# QUICK START-UP GUIDE

## FOR THE PASSENGER PLANE

# AN-24B

**(Now with pictures!)**

## For flight simulator FlightGear

**Description of the First Section**
„Quick“ means quick, so the first section is meant to explain how to simply put the AN from a „cold-and-dark“ into a „ready-for-take-off“-state without any safety checks or similar preparations as there are in real life. Anyway, this guide is the fast way to explore this aircraft as it is in FlightGear now;
Real life checklists, instructions, restrictions and so on will be implemented over time with regard to official publications (e.g. the manuals from Interflug or the Soviet Ministry of Civil Aviation - so expect good old fashioned hierarchical „do-or-die“ instructions in the future!).

**Description of the Second Section (to be extended)**
This is not just a „How-to“ but rather a „How-the-hell-does-it-work“ - Everything with the inclusion of the state of the „FlightGear AN-24B“, thus systems which are not yet or only cursory implemented are only described in a short way.

For further reading, see e.g.:
http://www.aviadocs.net/RLE/An-24/ (russian)
or
http://www.interflug.biz/Flugzeuge/AN-24/FZH/FZH%20AN-24.pdf (german)

# Operational Limitations

| | |
|---|---|
| **Masses** | |
| Maximum takeoff weight, kg | 21000 |
| Maximum landing weight, kg | 21000 |
| Maximum weight of commercial load, kg: | |
| Passenger variant | 5000 |
| Maximum number of passengers | 52 |
| **Centering** | |
| Operational centering, % CoG: | |
| extreme forward | 15 |
| extreme backward | 33 |
| CoG at overtilting to tail | 49,5 |
| **Speeds** | |
| Maximum speeds (CAS, km/h): | |
| Extreme descent ($V_{NE}$) | 540 |
| Normal operation ($V_{NO}$) | 460 |
| With gear extended ($V_{LGE}$) | 450 |
| Throughout manual gear extension | 320 |
| Throughout normal gear extension ($V_{LG}$) | 310 |
| Throughout flaps operating ($V_{FO}$) $\delta < 15°$ | 300 |
| With flaps extended ($V_{FE}$) $\delta > 15°$ | 250 |
| Critical Mach number | 0.7 |
| **Engine AI-24** | |
| Maximum time (minutes/% run duration): | |
| Take-off power | 5/3 |
| Maximum power (UPRT > 72,5°±1) | 15/3 |
| in-flight, with one engine failure | 90/3 |
| Nominal (58° < UPRT < 69°) | 60/32 |
| Cruise | -/ - |
| Idle on ground | 30/ - |
| Power stages (°UPRT) | |
| Take-off power | 87 - 100 |
| Nominal | 62±2 |
| Cruise ($N_{nom}$) | |
| 0,85 | 52±2 |
| 0,7 | 41±2 |
| 0,6 | 34±2 |
| 0,4 | 22±2 |
| Idle on ground | 0 |

# FIRST SECTION


**Tips:**
**- Try to use keys 1-4 and < to change views if needed**
**- Ctrl + C shows clickspots and instruments‘ names**
**- Tooltips available!**

**A. Electricity first - as always**

1. Open the hatch and close the two CIRCUIT-BREAKER SWITCHES of the BATTERIES at the fuse panel under the radio-operator/engineer‘s table
2. Close ALL SWITCHES on the AZS-(circuit-breaker) panel (best by clicking the "all-on"-clickspots to the right of each row)

**B. Fuel next**

1. Open CUT-OFF VALVES (up)
2. Turn main FUEL PUMPS ECN to „AUTO“ (up)
3. Turn secondary FUEL PUMPS 463 „ON“ (up)
4. Leave CROSSFEED VALVE closed
5. Turn on the RTMS FUEL FLOW COUNTERS (8.)
6. Click on the UAP-12
7. Look at the AMOUNT OF FUEL and divide by 2
8. Set this AMOUNT into each FUEL FLOW COUNTER (Left Click or Scroll Down, Shift accelerates your mouse actions)
9. Turn on the 2PPT-1 FUEL INDICATION left and right tanks,
10. Switch between „SUM“ (tanks groups 1+2), „1“ (tanks group 1) and „2“ (guess!) while...
11. ...Checking the AMOUNT on the 2PPT-1 FUEL INDICATOR

**C. Engine Start**

1. Open TG-16 APU CUT-OFF VALVE (up)
2. Put „HOT/COLD-Start“ switch to the down position („HOT“)
3. Start TG-16 APU
4. Wait until it has reached > 36.000rpm
5. Select LEFT AI-24 ENGINE (up)
6. Start LEFT AI-24 ENGINE - wait for it to spool until you select RIGHT AI-24 ENGINE (5. down) and Start RIGHT AI-24 ENGINE (6.)
7. Start the „FLIGHTTIMER“ on the AChS-CLOCK
8. After engine start, SHUT DOWN TG-16 APU and close CUT-OFF VALVE (1)


**D. During Engine Spool-Up You may already...**

1. Turn up ALL THESE SWITCHES under the left panel,
2. ALL THESE SWITCHES under the right panel and
3. ALL THESE ONES under the middle panel
4. Select „TAXI“ (up) or „T/O-LANDING“ (down) GEAR MODE

**E. Now let‘s Align Compasses**

1. Press ALIGN GIK (Gyro Induction Compass) BUTTON until
2. Needle on KPPM STOPS MOVING; set this HEADING on the
3. GPK (Gyro Poly Compass) by
4. Clicking here left or right (Shift helps!)
5. The correct LATITUDE should already be set here
6. Set desired initial AUTOPILOT HEADING on ZK



**F. Comm/Radio and Other Stuff...**

1. Adjust, tune and set to your needs as described in the Second section!

**G. Nearly Done!**

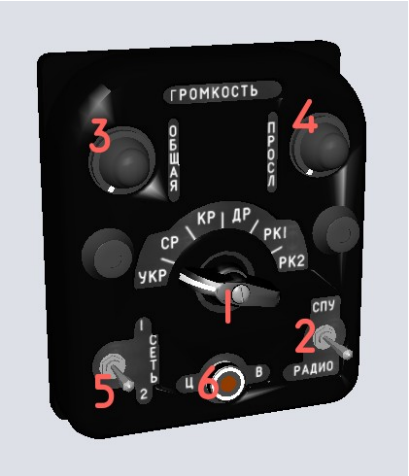
1. Set FLAPS 15° (by keyboard, switch missing...)
2. Prepare AUTOPILOT by putting up switch and
3. Wait until ORANGE LIGHT signalizes „ready“
4. Slowly ADVANCE THROTTLE to 100%; when reached
5. Start STOPWATCH,
6. Release PARKING BRAKE (Shift + B)

   At around 190km/h, lift nose gently ($V_R$) and take-off at around 200km/h while observing the AoA on the UAP-12; climb regarding engine limitations at low AoAs (<5°) and not less than 320km/h

# SECOND SECTION

**SPU-7 Communication device:**

It is located at all four workplaces and lets you communicate with your crew members and listen and/or talk to radio stations.



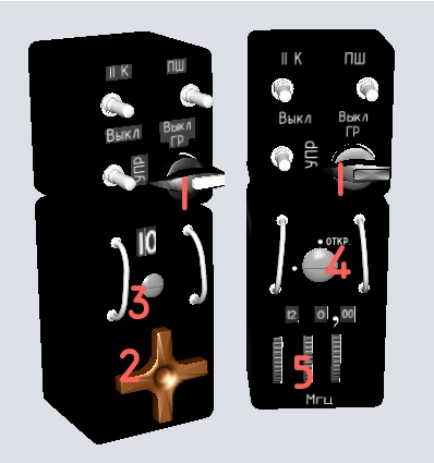

You can select to which radio station you want to listen/talk to by switching knob (1) to the following positions:

- "UKR": R-802 No.1; Ultra-Shortwave Radio Station; This is pretty much like what we usually know as „COMM 1“
- "SR" : Medium-range radio station (Receiver US-8K and Transmitter SVB-5)
- "KR" : Short-range radio station (Receiver US-8K and Transmitter R-836)
- „DR“ : Radio R-802 No.2; like „COMM 2“
- „RK1“ : Radiocompass ARK-11 No.1; like „ADF 1“/ Kurs-MP No.1 (like VOR1)
- „RK2“ : Radiocompass ARK-11 No.2; like „ADF 2“/ Kurs-MP No.2 (like VOR2)

„SR“ and „KR“ are not yet implemented, so forget about them...

The volume you hear depends on the setting of the „SPU-Radio“-switch (2). Set the „General Volume“ (3) to 100% (adviced!) and „Listen Volume“ (4) to, let‘s say 20% - With switch (2) set to „SPU“ (Intercomm), you will then hear crew-communication at 100%, the radio station you have selected at 20% volume - and vice versa with switch (2) set to „Radio“.
Please notice that the radio devices have volume-knobs, too, so don‘t forget to turn them up!

Switch (5) is used to switch between two networks, this function is rarely implemented on AN-24s, button (6) can be used as an „Emergency Call“-button - press it, and all participants will hear you at full loudness (not implementd yet).




**R-802 Comm Radios No.1 and 2**

The control panels of this Ultra-Shortwave Radio Station are mounted on the overhead panel with the left one being No.1 and the right one No.2.
No.1 serves as Comm1, No.2 as Comm2.
To the side each of these blocks are two switches: The outer ones power the stations on, so don’t forget! The inner ones change capacity and are not implemented yet, so forget!

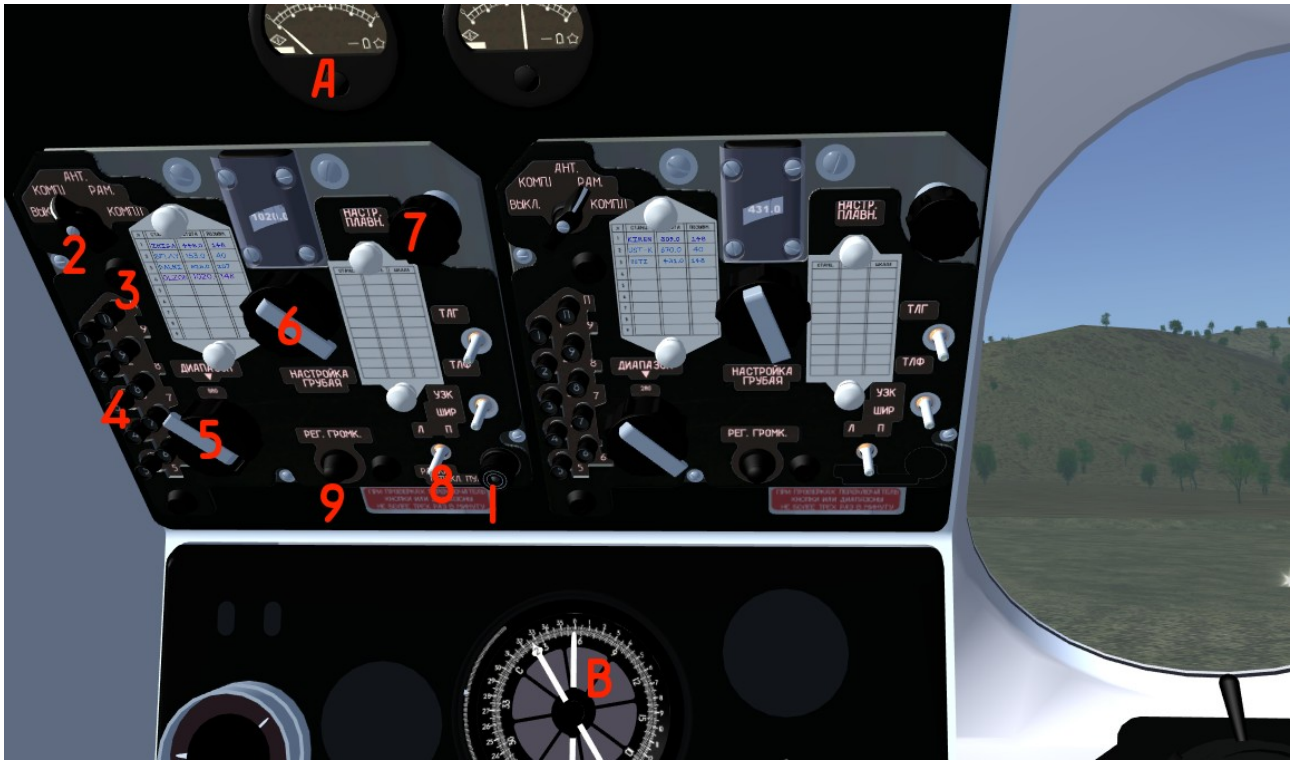
Block No.1 can store up to ten frequencies - which are “programmed” pre-flight in real life. In FlightGear, you can store them by doing the following:

1. Set a frequency by using the three wheels (5)
2. Choose any channel by turning (2)
3. Press screw (3) - frequency will now be stored at chosen channel
4. Repeat as desired!

Change output volume by knobs (1); Pressing screw (4) makes block No.2 “recall” the frequency which is currently selected on No.1. At the moment, frequencies in between .05 steps (e.g.133.77) have to be entered via FG’s Radio dialog (F12). Sorry!

**ARK-11 Automatic Radiocompass (ADF)**

Newer AN-24s are equipped with two sets of ARK-11s, No.1 and No.2. Set No.2 can be controlled by the remote panel No.2 at the navigator’s station; Set No.1 can be controlled by the remote panel No.1 at the navigator’s station or the remote panel on the pilots’ overhead. Press button (1) on the respective panel to take over control (the pilots’ panel has reduced functionality, so only the navigator’s will be described here).




By knob (2) you can choose between the following modes:

1. OFF
2. Compass 1: Similar to known “ADF” mode
3. Antenna: Well, “antenna” mode
4. Frame: Frame/loop antenna can be turned manually by switch (8)
5. Compass II: Like Compass I, but uses two frame antennas (not related to Set No.2!)

By knob (5) you can choose between the following frequency ranges (kHz):

1. 120-280
2. 280-440
3. 420-580
4. 580-740
5. 720-880
6. 880-1040
7. 1020-1180
8. 1180-1340

To select a frequency of e.g. 563kHz, choose “420” with knob (5). Then use the “rough adjustment” knob (6) until the white OSG-text shows “560”, then fine-tune (7) until it reaches “563” (The real life instrument has a disc with a helical scale ranging from 0-160kHz underneath the little display which should show “143kHz” (+ 420kHz=563kHz) in our example; here, a text shows the final sum).

To enter and store a frequency:

- Use any mode except OFF
- Press button P (3) to lock it (only locks when device is powered and selected by (1) )
- Select appropriate frequency range by turning knob (5), (6) and (7)
- Press any of the knobs (4) to store the displayed frequency under that number
- Unlock button P (3) when programming is finished
- With unlocked button P (3), the stored frequency can then be recalled

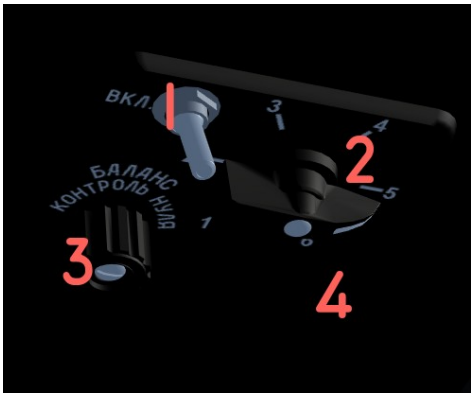
The nearest NDB will be displayed on the left table with Name, frequency and range (in km).

With “Compass” mode selected, the frame antenna, represented by instrument (B), is turned automatically towards the NDB station (respectively 90° to be correct, (B) shows correct bearing anyway); In the “Frame” mode, only the frame antenna is used and can be manually turned left-right with switch (8). The indicator “A” shows the strenght of the induced current in the frame; A minimum is used for bearing. Because the non-directional antenna is not used in this mode, the reading is ambiguous, so the needle may either point directly to or directly from the station. Anyway, a higher range can be achieved in this mode under some circumstances.

Use knob (9) to adjust output volume (respectively gain in “Antenna” and “Frame” modes).

The two unmarked switches are used to narrow/widen bandwidth, and to switch between “Telephone” and “Telegraph” mode (will be fun to implement that!).

**Landing System SP-50/ILS**




SP-50 was used in the Soviet Union and other states of the Eastern Block; it works with PRMG ground stations which are like ILS stations, with two exceptions: The frequencies (90/150Hz) of the AM signals of both glidepath and course beacons are interchanged, and the number of channels is limited to six.
To set a frequency, switch the system on (1), then choose a channel (2); if none of these channels matches your wish, just use the “cheat button” (4) - use Ctrl + c to see it.
When a localizer is in range, you have to calibrate the course receiver. Switch off the variable phase by pressing the balance knob (3) with the left mouse button - then turn the knob until the KPPM shows 0° deviation when the knob is pressed. This can best be done from the navigator’s seat (key “4”).

**Navigation System Kurs-MP**

This system can also receive and evaluate VOR-signals. To equip your plane with it, go to An-24B -> Radio-Equipment and choose “Kurs-MP”. Beware, swapping the equipment resets some radio-settings!


1. Switches VOR1/2 ON
2. Choose indication source and ident (VOR1-ARK I/VOR2-ARK II)
3. Signalisation (no clue yet)
4. ILS-SP-50 (no effect at the moment)
5. Marker sensitivity (OFF-Route-Landing; coming soon)
6. Course-balance knob (see SP-50)
7. Glide-slope-balance knob (see 6.)
8. Frequency select (1 MHz steps)
9. Frequency select (0.05 MHz steps)
10. Select set MP 1 or MP 2 to serve SDU (coming one fine day)
11. Radial selector
12. Switch TO (“HA”)-FROM (“OT”)

The real life Kurs-MP equipment consists also of a different set of indication/command instruments than the SP-50 system, like NPP instead of KPPM. At the moment, and until I’ll have finished these instruments, the KPPM has to serve as the instrument of choice...

**Autopilot AP-28L1**

The electric autopilot AP-28L1 is designed to automatically stabilize and control the flight of the aircraft on a given trajectory.
It provides:

- Stabilization of the position of the aircraft around the center of gravity relative to the three main axes (longitudinal, vertical and transverse)
- Automatic flight of the aircraft by orthodromy (according to the signals of GPK-52AP) and by loxodromy (according to the signals of GIK-1) with switching from GPK-52AP to GIK-1 and back without disabling the autopilot
- Flight altitude stabilization;
- Automatic turning angles up to 120° from ZK-2 course setting
- Making coordinated turns with roll angles up to ± 30°
- Adjusting pitch angle and holding pressure altitude
- Automatic trim of the elevator
- Bringing the aircraft to a horizontal position from roll angles up to ± 30° and pitch up to ± 20°

So, how to achieve all those graceful things? Easier than you might think, as not all restrictions are implemented yet...


1. Pitch adjustor switches pilot and F/O
2. Signal lamp “Ready”
3. Signal lamp “Engage”
4. Autotrim switch
5. Power switch
6. “Engage” button
7. Course mode selector switch
8. Vertical channel on/off switch
9. Warning lights “Plane trimmed nose-heavy” (left), “tail-heavy” (right)
10. “Horizon” button
11. Altitude Hold button and signal light
12. Roll knob

Switch (5) powers the AP, after 5-15s (up to 100s in real life, but we were kind), light (2) should indicate that the AP is ready. If not, check for neutral position of controls.

To engage, either

- press (6) (plane goes to wing-level at given pitch) or
- press (10) (plane goes to wing-level at 0° pitch) or
- press key”d” (like (6) )

To disengage

- press “d” (the real plane has disengage-switches on yokes)

<u>Vertical channel:</u>

- Use the pitch switches (1) to control pitch, then say “pitch switch” three times fast in a row, or press F3 (pitch down) or F4 (pitch up)

- Pressing button “KV” (11) holds the plane at given (pressure) altitude, using (1) again gets you back to pitch control
- Button “Horizon” (10) puts the plane into horizontal flight with zero pitch (and bank), after 10s, “KV” (“Altitude Hold”) is engaged, too
- Turn-off the vertical channel completely by turning down switch (8)
- Lights (9) indicate that you can expect the plane to be nose-heavy (left light) or tail-heavy (right light) when AP is turned off
- Switch (4) up turns autotrim on

Horizontal channel:

Button (7) lets you select between three modes: GIK (up), GPK (middle) and Roll (down). Under some conditions, knob (6) has to be pressed to change modes properly.

GIK mode

- Keeps the heading which is set at the “ZK” instrument and thereby the **G**yro **I**ndication **K**ompass (“loxodromic course”)
- Turns are made at a bank angle of 15°
- Max. deviation from current heading is 120° (no restriction here)

GPK mode

- To follow the current course of the **G**yro **P**oly **K**ompass (“orthodromic course”)

Roll mode:

- Use the roll knob (12) with mouse-scroll for bank angles up to 30°
- Left-click on it to put bank angle back to 0°

**AChS-Clock**

It’s a mechanical clock with a wind-up mechanism (three days run duration). The flighttimer is usually used to e.g. determine overall flighttime or to control fuel consumption, the stopwatch is e.g. used at engine start (spool-up) or climb (engine throttle restrictions).


Left (red) knob:

Controls needles of clock face (A) and flighttimer face (B)

- Push (left mouse button): Toggles flighttimer between Started (white)/ Stopped (red)/ Resetted (red-white flag (1) )
- Pulled (middle mouse button): Set clock time with scroll-wheel (with red flag, flighttimer needles move as well*)
- Neutral: Use scroll-wheel to wind up (counter-clockwise only)

Right (grey) knob:

Controls stopwatch (C)

- Push (left mouse button): Toggles stopwatch between Started/Stopped/Resetted
- Turn (scroll-wheel): Intermediate stop (stops second needle of clock, too*)

* Whyever... Anyway, as the real thing.

**Anti-Ice and Ice recognition/warning system**

As soviet/ukrainian plane, the AN-24 has a powerful anti-ice system, basically consisting of an electrical and a hot air system.

The propeller blades and hubs, pitot tubes and static ports, the left and the right front window, and the clocks can be electrically heated.

The wings, horizontal and vertical stabilizers, the inlet guide vanes, the engines and the TG-16 APU as well as the cockpit windows (except the top windows) can be heated by hot air from the compressor stage of both engines.

Here, only some basic elements  are shown, as not all elements are implemented yet.


1. Heating low/high of front right window  (equivalent on left panel)
2. Pitots/static ports heating
3. Bleed air control
4. Cabin temperature control
5. Air valve window heating left
6. Air valve window heating right
7. Turbo coolers

Window and pitot/static port icing effects are implemented, everything else can be safely ignored.

At the moment, 1,5 and 6 can be used to de-ice the cockpit windows; switches 2 can be used to prevent the pitot tubes and static ports from icing.