.e., select 3, 4; or 1 only, 2 only; or 1, 2, 3, 4 etc.) .
- Use the PHASE/GROUND key to examine phase or ground.

## High Current Lockout

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
140	1	0	YES	--	--	--	High Current Lockout - Phase (ON/OFF)	OFF
<ul style="list-style-type: none"> <li>High Current Lockout allows for tripping the recloser with a programmable operating sequence whenever fault current exceeds a programmed level.</li> <li>High Current Lockout is used to modify the operating sequence to allow for reduced through-faults on the substation transformer and connected equipment.</li> <li>Locks out a recloser at any current level above the selected fault current level. Levels are set as multiples of the minimum trip (Access Code 142)</li> <li>High Current Lockout-Phase is operable for phase only.</li> <li>Select High Current Lockout-Phase ON and OFF using the CHANGE key.</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
141	1	0	YES	--	--	--	High Current Lockout - Ground (ON/OFF)	OFF
<ul style="list-style-type: none"> <li>High Current Lockout allows for tripping the recloser with a programmable operating sequence whenever fault current exceeds a programmed level.</li> <li>High Current Lockout is used to modify the operating sequence to allow for reduced through-faults on the substation transformer and connected equipment.</li> <li>Locks out a recloser at any current above the selected fault current level. Levels are set as multiples of the minimum trip (Access Code 132).</li> <li>High Current Lockout is operable for phase and ground combined. It does not operate for ground only.</li> <li>Select High Current Lockout-Ground ON and OFF using the CHANGE key.</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
142	1	0	YES	30	1	1	High Current Lockout - Phase (Multiples of Minimum Trip)	30
142	1	0	YES	30	1	1	High Current Lockout - Ground (Multiples of Minimum Trip)	30
<ul style="list-style-type: none"> <li>Sets the operating level (in multiples of minimum trip) at which the operating sequence is modified when the fault current is above the programmed level.</li> <li>Operating levels are separately selectable from 1 to 30, in increments of 1, for phase and ground trip.</li> <li>Use the PHASE/GROUND key to examine phase or ground.</li> </ul>								

### High Current Lockout (cont'd)

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
143	1	0	YES	4	1	--	High Current Lockout - Phase (Active Trip Number)	4
143	1	0	YES	4	1	--	High Current Lockout - Ground (Active Trip Number)	4

- Indicates on which trip operation the high current lockout is active.
- Use PHASE/GROUND key to examine phase and ground.

### Clock

When the Form 4C control is first energized, the clock default date is January 1, 2001 (1/1/2001). The clock must be set to the proper date and time for the events to be properly recorded. (Refer to *Setting The Control Clock* section of this manual.)

**IMPORTANT:** Overcurrent protection is independent of the clock and will respond correctly regardless of the clock status.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
153	0	0	NO	2088	1989	1	Set Time Clock - Year	2001

- Enter the four-digits of the current year.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
154	0	0	YES	12.31	1.01	1.1	Set Time Clock - Month . Day	1.01

- Enter the month to the left and the day to the right of the decimal point.
- If the number of the day is a single digit, the digit must be preceded by a zero.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
155	0	0	YES	23:59	0:0	0:01	Set Time Clock - Hour : Minute	1:01

- Enter the hour and minutes based on 24 hour notation.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
156	0	0	YES	:59	:00	:01	Set Time Clock - Seconds	:00

- If the number of seconds is a single digit, the digit is preceded by a zero.

### Event Recorder

The Event Recorder provides detailed, time-related data for system analysis. Event recorder data will indicate time-tagged current values for thirteen different event types. The event types (Access Code 162) identify the fault history for numerous applications in operation and analysis of the distribution feeder.

Below is sample data from the event recorder. The access codes are referenced under the appropriate heading.

#### Event Recorder Sample Data

Event # (161)	Event Type (162)	Month.Day (163)	Hour:Min (164)	Seconds (165)	CURRENT (k Amps)			
					Ground (166)	Phase Bushing 1-2 (167)	Phase Bushing 3-4 (168)	Phase Bushing 5-6 (169)
1	2	2.17	14:20	:40	0.02	0.16	0.15	0.17
2	1	2.17	14:20	:08	2.80	0.16	0.15	2.80
3	1	2.17	14:20	:06	2.80	0.16	0.15	2.80
4	3	2.08	10:24	:15	0.00	0.00	0.00	0.00
5	1	2.08	9:21	:12	1.30	0.13	1.30	0.14
6	1	2.08	9:21	:07	1.30	0.13	1.30	0.14
7	1	2.08	9:21	:05	1.30	0.13	1.30	0.14
8	1	2.08	9:21	:03	1.30	0.13	1.30	0.14
9	2	2.03	14:40	:49	0.02	0.15	0.15	0.16
10	1	2.03	14:40	:16	2.40	2.40	0.15	0.16
11	1	2.03	14:40	:14	2.40	2.40	0.15	0.16
12	2	2.03	14:38	:40	0.02	0.15	0.15	0.17
13	1	2.03	14:37	:08	2.80	0.16	0.15	2.80

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>160</b>	<b>Reset 1</b>	<b>0</b>	<b>NO</b>	<b>50</b>	<b>1</b>	<b>1</b>	<b>No. of Events Since Last Reset</b>	<b>--</b>
<ul style="list-style-type: none"> <li>• Feature is enabled or disabled per Access Code 23 (ON/OFF).</li> <li>• Displays the number of events that have occurred since the last time Access Code 160 was reset to</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>161</b>	<b>--</b>	<b>0</b>	<b>NO</b>	<b>50</b>	<b>1</b>	<b>1</b>	<b>Event Number</b>	<b>--</b>
<ul style="list-style-type: none"> <li>• Upon entry of Access Code 161, Event 1 will appear. For a specific event, press the CHANGE key and enter the event number.</li> <li>• Key-in the event number for direct event interrogation.</li> <li>• The Form 4C control stores the 50 most recent events.</li> <li>• Data for a specific event is accessed using the SCROLL key.</li> </ul>								

### Event Recorder (cont'd)

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>162</b>	--	<b>0</b>	<b>YES</b>	--	--	--	<b>Event Type</b>	--
<ul style="list-style-type: none"> <li>• Access Code 162 identifies the type of event indicated by the event number of Access Code 161.</li> <li>• Access Code 162 can only be accessed from Access Code 161 using the SCROLL key.</li> </ul> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <ul style="list-style-type: none"> <li>• Access Code 163 identifies the month and day of the event indicated by Access Code 161.</li> </ul> </div> <div style="width: 45%;"> <p><b>Event Type:</b></p> <ol style="list-style-type: none"> <li>1 - Overcurrent Trip</li> <li>2 - Reset</li> <li>3 - Close (Manual Control Switch)</li> <li>4 - Close (Supervisory)</li> <li>5 - Lockout (Manual Control Switch)</li> <li>6 - Lockout (Remote)</li> <li>7 - Lockout (Supervisory)</li> <li>8 - Trip (Supervisory or Manual)</li> <li>9 - Loss of ac Power (2 minute minimum)</li> <li>10 - Restoration of ac Power (.03 seconds)</li> <li>11 - Sequence Coordination</li> <li>12 - Sensitive Ground Fault Trip</li> <li>13 - Close Retry Lockout</li> </ol> </div> </div>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>163</b>	--	<b>0</b>	<b>YES</b>	--	--	--	<b>Month . Day</b>	--
<ul style="list-style-type: none"> <li>• Access Code 163 identifies the month and day of the event indicated by Access Code 161.</li> <li>• Access Code 163 can only be accessed from Access Code 161 using the SCROLL key.</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>164</b>	--	<b>0</b>	<b>YES</b>	--	--	--	<b>Hour : Minute</b>	--
<ul style="list-style-type: none"> <li>• Access Code 164 identifies the hour and minute of the event indicated by Access Code 161.</li> <li>• Access Code 164 can only be accessed from Access Code 161 using the SCROLL key.</li> </ul>								

**Event Recorder (cont'd)**

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>165</b>	--	<b>0</b>	<b>YES</b>	--	--	--	<b>Second</b>	--
<ul style="list-style-type: none"> <li>Access Code 165 identifies the duration of the event indicated by Access Code 161.</li> <li>Access Code 165 can only be accessed from Access Code 161 using the SCROLL key.</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>166</b>	--	<b>0</b>	<b>YES</b>	--	--	--	<b>Ground Current (kAmps)</b>	--
<ul style="list-style-type: none"> <li>Access Code 166 identifies the ground current of the event indicated by Access Code 161.</li> <li>Access Code 166 can only be accessed from Access Code 161 using the SCROLL key.</li> </ul>								

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>167</b>	--	<b>0</b>	<b>YES</b>	--	--	--	<b>Phase Bushing1-2 Current (kAmps)</b>	--
<b>168</b>	--	<b>0</b>	<b>YES</b>	--	--	--	<b>Phase Bushing 3-4 Current (kAmps)</b>	--
<b>169</b>	--	<b>0</b>	<b>YES</b>	--	--	--	<b>Phase Bushing 5-6 Current (kAmps)</b>	--
<ul style="list-style-type: none"> <li>Access Codes 167 through 169 identify the current through the three phases of the event indicated by Access Code 161.</li> <li>Current values are in RMS kiloamperes. Current range is from 0 kA to 30 times programmed minimum trip value. If the fault exceeds 30 times minimum trip, an over-range message (-1) will be displayed.</li> <li>Access Codes 167 through 169 can only be accessed from Access Code 161 using the SCROLL key.</li> </ul>								

## Duty Cycle Monitor

Access Code	Security			Limits			Parameter	Factory Settings																																																
	Write	Read	Scroll	High	Low	Incr																																																		
<b>170</b>	<b>1</b>	<b>0</b>	<b>NO</b>	<b>9999</b>	<b>1</b>	<b>1</b>	<b>100% Interrupter Duty</b>	<b>97</b>																																																
<p>The Duty Cycle Monitor provides keyboard accessible duty cycle information which includes the following:</p> <ul style="list-style-type: none"> <li>Measures and records duty for each individual phase in non-volatile memory.</li> <li>The recloser duty is measured and stored on the basis of <math>Current^{1.5} \times Number\ of\ Operations\ for\ Each\ Phase</math> (ANSI C37.61).</li> <li>Readout is based on a percentage of total duty cycle for each phase.</li> <li>Duty record can be adjusted or reset if recloser is changed-out, serviced, etc.</li> <li>Feature is enabled and disabled via Access Code 24 (ON/OFF) through Security Level 1.</li> <li>Use CHANGE key to enter value or reset to zero.</li> <li>Readout does not require security access.</li> <li>Information is also accessible via Digital Communications.</li> </ul>							<p>Using the table below, select the appropriate recloser interrupting duty cycle factor and enter that value using Access Code 170.</p> <table border="1"> <thead> <tr> <th>Recloser Type</th> <th>Interrupting Rating (rms sym Amps)</th> <th>100% Duty Cycle Factor</th> </tr> </thead> <tbody> <tr> <td>RXE, RVE</td> <td>6000A</td> <td>97</td> </tr> <tr> <td>WE</td> <td>12000A @ 4.8kV</td> <td>257</td> </tr> <tr> <td>WE</td> <td>10000A @ 14.4kV</td> <td>196</td> </tr> <tr> <td>VVE</td> <td></td> <td></td> </tr> <tr> <td>VWVE27</td> <td>12000A</td> <td>1045</td> </tr> <tr> <td>VWVE38X</td> <td></td> <td></td> </tr> <tr> <td>WVE27</td> <td>8000A</td> <td>140</td> </tr> <tr> <td>WVE38X</td> <td>8000A</td> <td>140</td> </tr> <tr> <td>VSA12</td> <td>12000A</td> <td>1045</td> </tr> <tr> <td>VSA16</td> <td>16000A</td> <td>1608</td> </tr> <tr> <td>VSA20</td> <td></td> <td></td> </tr> <tr> <td>VSA20A</td> <td>20000A</td> <td>2248</td> </tr> <tr> <td>VSA20B</td> <td></td> <td></td> </tr> <tr> <td>VSO12</td> <td>12000A</td> <td>1045</td> </tr> <tr> <td>VSO16</td> <td>16000A</td> <td>1608</td> </tr> </tbody> </table>		Recloser Type	Interrupting Rating (rms sym Amps)	100% Duty Cycle Factor	RXE, RVE	6000A	97	WE	12000A @ 4.8kV	257	WE	10000A @ 14.4kV	196	VVE			VWVE27	12000A	1045	VWVE38X			WVE27	8000A	140	WVE38X	8000A	140	VSA12	12000A	1045	VSA16	16000A	1608	VSA20			VSA20A	20000A	2248	VSA20B			VSO12	12000A	1045	VSO16	16000A	1608
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	Write	Read	Scroll	High	Low	Incr		
<b>171</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>999.9</b>	<b>0</b>	<b>0.1</b>	<b>Bushing 1-2 Phase Interrupter Duty (%)</b>	<b>0</b>
<b>172</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>999.9</b>	<b>0</b>	<b>0.1</b>	<b>Bushing 3-4 Phase Interrupter Duty (%)</b>	<b>0</b>
<b>173</b>	<b>1</b>	<b>0</b>	<b>YES</b>	<b>999.9</b>	<b>0</b>	<b>0.1</b>	<b>Bushing 5-6 Phase Interrupter Duty (%)</b>	<b>0</b>
<ul style="list-style-type: none"> <li>Information is accessible via the keyboard or Digital Communications.</li> <li>Use CHANGE key to enter value or reset to zero.</li> <li>A new recloser, not in service, has 0% interrupting duty cycle. As the recloser is used, the duty cycle increases. When the interrupting duty reaches 100%, the interrupter contacts should be examined and replaced.</li> </ul>								

### Load Profile Monitor

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>180</b>	<b>0</b>	<b>0</b>	<b>NO</b>	<b>96</b>	<b>1</b>	<b>1</b>	<b>Load Profile - Reading Number</b>	<b>--</b>

- Data is accessible through the keyboard or Digital Communications.
- From the keyboard, Access Codes 181 through 185 are accessible from Access Code 180 using the SCROLL key.
- Data is read and recorded in 15 minute intervals and stored in memory for the most recent 24 hours for a total of 96 readings.
- Indicates the RMS demand current for each phase and ground.
- No security code is required for readout.

**IMPORTANT:** Load Profile Data will be lost if power to the Form 4C control is lost. Load Profile data will also be lost when the control resets after a change to a TCC Group (Access Code 70) or Line Frequency (Access Code 71) .

#### Load Profile Monitor Sample Data.

Reading (180)	Hr:Min (181)	Ground Current (182)	Phase Current Bushing 1-2 (Amps) (183)	Phase Current Bushing 3-4 (Amps) (184)	Phase Current Bushing 5-6 (Amps) (185)
1	15:30	2	258	261	262
2	15:15	0	260	257	259
3	15:00	2	253	251	255
4	14:45	1	261	255	257
5	14:30	1	257	248	257

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>181</b>	<b>0</b>	<b>0</b>	<b>YES</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>Time - Hour and Minute</b>	<b>--</b>

- Indicates the hour and minute of a specific phase RMS demand current profile.

### Load Profile Monitor (Cont'd)

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>182</b>	<b>0</b>	<b>0</b>	<b>YES</b>	--	--	--	<b>Ground Current</b>	--

• Indicates the RMS demand current profile for Ground Current.

Access Code	Security			Limits			Parameter	Factory Settings
	Write	Read	Scroll	High	Low	Incr		
<b>183</b>	<b>0</b>	<b>0</b>	<b>YES</b>	--	--	--	<b>Phase Bushing 1-2 Current</b>	--
<b>184</b>	<b>0</b>	<b>0</b>	<b>YES</b>	--	--	--	<b>Phase Bushing 3-4 Current</b>	--
<b>185</b>	<b>0</b>	<b>0</b>	<b>YES</b>	--	--	--	<b>Phase Bushing 5-6 Current</b>	--

• Indicates the RMS demand current profile for the three Phase Currents.

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P.O. Box 2850, Pittsburgh, PA 15230