



#61-152

#61-153

## SureTest® Model ST 1D Instructions

### Introduction

The SureTest® family of circuit analyzers identify problems common to electrical circuits quickly, easily and accurately. They have a patented voltage drop test, which applies a full 15 ampere load without causing interruption to equipment on the circuit.

### Product Features

- Identifies and Locates
  - Loose Wire Connections
  - Bad Splices/Receptacles
  - High Resistance Grounds
  - False (Bootleg) Grounds
  - Shared Neutrals
- Verifies
  - Proper Wiring in 3-Wire Receptacles
  - Proper GFCI Operation
  - Dedicated Circuit Presence
  - Isolated Ground Presence (with the 61-176 Isolated Ground Adapter)
- Measures
  - Line Voltage
  - Ground Impedance
  - % Voltage Drop by Conducting an Actual Full 15 Amp Load Test
  - % Voltage Drop by Simulating a 20 Amp Load Test
  - GFCI Trip Time
  - Neutral-to-Ground Voltage
  - Estimated Load on Circuit



### General Operation

The SureTest® Model ST-1D Circuit Analyzer takes only seconds to test each outlet and circuit under a full load. The ST-1D indicates proper wiring, voltage drop and line voltage in an easy pass/fail format. A simple programming menu gives access to measurements of line voltage, voltage drop at a full 15 amperes and 20 amperes, ground-to-neutral voltage, estimated load on the circuit and ground impedance. The ground fault circuit interrupter (GFCI) test is performed separately and will disrupt the electrical supply if a functional GFCI is present.

*Any discrepancies from a normal reading indicates that a problem has been detected in the circuit.*

For use in 3-prong (grounded) outlets, insert the ST-1D into the receptacle with the ground pin extended. For use in 2-prong (non-grounded) outlets, leave the ground pin retracted. Non-grounded (2-prong) outlets will be tested for voltage drop and line voltage only.



### WARNING

Do not use on outputs from UPS systems, light dimmers or square wave generating equipment.

Insert the unit in the receptacle, observe test results, remove and reinsert the unit while pressing the test button to perform the ground impedance test, and then move on to the next receptacle. Allow at least 20 seconds between insertions. Repeatedly inserting the SureTest into a receptacle will exceed its ability to dissipate heat within the unit, resulting in fluctuating readings or damage to the unit.

### False Ground Indication

Sometimes 2-wire receptacles are replaced with 3-wire receptacles to accommodate 3-wire plugs. A short placed between ground and neutral on the back of the receptacle will test and appear to be a normal 3-wire circuit. Common receptacle testers will test this configuration as a normal 3-wire outlet.

Display of "FG" on the LED display on power-up indicates a suspected false ground. False ground is defined as a short between the ground and neutral wires very close to the receptacle. A false ground may also be indicated if the receptacle is within 15 feet of the neutral-ground bonding point at the panel, or if conduit is being used as the ground conductor.

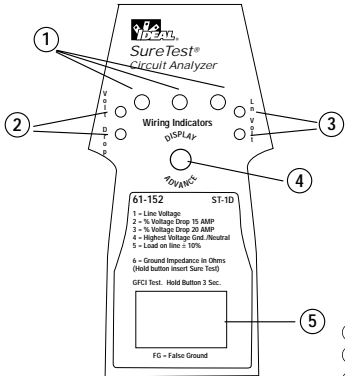
## Specifications

Case Construction:	GE Cycolac molded plastic
Operating Range:	108 to 132 Volts (61-152) 207 to 253 v. (61-153)
Power Consumption:	1 Watt contin; 1800 W peak
Wiring Indications:	Pass/Fail format.
Digital Display:	Seven segment L.E.D., .3"
Operating Temp.:	0 C to 50 C
Storage Temp.:	-20 C to +65 C
Dimensions:	17.78 x 7.62 x 3.81 cm
Weight:	200 grams (7 ounces)

## Accuracy

Line Voltage:	±2.5% full scale ±1 digit
Voltage Drop:	±2.5% full scale ±1 digit
Ground-to-Neutral Voltage:	±2.5% full scale ±1 digit
Est. Load on Circuit:	±10% full scale ±1 digit
Ground Impedance:	±2.5% full scale ±1 digit (0-1 Ohm) ±5.0% full scale ±1 digit (1-2 Ohm)
GFCI Trip Time:	±2.5" full scale ±1 digit

## Front Panel Indicators



- ① Wiring Indicators
- ② Ground Impedance Indicators
- ③ Ground-to-Neutral Indicators
- ④ G.F.C.I. Test Button
- ⑤ LED Display

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## Test Procedures

### Pass/Fail Indication

The ST-1D checks receptacles for proper wiring, and give a pass/fail indication of voltage drop and line voltage. These tests are performed immediately upon insertion of the SureTest into the receptacle.

### Wiring Verification

The ST-1D checks receptacle wiring for the following conditions:

Correct wiring, no ground, polarity reversed, no hot, or no neutral or hot and ground reversed. These conditions are indicated on the wiring indicators.

WIRING INDICATIONS		ON ●
○ ● ●	NORMAL	OFF ○
● ● ●	NO GROUND	
○ ● ●	POLARITY REVERSED	
○ ○ ○	NO HOT	
● ● ○	NO NEUTRAL or HOT/GROUND REVERSED	

Insert the ST-1D into the receptacle for indication of the wiring condition.



### WARNING

An indication of "No Ground" on the wiring indicators indicates a safety hazard is present. Defective grounds must be repaired prior to the GFCI test.

The ST-1D will not indicate a reversal of the ground and neutral connections, detect two hot connections, or indicate simultaneous defects.

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### Voltage Drop Testing

The ST-1D checks the voltage drop of a receptacle under a full 15 ampere load without interruption to equipment on the circuit. The voltage drop LEDs, located on the left side of the instrument, will indicate a pass/fail condition based on the maximum voltage drop for branch circuits recommended by the National Electrical Code for reasonable efficiency. (NEC article 210-19. FPN 4)

1. Insert the ST-1D into the receptacle
  - **Green** confirms that a full 15 ampere load causes less than a 5% voltage drop
  - **Amber** indicates that the voltage drop in the circuit is greater than 5% under a full 15 ampere load

### Line Voltage Testing

The ST-1D checks line voltage of the receptacle to ensure that it is within 10% of the nominal line voltage. For the 120VAC version, #61-152, the line voltage should be between 108 and 132 volts. For the 230VAC version, #61-153, the line voltage should be between 207 and 253 volts.

1. Insert the ST-1D into the receptacle
  - **Green** confirms that the line voltage is within 10%
  - **Red** indicates that the line voltage is beyond the specified 10% tolerance

NOTE: A failure of the line voltage test will force a failure of the voltage drop test.

### Electrical Measurements

In addition to pass fail/indication of key wiring and electrical test parameters, the ST-1D will measure key electrical values such as line voltage, voltage drop under 15 and 20 ampere loads, ground-to-neutral voltage, estimated load and ground impedance. These measurements are accessed through a simple programming menu.

Unless a false ground condition exists, the ST-1D will show "L-n" in the LED display, located on the bottom of the instrument. This indicates that the unit is calibrating itself prior to testing. After this calibration is performed, the ST-1D automatically enters into the programming menu. The LED display cycles between the numerical sequence of the test, and the measurement every four seconds. Press and hold the display advance button for 1 second to move through the menu to the next test.

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1. Insert the ST-1D into the receptacle
2. The LED display will show "L-n" to indicate self-calibration of the unit
3. The LED display will show "1=" to indicate that the first measurement is being taken.
4. The first measurement is tested and displayed
5. The LED display alternates between the numerical sequence of the test and the measurement every four seconds
6. Press and hold the display advance button for one second to move to the next test

The fifth measurement, estimated load, is the final test in the menu. Pressing and holding the display advance button will move back to line voltage, the first test in the menu.

### Line Voltage Measurement

The line voltage test is indicated on the LED display by "1=". After four seconds the display cycles to the actual line voltage measurement. The LED display alternates between "1=" and the line voltage measurement every four seconds.

### Voltage Drop Measurement - 15 Amp Load

The voltage drop test at 15 Amps is indicated on the LED display by "2=". This measurement is tested under a full 15 ampere load without interruption to equipment on the circuit. The National Electrical Code recommends 5% as the maximum voltage drop for branch circuits for reasonable efficiency. (NEC article 210-19. FPN 4)

### Voltage Drop Measurement - 20 Amp Load

The voltage drop test at 20 Amps is indicated on the LED display by "3=". This measurement is calculated from a 15 ampere load.

### Ground-to-Neutral Voltage Measurement

The ground-to-neutral voltage test is indicated on the LED display by "4=". Ground-to-neutral voltage results from current flowing in the neutral conductor from other equipment on the circuit. High ground-to-neutral voltage indicates that the circuit may be loaded near its capacity or the neutral conductor may be shared or carrying harmonic distortion. A reading of less than 2 volts usually indicates a usable outlet. An excessive ground-to-neutral voltage may result in inconsistent or intermittent equipment performance. This is a peak reading, which will be reset by pressing the display advance button, and cycling through the menu until the LED display shows "4=" again.

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This test can also be used to verify a dedicated circuit. **A measurement greater than 0.1 volts indicates that the receptacle under test is not on a dedicated circuit. If the LED display is flashing, the unit is unable to detect a ground. In the absence of a ground, the ground-to-neutral voltage can not be misused. A reading of high on the LED display indicates that the ground-to-neutral voltage is greater than 2 volts.**

#### Estimated Load Measurement

The estimated load test is indicated on the LED display by "5=". A current draw confirms that the receptacle under test is not on a dedicated circuit. This is a peak reading, which will be reset by pressing the display advance button, and cycling through the menu until the LED display shows "5=" again.

This is the final measurement in the programming menu. Pressing and holding the display advance button will move back to line voltage, the first test in the menu.

#### Ground Impedance Measurement



#### WARNING

An indication of "No Ground" on the wiring indicators indicates a safety hazard is present. Do not perform the ground impedance testing under these conditions.

The ground impedance measurement is a separate measurement and is outside the programming menu. To measure ground impedance, the SureTest must be removed and re-inserted into the receptacle while pressing the display advance button.

The ST-1D checks ground impedance by pulsing 15 amperes from hot-to-ground to ensure that the resistance is less than 1 Ohm. This test can not be performed on a GFCI receptacle. The pulse will trip the GFCI.

1. Remove the ST-1D from the receptacle
2. Re-insert the ST-1D into the receptacle while pressing the center button
3. The LED display will show "L-G" to indicate the ground impedance test
4. The LED display will show "6=" to indicate that the measurement is being taken.
5. Ground impedance is measured and displayed

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The ground impedance of an equipment chassis can be checked with #61-175 ground continuity adapter.

1. Attach the #61-175 ground adapter to the ST-1D
2. Clip the alligator lead from the adapter to the equipment chassis
3. Insert the St-1D into the receptacle while pressing the center button The LED display will show "L-G" to indicate the ground impedance test
4. The LED display will show "6=" to indicate that the measurement is being taken.
5. Ground impedance is measured and displayed

#### G.F.C.I. Testing

The ST-1D applies 6mA to ground through a fixed resistor to trip the GFCI. A functional GFCI will disconnect the power. The reset may be at the outlet or at the panel.



#### WARNING

When testing 3-wire outlets, do not proceed with the GFCI test if the Wiring Indicator lights indicate a "No Ground" condition exists. Repair the ground circuit first.

1. Operate the test button on the GFCI installed in the circuit. The GFCI should trip. If it does not, replace the GFCI. If it does trip, reset the GFCI.
2. Insert the ST-1D into the receptacle.
3. Press the GFCI test button on the ST-1D for 6 seconds.
4. The actual current being applied to ground will be displayed.
5. (6mA is the nominal current sent through the fixed resistor. The actual current will vary depending on the line voltage per UL1436.)
6. The tester will apply the current and count up to 6.5 seconds.
  - If the GFCI is functioning properly, the circuit will disconnect, and the LEDs on the ST-1D will go out. When the circuit is reset, and power is returned, the LED display will show the actual time to trip.
  - If the GFCI fails to trip, the LED display will show ibAdi, which indicates that the GFCI may be installed incorrectly, or the GFCI may be defective.

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**! WARNING**

In order to test GFCIs in a 2-wire system (no ground wire), the #61-175 ground continuity adapter must be used. Connect the ground lead on the adapter to a ground, such as a metal water or gas pipe.

**Optional Accessories**

**#61-175 Ground Continuity Adapter**

This adapter allows the operator to verify that a cabinet or equipment chassis has been properly connected to the power system ground. Plugging into the #61-175 adapter will isolate the SureTest from the power source ground. The Wiring Indicators of the unit will display a No Ground condition. If the equipment is properly grounded, then touching the alligator clip from the ground continuity adapter to the cabinet or equipment chassis should return the circuit to a Normal condition.

**! WARNING**

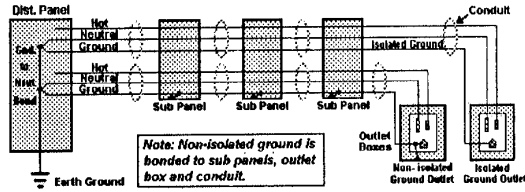
This is a static test and will not confirm the current carrying capacity of the ground.

With the ST-1D, this adapter can be used to check the ground impedance of a cabinet or equipment chassis. See the Ground Impedance Measurement section for test instructions.

This adapter can also be used to test GFCI receptacles on 2-wire circuits. Connect the ground lead on the adapter to a ground, such as a metal water or gas pipe, prior to GFCI testing.

**#61-176 Isolated Ground Adapter**

This adapter allows the operator to verify that a receptacle is completely isolated from the other grounds between the receptacle and the entry panel.



**! WARNING**

The receptacle should be tested for proper grounding prior to testing for ground insulation.

Test the ground impedance of the receptacle and make a note of the results. See the section on ground impedance testing for details. Remove the SureTest from the receptacle and plug it into the #61-176 adapter. Clip the ground wire to the metal outlet, center receptacle screw, or the metal outlet box. Press the display advance button, and re-insert the ST-1D into the receptacle. Make a note of the result.

If the two resistance readings are the same, then the receptacle is not isolated. If the receptacle is isolated, the reading with the #61-176 will be lower. A reading of half when the adapter is used is common, because a parallel ground path has been introduced by attaching the ground wire to the grounding point of the receptacle.

**#61-177 Extension Cord**

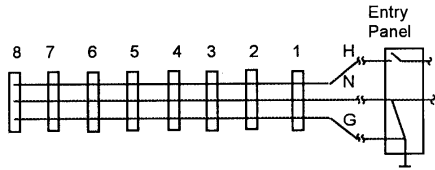
The ST-1 is supplied with an extension cord to make testing easier on hard-to-reach outlets. Replacement extension cords can be purchased from your authorized IDEAL distributor.

## #61-179 Carrying Case

The ST-1 is supplied with a lightweight carrying case to protect the units and store the instruction sheet and accessories. Replacement cases can be purchased from your authorized IDEAL distributor.

### Troubleshooting

#### Locating Loose (High Resistance) Connections and Splices



Loose connections, splices and bad connections can be isolated by using the SureTest to test receptacles in sequence along the branch circuit.

For example if the voltage drop at receptacle 5 is unacceptable, checking the other receptacles in the branch can help isolate the problem. If receptacles 1 through 4 and 6 through 8 check out OK, than further investigation should take place at the connection to receptacle 5. The additional resistance could be due to a loose connection/splice. If receptacles 6 through 8 are also unacceptable, chances are that the problem is in either the hot or neutral conductor in the wall between receptacles 4 and 5.

If all of the branch receptacles have unacceptable voltage drops, the problem is most likely in the circuit between the panel and the first receptacle or at the panel. If all branches are in high resistance, the problem may be in the circuit from the meter, or from the transformer to the service entrance.

Using the SureTest will help identify problem areas for further investigation of the receptacles and/or branch circuit.

### Troubleshooting Tips

Problem	Possible Causes/Solutions
High/Low Line Voltage	<ul style="list-style-type: none"> <li>• Too much load on branch n also causing excessive voltage drop</li> <li>• Poor connection at receptacle</li> <li>• Supply voltage too high/low</li> <li>• Clean and tighten receptacle connections</li> <li>• Consult power company</li> </ul>
High Voltage Drop (5% recommended by NEC)	<ul style="list-style-type: none"> <li>• Too much load on branch</li> <li>• Too many outlets on branch</li> <li>• Diameter of wire too small</li> <li>• Check and tighten connection at receptacle</li> <li>• Clean any corroded wires</li> <li>• Replace outlet, switch</li> <li>• Replace circuit breaker</li> </ul>
High Ground-to-Neutral Voltage (Greater than 2 Volts)	<ul style="list-style-type: none"> <li>• Current flowing in the neutral conductor</li> <li>• Locate/repair source</li> <li>• Install surge suppression</li> </ul>
High Ground Impedance (Greater than 1 Ohm)	<ul style="list-style-type: none"> <li>• Loose ground connection</li> <li>• Check and tighten ground connections</li> <li>• Clean any corroded wires</li> </ul>
Failure of GFCI Test (GFCI will not trip)	<ul style="list-style-type: none"> <li>• GFCI may be installed incorrectly</li> <li>• GFCI may be defective</li> </ul>
	<ul style="list-style-type: none"> <li>• Check for proper connections</li> <li>• Replace outlet</li> </ul>



#### WARNING

Maintenance on electrical wiring should only be performed by qualified personnel.



SureTest Circuit Analyzers

SureTest® Selection Guide	61-150 ST-1	61-151 ST-IP+	61-152 ST-ID	61-153 ST-ID
<b>Identifies and Locates</b>				
Loose Wire Connections	•	•	•	•
Bad Splices/Receptacles	•	•	•	•
High Resistance Grounds	•	•	•	•
False (Bootleg) Grounds		•	•	•
Shared Neutrals			•	•
<b>Indicates</b>				
Proper Wiring in 3-Wire Receptacles	•	•	•	•
Min/Max Line Voltage	•		•	•
Pass/Fail Voltage Drop	•		•	•
Pass/Fail Ground Impedance		•		
Pass/Fail Neutral-to-Ground Voltage		•		
<b>Verifies</b>				
Dedicated Circuit Presence			•	•
Isolated Ground Presence (with #61-176 Adapter)		•	•	•
Proper GFCI Operation	•	•	•	•
<b>Measures</b>				
Line Voltage		•	•	•
Ground Impedance (Ohms)			•	•
% Voltage Drop under 15 ampere load		•	•	•
% Voltage Drop under 20 ampere load			•	•
GFCI Trip Time		•	•	•
Neutral-to-Ground Voltage			•	•
Estimated Load on Circuit (Amps)			•	•
<b>Additional Features</b>				
220 VAC Operation				•

SureTest Circuit/Harmonics Analyzers

SureTest® Selection Guide	61-156 ST-1THD	61-157 ST-1THDC	61-158 ST-1THDC
<b>Identifies and Locates</b>			
Loose Wire Connections	•	•	•
Bad Splices/Receptacles	•	•	•
High Resistance Grounds	•	•	•
False (Bootleg) Grounds	•	•	•
Shared Neutrals	•	•	•
<b>Verifies</b>			
Dedicated Circuit Presence	•	•	•
Isolated Ground Presence (with #61-176 Adapter)	•	•	
Proper GFCI Operation	•	•	•
<b>Measures</b>			
Line Voltage	•	•	•
Ground Impedance (Ohms)	•	•	•
% Voltage Drop under 15 ampere load	•	•	•
% Voltage Drop under 20 ampere load	•	•	•
GFCI Trip Time	•	•	•
Neutral-to-Ground Voltage	•	•	•
Estimated Load on Circuit (Amps)	•	•	•
True RMS Measurements (Voltage)	•	•	•
True RMS Measurements (Current) (with #61-181 Adapter)		•	•
Line Frequency	•	•	•
Power Consumption (Watts)	•	•	•
Distortion to 31st Harmonic	•	•	•
<b>Additional Features</b>			
220 VAC Operation			
For use with #61-181 500AAC Adaptor		•	•
Included with #61-181 500AAC Adaptor			•
Event recording	•	•	•



Warranty limited solely to repair or replacement; no warranty of merchantability, fitness for a particular purpose or consequential damages.

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