

Arc Energy Reduction Procedure for PowerPact Circuit Breakers Using FFTK (Full-Function Test Kit)

0602DB2001

User Guide

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Addendum to Field Testing and Maintenance Guide 0600IB1201

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Maintenance Switch Testing Procedures

Table 1 - Maintenance Switch Testing Procedures—Simplified Table

	ERMS Energy Reducing Maintenance Setting	MMS¹ Maintenance Mode Setting	Instantaneous Trip Adjustment
Products Offered	PowerPact P PowerPact R MasterPact NT MasterPact NW	PowerPact P PowerPact R	PowerPact P PowerPact R MasterPact NT MasterPact NW
Trip Units	5.0P, 6.0P 5.0H, 6.0H	5.0A, 6.0A 5.0P, 6.0P 5.0H, 6.0H	ET1.0 All 3.0, 5.0, 6.0
Needed for Testing	Minimum available arcing current FFTK	Minimum available arcing current FFTK M2CTEST Jumper Wire	Minimum available arcing current FFTK
Control Power	Must be applied to IO Module and ERMS Switch	For 5.0A and 6.0A trip units 24 Vdc must be applied to terminals F1 (-) and F2 (+). The 24 Vdc is not necessary for the P and H trip units.	None
Ground Fault Jumper applied	—	For 6.0 trip units, install jumper wire between M1 and F1/T4 terminals.	—
Test Device	FFTK	FFTK + M2CTEST Adapter	FFTK
Device parameters	Some fields are pre-populated	Manually Enter	Some fields are pre-populated
Test Value	Minimum available arcing current	Minimum available arcing current	Minimum available arcing current
Test	Manually Test Trip Curve	Manually Test Trip Curve Enter 5.0 for 6.0 trip units.	Manually Test Trip Curve
Trip Curve Test Mode	Instantaneous	Short Time	Instantaneous
Passing Result	< 50 ms with ERMS ON	< 80 ms with MMS ON	< 50 ms
Reset Trip Unit Alarm	Press button on top right corner to clear trip unit fault indicator.	Press button on top right corner to clear trip unit fault indicator.	Press button on top right corner to clear trip unit fault indicator.
Additional Test	Switch ERMS OFF and complete the same test.	Switch MMS OFF and complete the same test.	—
Final Step	Clear trip unit fault on trip unit.	Remove jumper from 6.0 trip unit (ground fault). Clear trip unit fault on trip unit.	Clear trip unit fault on trip unit.

1. Same test procedure as used for AMS,(Alternate Maintenance Setting), which is no longer available.

Safety Requirements

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, NOM 029-STPS, or local equivalent.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Unless specified otherwise in the commissioning procedures, all operations (inspection, test, and preventive maintenance) must be carried out with the device, the cradle, and the auxiliary circuits de-energized.
- Check that the device and the cradle are de-energized on the upstream and downstream terminals.
- Always use a properly rated voltage sensing device to confirm that the device, the cradle, and the auxiliary circuits are de-energized.
- Install safety barriers and display a danger sign.
- During the tests, it is strictly forbidden for anyone to touch the device, the cradle, or the conductors while voltage is applied.
- Before putting the equipment back into operation, it is mandatory to check that all connections are made with the correct tightening torque, there are no tools or objects inside the equipment, all devices, doors, and protective covers are in position, and the device is off (open position).

Failure to follow these instructions will result in death or serious injury.

ERMS Testing

ERMS Tripping Test Requirements

The system should be tested upon initial start-up and:

- in accordance with your facility maintenance schedule.
- if any of the components in the system are replaced.
- if any work is done in the area of the system wiring.
- if required per installation requirements.

ERMS Tripping Test Necessary Tools

The following is needed to perform a tripping test (order separately).

- S33595 Full-Function Test Kit (FFTK)

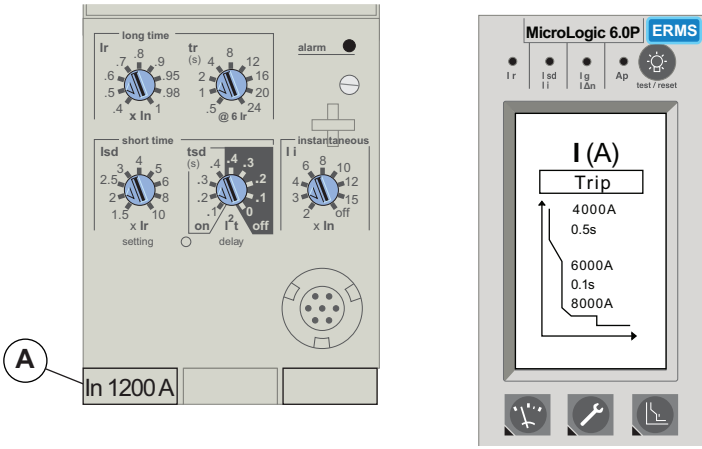
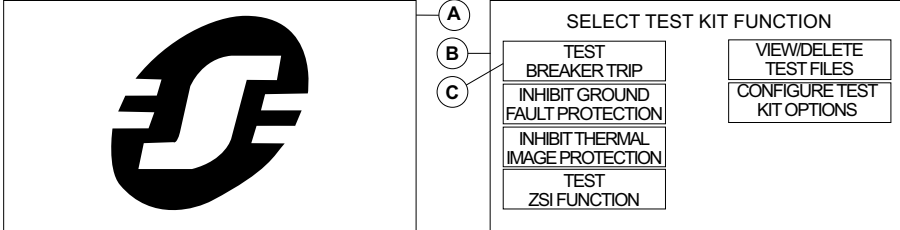
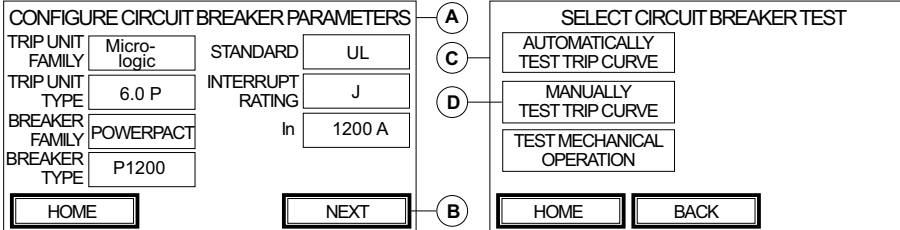
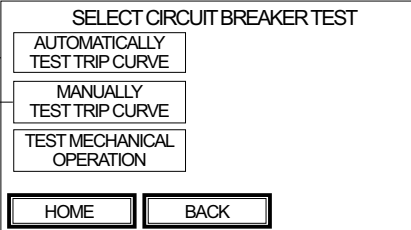
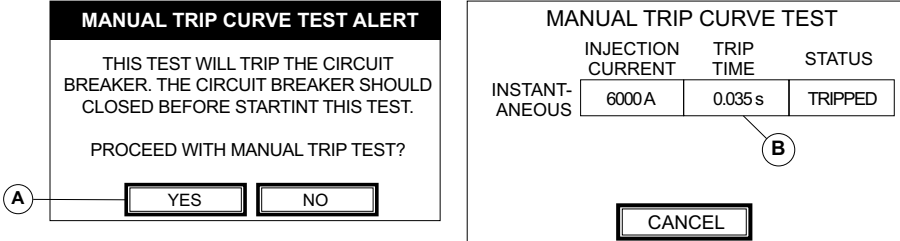
ERMS Full-Function Test Kit (FFTK) Setup

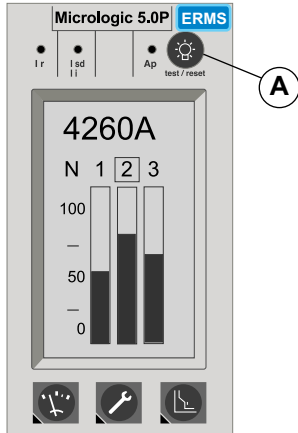

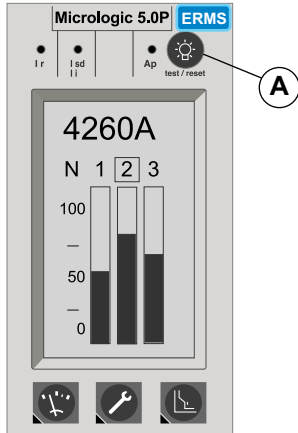
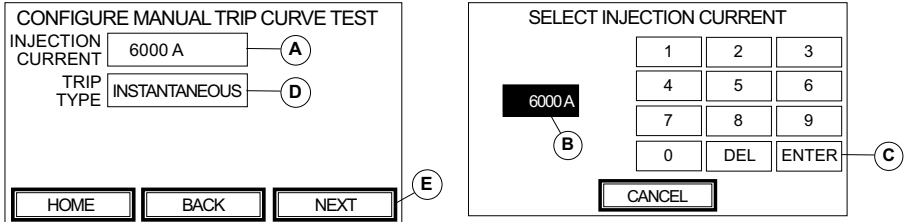
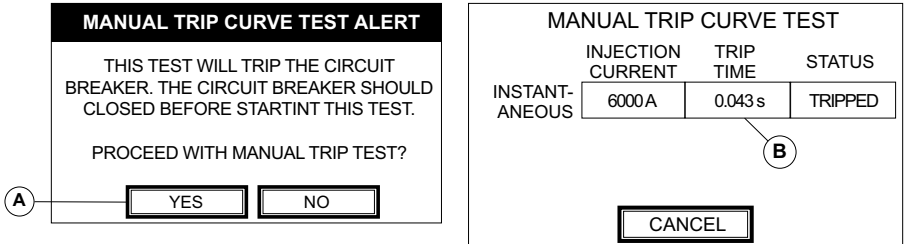
See the Full Function Test Kit (FFTK) Instruction Bulletin for information on operation of the test kit.

Energy Reduction Maintenance Setting (ERMS) Tripping Test

NOTE: The circuit breaker Energy Reduction Maintenance Setting (ERMS) instantaneous tripping can be tested with the circuit breaker Open or Closed. If the circuit breaker is closed, make sure all downstream loads are off. The circuit breaker cannot be carrying current for this test to be accurate.

<p>1 Turn on all control power to the trip unit, IO module and IFE.</p>	
<p>2 Make sure the ERMS switch is in the OFF position (A). The blue maintenance mode indicator light on the ERMS switch (A) must be off (not illuminated). If using the remote ERMS switch option, then the blue remote indicator light (B) must be off as well.</p>	
<p>3 Observe the load bar graph screen. If another screen is visible, press the wrench key (maintenance button) (D) on the trip unit. Make sure that "ERMS" is NOT displayed (C).</p>	
<p>4 Turn the ERMS switch to the ON position. The blue ERMS mode indicator light on the ERMS switch (A) must be illuminated. If using the remote ERMS switch option, then the remote indicator light (B) must be on as well.</p>	
<p>5 Press the wrench key (maintenance button) (D) on the trip unit to return to the load bar graph screen. After a short delay, check that the letters "ERMS" are displayed and flashing as shown (C). Go to the Ii setting by pressing the trip curve key (protection button) (E) on the trip unit. Select amperage protections and then I (A).</p>	

<p>6 Check that the I (A) value is the desired ERMS setting and not the Normal setting value.</p> <p>The ERMS system is programmed to default to an Instantaneous (Ii setting) of 2 x In. If this value is not correct, it can be adjusted using EcoStruxure Power Commission software and an IFE module. If there is no IFE module installed, one must be installed using the instructions shipped with the module.</p> <p>NOTE: The In value is shown at the bottom left of the trip unit (A).</p>	
<p>7 Connect FFTK to the MicroLogic trip unit with 7-pin test cable. Turn the Full Function Test Kit (FFTK) on and wait for the Power On test and for the Full-Function Test Kit Title screen (A) to come up. Select language as required.</p>	
<p>8 Click Next to go to the Select Test Kit Function screen (B). Wait for the Test Circuit Breaker Trip box to load on the screen.</p>	
<p>9 Press Test Breaker Trip box (C).</p>	
<p>10 The FFTK will communicate with the Micrologic P or H trip unit and populate most of the fields in the parameters screen (A). Enter the remaining fields manually from the nameplate of the circuit breaker being tested.</p>	
<p>11 Press the NEXT key (B) to go to the Select Circuit Breaker Test screen (C). Press Manually Test Trip Curve (D).</p>	
<p>12 Using numerical keypad, enter Minimum Available Arcing Current (if available) as amperage value to be tested (A). If Minimum Available Arcing Current is not available, enter a test value which is above the ERMS instantaneous pickup value and below the NORMAL instantaneous pickup value.</p> <p>Using keypad, enter Injection Current (B). Press ENTER (C).</p> <p>Use trip type touch key to select Instantaneous Trip option (D) to conduct the test. DO NOT use Long Time or Short Time setting to conduct the test as it injects different RMS values and can influence the trip time. Press NEXT (E).</p>	
<p>13 Click YES (A) to conduct the test. Record the values. For ERMS On mode, the trip time (B) should be < 50 ms (0.050 s). If the circuit breaker is in the ON position, the test will cause it to mechanically trip.</p> <p>Record the value manually or save the test file if desired. See the FFTK instruction bulletin for information on how to save the test file.</p>	

<p>14 Reset the trip indicator on the MicroLogic Trip Unit (A). The FFTK records trip time and evaluates the trip time to the trip curve to determine Pass or Fail.</p>	
<p>15 Turn the ERMS switch to the OFF position. Verify that The blue ERMS mode indicator light on the ERMS switch (A) is not illuminated. If using the remote ERMS switch option (B), verify that it is not illuminated either.</p>	
<p>16 Check the li setting on the trip unit screen. Make sure the li setting shown on this screen is the Normal setting and not the value for ERMS. (ERMS will be 2 x In or to the adjusted setting for ERMS, while the normal settings should be higher and would be recorded in the coordination study documents.)</p>	
<p>17 Using numerical keypad, enter Minimum Available Arcing Current (if available) as amperage value to be tested (A). If Minimum Available Arcing Current is not available, enter a test value which is above the ERMS instantaneous pickup value and below the NORMAL instantaneous pickup value. Using keypad, enter Injection Current (B). Press ENTER (C). Use trip type touch key to select Instantaneous Trip option (D) to conduct the test. DO NOT use Long Time or Short Time setting to conduct the test as it injects different RMS values and can influence the trip time. Press NEXT (E).</p>	
<p>18 Click YES (A) to conduct the test. Record the values (B). If the circuit breaker is in the ON position, the test will cause it to mechanically trip.</p>	
<p>19 Record the value manually or save the test file if desired. See the FFTK instruction bulletin for information on how to save the test file.</p>	
<p>20 Reset the trip unit.</p>	
<p>21 Turn off FFTK and disconnect from the trip unit.</p>	
<p>22 Verify NORMAL settings with ERMS disengaged (OFF position).</p>	
<p>23 Turn off all control power to the trip unit, IO module and IFE</p>	

MMS Testing

MMS Tripping Test Requirements

The system should be tested upon initial start-up and:

- in accordance with your facility maintenance schedule.
- if any of the components in the system are replaced.
- if any work is done in the area of the system wiring.

Tripping Test Necessary Tools

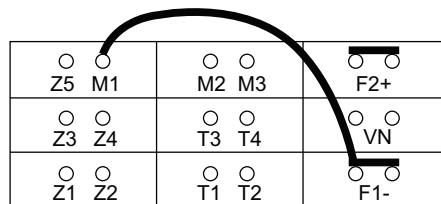
The following is needed to perform a tripping test (order separately).

- S33595 Full-Function Test Kit (FFTK)
- M2CTEST Special Tool Adapter for Full-Function Test Kit

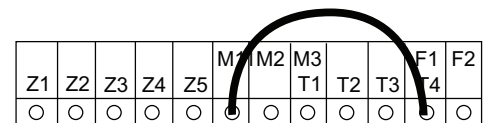
Before Testing Maintenance Mode Switch (MMS)

NOTE: For MicroLogic™ A trip units, 24 Vdc power must be available at F1(-) and F2(+) of the trip unit. The 24 Vdc power is not necessary for MicroLogic P and H trip units.

1. Complete the testing of the Maintenance Mode Switch (MMS) system wiring and indicator lights.
2. Verify that the MMS switch is in the OFF position.
3. If testing a MicroLogic 6.0 trip unit, install a jumper between trip unit terminals M1 and F1. This will assure that the residual ground-fault function will not interfere with this test.



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NOTE: On MDGF or SGR systems, the normal system wiring makes this M1 to F1 connection internally without the use of a jumper.

Full-Function Test Kit Connections

NOTE: The M2CTEST special adapter disables communication between the FFTK and MicroLogic A, P and H trip units so that some of the normal FFTK functions are intentionally disabled. These include:

- Trip unit parameter automatic population (trip unit type and In)
- Inhibit functions (thermal imaging and ground-fault)
- ZSI test
- Powering the trip unit

When using the M2CTEST special adapter, all advanced protections, logging of trips, logging of alarms, activation of alarms and incrementing the contact wear counter are enabled during the secondary injection test.

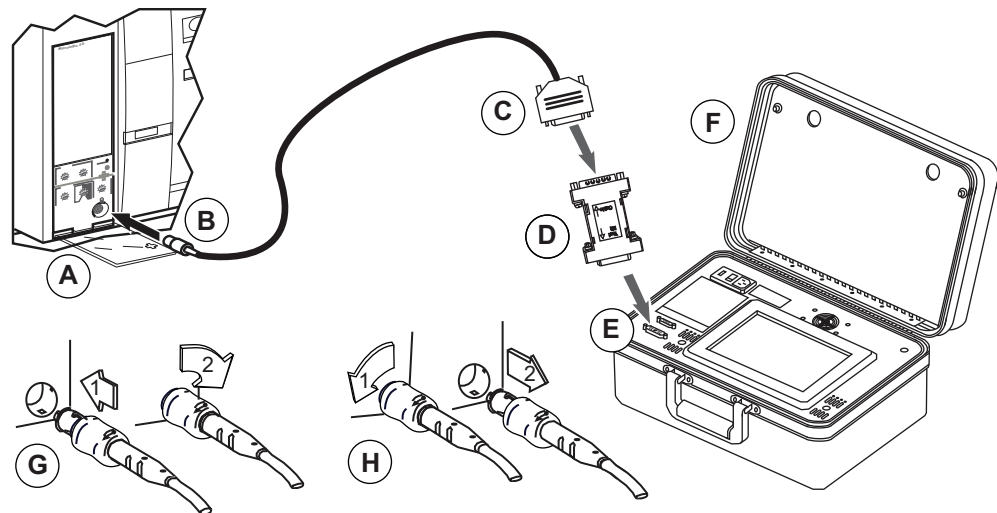
NOTICE

HAZARD OF EQUIPMENT DAMAGE

Pins on seven-pin test cable connector can bend or break if forced. Avoid using excessive force when connecting to trip unit test ports.

Failure to follow these instructions can result in equipment damage.

- A. Trip Unit
- B. Full-Function Test Kit Cable
- C. Ten Pin Test Cable Connector
- D. M2C Test Adapter Tool
- E. Ten Pin Port
- F. Full Function Test Kit
- G. Plugging in the 7-Pin Connector
- H. Unplugging the 7-Pin Connector



Maintenance Mode Switch (MMS) Testing

NOTE: This test allows manual current injection values regardless of trip unit settings. The Full-Function Test Kit monitors and displays trip time associated with selected current. Trip times reported by the Full-Function Test Kit must be manually compared to a published trip unit time-current curve for the trip unit being tested. Based on the trip unit settings, select an injection current that is just above the short time pickup (I_{sd}) trip curve pickup point. This will assure that sufficient current is injected to allow the trip unit to trip in the short time delay (T_{sd}) tripping curve.

See the Full-Function Test Kit (FFTK) Instruction Bulletin for information on operation of the test kit

1	Turn the Full Function Test Kit (FFTK) on and wait for the Power On test and for the Full-Function Test Kit Title screen (A) to come up. Select language as required.	
2	Click Next to go to the SELECT TEST KIT FUNCTION screen (B). Wait for the TEST BREAKER TRIP box to load on the screen.	
3	Press TEST BREAKER TRIP box (C).	
4	Press the boxes in the CONFIGURE CIRCUIT BREAKER PARAMETERS screen (A) to populate each field. Refer to the FFTK instruction bulletin for details on each parameter. NOTE: The trip unit type selections with the M2CTEST adapter will only be 2.0, 3.0 and 5.0. If the trip unit you are testing is a Micrologic 6.0, select 5.0 for these tests.	
5	Press the NEXT key (B) to go to the SELECT CIRCUIT BREAKER TEST screen (C). Press MANUALLY TEST TRIP CURVE (D).	
6	Press INJECTION CURRENT (A) to select Injection Current screen (B).	
7	Use numerical keypad (C) to type in desired fault current in amperes, which should be the minimum available arcing current. (If the minimum available arcing fault current value is not available, choose a value in the short time delay band of the time-current characteristic curve of the device which is being tested.)	
8	Press ENTER (D) to return to CONFIGURE MANUAL TRIP CURVE TEST screen (A).	
9	Turn the MMS switch to the ON position. The blue MMS mode indicator light on the ERMS switch (A) must be illuminated. If using the remote switch option, then the remote indicator light (B) must be on as well.	

<p>10</p>	<p>From the CONFIGURE MANUAL TRIP CURVE TEST screen (A), scroll the TRIP TYPE touch key to select "SHORT TIME" (B).</p>									
<p>11</p>	<p>Press NEXT (C) to proceed to the MANUAL TRIP CURVE TEST ALERT screen (D).</p>									
<p>12</p>	<p>Read the alert message, verify the circuit breaker is closed, and press YES (E) to initiate the test.</p>									
<p>13</p>	<p>The MANUAL TRIP CURVE TEST screen displays a table with three columns:</p> <ul style="list-style-type: none"> INJECTION CURRENT—shows magnitude of current, in amperes, during testing of each segment of time-current curve. TRIP TIME—displays time, in seconds, until circuit breaker trips. STATUS—indicates testing progress for each protective function. The following variables can appear in the status column: <ul style="list-style-type: none"> TESTING: injecting test signal STOPPING (blinking): exiting test mode TRIPPED: test signal caused circuit breaker to trip <p>The Full-Function Test Kit records the amount of time required to trip the circuit.</p>	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>INJECTION CURRENT</th> <th>TRIP TIME</th> <th>STATUS</th> </tr> </thead> <tbody> <tr> <td>SHORT TIME</td> <td>7200 A</td> <td>0.061 s</td> <td>TESTING</td> </tr> </tbody> </table>		INJECTION CURRENT	TRIP TIME	STATUS	SHORT TIME	7200 A	0.061 s	TESTING
	INJECTION CURRENT	TRIP TIME	STATUS							
SHORT TIME	7200 A	0.061 s	TESTING							
<p>14</p>	<p>Trip time (A) with MMS switch ON should be less than 80 ms.</p>	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>INJECTION CURRENT</th> <th>TRIP TIME</th> <th>STATUS</th> </tr> </thead> <tbody> <tr> <td>SHORT TIME</td> <td>7200 A</td> <td>0.061 s</td> <td>TRIPPED</td> </tr> </tbody> </table>		INJECTION CURRENT	TRIP TIME	STATUS	SHORT TIME	7200 A	0.061 s	TRIPPED
	INJECTION CURRENT	TRIP TIME	STATUS							
SHORT TIME	7200 A	0.061 s	TRIPPED							
<p>15</p>	<p>Locate the Maintenance Mode Setting (MMS) switch for the intended circuit breaker. If the MMS switch is in the ON position (A), turn it off (B). Verify that the maintenance mode indicator light located on the MMS switch is not illuminated (B).</p>									
<p>16</p>	<p>Press CANCEL on the MANUAL TRIP CURVE TEST screen (A) to return to the CONFIGURE MANUAL TRIP CURVE TEST screen (B).</p>									

<p>17</p>	<p>Press NEXT (A) to proceed to MANUAL TRIP CURVE TEST ALERT screen (B). Read the alert message, verify circuit breaker is closed, and press YES (C) to initiate manual trip curve test with MMS switch OFF.</p>	
<p>18</p>	<p>Once the circuit breaker trips, check the value recorded in the TRIP TIME column. This is the tripping time with MMS switch OFF.</p>	
<p>19</p>	<p>Compare the reduced tripping time with the MMS switch ON with the normal tripping time with the MMS switch OFF. This testing shows the tripping time reduction that MMS provides.</p>	

Remove Trip Unit Jumper

⚠️ ⚠️ WARNING

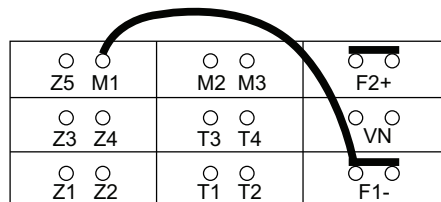
HAZARD OF LOSS OF GROUND-FAULT PROTECTION

Leaving the jumper installed between M1 and F1 will result in the circuit breaker no longer providing residual ground-fault protection

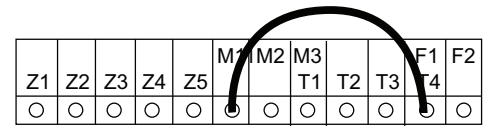
Failure to follow these instructions can result in death, serious injury, or equipment damage.

If a jumper was installed between terminals M1 and F1 before testing (see *Before Testing Maintenance Mode Switch (MMS)*, page 11), remove the jumper now. If a jumper was installed and is not removed after testing, the circuit breaker will not provide residual ground-fault protection.

NOTE: On MDGF or SGR systems, the normal system wiring makes the M1 to F1 connection internally without the use of a jumper.



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Instantaneous Trip Testing

Tripping Test Necessary Tools

The following is needed to perform a tripping test (order separately).

- S33595 Full-Function Test Kit (FFTK)

Full-Function Test Kit Connection

NOTICE

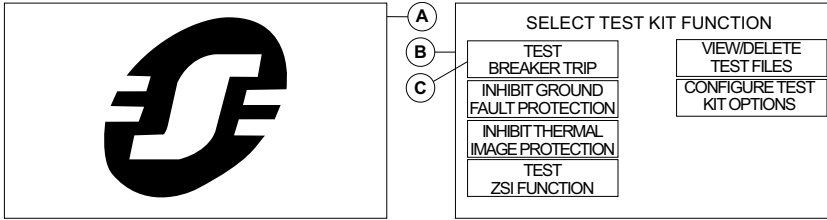
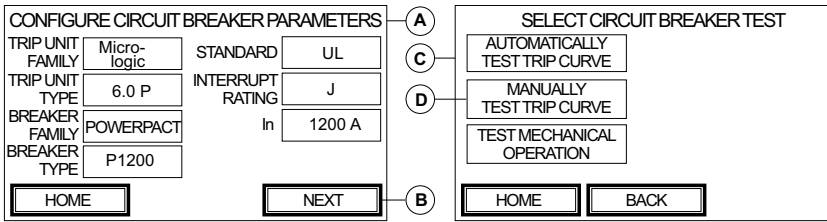
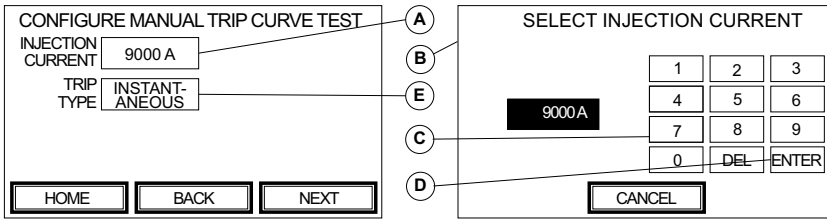
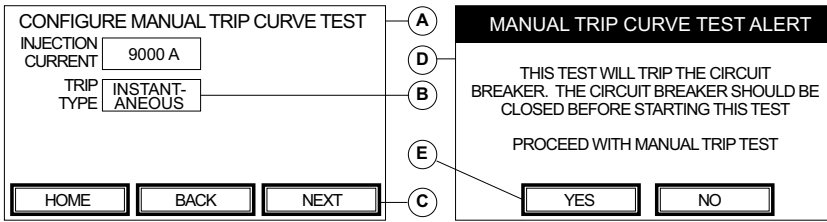
HAZARD OF EQUIPMENT DAMAGE

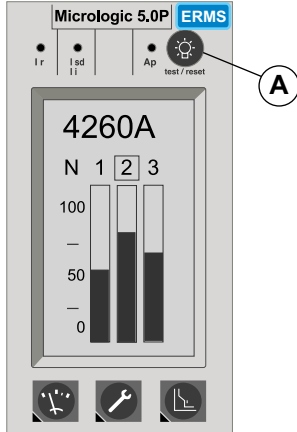
Pins on seven-pin test cable connector can bend or break if forced. Avoid using excessive force when connecting to trip unit test ports.

Failure to follow these instructions can result in equipment damage.

Instantaneous Testing

See the Full-Function Test Kit (FFTK) Instruction Bulletin for information on operation of the test kit

1	Make sure that the equipment is de-energized before conducting the test.	
2	Confirm that the circuit breaker is adjusted to the proper settings according to the coordination study. Use the dials on the trip unit to set long time, short time, and instantaneous trip setting. The Instantaneous adjustment (Ii) must be below the Minimum Available Arcing Current.	
3	It is recommended to have the circuit breaker in the OFF position, but it is not required to perform the test. The circuit breaker will trip during the test sequence.	
4	Turn the Full Function Test Kit (FFTK) on and wait for the Power On test and for the Full-Function Test Kit Title screen (A) to come up. Select language as required.	
5	Click Next to go to the SELECT TEST KIT FUNCTION screen (B). Wait for the TEST BREAKER TRIP box to load on the screen.	
6	Press TEST BREAKER TRIP box (C).	
7	Once the FFTK is powered, enter the circuit breaker parameters into the CONFIGURE CIRCUIT BREAKER PARAMETERS screen. The information can be found on the faceplate of the circuit breaker.	
8	Press the NEXT key (B) to go to SELECT CIRCUIT BREAKER TEST screen (C). Press MANUALLY TEST TRIP CURVE (D).	
9	Press INJECTION CURRENT (A) to select Injection Current screen (B).	
10	Use numerical keypad (C) to type in desired fault current in amperes (which should be above the instantaneous pickup level).	
11	Press ENTER (D) to return to CONFIGURE MANUAL TRIP CURVE TEST screen (A).	
12	From the CONFIGURE MANUAL TRIP CURVE TEST screen (A), scroll the TRIP TYPE touch key to select "INSTANTANEOUS" (B).	
13	Press NEXT (C) to proceed to the MANUAL TRIP CURVE TEST ALERT screen (D). DO NOT use Long Time or Short Time setting to conduct the test as they inject different RMS values and can influence the trip time.	
14	Read the alert message and press YES (E) to initiate the test.	

<p>15</p>	<p>The MANUAL TRIP CURVE TEST screen displays a table with three columns:</p> <ul style="list-style-type: none"> • INJECTION CURRENT—shows magnitude of current, in amperes, during testing of each segment of time-current curve. • TRIP TIME—displays time, in seconds, until circuit breaker trips. • STATUS—indicates testing progress for each protective function. The following variables can appear in the status column: <ul style="list-style-type: none"> ◦ TESTING: injecting test signal ◦ STOPPING (blinking): exiting test mode ◦ TRIPPED: test signal caused circuit breaker to trip <p>The Full-Function Test Kit records the amount of time required to trip the circuit.</p>	<div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>MANUAL TRIP CURVE TEST</p> <table border="1" style="margin: auto;"> <thead> <tr> <th></th> <th>INJECTION CURRENT</th> <th>TRIP TIME</th> <th>STATUS</th> </tr> </thead> <tbody> <tr> <td>INSTANT-ANEOUS</td> <td>9000 A</td> <td>0.038 s</td> <td>TESTING</td> </tr> </tbody> </table> <p style="margin-top: 10px;">CANCEL</p> </div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>MANUAL TRIP CURVE TEST</p> <table border="1" style="margin: auto;"> <thead> <tr> <th></th> <th>INJECTION CURRENT</th> <th>TRIP TIME</th> <th>STATUS</th> </tr> </thead> <tbody> <tr> <td>INSTANT-ANEOUS</td> <td>9000 A</td> <td>0.038 s</td> <td>TRIPPED</td> </tr> </tbody> </table> <p style="margin-top: 10px;">CANCEL</p> </div> </div>		INJECTION CURRENT	TRIP TIME	STATUS	INSTANT-ANEOUS	9000 A	0.038 s	TESTING		INJECTION CURRENT	TRIP TIME	STATUS	INSTANT-ANEOUS	9000 A	0.038 s	TRIPPED
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<p>16</p>	<p>Once the circuit breaker trips, the trip time should be < 50 ms (0.050 s).</p>																	
<p>17</p>	<p>Reset the trip indicator on the MicroLogic Trip Unit (A).</p> 																	

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As standards, specifications, and design change from time to time,
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