



High-speed, three-phase differential protection for transformer faults.

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.

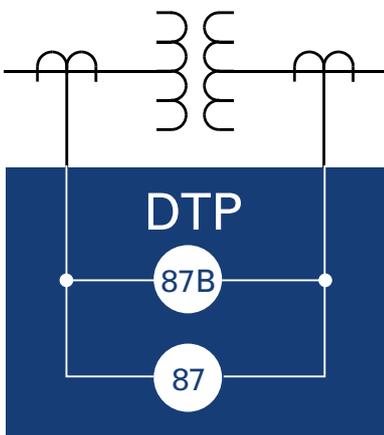
The DTP differential unit has programmable dual-slope percentage restraint with adjustable slope breakpoint.

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

Functional Block Diagram



703750A6.CDR

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 pre-fault 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

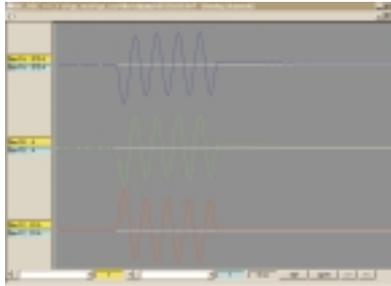
The possible causes for oscillography record generation are:

- 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.

DTP oscillography.



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.

A keypad and display allow local communication.



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.

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

Communications

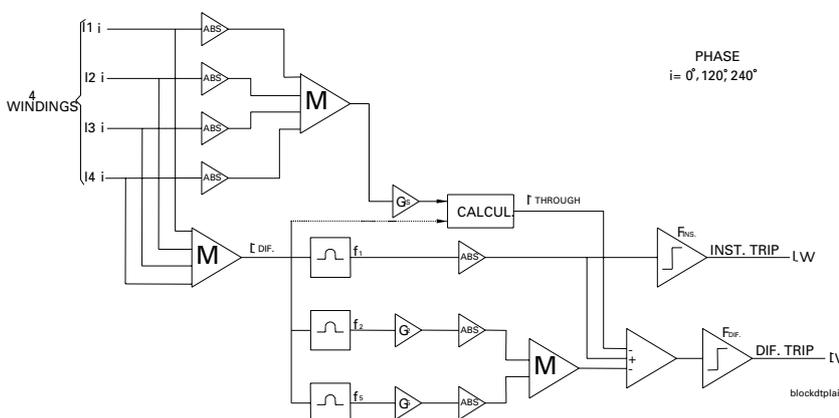
The DTP has two serial channels and three connectors. Channel 1 is accessed from the front panel in connector 1 (PORT 1) or from the back (PORT 3). Channel 2 is accessed from connector 2 (PORT 2) on the back.

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

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:

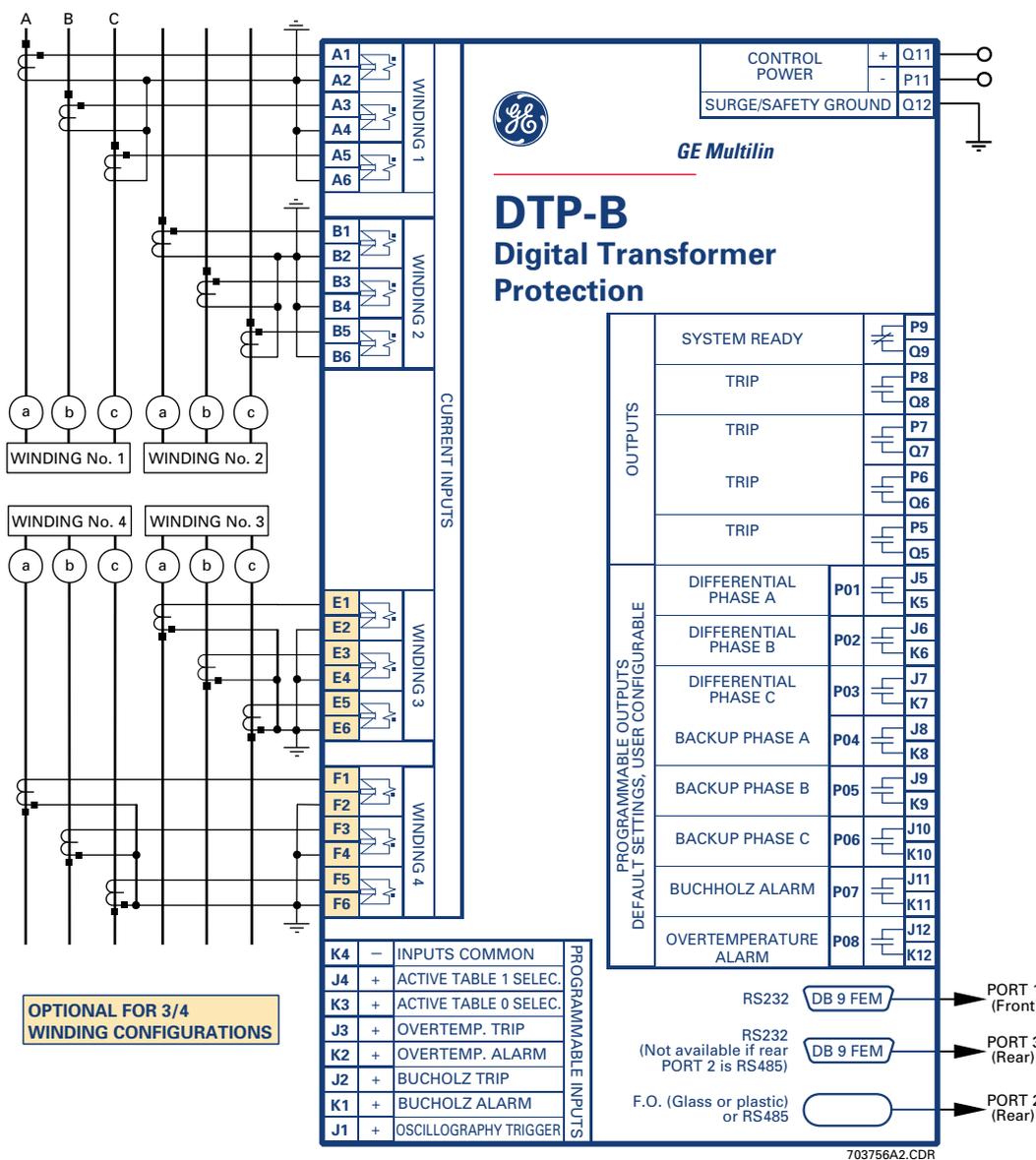
- GE-LOCAL enables the user to visualize the protection settings, alarms, LEDs, measurements and status, to retrieve oscillography records, to retrieve event records

- 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



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 x I _n
Winding configuration:	Y, D, ZZ
Winding time group:	0 – 11
Winding CT configuration:	Y0, Y6, D1, D5, D7, D11
Differential function settings:	
Sensitivity:	0.2 – 0.4 x I _{tap}
K1 percentage restraint:	15 – 100%
K2 percentage restraint:	15 – 100%
K1 – K2 inflexion:	0 – 10 x I _{tap}
2nd harmonic restraint:	12 – 100%
5th harmonic restraint:	12 – 100%
87B tap:	4 – 12 x I _{tap}

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 auxiliary voltage
Thermal capacity:	
Current circuits:	
Continuous:	4 x I _n
During 3 sec:	50 x I _n
During 1 sec:	100 x I _n
DC burden:	
	12 W
Burden per active input:	8 mA per input

COMMUNICATIONS	
Mode:	Half duplex
Speed:	1200 to 19200 bps
Physical media:	
RS232 (ports 1, 3)	
RS485 (port 2 optional)	
Plastic fiber optic (port 2 optional)	
Type of connector:	HFBR-4516
Power supplied:	-8 dBm
Receiver's sensitivity:	-39 dBm
Wave length:	660 nm
Glass fiber optic (port 2 optional)	
Type of connector:	STA
Power supplied:	-17.5 dBm
Receiver's sensitivity:	-24.5 dBm
Wave length:	820 nm

POWER SUPPLY	
Auxiliary voltage:	48/125 VDC 110/250 VDC

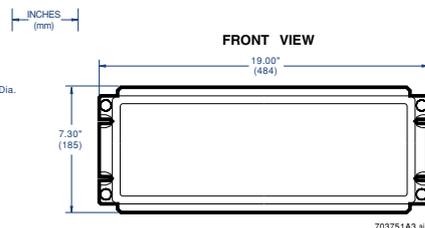
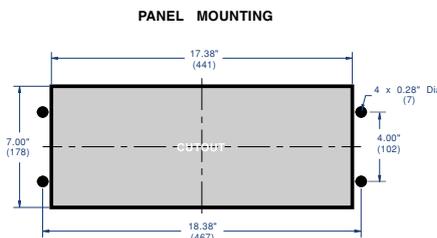
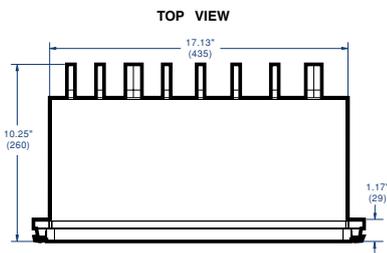
PACKAGING	
Weight:	
Net:	26.4 lbs (12 kg)
Shipping:	28.6 lbs (13 kg)
Dimensions:	
	NEED INCH EQUIVALENTS
	437 x 200 x 176 mm (19" rack 4 units high)

ENVIRONMENTAL	
Ambient temperature range:	
Operation:	-20° C to +55° C
Storage:	-40° C to +85° C
Humidity:	Up to 95% non-condensing

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 C37.90, 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 255-22-1, Class III
Electrostatic Discharge:	IEC 255-22-2, Class IV
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
Electromagnetic Fields Radiated with Frequency Modulation:	
ENV 50204, 10 V/m	
Fast Transients:	IEC 255-22-4, EN 61000-4-4, Class IV
Magnetic Fields at Industrial Frequency:	
EN 61000-4-8, 30 Av/m	
RF Emission:	EN 55011, Class B

*Specifications subject to change without notice.

Dimensions



Ordering

DTP	**	**	**	**	0	1	0	**	00	B		
DTP											Basic unit	
1											Restraint windings: 2 windings	
2											Restraint windings: 3 windings	
3											Restraint windings: 4 windings	
0											P1, P2, P3: M-LINK protocol	
2											P1, P3: M-LINK protocol; P2: ModBus® RTU protocol	
1											Nominal current rating I _n = 1 A all windings	
5											Nominal current rating I _n = 5 A all windings	
A											Nominal current rating I _n = 5 A for 1st winding, 1 A for all others	
B											Nominal current rating I _n = 1 A for 1st winding, 5 A for all others	
C											Nominal current rating I _n = 1 A for 1st and 2nd windings, 5 A for windings 3 and 4	
0											2 RS232 communication ports	
1											2 RS232 + plastic fiber optic communication ports	
2											2 RS232 + glass fiber optic communication ports	
3											RS232 + RS485 communication ports	
											} See ①	
M												Spanish language
D											English language	
											G	48/125 VDC supply voltage
											H	110/250 VDC supply voltage

DTP Guideform Specifications

For an electronic version of the DTP guideform specifications, please visit: www.GEindustrial.com/Multilin/specs, fax your request to 905-201-2098 or email to literature.multilin@indsys.ge.com.

- ① 0 P1: RS232 P2: RS232 P3: not available
- 1 P1: RS232 P2: plastic fiber optic P3: RS232
- 2 P1: RS232 P2: glass fiber optic P3: RS232
- 3 P1: RS232 P2: RS485 P3: not available

NOTE: P1 (front) is switched with P3 (rear) P2 (rear) is independent

DTP revision level A

For ordering information and features on the earlier DTP (Revision A) please visit us at www.GEindustrial.com/Multilin

enerVista enabled See page 275.
www.enerVista.com