**Features and Benefits**
- Multiple, configurable digital I/Os
- Transformer configuration selection up to four windings
- Software winding connection compensation
- Enhanced capabilities to ease servicing
- GE-NESIS Windows®-based programming software
- IRIG-B input
- DDS system compatible
- Harmonic restraint
- Self-checking functions

**Applications**
- High-speed differential and backup instantaneous differential three-phase protection functions for power transformers with two, three or four windings
- enerVista.com compatible (see page 275)

**Protection and Control**
- Current differential protection
- Dual-slope percentage restraint

**Monitoring and Metering**
- All currents
- Event and oscillography recording

**User Interfaces**
- 20 character keypad, alphanumeric two-line LCD
- RS232, RS485, plastic or glass fiber optic ports
- ModBus® communication protocol available
Protection and Control
The DTP is a digital relay that provides high-speed differential and backup instantaneous differential three-phase protection for power transformers with two, three or four windings.

Differential Protection
For high-magnitude external faults, the DTP uses a current differential with percentage restraint to compensate for unbalance caused by variation in CT outputs.

The DTP differential unit has programmable dual-slope percentage restraint with adjustable slope breakpoint.

Discrete Fourier Transformation (DFT) provides excellent frequency filtration, making the differential current measurement immune to noise, DC components and wave distortion. This gives the digital DTP relay a clear advantage over other analog and hybrid models.

The algorithm used to calculate the RMS value permits a high level of accuracy in the through current measurement.

Phase Shift Compensation
Internal compensation is selected to adjust for the phase shift across the protected transformer. This selection allows the DTP to make the proper phase adjustments to the applied currents and eliminates the zero-sequence component of the current.

Conventional external compensation can also be selected. This setting is useful for testing the relay with single and three-phase test sources that supply in-phase currents.

Harmonic Restraint
A second and fifth harmonic restraint current is calculated for each phase and extracted using DFTs. The magnitude of this current is used to discriminate between faults and inrush conditions, restraining differential function during inrush caused by energization and overexcitation.

Unrestrained IOC
This acts as a backup protection for high magnitude internal faults that produce sufficient CT saturation to cause harmonic restraint of the differential protection. The instantaneous trip function uses the fundamental component of the differential current.

Digital Inputs
The DTP has seven digital inputs configurable by the user with the GE-INTRO software. One of the following values can be assigned to each input:
- Unused input
- External trigger (P)
- Table 0 selection (L)
- Table 1 selection (L)
- Buchholz alarm (L)
- Buchholz trip (L)
- Overtemperature alarm (L)
- Overtemperature trip (L)
- Trip block (L)
- (P) function is activated by pulse
- (L) function is activated by level

The configurable inputs can be used to implement ‘AND’ logic schemes, and assigning them to the outputs.

Digital Outputs
The DTP system has eight user-configurable outputs, four trip contacts (rated 16 A) and an alarm contact. The configurable outputs can be programmed using logic based on the internal protection states. The internal states of the DTP can be used to carry out logical operations NOT, AND, and OR. The output configuration is done using the different levels. At the first level it is possible to use AND gates of up to 16 signals. Once the AND gates have been configured, it is possible to create a second level with OR gates of 16 inputs, whose logical outputs are assigned to physical outputs of the unit.

Monitoring and Metering
The DTP offers advanced measurement functions, including:

Magnitude Measurement
- Line current (module and argument for each phase and winding)
- Differential and through current for each phase
- Second and fifth harmonic current for each phase

Measurement data can be accessed locally on the front panel LCD display or via the GE-LOCAL software.

Event Recording
- Date and time (1 millisecond resolution)
- Type of event
- Value of the differential and through currents
- Internal states matrix of the unit

This 166 event recorder features a non-volatile memory that can be maintained indefinitely, even with no power supply. Each event is associated to the internal protection and communication states.

Oscillography
The DTP unit stores up to four oscillography records, with a resolution of 16 samples per cycle. Each
record has a maximum capacity of 66 cycles. The number of prefault cycles can be selected from two to 10 cycles. Each of the records includes the following information:
- Instantaneous values for current inputs
- Digital information
- Date and time
- Cause of record generation
- Active settings at moment of the record

The possible causes for oscillography record generation are:
- 87B phase A trip
- 87B phase B trip
- 87B phase C trip
- 87 phase A trip
- 87 phase B trip
- 87 phase C trip
- Buchholz trip
- Overtemperature trip
- Input trigger
- Communications trigger

A configurable mask determines which functions or internal trips start the oscillography. It may also be started by configurable digital input, communications or directly from the MMI.

Oscillography records can be converted into a COMTRADE IEEE file using the GE-LOCAL communications program. They can be viewed using the GE-OSC program, or any other program that accepts COMTRADE IEEE C37.111-1991 format.

Self-Checking Functions
Self-checking functions at startup and during normal operation will block operation if an error is detected. Additionally, the TARGET RESET button allows testing of LED.

Setting Tables
The DTP has three independent setting tables, stored in non-volatile memory. Only one table may be active at any time for use in performing system functions. The differential function settings group is accessed separately for each table.

User Interfaces
The DTP offers a variety of user interfaces, including:

Human-Machine Interface (HMI)
A 20 character keypad and two-line, 32 character LCD display provide local access.

Communications
The DTP has two serial channels and three connectors. Channel 1 is accessed from the front panel in connector 1 (PORT 1) or from the back (PORT 3). Channel 2 is accessed from connector 2 (PORT 2) on the back.

PORT 1 connector has priority over PORT 3 connector and is selected when the Data Carrier Detect (DCD) signal is activated. Channels 1 and 2 are independent and can be used simultaneously.

There are different port configurations available for each model:
- Two connectors are RS232 (PORT 3 does not exist)
- PORT 1 is RS232, PORT 2 is RS485 (PORT 3 does not exist)
- PORT 1 and PORT 3 are RS232 and a fiber optic connector replaces the PORT 2 connector

LED Indicators
The DTP features one fixed bicolor LED assigned to the critical alarm function and 16 red LEDs arranged in one column. They can be configured using the GE-INTRO software to any user definable alarm. Each LED can be configured to have memory in the absence of auxiliary power supply, or to blink when turned on.

Default LED configuration.

<table>
<thead>
<tr>
<th>LED #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>87 A trip</td>
</tr>
<tr>
<td>2</td>
<td>87 B trip</td>
</tr>
<tr>
<td>3</td>
<td>87 C trip</td>
</tr>
<tr>
<td>4</td>
<td>87B A trip</td>
</tr>
<tr>
<td>5</td>
<td>87B B trip</td>
</tr>
<tr>
<td>6</td>
<td>87B C trip</td>
</tr>
<tr>
<td>7</td>
<td>Buchholz alarm</td>
</tr>
<tr>
<td>8</td>
<td>Buchholz trip</td>
</tr>
<tr>
<td>9</td>
<td>Temperature alarm</td>
</tr>
<tr>
<td>10</td>
<td>Temperature trip</td>
</tr>
<tr>
<td>11</td>
<td>Out of service</td>
</tr>
<tr>
<td>12</td>
<td>Trip not permitted</td>
</tr>
<tr>
<td>13</td>
<td>EEPROM alarm</td>
</tr>
<tr>
<td>14</td>
<td>Date and time alarm</td>
</tr>
<tr>
<td>15</td>
<td>Internal communication error</td>
</tr>
<tr>
<td>16</td>
<td>Remote mode</td>
</tr>
</tbody>
</table>

Block Diagram
The communications protocol requires the use of the GE-LOCAL software to facilitate communication with different protection systems. It guarantees efficient data transfer (especially for oscillography and other large files) along with error detection and automatic communication recovery.

**Software**

- **Two Windows®-based software packages are included with the DTP:**
  - GE-LOCAL enables the user to visualize the protection settings, alarms, LEDs, measurements and status, to retrieve oscillography records, to retrieve event records
  - GE-INTRO enables the user to configure the I/Os and LEDs
  - As an option, GE-OSC software enables the user to study the oscillography records.
  - These software packages are part of the GE Network Substation Integration System (GE-NESIS) software used by the DDS system.

---

**Typical Wiring**

![Typical Wiring Diagram]

- **DTP-B Digital Transformer Protection**
  - **SYSTEM READY**
  - **TRIP**
  - **DIFFERENTIAL PHASE A**
  - **DIFFERENTIAL PHASE B**
  - **DIFFERENTIAL PHASE C**
  - **BACKUP PHASE A**
  - **BACKUP PHASE B**
  - **BACKUP PHASE C**
  - **BUCHHOLZ ALARM**
  - **OVERTEMPERATURE ALARM**
  - **DEFAULT SETTINGS, USER CONFIGURABLE**
  - **PROGRAMMABLE OUTPUTS**
  - **INPUTS COMMON**
  - **OPTIONAL FOR 3/4 WINDING CONFIGURATIONS**
  - **CONTROL POWER**
  - **SURGE/SAFETY GROUND**

---

www.GEindustrial.com/Multilin
DTP DDS Digital Transformer Protection

**DTP Technical Specifications**

### PROTECTION
- **General settings:**
  - Frequency: 50 or 60 Hz
  - Winding CT ratio: 1 – 4000 in 1 steps
- **Protection settings:**
  - Winding tap: 0.5 – 20 \( I_e \)
  - Winding configuration: Y, D, Z
  - Winding time group: 0 – 11
  - Winding CT configuration: Y0, Y, D1, D5, D7, D11
- **Differential function settings:**
  - Sensitivity: 0.2 – 0.4 \( Ie \)
  - K1 percentage restraint: 15 – 100%
  - K2 percentage restraint: 15 – 100%
  - K1 – K2 inflexion: 0 – 10 \( I_e \)
  - 2nd harmonic restraint: 12 – 100%
  - 5th harmonic restraint: 12 – 100%
  - DBT tag: 4 – 12 \( I_e \)

### COMMUNICATIONS
- **Mode:** Half duplex
- **Speed:** 1200 to 12800 bps
- **Physical media:**
  - RS232
  - RS485
  - Glass fiber optic (port 2 optional)
- **Power supplied:**
  - -8 dBm
  - -24.5 dBm
  - -17.5 dBm
- **Receiver's sensitivity:**
  - -28 dBm (port 2 optional)
  - -8 dBm
- **Wave length:**
  - 860 nm
  - 820 nm
- **Type of connector:**
  - STA
  - HFBR-4516

### OUTPUTS
- **TRIPPING CONTACTS**
  - **Rated voltage:** 250 VAC
  - **Maximum opening voltage:** 440 VAC
  - **Rated current:** 16 A
  - **Closing current:** 25 A
  - **Operating power:** 4000 VA
  - **Mechanical life:** 30 x 10^6 ops.

### INPUTS
- **Digital input voltage:** As an auxiliary voltage
- **Thermal capacity:**
  - Current circuits: 4 \( I_e \)
  - During 3 sec: 50 \( I_e \)
  - During 1 sec: 120 \( I_e \)
  - DC burden: 12 W
  - Burden per active input: 8 mA per input

### POWER SUPPLY
- **Auxiliary voltage:**
  - 48/125 VDC
  - 110/250 VDC

### PACKAGING
- **Weight:**
  - Net: 26.4 lbs (12 kg)
  - Shipping: 28.6 lbs (13 kg)
- **Dimensions:**
  - NEED INCH EQUIVALENTS

### ENVIRONMENTAL
- **Ambient temperature range:**
  - Operation: -20° C to +50° C
  - Storage: -40° C to +50° C
- **Humidity:**
  - Up to 95% non-condensing

### ENVIRONMENTAL
- **Electromagnetic Fields Radiated with Amplitude Modulation:**
  - IEC 255-22-2, Class IV
  - EN 55011, Class B
  - ENV 50141, 10 V/m
- **Electrostatic Discharge:**
  - IEC 255-22-1, Class III
  - EN 61000-4-2, 20 kV
  - ENV 50204, 10 V/m
- **1 MHz Interference:**
  - IEC 255-5, 600V, 2kV 50/60 Hz, 1 min
  - C37.90, IEC 255-5, IEC 255-6 and IEC 68.
- **Impulse Voltage Withstand:**
  - IEC 255-5, 5 kV, 0.5 J
- **Fast Transients:**
  - IEC 255-22-4, EN 61000-4-4, Class IV
  - C37.90, IEC 255-5, IEC 255-6 and IEC 68.
- **Wave length:**
  - 820 nm
  - 437 x 200 x 176 mm (19” rack 4 units high)

### CASE
- **Type of connector:**
  - STA
  - HFBR-4516
- **Power supplied:**
  - -8 dBm
  - -24.5 dBm
  - -17.5 dBm
- **Receiver's sensitivity:**
  - -28 dBm (port 2 optional)
  - -8 dBm
- **Wave length:**
  - 860 nm
  - 820 nm

### TYPE TESTS
- **The DTP equipment complies with the following standards,** which include the GE insulation and electromagnetic compatibility standard and the standards required by Community Directive 89/336 for the EC market, in line with European standards. It also complies with the European directive requirements for low voltage, and the environmental and operating requirements established in ANSI standards C23.90, IEC 255-5, IEC 255-6 and IEC 68.
- **Insulation Test Voltage:**
  - IEC 255-5, 600V, 2kV 50/60 Hz, 1 min
  - Impulse Voltage Withstand:
    - IEC 255-5, 5 kV, 0.5 J
  - 1 MHz Interference:
    - IEC 255-5, 5 kV, 0.5 J
  - Electrostatic Discharge:
    - IEC 255-5, 5 kV, 0.5 J
  - Immunity to Radio Interference:
    - IEC 255-22-3, Class III
  - Electromagnetic Fields Radiated with Amplitude Modulation:
    - ENV 50140, 10 V/m
  - Electromagnetic Fields Radiated with Amplitude Modulation:
    - Common mode: ENV 50141, 10 V/m
  - Frequency Transients:
    - IEC 255-22-4, EN 61000-4-4, Class IV
  - Magnetic Fields at Industrial Frequency:
    - EN 61000-4-8, 30 A/m

### Dimensions

### Ordering

<table>
<thead>
<tr>
<th>DTP</th>
<th>0</th>
<th>0</th>
<th>1</th>
<th>0</th>
<th>00 B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DTP Guideform Specifications</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>For an electronic version of the DTP guideform specifications, please visit:</strong> <a href="http://www.GEindustrial.com/Multilin/specs">www.GEindustrial.com/Multilin/specs</a>, fax your request to 905-201-2098 or email to <a href="mailto:literature.multilin@indsys.ge.com">literature.multilin@indsys.ge.com</a>.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>P1: RS232  P2: RS485  P3: not available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>P1: RS232  P2: plastic fiber optic  P3: RS232</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>P1: RS232  P2: RS485  P3: not available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NOTE:</strong> P1 (front) is switched with P3 (rear)  P2 (rear) is independent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DTP revision level A</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>For ordering information and features on the earlier DTP (Revision A) please visit us at <a href="http://www.GEindustrial.com/Multilin">www.GEindustrial.com/Multilin</a></strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>