Did you know? A failed bypass diode can cause a fire.

Inspect solar panel bypass diodes for opens and shorts in broad daylight without covering panels

Quickly identify faulty bypass diodes during operation and maintenance

Efficiently test strings without covering panels

Simultaneously measure all parameters

Automatically transfer data wirelessly

World’s first

Efficiently test strings without covering panels
Easily inspect bypass diodes for open and short-circuit faults even in broad daylight

Bypass diodes protect solar cells from overheating when partial shading occurs. However, they only jump into action when a panel is shaded, so defective diodes can go undiscovered until it is too late. When a defective bypass diode is unable to prevent a shaded cell from receiving more and more negative voltage, the cells can overheat and cause eventual damage.

World's first! Conduct open fault testing easily during any time of day

- Traditionally, bypass diodes can only be inspected for good working condition at night or when power is not being generated by the solar panels in order to verify that any applied current is guided past the solar cells. With the FT4310, you can detect for open faults even when the sun is out without covering the panels. Testing can also be performed at night.
  *Testing for short-circuit faults can only be performed during the day.*

- Easily test using the strings in the junction boxes, eliminating the need to climb onto the roof and dramatically improving work efficiency.
  *Disconnect the string being measured from the interconnect prior to measurement.

Save time - simultaneously measure all electrical parameters

- Simply set the rotary knob to “BPD TEST” and press the “Measure” button to measure and display all parameters necessary for fault identification (open-circuit voltage, short-circuit current, and bypass route resistance).

<table>
<thead>
<tr>
<th>Normal reading</th>
<th>Measurement takes 2 sec. or less per string</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBPR: Bypass route resistance value</td>
<td>PASS</td>
</tr>
<tr>
<td>Voc: Open-circuit voltage value</td>
<td>348 V</td>
</tr>
<tr>
<td>Isc + α1: Measuring current value</td>
<td>7.6 A</td>
</tr>
<tr>
<td>Isc: Short-circuit current value</td>
<td>6.6 A</td>
</tr>
</tbody>
</table>

Red backlight and audible warning alert the user to possible faults

<table>
<thead>
<tr>
<th>Open fault</th>
<th>Using BPD TEST mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open state</td>
<td>The instrument indicates the open state (&quot;opn&quot;).</td>
</tr>
<tr>
<td>Current values</td>
<td>The measurement current and short-circuit current are approximately equal.</td>
</tr>
</tbody>
</table>

- Principle
  If the bypass diode is functioning normally, the measured current value should be close to 1 A larger than the short-circuit current value.
  *Visit the Hioki website for a more detailed explanation of the underlying principles.

<table>
<thead>
<tr>
<th>Short-circuit fault</th>
<th>Using Voc mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured value</td>
<td>Voc: Measured value</td>
</tr>
<tr>
<td>Reference value (initial measured value)</td>
<td>REF: Reference value</td>
</tr>
<tr>
<td>Difference between measured value and reference value</td>
<td>DIF: Difference between measured value and reference value</td>
</tr>
<tr>
<td>Diode failure determination</td>
<td>The diode is determined to have failed since the values differ by -10 V.</td>
</tr>
</tbody>
</table>

- Principle
  When a bypass diode experiences a short-circuit fault, the output voltage decreases (by about 10 V) because the corresponding solar panels are not contributing to the array's generated power. By detecting this difference, it is possible to detect bypass diode short-circuit faults and cell string losses.
Ease of use and functionality in a powerful instrument that fits in the palm of your hand

**Improve work efficiency by continuing to measure and record without interruptions**
Automatically transfer data with Bluetooth® wireless technology

Measured values held on the display are sent immediately to a smartphone or tablet via Bluetooth® wireless technology. Eliminate the need to take notes - particularly useful at sites with a large number of test points.
(Use with the dedicated Hioki GENNECT Cross app.)

**Discover anomalies before they develop into failures**
Detect component degradation using the FT4310’s comparator function

Since the FT4310 can measure the resistance of the bypass route, including the wiring resistance of solar panel strings, you can detect degradation of bypass diodes (which manifests itself in the form of increased resistance) and increased contact resistance in the connections between modules (defective connections). The instrument’s comparator function can be used to compare measured values to a previously set value to generate PASS and FAIL judgments, making it easier to discover anomalies.

**Simultaneously measure all parameters**
BPD TEST mode
Batch measurement of open-circuit voltage, short-circuit current, and bypass route resistance
Easily discover open faults

Specialized for open-circuit voltage measurement
Voc mode
Measure open-circuit voltage in 1 sec. or less
Easily discover short-circuit faults since the FT4310 can display the difference between the measured value and the reference value

**Enhanced safety**
SELF CHECK mode
Detect anomalies in the instrument’s internal circuitry before measurement

**DROP PROOF**
Testers are built tough to withstand a 1-meter drop onto a concrete floor.

**Energy-saving design**
Six AA batteries provide enough power for 3000 measurements.

**Backlight (White LED)**
Bright backlight lets you work in dark or poorly lit locations.

**Integrated “hold” button right on test leads**
A button right at your fingertips on the test leads lets you hold measured values easily, eliminating the need to operate a control on the instrument itself. They also incorporate a handy light.

**Bundled case with neck strap**
Leave both hands free so you can precisely position test probes without worrying about dropping the instrument.

**Reference**
Issues caused by faulty bypass diodes

**Normal reading:** Current is routed around panels that are covered by shadows
When a solar panel is obscured by a partial shadow (or when it fails), the current bypasses the panel in order prevent any drop-off in generating efficiency.

**Short-circuit fault:** Generating capacity falls
When a short-circuit fault occurs, the generated current flows in a loop, making it impossible to capture the generated power, resulting in lowered efficiency.

**Open fault:** Potential fire
When an open fault occurs, current is forced to flow to the defective cell when it’s covered by a shadow, causing the panel to heat up and posing the risk of fire.
Specifications

General Specifications

Measurement items
- Open-circuit voltage, Short-circuit current, Bypass route resistor

Functions
- Displays the number of bypass diode measurements, Automatic polarity judgment function, Comparator display, Auto hold, Live circuit indicator, Buzzer sounds, Backlight, Comparator, Battery indicator, Auto power off, Bluetooth® wireless technology

Operating temperature and humidity
- 10 to 65°C, 80% RH or less (*no condensation)
- Less than 40°C

Storage temperature and humidity
- 20 to 65°C, 80% RH or less (*no condensation)

Maximum input voltage
- 1000 V DC

Dustproof and waterproof
- IP40 (EN60529)

Standards
- Safety: EN61010, EMC: EN61326

Drop proof
- On concrete: 1 m

Power supply
- LR6 (AA) alkaline battery×6, Maximum rated power 18 VA

Continuous operating time
- Approx. 45 hours (Comparator, backlight, Bluetooth® OFF)
- Approx. 18 hours (Comparator, backlight, Bluetooth® ON)

Dimensions
- 152W×92H×69D mm (5.98 W × 3.62 H × 2.72 D in)

Mass
- 650 g (22.9 oz) (including batteries, excluding test leads)

Description of functionality
- Displays the number of bypass diode measurements
- Automatic polarity judgment function
- Live circuit indicator
- Comparator: Compares measured values to a set reference value to generate a PASS or FAIL judgment
- Resistance: (set in BPD TEST mode)
- Voltage: (set in Voc mode)

Voc mode
- Measurement items: Open-circuit voltage
- Measurement range: 0 V to 1000 V DC (Displayed up to 1200 V DC)
- Response time: Within 1 sec

Accuracy specifications

<table>
<thead>
<tr>
<th>Range (displayed range)</th>
<th>Accuracy range</th>
<th>Accuracy</th>
<th>Input impedance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open-circuit voltage</td>
<td>0 to ±1200 V</td>
<td>±0.2% rdg.</td>
<td>±3% rdg.</td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>0.0 to 15.0 A</td>
<td>±3% rdg.</td>
<td>±5% rdg.</td>
</tr>
<tr>
<td>Bypass route resistance</td>
<td>0.0 to 15.0 Ω</td>
<td>±0.5% rdg.</td>
<td>±0.5% rdg.</td>
</tr>
</tbody>
</table>

*During pure resistance measurement

Software specifications

- GENNECT Cross (Freeware)
  - Interface: Bluetooth® 4.0 LE
  - Communication distance: 5 m (line of sight)
  - Supported Android™ devices: Android™ 4.3 or later
  - Supported iOS devices: iOS 10 or later

Order code/Options

Model: BYPASS DIODE TESTER FT4310
Model No. (Order Code) (Note)
FT4310 (Built-in Bluetooth® wireless technology)

Caution: The FT4310 cannot measure strings installed in parallel. Please contact Hioki for more information.

[Accessories]
- TEST LEAD SET WITH REMOTE SWITCH L9788-11
- CARRYING CASE C0206x1
- Instruction manualx1
- LR6 alkaline battery×6

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