



ELECTRONPRYLAD

PRODUCT
CATALOG

AESTHETICS
IS IN DETAILS



Public Joint-Stock Company
"Scientific-Technical Complex
"Electronprylad"



THE STATE
PROPERTY
FUND
OF UKRAINE



CATEGORIES OF DEVICES MANUFACTURED BY PJSC

«Scientific and Technical
Complex «Elektronprylad»

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6 GTD control units

- ◇ BUK-148 (synchronization of main GTDs as part of AN-148 and AN-158)
- ◇ BUK-500 (application of GTD MS-500)
- ◇ BUK-MS2 (application of GTD AI-450MS as part of AN-148, AN-158)
- ◇ BUK-500-3000 (development of GTD TV3-117SBM-1s, TV3-117SBM-5s)
- ◇ BUK-500-14 (application of GTD MS-500-14 as part of AN-2-100)
**GTD - gas turbine engine, BUK - management and control unit.*

11 Control and vibration detection units

- ◇ BSKV-436FM (application for GTD D-436FM as part of AN-178)
**BSKV - vibration monitoring system block.*

12 Ice prevention system control unit

- ◇ BUK-POS-158-01 (as part of AN-148, AN-158, AN-178)
**BUK-POS - anti-icing system control and monitoring unit.*

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**BPI - information rewriting (copying) unit.*

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- ◇ BUR-92A and its modifications (as part of AN-140, AN-74, AN-148, AN-158, AN-178, AN-124)
- ◇ BUR-4-1 and its modifications (as part of MI-2, MI-8, MI-24, MI-17, MI-35, AN-2-100, AN-24, AN-24, AN-32, L-39)
- ◇ BUR-4-1-10 and its modifications (as part of SU-25, SU-27, Il-76, AN-28)
**BUR - on-board registration device, on-board recorder.*

23 On-board built-in crew monitoring and warning system EKRAN-13M-4

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- ◇ M11A (thermocouple signal processing)
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- ◇ M15 (RV5 radio altimeter signal processing)
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- ◇ M3 (signal processing 115V 400 Hz)
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**M-module, SKT - sine-cosine transformer.*

27 System «EKRAN» 02M-3 Information collection and output system

28 Ground systems for servicing on-board systems BPK-88 series 3KM, BPK-88 series 3K and BSKP-99

- ◇ PIP-29
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32 Aircraft sensors

- ◇ DTK-158 (as part of AN-158 fuel level and temperature, analogue)
- ◇ DSV-01 (designed to detect water residues in fuel, digital)
- ◇ DTR-1 (as part of AN-178)
- ◇ PS (development as part of GDT, digital)
**DT - fuel sensor, DTK - fuel meter sensor with compensator, SSU - light-conducting level alarm; DSV - free water sensor, DTR - resistive temperature sensor.*

34 On-board aviation LED indicators of aircraft systems

- ◇ IPVD-2-1 (as part of MI-2, adapted for night vision goggles)
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**ІChSh - temperature indicator and frequency indicator, IPVD - helicopter engine parameter indicator, IPRT - fuel lever position indicator.*

36 On-board systems for monitoring, controlling and recording parameters of aircraft gas turbine engines

- ◇ BSKP-99 (as part of SU-27, SU-30)
- ◇ BPK-88 series 3KM (as part of MIG-29)

40 Audio and video registration system

- ◇ SAVR 27UD
- ◇ SAVR 39 (as part of L-39)
***SAVR - audio and video registration system.*

Public Joint-Stock Company STC «Electronprylad» was established on October 20th, 1962, based on the Department of Automated Control Systems of ASTC «Antonov». The enterprise is engaged in research activities aimed at designing, manufacturing, and testing experimental and serial products, providing maintenance and modernisation of on-board flight information recorders with special software, regulation and control systems of aircraft equipment and engines, indicators, modules, etc.

In the 60s and early 70s, the country's first on-board automated control systems for aviation equipment such as «SAKTA-24AN», «ASK-1», «Troyanda-2», «Tester», «Luch» were designed and serially developed for civil and military aviation. We have developed and mastered unique technologies to produce highly reliable reed switches, on-board printing mechanisms, devices for information storage on magnetic drums and metal tape, etc.

During the 1980s, the enterprise became the leading organisation of the Ministry

of Aviation Industry of the USSR in the development and manufacture of aircraft equipment automated control systems, power units, emergency, and operational systems for flight information recording («black boxes») and ground-based systems for its processing.

After Ukraine became independent, PJSC «STC «Electronprylad» became the leading instrument-making organisation of the aviation industry in Ukraine in terms of creating on-board aviation equipment for aircraft, including for military aviation.

THE FOLLOWING TECHNOLOGICAL PROCESSES ARE IMPLEMENTED AND OPERATED AT THE ENTERPRISE:

- ♦ Mechanical processing (metal cutting: turning, milling, etc.)
- ♦ Fitting and assembly operations (assembly of nodes and blocks)
- ♦ Painting and varnishing (painting of blocks, varnishing of printed circuit boards, etc.)
- ♦ Electroplating (oxidation, cadmium plating, etc.)
- ♦ Electrical installation (installation of radio components on printed circuit boards, wire mounting of blocks, etc.)
- ♦ Assembly of products (final assembly of blocks)
- ♦ Adjusting and bench testing of products (testing of products for heat, cold, vibration resistance, etc.).

The quality system is developed according to ISO 9001.

PJSC «STC «Electronprylad» production facilities are located on 2 sites. The total production area of the facilities is 34,368 sq. m, including the area of the main production facilities – 26,665 sq. m.

Products are developed and manufactured at the enterprise according to a single technological cycle on equipment that is on the balance sheet of PJSC «STC «Electronprylad».

Despite the unique production capacity, the main value of PJSC «Electronprylad» were and still are the enterprise's experts. As of September 1st, 2022, the registered number of employees at PJSC «STC «Electronprylad» is 323 persons.

PJSC «STC «Electronprylad» is still actively involved in

modernising the aviation of the Air Forces of the Armed Forces of Ukraine. The enterprise has developed, certified, and implemented into serial production components for the following aircraft and helicopters: An-26, An-72, L-39, Su-25, Su-27, MiG-29, Mi-2MSB, Mi-8MSB, Mi-24, Il-76 et al.

Products are supplied under contracts concluded with the State Enterprise «Antonov» in Kyiv, Joint-Stock Company «Motor Sich» in Zaporizhzhya, SE «ZDARZ» MiGremont» in Zaporizhzhya, State Aviation Enterprise «Ukraine» in Boryspil, Private Joint-Stock Company «Aviation Company «Ukrainian Helicopters» in Kyiv, SE «Odesa Aircraft Plant», SE «Konotop Aircraft Repair Plant», SE of MDU «Lviv Aircraft Repair Plant» and others.

On June 30th, 2021, the Cabinet of Ministers adopted Resolution No. 669 (669-2021-p) «On Granting Entities the Right to Export and Import Military Goods and Goods Containing Information Constituting State Secrets». According to this Resolution, PJSC «STC «Electronprylad» was granted the right to export military goods of its own production until December 1st, 2025. This opens new opportunities for the enterprise to expand the market for its products and services.

By participating in international exhibitions and meetings, the management of PJSC «STC «Electronprylad» has reached certain agreements on supplying its products abroad. Work meetings and negotiations

TODAY, THE MAIN CATEGORIES OF DEVICES MANUFACTURED BY PJSC «STC «ELECTRONPRYLAD» ARE:

- | | | |
|---|--|---|
| <ul style="list-style-type: none"> ◇ GTE control units. (CMU – control and monitoring unit) ◇ Units to monitor and determine the level of vibration ◇ De-icing system control units ◇ Reversal control units ◇ Systems for determining the fuel level ◇ Emergency data logging systems ◇ Information reading units | <ul style="list-style-type: none"> ◇ Signal processing modules ◇ «EKРАН» information collection and output system ◇ Limit command units ◇ Flight information processing systems with special software ◇ Sensors for aircraft ◇ On-board led indicators of aircraft systems ◇ On-board built-in control and crew warning systems | <ul style="list-style-type: none"> ◇ Cab audio and video recording systems ◇ On-board control, monitoring, and recording systems for parameters of aircraft gas turbine engines ◇ Ground systems for maintenance of on-board systems BPK-88 series 3KM, BPK-88 series 3K and BSKP-99 |
|---|--|---|

on signing the agreements with international parties are currently underway.

The enterprise's primary priority is the quality and timely fulfilment of orders for the supply of products to both domestic and foreign customers.

The total number of the product range of PJSC «Electronprylad» is 131 devices.

Today, the development and production of a full authority digital engine control system (FADEC) for the TV3-117 engine in cooperation with JSC «Motor Sich» is considered promising.

For the Air Forces of Ukraine, namely MiG-29 aircraft, a new element base BPK-88 of 3K series has been developed and put into operation. The PIP-29 software deserves high attention. BSKP-99 units and PIP-29 software developed as part of the Su-27 family modernisation programme within the framework of contracts with international contractors are popular.

The company has completed the development and is launching the product ZI-72M and ZI-470M – simulator plugs of R-73 and R-27

missiles. One of the promising developments is the flight information transmission system. The enterprise is the only manufacturer in Ukraine of the limit command unit (BPK-88), fuel measurement and audio, video recording systems.

At the beginning of 2021, the company completed the development of a digital fuel measurement system TIS-158A-02 for the An-178 aircraft and transferred the research sample to SE «Antonov» for flight design tests. The unique features of the system are its digital sensors, fuel meters and a digital information exchange line between the unit and the sensors. The transition to modern digital technologies in the development of such systems provides the opportunity to conduct many studies without real flights and fuelling the aircraft.

The 2E unit of the EKРАН system was developed for the modernisation and repair programme of various aircraft for the Air Forces of Ukraine.

One of the important issues of the enterprise's growth is the issue of intellectual property. «Electronprylad» has

several its own developments and patents. This is an important asset created by our developers, designers, and engineers.

PJSC «STC «Electronprylad» has recently celebrated its 60th anniversary. Given the vast experience and significant contribution to the instrumentation and modernisation of the aviation industry of Ukraine, it is safe to say that we have much to be proud of.

For emergency data recording (EDR) systems only, 10 modifications have been developed and produced with a total of almost 1,000 units (997 units). There are good reasons why the «black box», is the enterprise's business card. More than 1,700 signal processing modules, BPK-88 of 3K series – about 400 units and modified BPK-88 of 3KM series – 50 units. About 30 units of audio and video registration systems, as well as hundreds of other devices that have effectively and significantly improved the technical characteristics of aviation in Ukraine and beyond.

modernisation, and enhancement of the aviation industry of Ukraine. We are looking forward to cooperating and implementing joint projects not only with Ukrainian aviation industry, but with international aviation enterprises as well. We are confident that we have everything to preserve and increase our potential in the coming decades.

GTD CONTROL UNITS



BUK-148

OPERATION AND SUPERVISION UNIT

PURPOSE:

BUK-148 is intended to ensure the interfacing of electronic digital operation and supervision systems and control of engine units with controls and indicators located in the cockpit of An-148, An-158 planes.

- ◇ control of RFSU, dry motoring, wet motoring or engine preservation;
- ◇ forming of a control command for starting, cold motoring, wet motoring, and engine preservation;
- ◇ manual interruption of the sequences of start, cold motoring, wet motoring, and preservation;
- ◇ automatic interruption of the sequences of start, cold motoring, wet motoring, and preservation;
- ◇ normal shutdown of the engine;
- ◇ automatic shutdown of the engine;
- ◇ control of fuel injection at start and all engine operation modes;
- ◇ limiting of engine operation parameters;
- ◇ synchronization of operation of two engines of an object;
- ◇ data exchange with the unit of the adjacent engine via a communication channel according to ARINC-429 formation of failure mode of fuel flowrate;
- ◇ control of the working condition of the unit devices, sensors, and communication lines;
- ◇ issue of data to the object's systems via a communication channel according to ARINC-429

SHORT SPECIFICATIONS:

◇ Number of ARINC-429 input channels	22	◇ Electric engine power voltage MRD-27 MDU1, MDU2 (phases A, B, C), V	18–31
◇ Number of ARINC-429 output channels	6	◇ Alternating power voltage of coilings DPR MRD-27 MDU1, MDU2 (phases A, B, C) with a frequency of (100-0.1)	
◇ Number of «Event signal +27V» input signals	22	kHz, V	5-0.2
◇ Number of «Event signal -27V» input signals (Hull)	1	◇ Value of «Event signal +27V» input and output signals, V	27
◇ Number of «Event signal +27V» output signals	7	◇ Power voltage, V	18-31
◇ Number of «Event signal -27V» output signals (Hull)	2	◇ Power consumption, W	45, max.
		◇ Continuous operation time, h	20, max.
		◇ Unit weight, kg	8.1, max.

BUK-500

MS-500V TURBOSHAFT ENGINE OPERATION AND SUPERVISION UNIT

PURPOSE:

- ◇ control of RFSU, dry motoring, wet motoring or engine preservation;
- ◇ forming of a control command for starting, cold motoring, wet motoring, and engine preservation;
- ◇ manual interruption of the sequences of start, cold motoring, wet motoring, and preservation;
- ◇ automatic interruption of the sequences of start, cold motoring, wet motoring, and preservation;
- ◇ normal shutdown of the engine;
- ◇ automatic shutdown of the engine;



- ◇ control of fuel injection at start and all engine operation modes;
- ◇ limiting of engine operation parameters;
- ◇ automated protection of the power turbine;
- ◇ control of engine vibration;
- ◇ synchronization of operation of two engines of an object;
- ◇ data exchange with the unit of the adjacent engine via a communication channel according to ARINC-429.
- ◇ formation of failure mode of fuel flowrate;
- ◇ control of the working condition of the unit devices, sensors, and communication lines;
- ◇ issue of data to the object's systems via a communication channel according to ARINC-429

SHORT SPECIFICATIONS:

- | | | | |
|---|---------|---|-----------|
| ◇ Power voltage, V | 27 | ◇ Maximum output current of the channel for adjustment of installation angle of the fuel injection dosing valve, mA | ±35, max. |
| ◇ Consumption current excluding external loads, A | 2, max. | ◇ 5 Uptime, s | 5, max. |
| ◇ Output voltages of commands at signals at maximum load current $I_{n \max} = 1.5A$ (number of channels - 20), V | 27 | ◇ 6 Continuous operation time, h | 15, min. |
| | | ◇ 7 Unit weight, kg | 6, max. |



BUK-MS2

AI-450-MS AUXILIARY GAS TURBINE ENGINE OPERATION AND SUPERVISION UNIT

PURPOSE:

BUK-MS2 is intended for stationary installation on board An-148, An-158, An-178 planes: контроль готовності до запуску або холодного прокручування ДСУ;

- ◇ control of readiness for start or cold motoring of APU;
- ◇ control of readiness for wet motoring or preservation;
- ◇ formation of control commands to ensure APU start;

- ◇ formation of control commands to ensure APU cold motoring;
- ◇ formation of control commands to ensure APU wet motoring;
- ◇ formation of control commands to ensure APU preservation;
- ◇ manual interruption of cold motoring, wet motoring, preservation start sequences;
- ◇ normal shutdown of the engine;
- ◇ control of fuel injection during ignition;
- ◇ control of fuel flowrate in intermediate modes;
- ◇ control of fuel injection in steady-state modes;
- ◇ limiting of engine operation parameters;
- ◇ control of air bleed valve;
- ◇ control of the input stator of the load compressor;
- ◇ control of air bleeding door;
- ◇ automated protection of the power turbine;
- ◇ automatic sequence stopping;
- ◇ automatic APU shutdown;
- ◇ recording and storage of the values of start counter and APU operation time in the operation mode;
- ◇ APU condition control;
- ◇ formation of failure mode of fuel flowrate;
- ◇ formation of failure mode of the load compressor control channel;
- ◇ control of the working condition of the unit devices, sensors, and communication lines;
- ◇ issue of data to the plane systems via ARINC-429 channel

SHORT SPECIFICATIONS:

◇ Power voltage, V	27
◇ Consumption current excluding external loads, A	2, max.
◇ Output voltages of commands at signals at maximum load current $I_{n \max} = 1.5A$ (number of channels - 39), V	27
◇ Uptime, s	10, max.
◇ Continuous operation time, h	15, min.
◇ Unit weight (with frame), kg	7, max.

BUK-500-3000

OPERATION AND SUPERVISION UNIT



PURPOSE:

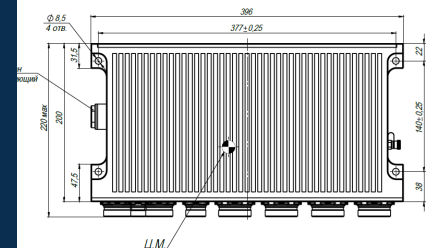
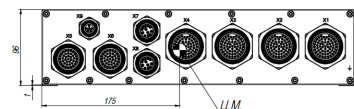
BUK-500-3000 operation and supervision unit is intended for the operation and supervision of the TV3-117VMA-SBM1V series 1 turboshaft engine and its modifications. The unit is built in a two-channel scheme (main and redundant control channel) with a separate free turbine protection module (AZST) and a separate vibration control module.

- ◇ The unit is intended for the following functions:
- ◇ acceptance and processing of signals from sensors and buzzers of the aircraft devices;
- ◇ control of the units of starting system and actuating mechanisms of the engine on land and in flight;
- ◇ control of fuel injection in all engine operation modes (ignition of the ignition chamber, engine start, steady-state modes, alternate modes);
- ◇ synchronization of engine operation with the current operation mode of the adjacent engine;
- ◇ protection of engine from exceeding of limit parameters;
- ◇ protection of engine from free turbine spin up;
- ◇ issue of information to the interfacing system (onboard object parameter indication system, protected flight data recorder, etc.) via information exchange channels;
- ◇ control of engine vibration parameters.

SHORT SPECIFICATIONS:

THE BUK-500-3000 UNIT INCLUDES:

- ◇ 55 pressure gage inputs from APTE-628DC type sensors. Measuring error $\pm 0,3\%$ of URL;
- ◇ 2 inputs for gas temperature measurement behind the compressor turbine from T80-T type sensors (thermocouple). Measuring error $\pm 3^{\circ}\text{C}$;
- ◇ 2 inputs for air temperature measurement at engine input from P-109M1 type sensors (thermal resistor). Measuring error $\pm 1.5^{\circ}\text{C}$;
- ◇ 1 input for oil temperature measurement at engine output from P-109M1 type sensors (thermal resistor). Measuring error $\pm 1.5^{\circ}\text{C}$;
- ◇ 1 input for air temperature measurement in PCM from chromel-copel type (L type) thermocouple. Measuring error $\pm 6^{\circ}\text{C}$;
- ◇ 1 input from type CC-78 chip detector. Measuring error $\pm 25 \Omega\text{hm}$;
- ◇ 9 inputs for rpm measurement from DTA-15 and VIT-1004 type sensors. Measuring error $\pm 0.1\%$;
- ◇ 4 inputs from DBSKT-650 type sensors. Measuring error $\pm 0.5^{\circ}$;
- ◇ 2 inputs from DBSKT-220 type sensors. Measuring error $\pm 0.5^{\circ}$;



- ◇ 2 inputs from SA-139 and SA-281 type vibration sensors. Measuring error $\pm 4\%$ of URL;
- ◇ 24 inputs of discrete event signals, type +27V/(hull or Interruption);
- ◇ 20 output discrete commands, type +27V/interruption with short-circuit protection.

VALUES OF LIMIT TEMPERATURES AND PRESSURES:

◇ high operating temperature	+ 55 °C;
◇ short-term overtemperature (for 20 min only on land)	+ 70 °C;
◇ limit overtemperature (for non-working condition)	+ 85 °C;
◇ lowered operating temperature	minus 40 °C;
◇ limit lowered temperature (for non-working condition)	minus 55 °C;
◇ atmospheric underpressure	23.84 kPa (178.8 mm Hg).



BUK-500-14

MC-14 TURBO-PROPELLER ENGINE OPERATION
AND SUPERVISION UNIT

PURPOSE:

- ◇ control of the actuating mechanisms of the engine in order to ensure starting, cold motoring, preservation, and wet motoring;
- ◇ adjustment of fuel flowrate in all engine operation modes to maintain optimal operation parameters at all flight stages, with the transfer of control in case of failure of the SAU hydromechanical part unit;
- ◇ control of engine vibration;
- ◇ protection from exceeding of limit operation parameters in all engine operation modes;
- ◇ control of good working order of the communication lines with sensors and actuating mechanisms, control of good working order of sensors and actuating mechanisms;
- ◇ issue of information to the interfacing systems (protected flight data recorder, object parameter indication system) via information exchange channels.

SHORT SPECIFICATIONS:

◇ Power voltage, V	27
◇ Power consumption excluding external loads, W	60
◇ Output voltages of commands and signals (number of channels - 20), V	27
◇ Maximum output control current of IM Gt, mA	± 35
◇ Maximum output control current of IM NAK, mA	± 35
◇ Uptime, s	5, max.
◇ Continuous operation time, h	15, min.
◇ Unit weight, kg	6, max.

CONTROL AND VIBRATION DETECTION UNITS

BSVK-436FM

CONTROL AND VIBRATION
DETECTION UNIT D-436-148FM

PURPOSE:

The unit is intended to provide control and diagnostics of the technical condition and control of vibration condition of the D436-148FM engine on the An-178 plane and its modifications:

- ◇ collection of analog parameters from sensors and event (binary) signals from engine annunciator and their conversion into digital code;
- ◇ interfacing with the plane's digital units via a sequential communication channel, as per ARINC-429, according to the information exchange protocol;
- ◇ control and diagnostics of engine condition according to engineering algorithms;
- ◇ control of the vibration condition of the engine;
- ◇ record and storage of engine characteristics (check values of rotor runout time, data on engine resource depletion and other variables and set values) in volatile RAM



SHORT SPECIFICATIONS:

◇ Power voltage, V	27
◇ Power consumption, W	40
◇ OF, ED output binary signal voltage, V	18-31
◇ Output analog and discrete signals	ARINC-429
◇ Uptime, s	60, max.
◇ Continuous operation time, h	20, min.
◇ Weight, kg	7, max.

ICE PREVENTION SYSTEM CONTROL UNIT



BUK-POS-158-01
ANTI-ICING SYSTEM CONTROL
AND MONITORING UNIT

PURPOSE:

- ◊ interfacing of AIS with aircraft on-board systems;
- ◊ activation and deactivation of AIS subsystems according to the position of controls and sensor signals;
- ◊ AIS units health control;
- ◊ generation of signals indicating the unit health and the state of the AIS units;
- ◊ automatic parrying of failures occurring during AIS operation;
- ◊ regulation of the amount of air supplied to the AIS (due to pressure control) depending on the parameters of the air supplied to the system and the flight mode;
- ◊ calculation of the air flow taken from AHS for AIS;
- ◊ monitoring of AHS tightness with output of monitoring results to GAECs and OMS;
- ◊ calculation of the current rate of air flow taken from the APU;
- ◊ registration of data (incoming, outgoing) and issuing of accumulated data on request.

BRIEF SPECIFICATIONS:

◊ Power supply voltage, V	27
◊ Power consumption, excluding external loads, W	30
◊ Output voltages of commands for control valves and ring valves at maximum load current $I_L \text{ max} = 2.8^{\circ}\text{A}$ (number of channels – 12), V	27
◊ Number of input data channels via ARINC-429	16
◊ Number of output data channels via ARINC-429	5
◊ Continuous operating time, h	22, max.
◊ Unit weight, kg	5, max.

INFORMATION READING UNIT

BPI-4TR INFORMATION REWRITE UNIT

PURPOSE:

The unit is intended for reading flight information from BR-4T, BR-4T-10, BR-4T-10-01, BR-4T-10-03, 3BN-24MT-03 (hereinafter referred to as recorder) via parameter and associated channels with further information rewrite to a PC in laboratory conditions.

The unit ensures:

- ◊ automated detection of the type of connected recorder;
- ◊ support of USB2.0 drives with FAT32 file system;
- ◊ reading of all information via parameter channel to internal or external USB drive;
- ◊ reading of all information via the associated channel to an internal or external USB drive;
- ◊ reading of information of any selected flight via parameter channel to an internal or external USB drive;
- ◊ reading of information of any selected flight via an associated channel to an internal or external USB drive;
- ◊ display of messages informing the operator about the unit's readiness for operation, execution of information copying, end of information copying, and condition of the internal and external USB drives;
- ◊ The unit has built-in self-control of its working order with further confirmation indication in the display.



SHORT SPECIFICATIONS:

- ◊ Rewrite time of 1 h of flight information, min:
 - ◊ parameter 1, max.
 - ◊ associated 6, max.
- ◊ Memory, GB 8, min.
- ◊ Unit uptime, s 5, max.
- ◊ Power voltage, V: 18-31
- ◊ Weight (without bundles), kg 1.0, max.

SYSTEM FOR DETERMINING THE AMOUNT OF FUEL ON THE SITE

TIS-158A-02 FUEL GAUGE SYSTEM

PURPOSE:

- ◇ TIS-158A-02 fuel gauge system is designed for regular deployment on board of aircraft An-158, An-178 in order to:
 - ◇ measure fuel weight and temperature in each aircraft tank;
 - ◇ issue a warning signal to the crew about the remaining fuel supply, fuel imbalance
 - ◇ fuel temperature approaching the crystallisation temperature;
 - ◇ monitor the presence of water in the fuel;
 - ◇ refuel aircraft in manual or automatic mode;
 - ◇ control fuel valves and pumps, as well as alarm of their state;
 - ◇ indicate fuel supply at PKUZ-158A-01;
 - ◇ issue information on the amount of fuel to aircraft systems.
- ◇ Maximum error of fuel weight measurement – $\pm 2.5\%$.
- ◇ The sensors included in the TIS-158A-02 set are designed to measure the fuel temperature and level in the tank, determine the presence of water in the fuel tank and signal when the specified fuel level is reached.

BRIEF SPECIFICATIONS:

◇ Data exchange via digital channels	Via ARINC-429
◇ Amount of fuel in tanks, kg:	
• in the left (right)	0–4,950
• in the central	0–6,700
◇ Amount of fuel in tanks measurement error, kg:	
◇ in the left (right)	± 100
◇ in the central	130
◇ Fuel amount in the first (second) engine, kg	0–8,250
◇ Amount of fuel in the first (second) engine measurement error, kg	± 165
◇ Amount of fuel in the fuel reservoir of the left (right) tank, kg	0–280
◇ Amount of fuel in the fuel reservoir of the left (right) tank measurement error, kg	± 6
◇ Amount of fuel in the root of the left (right) tank, kg	0–3,460
◇ Amount of fuel in the root of the left (right) tank measurement error, kg	± 70
◇ Amount of fuel in the pre-consumption part of the left (right) tank, kg	0–1,210
◇ Amount of fuel in the pre-consumption part of the left (right) tank measurement error, kg	± 24
◇ Total remaining fuel, kg	0–16,600
◇ Total remaining fuel measurement error, kg	± 330
◇ Total remaining fuel, %	0–100
◇ Lowest fuel temperature on board, °C	From -60 to +85



- ◇ Minimum fuel temperature in tanks: left, central, right, °C From -60 to +85
- ◇ Fuel temperature measurement error, °C ±2
- ◇ Fuel crystallisation temperature, °C From -60 to -30
- ◇ Error of measurement and data output on the total amount of fuel at refuelling relative to the maximum measured amount of fuel on the aircraft under operating conditions for the main fuel brand at the heeling of $0^\circ \pm 30'$ and the pitch of $0^\circ \pm 30'$, % ±2.0, max.
- ◇ Error of measurement and data output on the total amount of fuel in the cruising flight mode with heeling angles of 0° and pitch $(1-3)^\circ$ relative to the maximum measured amount of fuel on the aircraft for the main fuel brand, % ±2.5, max.
- ◇ Power supply voltage, V 18-33
- ◇ Illumination voltage (effective) at 400 Hz frequency, V 0-6

- ◇ Power consumption in 27 V circuit, W
- ◇ in flight 46, max.
- ◇ in refuelling mode 60, max.
- ◇ Time of readiness for operation, sec 30, max.
- ◇ System continuous operation time, h 15, max.
- ◇ Time of continuous operation of PKUZ-158, h 5, max.
- ◇ Weight, kg 29.5, max.

TIS-261

FUEL GAUGE SYSTEM

PURPOSE:

- ◇ TIS-261 is designed for:
- ◇ measuring fuel supply and fuel temperature in Mi-2 helicopter tanks;
- ◇ issuing a warning signal to the crew about the remaining fuel supply;
- ◇ calculating the remaining flight time;
- ◇ indicating the fuel supply, fuel consumption and the remaining flight time.
- ◇ Maximum fuel weight measurement error is $\pm 4\%$.
- ◇ The sensors included in the TIS-261 set are designed to measure the fuel temperature and level in the tank, signal when the specified fuel level is reached.

THE SYSTEM CONSISTS OF:

- ◇ fuel meter unit – BTI-261 1 pc.,
- ◇ fuel supply indicator – IZT-261 1 pc.,
- ◇ refuelling control indicator – IKZ-261 1 pc.,
- ◇ DT-261 type fuel meter sensors 2 pcs.,
- ◇ DTK-261 type fuel meter sensors with compensator 2 pcs.,
- ◇ type DTSK-261 fuel meter sensors with signaller and compensator 2 pcs.,
- ◇ DSU-261 fuel level indicator sensor 1 pc.
- ◇ TIS-261 receives data via three independent channels via ARINC-429





TIS-261 PROVIDES:

- ◇ Issuing data via two independent channels in the form of a 32-bit code (ARINC-429);
- ◇ FLIGHT/GROUND mode on the presence or absence of the WEIGHT ON WHEELS discrete signal;
- ◇ Receiving and measuring analogue signals from: fuel gauge sensors, temperature sensors, fuel level indicators;
- ◇ Reading data from non-volatile memory – UN-1;
- ◇ Indication of the total fuel supply on board the helicopter in litres.

BRIEF SPECIFICATIONS:

- ◇ Data transfer rate, kbit/s 100
- ◇ Refresh rate, Hz 2, min.
- ◇ Information signalling:
 - on left auxiliary tank fuel meter sensor connection; Green LED
 - on right auxiliary tank fuel meter sensor connection; Green LED
 - on filling the maximum permissible fuel volume; Red LED
 - on achieving unusable and non-removable fuel supply; Yellow LED
 - on the presence of a fault in the TIS-261 system Yellow LED

EMERGENCY DATA LOGGING SYSTEM

BR-4TS

ONBOARD EMERGENCY AND OPERATION
INFORMATION RECORDER



PURPOSE: The unit is intended to collect, convert, record and store the flight parameter and speech information allowing evaluation of the crew actions during flights, the technical condition of the aircraft, functioning of systems, units, power unit, radio and electronic systems and complexes in the volume of information determined by the list of recorded parameters, and determining the cause of a flight incident or its preconditions.

BR-4TS is intended to be the modern continuation of the BUR-4-1 type recorders with improved tactical and technical properties. BR-4TS is different from BUR-4-1 in terms of a monoblock design, and the fact that due to the use of a modern component base, information recording in the protected module is done simultaneously to three SSDs, where both parameter and speech information is recorded. The unit operation conditions comply with the requirements of DO-160D.

The duration of continuous operation of the recorder is at least 24 h.

The design of the BR-4TS unit, in case of a flight incident, ensures the retention of recorded data in case of external impacts according to the requirements of the European standard ED-55:

- ◊ single impact with impulse duration of 6.5ms and acceleration up to $33,354 \text{ m/s}^2$;
- ◊ resistance to penetration by a load of 227kg dropped from a height of 3m;
- ◊ static load of 22.25kN;
- ◊ fire resistance at 100% coverage of the overall surface creating a heat stream of 158 kW/m^2 with a flame temperature of 1100°C for at least 30 min;
- ◊ immersion in sea water for 30 days;
- ◊ immersion in kerosene liquid, hydraulic fluid, and firefighting liquids for 48 hours.

Two channels with a voltage of $+6.3\text{V} \pm 0.016\text{V}$ at max. current consumption of 0.1A per channel are provided for powering potentiometric sensors.

Information rerecording from the BR-4TS unit for further processing on PC is done via USB interface.

BR-4TS can be installed on board Mi-2, Mi-8, Mi-24, Mi-17, Mi-35, An-2-100, An-24, An-26, An-32, An-22, L-39.

SHORT SPECIFICATIONS:

◇ Power voltage	+ 18...33V
◇ Power consumption	10 W, max.
◇ Number of data inputs	
• DC voltage 0 to +6.3V	28 inputs
• DC voltage 0 to +42V	3 inputs
◇ active resistance 73-154 Ω	1 input
◇ AC current frequency 7 to 100Hz, amplitude 2-30V	4 inputs
◇ event signals (binary signals, «Yes» - + 15-33V, «No» - 0V or interruption)	32 inputs
◇ 4 Number of speech information inputs from pilot microphones (laringophones) and headphones	4 inputs
◇ 5 Number of information input channels per ARINC-429 standard	16 channels
◇ 6 Number of information input channels per RS-232 standard	2 channels

BUR-92A

DATA RECORDER AND ITS MODIFICATIONS



SHORT SPECIFICATIONS:

◇ Programmed Voltage Measurement Input	
◇ 0-6.3 V; 0-40 V; ± 12 V; ± 0.25 V 16	16
◇ Voltage 0 to 6.3 V 52	
◇ Voltage 0 to 50 mV (from thermocouples)	6
◇ SKT 0-360	15
◇ Active resistance 25-225 ohms (from a temperature sensor)	3
◇ Frequency (12-0-12) B 400 Hz or (6-0-6) B 400 Hz or 0-12 V 400 Hz 6	6
◇ Voltage ~ (0-140) V 400 Hz	3
◇ Voltage ~ (0-40) V 400 Hz	2
◇ Frequency from 400 to 16000 Hz	12
◇ Number of ARINC-429 input channels	64
◇ Single commands	200
◇ Supply voltage	+(18...33) V
◇ Power consumption	100 W, no more than
◇ Composition of the device	BSPI-92A
	ZBN-24MT-02
	EBN-92
	PU-BUR

The list of recorded parameters and composition of the recorder depend on the type of an aircraft the product shall be mounted on.

BUR-4-1

(and its modifications)

EMERGENCY AND OPERATIONAL FLIGHT DATA RECORDER



PURPOSE:

BUR-4-1 is designed to convert, record, and save flight parametric and voice data, allowing to assess the piloting technique of the flight crew, the technical condition of the aircraft, its systems, units, and equipment, and determine the cause of the flight incident or the prerequisites for it.

BUR-4-1 provides registration of the following service data:

- astronomical time: seconds (0...59), minutes (0...59), hours (0...23);
- board numbers (0...255);
- flight numbers (00...99).

The duration of the recorder's continuous operation is at least 24 hours.

The memory of the BR-4T-10-01 unit stores a record of parametric information for the last 25 hours of flight min. at 256 measurements per second and at least 4 hours of speech information. The design of the BR-4T-10-01 unit, in the event of a flight accident, ensures the safety of the recorded information under external influences in accordance with the requirements of the European standard ED-55:

- ◊ single impact with a pulse duration of 6.5 msec and acceleration up to 33354 m/s^2 ;
- ◊ resistance to breakdown produced by a load of 227 kg, which is dropped from a height of 3 m;
- ◊ static load by force of 22.25 kN;
- ◊ fire resistance to fire at 100% coverage of the total surface, creating a heat flux of 158 kW/m^2 with a flame temperature of 1100°C for at least 30 minutes;
- ◊ immersion in sea water for 30 days;
- ◊ immersion in kerosene, hydraulic fluid and fire-extinguishing fluids for 48 hours.
- ◊ Three $+6.3 \text{ V} \pm 0.016^\circ\text{V}$ channels are provided for power supply of potentiometers at consumption current of no more than 0.1 A per each channel.
- ◊ Overwriting data from the BR-4T-10-01 unit for further processing on a PC is carried out using BPI-4TR.
- ◊ BUR-4-1 is installed on board Mi-2, Mi-8, Mi-24, Mi-17, Mi-35, An-2-100, An-24, An-26, An-32, An-22, L-39.

BRIEF SPECIFICATIONS:

- ◊ Supply voltage $+18...31 \text{ V}$
- ◊ Power consumption 30 W, max.
- ◊ Number of inputs in BUR-4-1:
 - DC voltage from $0 \text{ to } +6.3 \text{ V}$ 28 inputs
 - DC voltage from $0 \text{ to } 30 \text{ mV}$ (from thermocouples) 2 inputs
 - active resistance $73\text{--}154^\circ\text{Ohm}$ 1 input
 - AC frequency from $7 \text{ to } 100 \text{ Hz}$ with an amplitude of $2\text{--}30 \text{ V}$ 4 inputs
 - one-time commands (binary signals, «Yes» – $+15\text{--}33 \text{ V}$, «No» – 0°V or interruption) 32 inputs
- ◊ Number of voice data inputs from microphones (laryngophones) and pilots' headphones 4 inputs
- ◊ Number of ARINC-429 data receiving channels 12

BUR-4-1-10

(and its modifications)
EMERGENCY AND
OPERATIONAL FLIGHT DATA
RECORDER



PURPOSE:

BUR-4-1-10 is designed to convert, record, and save flight parametric, voice and video data (from the SAVR-27U type system), allowing to assess the piloting technique of the flight crew, the technical condition of the aircraft, its systems, units, and equipment, and determine the cause of the flight incident or the prerequisites for it.

BUR-4-1-10 is a technical development of U3 Tester series 2 and U3 Tester series 3 recorders in operation.

In addition to a significant increase in the number of registered analogue signals and one-time commands, BUR-4-1-10-01 registers digital information via ARINC-429 (GOST 18977 and RTM1495 with rev. No. 3) and voice information (crew communication).

BRIEF SPECIFICATIONS:

◇ Supply voltage	+ 18...31 V	0.3 to 3.3°Hz with an amplitude of 0.2–4.5 V	4 inputs
◇ Power consumption	50 W, max.	• angular displacement	
◇ Number of inputs in BUR-4-1-10-01:		0–360° (SCT)	3 inputs
• DC voltage from 0 to +6.3 V	58 inputs	• digital information	
• DC voltage from 0 to +42°V	3 inputs	via ARINC-429	32 inputs
• DC voltage from 0 to 100°mV (from thermocouples)	2 inputs	• one-time commands (binary signals) with 15–33 V voltage	44 inputs
• AC voltage 115°V 400°Hz (from 0 to 150 V)	3 inputs	• one-time impulse (10 µs) commands (binary signals) with 15–33 V voltage	14 inputs
• AC voltage 36°V 400°Hz (from 0 to 40 V)	3 inputs	◇ Number of voice data inputs from microphones (laryngophones) and pilots' headphones	3 inputs
• active resistance 68.4–210°Ohm	4 inputs	◇ Video data from SAVR-27U	1 input
• AC frequency from 7 to 100°Hz with an amplitude of 2–31 V or frequency from			

COMPARISON OF RECORDERS SPECIFICATIONS

TYPE OF INPUT SIGNAL	NUMBER OF INPUTS			
	BUR-4-1-07	BUR-4-1-07-01	BUR-4-1-07-02	BR-4TC
Voltage 0 to 6.3 V	28	28	28	28
Voltage 0 to 42 V	-	-	-	3
Active resistance 73-154 Ohm (on a temperature sensor)	1	1	1	1
Frequency from 7 to 100 Hz with the amplitude of 2-30 V	4	4	4	4
Single commands ("Yes" - + 15-31 V, "No" - 0	32	32	32	32
Number of ARINC-429 input channels	-	1	12	16
Number of ARINC-825 input channels	-	-	-	1
Number of ARINC-429 output channels	-	-	-	1
Number of voice information inputs:				
from SPU;	-	2	3	3
from UMD-3 type open microphones (up to 3 pcs.)	-	1	-	1
Power consumption	25 W, not more than	30 W, not more than	30 W, not more than	10 W, not more than
Supply voltage	+(18...33)V	+(18...33)V	+(18...33)V	+(18...33)V
Composition of the device	BCI-4-07 BR-4T PU-4	BCI-4-07-01 BR-4T-10 PU-4, BU-10	BCI-4-07-02 BR-4T-10-01 PU-4, BU-10-01	BR-4TC
Weight (kg) / volume on board (l)	5,7/6,81	7,35/8,12	7,35/8,12	5/4,04

ON-BOARD BUILT-IN CREW MONITORING AND WARNING SYSTEMS



EKRAN-13M-4

ONBOARD GENERIC INTEGRATED CONTROL
AND CREW ALERT SYSTEM

PURPOSE:

Ekran onboard equipment is intended for the organization of in-flight and land control of the technical condition of onboard radio and electronic equipment and systems of an aircraft.

The Ekran system ensures:

- ◇ collection and logical processing of coded signals and signals coming from TCK, according to the established algorithms for evaluation of the technical condition of onboard equipment;
- ◇ issue of text messages, displayed on the indicator of block 2E-03 in order of their priority, to flight and technical crew;
- ◇ feed of control commands into controlled equipment during preparation for the flight of an aircraft;
- ◇ recording and accumulation of flight information in real time in the operational information storage device with the reproduction of the results of processing on the ground on the 2E-03 block indicator;
- ◇ reception of information from two BPK-88 series 3KM units and Tester system in the form of a sequential 32-bit code for recording to the flash cassette of the 2E-03 unit;
- ◇ ground processing of information, recorded on a flash cartridge, with the help of PIP-29 for expanded diagnostics of the technical condition of onboard equipment and for obtaining updated information on the condition of the power plant and the aircraft as a whole.

SIGNAL PROCESSING MODULES

M11 (A, S)

SIGNAL PROCESSING
MODULE



PURPOSE:

M11A (M11S) is designed to amplify the voltage of chromium-alumina thermocouples, where cold junction thermo-electromotive force is not compensated..

BRIEF SPECIFICATIONS:

- ◇ The absolute conversion error is no more than $\pm 60^{\circ}\text{mV}$.
- ◇ Input voltage from 0 to 50°mV ;
- ◇ Output voltage 0 to 6°V .
- ◇ The absolute conversion error of M11A (M11S) is no more than $\pm 90^{\circ}\text{mV}$.
- ◇ Weight 0.53 kg max.

MDT-1, MDM-1, MTT-1

SIGNAL PROCESSING
MODULE



PURPOSE:

- ◇ MDT-1 is designed for regular deployment on board of L-39M aircraft in order to convert signals from the LUN 1550-8 fuel pressure sensor of the AI-25TLSh engine and transfer them to the BUR (conversion of voltage from -500 to +450 mV, 400 Hz, to DC voltage from 0 to 6,000 mV with pressure change from 0 to 100 kg/cm²).
- ◇ MDM-1 is designed for regular placement on board of L-39M aircraft in order to convert the signals from the LUN 1556-8 oil pressure sensor of the AI-25TLSh engine and transfer them to the BUR (voltage conversion from -300 to +250 mV, 400 Hz, to DC voltage from 0 to 6,000 mV with pressure change from 0 to 6 kg/cm²).
- ◇ MTT-1 is designed for regular deployment on board of L-39M in order to convert the signals from the LUN 1671.02-8 fuel meter indicator of the AI-25TLSh engine and transfer them to the BUR (conversion of voltage from 5 to +120 mV, 400 Hz, to DC voltage from 0 to 6,000 mV with weight change from 50 to 825 kg). The conversion error of MDT-1, MDM-1, MTT-1 is no more than $\pm 1.0\%$.

Non-linearity of the amplitude characteristic of MDT-1, MDM-1, MTT-1 is no more than $\pm 1.0\%$. 1550-8 fuel pressure sensor of the AI-25TLSh engine and transfer them to the BUR (conversion of voltage kg).

M14 AND ITS MODIFICATIONS

SIGNAL PROCESSING MODULE

PURPOSE:

M14 is designed to convert SCT or synchro sensor signals into DC voltage of positive polarity via two or three conversion channels. The range of converted angles is ± 90 degrees, from 0 to 180 degrees, and from 0 to 360 degrees.



Absolute conversion error depending on the range of converted angles, respectively: ± 120 mV, ± 120 mV and ± 85 mV.

M15 AND ITS MODIFICATIONS

SIGNAL PROCESSING MODULE

PURPOSE:

M15 is designed to convert the output voltage of the RV-5 radio altimeter from 0 to 37.5 V into DC voltage from 0 to 5 V for automated control systems.



The conversion error at any destabilising factors is no more than $\pm 1.2\%$.

M429

SIGNAL PROCESSING MODULE

PURPOSE:

The module is designed to issue information about the current time (time stamps) to voice recorders in the form of a sequential code according to ARINC-429 at a clock frequency of 48 kHz. The module receives information about the current time from the BUR-4-1 on-board emergency operation recorder (and its modifications).



In regards to external factors, the module corresponds to DO-160D.

M3, M5, M7

SIGNAL PROCESSING MODULE

PURPOSE:

◇ M3 is designed to convert AC voltage of sinusoidal form of 100-125 V (eff) with a frequency from 300 to 900 Hz into DC voltage of positive polarity from 5 to 6.25 V.

The conversion error is no more than $\pm 1.0\%$.

◇ M5 is designed to convert voltage from 30 to 40 V with a frequency of 400 Hz to DC constant voltage of positive polarity according to the law $U_{out} = 0.152 \times U_{in} - 0.07$ V.

The conversion error is no more than $\pm 1.0\%$.

◇ M7, M7 (A, B, V) is designed to convert the value of active resistance in the de-energized circuit in the range from 30 to 85 Ohm, from 100 to 210 Ohm (from 70.9 to 112.62 Ohm, from 73.86 to 153.26 Ohm) to normalised voltage of positive polarity from 0.5 to 5.5 V.

The maximum relative conversion error for M7, M7B, M7V is no more than $\pm 2.0\%$.

The absolute conversion error for M7A is no more than ± 100 mV.

Weight: no more than 0.35 kg.

Dimensions: L×W×H – 46 × 109.5 × 92.5 mm.

USB ISO

DIGITAL ISOLATOR

PURPOSE:

The USB ISO digital isolator is designed for galvanic isolation between the USB port and various peripheral devices supporting USB 2.0 operation.

USB ISO can be used to isolate the following devices:

- flash drive;
- hub;
- transponder;
- repeater.



MAIN SPECIFICATIONS:

◇ USB	2.0 interface, Full Speed;	◇ ESD Protection	10 kV;
◇ supply voltage:	from 3.1 to 5.5 V;	◇ Insulation Rating	5 kV rms;
◇ load current via USB out,		◇ operating temperature range:	
	no more than 500 mA;		from 40°C to 105°C;
◇ current consumption, no more than 10 mA;		◇ USB connectors	A.

SYSTEM OF BUILT-IN CONTROL AND CREW WARNING

EKRAN-02M-3

ON-BOARD GENERALIZED SYSTEM OF BUILT-IN CONTROL AND CREW WARNING



PURPOSE:

The on-board equipment «Ekran» is intended for the organization of in-flight and ground control of technical condition of on-board radio and electronic equipment and systems of an aircraft.

«Ekran» system provides for:

- ◇ collection and logical processing of code signals and signals coming from VSK, in accordance with pre-set algorithms for assessing the technical condition of on-board equipment;
- ◇ issue of text messages, displayed on the indicator of block 2E-03 in order of their priority, to flight and technical crew;
- ◇ feed of control commands into controlled equipment during preparation for the flight of an aircraft;
- ◇ recording and accumulation of flight information in real time in the operational information storage device with the reproduction of the results of processing on the ground on the 2E-03 block indicator;
- ◇ receipt of information in the form of a serial 32-bit code for recording in the flash cartridge of block 2E-03 from BSKP-99 system and from BUR-4-1-10-01 system;
- ◇ ground processing of information, recorded on a flash cartridge, with the help of PIP-29 for expanded diagnostics of technical condition of on-board equipment and for obtaining of updated information on the condition of the power plant and on the aircraft as a whole.

GROUND SYSTEMS FOR SERVICING ON-BOARD SYSTEMS BPK-88 SERIES 3KM, BPK-88 SERIES 3K AND BSKP-99



PIP-29 ENGINEER SUPPORT PANEL

PURPOSE:

The PIP-29 engineer support panel powered by a protected portable computer GYTAC X500 G2 with an extension module, including:

- power supply (27V GOST 19705-82);
- ARINC-429 adapter;
- fast read CAN adapter, ISO 11898 standard;

PIP-29 is intended for:

- ◇ real-time display of information coming from BPK-88 series 3KM units about engine parameters;
- ◇ reading of information from OS of BPK-88 series 3KM units about the condition of parameters of RD-33 engines, GTDE-117 turbine starter, KSA, sensors, and BPK-88 series 3KM units themselves, as per ISO 11898 standard;
- ◇ routine activities and troubleshooting on the electrical circuit of the engines and plane;
- ◇ express check of recorded information about RD-33 engines and BPK-88 series 3KM units;
- ◇ routine activities and troubleshooting of BPK-88 series 3KM units.

The PIP-29 engineer support panel ensures:

- ◇ display of parameters of one or two engines at a time during land-based processing at the plane;
- ◇ troubleshooting of input and output electrical circuits of the BPK-88 series 3KM unit with onboard systems and sensors, both with operating, and non-operating engines;
- ◇ troubleshooting, control and adjustment of BPK-88 series 3KM units using the BP-3K checker, starting with the factory number 645 XXX 015;

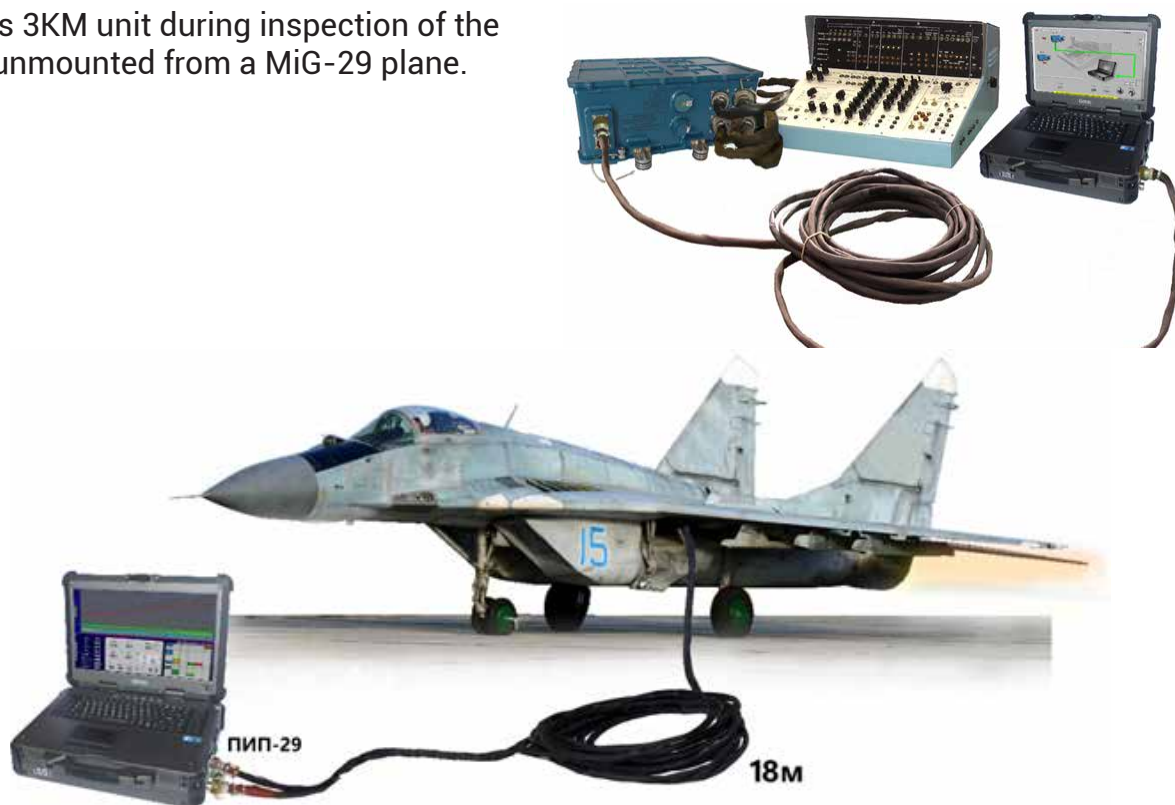
- ◇ recording the engine number and plane number, as well as engine installation date to the OS of the BPK-88 series 3KM unit;
- ◇ reading of information from OS of the BPK-88 series 3KM unit and express check of the read information;
- ◇ storage of flight information and land inspection data during operation of a specific engine with display both on the screen, and as charts and tables;
- ◇ fast reading from OS of the BPK-88 series 3KM unit via ISO 11898 bus with an express check of the power unit condition.

PIP-29 interfaces with the BPK-88 series 3KM unit via coded communication lines as per GOST 18977, RTM 1495-75, and ISO 11898, and is connected with a cable of at least 18m in length:

- ◇ directly to the X5 and X6 connectors of the BPK-88 series 3KM units when only BPK-88 series 3KM is used on board, without onboard rework

PIP-29 interfaces with the BPK-88 series 3KM unit via coded communication lines as per GOST 18977-79, RTM 1495-75, and ISO 11898 standard, and is connected using a cable (length 18 m):

- ◇ directly to X5 and X6 connectors of one or two BPK-88 series 3KM units when used onboard the plane, without onboard rework
- ◇ to two BPK-88 series 3KM units via onboard connectors when using the BPK-88 series 3KM as part of a modernized onboard system of BPK-88 series 3KM - Ekran-13M-4 (- Ekran-14M-2, Ekran UB-23M-2) - Tester U3-L»:
- ◇ to X5 and X6 connectors of the BPK-88 series 3KM unit during inspection of the unit unmounted from a MiG-29 plane.



Connection to units with onboard rework

PIP-27

ENGINEERING SUPPORT CONSOLE



PURPOSE:

PIP-27 is designed to exchange information with "BSKP-99" through encoded lines (GOST 18977-79, ISO 11898) and provides for performance of the following basic functions:

- ◊ on-line control and diagnostics of the "BSKP-99" system in a laboratory and on board of the Su-27 aircraft;
- ◊ displaying of information streams from two "BSKP-99" onboard an aircraft in real time, with saving on the hard drive, subsequent decoding and printing in the form of graphs;
- ◊ record of service information into the "BSKP-99" system;
- ◊ feed of stimulating signals (commands) to the "BSKP-99" system and control of their execution;
- ◊ copying both individual records and the entire volume of the solid-state drive of the "BSKP-99" system to the hard drive of PIP-27, with the accumulation of statistic data regarding the controlled engines;



- ◊ line and in-depth processing of the copied and stored information with construction of power plant performance charts, aircraft parameters on the flight route on the PIP-27 screen or via printer;
- ◊ maintenance of a database on aircraft equipment, performed checks and the state/condition of the serviced equipment;
- ◊ reading of information from the flash cartridge of the 2E-03 unit of the «Ekran-02M-3» system;
- ◊ recording of text messages in MP3 format in the ARO-64 block;
- ◊ control of operability of the hardware and software components of PIP-27.

Base computer is a protected laptop Getac X500 G2 with Intel Core i7 3.0 processor and a widescreen display Full HD 1920x1080 measuring 15.6».

Laptop is certified in accordance with MIL-STD-810G and IP65.

Operating temperature -20°C to +55°C.

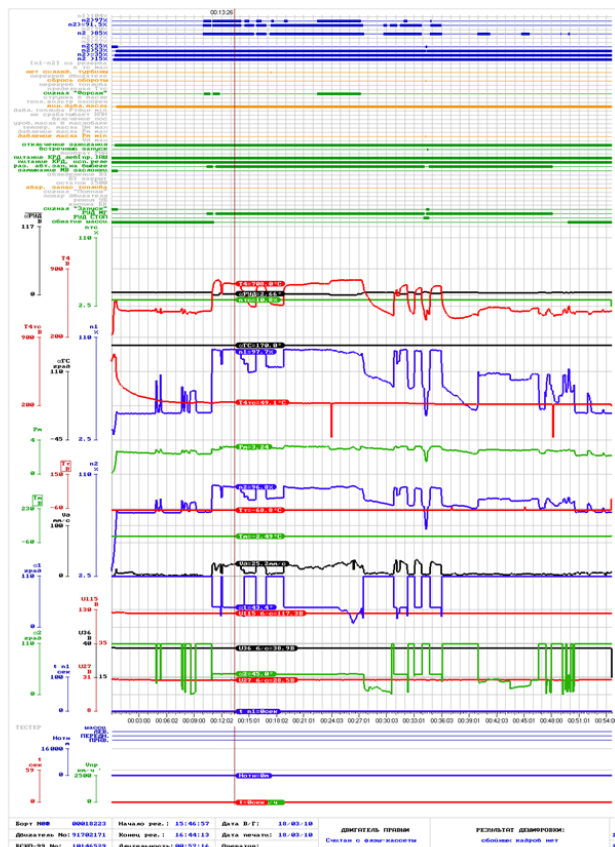
Operating system - Windows 10 Pro.

Connectors "X3" and "X4» to connect to BPK-88 series 3KM

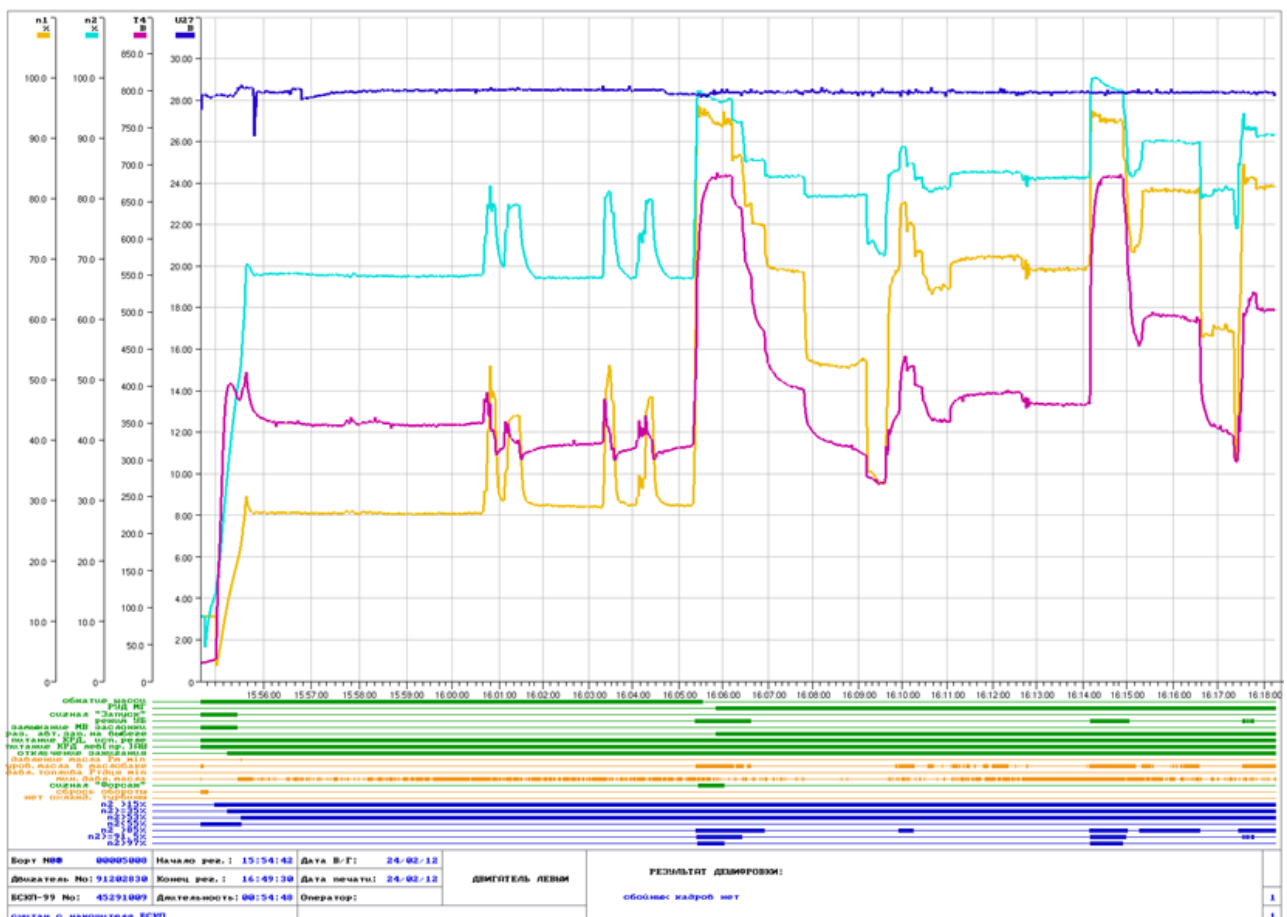
Onboard circuit switch +27V power-on of internal source)

Onboard circuit indicator (availability of power from aircraft circuit)

Special software allows to view the status/condition of the on-board systems (information from which is fed to BSKP-99) and the power plant of the Su-27 aircraft in real time. When connected to the BSKP-99 system with an 18-meter connecting cable, it is possible to evaluate the operation of the engines when they are tested on the ground (when "gassing"), while PIP-27 receives power from the Su-27 onboard circuit.



Software compiles lists of records (flights and 'gassing'), stored in the energy-independent memory of the BSKP-99 and on the flash cartridge of the «Ekran» system. Graphs display the parameters of the engines and aircraft of any record from the list.



AIRCRAFT SENSORS

DTK-158

FUEL LEVEL SENSOR



PURPOSE:

The sensor is designed for:

- measuring the current fuel level in a tank;
- measuring the fuel temperature in a tank.

SHORT SPECIFICATIONS:

- ◇ Sensor power supply voltage is ~10 V
- ◇ Power consumption > 50 mW
- ◇ Range of fuel temperature measurement is minus 60 to +85 °C
- ◇ Sensor weight is not more than 500 grams (for a sensor 500 mm long)
- ◇ Fuel level change error is ± 3 mm
- ◇ Output signal type: for the fuel level, the variable voltage is proportional to the sensor's wet level.
- ◇ Voltage range is 2.5 V to 6.5 V
- ◇ For temperature, resistance is 37.97 to 66.88 ohms, which corresponds to changes in temperature.

DSV-01

FREE WATER SENSOR



PURPOSE:

Sensor DSV-01 is designed to determine the presence of water in the fuel.

SHORT SPECIFICATIONS:

- ◇ Sensor power supply voltage is (8-15) V
- ◇ Power consumption is > 50 mW
- ◇ The level of water in the fuel tank at which the water presence signal is generated (5 ± 2) mm
- ◇ Output signal type digital code according to ARINC-825.

DTR-1

TEMPERATURE SENSOR

PURPOSE:

The temperature sensor is designed to measure the temperature of surrounding area of sensor. The principle of sensor operation is based on changing the resistance of sensor element depending on temperature change.

SHORT SPECIFICATIONS:

- ◇ Range of fuel temperature measurement is minus 60 to +150 °C.
- ◇ Resistance at a temperature of 0 °C is 50 ohms.

PS

PRESSURE SENSOR

PURPOSE:

The sensor is designed to measure the relative pressure in gaseous and liquid media.

SHORT SPECIFICATIONS:

- ◇ Sensor power supply voltage is (18-31) V
- ◇ Operating range of measured pressure is up to 1 bar
- ◇ Overload pressure is 3 bar
- ◇ Operating temperature range is minus 55 to +125 °C
- ◇ Pressure change error is $\pm 0.5\%$
- ◇ Output signal type:
 - digital code according to ARINC-825;
 - analog (one-time command to reach the set pressure) 18-31 V

ON-BOARD AVIATION LED INDICATORS OF AIRCRAFT SYSTEMS

IPVD-2-1 (IPVD-2-2)

MI-2 HELICOPTER ENGINE PARAMETERS INDICATOR

PURPOSE:

The indicator is designed to convert the information of the serial digital code via ARINC-429 and display the values of the gas generator (GG) rotor speed, torque, free turbine (FT) rotor speed and the temperature of the exhaust gases behind the free turbine of two engines.



BRIEF SPECIFICATIONS:

- ◇ Power supply voltage, V
- ◇ Time of readiness for operation, sec
- ◇ Continuous operating time, h
- ◇ Rotation speed range GG rotors, %
- ◇ Torque value range, %
- ◇ Rotation speed range FT rotors, %
- ◇ Gas temperature range behind the FT, C
- ◇ Power consumption, W
- ◇ Weight, kg

27
10, max.
8, max.
0-110
0-110
0-123
0-720
30, max.
1.5, max.



IPRT-4M

MOTOR CONTROL LEVERS POSITION INDICATOR



PURPOSE:

The indicator is designed to receive parameters from four units of the monitoring and vibration system (BSKV-18) and display the angular position of the D-18T engine control levers for continuous visual control by the crew of the An-124 aircraft.

BRIEF SPECIFICATIONS:

◇ Characteristics of input signals received from four BSKV-18 units	According to ARINC-429
◇ Indication range of angular position values engine control levers, deg:	
• on four digitised scales	0–80
• on four two-digit digital indicators	0–80
◇ Time of indicator readiness for operation, sec	10, max.
◇ Continuous operation time followed by a break 1 h max., h	20, max.
◇ Supply voltage, V	18–33
◇ Power consumption in 27 V circuit, W	30, max.
◇ Information scales brightness adjustment voltage:	
• DC, V	0–5.5
• AC with a frequency $(400 \pm 20)^{\circ}\text{Hz}$, V	0–6.3
◇ Consumption current in the circuit of information scales brightness adjustment, A	0.3, max.
◇ Weight, kg	1.5, max.

ICHZH-2V-1M

MOTOR FAN ROTOR SPEED INDICATOR

PURPOSE:

The indicator is designed to receive parameters from four units of the monitoring and vibration system (BSKV-18) and display the fans rotor speed for the D-18T engines for continuous visual control by the crew of the An-124 aircraft.



BRIEF SPECIFICATIONS:

◇ Characteristics of input signals received from four BSKV-18 According to ARINC-429	◇ Supply voltage, V	18–33
◇ Indication range of motor fan rotor speed values, %:	◇ 6 Power consumption in 27 V circuit, W	50, max.
• on four digitised scales	◇ 7 Information scales brightness adjustment voltage:	
• on four two-digit digital indicators	• DC, V	0–5.5
◇ Time of indicator readiness for operation at supply voltage of at least 18 V, sec	• AC with a frequency $(400 \pm 20)^{\circ}\text{Hz}$, V	0–6.3
20, max.	◇ Consumption current in the circuit of information scales brightness adjustment, A	0.3, max.
◇ Continuous operation time followed by a break 1 h max.,	◇ Weight, kg	1.5, max.
25, min.		

ON-BOARD SYSTEMS FOR MONITORING, CONTROLLING AND RECORDING PARAMETERS OF AIRCRAFT GAS TURBINE ENGINES



BSKP-99

ON-BOARD SYSTEMS FOR MONITORING
AND CONTROLLING PARAMETERS

PURPOSE:

BSKP-99 system, which is being mounted on the Su-27 aircraft anew, is designed to:

- ◇ collect, transform into digital form and register on electronic drive (SSD) parameters of onboard circuit, normalized signals of parameters, which are being fed from complex engine regulator – KRD, analog parameters, single (binary) signals from sensors and engine annunciators;
- ◇ register engine number, date of input of engine number, number of object (aircraft), date of input of object number, numbers of BSKP-99, numbers of flights and/or 'gassing', date of flight and/or 'gassing' as well as overall and current lifetime of BSKP-99 on the SSD.

BSKP-99 receives electric signals, characterizing technical condition of engine, from annunciators and sensors of information, normalized parameter signals from KRD-99 and transforms them into digital code, registers them on SSD and communicates through RZ-channel.





BSKP-99 ensures bringing values of changed engine parameters to physical quantities.

BSKP-99 interfaces with the onboard "Ekran" system and ground PIP-27 console via RZ-channel (GOST 18977-79, standard ISO 11898).

Registration on SSD and communication of information for interfacing with other systems is done in real time.

Start of registration of parameters on a SSD provided that n_{TC} (turbine starter revolution) $\geq 30\%$ or n_2 (high pressure reducer revolution) $\geq 35\%$, or when issuing discrete pulse/signal "Start", end of registration – at $n_{TC} \leq 12\%$ and $n_2 \leq 2,5\%$.

Maximum duration of parameters registration in an electronic storage – 75 hrs.

Upon expiration of the maximum storage time on SSD, information is being erased and new information is being recorded.

Number of recording and reading cycles of the solid state drive – not less than 10000.

After reading off of information from SSD, information is being stored and can be repeatedly read.

Recorded information when the aircraft is de-energized is not being erased and is being completely stored for not less 1000 hrs.

Volume of misinformation – not more than 0,5%.



BPK-88 SERIES 3KM

LIMIT COMMAND BLOCKS

PURPOSE:

The BPK-88 3KM series unit is intended both for replacement of the existing BPK-88 series 3, BPK-88 series 3A, BPK-88 series 3K units in operation on MIG-29 planes with RD-33 engines, and for operation as part of the modernized onboard system «BPK-88 series 3KM - Ekran-14M-2 (Erkan-13M-4, Ekran UB23M-2) - Tester U3-L».

BPK-88 series 3KM unit, as per circuit diagram (X1, X2 and X3 connectors), overall and installation dimensions and installation conditions, is only mutually interchangeable with BPK-88 series 3, BPK-88 series 3A, BPK-88 series 3K units.

When installing two BPK-88 series 3KM units instead of two BPK-88 series 3 units, replace the standard unit fixing panel with a panel manufactured for installation of BPK-88 with dampers.

The BPK-88 series 3KM unit ensures automated control and recording in its own operational storage (OS) of one power unit engine parameters with real-time information display on PIP-29 during engine processing on land.

The modernized BPK-88 series 3KM unit, apart from the functions (basic for BPK-88 series 3K), ensures the following:

- ◊ Increased measurement and OS registration of parameters for the RD-33 engine, GTDE-117 turbine starter and KSA aircraft accessory box (due to the use of precision component base and compensation of power voltage change of the pressure sensors).
- ◊ Additional control and record of:
 - rundown time of RND, RVD rotors;
 - number of starts of RD-33;
 - number of starts of GTDE-117;
 - rpm n of GTSAPU and T4 temperature of GTSAPU turbine starter;
 - pressure in the de-icing system of RD-33;
 - gas pressure behind the R4 turbine;
 - total and cumulative time of RD-33;
 - disrupts of sensor circuits and limited

commands issued by BPK-88;

- pressure drop at the fuel filter;
- minimum fuel pressure; - rpm of ND and RVD of the engine;
- 115V 400Hz electrical system;
- 27V electrical system;
- 36V 400Hz electrical system.
- ◊ Formation and record of:
 - current date (day, month, year);
 - international (Greenwich) time (seconds, minutes, hours).
- ◊ OS storage of information about the technical condition of the RD-33 engine, GTDE-117 turbine starter, KSA, with a record duration of 75 hours.
- ◊ OS record of all commands separately for each output issued by the BPK-88 series 3KM unit, and circuit disruption signals separately for each sensor with non-operating and operating RD-33 engines.

- ◇ Formation and issue of commands separately for each output (by coded parcels of PIP-29 land equipment) with non-operating engines, to check onboard lines and working condition of actuating members and systems connected with BPK-88 series 3KM at the stages of manufacturing, plane repair, and routine activities in operation.
- ◇ OS recording of operational parameters, including: no. of the engine, date of record of the no. of the engine, plane no., plane no. record date, flyout no., and date, as set from the PIP-29 ground equipment.
- ◇ Operation with PIP-29 equipment in dialog mode via CAN channel (ISO 11898 standard), which ensures reading of any data array from OS and formation of output commands of BPK-88 series 3KM with non-operating RD-33 engine.

TECHNICAL SPECIFICATIONS OF THE OPERATION STORAGE (OS)

- Duration of the record is 75 hours.
- After 75 hours, information previously recorded in the OS is deleted.
- Number of OS write-read cycles is at least 10,000.
- After information reading from OS, the information in it is stored, and repeated reading can be done.
- Information previously stored in OS is not deleted when the plane is de-energized, and is stored completely for at least 1000 hours.

APPLICATION

- ◇ BPK-88 series 3KM modernized unit and PIP-29 engineer support panel for comprehensive servicing of the power unit engines

ALLOWS:

- ◇ Creating a bank of high-quality data about the engine unit of a MiG-29 plane at all life cycle stages:
 - data of commissioning tests (electronic passport) at the manufacturing plant (repair plant);
 - results of engine testing on the stand and in operation at
 - programs as part of a plane;
 - operation data to ensure transfer to the operation of the plane power unit in terms of its technical condition and ensuring prediction of its technical condition.
- ◇ Rapid real-time display of complete information (graphs, physical values of controlled parameters, issued commands, and disruptions in the sensor circuits) about the technical condition of the operating engines and parameters of the BPK-88 series 3KM unit itself on the display of PIP-29 engineer support panel.
- ◇ Reducing material and financial expenses for operation of BPK-88 series 3KM units, RD-33 engines, GTDE-117 turbine starter, KSA.
- ◇ Obtaining new application properties of the BPK-88 series 3KM unit due to the existing possibility of fast search of failures in the power electronics and automatics of the unit and connected onboard circuits when using the PIP-29 engineer support panel.

AUDIO AND VIDEO REGISTRATION SYSTEM



SAVR-27UD

AUDIO-VIDEO RECORDING SYSTEM

AVRS COMPONENTS:

- BAVR-27UD unit;
- VK-29U camera;
- transponder;
- flash drives – 2 PCS.

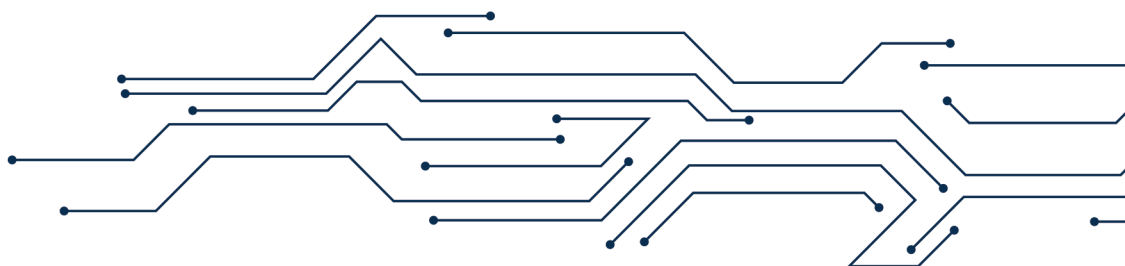
PURPOSE:

The SAVR-27UD audio-video recording system provides:

- In-flight forming and recording on a digital video cassette (DVC) and a remote video cassette (in the on-board recorder) of data from the VK-29U video camera. The VK-29U video camera captures the visible space in front of the aircraft against the background of the image from the ILS-31.
- In-flight recording of audio data from the internal and external radio communication circuit, time stamps and one-time commands («BK», «Weight on wheels») to the DVC.

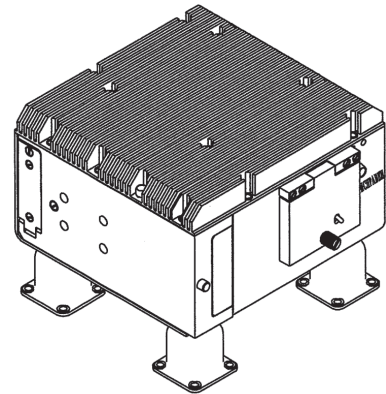
The BAVR-27UD unit ensures the start of recording of audio-video data from the AVRS tumbler on the cabin panel or the signal of the one-time «TEST» command, and the automatic start of recording at the «breakoff» signal of the one-time «Weight on wheels» command. The BAVR unit provides automatic time adjustment from the data received from the on-board recorder by a serial code or when connecting the laptop to the unit (time is synchronised with the system time of the laptop)

The VK-29U video camera is designed to shoot and form a coloured video of the cabin external space at the front hemisphere in the direction of the flight. The field of view of the VK-29U video camera is formed with a lens tuned to infinity.



MAIN ADVANTAGES OF THE SAVR-27UD SYSTEM

- ◇ Modern element base;
- ◇ Better reliability rate due to reducing the number of elements and applying a modern element base;
- ◇ Higher image resolution due to the use of modern cameras;
- ◇ Better manufacturability.



BRIEF SPECIFICATIONS:

Product supply voltage (nominal), V	18–33
Power, W	25, max.
VK-29U resolution, pixels	1280 × 720
Number of signals of one-time command type inquired, approx.	3
Number of inputs for ARINC-429 reception	1
Information reception speed, kbit/s	100±1.0
Capacity of the DVC, GB	8.0, min.
Recording audio and video data to the DVC, h	4.0, min.
Continuous recording time, h	5.0
The time of the SAVR unit readiness from the moment of power on, max.	30 seconds
Product weight, kg	4, max.



SAVR-39

AUDIO AND VIDEO RECORDING SYSTEM FOR
UPGRADED L-39 AIRCRAFT

PURPOSE:

The SAVR-39 system ensures recording of the external environment visible to the pilot with application of signature from the indicator in the windscreen, recording of crew communication. Information is recorded on a removable solid state drive - digital video cassette (hereinafter – DVC).

The SAVR-39 system ensures:

- ◊ recording of signals from the source of video information and aircraft intercom device on a DVC. Recording time is at least 2 hours. The video signal is in the PAL system. Nominal compression value is 720x576 pixels @ 25 fps;
- ◊ real-time recording of time stamps with date;
- ◊ ability to control the output analog video signal;
- ◊ control of operation modes of SAVR-39 using discrete commands and serial code via ARINC-429;
- ◊ three inputs to receive the serial code via ARINC-429;
- ◊ one output to issue the serial code via ARINC-429;
- ◊ information playback is in AVI format using standard video players;
- ◊ SAVR-39 uptime from power-on is max. 60s.

BRIEF SPECIFICATIONS:

◊ Power voltage	27 V	• VK-01 video camera;	max 0.2 kg
◊ Consumption current	0.5 A	• DVC	max.0.1 kg
◊ Weight:		◊ Dimensions:	
• SAVR-39;	max. 2.6 kg	• BAVR-39;	141x160x170 mm
• BAVR-39;	max. 2.3 kg	• VK-01 video camera;	95x38x62 mm
		• DVC	122x58x17 mm



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