

TR-3000 Digital Fault Recorder

FOR GENERATION, TRANSMISSION, AND DISTRIBUTION POWER SYSTEM MONITORING



MULTI-FUNCTION RECORDER

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 TR-3000 captures high speed transients and long term system disturbances with enough memory to give you a complete view of the system disturbance. While simple and quick to set up and diagnose a fault; it has the power to analyze complex system anomalies.

Multi-Function Capability

The TR-3000 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 simultaneously and independently 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 is easy to configure, install and operate using the same field proven Display Station Software used in other AMETEK Fault Recorders. The TR-3000 goes one step further with all system parameters configured by software including the selection of current and voltage inputs. The compact modular architecture is suited for small or large applications by adding input modules and chassis to fit your needs.

High Reliability

The TR-3000 is a highly reliable solid state design that incorporates a low-power fan-less operation with no moving parts and a 256 GB solid state drive for long term storage.



Each chassis can be equipped with a redundant power supply which can operate from the same or different power source. Input modules are hot-swappable and each one has it's own dedicated processor for independent monitoring. Multiple independent Ethernet ports support simultaneous connections for reliable network communications and secure data transfers.

Features & Benefits

- **Multiple Recording Modes**
Capture high speed transient faults and long term disturbances
- **Never miss an event**
Flexible triggering, continuous transient oscillography, longer recording times
- **Ease of Use**
100% software configurable - no jumpers or switches
- **High Reliability**
256GB Solid state memory - no moving parts, redundant power supplies
- Field Proven Display Station Software
Single software platform for all products

FAULT RECORDERS

Field Proven Technology - never miss an event

The core strength of AMETEK Recorders is the extensive triggering and recording capabilities to ensure you never miss an event. The TR-3000 has a 256GB solid state drive for recording high resolution data at 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 **Continuous Transient Oscillography** feature provides continuous waveform recording for up to 4 days to capture events that are too sensitive for your triggers or to extend your pre and post fault data recorded.

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	Voltage/Current	Over, Under, Rate of Change	X		
	Harmonics	Over (THD & Individual Harmonics)	X		
	Digital Inputs	Level, Edge, Return to normal	X		
	Phase Group	Zero, Negative, Positive Sequence		X	
	Frequency	Over, Under, Rate of Change	2		
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 (PMU)	Rate of Change		X	
	Analog Fundamental	Over, Under, Rate of Change	X		
	Frequency Oscillation	4 frequency bands	2		
	Power Oscillation	4 frequency bands			X
	Power (Watts, VARS, VA)	Over, Under, Rate of Change			X

Recording Modes

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

Triggered Recording Modes

Type	Recording Rates	Pre-Fault	Post Fault	Safety Window	Max Recording
Transient	32-512 samples/cycle 1.6-25.6 kHz (50Hz) 1.9-30.7 kHz (60 Hz)	2-600 cycles	8-100 cycles	0-16 cycles	60 seconds
Disturbance	0.5-2 samples/cycle 25-100 Hz (50 Hz) 30-120 Hz (60 Hz)	10 sec -10 min	30 sec-5 min	30 sec-2 min	45 minutes

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.

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 minute	52 weeks
	Flicker (Pst)	Min/Max/Avg			X	10 minute	52 weeks
	Harmonics (voltage/Current)	Magnitude/Phase Angle/Min/Max/Avg (up to 128th)	X			10 minute	52 weeks
SER	Digital Inputs	On/Off/	X			msec	52 weeks
Transient Oscillography	Voltage/Current	Waveform	X			8 to 32 samples/cycle (400-1,600 Hz / 480-1,920 Hz)	1-4 Days
Disturbance Logger	Voltage/Current	RMS, Fundamental, Phase Angle	X			30/60 Hz (25/50 Hz)	14-28 Days
	Frequency	Magntude	2			30/60 Hz (25/50 Hz)	14-28 Days

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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 (EN50160 and IEEE).

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

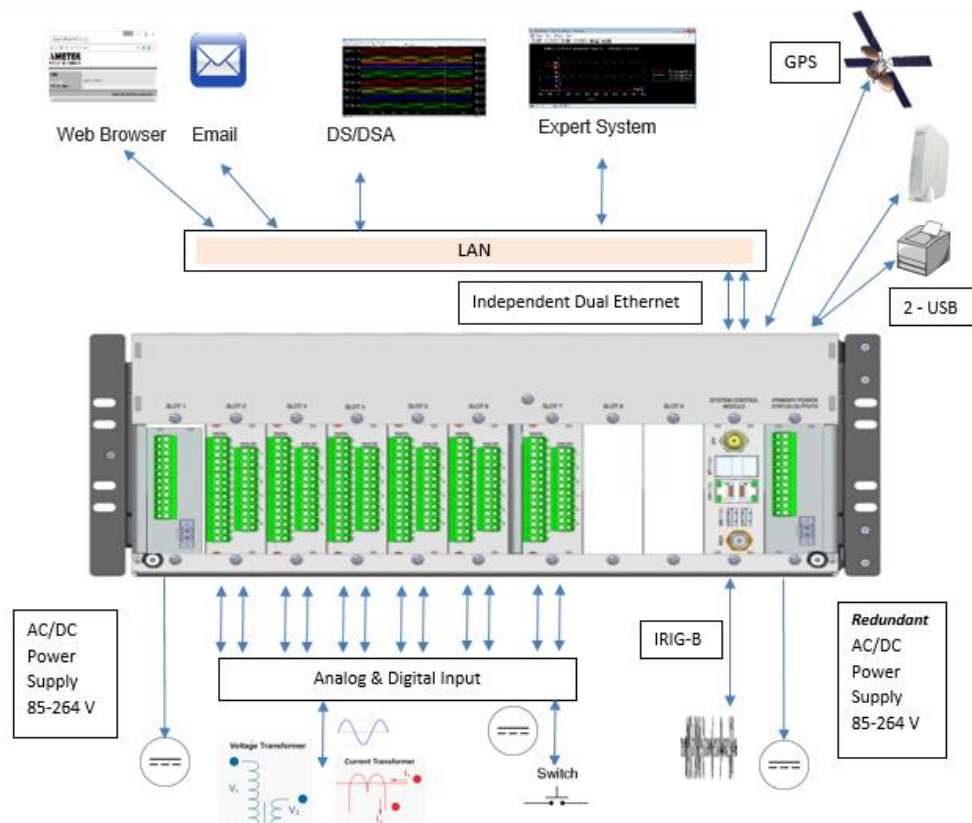
The 4U chassis holds up to 6 input modules that can accept 6 analog and 12 digital inputs each for a system capacity of 36 Analog and 72 Digital inputs. Multiple chassis can be combined together for larger systems. Each input module provides its own processing with a system control module managing the 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 USB port for configuration of the unit. The rear of the unit has dual independent Ethernet Ports, each with it's 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 (YYL & MOD and NTP).



FAULT RECORDERS

SPECIFICATIONS

INPUTS

Analog Inputs

- Built in DSP for computations
- 16 bits, 32768 levels (15 plus sign)
- Fixed 512 samples/cycle (26KHz/31KHz)
- Accuracy better than 0.1% of reading down to 3% of full scale

Voltage Input Ranges

- 1.414, 10, 150, 300V 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

Digital Inputs

- 24 to 250 VDC normally open or closed wetted contact

Input Module

- 6 analog (current or voltage) and 12 digital Inputs

System Capacity (1-6 Input Modules)

- 6, 12, 18, 24, 30 or 36 analog
- 12, 24, 36, 48, 60 or 72 digital (multiple units tied together for larger systems)

TRIGGERING

(Transient/Disturbance)

Analog Channels

- Voltage/current: over/under, rate of change (R-o-C)
- Harmonics: THD and individual harmonics (2 per channel)

Phase Group Sequence triggers

- Over zero, over negative, over/under and R-o-C positive sequence

Frequency

- Frequency channels 1 & 2, frequency differential, over/under, R-o-C

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 R-o-C, frequency and R-o-C-o-F

Line Group triggers

- Over/under, R-o-C
- Impedance, power factor, power factor displacement, power oscillation, power (Watts, VARs, VA)

RECORDING (Transient)

Recording Rate

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

Pre-fault Time

- 2 to 600 cycles

Post-fault Time

- 8 to 100 cycles. Fault length extends as long as trigger condition exists.

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 SPC
- ½, 1 or 2 X supply frequency (25/50/100Hz or 30/60/120Hz)

Pre-fault

- 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 phasors 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

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 (50Hz)
- 480, 960, 1,920 Hz (60 Hz)

Recording Duration

- 1 to 4 days (depending on Sample Rate)



CONTINUOUS RECORDING (Disturbance Logger)

Recording Rate

- ½ or 1 x supply frequency (25/50Hz or 30/60Hz)

Recording Time

- 14-28 days (based on recording rate)

Stored Parameters

- Voltage and current phasors and RMS values and frequency (x2)

SYSTEM TIMING

Time Synchronization

Accuracy

- 1 usec. or better
- Internal GPS receiver
- IRIG-B (Mod & TTL)
- NTP

COMMUNICATIONS

Network

- Network Protocol: TCP/IP
- 10/100 Base-TX, (1 - Front 2 - Rear)
- 3 X RJ/45 type (1 - Front 2 - Rear)

USB Serial Ports

- 3 x USB -2 (1 - Front 2 - Rear)

DATA STORAGE

Solid State Storage

- 256GB internal solid state memory

POWER SUPPLY

Input Voltage Options

- 88 to 240 VDC, 85 to 264 VAC, (optional dual redundant)

Power Requirement

- 65 Watts

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

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 60255-26-(IEC 61000-4- (2-12,16-18, 29) CISPR11,22

Electrical Equipment for Measurement, Control & laboratory use - EMC

- EC 61326 -1 (IEC 61000-4-(2-6,8,11)
- Environmental Testing
- IEC 60068-2-(1,2,14,30)

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