The 3159 INSULATION / WITHSTANDING HiTESTER is a combination insulation resistance as well as voltage endurance tester. It continuously performs insulation testing and voltage endurance testing of electrical equipment and parts, doing both tests in a simpler and more efficient way. This instrument implements all the applicable safety standards, and is small, light, and inexpensive. It also comes standard with external I/O for automating production lines.
One Unit Serves Two Functions -- Continuous Testing of Insulation and of Voltage Endurance

- **Continuous Testing of Insulation and Voltage Endurance**
  In automatic testing mode, the 3159 continuously tests either insulation followed by voltage endurance (the ability to "withstand" voltage) (I→W), or voltage endurance followed by insulation (W→I). In manual mode it separately performs insulation testing or voltage endurance testing.

- **Stores up to 10 Sets of Test Conditions**
  Stores up to 10 sets of test conditions for each of voltage endurance mode and insulation mode, and can quickly switch among the test conditions. (Save/Load)

- **Standards Testing**
  Contains on-board comparator and timer functions for determining compliance, thus simplify the testing of all applicable safety standards.

- **Interlock Function**
  Based on inputs such as a starter signal, enters a state where output is blocked and testing is impossible, to guarantee safety such as during automated testing.

**Analog Voltmeter**
The test voltage can be verified not only from the digital display but also in analog form. (Only for voltage endurance testing.)

**Danger Light**
The warning light flashes during testing and whenever there is a high voltage between the terminals.

**External Switch**
Start/stop may be controlled with the 9613 or the 9614. (The 9613 and 9614 are options.)

**Transformer Capacity**: 500VA
**Two Test Voltage Ranges**:
- AC 0 to 2.5 or 5.0 kV

**Voltage Comparator**
In order to prevent test voltage errors, the timer is only activated after the voltage rises to the specified test voltage ± 5% (or ± 50V, whichever is larger).

(Depending on options, it may be possible to change the voltage check just before test completion.)

**Fluorescent Display Tube**
The display uses a bright and clear fluorescent tube.

**Discharge Feature**
The charge on the object being tested is discharged within the tester. This discharge function avoids impacting the next test process.
Functions for Handling a Wide Range of Situations

This tester comes standard with features for automating EXT I/O, RS-232C, and status out (relay contact output), as well as data management features.

**Status Out**
When the output conditions set up by the dip switches are satisfied (OR condition), there is relay contact output.

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Signal Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>H.V.ON</td>
<td>Output voltage generation</td>
</tr>
<tr>
<td>2</td>
<td>TEST</td>
<td>Testing in progress</td>
</tr>
<tr>
<td>3</td>
<td>PASS</td>
<td>Passed</td>
</tr>
<tr>
<td>4</td>
<td>FAIL</td>
<td>Failed</td>
</tr>
<tr>
<td>5</td>
<td>INT.LOCK</td>
<td>Interlocked</td>
</tr>
<tr>
<td>6</td>
<td>READY</td>
<td>Ready</td>
</tr>
<tr>
<td>7</td>
<td>EXT.CONT.</td>
<td>Under external control</td>
</tr>
<tr>
<td>8</td>
<td>POWER ON</td>
<td>Powers the 3159 on</td>
</tr>
</tbody>
</table>

**RS-232C**
Allows automatic testing and reading of test results from a personal computer.

**Buzzer Volume Adjustment**
To indicate "pass" or "fail".

**Rear Panel Voltage Output Terminals**
These are normally connected to the front terminals.

**EXT I/O (Open Collector, Photocoupler Insulation)**

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Signal Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>READY</td>
<td>LO when in “ready state”</td>
</tr>
<tr>
<td>2</td>
<td>L-FAIL</td>
<td>LO when in “fail state” for the lower bound</td>
</tr>
<tr>
<td>3</td>
<td>U-FAIL</td>
<td>LO when in “fail state” for the upper bound</td>
</tr>
<tr>
<td>4</td>
<td>PASS</td>
<td>LO when in “pass state”</td>
</tr>
<tr>
<td>5</td>
<td>TEST</td>
<td>LO when in “test state”</td>
</tr>
<tr>
<td>6</td>
<td>H.V.ON</td>
<td>LO when a voltage is being generated to the output terminals</td>
</tr>
<tr>
<td>11</td>
<td>W-MODE</td>
<td>LO during voltage endurance (“withstanding”) testing</td>
</tr>
<tr>
<td>12</td>
<td>I-MODE</td>
<td>LO during insulation testing</td>
</tr>
<tr>
<td>13</td>
<td>W-FAIL</td>
<td>LO when in “fail state” for voltage endurance testing</td>
</tr>
<tr>
<td>14</td>
<td>I-FAIL</td>
<td>LO when in “fail state” for insulation testing</td>
</tr>
<tr>
<td>33 to 36</td>
<td>ISO.DCV</td>
<td>15 V (0.1 A) outputs</td>
</tr>
</tbody>
</table>

**EXT I/O Output Signals**

1. **Pass Hold Function** (0: No Hold, 1: Hold)
The pass state is held when it occurs. This is convenient for verifying the decision value.

2. **Fail Hold Function** (0: No Hold, 1: Hold)
The fail state is held when it occurs. This is convenient for temporarily stopping the test process.

3. **Hold State** (0: No Hold, 1: Hold)
This saves the state when the stop key is pressed during a test in order to unconditionally end the test.

4. **Momentary Out** (0: Not Specified, 1: Specified)
This function outputs a voltage only when the start key is being pressed. The start key is effective both as EXT SW and external I/O.

5. **Double Action** (0: Not Specified, 1: Specified)
This function starts the test if the start key is pressed less than about 0.5 seconds after the stop key.

6. **Fail Mode** (0: Not Specified, 1: Specified)
This function means that hold state can be released only by the stop key on the main body.

7. **RS Command “START”** (0: Not Specified, 1: Specified)
This specifies whether the RS command “START” should be effective.

8. **Interlock Function** (0: Not Specified, 1: Specified)
This specifies whether the interlock terminal for external I/O should be effective.

9. **Voltage Comparison Time** (0: Start of Test, 1: End of Test)
When the voltage comparator is on during voltage endurance testing, this specifies whether the comparison should be done at the start or the end of the test.

10. **Insulation Resistance Measurement Range**
(0: Fixed Range, 1: Automatic Range)
This specifies whether the measurement range for the insulation resistance test should be a fixed range or an automatic range.

11. **Insulation Resistance Test End Mode**
0 : Test for the specified time
1 : Stop when “pass” is determined
2 : Stop when “fail” is determined
This specifies the method of ending the insulation resistance test.
3159 Specifications

### Voltage Endurance Testing

#### [Test Voltage]
- **Output voltage**: Two ranges: AC 0 to 2.5 or 5.0 kV
- **Voltage output method**: Zero input switch
- **Transformer capacity**: 500 VA (rating: 30 minutes)
- **Voltage adjustment method**: Manual adjustment
- **Voltmeter**: Average value rectified root-mean-square display
  - Digital: AC 0.001 kV to 500 kV (full scale)
  - Accuracy: ± 1.5% f.s.
  - Analog: AC 0 to 5 kV (full scale)
  - Accuracy: ± 5% f.s.
- **Waveform**: Same as the power supply waveform
- **Frequency**: Same as the power supply frequency

#### [Current Detection]
- **Current measurement range**: 0.01 mA to 120 mA
- **Indicated value range**: Average value rectified root-mean-square display (digital)
  - Measurement resolution: 0.01 mA (2 mA or 8 mA range)
  - 0.1 mA (32 mA range)
- **Measurement accuracy**: ± 3% f.s.

#### Insulation Resistance Testing

#### [Test Voltage and Measurement Range]
- **Rated voltage**: DC 500 V or 1000 V
- **Rated measured current**: 1 mA to 1.2 mA
- **Short circuit current**: 5 mA (500 V) / 2 mA to 3 mA (1000 V)
- **Measurement range and accuracy**: 0.5 MΩ to 999 MΩ (500 V), 1 MΩ to 999 MΩ (1000 V) / ± 4% rdg.
  - 1000 MΩ to 2000 MΩ / ± 8% rdg.
- **Measured resistance range**: 2 MΩ, 20 MΩ, 200 MΩ, 2000 MΩ (500 V)
  - 4 MΩ, 40 MΩ, 400 MΩ, 2000 MΩ (1000 V)

#### General Specifications
- **Display**: Fluorescent display tube (digital display)
- **Monitor functions**: Output voltage, detected current, measured resistance
- **Monitor period**: 2 times/sec. minimum
- **Operating temperature range**: 0 °C to 40 °C, 80% rh maximum (no condensation)
- **Storage temperature range**: -10 °C to 50 °C, 90% rh maximum (no condensation)
- **Temperature and humidity range for assured accuracy**: 23 °C ± 5 °C, 80% rh maximum (no condensation), after warming up for at least 5 minutes
- **Operating locations**: Indoor, altitude 2000 m maximum
- **Power supply voltage**: AC 100 V (3159), AC 120 V (3159-01), AC 220 V (3159-02), AC 230 V (3159-03), AC 240 V (3159-04)
- **Power supply frequency**: 50 Hz to 60 Hz

### Decision Function
- **Decision method**: Window comparison method (digital specification).
- **Decision results**: 
  - **UPPER-FAIL**: The measured current (insulation resistance value) exceeded the specified upper bound.
  - **PASS**: The measured current (insulation resistance value) was between the specified upper and lower bounds and the specified time elapsed.
  - **LOWER-FAIL**: The measured current (insulation resistance value) was less than the specified lower bound.
- **Current decision**: For each decision result, output the display portion, the buzzer sound, and EXT I/O signal
- **Specification ranges**: 
  - Insulation testing: 0.2MΩ to 250 MΩ (same for the upper and lower bounds)
- **Specification resolution**: 
  - Voltage endurance testing: 0.1 mA to 120 mA (upper bound) / 0.1 mA to 110 mA (lower bound)
- **Timer**
  - **Specification range**: 0.5 to 999 sec
  - **Action**: When ON is specified:
    - After starting, a countdown from the specified time is displayed
    - When OFF is specified: Displays the elapsed time since the start.
  - **Specification resolution and accuracy**: 0.1 sec. (0.5 to 99.9 sec.) ± 50 msec
  - **Nondeterministic interval**: 0.5 sec. (Mask time until the determination begins during insulation resistance testing.)

### Interfaces
- **EXT I/O**: Output signal:
  - Open collector output
  - Maximum loaded voltage DC 30 V
  - Maximum output current DC 100 mA / 1 signal
- **EXT SW**: Input signal (contact point input)
  - START, STOP, SW.EN (front terminal switch is effective)
- **RS-232C**: Start-stop synchronization, full duplex, 9600 bps

### 3159 Options
- **9613 REMOTE CONTROL BOX (SINGLE)**
- **9614 REMOTE CONTROL BOX (DUAL)**
- **9616 WARNING LAMP**