IST Instrumented Sensor Technology

ENVIRONMENTAL
SHOCK&
VIBRATION
SENSOR/RECORDER

Models EDR-3, EDR-3C, EDR-3D

... Defining the State-of-the-Art

ENVIRONMENTAL

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The improved EDR-3 series recorders continue to offer the state-of-the-art performance and field-proven reliability users have come to expect from IST products. In addition to the largest available onboard memory and advanced high speed data communications, EDR-3 series recorders now offer the most advanced data management features found in any digital recorder of its kind. IST's new DynaMax™ Suite for Windows 95/98/NT and DynaMax™-for-DOS user interface software delivers proven performance for a myriad of field applications ranging from transportation measurements to automotive crash recording while at the same time delivering amazing ease of use.

- Measures Shock & Vibration
- Built-in PR Triaxial Accelerometer
- True DC Frequency Response
- Onboard Memory to 8 MB
- Advanced Data Management Features
- *NEW* Sliding Window Overwrite Mode™
- *NEW* Event Type Memory Partitioning
- Up to 6 High Speed Accel Channels
- High Speed Serial Data Transfer
- Precision Low Noise 10-bit A/D
- Selectable Digitization to 3.2kHz/CH
- Programmable Triggering Schemes
- Automatic (DC) Offset Correction
- Vibration Controller Compatibility
- Battery Powered 30-60 days
- Small size: 37 cubic in., 2 lbs.
- Powerful Windows 95 or DOS Software Included
- Easy To Setup and Use
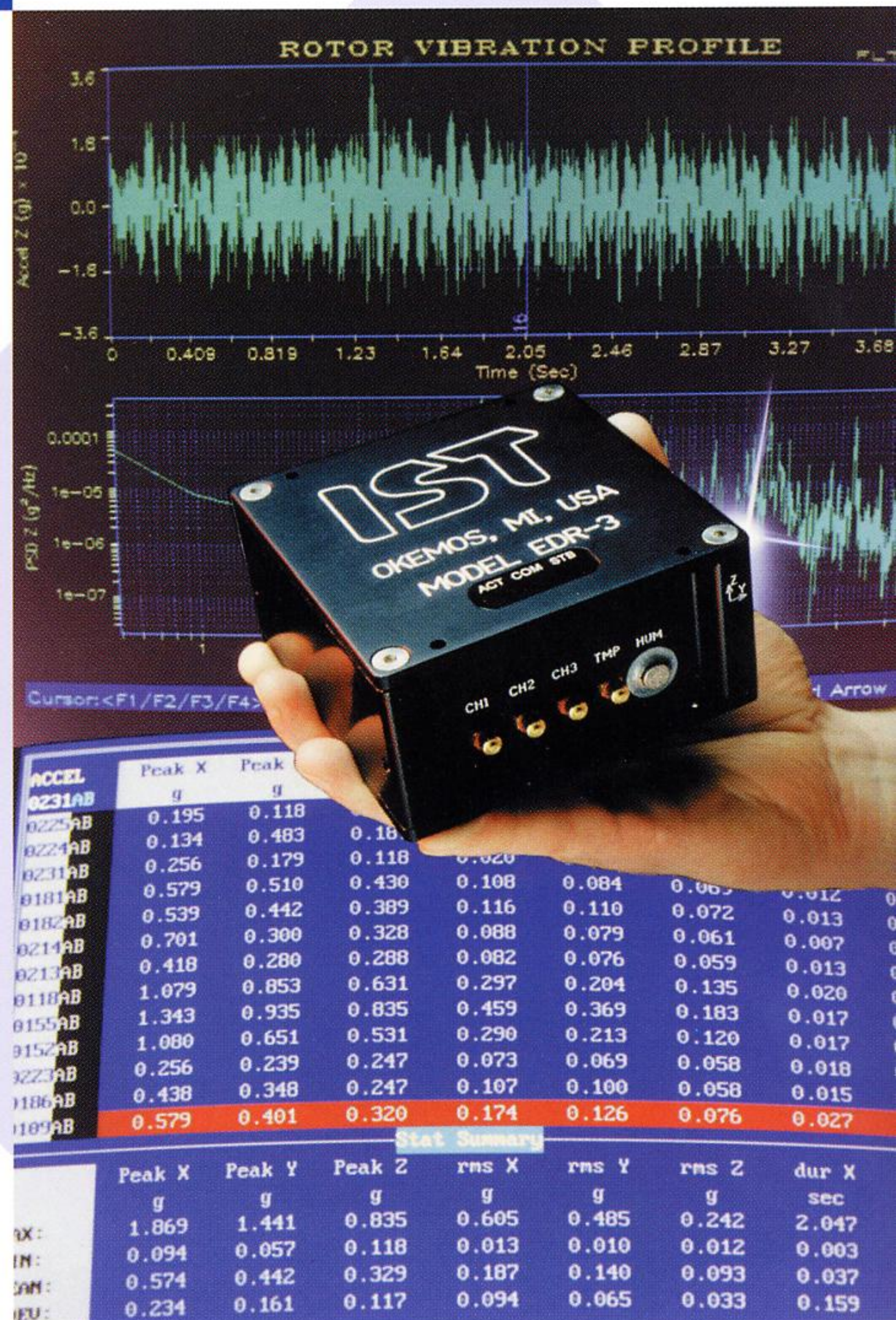
Typical Applications

- **Intermodal Transportation Studies**
- **High-Value Transport Monitoring**
- **Vibration Test Spec Development**
- **Launch Vehicle Vibration**
- **Avionics Environmental Reliability**
- **Concealed Monitoring**
- **Package Test Shipments**
- **Railcar Impact and Vibration**
- **Crash Recording**
- **Aircraft Flight Vibration**
- **Brake Testing**
- **Environmental Test Level Qualification**
- **In-Use Environments**
- **Structural Seismic Measurements**

Description

The Model EDR-3 series data recorders are self-contained, user-programmable acceleration sensor/recorders. The compact, 2 lb package is designed for remote, stand-alone shock and vibration measurement and recording over extended time periods ranging from several hours to several weeks. The models EDR-3, -3C and -3D are precision field measurement instruments offering significant improvements in size & weight, recording speed, onboard data storage, channel throughput, dynamic range, data management and programmability features. Additional improvements in high vibration environment survivability have also been made over earlier products of its kind. The EDR-3 series recorders offer the user a time-tested reputation for proven performance and reliability with hundreds of successful installations worldwide since 1989. The EDR-3, 3C and 3D models operate similarly, and differ mainly in programmability features, onboard memory and channel capacities.

The recorders are setup using a standard PC serial port, along with IST's **DynaMax**™ DM-1 software module. After field recording, data is transferred back to the host PC for processing and analysis. Each recorder is powered by a specially designed, convenient C-cell battery pack. An alternative 9 volt battery pack is also available.

The instrument's recording function is controlled by a custom designed digital recording and data management engine. The design is optimized for minimal power consumption while running at high, multichannel digitization rates and large data storage capacities. During active recording, acceleration signals are digitized to 10 bit resolution and stored in digital memory onboard. Each recorded event is also date and time tagged for future reference. The EDR-3(C,D) can be supplied with up to 4(4,8) Mbyte of onboard data memory for waveform recording. The choice of 10-bit A/D allows for precision, low noise measurements while still making efficient use of available data memory and battery power in comparison to 8-bit or 12-bit systems. For typical ground transportation applications the EDR-3 series recorder is capable of recording nearly three hours of equivalent real time data over a typical 100 Hz vibration analysis bandwidth. Advanced data management capabilities of the EDR-3 allows the unit to measure and record over 5000 separate 3-channel or 6-channel waveform sets comprising transient shock events and/or continuous vibration time samples. IST's unique "Event Type Partitioning" of **separate time-triggered and event-triggered data may also be performed during recording.** This feature improves post-collection data reduction and analysis. The length of each event is also user selectable between event types, enabling the unit to be optimized for capture of both shock and vibration data during a single field recording session.

Acceleration recording can be configured from the internal triaxial accelerometer channels and/or from up to three optional external accelerometer channel inputs. External accelerometer input channels provide signal conditioning, filtering, and constant current excitation for use with low power voltage mode piezoelectric accelerometers.

The EDR-3 also measures and records environment temperature using sensors built into the instrument and/or connected externally. Optional internal and external relative humidity sensors are also available.

Accelerometers

Each EDR-3 instrument is supplied with a specially designed and calibrated, built-in triaxial accelerometer. The internal accelerometers are **piezoresistive** devices, offering superior low frequency response characteristics and extremely low power consumption. Different full scale measurement ranges are available to optimize the recorder to a particular application. Internal accelerometers are temperature compensated to ensure accurate signal recording over a broad (-40 to +70 deg C) temperature range. The accelerometers are mounted approximately at the center-of-gravity of the instrument enclosure, enabling accurate sensing of the accelerations to which the unit is subjected. The rigid, machined aluminum instrument housing permits accurate transmission of mechanical shock and vibrations directly to the internal accelerometers, with a mechanical frequency response up to several kilohertz.

Self-Calibration Checks: Since internal PR accelerometers offer true DC response, the user can easily check the calibration of several ranges of internal transducers. This is done by simply recording the true 2.0g step generated by a simple 180 degree rotation of the recorder in earth gravity on each axis. This calibration check can easily be performed by the user.

Auto-Zero Calibration Feature: Before initiating a new recording session the EDR-3 unit performs an automatic, internal zero calibration check on each of the three axes. This procedure ensures that no erroneous offsets are present as a result of temperature variation or recent orientation changes.

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SHOCK & VIBRATION

SENSOR/RECORDER

Models EDR-3, EDR-3C, EDR-3D

Window 1   2

🚚 TRUCK

... Duri

Auto-Zero Offset Control: The EDR-3 recorder provides automatic digital offset correction between recorded events. This feature compensates for DC offsets resulting from temperature variation, as well as changes in orientation. The correction rate is 1% of full scale per second. Once a triggered recording begins the correction is disabled until the recording is completed. In this way the unit offers **true DC response** during the recording of an actual acceleration event.

TOTAL EQUIVALENT RECORDING TIME (EDR-3, 3C, 3D)

	MB	Total Onboard Memory		
Analysis Band Width	Hz	1	4	8
	60	35	144	290 min.,(*)
	100	21	87	174 min.
	500	4	17	35 min.
	1,000	2	8	17 min.

(*) Approximate-Max, Assuming Nyquist Digitization Rate

External Accelerometers: The optional external accelerometer input channels are designed for use with piezoelectric voltage mode devices. External channels provide signal conditioning, filtering, and constant current excitation for use with voltage mode accelerometers. This choice of transducer offers significant advantages in low noise performance and reliability as well as relative immunity to calibration errors in comparison to charge mode devices.

External Input Triggering: An external bi-directional trigger channel is available as an option on all EDR-3 models. This digital channel is used for communicating trigger status among multiple EDR-3s as well as for providing a remote control triggering capability. The channel can also be used to set an alarm condition whenever the unit triggers.
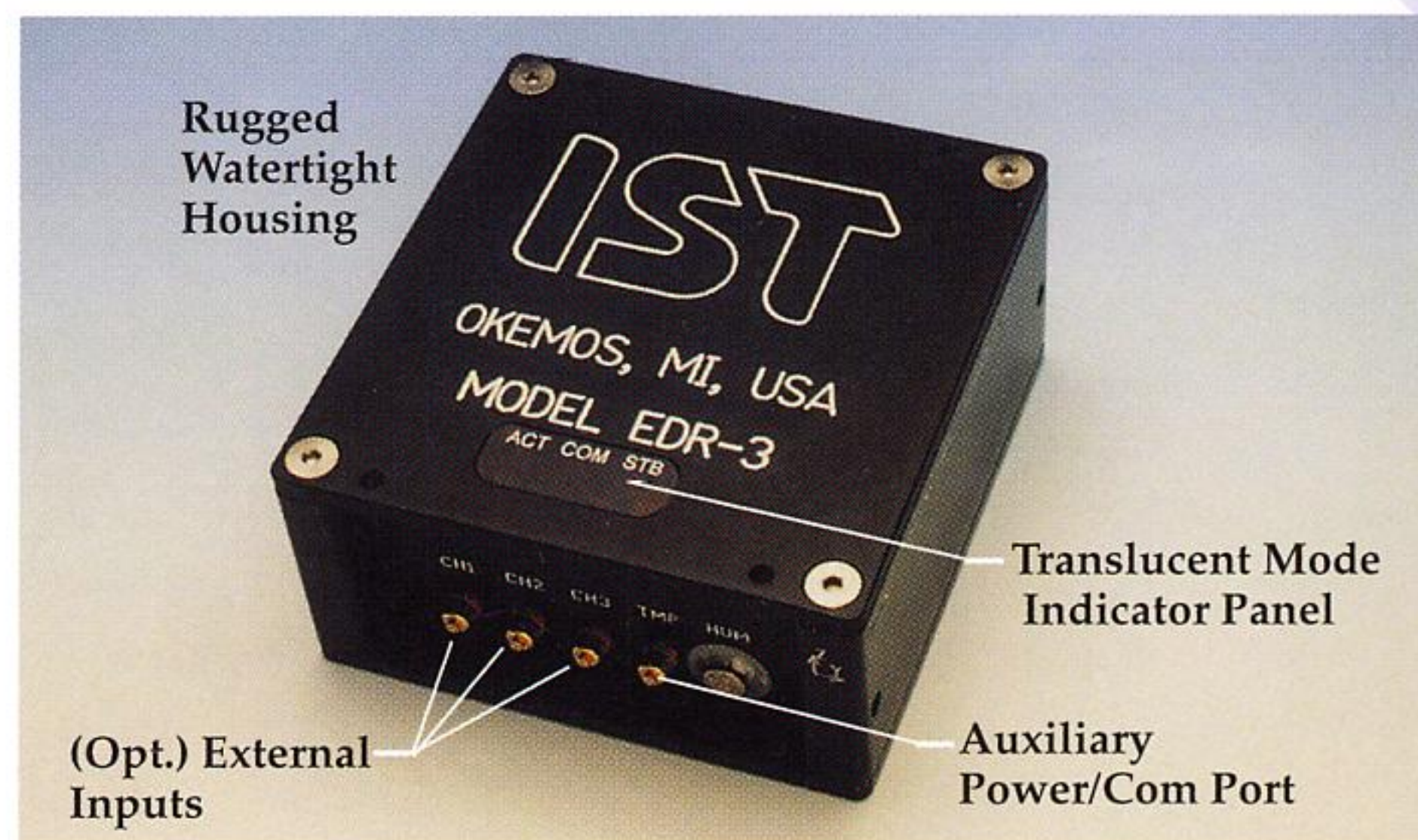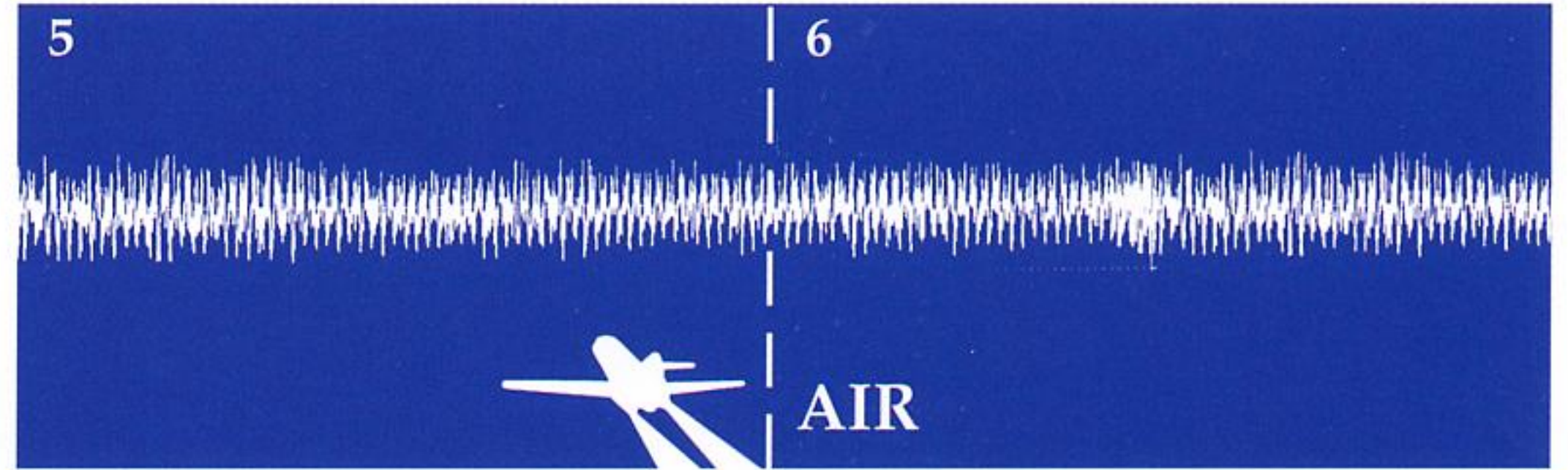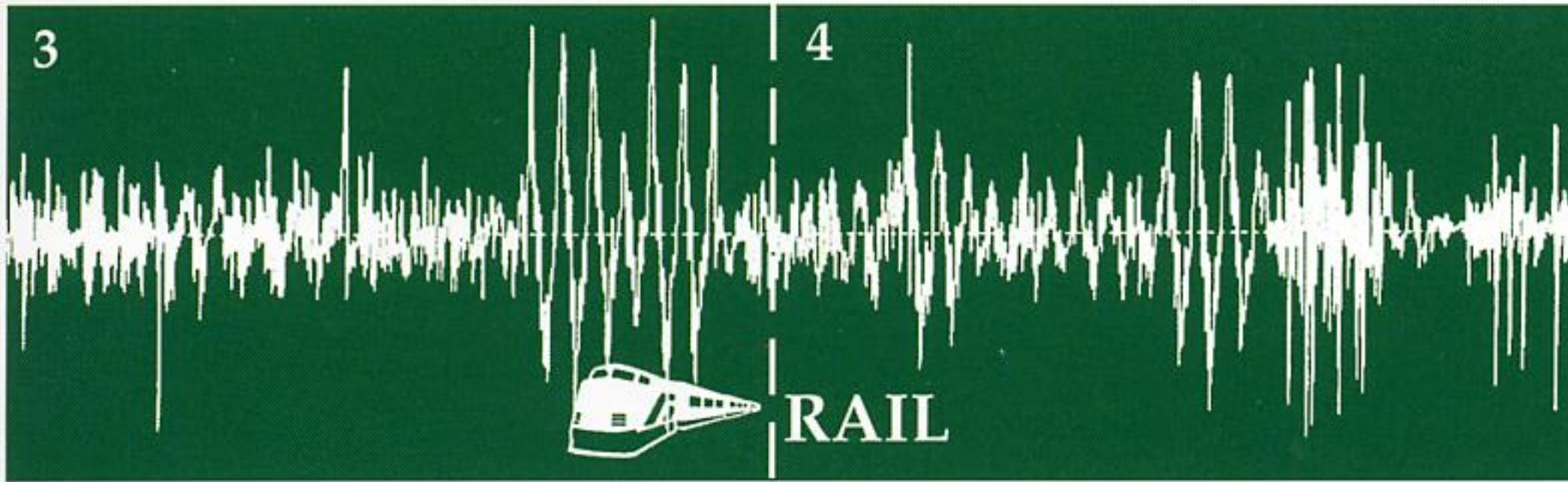
Flexible Serial Data Communications

The EDR-3C and -3D models offer a special serial communications port for standard **and** high speed serial data transfer to a host PC. The specially designed serial port enables standard rate communications at 9600 Baud as well as high speed data dump up to 115 kBaud. The high speed data dump feature is compatible with most PC RS-232 ports and does **not** require "add on" boards or cards. This unique capability enables the EDR-3 to maintain modem compatibility at 9600 Baud, while offering high speed dumps with direct PC connection. All EDR-3 models are compatible with IST's Field-Link™, remote control and data communications system.

Advanced Programmability

The EDR-3 is completely user programmable for accurate recording of either (transient) shock and/or pseudo-stationary vibration data. The instrument may be setup to operate under both event (amplitude-based) and/or time (periodic) triggered recording. Once triggered, high speed digital recording takes place simultaneously on all three or six of the selected internal or external accelerometer input channels. Each recorded event is then time-indexed with current date and time and stored in digital memory.

Rugged Watertight Housing

IST
OKEMOS, MI, USA
MODEL EDR-3
ACT COM STB

Translucent Mode Indicator Panel

(Opt.) External Inputs

Auxiliary Power/Com Port

RAIL

AIR

When a particular 3-channel set is operating under event triggered recording, a user selectable amplitude threshold (g-level) in conjunction with a duration threshold (milliseconds) provides the trigger criterion. When using this threshold combination selective capture of transient shock based upon measured amplitude as well as duration is possible. The result is effectively a velocity threshold for triggered recording. Recorded event lengths may be pre-selected by using specific **pre-** and **post-trigger sample lengths**. These parameters may be set separately for different triggering schemes (event or time-based) as well as for different accelerometer channel selections. Event lengths can also be data dependent.

Data Management

Several different data management features are available for handling large numbers of captured time histories. **Fill & stop memory mode** results in recording all frames satisfying the trigger criterion sequentially in time until the digital memory in the instrument is full. A second **overwrite memory mode** option causes recording in digital memory of a selectable number of events having the largest RMS levels of all events measured. When recording shock-type data the overwriting method accumulates those events having largest total resultant velocity change. This powerful memory mode is used to selectively record the highest level accelerations sensed by the instrument over an entire field test session.

Windows or MS-DOS Software Included (DM95-BASE)

Additional programmable parameters include **digital sample frequency** (125 - 3200 Hz/channel), overall **start and stop times** for active sensing/recording, and **time interval for temperature/humidity measurement.** These parameters may also be set differently among different input channel sets.
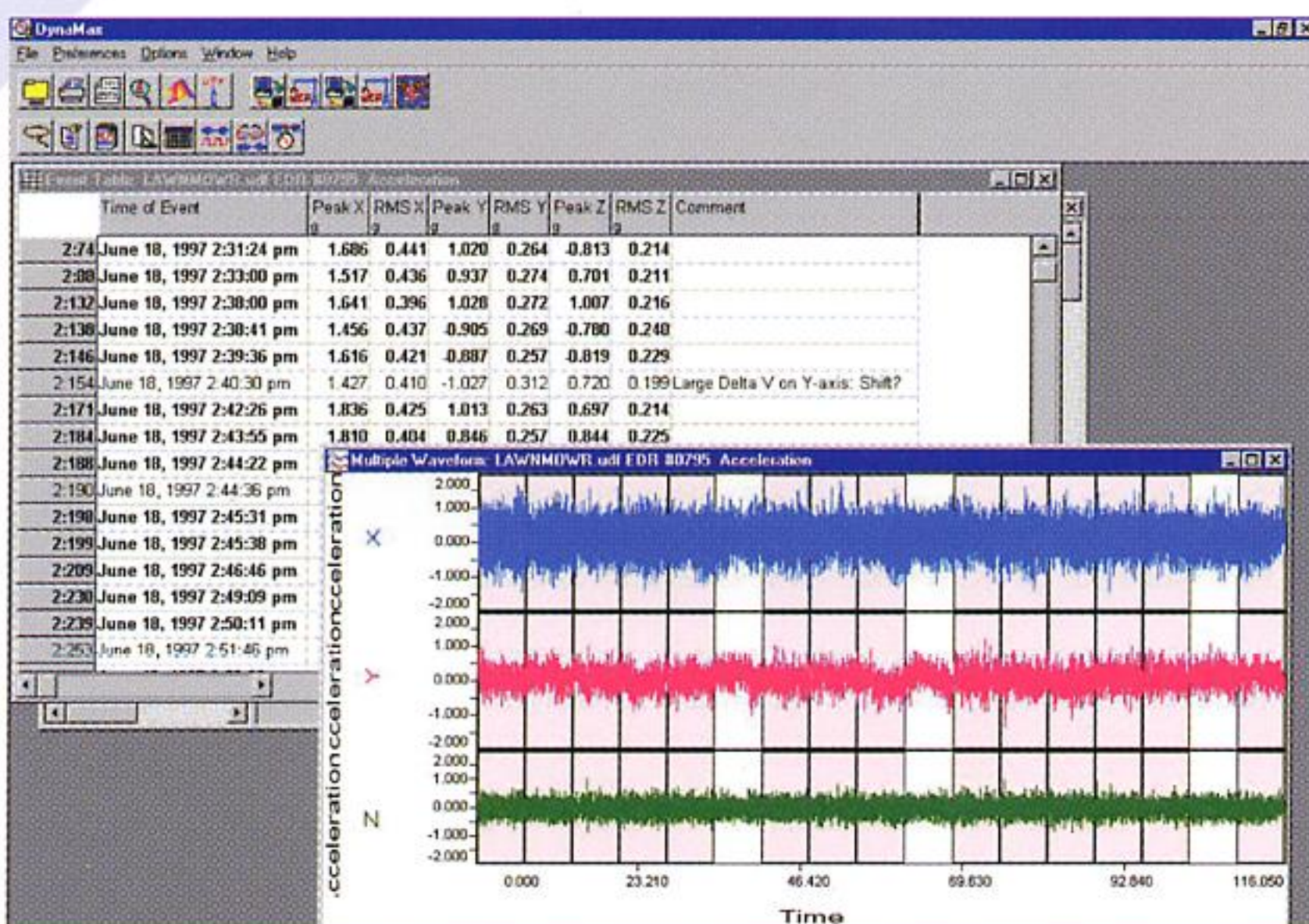
Sliding Window Overwrite Mode (SWO)™ (*)

The EDR-3C and -3D models offer a powerful new recording feature called Sliding Window Overwrite (or SWO) developed exclusively by IST. SWO provides the advantages of standard overwrite mode and much more. With SWO the field test period is effectively partitioned into a user selectable number of **time windows** or bins. The size of the time windows are also selected by the user. Event overwriting can only occur **within respective time windows**. As a result the user will be assured of having subsets of worst-case (ie. highest level) event data that is collected **uniformly** throughout the entire field test. This feature also enables the recorder to uniformly capture data during **different** modes of transport which may actually have significantly different overall amplitudes. Without SWO the recorder would often fill its entire memory (through overwriting) during transport through the particular mode having the highest levels.

Sliding Window Overwrite Mode with Event Type Partitioning (SWO-ETP)

As an extension of SWO Event Type Partitioning during SWO restricts overwriting to occur only within similar data types. Time-triggered data may only overwrite other time-triggered events, and amplitude-trig-

SHOCK & VIBRATION
SENSOR/RECORDER

Models EDR-3, EDR-3C, EDR-3D

Choice of Built-in Battery Packs

C-Cells

9-Volt

gered data may only overwrite other amplitude-triggered events. In this way shock data is recorded and overwritten separately from (time-triggered) vibration data, even when measured during the same time window.

Sliding Window Overwrite Mode with Channel Set Partitioning (SWO-CSP)

Event type partitioning can also apply to channel set selection, even when setup to capture similar event types. For example, both internal and external accelerometers could be set for time-triggered recording. However overwriting can be set to occur independently and with the same or different window sizes, etc.

Improved Laboratory Simulation

SWO enables the user to uniformly capture selective highest-level "time windows" of data during a field test. Recorded SWO data can be processed with IST's DM-3 software module to generate **a separate PSD profile for each time window**. Separate PSD profiles can then be used to build sequential PSD random vibration simulations, instead of using a single "average" profile for the entire field test. The result is an improved and more focused simulation of the actual field environment.

Vibration Test System Compatibility

Data recorded with all EDR-3 models can be processed with IST software for direct compatibility with many digital vibration controllers. Whether the requirement is for PSD test profile simulation or real time history reproduction IST can offer a software interface solution providing direct compatibility with most commercially available controllers.

Instrument Mounting

The instrumentation and sensors of the EDR-3 are built into a specially designed, machined aluminum enclosure. The enclosure is designed for accurate mechanical transmission of acceleration levels directly to the internal accelerometers. Four holes in the base flange of the housing are provided for rigid mounting of the instrument by the user. Magnetic mounting bracket assemblies are also available for use in mounting the recorder in 110 lb and 220 lb force ratings.

Setup/Data Recovery & Analysis

Supplied with the EDR-3 instrument is IST's **DynaMax™**Suite for Windows 95 software package. This software is available in either Windows or DOS versions on 3.5" diskettes or CD-Rom. The DM95-BASE package is used for preprogram-

ming the EDR-3 prior to field testing, retrieving recorded data subsequent to test, and processing and analyzing recorded time domain acceleration data. Other features of the DM95-BASE software include spreadsheet-like data manipulation, sorting and editing, waveform graphics, histogram generation, digital filtering, printing and exporting. Other **DynaMax**™ modules are available for velocity and displacement calculations, frequency domain analysis, package drop height calculations, ride quality profile generation, crash data analysis, and more.

Performance History

The EDR-3 series recorders have been used in a broad range of high performance applications worldwide for several years. A few of the EDR-3s more prominent application areas include:

- **The recorder of choice by damage prevention professionals at most major U.S. Railroads**

- **Mandated by U.S. Auto Club as the "crash recorder" for all INDY racecars**

- **Selected by NASA for measuring cargo bay vibration aboard U.S. Space Shuttle**

- **Selected by NASA Prime Contractor for continuous railcar transport of all Shuttle Solid Rocket Motors**

- **Selected by many Fortune 500 companies for in transit shipment monitoring**

- **Selected by numerous D.O.D. contractors for ground transport monitoring of critical aerospace hardware**

- **In use by most major small parcel delivery service companies**

Applications

The EDR-3 series recorder has been designed for applications requiring remote, unattended monitoring and recording of shock and vibration over extended periods of time. Its ultra-small size and weight combined with extraordinary recording and programmability features make it particularly attractive in applications where space and added weight come at a premium.

Since human monitoring during recording is not required, personnel costs associated with field testing using the EDR-3 can be reduced significantly. The instrument also offers a very high degree of operational reliability under harsh environmental test conditions.

Specific applications for the EDR-3 vary from industrial packaging and handling environmental monitoring to in transit vehicular measurements to airborne vibration measurement to crash recording. If there is an application for the EDR-3 series you would like to consider, feel free to give us a call. We would be pleased to discuss it.

EDR-3 Series Recorder Specifications

DATA ACQUISITION	EDR-3	EDR-3C	EDR-3D
#Selectable High Speed CHs:	3 (3)	3 (3)	6 (6)
#Simultaneous High Speed CHs:	3	3	6
Digitization	10-bit	10-bit	10-bit
#Low Speed CHs:	4	4	8
#Simultaneous Low Speed CHs	4	4	8
Temperature Sensor CHs	1 (1)	1 (1)	2 (2)
Humidity Sensor CHs	(1)	(1)	(2)
Battery Voltage CHs	1	1	2
#Trigger CHs	(1)	(1)	(2)
High Speed Digitization Rate	125-3200 (4800)	125-3200	125-3200
Low Speed	1 sample every 15 sec to 1 sample every 166 hours all models		
Digitization, Agreggate MAX, sps	9600 (14400)	9600	19200
DATA STORAGE			
MegaByte- Non-volatile SRAM	1 (2,4)	1 (2,4)	2 (4,8)
DATA MANAGEMENT			
Fill & Stop Memory Mode	X	X	X
Overwrite Memory Mode	X	X	X
Sliding Window Overwrite Mode™		X	X
Sliding Window Overwrite with Event Type Partitioning			X
Sliding Window Overwrite with Channel Set Partitioning			X
Sliding Window Size	N/A	Selectable 1 min to 30 days	
# Separate Time Windows	N/A	Selectable 1 to 100	

( ) = Optional

	EDR-3	EDR-3C	EDR-3D
DATA COMMUNICATION			
Plug & Play Serial RS-232, modem compatible	9.6kBaud	9.6 to 115kBaud	9.6 to 115kBaud
SENSORS			
Internal Accelerometer: Piezoresistive Triaxial	X	X	X
Accelerometer fs Range Choices	±2, ±5, ±10, ±20, ±50, ±100, ± 200, ±500g all models		
Accelerometer Frequency Responses	DC-250 Hz, DC-350 Hz		
2g, 5g fs	DC-400 Hz, DC-1000 Hz		
10g, 50g fs	DC-1500 Hz, DC-2000 Hz		
100g, 200g fs			
Signal Filtering: 4th Order Anti-Aliasing	60, 80, 90, 110, 140, 170, 200, 340, 420, 510, 620, 750, 930, 1120, 1915 Hz		
Standard 3dB cutoff choices	1% fs/sec all models		
Automatic Auto-Zero Offset Correction	Voltage mode piezoelectric, 0.5mA, 3.4V bias, 0.5mv/g to 1000 mv/g, all models		
External Accelerometers:			
PROGRAMMABILITY			
High Speed Sample Rate	X	X	X
Trigger selection	Internal or external channels and/or external trigger input, all models		
Triggering	X	X	X
Amplitude Threshold	X	X	X
Separate channel thresholds		X	X
Duration (time at level) Threshold	X	X	X
Separate channel thresholds		X	X
Trigger Duration Threshold	1 to 34463 samples all models		
Time Trigger Delay	0 to 35000 seconds all models		
(forced time delay between triggered recordings)			
Time Triggered Recording	1 sample every 15 sec to 1 sample every 166 hours all models		
Maximum Number of Events	5291	5291	10582
Event Length:	Fixed or Data Dependent		
Pre-trigger samples	2 to 9997 all models		
Post-trigger samples	1 to 9999 all models		
Maximum Event Length cutoff:	9999 samples all models		
Memory Modes:	FS, OW	FS, OW, SW	FS, OW, SWO, SWO-ETP,-CSP
OPERATIONAL			
Temperature Recording	Internal & external all models		
Range/Resolution	-40 to +70°C/ ±3°C all models		
Humidity Recording	Internal & external all models		
Range/Resolution	0 to 100% RH / ±3% RH all models		
Usable Temperature Range	1 to 60°C all models		
Digital Clock	Month/Day/Year, Hour:Min:Sec all models		
Date & Time Tagged to each acceleration event			
Resolution/Accuracy	53 msec / ±3 min/Mo all models		
Auto ON and OFF times	X	X	X
Connectors	DB9 for RS-232 serial all models		
	(4-pin microdot for external RS-232, aux. power, all models)		
	(10-32 microdot for external accelerometers)		
Battery Life(Typical) Alkaline C-cell Batteries	30-40 days	20+ days	15+ days
Data Memory Backup	12+ months all models		
PHYSICAL			
Size	4.2"x 4.4" x 2.2"	4.2"x 4.4"x 2.2"	4.2"x 4.4"x 2.5"
Housing	Black Anodized Aluminum, watertight, gasket sealed		
Weight	2.2 lb	2.2 lb	2.6 lb
Operating Temperature Range	-40 to + 70°C all models		
Shock Fragility	500g or 20 x fs, all models		

STANDARD ANALYSES
(with DM95-BASE Software package)

3-Channel Acceleration waveform graphics, histograms, temp/hum process
Resultant Acceleration waveforms
Spreadsheet tabulation of max, min, peak, duration, RMS, crest factor,
velocity change, temperature, humidity, dew point, battery volt
Data editing and sorting by selected event parameters, statistical summaries
Digital filtering- low pass, high pass, bandpass

OPTIONAL ANALYSIS SOFTWARE

DM95-int Velocity and Displacement Waveforms
DM95-psd Power Spectral Density (PSD) calculation and analysis
DM95-srs Shock Response Spectrum (SRS) calculation and analysis
DM95-drop Packaging Drop height - Equivalent impact, Zero-G free fall,
            package trajectory animation, impact direction & type.
DM95-deriv Jerk Waveform calculation and display

HARDWARE OPTIONS			
Memory expansion	2,4 Mb	2,4 Mb	4,8 Mb
External Channel inputs	3 accel, temp, power, COM, trigger		
Relative humidity sensor	internal and/or external		
Higher digitization rates	X		X
Auxiliary battery pack	X	X	X
Hand-Held remote trigger (HRT-1)	X	X	X
Remote Alarm Module (RALM-1)	X	X	X

Printed in the U.S.A.07/

THE PANTHER
SHOCK & VIBRATION SENSOR/RECORDER
MODEL EDR-4

- High Speed
- Large Memory

- Fast
- Powerful
- Precise

...Defining the State-of-the-Art

IST
Instrumented
Sensor
Technology

THE PANTHER

SHOCK & VIBRATION SENSOR/RECORDER
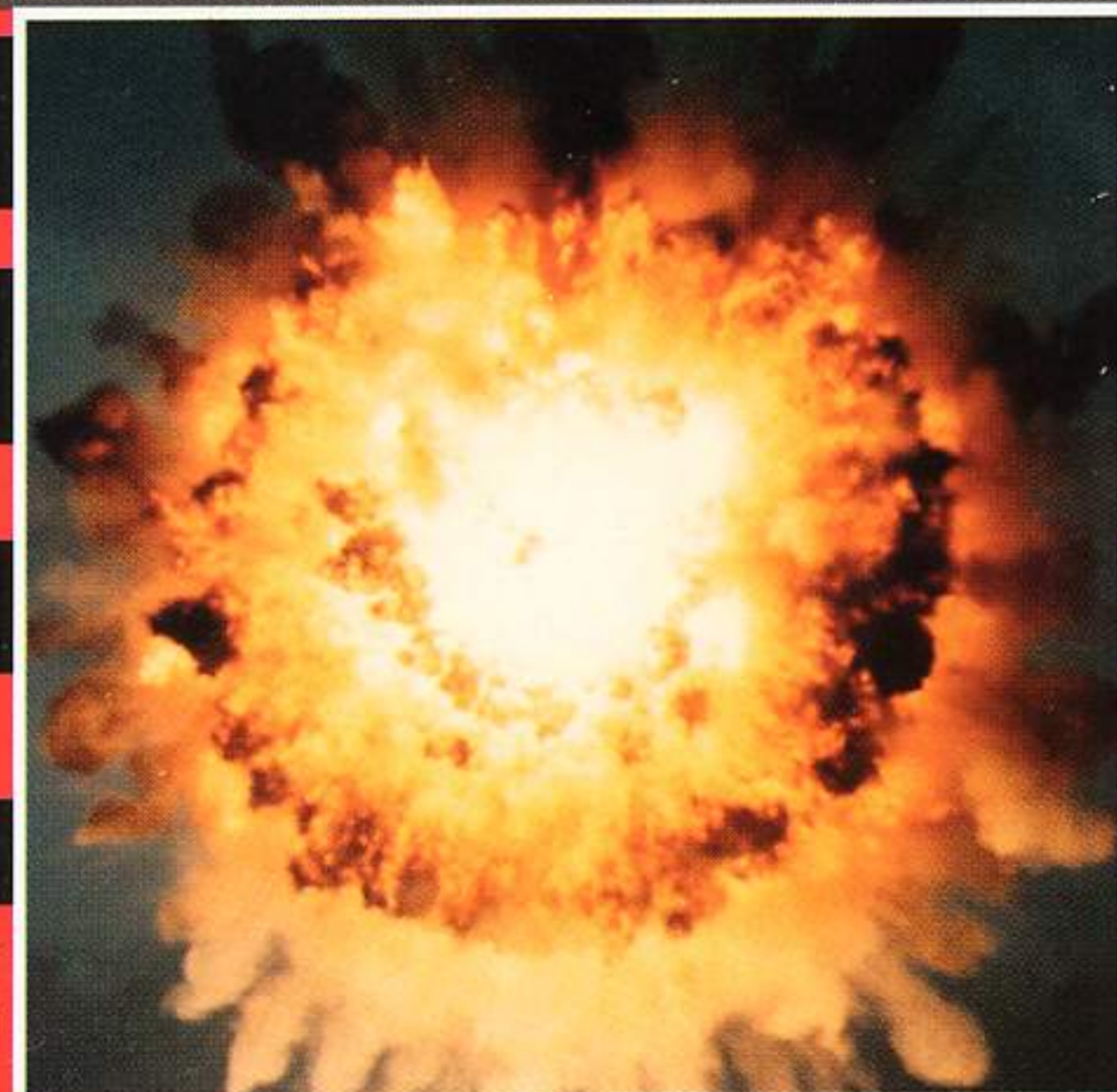
MODEL EDR-4

- **Loaded With Memory**
- **Packed With Programmable Features**
- **Compact...Yet Completely Self-Contained, Self-Sensing, Self-Powered**

Designed using the same high level IST engineering know-how that has set the standards for portable data recorders.

Record over 90 minutes of 2kHz, 3-axis flight vibration

Shock hardened for harsh environments

- **Triggered Waveform Recording**
- **3 & 6 - Channel Capabilities**
- **12-bit A/D, 74dB Dynamic Range**
- **Programmable Digitization to 60 kHz**
- **Three Single-Ended Inputs**
- **Three Differential Inputs**
- **Internal PR Triaxial Accelerometer**
- **Constant-Current Excitation For Low-Bias PE Accels**
- **User Adjustable (DC) Offset Correction**
- **Programmable Time or Event-Based Triggering**
- **Programmable Anti-Alias Filter From 10 Hz to 60 kHz**
- **Programmable Gain Adjust**
- **6 MB Onboard Memory, Expandable to 108 MB**
- **Programmable Data Memory Partitioning**
- **Sliding Window Overwrite™(*) Memory Management**
- **High Speed Parallel or Serial Port Data Communications**
- **RFI Flight Certified**
- **Intrinsically Safe**
- **Battery Powered for 30-60 Days**

Use the PANTHER for...

- **Flight Vibration Recording**
- **Crash Recording**
- **In-Depth Transportation Monitoring**
- **Random Vibration Test Spec Development**
- **Launch Vehicle Vibration**
- **Seismic Measurements**
- **Blast Recording**
- **Any Dynamic Measurement Project Requiring High-Speed, Large-Memory, Stand-Alone Measurement and Digital Recording**

D E S C R

The PANTHER Model EDR-4 series recorders are self-contained, user-programmable acceleration sensor/recorders. The compact, 5 lb. package is designed for remote, stand-alone shock and vibration measurement and recording over extended time periods ranging from several hours to several weeks. The EDR-4 is a precision field measurement instrument offering major improvements in recording speed, onboard data storage, dynamic range, data management, and programmability features. The PANTHER is programmed for test using a standard PC serial or parallel port, along with IST's DynaMax DM-1 software module. After field recording data is transferred back to the host computer for processing and analysis. Each PANTHER is powered by a specially designed, user serviceable D-cell battery pack. The PANTHER's recording function is controlled by a custom designed recording and data management engine. The design is highly optimized for minimal power consumption while running at high, multi-channel digitization rates, and extremely large data memory storage capacities. During active recording acceleration signals are digitized to 12 bit resolution and stored in digital memory onboard the unit. The PANTHER offers from
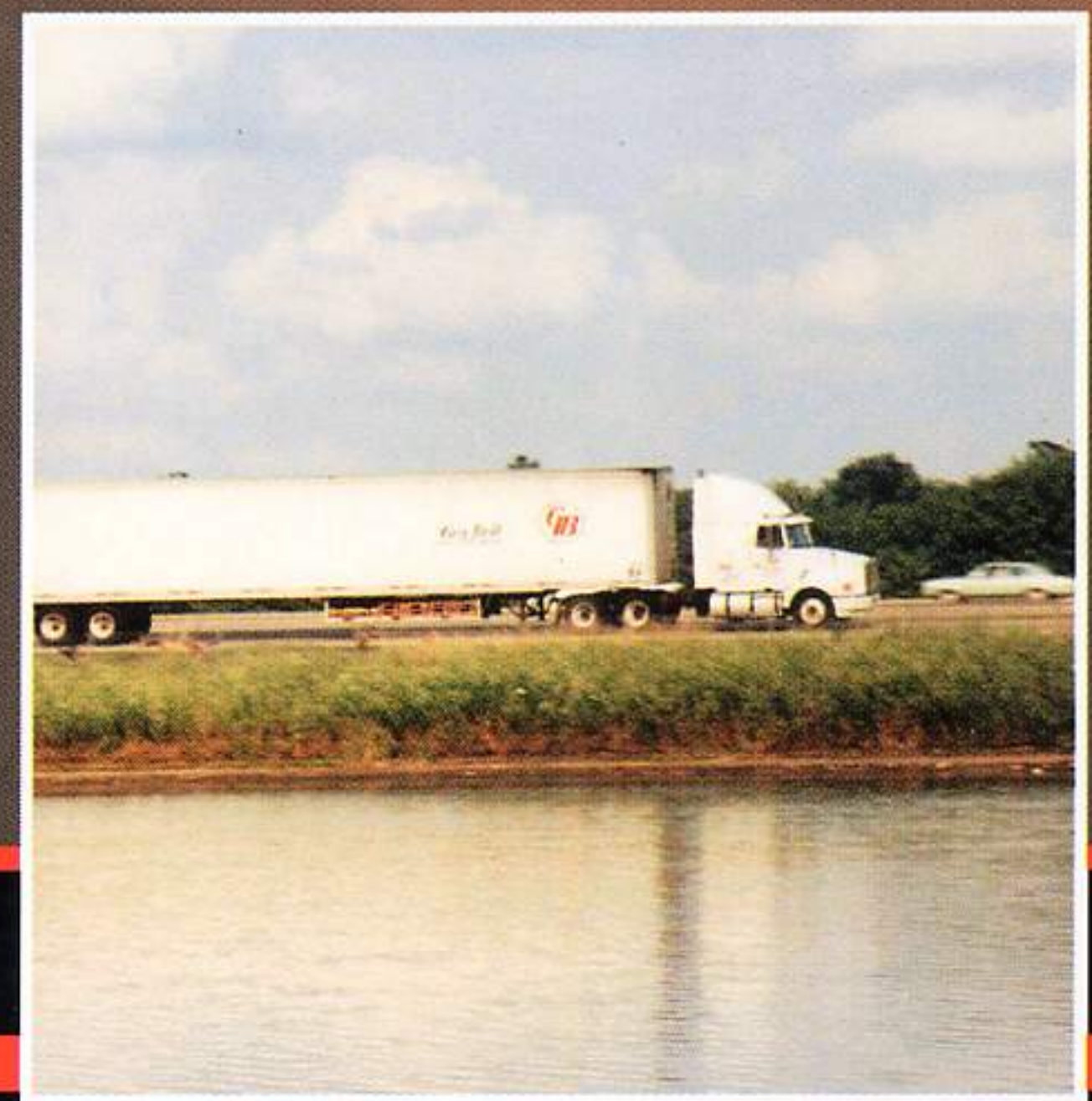
Improved laboratory simulation of transport environments

Built-in D-Cell battery pack

6 MB up to 108 MB of onboard data memory for waveform recording. For airborne applications the PANTHER is capable of recording upwards of 90 minutes of data while providing a 2kHz analysis bandwidth. For lower frequency ground transportation applications the unit is capable of recording continuously for several days before filling its memory. Data management in the PANTHER allows the unit to measure and record up to 32,000 individual 3-channel waveform sets comprising transient shock events or continuous vibration. The length of each event is user configurable enabling the unit to be tailored to particular measurement tasks. Acceleration recording can be configured for measurement from either the three internal(triaxial) accelerometer channels, or from up to three optional external accelerometer channel inputs.

The PANTHER EDR-4M6 model offers recording capability from six input channels simultaneously. The PANTHER also measures and records environment temperature using sensors built into the instrument. Optional external temperature and relative humidity sensors are also available.
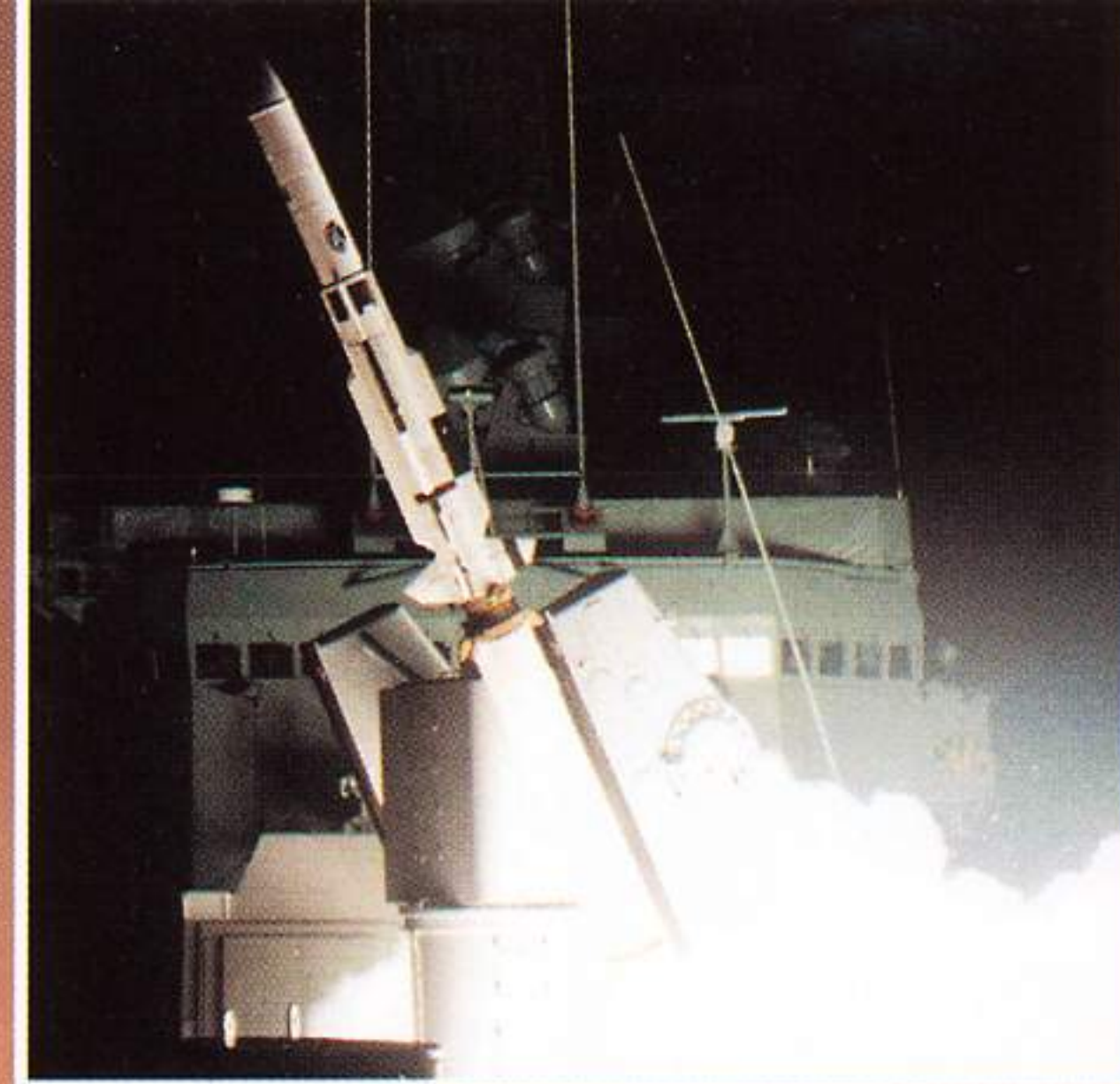
Better characterize harsh launch environments

TOTAL EQUIVALENT RECORDING TIME (minutes)
(EDR-4, 4M1, 4M4, 4M6)

Analysis Bandwidth (Hz) \ MB	Total Onboard Memory			
	6	24	72	108
50	230	920	2,760	3,910 min. ,(*)
100	115	460	1,380	1955 min.
500	23	92	276	391 min.
1,000	11	44	132	187 min.
2,000	6	23	69	98 min.

(*) Approximate-Max, Assuming Nyquist Digitization Rate
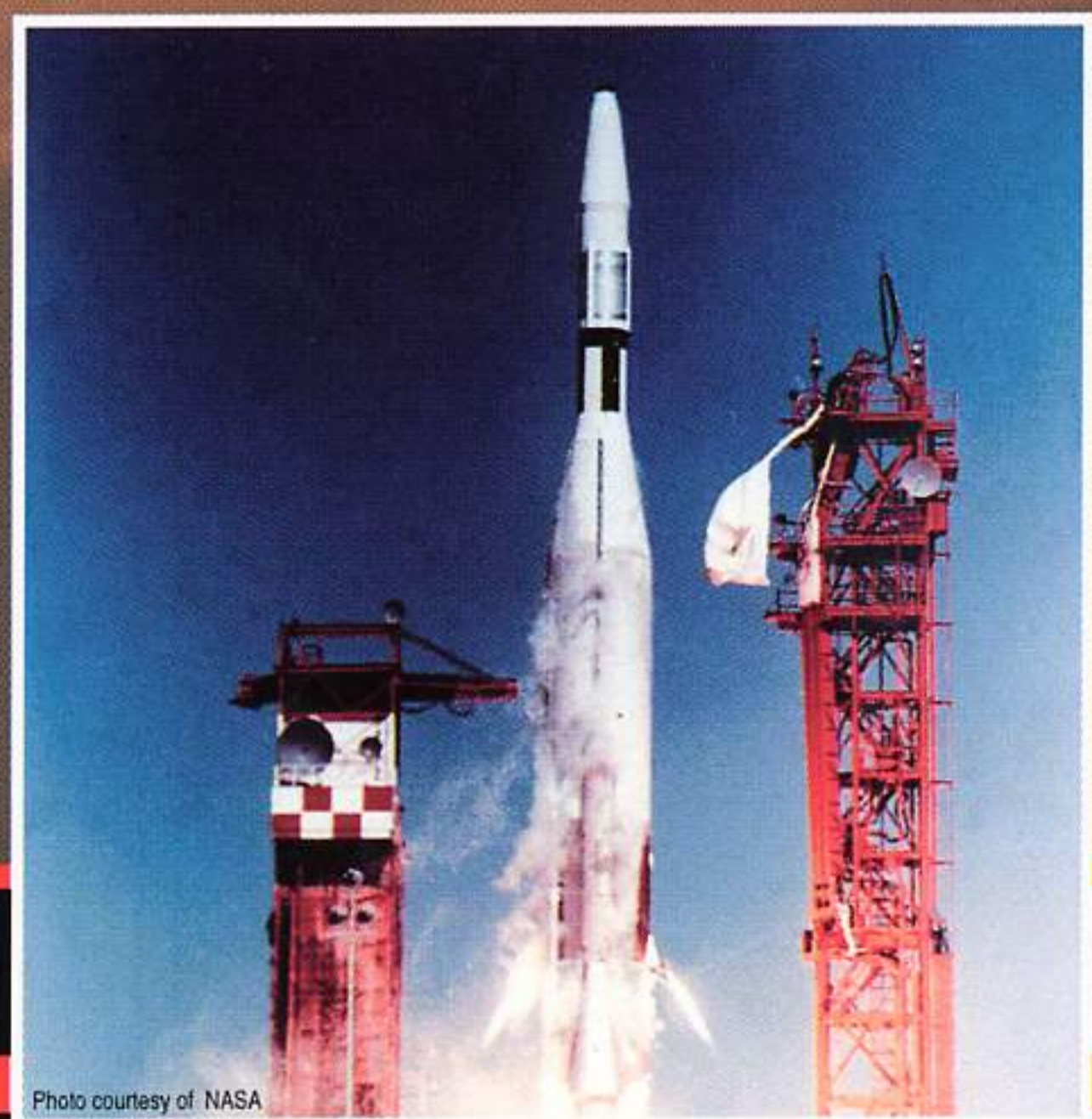
Accurately capture critical payload dynamics

Photo courtesy of NASA

IST recorders are EMI certified for flight testing

IST

**Instrumented
Sensor
Technology**

SIGNAL CONDITIONING

The PANTHER model EDR-4 is supplied with three or six high speed input channels: three differential inputs or three single-ended inputs. Recording may be selected from either channel set for any given recording session. On the standard PANTHER EDR-4 the three differential channels are connected to an internally mounted, triaxial PR accelerometer. Single-ended channels are available as an option for external connection and use with voltage mode, piezoelectric accelerometers. The single-ended channels incorporate their own constant current excitation for powering voltage mode accelerometers. Other input signal conditioning configurations can be supplied on special order.

The PANTHER model EDR-4M1 is supplied with three external single-ended accelerometer input channels only and no internal accelerometers. The PANTHER model EDR-4M4 is supplied with three external differential input channels only and no internal accelerometers. The EDR-4M4 may be used with external piezoresistive accelerometers as well as strain guages, load cells, and other types of bridge-type transducers.

User adjustable gain and analog low-pass filtering are also available on the input signal conditioning circuits. The unit employs 4th order Bessel LPFs with tunable 3dB cut-off frequencies from 10 Hz to over 50kHz. The recorder also provides user adjustable auto-zero offset correction which is tunable from a rate of no correction, (ie. absolute DC response) to a fast correction rate of 1 % of full scale per second. This feature is designed to correct for transducer drift and DC offsets resulting from temperature variations, orientation changes, etc.

APPLICATIONS

The PANTHER has been designed for applications requiring remote, unattended recording of high speed dynamic phenomenon over relatively long periods of time. The rugged, shock hardened unit is ideal for conducting unattended recording sessions in harsh environments. Features available in the PANTHER make it an ideal instrument for applications ranging from in-depth transportation studies and laboratory simulations, to aircraft and spacecraft flight vibration recording to vehicular crash recording.

To discuss what the PANTHER can do for your data acquisition projects call an IST applications engineer today.

PANTHER SPECIFICATIONS

	EDR-4	EDR-4M1, M4	EDR-4M6
DATA ACQUISITION			
#Selectable High Speed CHs	3 (3)	3 (3)	6 (6)
#Simultaneous High Speed CHs	3	3	6
Digitization	12-bit	12-bit	12-bit
Noise Level	Approximately 0.3 microvolts (less than 1 LSB of ADC), all models		
#Low Speed CHs:	3	3	8
#Simultaneous Low Speed CHs	4	4	8
#Trigger CHs	1	1	2
High Speed Digitization Rate	0.001 to 60,000 sps/Channel all models		
Low Speed	1 sample per 24 Hr to 16 samples/sec all models		
Digitization, Aggregate MAX, sps	180,000	180,000	360,000
DATA STORAGE			
MegaByte-Battery Backed RAM	6 (24, 72, 108)	6 (24, 72, 108)	12 (48)
DATA MANAGEMENT			
Fill & Stop Memory Mode (FS)	X	X	X
Fill & Wrap Memory Mode (FW)	X	X	X
Overwrite Memory Mode (OW)	X	X	X
Sliding Window Overwrite (SWO) Mode™	X	X	X
SWO with Event Type Partitioning (SWO-ETP)			X
SWO with Channel Set Partitioning (SWO-CSP)			X
Sliding Window Size	Selectable 1 minute to 30 days		
#Separate Time Windows	Selectable 1 to 100		
#Triggered Events Per Window	Memory dependent, 2 to 32,000		

DATA COMMUNICATIONS

	EDR-4	EDR-4M1, M4	EDR-4M6
Standard Serial RS-232	9.6 to 115 kBaud all models		
High Speed Parallel Port	X	X	X

SENSORS

	EDR-4	EDR-4M1, M4	EDR-4M6
Internal Accelerometer: Piezoresistive Triaxial	X		(X)
Accelerometer fs Range Choices	2, 5, 10, 50, 100, 200g all models		
Accelerometer Frequency Responses 2g, 5g, 10g, 50g, 100g, 200g	DC-250 Hz, DC-300 Hz, DC-400 Hz, DC-1000 Hz, DC-1500 Hz, DC-2400 Hz		
Signal Filtering: 4th Order Bessel Anti-Aliasing	User tunable continuous from 10 Hz to over 2 kHz 3dB cut-off		
Automatic Auto-Zero Offset Correction	User tunable from zero (0) to 1% of full scale per second		
External Accelerometers	Voltage model piezoelectric, 0.5mA, 3.6V bias,).5mv/g to 1000 mv/g, all models		

PROGRAMMABILITY

	EDR-4	EDR-4M1, M4	EDR-4M6
High Speed Sample Rate	X	X	X
Trigger Selection	Internal or external channels and/or external trigger input, all models		
Triggering	X	X	X
Amplitude Threshold	X	X	X
Separate Channel Thresholds	X	X	
Duration (time at level) Threshold	X	X	X
Separate Channel Thresholds or Resultant	X	X	X
Trigger Duration Threshold	1 to 256 samples all models		
Time Trigger Delay (forced time delay between triggered recordings)	0 to 65,535 samples all models		
Time Triggered Recording	1 sample/10 sec to 1 sample/4 years, continuosly selectable		
Maximum Number of Events	32,000	32,000	32,000
Event Length	Fixed or data dependent		
Pre-trigger samples	2 to 65,535 all models		
Post-trigger samples	Limited by maximum event length cut-off		
Maximum Event Length Cutoff	4 to maximum memory size all models		
Memory Modes	FS, FW, OW, SWO	FS, FW, OW, SWO	FS, FW, OW, SWO, SWO, SWO-EVP, CSP
Channel Gain	User adjustable from 1 to 30 all models		

OPERATIONAL

	EDR-4	EDR-4M1, M4	EDR-4M6
Temperature Recording	Internal & optional external all models		
Range/Resolution	-60 to +80 deg C/ +/- 0.25 deg C all models		
Humidity Recording	Optional (internal & external) all models		
Range/Resolution	0 to 100% RH/ +/- 0.25% RH all models		
Usable Temperature Range	1 to 60 deg. C all models		
Date & Time Tagged to each Acceleration Event	X		X
Clock Resolution/Accuracy	1 microsecond, +/- 1 min./mo., approximate, all models		
Auto ON and OFF times	X	X	X
Synchronization: Master/Slave Among Multiple EDR-4	To within 1 microsecond using PLL SYNCH connection; simultaneous sample & hold on all high speed channels		
Connectors	DB9 for RS-232 serial all models		
	10-32 microdot for external accelerometers		
	7 pin waterproof plug style for external differential, control, synch, parallel COM		
Battery @ 500 sps/CH	60 days	60 days	30 days
(Typ., Alkaline D-Cells, 6MB Memory) @ 15000 sps/CH	16 days	16 days	16 days
Data Memory Backup	12 months typical, all models (memory size dependent)		

PHYSICAL

	EDR-4	EDR-4M1, M4	EDR-4M6
Size	5.7" x 5.5" x 2.9" all models		
Housing	Black Anodized Aluminum, watertight, gasket sealed		
Weight	4.9 lb	4.9 lb	5.3 lb
Operating Temperature Range	-40 to + 70 deg C all models		
Shock Fragility	500g or 20 x fs, all models		

STANDARD ANALYSES
(with DM-1 Software Package)

3- channel acceleration waveform graphics
Resultant acceleration waveforms
Spreadsheet tabulation of max, min, peak, duration, RMS, crest factor,
velocity change, temperature, humidity, dew point, battery volt.
Data editing and sorting by selected event parameters
Digital filtering-low pass, high pass, bandpass

OPTIONAL ANALYSES

DM-2 Velocity and displacement waveforms
DM-3 Power spectral density (PSD) calculation and analysis
DM-4 Shock response spectrum (SRS) calculation and analysis
DM-5 Packaging drop height-equivalent impact, Zero-G free fall,
   package trajectory animation, impact direction & type.
DM-6 ISO ride quality profile calculation
DM-7 Jerk waveform calculation and display

HARDWARE OPTIONS

	EDR-4	EDR-4M1, M4	EDR-4M6
Memory expansion	24 to 108 MB	24 to 108 MB	48 MB
External channel inputs	3 single ended	3 single ended or differential	single ended or differential
Relative humidity sensor	Internal and/or external		
Global positioning system (GPS), with Field-Link	X	X	X
Auxiliary battery pack	X	X	X
Hand-held remote trigger (HRT-1)	X	X	X
Remote alarm module (RALM-1)	X	X	X

( ) = Optional   Sliding Window Overwrite (SWO) ™ is a trademark of Instrumented Sensor Technology, Inc.
* Sliding Window Overwrite (SWO) mode is patented by Instrumented Sensor Technology, Inc.

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