Mera


# Solutions for bench, transport and flight tests

## Mission

To provide our customers with high-quality automated measurement and control systems, setting world-class standards.


## Our Goal

To become the world's leading developer and supplier of measurement and control systems meeting the most demanding requirements of the industry.

## About the Company

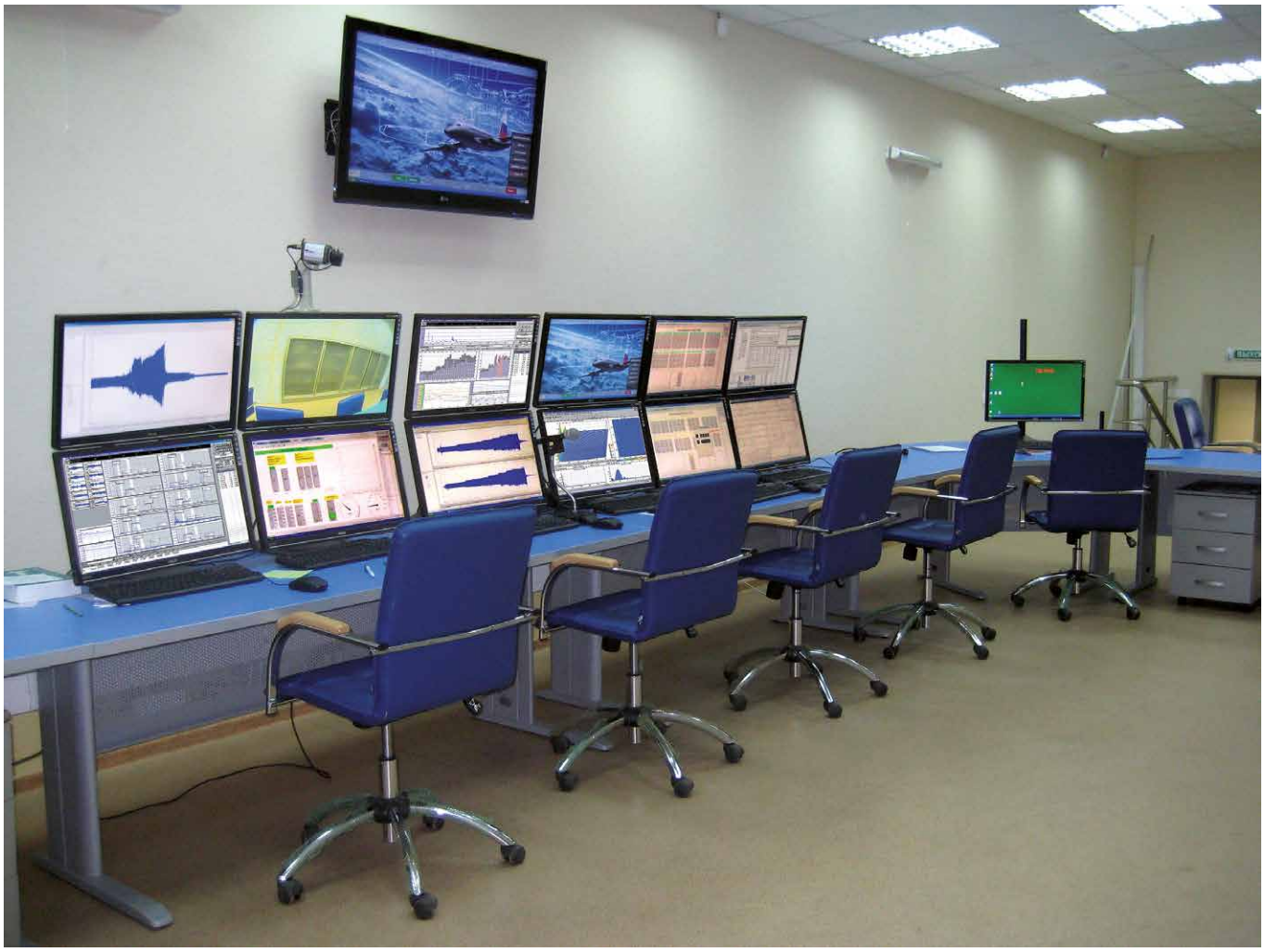
MERA specializes in providing aircraft, space & rocket engine bench tests with measurement and control systems. Full scope of works includes design, manufacture and commissioning. We create turnkey projects for many industrial bench test applications.

## The Concept

- The integral approach to automation of bench tests: from engineering research and thorough elaboration of technical requirements to manufacture and delivery of equipment, education of customer's staff and technical support.
- The most perfect hard and soft solutions, highly integrated reliable components, modern assembly and manufacture technologies
- The whole system works under control of unified software developed by MERA. User interfaces could be customized for customer's tasks allowing fast configuration and effective control of test processes.

## We Propose

Automation measurement systems for flight tests and bench tests of aircraft, engines, land and water transport, rocket and space technologies and power equipment.



## Function

Control and measurement systems based on mobile test units (MICs) and on-the-fly controllers perform:

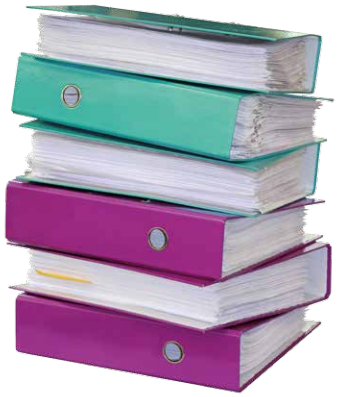
- Issuing control commands for test bench technical equipment,
- Parameter measurement and data recording,
- On-the-fly processing and post-experimental processing,
- Storing of metadata in unified database providing easy search, remote access, operative processing capabilities.

# Integral Approach in our Work

1

Investigation of
an automation object

2



Elaboration of technical specification meeting the customer's requirements

Creation of technical design and full set of technical documentation

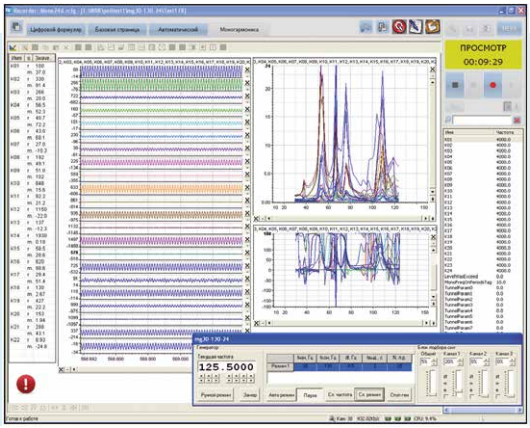
3

Development and manufacture of equipment, testing of system components on steadiness to external effects

Primary metrological check

Development of operational documentation

4



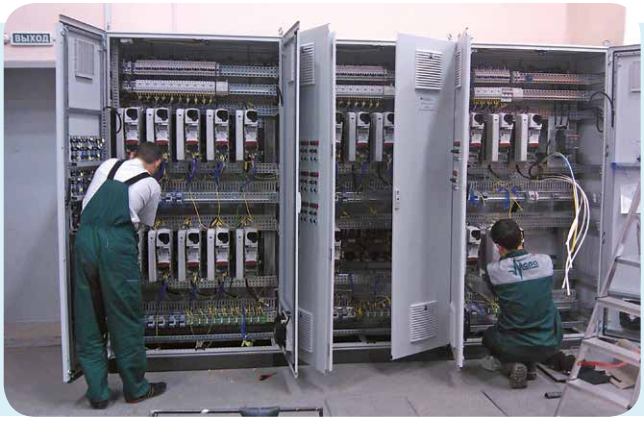

Development of specialized software

5

Design and manufacture of cross-boxes, signal conditioners

System integration using subcontractor's products

6

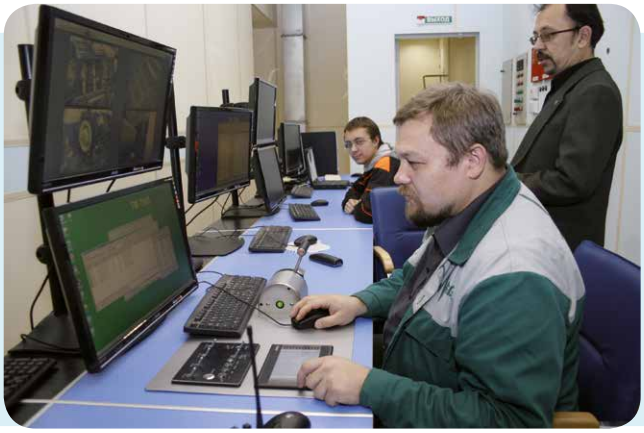


Deployment and complex adjustment

7

Training the customer's staff

8



Technical support and assistance

# Specialized Measurement Systems for Industrial Objects

## Control

Bench and ground tests of aviation and space & rocket industry products, creation of control systems for aviation, engine, power and other industries on the basis of integrated solutions of MERA.

## Action

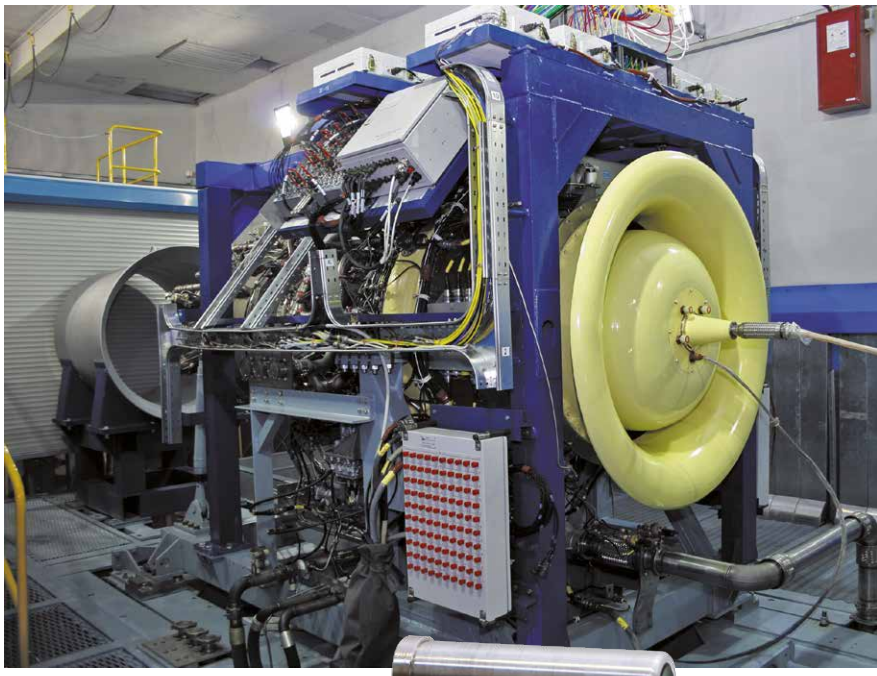
Control of testing process

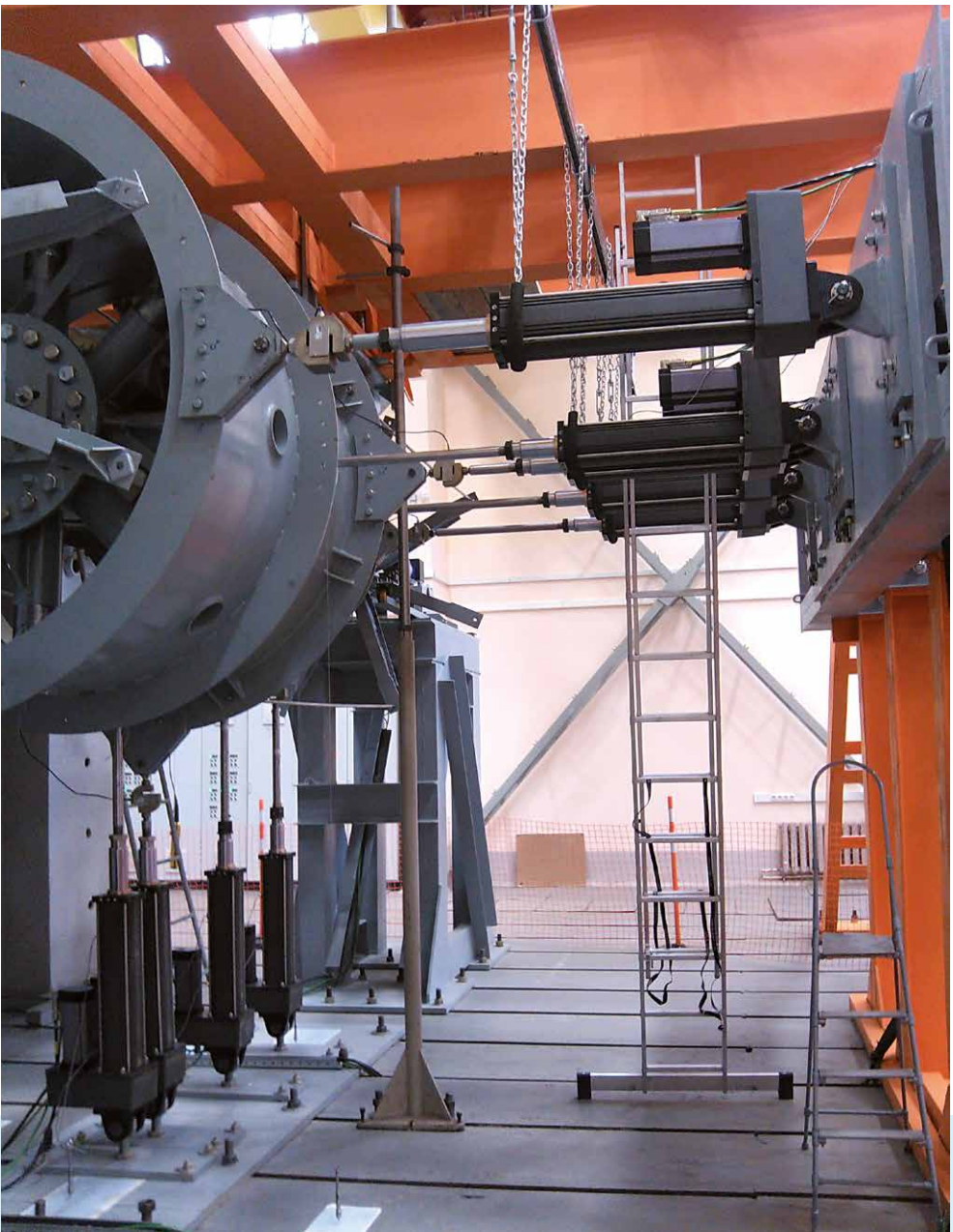
## Measurements

Data recording and processing

# Specialized Measurement and Control Systems for Industrial Facilities

Measurement systems for aircraft engine test benches





Strength test systems

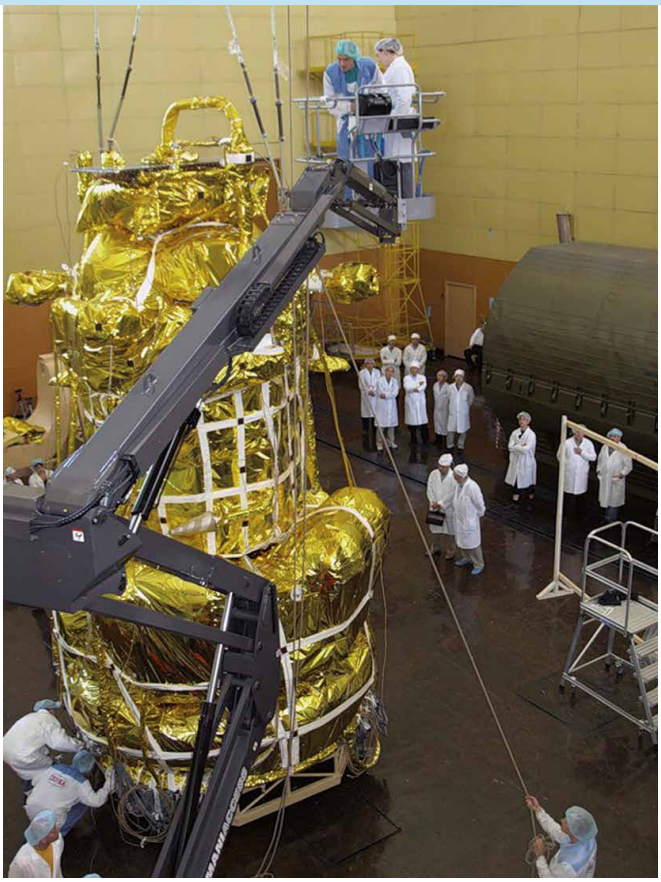
Bench tests of rocket stage engines and booster units

Vibration and acoustic tests of space & rocket units

Data recording and processing systems for centrifugal testing

Transport test systems

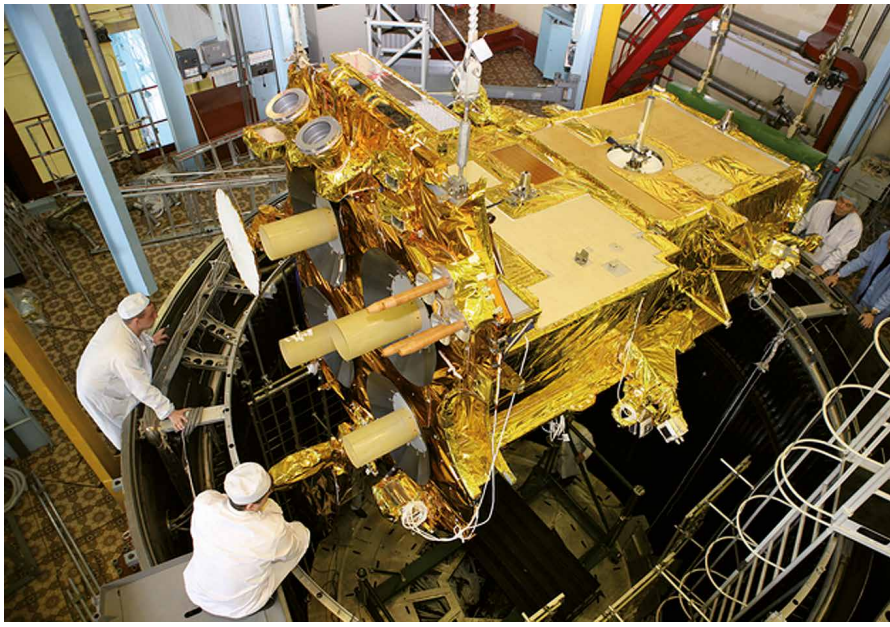
Telemetry systems



Strength tests at normal conditions and cryogenic temperatures

Bench cold tests of engine units

Thermal vacuum testing






On-board measurement systems

# Our Solutions for Aviation and Space & Rocket Industry

Telemetry stations and antennas

Strength tests (MIC-185)


Distributed systems for data acquisition (MIC-700, MIC-1150)

Accessories (wire control system, automated control system, video subsystem)


Wireless telemetry system for rotating machines (MIC-1500)

Temperature and pressure scanners (MIC-170, MIC-140)

Control and test equipment (MIC-800)

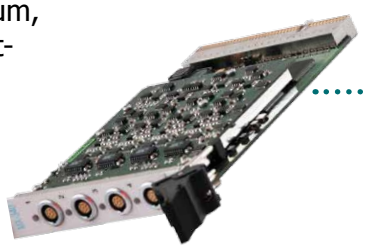
Steady-state processes (MIC-236)

Dynamic processes (MIC-553, MIC-355M)

Tip-timing, tip-clearance measurements (MIC-DPM, MIC-1200)

Transport tests (MIC-026)

# MIC-355M Portable Data Recorder



**Functions**

- Measurements and processing of dynamic process parameters
- Dynamic strain measurements
- Measurement data logging, visualization, playback, network translation
- On-the-fly (estimators, spectrum, 1/3 octave spectrum, order analysis, etc.) and post-experimental (offline) data analysis

**Features**

- 6 PXI slots available
- Switchable HPF and LPF for each input channel
- Ready for input signals from IEPE transducers (ICP™, Isotron™, Deltatron™, etc.), TEDS support
- Differential and single-ended signal inputs
- Inter-channel skew less than 200 ns
- IRIG-B time code support
- Familiar Windows OS user interface
- Data logging to Solid State Drive
- MR-300 data acquisition and processing software
- WinPOS post-experimental (offline) data analysis software
- LCD touch screen
- USB ports for connecting peripheral devices
- Speech recording channel
- Transportation bag

# MIC-553 Multi-Channel Modular Data Acquisition System

## Description

The MIC-553 is PXI standard Data Acquisition System (DAQ system) designed primarily for recording dynamic parameters. MX-224, MX-228. MX-240, MX-310, MX-340 and other types of PXI modules can be installed into the system. Intended use is for laboratory and test stand measurements.

The system features modular design of a crate type. Instrumentation modules are installed into the PXI slots. Crate controller module is installed to the system slot.

MIC-553 PXI

Fiber-channel line

Data recording and processing workstation with MXI-4 interface board

## Features

- Crate controller module controls the instrumentation modules and bridges DAQ system with a remote data recording and processing workstation via fiber optic line
- On-the-fly dynamic process measurement data recording and analysis executing at data recording and processing workstation
- Inter-channel skew less than 200 ns
- Inter-chassis synchronization module (MX-020) is available
- It is possible to install modules measuring signals from PE, IEPE sensors, strain gages into a single crate
- Up to the 64 (128) input channels with up to 216 kS/s per channel sampling rate
- MR-300 data recording and on-the-fly analysis software

# MX-224, MX-228 modules

## Description

The MX-224/228 PXI instrumentation module is designed for measuring parameters of dynamic processes like vibration, pressure pulsation, noise, acoustic signals, etc.

Primary applications include examination of rapidly changing processes, monitoring and diagnostics of mechanical, acoustical, and vibration condition of parts of machines and machinery.

The module can be used for configuring multi-channel DAQ systems with wide dynamic range, or vibration monitoring and diagnostics system, or acoustic condition monitoring system, etc. The module can be installed into modular DAQ systems like MIC-553 or MIC-355M.

MR-300 software provides functions of module configuration and control, data acquisition, recording and on-the-fly analysis.

WinPOS software provides post-experimental measurement data digital processing, visualization, in-depth analysis, report creating, printing and other functions.

MX-224

MX-228

## Features

- General purpose module for dynamic process instrumentation
- 4 analog input channels (MX-224), or 8 analog input channels (MX-228) with simultaneous ADCs
- Signal sources can be transducers like IEPE (ICP™, Isotron™, Deltatron™, etc.) sensors with 2-wire connection diagram including those equipped with TEDS, microphones, or other voltage output sources
- Switchable high-pass filters
- Allows measuring steady component of the dynamic process
- Built-in self-diagnostics functions
- Differential and single-ended voltage inputs
- Input range: -10 V …+10 V
- Bandwidth: DC … 96 kHz
- Sampling rate: up to 216 kS/s per channel, 16 or 24 bit sample
- Dynamic range: 120 dB

# MX-240 module

## Description

The MX-240 PXI instrumentation module is designed for measuring dynamic signals of voltage or electric charge sources.

The module can be used for configuring multi-channel DAQ systems with wide dynamic range, or vibration monitoring and diagnostics system, or acoustic condition monitoring system, etc. The module can be installed into modular DAQ systems like MIC-553 or MIC-355M.

MR-300 software provides functions of module configuration and control, data acquisition, recording and on-the-fly analysis.

WinPOS software provides post-experimental measurement data digital processing, visualization, in-depth analysis, report creating, printing and other functions.

MX-240

## Features

- 4 simultaneous analog input channels with built-in charge amplifiers
- Following signal sources (sensor outputs) can be used:
  - Single-ended output piezoelectric charge transducers (i. e. accelerometers or pressure sensors)
  - Differential output piezoelectric charge transducers
  - Integrated electronics piezoelectric sensors (IEPE), TEDS support
- Switchable high-pass and low-pass filters
- Built-in self-diagnostics functions
- Input range: -10 V … +10 V for voltage sources, or 10 … 100 000 pC for electric charge sources
- Bandwidth: DC … 96 kHz
- Sampling rate: up to 216 kS/s per channel, 16 or 24 bit sample
- Dynamic range: 120 dB

# MX-340 module

MX-340

## Description

The MX-340 PXI instrumentation module is designed for conditioning and measuring signals of strain gage of full-, ½- or ¼-bridge configuration, or single strain gage, or potentiometer, when dynamic or static and dynamic strain measurements are needed.

The module can be used for configuring multi-channel DAQ systems with wide dynamic range. The module can be installed into a modular PXI DAQ system like MIC-553 or MIC-355M.

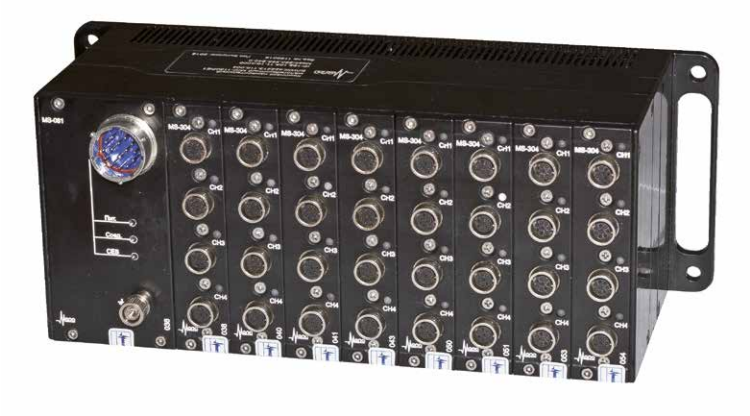
MR-300 software provides functions of module configuration and control, data acquisition, recording and on-the-fly analysis.

WinPOS software provides post-experimental measurement data digital processing, visualization, in-depth analysis, report creating, printing and other functions.

## Features

- Strain gage excitation by balanced currents using two matched current sources provides the advantage of significantly less susceptibility to electrostatic and electromagnetic noise sources when compared to single-ended constant current excitation
- Strain gage excitation by adjustable voltage source
- 4 simultaneous channels with built-in signal conditioners
- Bandwidth: DC … 96 kHz (full-, ½- or ¼-bridge configuration); 10 Hz … 100 kHz (single strain gage)
- Sampling rate: up to 216 kS/s per channel, 16 or 24 bit sample
- Gain factor: 100 … 10000
- Switchable high-pass and low-pass analog filters
- Two ¼-bridge completions (from options of 100, 120, 200, 350 Ohm)
- Two built-in shunt resistors
- Dynamic shunt mode
- Built-in self-diagnostics functions, self-calibration function
- Differential and single-ended inputs

# MIC-1150 Compact Measuring Complex



Industrial version for stand testing systems.

Outdoor version for working at adverse weather conditions.

On-board version, high vibration and acoustic pressure protection (up to 130 dB).

**Features**

- Standalone functioning and data logging to the integrated nonvolatile memory circuit (from 2 GB)
- Modular form-factor, that gives advantage to make flexible configuration for hardware
- Data communications via Ethernet and Wi-Fi
- Single connector: power, Ethernet, synchronization
- Power supplying with external Li-ion battery
- Custom-designed enclosure (up to IP65)

Modules MS are designed for working with compact data acquisition crate-units MIC-1150.

## MS-142

### Description

Module MS-142 is designed for voltage and current A/D conversion.

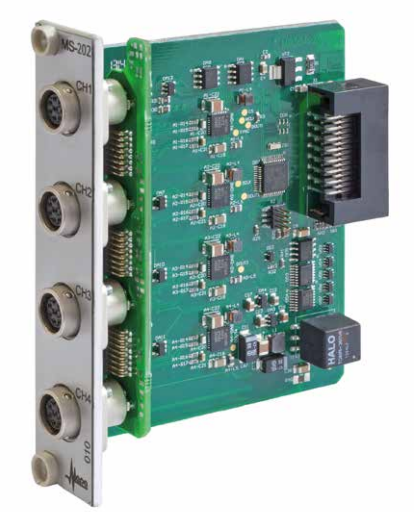
MS-142

### Features

- Channels are provided with differential pairs galvanically isolated from chassis and main power supply.
- Two types of switching converters: potentiometric sensors, sensors with voltage outputs.
- Three-wire and four-wire types of potentiometer connection.
- Individual integrated power supply for sensors.
- Sensor power supply checking ability.
- Short circuit protection in the peripheral lines

| Specifications | Value |
|---|---|
| Number of channels | 16 differential |
| Voltage measuring range, V | ±10;<br>±5;<br>±2,5;<br>±1,25;<br>±0,625;<br>±0,1 |
| Sampling frequency, kHz | up to 2 |
| Full-scale accuracy, % | ±0,05 |
| Sensor excitation, V | 6,25 |
| Temperature gain coefficient ,ppm/°C | 25 |
| Zero-drifting coefficient, ppm/°C | 25 |
| Input resistance, kOhm | 100 |
| Working temperature, °C | -40 … +85 |
| Dimensions, mm | 71×77 |

# MS-202



MS-202

## Description

Module MS-202 Is designed to work with data acquisition unit MIC-1150 and can be used for applications such as:

- Vibration monitoring systems
- Dynamic processes frequency analyzing
- Acoustic and noise level measuring systems
- Impulse response and transient process recorders

High band sensors with wide dynamic range, with voltage outputs, can be connected to MS-202. When piezoelectric accelerometers, microphones and another sensors with electrical charge output signal are used, external amplifiers with electrical charge converters are needed to be apply with MS-202.

## Features

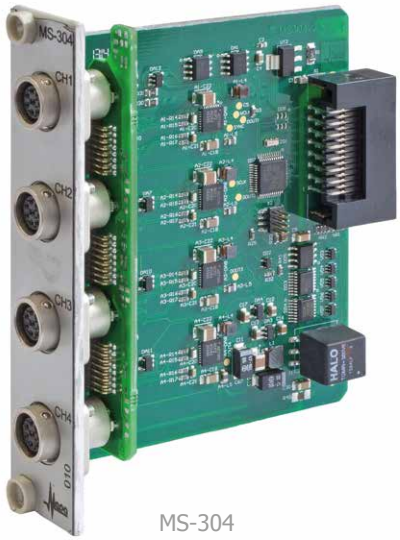
- Differential and single-ended voltage inputs
- Programmable configuration for inputs
- Input surge protection ±15 V, self-contained integrated sensors for overload detection
- Sensors with standard IEPE (ICP™, Isotron™, Deltatron™, etc.) may be connected, TEDS support
- Independent excitation (ICP™) switching for each channel, current adjustment, automatic condition diagnostic (good, short circuit/break)
- Programmable value for sensor supply current 4 mA ±5%, 10 mA ±5% (in voltage range 0 ... 30 V)
- ADC resolution of 24 bit

| Specifications | Value |
|---|---|
| Number of channels | 4 |
| Voltage measuring range, V | ±10 |
| Sampling frequency (with inter channel ground), kHz | 13 500;<br>27 000;<br>54 000;<br>108 000 |
| Full-scale accuracy, % | ±0,2 |
| Bandpass flatness, dB, not more than | ±0,015 |
| Input inphase signal 60Hz suppression, dB, more than | -80 |
| Signal to noise ratio dB | 98 |
| THD, % | 0,02 |
| Channel interference on 1kHz,dB, not more than | -90 |
| Outband signal rejection 100 kHz … 1 MHz (Fs=108 kHz), dB, more than | -95 |
| Working temperature, C | -40 … +50 |
| Dimensions, mm | 71×77 |

# MS-304

## Description

Module MS-304 is designed for carrying out static and quasi-static strain gage measurements. It can work with full bridge, ½-bridge strain gage sensors and single used strain sensors, connected according to ¼-bridge scheme. Strain sensors with resistance from 100 to 1000 Ohm can be used with MS-304.



MS-304

General applications:

- Mechanical load measurements
- Strain (weigh, draft force, etc.)
- Linear displacement
- Pressure

## Features

- 4-wired connection scheme for ¼-bridge sensors with line resistance compensation
- Input overload control in measurement passband provided by ADC
- Excitation with group-selectable voltage (2,5 V or 5 V).
- Group isolation for channels provides up to 500 volts safe measuring.
- Two measuring modes:
  - Dynamic. Mode dedicated to dynamic signals measuring.
    Sampling frequency 600, 1200, 2400, 4800 Hz, direct current sensor supply.
  - Static. Mode dedicated to steady-state signals measuring.
    Sampling frequency 6,25; 12,5; 50 Hz; alternating current sensor supply.

| Specifications | Value |
|---|---|
| Number of Channels | 4 |
| Measuring range, mV/V | 0 … 2,5; ±2,5;<br>0 … 10; ±10;<br>0 … 40; ±40 |
| Sampling frequency, Hz<br>• dynamic<br>• static | <br>600; 1 200; 2 400; 4 800<br>6,25; 12,5; 50 |
| Full-scale accuracy, %<br>• dynamic<br>• static | <br>±0,05<br>±0,01 |
| Addition inaccuracy according to temperature changing per 10°C (in working temperature range)<br>• dynamic<br>• static | <br><br>±0,05<br>±0,02 |
| Working temperature, °C | -40 … +85 |
| Dimensions, mm | 71×77 |

## MIC-140 Temperature Scanner

Multi-channel precision temperature scanner with internal cold junction compensation. Up to 96 standard customized termocouples could be connected. Because of the rugged design the unit can be installed at or close to device under test.

MIC-140

Industrial version for test stand application

On-board version (providing protection from high vibration levels and acoustic pressure of up to 130 dB)

**Features**

- Up to 96 temperature measurement channels
- Built-in cold junction temperature sensors
- Thermal isolated rugged case for harsh environment conditions
- Suitable for standardized and customized types of thermocouples
- Common synchronization (IRIG-B)
- Single connector: power, Ethernet, synchronization

## MIC-170 Pressure Scanner

Multi-channel pressure scanner for measuring absolute and differential pressure of dry non-corrosive gases. The unit can be installed close to device under test.

MIC-170

Industrial version for test stand application

On-board version (providing protection from high vibration levels and acoustic pressure of up to 130 dB)

**Features**

- 16 channels
- Compression pressure fittings
- Measurement data transfer via Ethernet
- Common synchronization (IRIG-B)
- Environment protection (IP65)
- Accessories: vibration insulators, wrench for compression pressure fittings

# MIC-185 Strain Gage Data Acquisition Unit


MIC-185

**Description**

The MIC-185 is a DAQ unit for measuring static and quasi-static strains using strain gages of full-, ½- or ¼-bridge configuration, or single strain gages.

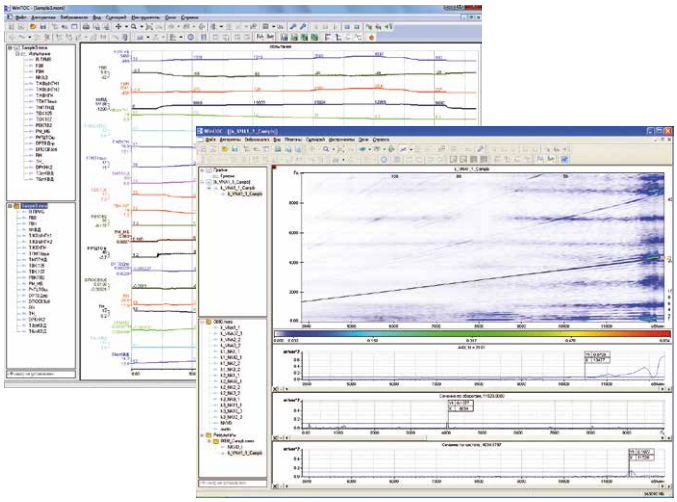
The unit has 64 input channels, and provides strain gage excitation, strain gage thermal compensation, analog to digital conversion and further measurement data transfer to a remote data recording and processing workstation.

**Features**

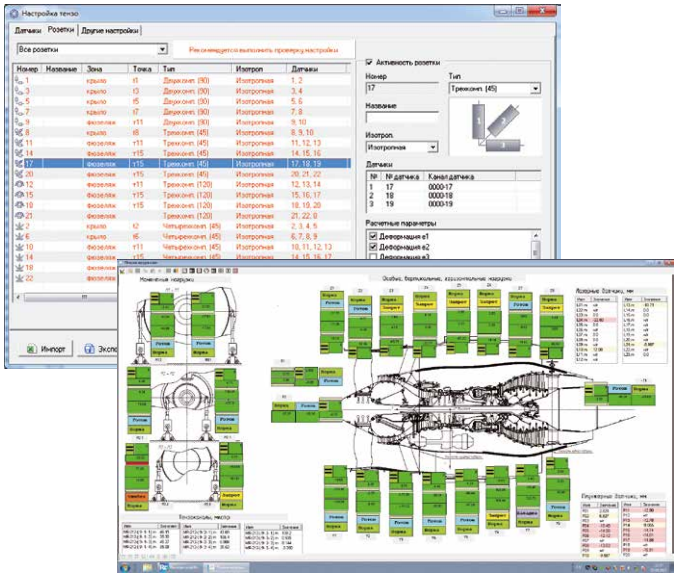
- Strain gage excitation by constant current
- Measurement data transfer via Ethernet
- Common synchronization (IRIG-B)
- Customized Tenzo software for setting up configuration and processing data acquired from strain gage rosettes and single strain gages
- Group (16 channel per group) thermal compensation
- Quick connectors of RJ-45 type
- 19” rack-mounted case
- Up to 10 000 channel system can be built using multiple MIC-185 units

# Software


**Recorder, MR-300** – control programs for MIC-units (configuration of measurement units, calibration, measurement, real-time mapping, recording and playback of recorded information).



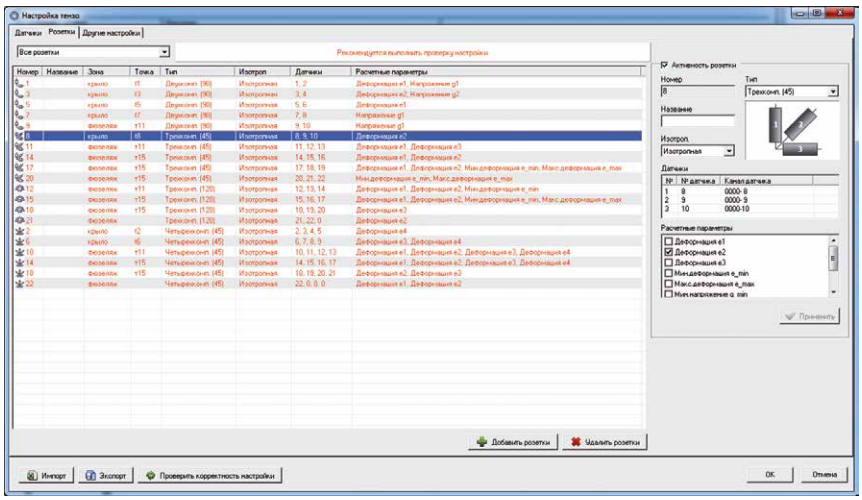
**WinPOS** – a program for post-processing analysis and report generation.



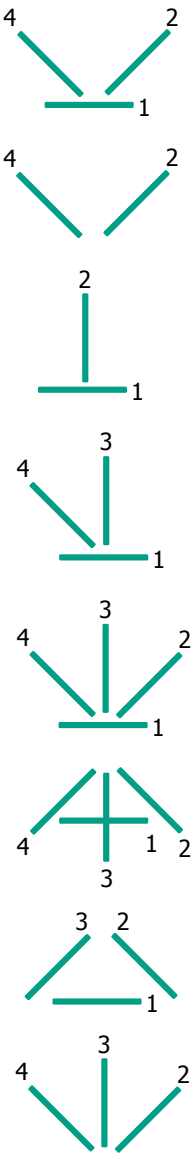
Specialized software for bench tests, data collection stations and operator stations. Database of test results.

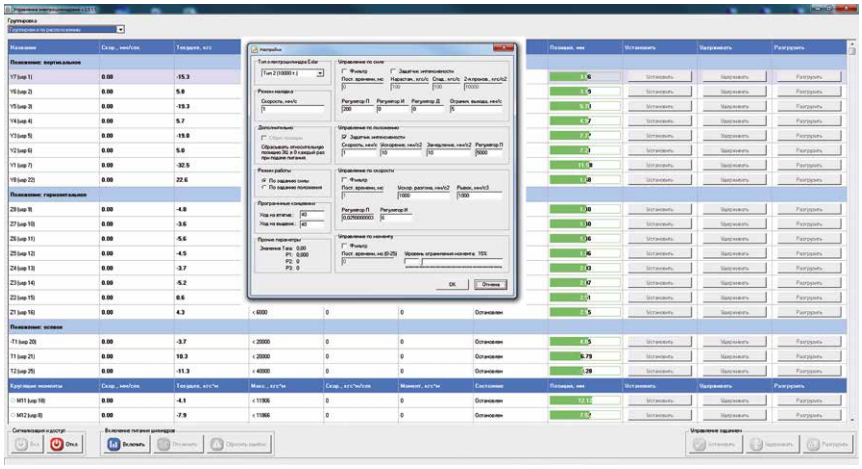
# Tenzo Software

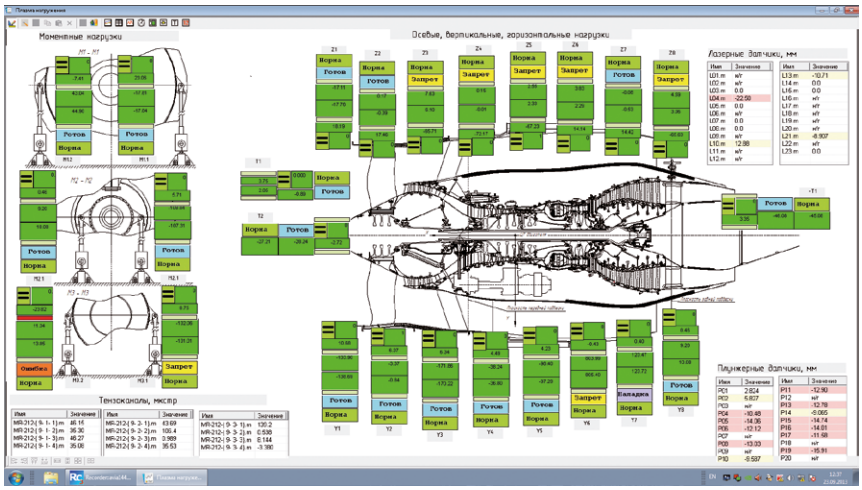
- Configuration
- On-the-fly data processing
- Strain rosettes support
- Data logging
- Report generation



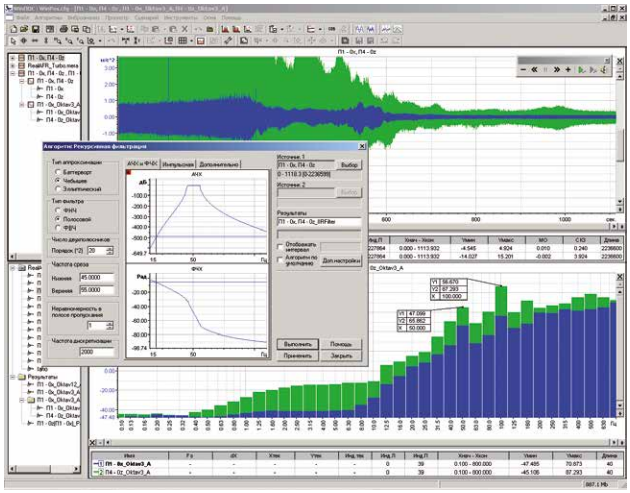
Complete and incomplete rosettes calculation

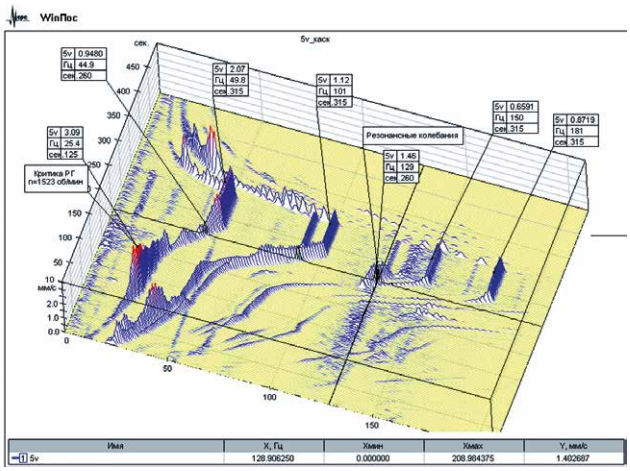


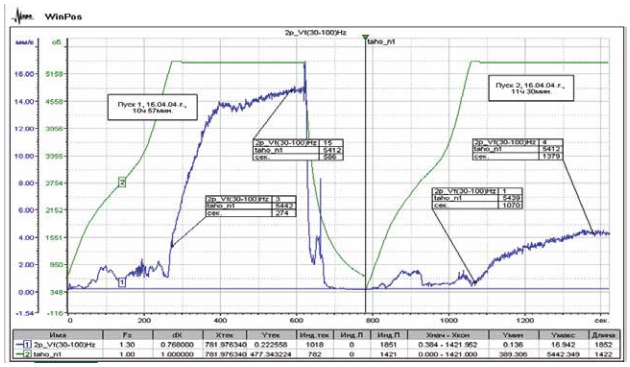





# Data Processing in WinPOS






- More than 50 signal processing algorithms
- Powerful plotting tools (two- and three-dimensional, parametric, polar coordinate plots)
- Express-report functions
- Batch processing
- WAV and UFF formats compatibility
- Editing of signals
- Support of scripts (embedded script-editor VBScript) and plug-ins (Interfaces allow creating your own plug-ins and applications practically in any modern IDE)
- Possibility of creating plug-ins for import/export
- Tabular view of signal values
- Unlimited signal length
- Integration with MATLAB™
- Can be used as distributed client-server system for data post-processing
- Detailed help system

**Analysis of non-stationary dynamic processes**

- Multichannel processing of vibrations, pressure pulsations, noises etc.
- Assessment of vibration conditions of rotary machines (steady-state)
- Shock spectrum
- Calculation of parameters for run / overrun modes
- Development of strain gage measurements
- Audio signal processing

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