



gtlab

about company



**GTLAB -
A team of
professionals**

**Sensors, instruments and software for the
analysis of vibration, pressure, force, acoustic
emission parameters**

From development to production



Over 30 years

**of experience in the
development and
production of piezoelectric
sensors and electronic
devices**

Over 1000

product types

From 2 weeks

**Development of sensors,
devices and software
modules**

3 years

**Verification interval
for charge and IEPE
sensors**

PRODUCTION CAPACITY

Enabling the company to offer comprehensive solutions of specific tasks for the delivery of measurement channels



OVER 800 M²
Own research and production capacity





- Production workshops:**
- assembly
 - electronic assembly
 - machine shop
 - cable assembly production
 - laser welding and marking
 - SLA printing



**GTLAB —
PRODUCTION**



- design department
- electronics and programming department
- metrology department
- thermal testing section
- materials and components warehouse
- finished goods warehouse



**GTLAB —
DEVELOPMENT**





**R&D BASED
ON YOUR
SoW/technical
specifications**

**Over 50 R&Ds
are in our weekly
pipeline**

Each product name in the gtlab catalog is the result of the company's proactive research and development.

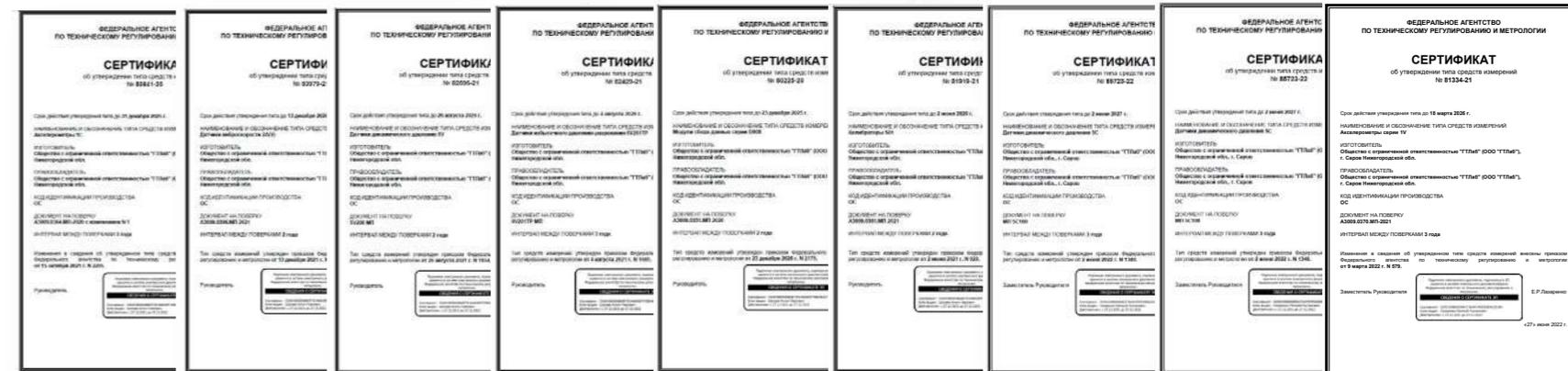
The continuous R&D workflow is gtlab's main development driver.

DECLARATIONS, PATENS, CERTIFICATES



Our products have passed all necessary tests and have Measurement Instruments, Customs Union Technical Regulations certifications.

Original solutions are protected with patents



SOLVING TASKS TOGETHER WITH YOU AND IMPLEMENTING IDEAS OF A SAFE INDUSTRIAL FUTURE



**OVER 1000
PRODUCT TYPES**



MAIN DEVELOPMENT AND PRODUCTION AREAS

1 ACCELEROMETERS



2 Vibration speed sensors



3 Dynamic pressure sensors



4 Static- dynamic pressure sensors



MAIN DEVELOPMENT AND PRODUCTION AREAS

5 Force sensors



6 Impulse hammers



7 Acoustic emission sensors



8 Eddy current sensors



MAIN DEVELOPMENT AND PRODUCTION AREAS

9

Calibrators



10

Signal generators



11

Vibration controllers



12

Accessories



MAIN DEVELOPMENT AND PRODUCTION AREAS

13

Portable instruments



14

Desktop data acquisition modules



15

Industrial ADCs



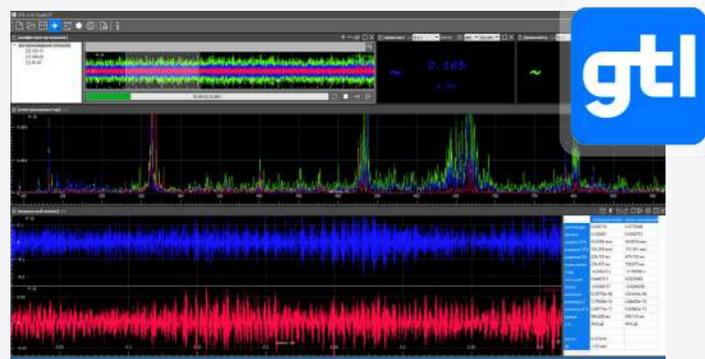
16

Multi-channel stationary solutions



MAIN DEVELOPMENT AND PRODUCTION AREAS

17 GTL. Software for registration, processing, recording and visualization of signals



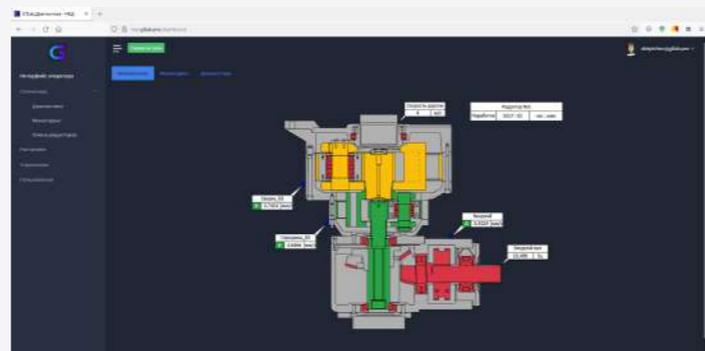
18 GTLd. Software for monitoring and automated vibration diagnostics of industrial machinery



19 Measurement laboratory channels



20 Stationary vibration monitoring systems



**Verification interval
for charge and
IEPE sensors**

3 YEARS



ACCELEROMETERS



1C1 general purpose

Sensitivity:
from 2 to 100 pC/g
Number of measuring axes:
from 1 to 3



1C2 industrial

Sensitivity:
from 2 to 100 pC/g
Temperature range
from -60 to 600 °C



1C3 shock

Measurement range:
to 100 000 g
Number of measuring axes:
from 1 to 3



1C4 high-sensitive

Sensitivity:
from 500 to 1 000 pC/g
Frequency range:
from 0,1 to 3 000 Hz

CHARGE // IEPE



1V1 general purpose

Sensitivity:
from 1 to 1 000 mV/g
Number of measuring axes:
from 1 to 3



1V2 industrial

Sensitivity:
from 10 to 100 mV/g
Internal shield, isolated sensing
element from the housing



1V3 shock

Measurement range:
to 5 000 g
Resonant frequency:
over 75 kHz



1V4 high-sensitive

Sensitivity:
from 500 to 10 000 mV/g
Frequency range:
from 0,1 to 4 500 Hz

ACCELEROMETERS



1D RS485

Measurement mode:
- vibration acceleration
- vibration velocity
- vibration displacement

Detector:
- Magnitude
- Peak
- RMS

MEMS sensing element, 3-axis.
High-pass filter: from 2 to 10 Hz
Low-pass filter:
from 200 to 1 000 Hz

HIGH-SENSITIVE // SPECIAL PURPOSE



1D USB

Measurement range:
to 1 000 g
Frequency range:
from 0,5 to 5 000 Hz

Number of ADC 24 bits
Sampling rate:
48 000 Hz



1V6 shock pulses

Double measurement technology:
- Vibration acceleration within the operating
frequency range
- Shock acceleration (shock pulses) at the
setting resonance frequency

Resonant frequency:
28 ... 36 kHz
Frequency range:
from 2 to 10 000 kHz



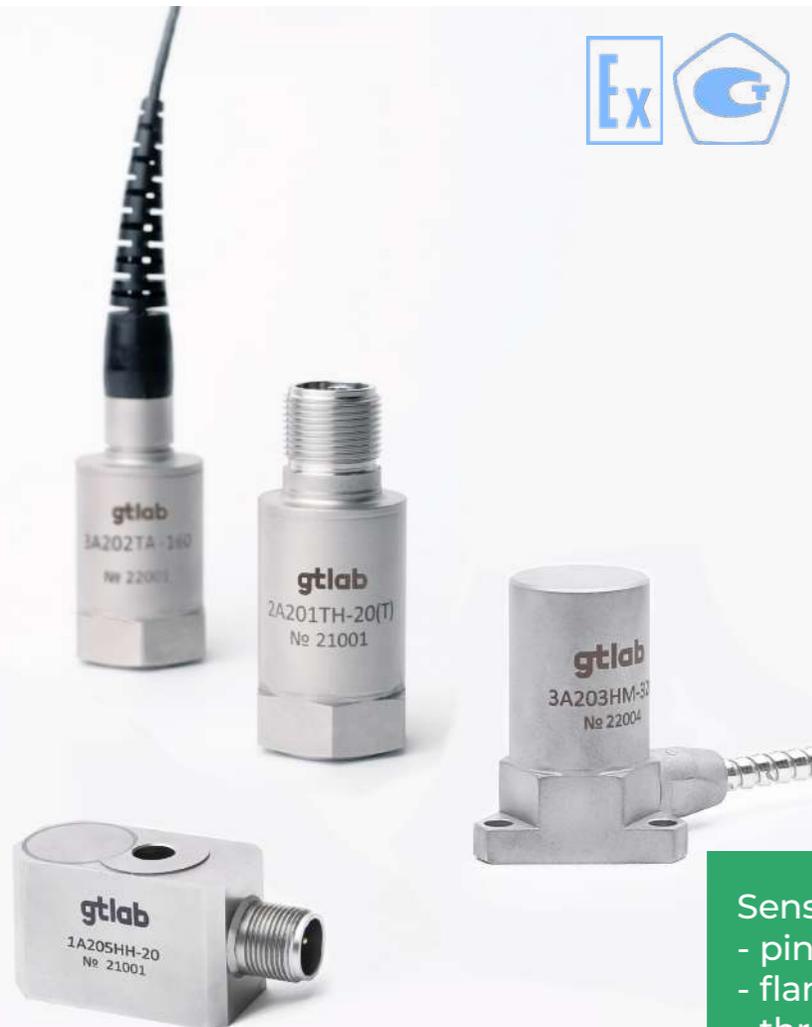
1C7/1V7 underwater

Underwater measurements to
depth 150 m
Resistance to oil, fuels and
lubricants, solvents

Sensitivity:
from 1 to 100 mV/g
Frequency range:
from 0,2 to 22 500 Hz

SENSORS WITH CURRENT OUTPUT

4-20 mA



1A2 vibration acceleration

The product range includes the following metrological characteristics implemented in all designs

90
design versions

Frequency range 2 ... 1 000 Hz

Range of measured vibration acceleration, RMS
 10 m/s²
 20 m/s²
 50 m/s²
 100 m/s²
 200 m/s²

Temperature range
 -40 ... +85 °C standard
 -40 ... +125 °C (T)

Sensor mounting:
 - pin-mounted
 - flanged
 - through

SENSORS WITH CURRENT OUTPUT

4-20 mA

2A2 vibration velocity

216
design versions

Frequency range 2 ... 1 000 Hz
 10 ... 1 000 Hz

Range of measured vibration speed, RMS
 10 mm/s
 20 mm/s
 40 mm/s
 50 mm/s
 80 mm/s
 100 mm/s
 160 mm/s
 200 mm/s

Temperature range
 -40 ... +85 °C standard
 -40 ... +125 °C (T)

3A2 vibration displacement

36
design versions

Frequency range 10 ... 1 000 Hz

Range of measured vibration displacement, magnitude
 160 μm
 320 μm
 640 μm
 1280 μm

Temperature range -40 ... +85 °C

ACCELEROMETERS



Operating mode

- autonomous diagnostic vibration monitor
- real-time transmission of oscillograms in the specified frequency band along three axes via wireless communication channel
- measurement of RMS, amplitude, vibration magnitude in the specified frequency band simultaneously along three axes X, Y, Z

Range of measured amplitudes vibration accelerations, (customizable):
 800 m/s²
 Frequency range (uneven frequency response ± 3 dB):
 0,5 ...10 000 Hz
 Sigma Delta 24-bit ADC

WIRELESS

IMPULSE HAMMER

 4V301, 4V302,
4V303, 4V304



Sensitivity:

- 10 mV/H
- 1 mV/H
- 0,2 mV/H

Hammer weight without
 additional weight and
 head:

- 200 g
- 300 g
- 2 000 g
- 5 000 g

FORCE SENSORS



4C charge

Force measurement range:
from -1 000 N tensile to +100 000 N compression
Temperature range:
-60 ... +200 °C

CHARGE // IEPE

Designed for the measurement of dynamic forces impacting test facilities, equipment and industrial structures.



4V IEPE

Force measurement range:
from -500 N tensile to +100 000 N compression
Temperature range:
-40 ... +125 °C

DYNAMIC PRESSURE SENSORS



5V/5C IEPE/charge

Upper limit of measurement:
from 25 to 600 MPa

Sensing element materials:
quartz / lithium niobate / GTL steel

Temperature range:
from 200 to 520 °C

Resonant frequency:
>30 / >100 / >150 kHz

CHARGE // IEPE



5V IEPE/spherical

Upper limit of measurement:
from 0,06 to 250 MPa

Sensing element materials:
quartz / CTS-19

Temperature range:
from 125 °C

Resonant frequency:
>25 / >30 / >100 kHz

STATIC-DYNAMIC PRESSURE SENSORS



gtlab
6V201TP-16
№ 23003

Measurement range:
from -0,1 to 160 MPa

Frequency:
from 18 to 170 kHz



gtlab
6V202TP-60
№ 21035

Temperature of the measured medium
(without cooling):
300 °C

Temperature of the measured medium
(with cooling):
1000 °C

6V industrial

IEPE

ACOUSTIC EMISSION TRANSDUCERS

CHARGE // IEPE



7C industrial

Explosion-proof Housing:
0ExialICT6...T3Ga



7C general purpose

Frequency range:
30 ... 80 kHz
50 ... 250 kHz
500 ... 750 kHz
500 ... 800 kHz

Maximum value of electroacoustic conversion coefficient in the operating frequency range when exposed to:

- longitudinal waves
> 300 · 10⁶ V/m
> 550 · 10⁶ V/m
> 1 000 · 10⁶ V/m

- surface waves
> 1 500 · 10⁶ V/m



7V industrial

Maximum value of electroacoustic conversion coefficient in the operating frequency range when exposed to surface waves:
> 1 000 · 10⁶ V/m

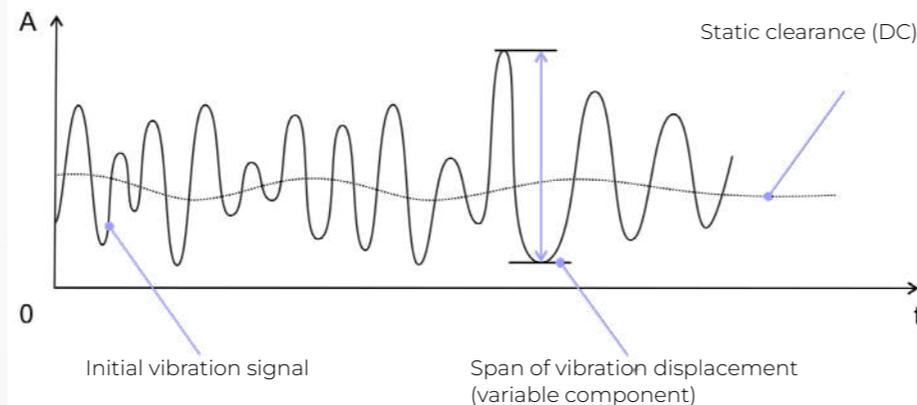
Frequency range:
50 ... 250 kHz

Explosion-proof Housing:
1ExibICT6...T4Ga

EDDY CURRENT SENSORS

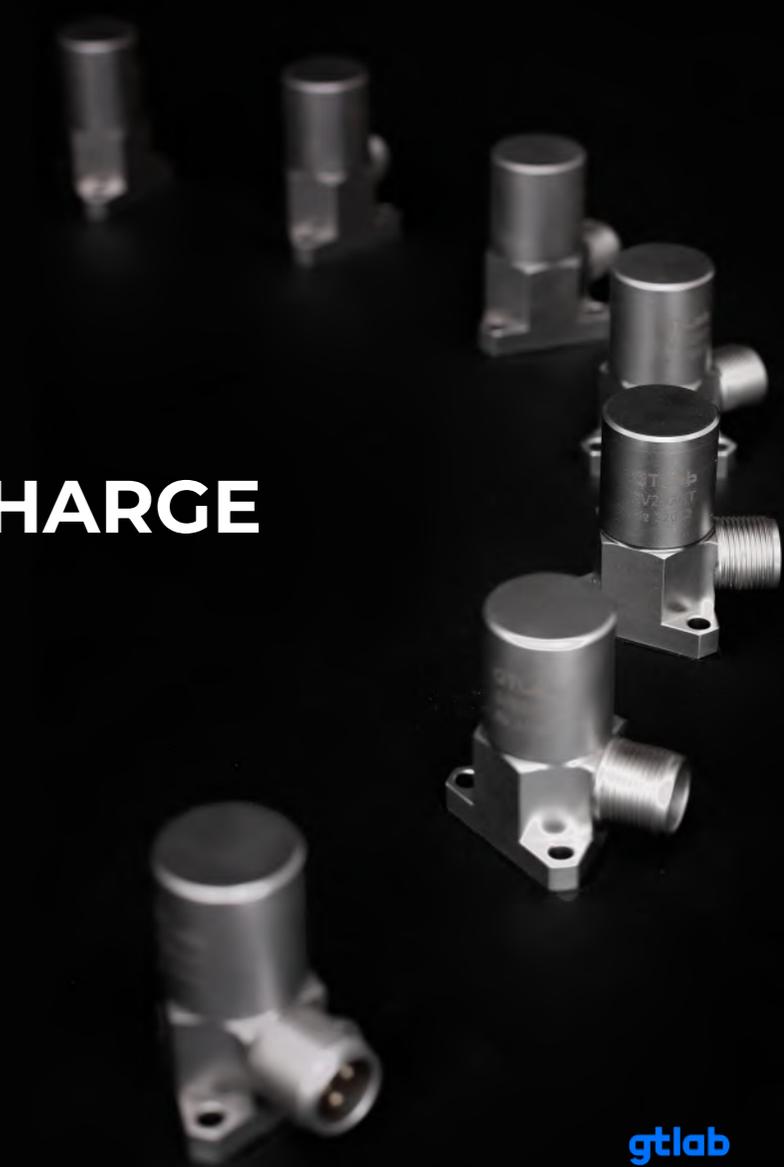
Application: axial shift measurements, vibration displacement and radial clearance magnitude.

An eddy current sensor features
 a primary transducer
 and a signal generator



MEASURING DIAMETER	DISPLACEMENT MEASURING RANGE	MEASURING RANGE OF REVOLUTIONS (AT 1 RESPONSE LO PER REVOLUTION)	LO
8 mm	0,2 – 2,2 mm	0 – 60 000 rpm	10 mm
10 mm	0,3 – 3,3 mm		
16 mm	0,5 – 5 mm		
20 mm	1 – 7 mm		

**GET A SENSOR
 FOR TESTING FREE OF CHARGE
 AND THEN
 PURCHASE AT 50%
 OF ITS COST**



CALIBRATOR



Maximum weight
of calibration
sensor 300g



Vibration frequency ($\pm 1\%$):
39,79; 79,58; 159,2; 636,6

Transverse vibration amplitude:
< 5 %

Vibration frequency ($\pm 1\%$):
40; 79; 58; 159,2

Transverse vibration amplitude:
< 5 %



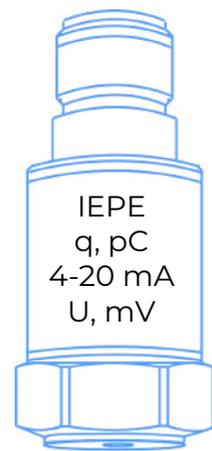
SIGNAL GENERATORS

Matching of
sensors' output
signal with
the recording
equipment input



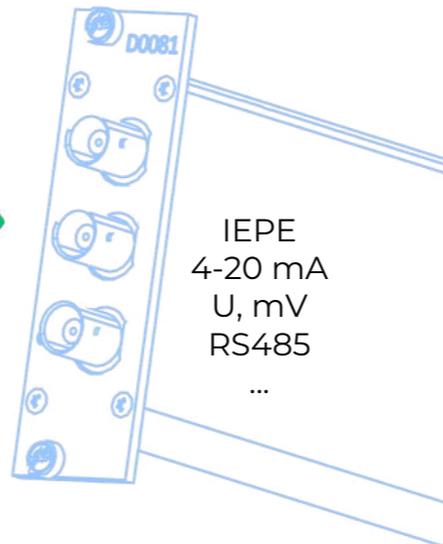
SIGNAL GENERATORS

Sensor



- amplification
- filtration
- integration
- indication
- conversion

Signal recorder



VIBRATION CONTROLLERS



A wide range of configurable operating frequencies:
High-pass filter: from 2 to 40 Hz,
Low-pass filter: from 200 to 2 000 Hz.

Galvanic isolation of:
- power circuits;
- current output;
- RS 485 interface.



- Built-in display:
- configuring filters, conversion coefficient, relay triggering conditions;
 - displaying measured values, error codes, configured parameters.

By type of connected sensors

Output

Control

	A621	A631	A632	A633	A634	A635	A636	A637	A638	A639
Charge	✓				✓	✓				
IEPE		✓	✓	✓	✓	✓	✓	✓		✓
4 - 20 mA		✓	✓							
Negative powered (-24 V) and voltage output				✓						
With positive supply (+24 V) and voltage output					✓	✓	✓	✓		✓
With voltage output (PU)						✓				
RS-485		✓								
Eddy current formers					✓	✓	✓	✓	✓	✓
Eddy current formers with IEPE output									✓	
Diagn (signal)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0 ... 10 V		✓		✓	✓					
0 ... 5 V	✓									
4 ... 20 mA	✓	✓	✓							
0/4 ... 20 mA				✓	✓	✓	✓	✓	✓	✓
RS-485	✓	✓	✓		✓	✓	✓	✓	✓	✓
AL1 (Dry contacts)	✓	✓	✓	✓				✓		
AL2 (Dry contacts)	✓	✓	✓	✓				✓		
AL3 (Dry contacts)			✓							
OK (Dry contacts)		✓		✓				✓		
Reset (Dry contacts)	✓			✓			✓	✓	✓	
Keyboard	✓	✓		✓	✓	✓		✓		
Display	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
RS-485	✓	✓	✓		✓	✓	✓	✓	✓	✓

VIBRATION CONTROLLERS



INPUT

BY TYPE OF CONNECTED SENSORS



Charge



IEPE, PU



Current (4-20 mA)



Digital (RS-485)



Eddy current formers

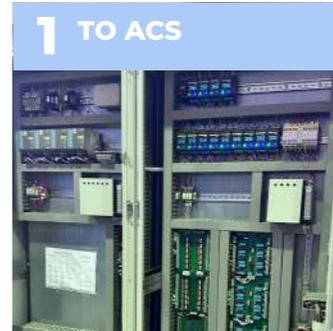


Negative/positive supply (+-24 V)

VIBRATION CONTROLLERS



INPUT



0...10 V
0...5 V
2...20 V
0/4...20mA
RS-485



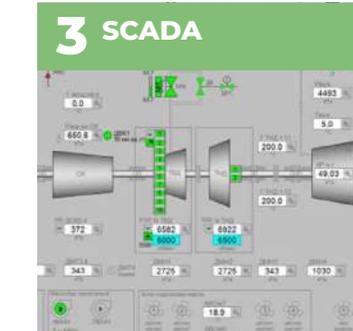
Local app for expert operation



Dry contact
Open collector



Developing custom SCADA based on a web interface



OPC UA server

VIBRATION CONTROLLERS

A6XX VIEWER SOFTWARE

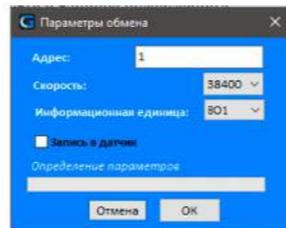


A6XX Viewer operating window for PC-enabled command of controllers

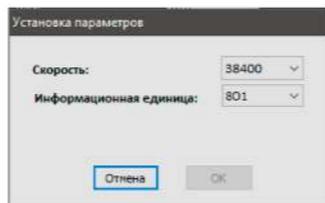
EXTERNAL SETUP (VIA RS-485)



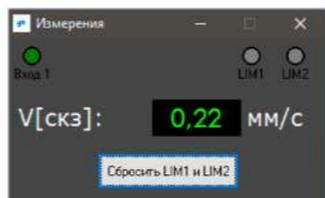
Exchange parameters



Connecting to COM port

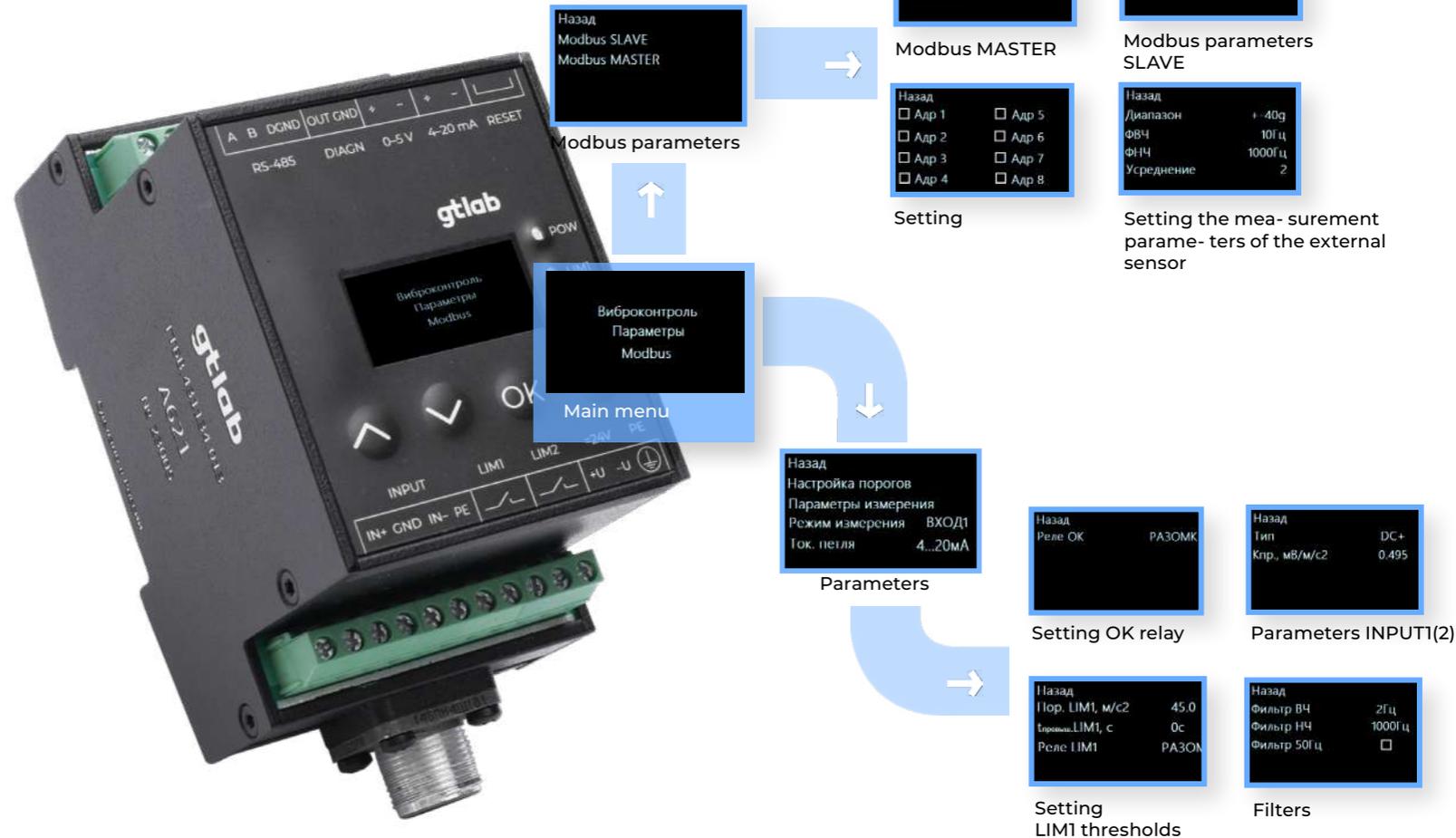


Setting



Measurement screen

Set-up of vibration controllers from a built-in keypad



DATA ACQUISITION MODULE (ADC)

D001, D002, D007, D008-XX

DATA ACQUISITION MODULE (ADC)

D009-XX, D010, D011



ADC sampling frequency	128 kHz 2 000 kHz	48 kHz	144 kHz 96 kHz
Number of channels	4	2	2
Number of ADC bits	24 bits 16 bits	24 bits	16 bits 24 bits

ADC sampling frequency	144 kHz 96 kHz	64 kHz	64 kHz
Number of channels	2	4	4
Number of ADC bits	24 bits 16 bits	16 bits	16 bits

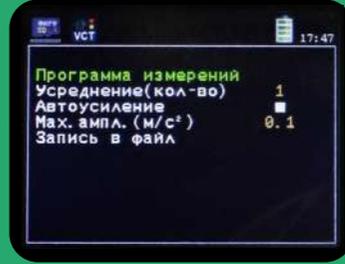
VIBROMETERS D101, D141, D142



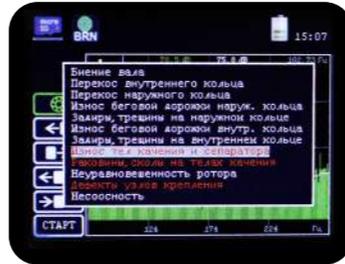
Measurement parameters

Measurement display windows

Vibrocontrol



Bearing diagnostics



Shock pulses

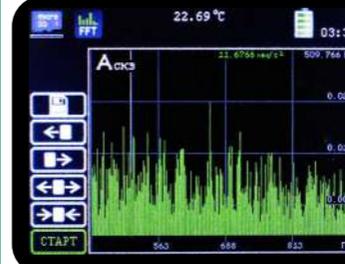


- Diagnostics and vibration monitoring
- Connection of optical tachometer (for D141, D142)
- Infrared pyrometer (for D142)
- MicroSD slot for signal recording
- Signal recording, route-based operation
- Virtual instruments

Vibrometer



Spectrum



Oscilloscope



Measurement parameters

Measurement display window

VIBROMETERS D101, D141, D142



VIBRATION ANALYZER D104

ADC sampling frequency: 128 kHz

ADC bits: 24 bits

Number of analog inputs : 4

Display: Shock-resistant display with enhanced sunlight readability, 10 inches, 1920 * 1200; 5 MP front camera



VIBRATION ANALYZER D104 D104

Software

- GTL
- GTLd



Accessories

- Pins
- Cable switches
- Magnets
- Adapters
- Ceramic insulators
- Mounting set
- Brackets
- Wax mastic
- O-rings
- Probe
- Thread



CABLE PRODUCTS



VIBRATION CONTROL SYSTEMS

gtlab



PREVENT

emergency shutdowns



CONTROL

equipment vibration parameters



FORECAST

remaining lifespan



Machines



Pumps



Compressors



Electric motors



Fans



Mobile



Stationary

PLATFORM GTLd

WEB

External visualizer

OPC UA, MODBUS

Data exchange

QML

Built-in visualizer

GTLd2 DESKTOP

Expert operation

Uniform analog signals

0/2...5/10/20V

0/4...20mA

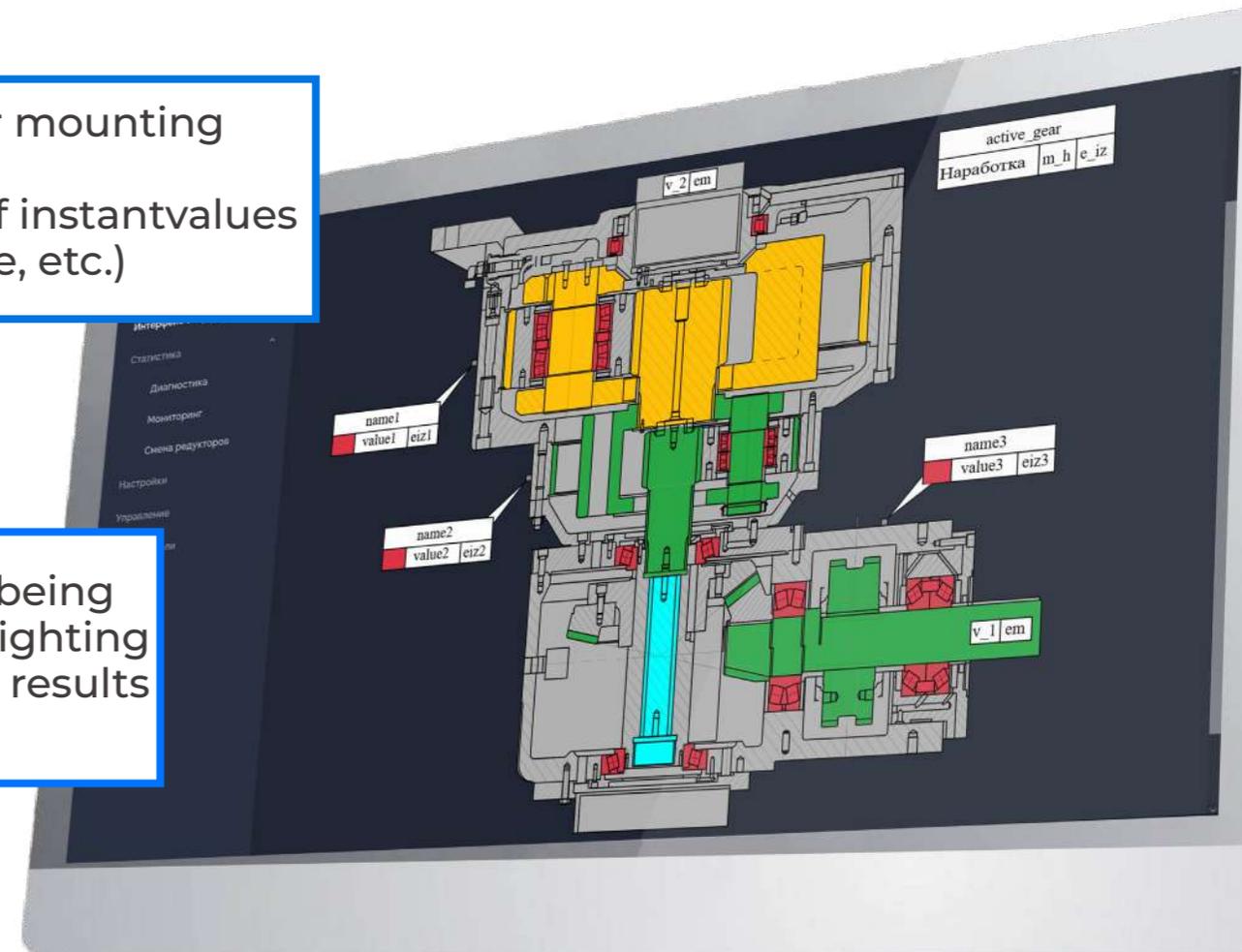
RS-485

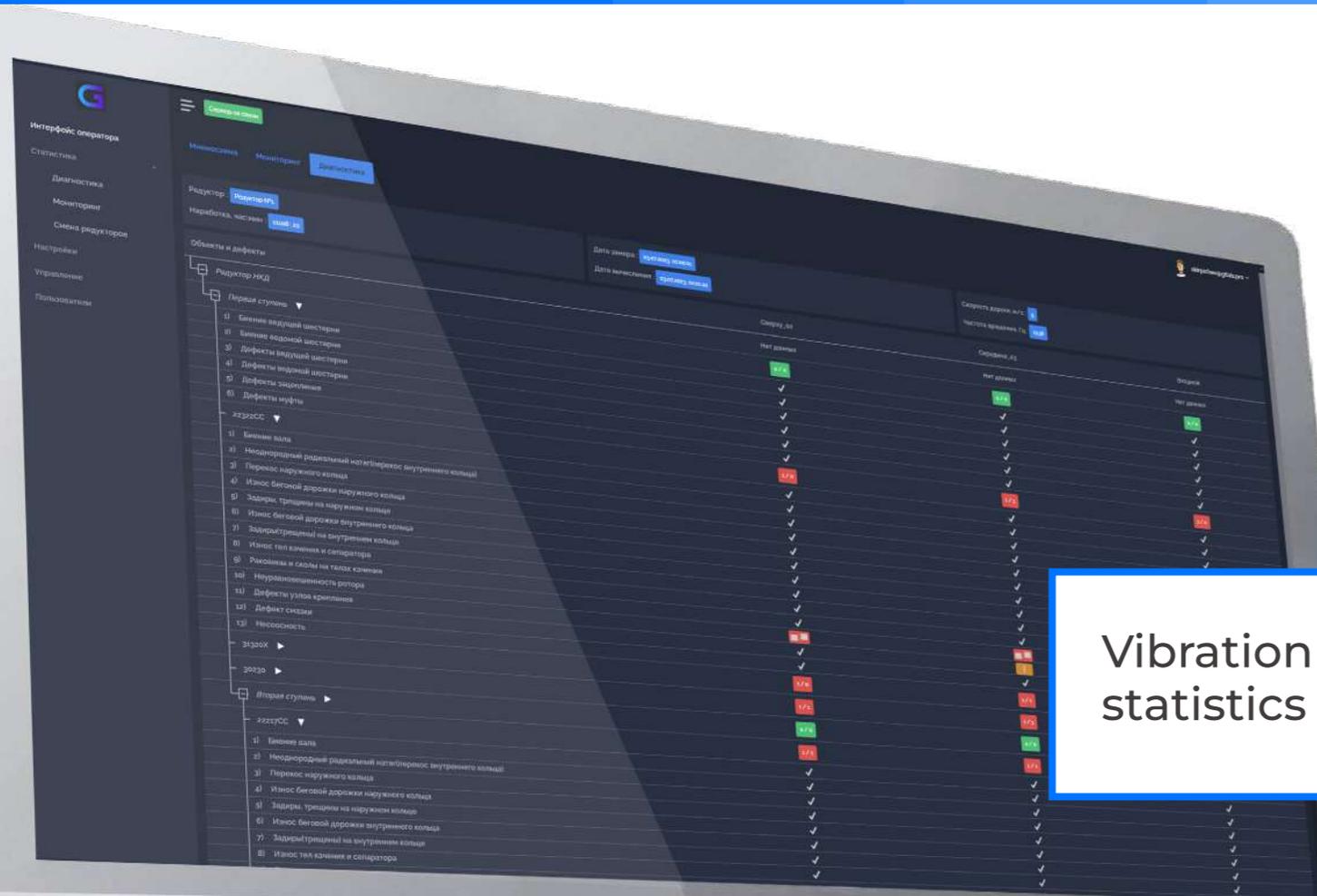
Emergency protection

Dry contact

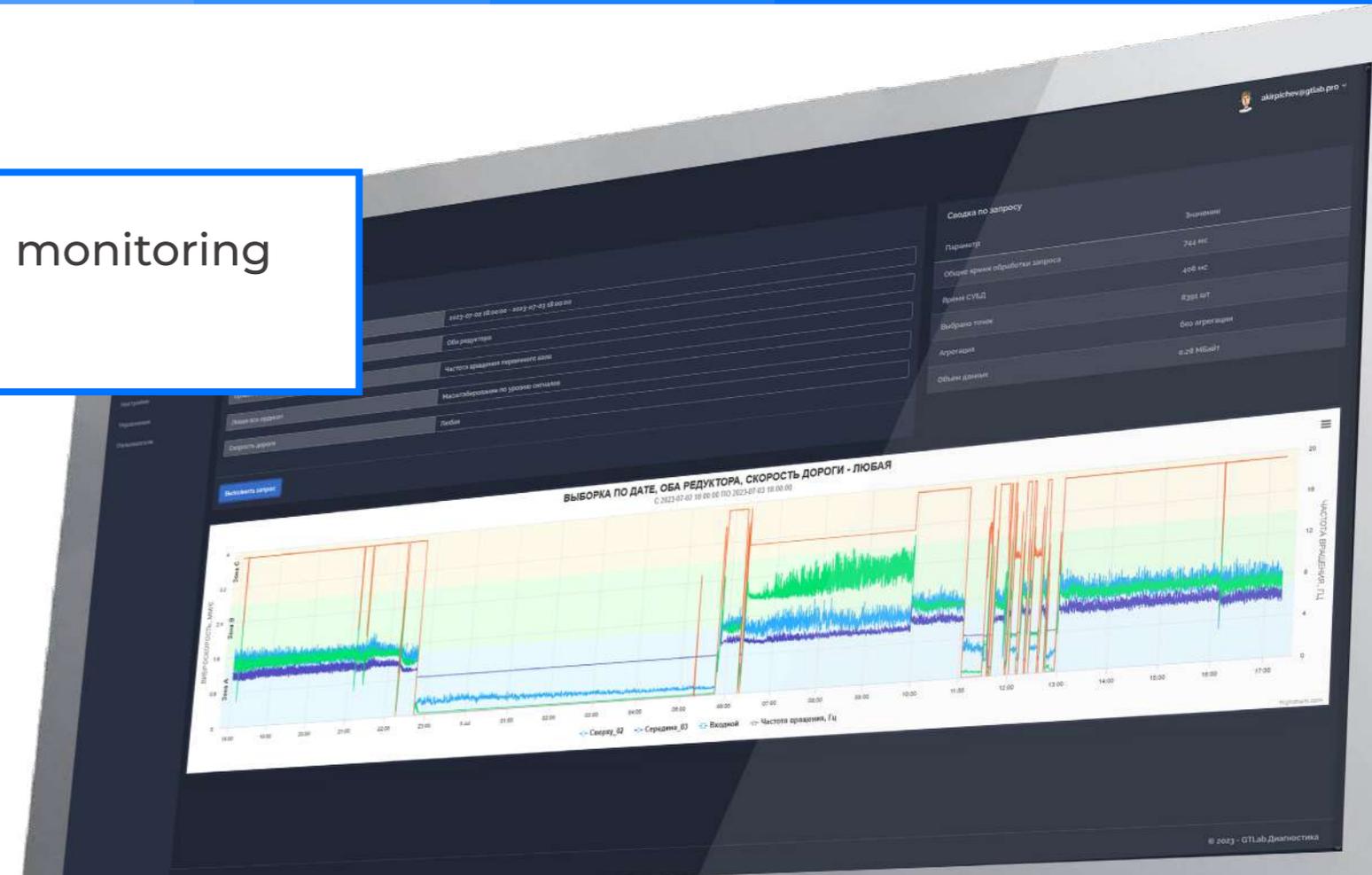
Showing sensor mounting locations with a display of instant values (RMS, amplitude, etc.)

Showing the assemblies being tested with colored highlighting based on the diagnostics results



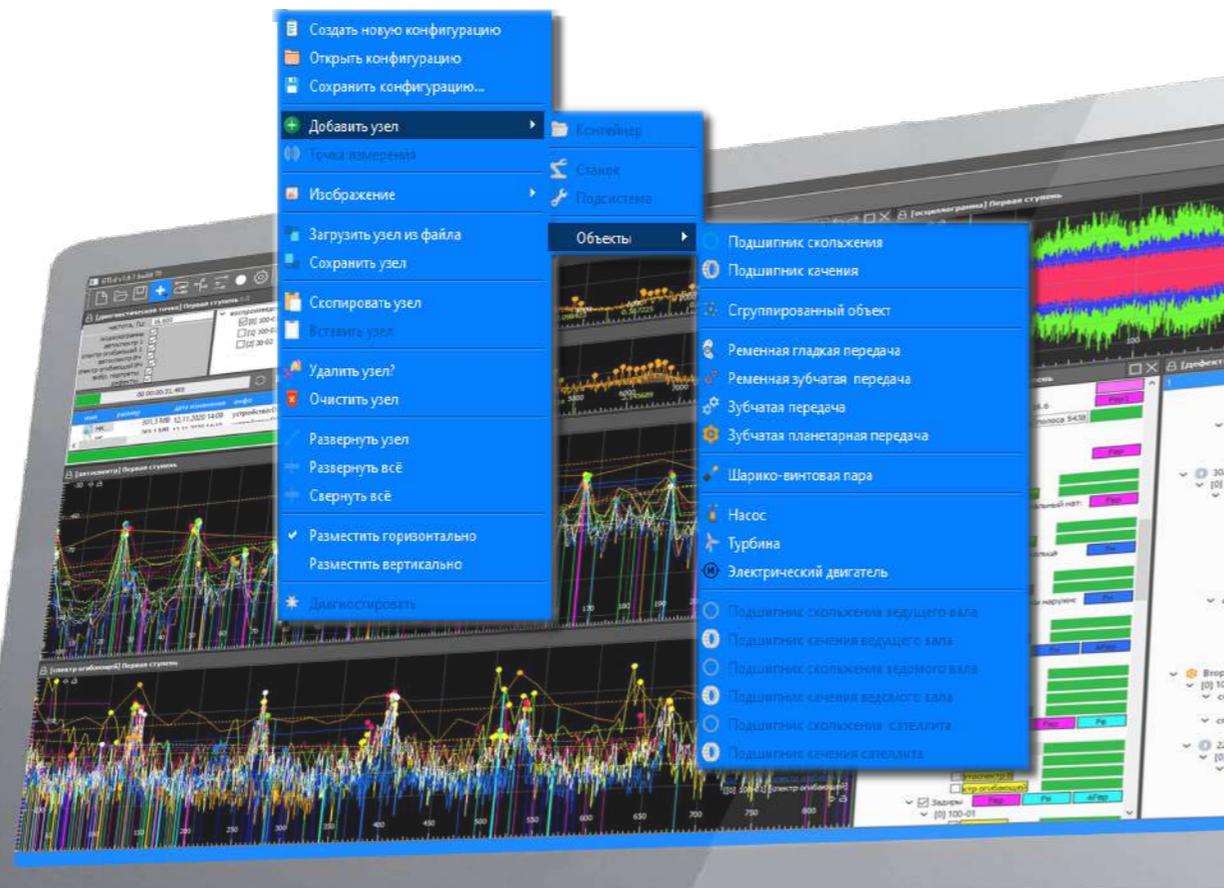


Vibration monitoring trends

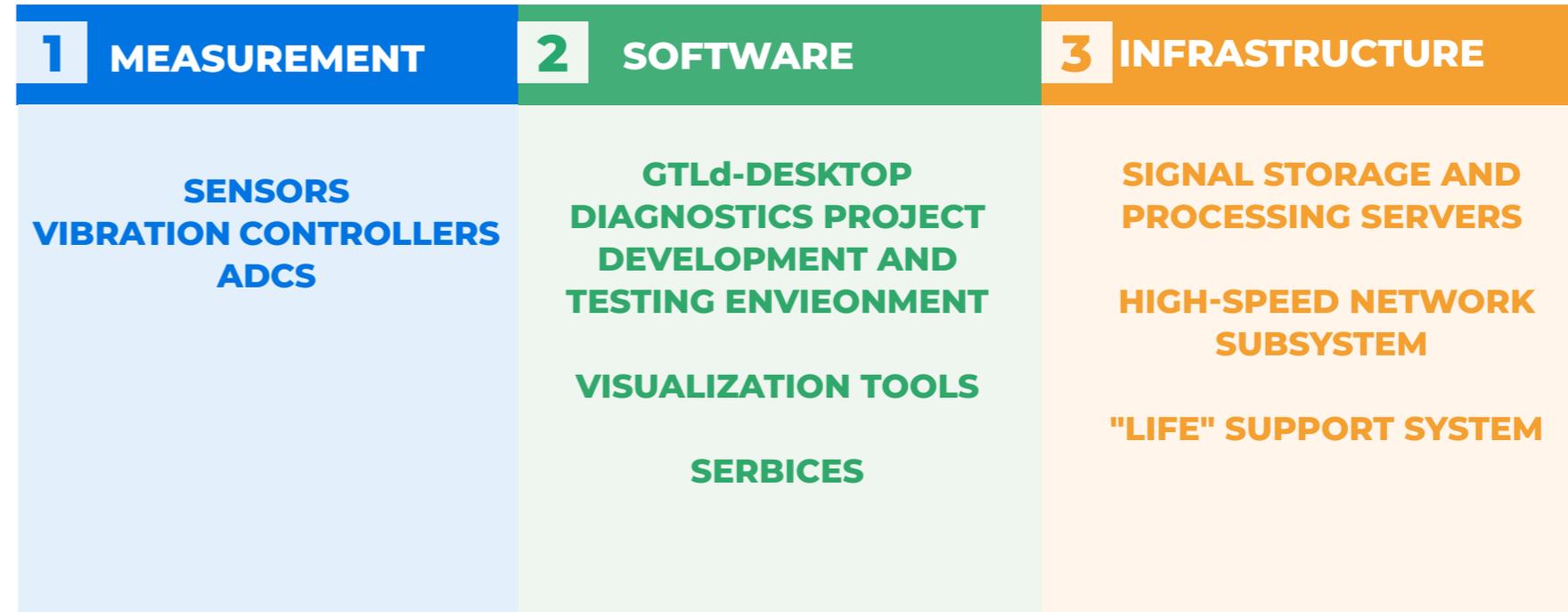


DETECTION OF DEFECTS IN THE FOLLOWING MECHANISMS:

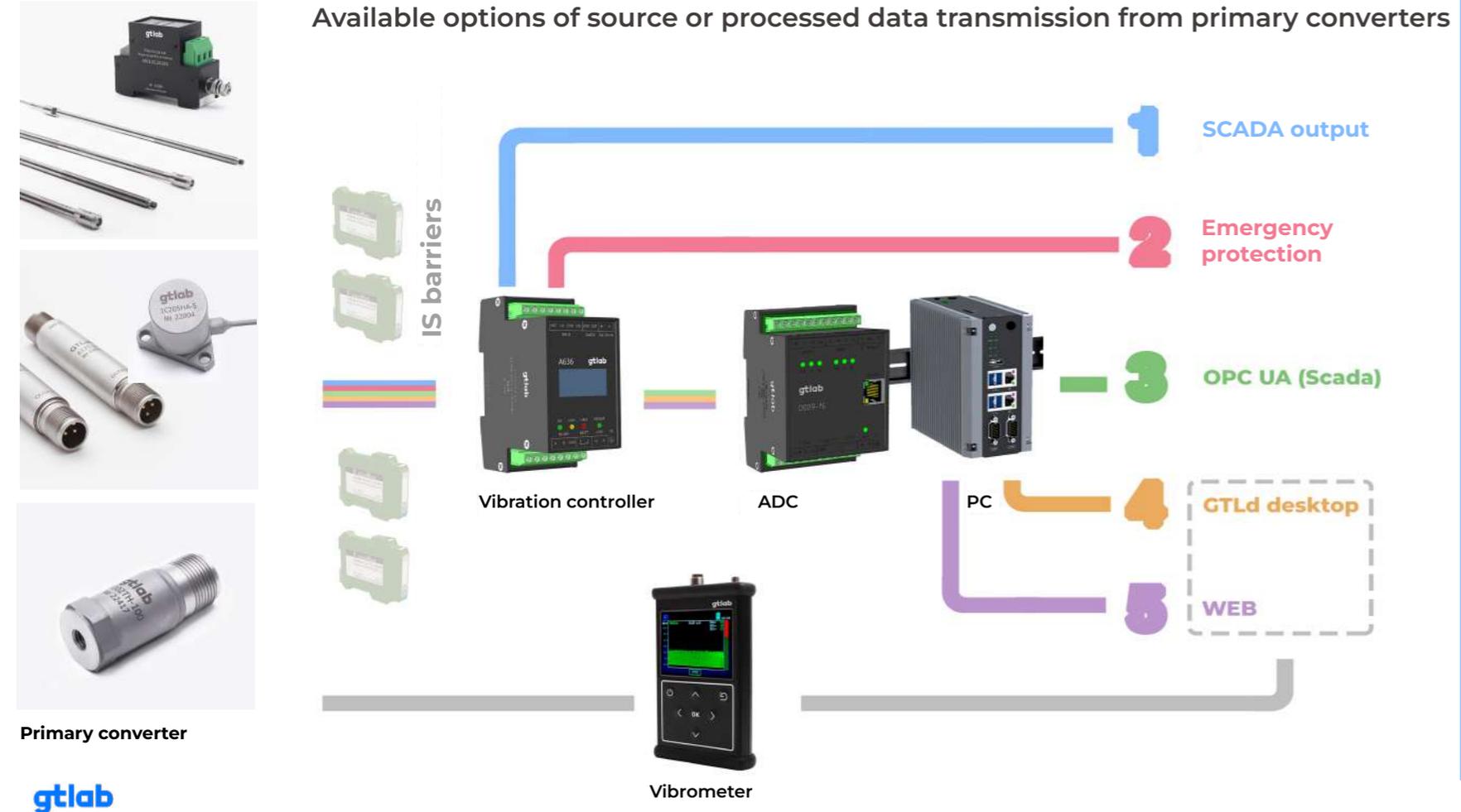
- Rolling bearings
- Plain bearings
- Ball screws (ball screw pairs of CNC machines)
- Gears
- Planetary gearboxes
- Belt transmission
- Chain transmission
- Pumps
- Compressors
- Electric motors



PILLARS OF THE VIBRATION DIAGNOSTICS SYSTEM



Available options of source or processed data transmission from primary converters



DEVELOPMENT ENVIRONMENT GTLd-DESKTOP

Debugging of the diagnostic project and building a cinematic test object scheme

Development of diagnostic algorithms

Configuring data acquisition modules and services

VISUALIZATION TOOLS

WEB

QML

Scada (OPC UA)

SERVICES

Storage

Calculation

Authorization

Configuration

GTLd SOFTWARE SUITE

Test object tree

Configuration of mechanisms

ROLL BEARING DATABASE (MORE THAN 2500 UNITS)

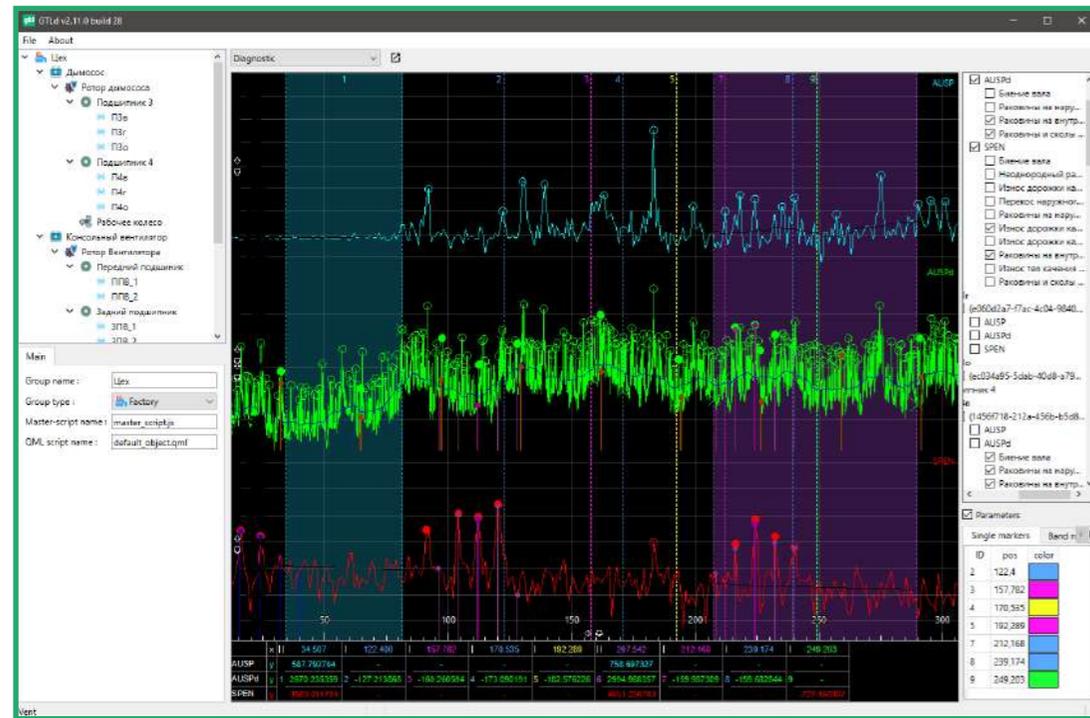
иня	производитель	внешн. д. (мм)	внутр. д. (мм)	диаметр т.к. (мм)	кол-во т.к. (шт)	угол (градус)	
2465	NNU4160M/34...	SKF	500,00	300,00	54,00	18	0,00
2466	NNU4164M/34...	SKF	540,00	320,00	64,00	18	0,00
2467	NNU4176M	SKF	620,00	380,00	64,00	20	0,00
2468	NNU4164/316275	SKF	700,00	420,00	70,00	21	0,00
2469	NNU4856	SKF	350,00	280,00	16,00	62	0,00
2470	NNU4860	SKF	380,00	300,00	18,00	59	0,00
2471	NNU49/500B	SKF	670,00	500,00	36,00	38	0,00
2472	NNU49/530B	SKF	710,00	530,00	38,00	43	0,00
2473	NNU49/560B	SKF	750,00	560,00	40,00	43	0,00
2474	NNU49/600B	SKF	800,00	600,00	42,00	44	0,00
2475	NNU49/630B	SKF	850,00	630,00	45,00	43	0,00
2476	NNU49/670B	SKF	900,00	670,00	52,00	39	0,00
2477	NNU49/710B	SKF	950,00	710,00	54,00	40	0,00
2478	NNU49/750B	SKF	1 000,00	750,00	54,00	42	0,00
2479	NNU49/800B	SKF	1 050,00	800,00	56,00	43	0,00
2480	NNU4920B	SKF	140,00	100,00	8,00	35	0,00
2481	NNU4921B	SKF	145,00	105,00	8,00	36	0,00
2482	NNU4922B	SKF	150,00	110,00	8,00	37	0,00
2483	NNU4924B	SKF	165,00	120,00	10,00	32	0,00

MACHINERY BALL SCREW UNIT (BSU) DATABASE

иня	внутр. д. (мм)	внешн. д. (мм)	диаметр т.к. (мм)	оличество т.к. (шт)	угол (град)
59	ШВПЗ1325Ф30				
60	ШВПЗ5М13				
61	ШВПЗ5М13.1				
62	ШВПЗDMC100				
63	ШВПЗDMC100.1				
64	ШВПЗEEN400				
65	ШВПЗEEN400.1				
66	ШВПЗR3212				
67	ШВПМС032				
68	ШВПМС032.1				
69	ШВПМС032.2				
70	ШВППронзШп				
71	ШВППронзШП7				
72	ШВППронзШП8				
73	ШВПст522МФ4				
74	ШВПст522МФ4	102,000	102,000	9,000	



Spectral vibration diagnostics



Logs, interim calculations

Level	Date	Time	Tag	Text
INFO	06.08.2023	10:19:12.783	Раковины на внутреннем кольце	Признаков дефекта не обнаружено
INFO	06.08.2023	10:19:12.783	Износ дорожки сцепления наружного кольца	Признаков дефекта не обнаружено
INFO	06.08.2023	10:19:12.783	Вибрация вала	Признаков дефекта не обнаружено
INFO	06.08.2023	10:19:12.783	Пик-Вектор в УВЧ диапазоне	4.749517705421927
INFO	06.08.2023	10:19:12.783	Пик-Вектор в ВЧ диапазоне	3.952403104501095
INFO	06.08.2023	10:19:12.783	СКЗ УВЧ вибрации	0.007340834819523093
INFO	06.08.2023	10:19:12.783	СКЗ ВЧ вибрации	0.007359834265699862
INFO	06.08.2023	10:19:12.783	срел/lines	400
INFO	06.08.2023	10:19:12.783	крат/линейность	200
INFO	06.08.2023	10:19:12.783	Расчетный коэффициент обнаружения, %	2.668000000000000
INFO	06.08.2023	10:19:12.783	Расчетное количество пиков	382.5261578047317
INFO	06.08.2023	10:19:12.783	Расчетное разрешение спектра	0.43822087310875116
INFO	06.08.2023	10:19:12.783	Граничная частота спектра	166.86596548372115
INFO	06.08.2023	10:19:12.783	Коэффициент для огибающей фильтра	0.2315633301090337
INFO	06.08.2023	10:19:12.783	Количество долей огибающей фильтра	3
INFO	06.08.2023	10:19:12.783	Центральная частота полосового фильтра	6400
INFO	06.08.2023	10:19:12.783	BFS	10.086170623202744
INFO	06.08.2023	10:19:12.783	ВРП	30.581327010846403
INFO	06.08.2023	10:19:12.783	ВРПО	21.78512567178971
INFO	06.08.2023	10:19:12.783	ФТФ	1.451088378193142
INFO	06.08.2023	10:19:12.783	Площадь спектра	0
INFO	06.08.2023	10:19:12.783	Максимально необходимая частота вращения	4.212487600791433
INFO	06.08.2023	10:19:12.783	FRFC	3.4897698935032493
INFO	06.08.2023	10:19:12.783	Максимально необходимая длительность сигнала	16.04
INFO	06.08.2023	10:19:12.783	Объект диагностики	Подшипник качения 36-2327282M
INFO	06.08.2023	10:19:12.783	Частота вращения вала/механически...	Минимальная рабочая частота...
INFO	06.08.2023	10:19:12.783	Результат	Диагностика прервана
INFO	06.08.2023	10:19:12.783	Критическая неустойчивость частоты вращения...	112.17759394947774
INFO	06.08.2023	10:19:12.783	Раковины на внутреннем кольце	Признаков дефекта не обнаружено
INFO	06.08.2023	10:19:12.783	Износ дорожки сцепления наружного кольца	Признаков дефекта не обнаружено
INFO	06.08.2023	10:19:12.783	Вибрация вала	Признаков дефекта не обнаружено
INFO	06.08.2023	10:19:12.783	Пик-Вектор в УВЧ диапазоне	3.787917963214313
INFO	06.08.2023	10:19:12.783	Пик-Вектор в ВЧ диапазоне	3.787917963214313
INFO	06.08.2023	10:19:12.783	СКЗ УВЧ вибрации	0.00595289901131086
INFO	06.08.2023	10:19:12.783	СКЗ ВЧ вибрации	0.00591833063376241
INFO	06.08.2023	10:19:12.783	срел/lines	400
INFO	06.08.2023	10:19:12.783	крат/линейность	200
INFO	06.08.2023	10:19:12.783	Расчетный коэффициент обнаружения, %	2.668000000000000
INFO	06.08.2023	10:19:12.783	Расчетное количество пиков	382.5261578047317
INFO	06.08.2023	10:19:12.783	Расчетное разрешение спектра	0.5749191518942308
INFO	06.08.2023	10:19:12.783	Граничная частота спектра	219.321795281492
INFO	06.08.2023	10:19:12.783	Коэффициент для огибающей фильтра	0.2315633301090337
INFO	06.08.2023	10:19:12.783	Количество долей огибающей фильтра	3
INFO	06.08.2023	10:19:12.783	Центральная частота полосового фильтра	6400
INFO	06.08.2023	10:19:12.783	BFS	13.267075904803752
INFO	06.08.2023	10:19:12.783	ВРП	40.354858448070636
INFO	06.08.2023	10:19:12.783	ВРПО	28.68549979429546
INFO	06.08.2023	10:19:12.783	ФТФ	1.612362629492974
INFO	06.08.2023	10:19:12.783	Площадь спектра	0
INFO	06.08.2023	10:19:12.783	Максимально необходимая частота вращения	4.212487600791433
INFO	06.08.2023	10:19:12.783	FRFC	4.983703113040095

Vibration diagnostics results (JSON)

```

JSON
Text
  scriptName: debug.js
  tachRatio: 1
  tBLabels: 0
  Diagnostic results
    Sensor1
      0
        debugJSON
        objectOptions
          objectUUID: ((a87a50f-5709-49f7-a993-e478eb50c7a))
        pointOptions
          comment:
            deviceIndex: -1
            idDeviceSelected: false
            label: Sensor1
            signalsModel
          tachOptions
            uuid: ((0160167-d427-484f-b1d3-140b14f63d49))
          pointUUID: ((0160167-d427-484f-b1d3-140b14f63d49))
          recordOptions
            channelInfo
              extended
                isUseOfDiagn: true
                playerChannelsCount: 4
                playerComment:
                playerDevice: D001
                playerRate: 128000
                playerTime: 100
                recordFileName: _2022_05_01_10_00_01.wav
                recordFileSize: 20480000
                recordPath: D:\Dropbox\GTLab\Compan\Диагностика\Проекты\КД\СИГНАЛЫ\
                recordType: 1
            signalsModel
            tachOptions
              timestamp: 1678288516
              uuid: ((d97366c5-df84-4a92-9ac1-9bbcf3dbdcfd))
              recordUUID: ((d97366c5-df84-4a92-9ac1-9bbcf3dbdcfd))
          resultJSON
            Defects: false
            PF: 3.8562658141017243
            PF_UHF: 4.380924700327852
            RMS: 0.004397336863746791
            RMS_UHF: 0.014635434341547376
            Result: true
            Square: 0
            Types
            tag: 13
  1
  2
  debugJSON
  objectOptions
  
```

BUILT-IN QML-BASED INTERFACE BUILDER (VIRTUAL INSTRUMENTS)



```
//асп. Freqency = 1000; //граничная частота спектра
ausp.lines = 1000; //разрешение спектра (количество линий)
ausp.average = 5; //количество усреднений
ausp.unit = gtl.spec.db; //отображение в дБ
ausp.smoothing_factor = 50; //коэффициент сглаживания спектра
ausp.smoothed_line_color = 0x800000ff; //цвет линии сглаживания (средней линии)
ausp.peak_level = 20; //порог обнаружения гармоник
ausp.harm_tolerance = ausp.resolution; //диапазон поиска гармоник */

//фильтр для формирования спектра огибающей
var n = 3; //количество долей октавного фильтра
var kf = (2 ** (1 / n) - 1) / ((2 ** (1 / n)) ** (1 / 2)); //коэффициент для полюс
var filter_spen = gtl.add_filter_iir(gtl.analog_inputs[signals[0].signalChannel];
filter_spen.kind = gtl.filter_iir_butterworth; //тип окна
filter_spen.type = gtl.filter_iir_bandpass; //тип фильтра (полосовой)
filter_spen.order = 10; //порядок фильтра
//filter_spen.frequency = 4000; //центральная частота полосового фильтра
filter_spen.frequency = 6013.41 * Math.log(0.266935 * imp.FREQ()) + 1.1201;
filter_spen.color = 255;
filter_spen.width = kf * filter_spen.frequency; //ширина полосы фильтра

//спектр огибающей
var spen = gtl.add_spen(filter_spen); //назначение переменной спектра огиб
spen.name = "SPEN"; //присвоение имени спектра огибающей
spen.color = 0x00ff0000; //цвет линии спектра огибающей
//spen.frequency = spen.frequency(); //граничная частота спектра огибающей
//spen.lines = spen.lines(); //разрешение спектра огибающей (количество л
spen.average = 0; //количество усреднений
spen.unit = gtl.spec.db; //отображение в дБ
spen.window = gtl.spec.hann; //окно
spen.smoothing_factor = 100; //коэффициент сглаживания спектра
spen.smoothed_line_color = 0xff004dff; //цвет средней линии
spen.peak_level = 10; //порог обнаружения гармоник
spen.harm_tolerance = spen.resolution; //диапазон поиска гармоник */

//RMS и Amplitude в диапазоне спектра огибающей (контроль работы смя тран
var rms_spen = gtl.add_value_rms(filter_spen); //назначение переменной RMS
var ampl_spen = gtl.add_value_ampl(filter_spen); //назначение переменной Amplitu
rms_spen.name = "RMS (spen)"; //присвоение имени RMS (spen)
rms_spen.time = 0.5; //интервал расчета RMS (spen)
ampl_spen.time = 0.5; //интервал расчета Amplitude (spen)
rms_spen.avg_cnt = 4; //количество усреднений RMS (spen)
ampl_spen.avg_cnt = 4; //количество усреднений Amplitude (spen)

//[Диагностика]
gtl.diagnostic.interval = freq.time * freq.avg_cnt;
let state = record.tachoOptions.tachoState; //начальное состояние после выбора
let acq_time = 0;

function diagnose() {
  switch (state) {
    case 0: // считаем частоту вращения и настраиваем спектры
      var freq_max = Math.max(...freq.values);
      var freq_min = Math.min(...freq.values);
      var instability = (freq_max - freq_min) / freq.value;

      if (instability > imp.tolerance()) {
        gtl.log.info("Критическая нестабильность частоты вращения, ⚠️, !
        gtl.log.info("Результат:", "Диагностика прервана");
        //gtl.diagnostic.stop(); //принудительная остановка диагностики

        let _result = {
          Result: false
        };
        gtl.results = _result;
      }
  }
}
```

EXTERNAL SOFTWARE SCRIPT – A BUILDER FOR A TAILORED DESIGN OF METHODS AND ALGORITHMS

OVER 70 POSSIBLE INDUSTRIAL EQUIPMENT DEFECTS ARE PRE-INTEGRATED IN AN OPEN SCRIPT, WITH WHICH YOU CAN INDEPENDENTLY:

- design and test your own unique algorithms and hypotheses
- adjust defect detection methods with no interventions in the main software
- implement classic methods and adjust them based on the data received as a result of experiments and operation
- recalculate all the recorded signals throughout the observation time

- Rolling bearings
- Friction-type bearings
- BSU (ball-and-screw units of CNC machines)
- Tooth gears
- Planetary gear units
- Belt gears
- Chain gears
- Pumps
- Compressors
- Electric engines

GTld desktop. SCRIPT SOFTWARE PILLAR

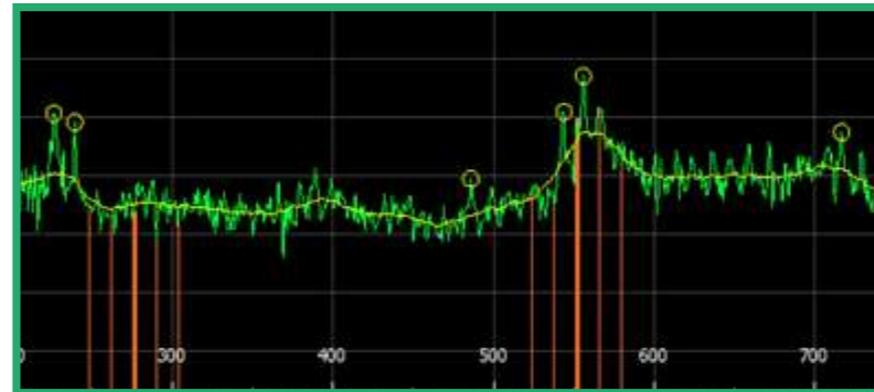
MAIN SIGNAL PROCESSING FUNCTIONS, WHICH CAN BE USED FOR WRITING ALGORITHMS WITH OUR EXTERNAL SCRIPT

- Filtration (HPF, LPF, Band pass, Band rejection) specifying window and order.
- Define monitoring indicators (RMS, amplitude, Peak-Factor, Excess, Frequency, minimum, maximum values, etc.) specifying calculation time and the number of averagings.
- Building Autospectra and Envelope spectra with static and dynamic selection of resolution, border frequency, type and number of averagings.

SELECT OR CREATE BEST DEFECT DETECTION METHODS



- Access spectra pixel arrays, time signal, envelope signal, average line for the calculation of squares and analysis of spectra differences in various frequency ranges.



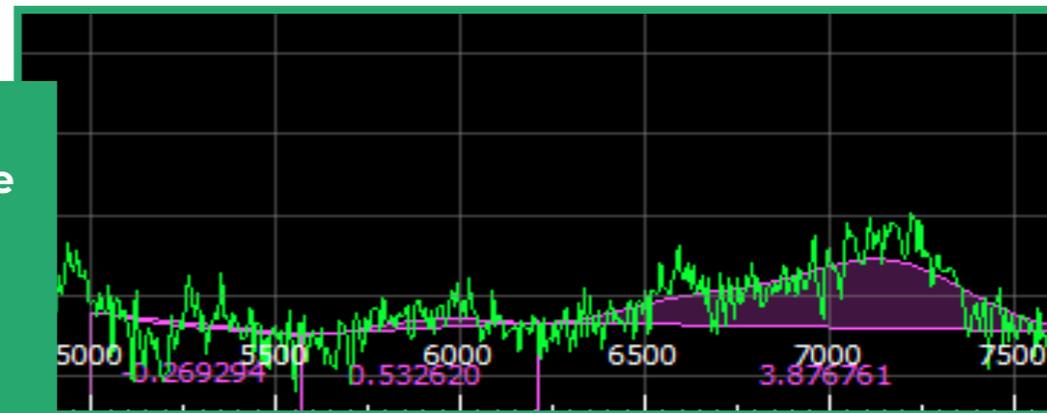
- Define vibration phase.
- Build harmonic series and amplitude modulations.
- Set conditions for the identification of harmonics on spectra (based on excess value and allowed search range).

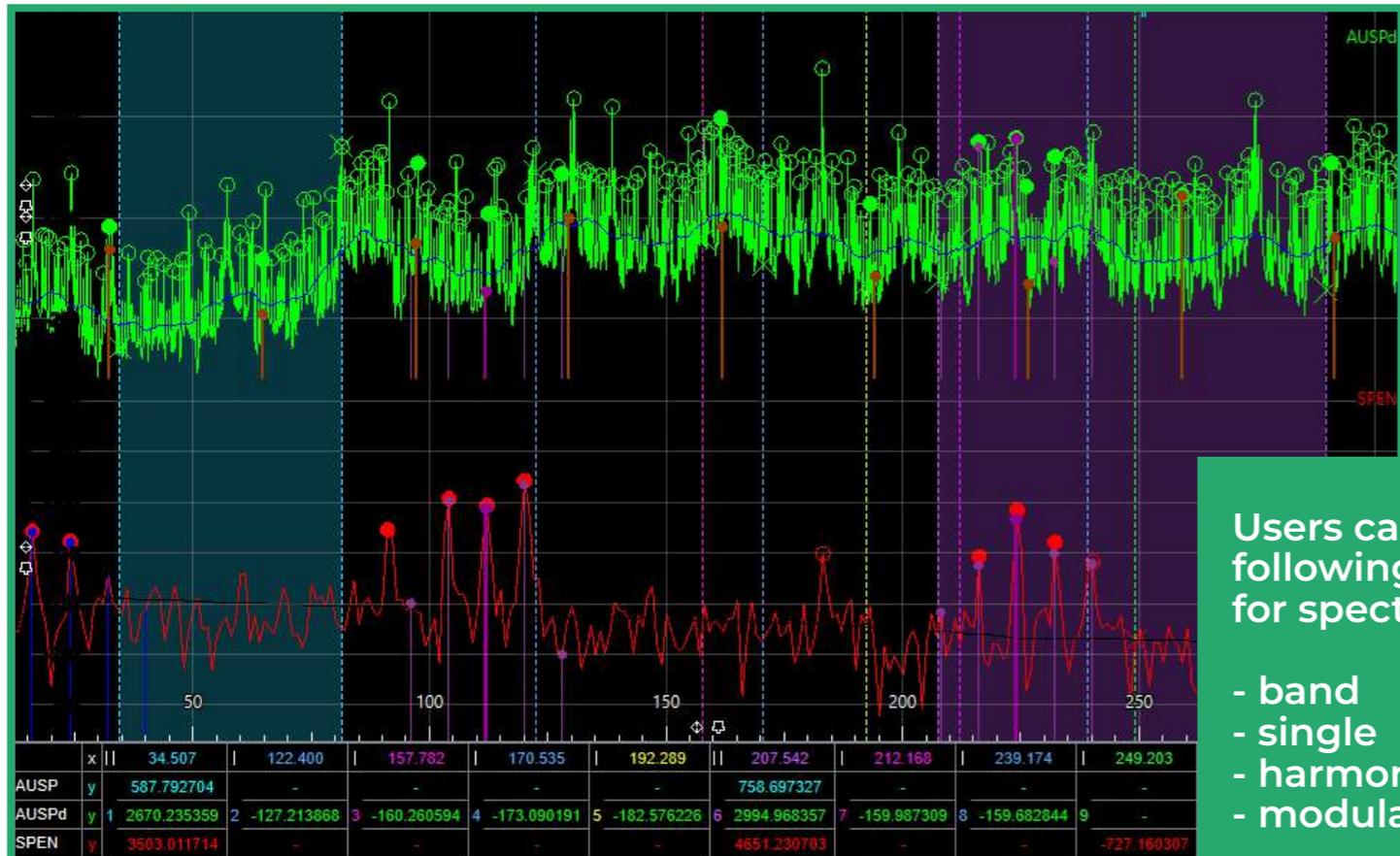


- Set rules for the calculation of spectra harmonics (based on reference point, allowed number of skipped harmonics, analysis of even harmonics).

- Color settings of spectra and harmonics display.

You can order a service of setting up your unique and original methods performed by our specialists





Users can use the following markers for spectra analysis:

- band
- single
- harmonic
- modulating



The scripts include a **JavaScript** interpreter, which allows describing your own logics by involving independent experts for the delivery of proprietary methods leveraging mathematical libraries, array processing functions, cycles and other data structures

The GTLd software uses JSON to transfer diagnostics results, which allows flexible visualization and using received data in your own interfaces.



GTLd-SERVER

Central storage of:

- source signals, spectra, integrated indices and results of diagnostics
- test objects (databases of roller bearings, BSUs, reducers, mechanisms, etc.)
- possibility of data replication, duplication and backup

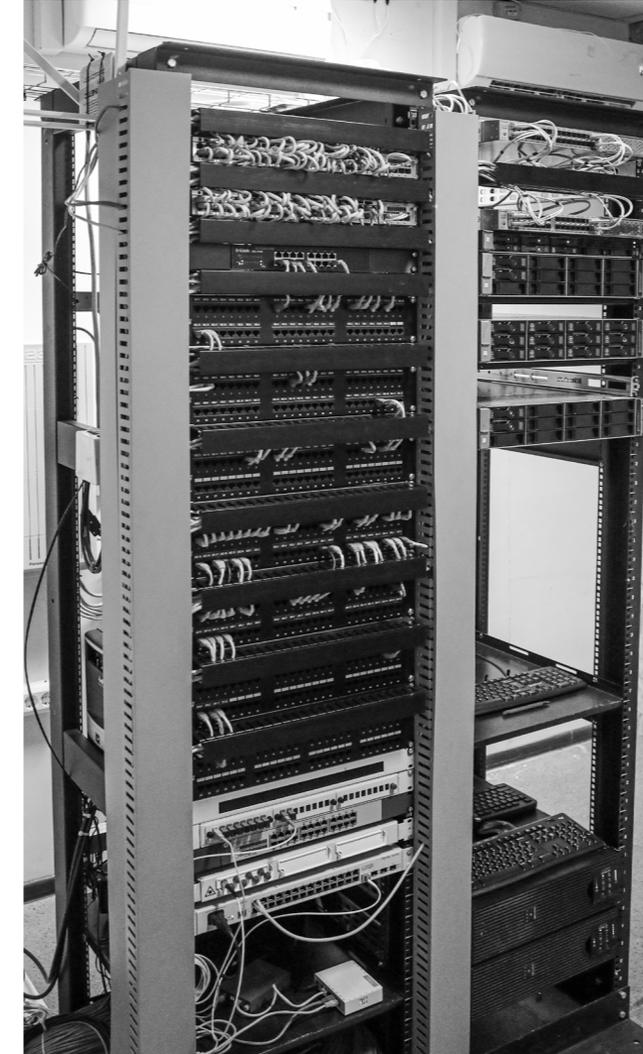
GTLd-DAEMON

ADC application ensuring:

- signal recording;
- preprocessing;
- transmission of recorded signals and their monitoring indicators to the the GTLd-SERVER or via standard communicators (OPC UA, Modbus type) to external Scada systems.

GTLd-SOLVER

Diagnostic calculations using remote computing capacities of remote resources. Automatic launching both via GTLd-Server and GTLd-Daemon applications or manually via GTLd-Desktop



SIGNAL STORAGE AND
PROCESSING SERVERS

HIGH-SPEED
NETWORK SUBSYSTEM

"LIFE" SUPPORT SYSTEM

Possibility of storing data on GTLAB servers

REFERENCES — VIBRATION CONTROL SYSTEMS

1

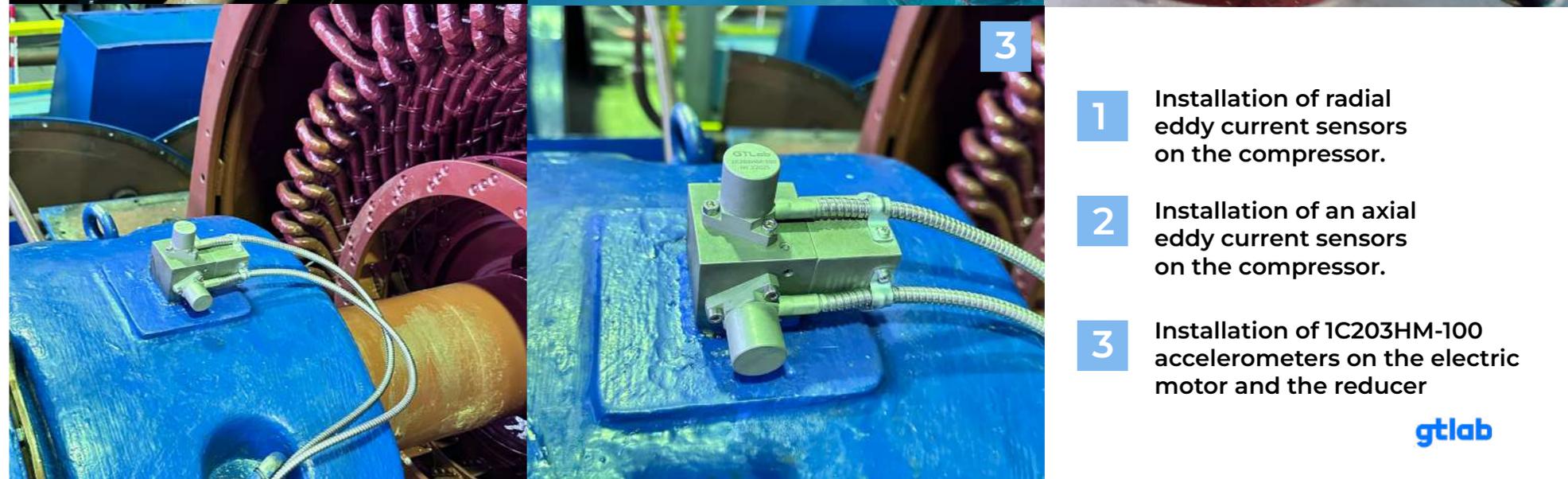
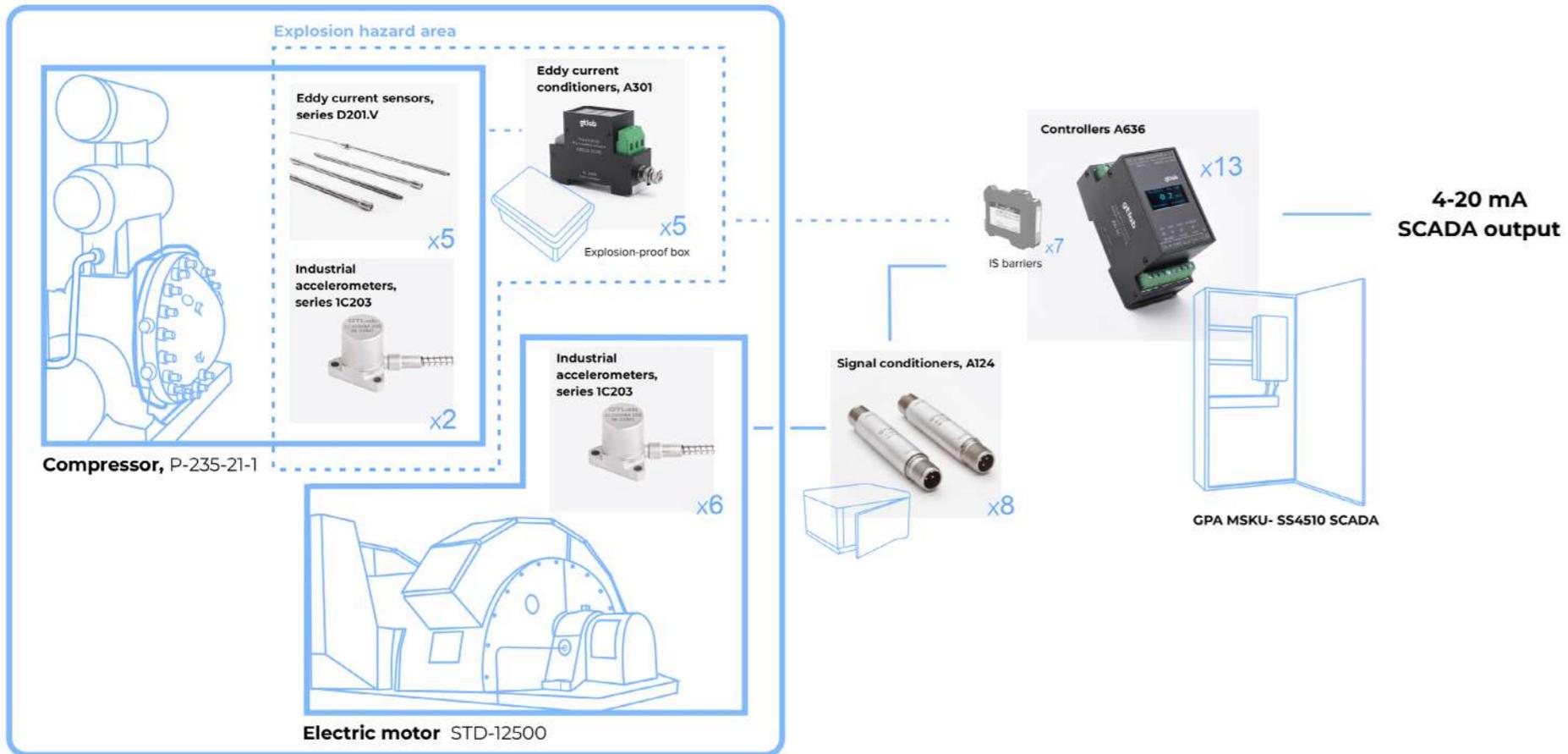
Integration of vibration
control system D5301
at EGPA-12500 to SCADA
GPU MSKU-SS 4510

Customer
Gas Pipeline Management Directorate –
branch of PJSC Gazprom



SCHEME OF VIBRATION CONTROL SYSTEM D5301

GPA EGPA-12500



- 1 Installation of radial eddy current sensors on the compressor.
- 2 Installation of an axial eddy current sensors on the compressor.
- 3 Installation of 1C203HM-100 accelerometers on the electric motor and the reducer



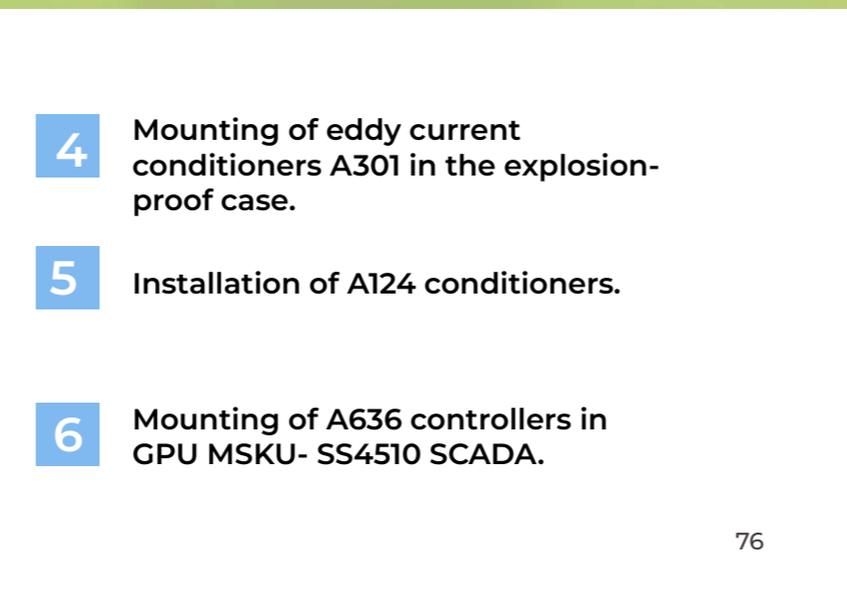
4



6



5



4

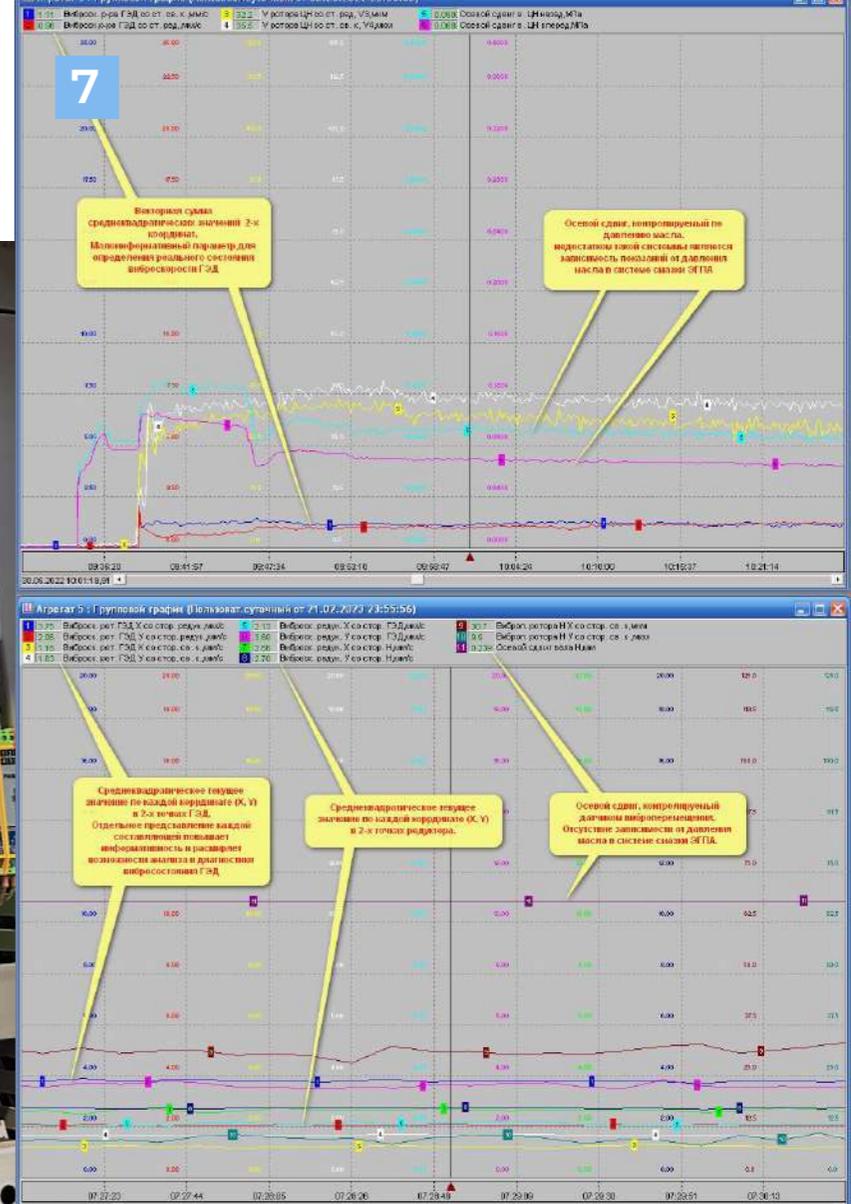
4 Mounting of eddy current conditioners A301 in the explosion-proof case.

5 Installation of A124 conditioners.

6 Mounting of A636 controllers in GPU MSKU- SS4510 SCADA.

7

Display of trends in the GPU SCADA operator screen.



DEVELOPMENT PROSPECTS – STATIONARY VIBRATION CONTROL SYSTEM D5301

Add the vibration diagnostics function of the parameters of linear vibration and torsional oscillations (angular vibrations).

ADVANTAGES:



Early identification of GPU defects, defining their causes, forecasting their development in time.



Prevention of GPU defect evolution and reduce recovery costs.

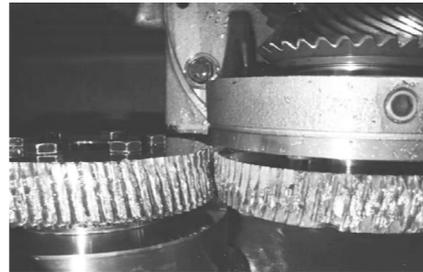


Defining the best GPU operation and recovery technology, if the appeared defects prevent normal GPU operation.

GPU failures due to breakdown of parts:



EGPA-12500 w/o hydraulic coupling

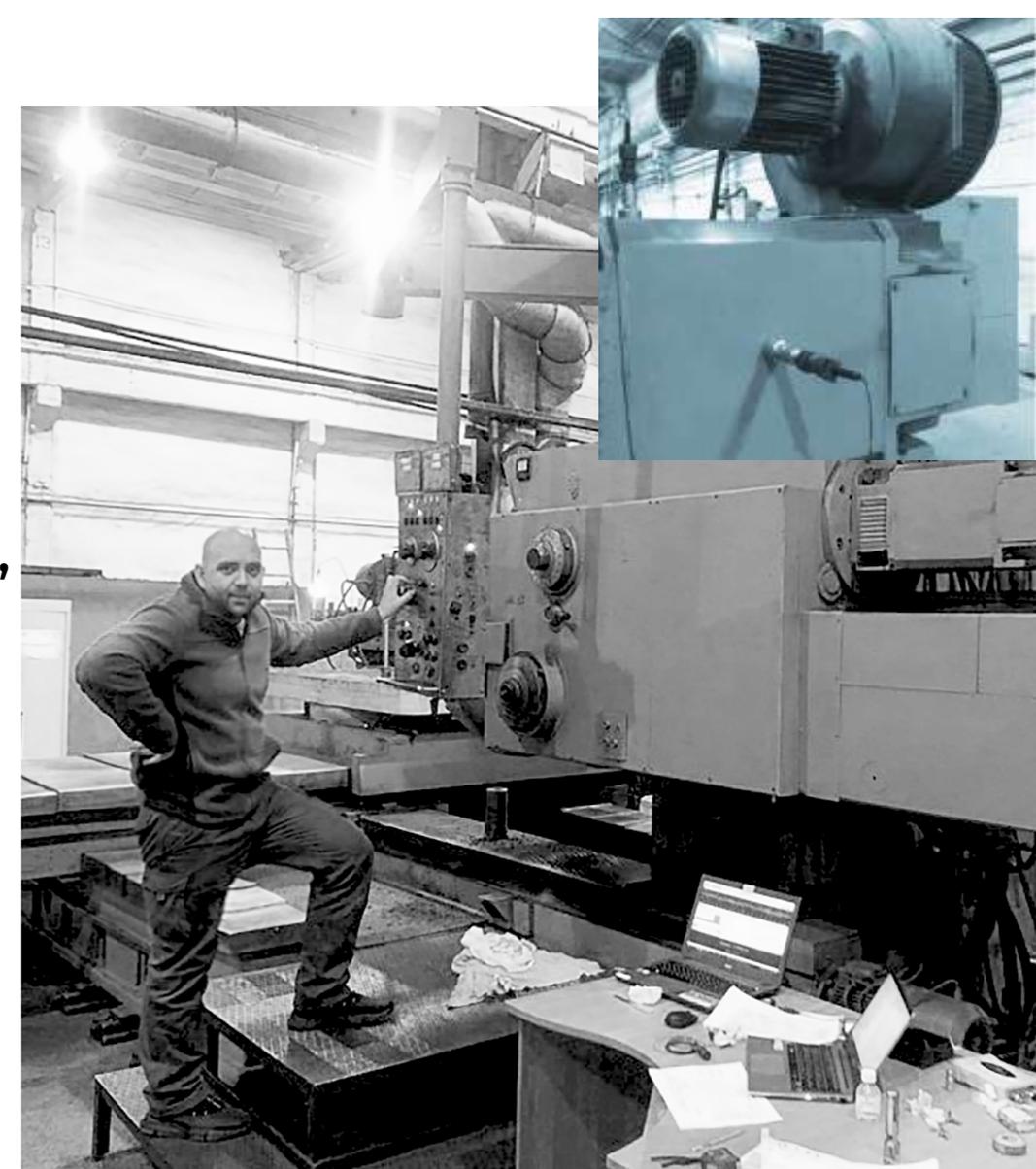


EGPA-12500 with hydraulic coupling

2

Mobile condition diagnostics, machine 2A626F

Spindle unit and bore drive of the horizontal boring mill 2A626F, performed in JSC STROYDORMASH in Alapayevsk



3

Stationary vibration control system of the drive reducer of Nizhny Novgorod – Bor ropeway

Customer:
JSC NKD

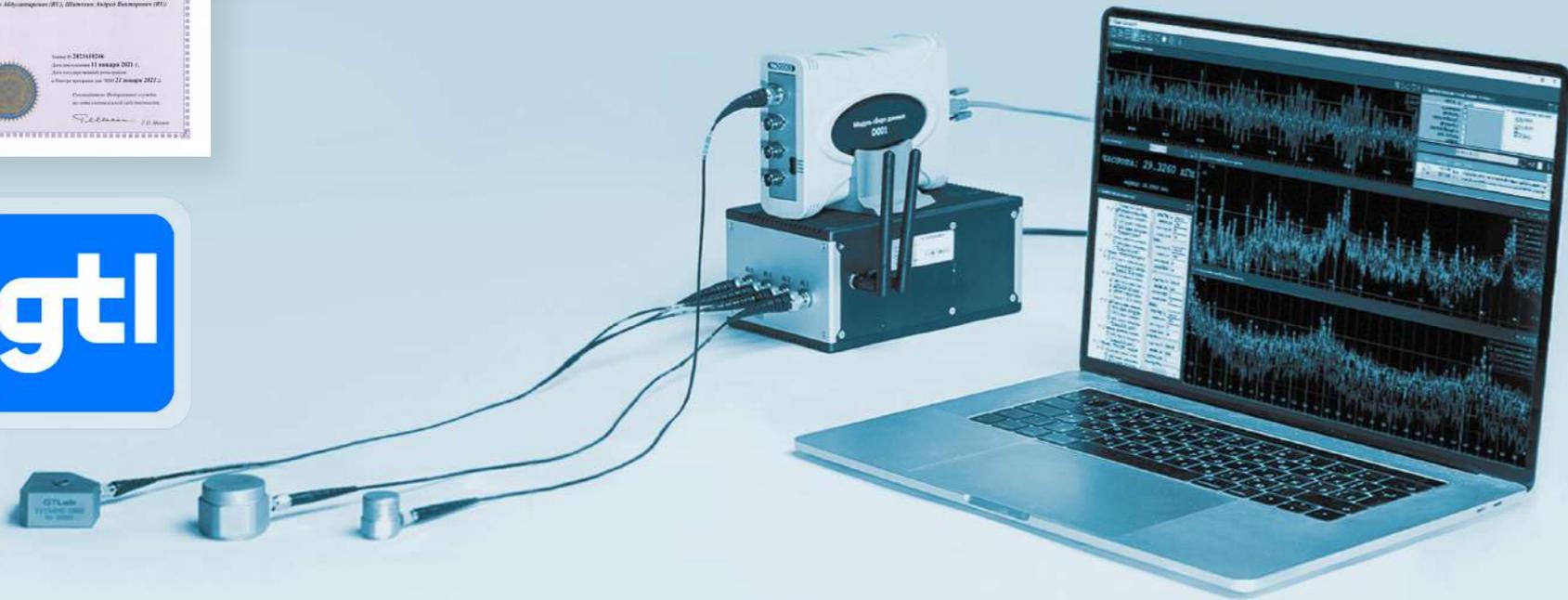


Individual WEB-interface SCADA design

- remote access to ADCs
- data storage server
- data acquisition module D003
- diagnostic calculation module
- signal storage server
- signal storage servers for vibration diagnostic data and separate storage of vibration monitoring data
- interactive WEB-interface for accessing the data



SOFTWARE FOR RECORDING, PROCESSING AND VISUALIZATION OF SIGNALS



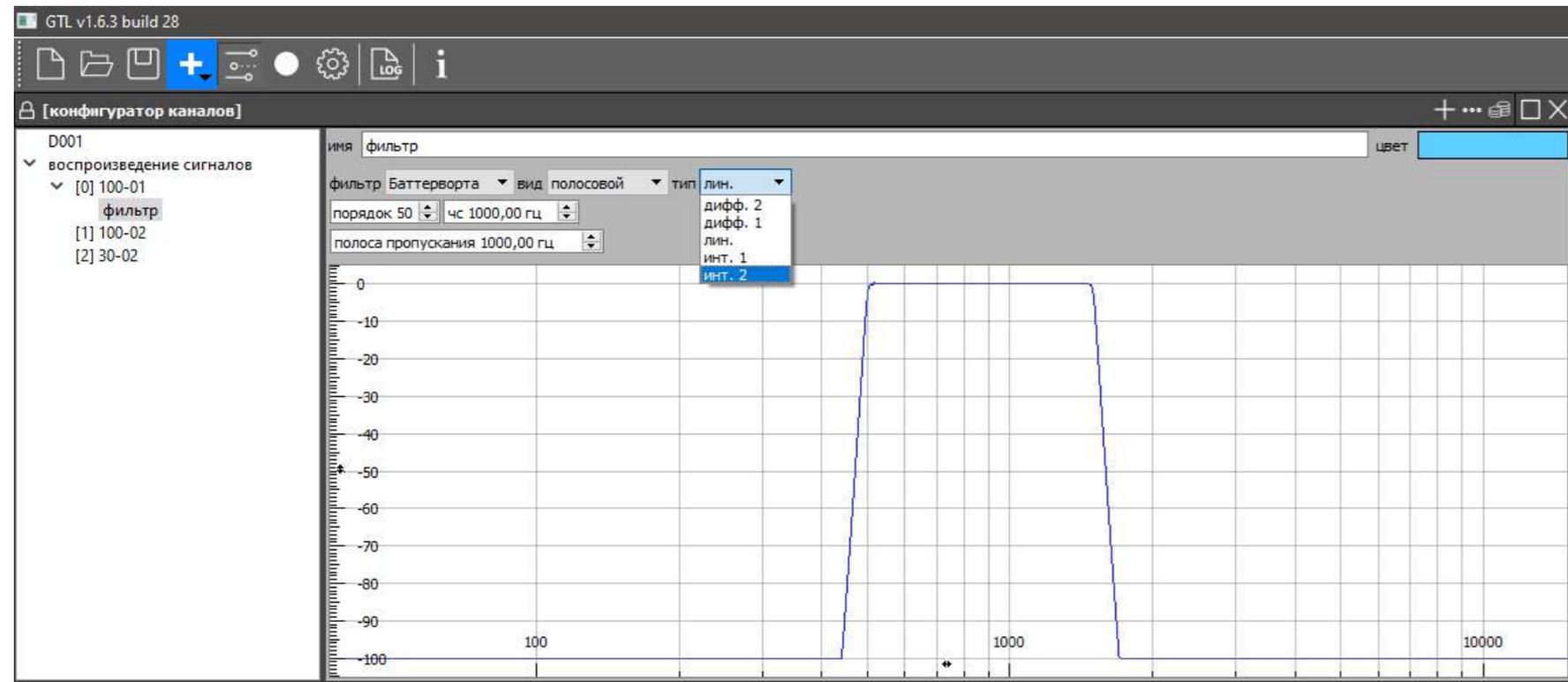
gtl Wide range of virtual devices

- 🔊 Акустическая эмиссия
- 📁 АФЧХ
- F_{xy} Взаимный спектр
- Hz Частотомер
- ☰ Модальный анализ
- 📊 Октавный анализ
- 📈 Осциллограф
- F Спектроанализатор
- 📊 Спектр огибающей
- ~V Вольтметр переменного тока
- V Вольтметр постоянного тока

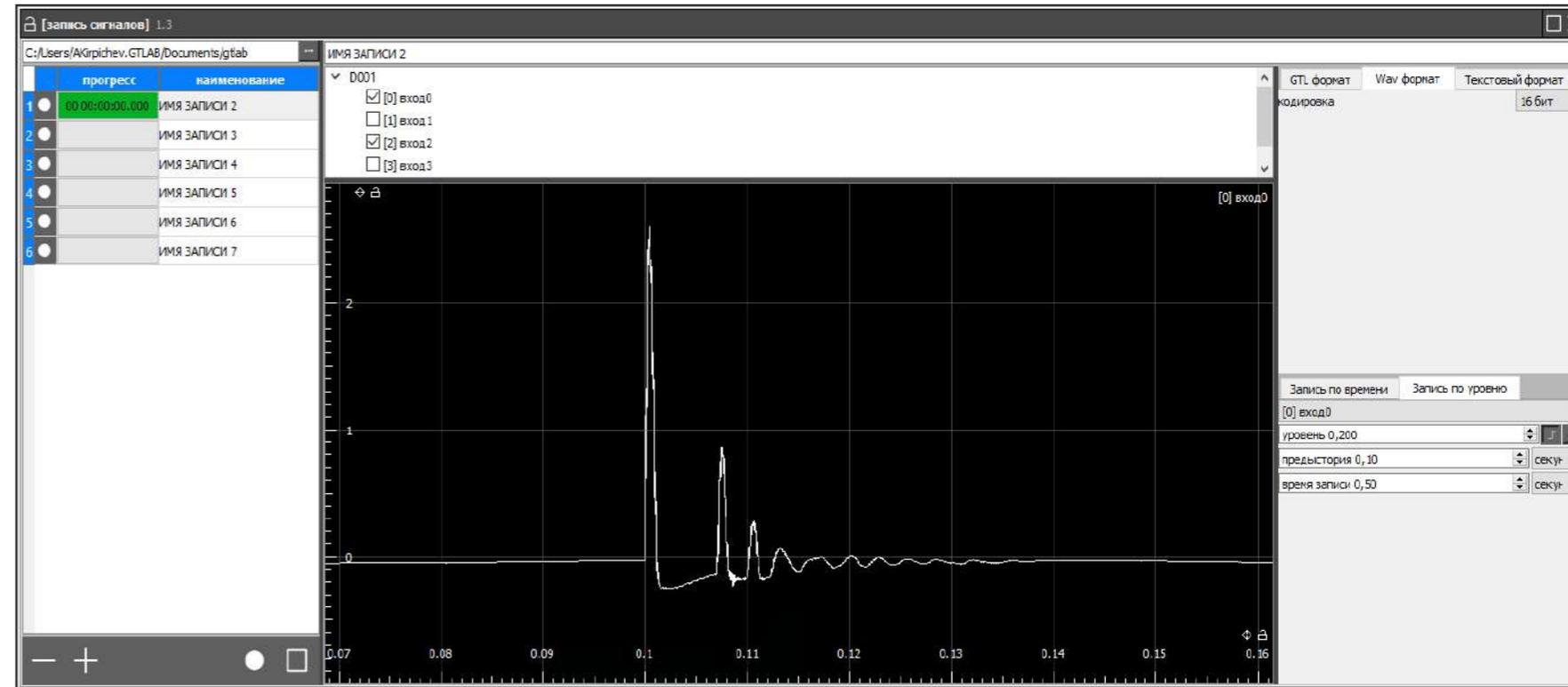




Signal filtering (up to order of 50), integration and signal differentiation

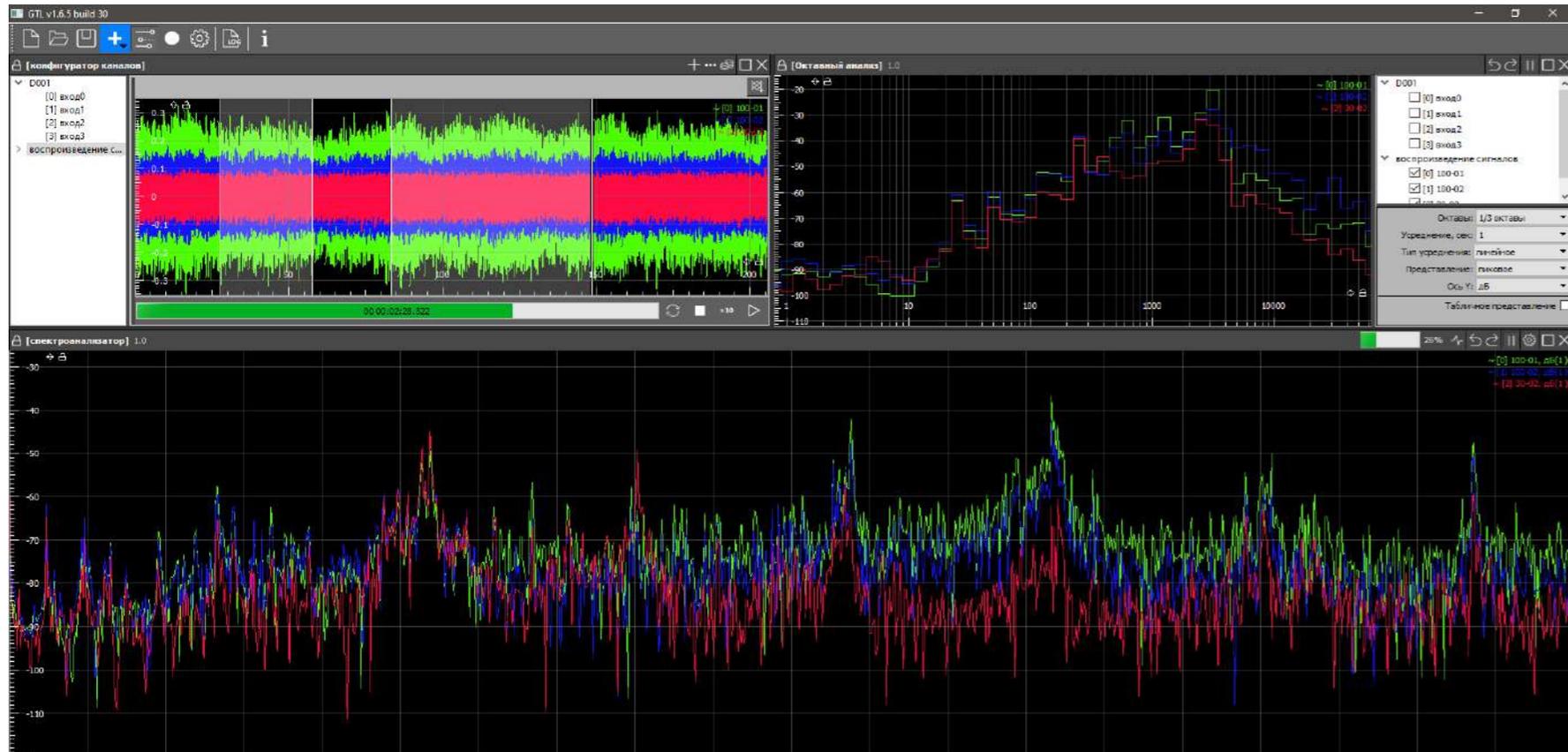


Multichannel time- and level-based signal recording with further display of recorded oscillogram



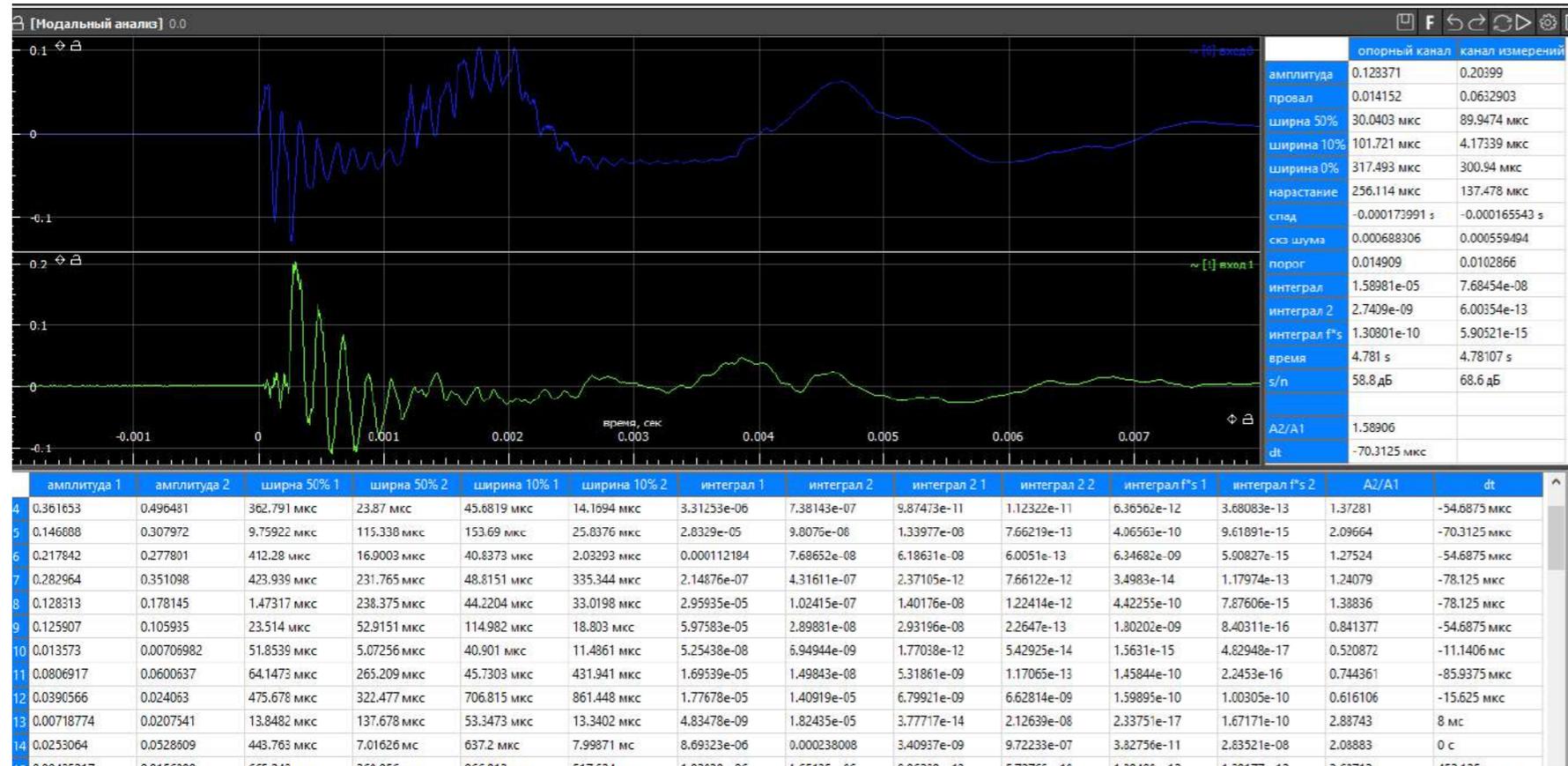


Reproduction of signals with a possibility to select individual sections for further spectrum analysis



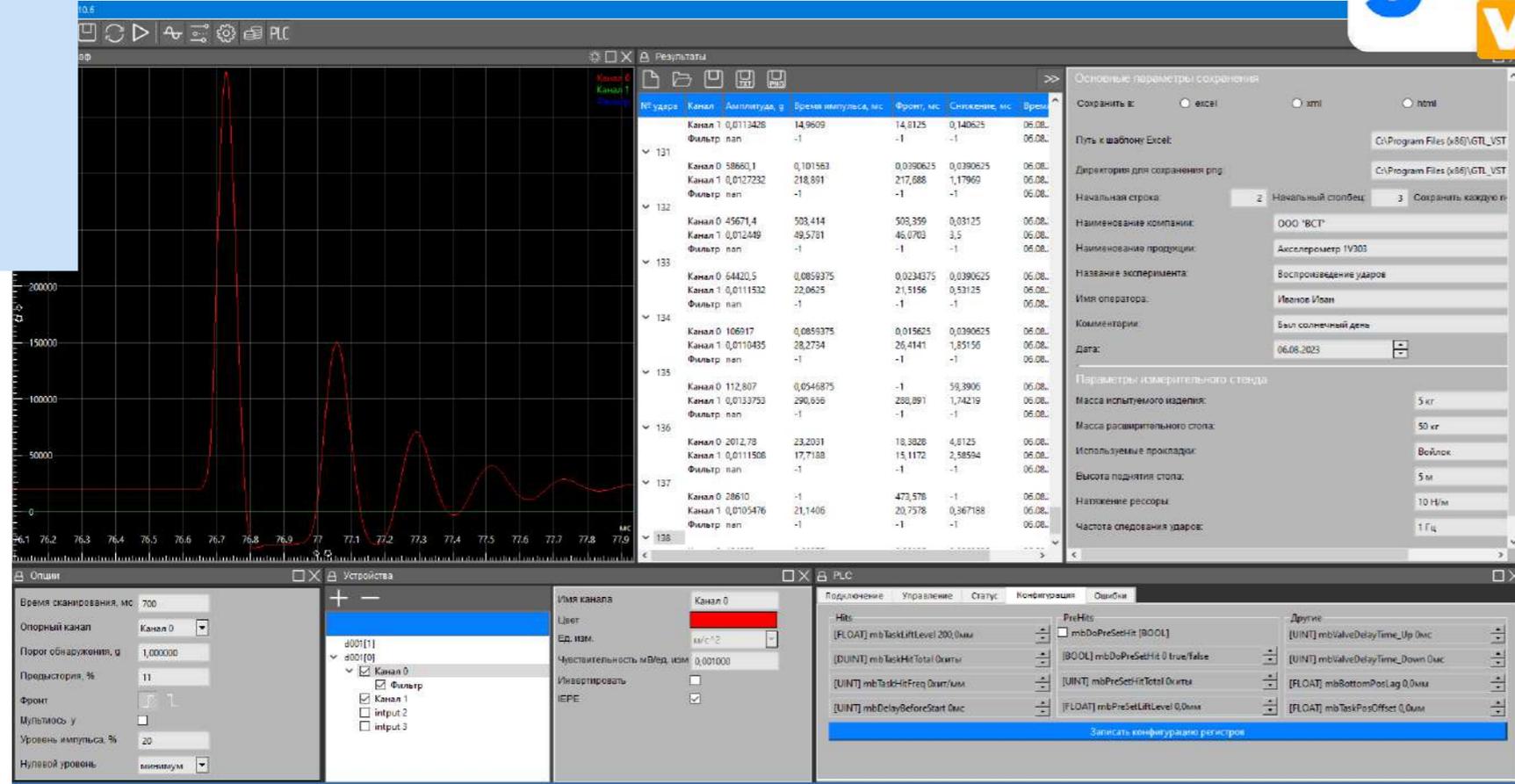
Flexible layout of virtual device windows





REFERENCES — DELIVERY OF DESKTOP APPLICATIONS

SHOCK TABLE MANAGEMENT SOFTWARE



1 Measurement and visualization of shock parameters using the reference channel and measurement channels.

2 Saving results in html, xml, xls, pdf formats.

3 Generation of the measurement protocol.

4 Controlling the moving element of the table via Modbus.

Протокол испытаний №

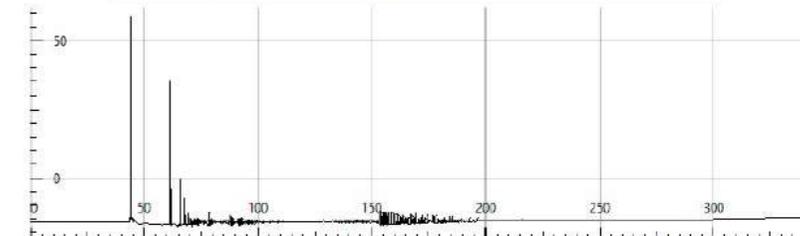
Наименование компании:	ООО «ВСТ»
Наименование продукции:	IV303
Наименование эксперимента:	Восп. удар
Имя оператора:	Иванов
Дата:	03.05.2023
Комментарии:	

Параметры ударного стола

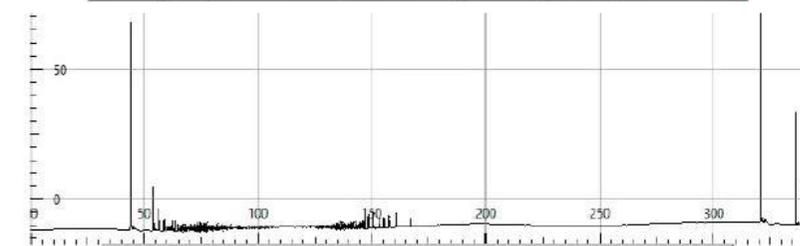
Масса испытываемого изделия:	5 кг
Масса расширительного стола:	50 кг
Используемые прокладки:	Войлок
Высота поднятия стола:	5 м
Напряжение рессоры:	10 Н/м
Частота следования ударов:	1 Гц

Результаты

№ удара	Канал	Амплитуда	Время импульса	Фронт	Снижение	Время
0	input 0	79.86484498471924	0.171875	0.03125	0.0546875	03.05.2023 22:49:16



№ удара	Канал	Амплитуда	Время импульса	Фронт	Снижение	Время
1	input 0	104.99315646504162	277.546875	277.4140625	0.046875	03.05.2023 22:49:16



№ удара	Канал	Амплитуда	Время импульса	Фронт	Снижение	Время
1	input 0	104.99315646504162	277.546875	277.4140625	0.046875	03.05.2023 22:49:16

Application for the recording of AFC from vibration sensors

The screenshot shows the software interface for recording AFC from vibration sensors. It includes a configuration window on the left, a central control panel with 'reference' and 'verified' values, a table of frequency and amplitude settings, and two graphs at the bottom: a time-domain waveform and a frequency-domain plot.

- 1 Calculation of the conversion factor at each of the selected frequencies
- 2 Controlling the vibration table.
- 3 Generation of the measurement protocol.

gtlab.pro
ООО "ГТЛАБ"
+7 831-30 49444

Протокол испытаний

Модель датчика: 1V102TB-10
 Серийный номер: №23007
 Изготовитель: ООО "ГТЛАБ"
 Номер измерения: 1
 Ось (канал): 1
 Дата: 10.07.2023
 Тип, размерн. к. пр.: IEP, мВ/мс2
 Испытания провел: Кирейчев Д.П.

Частота, Гц	Коэф. преобр.	Отклон., %	Ускор., м/с2
5	1,00183	-2,67058	0,655402
10	1,04594	1,614565	1,922852
15	1,04873	1,886009	3,313038
30	1,04016	1,052896	6,169838
35	1,04225	1,256157	7,458634
50	1,03522	0,573367	10,00249
100	1,03941	0,980159	10,47004
159	1,02905	-0,02663	11,73622
160	1,02937	0,004712	11,73844
200	1,02932	0	16,54346
300	1,02683	-0,24214	15,35062
400	1,02844	-0,08548	15,1682
500	1,02261	-0,65213	15,10927
600	1,01983	-0,92217	14,75814
700	1,01753	-1,14557	14,49031
800	1,01407	-1,48174	14,33307
900	1,01559	-1,33387	14,23088
1000	1,01703	-1,19376	14,37461
1500	1,01219	-1,6645	14,19589
1700	1,01347	-1,53951	14,19345
2000	1,02066	-0,84171	14,36678
3000	1,00046	-2,80415	14,82236
4000	1,00135	-2,71786	14,34599
5000	0,99191	-3,63502	14,45082
5500	0,99566	-3,27069	14,85328
6000	1,0125	-1,63449	14,75675
6500	1,01713	-1,18403	14,51592
7000	1,00928	-1,94689	14,45108
8000	1,01957	-0,94695	16,02629
9000	1,02848	-0,08156	19,27237
10000	1,0361	0,659001	11,32336
11000	1,05198	2,2013	12,97177
12000	1,05035	2,043245	13,13887
13000	1,08901	5,798628	12,88666
14000	1,10692	7,538738	12,51375
15000	1,06009	2,989332	12,20069
16000	1,09007	5,901485	16,16324
17000	1,11877	8,690192	16,03661
18000	1,12296	9,096779	8,45322
19000	1,16501	13,18274	15,66718
20000	1,2324	19,72949	16,60988

АЧХ

IMPORT SUBSTITUTION



We will select or design functional equivalents

IMPORT SUBSTITUTION

1C103HB-XX



1C103TB



1C302HA



1C307TB



1C201HA



gtlab

Charge accelerometers

357B01, 357B03, 357B21,
357B33



357B02, 357B04, 357B12,
357B14



357A08



357B14



357A100



PCB Piezotronics

IMPORT SUBSTITUTION

1V001HB-XX



1V101HB-XX



1V102HB-XX



1V101TB-XX



1V102TB-XX



IEPE accelerometers

IMPORT SUBSTITUTION

1V106HB-XX



1V107HG



1V151HC-XX



1V152HA-XX



1V152HC-XX



IEPE accelerometers

301A10, 301A11



353B31, 353B33, 353B51



353B01, 353B03



353B32, 353B34, 353B52



353B02, 353B04



355B02, 355B03, 355B04



PCB Piezotronics

352A24



354A04, 354C10



356A01, 356A61



356A02, 339A30



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PCB Piezotronics

IMPORT SUBSTITUTION

1V153HC-XX



1V154HC-XX



1V201HH-XX



1V202TH-XX



1V203HT-XX



IEPE accelerometers

IMPORT SUBSTITUTION

1V202TT-XX



1V203HH-XX



1V295HT-XX



1V158HA-XX



Pressure sensor 5V110TB-XX



IEPE accelerometers

gtlab

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354C02, 354C03



354A05



625B01, M625B01



603C01, M603C01, 622B01, M622B01, 601A01, M601A01



TO602D01

PCB PIEZOTRONICS
AN AMPHENOL COMPANY

PCB Piezotronics

PCB Piezotronics

TO603C01, TO622B01



602D01, M602D01



605B01



356A02



113B28



PCB PIEZOTRONICS
AN AMPHENOL COMPANY

IMPORT SUBSTITUTION

2A201TH-XX, 2A201TA-XX,
2A202TH-XX, 2A202TM-XX



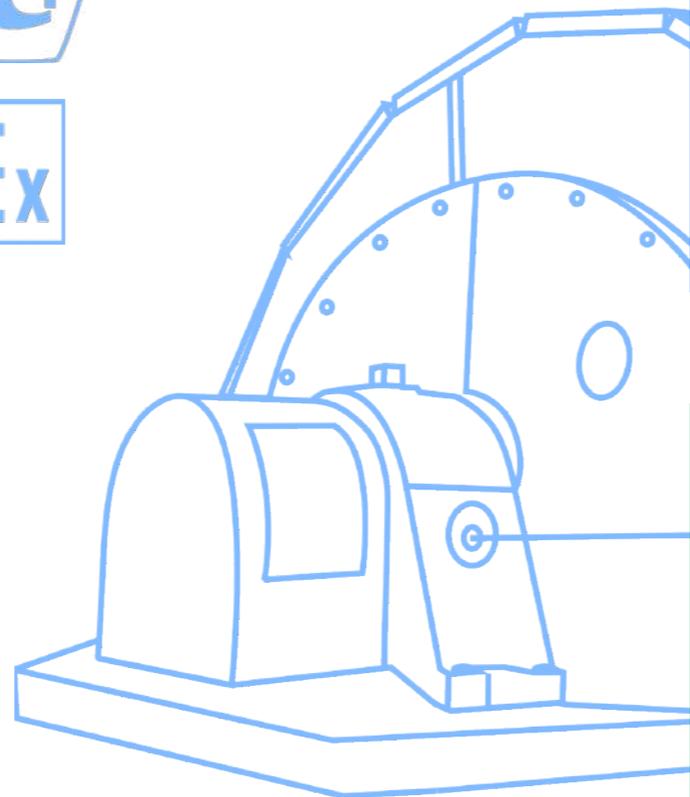
2A202TH-XX



2A206HH-XX



Vibration speed sensors



PCB PIEZOTRONICS
AN AMPHENOL COMPANY

IMPORT SUBSTITUTION

4V301D



4V302D



4V303D



4V304D



Impact hammers

640B11, 640B12, 640B61,
641B00, 641B01, 641B02,
641B11



640B00, 640B01, 640B02,
641B00, 641B01, 641B02,



642A01



PCB Piezotronics

086C03, 086C04



086C01, 086C02



086D05, 086D20, 086D50



086D50



PCB PIEZOTRONICS
AN AMPHENOL COMPANY

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PCB Piezotronics

PCB Piezotronics

IMPORT SUBSTITUTION

4V102HB-XX



4V103HB-XX



4V104HB-XX



4V105HB-XX



Force sensor

IMPORT SUBSTITUTION

2V203TH



5V101TB-XX



2V222HH-XX



Eddy current sensors D2XX.



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221B0



M223B



M224B



208C04



PCB PIEZOTRONICS
AN AMPHENOL COMPANY

330500



165855



BN-330750



3300 XL NSv Proximity Transducer



Bently Nevada

PCB Piezotronics

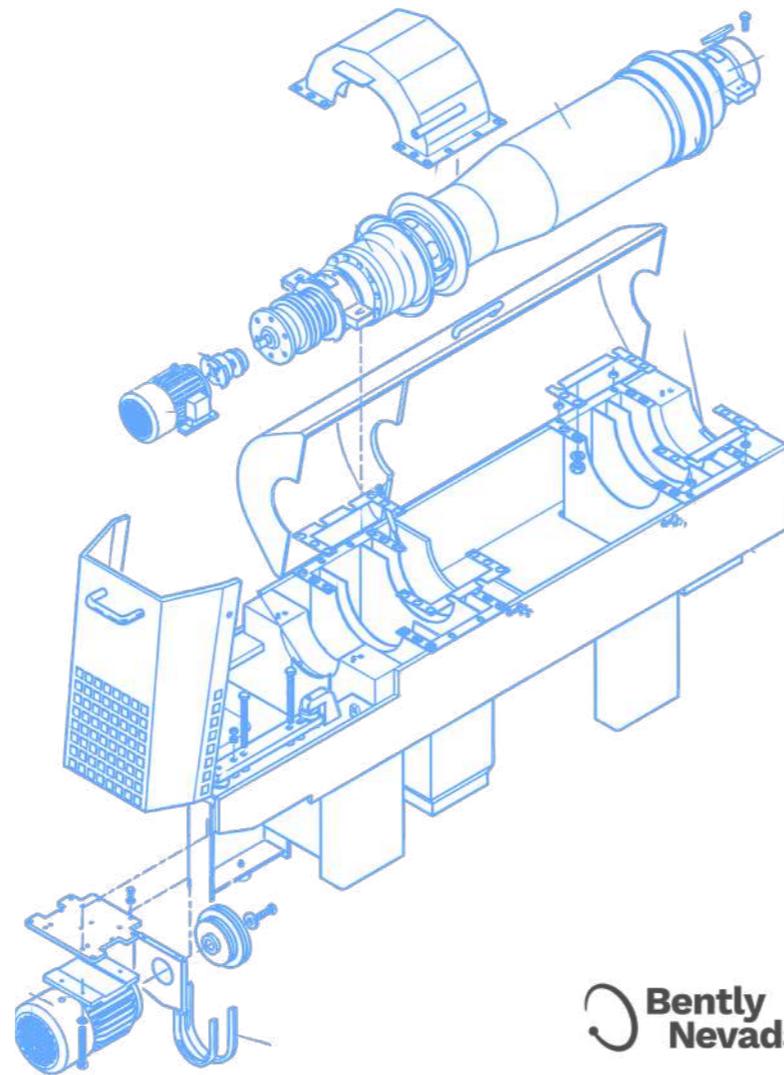
Bently Nevada

IMPORT SUBSTITUTION

TV202TH-XX



TV211TT-XX



Bently Nevada

200350



330400



IMPORT SUBSTITUTION

TV202TA-XX



1C103TB



1C102TB



1C102HB



TV202TH-XX



Accelerometers

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8325, 8326



4384, 4384-V



4370



4381, 4381V, 4394



AS063



Brüel & Kjær

Bruel & Kjaer

gtlab

Bently Nevada

IMPORT SUBSTITUTION

1C301HA



4C101HB-5



1V108HB/TB-XX



IMPORT SUBSTITUTION

1V208HA-XX



1V203HH-XX



Eddy current sensors D2XX.



Controller A633



8309



8200



4508



AS-020, AS-022, AS-030



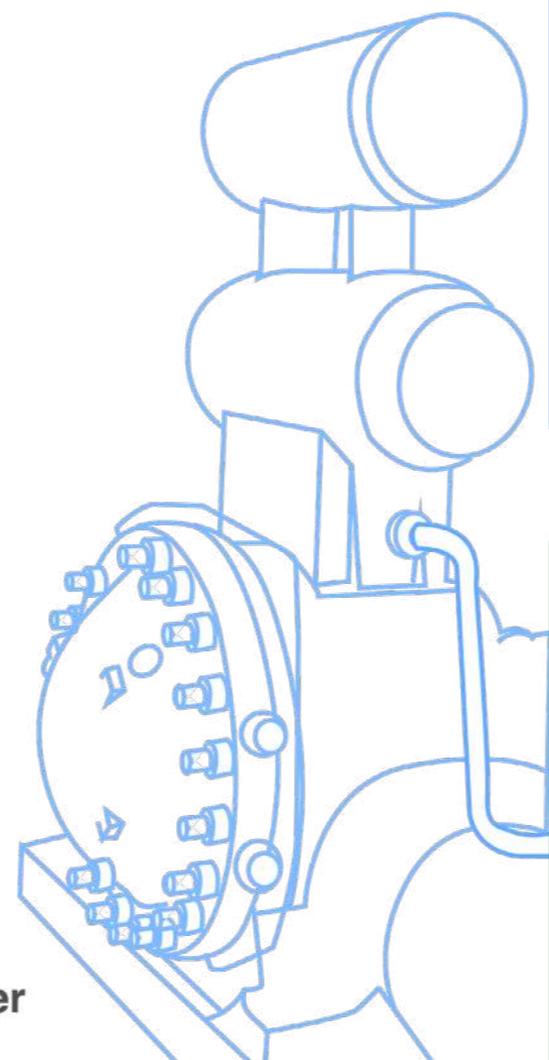
AS-079



Eddy current sensors IN-XXX



VIBROCONTROL 920



IMPORT SUBSTITUTION

Accelerometers

1C103HB-XX

1C103TB

1C201HA-XX

1V102HB-XX

1V104HB-XX



IMPORT SUBSTITUTION

Accelerometers

1V102TB-XX

1V151HC-XX

1V152HA-XX

1V152HC-XX



3055C, 3255C, 3088C,
3122C, 3122C

3056C, 3256C, 3152C

3035C1, 3035C1G

3055B, 3055D

3035B



3056D

3143D

3133A, 3133B

3023A, 3263A, 3023M, 3053B,
3333A



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Dytran Instruments

Dytran Instruments

IMPORT SUBSTITUTION

1V303TB-XX



1C221HA-XX



A120-XX



IMPORT SUBSTITUTION

1V101TB-XX



1V102HB-XX



1V303TB-XX



1V152HC-XX



5C203TA-100-60



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3200B



3245C2



4754B



8712



8640, 8703



8742A, 8743A



8688, 8766



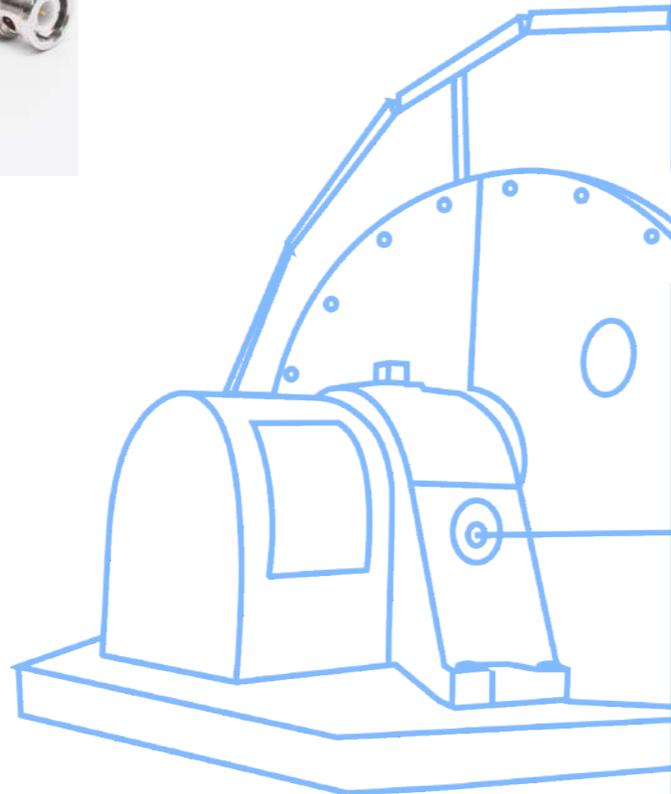
6021A



KISTLER

Dytran Instruments

KISTLER



IMPORT SUBSTITUTION

5C201TA-250-20



5C203HH-100-170



5C203HH-100-170



A123-25-02



IMPORT SUBSTITUTION

1V202TH-XX



1V601TH-XX



2A202TH-XX



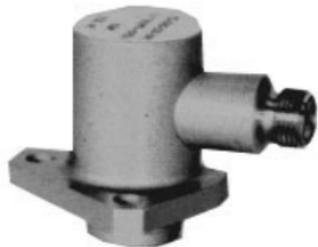
7C101HB



CP 216



CP 104



CP 104



IPC704



MEGGITT

Emerson

A0760GP



SPM Instrument

SLC144TB, SLD144
SLD243B, SLD244B



Metrix Instrument

ST6917, ST6918, ST6911, ST6923



MISTRAS

R15a



АНАЛОГИ

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MEGGIT

IMPORT SUBSTITUTION

TV202TT-XX

Vibration analyzer D104

Vibration meter D141



WILCOXON

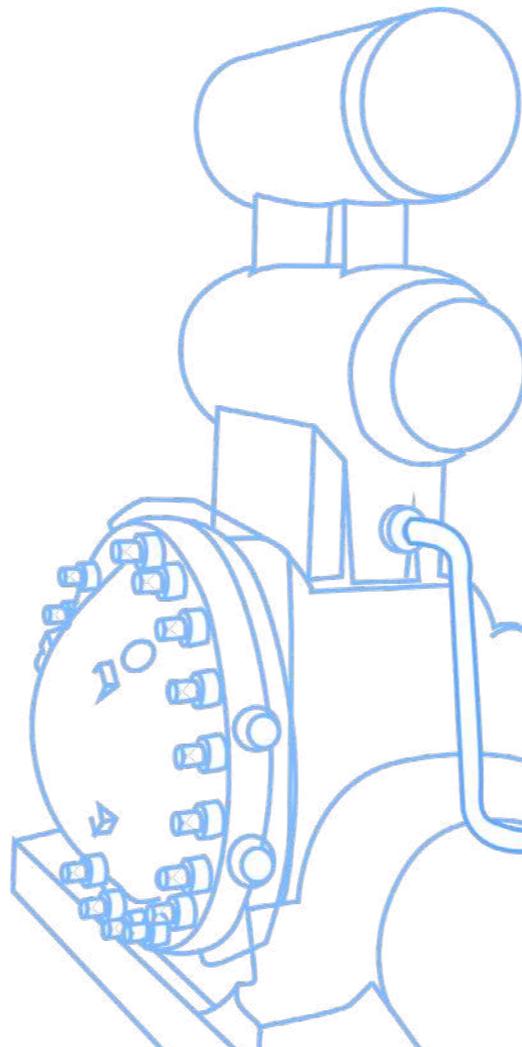
780A, 786A, 787A,
793L-33, 797L-33

OIDB-METRAVIB

Vibration analyzer ONEPROD
FALCON

SVANTEK

Vibration meter SVAN974

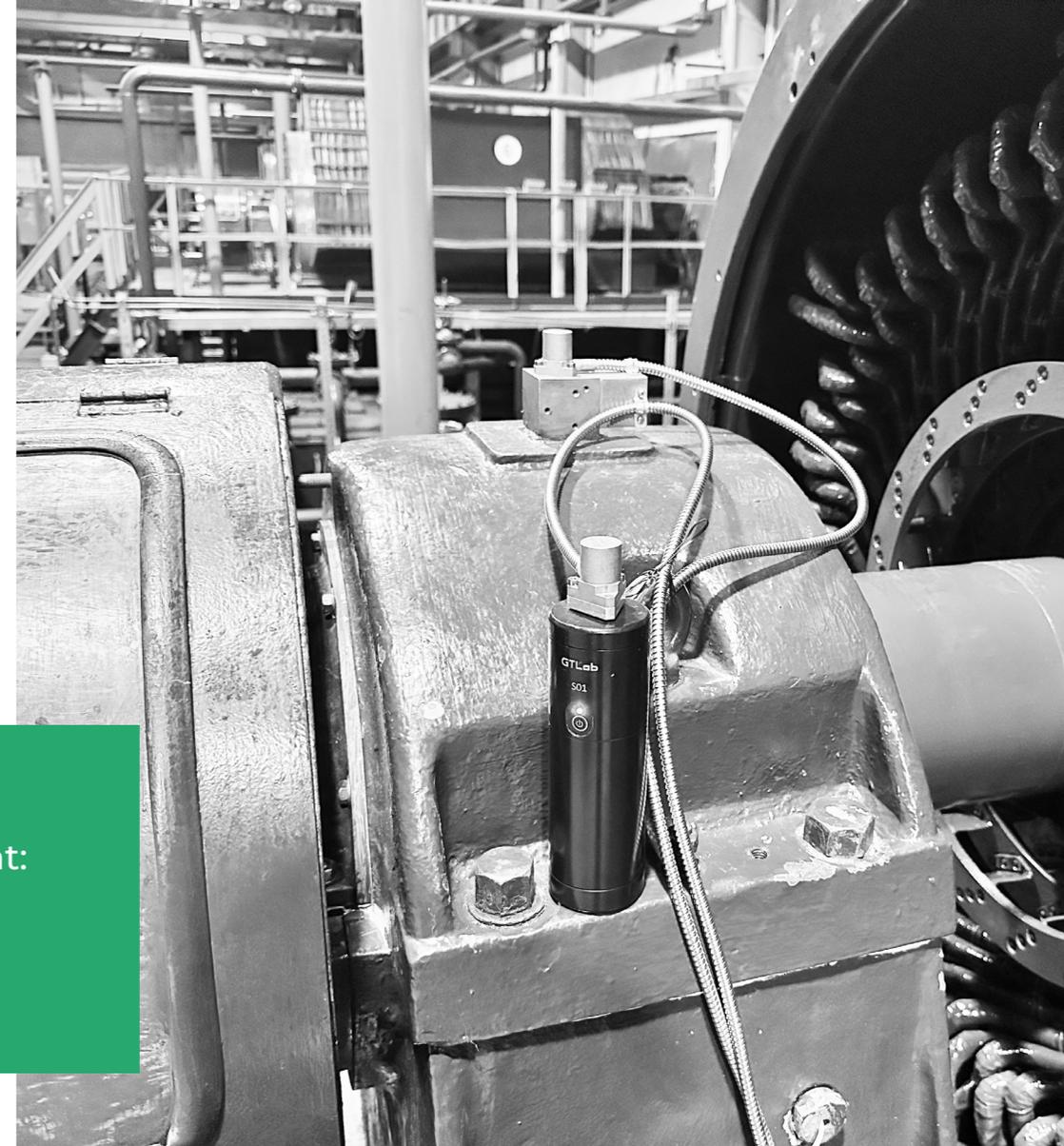


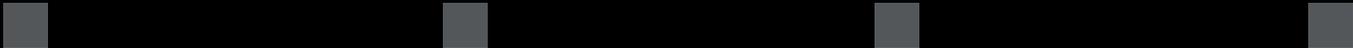
WHAT WE CAN DO AT OUR OWN COST IN YOUR PREMISES:

- Test operation of the measurement channel
- Equipment demonstration

Order test
measurements at:

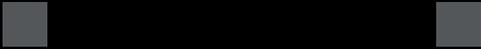
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