DCS Fw 190 D-9 Dora

Flight Manual

Dear User,

Thank you for your purchase of DCS: Fw 190 D-9. DCS: Fw 190 D-9 is a simulation of a legendary German World War II fighter, and is the fourth installment in the Digital Combat Simulator (DCS) series of PC combat simulations.

Like previous DCS titles, DCS: Fw 190 D-9 features a painstakingly reproduced model of the aircraft, including the external model and cockpit, as well as all of the mechanical systems and aerodynamic properties. Along the lines of our flagship P-51D Mustang title, DCS: Fw 190 D-9 places you behind the controls of a powerful, propeller-driven, piston engine combat aircraft. Designed long before "fly-by-wire" technology was available to assist the pilot in flight control or smart bombs and beyond visual range missiles were developed to engage targets with precision from afar, the Dora is a personal and exhilarating challenge to master. Powerful and deadly, the aircraft nicknamed the Long-Nosed Dora provides an exhilarating combat experience to its drivers, and a worthy challenge to all fans of DCS: P-51D Mustang.

As operators of one of the largest collections of restored World War II aircraft, we at The Fighter Collection and the development team at Eagle Dynamics were fortunate to be able to take advantage of our intimate knowledge of WWII aviation to ensure the DCS model is one of the most accurate virtual reproductions of this aircraft ever made. Combined with volumes of outside research and documentation, the field trips to the TFC hangar and countless consultations and tests by TFC pilots were invaluable in the creation of this simulation.

The contents of this manual are based largely on actual vintage Fw 190 D-9 manuals of the aircraft's service era.

With homage to the brave pilots of World War II, we hope you enjoy taking this true Flying Legend to the skies and into the fight!

Sincerely,

The DCS: Fw 190 D-9 Development Team

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INTRODUCTION

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The D for Dora variant of the famous Fw 190 fighter was nicknamed the Long-Nose by German pilots as well as the Allies. It was a departure from the radial-engine earlier variants and featured a more powerful inline engine, which gave the aircraft its characteristic long-nose shape compared to the iconic Fw 190 A. While experts may still argue about the Dora's looks, the performance gains were clear. While the earlier variants excelled at lower altitudes but suffered higher up, at the most crucial altitudes where Allied bombers operated, the Long-Nosed 190 could easily match the best the Allies had to offer at all altitudes.

The Focke-Wulf Fw 190 is not just one of Germany's greatest fighter planes; it is perhaps one of the most famous aircraft of the entire Second World War. Featuring many advances and innovations, it broke new ground in terms of pilot comfort, ease of use, and versatility. First appearing in 1941, it was a rude awakening to the Allies, easily outclassing the best Allied fighter of the time, the British Spitfire Mk V. In the skies over France, it had no equal for many months as the British scrambled to produce its answer, the Spitfire Mk IX almost a year later.

An Allied pilot serving on Western and Eastern Fronts, or the Mediterranean, and flying at tree-top level or at the edge of its envelope would be likely to encounter a Fw 190. Nearly 40 variants of the versatile Focke-Wulf aircraft were produced ranging from high-altitude reconnaissance to ground attack aircraft and even night fighters. By late war, the Fw 190 was even used in one of the most eclectic operational aircraft of WWII, the Mistel composite aircraft, where a pilot in a Fw 190 was mounted above a modified twin-engine bomber loaded with explosives, which could later be detached to fly into its target.

Figure 1: Fw 190 A Prototype

The first and the most mass-produced Fw 190 variant was the A series powered by a radial engine. Serving as a pure air superiority fighter as well as fighter-bomber and ground-attack variants, the A series was loved by its pilots and feared by enemies.

The design work started in 1939. The new aircraft proposed by Kurt Tank, the head of the technical department at Focke-Wulf, was, for its time, groundbreaking. It was a rare attempt to create a radial-engine fighter at the time when most designers preferred inline engines because of their supposed aerodynamic superiority. Unlike its main competitors, the Messerschmitt Bf 109 and the British Supermarine Spitfire, the 190 was not designed for speed but for durability. Its wide landing gear would make it easier to operate from primitive forward airfields, and sturdy gear struts and shocks could withstand much harder landings. Sturdy airframe, ample armor, and appropriately designed internal systems made the 190 capable of returning home after taking more than a couple of hits. An innovative pushrod control system in place of the conventional cables and pulleys made the controls light and responsive. An industry-first ergonomic cockpit placed all controls at pilot’s fingertips, and electrically powered equipment in place of hydraulics made simple push-button operations for gear, flaps, and weapons a reality. These simple cockpit controls and many automated systems made it easier to train new pilots on the Fw 190 in harsh war-time conditions.

Figure 2: Fw 190 A

The work on the D series began in 1942. As the new Junkers Jumo 213 engine offered clear improvements in performance, the decision was made to use it with the 190 airframe. While Kurt Tank, the Fw 190’s lead designer, preferred the Daimler-Benz DB 600 series, the engines were already used in Messerschmitt fighters, while a surplus of the Jumo 213 bomber engines were readily available. The brand-new 213, an improvement on the earlier Jumo 211, offered 1,750 hp (1,287 kW) of take-off power that could be boosted up to an astonishing 2,100 hp (1,508 kW) of emergency power with MW-50 injection.

A Fw 190 A-8 airframe was used as a basis for the new D-series design. While the earlier radial engine was air-cooled, the Jumo 213 required a radiator, which further added to airframe length and weight. Kurt Tank chose to go with a simple annular radiator design. The airframe was strengthened, and both the nose and the tail sections were increased in length by almost 1.52 meters.

The canopy design on the Dora series was changed during the production run. The first production examples used a flat-top canopy used on earlier A-series, the later Doras were upgraded to the advanced rounded top canopy similar to Allied bubble canopies which offered improved all-around visibility. Other airframe improvements included a smaller streamlined center weapons rack.

While originally intended to serve as a bomber interceptor, changing realities of the war in the air meant that by the time the Dora entered production in August of 1944, it mostly saw combat against enemy fighters or in a ground attack role.

The earliest pre-production variants designated D-0 had the external wing guns removed; this was often reversed and future D variants were produced with the wing guns. Most D-9s intended for lighter anti-fighter role were still built without the outer wing guns, featuring a pair of 13mm MG 131 machine-guns and twin 20mm MG 151/20E cannon.

Figure 3: Fw 190 D-9

The first production variants were designated D-9; there was no production of any interim designations between D-1 to D-8. The initial D-9 variants were rushed into service without the crucial MW-50 water injection. By December of 1944, all early variants were field-converted to spec. Later production D-9 variants built with the MW-50 at the factory had the tank that could be used for dual purposes, either for the methanol water injection or as an additional fuel tank.

Initial opinion of the upcoming Dora was not very high. Kurt Tank always stated that the D-9 was intended only as an interim stop-gap until a more perfect Ta-152 design could enter production. However, once Luftwaffe pilots got their hands on the stop-gap Long-Nosed Dora, they were pleasantly surprised. The performance and handling was good. When flown by capable pilots, the aircraft was more than a match to Allied fighters.

The Long-Nosed Dora is considered the best mass-produced late-war Luftwaffe fighter. In total, over 700 Doras were produced out of a total Fw 190 production run of over 20,000.

To this day it remains one of the most recognizable shapes in the skies, and one of the most influential aircraft designs of the entire aviation era.

AIRCRAFT OVERVIEW

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General Description

The Focke-Wulf Fw 190 D-9 fighter aircraft is a single-seat, low wing monoplane powered by a 12-cylinder liquid-cooled inverted Vee inline Jumo 213 A-1 engine. The engine is equipped with a single stage, two-speed supercharger and an automatic manifold pressure regulator. The engine spins a three blade constant speed propeller.

The powerplant consists of a Jumo engine that delivers approximately 1,776 horse power at 3,250 RPM. This could be further increased to 2,240 horse power by the use of MW-50 water-methanol injection. Maximum emergency power in level flight was 1,600 horse power at 3,250 RPM.

The fuselage is a semi-monocoque, all-metal structure. The forward section to the rear of the cockpit had four longerons and a horizontal partition dividing the cockpit from the fuel tank. The rear section of the fuselage was a conventional monocoque structure with light alloy frames. The entire structure is covered with light alloy stressed skin.

The wings comprised an all-metal structure with two main spars. Light alloy Frise-type ailerons with fabric covering are fitted. The split trailing-edge flaps operate electrically and depress 10 degrees for take-off and 60 degrees for landing.

The tail unit is an all-metal tailplane that continues through the fuselage and can be adjusted for incidence. The all-metal stressed skin tailplane is integral with the fuselage. The control surfaces are light alloy with fabric covering.

The armament consists of twin fixed synchronized 13mm Rheinmetall-Borsig MG 131 machine guns with 475 rounds per gun mounted above the engine cowling, and twin fixed synchronized Mauser MG 151/20 cannon with 250 rounds per gun mounted in the wing roots.

Specifications for the Fw 190 D are:

- Wing Span – 10.5 m
- Overall length – 10.24 m
- Empty Weight – 3490 kg
- Loaded Weight – 4830 kg
- Wing area – 18.3 square m

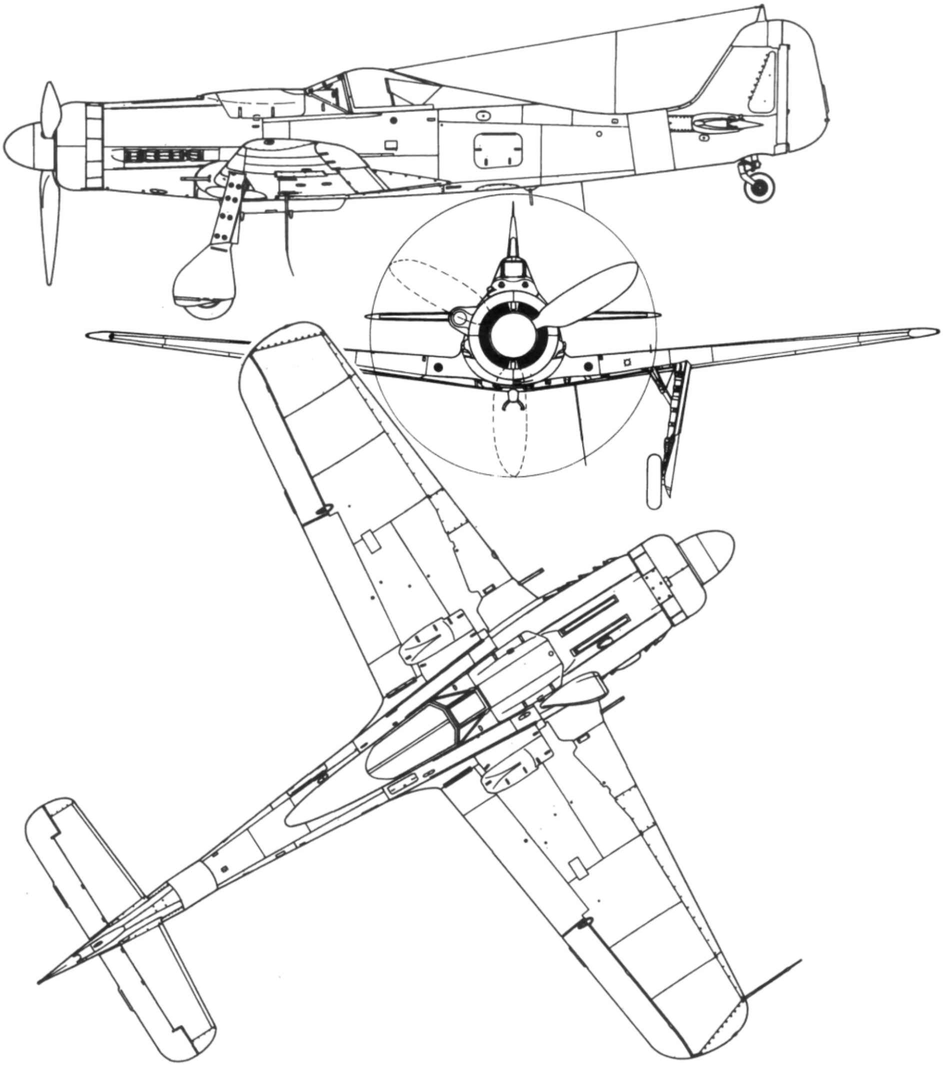


Figure 4: Fw 190 D-9 Drawings

Fw 190 D-9 Major Assembly Parts

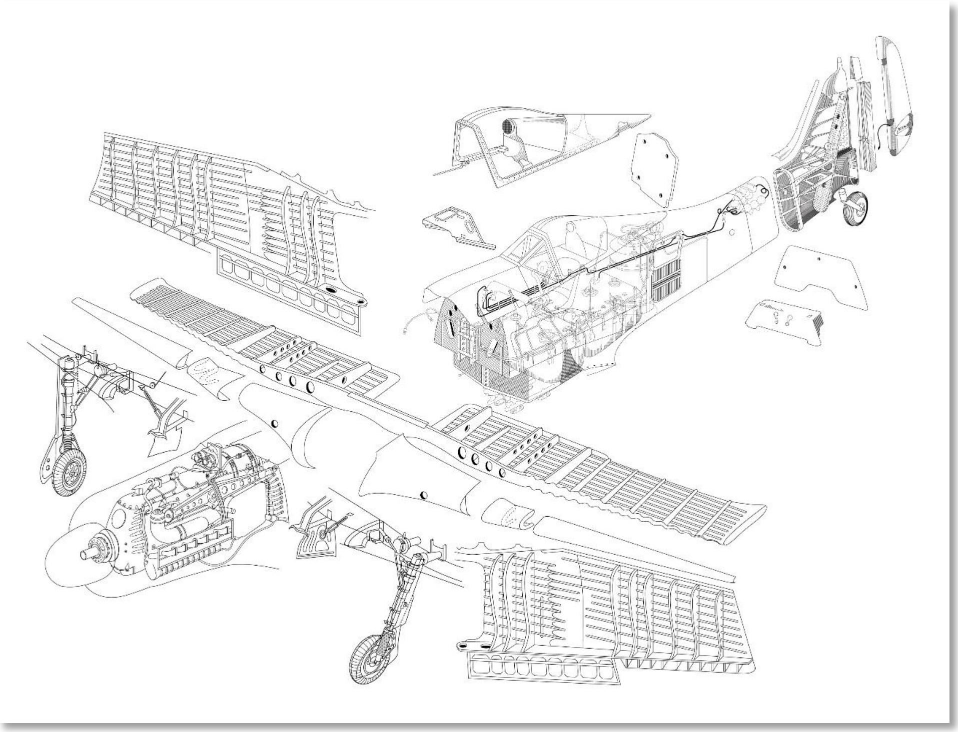


Figure 5: Major Assembly Parts

Fuselage

The Fw 190 has an all-metal semimonocoque fuselage. The fuselage is further divided by a partition behind the cockpit that separates the forward portion from the fuel tank. The forward cockpit section has four longerons between the front firewall and the rear bulkhead; the aft section, a conventional monocoque structure, contains shell segments that extend to the rear frame to which the tail section is attached. The entire fuselage is covered with light alloy.

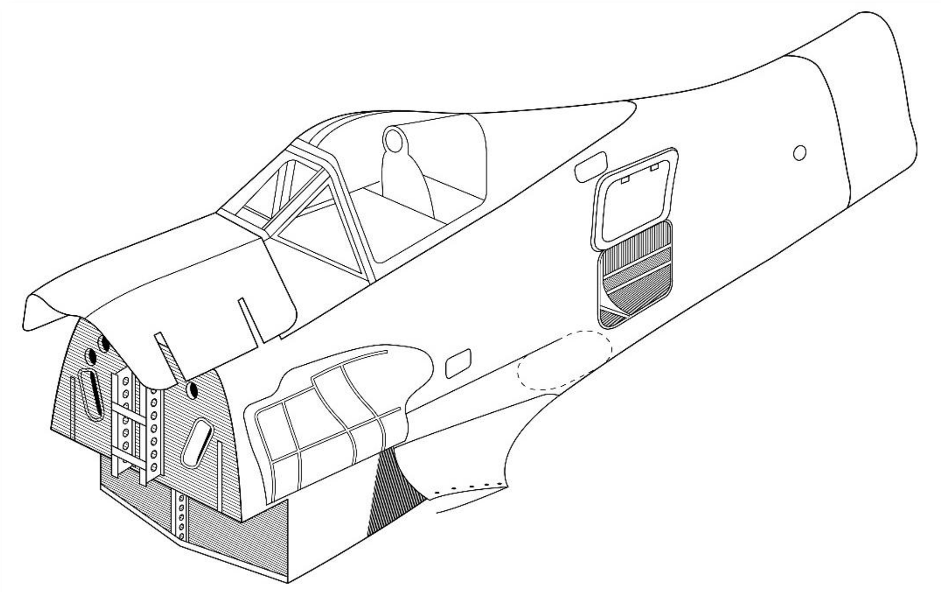


Figure 6: Fw 190 D-9 Fuselage

Canopy

The Fw 190 features a bulged plexiglass canopy on ball-bearing rollers. The rollers move along the fuselage upper decking. The front windscreen has a metal frame. The canopy features a piece of head armor protecting the pilot from gunfire from the rear.

The canopy can be opened or closed via a conventional hand crank found on the right-hand side of the cockpit. The canopy can also be jettisoned in an emergency via a jettison lever.

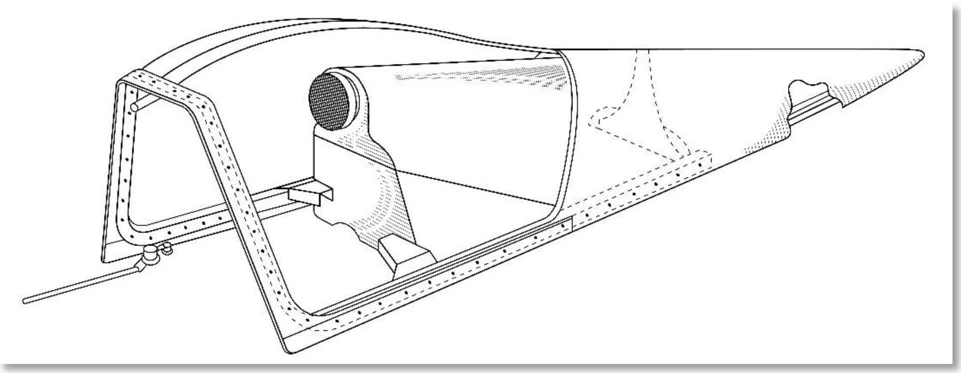


Figure 7: Fw 190 D-9 Canopy

Many earlier aircraft designs featured canopies consisting of small glass or Perspex planes in a “greenhouse” framework. That greatly limited visibility to all sides, especially the rear, and created blind spots. Advances in thermoforming that allowed for sheets of plastic to be vacuum-formed into complex shapes however led to a breakthrough in canopy design. Self-supporting bubble-type canopies could now be created, offering greatly improved all-around visibility.

All Fw 190 versions offered such improved views. Initial prototypes and most A-series variants featured the pilot sitting higher up in the fuselage than in many other contemporary aircraft, with only a single metal frame blocking his view where the sliding canopy met the windscreen.

Further advances created an even better solution, first tried on the F-2 ground attack variant of the Fw 190 and quickly adapted to other variants such as the A-8 and F-8. This new canopy used outward bulges on the sides of the cockpit that allowed the pilot to see more of the battlefield to the front and sides. Most useful when attacking ground targets, this also offered clear advantages in air combat. Sometimes incorrectly called a bubble canopy, the new design had more in common with the Malcolm Hood used on later variants of the Supermarine Spitfire and the P-51B and C.

The new bulged canopy also included improved head armor within reinforced bracing structure.

Both canopy types were used in the D-series of the Fw 190. First production examples shipped with the earlier flat-top canopy. Later production series used the improved bulged canopy design.

Wing

The Fw 190 D-9 has an all-metal monocoque wing with two spars. The main spar runs through the fuselage and connects the two wing panels. The rear spar consists of two sections, each attached to the fuselage.

Horizontally, each wing is divided into the upper and lower shells. The lower shell contains the main spar, while the upper shell contains the rear spar.

The interior of each wing contains the wing guns, the landing gear, aileron and flap controls and drive motors. The wings are further strengthened with wing ribs to which the shells are attached.

The main spar also holds the mounting points for the wing guns and the landing gear.

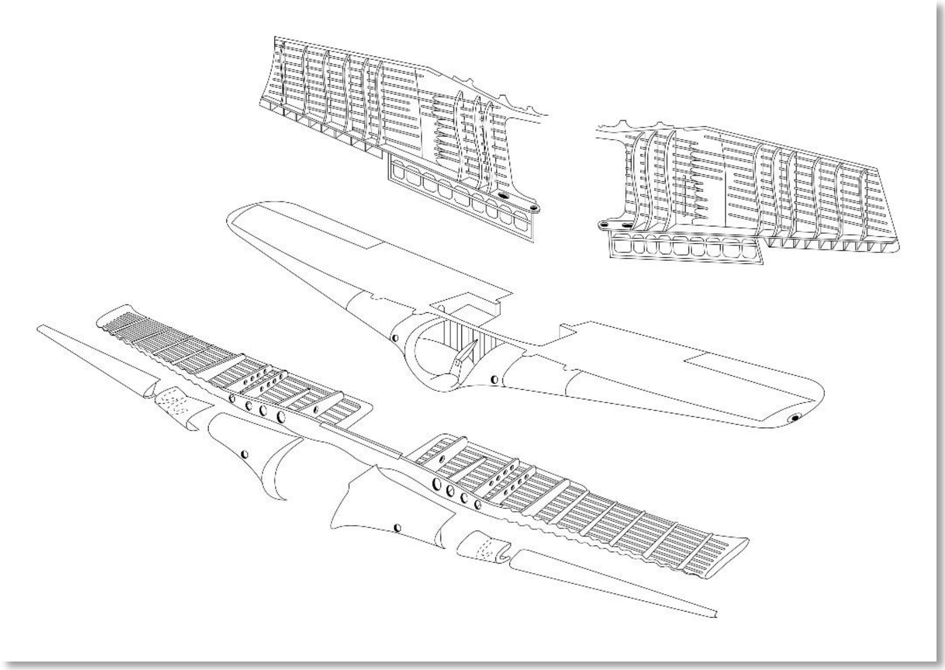


Figure 8: Fw 190 D-9 Wings

Tail Section

The Fw 190 D-9 has an all-metal tail unit that contains both the tail unit and the vertical stabilizer. It is attached to the rear fuselage attachment bulkhead.

The main load-bearing section of the vertical stabilizer is a diagonal spar, to which the all-metal horizontal stabilizer and the tailwheel assembly are attached.

The fabric-covered rudder contains a metal frame with a spar and seven ribs. It has both aerodynamic horn balancing and mass balancing. There is also a trim tab; due to the aircraft being generally very stable in flight, the trim tab is only adjustable on the ground.

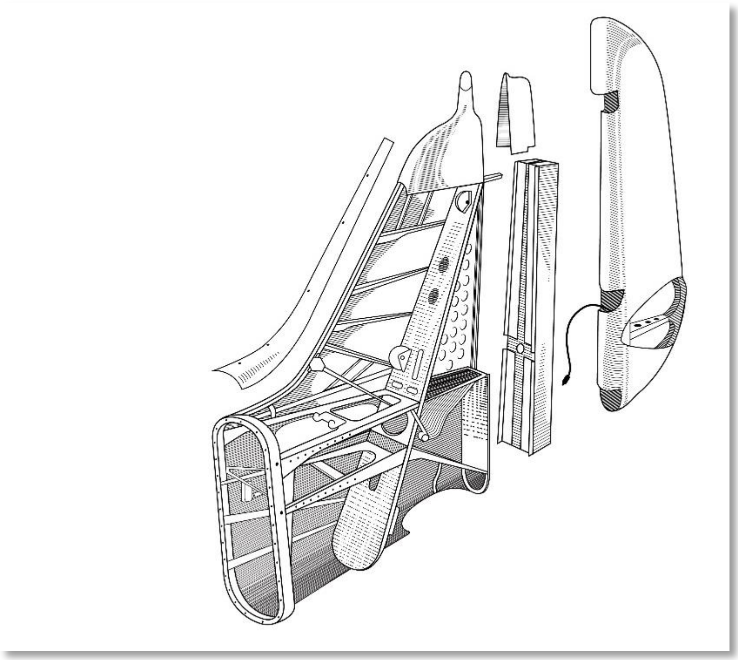


Figure 9: Fw 190 D-9 Tail Section

Flight Controls

The control unit assembly consists of the horizontal stabilizer and elevators, the vertical stabilizer and rudder, the ailerons, and the flaps.

The Fw 190 D-9 has a conventional control scheme with surfaces that include a vertical stabilizer, rudder, horizontal stabilizer, two elevators, two ailerons, and flaps.

As the Fw 190 D-9 is generally very stable in flight, only the horizontal stabilizer has trim adjustable in flight. Other control surfaces have trim tabs that can be adjusted on the ground.

The control system for the aircraft is advanced for its age and uses a system of push rods and control cables. Compared to a conventional pulleys and cables system, the controls in the Fw 190 D-9 are lighter and more precise.

The control system uses differential bell cranks that transfer control movement near the center position into finer control surface movement, while control movement is magnified as the controls approach their limit.

The flight stick can be moved forwards and backwards in conventional fashion to control the elevator. It can be moved 20 degrees forward and 21 degrees rearward.

The flight stick can also be moved sideways to control the ailerons in conventional fashion. Aileron deflection is limited by mechanical stops in the control stick mounting base.

Flap position is controlled via pushbuttons on the left-hand side of the cockpit.

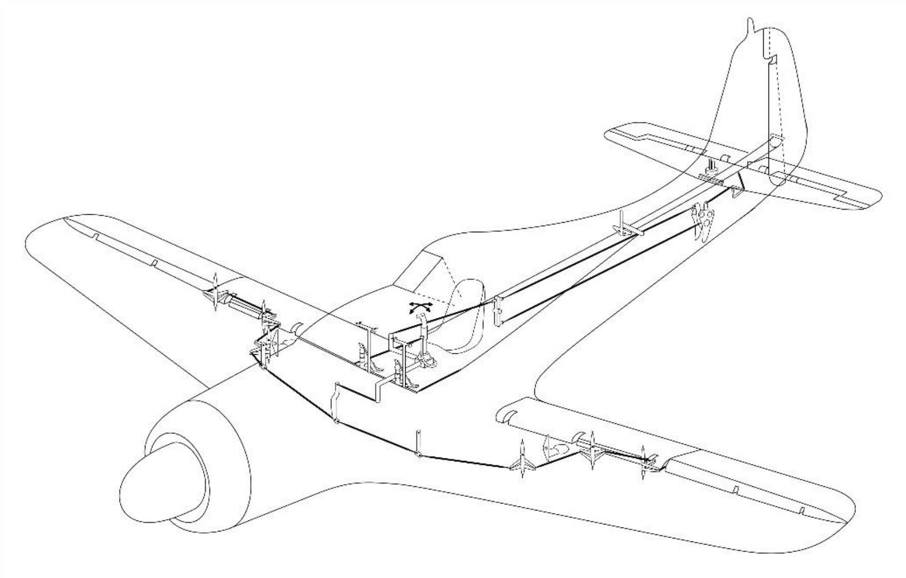


Figure 10: Fw 190 D-9 Control Cables

The horizontal stabilizer can be adjusted in flight to compensate for changes in aircraft trim. The operation is via an electric motor mounted within the vertical stabilizer.

The horizontal stabilizer trim switch is located on the left-hand side cockpit console. The motor is run as long as the button is depressed, and until the limit position is reached. The actual position of the stabilizer is shown via the corresponding indicator.

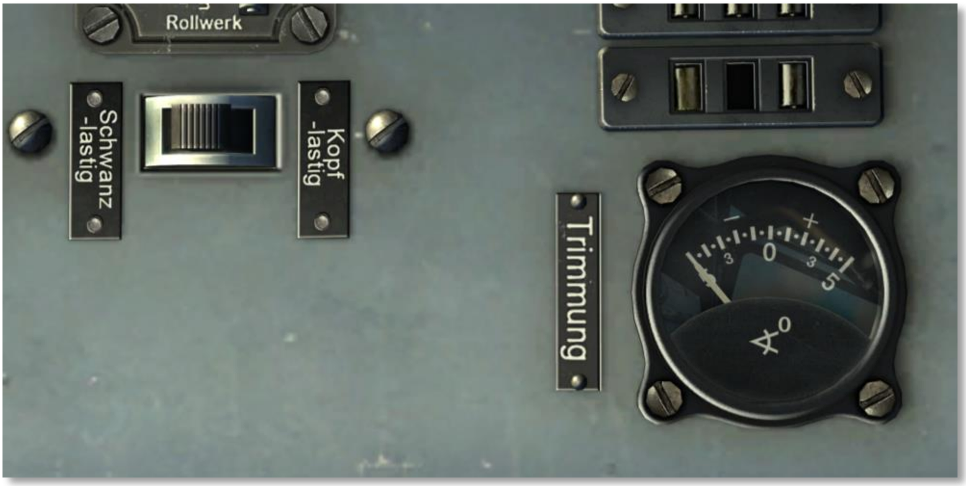


Figure 11: Horizontal Stabilizer Trim Switch and Position Indicator

The trapezoidal elevator unit has a symmetrical airfoil.

The horizontal stabilizer is actuated by a spring-loaded switch located on the cockpit's left-hand side and can be moved between +2 and -3 degrees in flight.

The elevator comprises two identical half units, each attached to the stabilizer via pivot bearings. The elevator is aerodynamically balanced as well as mass balanced. The elevator has a trim tab that can only be adjusted on the ground.

The center-mounted fabric-covered rudder has aerodynamic horn balancing as well as mass balancing, and has a trim tab that can only be adjusted on the ground.

Frise-type ailerons made of light alloy with fabric covering are similar to the other control surfaces in construction. They also have mass balancing and a trim tab that can only be adjusted on the ground.

The landing flaps are of the split-type design and are identical, i.e. the right and left landing flap are interchangeable. They are operated electrically and can be set to three positions in flight: cruise, take-off, and landing. The standard take-off setting is 10 degrees of deflection; the landing setting is a full 60 degrees. There are no interim settings available to the pilot.

Landing Gear

The landing gear is of the inward retracting type, with the main wheels being housed ahead of the front spar when raised. The tailwheel is semi-retractable and is interconnected with the main wheels to synchronize retraction which is achieved by electrical means.

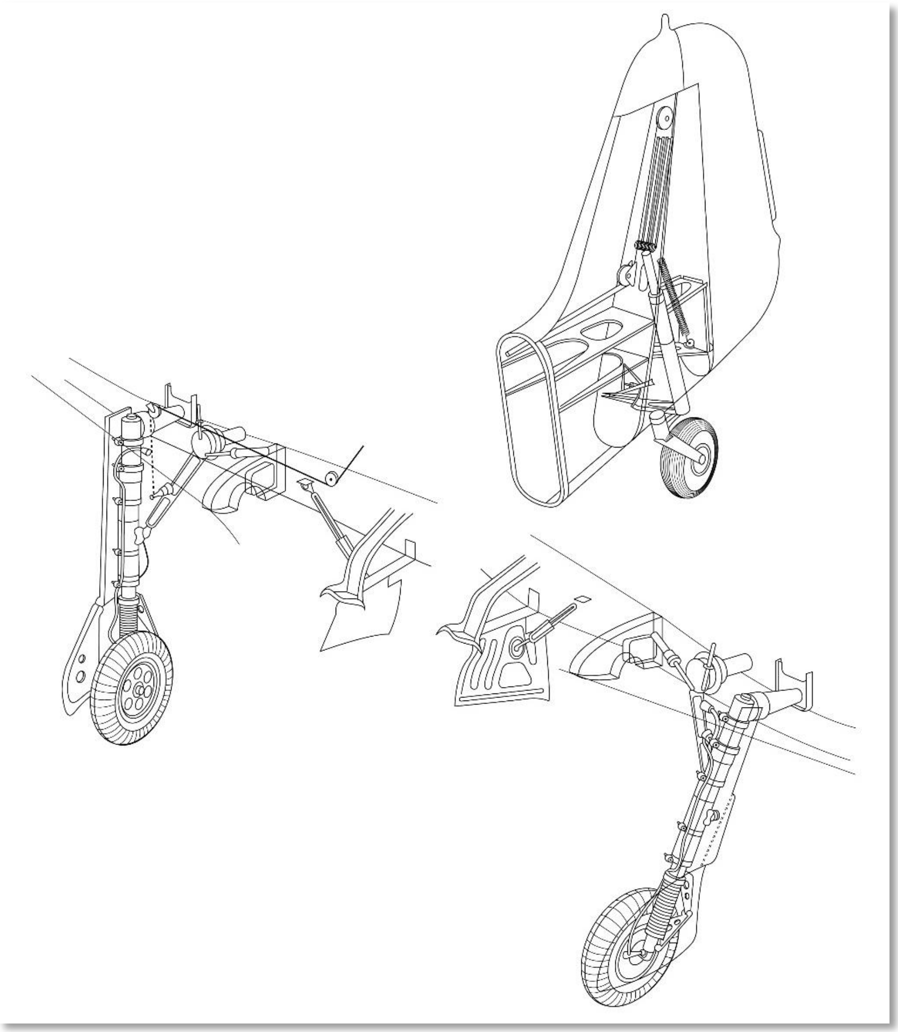


Figure 12: Fw 190 D-9 Landing Gear

The gear is extended or retracted electrically. A cable attached to the right main landing gear unit also retracts the tail wheel simultaneously with the main gear.

The main gear consists of two shock struts, with a scissors unit connecting the upper and lower shock strut members to absorb torque stresses.

Each main gear strut is operated individually by a drive unit powered by an electric motor mounted on the main spar.

A conventional tailwheel is also provided. It can be rotated 360 degrees and has a centering lock.

Both main gear members are secured in place by powerful locking hooks when retracted. The tailwheel is not locked in the up position, but is held in place by the tension of the retraction cable.

Undercarriage lowering is aided by a drive unit connected to a sealed air jack.

The undercarriage is controlled by simple pushbuttons located on the cockpit's left-hand side.

To raise the landing gear, simply depress the corresponding "Ein" (On/In) button and wait for the operation to complete. Once the gear is locked in position, red lights illuminate on the undercarriage indicator unit.

To lower the landing gear, depress the corresponding "Aus" (Off/Out) button and wait for the operation to complete. Once the gear is fully extended, green lights illuminate on the undercarriage indicator unit.

In case of electric motor failure, the main gear can also be lowered by pulling the emergency gear extension handle. This unlocks the shock struts which can then extend with the help of gravity and sealed air jacks.

The tailwheel is retracted simultaneously with the main gear.

When retracted, the lower half of the tailwheel remains exposed. In case of emergencies, it can be used as a tail skid.

Brake System

The Fw 190 D-9 has hydraulically operated brake shoes on each of the two main wheels. Each has its own hydraulic lines and can be braked individually.

The entire system is conventionally operated via rudder pedals.

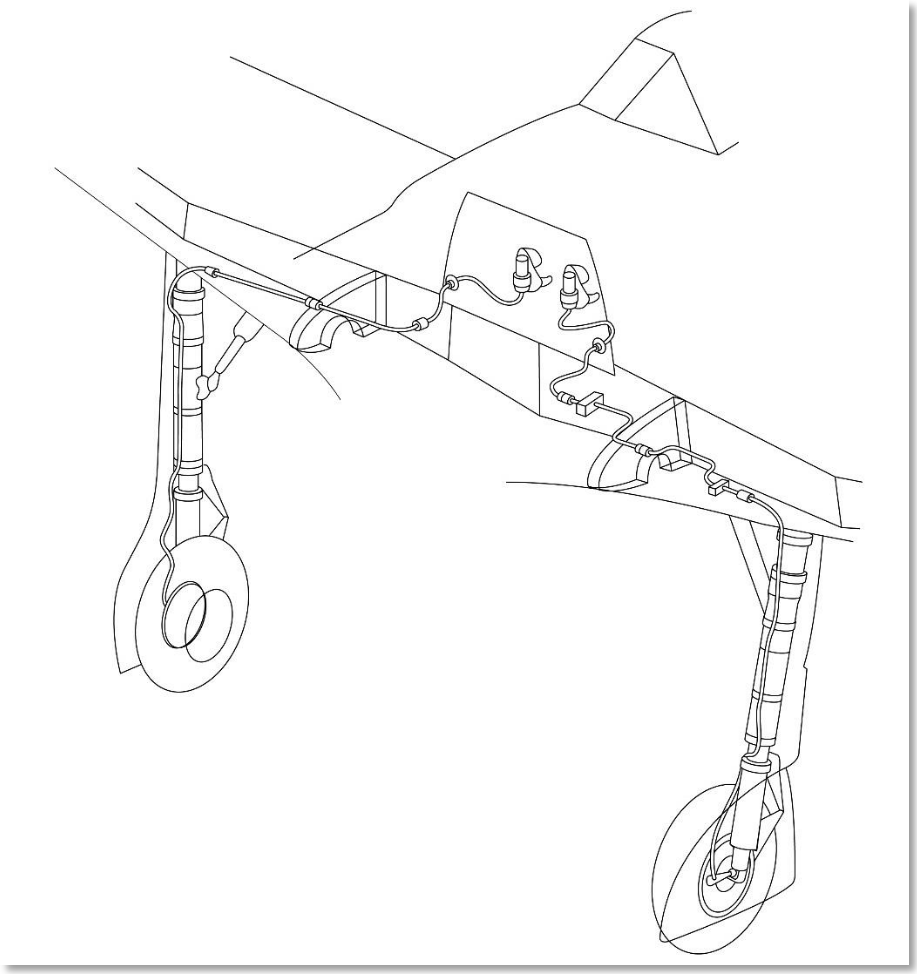


Figure 13: Fw 190 D-9 Brake System

Engine

The Fw 190 D-9 is powered by a Junkers Jumo 213 A-1 engine, a 12-cylinder liquid-cooled inverted inline Vee. The Jumo 213 features a single stage, two-speed supercharger and an automatic manifold pressure regulator. The engine drives a three-blade constant-speed propeller.

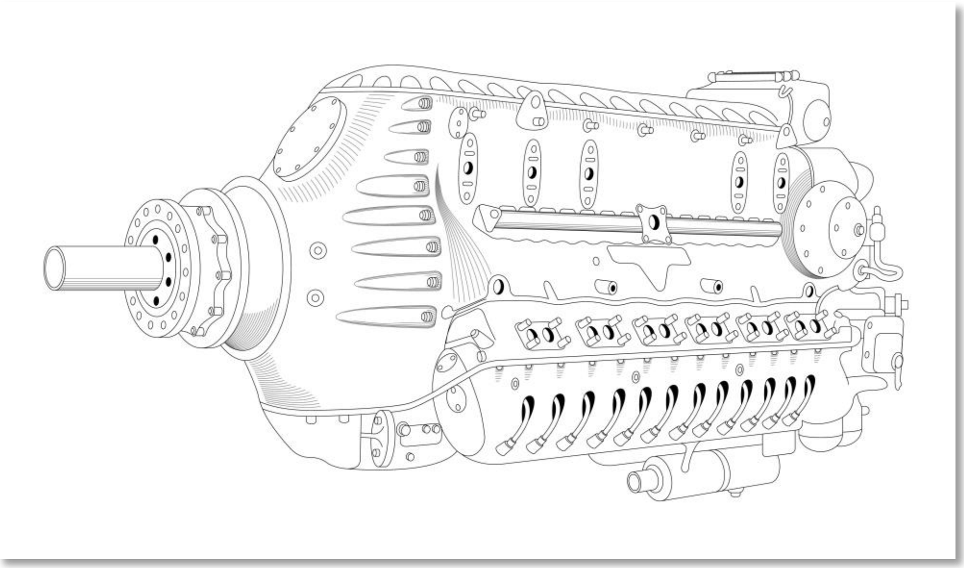


Figure 14: Junkers Jumo 213 A-1

Like most German aero engines, the Jumo 213 did not have a carburetor, but featured direct fuel injection.

Bediengerät Engine Control Unit

The Junkers Jumo 213 engine comes equipped with a "Bediengerät" (engine control unit). It is similar in function to the "Kommandogerät" (command device) used on BMW-801-powered earlier variants of the Fw 190.

The "Bediengerät" is a hydromechanical multifunction integrator that dramatically simplifies engine control. While in most other contemporary aircraft the pilot had to constantly operate a slew of levers to manage throttle level, propeller pitch, fuel mixture, and supercharger stages, the "Bediengerät" takes the majority of the workload away. The pilot simply has to move the throttle lever to set the desired manifold pressure. The "Bediengerät" takes care of the rest, setting all other parameters to allow the engine to properly operate at the desired manifold pressure, given the current flight conditions.

The gauge used to monitor desired supercharger pressure is the Supercharger Pressure Gauge to the right of the front dashboard labeled "ATA" (for "Absolute Technische Atmosphäre", an obsolete unit of pressure).

Additional controls are also available that allow for some Engine Control Unit parameters to be manually finetuned.

Supercharger

The Junkers Jumo 213 engine is equipped with a single stage, two speed centrifugal supercharger with MW-50 Water-Methanol injection.

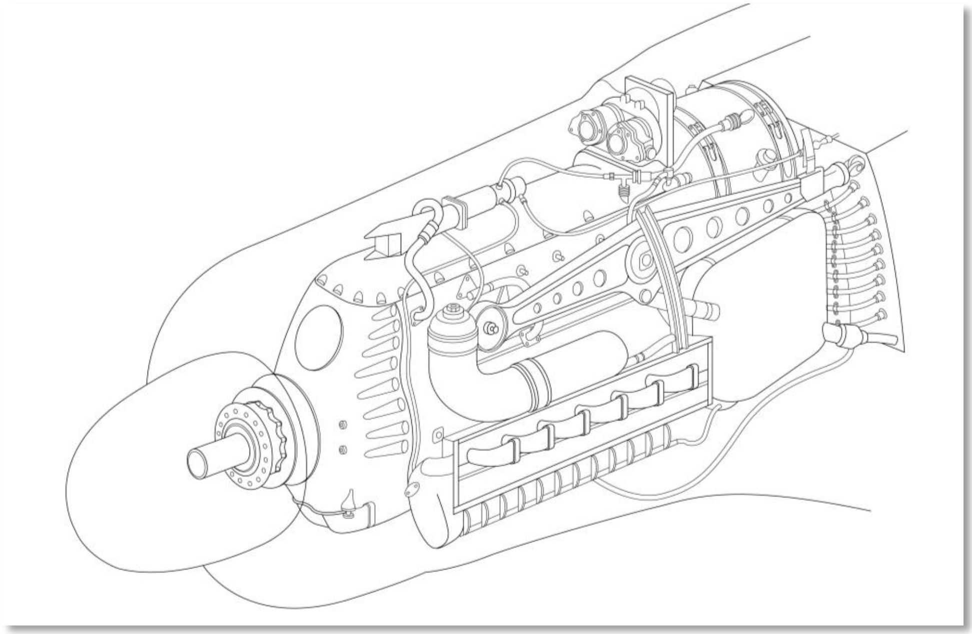


Figure 15: Junkers Jumo 213 A-1 assembly

Critical height is approx. 5500 meters.

MW-50 Water-Methanol Injection

MW-50 (MethanolWasser 50) is a 50-50 mixture of methanol and water sprayed into the Fw 190 D-9's supercharger, allowing the use of increased boost pressures.

The MW-50 tank has a capacity of 115 liters (85 kg). The fluid flow is about 160 liters/hour.

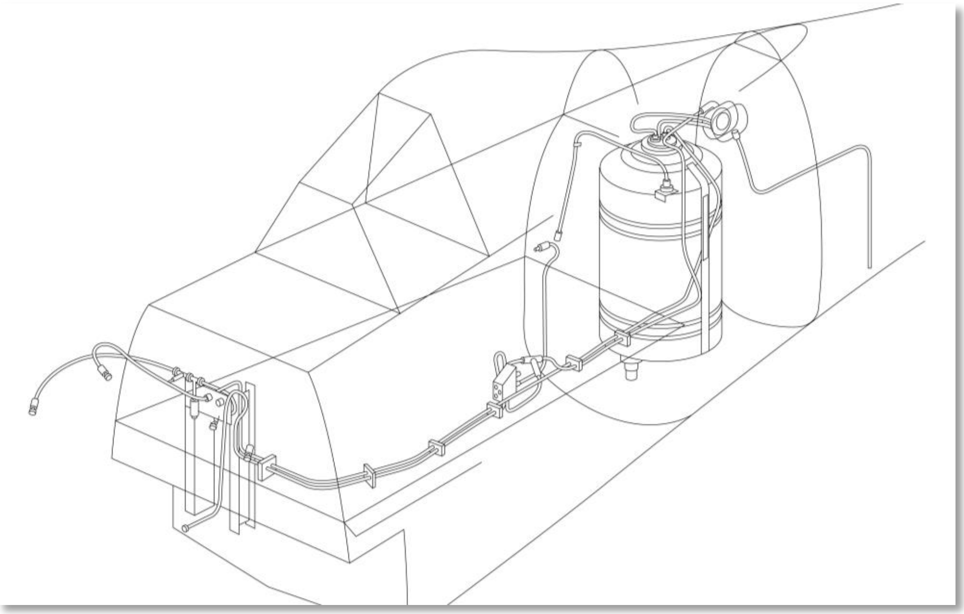


Figure 16: MW-50 System Diagram

The primary effect of the MW-50 mixture spray is cooling of the air-fuel mixture.

The secondary effect of the MW-50 mixture spray is its anti-detonant effect, which is how the increase in boost pressure is achieved.

While the secondary boost-increasing effects deteriorate with altitude, the primary cooling effects are still noticeable. Therefore, the MW-50 system can be used to cool down the air-fuel mixture at all altitudes in the event of an emergency.

The boost provided by the MW-50 begins to decrease in power at altitudes above 6,000 meters.

Figure 17: MW-50 Switch

Figure 18: Water/Methanol Pressure Gauge

The boost increase provided by MW 50 can be described with the word "incredible".

Turning the system on increases engine power by almost 100 HP due to the fact that a cooler mixture can pull in more air. At the same time it enables much higher supercharger boost levels. In optimal conditions, both effects combined increase engine power by a whopping 350…400 HP.

Please note that the MW 50 tank can also be used to store conventional aviation fuel, in essence providing extra range at the expense of available extra power.

The MW-B4 Selector on the left console is used to set the MW 50 tank status. Please note that incorrectly setting this switch can have catastrophic results, by either feeding the water-methanol mixture into the fuel lines, or spraying aviation fuel into the supercharger.

Propeller

The Junkers Jumo 213 A-1 engine drives a three-bladed V.D.M VS 111 constant speed propeller with wood blades. Propeller diameter is 3.5 meters.

Fuel System

The Fw 190 D-9 has two main tanks, forward (Vorn) and rear (Hinten), both conveniently located below the cockpit floor underneath the pilot's seat. The fuel tanks are self-sealing. Engine-driven pumps feed the fuel into the engine at a normal pressure of 1 to 2 kg/cm^2. There is also an electrical booster pump in each of the two tanks that prevents vapor lock at altitude, provides improved fuel supply and can serve as a back-up in case of main pump failure.

The tanks have a capacity of 232 liters (172 kg) front (Vorn) and 292 liters (216 kg) rear (Hinten).

The Fw 190 D-9 can also carry an external drop tank under the fuselage with the capacity of 300 liters.

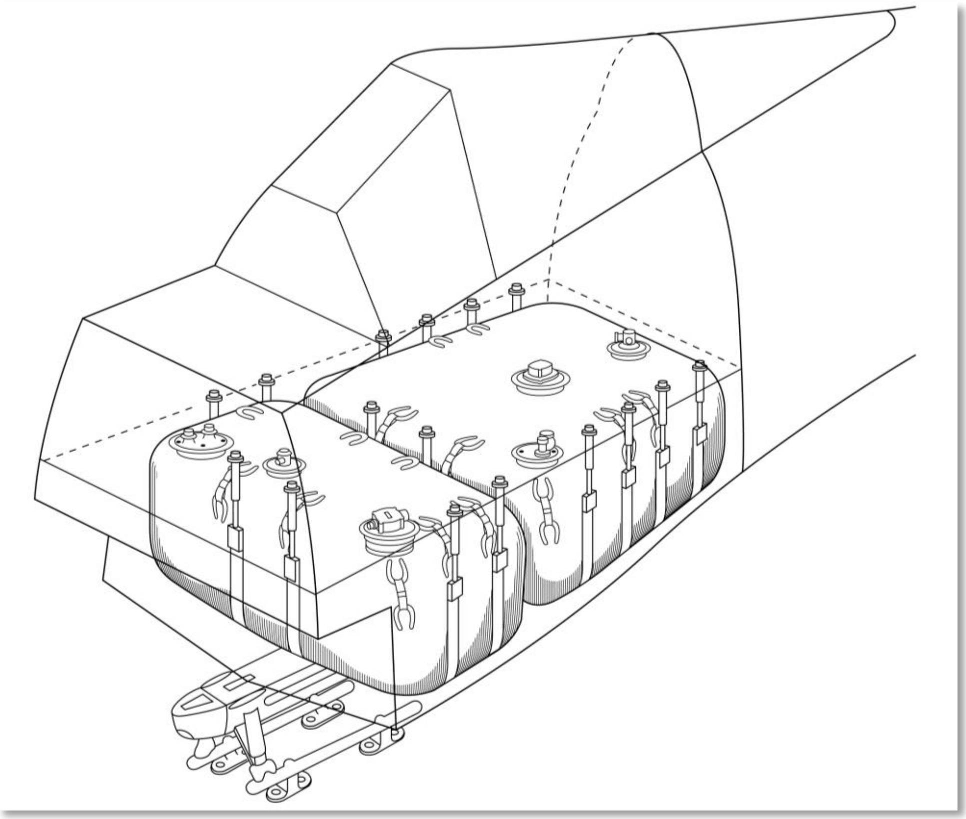


Figure 19: Front and Aft Fuel Tanks

The fuel system operates on a simple principle. Front and rear fuselage tanks feed into the engine's main pump. A Fuel Selector lever located on the left side of the Front Dash allows the pilot to manage the system.

Figure 20: Fuel Selector Lever

A single Fuel Contents gauge is also provided on the Front Dash. It can be switched to show the contents of the rear or the forward tank at any given time. The Fuel Gauge Selector Switch located to the right of the Fuel Contents Gauge can be used to switch between the two modes.

Figure 21: Fuel Contents Gauges

A Fuel Pressure gauge is also provided that monitors the fuel pressure as fed from the main fuel tank to the engine.

Finally, Fuel Warning Lights are also provided for each of the tanks. The top light labeled "vorn" illuminates when the fuel level in the front tank reaches approximately 95 liters.

The bottom light labeled "hinten" illuminates when the fuel level in the rear tank reaches approximately 10 liters.

Figure 22: Fuel Warning Lights, and Fuel Gauge Selector Switch

The engine consumes the fuel from a tank that is open according to position of the fuel selector.

If drop tanks are used, their fuel pump, in turn, feeds the rear tank.

The pipe that feeds from the drop tank to the rear tank actually connects to a special limiting valve, mounted in the rear tank. If the plane carries a drop tank, that limiting valve will only open when the rear tank content drops below 240 liters.

At first, no fuel is consumed from the drop tank, because the limiting valve is closed. So in the beginning fuel will be consumed from the rear tank, until its level drops to 240 liters. Only then, the limiting valve will open and allow fuel from the drop tank to feed into the rear tank. When the drop tank is empty, the fuel level in the rear tank will drop below 240 liters – this is the indication that the drop tank is empty.

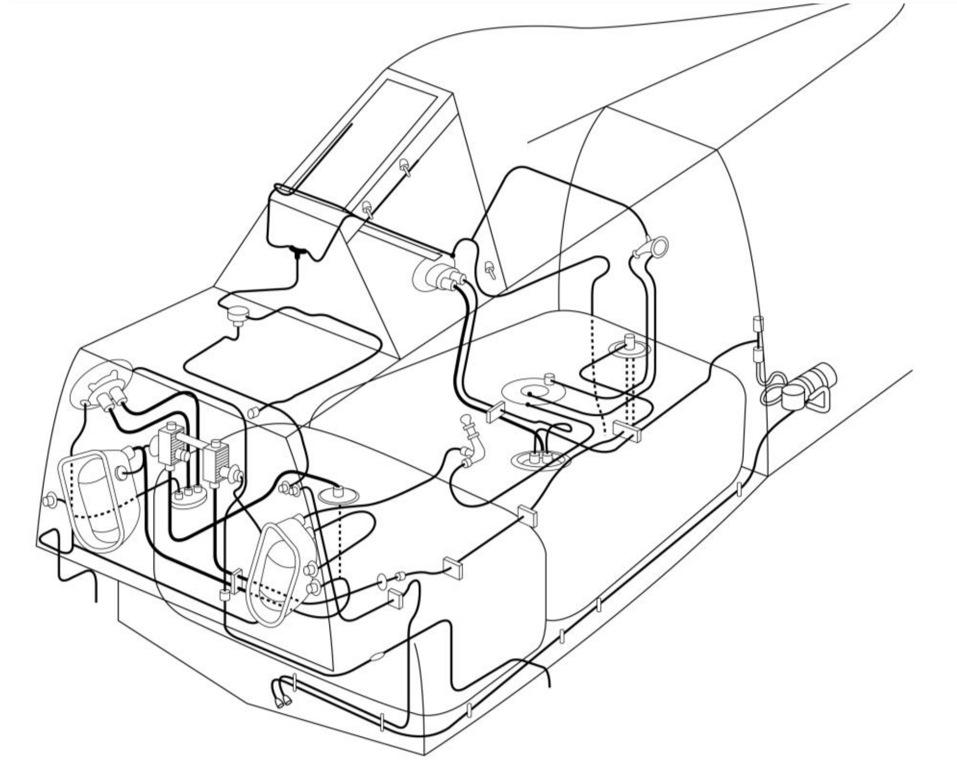


Figure 23: Fuel System

Oil System

A 55-liter oil tank is located in the left side of the engine. The air oil cooler isn't present. Oil is cooled by engine coolant in the special heat exchanger.

Two cockpit gauges are provided, both located on the Front Dash. The Oil Temperature gauge monitors the system with the normal operating temperature range of 110…130 degrees Celsius (min – 40, max – 135 degrees). The right-hand side of the Fuel and Oil Pressure gauge monitors the oil system with the normal operating pressure of 5 – 11 kg/cm^2.

Figure 24: Fuel and Oil Pressure, Coolant Temperature and Oil Temperature Gauges

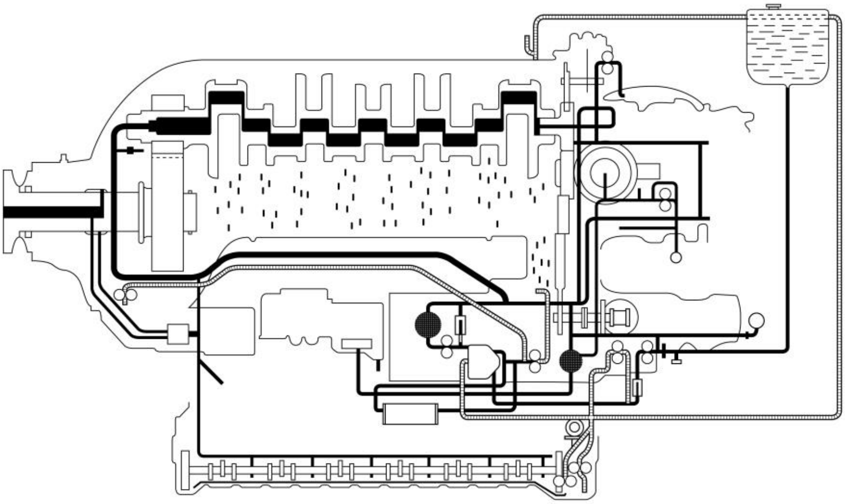


Figure 25: Oil System Diagram

Coolant System

The D-series of the Fw 190 uses the AJA 180 annular radiator with the capacity of 115 liters. It is installed in front of the engine.

The Jumo 213 coolant system has both the main system, consisting of the coolant pump, engine, radiator, and the heat exchanger; as well as the secondary system with the secondary flow pump, coolant pump, and the coolant tank. The two systems only interact within the coolant pump.

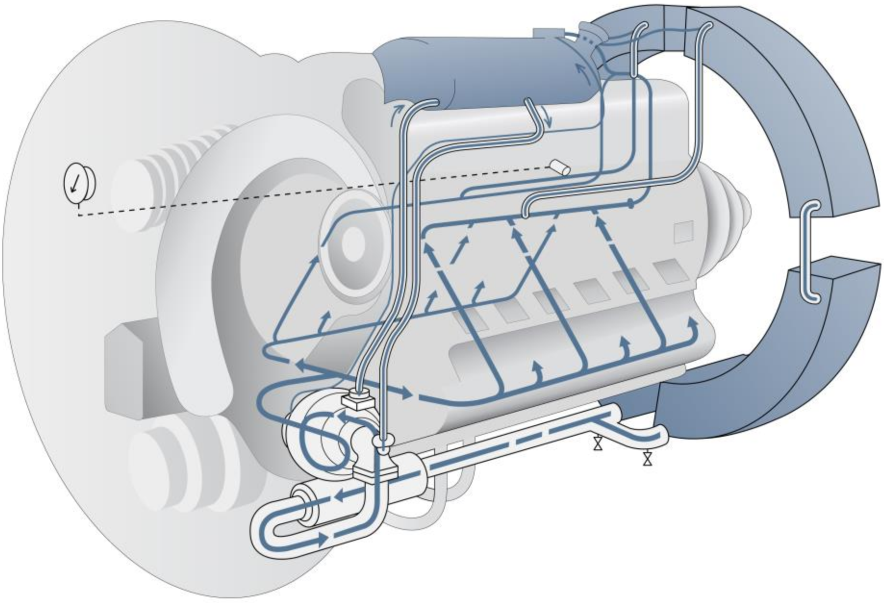


Figure 26: Coolant System Diagram

The coolant system attempts to operate at a temperature of about 100°C at all altitudes. A built-in electric temperature sensor between the engine and the radiator is used to control the temperature.

Proper pressure is required in the cooling system to prevent unwanted vapor formation. Any steam that may occur is separated in the Vapor Air Separator of the coolant pump and then sent to the secondary system coolant tank where it is condensed.

However, if the boiling limit in the coolant tank is exceeded, the pressure begins to rise. Therefore, the pressure and temperature gauges should be watched at all times to avoid overheating and possible engine damage.

To avoid excessive pressure, the cooling system has a pressure-controlled pressure regulating valve which also performs the task of maintaining pressure at greater altitudes via the evaporation of the coolant in the coolant tank.

Electrical System

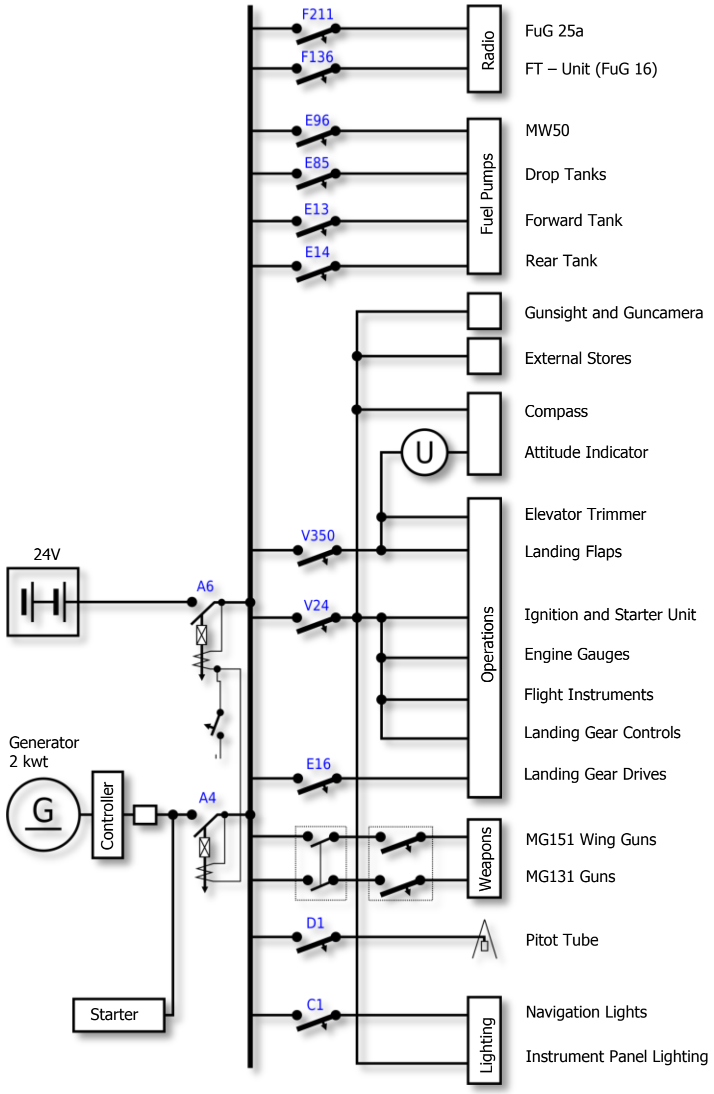


Figure 27: Electrical System Diagram

Oxygen System

The oxygen system consists of a cockpit-mounted flow valve with the attached flow monitor, the regulator unit with oxygen hose, and high-pressure lines with pressure gauge, and a set of spherical bottles located in the aircraft tail that contain the oxygen. The bottles are split into separate systems as an additional safety measure.

Figure 28: Oxygen Flow Indicator and Pressure Gauge

Opening the flow valve starts the flow of oxygen. Oxygen flows to the regulator unit. The provided Flow Indicator and the Pressure Gauge located on the right-hand side of the Front Dash correspondingly indicate system status.

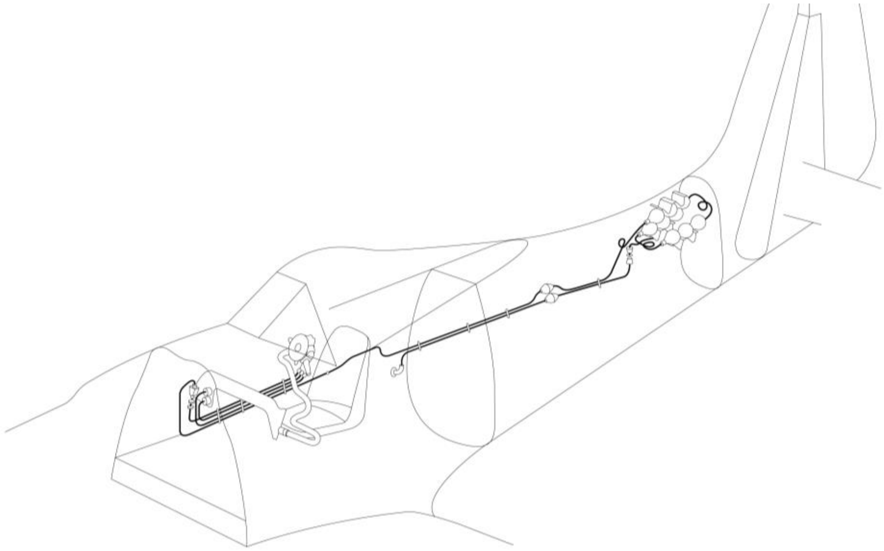


Figure 29: Oxygen System Diagram

Radio Equipment

The aircraft is equipped with a FuG 16ZY radio, a specially-designed airborne VHF transceiver. The FuG 16 can be used for in-flight communication and DF homing. The set operates in the frequency range between 38.4 and 42.4 MHz.

The FuG 16ZY can also be set to "Leitjäger" or Fighter Formation Leader mode that allows it to use a special "Y-Verfahren" (ground tracking and direction finding method) via the normal headphones.

The AFN-2 component of the radio set allows easy navigation to ground-based homing beacons, showing both direction and range on one simple dial.

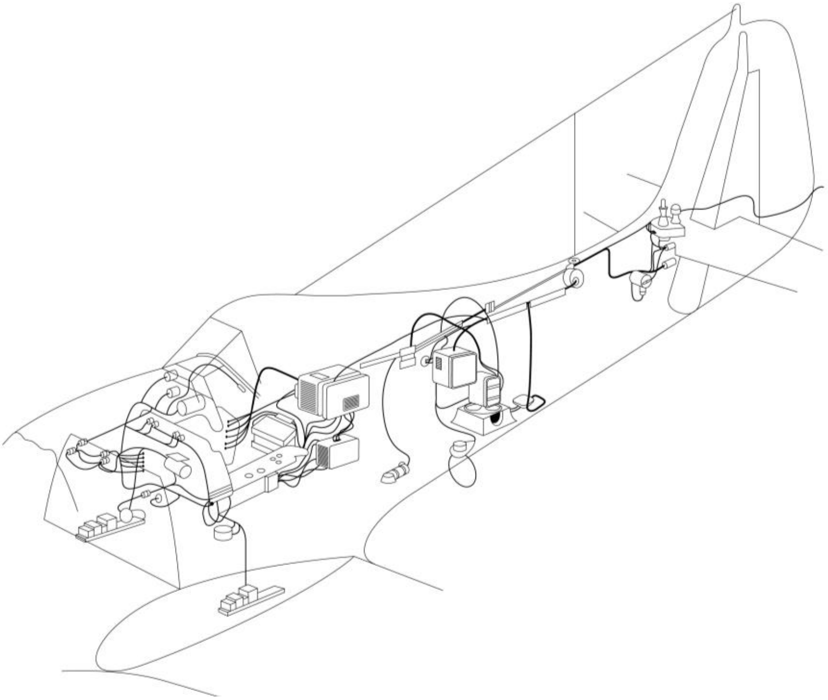


Figure 30: Radio Equipment Diagram

The FuG 25a "Erstling" (Debut) component is one of the world's first Identification Friend or Foe (IFF) units that allows ground-based radar to identify the aircraft as friendly. The unit receives impulses from "Freya" or "Würzburg" radar stations. When enabled and properly set with the day's codeword, the FuG 25a replies with a pre-defined signal that the ground station can process to identify the unit as friendly. The FuG 25a operates in the frequency range of 125 + / - 1.8 MHz, with the operating range of up to 100 km.

Figure 31: FuG 16ZY Frequency Selector, Receiver Fine Tuning Control, and Volume Control

Armor

The Fw 190 D-9 offers plentiful all-around pilot protection that includes an armored headrest, armored seat back, as well as a set of armor plating around cockpit walls.

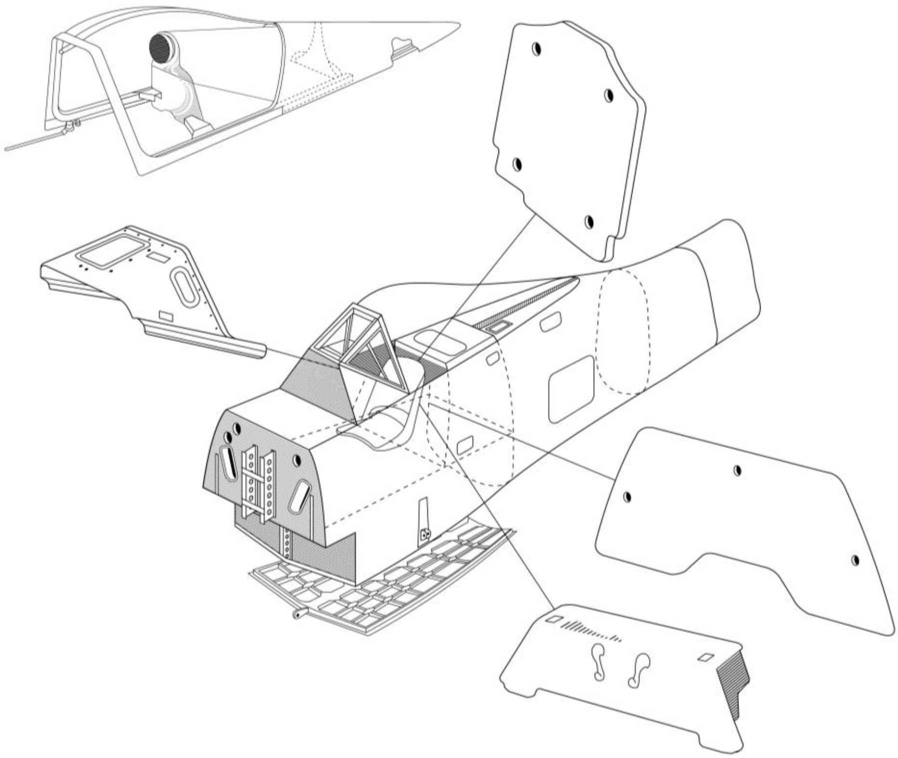


Figure 32: Fw 190 D-9 Armor

Armament

The Fw 190 D-9 carries powerful fixed armament that consists of twin synchronized 13mm Rheinmetall-Borsig MG 131 machine guns above the engine cowling with 475 rounds per gun, and twin synchronized Mauser MG 151/20 cannon in the wing roots with 250 rounds per gun.

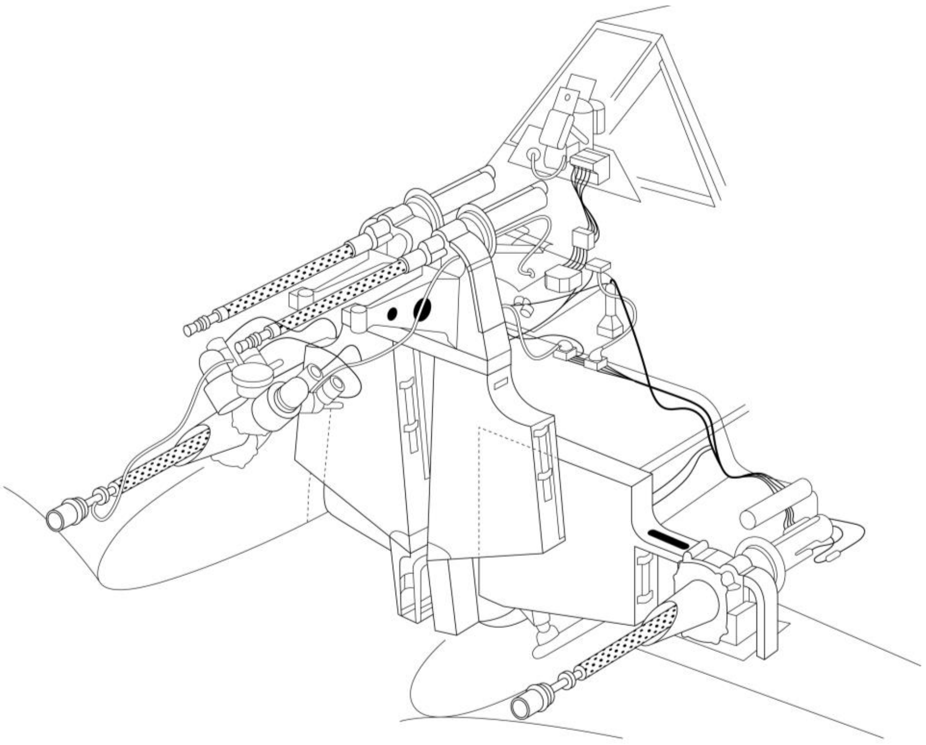


Figure 33: Fw 190 D-9 Armament

Cockpit equipment for the armament includes the EZ 42 gunsight as well as the SZKK 4 ammunition counter.

The SZKK 4 ammunition counter is from the SZKK (Schalt-, Zähl- und Kontrollkasten) family of German indicators used on many Luftwaffe aircraft during WWII. While most pilots from other air forces had to estimate the amount of ammunition remaining in their weapons, German pilots had the luxury of seeing the actual amount of ammunition in their stores right in their cockpit.

The Fw 190 D-9 is also equipped with the pioneering EZ 42 gunsight that is roughly equivalent to the well-known K-14 gunsight used on the North American P-51D Mustang.

The design history of the EZ gunsight began before the war, but the Reich Air Ministry continued to focus on conventional reflector sights, installing the ubiquitous REVI sight on most aircraft.

"Einheitszielvorrichtung" (Target Predictor Unit) development remained low-priority until captured US aircraft showed that the Allies had predictor gunsights in operational use. Development took two long years, with first production EZ 42 units delivered in spring of 1944.

803 EZ 42 gunsights were produced in total until production ceased in March of 1945.

Figure 34: Flight Stick, Trigger, and Bomb Release Button

A conventional flight stick is provided with a conventional trigger that allows the pilot to fire on-board armament as needed.

The stick also contains the Bomb Release Button that can be used to drop the bomb load, or fire the underwing rockets.

COCKPIT

Russische Jäger 10,0
Spitfire 11,2
Mustang 11,3
Hurricane 12,2
Thunderbolt 13,4
Lightning 14,8
Moskito 16,5
Boeing
Liberator 33,5
Rumpf
Rumpf
Gruppe
Schalter
Sinkt
Flügellast
Rumpflast
Notzug für Bedien-Getr.
Achtung
Kompaßeinstellring

COCKPIT

The cockpit in the Fw 190 D-9 was a revolutionary design that attempted to put all levers and instruments easily within reach. It was one of the first examples of ergonomic cockpit design, and can be seen as the early precursor of today's hands on throttle and stick (HOTAS) cockpits.

In stark contrast to its competitor, the Bf 109, the Fw 190 offered its pilot comfortable access to most important controls located easily within reach.

Figure 35: Fw 190 D-9 Cockpit Overview

The cockpit is divided into three main areas: the front dash that includes the instrument panel and the EZ 42 gunsight; the left-hand side that includes engine controls; and the right-hand side that includes canopy and oxygen controls, weapon controls, and electrical system breakers.

Front Dash Legend

The front dash includes the instrument panel and the EZ 42 gunsight.

Figure 36: Fw 190 D-9 Front Dash

1. EZ 42 Gunsight
2. Ammo Indicators
3. Artificial Horizon / Turn & Bank Indicator
4. Airspeed Indicator
5. Altimeter
6. FuG 25a IFF Control Unit (not implemented)
7. Stick
8. AFN-2 Homing Indicator

9. Vertical Speed Indicator
10. Repeater Compass
11. Supercharger Pressure Gauge
12. Tachometer
13. Oxygen Flow Indicator
14. Oxygen Pressure Gauge
15. Oxygen Flow Valve
16. Pedals

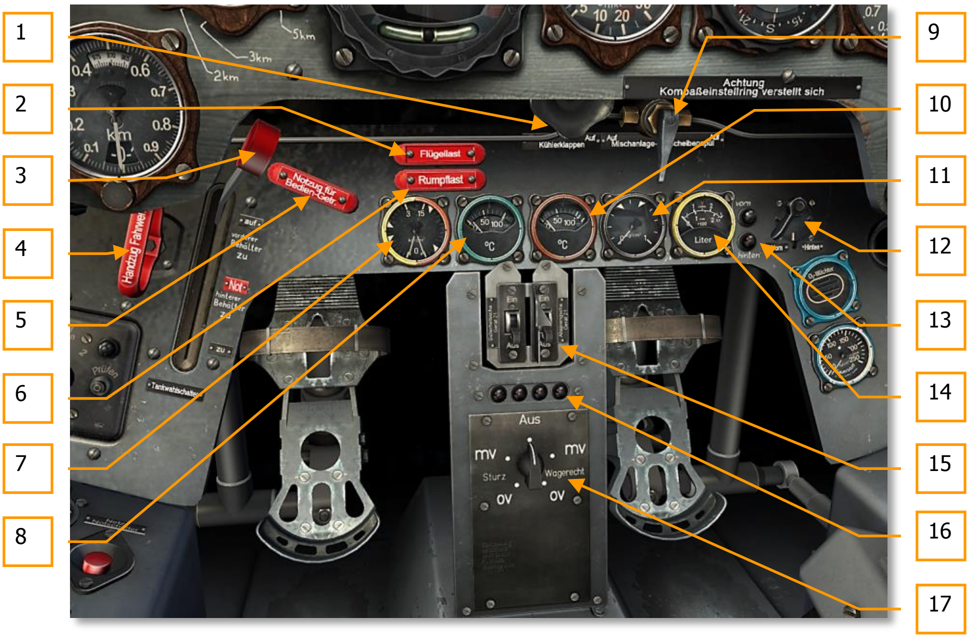


Figure 37: Fw 190 D-9 Front Dash Lower Part

1. Manual Radiator Flap Control
2. Emergency Wing Load Release
3. Fuel Tank Selector Lever
4. Landing Gear Manual Release
5. MBG Emergency Mode Handle
6. Emergency Fuselage Load Release

7. Fuel & Oil Pressure Gauge
8. Coolant Temperature Gauge
9. Cold Start and Window Rinsing (not implemented)
10. Oil Temperature Gauge
11. Water/Methanol Pressure Gauge
12. Fuel Gauge Selector Switch
13. Fuel Warning Lights
14. Fuel Contents Gauge
15. 21-cm Rocket Control Unit
16. Disposable Load Indicator Lights
17. Bomb Fusing Selector Unit

Left Side Legend

The left-hand side includes engine controls.

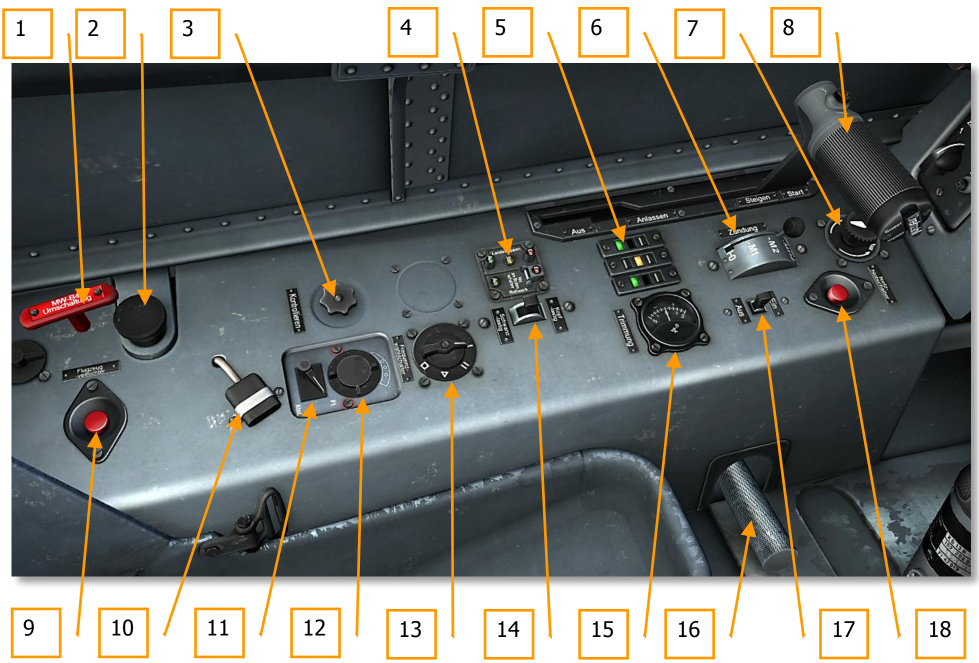


Figure 38: Fw 190 D-9 Left Side and Legend

1. MW-50 to Fuel Handle of water-methanol tank
2. Primer Pump Handle
3. FuG 16ZY Fine Tuning
4. Landing Gear and Flaps actuation buttons
5. Landing Gear (left and right) and flaps (center) indicators
6. Ignition (Magneto) Selector Switch
7. Instrument Panel Lighting Dimmer Control
8. Throttle Lever
9. Radio self-destruction button (not implemented)
10. Heated Suit Connector (not implemented)
11. FuG 16ZY Communications - Homing Switch
12. Headphone Volume Control
13. FuG 16ZY Frequency Selector
14. Horizontal Stabilizer Trim Switch
15. Horizontal Stabilizer Trim Indicator
16. Throttle friction knob
17. MW-50 Power Switch
18. Electric Kill-switch

Right Side Legend

The right-hand side includes electrical system circuit breakers, canopy and weapon controls and a flight clock.

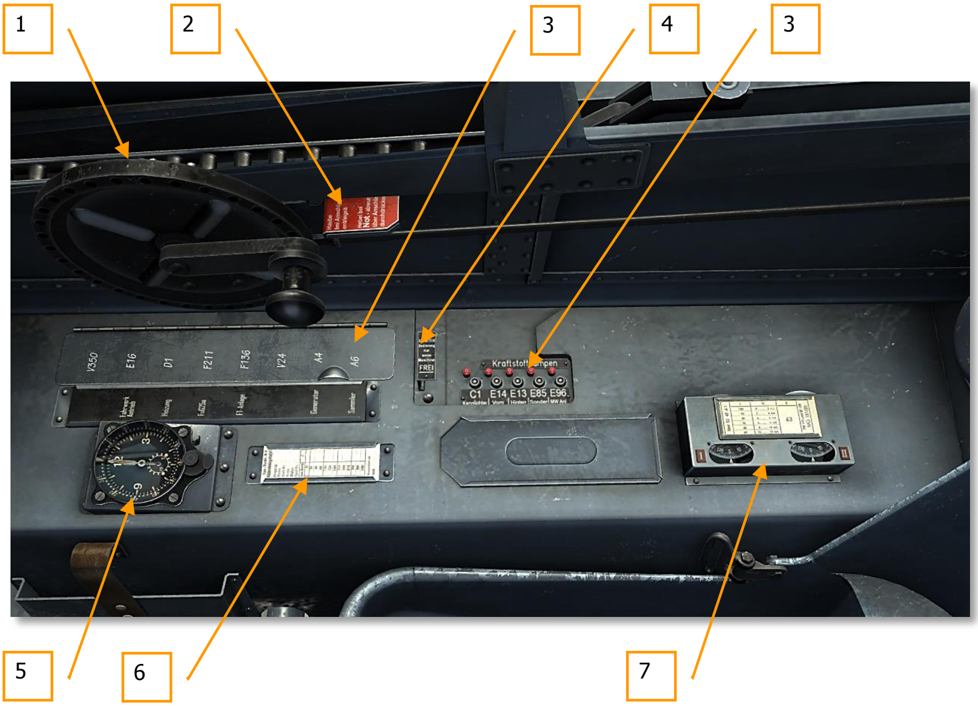


Figure 39: Fw 190 D-9 Right Side and Legend

1. Canopy Actuator Drive
2. Canopy Jettison Lever
3. Circuit Breakers Panels
4. Starter Switch
5. Flight Clock
6. Plate of compass variations
7. EZ 42 Gunsight Adjustment Unit

Front Dash Indicators and Controls

This section will overview in detail all of the indicators and controls located on the front dash.

EZ 42 Gunsight

Figure 40: EZ 42 Gunsight

An analog computer in the EZ 42 measures the aircraft angular velocity to automatically plot both bullet drop and target lead for on-board armament.

A target wingspan circle is used to aid in gauging distance to target, a crucial variable for accurate lead calculations. The floating aiming reticle is provided that plots estimated aiming point based on all input parameters.

A powered three-phase turn coordinator gyro provides the necessary computations. The gyro is mounted on the main base frame bracket. The movements of the gyro are transferred to the movements of the gunsight reticle.

A set of controls conveniently located in the cockpit allows the pilot to provide specific input to the gunsight relevant to specific target and flight conditions.

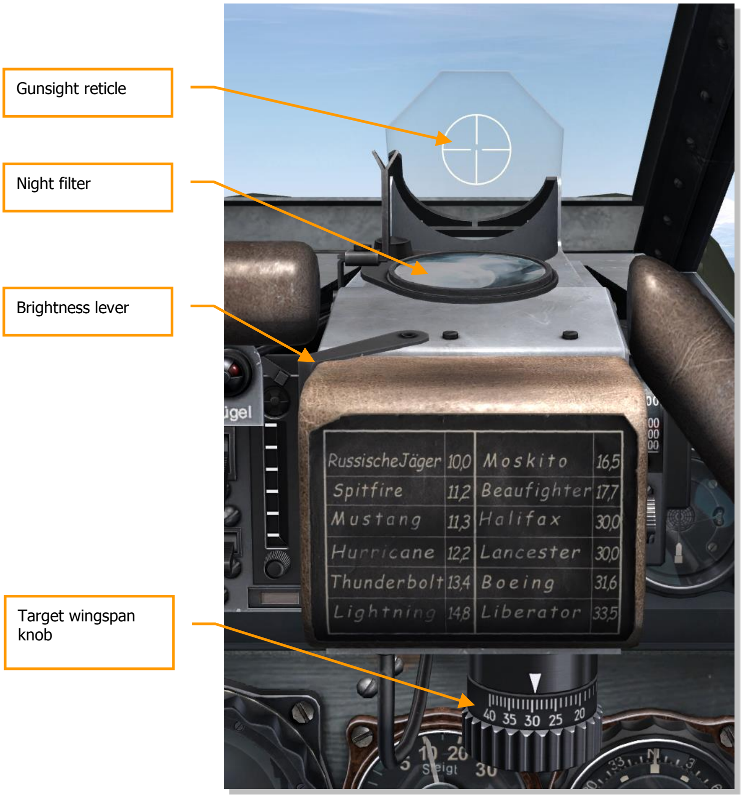


Figure 41: EZ 42 Gunsight controls

The lower front of the sight panel includes a target wingspan knob, calibrated from 10 to 40 meters. The target wingspan is set to match the expected enemy aircraft wingspan prior to the start of an engagement.

The throttle lever incorporates a twist grip. The grip is attached to the sight by cable and pulleys, ending with a range pulley containing a scale calibrated from 0 to 1000 meters on the right side of the gunsight.

As the grip is turned, the range scale indicator moves to show the set target range.

Figure 42: Throttle lever with twist grip and cable

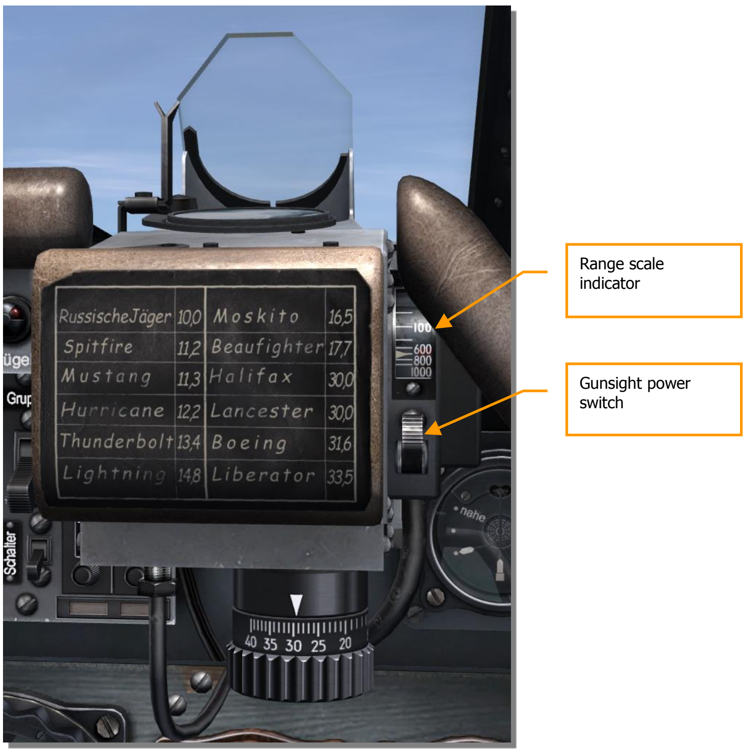


Figure 43: EZ 42 Gunsight controls

Instrument Panel

Ammo Indicators

The SZKK 4 shows the ammo stores for each of the four guns. The four vertical banks in the SZKK show the state of, from left to right, the left MG151, left MG131, right MG131, and the right MG151. In other words, the outer indicators show the ammunition in the outer wing guns, while the inner two indicators show the ammunition in the fuselage guns.

The ammo counters are not directly linked to the ammo stores. Instead, they are reset to full (top) position when the guns are loaded on the ground, and then each mechanical indicator bar is lowered by one notch whenever a weapon is fired.

Figure 44: SZKK 4 Ammo Indicators

Notches provided to the side of each indicator show the amount of rounds in the ammo store for each weapon.

White bar portion signifies ammunition in the stores; black bar portion signifies expended ammunition.

The circular Lock Control Lamps on top of each ammunition counter will flicker whenever a weapon is fired. The indicator is directly linked to each weapon's breechblock. If the lock control lamp is black, the breechblock is closed. If the lock control lamp is light, the breechblock is open.

If the lock control lamp remains black when the trigger is pressed, a weapon malfunction has occurred.

If the lock control lamp remains light when the trigger is depressed, a weapon malfunction has occurred.

AFN-2 Homing Indicator (not implemented)

This ubiquitous device was installed in most German aircraft of WWII. In the Fw 190 D-9, the AFN-2 indicator is a part of the FuG 16ZY equipment set.

Figure 45: AFN-2 Homing Indicator

The AFN-2 indicator allows for easy navigation to ground-based homing beacons, showing both direction and range on one simple dial.

The device has two moving bars that indicate homing beacon information. Each is similar to modern-day equipment, the VHF omnidirectional range, the VOR (vertical bar) and the Distance measuring equipment, the DME (horizontal bar).

The vertical bar indicates the general direction of the homing beacon.

The horizontal bar indicates the distance from the beacon.

As the AFN-2 is a very sensitive instrument, special care to reduce vibrations is used when the indicator is installed in the Fw 190 D-9. It is installed into a separate aluminum sheet attached to the dashboard with rubber screws. This makes the device provide more reliable input; however strong vibrations can still disrupt its operation.

Airspeed Indicator

A later model of a common Luftwaffe airspeed indicator, the gauge in the Fw 190 D-9 bears a km/h designation on the dial.

Figure 46: Airspeed Indicator

The indicator displays Indicated Airspeed (IAS) and is graduated from 0 to 700 km/h on the main outside range, with the airspeed continuing past the mark for up to 900 km/h. The scale is to 10 from 100 to 750 km/h and to 50 km/h thereafter.

Please note that ranges between 0 to 180 and 750 to 900 km/h overlap. No indication other than common sense is used to determine the airspeed within this overlap.

Artificial Horizon / Turn & Bank Indicator

Another commonly used Luftwaffe indicator, this gauge manufactured by Askania in Berlin combines a turn/bank indicator and an artificial horizon into one.

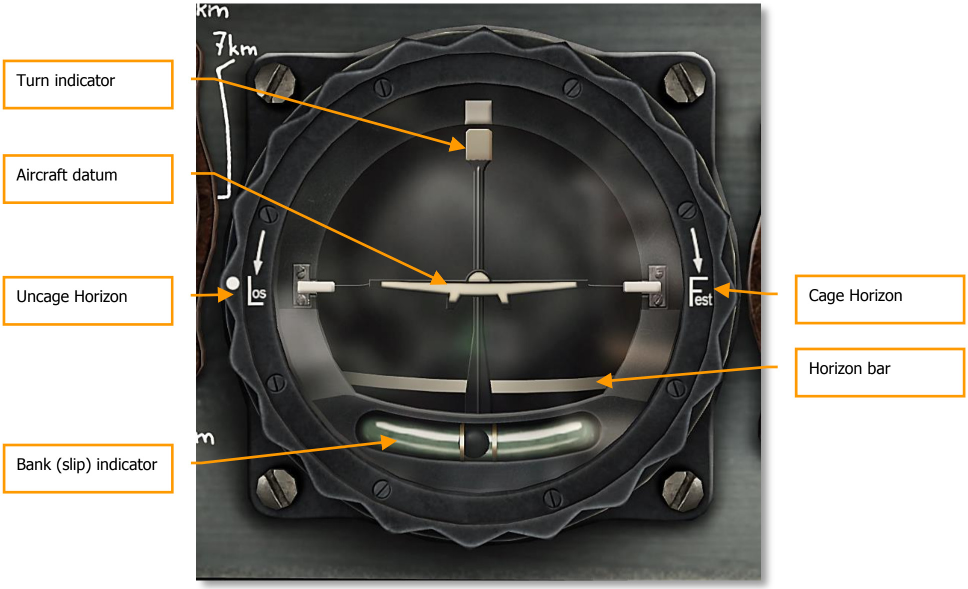


Figure 47: Artificial Horizon

The turn-and-bank portion of the gauge is composed of a gyroscope-type turn indicator and a ball-type bank (slip) indicator. The bank indicator is a liquid-filled curved tube in which a free-rolling inclinometer ball changes position according to the direction of the force of gravity and centrifugal force. The bank indicator is used to minimize side-slip by keeping the ball centered between the center reference lines while turning. The limits of the bank indicator are +/-35°.

The horizon bar will indicate pitch up to 60° and bank up to 110°. The top needle of the instrument indicates the angle of bank.

Please note that the artificial horizon bar is locked during aerobatics!

The outer rotary ring is intended for caging/uncaging the Artificial horizon. "Fest" is caged and "Los" is uncaged position.

Vertical Speed Indicator

The Vertical Speed Indicator or Variometer shows the rate of ascent or descent of the aircraft. The instrument is graduated from 0 to 30 m in both positive and negative directions and indicates vertical speed in meters per second. The face is scaled to 1 m/s between 0 and 5 m/s, and to 5 m/s thereafter.

Figure 48: Vertical Speed Indicator

The Variometer is used to maintain a constant altitude when turning and to establish a definite and constant rate of climb or descent when flying on instruments.

Repeater Compass

The Repeater Compass consists of a rotary compass rose, a current magnetic heading pointer, and a desired heading reference stripe.

Figure 49: Repeater Compass

The aircraft symbol with pointer rotates as the aircraft's heading changes. The compass rose can be rotated with bezel to adjust (turn) the desired magnetic heading to a desired heading.

Supercharger pressure gauge

A standard instrument of R. Fuess in Berlin, as it was found in almost all piston engine aircraft. This device was used to monitor the charge pressure of the engine supercharger.

The gauge is graduated from 0.5 to 2.5 atmospheres absolute. The scale is to 0.1 atm throughout.

Figure 50: Supercharger Pressure Gauge

Altitude Indicator

The Altitude Indicator determines the altitude at which the aircraft is flying by measuring atmospheric pressure. The instrument consists of 3 parts; the needle indicates altitude in tens of meters, the lower window shows the kilometers disk, and the upper window shows barometric pressure in Millibar.

The gauge is graduated from fractions of 1 km from 0.0 to 0.99. The scale is 1/100 of a km, or 10 meters, throughout.

The kilometer disk shows even kilometers of altitude, rounded down. The disk can show numbers from 0 to 9, for a total limit from 0 to 9,999 meters.

The information shown by the meters needle and the kilometers disk should be added. For example, if the km disk shows 3 and the needle points at 0.4, the actual altitude is 3400 meters (3 + 0.4 km).

Figure 51: Altitude Indicator

Tachometer

The Tachometer provides remote indication of engine speed.

The actual speed of the motor is gauged with an electric sensor, and then transmitted to the speed indicator. The absolute maximum permissible speed of the Jumo 213 is 3.300 RPM.

Figure 52: Tachometer

The instrument is graduated from 0 to 3600 and indicates engine speed as Revolutions Per Minute (RPM) in hundreds of RPM. The face is scaled to 100 RPM throughout. The normal operating RPM is 1600 - 2400. The maximum normal RPM is 3000.

Please note that, unlike in many Allied aircraft, the Tachometer is used to set power in the Fw 190 D-9.

Manual Radiator Flap Control

The Manual Radiator Flap Control is used to control engine cowl flaps.

Please note that the control is obscured by the dashboard and is invisible from a normal pilot's point of view. It is located above and behind the corresponding plaque stating "Zu – Kühlerklappen – Auf" (Closed – Radiator Flap – Open).

Figure 53: Manual Radiator Flap Control

The pilot reached behind the dashboard to operate the turn knob. Turning the knob clockwise, towards the "Auf" setting, mechanically opens the radiator flap. Turning the knob counterclockwise, towards the "Zu" setting, mechanically closes the radiator flap.

There is no radiator flap position indicator in cockpit.

Landing Gear Manual Release

When the main gear release buttons fail to work, a back-up manual system is provided. The emergency lever can be pulled, which unlocks the shock struts mechanically. This in turn allows the landing gear to extend under its own weight.

The aircraft should be in a generally wings-level attitude for the landing gear to drop.

Please note that the back-up system's spring will usually be sufficient to fully lock the landing gear in the down position. If it fails to do so, the standard gentle rocking aircraft wings for aircraft with hydraulic gear will not work for the Fw 190 D-9.

Figure 54: Landing Gear Manual Release

Fuel Tank Selector Lever

The lever is used to open or close the forward and rear fuel tanks depending on flight conditions.

The four possible settings are:

- "Auf" - Open
- "Vorderer Behälter zu" – Forward tank closed
- "Hinterer Behälter zu" – Rear tank closed
- "Zu" – Closed

Figure 40: Fuel Tank Selector Lever

If drop tanks are used, their fuel pump, in turn, feeds the rear tank.

When flying with drop tanks, drop tank fuel should be used first, and then the corresponding fuel pump should be turned off.

MBG Emergency Mode Handle

This handle is connected via cable to the aircraft's "Motorbediengerät" (MBG). In normal position MBG operates in automatic mode. In case of emergency, the handle can be pulled to allow the engine to operate at higher boost pressure than normal.

If at all possible, the handle should be pulled when the throttle is in Idle setting.

Speed control remains automatic.

Please take extra care to watch engine speed and boost. The engine must be loaded only as far as absolutely necessary in "Notzug" mode.

When flying in "Notzug" mode, boost pressure of 1.55 ATA should never be exceeded!

When flying in "Notzug" mode, engine speed of 2,700 RPM should never be exceeded!

Figure 55: MBG Emergency Mode Handle

Emergency Fuselage and Wings Load Release

Pull the necessary handle to jettison any load attached to the fuselage or wing, such as drop tank or bombs.

- "Flügellast" – Jettison Wings Stores.
- "Rumpflast" – Jettison Fuselage Stores.

Figure 56: Emergency Fuselage and Wing Load Release

Fuel and Oil Pressure Gauge

Typical pneumatic double pressure gauge for fuel and oil, with two independently operating measuring stations and terminals. Manufacturer is the Maximall-Apparatus company, Paul Willmann / Berlin.

Figure 57: Fuel and Oil Pressure Gauge

The gauge is divided into two sections. The left-hand side gauge and needle show fuel pressure in kg/cm^2. The right-hand side gauge and needle show oil pressure in kg/cm^2.

The fuel pressure gauge is graduated from 0 to 3 kg/cm^2. The gauge is scaled to 0.2 kg/cm^2 throughout. Two indicator strips indicate normal operating pressure of 1 – 2 kg/cm^2. The lower indicator strip shows minimum permissible pressure of 1.3 kg/cm^2 and the upper indicator strip the maximum permissible pressure of 1.7 kg/cm^2.

The oil pressure gauge is graduated from 0 to 15 kg/cm^2. The gauge is scaled to 1 kg/cm^2 throughout. Two indicator strips indicate normal operating pressure of 3 – 13 kg/cm^2. The lower indicator strip shows minimum permissible pressure of 3 kg/cm^2 and the upper indicator strip the maximum permissible pressure of 13 kg/cm^2.

Coolant Temperature Gauge

The Coolant Temperature Indicator shows the temperature of the coolant fluid. The gauge indicates temperature in degrees Celsius (°C) and is graduated from 0° to 130°C. The face is scaled to 10°C. Normal operating temperature is 70…120°C.

Figure 58: Coolant Temperature Gauge

Oil Temperature Gauge

The Oil Temperature Indicator shows the temperature of the oil. The gauge indicates temperature in degrees Celsius (°C) and is graduated from 0° to 130°C. The face is scaled to 10°C. Two indicator strips indicate normal operating temperature of 110…130°C.

Figure 59: Oil Temperature Gauge

Water/Methanol Pressure Gauge

The MW-50 Water/Methanol Pressure Gauge indicates mixture pressure in the MW-50 system in kg/cm^2.

The instrument is graduated from 0 to 1 kg/cm^2. The gauge is scaled to 0.1 kg/cm^2 throughout. Two indicator strips indicate normal operating pressure of 0.4 – 0.6 kg/cm^2. The lower indicator strip shows minimum permissible pressure of 0.4 kg/cm^2 and the upper indicator strip the maximum permissible pressure of 0.6 kg/cm^2.

Figure 60: Water/Methanol Pressure Gauge

Fuel Contents Gauge

One main fuel gauge is provided for all tanks. The Fuel Gauge Selector Switch to the right of the Fuel Contents Gauge can be used to display the contents of the forward or the aft fuel tank.

The instrument shows the contents of the selected fuel tank in hundreds of liters.

As both tanks are of unequal capacity, the instrument has two gauges. The upper gauge is to be used for the aft "Hinten" fuel tank. The lower gauge is to be used for the forward "Vorn" fuel tank.

Please note that there is no fuel content information for drop tanks.

If drop tanks are used, their fuel pump, in turn, feeds the rear tank.

When drop tanks are used, the Fuel Selector Switch should first be set to "Hinten". The Fuel Contents Gauge will continue to display full for as long as the drop tanks continue to feed the rear tank. Once the drop tanks are emptied, the fuel quantity in the rear tank begins to decrease.

Figure 61: Fuel Contents Gauge with Fuel Warning Lights

Fuel Warning Lights

While only one gauge is provided for both fuel tanks, both are equipped with their own Fuel Warning lights.

The top light labeled "Vorn" illuminates when the fuel level in the front tank reaches approximately 95 liters.

The bottom light labeled "Hinten" illuminates when the fuel level in the rear tank reaches approximately 10 liters.

Fuel Gauge Selector Switch

One main fuel gauge is provided for all tanks. The Fuel Gauge Selector Switch can be used to display the contents of the forward or the aft fuel tank in the Fuel Contents Gauge to the left.

Figure 62: Fuel Gauge Selector Switch

Move the Selector Switch to "Vorn" to display the contents of the forward fuel tank.

Move the Selector Switch to "Hinten" to display the contents of the rear fuel tank.

If drop tanks are used, their fuel pump, in turn, feeds the rear tank. When the fuel gauge shows fuel consumption from the rear tank, the drop tank is empty and can be jettisoned.

Oxygen Flow Indicator

The Oxygen Flow Indicator shows the flow of oxygen as it is inhaled and exhaled by the pilot. When the pilot inhales, the blinkers open as oxygen is moved through the system. As the pilot exhales and oxygen stops flowing, the blinkers close.

Figure 63: Oxygen Flow Indicator

Oxygen Pressure Gauge

The Oxygen Pressure Gauge is located on the bottom right corner of the instrument panel and indicates pressure in the oxygen system. The gauge measures pressure in kilograms per square centimeter (kg/cm^2). The instrument is graduated from 0 to 250 kg/cm^2 and scaled to 10 kg/cm^2. Normal full pressure of the system is 150 kg/cm^2. In normal working conditions, oxygen pressure should decrease by no more than 10 kg/cm^2 after 20 minutes of operation.

Note that the oxygen pressure readings can drop as altitude increases due to the cooling of the oxygen tanks. Conversely, the pressure can increase as altitude decreases due to the warming of the tanks. A rapid decrease of oxygen pressure in level flight or during a descent is abnormal and may indicate an oxygen system leak or malfunction.

Figure 64: Oxygen Pressure Gauge

Oxygen Flow Valve

The Oxygen Flow Valve is used to turn on the flow of oxygen to the pilot.

When the flow valve is opened, the oxygen is first sent to the Oxygen Regulator located on the right side of the cockpit, just behind the pilot seat. The oxygen regulator has a diaphragm which actuates a valve, permitting oxygen to flow through the regulator, where it mixes with free air in varying amount in accordance with barometric pressure.

Figure 65: Oxygen Flow Valve

Weapons Console

The Zünderschaltkasten 244 weapons console installed in the Fw 190 D-9 is a standard device used on many Luftwaffe aircraft.

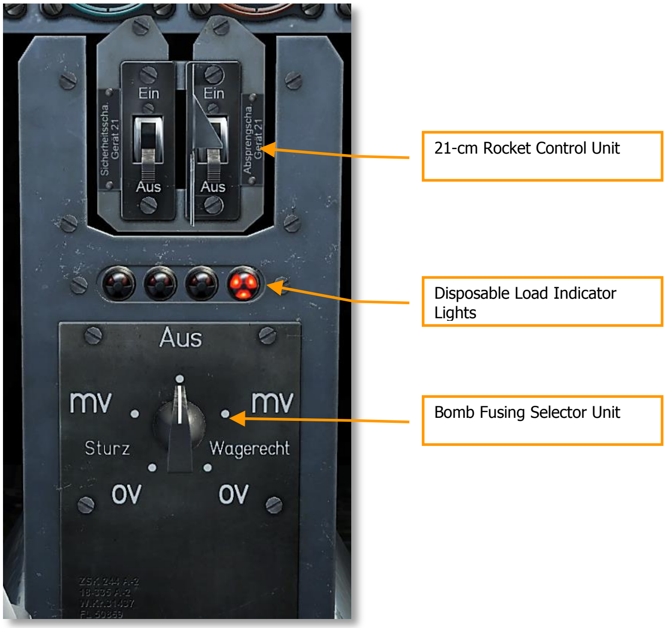


Figure 66: Weapons console

It consists of three parts. The top Rocket Control Unit contains two switches used to operate underwing 21-cm rockets.

Disposable Load Indicator Lights placed below.

The bottom Bomb Fusing Selector Unit contains a dial used to fusing control of bomb or bombs.

The Rocket Control Panel contains two switches, both marked "Ein" and "Aus".

The left-hand switch is Safety. Set it to "Aus" to disarm the rocket warheads; set it to "Ein" to arm them.

The right-hand switch is Jettison. "Ein" is the Safe position. Set the switch to "Aus" to enable the blasting mechanism that detaches the rocket housing and their struts from the aircraft wing and restores clean configuration.

The B2 Bomb Release Button located on the main control stick is used to launch both rockets simultaneously.

The Bomb Fusing Selector Unit is very simple in operation. It controls the amount of electrical charge sent from the battery to the bomb fuse. Depending on the switch position, different fusing situation is ensured.

Set it to "Aus" to disarm the bomb release.

The "Sturz" settings on the left-hand side are used for dive bombing.

The "Wagerecht" settings on the right-hand side are used for level bombing.

The "OV" settings stand for "Ohne Verzögerung" (Without Delay), which means the bomb explodes immediately upon contact with the ground.

The "MV" settings stand for "Mit Verzögerung" (With Delay), which means the bomb explodes after a short delay upon impact.

Therefore, the switch should be set in advance before the bombing run for a proper attack profile.

Left Side Controls

Throttle Lever

The Fw 190 is equipped with a revolutionary Bediengerät device, an early computer that greatly reduces pilot workload. Taking nothing but throttle and barometric conditions as input, the Bediengerät sets the optimal magneto timing, prop pitch, mixture, and engine RPM.

The throttle lever in the Fw 190 D-9 does not merely adjust the manifold pressure. Moving the lever influences nearly all engine and propeller parameters.

Figure 67: Throttle Lever

The throttle gate is marked with four standard positions:

- "Aus" (Off)
- "Anlassen" (Engine start)
- "Steigen" (Climb)
- "Start" (Take off)

The throttle lever should be moved according to desired supercharger pressure (shown on the Supercharger Pressure Gauge to the right of the front dashboard, the gauge labeled ATA).

The throttle lever can be fixed in place to maintain desired supercharger pressure by using the Throttle Lever Friction Knob located below the throttle lever by the cockpit floor.

The unmarked round button at the base of the throttle is the Push-to-Talk button for radio comms.

Ignition Selector Switch

The Ignition Selector switch controls the magnetos used to supply power to the engine ignition system and has four possible positions: "0" (Off), "M1" (right), "M2" (left), and "M1+2" (Both).

- "0". The magnetos are turned off.
- "M1". The right magneto is used to start the engine.
- "M2". The left magneto is used to start the engine.
- "M1+2". Both magnetos are used to start the engine.

Normally both magnetos are used to start the engine.

Figure 68: Ignition Selector Switch

MW-50 Switch

This switch toggles the MW-50 water/methanol injection that greatly increases engine power.

Switch to "Ein" position to enable the system. Switch to "Aus" to disable it.

No On/Off indicator is provided; however system status can be ascertained by watching the Supercharger Pressure Gauge, the Water/Methanol Pressure Gauge, and simply by engine sound.

Figure 69: MW-50 Switch

Landing Gear and Flaps Indicators

The indicator shows the position of each main gear leg (left and right) and flaps (center) between.

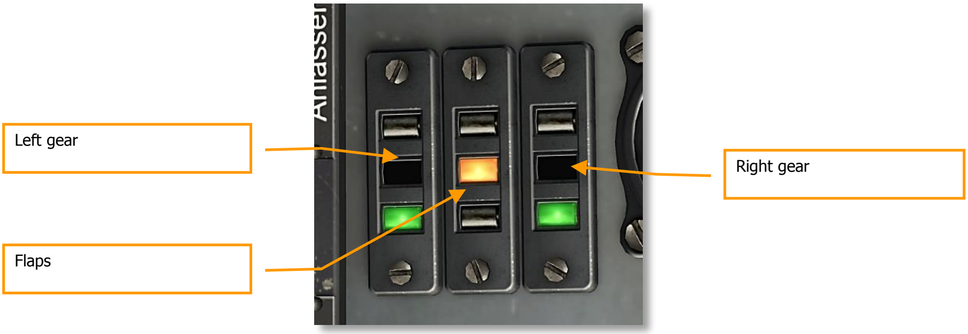


Figure 70: Landing Gear and Flaps Indicators

When the main gear is up, both lights illuminate red.

When the main gear is down, both lights illuminate green.

Flaps indication:

- Green – flaps down.
- Yellow – flaps in the intermediate, take-off position.
- Red – flaps up.

Horizontal Stabilizer Trim Switch

The Horizontal Stabilizer Trim Switch is used to electrically set the rotation angle for the adjustable horizontal stabilizer based on changing trim conditions.

Figure 71: Horizontal Stabilizer Trim Switch

The two available positions are "Kopflastig" (nose-heavy) and "Schwanzlastig" (tail-heavy).

Depress the button to change the horizontal stabilizer angle. The actuator motor continues to adjust the angle as long as the button is depressed until the limit is reached, at which time the motor is switched off.

Horizontal Stabilizer Trim Indicator

The indicator shows the current position of the adjustable Horizontal Stabilizer.

Figure 72: Horizontal Stabilizer Trim Indicator

The gauge is graduated from -5 to +5 degrees, but the operating range is -3 to +2 degrees of horizontal stabilizer inclination. The scale is to 0.5 degrees throughout.

The normal position is indicated by 0. It corresponds to actual +2 degrees of rotation on the horizontal stabilizer relative to the fuselage centerline.

Landing Gear and Flaps Controls

This set of pushbuttons allows the operation of both the landing gear and the flaps.

The “Rollwerk” set of buttons to the right is for controlling the landing gear.

Figure 73: Landing Gear and Flaps Controls

The two available positions are "Ein" (on, up position) and "Aus" (off, down position).

To raise the landing gear, retract the safety switch over the "Ein" (Up) button and press the button. The button remains pressed while the gear is in operation and pops up once the gear is raised and locked. The red "Ein" lights also illuminate on the Landing Gear Position Indicator.

To lower the landing gear, press the "Aus" (Down) button. The button remains pressed while the gear is in operation and pops up once the gear is down and locked. The green "Aus" lights also illuminate on the Landing Gear Position Indicator.

The "Landeklappen" set of buttons to the left is for controlling the flaps.

The three positions are "Ein" (Up), "Start" (Take off) and "Aus" (Landing).

To raise the flaps, press the "Ein" (Up) button. The button remains pressed while the flaps are in operation, and pops up once the flaps are fully raised.

To set Take-Off flaps, press the "Start" (Take off) button. The button remains pressed while the flaps are in operation, and pops up once the flaps are properly set to the Take-Off setting.

To fully lower the flaps, press the "Aus" (Landing) button. The button remains pressed while the flaps are in operation, and the flaps are fully lowered to the maximum angle.

FuG 16ZY Controls

FuG 16ZY Control panel has four controls:

- Frequency Selector
- Headphone Volume Control
- Communications - Homing Switch
- Fine Tuning Knob

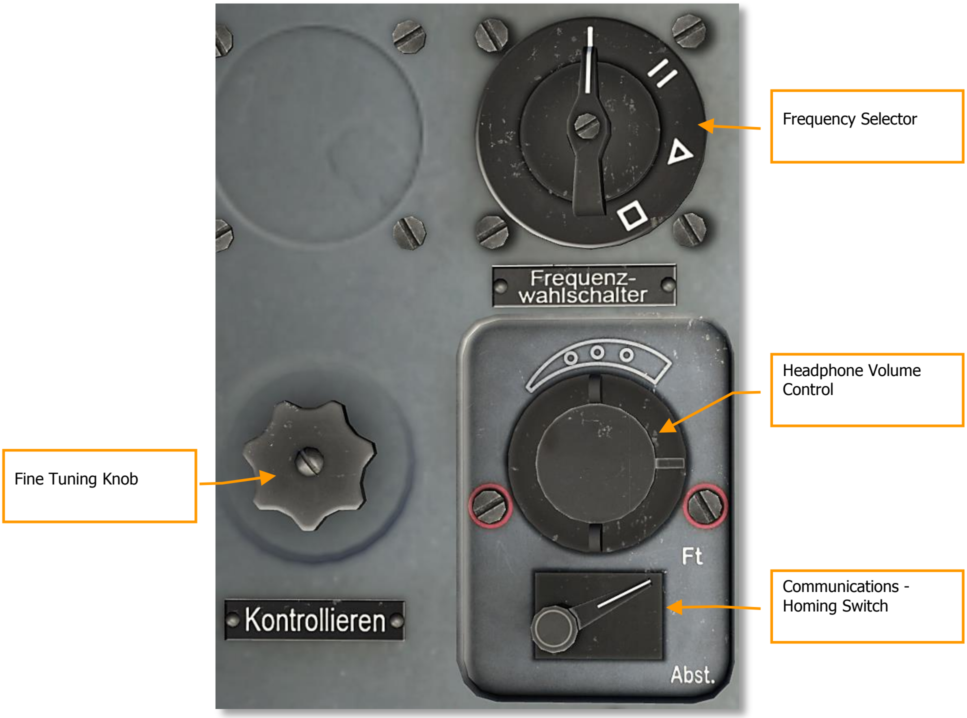


Figure 74: FuG 16ZY Controls

Frequency Selector

The Frequency Selector for the FuG 16ZY radio has four positions indicated by symbols. All four positions are locked to specific frequencies before flight. The pilot cannot manually set frequencies beyond the four presets. Presets can be set on the ground (in the special tab of mission editor) from band range 38.4 – 42.4 MHz.

The four frequencies are used for communication with increasingly larger groups of aircraft.

The "I" position is for "Y-Führungsfrequenz", or Management frequency, is used for communication within the flight or squadron.

The "II" position is for "Gruppenbefehlsfrequenz", or Group Order frequency, is used to communicate between several flights from different squadrons participating in a single raid.

The "Δ" position is for "Nah-Flugsicherungsfrequenz", or the Air Traffic Control frequency. It is used to communicate with the designated Air Traffic Controller.

The "□" position is for "Reichsjägerfrequenz", or Reich Fighter Defense Frequency, and is used to coordinate country-wide air defense efforts in large scale raids.

Headphone Volume Control

The Headphone Volume Control is used to adjust headphone volume. Turning the knob clockwise increases volume; turning the knob counterclockwise decreases it.

Communications - Homing Switch

The Communications - Homing Switch can be set to one of two positions, "Ft" ("Funktelefonie" - radio telephony) or "Abst" ("Abstimmen" - frequency tuning).

This works in conjunction with the FuG 16ZY Frequency Selector and determines the radio set operation.

Please see the below table for details.

Homing Switch	***Freq***	***Push-to-Talk Open***	***Push-To-Talk Depressed***	***Transm***	***Recvr***
"Ft"	I	Listen	Talk	I	II
"Abst"	I	Homing Listen	Homing Listen+Talk	I	II
"Ft"	II, Δ or □	Listen	Talk	II, Δ or □	
"Abst"	II, Δ or □	Listen to loop antenna Targeting	Talk	II, Δ or □	

Because on the first frequency selector position (I) sending and receiving are conducted at different frequencies, it is not used in this simulation.
For communication use II, Δ or □ selector positions with "Ft" position of Communications - Homing Switch.

The frequencies of all four positions should be assigned in the Mission Editor's Radio Presets tab.

Fine Tuning Knob

The FBG 16 "Fernbediengerät" (remote control unit) is used for fine frequency adjustment within a selected preset.

Right Side Controls

Canopy Crank

The canopy crank can be used to open or close the canopy.

Rotate clockwise to open; counterclockwise to close.

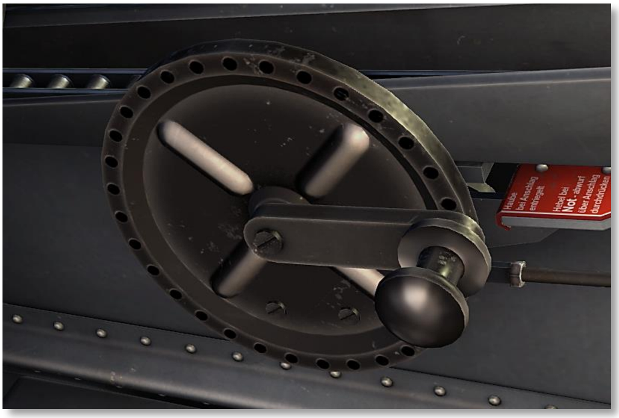


Figure 75: Canopy Crank

Flight Clock

The "Junghans Borduhr Bo-UK1" was the standard instrument chronograph for all German aircraft in WWII. The clock is installed at the top of the right-hand console of Fw 190.

You can adjust the clock with the round Wind/Set Knob below.

With the Start - Stop Button on the right and the round button you are able to start and stop the clock.

The stopwatch mechanism is started and stopped by pressing the stopwatch button, located directly below the wind/set knob. First press to start, second press to arrest and third press to puts it back. Each passing of the sweep second is recorded, up to 15 minutes, on the small register dial.

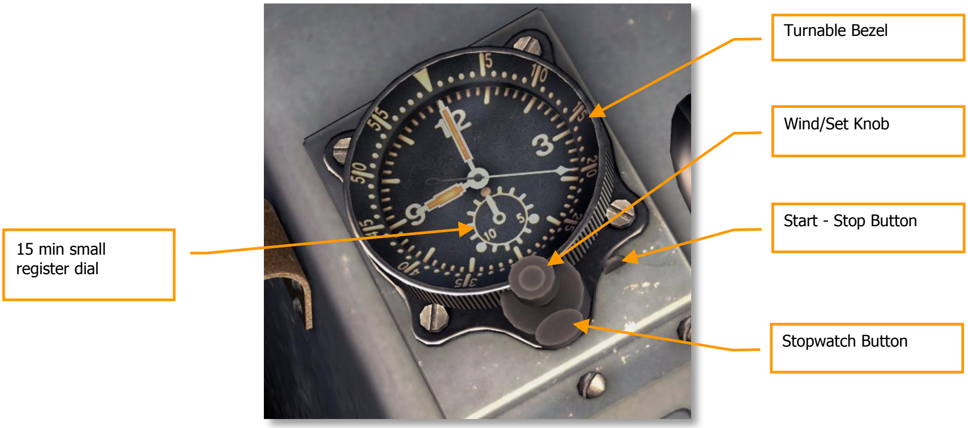


Figure 76: Flight Clock

Adjust clock:

- Pull down the Start-Stop button.
- Adjust desired time on Wind/Set Knob with mouse wheel.
- Push back the Start-Stop button.

Stopwatch:

- Start stopwatch with first press of stopwatch button.
- Arrest stopwatch with second press of stopwatch button.
- Put it back with third press of stopwatch button.

Circuit Breakers

Circuit breakers are used to control various electrical functions.

Each circuit breaker has two buttons: A larger black button with a white dot that switches the corresponding circuit on - and a red button that opens the circuit and switches it off.

Figure 77: Circuit Breakers cover down

The circuit breaker name and device is typed on the cover and plate around.

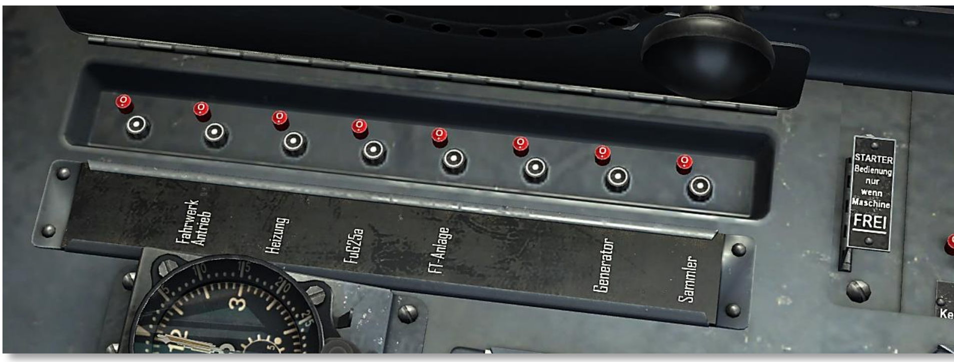


Figure 78: Circuit Breakers cover up

Figure 79: Circuit breakers of additional panel

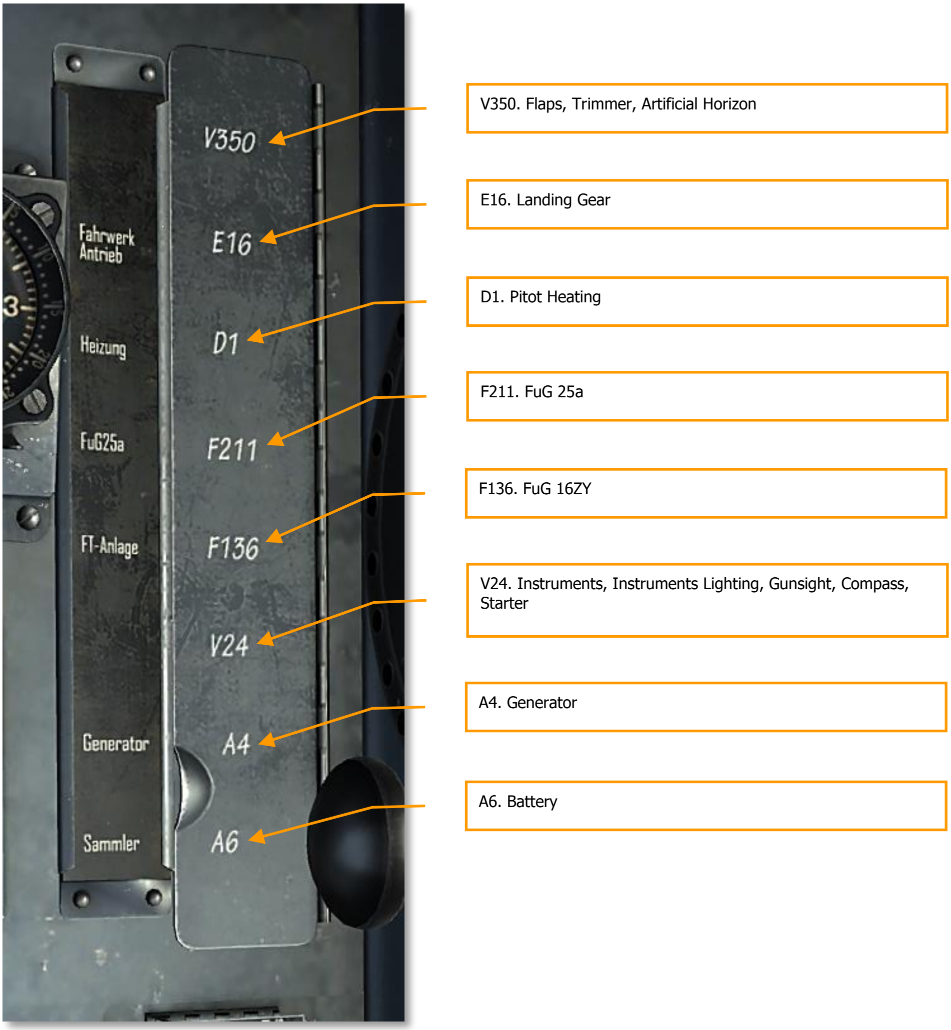


Figure 80: Circuit breaker legend of forward panel

Starter Switch

The Starter switch is used to flywheel spin-up and start engine. The switch is spring-loaded and needs to be held in the Down position to spin-up a starting flywheel, then in the Up position to execute an engine start.

Figure 81: Starter Switch with cover

Kneeboard Map

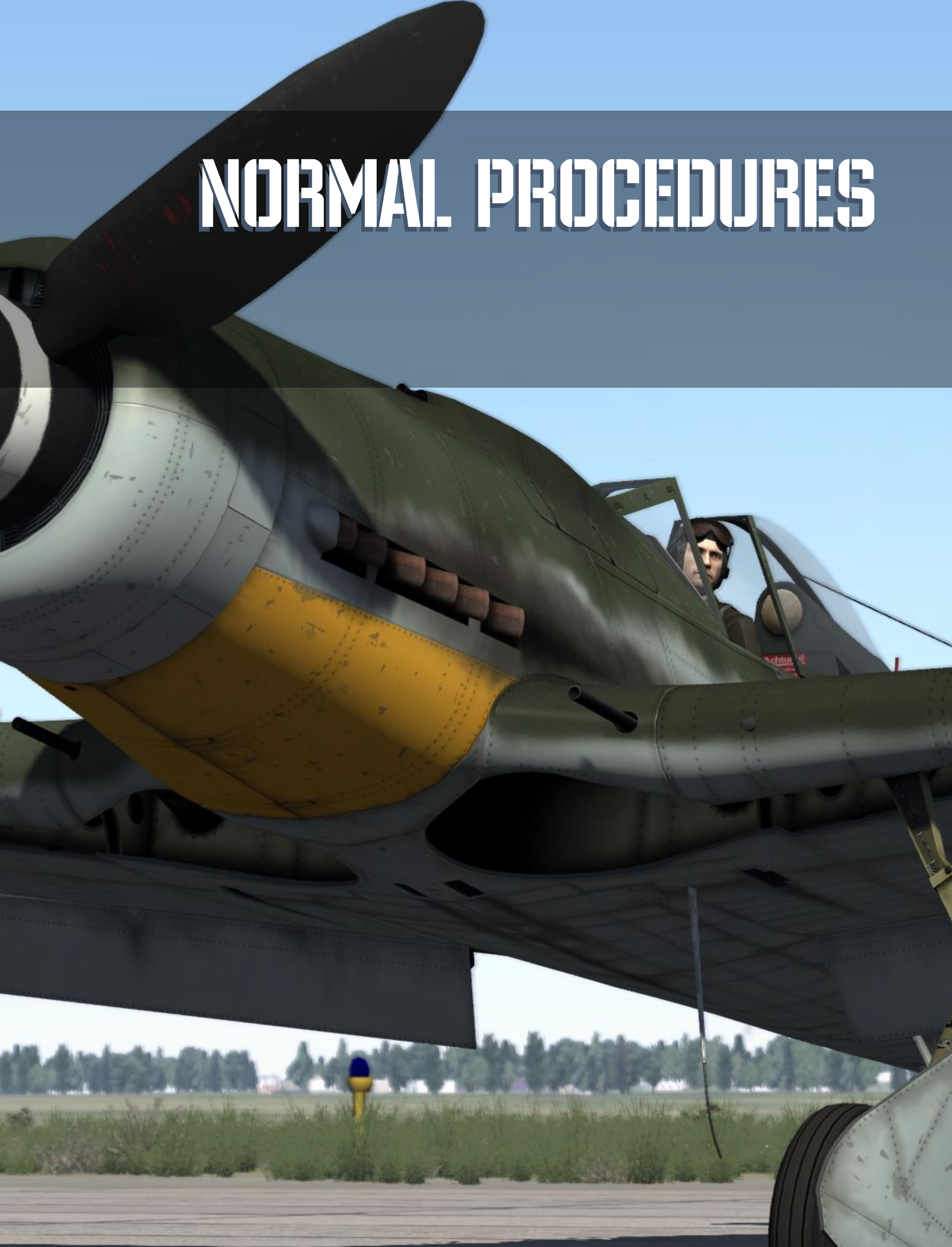
To aid with navigation, a kneeboard map is included in the cockpit. The map can be opened at any time in the cockpit for a quick glance by pressing and holding the [K] command or toggled on and off with the [RSHIFT + K] command. The map displays a plot of the flight plan and is initially centered on the starting waypoint. The [[] (open bracket) and []] (close bracket) commands can be used to change the kneeboard page, which cycles through the flight plan waypoints on the map view and airdromes database.

Additionally, the [RCTRL + K] command can be used to place a mark point on the map. A mark point indicates the location of the aircraft on the map in the current point in time (like pencil mark on the paper map).

The kneeboard can also be viewed on the pilot's left leg when the pilot is enabled in the cockpit ([RSHIFT + P]).

Figure 82: Kneeboard Map

NORMAL PROCEDURES



NORMAL PROCEDURES

Preflight checks and Engine Start

As soon as you enter the cockpit:

- Choose best seating position. This can be adjusted by using the Right Shift + Right Shirt + KP8 and Right Shift + Right Shirt + KP2.
- Check if the rudder has full free and correct movement, and that the central rudder pedal position corresponds with the central rudder position.
- Set altimeter to QFE of the takeoff airfield.
- Turn on the oxygen system's side-way valve (on the right lower front panel).
- On the left side panel, the push button "landing gear off" (green button) must be switched on, otherwise the landing gear will retract upon powering up of the aircraft's electrical system.
- Turn on all circuit breakers on forward circuit breaker panel:
    - Flaps, Trimmer, Artificial Horizon [LWin – 1]
    - Landing Gear [LWin – 2]
    - Pitot Heating [LWin – 3]
    - FuG 25a [LWin – 4]
    - FuG 16ZY [LWin – 5]
    - Instruments, Instruments Lighting, Gunsight, Compass, Starter [LWin – 6]
    - Generator [LWin – 7]
    - Battery [LWin – 8]
- Check fuel in both tanks with Fuel Gauge Selector Switch. To right [RAlt – T], to left [RCtrl – T]

- Ignition (Magneto) Selector Switch to M1+2 position. To forward [End], to back [RShift – End].

- MBG Emergency Mode Handle in automatic mode. Pushed in position (check). [RShift – M]

- Fuel Tank Selector Lever in "auf" (open, full up) position. Up [T], down [RShift – T].

- Switch on fuel pumps with additional circuit breaker panel:
    - E14 Forward tank pump [RWin – 2]
    - E13 Rear tank pump [RWin – 3]
    - E85 External tank fuel pump if external tank is connected [RWin – 4]
    - E96 MW50 if necessary [RWin – 5]

- Close canopy. Several times [LCtrl-C].
- Set throttle lever to "Anlassen" (Engine Start / Idle) position. [RALT – Home]

- Press starter switch about 15…20 seconds to flywheel spin-up. Press and hold [Home].

- After flywheel spin-up pull up starter switch for engine start. Press and hold [RCtrl – Home].
- Release star Set stabilizer trim to 0° (switch and indicator on left side panel).

Engine Warmup

1. With closed cooling flaps run engine at about 1000…1200 RPM until oil entry temperature reaches 40°C.
2. Slowly increase towards 1800 RPM, until coolant exit temperature has reached 60-70°C.

Stopping the Engine

At 1200 RPM let engine cool down, alternately switching M1 and M2. Keep coolant temperature below 100ºC, otherwise danger of thermal evaporation.

In warm weather, open all cooler flaps already during landing flare, when in cold weather during taxiing off. When stationary retard throttle lever and run engine at 1600-2000 RPM for some time in order to achieve uniform cooling. Stopping above coolant temperature above 120°C will generally lead to coolant fluid loss. Pull throttle lever beyond idle indent position with [LALT – End] keys, switch off ignition, close fuel shutoff valve.

Taxiing

1. Taxi and take-off with fully opened cooling flaps only. The hand wheel for setting of cooling flaps position is located in the cockpit above the lower front panel. Hold Left Alt + A for 20 seconds to fully open the cooling flaps. Refrain from unnecessarily operating the hand wheel, especially from stop to stop positions.

2. Avoid power settings below 1,000 RPM. Keep taxi times as short as possible in order to prevent coolant losses by vaporization.

3. When taxiing, first unlock the tail wheel, otherwise it will be impossible to make turns. In order to do so push flight stick forward by approximately 3cm.

4. Only after releasing the tail wheel, lock the brakes may be operated for testing purposes, left and right alternatively. Do not operate the brakes for too long.

5. In case the tail wheel does not unlock, it shall be tried to unlock by alternating brake application and simultaneous forward pushing of the flight stick.

6. On line up for takeoff, roll straight ahead for a short distance to ensure the tail wheel is in straight position.

7. The aircraft may have to be taxied below power settings of 1,000 RPM for a short while in order to avoid tire damage through braking heat. Taxiing has to be performed as to keep the usage of brakes down to a minimum; short braking impulses are better than continuous braking.

Preflight Check

Prior to takeoff, perform the following preflight check:

- Primary controls:

- Controls – Check the stick and rudder controls to ensure they operate without binding. Watch the control surfaces for correct response.
- Horizontal Stabilizer Trim Indicator – 0

- Instruments and switches:
  - Altitude Indicator set.

  - Desired heading set.

- Artificial Horizon Uncaged.

- All instrument readings in desired ranges.
- All switches and controls at desired positions.

- Fuel system:
  - Fuel Tank Selector Lever in Open (Auf) position (full up).
  - Fuel pump's circuit breakers ON.
- Flaps:
  - Flaps set for takeoff, pressed "Start" button.

Takeoff

Follow the below procedure to perform a normal takeoff:

1. In conditions of high humidity and temperatures below 0°, switch on pitot and windshield heating (respectively close circuit breakers for pitot heating, inner windshield heating and outer windshield heating).

2. Switch on both fuel pumps and switch the indicator to the rear tank.

3. In case flight is conducted with an auxiliary drop tank, initially only the rear tank fuel pump and the EP-1 E (drop tank pump) are to be switched on.

4. Set flaps to takeoff position. Push selector switch located on left side panel.

5. Verify take-off position by observing the mechanical indicator on the wing. The electrical indicator only shows full landing or up positions. (Green or red lights on the left side panel).

6. Pushing the stick forward unlocks the tail wheel, thereby making steering difficult. The best takeoff procedure is to hold the tail down by pulling the stick toward you until sufficient speed for rudder control is attained and then to allow the tail to rise slowly. Some rudder input may be necessary to maintain heading as the tail is lifted and stabilized in a takeoff attitude.

7. Swiftly advance throttle into take-off position. Hold flight stick back with only a light feel, but do not push forward.

8. Take-Off distance on the runway without wind effect is approximately 350-400m.

9. Take-off is at IAS = 170-180 km/h and performed on three points throughout take-off roll. Keep aircraft straight, the aircraft does not have a tendency to break out.

10. During takeoff, engine speed may reach a maximum of 3,300 RPM.

11. Engine power is set according to RPM indicator. Every throttle setting corresponds to a specific engine speed setting, maintained by the hydraulically operated governor.

Power Settings

Emergency Power (increased take-off power) 3,250 RPM only below 1,000m on 213A-G1 by pulling the MBG-emergency pull or as intermediary solution on 213-A RS by operation of a cock in the manifold pressure line. Hereby the manifold pressure increases by 0.2 ata while maintaining constant engine speed/RPM.

At the latest 3 min after takeoff, reduce to combat power and slightly push flight stick forward.

Throttle position can be fixed by turning the handgrip on lower left.

Throttle Position / Power Output / RPM / Permissible Time / Fuel Consumption Liter/hour:

- 90° command angle / Emergency Power (increased take-off power)* /
- 3250 / 3min / 620 -20
- 90° / Take-Off, Combat and Climb Power / 3250 / 30min / 590 +20/-40
- 75° / Continuous Power / 3000 / constant / 530
- 60° / Economy I / 2700 / constant / 375
- 47° / Economy II / 2400 / constant / 285
- 34° / Economy III / 2100 / constant / 215
- 0° / Idle (in flight) / app. 1200 / - / -
- 10° / Engine Stop position / - / - / -

Retraction of Landing Gear

The landing gear must be retracted at or below IAS = 250km/h. After takeoff, briefly and slightly apply brakes and retract landing gear.

Push the red operating button on left side panel (button under guard) to “On” position.

The landing gear has an electrical indicator on the left side panel, and mechanical ones on the upper wings. A colored marker pin retracts upon gear retraction.

Both main landing gears and the tail wheel are retracted when both red control lamps are illuminated. Check the marker pins on the wings.

Only after retraction of landing gear, <u>r e t r a c t f l a p s</u>. (Red button for flaps “On”.)

Red control lamp illuminates. Also observe the mechanical indication on side of the upper wings (cutout with degrees scale).

Avoid sudden bursts of power during takeoff! Make it smooth and steady.

Climb

Perform the following steps once a safe takeoff is accomplished:

- Set throttle for climb power, 3,250 RPM.
- Best climb speed is 280 - 290 km/h indicated.
- **Attention**! Desired position for radiator split flaps can be set for 110°C.
- At an altitude of approximately 3,300m +/- 200m, automatic switching from low to high blower occurs noticeably. Avoid cruising or frequent change of altitude around blower switching altitude.
- Raise the landing gear by retracting the safety switch over the "Ein" (Up) button and pressing the button. Ensure gear is properly raised and the red "Ein" light illuminates.
- Flaps up with "Ein" (Up) button.
- Check coolant and oil temperatures, and oil pressure.
- After reaching safety altitude, throttle back to 3000 RPM.
- Trim the aircraft for climbing attitude as necessary.
- Check all of your instruments for proper function within normal parameters.

Cruise and Fuel Management

Set coolant temperature to 100° C (regulator setting).

Retard throttle so that resulting power setting is no more than max continuous power, 3000RPM. Above 7500m, max continuous power at 3250RPM is certified.

Automatic rich/lean switching starts operating from 2800 to 2900 RPM.

In order to achieve longer ranges, and to save engine lifetime, choose power settings as possible.

Oil Entry Temperature at Max Continuous Power is 110° C, minimum pressure is 4.5 atü. Maximum temperature (short duration) 130° C, however hereby the presence of oil dilution (cold start) has to be taken into account. Maximum pressure must not exceed 13 atü.

Upon exceedance of maximum temperature engine power must be reduced.

Coolant Exit Temperature 100° C at all altitudes. Exceptions: During Climb 110 (100)° C is permissible, and during takeoff and taxi 130
(120)° C permissible for brief periods of time.

These exceptional values are only valid in case an Erhard Coolant Regulator Valve 2 atü (1.2 atü) is fitted.

Fuel Quantity Measuring. An electrical fuel quantity indicator is fitted to the lower front panel with a selection switch for the forward and rear fuel tanks. There is no fuel quantity indication for the drop tank or the additional fuel tank. Additional fuel is ducted into the rear tank. Recognition of additional tanks having emptied is by fuel quantity indication dropping below 240 liters in the rear tank, with the fuel quantity indicator switched to the rear tank.

Switching Warning for the rear fuel tank occurs at approximately 10 liters remaining, white lamp illuminates.

Low Fuel Warning in the forward fuel tank occurs at 90 - 100 liters remaining, red lamp illuminates. Upon illumination of red lamp, fuel remaining for approximately 15 minutes at Economy power setting.

Switching of Fuel Tanks

Without a drop tank, without additional tank, prior engine start:

- Fuel shutoff valve in position "Open"
- Both fuel tank pumps "On"
- Fuel Quantity Indicator switched to aft tank

In Flight

- Fuel shutoff valve "Open"
- Drawing of fuel is controlled by the switching "On" and "Off" of the fuel tank pumps.
- Monitoring of fuel quantity by observing the selectable fuel tank indicator.
- First empty the rear tank, with the rear fuel pump switched off. (Only when red lamp illuminates before the white lamp, isolate forward fuel tank with its fuel shutoff valve). Fuel quantity indicator on rear fuel tank.
- When white lamp illuminates, switch both fuel tank pumps to "On". Fuel shutoff valve remains in position "Open".
- Fuel quantity indicator to forward fuel tank.
- When red lamp illuminates, 90 - 100 liter remain in forward fuel tank, remaining available flight time approximately 10 to 15 minutes at Economy power setting.

With drop tank under the fuselage

- Fuel shutoff valve "Open"
- Drop tank fuel pump and rear fuel tank pump "On". Forward fuel tank pump "Off"
- At altitudes above 8000m it may become necessary to additionally switch the forward fuel tank pump on.
- Fuel quantity indicator switched to rear fuel tank
- Once fuel indicator starts showing quantity less than 240 liters, the drop tank is empty.
- Drop tank fuel pump "Off".
- In order to jettison drop tank, pull emergency handle in cockpit.

With additional fuel tank in fuselage

- Fuel shutoff valve in position "Open"
- Rear fuel tank pump "On". Forward fuel tank pump "Off"

- Additional fuel tank pump "On"
- Fuel quantity indicator on rear fuel tank
- Once fuel quantity in rear fuel tank drops below 240 liters, additional fuel tank is empty.
- Additional fuel tank pump "Off".

With drop tank and additional fuel tank

- Fuel shutoff valve "Open".
- Drop tank fuel pump, additional fuel tank pump and rear fuel tank pump "On". Rear fuel tank pump "Off".
- Fuel quantity indicator switched to rear fuel tank.
- When fuel quantity indicator starts showing fuel less than 240 liters, drop tank and additional fuel tank are empty.
- Drop tank fuel pump and additional fuel tank pump "Off".
- A t t e n t i o n ! When there is danger of incoming fire the drop tank has to be
- jettisoned, and the drain of the the unprotected additional tank into the fuselage has
- to be pulled.

High Altitude Flight

During high altitude flight check oxygen flow in short intervals. Oxygen pressure gauge is located on the right side of the lower front panel next to the O2 guard. Start breathing oxygen at altitude of 4000m.

Night Flight

In case of too bright illumination of instruments and warning lamps is too bright, reduce brightness with obfuscator (on left side panel).

Prior take-off it is especially important to ensure proper stabilizer trim setting at 0°.

Special Flight Maneuvers

Glide

- Engine speed at idle 1200 +/- 50 RPM.
- During longer periods of glide, advance throttle repeatedly to prevent spark plug fouling.
- Coolant exit temperature must not fall below 60° C.
- Switching from high- to low blower occurs automatically at 3300 +/- 300 m.

Dive

- Dive speeds for fighters and fighter-bombers equipped with airspeed indicator FI 22234.

- at 9km altitude IAS = 500km/h!
- at 7km altitude IAS = 600km/h!
- at 5km altitude IAS = 700km/h!
- at 3km altitude IAS = 800km/h!
- at 2-0 km altitude IAS = 850km/h

- Engine speeds of 3300 RPM as short period maximum must not be exceeded.

Inverted Flight

- No inverted flight, engine lubrication system is unsuitable. However, all aerobatic maneuvers may be performed, even if briefly leading through inverted flight.

Landing

- Reduce speed to approximately 300km/h.
- Extend Landing Gear. Push button switch on left side panel or pull the landing gear pull lever (on left side of the lower front panel), until the landing gear is properly unlatched.
- Mechanical indicator pins appear upon extension. The landing gear is only completely extended when the white bar (red arrow pointing to it) is visible.
- Extend landing flaps between IAS = 300 and 220km/h.
- Observe signal lamps. Do not exceed IAS = 300km/h with extended flaps.
- Trim aircraft tail-heavy as necessary (push button for flaps respectively toggle switch for elevator trim on Left Side Panel).
- Approach speed IAS = 220-220km/h
- Touchdown at IAS = 170km/h
- Pull back flight stick upon landing
- Retract flaps after rolling-out.
- Never hold the flight stick back when intending to make a turn, so that tail wheel has free movement.

Engine Shut Down

Open cooling flaps fully, in warm outside conditions during approach, in cold weather during taxi, run engine at 1800RPM for some time, hereby monitoring coolant temperature - must not be above 130° C, otherwise allow engine to run longer in order to cool down.

Retard throttle to stop position. Switch off ignition, fuel pumps, close fuel shutoff valve, and press the aircraft electrical power off switch.

Flight Emergencies

Go Around

- Go around with fully extended flaps.
- Retract landing gear.
- Only retract flaps to take off position when at sufficient altitude and with sufficient airspeed. Note that the aircraft tends to fall slightly upon retraction of flaps.
- Operation as during normal departure.

Failure of the Landing Gear Drive

- Use Emergency landing gear release in case of failure of the electrical drive. Operation as during normal operation.
- In case gear does not extend, push nose down and then recover sharply. Observe the mechanical indicator.
- In case gear does still not extend, proceed as follows:
  - Check if landing gear switch is set to "Off".
  - If yes, pull manual gear handle once again.
  - If this is not successful:
  - Open circuit breaker for landing gear drive (right side panel) and once again pull manual gear handle.
  - Make side slip maneuvers to extend landing gear.
  - Check that white marking on landing gear pins is visible.
- In case these procedures do not result in success, retract landing gear and carry out a belly landing.
- However, a single wheel landing is also possible, in this case touch down as for a normal landing but keep the aircraft level as long as possible with aileron input. Usually the propeller and wing tips will receive damage.

Power Plant Failure

- In case of a failure of engine regulator automatics, retard throttle towards idle as much as possible and pull emergency pull to the right of the fuel shutoff valve. Keep engine power to as to as little as possible in order to avoid engine stresses.
- When emergency pull is pulled, engine speeds higher than 2700RPM are prohibited.
- In case of falling oil pressure indication, landing has to carried out immediately, if possible.
- In case fuel vapors enter the cockpit, switch off fuel tank pumps, don oxygen mask and slightly open the canopy. Report leakage after landing.
- In case of a failed fuel pump, flight may continue to the next airfield at low RPM, using both fuel tank pumps.

Emergency Weapons Drop

Operate bomb emergency release handle on the lower front panel. The lever is returned to the original position by spring load forces upon release of the handle.

Emergency Landing in case of Engine Failure

- At low altitude, immediately pull up the airplane until IAS has reduced to approximately
- 300km/h.
- Retard throttle to quick stop position
- Switch off ignition
- Set fuel shutoff valve to "Closed"
- Open canopy to the last cog. Latch cradle (canopy does not fly off in flight!)
- Extend landing gear at airfields only - otherwise danger of flipping over
- Fully extend flaps, trim aircraft tail-heavy
- Operate aircraft electric system off switch to "Off"

In unfavorable terrain, perform emergency landing with landing gear up.

Sliding distance on belly landings approximately 150-200 m. If there is sufficient space, do not extend flaps as this causes damage to the propeller. Perform the landing as in a glider.

The aircraft's behavior is completely harmless during belly landings.

Starting from high altitude it makes sense - in order to be able to cover a greater distance - to only extend the gear and flaps when it is assured that the chosen landing airfield can be reached.

Ditching

Ditching should be avoided as much as possible, since after 2-3 bounces the aircraft will sink over the nose immediately. Prior to ditching the canopy has to be always jettisoned.

Landing without Flaps

- In case of a failure of the flap drive, it has to be noted that the aileron will become more sensitive on landing.
- The touchdown speed will increase by approximately 35 km/h. Since this differ greatly from airplane to airplane, it is recommended to establish the stall speed at high altitude with idle power setting (should result in speed of about 195 km/h), and add to this speed about 20 km/h to determine touchdown speed.
- The landing distance increases in this case from 600m to about 850m.

Parachuting

- As far as flight altitude is available and aircraft remains controllable, reduce speed as much as possible.
- If possible:
  - Operate electrical system “Off” switch
  - Switch off ignition
  - Close fuel shutoff valve
- Push the canopy emergency jettison lever at the punched disc. The canopy is jettisoned immediately by explosive cartridge. Prior to this, the canopy shall however be completely closed, or under no circumstances be open more than 300mm (check marking!).
- Attention! Canopy emergency jettison is secured by securing wire!
- The canopy can also be manually opened (latch hand crank at the last cog position). This method is preferable when there is sufficient time and slow flight (below 300 km/h).
- Unfasten seat belt, strongly kick flight stick forward with foot, pilot is thrown clear of aircraft.

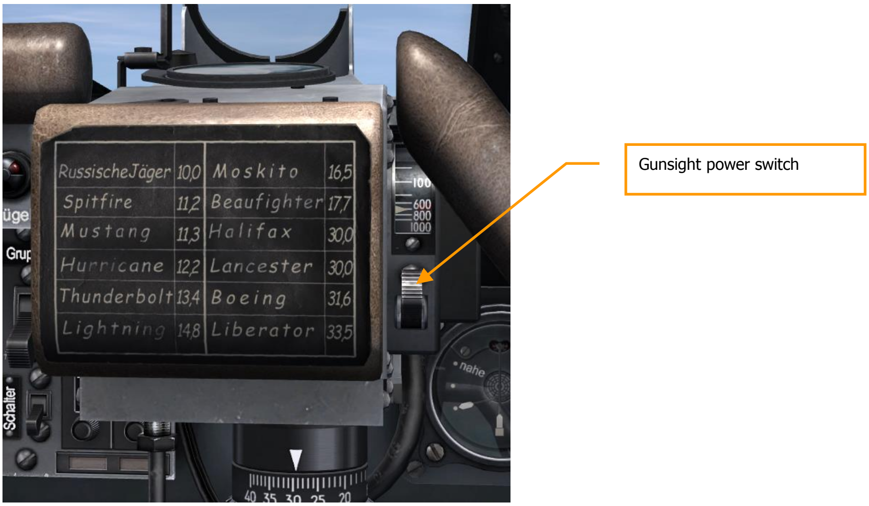
COMBAT EMPLOYMENT

COMBAT EMPLOYMENT

In this section, we will overview weapons employment procedures for the Fw 190 D-9.

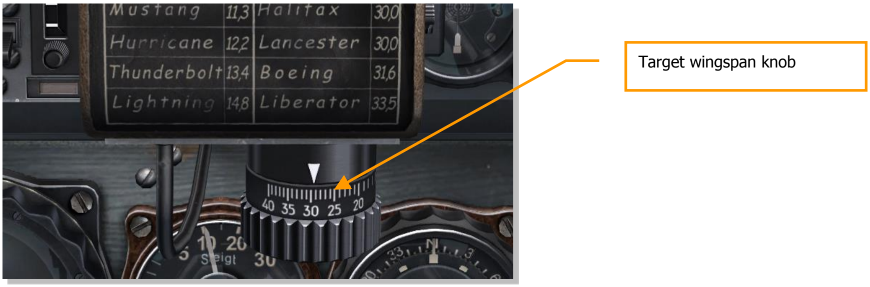
Guns

1. Turn On EZ 42 Gunsight Power Switch. [M]

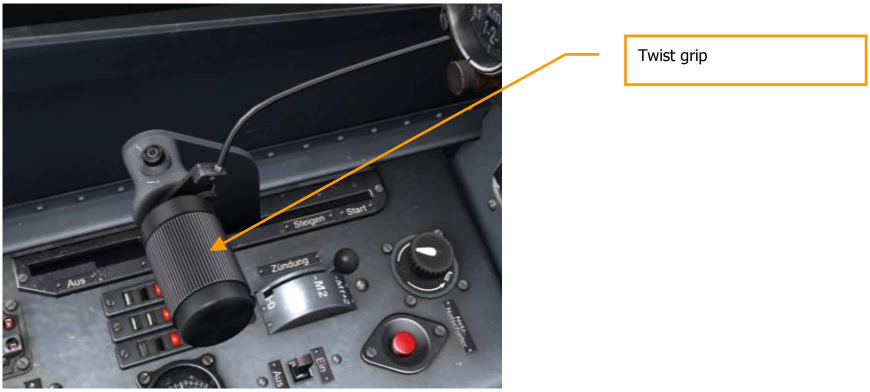


2. Turn on Guns Master Arm Switch. [C]

3. Set the target's wingspan. Increase [,], decrease [/].



4. Set the range to target via twist grip on the throttle. Increase [;], decrease [.].



Fly the aircraft so that the target appears within the reticle circle and rotate the throttle twist grip until the diameter of the reticle circle corresponds to the target size.

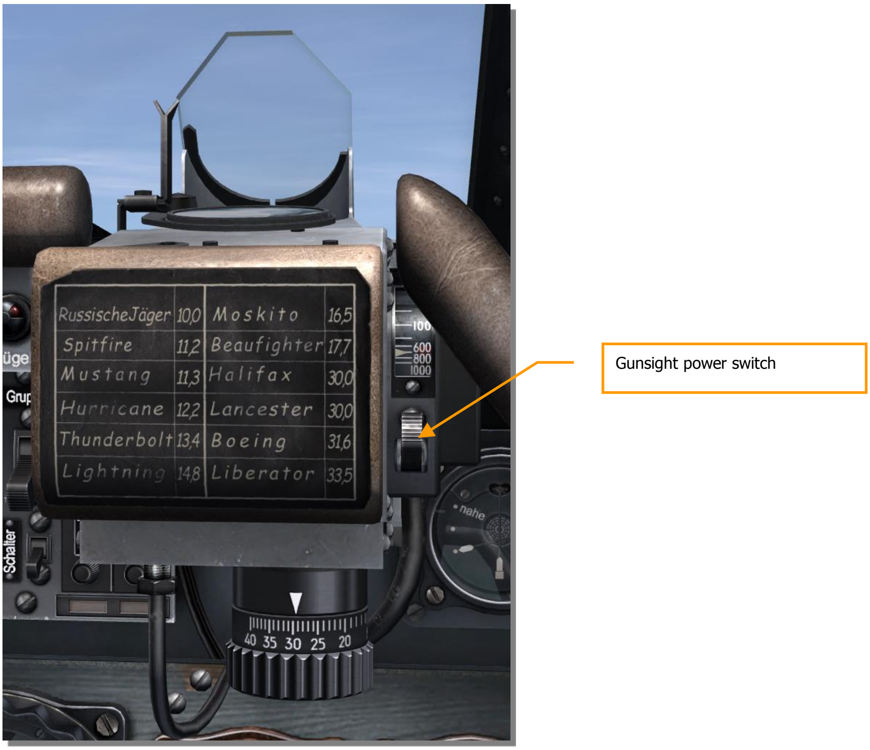
Continue to frame the target with the reticle circle by rotating the twist grip as range changes. Track the target smoothly for one-two second; then fire.

Bombs

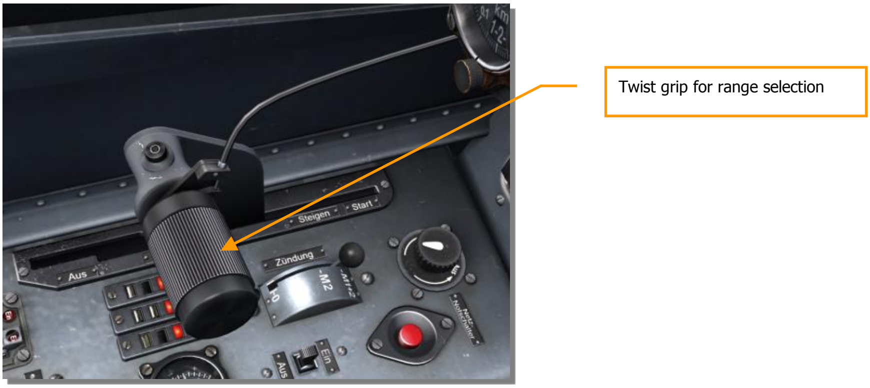
Releasing Bombs

The following is a standard procedure for releasing bombs:

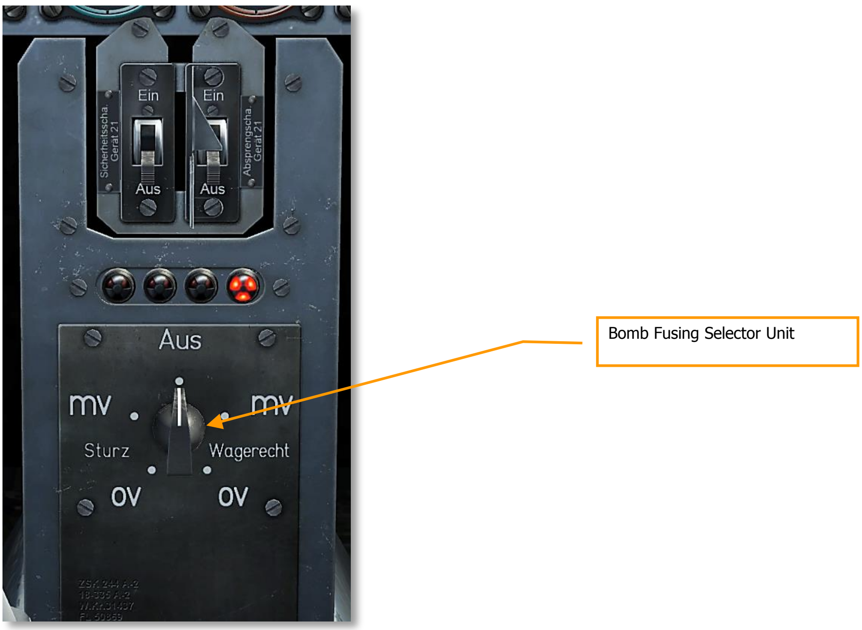
1. Turn On EZ 42 Gunsight Power Switch. [M]



2. Set the range to target to 0 with the twist grip on the throttle to fix gunsight reticule. Increase [;], decrease [.].



3. Set the Bomb Selector Switch to the proper profile and delay position. To left [LShift – B], to right [LCtrl – B].



4. Press the Bomb-Rocket Release button [RALT-Space] on the control stick to release bombs.

Note. Bombs may be released when the aircraft is in any pitch attitude from a 30-degree climb to a vertical dive.

Do not release bombs when you are sideslipping more than 5 degrees in a vertical dive. Doing so may collide a bomb and the propeller.

Emergency Bomb and Drop Tank Release

The Bombs may be jettisoned with the Jettison Fuselage Stores handle, located below the main instrument panel.

"Rumpflast" - Jettison Fuselage Stores. [LCtrl – R]

RADIO COMMUNICATIONS

RADIO COMMUNICATIONS

There are two optional modes of using the radio that depend on the "EASY COMMUNICATION" OPTION under the GAMEPLAY tab. This setting also determines the key commands used to access the radio menu in-game.

Because the radio of the Fw 190 D-9 is limited to 4 channels, you will only be able to communicate with those entities whose frequencies are loaded in your radio. Radio frequencies are loaded in the mission editor by the mission designer and should be made available as part of the mission briefing.

Easy Communication is enabled

The radio communications window is accessed by a press of the [\] forward slash key (this is for US keyboards, other language keyboards may vary). After the command selection the radio or interphone will be selected (if required) and tuned (if required) automatically. Also [\] key will close radio command menu.

When the radio menu is displayed, recipients are color-coded as follows:

Recipients on which at least one of the radios is tuned to is colored white.

Recipients on which at least one of the radios can be tuned to but is not currently on the correct frequency is colored gray.

Recipients that cannot be contacted due to range or terrain masking / earth curvature are colored black.

Each will also have their modulation / frequency listed. When you select a recipient, the appropriate radio will automatically be tuned to communicate with the selected recipient.

When Easy Communications mode is enabled, the following "quick" command shortcuts are also available:

[LWIN + U] Request AWACS vector to home plate.

[LWIN + G] Command flight to attack ground targets.

[LWIN + D] Command flight to attack air defense targets.

[LWIN + W] Command flight to cover me.

[LWIN + E] Command flight to proceed with the mission and return to base.

[LWIN + R] Command flight to proceed with the mission and rejoin.

[LWIN + T] Command flight to open/close the formation.

[LWIN + Y] Command flight to rejoin the formation.

Easy Communication is not enabled

When Easy Communications mode is OFF, the Push To Transmit (PTT) button [RALT-\] is used to open radio command panel. The PTT button opens and closes the radio communications window for currently selected radio.

When recipients are displayed, there is no color-coding of availability and no listing of their modulation / frequency. This is the more realistic play mode and requires you to know the correct modulation / frequencies for each recipient and you must manually enter the frequencies on the correct radio.

Radio Communications Window

Top Level Recipient List:

If using "Easy Communications", recipients not present in the mission will not be listed.

F1. Wingman...

F2. Flight...

F3. Second Element...

F4. JTAC...

F5. ATCs...

F8. Ground Crew...

F10. Other...

F12. Exit

Hotkeys will also be available to directly issue any command in the structure. These can be found in Input Options.

To exit radio communications, you can also press the ESC key.

F1 Wingman

Upon selecting F1 Wingman from the main radio communications window, you have the option to select the basic type of message you wish to send to your number 2 wingman. These are:

F1. Navigation...

F2. Engage...

F3. Engage with...

F4. Maneuvers...

F5. Rejoin Formation

F11. Previous Menu

F12. Exit

F1 Navigation...

The Navigation options allow you to direct where your wingman will fly to.

F1 Anchor Here. Your wingman will orbit at its current location until you issue a Rejoin command.

F2 Return to base. Your wingman will return to and land at the airbase designated in the flight plan.

F11 Previous Menu

F12 Exit

F2 Engage...

The Engage options allow you to direct your wingman to attack a specific type of target. After issuing the order, the wingman will attempt to locate the specified target type and attack it.

F1 Engage Ground Target. Wingman will attack any enemy ground unit it can locate.

F2 Engage Armor. Wingman will attack any tanks, infantry fighting vehicles, and armored personnel carriers it can locate.

F3 Engage Artillery. Wingman will attack any tube artillery or multiple rocket launchers that it can locate.

F4 Engage Air Defenses. Wingman will attack any enemy anti-aircraft artillery and surface to air missile units that it can locate.

F5 Engage Utility Vehicles. Wingman will attack all supply, transport, fuel, power generation, command and control, and engineering units it can locate.

F6 Engage Infantry. Wingman will attack hostile infantry units. Note that the infantry units are very difficult to detect unless they are moving or firing weapons.

F7 Engage Ships. Wingman will engage enemy surface combatants. Note that most surface combatants are heavily armed and that the FW 190D is not well-suited to attacking such targets.

F8 Engage Bandits. Wingman will engage any enemy fixed-wing and rotary-wing aircraft it can locate.

F11 Previous Menu

F12 Exit

F3 Engage With...

Whereas the F2 Engage command allows you to give basic orders for your wingman to attack a target type, the F3 Engage With set of commands not only allows you to determine target type, but also the direction of attack and what weapon type to use. This is done in a tiered manner by first selecting target type, then weapon type, and finally the attack heading. The wingman will then attempt to locate targets of the specified type and attack them according to your specified weapon and attacking heading. While the F2 Engage options are fast to issue, the F3 Engage With options provides much greater control.

Target Type. These options mirror those of the F2 Engage orders and allow you to determine the type of ground target you want your wingman to engage.

F1 Engage Ground Target. Wingman will attack any enemy ground unit it can locate.

F2 Engage Armor. Wingman will attack any tanks, infantry fighting vehicles, and armored personnel carriers it can locate.

F3 Engage Artillery. Wingman will attack any tube artillery or multiple rocket launchers that it can locate.

F4 Engage Air Defenses. Wingman will attack enemy anti-aircraft artillery and surface to air missile units that it can locate.

F5 Engage Utility Vehicles. Wingman will attack all supply, transport, fuel, power generation, command and control, and engineering units it can locate.

F6 Engage Infantry. Wingman will attack hostile infantry units. Note that the infantry units are very difficult to detect unless they are moving or firing weapons.

F7 Engage Ships. Wingman will engage enemy surface combatants. Note that most surface combatants are heavily armed and that your aircraft is not well-suited to attacking such targets.

Weapon Type. Once you have selected the target type, you will be given a list of weapon types that you want your wingman to engage the target with. These include:

F2 Unguided Bomb...

F4 Rocket...

F6 Gun...

F4 Maneuvers...

Although your wingman will generally do a good job of knowing when and how to maneuver, there may be times when you want to give him/her a very specific maneuvering order. This could be in response to a threat or to better set up an attack.

F1 Break Right. This command will order your wingman to make a maximum-G break to the right.

F2 Break Left. This command will order your wingman to make a maximum-G break to the left.

F3 Break High. This command will order your wingman to make a maximum-G break high.

F4 Break Low. This command will order your wingman to make a maximum-G break low.

F7 Clear Right. Your wingman will perform a 360-degree turn to the right of the current flight path while searching for targets.

F8 Clear Left. Your wingman will perform a 360-degree turn to the left of the current flight path while searching for targets.

F9 Pump. Your wingman will perform a 180-degree turn from its current heading and fly 10 nm. Once reached, it will turn 180-degrees back to the original heading.

F5 Rejoin Formation

Issuing this command will instruct your wingman to cease its current task and rejoin formation with you.

F2 Flight

Upon selecting F2 Flight from the main radio communications window, you have the option to select the basic type of message you wish to send. These are:

F1 Navigation...

F2 Engage...

F3 Engage with...

F4 Maneuvers...

F5 Formation

F6 Rejoin Formation

F11 Previous Menu

F12 Exit

F1 Navigation...

The Navigation options allow you to direct your flight where to fly to.

F1 Anchor Here

F2 Return to base

F11 Previous Menu

F12 Exit

These commands mirror those of the Wingman Navigation commands but apply to all flight members.

F2 Engage...

The Engage options allow you to direct your flight to attack a specific type of target. After issuing the order, the flight will attempt to locate the specified target type and attack it.

F1 Engage Ground Target

F2 Engage Armor

F3 Engage Artillery

F4 Engage Air Defenses

F5 Engage Utility Vehicles

F6 Engage Infantry

F7 Engage Ships

F8 Engage Bandits

F11 Previous Menu

F12 Exit

These commands mirror those of the Wingman Engage commands but apply to all flight members.

F3 Engage With...

These commands mirror those of the Wingman Engage With commands but apply to all flight members. These commands work the same as the Wingman Engage With Commands described above.

F4 Maneuvers...

F1 Break Right

F2 Break Left

F3 Break High

F4 Break Low

F7 Clear Right

F8 Clear Left

F9 Pump

F11 Previous Menu

F12 Exit

These commands mirror those of the Wingman Maneuvers commands but apply to all flight members.

F5 Formation

From the Formation menu, you can select the formation that the flight will fly in relation to you as the flight leader.

F1 Go Line Abreast

F2 Go Trail

F3 Go Wedge

F4 Go Echelon Right

F5 Go Echelon Left

F6 Go Finger Four

F7 Go Spread Four

F8 Open Formation

F9 Close Formation

F11 Previous Menu

F12 Exit

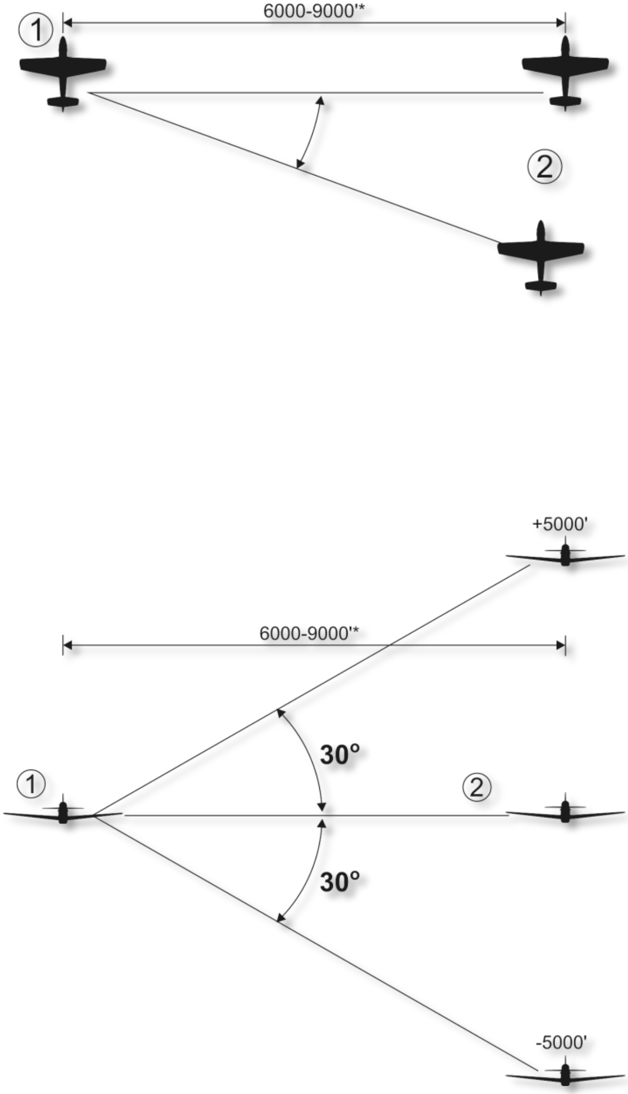


Figure 83: F1 Go Line Abreast

Figure 84: F2 Go Trail

Position may be modified within a 4000-12,000' envelope by flight lead.

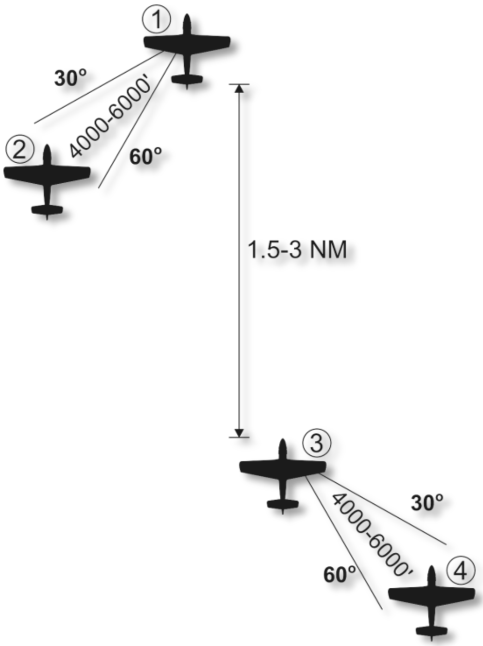


Figure 85: F3 Go Wedge

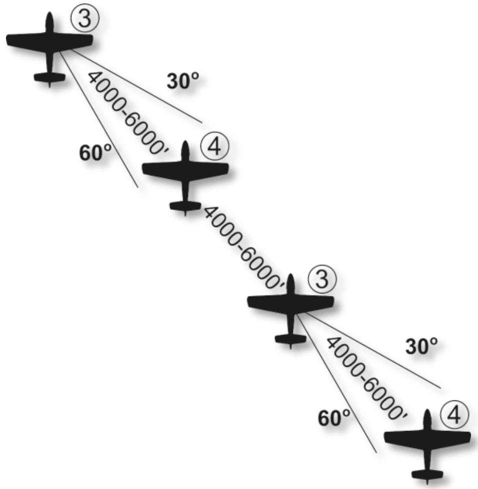


Figure 86: F4 Go Echelon Right

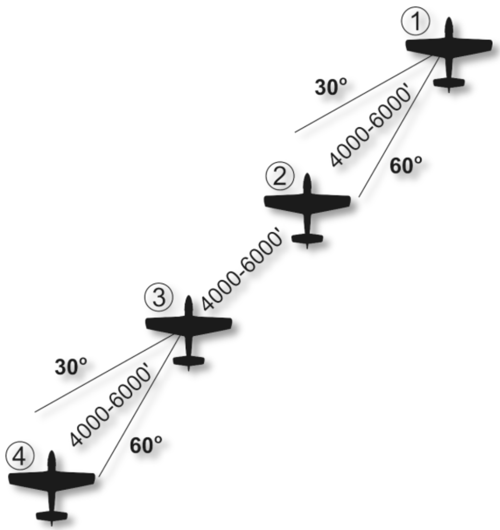


Figure 87: F5 Go Echelon Left

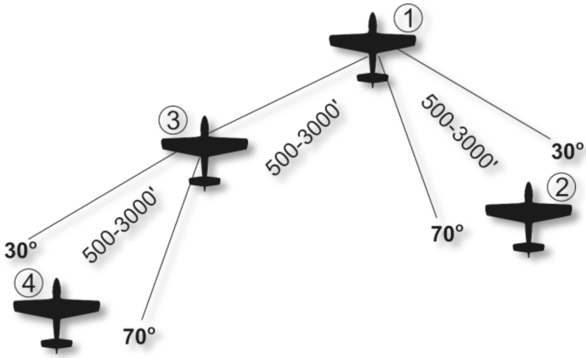


Figure 88: F6 Go Finger Four

Position may be modified within a 4000-12,000' envelope by flight lead.

Figure 89: F7 Go Spread Four

Position may be modified within a 4000-12,000' envelope by flight lead.

F8. Open Formation. Increase the distance between each aircraft in the current formation.

F9. Close Formation. Decrease the distance between each aircraft in the current formation.

F6 Rejoin Formation

Issuing this command will instruct your flight to cease their current task and rejoin formation with you.

Flight Member Responses

After sending a radio message to any of your flight members, you will have one of two responses:

Flight number of responder (2, 3, or 4). When a flight member will carry out the order, it will respond simply with its flight number.

(Flight member number) unable. When a flight member cannot carry out the order, it will respond with its flight number following by "unable". For example: "2, unable"

F5 ATC

The Air Traffic Control (ATC) system of this simulation is context sensitive to the location of your aircraft: on the parking ramp or runway/airborne.

Because the FuG 16 AM radio of the Fw 190 D-9 is limited to 4 channels, you will only be able to communicate with those entities whose frequencies are loaded in your radio. Radio frequencies are loaded in the mission editor by the mission designer and should be made available as part of the mission briefing.

Each airdrome's tower has a several radios in different radio bands to have a radio communication with aircrafts of different types.

ATC Communication Frequencies for Fw 190 D-9 radio band:

Anapa-Vityazevo: 38.40 MHz

Batumi: 40.40 MHz

Gelendzhik: 39.40 MHz

Gudauta: 40.20 MHz

Kobuleti: 40.80 MHz

Kutaisi (Kopitnari): 41.0 MHz

Krasnodar Center: 38.60 MHz

Krasnodar-Pashkovsky: 39.80 MHz

Krymsk: 39.0 MHz

Maykop-Khanskaya: 39.20 MHz

Mineralnye Vody: 41.20 MHz

Mozdok: 41.60 MHz

Nalchik: 41.40 MHz

Novorossiysk: 38.80 MHz

Senaki-Kolkhi: 40.60 MHz

Sochi-Adler: 39.60 MHz

Soganlug: 42.0 MHz

Sukhumi-Babushara: 40.0 MHz

Tbilisi-Lochini: 41.80 MHz

Vaziani: 42.20 MHz

Beslan: 42.40 MHz

Parking Ramp Start

Before you can communicate with ATC/Ground Control to get permission to start your engine, you first need to have your radio up and running.

With the radio now operating, press [\] or [RALT +\] to bring up the radio menu and then press F1 "Request Engine Start".

If you have wingmen, they will also now start their engine.

After the aircraft has been started and configured, select F1 "Request taxi to runway". Once you receive permission, you can taxi to the "hold short" area of the taxiway - the area on the taxiway just short of entering the runway.

If you have wingmen, they will also now taxi to the runway.

When at the hold short area, press [\] or [RALT +\] and F1 "Request takeoff". When permission is granted, you can taxi on to the runway and takeoff.

Runway and Air Start

If you are not starting from the parking ramp, you can access ATC by pressing the [\] or [RALT +\] key. Upon doing so, you can select F5 "ATCs".

If you are using "Easy Communications", a list of airfield ATCs are listed along with their contact frequencies. Select the airfield ATC you wish to contact. If not using Easy Communications, you will first need to push channel button of assigned ATC frequency you wish to land on the radio.

Once the airfield ATC is selected, you can either send them an "Inbound" message to indicate that you intend to land there, or an "I'm lost" message that will result in the ATC providing you guidance to reach the airfield.

When you select "Inbound", the ATC will respond with the following information:

Heading to fly to reach landing initial point.

Range to landing initial point.

The QFE, or atmospheric pressure at the airfield elevation.

Which runway to land on.

You can then radio:

"Request landing" indicates your intent to land at directed runway.

"Abort landing" indicates that you will not be landing at the directed runway.

"I'm lost" requests navigation assistance to reach the airfield.

If you've requested landing and are on final approach, radio request landing a second time and ATC tower control will provide permission if the runway is clear. It will also provide wind direction and speed.

After you have landed, proceed to the parking area and shut down the aircraft.

F6 Ground Crew

After landing at a friendly airfield and taxiing to a parking ramp, you can communicate with the ground crew for re-arming and re-fueling by pressing the F6 option to display the Ground Crew menu.

SUPPLEMENTS

Airbase Data

Airbase	Runway	TACAN, channel	ILS	Tower comm frequencies
UG23 Gudauta - Bambora (Abkhazia)	15-33, 2500m			130.0/40.20/209.00
UG24 Tbilisi - Soganlug (Georgia)	14-32, 2400m			139.0/42.0/218.0
UG27 Vaziani (Georgia)	14-32, 2500m	22X (VAS)	108.75	140.0/42.20/219.0
UG5X Kobuleti (Georgia)	07-25, 2400m	67X (KBL)	07 ILS - 111.5	133.0/40.80/212.0
UGKO Kutaisi - Kopitnari (Georgia)	08-26, 2500m	44X (KTS)	08 ILS - 109.75	134.0/41.0/213.0
UGKS Senaki - Kolkhi (Georgia)	09-27, 2400m	31X (TSK)	09 ILS - 108.9	132.0/40.60/211.0
UGSB Batumi (Georgia)	13-31, 2400m	16X (BTM)	13 ILS - 110.3	131.0/40.40/210.0
UGSS Sukhumi - Babushara (Abkhazia)	12-30, 2500m			129.0/40.0/208.0
UGTB Tbilisi - Lochini (Georgia)	13-31, 3000m		13 ILS - 110.3 31 ILS - 108.9	138.0/41.80/217.0
URKA Anapa - Vityazevo (Russia)	04-22, 2900m			121.0/38.40/200.0
URKG Gelendzhik (Russia)	04-22, 1800m			126.0/39.40/205.0
URKH Maykop - Khanskaya (Russia)	04-22, 3200m			125.0/39.20/204.0
URKI Krasnodar - Center (Russia)	09-27, 2500m			122.0/38.60/201.0
URKK Krasnodar - Pashkovsky (Russia)	05-23, 3100m			128.0/39.80/207.0
URKN Novorossiysk (Russia)	04-22, 1780m			123.0/38.80/202.0
URKW Krymsk (Russia)	04-22, 2600m			124.0/39.0/203.0
URMM Mineralnye Vody (Russia)	12-30, 3900m		12 ILS - 111.7 30 ILS - 109.3	135.0/41.20/214.0
URMN Nalchik (Russia)	06-24, 2300m		24 ILS - 110.5	136.0/41.40/215.0
URMO Beslan (Russia)	10-28, 3000m		10 ILS - 110.5	141.0/42.40/220.0
URSS Sochi - Adler (Russia)	06-24, 3100m		06 ILS - 111.1	127.0/39.60/206.0
XRMF Mozdok (Russia)	08-27, 3100m			137.0/41.60/216.0

Credits

Bronze Backers

Alex G
Matthew Lambert
Bob Evans
Rados?aw Pi?tkowski
Laurent Cunin
Scrub
Larry Lade
Mark Nowotarski
Lasstmichdurch
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Denis Kaplin
David Belvin
Sergii Gabal
Jazzerman
borownjak
Steve Barnes
Victor Tumanov
rutkov
Samuel Bera
Peter Ivady
Aksel Sandsmark Borgersen
Home Fries
Mark Duckett
Jordan Leidner
Guilherme Domene
Tim Shaw
Markus Ronkainen
Aaron Taylor
AndreasDitte
Tvrtko Kovacic
Bols Blue
Fred Schuit
Grzegorz Sikora
Kareem Vafin
Paulius Saul?nas
Rafa? Szekalski
Henri H?kkinen

Cliff Dover
Przemys?aw Cyga?ski
Flex1024
kamaz
Paul Brown
Jack
Simon Briggs
Jera Ora?em
Cameron Fenton
Thomas Reynolds
Dan Lake
Andy Wall
Ben Green
Lasse-Pekka Toivanen
Robert Stuart
mark downer
Darcy Mead
Koh Noel
Fredrik Silfverduk
Alan Whitlock
Jacek Karle
Ilya Kirillov
Novaflare
Oscar Codan
Jon Sigurd Bersvendsen
Marcus Schroeder
Mikko H?rmeinen
Thomas Schroeder
Vitor Pimentel
Seel
Fabiano Carlos Alves do Nascimento
David Carter
Fernando Becker
George ?lund
Imoel
Stuart Jarmain
Tony Baeza
Isaac Titcomb
George Xu
Traz
Marcin Bielski
Andrew MacPherson
mark poole
Kirill Ravikovitch
Cedric Girard
marco bellafante
Timur Kaziev
Rom?
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Doblejorge
Igor Bayborodov
UbiquitousUK
Sean
Goran Skoko
Anthony Wheeler
Rafal
Sami Juntunen
TAIKI SONOBE
Cody John Davis
Joel Cu?llar
Peter Orlemann
Arto S.
Max Taha
Christian Biagi
Ross Martin
TopFlyer
Jacob Knee
Garrett Longtin
Sebastian
roman olenich
Andre van Schaik
Mario Mariotta
Sigurd andre olaisen
Momo Tombo
David Ross Smith
Harkman
Erastos
Konstantin Borovik
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kurnz
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Or Yaron
M?ns Serneke
Polaris Penguin
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