Applications & Products Overview for *Automobile Testing*
Crash Test Measurement System

Front impact full wrap testing
Comprehensive Block Diagram Crash Test Measurement System 1

On-Vehicle Data Acquisition Unit
DIS-500A

Barrier Load Cell

Data Acquisition Unit for Barrier Load Cell

LAN

Control / Analysis Software

In-Dummy Data Logger DIS-632A

32CH/Unit

Force Sensor and Accelerometer for dummy

Distributor DIS-60A

Junction Unit DIS-61A

High-voltage Data Logging System
DIV-503A

Air-bag Timer DIA-512A

Control Software For Data Acquisition Unit

LAN
In case of full-scale automobile testing, setting measuring condition and data retrieve is using PC which is connected temporarily.

Photo by courtesy of National Organization for Automotive Safety & Victims’ Aid
On-Vehicle Data Acquisition Unit

Compact On-Vehicle Data Acquisition Unit for Automobile Crash Test

DIS-5010A

- Compact, light weight
- Max. 100kHz sampling
- 32ch/unit, Expansion of unit is available (without cable)
- Provide TEDS(IEEE1451-4) function
- Highly shock-resistant, lightweight
- Built-in Battery
On-Vehicle Data Acquisition Unit

Compact On-Vehicle Data Acquisition Unit
for Automobile Crash Test

DIS-5010A

- compact
- Max. 6un
- Direct connection
On-Vehicle Data Acquisition Unit

Compact On-Vehicle Data Acquisition Unit for Automobile Crash Test

2 types connector

DIS-5010A  DIS-5000A
LEMO 1B    TAJIMI

Display function
A trigger signal lets it output airbag firing current after a preset delay time. The firing current level and output duration can be set channel by channel.

- Small and light weight (the same size as DIS-5010A)
- The ignition current value and the current output time of each channel can be set.
- The state of the ignition current can be recorded in an internal memory.
- Current output timing of each channel and synchronizing digital signal.
- Provide LED indicator and display the character for the state display function.
Crash Test Measurement System

On-Vehicle Data Acquisition Unit
DIS-5010A

Air-bag Timer (Airbag firing unit)
DIA-512A

Direct connection
The crash data-logger for high voltage electric signals used in Electric Vehicles (EV) and Hybrid Electric Vehicles (HEV)

- High voltage measurements, ±500VDC
- Long term recording, Approx. 62sec@20 kHz sampling
  (Approx. 8hours@100 Hz sampling)
- Frequency response: DC ~ 1 kHz
- Number of measurement channels : 3
- Maximum sampling frequency: 20 kHz

The unit is rated to withstand up to 980.7m/s² (100g).
In-Dummy Data Logging System
DIS-632A

32CH/Unit

Designed to install into impactors, crash test vehicle, and dummy to acquiring impact test data.

This can synchronize trigger signal with on-vehicle DIS series data-logger and DIA airbag timer.

World-SID

Junction Unit
DIS-61A

Distributor
DIS-60A
Communication cable 60m
Power cable 60m
Trigger cable 60m

SLED control system
(Not provided by kyowa)

Power unit

HUB

Safety box

Control software DIS-51A

Control room

SLED TEST BLOCK DIAGRAM
Barriers Force Sensor for car crash test

- This 160-channel force sensor array mounts directly on the front barrier wall to measure Impact force distribution.

- Each force sensor consists of strain gage-based load cell, and measure impact forces.
Force Sensor Matrix for Frontal Barrier

Impact force distribution measure at car crash testing

Each sensor unit can offer various rated capacities.

2 or 3 components force sensors are available.
Offset Deformable Barriers

48 Force Sensor Matrix for Frontal Offset Barrier

This 48 force sensor matrix is designed for installation on an Offset Barrier Frame. Each of 48 sensor units consists a strain gage type 124mmX124mm load cell to evaluate compatibility.

This 4 force sensor matrix consists a strain gage type 3- component load cell.
Data Acquisition System for Barrier Load Cell

Crash Test Measurement System
Crash Test Measurement System

Analysis and Control Software for Force Sensor Matrix

**Distribution Graph**
- Test Name: Test data 01
- Test Date: 2001/12/05
- Time: 11.5 [msec]

**Contour Map**
Plots the values detected by all load cells on the isobaric force graticule.

**Load Distribution Graph**
Identifies the values detected by all load cells by applying proper coded colors to cells on the matrix pattern.
Moving Deformable Barrier Matrix for Side Impact Test

This 3 force sensor matrix is designed to be mounted to an impact giving cart. Each load cell contains 3-component force sensor with rated capacities of 100, 50 and 50kN or 50, 20, and 20kN.

Applicable carts:
- FMVSS Cart / All Honeycomb (FMVSS / ECE / IIHS)
- ECE Cart / All Honeycomb (FMVSS / ECE / IIHS)
- IIHS Cart / All Honeycomb (FMVSS / ECE / IIHS)
Off-Vehicle Data Acquisition System

For Dummy calibration, Pedestrian testing and component testing

8ch / Unit, Expansion is available by cascade connection

DIS-5210A
Pedestrian Leg Protection Performance Test

Current / conventional test

Legform Impactor

Test Car
Crash Test Measurement System

Miniature Data Acquisition System
KYOWA6

Install 4-units of DIS-506A into FLEX-PLI to make 24 channel Measurement.

Achieve cable-less testing

← FLEX-PLI (Pedestrian Leg-form Impactor) - GTR
Crash Test Measurement System

Miniature Data Acquisition Unit  KYOWA6

Flex–GTR Measurement System
Features of Data Acquisition Unit DIS-506A

- Each unit has built-in battery
- High speed data transfer by USB 2.0
- Provide TEDS (IEEE1451-4) function
- Maximum sampling speed: 150kHz
- Cable outlet direction is selectable
Application Example for Pedestrian Head Protection Performance Tests

Current / conventional test

ASE-A mounted on Three Axis Bracket

DIS-5210A
Miniature Data Acquisition System
for Pedestrian Headform Impactor DIS-503A

- 3 channels / 1 unit
- DAS unit has built-in battery
- Shock resistance 4903m/s² (500g), 3msec
- Maximum sampling speed: 150kHz
- High speed data transfer by USB 2.0
Application Example for Pedestrian Head Protection Performance Tests

Crash Test Measurement System

Data Logging System and Damped Accelerometer mounted in the Headform Impactor

Achieve cable-less testing
Undamped Accelerometer Measurement Problems

If the resonant waveform signals exceed input range of amplifier...

Accelerometer Output Signal
160kHz AD sampling by DAT

Recording Data
10kHz AD sampling by On-Vehicle DAS using low-pass analog filter fc=1650Hz

Reprinted by courtesy of Japan Automobile Research Institute
Undamped Accelerometer Measurement Problems

If resonance output signal appears...

Accelerometer

Analog amplifier

Analog filter

A/D converter

Memory

Undamped Accelerometer

Damped Accelerometer

(Image)

Undamped Accelerometer

Damped Accelerometer
Damped Accelerometer ASE-A

- **Model:** ASE-A
- **Rated capacity:** +/-4903m/s² (500g), +/-9807m/s² (1000g),
- **Dimensions:** 10 x 10 x 5mm
- **Rated Output:** 1mV/V typical.
- **Freq. Response (at 23°C):** DC to 1kHz, +/-3%
  1 to 4kHz, +/-10%
- **Non-linearity:** +/-1%RO max.
- **Acceleration Limits:** 2,000g
- **Excitation Voltage:** 1 to 10V AC or DC
- **Cable:** 7m long, terminated with LEMO (FGG 1B 307) connector plug

Recommended by EURO NCAP from 2008
Minimizes the resonant peak to prevent overranging at any frequency

◆ Weight: Approx. 1.2g
◆ Rated Capacity: ±9807m/s² (1000G)
◆ Fluid damped
Multi Force Sensors for Crash Dummies

Upper Chest 4-component force transducer

Pelvic 3-component force transducer

Cervical 6-component force transducer

Femoral Load Cell

Accelerometer

Superior Tibia 4-componet force transducer
Crash Test Measurement System

Accelerometers for Dummy and Car body

**ASH-A**
- Damped type
- Dummy/Car-body
- 20G to 1000G

**ASD-B**
- Undamped type
- Dummy/Car-body
- 1000G

**ASM-200BA**
- Undamped type
- Dummy
- 200G

**ASM-BC**
- Undamped type
- Exchangeable cable
- Car-body
- 1000G
Seat Belt Tension Transducer

Small and lightweight.
- Rated Capacity 15kN, 20kN
- Non-Linearity +/- 1.5%RO (with built-in compensating circuit)

LBT-E-15KN
LBT-E-20KN

Small and Lightweight
Only 65g
Seat Belt Tension Transducer

◆ This sensor detects the impact-initiated tension applied through the dummy to the seat belt.

LBT-A-20KNS
◆ Made of aluminum alloy, it is small and lightweight.
◆ Rated Capacity 20kN
Crash Test Measurement System

**Seat Belt Tension Transducer for CRS**

**LBT-D-100NSA1**

Use for measuring tensile force to install **CRS (Child Restraint Seat)**
Seat Belt Tension Transducer for CRS

Use for measuring tensile force to install CRS (Child Restraint Seat)
Measuring Instruments for Strength, Reliability

Strength, Reliability
- Car-Body Construction
- Characteristic of Components & Materials
- Dynamic Measurement
- Static Measurement
- Durability
- Road Input
- Strength
Dynamic/ Static Strength Evaluation

Dynamic Measurement

Static Measurement

Memory Recorder /Analyzer

Data Logger

Car-Body

Components, Materials

Measuring Instruments for Strength, Reliability
Universal Recorder  **EDX-100A**

for Dynamic Measurement
Universal Recorder **EDX-100A**

for Dynamic Measurement

**Universal Recorder EDX-100A**

Dynamic Data Acquisition Software **DCS-100A**
Universal Recorder  EDX-100A

for Dynamic Measurement

microphone
Signal conditioner card for EDX series

◆ Built-in signal conditioner card
  - Strain/voltage measuring card
  - Carrier type Strain measuring card
  - CAN I/F card
    for CAN data measuring
  - F-V converter card
    for measuring pulse
  - Thermocouple card
    for measuring temperature
  - DA card
    for analog signal output
  - Charge amplifier card

◆ Applicable DAS
  EDX-100A, EDX-3000A, EDX-2000B
Memory Recorder /Analyzer EDX-2000B

◆ Model
  EDX-2000B-32 : Max. 32 channel
  EDX-2000B-64 : Max. 64 channel

◆ Built-in signal conditioner card

◆ Data Logger with LCD
  Useful for monitoring & check of data

◆ Built-in Memory

◆ Enhancement of Simultaneous Processing, Analysis Function
  FFT Analysis, Histogram Analysis, Arithmetic Calculations etc.

◆ High speed data sampling
  200kHz sampling (at 16 channel)

◆ Voice memo function
Memory Recorder /Analyzer EDX-3000A

◆ High speed data sampling
  : Max. 200kHz / 32 channel

◆ Input channel
  : Max. 64 channel

◆ Movie simultaneously recordable

◆ Selectable built-in amplifier cards

◆ Built-in back-up battery

◆ Enhancement of Simultaneous Processing, Analysis Function

◆ Voice memo function
Characteristic of Components & Materials

- Stress, load, displacement measurement is necessary for strength/durability test of parts & materials
- Multi channel measurement is available with Kyowa’s data logger

All-in-one Data Logger for
- strain gages
- strain-gage transducers
- Potentiometer sensors
- Thermocouples
- DC voltage-output instruments
All-in-one Data Logger
UCAM-60B

- Connectable sensors include strain gages, strain-gage transducers, potentiometer sensors, thermocouples and DC voltage-output instruments.

- Scanning at a speed of 50mS/channel, useful for stress measurement of materials and for multi-point measurement.

- Built-in scanning units enable 30-channel measurement. Max. measurement channel is 1000ch (with external scanning unit).
Control Software UCS-60B

Control by PC via LAN, RS-232C are available
Measurement Data Graph Display
Numeric Display
Arithmetic Processing
Measuring Instruments for Strength, Reliability

Strength Evaluation on Running Test

Road Input

Demand for measuring Forces and Moments

Wheel 6-component Force Transducer
Road Input Measurement

Wheel 6-component Force Transducer

Thin and lightweight Wheel sensor
Wheel 6-component Force Transducer

Slalom Test
Measuring Instruments for Controllability
Controllability - Running

- Braking test
- Traction control test
- ABS performance test
- CVT performance test

Wheel torque measurement of running vehicle

Slip-ring type Wheel Torque Transducer
Slip-ring type Wheel Torque Transducer

Features

- Thin and lightweight
- Easy to install
- Attached Wheel Rotation Angle Detector (option), to measure wheel rotation behavior with wheel torque.

For Braking test, Traction control test, etc.
Wheel Torque Transducer

Measuring Screen using EDX series data logger

Wheel angle data

Stop

Running  Decelerate  Torque data (Right / Left wheel)

Fasten the data acquisition system to the seat
Measuring Instruments for Controllability

**Controllability - Operation**

- Gear-change Lever Operating Force Transducer
- Small-size DAS (8 to 32 channel)
- Pedal Force Transducer
- Steering Force / Angle Transducer
Steering Force/Angle Transducer **SFA-E**

- Measure steering force and angle with high accuracy on steering operation
- Torque: 20 to 200N·m    Angle: 18000 pulse / 360 deg.
Measuring Instruments for Controllability

Steering Force/Angle Transducer **SFA-E**

- **Display Unit for SFA-E**
- **Signal Conditioning Unit**
- **Connected condition**
Measuring Instruments for Controllability

Hand-Brake Operating Force Transducer LCR-S

Easy installation on the Hand brake to measure operating force

- Easy to install and use on a variety of hand brakes
- Rated capacity: 1kN
- Weight: Approx. 650g (excluding cable)
Gear-Change Lever Operating Force Transducer

- Measure 2 or 3-components force at gear-change.
- Minimal interference between axes to ensure precise measurement
- Small, lightweight and easy to install and handle
Braking Test

Pedaling Force Monitor

G-Meter
Acceleration Transducer & Analog Monitor

On-Vehicle Data Acquisition Unit

Pedaling Force Transducer
Pedal Force Transducer

LPR-C 12mm-thick

- Thin & Light Weight
- Rated Capacity 200N to 2kN

For parking brake pedal

LPR-S-S3
Wheel alignment measuring system

A system for measuring anteroposterior, transverse and vertical displacements of wheels to the vehicle body, and changes in steering and camber angles during driving.

The system can be used independently (left), or with the slip-ring type wheel 6-component force measuring system (right).
Wheel alignment measuring system

Wheel alignment sensor

Data processor

DAS

Data processing
Physical value output

Analog voltage output
On-Vehicle type Small-size DAS

Compact Recorder
**EDS-400A**

- Small-size DAS
- Power Supply is AC/DC
- Strain/Voltage Measurement / Unit (4ch/Unit)
- Max. 32ch (8units)
- On-line, Off-line measurement
Compact Recorder

**EDS-400A**

- Start & Stop Operation is available by Main body switch or Remote Controller
- Max. 20kHz/4ch & simultaneous measurement is available
- Data is saved to compact flush card. Long-time measurement is available.
- Control by PC via LAN interface and data recording are available.
- 4ch/unit, max. 32ch/8units
Analyzing Software DAS-200A

Data that is collected by EDS-400A can be analyzed by DAS-200A.

Main Functions
- Data file editing
- FFT analysis
- Histogram analysis
- Arithmetic calculations
- Filter processing
- Differential
  integral processing
Measuring Instruments for Engine

- Pressure measurement
- Stress measurement of Exhaust Manifold
- Stress measurement of Each portion
- Torque measurement
High Temperature Weldable Strain Gages

Stress/Strain measurement for exhaust manifold and muffler

- Operating Temp. up to 800°C and 650°C
- Designs for all Exhaust System Components
- Easy install by exclusive spot welder

Spot welding

Install to exhaust manifold
Measuring Instruments for Power train and Drive train

Measurement Strain by Vibration Exhaust Pipe, Muffler

- Fixed Part
- Welding Part
- Joint Part

Evaluation of welding strength by vibration,
Use High-Temperature Foil Strain Gages KFH(Max.250degC), KH(Max.350deg.C)
Hydraulic pressure measurement of

- Transmission
- Gearbox
- CVT

Compact High-temp. Pressure Transducers
Compact High-temp. Pressure Transducers

- **Maximum operating temp.** 150°C (Max.302°F)
- **Suitable for hydraulic pressure measurement of transmission, gear box, and CVT.**

**Feature**

- **Outstanding Temp. Characteristics**
  - Thermal effect on zero: ±0.008% RO/°C
- **Compensated temp. range:** -40 to 150°C (Max.302°F)
- **Endurance against vibration**
  - 490.3 m/s² (50g)
- **Provide air vent**
- **Rated capacity:** 2MPa (20.39kgf/cm²) to 10MPa (約102.0kgf/cm²)

**PHF-S-SA2**

**PHF-S-SA4**

**Feature**

- **Small size** (length 32mm)
  - It is useful on small space.
- **Lightweight** (Approx.20g)
- **Maximum operating temp.** 150°C
- **Rated capacity:**
  - 2MPa (20.39kgf/cm²) to 10MPa (約102.0kgf/cm²)
Measuring Instruments for Power train and Drive train

◆ Suitable for hydraulic pressure measurement of transmission

Removable cable by connector plug

Easy to install / remove sensor

PHF-S-SA27
providing air vent screw

PHF-S-SA28
Not providing air vent screw
Applications & Products Overview for Automotive Field

Thank you for your attention!