AMETEK
POWER INSTRUMENTS

TR-3000 Digital Fault Recorder
For Generation, Transmission and Distribution Power System Monitoring

The TR-3000 is the only tool you need to capture and diagnose power system anomalies. With multiple recording modes and continuous transient oscillography, you will never miss an event. The multiple recording modes capture high-speed transients and long-term system disturbances. Our large record storage capacity, feature capabilities and processing power give you a more complete view of disturbances. While it's simple and quick to set up and diagnose a fault, it has the power to analyze complex system anomalies.

Multi-Function Capability
This digital fault recorder takes the place of several devices, by providing fault and disturbance recording, continuous logging, power quality monitoring and sequence of events recording. It integrates these functions into one unit, saving you money on equipment and installation. All recording modes operate independently and simultaneously to provide a complete picture of your system event. It's the ideal tool to help you optimize your power system to provide fault location, improve reliability, shorten fault clearance times and verify correct operation of your switchgear and protection equipment.

Ease of Use
The TR-3000 leverages our more than 50 years of experience with digital fault recorder hardware and software, making it easy to configure, install and update. The compact modular architecture is suited for small or large applications by adding input modules and chassis to fit your needs.

ports can support simultaneous connections for reliable network communications and secure data transfers.

Field Proven Technology - Never Miss an Event
Our core strengths are the extensive triggering and recording capabilitiesthat ensure you never miss an event. The TR-3000 has a 256 GB solid state drive that record high resolution data for longer durations. The flexible triggering options make it easy to capture a simple fault or uncover a complex system anomaly. Independent of any triggers, the transient oscillography feature provides continuous waveform recording for up to 601 days to capture events that are too sensitive for your triggers or to extend your pre- and post-fault data.

FEATURES AND BENEFITS

1. Multiple recording modes—capture high speed transient faults and long-term disturbances

2. Never miss an event—flexible triggering, continuous transient oscillography longer recording times

3. Ease of use—100% software configurable - no jumpers or switches

4. High reliability—to match other features no moving parts, redundant power supplies

5. Field proven display station software—single software platform for all products

Triggering

The system can be triggered with independent settings for transient and disturbance recording or combined settings for both transient and disturbance recording modes. This allows you to customize the recording for your specific application, including fault analysis, switchgear operation, grid instability, circuit breaker performance and power quality.

Type	Measurement	Trigger	Per Channel	Phase Group	Line Group
Transient and Disturbance Triggers	Analog (Voltage/Current)	Over, Under, Rate of Change	X		
	Analog (Harmonics)	Over (THD & 2 specified Individual Harmonics per channel)	X		
	Digital Inputs	Level, Edge, Return to Normal	X		
	Phase Group	Zero, Negative, Positive Sequence, PQ Events (Sags, Swells, Interruptions)		X	
	Frequency	Over, Under, Rate of Change	2		
	Timed	Daily, Weekly, Monthly & Time selectable automatic Triggers			
Disturbance Triggers (only)	Voltage Imbalance	Over			X
	PF & Displacement PF	Over, Under, Rate of Change			X
	Impedance	Over, Under, Rate of Change			X
	Phase Difference	Over		X	
	Analog Fundamental	Over, Under, Rate of Change	X		
	Frequency Oscillation[1]	4 Frequency Bands	2		
	Power Oscillation[1]	4 Frequency Bands			X
	Power (Watts, VARS, VA)	Over, Under, Rate of Change			X

Recording Modes

The TR-3000 has both triggered and continuous recording modes. Both are enabled simultaneously for capturing high resolution data from a system anomaly and performing long-term trending. The 256 GB solid state drive provides ample storage for all your data.

Triggered Recording Modes			
Type	**Measurement**	**Pre-Trigger Data**	**Post-Trigger Data**
Transient	32 - 512 Samples/Cycle 1.6 - 25.6 kHz (50 Hz) 1.9 - 30.7 kHz (60 Hz)	2 - cycles to 10 Seconds	8 - cycles to 60 Seconds
Disturbance	0.5 - 2 Samples/Cycle 25 - 100 Hz (50 Hz) 30 - 120 Hz (60 Hz)	10 Seconds - 10 Minutes	30 Seconds - 45 Minutes

Continuous Recording Modes							
Type	**Measurement**	**Values**	**Per Channel**	**Phase Group**	**Line Group**	**Recording Interval**	**Duration**
Logger	Voltage/Current	Min/Max/Avg	X			1 Minute	52 Weeks
	Frequency	Min/Max/Avg	2			1 Minute	52 Weeks
	Power (Watts)	Min/Max/Avg			X	1 Minute	52 Weeks
Power Quality	Voltage Imbalance	Min/Max/Avg		X		10 Minutes	52 Weeks
	Flicker (Short & long-term)	Min/Max/Avg			X	10 Minutes	52 Weeks
	Harmonics (Voltage/Current)	Magnitude/Phase Angle/ Min/Max/ Avg (Up to 128th)	X			10 Minutes	52 Weeks
SER	Digital Inputs	On/Off	X			Millisecond	52 Weeks
Transient Oscillography	Voltage/Current	Waveform	X			8 to 32 Samples/Cycle (480 - 1,920 Hz /400 - 1,600 Hz)	1 - 60 Days[1]
Disturbance Logger	Voltage/Current	RMS, Fundamental, Phase Angle	X			30/60/120 Hz (25/50/100 Hz)	14 - 60 Days[1]
	Frequency	Magnitude	X			30/60/120 Hz (25/50/100 Hz)	14 - 60 Days[1]

Fault recording data is stored in COMTRADE format inside the recorder for convenient retrieval and analysis. All recorded data can be retrieved by date/time frame and at lower resolutions than what was recorded. This lets you quickly retrieve data at lower sample rates with the assurance that high resolution data can be reviewed at another time.

Note:
[1]Additional licensing required

Power Quality Recording

The power quality at your site is recorded automatically with logs to store individual current and voltage Harmonics up to the 128th, Flicker, imbalance, frequency and steady state RMS voltage/current with 52 weeks of internal storage. Data can be retrieved and displayed graphically in the display station analysis software using preconfigured templates for voltage sags and swells, harmonics and comparisons to PQ standards (IEC 61000-4-30 Class A).

Sequence of Events Recording

The digital inputs are timestamped to the millisecond during an event, recording alarms and return to normal states in a separate log.

System Architecture

The 4U chassis holds up to eight input modules that can accept six analog and 12 digital inputs, 12 analog or 24 digital inputs depending on Module type for a system capacity of up to 96 analog with zero digitals or up to 24 analog with 144 digital inputs depending on configuration. Multiple chassis can be combined for larger systems. Each input module provides its own processing with a system control module managing the flow of data to and from the recorder. A universal AC/DC power supply is provided with each chassis and there is a slot available for a redundant power supply. The hot-swappable input modules are accessible from the front of the unit.

Communications

The TR-3000 front panel has a local ethernet port for communications and a USB port for configuration of the unit. The rear of the unit has dual independent ethernet ports, each with its own IP address for configuration and data retrieval. The unit has a built-in web server for system configuration and updates. Communications are secured using SSH encryption and data can be manually or automatically retrieved using our Autocall/ Autopoll functions.

Time Sync

Several time sync options are available including a built-in GPS receiver for connecting to external antennas, IRIG-B, SNTP and PTP.[2]
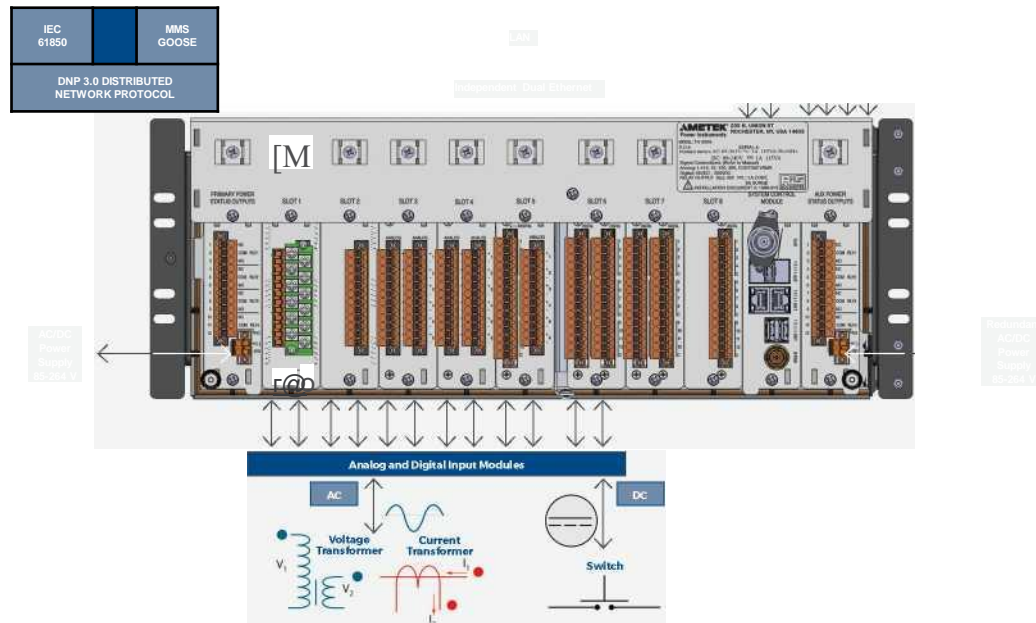
Note:
[2]Available soon

SPECIFICATIONS

INPUTS

Analog Inputs
• Built in DSP for 24-bit computations
• 16 bits COMTRADE, 32,768 levels (15 plus sign)
• Fixed 512 samples/cycle (26 kHz/31 kHz)
• Accuracy better than 0.1% of reading down to 3% of full-scale

Voltage Input Ranges
• 1.414, 10, 150, 300 V RMS full-scale or custom range (AC or DC compatible)

Current Input Ranges
• 1 A or 5 A RMS nominal (thru current shunts/ CICT's)

Frequency Response
• DC-1/2 sampling rate (12.8 kHz/15.4 kHz)

Digital Inputs
• 24 to 250 VDC normally open or closed wetted contact

Input Module Types
• 6 Analog (current or voltage) and 12 digital Inputs
• 6 or 12 Analog (current or voltage) Inputs
• 12 or 24 Digital Inputs

System Capacity (1 - 8 Input Modules)
• 6, 12, 18... up to 96 with Dual Analog Modules
• 12, 24, 36. up to 144 with Dual Digital Modules (multiple units for even larger systems)

TRIGGERING (TRANSIENT/ DISTURBANCE)

Analog Channels
• Voltage/current: over/under, rate of change (ROC)
• Harmonics: THD and individual harmonics (2 per channel)

Phase Group Sequence Triggers
• Over zero, over negative, over/under and ROC positive sequence

Frequency
• Frequency channels 1 & 2, frequency differential, over/under, ROC

Digital Channels
• Normal to alarm state and return to normal state. Edge or level sensitive

TRIGGERING (DISTURBANCE)

Analog Channels
• Over/under level of fundamental and ROC, frequency and ROCOF

Line Group Triggers
• Over/under, ROC
• Impedance, power factor, power factor displacement, power oscillation, power (Watts, VARs, VA)

RECORDING (TRANSIENT)

Recording Rate
• 32, 64, 128, 256 & 512 samples/cycle
• 1.6, 3.2, 6.4, 12.8 & 25.6 kHz (50 Hz)
• 1.9, 3.8, 7.7, 15.6 & 30.7 kHz (60 Hz)

Pre-fault Time
• 2 to 600 cycles

Post-fault Time

Safety Window
• 0 to 16 cycles recording time after active trigger

Recording Duration
• 0 to 60 sec. (prevents memory filling with a continuous trigger)

RECORDING (DISTURBANCE)

Recording Rate
• 0.5, 1.0 & 2.0 samples/cycle
• й, 1 or 2 X supply frequency (25/50/100 Hz or 30/60/120 Hz)

Pre-fault Time
• 10 sec. to 10 min.

Post-fault Time
• 30 sec. to 5 min. Fault length extends as long as trigger point condition exists

Safety Window
• 30 sec. to 2 min. recording time after active trigger

Recording Duration
• 60 sec. to 45 min.

Recorded Values
• Voltage and current phasor and RMS values and frequency (x2)

CONTINUOUS RECORDING (LOGGING)

Recording Rate
• 1 min.

Recording Time
• 52 weeks

Stored Parameters
• Voltage and current per channel, Watts (per circuit)
• Frequency (2 channels)

CONTINUOUS RECORDING (POWER QUALITY)

Recording Rate
• 10 min.

Recording Time
• 52 weeks

Stored Parameters
• Voltage imbalance, Flicker, individual harmonics to 128th , (W, VAR, VA)

SER RECORDING
• 1 msec. recording of all digital inputs

CONTINUOUS RECORDING (TRANSIENT OSCILLOGRAPHY)

Recording Interval
• 8, 16, 32 samples/cycle
• 400, 800, 1,600 Hz (50 Hz)
• 480, 960, 1,920 Hz (60 Hz)

Recording Duration
• 1 to 60[1] Days (depending on Sample Rate)

CONTINUOUS RECORDING (DISTURBANCE LOGGER)
• й, 1 or 2 x supply frequency
• (25/50/100 Hz or 30/60/120 Hz)

Recording Time
• 14 - 60[1] days (based on recording

Stored Parameters
• Voltage and current phasors and RMS values and frequency (x2)

SYSTEM TIMING

Time Synchronization Accuracy
• 1 |jsec. or better
• Internal GPS receiver
• IRIG-B (Mod & TTL)
• Network Time Protocol (SNTP)

COMMUNICATIONS

Network
• Network Protocol: TCP/IP, Fiber
• 10/100 Base-TX, (1 - Front)
• 10/100 Base-TX (or -FX), (2 - Rear)

USB Serial Ports (user can disable)
• 3 x USB -2 (1 - Front 2 - Rear)

DATA STORAGE

Solid State Storage
• 256 GB internal solid state memory (Upgradable to 2 TB)

POWER SUPPLY

Input Voltage Options
• 88 to 373 VDC, 85 to 264 VAC, (optional redundant)
• 24 to 75 VDC

Power Requirement
• 10 - 65 Watts depending on system configuration

ENCLOSURE

Chassis
• 4U (7") 19" chassis mount

ENVIRONMENT

Operating Temperature
• 14 °F to 131 °F (-10°C to 55°C)

Relative Humidity
• 0 to 97% non-condensing

CERTIFICATIONS
CE (IEC 61010-1 / IEC 61326-1)

STANDARDS
Complies with Power Industry Substation Standards Including: Vibration Tests for Relays and Protection Equipment
• IEC 60255-21-(1, 2, 3)

Measuring Relays and Protection Equipment, Electromechanical Compatibility - For Class B Installation
• IEC 61326 -1
• IEC 60255-26 (IEC 61000-4-(2-6, 8-12, ▪T16-18), 29)
• CISPR11, 22
• IEC 60255-27

Electrical Equipment for Measurement, Control and Laboratory Use - EMC
• Environmental Testing
• IEC 60068-2-(1, 2, 14, 30)

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