AIRBORNE EQUIPMENT
OF SATELLITE NAVIGATION

USER`S MANUAL

OPERATION
PART 1 ТДЦК.461513.077-02 РЭ

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Airborne equipment of satellite navigation
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Operator's Guide
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(Appendix J)

ABBREVIATION LIST

ACA	- Actual Course Angle;
ACS	- Automatic Control System;
AD	- Angle of Drift;
AE	- Airborne Equipment;
AES	- Airborne Equipment Set;
AESN	- Airborne equipment of satellite navigation;
AHS	- Airborne Heading Systems;
Aircraft	- Aircraft;
ASPMS	- Altitude and Speed Parameter Measurement System;
ASS	- Air Signal System;
AVPS	- Altitude-Velocity Parameters System;
BC	- Binary Code;
BDC	- Binary Decimal Code
BIU	- Background Information Unit;
CA	- Civil Aviation;
CAIO	- Civil Aviation International Organization;
CDM-94	- Compact Distance Meter;
CP	- Central Processor;
CR	- Customer Representation;
CS-42	- Coordinate System 1942;
DDRE	- Differential Data Receiving Equipment;
DIU	- Dynamic Information Unit;
DME	- Distance Measuring Equipment;
DT	- Desired Track;
DTA	- Desired Track Angle;
E/W-component	- Ground Speed Component for East/West Direction;
EBA	- Electronic Barometric Altimeter;
EGNOS	- European Geostationary Navigation Overlay System;
EP-90	- Earth Parameters 1990;
FAWP	- Final Approach Waypoint;
FCC	- Frequency-Code Channel;
FDE	- Fault Detection and Exclusion Algorithm;
FNE	- Flight & Navigation Equipment;
FNI	- Flight & Navigation Instrument;

FOM	- Flight Operation Manual;
FS	- Flow Sheet;
GLONASS	- Global Navigation Satellite System;
C/A-code	- GPS Law Range Accuracy Code;
GNSS	- GPS+GLONASS Joint System;
GPS	- US Global Positioning System;
HDOP	- Horizontal Dilution of Precision;
HF	- High Frequency;
HFOM	- Horizontal signals quality evaluation;
HIL	- Horizontal Integrity Limit;
HVSS	- Heading and Vertical Strapdown System;
IK	- Installation Kit;
ILS	- Instrumental Landing System;
IM	- Instructional Manuals.
IST	- integrity signaling threshold;
LAAS	- Local Area Augmentation System;
LCTD	- Linear Cross-Track Deviation;
LLT	- Linear Lead of Turn;
LNA-SSF	- Low Noise Amplifier with Signal Separate System;
M	- Maintenance;
MFD	- Multifunctional Display (A813);
MLS	- Microwave Landing System;
MS	- Maintenance Schedule;
MSAS	-Multi-transport Satellite-based Augmentation System;
n.m.	- Nautical Mile;
NDB	- Navigation Database;
NOTAM	- Notice To Airmen;
NP	- Navigation Point;
NSC	- Navigation Spacecraft;
NT	- Navigation Task;
OCTM	- On Condition Technical Maintenance;
PCU	- Peripheral Control Unit;
Proc.Con.	- Process Connector;
QD	- Quality Department;
RA	- Runway;

RAIM	- GNSS (GPS) Receiver Autonomous Integrity Monitoring;
RAM	- Random Access Memory;
RB	- Radio Beacon;
RICU	- Receiver and control unit (Receiver indicator and control unit);
RNAV	- Area Navigation;
RNP	- Required Navigation Performance;
ROM	- Read Only Memory;
RR	- Radio Receiver;
SAR	- Standard Arrival Route;
SARPs	- Standards and Recommended Practices;
SBAS	- Satellite Based Augmentation System;
SC	- Short Circuit;
SD	- Standard Deviation;
SDR	- Standard Departure Route;
SHF	- Superhigh frequencies;
SNS	- Satellite Navigation System;
SRNRS	- Short-Range Navigation Radio System;
ST-code	- Standard Accuracy Code;
SW	- Software;
TAWS	- Terrain Awareness and Warning System;
TR	- Technical Requirements;
TRTM	- To Refusal Technical Maintenance;
UART	- Universal Asynchronous Receiver/Transmitter;
UM	- User's Manual;
UPS	- Uninterruptible power supply;
UTC	- Universal Coordinated Time;
VDOP	- Vertical Dilution of Precision;
VFOM	- Vertical signals quality evaluation;
VIL	- Vertical Integrity Limit;
VOR	- VHF Omnidirectional Range (radio beacon);
VSWR	- Voltage Standing Wave Ratio;
WAAS	- Wide Area Augmentation System (US);
WGS-84	- World Geodetic System 1984;
WP	- Waypoint.

Definitions Used For Equipment Operation Description

Airway **-** corridor in the airspace, limited by altitude and width, purposed for aircraft flights, provided with intermediate airfield and equipped with radio navigation facilities, air traffic monitoring and control facilities.

Airspeed – airplane movement velocity relating the air.

Pop-up – part of the window or the form page, indicated at **MENU** button pressing, when parameters, that suppose some specified values, are being inserted and when confirmation or cancellation of any function IS required.

Desired Track – projection of the aircraft assigned flight path onto the Earth horizontal surface.

Route – desired track, specified by the waypoints, through which the airplane shall fly.

Airplane position – point on the Earth surface, where the airplane mass center is being projected at the present moment

Viewpoint – serial character cells range in the form line for one parameter or one function indication.

Track angle (desired or true) – angle between the northwards direction (taken as a reference point) and a track (desired or true).

Airplane Ground Speed – velocity of travel of airplane mass center projection point on the Earth surface, directed at a tangent to the track.

Form Page – part of the form, indicated simultaneously on the RICU display. The form pages should be overviewed rotating the shaft-encoder handle clockwise or counterclockwise.

Window – part of the form page, indicated simultaneously on RICU display.

Flight Path – spatial track (desired or true), circumscribing by the airplane mass center during its movement.

Form – range of parameters, indicated on the RICU display, after the corresponding button pressing on RICU.

Way point – navigation point or waypoint, where the flight is directed.

Nonvolatile parameters – parameters, whose last settings are saved when the equipment power supply is on/off.

This User's Manual involves ТДЦК.461513.077-02, code CH-4312-02 (hereinafter referred to as equipment) airborne equipment of satellite navigation, purposed for operation in civil airplanes and helicopters included into the radioelectronic aircraft equipment with information interchange digital lines.

By means of this User's Manual Customer shall learn main specifications, principle and rules of equipment operation. User's Manual consists of two parts:

- «Airborne equipment of satellite navigation. User's Manual. Technical Maintenance. Part 1. ТДЦК.461513.077-02 РЭ»;
- «Airborne equipment of satellite navigation. User's Manual. Operator's Guidance. Part 2. ТДЦК.461513.077-02 РЭ1».

The equipment shall meet requirements for AESN subclasses A1, B1, C1 pursuant to Qualified Requirements КТ-34-01 (the 3rd edition) and requirements for SBAS airborne equipment pursuant to SARPs.

The equipment is intended for On Condition Technical Maintenance (OCTM). OCTM technique shall identify the type and volume of maintenance works, being specified in 034.50.00 Maintenance Technique.

Only personnel who learned thoroughly this Manual shall operate the equipment.

In order to exclude any contingencies that may affect the equipment functionality, please, consider the following warnings.

CAUTIONS

1 FOLLOW THE GOVERNING RULE OF AERONAVIGATION - NEVER USE ONE AND THE ONLY NAVIGATION SYSTEM! ERRORS OR FAILURES ARE POSSIBLE IN ANY SYSTEM, SO DUPLICATION AND CROSS-CHECKING OF NAVIGATION INFORMATION ARE COMPULSORY CONDITIONS OF A SAFE FLIGHT.

2 THOUGH THE EQUIPMENT MAY EFFICIENTLY PERFORM THE NAVIGATION REQUIRED TASKS AND DISPLAY A LOT OF NECESSARY AND USEFUL INFORMATION, YOU SHOULD REMEMBER THAT THE GOVERNING RULE OF A SAFE FLIGHT IS "TO SEE EVERYTHING AROUND AND THAT EVERYBODY AROUND CAN SEE YOU."

3 THE EQUIPMENT SHALL BE USED STRICTLY ACCORDING TO THE USER'S MANUAL IN ORDER TO PROVIDE ITS EFFECTIVE OPERATION.

4 ALTITUDE CALCULATED BY THE EQUIPMENT AS A RESULT OF NAVIGATION COMPUTATIONS IS AN ALTITUDE OVER GEOID AND CAN DIFFER SIGNIFICANTLY FROM THE BAROMETRIC ALTITUDE. NEVER USE IT FOR VERTICAL NAVIGATION!

5 WHEN INFORMATION MESSAGE APPEARS (HIGHLIGHT OF THE BUTTON MSG TURNED ON), A PILOT SHOULD BECOME ACQUAINTED WITH ITS CONTENT AND TAKE A DECISION AS TO FURTHER ACTIONS

6 THE EQUIPMENT INDICATES THE NAVIGATION DATABASE (NDB) EXPIRATION DATE, STORED ON THE NDB STORAGE REMOVABLE UNIT. THE DELIVERY SET INCLUDES THE DEMO NDB.
THE NDB SHALL BE UPDATED EACH 28 DAYS. NDB SHALL BE SUPPLIED REGULARLY TO THE CUSTOMER UNDER THE SPECIAL AGREEMENT IN ACCORDANCE WITH AIRAC CYCLES.
THE PILOTS USING THE OUT OF DATE DATABASE, DO IT ON THEIR OWN RISK!

7 DETACHABLE NDB STORAGE DEVICE SHOULD BE REMOVED OR SET IN RICU ONLY IF RICU IS TURNED OFF.

AIRBORNE EQUIPMENT OF SATELLITE NAVIGATION – DESCRIPTION AND OPERATION

General Information

Purpose

The equipment is purposed for operation as an element of the radioelectronic aircraft equipment with information interchange digital lines.

The equipment is intended both for standalone installation and as element of the civil aircraft instrumentation. The equipment tasks are as follows:

- to resolve the navigation tasks and provide with aeronavigation control at all stages of flight, from takeoff till approach, airway flight and arbitrary routes flight, on the equipped/unequipped airways, day or night time, by means of GLONASS and GPS navigation satellite systems;
- control system delivery in ACS;
- work with the standard worldwide and user's navigation databases;
- alpha-digital and graphical indication of aircraft information and operation modes;
- airborne system centralized control of radio equipment (VOR, DME) in automatic and manual modes;
- navigation information formatting and delivery for its displaying on the aircraft instrumentation and on electronic system displays (or multipurpose displays).

Performance Characteristics and Operating Conditions

Intended-Purpose Function

The equipment shall provide with the intended-purpose functions as follows:

- automatic, continuous, in the true time, at parking and in the flight - *navigation parameters detection* by GLONASS, GPS satellite radio navigation systems' signals, also using the information from the airborne equipment:

geographical coordinates of aircraft position;

aircraft geodetic altitude;

aircraft ground speed vector components;

ground speed;

path angle;

UTC scale time;

- receiver autonomous integrity monitoring (RAIM) via HDOP, VDOP, HIL, VIL, HFOM and VFOM values calculation;
- detection and elimination of failed navigation satellites' signals (FDE function);
- automatic and manual setting of integrity warning threshold. In the case of automatic setting the integrity warning threshold shall be set in accordance with the flight stage: 3,6 km – for *Route* stage; 1,8 km – for *Terminal Area* stage; 556 m – for *Approach* stage in the case of non-precision approach;
- availability forecasting of RAIM function for navigation point shall be provided within 12 hours, from the set time of calculation start with the desired pitch set by operator. RAIM function availability forecasting shall be provided any time when the equipment has received the full almanac. During the forecasting process NOTAM information may be used additionally relating the satellites status at the set time;

- RAIM function availability forecasting for active route shall be provided within the route duration from the set time for en-route traffic start;
- time marker delivery with form and loading specifications, corresponding to ARINC 743A-4 requirements – pulse of $(1 \pm 2 \cdot 10^{-7})$ s period, $(1{,}00 \pm 0{,}01)$ ms duration, 200 ns maximal rise and fall time between 0,1 and 0,9 maximal level values. Leading edge of pulses of time marker is synchronized with UTC time scale;
- providing with data continuous delivery, exclusion of any possibility that incorrect data can be delivered when passing the 1024 reading - GPS weekly cycle to the original status (i.e. to the cycle Nr. «0001»);
- delivery for indication of additional parameters: numbers of each tracking satellite, azimuth, angle of elevation, S/N ratio with reference to GLONASS SNS or GPS;
- delivery for indication of current coordinates within WGS-84, CS-42 coordinate system or CR-90 (on default, within WGS-84 coordinate system);
- delivery of current coordinates to external consumers within WGS-84 coordinate system;
- updating with 10 Hz minimal frequency;
- calculation on the ground of navigation parameters and inserted coordinates of route points:
  - particular coordinates of great-circle aircraft position (S_{OST} and Z);
  - distance from the aircraft current position to the next WP;
  - desired path angle, true or magnetic;
  - actual path angle, true or magnetic;
  - deflection angle (route correction) equal to difference between DTA и ACA, true or magnetic;
  - ground speed;
  - flight time from aircraft position to the next WP and to the destination WP on the desired track;
  - the next WP and destination WP on the desired track passing time;
  - WP passing calculation and generation of signal for aircraft course change (with or without turn lead);
- data reception, formatting and delivery for aircraft FNE via communication lines in accordance with the Table 1;

Table 1

RICU Interface	Number of channels	Note
Receive channel for ARINC 429	8	Appendix E
Delivery channel for ARINC 429	4	Appendix E
One-time commands receive channel (+27 V short circuit /break)	8	
One-time commands receive channel (enclosure short circuit /break)	8	
One-time commands delivery channel (enclosure short circuit/break)	8	Maximal commutation current 200 mA
One-time commands delivery channel ((+27 V short circuit/break)	8	Maximal commutation current 100 mA
Analog information delivery channel (±150 MV)	3	Current outputs
Analog information delivery channel (±10 V)	1	
UART Serial asynchronous ports: - RS-232 - RS-422	 4 2	

- automatic correction of aircraft current position using data of a radio range finder (DME) and omnidirectional radio beacons (VOR);
- SID/STAR/APPROACH procedures using the navigation database, developed in accordance with procedures, described in KT-200A;
- displaying on RICU display:
  – flight route with displaying of navigation references (route displaying indication is possible, when the route is oriented in the northern direction or by desired path angle (or actual path angle) with the scale change);
  – graphical image of departure, arrival and approach standard procedures;
  – route current segment;
- operator selects between GLONASS or GPS working SNS with the selected SNS indication on RICU display. The equipment operates by default on GLONASS/GPS mixed SNS;

- reckoning with navigation parameters characterization accuracy values delivery («**ASS Navigation**» mode) at interfacing with the aircraft trajectory parameters sensors;
- availability of flight from the current position to any desired WP via:
  - change of WP given in flight plan passing sequence;
  - return to the WP given in flight plan passing sequence;
  - new WP insertion;
  - flight on parallel DT with displacement given value relative to DT, inserted into the flight plan within ±99 km range with 1 km discreteness, and possibility of flight by DTA insertion;
  - new path angle insertion (without WP insertion);
- insertion, storage, use, updating and indication of WP, given by user;
- insertion and storage of 1000 waypoints at the most;
- insertion and storage of 90 flight routes at the most, quantity of WP in the route is 144 at the most;
- delivery of information concerning NDB validity or its expiration;
- maneuvering availability in accordance with the NDB procedures, including «**Fly-By**» and «**Fly-Over**» turns;
- availability of maneuvering the following paths control in accordance with ARINC 424 recommendations:
  - appearance in the point of the approach beginning;
  - flight in the line connecting two points;
  - flight to the desired point with the desired path angle;
  - flight from the desired point with the desired path angle;
  - flight from the current position directly to the desired point;
  - constant radius arc flight.

NDB storage

The equipment has a standard and user (online) database. The standard database is stored on the navigation database storage unit (flash card), inserted into the RICU front panel's notch. The navigation database stotage unit has a permanent memory and provides with NDB storage for a certain region of the aircrafts flights. The standard database information is updated each 28 days (in accordance with AIRAC cycles) and supplied to the customer under the agreement**.**

The online database contains the information of the online WP and the flight plans, entered manually by the operator.

The online database information is accessible for any review, amendment, deleting and updating. The online database is permanent.

Automatic interface of two RICUs

To guarantee RNP-1 RNAV requirements two sets of equipment shall be installed on the aircraft board. The equipment provides automatic interaction of two RICUs between them for data transfer and operation modes during the equipment control from one of the two RICUs. Connection diagram of two equipment sets is shown in Appendix K.

When on one RICU the following operations are being processed:

- parameter setting in **Limit Data** window;
- user points creation (edition);
- routs creation (edition);
- route activation;
- flight activation in **DIRECT ON** mode

the same operations are processed automatically on the second RICU.

When you run these procedures in one RICU and in the second RICU set **NAV** data card.

In the absence of NT solution from GNSS sensor since power-up time in one of the RICUs it is necessary to set coordinates in this RICU which were received by other RICU as initial ones (**AUX3/ DATA CROSS - BPIU**).

To synchronize operation of both RICUs in case when a route is activated in one RICU and other RICU is turned off, then at power-up other RICU and after receiving valid coordinates it is necessary to reactivate an active leg of route in earlier operating RICU, or activate a flight in **DIRECT-TO** mode.

WARNING IN THE CASE OF OPERATION WITH TWO SETS OF EQUIPMENT NDB SHALL BE IDENTICAL.

Dimension of navigation parameters indication

Dimension of the navigation parameters, identified on RICU display, is as follows:

- geographical coordinates - degrees, minutes, hundredth of a minute;
- DT deviation - kilometers (NM).

The indication resolution of desired track error is 0,01 km (NM) at distance up to 9,99 km (NM), and it is 0,1 km (NM) at distance from 10 to 99,9 km (NM);

- distance - kilometers (NM).

The indication resolution of remaining distance value is 0,1 km (NM) at distance up to 999,9 km (NM) and it is 1 km (NM) at distance from 1000 to 99999 km (NM);

- altitude - meters (feet);
- ground speed – kilometers per hour (knots);
- path angle and ACA correction - degrees;
- current UTC time - hours, minutes, seconds;
- flight time to WP – hours and minutes if the reminded time exceeds one hour; minutes and seconds if the remained time is less than one hour;
- time of appearance in WP – hours and minutes.

Note – indicated parameters dimension shall be changed for the dimension given in parenthesis when metric system is changed for the British one.

Tolerance of Navigation Parameters

Tolerance of navigation parameters detection shall correspond to KT-34-01 requirements (3rd edition).

Navigation parameter errors with 0,95 probability if HDOP is $\leq 1,5$, VDOP is $\leq 3,0$ in «**SNS Navigation**» mode and operation using GLONASS SNS, GPS SNS and mixed GLONASS/GPS SNS is no more than:

- horizontal coordinates 44 m;
- altitude 70 m;
- ground speed 0,3 m/s.

In «**SNS Navigation**» mode the horizontal coordinates' deviation shall be detected by calculations depending on airborne sensors deviation (airspeed sensor and route sensor) and operation time in «**SNS Navigation**» mode.

In «**DME/DME navigation**» and «**VOR/DME navigation**» modes errors are defined by calculation depending on the distance to radio beacons and geometric position of the aircraft and radio beacons.

Coordinates taking time

The first reading of navigation parameters shall be taken in 2,5 minutes at the latest.

Work continuity

The equipment continuous operation time is 24 hours.

Number of RR radio channels

Number of RR radio channels – 24.

The equipment works with all NSCs within the radio-visibility area.

Information interchange

Electric signal types, kinds and levels, as well as one-time commands, shall correspond to requirements PTM 1495-75 with amendment 3.

Information interchange between the equipment and AES shall be communicated via bipolar code "to all" asynchronous way, when the information sensor delivers continuously the information as information words, appearing in the line after the given time intervals, and information consumer shall be ready to receive the necessary code words anytime.

Power Supply

The equipment shall be powered from the airborne DC mains having 27 V nominal voltage.

Maximum power consumption is 30 W.

Note –*If power supply interrupts for more then 3 seconds in the case of defective work of the power supply system, the equipment may stop and then restart automatically in the testing mode providing its output characteristics after 2.5 minutes.*

The power voltage from the airborne mains shall be supplied to UPS «**X1**» connector. RICU switching ON/OFF is executed by ON/OFF locking button pressing.

Operation conditions

The equipment shall resolve functional tasks at parking, during movement within the airport limits, and during flight day or nighttime in any physical and geographical conditions, regardless weather conditions, in any point of the Earth if the aircraft flight following parameters change as follows:

- ground speed	0 … 1300 km/h;
- angle of list and angle of pitch	- 30 … + 30°;
- vertical speed	- 50 …+ 50 m/s;
- drift angle	- 180 …+ 180°;
- acceleration	- 30 …+ 30 m/s^2;
- path angle	0 … 360°;
- barometer elevation	- 500 …+ 15000 m.

Environmental Influencing Factors

Operating temperature range:

- RICU	- 20 …+ 55 °C;
- UPS	- 40 …+ 55 °C;
- LNA-SSF	- 55 …+ 55 °C;
- A101П antenna	- 55 …+ 85 °C.

Higher short-time operating temperature (up to 30 min)

RICU, UPS, LNA-SSF	+ 70 °C.

Limiting temperature:

- lower:	
- RICU	- 55 °C;
- A101П antenna, LNA-SSF, UPS	- 60 °C;
- upper:	+ 85 °C.

Sinusoidal vibrations:

- frequency range	5 … 2000 Hz;
- vibration acceleration range, max:	
- RICU	3 g;
- UPS	5 g;
- A101П antenna, LNA-SSF	10 g.

The equipment efficiency in the case of ice formation shall be guaranteed, if ice layer on A101П antenna surface does not exceed 1,3 mm.

Weight

Equipment units' weight:

- RICU	(2,50 ± 0,25) kg;
- A101П antenna	(0,180±0,015) kg;
- LNA-SSF	(0,22±0,02) kg;
- UPS	(1,10 ± 0,11) kg.

Electromagnetic Compatibility

The equipment by its noise immunity meets КТ-34-01 (3rd edition) requirements for GPS and GLONASS signals receivers considering operation conditions on aircrafts, equipped with radio communication satellite systems.

As for interference generation and interference susceptibility (except antenna) the equipment corresponds to П8.1.4.1. ЕНЛГ-С requirements by 1Z, 2Z, 3Z rigidity categories.

The equipment shall correspond to КТ-160D requirements regarding:

- susceptibility to audio frequency interference, coming through power supply inputs – J category of rigidity;
- susceptibility to induction interference, exposed through the communication wiring in the equipment enclosure - C category of rigidity;
- radio frequency susceptibility - W category of rigidity;
- radio frequency energy emanation susceptibility - H category of rigidity;
- transient processes susceptibility, caused by lighting - A1XXX category of rigidity.

By lightening direct action the antenna corresponds to 2B category КТ-160D requirements.

Equipment Units

For equipment units see Table 2.

Table 2

Unit	Code	Quantity
Receiver indicator and control unit	ТДЦК.467855.039	1 pc.
А101П Antenna	ПКАН.464656.005	1 pc.
LNA-SSF	АПМА.434816.034	1 pc.
Uninterruptible power supply	ТДЦК.436434.006	1 pc.
Installation kit	ТДЦК.468911.020-02	1 set
Operation and maintenance documents	ТДЦК.461513.077-02 ЭД	1 set
Packing	ТДЦК.305642.048-01	1 set

Operation Principle

The equipment consists of:

- A101П antenna;
- LNA-SSF;
- Receiver indicator and control unit;
- Uninterruptible power supply.

For equipment functional diagram see Fig. 1.

For equipment Connection Layout see Appendix A.

For units appearance and dimensions, that are included into the equipment, see Appendix B, Appendix C and Appendix D.

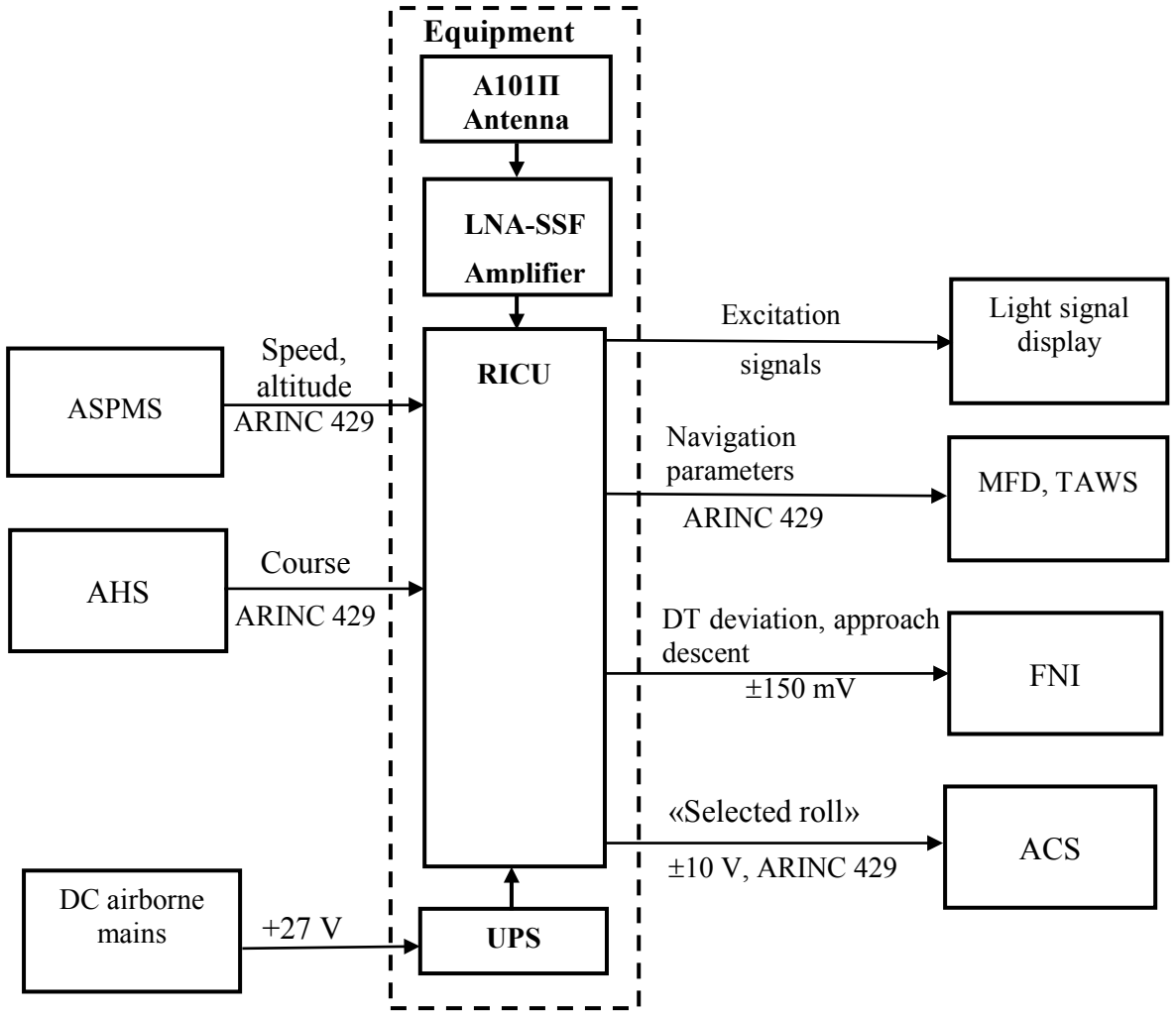


Figure 1

A101П antenna receives signals from GLONASS, GPS SNS within the frequency range from 1570 to 1610 MHz. Received signals are enhanced in A101П antenna and transferred for further processing to LNA-SSF.

LNA-SSF enhances signals, coming from A101П passive antenna, makes separate GLONASS and GPS SNS signal filtering. From LNA-SSF signals via the high-frequency cable are transmitted to RICU input.

RICU processes the received signals and selects the useful information. The selected information is processed in the navigation processor; the results of definition are indicated on RICU display, and issued via ARINC 429 interface.

For list of words, transmitted and received via ARINC 429, and their format see Appendix E of this Manual.

RICU generates and delivers analog signals to the aircraft airborne systems:

- «**Z**» signal (deviation from DT) as DC voltage, changes within the range from -150 to +150 mV, load from 200 to 1000 Ohm («+» voltage- right deviation, «-» voltage – left deviation).
  To the aircraft linear deviation from DT:
  - 5 minus - 5 plus km in route;
  - 1 minus - 1 plus km at flight in the airport area;
  - 0,5 minus - 0,5 plus km at approach

  corresponds «**Z**» signal linear change -150 mV - +150 mV. «**Z**» signal scale changes automatically, depending on the flight stage.

  «**Z**»signal description inclination, depending on the flight stage
  - 0,030 V/km for the route stage;
  - 0,150 V/km for the airport area stage;
  - 0, V/km for the approach stage;
- «**Availability Z**» signal (deviation from DT availability) as DC voltage of +27 V nominal value at (1000±100) Ohm load, specifying deviation from DT analog signal availability;

- «**Selected roll**» signal for automatic flight on the desired route, changing from (10±1) V to minus (10±1) V on 1000 Ohm minimal load, for aircraft roll control within the range ±30° with 0,33 V/degree gradient, with information updating maximal period 0,1 second and

100 mV maximal ripple «peak to peak»;

- « **Selected roll availability**» signal as DC voltage of +27 V nominal value on (1000±100) Ohm load, specifying «**Selected roll**» analog signal availability;
- «**TO**/**FROM**» signal DC voltage of +27 V nominal value on (1000±100) Ohm load, specifying **TO** point direction.

RICU generates and delivers «**Second marker**» signal with 1 Hz frequency. Signal specifications are given below at RICU description.

RICU generates and delivers control signals to the light alarm board in the case of:
- impossibility of RAIM function performance (**RAIM** signal);
- parallel route movement («**OFFSET**» signal);
- intermediate route point transition («**WPT**» signal);
- warning or information message («**MSG**» signal);
- when putting an aircraft on the first leg of **APPROACH** procedure «**ACTV**» signal is generated. When canceling **APPROACH** procedure «**ACTV**» signal is turned off;
- when an aircraft performs **APPROACH** procedure two miles before FAWP fly-over, «**ARM**» signal is generated. When canceling **APPROACH** procedure or at missed approach «**ARM**» signal is turned off;
- aircraft position in the airport area («**Airport area**» signal);
- with navigation solution and positive results of testing («**SNS availability**» signal).

- fulfillment of the following conditions for a selected terminal (**NAV5** page):

  - $400 \le H \le 1500$,

  - $12000 \le Y \le 30000$,

  - $|X| \le 0{,}6\,|Y|$,

  where H is aircraft altitude, m

  X is lateral deviation from runway axis, m

  Y is a distance from runway threshold, m

  «**Switch on ERLA**» signal is generated.

The equipment control and data insert are made by controls, placed on RICU front board.

RICU receives the information from the route and airspeed airborne systems; and on the ground of the received information makes the wind conditions calculations.

With automatic mode of aircraft control (**AUTOPILOT**), if the equipment is connected to ACS, «**Selected roll**» signal is delivered to ACS for flight on DT.

With manual mode of aircraft control a pilot shall adjust the heading on the ground of information concerning deviation from DT, received by CDI scale on RICU display.

If during the en route flight (or **DIRECT ON** mode flight) at the automatic mode of the airplane control (**AUTOPILOT**) the SNS signals are lost, the equipment shall perform the navigation parameters automatic reckoning in accordance with the information from the plane course and speed sensors, taking into consideration the last stored wind conditions. The reckoning time shall be changed depending on the aircraft flight stage and speed. The navigation parameters automatic reckoning shall stop in the case of the integrity signalization threshold coordinates definition accuracy crossing.

UPS must provide the equipment no-break power supply during short-time breaks in voltage supply of airborne mains with nominal voltage of 27 V.

Description

Receiver indicator and control unit

ТДЦК.467855.039 Receiver indicator and control unit's purpose is to process the received signals and deliver the results on the display and to external users.

External view of RICU front panel since serial № C03910021 is shown in fig. 2.

Figure 2

Receiver indicator and control unit Operation

GPS, GLONASS SNS signals received by A101П antenna and amplified in LNA-SSF enter the RICU input. In RICU these signals are amplified, filtered, separated and their further analog and digital processing occurs.

RICU makes all calculations associated with formation of output control "**Y-required"** signal, generated in ACS and lateral deviation from desired track generated in FNI.

RICU forms word packages transferred in ARINC 429 format to aircraft systems interfaced with RICU;

RICU maintains data exchange control with interfaced airborne equipment.

Navigation database is stored in detachable storage device. This navigation database storage device may contain information on two bases of navigation data.

RICU operating mode control, its turning on and off is performed by means of the following controls: keyboard, shaft encoder and ON/OFF button located on the front panel.

Navigation information is shown on RICU display.

RICU electric supply is performed from aircraft on-board power system across uninterruptible power supply unit.

RICU Connectors Purpose

There are five connectors on the RICU enclosure's rear panel.

«**X1**» connector (ОНц-БГ-1-10/18В-1М-В plug) is purposed for UPS connection. «**X1**» connector contacts' purpose is given in the Table 3.

Connectors':

- «**X2**» (ОНц-БГ-1-41/30В-1М-В plug);
- «**X3**» (ОНц-БГ-1-41/30В-1М-а-В plug);
- «**X4**» (ОНц-БГ-1-41/30В-1М-б-В plug),

purpose is connection of RICU to the airborne equipment.

«**X2**», «**X3**», «**X4**» connector contacts' purpose is given in the Tables 4, 5, 6 respectively.

«**X5**» connector (TNC R 143 324 000 RADIALL socket) is purposed for RICU connection to LNA-SSF. LNA-SSF feed voltage is supplied via the connector central contact, having minimal voltage of (12±1) V and maximal current consumption of 75 mA.

Table 3 - «**X1**»connectors' purpose

Contact	Circuit	Purpose
1	+27_UPS	Power source, +27 V, input
2	ON/OFF_IN	Equipment power on signal, input (reserved)
3	-27_UPS	Power source, -27 V, input
4	-27_UPS	Power source, -27 V, input
5	ON/OFF_IN	Equipment power on signal, input
6	+27_UPS	Power source, +27 V, input
7	ON/OFF_OUT	Equipment power on signal, output (reserved)
8	ON/OFF_OUT	Equipment power on signal, output
9	ENCLOSURE	Enclosure
10	ENCLOSURE	Enclosure

Table 4 - «**X2**»connector contacts' purpose

Contact	Circuit	Signal	Purpose
1	GND	-	Common
2	RK0_OUT	OFFSET	One-time command 0, common, output
3	RK1_OUT	RAIM	One-time command 1, common, output
4	GND	-	Common
5	GND	-	Common
6	RK2_OUT	WPT	One-time command 2, common, output
7	RK3_OUT	MSG	One-time command 3, common, output
8	RK4_OUT	SNS availability	One-time command 4, common, output
9	RK5_OUT	ACTV	One-time command 5, common, output
10	ARM1_RX	Reserved	Free
11	ARM1_TX	Reserved	Free
12	RK6_OUT	Airport area	One-time command 6, common, output
13	RK7_OUT	Switch on ERLA	One-time command 7, common, output
14	RK8_OUT	Ek availability (reserved)	One-time command 8, +27 V, output
15	RK9_OUT	Eg availability (reserved)	One-time command 9, +27 V, output
16	RK10_OUT	Z availability	One-time command 10, +27 V, output
17	GND	-	Common
18	GND	-	Common
19	RK11_OUT	Selected roll availability	One-time command 11, +27 V, output
20	RK12_OUT	Close RB (reserved)	One-time command 12, +27 V, output
21	RK13_OUT	Far RB (reserved)	One-time command 13, +27 V, output
22	RK14_OUT	TO/FROM	One-time command 14, +27 V, output
23	RK15_OUT	ARM	One-time command 15, +27 V, output
24	GND	-	Common
25	GND	-	Common
26	AGND_F	Ek common (reserved)	Analog common
27	A1_OUT	Ek signal (reserved)	Channel 1, ±150 mV, analog output
28	REZ1_F	Reserved	Free
29	A2_OUT	Eg signal (reserved)	Channel 2, ±150 mV, analog output
30	AGND_F	Eg common (reserved)	Analog common
31	GND	-	Common
32	GND	-	Common
33	AGND_F	Z Common	Analog common
34	A3_OUT	Z Signal	Channel 3, ±150 mV, analog output
35	A4_OUT	Selected roll signal	Channel 4, ±10 V, analog output
36	AGND_F	Selected roll common	Analog common
37	GND	-	Common
38	0_LIGHT	Lighting adjusting	Lighting, common
39	5V_LIGHT	Lighting adjusting	Lighting, +5 V
40	27V_LIGHT	Lighting adjusting	Lighting, +27 V
41	ENCLOSURE	-	Enclosure

Table 5 - «**X3**» connector contacts purpose

Contact	Circuit	Signal	Purpose
1	GND	-	Common
2	1S	Second marker	Second marker
3	#1S		Second marker, inverse output
4	GND	-	Common
5	GND	-	Common
6	GNSS_RX2	1 GNSS module port process	Channel 2 RS-232, receiver
7	GNSS_TX2		Channel 2 RS-232, transmitter
8	ARM_RX	0 port PCU Arm7, process	Channel 1 RS-232, receiver
9	ARM_TX		Channel 1 RS-232, transmitter
10	GND	-	Common
11	USB+_OUT	USB Output (reserved)	USB-port positive output
12	PXA_RX0	Process	Channel 0 RS-232, receiver
13	PXA_TX0		Channel 0 RS-232, transmitter
14	PLM_RX4	Reserved	Channel 4, RS-422, receiver, direct input
15	PXA_RX3	Connection with the second RICU	Channel 3, RS-422, receiver, direct input
16	#PXA_RX3		Channel 3, RS-422, receiver, inverse input
17	USB- OUT	Inverse USB output (reserved)	USB-port negative output
18	USBGND OUT	USB power supply (reserved)	USB-port power supply, common
19	PXA_TX3	Connection with the second RICU	Channel 3, RS-422, transmitter, direct output
20	#PXA_TX3		Channel 3, RS-422, transmitter, inverse output
21	#PLM_RX4	Reserved	Channel 4, RS-422, receiver, inverse input
22	PLM_TX4	Reserved	Channel 4, RS-422, transmitter, direct output
23	#PLM_TX4		Channel 4, RS-422, transmitter, inverse output
24	USB_VCC_OUT	USB power supply (reserved)	USB-port power supply, output
25	GND	-	Common
26	PLM_RX5	Reserved	Channel 5 RS-232, receiver
27	PLM_TX5		Channel 5 RS-232, transmitter
28	-	Reserved	Free
29	AR_A0_OUT	See paragraph E.1.2 of Appendix E	Channel 0, ARINC 429, line A, output, 100 KHz
30	AR_B0_OUT		Channel 0, ARINC 429, line B, output, 100 KHz
31	GND	-	Common
32	GND	-	Common
33	AR_A1_OUT	See paragraph E.1.3 of Appendix E	Channel 1, ARINC 429, line A, output, 100 KHz
34	AR_B1_OUT		Channel 1, ARINC 429, line B, output, 100 KHz
35	AR_A2_OUT	See paragraph E.1.4 of Appendix E	Channel 2, ARINC 429, line A, output, 12,5 KHz
36	AR_B2_OUT		Channel 2, ARINC 429, line B, output, 12,5 KHz
37	GND	-	Common
38	GND_OUT	-	Common
39	AR_A3_OUT	See paragraph E.1.5 of Appendix E	Channel 3, ARINC 429, line A, output
40	AR_B3_OUT		Channel 3, ARINC 429, line B, output
41	ENCLOSURE	-	Enclosure

Table 6 - «**X4**» connector contacts' purpose

Contact	Circuit	Signal	Purpose
1	GND	-	Common
2	AR_A0_IN	Course system (HVSS-П-2A or LCR-93). Hydromagnetic heading (word 320_8)	Channel 0, ARINC 429, line A, input, 100 KHz
3	AR_B0_IN		Channel 0, ARINC 429, line B, input, 100 KHz
4	GND	-	Common
5	GND	-	Common
6	AR_A1_IN	ASPMS (ASPMS-140-01, УИФ-2Б), H_{abs} (word 203_8), V_{true} (word 210_8)	Channel 1, ARINC 429, line A, input, 12,5 KHz
7	AR_B1_IN		Channel 1, ARINC 429, line B, input, 12,5 KHz
8	AR_A2_IN	CDM-94 (СД-75М). Adjusting frequency (word 035_8), slant range (word 202_8)	Channel 2, ARINC 429, line A, input, 100 KHz
9	AR_B2_IN		Channel 2, ARINC 429, line B, input, 100 KHz
10	GND	-	Common
11	GND	-	Common
12	AR_A3_IN	МП heading	Channel 3, ARINC 429, line A, input
13	AR_B3_IN		Channel 3, ARINC 429, line B, input
14	IN_H_1	Reserved (Strut compression)	One-time command 1, +27 V, input
15	AR_A4_IN	DDRE	Channel 4, ARINC 429, line A, input
16	AR_B4_IN		Channel 4, ARINC 429, line B, input
17	GND	-	Common
18	GND	-	Common
19	AR_A5_IN	Reserved	Channel 5, ARINC 429, line A, input
20	AR_B5_IN	Reserved	Channel 5, ARINC 429, line B, input
21	IN_H_2*	Exchange parameters identifier, «0» - breakage, «1» - short circuit at +27 V	One-time command 2, +27 V, input
22	AR_A6_IN	Reserved	Channel 6, ARINC 429, line A, input
23	AR_B6_IN	Reserved	Channel 6, ARINC 429, line B, input
24	AR_A7_IN	Reserved	Channel 7, ARINC 429, line A, input
25	AR_B7_IN	Reserved	Channel 7, ARINC 429, line B, input
26	IN_H_3*	Exchange parameters identifier, «0» - breakage, «1» - short circuit at +27 V	One-time command 3, +27 V, input
27	IN_H_4*		One-time command 4, +27 V, input
28	IN_H_5*		One-time command 5, +27 V, input
29	IN_H_6	Reserved	One-time command 6, +27 V, input
30	IN_H_7	Reserved	One-time command 7, +27 V, input
31	IN_H_8	Reserved	One-time command 8, +27 V, input

Table 6 Continuation

Contact	Circuit	Signal	Purpose
32	GND	-	Common
33	IN_L_1	Strut compression (Air/Earth) «Air» - GND short circuit, «Earth» - breakage	One-time command 1, GND, input,
34	IN_L_2**	RICU identifier, «0» - breakage, «1» - GND short circuit	One-time command 2, GND, input
35	IN_L_3	Reserved	One-time command 3, GND, input
36	IN_L_4*	Exchange parameters identifier, «0» - breakage, «1» - GND short circuit	One-time command 4, GND, input
37	IN_L_5*		One-time command 5, GND, input
38	IN_L_6*		One-time command 6, GND, input
39	IN_L_7*		One-time command 7, GND, input
40	IN_L_8	Reserved	One-time command 8, GND, input
41	+12V_OUT	Pendant power supply	+12 V, output

* Exchange parameters identifier:

a) if IN_H_2 - IN_H_5, IN_L_4 - IN_L_7 are set on «0» then information delivery rate in MFD is 12,5 Kbit/s;

b) if IN_L_4 is set on «1», IN_H_2 - IN_H_5, IN_L_5 - IN_L_7 are set on «0» then information delivery rate in MFD is 100 Kbit/s.

** RICU identifier:

a) if IN_L_2 is set at «0» (break), then «0» is set in a bit of 9 words issued according to ARINC 429.

if IN_L_2 is set at «1» (fault to GND), then «1» is set in a bit of 9 words issued according to ARINC 429.

b) if IN_L_3 is set at «0» (break), then «0» is set in a bit of 10 words issued according to ARINC 429.

if IN_L_3 is set at «1» (fault to GND), then «1» is set in a bit of 10 words issued according to ARINC 429.

Time Marker Signal

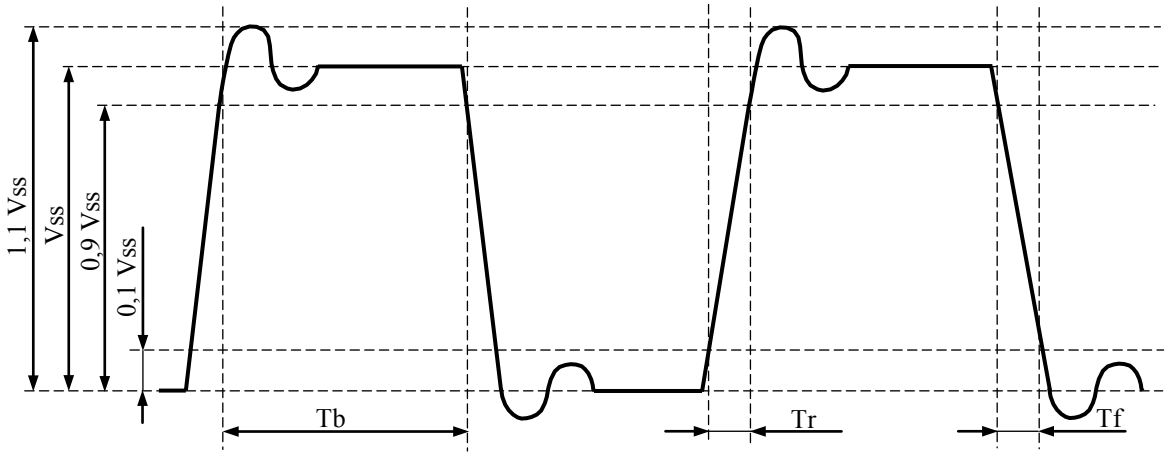
Time marker signal, synchronized with UTC time scale, shall be brought out to RICU's connector «**X3**» contact 2 («**1S**» signal – positive polarity) and to RICU's connector «**X3**» contact 3 («**#1S**» signal - negative polarity).

Time marker signal form and load characteristics shall meet ARINC 743A-4.

Figure 3 shows «**1S**» output signal form regarding «**#1S**» signal output.

Note – *Voltage marks of time marker output signal on «**1S**» output regarding «**#1S**» output, delivered to connecting cable, are identified as follows:*

- *plus - at logical binary«1»;*
- *minus – at logical binary «0».*



Vss – steady-state voltages differential («**1S**» signal regarding «**#1S**» signal)

Tb – pulse duration

Tr - pulse rise time

Tf - pulse fall time

Figure 3

Vss voltage shall be deducted as differential between the two steady states of «**1S**» output signal regarding «**#1S**» signal.

Vss voltage shall be measured (100+10) Ohm on test load, connected between outputs «**1S**» and «**#1S**». Vss value shall be within the range from 1,4 to 6,0 V.

Tb pulse duration - (1,00±0,01) ms, pulse period - ($1\pm2\cdot10^{-7}$) c, Tr pulse rise and Tf pulse fall not more than 200 ns between the values 0,1 and 0,9 of the set signal level.

Receiver indicator and control unit Design

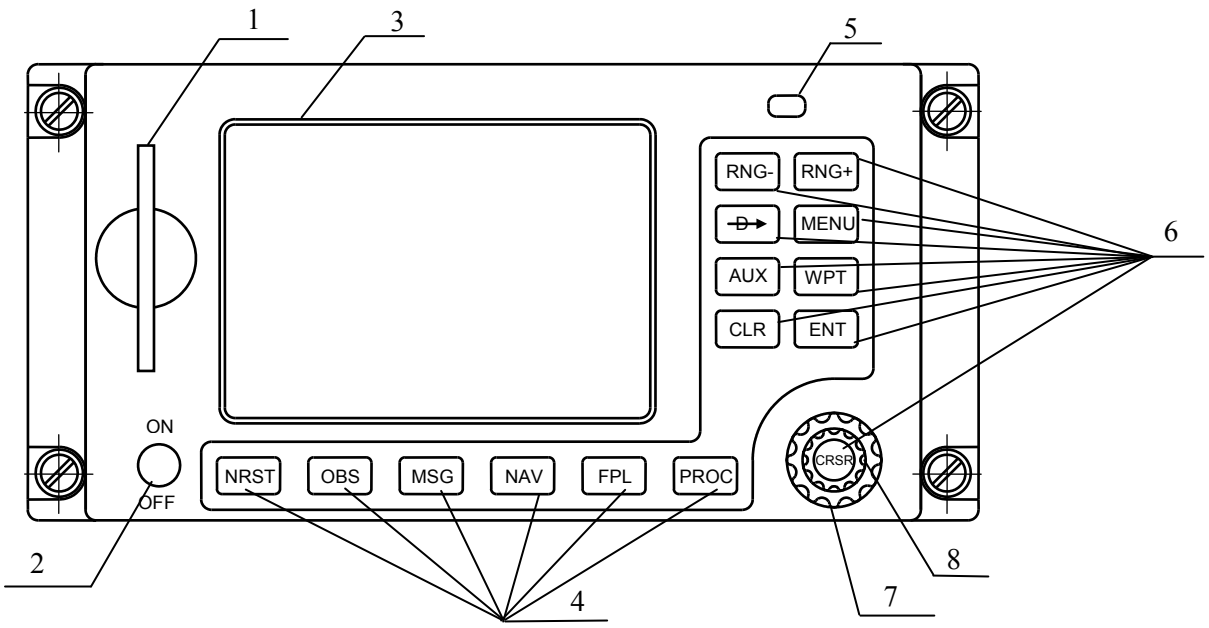
RICU housing is made of aluminum alloy. The rear panel contains connectors for RICU when installation in aircraft.

On the front panel there is a graphical LCD with adjustable lighting (hereinafter referred to as display), on/off equipment button, control buttons, shaft encoder, photoresistor and navigation database storage removable unit. Display and photoresistor are protected with glass.

RICU is fixed on the enclosure by means of screws (4 pcs.) on RICU front panel.

See figure 4 for the RICU front panel appearance.

See Appendix B for RICU outline drawing.



1 Navigation database storage removable unit
2 Equipment on/off button
3 Display
4, 6 Control buttons
5 Photoresistor, adjusting display brightness
7 Shaft encoder external handle.
8 Shaft encoder internal handle. By pressing on the shaft coder internal handle edge, **CRSR** button function shall be performed.

Figure 4

Controls Purpose

RICU ON/OFF button

ON/OFF button identification**:**

- ON/OFF – for RICU before serial № 03908020 inclusive;

- ⏻ **-** for RICU since serial № 03910021.

***Note* – Hereinafter in the text ON/OFF button is indicated for RICU turning on/off. All ON/OFF button operations refer also to** ⏻ **button.**

NRST button

NRST button is purposed for transition into the nearest navigation points form from the database.

Repeated pressing of **NRST** button shall return the form previous to **NRST** form call.

***OBS** button*

OBS button is designed for the flight task in **OBS** mode (output in WP with desired angle of transit).

During **OBS** mode flight, the **OBS** button signal lighting is on. When **OBS** mode flight is cancelled, **OBS background** lighting is on.

Pressing **OBS** button, when indication in the status line is **SUSP**, the automatic switch to the next route segment is interrupted and transits to:

- repeated flight through the holding area, for **STAR** operation;
- missed approach, for **APPROACH** operation.

Note – ***SUSP*** *– demand for interruption of the automatic switch to the next route segment, when **STAR** or **APPROACH** operations are to be done.*

MSG button

MSG button is designed for delivering system messages and messages of conjugated equipment operation on the display.

As soon as message is delivered, **MSG** button signal lighting is on. If there is more than one message, **MSG** button lighting blinks, until the last message is read. As soon as all messages are read, **MSG** button background lighting is on.

NAV button

NAV button is designed for transit into the navigation form.

This form is basic for the equipment, thus repeated pressing on **NAV** button shall result in no actions.

FPL button

FPL button is designed for transit into the routes procedure form.

Repeated pressing on **FPL** button shall return the form, previous to **FPL** form call.

PROC button

PROC button is designed for transit into the takeoff, arrival and approach standard procedures selection and load form.

Repeated pressing on **PROC** button shall return the form, previous to **PROC** form call.

RNG- and **RNG+** buttons

RNG- и **RNG+** buttons are designed for change the indicated graphic data scale.

Button **D►**

Button **D►** is designed for provide **DIRECT TO** mode flight to the desired WP.

AUX Button

AUX button is designed for transit into **AUX** form.

Repeated pressing of **AUX** button shall return the form previous to **AUX** form call.

MENU Button

MENU Button is designed for call **PAGE MENU** popup, related to the form active page.

The button shall provide the selection of supplementary operations of the active page or for the current page settings.

Repeated pressing of **MENU** button shall close **PAGE MENU** popup.

WPT Button

WPT Button is designed for transit to the database form. Repeated pressing of **WPT** button shall return the form previous to **WPT** form call.

CLR Button

CLR button is designed for refusing editing, returning from the window to the correspondent form page and closing **PAGE MENU** popup.

ENT Button

ENT Button is designed for confirming the entry of the typed information, confirming the certain action execution or moving lighting to the next editing parameter.

CRSR Button

CRSR Button is placed on the shaft encoder internal handle edge. It is designed for activation/deactivation of parameter indication field in the form window or page, editing refusal, return from the window to the correspondent form page and **PAGE MENU** popup closing. **CRSR** button functions shall be performed after pressing the shaft encoder internal handle edge.

Note *– Control buttons background lighting is constantly on.*

Shaft Encoder

Shaft encoder consists of two rotating handles: external and internal.

Shaft encoder external handle is designed for selecting the edit element, lighting moving in the pop-up window fields.

Shaft encoder internal handle is designed for switch pages inside the form and to go over the option within the edit element's limits.

CRSR button functions shall be performed after pressing the shaft encoder internal handle edge.

Service Connector Purpose

Service connector is used at the equipment software replacement at the aircraft. «**X9**» «**Service Connector**» (СНЦ 23-10/18P-2-B socket, see Appendix A).

«**X9**» service connector is connected to the counterpart of RICU «**X3**» connector (to СНЦ 23-41/30P-6-a-B socket from IK) corresponding to Connection Layout (see Appendix A).

A101П Antenna

A101П antenna ПКАН.464656.005 meets КТ-34-01 (the third edition) by its electric parameters.

A101П antenna operating frequency range is from 1570 MHz to 1610 MHz. A101П antenna VSWR within the operating frequencies range is 1,5 at the most. A101П antenna directional diagram provides the reception of signals at frequencies from 1570 MHz to 1610 MHz in the upper hemisphere with angles of elevation of NSC not less than 5°.

A101П antenna is connected to LNA-SSF with HF line having signal attenuation not more than 0,6 dB at frequency of 1600 MHz.

A101П Antenna construction

A101П antenna structure meets the requirements of ARINC 743A-3. A101П antenna is sealed.

A101П antenna shall be earthed in accordance with OST 1 01025-93 requirements through the surface, touching the aircraft fuselage at mounting. A101П antenna is mounted on the aircraft with 4 screws. Rubber gasket (available in ТДЦК.468911.020-02 installation kit) is used for sealing.

A101П antenna outline drawing is shown on the Figure C.1 Appendix C of this Manual.

Low Noise Amplifier with Signal Separate Filtering

LNA-SSF АПМА.434816.034 is used for amplification and separate filtration of GLONASS and GPS SNS NSC signals within the range from 1570 MHz to 1610 MHz of frequencies, coming from A101П antenna.

LNA-SSF technical specifications are given in the Table 7.

Table 7

Specification	Value
Operating frequencies sub-ranges: - L1 GLONASS, MHz - L1 GPS, MHz	 1593 … 1610 1570 … 1585
Pass-band edge frequency at minus 30 dB level: - lower, MHz, min. - upper, MHz, max.	 1545 1626
Coefficient of transmission on frequencies 1575 and 1602 MHz, dB	30,0 (+3,5; -2,5)
Transmission coefficient unevenness, dB, max.	3,0*
Noise coefficient: - within range of frequencies 1570 … 1573 MHz, dB, max. - within range of frequencies 1573 … 1610 MHz, dB, max	 4,5 4,0
input VSWR, max.	1,75
output VSWR, max.	1,75
Current consumption, mA, max	65
Power supply voltage, V	4,5 … 14,4

*Transfer ratio irregularity admissible value regarding the transfer ratio maximal value in GLONASS L1 sub-range on frequencies from 1593 to 1597 MHz shall not exceed 3,5 dB

* Admissible value of transfer ratio irregularity in frequency sub-range:
- from 1582 MHz to 1585 MHz relatively transfer ratio value at frequency 1575 MHz is no more than 4,0 dB;
- from 1593 MHz to 1597 MHz and from 1608 MHz to 1610 MHz relatively transfer ratio value at frequency 1602 MHz is no more than 4,0 dB

Power is supplied to LNA-SSF from RICU («**X5**» connector) through coaxial cable.

LNA-SSF is connected to RICU via HF line with signal attenuation not more than 10 dB at 1600 MHz.

LNA-SSF construction

LNA-SSF housing is made of aluminum alloy and has three-layer protective coating.

Two TNC R143 557 000 RADIALL sockets are hermetically soldered at LNA-SSF output and input for HF-cables connection.

LNA-SSF is earthed in accordance with OST 1 01025-93 requirements through the surface touching the aircraft fuselage at LNA-SSF mounting. LNA-SSF outline drawing is shown in the Figure C.2 Appendix C of this Manual.

Uninterruptible Power Supply

Uninterruptible power supply ТДЦК.436434.006 purpose is to maintain the equipment performance during any short-term voltage supply interruptions, and to protect the equipment against any voltage surge.

Uninterruptible power supply includes the following devices and functional units:

- input filter;
- control circuit;
- energy storage charger;
- energy storage system;
- voltage transducer;
- switch.

Uninterruptible power supply operation

As soon as voltage is supplied, the control circuit switches on the energy storage charger. Storage charger can be charged up to 20 V, maintained this voltage during all operation time.

Upon reception the command from RICU the control circuit by means of the switch shall connect input voltage for the equipment power supply system.

In the case if input voltage drops (voltage supply depression) under 18 V, the control circuit shall switch on the voltage transducer, which uses the accumulated energy transmitting it through the switch for the equipment energizing.

UPS Specifications

UPS Specifications are given in the Table 8.

Table 8

Parameter	Value, specification
1 Input voltage (Uвх), V	18 … 33
2 Input current, A, max	2
3 Output voltage at operation from DC airborne mains, V	Uвх – 1
4 Output voltage at operation from reserved source, V	18 ± 1
5 Output voltage ripple (peak to peak), mV, max.	100
6 DC Output voltage ripple rate, %, max	7,4
7 Maximal load current, A	1,8
8 Operation time when input voltage is not available, at 1,5 A load current, s, min.	3
9 No-load current, mA, max	50
10 No-load output voltage, V, min.	Uвх – 0,3
11 Consumption power at maximal load, W, max	60

UPS Construction

UPS enclosure is made of aluminum alloy with oxide and enamel coating.

There are three connectors installed on UPS.

«**X1**» connector (СНЦ 23-10/18В-1-В plug) for power connection from DC airborne mains.

«**X2**» connector (СНЦ 23-10/18Р-1-В plug) for RICU connection.

«**X3**» connector is not used in this equipment, thus it is closed with ЭП-18 cap provided in IK.

Note –Unauthorized connection of RICU to UPS «**X3**»connector shall not result in the equipment failure.

«**X1**», «**X2**» connectors contacts' purpose is described in Tables 9, 10.

Table 9 - «**X1**» connector contacts' purpose

Contact	Circuit	Purpose
1	+27_IN	Supply input voltage plus 27 V
2	-	Reserved
3	-27_IN	Supply input voltage minus 27 V
4	-27_IN	Supply input voltage minus 27 V
5	-	Reserved
6	+27_IN	Supply input voltage plus 27 V
7	-	Reserved
8	-	Reserved
9	ENCLOSURE	*UPS* enclosure
10	ENCLOSURE	*UPS* enclosure

Table 10 - «**X2**» connector contacts' purpose

Contact	Circuit	Purpose
1	+27_OUT	Supply output voltage plus 27 V
2	-	Reserved
3	-27_OUT	Supply input voltage minus 27 V
4	-27_OUT	Supply input voltage plus 27 V
5	$\overline{\text{ON}}$	Equipment ON signal (GND – ON, break – OFF)
6	+27_OUT	Supply input voltage minus 27 V
7	-	Reserved
8	GND	Common, Equipment power ON signal
9	ENCLOSURE	UPS enclosure
10	ENCLOSURE	UPS enclosure

Two green LEDs for input and output voltage availability indication are installed on UPS enclosure.

UPS has 4 holes for its mounting.

UPS shall be earthed through the earthing rod.

UPS dimensions are given in Appendix D.

Installation Kit

Installation kit ТДЦК.468911.020-02 is used for the equipment unit mounting on the object and for inter-unit connections. Installation kit components are listed in Table 11.

Table 11

Name	Designation	Number, pcs	Note
Bracket	ПКАН.301532.003	4	RICU, A101П, LNA-SSF
Enclosure	ТДЦК.305154.001	1	RICU
Washer	ПКАН.754114.007	1	A101П
Screw	В2.М5-6g×20.21 ГОСТ 17473-80	4	A101П
Nut	М5-6Н.21 ГОСТ 5916-70	4	A101П
Spacer	5.30Х13 ГОСТ 6402-70	4	A101П
Spacer	5.21 ГОСТ 11371-78	8	A101П
Plug	R 143 008 000 RADIALL	3	RICU, LNA-SSF
Angle plug	R 143 156 000 RADIALL	1	A101П
Plug	СНЦ 23-10/18В-6-В ГЕО.364.241 ТУ	1	UPS
Socket	СНЦ 23-10/18Р-2-В ГЕО.364.241 ТУ	1	process, connective)
Socket	СНЦ 23-10/18Р-6-В ГЕО.364.241 ТУ	2	RICU, UPS
Socket	СНЦ 23-41/30Р-6-В ГЕО.364.241 ТУ	1	RICU
Socket	СНЦ 23-41/30Р-6-а-В ГЕО.364.241 ТУ	1	RICU
Socket	СНЦ 23-41/30Р-6-б-В ГЕО.364.241 ТУ	1	RICU
Cap	ЭП-18 бРО.364.038 ТУ	2	UPS, process, connective)

Table 11 (continuation)

Name	Designation	Number, pcs	Note
Wire	0,3-12X18H9T ГОСТ 18143-72, *l*=1 m	1	RICU, A101П, LNA-SSF
PANDUIT tube	HSTTA 50-48-5, *l*=0,15 m	1	RICU, A101П, LNA-SSF
Tip	2,2-4,2-20,5-02 ОСТ 92-0528-70	2	RICU, UPS

Operation

Equipment Units Installation and Mounting on Aircraft

General

Having received the equipment from storehouse or from manufacturer:

- check up seals and package. No mechanical damage or choke marks, caused by the transportation provisions violation are acceptable;
- after opening the packing check up all components availability (consult Manual);
- check up the equipment units for mechanical damages;
- check up seals availability on RICU, A101П antenna, UPS;
- take off process caps from the units connectors and examine plugs and sockets of HF-connectors in accordance with FS #11 of this Manual.

If any damages are detected, inform immediately the equipment supplier.

Requirements for Units Installation

To start the units' installation in the aircraft take into consideration the following requirements:

a) equipment units shall be installed in the areas, specified in:

1) Table 12, if the equipment shall be operated in an airplane;

2) Table 13, if the equipment shall be operated in a helicopter;

Table 12

Unit	Units installation areas / impose levels of vibration test standards curve, in accordance with КТ-160D	Installation area in accord. with П8.1.2 НЛГС-3
RICU	Instrumentation panels, consoles, gage boards / B1A	A1
UPS	Fuselage / C1A	A
A101П, LNA-SSF	Fuselage, empennage group / Z	D

Table 13

Unit	Units installation areas / impose levels of vibration test standards curve, in accordance with КТ-160D	Installation area in accord. with П8.1 НЛГВ-2
RICU	Instrumentation panels, consoles, gage boards / G	Б
UPS	Fuselage / G	Б
A101П, LNA-SSF	Fuselage, empennage group / J	D

b) equipment units shall not be installed:

1) in areas containing explosives;

2) in airplane efflux area;

c) during RICU installation, please, consider:

1) RICU shall be installed on the flight deck, where its optimal operation is available;

2) switch on the equipment when the temperature at RICU installation place is higher than -20 ºC;

d) during A101П antenna installation, please, consider:

1) A101П antenna shall be installed on the fuselage surface, in airplane longitudinal axis;

2) A101П antenna shall be installed so to provide optimal overview in the upper hemisphere;

3) A101П antenna shall not be installed close to the airplane metal extensions, that may impede the antenna visibility;

4) there shall be no radiating antennas in immediate vicinity with A101П antenna, especially within the operating frequencies range of the latter;

5) during A101П antenna installation all necessary measures shall be taken for its protection against static electricity;

6) rubber gasket from ТДЦК.468911.020-02 installation kit shall be used for A101П antenna fastening closure;

7) A101П antenna shall be installed in the places, where its minimal icing is guaranteed;

e) during UPS installation consider that length of the cable connecting UPS and RICU shall not exceed 5 m;

f) UPS and LNA-SSF operational position is free;

g) «**X9**» connector («**Process CH**» see Appendix A, СНЦ 23-10/18Р-2-В socket from installation kit) shall be installed, where it shall be easy available during equipment software replacement on the aircraft board.

Units Assemblage

The equipment units electrical assemblage on the aircraft shall be performed in accordance with electrical connections scheme, given in Appendix A.

The equipment units interconnection and connection with the aircraft AE shall be performed through cables, not included into the equipment set. Cables shall be assembled at the units' installation depending on the aircraft model, the following requirements shall be considered at that:

a) for TNC R143 008 000 and TNC R143 156 000 connectors assemblage a radio-frequency cable shall be used with specification as below:
   1) inner conductor diameter (1,0±0,1) mm;
   2) diameter over insulation (3,0±0,2) mm;
   3) cable outer diameter: from 4 mm to 5 mm.
   It is recommended to use PK 50-3-23 radio-frequency;
b) oscillation damping in the high-frequency cable from A101П antenna to LNA-SSF shall not exceed 0,6 dB on 1600 MHz frequency;
c) oscillation damping in the high-frequency cable from LNA-SSF to RICU shall not exceed 10 dB on 1600 MHz frequency.

For cable assemblage:
- make the counterparts soldering (included into IK set) of UPS «X1», «X2» connectors: СНЦ 23-10/18P-6-B sockets and СНЦ 23-10/18B-6-B plugs in accordance with Connection Layout (see Appendix A);
- make the counterparts soldering (included into IK set) of RICU «X1», «X2», «X3», «X4» connectors: СНЦ 23-10/18P-6-B sockets, СНЦ 23-41/30P-6-B sockets, СНЦ 23-41/30P-6-а-B sockets, СНЦ 23-41/30P-6-б-B sockets in accordance with Connection Layout (see Appendix A);
- make the СНЦ 23-10/18P-2-B socket soldering (included into IK set) - «X9» process connector in accordance with Connection Layout (see Appendix A);

Note – *For cable sealing in СНЦ 23 connector contacts see Fig. F.3 Appendix F.*
- perform the cable termination (high-frequency cable from A101П antenna to LNA-SSF see Appendix A) from one end for R143 156 000 RADIALL connector, from another end for

R143 008 000 RADIALL connector in accordance with provisions in the figure F.3 Appendix F of this Manual;

- make the cable soldering and sealing into R143 156 000 RADIALL and R143 008 000 RADIALL connectors (see figure F.3 Appendix F);
- perform the cable termination (HF high-frequency cable from LNA-SSF to RICU see Appendix A) on both ends for R143 008 000 RADIALL connectors (see Figure F.3 Appendix F);
- make the cable soldering and sealing into R143 008 000 RADIALL connector (see figure F.3 Appendix F);

Note – *At cable assemblage the due spare length of cables shall be provided for the possible three resolderings of connectors during the cable net maintenance.*

- fix the cables connectors; PANDUIT HSTTA heat-shrinkage tube shall guarantee their simultaneous fixing and sealing.

Note - *PANDUIT HSTTA heat-shrinkage tube and TNC R143 156 000, R143 008 000 RADIALL plugs are included into ТДЦК.468911.020-02 ІК.*

A101П antenna, LNA-SSF, RICU and UPS installation and assemblage on the aircraft are described in Appendix F, Appendix **G**, Appendix **H**, Appendix **I** of this Manual.

Process connector (СНЦ 23-10/18Р-2-В socket included into ІК) and ЭП-18 cap (included into ІК) installation on the aircraft is given on Figure F.4 Appendix F. ЭП-18 cap installation (included into ІК), installed on UPS «**X3**» connector is given on Figure I.1 Appendix I.

Installation of equipment components in aircraft shall be performed in accordance with FS #2.

RICU, UPS earthing shall be performed by connection of earthing rod to the earthing bar.

Equipment units mounting and dismantling shall be performed in random sequence.

Equipment Start and Performance Test

For equipment start and its performance test:

- Switch on the equipment power on the aircraft standard power distribution unit. **INPUT** indicator on UPS shall switch on;

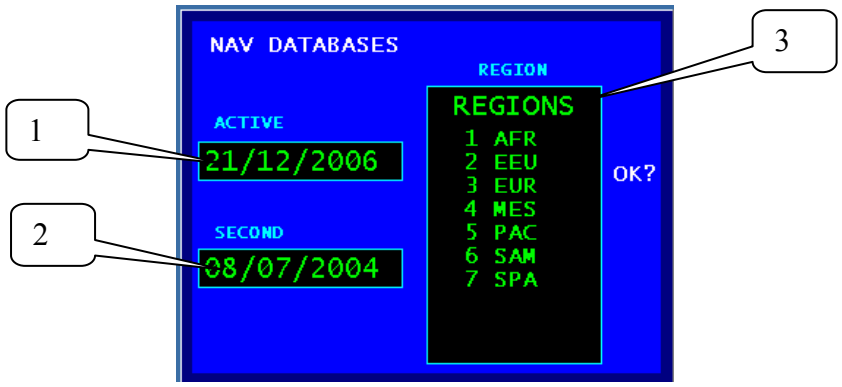
- Switch on the equipment by pressing **ON/OFF** button on RICU, at that:
  - **OUTPUT** indicator on UPS shall switch on;
  - **NRST**, **OBS**, **MSG**, **NAV**, **FPL** and **PROC** buttons lighting shall switch on and off in turn, then background lighting of all buttons on the RICU front panel switches on;
  - as soon as **Self-control** mode is successfully terminated, start form is indicated on the RICU display. See Figure 5 for the start form view. During start form indication NDB test (in the navigation database storage unit) is performed;

  Note – *Software version number and date on Figure 5 are given provisionally*.

1 Software version number
2 Software version date

Figure 5

- as soon as NDB test is terminated, NDB indication shall be indicated on RICU display. See Figure 6 for NDB indication form view.



1 Active NDB
2 Second NDB
3 List of active NDB regions

Note – *In NDB indication form, in the list of active NDB regions except the regions, guaranteed by the Agreement of NDB supply, the bordering are also indicated.*

Figure 6

- press **ENT** button to confirm work with the set active NDB (change NDB if necessary, and then press **ENT** button). NDB initialization form shall be indicated on RICU display. See Figure 7 for NDB initialization form. Simultaneously with NDB initialization form indication, NDB initialization is performed;

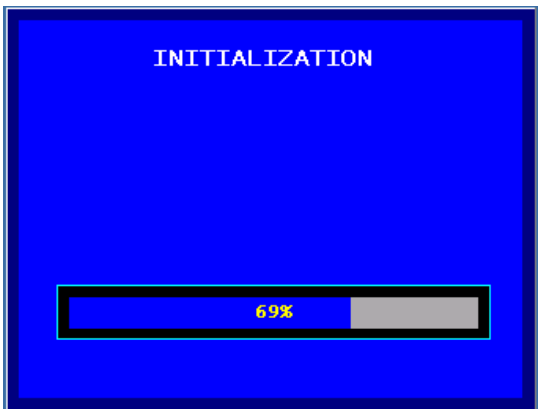
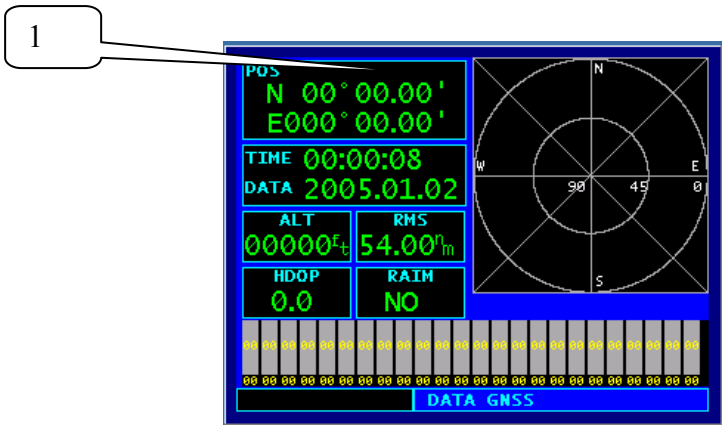


Figure 7

- upon completion of NDB initialization (progress strip indication is 100 %) **DATA GNSS** window of **AUX2** page will be displayed in RICU display (Figure 8). **DATA GNSS** window is displayed until coordinates will be received from GNSS receiver (**GNSS** flag is displayed in the flag field of reference coordinate NP receiving), and then **NAV1** page is displayed

(Figure 9). Failing coordinates from GNSS sensor the transfer to other data cards is performed by the operator.



1 Flag of reference coordinate NP receiving

Figure 8

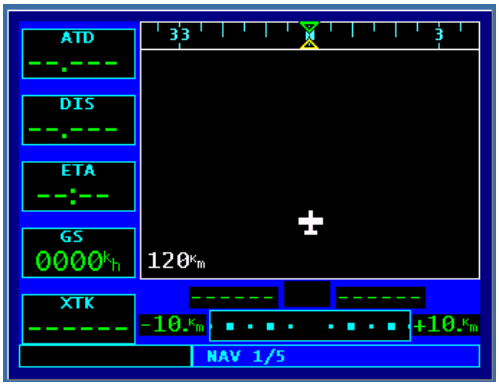
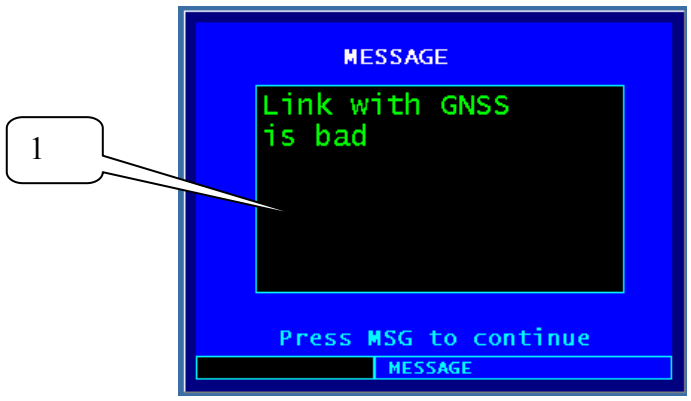


Figure 9

If messages are available, upon completion of NDB initialization or during equipment operation **MESSAGE** window is displayed on RICU (figure 10).

In the presence of several messages **MSG** button lighting turns on. To read the messages issued by the equipment, press **MSG** button. After reading all messages **MSG** button lighting will turn off. To continue the operation press **MSG** button.



1 Failure message window

Figure 10

The equipment is operable, if none of the below messages are not seen in **MESSAGE** window, when initialization testing is terminated:

- **DATABASE EXPIRED**;
- **DATABASE MISSING**;
- **Antenna is bad**;
- **Link with GNSS is bad**;
- **Link with KVU is bad**;
- **Receiver's testing is failed**.

If 5 minutes after RICU switching on valid coordinates are not defined (there are no data from GNSS sensor or they are not set manually by the operator), **Enter coordinates time and date** message is displayed in **MESSAGE** box of RICU display.

If 5 minutes after RICU switching on valid coordinates, date and time are set manually by the operator then in the presence of data from air data sensors (SVS) and heading reference system (IRS) and in the absence of wind parameters **Enter wind speed** message is displayed in **MESSAGE** box.

Operational procedure with the equipment is shown in Part 2 of Technical Maintenance Manual 461513.077-02 РЭ1 (User's Manual).

Active NDB Change

Navigation database storage unit can store two NDBs. Expiration date for both NDBs is shown in NDB indication form, in **ACTIVE** and **SECOND** fields (Figure 6).

To change active NDB for the second database the procedure is as follows:

- when NDB indication form is indicated on RICU display, press **MENU** button, **PAGE MENU** popup window shall be indicated in NDB indication form as shown in Figure 11;

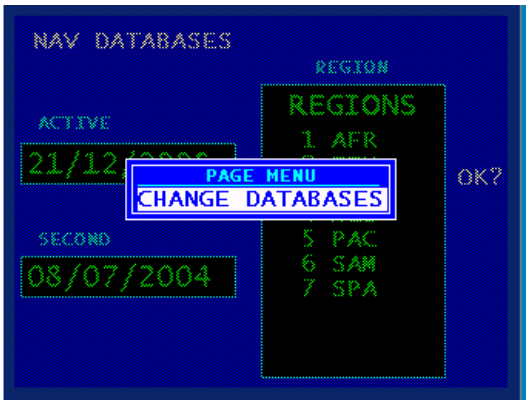


Figure 11

- press **ENT** button to confirm NDB change. RICU display shall indicate NDB indication form in accordance with Fig. 6. The second NDB shall be indicated instead of the active NDB.

Equipment Factory Settings

The equipment system parameters factory settings are demonstrated on Figure 12 (**AUX3** page, **SETTING** window).

Parameters: units of measuring system (**UNITS**), coordinate system (**DATUM**), magnetic declination consideration (**MAG**), message delivery language (**LANGUAGE**) are nonvolatile parameters.

All GLONASS and GPS satellites are on for use (Figure 13).

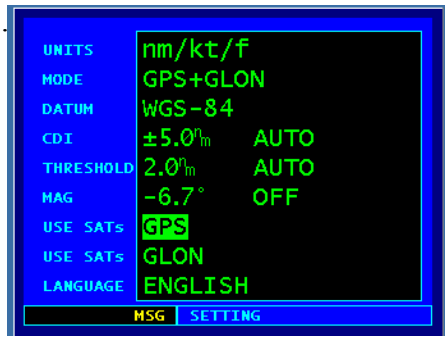


Figure 12

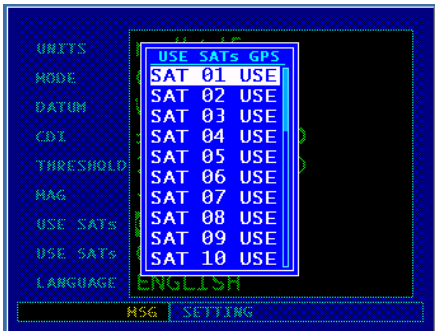


Figure 13

Figure 14 shows factory settings of display and keyboard lighting brightness (page **AUX3** window **BRIGHTNESS**). Display and keyboard highlight brightness parameters are nonvolatile parameters.

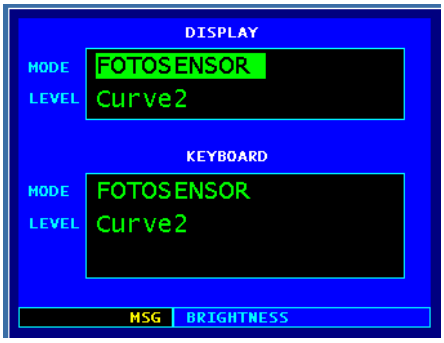


Figure 14

Figure 15 (**AUX3** page, **LIMIT DATA** window) shows factory settings of:

- **SID**, **STAR**, **APPROACH** standard procedures parameters' calculation:
- aircraft average speed (**SPEED**);
- boundary angle of list (**BANK**);
- gradient of altitude change (**GRAD**);
- boundary angle of list en route(**BANK MAX**);

- roll angle rate of rise;
- slope of a signal "**Selected roll**"
- average speed in the terminal sides of departure, arrival and en route, used for RAIM function forecast calculation (**AVERAGE SPEED**).

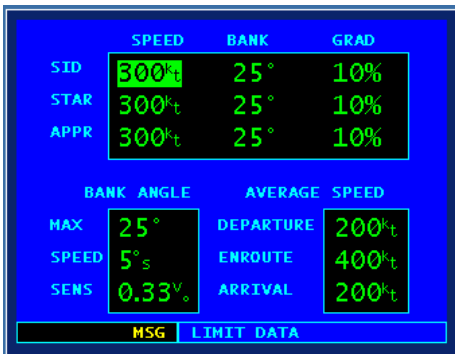


Figure 15

All parameters on Figure 15 are the nonvolatile parameters.

Factory settings of possible air sides (**AIRSPAGE**) and navigation references (**NAVAID**) draw on pages **NAV1** and **NAV2,** given on Figure 16, are the nonvolatile parameters.

Figure 16

Equipment Operating Modes General Information

The equipment is supplied with both automatic and manual (on operator's discretion) selection of the equipment operating modes as follows:

- «**Self-control**»;
- «**Search**»;
- navigation modes:
  - «**SNS navigation**»;
  - «**SNS SBAS navigation**»;
  - «**ASS navigation**»;
  - «**DME/DME navigation**»;
  - «**VOR/DME navigation**»;
- «**Autonomous Control**»;
- «**Ground Extended Control**».

Note – *Do not use «**SNS SBAS navigation**» operating mode for the equipment. As soon as the equipment operation in this mode is available you will receive the corresponding notification concerning this mode inclusion into Manual.*

Operating mode selection depends on:

- availability and quality of the navigation satellites signals;
- information from course and vertical systems, ASS; VOR, DME;
- commands from the ground extended control.

Selected mode is indicated in the output information and on RICU.

«**Self-control**» mode shall be set as soon as the power supply is on or if there was no power for more than 80 ms. In «**Self-control**» mode RAM and ROM testing, control module and processor interface test are performed.

«**Search**» mode shall be set when «**Self-control**» mode is successfully completed, as well as if signals less than from four NSC are available. As soon as «**Search**» mode is terminated the navigation mode of the equipment operation is set.

«**SNS navigation**» mode is set if signals from at least four NSC of one SNS are received.

«**SNS SBAS navigation**» mode is set at reception of:

- signals from six NSC of SNS GPS at least;
- signals from SBAS satellites (WAAS, EGNOS, MSAS).

«**ASS Navigation**» mode shall be set if information of heading and airspeed from AES is available and if signals from less than 4 navigation satellites of the same system are available, in the case if the navigation parameters evaluation precision in «**ASS navigation**» mode is higher than in the previous mode.

«**DME/DME navigation**» mode is set when data are available from airborne radio range finder on the distance to 2 radio beacons at least, in case if definition accuracy of navigation parameters in «**DME/DME navigation**» mode is higher than in the current mode.

«**VOR/DME navigation**» mode is set when data are available from aircraft systems on the range and bearing to a radio beacon, in case if definition accuracy of navigation parameters in «**VOR/DME navigation**» mode is higher than in the current mode.

«**Autonomous Control**» mode is performed automatically, during the entire time of the equipment operation. In «**Autonomous Control**» mode the background testing of the equipment main units is performed. In the case of any failures in «**Autonomous Control**» mode, that may affect the equipment operability, RICU display shall indicate **MESSAGE** window (Figure 10) about a failure.

Information about the background testing results shall be indicated on **AUX4** page in **FonTest1** and **FonTest2** windows and shall be controlled during the equipment operability extended testing.

«**Ground Extended Control**» mode is set in the case of «Strut compression» one-time command in «breaoff (Earth)» state and if operator performs:

- RAM extended test;
- extended testing of the equipment operability.

AIRBORNE EQUIPMENT
OF SATELLITE NAVIGATION

TROUBLESHOOTING

General Instructions for Troubleshooting

The equipment malfunction may cause the equipment complete failure or the equipment parameters may not meet to the required values.

Defects can be both of mechanical (defect fastening, destroyed parts, bundles and cables defect insulation, open circuit etc) and electrical origin (equipment radio elements breakage).

Mechanical defects are detected by detailed examination of units and connectors, by test of chains, insulation and metallization bares integrity. Built-in control system provides with electrical defects detection.

Aircraft Equipment Fault-Indication and Troubleshooting

Fault-indication scheme is organized as a logical tree of troubleshooting sequential operation. Each scheme has its code, written on the right of the failure symptom formulation.

The defect unit search is explained on the example as follows.

E.g. – no indication on RICU display when the equipment is switched on (by pressing **ON/OFF** button on RICU). In accordance with the Table 101 troubleshooting is performed in accordance with scheme 1-1. Checkup of the voltage availability on «**X5**» cable connector, connected to RICU «**X1**» connector.

If the test result on the "no" branch is negative, the further scheme for troubleshooting is given.

In the case of the positive result on «yes» branch, the command for RICU replacement shall be given.

During the troubleshooting in the aircraft accurate up to a unit, check up the cables connecting the equipment units, visually and as for their integrity in accordance with the electrical connections diagram.

In the case of any mechanical damages:

a) Cable damage:
   - where it is sealed into the connector, cut the cable for 1 or 2 cm from the damage place;
   - die and seal it again into connector (cable tension is not allowed when connecting with devices and units, minimal banding radius shall be 5 cm, cable splicing is prohibited);

b) in the case of the earthing bar and the units earthing rod defective contact due to corrosion, remove the corrosion signs from the earthing bar with abrasive cloth, in the case of the earthing bar breakage replace it;

c) if connector pins and sockets are dirty, clean dirty and corrosive places with clean cloth or brush, wetted in alcohol, then dry the connector. In the case if any defective pins or sockets are detected in the cable connector, replace the connector;

d) if connector tightening and locking are faulty, tighten home connectors nuts and lock the nuts with safety wire.

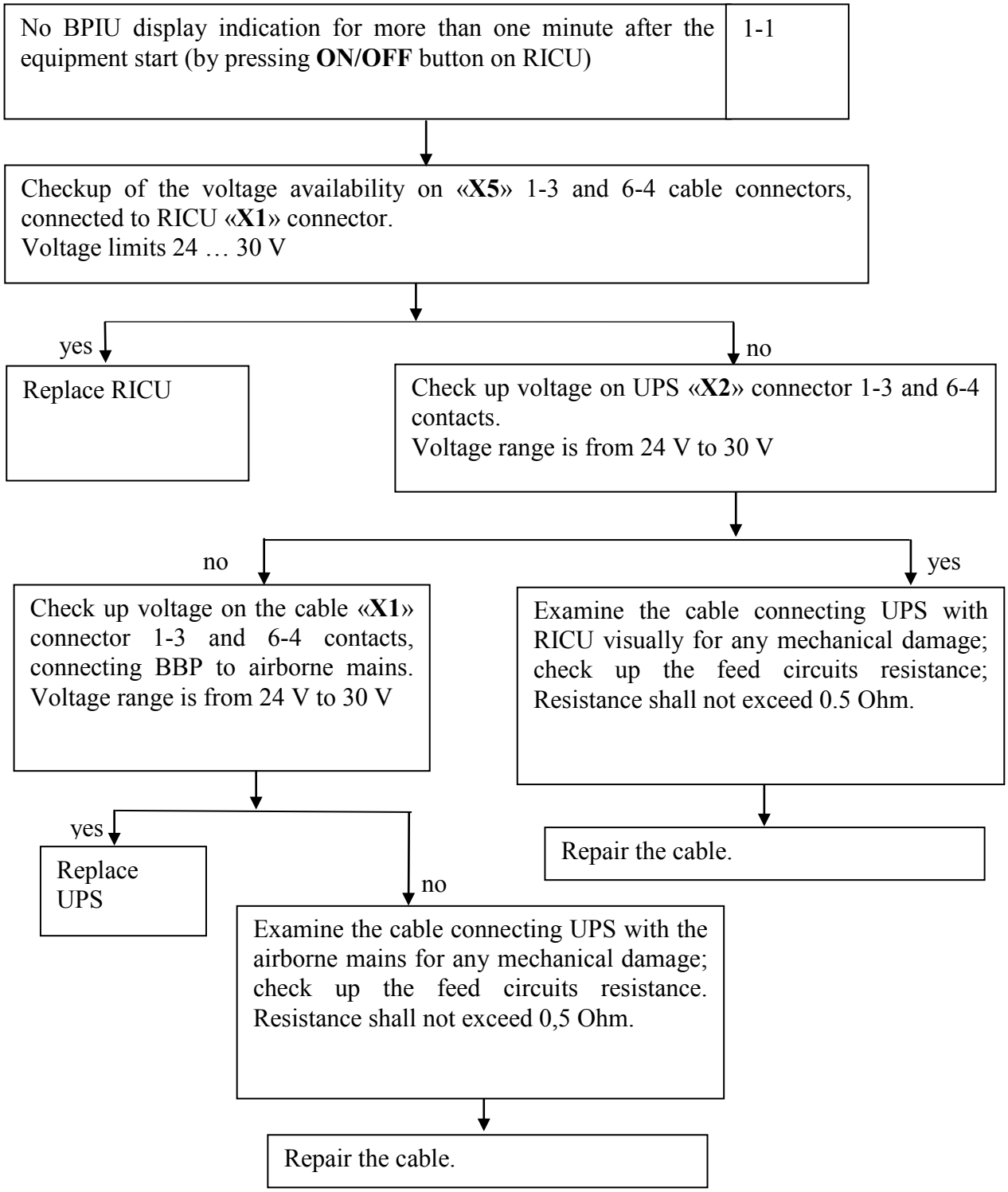
To check up the equipment workability by means of the inbuilt control system start the equipment and perform the operability extended testing of the equipment workability (see FS #3). Evaluate the testing results. Replace defective units if necessary.

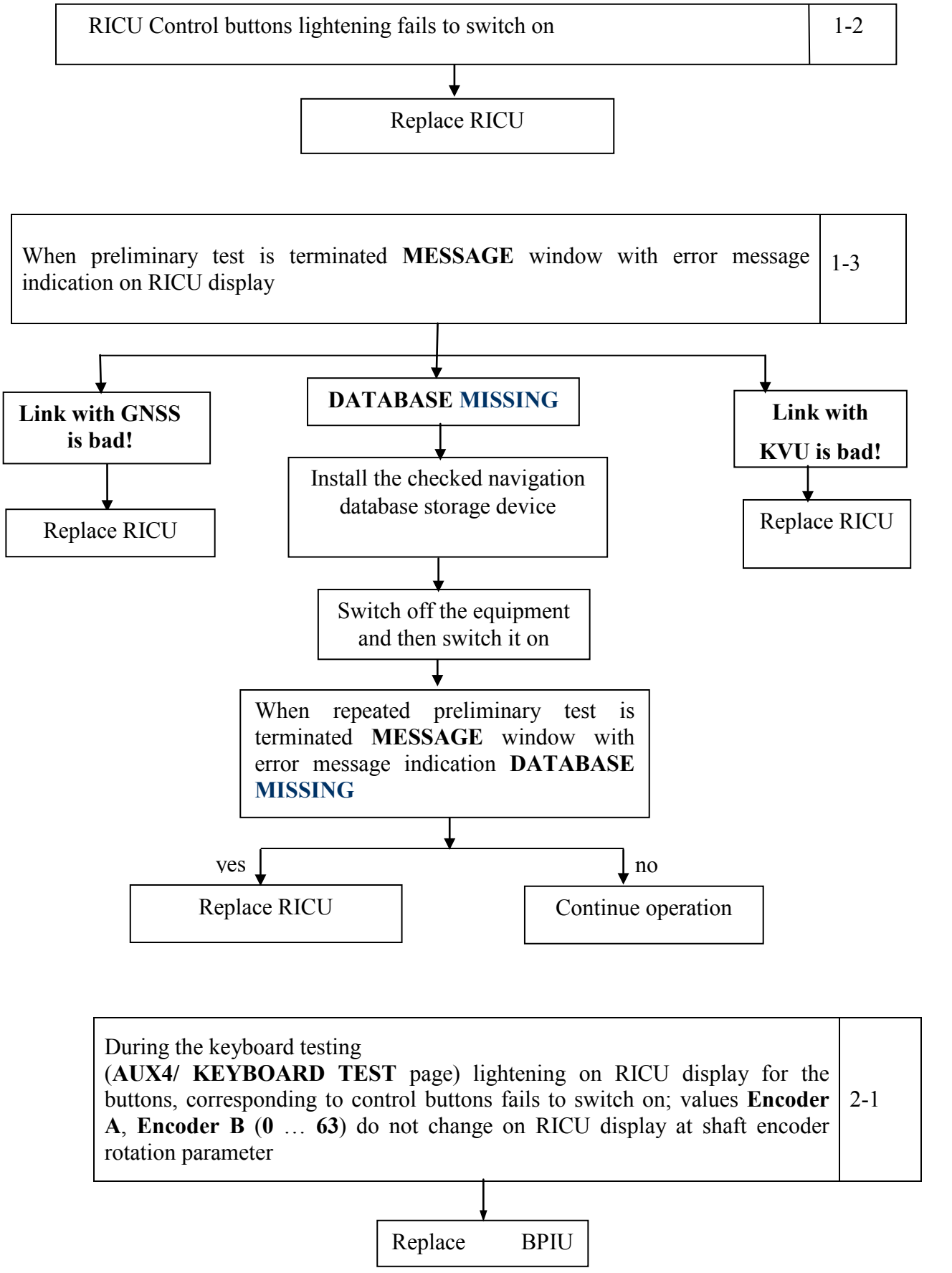
Failure Symptom List

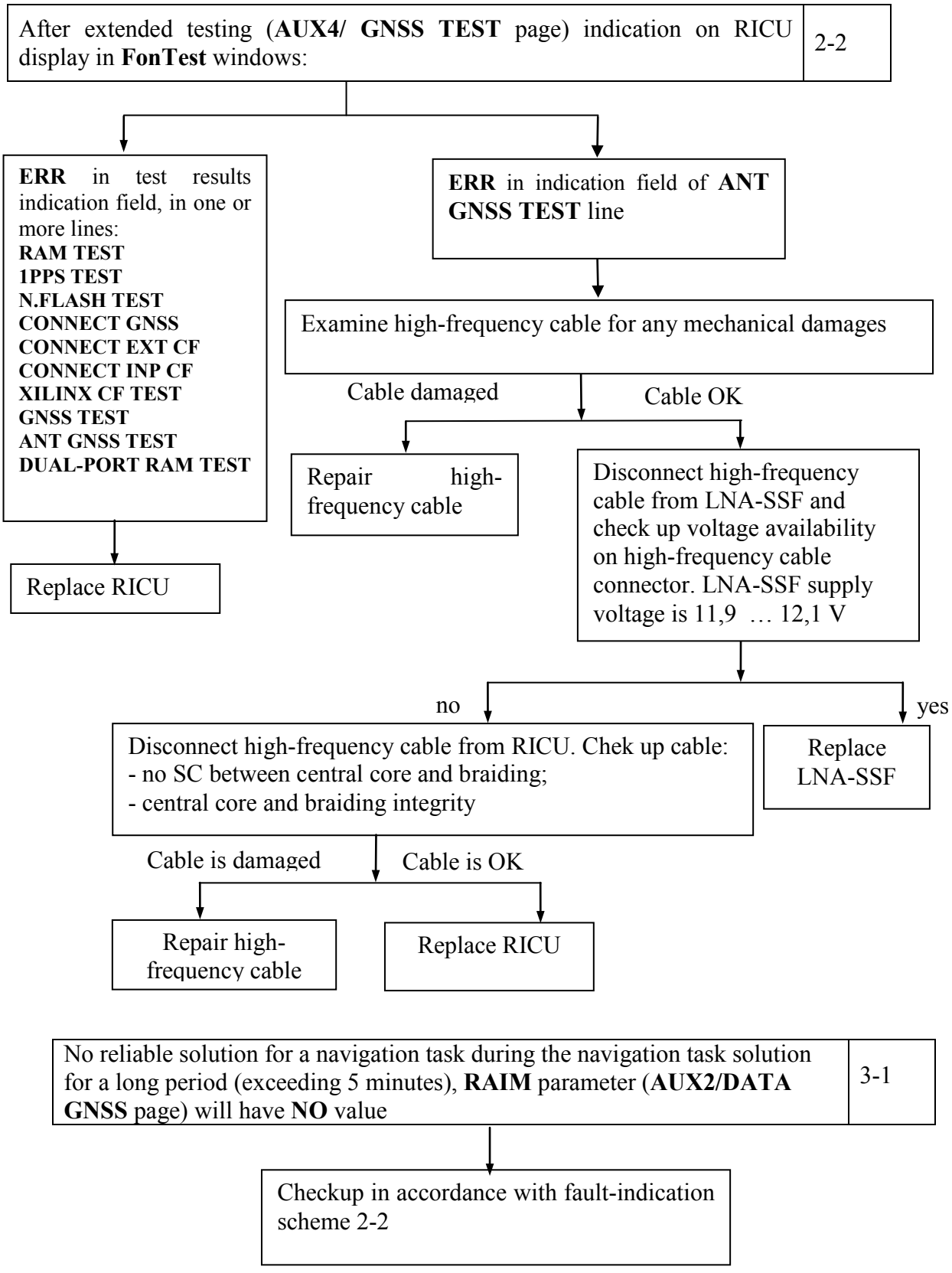
Table 101

MS item (test number)	Performed test contents	Failure symptom	Scheme
-	Equipment workability testing at start (preliminary test)	1 No RICU display indication for more than one minute after the equipment start (by pressing **ON/OFF** button on RICU). 2 Control buttons lighting fails to switch on. 3 When preliminary test is finished Error Message indication on RICU display	1-1 1-2 1-3
034.50.00b	Equipment workability extended testing	1 During the keyboard testing (**AUX4/ KEYBOARD TEST** page) lightening on RICU display for the buttons, corresponding to control buttons fails to switch on; parameter values **Encoder A**, **Encoder B** (**0** … **63**) do not change on RICU display at shaft encoder rotation. 2 After extended testing (**AUX4/ GNSS TEST** page) **ERR** indication in **FonTest** windows on RICU display.	2-1 2-2
034.50.00j	Navigation task solution check	No navigation task solution, **RAIM** parameter (**AUX2/DATA GNSS** page) shall have **NO** value	3-1

Fault-Indication Scheme




RICU Control buttons lightening fails to switch on
1-2
Replace RICU
When preliminary test is terminated **MESSAGE** window with error message indication on RICU display
1-3
Link with GNSS is bad!
Replace RICU
DATABASE MISSING
Install the checked navigation database storage device
Switch off the equipment and then switch it on
When repeated preliminary test is terminated **MESSAGE** window with error message indication **DATABASE MISSING**
yes
Replace RICU
no
Continue operation
Link with KVU is bad!
Replace RICU
During the keyboard testing (**AUX4/ KEYBOARD TEST** page) lightening on RICU display for the buttons, corresponding to control buttons fails to switch on; values **Encoder A**, **Encoder B** (**0** … **63**) do not change on RICU display at shaft encoder rotation parameter
2-1
Replace BPIU


After extended testing (AUX4/ GNSS TEST page) indication on RICU display in FonTest windows:
2-2
ERR in test results indication field, in one or more lines:
RAM TEST
1PPS TEST
N.FLASH TEST
CONNECT GNSS
CONNECT EXT CF
CONNECT INP CF
XILINX CF TEST
GNSS TEST
ANT GNSS TEST
DUAL-PORT RAM TEST
Replace RICU
ERR in indication field of ANT GNSS TEST line
Examine high-frequency cable for any mechanical damages
Cable damaged
Cable OK
Repair high-frequency cable
Disconnect high-frequency cable from LNA-SSF and check up voltage availability on high-frequency cable connector. LNA-SSF supply voltage is 11,9 … 12,1 V
no
yes
Disconnect high-frequency cable from RICU. Chek up cable:
- no SC between central core and braiding;
- central core and braiding integrity
Replace LNA-SSF
Cable is damaged
Cable is OK
Repair high-frequency cable
Replace RICU
No reliable solution for a navigation task during the navigation task solution for a long period (exceeding 5 minutes), RAIM parameter (AUX2/DATA GNSS page) will have NO value
3-1
Checkup in accordance with fault-indication scheme 2-2

AIRBORNE EQUIPMENT OF SATELLITE NAVIGATION– MAINTENANCE TECHNIQUE

This section includes the equipment maintenance technique for the online, periodical and calendar maintenance. The section includes Flow Sheets for each type of the equipment maintenance:

а) before flight online maintenance (A1);

б) periodical maintenance (routine maintenance after 600 and 6000 running hours);

в) calendar maintenance (after 12 and 48 months).

Any equipment maintenance shall be performed in accordance with «Schedule of Maintenance» ТДЦК.461513.077-02 РО.

The equipment is designed for on condition maintenance.

On condition maintenance is provided by the required control of operating conditions during the operation (with all maintenance types). With OCTM the equipment shall be replaced (with all maintenance types) for its rehabilitation or retirement in the case of the equipment refusal only.

With on condition technical maintenance the *to refusal technical maintenance technique* shall be applied. With TFTM the equipment shall be operated till safe refusal, and the equipment status management (rehabilitation or retirement) shall be performed on the ground of reliability analysis.

Safe refusal – when the equipment refusal (under condition of its single appearance at any flight stage) will not result in more serious consequences than the flight harder conditions.

Operating condition control and the equipment refusals qualification is performed with all and any technical maintenance by means of the equipment workability extended testing.

Maintenance

The equipment shall be connected to +27 V power source through the aircraft standard power distribution unit and airborne cable net.

The line maintenance before each flight shall be performed in the following scope:

- Equipment test in «**Self-control**» mode. Reception test of navigation parameters (FS #8);
- Operability extended testing (FS #3);
- Altimeter and heading system communications test. Two RICUs interaction test. Communications test with MFD. Communications test with airborne range finder. Communications test with navigation and landing system (FS #5).

Routine maintenance after (600±20) running hours shall be performed on the aircraft without disassembly of units in the following scope:

- Inspection of A101П antenna radio transparent radome and unit appearance (FS #9);
- Check of nut tightening and locking in connectors. Earthing quality check (FS #10);
- RAM extended test (FS #7);
- Operability extended testing (FS #3);
- Test of navigation task solution (FS #4);
- Altimeter and heading system communications test. Two RICUs interaction test. Communications test with MFD. Communications test with airborne range finder. Communications test with navigation and landing system (FS #5);
- Shaping test of aircraft light panel control signals produced by the equipment. Generation test of «**Selected roll**» and «**Z**» signals». (FS #6).

Routine maintenance after (6000±60) running hours shall be performed with A101П antenna, LNA-SSF disassembly (if necessary), and RICU removal from the aircraft within the following scope:

- Removal of equipment components from aircraft (FS #1);
-Check of high-frequency connector pins and sockets (FS #11);
- Installation of equipment components in aircraft (FS #2);
- Inspection of A101П antenna radio transparent radome and unit appearance (FS #9);
- Check of nut tightening and locking in connectors. Earthing quality check (FS #10);
- RAM extended test (FS #7);
- Operability extended testing (FS #3);
- Test of navigation task solution (FS #4);
- Altimeter and heading system communications test. Two RICUs interaction test. Communications test with MFD. Communications test with airborne range finder. Communications test with navigation and landing system (FS #5).

Calendar maintenance shall be performed after 12 months within the periodical technical maintenance after 600 running hours.

Calendar maintenance shall be performed after 48 months within the periodical technical maintenance after 6000 running hours.

Removal and Installation

This sub-section includes technique and sequence of the equipment removal and installation in the aircraft and includes Flow Sheets #1 and #2:

a) FS #1 «Removal of equipment components from aircraft» meets **MS** 034.50.00d,

b) FS #2 «Installation of equipment components in aircraft» meets **MS** 034.50.00f.

FS #1 and FS #2 provide the equipment removal and installation operations sequence in the aircraft. These operations stages are shown in the Table 201.

Table 201

Operation	Operation Stage	FS
Removal of equipment components from aircraft	In the case of routine tests after 6000 running hours (if necessary), calendar maintenance – after 48 months (if necessary), after repair	**FS** #1 MS Item 034.50.00d
Installation of equipment components in aircraft	At the first installation in the aircraft, at routine tests after 6000 running hours, calendar maintenance – after 48 months, after repair	FS #2 MS Item 034.50.00f

Flow Sheet #1 for MS item 034.50.00d

MS #	Flow Sheet #1	Pages 205-206	
MS Item 034.50.00d	Operation: «Removal of equipment components from aircraft»	Work Content 1,0 man/hour	
Operation and Technical Requirements (TR)		Works performed with TR deviations	Control
WARNING. DE-ENERGIZE +27 V POWER-CIRCUIT ON THE AIRCRAFT POWER DISTRIBUTION UNIT BEFORE REMOVAL. **1 RICU Removal** For RICU removal perform the operations as follows: - unscrew and remove screws fastening enclosure to RICU front panel; - remove RICU out from the enclosure; - disconnect RICU earthing rod from the aircraft common earthing bar; - disconnect cables from RICU connectors; - install process covers on RICU connectors. **2 A101П Antenna removal** For A101П Antenna removal perform the operations as follows: - unlock and disconnect the high-frequency cable from A101П antenna; - install process cover on A101П antenna connector; - unscrew and remove 4 screws and 4 nuts, remove A101П antenna from its site together with the gasket.			

Flow Sheet #1 for MS item 034.50.00d (Continuation)

Operation and Technical Requirements (TR)	Works performed with TR deviations	Control
3 LNA-SSF removal For LNA-SSF removal perform the operations as follows: - unlock and disconnect cables from LNA-SSF; - install process covers on LNA-SSF connectors; - disconnect the amplifier holder, remove LNA-SSF from its location. **4 UPS removal** For UPS removal perform the operations as follows: - disconnect earthing rod from the aircraft common earthing bar; - disconnect cables from UPS «**X1**», «**X2**» connectors; - install process covers on UPS connectors; - disconnect UPS holder, remove UPS from its location. ***Note*** *– Units shall not be obligatory removed from their sites during maintenance, under condition of accessibility of high-frequency pins and sockets connectors' condition test without their removal.*		

Instruments	Tools and accessories	Expendables
-	Screwdriver 7810-0977 X9 Screwdriver 7810-0982 X9 Spanner 7811-0006 C1 X9	-

Flow Sheet #2 for MS item 034.50.00f

MS #	Flow Sheet #2	Pages 207-209	
MS Item 034.50.00f	Operation: «Installation of equipment components in aircraft»	Work Content 1,0 man/hour	
Operation and Technical Requirements (TR)		Works performed with TR deviations	Control
WARNING. DE-ENERGIZE +27 V POWER-CIRCUIT ON THE AIRCRAFT POWER DISTRIBUTION UNIT BEFORE INSTALLATION. **1 RICU Installation** For RICU installation perform the operations as follows: set RICU enclosure on its location, secure it in 20 mounting points (it is allowed to secure RICU in 12 points as directed in Appendix G of this Operating Manual); - check up seals availability and integrity on RICU upper and lower cover; - connect RICU earthing rod to the aircraft earthing bar; - check up the earthing quality between RICU earthing rod and the earthing bar by means of milliohm meter, the resistance value shall not exceed 2000 mcOhms; - remove process covers from connectors; - connect cables to RICU connectors; - to fix connector «**X5**» install the bracket as shown on Figure H.1 Appendix H. Lock connector with 0,3-12X18H9T safety wire and seal it; - install RICU into enclosure by guideways; - tighten screws on RICU front panels.			

Flow Sheet #2 for MS item 034.50.00f (Continuation)

Operation and Technical Requirements (TR)	Works performed with TR deviations	Control
2 A101П antenna installation For A101П antenna mounting perform the operations as follows: - remove the process cover from connector; - install A101П antenna on its site with the gasket (surface for antenna installation shall meet OST1 01025-82 requirements); - check up the earthing quality by measuring resistance between A101П antenna metallization surface and the earthing bar by means of E6-18milliohm meter, the resistance value shall not exceed 2000 mcOhms; - fix antenna with 4 screws and 4 nuts, see figure F.1 Appendix F, screw torque is 0,9±0,09 newton-meters; - connect A101П antenna high-frequency cable «**X2**» connector to «**X1**» connector in accordance with the Connection Layout (see Appendix A); - to immobilize connector install retaining bracket, consult Figure F.1 Appendix F; - lock A101П antenna connector with safety wire 0,3-12X18H9T and lock it; - check up A101П antenna fixing on the site. **3 LNA-SSF installation** For LNA-SSF installation perform the operation as follows: - remove the process cover from connector; - install LNA-SSF on the site (surface for LNA-SSF installation shall meet OST1 01025-93 requirements);		

Flow Sheet #2 for MS item 034.50.00f (Continuation)

Operation and Technical Requirements (TR)	Works performed with TR deviations	Control
- check up the earthing quality by measuring resistance between LNA-SSF metallization surface and the earthing bar by means of E6-18 milliohm meter, the resistance value shall not exceed 2000 microohms; - fix LNA-SSF with 4 screws and 4 nuts from the assemblage kit (see figure F.2 Appendix F); - connect the high-frequency cable «**X4**» connector to LNA-SSF «**BX.**» connector, the high-frequency cable «**X6**» connector to LNA-SSF «**ВЫХ**» connector - in correspondence with Connection Layout in Appendix A; - to fix the connectors install the brackets, as shown on Fig. F.2 Appendix F of this UM; - lock the connectors of LNA-SSF with 0,3-12X18H9T safety wire and seal it; - check up LNA-SSF fixing on the site. **4 UPS installation** For UPS installation perform the operations as follows: - Install UPS on the site and fix it with fastening bolts (see figure I.1 Appendix I); - connect UPS earthing rod to the aircraft earthing bar; - check up the earthing quality by measuring resistance between UPS earthing rod and the earthing bar by means of E6-18 milliohm meter, the resistance value shall not exceed 2000 microohms; - remove process covers from UPS «**X1**», «**X2**» connectors; - connect cables to UPS «**X1**», «**X2**» connectors.		

Instruments	Tools and accessories	Expendables
Milliohm meter E6-18 TR ЯЫ2.722.015	Screwdriver 7810-0053 Screwdriver 7810-0977 X9 Screwdriver 7810-0982 X9 Spanner 7811-0006 C1 X9	Wire 0,3 12X18H9T Filler ЭП-0010

Adjustment and Testing

The equipment shall be capable during the units (A101П antenna, LNA-SSF, RICU, UPS) replacement with no supplementary adjustment.

This section describes the equipment testing technique and sequence. Works for the equipment workability check up and stages of these operation are given in Table 202.

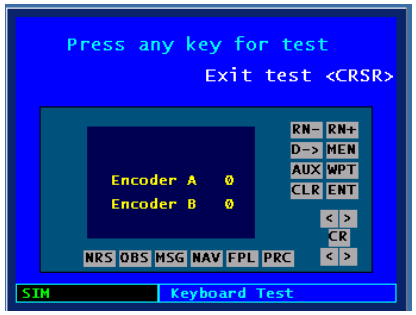
Table 202

Operation	Operation Stage	FS
Operability extended testing	At the first installation in the aircraft, before each flight, at periodical maintenance after 600 and 6000 operation hours, at calendar maintenance - after 12 and 48 months and after repair	FS #3 Item MS 034.50.00b
Test of navigation task solution	At the first installation in the aircraft, at periodical maintenance after 600 and 6000 operation hours, at calendar maintenance - after 12 and 48 months and after repair	FS #4 Item MS 034.50.00j
Altimeter and heading system communications test. Two RICUs interaction test. Communications test with MFD. Communications test with airborne range finder. Communications test with navigation and landing system	At the first installation in the aircraft, before each flight, at periodical maintenance after 600 and 6000 operation hours, at calendar maintenance - after 12 and 48 months and after repair	FS #5 Item MS 034.50.00c
Shaping test of aircraft light panel control signals produced by the equipment. Generation test of «**Selected roll**» and «**Z**» signals»	At the first installation in the aircraft, at periodical maintenance after 600 and 6000 operation hours, at calendar maintenance - after 12 and after repair	FS #6 Item MS 034.50.00k
RAM extended test	At the first installation in the aircraft, after 600 and 6000 operation hours, at calendar maintenance - after 12 and 48 months and after repair	FS #7 Item MS 034.50.00i
Equipment test in «**Self-control**» mode. Reception test of navigation parameters.	Before each flight	FS #8 Item MS 034.50.00a

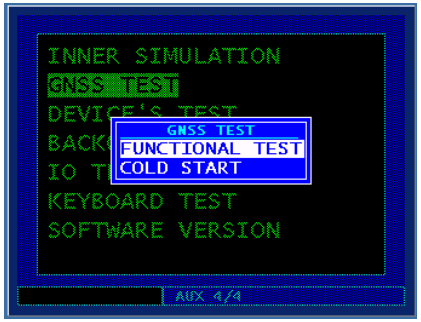
Flow Sheet #3 MS Item 034.50.00b

MS #	Flow Sheet #3	On pages 213-217	
MS Item 034.50.00b	Operation: «Operability extended testing»	Work Content 0.4 man/hour	
Operation and Technical Requirements (TR)		Works performed with TR deviations	Control
1 General Recommendations For the equipment workability extended test NSC signals consistent reception with minimal elevation angles 5ºshall be provided. Equipment workability extended test on the aircraft shall be performed as follows: - switch on the equipment power supply on the airborne power board; - press **ON/OFF** button in RICU. As soon as NDB indication form appears on the display, press **ENT** button. **2 Keyboard test** For keyboard test: - set **AUX4** page; - press **CRSR** button; - set lighting on **KEYBOARD TEST** field and press **ENT** button. **Keyboard Test** window shall appear on RICU display;			

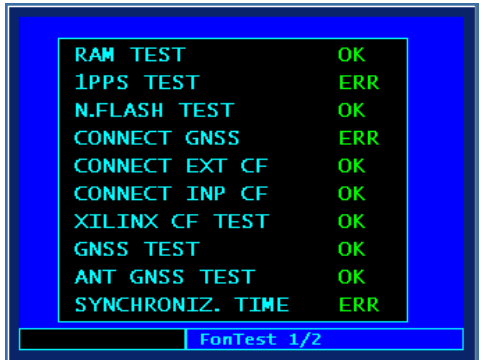
Flow Sheet #3 MS Item 034.50.00b Continuation

Operation and Technical Requirements (TR)	Works performed with TR deviations	Cont rol
 - press by turns buttons on RICU front panel. After pressing the button a short-term field lighting appears on RICU display, corresponding to the pressed button; - start rotating the shaft encoder external handle clockwise. On RICU display in **Encoder A** parameter field values from 0 to 63 shall be indicated by turns, starting from the value, which was indicated before turning. During shaft encoder external handle turning « > » symbol field shall be lightened on RICU display (above **CR** field); - start rotating the shaft encoder external handle counter-clockwise. On RICU display in **Encoder B** parameter field values from 63 to 0, shall be indicated by turns, starting from the value, which was indicated before turning. During shaft encoder external handle turning « < » symbol field shall be lightened on RICU display (under **CR**); If the above indications are not performed, decision of RICU replacement shall be taken. To exit from the keyboard test press **CRSR** button, then press **ENT** button. **AUX4** page shall appear on RICU display.		

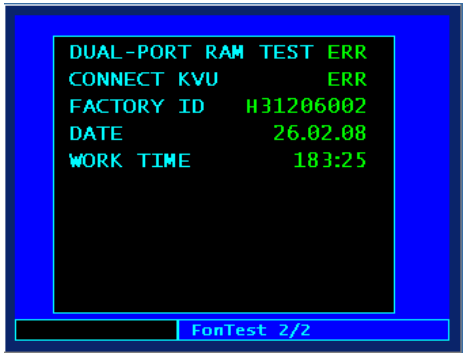
Flow Sheet #3 MS Item 034.50.00b Continuation

Operation and Technical Requirements (TR)	Works performed with TR deviations	Cont rol
3 GNSS receiver extended testing For reliable NSV signal reception maximum upward visibility should be provided. This procedure should not be performed in a room. For GNSS receiver extended testing: - set lighting on **AUX4** page in **GNSS TEST** field; - press **ENT** button. **GNSS TEST** pop-up window is shown in **AUX4** page;  - set the highlighting in **FUNCTIONAL TEST** field; - press **ENT** button; - pop-up window will disappear on **AUX4** page; - control testing results after 3 minutes.		

Flow Sheet #3 MS Item 034.50.00b Continuation

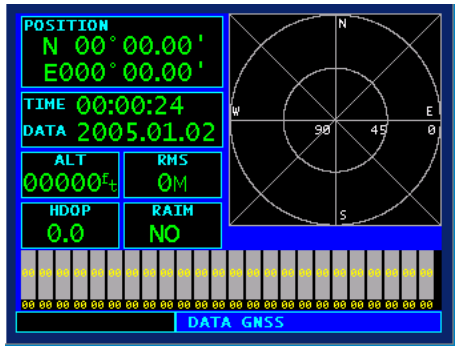
Operation and Technical Requirements (TR)	Works performed with TR deviations	Cont rol
To control test results: - set the highlighting on **AUX4** page in **BACKGROUND TEST** field; - press **ENT** button; - on RICU display **FonTest 1** (the first window of equipment background test) shall be indicated with GNSS receiver extended test results (**GNSS TEST** line) and the equipment operation modules background test;  		

Flow Sheet #3 MS Item 034.50.00b Continuation

Operation and Technical Requirements (TR)	Works performed with TR deviations	Control
- rotating the shaft encoder external handle enter the second window of the equipment background test- **FonTest 2** to review test results.  If test is OK, then in test results indication fields in **FonTest 1** and **FonTest 2** windows **OK** shall be seen. If **ERR** indication appears, this is the evidence of some functional module defect.		

Instruments	Tools and accessories	Expendables
-	-	-

Flow Sheet #4 Item MS 034.50.00j

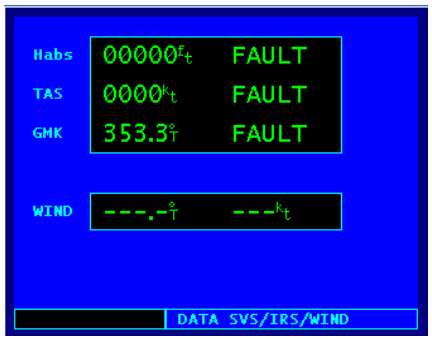
MS #	Flow Sheet #4	On pages 219-220	
Item MS 034.50.00j	Operation: «Test of navigation task solution»	Work Content 0.4 man/hour	
Operation and Technical Requirements (TR)		Works performed with TR deviations	Control
To have consistent reception of NSC signals maximum upward visibility should be provided. This check should not be performed in a room. To do the test of navigation task solution: - switch on the equipment on the airborne power supply unit; - press **ON/OFF** button on RICU. As soon as NDB indication form appears on the display, press **ENT** button; - execute an operation of user position coordinate determination during 30 minutes; -make sure that generated coordinates are valid, for this check the value of RAIM-control function in **DATA GNSS** box of **AUX2** page. 			

Flow Sheet #4 Item MS 034.50.00j Continuation

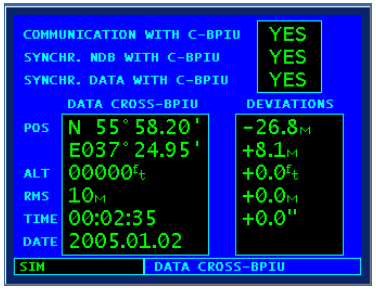
Operation and Technical Requirements (TR)	Works performed with TR deviations	Control
RAIM-control function may take the following values: - **YES** – RAIM is accessible; - **NO** –RAIM functions are lost. The navigation task solution is performed correctly if during 30 minutes you have obtained a stable determination of position, confirmed by RAIM-control (in RAIM-control function indication field **YES** value is indicated).		

Instruments	Tools and accessories	Expendables
-	-	-

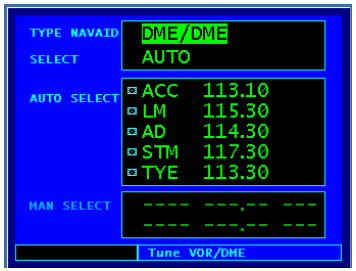
Flow Sheet #5 Item MS 034.50.00c

MS #	Flow Sheet #5	On pages 221 - 226	
Item MS 034.50.00c	Operation: « Altimeter and heading system communications test. Two RICUs interaction test. Communications test with MFD. Communications test with airborne range finder. Communications test with navigation and landing system»	Work control 0,2 man/hour	
Operation and Technical Requirements (TR)		Works performed with TR deviations	Control
1 Altimeter and heading system communication test Test is performed on aircraft board. For altimeter and heading system communication test: - switch on altimeter and heading system in accordance with FOM in aircraft; - connect the equipment power supply on the airborne power supply unit; - press **ON/OFF** button on RICU. As soon as NDB indication form appears on the display, press **ENT** button; - open **AUX2** page. Set lighting on DATA **SVS/IRS/WIND** field and **ENT** button. **DATA SVS/IRS/WIND** window is indicated on RICU display as follows;  - in **Habs, TAS** and **GMK** fields control whether altitude, speed and gyro-magnetic heading values are correct (**OK/FAULT**);			

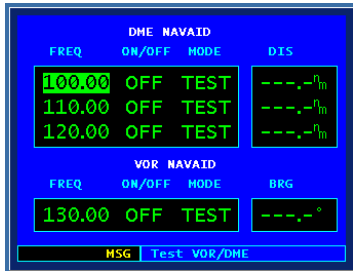
Flow Sheet #5 Item MS 034.50.00c Continuation

Operation and Technical Requirements (TR)	Works performed with TR deviations	Control
-- **OK** value is indicated if two words come periodically from altimeter to the equipment (no more rarely than once a second) with the «normal operation» state matrix. **Note - *Habs, TAS, GMK*** *values are checked according to User's Manual for specific interconnected systems. Wind conditions are not checked.* **2 Two RICUs interaction test** The test shall be performed in that case if two RICUs are installed on aircraft board. To test two RICUs interaction: **-** press **ON/OFF** button on both **RICUs**; - when NDB form appears on RICU display, press **ENT** button; - open **AUX2** page; - set the highlighting on **DATA CROSS - RICU** field and press **ENT** button. **DATA CROSS - RICU** window shall be indicated on RICU display.  If two RICUs interact correctly, in **DATA CROSS - RICU** window in three top lines **YES** value shall be indicated. The indication of **NO** value is evidence of failure of connection with another RICU or else of un-synchronized databases of two RICUs.		

Flow Sheet #5 Item MS 034.50.00c Continuation

Operation and Technical Requirements (TR)	Works performed with TR deviations	Control
3 Communications test with MFD The test is performed in an aircraft if the equipment is connected to MFD. - switch on MFD; - switch on the equipment power supply on the airborne power board; - press **ON/OFF** button in RICU. As soon as NDB indication form appears on RICU display, press **ENT** button; - set up **DATA GNSS** window, wait for valid position finding which was proved by RAIM control (**YES** value is displayed in the value indication field of RAIM control function); - turn on **NAV** mode indication in MFD; - compare current time indicated by RICU and MFD displays. Current time should be identical. **4 Communications test with aircraft rangefinder (DME)** The test is performed in an aircraft if the equipment is connected to aircraft rangefinder. To test the communication with aircraft rangefinder: - switch on aircraft rangefinder; - switch on the equipment power supply on the airborne power board; - press **ON/OFF** button in RICU. As soon as NDB indication form appears on RICU display, press **ENT** button; - set up **AUX2** page. Turn on highlighting in **TUNE VOR/DME** field and press **ENT** button. RICU will display **Tune VOR/DME** window;  		

Flow Sheet #5 Item MS 034.50.00c Continuation

Operation and Technical Requirements (TR)	Works performed with TR deviations	Control
- set the highlighting in **SELECT** field; - rotate shaft encoder internal knob for one position, **MODE** pop-up window will appear in **Tune VOR/DME** window;  - set the highlighting in **TEST** field. Press **ENT** button, RICU will display **Test VOR/DME** window;  - set the highlighting in **DME NAVAID** table of **FREQ** field. Input tuning frequency of **DME** (**VOR**) device; - set the highlighting in **DME NAVAID** table of **ON/OFF** field for the first beacon. Rotate shaft encoder internal knob for one position, **SELECT** pop-up window will display in **Test VOR/DME** window;  		

Flow Sheet #5 Item MS 034.50.00c Continuation

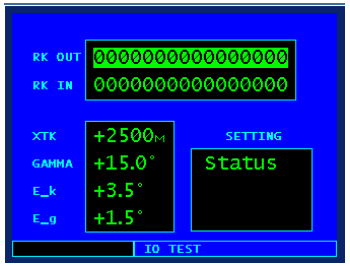
Operation and Technical Requirements (TR)	Works performed with TR deviations
- set the highlighting in **ON** field for communications test with aircraft rangefinder, press **ENT** button; - set the highlighting in **DME NAVAID** table of **MODE** field for the first beacon. Turn shaft encoder internal knob for one position, **SELECT** pop-up window will display in **Test VOR/DME** window;  - turn on highlighting in **CTRL** field. Press **ENT** button; - For approximately 4 seconds aircraft rangefinder range indicator will display the consistency of zeroes and hyphens. Thereafter **000,0** value should be displayed in **Test VOR/DME** window of **DIS** field for the first frequency. Indicated consistency of symbol displaying shown by aircraft rangefinder range indicator is valid for СД-75М range finder. Using other aircraft rangefinders the control should be maintained according to applied rangefinder documentation. **5 Communications test with navigation and landing system (VOR)** The test is performed in an aircraft if the equipment is connected to navigation and landing system. To test the communication with navigation and landing system: - switch on navigation and landing system and devices interacting with it; - switch on the equipment power supply on the airborne power board;	

Flow Sheet #5 Item MS 034.50.00c (Continuation)

Operation and Technical Requirements (TR)	Works performed with TR deviations	Control
- press **ON/OFF** button in RICU. As soon as NDB indication form appears on RICU display, press **ENT** button; - set up **AUX2** page. Set the highlighting in **TUNE VOR/DME** field and press **ENT** button. RICU will display **Tune VOR/DME** window; - set the highlighting in **SELECT** field; - rotate shaft encoder internal knob for one position, **MODE** pop-up window will appear in **Tune VOR/DME** window; - set the highlighting in **TEST** field. Press **ENT** button, RICU will display **Test VOR/DME** window; - set the highlighting in **VOR NAVAID** table of **MODE** field. Rotate shaft encoder internal knob for one position, **SELECT** pop-up window will be displayed in **Test VOR/DME** window; - set the highlighting in **CTRL** field. Press **ENT** button; - set the highlighting in **ON/OFF** field. Rotate shaft encoder internal knob for one position, **SELECT** pop-up window will display in **Test VOR/DME** window; - set the highlighting in **ON** field for communications test with navigation and landing system, press **ENT** button; - switch the flight navigation instrument connected to navigation and landing system into operating mode from **VOR/ILS**; - observe arrow position change of the current azimuth (A) in flight navigation instrument. The arrow of the current azimuth should be set sequentially into position of 135º, 0º, 225º on the scale of flight navigation instrument. Indicated test is valid for navigation and landing system КУРС-93М. Using other navigation and landing systems the control should be maintained according to applied system documentation.		

Instruments	Tools and accessories	Expendables
-	-	-

Flow Sheet #6 Item MS 034.50.00k

MS #	Flow Sheet #6	Pages 227-229	
Item MS 034.50.00k	Operation: «Shaping test of aircraft light panel control signals produced by the equipment». Generation test of «**Selected roll**» and «**Z** signals»	Work control 0,4 man/hour	
Operation and Technical Requirements (TR)		Works performed with TR deviations	Control
1 Test shall be performed on aircraft board. To do this test: - connect the equipment power supply on the airborne power supply unit; - press **ON/OFF** button on RICU. As soon as NDB indication form appears on the display, press **ENT** button; - open **AUX4** page. Set the highlighting in **IO TEST** field and press **ENT** button. **IO TEST** window is indicated on RICU display as follows. 			

Flow Sheet #6 Item MS 034.50.00k Continuation

Operation and Technical Requirements (TR)	Works performed with TR deviations	Control
2. Shaping test of aircraft light panel control signals produced by the equipment: - install lighting in **RK OUT** window. In **RK OUT** filed the last symbol on the right meets the one-time command **RK0_OUT**, the last symbol on the left corresponds to the one-time command **RK15_OUT**; - place the symbol «**1**» by turns in the character cells, corresponding to one-time commands **RK0_OUT** (**OFFSET**), **RK1_OUT** (**RAIM**), **RK2_OUT** (**WPT**), **RK3_OUT** (**MSG**), **RK4_OUT** (**Avail. SNS**), **RK5_OUT (ACTV)**, **RK6_OUT** (**Airport area**), **RK7_OUT** (**Switch on ERLA**), **RK15_OUT** (**ARM**). Appropriate indicators will light on the airplane light alarm board. ***Note*** *It is allowed to modify the check sequence of one-time commands. Test control signals used in a specific aircraft.* 3 «**Selected roll**» signals generation test: - in **RK OUT** field install the symbol «**1**» in the character cells, corresponding to one-time commands **RK11_OUT** (**Selected roll availability**). Check up **Selected roll availability** signal availability (+27 V on contact 19 of connector «**X2**»); - set the highlighting in **GAMMA** field; - install the verified value of «**Selected roll**» signal («**Selected roll**» has value +15°on default) - press **ENT**; - check up the accuracy of «**Selected roll**» shaping on the contact 35 of connector «**X2**». Voltage shall meet the «**Selected roll**» set value in **GAMMA** field (at a rate of 0,333 V per 1 degree, positive value – the right turn. Voltage of 5 V meets the list of 15 degrees); - set the highlighting in **RK OUT** field; - set symbol «**0**» in the character cell, corresponding to one-time command **RK11_OUT** (**Selected roll availability**). Check up interruption of «**Selected roll availability**» output signal.		

Flow Sheet #6 Item MS 034.50.00k Continuation

Operation and Technical Requirements (TR)	Works performed with TR deviations	Control
4 «**Z**» signal forming test (deviation from DT): - in **RK OUT** field set the symbol "1" in character location which meets **RK10_OUT** one-time command **(«Availability Z»).** Check for «**Availability Z**» signal (voltage +27V on pin 16 of the connector "X2"); - set the highlighting in **XTK** field; - set a testable «**Z**» signal value (by default «**Z**» signal value is 2,5 km); - press **ENT** button; - check a validity of Z signal forming on pin 33 of the connector «**X2**» (at the rate of 0,03 V per 1 km, positive value is a set to the right, i.e., DT is at the left. Voltage + 0,75 mV meets a deviation from DT 2,5 km); - set the highlighting in **RK OUT** field; - set the symbol "0" in character location which meets **RK10_OUT** one-time command **(Availability Z).** Check a disconnection of «**Availability Z**» output signal.		

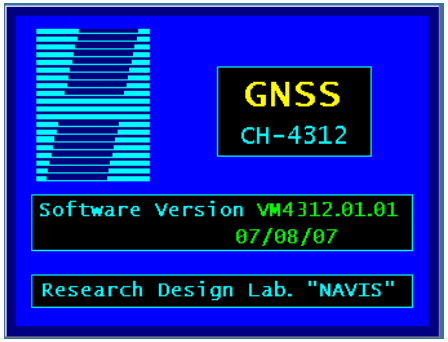
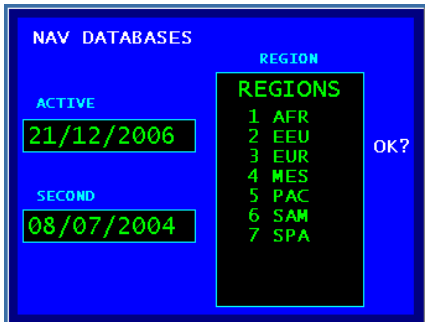
Instruments	Tools and accessories	Expendables
-	-	-

Flow Sheet #7 Item MS 034.50.00i

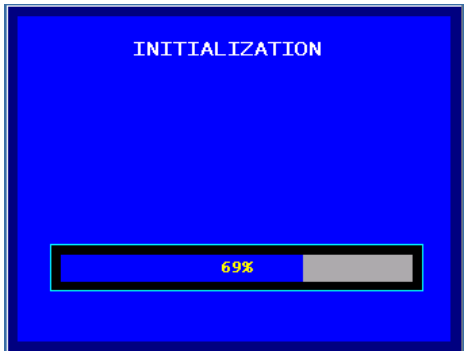
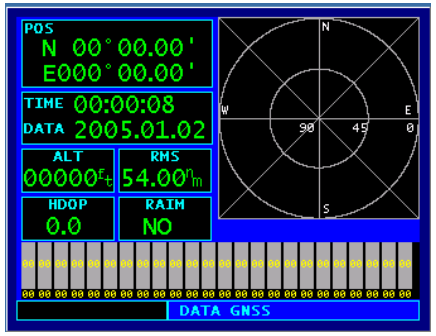
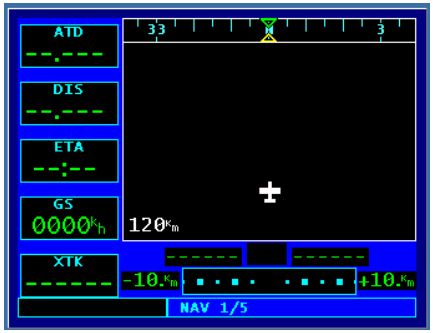
K #	Flow Sheet #7	On page 231	
Item MS 034.50.00i	Operation: «RAM extended test»	Work control 0,3 man/hour	
Operation and Technical Requirements (TR)		Works performed with TR deviations	Control
For RAM extended test: - connect the equipment power supply on the airborne power supply unit; - press any button on RICU front panel (except **ON**/**OFF** button) and, while keeping it pressed, press **ON**/**OFF** button. Immediately after start RAM extended test will be performed. RAM extended test will last not longer than 10 minutes. During test **D** button shall be constantly lighted, **NRST**, **OBS**, **MSG**, **NAV**, **FPL**, **PROC** buttons will light in turn. **PROC** button stays highlighted to the end of test. If RAM extended test is OK **NRST**, **OBS**, **MSG**, **NAV**, **FPL**, **PROC** buttons will be simultaneously lighted, equipment test in «**Self-control**» mode shall be performed and the start form shall be indicated. If any RAM failure is detected, simultaneous lighting of **D**, **MENU**, **AUX**, **WPT** buttons is on. No forms indication on RICU display.			

Instruments	Tools and accessories	Expendables
-	-	-

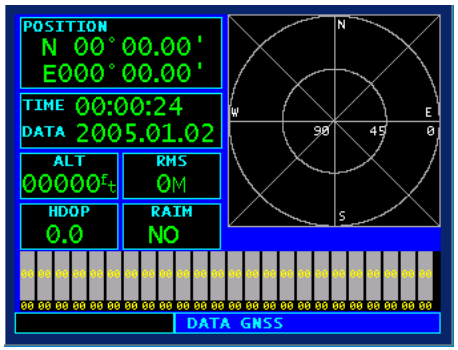
Flow Sheet #8 item MS 034.50.00a

MS #	Flow Sheet #8	Page 233-235	
Item MS 034.50.00a	Operation: «Equipment test in «**Selfcontrol**» mode. Reception test of navigation parameters»	Work control 0,1 man/hour	
Operation and Technical Requirements (TR)		Works performed with TR deviations	Control
For equipment test in «**Self-control**» mode: - connect the equipment power supply on the airborne power supply unit; - press **ON**/**OFF** button on RICU. Immediately after start «**Self-control**» mode operation is set. In «**Self-control**» mode RAM and ROM testing, control unit and processor communication testing are performed. If any RAM or ROM failures are detected, the simultaneous lighting of one of: **NRST**, **OBS** or **MSG** buttons is on and that of **D**, **MENU**, **AUX**, **WPT** buttons lighting. In the case of no communication between control unit and processor, all buttons on the RICU front panel blink. In the case of any failure in «**Self-control**» mode no forms indication on RICU display. *When **Self-control**» mode termination is OK:* - the start form indication, then NDB form indication;  			

Flow Sheet #8 item MS 034.50.00a Continuation

Operation and Technical Requirements (TR)	Works performed with TR deviations	Control
- press **ENT** button to confirm operation with the installed active NDB (change NDB if necessary, and then press **ENT** button). NDB initialization form indication on RICU display;  - when NDB initialization is terminated, **DATA GNSS** window of **AUX2** page indication on RICU display. **DATA GNSS** window is displayed until coordinates will be received from GNSS receiver (**GNSS** flag is displayed in the flag field of reference coordinate NP receiving), and then **NAV1** page is displayed. Failing coordinates from GNSS sensor the transfer to other data cards is performed by the operator. .   		

Flow Sheet #8 item MS 034.50.00a Continuation

Operation and Technical Requirements (TR)	Works performed with TR deviations	Control
For navigation accessed parameters test: - press **AUX** button. Set **AUX2** page; - set the highlighting in **DATA GNSS** field, press **ENT** button; - on RICU display - **DATA GNSS** window indication;  - make sure that the performed position is correct, for this control the value of RAIM-control function. RAIM-control function may take values as follows: - **YES** – RAIM is accessible; - **NO** –RAIM functions are lost. The navigation parameters are correct if in RAIM-control function indication field **YES** value is indicated.		

Instruments	Tools and accessories	Expendables

Inspection and Checkout

The equipment shall be examined on various stages of the technical maintenance in order to test the units' appearance, their fastening, cables and cable connectors' condition, as well as earthing bars condition. All works connected with the equipment units' examination and test, together with stages of these works are listed in Table 203.

Table 203

Operation	Operation Stage	FS
Inspection of A101Π antenna radio transparent radome and unit appearance.	At periodical maintenance after 600 and 6000 hours of operation, at calendar maintenance after 12 and 48 months, after repair.	FS #9 item MS 034.50.00g
Check of nut tightening and locking in connectors. Earthing quality check	At periodical maintenance after 600 and 6000 hours of operation, at calendar maintenance after 12 and 48 months, after repair.	FS #10 item MS 034.50.00h
Check of high-frequency connector pins and sockets	At periodical maintenance after 6000 hours of operation, at calendar maintenance after 48 months, after repair.	FS #11 item MS 034.50.00e
Replacement of detachable device for navigation database storage	Navigation database storage unit is updated each 28 days, as agreed with the navigation database supplier.	FS # 12

Flow Sheet #9 Item MS 034.50.00g

MS #	Flow Sheet #9	Page 239	
Item MS 034.50.00g	Operation: «Inspection of A101П Antenna radio transparent radome and unit appearance»	Work control 0,2 man/hour	
Operation and Technical Requirements (TR)		Works performed with TR deviations	Control
1 Examine A101П antenna radio transparent radome external condition. Clean the radome if dirty with dry cloth, if very dirty wash it with warm water with domestic detergent. In the case of any cracks or chips on radome, return A101П antenna to the manufacturing enterprise as provided by the normal procedure. 2 Examine RICU, UPS, LNA-SSF external condition. The units shall have no mechanical damages. In the case of any mechanical damage repair the unit as provided by the normal procedure.			

Instruments	Tools and accessories	Expendables
-	-	Domestic detergent Cotton cloth

Flow Sheet #10 Item MS 034.50.00h

MS #	Flow Sheet #10	Page 241	
Item MS 034.50.00h	Operation: «Check of nut tightening and locking in connectors. Earthing quality check »	Work control 0,3 man/hour	
Operation and Technical Requirements (TR)		Works performed with TR deviations	Control
1 Check up the equipment unit fastenings' condition on sites. 2 Check up nuts tightening in the fastening units. Nuts shall be tightened firmly. 3 Check up connectors tightening, tighten the loss high-frequency connectors firmly. 4 Check up connectors locking. Replace the cables connectors locking if defect. 5 Check up the units' earthing quality by measuring resistance between the units' earthing rods and the aircraft-earthing bar with E6-18 milliohm meter. Resistance value shall not exceed 2000 microohms.			

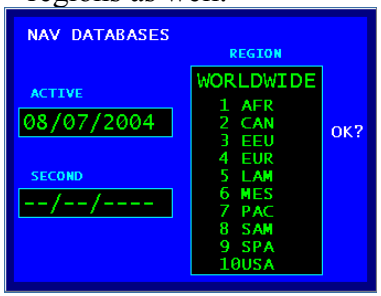
Instruments	Tools and accessories	Expendables
E6-18 ТУ ЯЫ2.722.015 milliohm meter	Screw driver 7810-0977 X9 Screw driver 7810-0982 X9 Spanner 7811-0006 C1 X9	Wire 0,3 12X189T

Flow Sheet #11 Item MS 034.50.00e

K MS #	Flow Sheet #11	Page 243	
Item MS 034.50.00e	Operation: «Check of high-frequency connector pins and sockets»	Work control 0,3 man/hour	
Operation and Technical Requirements (TR)		Works performed with TR deviations	Control
1 Examine RICU, A101П antenna and LNA-SSF high-frequency connectors pins and sockets condition, as well as that of high-frequency cables connectors, connected to these units. The high-frequency connector pins and sockets shall contain neither any mechanical damage nor shall be dirty. Clean the high-frequency connector pins and sockets with alcohol and brush. In the case of any damage of the high-frequency connectors pins and sockets, replace the connector, make soldering of the new connector in correspondence with the Connection Layout in Appendix A of this Manual. 2 Examine cable insulation's external condition, especially near the high-frequency connectors and where cables pass openings and where they may rub against some aircraft parts. Cables damaged insulation shall be protected with insulation tape.			

Instruments	Tools and accessories	Expendables
-	Flat brush N8 OST 17-888-81	Alcohol Insulation tape

Chart #12

#12	Chart #12	Page 245	
	Operation: «Replacement of detachable device for navigation database storage»	Work control 0,1 man/hour	
Operation and Technical Requirements (TR)		Works performed with TR deviations	Control
To replace the navigation database storage removable unit perform the operations as follows: - remove the navigation database storage removable unit out from RICU; ***Note*** *– Remove or set detachable device for NDB storage in RICU only if RICU is turned off.* - set the new navigation database storage removable unit into RICU; - connect RICU; - when NDB indication form appears on RICU display monitor NDB expiration date in **ACTIVE** field. **ACTIVE** field shall contain no «-» symbols, NDB shall be not expired. The list of regions in the active NDB indicates, except the regions stipulated by Agreement of NDB supply, the boarding regions as well.  			

Instruments	Tools and accessories	Expendables
-	-	-

Cleaning and Painting

The equipment requires no special cleaning or painting.

WARNING. THE FOLLOWING LIQUIDS SHALL BE EXPOSURED ON A101П ANTENNA ENCLOSURE UNDER NO CONDITIONS:

- НГЖ-5У (HYDRAULIC FLUID ON BASE OF ORGANOPHOSPHORUS COMPOUND ETHER),

- 1,1,1 TRYCHLORETHANE.

Servicing

In the case of any troubles during the equipment operation the trouble shall be detected accurate within the unit, following the "Troubleshooting" recommendations.
A faulty unit shall be repaired at the manufacturing factory. Check up the seals availability before forwarding the faulty unit to the manufacturer.

WARNING. FOR FAULTY UNIT REPLACEMENT TURN OFF IT FROM +27 V SUPPLY CIRCUIT.

AIRBORNE EQUIPMENT OF SATELLITE NAVIGATION – STORAGE CONDITIONS

The entire equipment or separate units shall be stored, packed and preserved in original packing.

The equipment shall be stored in heated rooms at temperatures from 5°C to 40°C and maximum relative humidity 80% during 5 years without re-preservation.

The equipment requires no maintenance and technical condition testing during the storage period.

For storage of the equipment, dismantled from the aircraft, prepare the units for storage as follows:

a) place the equipment units into a plastic bag;

b) place some silica-gel into this plastic bag;

c) seal the plastic bags hermetically (faulty fusion, pinches and rapture of plastic bags are not permitted);

d) place the plastic bags containing the units into the cardboard boxes;

e) place the cardboard boxes containing the units into original packing box;

f) shut the box with the cover and seal it.

AIRBORNE EQUIPMENT OF SATELLITE NAVIGATION – TRANSPORTATION

The equipment shall be transported packed and preserved in original packing.

The equipment in original packing shall be transported both by air and by any ground transport in accordance with the regulations on the corresponding transport.

The packing box shall be placed in accordance with the regulations on the corresponding transport.

The packing box containing the equipment shall be fixed so to avoid any displacement or strokes during the transportation.

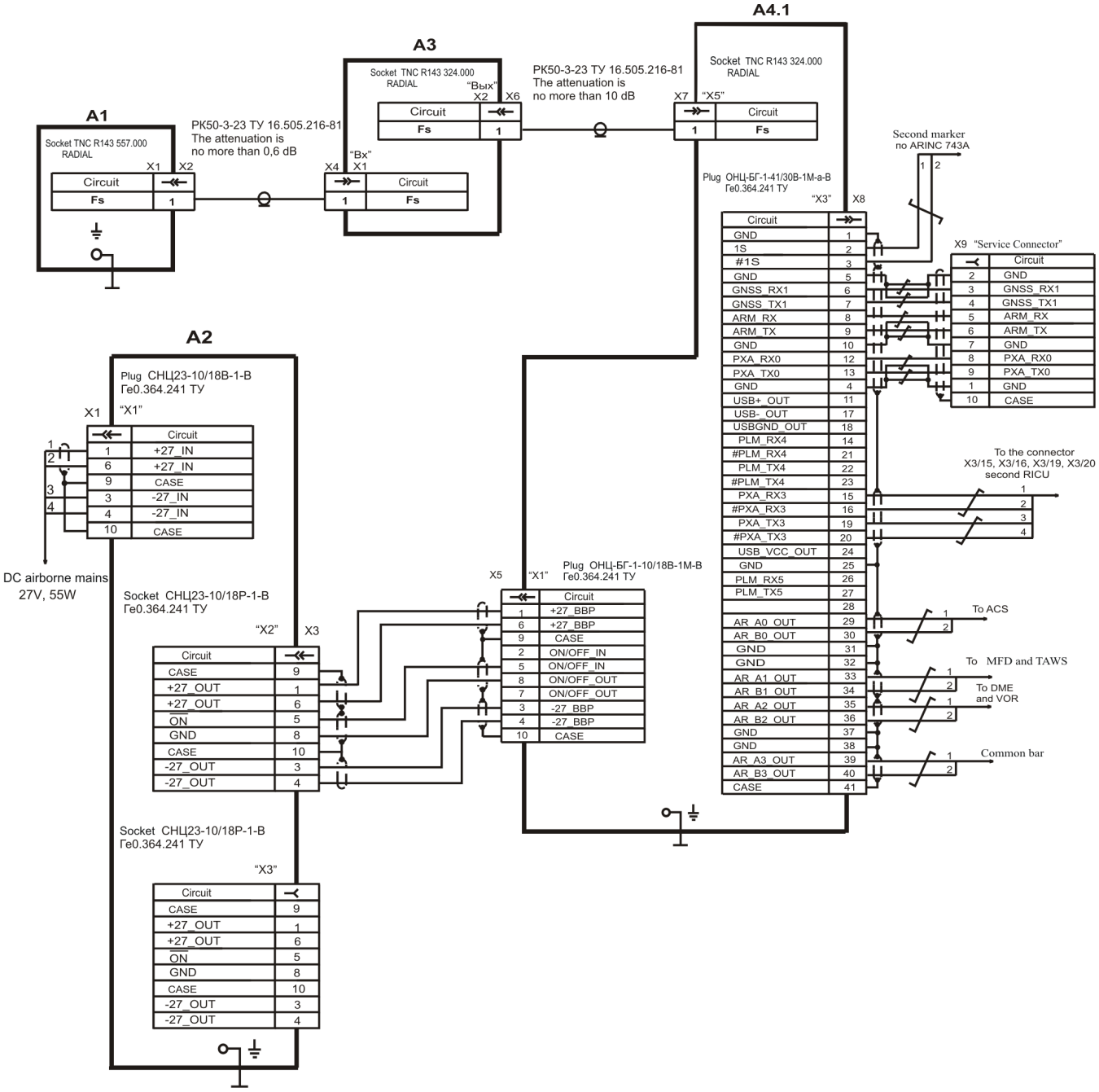
The packing box containing the equipment shall be neither thrown nor turned over during handling.

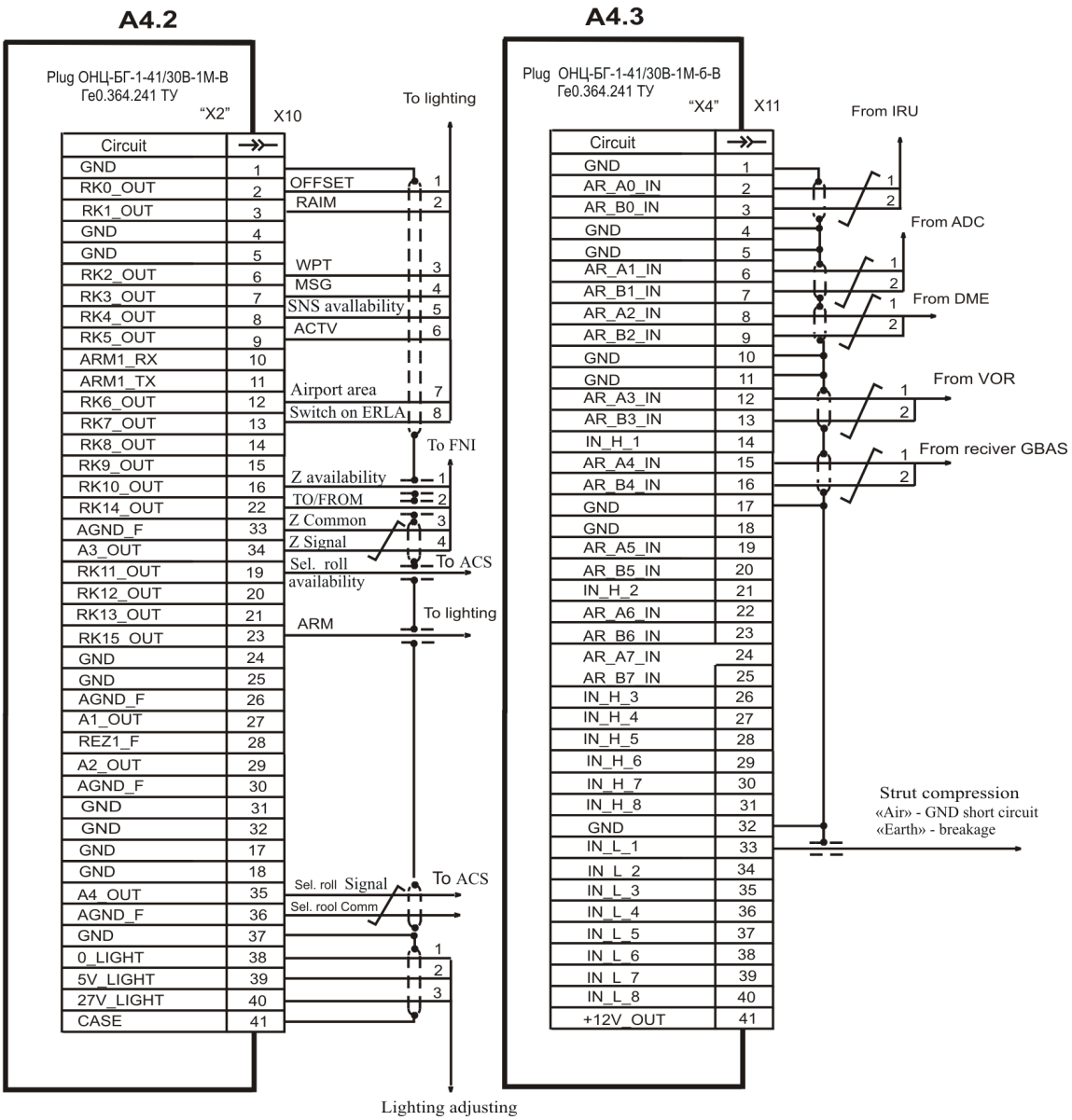
AIRBORNE EQUIPMENT OF SATELLITE NAVIGATION -

APPENDIX A

(mandatory)

Connection Layout





A1	A101П Antenna	ПКАН.464656.005
A2	Uninterruptible power supply	ТДЦК.436434.006
A3	LNA-SSF Amplifier	АПМА.434816.034
A4	Receiver indicator and control unit	ТДЦК.467855.039
X1	СНЦ 23-10/18Р-6-В socket*	Ге0.364.241 ТУ
X2	R 143 156 000 (TNC) angle plug*	RADIALL
X3	СНЦ 23-10/18В-6-В plug*	Ге0.364.241 ТУ
X4, X6, X7	R 143 008 000 (TNC) plug*	RADIALL
X5	СНЦ 23-10/18Р-6-В socket*	Ге0.364.241 ТУ
X8	СНЦ 23-41/30Р-6-а-В socket*	Ге0.364.241 ТУ
X9	СНЦ 23-10/18Р-2-В socket*	Ге0.364.241 ТУ
X10	СНЦ 23-41/30Р-6-В socket*	Ге0.364.241 ТУ
X11	СНЦ 23-41/30Р-6-б-В socket*	Ге0.364.241 ТУ

*Included into ТДЦК.468911.020-02 ІК

Figure A.1 (page 2 of 2)

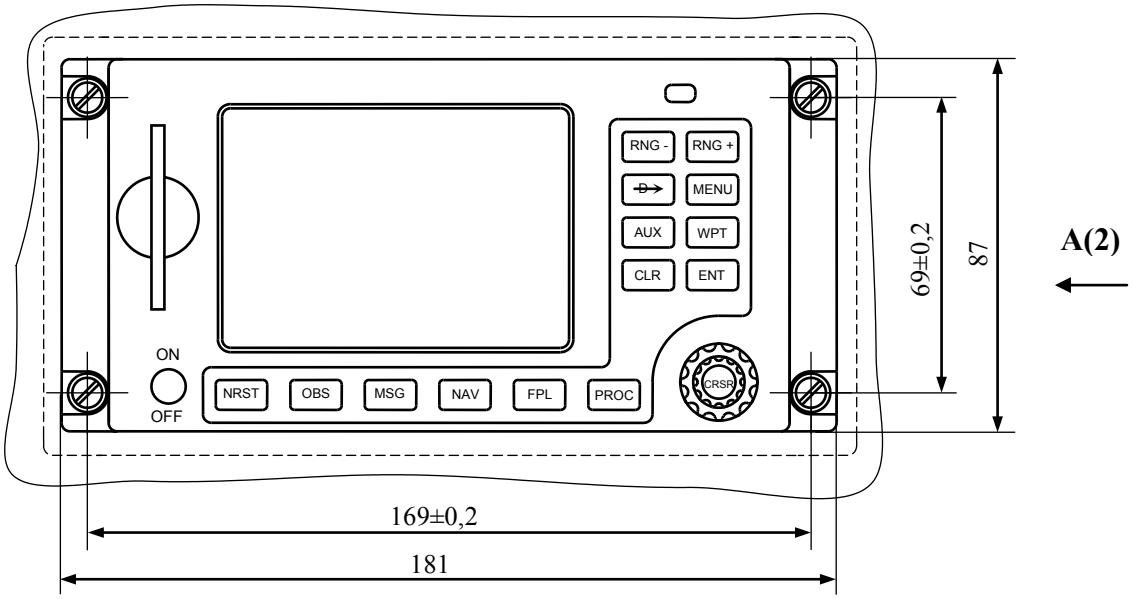
AIRBORNE EQUIPMENT OF SATELLITE NAVIGATION - APPENDIX B

(reference)

RICU Outline Drawing

RICU outline drawing is shown in fig. B.1 before serial № C03908020 and before serial № Г516030 inclusive.

RICU outline drawing is shown in fig. B.2 since serial № C03910021.



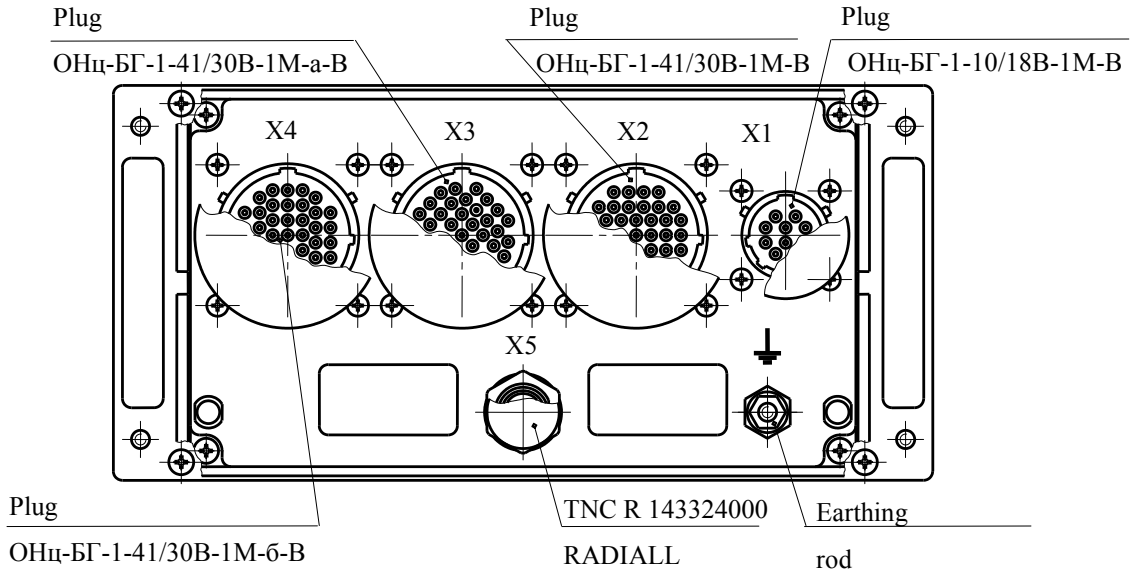


Figure B.1 (page 1 of 2)

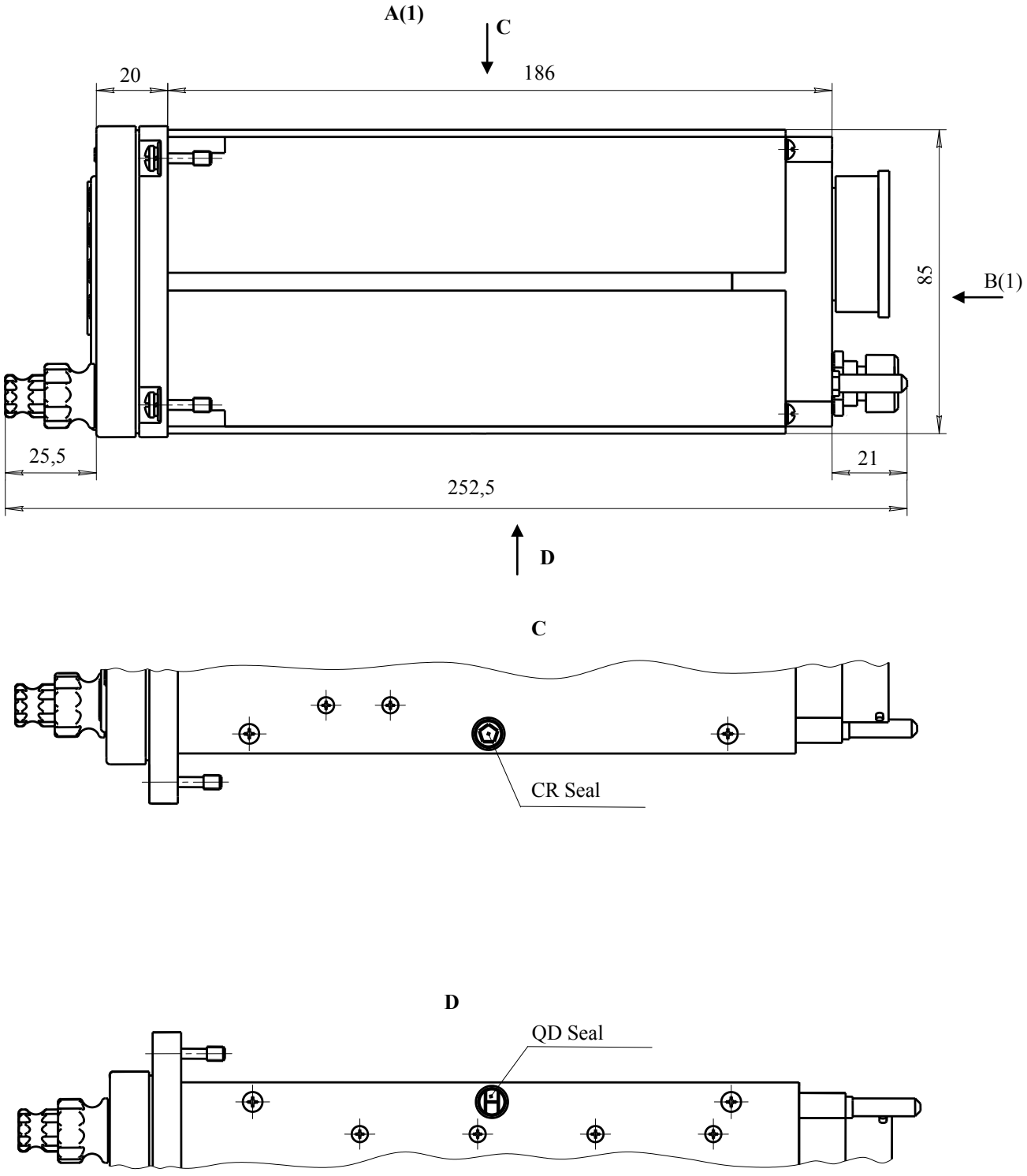
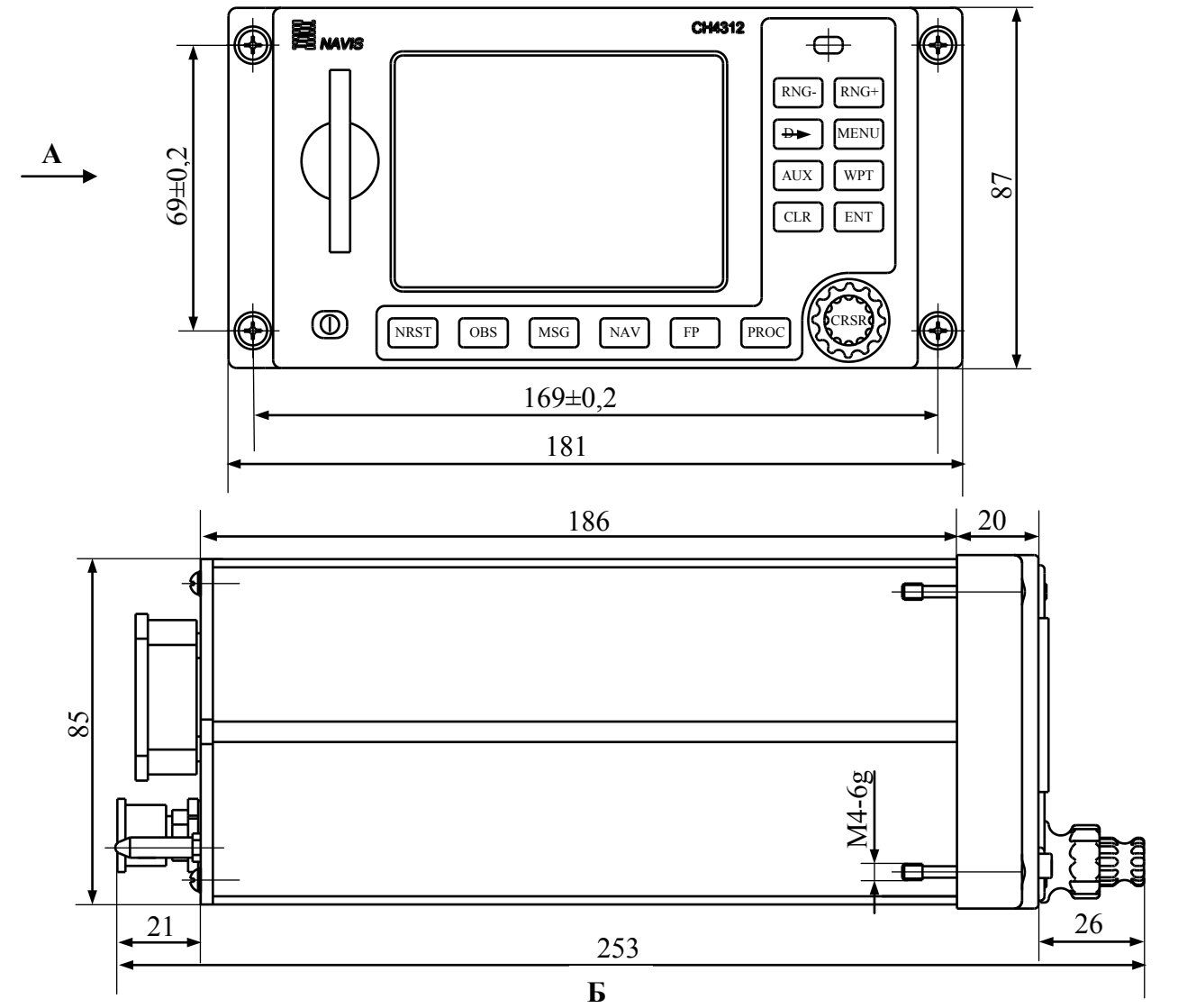


Figure B.1 (page 2 of 2)


A
NAVIS
CH4312
RNG-
RNG+
MENU
AUX
WPT
CLR
ENT
NRST
OBS
MSG
NAV
FP
PROC
CRSR
69±0,2
87
169±0,2
181
186
20
85
M4-6g
21
253
26
Б

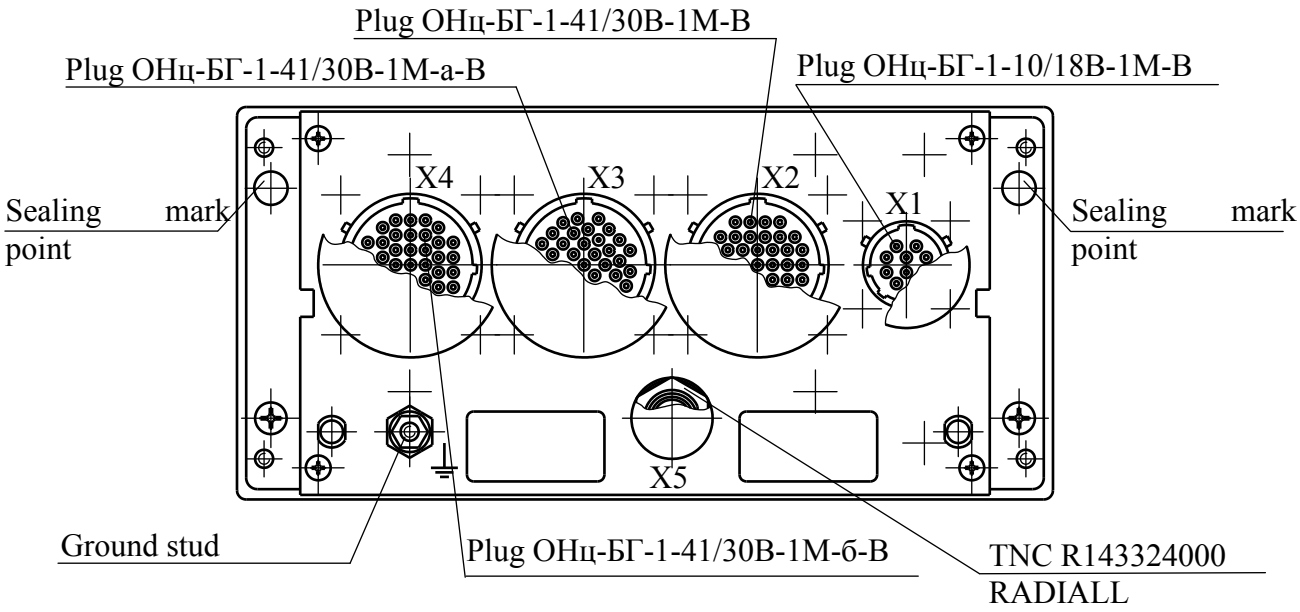

Plug ОНц-БГ-1-41/30В-1М-В
Plug ОНц-БГ-1-41/30В-1М-а-В
Plug ОНц-БГ-1-10/18В-1М-В
X4
X3
X2
X1
Sealing mark point
Sealing mark point
X5
Ground stud
Plug ОНц-БГ-1-41/30В-1М-б-В
TNC R143324000 RADIALL

Figure B.2

AIRBORNE EQUIPMENT OF SATELLITE NAVIGATION - APPENDIX C

(reference)

A101П Antenna and LNA-SSF Outline Drawing

A101П antenna outline drawing is shown in fig. C.1

LNA-SSF outline drawing is shown in fig. C.2 before serial No Б516229 inclusive.

LNA-SSF outline drawing is shown in fig. C.3 since serial № Б516230.

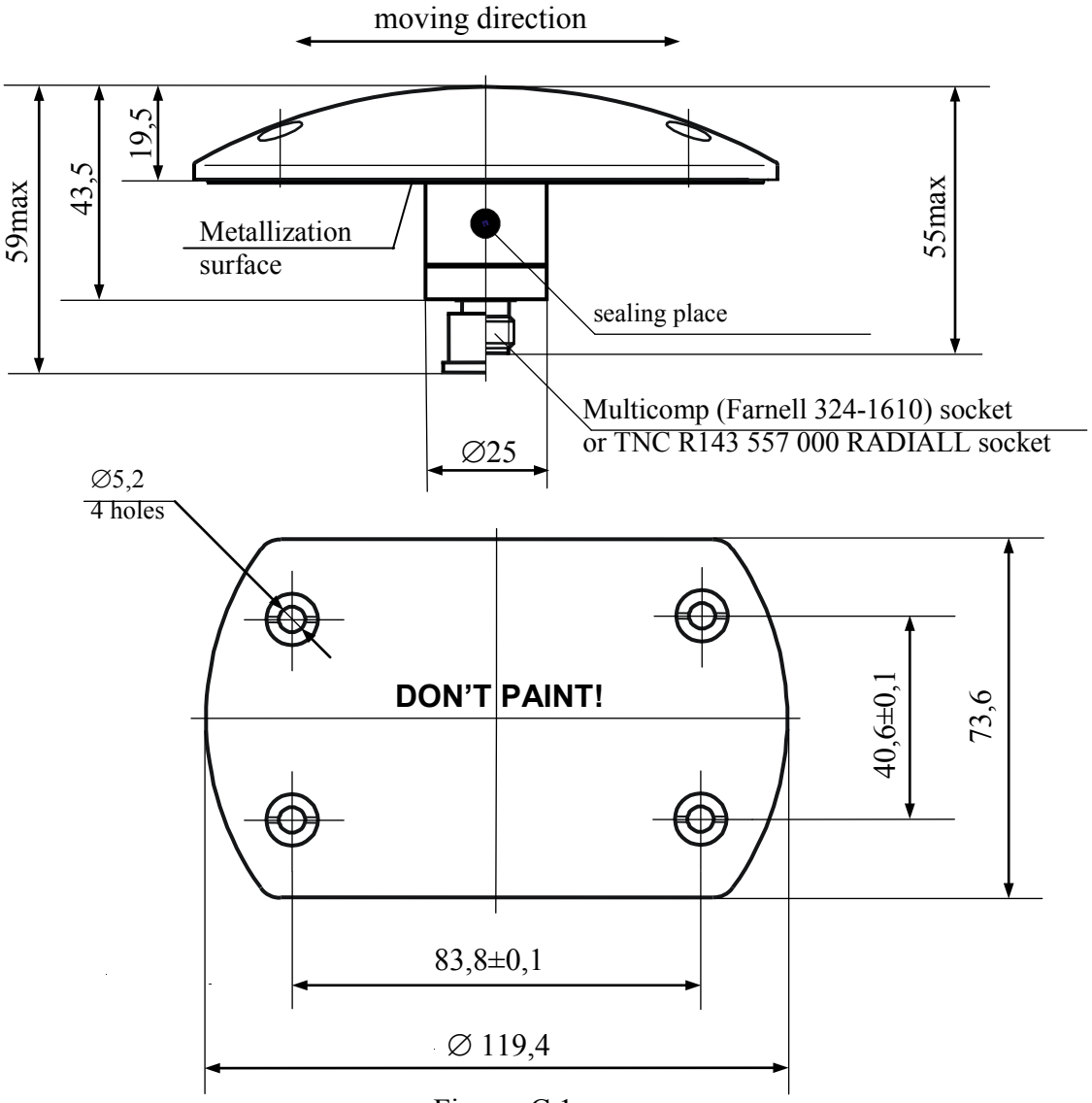


Figure C.1

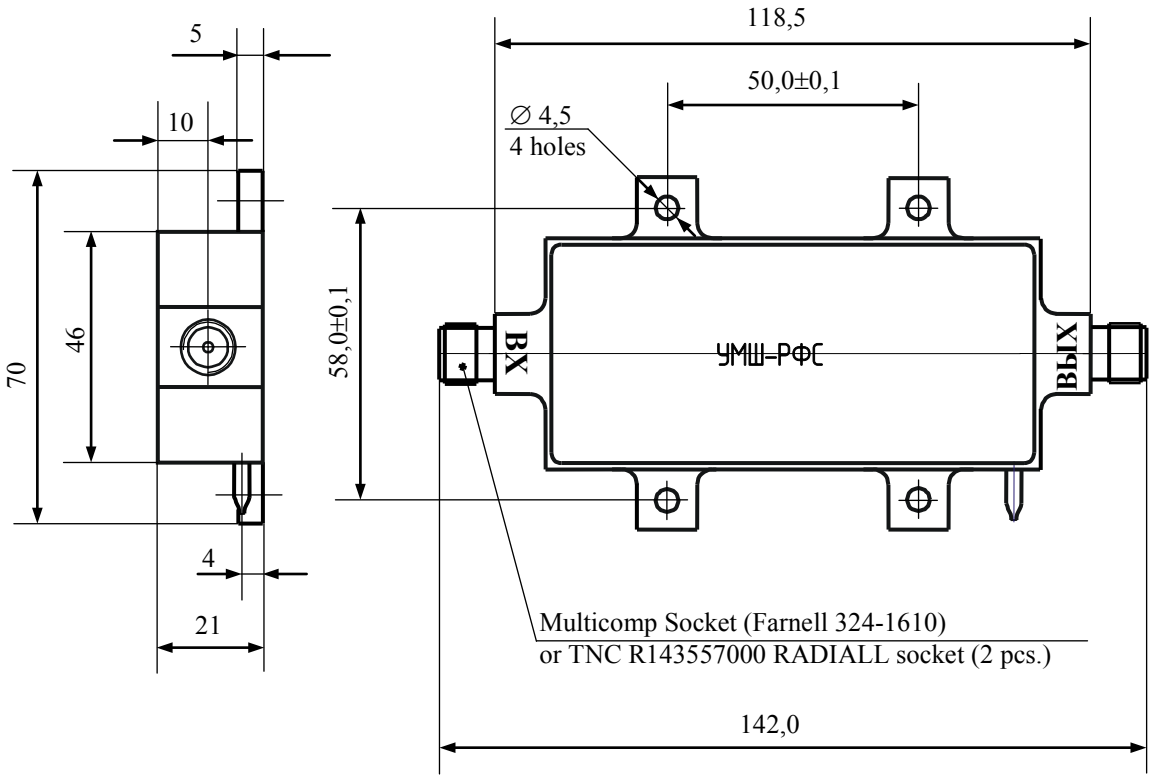
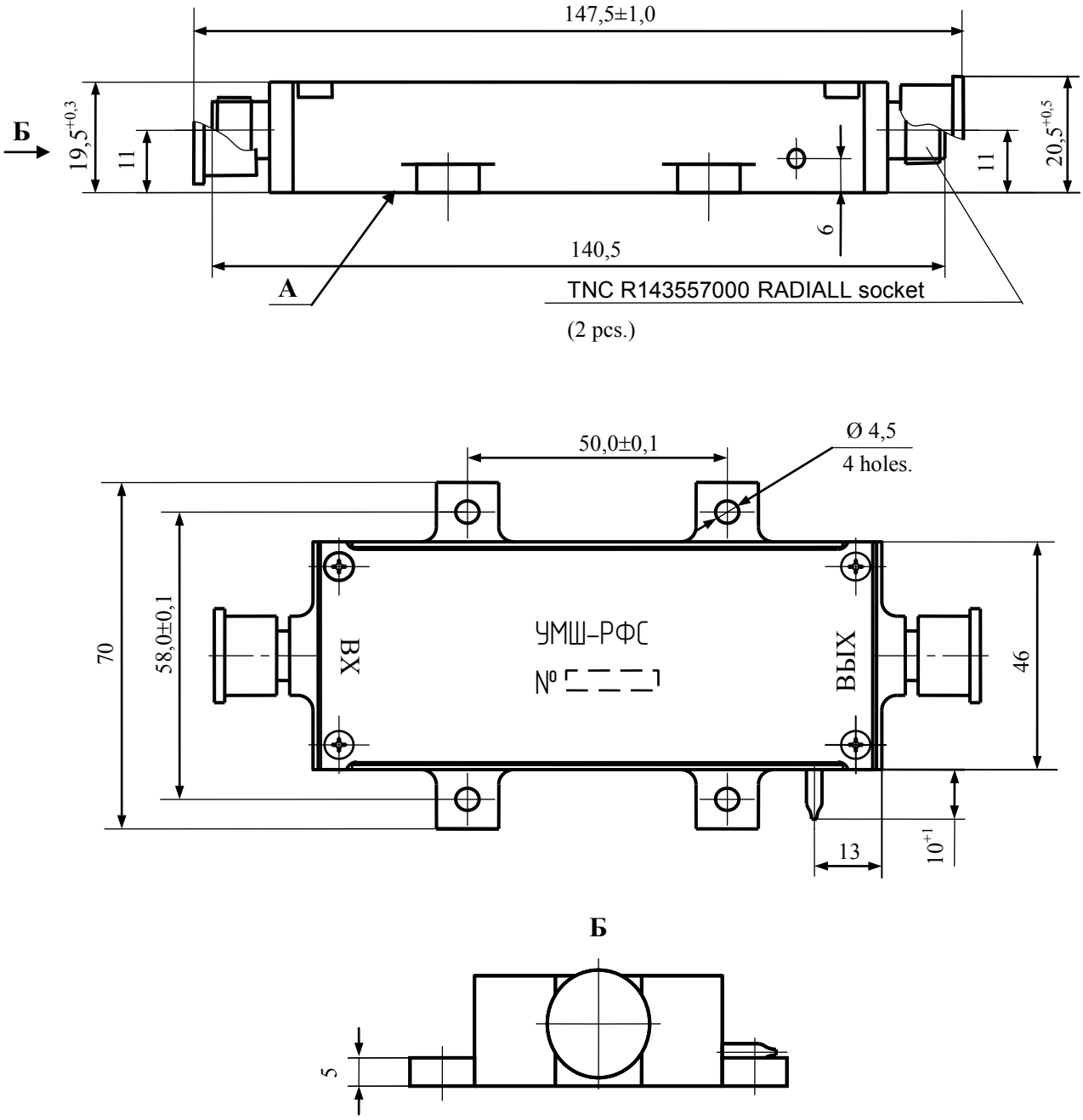

118,5
50,0±0,1
∅ 4,5
4 holes
5
10
70
46
58,0±0,1
4
21
ВХ
УМШ-РФС
ВЫХ
Multicomp Socket (Farnell 324-1610)
or TNC R143557000 RADIALL socket (2 pcs.)
142,0

Figure C.2



A – metallization surface of LNA-SSF amplifier

Figure C.3

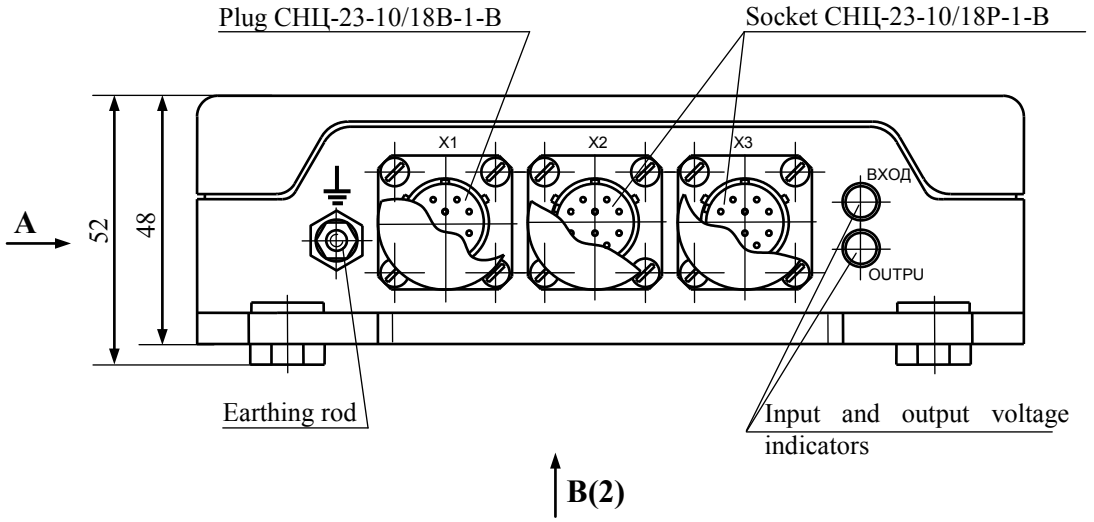
AIRBORNE EQUIPMENT OF SATELLITE NAVIGATION – APPENDIX D

(reference)

UPS Outline Drawing

UPS outline drawing is shown in fig. D.1 before serial № Б516056 inclusive.

UPS outline drawing is shown in fig. D.2 since serial № Б516057.



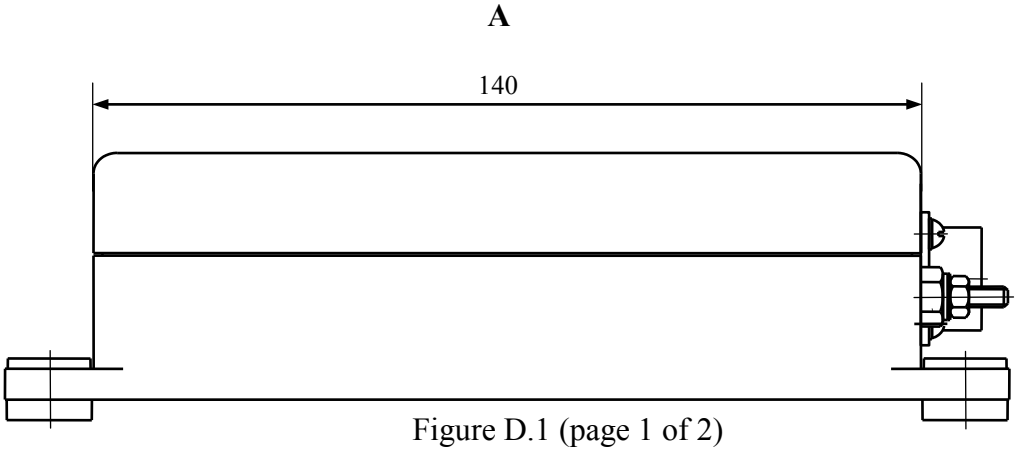


Figure D.1 (page 1 of 2)

B(1)

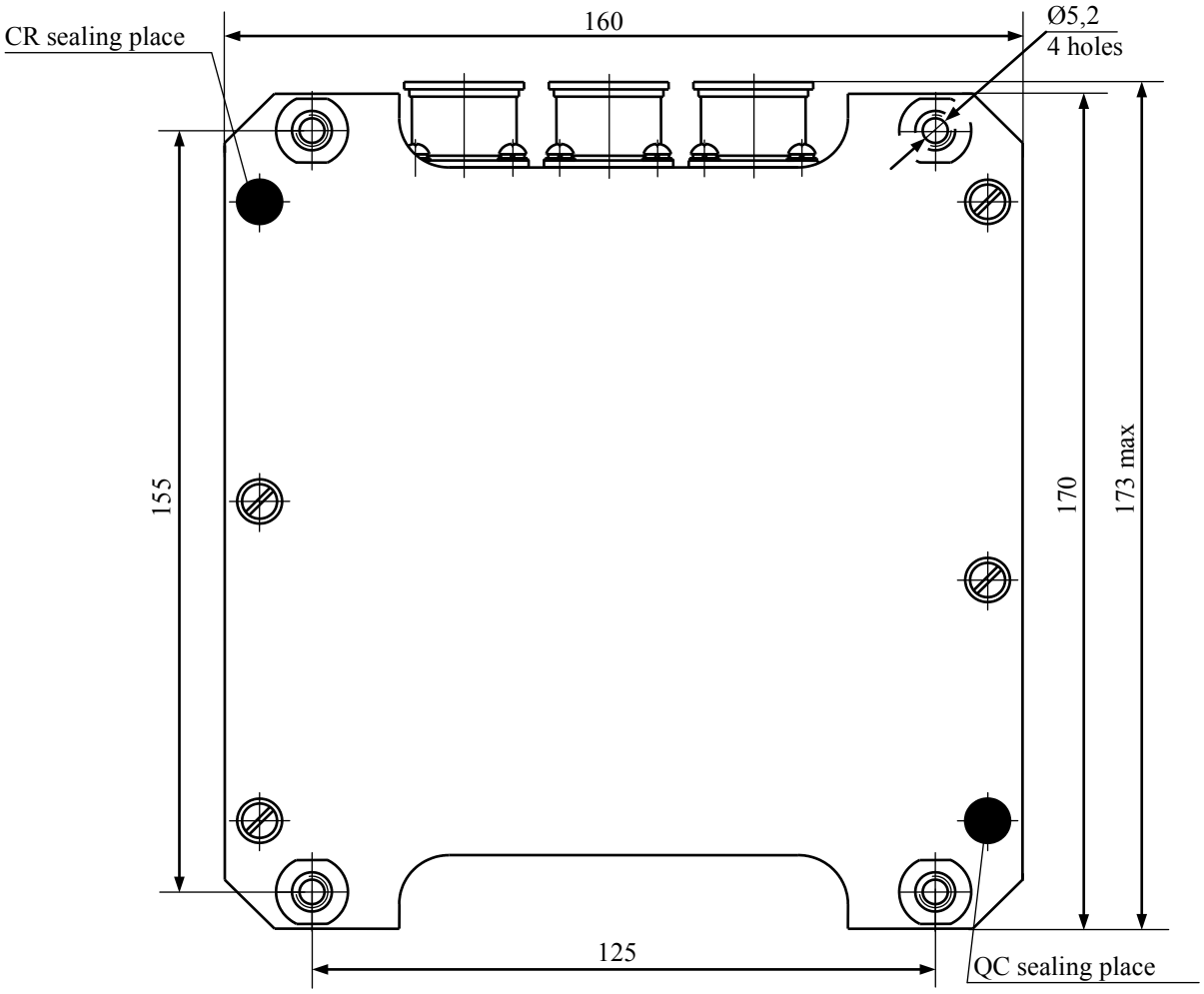


Figure D.1 (page 2 of 2)

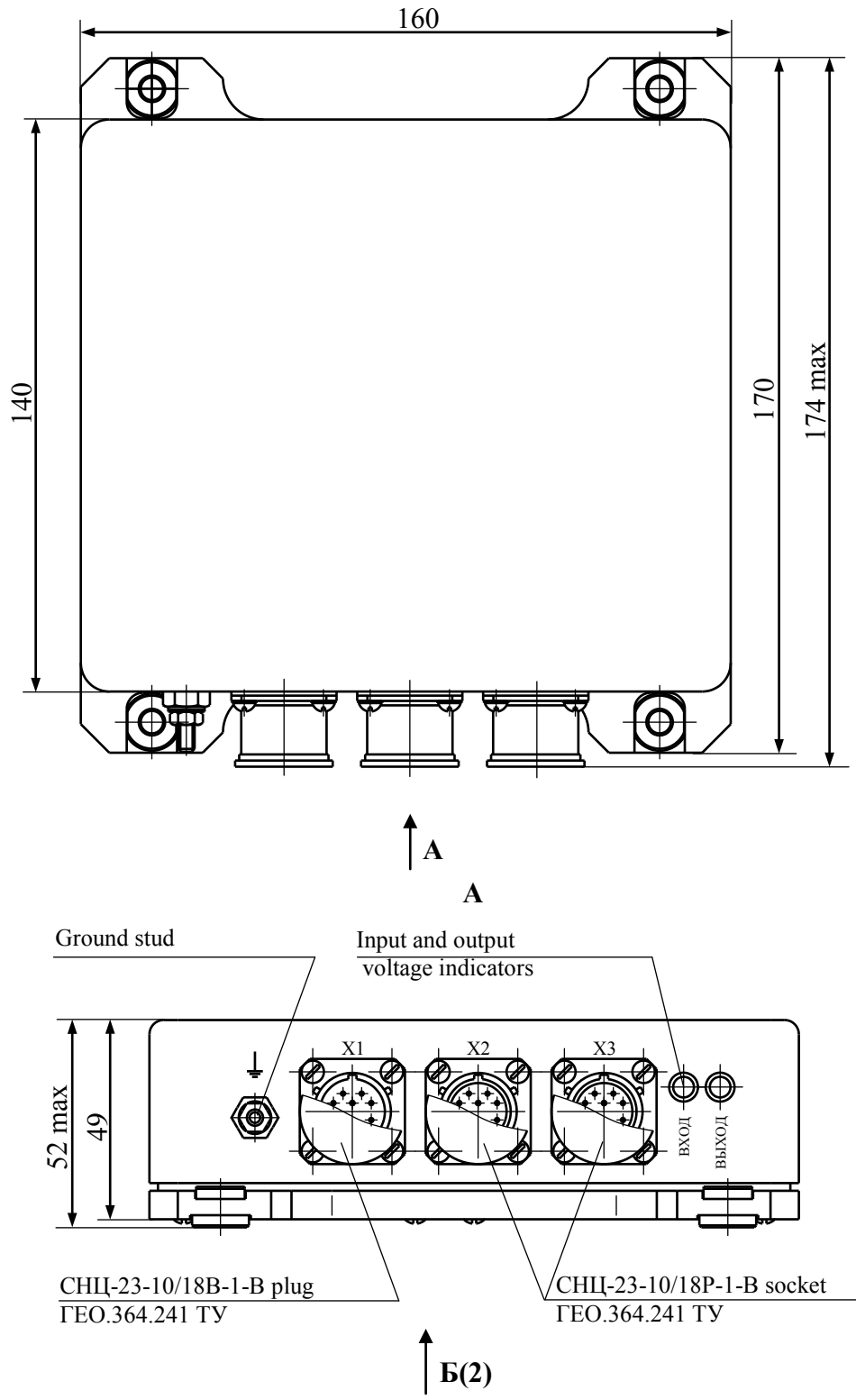


Figure D.2 (page 1 of 2)

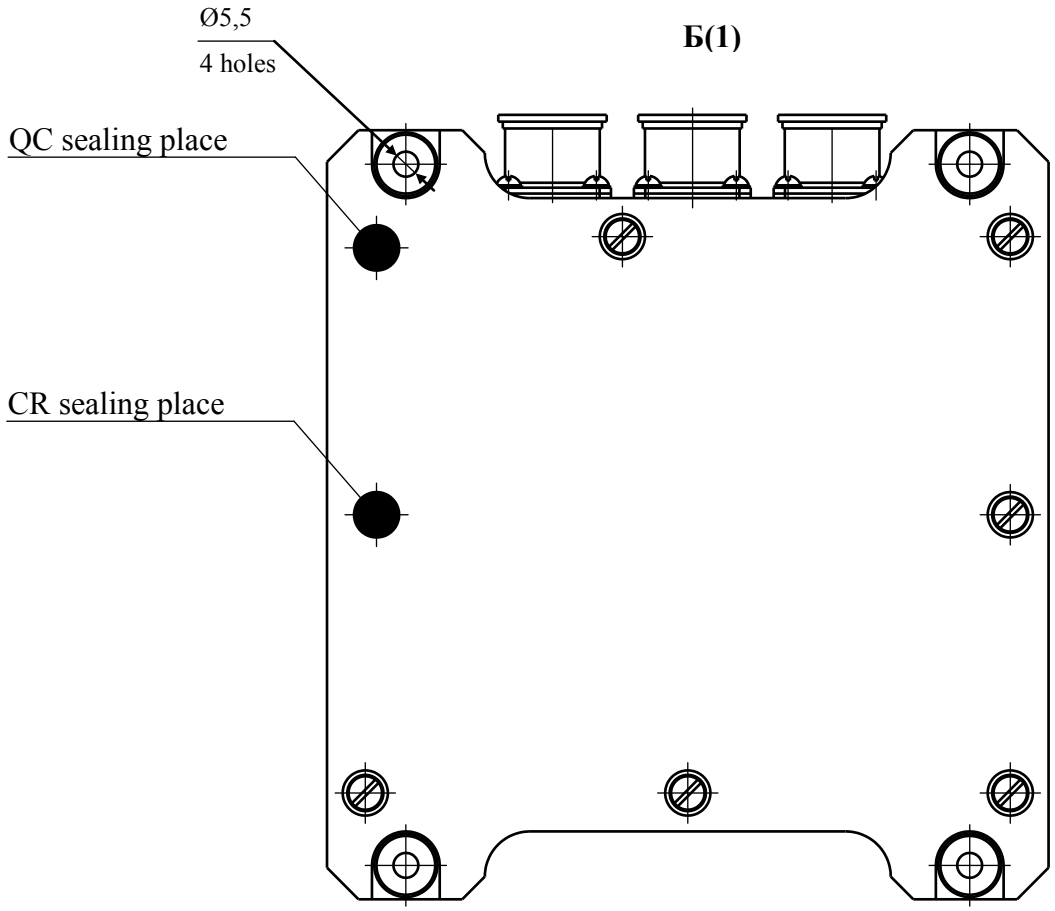


Figure D.2 (page 1 of 2)

AIRBORNE EQUIPMENT OF SATELLITE NAVIGATION – APPENDIX E

(reference)

Information output and receiving according to ARINC 429

E.1 Information output by the equipment according to ARINC 429

E.1.1 The equipment outputs the information to external consumers as serial bipolar code using asynchronous method in accordance with GOST 18977-79, PTM 1495-75 with amendment 3 (ARINC-429).

The equipment has 4 channels of digital information output:

- **channel 0** is designed for output in ACS of «Y -required» signal and output of auxiliary signals with 100 KHz frequency (contacts 29 and 30 of RICU «**X3**»);
- **channel 1** is designed for information output to MFD. Information output frequency is 100 KHz (contacts 33 and 34 of RICU **X3** connector);
- **channel 2** is designed for output of control words for airborne rangefinders with 12,5 KHz frequency (contacts 35 and 36 of RICU **X3** connector);
- **channel 3** is designed for output of navigation information words with 100 KHz frequency (contacts 39 and 40 of RICU **X3** connector);

E.1.2 Information delivered on the channel 0

List of information delivered on **channel 0** is given in Table E.1.1.

Table E.1.1

Parameter name	Address (octal)	Table number	Note
Y-required	121_8(BC)	E.1.28	10 Hz
Flight stage	132_8(DISCR)	E.1.31	Flight stage, system of coordinates, SNS type, 10 Hz
CH-4312 state	273_8 (DISCR)	E.1.43	Mode of operation, number of satellites, 10 Hz
Wind speed	315_8(BC)	E.1.52	10 Hz
Wind angle	316_8(BC)	E.1.53	10 Hz
Linear turn lead	062_8(BC)	E.1.11	10 Hz
Remaining distance to WPT along desired track	063_8(BC)	E.1.12	10 Hz
Header of data record	074(BC)	E.1.13	*, **
Active leg of the route	075(BDC)	E.1.14	*
Control sum	113(BC)	E.1.22	*
Message length	303(BC)	E.1.46	*
Identifier 1, 2, 3 symbols	304(BC)	E.1.47	WPT, RB identifier*
Identifier 4, 5, 6 symbols	305(BC)		
NP latitude	306(BC)	E.1.48	NP coordinates*
NP longitude	307(BC)		
Arc direction	330(BC)	E.1.55	*, ***
Arc radius	331(BC)	E.1.56	*, ***
Angle of arc heading alteration	332(BC)	E.1.57	*, ***

* It is output only if an active route is available. Output period depends on the length of active route and is determined by the formula

$(N+2)\cdot 0{,}1$ sec. (1)

where N is WPT number in the route.

Data output is performed in two serial 100 ms intervals in step with data output in MFD on **channel 1** containing information about initial and final WPT of active leg of the route. In the first interval information is output on initial WPT of active leg of the route, in the second interval information is output on final WPT of active leg of the route..

** It is output only in a sentence containing information on initial WPT;

*** It is output on arc leg having fixed radius.

E.1.3 Information output via channel 1

The equipment outputs information to MFD via **channel 1**.

The information delivered to MFD, is divided in dynamic and background one.

Dynamic information includes all alternating parameters, such as aircraft position, time response of movement, angular parameters of movement etc. All dynamic information is integrated into one unit, dynamic information unit (DIU). The equipment delivers DIU 10 times a second.

DIU composition is given in Table E.1.2.

Table E.1.2

Parameter	Address (octal)	Table number
Desired Track angle	114(BC)	E.1.23
Desired heading	100 (BC)	E.1.16
Azimuth of point	115(BC)	E.1.24
Horizontal deviation from DT	116(BC)	E.1.25
Time (UTC)	125(BDC)	E.1.29
Magnetic declination	147(BC)	E.1.34
Current Greenwich time	150(BDC)	E.1.35
Remaining distance to the current WPT	251(BC)	E.1.40
Flight time to the next WPT	252(BC)	E.1.41
Date	260(BDC)	E.1.42
Current latitude	310(BC)	E.1.49
Current longitude	311(BC)	E.1.49
Ground speed	312(BC)	E.1.50
Path angle (true)	313(BC)	E.1.51
Magnetic heading	320(BC)	E.1.19
Angle of drift	321(BC)	E.1.16
LCTD scale	326(BC)	E.1.54
Remaining distance to the destination WPT	351(BC)	E.1.58
Time-to-go to the destination WPT	352(BC)	E.1.59

Background information includes the main navigation point specifications of flight plan. All background information is integrated into the background information unit (BIU). In its turn background information unit is divided into a series of sentences, each of which provides the information of a certain navigation point (WPT, RB etc.)

Word list which can be used for BIU sentence forming are given in Table E.1.3.

Table E.1.3

Parameter	Address (octal)	Table number	Note
Data record header	074(BC)	E.1.13	
Active leg of the route	075(BDC)	E.1.14	
Check sum	113(BC)	E.1.22	
Identifier 7, 8, 9 symbols	301(BC)	E.1.44	WP, RB identifier
Identifier 10, 11, 12 symbols	302(BC)		
Message length	303(BC)	E.1.46	
Identifier 1, 2, 3 symbols	304(BC)	E.1.47	WP, RB identifier
Identifier 4, 5, 6 symbols	305(BC)		
NP latitude	306(BC)	E.1.48	NP position
NP longitude	307(BC)		
Arc direction	330(BC)	E.1.55	
Arc radius	331(BC)	E.1.56	
Arc track change angle	332(BC)	E.1.57	

Words with addresses 074 and 075 shall be the first in BIU sentence, and the word with address 113 should be the last one.

The equipment outputs DIU and one BIU sentence in each information output cycle.

The sentences should be transmitted as follows:

- sentences describing WPTs from the first to the last one;

- sentences describing navigation references.

Cyclogram of dynamic and background information output is shown in Figure E.1.1.

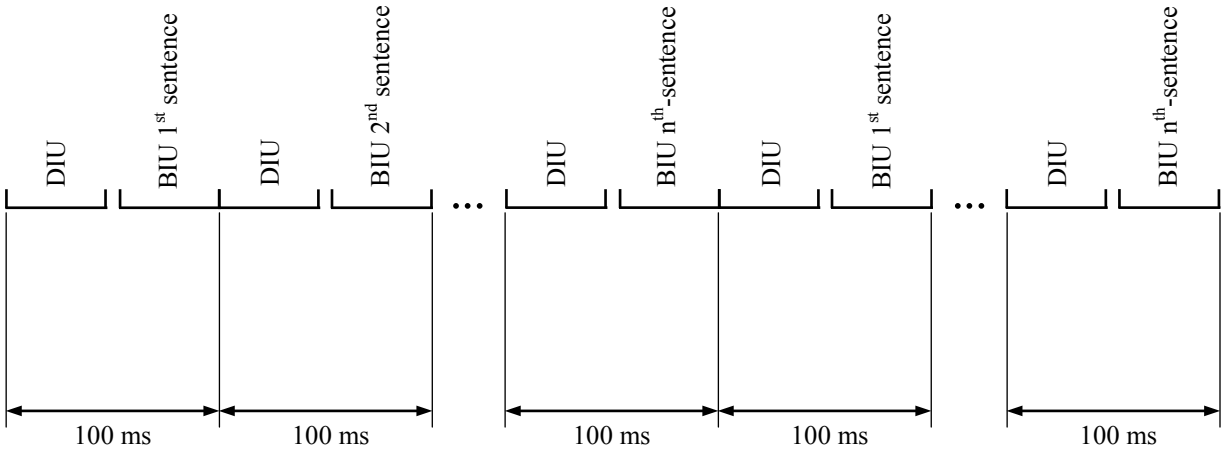


Figure E.1.1

Routing line on MFD display is defined by the sequence of BIU output sentences. Its contouring is performed from the first WPT (BIU first sentence) to the last (BIU last sentence). Active leg of the route is marked with color. The airplane position is contoured in accordance with aircraft current position from the dynamic information unit.

Example of BIU data transfer

Example of BIU data transfer for active flight plan containing 29 WPTs, five nearest radio beacons and three nearest airports. The transfer of each sentence occurs at 0,1 s interval.

Sentence 1 (T = 0,0 c, WPT 1)

Address 74: Data record header

Address 75: Active leg of the route

Address 303: Message length

Address 304: Symbols 1 - 3

Address 305: Symbols 4 - 6

Address 306: NP latitude

Address 307: NP longitude

Address 113: Check sum

Sentence 2 (T = 0,1 s, WPT 2)

Address 74: Data record header

Address 75: Active route leg

Address 303: Message length

Address 304: Symbols 1 - 3

Address 305: Symbols 4 - 6

Address 306: NP latitude

Address 307: NP longitude

Address 113: Check sum

3-29 sentence transfer occurs similarly.

Sentence 30 (T = 2,9 s, RB 1)

Address 74: Data record header

Address 75: Active route leg

Address 303: Message length

Address 304: Symbols 1 - 3

Address 305: Symbols 4 - 6

Address 306: NP latitude

Address 307: NP longitude

Address 113: Check sum

31-34 sentence transfer occurs similarly.

Sentence 35 (T = 3,4 s, Airport 1)

Address 74: Data record header

Address 75: Active route leg

Address 303: Message length

Address 304: Symbols 1 - 3

Address 305: Symbols 4 - 6

Address 306: NP latitude

Address 307: NP longitude

Address 113: Check sum

36, 37 sentence transfer occurs similarly.

E.1.4 Information output via channel 2

The equipment outputs a command word 10 times per second via **channel 2** for DME beacon adjusting (word address 035_8), a command word for "Course-93M" navigation and landing system (word address 034_8), and "Required azimuth" word (word address 024_8).

024_8 word structure is given in Table E.1.8.

034_8 word structure is given in Table E.1.9.

035_8 word structure is given in Table E.1.10.

E.1.5 Information output via channel 3

The equipment outputs information via **channel 3** 10 times per second. The list of information delivered via **channel 3** is given in the table E.1.4.

Table E.1.4

Parameter	Word address	Table number
Current latitude (precisely)	120_8	E.1.26
Current longitude (precisely)	121_8	E.1.27
Integrity alarm threshold	130_8	E.1.30
Vertical Figure of Merit (VFOM)	136_8	E.1.32
Current time UTC (precisely)	140_8	E.1.33
Current Greenwich time	150_8	E.1.35
Vertical speed	165_8	E.1.36
Ground speed component N/S value	166_8	E.1.37
Ground speed component E/W value	174_8	E.1.38
Horizontal Figure of Merit (HFOM)	247_8	E.1.39
Remaining distance to the current WPT	251_8	E.1.40
Time to go to the next WPT	252_8	E.1.41
Date	260_8	E.1.42
Magnetic track angle	317_8	E.1.19
Magnetic heading	320_8	E.1.19
Angle of drift	321_8	E.1.16
Deviation from DT in horizontal plane	116_8	E.1.25
Desired heading	100_8	E.1.16
Desired track angle	114_8	E.1.23
Desired magnetic track angle	057_8	E.1.23
Altitude over geoid	076_8	E.1.15
HDOP	101_8	E.1.17
VDOP	102_8	E.1.18
True path angle	103_8	E.1.19
Current latitude	110_8	E.1.20
Current longitude	111_8	E.1.20

Ground speed	112_8	E.1.21

Navigation information which is output via channels **0**, **1** and **3** during one 100 millisecond period, valid at the time specified by 260_8, 150_8, 140_8. The start of navigation data package (navigation data package means words output in one 100 millisecond cycle) in **channel 3** is 076_8 word. All words from 076_8 to 100_8 meet the time indicated in 150_8 and 140_8 words sent in this package

E.1.6 Word structure output by the equipment according to ARINC 429

State matrix of words output and received by the equipment according to ARINC 429 are given in tables E.1.5, E.1.6, E.1.7. Word structure output by the equipment according to ARINC 429 is given in tables E.1.8 - E.1.59.

Identifier in output words (digits 9, 10):

- #1 – means operation from the 1st RICU;

- #2 - means operation from the 2nd RICU.

Table E.1.5 – State matrix (BC)

Bit		Value
31	30	
0	0	Failure warning
0	1	No calculated data
1	0	Functional test
1	1	Normal operation

Table E.1.6 - State matrix (BDC)

Bit		Value
31	30	
0	0	Plus, North, East, right, to, above
0	1	No calculated data
1	0	Functional test
1	1	Minus, south, west, left, from, under

Table E.1.7 – State matrix (Discr.)

Bit		Value
31	30	
0	0	Normal operation
0	1	No calculated data
1	0	Functional test

1	1	Not used

Table E.1.8 – "Desired track angle" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 024_8	00 010 100
9 - 10	Source identifier	00 – all sets 10 – set #1 01 – set #2 11 – set #3
11 - 18	Reserved	Zero
19 - 22	Ones of degrees	Desired track angle
23 - 26	Tens of degrees	
27 - 29	Hundreds of degrees	
30 - 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.9 - "Tuning frequency of navigation and landing system (command word)" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 034_8	00 011 100
9 - 10	Source identifier	00 – all sets 10 – set #1 01 – set #2 11 – set #3
11	Operability of AFD	1 – AFD failure 0 – AFD operability
12	Reserved	Zero
13 - 14	Mode of operation	00 - VOR 01 – ILS 11 – CII-50
15 - 18	Hundredths of MHz	
19 - 22	Tenths of MHz	
23 - 26	Ones of MHz	
27 - 29	Tens of MHz	
30 - 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number
Note – *All frequencies have "1" in hundreds of MHz values.*		

Table E.1.10 – "Tuning frequency of DME beacon (command word)" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 035_8	00 011 101
9 - 28	Identifier	00 - all 01 - #1 10 - #2 11 – not used
13 - 11	Operating mode	Bits 13, 12, 11 000 – not used 001 – frequency #1 010 – frequency #2 011 – frequency #3 100 – frequency #4 101 – frequency #5 110 – free scanning 111 – not used
15, 14	Coding of tuning frequency pairing	00 – paired with VOR 01 – paired with ILS 10 – paired with MLS 11 – not used
16	201_8 word output	1
17	Identification signal character	1
18	0.05 MHz	1 – 0.05 MHz 0 – 0.00 MHz
19 20 21 22	Tenths of MHz	0.1 MHz 0.2 MHz 0.4 MHz 0.8 MHz
23 24 25 26	Ones of MHz	1 MHz 2 MHz 4 MHz 8 MHz
27 28 29	Tens of MHz	10 MHz 20 MHz 40 MHz
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.11 – "Linear turn lead" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 062_8,	01 110 010
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 13	Reserved	Zero
14 - 28	Significant part is 15 bits	Range: ± 128 NM m.s. bit = 64 NM. Negative values are transmitted in additional code
29	Sign	0
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.12 – "Remaining distance to WPT along DT" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 063_8	00 110 011
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 13	Reserved	Zero
14 - 28	Significant part is 15 bits	Range: 4096 NM, m.s. bit 28 = 2048 NM
29	Sign	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.13 – "Data record header" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 074_8	00 111 100
9 - 15	Total number of records	Max. 127
16 - 20	Reserved	Zero
21	Updating of background information unit	1 - yes 0 - no
22 - 29	Reserved	Zero
30, 31	Status matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.14 – "Active route leg" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 075_8	00 111 101
9	Mode	1 – manual 0 – automatic (always 0)
10	Fly-over with preset angle	1 – true 0 – magnetic (always 1)
11	Reserved	Zero
12	Coordinates	1 – azimuth/distance 0 – longitude/latitude (always 0)
13 - 16	Most Significant part is of WPT number to which aircraft flies.	Tens
17 - 20	Most Significant part is of WPT number from which aircraft flies.	Tens
21 - 24	Least Significant part is of WPT number to which aircraft flies.	Ones
25 - 28	Least Significant part is of WPT number from which aircraft flies.	Ones
29	Reserved	Zero
30, 31	State matrix	In accordance with Table E.1.6
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.15 – "Height above geoid" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 076_8	00 111 110
9 - 28	Significant part is 20 bits	Range: 131072 feet, m.s. bit 28 = 65536 feet Negative values are transmitted in additional code
29	Sign	1 – negative value of altitude 0 – positive value of altitude
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.16 – "Desired heading", "Drift angle" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 100_8 321_8	01 000 000 11 010 001
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 16	Reserved	Zero
17 - 28	Significant part is, 12 bits	Range: 180°, m.s. bit 28 = 90° Negative values are transmitted in additional code
29	Sign	0 – from 0° to 180° 1 – from 180° to 360°
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.17 – "HDOP" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 113_8	01 001 011
9 - 29	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 13	Reserved	Zero
14 - 28	Significant part is 15 bits	Range: 1024 m.s. bit 28 = 512
29	Reserved	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.18 – "VDOP" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 102_8	01 000 010
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 13	Reserved	Zero
14 - 28	Significant part is 15 bits	Range: 1024 m.s. bit 28 = 512
29	Reserved	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.19 – "True track angle", "Magnetic track angle", "Magnetic heading" word structure

Bit No	Information content	Bit coding
1 - 8	Address 103_8 317_8 320_8	01 000 011 11 001 111 11 010 000
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 13	Reserved	Zero
14 - 28	Significant part is 15 bits	Range: 180° m.s. bit 28 = 90°. Negative values are transmitted in additional code
29	Sign	0 - from 0° to 180° 1 - from 180° to 360°
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.20 – "Current latitude", "Current longitude" word structure

Bit No	Information content	Bit coding
1 - 8	Address 110_8 111_8	01 001 000 01 001 001
9 - 28	Significant part is 20 bits	Range: ±180°, m.s. bit 28 = 90°. Negative values are transmitted in additional code
29	Sign	1 – South, West 0 – North, East
30, 31	State matrix	In accordance with E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.21 – "Ground speed" word structure

Bit No	Information content	Bit coding
1 - 8	Address 112_8	01 001 010
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 13	Reserved	Zero
14 - 28	Significant part is 15 bits	Range: 4096 knots, m.s. bit. 28 = 2048 knots
29	Reserved	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.22 – "Check sum" word structure

Bit No	Information content	Bit coding
1 - 8	Address 113_8	01 001 011
9 - 29	Significant part is 21 bits	
30, 31	State matrix	In accordance with Table E.1.5
32	Четность	0 – if sum of ones is odd number 1 – if sum of ones is even number

Check sum

A check sum of transmitted messages is sent in word 113_8. Check sum is calculated by summing words of message (bits from 9 to 29), beginning from word 303_8 «Message length» and finishing by word 113_8 «check sum», excluding word 113_8. Math check sum calculation of message may be expressed by the following formula:

$$SUM = Mod\ 2^{21} \sum_{i=1}^{n} Word(i), \qquad (2)$$

where n is a number of words in the sentence.

If SUM==-2097152 SUM

Else -SUM

Notes

1 Summing is algebraic binary addition of words, indicated by i index.

2 2^{21} module indicates that 21 less significant bits only participate in algebraic binary addition. This means that bit carry to the 21^{st} bit is ignored.

3 Check sum shall be calculated as a supplement-on--two of the 21-bit word of the binary sum received (-SUM), except special case when SUM = –2097152, being this check sum.

Table E.1.23 – "Desired track angle", "Desired magnetic track angle" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 114_8 057_8	01 001 100 00 101 111
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 16	Reserved	Zero
17 - 28	Significant part is 12 bits	Range: ±180° m.s. bit 28 = 90°. Negative values are transmitted in additional code
29	Sign	0 - from 0° to 180° 1 - from 180° to 360°
30, 31	Status matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.24 – "Azimuth to WPT" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 115_8	01 001 101
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 16	Reserved	Zero
17 - 28	Significant part is - 12 bits	Range: ±180° m.s. bit 28 = 90°. Negative values are transmitted in additional code
29	Sign	0 - from 0° to 180° 1 - from 180° to 360°
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.25 – "Deviation from DT in horizontal plane" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 116_8	01 001 110
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 13	Flight stage	000 – en route 001 – terminal area 010 - approach
14 - 28	Significant part is 15 bits	Range: ±128 NM m.s. bit = 64 NM. Negative values are transmitted in additional code
29	Sign	1 - left° 0 - right
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.26 – "Current latitude (precisely)" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 120_8	01 010 000
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 17	Reserved	Zero
18 - 28	Significant part is - (less significant bits)	Range $\pm 17{,}2 \cdot E^{-5}$°, m.s. bit 28 = $8{,}6 \cdot E^{-5}$°. Negative values are transmitted in additional code
29	Sign	1 - South, 0 - North
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.27 – "Current longitude (precisely)" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 121_8	01 010 001
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 17	Reserved	Zero
18 - 28	Longitude value (less significant bits)	Range $\pm 17{,}2 \cdot E^{-5}$°, m.s. bit 28 = $8{,}6 \cdot E^{-5}$°. Negative values are transmitted in additional code
29	Sign	1 – West, 0 - East
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.28 – "Y – required" word structure

Bit No.	Information content	Bit coding
1-8	Address 121_8	01 010 001
9,10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11-14	Reserved	Zero
15-28	Significant part is 14 bits	Range: ±180°, m.s. bit 28 = 90°. Negative values are transmitted in additional code
29	Sign	1 – left, 0 – right
30-31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.29 – "UTC" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 125_8	01 010 101
9, 10	Identifier	00 – all 01 - #1 10 - #2 11 – not used
11 12 13 14	Tenths of minutes	0,1 min 0,2 min 0,4 min 0,8 min
15 16 17 18	Ones of minutes	1,0 min 2,0 min 4,0 min 8,0 min
19 20 21 22	Tens of minutes	10 min 20 min 40 min 80 min
23 24 25 26	Ones of hours	1,0 hr 2,0 hrs 4,0 hrs 8,0 hrs
27 28	Tens of hours	10,0 hrs 20,0 hrs
29	Reserved	Zero
30, 31	Status matrix	In accordance with Table E.1.6
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.30 – "Integrity alarm threshold" word structure

Bit No.	Information ciontent	Bit coding
1 - 8	Address 130_8	01 011 000
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11	RAIM detected an unhealthy satellite	1 - yes, 0 - no
12 - 28	Significant part is 17 bits	Range: 16 NM, m.s. bit 28 = 8 NM
29	Reserved	Zero
30, 31	State matrix	In accordance with Table E.1.5

32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.31 – "Flight stage" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 132_8	01 011 010
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11	Integrity alarm threshold is set manually	0 – no 1 – yes
12-14	Flight stage	100 – en route 010 – terminal area 110 - approach
15, 16	Coordinate system	10 – WGS-84 01 – EP-90 11 – CS-42
17	Integrity alarm threshold set manually exceeds integrity alarm threshold of flight stage	0 – no 1 - yes
18 - 20	SNS type	000 – GLONASS+GPS 100 – GLONASS 010 - GPS
21 - 24	GPS satellite number used in calculations	
25 - 28	GLONASS satellite number used in calculations	
29	Reserved	
30, 31	Status matrix	In accordance with Table E.1.7
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number
Note – By default the following is set: - En route flight stage; - WGS-84 coordinate system; - GLONASS+GPS SNS type		

Table E.1.32 – "Vertical figure of merit (VFOM)" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 136_8	01 011 110
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 28	Significant part is 18 bits	Range: 32768 feet m.s. bit 28 = 16384 feet
29	Reserved	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.33 – "Current UTC (precisely)" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 140_8	01 100 000
9 - 28	Significant part is 20 bits	Range: 1s m.s. bit 28 = 0.5s.
29	Reserved	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.34 – "Magnetic declination" word structure

Bit No.	Function	Bit status
1 - 8	Address 147_8	01 100 111
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 16	Reserved	Zero
17 - 28	Significant part is 12 bits	Range: ±180°, m.s. bit 28 = 90° Negative values are transmitted in additional code
29	Sign	0 – from 0° to 180° 1 – from 180° to 360°
30, 31	Status matrix	In accordance with Table E.1.6
32	Parity	0 – if sum of "1" is odd number 1 – if sum of "1" is even number

Table E.1.35 – "Current Greenwich time" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 150_8	01 101 000
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11	Reserved	Zero
12 - 17	Seconds, Significant part is 6 bits	Range: 60 s, m.s. bit 17 = 30 s
18 - 23	Minutes, Significant part is 6 bits	Range: 60 min., m.s. bit 23 = 30 min.
24 - 28	Hours, Significant part is 5 bits	Range: 24 hours, m.s. bit 28 = 12 hours
29	Reserved	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.36 – "Vertical speed" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 165_8	01 110 101
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 13	Reserved	Zero
14 - 28	Significant part is 15 bits	Range: ±32768 feet/min., m.s. bit 28 = 16384 feet/min. Negative values are transmitted by additional code
29	Sign	0 - up 1 - down
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.37 – "Ground speed component, N/S value" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 166_8	01 110 110
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 13	Reserved	Zero
14 - 28	Significant part is 15 bits	Range ±4096 knots, m.s. bit 28 = 2048 knots. Negative values are transmitted in additional code
29	Sign	0 - North 1 - South
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.38 – "Ground speed component, E/W value" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 174_8	01 111 100
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 13	Reserved	Zero
14 - 28	Significant part is 15 bits	Range: ±4096 knots, m.s. bit 28 = 2048 knots Negative values are transmitted in addition code
29	Sign	0 – East 1 - West
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.39 – "Horizontal figure of merit (HFOM)" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 247_8	10 100 111
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 28	Significant part is 18 bits	Range 4096 NM sen. bit 28 = 2048 NM.
29	Sign	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.40 – "Distance remaining to the next WPT» word structure

Bit No.	Information content	Bit coding
1 - 8	Address 251_8	10 101 001
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 13	Reserved	Zero
14 - 28	Significant part is 15 bits	Range: 4096 NM, m.s. bit 28 = 2048 NM
29	Sign	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.41 – "Flight time to the next WPT"

Bit No.	Information content	Bit coding
1 - 8	Address 252_8	10 101 010
9, 10	Идентификатор	00 - all 01 - #1 10 - #2 11 – not used
11 - 13	Reserved	Zero
14 - 28	Significant part is 15 bits	Range: 512 min., m.s. bit 28 = 256 min.
29	Sign	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Четность	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.42 – "Date" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 260_8	10 110 000
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 12 13 14	Ones of years	1 year 2 years 4 years 8 years
15 16 17 18	Tens of years	10 years 20 years 40 years 80 years
19 20 21 22	Ones of months	1 month 2 months 4 months 8 months
23	Tens of months	10 months
24 25 26 27	Ones of days	1 day 2 days 4 days 8 days
28 29	Tens of days	10 days 20 days
30, 31	State matrix	In accordance with Table E.1.6
32	Parity	0 – if sum of "1" is odd number

		1 – if sum of "1" is even number

Table E.1.43 – "CHP-4312 status" word structure

Bit No	Information content	Bit coding						
1-8	Address 273_8	10 111 011						
9-10	Identifier	00 - all 01 - #1 10 - #2 11 – not used						
11	Number of visible NSV (most significant bit)	1 > 15, 0 ≤ 15						
12, 13	Reserved	Zero						
14, 15	Operating modes (see below)							
16-19	Number of visible NSV	l.s. bit 16						
20-23	Number of used NSV	l.s. bit. 20						
24-28	**Operating mode**	**Bit state**						
		28	**27**	**26**	**25**	**24**	**15**	**14**
	Self-controlling	0	0	0	0	0	0	0
	Search	0	1	0	0	0	0	0
	SNS navigation	0	1	1	0	0	0	0
	SBAS navigation	0	1	1	0	1	0	0
	CBC navigation	1	1	0	0	0	0	0
	DME/DME navigation	1	1	1	0	0	0	0
	VOR/DME navigation	1	1	1	1	0	0	0
29	Number of used NSV (most significant bit)	1 > 15, 0 ≤ 15						
30 - 31	State matrix	In accordance with Table E.1.7						
32	Parity	0 – if sum of "1" is odd number 1 – if sum of "1" is even number						

Table E.1.44 – "Symbol 7, 8, 9 identifier", "Symbol 10, 11, 12 identifier" word structure

Bit No	Information content	Bit coding
1 - 8	Address 301_8 302_8	11 000 001 11 000 010
9 - 15	7, 10 symbol	-
16 - 22	8, 11 symbol	-
23 - 29	9, 12 symbol	-
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of "1" is odd number 1 – if sum of "1" is even number

Letter coding of WPT, RB identifier is given in Table E.1.45.

Table E.1.45

Symbol number in identifier	Bit No. of output word							Symbol number in identifier	Bit No. of output word						
1, 4, 7, 10	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**1, 4, 7, 10**	**15**	**14**	**13**	**12**	**11**	**10**	**9**
2, 5, 8, 11	**22**	**21**	**20**	**19**	**18**	**17**	**16**	**2, 5, 8, 11**	**22**	**21**	**20**	**19**	**18**	**17**	**16**
3, 6, 9, 12	**29**	**28**	**27**	**26**	**25**	**24**	**23**	**3, 6, 9, 12**	**29**	**28**	**27**	**26**	**25**	**24**	**23**
A	1	0	0	0	0	0	1	T	1	0	1	0	1	0	0
B	1	0	0	0	0	1	0	U	1	0	1	0	1	0	1
C	1	0	0	0	0	1	1	V	1	0	1	0	1	1	0
D	1	0	0	0	1	0	0	W	1	0	1	0	1	1	1
E	1	0	0	0	1	0	1	X	1	0	1	1	0	0	0
F	1	0	0	0	1	1	0	Y	1	0	1	1	0	0	1
G	1	0	0	0	1	1	1	Z	1	0	1	1	0	1	0
H	1	0	0	1	0	0	0	,	0	1	0	1	1	0	0
I	1	0	0	1	0	0	1	.	0	1	0	1	1	1	0
J	1	0	0	1	0	1	0	space	0	0	0	0	0	0	0
K	1	0	0	1	0	1	1	0	0	1	1	0	0	0	0
L	1	0	0	1	1	0	0	1	0	1	1	0	0	0	1
M	1	0	0	1	1	0	1	2	0	1	1	0	0	1	0
N	1	0	0	1	1	1	0	3	0	1	1	0	0	1	1
O	1	0	0	1	1	1	1	4	0	1	1	0	1	0	0
P	1	0	1	0	0	0	0	5	0	1	1	0	1	0	1
Q	1	0	1	0	0	0	1	6	0	1	1	0	1	1	0
R	1	0	1	0	0	1	0	7	0	1	1	0	1	1	1
S	1	0	1	0	0	1	1	8	0	1	1	1	0	0	0
								9	0	1	1	1	0	0	1

Table E.1.46 – "Message length" word structure

<table>
<tr><th>Bit No.</th><th>Information content</th><th colspan="4">Bit coding</th></tr>
<tr><td>1 - 8</td><td>Address 303_8</td><td colspan="4">11 000 011</td></tr>
<tr><td>9 - 12</td><td>Number of words in message</td><td colspan="4">Max. 15</td></tr>
<tr><td rowspan="10">13 - 15</td><td rowspan="10">Point type</td><td colspan="3">Bit</td><td rowspan="2">Meaning</td></tr>
<tr><td>15</td><td>14</td><td>13</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>User WPT</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Not used</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Airport</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>NDB Beacon</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>Not used</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>Do not draw any symbol</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>VOR</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>Intersection</td></tr>
<tr><td>16</td><td>Belonging to the route</td><td colspan="4">1 – en route
0 – not en route</td></tr>
<tr><td>17 - 23</td><td>Point number</td><td colspan="4">Max. 127</td></tr>
<tr><td>24</td><td>FMS mode</td><td colspan="4">1 - selected
0 – not selected
(always 0)</td></tr>
<tr><td>25</td><td>Point in route center</td><td colspan="4">1 – in center
0 – not in center
(always 0)</td></tr>
<tr><td>26</td><td>Space</td><td colspan="4">1 - set
0 – not set</td></tr>
<tr><td>27</td><td>Graphics</td><td colspan="4">1 - graphical
0 – not graphical</td></tr>
<tr><td>28 - 29</td><td>Reserved</td><td colspan="4">Zero</td></tr>
<tr><td>30, 31</td><td>State matrix</td><td colspan="4">In accordance with Table E.1.5</td></tr>
<tr><td>32</td><td>Parity</td><td colspan="4">0 – if sum of "1" is odd number
1 – if sum of "1" is even number</td></tr>
<tr><td colspan="6">**Note** – *In the case when the arc should be depicted, whose original coordinates do not coincide with those of the last depicted point bit 26 shall be set in «1» for the time of this point representation and after that it shall be returned in «0» state at the arc original coordinate assignment.*</td></tr>
</table>

Table E.1.47 – "Symbols 1, 2, 3 identifier", "Symbols 4, 5, 6 identifier" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 304_8 305_8	11 000 100 11 000 101
9 - 15	Symbol 1, 4	-
16 - 22	Symbol 2, 5	-
23 - 29	Symbol 3, 6	-
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of "1" is odd number 1 – if sum of "1" is even number

Table E.1.48 – "Navigation point latitude", "Navigation point longitude" word structure

Bit No.	Information content	Bit coding
1 – 8	Address 306_8 307_8	11 000 110 11 000 111
9 - 28	Significant part is 10 bits	Range: ±180°, m.s. bit 28 = 90°. Negative values are transmitted in additional code
29	Sign	1 - South, West, 0 - North, East
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of "1" is odd number 1 – if sum of "1" is even number

Table E.1.49– "Current latitude", "Current longitude" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 310_8 311_8	11 001 000 11 001 001
9 - 28	Significant part is 20 bits	Range: ±180°, m.s. bit 28 = 90°. Negative values are transmitted in additional code
29	Sign	0 - North, East, 1 - South, West
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.50 – "Ground speed" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 312_8	11 001 010
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 13	Reserved	Zero
14 - 28	Significant part is 15 bits	Range: 4096 knots, m.s. bit 28 = 2048 knots
29	Sign	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.51 – "Path angle (true)" word structure

Bit No.	Information content	Bit coding
1 – 8	Address 313_8	11 001 011
9 – 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 – 16	Reserved	Zero
17 - 28	Significant part is 12 bits	Range: ±180° m.s. bit 28 = 90°. Negative values are transmitted in additional code
29	Sign	0 - from 0° to 180° 1 - from 180° to 360°
30,31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.52 – "Wind speed" word structure

Bit No.	Information content	Bit coding
1 - 8	Адрес 315_8	11 001 101
9, 10	Идентификатор	00 - all 01 - #1 10 - #2 11 – not used
11 - 20	Reserved	Zero
21 - 28	Significant part is 8 bits	Range: 256 knots, m.s. bit 28 = 128 knots
29	Sign	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.53 – "Wind angle" word structure

Bit No.	Information content	Bit coding
1 – 8	Address 316_8	11 001 110
9 – 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 – 16	Reserved	Zero
17 - 28	Significant part is 12 bits	Range: ±180° m.s. bit 28 = 90°. Negative values are transmitted in additional code
29	Sign	0 - from 0° to 180° 1 - from 180° to 360°
30,31	Матрица состояния	In accordance with Table E.1.5
32	Четность	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.54 – "LCTD scale range" word structure

Bit No.	Information content	Bit coding
1 – 8	Address 326_8	11 010 110
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11-13	Reserved	Zero
14- 28	Significant part is 15 bits	Range: 128 NM, m.s. bit 28 = 64 NM
29	Sign	Zero
30,31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.55 – "Arc direction" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 330_8	11 011 000
9, 10	Reserved	Zero
11	Arc direction	0 - clockwise 1 - counterclockwise
12, 13	Reserved	Zero
14 - 28	Significant part is 15 bits	Range ±180° m.s. bit 28 = 90°. Negative values are transmitted in additional code
29	Sign	0 - from 0° to 180° 1 - from 180° to 360°
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.56 – "Arc radius" word structure

Bit No.	Information content	Bit coding
1 – 8	Address 331_8	11 011 001
9 - 13	Reserved	Zero
14 - 28	Significant part is 15 bits	Range: 256 NM, m.s. bit 28 = 128 NM
29	Reserved	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.57 – "Angle of arc course change" word structure

Bit No.	Information content	Bit coding
1 – 8	Address 332_8	11 011 010
9 – 13	Reserved	Zero
14 - 28	Significant part is 15 bits	Range: ±180° m.s. bit 28 = 90°. Negative values are transmitted in additional code
29	Sign	0 - from 0° to 180° 1 - from 180° to 360°
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.58 – "Remaining distance to destination WPT» word structure

Bit No.	Information content	Bit coding
1 – 8	Address 351_8	11 101 001
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11- 28	Significant part is 18 bits	Range: 32768 NM, m.s. bit 28 = 16384 NM.
29	Sign	Zero
30,31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.1.59 – "Time to go to destination WPT" word structure

Bit No.	Information content	Bit coding
1 – 8	Address 352_8	11 101 010
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11-16	Reserved	Zero
17- 28	Significant part is 12 bits	Range: 4096 min, m.s. bit 2048 min
29	Sign	Zero
30,31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

E.2 Information received by the equipment according to ARINC 429

Words received by the equipment according to ARINC 429 are given in Table E.2.1.

Word structure received by the equipment according to ARINC 429 is given in Tables E.2.2-E.2.11. State matrices of words putting out and received by the equipment are given in Tables E.1.5 - E.1.7.

Table E.2.1

Parameter	Word address	Putting out data device	Table number
Beacon adjustment frequency (affirmative character)	035_8	Rangefinder	E.2.2
Distance to beacon	202_8	Rangefinder	E.2.3
Barometric altitude (H_{abs})	203_8	AVPS	E.2.4
True airspeed (V_{true})	210_8	AVPS	E.2.5
Heading reception status word	270_8	Heading sensors	E.2.6
Gyromagnetic heading / gyro-semicompass heading	320_8	Heading sensors	E.2.7
Navigation and landing system adjustment frequency (affirmative character)	034_8	Navigation and landing system	E.2.8
Magnetic azimuth	222_8	Navigation and landing system	E.2.9
Mach number	205_8	AVPS	E.2.10
Outside air temperature (T_{oa})	213_8	AVPS	E.2.11

Table E.2.2 – "Beacon adjustment frequency (affirmative character)" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 035_8	00 011 101
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 13	Operating mode	Bits 13, 12, 11 000 – not used 001 – frequency #1 010 - frequency #2 011 - frequency #3 100 - frequency #4 101 - frequency #5 110 – free scanning 111 – not used
14, 15	Coding of adjustment frequency pairing	00 - paired with VOR
16	201_8 word output	1 – word is output, 0 – not available
17	Identification signal character	1
18	0,05 MHz	«1» - 0,05 MHz «0» - 0,00 MHz
19 20 21 22	Tenths of MHz	0,1 MHz 0,2 MHz 0,4 MHz 0,8 MHz
23 24 25 26	Ones of MHz	1 MHz 2 MHz 4 MHz 8 MHz
27 28 29	Tens of MHz	10 MHz 20 MHz 40 MHz
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number
Note – *"Normal operation" character in state matrix is a termination character of the beacon adjustment.*		

Table E.2.3 – "Beacon distance" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 202_8	10 000 010
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11	Memory mode	1 - on 0 - off
12	Beacon in near-field region	1 – beacon is available, 0 - beacon is not available
13-28	Significant part is 14 bits	Range: 512 NM, m.s. bit=256 NM
29	Sign	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of "1" is odd number 1 – if sum of "1" is even number
Note – *"Normal operation" character in state matrix is a validity character of measured distance.*		

Table E.2.4 – "Barometric altitude (H_{abs})" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 203_8	10 000 011
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11	Reserved	Zero
12-28	Significant part is 17 bits	Range: 131072 feet, m.s. bit = 65536 feet Negative values are transmitted by additional code
29	Sign	0 – positive altitude, 1 – negative altitude
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.2.5 - "True airspeed (V_{true})" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 210_8	10 001 000
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 13	Reserved	Zero
14 - 28	Significant part is 15 bits	Range: 2048 knots, m.s. bit 28=1024 knots
29	Sign	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.2.6 – "Heading reception state" word structure

Bit No.	Information content	Bit coding
1 - 8	Address 270_8	10 111 000
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11	Alignment/Operation mode	1 - alignment 0 - operation
12	Reserved	Zero
13	Normal/Basic mode*	1 - normal 0 - basic
14	GMH/GSMH mode**	1 – gyro-magnetic heading 0 - gyro-semicompass heading
15	Spatial position (vertical)	1 - failure 0 – normal operation
16	Autopilot heading locking	1 - failure 0 – normal operation
17	Reserved	Zero
18	True airspeed	1 - failure 0 – normal operation
19	Altitude heading reference unit (AHRU)	1 - failure 0 – normal operation
20 - 29	Reserved	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

*Normal operation is the mode when attitude-and-heading reference system uses true airspeed data and barometric altitude data from AVPS system.
Basic mode is the mode when data from AVPS are not available or invalid for some reason.
Transition from one mode to another and vice versa is performed automatically.
Bit 13 at the test control is equal to «0» (basic mode character).

** GMH mode– gyro-magnetic heading mode, GSMH mode – gyro-semicompass heading mode

Table E.2.7 – "Gyromagnetic heading/gyro-semicompass heading» word structure

Bit No.	Information content	Bit coding
1 - 8	Address 320_8	11 010 000
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11-13	Reserved	Standard
14-28	Significant part is 15 bits	Range ±180° m.s. bit 28 = 90°. Negative values are transmitted in additional code
29	Sign	0 - from 0° to 180° 1 - from 180° to 360°
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.2.8 – "Adjustment frequency of navigation and landing system (affirmative character)" word structure

Bit No	Information content	Bit coding
1 - 8	Address 034_8	00 011 100
9 - 10	Identifier	00 - all 01 - №1 10 - №2 11 – not used
11	Operability of antenna feeder device (AFD)	1 – AFD failure 0 – AFD operability
12	Reserved	Zero
13 - 14	Operating mode	00 - VOR 01 - ILS 11 - СП-50
15 - 18	Hundredths of MHz	
19 - 22	Tenths of MHz	
23 - 26	Ones of MHz	
27 - 29	Tens of MHz	
30 - 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number
Note *– All frequencies have ones in MHz hundred values.*		

Table E.2.9 – "Magnetic azimuth" word structure

Bit No	Information content	Bit coding
1 - 8	Address 222_8	10 010 010
9 - 10	Source identifier	00 - all 01 - #1 10 - #2 11 – not used
11 - 13	Fly-by character of marker beacon	100 - far 010 – middle 001 - close
14 - 16	Reserved	
17 - 28	Magnetic azimuth (12 bits).	Range: ±180° m.s. bit 28 = 90°. Negative values are transmitted in additional code
29	Sign	0 – from 0° to 180°, 1 - from 180° to 360°
30 - 31	State matrix	In accordance with Table E.1.5
32	Parity flag	

Table E.2.10 "Mach number" word structure

Bit No	Information content	Bit coding
1 - 8	Address 205_8c	10.000.101
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11,12	Reserved	Zero
13-28	Significant part is 14 bits	Range: 4,096 m.s bit 28 = 2,048
29	Sign	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

Table E.2.11 "Outside air temperature (T_{oa})" word structure

Bit No	Information content	Bit coding
1 - 8	Address 213_8c	10.001.011
9, 10	Identifier	00 - all 01 - #1 10 - #2 11 – not used
11-17	Reserved	Zero
13-28	Significant part is 14 bits	Range: 512°C m.s. bit 28 = 256°C Negative values are transmitted in additional code.
29	Sign	Zero
30, 31	State matrix	In accordance with Table E.1.5
32	Parity	0 – if sum of ones is odd number 1 – if sum of ones is even number

AIRBORNE EQUIPMENT OF SATELLITE NAVIGATION – APPENDIX F

(reference)

A101П Antenna, LNA-SSF and process connector installation in aircraft

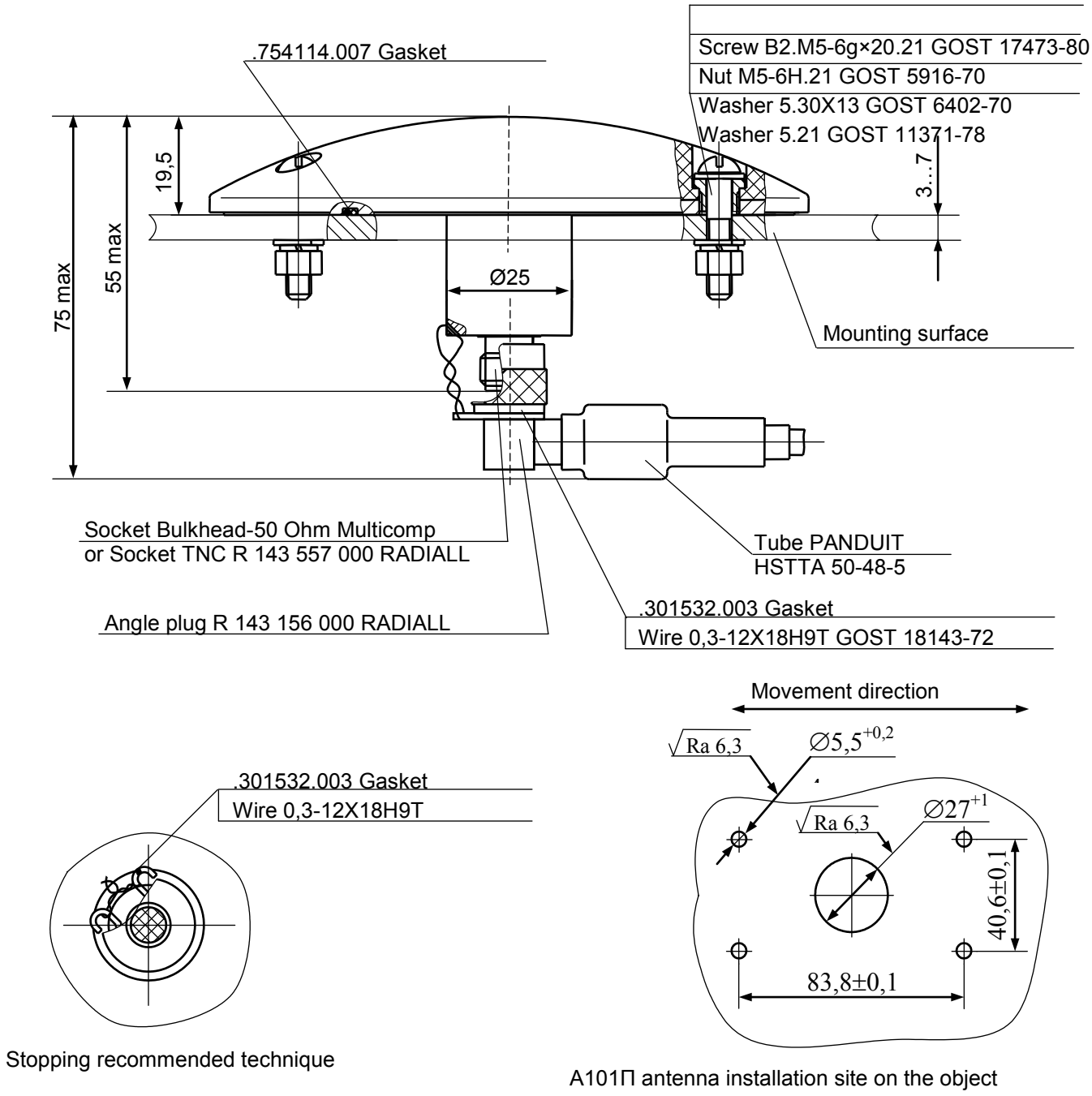


Figure F.1 - A101П antenna installation

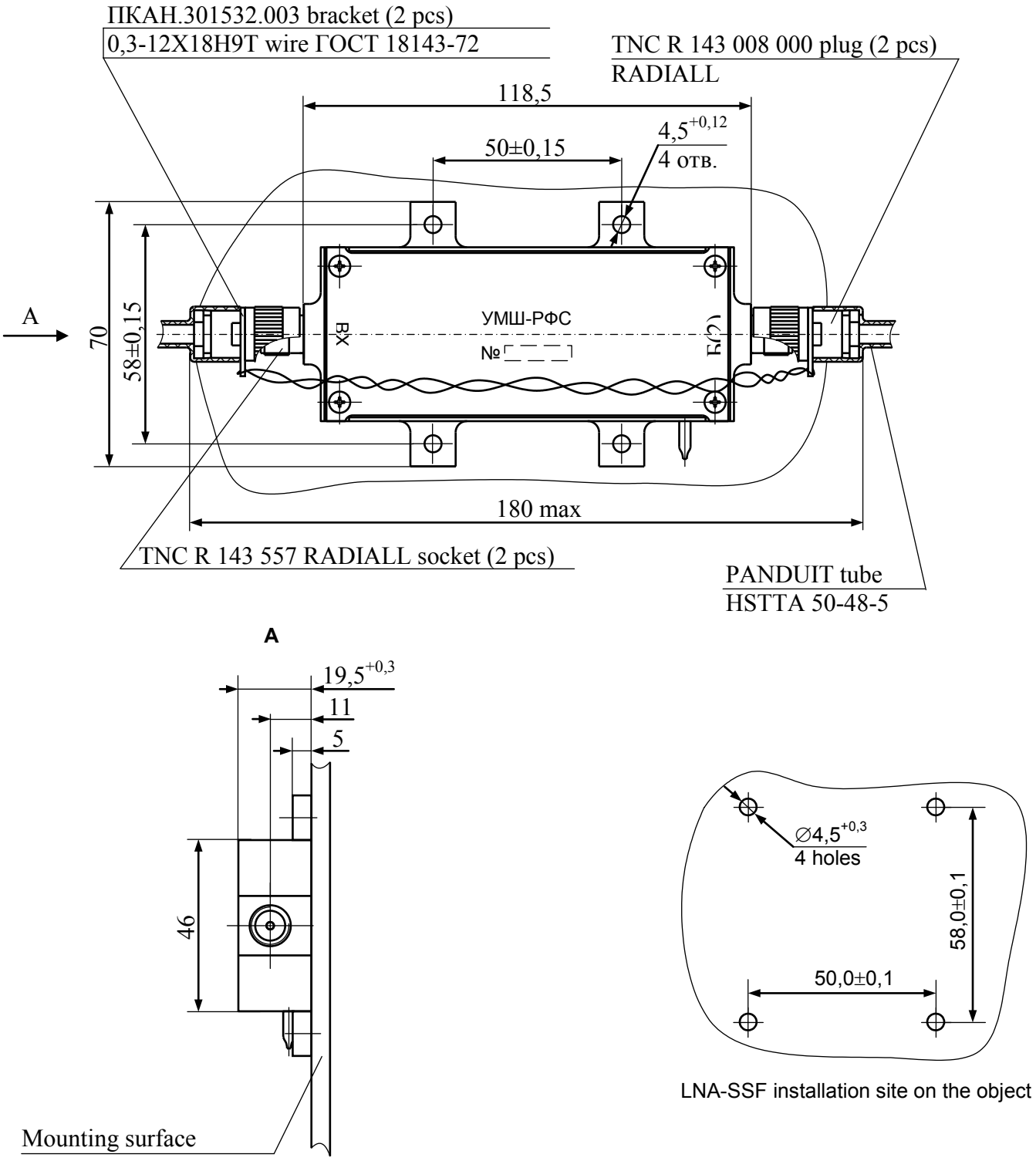
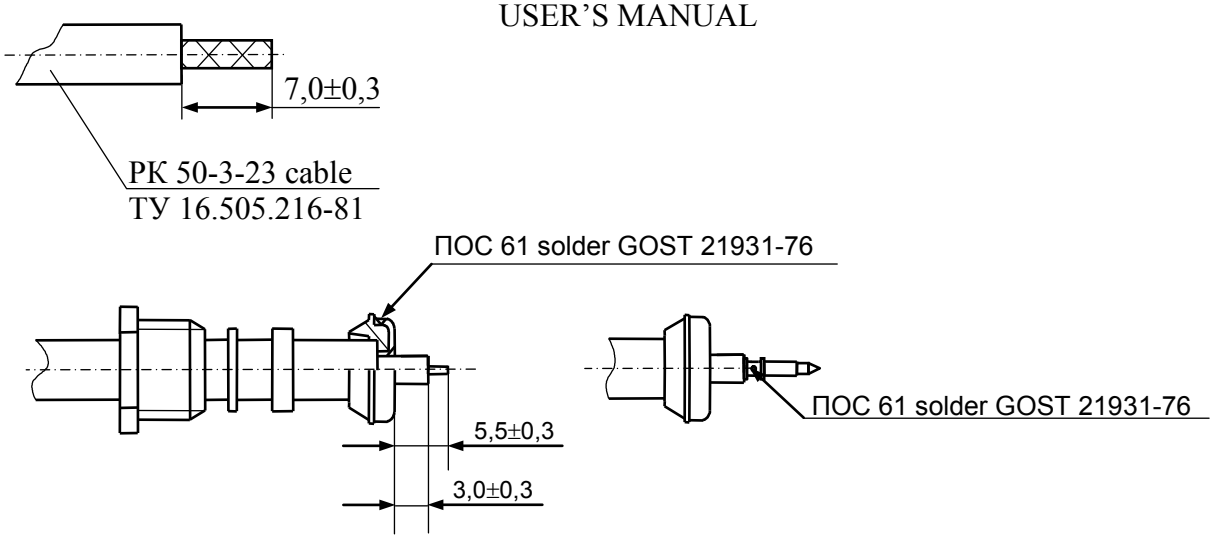
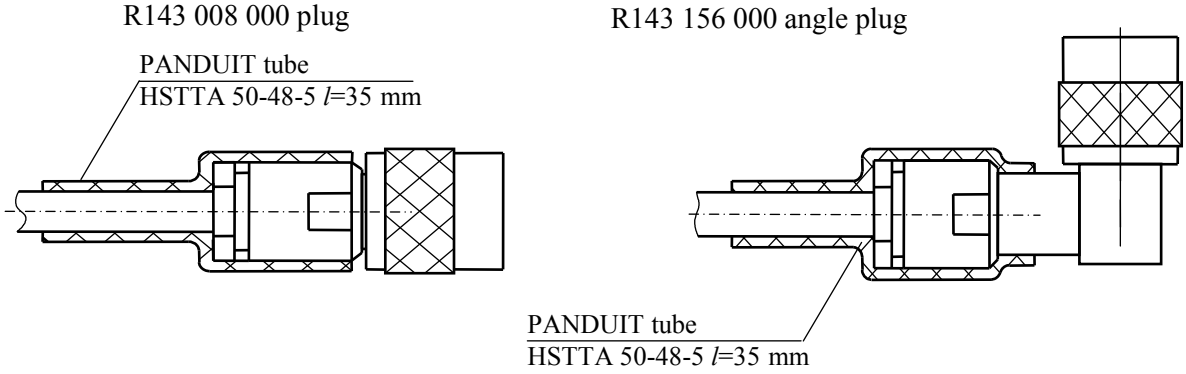


Figure F.2 –LNA-SSF installation

Note - *LNA-SSF mounting method is shown in fig. F.2 since serial № Б516230, LNA-SSF mounting method before serial № Б516229 inclusive is similar to that one which is shown in fig. F.2.*

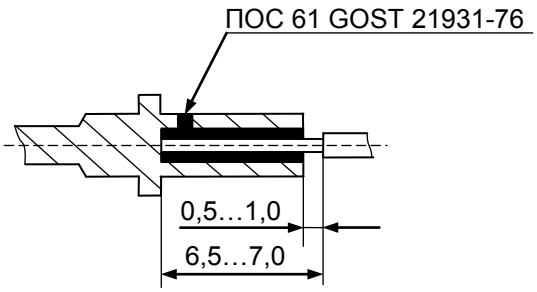


а) cable termination and soldering in connectors R143 008 000 and R 143 156 000



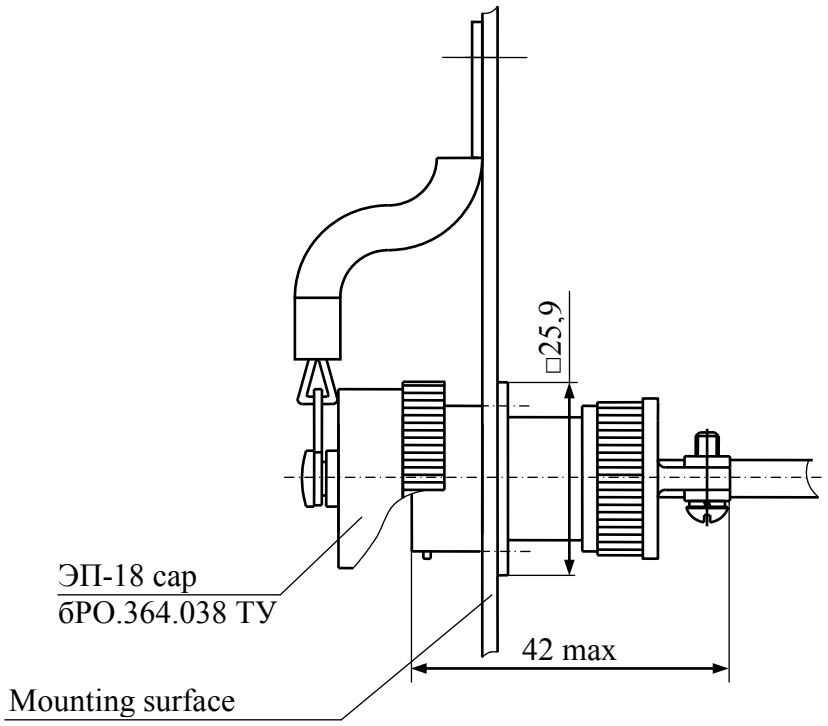
PANDUIT tubes shall be shrinked at (121±5) °C.

б) PANDUIT tube installation on connectors R143 008 000 and R 143 156 000 000



в) wire soldering into СНЦ 23 connector contacts

Figure F.3 – Cable termination for installation in aircraft



Site for СНЦ 23-10/18Р-2-В socket installation on the object

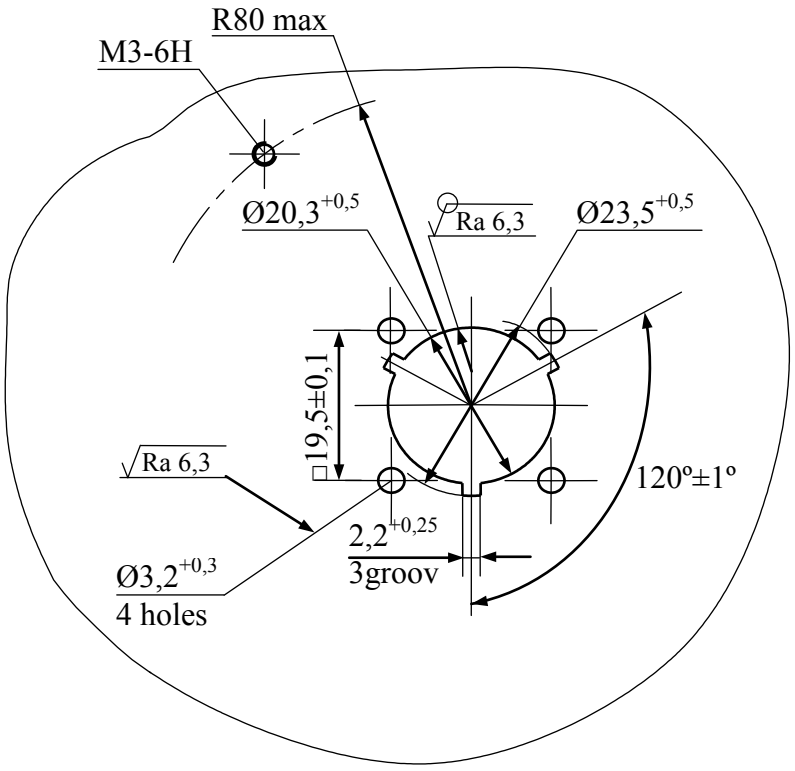
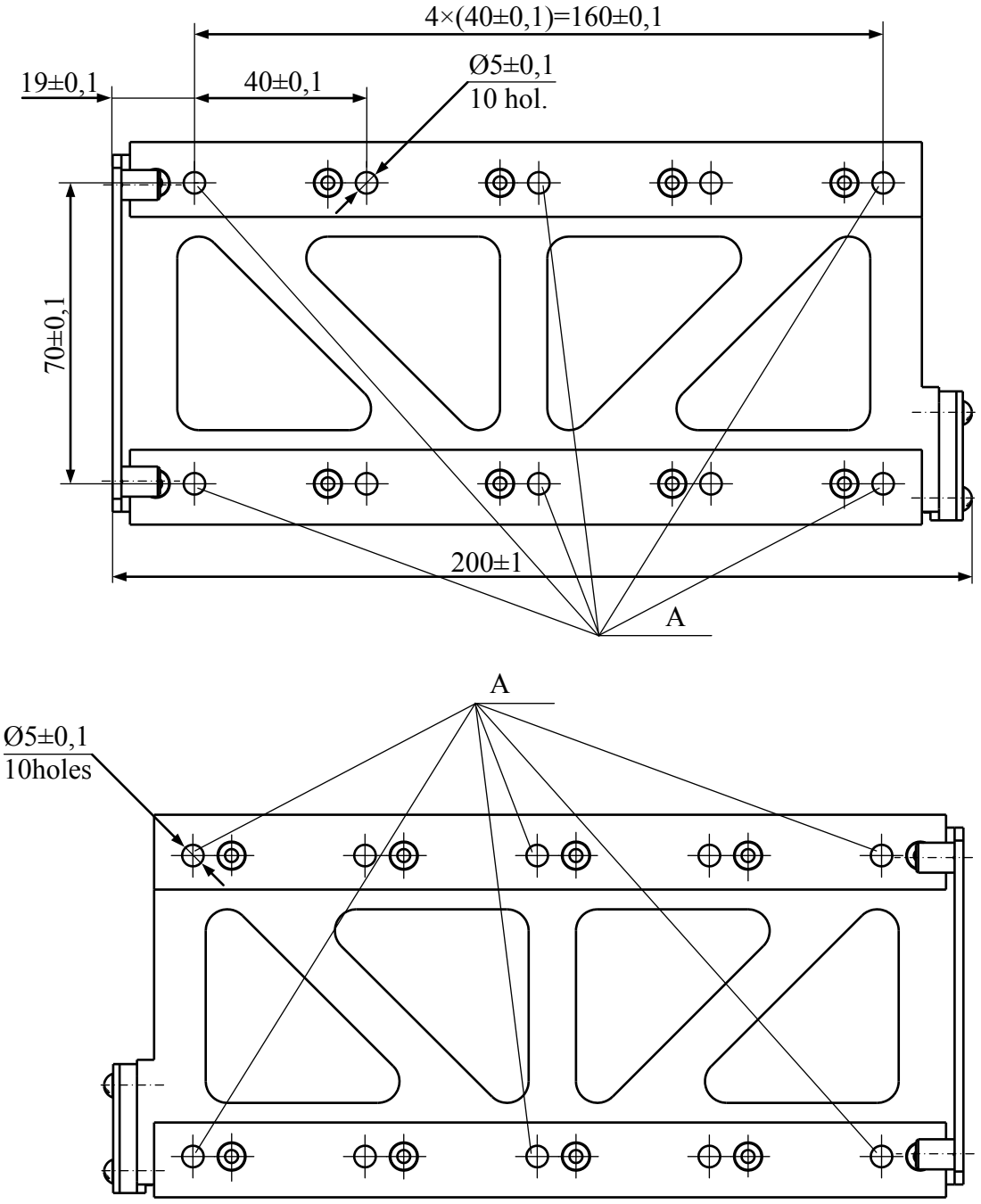


Figure F.4 – Process connector and cap installation in aircraft

AIRBORNE EQUIPMENT OF SATELLITE NAVIGATION – APPENDIX G

(reference)

Enclosure mounting points



It is admissible to fix an enclosure with 12 screws in points A from two sides of enclosure.

Figure G.1- Enclosure mounting points on lateral walls

AIRBORNE EQUIPMENT OF SATELLITE NAVIGATION – APPENDIX H

(reference)

RICU installation in aircraft

RICU mounting method in aircraft is shown in fig. H.1 since serial № C03910021. For RICU before serial № C03908020 and before serial № Г516030 inclusive mounting method is similar to that one shown in fig. H.1.

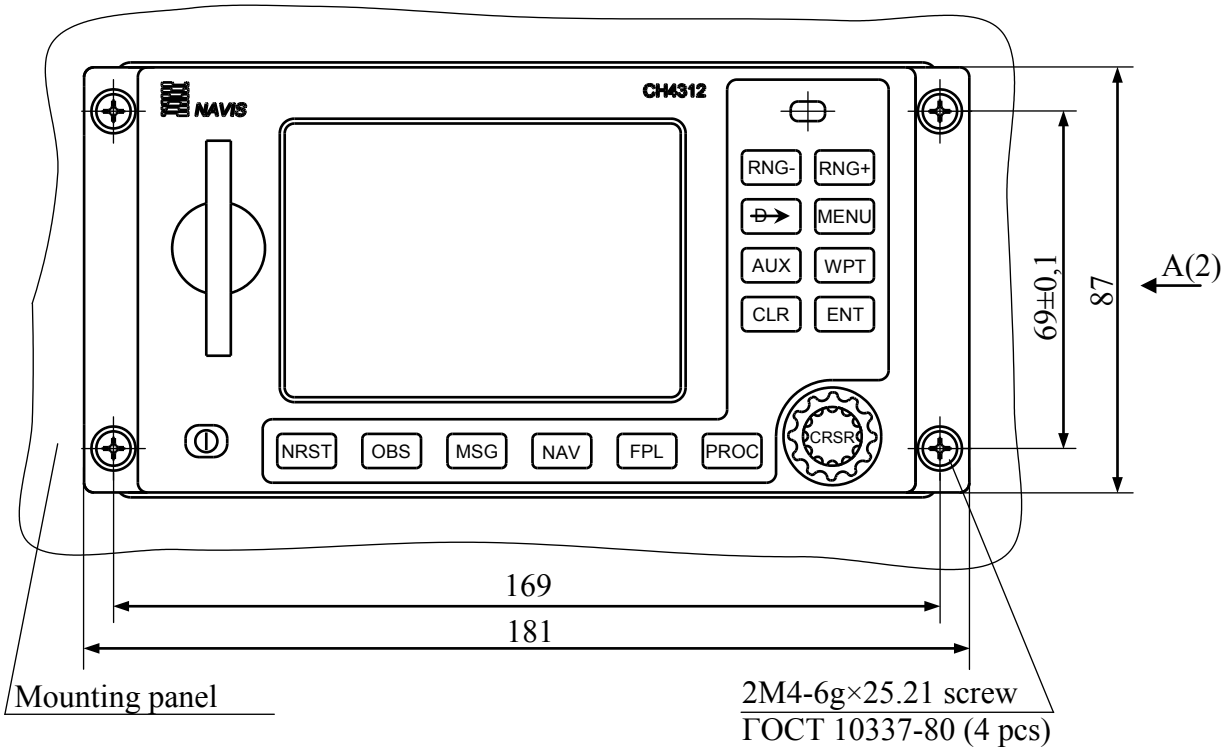


Figure H.1 (page 1 of 5)

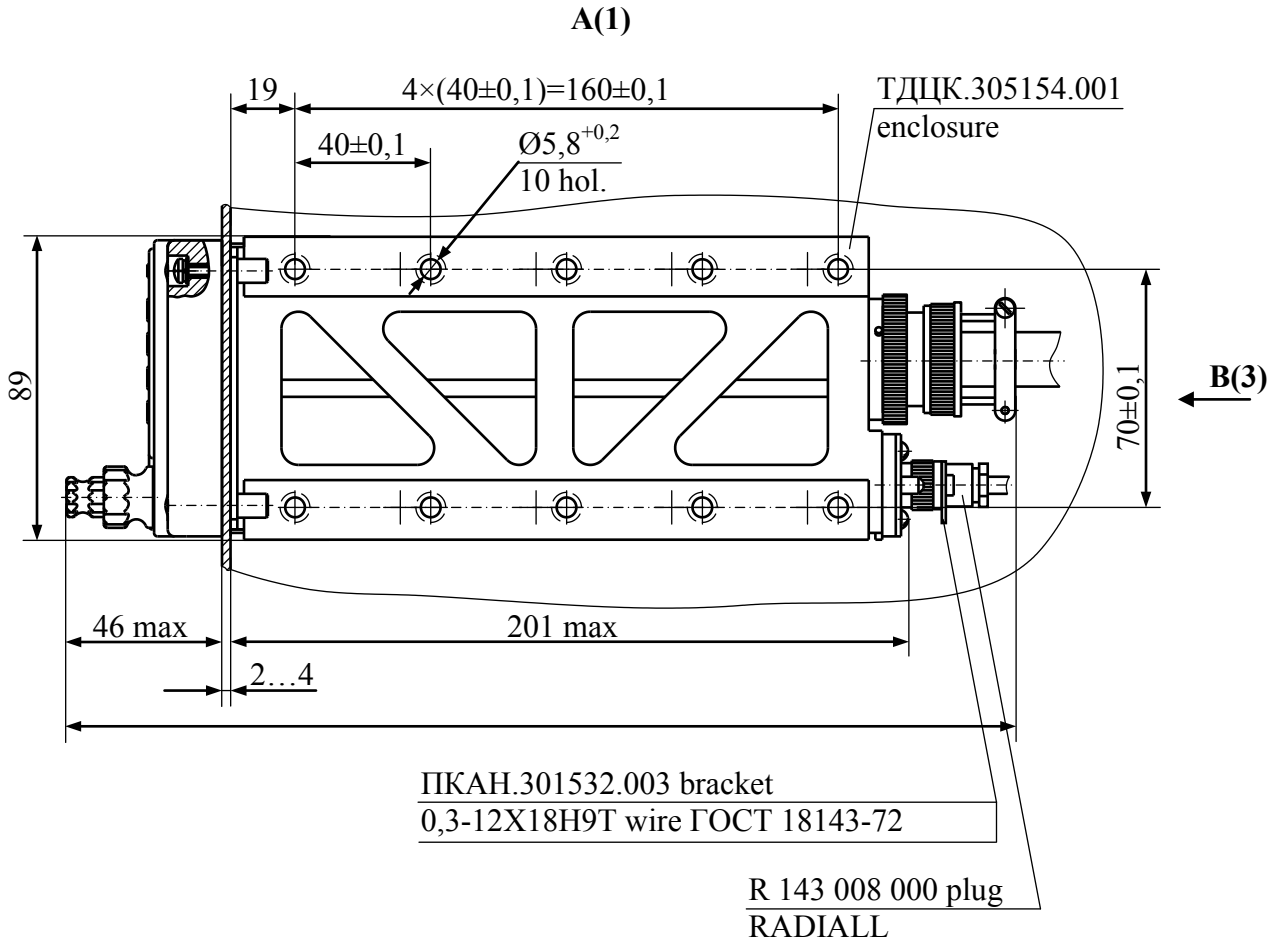


Figure H.1 (page 2 of 5)

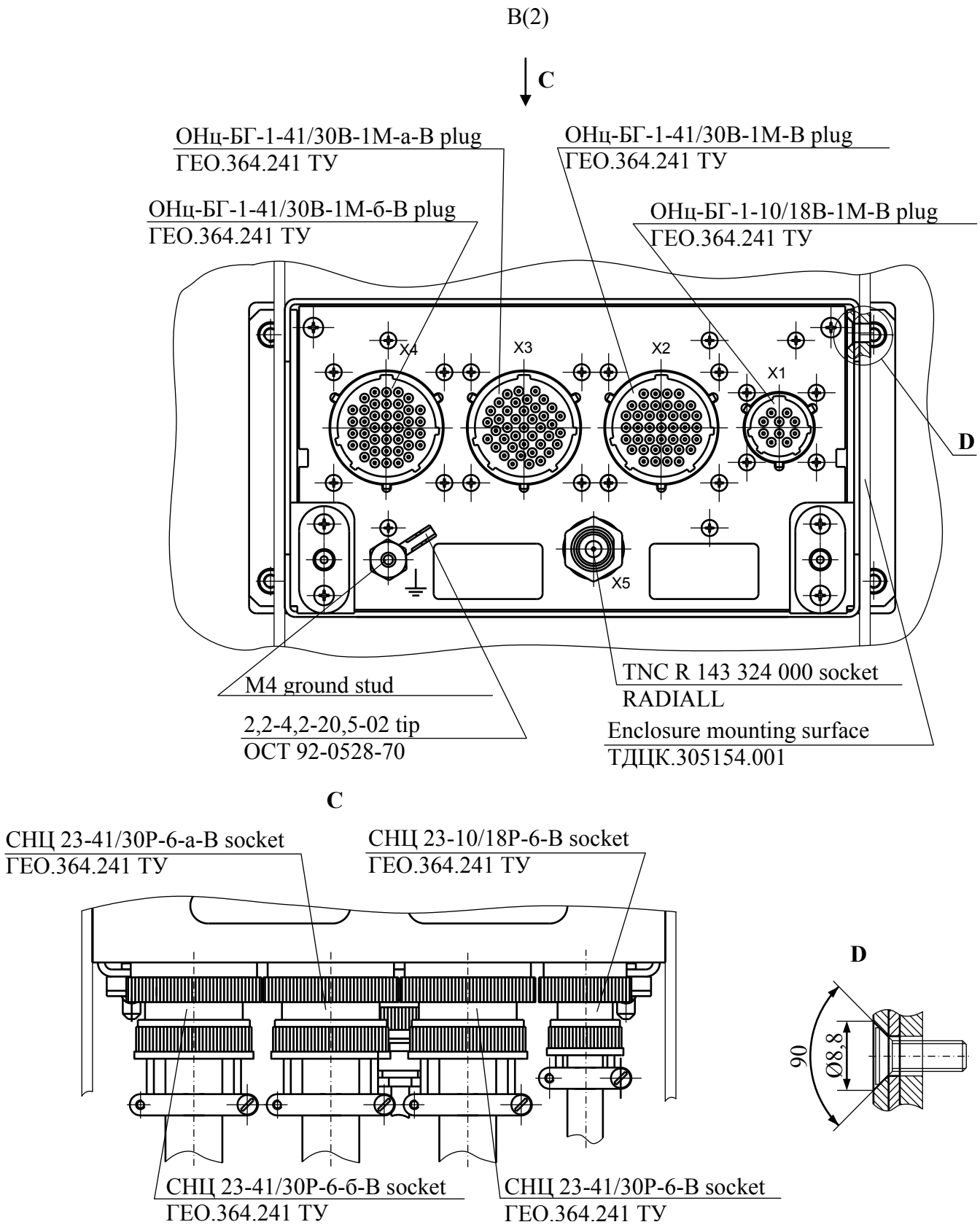
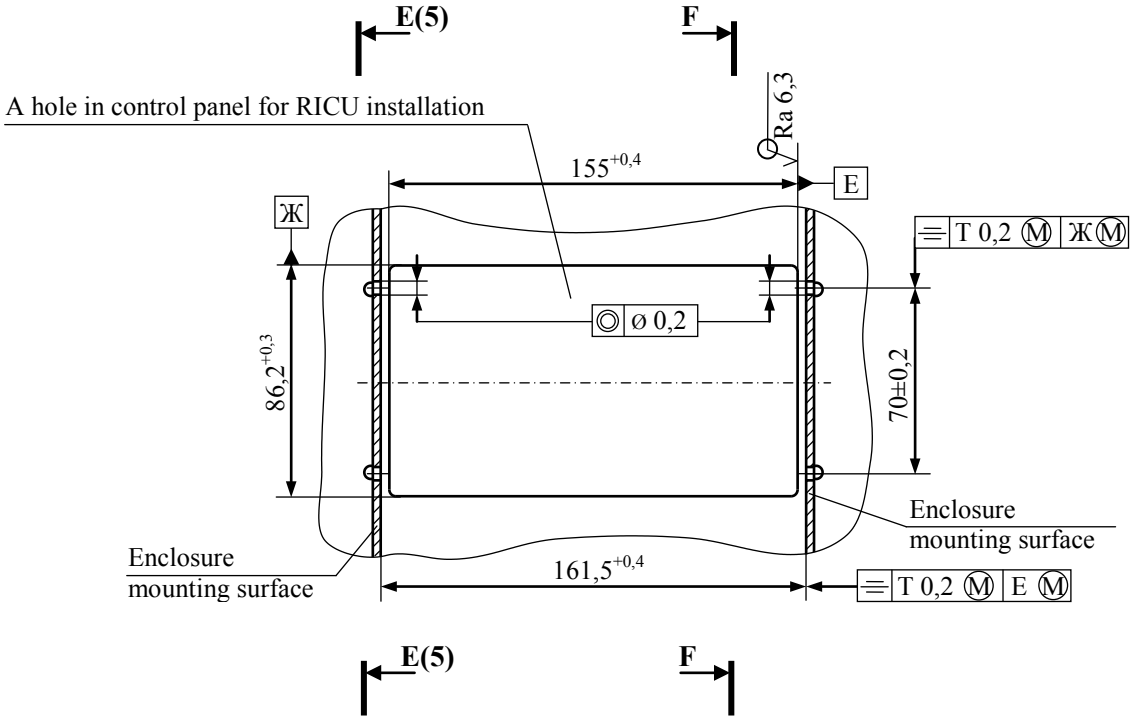


Figure H.1 (page 3 of 5)

Site for enclosure and receiver
and control unit (RICU) installation in aircraft



F-F

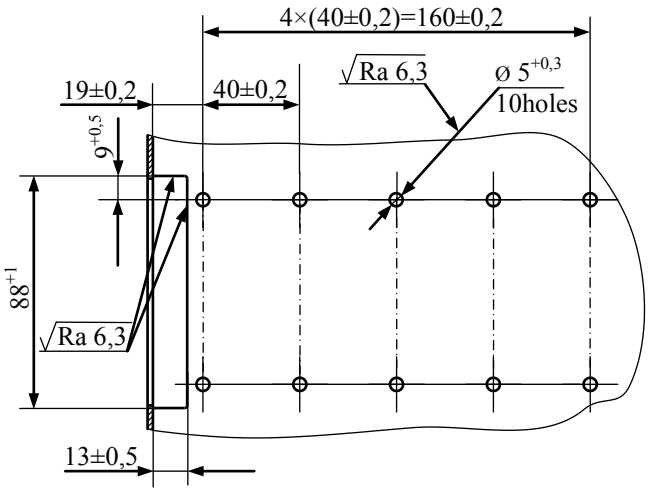
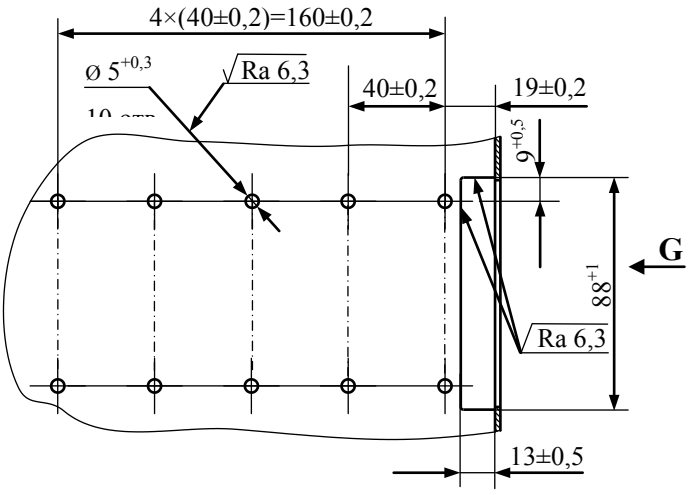


Figure H.1 (page 4 of 5)

E-E(4)



G

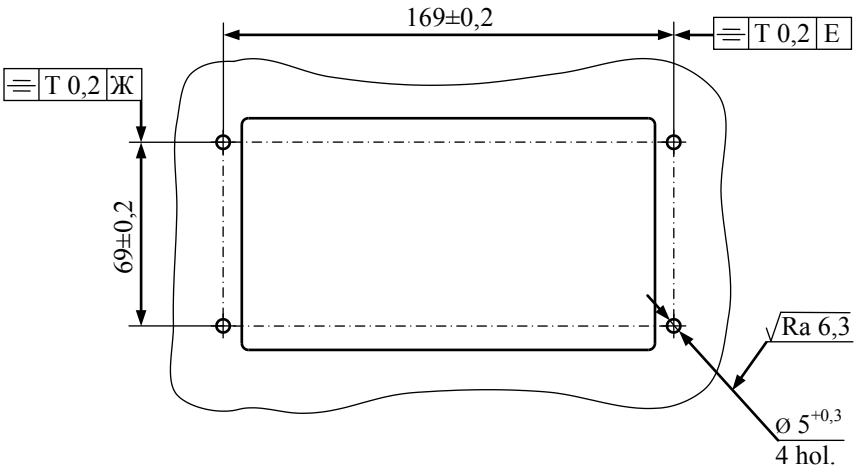


Figure H.1 (page 5 of 5)

AIRBORNE EQUIPMENT OF SATELLITE NAVIGATION – APPENDIX I

(reference)

UPS installation in aircraft

In fig. I.1 UPS mounting method in aircraft is shown since serial № Б516057. For UPS before serial № Б516056 inclusive mounting method is similar to that one shown in fig. I.1.

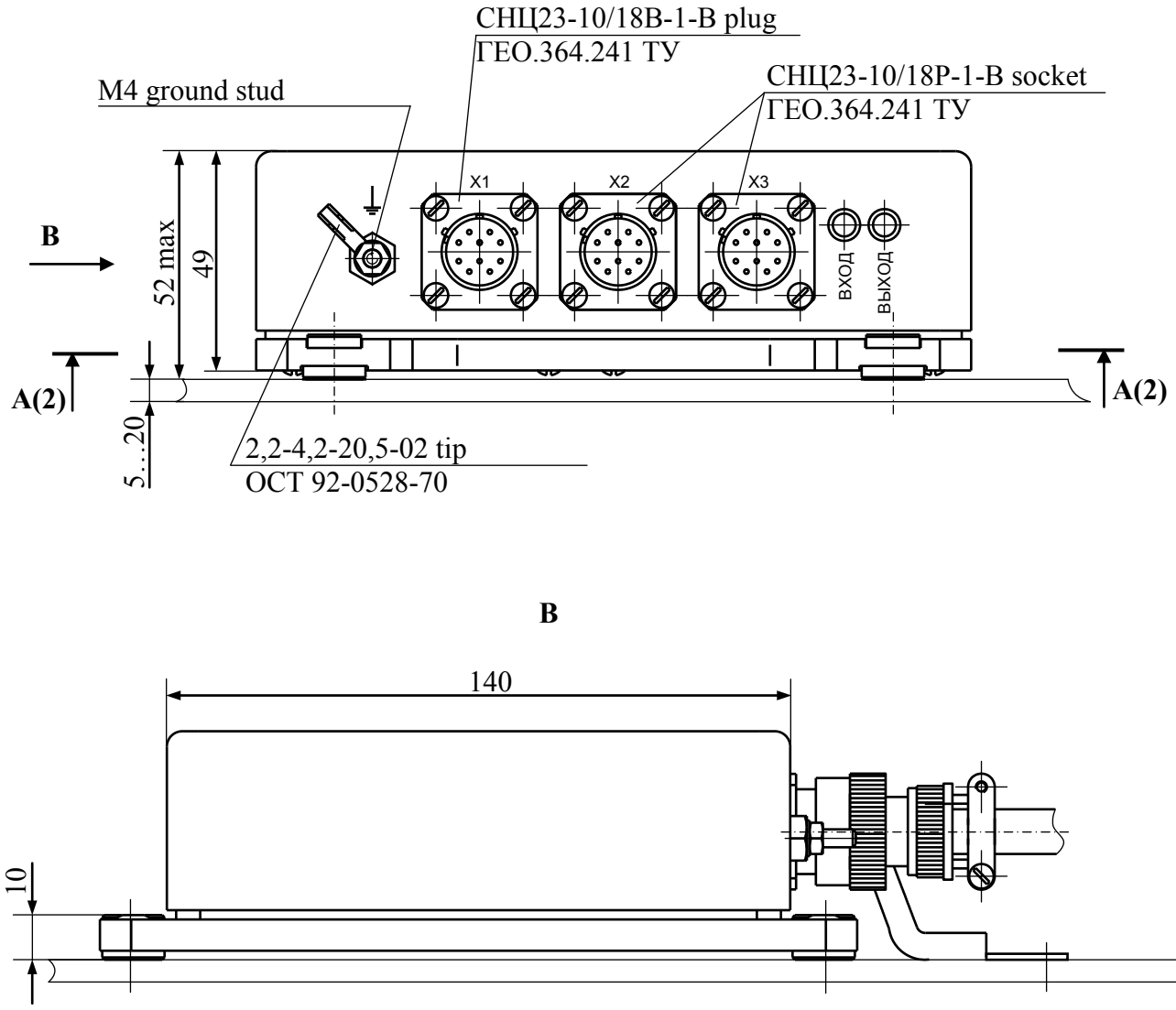


Figure I.1 (page 1 of 3)

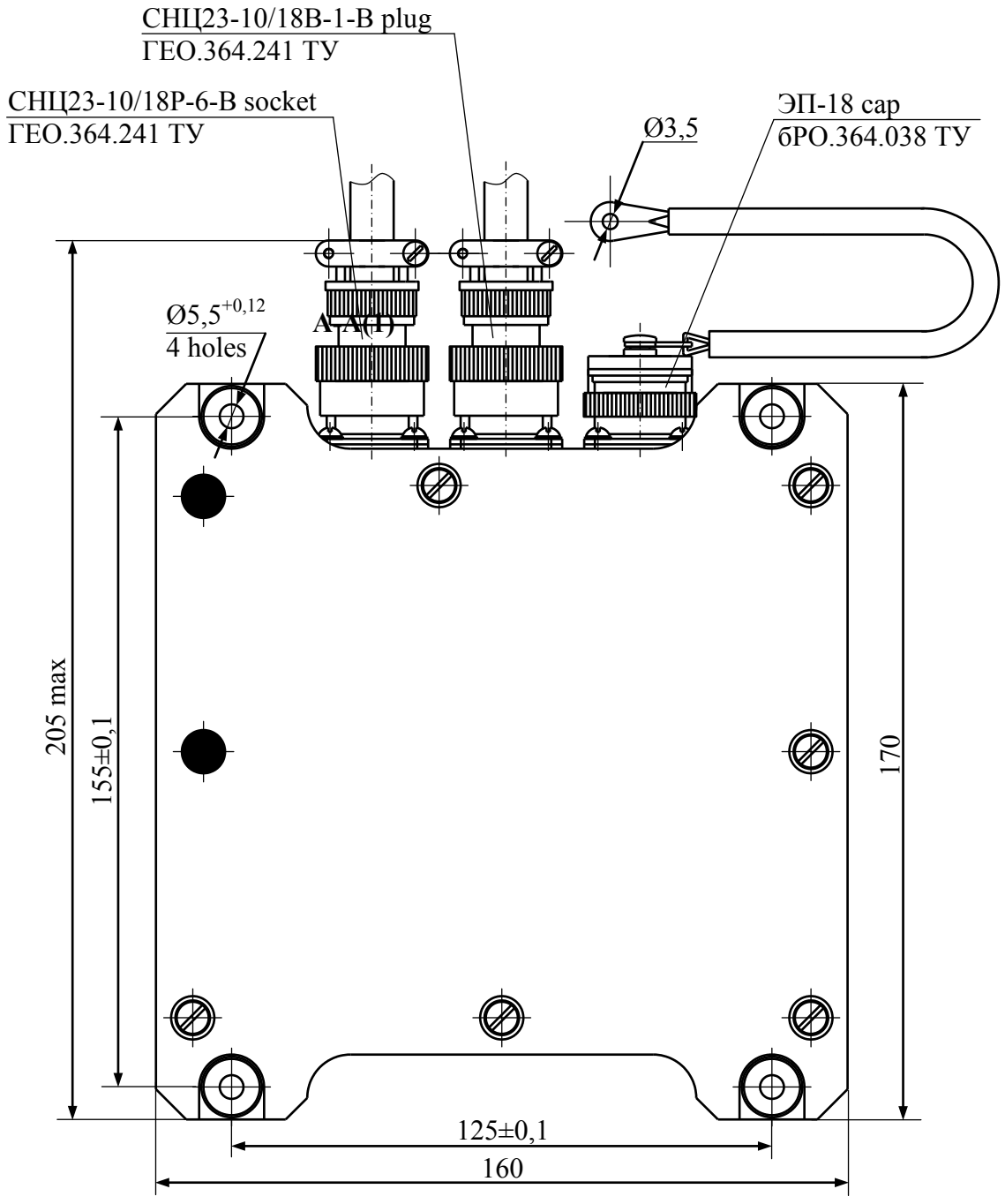


Figure I.1 (page 2 of 3)

Site for UPS installation on object

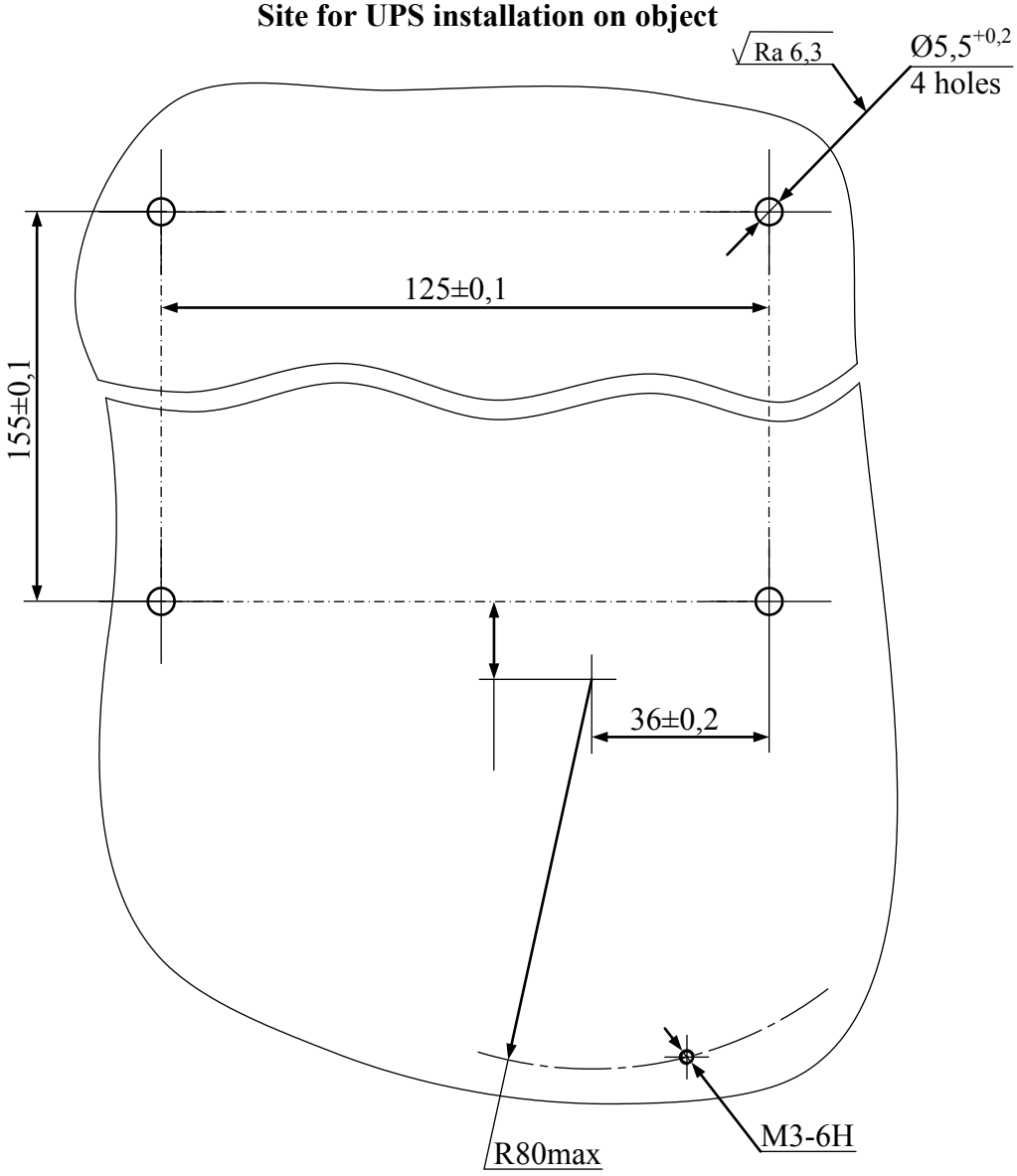
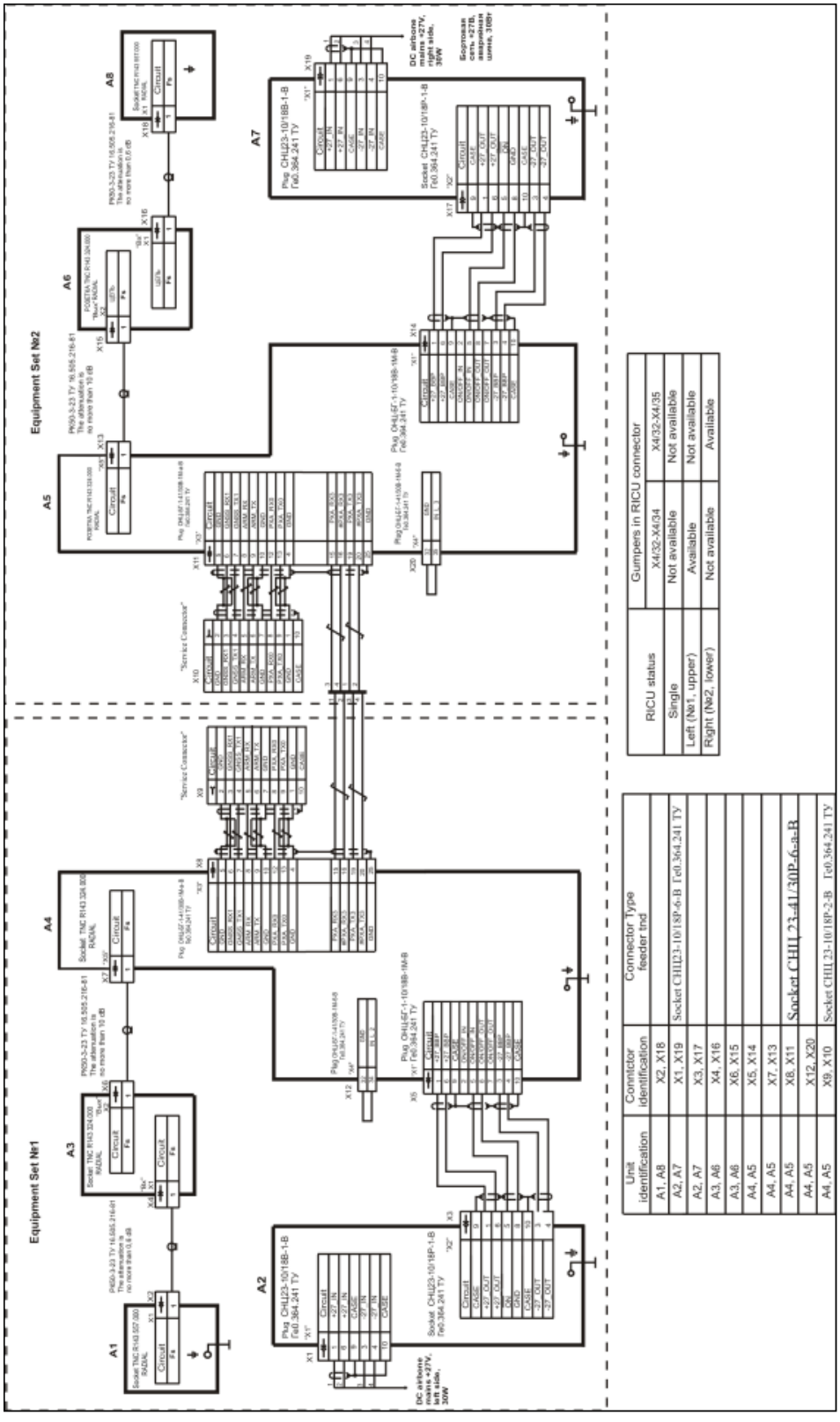


Figure I.1 (page 3 of 3)

AIRBORNE EQUIPMENT OF SATELLITE NAVIGATION – APPENDIX K

(reference)

Connection diagram of two equipment sets



RICU status	Gumpers in RICU connector	
	X4/32-X4/34	X4/32-X4/35
Single	Not available	Not available
Left (№1, upper)	Available	Not available
Right (№2, lower)	Not available	Available

Unit identification	Connector identification	Connector Type feeder end	
A1, A8	X2, X18		
A2, A7	X1, X19	Socket CHJ23-10/18P-6-B	ТеО.364.241 ТУ
A2, A7	X3, X17		
A3, A6	X4, X16		
A3, A6	X6, X15		
A4, A5	X5, X14		
A4, A5	X7, X13		
A4, A5	X8, X11	Socket CHJ 23-41/30P-6-a-B	
A4, A5	X12, X20		
A4, A5	X9, X10	Socket CHJ 23-10/18P-2-B	ТеО.364.241 ТУ