

DISTRIBUTED DIGITAL FAULT RECORDER

Utilizing the fault recording power you already possess

The GE Multilin DDFR™ is a Power System Fault Recorder that collects, archives and manages Disturbance and Fault information that is recorded by microprocessor based protective relays distributed throughout your local power system.

KEY BENEFITS

- Provides a permanent detailed record of all substation activity at a fraction of the cost of installing traditional Digital Fault Recorders (DFR)
- Eliminates up to one-third of substation wiring needed for protection, metering and disturbance recording
- Allows for recording of Transfer Trip Signals, Block Signals and other inter-substation messages that are sent via IEC61850 peer-to-peer messages and not recordable by traditional DFR's
- Permits recording of internal protection relay operands and calculations in Sequence of Events (SOE) and Fault records
- Meets requirements of international Fault Recording standards when used with GE Multilin's Universal Relay family including NERC, IEEE, ECAR, & NPCC
- Provides secure data collection while also isolating the IED network and the IT or Control network from each other with use of two separate Ethernet ports.
- Allows users to define the poll rate for Events and Waveforms

APPLICATIONS

- Substation Distributed Digital Fault Recording
- Component in a larger enterprise wide fault and disturbance recording system

FEATURES

- Retrieves and Archives Transient Fault Records, Sequence of Event Records, and Disturbance Records recorded in protection relays distributed across the substation
- Automatically merges Events recorded in protection relays distributed across the network into a single substation wide Sequence of Event Record
- Stores months of fault and disturbance records internally, facilitating local substation analysis
- Effortlessly archives recorded data to a permanent enterprise network location or server for remote investigation and analysis
- Discrete second Ethernet port will allow isolation between the network LAN and the IED's connected to the DDFR.

Distributed Fault Recording

Enhancements to the fault and disturbance recording abilities of modern microprocessor based protection relays has eliminated the need to install costly equipment whose sole purpose is to record information about power system events. The DDFR is a substation-hardened device built to protection relay standards that will use communications to retrieve Fault, Disturbance and Sequence of Event records that are recorded in existing protection relays and archive this critical data locally as well as in a permanent enterprise network location.

Fault and disturbance information will be retrieved and stored from the protection relays within seconds of the file initially being recorded. Having this information quickly archived into a permanent location eliminates the risk of the files being overwritten in the finite storage space within the relay before users had a chance to manually retrieve these files.

International Standards Compliant

When used with advanced protection relays such as the GE Multilin Universal

Relay family, the DDFR complies with most international standards requirements for fault recording including:

- NERC - RFC-PRC-002-1
- IEEE
- NPCC
- ECAR Doc. #14

Data Recording

The DDFR will detect that new information has been recorded in a relay and automatically retrieve and archive this data. Information that will be archived from protection relays include:

- Transient Fault Records
- Sequence of Event Records
- Disturbance Records

Sequence of Event Record (SOE)

The DDFR will retrieve the Event Records stored in protection relays distributed across a substation and merge all of these Events into a Station-Wide Sequence of Event Record. Connecting the protection relays to an IRIG-B time clock will synchronize the relay internal clocks with 1 millisecond accuracy and enable the DDFR

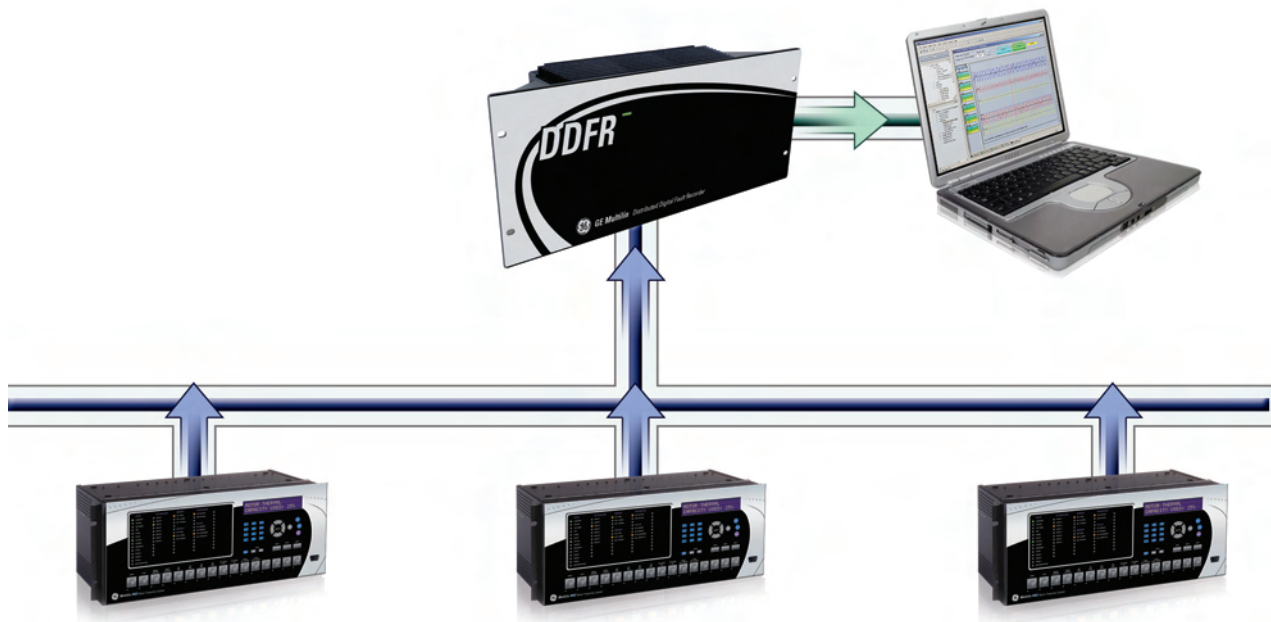
to create a Station-Wide Event Record that will be an exact representation of the sequence of operations that occurred in the substation.

Transient Fault Records

Transient Fault Records (also known as Oscillography records) that are recorded in protection relays will be retrieved by the DDFR and stored in its internal memory space. All Transient Fault Records will be archived using a naming convention that will make it easy for users to relate the Transient Fault records with a particular substation fault. Each record will be stored with a name that includes the exact date and time that the record was initially triggered. If the Transient Fault record was originally recorded in the relay as a COMTRADE file, the DDFR will store this record in its native format; if the protection relay stores its record in another format, such as a CSV file, the DDFR will automatically convert this file into the COMTRADE-1999 format so that the record can be analyzed using a standard COMTRADE viewer.

Disturbance Records

Protection relays that are capable of recording Disturbance Records that are used for analyzing extended or evolving power system disturbances such as



The DDFR is a Transient Fault, Sequence of Event, and Disturbance record archiving system that will seamlessly make available all of the recorded power system information necessary for performing post mortem fault and disturbance analysis.

Voltage Sags or Swells will be retrieved and archived by the DDFR. All Disturbance Records will be archived using a naming convention that will make it easy for users to relate the Disturbance records with a particular power system disturbance. Each record will be stored with a name that includes the exact date and time that the record was initially triggered. Disturbance records will be stored in COMTRADE format and if needed, first convert this file to a COMTRADE file from its native format.

Automatic Data Management

The DDFR is equipped with eight gigabytes of internal non-volatile memory that provides the ability of storing months worth of fault and disturbance information inside the DDFR. The data storage space that is available is constantly monitored by the DDFR to ensure that adequate space is available for storing any new data recorded by the protection relays. The DDFR has an automatic data clearing function that will erase older stored data as the DDFR approaches its recording capacity. The DDFR will erase old data based on a First-in-First-Out basis that newer fault information is available for analysis by engineering personnel when required.

Local Disturbance Analysis

Fault, Disturbance, and Sequence of Event Records archived in the DDFR can be viewed and analyzed locally in the substation by communicating directly to the DDFR using the EnerVista DDFR Setup Software. The DDFR setup software includes an event record viewer for analyzing the station-wide sequence of event record, and a powerful COMTRADE viewer for analyzing the transient fault records and disturbance records.

Enterprise Network Archiving

The DDFR Archiving System will automatically copy all data stored in DDFR's located throughout a company's wide area network into a centralized network location allowing users to analyze fault and disturbance data without having to be at the same location as the DDFR. This DDFR Archiving System that runs on

The screenshot shows the 'Event / Alarm Viewer - Device Alarms, Fault Reports, WaveForm Events' window. It features a menu bar (File, Edit, View, Settings, Window, Help) and a toolbar with various icons. The main area displays a table with the following data:

CreatedTime	SourceName	Event
03/02/2005 08:43:09.680547	F80_Feeder_M3	PHASE TDC1 DPO A
03/02/2005 08:43:07.872383	F80_Feeder_M3	PHASE TDC1 PKP A
03/02/2005 08:36:17.178986	C30_Controller	Bus2 SW2 Closed
03/02/2005 08:36:16.810324	C30_Controller	HMI Bus2 SW2 Close
03/02/2005 08:36:13.488095	C30_Controller	Bus2 Bkr Closed
03/02/2005 08:36:13.415195	C30_Controller	HMI Close Bus2 Bkr
03/02/2005 08:35:26.217148	F80_Feeder_M3	Breaker M3 Open
03/02/2005 08:35:26.217148	F80_Feeder_M3	Protection Trip
03/02/2005 08:35:26.158828	F80_Feeder_M3	PHASE LV1 DPO A
03/02/2005 08:35:24.155067	F80_Feeder_M3	PHASE LV1 PKP A
03/02/2005 08:35:19.231200	F80_Feeder_M3	PHASE TDC1 DPO A
03/02/2005 08:35:18.506355	F80_Feeder_M3	PHASE TDC1 PKP A
03/02/2005 08:35:02.047880	F80_Feeder_M3	EVENTS CLEARED

At the bottom of the window, it says 'Refresh is Over' and 'Database'.

The DDFR will create station-wide Sequence Of Event Records (SOE) from events collected from relays distributed across the substation.

a network PC or Server can retrieve data from multiple DDFR's thereby creating a permanent enterprise wide library of all past disturbances on your power system. The information collected by the DDFR Archiving System will be categorized in separate directories for each DDFR, making it easy for users to identify data about faults and disturbances related to each individual substation.

Viewing Archived Records

Users can analyze sequence of Event Records, Transient Fault Records, and Disturbance Records that have been stored on a DDFR or archived onto a network location by the DDFR Archiving System by using the EnerVista DDFR Setup Software. The DDFR Setup Software's Event Record viewer and COMTRADE viewer can access archived records to provide local or remote analysis capability to anyone with access to network storage location.

Sequence of Event Viewer

The EnerVista™ DDFR Setup Software contains a Sequence of Event viewer that allows for easy analysis of the Events stored in the DDFR or archived to the network location. Each recorded event will contain detailed information including:

- Timestamp of Event
- Description of the Event
- Name of Substation
- Name of Source Relay
- Model of the Source Relay

The Sequence of Event viewer provides the ability to sort the recorded events by any of the available fields of information or to perform queries to show only the events that are necessary for troubleshooting a particular fault.

COMTRADE Viewer

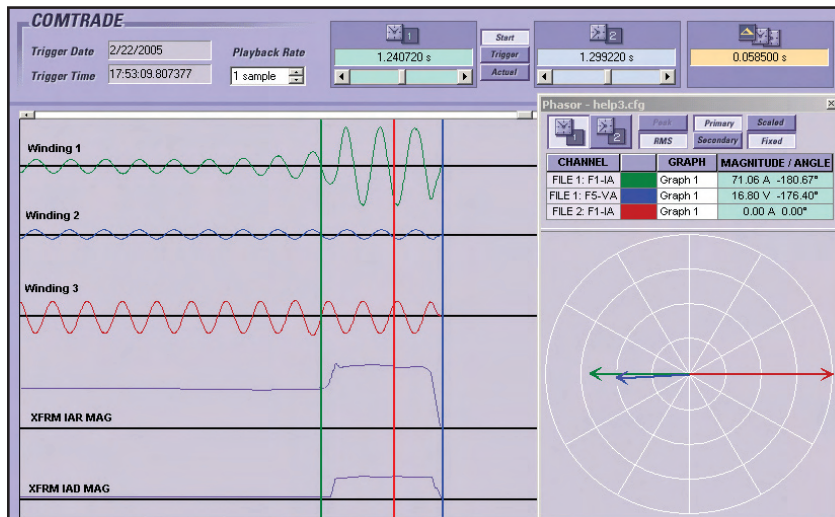
The COMTRADE viewer that is included with the EnerVista DDFR Setup Software provides the ability of analyzing the Transient Fault Records and Disturbance Records that have been archived by the DDFR. This full featured COMTRADE viewer allows for analyzing records in a standard time based format that shows the magnitude of all measured quantities, or in Phasor diagram view that shows the magnitude and angle differences between any of the parameters. The COMTRADE viewer can also perform a harmonic analysis on all measured Phasor quantities and display the harmonic content for every point in the record up to the 25th harmonic.

DDFR System Monitoring

The DDFR has built in system monitoring functions that ensures the DDFR can communicate with all of the protection relays in the substation. If the DDFR is unable to communicate with any of the required relays for a predetermined amount of time, the DDFR will send a signal to a substation device that is being monitored by a SCADA or DCS system that station maintenance or repairs is required.

Substation Hardened

The DDFR is designed to withstand substation conditions and adheres to the same standards and operational requirements as our protection relays. The solid metal construction is ideal for use in harsh environments and can withstand temperatures from -20°C to 70°C. The DDFR contains no moving parts and comes installed with solid-state flash memory for storing all fault and disturbance information. This available memory allows for storage of thousands of power system events and hundreds of Transient Fault and Disturbance records in the DDFR for future analysis

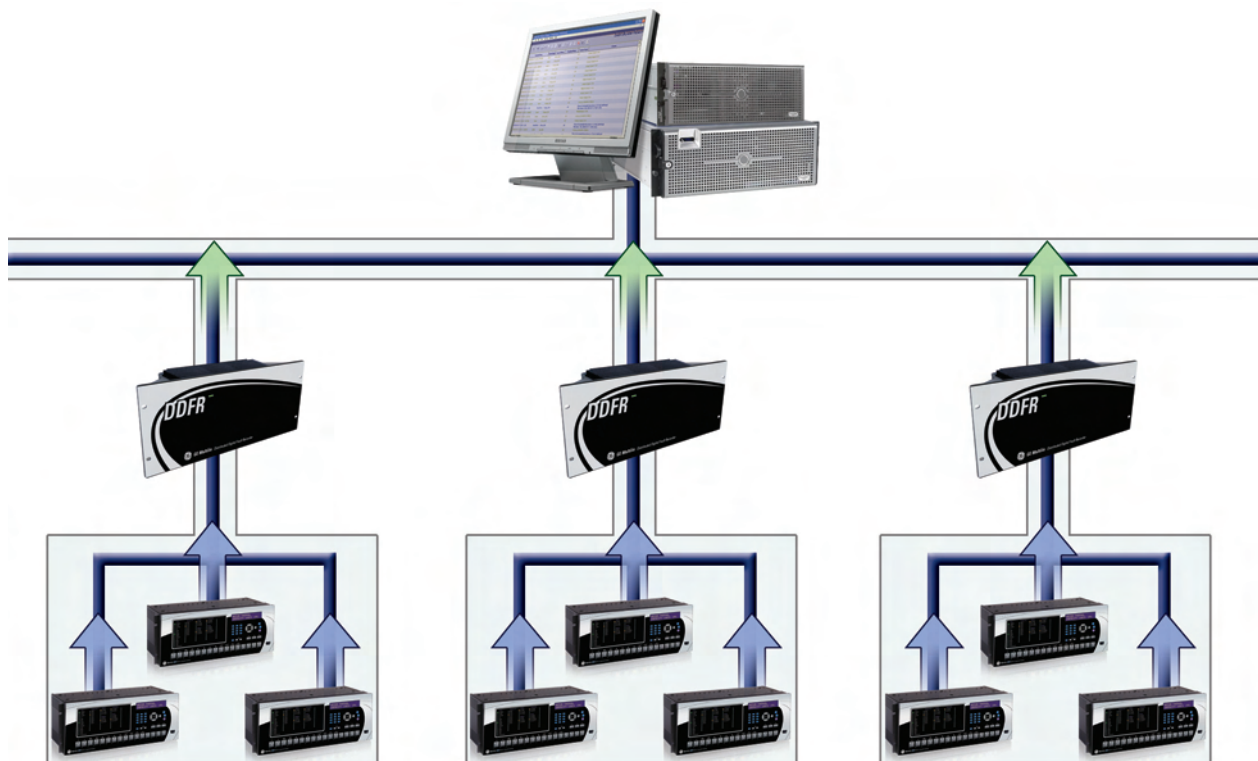


The DDFR will collect all Transient Fault records recorded in your protection relays and archive these records for further analysis

System Expandability

Many substations contain power system equipment and circuits that are still being protected by electromechanical relays or equipment that does not possess fault and disturbance recording ability. This existing equipment can be integrated into a DDFR fault recording system by

connecting them to Universal Relay C60 or C30 power system controllers that will perform the necessary Sequence of Event, Transient Fault and Disturbance recording. The DDFR will then be able to retrieve this recorded information and merge it in with the information recorded in the other station protection relays.



Archive data collected in DDFR's distributed across the network into a centralized, accessible network location

Meets Standard DFR Requirements

When used with advanced microprocessor based relays such as the UR family, the DDFR System meets or exceeds requirements of International Standards for Digital Fault Recording.

DDFR Recording Specifications when used with the UR Family

Sequence of Event Records (SOE)

Timestamp Resolution	0.5 ms Digital Inputs, 2.0 ms Protection Elements
Time Synchronization	IRIG-B, SNTP
Digital Input Quantity	96 x number of UR's
Data Available	Digital Input Status Changes, Protection Element Status Changes, Automation Logic Status Changes, Peer-to-Peer Communication Messaging (IEC61850)

Transient Fault Recording

Sample Rate	Up to 64 samples/cycle
Length of Record	Up to 2 sec. @ 64samples/cycle
Number of Analog Channels	24 x number of UR's
Number of Digital Channels	64 x number of UR's
Data Available	V, I, Vrms, Irms, Hz, W, VA, vars, PF, Harmonics, Symmetrical Components, Calculated Protection Quantities (Diff/Rest Current etc.) Digital Status – Contact I/O, Remote I/O, Virtual I/O, Protection Element Status
File Format	COMTRADE
Trigger	Configurable

Disturbance Record

Sample Rate	Up to 1 samples/cycle
Length of Record	Up to 120 seconds @ 1 samples/cycle with 8 Analog Channels
Number of Analog Channels	16 x number of UR's
Data Available	V, I, Vrms, Irms, Hz, W, VA, vars, PF, Harmonics, Symmetrical Components, Calculated Protection Quantities (Diff/Rest Current etc.)
File Format	COMTRADE

DDFR Recording Specifications when used with the SR Family

Sequence of Event Record (SOE)

Timestamp Resolution	14 ms Digital Inputs and Protection Elements
Time Synchronization	IRIG-B
Digital Input Quantity	16 x # of SR750's & SR745's, 9 x # of SR469's & SR489's
Data Available	Digital Input Status Changes Protection Element Status Changes

Transient Fault Recording

Sample Rate	16 samples/cycle SR750, SR469, SR 489, 64 samples/cycle SR745
Length of Record	2 sec. – SR750 1 sec. – SR469, SR489 250 ms – SR745
Number of Analog Channels	8 x number of SR relays
Data Available	Voltage Phasors Current Phasors
File Format	COMTRADE
Trigger	Configurable

Disturbance Record (UR's Only)

Sample Rate	Up to 1 samples/cycle
Length of Record	Up to 34 sec. @ 1 samples/cycle
Number of Analog Channels	8 x number of UR's
Data Available	V, I, Vrms, Irms, Hz, W, VA, vars, PF,
File Format	COMTRADE
Trigger	Configurable

Technical Specifications

POWER SUPPLY

CONTROL POWER

HI Voltage: 110-250 VDC (range 88-300 VDC)
120-230 VAC (range 96-250 VAC)
Power: 30W

ENVIRONMENTAL

Temperature Range: -20°C to + 70°C
Humidity: Operating up to 95% RH (non condensing) @ 55°C

COMMUNICATIONS

Ethernet Port: 10Base-T, RJ45 connector

TYPE TESTS

Dielectric voltage withstand: EN60255-5
Impulse voltage withstand: EN60255-5
Insulation resistance: EN60255-5
Damped Oscillatory: IEC61000-4-18 / IEC60255-22-1
Electrostatic Discharge: EN61000-4-2 / IEC60255-22-2
RF immunity: EN61000-4-3 / IEC60255-22-3
Fast Transient Disturbance: EN61000-4-4 / IEC60255-22-4

Surge Immunity: EN61000-4-5 / IEC60255-22-5
Conducted RF Immunity: EN61000-4-6 / IEC60255-22-6
Power Frequency Immunity: EN61000-4-7 / IEC60255-22-7
Voltage interruption and Ripple DC: IEC60255-11
Radiated & Conducted Emissions: CISPR11 / CISPR22 / IEC60255-25
Sinusoidal Vibration: IEC60255-21-1
Shock & Bump: IEC60255-21-2
Power magnetic Immunity: IEC61000-4-8
Pulse Magnetic Immunity: IEC61000-4-9
Voltage Dip & interruption: IEC61000-4-11
Damped Oscillatory: IEC61000-4-12
Conducted RF Immunity 0-150khz: IEC61000-4-16
Voltage Ripple: IEC61000-4-17
Ingress Protection: IEC60529
Environmental (Cold): IEC60068-2-1
Environmental (Dry heat): IEC60068-2-2
Relative Humidity Cyclic: IEC60068-2-30
Damped Oscillatory: IEEE / ANSI C37.90.1
RF Immunity: IEEE/ANSIC37.90.2
Voltage effects-Over voltage: ETP910 Sec 3.1
Voltage effects-Under voltage: ETP910 Sec 3.2

APPROVALS:

CE: EN60255-5, EN60255-26, EN-50263
ISO: Manufactured under ISO9001 quality program

Please refer to Multilin DDFR Distributed Digital Fault Recording Instruction Manual for complete technical specifications

Ordering Information:

DDFR	**	**	Description
	HI		120-230 VAC / 110-250 VDC
		HI	Redundant 120-230 VAC / 110-250 VDC

Visit www.GEMultilin.com/DDFR to:



- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a DDFR online