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## Pilot's Operating Handbook

1982 Turbo

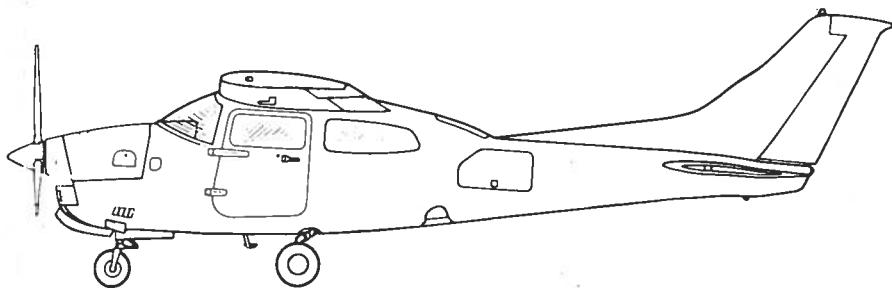
# Centurion

Model T210N

# PILOT'S OPERATING HANDBOOK

and

## FAA APPROVED AIRPLANE FLIGHT MANUAL



CESSNA AIRCRAFT COMPANY

1982 MODEL T210N

THIS DOCUMENT MUST BE  
CARRIED IN THE AIRPLANE  
AT ALL TIMES.

Serial #

Regist

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE  
FURNISHED TO THE PILOT BY CAR PART 3 AND CONSTITUTES  
THE FAA APPROVED AIRPLANE FLIGHT MANUAL.

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CESSNA AIRCRAFT COMPANY  
WICHITA, KANSAS, USA



Member of GAMA

11 September 1981

THIS MANUAL WAS PROVIDED FOR THE AIRPLANE  
IDENTIFIED ON THE TITLE PAGE ON \_\_\_\_\_.  
SUBSEQUENT REVISIONS SUPPLIED BY CESSNA  
AIRCRAFT COMPANY MUST BE PROPERLY IN-  
SERTED.

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CESSNA AIRCRAFT COMPANY, PAWNEE DIVISION

# CONGRATULATIONS . . .

Welcome to the ranks of Cessna owners! Your Cessna has been designed and constructed to give you the most in performance, economy, and comfort. It is our desire that you will find flying it, either for business or pleasure, a pleasant and profitable experience.

This Pilot's Operating Handbook has been prepared as a guide to help you get the most pleasure and utility from your airplane. It contains information about your Cessna's equipment, operating procedures, and performance; and suggestions for its servicing and care. We urge you to read it from cover to cover, and to refer to it frequently.

Our interest in your flying pleasure has not ceased with your purchase of a Cessna. Worldwide, the Cessna Dealer Organization backed by the Cessna Customer Services Department stands ready to serve you. The following services are offered by most Cessna Dealers:

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A current Worldwide Customer Care Directory accompanies your new airplane. The Directory is revised frequently, and a current copy can be obtained from your Cessna Dealer. Make your Directory one of your cross-country flight planning aids; a warm welcome awaits you at every Cessna Dealer.

**PERFORMANCE-  
SPECIFICATIONS**

**CESSNA  
MODEL T210N**

# **PERFORMANCE - SPECIFICATIONS**

**\*SPEED:**

Maximum at 17,000 Ft	.....	204 KNOTS
Cruise, 80% Power at 20,000 Ft	.....	193 KNOTS
Cruise, 80% Power at 10,000 Ft	.....	176 KNOTS

**CRUISE:** Recommended lean mixture with fuel allowance for engine start, taxi, takeoff, climb and 45 minutes reserve at 45% power.

80% Power at 20,000 Ft	.....	Range	715 NM
522 Pounds Usable Fuel	.....	Time	4.0 HRS
80% Power at 10,000 Ft	.....	Range	685 NM
522 Pounds Usable Fuel	.....	Time	4.0 HRS
Maximum Range at 20,000 Ft	.....	Range	880 NM
522 Pounds Usable Fuel	.....	Time	6.8 HRS
Maximum Range at 10,000 Ft	.....	Range	900 NM
522 Pounds Usable Fuel	.....	Time	7.2 HRS

**RATE OF CLIMB AT SEA LEVEL** .....

**SERVICE CEILING** .....

**TAKEOFF PERFORMANCE:**

Ground Roll	.....	1300 FT
Total Distance Over 50-Ft Obstacle	.....	2160 FT

**LANDING PERFORMANCE:**

Ground Roll	.....	765 FT
Total Distance Over 50-Ft Obstacle	.....	1500 FT

**STALL SPEED (KCAS):**

Flaps Up, Power Off	.....	67 KNOTS
Flaps Down, Power Off	.....	58 KNOTS

**MAXIMUM WEIGHT:**

Ramp	.....	4016 LBS
Takeoff	.....	4000 LBS
Landing	.....	3800 LBS

**STANDARD EMPTY WEIGHT:**

Turbo Centurion	.....	2237 LBS
Turbo Centurion II	.....	2303 LBS

**MAXIMUM USEFUL LOAD:**

Turbo Centurion	.....	1779 LBS
Turbo Centurion II	.....	1713 LBS

**BAGGAGE ALLOWANCE:** Maximum With 4 People

.....	.....	240 LBS
.....	.....	22.9

**WING LOADING:** Pounds/Sq Ft

.....	.....	12.9
.....	.....	90 GAL.

**POWER LOADING:** Pounds/HP

**FUEL CAPACITY:** Total

.....	.....	11 QTS
.....	.....	TSIO-520-R

**OIL CAPACITY**

**ENGINE:** Teledyne Continental, Turbocharged Fuel Injection

310 BHP at 2700 RPM (5-Minute Takeoff Rating)	.....
285 BHP at 2600 RPM (Maximum Continuous Rating)	.....

PROPELLER: 3-Bladed Constant Speed, Diameter	.....	80 IN.
--	-------	--------

\* Speeds are based on mid-cruise weight.

The above performance figures are based on the indicated weights, standard atmospheric conditions, level hard-surface dry runways, and no wind. They are calculated values derived from flight tests conducted by the Cessna Aircraft Company under carefully documented conditions and will vary with individual airplanes and numerous factors affecting flight performance.

## COVERAGE

The Pilot's Operating Handbook in the airplane at the time of delivery from Cessna Aircraft Company contains information applicable to the 1982 Model T210 airplane designated by the serial number and registration number shown on the Title Page of this handbook. This information is based on data available at the time of publication.

## REVISIONS

Changes and/or additions to this handbook will be covered by revisions published by Cessna Aircraft Company. These revisions are distributed to owners of U. S. Registered aircraft according to FAA records at the time of revision issuance.

Revisions should be examined immediately upon receipt and incorporated in this handbook.

### NOTE

**It is the responsibility of the owner to maintain this handbook in a current status when it is being used for operational purposes.**

Owners should contact their Cessna Dealer whenever the revision status of their handbook is in question.

A revision bar will extend the full length of new or revised text and/or illustrations added on new or presently existing pages. This bar will be located adjacent to the applicable revised area on the outer margin of the page.

All revised pages will carry the revision number and date on the applicable page.

The following Log of Effective Pages provides the dates of issue for original and revised pages, and a listing of all pages in the handbook. Pages affected by the current revision are indicated by an asterisk (\*) preceding the pages listed.

## LOG OF EFFECTIVE PAGES

Dates of issue for original and revised pages are:

Original ..... 11 September 1981  
Revision 1 ..... 16 December 1981

Page	Date	Page	Date
Title .....	11 September 1981	4-1 thru 4-4 .....	11 September 1981
Assignment Record	11 September 1981	*4-5 thru 4-7 .....	16 December 1981
i thru ii .....	11 September 1981	4-8 .....	11 September 1981
*iii thru iv.....	16 December 1981	*4-9 .....	16 December 1981
v .....	11 September 1981	4-10 thru 4-13 .....	11 September 1981
vi Blank .....	11 September 1981	4-14 Blank .....	11 September 1981
1-1 thru 1-8 .....	11 September 1981	4-15 .....	11 September 1981
2-1 .....	11 September 1981	*4-16 .....	16 December 1981
2-2 Blank .....	11 September 1981	4-17 thru 4-28 .....	11 September 1981
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3-1 thru 3-3 .....	11 September 1981	5-2 Blank .....	11 September 1981
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## LOG OF EFFECTIVE PAGES

CESSNA  
MODEL T210N

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NOTE  
Refer to Section 9 Table of Contents for  
supplements applicable to optional sys-  
tems.

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SECTION 1  
GENERAL

CESSNA  
MODEL T210N

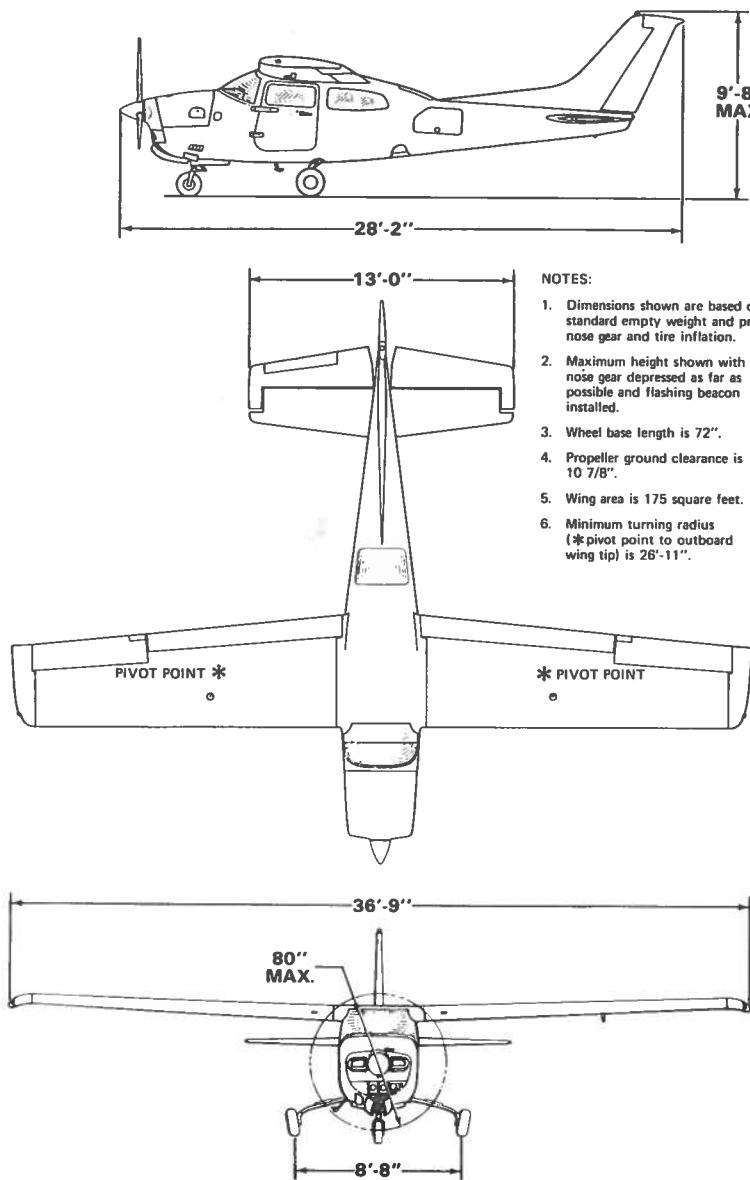


Figure 1-1. Three View

## INTRODUCTION

This handbook contains 9 sections, and includes the material required to be furnished to the pilot by CAR Part 3. It also contains supplemental data supplied by Cessna Aircraft Company.

Section 1 provides basic data and information of general interest. It also contains definitions or explanations of symbols, abbreviations, and terminology commonly used.

## DESCRIPTIVE DATA

### ENGINE

Number of Engines: 1.

Engine Manufacturer: Teledyne Continental.

Engine Model Number: TSIO-520-R.

Engine Type: Turbocharged, direct-drive, air-cooled, horizontally-opposed, fuel-injected, six-cylinder engine with 520 cu. in. displacement.

Horsepower Rating and Engine Speed:

Maximum Power(5 minutes -takeoff): 310 rated BHP at 36.5 inches Hg and 2700 RPM.

Maximum Continuous Power: 285 rated BHP at 35 inches Hg and 2600 RPM.

### PROPELLER

Propeller Manufacturer: McCauley Accessory Division.

Propeller Model Number: D3A34C402/90DFA-10.

Number of Blades: 3.

Propeller Diameter, Maximum: 80 inches.

Minimum: 78.5 inches.

Propeller Type: Constant speed and hydraulically actuated, with a low pitch setting of 12.4° and a high pitch setting of 28.5° (30 inch station).

### FUEL

Approved Fuel Grades (and Colors):

100LL Grade Aviation Fuel (Blue).

100 (Formerly 100/130) Grade Aviation Fuel (Green).

### NOTE

Isopropyl alcohol or ethylene glycol monomethyl ether may be added to the fuel supply. Additive concentrations shall not exceed 1% for isopropyl alcohol or .15% for ethylene glycol monomethyl ether. Refer to Section 8 for additional information.

## SECTION 1 GENERAL

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Total Capacity: 90 gallons.

Total Capacity Each Tank: 45 gallons.

Total Usable: 87 gallons.

### NOTE

Before refueling or when the airplane is parked on a slope, place the fuel selector handle in the LEFT ON or RIGHT ON position, whichever corresponds to the low wing. This action minimizes cross-feeding from the fuller tank and reduces fuel seepage from the wing tank vents.

## OIL

Oil Grade (Specification):

MIL-L-6082 Aviation Grade Straight Mineral Oil: Use to replenish supply during first 25 hours and at the first 25-hour oil change. Continue to use until a total of 50 hours has accumulated or oil consumption has stabilized.

### NOTE

The airplane was delivered from the factory with a corrosion preventive aircraft engine oil. This oil should be drained after the first 25 hours of operation.

Continental Motors Specification MHS-24 (and all revisions thereto), Ashless Dispersant Oil: This oil **must be used** after first 50 hours or oil consumption has stabilized.

Recommended Viscosity for Temperature Range:

All temperatures, use SAE 20W-50 or

Above 4°C (40°F), use SAE 50

Below 4°C (40°F), use SAE 30

### NOTE

Multi-viscosity oil with a range of SAE 20W-50 is recommended for improved starting and turbocharger controller operation in cold weather.

Oil Capacity:

Sump: 10 Quarts.

Total: 11 Quarts.

## MAXIMUM CERTIFICATED WEIGHTS

Ramp: 4016 lbs.

Takeoff: 4000 lbs.

Landing: 3800 lbs.

Weight in Baggage Compartment:

Baggage - Forward of wheel well on folded down aft seat (Station 89 to 110): 120 lbs.

Baggage - On wheel well (Station 110 to 124): 50 lbs.

Baggage - On and aft of wheel well (Station 110 to 152): 200 lbs.

NOTE

The maximum allowable combined weight capacity for baggage forward, on and aft of the wheel well is 240 pounds.

## STANDARD AIRPLANE WEIGHTS

Standard Empty Weight, Turbo Centurion: 2237 lbs.

Turbo Centurion II: 2303 lbs.

Maximum Useful Load, Turbo Centurion: 1779 lbs.

Turbo Centurion II: 1713 lbs.

## CABIN AND ENTRY DIMENSIONS

Detailed dimensions of the cabin interior and entry door openings are illustrated in Section 6.

## BAGGAGE SPACE AND ENTRY DIMENSIONS

Dimensions of the baggage area and baggage door opening are illustrated in detail in Section 6.

## SPECIFIC LOADINGS

Wing Loading: 22.9 lbs./sq. ft.

Power Loading: 12.9 lbs./hp.

## SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

### GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

KCAS           **Knots Calibrated Airspeed** is indicated airspeed corrected for position and instrument error and expressed in knots. Knots calibrated airspeed is equal to KTAS in standard atmosphere at sea level.

KIAS           **Knots Indicated Airspeed** is the speed shown on the airspeed indicator and expressed in knots.

SECTION 1  
GENERAL

CESSNA  
MODEL T210N

KTAS	<b>Knots True Airspeed</b> is the airspeed expressed in knots relative to undisturbed air which is KCAS corrected for altitude and temperature.
$V_A$	<b>Maneuvering Speed</b> is the maximum speed at which full or abrupt control movements may be used.
$V_{FE}$	<b>Maximum Flap Extended Speed</b> is the highest speed permissible with wing flaps in a prescribed extended position.
$V_{LE}$	<b>Maximum Landing Gear Extended Speed</b> is the maximum speed at which an airplane can be safely flown with the landing gear extended.
$V_{LO}$	<b>Maximum Landing Gear Operating Speed</b> is the maximum speed at which the landing gear can be safely extended or retracted.
$V_{NO}$	<b>Maximum Structural Cruising Speed</b> is the speed that should not be exceeded except in smooth air, then only with caution.
$V_{NE}$	<b>Never Exceed Speed</b> is the speed limit that may not be exceeded at any time.
$V_S$	<b>Stalling Speed or the minimum steady flight speed</b> at which the airplane is controllable.
$V_{S_0}$	<b>Stalling Speed or the minimum steady flight speed</b> at which the airplane is controllable in the landing configuration at the most forward center of gravity.
$V_X$	<b>Best Angle-of-Climb Speed</b> is the speed which results in the greatest gain of altitude in a given horizontal distance.
$V_Y$	<b>Best Rate-of-Climb Speed</b> is the speed which results in the greatest gain in altitude in a given time.

## METEOROLOGICAL TERMINOLOGY

OAT	<b>Outside Air Temperature</b> is the free air static temperature. It is expressed in either degrees Celsius or degrees Fahrenheit.
Standard Temperature	<b>Standard Temperature</b> is 15°C at sea level pressure altitude and decreases by 2°C for each 1000 feet of altitude.

Pressure Altitude      **Pressure Altitude** is the altitude read from an altimeter when the altimeter's barometric scale has been set to 29.92 inches of mercury (1013 mb).

## ENGINE POWER TERMINOLOGY

BHP      **Brake Horsepower** is the power developed by the engine. Percent power values in this handbook are based on the maximum continuous power rating.

RPM      **Revolutions Per Minute** is engine speed.

MP      **Manifold Pressure** is a pressure measured in the engine's induction system and is expressed in inches of mercury (Hg).

## AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

Demonstrated Crosswind Velocity      **Demonstrated Crosswind Velocity** is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests. The value shown is not considered to be limiting.

Usable Fuel      **Usable Fuel** is the fuel available for flight planning.

Unusable Fuel      **Unusable Fuel** is the quantity of fuel that can not be safely used in flight.

PPH      **Pounds Per Hour** is the amount of fuel consumed per hour.

NMPG      **Nautical Miles Per Gallon** is the distance which can be expected per gallon of fuel consumed at a specific engine power setting and/or flight configuration.

g      **g** is acceleration due to gravity.

## WEIGHT AND BALANCE TERMINOLOGY

Reference Datum      **Reference Datum** is an imaginary vertical plane from which all horizontal distances are measured for balance purposes.

Station      **Station** is a location along the airplane fuselage given in terms of the distance from the reference datum.

Arm	<b>Arm</b> is the horizontal distance from the reference datum to the center of gravity (C.G.) of an item.
Moment	<b>Moment</b> is the product of the weight of an item multiplied by its arm. (Moment divided by the constant 1000 is used in this handbook to simplify balance calculations by reducing the number of digits.)
Center of Gravity (C.G.)	<b>Center of Gravity</b> is the point at which an airplane, or equipment, would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.
C.G. Arm	<b>Center of Gravity Arm</b> is the arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. Limits	<b>Center of Gravity Limits</b> are the extreme center of gravity locations within which the airplane must be operated at a given weight.
Standard Empty Weight	<b>Standard Empty Weight</b> is the weight of a standard airplane, including unusable fuel, full operating fluids and full engine oil.
Basic Empty Weight	<b>Basic Empty Weight</b> is the standard empty weight plus the weight of optional equipment.
Useful Load	<b>Useful Load</b> is the difference between ramp weight and the basic empty weight.
Maximum Ramp Weight	<b>Maximum Ramp Weight</b> is the maximum weight approved for ground maneuver. (It includes the weight of start, taxi and runup fuel.)
Maximum Takeoff Weight	<b>Maximum Takeoff Weight</b> is the maximum weight approved for the start of the takeoff roll.
Maximum Landing Weight	<b>Maximum Landing Weight</b> is the maximum weight approved for the landing touchdown.
Tare	<b>Tare</b> is the weight of chocks, blocks, stands, etc. used when weighing an airplane, and is included in the scale readings. Tare is deducted from the scale reading to obtain the actual (net) airplane weight.

# SECTION 2 LIMITATIONS

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## INTRODUCTION

Section 2 includes operating limitations, instrument markings, and basic placards necessary for the safe operation of the airplane, its engine, standard systems and standard equipment. The limitations included in this section and in Section 9 have been approved by the Federal Aviation Administration. Observance of these operating limitations is required by Federal Aviation Regulations.

### NOTE

Refer to Section 9 of this Pilot's Operating Handbook for amended operating limitations, operating procedures, performance data and other necessary information for airplanes equipped with specific options.

### NOTE

The airspeeds listed in the Airspeed Limitations chart (figure 2-1) and the Airspeed Indicator Markings chart (figure 2-2) are based on Airspeed Calibration data shown in Section 5 with the normal static source. If the alternate static source is being used, ample margins should be observed to allow for the airspeed calibration variations between the normal and alternate static sources as shown in Section 5.

Your Cessna is certificated under FAA Type Certificate No. 3A21 as Cessna Model No. T210N.

## SECTION 2 LIMITATIONS

CESSNA  
MODEL T210N

### AIRSPEED LIMITATIONS

Airspeed limitations and their operational significance are shown in figure 2-1.

	SPEED	KCAS	KIAS	REMARKS
$V_{NE}$	Never Exceed Speed	198	203	Do not exceed this speed in any operation.
$V_{NO}$	Maximum Structural Cruising Speed	165	168	Do not exceed this speed except in smooth air, and then only with caution.
$V_A$	Maneuvering Speed: 4000 Pounds 3350 Pounds 2700 Pounds	129 118 105	130 119 106	Do not make full or abrupt control movements above this speed.
$V_{FE}$	Maximum Flap Extended Speed: To $10^{\circ}$ Flaps $10^{\circ}$ - $20^{\circ}$ Flaps $20^{\circ}$ - $30^{\circ}$ Flaps	158 130 116	160 130 115	Do not exceed these speeds with the given flap settings.
$V_{LO}$	Maximum Landing Gear Operating Speed	163	165	Do not extend or retract landing gear above this speed.
$V_{LE}$	Maximum Landing Gear Extended Speed	198	203	Do not exceed this speed with landing gear extended.
	Maximum Window Open Speed	198	203	Do not exceed this speed with windows open.

Figure 2-1. Airspeed Limitations

### AIRSPEED INDICATOR MARKINGS

Airspeed indicator markings and their color code significance are shown in figure 2-2.

MARKING	KIAS VALUE OR RANGE	SIGNIFICANCE
White Arc	58 - 115	Full Flap Operating Range. Lower limit is maximum weight $V_{S_0}$ in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc	74 - 168	Normal Operating Range. Lower limit is maximum weight $V_S$ at most forward C.G. with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Arc	168 - 203	Operations must be conducted with caution and only in smooth air.
Red Line	203	Maximum speed for all operations.

Figure 2-2. Airspeed Indicator Markings

## POWER PLANT LIMITATIONS

Engine Manufacturer: Teledyne Continental.

Engine Model Number: TSIO-520-R.

Maximum Power, 5 Minutes - Takeoff: 310 BHP rating.

Continuous: 285 BHP rating.

Engine Operating Limits for Takeoff and Continuous Operations:

Maximum Engine Speed, 5 Minutes - Takeoff: 2700 RPM.

Continuous: 2600 RPM.

Maximum Manifold Pressure, 5 Minutes - Takeoff: 36.5 inches Hg.

Continuous: 35 inches Hg.

### NOTE

For manifold pressure limitations above 17,000 feet, refer to the Minimum Fuel Flows placard in this section.

Maximum Cylinder Head Temperature: 460°F (238°C).

Maximum Oil Temperature: 240°F (116°C).

Oil Pressure, Minimum: 10 psi.

Maximum: 100 psi.

Fuel Pressure, Minimum: 3.0 psi.

Maximum: 19.5 psi (186 PPH).

Fuel Grade: See Fuel Limitations.

Oil Grade (Specification):

MIL-L-6082 Aviation Grade Straight Mineral Oil or Ashless Disper-

## SECTION 2 LIMITATIONS

CESSNA  
MODEL T210N

sant Oil conforming to Continental Motors Specification MHS-24 and all revisions thereto.

Propeller Manufacturer: McCauley Accessory Division.

Propeller Model Number: D3A34C402/90DFA-10.

Propeller Diameter, Maximum: 80 inches.

Minimum: 78.5 inches.

Propeller Blade Angle at 30 Inch Station, Low: 12.4°.

High: 28.5°.

Propeller Operating Limits: Avoid continuous operation between 1850 and 2150 RPM above 24 inches manifold pressure.

## POWER PLANT INSTRUMENT MARKINGS

Power plant instrument markings and their color code significance are shown in figure 2-3.

INSTRUMENT	RED LINE	GREEN ARC	YELLOW ARC	WHITE ARC	RED LINE
	MINIMUM LIMIT	NORMAL OPERATING	CAUTION RANGE	NORMAL CLIMB RANGE	MAXIMUM LIMIT
Tachometer	---	2200 - 2500 RPM	2600 - 2700 RPM	---	2700 RPM
Manifold Pressure	---	15 - 30 in. Hg	35 - 36.5 in. Hg	---	36.5 in. Hg
Oil Temperature	---	100° - 240°F	---	---	240°F
Cylinder Head Temperature	---	200° - 460°F	---	---	460°F
Fuel Flow (Pressure)	(3.0 psi)	36 - 120 PPH	---	120 - 162 PPH	186 PPH (19.5 psi)
Oil Pressure	10 psi	30 - 60 psi	---	---	100 psi
Fuel Quantity	E (1.5 Gal Unusable Each Tank)	---	---	---	---
Suction	---	4.6 - 5.4 in. Hg	---	---	---

Figure 2-3. Power Plant Instrument Markings

## WEIGHT LIMITS

Maximum Ramp Weight: 4016 lbs.

Maximum Takeoff Weight: 4000 lbs.

Maximum Landing Weight: 3800 lbs.

Maximum Weight in Baggage Compartment:

Baggage - Forward of wheel well on folded down aft seat (Station 89 to 110): 120 lbs.

Baggage - On wheel well (Station 110 to 124): 50 lbs.

Baggage - On and aft of wheel well (Station 110 to 152): 200 lbs.

### NOTE

The maximum allowable combined weight capacity for baggage forward, on and aft of the wheel well is 240 pounds.

## CENTER OF GRAVITY LIMITS

Center of Gravity Range with Landing Gear Extended:

Forward: 37.0 inches aft of datum at 3000 lbs. or less, with straight line variation to 43.9 inches aft of datum at 4000 lbs.  
Aft: 52.0 inches aft of datum at 4000 lbs., with straight line variation to 53.0 inches aft of datum at 3800 lbs., and 53.0 inches aft of datum at 3800 lbs. or less.

Reference Datum: Lower portion of front face of firewall.

## MANEUVER LIMITS

This airplane is certificated in the normal category. The normal category is applicable to aircraft intended for non-aerobatic operations. These include any maneuvers incidental to normal flying, stalls (except whip stalls), lazy eights, chandelles, and turns in which the angle of bank is not more than 60°.

Aerobatic maneuvers, including spins, are not approved.

## FLIGHT LOAD FACTOR LIMITS

Flight Load Factors:

\*Flaps Up: +3.8g, -1.52g

\*Flaps Down: +2.0g

\*The design load factors are 150% of the above, and in all cases, the structure meets or exceeds design loads.

## KINDS OF OPERATION LIMITS

The airplane is equipped for day VFR and may be equipped for night VFR and/or IFR operations. FAR Part 91 establishes the minimum required instrumentation and equipment for these operations. The reference to types of flight operations on the operating limitations placard reflects equipment installed at the time of Airworthiness Certificate issuance.

Flight into known icing conditions is prohibited; however, the airplane may be equipped with a known icing equipment package which allows flight penetration of icing conditions as defined by the FAA.

## FUEL LIMITATIONS

2 Standard Tanks: 45 U.S. gallons each.

Total Fuel: 90 U.S. gallons.

Usable Fuel (all flight conditions): 87 U.S. gallons.

Unusable Fuel: 3 U.S. gallons.

Takeoff and land with the fuel selector valve handle in the BOTH ON position.

With 1/4 tank or less, prolonged uncoordinated flight is prohibited when operating on either left or right tank.

When switching from dry tank, turn auxiliary fuel pump on momentarily.

Use of left or right tank only is reserved for level flight.

Approved Fuel Grades (and Colors):

100LL Grade Aviation Fuel (Blue).

100 (Formerly 100/130) Grade Aviation Fuel (Green).

## OTHER LIMITATIONS

### FLAP LIMITATIONS

Approved Takeoff Range: 0° to 20°.

Approved Landing Range: 0° to 30°.

## PLACARDS

The following information must be displayed in the form of composite or individual placards.

1. In full view of the pilot: (The "DAY-NIGHT-VFR-IFR" entry, shown on the example below, will vary as the airplane is equipped.)

The markings and placards installed in this airplane contain operating limitations which must be complied with when operating this airplane in the Normal Category. Other operating limitations which must be complied with when operating this airplane in this category are contained in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

No acrobatic maneuvers, including spins, approved.

Flight into known icing conditions prohibited.

This airplane is certified for the following flight operations as of date of original airworthiness certificate:

DAY—NIGHT—VFR—IFR

2. On control lock:

**CAUTION!**  
**CONTROL LOCK REMOVE BEFORE STARTING ENGINE**

3. On fuel selector valve (at appropriate locations):

**ALL FLIGHT ATTITUDES**

BOTH                  87.0  
ON                  GAL.

FUEL                  SELECTOR

LEFT  
ON

RIGHT  
ON

43.5 GAL.  
LEVEL FLT ONLY

43.5 GAL.  
LEVEL FLT ONLY

**SECTION 2  
LIMITATIONS**

**CESSNA  
MODEL T210N**

- 4. Near fuel selector valve:**

**TAKEOFF AND LANDING ON BOTH**

**WHEN SWITCHING FROM DRY TANK TURN  
AUX FUEL PUMP ON MOMENTARILY.**

- 5. Adjacent to fuel on-off valve control knob:**

**FUEL VALVE PUSH ON**

- 6. Aft of fuel tank caps:**

**SERVICE THIS AIRPLANE WITH 100LL/100 MIN AVIATION  
GRADE GASOLINE. TOTAL CAPACITY 45.0 GAL.**

- 7. Forward of fuel tank cap:**

**CAPACITY 33.5 GALLONS TO  
BOTTOM OF FILLER NECK EXTENSION.**

- 8. On baggage compartment door:**

**MAX BAGGAGE 200 LBS. TOTAL. REFER TO WEIGHT AND  
BALANCE DATA FOR BAGGAGE/CARGO LOADING.**

- 9. On hand pump cover:**

**MANUAL GEAR EXTENSION**

- 1. SELECT GEAR DOWN.**
- 2. PULL HANDLE FWD.**
- 3. PUMP VERTICALLY.**

**CAUTION:**

**DO NOT PUMP WITH  
GEAR UP SELECTED**

10. Near manifold pressure/fuel flow indicator:

MINIMUM FUEL FLOWS

T.O.: 2700 RPM  
36.5 IN. MP., 186 LBS/HR

ALT-FT/1000	MAX. CONTINUOUS POWER: 2600 RPM							
	SL-17	18	20	22	24	26	28	30
MP. IN. HG	35	34	32	30	28	26	24	22
FUEL FLOW-LBS/HR	162	156	144	132	120	108	102	96

AVOID CONTINUOUS OPERATION BETWEEN 1850 AND 2150 RPM  
ABOVE 24 IN. M.P.

11. On flap control indicator:

0°- 10°	160 KIAS (partial flap range with dark blue color code; also, mechanical detent at 10°.)
10°- 20°	130 KIAS (indices at these positions with light blue color code; also, mechanical detent at 20°.)
20°- FULL	115 KIAS (white color code.)

12. On inside nose wheel doors;

**WARNING**

BEFORE WORKING IN WHEEL WELL AREA PULL HYDRAULIC PUMP CIRCUIT BREAKER OFF.

SECTION 2  
LIMITATIONS

CESSNA  
MODEL T210N

13. Near landing gear lever:

<b>MAX SPEED IAS</b>	
GEAR OPER	165 KTS
GEAR DOWN	203 KTS

14. A calibration card must be provided to indicate the accuracy of the magnetic compass in 30° increments.
15. On oil filler cap:

OIL
10 QTS

16. Near airspeed indicator:

MANEUVER SPEED
130 KIAS

17. In full view of the pilot:

MAJOR FUEL FLOW FLUCTUATIONS/POWER SURGES
1. AUX FUEL PUMP - ON, ADJUST MIXTURE.
2. FUEL SELECTOR - BOTH..
3. WHEN FUEL FLOW STEADY, RESUME NORMAL OPERATIONS.
SEE P.O.H. SECTION 3 FOR EXPANDED INSTRUCTIONS.

18. Forward of each fuel tank filler cap in line with fwd arrow:

FUEL CAP FWD ▲ ARROW ALIGNMENT
CAP MUST NOT ROTATE DURING CLOSING

# Severe Icing AD Supplement to AFM Limitations

Federal Aviation Administration

1203 J. S. T.

## Airworthiness Directive

- #### Federal Register Information

- ## Header Information

DEPARTMENT OF TRANSPORTATION

## Federal Aviation Administration

14 CFR Part 39 [63 FR 49819 No. 181 D9/18/98]

Docket No. 97-CE-62-AD; Amendment 39-10773; AD 98-05-14 RI

RIN 2120-AA64

## Airworthiness Directives: Cessna Models T210N, P210N, and P210R Airplanes **PDF Copy (If Available):**

- ### Preamble Information

AGENCY: Federal Aviation Administration, DOT

#### ACTION: Final rule; correction

**SUMMARY:** This amendment clarifies information contained in Airworthiness Directive (AD) 98-05-14, which currently requires revising the FAA-approved Airplane Flight Manual (AFM) to specify procedures that would prohibit flight in severe icing conditions (as determined by certain visual cues), limit or prohibit the use of various flight control devices while in severe icing conditions, and provide the flight crew with recognition cues for and procedures for exiting from severe icing conditions on certain Cessna Aircraft Company (Cessna) Models T210N, P210N, and P210R airplanes. That publication incorrectly references the possibility of certain ice accumulation on the "lower" surface of the wing, instead of the "upper" surface of the wing while operating with the flaps extended. This incorrect statement may result in pilot misinterpretation of the icing effects with the flaps extended, and lead to an incorrect action. This document replaces the word "lower" with "upper" in this sentence. The actions specified in this AD are intended to continue to minimize the potential hazards associated with operating these airplanes in severe icing conditions by providing more clearly defined procedures and limitations associated with such conditions.

DATES: Effective September 22, 1998.

ADDRESSES: Submit comments in triplicate to the Federal Aviation Administration (FAA), Central Region, Office of the Regional Counsel, Attention: Rules Docket No. 97-CE-62-AD, Room 1558, 601 E. 12th Street, Kansas City, Missouri 64106.

FOR FURTHER INFORMATION CONTACT: Mr John P. Dow, Sr., Aerospace Engineer, FAA, Small Airplane Directorate, 1201 Walnut, suite 900, Kansas City, Missouri 64106; telephone: (816) 426-6932, facsimile: (816) 426-2169.

## SUPPLEMENTARY INFORMATION:

### Discussion

On February 24, 1998, the FAA issued AD 98-05-14, Amendment 39-10375 (63 FR 10519, March 4, 1998), which applies to Cessna Models T210N, P210N, and P210R airplanes. AD 98-05-14 was the result of a review of the requirements for

Cessna Models 1210N, P210N, and P210R Airplane

certification of these airplanes in icing conditions, new information on the icing environment, and icing data provided currently to the flight crew.

AD 98-05-14 requires revising the Limitations Section of the FAA-approved Airplane Flight Manual (AFM) to specify procedures that would:

Require flight crews to immediately request priority handling from Air Traffic Control to exit severe icing conditions (as determined by certain visual cues);

Prohibit flight in severe icing conditions (as determined by certain visual cues);

Prohibit use of the autopilot when ice is formed aft of the protected surfaces of the wing, or when an unusual lateral trim condition exists; and

Require that all icing wing inspection lights be operative prior to flight into known or forecast icing conditions at night.

That action also requires revising the Normal Procedures Section of the FAA-approved AFM to specify procedures that would:

Limit the use of the flaps and prohibit the use of the autopilot when ice is observed forming aft of the protected surfaces of the wing, or if unusual lateral trim requirements or autopilot trim warnings are encountered; and

Provide the flight crew with recognition cues for, and procedures for exiting from, severe icing conditions.

**Need for the Correction**

The AD incorrectly states in paragraph (a)(2) of AD 98-05-14 that:

Operation with flaps extended can result in a reduced wing angle-of-attack, with the possibility of ice forming on the lower surface further aft on the wing than normal, possibly aft of the protected area. The word "lower" in this sentence should be "upper."

This incorrect statement may result in pilot misinterpretation of the icing effects with the flaps extended and lead to an incorrect action. The pilot of the affected airplanes can only see the lower wing surface. However, ice accretion on the upper surface of the wing, which the pilot cannot observe, is usually accompanied by ice accretion on the lower surface. As stated earlier, the pilot can observe ice accretion on the lower surface.

Extension of flaps that results in a reduced angle-of-attack can change the relationship of the extent of ice on the upper and lower surfaces of the wing. For example, ice will tend to accrete more on the upper surface than on the lower surface at a reduced angle-of-attack. However, when flaps are extended in certain icing conditions, the reduction of ice further aft on the lower surface of the wing may lead the pilot to conclude incorrectly that there is a reduction of ice further aft on the upper surface. This is not correct; as stated earlier, the tendency is for more ice accretion on the upper surface. Usually, ice on the upper surface of the wing is more adverse to the aerodynamic characteristics of the airplane than is ice on the lower surface of the wing.

Consequently, the FAA saw a need to clarify AD 98-05-14 to assure that this visual cue can be followed and that the appropriate cause and effect relationship is described.

**Correction of Publication**

This document clarifies the intent of the previously discussed visual cue in paragraph (a)(2) of AD 98-05-14. This document also adds the amendment to section 39.13 of the Federal Aviation Regulations (14 CFR 39.13).

Since this action only clarifies the description of a visual cue in AD 98-05-14, it has no adverse economic impact and imposes no additional burden on any person that would have been necessary by the existing AD. Therefore, the FAA has determined that prior notice and opportunity for public comment are unnecessary.

**List of Subjects in 14 CFR Part 39**

Air transportation, Aircraft, Aviation safety, Safety.

#### **Adoption of the Amendment**

Accordingly, pursuant to the authority delegated to me by the Administrator, the Federal Aviation Administration amends part 39 of the Federal Aviation Regulations (14 CFR part 39) as follows:

#### **PART 39 - AIRWORTHINESS DIRECTIVES**

1. The authority citation for part 39 continues to read as follows:

Authority: 49 U.S.C. 40113, 44701.

#### **§ 39.13 [Amended]**

2. Section 39.13 is amended by removing Airworthiness Directive (AD) 98-05-14, Amendment 39-10375 (63 FR 10519, March 4, 1998), and by adding a new AD to read as follows:

#### **Regulatory Information**

**98-05-14 R1 CESSNA AIRCRAFT COMPANY:** Amendment 39-10773; Docket No. 7-CE-62-AD; Revises AD 98-05-14, Amendment 39-10375.

**Applicability:** Models T210N (serial numbers 21063641 through 21064897), P210N (serial numbers P21000386 through P21000834), and P210R (all serial numbers) airplanes; certificated in any category.

**NOTE 1:** This AD applies to each airplane identified in the preceding applicability provision, regardless of whether it has been modified, altered, or repaired in the area subject to the requirements of this AD. For airplanes that have been modified, altered, or repaired so that the performance of the requirements of this AD is affected, the owner/operator must request approval for an alternative method of compliance in accordance with paragraph (d) of this AD. The request should include an assessment of the effect of the modification, alteration, or repair on the unsafe condition addressed by this AD; and, if the unsafe condition has not been eliminated, the request should include specific proposed actions to address it.

**Compliance:** Required as indicated in the body of this AD, unless already accomplished.

To minimize the potential hazards associated with operating the airplane in severe icing conditions by providing more clearly defined procedures and limitations associated with such conditions, accomplish the following:

(a) Within 30 days after April 30, 1998 (the effective date AD 98-05-14), accomplish the requirements of paragraphs (a)(1) and (a)(2) of this AD.

**NOTE 2:** Operators should initiate action to notify and ensure that flight crewmembers are apprised of this change.

(1) Revise the FAA-approved Airplane Flight Manual (AFM) by incorporating the following into the Limitations Section of the AFM. This may be accomplished by inserting a copy of this AD in the AFM.

#### **"WARNING**

Severe icing may result from environmental conditions outside of those for which the airplane is certificated. Flight in freezing rain, freezing drizzle, or mixed icing conditions (superecooled liquid water and ice crystals) may result in ice build-up on protected surfaces exceeding the capability of the ice protection system, or may result in ice forming aft of the protected surfaces. This ice may not be shed using the ice protection systems, and may seriously degrade the performance and controllability of the airplane.

- During flight, severe icing conditions that exceed those for which the airplane is certificated shall be determined by the following visual cues. If one or more of these visual cues exists, immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the icing conditions.

Unusually extensive ice accumulation on the airframe and windshield in areas not normally observed to collect ice.

Accumulation of ice on the lower surface of the wing aft of the protected area.

- Since the autopilot, when installed and operating, may mask tactile cues that indicate adverse changes in handling

Cessna Models 121(N), P210(N), and P210(R) Airplanes

characteristics, use of the autopilot is prohibited when any of the visual cues specified above exist, or when unusual lateral trim requirements or autopilot trim warnings are encountered while the airplane is in icing conditions.

- All wing icing inspection lights must be operative prior to flight into known or forecast icing conditions at night. [NOTE: This supersedes any relief provided by the Master Minimum Equipment List (MMEL).]"

(2) Revise the FAA-approved AFM by incorporating the following into the Normal Procedures Section of the AFM. This may be accomplished by inserting a copy of this AD in the AFM.

**"THE FOLLOWING WEATHER CONDITIONS MAY BE CONDUCIVE TO SEVERE IN-FLIGHT ICING:**

- Visible rain at temperatures below 0 degrees Celsius ambient air temperature.
- Droplets that splash or splatter on impact at temperatures below 0 degrees Celsius ambient air temperature.

**PROCEDURES FOR EXITING THE SEVERE ICING ENVIRONMENT:**

These procedures are applicable to all flight phases from takeoff to landing. Monitor the ambient air temperature. While severe icing may form at temperatures as cold as -18 degrees Celsius, increased vigilance is warranted at temperatures around freezing with visible moisture present. If the visual cues specified in the Limitations Section of the AFM for identifying severe icing conditions are observed, accomplish the following:

- Immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the severe icing conditions in order to avoid extended exposure to flight conditions more severe than those for which the airplane has been certificated.
- Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.
- Do not engage the autopilot.
- If the autopilot is engaged, hold the control wheel firmly and disengage the autopilot.
- If an unusual roll response or uncommanded roll control movement is observed, reduce the angle-of-attack.
- Do not extend flaps when holding in icing conditions. Operation with flaps extended can result in a reduced wing angle-of-attack, with the possibility of ice forming on the upper surface further aft on the wing than normal, possibly aft of the protected area.
- If the flaps are extended, do not retract them until the airframe is clear of ice.
- Report these weather conditions to Air Traffic Control."

(b) Incorporating the AFM revisions, as required by this AD, may be performed by the owner operator holding at least a private pilot certificate as authorized by section 43.7 of the Federal Aviation Regulations (14 CFR 43.7), and must be entered into the aircraft records showing compliance with this AD in accordance with section 43.9 of the Federal Aviation Regulations (14 CFR 43.9).

(c) Special flight permits may be issued in accordance with sections 21.197 and 21.199 of the Federal Aviation Regulations (14 CFR 21.197 and 21.199) to operate the airplane to a location where the requirements of this AD can be accomplished.

(d) An alternative method of compliance or adjustment of the compliance time that provides an equivalent level of safety may be approved by the Manager, Small Airplane Directorate, FAA, 1201 Walnut, suite 900, Kansas City, Missouri 64106. The request shall be forwarded through the appropriate FAA Maintenance Inspector, who may add comments and then send it to the Manager, Small Airplane Directorate.

NOTE 3: Information concerning the existence of approved alternative methods of compliance with this AD, if any, may be obtained from the Small Airplane Directorate.

(e) All persons affected by this directive may examine information related to this AD at the FAA, Central Region, Office of the Regional Counsel, Room 1558, 601 E. 12th Street, Kansas City, Missouri 64106.

(f) This amendment revises AD 98-05-14, Amendment 39-10375.

(g) This amendment becomes effective on September 22, 1998.

# SECTION 3

# EMERGENCY PROCEDURES

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## INTRODUCTION

Section 3 provides checklist and amplified procedures for coping with emergencies that may occur. Emergencies caused by airplane or engine malfunctions are extremely rare if proper preflight inspections and maintenance are practiced. Enroute weather emergencies can be minimized or eliminated by careful flight planning and good judgment when unexpected weather is encountered. However, should an emergency arise, the basic guidelines described in this section should be considered and applied as necessary to correct the problem. Emergency procedures associated with ELT and other optional systems can be found in Section 9.

## AIRSPEEDS FOR EMERGENCY OPERATION

### Engine Failure After Takeoff:

Wing Flaps Up . . . . .	85 KIAS
Wing Flaps Down . . . . .	80 KIAS

### Maneuvering Speed:

4000 Lbs . . . . .	130 KIAS
3350 Lbs . . . . .	119 KIAS
2700 Lbs . . . . .	106 KIAS

### Maximum Glide:

4000 Lbs . . . . .	88 KIAS
3350 Lbs . . . . .	80 KIAS
2700 Lbs . . . . .	72 KIAS

### Precautionary Landing With Engine Power, Flaps Down . . . . .

75 KIAS

### Landing Without Engine Power:

Wing Flaps Up . . . . .	90 KIAS
Wing Flaps Down . . . . .	80 KIAS

### Emergency Descent:

Smooth Air . . . . .	203 KIAS
Rough Air:	
4000 Lbs . . . . .	130 KIAS
3350 Lbs . . . . .	119 KIAS
2700 Lbs . . . . .	106 KIAS

## OPERATIONAL CHECKLISTS

Procedures in the Operational Checklists portion of this section shown in **bold-faced** type are immediate-action items which should be committed to memory.

## ENGINE FAILURES

### ENGINE FAILURE DURING TAKEOFF ROLL

1. Throttle -- IDLE.
2. Brakes -- APPLY.
3. Wing Flaps -- RETRACT.
4. Mixture -- IDLE CUT-OFF.
5. Ignition Switch -- OFF.
6. Master Switch -- OFF.

### ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

1. Airspeed -- 85 KIAS.
2. Mixture -- IDLE CUT-OFF.
3. Fuel On-Off Valve -- OFF (pull out).
4. Wing Flaps -- AS REQUIRED ( $30^\circ$  recommended).
5. Ignition Switch -- OFF.
6. Master Switch -- OFF.

### ENGINE FAILURE DURING FLIGHT (RESTART PROCEDURES)

1. Airspeed -- 85 KIAS.
2. Fuel Selector Valve -- BOTH ON.
3. Auxiliary Fuel Pump -- ON.
4. Throttle -- HALF OPEN.
5. Mixture -- Lean from full rich until restart occurs.

#### NOTE

If propeller is windmilling, engine will restart automatically within a few seconds. If propeller has stopped, verify fuel flow indicator is in middle of the green arc range, then retard the throttle and turn auxiliary fuel pump off. Turn the ignition switch to START, advance throttle slowly from idle, and (at higher altitudes) lean the mixture from full rich.

6. Mixture -- ADJUST as required as power is restored.
7. Throttle -- ADJUST power as required (slowly at higher altitudes).
8. Auxiliary Fuel Pump -- OFF.

#### NOTE

If the fuel flow indication immediately drops to zero, signifying an engine-driven fuel pump failure, return the auxiliary fuel pump switch to ON.

9. Mixture -- ADJUST.
10. Fuel Selector Valve -- AS DESIRED after fuel flow is stabilized.

## FORCED LANDINGS

### EMERGENCY LANDING WITHOUT ENGINE POWER

1. Airspeed -- 90 KIAS (flaps UP).  
      80 KIAS (flaps DOWN).
2. Mixture -- IDLE CUT-OFF.
3. Fuel On-Off Valve -- OFF (pull out).
4. Ignition Switch -- OFF.
5. Landing Gear -- DOWN (UP if terrain is rough or soft).
6. Wing Flaps -- AS REQUIRED (30° recommended).
7. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
8. Master Switch -- OFF when landing is assured.
9. Touchdown -- SLIGHTLY TAIL LOW.
10. Brakes -- APPLY HEAVILY.

### PRECAUTIONARY LANDING WITH ENGINE POWER

1. Airspeed -- 85 KIAS.
2. Wing Flaps -- 10°.
3. Selected Field -- FLY OVER, noting terrain and obstructions, then retract flaps upon reaching a safe altitude and airspeed.
4. Electrical Switches -- OFF.
5. Landing Gear -- DOWN (UP if terrain is rough or soft).
6. Wing Flaps -- 30° (on final approach).
7. Airspeed -- 75 KIAS.
8. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
9. Avionics Power and Master Switches -- OFF when landing is assured.
10. Touchdown -- SLIGHTLY TAIL LOW.
11. Ignition Switch -- OFF.
12. Brakes -- APPLY HEAVILY.

### DITCHING

1. Radio -- TRANSMIT MAYDAY on 121.5 MHz, giving location and intentions and SQUAWK 7700 if transponder is installed.
2. Heavy Objects (in baggage area) -- SECURE OR JETTISON.
3. Landing Gear -- UP.
4. Wing Flaps -- 30°.
5. Power -- ESTABLISH 300 FT/MIN DESCENT AT 75 KIAS.
6. Approach -- High Winds, Heavy Seas -- INTO THE WIND.  
      Light Winds, Heavy Swells -- PARALLEL TO SWELLS.

#### NOTE

If no power is available, approach at 85 KIAS with flaps up

or at 80 KIAS with 10° flaps.

7. Cabin Doors -- UNLATCH.
8. Touchdown -- LEVEL ATTITUDE AT 300 FT/MIN DESCENT.
9. Face -- CUSHION at touchdown with folded coat.
10. Airplane -- EVACUATE through cabin doors. If necessary, open window and flood cabin to equalize pressure so doors can be opened.
11. Life Vests and Raft -- INFLATE.

## FIREs

### DURING START ON GROUND

1. Ignition Switch -- START (continue cranking to obtain start).
2. Auxiliary Fuel Pump -- OFF.

If engine starts:

3. Power -- 1700 RPM for a few minutes.
4. Engine -- SHUTDOWN and inspect for damage.

If engine fails to start:

3. Cranking -- CONTINUE (ignition switch in START).
4. Throttle -- FULL OPEN.
5. Mixture -- IDLE CUT-OFF.
6. Fire Extinguisher -- OBTAIN (have ground attendants obtain if not installed).
7. Engine -- SECURE.
  - a. Ignition Switch -- OFF.
  - b. Master Switch -- OFF.
  - c. Fuel On-Off Valve -- OFF (pull out).
8. Fire -- EXTINGUISH using fire extinguisher, wool blanket or dirt.

#### NOTE

If sufficient ground personnel are available (and fire is on ground and not too dangerous) move airplane away from the fire by pushing rearward on the leading edge of the horizontal tail.

9. Fire Damage -- INSPECT, repair damage or replace damaged components or wiring before conducting another flight.

## ENGINE FIRE IN FLIGHT

1. Mixture -- IDLE CUT-OFF.
2. Fuel On-Off Valve -- OFF (pull out).
3. Master Switch -- OFF.
4. Cabin Heat and Air -- OFF (except overhead vents).
5. Airspeed -- 120 KIAS (If fire is not extinguished, increase glide speed to find an airspeed which will provide an incombustible mixture).
6. Forced Landing -- EXECUTE (as described in Emergency Landing Without Engine Power).

## ELECTRICAL FIRE IN FLIGHT

1. Master Switch -- OFF.
2. Avionics Power Switch -- OFF.
3. All Other Switches (except ignition switch) -- OFF.
4. Vents/Cabin Air/Heat -- CLOSED.
5. Fire Extinguisher -- ACTIVATE (if available).

### **WARNING**

If an oxygen system is available, occupants should use oxygen masks until smoke and discharged dry powder clears. After discharging an extinguisher within a closed cabin, ventilate the cabin.

If fire appears out and electrical power is necessary for continuance of flight:

6. Master Switch -- ON.
7. Circuit Breakers -- CHECK for faulty circuit; do not reset.
8. Radio Switches -- OFF.
9. Avionics Power Switch -- ON.
10. Radio and Electrical Switches -- ON one at a time, with delay after each until short circuit is localized.
11. Vents/Cabin Air/Heat -- OPEN when it is ascertained that fire is completely extinguished.

## CABIN FIRE

1. Master Switch -- OFF.
2. Vents/Cabin Air/Heat -- CLOSED (to avoid drafts).
3. Fire Extinguisher -- ACTIVATE (if available).

## WARNING

If an oxygen system is available, occupants should use oxygen masks until smoke and discharged dry powder clears. After discharging an extinguisher within a closed cabin, ventilate the cabin.

4. Land the airplane as soon as possible to inspect for damage.

## WING FIRE

1. Radar Altimeter (if installed) -- OFF.
2. Navigation Light Switch -- OFF.
3. Strobe Light Switch (if installed) -- OFF.
4. Pitot Heat Switch (if installed) -- OFF.
5. Radar (if installed) -- OFF.

### NOTE

Perform a sideslip to keep the flames away from the fuel tank and cabin, and land as soon as possible.

## ICING

### INADVERTENT ICING ENCOUNTER

1. Turn pitot heat, propeller anti-ice, and windshield anti-ice switches ON (if installed).
2. Turn back or change altitude to obtain an outside air temperature that is less conducive to icing.
3. Pull cabin heat and defrost controls full out to obtain maximum windshield defroster effectiveness.
4. Increase engine speed to minimize ice build-up on propeller blades. If excessive vibration is noted, momentarily reduce engine speed to 2200 RPM with the propeller control, and then rapidly move the control full forward.

### NOTE

Cycling the RPM flexes the propeller blades and high RPM increases centrifugal force, causing ice to shed more readily.

5. Watch for signs of induction air filter ice and regain manifold pressure by increasing the throttle setting.

NOTE

If ice accumulates on the intake filter (causing the alternate air valve to open), a decrease of up to 10 inches of full throttle manifold pressure will be experienced.

6. If icing conditions are unavoidable, plan a landing at the nearest airport. With an extremely rapid ice build-up, select a suitable "off airport" landing site.
7. With an ice accumulation of 1/4 inch or more on the wing leading edges, be prepared for a significantly higher power requirement, approach speed, stall speed, and landing roll.
8. Open the window and, if practical, scrape ice from a portion of the windshield for visibility in the landing approach.
9. Use a 10° to 20° landing flap setting for ice accumulations of 1 inch or less. With heavier ice accumulations, approach with flaps retracted to ensure adequate elevator effectiveness in the approach and landing.
10. Approach at 85 to 95 KIAS with 20° flaps and 95 to 105 KIAS with 0° to 10° flaps, depending upon the amount of ice accumulation. If ice accumulation is unusually large, decelerate to the planned approach speed while in the approach configuration (landing gear and flaps down) at a high enough altitude which would permit recovery in the event that a stall buffet is encountered.
11. Land on the main wheels first, avoiding the slow and high type of flare-out.
12. Missed approaches should be avoided whenever possible because of severely reduced climb capability. However, if a go-around is mandatory, make the decision much earlier in the approach than normal. Apply maximum power and maintain 95 KIAS while retracting the flaps slowly in 10° increments. Retract the landing gear after immediate obstacles are cleared.

**STATIC SOURCE BLOCKAGE**  
(Erroneous Instrument Reading Suspected)

1. Static Pressure Alternate Source Valve -- PULL ON.
2. Airspeed -- Climb 5 knots faster and approach 7 knots faster than normal or consult appropriate table in Section 5.
3. Altitude -- Cruise 160 feet higher and approach 70 feet higher than normal.

**EXCESSIVE FUEL VAPOR**

**FUEL FLOW STABILIZATION PROCEDURES**  
(If Fuel Flow Fluctuations Of 5 PPH Or More Or Power Surges Occur)

1. Auxiliary Fuel Pump -- ON.

2. Mixture -- RESET as required.
3. Fuel Selector Valve -- BOTH ON if vapor symptoms continue.

NOTE

If selector was on BOTH ON, select a single tank which contains fuel. If symptoms persist, select opposite tank for 30 seconds, then switch back to previous single tank.

4. Auxiliary Fuel Pump -- OFF after fuel flow has stabilized.
5. Mixture -- RESET as required.
6. Fuel Selector Valve -- AS DESIRED after fuel flow has stabilized for one minute, provided there is fuel in any single tank selected.

## LANDING GEAR MALFUNCTION PROCEDURES

### LANDING GEAR FAILS TO RETRACT

1. Master Switch -- ON.
2. Landing Gear Lever -- CHECK (lever full up).
3. Landing Gear and Gear Pump Circuit Breakers -- IN.
4. Gear Up Light -- CHECK.
5. Landing Gear Lever -- RECYCLE.
6. Gear Motor -- CHECK operation (ammeter and noise).

### LANDING GEAR FAILS TO EXTEND

1. Landing Gear Lever -- DOWN.
2. Emergency Hand Pump -- EXTEND HANDLE, and PUMP (perpendicular to handle until resistance becomes heavy -- about 35 cycles).
3. Gear Down Light -- ON (master switch on).
4. Pump Handle -- STOW.

### GEAR UP LANDING

1. Landing Gear Lever -- UP.
2. Landing Gear and Gear Pump Circuit Breakers -- IN.
3. Runway -- SELECT longest hard surface or smooth sod runway available.
4. Wing Flaps -- 30° (on final approach).

5. Airspeed -- 75 KIAS.
6. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
7. Avionics Power and Master Switches -- OFF when landing is assured.
8. Touchdown -- SLIGHTLY TAIL LOW.
9. Mixture -- IDLE CUT-OFF.
10. Ignition Switch -- OFF.
11. Fuel On-Off Valve -- OFF (pull out).
12. Airplane -- EVACUATE.

### LANDING WITHOUT POSITIVE INDICATION OF GEAR LOCKING

1. Before Landing Check -- COMPLETE.
2. Approach -- NORMAL (full flap).
3. Landing Gear and Gear Pump Circuit Breakers -- IN.
4. Landing -- TAIL LOW as smoothly as possible.
5. Braking -- MINIMUM necessary.
6. Taxi -- SLOWLY.
7. Engine -- SHUTDOWN before inspecting gear.

### LANDING WITH A DEFECTIVE NOSE GEAR (Or Flat Nose Tire)

1. Movable Load -- TRANSFER to baggage area.
2. Passenger -- MOVE to rear seat.
3. Before Landing Checklist -- COMPLETE.
4. Runway -- HARD SURFACE or SMOOTH SOD.

#### NOTE

If sod runway is rough or soft, plan a wheels-up landing.

5. Wing Flaps -- 30°.
6. Cabin Doors -- UNLATCH PRIOR TO TOUCHDOWN.
7. Avionics Power and Master Switches -- OFF when landing is assured.
8. Land -- SLIGHTLY TAIL LOW.
9. Mixture -- IDLE CUT-OFF.
10. Ignition Switch -- OFF.
11. Fuel On-Off Valve -- OFF (pull out).
12. Elevator Control -- HOLD NOSE OFF GROUND as long as possible.
13. Airplane -- EVACUATE as soon as it stops.

### LANDING WITH A FLAT MAIN TIRE

1. Approach -- NORMAL (full flap).
2. Touchdown -- GOOD TIRE FIRST, hold airplane off flat tire as long

- as possible with aileron control.
3. Directional Control -- MAINTAIN using brake on good wheel as required.

## ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

### AMMETER SHOWS EXCESSIVE RATE OF CHARGE (Full Scale Deflection)

1. Alternator -- OFF.
2. Alternator Circuit Breaker -- PULL.
3. Nonessential Electrical Equipment -- OFF.
4. Flight -- TERMINATE as soon as practical.

### LOW-VOLTAGE LIGHT ILLUMINATES DURING FLIGHT (Ammeter Indicates Discharge)

#### NOTE

Illumination of the low-voltage light may occur during low RPM conditions with an electrical load on the system such as during a low RPM taxi. Under these conditions, the light will go out at higher RPM. The master switch need not be recycled since an over-voltage condition has not occurred to de-activate the alternator system. Momentary illumination and/or ammeter needle deflection may also occur during startup of the landing gear system hydraulic pump motor.

1. Avionics Power Switch -- OFF.
2. Alternator Circuit Breaker -- CHECK IN.
3. Master Switch -- OFF (both sides).
4. Master Switch -- ON.
5. Low-Voltage Light -- CHECK OFF.
6. Avionics Power Switch -- ON.

If low-voltage light illuminates again:

7. Alternator -- OFF.
8. Nonessential Radio and Electrical Equipment -- OFF.
9. Flight -- TERMINATE as soon as practical.

## EMERGENCY DESCENT PROCEDURES

### SMOOTH AIR

1. Seat Belts and Shoulder Harnesses -- SECURE.
2. Throttle -- IDLE.
3. Propeller -- HIGH RPM.
4. Mixture -- FULL RICH
5. Landing Gear -- EXTEND.
6. Wing Flaps -- UP.
7. Airspeed:
  - a. During landing gear extension -- 165 KIAS.
  - b. After landing gear is fully extended -- 203 KIAS.

### ROUGH AIR

1. Seat Belts and Shoulder Harnesses -- SECURE.
2. Throttle -- IDLE.
3. Propeller -- HIGH RPM.
4. Mixture -- FULL RICH.
5. Landing Gear -- EXTEND
6. Wing Flaps -- UP.
7. Airspeeds:
  - 4000 Lbs -- 130 KIAS.
  - 3350 Lbs -- 119 KIAS.
  - 2700 Lbs -- 106 KIAS



## AMPLIFIED PROCEDURES

The following Amplified Procedures elaborate upon information contained in the Operational Checklists portion of this section. These procedures also include information not readily adaptable to a checklist format, and material to which a pilot could not be expected to refer in resolution of a specific emergency.

### ENGINE FAILURE

If an engine failure occurs during the takeoff roll, the most important thing to do is stop the airplane on the remaining runway. Those extra items on the checklist will provide added safety after a failure of this type.

Prompt lowering of the nose to maintain airspeed and establish a glide attitude is the first response to an engine failure after takeoff. In most cases, the landing should be planned straight ahead with only small changes in direction to avoid obstructions. Altitude and airspeed are seldom sufficient to execute a 180° gliding turn necessary to return to the runway. The checklist procedures assume that adequate time exists to secure the fuel and ignition systems prior to touchdown.

After an engine failure in flight, the best glide speed as shown in figure 3-1 should be established as quickly as possible. While gliding toward a

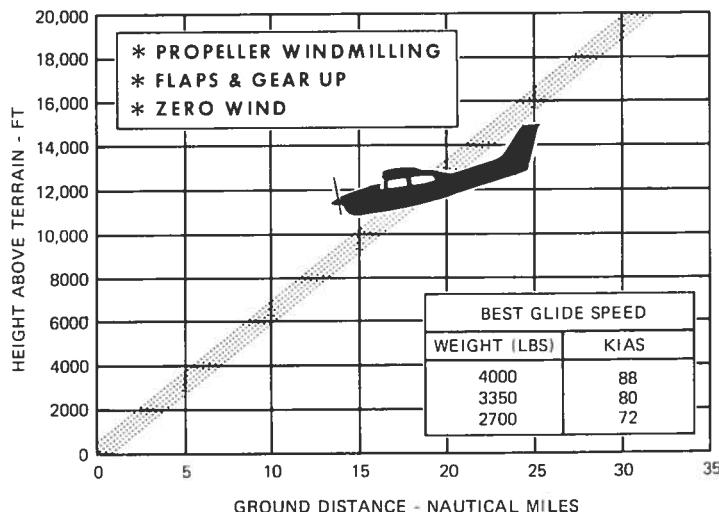


Figure 3-1. Maximum Glide

suitable landing area, an effort should be made to identify the cause of the failure. If time permits, an engine restart should be attempted as shown in the checklist. If the engine cannot be restarted, a forced landing without power must be completed.

## FORCED LANDINGS

If all attempts to restart the engine fail and a forced landing is imminent, select a suitable field and prepare for the landing as discussed under the Emergency Landing Without Engine Power checklist.

Before attempting an "off airport" landing with engine power available, one should fly over the landing area at a safe but low altitude to inspect the terrain for obstructions and surface conditions, proceeding as discussed under the Precautionary Landing With Engine Power checklist.

Prepare for ditching by securing or jettisoning heavy objects located in the baggage area and collect folded coats for protection of occupants' face at touchdown. Transmit Mayday message on 121.5 MHz giving location and intentions and squawk 7700 if a transponder is installed. Avoid a landing flare because of difficulty in judging height over a water surface.

In a forced landing situation, do not turn off the avionics power and master switches until a landing is assured. Premature deactivation of the switches will disable the encoding altimeter and airplane electrical systems.

## LANDING WITHOUT ELEVATOR CONTROL

Trim for horizontal flight (with an airspeed of approximately 80 KIAS and flaps set to 20°) by using throttle and trim tab controls. Then do not change the trim tab setting and control the glide angle by adjusting power exclusively.

At flareout, the nose-down moment resulting from power reduction is an adverse factor and the airplane may hit on the nose wheel. Consequently, at flareout, the trim tab should be set at full nose-up position and the power adjusted so that the airplane will rotate to the horizontal attitude for touchdown. Close the throttle at touchdown.

## FIREs

Improper starting procedures involving the excessive use of auxiliary fuel pump operation can cause engine flooding and subsequent collection of fuel on the parking ramp as the excess fuel drains overboard from the intake manifolds. This is sometimes experienced in difficult starts in cold weather where engine pre-heat service is not available. If this occurs, the

airplane should be pushed away from the fuel puddle before another engine start is attempted. Otherwise, there is a possibility of raw fuel accumulations in the exhaust system igniting during an engine start, causing a long flame from the tailpipe, and possibly igniting the collected fuel on the pavement. If a fire occurs, proceed according to the checklist.

Although engine fires are extremely rare in flight, the steps of the appropriate checklist should be followed if one is encountered. After completion of this procedure, execute a forced landing. Do not attempt to restart the engine.

The initial indication of an electrical fire is usually the odor of burning insulation. The checklist for this problem should result in elimination of the fire.

## **EMERGENCY OPERATION IN CLOUDS (Vacuum System Failure)**

In the event of a complete vacuum system failure during flight, the directional indicator and attitude indicator will be disabled, and the pilot will have to rely on the turn coordinator or the turn and bank indicator if he inadvertently flies into clouds. The following instructions assume that only the electrically-powered turn coordinator or the turn and bank indicator is operative, and that the pilot is not completely proficient in instrument flying.

### **EXECUTING A 180° TURN IN CLOUDS**

Upon inadvertently entering the clouds, an immediate plan should be made to turn back as follows:

1. Note the compass heading.
2. Note the time of the minute hand and observe the position of the sweep second hand on the clock (use timer mode with digital clock).
3. When the sweep second hand (or timer) indicates the nearest half-minute, initiate a standard rate left turn, holding the turn coordinator symbolic airplane wing opposite the lower left index mark for 60 seconds. Then roll back to level flight by leveling the miniature airplane.
4. Check accuracy of the turn by observing the compass heading which should be the reciprocal of the original heading.
5. If necessary, adjust heading primarily with skidding motions rather than rolling motions so that the compass will read more accurately.
6. Maintain altitude and airspeed by cautious application of elevator control. Avoid overcontrolling by keeping hands off the control wheel as much as possible and steering only with rudder.

## EMERGENCY DESCENT THROUGH CLOUDS

If conditions preclude reestablishment of VFR flight by a 180° turn, a descent through a cloud deck to VFR conditions may be appropriate. If possible, obtain radio clearance for an emergency descent through clouds. To guard against a spiral dive, choose an easterly or westerly heading to minimize compass card swings due to changing bank angles. In addition, keep hands off the control wheel and steer a straight course with rudder control by monitoring the turn coordinator. Occasionally check the compass heading and make minor corrections to hold an approximate course. Before descending into the clouds, set up a stabilized let-down condition as follows:

1. Extend landing gear.
2. Reduce power to set up a 500 to 800 ft /min rate of descent.
3. Adjust mixture for smooth operation.
4. Adjust the elevator and rudder trim control wheels for a stabilized descent at 105 KIAS.
5. Keep hands off control wheel.
6. Monitor turn coordinator and make corrections by rudder alone.
7. Adjust rudder trim to relieve unbalanced rudder force.
8. Check trend of compass card movement and make cautious corrections with rudder to stop turn.
9. Upon breaking out of clouds, resume normal cruising flight.

## RECOVERY FROM A SPIRAL DIVE

If a spiral is encountered, proceed as follows:

1. Close the throttle.
2. Stop the turn by using coordinated aileron and rudder control to align the symbolic airplane in the turn coordinator with the horizon reference line.
3. Cautiously apply control wheel back pressure to slowly reduce the airspeed to 105 KIAS.
4. Adjust the elevator trim control to maintain a 105 KIAS glide.
5. Keep hands off the control wheel, using rudder control to hold a straight heading. Adjust the rudder trim to relieve unbalanced rudder force.
6. Clear engine occasionally, but avoid using enough power to disturb the trimmed glide.
7. Upon breaking out of clouds, resume normal cruising flight.

## INADVERTENT FLIGHT INTO ICING CONDITIONS

Flight into icing conditions is prohibited. An inadvertent encounter

with these conditions can best be handled using the checklist procedures. The best procedure, of course, is to turn back or change altitude to escape icing conditions.

### STATIC SOURCE BLOCKED

If erroneous readings of the static source instruments (airspeed, altimeter and vertical speed) are suspected, the static pressure alternate source valve should be pulled on, thereby supplying static pressure to these instruments from the cabin.

Cabin pressures will be affected by open ventilators or windows and varying airspeeds, and this will affect the readings.

With windows closed, maximum airspeed and altimeter variation from normal occurs with the vents closed and reaches 10 knots and 160 feet respectively at maximum cruise (instruments read high). During approach with vents closed, typical variations are 7 knots and 70 feet respectively (reads high). Opening the vents tends to reduce these variations by one third.

With windows open, variations up to 18 knots and 130 feet occur near stall (reads low) and up to 14 knots and 220 feet at maximum cruise (reads high). During approach, typical variations are 3 knots and 30 feet (reads high).

With the alternate static source on, fly the airplane at airspeeds and altitudes which compensate for the variations from normal indications. For more exact airspeed correction, refer to the alternate static source airspeed calibration table in Section 5, appropriate to the vent/window configuration.

### SPINS

Intentional spins are prohibited in this airplane. Should an inadvertent spin occur, the following recovery technique may be used:

1. RETARD THROTTLE TO IDLE POSITION.
2. PLACE AILERONS IN NEUTRAL POSITION.
3. APPLY AND HOLD FULL RUDDER OPPOSITE TO THE DIRECTION OF ROTATION.
4. JUST AFTER THE RUDDER REACHES THE STOP, MOVE THE CONTROL WHEEL BRISKLY FORWARD FAR ENOUGH TO BREAK THE STALL. Full down elevator may be required at aft center of gravity loadings to assure optimum recoveries.

5. HOLD THESE CONTROL INPUTS UNTIL ROTATION STOPS. Premature relaxation of the control inputs may extend the recovery.
6. AS ROTATION STOPS, NEUTRALIZE RUDDER, AND MAKE A SMOOTH RECOVERY FROM THE RESULTING DIVE.

NOTE

If disorientation precludes a visual determination of the direction of rotation, the symbolic airplane in the turn coordinator or the needle of the turn and bank indicator may be referred to for this information.

## ROUGH ENGINE OPERATION OR LOSS OF POWER

### SPARK PLUG FOULING

A slight engine roughness in flight may be caused by one or more spark plugs becoming fouled by carbon or lead deposits. This may be verified by turning the ignition switch momentarily from BOTH to either L or R position. An obvious power loss in single ignition operation is evidence of spark plug or magneto trouble. Assuming that spark plugs are the more likely cause, lean the mixture to the recommended lean setting for cruising flight. If the problem does not clear up in several minutes, determine if a richer mixture setting will produce smoother operation. If not, proceed to the nearest airport for repairs using the BOTH position of the ignition switch unless extreme roughness dictates the use of a single ignition position.

### MAGNETO MALFUNCTION

A sudden engine roughness or misfiring is usually evidence of magneto problems. Switching from BOTH to either L or R ignition switch position will identify which magneto is malfunctioning. Select different power settings and enrichen the mixture to determine if continued operation on BOTH magnetos is practicable. If not, switch to the good magneto and proceed to the nearest airport for repairs.

### ENGINE-DRIVEN FUEL PUMP FAILURE

Failure of the engine-driven fuel pump will be evidenced by a sudden reduction in the fuel flow indication prior to a loss of power, while operating from a fuel tank containing adequate fuel.

In the event of an engine-driven fuel pump failure during takeoff, immediately hold the left half of the auxiliary fuel pump switch in the HI position until the airplane is well clear of all obstacles. Upon reaching a safe altitude, reduce the power settings to give cruise power. Then release the HI side of the switch, allowing the right side of the switch to remain in the ON position for level flight.

This ON position provides a reduced fuel flow which results in lean mixtures at two portions of the manifold pressure range. For example, at 2500 RPM excessively lean mixtures with resulting roughness and/or power drop off are experienced at approximately 22 inches (just before the throttle switch activates) and again at 28 or more inches of manifold pressure.

To avoid these areas of rough engine operation, select 2200 RPM and sufficient manifold pressure within the green arc range for the flight condition at hand. If more power is required, use progressively more RPM and select a manifold pressure where smooth engine operation and normal airspeed can be obtained.

The landing approach should be planned so that approximately 15 inches of manifold pressure can be used. If the throttle is brought back to idle position, the mixture becomes very rich. This could cause a sluggish power response if the throttle had to be advanced rapidly during landing.

## EXCESSIVE FUEL VAPOR INDICATIONS

Excessive fuel vapor indications are most likely to appear during climb and the first hour of cruise on each tank, especially when operating at higher altitudes or in unusually warm temperatures.

Indications of excessive fuel vapor accumulation are fuel flow gage fluctuations greater than 5 PPH. This condition with leaner mixtures or with larger fluctuations may result in power surges, and if not corrected, may cause power loss.

To eliminate vapor and stabilize fuel flows, turn the auxiliary fuel pump on and reset the mixture as required. If vapor symptoms persist, change the selector valve position in accordance with the checklist. When fuel flows stabilize, turn off the auxiliary fuel pump and reset the mixture as desired.

## LOW OIL PRESSURE

If low oil pressure is accompanied by normal oil temperature, there is a possibility the oil pressure gage or relief valve is malfunctioning. A leak in the line to the gage is not necessarily cause for an immediate precautionary landing because an orifice in this line will prevent a sudden loss of

oil from the engine sump. However, a landing at the nearest airport would be advisable to inspect the source of trouble.

If a total loss of oil pressure is accompanied by a rise in oil temperature, there is good reason to suspect an engine failure is imminent. Reduce engine power immediately and select a suitable forced landing field. Use only the minimum power required to reach the desired touchdown spot.

## **LANDING GEAR MALFUNCTION PROCEDURES**

In the event of possible landing gear retraction or extension malfunctions, there are several general checks that should be made prior to initiating the steps outlined in the following paragraphs.

In analyzing a landing gear malfunction, first check that the master switch is ON and the LDG GEAR and GEAR PUMP circuit breakers are in; reset if necessary. Also, check both landing gear position indicator lights for operation by "pressing-to-test" the light units and rotating them at the same time to check for open dimming shutters. A burned-out bulb can be replaced in flight by using the bulb from the remaining gear position indicator light.

### **RETRACTION MALFUNCTIONS**

Normal landing gear retraction time is approximately 8 seconds. If the landing gear fails to retract normally or an intermittent GEAR UP indicator light is present, check the indicator light for proper operation and attempt to recycle the landing gear. Place the landing gear lever in the GEAR DOWN position. When the GEAR DOWN light illuminates, reposition the gear lever in the GEAR UP position for another retraction attempt. If the GEAR UP light still fails to illuminate, the flight may be continued to an airport having maintenance facilities, if practical. If gear motor operation is audible after a period of one minute following gear lever retraction actuation, pull the GEAR PUMP circuit breaker to prevent the electric motor from overheating. In this event, remember to re-engage the circuit breaker just prior to landing. Intermittent gear motor operation may also be detected by momentary fluctuations of the ammeter needle.

### **EXTENSION MALFUNCTIONS**

Normal landing gear extension time is approximately 6 seconds. If the landing gear will not extend normally, perform the general checks of circuit breakers and master switch and repeat the normal extension procedures at a reduced airspeed of 100 KIAS. The landing gear lever must be in the down position with the detent engaged. If efforts to extend and lock

the gear through the normal landing gear system fail, the gear can be manually extended (as long as hydraulic system fluid has not been completely lost) by use of the emergency hand pump. The hand pump is located between the front seats.

A checklist is provided for step-by-step instructions for a manual gear extension.

If gear motor operation is audible after a period of one minute following gear lever extension actuation, pull the GEAR PUMP circuit breaker to prevent the electric motor from overheating. In this event, remember to re-engage the circuit breaker just prior to landing.

## GEAR UP LANDING

If the landing gear remains retracted or is only partially extended, and all efforts to fully extend it (including manual extension) have failed, plan a wheels up landing. In preparation for landing, reposition the landing gear lever to GEAR UP and push the LDG GEAR and GEAR PUMP circuit breakers in to allow the landing gear to swing into the gear wells at touchdown. Then proceed in accordance with the checklist.

## ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

Malfunctions in the electrical power supply system can be detected by periodic monitoring of the ammeter and low-voltage warning light; however, the cause of these malfunctions is usually difficult to determine. A broken alternator drive belt or wiring is most likely the cause of alternator failures, although other factors could cause the problem. A defective alternator control unit can also cause malfunctions. Problems of this nature constitute an electrical emergency and should be dealt with immediately. Electrical power malfunctions usually fall into two categories: excessive rate of charge and insufficient rate of charge. The paragraphs below describe the recommended remedy for each situation.

### EXCESSIVE RATE OF CHARGE

After engine starting and heavy electrical usage at low engine speeds (such as extended taxiing) the battery condition will be low enough to accept above normal charging during the initial part of a flight. However, after thirty minutes of cruising flight, the ammeter should be indicating less than two needle widths of charging current. If the charging rate were to remain above this value on a long flight, the battery would overheat and evaporate the electrolyte at an excessive rate.

Electronic components in the electrical system could be adversely affected by higher than normal voltage. The alternator control unit includes an over-voltage sensor which normally will automatically shut down the alternator if the charge voltage reaches approximately 31.5 volts. If the over-voltage sensor malfunctions, as evidenced by an excessive rate of charge shown on the ammeter, the alternator should be turned off, the alternator circuit breaker pulled, nonessential electrical equipment turned off and the flight terminated as soon as practical.

## INSUFFICIENT RATE OF CHARGE

### NOTE

Illumination of the low-voltage light and ammeter discharge indications may occur during low RPM conditions with an electrical load on the system, such as during a low RPM taxi. Under these conditions, the light will go out at higher RPM. The master switch need not be recycled since an over-voltage condition has not occurred to de-activate the alternator system. Momentary illumination and/or ammeter needle deflection may also occur during startup of the landing gear system hydraulic pump motor.

If the over-voltage sensor should shut down the alternator or if the alternator output is low, a discharge rate will be shown on the ammeter followed by illumination of the low-voltage warning light. Since this may be a "nuisance" trip-out, an attempt should be made to reactivate the alternator system. To do this, turn the avionics power switch off, check that the alternator circuit breaker is in, then turn both sides of the master switch off and then on again. If the problem no longer exists, normal alternator charging will resume and the low-voltage light will go off. The avionics power switch may then be turned back on. If the light illuminates again, a malfunction is confirmed. In this event, the flight should be terminated and/or the current drain on the battery minimized because the battery can supply the electrical system for only a limited period of time. Battery power must be conserved for later operation of the landing gear and wing flaps and, if the emergency occurs at night, for possible use of the landing lights during landing.

# SECTION 4

## NORMAL PROCEDURES

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## INTRODUCTION

Section 4 provides checklist and amplified procedures for the conduct of normal operation. Normal procedures associated with optional systems can be found in Section 9.

## SPEEDS FOR NORMAL OPERATION

Unless otherwise noted, the following speeds are based on a maximum weight of 4000 pounds and may be used for any lesser weight. However, to achieve the performance specified in Section 5 for takeoff distance and climb performance, the speed appropriate to the particular weight must be used.

### Takeoff:

Normal Climb Out . . . . .	80-90 KIAS
Short Field Takeoff, Flaps 10°, Speed at 50 Feet . . . . .	78 KIAS

### Enroute Climb, Flaps and Gear Up:

Normal . . . . .	105-120 KIAS
Best Rate of Climb, Sea Level to 17,000 Feet . . . . .	100 KIAS
Best Rate of Climb, 24,000 Feet . . . . .	97 KIAS
Best Angle of Climb . . . . .	82 KIAS

### Landing Approach (3800 Lbs):

Normal Approach, Flaps Up . . . . .	85-95 KIAS
Normal Approach, Flaps 30° . . . . .	70-80 KIAS
Short Field Approach, Flaps 30° . . . . .	74 KIAS

### Balked Landing (3800 Lbs):

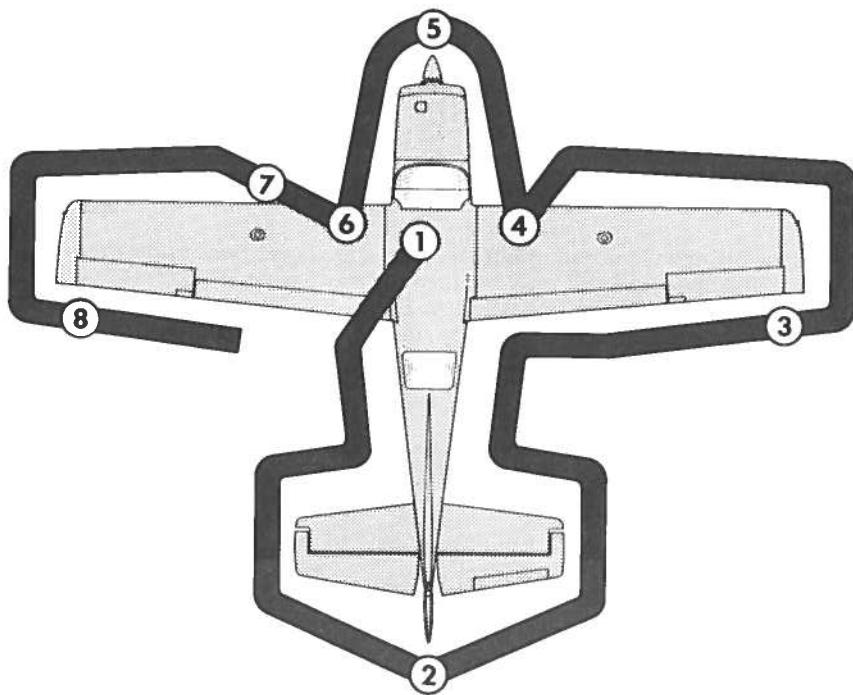
Maximum Power, Flaps 20° . . . . .	70 KIAS
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### Maximum Recommended Turbulent Air Penetration Speed:

4000 Lbs . . . . .	130 KIAS
3350 Lbs . . . . .	119 KIAS
2700 Lbs . . . . .	106 KIAS

### Maximum Demonstrated Crosswind Velocity:

Takeoff or Landing . . . . .	21 KNOTS
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NOTE

Visually check airplane for general condition during walk-around inspection. In cold weather, remove even small accumulations of frost, ice or snow from wing, tail and control surfaces. Also, make sure that control surfaces contain no internal accumulations of ice or debris. Prior to flight, check that pitot heater (if installed) is warm to touch within 30 seconds with battery and pitot heat switches on. If a night flight is planned, check operation of all lights, and make sure a flashlight is available.

Figure 4-1. Preflight Inspection

## **PILOT OPERATING PROCEDURES - PREFLIGHT FUEL SYSTEM QUANTITY CHECK**

The following procedures are to be used on certain Cessna 210, P210, and T210 Series airplanes whenever more than 75 gallons of fuel are needed for range and reserve.

1. Verify that the airplane is level laterally and is approximately 4.5 degrees nose up (normal nose strut on a level surface).

NOTE: The airplane turn and bank instrument may be used to check lateral leveling.

2. Visually inspect each fuel tank for fuel level with the upper wing surface when full fuel capacity is intended to be in each tank.

3. Check each fuel cap and seal for security and wing surface for a lack of fuel stains aft of each fuel cap.

NOTE: It is highly recommended that the wing tips and flap trailing edges are checked during flight for evidence of fuel siphoning.



APPENDIX 86-19-11

PILOT OPERATING PROCEDURES-PREFLIGHT FUEL SYSTEM CHECK

Fuel sampling: Fuel strainer, wing tank and reservoir quick drains.

1. Place a suitable container under the fuel strainer drain outlet prior to operating the strainer drain control for at least 4 seconds. Check strainer drain closed.

2. Inspect the fluid drained from the fuel strainer and each wing tank quick drain for evidence of fuel contamination in the form of water, rust, sludge, ice or any other substance not compatible with fuel. Also check for proper fuel grade before the first flight of each day and after each refueling. If any contamination is detected, comply with 4 below.

3. Repeat Steps 1 and 2 on each wing tank quick drain.

4. If the airplane has been exposed to rain, sleet or snow, or if the wing fuel tanks or fuel strainer drains produce water, the fuel reservoir(s) must be checked for the presence of water by operating the fuel reservoir quick drains. The airplane fuel system must be purged to the extent necessary to insure that there is no water, ice or other fuel contamination.

NOTE 1: The fuel reservoir(s) are located under the fuselage between the firewall and forward door post on all airplane models. Consult the pilots Operating Handbook or Owners Manual in order to determine if one or two reservoir(s) are installed.

NOTE 2: A check for the presence of water using the fuel reservoir quick drains prior to the first flight of each day is considered good operating practice.

## Airworthiness Directive

### Federal Register Information

#### Header Information

#### DEPARTMENT OF TRANSPORTATION

#### Federal Aviation Administration

14 CFR Part 39

Amendment 39-5407, AD 86-19-11

Airworthiness Directives: Cessna Models R172 thru R172K, FR172E thru R172K, 177 thru 177B and 177RG, F177RG, 185 thru 185E, A185F, A188A, A188B, T188C, 205 and 205A, 206, U206, U206A thru U206G, TU206A thru TU206G, P206, P206A thru P206E, TP206A thru TP206E, 207 and 207A, 210B thru 210R, T210F thru T210R, P210N and P210R

Airplanes  
Airplanes  
PDF Copy (if Available):  
Amendment 39-5407, AD 86-19-11

### Preamble Information

AGENCY: Federal Aviation Administration, DOT

DATES: Effective October 4, 1986

whichever comes first after the effective date of this AD, unless already accomplished.

To eliminate the possibility of engine power reduction due to contaminated fuel, accomplish the following:

- (a) On Cessna Models R172, R172E thru R172H, (S/Ns R172-0001 thru R1720625) FR172E thru FR172J (S/Ns FR1720001 thru FR17200530) 177 thru 177A (S/Ns 17700001 thru 17702123) Model 177RG (S/Ns 177RG0001 thru 177RG0592) F177RG (S/Ns F177RG0001 thru F177RG122) 210G and T210G thru 210L and T210L (S/Ns 21058919 thru 21060539 and T210-0198 thru T2100454) airplanes, install quick drains in the fuel reservoirs and wing fuel tanks if not presently equipped in accordance with Cessna Single Engine Customer Care Service Information Letters SE79-45 dated September 10, 1979, and SE84-8 dated March 16, 1984, or using equivalent aircraft standard hardware.

- (b) On all Cessna Models R172, R172E, R172F, R172G, R172H, R172J, R172K, (S/Ns R172-0001 thru R172-0409 and R172-0410 and on) FR172E, FR172F, FR172G, FR172H, FR172J, FR172K (S/Ns FR1720001 thru FR17200675) 177, 177A, 177B (S/Ns 17700001 and on), 177RG (S/Ns 177RG0001 and on) F177RG (S/Ns F177RG0001 thru F177RG177) 185, 185A, 185B, 185C, 185D, 185E, A185F (S/Ns 632, 185-0001 thru 185-1599, 18501600 and on) A188 (S/Ns 653, 188-0001 thru 188-0572) A188A (S/Ns 18800573 thru 18800832), A188B (S/Ns 678T, 18800533 and on) T188C (S/Ns T188033077, T188033087, T188033257 and on) 205, 205A, (S/Ns 205-0001 and on) 206, U206, U206A, U206B, U206C, U206D, U206E, U206F, U206G, TU206A, TU206B, TU206C, TU206D, TU206E, TU206F, TU206G ((S/Ns 206-0001 thru 206-00275, U206-00276 and on) P206, P206A, P206C, P206D, P206E, TP206A, TP206B, and on) P206, P206A, P206C, P206D, P206E, (S/Ns P206-0001 thru P2060647) 207, 207A, T207, TP206C, TP206D, TP206E, (S/Ns P206-0001 thru P2060647) 207, 207A, T207A (S/Ns 2070001 and on) 210B, 210C, 210D, 210E, 210F, 210G, T210J, 210K, 210L, 210M, 210N, 210R, T210F, T210G, T210J, T210K, T210L, T210M, T210N, T210R (S/Ns 210578-1 and on) P210N and P210R (S/Ns P2100001 and on) airplanes, attach the information that is included in the appendix to this AD (entitled PILOT OPERATING PROCEDURES - PREFLIGHT FUEL SYSTEM CHECK) to the airplane documents.

### Regulatory Information

86-19-11 CESSNA: Amendment 39-5407. Applies to Models R172 thru R172K, A172E thru FR172K, 177 thru 177B and 177RG, F177RG, 185 thru 185E, A185E, A185, A188, A188A, A188B, T188C, 205 and 205A, 206, U206, U206A thru U206G, TU206A thru TU206G, P206, P206A thru P206E, TP206A thru P206E, 207 and 207A, 210B thru 210R, T210F thru T210R, P210N and P210R (all Serial Numbers (S/N)) airplanes equipped with fuel

(c) An equivalent means of compliance with this AD may be used if approved by the Manager, Aircraft Certification Office, FAA, 1801 Airport Road, Room 100, Mid-Continent Airport, Wichita, Kansas 67209.

All persons affected by this directive may obtain copies of the document(s) referred to herein upon request to Cessna Aircraft Company, Piston Aircraft Marketing Division, Post Office Box 1521, Wichita, Kansas 67201, or FAA, Office of the Regional Counsel, Room 1558, 601 East 12th Street, Kansas City, Missouri 64106.

## CHECKLIST PROCEDURES

### PREFLIGHT INSPECTION

#### ① CABIN

1. Pilot's Operating Handbook -- AVAILABLE IN THE AIRPLANE.
2. Control Wheel Lock -- REMOVE.
3. Parking Brake -- SET.
4. Avionics Power Switch -- OFF.
5. Ignition Switch -- OFF.
6. Landing Gear Lever -- DOWN.
7. Radar (if installed) -- OFF.
8. Air Conditioner (if installed) -- OFF.
9. Master Switch -- ON.

#### WARNING

When turning on the master switch, using an external power source, or pulling the propeller through by hand, treat the propeller as if the ignition switch were on. Do not stand, nor allow anyone else to stand, within the arc of the propeller, since a loose or broken wire, or a component malfunction, could cause the propeller to rotate.

10. Low Voltage and Alternator Out Warning Lights (if installed) -- ON.
11. Vacuum Gage Warning Buttons (if installed) -- CHECK both extended.
12. Landing Gear Lights and Horn -- GREEN and PRESS TO TEST (with throttle closed).
13. Fuel On-Off Valve -- ON (push full in).
14. Fuel Quantity Indicators -- CHECK QUANTITY.
15. Fuel Selector Valve -- BOTH ON.
16. Avionics Cooling Fan -- CHECK AUDIBLY FOR OPERATION.
17. Master Switch -- OFF.
18. Static Pressure Alternate Source Valve -- OFF.
19. Trim Controls -- NEUTRAL.
20. Oxygen Supply Pressure (if installed) -- CHECK.
21. Oxygen Masks (if installed) -- AVAILABLE.

#### ② EMPENNAGE

1. Static Source Openings (both sides of fuselage) -- CHECK for stoppage.

2. Baggage Door -- CHECK for security.
3. Rudder Gust Lock -- REMOVE.
4. Tail Tie-Down -- DISCONNECT.
5. Control Surfaces -- CHECK freedom of movement and security.

(3) **RIGHT WING Trailing Edge**

1. Main Wheel Tire and Wheel Well -- CHECK tire for proper inflation and wheel well for condition and cleanliness.
2. Aileron -- CHECK for freedom of movement and security.
3. Aileron Gap Seal -- CHECK security and fit.
4. Fuel Tank Vent at Wing Tip Trailing Edge -- CHECK for stoppage.

(4) **RIGHT WING**

1. Wing Tie-Down -- DISCONNECT.
2. Fuel Quantity -- CHECK VISUALLY for desired level.
3. Fuel Filler Cap -- SECURE and vent unobstructed.
4. Radome (if weather radar is installed) -- CHECK for condition and security.
5. Fuel Tank Sump Quick-Drain Valve -- DRAIN fuel (using sampler cup) to check for water, sediment, and proper fuel grade before first flight of the day and after each refueling. If water is observed, take further samples until there is no evidence of water contamination.
6. Retractable Cabin Step (if installed) -- CHECK for security and cleanliness and retraction well for cleanliness.

(5) **NOSE**

1. Propeller and Spinner -- CHECK for nicks, security and oil leaks.
2. Air Inlets -- CHECK engine induction air (right), heater air (left) and oil cooler air (lower), for restrictions.
3. Landing and Taxi Lights -- CHECK for condition and cleanliness.
4. Nose Gear Doors -- CHECK for security.
5. Nose Wheel Tire, Strut and Wheel Well -- CHECK tire and strut for proper inflation and wheel well for condition and cleanliness.
6. Nose Tie-Down -- DISCONNECT.
7. Engine Oil Filler Cap -- CHECK secure.
8. Engine Oil Dipstick -- CHECK oil level, then check dipstick SECURE. Do not operate with less than seven quarts. Fill to ten quarts for extended flight.
9. Fuel Strainer Quick-Drain Valve -- DRAIN fuel (using sampler cup) to check for water, sediment and proper fuel grade before first flight of day and after each refueling. Check strainer drain CLOSED. If water is observed, the fuel system may contain additional water, and further draining of the system at the strainer, fuel tank sumps, reservoir, and vapor return line drain (below vicinity of selector valve) must be accomplished.

**(6) LEFT WING**

1. Fuel Tank Sump Quick-Drain Valve -- DRAIN fuel (using sampler cup) to check for water, sediment, and proper fuel grade before first flight of day and after each refueling. If water is observed, take further samples until there is no evidence of water contamination.
2. Fuel Quantity -- CHECK VISUALLY for desired level.
3. Fuel Filler Cap -- SECURE and vent unobstructed.

**(7) LEFT WING Leading Edge**

1. Pitot Tube Cover -- REMOVE and check opening for stoppage.
2. Stall Warning Vane -- CHECK for freedom of movement. While master switch is turned on, horn should sound when vane is pushed upward.
3. Wing Tie-Down -- DISCONNECT.

**(8) LEFT WING Trailing Edge**

1. Fuel Tank Vent at Wing Tip Trailing Edge -- CHECK for stoppage.
2. Aileron -- CHECK for freedom of movement and security.
3. Aileron Gap Seal -- CHECK security and fit.
4. Main Wheel Tire and Wheel Well -- CHECK tire for proper inflation and wheel well for condition and cleanliness.

**BEFORE STARTING ENGINE**

1. Preflight Inspection -- COMPLETE.
2. Passenger Briefing -- COMPLETE.
3. Seats, Seat Belts, Shoulder Harnesses -- ADJUST and LOCK.
4. Brakes -- TEST and SET.
5. Avionics Power Switch -- OFF.

**CAUTION**

The avionics power switch must be OFF during engine start to prevent possible damage to avionics.

6. Circuit Breakers -- CHECK IN.
7. Radar Altimeter (if installed) -- OFF.
8. Electrical Equipment -- OFF.
9. Landing Gear Lever -- DOWN.
10. Air Conditioner (if installed) -- OFF.
11. Radar (if installed) -- OFF.
12. Autopilot (if installed) -- OFF.
13. Cowl Flaps -- OPEN (move lever out of locking hole to reposition).
14. Manual Primer (if installed) -- IN and LOCKED.

## STARTING ENGINE

1. Throttle -- CLOSED.
2. Propeller -- HIGH RPM.
3. Mixture -- RICH.
4. Propeller Area -- CLEAR.
5. Master Switch -- ON.
6. Auxiliary Fuel Pump -- ON.
7. Throttle -- ADVANCE to obtain 50-60 PPH, then RETURN to IDLE POSITION.
8. Auxiliary Fuel Pump -- OFF.
9. Ignition Switch -- START.
10. Throttle -- ADVANCE slowly.
11. Ignition Switch -- RELEASE when engine starts.

### NOTE

The engine should start in two or three revolutions. If it does not continue running, start again at step 6 above. If the engine does not start, leave auxiliary fuel pump switch off, set mixture to idle cut-off, open throttle, and crank until engine fires or for approximately 15 seconds. If still unsuccessful, start again using the normal starting procedure after allowing the starter motor to cool.

12. Throttle -- RESET to desired idle speed.
13. Oil Pressure -- CHECK.
14. Avionics Power Switch -- ON.
15. Low-Voltage Light -- OFF (approximately 800 RPM).
16. Alternator Off Lights (if installed) -- OFF.
17. Fuel Computer/Digital Clock (if installed) -- SET.
18. Navigation Lights and Flashing Beacon -- ON as required.
19. Radios -- ON.

## BEFORE TAKEOFF

1. Parking Brake -- SET.
2. Seats, Seat Belts, Shoulder Harnesses -- CHECK SECURE.
3. Cabin Doors -- CLOSED and LOCKED.
4. Flight Controls -- FREE and CORRECT.
5. Flight Instruments -- CHECK and SET.
6. Auxiliary Fuel Pump Switch -- OFF.
7. Mixture -- RICH.
8. Fuel On-Off Valve -- RECHECK ON (full in).
9. Fuel Quantity -- CHECK.

10. Fuel Selector Valve -- RECHECK BOTH ON.
11. Elevator and Rudder Trim -- SET for takeoff.
12. Throttle -- 1700 RPM.
  - a. Magneto -- CHECK (RPM drop should not exceed 150 RPM on either magneto or 50 RPM differential between magnetos).
  - b. Propeller -- CYCLE from high to low RPM; return to high RPM (full forward).
  - c. Suction Gage -- CHECK in green arc and low vacuum warning buttons retracted (if installed).
  - d. Engine Instruments and Ammeter/Voltmeter (if installed) -- CHECK.
13. Throttle -- 1000 RPM.
14. Throttle Friction Lock -- ADJUST.
15. Strobe Lights -- AS DESIRED.
16. Radios and Avionics -- SET.
17. Autopilot (if installed) (200A, 300A) -- OFF.  
(400B, IFCS) -- PREFLIGHT TEST (See Section 9), then OFF.
18. Wing Flaps -- SET for takeoff (see Takeoff checklists).
19. Cowl Flaps -- FULL OPEN.
20. Air Conditioner (if installed) -- OFF
21. Brakes -- RELEASE.

## TAKEOFF

### NORMAL TAKEOFF

1. Wing Flaps -- 0°- 10° (10° preferred).
2. Power -- 36.5 INCHES Hg and 2700 RPM (5 minute limitation).
3. Mixture -- ADJUST to 186 PPH.
4. Elevator Control -- LIFT NOSE WHEEL at 65 to 70 KIAS.

#### NOTE

When the nose wheel is lifted, the gear motor may run 2-3 seconds to restore hydraulic pressure.

5. Climb Speed -- 80-90 KIAS.
6. Brakes -- APPLY momentarily when airborne.
7. Landing Gear -- RETRACT in climb out.
8. Wing Flaps -- RETRACT after reaching 85 KIAS.

### SHORT FIELD TAKEOFF

1. Wing Flaps -- 10°.
2. Brakes -- APPLY.

3. Power -- 36.5 INCHES Hg and 2700 RPM (5 minute limitation).
4. Mixture -- ADJUST to 186 PPH.
5. Brakes -- RELEASE.
6. Elevator Control -- LIFT NOSE WHEEL AT 65 KIAS.
7. Climb Speed -- 78 KIAS until all obstacles are cleared.
8. Landing Gear -- RETRACT after obstacles are cleared.
9. Wing Flaps -- RETRACT after reaching 85 KIAS.

NOTE

Do not reduce power until wing flaps and landing gear have been retracted.

## ENROUTE CLIMB

### NORMAL CLIMB

1. Airspeed -- 105-120 KIAS.
2. Power -- 30 INCHES Hg and 2500 RPM.
3. Mixture -- LEAN to 120 PPH.

NOTE

On hot days, it may be necessary to utilize the auxiliary fuel pump to maintain 120 PPH fuel flow.

4. Cowl Flaps -- OPEN as required (full open on warm days).

NOTE

On hot days, turn on auxiliary fuel pump momentarily if switching tanks in climb.

### MAXIMUM PERFORMANCE CLIMB

1. Airspeed -- 100 KIAS.
2. Power -- 35 INCHES Hg and 2600 RPM.
3. Mixture -- ADJUST to 162 PPH.

NOTE

See power and fuel flow placard for maximum continuous power manifold pressure and fuel flow above 17,000 feet. Refer to Section 5 for airspeed above 17,000 feet.

NOTE

On hot days at higher altitudes, be alert for fuel vapor indications. If fuel flow fluctuations are observed or if desired fuel flows cannot be maintained, turn the auxiliary fuel pump ON and reset the mixture as required. If symptoms persist, select a single fuel tank having adequate fuel.

4. Cowl Flaps -- FULL OPEN.

NOTE

On hot days, turn auxiliary fuel pump ON momentarily if switching tanks in climb.

## CRUISE

1. Power -- 15-30 INCHES Hg, 2200-2500 RPM.
2. Elevator and Rudder Trim -- ADJUST.
3. Mixture -- LEAN for cruise fuel flow using the EGT gage, a Cessna Power Computer, or the data in Section 5.

NOTE

In hot weather at high altitudes, be alert for fuel vapor indications. If fuel flow fluctuations or an unexplained drop in fuel flow are observed, place the auxiliary fuel pump switch in the ON position and reset mixture control as desired. If vapor symptoms persist, place the fuel selector valve in either of the other two detent positions. When fuel flow remains steady, the auxiliary fuel pump may be turned off and the mixture reset as desired.

4. Cowl Flaps -- CLOSED (open as required on hot days or at high altitude).

NOTE

On hot days, turn auxiliary fuel pump ON momentarily if switching tanks within first 30 minutes of cruise.

## DESCENT

1. Auxiliary Fuel Pump -- OFF.

**CAUTION**

Failure to turn the auxiliary fuel pump off may result in a complete power loss at reduced throttle settings due to an excessively rich mixture.

2. Power -- AS DESIRED.
3. Mixture -- ADJUST for smooth operation (full rich for idle power).
4. Cowl Flaps -- CLOSED.

**BEFORE LANDING**

1. Seats, Seat Belts, and Shoulder Harnesses -- SECURE.
2. Auxiliary Fuel Pump -- OFF.

**CAUTION**

Failure to turn the auxiliary fuel pump off may result in a complete power loss at reduced throttle settings due to an excessively rich mixture.

3. Fuel Selector Valve -- BOTH ON.
4. Landing Gear -- EXTEND (below 165 KIAS).
5. Landing Gear -- CHECK (observe main gear down and green indicator light on).
6. Mixture -- RICH.
7. Propeller -- HIGH RPM.
8. Radar (if installed) -- OFF (after landing assured).
9. Autopilot (if installed) -- OFF.
10. Wing Flaps -- AS DESIRED ( $0^\circ$  to  $10^\circ$  below 160 KIAS,  $10^\circ$  to  $20^\circ$  below 130 KIAS, and  $20^\circ$  to  $30^\circ$  below 115 KIAS).
11. Air Conditioner (if installed) -- OFF.

**LANDING**

**NORMAL LANDING**

1. Airspeed -- 85-95 KIAS (flaps UP).
2. Wing Flaps -- AS DESIRED (flaps down preferred).
3. Airspeed -- 70-80 KIAS (flaps DOWN).
4. Elevator Trim -- ADJUST.
5. Touchdown -- MAIN WHEELS FIRST.
6. Landing Roll -- LOWER NOSE WHEEL GENTLY.

7. Braking -- MINIMUM REQUIRED.

## SHORT FIELD LANDING

1. Wing Flaps -- FULL DOWN.
2. Airspeed -- 74 KIAS.
3. Elevator Trim -- ADJUST.
4. Power -- REDUCE to idle after clearing obstacle.
5. Touchdown -- MAIN WHEELS FIRST.
6. Brakes -- APPLY HEAVILY.
7. Wing Flaps -- RETRACT.

## BALKED LANDING

1. Power -- 36.5 INCHES Hg and 2700 RPM.
2. Wing Flaps -- RETRACT to 20° (immediately).
3. Climb Speed -- 70 KIAS (until obstacles are cleared).
4. Wing Flaps -- RETRACT SLOWLY (after reaching safe altitude and 75 KIAS).
5. Cowl Flaps -- OPEN.

## AFTER LANDING

1. Wing Flaps -- RETRACT.
2. Cowl Flaps -- OPEN.

## SECURING AIRPLANE

1. Parking Brake -- SET.
2. Avionics Power Switch, Electrical Equipment -- OFF.
3. Mixture -- IDLE CUT-OFF (pulled full out).
4. Ignition Switch -- OFF.
5. Master Switch -- OFF.
6. Control Lock -- INSTALL.
7. Fuel Selector Valve -- LEFT ON or RIGHT ON (select low-wing tank if parked on sloping surface to minimize cross-feeding and spillage).



## AMPLIFIED PROCEDURES

### PREFLIGHT INSPECTION

The Preflight Inspection, described in figure 4-1 and adjacent checklist, is recommended for the first flight of the day. Inspection procedures for subsequent flights are normally limited to brief checks of control surface hinges, fuel and oil quantity, security of fuel and oil filler caps and draining of the fuel tank sumps and strainer. If the airplane has been in extended storage, has had recent major maintenance, or has been operated from marginal airports, a more extensive exterior inspection is recommended.

After major maintenance has been performed, the flight and trim tab controls should be double-checked for free and correct movement and security. The security of all inspection plates on the airplane should be checked following periodic inspections. If the airplane has been waxed or polished, check the external static pressure source holes for stoppage.

If the airplane has been exposed to much ground handling in a crowded hangar, it should be checked for dents and scratches on wings, fuselage, and tail surfaces, as well as damage to navigation and anti-collision lights, and avionics antennas.

Outside storage for long periods may result in dust and dirt accumulation on the induction air filter, obstructions in airspeed system lines, and condensation in fuel tanks. If any water is detected in the fuel system, the fuel tank sump quick-drain valves, fuel reservoir quick-drain valve, vapor return line quick-drain valve, and fuel strainer quick-drain valve should all be thoroughly drained until there is no evidence of water or sediment contamination. Outside storage in windy or gusty areas, or tie-down adjacent to taxiing airplanes, calls for special attention to control surface stops, hinges, and brackets to detect the presence of wind damage.

If the airplane has been operated from muddy fields or in snow or slush, check the main and nose gear wheel wells for obstructions and cleanliness. Operation from a gravel or cinder field will require extra attention to propeller tips and abrasion on leading edges of the horizontal tail. Stone damage to the propeller can seriously reduce the fatigue life of the blades.

Airplanes that are operated from rough fields, especially at high altitudes, are subjected to abnormal landing gear abuse. Frequently check all components of the landing gear, shock strut, tires, and brakes. If the shock strut is insufficiently extended, undue landing and taxi loads will be subjected on the airplane structure.

To prevent loss of fuel in flight, make sure the fuel tank filler caps are tightly sealed after any fuel system check or servicing. Fuel system vents should also be inspected for obstructions, ice or water, especially after exposure to cold, wet weather.

The interior inspection will vary according to the planned flight and the optional equipment installed. For example, if the airplane is equipped with an oxygen system, check the condition and quantity of oxygen face masks and hose assemblies prior to high-altitude flight. The oxygen supply system should be functionally checked to ensure that it is in working order and that an adequate supply of oxygen is available.

## STARTING ENGINE

Proper fuel management and throttle adjustments are the determining factors in securing an easy start from your turbocharged continuous-flow fuel-injection engine. The procedure outlined below should be followed closely as it is effective under nearly all operating conditions.

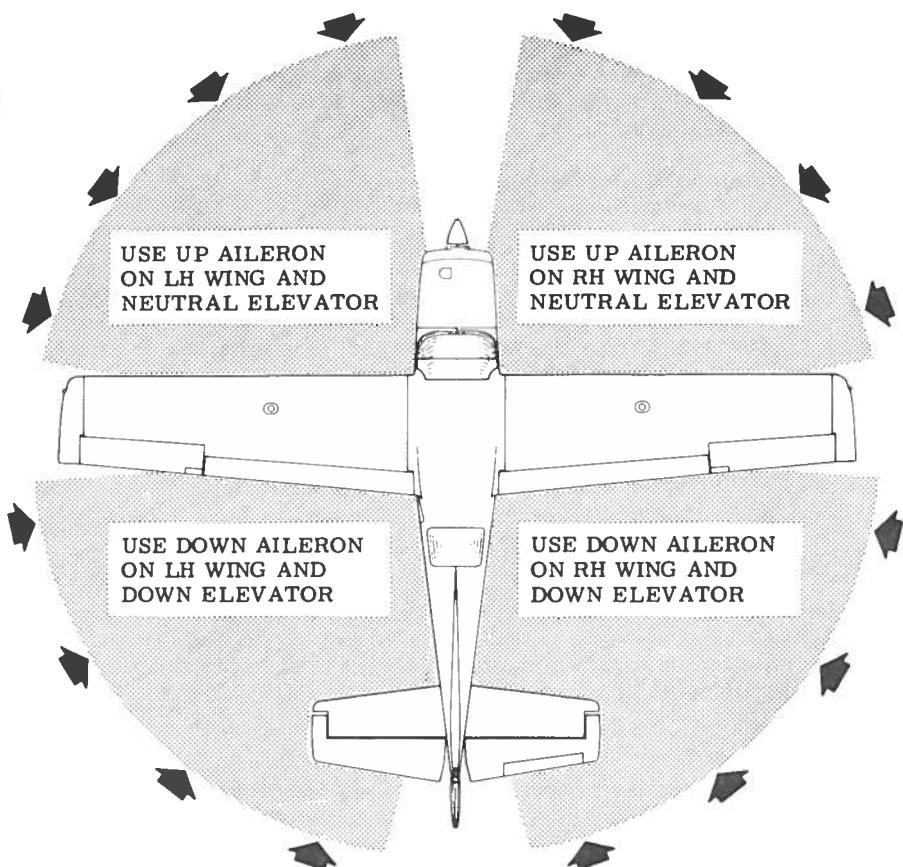
Conventional full rich mixture and high RPM propeller settings are used for starting; the throttle, however, should be fully closed initially. When ready to start, place the auxiliary fuel pump switch in the ON position and advance the throttle to obtain 50-60 PPH fuel flow. Then promptly return the throttle to idle and turn off the auxiliary fuel pump. Place the ignition switch in the START position. While cranking, slowly advance the throttle until the engine starts. Slow throttle advancement is essential since the engine will start readily when the correct fuel/air ratio is obtained. When the engine has started, reset the throttle to the desired idle speed.

When the engine is hot or outside air temperatures are high, the engine may die after running several seconds because the mixture became either too lean due to fuel vapor, or too rich due to excessive prime fuel. The following procedure will prevent over-priming and alleviate fuel vapor in the system:

1. Set the throttle 1/3 to 1/2 open.
2. When the ignition switch is in the BOTH position and you are ready to engage the starter, place the right half of the auxiliary fuel pump switch in the ON position until the indicated fuel flow comes up to 25 to 35 PPH; then turn the switch off.

### NOTE

During a restart after a brief shutdown in extremely hot weather, the presence of fuel vapor may require the use of the auxiliary fuel pump switch in the ON position for up to



**CODE**

**WIND DIRECTION**



**NOTE**

Strong quartering tail winds require caution.  
Avoid sudden bursts of the throttle and sharp  
braking when the airplane is in this attitude.  
Use the steerable nose wheel and rudder to  
maintain direction.

Figure 4-2. Taxiing Diagram

1 minute or more before the vapor is cleared sufficiently to obtain 25 to 35 PPH for starting. If the above procedure does not obtain sufficient fuel flow, fully depress and hold the left half of the switch in the HI position to obtain additional fuel pump capability.

3. Without hesitation, engage the starter and the engine should start in 3 to 5 revolutions. Adjust throttle for 1200 to 1400 RPM.
4. If there is fuel vapor in the lines, it will pass into the injector nozzles in 2 to 3 seconds and the engine will gradually slow down and stop. When engine speed starts to decrease, hold the left half of the auxiliary fuel pump switch in the HI position for approximately one second to clear out the vapor. Intermittent use of the HI position of the switch is necessary since prolonged use of the HI position after vapor is cleared will flood out the engine during a starting operation.
5. Let the engine run at 1200 to 1400 RPM until the vapor is eliminated and the engine idles normally.

If prolonged cranking is necessary, allow the starter motor to cool at frequent intervals, since excessive heat may damage the armature.

After starting, if the oil pressure gage does not begin to show pressure within 30 seconds in normal temperatures and 60 seconds in very cold weather, shut off the engine and investigate. Lack of oil pressure can cause serious engine damage.

## **TAXIING**

Taxiing over loose gravel or cinders should be done at low engine speed to avoid abrasion and stone damage to the propeller tips. Refer to figure 4-2 for additional taxiing instructions.

## **BEFORE TAKEOFF**

### **WARM-UP**

Since the engine is closely cowled for efficient in-flight cooling, precautions should be taken to avoid overheating on the ground. Full power checks on the ground are not recommended unless the pilot has good reason to suspect that the engine is not turning up properly.

### **MAGNETO CHECK**

The magneto check should be made at 1700 RPM as follows. Move ignition switch first to R position and note RPM. Next move switch back to BOTH to clear the other set of plugs. Then move switch to the L position,

note RPM and return the switch to the BOTH position. RPM drop should not exceed 150 RPM on either magneto or show greater than 50 RPM differential between magnetos. If there is a doubt concerning operation of the ignition system, RPM checks at higher engine speeds will usually confirm whether a deficiency exists.

An absence of RPM drop may be an indication of faulty grounding of one side of the ignition system or should be cause for suspicion that the magneto timing is set in advance of the setting specified.

### ALTERNATOR CHECK

Prior to flights where verification of proper alternator and alternator control unit operation is essential (such as night or instrument flights), a positive verification can be made by loading the electrical system momentarily (3 to 5 seconds) with the landing light during the engine runup (1700 RPM). The ammeter will remain within a needle width of the initial indication if the alternator and alternator control unit are operating properly.

## TAKEOFF

### POWER CHECK

It is important to check takeoff power early in the takeoff roll. Any sign of rough engine operation or sluggish engine acceleration is good cause for discontinuing the takeoff.

Full power runups over loose gravel are especially harmful to propeller tips. When takeoffs must be made over a gravel surface, it is very important that the throttle be advanced slowly. This allows the airplane to start rolling before high RPM is developed, and the gravel will be blown back of the propeller rather than pulled into it.

On the first flight of the day, when the throttle is advanced for takeoff, manifold pressure will normally exceed 36.5 inches Hg and fuel flows will exceed 186 PPH if the throttle is opened fully. On any takeoff, the manifold pressure should be monitored and the throttle set to provide 36.5 inches Hg; then, for maximum engine power, the mixture should be adjusted during the initial takeoff roll to 186 PPH. With a heat-soaked engine on a hot day, it may be necessary to use the auxiliary fuel pump to obtain the recommended takeoff fuel flow.

After the throttle is advanced to 36.5 inches Hg, adjust the throttle friction lock clockwise to prevent the throttle from creeping from a maximum power position. Similar friction lock adjustments should be

made as required in other flight conditions to maintain a fixed throttle setting.

### **WING FLAP SETTINGS**

For normal takeoffs, use of 10° flaps is preferred since it results in easier nose wheel lift-off and lower initial climb attitude, as well as a 10% reduction in ground roll and total distance over an obstacle compared to takeoff with flaps up. Compared to 20° flaps, use of 10° flaps facilitates transition to normal climb without significantly increasing total takeoff distance over an obstacle.

The use of 20° flaps is reserved for minimum ground roll or takeoffs from soft or rough fields, since it will allow safe use of slower takeoff speeds, resulting in shortening the ground roll approximately 10% compared to 10° flaps. However, most of the advantage is lost in the climb to the obstacle.

Flap settings greater than 20° are not approved for takeoff.

### **SHORT FIELD TAKEOFF**

If an obstruction dictates the use of a steep climb angle, after liftoff accelerate to and climb out at an obstacle clearance speed of 78 KIAS with 10° flaps and gear extended. This speed provides the best overall climb speed to clear obstacles when taking into account the turbulence often found near ground level. The takeoff performance data in Section 5 is based on this speed and configuration.

Minimum ground roll takeoffs are accomplished using 20° flaps by lifting the nose wheel off the ground as soon as practical and leaving the ground in a slightly tail-low attitude. However, the airplane should be leveled off immediately to accelerate to a safe climb speed. If 20° of flaps are used on soft or rough fields with obstacles ahead, it is normally preferable to leave them extended rather than partially retract them in the climb to the obstacle. With 20° flaps, use an obstacle clearance speed of 74 KIAS. After clearing the obstacle, and reaching a safe altitude, the flaps may be retracted slowly as the airplane accelerates to the normal climb-out speed.

### **CROSSWIND TAKEOFF**

Takeoffs into strong crosswinds normally are performed with the minimum flap setting necessary for the field length, to minimize the drift angle immediately after takeoff. With the ailerons partially deflected into the wind, the airplane is accelerated to a speed higher than normal, and then pulled off abruptly to prevent possible settling back to the runway

while drifting. When clear of the ground, make a coordinated turn into the wind to correct for drift.

## LANDING GEAR RETRACTION

Landing gear retraction normally is started after reaching the point over the runway where a wheels-down, forced landing on that runway would become impractical. Since the landing gear swings downward approximately two feet as it starts the retraction cycle, damage can result by retracting it before obtaining at least that much ground clearance.

Before retracting the landing gear, the brakes should be applied momentarily to stop wheel rotation. Centrifugal force caused by the rapidly-spinning wheel expands the diameter of the tire. If there is an accumulation of mud or ice in the wheel wells, the rotating wheel may rub as it is retracted into the wheel well.

## ENROUTE CLIMB

Power settings for climb must be limited to 35 inches of manifold pressure and 2600 RPM up to 17,000 feet with decreasing manifold pressure above 17,000 feet as noted on the power and fuel flow placard.

A cruising climb at 30 inches of manifold pressure, 2500 RPM, 120 PPH fuel flow, and 105 to 120 KIAS is normally recommended to provide an optimum combination of performance, visibility ahead, engine cooling, economy and passenger comfort (due to lower noise level). However, use of higher power may be desirable on hot days near maximum weight to increase climb performance. In this event, establish 2600 RPM and consult the power and fuel flow placard for manifold pressure and fuel flow setting combinations.

### NOTE

During warm weather, if there is an indication of vapor in the fuel system (fluctuating fuel flow) or if the desired fuel flow cannot be maintained with the mixture control in the full rich position, turn on the auxiliary fuel pump and reset the mixture as required until cruising altitude has been obtained and the system is purged (usually 5 to 15 minutes after establishing cruising flight). If vapor symptoms persist, select BOTH ON or a single tank having adequate fuel. When fuel flow remains steady, the auxiliary fuel pump may be turned off and the mixture reset as desired.

## SECTION 4 NORMAL PROCEDURES

CESSNA  
MODEL T210N

If it is necessary to climb rapidly to clear mountains or reach favorable winds or better weather at high altitudes, the best rate-of-climb speed should be used with maximum continuous power. This speed is 100 KIAS from sea level to 17,000 feet, decreasing to 97 KIAS at 24,000 feet.

If an obstruction dictates the use of a steep climb angle, climb with flaps retracted and maximum continuous power at 82 KIAS.

## CRUISE

Normal cruising is performed between 60% and 80% of the maximum continuous power rating. The power settings and corresponding fuel consumption for various altitudes can be determined by using your Cessna Power Computer or the data in Section 5.

### NOTE

Cruising should be done at 70% to 80% power until a total of 50 hours has accumulated or oil consumption has stabilized. This is to ensure proper seating of the rings and is applicable to new engines, and engines in service following cylinder replacement or top overhaul of one or more cylinders.

The Cruise Performance Table, figure 4-3, illustrates the advantage of higher altitude on both true airspeed and nautical miles per gallon. In addition, the beneficial effect of lower cruise power on nautical miles per gallon at a given altitude can be observed. This table should be used as a guide, along with the available winds aloft information, to determine the most favorable altitude and power setting for a given trip. The selection of

ALTITUDE	80% POWER		70% POWER		60% POWER	
	KTAS	NMPG	KTAS	NMPG	KTAS	NMPG
5000 Feet	166	9.5	158	10.3	146	11.0
10,000 Feet	174	10.0	164	10.7	151	11.4
15,000 Feet	183	10.4	170	11.1	156	11.8
20,000 Feet	190	10.9	177	11.6	161	12.2
Standard Conditions				Zero Wind		

Figure 4-3. Cruise Performance Table

cruise altitude on the basis of the most favorable wind conditions and the use of low power settings are significant factors that should be considered on every trip to reduce fuel consumption.

For reduced noise levels, it is desirable to select the lowest RPM in the green arc range for a given percent power that will provide smooth engine operation. The cowl flaps should be opened, if necessary, to maintain the cylinder head temperature at approximately two-thirds of the normal operating range (green arc).

For best fuel economy at 70% power or less, the engine should be operated at six pounds per hour leaner than shown in this handbook and on the power computer. This will result in approximately 5% greater range than shown in this handbook accompanied by approximately 4 knots decrease in speed.

The fuel injection system employed on this engine is considered to be non-icing. In the event that unusual conditions cause the intake air filter to become clogged or iced over, an alternate intake air valve opens automatically for the most efficient use of either normal or alternate air, depending on the amount of filter blockage. Due to the lower intake pressure available through the alternate air valve or a partially blocked filter, manifold pressure can decrease up to 10 in. Hg from a cruise power setting. This pressure should be recovered by increased throttle setting or higher RPM as necessary to maintain the desired power. Maximum continuous manifold pressure (35 in. Hg) is available up to 14,000 feet under hot day conditions using the alternate air source with a fully blocked filter.

## LEANING WITH AN EGT INDICATOR

Exhaust gas temperature (EGT) as shown on the Cessna economy mixture indicator or the optional engine combustion analyzer (when set on position 7) may be used as an aid for mixture leaning in cruising flight at 80% power or less. To adjust the mixture, using either of these indicators,

MIXTURE DESCRIPTION	EXHAUST GAS TEMPERATURE
RECOMMENDED LEAN (Pilot's Operating Handbook and Power Computer)	50°F Rich of Peak EGT
BEST ECONOMY (70% Power or Less)	Peak EGT

Figure 4-4. EGT Table

lean to establish the peak EGT as a reference point and then enrichen by an increment based on data in figure 4-4.

Continuous operation at peak EGT is authorized only at 70% power or less. This best economy mixture setting results in approximately 5% greater range than shown in this handbook accompanied by approximately 4 knots decrease in speed.

**NOTE**

Operation on the lean side of peak EGT is not approved.

When leaning the mixture, if a distinct peak is not obtained, use the corresponding maximum EGT as a reference point for enrichening the mixture to the desired cruise setting. Any change in altitude or power will require a recheck of the EGT indication.

Detailed information on use of the engine combustion analyzer is presented in Section 9, Supplements.

## **STALLS**

The stall characteristics are conventional and aural warning is provided by a stall warning horn which sounds between 5 and 10 knots above the stall in all configurations. Altitude loss during a stall recovery may be as much as 300 feet from a wings-level stall and even greater from a turning stall.

Power-off stall speeds at maximum weight for both forward and aft C.G. are presented in Section 5.

## **DESCENT**

Descent should be initiated far enough in advance of estimated landing to allow a gradual rate of descent at cruising speed. Just prior to beginning the descent, check that the auxiliary fuel pump has been turned off.

**CAUTION**

Failure to turn the auxiliary fuel pump off could cause a complete power failure at reduced throttle settings due to an abnormally rich mixture if throttle switch rigging or

fuel pressure settings are out of tolerance. In this event, turn the auxiliary fuel pump off, set the throttle to one-half open, and lean or adjust the mixture to regain power. Have the fuel metering system inspected as soon as practicable.

Descent should be at approximately 500 FPM for passenger comfort, using enough power to keep the engine warm. The optimum engine RPM in a descent is usually the lowest RPM in the green arc range that will allow cylinder head temperature to remain in the recommended operating range and provide smooth engine operation. If a steep descent is required, the landing gear can be extended at speeds as high as 165 KIAS after which the speed can be increased as desired in smooth air up to 203 KIAS.

The airplane is equipped with a specially marked altimeter to attract the pilot's attention and prevent misreading the altimeter. A striped warning segment on the face of the altimeter is exposed at all altitudes below 10,000 feet to indicate low altitude.

## BEFORE LANDING

In view of the relatively low drag of the extended landing gear and the high allowable gear operating speed (165 KIAS), the landing gear should be extended before entering the traffic pattern. This practice will allow more time to confirm that the landing gear is down and locked. As a further precaution, leave the landing gear extended in go-around procedures or traffic patterns for touch-and-go landing.

Landing gear extension can be detected by illumination of the gear down indicator light (green), absence of a gear warning horn with the throttle retarded below 15 inches of manifold pressure, and visual inspection of the main gear position. Should the gear indicator light fail to illuminate, the light should be checked for a burned-out bulb by pushing to test. A burned-out bulb can be replaced in flight with the landing gear up (amber) indicator light.

## LANDING

### NORMAL LANDING

Normal landing approaches can be made with power-on or power off with any flap setting desired. Use of flaps down is normally preferred to minimize touchdown speed and subsequent need for braking. For a given flap setting, surface winds and turbulence are usually the primary factors in determining the most comfortable approach speed.

Actual touchdown should be made with power off and on the main wheels first to reduce the landing speed and subsequent need for braking in the landing roll. The nose wheel is lowered to the runway after the speed has diminished to avoid unnecessary nose gear load. This procedure is especially important in rough or soft field landings.

### **SHORT FIELD LANDING**

For short field landings, make a power approach at 74 KIAS with full flaps. After all approach obstacles are cleared, progressively reduce power. Maintain 74 KIAS approach speed by lowering the nose of the airplane. Touchdown should be made with the throttle closed, and on the main wheels first. Immediately after touchdown, lower the nose gear and apply heavy braking as required. For maximum brake effectiveness after all three wheels are on the ground, retract the flaps, hold full nose up elevator and apply maximum possible brake pressure without sliding the tires.

At light operating weights, during ground roll with full flaps, hold the control wheel full back to ensure maximum weight on the main wheels for braking. Under these conditions, full nose down elevator (control wheel full forward) will raise the main wheels off the ground.

### **CROSSWIND LANDING**

When landing in a strong crosswind, use the minimum flap setting required for the field length. Although the crab or combination method of drift correction may be used, the wing-low method gives the best control. After touchdown, hold a straight course with the steerable nose wheel and occasional braking if necessary.

### **BALKED LANDING**

In a balked landing (go-around) climb, the wing flap setting should be reduced to 20° immediately after full power is applied. After all obstacles are cleared and a safe altitude and airspeed are obtained, the wing flaps should be retracted.

### **COLD WEATHER OPERATION**

The use of an external pre-heater and an external power source is recommended whenever possible to reduce wear and abuse to the engine and the electrical system. Pre-heat will thaw the oil trapped in the oil cooler, which probably will be congealed prior to starting in extremely cold temperatures. When using an external power source, the position of

the master switch is important. Refer to Section 7, paragraph Ground Service Plug Receptacle, for operating details.

For quick, smooth engine starts in very cold temperature, use six strokes of the manual primer (if installed) before cranking, with an additional one or two strokes as the engine starts.

In very cold weather, no oil temperature indication need be apparent before takeoff. After a suitable warm-up period (2 to 5 minutes at 1000 RPM), the engine is ready for takeoff if it accelerates smoothly and the oil pressure is normal and steady.

#### NOTE

The waste gate controller will not respond quickly to variations in manifold pressure when oil temperature is near the lower limit of the green arc. Therefore, under these conditions, throttle motions should be made slowly and care should be exercised to prevent exceeding the 36.5 inches Hg manifold pressure limit. In addition, the fuel flow indications may exceed 186 PPH on takeoff if the mixture isn't leaned to compensate.

The turbocharged engine installation has been designed such that a winterization kit is not required. With the cowl flaps fully closed, engine temperature will be normal (in the lower green arc range) in outside air temperatures as low as 20° to 30°C below standard. When colder surface temperatures are encountered, the normal air temperature inversion will result in warmer temperatures at cruise altitudes above 5000 feet.

If low altitude cruise in very cold temperatures results in engine temperature below the green arc, increasing cruise altitude or cruise power will increase engine temperature into the green arc. Cylinder head temperatures will increase approximately 50°F as cruise altitudes increase from 5000 to 24,000 feet.

During descent, observe engine temperatures closely and carry sufficient power to maintain them in the recommended green arc operating range.

## NOISE CHARACTERISTICS

Increased emphasis on improving the quality of our environment requires renewed effort on the part of all pilots to minimize the effect of airplane noise on the public.

**SECTION 4  
NORMAL PROCEDURES**

**CESSNA  
MODEL T210N**

We, as pilots, can demonstrate our concern for environmental improvement, by application of the following suggested procedures, and thereby tend to build public support for aviation:

1. Pilots operating aircraft under VFR over outdoor assemblies of persons, recreational and park areas, and other noise-sensitive areas should make every effort to fly not less than 2000 feet above the surface, weather permitting, even though flight at a lower level may be consistent with the provisions of government regulations.
2. During departure from or approach to an airport, climb after takeoff and descent for landing should be made so as to avoid prolonged flight at low altitude near noise-sensitive areas.

**NOTE**

The above recommended procedures do not apply where they would conflict with Air Traffic Control clearances or instructions, or where, in the pilot's judgment, an altitude of less than 2000 feet is necessary for him to adequately exercise his duty to see and avoid other aircraft.

The certificated noise level for the Model T210N at 4000 pounds maximum weight is 77.4 dB(A). No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

Severe Icing AD  
AFM Supplement  
Federal Aviation Administration Normal Procedures

[RCM Home](#)

Airworthiness Directive

[Federal Register Information](#)

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 39 [63 FR 49819 No. 181 09/18/98]

Docket No. 97-CE-62-AD; Amendment 39-10773; AD 98-05-14 RI

RIN 2120-AA64

Airworthiness Directives: Cessna Models T210N, P210N, and P210R Airplanes

[PDF Copy \(If Available\)](#):

[Preamble Information](#)

AGENCY: Federal Aviation Administration, DOT

ACTION: Final rule; correction

**SUMMARY:** This amendment clarifies information contained in Airworthiness Directive (AD) 98-05-14, which currently requires revising the FAA-approved Airplane Flight Manual (AFM) to specify procedures that would prohibit flight in severe icing conditions (as determined by certain visual cues), limit or prohibit the use of various flight control devices while in severe icing conditions, and provide the flight crew with recognition cues for, and procedures for exiting from, severe icing conditions on certain Cessna Aircraft Company (Cessna) Models T210N, P210N, and P210R airplanes. That publication incorrectly references the possibility of certain ice accumulation on the "lower" surface of the wing, instead of the "upper" surface of the wing while operating with the flaps extended. This incorrect statement may result in pilot misinterpretation of the icing effects with the flaps extended, and lead to an incorrect action. This document replaces the word "lower" with "upper" in this sentence. The actions specified in this AD are intended to continue to minimize the potential hazards associated with operating these airplanes in severe icing conditions by providing more clearly defined procedures and limitations associated with such conditions.

DATES: Effective September 22, 1998.

ADDRESSES: Submit comments in triplicate to the Federal Aviation Administration (FAA), Central Region, Office of the Regional Counsel, Attention: Rules Docket No. 97-CE-62-AD, Room 1558, 601 E. 12th Street, Kansas City, Missouri 64106.

FOR FURTHER INFORMATION CONTACT: Mr. John P. Dow, Sr., Aerospace Engineer, FAA, Small Airplane Directorate, 1201 Walnut, suite 900, Kansas City, Missouri 64106; telephone: (816) 426-6932, facsimile: (816) 426-2169.

**SUPPLEMENTARY INFORMATION:**

**Discussion**

On February 24, 1998, the FAA issued AD 98-05-14, Amendment 39-10375 (63 FR 10519, March 4, 1998), which applies to Cessna Models T210N, P210N, and P210R airplanes. AD 98-05-14 was the result of a review of the requirements for

Cessna Models T210N, P210N, and P210R Airplane.

certification of these airplanes in icing conditions, new information on the icing environment, and icing data provided currently to the flight crew.

AD 98-05-14 requires revising the Limitations Section of the FAA-approved Airplane Flight Manual (AFM) to specify procedures that would:

Require flight crews to immediately request priority handling from Air Traffic Control to exit severe icing conditions (as determined by certain visual cues);

Prohibit flight in severe icing conditions (as determined by certain visual cues);

Prohibit use of the autopilot when ice is formed aft of the protected surfaces of the wing, or when an unusual lateral trim condition exists; and

Require that all icing wing inspection lights be operative prior to flight into known or forecast icing conditions at night.

That action also requires revising the Normal Procedures Section of the FAA-approved AFM to specify procedures that would:

Limit the use of the flaps and prohibit the use of the autopilot when ice is observed forming aft of the protected surfaces of the wing, or if unusual lateral trim requirements or autopilot trim warnings are encountered; and

Provide the flight crew with recognition cues for, and procedures for exiting from, severe icing conditions.

#### Need for the Correction

The AD incorrectly states in paragraph (a)(2) of AD 98-05-14 that:

Operation with flaps extended can result in a reduced wing angle-of-attack, with the possibility of ice forming on the lower surface further aft on the wing than normal, possibly aft of the protected area. The word "lower" in this sentence should be "upper."

This incorrect statement may result in pilot misinterpretation of the icing effects with the flaps extended and lead to an incorrect action. The pilot of the affected airplanes can only see the lower wing surface. However, ice accretion on the upper surface of the wing, which the pilot cannot observe, is usually accompanied by ice accretion on the lower surface. As stated earlier, the pilot can observe ice accretion on the lower surface.

Extension of flaps that results in a reduced angle-of-attack can change the relationship of the extent of ice on the upper and lower surfaces of the wing. For example, ice will tend to accrete more on the upper surface than on the lower surface at a reduced angle-of-attack. However, when flaps are extended in certain icing conditions, the reduction of ice further aft on the lower surface of the wing may lead the pilot to conclude incorrectly that there is a reduction of ice further aft on the upper surface. This is not correct; as stated earlier, the tendency is for more ice accretion on the upper surface. Usually, ice on the upper surface of the wing is more adverse to the aerodynamic characteristics of the airplane than is ice on the lower surface of the wing.

Consequently, the FAA saw a need to clarify AD 98-05-14 to assure that this visual cue can be followed and that the appropriate cause and effect relationship is described.

#### Correction of Publication

This document clarifies the intent of the previously discussed visual cue in paragraph (a)(2) of AD 98-05-14. This document also adds the amendment to section 39.13 of the Federal Aviation Regulations (14 CFR 39.13).

Since this action only clarifies the description of a visual cue in AD 98-05-14, it has no adverse economic impact and imposes no additional burden on any person than would have been necessary by the existing AD. Therefore, the FAA has determined that prior notice and opportunity for public comment are unnecessary.

#### List of Subjects in 14 CFR Part 39

Air transportation, Aircraft, Aviation safety, Safety.

#### **Adoption of the Amendment**

Accordingly, pursuant to the authority delegated to me by the Administrator, the Federal Aviation Administration amends part 39 of the Federal Aviation Regulations (14 CFR part 39) as follows:

#### **PART 39 - AIRWORTHINESS DIRECTIVES**

1. The authority citation for part 39 continues to read as follows:  
Authority: 49 U.S.C. 106(g), 40113, 44701.

#### **§ 39.13 [Amended]**

2. Section 39.13 is amended by removing Airworthiness Directive (AD) 98-05-14, Amendment 39-10375 (63 FR 10519, March 4, 1998), and by adding a new AD to read as follows:

##### **Regulatory Information**

**98-05-14 R1 CESSNA AIRCRAFT COMPANY:** Amendment 39-10773; Docket No. 7-CE-62-AD; Revises AD 98-05-14, Amendment 39-10375.

**Applicability:** Models T210N (serial numbers 21063641 through 21064897), P210N (serial numbers P21000386 through P21000834), and P210R (all serial numbers) airplanes; certificated in any category.

**NOTE 1:** This AD applies to each airplane identified in the preceding applicability provision, regardless of whether it has been modified, altered, or repaired in the area subject to the requirements of this AD. For airplanes that have been modified, altered, or repaired so that the performance of the requirements of this AD is affected, the owner/operator must request approval for an alternative method of compliance in accordance with paragraph (d) of this AD. The request should include an assessment of the effect of the modification, alteration, or repair on the unsafe condition addressed by this AD; and, if the unsafe condition has not been eliminated, the request should include specific proposed actions to address it.

**Compliance:** Required as indicated in the body of this AD, unless already accomplished.

To minimize the potential hazards associated with operating the airplane in severe icing conditions by providing more clearly defined procedures and limitations associated with such conditions, accomplish the following:

- (a) Within 30 days after April 30, 1998 (the effective date AD 98-05-14), accomplish the requirements of paragraphs (a)(1) and (a)(2) of this AD.

**NOTE 2:** Operators should initiate action to notify and ensure that flight crewmembers are apprised of this change.

(1) Revise the FAA-approved Airplane Flight Manual (AFM) by incorporating the following into the Limitations Section of the AFM. This may be accomplished by inserting a copy of this AD in the AFM.

#### **"WARNING**

Severe icing may result from environmental conditions outside of those for which the airplane is certificated. Flight in freezing rain, freezing drizzle, or mixed icing conditions (supercooled liquid water and ice crystals) may result in ice build-up on protected surfaces exceeding the capability of the ice protection system, or may result in ice forming aft of the protected surfaces. This ice may not be shed using the ice protection systems, and may seriously degrade the performance and controllability of the airplane.

- During flight, severe icing conditions that exceed those for which the airplane is certificated shall be determined by the following visual cues. If one or more of these visual cues exists, immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the icing conditions.

Unusually extensive ice accumulation on the airframe and windshield in areas not normally observed to collect ice.

Accumulation of ice on the lower surface of the wing aft of the protected area.

- Since the autopilot, when installed and operating, may mask tactile cues that indicate adverse changes in handling

**Cessna Models T210N, P210N, and P210R Airplanes**

characteristics, use of the autopilot is prohibited when any of the visual cues specified above exist, or when unusual lateral trim requirements or autopilot trim warnings are encountered while the airplane is in icing conditions.

- All wing icing inspection lights must be operative prior to flight into known or forecast icing conditions at night. [NOTE: This supersedes any relief provided by the Master Minimum Equipment List (MMEL).]<sup>16</sup>

(2) Revise the FAA-approved AFM by incorporating the following into the Normal Procedures Section of the AFM. This may be accomplished by inserting a copy of this AD in the AFM.

**"THE FOLLOWING WEATHER CONDITIONS MAY BE CONDUCIVE TO SEVERE IN-FLIGHT ICING:**

- Visible rain at temperatures below 0 degrees Celsius ambient air temperature.
- Droplets that splash or splatter on impact at temperatures below 0 degrees Celsius ambient air temperature.

**PROCEDURES FOR EXITING THE SEVERE ICING ENVIRONMENT:**

These procedures are applicable to all flight phases from takeoff to landing. Monitor the ambient air temperature. While severe icing may form at temperatures as cold as -18 degrees Celsius, increased vigilance is warranted at temperatures around freezing with visible moisture present. If the visual cues specified in the Limitations Section of the AFM for identifying severe icing conditions are observed, accomplish the following:

- Immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the severe icing conditions in order to avoid extended exposure to flight conditions more severe than those for which the airplane has been certificated.
- Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.
- Do not engage the autopilot.
- If the autopilot is engaged, hold the control wheel firmly and disengage the autopilot.
- If an unusual roll response or uncommanded roll control movement is observed, reduce the angle-of-attack.
- Do not extend flaps when holding in icing conditions. Operation with flaps extended can result in a reduced wing angle-of-attack, with the possibility of ice forming on the upper surface further aft on the wing than normal, possibly aft of the protected area.
- If the flaps are extended, do not retract them until the airframe is clear of ice.
- Report these weather conditions to Air Traffic Control.

(b) Incorporating the AFM revisions, as required by this AD, may be performed by the owner/operator holding at least a private pilot certificate as authorized by section 43.7 of the Federal Aviation Regulations (14 CFR 43.7), and must be entered into the aircraft records showing compliance with this AD in accordance with section 43.9 of the Federal Aviation Regulations (14 CFR 43.9).

(c) Special flight permits may be issued in accordance with sections 21.197 and 21.199 of the Federal Aviation Regulations (14 CFR 21.197 and 21.199) to operate the airplane to a location where the requirements of this AD can be accomplished.

(d) An alternative method of compliance or adjustment of the compliance time that provides an equivalent level of safety may be approved by the Manager, Small Airplane Directorate, FAA, 1201 Walnut, suite 900, Kansas City, Missouri 64106. The request shall be forwarded through an appropriate FAA Maintenance Inspector, who may add comments and then send it to the Manager, Small Airplane Directorate.

NOTE 3: Information concerning the existence of approved alternative methods of compliance with this AD, if any, may be obtained from the Small Airplane Directorate.

(e) All persons affected by this directive may examine information related to this AD at the FAA, Central Region, Office of the Regional Counsel, Room 1558, 601 E. 12th Street, Kansas City, Missouri 64106.

(f) This amendment revises AD 98-05-14, Amendment 39-10375.

(g) This amendment becomes effective on September 22, 1998.

# SECTION 5

# PERFORMANCE

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## INTRODUCTION

Performance data charts on the following pages are presented so that you may know what to expect from the airplane under various conditions, and also, to facilitate the planning of flights in detail and with reasonable accuracy. The data in the charts has been computed from actual flight tests with the airplane and engine in good condition and using average piloting techniques.

It should be noted that the performance information presented in the range and endurance profile charts allows for 45 minutes reserve fuel at the specified cruise power. Fuel flow data for cruise is based on the recommended lean mixture setting. Some indeterminate variables such as mixture leaning technique, fuel metering characteristics, engine and propeller condition, and air turbulence may account for variations of 10% or more in range and endurance. Therefore, it is important to utilize all available information to estimate the fuel required for the particular flight.

## USE OF PERFORMANCE CHARTS

Performance data is presented in tabular or graphical form to illustrate the effect of different variables. Sufficiently detailed information is provided in the tables so that conservative values can be selected and used to determine the particular performance figure with reasonable accuracy.

## SAMPLE PROBLEM

The following sample flight problem utilizes information from the various charts to determine the predicted performance data for a typical flight. The following information is known:

### AIRPLANE CONFIGURATION

Takeoff weight	3950 Pounds
Usable fuel	522 Pounds

### TAKEOFF CONDITIONS

Field pressure altitude	3500 Feet
Temperature	24°C (16°C above standard)
Wind component along runway	12 Knot Headwind
Field length	4000 Feet

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CESSNA  
MODEL T210N

### CRUISE CONDITIONS

Total distance	665 Nautical Miles
Pressure altitude	11,500 Feet
Temperature	8°C
Expected wind enroute	10 Knot Headwind

### LANDING CONDITIONS

Field pressure altitude	3000 Feet
Temperature	25°C
Field length	3000 Feet

## TAKEOFF

The takeoff distance chart, figure 5-5, should be consulted, keeping in mind that the distances shown are based on the short field technique. Conservative distances can be established by reading the chart at the next higher value of weight, altitude and temperature. For example, in this particular sample problem, the takeoff distance information presented for a weight of 4000 pounds, pressure altitude of 4000 feet and a temperature of 30°C should be used and results in the following:

Ground roll	1920 Feet
Total distance to clear a 50-foot obstacle	3200 Feet

These distances are well within the available takeoff field length. However, a correction for the effect of wind may be made based on Note 2 of the takeoff chart. The correction for a 12 knot headwind is:

$$\frac{12 \text{ Knots}}{10 \text{ Knots}} \times 10\% = 12\% \text{ Decrease}$$

This results in the following distances, corrected for wind:

Ground roll, zero wind	1920
Decrease in ground roll (1920 feet × 12%)	230
Corrected ground roll	1690 Feet
Total distance to clear a 50-foot obstacle, zero wind	3200
Decrease in total distance (3200 feet × 12%)	384
Corrected total distance to clear a 50-foot obstacle	2816 Feet

## CRUISE

The cruising altitude should be selected based on a consideration of trip length, winds aloft, and the airplane's performance. A cruising altitude and the expected wind enroute have been given for this sample problem. However, the power setting selection for cruise must be determined based on several considerations. These include the cruise performance characteristics presented in figure 5-8, the range profile charts presented in figure 5-9, and the endurance profile charts presented in figure 5-10.

The relationship between power and range is illustrated by the range profile charts. Considerable fuel savings and longer range result when lower power settings are used. For this sample problem, a cruise power of approximately 70% will be used.

The cruise performance chart for 12,000 feet pressure altitude is entered using 20°C above standard temperature. These values most nearly correspond to the planned altitude and expected temperature conditions. The power setting chosen is 2300 RPM and 30 inches of manifold pressure which results in the following:

Power	70%
True airspeed	169 Knots
Cruise fuel flow	91 PPH

The power computer may be used to determine power and fuel consumption more accurately during the flight.

## FUEL REQUIRED

The total fuel requirement for the flight may be estimated using the performance information in figures 5-7 and 5-8. For this sample problem, the time, fuel, and distance to climb may be determined from figure 5-7 for a normal climb using the data for 4000 pounds. The difference between the values shown in the table for 4000 feet and 12,000 feet results in the following:

Time	15 Minutes
Fuel	30 Pounds
Distance	30 Nautical Miles

The above values are for a standard temperature and are sufficiently accurate for most flight planning purposes. However, a further correction for the effect of temperature may be made as noted on the climb chart. The

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approximate effect of a non-standard temperature is to increase the time, fuel, and distance by 10% for each 7°C above standard temperature, due to the lower rate of climb. In this case, assuming a temperature 16°C above standard, the correction would be:

$$\frac{16^{\circ}\text{C}}{7^{\circ}\text{C}} \times 10\% = 23\% \text{ Increase}$$

With this factor included, the fuel estimate would be calculated as follows:

Fuel to climb, standard temperature	30
Increase due to non-standard temperature (30 × 23%)	$\frac{7}{37}$
Corrected fuel to climb	Pounds

Using a similar procedure for time and distance during a climb, the following results are obtained:

Time to climb	18 Minutes
Distance to climb	37 Nautical Miles

The distances shown on the climb chart are for zero wind. A correction for the effect of wind may be made as follows:

Distance with no wind	37
Decrease in distance due to wind (18/60 × 10 knot headwind)	$\frac{3}{34}$
Corrected Distance to Climb	Nautical Miles

The resultant cruise distance is:

Total distance	665
Climb distance	$\frac{-34}{}$
Cruise distance	Nautical Miles

With an expected 10 knot headwind, the ground speed for cruise is predicted to be:

$$\begin{array}{r} 169 \\ -10 \\ \hline 159 \end{array} \text{ Knots}$$

Therefore, the time required for the cruise portion of the trip is:

$$\frac{631 \text{ Nautical Miles}}{159 \text{ Knots}} = 4.0 \text{ Hours}$$

The fuel required for cruise is:

$$4.0 \text{ hours} \times 91 \text{ pounds/hour} = 364 \text{ Pounds}$$

A 45-minute reserve requires:

$$\frac{45}{60} \times 91 \text{ pounds/hour} = 68 \text{ Pounds}$$

The total estimated fuel required is as follows:

Engine start, taxi, and takeoff	16
Climb	37
Cruise	364
Reserve	68
Total fuel required	485 Pounds

Once the flight is underway, ground speed checks will provide a more accurate basis for estimating the time enroute and the corresponding fuel required to complete the trip with ample reserve.

## LANDING

A procedure similar to takeoff should be used for estimating the landing distance at the destination airport. Figure 5-11 presents landing-distance information for the short field technique. The distances corresponding to 3000 feet pressure altitude and a temperature of 30°C are as follows:

Ground roll	900 Feet
Total distance to clear a 50-foot obstacle	1705 Feet

A correction for the effect of wind may be made based on Note 2 of the landing chart using the same procedure as outlined for takeoff.

## DEMONSTRATED OPERATING TEMPERATURE

Satisfactory engine cooling has been demonstrated for this airplane with an outside air temperature 23°C above standard. This is not to be considered as an operating limitation. Reference should be made to Section 2 for engine operating limitations.

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PERFORMANCE**

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**AIRSPEED CALIBRATION  
NORMAL STATIC SOURCE**

**CONDITIONS:**

4000 Pounds

Power required for level flight or maximum power during descent.

FLAPS UP								
KIAS	60	80	100	120	140	160	180	200
KCAS	60	80	99	119	139	158	177	196
FLAPS 10°								
KIAS	60	70	80	90	100	120	140	160
KCAS	60	70	80	90	99	119	138	158
FLAPS 20°								
KIAS	60	70	80	90	100	110	120	130
KCAS	63	72	81	91	100	110	120	130
FLAPS 30°								
KIAS	50	60	70	80	90	100	110	115
KCAS	59	66	74	82	91	100	111	116

**Figure 5-1. Airspeed Calibration (Sheet 1 of 2)**

**AIRSPEED CALIBRATION  
ALTERNATE STATIC SOURCE****HEATER/VENTS AND WINDOWS CLOSED**

FLAPS UP		60	80	100	120	140	160	180
NORMAL KIAS		59	83	105	127	148	170	192
ALTERNATE KIAS								
FLAPS 10°								
NORMAL KIAS		60	70	80	90	100	120	140
ALTERNATE KIAS		60	73	85	96	107	128	147
FLAPS 30°								
NORMAL KIAS		50	60	70	80	90	100	110
ALTERNATE KIAS		60	69	78	87	98	109	122

**HEATER/VENTS OPEN AND WINDOWS CLOSED**

FLAPS UP		60	80	100	120	140	160	180
NORMAL KIAS		58	81	103	126	147	168	189
ALTERNATE KIAS								
FLAPS 10°								
NORMAL KIAS		60	70	80	90	100	120	140
ALTERNATE KIAS		58	70	82	92	104	125	145
FLAPS 30°								
NORMAL KIAS		50	60	70	80	90	100	110
ALTERNATE KIAS		57	66	75	84	95	105	117

**WINDOWS OPEN**

FLAPS UP		60	80	100	120	140	160	180
NORMAL KIAS		42	73	102	129	152	174	194
ALTERNATE KIAS								
FLAPS 10°								
NORMAL KIAS		60	70	80	90	100	120	140
ALTERNATE KIAS		40	57	73	87	103	130	153
FLAPS 30°								
NORMAL KIAS		50	60	70	80	90	100	110
ALTERNATE KIAS		45	58	70	82	95	107	122

Figure 5-1. Airspeed Calibration (Sheet 2 of 2)

## TEMPERATURE CONVERSION CHART

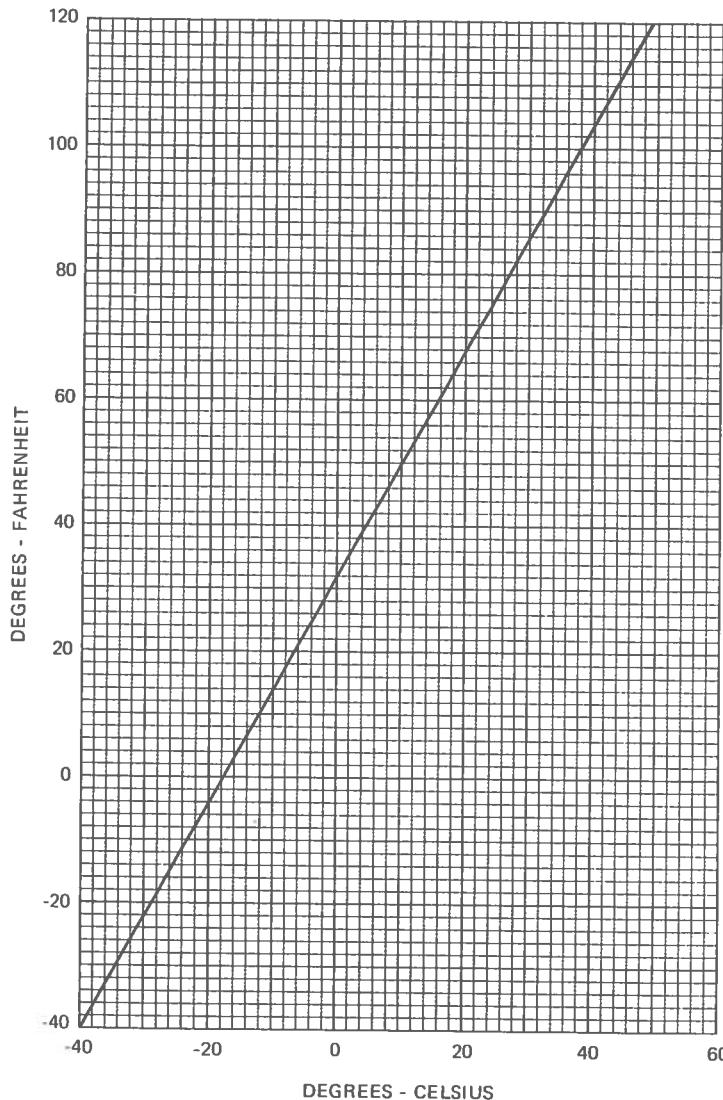


Figure 5-2. Temperature Conversion Chart

## STALL SPEEDS

**CONDITIONS:**

Power Off  
Gear Up or Down

**NOTES:**

- Altitude loss during a stall recovery may be as much as 300 feet from a wings-level stall and even greater from a turning stall.
- KIAS values are approximate.

### MOST REARWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
4000	UP	68	67	73	72	81	80	96	95
	10°	62	63	67	68	74	75	88	89
	20°	58	60	62	64	69	71	82	85
	30°	55	58	59	62	65	69	78	82

### MOST FORWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
4000	UP	74	73	80	78	88	87	105	103
	10°	68	68	73	73	81	81	96	96
	20°	63	64	68	69	75	76	89	91
	30°	58	61	62	66	69	73	82	86

Figure 5-3. Stall Speeds



## WIND COMPONENTS

NOTE:

Maximum demonstrated crosswind velocity is 21 knots (not a limitation).

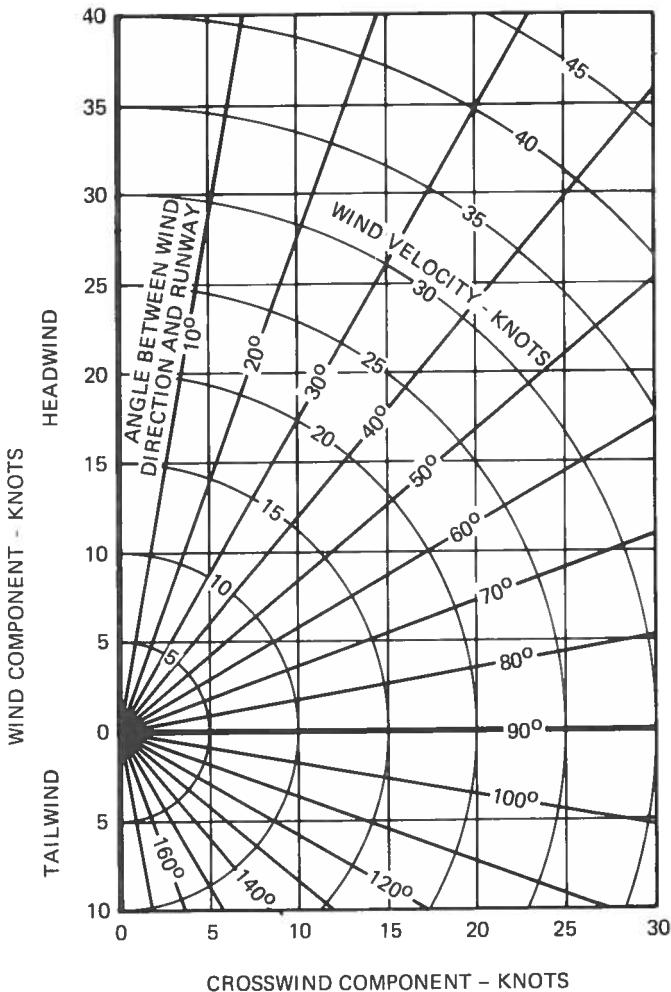


Figure 5-4. Wind Components

**SECTION 5  
PERFORMANCE**

**CESSNA  
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\* Changes from  
P.O.4 Supplement

**TAKEOFF DISTANCE  
MAXIMUM WEIGHT 4000 LBS**

**SHORT FIELD**

CONDITIONS: 34  
Flaps 10°

2700 RPM, 36.5 inches Hg, and Mixture Set at 186 PPH Prior to Brake Release.  
Cow Flaps Open

Paved, Level, Dry Runway  
Zero Wind

NOTES:

1. Short field technique as specified in Section 4.
2. Decrease distances 10% for each 10 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2.5 knots.
3. For operation on a dry, grass runway, increase distances by 15% of the "ground roll" figure.

WEIGHT LBS	TAKEOFF SPEED KIAS	PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
			LIFT OFF	AT 50 FT	TOTAL GRND TO CLEAR ROLL 50 FT OBS							
4000	72	78	S.L.	1140	1245	2065	1360	2225	1485	2490	1620	2755
			1000	1215	1995	2125	2185	2400	1580	2650	1730	2930
			2000	1290	2115	2320	1540	2555	1685	2820	1845	3125
			3000	1375	2245	1505	2465	1645	2715	1795	3000	3340
			4000	1465	2380	1605	2620	1755	2890	1920	3200	3570
			5000	1565	2530	1710	2790	1870	3080	2050	3420	3820
			6000	1670	2695	1825	2970	2000	3285	2190	3655	4095
			7000	1785	2885	1950	3165	2140	3510	2345	3915	4400
			8000	1905	3055	2085	3380	2290	3755	2510	4195	4735

Figure 5-5. Takeoff Distance (Sheet 1 of 2)

**TAKEOFF DISTANCE**  
**3700 LBS AND 3400 LBS**

**SHORT FIELD**

REFER TO SHEET 1 FOR APPROPRIATE CONDITIONS AND NOTES.

WEIGHT LBS	TAKEOFF SPEED KIAS	PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
			LIFT AT OFF	50 FT	GRND TO CLEAR	GRND ROLL	TOTAL 50 FT OBS	GRND TO CLEAR	GRND ROLL	TOTAL 50 FT OBS	GRND TO CLEAR	GRND ROLL
3700	69	75	S.L.	950	1565	1035	1705	1125	1865	1230	2045	1340
			1000	1010	1655	1100	1805	1200	1975	1310	2170	1430
			2000	1075	1750	1170	1915	1275	2095	1395	2300	1525
			3000	1145	1855	1245	2030	1360	2225	1485	2445	1625
			4000	1215	1965	1330	2155	1450	2365	1585	2605	1735
			5000	1300	2085	1420	2290	1550	2515	1695	2775	1855
			6000	1385	2215	1515	2435	1655	2675	1810	2955	1980
			7000	1480	2385	1615	2590	1770	2855	1935	3155	2120
			8000	1580	2505	1725	2760	1890	3045	2070	3370	2270
3400	66	72	S.L.	780	1290	850	1405	925	1530	1010	1670	1100
			1000	830	1365	905	1485	985	1620	1075	1770	1170
			2000	885	1440	965	1570	1050	1715	1145	1875	1250
			3000	940	1525	1025	1665	1120	1820	1220	1990	1330
			4000	1000	1615	1095	1765	1190	1930	1300	2115	1420
			5000	1070	1715	1165	1870	1270	2050	1390	2250	1515
			6000	1140	1815	1245	1985	1355	2180	1480	2390	1620
			7000	1215	1930	1325	2110	1450	2315	1585	2550	1730
			8000	1300	2050	1415	2245	1550	2465	1695	2715	1855

Figure 5-5. Takeoff Distance (Sheet 2 of 2)

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**CESSNA  
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**MAXIMUM RATE OF CLIMB**

**CONDITIONS:**

Flaps Up  
Gear Up  
2600 RPM  
Cowl Flaps Open

PRESS ALT	MP	PPH
S.L. to 17,000	35	162
18,000	34	156
20,000	32	144
22,000	30	132
24,000	28	120

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB - FPM			
			-20°C	0°C	20°C	40°C
4000	S.L.	100	1170	1035	895	755
	4000	100	1080	940	800	655
	8000	100	980	840	695	555
	12,000	100	870	730	590	---
	16,000	100	740	605	470	---
	20,000	99	485	355	---	---
	24,000	97	190	70	---	---
3700	S.L.	99	1310	1165	1020	875
	4000	99	1215	1070	925	775
	8000	99	1115	965	815	670
	12,000	99	1000	855	710	---
	16,000	99	865	730	590	---
	20,000	97	600	470	---	---
	24,000	95	295	170	---	---
3400	S.L.	97	1465	1320	1165	1015
	4000	97	1370	1220	1065	910
	8000	97	1265	1110	955	795
	12,000	97	1150	995	845	---
	16,000	97	1010	865	725	---
	20,000	96	730	595	---	---
	24,000	94	405	275	---	---

**Figure 5-6. Maximum Rate of Climb**

## TIME, FUEL, AND DISTANCE TO CLIMB

## MAXIMUM RATE OF CLIMB

## CONDITIONS:

Flaps Up  
 Gear Up  
 2600 RPM  
 Cowl Flaps Open  
 Standard Temperature

PRESS ALT	MP	PPH
S.L. to 17,000	35	162
18,000	34	156
20,000	32	144
22,000	30	132
24,000	28	120

## NOTES:

1. Add 16 pounds of fuel for engine start, taxi and takeoff allowance.
2. Increase time, fuel and distance by 10% for each 10°C above standard temperature.
3. Distances shown are based on zero wind.

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB FPM	FROM SEA LEVEL		
				TIME MIN	FUEL USED POUNDS	DISTANCE NM
4000	S.L.	100	930	0	0	0
	4000	100	890	4	12	7
	8000	100	845	9	24	16
	12,000	100	790	14	38	25
	16,000	100	720	19	52	36
	20,000	99	515	26	69	50
	24,000	97	270	37	92	74
3700	S.L.	99	1060	0	0	0
	4000	99	1020	4	10	6
	8000	99	975	8	21	13
	12,000	99	915	12	33	21
	16,000	99	845	17	45	30
	20,000	97	630	22	59	42
	24,000	95	370	30	77	60
3400	S.L.	97	1205	0	0	0
	4000	97	1165	3	9	5
	8000	97	1120	7	19	12
	12,000	97	1060	11	29	18
	16,000	97	985	15	39	26
	20,000	96	760	19	51	36
	24,000	94	485	26	65	50

Figure 5-7. Time, Fuel, and Distance to Climb (Sheet 1 of 2)

## TIME, FUEL, AND DISTANCE TO CLIMB

**NORMAL CLIMB - 110 KIAS**

**CONDITIONS:**

Flaps Up  
Gear Up  
2500 RPM  
30 Inches Hg  
120 PPH Fuel Flow  
Cowl Flaps Open  
Standard Temperature

**NOTES:**

1. Add 16 pounds of fuel for engine start, taxi and takeoff allowance.
2. Increase time, fuel and distance by 10% for each  $7^{\circ}\text{C}$  above standard temperature.
3. Distances shown are based on zero wind.

WEIGHT LBS	PRESS ALT FT	RATE OF CLIMB FPM	FROM SEA LEVEL		
			TIME MIN	FUEL USED POUNDS	DISTANCE NM
4000	S.L.	605	0	0	0
	4000	570	7	14	13
	8000	530	14	28	27
	12,000	485	22	44	43
	16,000	430	31	62	63
	20,000	365	41	82	87
3700	S.L.	700	0	0	0
	4000	665	6	12	11
	8000	625	12	24	23
	12,000	580	19	37	37
	16,000	525	26	52	53
	20,000	460	34	68	72
3400	S.L.	810	0	0	0
	4000	775	5	10	9
	8000	735	10	21	20
	12,000	690	16	32	31
	16,000	635	22	44	45
	20,000	565	29	57	61

Figure 5-7. Time, Fuel, and Distance to Climb (Sheet 2 of 2)

*\* See Supplement for  
Liberator*

## CRUISE PERFORMANCE

### PRESSURE ALTITUDE 2000 FEET

## CONDITIONS:

4000 Pounds

Recommended Lean Mixture

Cowl Flaps Closed

## NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT.

		20°C BELOW STANDARD TEMP -9°C			STANDARD TEMPERATURE 11°C			20°C ABOVE STANDARD TEMP 31°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	80	162	105	75	161	99
	28	78	157	102	74	157	96	69	156	91
	26	71	151	93	67	151	88	63	149	83
	24	64	145	84	60	143	80	57	141	75
	22	57	136	75	53	134	72	50	131	68
2400	30	80	158	105	76	158	99	71	158	93
	28	74	153	96	69	153	91	65	152	86
	26	67	147	88	63	146	83	59	144	78
	24	60	141	80	57	139	75	53	136	71
	22	54	132	72	51	130	68	48	127	65
2300	30	76	155	99	71	155	94	67	154	88
	28	70	150	92	66	150	87	62	148	82
	26	64	145	84	61	144	80	57	141	76
	24	58	138	77	55	136	73	51	133	69
	22	52	129	69	49	127	66	46	124	62
2200	30	72	152	95	68	152	89	64	150	84
	28	66	147	87	62	146	82	59	143	78
	26	60	141	79	57	138	75	53	136	71
	24	54	133	72	51	131	69	48	128	65
	22	48	125	66	46	122	62	43	118	59

Figure 5-8. Cruise Performance (Sheet 1 of 12)

\* See Supplemental To P.O.T.  
for intervals

## SECTION 5 PERFORMANCE

CESSNA  
MODEL T210N

### CRUISE PERFORMANCE PRESSURE ALTITUDE 4000 FEET

#### CONDITIONS:

4000 Pounds

Recommended Lean Mixture

Cowl Flaps Closed

#### NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT.

		20°C BELOW STANDARD TEMP -13°C			STANDARD TEMPERATURE 7°C			20°C ABOVE STANDARD TEMP 27°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	81	166	106	76	165	100
	28	79	160	103	74	160	97	70	159	91
	26	72	155	95	68	155	90	64	152	84
	24	65	149	86	62	147	81	58	144	77
	22	58	140	77	55	138	73	51	135	69
2400	30	80	161	105	76	161	99	71	160	93
	28	74	156	97	70	156	92	66	155	86
	26	68	151	89	64	150	84	60	147	79
	24	61	144	81	58	142	77	54	139	73
	22	55	136	73	52	133	70	49	130	66
2300	30	77	158	100	72	158	95	68	157	89
	28	71	154	93	67	153	88	63	151	83
	26	65	148	85	61	147	81	58	144	76
	24	59	141	78	55	139	74	52	136	70
	22	52	132	70	49	130	67	46	127	63
2200	30	73	155	95	68	155	90	64	153	84
	28	67	150	88	63	149	83	59	146	78
	26	61	144	80	57	141	76	54	138	72
	24	55	136	73	52	133	70	49	130	66
	22	49	127	67	46	125	63	44	121	60

Figure 5-8. Cruise Performance (Sheet 2 of 12)

CRUISE PERFORMANCE  
PRESSURE ALTITUDE 6000 FEET

## CONDITIONS:

4000 Pounds

Recommended Lean Mixture

Cowl Flaps Closed

## NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT.

		20°C BELOW STANDARD TEMP -17°C			STANDARD TEMPERATURE 3°C			20°C ABOVE STANDARD TEMP 23°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	81	169	107	76	168	100
	28	79	164	104	75	164	98	70	162	92
	26	73	159	96	69	158	91	65	156	85
	24	67	152	88	63	151	83	59	148	78
	22	59	144	79	56	141	75	53	138	71
2400	30	81	165	106	76	165	100	72	164	94
	28	75	160	98	71	160	93	66	158	87
	26	69	154	90	65	153	85	61	150	80
	24	62	147	82	59	145	78	55	142	74
	22	56	139	75	53	137	71	50	134	67
2300	30	77	162	101	73	162	96	69	160	90
	28	72	157	94	68	156	89	64	154	84
	26	66	152	87	62	150	82	58	147	77
	24	60	144	79	56	142	75	53	139	71
	22	53	135	72	50	133	68	47	129	64
2200	30	73	158	96	69	158	90	65	156	85
	28	68	153	89	64	152	84	60	149	79
	26	62	147	82	58	144	77	55	141	73
	24	56	139	75	53	137	71	50	133	67
	22	50	130	68	47	128	64	44	124	61

Figure 5-8. Cruise Performance (Sheet 3 of 12)

\* See Supplement for  
Intervals

SECTION 5  
PERFORMANCE

CESSNA  
MODEL T210N

**CRUISE PERFORMANCE**  
**PRESSURE ALTITUDE 8000 FEET**

CONDITIONS:

4000 Pounds

Recommended Lean Mixture

Cowl Flaps Closed

NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT.

		20°C BELOW STANDARD TEMP -21°C			STANDARD TEMPERATURE -1°C			20°C ABOVE STANDARD TEMP 19°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	81	172	107	76	171	100
	28	80	167	105	75	167	99	71	165	93
	26	74	162	97	70	161	91	65	159	86
	24	68	156	89	64	154	84	60	151	79
	22	60	147	80	57	144	76	53	141	72
2400	30	81	168	106	76	168	100	72	166	94
	28	75	163	99	71	163	93	67	160	87
	26	69	158	91	65	156	86	61	153	81
	24	63	150	83	60	148	79	56	145	74
	22	57	142	76	54	140	72	51	136	68
2300	30	78	165	102	73	165	96	69	163	90
	28	72	161	95	68	160	90	64	157	84
	26	67	155	87	63	153	83	59	150	78
	24	60	147	80	57	145	76	54	142	72
	22	54	138	72	51	136	69	48	132	65
2200	30	73	162	96	69	161	91	65	158	86
	28	68	156	89	64	155	85	60	152	80
	26	63	150	82	59	147	78	55	144	74
	24	57	142	75	54	139	72	50	136	68
	22	51	133	69	48	130	65	45	126	62

Figure 5-8. Cruise Performance (Sheet 4 of 12)

CRUISE PERFORMANCE  
PRESSURE ALTITUDE 10,000 FEET

## CONDITIONS:

4000 Pounds

Recommended Lean Mixture

Cow Flaps Closed

## NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT.

		20°C BELOW STANDARD TEMP -25°C			STANDARD TEMPERATURE -5°C			20°C ABOVE STANDARD TEMP 15°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	81	176	107	76	175	100
	28	80	170	105	76	170	99	71	168	93
	26	75	166	98	71	165	92	66	162	87
	24	69	159	90	65	157	85	61	154	80
	22	62	151	81	58	148	77	55	145	73
2400	30	81	171	107	77	171	101	72	170	94
	28	76	167	99	71	166	94	67	163	88
	26	70	161	92	66	159	87	62	156	82
	24	64	154	84	60	151	80	57	148	75
	22	58	146	77	55	143	73	51	140	69
2300	30	78	169	103	74	169	97	69	166	91
	28	73	164	96	69	163	90	65	160	85
	26	67	158	88	64	156	84	60	153	79
	24	61	150	81	58	148	77	54	145	73
	22	55	141	73	52	139	70	49	135	66
2200	30	74	165	97	70	164	92	66	161	86
	28	69	160	90	65	158	85	61	155	81
	26	63	153	84	60	151	79	56	147	75
	24	58	145	77	54	143	73	51	139	69
	22	52	136	70	49	133	66	46	129	63

Figure 5-8. Cruise Performance (Sheet 5 of 12)

*& see Supplement for  
Intake valve*

SECTION 5  
PERFORMANCE

CESSNA  
MODEL T210N

CRUISE PERFORMANCE  
PRESSURE ALTITUDE 12,000 FEET

CONDITIONS:

4000 Pounds

Recommended Lean Mixture

Cowl Flaps Closed

NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT.

		20°C BELOW STANDARD TEMP -29°C			STANDARD TEMPERATURE -9°C			20°C ABOVE STANDARD TEMP 11°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	-----	-----	-----	81	179	107	76	177	100
	28	80	174	105	76	173	99	71	171	93
	26	75	169	98	71	167	93	66	165	87
	24	69	162	90	65	160	85	61	157	81
	22	62	153	82	59	151	78	55	147	73
2400	30	81	175	107	77	174	101	72	172	94
	28	76	170	99	71	169	94	67	166	88
	26	70	164	92	66	162	87	62	159	82
	24	65	157	85	61	154	80	57	151	76
	22	59	149	78	55	146	74	52	142	70
2300	30	79	172	103	74	172	97	70	169	91
	28	73	167	96	69	166	91	65	163	85
	26	68	161	89	64	159	84	60	155	79
	24	62	153	82	58	150	77	55	147	73
	22	56	144	74	53	141	71	49	137	67
2200	28	69	163	91	65	160	86	61	157	81
	26	64	156	84	60	153	80	57	150	75
	24	58	148	77	55	145	73	52	142	70
	22	52	139	70	49	136	67	46	131	63
	20	46	128	63	44	124	60	41	118	57

Figure 5-8. Cruise Performance (Sheet 6 of 12)

\* See Supplement for  
detailed

CESSNA  
MODEL T210N

SECTION 5  
PERFORMANCE

## CRUISE PERFORMANCE

### PRESSURE ALTITUDE 14,000 FEET

**CONDITIONS:**

4000 Pounds  
Recommended Lean Mixture  
Cowl Flaps Closed

**NOTE**

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT.

		20°C BELOW STANDARD TEMP -33°C			STANDARD TEMPERATURE -13°C			20°C ABOVE STANDARD TEMP 7°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	81	182	107	76	180	100
	28	80	177	105	76	176	99	71	174	93
	26	75	172	99	71	170	93	67	167	88
	24	70	165	91	66	163	86	62	160	81
	22	63	157	83	59	154	78	56	150	74
2400	30	82	178	107	77	178	101	72	175	95
	28	76	173	100	72	171	94	67	168	89
	26	71	167	93	67	165	88	63	161	83
	24	65	160	86	61	157	81	58	154	77
	22	60	152	79	56	149	75	53	145	71
2300	30	79	176	104	74	175	98	70	172	92
	28	74	171	97	70	169	92	66	166	86
	26	68	164	90	65	162	85	61	158	80
	24	63	156	83	59	154	78	55	150	74
	22	57	147	75	53	144	72	50	140	68
2200	28	70	166	92	66	164	87	62	160	82
	26	65	159	85	61	157	81	57	153	76
	24	59	151	78	56	149	74	52	144	70
	22	53	142	71	50	138	68	47	133	64
	20	47	131	64	45	126	61	42	120	58

Figure 5-8. Cruise Performance (Sheet 7 of 12)

\* See Supplement for  
interpolate

SECTION 5  
PERFORMANCE

CESSNA  
MODEL T210N

## CRUISE PERFORMANCE

### PRESSURE ALTITUDE 16,000 FEET

CONDITIONS:

4000 Pounds

Recommended Lean Mixture

Cowl Flaps Closed

NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT.

		20°C BELOW STANDARD TEMP -37°C			STANDARD TEMPERATURE -17°C			20°C ABOVE STANDARD TEMP 3°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	81	185	106	76	183	100
	28	80	180	105	76	179	99	71	176	93
	26	75	175	99	71	173	93	67	170	88
	24	70	168	91	66	166	86	62	162	81
	22	63	159	83	60	156	79	56	153	74
2400	30	81	182	107	77	180	101	72	177	94
	28	76	176	100	72	174	94	67	171	88
	26	71	170	93	67	167	88	63	164	83
	24	66	163	86	62	160	81	58	156	77
	22	60	155	79	57	152	75	53	147	71
2300	30	79	179	103	74	177	97	70	174	91
	28	74	174	97	70	171	92	66	168	86
	26	69	167	90	65	164	85	61	161	80
	24	63	159	83	59	156	79	56	153	74
	22	57	150	76	54	147	72	51	142	68
2200	28	70	169	92	66	166	87	62	163	82
	26	65	162	86	62	160	81	58	156	77
	24	60	154	79	56	151	75	53	147	71
	22	54	145	72	51	141	68	48	135	65
	20	48	134	65	45	129	62	42	122	59

Figure 5-8. Cruise Performance (Sheet 8 of 12)

## CRUISE PERFORMANCE

PRESSURE ALTITUDE 18,000 FEET

CONDITIONS:

4000 Pounds

Recommended Lean Mixture

Cowl Flaps Closed

NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT.

		20°C BELOW STANDARD TEMP -41°C			STANDARD TEMPERATURE -21°C			20°C ABOVE STANDARD TEMP -1°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	81	188	106	76	185	100
	28	80	184	105	76	182	99	71	178	93
	26	75	178	99	71	176	93	67	172	88
	24	70	171	91	66	168	86	62	164	81
	22	63	162	84	60	159	79	56	155	75
2400	30	81	185	107	77	183	101	72	180	94
	28	76	179	100	72	177	94	67	173	88
	26	71	172	93	67	170	88	63	166	83
	24	66	165	87	62	163	82	58	159	77
	22	61	158	80	57	155	76	54	150	72
2300	30	79	182	103	74	180	97	70	176	91
	28	74	176	97	70	174	91	65	170	86
	26	69	170	91	65	167	86	61	163	81
	24	64	162	84	60	159	79	56	155	75
	22	58	154	77	55	150	73	51	145	65
2200	26	66	166	87	62	163	82	58	159	77
	24	61	158	80	57	154	76	54	150	72
	22	55	148	73	51	144	69	48	138	66
	20	49	136	66	46	131	63	43	124	59

Figure 5-8. Cruise Performance (Sheet 9 of 12)

SECTION 5  
PERFORMANCE

*See Supplement for Intake Air*  
CESSNA  
MODEL T210N

## CRUISE PERFORMANCE

### PRESSURE ALTITUDE 20,000 FEET

CONDITIONS:

4000 Pounds

Recommended Lean Mixture

Cowl Flaps Closed

NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT.

		20°C BELOW STANDARD TEMP -45°C			STANDARD TEMPERATURE -25°C			20°C ABOVE STANDARD TEMP -5°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	80	191	105	76	188	99
	28	80	186	105	75	184	99	71	181	93
	26	75	180	98	71	178	93	66	174	87
	24	70	173	91	66	170	86	62	166	81
	22	64	164	84	60	161	79	56	156	75
2400	30	81	188	106	76	186	100	72	182	94
	28	76	182	100	72	179	94	67	175	88
	26	71	175	93	67	172	88	63	168	83
	24	66	168	87	62	165	82	58	160	77
	22	61	160	81	57	157	76	54	151	72
2300	28	74	179	97	69	176	91	65	172	86
	26	69	172	91	65	170	86	61	166	81
	24	64	165	84	60	162	80	57	157	75
	22	59	157	78	55	153	74	52	147	70
2200	24	61	161	81	58	157	76	54	152	72
	22	55	151	74	52	146	70	49	139	66
	20	49	138	67	46	133	63	44	125	60

Figure 5-8. Cruise Performance (Sheet 10 of 12)

CRUISE PERFORMANCE  
PRESSURE ALTITUDE 22,000 FEET

CONDITIONS:

4000 Pounds

Recommended Lean Mixture

Cowl Flaps Closed

## NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT.

		20°C BELOW STANDARD TEMP -49°C			STANDARD TEMPERATURE -29°C			20°C ABOVE STANDARD TEMP -9°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	80	193	104	75	189	98
	28	80	189	104	75	186	98	70	183	92
	26	75	182	98	70	180	92	66	176	87
	24	69	175	91	65	172	86	61	167	81
	22	63	166	83	59	162	79	56	157	74
2400	30	80	189	105	75	187	99	71	183	93
	28	76	184	99	71	181	93	67	178	88
	26	71	177	93	67	174	87	62	170	82
	24	66	170	86	62	166	82	58	161	77
	22	61	162	80	57	158	76	54	152	72
2300	26	69	175	91	65	172	86	61	168	81
	24	65	168	85	61	165	80	57	160	76
	22	59	160	79	56	156	75	53	149	71
	20	54	151	73	51	145	69	48	138	65
2200	24	61	163	81	58	159	77	54	153	73
	22	56	153	74	52	148	70	49	141	67
	20	50	141	67	47	135	64	44	127	61

Figure 5-8. Cruise Performance (Sheet 11 of 12)

## CRUISE PERFORMANCE

PRESSURE ALTITUDE 24,000 FEET

## CONDITIONS:

4000 Pounds

Recommended Lean Mixture

Cowl Flaps Closed

## NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT.

		20°C BELOW STANDARD TEMP -53°C			STANDARD TEMPERATURE -33°C			20°C ABOVE STANDARD TEMP -13°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	28	79	191	104	74	188	98	70	185	92
	26	74	184	97	70	181	91	65	177	86
	24	68	176	90	64	173	85	60	168	80
	22	62	167	82	59	163	78	55	156	74
2400	28	75	186	99	71	183	93	66	179	87
	26	70	179	92	66	176	87	62	171	82
	24	65	171	85	61	167	81	57	162	76
	22	60	163	79	57	158	75	53	151	71
2300	26	69	177	91	65	174	86	61	169	81
	24	65	171	85	61	167	81	57	161	76
	22	60	163	79	57	158	75	53	151	71
	20	55	154	74	52	148	70	49	141	66
2200	22	56	154	74	52	149	70	49	141	66
	20	50	142	68	47	136	64	44	127	61

Figure 5-8. Cruise Performance (Sheet 12 of 12)

**RANGE PROFILE  
45 MINUTES RESERVE  
384 LBS. USABLE FUEL**

**CONDITIONS:**

4000 Pounds

Recommended Lean Mixture for Cruise

Standard Temperature

Zero Wind

**NOTE:**

This chart allows for the fuel used for engine start, taxi, takeoff and climb and the distance during a normal climb up to 20,000 feet and maximum climb above 20,000 feet.

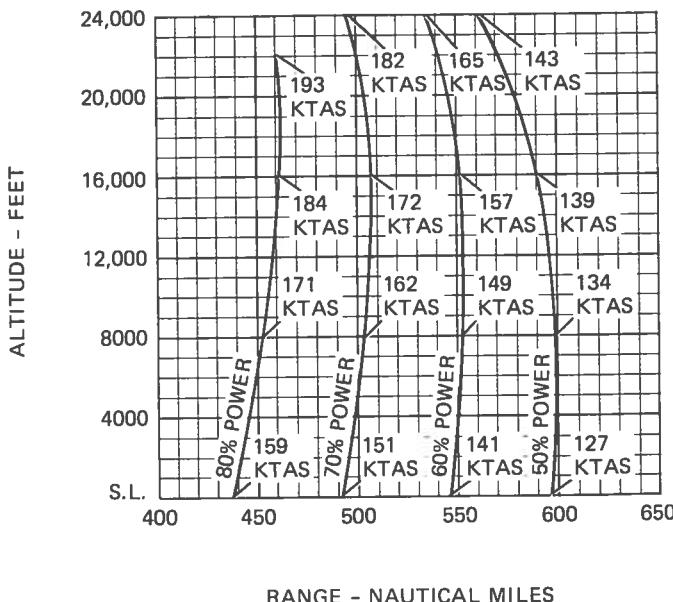


Figure 5-9. Range Profile (Sheet 1 of 2)

**RANGE PROFILE**  
**45 MINUTES RESERVE**  
**522 LBS. USABLE FUEL**

**CONDITIONS:**

4000 Pounds

Recommended Lean Mixture for Cruise

Standard Temperature

Zero Wind

**NOTE:**

This chart allows for the fuel used for engine start, taxi, takeoff and climb and the distance during a normal climb up to 20,000 feet and maximum climb above 20,000 feet.

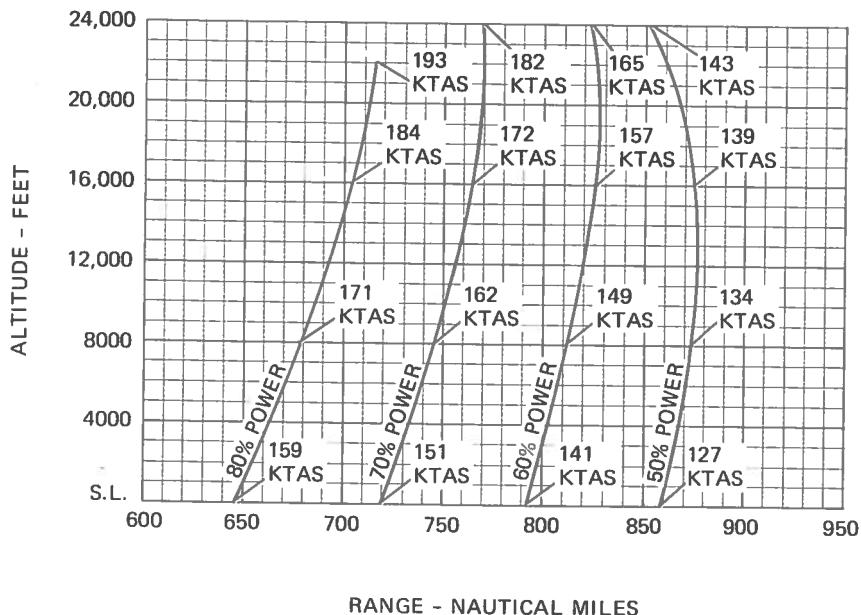


Figure 5-9. Range Profile (Sheet 2 of 2)

## ENDURANCE PROFILE

45 MINUTES RESERVE  
384 LBS. USABLE FUEL

CONDITIONS:

4000 Pounds

Recommended Lean Mixture for Cruise

Standard Temperature

NOTE:

This chart allows for the fuel used for engine start, taxi, takeoff and climb and the time during a normal climb up to 20,000 feet and maximum climb above 20,000 feet.

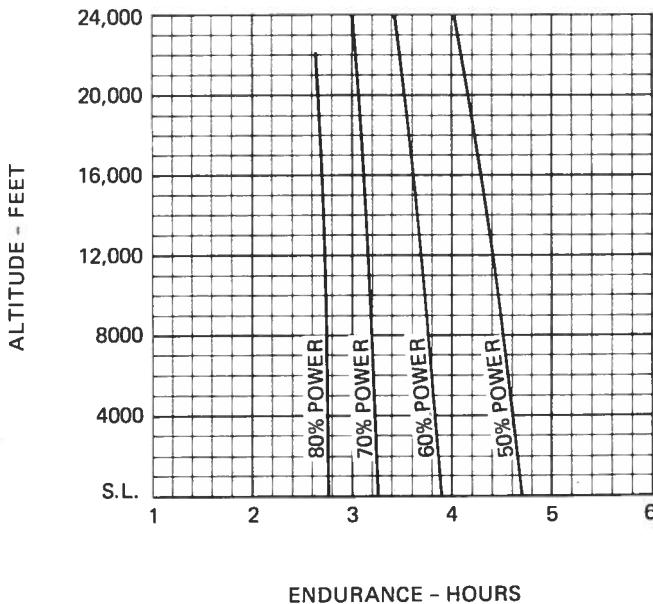


Figure 5-10. Endurance Profile (Sheet 1 of 2)

## ENDURANCE PROFILE

45 MINUTES RESERVE  
522 LBS. USABLE FUEL

CONDITIONS:

4000 Pounds

Recommended Lean Mixture for Cruise

Standard Temperature

NOTE:

This chart allows for the fuel used for engine start, taxi, takeoff and climb and the time during a normal climb up to 20,000 feet and maximum climb above 20,000 feet.

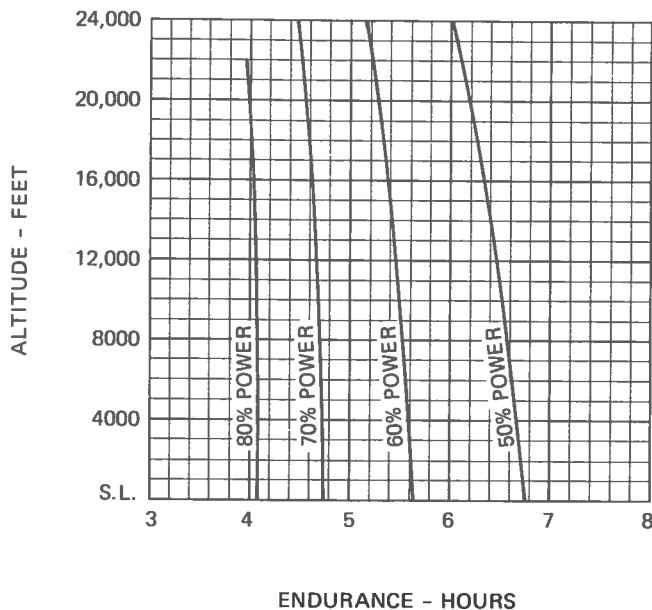


Figure 5-10. Endurance Profile (Sheet 2 of 2)

**LANDING DISTANCE****SHORT FIELD****CONDITIONS:**

Flaps 30°

Power Off

Maximum Braking

Paved, Level, Dry Runway

Zero Wind

**NOTES:**

1. Short field technique as specified in Section 4.
2. Decrease distances 10% for each 10 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2.5 knots.
3. For operation on a dry, grass runway, increase distances by 40% of the "ground roll" figure.
4. If a landing with flaps up is necessary, increase the approach speed by 14 KIAS and allow for 35% longer distances.

WEIGHT LBS	SPEED AT 50 FT KIAS	PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
			TOTAL GRND TO CLEAR ROLL 50 FT OBS									
3800	74	S.L.	725	1440	750	1480	780	1520	805	1560	830	1600
		1000	750	1480	780	1525	810	1565	835	1605	860	1645
		2000	780	1525	810	1565	840	1610	870	1660	895	1695
		3000	810	1565	840	1615	870	1660	900	1705	930	1750
		4000	840	1615	870	1660	905	1710	935	1755	965	1800
		5000	870	1660	905	1710	940	1765	970	1810	1005	1855
		6000	905	1710	940	1765	975	1815	1010	1870	1045	1910
		7000	940	1765	975	1815	1010	1870	1050	1930	1085	1970
		8000	975	1815	1010	1870	1050	1930	1085	1980	1120	2035

Figure 5-11. Landing Distance

C

Q

O

Q

Q

O

Q

# SECTION 6

# WEIGHT & BALANCE/ EQUIPMENT LIST

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Q

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## INTRODUCTION

This section describes the procedure for establishing the basic empty weight and moment of the airplane. Sample forms are provided for reference. Procedures for calculating the weight and moment for various operations are also provided. A comprehensive list of all Cessna equipment available for this airplane is included at the back of this section.

It should be noted that specific information regarding the weight, arm, moment and installed equipment for this airplane as delivered from the factory can only be found in the plastic envelope carried in the back of this handbook.

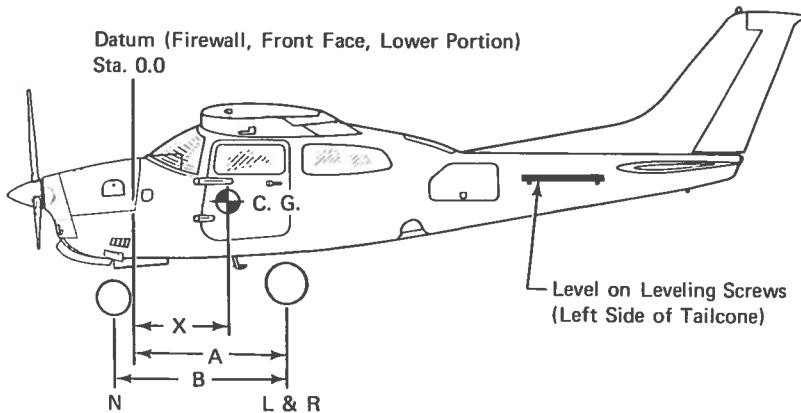
It is the responsibility of the pilot to ensure that the airplane is loaded properly.

## AIRPLANE WEIGHING PROCEDURES

1. Preparation:
  - a. Inflate tires to recommended operating pressures.
  - b. Remove the fuel tank sump quick-drain fittings and use sampler cup at quick-drain valve in reservoir to drain all fuel.
  - c. Service engine oil as required to obtain a normal full indication (ten quarts on dipstick).
  - d. Move sliding seats to the most forward position.
  - e. Raise flaps to the fully retracted position.
  - f. Place all control surfaces in neutral position.
2. Leveling:
  - a. Place scales under each wheel (minimum scale capacity, 1000 pounds).
  - b. Deflate the nose tire and/or lower or raise the nose strut to properly center the bubble in the level (see figure 6-1).
3. Weighing:
  - a. With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.
4. Measuring:
  - a. Obtain measurement A by measuring horizontally (along the airplane center line) from a line stretched between the main wheel centers to a plumb bob dropped from the firewall.
  - b. Obtain measurement B by measuring horizontally and parallel to the airplane center line, from center of nose wheel axle, left side, to a plumb bob dropped from the line between the main wheel centers. Repeat on right side and average the measurements.
5. Using weights from item 3 and measurements from item 4, the airplane weight and C.G. can be determined.
6. Basic Empty Weight may be determined by completing figure 6-1.

**SECTION 6**  
**WEIGHT & BALANCE/**  
**EQUIPMENT LIST**

**CESSNA**  
**MODEL T210N**



Scale Position	Scale Reading	Tare	Symbol	Net Weight
Left Wheel			L	
Right Wheel			R	
Nose Wheel			N	
Sum of Net Weights (As Weighed)			W	

$$X = ARM = \frac{(A) - (N) \times (B)}{W} ; X = \frac{(\quad) - (\quad) \times (\quad)}{(\quad)} = (\quad) \text{ IN.}$$

Item	Weight (Lbs.)	X C.G. Arm (In.)	Moment/1000 (Lbs.-In.)
Airplane Weight (From Item 5, Page 6-3)			
Add: Unusable Fuel (3 Gal at 6 Lbs/Gal)	18	38.0	0.7
Equipment Changes			
Airplane Basic Empty Weight			

**Figure 6-1. Sample Airplane Weighing**

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## SAMPLE WEIGHT AND BALANCE RECORD

## (Continuous History of Changes in Structure or Equipment Affecting Weight and Balance)

Figure 6-2. Sample Weight and Balance Record

## WEIGHT AND BALANCE

The following information will enable you to operate your Cessna within the prescribed weight and center of gravity limitations. To figure weight and balance, use the Sample Loading Problem, Loading Graph, and Center of Gravity Moment Envelope as follows:

Take the basic empty weight and moment from appropriate weight and balance records carried in your airplane, and enter them in the column titled YOUR AIRPLANE on the Sample Loading Problem.

### NOTE

In addition to the basic empty weight and moment noted on these records, the C.G. arm (fuselage station) is also shown, but need not be used on the Sample Loading Problem. The moment which is shown must be divided by 1000 and this value used as the moment/1000 on the loading problem.

Use the Loading Graph to determine the moment/1000 for each additional item to be carried, then list these on the loading problem.

### NOTE

Loading Graph information for the pilot, passengers and baggage is based on seats positioned for average occupants and baggage loaded in the center of the baggage areas as shown on the Loading Arrangements diagram. For loadings which may differ from these, the Sample Loading Problem lists fuselage stations for these items to indicate their forward and aft C.G. range limitation (seat travel or baggage area limitation). Additional moment calculations, based on the actual weight and C.G. arm (fuselage station) of the item being loaded, must be made if the position of the load is different from that shown on the Loading Graph.

Total the weights and moments/1000 and plot these values on the Center of Gravity Moment Envelope to determine whether the point falls within the envelope, and if the loading is acceptable.

## BAGGAGE TIE-DOWN

A nylon baggage net having six tie-down straps is provided to secure baggage in the area aft of the wheel well and on the backs of the fifth and sixth seats when they are used for stowing baggage.

When using the baggage net to secure baggage stowed aft of the wheel well, only four of the net tie-down straps are usually used. They are fastened to the two tie-down rings located on the forward edge of the wheel well and two rings at the bottom edge of the rear cabin window. If the fifth and sixth seats are not occupied, the seat backs may be folded forward to create more baggage area. If this area is used, all six tie-down straps must be used. Tie the front straps of the net to the front legs of the fifth and sixth seats and the remaining four straps to the tie-down rings provided.

Weight and balance calculations for baggage forward of the wheel well and stowed on the backs of the fifth and sixth seats can be figured on the AFT PASSENGERS line of the Loading Graph. Note that the baggage load in this area is limited to 120 pounds. Separate lines are provided for computing weight and balance of baggage in the baggage areas on and aft of the wheel well. The baggage load on the wheel well is limited to 50 pounds. The baggage load aft of the wheel well is limited to 200 pounds. The maximum allowable combined weight capacity for baggage on and aft of the wheel well is 200 pounds. The maximum allowable combined weight capacity forward, on and aft of the wheel well is 240 pounds.

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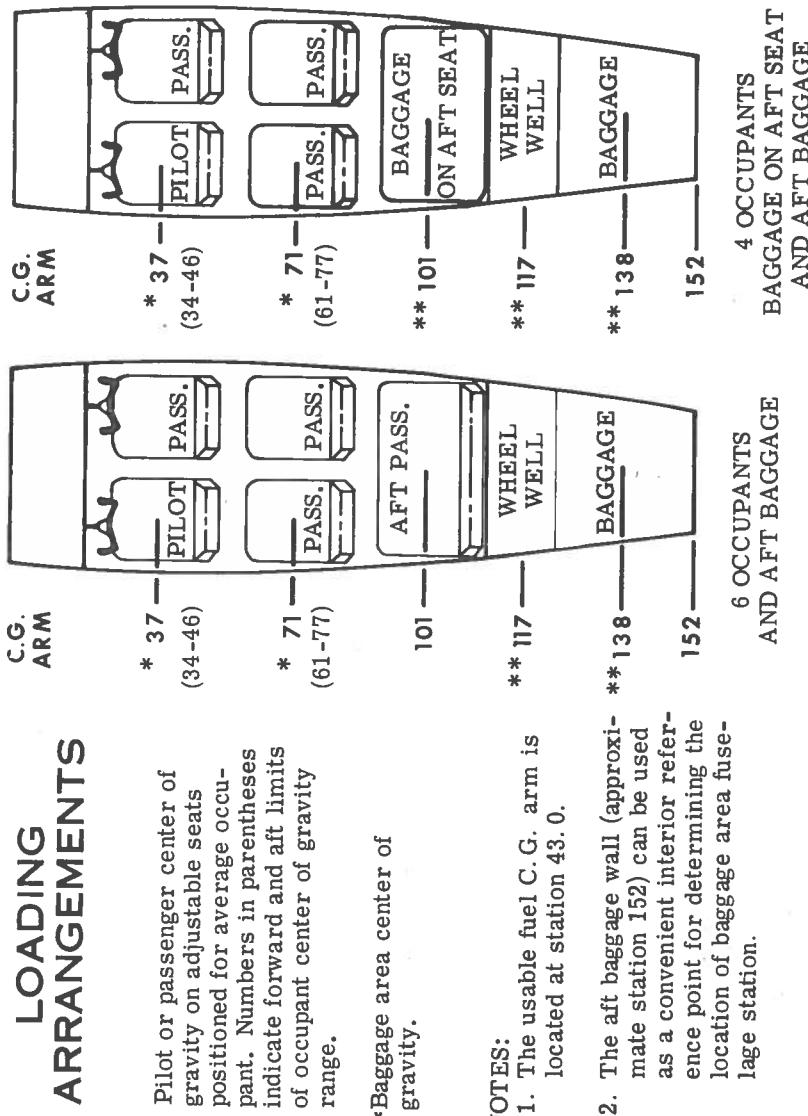
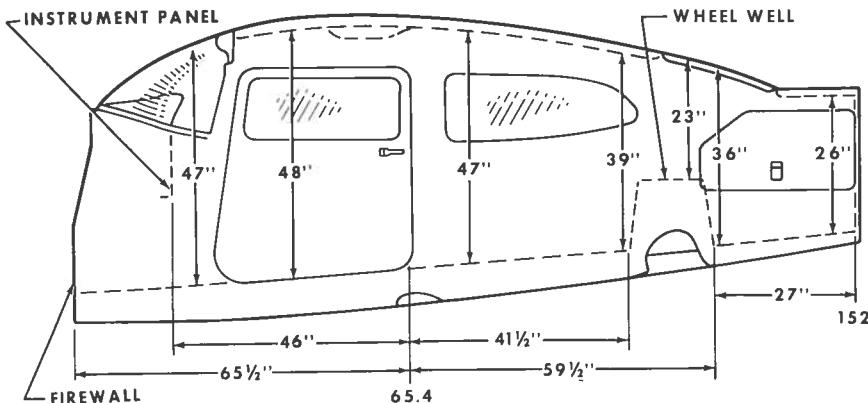


Figure 6-3. Loading Arrangements

CABIN HEIGHT MEASUREMENTS



DOOR OPENING DIMENSIONS

	WIDTH (TOP)	WIDTH (BOTTOM)	HEIGHT (FRONT)	HEIGHT (REAR)
CABIN DOOR	31"	36"	40"	38 1/4"
BAGGAGE DOOR	19"	28 1/2"	8 1/2"	14 1/4"

— WIDTH —  
 • LWR WINDOW LINE  
 \* CABIN FLOOR

CABIN WIDTH MEASUREMENTS

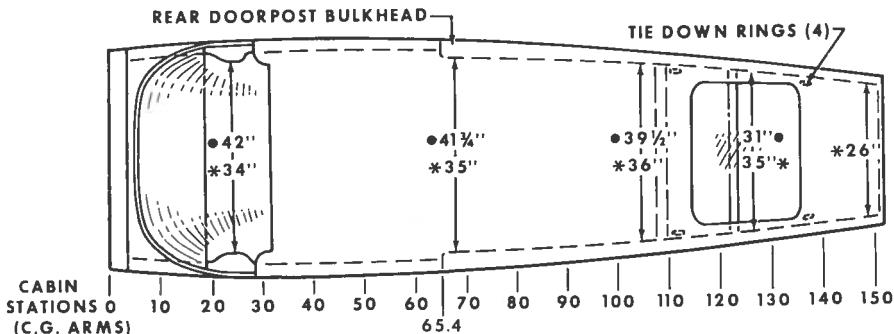


Figure 6-4. Internal Cabin Dimensions

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<b>SAMPLE LOADING PROBLEM</b>	<b>SAMPLE AIRPLANE</b>		<b>YOUR AIRPLANE</b>	
	Weight (lbs.)	Moment (lb.-ins. /1000)	Weight (lbs.)	Moment (lb.-ins. /1000)
1. Basic Empty Weight (Use the data pertaining to your airplane as it is presently equipped. Includes unusable fuel and full oil) . . . . .	2362	99.5	2536.8	101.7
2. Usable Fuel (At 6 Lbs./Gal.) Standard Tanks (87 Gal. Maximum) . . . . .	522	22.4		
Reduced Fuel (64 Gal.) . . . . .				
3. Pilot and Front Passenger (Station 34 to 46) . . . . .	340	12.6		
4. Center Passengers (Station 61 to 77) . . . . .	340	24.1		
5. Aft Passengers . . . . .	340	34.3		
6. * Baggage - Forward of wheel well on folded down aft seat (Station 89 to 110) (120 lbs. max.) . . . . .				
7. * Baggage - On wheel well (Station 110 to 124) (50 lbs. max.) . . . . .				
8. * Baggage - Aft of wheel well (Station 124 to 152) (200 lbs. max.) . . . . .	112	15.5		
9. RAMP WEIGHT AND MOMENT	4016	208.4		
10. Fuel allowance for engine start, taxi and runup	-16	-.7		
11. TAKEOFF WEIGHT AND MOMENT (Subtract step 10 from step 9)	4000	207.7		
12. Locate this point (4000 at 207.7) on the Center of Gravity Moment Envelope. Since this loading falls within the shaded area of the moment envelope, proceed with steps 13, 14 and 15. If the computed loading point falls within the clear area of the moment envelope, no further steps are required and the loading is assumed satisfactory for take-off and landing provided that flight time is allowed for fuel burn-off to a maximum of 3800 pounds before landing.				
13. Estimated Fuel Burn-Off (Climb and Cruise) (38 gallons at 6 lbs./gal.) . . . . .	-228	-9.8		
14. Subtract step 13 from step 11 for estimated airplane landing weight . . . . .	3772	197.9		
15. Locate this point (3772 at 197.9) on the Center of Gravity Moment Envelope. Since this point falls within the overall envelope, the loading may be assumed acceptable for landing.				
* The maximum allowable combined weight capacity for baggage on and aft of the wheel well is 200 lbs. The maximum allowable combined weight capacity for baggage forward, on and aft of the wheel well is 240 lbs.				

**Figure 6-5. Sample Loading Problem (Sheet 1 of 2)**

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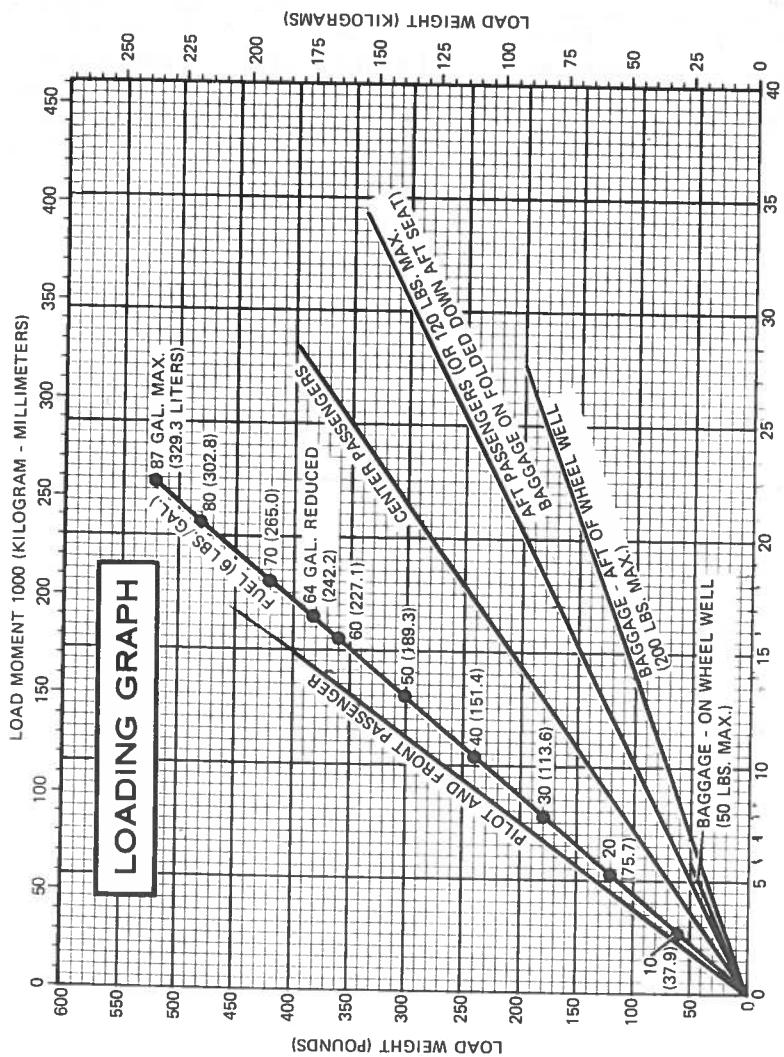
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When several loading configurations are representative of your operations, it may be useful to fill out one or more of the above columns so that specific loadings are available at a glance.

Figure 6-5. Sample Loading Problem (Sheet 2 of 2)

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NOTES: Lines representing adjustable seats show the pilot or passenger center of gravity on adjustable seats positioned for an average occupant. Refer to the Loading Arrangements diagram for forward and aft limits of occupant C.G. range.

Figure 6-6. Loading Graph

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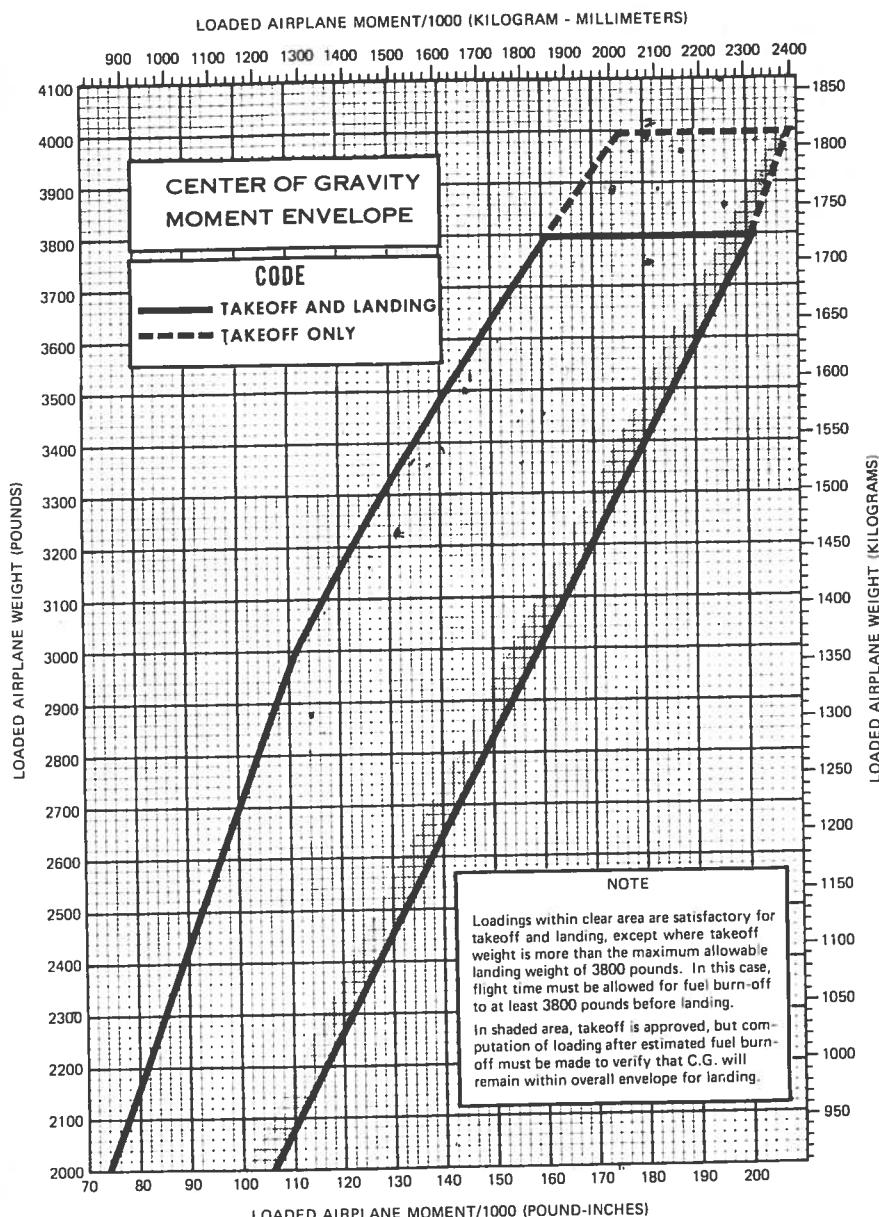
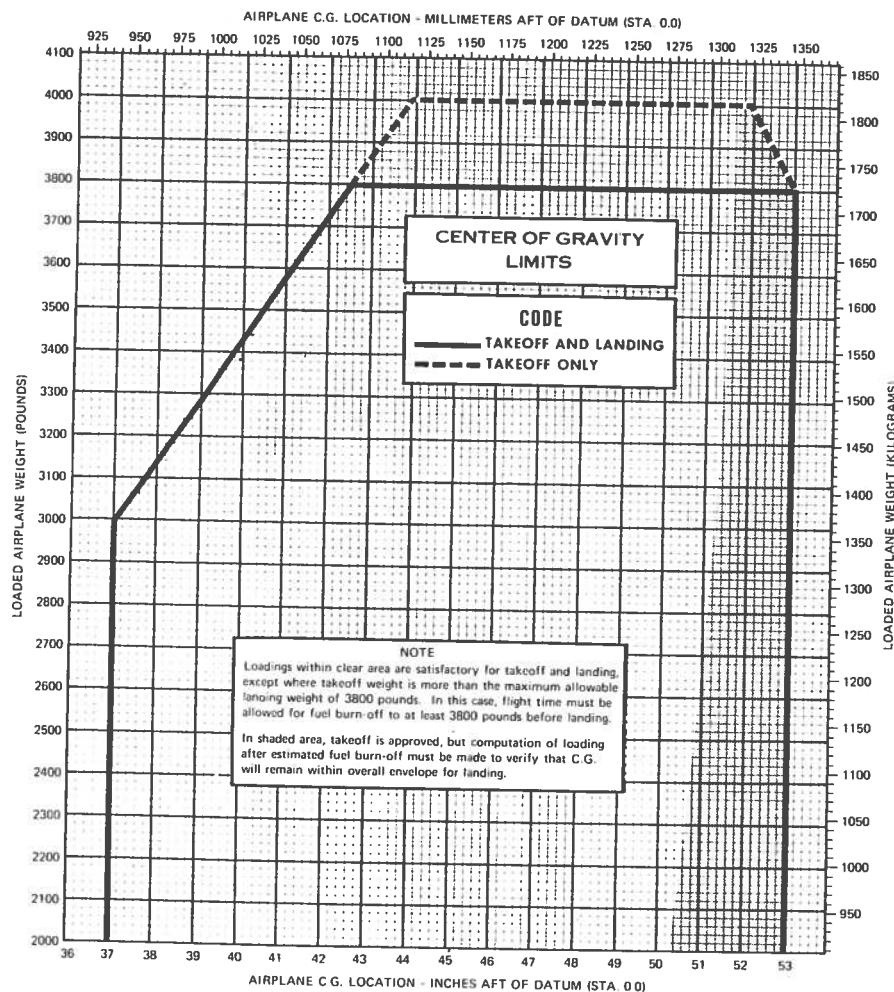


Figure 6-7. Center of Gravity Moment Envelope

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**Figure 6-8. Center of Gravity Limits**

## EQUIPMENT LIST

The following equipment list is a comprehensive list of all Cessna equipment available for this airplane. A separate equipment list of items installed in your specific airplane is provided in your aircraft file. The following list and the specific list for your airplane have a similar order of listing.

This equipment list provides the following information:

An **item number** gives the identification number for the item. Each number is prefixed with a letter which identifies the **descriptive** grouping (example: A Powerplant & Accessories) under which it is listed. Suffix letters identify the equipment as a required item, a standard item or an optional item. Suffix letters are as follows:

- R = required items of equipment for FAA certification
- S = standard equipment items
- O = optional equipment items replacing required or standard items
- A = optional equipment items which are in addition to required or standard items

A **reference drawing** column provides the drawing number for the item.

### NOTE

If additional equipment is to be installed, it must be done in accordance with the reference drawing, accessory kit instructions, or a separate FAA approval.

Columns showing **weight (in pounds)** and **arm (in inches)** provide the weight and center of gravity location for the equipment.

### NOTE

Unless otherwise indicated, true values (not net change values) for the weight and arm are shown. Positive arms are distances aft of the airplane datum; negative arms are distances forward of the datum.

### NOTE

Asterisks (\*) after the item weight and arm indicate complete assembly installations. Some major components of the assembly are listed on the lines immediately following. The summation of these major components does not necessarily equal the complete assembly installation.

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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
A01-R	A. POWERPLANT & ACCESSORIES			
A01-R	ENGINE, CONTINENTAL TSIO 520R SPeC-6	1250051	455.5*	-17.7*
	-TWO MAGNETOS WITH IMPULSE COUPLINGS	SLICK 662	12.9	-12.5
	-OIL COOLER	-	4.2	-18.5
	-TWELVE 16MM X 3/4" 20-3A SPARK PLUGS	SL 350C	3.1	-19.5
	-STARTER, 24VULI PRESTULITE	TCM 634-433	17.8	-5.0
	-FILTER ASSEMBLY	C294507-0102	1.1	-4.8
A05-K	FILTER ENGINE AIR INDUCTION	1250846-1	1.2	-8.7*
A09-R	ALTERNATOR, 28 VULI, 60 AMP	C611503-0102	10.7	-4.7
A09-U-1	ALTERNATOR INSTALLATION, NEI CHANGE	1201192-7	4.8*	-4.1*
	-ALTERNATOR, 28 VOLI, 55 AMP. ADDED	C611505-0101	15.2	-4.4
	-ALTERNATOR, 28 VOLI, 60 AMP. DELETED	C611503-0102	-10.7	-4.7
A09-U-2	SECOND ALTERNATOR INSTALLATION	1201189-1	19.6*	-34.0*
	-ALTERNATOR 60 AMP	C611503-0103	10.7	-35.4
	-BELT	D40205	4.1	-37.0
	-BRAKE & MISC. ITEMS	N7365	0.3	-37.0
A33-K	PROPELLER ASSEMBLY, 3 BLADE 80 INCHES MCCAULEY HUB/BLADE U3A34C402/9UDH-A10	C161007-C101	71.9	-44.0
A37-K	GOVERNOR, PRUP MCCAULEY C290U4/T41	C161040-0106	3.0	-35.5
A41-K	SPINNER, PRUPPELLER	1250419-12	3.5	-44.5
A41-L	SPINNER, POLISHED	1250419-14	3.5	-44.5
A45-R	TURBUCHARGER ASSEMBLY	C295001-0101	26.5	-13.0
A49-K	TURBUCHARGER WASTE GATE VALVE ASSEMBLY	C165006-0105	4.0	-26.5
A53-K	TURBUCHARGER CONTROLLER	C165004-0502	1.4	0.0
A57-K	TURBUCHARGER OVERPRESSURE RELIEF VALVE	C482002-0108	1.2	-7.0

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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
A61-A-1	VACUUM SYSTEM, SINGLE PUMP - VACUUM PUMP - RELIEF VALVE - SUCTION GAGE - YOKE FILTER - 115C.	1201182-2 C431003-0102 C482001-0701 C668540-0101 1201075-1	4.5* 1.9 0.3 0.3 1.8	1.1* -6.1 5.1 18.5 11.6 3.3
A61-A-2	DUAL VACUUM PUMP INSTALLATION - VACUUM PUMP (2) - SUCTION GAGE - RELIEF VALVE (2) - YOKE FILTER ASSY - HOSES & MISC. HARDWARE	1201180-1 C431003-0102 C668519-0101 C482001-0702 1201075-1	8.8* 3.8 0.3 0.7 0.3	1.1* -6.1 18.5 5.1 11.6 7.5
A70-A	ENGINE PRIMER SYSTEM, MANIFOLD 2-POINT	2101010-4	0.8	5.7
B. LANDING GEAR & ACCESSORIES				
B01-R-1	WHEEL & BRAKE & TIRE ASSY, CLEVELAND, 40-75B MAIN (2) - WHEEL ASSY, CLEVELAND 40-75B (LEFT) - BRAKE ASSY, CLEVELAND 30-52 (LEFT) - BRAKE ASSY, CLEVELAND 30-52 (RIGHT) - TIRE, 8 PLI, RATED - TUBE	- C163001-0301 C163030-0301 C163030-0316 C262003-0208 C262023-0102	40.2* 7.8 3.0 3.0 8.0 1.3	64.3* 64.0 66.5 66.5 64.0
B01-K-2	WHEEL & BRAKE & TIRE ASSY, 600X6 MAIN (2) - WHEEL ASSY, MCCAULEY (LEFT) - BRAKE ASSY, MCCAULEY (RIGHT) - BRAKE ASSY, MCCAULEY (RIGHT) - TIRE, 6 PLI, RATED - TUBE	C163019B0-207 C163006-0103 C163032-0209 C163032-0210 C262003-0208 C262023-0102	41.6* 8.4 3.1 3.1 8.0 1.3	64.3* 64.0 66.5 66.5 64.0
B04-K	WHEEL & BRAKE & TIRE ASSY, 500X5 NUSE, MCCAULEY - WHEEL ASSY, NUSE - TIRE, 10 PLI, RATED - TUBE	C163018B0-107 C163005-0201 C262003-0202 C262023-0101	9.8* 3.8 4.6 1.4	-7.4* -7.4 -7.4
C. ELECTRICAL SYSTEMS				

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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
CC1-K	BATTERY, 24 VOLT, STANDARD DUTY	C614001-0105	22.8	3.0
CC1-L	BATTERY, 24 VOLT, HEAVY DUTY	C614001-0106	24.8	3.0
CC4-K	ALTERNATOR CONTROL UNIT WITH HIGH AND LOW VOLTAGE SENSING	C611005-0101	0.4	3.4
CC7-A	GROUND SERVICE PLUG KEEPTAILE	1270621-1	2.0	-4.5
C10-A	ÉLEVATOR ELECTRICAL TRIM INSTALLATION -VOLTAGE REGULATOR -DRIVE ACTUATOR ASSY.	1260671-1 C611005-0101 1260153-1	4.1* 0.2* 3.3	216.7* 215.2 220.0
C19-U-1	HEATED PILOT STALL SENSOR & PILOT HEAD WITH J46-A UNLV (WT. NET CHANGE)	1201092	0.7	27.4
C19-U-2	HEATING SYSTEM, STALL SENSOR & PILOT HEAD (WT. NET CHANGE)	1201093-1	0.2	26.3
C22-A	LIGHT INSTL., INSTRUMENT POST (SET OF 18)	2101009	0.5	19.5
C23-A	LIGHT INSTRUMENT PANEL INSTALLATION ELECTROLUMINESCENCE	2101009-5	2.3	17.5
C31-A	DUCTS, LIGHTS, WING UNDERSIDE (SET OF 2)	1221103-2	0.5	51.4
C40-A	DETECTORS, NAVIGATION LIGHT (SET OF 2)	1221201-1	NEGL	—
C43-A	LIGHT INSTALLATION, OMNIFLASH BEACON -FLASHER LIGHT IN FINTIP -FLASHER POWER SUPPLY (IN FIN TIP)	1201049-1 C621001-0102 C594502-0102	1.0*	226.0*
C46-A	LIGHTS INSTL., WING TIP STROBE -FLASHING POWER SUPPLY -STROBE LIGHTS IN WING TIP (SET OF 2) -WIRING & MISL. HARDWARE	1201129-1 C622008-0104 C622009-0107	3.3* 2.3	38.9* 39.9
C49-S	LIGHTS, COWL MUNITION LANDING & TAXI -LIGHT BULBS (SET OF 2)	1213401 GE 4591	2.0* 1.0	-30.0* -34.5
C57-A	ILLUMINATING LIGHT (FLOOD)	1251069-1	1.7	226.0

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C61-A	LIGHT INSTALLATION, ICE DETECTOR (WING)	1201100-1	0.6	9.6
	b. INSTRUMENTS			
D01-K	INDICATOR, AIRSPEED	661064-0227	0.7	18.0
D01-U	INDICATOR, TRUE AIRSPEED	1201108-11	0.8	18.0
D04-R	STATIC AIR ALTERNATE SOURCE	1201032-1	0.3	16.5
D07-K	ALTIMETER, SENSITIVE	661071-0201	0.9	18.0
U07-U-1	ALTIMETER, SENSITIVE (FEET & MILLIBARS)	661071-0202	0.9	18.0
D07-D-2	ALTIMETER, SENSITIVE 35,000 FT, 20 FEET MARKING INTERVALS	661025-0102	0.7	18.0
D10-A	ALTIMETER, ZNC INSTRUMENT (K.H. SIDE)	2101013-6	1.1	17.5
D10-A-1	ALTIMETER, ENCLUDING (REQUIRES RELOCATION OF REGULAR ALTIMETER)	2101013	3.0	16.0
D16-A-2	ALTIMETER, ENCLUDING (REQUIRES RELOCATION OF REGULAR ALTIMETER) (FEET & MILLIBARS)	2101013-5	3.0	16.0
D16-A-3	ATTITUDE ENCLUDER, BLIND (INSTRUMENT PANEL MOUNTINGS, NOT REQUIRED) -ENCLUDER	2101011-2	1.6*	16.6*
		C744001-0102	1.3	15.5
D16-A-4	ATTITUDE ALERT INSTALLATION -ENCLUDING ALTIMETER -ATTITUDE ALERTEK -CABLES & MISC. ITEMS	3910216-5 2101013-10 43310-0000	4.1* 2.7 0.7	17.4* 17.5 18.7 15.7
D25-S	ELECTRIC CLOCK	664208-0102	0.3	18.0
D25-C	ELECTRIC CLOCK, DIGITAL READ-OUT	664511-0102	0.3	18.0

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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
D28-R	COMPASS, MAGNETIC	C660501-01C2	0.5	20.0
D38-R	GAGE, FUEL QUANTITY (IN LOWER PEDESTAL)	- -	0.5	20.0
D41-K	GAGE, CYLINDER HEAD & OIL TEMPERATURE	C669526-0101	0.5	18.2
D45-R	GAGE, AMMETER & OIL PRESSURE	C669527-0101	0.4	18.2
U49-S	INDICATOR INSTL. ECONOMY MIXTURE -GT IND. ALCLK 202-2AY -THERMOFILE LEAD WIRE +THERMOFILE LEAD WIRE +THERMOFILE LEAD WIRE +THERMOFILE LEAD WIRE	1200677-4 C668501-0211 C668501-0208 C668501-0204	0.7* 0.4 0.1 -18.0	10.8* 18.3 0.1 -18.0
D49-O	ALLOR EGT INU. INSTL. ENGINE ANALYSER	1200567-2	2.0	-8.3
D52-U	FUEL COMPUTER/CLKU INSTALLATION	2101057-2	0.7	13.5
D55-K	GAGE, MANIFOLD PRESSURE AND FUEL FLOW	U662037-0205	1.0	17.5
D64-A-1	GYRO INSTL., NUN AUTO-PILOT -HEADING INDICATOR -ATTITUDE INDICATOR -THROTTLE & MISC. HARDWARE	2101001-1 C661075-0101 C661076-0103	5.5* 3.0 2.1	15.1* 15.0 11.2
D64-A-2	GYRO INSTL., SCUA NAV-O-MATIC W/HSL UNSLAVED -ATTITUDE INDICATOR -SOL GYRO (UNSLAVED) -HOSES & MISC. HARDWARE	2101001-2 C661076-0103 44690-2000	7.0*	15.1*
D64-A-3	GYRO INSTALLATION, SCUA NAV-O-MATIC -ATTITUDE INDICATOR -HEADING INDICATOR (UG ) (AKC) -HOSES & MISC. HARDWARE	2101001-3 C661076-0103 40760-0104	5.3* 2.1 0.4	15.1* 16.0 11.2
D64-A-4	GYRO INSTALLATION, 400E NAV-O-MATIC WITH UNSLAVED HEADING INDICATOR -ATTITUDE INDICATOR -DIRECTIONAL INDICATOR -HOSES & MISC. HARDWARE	2101001-4 37576-0105 40760-0104	5.4* 2.3 0.4	15.1* 16.0 11.2
D64-A-5	GYRO INSTALLATION, 400B NAV-O-MATIC	2101001-7	0.0*	15.1*

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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
D64-A-6	W/SLAVED HEADING IND. (USE FOR H31-A-5) -A +HORIZONTAL INDICATOR (HG) +USES & MISC. HARDWARE	37570-0105 44760-0000	2.3 3.3 0.4	16.0 15.0 11.2
D64-A-7	GYRO INSTALLATION, 400B NAV-O-MATIC W/SLAVED HG (USE FOR H31-A-7) +HORIZONTAL GYRO +SITG - YRU - SLAVED +HOSES & MISC. HARDWARE	2101001-8	7.7*	15.1*
D64-A-7	GYRO INSTALLATION, 400E 1T-CS (USE FOR H31-A-3) +ADI +SITG +HOSES & MISC. HARDWARE	2101001-6	8.5*	15.1*
D64-A-8	GYRO INSTALLATION, 400B NAV-O-MATIC W/UNSLAVED HG (USE FOR H31-A-6) +HORIZONTAL INDICATOR +SITG - GYRO UNSLAVED +HOSES & MISC. HARDWARE	2101001-10 37570-0105 44690-2000	7.2*	15.1*
D67-A	HUMMETER INSTALLATION	2100010-1	0.5	9.8
D82-S	GAUGE, OUTSIDE AIR TEMPERATURE	C668507-0101	0.1	26.5
D85-R	TACHOMETER, RECURRING	-	0.6	17.5
D88-S-1	INDICATOR, TURN COORDINATOR (24 VOLT ONLY)	C661003-0507	1.3	17.8
D88-S-2	INDICATOR, TURN COORDINATOR (10-30 VOLTS)	C661003-0506	1.3	17.8
D88-U-1	INDICATOR, TURN COORDINATOR (USE WITH NAV-O-MATIC 200A AND 300A)	42320-0028	1.3	17.8
D88-U-2	INDICATOR, TURN AND BANK	S-1303-2	1.0	17.5
D91-S	INDICATOR, VERTICAL SPEED	C661080-0101	1.0	17.5
E. CABIN ACCOMMODATIONS				

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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
E01-A	ARM RESTS (2) 1ST ROW REMOVABLE INBOARD	1214121	1.5	37.0
E02-A	ARM RESTS (2) 2ND ROW REMOVABLE INBOARD	1214121	1.5	71.0
E03-R	SEAT, PILOT, INFINITE VERTICAL ADJUSTING	1214175	23.5	44.0
E05-O	SEAT, PILOT ARTICULATING VERTICAL ADJUST WITH LUMBAR SUPPORT	1214175	25.4	39.5
E07-S	SEAT, CO-PILOT FIXED HEIGHT, ARTICULATING	1214175	18.5	44.0
E07-0-1	SEAT, CO-PILOT FIXED HEIGHT, ARTICULATING WITH LUMBAR SUPPORT	1214175	19.4	44.0
E07-0-2	SEAT, CO-PILOT VERTICAL ADJUST.	1214175	24.3	39.5
E07-0-3	SEAT CO-PILOT VERTICAL ADJUST. AND ARTICULATING WITH LUMBAR SUPPORT	1214175	25.4	39.5
E09-S	SEATS, 2 PLACES 2ND ROW INDIVIDUAL	1214174	37.5	73.0
E11-S	SEAT, 2 PLACES 3RD ROW BENCH	1214176	23.4	104.5
E15-K	SEAT BELT ASSY, PILOT	S-2275-103	1.0	37.0
E15-S	SHOULDER HARNESS ASSY, PILOT	S-2275-201	0.6	37.0
E19-A	INERTIA REEL INSIL-PAK 1ST ROW SEAT BELT AND SHOULDER HARNESS (NET CHG)	1201057-1	0.6	89.1
E23-S	BELT & SHOULDER HARNESS ASSY, CO-PILOT	S-2275-3	1.6	37.0
E27-S	BELT ASSY, 2ND ROW OCCUPANT LAP (SET OF 2)	S-1746-25	2.0	71.0
E27-U	BELTS & SHOULDER HARNESS, 2ND ROW OCCUPANT LAP (SET OF 2)	S-2275-5	3.2	71.0
E29-S	BELT ASSY, 3RD ROW OCCUPANTS (SET OF 2)	S-1746	2.0	101.0
E29-U	BELT & HARNESS ASSY., 3RD ROW (SET OF 2)	S-2275	3.2	101.0

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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
E34-0	UPHOLSTERY, LEATHER SIDE PANELS NEW CHANGE	L215150	2.0	65.0
E35-U-1	LEATHER SEATS PART COVERING, 6 PLACE		1.5	73.1
E35-C-2	LEATHER SEATS FULL COVERING, 6 PLACE (ADDS WEIGHT OF 0.5 LB. PER SEAT)		3.0	73.1
E37-A	OPENABLE WINDOW, RH CABIN DOOR, NET CHANGE	C701065-5	2.3	47.0
E47-S	PARTIAL OXYGEN SYSTEM INSTALLATION	I201166-3	3.0	71.3
E47-A-1	OXYGEN SYSTEM INSTALLATION, AFT CYLINDER 76 CU. FT., CAPACITY 100% -OXYGEN CYLINDER EMPTY, OVERHEM. WELL -OXYGEN (16 CU. FT., 1800 PSI @ 0.0832 LBS/CU. FT.) -OXYGEN MASKS (1 PILOT & 5 PASSENGERS) -HOSES & HARDWARE	I201166-4	33.6*	111.7*
E47-A-2	OXYGEN SYSTEM INSTALLATION OVERHEAD CYLINDER, 74 CU. FT., CAPACITY -OXYGEN CYLINDER, EMPTY -OXYGEN CYLINDERS, ON-OFF VALVES, EMPTY ISLT OF 24 -OXYGEN CYLINDER, ON-OFF VALVE, EMPLY -OXYGEN MASKS, 1 PILOT & 5 PASSENGERS -HOSES & MISC. HARWARE	I201166-5 C166001-0005 C166003-0102 C166005 C166006-0103	54.6*	55.4*
E49-A-1	BEVERAGE CUP MULTEK, RETRACTABLE, PILOT	I201124-1	0.1	17.0
E49-A-2	BEVERAGE CUP MULTEK, RETRACTABLE, LU-PIL01	I201142-2	0.1	17.0
E50-A	HEADREST, FRONT ROW (EACH)	I215073	0.9	48.0
E51-A	HEADREST, 2ND ROW (EACH)	I215073	0.9	82.0
E52-A	HEADREST, 3RD ROW (EACH)	I215073	0.9	112.0
E55-S	SUNVISORS (SET OF 2)	I414087	1.0	33.0
E59-A	APPROACH PLATE HOLDER	0715063-1	0.1	22.0

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E65-S	BAGGAGE TIE DOWN NET	1215171-1	0.7	138.0
E75-A	STRETCHER INSTALL CUSTOM-AIR (BOXED) (USE ACTUAL INSTALLED WT & ARM CHANGE) (NOT FACTORY INSTALLED)	0700164-8	—	—
E85-A	DUAL CONTROL INSTALLATION, RIGHT SIDE WHEEL, PEDALS & TOE BRAKES	1260004-8	7.3	14.1
E88-A	AIR CONDITIONING SYSTEM INSTL. COMPRESSOR & CLUTCH CONDENSER COIL EVAPORATOR COIL (2) & BLUMER HOSES, BOXES & MISCELL. ITEMS	1201162-2 C413001-0113 C413010-0101 C413011-0101	65.3* 20.2 10.4 14.2 31.6	50.9* 31.2 17.2* 49.1 71.5
E89-S	CONTROL WHEEL ALL PURPOSE, NET CHANGE INCLUDE MIL. SWITCH, MAP LIGHT, AUX LIARY MIL. JACK WITH WIRING	1270747-1	NEGL	—
E93-R	CABIN HEATING & ENGINE EXHAUST SYSTEM	1250800	26.0	-20.5
	F. PLACARDS, WARNINGS & MANUALS			
F01-K	PLACARD, OPERATIONAL LIMITATIONS VFR, DAY	0505087-13	NEGL	—
F01-U-1	PLACARD, OPERATIONAL LIMITATIONS VFR, DAY	0505087-14	NEGL	—
F01-U-2	PLACARD, OPERATIONAL LIMITATIONS IFR, DAY-NIGHT	0505087-15	NEGL	—
F01-O-3	PLACARD, FLIGHT INTO KNOWN ICING CONDITION	2105015-4	NEGL	—
F07-R	STALL & BREAK WARNING BLACKBOX (REQUIRES ITEM H61-K FOR AUDIBLE OPERATION)	1270733-2	0.5	41.0
F10-S	PILOT'S CHECK LIST (STOWED)	120090	0.3	—

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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
F10-K	PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRCRAFT FLIGHT MANUAL (STOWED LOCATED AT BACK OF PILOT SEAT)	D1227-13PH	1.5	49.5
	6. AUXILIARY EQUIPMENT			
604-A	TOW ROPE (INSTALLED ARM SHOWN) (NOT FACTORY INSTALLED)	0712643-3	0.5	231.0
607-A	HOLDING KINGS AIRPLANE (NOT FACTORY INSTALLED)	12001190-6	1.0	38.5
613-A	CORRUSSION PROOFING, INTERNAL	1260100-1	10.0	70.0
616-A	STATIC DISCHARGERS INSTL. (SET OF 10)	1201131-3	0.4	130.5
619-A	STABILIZER ABRASION COATS	0500041-3	2.7	202.0
622-S	TOW BAR, TELESCOPE HANDLE	1200008-8	2.0	138.0
625-S	PAINT, OVERALL EXTERIOR -OVERALL WHITE BASE -COLORED STRIPE	1204044-3	13.2* 12.2 0.6	92.1* 91.5 103.7
628-S	JACK PADS, STOWED (INSTALLED ARM SHOWN)	12000028-1	0.2	54.9
631-0	CUNTROL CABLES, CORRUSION RESISTANT (INCLUDED OBLIQUE & 4260505) (NET CHG)	1260417-7	NEGL	--
655-A	FIRE EXTINGUISHER, HAND TYPE	1201177-1	5.5	35.0
661-A	WALKING TABLE, MOUNTED ON BACK PILOT SEAT CO-PILOT SEAT	1715072-1	5.5	61.5
667-A	PTUAL EXTENSIONS, KULUDER REMOVABLE (SET OF 2) (STOWABLE) INSTALLED ARM SHOWN, NOT FACTORY INSTALLED	0501082-1	2.3	8.0
G76-A-1	DE-IC SYSTEM, WING, STABILIZER & VTL FIN	1201147-1	29.2*	63.7*

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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
G76-A-1	(INCLUDED DUAL VACUUM PUMP & USE W/J46-A) -TIMER -FLOW VALVES (SET OF 3) -DE-ICE BOOTS (SET OF 5) -DE-ICE VERTICAL FIN -HOSES & MISC. HARDWARE	3D2600-03 3D2357-01 25550101 5D5101-5	0.4 1.7 12.0 0.8 13.7	10.0* 9.0* 23.0* 24.3.0
G76-A-2	DE-ICE, PARTIAL PLUMBING	1201197-2	4.2	48.9
G76-A-3	DE-ICE SYSTEM, WING & STABILIZER (INCLUDED DUAL VACUUM SYSTEM) -FLOW VALVES (SET OF 3) -DE-ICE BOOTS (SET OF 4) -HOSES & MISC. HARDWARE	1201197-3 3D2600-03 3D2357-01 25D505101	28.3* 0.4 1.7 12.6 13.6	56.3* 10.0* 9.0* 73.7 37.3
G79-A	DE-ICE SYSTEM, 3 BLADE PROPELLER -SLIP RING -BRUSH BLOCK -WIRING & HARDWARE	1201188-1 C185020-0101 D40106 C40187	5.1* 0.9 1.7 0.3 2.2	-22.0* 29.0 37.0 36.2 -21.2
G82-A-1	WINDSHIELD ANTI-ICE SYSTEM -REMOVABLE HEATING PANEL (INSTALLED ARM SHOWN)	1201060-1 1513460-1	2.1* 1.9	9.2* 9.0
G82-A-2	WINDSHIELD ANTI-ICE SYSTEM INSTALLATION (USED FOR J46-A KNOWN ICING CONDITIONS)	2101019-12	2.7	17.1
G96-A	CABIN STEP, RH SIDE, RETRACTABLE  H. AVIONICS & AUTOPILOTS	1211500-2	3.5	42.0
H01-A-1	CESSNA 300 AUF INSTALLATION W/BFO -RECEIVER, K-546E -INDICATOR, IN-346A -LOOP ANTENNA -SENSE ANTENNA INSTL. -WIRING & HARDWARE	3910159-10 41240-0001 40980-1001 41000-1000 3960115-2	7.5* 3.5* 0.9 1.4 0.3 - -	25.4* 12.5* 16.0* 39.8 142.4 22.7

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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
HCI-A-2	CESSNA 40C AUF INSTALLATION -RECEIVER W/DUAL TUNERS. H-446A -INDICATOR, IN-346A -LOOP ANTENNA -SENSE ANTENNA INSTL. -WIRING & HARDWARE	3910160-8 43090C-1028 40980-1001 41000-1000 3900115-2 -	7.7* 3.3 0.9 1.4 0.3 1.6	25.7* 12.5 16.0 39.8 142.4 22.7
HCL-A	KMI INSTALLATION, WITHOUT CKS DATUM IRQS AUF. SLAVE SYSTEM & SLAVE GYROS - AUTOPILLOT BE INSTALLED W/BOUT SIKA TYPE SLAVED ACCESS S.) MINI INDICATOR, IN-40A (DUAL NEEDLE) REMOTE DODIMETER (KMI IND. DRIVER) TUNAVYERIER -AUT INDICATOR, DELETETU -WIRING & MISC. ITEMS	3910204 46450-0404 41950-0001 47550-0000 40980-1001	8.7*	69.2*
HO3-A	AM-FM STEREO & CASSETTE RECEIVER/PLAYER INSTALLATION WITH 2 HEADSETS RECEIVE/TAPE PLAYER INSTL. HEADSETS (2 LISTED) 4 MAY BE USED) -ANT. * WIRING & MISL. HARDWARE	3910204-5 3930211-1 C596532-0101	5.4*	31.0*
HO4-A-1	CESSNA 400 UME INSTALL 300 UR 400 NAV/LDM CONTINUUM UNIT C-470A REMOTE TRANSCEIVER UNIT ANTENNA REMOTE MOUNTING KIT -WIRING & MISL. HARDWARE	3910167-8 44020-1000 44000-0000 42940-0000 44088-0000	14.6*	132.1*
HC4-A-2	COLLINS UME-4700 INSTALLATION -INDICATOR, IN-350C -TRANSCEIVER, TCK-421 -ANTENNA, ANI-451 -WIRING & HARDWARE	3910213-15 622-5588-001 622-3670-001 022-4011-001	9.2*	156.9*
HC5-A-1	COLLINS ANS-2501 K-NAV INSTALLATION -INDICATOR, IN-446A ALUMIN -TRANSCEIVER, IN-350A DELET -COMPUTER K-NAV, ANS-351C -COUPLING, WIRING & HARDWARE	3910214-8 43916-1000 40860-1000 622-2579-001	3.6* 1.0 -1.0 -3.3 0.9	16.4* 14.0 173.0 173.0 155.3

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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H05-A-2	CESSNA 400 K-NAV w/ 300 DR 400 NAV/COM WITH 300 SERIES INDICATORS EXCHANGE -K-NAV COMPUTER, KN-478A -COMPUTER MOUNT -VOR/LUC INDICATOR, IN-44 SAC ADDED -NAV/CUM INDICATOR, IN-38 SA DELETED -WIRING & MISC. HARDWARE	3910168 44100-0000 44091-0000 43910-0000 40860-1000	4.6* 3.8 0.8 1.0 -1.6 0.6	13.8* 14.2 14.2 16.5 16.5 13.4
H05-A-3	CESSNA 400 K-NAV WITH IN-104 SAC EXCHANGE AVAILABLE WITH 400 NAV/COM (ONLY) -K-NAV COMPUTER, KN-476A -COMPUTER MOUNT -INDICATOR, IN-44 SAC ADDED -NAV/LUM INDICATOR, IN-38 SA DELETED -WIRING & MISC. ITEMS	3910168 44100-0000 44091-0000 40860-310 40870-120C	4.6* 3.8 0.6 1.5 0.6	13.6* 14.2 14.2 16.5 16.5 10.9
H07-A-1	CESSNA 400 GLIDESLOPE INSTL, IN-366A ILS EXCH (W/IN-365A VUK/LDL (1ST & 2ND UNIT)) -GLIDESLOPE RECEIVER, K-443B -COUPLEK ANTENNA (INT CHANGE) -VOK/ILS INDICATOR, IN-38 SA ADDED -VOR/LUC INDICATOR, IN-38 SA DELETED -WIRING & MISC. HARDWARE	3910157-9 42100-0000 52473-1 40860-2000 40860-1000	4.1* 2.1 NEGL 1.7 -1.9 1.9	72.5* 99.3 -- 16.5 16.5 47.8
H07-A-2	CESSNA 400 GLIDESLOPE INSTL, IN-486AC ILS EXCH (W/IN-465AC VOK/LDL (1ST & 2ND UNIT)) -GLIDESLOPE RECEIVER, R-443B -VOK/LUC INDICATOR, IN-46 SAC DELETED -VOK/ILS INDICATOR, IN-45 SAC ADDED -COUPLEK ANTENNA (INT CHANGE) -WIRING & MISC. HARDWARE	3910157-16 42100-0000 40870-1300 40870-2300 52473-1	4.1* 2.1 -1.9 2.0 NEGL 1.9	72.5* 99.3 16.5 16.5 -- 47.8
H08-A-1	NAV. IND. ARK/LUL EXCHANGE W/VUK-LOC (USE W/MCZ-A-16 H22-A-21 WT NET CHG) -ARC/LUC INDICATOR, IN-38 SAC ADDED -LAU/LUC RADIAL CENTERING) -VOK/LUC INDICATOR, IN-38 SA DELETED	3910196-1 40860-1200	0.2* 1.8	16.5* 16.5
H08-A-2	NAV. IND. ARK-LUL EXCHANGE W/VOR-ILS (USE W/MCZ-A-16 H07-A-21 WT NET CHG) -ARC/LIL INDICATOR, IN-38 SAC ADDED	40860-1000 3910196-2 40860-2200	-1.6 0.1* 1.8	16.5* 16.5* 16.5

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H11-A	-VOR/ILS INDICATOR, IN-386A UELLETED -SUNAIK SINGLE SIDE BAND INSTL., ASB-125 -ANTENNA LOAD BOX -TRANSCIEIVER SSB -POWER SUPPLY & SHUCK MOUNT -HF ANTENNA INSTL. -WIRING & MISC. ITEMS	4686U-2600 3910158-19 99816 9981 9981 39b0117-1 3950129	-1.7 23.9* 4.9 5.3 8.5 0.3 4.9	16.5 113.7* 159.4 13.5 159.7 173.4 78.5
H13-A	CESSNA 400 MARKER BEACON INSTALLATION -REMOTE RECEIVER, RT-402A -ANT. INSTL. FLUSH MTU IN TAIL -WIRING & MISC. ITEMS	3910164 42410-5128 3960126-2	2.5* 0.7 0.9	88.0* 11.5 206.9
H14-A	RADAR ALTIMETER INSTALLATION -INDICATOR -VOLT. CONVERTER -ANTENNA -WIRING & HARDWARE	3910225-2 104-0184-00 104-0185-00 104-0183-00	3.5* 1.0 1.0 1.0	28.9* 18.7 14.6 46.7
H15-A-1	WEATHER RADAR INSTL. BENDIX KOK-160 -INDICATOR (VIEWING SCREEN), IN-2026A -RADAR ANTENNA-TRANSCEIVER, ART-161 -RADOME & WING POD ASSEMBLY -CABLES & MISCELLANEOUS ITEMS	3910207-14 4001294-2601 4001018-6105 2170300-1	27.9* 29.5 9.3 6.1	28.4* 12.0 34.4 43.9
H15-A-2	WEATHER RADAR INSTL. BENDIX RDR-160 (B&W) -INDICATOR (VIEWING SCREEN), IN-152A -RADAR ANTENNA-TRANSCEIVER, ART-161 -RADOME & WING POD ASSEMBLY -CABLES & MISCELLANEOUS ITEMS	3910179-3 4000946-5201 4001018-6101 2170300-1	23.5* 25.1 9.3 6.1	31.5* 12.2 34.4 43.9
H15-A-3	WEATHER RADAR INSTL. KCA SCOUT II (B & W)	3910207-3 M1585256-1 M1585264-1 2170300-1	22.6* 4.6 8.9 6.1	31.9* 12.2 34.4 43.9
H16-A	CESSNA 400 TRANSUNDER INSTALLATION -TRANSCEIVER, RT-459A -ANTENNA -WIRING & MISC. HARDWARE	3910128-16 41470-1028 42940-0600	3.7* 2.8 0.2	14.8* 11.5 60.5
			0.7	14.5

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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H22-A-1	CESSNA 300 NAV/CUM 720 CH COM INSTALLATION 1ST & 2ND UNITS M/300 SERIES INDICATORS REQUIRES - H34-A TO OPERATE 1ST UNIT H37-A TO OPERATE 2ND UNIT RECEIVER-TRANSCIVER RT-385A VOR/LUC INDICATOR IN-385A MOUNT, WIRING & MISC. HARDWARE	3910183	6.3*	13.7*
H22-A-2	CESSNA 400 NAV/CUM 720 CH COM INSTALLATION 1ST & 2ND UNITS M/400 SERIES INDICATORS REQUIRES - H34-A TO OPERATE 1ST UNIT H37-A TO OPERATE 2ND UNIT RECEIVER-TRANSCIVER RT-485A VOR/LUC INDICATOR IN-385A MOUNT, WIRING & MISC. HARDWARE	3910189	8.3*	13.7*
H22-A-3	CESSNA 400 NAV/CUM 720 CH COM INSTALLATION 1ST & 2ND UNITS M/400 SERIES INDICATORS REQUIRES - H34-A TO OPERATE 1ST UNIT H37-A TO OPERATE 2ND UNIT RECEIVER-TRANSCIVER RT-485A VOR/LUC INDICATOR IN-485AC MOUNT, WIRING & MISC. HARDWARE	3910189	8.5*	13.7*
H22-A-4	CESSNA 400 NAV/CUM M/K1-485B TRANSEIVER REQUIRES - H34-A TU BE OPERATIONAL 1ST UNIT H37-A TU BE OPERATIONAL 2ND UNIT RECEIVER-TRANSCIVER RT-485B VOR/LUC INDICATOR IN-385A WIRING & HARDWARE	3910222-12	8.3*	13.7*
H28-A-1	EMERGENCY LOCATOR TRANSMITTER -TRANSMITTER, D & M DMELI-O-1 -ANTENNA, CABLES & HARDWARE	0470419-15 C589511-0117 C589511-0109	3.5* 3.3 0.2	159.0* 160.1 142.5
H28-A-2	EMERGENCY LOCATOR TRANSMITTER (USED IN CANADA) -TRANSMITTER, D & M DMELI-O-1C -ANTENNA, CABLES & HARDWARE	0470419-16 C589511-0113 C589511-0109	3.5* 3.3 0.2	159.0* 160.1 142.5
H31-A-1	NAV-O-MATIC ZUUA INSTL., AF-295B	3910162-16	8.2*	44.5*

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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H51-A-2	<p>-CONTROLLER INSTALLATION -D-88-OUT TURN COORDINATOR (NET CHG) -TURN SERVO INSTALLATION -TIRING &amp; MISC. HARDWARE</p> <p>NAV-D-MATIC 300A INSTL. # AF-395A</p> <p>-TURN SERVO AMPLIFIER INSTL. # C-395A</p> <p>-CONTROLLER-AMPLIFIER INSTL. # C-395A</p> <p>-D-64-A-3 GYRO INSTALLATION</p> <p>-D-61-A-1 VACUUM SYSTEM</p> <p>-D-88-O-1 TURN COORDINATOR (NET CHG)</p> <p>-TIRING &amp; MISC. ITEMS</p>	<p>3930144-7 42320-0028 1200237-7</p> <p>3910163-10 3930145-7 2101001-3 1201182-2 42320-0028</p> <p>3910198-5</p>	<p>18.6* 14.6 2.2 18.6* 14.6 2.2 5.3 4.5 NEGL 2.0</p>	<p>14.5 - 56.6 42.1 24.9* 56.6 14.5 15.1 1.1 - 48.1</p>
H51-A-3	<p>CESSNA 400B IFCS W/SLAVED MSI INSTALLATION CESSNA 400B IFCS W/ALITUDE ALERT OPTION</p> <p>-CONTROLLER</p> <p>-MODE SELECTOR</p> <p>-PITCH ACTUATOR</p> <p>-ALTITUDE SENSOR</p> <p>-COMPUTER-AMPLIFIER</p> <p>-PITCH TRIM ACTUATOR</p> <p>-D-64-A-7 GYRO PUK IFCS</p> <p>-D-61-A-1 VACUUM SYSTEM</p> <p>-UNVERTER INSTL.</p> <p>-FORVIS INDICATOR DELETED</p> <p>-FLUX DENSITY SENSOR INSTL.</p> <p>-OL-D BATTERY CHANGED TO HEAVY DUTY</p> <p>-PILATEK WALKING &amp; MISC. ITEMS</p> <p>-D-16-A-4 ALTITUDE ALERT</p>	<p>41090-1028 42710-0000 42850-3912 44400-0000 42680-0007 44430-3025 45850-2909 2101001-6 1201162-2 3940236-1 46870-1300 C614001-0106 3910216-5</p>	<p>61.6* 65.7* 1.3 2.6 4.2 2.3 5.8 4.2 8.5 4.5 1.1 1.1 1.1 -1.7 -0.8 2.0 23.2 4.1</p>	<p>57.2* 54.3* 16.5 13.0 15.4 7.5 98.0 220.5 56.2 15.1 1.1 98.0 16.5 44.9 3.0 3.0 43.7 17.4</p>
H51-A-4	<p>CESSNA 400B NAV-U-MATIC INSTALLATION WITHOUT RADIO (PARTIAL INSTL.)</p> <p>-AILERON KULL ACTUATOR, PA-495-1</p> <p>-ELEVATOR PITCH ACTUATOR, PA-495-2</p> <p>-CONTROLLER</p> <p>-COMPUTER-AMPLIFIER</p> <p>-ALTITUDE SENSOR</p> <p>-PITCH TRIM ACTUATOR</p> <p>-D-64-A-4 GYRO, NON-SLAVED</p> <p>-D-61-A-1 VACUUM SYSTEM</p> <p>-ACCESS UNIT INSTALLATION</p>	<p>3910154-129</p>	<p>47.3*</p>	<p>65.8*</p>

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H31-A-5	T-01-U BATTERY CHANGE TO HEAVY DUTY +FLITK, WIRING & MISC. ITEMS CESSNA 400B NAV-U-MATIC, SLAVED HEADING IND., INCLUDES THE FOLLOWING ITEMS-- +H31-A-4 4COB NAV-U-MATIC, PARTIAL -SLAVED ACCESSORY (W/U BOOT STRAP) +LUX DECTECTOR INSTL. +U04-A-4 GYRU AT H31-A-4*, DELETED +U04-A-5 GYRU SLAVED, ADDED -CABLES SLAVED	Col4001-0106 3910197-9 3910154-129 3940229-1 3940200-2 2101001-4 2101001-7 3950139-25	2.0 14.1 50.4* 47.3 0.6 0.8 -5.4* 6.0 1.1	3.0 58.1 04.2* 65.8 44.4 15.1 15.1 38.3
H31-A-6	CESSNA 400B NAV-U-MATIC W/NUN-SLAVED HSI IND., INCLUDES THE FOLLOWING ITEMS-- +H31-A-4 4CUB NAV-O-MATIC, PARTIAL -CUNE KTEK INSTLLATION +U04-A-4 GYRU AT H3A-A-4*, DELETED +U04-A-5 GYRU UNSLAVED HSI, ADDED -CABLES UNSLAVED HSI +VOR-ILS INDICATOR, DELETED	3910197-25 3910154-129 3940236-1 2101001-4 2101001-10 3950139-29 46870-1300	50.1* 47.3 1.1 -5.4* 7.0* 1.0 -1.7	66.0* 65.8 15.1 15.1 55.5 16.5
H31-A-7	CESSNA 400B NAV-U-MATIC W/SLAVED HSI IND., INCLUDES THE FOLLOWING ITEMS-- +H31-A-4 4COB NAV-O-MATIC, PARTIAL -UNVERTER INSTLLATION -SLAVING ACCESSORY +LUX DECTECTOR INSTL. +U04-A-4 GYRU AT H31-A-4*, DELETED +U04-A-5 GYRU SLAVED HSI, ADDED -VOR-ILS INDICATOR, DELETED	3910197-17 3910154-129 3940236-1 3940229-1 3940200-2 2101001-4 2101001-8 3950139-3 46870-1300	52.5* 47.3 1.1 0.6 0.8 -5.4* -7.7 2.1 -1.7	64.4* 65.8 98.0 49.4 44.9 15.1 15.1 16.5
H33-A	INTERCOM SYSTEM INSTALLATION REVS-+EB5-A-1 DUAL CONTROL WHEEL -VACK FUR ANTEKPHONE K.H. +H26-A HEADPHONE L.MIKE (2) -INTERCOM P/C BOARD ASSY -CONTROL WHEEL INSTL., R.H.	3910210-12 3970150-5 C59653-101 3970149-1 3970153-12	2.9* 0.3 2.2 0.2 0.3	15.0* 18.0 13.0 14.0 19.0
H34-A	BASIC AVIONICS KIT INSTALLATION RELATED W/1ST UNIT NAV/COM RADIO INSTL. -MICROPHONE INSTL., HAND HELD	3910186-11 3970143-1	6.2* 0.3	56.3* 17.9

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EQUIPMENT LIST

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	-AUDIO COUPLING INSTL. -NOISE FILTER INSTL. -VHF COM ANT. CABLE INSTL. -VHF NAV ANI. CABLE INSTL. -VHF OMNI ANT. INSTL. -VHF COM ANT. INSTL. -AUDIO CONTROL PANEL & WIRING -LEADPHONE INSTALLATION -1ST N/C TRANSCIEVER KIT INSTL. -ADAPTER ANT. INSTALLATION -DUS-BAR INSTL. -USE MULDEK INSTL.	3930217-1*-2 3940148-1 3950129-47 3950129-10 3960142-2 3960113-1 3970121-1 3970138-4 3930186-0 3960139-3 3930178-10 3940247-3	1.1 0.6 0.8 0.5 0.5 0.5 1.8 0.2 0.2 18.5 NEGL 0.1	12.0 43.3 132.6 250.5 250.7 12.0 12.0 14.5 18.5 18.5 NEGL 0.1
H37-A	COM ANTENNA & OMNI COUPLER KIT INSTL. REQUIRED W/2ND UNIT NAV/CUM RADIO INSTL. -OMNI ANT. COUPLER INSTL. -VHF COM ANT. INSTL. -VHF COM ANT. CABLE INSTL. -2ND NAV/CUM TRANSCEIVER KIT -ADAPTER ANTENNA (DELETED)	3910185-9 3960111-14 3960113-2 3950129-46 3930186-7 3960139-3	1.1* 0.2 0.5 0.5 0.1 -0.2	44.0* 5.0 50.7 43.3 18.5 7.0
H46-A	ADF ANTI-PRECIP ANTEENA	3910154-71	0.7	94.7
H49-A	BALANCED LOOP ANTENNA INSTALLATION (EXCHANGED W/OMNI ANT.) (WT. NET CHG.) -BALANCED LOOP ANTENNA -OMNI ANT. KIT (DELETED) -PKT. HARDWARE	3910154-139 C598505-0101 C598504-0101	2.2*	244.0*
H55-A	HEADSET-MICROPHONE COMBINATION	C590533-0101	0.3	245.4
H56-A	HEADSET/MICROPHONE, PADDED (STOWED ITEM)	C596531-0101	0.4	243.0
H61-R	GEAR WARNING & CABIN SPEAKER	C596510-U101	0.3	231.1
H64-A	AVIONICS PARTIAL UPTIM "A" (EXPORT ONLY) -HOME KIT COOLING INSTL. -OMNI ANTENNA CABLE INSTL. -COM ANTENNA CABLE INSTL. -OMNI ANTENNA INSTALLATION -COM ANTENNA INSTALLATION -LEADPHONE INSTALLATION	3910206-19 3930217-1 3950129-10 3960142-0 3960113-1 3970138-4	4.0* 1.1 0.8 0.6 0.5 0.2	76.2* 12.7 143.3 250.5 250.5 14.5

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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H67-A	MICROPHONE INSTALLATION AVIONICS PAMILL OPTIUN "B" (EXPORT ONLY) AVIONICS OPTIUN A EQUIPMENT ANT. COUPLER FOR 2ND NAV RECEIVER -COM ANTENNA INSTALLATION, RH -CUM ANTENNA CABLE INSTL., KH REMOTE TRANSPUNDER JOINT SWITCH (IN PILOT CONTROL WHEEL)	3970143-1 3910206-2C 3910206-19 3960111-14 3960113-2 3950129-46 3910205-5	0.3 5.3* 4.0* 0.2 0.5 0.6 0.2	17.9 67.4** 76.2 5.0 50.7 43.3 22.5
H70-A				
J01-A	THE TURBO CENTURION II KIT CONSISTS OF THE FOLLOWING ITEMS -A61-A VACUUM SYSTEM (REQ FOR GYRO) -CUT-7-A GROUND SERVICE RECEPTACLE -CUT-19-U-2 HEATED PILOT'S STALL SWITCH (NET CHANGE) -Y22-A INSTRUMENT POST LIGHTS -Y31-A COUPLED ENTRANCE LIGHTS -C40-A NAVIGATION LIGHT DEFECTS -C42-A UMBRI FLASHING BEACON -Y01-U TRUE AIRSPEED IND. (NET CHG) -D64-A-1 GYRO INSTALLATION -CUT-7-U-2 VER1. ADJUST KM SEAT (NET CHG) -T85-A DUAL FLIGHT CONTROLS -T16-A STATIC DISCHARGERS (SET OF 10) -U25-S EXTERIOR STYLING (NET CHG) -T01-A-1 300 ADF INSTL. R-240E -T16-A 400 TRANSPOUNDER, RT-459A -T22-A-1 300 NAV/CUM VOR/LOC, 1ST UNIT -T28-A-1 200A NAV/CUM VOR/LOC, 1ST UNIT -T31-A-1 200A NAV-O-MATIC -T34-A BASIC AVIONICS KIT	- - 1201182-2 1270621-1 1201093-1 2101009-1 1221103-2 1221201-1,-2 1201049-1 1201108-11 2101001-1 21014175 1260004-8 1201121-3 1204044-4 3910159-10 3910128-16 3910163-32 0470419-15 3910162-16 3910186-11	65.8* 4.5 2.0 0.2 0.5 0.5 NEGL 1.0 0.6 0.5 0.5 5.0 2.5 5.0 7.0 0.4 NEGL 7.5 3.7 8.0 3.5 8.2 0.2 16.0*	36.6* 1.1 -4.5 26.3 0.5 19.5 51.1 226.0 118.0 15.1 25.1 25.1 130.5 -1 25.4 14.8 13.7 159.0 56.3 4.1 13.7 72.5
J04-A	NAV-TAC INSTL. <sup>1</sup> (AVAILABLE W/LL KIT) -T22-A-1 300 NAV/CUM VOR/LOC, 2ND UNIT -H07-A-2 400 GLIDESLOPE BASIC AVIONICS KIT	- 3910157-24		

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SECTION 6  
WEIGHT & BALANCE/  
EQUIPMENT LIST

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM IN
J46-A	<p>400 MARKER BEACON, R-402A ANTENNA &amp; COUPLER KIT</p> <p>FLIGHT INTL KNOWN FLGNG CONDITONS FLGS INSTL GYRO &amp; 95 AMP ALTERNATOR OK OR AMP DUAL ALTERNATOR WHICH ARE NOT INCLUDED IN WEIGHT</p> <p>STATIC ALTERNATE SOURCE (NET CHG) C19-0-1 HEATED PILOT &amp; STALL WARNING SWITCH NET CHANGE</p> <p>C94-A WING ICE DETECTOR LIGHT</p> <p>C16-A STATIC DISCHARGERS</p> <p>C76-A-1 WING STABILIZER &amp; VERT. FIN VERTICE SYS. W/DUAL VAC. PUMP</p> <p>C79-A PROPULLEK ANTI-ICING SYSTEM C32-A-2 WINDSHIELD ANTI-ICING SYSTEM</p>	<p>3910164 3910185-9 1200254-1</p> <p>NEGL 0.7</p> <p>1201099 1201093</p> <p>1201100 1201131</p> <p>1201197-1</p> <p>14C1188-1 2101019-12</p>	<p>2.5 1.1 38.7*</p> <p>88.0 42.4 48.4*</p> <p>27.4</p> <p>0.6 0.4</p> <p>130.5 63.7</p> <p>2.1</p> <p>-22.0 -17.0</p>	

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# SECTION 7

## AIRPLANE & SYSTEMS DESCRIPTIONS

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## INTRODUCTION

This section provides description and operation of the airplane and its systems. Some equipment described herein is optional and may not be installed in the airplane. Refer to Section 9, Supplements, for details of other optional systems and equipment.

## AIRFRAME

The airplane is an all-metal, six-place, high-wing, single-engine airplane equipped with retractable tricycle landing gear and designed for general utility purposes.

The construction of the fuselage is a conventional formed sheet metal bulkhead and skin design referred to as semimonocoque. Incorporated into the fuselage structure are two large cabin door openings and a baggage door opening. Major items of structure include a forward carry-through spar and a forged aluminum main carry-through spar to which the wings are attached. The lower aft portion of the fuselage center section contains the forgings and structure for the retractable main landing gear.

The full cantilever wings have integral fuel tanks and are constructed of a forward spar, main spar, conventional formed sheet metal ribs and aluminum skin. The integral fuel tanks are formed by the forward spar, two sealing ribs, and an aft fuel tank spar forward of the main spar. The Frise-type ailerons and single-slot type flaps are of conventional formed sheet metal ribs and smooth aluminum skin construction. The ailerons are equipped with ground adjustable trim tabs on the inboard end of the trailing edge, and balance weights in the leading edges.

The empennage (tail assembly) consists of a conventional vertical stabilizer, rudder, horizontal stabilizer, and elevator. The vertical stabilizer consists of a forward and aft spar, formed sheet metal ribs and reinforcements, four skin panels, formed leading edge skins, and a dorsal. The rudder is constructed of a forward and aft spar, formed sheet metal ribs and reinforcements, and a wrap-around skin panel. The top of the rudder incorporates a leading edge extension which contains a balance weight. The horizontal stabilizer is constructed of a forward and aft spar, ribs and stiffeners, center upper skin panel, and two left and two right wrap-around skin panels which also form the leading edges. The horizontal stabilizer also contains the elevator trim tab actuator. Construction of the elevator consists of a forward and aft spar, ribs, torque tube and bellcrank, left upper and lower skin panels, a formed one-piece left trailing edge, right upper and lower skin panels, and right inboard and outboard formed trailing edges. The elevator trim tab consists of a bracket assembly, hinge

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**AILERON CONTROL SYSTEM**



**RUDDER AND RUDDER TRIM  
CONTROL SYSTEMS**

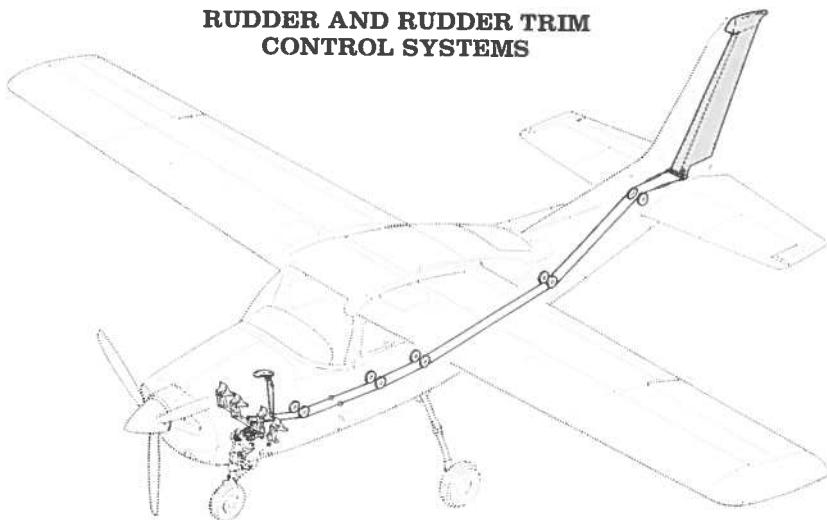
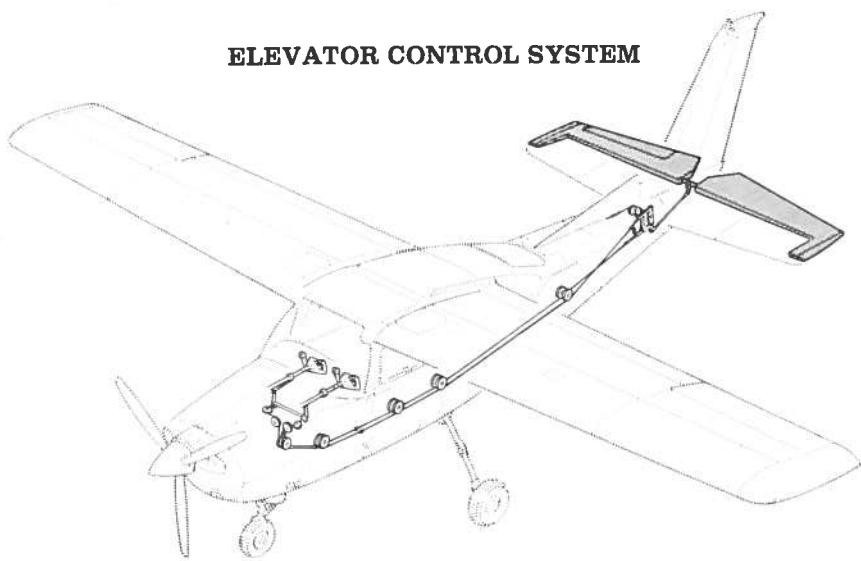


Figure 7-1. Flight Control and Trim Systems (Sheet 1 of 2)

**ELEVATOR CONTROL SYSTEM**



**ELEVATOR TRIM  
CONTROL SYSTEM**

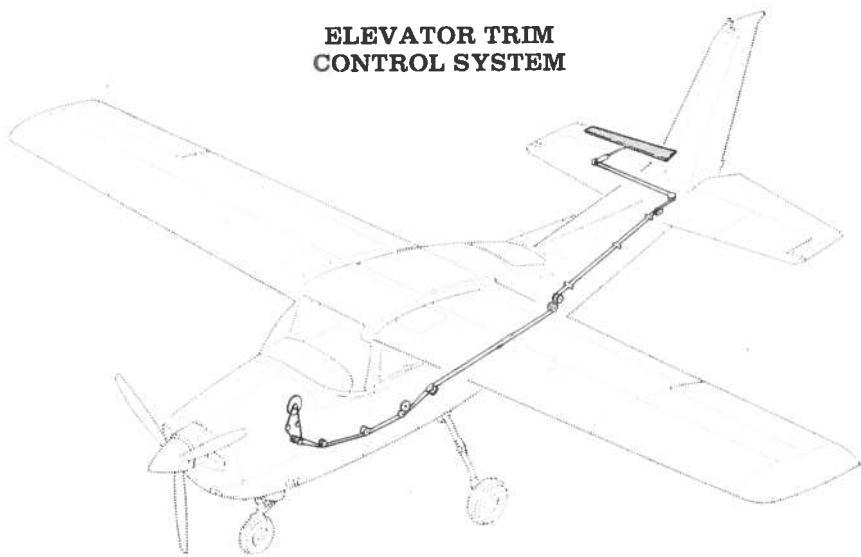
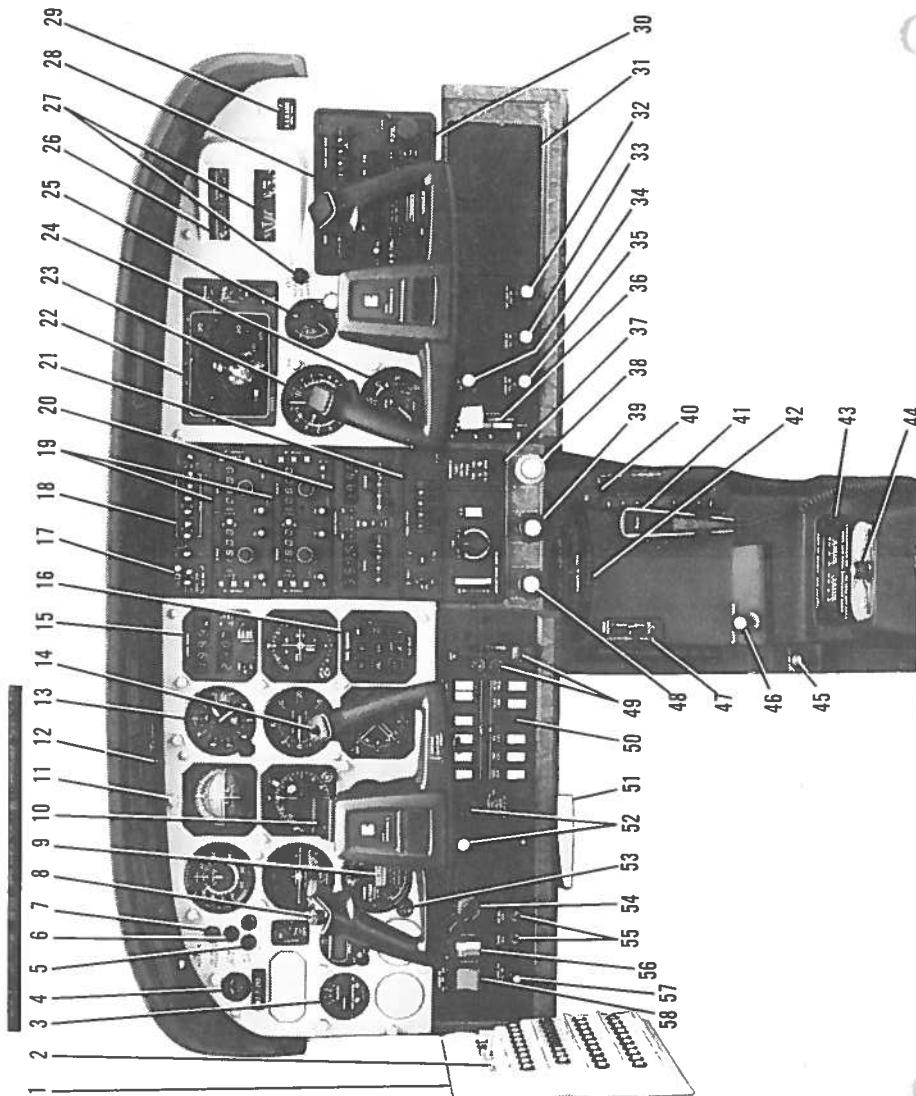


Figure 7-1. Flight Control and Trim Systems (Sheet 2 of 2)

**SECTION 7**  
**AIRPLANE & SYSTEMS DESCRIPTIONS**

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**Figure 7-2. Instrument Panel (Sheet 1 of 2)**

1. Sidewall Circuit Breaker Panel
2. Avionics Power and Avionics Emergency Power Switches
3. Suction Gage
4. Propeller Anti-Ice Ammeter
5. Alternator Off Warning Lights
6. Low-Voltage Warning Light
7. Wing De-Ice Pressure Indicator Light
8. Electric Elevator Trim, IFCS
9. Autopilot and Microphone Switches
10. Autopilot and Electric Elevator Trim Disengage Switches
11. Approach Plate Holder
12. Flight Instrument Group
13. Map Light and Switch
14. Altimeter
15. IFCS Pitch Synchronizer and Transponder Remote IDENT Switches
16. DME
17. IFCS Mode Selector
18. Marker Beacon Indicator Lights and Switches
19. Audio Control Panel
20. NAV/COM Radios
21. Area Navigation (RNAV) Radio Transponder
22. Weather Radar
23. Manifold Pressure/Fuel Flow Indicator
24. Tachometer
25. Engine Combustion Analyzer
26. Cylinder Head Temperature and Oil Temperature Gages
27. Volt-Ammeter, Selector Switch and Oil Pressure Gage
28. ADF Radio
29. Flight Hour Recorder
30. AM/FM Cassette Stereo Entertainment Center
31. Map Compartment
32. Auxiliary Cabin Air Control
33. Cabin Air Control
34. Defrost Control
35. Cabin Heat Control
36. Wing Flap Switch Lever and Position Indicator
37. Autopilot Control Unit
38. Mixture Control
39. Propeller Control!
40. Cowl Flap Control Lever
41. Microphone
42. Rudder Trim Control Wheel and Position Indicator
43. Fuel Quantity Indicators
44. Fuel Selector Valve Handle
45. Fuel ON-OFF Valve Control
46. Primer
47. Elevator Trim Control Wheel and Position Indicator
48. Throttle (With Friction Lock)
49. Landing Gear Lever and Position Indicator Lights
50. Electrical Switches
51. Parking Brake Handle
52. Instrument and Control Panel Lighting Controls
53. Radar Altimeter
54. Ignition Switch
55. Auxiliary Mike and Phone Jacks
56. Auxiliary Fuel Pump Switch
57. Static Pressure Alternate Source Valve
58. Master Switch

Figure 7-2. Instrument Panel (Sheet 2 of 2)

half, and a wrap-around skin panel. Both elevator tip leading edge extensions incorporate balance weights.

## FLIGHT CONTROLS

The airplane's flight control system (see figure 7-1) consists of conventional aileron, elevator and rudder control surfaces. The control surfaces are manually operated through mechanical linkage using a control wheel for the ailerons and elevator, and rudder/brake pedals for the rudder. The elevator control system is equipped with a down-spring, and an aileron-rudder interconnect is incorporated to provide improved stability in flight.

Extensions are available for the rudder/brake pedals. They consist of a rudder pedal face, two spacers and two spring clips. To install an extension, place the clip on the bottom of the extension under the bottom of the rudder pedal and snap the top clip over the top of the rudder pedal. Check that the extension is firmly in place. To remove the extensions, reverse the above procedures.

## TRIM SYSTEMS

Manually-operated rudder and elevator trim is provided (see figure 7-1). Rudder trimming is accomplished through a bungee connected to the rudder control system and a trim control wheel mounted on the control pedestal. Rudder trimming is accomplished by rotating the horizontally mounted trim control wheel either left or right to the desired trim position. Rotating the trim wheel to the right will trim nose-right; conversely, rotating it to the left will trim nose-left. Elevator trimming is accomplished through the elevator trim tab by utilizing the vertically mounted trim control wheel. Forward rotation of the trim wheel will trim nose-down; conversely, aft rotation will trim nose-up. The airplane may also be equipped with an electric elevator trim system. For details concerning this system, refer to Section 9, Supplements.

## INSTRUMENT PANEL

The instrument panel (see figure 7-2) is designed around the basic "T" configuration. The gyros are located immediately in front of the pilot, and arranged vertically. The airspeed indicator and altimeter are located to the left and right of the gyros respectively. The remainder of the flight instruments are located around the basic "T". Avionics equipment is stacked approximately on the centerline of the panel, with the right side of

the panel containing the manifold pressure/fuel flow indicator, tachometer, weather radar, AM/FM cassette stereo, map compartment, and space for additional instruments and avionics equipment. The engine instrument cluster and economy mixture indicator (EGT) or engine combustion analyzer are on the right side of the avionics stack near the top of the panel. A switch and control panel, at the lower edge of the instrument panel, contains most of the switches and controls necessary to operate the airplane. The left side of the panel contains the master switch, auxiliary fuel pump switch, ignition switch, light intensity controls, electrical switches, landing gear lever and indicator lights, and static pressure alternate source valve control knob. The center area contains the throttle, propeller control, and mixture control. The right side of the panel contains the wing flap switch lever and indicator, cabin heat control knob, cabin air control knob, defroster control knob and auxiliary cabin air control knob. A pedestal, extending from the edge of the switch and control panel to the floorboard, contains the elevator and rudder trim control wheels, cowl flap control lever, engine primer, fuel on-off valve control, and microphone bracket. The fuel selector valve handle is located at the base of the pedestal with the fuel quantity indicators immediately forward of the handle. A parking brake handle is mounted under the switch and control panel in front of the pilot. All circuit breakers for general electrical equipment and avionics are mounted in a circuit breaker panel located on the left cabin sidewall adjacent to the pilot's seat.

For details concerning the instruments, switches, circuit breakers and controls on this panel, and the circuit breaker panel, refer in this section to the description of the systems to which these items are related.

## GROUND CONTROL

Effective ground control while taxiing is accomplished through nose wheel steering by using the rudder pedals; left rudder pedal to steer left and right rudder pedal to steer right. When a rudder pedal is depressed, a spring-loaded steering bungee (which is connected to the nose gear and to the rudder bars) will turn the nose wheel through an arc of approximately 14.5° each side of center. By applying either left or right brake, the degree of turn may be increased up to 35° each side of center.

Moving the airplane by hand is most easily accomplished by attaching a tow bar to the nose gear strut. If a tow bar is not available, or pushing is required, use the main landing gear struts as push points. Do not use the vertical or horizontal tail surfaces to move the airplane. If the airplane is to be towed by vehicle, never turn the nose wheel more than 35° either side of center or structural damage to the nose gear could result.

The minimum turning radius of the airplane, using differential

braking and nose wheel steering during taxi, is approximately 26 feet 11 inches.

## WING FLAP SYSTEM

The wing flaps are of the large span, single-slot type (see figure 7-3), and are extended or retracted by positioning the wing flap switch lever on the instrument panel to the desired flap deflection position. The switch lever is moved up or down in a slotted panel that provides mechanical stops at the 10° and 20° positions. For flap settings greater than 10°, move the switch lever to the right to clear the stop and position it as desired. A scale and pointer on the left side of the switch lever indicates flap travel in degrees. The wing flap system circuit is protected by an 10-ampere circuit breaker, labeled FLAP, on the left sidewall circuit breaker panel.

## LANDING GEAR SYSTEM

The landing gear is a retractable, tricycle type with a steerable nose wheel and two main wheels. Shock absorption is provided by the tubular spring-steel main landing gear struts and the air/oil nose gear shock strut.

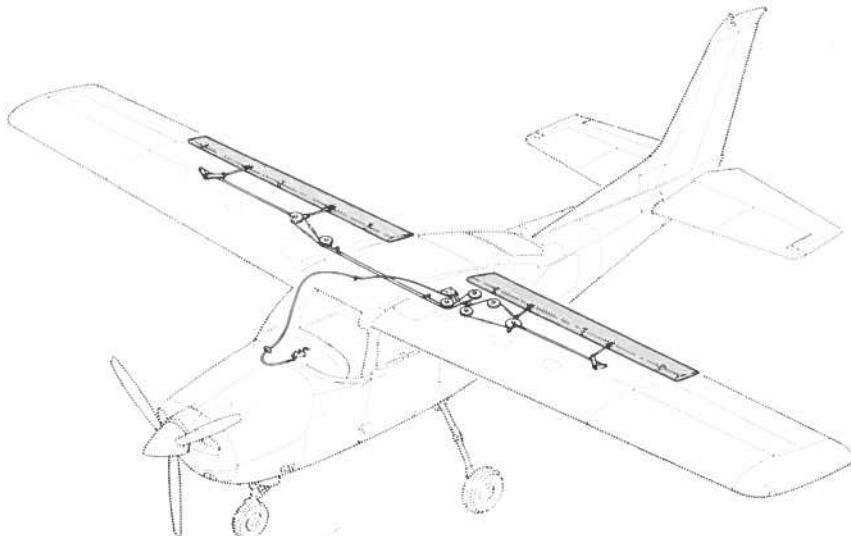


Figure 7-3. Wing Flap System

Each main wheel is equipped with a hydraulically actuated disc-type brake on the inboard side of the wheel.

Landing gear extension, retraction, and down lock operation is accomplished by hydraulic actuators powered by an electrically-driven hydraulic power pack (see figure 7-8). The power pack assembly is housed within the control pedestal. Hydraulic system fluid level may be checked by utilizing the dipstick/filler cap, on the power pack, behind a snap-out cover panel on the right side of the control pedestal. The system should be checked at 25-hour intervals. If the fluid level is at or below the ADD line on the dipstick, hydraulic fluid (MIL-H-5606) should be added. Nose gear wheel and strut door operation is accomplished mechanically.

Power pack operation is initiated by a landing gear lever, and is turned off by a pressure switch. Two position-indicator lights are provided to show landing gear position. The landing gear system is also equipped with a nose gear safety switch, an emergency extension hand pump, and a gear-up warning system.

### LANDING GEAR LEVER

The landing gear lever, mounted to the left of the engine controls, has two positions (up labeled GEAR UP and down labeled GEAR DOWN) which give a mechanical indication of the gear position selected. From either position, the lever must be pulled out to clear a detent before it can be repositioned. Moving the lever out of the GEAR DOWN detent will start the hydraulic power pack. Positioning the lever in the GEAR UP position will direct hydraulic pressure to retract the landing gear. Operation of the landing gear system to extend the gear will not begin until the landing gear lever is repositioned in the GEAR DOWN detent.

### LANDING GEAR POSITION INDICATOR LIGHTS

Two position indicator lights, mounted adjacent to the landing gear lever, indicate that the gear is either up or down and locked. The lights are the press-to-test type. The gear-down indicator light (green) has two positions; with the light pushed in half way (throttle retarded and master switch on) the gear warning system should be heard intermittently on the airplane speaker, and with the light pushed full in, it should illuminate. The gear-up indicator light (amber) has only one test position; with the light pushed full in, it should illuminate. The indicator lights contain dimming shutters for night operation.

### LANDING GEAR OPERATION

To retract or extend the landing gear, pull out on the gear lever and move it to the desired position. After the lever is positioned, the

electrically-driven hydraulic power pack will create pressure in the system and the landing gear will be actuated to the selected position.

**CAUTION**

If for any reason the hydraulic pump continues to run after gear cycle completion (up or down), the 35-amp "pull-off" type circuit breaker, labeled GEAR PUMP should be pulled out. This will shut off the hydraulic pump motor and prevent damage to the pump and motor. Refer to Section 3 for complete emergency procedures.

During a normal cycle, the gear stops full up or locks down and the position-indicator light (amber for up and green for down) comes on. When the light illuminates, hydraulic pressure will continue to build until a pressure switch turns off the hydraulic pump. The gear is held in the full up position by hydraulic pressure. If the system pressure drops below minimum, the power pack pressure switch will turn the power pack on and return the pressure to maximum except when the nose gear safety (squat) switch is open. During cruising flight with the landing gear retracted, automatic cycling on of the hydraulic pump motor to restore system pressure bleed down may normally occur up to twice per hour. More frequent cycling is an indication of abnormal pressure loss and the cause of this condition should be investigated.

A landing gear safety (squat) switch, actuated by the nose gear strut, electrically prevents inadvertent retraction by the electrically-driven hydraulic power pack whenever the nose gear strut is compressed by the weight of the airplane. When the nose gear is lifted off the runway during takeoff, the squat switch will close, causing the power pack to operate for 1 to 2 seconds which will return system pressure to maximum in the event pressure has dropped.

A "pull-off" type circuit breaker, mounted on the left sidewall circuit breaker panel, should be used for safety during maintenance. With the circuit breaker pulled out, landing gear operation by the gear motor cannot occur. After maintenance is completed, and prior to flight the circuit breaker should be pushed back in.

**WARNING**

Safety placards are installed in the nose wheel well to warn against any maintenance in this area with the circuit breaker pushed in.

**EMERGENCY HAND PUMP**

A hand-operated hydraulic pump, located between the two front seats,

is provided for extension of the landing gear in the event of a hydraulic or electrical system failure. The landing gear cannot be retracted with the hand pump. To utilize the pump, extend the handle forward and pump vertically. For complete emergency procedures, refer to Section 3.

For practice manual gear extensions, pull out the GEAR PUMP circuit breaker before placing the landing gear lever in the GEAR DOWN position. After the practice manual extension is completed, push the circuit breaker in to restore normal gear operation.

### LANDING GEAR WARNING SYSTEM

The airplane is equipped with a landing gear warning system designed to help prevent the pilot from inadvertently making a wheels-up landing. The system consists of a throttle-actuated switch which is electrically connected to a dual warning unit. The warning unit is connected to the airplane speaker.

When the throttle is retarded below approximately 15 inches of manifold pressure (master switch on), the throttle linkage will actuate a switch which is electrically connected to the gear warning portion of a dual warning unit. If the landing gear is retracted (or not down and locked), an intermittent tone will be heard on the airplane speaker. The system may be checked for correct operation before flight by retarding the throttle to idle and depressing the green gear-down position indicator light half way in. With the indicator light depressed as described, an intermittent tone should be heard on the airplane speaker.

### RETRACTABLE CABIN ENTRY STEP

The airplane may be equipped with a retractable cabin entry step located on the right side of the fuselage below the cabin door. The step cycles directly with the landing gear, and is spring loaded to the extended position. A cable attached to the nose gear hydraulic actuator thru-bolt retracts the step as the nose gear is retracted.

### BAGGAGE COMPARTMENT

The baggage compartment consists of the area from the back of the rear passenger seats to the aft cabin bulkhead. Access to the baggage compartment is gained through a lockable baggage door on the left side of the airplane, or from within the airplane cabin. A baggage net with six tie-down straps is provided for securing baggage and is attached by tying the straps to tie-down rings provided in the airplane. When loading the airplane, children should not be placed or permitted in the baggage compartment, and any material that might be hazardous to the airplane or

occupants should not be placed anywhere in the airplane. For baggage area and door dimensions, refer to Section 6.

## SEATS

The seating arrangement consists of four separate adjustable seats and a one-piece fixed seat. The pilot's seat is a six-way adjustable seat, and the front and center passengers seats are four-way adjustable. The front passenger's seat is also available in the six-way adjustable configuration. The two aft passengers utilize a one-piece fixed seat.

The six-way adjustable pilot's seat may be moved forward or aft, adjusted for height, and the seat back angle is infinitely adjustable. Position the seat by lifting the tubular handle, under the center of the seat bottom and slide the seat into position; then release the handle and check that the seat is locked in place. Raise or lower the seat by rotating a large crank under the right corner of the seat. Seat back angle is adjustable by rotating a small crank under the left corner of the seat. The seat bottom angle will change as the seat back angle changes, providing proper support. The seat back will also fold full forward. If the front passenger's seat is six-way adjustable, it will function the same as the pilot's seat except the height adjusting and back reclining cranks will be opposite the respective adjustment cranks of the pilot's seat.

Six-way adjustable seats may be equipped with variable lumbar supports located inside the lower seat backs. The firmness of the lower seat back may be controlled by utilizing a button located on the lower inboard side of the seat back. After adjusting the seat back to a comfortable position, move forward on the seat to remove all the weight from the seat back. Hold the button in until the support fully inflates, release the button, and lean back in the seat. If the support is too firm, hold the button in until the desired amount of firmness is obtained.

The four-way adjustable front and center passenger's seats may be moved forward and aft, and the seat back angle is infinitely adjustable. Position the seat by lifting up on the tubular handle under the center of the seat bottom of the front passenger's seat, or the handle under the inboard corner of the center passenger's seats, and slide the seat into position; then release the handle and check that the seat is locked in place. The seat back angle of either front or center passenger seats may be adjusted by rotating a crank under the outboard corner of the seat. The seat bottom angle will change as the seat back angle changes, providing proper support. The seat backs will also fold full forward.

The aft passenger's seats consist of a fixed position one-piece seat bottom and a one-piece fold-down seat back. If the seats are not to be

occupied, a camming action permits the seat back to fold down completely flat, providing more space for baggage. To fold down the seat back, grasp the top edge and rotate it downward.

Headrests are available for any of the seat configurations. To adjust the headrest, apply enough pressure to it to raise or lower it to the desired level. The headrest may be removed at any time by raising it until it disengages from the top of the seat back.

## SEAT BELTS AND SHOULDER HARNESSES

All seat positions are equipped with seat belts (see figure 7-4). The pilot's and front passenger's seats are also equipped with separate shoulder harnesses; separate shoulder harnesses are available for the remaining seat positions and can be readily installed to attach points furnished in the airplane. Integrated seat belt/shoulder harnesses with inertia reels can be furnished for the pilot's and front passenger's seat positions if desired.

### SEAT BELTS

The seat belts used with the pilot, front passenger, and center passenger seats are attached to fittings on the floorboard. The buckle half is inboard of each seat and the link half is outboard of each seat. The belts for the aft seat are attached to the seat frame, with the link halves on the left and right sides of the seat bottom, and the buckles at the center of the seat bottom.

To use the seat belts for the front and center seats, position the seat as desired, and then lengthen the link half of the belt as needed by grasping the sides of the link and pulling against the belt. Insert and lock the belt link into the buckle. Tighten the belt to a snug fit. Seat belts for the aft seat are used in the same manner as the belts for the front and center seats. To release the seat belts, grasp the top of the buckle opposite the link and pull upward.

### SHOULDER HARNESSES

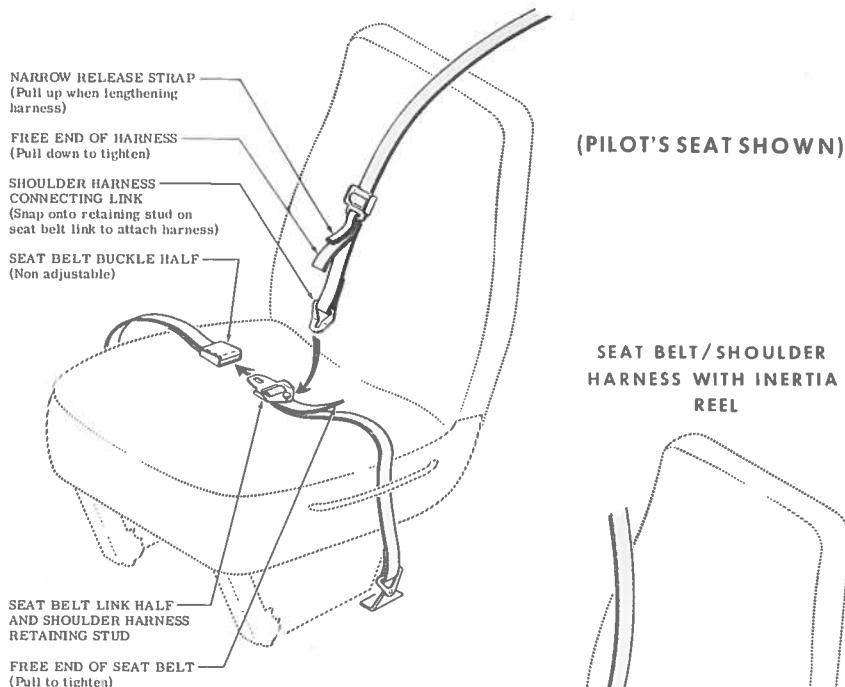
Each front seat shoulder harness is attached to a rear doorpost above the window line and is stowed behind a stowage sheath above the cabin door. To stow the harness, fold it and place it behind the sheath. When shoulder harnesses are furnished for the remaining seats, they are attached above and aft of the side windows. Each harness is stowed behind a stowage sheath above the side windows.

To use the shoulder harness, fasten and adjust the seat belt first. Lengthen the harness as required by pulling on the connecting link on the

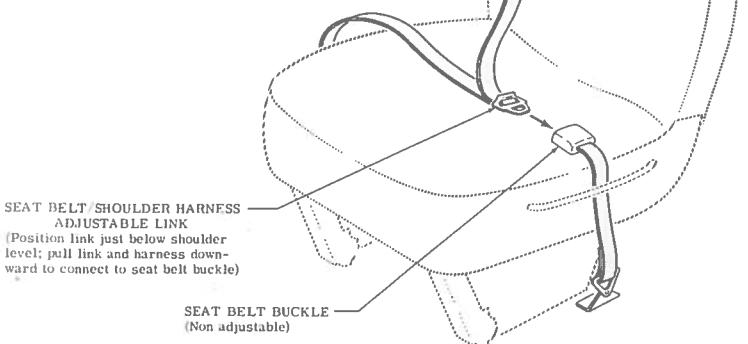
**SECTION 7**  
**AIRPLANE & SYSTEMS DESCRIPTIONS**

**CESSNA  
MODEL T210N**

**STANDARD SHOULDER  
HARNESS**



**SEAT BELT/SHOULDER  
HARNESS WITH INERTIA  
REEL**



**Figure 7-4. Seat Belts and Shoulder Harnesses**

end of the harness and the narrow release strap. Snap the connecting link firmly onto the retaining stud on the seat belt link half. Then adjust to length. A properly adjusted harness will permit the occupant to lean forward enough to sit completely erect, but prevent excessive forward movement and contact with objects during sudden deceleration. Also, the pilot will want the freedom to reach all controls easily.

Removing the shoulder harness is accomplished by pulling upward on the narrow release strap, and removing the harness connecting link from the stud on the seat belt link. In an emergency, the shoulder harness may be removed by releasing the seat belt first and allowing the harness, still attached to the link half of the seat belt, to drop to the side of the seat.

## **INTEGRATED SEAT BELT/SHOULDER HARNESES WITH INERTIA REELS**

Integrated seat belt/shoulder harnesses with inertia reels are available for the pilot and front seat passenger. The seat belt/shoulder harnesses extend from inertia reels located in the cabin top structure, through the overhead console marked PILOT and COPILOT, to attach points inboard of the two front seats. A separate seat belt half and buckle is located outboard of the seats. Inertia reels allow complete freedom of body movement. However, in the event of a sudden deceleration, they will lock automatically to protect the occupants.

To use the seat belt/shoulder harness, position the adjustable metal link on the harness just below shoulder level, pull the link and harness downward, and insert the link in the seat belt buckle. Adjust belt tension across the lap by pulling upward on the shoulder harness. Removal is accomplished by releasing the seat belt buckle, which will allow the inertia reel to pull the harness inboard of the seat.

## **ENTRANCE DOORS AND CABIN WINDOWS**

Entry to, and exit from the airplane is accomplished through either of two entry doors, one on each side of the cabin at the front seat positions (refer to Section 6 for cabin and cabin door dimensions). The doors incorporate a recessed exterior door handle, a conventional interior door handle, a key-operated door lock (left door only), a door stop mechanism, and an openable window in the left door. An openable right door window is also available.

### **NOTE**

The door latch design on this model requires that the outside door handle on the pilot and front passenger doors be extended out whenever the doors are open. When closing the door, do not attempt to push the door handle in until the door is fully shut.

To open the doors from outside the airplane, utilize the recessed door handle near the aft edge of each door. Grasp the forward end of the handle and pull outboard. To close or open the doors from inside the airplane, use the conventional door handle and arm rest. The inside door handle is a three-position handle having a placard at its base with the positions OPEN, CLOSE, and LOCK shown on it. The handle is spring-loaded to the CLOSE (up) position. When the door has been pulled shut and latched, lock it by rotating the door handle forward to the LOCK position (flush with the arm rest). When the handle is rotated to the LOCK position, an over-center action will hold it in that position. Both cabin doors should be locked prior to flight, and should not be opened intentionally during flight.

NOTE

Accidental opening of a cabin door in flight due to improper closing does not constitute a need to land the airplane. The best procedure is to set up the airplane in a trimmed condition at approximately 85 KIAS, momentarily shove the door outward slightly, and forcefully close and lock the door.

Exit from the airplane is accomplished by rotating the door handle full aft to the OPEN position and pushing the door open. To lock the airplane, lock the right cabin door with the inside handle, close the left cabin door, and using the ignition key, lock the door.

The left entry door is equipped with an openable window which is held in the closed position by a detent-equipped latch on the lower edge of the window frame. To open the window, rotate the latch upward. The window is equipped with a spring-loaded retaining arm which will help rotate the window outward and hold it there. An openable window is also available for the right door, and functions in the same manner as the left window. If required, either window may be opened at any speed up to 203 KIAS. The aft side windows, and rear window are of the fixed type and cannot be opened.

## CONTROL LOCKS

A control lock is provided to lock the aileron and elevator control surfaces to prevent damage to these systems by wind buffeting while the airplane is parked. The lock consists of a shaped steel rod and flag. The flag identifies it as a control lock and cautions about its removal before starting the engine. To install the control lock, align the hole in the right side of the pilot's control wheel shaft with the hole in the right side of the shaft collar on the instrument panel and insert the rod into the aligned holes. Install-

tion of the lock will secure the ailerons in a neutral position and the elevators in a slightly trailing edge down position. Proper installation of the lock will place the flag over the ignition switch. In areas where high or gusty winds occur, a control surface lock should be installed over the vertical stabilizer and rudder. The control lock and any other type of locking device should be removed prior to starting the engine.

## ENGINE

The airplane is powered by a horizontally-opposed, six-cylinder, overhead-valve, turbocharged, air-cooled, fuel injected engine with a wet sump oil system. The engine is a Continental Model TSIO-520-R and is rated at 310 horsepower at 2700 RPM and 36.5 inches of manifold pressure for five minutes, and 285 horsepower at 2600 RPM and 35 inches of manifold pressure continuous. Major accessories include a propeller governor on the front of the engine and dual magnetos, starter, belt-driven alternator, and full flow oil filter on the rear of the engine. Other major accessories include a turbocharger, connected to the induction air and exhaust systems, and associated components. Provisions are also made for a second belt-driven alternator and air conditioner compressor on the front of the engine and either one or two vacuum pumps on the rear of the engine.

## ENGINE CONTROLS

Engine manifold pressure is controlled by a throttle located on the lower center portion of the instrument panel. The throttle operates in a conventional manner; in the full forward position, the throttle is open, and in the full aft position, it is closed. A friction lock, which is a round knurled disk, is located at the base of the throttle and is operated by rotating the lock clockwise to increase friction or counterclockwise to decrease it. The throttle linkage is designed to mechanically actuate a microswitch electrically connected to the landing gear warning system. The switch will cause a warning tone to sound anytime the throttle is retarded with the landing gear retracted, with less than approximately 15 inches of manifold pressure.

The mixture control, mounted above the right corner of the control pedestal, is a red knob with raised points around the circumference and is equipped with a lock button in the end of the knob. The rich position is full forward, and full aft is the idle cut-off position. For small adjustments, the control may be moved forward by rotating the knob clockwise, and aft by rotating the knob counterclockwise. For rapid or large adjustments, the knob may be moved forward or aft by depressing the lock button in the end

of the control, and then positioning the control as desired.

## ENGINE INSTRUMENTS

Engine operation is monitored by the following instruments: oil pressure gage, oil temperature gage, cylinder head temperature gage, tachometer, manifold pressure/fuel flow indicator and an economy mixture (EGT) indicator. An engine combustion analyzer is also available.

The oil pressure gage, located on the upper right side of the instrument panel, is operated by oil pressure. A direct pressure oil line from the engine delivers oil at engine operating pressure to the oil pressure gage. Gage markings indicate that minimum idling pressure is 10 PSI (red line), the normal operating range is 30 to 60 PSI (green arc), and maximum pressure is 100 PSI (red line).

Oil temperature is indicated by a gage adjacent to the oil pressure gage. The gage is operated by an electrical-resistance type temperature sensor which receives power from the airplane electrical system. Gage markings indicate the normal operating range (green arc) which is 100°F (38°C) to 240°F (116°C), and the maximum (red line) which is 240°F (116°C).

The cylinder head temperature gage, adjacent to the oil temperature gage, is operated by an electrical-resistance type temperature sensor on the engine and is powered by the airplane electrical system. Gage markings indicate the normal operating range (green arc) which is 200°F (93°C) to 460°F (238°C) and the maximum (red line) which is 460°F (238°C).

The engine-driven mechanical tachometer is located on the lower right side of the instrument panel. The instrument is calibrated in increments of 100 RPM and indicates both engine and propeller speed. An hour meter below the center of the tachometer dial records elapsed engine time in hours and tenths. Instrument markings include a normal operating range (green arc) of 2200 to 2500 RPM, a five minute maximum power range (yellow arc) of 2600 to 2700 RPM, and a maximum (red line) of 2700 RPM.

The manifold pressure gage is the left half of a dual-indicating instrument mounted above the tachometer. The gage is direct reading and indicates induction air manifold pressure in inches of mercury. It has a normal operating range (green arc) of 15 to 30 inches of mercury, a five minute maximum power range (yellow arc) of 35 to 36.5 inches of mercury, and a maximum (red line) of 36.5 inches of mercury.

The fuel flow indicator is the right half of a dual-indicating instrument mounted above the tachometer. The indicator is a fuel pressure gage

calibrated to indicate the approximate pounds per hour of fuel being metered to the engine. The normal cruise range (green arc) is from 36 to 120 PPH the normal climb range (white arc) is from 120 to 162 PPH the minimum (red line) is 3.0 PSI, and the maximum (red line) is 186 PPH (19.5 PSI).

An economy mixture (EGT) indicator is located on the right side of the instrument panel. A thermocouple probe in the exhaust manifold at the inlet to the turbocharger measures exhaust gas temperature and transmits it to the indicator. The indicator serves as a visual aid to the pilot in adjusting cruise mixture. Exhaust gas temperature varies with fuel-to-air ratio, power, and RPM. However, the difference between the peak EGT and the EGT at the cruise mixture setting is essentially constant and this provides a useful leaning aid. The indicator is equipped with a manually positioned reference pointer. An engine combustion analyzer (seven probe EGT system) is also available. Details of this system are presented in Section 9, Supplements.

## NEW ENGINE BREAK-IN AND OPERATION

The engine underwent a run-in at the factory and is ready for the full range of use. It is, however, suggested that cruising be accomplished at 70% to 80% power until a total of 50 hours has accumulated or oil consumption has stabilized. This will ensure proper seating of the rings.

The airplane is delivered from the factory with corrosion preventive oil in the engine. If, during the first 25 hours, oil must be added, use only aviation grade straight mineral oil conforming to Specification No. MIL-L-6082.

## ENGINE OIL SYSTEM

Oil for engine lubrication, propeller governor operation, and turbocharger system control is supplied from a sump on the bottom of the engine. The capacity of the engine sump is 10 quarts (one additional quart is contained in the engine oil filter). Oil is drawn from the sump through a filter screen on the end of a pickup tube to the engine-driven oil pump. Oil from the pump passes through the full flow oil filter to the turbocharger system controls, a pressure relief valve at the rear of the right oil gallery, and a thermostatically controlled remotely located oil cooler. Oil from the cooler is then circulated to the left gallery and propeller governor. The engine parts and turbocharger are then lubricated by oil from the galleries. After lubricating the engine, the oil returns to the sump by gravity, and oil from the turbocharger is returned to the sump by a scavenger pump. The oil filter adapter is equipped with a bypass valve which will cause lubricating oil to bypass the filter in the event the filter becomes plugged, or the oil temperature is extremely cold.

An oil dipstick is located at the rear of the engine on the left side, and an oil filler tube is on top of the crankcase near the front of the engine. The dipstick and oil filler are accessible through doors on the engine cowling. The engine should not be operated on less than 7 quarts of oil. To minimize loss of oil through the breather, fill to 8 quarts for normal flights of less than three hours. For extended flight, fill to 10 quarts (dipstick indication only). For engine oil grade and specifications, refer to Section 8 of this handbook.

## **IGNITION-STARTER SYSTEM**

Engine ignition is provided by two engine-driven magnetos and two spark plugs in each cylinder. The right magneto fires the lower left and upper right spark plugs, and the left magneto fires the lower right and upper left spark plugs. Normal operation is conducted with both magnetos due to the more complete burning of the fuel-air mixture with dual ignition.

Ignition and starter operation is controlled by a rotary type switch located on the left switch and control panel. The switch is labeled clockwise, OFF, R, L, BOTH, and START. The engine should be operated on both magnetos (BOTH position) except for magneto checks. The R and L positions are for checking purposes and emergency use only. When the switch is rotated to the spring-loaded START position, (with the master switch in the ON position), the starter contactor is energized and the starter will crank the engine. When the switch is released, it will automatically return to the BOTH position.

## **AIR INDUCTION SYSTEM**

The engine air induction system receives ram air through a duct in the right intake in the front of the engine cowling. The duct extends down the right side of the engine to an air filter which removes dust and other foreign matter from the induction air. On the aft side of the filter is a duct assembly which contains an alternate air door. If the induction air filter becomes blocked, suction created by the engine will open the door and draw unfiltered air from inside the cowling. An open alternate air door will result in a decrease of up to 10 inches Hg manifold pressure from a cruise power setting. Maximum continuous manifold pressure (35 inches Hg) can be maintained with throttle and/or RPM adjustment up to 14,000 feet under hot day conditions with the alternate air door open. A flexible duct, connected to the duct assembly, directs induction air from the air filter to the compressor section of the turbocharger. At this point, induction air is compressed. The pressurized air is then ducted through a fuel/air control unit and induction manifold to the cylinders.

## EXHAUST SYSTEM

Exhaust gas from each cylinder passes through riser assemblies into an exhaust manifold which discharges the gas into the turbine section of the turbocharger. After the exhaust gas has passed through the turbine, it is vented overboard through a tailpipe. A waste gate is incorporated into the exhaust manifold, and controls the amount of exhaust gas to the turbine by venting excess gas to the tailpipe through a bypass. A shroud, attached to the left side of the exhaust manifold, forms a heating chamber for cabin heater and windshield defrost air.

## FUEL INJECTION SYSTEM

The engine is equipped with a fuel injection system. The system is comprised of an engine-driven fuel pump, fuel/air control unit, fuel manifold, fuel flow indicator, and air-bleed type injector nozzles.

Fuel is delivered by the engine-driven fuel pump to the fuel/air control unit behind the engine. The fuel/air control unit correctly proportions the fuel flow to the induction air flow. After passing through the control unit, induction air is delivered to the cylinders through intake manifold tubes, and metered fuel is delivered to a fuel manifold. The fuel manifold, through spring tension on a diaphragm and valve, evenly distributes the fuel to an air-bleed type injector nozzle in the intake valve chamber of each cylinder. A pressure line is also attached to the fuel manifold, and is connected to a fuel flow indicator on the instrument panel.

## COOLING SYSTEM

Ram air for engine cylinder cooling enters through two intake openings in the front of the engine cowling. The cooling air is directed around the cylinders and other areas of the engine by baffling, and is then exhausted through cowl flaps on the lower aft edge of the cowling. A separate inlet on the lower left front of the cowling provides cooling air for the remote air cooler. The cowl flaps are mechanically operated from the cabin by means of a cowl flap lever on the right side of the control pedestal. The pedestal is labeled COWL FLAP, OPEN, CLOSED. During takeoff and high power operation, the cowl flap lever should be placed in the OPEN position for maximum cooling. This is accomplished by moving the lever to the right to clear a detent, then moving the lever up to the OPEN position. Anytime the lever is repositioned, it must first be moved to the right. While in cruise flight, cowl flaps should be adjusted to keep the cylinder head temperature at approximately two-thirds of the normal operating range (green arc). During extended let-downs, it may be necessary to completely close the cowl flaps by pushing the cowl flap lever down to the CLOSED position.

## TURBOCHARGING SYSTEM

Because the engine is turbocharged, some of its characteristics are different from a normally aspirated engine. The following information describes the system and points out some of the items that are affected by turbocharging. Section 4 contains the normal operating procedures for the turbocharged engine.

The following steps, when combined with the turbocharger system schematic (figure 7-5), provide a better understanding of how the turbocharger system works. The steps follow the induction air as it enters and passes through the engine until it is expelled as exhaust gases.

1. Engine induction air is taken in through an opening in the nose cap, ducted through a filter and into the compressor where it is compressed.
2. The pressurized induction air then passes through the throttle body and induction manifold into the cylinders.
3. The air and fuel are burned and exhausted to the supercharger turbine.
4. The exhaust gases drive the turbine which, in turn, drives the compressor, thus completing the cycle.

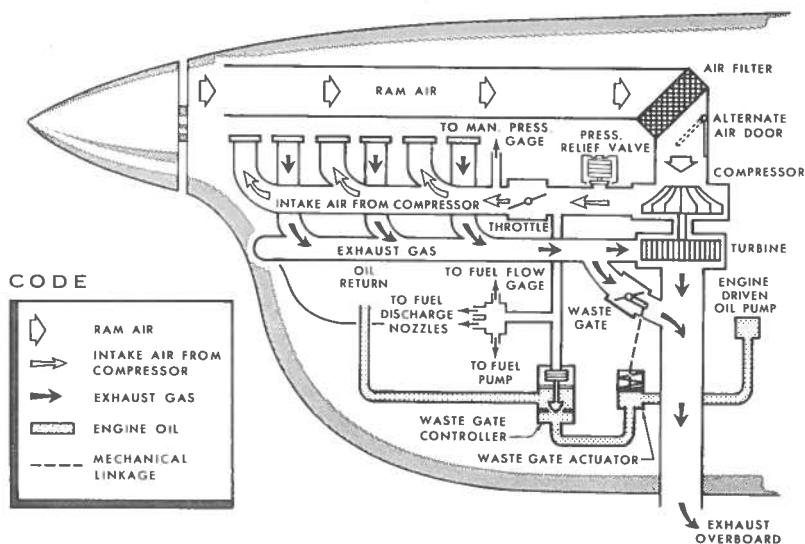


Figure 7-5. Turbocharger System

The compressor has the capability of producing manifold pressures in excess of the 5 minute takeoff maximum of 36.5 inches Hg. In order not to exceed 36.5 inches of manifold pressure, a waste gate is used so that some of the exhaust will bypass the turbine and be vented into the tailpipe.

It can be seen from studying Steps 1 through 4 that anything that affects the flow of induction air into the compressor or the flow of exhaust gases into the turbine will increase or decrease the speed of the turbocharger. This resultant change in flow will have no effect on the engine if the waste gate is still open because the waste gate position is changed to hold compressor discharge pressure constant. A waste gate controller automatically maintains maximum allowable compressor discharge pressure any time the turbine and compressor are capable of producing that pressure.

At high altitude, part throttle, or low RPM, the exhaust flow is not capable of turning the turbine and compressor fast enough to maintain maximum compressor discharge pressure, and the waste gate will close to force all of the exhaust flow through the turbine.

When the waste gate is fully closed, any change in turbocharger speed will mean a change in engine operation. Thus, any increase or decrease in turbine speed will cause an increase or decrease in manifold pressure and fuel flow. If turbine speed increases, the manifold pressure increases; if the turbine speed decreases, the manifold pressure decreases. Since the compression ratio approaches 3 to 1 at high altitude, any change in exhaust flow to the turbine or ram induction air pressure will be magnified proportionally by the compression ratio and the change in flow through the exhaust system.

#### MANIFOLD PRESSURE VARIATION WITH ENGINE RPM

When the waste gate is open, the turbocharged engine will react the same as a normally aspirated engine when the engine RPM is varied. That is, when the RPM is increased, the manifold pressure will decrease slightly. When the engine RPM is decreased, the manifold pressure will increase slightly.

However, when the waste gate is closed, manifold pressure variation with engine RPM is just the opposite of the normally aspirated engine. An increase in engine RPM will result in an increase in manifold pressure, and a decrease in engine RPM will result in a decrease in manifold pressure.

#### MANIFOLD PRESSURE VARIATION WITH ALTITUDE

At full throttle, the turbocharger has the capability of maintaining the

maximum continuous manifold pressure of 35 inches Hg to well above 17,000 feet depending on engine and atmospheric conditions. However, engine operating limitations establish the maximum manifold pressure that may be used. Manifold pressure should be reduced above 17,000 feet, as noted on the operating placard in the airplane (subtract 1 inch Hg from 35 inches for each 1000 feet above 17,000 feet).

At part throttle, the turbocharger is capable of maintaining cruise climb power of 2500 RPM and 30 inches Hg from sea level to 20,000 feet in standard temperatures, and from sea level to 8000 feet under hot day conditions without changing the throttle position, once the power setting is established after takeoff. Under hot day conditions, this climb power setting is maintained above 8000 feet by advancing the throttle as necessary to maintain 30 inches of manifold pressure in the same manner as a normally aspirated engine during climb.

#### MANIFOLD PRESSURE VARIATION WITH AIRSPEED

When the waste gate is closed, manifold pressure will vary with variations in airspeed. This is because the compressor side of the turbocharger operates at pressure ratios of up to 3 to 1 and any change in pressure at the compressor inlet is magnified at the compressor outlet with a resulting effect on the exhaust flow and turbine side of the turbocharger.

#### FUEL FLOW VARIATIONS WITH CHANGES IN MANIFOLD PRESSURE

The engine-driven fuel pump output is regulated by engine speed and compressor discharge pressure. Engine fuel flow is regulated by fuel pump output and the metering effects of the throttle and mixture control. When the waste gate is open, fuel flow will vary directly with manifold pressure, engine speed, mixture, or throttle control position. In this case, manifold pressure is controlled by throttle position and the waste gate controller, while fuel flow varies with throttle movement and manifold pressure.

When the waste gate is closed and manifold pressure changes are due to turbocharger output, as discussed previously, fuel flow will follow manifold pressure even though the throttle position is unchanged. This means that fuel flow adjustments required of the pilot are minimized to (1) small initial adjustments on takeoff or climb-out for the proper rich climb setting, (2) lean-out in cruise, and (3) return to full rich position for approach and landing.

**MANIFOLD PRESSURE VARIATION WITH INCREASING OR DECREASING FUEL FLOW**

When the waste gate is open, movement of the mixture control has little or no effect on the manifold pressure of the turbocharged engine.

When the waste gate is closed, any change in fuel flow to the engine will have a corresponding change in manifold pressure. That is, increasing the fuel flow will increase the manifold pressure and decreasing the fuel flow will decrease the manifold pressure. This is because an increased fuel flow to the engine increases the mass flow of the exhaust. This turns the turbocharger faster, increasing the induction air flow and raising the manifold pressure.

**MOMENTARY OVERSHOOT OF MANIFOLD PRESSURE**

Under some circumstances (such as rapid throttle movement, especially with cold oil), it is possible that the engine can be overboosted slightly above the maximum five minute takeoff manifold pressure of 36.5 inches. This would most likely be experienced during the takeoff roll or during a change to full throttle operation in flight. The induction air pressure relief valve will normally limit the overboost to 2 to 3 inches.

A slight overboost of 2 to 3 inches of manifold pressure is not considered detrimental to the engine as long as it is momentary. No corrective action is required when momentary overboost corrects itself and is followed by normal engine operation. However, if overboosting of this nature persists when oil temperature is normal or if the amount of overboost tends to exceed 3 inches or more, the throttle should be retarded to eliminate the overboost and the controller system, including the waste gate and relief valve, should be checked for necessary adjustment or replacement of components.

**ALTITUDE OPERATION**

Because a turbocharged airplane will climb faster and higher than a normally aspirated airplane, fuel vaporization may be encountered. When fuel flow variations of  $\pm 5$  PPH or more are observed (as a "nervous" fuel flow needle), or if a full rich mixture setting does not provide the desired fuel flow, placing the auxiliary fuel pump switch in the ON position will control vapor. However, it will also increase fuel flow, making it necessary to adjust the mixture control for the desired fuel flow. The auxiliary fuel pump should be left on for the remainder of the climb. It can be turned off whenever fuel flow will remain steady with it off, and the mixture must be adjusted accordingly. The auxiliary fuel pump should be turned off and the mixture reset prior to descent.

### **HIGH ALTITUDE ENGINE ACCELERATION**

The engine will accelerate normally from idle to full throttle with full rich mixture at any altitude below 20,000 feet. At higher altitudes, it is usually necessary to lean the mixture to get smooth engine acceleration from idle to maximum power. At altitudes above 25,000 feet, and with temperatures above standard, it takes one to two minutes for the turbine to accelerate from idle to maximum RPM although adequate power is available in 20 to 30 seconds.

### **PROPELLER**

The airplane has an all-metal, three-bladed, constant-speed, governor-regulated propeller. A setting introduced into the governor with the propeller control establishes the propeller speed, and thus the engine speed to be maintained. The governor then controls flow of engine oil, boosted to high pressure by the governing pump, to or from a piston in the propeller hub. Oil pressure acting on the piston twists the blades toward high pitch (low RPM). When oil pressure to the piston in the propeller hub is relieved, centrifugal force, assisted by an internal spring, twists the blades toward low pitch (high RPM).

A control knob on the lower center portion of the instrument panel is used to set the propeller and control engine RPM as desired for various flight conditions. The knob is labeled PROP PITCH PUSH INCR RPM. When the control knob is pushed in, blade pitch will decrease, giving a higher RPM. When the control knob is pulled out, the blade pitch increases, thereby decreasing RPM. The propeller control knob is equipped with a vernier feature which allows slow or fine RPM adjustments by rotating the knob clockwise to increase RPM, and counterclockwise to decrease it. To make rapid or large adjustments, depress the button on the end of the control knob and reposition the control as desired.

### **FUEL SYSTEM**

The fuel system (see figure 7-6) consists of two vented integral fuel tanks (one in each wing), a fuel selector valve, a reservoir, an auxiliary fuel pump, on-off valve, fuel strainer, engine-driven fuel pump, fuel/air control unit, fuel manifold, and fuel injection nozzles.

#### **NOTE**

**Unusable fuel is at a minimum due to the design of the fuel**

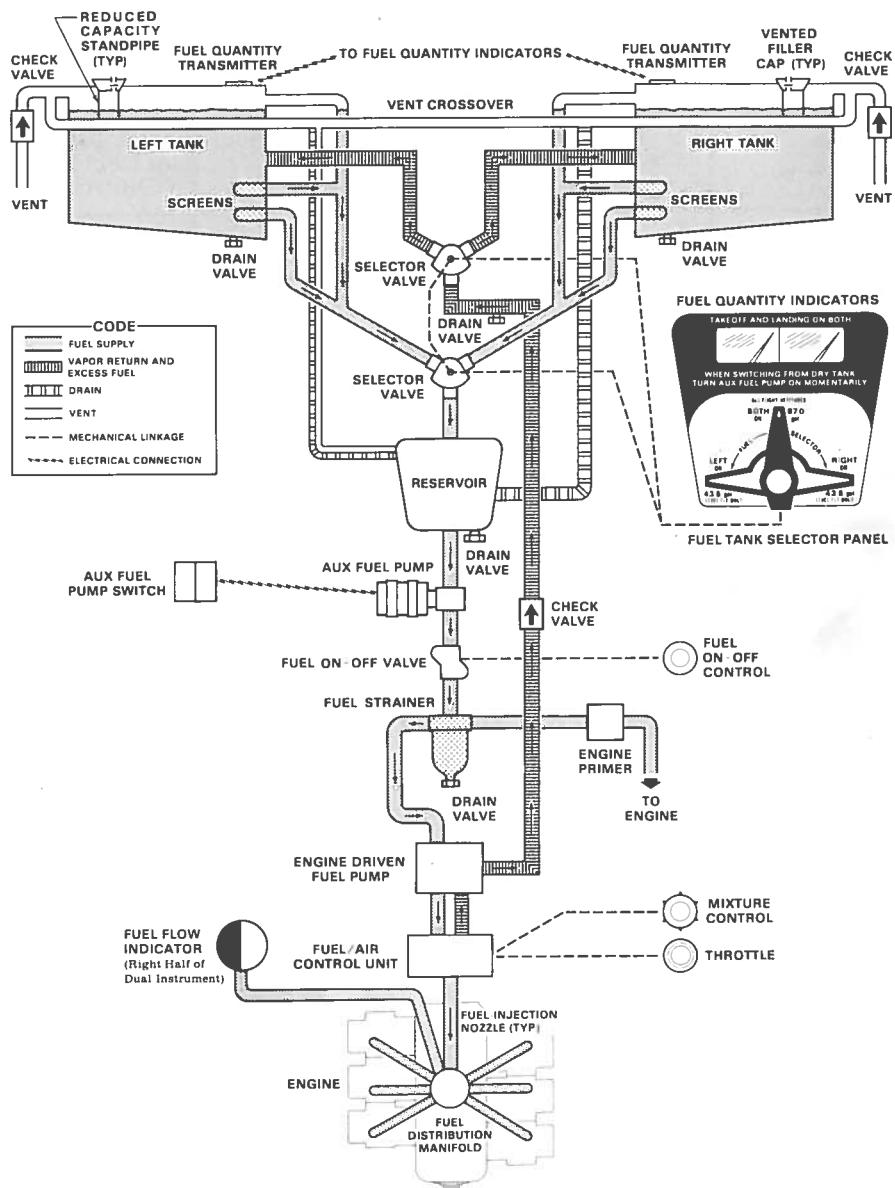


Figure 7-6. Fuel System

FUEL QUANTITY DATA (U.S. GALLONS)				
FUEL TANKS	FUEL LEVEL (QUANTITY EACH TANK)	TOTAL FUEL	TOTAL UNUSABLE	TOTAL USABLE ALL FLIGHT CONDITIONS
STANDARD	FULL (45)	90	3	87
	REDUCED (33.5)	67	3	64

Figure 7-7. Fuel Quantity Data

system. However, when the fuel tanks are 1/4 full or less, prolonged uncoordinated flight such as slips or skids can uncover the fuel tank outlets, possibly causing fuel starvation and engine stoppage. Therefore, with low fuel reserves, do not allow the airplane to remain in uncoordinated flight for periods in excess of 30 seconds with the fuel selector on left or right tanks or one minute with the selector in the BOTH ON position.

Fuel flows by gravity from the two integral tanks (one in each wing) to a two-segment, three-position selector valve labeled LEFT ON, RIGHT ON, and BOTH ON.

#### NOTE

When the fuel selector valve handle is in the BOTH ON position in cruising flight, unequal fuel flow from each tank may occur if the wings are not maintained exactly level. Resulting wing heaviness can be alleviated gradually by turning the selector valve handle to the tank in the "heavy" wing.

With the selector valve handle in one of the designated (detent) positions, fuel from either the left tank, right tank or both tanks flows through the selector valve, the reservoir, through a bypass in the auxiliary fuel pump (when it is not in operation, and through a fuel on-off valve to a strainer mounted on the firewall. The engine-driven fuel pump delivers fuel from the strainer to the fuel/air control unit where it is metered and directed to a manifold which distributes it to each cylinder. Vapor and excess fuel from the engine-driven fuel pump and the fuel/air control unit are returned by way of a separate segment of the selector valve to the wing fuel tank or tanks, as selected by the fuel selector handle position.

A two-position on-off valve is incorporated into the fuel system to be used for maintenance purposes or in the event of emergency conditions requiring fuel flow to be shut off. A push-pull control, labeled FUEL VALVE PUSH ON and located on the lower left side of the pedestal, controls valve position. Under normal conditions the control is pushed fully in to the ON position. To shut off fuel flow, the control is pulled fully out.

Fuel system venting is essential to system operation. Complete blockage of the venting system will result in decreasing fuel flow and eventual engine stoppage. Venting is accomplished by vent lines, one from each fuel tank, which are equipped with check valves, and a tank interconnect vent line. The fuel filler caps are equipped with vacuum operated vents which open, allowing air into the tanks, should the fuel tank vent lines become blocked.

Fuel quantity is measured by two float-type fuel quantity transmitters (one in each tank) and indicated by two electrically-operated fuel quantity indicators on the lower portion of the pedestal adjacent to the fuel selector valve handle. The indicators are marked in pounds (top scale) and gallons (bottom scale) with a red line indicating an empty tank. When an indicator shows an empty tank, approximately 1.5 gallon remains in the tank as unusable fuel. The indicators cannot be relied upon for accurate readings during skids, slips or unusual attitudes. Maximum indicator travel is reached with 40 to 41 gallons in the tank. Therefore, indications at the right end of the scale (40 gallons to F) should be verified by visual inspection of the tanks if a short field takeoff or a long range flight is planned. If both indicator pointers should rapidly move to a zero reading, check the cylinder head temperature and oil temperature gages for operation. If these gages are not indicating, an electrical malfunction has occurred.

The airplane may be serviced to a reduced capacity to permit heavier cabin loadings. This is accomplished by filling each tank to the bottom edge of the fuel filler neck, thus giving a reduced fuel load of ~~201~~ pounds in each tank (192 pounds usable in all flight conditions).

Before refueling or when the airplane is parked on a slope, place the fuel selector handle in the LEFT ON or RIGHT ON position, whichever corresponds to the low wing. This action minimizes crossfeeding from the fuller tank and reduces fuel seepage from the wing tank vents.

The auxiliary fuel pump switch is located on the left side of the instrument panel and is a yellow and red split-rocker type switch. The yellow right half of the switch is labeled START, and its upper ON position is used for normal starting, minor vapor purging and continued engine operation in the event of an engine-driven fuel pump failure. With the right half of the switch in the ON position, the pump operates at one of two flow

rates that are dependent upon the setting of the throttle. With the throttle open to a cruise setting, the pump operates at a high enough capacity to supply sufficient fuel flow to maintain flight with an inoperative engine-driven fuel pump. When the throttle is moved toward the closed position (as during letdown, landing, and taxiing), the fuel pump flow rate is automatically reduced, preventing an excessively rich mixture during these periods of reduced engine speed.

NOTE

If the engine-driven fuel pump is functioning and the auxiliary fuel pump switch is placed in the ON position, an excessively rich fuel/air ratio is produced unless the mixture is leaned. Therefore, this switch should be turned off during takeoff and landing.

NOTE

If the auxiliary fuel pump switch is accidentally placed in the ON position with the master switch on and the engine stopped, the intake manifolds will be flooded.

The red left half of the switch is labeled EMERG, and its upper HI position is used in the event of an engine-driven fuel pump failure during takeoff or high power operation. The HI position may also be used for extreme vapor purging. Maximum fuel flow is produced when the left half of the switch is held in the spring-loaded HI position. In this position, an interlock within the switch automatically trips the right half of the switch to the ON position. When the spring-loaded left half of the switch is released, the right half will remain in the ON position until manually returned to the off position.

Under hot day-high altitude conditions, or conditions during a climb that are conducive to fuel vapor formation, it may be necessary to utilize the auxiliary fuel pump to attain or stabilize the fuel flow required for the type of climb being performed. In this case, turn the auxiliary fuel pump on and adjust the mixture to the desired fuel flow. If fluctuating fuel flow (greater than 5 PPH) is observed during climb or cruise at high altitudes on hot days, place the auxiliary fuel pump switch in the ON position to clear the fuel system of vapor. The auxiliary fuel pump may be operated continuously in cruise, if necessary, but should be turned off prior to descent. Each time the auxiliary fuel pump switch is turned on or off, the mixture should be readjusted.

If it is desired to completely exhaust a fuel tank quantity in flight, the auxiliary fuel pump will be needed to assist in restarting the engine when fuel exhaustion occurs. Therefore, it is recommended that proper operation of the auxiliary fuel pump be verified prior to running a fuel tank dry

by turning the auxiliary fuel pump ON momentarily and checking for a slight rise in fuel flow indication.

To ensure a prompt engine restart in flight after running a fuel tank dry, immediately switch to the tank containing fuel or to BOTH ON at the first indication of fuel pressure fluctuation and/or power loss. Then place the right half of the auxiliary fuel pump switch in the ON position momentarily (3 to 5 seconds) with the throttle at least 1/2 open. Excessive use of the ON position at high altitude and full rich mixture can cause flooding of the engine as indicated by a short (1 to 2 seconds) period of power followed by a loss of power. This can later be detected by a fuel flow indication accompanied by a lack of power. If flooding does occur, turn off the auxiliary fuel pump switch, and normal propeller windmilling should start the engine in 1 to 2 seconds.

If the propeller should stop (possible at very low airspeeds) before the tank containing fuel is selected, place the auxiliary fuel pump switch in the ON position and advance the throttle promptly until the fuel flow indicator registers approximately 1/2 way into the green arc for 1 to 2 seconds duration. Then retard the throttle, turn off the auxiliary fuel pump, and use the starter to turn the engine over until a start is obtained.

The fuel system is equipped with drain valves to provide a means for the examination of fuel in the system for contamination and grade. The system should be examined before the first flight of every day and after each refueling, by using the sampler cup provided to drain fuel from the wing tank sumps, and by utilizing the fuel strainer quick-drain on the lower left side of the engine cowling. A quick-drain valve is also provided for the fuel reservoir and in the vapor return line. These valves are located beneath the cabin. The fuel tanks should be filled after each flight to minimize condensation.

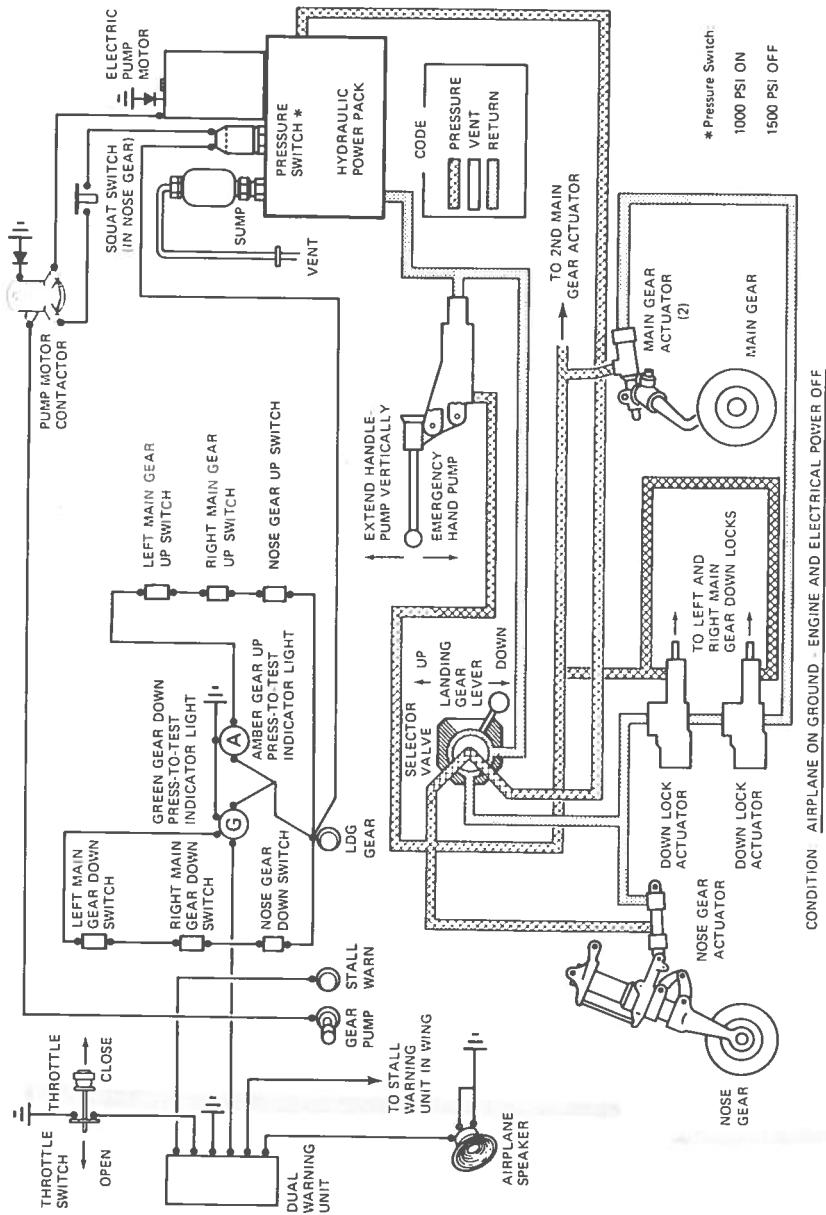
## HYDRAULIC SYSTEM

Hydraulic power (see figure 7-8) is supplied by an electrically-driven hydraulic power pack located behind the control pedestal. The power pack's only function is to supply hydraulic power for operation of the retractable landing gear. This is accomplished by applying hydraulic pressure to actuator cylinders which extend or retract the gear and operate the gear down locks. The electrical portion of the power pack is protected by a 35-amp "pull-off" type circuit breaker on the circuit breaker panel.

The hydraulic power pack is turned on, and the direction of actuation is selected by the landing gear lever when it is placed in either the gear-up or gear-down position. When the gear has fully extended and locked, or

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**Figure 7-8. Hydraulic System**

retracted, a series of electrical switches will illuminate one of two indicator lights on the instrument panel to show gear position. A hydraulic pressure switch will automatically turn off the power pack when hydraulic pressure reaches a preset value.

The hydraulic system includes an emergency hand pump to permit manual extension of the landing gear in the event of hydraulic power pack or electrical system failure. The hand pump is located on the cabin floor between the front seats.

During normal operations, the landing gear should require from 6 to 8 seconds to fully extend or retract. For malfunctions of the hydraulic and landing gear systems, refer to Section 3 of this handbook.

## BRAKE SYSTEM

The airplane has a single-disc, hydraulically-actuated brake on each main landing gear wheel. Each brake is connected, by a hydraulic line, to a master cylinder attached to each of the pilot's rudder pedals. The brakes are operated by applying pressure to the top of either the left (pilot's) or right (copilot's) set of rudder pedals, which are interconnected. When the airplane is parked, both main wheel brakes may be set by utilizing the parking brake which is operated by a handle under the left side of the instrument panel. To apply the parking brake, set the brakes with the rudder pedals, pull the handle aft, and rotate it 90° down.

For maximum brake life, keep the brake system properly maintained, and minimize brake usage during taxi operations and landings.

Some of the symptoms of impending brake failure are: gradual decrease in braking action after brake application, noisy or dragging brakes, soft or spongy pedals, and excessive travel and weak braking action. If any of these symptoms appear, the brake system is in need of immediate attention. If, during taxi or landing roll, braking action decreases, let up on the pedals and then re-apply the brakes with heavy pressure. If the brakes become spongy or pedal travel increases, pumping the pedals should build braking pressure. If one brake becomes weak or fails, use the other brake sparingly while using opposite rudder, as required, to offset the good brake.

## ELECTRICAL SYSTEM

The airplane is equipped with a 28-volt, direct-current electrical

system (see figure 7-9). The system uses a battery located on the forward side, upper left portion, of the firewall as the source of electrical energy and a belt-driven, 60-amp alternator (or 95-amp, if installed) to maintain the battery's state of charge. Power is supplied to most general electrical and all avionics circuits through the primary bus bar and the avionics bus bar, which are interconnected by an avionics power switch. The primary bus is on anytime the master switch is turned on, and is not affected by starter or external power usage. Both bus bars are on anytime the master and avionics power switches are turned on. The airplane may be equipped with a dual 60-amp alternator electrical system. Details of this system are presented in Section 9, Supplements.

### **CAUTION**

Prior to turning the master switch on or off, starting the engine or applying an external source, the avionics power switch labeled AVN PWR should be turned off to prevent any harmful transient voltage from damaging the avionics equipment.

### **MASTER SWITCH**

The master switch is a split-rocker type switch labeled MASTER, and is on in the up position and off in the down position. The right half of the switch, labeled BAT, controls electrical power to the airplane through the primary bus bar. The left half, labeled ALT, controls the alternator.

Normally, both sides of the master switch should be used simultaneously; however, the BAT side of the switch could be turned on separately to check equipment while on the ground. To check or use avionics equipment or radios while on the ground, the avionics power switch must also be turned on. The ALT side of the switch, when placed in the off position, removes the alternator from the electrical system. With this switch in the off position, the entire electrical load is placed on the battery. Continued operation with the alternator switch in the off position will reduce battery power low enough to open the battery contactor, remove power from the alternator field, and prevent alternator restart.

### **AVIONICS POWER SWITCH**

Electrical power from the airplane primary bus to the avionics bus (see figure 7-9) is controlled by a rocker-type circuit breaker-switch labeled AVN PWR. The switch is located on the left sidewall circuit breaker panel and is ON in the forward position and OFF in the aft position. With the switch in the OFF position, no electrical power will be applied to the avionics equipment, regardless of the position of the master switch or the individual equipment switches. The avionics power switch also functions

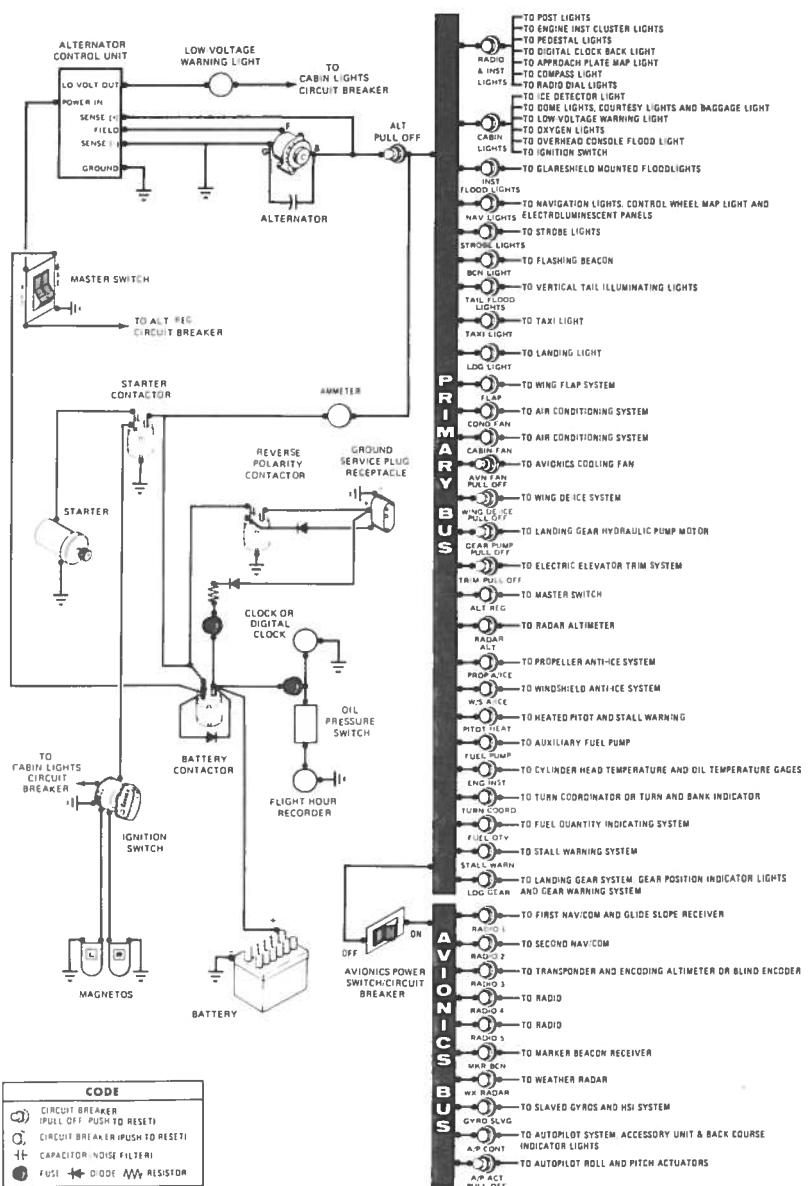


Figure 7-9. Electrical System

as a circuit breaker. If an electrical malfunction should occur and cause the circuit breaker to open, electrical power to the avionics equipment will be interrupted and the switch will automatically move to the OFF position. If this occurs, allow the circuit breaker to cool approximately two minutes before placing the switch in the ON position again. If the circuit breaker opens again, do not reset it. The avionics power switch should be placed in the OFF position prior to turning the master switch on or off, starting the engine, or applying an external power source, and may be utilized in place of the individual avionics equipment switches.

## AMMETER

The ammeter, located on the upper right side of the instrument panel, indicates the amount of current, in amperes, from the alternator to the battery or from the battery to the airplane electrical system. When the engine is operating and the master switch is turned on, the ammeter indicates the charging rate applied to the battery. In the event the alternator is not functioning or the electrical load exceeds the output of the alternator, the ammeter indicates the battery discharge rate.

## ALTERNATOR CONTROL UNIT AND LOW-VOLTAGE WARNING LIGHT

The airplane is equipped with a combination alternator regulator high-low voltage control unit mounted on the cabin side of the firewall and red warning light, labeled LOW VOLTAGE, near the upper left corner of the instrument panel.

In the event an over-voltage condition occurs, the alternator control unit automatically removes alternator field current which shuts down the alternator. The battery will then supply system current as shown by a discharge rate on the ammeter. Under these conditions, depending on electrical system load, the low-voltage warning light will illuminate when system voltage drops below normal. The alternator control unit may be reset by turning the master switch off and back on again. If the warning light does not illuminate, normal alternator charging has resumed; however, if the light does illuminate again, a malfunction has occurred, and the flight should be terminated as soon as practicable.

### NOTE

Illumination of the low-voltage light and ammeter discharge indications may occur during low RPM conditions with an electrical load on the system, such as during a low RPM taxi. Under these conditions, the light will go out at higher RPM. The master switch need not be recycled since an over-voltage condition has not occurred to de-activate the alternator system. Momentary illumination of the low-voltage warning light and/or ammeter needle deflection

may also occur during startup of the landing gear system hydraulic pump motor.

The warning light may be tested by turning on the landing lights and momentarily turning off the ALT portion of the master switch while leaving the BAT portion turned on.

## CIRCUIT BREAKERS AND FUSES

Most of the electrical circuits in the airplane are protected by "push-to-reset" type circuit breakers mounted on a single circuit breaker panel on the left cabin sidewall between the forward doorpost and the instrument panel. Six "pull off" type circuit breakers on this panel protect the alternator output, landing gear system hydraulic pump motor, wing and stabilizer de-ice system, electric elevator trim system, autopilot pitch and roll actuators and the avionics cooling fan circuits. All of the avionics circuits are protected by circuit breakers grouped together in the lower portion of the circuit breaker panel and also by a rocker-type circuit breaker switch labeled AVN PWR. Fuses protect the battery contactor closing circuit (when used with external power), and the clock and flight hour recorder circuits.

## GROUND SERVICE PLUG RECEPTACLE

A ground service plug receptacle may be installed to permit the use of an external power source for cold weather starting and during lengthy maintenance work on the airplane electrical system. Details of the ground service plug receptacle are presented in Section 9, Supplements.

## LIGHTING SYSTEMS

### EXTERIOR LIGHTING

Conventional navigation lights are located on the wing tips and tail stinger, and dual landing lights are installed in the cowl nose cap. Additional lighting is available and includes a strobe light on each wing tip, a flashing beacon on top of the vertical stabilizer, two courtesy lights, one under each wing, just outboard of the cabin door, and vertical tail illumination lights, mounted on the top of each horizontal stabilizer. Details of the strobe light system are presented in Section 9, Supplements. The courtesy lights are operated by a switch located on the left rear door post. All exterior lights, except the courtesy lights, are controlled by rocker-type switches on the left switch and control panel. The switches are on in the up position and off in the down position.

The flashing beacon should not be used when flying through clouds or overcast; the flashing light reflected from water droplets or particles in the atmosphere, particularly at night, can produce vertigo and loss of orientation.

## INTERIOR LIGHTING

Instrument and control panel lighting is provided by flood and integral lighting, with electroluminescent and post lighting also available. Rheostats and control knobs, located on the left switch and control panel, control the intensity of all lighting. The following paragraphs describe the various lighting systems and their controls.

Switches and controls on the lower part of the instrument panel and the marker beacon/audio control panel may be lighted by electroluminescent panels which do not require light bulbs for illumination. To utilize this lighting, turn on the NAV light switch and adjust light intensity with the small (inner) control knob of the concentric control knobs labeled EL PANEL, ENG-RADIO.

Instrument panel flood lighting consists of six red flood lights on the underside of the glare shield, up to eight red post lights for the bottom and left and right instruments, and two red flood lights in the forward part of the overhead console (one, if an air conditioner is installed). All of these lights are utilized by adjusting light intensity with the large (outer) control knob of the concentric control knobs labeled POST, FLOOD.

The instrument panel may be equipped with white post lights which are mounted at the edge of each instrument or control and provide direct lighting. To operate the post lights, adjust light intensity with the small (inner) control knob of the concentric control knobs labeled POST, FLOOD. To combine post and flood lighting, adjust flood light intensity with the large (outer) control knob.

The engine instrument cluster, radio equipment, digital clock, and magnetic compass have integral lighting and operate independently of post or flood lighting. The light intensity of instrument cluster, magnetic compass, digital clock, and radio equipment lighting is controlled by the large (outer) control knob of the concentric control knobs labeled EL PANEL, ENG-RADIO. If the airplane is equipped with avionics incorporating incandescent digital readouts, the ENG-RADIO (large outer) control knob controls the light intensity of the digital readouts. For daylight operation, the control knob should be rotated full counterclockwise to produce maximum light intensity for the digital readouts only. Clockwise rotation of the control knob will provide normal variable light intensity for nighttime operation.

If the airplane is equipped with a Cessna 400B Integrated Flight Control System, individual dimming of both the white and the green Mode Selector panel lamps is provided by the concentric control knobs labeled IFCS, WHITE, GREEN. A push-to-test feature is incorporated into the small (inner) knob to test for proper green mode selector lamp operation.

The control pedestal has integral lights, and a white post light adjacent to the fuel on-off valve. If the airplane is equipped with oxygen or air conditioning, the overhead console is illuminated by post lights. Pedestal and console light intensity is controlled by the large (outer) control knob of the concentric control knobs labeled POST, FLOOD.

Map lighting is provided by overhead console map lights and a glare shield mounted map light. The airplane may also be equipped with a control wheel map light. The overhead console map lights (not installed if an air conditioner is installed) operate in conjunction with instrument panel flood lighting and consist of two openings just aft of the red instrument panel flood lights. The map light openings have sliding covers controlled by small round knobs which uncover the openings when moved toward each other. The covers should be kept closed unless the map lights are required. A map light and toggle switch, mounted in front of the pilot on the underside of the glare shield, is used for illuminating approach plates or other charts when using a control wheel mounted approach plate holder. The switch is labeled MAP LIGHT ON, OFF and light intensity is controlled by the POST, FLOOD control knob. A map light mounted on the bottom of the pilot's control wheel illuminates the lower portion of the cabin in front of the pilot, and is used for checking maps and other flight data during night operation. The light is utilized by turning on the NAV LIGHTS switch, and adjusting light intensity with the rheostat control knob on the bottom of the control wheel.

The airplane is equipped with a dome light aft of the overhead console, and a baggage compartment light above the baggage area. The lights are operated by a slide-type switch, adjacent to the dome light.

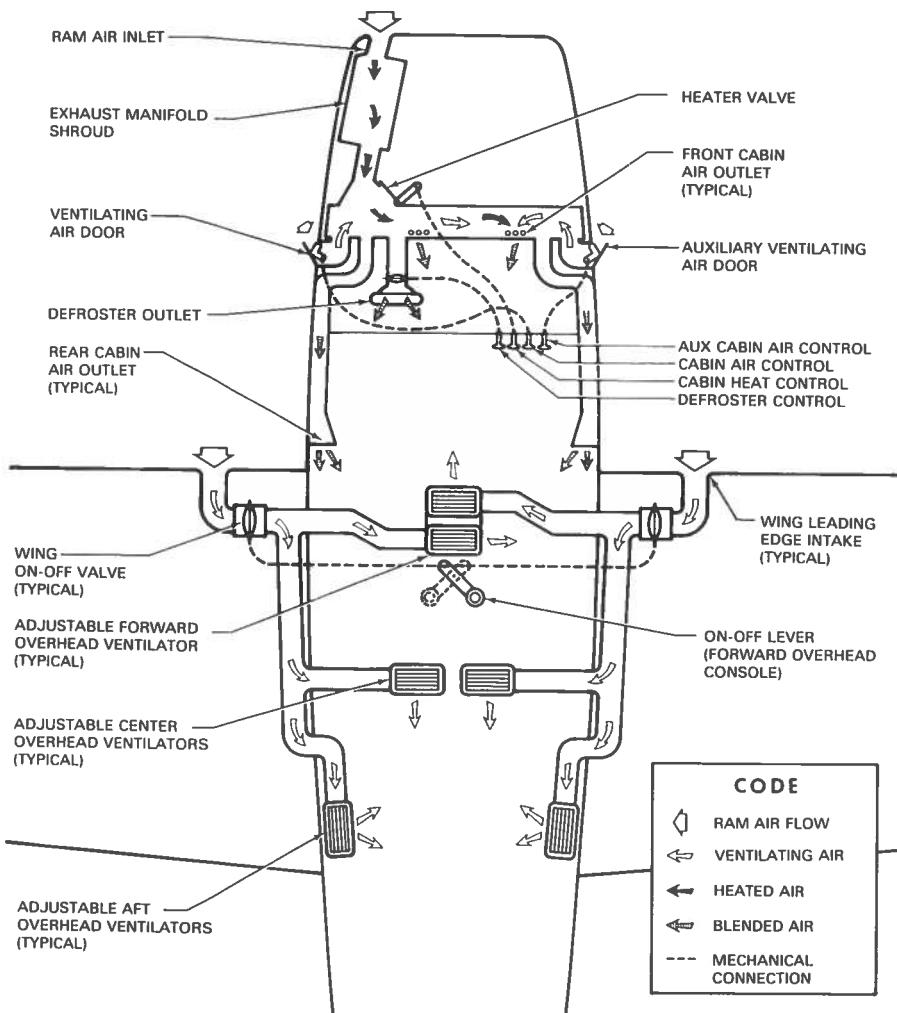
The most probable cause of a light failure is a burned out bulb; however, in the event any of the lighting systems fail to illuminate when turned on, check the appropriate circuit breaker. If the circuit breaker has opened (white button popped out), and there is no obvious indication of a short circuit (smoke or odor), turn off the light switch of the affected lights, reset the breaker, and turn the switch on again. If the breaker opens again, do not reset it.

## CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM

The temperature and volume of airflow into the cabin can be regulated

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**Figure 7-10. Cabin Heating, Ventilating, and Defrosting System**

by manipulation of the push-pull CABIN HEAT and CABIN AIR control knobs (see figure 7-10). When partial cabin heat is desired, blending warm and cold air will result in improved ventilation and heat distribution throughout the cabin. Additional outside air for summer ventilation is provided through the heat and vent system by operation of the push-pull AUX CABIN AIR knob. All three control knobs are the double button type with locks to permit intermediate settings.

Front cabin heat and ventilating air is supplied by outlet holes spaced across a cabin manifold just forward of the pilot's and copilot's feet. Rear cabin heat and air is supplied by two ducts from the manifold, one extending down each side of the cabin to an outlet at the front door post at floor level.

Windshield defrost air is supplied by a duct from the cabin manifold to an outlet on top of the antiglare shield; therefore, the temperature of the defrosting air is the same as heated cabin air. A push-pull type control knob, labeled DEFROST, regulates the volume of air to the windshield. Pulling out on the knob increases defroster air flow.

Additional cabin ventilating air is supplied by two adjustable ventilators mounted in the forward and aft overhead consoles and one ventilator in each console located above the rear side windows. Flow to the outlets is controlled by valves in each wing root, as selected by a single lever in the forward overhead console labeled OVERHEAD AIR VENTS. In the ON (right) position, the valves are open and ventilating airflow from the wing leading edge intakes is supplied to all the adjustable outlets. When the OFF (left) position is selected, the valves are closed and flow to the outlets is shut off. An air conditioning system may be installed in the airplane. Details of this system are presented in Section 9, Supplements.

## OXYGEN SYSTEM

The airplane is equipped with a partial oxygen system which consists of the outlets, pressure gage, a filler valve, associated plumbing, and an on-off control. If the airplane is equipped with a complete oxygen system, refer to Section 9, Supplements, for complete details and operating instructions.

## PITOT-STATIC SYSTEM AND INSTRUMENTS

The pitot-static system supplies ram air pressure to the airspeed indicator and static pressure to the airspeed indicator, vertical speed indicator and altimeter. The system is composed of a pitot tube mounted on the lower surface of the left wing, two external static ports, one on each side of the fuselage below the rear corners of the aft side windows, and the associated plumbing necessary to connect the instruments to the sources.

The airplane may also be equipped with a pitot heat system. The system consists of a heating element in the pitot tube, a rocker-type switch labeled PITOT HEAT on the lower left side of the instrument panel, a 10-amp circuit breaker on the left sidewall circuit breaker panel, and associated wiring. When the pitot heat switch is turned on, the element in the pitot tube is heated electrically to maintain proper operation in possible icing conditions. Pitot heat should be used only as required.

A static pressure alternate source valve is installed on the left side of the lower instrument panel and can be used if the external static source is malfunctioning. This valve supplies static pressure from inside the cabin instead of the external static ports.

If erroneous instrument readings are suspected due to water or ice in the pressure lines going to the standard external static pressure source, the alternate static source valve should be pulled on.

Pressures within the cabin will vary with open cabin ventilators and windows. Refer to Sections 3 and 5 for the effect of varying cabin pressures on airspeed and altimeter readings.

## AIRSPEED INDICATOR

The airspeed indicator is calibrated in knots and miles per hour. Limitation and range markings (in KIAS) include the white arc (58 to 115 knots), green arc (74 to 168 knots), yellow arc (168 to 203 knots), and a red line (203 knots).

If a true airspeed indicator is installed, it is equipped with a rotatable ring which works in conjunction with the airspeed indicator dial in a manner similar to the operation of a flight computer. To operate the indicator, first rotate the ring until pressure altitude is aligned with outside air temperature in degrees Fahrenheit. Pressure altitude should not be confused with indicated altitude. To obtain pressure altitude, momentarily set the barometric scale on the altimeter to 29.92 and read pressure altitude on the altimeter. Be sure to return the altimeter barometric scale to the original barometric setting after pressure altitude has been obtained. Having set the ring to correct for altitude and temperature, read the true airspeed shown on the rotatable ring by the indicator pointer. For best accuracy, the indicated airspeed should be corrected to calibrated airspeed by referring to the Airspeed Calibration chart in Section 5. Knowing the calibrated airspeed, read true airspeed on the ring opposite the calibrated airspeed.

## VERTICAL SPEED INDICATOR

The vertical speed indicator depicts airplane rate of climb or descent in

feet per minute. The pointer is actuated by atmospheric pressure changes resulting from changes of altitude as supplied by the static source.

## ALTIMETER

Airplane altitude is depicted by a barometric type altimeter. A knob near the lower left portion of the indicator provides adjustment of the instrument's barometric scale to the current altimeter setting.

# VACUUM SYSTEMS AND INSTRUMENTS

Two engine-driven vacuum systems are available and provide the suction necessary to operate the attitude indicator and directional indicator. One system (see figure 7-11) consists of a single vacuum pump on the engine, a vacuum relief valve and vacuum system air filter on the aft side of the firewall below the instrument panel, vacuum-operated instruments, and a suction gage on the left side of the instrument panel. The other vacuum system (see figure 7-12) offers a dual pump installation on the rear of the engine, two vacuum relief valves a system air filter, a check valve manifold, vacuum-operated instruments, and a suction gage, equipped with dual warning indicators labeled L and R, on the left side of the instrument panel.

## ATTITUDE INDICATOR

An attitude indicator is available and gives a visual indication of flight attitude. Bank attitude is presented by a pointer at the top of the indicator relative to the bank scale which has index marks at 10°, 20°, 30°, 60°, and 90° either side of the center mark. Pitch and roll attitudes are presented by a miniature airplane superimposed over a symbolic horizon area divided into two sections by a white horizon bar. The upper "blue sky" area and the lower "ground" area have arbitrary pitch reference lines useful for pitch attitude control. A knob at the bottom of the instrument is provided for in-flight adjustment of the miniature airplane to the horizon bar for a more accurate flight attitude indication.

## DIRECTIONAL INDICATOR

A directional indicator is available and displays airplane heading on a compass card in relation to a fixed simulated airplane image and index. The directional indicator will precess slightly over a period of time. Therefore, the compass card should be set in accordance with the magnetic compass just prior to takeoff, and occasionally re-adjusted on extended flights. A knob on the lower left edge of the instrument is used to adjust the compass card to correct for any precession.

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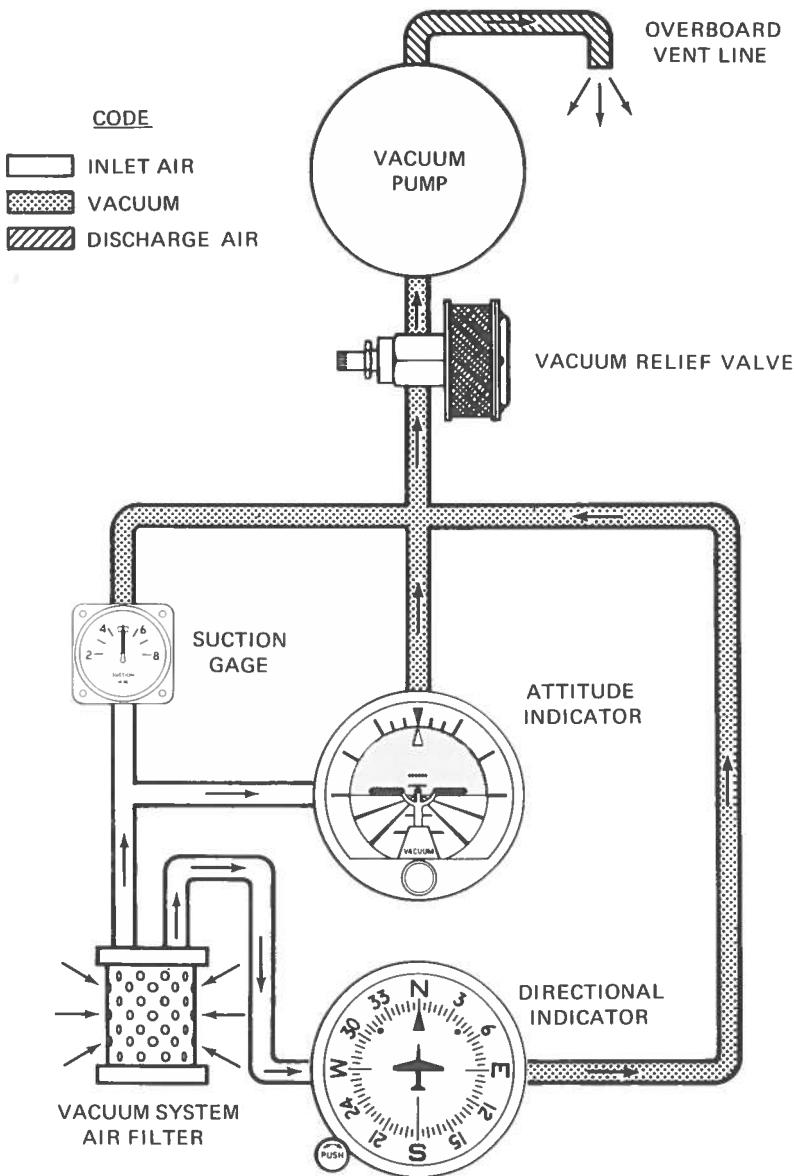


Figure 7-11. Single-Pump Vacuum System

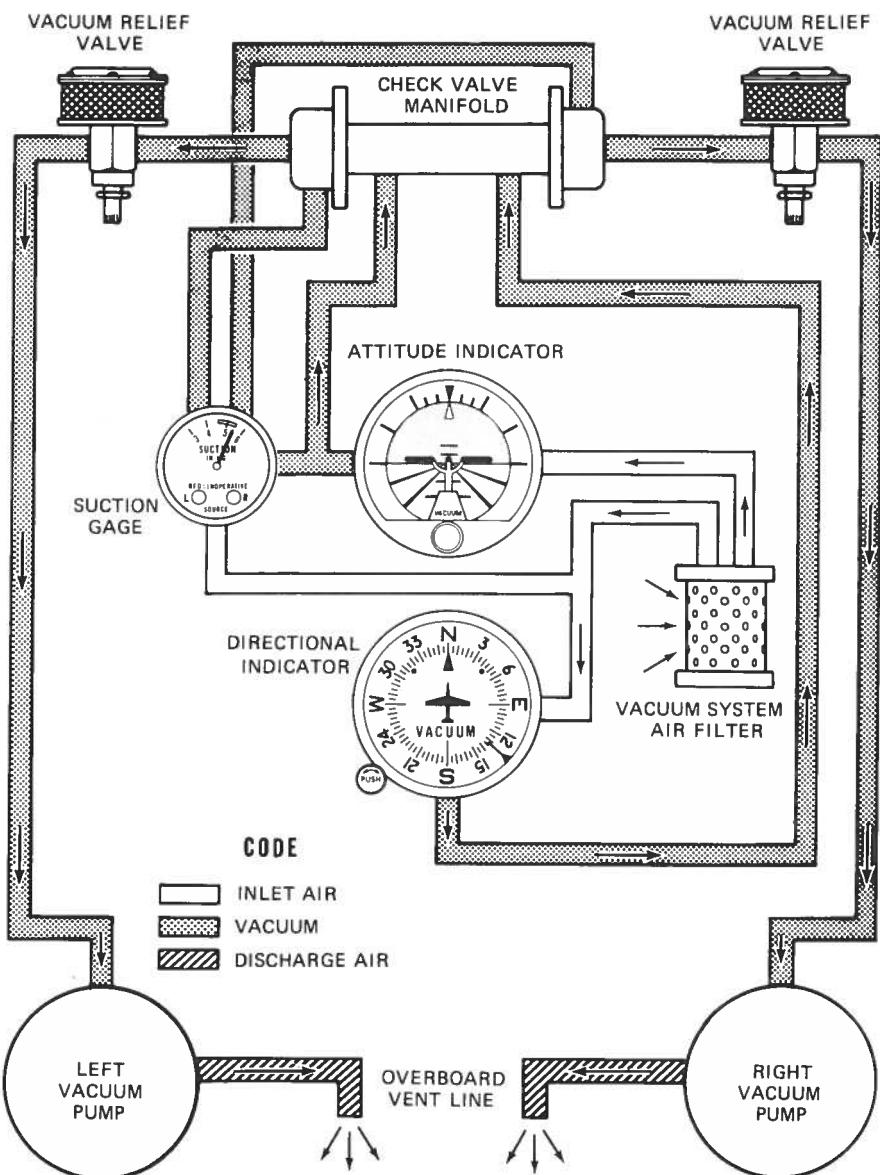


Figure 7-12. Dual-Pump Vacuum System

## SUCTION GAGE

A suction gage is located on the left side of the instrument panel when the airplane is equipped with a vacuum system. Suction available for operation of the attitude indicator and directional indicator is shown by this gage, which is calibrated in inches of mercury. The desired suction range is 4.6 to 5.4 inches of mercury. A suction reading out of this range may indicate a system malfunction or improper adjustment, and in this case, the indicators should not be considered reliable.

If the airplane is equipped with a dual vacuum pump system, the suction gage incorporates two red warning buttons, marked L and R, which extend visibly in the event either or both sources fail.

## STALL WARNING SYSTEM

The airplane is equipped with a vane-type stall warning unit in the leading edge of the left wing. The unit is electrically connected to a dual warning unit located above the right cabin door behind the headliner. The vane in the wing senses the change in airflow over the wing, and operates the dual warning unit, which produces a continuous tone over the airplane speaker between 5 and 10 knots above the stall in all configurations.

If the airplane has a heated stall warning system, the vane-type unit in the wing leading edge is equipped with a heating element. The heated part of the system is operated by the PITOT HEAT switch, and is protected by the PITOT HEAT circuit breaker.

The stall warning system should be checked during the preflight inspection by momentarily turning on the master switch and actuating the vane in the wing. The system is operational if a continuous tone is heard on the airplane speaker as the vane is pushed upward.

## AVIONICS SUPPORT EQUIPMENT

If the airplane is equipped with avionics, various avionics support equipment may also be installed. Equipment available includes an avionics cooling fan, microphone-headset installations and control surface static dischargers. The following paragraphs discuss these items. Description and operation of radio equipment is covered in Section 9 of this handbook.

## AVIONICS COOLING FAN

An avionics cooling fan system is provided whenever a factory-installed Nav/Com radio is installed. The system is designed to provide internal cooling air from a small electric fan to the avionics units and thereby eliminate the possibility of moisture contamination using an external cooling air source.

Power to the electric fan is supplied directly from a "pull-off" type circuit breaker labeled AVN FAN, located on the left sidewall circuit breaker panel. Hence, power is supplied to the fan anytime the master switch is ON. This arrangement provides air circulation through the radios to remove a possible heat soak condition before the radios are turned on after engine start. It is recommended that the circuit breaker be left ON except during periods of lengthy maintenance with the master switch ON.

## MICROPHONE-HEADSET INSTALLATIONS

Three types of microphone-headset installations are offered. The standard system provided with avionics equipment includes a hand-held microphone and separate headset. The keying switch for this microphone is on the microphone. Two optional microphone-headset installations are also available; these feature a single-unit microphone-headset combination which permits the pilot or front passenger to conduct radio communications without interrupting other control operations to handle a hand-held microphone. One microphone-headset combination is a lightweight type without a padded headset and the other version has a padded headset. The microphone-headset combinations utilize a remote keying switch located on the left grip of the pilot's control wheel and, if an optional intercom system is installed, a second switch on the right grip of the front passenger's control wheel. The microphone and headset jacks are located on the lower left and right sides of the instrument panel. Audio to all three headsets is controlled by the individual audio selector switches and adjusted for volume level by using the selected receiver volume controls.

### NOTE

When transmitting, with the hand-held microphone, the pilot should key the microphone, place the microphone as close as possible to the lips and speak directly into it.

## STATIC DISCHARGERS

If frequent IFR flights are planned, installation of wick-type static dischargers is recommended to improve radio communications during flight through dust or various forms of precipitation (rain, snow or ice

crystals). Under these conditions, the build-up and discharge of static electricity from the trailing edges of the wings, rudder, elevator, propeller tips, and radio antennas can result in loss of usable radio signals on all communications and navigation radio equipment. Usually the ADF is first to be affected and VHF communication equipment is the last to be affected.

Installation of static dischargers reduces interference from precipitation static, but it is possible to encounter severe precipitation static conditions which might cause the loss of radio signals, even with static dischargers installed. Whenever possible, avoid known severe precipitation areas to prevent loss of dependable radio signals. If avoidance is impractical, minimize airspeed and anticipate temporary loss of radio signals while in these areas.

# SECTION 8

# AIRPLANE HANDLING, SERVICE & MAINTENANCE

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## INTRODUCTION

This section contains factory-recommended procedures for proper ground handling and routine care and servicing of your Cessna. It also identifies certain inspection and maintenance requirements which must be followed if your airplane is to retain that new-plane performance and dependability. It is wise to follow a planned schedule of lubrication and preventive maintenance based on climatic and flying conditions encountered in your locality.

Keep in touch with your Cessna Dealer and take advantage of his knowledge and experience. He knows your airplane and how to maintain it. He will remind you when lubrications and oil changes are necessary, and about other seasonal and periodic services.

## IDENTIFICATION PLATE

All correspondence regarding your airplane should include the SERIAL NUMBER. The Serial Number, Model Number, Production Certificate Number (PC) and Type Certificate Number (TC) can be found on the Identification Plate, located on the lower part of the left forward doorpost. Located adjacent to the Identification Plate is a Finish and Trim Plate which contains a code describing the interior color scheme and exterior paint combination of the airplane. The code may be used in conjunction with an applicable Parts Catalog if finish and trim information is needed.

## OWNER NOTIFICATION SYSTEM

As the owner of a Cessna, you will receive applicable Cessna Owner Advisories at no charge. These Owner Advisories will be mailed to owners of record. A subscription service for Service Information Letters is available directly from the Cessna Customer Services Department. Your Cessna Dealer will be glad to supply you with details concerning this subscription program, and stands ready, through his Service Department, to supply you with fast, efficient, low-cost service.

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**PUBLICATIONS**

Various publications and flight operation aids are furnished in the airplane when delivered from the factory. These items are listed below.

- CUSTOMER CARE PROGRAM BOOK
- PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL
- PILOT'S CHECKLISTS
- POWER COMPUTER
- WORLDWIDE CUSTOMER CARE DIRECTORY
- DO'S AND DON'TS ENGINE BOOKLET

The following additional publications, plus many other supplies that are applicable to your airplane, are available from your Cessna Dealer.

- INFORMATION MANUAL (Contains Pilot's Operating Handbook Information)
- SERVICE MANUALS AND PARTS CATALOGS FOR YOUR:  
AIRPLANE  
ENGINE AND ACCESSORIES  
AVIONICS AND AUTOPILOT

Your Cessna Dealer has a Customer Care Supplies Catalog covering all available items, many of which he keeps on hand. He will be happy to place an order for any item which is not in stock.

**NOTE**

A Pilot's Operating Handbook and FAA Approved Airplane Flight Manual which is lost or destroyed may be replaced by contacting your Cessna Dealer or writing directly to the Customer Services Department, Cessna Aircraft Company, Wichita, Kansas. An affidavit containing the owner's name, airplane serial number and registration number must be included in replacement requests since the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual is identified for specific airplanes only.

## AIRPLANE FILE

There are miscellaneous data, information and licenses that are a part of the airplane file. The following is a checklist for that file. In addition, a periodic check should be made of the latest Federal Aviation Regulations to ensure that all data requirements are met.

- A. To be displayed in the airplane at all times:
  - 1. Aircraft Airworthiness Certificate (FAA Form 8100-2).
  - 2. Aircraft Registration Certificate (FAA Form 8050-3).
  - 3. Aircraft Radio Station License, if transmitter installed (FCC Form 556).
- B. To be carried in the airplane at all times:
  - 1. Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.
  - 2. Weight and Balance, and associated papers (latest copy of the Repair and Alteration Form, FAA Form 337, if applicable).
  - 3. Equipment List.
- C. To be made available upon request:
  - 1. Airplane Log Book.
  - 2. Engine Log Book.

Most of the items listed are required by the United States Federal Aviation Regulations. Since the Regulations of other nations may require other documents and data, owners of airplanes not registered in the United States should check with their own aviation officials to determine their individual requirements.

Cessna recommends that these items, plus the Pilot's Checklists, Power Computer, Customer Care Program book and Customer Care Card, be carried in the airplane at all times.

## AIRPLANE INSPECTION PERIODS

### FAA REQUIRED INSPECTIONS

As required by Federal Aviation Regulations, all civil aircraft of U.S. registry must undergo a complete inspection (annual) each twelve calendar months. In addition to the required ANNUAL inspection, aircraft operated commercially (for hire) must have a complete inspection every 100 hours of operation.

The FAA may require other inspections by the issuance of airworthi-

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ness directives applicable to the airplane, engine, propeller and components. It is the responsibility of the owner/operator to ensure compliance with all applicable airworthiness directives and, when the inspections are repetitive, to take appropriate steps to prevent inadvertent noncompliance.

In lieu of the 100 HOUR and ANNUAL inspection requirements, an airplane may be inspected in accordance with a progressive inspection schedule, which allows the work load to be divided into smaller operations that can be accomplished in shorter time periods.

The CESSNA PROGRESSIVE CARE PROGRAM has been developed to provide a modern progressive inspection schedule that satisfies the complete airplane inspection requirements of both the 100 HOUR and ANNUAL inspections as applicable to Cessna airplanes. The program assists the owner in his responsibility to comply with all FAA inspection requirements, while ensuring timely replacement of life-limited parts and adherence to factory-recommended inspection intervals and maintenance procedures.

**CESSNA PROGRESSIVE CARE**

The Cessna Progressive Care Program has been designed to help you realize maximum utilization of your airplane at a minimum cost and downtime. Under this program, your airplane is inspected and maintained in four operations at 50-hour intervals during a 200-hour period. The operations are recycled each 200 hours and are recorded in a specially provided Aircraft Inspection Log as each operation is conducted.

The Cessna Aircraft Company recommends Progressive Care for airplanes that are being flown 200 hours or more per year, and the 100-hour inspection for all other airplanes. The procedures for the Progressive Care Program and the 100-hour inspection have been carefully worked out by the factory and are followed by the Cessna Dealer Organization. The complete familiarity of Cessna Dealers with Cessna equipment and factory-approved procedures provides the highest level of service possible at lower cost to Cessna owners.

Regardless of the inspection method selected by the owner, he should keep in mind that FAR Part 43 and FAR Part 91 establishes the requirement that properly certified agencies or personnel accomplish all required FAA inspections and most of the manufacturer recommended inspections.

**CESSNA CUSTOMER CARE PROGRAM**

Specific benefits and provisions of the CESSNA WARRANTY plus other important benefits for you are contained in your CUSTOMER CARE

PROGRAM book supplied with your airplane. You will want to thoroughly review your Customer Care Program book and keep it in your airplane at all times.

Coupons attached to the Program book entitle you to an initial inspection and either a Progressive Care Operation No. 1 or the first 100-hour inspection within the first 6 months of ownership at no charge to you. If you take delivery from your Dealer, the initial inspection will have been performed before delivery of the airplane to you. If you pick up your airplane at the factory, plan to take it to your Dealer reasonably soon after you take delivery, so the initial inspection may be performed allowing the Dealer to make any minor adjustments which may be necessary.

You will also want to return to your Dealer either at 50 hours for your first Progressive Care Operation, or at 100 hours for your first 100-hour inspection depending on which program you choose to establish for your airplane. While these important inspections will be performed for you by any Cessna Dealer, in most cases you will prefer to have the Dealer from whom you purchased the airplane accomplish this work.

## PILOT CONDUCTED PREVENTIVE MAINTENANCE

A certified pilot who owns or operates an airplane not used as an air carrier is authorized by FAR Part 43 to perform limited maintenance on his airplane. Refer to FAR Part 43 for a list of the specific maintenance operations which are allowed.

### NOTE

Pilots operating airplanes of other than U.S. registry should refer to the regulations of the country of certification for information on preventive maintenance that may be performed by pilots.

A Service Manual should be obtained prior to performing any preventive maintenance to ensure that proper procedures are followed. Your Cessna Dealer should be contacted for further information or for required maintenance which must be accomplished by appropriately licensed personnel.

## ALTERATIONS OR REPAIRS

It is essential that the FAA be contacted **prior to** any alterations on the airplane to ensure that airworthiness of the airplane is not violated. Alterations or repairs to the airplane must be accomplished by licensed personnel.

## GROUND HANDLING

### TOWING

The airplane is most easily and safely maneuvered by hand with the tow-bar attached to the nose wheel. When towing with a vehicle, do not exceed the nose gear turning angle of 35° either side of center, or damage to the gear will result. If the airplane is towed or pushed over a rough surface during hangaring, watch that the normal cushioning action of the nose strut does not cause excessive vertical movement of the tail and the resulting contact with low hangar doors or structure. A flat nose tire or deflated strut will also increase tail height.

### PARKING

When parking the airplane, head into the wind and set the parking brakes. Do not set the parking brakes during cold weather when accumulated moisture may freeze the brakes, or when the brakes are overheated. Close the cowl flaps, (except when engine is hot in hot weather), install the control wheel lock and chock the wheels. When the airplane is parked on a slope, place the fuel selector handle in the LEFT ON or RIGHT ON position, whichever corresponds to the low wing. This action minimizes cross-feeding from the fuller tank and reduces fuel seepage from the wing tank vents. In severe weather and high wind conditions, tie the airplane down as outlined in the following paragraph.

### TIE-DOWN

Proper tie-down procedure is the best precaution against damage to the parked airplane by gusty or strong winds. To tie-down the airplane securely, proceed as follows:

1. Set the parking brake and install the control wheel lock.
2. Install a surface control lock over the fin and rudder.
3. Tie sufficiently strong ropes or chains (700 pounds tensile strength) to the wing and tail tie-down fittings and secure each rope or chain to a ramp tie-down.
4. Tie a rope (no chains or cables) to the nose gear torque link and secure to a ramp tie-down.
5. Install a pitot tube cover.

### JACKING

When a requirement exists to jack the entire airplane off the ground, or when wing jack points are used in the jacking operation, refer to the

Service Manual for specific procedures and equipment required.

A jack pad assembly is available to facilitate jacking individual main gear. When using the individual gear strut jack pad, flexibility of the gear strut will cause the main wheel to slide inboard as the wheel is raised, tilting the jack. The jack must then be lowered for a second jacking operation. **Do not** jack both main wheels simultaneously using the individual main gear jack pads.

If nose gear maintenance is required, the nose wheel may be raised off the ground by pressing down on a tailcone bulkhead, just forward of the horizontal stabilizer, and allowing the tail to rest on the tail tie-down ring.

**NOTE**

Do not apply pressure on the elevator or outboard horizontal stabilizer surfaces. When pushing on the tailcone, always apply pressure at a bulkhead to avoid buckling the skin.

To assist in raising and holding the nose wheel off the ground, weight down the tail by placing sand-bags, or suitable weights, on each side of the horizontal stabilizer, next to the fuselage. If ground anchors are available, the tail should be securely tied down.

**NOTE**

Ensure that the nose will be held off the ground under all conditions by means of suitable stands or supports under weight supporting bulkheads near the nose of the airplane.

**LEVELING**

Longitudinal leveling of the airplane is accomplished by placing a level on the leveling screws located on the left side of the tailcone. Deflate the nose tire and/or lower or raise the nose strut to properly center the bubble in the level. Corresponding points on either the upper or lower main door sills may be used to level the airplane laterally.

**FLYABLE STORAGE**

Airplanes placed in non-operational storage for a maximum of 30 days or those which receive only intermittent operational use for the first 25 hours are considered in flyable storage status. Every seventh day during these periods, the propeller should be rotated by hand through five

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revolutions. This action "limbers" the oil and prevents any accumulation of corrosion on engine cylinder walls.

**WARNING**

For maximum safety, check that the ignition switch is OFF, the throttle is closed, the mixture control is in the idle cut-off position, and the airplane is secured before rotating the propeller by hand. Do not stand within the arc of the propeller blades while turning the propeller.

After 30 days, the airplane should be flown for 30 minutes or a ground runup should be made just long enough to produce an oil temperature within the lower green arc range. Excessive ground runup should be avoided.

Engine runup also helps to eliminate excessive accumulations of water in the fuel system and other air spaces in the engine. Keep fuel tanks full to minimize condensation in the tanks. Keep the battery fully charged to prevent the electrolyte from freezing in cold weather. If the airplane is to be stored temporarily, or indefinitely, refer to the Service Manual for proper storage procedures.

**SERVICING**

In addition to the PREFLIGHT INSPECTION covered in Section 4, COMPLETE servicing, inspection, and test requirements for your airplane are detailed in the Service Manual. The Service Manual outlines all items which require attention at 50, 100, and 200 hour intervals plus those items which require servicing, inspection, and/or testing at special intervals.

Since Cessna Dealers conduct all service, inspection, and test procedures in accordance with applicable Service Manuals, it is recommended that you contact your Cessna Dealer concerning these requirements and begin scheduling your airplane for service at the recommended intervals.

Cessna Progressive Care ensures that these requirements are accomplished at the required intervals to comply with the 100-hour or ANNUAL inspection as previously covered.

Depending on various flight operations, your local Government Aviation Agency may require additional service, inspections, or tests. For

these regulatory requirements, owners should check with local aviation officials where the airplane is being operated.

For quick and ready reference, quantities, materials, and specifications for frequently used service items are as follows:

## ENGINE OIL

### GRADE AND VISCOSITY FOR TEMPERATURE RANGE --

All temperatures, use SAE 20W-50 or

Above 4°C (40°F), use SAE 50

Below 4°C (40°F), use SAE 30

Multi-viscosity oil with a range of SAE 20W-50 is recommended for improved starting and turbocharger controller operation in cold weather. Ashless dispersant oil, conforming to Continental Motors Specification MHS-24 (and all revisions thereto), must be used.

### NOTE

Your Cessna was delivered from the factory with a corrosion preventive aircraft engine oil. If oil must be added during the first 25 hours, use only aviation grade straight mineral oil conforming to Specification No. MIL-L-6082.

### CAPACITY OF ENGINE SUMP -- 10 Quarts.

Do not operate on less than 7 quarts. To minimize loss of oil through breather, fill to 8 quart level for normal flights of less than 3 hours. For extended flight, fill to 10 quarts. These quantities refer to oil dipstick level readings. During oil and oil filter changes, one additional quart is required.

### OIL AND OIL FILTER CHANGE --

After the first 25 hours of operation, drain engine oil sump and replace filter. Refill sump with straight mineral oil and use until a total of 50 hours has accumulated or oil consumption has stabilized; then change to dispersant oil and replace the filter. Drain the engine oil sump and replace the filter each 50 hours thereafter. The oil change interval may be extended to 100-hour intervals, providing the oil filter is changed at 50-hour intervals. Change engine oil at least every 6 months even though less than the recommended hours have accumulated. Reduce intervals for prolonged operation in dusty areas, cold climates, or when short flights and long idle periods result in sludging conditions.

### NOTE

During the first 25-hour oil and filter change, a general inspection of the overall engine compartment is required. Items which are not normally checked during a preflight

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inspection should be given special attention. Hoses, metal lines and fittings should be inspected for signs of oil and fuel leaks, and checked for abrasions, chafing, security, proper routing and support, and evidence of deterioration. Inspect the intake and exhaust systems for cracks, evidence of leakage, and security of attachment. Engine controls and linkages should be checked for freedom of movement through their full range, security of attachment and evidence of wear. Inspect wiring for security, chafing, burning, defective insulation, loose or broken terminals, heat deterioration, and corroded terminals. Check the alternator belt(s) in accordance with Service Manual instructions, and retighten if necessary. A periodic check of these items during subsequent servicing operations is recommended.

**FUEL**

**APPROVED FUEL GRADES (AND COLORS) --**

100LL Grade Aviation Fuel (Blue).

100 (Formerly 100/130) Grade Aviation Fuel (Green).

**NOTE**

Isopropyl alcohol or ethylene glycol monomethyl ether may be added to the fuel supply in quantities not to exceed 1% or .15% by volume, respectively, of the total. Refer to Fuel Additives in later paragraphs for additional information.

**CAPACITY EACH TANK -- 45 Gallons.**

**REDUCED CAPACITY EACH TANK (WHEN FILLED TO BOTTOM OF FUEL FILLER NECK EXTENSION) -- 33.5 Gallons.**

**NOTE**

Service the fuel system after each flight, and keep fuel tanks full to minimize condensation in the tanks.

**FUEL ADDITIVES --**

Strict adherence to recommended preflight draining instructions as called for in Section 4 will eliminate any free water accumulations from the tank sumps. While small amounts of water may still remain in solution in the gasoline, it will normally be consumed and go unnoticed in the operation of the engine.

One exception to this can be encountered when operating under the combined effect of: (1) use of certain fuels, with (2) high humidity conditions on the ground (3) followed by flight at high altitude and low temperature. Under these unusual conditions, small amounts of water in solution can precipitate from the fuel stream and freeze in sufficient quantities to induce partial icing of the engine fuel system.

While these conditions are quite rare and will not normally pose a problem to owners and operators, they do exist in certain areas of the world and consequently must be dealt with, when encountered.

Therefore, to alleviate the possibility of fuel icing occurring under these unusual conditions, it is permissible to add isopropyl alcohol or ethylene glycol monomethyl ether (EGME) compound to the fuel supply.

The introduction of alcohol or EGME compound into the fuel provides two distinct effects: (1) it absorbs the dissolved water from the gasoline and (2) alcohol has a freezing temperature depressant effect.

Alcohol, if used, is to be blended with the fuel in a concentration of 1% by volume. Concentrations greater than 1% are not recommended since they can be detrimental to fuel tank materials.

The manner in which the alcohol is added to the fuel is significant because alcohol is most effective when it is completely dissolved in the fuel. To ensure proper mixing, the following is recommended:

1. For best results, the alcohol should be added during the fueling operation by pouring the alcohol directly on the fuel stream issuing from the fueling nozzle.
2. An alternate method that may be used is to premix the complete alcohol dosage with some fuel in a separate clean container (approximately 2-3 gallon capacity) and then transferring this mixture to the tank prior to the fuel operation.

Any high quality isopropyl alcohol may be used, such as Anti-Icing Fluid (MIL-F-5566) or Isopropyl Alcohol (Federal Specification TT-I-735a). Figure 8-1 provides alcohol-fuel mixing ratio information.

Ethylene glycol monomethyl ether (EGME) compound, in compliance with MIL-I-27686 or Phillips PFA-55MB, if used, must be carefully mixed with the fuel in concentrations not to exceed .15% by volume. Figure 8-1 provides EGME-fuel mixing ratio information.

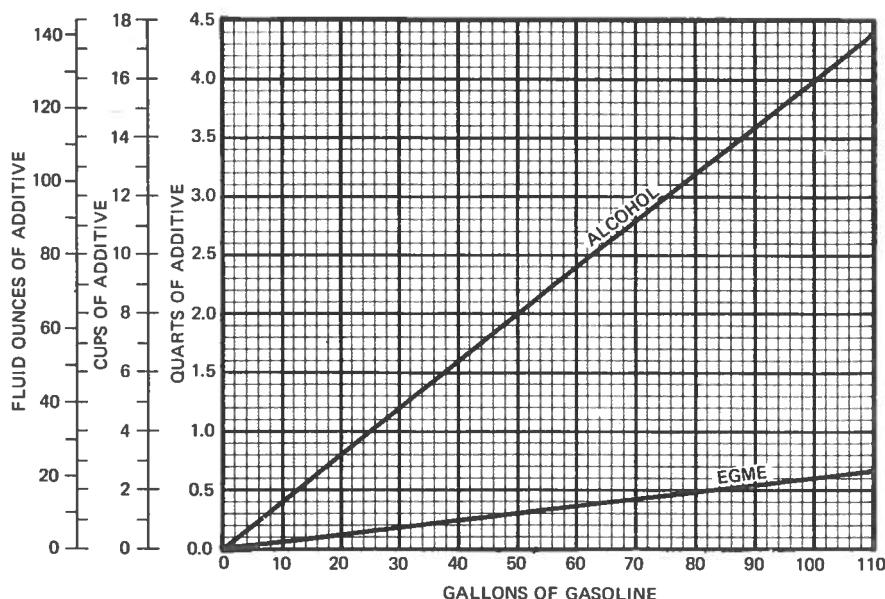


Figure 8-1. Additive Mixing Ratio

**CAUTION**

Mixing of the EGME compound with the fuel is extremely important because a concentration in excess of that recommended (.15% by volume maximum) will result in detrimental effects to the fuel tanks, such as deterioration of protective primer and sealants and damage to O-rings and seals in the fuel system and engine components. Use only blending equipment that is recommended by the manufacturer to obtain proper proportioning.

**CAUTION**

Do not allow the concentrated EGME compound to come in contact with the airplane finish as damage can result.

Prolonged storage of the airplane will result in a water buildup in the fuel which "leeches out" the additive. An indication of this is when an excessive amount of water accumulates in the fuel tank sumps. The concentration can be checked using a differential refractometer. It is imperative that the technical manual for the differential refractometer be followed explicitly when checking the additive concentration.

**FUEL CONTAMINATION --**

Fuel contamination is usually the result of foreign material present in the fuel system, and may consist of water, rust, sand, dirt, microbes or bacterial growth. In addition, additives that are not compatible with fuel or fuel system components can cause the fuel to become contaminated.

Before the first flight of the day and after each refueling, use a clear sampler cup and drain a cupful of fuel from the wing tank sumps and fuel strainer quick-drain valves to determine if contaminants are present, and that the airplane has been fueled with the proper grade of fuel.

If contamination is detected, continue draining from all fuel drain points, including the vapor return line and reservoir quick-drain valves, until all contamination has been removed. If the airplane has been serviced with the improper fuel grade, defuel completely and refuel with the correct grade. **Do not fly the airplane with contaminated or unapproved fuel.**

In addition, Owners/Operators who are not acquainted with a particular fixed base operator should be assured that the fuel supply has been checked for contamination and is properly filtered before allowing the airplane to be serviced. Also, fuel tanks should be kept full between flights, provided weight and balance considerations will permit, to reduce the possibility of water condensing on the walls of partially filled tanks.

To further reduce the possibility of contaminated fuel, routine maintenance of the fuel system should be performed in accordance with the airplane Service Manual. Only the proper fuel, as recommended in this handbook, should be used, and fuel additives should not be used unless approved by Cessna and the Federal Aviation Administration.

**LANDING GEAR**



NOSE WHEEL TIRE PRESSURE -- 88 PSI on 5.00-5, 10-Ply Rated Tire.  
MAIN WHEEL TIRE PRESSURE -- 55 PSI on 6.00-6, 8-Ply Rated Tires.

NOSE GEAR SHOCK STRUT --

Keep filled with MIL-H-5606 hydraulic fluid per filling instructions placard, and with no load on the strut, inflate with air to 90 PSI. Do not over-inflate.

HYDRAULIC FLUID RESERVOIR -- Check every 25 hours and service with MIL-H-5606 hydraulic fluid. At first 25 hours, first 50 hours, and each 100 hours thereafter, clean the filter on the right side of the reservoir.

BRAKES -- Service as required with MIL-H-5606 hydraulic fluid.

## **OXYGEN**

**AVIATOR'S BREATHING OXYGEN -- Spec. No. MIL-O-27210.**

**MAXIMUM PRESSURE** (cylinder temperature stabilized after filling) --  
1800 PSI (overhead cylinders) or 1850 PSI (aft cylinder) at 21°C (70°F).  
Refer to Oxygen System Supplement (Section 9) for filling pressures.

## **CLEANING AND CARE**

### **WINDSHIELD-WINDOWS**

The plastic windshield and windows should be cleaned with an aircraft windshield cleaner. Apply the cleaner sparingly with soft cloths, and rub with moderate pressure until all dirt, oil scum and bug stains are removed. Allow the cleaner to dry, then wipe it off with soft flannel cloths.

If a windshield cleaner is not available, the plastic can be cleaned with soft cloths moistened with Stoddard solvent to remove oil and grease.

#### **NOTE**

**Never use gasoline, benzine, alcohol, acetone, fire extinguisher or anti-ice fluid, lacquer thinner or glass cleaner to clean the plastic. These materials will attack the plastic and may cause it to craze.**

Follow by **carefully** washing with a mild detergent and plenty of water. Rinse thoroughly, then dry with a clean moist chamois. **Do not rub** the plastic with a dry cloth since this builds up an electrostatic charge which attracts dust. Waxing with a good commercial wax will finish the cleaning job. A thin, even coat of wax, polished out by hand with clean soft flannel cloths, will fill in minor scratches and help prevent further scratching.

**Do not use** a canvas cover on the windshield unless freezing rain or sleet is anticipated since the cover may scratch the plastic surface.

### **PAINTED SURFACES**

The painted exterior surfaces of your new Cessna have a durable, long lasting finish and, under normal conditions, require no polishing or buffing. Approximately 10 days are required for the paint to cure completely; in most cases, the curing period will have been completed prior to delivery of the airplane. In the event that polishing or buffing is required within the curing period, it is recommended that the work be done by someone experienced in handling uncured paint. Any Cessna Dealer can

accomplish this work.

Generally, the painted surfaces can be kept bright by washing with water and mild soap, followed by a rinse with water and drying with cloths or a chamois. Harsh or abrasive soaps or detergents which cause corrosion or scratches should never be used. Remove stubborn oil and grease with a cloth moistened with Stoddard solvent.

Waxing is unnecessary to keep the painted surfaces bright. However, if desired, the airplane may be waxed with a good automotive wax. A heavier coating of wax on the leading edges of the wings and tail and on the engine nose cap and propeller spinner will help reduce the abrasion encountered in these areas.

When the airplane is parked outside in cold climates and it is necessary to remove ice before flight, care should be taken to protect the painted surfaces during ice removal with chemical liquids. Isopropyl alcohol will satisfactorily remove ice accumulations without damaging the paint. However, keep the isopropyl alcohol away from the windshield and cabin windows since it will attack the plastic and may cause it to craze.

## STABILIZER ABRASION BOOT CARE

If the airplane is equipped with stabilizer abrasion boots, keep them clean and free from oil and grease which can swell the rubber. Wash them with mild soap and water, using Form Tech AC cleaner or naphtha to remove stubborn grease. Do not scrub the boots, and be sure to wipe off all solvent before it dries. Boots with loosened edges or small tears should be repaired. Your Cessna Dealer has the proper material and know-how to do this correctly.

## PROPELLER CARE

Preflight inspection of propeller blades for nicks, and wiping them occasionally with an oily cloth to clean off grass and bug stains will assure long blade life. Small nicks on the propeller, particularly near the tips and on the leading edges, should be dressed out as soon as possible since these nicks produce stress concentrations, and if ignored, may result in cracks. Never use an alkaline cleaner on the blades; remove grease and dirt with Stoddard solvent.

## DE-ICE/ANTI-ICE BOOT CARE

The optional wing and stabilizer de-ice and propeller anti-ice boots have a special electrically-conductive coating to bleed off static charges which cause radio interference and may perforate the boots. Fueling and

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other servicing operations should be done carefully to avoid damaging this conductive coating or tearing the boots.

To prolong the life of de-ice/anti-ice boots, they should be washed and serviced on a regular basis. Keep the boots clean and free from oil, grease and other solvents which cause rubber to swell and deteriorate. Outlined below are recommended cleaning and servicing procedures.

**CAUTION**

Use only the following instructions when cleaning boots. Disregard instructions which recommend petroleum base liquids (MEK, non-leaded gasoline, etc.) which can harm the boot material.

1. Clean boots with mild soap and water, then rinse thoroughly with clean water.

**NOTE**

Isopropyl alcohol can be used to remove grime which cannot be removed using soap. If isopropyl alcohol is used for cleaning, wash area with mild soap and water, then rinse thoroughly with clean water.

2. Allow the boots to dry, then apply a coating of Age Master No. 1 to the boots in accordance with application instructions on the container.

**NOTE**

Age Master No. 1 is beneficial for its ozone and weather resistance features.

3. After the boots have been treated with Age Master No. 1, apply a coating of ICEX to the boots in accordance with application instructions on the ICEX container.

**NOTE**

ICEX may be beneficial as an ice adhesion depressant. Both Age Master No. 1 and ICEX are distributed by the B.F. Goodrich Company.

**CAUTION**

ICEX contains silicone, which lessens paint adhesion. Use care when applying ICEX, and protect adjacent surfaces

from overspray, since overspray of ICEX will make touch-up painting almost impossible.

Age Master No. 1 and ICEX coatings last approximately 150 hours on the wing and stabilizer de-ice boots and 15 hours on propeller anti-ice boots.

Small tears and abrasions on de-ice boots can be repaired temporarily without removing the boots and the conductive coating can be renewed. Your Cessna Dealer has the proper materials and know-how to do this correctly.

## LANDING GEAR CARE

Cessna Dealer's mechanics have been trained in the proper adjustment and rigging procedures on the airplane hydraulic system. To assure trouble-free operation, have your Cessna Dealer check the gear regularly and make any necessary adjustments. Only properly trained mechanics should attempt to repair or adjust the landing gear.

## ENGINE CARE

An engine and accessories wash-down should be accomplished during each 100-hour inspection to remove oil, grease, salt corrosion or other residue that might conceal component defects during inspection. Also periodic cleaning can be very effective in preventive maintenance.

Precautions should be taken when working with cleaning agents such as wearing of rubber gloves, an apron or coveralls and a face shield or goggles. Use the least toxic of available cleaning agents that will satisfactorily accomplish the work. These cleaning agents include: (1) Stoddard solvent (Specification P-D-680, Type II), (2) a water base alkaline detergent cleaner (MIL-C-25769J) mixed 1 part cleaner, 2 to 3 parts water and 8 to 12 parts Stoddard solvent, or (3) a solvent base emulsion cleaner (MIL-C-43616B) mixed 1 part cleaner and 3 parts Stoddard solvent.

### **CAUTION**

Do not use gasoline or other highly flammable substance for wash-down.

Perform all cleaning operations in well ventilated work areas, and ensure that adequate fire-fighting and safety equipment is available. Do not smoke or expose a flame within 100 feet of the cleaning area. Compressed air, used for cleaning agent application or drying, should be regulated to the lowest practical pressure. Use of a stiff bristle fiber brush rather than a steel brush is recommended if cleaning agents do not remove excess

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grease and grime during spraying.

A recommended procedure for cleaning an engine and accessories is as follows:

1. Remove engine cowling.

**CAUTION**

Do not attempt to wash an engine which is still hot or running. Allow the engine to cool before cleaning.

2. Use fresh water for wash-down when the engine is contaminated with salt or corrosive chemicals. A cleaning agent such as described previously may then be used to remove oil and grime.

**CAUTION**

Care should be exercised to not direct cleaning agents or water streams at openings on the starter, magneto(s), alternator(s), vacuum pump(s) and turbocharger pressure relief valve.

3. Thoroughly rinse with clean, warm water to remove all traces of cleaning agents.

**CAUTION**

Cleaning agents should never be left on engine components for an extended period of time. Failure to remove them may cause damage to components such as neoprene seals and silicone fire sleeves, and could cause additional corrosion.

4. Completely dry the engine and accessories using clean, dry compressed air.
5. If desired, the engine cowling may be washed with the same cleaning agents, then rinsed thoroughly and wiped dry.
6. Reinstall engine cowling.
7. Before starting the engine, rotate the propeller by hand no less than four complete revolutions.

**WARNING**

For maximum safety, check that the ignition switch is OFF, the throttle is closed, the mixture control is in the idle

cut-off position, and the airplane is secured before rotating the propeller by hand. Do not stand within the arc of the propeller blades while turning the propeller.

## INTERIOR CARE

To remove dust and loose dirt from the upholstery and carpet, clean the interior regularly with a vacuum cleaner.

Blot up any spilled liquid promptly with cleansing tissue or rags. Don't pat the spot; press the blotting material firmly and hold it for several seconds. Continue blotting until no more liquid is taken up. Scrape off sticky materials with a dull knife, then spot-clean the area.

Oily spots may be cleaned with household spot removers, used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place on the fabric to be cleaned. Never saturate the fabric with a volatile solvent; it may damage the padding and backing materials.

Soiled upholstery and carpet may be cleaned with foam-type detergent, used according to the manufacturer's instructions. To minimize wetting the fabric, keep the foam as dry as possible and remove it with a vacuum cleaner.

If your airplane is equipped with leather seating, cleaning of the seats is accomplished using a soft cloth or sponge dipped in mild soap suds. The soap suds, used sparingly, will remove traces of dirt and grease. The soap should be removed with a clean damp cloth.

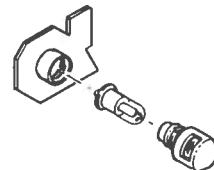
The plastic trim, headliner, instrument panel and control knobs need only be wiped off with a damp cloth. Oil and grease on the control wheel and control knobs can be removed with a cloth moistened with Stoddard solvent. Volatile solvents, such as mentioned in paragraphs on care of the windshield, must never be used since they soften and craze the plastic.

## **BULB REPLACEMENT DURING FLIGHT**

Figure 8-2 provides instructions to aid the pilot in the replacement of defective light bulbs during flight without tools. It is suggested that spare bulbs be stored in the map compartment. However, if a spare bulb is not available, an identical bulb which is found to be available from other lights listed herein can be substituted for the defective bulb. For a listing of other bulb requirements and specific tools needed, refer to the Service Manual for this airplane.

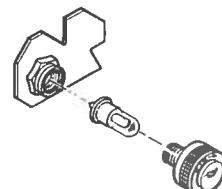
### **POST LIGHTS**

Grasp lens cap and pull straight out from socket. Pull bulb from cap and replace with MS25237-327 bulb. Replace cap in socket and rotate cap to direct light in desired direction.



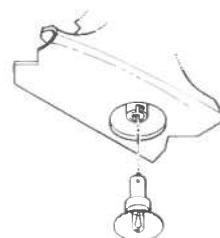
### **LANDING GEAR LIGHTS, DE-ICE PRESSURE LIGHT, LOW VOLTAGE LIGHT, ALTERNATOR OFF LIGHTS AND RADAR ALTIMETER LIGHT.**

Remove lens cap by turning counterclockwise until it separates from housing. Pull bulb from back side of lens cap and replace with MS25237-327 bulb. Replace lens cap by turning it clockwise until hand-tight. After replacing lens cap, check that dimming shutter is not closed. Replacement procedure is identical for "gear up" and "gear down" lights, and either bulb may be used to replace the other, if a spare bulb is not available.



### **CONTROL WHEEL MAP LIGHT**

Grasp rim of bulb, push straight up and turn counterclockwise as far as possible, then pull bulb straight down and out of socket. Replace with 24RB bulb. To install new bulb in socket, align pins on bulb with slots in socket, then push straight up and rotate bulb clockwise as far as possible.



**Figure 8-2. Bulb Replacement**

# SECTION 9 SUPPLEMENTS

## (Optional Systems Description & Operating Procedures)

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## INTRODUCTION

This section consists of a series of supplements, each covering a single optional system which may be installed in the airplane. Each supplement contains a brief description, and when applicable, operating limitations, emergency and normal procedures, and performance. As listed in the Table of Contents, the supplements are classified under the headings of General and Avionics, and have been provided with reference numbers. Also, the supplements are arranged alphabetically and numerically to make it easier to locate a particular supplement. Other routinely installed items of optional equipment, whose function and operational procedures do not require detailed instructions, are discussed in Section 7.

Limitations contained in the following supplements are FAA approved. Observance of these operating limitations is required by Federal Aviation Regulations.



# SUPPLEMENT AIR CONDITIONING SYSTEM

## SECTION 1 GENERAL

The air conditioning system provides comfortable cabin temperatures during hot weather operations, both on the ground or in flight. Controls for the air conditioning system are located in the overhead console above the front seats. The controls consist of two rotary switches and a push-pull lever, labeled OVERHEAD AIR SELECTOR. Rotating the switch, labeled TEMP, to the ON position starts the system compressor.

### NOTE

The compressor will not operate unless the AIR control switch is in the LOW, MED or HI position.

With continued clockwise rotation from ON, progressively cooler cabin temperature is obtained by longer cycles of compressor operation. When the switch is rotated fully clockwise, the compressor runs continuously to provide the coolest cabin temperature. Airflow is controlled by the switch, labeled AIR, which rotates clockwise from OFF through three positions, labeled LOW, MED and HI, to provide three blower speeds. Positioning the overhead air selector lever to its forward position, labeled FRESH AIR, supplies outside air from inlets located in both wings to the air conditioning system. When moved to the aft position, labeled CABIN AIR, the overhead air selector shuts off air from the wing inlets, and instead, only allows air from inside the cabin to circulate through the air conditioning system. System electrical protection is provided by a 10-amp circuit breaker, labeled A/C FAN, and a 15-amp circuit breaker, labeled COND FAN, located on the left sidewall circuit breaker panel.

In this system (see figure 1), a belt-driven compressor is located on the right front side of the engine. Twin evaporator coils with blowers, located above the headliner in the cabin top, direct cold air to eight adjustable outlets in the overhead console. Refrigerant lines under the floorboards and in the cabin top interconnect the compressor, evaporators and the condenser and blower unit located behind the aft baggage compartment wall in the aft fuselage. To provide outside cooling air to the condenser, an inlet and an outlet are located on the left side and bottom, respectively, of the aft fuselage. Protective covers are provided to replace the condenser

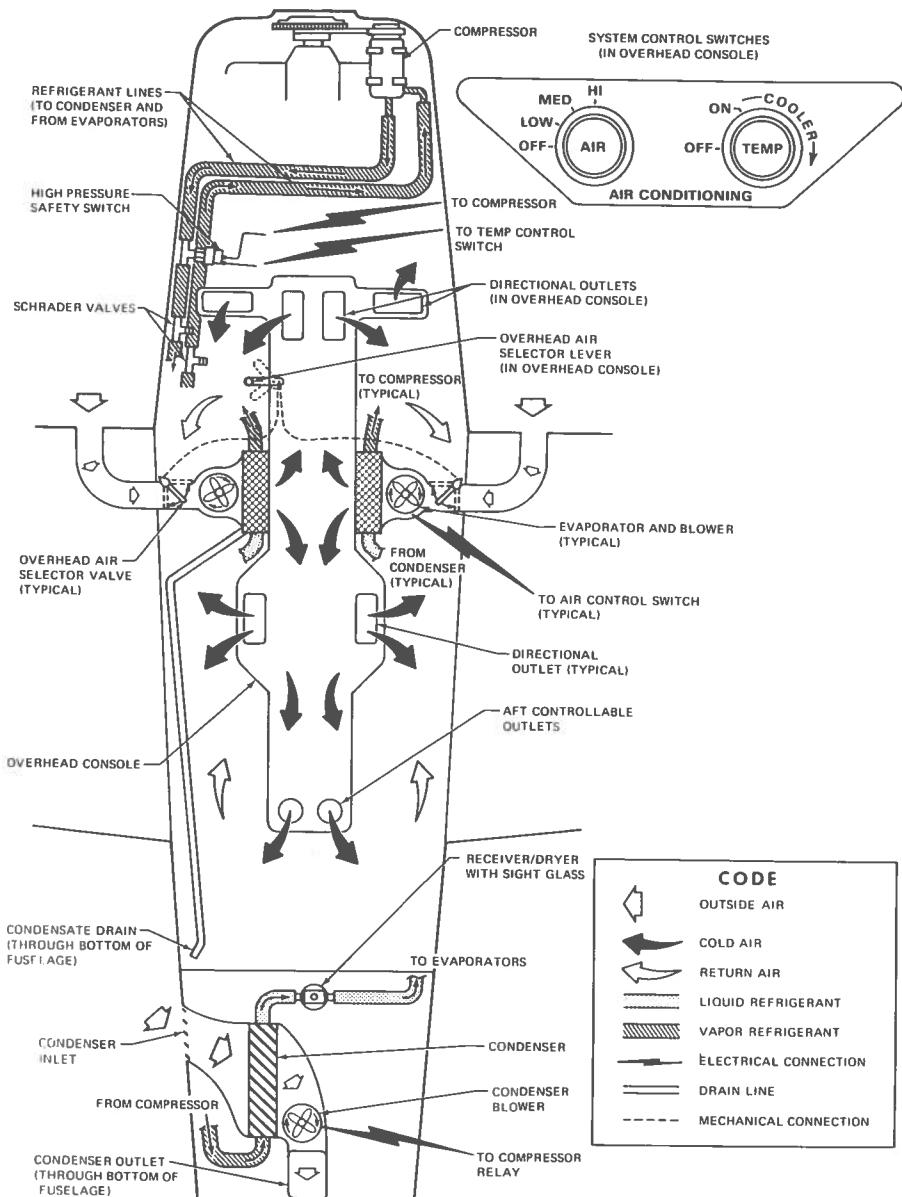


Figure 1. Air Conditioning System

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inlet louvers and outlet duct during off-season flight operations.

**NOTE**

Do not operate the air conditioner with the condenser covers installed.

Access for servicing the system is provided through the aft baggage compartment wall to the receiver/dryer sight glass, and through a floorboard inspection cover beneath the pilot's seat to the Schrader valves.

Refer to the Air Conditioner Service/Parts Manual for specific testing, servicing procedures, and instructions for removing and replacing system components.

**SECTION 2  
LIMITATIONS**

The air conditioning system must not be operated during takeoff and landing. When the system is installed, the airplane must be equipped with a placard located on the instrument panel which reads as follows:

TURN OFF AIR CONDITIONER  
FOR TAKEOFF AND LANDING

**SECTION 3  
EMERGENCY PROCEDURES**

There is no change to the airplane emergency procedures when the air conditioning system is installed.

**SECTION 4  
NORMAL PROCEDURES****PREFLIGHT INSPECTION**

During the preflight (walk around) inspection, open cabin doors to aid in cool-down of the cabin before flight. Air conditioning system components should be inspected as follows:

1. Check compressor condition and drive belt for tightness.
2. Check hoses (where visibility permits) from compressor to the condenser and evaporators for evidence of damage or leakage.
3. Check condenser inlet on left side of aft fuselage and outlet on the bottom of the aft fuselage for condition and blockage.
4. Check condensate drain at left main landing gear cutout for damage or blockage.

#### OPERATION ON GROUND

After preflight inspection and engine start, use the following procedures for quickest reduction of hot cabin temperatures prior to takeoff:

1. Cabin Doors and Windows -- CLOSED.
2. Cabin Air and Auxiliary Cabin Air Controls -- PUSHED IN.
3. Overhead Air Selector -- CABIN AIR.
4. Overhead Air Outlets -- OPEN.
5. AIR Control Switch -- HI.
6. TEMP Control Switch -- ROTATED FULLY CLOCKWISE.
7. Throttle -- 1000 RPM.

#### NOTE

If the temperature of the air coming from the outlets does not start to cool within a minute or two, the system may be malfunctioning and should be turned off.

8. After Initial Cool-Down -- REPOSITION AIR and TEMP controls as desired.

#### BEFORE TAKEOFF

1. TEMP Control Switch -- OFF.
2. AIR Control Switch -- AS DESIRED.

#### OPERATION IN FLIGHT

Initially, it may be desirable to operate the system at its coldest setting and highest blower speed for fast cool-down. Later in the flight, adjustment of the controls to reduced settings and selection of fresh air may be more comfortable.

During extended flight when temperature and humidity are extremely high, the evaporator coils may frost over. Normally, the compressor cycles off when temperatures in the evaporators near 32°F (0°C). However, when the TEMP control is at its coldest setting, the compressor runs continuously. Therefore, if frost does form as evidenced by reduced cooling

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airflow, move the temperature control counterclockwise slightly toward the OFF position and select the HI position of the AIR (blower) control. This should increase evaporator discharge temperature sufficiently to clear the frost.

**NOTE**

A high pressure safety switch in the air conditioning system disengages the compressor clutch and stops system operation in the event the system becomes overloaded. The system will cycle on again when the pressure reduces. However, if cooling ability cannot be restored within a reasonable amount of time, the system may be malfunctioning and should be turned off.

When maximum cabin cooling is desired during cruise, opening the cowl flaps 1/4 to 1/3 (2 to 3 notches from full close) will help provide more comfortable front cabin temperatures with only a 1 to 2 knot additional speed loss.

The blower portion of the system may be used anytime air circulation (outside or cabin air) is desired. This is accomplished by leaving the TEMP control switch in the OFF position and placing the AIR (blower) control switch in the LOW, MED or HI positions as desired.

**BEFORE LANDING**

1. TEMP Control Switch -- OFF.
2. AIR Control Switch -- AS DESIRED.

**AFTER LANDING**

The TEMP control switch may be rotated from OFF to a position which will maintain cabin temperature at a comfortable level while operating on the ground.

**SECTION 5  
PERFORMANCE**

There is a 1 KTAS decrease in cruise performance and a 20 FPM loss in rate of climb when the air conditioner is installed. When the compressor is engaged, there is an additional 1 to 2 KTAS loss and an additional 20 FPM climb loss.

**DEMONSTRATED OPERATING TEMPERATURE**

Satisfactory engine cooling has been demonstrated for the airplane with this equipment installed and operating with an outside air temperature 23°C above standard. This is not to be considered as an operating limitation. Reference should be made to Section 2 of the basic handbook for engine operating limitations.

# SUPPLEMENT

## CONVENIENCE TABLE

### SECTION 1 GENERAL

The convenience table and its stowage compartment are installed on the back of the pilot's or copilot's seat for use by the second row passengers. The table is equipped with guides which follow tracks inside the stowage compartment.

### SECTION 2 LIMITATIONS

The following information must be presented in the form of a placard located on the back of the convenience table.

STOW LEAF DURING  
TAKEOFF AND LANDING

### SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when the convenience table is installed.

## **SECTION 4 NORMAL PROCEDURES**

To remove the table from the stowage compartment, grasp the handle near the top edge of the leaf, slide it upward and aft until the leaf contacts the stops at the top of the compartment. Stowing the table is accomplished by rotating it upward and sliding it back down into the stowage compartment.

## **SECTION 5 PERFORMANCE**

There is no change to the airplane performance when the convenience table is installed.

# SUPPLEMENT

## DIGITAL CLOCK

### SECTION 1 GENERAL

The Astro Tech LC-2 Quartz Chronometer (see figure 1) is a precision, solid state time keeping device which will display to the pilot the time-of-day, the calendar date, and the elapsed time interval between a series of selected events, such as in-flight check points or legs of a cross-country flight, etc. These three modes of operation function independently and can be alternately selected for viewing on the four digit liquid crystal display (LCD) on the front face of the instrument. Three push button type switches directly below the display control all time keeping functions. These control functions are summarized in figures 2 and 3.

The digital display features an internal light (back light) to ensure good visibility under low cabin lighting conditions or at night. The intensity of the back light is controlled by the ENG-RADIO lights rheostat. In addition, the display incorporates a test function (see figure 1) which allows checking that all elements of the display are operating. To activate the test function, press the LH and RH buttons at the same time.

### SECTION 2 LIMITATIONS

There is no change to the airplane limitations when the digital clock is installed.

### SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when the digital clock is installed.

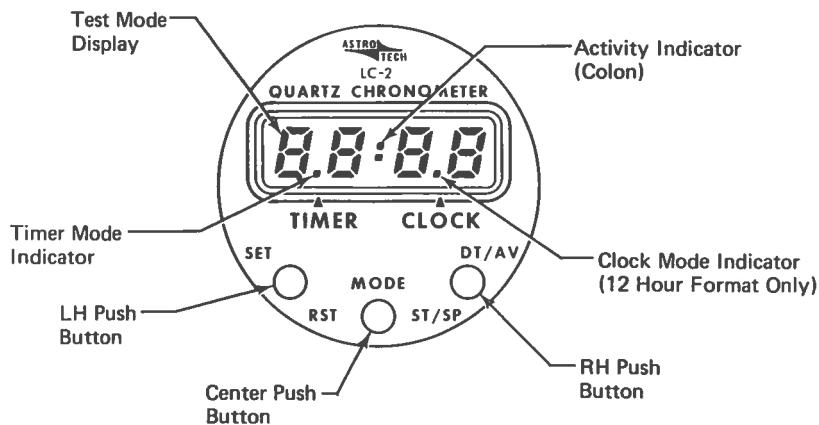


Figure 1. Digital Clock

## SECTION 4

### NORMAL PROCEDURES

#### CLOCK AND DATE OPERATION

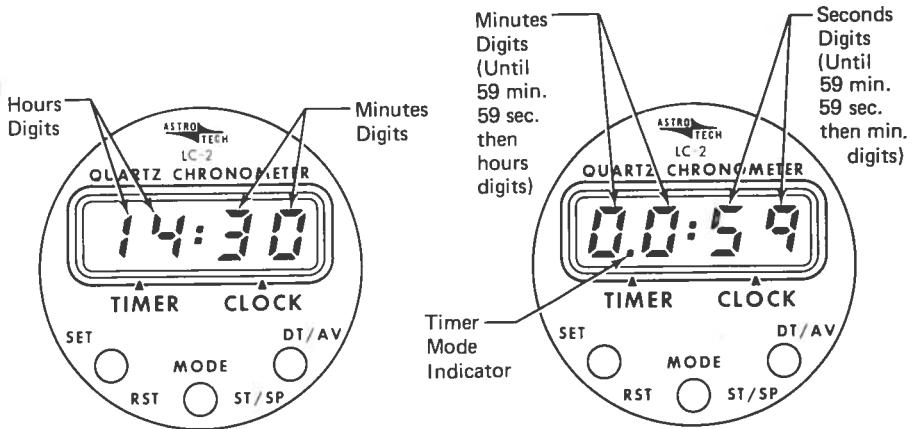
When operating in the clock mode (see figure 2), the display shows the time of day in hours and minutes while the activity indicator (colon) will blink off for one second each ten seconds to indicate proper functioning. If the RH push button is pressed momentarily, while in the clock mode, the calendar date appears numerically on the display with month of year to the left of the colon and day of the month shown to the right of the colon. The display automatically returns to the clock mode after approximately 1.5 seconds. However, if the RH button is pressed continuously longer than approximately two seconds, the display will return from the date to the clock mode with the activity indicator (colon) blinking altered to show continuously or be blanked completely from the display. Should this occur, simply press the RH button again for two seconds or longer, and correct colon blinking will be restored.

#### NOTE

The clock mode is set at the factory to operate in the 24-hour format. However, 12-hour format operation may be selected by changing the position of an internal slide switch accessible through a small hole on the bottom of the instrument case. Notice that in the 24-hour format, the clock mode indicator does not appear.

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LH Button: Sets date and time of day (when used with RH button).

Center Button: Alternately displays clock or timer status

RH Button: Shows calendar date momentarily; display returns to clock mode after 1.5 seconds.

Figure 2. Clock Mode

LH Button: Resets timer to "zero".

Center Button: Alternately displays clock or timer status

RH Button: Alternately starts and stops timer; timer starts from any previously accumulated total.

Figure 3. Timer Mode

#### SETTING CORRECT DATE AND TIME

The correct date and time are set while in the clock mode using the LH and RH push buttons as follows: press the LH button once to cause the date to appear with the month flashing. Press the RH button to cause the month to advance at one per second (holding button), or one per push until the correct month appears. Push the LH button again to cause the day of month to appear flashing, then advance as before using RH button until correct day of month appears.

Once set correctly, the date advances automatically at midnight each day. February 29 of each leap year is not programmed into the calendar mode, and the date will advance to March 1. This may be corrected the following day by resetting the mode back to March 1.

Pressing the LH button two additional times will cause the time to appear with the hours digits flashing. Using the RH button as before, advance the hour digits to the correct hour as referenced to a known time standard. Another push of the LH button will now cause the minutes digits to flash. Advance the minutes digits to the next whole minute to be reached by the time standard and "hold" the display by pressing the LH button once more. At the exact instant the time standard reaches the value "held" by the display, press the RH button to restart normal clock timing, which will now be synchronized to the time standard.

In some instances, however, it may not be necessary to advance the minutes digits of the clock; for example when changing time zones. In such a case, do not advance the minutes digits while they are flashing. Instead, press the LH button again, and the clock returns to the normal time keeping mode without altering the minutes timing.

#### TIMER OPERATION

The completely independent 24-hour elapsed timer (see figure 3) is operated as follows: press the center (MODE) push button until the timer mode indicator appears. Reset the display to "zero" by pressing the LH button. Begin timing an event by pressing the RH button. The timer will begin counting in minutes and seconds and the colon (activity indicator) will blink off for 1/10 second each second. When 59 minutes 59 seconds have accumulated, the timer changes to count in hours and minutes, up to a maximum of 23 hours, 59 minutes. During the count in hours and minutes, the colon blinks off for one second each ten seconds. To stop timing the event, press the RH button once again and the time shown by the display is "frozen". Successive pushes of the RH button will alternately restart the count from the "held" total or stop the count at a new total. The hold status of the timer can be recognized by lack of colon activity, either continuously on or continuously off. The timer can be reset to "zero" at anytime using the LH button.

## SECTION 5

### PERFORMANCE

There is no change to the airplane performance when the digital clock is installed.

## SUPPLEMENT

# DUAL ALTERNATOR SYSTEM

### SECTION 1 GENERAL

The dual 60-amp alternator system (see figure 1) modifies the existing system (for details of the existing system, refer to Section 7 Electrical System paragraphs in the basic handbook). The dual alternator system features a second 60-amp alternator, located on the left front side of the engine, belt-driven by the propeller shaft. Each alternator is controlled by a special ACU (alternator control unit) which includes circuits to operate a line contactor and provide alternator load sharing (within 15 amps under low-load conditions). A field switch for the second alternator is provided by installing a triple-rocker master switch in place of the double-rocker master switch. The switch is labeled MASTER ON, ALT 1, BAT, and ALT 2. Additional field and output circuit breakers and a push button alternator restart switch, labeled ALT RESTART PUSH ON, are located on the left sidewall circuit breaker panel. The ALT RESTART switch is used in conjunction with a drycell battery pack, located under the floor access panel below the pilot's seat, to provide alternator restart capability in the event of a failure in the airplane battery system. Additional system monitoring capability is provided by two warning lights, located below the LOW VOLTAGE light on the upper left side of the instrument panel. The lights, labeled ALT OFF, ALT 1, and ALT 2, are the press-to-test type and contain dimming shutters for night operation. The bulbs are interchangeable with the landing gear indicator bulbs. A volt/ammeter replaces the existing ammeter on the right side of the instrument panel. A rotary type volt/amp selector switch, adjacent to the volt/ammeter, has three AMP (amperage) and one VOLT (voltage) positions. The amperage positions are labeled ALT 1, ALT 2, and BAT, and the voltage position is labeled VOLT, and monitors bus voltage. The rocker type avionics power switch, on the left sidewall circuit breaker panel, is replaced by two toggle type switches. The switches furnish primary and standby (emergency) electrical power to the avionics bus, and are labeled AVN PWR, STBY, and PRIM. They are OFF in the down position, and ON in the up position.

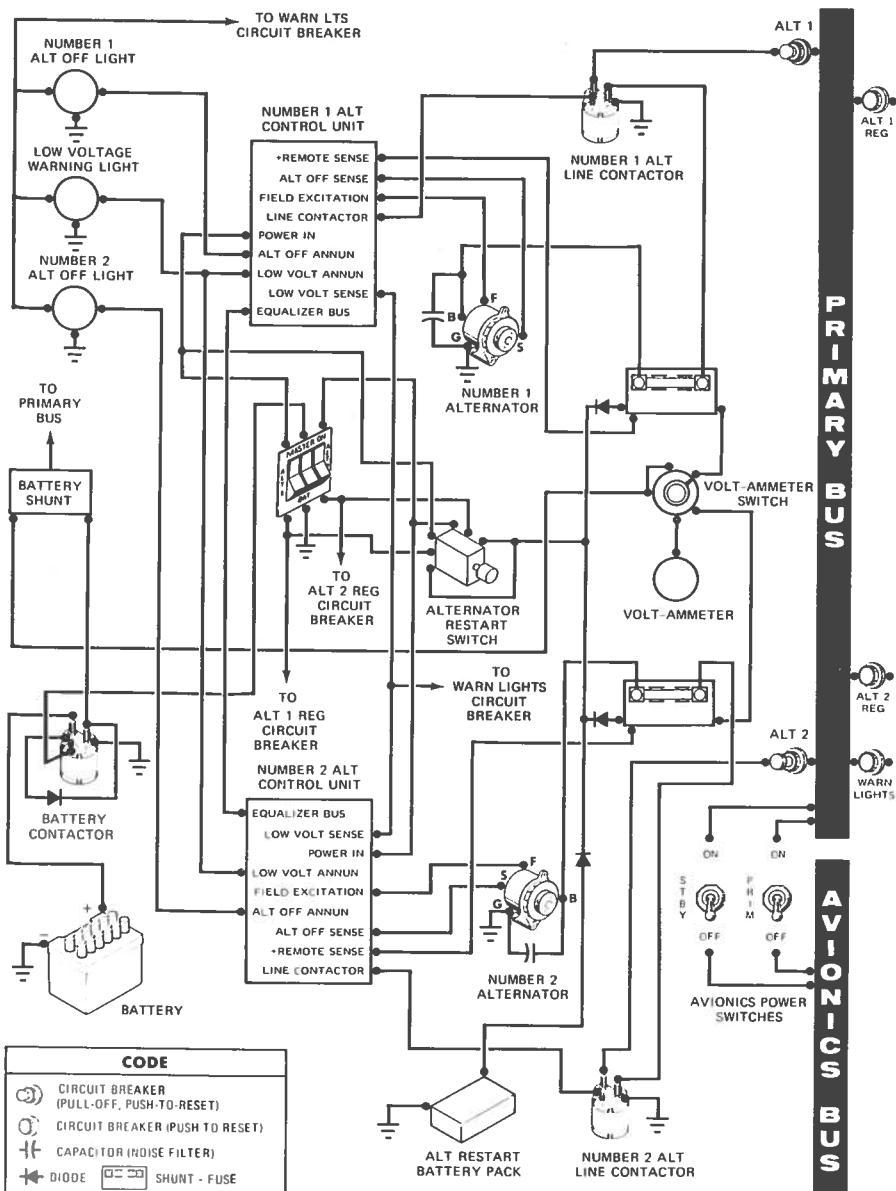


Figure 1. Dual Alternator System

## SECTION 2 LIMITATIONS

There is no change to the airplane limitations when the dual alternator system is installed.

## SECTION 3 EMERGENCY PROCEDURES

### ONE ALT OFF LIGHT ILLUMINATED

1. Cycle affected alternator section of the master switch off and ON.
2. If ALT OFF light is still illuminated, turn off affected alternator section and reduce electrical load to extinguish LOW VOLTAGE light if illuminated.
3. If affected alternator ALT REG circuit breaker is tripped, reset and repeat steps 1 and 2.

If affected alternator ALT circuit breaker is tripped:

4. Select affected alternator on volt/ammeter switch and turn on affected alternator section while monitoring output.
5. If significant output is indicated, turn off alternator and continue or terminate flight with electrical load reduced to capacity of single alternator.
6. If no output is indicated, turn off alternator, reset ALT circuit breaker, and turn alternator on again.
7. If ALT circuit breaker trips again or output is excessive relative to equipment load, turn off the affected alternator section of the master switch and continue or terminate flight with electrical load reduced to capacity of single alternator.
8. If output is not excessive relative to equipment load, disregard ALT OFF light and have system checked prior to next flight.

### LOSS OR SUDDEN REDUCTION OF ALL ELECTRICAL POWER

1. If ALT circuit breakers are tripped, reset.
  2. Cycle both alternator sections of the master switch off and ON.
- If electrical power is restored:
3. Continue normal operation and have system checked prior to next flight.

If electrical power is not restored:

3. Turn BAT section of master switch off.
4. Turn PRIM avionics power switch and electrical equipment off.
5. Depress and release ALT RESTART push button.

If electrical power is restored:

6. Check that LOW VOLTAGE, ALT 1, and ALT 2 lights are extinguished.
7. Turn PRIM avionics power switch and electrical equipment on as desired.
8. Continue or terminate flight with BAT section of master switch turned off.

If electrical power is not restored:

6. Pull both ALT circuit breakers off and turn off the alternator sections of the master switch.
7. Set volt/ammeter selector switch to BAT and observe as the BAT section of the master switch is turned ON. If the volt/ammeter shows a full scale discharge, turn BAT section of the master switch off and terminate the flight without electrical power.
8. With normal battery discharge, use essential avionics and electrical equipment as required, and terminate the flight as soon as practical.

## LOSS OF AVIONICS POWER

1. Turn PRIM avionics power switch OFF.
2. Turn STBY avionics power switch ON.

## SECTION 4 NORMAL PROCEDURES

### BEFORE TAKEOFF

The following functional check of the dual alternator system is recommended prior to each flight:

1. Run the engine at a minimum speed of 1000 RPM with some electrical equipment turned on and both avionics power switches turned OFF.
2. Turn ALT 1 and ALT 2 sections of the master switch off.

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3. Verify LOW VOLTAGE and both ALT OFF warning lights are illuminated.

## NOTE

There may be a short time delay required for the LOW VOLTAGE light to illuminate depending on battery state of charge and load.

4. Turn ALT 1 section ON and verify LOW VOLTAGE and ALT 1 lights extinguished.
5. Select ALT 1 on volt/ammeter switch and verify an indication that the alternator is supplying power to the system.
6. Turn ALT 1 section off.
7. Turn ALT 2 section of the master switch ON and verify LOW VOLTAGE and ALT 2 lights extinguished.
8. Select ALT 2 on volt/ammeter switch and verify an indication that the alternator is supplying power to the system.
9. Turn ALT 1, and ALT 2 sections of the master switch ON for normal operation.
10. Select BAT position on volt/ammeter switch and verify that the battery is being charged.
11. Select VOLT position on volt/ammeter switch and verify that voltage indication is normal ( $28.0 \pm 1$  volts).

## ALTERNATOR EMERGENCY RESTART SYSTEM

The following system check should be performed approximately every 25 hours:

1. Run the engine at a minimum speed of 1000 RPM with both avionics power switches turned OFF and some electrical equipment turned on.
2. Turn all 3 sections of the master switch off.
3. Turn ALT 1, and ALT 2 sections ON, depress and release alternator restart button.
4. Verify LOW VOLTAGE, ALT 1, and ALT 2 warning lights are extinguished.

## NOTE

It may be necessary to turn on additional equipment such as landing and taxi lights for both ALT OFF lights to be extinguished. Due to component tolerances and low signal levels, it may be normal for either ALT 1 or ALT 2 light to be illuminated when the total load on both alternators is less than 15 amps.

5. Turn all 3 sections of the master switch ON for normal operation.

#### NOTE

The alternator restart drycell battery pack supplies sufficient electrical power for approximately 100 alternator restarts. The battery pack should be replaced biannually or sooner if the alternators cannot be restarted under a heavy electrical load.

During flight, occasionally monitor the system by utilizing the volt/amp selector switch to check the ALT 1, ALT 2, BAT, and VOLT functions. Excessively uneven output (greater than 20-amps) between the alternators indicates the system should be checked and adjusted prior to the next flight.

Due to the component tolerance and low signal levels, it may be normal for one ALT OFF light to be illuminated when the total load on both alternators is less than 15 amps. However, the ONE ALT OFF LIGHT ILLUMINATED system check in Section 3 of this supplement should be made.

Since the avionics power standby switch is not used in normal operation of the system, check it occasionally to verify its function by turning the AVN PWR PRIM switch OFF and the STBY switch ON. This action may help avoid a possible malfunction of this switch caused by its infrequent use.

## SECTION 5 PERFORMANCE

There is no change to the airplane performance when the dual alternator system is installed.

## SUPPLEMENT

# ELECTRIC ELEVATOR TRIM SYSTEM

### SECTION 1 GENERAL

The electric elevator trim system provides a simple method of relieving pitch control pressures without interrupting other control operations to adjust the manual elevator trim wheel. The system is controlled by a slide-type trim switch on the top of the left control wheel grip, a disengage switch on the left side of the control wheel pad and a "pull-off" type circuit breaker on the left sidewall circuit breaker panel. Pushing the trim switch to the forward position, labeled DN, moves the elevator trim tab in the "nose down" direction; conversely, pulling the switch aft to the UP position moves the tab in the "nose up" direction. When the switch is released, it automatically returns to the center off position, and elevator trim tab motion stops. The disengage switch, labeled ELEC TRIM DISENGAGE, disables the system when placed in the DISENGAGE position. The elevator trim circuit breaker, labeled TRIM PULL-OFF, is provided as a secondary control of all electrical power to the system and can be pulled to the off position in case of a system malfunction.

A servo unit (which includes a motor and chain-driven, solenoid-operated clutch) actuates the trim tab to the selected position. When the clutch is not energized (trim switch off) the electric portion of the trim system freewheels so that manual operation is not affected. The electric trim system can be overridden at any time by manually rotating the elevator trim wheel, thus overriding the servo that drives the trim tab.

### SECTION 2 LIMITATIONS

The following limitation applies to the electric elevator trim system:

1. The maximum altitude loss during an electric elevator trim malfunction may be as much as 250 feet.

## SECTION 3

### EMERGENCY PROCEDURES

1. Elevator Trim Disengage Switch -- DISENGAGE.
2. Elevator Trim Circuit Breaker -- PULL-OFF for the remainder of the flight.
3. Manual Trim -- AS REQUIRED.

## SECTION 4

### NORMAL PROCEDURES

To operate the electric elevator trim system, proceed as follows:

1. Master Switch -- ON.
2. Elevator Trim Circuit Breaker -- PUSH-TO-RESET, if off.
3. Elevator Trim Disengage Switch -- ON.
4. Trim Switch -- ACTUATE as desired.
5. Elevator Trim Position Indicator -- CHECK.

#### NOTE

To check the operation of the disengage switch, actuate the elevator trim switch with the disengage switch in the DISENGAGE position. Observe that the manual trim wheel and indicator do not rotate when the elevator trim switch is activated.

## SECTION 5

### PERFORMANCE

There is no change to the airplane performance when this trim system is installed.

## SUPPLEMENT

# ENGINE COMBUSTION ANALYZER

### SECTION 1 GENERAL

An engine combustion analyzer system, useful as an aid for mixture leaning in cruising flight at 80% power or less, and detection of possible combustion problems, may be installed in the airplane. This system is similar to the economy mixture indicator (EGT) but employs additional components so that exhaust gas temperature (EGT) of the individual engine cylinders can be monitored.

The combustion analyzer system consists of an instrument panel-mounted indicator with selector switch (see figure 1), seven temperature sensing probes installed in the engine exhaust system, and wiring connecting the indicator to the probes. The system does not require airplane electrical power for proper operation.

### SECTION 2 LIMITATIONS

There is no change to the airplane limitations when the engine combustion analyzer system is installed.

### SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when the engine combustion analyzer system is installed.

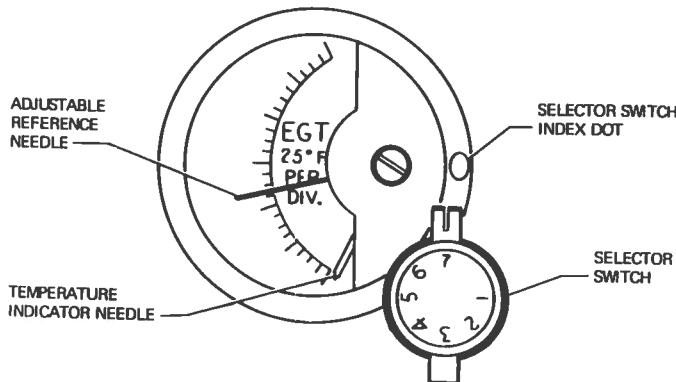


Figure 1. Engine Combustion Analyzer Indicator

## SECTION 4 NORMAL PROCEDURES

The operation of the combustion analyzer system is similar to the economy mixture indicator (see Section 4 of the basic handbook) with the exception that the pilot can monitor individual cylinder exhaust gas temperatures by selecting the desired cylinder using the indicator selector switch (see figure 1). Aligning a number on the selector switch with the white index dot on the indicator face selects the corresponding engine cylinder for temperature sensing. For example, position 1 is engine cylinder number 1. Position 7 selects the turbine inlet temperature indication and is, thus, used as a "single point" system like the economy mixture indicator. Normally, leaning of fuel-air mixtures is accomplished using position 7. Position 7 temperature is normally 25°F to 100°F higher than the other positions, except at low cruise powers. All performance data shown in Section 5 of the basic handbook is based on use of the engine combustion analyzer selector switch set on the number 7 position.

For combustion problem detection procedures, refer to the combustion analyzer manufacturer's information provided in the airplane when this equipment is installed.

## SECTION 5 PERFORMANCE

There is no change to the airplane performance when the engine combustion analyzer system is installed.

## SUPPLEMENT

# FUEL COMPUTER/DIGITAL CLOCK

### SECTION 1 GENERAL

The Astro Tech FT-2 Fuel Computer/Digital Clock (see figure 1) is a dual function instrument providing a complete fuel management system and a multi-purpose time keeping device in a single instrument with each function sharing a common display panel. The instrument may be used as a replacement for the digital or electric clock, and may be mounted in the same location on the instrument panel.

The fuel computer portion of the instrument displays the following selections: fuel flow as measured by an engine mounted transducer, total fuel used, current fuel remaining and time remaining based on fuel remaining at the current flow rate. Fuel quantities are displayed in pounds with a gallon display available by utilizing a push button located below and to the right of the display. When time remaining at the current flow rate reaches 45 minutes or less, the display will be blanked from one-tenth to three-tenths of a second per second in all of the selections.

The digital clock portion of the instrument displays the following selections: current time of day in either local (LCL) or Greenwich Mean Time (GMT) in hours and minutes, cumulative flight time in minutes and

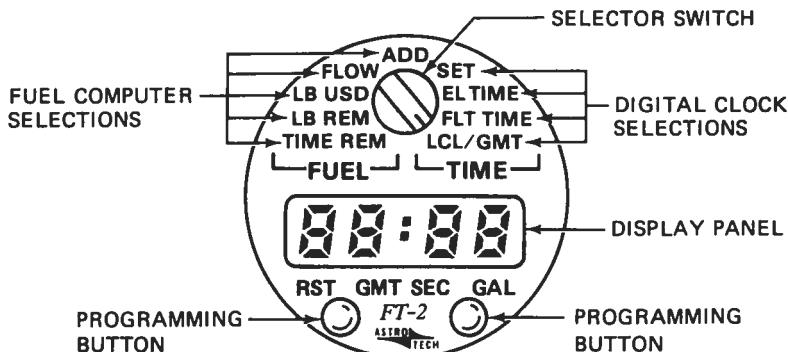


Figure 1. Fuel Computer/Digital Clock

seconds (first hour) and hours and minutes (up to 100 hours) whenever fuel flow is greater than 25 to 30 pounds per hour (PPH) and elapsed time in minutes and seconds (first hour) and hours and minutes (up to 100 hours).

Fuel selections and time selections are made by utilizing a rotary-type selector switch common to both functions. Two push-buttons, located below the display, are used to program the fuel computer/digital clock.

If power is interrupted during programming sequences, such as the reset sequence, it is possible for the instrument to enter a "locked up" condition in which the display will not change with selector switch selection. Should this occur, if will be necessary to remove both the display power and the keep-alive power from the instrument to clear the condition. Display power is removed by turning off the master switch. Keep alive power is removed by removing the clock fuse from the fuseholder located on the firewall near the battery. Replace the clock fuse and turn the master switch on. The instrument should now operate normally, but will have to be reprogrammed as outlined in the power interruption paragraph in Section 4 of this supplement.

## **SECTION 2 LIMITATIONS**

There is no change to the airplane limitations when the fuel computer / digital clock is installed.

## **SECTION 3 EMERGENCY PROCEDURES**

There is no change to the airplane emergency procedures when the fuel computer/digital clock is installed.

## **SECTION 4 NORMAL PROCEDURES**

### **FUEL COMPUTER OPERATION**

The fuel computer contains five selections (see figure 2). They are selected by rotating the selector switch to the positions labeled ADD, FLOW, LB USD, LB REM, and TIME REM. These selections, when used in

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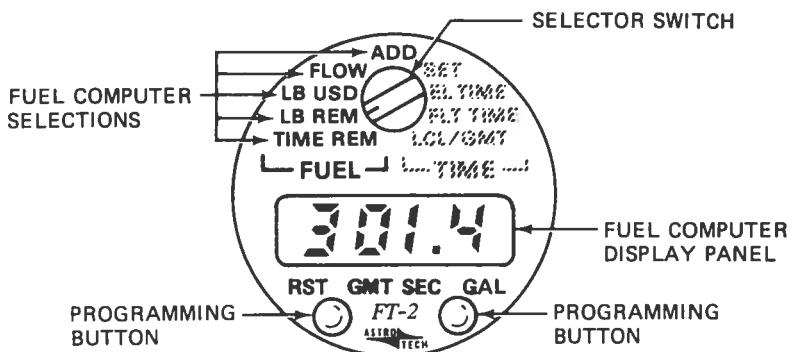


Figure 2. Fuel Computer Controls and Display

proper sequence with the programming buttons, will correctly program the computer.

The fuel quantity added during servicing of the airplane must be entered in the computer so that the LB REM position accurately represents the correct amount of usable fuel on board for each flight. The fuel quantity added is entered in the computer as follows:

To enter fill-up:

1. Rotate the selector switch to the ADD position.
2. Press left and right programming buttons together until display panel reads FULL.
3. Rotate the selector switch to LB REM position to display the usable fuel quantity in pounds on board.

#### NOTE

The usable fuel quantity for each airplane is programmed into the instrument at the factory. A battery disconnect or other power interruption will not alter this quantity.

To enter less than fill-up:

1. Rotate the selector switch to the ADD position.

2. Press right programming button, labeled GAL, until the right digit represents the correct units of gallons of fuel added.
3. Press left programming button, labeled RST, until the left two digits represent the correct tens and hundreds of gallons of fuel added.
4. Rotate the selector switch to LB REM position to display the correct usable fuel quantity in pounds on board.

If an error has been made, resulting in an incorrect display of LB REM, the correct amount may be entered as follows:

1. Leave the selector switch in the ADD position.
2. Enter the corrected fuel quantity in gallons.
3. Rotate the selector switch to FLOW, then press and hold the left programming button.
4. While holding the left button pressed, slowly rotate the selector switch to the LB REM position. The set-in amount in gallons, multiplied by six, will now appear as LB REM.

When the selector switch is placed in the FLOW position, the display indicates the current fuel flow rate in pounds per hour (PPH). Press the GAL programming button to display the flow rate in gallons per hour (GPH).

Placing the selector switch in the LB USD position displays the current fuel quantity used (in pounds) since the last addition of fuel to the airplane. Press the GAL programming button to display the fuel used in gallons.

#### NOTE

Any entry of additional fuel to LB REM will reset the LB USD to zero.

The LB REM position displays the current total remaining fuel (in pounds) on board the airplane, based on the takeoff amount minus the fuel used as computed using fuel flow rates. Press the GAL programming button to display the remaining fuel in gallons.

#### NOTE

When the display is changed from pounds to gallons in the FLOW, LB USD, and LB REM positions, the gallons shown are computed on the ratio of 6 pounds per gallon and no volumetric correction for temperature change is made. Therefore maximum accuracy may be obtained by referring to the gallons functions.

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The TIME REM position displays the flight time remaining in hours and minutes as computed using the current fuel flow rate and fuel remaining amounts. Since this displayed value is dependent upon flow rate, a reduction in engine power will show an increase in time remaining.

## NOTE

With the selector switch in the TIME REM position power settings of less than 25 to 30 PPH flow rate will cause the word OFF to be displayed.

If it is desired to test the display, rotate the selector switch to TIME REM position, then press the right programming button. This will cause all 8's to be shown, thereby testing each segment of each digit.

Any power interruption that might alter any memory value will cause a line of dashes to be displayed in all selector switch positions. Pressing the right programming button will clear the dashes from the display and show the current selector switch position. All memory values will be erased and must be re-entered. However, the usable fuel quantity will not be altered, since it is permanently entered in the instrument.

## DIGITAL CLOCK OPERATION

The digital clock contains four selections (see figure 3). They are selected by rotating the selector switch to the positions labeled SET, EL TIME, FLT TIME, and LCL/GMT. These selections, when used in proper sequence with the programming buttons, will correctly program the digital clock.

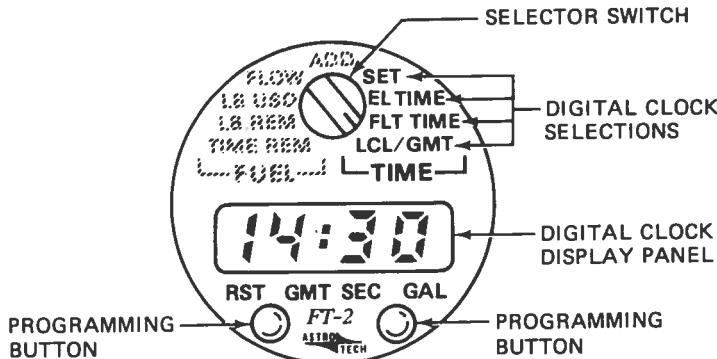


Figure 3. Digital Clock Controls and Display

## NOTE

Some models may have an unmarked detent position between the ADD and SET positions. This position performs the same function as the SET position.

The digital clock may be set the local (LCL) and Greenwich Mean Time (GMT) as follows:

1. Rotate the selector switch to the SET position.
2. Press the left programming button until local hours advance to the correct value.
3. Press both programming buttons together until Greenwich Mean Time hours advance to the correct value.
4. Press right programming button until minutes advance to correct value. This action sets and holds seconds to zero.
5. Rotate selector switch from SET to start seconds from zero hold.

To display the local time-of-day in hours and minutes, rotate the selector switch to LCL/GMT. If a minutes and seconds display is desired, press the right programming button, labeled SEC. If Greenwich Mean Time in hours and minutes is desired, press the left programming button, labeled GMT.

## NOTE

Local or Greenwich Mean Time hours may be changed without resetting the minutes and seconds.

To display accumulated flight time, rotate the selector switch to FLT TIME. After the first hour, if a minutes and seconds display is desired in place of the hours and minutes display, press the right (SEC) programming button. Flight time may be reset to zero by pressing the left (RST) programming button.

## NOTE

Accumulated flight time may be zeroed only when the instrument is not counting, (whenever fuel flow is less than 25-30 PPH) to prevent accidentally zeroing flight time in the air.

Elapsed time (since pressing the RST button) is displayed by rotating the selector switch to the EL TIME position. After the first hour, if a minutes and seconds display is desired in place of the hours and minutes display, press the right (SEC) programming button. Elapsed time may be reset to zero by pressing the left (RST) programming button.

## SECTION 5

### PERFORMANCE

There is no change to the airplane performance when the fuel computer/digital clock is installed.

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## SUPPLEMENT

# GROUND SERVICE PLUG RECEPTACLE

### SECTION 1 GENERAL

The ground service plug receptacle permits the use of an external power source for cold weather starting and during lengthy maintenance work on electrical and avionics equipment. The receptacle is located behind the engine oil dipstick access door on the left side of the upper cowling.

#### NOTE

If no avionics equipment is to be used or worked on, the avionics power switch should be turned off. If maintenance is required on the avionics equipment, it is advisable to utilize a battery cart external power source to prevent damage to the avionics equipment by transient voltage. Do not crank or start the engine with the avionics power switch turned on.

A special fused circuit is included with the ground service plug receptacle which will close the battery contactor when external power is applied with the master switch turned on. This circuit is intended as a servicing aid when battery power is too low to close the contactor, and should not be used to avoid performing proper maintenance procedures on a low battery.

#### NOTE

Use of the ground service plug receptacle for starting an airplane with a "dead" battery or charging a "dead" battery in the airplane is not recommended. The battery should be removed from the airplane and serviced in accordance with Service Manual procedures. Failure to observe this precaution could result in loss of electrical power during flight.

## SECTION 2

### LIMITATIONS

The following information must be presented in the form of a placard located on the inside of the engine oil dipstick access door:

<b>CAUTION</b>	<b>24 VOLTS D.C.</b>
This aircraft is equipped with alternator and a negative ground system.	
<b>OBSERVE PROPER POLARITY</b>	
Reverse polarity will damage electrical components.	

## SECTION 3

### EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when the ground service plug receptacle is installed.

## SECTION 4

### NORMAL PROCEDURES

Just before connecting an external power source (generator type or battery cart), the avionics power switch should be turned off, and the master switch turned on.

#### **WARNING**

When turning on the master switch, using an external power source, or pulling the propeller through by hand, treat the propeller as if the ignition switch were ON. Do not stand, nor allow anyone else to stand, within the arc of the propeller since a loose or broken wire or a component malfunction could cause the propeller to rotate.

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The ground service plug receptacle circuit incorporates a polarity reversal protection. Power from the external power source will flow only if the ground service plug is correctly connected to the airplane. If the plug is accidentally connected backwards, no power will flow to the electrical system, thereby preventing any damage to electrical equipment.

The following check should be made after engine start and removal of the external power source, if there is any question as to the condition of the battery.

1. Master Switch -- OFF.
2. Taxi and Landing Light Switches -- ON.
3. Engine RPM -- REDUCE to idle.
4. Master Switch -- ON (with taxi and landing lights turned on).
5. Engine RPM -- INCREASE to approximately 1500 RPM.
6. Ammeter and Low-Voltage Warning Light -- CHECK.

NOTE

If the ammeter does not show a charge or the low-voltage warning light does not go out, the battery should be removed from the airplane and properly serviced prior to flight.

## SECTION 5 PERFORMANCE

There is no change to the airplane performance when the ground service plug receptacle is installed.

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## SUPPLEMENT

# KNOWN ICING EQUIPMENT

### SECTION 1 GENERAL

The flight into known icing equipment package allows flight penetration of icing conditions as defined by the FAA. The package includes extended coverage pneumatic de-icing boots on the wings and horizontal and vertical stabilizer leading edges, electrically-heated propeller blade anti-ice boots, a permanently installed electric windshield anti-ice panel, a high power heated pitot tube, a high power heated stall warning transducer, a high capacity (95-amp) alternator or dual 60-amp alternators, dual vacuum pumps, an ice detector light, and control surface-mounted static discharger wicks. The package is designed to provide adequate in-flight protection during the normally encountered extremes of icing conditions produced by moisture laden clouds. It will not necessarily provide total protection under abnormally severe conditions such as those which exist in areas of freezing rain or extremely widespread areas of heavy cloud moisture content. During all operations, the pilot must exercise good judgment and be prepared to alter his flight if conditions exceed the capacity of the ice protection equipment or if any component of this equipment fails.

The in-flight ice protection equipment was not designed to remove ice, snow, or frost accumulations on a parked airplane sufficiently enough to ensure a safe takeoff or subsequent flight. Other means (such as a heated hangar or approved de-icing solutions) should be employed to ensure that all wing, tail, control, propeller, windshield and static port surfaces are free of ice, snow, and frost accumulations, and that there are no internal accumulations of ice or debris in the control surfaces, engine intakes and pitot-static system ports prior to takeoff.

#### WING AND STABILIZER DE-ICE BOOTS

The pneumatic de-ice boot system installed on the leading edges of the wings and horizontal and vertical stabilizers is designed to remove ice after accumulation in flight rather than prevent ice formation. The system consists of the pneumatically-operated boots, dual engine-driven vacuum pumps, an annunciator light to monitor system operation, system controls, and the hardware necessary to complete the installation. In operation, the boots expand and contract, using pressure or vacuum from the right vacuum pump.

## NOTE

Although the airplane is equipped with a dual vacuum system, the wing and stabilizer de-ice boots are operated by the right vacuum pump only.

Normally, vacuum is applied to all boots to hold them against the leading edge surfaces. When a de-icing cycle is initiated, the vacuum is removed and a pressure is applied to "blow up" the boots. The resulting change in contour will break the ice accumulation on the leading edges. Ice on the boots will then be removed by normal in-flight air forces.

Controls for the de-icing system consist of a two-position rocker-type de-icing switch on the left switch and control panel, a pressure indicator light on the upper left side of the instrument panel, and a 5-amp "pull-off" type circuit breaker on the left sidewall circuit breaker panel. The de-icing switch, labeled DE-ICE PRESS, is spring-loaded to the normal off (lower) position. When pushed to the ON (upper) position and released, it will activate one de-icing cycle. Each time a cycle is desired, the switch must be pushed to the ON position and released. If necessary, the system can be stopped at any point in the cycle (deflating the boots) by pulling the circuit breaker, labeled WING, DE-ICE PULL-OFF, to the off position.

During a normal de-icing cycle, the boots will inflate according to the following sequence: first the tail section (horizontal and vertical stabilizer) boots inflate for approximately six seconds, then the inboard wing boots inflate for the next six seconds, followed by the outboard wing boots for another six seconds. The total time required for one cycle is approximately 18 seconds.

The pressure indicator light, labeled DE-ICE PRESSURE, should illuminate when the tail section boots reach proper operating pressure. At lower altitudes, it should come on within one to two seconds after the cycle is initiated and remain on for approximately 17 seconds if the system is operating properly. At higher altitudes, the light will come on initially within three seconds and will go off for one to three seconds during sequencing. The system may be recycled six seconds after the light goes out. The absence of illumination during any one of the three sequences of a cycle indicates insufficient pressure for proper system operation, and icing conditions should be avoided.

## PROPELLER ANTI-ICE BOOTS

The propeller anti-ice system provides a measure of protection for the propeller blade surfaces if icing conditions are encountered. The system is operated by a rocker-type switch on the left switch and control panel. When

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the switch, labeled PROP A/ICE, is placed in the ON position, current flows to an anti-ice timer which cycles electric power every 20 seconds between the inboard and outboard set of heating elements in the anti-icing boots located on the propeller blades. ~~Operation of the anti-ice system can be checked by monitoring a propeller anti-ice ammeter near the upper left corner of the instrument panel.~~ The system is protected by a 20-amp "push-to-reset" type circuit breaker, labeled PROP A/ICE, located on the left sidewall circuit breaker panel.

## WINDSHIELD ANTI-ICE PANEL

An electrically-heated panel is permanently installed on the pilot's side of the windshield to assure a clear view for landing during icing conditions. The system is designed to prevent ice formation rather than remove it once formed. Components of the system include a heating element and temperature sensor within the windshield panel, a 15-amp "push-to-reset" type circuit breaker, labeled W/S A/ICE, on the left sidewall circuit breaker panel and a rocker-type switch, labeled W/S A/ICE, on the left switch and control panel.

During operation, the windshield heat will cycle on and off as required to maintain the proper heater element temperature. Operation can be verified by feeling the inside of the windshield and noting the relatively warmer surface behind the panel as compared to elsewhere on the windshield. In addition, slight changes to the panel light transmissibility, compass deviation, and airplane ammeter readings will provide an indication as the element cycles on and off.

## PITOT TUBE AND STALL WARNING HEATER

A special pitot tube with a larger inlet and higher capacity heating element and a higher capacity heated stall warning transducer are installed in the left wing to assure proper airspeed indications and stall warning in the event icing conditions are encountered. These systems are designed to prevent ice formation rather than remove it once formed. Electrical components of these systems include a rocker-type switch, labeled PITOT HEAT, on the left switch and control panel and a 15-amp "push-to-reset" type circuit breaker, labeled PITOT HEAT, on the left sidewall circuit breaker panel. When the airplane is on the ground, a resistor is introduced into the stall warning heater circuit by the nose wheel squat switch in order to prevent overheating.

## ICE DETECTOR LIGHT

An ice detector light is flush-mounted on the left side of the cowl deck to facilitate the detection of wing ice at night or during reduced visibility by lighting the leading edge of the wing. Components of the system include the ice detector light, a two-position rocker-type switch, labeled DE-ICE

LIGHT, on the left switch and control panel and a 5-amp "push-to-reset" type circuit breaker, labeled CABIN LIGHTS, on the left sidewall circuit breaker panel. The rocker switch is spring-loaded to the off (lower) position and must be held in the ON (upper) position to keep the ice detector light illuminating.

## SECTION 2 LIMITATIONS

This airplane is approved for flight into icing conditions as defined by the FAA provided the following Cessna (drawing number 1200254) and FAA approved equipment is installed and is operational:

1. Wing leading edge boots.
2. Horizontal stabilizer leading edge boots.
3. Vertical stabilizer leading edge boots.
4. Propeller anti-ice boots.
5. Windshield anti-ice panel.
6. Heated pitot tube (high capacity).
7. Heated stall warning transducer (high capacity).
8. Ice detector light.
9. 95-amp alternator or dual 60-amp alternators.
10. Control surface static dischargers.

If the pilot's windshield is covered with ice, do not leave the windshield anti-ice switch on for more than one minute. Prolonged operation may cause an overheat condition which can result in warpage and distortion of the panel and possible damage to the windshield.

The following placard must be installed when a known icing equipment package is installed:

1. In full view of the pilot in place of the similar type placard shown in Section 2 of the basic handbook:

The markings and placards installed in this airplane contain operating limitations which must be complied with when operating this airplane in the Normal Category. Other operating limitations which must be complied with when operating this airplane in this category are contained in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

No acrobatic maneuvers, including spins, approved.  
This airplane is approved for flight into icing conditions if the proper optional equipment is installed and operational.

This airplane is certified for the following flight operations as of date of original airworthiness certificate:

DAY—NIGHT—VFR—IFR

## SECTION 3 EMERGENCY PROCEDURES

### PROPELLER ANTI-ICE SYSTEM MALFUNCTION

If uneven de-icing of propeller blades is indicated by excessive vibration:

1. Propeller -- EXERCISE to MAX RPM.
2. Propeller Anti-Ice Ammeter -- CHECK for proper operation by periodic fluctuations within the green arc.
3. If reading is below the green arc indicating that the propeller blades may not be de-iced uniformly:
  - a. Propeller Anti-Ice Switch -- OFF.

### WARNING

When uneven anti-icing of the propeller blades is indicated, it is imperative that the anti-ice system be turned OFF. Uneven anti-icing of the blades can result in propeller unbalance and engine failure.

4. Icing Conditions -- DIVERT to non-icing conditions with assistance of ATC.

**CAUTION**

If after leaving icing conditions, roughness or vibration develops or persists that is not traceable to icing or another cause, reduce engine RPM to smoothest condition and plan a landing at the nearest airport to check the security of the anti-ice boots as a possible cause.

**WING AND STABILIZER DE-ICE SYSTEM MALFUNCTION**

If the wing and stabilizer de-ice boots fail to inflate sufficiently during any or all of the three sequences of one cycle, verify that the right vacuum pump is operating (red button is not visible), the circuit breaker is pushed full in and the pressure indicator light is operative (press to test); then attempt another cycle. If the system is still deficient, avoid or divert from the existing icing conditions. If there are unshed ice accumulations along the wing and stabilizer leading edges during an approach and landing, follow the procedures listed under Inadvertent Icing Encounters in Section 3 of the basic handbook.

**SECTION 4  
NORMAL PROCEDURES****PREFLIGHT INSPECTION**

1. De-Ice Boots -- CHECK for tears, abrasions and cleanliness.
2. Propeller Anti-Ice Boots -- CHECK condition of boots and wires.
3. Pitot Heat Switch -- ON for 30 seconds, then OFF (ensure pitot cover is removed).
4. Pitot Tube -- CLEAR and VERY WARM.
5. Stall Warning Transducer -- PERCEPTIBLY WARM.
6. Ice Detector Light Switch -- ON.
7. Ice Detector Light -- ILLUMINATED.
8. Wing, Tail, Control, Propeller, Windshield and Static Port Surfaces -- CHECK free of ice, snow and frost accumulations. Also, check that control surfaces, engine intakes and static ports contain no internal accumulations of ice or debris.

**DURING ENGINE RUNUP**

1. De-Icing Switch -- ON and release. Check inflation and deflation cycle of tail and wing boots.
2. Pressure Indicator Light -- CHECK ON within three seconds and OFF after 18 seconds.
3. Boots -- CHECK VISUALLY FOR COMPLETE DEFLATION to the

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- vacuum hold-down condition.
4. Propeller Anti-Ice Switch -- ON.
  5. Propeller Anti-Ice Ammeter -- CHECK in green arc range and for periodic cycling.

## NOTE

To check the heating elements and anti-ice timer for one complete cycle, the system must be left on for approximately one minute. Ammeter readings must remain in the green arc except during momentary change when cycling.

6. Windshield Anti-Ice Switch -- ON and observe momentary flicker of airplane ammeter and/or slight change in compass indication.
7. Windshield Surface -- WARM to touch behind panel after 5 minutes.

---

**CAUTION**

Do not operate the windshield anti-ice system if the windshield is covered with ice. Refer to Section 2, Limitations.

8. Pitot Heat, Propeller Anti-Ice and Windshield Anti-Ice Switches -- AS REQUIRED for takeoff and climbout conditions.

---

**CAUTION**

Do not operate the pitot heat and propeller anti-ice heaters for prolonged periods on the ground.

## INFLIGHT

1. Before Visible Moisture is Encountered Below Approximately 40°F (4°C):
  - a. Propeller Anti-Ice Switch -- ON.
  - b. Propeller Anti-Ice Ammeter -- MONITOR.

---

**CAUTION**

If the ammeter indicates unusually high or low amperage during the 20-second cycle of operation, a malfunction has occurred and it is imperative that the system be turned off. Uneven anti-icing may result, causing propeller unbalance and engine roughness.

- c. Windshield Anti-Ice Switch -- ON.

**NOTE**

Under non-icing conditions (especially at night), turn the windshield anti-ice switch OFF to avoid a mild impairment (distortion) of vision through the panel that occurs when the heating elements in the panel are activated during the on cycle.

**NOTE**

For accurate magnetic compass readings, turn the pitot heat, propeller anti-ice and windshield anti-ice switches OFF momentarily.

**d. Pitot Heat Switch -- ON.****NOTE**

While using the anti-ice systems, monitor the airplane ammeter to ensure that the electrical system does not become overloaded. If the total electrical load is high, resulting in a discharge indication, limit the use of other electrical equipment so that the airplane ammeter maintains a slight charge.

**2. During Icing Encounters:**

- a. Ice Detector Light -- ON as required.
- b. Ice Build-up -- MONITOR until approximately 1/4 to 1/2 inch thick on the leading edges.

**NOTE**

De-icing boots are intended for removal of ice after it has accumulated rather than prevent its formation. If ice accumulation is slow, best results can be obtained by not using the de-ice system until approximately 1/4 to 1/2 inch of ice has accumulated. Clear the accumulation with one or two cycles of operation. Do not repeat de-icing procedure until ice has again accumulated.

- c. De-Icing Switch -- ON and release. The switch must be actuated after each complete boot cycle if additional cycles are required.

**NOTE**

Cycling the de-icing boots produces no adverse aerody-

namic effects in any attitude within the allowable flight limitations. Continual cycling of the de-ice system, however, is not recommended as this may cause ice to form outside the contour of the inflated boots, preventing its removal. The de-ice system will operate effectively up to a maximum altitude of 22,000 feet; however, at or near this altitude, engine RPM must be a minimum of 2500 RPM.

- d. Power -- INCREASE as required to maintain a safe airspeed or to climb out of icing conditions, if feasible.

#### NOTE

An accumulation of 1/2 inch of ice on the leading edges can cause a large (up to 500 FPM) loss in rate of climb, a cruise speed reduction of up to 30 KIAS, as well as a significant buffet and stall speed increase (up to 15 knots). Even after cycling the de-icing boots, the ice accumulation remaining on the unprotected areas of the airplane can cause large performance losses. With residual ice from the initial 1/2 inch accumulation, losses up to 300 FPM in climb, 15 KIAS in cruise, and a stall speed increase of 7 knots can result. With one inch of residual accumulation, these losses can double.

- e. Airspeed -- MAINTAIN BETWEEN 90 KIAS AND 165 KIAS with 1/2 inch or more of ice accumulation.

#### NOTE

Prior to a landing approach, cycle the wing and stabilizer de-ice boots to shed any accumulated ice. Maintain extra airspeed on approach to compensate for the increased prestall buffet associated with ice on unprotected areas. Do not cycle the boots during an approach or landing since boot inflation increases stall speeds by 3 knots, decreases stall warning by the same amount, and may cause or increase any rolling tendency during stall.

Refer to Section 8 of the basic handbook for care and maintenance of the wing and stabilizer de-ice and propeller anti-ice boots.

## SECTION 5 PERFORMANCE

The following approximate performance changes from those shown in

Section 5 of the basic handbook occur in clear air (no ice accumulation) as a result of the installation of the flight into known icing package:

Climb Rate: 30 FPM decrease.

Cruise Speed: 2 to 3 KTAS decrease.

As noted in Section 4 of this supplement, much greater changes in performance occur with ice accumulation. Make appropriate allowances for the possibility of these losses occurring when planning a flight into or through forecast or reported icing conditions.

# SUPPLEMENT

## OXYGEN SYSTEM

### SECTION 1 GENERAL

A six-place oxygen system provides the supplementary oxygen necessary for continuous high altitude flight. If the airplane is not equipped with air conditioning, this system contains four oxygen cylinders located in the fuselage cabin top. In airplanes equipped with air conditioning, the system contains one oxygen cylinder located above the main gear wheel wells aft of the baggage compartment. Cylinder pressure is reduced to an operating pressure of 70 PSI by pressure regulator/shutoff valve assemblies. An oxygen cylinder filler valve is located under a cover plate on the bottom of the right wing just outboard of the rear door post. Cylinder pressure is indicated by a pressure gage located in the overhead console above the pilot and front passenger's seats.

Six oxygen outlets are provided; two each in consoles above the front seats and center passenger seats, and one each in two separate consoles near the aft passenger seats. One permanent, microphone equipped mask is provided for the pilot, and five disposable type masks are provided for the passengers. All masks are the partial rebreathing type, equipped with vinyl plastic hoses and flow indicators.

#### NOTE

The hose provided for the pilot is of a higher flow rate than those for the passengers; it is color-coded with a red band adjacent to the plug-in fitting. The passenger hoses are color-coded with an orange band. If the airplane owner prefers, he may provide higher flow hoses for all passengers. In any case, it is recommended that the pilot use the larger capacity hose. The pilot's mask is equipped with a microphone to facilitate use of the radio while using oxygen. An adapter cord is furnished with the microphone-equipped mask to mate the mask microphone lead to the auxiliary microphone jack located on the left side of the instrument panel. To connect the oxygen mask microphone, connect the mask lead to the adapter cord and plug the cord into the auxiliary microphone jack. (If an optional microphone-headset combination has been in use, the microphone lead from this equipment is already

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plugged into the auxiliary microphone jack. It will be necessary to disconnect this lead from the auxiliary microphone jack so that the adapter cord from the oxygen mask microphone can be plugged into the jack.) A switch is incorporated on the left hand control wheel to operate the microphone.

A remote shutoff valve control in the overhead console above the pilot's and front passenger's seats is used to shut off the supply of oxygen to the system when not in use. The control is mechanically connected to the shutoff valve at the cylinder. With the exception of the shutoff function, the system is completely automatic and requires no manual regulation for change of altitude.

The oxygen cylinders, when fully charged, contain a total of approximately 74 cubic feet at 1800 PSI (overhead cylinders) or 76 cubic feet at 1850 PSI (aft cylinder) of aviator's breathing oxygen (Spec. No. MIL-O-27210), at 21°C (70°F). Filling pressures will vary with ambient temperature in the filling area, and the temperature rise resulting from compression of the oxygen. Because of these factors, merely filling the overhead cylinders to 1800 PSI or the aft cylinder to 1850 PSI, will not result in properly filled cylinders. Fill to pressures indicated in the Oxygen Filling Pressures tables, figures 1 and 2.

### WARNING

Oil, grease or other lubricants in contact with oxygen create a serious fire hazard, and such contact must be avoided when handling oxygen equipment.

74 CUBIC FEET CAPACITY AT 1800 PSI			
AMBIENT TEMPERATURE °F	FILLING PRESSURE PSIG	AMBIENT TEMPERATURE °F	FILLING PRESSURE PSIG
0	1600	50	1825
10	1650	60	1875
20	1675	70	1925
30	1725	80	1950
40	1775	90	2000

Figure 1. Oxygen Filling Pressures (Without Air Conditioning)

76 CUBIC FEET CAPACITY AT 1850 PSI			
AMBIENT TEMPERATURE °F	FILLING PRESSURE PSIG	AMBIENT TEMPERATURE °F	FILLING PRESSURE PSIG
0	1650	50	1875
10	1700	60	1925
20	1725	70	1975
30	1775	80	2000
40	1825	90	2050

Figure 2. Oxygen Filling Pressures (With Air Conditioning)

## SECTION 2 LIMITATIONS

There is no change to the airplane limitations when oxygen equipment is installed.

## SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when oxygen equipment is installed.

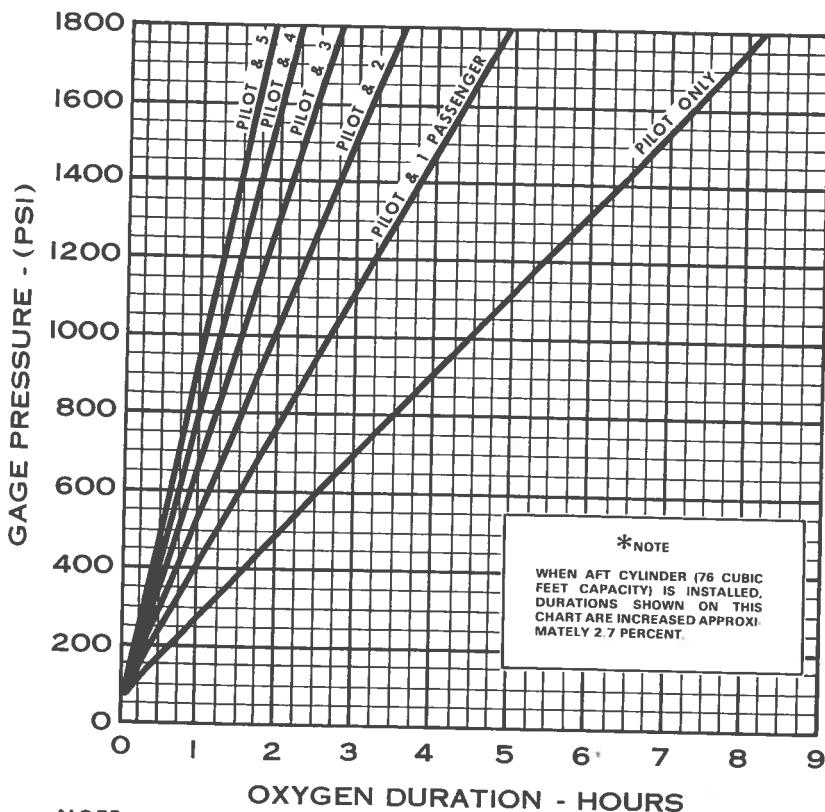
## SECTION 4 NORMAL PROCEDURES

For FAA requirements concerning supplemental oxygen, refer to FAR 91.32. Supplemental oxygen should be used by all occupants when cruising above 12,500 feet. As described in the Cessna booklet "Man At Altitude," it is often advisable to use oxygen at altitudes lower than 12,500 feet under conditions of night flying, fatigue, or periods of physiological or emotional disturbances. Also, the habitual and excessive use of tobacco or alcohol will usually necessitate the use of oxygen at less than 10,000 feet.

Prior to flight, check to be sure that there is an adequate oxygen supply for the trip, by noting the oxygen pressure gage reading, and referring to the Oxygen Duration Chart (figure 3). Also, check that the face masks and hoses are accessible and in good condition.

## OXYGEN DURATION CHART

\* (74 CUBIC FEET CAPACITY)



**NOTE:**

This chart is based on a pilot with a red color-coded oxygen line fitting and passengers with orange color-coded line fittings.

Figure 3. Oxygen Duration Chart

The Oxygen Duration Chart (figure 3) should be used in determining the usable duration (in hours) of the oxygen supply in your airplane. The following procedure outlines the method of finding the duration from the chart.

1. Note the available oxygen pressure shown on the pressure gage.
2. Locate this pressure on the scale on the left side of the chart, then go across the chart horizontally to the right until you intersect the line representing the number of persons making the flight. After intersecting the line, drop down vertically to the bottom of the chart and read the duration in hours given on the scale.
3. As an example of the above procedure, 1400 PSI of pressure will safely sustain the pilot only for 6 hours and 20 minutes. The same pressure will sustain the pilot and three passengers for approximately 2 hours and 10 minutes.

#### NOTE

The Oxygen Duration Chart is based on a standard configuration oxygen system having one red color-coded hose assembly for the pilot and orange color-coded hoses for the passengers. If red color-coded hoses are provided for pilot and passengers, it will be necessary to compute new oxygen duration figures due to the greater consumption of oxygen with these hoses. This is accomplished by computing the total duration available to the pilot only (from PILOT ONLY line on chart), then dividing this duration by the number of persons (pilot and passengers) using oxygen.

When ready to use the oxygen system, proceed as follows:

1. Mask and Hose -- SELECT. Adjust mask to face and adjust metallic nose strap for snug mask fit.

#### **WARNING**

Permit no smoking when using oxygen. Oil, grease, soap, lipstick, lip balm, and other fatty materials constitute a serious fire hazard when in contact with oxygen. Be sure hands and clothing are oil-free before handling oxygen equipment.

2. Delivery Hose -- PLUG INTO OUTLET nearest to the seat you are occupying.

**NOTE**

When the oxygen system is turned on, oxygen will flow continuously at the proper rate of flow for any altitude without any manual adjustments.

3. Oxygen Supply Control Knob -- ON.
4. Face Mask Hose Flow Indicator -- CHECK. Oxygen is flowing if the indicator is being forced toward the mask.
5. Delivery Hose -- UNPLUG from outlet when discontinuing use of oxygen. This automatically stops the flow of oxygen.
6. Oxygen Supply Control Knob -- OFF when oxygen is no longer required.

**SECTION 5**  
**PERFORMANCE**

There is no change to the airplane performance when oxygen equipment is installed.

## SUPPLEMENT

# PROPELLER ANTI-ICE SYSTEM

### SECTION 1 GENERAL

The propeller anti-ice system provides a measure of protection for the propeller blade surfaces if unexpected icing conditions are encountered. The system is operated by a rocker switch, labeled PROP A/ICE, on the left switch and control panel. When the switch is placed in the ON position, electric current flows to an anti-ice timer which cycles the current every 20 seconds between the inboard and outboard set of heating elements in the anti-icing boots located on the propeller blades. Operation of the anti-icing system can be checked by monitoring an ammeter, labeled PROP ANTI-ICE AMPS, near the upper left corner of the instrument panel. The system is protected by a 20-amp "push-to-reset" type circuit breaker, labeled PROP A/ICE, located on the left sidewall circuit breaker panel.

### SECTION 2 LIMITATIONS

There is no change to the airplane limitations when the propeller anti-ice system is installed; intentional flight into known icing conditions is prohibited, regardless of installed ice protection equipment.

### SECTION 3 EMERGENCY PROCEDURES

Flight into known icing conditions is prohibited. If unexpected icing conditions are encountered, the Inadvertent Icing Encounter checklist in Section 3 of the basic handbook should be followed. In addition the following procedure is recommended:

1. Master Switch -- ON.
2. Propeller Anti-Ice Switch -- ON.
3. Propeller Anti-Ice Ammeter -- CHECK in green arc range (14 to 18)

amps) and ammeter pointer for periodic cycling (approximately every 20 seconds).

**NOTE**

To check the heating elements and anti-ice timer for one complete cycle, the system must be left on for approximately 1 minute. Ammeter readings must remain in the green arc except during momentary change.

**NOTE**

While using the anti-ice system, monitor the airplane ammeter to ensure that the electrical system does not become overloaded. If the total electrical load is high, resulting in a discharge indication, limit the use of other electrical equipment so that the airplane ammeter maintains a slight charge.

**CAUTION**

If the anti-ice ammeter indicates unusually high or low amperage (out of the green arc range limits) anytime during system operation, or if the ammeter pointer does not "flick" approximately every 20 seconds, a malfunction has occurred. It is imperative that the system be turned off, since uneven anti-icing may result, causing propeller unbalance and engine roughness. If, after leaving icing conditions, roughness or vibration develops or persists that is not traceable to icing or another cause, reduce engine RPM to smoothest condition and plan a landing at the nearest airport to check the security of the anti-ice boots as a possible cause.

4. Propeller Anti-Ice Switch -- OFF when anti-icing is no longer required.

## **SECTION 4**

### **NORMAL PROCEDURES**

There is no change to the airplane normal procedures when the propeller anti-ice system is installed.

Refer to Section 8 of the basic handbook for care and maintenance of the propeller anti-ice boots.

## SECTION 5

### PERFORMANCE

There is no change to the airplane performance when the propeller anti-ice system is installed.



## SUPPLEMENT

# STROBE LIGHT SYSTEM

### SECTION 1 GENERAL

The high intensity strobe light system enhances anti-collision protection for the airplane. The system consists of two wing tip-mounted strobe lights (with integral power supplies), a two-position rocker switch labeled STROBE LIGHTS, on the left switch and control panel, and a 5-amp "push-to-reset" type circuit breaker, labeled STROBE LIGHTS, on the left sidewall circuit breaker panel.

### SECTION 2 LIMITATIONS

Strobe lights must be turned off when taxiing in the vicinity of other airplanes, or during night flight through clouds, fog or haze.

### SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when strobe lights are installed.

## **SECTION 4 NORMAL PROCEDURES**

To operate the strobe light system, proceed as follows:

1. Master Switch -- ON.
2. Strobe Light Switch -- ON.

## **SECTION 5 PERFORMANCE**

The installation of strobe lights will result in a minor (less than 1 knot) reduction in cruise performance.

## SUPPLEMENT

# WINDSHIELD ANTI-ICE SYSTEM

### SECTION 1 GENERAL

The windshield anti-ice system assures adequate visibility for a landing during flight conditions where ice may form on the windshield. A detachable electrically-heated glass panel, 11.0 inches high by 5.5 inches wide, mounts to the base of the windshield in front of the pilot. Quick disconnects are provided to facilitate ease of installation and removal. When not in use, a padded cover is provided for protection against scratches, breakage, and wiring damage, and the panel may be stowed in the seat pocket on the aft side of the pilot's or front passenger's seat back. Windshield anti-icing is controlled by a rocker-type switch, labeled W/S A/ICE, located on the left switch and control panel. The system is protected by a 5-ampere, "push-to-reset" type circuit breaker, labeled W/S A/ICE, located on the left sidewall circuit breaker panel.

The heated glass panel should be installed whenever icing conditions are a possibility on a proposed flight, especially if the freezing level is near or at the surface.

### SECTION 2 LIMITATIONS

There is no change to the airplane limitations when the windshield anti-ice system is installed; intentional flight into known icing conditions is prohibited regardless of installed ice protection equipment. Prolonged operation of the system without the engine running should be avoided.

### SECTION 3 EMERGENCY PROCEDURES

Flight into known icing conditions is prohibited. If unexpected icing conditions are encountered, the Inadvertent Icing Encounter checklist in Section 3 of the basic handbook should be followed. In addition, the following procedure is recommended:

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- 1.** Windshield Anti-Ice Switch -- ON 5 to 10 minutes in advance of its need. The anti-ice system may become ineffective if a large accumulation of ice is allowed to form.

### **NOTE**

For accurate magnetic compass readings, turn the pitot heat, propeller anti-ice and windshield anti-ice switches OFF momentarily.

- 2.** Windshield Anti-Ice Switch -- OFF when the possibility of icing no longer exists.

## **SECTION 4 NORMAL PROCEDURES**

The anti-ice system should be checked, prior to engine start, as follows:

- 1.** Anti-Ice Panel -- INSTALL.
- 2.** Master Switch -- ON.
- 3.** Windshield Anti-Ice Switch -- ON for one minute.
- 4.** Anti-Ice Panel -- CHECK FOR WARMTH (step outside the airplane to feel for warmth in the panel).
- 5.** Windshield Anti-Ice and Master Switches -- OFF.

### **CAUTION**

Inadvertent prolonged operation of the heated anti-icing panel without the engine running may cause damage to the panel and crazing of the windshield.

## **SECTION 5 PERFORMANCE**

There is no change to the airplane performance when the windshield anti-ice system is installed.

## SUPPLEMENT

# WING AND STABILIZER DE-ICE SYSTEM

## SECTION 1 GENERAL

Pneumatic de-icing boots, installed on the leading edges of the wings, and the horizontal stabilizer provide a measure of protection if unexpected icing conditions are encountered. The system is designed to remove ice after accumulation in flight, rather than prevent ice formation.

### NOTE

This system was not designed to remove ice, snow, or frost accumulations on a parked airplane sufficiently enough to ensure a safe takeoff or subsequent flight. Other means (such as a heated hangar or approved de-icing solutions) should be employed to ensure that all wing, tail, control, propeller, windshield and static port surfaces are free of ice, snow, and frost accumulations, and that there are no internal accumulations of ice or debris in the control surfaces, engine intakes and pitot-static system ports prior to takeoff.

The de-ice boot system consists of pneumatically operated boots, dual engine-driven vacuum pumps, an annunciator light to monitor system operation, system controls and the hardware necessary to complete the system. In operation, the boots expand and contract, using pressure or vacuum from the right vacuum pump.

### NOTE

Although the airplane is equipped with a dual vacuum system, the wing and stabilizer de-ice boots are operated by the right vacuum pump only.

Normally, vacuum is applied to all boots to hold them against the leading edge surfaces. When a de-icing cycle is initiated, the vacuum is removed and a pressure is applied to "blow up" the boots. Ice on the boots will then be removed by normal in-flight air forces.

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### **WING AND STABILIZER DE-ICE SYSTEM MODEL T210N**

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Controls for the de-icing system consist of a rocker-type switch on the left switch and control panel, a pressure indicator light on the upper left side of the instrument panel, and a 5-amp "pull-off" type circuit breaker on the left sidewall circuit breaker panel. The two-position de-icing switch, labeled DE-ICE PRESS, is spring-loaded to the normal off (lower) position. When pushed to the ON (upper) position and released, it will activate one de-icing cycle. Each time a cycle is desired, the switch must be pushed to the ON position and released. If necessary, the system can be stopped at any point in the cycle (deflating the boots) by pulling the circuit breaker labeled WING, DE-ICE PULL-OFF, to the off position.

During a normal de-icing cycle, the boots will inflate according to the following sequence: first the horizontal stabilizer boots will inflate for approximately six seconds, then the inboard wing boots inflate for the next six seconds, followed by the outboard wing boots for another six seconds. The total time required for one cycle is approximately 18 seconds.

The pressure indicator light, labeled DE-ICE PRESSURE, should illuminate when the horizontal stabilizer boots reach proper operating pressure. At lower altitudes, it should come on within one to two seconds after the cycle is initiated and remain on for approximately 17 seconds if the system is operating properly. At higher altitudes, the light will come on initially within three seconds and will go off for one to three seconds during sequencing. The system may be recycled six seconds after the light goes out. The absence of illumination during any one of the three sequences of a cycle indicates insufficient pressure for proper boot inflation and effective de-icing ability.

An ice detector light is flush-mounted on the left side of the cowl deck to facilitate the detection of wing ice at night or during reduced visibility by lighting the leading edge of the wing. Components of the system include the ice detector light, a two-position rocker-type switch, labeled DE-ICE LIGHT, on the left switch and control panel and a 5-amp "push-to-reset" type circuit breaker, labeled CABIN LIGHTS, on the left sidewall circuit breaker panel. The rocker switch is spring-loaded to the off (lower) position and must be held in the ON (upper) position to keep the ice detector light illuminating.

## **SECTION 2 LIMITATIONS**

There is no change to the airplane limitations when the wing and stabilizer de-ice system is installed; intentional flight into known icing conditions is prohibited.

## SECTION 3

### EMERGENCY PROCEDURES

Flight into known icing conditions is prohibited. If unexpected icing conditions are encountered, the Inadvertent Icing Encounter checklist in Section 3 of the basic handbook should be followed. In addition, the following procedure is recommended.

1. Icing Condition -- LEAVE as soon as possible. Divert to non-icing conditions with assistance of ATC.

#### NOTE

Since wing and horizontal stabilizer de-icer boots alone do not provide adequate protection for the entire airplane, known icing conditions should be avoided. If icing is inadvertently encountered, close attention should be given to the pitot-static system, propeller, induction system and other components subject to icing.

2. Ice Detector Light -- ON as required.
3. Ice Build-up -- MONITOR until approximately 1/4 to 1/2 inch thick on the leading edges.

#### NOTE

De-icing boots are intended for removal of ice after it has accumulated rather than prevent its formation. If ice accumulation is slow, best results can be obtained by not using the de-ice system until approximately 1/4 to 1/2 inch of ice has accumulated. Clear the accumulation with one or two cycles of operation. Do not repeat de-icing procedure until ice has again accumulated.

4. De-Icing Switch -- ON and release. The switch must be actuated after each complete boot cycle if additional cycles are required.

#### NOTE

Cycling the de-icing boots produces no adverse aerodynamic effects in any attitude within the allowable flight limitations. Continual cycling of the de-ice system, however, is not recommended as this may cause ice to form outside the contour of the inflated boots, preventing its removal. The de-ice system will operate effectively up to a maximum altitude of 22,000 feet; however, at or near this

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altitude, engine RPM must be a minimum of 2500 RPM.

5. Power -- INCREASE as required to maintain a safe airspeed or, if feasible, to climb out of icing conditions.

### **NOTE**

An accumulation of 1/2 inch of ice on the leading edges can cause a large (up to 500 FPM) loss in rate of climb, a cruise speed reduction of up to 30 KIAS, as well as a significant buffet and stall speed increase (up to 15 knots). Even after cycling the de-icing boots, the ice accumulation remaining on the unprotected areas of the airplane can cause large performance losses. With residual ice from the initial 1/2 inch accumulation, losses up to 300 FPM in climb, 15 KIAS in cruise, and a stall speed increase of 7 knots can result. With one inch of residual accumulation, these losses can double.

6. Airspeed -- MAINTAIN BETWEEN 90 KIAS AND 165 KIAS with 1/2 inch or more ice accumulation.

### **NOTE**

Prior to a landing approach, cycle the wing and stabilizer de-ice boots to shed any accumulated ice. Maintain extra airspeed on approach to compensate for the increased prestall buffet associated with ice on unprotected areas. Do not cycle the boots during an approach or landing since boot inflation increases stall speeds by 3 knots, decreases stall warning by the same amount, and may cause or increase any rolling tendency during stall. If there are unshed ice accumulations along the wing and stabilizer leading edges during an approach and landing, follow the procedures listed under Inadvertent Icing Encounters in Section 3 of the basic handbook.

## **SECTION 4**

## **NORMAL PROCEDURES**

### **PREFLIGHT INSPECTION**

Prior to flight, make an exterior inspection to check the de-icing boots for tears, abrasions, and cleanliness. Any damage must be repaired prior to flight.

**DURING ENGINE RUNUP**

The system should be checked through several cycles as follows:

1. De-Icing Switch -- ON and release. Check inflation and deflation cycle of all boots.

**NOTE**

If the wing and stabilizer de-ice boots fail to inflate sufficiently during any or all of the three sequences of one cycle, verify that the right vacuum pump is operating (red button is not visible), the circuit breaker is pushed full in and the pressure indicator light is operative (press to test); then attempt another cycle. If the system is still deficient, maintenance is required.

2. Pressure Indicator Light -- CHECK ON within three seconds and OFF after 18 seconds.
3. Boots -- CHECK VISUALLY FOR COMPLETE DEFLATION to the vacuum hold-down condition.

Refer to Section 8 of the basic handbook for care and maintenance of the wing and stabilizer de-ice boots.

**SECTION 5  
PERFORMANCE**

The following approximate performance changes from those shown in Section 5 of the basic handbook occur as a result of the installation of the wing and stabilizer de-ice system:

Climb Rate: 30 FPM decrease.

Cruise Speed: 2 to 3 KTAS decrease.



# SUPPLEMENT

## AUDIO CONTROL PANELS

### SECTION 1

#### GENERAL

Two types of audio control panels (see figure 1) are available for this airplane, depending upon how many transmitters are included. The operational features of both audio control panels are similar and are discussed in the following paragraphs.

#### TRANSMITTER SELECTOR SWITCH

When the avionics package includes a maximum of two transmitters, a two-position toggle-type switch, labeled XMTR, is provided to switch the microphone to the transmitter the pilot desires to use. If the airplane avionics package includes a third transmitter, the transmitter selector switch is a three-position rotary-type switch, labeled XMTR SEL. To select a transmitter, place the transmitter selector switch in the position number corresponding to the desired transmitter.

The action of selecting a particular transmitter using the transmitter selector switch simultaneously selects the audio amplifier associated with that transmitter to provide speaker audio. For example, if the number one transmitter is selected, the audio amplifier in the number one NAV/COM is also selected and is used for ALL speaker audio. Headset audio is not affected by audio amplifier operation.

#### AUDIO SELECTOR SWITCHES

Both audio control panels (see figure 1) incorporate three-position toggle-type audio selector switches for individual control of the audio systems installed in the airplane. These switches allow receiver audio to be directed to the airplane speaker or to a headset, and heard singly or in combination with other receivers. To hear a particular receiver on the airplane speaker, place that receiver's audio selector switch in the up (SPEAKER) position. To listen to a receiver over a headset, place that receiver's audio selector switch in the down (PHONE) position. The center (OFF) position turns off all audio from the associated receiver.

#### NOTE

Volume level is adjusted using the individual receiver volume controls on each radio.

A special feature of the audio control panel used when one or two transmitters are installed is separate control of NAV and COM audio from the NAV/COM radios. With this installation, the audio selector switches labeled NAV, 1 and 2 select audio only from the navigation receivers of the NAV/COM radios. Communication receiver audio is selected by the switches labeled COM, AUTO and BOTH. Description and operation of these switches is described in figure 1.

When the audio control panel for three transmitters is installed, audio from both NAV and COM frequencies is combined, and is selected by the audio selector switches labeled NAV/COM, 1, 2 and 3.

#### COM AUTO AUDIO SELECTOR SWITCH

The audio control panel used with either one or two transmitters incorporates a three-position toggle switch, labeled COM AUTO, which is provided to automatically match the audio of the appropriate NAV/COM communications receiver to the radio selected by the transmitter selector switch.

#### COM BOTH AUDIO SELECTOR SWITCH

The audio control panel used with either one or two transmitters incorporates a three-position toggle switch, labeled COM BOTH, which is provided to allow both COM receivers to be monitored at the same time.

#### AUTO AUDIO SELECTOR SWITCH

The audio control panel used with three transmitters incorporates a three-position toggle switch, labeled AUTO, which is provided to automatically match the audio of the appropriate NAV/COM receiver to the selected transmitter.

#### ANNUNCIATOR LIGHTS BRIGHTNESS AND TEST SWITCH

The audio control panel used with either one or two transmitters incorporates a three-position toggle switch with NITE (up) and DAY (middle) positions to control the brightness level of the marker beacon indicator lights, and the BC and RN Nav indicator lights (when installed). In the TEST (down) position, all annunciator lights (Mkr Bcn, BC and RN) will illuminate full bright to verify lighting test.

#### NOTE

A potentiometer is installed inside the audio control panel to provide further minimum light dimming capabilities. Refer to the appropriate Avionics Service/Parts manual for adjustment procedures.

### SIDETONE OPERATION

Cessna radios are equipped with sidetone capability (monitoring of the operator's own voice transmission). While adjusting speaker sidetone, be aware that if the sidetone volume level is set too high, audio feedback (squeal) may result when transmitting.

When the airplane has one or two transmitters, sidetone is provided in either the speaker or headset anytime the COM AUTO selector switch is utilized. Placing the COM AUTO selector switch in the OFF position will eliminate sidetone. Sidetone internal adjustments are available to the pilot through the front of the audio control panel (see figure 1).

When the airplane has three transmitters, sidetone will be heard on either the speaker or a headset as selected with the AUTO selector switch. Sidetone may be eliminated by placing the AUTO selector switch in the OFF position, and utilizing the individual audio selector switches. Adjustment of speaker and headset sidetone volume can only be accomplished by adjusting the sidetone potentiometers located inside the audio control panel.

#### NOTE

Sidetone is not available on HF Transceiver (Type ASB-125), when installed.

### OPTIONAL INTERCOM SYSTEM

The optional intercom system is a pilot and copilot intercom phone system which is only offered with the one and two transmitter type audio control panel. The system incorporates its own audio amplifier with a volume control (labeled INT) and a "hot mike" feature. The intercom system is used with the headphones only.

The "hot mike" feature allows the pilot and copilot to communicate at anytime through their microphone/headsets without having to key the mike. However, they must key the mike button on their control wheel to transmit over the aircraft's transceiver. Sidetone is present on the intercom system when the COM AUTO switch is in the PHONE position.

#### NOTE

Any ambient noise attenuating type padded headset and boom mike combination may not be compatible with this system.

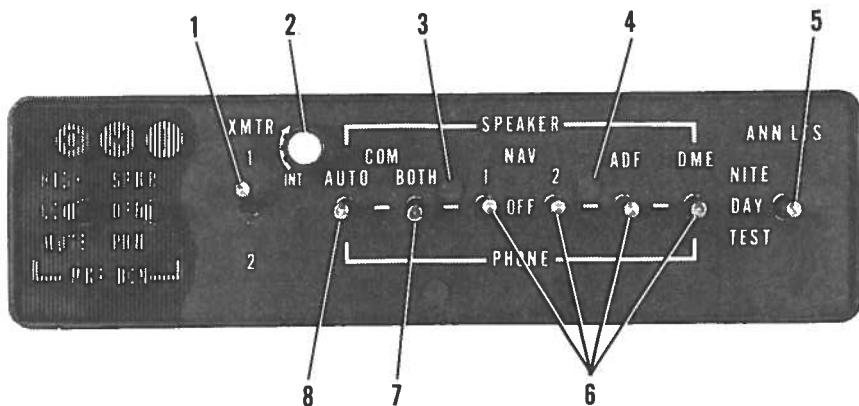
The intercom audio volume is controlled by the INT knob located on the front of the audio control panel. Clockwise rotation of the knob increases the volume of the intercom audio and counterclockwise rotation decreases it. The INT knob controls the audio volume for the intercom system only. Receiver audio volume is adjusted using the individual receiver volume controls. When the intercom system is not being used, the INT volume control should be turned full counterclockwise to eliminate any noise over the headphones.

#### NOTE

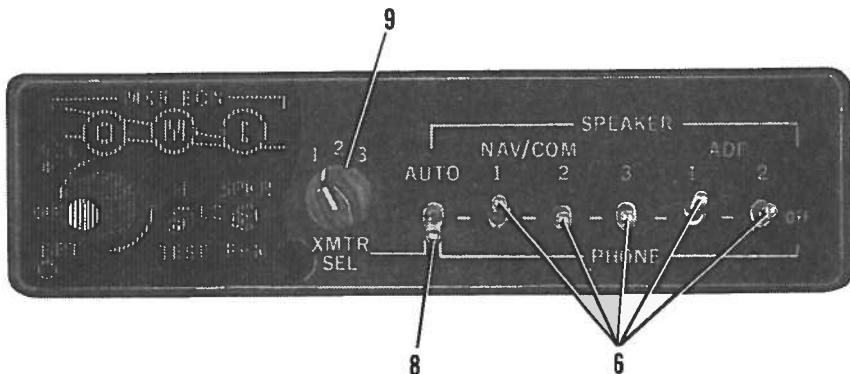
When the intercom volume is turned up and an auxiliary mike is plugged in, there will be a loud squeal over the speaker if the COM BOTH and COM AUTO switches are inadvertently placed in the opposite positions (one in the SPEAKER position and the other in the PHONE position). To eliminate this squeal turn the volume down or place both switches in the same position.

When the optional intercom system is not installed, a plug button will be installed in place of the INT volume control knob.

## USED WITH ONE OR TWO TRANSMITTERS



## USED WITH THREE TRANSMITTERS OR DUAL ADF'S



1. TRANSMITTER SELECTOR SWITCH (XMTR) - A two-position toggle switch used to activate the audio amplifier and switch the microphone to the desired transmitter. The number 1 (up position) and 2 (down position) corresponds to the first and second (from top to bottom) transmitters, respectively.

Figure 1. Audio Control Panel Operating Controls  
(Sheet 1 of 2)

2. INTERCOM VOLUME CONTROL (INT) - Controls the intercom audio volume. Clockwise rotation of the knob increases the intercom audio volume and counter-clockwise rotation decreases it.
3. HEADSET SIDETONE INTERNAL ADJUSTMENT ACCESS - To adjust headset sidetone, remove the plug button, place COM AUTO selector switch in the PHONE position, insert a small screwdriver into the adjustment potentiometer and rotate it clockwise to increase the sidetone volume or counterclockwise to decrease sidetone.
4. SPEAKER SIDETONE INTERNAL ADJUSTMENT ACCESS - To adjust speaker sidetone, remove the plug button, place COM AUTO selector switch in the SPEAKER position, insert a small screwdriver into the adjustment potentiometer and rotate it clockwise to increase the sidetone volume or counterclockwise to decrease sidetone. While adjusting sidetone, be aware that if the sidetone volume level is set too high, audio feedback (squeal) may result when transmitting.
5. ANNUNCIATOR LIGHTS BRIGHTNESS SELECTOR AND TEST SWITCH (ANN LTS-NITE/DAY/TEST) - Three-position toggle switch; in the up (NITE) position, annunciator lights (Mkr Bcn, BC and RN) will show at a reduced light level for typical night operations. In the center (DAY) position, annunciator lights (Mkr Bcn, BC and RN) will show full bright to verify lamp operation. In the NITE position, annunciator light (Mkr Bcn, BC and RN) level can be further adjusted down to a preset minimum using the RADIO LT dimming rheostat knob.
6. AUDIO SELECTOR SWITCHES - Three-position selector switches used to select either SPEAKER or PHONE operation for audio outputs. Enables the operator to select any one or more, audio signals on either SPEAKER or PHONE at the same time or to silence audio when placed in the OFF position.
7. COM BOTH AUDIO SELECTOR SWITCH (COM BOTH) - A three-position toggle switch used to allow both COM receivers to be monitored at the same time. Placing the COM BOTH switch in the up (SPEAKER) position will enable the pilot to monitor both the number 1 and number 2 COM receivers over the SPEAKER at the same time. Placing the switch in the down (PHONE) position allows the pilot to monitor both the number 1 and number 2 COM receivers through the headset at the same time. Center (OFF) position, removes the non-selected COM receiver (or both COM receivers if COM AUTO switch is OFF) from the audio system.
8. COM AUTO AUDIO SELECTOR SWITCH (COM AUTO OR AUTO) - A three-position toggle switch provided to automatically match the audio of the appropriate NAV/COM communications receiver to the transmitter selected by the transmitter selector switch. In the up (SPEAKER) position, audio from the selected receiver will be heard on the airplane speaker. In the down (PHONE) position, audio from the selected receiver will be heard through the headset. Center (OFF) position, removes the automatic SPEAKER/PHONE selection feature and will also disable the sidetone feature.
9. TRANSMITTER SELECTOR SWITCH (XMTR SEL) - A three-position rotary switch used to activate the audio amplifier and switch the microphone to the desired transmitter. The numbers 1, 2 and 3 positions correspond to the first, second and third (from top to bottom) transmitters, respectively.

Figure 1. Audio Control Panel Operating Controls  
(Sheet 2 of 2)

## SECTION 2 LIMITATIONS

There is no change to the airplane limitations when either of these audio control panels is installed.

## SECTION 3 EMERGENCY PROCEDURES

In the event the audio amplifier in use fails, as evidenced by loss of all speaker audio, selecting an alternate transmitter will reestablish speaker audio using the alternate transmitter audio amplifier.

## SECTION 4 NORMAL PROCEDURES

### AUDIO CONTROL PANEL OPERATIONS:

1. Transmitter Selector (XMTR or XMTR SEL) Switch -- SELECT desired transmitter for transceiver operation.
2. COM AUTO or AUTO Selector Switch -- SELECT SPEAKER or PHONE position to automatically select SPEAKER or PHONE audio.

#### NOTE

If the NAV/COM audio selector switch corresponding to the selected transmitter is in the PHONE position with the AUTO selector switch in the SPEAKER position, all audio selector switches placed in the PHONE position will automatically be connected to both the airplane speaker and any headsets in use.

3. COM BOTH Selector Switch -- SELECT the same SPEAKER or PHONE position which was set on the COM AUTO selector switch to allow both COM receivers to be monitored at the same time.

**NOTE**

The combination of placing the COM AUTO switch in the SPEAKER position and the COM BOTH switch in the PHONE position (or vice versa) is not normally recommended as it will cause audio from both communications receivers (and any other navigation receiver with its audio selector switch in the PHONE position) to be heard on both the airplane speaker and the headset simultaneously.

4. Audio SPEAKER/PHONE Selector Switches -- SELECT desired SPEAKER or PHONE audio position only if COM AUTO switch is not used.
5. INT Control Knob -- ROTATE as desired to increase or decrease intercom audio volume.
6. ANN LTS Switch:
  - a. TEST Position -- SELECT to verify operation of marker beacon, BC and RN annunciator lights (when installed).
  - b. DAY Position -- SELECT for typical daytime lighting.
  - c. NITE Position -- SELECT for typical night lighting.

**NOTE**

In the NITE position, further lighting adjustment for the Mkr Bcn, BC and RN (when installed)annunciator lights can be obtained using the RADIO LT dimming rheostat knob.

## **SECTION 5**

## **PERFORMANCE**

There is no change to the airplane performance when either of these audio control panels is installed.

# SUPPLEMENT

## AM/FM CASSETTE STEREO ENTERTAINMENT CENTER

### (Type EC-100)

#### SECTION 1 GENERAL

The EC-100 Cassette Stereo Player and AM/FM Radio is a compact, fully automatic AM/FM Mpx radio and stereo cassette player mounted in the instrument panel above the glove box, or in the alternate location utilizing the glove box. In addition to the player/radio, the system consists of stereo headphones and an externally mounted, fixed-wire antenna. All operating controls for the player/radio and headphones are shown and described in figure 1.

The AM/FM Mpx Radio will receive AM frequencies between 525 and 1650 kHz or FM frequencies between 88 and 108 MHz. AM or FM reception is selected by an AM/FM pushbutton located on the front of the set and with strong FM stations, at altitude, the radio can receive FM stations for over 200 miles.

The cassette stereo player is equipped with four-track, two-channel stereo cassette type playback with a tape speed of 4.76 cm/sec. Any standard-size monaural or stereo cassette may be used in the player. Cassettes are automatically activated when inserted in cassette receptacle (with tape play side to the right) with radio ON and AM/FM switch in either AM or FM position. When cassette is removed, radio play will automatically resume. Annunciator lights will illuminate monitoring the STEREO, TAPE, or COM Interrupt modes.

A COM Interrupt mode in this system, when activated, will interrupt stereo and cassette audio to provide selected aircraft radio audio to the stereo headphones. After a short delay, preselected stereo or cassette play will return following the completion of the aircraft communications.

A COM ONLY mode in the EC-100, allows the pilot to eliminate all entertainment modes and activate uninterrupted navigation and communications audio.

Headphones are equipped with individual earphone volume controls and a phone plug which must be attached to one of the phone jacks mounted overhead. Stereo phone jacks are placarded either "STEREO" or "STereo HEADPHONE".

### NOTICE

Sound from the player/radio is only available through stereo headphones.

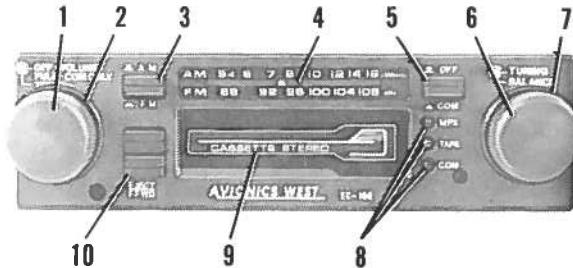


Figure 1. Cassette Stereo AM/FM Entertainment Center, Operating Control (Sheet 1 of 3)

**PILOT'S OPERATING HANDBOOK  
SUPPLEMENT****CASSETTE STEREO AM/FM  
(TYPE EC-100)****1. OFF/VOLUME AND PULL-COM ONLY CONTROL KNOB:**

OFF-VOLUME CONTROL - Turning knob fully counterclockwise to detent turns off entire system. Advancing the knob clockwise past the detent, applies power to the unit. Advancing it further clockwise increases the volume of audio level.

**NOTE**

This control affects the audio level of both the radio/tape system as well as the communications audio.

PULL-COM ONLY - Pull out on this knob to eliminate all entertainment modes and enable the NAV/COM input only.

2. RADIO/PLAYER AND COM TONE CONTROL (TONE) - Normal position of this control is fully clockwise for flat audio response. If excessive high frequency hiss is evident in the headphones, the control may be rotated counterclockwise to reduce the high frequency response.
3. AM/FM PUSHBUTTON SELECTOR SWITCH (AM/FM) - Selects AM or FM radio reception; IN for FM and OUT for AM.
4. AM and FM RADIO FREQUENCY INDICATOR DIAL (AM/FM) - Indicates selected operating radio frequencies for AM between 525 and 1650 kHz and FM between 88 and 108 MHz.
5. COM INTERRUPT PUSHBUTTON SELECTOR SWITCH (OFF/COM) - To activate the communications override feature, pushbutton is pushed in. Communications override is eliminated by pushing button completely in and releasing (button out).
6. TUNING SELECTOR CONTROL KNOB (TUNING) - Rotate to tune in desired AM or FM operating frequencies.
7. RADIO/PLAYER AND COM SPEAKER BALANCE CONTROL KNOB (BALANCE) - Left and right speaker balance is controlled by counterclockwise and clockwise rotation of control knob.
8. MODE ANNUNCIATOR LIGHTS:

MPX (GREEN) - Illuminates green to indicate that a stereo FM station has been tuned-in.

TAPE (AMBER):

Dim Position - Illuminates dim amber to indicate tape mode of operation.

Bright Position - Illuminates bright amber to indicate cassette has reached end of tape and requires changing.

COM (RED) - Illuminates red to indicate com mode has been activated and a com transmission is being received.

**Figure 1. Cassette Stereo AM/FM Entertainment Center, Operating Control (Sheet 2 of 3)**

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## CASSETTE STEREO AM/FM (TYPE EC-100)

## PILOT'S OPERATING HANDBOOK SUPPLEMENT

9. **CASSETTE RECEPTACLE** - Insert cassette cartridge, turned sideways, with tape play side to the right. When the cartridge is inserted far enough, the mechanism will snap it into place and the EJECT pushbutton will move to the extended position (button out). Top numbered side will play. Either monural or standard stereo cassettes may be used.
10. **TAPE EJECT AND FAST FORWARD PUSHBUTTON (EJECT/F. FWD)** - This pushbutton has two modes of control. For fast forward (rewind), pushbutton is pushed in slightly. Cassette is ejected when button is pushed completely in.
11. **HEADPHONE EXTENSION-ADJUSTMENT ARMS** - Located on both sides of the headphones. Earphone extension is adjusted by sliding the adjustment arms in, or out, of the head pad to a comfortable listening position.
12. **EARPHONE VOLUME CONTROL LEVERS** - Regulates volume of audio to individual earphones. Volume increases as levers are moved to higher settings.
13. **HEADPHONE PLUG** - Inserts into one of the phone jacks located overhead and placarded "STEREO" or "STEREO HEADPHONE". Jacks are for 1/4-inch stereo plugs only.

### **CAUTION**

To prevent damage to the entertainment center, use only 8-ohm headphones with 1/4-inch stereo type plugs.

Figure 1. Cassette Stereo AM/FM Entertainment Center, Operating Control (Sheet 3 of 3)

## SECTION 2 LIMITATIONS

There is no change to the airplane limitations when this avionics equipment is installed.

## SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionics equipment is installed.

## SECTION 4 NORMAL PROCEDURES

### AM/FM RADIO OPERATIONS:

1. Headphones -- INSERT headphone plug(s) into jack(s) mounted overhead and placarded either "STEREO" or "STEREO HEADPHONE".
2. Earphone Volume Control Levers -- SELECT a position slightly lower than medium volume for both volume control levers on the headphones.
3. Headphone Extension-Adjustment Arms -- ADJUST to comfortable listening position.
4. OFF/VOLUME AND PULL-COM ONLY CONTROL KNOB -- ROTATE control knob clockwise past detent to activate unit. Continue to rotate knob clockwise to desired volume setting.

### NOTE

Audio can only be heard through stereo headphones.

### **CAUTION**

The stall and gear warning horn may not be heard with the stereo headphones in use.

With headphones plugged in, extended play at full volume should be avoided in order to prevent damage to headphones and hearing.

5. AM/FM Pushbutton Selector Switch -- SELECT as desired; IN for FM, OUT for AM.
6. TUNING Knob -- SELECT desired frequency.
7. MPX Stereo Annunciator Light -- CHECK ON (green light will illuminate) if FM radio station reception is selected.
8. Earphone Volume Control Levers -- ADJUST to desired audio setting. Volume is increased by moving levers to HI settings, and lowered by moving levers to LO settings.

NOTE

Improper tuning will result in poor tone and excessive noise.

9. TONE Control -- ROTATE to a fully clockwise position for normal operation.

NOTE

If excessive high frequency hiss is evident in the headphones, the control may be rotated counterclockwise to reduce the high frequency response.

10. BALANCE Control -- ADJUST to desired audio setting.

#### CASSETTE PLAYER OPERATIONS:

1. Tape Receptacle -- INSERT CASSETTE with tape play side to right and adjust listening controls on unit and headphones. Player will play top numbered side.

NOTE

When tape is ejected, radio play will automatically resume.

2. TAPE Annunciator Light -- CHECK ON; Light will illuminate dim amber when cassette is installed and will illuminate bright amber when cassette has reached end of tape play and requires changing.

**CAUTION**

To insure the best performance and operation of your cassette player, follow these simple rules:

- a. Loose cassette tape should not be played. If your tape is loose,

- rewind it before playing.
- b. Do not keep cassette tape in your player long after cassette play is finished.
- c. Do not use non-standard cassette tapes. Damage to your player will result.
- 3. Tape EJECT/Fast Forward Pushbutton:
  - a. To Eject Tape -- PUSH IN button all the way to eject cassette at end of play or at any point desired.
  - b. To Select Fast Forward (Rewind) -- PUSH SLIGHTLY in for fast forward position (push button in approximately half way).
  - c. To Cancel Fast Forward -- RELEASE BUTTON.

#### COM INTERRUPT OPERATIONS:

##### NOTE

Aircraft radio(s) must be turned on and the desired audio, to be monitored by COM Interrupt, must have the associated receiver's SPEAKER/PHONE selector switch(es) placed in the PHONE position on the audio control panel in order for the COM Interrupt feature to be operational. Audio signals that the pilot does not want to monitor, by the COM Interrupt feature, must have their associated receiver's SPEAKER/PHONE selector switch(es) on the audio control panel placed in the OFF position.

- 1. AM/FM Radio/Cassette Player -- SELECT and TURN ON desired system to be operated.
- 2. VOL Control -- SET to desired listening level.

##### NOTES

This control affects the stereo headphone audio level of the radio/tape system and other aircraft radios selected.

If the audio level from the Nav/Com Radio is too weak getting to the entertainment center, the COM Interrupt circuit will not be activated. If the audio level is too strong, distortion will be produced in the audio signal.

- 3. Com Interrupt Pushbutton Selector Switch (on EC-100) -- PUSH button in halfway and release to activate COM Interrupt circuit.
- 4. Aircraft's COM Radio SQ Control -- ROTATE clockwise until background noise is noticeable and note that the red (COM) annunciator illuminates on the EC-100 to verify COM Interrupt operation, and then, backoff slightly on the SQ Control until background noise disappears. Repeat this operation periodically in normal flight.

**COM ONLY OPERATIONS:**

1. PULL-COM ONLY Selector Knob -- PULL knob out to override all audio modes in the EC-100 and activate audio signals as selected by the PHONE switches on the audio control panel.
2. COM Annunciator Light -- CHECK ON (Red) when selected audio is being received.

## **SECTION 5**

## **PERFORMANCE**

There is no change to the airplanes performance when this avionics equipment is installed. However, the installation of an externally mounted antenna or several related external antennas will result in a minor reduction in cruise performance.

# SUPPLEMENT

## DME

### (TYPE 450C WITH IND-450C INDICATOR)

#### SECTION 1 GENERAL

The DME-450C system consists of a panel-mounted IND-450C Indicator, a remotely-mounted TCR-451 Transceiver and an externally-mounted antenna.

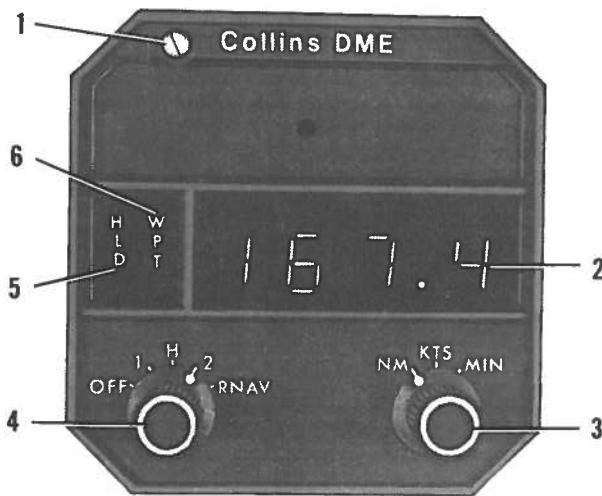
Except for selection of the operating channel, which is selected by the VHF navigation receiver frequency selector switches, the DME-450C system is capable of independent operation. The DME-450C transmits interrogating pulse pairs on 200 channels between 1041 MHz and 1150 MHz; it receives associated ground-to-air replies between 978 MHz and 1213 MHz. The IND-450C digitally displays distances to or from the selected station up to 200 nautical miles, aircraft ground speed from 30 to 399 knots, or time-to-station with a maximum time of 120 minutes. A Nav mode selector switch provides selection of ON/OFF, Nav 1, Nav 2, Hold and RNAV operation. A DME display selector switch provides selection of distance to or from station (NM), aircraft ground speed (KTS) or time-to-station (MIN). An ambient light sensor automatically controls brightness of digital display and annunciators.

#### SECTION 2 LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

#### SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.



1. AMBIENT LIGHT SENSOR - Senses ambient cockpit light and controls brightness of digital display and WPT and HLD annunciations.
2. DIGITAL DISPLAY - Displays distance to or from station (NM), aircraft ground speed (KTS), or time-to-station (MIN), depending on the position of the display selector (3).

**NOTE**

Dashes will be observed on the display until station lock-on occurs in the NM mode or until a velocity of at least 30 knots is established with lock-on in the KTS or MIN mode.

**NOTE**

In all DME modes except RNAV, aircraft ground speed and time-to-station are meaningful only when the aircraft track is directly to or from the ground station. The KTS and MIN indications require approximately 1.5 minutes after station acquisition for final accuracy.

3. DME DISPLAY SELECTOR SWITCH - Selects desired mode readouts as follows:  
NM Position: Displays distance to or from the selected station in nautical miles up to 199.9 nmi.  
KTS Position: Displays aircraft ground speed up to 399 knots.  
MIN Position: Displays time-to-station with a maximum time of 120 minutes.

Brightness of this switch is controlled by the radio light dimming rheostat.

**Figure 1. IND-450C Indicator  
(Sheet 1 of 2)**

PILOT'S OPERATING HANDBOOK  
SUPPLEMENT

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DME  
(TYPE 450C)

4. NAV MODE SELECTOR SWITCH - Applies power to the DME and selects DME operating modes as follows:
  - OFF: Turns the DME OFF.
  - NAV 1: Selects DME operation with No. 1 VHF navigation set; enables channel selection by Nav 1 frequency selector switches.
  - HOLD: Selects DME memory circuit; DME remains channeled to station to which it was last channeled when HOLD was selected and will continue to display information relative to this channel. Allows both the Nav 1 and Nav 2 navigation receivers to be set to new operational frequencies without affecting the previously selected DME operation.

**CAUTION**

In the Hold mode there is no annunciation of the VOR/DME station frequency. However, an annunciator labeled "HLD" will illuminate on the DME to flag the pilot that the DME is in the Hold mode.

NAV 2: Selects DME operation with No. 2 VHF navigation set; enables channel selection by Nav 2 frequency selector switches.  
RNAV: Selects area navigation operation.

Brightness of this switch is controlled by the radio light dimming rheostat.

5. HOLD ANNUNCIATOR (HLD) - Illuminates amber to indicate HOLD mode is selected.
6. WAYPOINT ANNUNCIATOR (WPT) - Illuminates amber to indicate RNAV mode is selected. (Annunciator will not illuminate when DME is installed without RNAV.)

Figure 1. IND-450C Indicator  
(Sheet 2 of 2)

## SECTION 4

### NORMAL PROCEDURES

#### DME OPERATION

1. NAV 1 and NAV 2 VHF Navigation Receivers -- ON; SET frequency selector switches to VOR/DME station frequencies as required.
2. NAV Mode Selector Switch -- SET to NAV 1 or NAV 2.

#### NOTE

When the VOR frequency is selected, the appropriate DME frequency is automatically channeled.

3. DME SPEAKER/PHONE Selector Switch (on audio control panel) -- SET to desired mode to identify station ident tone.
4. DME Display Selector Switch -- SELECT desired readout.

#### DME HOLD FUNCTION:

The HOLD position is selected when the currently controlling Nav receiver (1 or 2) frequency is about to be changed but the pilot wishes the DME to remain operating on the current frequency after the navigation frequency has been changed.

1. NAV Mode Selector Switch -- SELECT HOLD.

#### CAUTION

Inadvertent switching to any other DME Nav Mode position other than HOLD must be avoided, since this could cause the DME to display erroneous information.

2. NAV 1 or NAV 2 Receiver -- SELECT new operating frequency.

## SECTION 5

### PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally-mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

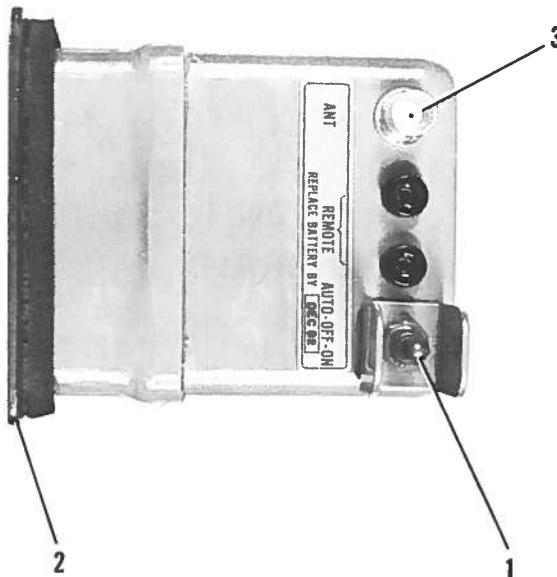
## SUPPLEMENT

# EMERGENCY LOCATOR TRANSMITTER (ELT)

### SECTION 1 GENERAL

The ELT consists of a self-contained dual-frequency radio transmitter and battery power supply, and is activated by an impact of 5g or more as may be experienced in a crash landing. The ELT emits an omni-directional signal on the international distress frequencies of 121.5 and 243.0 MHz. (Some ELT units in export aircraft transmit only on 121.5 MHz.) General aviation and commercial aircraft, the FAA, and CAP monitor 121.5 MHz, and 243.0 MHz is monitored by the military. Following a crash landing, the ELT will provide line-of-sight transmission up to 100 miles at 10,000 feet. The ELT supplied in domestic aircraft transmits on both distress frequencies simultaneously at 75 mw rated power output for 50 continuous hours in the temperature range of -4°F to +131°F (-20°C to +55°C). The ELT unit in export aircraft transmits on 121.5 MHz at 25 mw rated power output for 50 continuous hours in the temperature range of -4°F to +131°F (-20°C to +55°C).

The ELT is readily identified as a bright orange unit mounted behind the baggage compartment on the right-hand side of the tailcone. To gain access to the unit, remove the rear baggage compartment decorative wall panel, and untape and pull out the ELT access plug. The ELT is operated by a control panel at the forward facing end of the unit (see figure 1).



1. FUNCTION SELECTOR SWITCH (3-position toggle switch):
  - ON - Activates transmitter instantly. Used for test purposes and if "g" switch is inoperative.
  - OFF - Deactivates transmitter. Used during shipping, storage and following rescue.
  - AUTO - Activates transmitter only when "g" switch receives 5g or more impact.
2. COVER - Removable for access to battery pack.
3. ANTENNA RECEPTACLE - Connects to antenna mounted on top of tailcone.

Figure 1. ELT Control Panel

## SECTION 2 LIMITATIONS

The following information is presented in the form of a placard located on the rear baggage compartment decorative wall panel.

EMERGENCY LOCATOR TRANSMITTER  
INSTALLED AFT OF THIS PARTITION.  
MUST BE SERVICED IN ACCORDANCE  
WITH FAR PART 91.52

In addition, the following information must be presented in the form of a placard located on the ELT access plug door in the baggage compartment wall (behind the decorative panel).



## SECTION 3 EMERGENCY PROCEDURES

Immediately after a forced landing where emergency assistance is required, the ELT should be utilized as follows.

1. ENSURE ELT ACTIVATION -- Turn a radio transceiver ON and select 121.5 MHz. If the ELT can be heard transmitting, it was activated by the "g" switch and is functioning properly. If no emergency tone is audible, gain access to the ELT and place the function selector switch in the ON position.
2. PRIOR TO SIGHTING RESCUE AIRCRAFT -- Conserve airplane battery. Do not activate radio transceiver.

3. AFTER SIGHTING RESCUE AIRCRAFT -- Place ELT function selector switch in the OFF position, preventing radio interference. Attempt contact with rescue aircraft with the radio transceiver set to a frequency of 121.5 MHz. If no contact is established, return the function selector switch to ON immediately.
4. FOLLOWING RESCUE -- Place ELT function selector switch in the OFF position, terminating emergency transmissions.

## **SECTION 4**

### **NORMAL PROCEDURES**

As long as the function selector switch remains in the AUTO position, the ELT automatically activates following an impact of 5g or more over a short period of time.

Following a lightning strike, or an exceptionally hard landing, the ELT may activate although no emergency exists. To check your ELT for inadvertent activation, select 121.5 MHz on your radio transceiver and listen for an emergency tone transmission. If the ELT can be heard transmitting, place the function selector switch in the OFF position and the tone should cease. Immediately place the function selector switch in the AUTO position to re-set the ELT for normal operation.

## **SECTION 5**

### **PERFORMANCE**

There is no change to the airplane performance data when this equipment is installed.

# SUPPLEMENT

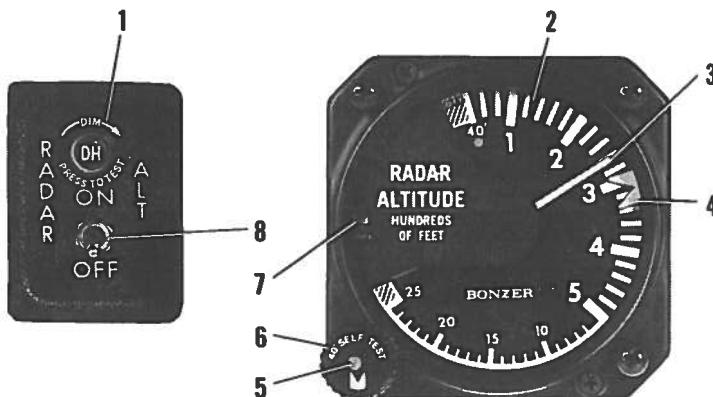
## RADAR ALTIMETER (Bonzer Impatt)

### SECTION 1 GENERAL

The Bonzer Impatt Radar Altimeter System is a short pulse radar altitude system designed for automatic continuous operation over wide variations of terrain, target reflectivity, weather and aircraft altitude. The Bonzer Impatt Radar Altimeter may be used inflight to monitor absolute altitude at any altitude from 40 to 2500 feet, or the pilot may select a warning absolute altitude with the DH SET control and be alerted automatically with aural and visual warnings whenever the aircraft descends below that absolute altitude. The Bonzer Impatt Radar Altimeter may also be used for displaying ground separation during night or instrument climbouts, as well as indicating ground clearances during approaches.

The Bonzer Impatt Radar Altimeter is turned on by a panel mounted toggle switch (labeled RADAR ALT) prior to takeoff and may be left on for the duration of the flight. An initial warm-up period of approximately one minute is required before indicator accuracy can be assured. At altitude within the usable range of the indicator, proper system operation is indicated by the red OFF flag being out of view and an accurate indication of aircraft height above the nearest terrain. Once the aircraft has flown above the usable range of the indicator the pointer remains in the high altitude position. If an electrical failure occurs at anytime, the red OFF flag will appear and the pointer will stop and remain in that position. Momentary signal loss within the usable range of the indicator will cause the pointer to swing to the high altitude position.

The radar altimeter indicator provides an absolute altitude display from 40 to 2500 feet, an integral TEST button and a decision height (DH) selector knob. Internal indicator lighting is controlled by the radio light dimming rheostat. Also included is a remote mounted DH warning light. The indicator and controls for the Bonzer Impatt Radar Altimeter are shown and described in figure 1.



1. DECISION HEIGHT (DH) WARNING LIGHT - A press-to-test light which illuminates amber to indicate aircraft has descended below the selected decision height, a warning horn will also sound. Light level may be dimmed by turning the outside ring clockwise.
2. ALTITUDE DISPLAY DIAL - From 40 to 500 feet, calibrated in numerical graduations which represent increments of 100 feet; from 500 to 2500 numerical graduations represent increments of 500 feet.
3. ALTITUDE DISPLAY POINTER - Indicates airplane altitude from 40 to 2500 feet. If the aircraft is out of the system's range the pointer will remain in the high altitude position. When descending through 40 feet, the pointer will pause momentarily, then start back around toward the high altitude position indicating that useful information is no longer provided. If the system is turned off or becomes inoperative the pointer will stop and remain in that position.
4. DECISION HEIGHT BUG - Indicates selected warning altitude.
5. SELF-TEST BUTTON - Press the TEST button, the pointer will swing to the red dot on the face of the dial located below the 40 feet marker. If the aircraft absolute altitude is less than the preselected DH, the DH warning light will illuminate, and the warning horn will sound.
6. DECISION HEIGHT SET CONTROL KNOB - Used to select a warning absolute altitude. The pilot will be alerted automatically with a visual and audio alert whenever the aircraft descends below the selected altitude.
7. OFF FLAG - Red OFF flag indicates power is turned off or system is inoperative.
8. RADAR ALTIMETER (RADAR ALT ON/OFF) POWER SWITCH - Applies power to radar altimeter.

Figure 1. Radar Altimeter (Bonzer Impatt)

## SECTION 2 LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

## SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

## SECTION 4 NORMAL PROCEDURES

### TEST FUNCTION:

#### Preflight Test:

1. RADAR ALT Switch -- ON. Allow approximately one minute for warm up. Verify OFF flag is out of view. Pointer will travel to the high altitude position.

#### NOTE

Inside a hangar or near large reflective objects, an erroneous reading may appear.

2. Decision Height Set Knob -- SELECT desired warning altitude.
3. TEST Switch -- PRESS. The pointer will swing to the red dot on the dial below the 40 ft. marker. DH warning light will illuminate and warning horn will sound as the pointer descends through the DH setting. After a 20 second pause and if no reflective objects are nearby, the pointer will travel back to the high altitude position.

**ALTIMETER OPERATION:**

1. RADAR ALT Switch -- ON. Allow approximately one minute for warm-up. Verify OFF flag is out of view.
2. Decision Height Set Knob -- SELECT desired warning altitude.

**CAUTION**

The radar altimeter must not be used to identify the MDA (Minimum Descent Altitude) or DH (Decision Height) while making an instrument approach.

**OPERATIONAL NOTES:**

1. System lag makes radar altimeter indications unreliable during approximately the first 30 seconds or 300 feet altitude after takeoff, and when initially descending through the 2500 foot level, until absolute altitudes of 2200 feet, 1900 feet and 1600 feet are reached with descent rates of 500, 1000 and 1500 FPM, respectively.
2. Accuracy in level flight or in descents at rates up to 500 FPM is within 7% or 50 feet, whichever is greater.
3. The pointer will disappear from view below 2500 feet if the ground return signal is lost. The pointer may also disappear from view momentarily when the aircraft is in a bank in excess of 20°.
4. Erroneous or spurious indications may occasionally occur at altitudes above 2500 feet even though the OFF flag may not be showing.
5. The press-to-test function should not be actuated on approach since it may require up to 45 seconds to complete and reliable altitude indications are again available.

**SECTION 5**  
**PERFORMANCE**

There is no change to the airplane performance when this avionic equipment is installed.

## SUPPLEMENT

# AREA NAVIGATION SYSTEM (TYPE ANS-351C)

## SECTION 1 GENERAL

The Area Navigation System (Type ANS-351C) consists of an ANS-351C Area Navigation Computer, a compatible Cessna 300 or 400 Series VHF navigation receiver with a course deviation indicator, and a DME-450C System with an IND-450C Indicator.

There are two types of Course Deviation Indicators which may be used with this Area Navigation System. Either a type IN-442AR Indicator with VOR/LOC capabilities, or a type IN-443AR Indicator with VOR/LOC/ILS capabilities may be coupled with the No. 2 navigation receiver. These 400 Series Indicators are not equipped with a course datum synchro to provide course datum information to the autopilot.

### NOTE

This is the only installation in which a 400 Series Radio and 400 Series Indicator, coupled with a slaved gyro system, are installed without Course Datum.

The ANS-351C Area Navigation Computer contains concentric rotary switches for waypoint definition entry, an eight-waypoint number selector, an enroute/approach sensitivity control, use and return pushbuttons for waypoint management, a check pushbutton, electronic displays for data readout, and an ambient light sensor to control brightness of digital displays and annunciators. Primary power is applied to the ANS-351C by the Number 2 VHF Navigation Receiver to which it is coupled.

The ANS-351C Area Navigation Computer calculates the following parameters when activated: Crosstrack deviation of the aircraft from the selected course and to/from information displayed on the associated CDI, and (as selected on the DME) ground speed displayed in knots, time-to-waypoint displayed in minutes, or distance-to-waypoint displayed in nautical miles.

The ANS-351C Area Navigation Computer has a built-in flag circuit which causes the waypoint display number to blink anytime a non-active waypoint is displayed. Another built-in flag circuit is built into the RNAV Computer to alert the pilot that the system is not operating in the RNAV mode and that the RNAV has electrically been eliminated from the system, making the computer transparent to all incoming data. When the DME has been switched to NAV 1, HOLD or NAV 2, the RADIAL readout will be flagged with either the word "Vor" or "Loc" to alert the pilot that RNAV mode is inactive. An additional flag circuit is provided in the CDI which causes a red OFF flag to appear anytime a non-usable VOR/DME signal is being received.

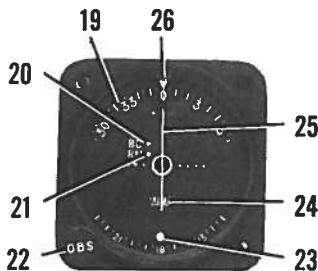
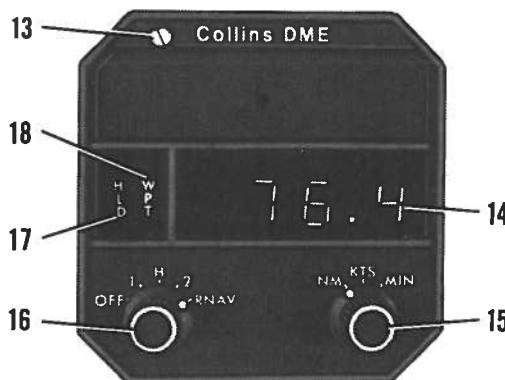
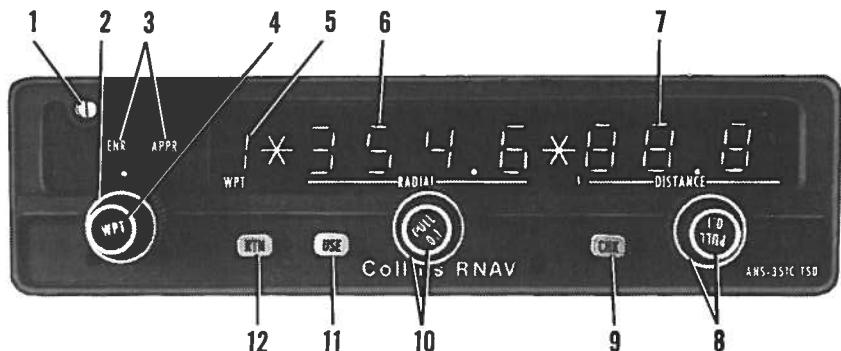
**CAUTION**

If RNAV set is removed from the airplane or becomes inoperative, the associated VHF navigation indicator will be inoperative.

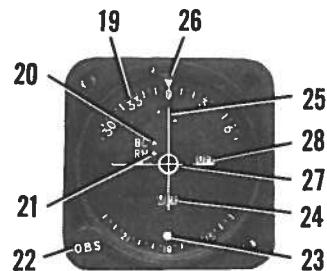
The DME-450C system used in conjunction with this RNAV system consists of a panel-mounted IND-450C Indicator, a remotely-mounted TCR-451 Transceiver and an externally-mounted antenna.

Except for selection of the operating channel, which is selected by the VHF navigation receiver frequency selector switches, the DME-450C system is capable of independent operation. However, only the RNAV mode is to be used with this RNAV system. The DME-450C transmits interrogating pulse pairs on 200 channels between 1041 MHz and 1150 MHz; it receives associated ground-to-air replies between 978 MHz and 1213 MHz. The IND-450C digitally displays distances to or from the selected station up to 200 nautical miles, aircraft ground speed from 30 to 399 knots, or time-to-station with a maximum time of 120 minutes. A Nav mode selector switch provides selection of ON/OFF, Nav 1, Nav 2, Hold and RNAV operation. A DME display selector switch provides selection of distance to or from station (NM), aircraft ground speed (KTS) or time-to-station (MIN). An ambient light sensor automatically controls display intensity.

All operating controls and displays which are part of the ANS-351C Area Navigation Computer, IND-450C Indicator and Course Deviation Indicators IN-442AR and IN-443AR are shown and described in Figure 1. Other controls required for operation of the ANS-351C RNAV system with DME-450C are included on the VHF Nav 2 receiver and are shown and described in the 300 and 400 Nav/Com (Types RT-385A and RT-485A) Supplements in this section.

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IN-442AR STANDARD VOR/LOC CDI



IN-443AR OPTIONAL VOR/LOC/ILS CDI

Figure 1. ANS-351C Computer, IND-450C Indicator  
and Associated CDI Controls (Sheet 1 of 5)

1. AMBIENT LIGHT SENSOR - Senses ambient cockpit light and controls brightness of digital displays (5, 6, 7) and ENR/APPR annunciators (3).
2. MODE CONTROL KNOB - Selects ENR (enroute) or APPR (approach) modes of operation. In the enroute mode, CDI deviation is 1 nmi/dot, 5 nmi full scale. In approach, deviation is 0.25 nmi/dot, 1 1/4 nmi full scale deflection out to 40 nmi from the waypoint.
3. ENROUTE AND APPROACH MODE ANNUNCIATOR LIGHTS (ENR/APPR) - When the annunciator light illuminates amber under either ENR or APPR modes, it indicates selection of ENR (enroute) sensitivity (1 nmi/dot) or APPR (approach) sensitivity (0.25 nmi/dot).
4. WAYPOINT SELECTOR KNOB (WPT) - Selects the desired display waypoints, from 1 through 8.
5. WAYPOINT NUMBER DISPLAY (WPT 1 thru 8) - Digitally displays (from 1 thru 8) the selected waypoint defined by the displayed data. A blinking number indicates a non-active waypoint; continuously ON number indicates the active waypoint.
6. RADIAL DISPLAY READOUT (RADIAL) - When DME is set to RNAV mode, the computer will digitally display the VOR RADIAL from the reference station on which the waypoint is located. When the DME is set to Nav 1, Hold, or Nav 2, the computer display will spell out "Vor" when a VOR frequency is selected on the Nav receiver, or "Loc" will be spelled out if a localizer frequency is selected on the Nav receiver.

**NOTE**

Four zeros will be displayed until desired radial data is dialed in.

7. DISTANCE DISPLAY READOUT (DISTANCE) - Digitally displays DISTANCE in nautical miles from the reference station to the waypoint.

**NOTE**

Three zeros will be displayed until desired distance data is dialed in.

8. DISTANCE SELECTOR KNOBS - Sets distance information in nautical miles into the display. Two concentric knobs control information as follows:

Large outer knob: Changes display in 10 nmi increments.

Small inner knob : Pushed in, changes display in 1 nmi increments.

Pulled out, changes display in 0.1 nmi increments when less than 100 nmi.

Beyond 100 nmi, changes display in 1 nmi increments.

**Figure 1. ANS-351C Computer, IND-450C Indicator  
and Associated CDI Controls (Sheet 2 of 5)**

9. CHECK BUTTON (CHK) - When the CHK pushbutton is pressed and held, and the DME display selector switch is in the NM position, the DME indicator will display distance from the selected DME facility rather than the waypoint. As a signal that raw data is being displayed on the DME, the waypoint annunciator on the DME will be extinguished. Exercising the check feature does not disturb the RNAV calculation, RNAV course deviation display on the CDI, to/from flag or RNAV autopilot coupling. The CHK pushbutton is spring-loaded to ensure return to the RNAV position when released. Brightness of this button is controlled by the radio light dimming rheostat.
10. RADIAL SELECTOR KNOBS - Sets information into the display. Two concentric knobs control information as follows:

Large outer knob: Changes display in 10° increments.  
Small inner knob: Pushed in, changes display in 1° increments.  
Pulled out, changes display in 0.1° increments.
11. USE PUSHBUTTON - Pressing the USE pushbutton converts the displayed preview waypoint (indicated by a blinking WPT number) into the active waypoint. Brightness of this button is controlled by the radio light dimming rheostat.
12. RETURN PUSHBUTTON (RTN) - Pressing the RTN pushbutton returns the display to the previously selected active waypoint when a non-active waypoint is currently being displayed. Brightness of this button is controlled by the radio light dimming rheostat.
13. AMBIENT LIGHT SENSOR - Senses ambient cockpit light and controls brightness of digital display and WPT and HLD annunciators.
14. DIGITAL DISPLAY - Displays distance to or from station or waypoint (NM), aircraft ground speed (KTS), or time-to-station or waypoint (MIN), depending on the position of the display selector (15).

NOTE

Dashes will be observed on the display until station lock-on occurs in the NM mode or until a velocity of at least 30 knots is established with lock-on in the KTS or MIN mode.

NOTE

In all DME modes including RNAV, aircraft ground speed and time-to-station are meaningful only when the aircraft track is directly to or from the ground station or waypoint. The KTS and MIN indications require approximately 10-12 minutes in RNAV ENR mode or 4-5 minutes in the RNAV APPR mode to attain 90-95 percent final (stabilized) calculated value.

Figure 1. ANS-351C Computer, IND-450C Indicator and Associated CDI Controls (Sheet 3 of 5)

15. DME DISPLAY SELECTOR SWITCH - Selects desired mode readouts as follows:
  - NM Position: Displays distance to or from the selected station or waypoint in nautical miles up to 199.9 nmi.
  - KTS Position: Displays aircraft ground speed up to 399 knots.
  - MIN Position: Displays time-to-station or waypoint with a maximum time of 120 minutes.

Brightness of this switch is controlled by the radio light dimming rheostat.

16. NAV MODE SELECTOR SWITCH - Applies power to the DME and selects DME operating modes as follows:

OFF: Turns the DME OFF.

NAV 1: Selects DME operation with No. 1 VHF navigation set; enables channel selection by Nav 1 frequency selector switches.

HOLD: Selects DME memory circuit; DME remains channeled to station to which it was last channeled when HOLD was selected and will continue to display information relative to this channel. Allows both the Nav 1 and Nav 2 navigation receivers to be set to new operational frequencies without affecting the previously selected DME operation.

### **CAUTION**

In the Hold mode there is no annunciation of the VOR/DME station frequency. However, an annunciator labeled "HLD" will illuminate on the DME to flag the pilot that the DME is in the Hold mode.

NAV 2: Selects DME operation with No. 2 VHF navigation set; enables channel selection by Nav 2 frequency selector switches.

RNAV: Selects area navigation operation with the No. 2 VHF navigation set.

Brightness of this switch is controlled by the radio light dimming rheostat.

17. HOLD ANNUNCIATOR (HLD) - Illuminates amber to indicate HOLD mode is selected.
18. WAYPOINT ANNUNCIATOR (WPT) - Illuminates amber to indicate RNAV mode is selected.
19. COURSE CARD - Indicates selected VOR or RNAV course under course index.
20. BACK-COURSE LAMP (BC) - Amber light illuminates when an autopilot's back-course function is engaged and receiver is tuned to a localizer frequency; indicates course deviation pointer is reversed. Light dimming is only available when installed with an audio control panel incorporating the annunciator lights DAY/NITE selector switch.
21. AREA NAV LAMP (RN) - When green light is illuminated, indicates that RNAV operation is selected. Light dimming is only available when installed with an audio control panel incorporating the annunciator lights DAY/NITE selector switch.

Figure 1. ANS-351C Computer, IND-450C Indicator and Associated CDI Controls (Sheet 4 of 5)

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20  
RNAV  
(TYPE ANS-351C)

22. OMNI BEARING SELECTOR (OBS) - Rotates course card (19) to select desired bearing to or from a VOR station or to or from a selected RNAV waypoint.
23. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR or RNAV course.
24. OFF/TO-FROM INDICATOR - Operates only with VOR, localizer or RNAV signal. OFF position (red flag) indicates unusable signal. With usable VOR signal, when OFF position disappears, indicates whether selected course is TO or FROM station or waypoint. With usable localizer signal, white TO flag is in view.
25. COURSE DEVIATION POINTER - Indicates course deviation from selected VOR or RNAV course or localizer centerline.
26. COURSE INDEX - Indicates selected VOR or RNAV course (bearing)
27. GLIDE SLOPE DEVIATION POINTER - Indicates deviation from ILS glide slope.
28. GLIDE SLOPE "OFF" FLAG - When visible, red OFF flag indicates unreliable glide slope signal or improperly operating equipment. Flag disappears when a reliable glide slope signal is being received.

Figure 1. ANS-351C Computer, IND-450C Indicator  
and Associated CDI Controls (Sheet 5 of 5)

## **SECTION 2**

### **LIMITATIONS**

The following RNAV IFR approach limitation must be adhered to during airplane operation.

1. IFR Approaches -- Follow approved published RNAV instrument approach procedures.

## **SECTION 3**

### **EMERGENCY PROCEDURES**

There is no change to the airplane emergency procedures when this avionic equipment is installed.

## **SECTION 4**

### **NORMAL OPERATION**

#### **300 & 400 NAV/COM VOR NAVIGATION CIRCUITS VERIFICATION TEST:**

1. Since the TEST position on the 300 and 400 Nav/Com radios is inoperative when the Nav/Coms are coupled to this Area Navigation System, the "VOR SELF TEST OPERATION" as outlined in the 300 and 400 Nav/Com (Types RT-385A and RT-485A) Supplements cannot be used. To check out the complete system, follow the "GROUND CHECK PROCEDURES" as outlined later in this Supplement.

#### **VOR/LOC NAVIGATION:**

As a convenience to the pilot, a separate supplement (Avionic Operation Guide) is supplied to explain the various procedures for using the VHF Navigation Set for VOR and localizer navigation. Refer to the Avionic Operation Guide for flight procedures.

## AREA NAVIGATION OPERATION NOTES

1. Proper RNAV operation requires valid VOR and DME inputs to the RNAV system. In certain areas, the ground station antenna patterns and transmitter power may be inadequate to provide valid signals to the RNAV. For this reason, intermittent RNAV signal loss may be experienced enroute. Prolonged loss of RNAV signal shall require the pilot to revert to other navigational procedures.
2. As the flight progresses, sequence through waypoints in order, always keep within range of VORTAC being used by maintaining proper altitude and distance from the facility. If usable range is exceeded, the OFF flag will appear on the CDI. Normally, switching waypoints should be done long before flag appearances to ensure the accurate distance, ground speed, time-to-waypoint and minimum crosstrack deviation that will result if closest and strongest signal is used.
3. Selection of the Nav 1, Hold, or Nav 2 positions on the DME Nav mode selector switch electrically eliminates the ANS-351C from the RNAV system, making the computer non-receptive to all incoming data. When operating in these conventional VOR/DME modes, the ANS-351C RADIAL display will spell out "Vor" or "Loc" to prevent being misled into believing that an RNAV waypoint is being flown. Rotating the waypoint selector knob allows preview and set up of waypoints even though operating in the conventional DME modes. Attempting to activate a waypoint in the conventional DME modes by pressing the USE pushbutton will yield no results and the WPT number display will remain blinking, indicating a preview waypoint. Pressing the RTN button will restore the "Vor" or "Loc" annunciation on the RADIAL display and the previously preset waypoints will remain in memory.

### NOTE

The ILS mode selection takes precedence over all other mode selection and is automatic whenever an ILS frequency is selected on the No. 2 navigation receiver.

4. If at anytime an ILS frequency is selected on the No. 2 set, with the ANS-351C operating in the RNAV mode, operation will be restored on the same waypoint when a VOR frequency is again selected. This feature allows channeling through ILS frequencies without changing the selected waypoint number.

5. Ground speed, time-to-waypoint, and distance-to-waypoint functions require stabilization time after initial function selection has been made. Allowing 10 minutes for stabilization when operating in the ENR mode will provide a display that is 90 percent of the final calculated value; 12 minutes after initial selection, a display that is 95 percent of the final calculated value will be provided. Stabilization time can be greatly reduced if the APPR mode is selected just prior to, or immediately after, the time that any one of the subject functions is selected. The APPR mode switches in a speed-up circuit that reduces the time for 90 percent of final value display to 4 minutes, and the time for 95 percent of final value display to 5 minutes. After stabilization is achieved, the ENR/APPR control may be switched back to ENR for normal enroute operation.
6. Course changes in excess of 45 degrees will result in temporary display changes for ground speed, time-to-waypoint, or distance-to-waypoint. Initially, ground speed will decrease and both time-to-waypoint and distance-to-waypoint will increase after the course change is made. After the new course has been established for several minutes, all functions will again stabilize and display final calculated values. Course changes exceeding 120 degrees require stabilization time greater than 12 minutes in ENR mode or 5 minutes in APPR mode.
7. For accurate CDI sensitivity, approach mode is restricted to 50 nautical miles or less from the waypoint in use. Enroute mode is restricted to distances no greater than 200 nautical miles from the waypoint in use.
8. VOR/DME facilities must be co-located.
9. The display of time-to-station/waypoint on the DME display, when in RNAV mode, is only valid if aircraft track is "TO" the waypoint.

#### **GROUND CHECK PROCEDURES:**

Before each flight in which RNAV is to be used for primary guidance, the following procedures should be used, when possible, to verify RNAV system performance.

1. Taxi the aircraft to position free and clear of metal structures and within good reception distance of a local VOR/DME facility.

2. SPEAKER/PHONE Selector Switches (on audio control panel) -- SET NAV 2 to desired mode.
3. COM OFF/VOL Control -- TURN ON; adjust NAV VOL control to desired audio level.
4. NAV Frequency Selection (on No. 2 Nav Receiver) -- SELECT the local VOR/DME frequency.
5. DME NAV Mode Selector Switch -- SELECT RNAV mode.
6. DME DISPLAY Selector Switch -- SET to NM.
7. RNAV Mode Control Knob -- SELECT APPR (approach) mode.
8. RADIAL and DISTANCE Selector Knobs -- SELECT all zeros.
9. NAV 2 Indicator OBS Knob -- ROTATE to center the course deviation pointer.
10. DME DIGITAL DISPLAY -- NOTE DME distance display readout (after the CDI and Distance displays have stabilized).
11. RNAV CHK Button -- PRESS to display raw VOR/DME data. The DME distance-to-VOR readout should agree with the previous (step 10) RNAV DME distance-to-waypoint readout within 0.5 NM.
12. DME NAV MODE Selector Switch -- SELECT NAV 2 and observe that the CDI remains within 2 dots of center and check that the DME distance-to VOR display remains within 0.5 NM of the distance displayed in step 10.

## PREVIEWING AND MODIFYING WAYPOINTS:

### NOTES

Modifications to the active waypoint should not be made while the RNAV system is coupled to the autopilot.

Any of the waypoints may be previewed at anytime in any mode.

1. WPT Selector Knob -- ROTATE until the desired waypoint number is displayed.
2. WPT Number Display -- OBSERVE that number is blinking, indicating that the waypoint is a preview waypoint and not the active waypoint.
3. RADIAL and DISTANCE Selector Knobs -- SET as desired if preview waypoint is to be modified.

### NOTE

Only the displayed waypoint, whether it is the active waypoint or a preview waypoint, will be affected by the data (Radial and Distance) selector switches.

4. RTN Pushbutton -- PRESS to return the display to the active waypoint number or operating mode (VOR or LOC).

NOTE

In the RNAV mode of operation, the waypoint selector may also be manually rotated until the active waypoint number is again displayed in lieu of using the RTN pushbutton.

5. WAYPOINT Number -- OBSERVE that number is continuously on, indicating that active waypoint is now displayed.

NOTE

Previewing waypoints, whether in the conventional VOR/DME modes or RNAV mode, will not affect system operation in any way.

#### **WAYPOINT PROGRAMMING ON THE GROUND:**

1. Using a VFR sectional, enroute instrument chart, instrument approach plate, or enroute RNAV chart -- DETERMINE distance and radial for desired waypoints from appropriate VOR/DME stations.

NOTE

Start engine prior to turning ON avionics equipment.

2. VHF NAV 2 Receiver -- ON to apply power to Nav receiver and RNAV set.
3. DME Nav Mode Selector Switch -- RNAV.
4. WPT Selector Knob -- 1.

NOTE

When power is first applied to the RNAV set, waypoint number 1 will be displayed above the WPT legend as the active waypoint with zero RADIAL and DISTANCE displayed.

5. RADIAL and DISTANCE Selector Knobs -- ROTATE until the desired data is displayed. The displayed data will be automatically transferred into the number 1 waypoint memory.

6. REPEAT Steps 4 and 5 to program remaining waypoints.

NOTE

The displayed waypoint data in the RADIAL and DISTANCE displays before modification is never retained after new waypoint data has been entered. If the active waypoint is revised, the new data will immediately be used in the RNAV computation. Similarly, previewed waypoints, once modified, retain the new data until the waypoint definition is again modified, or the system is turned off.

7. RTN (Return) Pushbutton -- PRESS to display active waypoint.

**CHANGING WAYPOINTS IN FLIGHT:**

1. WPT Selector Knob -- ROTATE until the desired waypoint number and coordinates are displayed.
2. VHF Nav 2 Receiver -- SELECT the desired reference frequency and identify station by listening to ident tone.
3. Nav Indicator OBS Knob -- SET to desired course.
4. USE Pushbutton -- PRESS and observe that the waypoint identification number stops blinking.
5. DME Display Selector Switch -- SELECT desired display readout. (Distance-to-waypoint will be displayed when NM position is selected.)

NOTE

In the KTS and MIN modes, allow 10-12 minutes to attain a 90-95 percent final (stabilized) calculated value in the ENR mode or 4-5 minutes to attain a 90-95 percent final (stabilized) calculated value in the APPR mode. The NM display is accurate immediately after "lock on".

### CHECK FUNCTION:

The distance of the aircraft from the selected VOR/DME station may be checked at anytime while operating in the RNAV mode whenever the DME display selector switch is in the NM position.

1. CHK Pushbutton -- PRESS and HOLD.
2. DME Digital Display -- OBSERVE distance from VOR/DME station displayed.
3. DME WAYPOINT (WPT) Annunciator -- OBSERVE WPT annunciator EXTINGUISHED as a signal that raw DME data is being displayed on the DME.
4. CHK Pushbutton -- RELEASE.

## SECTION 5

## PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

## SUPPLEMENT

# OPTIONAL SLAVED HORIZONTAL SITUATION INDICATOR (HSI) (TYPE IG-832A)

## (STANDARD EQUIPMENT ON 400B IFC SYSTEM)

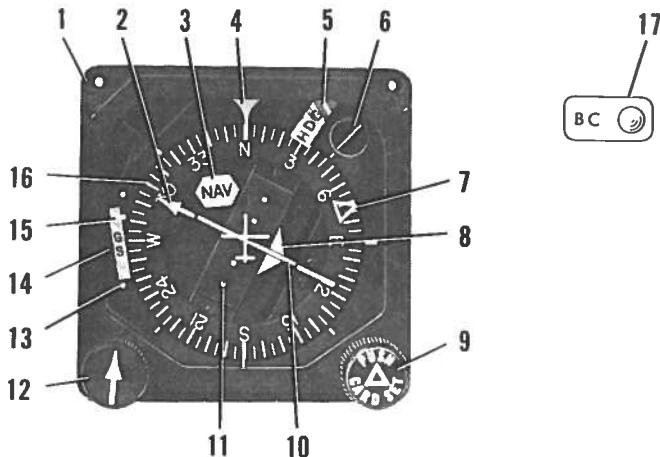
### SECTION 1 GENERAL

The IG-832A Horizontal Situation Indicator (HSI) is an additional navigation indicator option available with Cessna 300 or 400 Nav/Com radios. When dual Nav/Coms are installed, the HSI is coupled to the first Nav/Com and a standard 300 or 400 series VOR/LOC indicator is coupled to the second Nav/Com.

This system consists of a Horizontal Situation Indicator (HSI), a SA-832A remote slaving accessory without course datum or an alternate SA-832B with a bootstrap syncro transmitter for RMI and Course Datum operation, a remote magnetic flux detector and a remote VOR/LOC converter which is only installed without a RNAV installation. The HSI features the modified ARINC face presentation, providing a slaved gyro heading display with a built-in slaving indicator and full ILS navigation capability. When the HSI is installed with a 400B series Autopilot, a BC light is installed on the instrument panel, adjacent to the HSI, to alert the pilot of back-course operations. Each control and indicator function is described in Figure 1.

### SECTION 2 LIMITATIONS

There is no change to the airplane limitations when this instrument is installed.



1. HORIZONTAL SITUATION INDICATOR (HSI) - Provides a pictorial presentation of aircraft deviation relative to VOR radials and localizer beams. It also displays glide slope deviations and gives heading reference with respect to magnetic north.
2. OMNI BEARING POINTER - Indicates selected VOR course or localizer course on compass card (16). The selected VOR radial or localizer heading remains set on the compass card when the compass card (16) is rotated.
3. NAV FLAG - When flag is in view, indicates that the NAV receiver signal being received is not reliable.
4. HEADING REFERENCE (LUBBER LINE) - Indicates aircraft magnetic heading on compass card (16).
5. HEADING WARNING FLAG (HDG) - When flag is in view the heading display is invalid due to interruption of either electrical or vacuum power.
6. GYRO SLAVING INDICATOR - Displays visual indication of heading indicator and flux detector synchronization. When slaving needle is aligned with the HSI 45° right index, it shows that the heading indicator agrees with the aircraft magnetic heading. Off-center pointer deflections show the direction of heading indicator error relative to aircraft magnetic heading. The compass CARD SET knob (9) may be used at any time to more rapidly accomplish synchronization of the heading indicator reading with magnetic heading as indicated by the slaving indicator.

Figure 1. Horizontal Situation Indicator (HSI) (Type IG-832A)  
(Sheet 1 of 2)

**PILOT'S OPERATING HANDBOOK  
SUPPLEMENT**

(TYPE IG-832A)

7. HEADING BUG - Indicates selected reference heading relative to the compass card (16).
8. TO/FROM INDICATOR FLAG -- Indicates direction of VOR station relative to selected course.
9. HEADING SELECTOR AND CARD SET KNOB (PUSH  $\Delta$  CARD SET) - When rotated in normal (out) position, positions heading "bug" (7) on compass card (16) to indicate selected heading for reference or for autopilot tracking. When pushed in and rotated, sets compass card (16) to agree with magnetic compass. The omni bearing pointer (2), heading bug (7), and deviation bar (10) rotate with the compass card (16).
10. COURSE (OMNI) DEVIATION BAR - Bar is center portion of omni bearing pointer and moves laterally to pictorially indicate relationship of aircraft to selected course. It relates in degrees of angular displacement from VOR radials or localizer beam center.
11. COURSE DEVIATION DOTS - Indicates aircraft displacement from VOR, or localizer beam center. A course deviation bar displacement of 2 dots represents full scale (VOR =  $\pm 10^\circ$  or LOC =  $\pm 2\frac{1}{2}^\circ$ ) deviation from beam centerline.
12. COURSE SELECTOR ( $\frac{1}{4}$ ) KNOB - When rotated, positions omni bearing pointer (2) on the compass card (16) to select desired VOR radial or localizer course.
13. GLIDE SLOPE SCALE - Indicates displacement from glide slope beam center. A glide slope deviation bar displacement of 2 dots, represents full scale ( $0.7^\circ$ ) deviation above or below glide slope beam centerline.
14. GLIDE SLOPE POINTER - Indicates on glide slope scale (13) aircraft displacement from glide slope beam center.
15. GLIDE SLOPE FLAG - When in view, indicates glide slope receiver signal is not reliable.
16. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (4).
17. BACK-COURSE LIGHT (BC) (Installed in a remote position, as shown, with a 400B Autopilot only. The BC light is incorporated in the mode selector on the 400B IFC system.) - Remote amber BC light installed with a 400B Autopilot will illuminate when back-course operation is selected by the REV SNS (Reverse Sense) LOC 1 switch located in the autopilot accessory unit. With 400B IFC system, when back-course operation is selected, the BC light incorporated in the MODE SELECTOR will illuminate green.

---

**CAUTION**

When back-course operation is selected, the course (omni) deviation bar on the HSI does not reverse. However, selection of back-course operation will always cause the localizer signal to the autopilot to reverse for back-course operation.

Figure 1. Horizontal Situation Indicator (HSI) (Type IG-832A)  
(Sheet 2 of 2)

## SECTION 3

## EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this instrument is installed.

## SECTION 4

## NORMAL PROCEDURES

### **CAUTION**

Both electrical and vacuum power must be supplied to this instrument for proper functioning. Absence of either will result in unreliable heading information. However, loss of the vacuum power will not affect the omni bearing pointer or glide slope pointer.

Normal procedures for operation of this system differ little from those required for the more conventional Course Deviation Indicators. However, several small differences are worth noting.

The rectilinear movement of the omni deviation bar in combination with the rotation of the compass card in response to heading changes, provides an intuitive picture of the navigation situation at a glance when tuned to an omni station. When tuned to a localizer frequency, the omni bearing pointer must be set to the inbound front course for both front and back-course approaches to retain this pictorial presentation.

When the HSI system is installed with a Cessna 400B (Type IF-550A) Autopilot, a back-course indicator light labeled BC, is mounted adjacent to the HSI and will illuminate amber when the reverse sense (REV SNS) switch (mounted in the autopilot accessory unit) is placed in the ON (LOC 1) position to alert the pilot that back-course operation is selected. The BC light is incorporated in the MODE SELECTOR on the 400B IFCS system. The HSI needle will not be reversed but the LOC signals to the autopilot will be. Light dimming for both types of BC lighting is provided for low ambient light conditions.

For normal procedures with autopilots, refer to the 400B and 400B IFCS Autopilot Supplements in this handbook if they are listed in this section as options. A description of course datum and autopilot procedures for course datum are incorporated in the appropriate autopilot supplements.

## SECTION 5

## PERFORMANCE

There is no change to the airplane performance when this instrument is installed.

## SUPPLEMENT

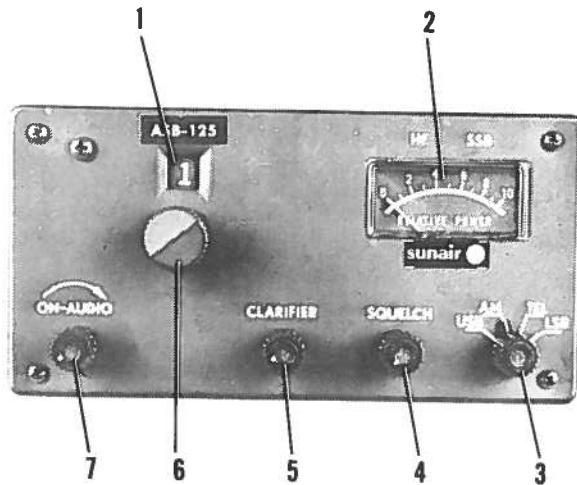
### SSB HF TRANSCEIVER (TYPE ASB-125)

#### SECTION 1 GENERAL

The ASB-125 HF transceiver is an airborne, 10-channel, single sideband (SSB) radio with a compatible amplitude modulated (AM) transmitting-receiving system for long range voice communications in the 2 to 18 MHz frequency range. The system consists of a panel mounted receiver/exciter, a remote mounted power amplifier/power supply, an antenna coupler and an externally mounted, fixed wire, medium/high frequency antenna.

A channel selector knob determines the operating frequency of the transceiver which has predetermined crystals installed to provide the desired operating frequencies. A mode selector control is provided to supply the type of emission required for the channel, either sideband, AM or telephone for public correspondence. An audio knob, clarifier knob and squelch knob are provided to assist in audio operation during receive. In addition to the aforementioned controls, which are all located on the receiver/exciter, a meter is incorporated to provide antenna loading readouts.

The system utilizes the airplane microphone, headphone and speaker. Operation and description of the audio control panels used in conjunction with this radio are shown and described in another supplement in this section.



1. CHANNEL WINDOW - Displays selected channel.
2. RELATIVE POWER METER - Indicates relative radiated power of the power amplifier/antenna system.
3. MODE SELECTOR CONTROL - Selects one of the desired operating modes:
  - USB - Selects upper sideband operation for long range voice communications.
  - AM - Selects compatible AM operation and full AM reception.
  - TEL - Selects upper sideband with reduced carrier, used for public correspondence telephone and ship-to-shore.
  - LSB - (Optional) Selects lower sideband operation (not legal in U.S., Canada and most other countries).
4. SQUELCH CONTROL - Used to adjust signal threshold necessary to activate receiver audio. Clockwise rotation increases background noise (decreases squelch action); counterclockwise rotation decreases background noise.
5. CLARIFIER CONTROL - Used to "clarify" single sideband speech during receive while in USB mode only.
6. CHANNEL SELECTOR CONTROL - Selects desired channel. Also selects AM mode if channel frequency is 2003 kHz, 2182 kHz or 2638 kHz.
7. ON - AUDIO CONTROL - Turns set ON and controls receiver audio gain.

Figure 1. SSB HF Transceiver Operating Controls

## SECTION 2 LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

## SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

## SECTION 4 NORMAL PROCEDURES

### COMMUNICATIONS TRANSCEIVER OPERATION:

#### NOTE

The pilot should be aware of the two following radio operational restrictions:

- a. For sideband operation in the United States, Canada and various other countries, only the upper sideband may be used. Use of lower sideband is prohibited.
  - b. Only AM transmissions are permitted on frequencies 2003 kHz, 2182 kHz and 2638 kHz. The selection of these channels will automatically select the AM mode of transmission.
- 
1. XMTR SEL Switch (on audio control panel) -- SELECT transceiver.
  2. SPEAKER/PHONE Selector Switches (on audio control panel) -- SELECT desired mode.
  3. ON-AUDIO Control -- ON (allow equipment to warm up for 5 minutes for sideband or one minute for AM operation and adjust audio to comfortable listening level).
  4. Channel Selector Control -- SELECT desired frequency.
  5. Mode Selector Control -- SELECT operating mode.

6. SQUELCH Control -- ADJUST clockwise for normal background noise output, then slowly adjust counterclockwise until the receiver is silent.
7. CLARIFIER Control -- ADJUST when upper single sideband RF signal is being received for maximum clarity.
8. Mike Button:
  - a. To Transmit -- DEPRESS and SPEAK into microphone.

**NOTE**

Sidetone and interphone intercom are not available on this radio.

- b. To Receive -- RELEASE mike button.

**NOTE**

Voice communications are not available in the LSB mode.

**NOTE**

Lower sideband (LSB) mode is not legal in the U.S., Canada, and most other countries.

## **SECTION 5**

## **PERFORMANCE**

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

# SUPPLEMENT

## OPTIONAL UNSLAVED HORIZONTAL SITUATION INDICATOR (HSI) (TYPE IG-832C)

### SECTION 1

#### GENERAL

The IG-832C Horizontal Situation Indicator (HSI) is an additional navigation indicator option which provides a heading reference with respect to an unslaved directional gyro, a heading reference bug, VOR course selection, and a pictorial presentation of the airplane position relative to VOR and localizer courses and glide slopes. This indicator is used with Cessna 300 and 400 Nav/Com radios. When dual Nav/Com radios are installed, the HSI is coupled to the number 1 NAV/COM and a standard 300 or 400 series VOR/LOC course deviation indicator is coupled to the number 2 NAV/COM.

This system consists of a Horizontal Situation Indicator (HSI-Type IG-832C) and a remote mounted VOR/LOC Converter (Type B-445A). The HSI indicator is unslaved and course datum is not available. However, the HSI features the modified ARINC face presentation with full ILS navigation capability. When the HSI is installed with a 300A or 400B Autopilot system, a BC light is installed on the instrument panel, adjacent to the HSI, to alert the pilot of back-course operation. Each control and indicator function is described in Figure 1.

### SECTION 2

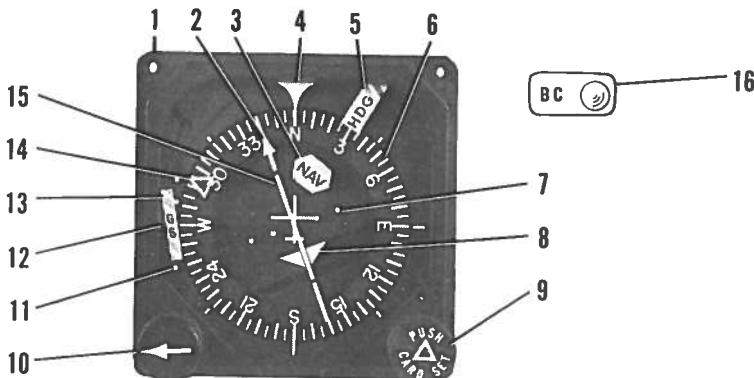
#### LIMITATIONS

There is no change to the airplane limitations when this instrument is installed.

### SECTION 3

#### EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this instrument is installed.



1. HORIZONTAL SITUATION INDICATOR (HSI) - Provides a pictorial presentation of aircraft deviation relative to VOR radials and localizer beams. It also displays glide slope deviations and gives heading reference with respect to magnetic north when compass card is set to agree with compass.
2. OMNI BEARING POINTER - Indicates selected VOR course or localizer course on compass card (6). The selected VOR radial or localizer heading remains set on the compass card when the compass card (6) is rotated.
3. NAV FLAG - When flag is in view, indicates that the NAV receiver signal being received is not reliable.
4. HEADING REFERENCE (LUBBER LINE) - Indicates aircraft magnetic heading on compass card (6).
5. HEADING WARNING FLAG (HDG) - When flag is in view the heading display is invalid due to interruption of either electrical or vacuum power.
6. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (4). Must be set to agree with aircraft compass using Card Set Knob (9).
7. COURSE DEVIATION DOTS - Indicates aircraft displacement from VOR, or localizer beam center. A course deviation bar (15) displacement of 2 dots represents full scale (VOR =  $\pm 10^\circ$  or LOC =  $\pm 2\frac{1}{2}^\circ$ ) deviation from beam centerline.
8. TO/FROM INDICATOR FLAG - Indicates direction of VOR station relative to selected course.

Figure 1. Horizontal Situation Indicator (HSI) (Type IG-832C)  
(Sheet 1 of 2)

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(TYPE IG-832C)

9. HEADING SELECTOR AND CARD SET KNOB (PUSH $\Delta$ CARD SET) - When rotated in normal (out) position, positions heading "bug" (14) on compass card (6) to indicate selected heading for reference or for autopilot tracking. When pushed in and rotated, sets compass card (6) to agree with magnetic compass. The omni bearing pointer (2), heading bug (14), and deviation bar (15) rotate with the compass card (6).

**NOTE**

The compass card (6) must be reset periodically to compensate for precessional errors in the gyro.

10. COURSE SELECTOR ( $\uparrow$ ) KNOB - When rotated, positions omni bearing pointer (2) on the compass card (6) to select desired VOR radial or localizer course.
11. GLIDE SLOPE SCALE - Indicates displacement from glide slope beam center. A glide slope deviation bar displacement of 2 dots, represents full scale (0.7°) deviation above or below glide slope beam centerline.
12. GLIDE SLOPE POINTER - Indicates on glide slope scale (11) aircraft displacement from glide slope beam center.
13. GLIDE SLOPE FLAG - When in view, indicates glide slope receiver signal is not reliable.
14. HEADING BUG - Indicates selected reference heading relative to compass card (6).
15. COURSE (OMNI) DEVIATION BAR - Bar is center portion of omni bearing pointer and moves laterally to pictorially indicate relationship of aircraft to selected course. It relates in degrees of angular displacement from VOR radials or localizer beam center (see Item 7).
16. BACK-COURSE LIGHT (BC) (Installed in a remote position, as shown, with 300A and 400B Autopilots only.) - The remote BC light will illuminate amber when back-course operation is selected either by the REV SNS LOC 1 switch (17) mounted in the 400B autopilot's accessory unit or the BACK CRS pushbutton on the 300A autopilot. Light dimming is only available when installed with an audio control panel incorporating the annunciator lights DAY/NITE selector switch.

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**CAUTION**

When back-course operation is selected, the course (omni) deviation bar (15) on the HSI does not reverse. However, selection of back-course operation will always cause the localizer signal to the autopilot to reverse for back-course operation.

**Figure 1. Horizontal Situation Indicator (HSI) (Type IG-832C)  
(Sheet 2 of 2)**

## SECTION 4

### NORMAL PROCEDURES

#### **CAUTION**

Both electrical and vacuum power must be supplied to this instrument for proper functioning. Absence of either will result in unreliable heading information. However, loss of the vacuum power will not affect the omni bearing pointer or glide slope pointer.

Normal procedures for operation of this system differ little from those required for the more conventional Course Deviation Indicators. However, several small differences are worth noting.

The rectilinear movement of the omni deviation bar in combination with the rotation of the compass card in response to heading changes, provides an intuitive picture of the navigation situation at a glance when tuned to an omni station. When tuned to a localizer frequency, the omni bearing pointer must be set to the inboard front course for both front and back-course approaches to retain this pictorial presentation.

When the HSI system is installed with a Cessna 300A (Type AF-395A) or Cessna 400B (Type IF-550A) Autopilot, a back-course indicator light labeled BC, is mounted adjacent to the HSI and will illuminate amber when either the reverse sense (REV SNS) switch (mounted in the 400B autopilot's accessory unit) is placed in the ON (LOC 1) position or the BACK CRS pushbutton on the 300A Autopilot is activated to alert the pilot that back-course operation is selected. With either autopilot, the HSI needle will not be reversed but the LOC signals to the autopilot will be. Light dimming for the BC light is only available when installed with an audio control panel incorporating the annunciator lights DAY/NITE selector switch.

For normal procedures with autopilots, refer to the 300A or 400B Autopilot Supplements in this handbook if they are listed in this section as options.

## SECTION 5

### PERFORMANCE

There is no change to the airplane performance when this instrument is installed.

## SUPPLEMENT

### WEATHER RADAR (Type RDR-160)

#### SECTION 1 GENERAL

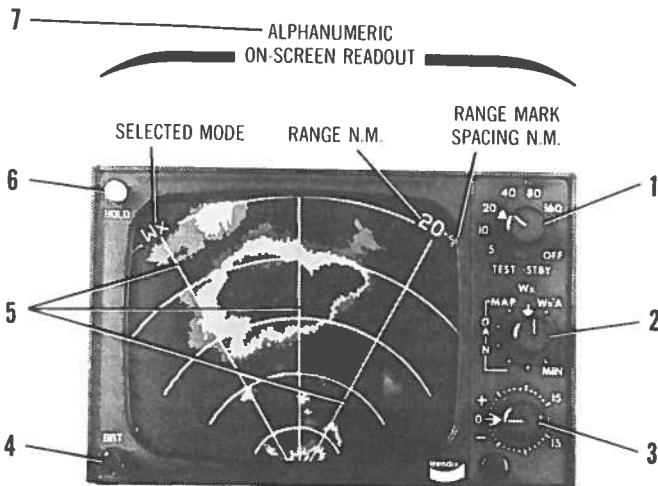
The RDR-160 Weather Radar system consists of a wing pod mounted receiver-transmitter and X-band radar antenna, and a panel mounted radar indicator. All operating controls are mounted on the front panel of the radar indicator and operating controls and functions are described in Figure 1.

The RDR-160 Weather Radar is designed to detect significant enroute weather formations within a range of 160 nautical miles to preclude undesirable penetration of heavy weather and its usually associated turbulence. Internally generated range marks appear as evenly spaced concentric circular arcs on the display to assist in determining distance from weather targets. Reference marks on each side of the zero heading assist in determining bearing of weather targets. A secondary objective of the weather radar system is the gathering and presentation of terrain data.

#### **WARNING**

This system generates microwave radiation and improper use, or exposure, may cause serious bodily injury. DO NOT OPERATE UNTIL YOU HAVE READ AND CAREFULLY FOLLOWED ALL SAFETY PRECAUTIONS AND INSTRUCTIONS CALLED OUT IN SECTION 4 (NORMAL PROCEDURES) OF THIS SUPPLEMENT.

For expanded information and operational instructions, refer to the RDR-160 Pilot's Manual supplied with your aircraft. Users of this equipment are strongly urged to familiarize themselves with FAA Advisory Circular AC No. 00-24A(6-23-78), subject: "Thunderstorms".



1. FUNCTION SWITCH - Controls application of power and selects mode of operation for testing, warm-up and antenna scanning in the range of 5 nautical miles to 160 nautical miles. Switch positions are as follows:

OFF - Turns set off.

- STBY - Turns set on to standby for warmup but transmitter, antenna scan and indicator display are inhibited. (Warmup time is approximately 2 minutes.)
- TEST - Applies drive to antenna and activates test circuit and indicator display to determine operability of system.
- 5 - Energizes Transmitter. Selects 5 nautical mile range presentation with 1 mile range marks.
  - 10 - Energizes Transmitter. Selects 10 nautical mile range presentation with 2 mile range marks.
  - 20 - Energizes Transmitter. Selects 20 nautical mile range presentation with 4 mile range marks.
  - 40 - Energizes Transmitter. Selects 40 nautical mile range presentation with 10 mile range marks.
  - 80 - Energizes Transmitter. Selects 80 nautical mile range presentation with 20 mile range marks.
  - 160 - Energizes Transmitter. Selects 160 nautical mile range presentation with 40 mile range marks.

#### NOTE

Each time the function switch position is changed, the indicator presentation is automatically erased so that information on the newly selected function may be presented without confusion.

Figure 1. Weather Radar (X-Band Type RDR-160) (Sheet 1 of 3)

2. MODE SELECTOR AND GAIN CONTROL - Selects weather radar and ground mapping modes of operation with manual gain selection for ground mapping. Switch positions are as follows:

MAP/GAIN (Ground Mapping) - Places indicator in MAP mode and disables contour feature. In the MAP mode, 6 levels of GAIN may be manually selected from MAP (maximum gain) to MIN (minimum gain) during ground mapping mode. All targets will be presented on the indicator in up to 3 different shades, depending on the radar echo strength and the particular click-gain setting used.

Wx (Weather) - Places weather indicator image gain in a preadjusted level. Contour operation is automatic and constant. Contoured storm cells will appear as dark holes which will be outlined by lighter shades automatically.

WxA (Weather Alert) - When the Mode Selector is in the WxA position, verification of storm cloud contouring is provided. If a dark hole seen in the Wx mode is a contour or storm cell, its presentation will alternate from darkest shade to brightest shade approximately 1 time per second. If a dark hole remains the same intensity while in the WxA mode, then this area of the display does not represent a contour or storm cell.

3. ANTENNA TILT CONTROL - Electronically adjusts the radar beam to 15 degrees up, or down, with respect to the airplane axis to compensate for differences in airplane attitude.
4. BRT CONTROL - Controls the three brightness levels of the indicator display.
5. BEARING MARKS - To assist in determining relative bearing of return echos, marks are provided 30° either side of the 0° or forward mark.
6. HOLD SWITCH - The HOLD switch is a push-pushbutton. Pushing the HOLD button in places the indicator in the hold mode; pushing the button in again places the indicator in the scan mode.

HOLD (Pushbutton Engaged) - Weather or ground mapping image last presented is retained (frozen) on the indicator display in order to evaluate the significance of storm cell movement. Switching back to scan from Hold mode reveals relative direction and distance of target movement during hold period if airplane heading and speed were not changed. The word "HOLD" will be flashing on the display screen when in the HOLD mode.

SCAN (Pushbutton Disengaged) - When the HOLD pushbutton is disengaged, presentation is unfrozen and normal scanning updates the picture with each sweep.

Figure 1. Weather Radar (X-Band Type RDR-160) (Sheet 2 of 3)

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### WEATHER RADAR (X-BAND) (TYPE RDR-160)

### PILOT'S OPERATING HANDBOOK SUPPLEMENT

7. ALPHANUMERIC ON-SCREEN READOUTS - The indicator features alphanumeric readouts of full scale range, range mark spacing, and mode selection. The following Table lists the readouts as a function of switch positions:

Function Switch Position	Range-Range Mks Spacing
TEST	40-10
5	5-1
10	10-2
20	20-4
40	40-10
80	80-20
160	160-40

Mode Selector Switch Position	Mode Readout*
MAP/GAIN	MAP
Wx	Wx
WxA	WxA

\*Footnote - When the HOLD switch is energized, the mode readout displays HOLD which flashes at the rate of once per second. Also when TEST is selected on the function switch the word TEST appears at the mode readout location.

Figure 1. Weather Radar (X-Band Type RDR-160) (Sheet 3 of 3)

## SECTION 2 LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

## SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

## SECTION 4 NORMAL PROCEDURES

### PRIOR TO FLIGHT:

#### **WARNING**

The radar system generates microwave radiation and improper use, or exposure, may cause serious bodily injury. DO NOT OPERATE THIS EQUIPMENT UNTIL YOU HAVE READ AND CAREFULLY FOLLOWED THE FOLLOWING SAFETY PRECAUTIONS AND INSTRUCTIONS:

### **SAFETY PRECAUTIONS AND INSTRUCTIONS TO BE FOLLOWED PRIOR TO RADAR OPERATION:**

1. Do not turn on, or operate radar within 15 feet of ground personnel or containers holding flammable or explosive material.
2. Do not turn on, or operate radar during refueling operations.

### **PREFLIGHT CHECKS PRIOR TO ENERGIZING RADAR:**

#### **WARNING**

IN ORDER TO PREVENT POSSIBLE SERIOUS BODILY INJURY TO GROUND PERSONNEL OR IGNITION OF

FLAMMABLE OR EXPLOSIVE MATERIALS, THE FOLLOWING TESTS MUST BE ACCOMPLISHED WITH THE FUNCTION SWITCH ALWAYS IN THE "TEST" MODE OF OPERATION.

1. Function Switch -- STBY position and after 30 seconds select TEST position.
2. HOLD Selector Switch -- DISENGAGED (scan mode).
3. Mode Selector Control -- Wx position.
4. BRT Control -- ADJUST to desired brightness.
5. Indicator Display -- CHECK TEST PATTERN with the following:
  - a. Four equally spaced range marks should be visible, the word "TEST" and numerals "40-10" should appear in the alphanumeric area of display.
  - b. No video noise distortion should appear on the display.
  - c. There are two distinct brightness levels appearing on the indicator.
  - d. Starting at the lower center of the display, there will either be four or five bands extending outward. The variance in the number of bands is due to the design of the display unit which causes the nearest light shading band (small) to appear on units with a five band display and not appear on units with a four band display. The four and five band displays are as follows:

Nearest is light shading (appears on five band display only).  
Next (or nearest) is intermediate shading (intermediate shading appears as the nearest band on four band displays).  
Next is dark or contour area.  
Next is intermediate shading.  
Next is light shading.

6. Mode Selector Control -- WxA position and observe that the word "TEST" and numbers "40-10" appear in the alphanumeric area of display. Ensure that the pattern center band alternates between the darkest shade and the brightest shade at about 1 time per second.
7. Mode Selector Control -- MAP (maximum gain) position and observe that the word "TEST" and numbers "40-10" appear in the alphanumeric area display. Note that stroke line (antenna position) moves across the indicator screen through the range marks for the full 90 degrees without jumping.
8. HOLD Selector Switch -- ENGAGE HOLD pushbutton and observe that the word "HOLD" replaces TEST and flashes at the rate of once per second in the alphanumeric area of display. Note that the strobe line disappears.

**PREFLIGHT CHECKS WITH RADAR ENERGIZED:****WARNING**

IN ORDER TO PREVENT POSSIBLE BODILY INJURY TO GROUND PERSONNEL OR IGNITION OF FLAMMABLE OR EXPLOSIVE MATERIALS, THE AIRPLANE MUST BE TAXIED WITH THE FUNCTION SWITCH IN THE OFF, STBY, OR TEST POSITIONS ONLY TO A "CLEAR-AHEAD" AREA WHERE METAL BUILDINGS, AIRCRAFT, GROUND PERSONNEL, ETC., ARE NOT IN THE LINE-OF-SIGHT OF THE RADAR UNIT. OBSERVE THE SAFETY PRECAUTIONS AND INSTRUCTIONS AT THE START OF SECTION 4 PRIOR TO PERFORMING THE FOLLOWING CHECKS WITH THE RADAR UNIT ENERGIZED.

1. Ensure safety precautions have been observed.
2. Function Switch -- 40 position. Observe that the numbers "40-10" are present in the alphanumeric area of the display.
3. HOLD Selector Switch -- DISENGAGED (scan position).
4. Mode Selector -- Wx position. Observe that letters "Wx" are present in the alphanumeric area of the display.
5. TILT Control +4° to minimize ground return.
6. BRT Control -- ADJUST as required.
7. Antenna Tilt Control -- TILT UP (+ degrees) and DOWN (- degrees) in small increments. Close-in ground targets should appear on the display at low tilt angles and any local moisture laden weather should appear at higher angles.

**OPERATIONAL NOTES:****ALTITUDE RING DISPLAY:**

1. Some energy is radiated peripherally from the radar antenna which, under some atmospheric conditions, will create a false return on the radar screen when the display is set on the 5, 10, or 20 mile ranges. The false return will usually be most prominently displayed at approximately 2 miles from the origin when flying at altitudes near 12,000 ft. However, under certain atmospheric conditions, the false return can still be observed at a distance from the origin approximately equivalent to the airplane's altitude. Care must be taken not to confuse this normal interference return with a weather return. This is best accomplished by using the longer distance displays (40 or more) for early detection of significant weather.

## **24**

**WEATHER RADAR (X-BAND)  
(TYPE RDR-160)**

**PILOT'S OPERATING HANDBOOK  
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### **FALSE RETURN DISPLAY:**

1. Ground radar stations may occasionally cause interference with the presentation of the return. The effect of this interference is to create one or more radial bands of false signal or noise extending from the bottom center outward to the outer range scale. These effects are usually of short duration and are dependent on the airplane's position and range from the ground station, the signal strength, and other factors.

### **EXTENDING LIFE OF THE MAGNETRON TRANSMITTING TUBE:**

1. The RDR-160 weather radar system is designed so that full operation is possible approximately two minutes after turn on. Therefore, the pilot may choose to leave the function switch in OFF rather than STBY if no significant weather is in the immediate area of the aircraft. The life of the magnetron transmitting tube will be extended by leaving the system "OFF" when possible. This in turn will reduce the cost of maintenance.

### **EFFECT OF SOME SUNGLASSES ON THE RADAR DISPLAY SCREEN:**

1. The RDR-160 Indicator utilizes a special filter to assure optimum video contrast to the pilot in the presence of high cockpit ambient light. Some sunglasses may interfere with the effectiveness of this filter. To check for this, cock your head to one side while viewing the display and note any dramatic change in brilliance. If the brilliance decreases sharply, some compromise such as removing or changing sunglasses should be effected.

### **NORMAL OPERATION:**

#### **WEATHER DETECTION:**

1. Function Switch -- 80 position (allow 2 minutes warm-up).
2. Mode Selector Switch -- SELECT as desired.  
    Wx - Weather.  
    WxA - Weather Alert.
3. BRT Switch -- ADJUST as required for ambient light conditions.
4. Antenna Tilt Control -- +4° to +6° (approximate minimum angle relative to horizon without ground return).

#### **NOTE**

If airplane is climbing or descending, tilt angles must be reduced or increased by approximately the pitch angle indicated on the attitude gyro.

**PILOT'S OPERATING HANDBOOK  
SUPPLEMENT****WEATHER RADAR (X-BAND)  
(TYPE RDR-160)**

5. Function Switch -- SELECT desired range.
6. HOLD Switch -- ENGAGE if desired to "freeze" display on indicator to track storm movements.
7. Aircraft -- MAINTAIN SPEED and HEADING to assure an accurate picture of relative motion of storm in next step.
8. HOLD Switch -- DISENGAGE HOLD switch to compute storm movement and return antenna to scan mode.

**GROUND MAPPING:****NOTE**

Ground mapping is a secondary feature of this radar which is only useful after the operator is very familiar with this equipment. More complete discussion of this feature is included in the RDR-160 Pilot's Manual.

1. Function Switch -- SELECT DESIRED RANGE (allow 2 minutes warmup).
2. Mode Selector Switch -- MAP. Set GAIN as desired for clearest display.
3. BRT Switch -- ADJUST as required.
4. Antenna Tilt Control -- ADJUST for clearest display.

**SECTION 5  
PERFORMANCE**

There is a slight reduction in cruise speed performance with the radar pod installed which varies from approximately 1 knot at high cruise power at lower altitudes to 3 knots at low cruise power or at very high altitudes. All other performance data is unchanged.



## SUPPLEMENT

### WEATHER RADAR (Type RDR-160 COLOR)

#### SECTION 1 GENERAL

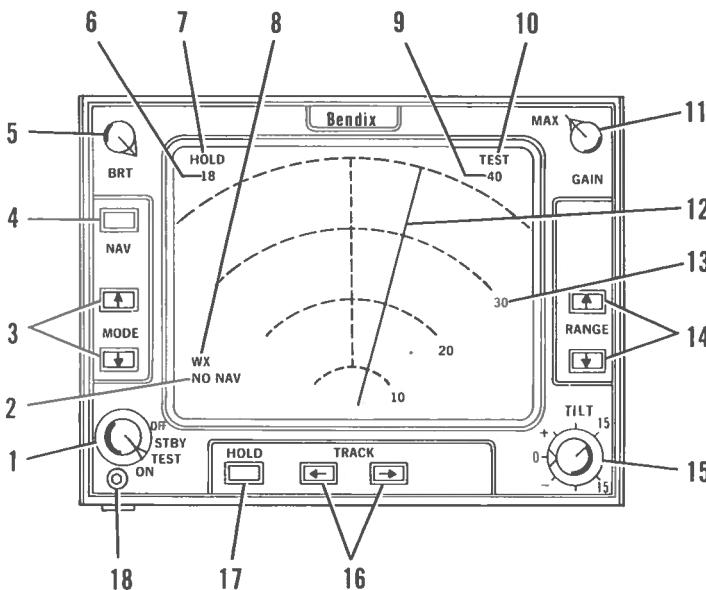
The RDR-160 Color Weather Radar system consists of a wing pod mounted receiver-transmitter and X-band radar antenna, and a panel mounted radar indicator. All operating controls are mounted on the front panel of the radar indicator and operating controls and functions are described in Figure 1.

The RDR-160 Color Weather Radar system is designed to detect significant enroute weather formations within a range of 160 nautical miles to preclude undesirable penetration of heavy weather and its usually associated turbulence. The indicator provides a three-color map display, showing three separate levels of rainfall intensity in green, yellow, and red. Blue segmented range circles, blue alphanumerics, a zero-degree azimuth line, and a yellow "track" cursor are also provided. In addition to its primary purpose of weather mapping, a ground mapping mode permits displaying prominent topographical features such as lakes, bays, islands, shore lines and urban areas.

#### **WARNING**

This system generates microwave radiation and improper use, or exposure, may cause serious bodily injury. DO NOT OPERATE UNTIL YOU HAVE READ AND CAREFULLY FOLLOWED ALL SAFETY PRECAUTIONS AND INSTRUCTIONS CALLED OUT IN SECTION 4 (NORMAL PROCEDURES) OF THIS SUPPLEMENT.

For expanded information and operational instructions, refer to the RDR-160 Pilot's Manual supplied with your aircraft. Users of this equipment are strongly urged to familiarize themselves with FAA Advisory Circular AC No. 00-24A(6-23-78), subject: "Thunderstorms".



1. **FUNCTION SELECTOR SWITCH** - Controls application of power and selects mode of operation for transmitting, testing and warm up. Switch positions are as follows:
  - OFF-** Primary power is removed from the system.
  - STBY-** Places system in operational ready status. Use during warm-up and in-flight periods when the system is not in use.
  - TEST-** Displays a test pattern having 5 colored bands. Starting with the closest band to the origin, the bands will be green, yellow, red, yellow and green. The red band represents the most intense level. All range marks will be visible and displayed in blue numerals. The update action may be observed as a small "ripple" moving along the outer green band, indicating that the antenna is scanning the full 90°. No radar energy is transmitted in the TEST position.
  - ON-** Primary power is applied to the system. Radar energy is transmitted.
2. **NO NAV DISPLAY** - Indicates NAV button is pressed, but NAV option is not connected to the system.

Figure 1. Weather Radar (X-Band Type RDR-160 Color)  
(Sheet 1 of 4)

PILOT'S OPERATING HANDBOOK  
SUPPLEMENTWEATHER RADAR (X-BAND)  
(TYPE RDR-160 COLOR)

3. MODE SELECTOR PUSHBUTTONS - Press and hold either button to display an information list of operational data including available modes; range, range-marks and a weather chart color/signal level reference. Pressing either button again, while information display is still present, advances the display to the next adjacent mode on the information list, above or below the displayed mode, depending upon the button pressed. The information list display automatically reverts to the selected operating mode after approximately two seconds. When either the top or bottom mode is reached, the opposite button must be pressed in order to further change the operational mode. The active mode is displayed in blue while the remaining modes are yellow. The modes are as follows:

MAP (Ground Mapping) - In the ground mapping mode, prominent terrain features are presented in up to three colors, depending upon the amount of reflected energy being received. The levels are:  
DARK - No significant ground return.  
GREEN - Light ground return.  
YELLOW - Medium ground return.  
RED - Heavy ground return.

WX (Weather) - In the weather mode, storm cells are presented in up to three colors, depending upon the level of intensity. The levels are:

1 MM/HR (.039 IN/HR)	Rainfall Rate or Less	Dark Screen
1-4 MM/HR (.039 - .157 IN/HR)	Rainfall Rate	Green Screen
4-12 MM/HR (.157 - .472 IN/HR)	Rainfall Rate	Yellow Screen
12 MM/HR (.472 IN/HR)	Rainfall Rate or More	Red Screen

WXA (Weather Alert) - Operation is same as the Weather (WX) mode, except 12 MM/HR (.472 IN/HR) cells cause a flashing, rather than constant, red screen.

4. NAV PUSHBUTTON - Non-operational on this installation. Pressing the NAV button displays the words "NO NAV" in the lower left corner of the screen below the active mode display.
5. BRIGHTNESS CONTROL - Adjusts brightness of the display to accommodate varying cockpit lighting.
6. TRACK CURSOR BEARING DIFFERENTIAL DISPLAY - Displays track cursor differential bearing readout, in yellow numerals, in degrees from centerline of aircraft when track buttons are pressed. (Disappears approximately 15 seconds after track button is released.)
7. HOLD DISPLAY - Flashing display indicates system is in HOLD condition.
8. MODE DISPLAY - Displays selected mode of operation for ground mapping (MAP), weather (WX) or weather alert (WXA).
9. RANGE DISPLAY - Displays selected range in nautical miles.
10. TEST DISPLAY - Displays the word TEST and a test pattern when the TEST position is selected on the Function Selector Switch.

Figure 1. Weather Radar (X-Band Type RDR-160 Color)  
(Sheet 2 of 4)

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### WEATHER RADAR (X-BAND) (TYPE RDR-160 COLOR)

### PILOT'S OPERATING HANDBOOK SUPPLEMENT

11. GAIN CONTROL - Permits adjusting the radar receiver gain in the terrain MAP mode only.

#### NOTE

In the TEST function as well as in all weather modes the receiver gain is preset, thus no adjustment is required.

12. A yellow azimuth track line which may be superimposed over the weather or terrain mapping display to permit determination of heading to new course intercepts when unexpected deviations arise. The movable line or radial may be shifted up to 30° either side of the aircraft centerline. The amount of deviation is displayed in degrees by a yellow readout in the upper left corner of the screen. After approximately 15 seconds (after the selected TRACK pushbutton is released), the azimuth track line disappears from the display, but may be initiated again, as required, by pressing one of the TRACK pushbuttons.

#### NOTE

The track cursor will appear at zero degrees azimuth the next time a TRACK pushbutton is pressed.

13. RANGE MARKS - Displays individual range readout in blue at the end of each blue range arc. Displays are in nautical miles and will change to correspond to the selected range setting.

14. RANGE SELECTOR PUSHBUTTONS - Top button  clears the screen and advances the display to the next higher range, each time the button is pressed, until the maximum range is reached. Subsequently, the bottom  RANGE button must be pressed in order to select a lower range. The selected range is displayed in blue in the upper right corner of the screen adjacent to the top range mark. The distance from the apex of the display to each of the other range marks is also displayed in the blue at the right end of each range mark. The range/range marks are as follows:

160 Nautical mile range with 40 mile range marks  
80 Nautical mile range with 20 mile range marks  
40 Nautical mile range with 10 mile range marks  
20 Nautical mile range with 5 mile range marks  
10 Nautical mile range with 2.5 mile range marks

15. ANTENNA TILT CONTROL - Electronically adjusts the radar beam to 15 degrees up or down, with respect to the airplane axis to compensate for differences in airplane attitude.

Figure 1. Weather Radar (X-Band Type RDR-160 Color)  
(Sheet 3 of 4)

PILOT'S OPERATING HANDBOOK  
SUPPLEMENTWEATHER RADAR (X-BAND)  
(TYPE RDR-160XD)

18. FLIGHT LOG PUSHBUTTON - Nonoperational on this installation.
19. TRACK SELECTOR PUSHBUTTONS - When either the left or right TRACK button is pressed, a yellow track cursor line extending from the apex of the display through the top range mark appears and moves either right or left from center, depending upon the button pressed. The cursor line moves from the airplane centerline while the button is held depressed and stops when the button is released. The differential bearing is indicated in yellow numerals in the upper left corner of the screen. The track cursor line and relative bearing display disappear approximately 20 seconds after the button is released, but may be initiated again, as required, by pressing either the left or right TRACK pushbuttons.
20. NAV PUSHBUTTON - Non-operational on this installation. Pressing the NAV button displays the words "NO NAV" in the lower left corner of the screen below the active mode display.
21. LOCKING PAWL - Secures display unit into instrument panel.

Figure 1. Weather Radar (X-Band Type RDR-160XD)  
(Sheet 4 of 4)

## **SECTION 2**

### **LIMITATIONS**

There is no change to the airplane limitations when this avionic equipment is installed.

## **SECTION 3**

### **EMERGENCY PROCEDURES**

There is no change to the airplane emergency procedures when this avionic equipment is installed.

## **SECTION 4**

### **NORMAL PROCEDURES**

#### **PRIOR TO FLIGHT:**

#### **WARNING**

The radar system generates microwave radiation and improper use, or exposure, may cause serious bodily injury. DO NOT OPERATE THIS EQUIPMENT UNTIL YOU HAVE READ AND CAREFULLY FOLLOWED THE FOLLOWING SAFETY PRECAUTIONS AND INSTRUCTIONS:

#### **SAFETY PRECAUTIONS AND INSTRUCTIONS TO BE FOLLOWED PRIOR TO RADAR OPERATION:**

1. Do not turn on, or operate radar within 15 feet of ground personnel or containers holding flammable or explosive material.
2. Do not turn on, or operate radar during refueling operations.

**PREFLIGHT CHECKS PRIOR TO ENERGIZING RADAR:****WARNING**

IN ORDER TO PREVENT POSSIBLE SERIOUS BODILY INJURY TO GROUND PERSONNEL OR IGNITION OF FLAMMABLE OR EXPLOSIVE MATERIALS, THE FOLLOWING TESTS MUST BE ACCOMPLISHED WITH THE FUNCTION SWITCH ALWAYS IN THE "TEST" MODE OF OPERATION.

1. Function Selector Switch -- STBY position and after 30 seconds select TEST position.
2. HOLD Selector Pushbutton -- DISENGAGE pushbutton.
3. Antenna Tilt Control -- Set to 0°.
4. BRT Control -- ADJUST to mid-range.
5. Indicator Test Display -- CHECK TEST PATTERN with the following:
  - a. Within 15 seconds four equally spaced blue range marks should be visible, the word "TEST" and the number "40" should appear and be visible in blue displays in the upper right corner of the display. The weather mode indication "WX" should appear in blue in the lower left corner of the display.
  - b. No video noise distortion should appear on the display.
  - c. There are five colored bands appearing on the indicator.
  - d. Starting with the closest band to the origin, the bands will be green, yellow, red, yellow and green.

**NOTE**

The width of the test pattern bands is not critical, nor is the position of the bands relative to the range marks.

- e. The update action may be observed as a small "ripple" moving along the outer green band, indicating that the antenna is scanning.
6. MODE Selector Pushbuttons -- SELECT WXA position and observe that the red band alternates from red to black approximately once per second.
7. HOLD Selector Pushbutton -- PUSH-IN to engage pushbutton and observe that the update ripple disappears and the test pattern should remain stable. The word "HOLD" should flash in blue in the upper left corner.
8. HOLD Selector Pushbutton -- PUSH-OFF to disengage and then verify that update resumes.
9. Function Selector Switch -- STBY position.

**PREFLIGHT CHECKS WITH RADAR ENERGIZED:****WARNING**

IN ORDER TO PREVENT POSSIBLE BODILY INJURY TO GROUND PERSONNEL OR IGNITION OF FLAMMABLE OR EXPLOSIVE MATERIALS, THE AIRPLANE MUST BE TAXIED WITH THE FUNCTION SWITCH IN THE OFF, STBY, OR TEST POSITIONS ONLY TO A "CLEAR-AHEAD" AREA WHERE METAL BUILDINGS, AIRCRAFT, GROUND PERSONNEL, ETC., ARE NOT IN THE LINE-OF-SIGHT OF THE RADAR UNIT. OBSERVE THE SAFETY PRECAUTIONS AND INSTRUCTIONS AT THE START OF SECTION 4 PRIOR TO PERFORMING THE FOLLOWING CHECKS WITH THE RADAR UNIT ENERGIZED.

1. Ensure safety precautions have been observed.
2. HOLD Selector Pushbutton -- PUSH-OFF to disengage (scan position).
3. Function Selector Switch -- ON position. The indicator will automatically be in the weather (WX) mode.
4. RANGE Selector Pushbuttons -- 40-10 range.
5. Antenna TILT Control -- +4° to minimize ground return.
6. BRT Control -- ADJUST as required.
7. Antenna TILT Control -- TILT UP (+ degrees) and DOWN (- degrees) in small increments. Close-in ground targets should appear on the display at low tilt angles and any local moisture laden weather should appear at higher angles.
8. Function Selector Switch -- STBY position for taxi manuevers.

**OPERATIONAL NOTES:****ALTITUDE RING DISPLAY:**

1. Some energy is radiated peripherally from the radar antenna which, under some atmospheric conditions, will create a false return on the radar screen when the display is set on the 10 or 20 mile ranges. The false return will usually be most prominently displayed at approximately 2 miles from the origin when flying at altitudes near 12,000 ft. However, under certain atmospheric conditions, the false return can still be observed at a distance from the origin approximately equivalent to the airplane's altitude. Care must be taken not to confuse this normal interference return with a weather return. This is best accomplished by using the longer distance displays (40 or more) for early detection of significant weather.

**FALSE RETURN DISPLAY:**

1. Ground radar stations may occasionally cause interference with the presentation of the return. The effect of this interference is to create one or more radial bands of false signal or noise extending from the bottom center outward to the outer range scale. These effects are usually of short duration and are dependent on the airplane's position and range from the ground station, the signal strength, and other factors.

**EXTENDING LIFE OF THE MAGNETRON TRANSMITTING TUBE:**

1. The RDR-160 Color weather radar system is designed so that full operation is possible approximately two minutes after turn on. Therefore, the pilot may choose to leave the function switch in OFF rather than STBY if no significant weather is in the immediate area of the aircraft. The life of the magnetron transmitting tube will be extended by leaving the system "OFF" when possible. This in turn will reduce the cost of maintenance.

**EFFECT OF SOME SUNGLASSES ON THE RADAR DISPLAY SCREEN:**

1. The RDR-160 Color Indicator utilizes a special filter to assure optimum video contrast to the pilot in the presence of high cockpit ambient light. Some sunglasses may interfere with the effectiveness of this filter. To check for this, cock your head to one side while viewing the display and note any dramatic change in brilliance. If the brilliance decreases sharply, some compromise such as removing or changing sunglasses should be effected.

**HIGH ALTITUDE OPERATION:**

1. The RDR-160 Color weather radar system has been approved to a maximum cabin altitude of 25,000 feet. If flying at altitudes above 25,000 feet, it is recommended that the radar be turned off to protect electrical circuitry in the indicator unit.

**NORMAL OPERATION:****WEATHER DETECTION:**

1. Function Selector Switch -- ON position (allow 2 minutes warm-up).
2. Mode Selector Pushbuttons -- SELECT as desired.
  - Wx - Weather.
  - WxA - Weather Alert.
3. BRT Control -- ADJUST as required for ambient light conditions.
4. Antenna Tilt Control -- +4° to +6° (approximate minimum angle relative to horizon without ground return).

**NOTE**

If airplane is climbing or descending, tilt angles must be reduced or increased by approximately the pitch angle indicated on the attitude gyro.

5. RANGE Selector Pushbuttons -- SELECT desired range.
6. HOLD Selector Pushbuttons -- ENGAGE if desired to "freeze" display on indicator to track storm movements.

**WARNING**

The existing display is the last image stored in the indicator memory and does not represent the true or changing conditions relative to the moving aircraft.

7. Aircraft -- MAINTAIN SPEED and HEADING to assure an accurate picture of relative motion of storm in next step.
8. HOLD Selector Pushbutton -- PUSH to disengage HOLD and evaluate storm movement with updated information.

**GROUND MAPPING:****NOTE**

Ground mapping is a secondary feature of this radar which is only useful after the operator is very familiar with this equipment. More complete discussion of this feature is included in the RDR-160 Pilot's Manual.

1. Function Selector Switch -- ON position (allow 2 minutes warm-up).
2. RANGE Selector Pushbuttons -- SELECT desired range.
3. Mode Selector Pushbuttons -- MAP. Set GAIN as desired for clearest ground mapping interpretation.
4. BRT Control -- ADJUST as required.
5. Antenna Tilt Control -- ADJUST for clearest display.

## **SECTION 5**

## **PERFORMANCE**

There is a slight reduction in cruise speed performance with the radar pod installed which varies from approximately 1 knot at high cruise power at lower altitudes to 3 knots at low cruise power or at very high altitudes. All other performance data is unchanged.

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## SUPPLEMENT

### COLOR WEATHER RADAR (Type RDR-160XD)

#### SECTION 1 GENERAL

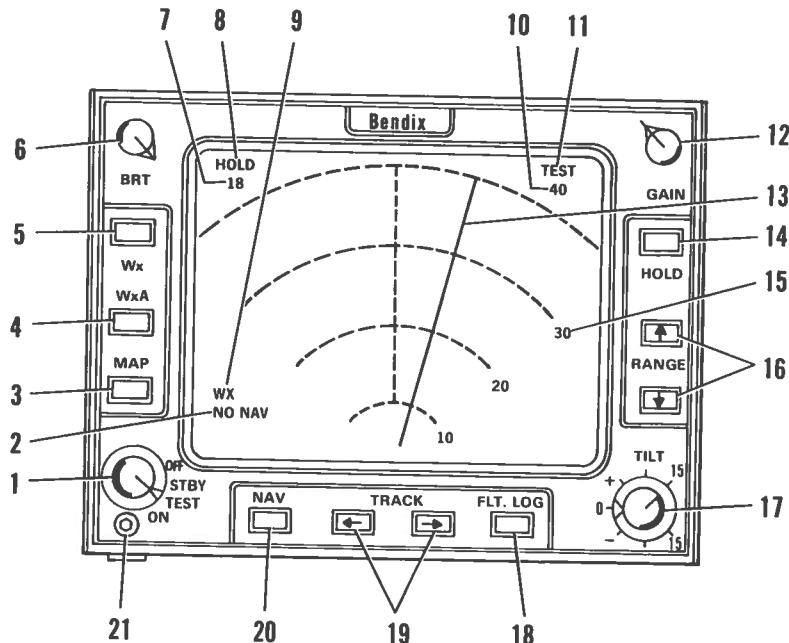
The RDR-160XD Color Weather Radar system consists of a wing pod mounted receiver-transmitter and X-band radar antenna, and a panel mounted radar indicator. All operating controls are mounted on the front panel of the radar indicator and operating controls and functions are described in Figure 1.

The RDR-160XD Color Weather Radar system is designed to detect significant enroute weather formations within a range of 240 nautical miles to preclude undesirable penetration of heavy weather and its usually associated turbulence. The indicator provides a three-color map display, showing three separate levels of rainfall intensity in green, yellow, and red. Blue segmented range circles, blue alphanumerics, a zero-degree azimuth line, and a yellow "track" cursor are also provided. In addition to its primary purpose of weather mapping, a ground mapping mode permits displaying prominent topographical features such as lakes, bays, islands, shore lines and urban areas.

#### WARNING

This system generates microwave radiation and improper use, or exposure, may cause serious bodily injury. DO NOT OPERATE UNTIL YOU HAVE READ AND CAREFULLY FOLLOWED ALL SAFETY PRECAUTIONS AND INSTRUCTIONS CALLED OUT IN SECTION 4 (NORMAL PROCEDURES) OF THIS SUPPLEMENT.

For expanded information and operational instructions, refer to the RDR-160XD Pilot's Manual supplied with your aircraft. Users of this equipment are strongly urged to familiarize themselves with FAA Advisory Circular AC No. 00-24A(6-23-78), subject: "Thunderstorms".



1. **FUNCTION SELECTOR SWITCH -** Controls application of power and selects mode of operation for transmitting, testing and warm up. Switch positions are as follows:

**OFF-** Primary power is removed from the system.

**STBY-** Places system in operational ready status. Use during warm-up and in-flight periods when the system is not in use.

**TEST-** Displays a test pattern having 5 colored bands. Starting with the closest band to the origin, the bands will be green, yellow, red, yellow and green. The red band represents the most intense level. All range marks will be visible and displayed in blue numerals. The update action may be observed as a small "ripple" moving along the outer green band, indicating that the antenna is scanning the full 90°. No radar energy is transmitted in the TEST position.

**ON-** Primary power is applied to the system. Radar energy is transmitted. The indicator will automatically be in the Wx mode.

2. **NO NAV DISPLAY -** Indicates NAV button is pressed, but NAV option is not connected to the system.

Figure 1. Weather Radar (X-Band Type RDR-160XD)  
(Sheet 1 of 4)

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SUPPLEMENT

WEATHER RADAR (X-BAND)  
(TYPE RDR-160XD)

3. MAP MODE SELECTOR PUSHBUTTON - Places indicator in the ground mapping mode, prominent terrain features are presented in up to three colors, depending upon the amount of reflected energy being received. The levels are:
  - DARK - No significant ground return.
  - GREEN - Light ground return.
  - YELLOW - Medium ground return.
  - RED - Heavy ground return.
4. WEATHER ALERT SELECTOR PUSHBUTTON - Places indicator in the weather alert mode. Operation is same as the Weather (WX) mode, except 12 MM/HR (.472 IN/HR) cells cause a flashing, rather than constant, red screen. The button may be pushed a second time to release and return to Wx mode.
5. WEATHER MODE SELECTOR PUSHBUTTON - Places indicator in the weather mode, storm cells are presented in up to three colors, depending upon the level of intensity. The levels are:
 

1 MM/HR (.039 IN/HR) Rainfall Rate or Less	Dark Screen
1-4 MM/HR (.039 - .157 IN/HR) Rainfall Rate	Green Screen
4-12 MM/HR (.157 - .472 IN/HR) Rainfall Rate	Yellow Screen
12 MM/HR (.472 IN/HR) Rainfall Rate or More	Red Screen
6. BRIGHTNESS CONTROL - Adjusts brightness of the display to accommodate varying cockpit lighting.
7. TRACK CURSOR BEARING DIFFERENTIAL DISPLAY - Displays track cursor differential bearing readout, in yellow numerals, in degrees from centerline of aircraft when track buttons are pressed. (Disappears approximately 20 seconds after track button is released.)
8. HOLD DISPLAY - Flashing display indicates system is in HOLD condition.
9. MODE DISPLAY - Displays selected mode of operation for ground mapping (MAP), weather (WX) or weather alert (WXA).
10. RANGE DISPLAY - Displays selected range in nautical miles.
11. TEST DISPLAY - Displays the word TEST and a test pattern when the TEST position is selected on the Function Selector Switch.
12. GAIN CONTROL - Permits adjusting the radar receiver gain in the terrain MAP mode only.

NOTE

In the TEST function as well as in all weather modes the receiver gain is preset, thus no adjustment is required.

Figure 1. Weather Radar (X-Band Type RDR-160XD)  
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### WEATHER RADAR (X-BAND) (TYPE RDR-160XD)

### PILOT'S OPERATING HANDBOOK SUPPLEMENT

13. A yellow azimuth track line which may be superimposed over the weather or terrain mapping display to permit determination of heading to new course intercepts when unexpected deviations arise. The movable line or radial may be shifted to either side of the aircraft centerline. The amount of deviation is displayed in degrees by a yellow readout in the upper left corner of the screen. After approximately 20 seconds (after the selected TRACK pushbutton is released), the azimuth track line disappears from the display, but may be initiated again, as required, by pressing one of the TRACK pushbuttons.

#### NOTE

The track cursor will appear at zero degrees azimuth the next time a TRACK pushbutton is pressed.

14. HOLD SELECTOR PUSHBUTTON - The HOLD switch is a push-to-engage pushbutton. Pushing the HOLD button in (engage) puts the image in the HOLD mode; pushing the button in again releases the HOLD mode. In the HOLD mode weather or ground image last presented is retained (frozen) on the indicator display in order to evaluate the significance of storm cell movement. In this mode the word "HOLD" flashes on and off in the upper left corner of the screen as a reminder that no new data is being presented. However, the antenna continues to scan in order that an accurate and instant update can occur the moment HOLD is deactivated.

#### NOTE

A change in range selection during HOLD results in a blank screen.

15. RANGE MARKS - Displays individual range readout in blue at the end of each blue range arc. Displays are in nautical miles and will change to correspond to the selected range setting.
16. RANGE SELECTOR PUSHBUTTONS - Top button clears the screen and advances the display to the next higher range, each time the button is pressed, until the maximum range is reached. Subsequently, the bottom RANGE button must be pressed in order to select a lower range. The selected range is displayed in blue in the upper right corner of the screen adjacent to the top range mark. The distance from the apex of the display to each of the other range marks is also displayed in the blue at the right end of each range mark. The range/range marks are as follows:

240 Nautical mile range with 60 mile range marks  
160 Nautical mile range with 40 mile range marks  
80 Nautical mile range with 20 mile range marks  
40 Nautical mile range with 10 mile range marks  
20 Nautical mile range with 5 mile range marks  
10 Nautical mile range with 2.5 mile range marks

17. ANTENNA TILT CONTROL - Electronically adjusts the radar beam to 15 degrees up or down, with respect to the airplane axis to compensate for differences in airplane attitude.

Figure 1. Weather Radar (X-Band Type RDR-160XD)  
(Sheet 3 of 4)

16. TRACK SELECTOR PUSHBUTTONS - When either the left or right TRACK button is pressed, a yellow track cursor line extending from the apex of the display through the top range mark appears and moves either right or left from center, depending upon the button pressed. The cursor line moves in one degree steps at a speed of 15 degrees per second up to a maximum of 30 degrees differential from the airplane centerline while the button is held depressed and stops when the button is released. The differential bearing is indicated in yellow numerals in the upper left corner of the screen. The track cursor line and relative bearing display disappear approximately 15 seconds after the button is released, but may be initiated again, as required, by pressing either the left or right TRACK pushbuttons.
17. HOLD SELECTOR PUSHBUTTON - The HOLD switch is a push-to-engage pushbutton. Pushing the HOLD button in (engage) puts the image in the HOLD mode; pushing the button in again releases the HOLD mode. In the HOLD mode weather or ground image last presented is retained (frozen) on the indicator display in order to evaluate the significance of storm cell movement. In this mode the word "HOLD" flashes on and off in the upper left corner of the screen as a reminder that no new data is being presented. However, the antenna continues to scan in order that an accurate and instant update can occur the moment HOLD is deactivated.

NOTE

A change in range selection during HOLD results in a blank screen.

18. LOCKING PAWL - Secures display unit into instrument panel.

Figure 1. Weather Radar (X-Band Type RDR-160 Color)  
(Sheet 4 of 4)

## **SECTION 2**

### **LIMITATIONS**

There is no change to the airplane limitations when this avionic equipment is installed.

## **SECTION 3**

### **EMERGENCY PROCEDURES**

There is no change to the airplane emergency procedures when this avionic equipment is installed.

## **SECTION 4**

### **NORMAL PROCEDURES**

#### **PRIOR TO FLIGHT:**

#### **WARNING**

The radar system generates microwave radiation and improper use, or exposure, may cause serious bodily injury. DO NOT OPERATE THIS EQUIPMENT UNTIL YOU HAVE READ AND CAREFULLY FOLLOWED THE FOLLOWING SAFETY PRECAUTIONS AND INSTRUCTIONS:

#### **SAFETY PRECAUTIONS AND INSTRUCTIONS TO BE FOLLOWED PRIOR TO RADAR OPERATION ON THE GROUND:**

1. Direct nose of aircraft such that antenna scan sector is away from large metallic objects (hangars, other aircraft), and tilt antenna fully upward.
2. Do not turn on or operate radar within 15 feet of ground personnel or containers holding flammable or explosive material.
3. Do not turn on or operate radar during refueling operations.

**PREFLIGHT CHECKS PRIOR TO ENERGIZING RADAR:****WARNING**

IN ORDER TO PREVENT POSSIBLE SERIOUS BODILY INJURY TO GROUND PERSONNEL, IGNITION OF FLAMMABLE OR EXPLOSIVE MATERIALS OR DAMAGE TO THE RADAR UNIT, THE FOLLOWING TESTS MUST BE ACCOMPLISHED WITH THE FUNCTION SELECTOR SWITCH ALWAYS IN THE "TEST" MODE OF OPERATION.

1. Function Selector Switch -- STBY position and after 30 seconds select TEST position.
2. HOLD Selector Pushbutton -- DISENGAGE pushbutton.
3. Antenna Tilt Control -- Set to 0°.
4. BRT Control -- ADJUST to mid-range.
5. Indicator Test Display -- CHECK TEST PATTERN with the following:
  - a. Within 15 seconds four equally spaced blue range marks should be visible, the word "TEST" and the number "40" should appear and be visible in blue displays in the upper right corner of the display. The weather mode indication "WX" should appear in blue in the lower left corner of the display.
  - b. No video noise distortion should appear on the display.
  - c. There are five colored bands appearing on the indicator.
  - d. Starting with the closest band to the origin, the bands will be green, yellow, red, yellow and green.

**NOTE**

The width of the test pattern bands is not critical, nor is the position of the bands relative to the range marks.

- e. The update action may be observed as a small "ripple" moving along the outer green band, indicating that the antenna is scanning.
6. WXA MODE Selector Pushbutton -- PUSH-IN to engage pushbutton and observe that the red band alternates from red to black approximately once per second.
7. HOLD Selector Pushbutton -- PUSH-IN to engage pushbutton and observe that the update ripple disappears and the test pattern should remain stable. The word "HOLD" should flash in blue in the upper left corner.

8. HOLD Selector Pushbutton -- PUSH-OFF to disengage and then verify that update resumes.
9. Function Selector Switch -- STBY position.

**PREFLIGHT CHECKS WITH RADAR ENERGIZED:****WARNING**

IN ORDER TO PREVENT POSSIBLE BODILY INJURY TO GROUND PERSONNEL, IGNITION OF FLAMMABLE OR EXPLOSIVE MATERIALS OR DAMAGE TO THE RADAR UNIT, THE AIRPLANE MUST BE TAXIED WITH THE FUNCTION SELECTOR SWITCH IN THE OFF, STBY, OR TEST POSITIONS ONLY TO A "CLEAR-AHEAD" AREA WHERE METAL BUILDINGS, AIRCRAFT, GROUND PERSONNEL, ETC., ARE NOT IN THE LINE-OF-SIGHT OF THE RADAR UNIT. OBSERVE THE SAFETY PRECAUTIONS AND INSTRUCTIONS AT THE START OF SECTION 4 PRIOR TO PERFORMING THE FOLLOWING CHECKS WITH THE RADAR UNIT ENERGIZED.

1. Ensure safety precautions have been observed.
2. HOLD Selector Pushbutton -- PUSH-OFF to disengage (scan position).
3. Function Selector Switch -- ON position. The indicator will automatically be in the weather (WX) mode.
4. RANGE Selector Pushbuttons -- 40-10 range.
5. Antenna TILT Control -- +4° to minimize ground return.
6. BRT Control -- ADJUST as required.
7. Antenna TILT Control -- TILT UP (+ degrees) and DOWN (- degrees) in small increments. Close-in ground targets should appear on the display at low tilt angles and any local moisture laden weather should appear at higher angles.
8. Function Selector Switch -- STBY position for taxi manuevers.

**OPERATIONAL NOTES:****ALTITUDE RING DISPLAY:**

1. Some energy is radiated peripherally from the radar antenna which, under some atmospheric conditions, will create a false return on the radar screen when the display is set on the 10 or 20 mile ranges. The false return will usually be most prominently displayed at approximately 2 miles from the origin when flying at altitudes near 12,000 ft. However, under certain atmospheric conditions, the false return can still be observed at a distance from the origin approximately equivalent to the airplane's altitude. Care must be taken not to confuse this normal interference return with a weather return. This is best accomplished by using the longer distance displays (40 or more) for early detection of significant weather.

**FALSE RETURN DISPLAY:**

1. Ground radar stations may occasionally cause interference with the presentation of the return. The effect of this interference is to create one or more radial bands of false signal or noise extending from the bottom center outward to the outer range scale. These effects are usually of short duration and are dependent on the airplane's position and range from the ground station, the signal strength, and other factors.

**EXTENDING LIFE OF THE MAGNETRON TRANSMITTING TUBE:**

1. The RDR-160 Color weather radar system is designed so that full operation is possible approximately two minutes after turn on. Therefore, the pilot may choose to leave the function switch in OFF rather than STBY if no significant weather is in the immediate area of the aircraft. The life of the magnetron transmitting tube will be extended by leaving the system "OFF" when possible. This in turn will reduce the cost of maintenance.

**EFFECT OF SOME SUNGLASSES ON THE RADAR DISPLAY SCREEN:**

1. The RDR-160 Color Indicator utilizes a special filter to assure optimum video contrast to the pilot in the presence of high cockpit ambient light. Some sunglasses may interfere with the effectiveness of this filter. To check for this, cock your head to one side while viewing the display and note any dramatic change in brilliance. If the brilliance decreases sharply, some compromise such as removing or changing sunglasses should be effected.

**HIGH ALTITUDE OPERATION:**

1. The RDR-160 Color weather radar system has been approved to a maximum cabin altitude of 25,000 feet. If flying at altitudes above 25,000 feet, it is recommended that the radar be turned off to protect electrical circuitry in the indicator unit.

**NORMAL OPERATION:****WEATHER DETECTION:**

1. Function Selector Switch -- ON position (allow 2 minutes warm-up).
2. Mode Selector Pushbuttons -- SELECT as desired.  
Wx - Weather.  
WxA - Weather Alert.
3. BRT Control -- ADJUST as required for ambient light conditions.
4. Antenna Tilt Control --  $+4^\circ$  to  $+6^\circ$  (approximate minimum angle relative to horizon without ground return).

**NOTE**

If airplane is climbing or descending, tilt angles must be reduced or increased by approximately the pitch angle indicated on the attitude gyro.

5. RANGE Selector Pushbuttons -- SELECT desired range.
6. HOLD Selector Pushbutton -- ENGAGE if desired to "freeze" display on indicator to track storm movements.

**WARNING**

The existing display is the last image stored in the indicator memory and does not represent the true or changing conditions relative to the moving aircraft.

7. Aircraft -- MAINTAIN SPEED and HEADING to assure an accurate picture of relative motion of storm in next step.
8. HOLD Selector Pushbutton -- PUSH to disengage HOLD and evaluate storm movement with updated information.

**GROUND MAPPING:****NOTE**

Ground mapping is a secondary feature of this radar which is only useful after the operator is very familiar with this equipment. More complete discussion of this feature is included in the RDR-160XD Pilot's Manual.

1. Function Selector Switch -- ON position (allow 2 minutes warm-up).
2. RANGE Selector Pushbuttons -- SELECT desired range.
3. MAP Mode Selector Pushbutton -- ENGAGE. Set GAIN as desired for clearest ground mapping interpretation.
4. BRT Control -- ADJUST as required.
5. Antenna Tilt Control -- ADJUST for clearest display.

**SECTION 5****PERFORMANCE**

There is a slight reduction in cruise speed performance with the radar pod installed which varies from approximately 1 knot at high cruise power at lower altitudes to 3 knots at low cruise power or at very high altitudes. All other performance data is unchanged.

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## SUPPLEMENT

### WEATHER RADAR (Type Weather Scout II)

#### SECTION I GENERAL

The Weather Scout II, weather radar system consists of two units: A wing mounted Receiver-Transmitter-Antenna Assembly and a panel mounted Digital Indicator. All operating controls are mounted on the front panel of the indicator and all operating controls and functions are described in Figure 1.

The Weather Scout II is an alphanumeric digital weather radar system with a maximum 120 nautical mile range which is designed to detect significant enroute weather formations along the flight path and will provide the pilot with a 4-level visual display of their intensity. Areas of heaviest rainfall (level 3) will be brightest; areas of less severe and moderate rainfall (levels 2 and 1) will be progressively less bright; and no rainfall (level 0) will be black. The radar system performs only the function of weather detection and should not be used, nor relied upon, for proximity warning or anticollision protection.

Range, mode alphanumerics and a test-bar pattern are always displayed on the 5-inch rectangular cathode-ray tube to facilitate evaluation of the weather display. The weather (WX) mode is normally selected for weather detection. The cyclic (CYC) mode can be used to highlight intense areas of rainfall after the weather target has been located. When CYC mode is selected, the brightest areas will flash on and off to alert the pilot of the most intense areas of rainfall. Internally generated range marks appear as three evenly spaced concentric circular arcs on the display to assist in determining distance from weather targets. Reference marks on each side of zero-heading assist in determining bearing of weather targets.

Experience will soon enable the pilot to detect and evaluate the various types of storm displays. To avoid turbulent weather, the pilot should evaluate the storm display and then determine the approximate heading change required to bypass the storm, or to navigate between storm cells. After the aircraft has been established on its new heading, the pilot should monitor the radar display to see if further correction is needed.

**WARNING**

This system generates microwave radiation and improper use, or exposure, may cause serious bodily injury. DO NOT OPERATE UNTIL YOU HAVE READ AND CAREFULLY FOLLOWED ALL SAFETY PRECAUTIONS AND INSTRUCTIONS CALLED OUT IN SECTION 4(NORMAL PROCEDURES) OF THIS SUPPLEMENT.

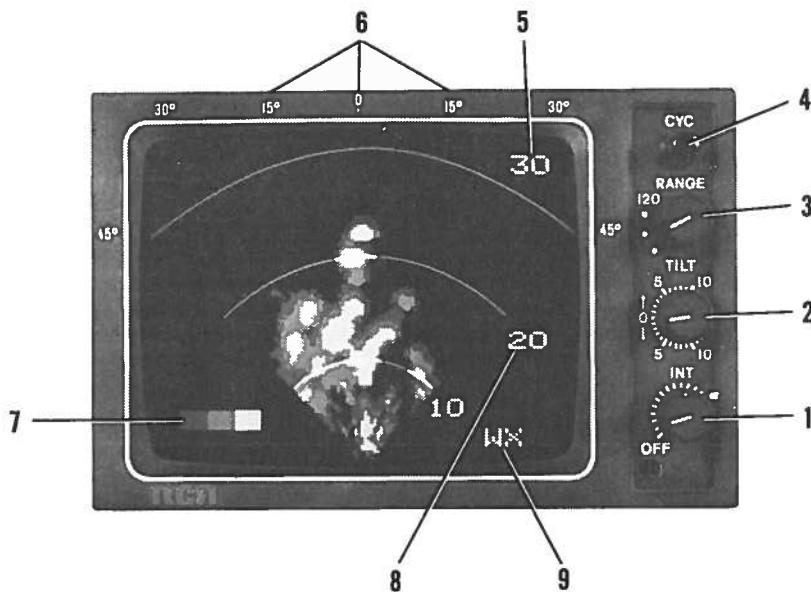
For expanded information and operational instructions, refer to the Weather Scout Digital Weather Radar System Pilot's Handbook supplied with your aircraft. Users of this equipment are strongly urged to familiarize themselves with FAA Advisory Circular AC No. 00-24A (6-23-78), subject: "Thunderstorms".

**SECTION 2  
LIMITATIONS**

There is no change to the airplane limitations when this avionic equipment is installed.

**SECTION 3  
EMERGENCY PROCEDURES**

There is no change to the airplane emergency procedures when this avionic equipment is installed.



1. **ON/OFF AND INTENSITY CONTROL SWITCH (OFF/INT)** - Controls application of power and regulates brightness. Switch positions are as follows:
  - OFF** - Fully counterclockwise rotation of INT control (detented position) places the system in the OFF condition.
  - INT** - Rotary control used to regulate brightness (INTensity) of display.
2. **ANTENNA TILT CONTROL (TILT)** - Rotary control used to electronically adjust the radar beam to 12 degrees up, or down, with respect to the airplane axis to compensate for differences in airplane attitude. Control is indexed with increments of tilt from 0 to 12 degrees up, and down.

Figure 1. Weather Scout II Operating Controls and Indicators  
(Sheet 1 of 2)

3. RANGE SELECTOR SWITCH - Rotary switch used to select one of four display ranges: 12, 30, 60 or 120 nautical mile ranges. Switch positions and range mark spacings are as follows:
  - 12 N.M. Range (Bottom Dot Position) - Selects 12 nautical mile maximum range with range marks displayed in 4 nautical mile increments (Range Mark Identifiers will be displayed as 4, 8 and 12 nautical miles and Range will display, 12).
  - 30 N.M. Range (Next To Bottom Dot Position) - Selects 30 nautical mile maximum range with range marks displayed in 10 nautical mile increments (Range Mark Identifiers will be displayed as 10, 20 and 30 nautical miles and Range will display, 30).
  - 60 N.M. Range (Top Dot Position) - Selects 60 nautical mile maximum range with range marks displayed in 20 nautical mile increments (Range Mark Identifiers will be displayed as 20, 40 and 60 nautical miles and Range will display, 60).
  - 120 N.M. Range (120 Position) - Selects 120 nautical mile maximum range with range marks displayed in 40 nautical mile increments (Range Mark Identifiers will be displayed as 40, 80 and 120 nautical miles and Range will display, 120).
4. CYCLICAL CONTOUR SELECTOR SWITCH (CYC) - Pushbutton switch used to select cyclical contour mode. Data is presented alternately as normal for 0.5 seconds, then contoured for 0.5 seconds. Pressing the CYC pushbutton switch a second time, restores normal or WX mode.
5. RANGE FIELD - Selected range display. Selected range (in nautical miles) is always displayed when the indicator is in the on-condition.
6. BEARING MARKS - Bearing marks are provided on the outside of the indicator in  $15^{\circ}$  increments up to  $45^{\circ}$  on either side of  $0^{\circ}$  (forward mark) to assist in determining relative bearing of return.
7. TEST FIELD - Test block displays in three light illumination levels to depict rainfall intensities. Brightest illumination (level 3) displays heaviest rainfall; illumination levels 2 and 1 will depict areas of less severe and moderate rainfall, respectively. Near maximum intensity position, all three areas of the test bar will be level 3 brightness.
8. RANGE MARK IDENTIFIER - Displays individual range readout at end of each range arc. Displays are in nautical miles and will change to correspond to the selected range setting.
9. MODE FIELD DISPLAY - When set is on, operating mode is displayed as WX or CYC.

#### NOTE

When system is first turned on, WAIT is displayed until system warms-up (30-40 seconds).

Figure 1. Weather Scout II Operating Controls and Indicators  
(Sheet 2 of 2)

## SECTION 4

### NORMAL PROCEDURES

#### PRIOR TO FLIGHT:

#### **WARNING**

The radar system generates microwave radiation and improper use, or exposure, may cause serious bodily injury. DO NOT OPERATE THIS EQUIPMENT UNTIL YOU HAVE READ AND CAREFULLY FOLLOWED THE FOLLOWING SAFETY PRECAUTIONS AND INSTRUCTIONS:

#### SAFETY PRECAUTIONS AND INSTRUCTIONS TO BE FOLLOWED PRIOR TO RADAR OPERATION:

1. Do not turn on or operate radar within 15 feet of ground personnel or containers holding flammable or explosive material.
2. Do not turn on or operate radar during refueling operations.

#### OPERATIONAL NOTES:

##### ALTITUDE RING DISPLAY:

1. Some energy is radiated peripherally from the radar antenna which, under some atmospheric conditions, will create a false return on the radar screen when the display is set on the 12 or 30 mile ranges. The false return will usually be most prominently displayed at approximately 2 miles from the origin when flying at altitudes near 12,000 ft. However, under certain atmospheric conditions, the false return can still be observed at a distance from the origin approximately equivalent to the airplane's altitude. Care must be taken not to confuse this normal interference return with a weather return. This is best accomplished by using the longer distance displays (60 or more) for early detection of significant weather.

##### FALSE RETURN DISPLAY:

1. Ground radar stations and airborne radar equipment may occasionally cause interference with the presentation of the return. The effect of this interference is to create one or more radial bands of false signal or noise extending from the bottom center outward to the outer range scale. These effects are usually of short duration

and are dependent on the airplane's position and range from the radar station, the signal strength, and other factors.

**EXTENDING LIFE OF THE MAGNETRON TRANSMITTING TUBE:**

1. The Weather Scout II weather radar system is designed so that full operation is possible approximately 30 to 40 seconds after turn on. Therefore, the pilot should leave the intensity (INT) switch in the OFF position if no significant weather is in the immediate area of the aircraft. The life of the magnetron transmitting tube will be extended by leaving the system "OFF" when possible. This in turn will reduce the cost of maintenance.

**HIGH ALTITUDE OPERATION:**

1. It may be noted at altitudes above approximately 23,000 feet that clarity of the radar's visual display starts to deteriorate. Range arcs may become wavy and contrast between the three test block displays decreases. Although some deterioration in the radar display may be noted at these high altitudes, the unit has been approved and can be used to a cabin altitude of 30,000 feet.

**NORMAL OPERATION:****WEATHER DETECTION:**

1. INT Control -- ROTATE CLOCKWISE to turn system on.

**NOTE**

Observe that WAIT is displayed during the warm-up period of 30-40 seconds. WX will display after the warm-up period and the system will be operational.

2. INT Control -- ROTATE control clockwise until brightness of the Test Block Display is at the desired level for ambient light conditions.

**NOTE**

To enhance viewing under high ambient light conditions, the 3-areas of the test bar display become maximum brightness when the INT control is positioned at a point between 3 o'clock and maximum CW rotation. At this position, all weather returns are displayed at maximum intensity.

3. RANGE Control -- SET to desired operating range of either 12, 30, 60 or 120 nautical miles.

NOTE

Observe that the maximum selected range for the operating range selected is displayed in the upper, right-hand portion of the display screen. Also observe that the three range arcs display with the appropriate range is displayed for each range arc.

4. Antenna TILT Control -- +4° to 6° (approximate minimum angle relative to horizon without ground return).

NOTE

If airplane is climbing or descending, tilt angles must be reduced or increased by approximately the pitch angle indicated on the attitude gyro.

5. CYC Pushbutton Switch -- PRESS once to select CYC (the most intense areas of rainfall will flash on and off at 0.5-second intervals). Press the switch a second time to restore normal or WX mode of operation.

NOTE

Use of CYC mode is highly recommended when INT control is set near the maximum CW position. All returns will be displayed at maximum intensity but only the intense rainfall areas will be flashed.

## SECTION 5 PERFORMANCE

There is a slight reduction in cruise speed performance with the radar pod installed which varies from approximately 1 knot at high cruise power at lower altitudes to 3 knots at low cruise power or at very high altitudes. All other performance data is unchanged.

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## SUPPLEMENT

# CESSNA NAVOMATIC 200A AUTOPILOT (Type AF-295B)

## SECTION 1 GENERAL

The Cessna 200A Navomatic is an all electric, single-axis (aileron control) autopilot system that provides added lateral and directional stability. Components are a computer-amplifier, a turn coordinator, an aileron actuator, and a course deviation indicator(s) incorporating a localizer reversed (BC) indicator light.

Roll and yaw motions of the airplane are sensed by the turn coordinator gyro. The computer-amplifier electronically computes the necessary correction and signals the actuator to move the ailerons to maintain the airplane in the commanded lateral attitude.

The actuator includes a thermostatic switch which monitors the operating temperature of the motor. If the temperature becomes abnormal, the thermostatic switch opens and disengages the autopilot to remove power from the actuator. After approximately 10 minutes, the switch will automatically close to reapply power to the actuator and autopilot system.

The 200A Navomatic will also capture and track a VOR or localizer course using signals from a VHF navigation receiver.

The operating controls for the Cessna 200A Navomatic are located on the front panel of the computer-amplifier, shown in Figure 1. The primary function pushbuttons (DIR HOLD, NAV CAPT, and NAV TRK), are interlocked so that only one function can be selected at a time. The HI SENS and BACK CRS pushbuttons are not interlocked so that either or both of these functions can be selected at any time.

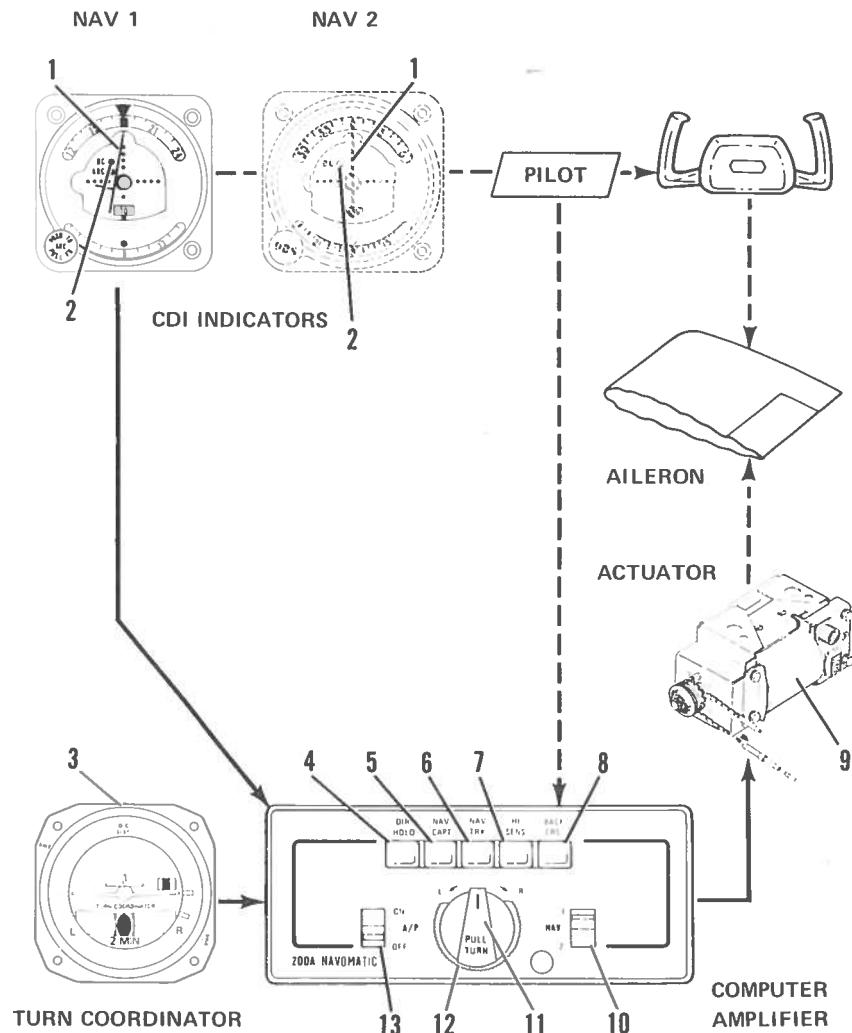


Figure 1. Cessna 200A Autopilot, Operating Controls and Indicators  
(Sheet 1 of 2)

1. COURSE DEVIATION INDICATOR - Provides VOR/LOC navigation inputs to autopilot for intercept and tracking modes.
2. LOCALIZER REVERSED INDICATOR LIGHT - Amber light, labeled BC, illuminates when BACK CRS button is pushed in (engaged) and LOC frequency selected. BC light indicates course indicator needle is reversed on selected receiver (when turned to a localizer frequency). This light is located within the CDI indicator.
3. TURN COORDINATOR - Senses roll and yaw for wings leveling and command turn functions.
4. DIR HOLD PUSHBUTTON - Selects direction hold mode. Airplane holds direction it is flying at time button is pushed.
5. NAV CAPT PUSHBUTTON - Selects NAV capture mode. When parallel to desired course, the airplane will turn to a pre-described intercept angle and capture selected VOR or LOC course.
6. NAV TRK PUSHBUTTON - Selects NAV track mode. Airplane tracks selected VOR or LOC course.
7. HI SENS PUSHBUTTON - During NAV CAPT or NAV TRK operation, this high sensitivity setting increases autopilot response to NAV signal to provide more precise operation during localizer approach. In low sensitivity position (pushbutton out), response to NAV signal is damped for smoother tracking of enroute VOR radials; it also smooths out effect of course scalloping during NAV operation.
8. BACK CRS PUSHBUTTON - Used with LOC operation only. With A/P switch OFF or ON, and when navigation receiver selected by NAV switch is set to a localizer frequency, it reverses normal localizer needle indication (CDI) and causes localizer reversed (BC) light to illuminate. With A/P switch ON, reverses localizer signal to autopilot.
9. ACTUATOR - The torque motor in the actuator causes the ailerons to move in the commanded direction.
10. NAV SWITCH - Selects NAV 1 or NAV 2 navigation receiver.
11. PULL TURN KNOB - When pulled out and centered in detent, airplane will fly wings-level; when turned to the right (R), the airplane will execute a right, standard rate turn; when turned to the left (L), the airplane will execute a left, standard rate turn. When centered in detent and pushed in, the operating mode selected by a pushbutton is engaged.
12. TRIM - Used to trim autopilot to compensate for minor variations in aircraft trim or weight distribution. (For proper operation, the aircraft's rudder trim, if so equipped, must be manually trimmed before the autopilot is engaged.)
13. A/P SWITCH - Turns autopilot ON or OFF.

Figure 1. Cessna 200A Autopilot, Operating Controls and Indicators  
(Sheet 2 of 2)

## SECTION 2 LIMITATIONS

The following autopilot limitation must be adhered to:

### BEFORE TAKE-OFF AND LANDING:

1. A/P ON-OFF Switch -- OFF.

## SECTION 3 EMERGENCY PROCEDURES

### TO OVERRIDE THE AUTOPILOT:

1. Airplane Control Wheel -- ROTATE as required to override autopilot.

#### NOTE

The servo may be overpowered at anytime without damage.

### TO TURN OFF AUTOPILOT:

1. A/P ON-OFF Switch -- OFF.

## SECTION 4 NORMAL PROCEDURES

### BEFORE TAKE-OFF AND LANDING:

1. A/P ON-OFF Switch -- OFF.
2. BACK CRS Button -- OFF (see Caution note under Nav Capture).

#### NOTE

Periodically verify operation of amber warning light(s), labeled BC on CDI(s), by engaging BACK CRS button with a LOC frequency selected, or use TEST function on the audio control panel to verify BC light operation.

## INFLIGHT WINGS LEVELING:

1. Airplane Rudder Trim -- ADJUST for zero slip ("Ball" centered on Turn Coordinator).
2. PULL-TURN Knob -- PULL out and CENTER.
3. A/P ON-OFF Switch -- ON.
4. Autopilot TRIM Control -- ADJUST for zero turn rate (wings level indication on Turn Coordinator).

## NOTE

For optimum performance in airplanes equipped as floatplanes, use autopilot only in cruise flight or in approach configuration with flaps down no more than 10° and airspeed no lower than 75 KIAS on 172 and R172 Series Models, 90 KIAS on 180, 185 Models and 95 KIAS on U206 and TU206 Series Models.

## COMMAND TURNS:

1. PULL-TURN Knob -- PULL out and ROTATE.

## DIRECTION HOLD:

1. PULL-TURN Knob -- PULL out and CENTER.
2. Autopilot TRIM Control -- ADJUST for zero turn rate.
3. Airplane Rudder Trim -- ADJUST for zero slip ("Ball" centered).
4. DIR HOLD Button -- PUSH.
5. PULL-TURN Knob -- PUSH in detent position when airplane is on desired heading.
6. Autopilot TRIM Control -- READJUST for zero turn rate.

## NAV CAPTURE (VOR/LOC):

1. PULL-TURN Knob -- PULL out and CENTER.
2. NAV 1-2 Selector Switch -- SELECT desired VOR receiver.
3. Nav Receiver OBS or ARC Knob -- SET desired VOR course (if tracking omni).

## NOTE

Optional ARC knob should be in center position and ARC amber warning light should be off.

4. NAV CAPT Button -- PUSH.
5. HI SENS Button -- PUSH for localizer and "close-in" omni intercepts.

6. BACK CRS Button -- PUSH only if intercepting localizer front course outbound or back course inbound.

**CAUTION**

With BACK CRS button pushed in and localizer frequency selected, the CDI on selected nav radio will be reversed even when the autopilot switch is OFF.

7. PULL-TURN Knob -- Turn airplane parallel to desired course.

**NOTE**

Airplane must be turned until heading is within  $\pm 5^\circ$  of desired course.

8. PULL TURN Knob -- CENTER and PUSH in. The airplane should then turn toward desired course at  $45^\circ \pm 10^\circ$  intercept angle (if the CDI needle is in full deflection).

**NOTE**

If more than 15 miles from the station or more than 3 minutes from intercept, use a manual intercept procedure.

**NAV TRACKING (VOR/LOC):**

1. NAV TRK Button -- PUSH when CDI centers and airplane is within  $\pm 5^\circ$  of course heading.
2. HI SENS BUTTON -- DISENGAGE for enroute omni tracking (leave ENGAGED for localizer).
3. Autopilot TRIM Control -- READJUST as required to maintain track.

**NOTE**

Optional ARC function, if installed, should not be used for autopilot operation. If airplane should deviate off course, pull out PULL TURN knob and readjust airplane rudder trim for straight flight on the turn coordinator. Push in PULL TURN knob to reintercept course. If deviation persists, progressively make slight adjustments of autopilot TRIM control or heading bug on the directional gyro, towards the course as required to maintain track.

**SECTION 5**  
**PERFORMANCE**

There is no change to the airplane performance when this avionic equipment is installed.

## SUPPLEMENT

### CESSNA 300 ADF (Type R-546E)

#### SECTION 1 GENERAL

The Cessna 300 ADF is a panel-mounted, digitally tuned automatic direction finder. It is designed to provide continuous 1 kHz digital tuning in the frequency range of 200 kHz to 1,699 kHz and eliminates the need for mechanical band switching. The system is comprised of a receiver, a bearing indicator, a loop antenna, and a sense antenna. Operating controls and displays for the Cessna 300 ADF are shown and described in Figure 1. The audio systems used in conjunction with this radio for speaker-phone selection are shown and described in another supplement in this section.

The Cessna 300 ADF can be used for position plotting and homing procedures, and for aural reception of amplitude-modulated (AM) signals.

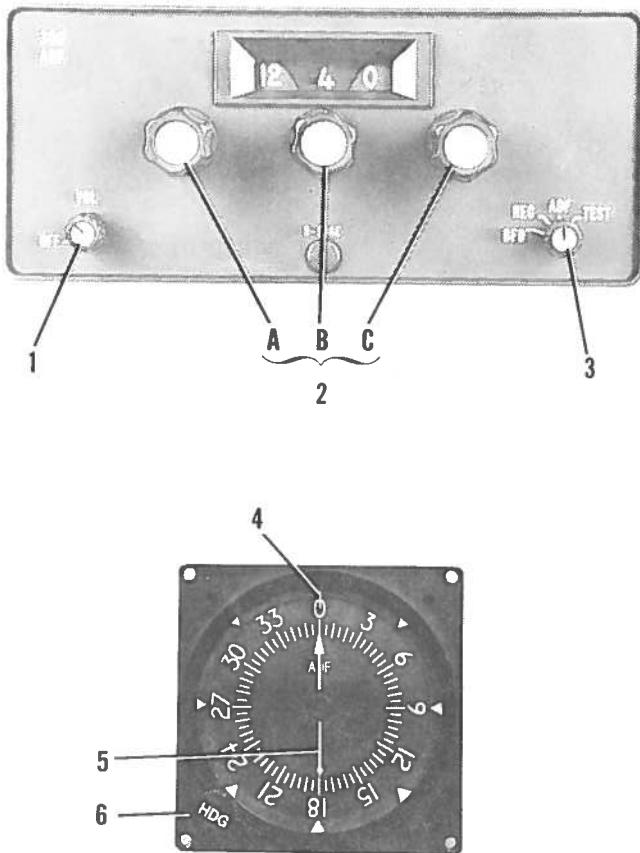
With the function selector knob at ADF, the Cessna 300 ADF provides a visual indication, on the bearing indicator, of the bearing to the transmitting station relative to the nose of the airplane. This is done by combining signals from the sense antenna with signals from the loop antenna.

With the function selector knob at REC, the Cessna 300 ADF uses only the sense antenna and operates as a conventional low-frequency receiver.

The Cessna 300 ADF is designed to receive transmission from the following radio facilities: commercial AM broadcast stations, low-frequency range stations, non-directional radio beacons, ILS compass locators.

#### SECTION 2 LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.



1. OFF/VOL CONTROL - Controls primary power and audio output level. Clockwise rotation from OFF position applies primary power to receiver; further clockwise rotation increases audio level.
2. FREQUENCY SELECTORS - Knob (A) selects 100-kHz increments of receiver frequency, knob (B) selects 10-kHz increments, and knob (C) selects 1 kHz increments.

Figure 1. Cessna 300 ADF Operating Controls and Indicators (Sheet 1 of 2)

**PILOT'S OPERATING HANDBOOK  
SUPPLEMENT****CESSNA 300 ADF  
(TYPE R-546E)****3. FUNCTION SWITCH:**

**BFO:** Selects operation as communication receiver using only sense antenna and activates 1000-Hz tone beat frequency oscillator to permit coded identifier of stations transmitting keyed CW signals (Morse Code) to be heard.

**REC:** Selects operation as standard communication receiver using only sense antenna.

**ADF:** Set operates as automatic direction finder using loop and sense antennas.

**TEST:** Momentary-on position used during ADF operation to test bearing reliability. When held in TEST position, slews indicator pointer clockwise; when released, if bearing is reliable, pointer returns to original bearing position.

4. **INDEX (ROTATABLLE CARD)** - Indicates relative, magnetic, or true heading of aircraft, as selected by HDG control.
5. **POINTER** - Indicates station bearing in degrees of azimuth, relative to the nose of the aircraft. When heading control is adjusted, indicates relative, magnetic, or true bearing of radio signal.
6. **HEADING CARD CONTROL (HDG)** - Rotates card to set in relative, magnetic, or true bearing information.

**Figure 1. Cessna 300 ADF Operating Controls and Indicators (Sheet 2 of 2)**

## SECTION 3

### EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

## SECTION 4

### NORMAL PROCEDURES

TO OPERATE AS A COMMUNICATIONS RECEIVER ONLY:

1. OFF/VOL Control -- ON.
2. Function Selector Knob -- REC.
3. Frequency Selector Knobs -- SELECT operating frequency.
4. ADF SPEAKER/PHONE Selector Switch (on audio control panel) -- SELECT speaker or phone position as desired.
5. VOL Control -- ADJUST to desired listening level.

TO OPERATE AS AN AUTOMATIC DIRECTION FINDER:

1. OFF/VOL Control -- ON.
2. Frequency Selector Knobs -- SELECT operating frequency.
3. ADF SPEAKER/PHONE Selector Switch (on audio control panel) -- SELECT AS DESIRED.
4. Function Selector Knob -- ADF position and note relative bearing on indicator.

TO TEST RELIABILITY OF AUTOMATIC DIRECTION FINDER:

1. Function Selector Knob -- ADF position and note relative bearing on indicator.
2. Function Selector Knob -- TEST position and observe that pointer moves away from relative bearing at least 10 to 20 degrees.
3. Function Selector Knob -- ADF position and observe that pointer returns to same relative bearing as in step (1).

**TO OPERATE BFO:**

1. OFF/VOL Control -- ON.
2. Function Selector Knob -- BFO.
3. Frequency Selector Knobs -- SELECT operating frequency.
4. ADF SPEAKER/PHONE Selector Switch (on audio control panel)  
-- SELECT speaker or phone position.
5. VOL Control -- ADJUST to desired listening level.

**NOTE**

A 1000-Hz tone is heard in the audio output when a CW signal (Morse Code) is tuned in properly.

## **SECTION 5** **PERFORMANCE**

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or related external antennas, will result in a minor reduction in cruise performance.



## SUPPLEMENT

# CESSNA 300 NAV/COM (720-Channel - Type RT-385A)

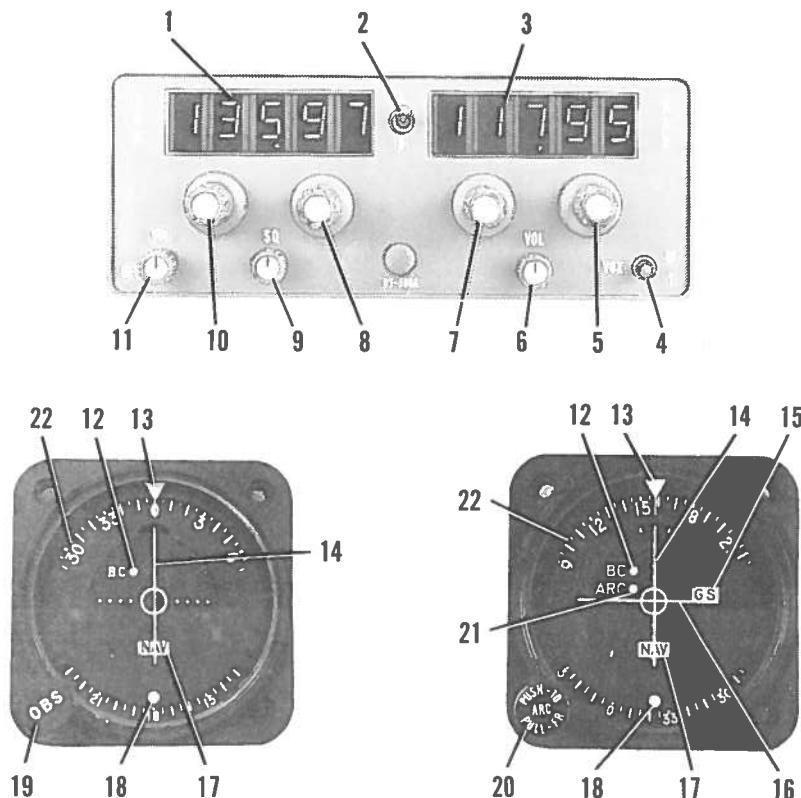
## SECTION 1 GENERAL

The Cessna 300 Nav/Com (Type RT-385A), shown in figure 1, consists of a panel-mounted receiver-transmitter and a single or dual-pointer remote course deviation indicator.

The set includes a 720-channel VHF communications receiver-transmitter and a 200-channel VHF navigation receiver, both of which may be operated simultaneously. The communications receiver-transmitter receives and transmits signals between 118.000 and 135.975 MHz in 25-kHz steps. The navigation receiver receives omni and localizer signals between 108.00 and 117.95 MHz in 50-kHz steps. The circuits required to interpret the omni and localizer signals are located in the course deviation indicator. Both the communications and navigation operating frequencies are digitally displayed by incandescent readouts on the front panel of the Nav/Com.

A DME receiver-transmitter or a glide slope receiver, or both, may be interconnected with the Nav/Com set for automatic selection of the associated DME or glide slope frequency. When a VOR frequency is selected on the Nav/Com, associated VORTAC or VOR-DME station frequency will also be selected automatically; likewise, if a localizer frequency is selected, the associated glide slope will be selected automatically.

The course deviation indicator includes either a single-pointer and related NAV flag for VOR/LOC indication only, or dual pointers and related NAV and GS flags for both VOR/LOC and glide slope indications. Both types of course deviation indicators incorporate a back-course lamp (BC) which lights when optional back course (reversed sense) operation is selected. Both types may be provided with Automatic Radial Centering which, depending on how it is selected, will automatically indicate the bearing TO or FROM the VOR station.



1. COMMUNICATION OPERATING FREQUENCY READOUT (Third decimal-place is shown by the position of the "5-0" switch).
2. 5-0 SWITCH - Part of Com Receiver-Transmitter Fractional MHz Frequency Selector. In "5" position, enables Com frequency readout to display and Com Fractional MHz Selector to select frequency in .05-MHz steps between .025 and .975 MHz. In "0" position, enables COM frequency readout to display and Com Fractional MHz Selector to select frequency in .05-MHz steps between .000 and .950 MHz.

## NOTE

The "5" or "0" may be read as the third decimal digit, which is not displayed in the Com fractional frequency display.

**Figure 1. Cessna 300 Nav/Com (Type RT-385A), Operating Controls and Indicators (Sheet 1 of 3)**

3. NAVIGATION OPERATING FREQUENCY READOUT.
4. ID-VOX-T SWITCH - With VOR or LOC station selected, in ID position, station identifier signal is audible; in VOX (Voice) position, identifier signal is suppressed; in T (Momentary On) position, the VOR navigational self-test function is selected.
5. NAVIGATION RECEIVER FRACTIONAL MEGAHERTZ SELECTOR - Selects Nav frequency in .05-MHz steps between .00 and .95 MHz; simultaneously selects paired glide slope frequency and DME channel.
6. NAV VOL CONTROL - Adjusts volume of navigation receiver audio.
7. NAVIGATION RECEIVER MEGAHERTZ SELECTOR - Selects NAV frequency in 1-MHz steps between 108 and 117 MHz; simultaneously selects paired glide slope frequency and DME channel.
8. COMMUNICATION RECEIVER-TRANSMITTER FRACTIONAL MEGAHERTZ SELECTOR - Depending on position of 5-0 switch, selects COM frequency in .05-MHz steps between .000 and .975 MHz. The 5-0 switch identifies the last digit as either 5 or 0.
9. SQUELCH CONTROL - Used to adjust signal threshold necessary to activate COM receiver audio. Clockwise rotation increases background noise (decreases squelch action); counterclockwise rotation decreases background noise.
10. COMMUNICATION RECEIVER-TRANSMITTER MEGAHERTZ SELECTOR - Selects COM frequency in 1-MHz steps between 118 and 135 MHz.
11. COM OFF-VOL CONTROL - Combination on/off switch and volume control; turns on NAV/COM set and controls volume of communications receiver audio.
12. BC LAMP - Amber light illuminates when an autopilot's back-course (reverse sense) function is engaged; indicates course deviation pointer is reversed on selected receiver when tuned to a localizer frequency. Light dimming is only available when installed with an audio control panel incorporating the annunciator lights DAY/NITE selector switch.
13. COURSE INDEX - Indicates selected VOR course.
14. COURSE DEVIATION POINTER - Indicates course deviation from selected omni course or localizer centerline.
15. GLIDE SLOPE "GS" FLAG - When visible, red GS flag indicates unreliable glide slope signal or improperly operating equipment. Flag disappears when a reliable glide slope signal is being received.
16. GLIDE SLOPE DEVIATION POINTER - Indicates deviation from ILS glide slope.

Figure 1. Cessna 300 Nav/Com (Type RT-385A), Operating Controls and Indicators (Sheet 2 of 3)

17. NAV/TO-FROM INDICATOR - Operates only with a VOR or localizer signal. Red NAV position (Flag) indicates unusable signal. With usable VOR signal, indicates whether selected course is TO or FROM station. With usable localizer signal, shows TO.
18. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR course.
19. OMNI BEARING SELECTOR (OBS) - Rotates OBS course card to select desired course.
20. AUTOMATIC RADIAL CENTERING (ARC-PUSH-TO/PULL-FR) SELECTOR - In center detent, functions as conventional OBS. Pushed to inner (Momentary On) position, turns OBS course card to center course deviation pointer with a TO flag, then returns to conventional OBS selection. Pulled to outer detent, continuously drives OBS course card to indicate bearing from VOR station, keeping course deviation pointer centered, with a FROM flag. ARC function will not operate on localizer frequencies.
21. AUTOMATIC RADIAL CENTERING (ARC) LAMP - Amber light illuminates when Automatic Radial Centering is in use. Light dimming is only available when installed with an audio control panel incorporating the annunciator lights DAY/NITE selector switch.
22. OBS COURSE CARD - Indicates selected VOR course under course index.

Figure 1. Cessna 300 Nav/Com (Type RT-385A), Operating Controls and Indicators (Sheet 3 of 3)

The Cessna 300 Nav/Com incorporates a variable threshold automatic squelch. With this squelch system, you set the threshold level for automatic operation - the further clockwise the lower the threshold - or the more sensitive the set. When the signal is above this level, it is heard even if the noise is very close to the signal. Below this level, the squelch is fully automatic so when the background noise is very low, very weak signals (that are above the noise) are let through. For normal operation of the squelch circuit, just turn the squelch clockwise until noise is heard - then back off slightly until it is quiet, and you will have automatic squelch with the lowest practical threshold. This adjustment should be rechecked periodically during each flight to assure optimum reception.

All controls for the Nav/Com, except the standard omni bearing selector (OBS) knob or the optional automatic radial centering (ARC) knob located on the course deviation indicator, are mounted on the front panel of the receiver-transmitter. Operation and description of the audio control panels used in conjunction with this radio are shown and described in another supplement in this section.

## SECTION 2 LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

## SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed. However, if the frequency readouts fail, the radio will remain operational on the last frequency selected. The frequency control should not be moved due to the difficulty of obtaining a known frequency under this condition.

## SECTION 4

### NORMAL PROCEDURES

#### COMMUNICATION RECEIVER-TRANSMITTER OPERATION:

1. COM OFF/VOL Control -- TURN ON; adjust to desired audio level.
2. XMTR SEL Switch (on audio control panel) -- SET to desired Nav/Com Radio.
3. SPEAKER/PHONE Selector Switches (on audio control panel) -- SET to desired mode.
4. 5-0 Fractional MHz Selector Switch -- SELECT desired operating frequency (does not affect navigation frequencies).
5. COM Frequency Selector Switch -- SELECT desired operating frequency.
6. SQ Control -- ROTATE counterclockwise to just eliminate background noise. Adjustment should be checked periodically to assure optimum reception.
7. Mike Button:
  - a. To Transmit -- DEPRESS and SPEAK into microphone.

#### NOTE

Sidetone may be selected by placing the AUTO selector switch (on audio control panel) in either the SPEAKER or PHONE position. Sidetone may be eliminated by placing the AUTO selector switch in the OFF position. Adjustment of sidetone on audio control panels supplied with three transmitters cannot be accomplished externally. However, audio control panels supplied with one or two transmitters have sidetone adjustment pots that are accessible through the front of the audio control panel with a small screwdriver.

- b. To Receive -- RELEASE mike button.

#### NAVIGATION OPERATION:

#### NOTE

The pilot should be aware that on Cessna airplanes equipped with the vertical fin mounted combination glide slope and omni antenna, pilots should avoid use of  $2700 \pm 100$  RPM on airplanes equipped with a two-bladed propeller or  $1800 \pm 100$  RPM on airplanes equipped with a three-bladed propeller during ILS approaches to avoid oscillations of the glide slope deviation pointer caused by propeller interference.

1. COM OFF/VOL Control -- TURN ON.
2. SPEAKER/PHONE Selector Switches (on audio control panel) -- SET to desired mode.
3. NAV Frequency Selector Knobs -- SELECT desired operating frequency.
4. NAV VOL -- ADJUST to desired audio level.
5. ID-VOX-T Switch:
  - a. To Identify Station -- SET to ID to hear navigation station identifier signal.
  - b. To Filter Out Station Identifier Signal -- SET to VOX to include filter in audio circuit.
6. ARC PUSH-TO/PULL-FROM Knob (If Applicable):
  - a. To Use As Conventional OBS -- PLACE in center detent and select desired course.
  - b. To Obtain Bearing TO VOR Station -- PUSH (ARC/PUSH-TO) knob to inner (momentary on) position.

#### NOTE

ARC lamp will illuminate amber while the OBS course card is moving to center with the course deviation pointer. After alignment has been achieved to reflect bearing to VOR, automatic radial centering will automatically shut down, causing the ARC lamp to go out.

- c. To Obtain Continuous Bearing FROM VOR Station -- PULL (ARC/PULL-FR) knob to outer detent.

#### NOTE

ARC lamp will illuminate amber, OBS course card will turn to center the course deviation pointer with a FROM flag to indicate bearing from VOR station.

7. OBS Knob (If Applicable) -- SELECT desired course.

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CESSNA 300 NAV/COM  
(TYPE RT-385A)

## **PILOT'S OPERATING HANDBOOK SUPPLEMENT**

### **VOR SELF-TEST OPERATION:**

1. COM OFF/VOL Control -- TURN ON.
2. NAV Frequency Selector Switches -- SELECT usable VOR station signal.
3. OBS Knob -- SET for 0° course at course index; course deviation pointer centers or deflects left or right, depending on bearing of signal; NAV/TO-FROM indicator shows TO or FROM.
4. ID/VOX/T Switch -- PRESS to T and HOLD at T; course deviation pointer centers and NAV/TO-FROM indicator shows FROM.
5. OBS Knob -- TURN to displace course approximately 10° to either side of 0° (while holding ID/VOX/T to T). Course deviation pointer deflects full scale in direction corresponding to course displacement. NAV/TO-FROM indicator shows FROM.

#### **NOTE**

When the 300 NAV/COM is coupled to the ANS-351C RNAV system the TEST operation is non-functional. Refer to the "Ground Check Procedures" in the Area Navigation System (Type ANS-351C) Supplement in this section to verify VOR operation of the CDI.

6. ID/VOX/T Switch -- RELEASE for normal operation.

#### **NOTE**

This test does not fulfill the requirements of FAR 91.25.

## **SECTION 5 PERFORMANCE**

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

## SUPPLEMENT

### CESSNA 300 NAV/COM (Type RT-385A)

WITH

### CESSNA 400 AREA NAVIGATION SYSTEM (Type RN-478A)

## SECTION 1 GENERAL

The Cessna 300 Nav/Com (Type RT-385A) Set with Cessna 400 Area Navigation (RNAV-Type RN-478A) consists of a RT-385A Nav/Com, a R-476A DME system, a RN-478A Area Navigation Computer and a IN-442AR Course Deviation Indicator. The RN-478A includes circuits which combine the VOR navigation information with distance information from the R-476A DME system to provide data for area navigation. Operating information for the communication set and for VOR/localizer navigation is presented in this supplement. Operating information for area navigation and for DME is presented in separate supplements.

The RT-385A Receiver-Transmitter includes a 720-channel VHF communication receiver-transmitter which receives and transmits signals between 118.000 MHz and 135.975 MHz in 25-kHz steps. It also includes a 200-channel VHF navigation receiver which receives VOR and localizer signals between 108.00 MHz and 117.95 MHz in 50-kHz steps. The communication receiver-transmitter and the navigation receiver can be operated simultaneously.

The VOR or localizer signal from the No. 2 Navigation Receiver is applied to the converter circuits in the RN-478A Area Navigation Compu-

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**CESSNA 300 NAV/COM  
(RT-385A) WITH CESSNA  
400 RNAV (RN-478A)**

**PILOT'S OPERATING HANDBOOK  
SUPPLEMENT**

ter. The converter processes the received navigation signal to provide omni bearing or localizer information for display by the course indicator.

### **CAUTION**

If the RNAV set is removed from the airplane or becomes inoperative, the associated VHF navigation indicator will be inoperative.

The course indicator includes a Course Deviation Indicator (CDI), an Omni Bearing Selector (OBS) and OFF/TO-FROM Indicator Flags. It also includes an RNAV lamp (RN) which lights when area navigation operation is selected, and a back-course lamp (BC) which lights when back-course operation is selected. The IN-442AR is offered as the standard Course Deviation Indicator.

All operating controls and indicators for the Cessna 300 Nav/Com are included on the front panel of the RT-385A Receiver-Transmitter and the associated Course Deviation Indicator. These controls and indicators are shown and described in Figure 1. Operating controls for the RN-478A Area Navigation Computer, which are used for area navigation, and operating controls for the associated Type R-476A DME are shown in the appropriate supplements in this manual. Operating controls for the audio control panels used in conjunction with this radio are shown and described in another supplement in this section.

## **SECTION 2 LIMITATIONS**

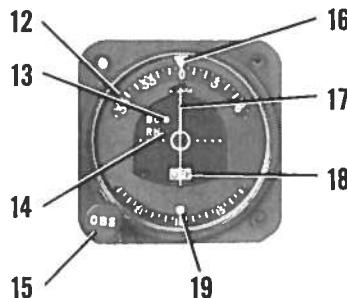
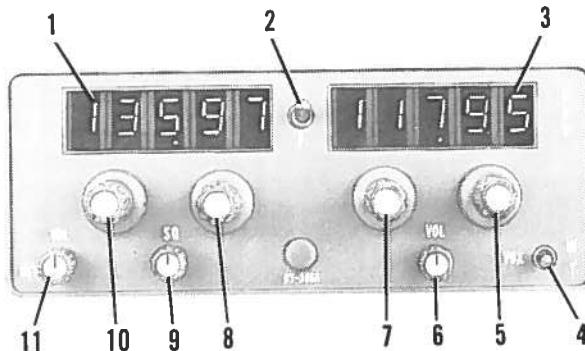
There is no change to the airplane limitations when this avionic equipment is installed.

## **SECTION 3 EMERGENCY PROCEDURES**

There is no change to the airplane emergency procedures when this avionic equipment is installed. However, if the frequency readouts fail, the radio will remain operational on the last frequency selected. The frequency controls should not be moved due to the difficulty of obtaining a known frequency under this condition.

PILOT'S OPERATING HANDBOOK  
SUPPLEMENT

CESSNA 300 NAV/COM  
(RT-385A) WITH CESSNA  
400 RNAV (RN-478A)



1. COMMUNICATION OPERATING FREQUENCY READOUT (Third decimal place is shown by the position of the "5-0" switch).
2. 5-0 SWITCH - Part of COM Receiver-Transmitter Fractional MHz Frequency Selector. In "5" position, enables COM frequency readout to display and COM Fractional MHz Selector to select frequency in .05 MHz steps between .025 and .975 MHz. In "0" position, enables COM frequency readout to display and COM Fractional MHz Selector to select frequency in .05 MHz steps between .000 and .950 MHz.

NOTE

The "5" or "0" may be read as the third decimal digit, which is not displayed in the Com fractional frequency display.

Figure 1. Cessna 300 Nav/Com Set, Operating Controls and Indicators  
(Sheet 1 of 3)

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CESSNA 300 NAV/COM  
(RT-385A) WITH CESSNA  
400 RNAV (RN-478A)

## PILOT'S OPERATING HANDBOOK SUPPLEMENT

3. NAVIGATION OPERATING FREQUENCY READOUT.
4. ID-VOX-T SWITCH - With VOR or LOC station selected, in ID position, station identifier signal is audible; in center VOX (Voice) position, identifier signal is suppressed; in T (Momentary On) position, the VOR navigational self-test function is selected.
5. NAVIGATIONAL RECEIVER FRACTIONAL MEGAHERTZ FREQUENCY SELECTOR - Selects NAV frequency in .05 MHz steps between .00 and .95 MHz; simultaneously selects paired glide slope frequency and DME channel.
6. NAV VOLUME CONTROL (VOL) - Adjusts volume of navigation receiver audio. Clockwise rotation increases audio level.
7. NAVIGATION RECEIVER MEGAHERTZ FREQUENCY SELECTOR - Selects NAV frequency in 1-MHz steps between 108 and 117 MHz; simultaneously selects paired glide slope frequency and DME channel.
8. COMMUNICATION RECEIVER-TRANSMITTER FRACTIONAL MHz FREQUENCY SELECTOR - Depending on position of the 5-0 Switch, selects COM frequency in .05 MHz steps between .000 and .975 MHz. The 5-0 switch identifies the last digit as either 5 or 0.
9. SQUELCH CONTROL - Used to adjust signal threshold necessary to activate COM receiver audio. Clockwise rotation increases background noise (decreases squelch action); counterclockwise rotation decreases background noise.
10. COMMUNICATION RECEIVER-TRANSMITTER MHz FREQUENCY SELECTOR - Selects COM frequency in 1 MHz steps between 118 and 135 MHz.
11. COM OFF-VOL CONTROL - Combination on/off switch and volume control; turns on NAV/COM Set and RNAV Computer circuits; controls volume of communication receiver audio.
12. OBS COURSE CARD - Indicates selected VOR course under course index.
13. BACK COURSE LAMP (BC) - Amber light illuminates when an autopilot with reverse sense feature is installed and the reverse sense switch or the autopilot's back-course function is engaged and receiver is tuned to a localizer frequency; indicates course deviation pointer is reversed. BC light dimming is only available when installed with an audio control panel incorporating the annunciator lights DAY/NITE selector switch.
14. AREA NAV LAMP (RN) - When green light is illuminated, indicates that RNAV operation is selected. RN light dimming is only available when installed with an audio control panel incorporating the annunciator lights DAY/NITE selector switch.
15. OMNI BEARING SELECTOR (OBS) - Rotates OBS course card (12) to select desired bearing to or from a VOR station or to a selected RNAV waypoint.

Figure 1. Cessna 300 Nav/Com Set, Operating Controls and Indicators  
(Sheet 2 of 3)

PILOT'S OPERATING HANDBOOK  
SUPPLEMENT

CESSNA 300 NAV/COM  
(RT-385A) WITH CESSNA  
400 RNAV (RN-478A)

16. COURSE INDEX - Indicates selected VOR or RNAV course (bearing).
17. COURSE DEVIATION POINTER - Indicates deviation from selected VOR or RNAV course or localizer centerline.
18. OFF/TO-FROM INDICATOR - Operates only with VOR or localizer signal. OFF position (flag) indicates unusable signal. With usable VOR signal, when OFF position disappears, indicates whether selected course is TO or FROM station or waypoint. With usable localizer signal, shows TO.
19. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR or RNAV course.

Figure 1. Cessna 300 Nav/Com Set, Operating Controls and Indicators  
(Sheet 3 of 3)

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**CESSNA 300 NAV/COM  
(RT-385A) WITH CESSNA  
400 RNAV (RN-478A)**

**PILOT'S OPERATING HANDBOOK  
SUPPLEMENT**

## **SECTION 4**

### **NORMAL PROCEDURES**

#### **COMMUNICATIONS OPERATION:**

1. COM OFF/VOL Control -- TURN ON; adjust to desired audio level.
2. XMTR SEL Switch (on audio control panel)-- SET to desired 300 NAV/COM.
3. SPEAKER PHONE Selector Switches (on audio control panel) -- SET to desired mode.
4. 5-0 Fractional MHz Selector Switch -- SELECT desired operating frequency (does not affect navigation frequencies).
5. COM Frequency Selector Knobs -- SELECT desired operating frequency.
6. SQ Control -- ROTATE counterclockwise to just eliminate background noise.
7. Mike Button:
  - a. To Transmit -- DEPRESS and SPEAK into microphone.

#### **NOTE**

Sidetone may be selected by placing the AUTO selector switch (on audio control panel) in either the SPEAKER or PHONE position, or may be eliminated by placing the AUTO selector switch in the OFF position. Adjustment of sidetone on audio control panels supplied with three transmitters cannot be accomplished externally. However, audio control panels supplied with one or two transmitters have sidetone adjustment pots that are accessible through the front of the audio control panel with a small screwdriver.

- b. To Receive -- RELEASE mike button.

#### **NAVIGATION OPERATION:**

#### **NOTE**

The pilot should be aware that on Cessna airplanes equipped with the vertical fin mounted combination glide slope and omni antenna, pilots should avoid use of 2700  $\pm$ 100 RPM on airplanes equipped with a two-bladed propeller or 1800  $\pm$ 100 RPM on airplanes equipped with a three-bladed propeller during ILS approaches to avoid oscillations of the glide slope deviation pointer caused by propeller interference.

**PILOT'S OPERATING HANDBOOK  
SUPPLEMENT****CESSNA 300 NAV/COM  
(RT-385A) WITH CESSNA  
400 RNAV (RN-478A)**

1. COM OFF/VOL Control -- TURN ON.
2. SPEAKER/PHONE Selector Switches (on audio control panel) -- SET to desired mode.
3. NAV Frequency Selector Knobs -- SELECT desired operating frequency.
4. NAV VOL Control -- ADJUST to desired audio level.
5. ID-VOX-T Switch:
  - a. To Identify Station -- SET to ID to hear navigation station identifier (Morse Code) signal.
  - b. To Filter Out Station Identifier Signal -- SET to VOX (center) position to include filter in audio circuit.
6. OBS Knob -- SELECT desired course.

**TO SELF TEST VOR NAVIGATION CIRCUITS:**

1. COM OFF/VOL Control -- TURN ON.
2. NAV Frequency Selector Switches -- SELECT usable VOR station signal.
3. OBS Knob -- SET for 0° course at index; CDI pointer centers or deflects left or right, depending on bearing of signal; OFF/TO-FROM indicator shows TO or FROM.
4. ID-VOX-T Switch -- PRESS to T and HOLD at T; CDI pointer should center and OFF/TO-FROM indicator should show FROM.
5. OBS Knob -- TURN to displace course approximately 10° to either side of 0° (while holding ID-VOX-T switch at T); CDI pointer should deflect full scale in direction corresponding to course displacement. OFF/TO-FROM indicator should still show FROM.

**NOTE**

This test does not fulfill the requirements of FAR 91.25.

**SECTION 5  
PERFORMANCE**

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.



## SUPPLEMENT

# CESSNA NAVOMATIC 300A AUTOPILOT (Type AF-395A)

## SECTION 1 GENERAL

The Cessna 300A Navomatic is an all electric, single-axis (aileron control) autopilot system that provides added lateral and directional stability. Components are a computer-amplifier, a turn coordinator, a directional gyro, an aileron actuator and a course deviation indicator(s) incorporating a localizer reversed (BC) indicator light.

Roll and yaw motions of the airplane are sensed by the turn coordinator gyro. Deviations from the selected heading are sensed by the directional gyro. The computer-amplifier electronically computes the necessary correction and signals the actuator to move the ailerons to maintain the airplane in the commanded lateral attitude or heading.

The actuator includes a thermostatic switch which monitors the operating temperature of the motor. If the temperature becomes abnormal, the thermostatic switch opens and disengages the autopilot to remove power from the actuator. After approximately 10 minutes, the switch will automatically close to reapply power to the actuator and autopilot system.

The 300A Navomatic will also intercept and track a VOR or localizer course using signals from a VHF navigation receiver.

The operating controls for the Cessna 300A Navomatic are located on the front panel of the computer-amplifier and on the directional gyro, shown in Figure 1. The primary function pushbuttons (HDG SEL, NAV INT, and NAV TRK), are interlocked so that only one function can be selected at a time. The HI SENS and BACK CRS pushbuttons are not interlocked so that either or both of these functions can be selected at any time.

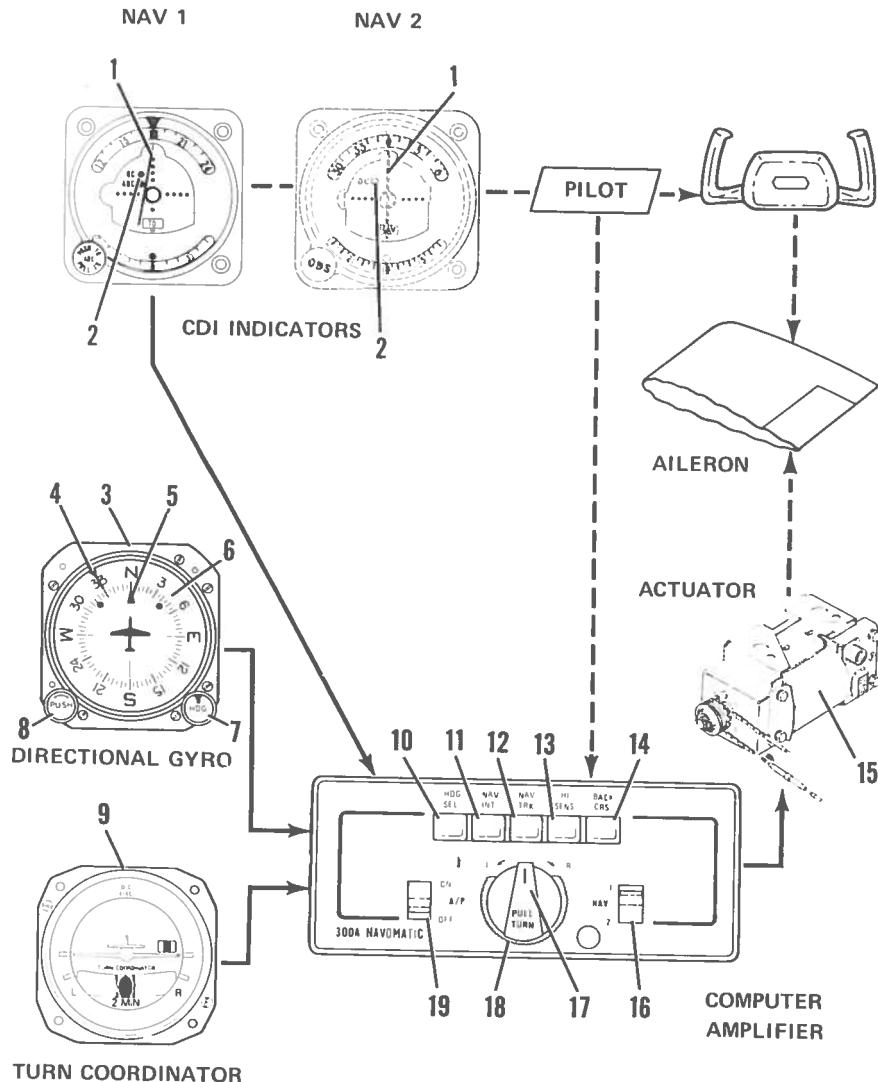


Figure 1. Cessna 300A Autopilot, Operating Controls and Indicators  
(Sheet 1 of 3)

1. COURSE DEVIATION INDICATOR - Provides VOR/LOC navigation inputs to autopilot for intercept and tracking modes.
2. LOCALIZER REVERSED INDICATOR LIGHT - Amber light, labeled BC, illuminates when BACK CRS button is pushed in (engaged) and LOC frequency selected. BC light indicates course indicator needle is reversed on selected receiver (when tuned to a localizer frequency). This light is located within the CDI indicator.
3. NON-SLAVED DIRECTIONAL GYRO - Provides a stable visual indication of aircraft heading to the pilot and provides heading information to the autopilot for heading intercept and hold.
4. HEADING BUG - Moved by HDG knob to select desired heading.
5. LUBBER LINE - Indicates aircraft heading on compass card (6).
6. COMPASS CARD - Rotates to display heading of airplane with reference to rubber line (5).
7. HEADING SELECTOR KNOB (HDG) - When pushed in, the heading bug (4) may be positioned to the desired magnetic heading by rotating the HDG selector knob. Also used to select VOR or LOC course.
8. GYRO ADJUSTMENT KNOB (PUSH) - When pushed in, allows the pilot to manually rotate the compass card (6) to correspond with the magnetic heading indicated by the compass. The compass card must be manually reset periodically to compensate for precessional errors in the gyro.
9. TURN COORDINATOR - Senses roll and yaw for wings leveling and command turn functions.
10. HDG SEL PUSHBUTTON - Aircraft will turn to and hold heading selected by the heading "bug" on the directional gyro.
11. NAV INT PUSHBUTTON - When heading "bug" on DG is set to selected course, aircraft will turn to and intercept selected VOR or LOC course.
12. NAV TRK PUSHBUTTON - When heading "bug" on DG is set to selected course, aircraft will track selected VOR or LOC course.
13. HI SENS PUSHBUTTON - During NAV INT or NAV TRK operation, this high sensitivity setting increases autopilot response to NAV signal to provide more precise operation during localizer approach. In low-sensitivity position (push-button out), response to NAV signal is damped for smoother tracking of enroute VOR radials; it also smooths out effect of course scalloping during NAV operation.
14. BACK CRS PUSHBUTTON - Used with LOC operation only. With A/P switch OFF or ON, and when navigation receiver selected by NAV switch is set to a localizer frequency, it reverses normal localizer needle indication (CDI) and causes localizer reversed (BC) light to illuminate. With A/P switch ON, reverses localizer signal to autopilot.

Figure 1. Cessna 300A Autopilot, Operating Controls and Indicators  
(Sheet 2 of 3)

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### **CESSNA 300A AUTOPILOT (TYPE AF-395A)**

### **PILOT'S OPERATING HANDBOOK SUPPLEMENT**

15. ACTUATOR - The torque motor in the actuator causes the ailerons to move in the commanded direction.
16. NAV SWITCH - Selects NAV 1 or NAV 2 navigation receiver.
17. PULL TURN KNOB - When pulled out and centered in detent, airplane will fly wings-level; when turned to the right (R), the airplane will execute a right, standard rate turn; when turned to the left (L), the airplane will execute a left, standard rate turn. When centered in detent and pushed in, the operating mode selected by a pushbutton is engaged.
18. TRIM - Used to trim autopilot to compensate for minor variations in aircraft trim or lateral weight distribution. (For proper operation, the aircraft's rudder trim, if so equipped, must be manually trimmed before the autopilot is engaged.)
19. A/P SWITCH - Turns autopilot ON or OFF.

**Figure 1. Cessna 300A Autopilot, Operating Controls and Indicators  
(Sheet 3 of 3)**

## SECTION 2 LIMITATIONS

The following autopilot limitation must be adhered to:

### BEFORE TAKE-OFF AND LANDING:

1. A/P ON-OFF Switch -- OFF.

## SECTION 3 EMERGENCY PROCEDURES

### TO OVERRIDE THE AUTOPILOT:

1. Airplane Control Wheel -- ROTATE as required to override autopilot.

#### NOTE

The servo may be overpowered at any time without damage.

### TO TURN OFF AUTOPILOT:

1. A/P ON-OFF Switch -- OFF.

## SECTION 4 NORMAL PROCEDURES

### BEFORE TAKE-OFF AND LANDING:

1. A/P ON-OFF Switch -- OFF.
2. BACK CRS Button -- OFF (see Caution note under Nav Intercept).

#### NOTE

Periodically verify operation of amber warning light(s), labeled BC on CDI(s), by engaging BACK CRS button with a LOC frequency selected, or use TEST function on the audio control panel to verify BC light operation.

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**CESSNA 300A AUTOPILOT  
(TYPE AF-395A)**

**PILOT'S OPERATING HANDBOOK  
SUPPLEMENT**

### **INFLIGHT WINGS LEVELING:**

1. Airplane Rudder Trim -- ADJUST for zero slip ("Ball" centered on Turn Coordinator).
2. PULL-TURN Knob -- PULL out and CENTER.
3. A/P ON-OFF Switch -- ON.
4. Autopilot TRIM Control -- ADJUST for zero turn rate (wings level indication on Turn Coordinator).

#### **NOTE**

For optimum performance in airplanes equipped as floatplanes, use autopilot only in cruise flight or in approach configuration with flaps down no more than 10° and airspeed no lower than 75 KIAS on 172 and R172 Series Models or 90 KIAS on 180, 185, U206 and TU206 Series Models.

### **COMMAND TURNS:**

1. PULL-TURN Knob -- PULL out and ROTATE.

### **HEADING SELECT:**

1. Directional Gyro -- SET to airplane magnetic heading.
2. Heading Selector Knob -- ROTATE bug to desired heading.
3. Heading Select Button -- PUSH.
4. PULL-TURN Knob -- CENTER and PUSH.

#### **NOTE**

Airplane will turn automatically to selected heading. If airplane fails to hold the precise heading, readjust autopilot TRIM control as required or disengage autopilot and reset manual rudder trim (if installed).

### **NAV INTERCEPT (VOR/LOC):**

1. PULL-TURN Knob -- PULL out and CENTER.
2. NAV 1-2 Selector Switch -- SELECT desired receiver.
3. Nav Receiver OBS or ARC Knob -- SET desired VOR course (if tracking omni).

#### **NOTE**

Optional ARC knob should be in center position and ARC warning light should be off.

4. Heading Selector Knob -- ROTATE bug to selected course (VOR or localizer - inbound or outbound as appropriate).
5. Directional Gyro --SET for magnetic heading.
6. NAV INT Button -- PUSH.
7. HI SENS Button -- PUSH for localizer and "close-in" omni intercepts.
8. BACK CRS Button -- PUSH only if intercepting localizer front course outbound or back course inbound.

### **CAUTION**

With BACK CRS button pushed in and localizer frequency selected, the CDI on selected nav radio will be reversed even when the autopilot switch is OFF.

9. PULL-TURN Knob -- PUSH.

### **NOTE**

Airplane will automatically turn to a 45° intercept angle.

#### **NAV TRACKING (VOR/LOC):**

1. NAV TRK Button -- PUSH when CDI centers (within one dot) and airplane is within  $\pm 10^\circ$  of course heading.
2. HI SENS Button -- Disengage for enroute omni tracking (leave engaged for localizer).

### **NOTE**

Optional ARC function, if installed, should not be used for autopilot operation. If airplane should deviate off course, pull out PULL TURN knob and readjust airplane rudder trim for straight flight on the turn coordinator. Push in PULL TURN knob to reintercept course. If deviation persists, progressively make slight adjustments of autopilot TRIM control or heading bug on the directional gyro, towards the course as required to maintain track.

## **SECTION 5**

## **PERFORMANCE**

There is no change to the airplane performance when this avionic equipment is installed.



## SUPPLEMENT

### CESSNA 400 ADF (Type R-446A)

#### SECTION 1 GENERAL

The Cessna 400 ADF is an automatic direction finder set which provides continuous, visual bearing indications of the direction from which an RF signal is being received. It can be used for plotting position, for homing, and for aural reception of AM signals between 200 kHz and 1699 kHz. In addition, a crystal-controlled, beat frequency oscillator (BFO) permits coded identifier of stations transmitting keyed CW signals (Morse Code) to be heard.

The basic units of the Cessna 400 ADF are a R-446A Receiver with dual frequency selectors, a goniometer-indicator (IN-346A), a sense antenna and a loop antenna. The receiver and goniometer-indicator are panel-mounted units. The sense and loop antennas are mounted on the external airplane surfaces. The goniometer-indicator presents station bearing in degrees of azimuth. An automatic pointer-stow feature alerts the operator to non-ADF operation by slewing the pointer to the 3:00 o'clock position when the REC mode is selected. Operating controls and displays for the Cessna 400 ADF are shown and described in Figure 1. The audio control panels used in conjunction with this radio for speaker-phone selection are shown and described in another supplement in this section.

The operating frequency is selected by a four-section Minilever switch which displays a digital readout of the frequency selected and supplies a binary code to control the logic circuits within the set. A secondary (standby) operating frequency is selected by another four-section Minilever switch. Frequency control of the ADF is switched to the primary or the secondary operating frequency by a toggle switch. The operating modes (ADF and REC) are selected by individual pushbutton switches. Additional pushbutton switches are used to select the BFO and to test signal reliability during ADF operation.

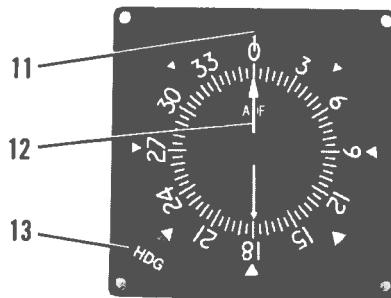
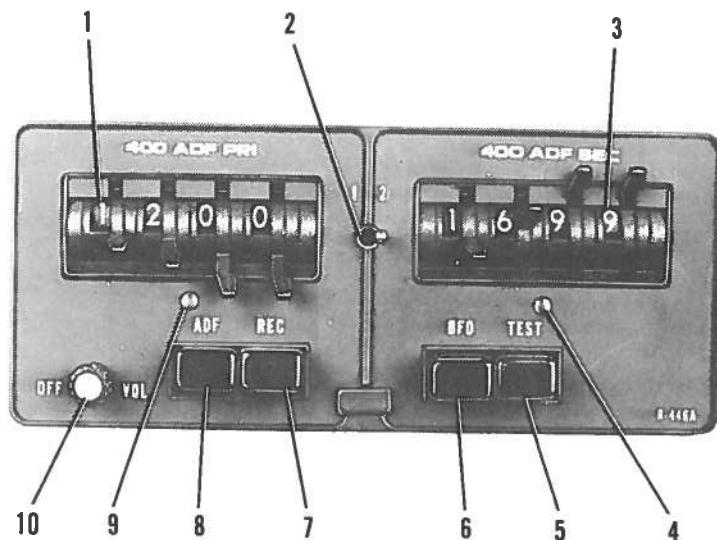


Figure 1. Cessna 400 ADF Operating Controls and Indicator  
(Sheet 1 of 2)

**PILOT'S OPERATING HANDBOOK  
SUPPLEMENT****CESSNA 400 ADF  
(TYPE R-446A)**

1. **PRI (PRIMARY FREQUENCY SELECTOR)** - Selects and displays "primary" frequency.
2. **1-2** - The "1" position activates "primary" (PRI) frequency. The "2" position activates "secondary" (SEC) frequency.
3. **SEC (SECONDARY FREQUENCY SELECTOR)** - Selects and displays "secondary" frequency.
4. **SECONDARY RESELECT LAMP** - Lamp will flash only when "secondary" (SEC) frequency selection is outside of operating range of the receiver and 1-2 switch is in the "2" position.
5. **TEST** - Momentary-on switch used only with ADF function to test bearing reliability. When held depressed, slews indicator pointer; when released, if bearing is reliable, pointer returns to original position.
6. **BFO** - Pushed in: Activates beat frequency oscillator tone to permit coded identifier of stations transmitting keyed CW signals (Morse Code) to be heard.
7. **REC** - Pushed in: Selects receive mode (set operates as a standard communications receiver using sense antenna only).

**NOTE**

In this position an automatic pointer stow feature will alert the pilot to non-ADF operation by positioning and retaining the pointer at the 3:00 o'clock position when the 400 ADF is in the REC function.

8. **ADF** - Pushed in: Selects ADF mode (set operates as automatic direction finder using loop and sense antennas).
9. **PRIMARY RESELECT LAMP** - Lamp will flash only when "primary" (PRI) frequency selection is outside of operating range of the receiver and 1-2 switch is in the "1" position.
10. **OFF-VOL** - Turns set on or off and adjusts receiver volume.
11. **INDEX** - Fixed reference line for dial rotation adjustment.
12. **POINTER** - When HDG control is adjusted, indicates either relative, magnetic, or true bearings of a radio station.
13. **HDG** - Rotates dial to facilitate relative, magnetic, or true bearing information.

**Figure 1. Cessna 400 ADF Operating Controls and Indicator  
(Sheet 2 of 2)**

## SECTION 2 LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

## SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

## SECTION 4 NORMAL PROCEDURES

TO OPERATE AS A COMMUNICATIONS RECEIVER ONLY:

1. OFF/VOL Control -- ON.
2. REC Pushbutton -- PUSH in.

### NOTE

ADF indicator pointer will stow at a 90-degree position to alert the pilot to non-ADF operation.

3. PRI Frequency Selectors -- SELECT desired operating frequency.
4. SEC Frequency Selectors -- SELECT desired operating frequency.
5. 1-2 Selector Switch -- 1 position.

### NOTE

1-2 selector switch can be placed in the 2 position for operation on secondary frequency. The re-select lamp will flash only when frequency selection is outside of operating range of the receiver.

6. ADF SPEAKER/PHONE Selector Switch (on audio control panel) -- SELECT speaker or phone position.
7. VOL Control -- ADJUST to desired listening level.

## TO OPERATE AS AN AUTOMATIC DIRECTION FINDER:

1. OFF/VOL Control -- ON.
2. PRI Frequency Selectors -- SELECT desired operating frequency.
3. SEC Frequency Selectors -- SELECT desired operating frequency.
4. 1-2 Selector Switch -- 1 position.

## NOTE

1-2 selector switch can be placed in the 2 position for operation on secondary frequency. The re-select lamp will flash only when frequency selection is outside of operating range of the receiver.

5. ADF SPEAKER/PHONE Selector Switch (on audio control panel) -- SELECT speaker or phone position as desired.
6. ADF Pushbutton -- PUSH in and note relative bearing on ADF indicator.
7. HDG Control -- SET goniometer-indicator dial so that index indicates 0°, magnetic, or true heading of airplane. Pointer then indicates relative, magnetic, or true bearing to station.
8. VOL Control -- ADJUST to desired listening level.

## NOTE

When switching stations, place function pushbutton in the REC position. Then, after station has been selected, place function pushbutton in the ADF position to resume automatic direction finder operation. (This practice prevents the bearing indicator from swinging back and forth as frequency dial is rotated.)

## TO TEST RELIABILITY OF AUTOMATIC DIRECTION FINDER:

1. ADF Pushbutton -- PUSH in and note relative bearing on indicator.
2. TEST Pushbutton -- PUSH in and hold TEST button until indicator pointer slews off indicated bearing at least 10 to 20 degrees.
3. TEST Pushbutton -- RELEASE and OBSERVE that indicator pointer returns to the same relative bearing as in step (1).

## TO OPERATE BFO:

1. OFF/VOL Control -- ON.
2. ADF SPEAKER/PHONE Selector Switch (on audio control panel) -- SELECT speaker or phone position as desired.
3. BFO Pushbutton -- PUSH in.
4. 1-2 Selector Switch -- SELECT 1 position to activate PRI frequency

or 2 to activate SEC frequency that is transmitting keyed CW signals (Morse Code).

5. VOL Control -- ADJUST to desired listening level.

#### NOTE

A 1000-Hz tone is heard in the audio output when CW signal (Morse Code) is tuned in properly.

## SECTION 5 PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

## SUPPLEMENT

# CESSNA 400 AREA NAVIGATION SYSTEM

(Type RN-478A)

## SECTION 1 GENERAL

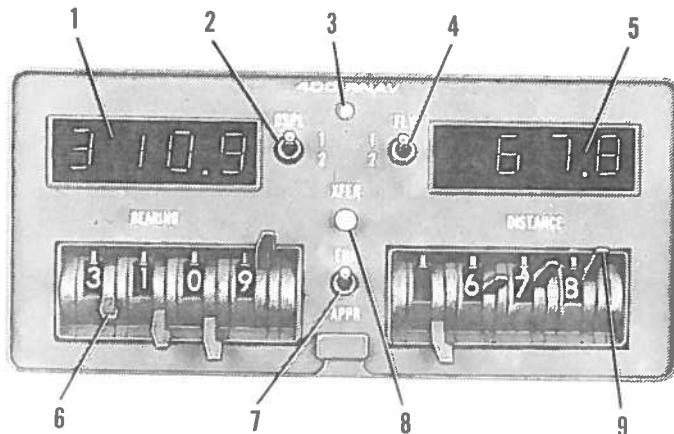
The Cessna 400 Area Navigation System (Type RN-478A) consists of an RN-478A Area NAV Computer (RNAV), a compatible VHF navigation receiver and course deviation indicator, and the Type R-476A distance measuring equipment (DME). The RNAV includes converter circuits which operate with the VHF navigation receiver and produce positional information for display by the course deviation indicator. It also includes computer circuits which combine the bearing information from the navigation set with the distance information from the R-476A DME to establish navigation data for selected waypoints. During RNAV operation, a course scalloping suppressor circuit suppresses the spurious navigation signal phases to provide stable waypoint information which enhances autopilot operation. The 400 RNAV is coupled to the number 2 Nav/Com and includes storage for 3 waypoints.

Ground speed/time-to-station information to the selected VOR (not the waypoint) is available on this system. This capability, along with the course scalloping suppression (radial straightening), may be used to an advantage while tracking inbound or outbound from the VOR station by programming a waypoint directly over the associated VOR (000.0°/000.0 nautical miles) and using RNAV for course smoothing while enroute.

### **CAUTION**

If RNAV set is removed from the airplane or becomes inoperative, the associated VHF navigation indicator will be inoperative.

All operating controls and displays which are part of the RN-478A are shown and described in Figure 1. Other controls required for operation of the Cessna 400 Area Navigation System are included on the VHF navigation receiver and on the R-476A DME control; these controls are shown and described in the respective supplements included for this equipment.



1. BEARING DISPLAY READOUT - Depending on position of DSPL Switch, displays bearing programmed for waypoint 1 or waypoint 2.
2. DISPLAY 1-2 SWITCH (DSPL) - Determines information shown on DISTANCE and BEARING displays: In position 1, distance and bearing programmed for waypoint 1 are displayed; in position 2, distance and bearing programmed for waypoint 2 are displayed.
3. FLY/DISPLAY LAMP - Flashes amber when FLY Switch and DSPL Switch are not set to same number; indicates that waypoint information being displayed is not waypoint information being flown.
4. FLY SWITCH - Determines waypoint being used for navigation. In position 1, waypoint 1 is in use; in position 2, waypoint 2 is in use.
5. DISTANCE DISPLAY READOUT - Depending on position of DSPL Switch, displays distance programmed for waypoint 1 or waypoint 2.
6. BEARING MINILEVER SWITCHES (4) - Select bearing of desired waypoint from VOR/DME station. May be used to store bearing of 3rd waypoint.
7. ENROUTE/APPROACH SWITCH (ENR/APPR) - Controls width of navigation corridor. ENR position provides standard ( $\pm 5$  NM) enroute sensitivity; APPR position provides standard ( $\pm 1\frac{1}{4}$  NM) approach course sensitivity.

**NOTE**

Due to unreliable signals, do not operate in the APPR position when computed distance to waypoint exceeds 51 nautical miles.

8. TRANSFER PUSHBUTTON SWITCH (XFER) - Transfers waypoint distance and bearing from minilevers into either waypoint 1 or 2 as selected by DSPL switch position.
9. DISTANCE MINILEVER SWITCHES (4) - Select distance of desired waypoint from VOR/DME station. May be used to store distance of 3rd waypoint.

**Figure 1. Cessna 400 Area Nav (Type RN-478A) Computer, Operating Controls and Indicators**

## SECTION 2 LIMITATIONS

The following RNAV IFR approach limitation must be adhered to during airplane operation.

### OPERATING LIMITATION:

1. IFR Approaches -- Follow approved published RNAV instrument procedures.

## SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

## SECTION 4 NORMAL PROCEDURES

### VOR/LOC OPERATION

#### VOR NAVIGATION CIRCUITS VERIFICATION TESTS:

1. See appropriate Nav/Com supplement.

### VOR/LOC NAVIGATION:

As a convenience to the pilot, a separate supplement (Avionic Operation Guide) is supplied to explain the various procedures for using the VHF Navigation Set for VOR and localizer navigation. Refer to the Avionic Operations Guide for flight procedures.

### AREA NAVIGATION OPERATION

#### NOTE

Proper RNAV operation requires valid VOR and DME inputs to the RNAV system. In certain areas, the ground station antenna patterns and transmitter power may be inadequate to provide valid signals to the RNAV. For this

reason, intermittent RNAV signal loss may be experienced enroute. Prolonged loss of RNAV signal shall require the pilot to revert to other navigational procedures.

#### WAYPOINT PROGRAMMING:

1. Using a VFR sectional, enroute instrument chart, instrument approach plate, or enroute RNAV chart -- DETERMINE distance and bearing for desired waypoint(s) from appropriate VOR/DME stations.
2. VHF Navigation Receiver -- ON.
3. DME TEST/ON-OFF Switch -- ON.
4. DME Mode Selector Switch -- RNAV.
5. RNAV DSPL Switch -- 1.

#### NOTE

When DSPL and FLY switches are not set to the same waypoint number, the display/fly light slowly blinks on and off as a reminder to the pilot that values displayed are not those being used for navigation. This does not affect operation of the unit.

6. BEARING Minilever Switches -- SET to first waypoint bearing.
7. DISTANCE Minilever Switches -- SET to first waypoint distance.
8. XFER Pushbutton Switch -- PUSH in.
  - a. First waypoint bearing and distance are placed in memory as waypoint 1.
  - b. BEARING Display Readout -- DISPLAYS readout of first waypoint bearing.
  - c. DISTANCE Display Readout -- DISPLAYS readout of first waypoint distance.
9. RNAV DSPL Switch -- SET to 2.
10. BEARING Minilever Switches -- SET to second waypoint bearing.
11. DISTANCE Minilever Switches -- SET to second waypoint distance.
12. XFER Pushbutton Switch -- PUSH in.
  - a. Second Waypoint Readout -- BEARING and DISTANCE are placed in memory as waypoint 2.
  - b. BEARING Display Readout -- DISPLAYS readout of second waypoint bearing.
  - c. DISTANCE Display Readout -- DISPLAYS readout of second waypoint distance.
13. BEARING Minilever Switches -- SET to standby waypoint bearing.

14. DISTANCE Minilever Switches -- SET to standby waypoint distance.

## NOTE

As first waypoint is reached, it can be replaced with the third "standby" waypoint (already set) before placing the RNAV "DSPL" switch to 2. Then a fourth waypoint, if necessary, can be set with the minilever selectors.

## DISPLAY RELIABILITY TESTS:

## NOTE

This test must be conducted following the "Waypoint Programming" procedures with the VHF Navigation Receiver and DME TEST/ON-OFF switches still in the ON position.

1. VHF Navigation Receiver Frequency Selector Switches -- SET to VOR frequency.
2. RNAV DSPL and FLY Switches -- DSPL set to 1, FLY set to 2.
  - a. Readout -- DISPLAYS first waypoint bearing and distance that was selected in Waypoint Programming.
  - b. Fly/Display Lamp (On RNAV Control Head) -- FLASHES.
3. RNAV DSPL and FLY Switches -- DSPL set to 2, FLY set to 1.
  - a. Readout -- DISPLAYS second waypoint bearing and distance.
  - b. Fly/Display Lamp (On RNAV Control Head) -- FLASHES.
4. RNAV DSPL and FLY Switches -- BOTH SET to same number.
  - a. Readout -- DISPLAYS waypoint bearing and distance as selected by DSPL switch.
  - b. Fly/Display Lamp (On RNAV Control Head) -- NOT LIGHTED.
5. DME Mode Selector Switch -- SET to RNAV.
  - a. Both RN and NM Annunciators on DME -- LIGHTED.
  - b. RN Lamp on Course Deviation Indicator -- LIGHTS.
6. VHF Navigation Receiver Frequency Selector Switches -- SET to LOC frequency.
  - a. Both RN and NM Annunciators -- LIGHTED.
  - b. RN Lamp on Course Deviation Indicator -- LIGHTED.
  - c. Course Deviation Indicator OFF(or NAV)/TO-FROM Indicator -- OFF (or NAV) flag in view.
7. DME Mode Selector Switch -- SET to NAV 1, NAV 2, or HOLD.
  - a. NM Annunciator on DME -- LIGHTED.
  - b. RN Annunciator on DME -- NOT LIGHTED.
  - c. RN Lamp on Course Deviation Indicator -- NOT LIGHTED.
  - d. Course Indicator OFF(or NAV)/TO-FROM Indicator -- Shows TO if a usable signal is received.

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CESSNA 400 RNAV  
(TYPE RN-478A)

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8. DME Mode Selector Switch -- RNAV.
9. DME TEST/ON-OFF Switch -- HOLD to TEST.
  - a. DME RN/NM Distance Display -- READOUT is 888.8.
  - b. DME KTS/MIN Ground Speed/Time-to-Station Display -- READOUT is 888.
  - c. RNAV BEARING Display -- READOUT is 888.8.
  - d. RNAV DISTANCE Display -- READOUT is 188.8.

### **AREA NAVIGATION CIRCUITS SELF-TEST:**

1. VHF Navigation Receiver -- ON.
2. VHF Navigation Receiver Frequency Selector Switches -- SET to a usable VOR/DME frequency.
3. DME TEST/ON-OFF Switch -- ON.
4. DME Mode Selector Switch -- RNAV.
  - a. RN Lamp on Course Deviation Indicator -- LIGHTED.
5. RNAV Computer -- PROGRAMMED to waypoint.
6. DSPL and FLY Switches -- SET both to waypoint to be tested.
  - a. BEARING Display -- READOUT is waypoint bearing.
  - b. DISTANCE Display -- READOUT is waypoint distance.
  - c. Course Indicator -- RN LAMP lights.
7. Course Indicator OBS (or ARC) -- SET to waypoint bearing.
8. VHF Navigation Receiver ID/VOX/T Switch -- HOLD in T position.
  - a. Course Deviation Pointer -- CENTERS.
  - b. Course Deviation Indicator OFF(or NAV)/TO-FROM Flag -- Shows TO.
  - c. DME Distance Display -- READOUT is the same as the RNAV DISTANCE readout.

### **NOTE**

After releasing the navigation receiver test (T) switch, the return to accurate computed bearing and distance data can take up to 60 seconds depending upon airplane position and waypoint.

## **SECTION 5**

## **PERFORMANCE**

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

## SUPPLEMENT

### CESSNA 400 DME (TYPE R-476A)

#### SECTION 1 GENERAL

The Cessna 400 DME (Type R-476A) is the airborne "interrogator" portion of a navigation system which supplies continuous, accurate, slant range distance information from a fixed ground station to an aircraft in flight.

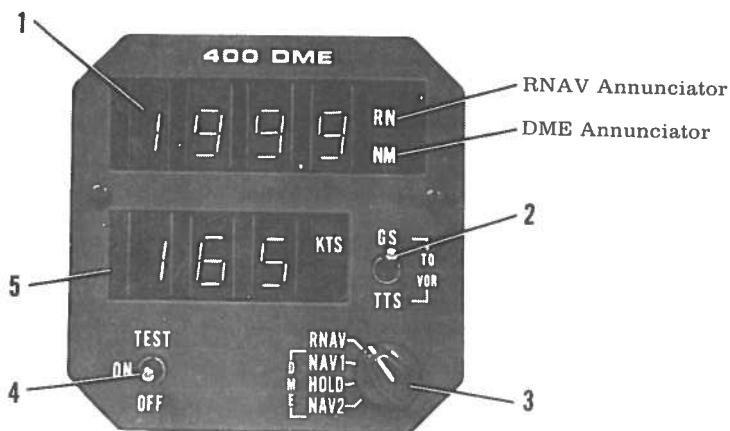
Except for selection of the operating channel, which is selected by the VHF navigation receiver frequency selector switches, the Cessna 400 DME is capable of independent operation. The equipment consists of a panel-mounted C-476A Control Unit which contains all of the operating controls and displays, and a remotely mounted RTA-476A Receiver-Transmitter. The RTA-476A transmits interrogating pulse pairs on 200 channels between 1041 MHz and 1150 MHz; it receives associated ground-to-air replies between 978 MHz and 1213 MHz. The C-476A Control Unit digitally displays distances up to 200 nautical miles and either ground speed or time-to-station information, as selected. All operating controls and displays for the DME are shown in Figure 1, and the functions of each are described.

#### SECTION 2 LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

#### SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.



1. **DISTANCE DISPLAY** - In NAV 1, NAV 2, or HOLD mode, displays distance to selected VOR/DME station in nautical miles; only NM (Nautical Miles) annunciator lights. In RNAV mode, displays distance to selected waypoint in nautical miles; both RN (RNAV) and NM annunciators light.
2. **GS/TTS SELECTOR SWITCH** - In NAV 1, NAV 2, or HOLD mode, selects display of ground speed (GS) or time-to-station (TTS). In RNAV mode, display shows ground speed component to or from the VOR (not to waypoint) or the time to the VOR station at that indicated ground speed.
3. **DME MODE SELECTOR SWITCH** - Selects DME operating mode as follows:
  - RNAV: Selects area navigation operation; selects display of nautical miles (distance) to selected RNAV waypoint.
  - NAV 1: Selects DME operation with No. 1 VHF navigation set; enables channel selection by NAV 1 frequency selector switches.
  - HOLD: Selects DME memory circuit; DME remains channeled to station to which it was channeled when HOLD was selected; display of distance continues to be nautical miles to that station. Both the NAV 1 and the NAV 2 sets may be set to new operation frequencies.

### **CAUTION**

In the HOLD mode, there is no annunciation of the VOR/DME station frequency.

NAV 2: Selects DME operation with No. 2 VHF navigation set; enables channel selection by NAV 2 frequency selector switches.

Figure 1. Cessna 400 DME (Type R-476A) (Sheet 1 of 2)

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SUPPLEMENTCESSNA 400 DME  
(TYPE R-476A)

4. TEST/ON-OFF SWITCH - Controls application of power to DME circuits (turns equipment on or off); selects display lamp test for DME and RNAV displays.
5. GROUND SPEED/TIME DISPLAY - Displays ground speed in knots or time-to-station in minutes, as follows:
  - a. With GS/TTS Switch set to GS, displays ground speed component to or from station in knots (aircraft must be flying directly to or from the VOR/DME station for true ground speed indication).
  - b. With GS/TTS Switch set to TTS, displays time to VOR/DME station in minutes at the ground speed component indicated.
  - c. With GS/TTS in RNAV mode will display ground speed component or time-to-station at that speed to the selected VOR (not the waypoint).

Figure 1. Cessna 400 DME (Type R-476A) (Sheet 2 of 2)

## SECTION 4

### NORMAL PROCEDURES

#### DME OPERATION:

1. TEST/ON-OFF Switch -- SET to ON.
2. DME Mode Selector Switch -- SET to NAV 1 or NAV 2.
3. NAV 1 and NAV 2 VHF Navigation Receivers -- ON; SET FREQUENCY selector switches to VOR/DME station frequencies, as required.

#### NOTE

When the VOR frequency is selected, the appropriate DME frequency is automatically channeled. Therefore, the system does not provide independent operation of the DME for reception of the DME Morse Code identifier.

4. DME SPEAKER/PHONE Selector Switch (on audio control panel) -- SET to desired mode.
5. GS/TTS Switch -- SET as desired.
6. TEST/ON-OFF Switch -- HOLD to TEST:
  - a. Distance-to-Station Display readout is 188.8.
  - b. Knots/Minutes Display readout is 888.
7. TEST/ON-OFF Switch -- RELEASE to ON; display readouts return to normal.

## SECTION 5

### PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

## SUPPLEMENT

# CESSNA 400 GLIDE SLOPE

## (Type R-443B)

### SECTION 1 GENERAL

The Cessna 400 Glide Slope is an airborne navigation receiver which receives and interprets glide slope signals from a ground-based Instrument Landing System (ILS). It is used with the localizer function of a VHF navigation system when making instrument approaches to an airport. The glide slope provides vertical path guidance while the localizer provides horizontal track guidance.

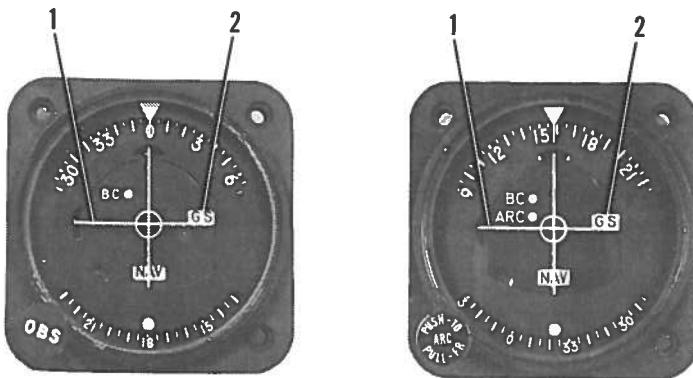
The Cessna 400 Glide Slope system consists of a remote-mounted receiver coupled to an existing navigation system, a panel-mounted indicator and an externally mounted antenna. The glide slope receiver is designed to receive ILS glide slope signals on any of 40 channels. The channels are spaced 150 kHz apart and cover a frequency range of 329.15 MHz through 335.0 MHz. When a localizer frequency is selected on the NAV receiver, the associated glide slope frequency is selected automatically.

Operation of the Cessna 400 Glide Slope system is controlled by the associated navigation system. The functions and indications of typical 300 series glide slope indicators are pictured and described in Figure 1. The 300 series glide slope indicators shown in Figure 1 depict typical indications for Cessna-crafted glide slope indicators. However, refer to the 400 Nav/Com or HSI write-ups if they are listed in this section as options for additional glide slope indicators.

### SECTION 2 LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

## TYPICAL 300 SERIES GLIDE SLOPE INDICATORS



1. GLIDE SLOPE DEVIATION POINTER - Indicates deviation from normal glide slope.
2. GLIDE SLOPE "OFF" OR "GS" FLAG - When visible, indicates unreliable glide slope signal or improperly operating equipment. The flag disappears when a reliable glide slope signal is being received.

**CAUTION**

Spurious glide slope signals may exist in the area of the localizer back course approach which can cause the glide slope "OFF" or "GS" flag to disappear and present unreliable glide slope information. Disregard all glide slope signal indications when making a localizer back course approach unless a glide slope (ILS BC) is specified on the approach and landing chart.

Figure 1. Typical 300 Series VOR/LOC/IILS Indicator

## SECTION 3

### EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

## SECTION 4

### NORMAL PROCEDURES

#### TO RECEIVE GLIDE SLOPE SIGNALS:

##### NOTE

The pilot should be aware that on Cessna airplanes equipped with the vertical fin mounted glide slope antenna, pilots should avoid use of 2700  $\pm$ 100 RPM on airplanes equipped with a two-bladed propeller or 1800  $\pm$ 100 RPM on airplanes equipped with a three-bladed propeller during ILS approaches to avoid oscillations of the glide slope deviation pointer caused by propeller interference.

1. NAV Frequency Select Knobs -- SELECT desired localizer frequency (glide slope frequency is automatically selected).
2. NAV/COM VOX-ID-T Switch -- SELECT ID position to disconnect filter from audio circuit.
3. NAV VOL Control -- ADJUST to desired listening level to confirm proper localizer station.

##### CAUTION

When glide slope "OFF" or "GS" flag is visible, glide slope indications are unusable.

## SECTION 5

### PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed.



## SUPPLEMENT

# CESSNA 400 MARKER BEACON (Type R-402A)

## SECTION 1 GENERAL

The system consists of a remote mounted 75 MHz marker beacon receiver, an antenna which is either flush mounted or externally mounted on the under side of the aircraft and operating controls and annunciator lights which are mounted on the front of the audio control panel.

Operating controls for the marker beacon system are supplied on the front of the two types of audio control panels used in this Cessna aircraft. The operating controls for the marker beacon are different on the two audio control panels. One type of audio control panel is supplied with one or two transmitters and the other is supplied with three transmitters.

The marker beacon operating controls and annunciator lights used on the audio control panel supplied with two or less transmitters are shown and described in Figure 1. The operating controls consist of three, three-position toggle switches. One switch is labeled "HIGH/LO/MUTE" and provides the pilot with HIGH-LO sensitivity selection and marker beacon audio muting, for approximately 30 seconds, to enable voice communication to be heard without interference of marker beacon signals. The marker beacon audible tone is automatically restored at the end of the 30 second muting period to continue marker audio for passage over the next marker. Another switch is labeled "SPKR/OFF/PHN" and is used to turn the set on and select the desired speaker or phone position for marker beacon signals. The third toggle switch labeled, "ANN LT", is provided to enable the pilot to select the desired DAY or NITE lighting position for annunciator lights, and also a "TEST" position to verify operation of marker beacon annunciator lights.

The marker beacon operating controls and annunciator lights used on the audio control panel supplied with three transmitters are shown and described in Figure 2. The operating controls consist of two, three-position toggle switches, and two concentric control knobs. One switch is labeled "SPKR/PHN" and is used to select the desired speaker or phone position for marker beacon signals. The other switch is labeled "HI/LO/TEST" and

provides the pilot with HI-LO sensitivity selection and a TEST position to verify operation of all annunciator lights. The small, inner control knob labeled OFF/VOL, turns the set on or off and adjusts the audio listening level. The large, outer control knob labeled BRT, provides light dimming for the marker beacon lights.

When the Cessna 400 Marker Beacon controls are incorporated in an audio control panel incorporated with two or less transmitters a marker Beacon audio level adjustment potentiometer and an annunciator lights minimum dimming potentiometer are mounted on the audio control panel circuit board. Potentiometer adjustments cannot be accomplished externally. However, if readjustments are desired, adjustments can be made in accordance with instructions found in the Avionics Installations Service/Parts Manual for this aircraft.

## **MARKER FACILITIES**

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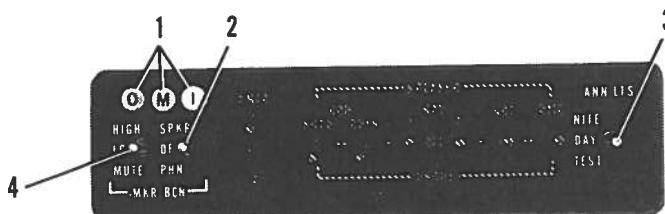
<b>MARKER</b>	<b>IDENTIFYING TONE</b>	<b>LIGHT*</b>
Inner & Fan	Continuous 6 dots/sec (3000 Hz)	White
Middle	Alternate dots and dashes (1300 Hz)	Amber
Outer	2 dashes/sec (400 Hz)	Blue

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\* When the identifying tone is keyed, the respective indicating light will blink accordingly.

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PILOT'S OPERATING HANDBOOK CESSNA 400 MARKER BEACON  
(TYPE R-402A)  
SUPPLEMENT



AUDIO CONTROL PANEL FOR USE WITH ONE OR TWO TRANSMITTERS

1. MARKER BEACON ANNUNCIATOR LIGHTS:

OUTER - Light illuminates blue to indicate passage of outer marker beacon.  
MIDDLE - Light illuminates amber to indicate passage of middle marker beacon.  
INNER and FAN - Light illuminates white to indicate passage of inner and fan marker beacon.

2. SPEAKER/OFF/PHONE SELECTOR SWITCH:

SPEAKER POSITION - Turns set on and selects speaker for aural reception.  
OFF POSITION - Turns set off.  
PHONE POSITION - Turns set on and selects phone for aural reception.

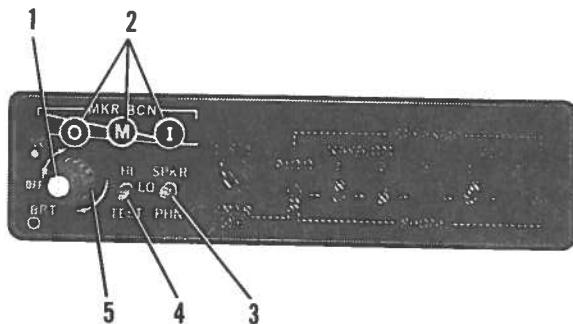
3. ANNUNCIATOR LIGHTS SWITCH:

NITE POSITION - Places the annunciator lights in a dim lighting mode for night flying operations. Light intensity of the NITE position is controlled by the RADIO LT dimming rheostat.  
DAY POSITION - Places the annunciator lights in the full bright position for daylight flying operations.  
TEST POSITION - Illuminates all marker beacon annunciator lights (and other annunciators) in the full bright position to verify operation of annunciator lights.

4. HIGH/LO/MUTE SELECTOR SWITCH:

HIGH POSITION - Receiver sensitivity is positioned for airway flying.  
LO POSITION - Receiver sensitivity is positioned for ILS approaches.  
MUTE POSITION - The marker beacon audio signals are temporarily blanked out (for approximately 30 seconds) and then automatically restored, over the speaker or headset in order to provide voice communications without interference of marker beacon signals.

Figure 1. Cessna 400 Marker Beacon Operating Controls and Indicator Lights Supplied with Two or Less Transmitters



### AUDIO CONTROL PANEL FOR USE WITH THREE TRANSMITTERS

#### 1. OFF/VOLUME CONTROL:

OFF/VOL - Turns the set on or off and adjusts the audio listening level. Clockwise rotation of the smaller knob turns the set on and increases the audio level.

#### 2. MARKER BEACON ANNUNCIATOR LIGHTS:

OUTER - Light illuminates blue to indicate passage of outer marker beacon.  
MIDDLE - Light illuminates amber to indicate passage of middle marker beacon.  
INNER and FAN - Light illuminates white to indicate passage of inner or fan marker beacon.

#### 3. SPEAKER/PHONE SELECTOR SWITCH:

SPEAKER POSITION - Selects speaker for aural reception.  
PHONE POSITION - Selects headphone for aural reception.

#### 4. HI/LO/TEST SELECTOR SWITCH:

HI POSITION - Receiver sensitivity is positioned for airway flying.  
LO POSITION - Receiver sensitivity is positioned for ILS approaches.  
TEST POSITION - Illuminates all annunciation lights in the full bright position to verify operation of annunciation lights.

#### 5. LIGHT DIMMING CONTROL:

BRT - Provides light dimming for the annunciation lights. Clockwise rotation of the larger knob increases light intensity.

Figure 2. Cessna 400 Marker Beacon Operating Controls and Indicator Lights Supplied With Three Transmitters.

## SECTION 2 LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

## SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

## SECTION 4 NORMAL PROCEDURES

MARKER BEACON OPERATING PROCEDURES FOR USE WITH  
AUDIO CONTROL PANELS PROVIDED WITH ONE OR TWO TRANS-  
MITTERS (REF. FIG. 1)

1. SPKR/OFF/PHN Selector Switch -- SELECT desired speaker or phone audio. Either selected position will turn set on.
2. NITE/DAY/TEST Selector Switch -- PRESS to TEST position and verify that all marker beacon annunciator lights illuminate full bright to indicate lights are operational.
3. NITE/DAY/TEST Selector Switch -- SELECT desired position for NITE or DAY lighting.
4. HIGH/LO/MUTE Selector Switch -- SELECT HI position for airway flying or LO position for ILS approaches.

### NOTE

Press MUTE switch to provide an approximate 30 seconds temporary blanking out of Marker Beacon audio tone. The marker beacon audio tone identifier is automatically restored at the end of the muting period.

**NOTE**

Due to the short distance typical between the middle marker and inner marker, audio identification of the inner marker may not be possible if muting is activated over the middle marker.

**MARKER BEACON OPERATING PROCEDURES FOR USE WITH  
AUDIO CONTROL PANELS PROVIDED WITH THREE TRANSMIT-  
TERS. (REF. FIG. 2)**

1. OFF/VOL Control -- TURN to VOL position and adjust to desired listening level. Clockwise rotation increases audio level.
2. HI/LO Sen Switch -- SELECT HI position for airway flying or LO position for ILS approaches.
3. SPKR/PHN Switch -- SELECT speaker or phone audio.
4. BRT Control -- SELECT BRT (full clockwise). ADJUST as desired when illuminated over marker beacon.
5. TEST Switch -- PRESS to TEST position and verify that all marker beacon annunciator lights will illuminate full bright to indicate lights are operational.

**SECTION 5  
PERFORMANCE**

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

# SUPPLEMENT

## CESSNA 400 NAV/COM (720-Channel - Type RT-485A)

### SECTION 1

#### GENERAL

The Cessna 400 Nav/Com (Type RT-485A), shown in Figure 1, consists of a panel-mounted receiver-transmitter and a single or dual-pointer remote 300 or 400 Series course deviation indicator.

The set includes a 720-channel VHF communications receiver-transmitter and a 200-channel VHF navigation receiver, both of which may be operated simultaneously. The communications receiver-transmitter receives and transmits signals between 118.000 and 135.975 MHz in 25-kHz steps. The navigation receiver receives omni and localizer signals between 108.00 and 117.95 MHz in 50 kHz steps. The circuits required to interpret the omni and localizer signals are located in the course deviation indicator. Microprocessor frequency management provides storage for 3 preset NAV and 3 preset COM frequencies in MEMORY. A "keep-alive" voltage prevents loss of the preset frequencies when the Nav/Com is turned off. Both the communications and navigation operating frequencies are digitally displayed by incandescent readouts on the front panel of the Nav/Com.

A DME receiver-transmitter or a glide slope receiver, or both, may be interconnected with the Nav/Com set for automatic selection of the associated DME or glide slope frequency. When a VOR frequency is selected on the Nav/Com, the associated VORTAC or VOR-DME station frequency will also be selected automatically; likewise, if a localizer frequency is selected, the associated glide slope frequency will be selected automatically.

The 400 Nav/Com is installed with either 300 or 400 Series course deviation indicators. The 400 Series Nav/Com indicators incorporate Automatic Radial Centering and a Course Datum synchro as standard features. The 300 Series course deviation indicators do not incorporate a Course Datum synchro but are offered with, or without, Automatic Radial Centering.

#### NOTE

The Course Datum synchro incorporated in 400 Series course deviation indicators is only operational when

coupled to a slaved directional gyro system which is coupled to a 400B Autopilot or Integrated Flight Control System (IFCS).

Both the 300 and 400 Series course deviation indicators include either a single-pointer and related NAV flag for VOR/LOC indication only, or dual pointers and related NAV and GS flags for both VOR/LOC and glide slope indications. Both types of indicators incorporate a back-course lamp (BC) which lights when back course (reversed sense) operation is selected. Indicators with Automatic Radial Centering will, when selected, automatically indicate the bearing TO or FROM the VOR station.

The Cessna 400 Nav/Com incorporates a variable threshold automatic squelch. With this squelch system, you set the threshold level for automatic operation - the further clockwise the lower the threshold - or the more sensitive the set. When the signal is above this level, it is heard even if the noise is very close to the signal. Below this level, the squelch is fully automatic so when the background noise is very low, very weak signals (that are above the noise) are let through. For normal operation of the squelch circuit, just turn the squelch clockwise until noise is heard - then back off slightly until it is quiet, and you will have automatic squelch with the lowest practical threshold. This adjustment should be rechecked periodically during each flight to assure optimum reception.

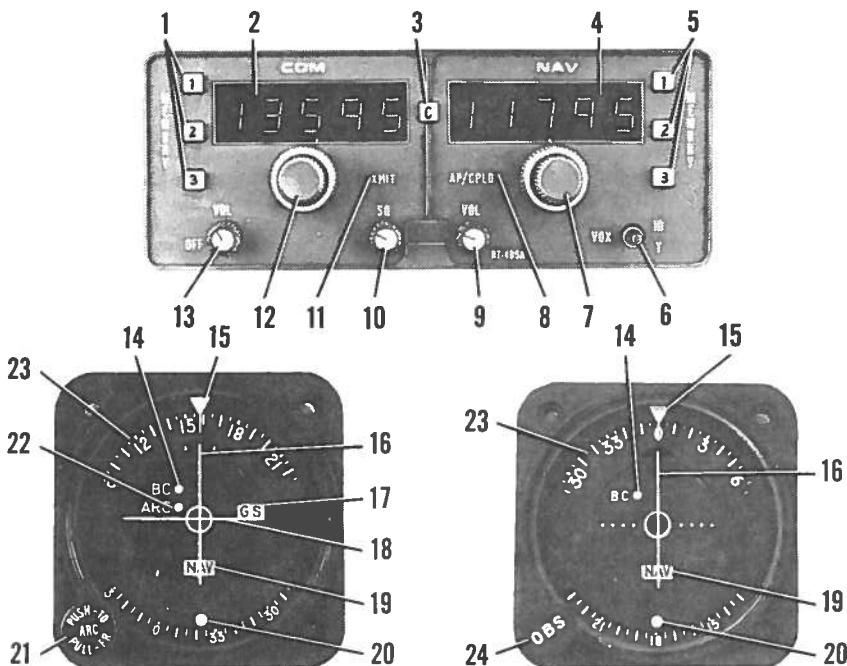
All controls for the Nav/Com, except the omni bearing selector (OBS) knob or automatic radial centering (ARC) knob, which is located on the course deviation indicator, are mounted on the front panel of the receiver-transmitter. The audio control panels used in conjunction with this radio are shown and described in another supplement in this section.

## **SECTION 2 LIMITATIONS**

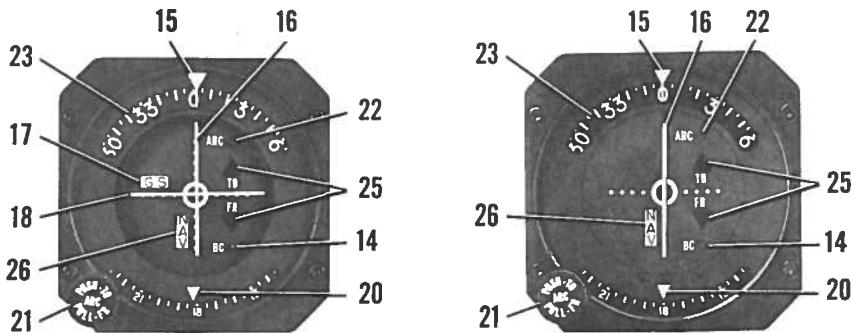
There is no change to the airplane limitations when this avionic equipment is installed.

## **SECTION 3 EMERGENCY PROCEDURES**

There is no change to the airplane emergency procedures when this avionic equipment is installed. However, if the frequency readouts fail, the frequency controls should not be moved due to the difficulty of obtaining a known frequency under this condition. The radio will remain operational on the last frequency selected, and the preset frequencies in MEMORY may be selected by pressing the appropriate MEMORY pushbutton.



TYPICAL 300 SERIES INDICATORS



TYPICAL 400 SERIES INDICATORS

Figure 1. Cessna 400 Nav/Com (Type RT-485A), Operating Controls and Indicators (Sheet 1 of 4)

1. COM MEMORY 1, 2 & 3 PUSHBUTTONS - When a COM MEMORY pushbutton is pressed, the preset selected frequency will appear in the COM frequency window for use as the selected operating frequency. Each pushbutton will illuminate white when pressed and the light will go out on the previously selected pushbutton. Three preset frequencies may be stored in MEMORY and selected as desired, by merely pressing the appropriate COM MEMORY pushbutton to recall the desired operating frequency. If electrical power to the set's "keep-alive" circuit has not been interrupted, upon turn-on, the set will automatically recall the last COM MEMORY frequency selected by the MEMORY pushbutton. If electrical power is removed from the set's "keep-alive" circuit (such as radio removal or battery replacement) for more than 15 seconds, upon turn-on, all COM MEMORY circuits will display the lowest operating frequency (118.000 MHz) and will have to be reset. COM 1 MEMORY will automatically be selected.
2. COMMUNICATION OPERATING FREQUENCY READOUT - Indicates COM frequency in use. Third decimal place not shown.
3. CYCLE BUTTON (C) - Selects last illuminated decimal place on COM frequency in use. If last decimal place is 2 or 7, pressing C pushbutton changes number to 5 or 0, respectively. If last decimal place is 5 or 0, pressing C pushbutton changes number to 7 or 2, respectively. When the last illuminated digit on the set is 2 or 7, the third digit on the set (not shown) will always be 5. When the last illuminated digit on the set is 0 or 5, the third digit on the set (not shown) will always be 0. Also provides test function by holding C pushbutton pressed for more than 1.7 seconds. This lights each COM and NAV MEMORY pushbutton in turn, and displays the corresponding preset frequency in MEMORY.
4. NAVIGATION OPERATING FREQUENCY READOUT - Indicates NAV frequency in use.
5. NAV MEMORY 1, 2 & 3 PUSHBUTTONS - When a NAV MEMORY pushbutton is pressed, the preset selected frequency will appear in the NAV frequency window for use as the selected operating frequency. Each pushbutton will illuminate white when pressed and the light will go out on the previously selected pushbutton. Three preset frequencies may be stored in MEMORY and selected as desired, by merely pressing the appropriate NAV MEMORY pushbutton to recall the desired operating frequency. If electrical power to the set's "keep-alive" circuit has not been interrupted, upon turn-on, the set will automatically recall the last NAV MEMORY frequency selected by the MEMORY pushbutton. If electrical power is removed from the set's "keep-alive" circuit (such as radio removal or battery replacement) for more than 15 seconds, upon turn-on, all NAV MEMORY circuits will display the lowest operating frequency (108.00 MHz) and will have to be reset. NAV 1 MEMORY will automatically be selected.
6. ID-VOX-T SWITCH - In ID position, station identifier signal is audible; in VOX (Voice) position, identifier signal is suppressed; in T (Momentary On) position, the self-test function is selected, and the AP/CPLD annunciator illuminates amber and the XMIT annunciator illuminates green.
7. NAVIGATION RECEIVER FREQUENCY SELECTORS - Outer knob changes NAV frequency in 1-MHz steps between 108 and 117 MHz; inner knob changes NAV frequency in .05-MHz steps between .00 and .95 MHz; simultaneously selects paired glide slope frequency and DME channel.

Figure 1. Cessna 400 Nav/Com (Type RT-485A), Operating Controls and Indicators (Sheet 2 of 4)

PILOT'S OPERATING HANDBOOK  
SUPPLEMENTCESSNA 400 NAV/COM  
(TYPE RT-485A)

8. AUTOPILOT COUPLED ANNUNCIATOR (AP/CPLD) - Illuminates amber when a 400B or 400B IFCS autopilot is coupled to NAV VOR/LOC converter output, (non-operational with 200A and 300A autopilots).
9. NAV VOLUME CONTROL (VOL) - Adjusts volume of navigation receiver audio.
10. SQUELCH CONTROL - Used to adjust signal threshold necessary to activate COM receiver audio. Clockwise rotation increases background noise (decreases squelch action); counterclockwise rotation decreases background noise.
11. TRANSMIT ANNUNCIATOR (XMIT) - Illuminates green when transmitter output is normal while mike is keyed.

## NOTE

Due to limited antenna isolation and production tolerances, the Transmit Annunciator on both Nav/Coms on dual installations may be illuminated when one transmitter is keyed.

12. COMMUNICATION RECEIVER FREQUENCY SELECTORS - Outer knob changes COM frequency in 1-MHz steps between 118 and 135 MHz; inner knob changes COM frequency in .05 MHz steps between .025 and .975 MHz or between .000 and .950 MHz depending on selection of C button.
13. COM OFF-VOLUME CONTROL (OFF-VOL) - Combination ON/OFF switch and volume control; turns on Nav/Com set and controls volume of COM receiver audio.
14. BACK-COURSE LAMP (BC) - Amber light illuminates when an autopilot with reverse sense feature is installed and the reverse sense switch or autopilot's back-course function is engaged and receiver is tuned to a localizer frequency; indicates course deviation pointer is reversed. BC light dimming is only available when installed with an audio control panel incorporating the annunciator lights DAY/NITE selector switch.
15. COURSE INDEX - Indicates selected VOR COURSE.
16. COURSE DEVIATION POINTER - Indicates course deviation from selected omni course or localizer centerline.
17. GLIDE SLOPE "GS" FLAG - When visible, red GS flag indicates unreliable glide slope signal or improperly operating equipment. Flag disappears when a reliable glide slope signal is being received.
18. GLIDE SLOPE DEVIATION POINTER - Indicates deviation from ILS glide slope.
19. NAV/TO-FROM INDICATOR - Operates only with a VOR or localizer signal. Red NAV position (Flag) indicates unusable signal. With usable VOR signal, indicates whether selected VOR course is TO or FROM station. With usable localizer signal, TO flag is in view.

Figure 1. Cessna 400 Nav/Com (Type RT-485A), Operating Controls and Indicators (Sheet 3 of 4)

20. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR course.
21. AUTOMATIC RADIAL CENTERING (ARC) PUSH-TO/PULL-FR SELECTOR - In center detent, functions as conventional OBS. Pushed to inner (Momentary On) position, rotates OBS course card to center course deviation pointer with a TO flag, then returns to conventional OBS selection. Pulled to outer detent, continuously drives OBS course card to indicate bearing from VOR station, keeping course deviation pointer centered, with a FROM flag. ARC function will not operate on localizer frequencies.

#### NOTE

Engaging either Automatic Radial Centering (ARC) functions will alter the airplane's course anytime the autopilot is engaged and coupled to the associated Nav when tuned to a VOR frequency.

22. AUTOMATIC RADIAL CENTERING (ARC) LAMP - Amber light illuminates when Automatic Radial Centering is in use. ARC light dimming is only available when installed with an audio control panel incorporating the annunciator lights, DAY/NITE selector switch.
23. OBS COURSE CARD - Indicates selected VOR course under course index.
24. OMNI BEARING SELECTOR (OBS) - Rotates course card to select desired VOR radial.
25. TO/FROM INDICATOR (TO/FR) - Operates only with a usable VOR or localizer signal. When white flag is in view, indicates whether selected course is TO or FROM station. With usable localizer signal, TO flag is in view.
26. NAV INDICATOR FLAG - When in view, red NAV position (Flag) indicates the selected VOR or localizer signal is unusable.

Figure 1. Cessna 400 Nav/Com (Type RT-485A), Operating Controls and Indicators (Sheet 4 of 4)

## SECTION 4

### NORMAL PROCEDURES

#### PRESETTING NAV/COM FREQUENCIES IN MEMORY:

1. COM OFF/VOL CONTROL -- TURN ON; adjust to desired audio level.
2. MEMORY 1 Pushbutton -- PRESS desired NAV or COM pushbutton 1 momentarily to alert the memory bank of a forthcoming frequency to be stored.
3. FREQUENCY SELECTORS -- MANUALLY ROTATE corresponding NAV or COM frequency selectors (press C pushbutton as required to select the desired third fractional COM digit) until the desired frequency is shown in the operating frequency readout window. The frequency displayed will be automatically transferred into MEMORY 1.

#### NOTE

Do not press the C pushbutton more than about 2 seconds while selecting fractional frequencies or you will activate the MEMORY test function.

4. MEMORY 2 and 3 Pushbuttons -- REPEAT STEPS 2 and 3 using next desired NAV or COM MEMORY to be stored. Up to 3 NAV and 3 COM frequencies may be stored for automatic recall frequency selection.

#### NOTE

The operating frequency set in the selected MEMORY position will automatically be changed in the MEMORY bank any time the operating frequency is manually changed.

#### COMMUNICATION RECEIVER-TRANSMITTER OPERATION:

1. COM OFF/VOL Control -- TURN ON.
2. XMTR SEL Switch (on audio control panel) -- SET to desired 400 Nav/Com.
3. SPEAKER/PHONE Selector Switches (on audio control panel) -- SET to desired mode.
4. COM Frequency Selection -- SELECT desired operating frequency by either pressing a COM MEMORY 1, 2 or 3 pushbutton to recall a preset frequency, or by manually selecting the desired operating frequency using the COM frequency selectors and C pushbutton.

5. VOL Control -- ADJUST to desired audio level.
6. SQ Control -- ROTATE counterclockwise to just eliminate background noise.
7. Mike Button:
  - a. To Transmit -- DEPRESS and SPEAK into microphone.

NOTE

Sidetone may be selected by placing the AUTO selector switch (on audio control panel) in either the SPEAKER or PHONE position, or may be eliminated by placing the AUTO selector switch in the OFF position. Adjustment of sidetone on audio control panels supplied with three transmitters cannot be accomplished externally. However, audio control panels supplied with one or two transmitters have sidetone adjustment pots that are accessible through the front of the audio control panel with a small, nonconductive screwdriver.

- b. XMIT Annunciator Light -- CHECK ON (green light illuminated).
- c. To Receive -- RELEASE mike button.

NAVIGATION OPERATION:

1. COM OFF/VOL Control -- TURN ON; adjust to desired audio level.
2. SPEAKER/PHONE Selector Switches (on audio control panel) -- SET to desired mode.
3. NAV Frequency Selection -- SELECT desired operating frequency by either pressing a NAV MEMORY 1, 2 or 3 pushbutton to recall a preset frequency, or by using NAV frequency selectors.
4. NAV VOL Control -- ADJUST to desired audio level.
5. ID-VOX-T Switch:
  - a. To Identify Station -- SET to ID to hear navigation station identifier signal.
  - b. To Filter Out Station Identifier Signal -- SET to VOX to include filter in audio circuit.

6. ARC PUSH-TO/PULL-FROM Knob (If Applicable):
  - a. To Use As Conventional OBS -- PLACE in center detent and select desired course.
  - b. To Obtain Bearing TO VOR Station -- PUSH (ARC/PUSH-TO) knob to inner (Momentary On) position.

NOTE

ARC lamp will illuminate amber while the OBS course card is moving to center the course deviation pointer. After alignment has been achieved to reflect bearing TO VOR, automatic radial centering will automatically shut down, causing the ARC lamp to go out and the ARC knob to return to the center detent position and function as a normal OBS.

- c. To obtain Continuous Bearing FROM VOR Station -- PULL (ARC/PULL-FR) knob to outer detent.

NOTE

ARC lamp will illuminate amber, OBS course card will turn to center the course deviation pointer with a FROM flag to indicate bearing from VOR station. This system will continually drive to present the VOR radial the aircraft is on until manually returned to the center detent by the pilot.

7. AP/CPLD Annunciator Light -- CHECK ON (light is only operational if a 400B Autopilot or 400B IFCS is engaged), amber light illuminated.

VOR SELF-TEST OPERATION:

1. COM OFF/VOL Control -- TURN ON.
2. NAV Frequency Selector Switches -- SELECT usable VOR station signal.
3. OBS Knob -- SET for 0° course at course index; course deviation pointer centers or deflects left or right, depending on bearing of signal; NAV/TO-FROM indicator shows TO or FROM.
4. ID/VOX/T Switch -- PRESS to T and HOLD at T; course deviation pointer centers, NAV/TO-FROM indicator shows FROM and AP/CPLD and XMIT annunciators light.

5. OBS Knob -- TURN to displace course approximately  $10^{\circ}$  to either side of  $0^{\circ}$  (while holding ID/VOX/T to T). Course deviation pointer deflects full scale in direction corresponding to course displacement. NAV/TO-FROM indicator shows FROM.

**NOTE**

When the 400 NAV/COM is coupled to the ANS-351C RNAV system the TEST operation is non-functional. Refer to the "Ground Check Procedures" in the Area Navigation System (Type ANS-351C) Supplement in this section to verify VOR operation of the CDI.

6. ID/VOX/T Switch -- RELEASE for normal operation.

**NOTE**

This test does not fulfill the requirements of FAR 91.25.

**MEMORY TEST OPERATION:**

1. C Pushbutton -- PUSH for about 2 seconds. Each COM and NAV MEMORY pushbutton (1, 2 & 3) will illuminate white, in turn, with the corresponding preset frequency displayed.

**NOTE**

If the "keep-alive" circuit has not been interrupted, the MEMORY test will always start with the last COM MEMORY selected and cycle through the remaining COM and NAV preset frequencies. The MEMORY test will always stop on the last selected COM and NAV preset frequencies.

## **SECTION 5**

## **PERFORMANCE**

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

# SUPPLEMENT

## CESSNA 400 NAV/COM

### (720-Channel - Type RT-485B)

#### SECTION 1

#### GENERAL

The Cessna 400 Nav/Com (Type RT-485B), shown in Figure 1, consists of a panel-mounted receiver-transmitter and a single or dual-pointer remote 300 or 400 Series course deviation indicator.

The set includes a 720-channel VHF communications receiver-transmitter and a 200-channel VHF navigation receiver, both of which may be operated simultaneously. The communications receiver-transmitter receives and transmits on frequencies between 118.000 and 135.975 MHz in 25-kHz steps. The navigation receiver receives omni and localizer signals between 108.00 and 117.95 MHz in 50 kHz steps. The circuits required to interpret the omni and localizer signals are located in the course deviation indicator. Microprocessor frequency management provides storage for 3 preset NAV and 3 preset COM frequencies in MEMORY. A "keep-alive" voltage prevents loss of the preset frequencies when the Nav/Com is turned off. Both the communications and navigation operating frequencies are digitally displayed by LED readouts on the front panel of the Nav/Com.

A DME receiver-transmitter or a glide slope receiver, or both, may be interconnected with the Nav/Com set for automatic selection of the associated DME or glide slope frequency. When a VOR frequency is selected on the Nav/Com, the associated VORTAC or VOR-DME station frequency will also be selected automatically; likewise, if a localizer frequency is selected, the associated glide slope frequency will be selected automatically.

The 400 Nav/Com is installed with either 300 or 400 Series course deviation indicators. The 400 Series Nav/Com indicators incorporate Automatic Radial Centering and a Course Datum synchro as standard features. The 300 Series course deviation indicators do not incorporate a Course Datum synchro but are offered with, or without, Automatic Radial Centering.

#### NOTE

The Course Datum synchro incorporated in 400 Series

course deviation indicators is only operational when coupled to a slaved directional gyro system which is coupled to a 400B Autopilot or Integrated Flight Control System (IFCS).

Both the 300 and 400 Series course deviation indicators include either a single-pointer and related NAV flag for VOR/LOC indication only, or dual pointers and related NAV and GS flags for both VOR/LOC and glide slope indications. Both types of indicators incorporate a back-course lamp (BC) which lights when back course (reversed sense) operation is selected. Indicators with Automatic Radial Centering will, when selected, automatically indicate the bearing TO or FROM the VOR station.

The Cessna 400 Nav/Com incorporates a variable threshold automatic squelch. With this squelch system, you set the threshold level for automatic operation - the further clockwise the lower the threshold - or the more sensitive the set. When the signal is above this level, it is heard even if the noise is very close to the signal. Below this level, the squelch is fully automatic so when the background noise is very low, very weak signals (that are above the noise) are let through. For normal operation of the squelch circuit, just turn the squelch clockwise until noise is heard - then back off slightly until it is quiet, and you will have automatic squelch with the lowest practical threshold. This adjustment should be rechecked periodically during each flight to assure optimum reception.

All controls for the Nav/Com, except the omni bearing selector (OBS) knob or automatic radial centering (ARC) knob, which is located on the course deviation indicator, are mounted on the front panel of the receiver-transmitter. The audio control panels used in conjunction with this radio are shown and described in another supplement in this section.

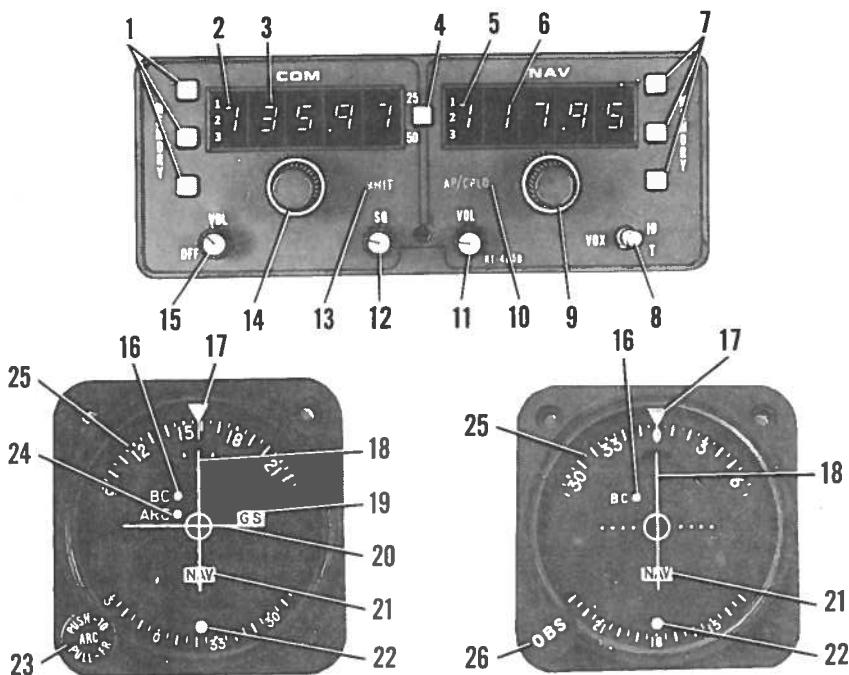
## **SECTION 2**

### **LIMITATIONS**

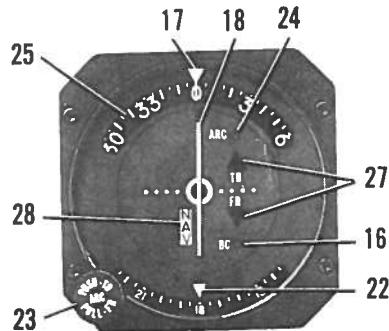
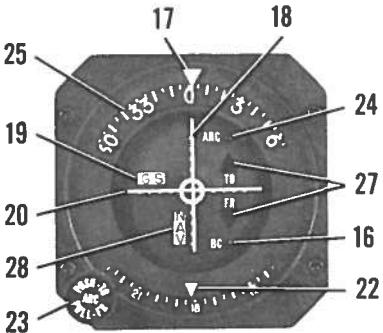
There is no change to the airplane limitations when this avionic equipment is installed.

PILOT'S OPERATING HANDBOOK  
SUPPLEMENT

CESSNA 400 NAV/COM  
(TYPE RT-485B)



TYPICAL 300 SERIES INDICATORS



TYPICAL 400 SERIES INDICATORS

Figure 1. Cessna 400 Nav/Com (Type RT-485B), Operating Controls and Indicators (Sheet 1 of 4)

1. COM MEMORY 1, 2 & 3 PUSHBUTTONS - When a COM MEMORY pushbutton is pressed, the preset frequency will appear in the COM frequency window for use as the operating frequency. Three preset frequencies may be stored in MEMORY and selected as desired, by merely pressing the appropriate COM MEMORY pushbutton to recall the desired operating frequency. If electrical power to the set's "keep-alive" circuit has not been interrupted, upon turn-on, the set will automatically recall the last COM MEMORY frequency selected by a MEMORY pushbutton. If electrical power is removed from the set's "keep-alive" circuit (such as radio removal or battery replacement) upon turn-on, all COM MEMORY circuits will display the lowest operating frequency (118.000 MHz) and will have to be reset. COM 1 MEMORY will automatically be selected. Pushbutton light dimming is controlled by the RADIO light dimming rheostat knob.
2. COM MEMORY BARS 1, 2, 3 - When a COM MEMORY pushbutton is pressed, the corresponding memory bar is illuminated to indicate which COM MEMORY is in use.
3. COMMUNICATION OPERATING FREQUENCY READOUT - Steady display indicates COM frequency in use. Blinking display indicates a frequency selected prior to memory storing and not the frequency in use. Third decimal place (either 0 or 5) is not shown on display.
4. 25/50 PUSHBUTTON - Selects last illuminated decimal place on COM frequency in use. If last decimal place is 2 or 7, pressing 25/50 pushbutton changes number to 5 or 0, respectively. If last decimal place is 5 or 0, pressing 25/50 pushbutton changes number to 7 or 2, respectively. When the last illuminated digit on the set is 2 or 7, the third digit on the set (not shown) will always be 5. When the last illuminated digit on the set is 0 or 5, the third digit on the set (not shown) will always be 0.
5. NAV MEMORY BARS 1, 2, 3 - When a NAV MEMORY pushbutton is pressed, the corresponding memory bar is illuminated to indicate which NAV MEMORY is in use.
6. NAVIGATION OPERATING FREQUENCY READOUT - Steady display indicates NAV frequency in use. Blinking display indicates a frequency selected prior to memory storing and not the frequency in use.
7. NAV MEMORY 1, 2 & 3 PUSHBUTTONS - When a NAV MEMORY pushbutton is pressed, the preset frequency will appear in the NAV frequency window for use as the operating frequency. Three preset frequencies may be stored in MEMORY and selected as desired, by merely pressing the appropriate NAV MEMORY pushbutton to recall the desired operating frequency. If electrical power to the set's "keep-alive" circuit has not been interrupted, upon turn-on, the set will automatically recall the last NAV MEMORY frequency selected by a MEMORY pushbutton. If electrical power is removed from the set's "keep-alive" circuit (such as radio removal or battery replacement) upon turn-on, all NAV MEMORY circuits will display the lowest operating frequency (108.00 MHz) and will have to be reset. NAV 1 MEMORY will automatically be selected. Pushbutton light dimming is controlled by the RADIO light dimming rheostat knob.

Figure 1. Cessna 400 Nav/Com (Type RT-485B), Operating Controls and Indicators (Sheet 2 of 4)

PILOT'S OPERATING HANDBOOK  
SUPPLEMENTCESSNA 400 NAV/COM  
(TYPE RT-485B)

8. ID-VOX-T SWITCH - In the ID position, both voice transmission and station identifier signal are heard over the selected navigation frequency; in the VOX (Voice) position, the identifier signal is suppressed and only the voice transmission is heard; in the T (TEST, Momentary ON) position, a test signal is sent to the CDI causing a 0° FROM bearing indication, the XMIT and AP/CPLD annunciators are illuminated, and the COM and NAV frequency displays show 188.88 with all memory bars illuminated.
9. NAVIGATION RECEIVER FREQUENCY SELECTORS - Outer knob changes NAV frequency in 1-MHz steps between 108 and 117 MHz; inner knob changes NAV frequency in .05-MHz steps between .00 and .95 MHz; simultaneously selects paired glide slope frequency and DME channel.
10. AUTOPILOT COUPLED ANNUNCIATOR (AP/CPLD) - Illuminates amber when a 400B or 400B IFCS autopilot is coupled to NAV VOR/LOC converter output (non-operational with 200A and 300A autopilots).
11. NAV VOLUME CONTROL (VOL) - Adjusts volume of navigation receiver audio.
12. SQUELCH CONTROL - Used to adjust signal threshold necessary to activate COM receiver audio. Clockwise rotation increases background noise (decreases squelch action); counterclockwise rotation decreases background noise.
13. TRANSMIT ANNUNCIATOR (XMIT) - Illuminates green when transmitter output is normal while mike is keyed.
14. COMMUNICATION RECEIVER FREQUENCY SELECTORS - Outer knob changes COM frequency in 1-MHz steps between 118 and 135 MHz; inner knob changes COM frequency in .05 MHz steps between .025 and .975 MHz or between .000 and .950 MHz depending on selection of 25/50 button.
15. COM OFF-VOLUME CONTROL (OFF-VOL) - Combination ON/OFF switch and volume control; turns on Nav/Com set and controls volume of COM receiver audio.
16. BACK-COURSE LAMP (BC) - Amber light illuminates when an autopilot with reverse sense feature is installed and the reverse sense switch or autopilot's back-course function is engaged and receiver is tuned to a localizer frequency; indicates course deviation pointer is reversed. BC light dimming is only available when installed with an audio control panel incorporating the annunciator lights DAY/NITE selector switch.
17. COURSE INDEX - Indicates selected VOR COURSE.
18. COURSE DEVIATION POINTER - Indicates course deviation from selected omni course or localizer centerline.
19. GLIDE SLOPE "GS" FLAG - When visible, red GS flag indicates unreliable glide slope signal or improperly operating equipment. Flag disappears when a reliable glide slope signal is being received.
20. GLIDE SLOPE DEVIATION POINTER - Indicates deviation from ILS glide slope.

Figure 1. Cessna 400 Nav/Com (Type RT-485B), Operating Controls and Indicators (Sheet 3 of 4)

21. NAV/TO-FROM INDICATOR - Operates only with a VOR or localizer signal. Red NAV position (Flag) indicates unusable signal. With usable VOR signal, indicates whether selected VOR course is TO or FROM station. With usable localizer signal, TO flag is in view.
22. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR course.
23. AUTOMATIC RADIAL CENTERING (ARC) PUSH-TO/PULL-FR SELECTOR - In center detent, functions as conventional OBS. Pushed to inner (Momentary On) position, rotates OBS course card to center course deviation pointer with a TO flag, then returns to conventional OBS operation. Pulled to outer detent, continuously drives OBS course card to indicate bearing from VOR station, keeping course deviation pointer centered, with a FROM flag. ARC function will not operate on localizer frequencies.

#### NOTE

Engaging either Automatic Radial Centering (ARC) functions will alter the airplane's course anytime the autopilot is engaged and coupled to the associated Nav when tuned to a VOR frequency.

24. AUTOMATIC RADIAL CENTERING (ARC) LAMP - Amber light illuminates when Automatic Radial Centering is in use. ARC light dimming is only available when installed with an audio control panel incorporating the annunciator lights, DAY/NITE selector switch.
25. OBS COURSE CARD - Indicates selected VOR course under course index.
26. OMNI BEARING SELECTOR (OBS) - Rotates course card to select desired VOR radial.
27. TO/FROM INDICATOR (TO/FR) - Operates only with a usable VOR or localizer signal. When white flag is in view, indicates whether selected course is TO or FROM station. With usable localizer signal, TO flag is in view.
28. NAV INDICATOR FLAG - When in view, red NAV position (Flag) indicates the selected VOR or localizer signal is unusable.

Figure 1. Cessna 400 Nav/Com (Type RT-485B), Operating Controls and Indicators (Sheet 4 of 4)

## SECTION 3

### EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed. However, if the frequency readouts fail, the frequency controls should not be moved due to the difficulty of obtaining a known frequency under this condition. The radio will remain operational on the last frequency selected, and the preset frequencies in MEMORY may be selected by pressing the appropriate MEMORY pushbutton.

## SECTION 4

### NORMAL PROCEDURES

#### SELECTING A NEW NAV/COM ACTIVE FREQUENCY:

1. COM OFF/VOL CONTROL -- TURN ON; adjust to desired audio level.
2. FREQUENCY SELECTORS -- MANUALLY ROTATE corresponding NAV or COM frequency selectors (press 25/50 pushbutton as required to select the desired third fractional COM digit) until the desired frequency is shown in the frequency readout window. The display blinks for approximately 8 seconds, indicating that the selected frequency is ready for storage in memory.
3. MEMORY 1, 2, 3 Pushbuttons -- PRESS the active frequency memory button as indicated by the illuminated memory bar. The display immediately stops blinking, indicating that the new frequency is stored in the active memory, and displays the new active frequency. The original active frequency is replaced.

#### NOTE

If a memory button is not pressed, the display stops blinking after approximately 8 seconds and returns to the original active frequency.

PRESELECTING AND STORING NAV/COM FREQUENCIES IN  
MEMORY:

1. COM OFF/VOL CONTROL -- TURN ON; adjust to desired audio level.
2. FREQUENCY SELECTORS -- MANUALLY ROTATE corresponding NAV or COM frequency selectors (press 25/50 pushbutton as required to select the desired third fractional COM digit) until the desired frequency is shown in the frequency readout window. The display blinks for approximately 8 seconds, indicating that the selected frequency is ready for storage in memory.
3. MEMORY 1, 2, 3 Pushbuttons -- PRESS the memory pushbutton of one of the NAV or COM memories not in use. The display immediately stops blinking, and displays the new frequency for 1 second to indicate that it is now stored in the selected memory. The display then reverts to indicating the active frequency.
4. MEMORY 1, 2, 3 Pushbuttons -- REPEAT STEPS 2 and 3 to store another frequency in the second NAV or COM memory not in use.

## NOTE

This presetting sequence does not affect communication and/or navigation operation on the original active frequency.

## RECALLING A STORED FREQUENCY:

1. MEMORY 1, 2, 3 Pushbuttons -- SELECT and PRESS the desired NAV or COM memory button, and observe the following:
  - a. Frequency in selected memory becomes the active frequency.
  - b. Frequency readout window indicates new active frequency.
  - c. Corresponding memory bar indicates selected memory.

## COMMUNICATION RECEIVER-TRANSMITTER OPERATION:

1. COM OFF/VOL Control -- TURN ON.
2. XMTR SEL Switch (on audio control panel) -- SET to desired 400 Nav/Com.
3. SPEAKER/PHONE Selector Switches (on audio control panel) -- SET to desired mode.
4. COM Frequency Selection -- SELECT desired operating frequency by either pressing a COM MEMORY 1, 2 or 3 pushbutton to recall a preset frequency, or by manually selecting the desired operating frequency using the COM frequency selectors and 25/50 pushbutton.
5. VOL Control -- ADJUST to desired audio level.

6. SQ Control -- ROTATE counterclockwise to just eliminate background noise.
7. Mike Button:
  - a. To Transmit -- DEPRESS and SPEAK into microphone.

NOTE

Sidetone may be selected by placing the AUTO selector switch (on audio control panel) in either the SPEAKER or PHONE position, or may be eliminated by placing the AUTO selector switch in the OFF position. Adjustment of sidetone on audio control panels supplied with three transmitters cannot be accomplished externally. However, audio control panels supplied with one or two transmitters have sidetone adjustment pots that are accessible through the front of the audio control panel with a small, nonconductive screwdriver.

- b. XMIT Annunciator Light -- CHECK ON (green light illuminated).
- c. To Receive -- RELEASE mike button.

NAVIGATION OPERATION:

1. COM OFF/VOL Control -- TURN ON; adjust to desired audio level.
2. SPEAKER/PHONE Selector Switches (on audio control panel) -- SET to desired mode.
3. NAV Frequency Selection -- SELECT desired operating frequency by either pressing a NAV MEMORY 1, 2 or 3 pushbutton to recall a preset frequency, or by using NAV frequency selectors.
4. NAV VOL Control -- ADJUST to desired audio level.
5. ID-VOX-T Switch:
  - a. To Identify Station -- SET to ID to hear navigation station identifier signal.
  - b. To Filter Out Station Identifier Signal -- SET to VOX to include filter in audio circuit.

6. ARC PUSH-TO/PULL-FROM Knob (If Applicable):
  - a. To Use As Conventional OBS -- PLACE in center detent and select desired course.
  - b. To Obtain Bearing TO VOR Station -- PUSH (ARC/PUSH-TO) knob to inner (Momentary On) position.

NOTE

ARC lamp will illuminate amber while the OBS course card is moving to center the course deviation pointer. After alignment has been achieved to reflect bearing TO VOR, automatic radial centering will automatically shut down, causing the ARC lamp to go out and the ARC knob to return to the center detent position and function as a normal OBS.

- c. To obtain Continuous Bearing FROM VOR Station -- PULL (ARC/PULL-FR) knob to outer detent.

NOTE

ARC lamp will illuminate amber, OBS course card will turn to center the course deviation pointer with a FROM flag to indicate bearing from VOR station. This system will continually drive to present the VOR radial the aircraft is on until manually returned to the center detent by the pilot.

7. AP/CPLD Annunciator Light -- CHECK ON (light is only operational if a 400B Autopilot or 400B IFCS is engaged), amber light illuminated.

VOR SELF-TEST OPERATION:

1. COM OFF/VOL Control -- TURN ON.
2. NAV Frequency Selector Switches -- SELECT usable VOR station signal.
3. OBS Knob -- SET for 0° course at course index; course deviation pointer centers or deflects left or right, depending on bearing of signal; NAV/TO-FROM indicator shows TO or FROM.
4. ID/VOX/T Switch -- PRESS to T and HOLD at T; course deviation pointer centers, NAV/TO-FROM indicator shows FROM, AP/CPLD and XMIT annunciators are illuminated and the COM and NAV displays show 188.88 with all memory bars illuminated.
5. OBS Knob -- TURN to displace course approximately 10° to either side of 0° (while holding ID/VOX/T to T). Course deviation pointer deflects full scale in direction corresponding to course displacement.

6. OBS Knob -- SET for 180° course at course index, course deviation pointer centers or deflects left or right, depending on bearing of signal. NAV/TO-FROM indicator shows FROM or TO.
7. ID/VOX/T Switch -- PRESS to T and HOLD at T; course deviation pointer centers, NAV/TO-FROM indicator shows TO, AP/CPLD and XMIT annunciators are illuminated and the COM and NAV displays show 188.88 with all memory bars illuminated.
8. OBS Knob -- TURN to displace course approximately 10° to either side of 180° (while holding ID/VOX/T to T). Course deviation pointer deflects full scale in direction corresponding to course displacement.

#### NOTE

When the 400 NAV/COM is coupled to the ANS-351C RNAV system the TEST operation is non-functional. Refer to the "Ground Check Procedures" in the Area Navigation System (Type ANS-351C) Supplement in this section to verify VOR operation of the CDI.

9. ID/VOX/T Switch -- RELEASE for normal operation.

#### NOTE

This test does not fulfill the requirements of FAR 91.25.

## SECTION 5 PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

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# SUPPLEMENT

## CESSNA 400 NAV/COM (Type RT-485A)

WITH

## CESSNA 400 AREA NAVIGATION SYSTEM (Type RN-478A)

### SECTION 1 GENERAL

The Cessna 400 Nav/Com (Type RT-485A) Set with Cessna 400 Area Navigation (RNAV-Type RN-478A) consists of a RT-485A Nav/Com, a R-476A DME system, a RN-478A Area Navigation Computer and a Course Deviation Indicator, with or without, the optional Automatic Radial Centering (ARC) feature. The RN-478A includes circuits which combine the VOR navigation information with distance information from the R-476A DME system to provide data for area navigation. Operating information for the communication set and for VOR/localizer navigation is presented in this supplement. Operating information for area navigation and for DME is presented in separate supplements. Microprocessor frequency management provides storage for 3 preset NAV and 3 preset COM frequencies in MEMORY. A "keep-alive" voltage prevents loss of the preset frequencies when the NAV/COM Switch, Avionics Power Switch, or Master Switch is turned OFF.

The RT-485A Receiver-Transmitter includes a 720-channel VHF communication receiver-transmitter which receives and transmits signals between 118.000 MHz and 135.975 MHz in 25-kHz steps. It also includes a 200-channel VHF navigation receiver which receives VOR and localizer signals between 108.00 MHz and 117.95 MHz in 50-kHz steps. The communication receiver-transmitter and the navigation receiver can be operated simultaneously.

The VOR or localizer signal from the No. 2 Navigation Receiver is

applied to the converter circuits in the RN-478A Area Navigation Computer. The converter processes the received navigation signal to provide omni bearing or localizer information for display by the course indicator.

**CAUTION**

If the RNAV set is removed from the airplane or becomes inoperative, the associated VHF navigation indicator will be inoperative.

The course indicator includes a Course Deviation Indicator (CDI), an Omni Bearing Selector (OBS) or Automatic Radial Centering (ARC) knob, and OFF (or NAV)/To-From Indicator Flags. It also includes an RNAV lamp (RN) which lights when area navigation operation is selected, and a back-course lamp (BC) which lights when back-course operation is selected. The IN-442AR is offered as the standard Course Deviation Indicator and an optional IN-1048AC or IN-1049AC Course Deviation Indicator is also offered when Automatic Radial Centering (ARC) is desired. When the optional IN-1048AC Course Deviation Indicator is installed, an Automatic Radial Centering lamp (ARC) is incorporated in the CDI to alert the pilot that the Automatic Radial Centering feature has been selected.

**NOTE**

The IN-442AR Course Deviation Indicator does not incorporate synchro circuits for Course Datum. The IN-1048AC and IN-1049AC optional Course Deviation Indicators incorporate Course Datum synchro circuits as standard equipment but Course Datum is only operational when coupled to a slaved directional gyro system which is coupled to a 400B Autopilot or Integrated Flight Control System.

All operating controls and indicators for the Cessna 400 Nav/Com are included on the front panel of the RT-485A Receiver-Transmitter and the associated Course Deviation Indicator. These controls and indicators are shown and described in Figure 1. Operating controls for the RN-478A Area Navigation Computer, which are used for area navigation, and operating controls for the associated Type R-476A DME are shown in the appropriate supplements in this manual. Operating controls for the audio control panels used in conjunction with this radio are shown and described in another supplement in this section.

**SECTION 2  
LIMITATIONS**

There is no change to the airplane limitations when this avionic equipment is installed.

PILOT'S OPERATING HANDBOOK  
SUPPLEMENT

CESSNA 400 NAV/COM  
(RT-485A) WITH CESSNA  
400 RNAV (RN-478A)

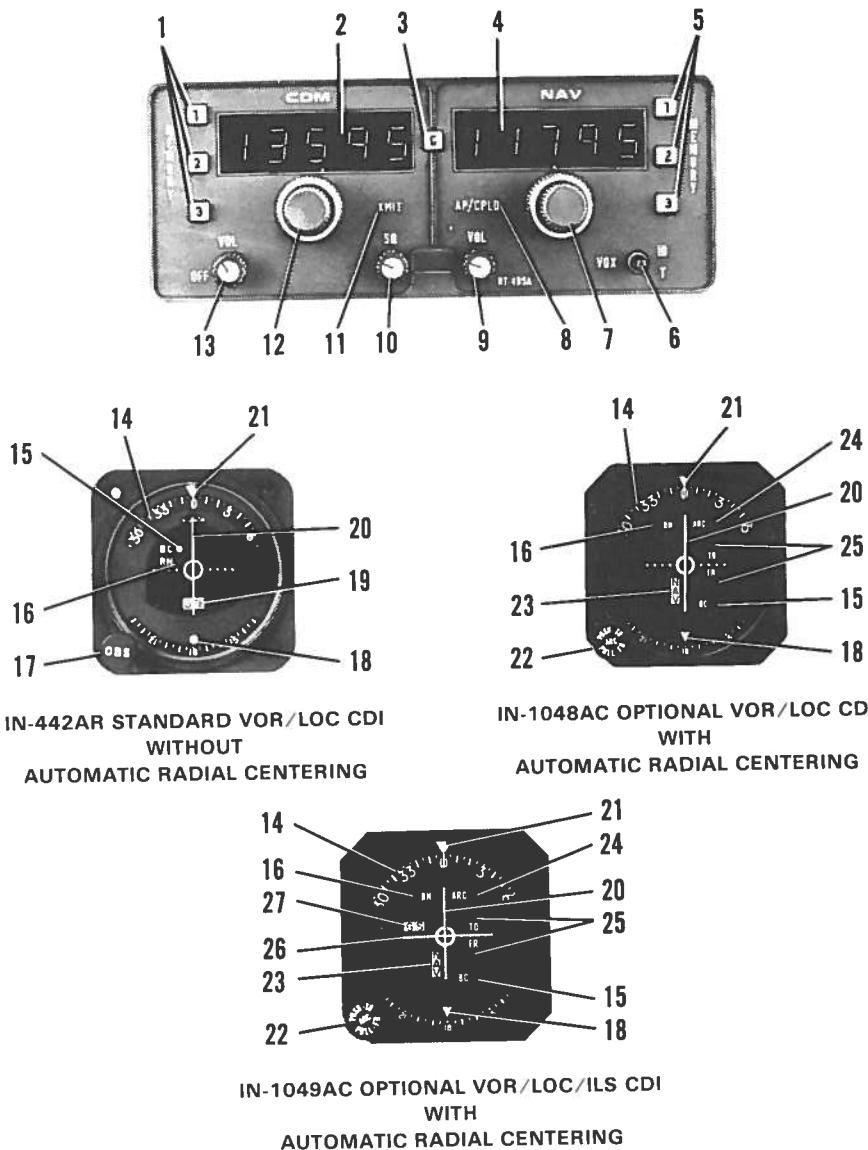


Figure 1. Cessna 400 Nav/Com Set, Operating Controls and Indicators  
(Sheet 1 of 4)

1. **COMM MEMORY 1, 2 & 3 PUSHBUTTONS** - When a COM MEMORY pushbutton is pressed, the preset selected frequency will appear in the COM frequency window for use as the selected operating frequency. Each pushbutton will illuminate white when pressed and the light will go out on the previously selected pushbutton. Three preset frequencies may be stored in MEMORY and selected as desired, by merely pressing the appropriate COM MEMORY pushbutton to recall the desired operating frequency. If electrical power to the set's "keep-alive" circuit has not been interrupted, upon turn-on, the set will automatically recall the last COM MEMORY frequency selected by the MEMORY pushbutton. If electrical power is removed from the set's "keep-alive" circuit (such as radio removal or battery replacement) for more than 15 seconds, upon turn-on, all COM MEMORY circuits will display the lowest operating frequency (118.000 MHz) and will have to be reset. COM 1 MEMORY will automatically be selected.
2. **COMMUNICATION OPERATING FREQUENCY READOUT** - Indicates COM frequency in use. Third decimal place not shown.
3. **CYCLE BUTTON (C)** - Selects last illuminated decimal place on COM frequency in use. If last decimal place is 2 or 7, pressing C pushbutton changes number to 5 or 0, respectively. If last decimal place is 5 or 0, pressing C pushbutton changes number to 7 or 2, respectively. When the last illuminated digit on the set is 2 or 7, the third digit on the set (not shown) will always be 5. When the last illuminated digit on the set is 0 or 5, the third digit on the set (not shown) will always be 0. Also provides test function by holding C pushbutton pressed for more than 1.7 seconds. This lights each COM and NAV MEMORY pushbutton in turn, and displays the corresponding preset frequency in MEMORY.
4. **NAVIGATION OPERATING FREQUENCY READOUT** - Indicates NAV frequency in use.
5. **NAV MEMORY 1, 2 & 3 PUSHBUTTONS** - When a NAV MEMORY pushbutton is pressed, the preset selected frequency will appear in the NAV frequency window for use as the selected operating frequency. Each pushbutton will illuminate white when pressed and the light will go out on the previously selected pushbutton. Three preset frequencies may be stored in MEMORY and selected as desired, by merely pressing the appropriate NAV MEMORY pushbutton to recall the desired operating frequency. If electrical power to the set's "keep-alive" circuit has not been interrupted, upon turn-on, the set will automatically recall the last NAV MEMORY frequency selected by the MEMORY pushbutton. If electrical power is removed from the set's "keep-alive" circuit (such as radio removal or battery replacement) for more than 15 seconds, upon turn-on, all NAV MEMORY circuits will display the lowest operating frequency (108.00 MHz) and will have to be reset. NAV 1 MEMORY will automatically be selected.
6. **ID-VOX-T SWITCH** - In ID position, station identifier signal is audible; in VOX (Voice) position, identifier signal is suppressed; in T (Momentary On) position, the self-test function is selected, and the AP/CPLD annunciator illuminates amber and the XMIT annunciator illuminates green.

Figure 1. Cessna 400 Nav/Com Set, Operating Controls and Indicators  
(Sheet 2 of 4)

PILOT'S OPERATING HANDBOOK  
SUPPLEMENT

CESSNA 400 NAV/COM  
(RT-485A) WITH CESSNA  
400 RNAV (RN-478A)

7. NAVIGATION RECEIVER FREQUENCY SELECTORS - Outer knob changes NAV frequency in 1-MHz steps between 108 and 117 MHz; inner knob changes NAV frequency in .05-MHz steps between .00 and .95 MHz; simultaneously selects paired glide slope frequency and DME channel.
8. AUTOPILOT COUPLED ANNUNCIATOR (AP/CPLD) - Illuminates amber when a 400B or 400B IFCS autopilot is coupled to NAV VOR/LOC converter output (non-operational with 200A and 300A autopilots).
9. NAV VOLUME CONTROL (VOL) - Adjusts volume of navigation receiver audio.
10. SQUELCH CONTROL - Used to adjust signal threshold necessary to activate COM receiver audio. Clockwise rotation increases background noise (decreases squelch action); counterclockwise rotation decreases background noise.
11. TRANSMIT ANNUNCIATOR (XMIT) - Illuminates green when transmitter output is normal while mike is keyed.

NOTE

Due to limited antenna isolation and production tolerances, the Transmit Annunciator on both Nav/Coms on dual installations may be illuminated when one transmitter is keyed.

12. COMMUNICATION RECEIVER FREQUENCY SELECTORS - Outer knob changes COM frequency in 1-MHz steps between 118 and 135 MHz; inner knob changes COM frequency in .05 MHz steps between .025 and .975 MHz or between .000 and .950 MHz depending on setting of C button.
13. COM OFF-VOLUME CONTROL (OFF-VOL) - Combination ON/OFF switch and volume control; turns on Nav/Com set and controls volume of COM receiver audio.
14. OBS COURSE CARD - Indicates selected VOR course under course index.
15. BACK-COURSE LAMP (BC) - Amber light illuminates when an autopilot with reverse sense feature is installed and the reverse sense switch or autopilot's back-course function is engaged and receiver is tuned to a localizer frequency; indicates course deviation pointer is reversed. BC light dimming is only available when installed with an audio control panel incorporating the annunciator lights DAY/NITE selector switch.
16. AREA NAV LAMP (RN) - When green light is illuminated, indicates that RNAV operation is selected. RN light dimming is only available when installed with an audio control panel incorporating the annunciator lights DAY/NITE selector switch.
17. OMNI BEARING SELECTOR (OBS) - Rotates OBS course card (14) to select desired bearing to or from a VOR station or to a selected RNAV waypoint.
18. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR or RNAV course.

Figure 1. Cessna 400 Nav/Com Set, Operating Controls and Indicators  
(Sheet 3 of 4)

19. OFF/TO-FROM INDICATOR - Operates only with VOR, localizer or RNAV signal. OFF position (flag) indicates unusable signal. With usable VOR signal, when OFF position disappears, indicates whether selected course is TO or FROM station or waypoint. With usable localizer signal, TO flag is in view.
20. COURSE DEVIATION POINTER - Indicates course deviation from selected VOR or RNAV course or localizer centerline.
21. COURSE INDEX - Indicates selected VOR or RNAV course (bearing).
22. AUTOMATIC RADIAL CENTERING (ARC - PUSH-TO/PULL-FR) SELECTOR - In center detent, functions as conventional OBS. Pushed to inner (Momentary On) position, turns OBS course card (14) to center course deviation pointer (20) with a TO flag (25), then returns to conventional OBS selection. Pulled to outer detent, continuously drives OBS course card (14) to indicate bearing from VOR station, keeping course deviation pointer (20) centered, with a FROM flag (25). ARC function will not operate on localizer frequencies.

## NOTE

Engaging either Automatic Radial Centering (ARC) functions will alter the airplane's course anytime the autopilot is engaged and coupled to the associated Nav when tuned to a VOR frequency.

23. NAV INDICATOR FLAG - When in view, red NAV position (Flag) indicates the selected VOR or localizer signal is unusable.
24. AUTOMATIC RADIAL CENTERING (ARC) LAMP - Amber light illuminates when Automatic Radial Centering is in use. ARC light dimming is only available when installed with an audio control panel incorporating the annunciator lights, DAY/NITE selector switch.
25. INDICATOR (TO/FR) - Operates only with a usable VOR, localizer or RNAV signal. When white flag is in view, indicates whether selected course is TO or FROM station. With usable localizer signal, TO flag is in view.
26. GLIDE SLOPE DEVIATION POINTER - Indicates deviation from ILS glide slope.
27. GLIDE SLOPE "GS" FLAG - When visible, red GS flag indicates unreliable glide slope signal or improperly operating equipment. Flag disappears when a reliable glide slope signal is being received.

Figure 1. Cessna 400 Nav/Com Set, Operating Controls and Indicators  
(Sheet 4 of 4)

## SECTION 3

### EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed. However, if the frequency readouts fail, the frequency controls should not be moved due to the difficulty of obtaining a known frequency under this condition. The radio will remain operational on the last frequency selected, and the preset frequencies in MEMORY may be selected by pressing the appropriate MEMORY pushbutton.

## SECTION 4

### NORMAL PROCEDURES

#### PRESETTING NAV/COM FREQUENCIES IN MEMORY:

1. COM OFF/VOL CONTROL -- TURN ON; adjust to desired audio level.
2. MEMORY 1 Pushbutton -- PRESS desired NAV or COM pushbutton 1 momentarily to alert the memory bank of a forthcoming frequency to be stored.
3. FREQUENCY SELECTORS -- MANUALLY ROTATE corresponding NAV or COM frequency selectors (press C pushbutton as required to select the desired third fractional COM digit) until the desired frequency is shown in the operating frequency readout window. The frequency displayed will be automatically transferred into MEMORY 1.

#### NOTE

Do not press the C pushbutton more than about 2 seconds while selecting fractional frequencies or you will activate the MEMORY test function.

4. MEMORY 2 and 3 Pushbutton -- REPEAT STEPS 2 and 3 using next desired NAV or COM MEMORY to be stored. Up to 3 NAV and 3 COM frequencies may be stored for automatic recall frequency selection.

#### NOTE

The operating frequency set in the selected MEMORY position will automatically be changed in the memory bank anytime the operating frequency is manually changed.

## COMMUNICATIONS OPERATION:

1. COM OFF/VOL Control -- TURN ON.
2. XMTR SEL Switch (on audio control panel) -- SET to No. 2 400 Nav/Com.
3. SPEAKER/PHONE Selector Switches (on audio control panel) -- SET to desired mode.
4. COM Frequency Selection -- SELECT desired operating frequency by either pressing a COM MEMORY 1, 2 or 3 pushbutton to recall a preset frequency, or by manually selecting the desired operating frequency using the COM frequency selectors and C pushbutton.
5. VOL Control -- ADJUST to desired audio level.
6. SQ Control -- ROTATE counterclockwise to just eliminate background noise.
7. Mike Button:
  - a. To Transmit -- DEPRESS and SPEAK into microphone.

## NOTE

Sidetone may be selected by placing the AUTO selector switch (on audio control panel) in either the SPEAKER or PHONE position, or may be eliminated by placing the AUTO selector switch in the OFF position. Adjustment of sidetone on audio control panels supplied with three transmitters cannot be accomplished externally. However, audio control panels supplied with one or two transmitters have sidetone adjustment pots that are accessible through the front of the audio control panel with a small, nonconductive screwdriver.

- b. XMIT Annunciator Light -- CHECK ON (green light illuminated).
- c. To Receive -- RELEASE mike button.

**PILOT'S OPERATING HANDBOOK  
SUPPLEMENT****CESSNA 400 NAV/COM  
(RT-485A) WITH CESSNA  
400 RNAV (RN-478A)****NAVIGATION OPERATION:**

1. COM OFF/VOL Control -- TURN ON; adjust to desired audio level.
2. SPEAKER/PHONE Selector Switches (on audio control panel) -- SET to desired mode.
3. NAV Frequency Selection -- SELECT desired operating frequency by either pressing a NAV MEMORY 1, 2 or 3 pushbutton to recall a preset frequency, or by using NAV frequency selectors.
4. NAV VOL Control -- ADJUST to desired audio level.
5. ID-VOX-T Switch:
  - a. To Identify Station -- SET to ID to hear navigation station identifier signal.
  - b. To Filter Out Station Identifier Signal -- SET to VOX to include filter in audio circuit.
6. ARC PUSH-TO/PULL-FROM Knob (If Applicable):
  - a. To Use As Conventional OBS -- PLACE in center detent and select desired course.
  - b. To Obtain Bearing TO VOR Station -- PUSH knob to inner (Momentary On) position.

**NOTE**

ARC lamp will illuminate amber while the OBS course card is moving to center the course deviation pointer. After alignment has been achieved to reflect bearing TO VOR, automatic radial centering will automatically shut down, causing the ARC lamp to go out and the ARC knob to return to center detent position and function as a normal OBS.

- c. To obtain Continuous Bearing FROM VOR Station -- PULL (ARC/PULL-FR) knob to outer detent.

**NOTE**

ARC lamp will illuminate amber, OBS course card will turn to center the course deviation pointer with a FROM flag to indicate bearing from VOR station. This system will continually drive to present the VOR radial the aircraft is on until manually returned to the center detent by the pilot.

7. AP/CPLD Annunciator Light -- CHECK ON (light is only operational if a 400B Autopilot or 400B IFCS is engaged), amber light illuminated.

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CESSNA 400 NAV/COM  
(RT-485A) WITH CESSNA  
400 RNAV (RN-478A)

## **PILOT'S OPERATING HANDBOOK SUPPLEMENT**

### **VOR SELF-TEST OPERATION:**

1. COM OFF/VOL Control -- TURN ON.
2. NAV Frequency Selector Switches -- SELECT usable VOR station signal.
3. OBS Knob -- SET for 0° course at course index; course deviation pointer centers or deflects left or right, depending on bearing of signal; NAV/TO-FROM indicator shows TO or FROM.
4. ID/VOX/T Switch -- PRESS to T and HOLD at T; course deviation pointer centers, NAV/TO-FROM indicator shows FROM and AP/CPLD and XMIT annunciators light.
5. OBS Knob -- TURN to displace course approximately 10° to either side of 0° (while holding ID/VOX/T to T). Course deviation pointer deflects full scale in direction corresponding to course displacement. NAV/TO-FROM indicator shows FROM.
6. ID/VOX/T Switch -- RELEASE for normal operation.

#### **NOTE**

This test does not fulfill the requirements of FAR 91.25.

### **MEMORY TEST OPERATION:**

1. C Pushbutton -- PUSH for about 2 seconds. Each COM and NAV MEMORY pushbutton (1, 2 & 3) will illuminate white, in turn, with the corresponding preset frequency displayed.

#### **NOTE**

If the "keep-alive" circuit has not been interrupted, the MEMORY test will always start with the last COM MEMORY selected and cycle through the remaining COM and NAV preset frequencies. The MEMORY test will always stop on the last selected COM and NAV preset frequencies.

## **SECTION 5 PERFORMANCE**

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

## SUPPLEMENT

### CESSNA 400 NAV/COM (Type RT-485B)

WITH

### CESSNA 400 AREA NAVIGATION SYSTEM (Type RN-478A)

#### SECTION 1

#### GENERAL

The Cessna 400 Nav/Com (Type RT-485B) Set with Cessna 400 Area Navigation (RNAV-Type RN-478A) consists of a RT-485B Nav/Com, a R-476A DME system, a RN-478A Area Navigation Computer and a Course Deviation Indicator, with or without, the optional Automatic Radial Centering (ARC) feature. The RN-478A includes circuits which combine the VOR navigation information with distance information from the R-476A DME system to provide data for area navigation. Operating information for the communication set and for VOR/localizer navigation is presented in this supplement. Operating information for area navigation and for DME is presented in separate supplements. Microprocessor frequency management provides storage for 3 preset NAV and 3 preset COM frequencies in MEMORY. A "keep-alive" voltage prevents loss of the preset frequencies when the NAV/COM Switch, Avionics Power Switch, or Master Switch is turned OFF.

The RT-485B Receiver-Transmitter includes a 720-channel VHF communication receiver-transmitter which receives and transmits on frequencies between 118.000 MHz and 135.975 MHz in 25-kHz steps. It also includes a 200-channel VHF navigation receiver which receives VOR and localizer signals between 108.00 MHz and 117.95 MHz in 50-kHz steps. The communication receiver-transmitter and the navigation receiver can be operated simultaneously.

The VOR or localizer signal from the No. 2 Navigation Receiver is

applied to the converter circuits in the RN-478A Area Navigation Computer. The converter processes the received navigation signal to provide omni bearing or localizer information for display by the course indicator.

### **CAUTION**

If the RNAV set is removed from the airplane or becomes inoperative, the associated VHF navigation indicator will be inoperative.

The course indicator includes a Course Deviation Indicator (CDI), an Omni Bearing Selector (OBS) or Automatic Radial Centering (ARC) knob, and OFF (or NAV)/To-From Indicator Flags. It also includes an RNAV lamp (RN) which lights when area navigation operation is selected, and a back-course lamp (BC) which lights when back-course operation is selected. The IN-442AR is offered as the standard Course Deviation Indicator and an optional IN-1048AC or IN-1049AC Course Deviation Indicator is also offered when Automatic Radial Centering (ARC) is desired. When the optional IN-1048AC Course Deviation Indicator is installed, an Automatic Radial Centering lamp (ARC) is incorporated in the CDI to alert the pilot that the Automatic Radial Centering feature has been selected.

### **NOTE**

The IN-442AR Course Deviation Indicator does not incorporate synchro circuits for Course Datum. The IN-1048AC and IN-1049AC optional Course Deviation Indicators incorporate Course Datum synchro circuits as standard equipment but Course Datum is only operational when coupled to a slaved directional gyro system which is coupled to a 400B Autopilot or Integrated Flight Control System.

All operating controls and indicators for the Cessna 400 Nav/Com are included on the front panel of the RT-485B Receiver-Transmitter and the associated Course Deviation Indicator. These controls and indicators are shown and described in Figure 1. Operating controls for the RN-478A Area Navigation Computer, which are used for area navigation, and operating controls for the associated Type R-476A DME are shown in the appropriate supplements in this manual. Operating controls for the audio control panels used in conjunction with this radio are shown and described in another supplement in this section.

PILOT'S OPERATING HANDBOOK  
SUPPLEMENT

CESSNA 400 NAV/COM  
(RT-485B) WITH CESSNA  
400 RNAV (RN-478A)

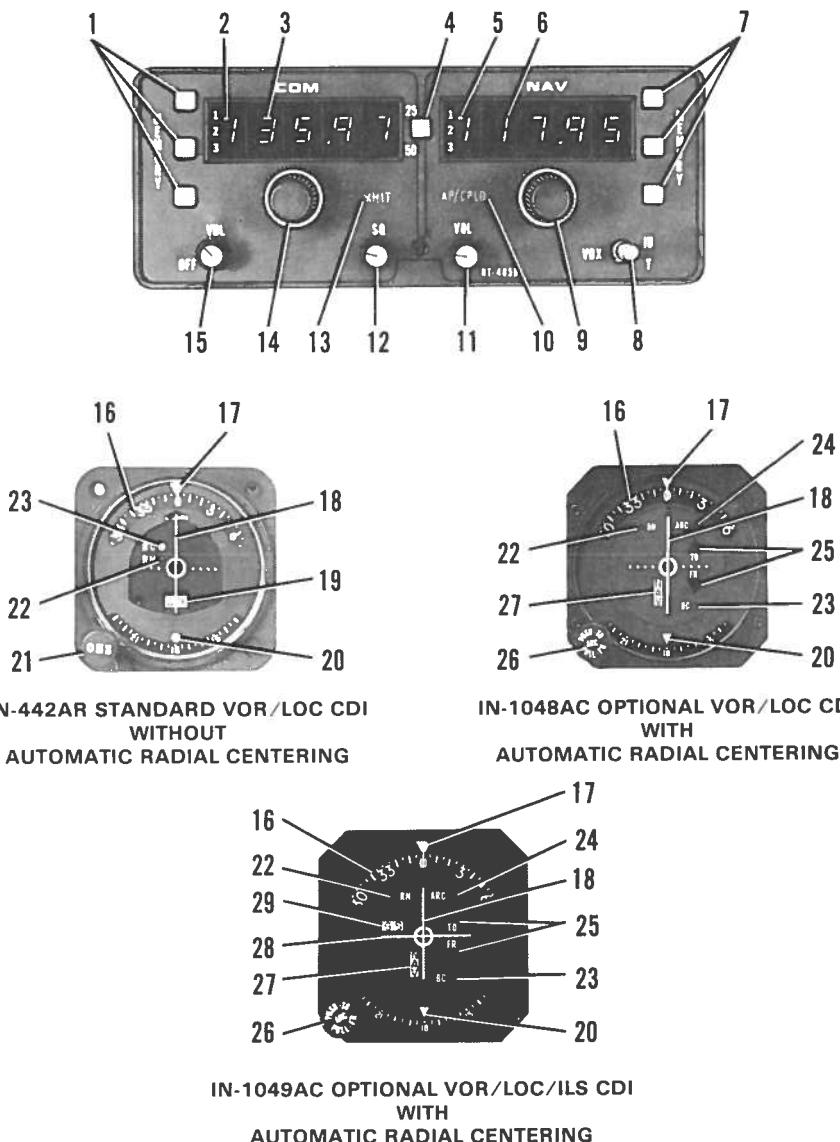


Figure 1. Cessna 400 Nav/Com Set, Operating Controls and Indicators  
(Sheet 1 of 4)

1. COM MEMORY 1, 2 & 3 PUSHBUTTONS - When a COM MEMORY pushbutton is pressed, the preset frequency will appear in the COM frequency window for use as the operating frequency. Three preset frequencies may be stored in MEMORY and selected as desired, by merely pressing the appropriate COM MEMORY pushbutton to recall the desired operating frequency. If electrical power to the set's "keep-alive" circuit has not been interrupted, upon turn-on, the set will automatically recall the last COM MEMORY frequency selected by a MEMORY pushbutton. If electrical power is removed from the set's "keep-alive" circuit (such as radio removal or battery replacement) upon turn-on, all COM MEMORY circuits will display the lowest operating frequency (118.000 MHz) and will have to be reset. COM 1 MEMORY will automatically be selected. Pushbutton light dimming is controlled by the RADIO light dimming rheostat knob.
2. COM MEMORY BARS 1, 2, 3 - When a COM MEMORY pushbutton is pressed, the corresponding memory bar is illuminated to indicate which COM MEMORY is in use.
3. COMMUNICATION OPERATING FREQUENCY READOUT - Steady display indicates COM frequency in use. Blinking display indicates a frequency selected prior to memory storing and not the frequency in use. Third decimal place (either 0 or 5) is not shown on display.
4. 25/50 PUSHBUTTON - Selects last illuminated decimal place on COM frequency in use. If last decimal place is 2 or 7, pressing 25/50 pushbutton changes number to 5 or 0, respectively. If last decimal place is 5 or 0, pressing 25/50 pushbutton changes number to 7 or 2, respectively. When the last illuminated digit on the set is 2 or 7, the third digit on the set (not shown) will always be 5. When the last illuminated digit on the set is 0 or 5, the third digit on the set (not shown) will always be 0.
5. NAV MEMORY BARS 1, 2, 3 - When a NAV MEMORY pushbutton is pressed, the corresponding memory bar is illuminated to indicate which NAV MEMORY is in use.
6. NAVIGATION OPERATING FREQUENCY READOUT - Steady display indicates NAV frequency in use. Blinking display indicates a frequency selected prior to memory storing and not the frequency in use.
7. NAV MEMORY 1, 2 & 3 PUSHBUTTONS - When a NAV MEMORY pushbutton is pressed, the preset frequency will appear in the NAV frequency window for use as the operating frequency. Three preset frequencies may be stored in MEMORY and selected as desired, by merely pressing the appropriate NAV MEMORY pushbutton to recall the desired operating frequency. If electrical power to the set's "keep-alive" circuit has not been interrupted, upon turn-on, the set will automatically recall the last NAV MEMORY frequency selected by a MEMORY pushbutton. If electrical power is removed from the set's "keep-alive" circuit (such as radio removal or battery replacement) upon turn-on, all NAV MEMORY circuits will display the lowest operating frequency (108.00 MHz) and will have to be reset. NAV 1 MEMORY will automatically be selected. Pushbutton light dimming is controlled by the RADIO light dimming rheostat knob.

Figure 1. Cessna 400 Nav/Com Set, Operating Controls and Indicators  
(Sheet 2 of 4)

PILOT'S OPERATING HANDBOOK  
SUPPLEMENT

CESSNA 400 NAV/COM  
(RT-485B) WITH CESSNA  
400 RNAV (RN-478A)

8. ID-VOX-T SWITCH - In the ID position, both voice transmission and station identifier signal are heard over the selected navigation frequency; in the VOX (Voice) position, the identifier signal is suppressed and only the voice transmission is heard; in the T (TEST, Momentary ON) position, a test signal is sent to the CDI causing a 0° FROM bearing indication, the XMIT and AP/CPLD annunciators are illuminated, and the COM and NAV frequency displays show 188.88 with all memory bars illuminated.
9. NAVIGATION RECEIVER FREQUENCY SELECTORS - Outer knob changes NAV frequency in 1-MHz steps between 108 and 117 MHz; inner knob changes NAV frequency in .05-MHz steps between .00 and .95 MHz; simultaneously selects paired glide slope frequency and DME channel.
10. AUTOPILOT COUPLED ANNUNCIATOR (AP/CPLD) - Illuminates amber when a 400B or 400B IFCS autopilot is coupled to NAV VOR/LOC converter output (non-operational with 200A and 300A autopilots).
11. NAV VOLUME CONTROL (VOL) - Adjusts volume of navigation receiver audio.
12. SQUELCH CONTROL - Used to adjust signal threshold necessary to activate COM receiver audio. Clockwise rotation increases background noise (decreases squelch action); counterclockwise rotation decreases background noise.
13. TRANSMIT ANNUNCIATOR (XMIT) - Illuminates green when transmitter output is normal while mike is keyed.
14. COMMUNICATION RECEIVER FREQUENCY SELECTORS - Outer knob changes COM frequency in 1-MHz steps between 118 and 135 MHz; inner knob changes COM frequency in .05 MHz steps between .025 and .975 MHz or between .000 and .950 MHz depending on selection of 25/50 button.
15. COM OFF-VOLUME CONTROL (OFF-VOL) - Combination ON/OFF switch and volume control; turns on Nav/Com set and controls volume of COM receiver audio.
16. OBS COURSE CARD - Indicates selected VOR course under course index.
17. COURSE INDEX - Indicates selected VOR or RNAV course (bearing).
18. COURSE DEVIATION POINTER - Indicates course deviation from selected VOR or RNAV course or localizer centerline.
19. NAV/TO-FROM INDICATOR - Operates only with a VOR, localizer or RNAV signal. OFF position (flag) indicates unusable signal. With usable VOR signal, when OFF position disappears, indicates whether selected course is TO or FROM station or waypoint. With usable localizer signal, TO flag is in view.
20. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR or RNAV course.
21. OMNI BEARING SELECTOR (OBS) - Rotates OBS course card (16) to select desired bearing to or from a VOR station or to a selected RNAV waypoint.

Figure 1. Cessna 400 Nav/Com Set, Operating Controls and Indicators  
(Sheet 3 of 4)

22. AREA NAV LAMP (RN) - When green light is illuminated, indicates that RNAV operation is selected. RN light dimming is only available when installed with an audio control panel incorporating the annunciator light DAY/NITE selector switch.
23. BACK-COURSE LAMP (BC) - Amber light illuminates when an autopilot with reverse sense feature is installed and the reverse sense switch or autopilot's back-course function is engaged and receiver is tuned to a localizer frequency; indicates course deviation pointer is reversed. BC light dimming is only available when installed with an audio control panel incorporating the annunciator lights DAY/NITE selector switch.
24. AUTOMATIC RADIAL CENTERING (ARC) LAMP - Amber light illuminates when Automatic Radial Centering is in use. ARC light dimming is only available when installed with an audio control panel incorporating the annunciator lights, DAY/NITE selector switch.
25. TO/FROM INDICATOR (TO/FR) - Operates only with a usable VOR, localizer or RNAV signal. When white flag is in view, indicates whether selected course is TO or FROM station. With usable localizer signal, TO flag is in view.
26. AUTOMATIC RADIAL CENTERING (ARC - PUSH-TO/PULL-FR) SELECTOR - In center detent, functions as conventional OBS. Pushed to inner (Momentary On) position, turns OBS course card (16) to center course deviation pointer (18) with a TO flag (25), then returns to conventional OBS operation. Pulled to outer detent, continuously drives OBS course card (16) to indicate bearing from VOR station, keeping course deviation pointer (18) centered, with a FROM flag (25). ARC function will not operate on localizer frequencies.

## NOTE

Engaging either Automatic Radial Centering (ARC) functions will alter the airplane's course anytime the autopilot is engaged and coupled to the associated Nav when tuned to a VOR frequency.

27. NAV INDICATOR FLAG - When in view, red NAV position (Flag) indicates the selected VOR or localizer signal is unusable.
28. GLIDE SLOPE DEVIATION POINTER - Indicates deviation from ILS glide slope.
29. GLIDE SLOPE "GS" FLAG - When visible, red GS flag indicates unreliable glide slope signal or improperly operating equipment. Flag disappears when a reliable glide slope signal is being received.

Figure 1. Cessna 400 Nav/Com Set, Operating Controls and Indicators  
(Sheet 4 of 4)

## SECTION 2 LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

## SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed. However, if the frequency readouts fail, the frequency controls should not be moved due to the difficulty of obtaining a known frequency under this condition. The radio will remain operational on the last frequency selected, and the preset frequencies in MEMORY may be selected by pressing the appropriate MEMORY pushbutton.

## SECTION 4 NORMAL PROCEDURES

### SELECTING A NEW NAV/COM ACTIVE FREQUENCY:

1. COM OFF/VOL CONTROL -- TURN ON; adjust to desired audio level.
2. FREQUENCY SELECTORS -- MANUALLY ROTATE corresponding NAV or COM frequency selectors (press 25/50 pushbutton as required to select the desired third fractional COM digit) until the desired frequency is shown in the frequency readout window. The display blinks for approximately 8 seconds, indicating that the selected frequency is ready for storage in memory.
3. MEMORY 1, 2, 3 Pushbuttons -- PRESS the active frequency memory button as indicated by the illuminated memory bar. The display immediately stops blinking, indicating that the new frequency is stored in the active memory, and displays the new active frequency. The original active frequency is replaced.

### NOTE

If a memory button is not pressed, the display stops blinking after approximately 8 seconds and returns to the original active frequency.

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CESSNA 400 NAV/COM  
(RT-485B) WITH CESSNA  
400 RNAV (RN-478A)

## **PILOT'S OPERATING HANDBOOK SUPPLEMENT**

### **PRESELECTING AND STORING NAV/COM FREQUENCIES IN MEMORY:**

1. COM OFF/VOL CONTROL -- TURN ON; adjust to desired audio level.
2. FREQUENCY SELECTORS -- MANUALLY ROTATE corresponding NAV or COM frequency selectors (press 25/50 pushbutton as required to select the desired third fractional COM digit) until the desired frequency is shown in the frequency readout window. The display blinks for approximately 8 seconds, indicating that the selected frequency is ready for storage in memory.
3. MEMORY 1, 2, 3 Pushbuttons -- PRESS the memory pushbutton of one of the NAV or COM memories not in use. The display immediately stops blinking, and displays the new frequency for 1 second to indicate that it is now stored in the selected memory. The display then reverts to indicating the active frequency.
4. MEMORY 1, 2, 3 Pushbuttons -- REPEAT STEPS 2 and 3 to store another frequency in the second NAV or COM memory not in use.

#### **NOTE**

This presetting sequence does not affect communication and/or navigation operation on the original active frequency.

### **RECALLING A STORED FREQUENCY:**

1. MEMORY 1, 2, 3 Pushbuttons -- SELECT and PRESS the desired NAV or COM memory button, and observe the following:
  - a. Frequency in selected memory becomes the active frequency.
  - b. Frequency readout window indicates new active frequency.
  - c. Corresponding memory bar indicates selected memory.

### **COMMUNICATION RECEIVER-TRANSMITTER OPERATION:**

1. COM OFF/VOL Control -- TURN ON.
2. XMTR SEL Switch (on audio control panel) -- SET to desired 400 Nav/Com.
3. SPEAKER/PHONE Selector Switches (on audio control panel) -- SET to desired mode.
4. COM Frequency Selection -- SELECT desired operating frequency by either pressing a COM MEMORY 1, 2 or 3 pushbutton to recall a preset frequency, or by manually selecting the desired operating frequency using the COM frequency selectors and 25/50 pushbutton.
5. VOL Control -- ADJUST to desired audio level.

PILOT'S OPERATING HANDBOOK  
SUPPLEMENT

CESSNA 400 NAV/COM  
(RT-485B) WITH CESSNA  
400 RNAV (RN-478A)

6. SQ Control -- ROTATE counterclockwise to just eliminate background noise.
7. Mike Button:
  - a. To Transmit -- DEPRESS and SPEAK into microphone.

NOTE

Sidetone may be selected by placing the AUTO selector switch (on audio control panel) in either the SPEAKER or PHONE position, or may be eliminated by placing the AUTO selector switch in the OFF position. Adjustment of sidetone on audio control panels supplied with three transmitters cannot be accomplished externally. However, audio control panels supplied with one or two transmitters have sidetone adjustment pots that are accessible through the front of the audio control panel with a small, nonconductive screwdriver.

- b. XMIT Annunciator Light -- CHECK ON (green light illuminated).
- c. To Receive -- RELEASE mike button.

NAVIGATION OPERATION:

1. COM OFF/VOL Control -- TURN ON; adjust to desired audio level.
2. SPEAKER/PHONE Selector Switches (on audio control panel) -- SET to desired mode.
3. NAV Frequency Selection -- SELECT desired operating frequency by either pressing a NAV MEMORY 1, 2 or 3 pushbutton to recall a preset frequency, or by using NAV frequency selectors.
4. NAV VOL Control -- ADJUST to desired audio level.
5. ID-VOX-T Switch:
  - a. To Identify Station -- SET to ID to hear navigation station identifier signal.
  - b. To Filter Out Station Identifier Signal -- SET to VOX to include filter in audio circuit.

6. ARC PUSH-TO/PULL-FROM Knob (If Applicable):
  - a. To Use As Conventional OBS -- PLACE in center detent and select desired course.
  - b. To Obtain Bearing TO VOR Station -- PUSH (ARC/PUSH-TO) knob to inner (Momentary On) position.

#### NOTE

ARC lamp will illuminate amber while the OBS course card is moving to center the course deviation pointer. After alignment has been achieved to reflect bearing TO VOR, automatic radial centering will automatically shut down, causing the ARC lamp to go out and the ARC knob to return to the center detent position and function as a normal OBS.

- c. To obtain Continuous Bearing FROM VOR Station -- PULL (ARC/PULL-FR) knob to outer detent.

#### NOTE

ARC lamp will illuminate amber, OBS course card will turn to center the course deviation pointer with a FROM flag to indicate bearing from VOR station. This system will continually drive to present the VOR radial the aircraft is on until manually returned to the center detent by the pilot.

#### VOR SELF-TEST OPERATION:

1. COM OFF/VOL Control -- TURN ON.
2. NAV Frequency Selector Switches -- SELECT usable VOR station signal.
3. OBS Knob -- SET for 0° course at course index; course deviation pointer centers or deflects left or right, depending on bearing of signal; NAV/TO-FROM indicator shows TO or FROM.
4. ID/VOX/T Switch -- PRESS to T and HOLD at T; course deviation pointer centers, NAV/TO-FROM indicator shows FROM, AP/CPLD and XMIT annunciators are illuminated and the COM and NAV displays show 188.88 with all memory bars illuminated.
5. OBS Knob -- TURN to displace course approximately 10° to either side of 0° (while holding ID/VOX/T to T). Course deviation pointer deflects full scale in direction corresponding to course displacement.
6. OBS Knob -- SET for 180° course at course index, course deviation pointer centers or deflects left or right, depending on bearing of signal. NAV/TO-FROM indicator shows FROM or TO.

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CESSNA 400 NAV/COM  
(RT-485B) WITH CESSNA  
400 RNAV (RN-478A)

7. ID/VOX/T Switch -- PRESS to T and HOLD at T; course deviation pointer centers, NAV/TO-FROM indicator shows TO, AP/CPLD and XMIT annunciators are illuminated and the COM and NAV displays show 188.88 with all memory bars illuminated.
8. OBS Knob -- TURN to displace course approximately 10° to either side of 180° (while holding ID/VOX/T to T). Course deviation pointer deflects full scale in direction corresponding to course displacement.
9. ID/VOX/T Switch -- RELEASE for normal operation.

NOTE

This test does not fulfill the requirements of FAR 91.25.

## SECTION 5 PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.



## SUPPLEMENT

# CESSNA 400 RADIO MAGNETIC INDICATOR (Type IN-404A)

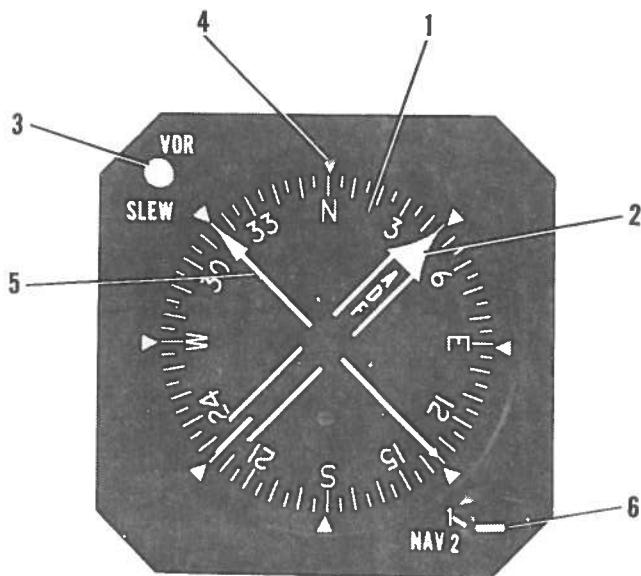
## SECTION 1 GENERAL

The Cessna 400 Radio Magnetic Indicator (RMI) is used in conjunction with other airborne navigation equipment to aid the pilot in navigating the airplane. The RMI eliminates the need for many of the numerical and graphical computations necessary for determining airplane position.

The RMI is a panel mounted navigation instrument that combines the display of VOR and ADF bearing information with the airplane heading on a single instrument. The VOR and ADF magnetic bearings to the selected stations are displayed by individual rotating pointers against the background of a rotating azimuth card. The azimuth card is driven by the slaved magnetic compass system in the airplane and continuously indicates airplane heading. Thus, the relative bearing between the aircraft heading and the station is pictorially displayed.

Each pointer in the Type IN-404A RMI is dependent only on its associated receiver for indicating bearings. A single-bar pointer indicates VOR bearings and a double-bar pointer indicates ADF bearings. Two NAV receivers supply VOR signals to the RMI for selection. A two position selector switch (NAV 1/NAV 2) on the lower right of the RMI selects the desired VOR signal for display of bearing information.

The RMI contains a VOR test feature to verify the reliability of the VOR signal and the operational status of the RMI circuitry and mechanism that drives the VOR pointer. This test feature is a pushbutton switch (VOR SLEW) on the upper left of the RMI. (A similar ADF test feature for verifying the ADF received signal and pointer mechanism is provided on the 400 ADF receiver.)



1. ROTATING AZIMUTH (COMPASS) CARD - Rotates as the airplane turns so that the airplane magnetic heading is continuously displayed at the heading index.
2. DOUBLE-BAR POINTER - Indicates the magnetic bearing to the station to which the ADF is tuned.
3. VOR SLEW PUSHBUTTON SWITCH - Momentary switch used to verify the displayed VOR bearing. When the switch is pressed, the single bar pointer slews away from the station bearing. When the switch is released, if equipment operation and signal strength are normal, the pointer will return to the station bearing.
4. HEADING INDEX - Indicates the airplane magnetic heading on the azimuth card.
5. SINGLE-BAR POINTER - Indicates the magnetic bearing to the selected VOR station.
6. NAV 1/NAV 2 FUNCTION SWITCH - Selects either NAV 1 or NAV 2 VOR signal for display by the single-bar pointer.

Figure 1. Cessna 400 RMI (Type IN-404A), Operating Controls and Indicators

## SECTION 2 LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

## SECTION 3 EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

## SECTION 4 NORMAL PROCEDURES

### NORMAL OPERATION:

#### NOTE

Operation of the RMI is dependent upon input information from the compass system (slaved directional gyro), the associated VHF navigation and ADF receivers. Refer to the appropriate supplements in this section for operation of this equipment.

1. Compass Cards (on RMI, Directional Gyro or HSI) -- HEADING READINGS indicated on RMI, Directional Gyro or HSI will be the same.
2. ADF Receiver -- SELECT STATION on receiver. The double-bar pointer will indicate the magnetic bearing to the station.

#### NOTE

If the ADF receiver is turned OFF, the double-bar pointer will be in the stowed position (fixed at the 3 o'clock position).

3. NAV 1-2 Selector Switch (on RMI) -- SET to NAV 1 or NAV 2 and select VOR station on the associated NAV receiver. The single-bar pointer will indicate the magnetic bearing to the VOR station.

**NOTE**

This reading is equivalent to the "TO" course reading obtained with the standard CDI omni bearing selector. The radial from the VOR station is indicated by reading the opposite end of the pointer.

**RMI TEST:**

1. ADF TEST Pushbutton (on 400 ADF Receiver only) -- PUSH in and hold TEST button until the double-bar pointer (on RMI) slews off away from the station bearing at least 10 to 20 degrees.
2. ADF TEST Pushbutton (on 400 ADF Receiver only) -- RELEASE and OBSERVE that double-bar pointer (on RMI) returns to the same station bearing as in step 1 to indicate a normal operation.

**NOTE**

If the ADF Receiver is turned OFF, the double-bar pointer will be in the stowed position (fixed at the 3 o'clock position).

3. VOR SLEW Test Pushbutton (on RMI) -- PUSH in and hold VOR SLEW pushbutton until the single-bar pointer slews away from the station bearing.
4. VOR SLEW Test Pushbutton (on RMI) -- RELEASE and OBSERVE that single-bar pointer (on RMI) returns to the same station bearing as in step 3 to indicate a normal operation.

**NOTE**

If the selected VOR Receiver is turned OFF, the single-bar pointer will remain fixed in its last position.

## **SECTION 5**

## **PERFORMANCE**

There is no change to the airplane performance when this avionic equipment is installed in addition to that which occurs with installation of the ADF or VOR antennas.

# SUPPLEMENT

# CESSNA 400 TRANSPONDER

(Type RT-459A)

# AND

# OPTIONAL ALTITUDE ENCODER

(BLIND)

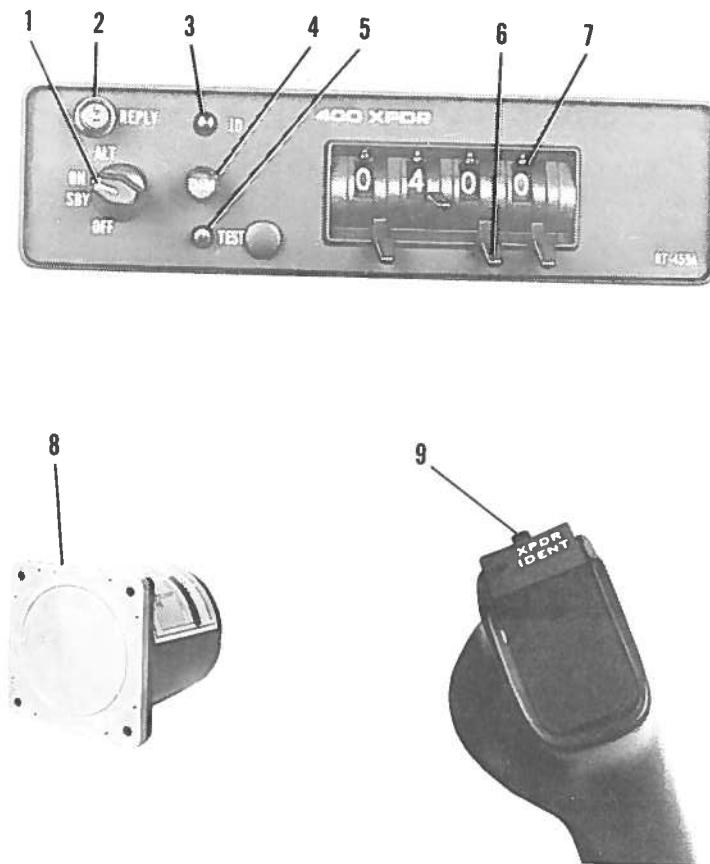
## SECTION 1

### GENERAL

The Cessna 400 Transponder (Type RT-459A), shown in Figure 1, is the airborne component of an Air Traffic Control Radar Beacon System (ATCRBS). The transponder enables the ATC ground controller to "see" and identify the aircraft, while in flight, on the control center's radarscope more readily.

The Cessna 400 Transponder system consists of a panel-mounted unit, an externally-mounted antenna and an optional control wheel-mounted XPDR IDENT switch. The transponder receives interrogating pulse signals on 1030 MHz and transmits pulse-train reply signals on 1090 MHz. The transponder is capable of replying to Mode A (aircraft identification) and also to Mode C (altitude reporting) when coupled to an optional altitude encoder system. The transponder is capable of replying on both modes of interrogation on a selective reply basis on any of 4096 information code selections. The optional altitude encoder system (not part of a standard 400 Transponder system) required for Mode C (altitude reporting) operation consists of a completely independent remote-mounted digitizer that is connected to the static system and supplies encoded altitude information to the transponder. When the altitude encoder system is coupled to the 400 Transponder system, altitude reporting capabilities are available in 100-foot increments between -1000 feet and the airplane's maximum service ceiling.

All Cessna 400 Transponder operating controls, with the exception of the optional XPDR IDENT switch, are located on the front panel of the unit. The remote XPDR IDENT switch is located on the right hand grip of the pilot's control wheel. Functions of the operating controls are shown and described in Figure 1.



1. FUNCTION SELECTOR SWITCH - Controls application of power and selects transponder operating mode as follows:
  - OFF - Turns set off.
  - SBY - Turns set on for equipment warm-up or standby power.
  - ON - Turns set on and enables transponder to transmit Mode A (aircraft identification) reply pulses.
  - ALT - Turns set on and enables transponder to transmit either Mode A (aircraft identification) reply pulses or Mode C (altitude reporting) pulses selected automatically by the interrogating signal.

Figure 1. Cessna 400 Transponder and Altitude Encoder (Blind)  
(Sheet 1 of 2)

PILOT'S OPERATING HANDBOOK      CESSNA 400 TRANSPONDER  
SUPPLEMENT                            AND ALTITUDE ENCODER (BLIND)

2. REPLY LAMP - Lamp flashes to indicate transmission of reply pulses; glows steadily to indicate transmission of IDENT pulse or satisfactory self-test operation. (Reply lamp will also glow steadily during initial warm-up period.)
3. IDENT (ID) SWITCH - When depressed, selects special pulse identifier to be transmitted with transponder reply to effect immediate identification of aircraft on ground controller's display. (Reply lamp will glow steadily during duration of IDENT pulse transmission.)
4. DIMMER (DIM) CONTROL - Allows pilot to control brilliance of reply lamp.
5. SELF-TEST (TEST) SWITCH - When depressed, causes transponder to generate a self-interrogating signal to provide a check of transponder operation. (Reply lamp will glow steadily to verify self-test operation.)
6. REPLY-CODE SELECTOR SWITCHES (4) - Select assigned Mode A reply code.
7. REPLY-CODE INDICATORS (4) - Display selected Mode A reply code.
8. REMOTE-MOUNTED DIGITIZER - Provides an altitude reporting code range of -1000 feet up to the airplane's maximum service ceiling.
9. REMOTE ID SWITCH (XPDR IDENT) - Same as panel-mounted ID switch described in Item 3.

Figure 1. Cessna 400 Transponder and Altitude Encoder (Blind)  
(Sheet 2 of 2)

## SECTION 2

### LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, the following information must be displayed in the form of a placard located near the altimeter.

ALTITUDE ENCODER EQUIPPED

## SECTION 3

### EMERGENCY PROCEDURES

#### TO TRANSMIT AN EMERGENCY SIGNAL:

1. Function Selector Switch -- ON.
2. Reply-Code Selector Switches -- SELECT 7700 operating code.

#### TO TRANSMIT A SIGNAL REPRESENTING LOSS OF ALL COMMUNICATIONS (WHEN IN A CONTROLLED ENVIRONMENT):

1. Function Selector Switch -- ON.
2. Reply-Code Selector Switches -- SELECT 7700 operating code for 1 minute; then SELECT 7600 operating code for 15 minutes and then REPEAT this procedure at same intervals for remainder of flight.

## SECTION 4

### NORMAL PROCEDURES

#### BEFORE TAKEOFF:

1. Function Selector Switch -- SBY.

#### TO TRANSMIT MODE A (AIRCRAFT IDENTIFICATION) CODES IN FLIGHT:

1. Reply-Code Selector Switches -- SELECT assigned code.
2. Function Selector Switch -- ON.
3. DIM Control -- ADJUST light brilliance of reply lamp.

#### NOTE

During normal operation with function selector switch in ON position, reply lamp flashes indicating transponder replies to interrogations.

4. ID or XPDR IDENT Button -- DEPRESS momentarily when instructed by ground controller to "squawk IDENT" (reply lamp will glow steadily, indicating IDENT operation).

#### TO TRANSMIT MODE C (ALTITUDE REPORTING) CODES IN FLIGHT:

1. Reply-Code Selector Switches -- SELECT assigned code.
2. Function Selector Switch -- ALT.

#### NOTE

When directed by ground controller to "stop altitude squawk", turn Function Selector Switch to ON for Mode A operation only.

#### NOTE

Pressure altitude is transmitted by the transponder for altitude squawk and conversion to indicated altitude is done in ATC computers. Altitude squawked will only agree with indicated altitude when the local altimeter setting in use by the ground controller is set in the aircraft altimeter.

3. DIM Control -- ADJUST light brilliance of reply lamp.

**TO SELF-TEST TRANSPONDER OPERATION:**

1. Function Selector Switch -- SBY and wait 30 seconds for equipment to warm-up.
2. Function Selector Switch -- ON.
3. TEST Button -- DEPRESS (reply lamp should light brightly regardless of DIM control setting).
4. TEST Button -- RELEASE for normal operation.

**SECTION 5  
PERFORMANCE**

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

## SUPPLEMENT

# CESSNA 400 TRANSPONDER (Type RT-459A)

AND

# OPTIONAL ENCODING ALTIMETER (Type EA-401A)

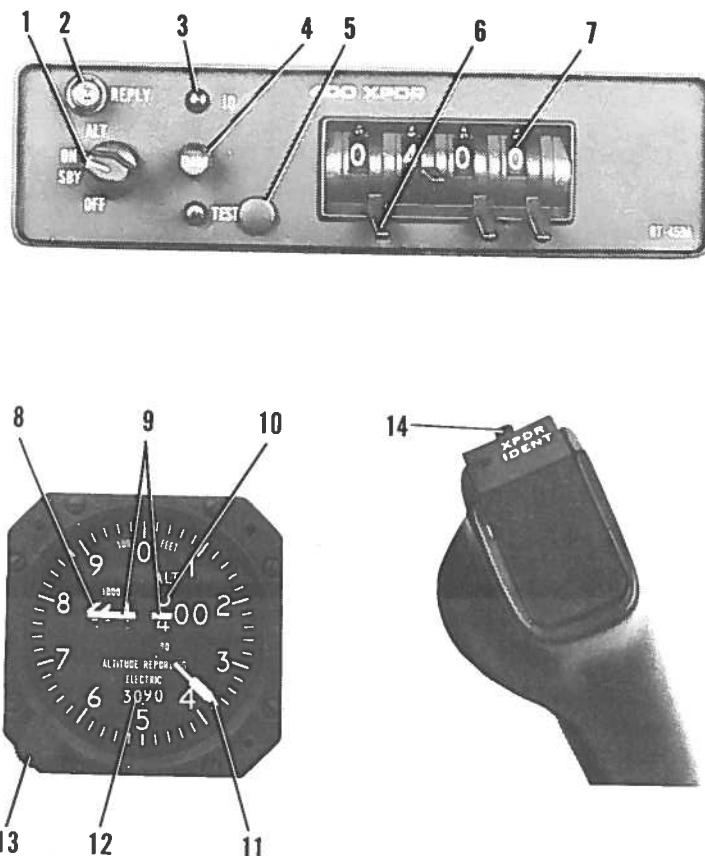
## SECTION 1

### GENERAL

The Cessna 400 Transponder (Type RT-459A), shown in Figure 1, is the airborne component of an Air Traffic Control Radar Beacon System (ATCRBS). The transponder enables the ATC ground controller to "see" and identify the aircraft, while in flight, on the control center's radarscope more readily.

The Cessna 400 Transponder system consists of a panel-mounted unit, an externally-mounted antenna and an optional control wheel-mounted XPDR IDENT switch. The transponder receives interrogating pulse signals on 1030 MHz and transmits coded pulse-train reply signals on 1090 MHz. It is capable of replying to Mode A (aircraft identification) and also to Mode C (altitude reporting) interrogations on a selective reply basis on any of 4096 information code selections. When an optional panel mounted EA-401A Encoding Altimeter (not part of 400 Transponder System) is included in the avionic configuration, the transponder can provide altitude reporting in 100-foot increments between -1000 and +35,000 feet.

All Cessna 400 Transponder operating controls, with the exception of the optional altitude encoder's altimeter setting knob and the optional remote XPDR IDENT switch, are located on the front panel of the unit. The altimeter setting knob is located on the encoding altimeter and the remote XPDR IDENT switch is located on the right hand grip of the pilot's control wheel. Functions of the operating controls are described in Figure 1.



1. **FUNCTION SELECTOR SWITCH** - Controls application of power and selects transponder operating mode as follows:

- OFF - Turns set off.
- SBY - Turns set on for equipment warm-up or stand-by power.
- ON - Turns set on and enables transponder to transmit Mode A (aircraft identification) reply pulses.
- ALT - Turns set on and enables transponder to transmit either Mode A (aircraft identification) reply pulses or Mode C (altitude reporting) pulses selected automatically by the interrogating signal.

Figure 1. Cessna 400 Transponder and Encoding Altimeter  
Operating Controls (Sheet 1 of 2)

PILOT'S OPERATING HANDBOOK  
SUPPLEMENTCESSNA 400 TRANSPONDER  
AND ENCODING ALTIMETER

2. REPLY LAMP - Lamp flashes to indicate transmission of reply pulses; glows steadily to indicate transmission of IDENT pulse or satisfactory self-test operation. (Reply lamp will also glow steadily during initial warm-up period.)
3. IDENT (ID) SWITCH - When depressed, selects special pulse identifier to be transmitted with transponder reply to effect immediate identification of aircraft on ground controller's display. (Reply lamp will glow steadily during duration of IDENT pulse transmission.)
4. DIMMER (DIM) CONTROL - Allows pilot to control brilliance of reply lamp.
5. SELF-TEST (TEST) SWITCH - When depressed, causes transponder to generate a self-interrogating signal to provide a check of transponder operation. (Reply lamp will glow steadily to verify self-test operation.)
6. REPLY-CODE SELECTOR SWITCHES (4) - Select assigned Mode A reply code.
7. REPLY-CODE INDICATORS (4) - Display selected Mode A reply code.
8. 1000-FOOT DRUM TYPE INDICATOR - Provides digital altitude readout in 1000-foot increments between -1000 feet and +35,000 feet. When altitude is below 10,000 feet, a diagonally striped flag appears in the 10,000-foot window.
9. OFF INDICATOR WARNING FLAG - Flag appears across altitude readout when power is removed from the altimeter to indicate that readout is not reliable.
10. 100-FOOT DRUM TYPE INDICATOR - Provides digital altitude readout in 100-foot increments between 0 and 1000 feet.
11. 20-FOOT INDICATOR NEEDLE - Indicates altitude in 20-foot increments between 0 feet and 1000 feet.
12. ALTIMETER SETTING SCALE - DRUM TYPE - Indicates selected altimeter setting in the range of 27.9 to 31.0 inches of mercury on the standard altimeter or 950 to 1050 millibars on the optional altimeter.
13. ALTIMETER SETTING KNOB - Dials in desired altimeter setting in the range of 27.9 to 31.0 inches of mercury on the standard altimeter or 950 to 1050 millibars on the optional altimeter.
14. REMOTE ID SWITCH (XPDR IDENT) - Same as panel-mounted ID switch described in Item 3.

Figure 1. Cessna 400 Transponder and Encoding Altimeter  
Operating Controls (Sheet 2 of 2)

## SECTION 2 LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, the encoding altimeter used in this installation does have a limitation that requires a standard barometric altimeter be installed as a back-up altimeter.

## SECTION 3 EMERGENCY PROCEDURES

### TO TRANSMIT AN EMERGENCY SIGNAL:

1. Function Selector Switch -- ON.
2. Reply-Code Selector Switches -- SELECT 7700 operating code.

### TO TRANSMIT A SIGNAL REPRESENTING LOSS OF ALL COMMUNICATIONS (WHEN IN A CONTROLLED ENVIRONMENT):

1. Function Selector Switch -- ON.
2. Reply-Code Selector Switches -- SELECT 7700 operating code for 1 minute; then SELECT 7600 operating code for 15 minutes and then REPEAT this procedure at same intervals for remainder of flight.

## SECTION 4 NORMAL PROCEDURES

### BEFORE TAKEOFF:

1. Function Selector Switch -- SBY.

### TO TRANSMIT MODE A (AIRCRAFT IDENTIFICATION) CODES IN FLIGHT:

1. Reply-Code Selector Switches -- SELECT assigned code.

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2. Function Selector Switch -- ON.
3. DIM Control -- ADJUST light brilliance of reply lamp.

## NOTE

During normal operation with function selector switch in ON position, REPLY lamp flashes indicating transponder replies to interrogations.

4. ID or XPDR IDENT Button -- DEPRESS momentarily when instructed by ground controller to "squawk IDENT" (REPLY lamp will glow steadily, indicating IDENT operation).

## TO TRANSMIT MODE C (ALTITUDE REPORTING) CODES IN FLIGHT:

1. Off Indicator Warning Flag -- VERIFY that flag is out of view on encoding altimeter.
2. Altitude Encoder Altimeter Setting Knob -- SET IN assigned local altimeter setting.
3. Reply-Code Selector Switches -- SELECT assigned code.
4. Function Selector Switch -- ALT.

## NOTE

When directed by ground controller to "stop altitude squawk", turn Function Selector Switch to ON for Mode A operation only.

## NOTE

Pressure altitude is transmitted by the transponder for altitude squawk and conversion to indicated altitude is done in ATC computers. Altitude squawked will only agree with indicated altitude when the local altimeter setting in use by the ground controller is set in the encoding altimeter.

5. DIM Control -- ADJUST light brilliance of reply lamp.

## TO SELF-TEST TRANSPONDER OPERATION:

1. Function Selector Switch -- SBY and wait 30 seconds for equipment to warm-up.
2. Function Selector Switch -- ON or ALT.

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3. TEST Button -- DEPRESS and HOLD (reply lamp should light with full brilliance regardless of DIM control setting).
4. TEST Button -- RELEASE for normal operation.

## **SECTION 5 PERFORMANCE**

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

## SUPPLEMENT

# CESSNA 400B INTEGRATED FLIGHT CONTROL SYSTEM (Type IF-550A)

## SECTION 1 GENERAL

The Cessna 400B Integrated Flight Control System (IFCS) provides a capability of automatic flight control or manual control with precision flight direction command provided by computed information. The complete presentation for the system is displayed on the Flight Director Indicator (FDI), the Mode Selector and the Horizontal Situation Indicator (HSI).

The operation of the manual and the automatic system is basically the same. The difference is whether the pilot decides to follow the Flight Director commands manually or allows the autopilot to fly the airplane.

Precision flight direction information for manual control is provided on the FDI. The FDI includes a symbolic airplane and incorporates pitch and roll command bars. The pilot merely flies the airplane to center the two command bars to follow the calculated flight path determined by the computer. In this way, climbs, descents, or turns are easily and accurately executed.

A Horizontal Situation Indicator (HSI) displays a pictorial presentation of the airplane's position relative to VOR radials, localizer and glide slope beams. The HSI also gives heading reference with respect to magnetic north and provides selection of the desired heading, VOR radials, LOC runway heading, and RNAV course when installed.

For automatic flight, the autopilot ON-OFF switch on the autopilot controller, is activated. Pitch and roll manual command controls are also located on this unit. All other normal modes of flight are controlled from the Mode Selector.

An automatic autopilot disengage function (provided by the "G" switch in the acceleration sensor) will automatically disengage the autopilot anytime the airplane pitches down at more than a normal rate from normal flight attitudes. The operational capability of the disengage function should be tested before takeoff by pressing the TEST-EA FLT

button, located on the autopilot accessory unit. When the TEST button is pressed with the autopilot engaged, the "G" switch in the acceleration sensor is actuated and if the "G" switch is functional, the autopilot will disengage, the autopilot disconnect horn will sound, and the yellow autopilot disconnect (DISC) warning (WARN) light will illuminate on the autopilot accessory unit to advise the pilot the autopilot disengage system is operational.

The autopilot will also be automatically disengaged anytime the airplane pitches up or down more than a normal amount from a level flight attitude. In this event, the disconnect horn would sound and the disconnect light would illuminate, advising the pilot that the autopilot has disengaged.

An additional autopilot disengage feature is provided by a thermostatic switch which monitors the operating temperature of the aileron and elevator actuators. If the temperature becomes abnormal in either the roll or pitch actuators, the thermostatic switch opens and disengages the autopilot to remove power from the actuator. After approximately 10 minutes, the switch automatically resets to close the autopilot interlock circuit. Power can then be reapplied to the actuator by re-engaging the AP/ON-OFF switch.

The autopilot disconnect warning light, on the accessory unit, will illuminate yellow when the autopilot is disengaged by any means other than the control wheel AUTOPILOT DISENGAGE switch. Whenever the autopilot is disengaged by any means, the autopilot disengage horn will produce a short tone lasting 1 to 2 seconds with decreasing amplitude. The autopilot disconnect warning light (yellow) will remain on, until it is cancelled by pressing the control wheel AUTOPILOT DISENGAGE switch.

The pilot's control wheel incorporates five switches for other related autopilot operations. Four of the switches are mounted on the left-hand side of the control wheel and provide for operation of go-around, electric trim, autopilot disengage, and electric trim disengage. The other switch, mounted on the right-hand side of the control wheel, provides for operation of pitch synchronization.

When this system is installed, the aircraft is supplied with a heavy duty battery as standard equipment.

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SUPPLEMENT

CESSNA 400B IFCS  
(TYPE IF-550A)

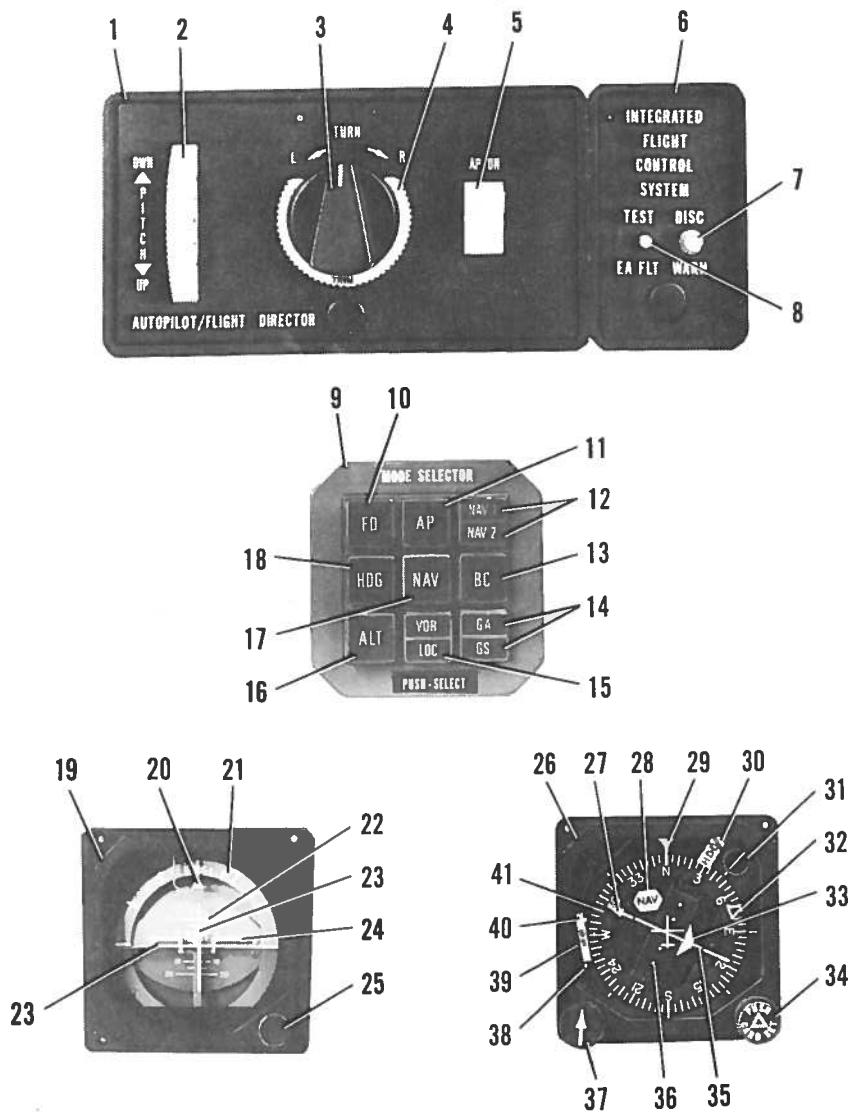
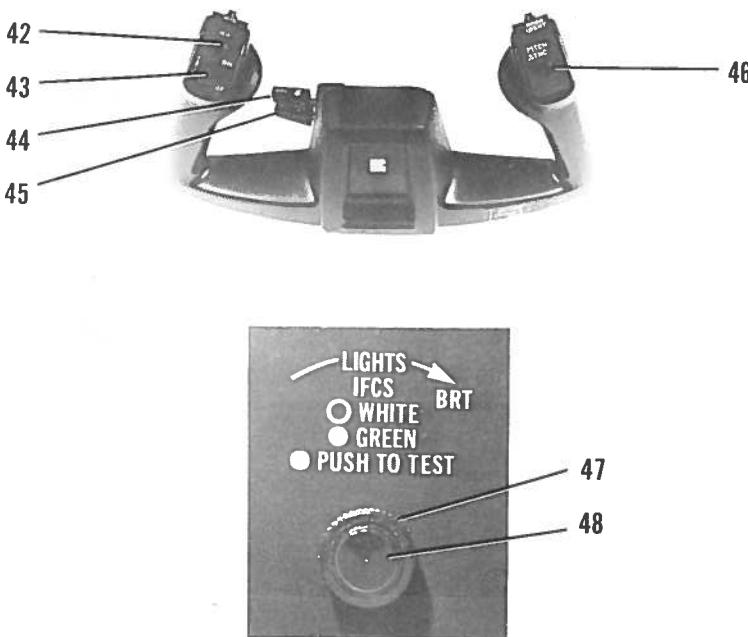


Figure 1. Cessna 400B IFCS (Type IF-550A) (Sheet 1 of 6)



1. CONTROL UNIT - Provides the autopilot ON-OFF switch and the primary manual controls for operating the autopilot.
2. PITCH CONTROL - Controls pitch attitude of airplane. When rotated toward UP, airplane will pitch up. When rotated toward DWN, airplane will pitch down. Pitch attitude depends on displacement of the control from level flight position.
3. TURN CONTROL KNOB (TURN) - When turned, airplane will bank right (R) or left (L). When turned, disconnects heading (HDG) or navigation (NAV) modes selected on Mode Selector.
4. LATERAL TRIM CONTROL (TRIM) - When TURN knob is centered, (with autopilot, but no lateral modes engaged and the airplane manually trimmed directionally for existing flight conditions), the TRIM control is used to trim for a wings level attitude.
5. AUTOPILOT ON-OFF SWITCH (AP/ON) - Controls primary power to autopilot. AP annunciation on Mode Selector will illuminate green when autopilot is engaged.
6. ACCESSORY UNIT - Provides the pilot with an automatic autopilot disconnect warning light and an autopilot disconnect self-test operation for use prior to flight.

Figure 1. Cessna 400B IFCS (Type IF-550A) (Sheet 2 of 6)

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(TYPE IF-550A)

7. AUTOPILOT DISCONNECT WARNING INDICATOR LIGHT (DISC WARN) - Whenever the autopilot is disengaged by any means, other than the control wheel AUTOPILOT DISENGAGE switch, the autopilot disconnect warning indicator light (DISC WARN) will illuminate yellow and will remain lighted until it is cancelled by pressing the control wheel AUTOPILOT DISENGAGE switch. When the DISC WARN indicator light is activated, the circuit will also automatically activate an autopilot disengage warning horn that will produce a short tone lasting from 1 to 2 seconds with decreasing amplitude.
8. AUTOPILOT DISCONNECT TEST BUTTON (TEST EA FLT) - When the TEST EA FLT pushbutton is pressed and held with the autopilot engaged, the "G" switch in the acceleration sensor is actuated and if the "G" switch is functional, the AP/ON-OFF switch will automatically disengage, the autopilot disconnect horn will produce a short tone and the yellow autopilot disconnect warning (DISC WARN) light will illuminate to advise the pilot the "G" switch disengaging function is operational.
9. MODE SELECTOR UNIT - A function mode selector and mode annunciators for the IFCS. Pushbutton switches are the push-to-engage, push-to-disengage type, and will illuminate green when engaged.
10. FLIGHT DIRECTOR (FD) MODE SELECTOR SWITCH - Engages flight director mode. FD annunciator will illuminate green and command bars (23) on the attitude gyro (FDI) will appear.
11. AUTOPILOT (AP) MODE SELECTOR ANNUNCIATOR LIGHT - AP annunciator will illuminate green when autopilot is engaged.
12. NAV 1/NAV 2 MODE SELECTOR SWITCH - Permits selection of either one of the two Nav receivers to be coupled to the Integrated Flight Control System by pressing the NAV 1/NAV 2 pushbutton. The NAV 1/NAV 2 annunciator will illuminate green to show NAV 1 when engaged. By pressing NAV 1/NAV 2 a second time the alternate NAV 2 receiver will be coupled, NAV 1 will be dropped out and the annunciator light NAV 2 will illuminate green.
13. BACK-COURSE (BC) MODE SELECTOR SWITCH - Used with localizer operation only. With AP switch (on control unit) or FD pushbutton ON or OFF and when associated navigation receiver selected by NAV 1/NAV 2 is set to a localizer frequency, it will always reverse localizer signals to the computer for back-course operation which provides the capability to fly the localizer back-course inbound or the front course outbound. BC annunciator on mode selector will illuminate green when engaged. It also reverses normal localizer needle indication on the #2 navigation CDI needle.
14. GO-AROUND (GA) AND GLIDE SLOPE (GS) MODE SELECTOR ANNUNCIATOR LIGHTS - GA annunciator illuminates green when go-around switch on control wheel is pressed; indicates a preset pitch-up and wings-level flight director command, and that all modes of operation, including autopilot, are cancelled. The GA mode may be cancelled by repressing the GA switch, pressing the HDG pushbutton or reengaging the autopilot. During approach, GS annunciator illuminates green when glide slope is captured by IFCS.

Figure 1. Cessna 400B IFCS (Type IF-550A) (Sheet 3 of 6)

15. VOR/LOCALIZER (VOR/LOC) MODE ANNUNCIATOR LIGHTS - When NAV pushbutton is engaged, either the VOR or LOC annunciator will illuminate green to reflect the selected frequency on the selected nav receiver. VOR/LOC light will only illuminate while in NAV mode.
16. ALTITUDE HOLD (ALT) MODE SELECTOR SWITCH - Engagement may be accomplished in climb, descent, or level attitude and commands the airplane to maintain pressure altitude existing at the moment of selection. Mode can be used with lateral command modes. In approach mode, altitude hold will automatically disengage when glide slope is captured. The go-around (GA) switch, when engaged, will also disengage altitude hold (ALT). ALT annunciator will illuminate green when engaged.
17. NAVIGATION (NAV) MODE SELECTOR SWITCH - Engagement provides for capture of VOR (omni) or LOC (localizer) track using NAV 1 or NAV 2 mode as selected. The TURN knob must be centered. During NAV-LOC operation, the glide slope (GS) mode will automatically engage only at beam center and only when the beam is approached from below. If the go-around (GA) switch on the airplane control wheel is actuated, the navigation (NAV) mode will automatically be cancelled and the associated NAV annunciator light will go out. Depending on the frequency selected at the time the NAV mode is activated, the VOR/LOC annunciator will illuminate green to show either VOR or LOC and the NAV mode annunciator will also illuminate green.
18. HEADING (HDG) MODE SELECTOR SWITCH - Engages the heading mode, which commands the airplane to turn to and maintain heading selected on Horizontal Situation Indicator (HSI). A new heading may be selected at anytime and will result in airplane turning to new heading with maximum bank angle of 25°. HDG mode will cancel GA mode and HDG annunciator will illuminate green.
19. FLIGHT DIRECTOR INDICATOR (FDI) - Displays airplane attitude as a conventional attitude gyro and displays commands for flight director operation; also provides the IFCS with electrical roll and pitch signals.
20. FDI ROLL ATTITUDE INDEX - Displays airplane roll attitude read against roll attitude scale.
21. FDI ROLL ATTITUDE SCALE - Movable scale marked at 0, ±10, 20, 30, 60, and 90 degrees.
22. FDI PITCH ATTITUDE SCALE - Moves with respect to the symbolic airplane to present pitch attitude. Scale graduated at 0, ±5, 10, 15, and 20 degrees.
23. FDI COMMAND BARS - Display computed steering commands referenced to dot on symbolic airplane. Command bars are only visible when FD mode is selected on the MODE SELECTOR.
24. FDI SYMBOLIC AIRPLANE - Airplane pitch and roll attitude is displayed by the relationship between the fixed symbolic airplane and the movable background. During flight director operation, the symbolic airplane is flown to align its center dot with the command bars to satisfy the flight director commands.
25. FDI SYMBOLIC AIRPLANE ALIGNMENT KNOB - Provides manual positioning of the symbolic airplane for pitch attitude alignment.

Figure 1. Cessna 400B IFCS (Type IF-550A) (Sheet 4 of 6)

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26. HORIZONTAL SITUATION INDICATOR (HSI) - Provides a pictorial presentation of aircraft deviation relative to VOR radials or localizer beams. It also displays glide slope deviations and gives heading reference with respect to magnetic north.
27. COURSE BEARING POINTER - Indicates selected VOR course or localizer course on compass card (41). The selected VOR radial or localizer heading remains set on the compass card when the compass card (41) is rotated.
28. NAV FLAG - Flag is in view when the NAV receiver signal is inadequate.
29. LUBBER LINE - Indicates aircraft magnetic heading on compass card (41).
30. HEADING WARNING FLAG (HDG) - When flag is in view the heading display is invalid due to interruption of either electrical or vacuum power.
31. GYRO SLAVING INDICATOR - Displays visual indication of heading indicator and flux detector synchronization. When slaving needle is aligned with the 45° right index on the HSI, it shows that the heading indicator agrees with the aircraft magnetic heading. Off-center pointer deflections show the direction of heading indicator error relative to aircraft magnetic heading. The compass CARD SET knob (34) may be used at any time to more rapidly accomplish synchronization of the heading indicator reading with magnetic heading as indicated by the slaving indicator.
32. HEADING BUG - Indicates selected heading relative to the compass card (41). Bug remains set on compass card when card rotates.
33. TO/FROM INDICATOR FLAG - Indicates direction of VOR station relative to selected course.
34. HEADING SELECTOR AND CARD SET KNOB (PUSH/CARD SET/Δ) - Positions heading "bug" on compass card (41) by rotating the PUSH/CARD SET knob. Pushing in and rotating the PUSH/CARD SET knob sets the compass card. The "bug" (32) rotates with the compass card.
35. COURSE DEVIATION BAR - Bar is center portion of omni bearing pointer and moves laterally to pictorially indicate relationship of aircraft to selected course. It relates in degrees of angular displacement from VOR radials or localizer beam center.
36. COURSE DEVIATION DOTS - A course deviation bar displacement of 2 dots represents full scale ( $VOR = \pm 10^\circ$  or  $LOC = \pm 2\frac{1}{2}^\circ$ ) deviation from beam centerline.
37. COURSE SELECTOR KNOB - Positions omni bearing pointer (27) on the compass card (41) by rotating the course selector knob.
38. GLIDE SLOPE SCALE - Indicates displacement from glide slope beam center. A glide slope deviation bar displacement of 2 dots represents full scale ( $0.7^\circ$ ) deviation above or below glide slope beam centerline.
39. GLIDE SLOPE POINTER - Indicates on glide slope scale (38) aircraft displacement from glide slope beam center.

Figure 1. Cessna 400B IFCS (Type IF-550A) (Sheet 5 of 6)

40. GLIDE SLOPE FLAG - When in view, indicates glide slope receiver signal is not reliable.
41. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (29) on HSI.
42. GO-AROUND (GA) SWITCH - When depressed, GA annunciator will illuminate green and the flight director command is a preset pitch-up and wings-level, and all other modes, including autopilot, are cancelled. The GA mode may be cancelled by repressing the GA switch, engaging the HDG mode selector, or re-engaging the autopilot.
43. ELECTRIC TRIM SWITCH - When moved forward to DN position, moves the elevator trim tab in the "nose down" direction; conversely, pulling the switch aft to the UP position moves the tab in the "nose-up" direction. Electric trim switch is only operational with AP/ON-OFF switch OFF.
44. ELECTRIC TRIM DISENGAGE SWITCH - When pulled aft to the OFF position, disengages the electric trim system. A secondary disengagement of electric trim is provided by a TRIM/PULL OFF circuit breaker; pull out to remove all electrical power from the electric trim system.
45. AUTOPILOT DISENGAGE SWITCH - When momentarily pulled aft to the OFF position, trips primary AP ON/OFF switch to OFF and removes all electrical power from the system. Autopilot will remain OFF until primary AP ON/OFF switch (5) is turned ON even though the switch (45) is spring loaded to return to ON when released. The AUTOPILOT DISENGAGE SWITCH is also used to turn the AUTOPILOT DISCONNECT light off.
46. PITCH SYNCHRONIZATION (PITCH SYNC) SWITCH - When the FD mode selector switch is ON and AP is OFF; the command bars will automatically synchronize to the pitch attitude at the time of flight director engagement. If a new pitch attitude is established, align the pitch command bar with the symbolic aircraft by depressing (but do not hold) the PITCH SYNC switch on the control wheel. The pitch command wheel can also be used for this.
47. MODE SELECTOR WHITE LIGHT DIMMING CONTROL - The annunciations in the Mode Selector will be illuminated with white lighting which identifies the function of each switch or mode. Rotate the large knob as desired to adjust the intensity of the white lights.
48. COMBINATION MODE SELECTOR GREEN LIGHT DIMMING CONTROL AND PUSH TEST CONTROL - Rotate the small knob as desired to adjust the intensity of the lights. The small knob is also used to test the mode selector lights. Press the small knob inward to test the green mode selector lights.

Figure 1. Cessna 400B IFCS (Type IF-550A) (Sheet 6 of 6)

## SECTION 2 LIMITATIONS

The following autopilot limitations must be followed during airplane operation.

1. Autopilot must be OFF for takeoff and landing.
2. Preflight test must be completed prior to any flight during which the autopilot is to be used.

### OPERATING LIMITATIONS WITH AUTOPILOT ENGAGED:

1. Maximum Airspeed -- 165 KIAS.  
Reduce maximum speed 10 KTS every 3,000 Ft. above FL 180.
2. Maximum Altitude Loss During Malfunction Recovery:  
Cruise -- 300 Ft.  
Approach -- 200 Ft.
3. Maximum Flap Deflection -- 10°.
4. In Altitude Hold Mode or Coupled Approach Modes:  
Maximum Speed for Flap and Gear Operation -- 115 KIAS.
5. Disengage autopilot before retracting flaps.

## SECTION 3 EMERGENCY PROCEDURES

### IN CASE OF AUTOPILOT MALFUNCTION:

1. Airplane Control Wheel -- OPERATE as required to manually override the autopilot.

### NOTES

The servos may be manually overpowered at any time without damage. If pitch axis is overpowered, electric trim will automatically run in opposition to overpowering force. Manually overpowering the autopilot should be kept to a minimum since slip clutch wear will result from extended periods of manual overpower.

Control wheel electric trim switch and electric trim disengage switch are inoperative with autopilot engaged.

2. AUTOPILOT DISENGAGE Switch (on Control Wheel) -- PULL OFF.

**NOTE**

This action automatically trips autopilot ON-OFF switch OFF. If electrical malfunction still persists, turn avionics power switch OFF and, if necessary, also turn the airplane master switch OFF.

## **SECTION 4**

### **NORMAL PROCEDURES**

#### **BEFORE TAKEOFF**

##### **RELIABILITY TESTS:**

1. Autopilot Automatic Disconnect Check (with Engine Running and Gyros Erected) -- PERFORM the following checks.
  - a. TURN Knob -- CENTER.
  - b. Autopilot Lateral TRIM Control -- CENTER.
  - c. AP ON-OFF Rocker Switch -- ON and observe annunciator illuminates green on mode selector.

**NOTE**

The roll servo will engage immediately. The pitch servo will engage after pitch synchronization as evidenced by the autopilot pitch command wheel coming to rest.

- d. FD Mode Selector Button -- ENGAGE and observe annunciator illuminates green on mode selector.
- e. Airplane Control Wheel -- HOLD to reduce movement.
- f. Autopilot Disconnect TEST Prior To EA FLT Button -- PUSH and HOLD
- g. Verify the following:
  - (1) Flight Director Indicator -- OBSERVE command bars are visible.
  - (2) AP ON-OFF Switch -- OBSERVE disengage.
  - (3) Autopilot Disconnect Warning Light -- OBSERVE yellow illumination.
  - (4) Autopilot Disengage Horn -- OBSERVE 1 to 2 second aural tone.

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**CAUTION**

If disengage function is nonoperational, do not use autopilot.

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(TYPE IF-550A)**

- h. Airplane Control Wheel AUTOPILOT DISENGAGE Switch -- PULL AFT to turn off Autopilot Disconnect Warning light.
- j. FD Mode Selector Button -- DISENGAGE and observe that command bars recess out of view.

**AUTOPILOT MODE****BEFORE TAKEOFF AND LANDING:**

1. AP ON-OFF Rocker Switch -- PUSH OFF.
2. MODE SELECTOR Rheostats -- ADJUST illumination intensities.
3. MODE SELECTOR AP Annunciator -- CHECK OFF (green light extinguished).
4. MODE SELECTOR FD Annunciator -- CHECK OFF (green light extinguished).

**IN-FLIGHT WING LEVELING:**

1. Airplane Elevator and Rudder Trim -- ADJUST.
2. TURN Knob -- CENTERED in detent.
3. AP/ON-OFF ROCKER SWITCH -- ON.
4. MODE SELECTOR AP Annunciator -- CHECK ON (green light illuminated).
5. Lateral Trim Knob -- ADJUST to level wings.
6. PITCH Command Wheel -- ADJUST as desired.

**ALTITUDE HOLD:**

1. MODE SELECTOR ALT Button -- PUSH.
2. MODE SELECTOR ALT Annunciator -- CHECK ON (green light illuminated).

**NOTE**

The autopilot ON-OFF switch must be engaged and the pitch servo synchronized, as evidenced by the autopilot pitch command wheel coming to rest, before the ALT switch can be engaged.

**COMMAND TURNS:**

1. TURN Knob -- ROTATE as desired.

**CLIMB OR DESCENT:**

1. MODE SELECTOR ALT Button -- PUSH to DISENGAGE.
2. Pitch Command Wheel -- ROTATE UP or DOWN as desired.
3. Rudder Trim -- ADJUST as required.

**HEADING SELECT:**

1. Heading Selector Knob on HSI -- ROTATE bug to desired heading.
2. TURN Knob -- CENTERED in detent.
3. MODE SELECTOR HDG Button -- PUSH.
4. MODE SELECTOR HDG Annunciator -- CHECK ON (green light illuminated).

**NOTE**

Airplane will turn automatically to selected heading.

**VOR COUPLING:**

1. TURN Knob -- CENTERED in detent (after turning airplane heading within 135° of desired course).
2. MODE SELECTOR NAV 1/NAV 2 Button -- PUSH for desired receiver.
3. HSI Course Selector Knob (or CDI OBS Knob) -- SET desired VOR course.
4. MODE SELECTOR NAV Button -- PUSH.
5. MODE SELECTOR NAV Annunciator -- CHECK ON (green light illuminated).

**NOTE**

Airplane will automatically intercept at 45° and then track the selected VOR course. The NAV mode selector switch must be turned OFF when the selected VOR course is changed, and then on again.

**ILS/LOC APPROACH:**

1. Wing Flaps -- SELECT desired 0° to 10° approach setting.

**NOTE**

Maximum allowable flap deflection is 10° with autopilot engaged. Airspeed should be reduced to 115 KIAS prior to operation of the flaps if operating in the altitude hold mode.

2. Airspeed -- ADJUST to approach speed (95 to 115 KIAS).
3. Rudder Trim -- ADJUST as required.
4. MODE SELECTOR NAV 1/NAV 2 Button -- PUSH for NAV 1 receiver (or NAV 2 as desired, if optional second Glide Slope receiver is installed).
5. MODE SELECTOR NAV 1/NAV 2 Annunciator -- CHECK correct NAV ON (green light illuminated).

6. MODE SELECTOR BC Button -- PUSH for front course outbound or back course inbound.

NOTE

If BC mode is selected, ensure that BC annunciator light illuminates green on the MODE SELECTOR.

7. HSI Course Selector Knob (or NAV 2 OBS Knob if NAV 2 is selected) -- SET localizer front course heading for both front and back-course approaches.
8. MODE SELECTOR NAV Button -- PUSH for automatic intercept and ILS tracking (aircraft heading must be within 90° of selected course).
9. MODE SELECTOR NAV Annunciator -- CHECK ON (green light illuminated).
10. Heading Selector Knob on HSI -- ROTATE bug for missed approach heading.
11. MODE SELECTOR ALT Button -- PUSH upon reaching published approach altitude.
12. MODE SELECTOR ALT Annunciator -- CHECK ON (green light illuminated).

NOTE

As glide slope needle passes down through center position, ALT annunciator will deactivate automatically and GS annunciator will illuminate. Autopilot can only capture glide slope from below beam center. ALT engaged is not required to capture glide slope.

13. MODE SELECTOR ALT Button -- OFF at final approach fix if localizer approach only. Adjust autopilot pitch command wheel for proper descent.
14. Landing Gear -- EXTEND by outer marker.

NOTE

Airspeed should be reduced to 115 KIAS prior to operating the gear if operating in the altitude hold mode.

15. AUTOPILOT DISENGAGE Switch (Control Wheel)-- OFF before descending below 200 feet above ground, or extending flaps more than 10°.
16. Wing Flaps -- EXTEND as REQUIRED after landing is assured.

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(TYPE IF-550A)

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### MISSED APPROACH:

1. Control Wheel GA Switch -- PRESS.

#### NOTE

Autopilot will disengage and an autopilot disengage warning horn will produce a short tone lasting from 1 to 2 seconds with decreasing amplitude. Flight Director will automatically engage to provide a preset pitch up climb attitude and wings level command. All other modes will be cancelled.

2. Control Wheel/Elevator Trim Switch -- OPERATE as necessary to satisfy command signals.
3. Power and Cowl Flaps -- SET as required for climb.
4. Landing Gear and Wing Flaps -- RETRACT.
5. Rudder Trim -- ADJUST as required.
6. Heading Bug on HSI -- VERIFY set for missed approach heading.
7. Control Wheel GA Switch -- PRESS to disengage GA mode.
8. Autopilot ON-OFF Switch -- ON if 200 feet or more above ground.
9. MODE SELECTOR AP Annunciator -- CHECK ON (green light illuminated).
10. MODE SELECTOR HDG Button -- PUSH.
11. MODE SELECTOR HDG Annunciator -- CHECK ON (green light illuminated).
12. PITCH Command Wheel -- ROTATE for desired climb attitude.

## **FLIGHT DIRECTOR MODE**

### BEFORE TAKEOFF AND LANDING:

1. AP ON-OFF Rocker Switch -- PUSH OFF.
2. MODE SELECTOR Rheostats -- ADJUST illumination intensities.
3. MODE SELECTOR AP Annunciator -- CHECK OFF (green light extinguished).
4. MODE SELECTOR FD Annunciator -- CHECK OFF (green light extinguished).

## CLIMB:

1. Airplane Climb Attitude -- ESTABLISH.
2. MODE SELECTOR FD Button -- PUSH ON and observe that command bars appear on FD Indicator.
3. MODE SELECTOR FD Annunciator -- CHECK ON (green light illuminated).

## NOTE

If pitch command bar is not aligned in pitch with the symbolic aircraft, readjust flight director indicator's symbolic airplane alignment knob.

4. Autopilot Lateral TRIM Knob -- ADJUST as required to center vertical command bar.
5. Airplane Control Wheel/Elevator Trim Switch -- OPERATE to keep dot on symbolic airplane aligned with command bars, satisfying command signal.

## NOTE

If climb attitude is changed, press PITCH SYNC button on control wheel to realign pitch command bar with symbolic airplane.

## LEVEL FLIGHT:

1. MODE SELECTOR ALT Button -- PUSH.
2. MODE SELECTOR ALT Annunciator -- CHECK ON (green light illuminated).
3. Control Wheel/Elevator Trim Switch -- OPERATE as necessary to satisfy command signal.

## HEADING SELECT:

1. Heading Selector Knob on HSI -- ROTATE bug to desired heading.
2. MODE SELECTOR HDG Button -- PUSH.
3. Control Wheel -- OPERATE as necessary to satisfy command signal.

## NOTE

Airplane will not be commanded to bank more than 25° toward the selected heading.

## VOR INTERCEPT:

1. MODE SELECTOR NAV 1/NAV 2 Button -- PUSH for desired receiver.
2. MODE SELECTOR NAV 1/NAV 2 Annunciator -- CHECK CORRECT NAV ON (green light illuminated).
3. HSI Course Selector Knob (or OBS on CDI) -- SET desired VOR course.
4. MODE SELECTOR NAV Button -- PUSH.
5. MODE SELECTOR NAV Annunciator -- CHECK ON (green light illuminated).
6. Control Wheel -- OPERATE as necessary to satisfy command signal.

## NOTE

Vertical command bar will lead airplane to an intercept angle and then a smooth transition to the VOR radial.

## ILS/LOC APPROACH:

1. Wing Flaps -- SELECT desired 0° to 10° approach setting.
2. Airspeed -- ADJUST to initial approach speed.
3. MODE SELECTOR NAV 1/NAV 2 Button -- PUSH for NAV 1 receiver (or NAV 2 as desired, if optional second Glide Slope receiver is installed).
4. MODE SELECTOR NAV 1/NAV 2 Annunciator -- CHECK correct NAV ON (green light illuminated).
5. MODE SELECTOR BC Button -- PUSH for front course outbound or back course inbound.

## NOTE

If BC mode is selected, ensure that BC annunciator light illuminates green on the MODE SELECTOR.

6. HSI Course Selector (or OBS on CDI if NAV 2 is selected) -- SET localizer front course heading for both front and back-course approaches.
7. MODE SELECTOR NAV Button -- PUSH.
8. MODE SELECTOR NAV Annunciator Light -- CHECK ON (green light illuminated).
9. Heading Selector Knob on HSI -- SET bug for missed approach heading.
10. MODE SELECTOR ALT Button -- PUSH upon reaching published approach altitude.

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11. MODE SELECTOR ALT Annunciator -- CHECK ON (green light illuminated).

## NOTE

As glide slope needle passes through center position, the ALT annunciator will automatically go out and GS annunciator will illuminate green. Flight director can only capture glide slope from below beam center. ALT engaged is not required to capture glide slope.

12. MODE SELECTOR ALT Button -- OFF at final approach fix if localizer approach only. Use pitch trim wheel to establish proper command attitude.
13. Control Wheel/Elevator Trim Switch -- OPERATE as necessary to satisfy command signals.
14. Landing Gear -- EXTEND by outer marker.
15. Wing Flaps -- EXTEND as required after landing is assured.

## MISSED APPROACH:

1. Control Wheel GA Switch -- PRESS.

## NOTE

Flight Director will disengage on all modes of operation except a preset pitch up climb attitude and wings level command.

2. Control Wheel/Elevator Trim -- OPERATE as necessary to satisfy command signals.
3. Power and Cowl Flaps -- SET as required for climb.
4. Landing Gear and Wing Flaps -- RETRACT.
5. Heading Selector Knob on HSI -- VERIFY bug set for missed approach heading.
6. MODE SELECTOR HDG Button -- PUSH.
7. MODE SELECTOR HDG Annunciator -- CHECK ON (green light illuminated).
8. Control Wheel -- OPERATE as necessary to satisfy command signals.

## SECTION 5

## PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed.



# SUPPLEMENT

## CESSNA 400B

### NAVOMATIC AUTOPILOT

#### (Type AF-550A)

## SECTION 1

### GENERAL

Cessna 400B Navomatic Autopilot (Type AF-550A) is a two axis automatic flight control system that governs the positions of the ailerons and elevators to provide automatic roll and pitch stability as commanded by the selected mode of operation. The system also provides for tracking of any magnetic heading, automatic intercept and tracking of VOR radials or ILS localizer and glide slope beams, and includes automatic pitch synchronization and trim, manual turn and pitch command, altitude hold, back course switching, Nav 1 or Nav 2 receiver selection, an automatic autopilot disengage acceleration sensor with an associated autopilot disengagement warning horn and a prior-to-flight test function.

The major components in a standard 400B autopilot system consist of a control unit and accessory unit mounted side-by-side in the lower center stack of the instrument panel, a panel-mounted vacuum driven unslaved directional gyro and an attitude gyro, a remote mounted acceleration sensor with a built in "G" switch, an associated autopilot disengage warning horn, an altitude sensor, and aileron, elevator and elevator trim actuators. A heavy duty aircraft battery is also installed as standard equipment with this autopilot system. In addition, an optional unslaved HSI is offered as replacement for the standard unslaved directional gyro and two optional slaved compass systems consisting of a remote mounted flux detector, a slaving accessory unit (offered without course datum on 300 Series Radios and with, or without, course datum on 400 Series Radios), and either a slaved directional gyro or a slaved Horizontal Situation Indicator (HSI) are offered. Both the optional slaved DG and optional slaved HSI are panel-mounted and incorporate a slaving meter that monitors heading displacement error between the flux detector and the slaved DG or slaved HSI. The HSI, in addition to replacing the standard DG, also replaces the standard Course Deviation Indicator (CDI) normally installed with the navigational receiver.

#### NOTE

400 Nav/Com radios equipped with course datum aid the

pilot by eliminating the need to set the DG heading bug to the desired VOR or ILS course. When course datum is installed, the autopilot will automatically track the VOR or ILS course selected by the OBS on the CDI or course selector on the slaved HSI.

The control unit (flight controller) and accessory unit contain most of the operating controls for the autopilot. In addition, there are three switches mounted on the pilot's control wheel and two switches mounted in the autopilot accessory unit. The three switches on the pilot's control wheel provide for manual electric trim operation, autopilot disengage and electric trim disengage. An AP NAV 1/NAV 2 switch in the autopilot accessory unit provides for selection of the desired VOR receiver (NAV 1 or NAV 2) and a REV SNS selector switch (LOC 1 or LOC 2), also in the autopilot accessory unit, is provided to select back-course (reverse sensing) operation on the desired navigation receiver. All operating controls necessary to properly operate the 400B autopilot are shown in Figure 1.

An automatic autopilot disengage function (provided by the "G" switch in the acceleration sensor) will automatically disengage the autopilot anytime the airplane pitches down at more than a normal rate from normal flight attitude. The operational capability of the disengage function should be tested before takeoff by pressing the TEST EA FLT button, located on the accessory unit. When the TEST button is pressed with the autopilot engaged, the "G" switch in the acceleration sensor is actuated and if the "G" switch is functional, the autopilot will disengage, the autopilot disconnect horn will sound, and the autopilot disconnect (DISC) warning (WARN) light will illuminate yellow to advise the pilot the autopilot disengage system is operational.

The autopilot will also be automatically disengaged anytime the airplane pitches up or down more than a normal amount from a level flight attitude. In this event, the disconnect horn would sound and the disconnect light would illuminate, advising the pilot that the autopilot has disengaged.

An additional autopilot disengage feature is provided by a thermostatic switch which monitors the operating temperature of the aileron and elevator actuators. If the temperature becomes abnormal in either the roll or pitch actuator, the thermostatic switch opens and disengages the autopilot to remove power from the actuator. After approximately 10 minutes, the switch automatically resets to close the autopilot interlock circuit. Power can then be reapplied to the actuator by re-engaging the AP/ON-OFF switch.

The autopilot disconnect (DISC) warning (WARN) light, on the acces-

sory unit, will illuminate yellow when the autopilot is disengaged by any means other than the control wheel AUTOPILOT DISENGAGE switch. Whenever the autopilot is disengaged by any means, the autopilot disengage horn will produce a short tone lasting 1 to 2 seconds with decreasing amplitude. The autopilot disconnect warning (WARN) light (yellow) will remain on, until it is cancelled by pressing the control wheel AUTOPILOT DISENGAGE switch.

The REV SNS LOC 1/LOC 2 selector switch, mounted in the autopilot accessory unit, is only used when conducting localizer back course approaches. With the navigation receiver set to a localizer frequency, positioning the switch to LOC 1 or LOC 2 will reverse the appropriate signals to provide for back course operation for either autopilot or manual flight. Except when a horizontal situation indicator is installed, selecting REV SNS LOC 1/LOC 2 causes reversal of the Course Deviation Indicator (CDI) indication, whether or not the autopilot is being used.

The navigation receiver selector switch (AP NAV 1/NAV 2), installed in the autopilot accessory unit when dual navigation receivers are installed, allows the autopilot to operate in conjunction with either navigation receiver.

When this system is installed, the aircraft is supplied with a heavy duty battery as standard equipment.

## SECTION 2 LIMITATIONS

The following autopilot limitations must be followed during airplane operation.

1. Autopilot must be OFF for takeoff and landing.
2. Preflight test must be completed prior to any flight during which the autopilot is to be used.

### OPERATING LIMITATIONS WITH AUTOPILOT ENGAGED:

1. Maximum Airspeed -- 165 KIAS.  
Reduce maximum speed 10 KTS every 3,000 Ft. above FL 180.
2. Maximum Altitude Loss During Malfunction Recovery:  
Cruise -- 300 Ft.  
Approach -- 200 Ft.
3. Maximum Flap Deflection -- 10°.
4. In Altitude Hold Mode or Coupled Approach Modes:  
Maximum Speed for Flap and Gear Operation -- 115 KIAS.
5. Disengage autopilot before retracting flaps.

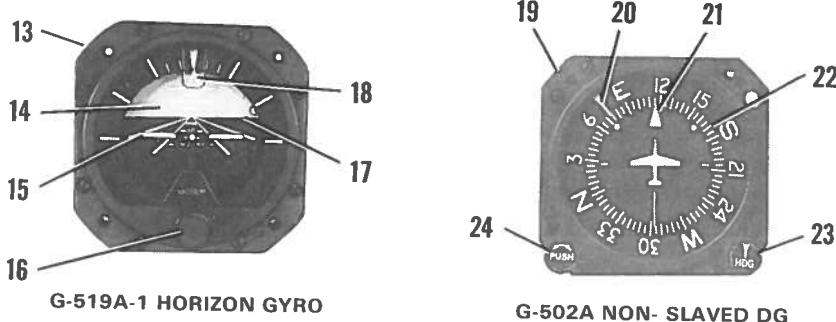
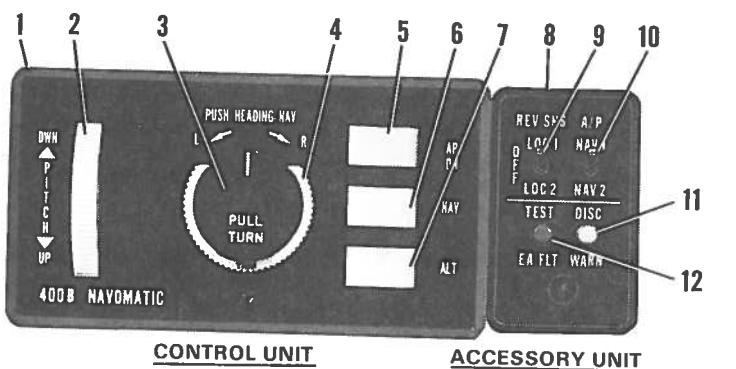
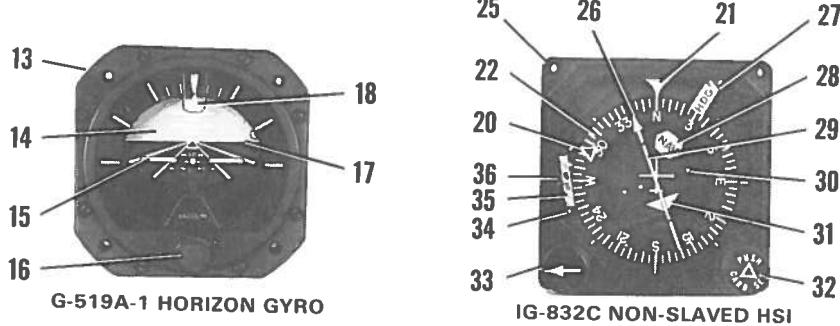
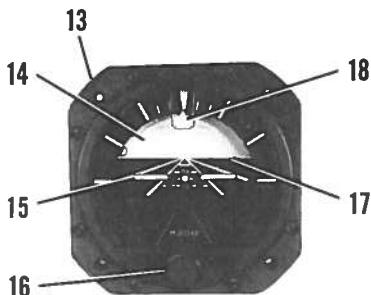
STANDARD NON-SLAVED GYRO SYSTEMOPTIONAL NON-SLAVED GYRO SYSTEM

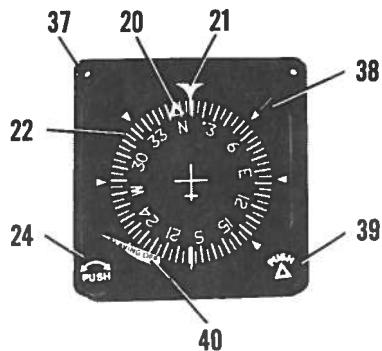
Figure 1. Cessna 400B Navomatic Autopilot (Type AF-550A)  
(Sheet 1 of 6)

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CESSNA 400B AUTOPILOT  
(TYPE AF-550A)

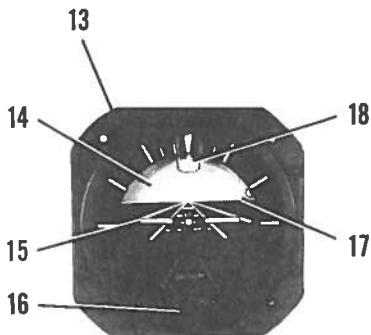


G-519A-1 HORIZON GYRO

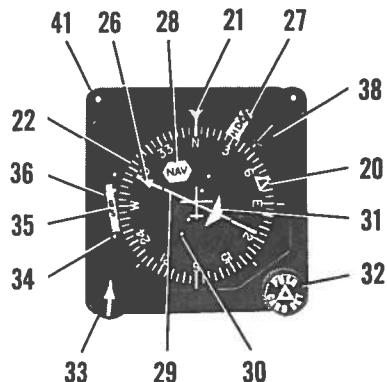


G-504A SLAVED DG

OPTIONAL SLAVED GYRO SYSTEM

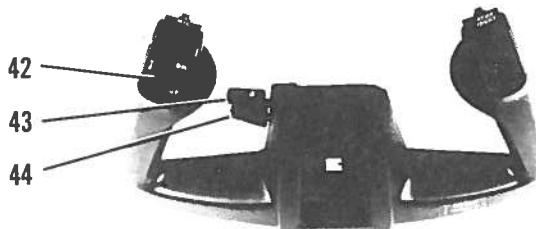


G-519A-1 HORIZON GYRO



IG-832A SLAVED HSI

OPTIONAL SLAVED GYRO SYSTEM



CONTROL WHEEL SWITCHES

Figure 1. Cessna 400B Navomatic Autopilot (Type AF-550A)  
(Sheet 2 of 6)

1. CONTROL UNIT - Provides the primary switches and controls for operating the autopilot.
2. PITCH COMMAND WHEEL - Controls pitch attitude of airplane. When rotated toward UP, airplane will pitch up. When rotated toward DWN, airplane will pitch down. Pitch attitude depends on displacement of control from level flight position.
3. PULL-TURN CONTROL KNOB - When pulled out and turned, aircraft will bank right (R) or left (L). When in detent and pushed in intercepts and maintains selected heading (HDG). When pulled out and in detent, acts as wing leveler.
4. LATERAL TRIM CONTROL (TRIM) - When PULL-TURN knob is pulled out and centered, control is used to trim autopilot for wings level attitude.
5. AUTOPILOT ON-OFF SWITCH (AP/ON) - Controls primary power to turn on or off the Navomatic 400B. When the AP/ON switch is turned off, the autopilot disengage horn will produce a short tone lasting from 1 to 2 seconds with decreasing amplitude and autopilot disconnect light will illuminate.
6. NAVIGATION ENGAGE SWITCH (NAV) - When PULL-TURN knob is pushed in, selects automatic VOR radial or localizer intercept and tracking operation.
7. ALTITUDE HOLD ENGAGE SWITCH (ALT) - Selects automatic altitude hold. If aircraft is in anything but level flight, the altitude control will smoothly level the airplane and return it to the altitude existing when ALT hold switch was pressed.
8. ACCESSORY UNIT - Provides the pilot with an automatic autopilot disconnect warning light, an autopilot disconnect system self-test button for use prior to flight, a reverse sense (back-course) selector switch and a navigation receiver selector switch.
9. BACK COURSE REVERSE SENSE (REV SNS) LOC 1 OR LOC 2 SELECTOR SWITCH - Used with LOC operation only. With AP switch OFF or ON, and when navigation receiver selected by AP switch (on autopilot accessory unit) is set to a localizer frequency, it reverses normal localizer needle indication on a course deviation indicator (CDI) and causes localizer reversed (BC) light to illuminate. With AP switch ON (on autopilot flight controller), reverses localizer signal to autopilot.

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**CAUTION**

When an optional horizontal situation indicator (HSI) is installed, the omni deviation bar does not reverse. However, with AP switch ON (on autopilot control unit), selection of either LOC 1 or LOC 2 will always cause the localizer signal to the autopilot to reverse for back-course operation.

10. AUTOPILOT (AP) NAV 1 OR NAV 2 SELECTOR SWITCH - Selects appropriate signals from the desired navigation receiver.
11. AUTOPILOT DISCONNECT WARNING INDICATOR LIGHT (DISC WARN) - Whenever the autopilot is disengaged by any means, other than the control wheel

Figure 1. Cessna 400B Navomatic Autopilot (Type AF-550A)  
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AUTOPILOT DISENGAGE switch, the autopilot disconnect (DISC) warning (WARN) light will illuminate yellow and will remain lighted until it is cancelled by pulling aft the control wheel AUTOPILOT DISENGAGE switch. When the autopilot disconnect DISC WARN indicator light is activated, the circuit will also automatically activate an autopilot disengage warning horn that will produce a short tone lasting from 1 to 2 seconds with decreasing amplitude.

12. AUTOPILOT DISCONNECT TEST BUTTON (TEST EA FLT) - When the TEST EA FLT pushbutton is pressed and held with the autopilot engaged, the "G" switch in the acceleration sensor is actuated and if the "G" switch is functional, the AP/ON-OFF switch will automatically disengage, the autopilot disconnect horn will produce a short tone and the yellow autopilot disconnect warning light will illuminate to advise the pilot the "G" switch disengaging function is operational.
13. ATTITUDE GYRO - Provides the pilot with a visual indication of the airplane's pitch and roll attitude with respect to the earth and also provides the autopilot with electrical roll and pitch signals.
14. GYRO HORIZON (ATTITUDE BACKGROUND) - Moves with respect to symbolic aircraft to display actual pitch and roll attitude.
15. SYMBOLIC AIRCRAFT - Serves as a stationary symbol of the aircraft. Aircraft pitch and roll attitudes are displayed by the relationship between the fixed symbolic aircraft and the movable background.
16. SYMBOLIC AIRCRAFT ALIGNMENT KNOB - Provides manual positioning of the symbolic aircraft for level flight under various load conditions.
17. HORIZON LINE - Provides identification of artificial horizon.
18. ROLL ATTITUDE INDEX - Displays actual roll attitude through movable index and fixed reference marks at 0, 10, 20, 30, 60 and 90 degrees.
19. NON-SLAVED DIRECTIONAL GYRO - Provides a stable visual indication of aircraft heading to the pilot and provides electrical heading information to the autopilot.
20. HEADING BUG - Moved by HDG knob on DG or PUSH  $\Delta$  Knob on Slaved DG or PUSH CARD SET  $\Delta$  Knob on HSI's to select desired heading. Bug remains set on compass card when card rotates.
21. LUBBER LINE - Indicates aircraft magnetic heading on compass card (22).
22. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (21) on DG's or HSI.
23. HEADING SELECTOR KNOB (HDG) - When pushed in, the heading bug (20) may be positioned to the desired magnetic heading by rotating the HDG selector knob. Also used to select VOR or ILS course when the autopilot is installed with 300 Series Radios or 400 Series Radios without course datum.
24. GYRO ADJUSTMENT KNOB (PUSH) - When pushed in, allows the pilot to manually rotate the gyro compass card (22) to correspond with the magnetic

Figure 1. Cessna 400B Navomatic Autopilot (Type AF-550A)  
(Sheet 4 of 6)

heading indicated by the compass. The unslaved directional gyro's (19) compass card (22) must be manually reset periodically to compensate for precessional errors in the gyro. The slaved directional gyro's (37) compass card (22) will automatically realign itself due to the slaving features. However the slaved DG may be manually reset at any time in order to accelerate precession adjustment.

25. NON-SLAVED HORIZONTAL SITUATION INDICATOR (HSI) - Provides a pictorial presentation of aircraft deviation relative to VOR radials and localizer beams. It also displays glide slope deviations and gives heading reference with respect to magnetic north. The unslaved HSI's directional gyro compass card (22) must be manually reset periodically to compensate for precessional errors in the gyro.
26. OMNI BEARING POINTER - Indicates selected VOR course or localizer course on compass card (22). The selected VOR radial or localizer heading remains set on the compass card when the compass card (22) is rotated.
27. HEADING WARNING FLAG (HDG) - When flag is in view, the heading display is invalid due to interruption of either electrical or vacuum power.
28. NAV FLAG - Flag is in view when the NAV receiver signal is inadequate.
29. COURSE DEVIATION BAR - Bar is center portion of omni bearing pointer and moves laterally to pictorially indicate relationship of aircraft to selected course. It relates in degrees of angular displacement from VOR radials or localizer beam center.
30. COURSE DEVIATION DOTS - A course deviation bar displacement of 2 dots represents full scale (VOR =  $\pm 10^\circ$  or LOC =  $\pm 2\frac{1}{2}^\circ$ ) deviation from beam centerline.
31. TO/FROM INDICATOR FLAG - Indicates direction of VOR station relative to selected course.
32. HEADING SELECTOR KNOB (PUSH/CARD SET/ $\Delta$ ) - Positions heading "bug" on compass card (22) by rotating the CARD SET knob. Pushing in and rotating the CARD SET knob sets the compass card. The "bug" (20) rotates with the compass card. Also used to select VOR or ILS course when the autopilot is installed with 300 Series Radios or 400 Series Radios without course datum.
33. COURSE SELECTOR KNOB - Positions omni bearing pointer (26) on the compass card (22) by rotating the course selector knob.
34. GLIDE SLOPE SCALE - Indicates displacement from glide slope beam center. A glide slope deviation bar displacement of 2 dots, represents full scale ( $0.7^\circ$ ) deviation above or below glide slope beam centerline.
35. GLIDE SLOPE FLAG - When in view, indicates glide slope receiver signal is not reliable.

Figure 1. Cessna 400B Navomatic Autopilot (Type AF-550A)  
(Sheet 5 of 6)

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36. GLIDE SLOPE POINTER - Indicates on glide slope scale (34) aircraft displacement from glide slope beam center.
37. OPTIONAL SLAVED DIRECTIONAL GYRO - When properly set to agree with the magnetic compass, the slaved DG will provide a magnetically stabilized visual indication of aircraft heading and also provides electrical heading information to the autopilot. The slaved DG eliminates the need to manually compensate for precessional errors in the gyro since the slaving motor will keep the card aligned with the earth's magnetic field.
38. GYRO SLAVING INDICATOR - Displays visual indication of heading indicator and flux detector synchronization. When slaving needle is aligned with the 45° right index on the DG or HSI, it shows that the heading indicator agrees with the aircraft magnetic heading. Off-center pointer deflections show the direction of the heading indicator error relative to aircraft magnetic heading. The slaved HSI's (41) compass CARD SET knob (32) or the slaved DG's gyro adjustment knob (24) may be used at any time to more rapidly accomplish synchronization of the heading indicator reading with magnetic heading as indicated by the slaving indicator.
39. HEADING SELECTOR KNOB (PUSH/ $\Delta$ ) - When pushed in the heading bug (20) may be positioned to the desired magnetic heading by rotating the PUSH/ $\Delta$  selector knob. Also used to select VOR or ILS course when autopilot is installed with a 300 Series Radio or 400 Series Radios without course datum.
40. SLAVING OFF WARNING FLAG - When out of view, indicates adequate slaving voltage. When in view, indicates absent or low slaving voltage.
41. SLAVED HORIZONTAL SITUATION INDICATOR (HSI) - Provides a pictorial presentation of aircraft deviation relative to VOR radials and localizer beams. It also displays glide slope deviations and gives heading reference with respect to magnetic north. The slaving feature associated with the HSI's directional gyro compass card (22) eliminates the need to manually compensate for precessional errors in the gyro. However, the slaved compass card may be manually reset at any time in order to accelerate precessional adjustment.
42. ELECTRIC TRIM SWITCH - When moved forward to DN position, moves the elevator trim tab in the "nose-down" direction; conversely, pulling the switch aft to the up position, moves the tab in the "nose-up" direction. Electric trim switch is only operational with autopilot AP/ON-OFF switch OFF.
43. ELECTRIC TRIM DISENGAGE SWITCH - When pulled aft to the OFF position, disengages the electric trim system. A secondary disengagement of electric trim is provided by a TRIM/PULL OFF circuit breaker; pull out to remove all electrical power from the electric trim system.
44. AUTOPILOT DISENGAGE SWITCH - When momentarily pulled aft to the OFF position, trips primary AP ON/OFF switch to OFF and removes all electrical power from the system. Autopilot will remain OFF until primary AP ON/OFF switch (5) is turned ON even though the switch (44) is spring loaded to return to ON when released.

Figure 1. Cessna 400B Navomatic Autopilot (Type AF-550A)  
(Sheet 6 of 6)

## SECTION 3

### EMERGENCY PROCEDURES

#### IN CASE OF AUTOPILOT MALFUNCTION:

1. Airplane Control Wheel -- OPERATE as required to manually override the autopilot.

#### NOTES

The servos may be manually overpowered at any time without damage. If pitch axis is overpowered, electric trim will automatically run in opposition to overpowering force. Manually overpowering the autopilot should be kept to a minimum since slip clutch wear will result from extended periods of manual overpower.

Control wheel electric trim switch and electric trim disengage switch are inoperative with autopilot engaged.

2. AUTOPILOT DISENGAGE Switch (on Control Wheel) -- PULL OFF.

#### NOTE

This action automatically trips autopilot ON-OFF switch OFF. If electrical malfunction still persists, turn avionics power switch OFF and, if necessary, also turn the airplane master switch OFF.

## SECTION 4

### NORMAL PROCEDURES

#### BEFORE TAKEOFF RELIABILITY TESTS:

1. Autopilot Automatic Disconnect Check (with Engine Running and Gyros Erected) -- PERFORM the following checks.
  - a. PULL-TURN Knob -- CENTER and PULL OUT.
  - b. Autopilot Lateral TRIM Control -- CENTER.
  - c. AP ON-OFF Rocker Switch -- ON.

#### NOTE

The roll servo will engage immediately. The pitch servo will engage after pitch synchronization as evidenced by the autopilot pitch command wheel coming to rest.

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- d. Airplane Control Wheel -- HOLD to reduce movement.
- e. Autopilot Disconnect TEST Prior To EA FLT Button -- PUSH and HOLD.
- f. Verify the following:
  - (1) AP ON-OFF Rocker Switch -- OBSERVE disengage to OFF position.
  - (2) Autopilot DISC WARN Light -- OBSERVE yellow illumination.
  - (3) Autopilot Disengage Horn -- OBSERVE 1 to 2 second aural tone.

**CAUTION**

If disengage function is nonoperational, do not use autopilot.

- g. Airplane Control Wheel AUTOPILOT DISENGAGE Switch -- PULL to turn off autopilot DISC WARN light.

**BEFORE TAKEOFF AND LANDING:**

1. AP ON-OFF Rocker Switch -- PUSH OFF.
2. REV SNS LOC 1/LOC 2 Switch (on Autopilot Accessory Unit) -- OFF.

**IN-FLIGHT WINGS LEVELING:**

1. Airplane Elevator and Rudder Trim -- ADJUST.
2. PULL-TURN Knob -- CENTER and PULL OUT.
3. AP ON-OFF ROCKER SWITCH -- PUSH ON.
4. Lateral TRIM Knob -- ADJUST to level wings.
5. Pitch Command Wheel -- ADJUST as desired.

**ALTITUDE HOLD:**

1. ALT Rocker Switch -- PUSH to hold altitude.

**NOTES**

The autopilot ON-OFF switch must be engaged and the pitch servo synchronized, as evidenced by the autopilot pitch command wheel coming to rest, before the ALT switch can be engaged.

Altitude Hold mode will automatically disengage on a coupled ILS approach when the glide slope is captured.

2. Airplane Rudder Trim -- ADJUST.
3. Lateral TRIM -- ADJUST to level wings.

**COMMAND TURNS:**

1. PULL-TURN Knob -- PULL OUT and ROTATE as desired.

**CLIMB OR DESCENT:**

1. ALT Rocker Switch -- DISENGAGE.
2. Pitch Command Wheel -- ROTATE UP or DOWN as desired.
3. Rudder Trim -- ADJUST as required.

**HEADING SELECT:**

1. PUSH Knob on DG or HSI -- SET to aircraft magnetic heading.
2. HDG Knob on DG or CARD SET Knob on HSI -- ROTATE bug to desired heading.
3. NAV Rocker Switch -- OFF.
4. PULL-TURN Knob -- PUSH IN.

**NOTE**

Airplane will turn automatically to selected heading.

**VOR COUPLING:**

1. PULL-TURN Knob -- PULL OUT.
2. AP NAV 1/NAV 2 Selector Switch (on Autopilot Accessory Unit) -- SET to desired VOR receiver.
3. Nav Indicator OBS or Course Selector Knob on HSI -- SET VOR course.
4. HDG Knob on DG or CARD SET Knob on HSI (300 or 400 Nav/Com Radios without Course Datum Only) -- ROTATE bug to agree with OBS.
5. PULL-TURN Knob -- PUSH IN.
6. NAV Rocker Switch -- ON (within 135° of desired heading).

**NOTE**

Airplane will automatically intercept and then track the selected VOR course. The NAV rocker switch must be turned OFF when the selected VOR course is changed and then ON again.

**ILS/LOC APPROACH:**

1. Wing Flaps -- SELECT desired 0° to 10° approach setting.

**NOTE**

Maximum allowable flap deflection is 10° with autopilot engaged. Airspeed should be reduced to 115 KIAS prior to operation of the flaps if operating in the altitude hold mode.

2. Airspeed -- ADJUST to approach speed (95 to 115 KIAS).
3. Rudder Trim -- ADJUST as required.
4. PULL-TURN KNOB -- PULL out and turn airplane to within 30° to 45° of localizer heading.
5. A/P NAV 1/NAV 2 Selector Switch (on Autopilot Accessory Unit) -- SET for NAV 1 receiver (or NAV 2 as desired, if optional second Glide Slope receiver is installed).
6. REV SNS LOC 1/LOC 2 Selector Switch (on Autopilot Accessory Unit) -- SELECT only if intercepting localizer front course outbound or back course inbound.

### **CAUTION**

When Rev SNS switch is placed in the LOC 1 or LOC 2 position (on Autopilot Accessory Unit), and a localizer frequency is selected, the CDI on the selected Nav radio will be reversed even when the autopilot switch is OFF.

### **NOTE**

Selection of LOC 1 or LOC 2 will only reverse the vertical needle on a Course Deviation Indicator. When the optional Horizontal Situation Indicator is installed, operation of the HSI needle is unaffected by the selection of LOC 1 or LOC 2. However, selection of LOC 1 or LOC 2 (corresponding to the selected A/P NAV 1/NAV 2 switch position) will always cause the localizer signal to the autopilot to reverse for back-course operation.

7. Nav Indicator OBS or Course Selector Knob on HSI -- SET to localizer front course heading for both front and back course approaches.
8. HDG Knob on DG or CARD SET Knob on HSI (300 or 400 Nav/Com Radios without Course Datum Only) -- ROTATE bug to localizer course (inbound or outbound as appropriate).
9. PULL-TURN Knob -- PUSH.
10. NAV Rocker Switch -- ON for automatic intercept and ILS tracking.
11. HDG Knob on DG or CARD SET Knob on HSI (400 Nav/Com Radios with Course Datum Only) -- ROTATE bug to missed approach heading.
12. ALT Rocker Switch -- ON when at published approach altitude.

### **NOTE**

Autopilot can only capture glide slope from below beam center.

13. ALT Rocker Switch:  
    CHECK -- AUTOMATIC DISENGAGEMENT at glide slope capture.  
    OFF -- AT FINAL APPROACH FIX if localizer approach only.
14. Autopilot PITCH Command Wheel -- ADJUST for proper descent if localizer approach only.
15. Landing Gear -- EXTEND by outer marker.

**NOTE**

Airspeed should be reduced to 115 KIAS prior to operation of the gear if operating in the altitude hold mode.

16. AUTOPILOT DISENGAGE SWITCH (on Control Wheel) -- OFF before descending below 200 feet above ground, extending flaps more than 10°, or when executing missed approach.
17. Wing Flaps -- EXTEND as required after landing is assured.

## **SECTION 5 PERFORMANCE**

There is no change to the airplane performance when this avionic equipment is installed.

## SUPPLEMENT

# CESSNA 800 ALTITUDE ENCODING (Type EA-801A)

WITH

# ALTITUDE ALERTING/PRESELECT (Type AA-801A)

## SECTION 1 GENERAL

The Cessna 800 encoding altimeter (Type EA-801A) is an electrically driven instrument that senses airplane altitude and provides the pilot with a visual display of the altitude. It also includes an optical encoder which automatically produces a logic code corresponding to the sensed altitude. This code is supplied to the Air Traffic Control Radar Beacon System transponder in the airplane to generate replies to Mode C (altitude reporting) interrogations from the ground radar. A second altitude information output from the altimeter can be coupled to airplane accessory equipment such as an altitude alerter or an autopilot altitude preselector circuit.

The altitude alerter (Type AA-801A) is an accessory unit used with the Cessna 800 encoding altimeter to supply a preselected altitude capture signal to arm the altitude hold function of the Integrated Flight Control System. It also provides visual and aural warnings as the airplane approaches and then deviates from the selected altitude.

The encoding altimeter is a panel-mounted barometric altimeter with an altitude range of -1000 to +35,000 feet. Altitude is displayed by a dial and a digital readout. The dial is graduated in 10 numerical divisions which represent increments of 100 feet, with subdivision markings for every 20 feet; the dial pointer completes one revolution for every 1000 feet of altitude change. The digital readout displays airplane altitude in increments of hundreds and thousands of feet only. Friction-induced lag and jumping of the display is reduced by the use of a combined aneroid sensor and motor-driven display. Electronic damping circuits in the unit insure that the display follows altitude changes rapidly with no overshoot. When power is

removed from the altimeter, a striped warning flag appears across the digital altitude display to indicate a "power-off" condition.

The local altimeter setting is set into the altimeter with a manually operated baroset knob, and is displayed on a four-digit readout, either in inches of mercury or in millibars (as ordered). The altimeter setting does not affect the output of the optical encoder, since the encoder is always referenced to standard pressure (sea level; 29.92 inches of mercury or 1013.2 millibars).

Except for introducing the altimeter setting with the baroset knob, operation of the altimeter is completely automatic. The baroset knob and the display indicators are shown in Figure 1.

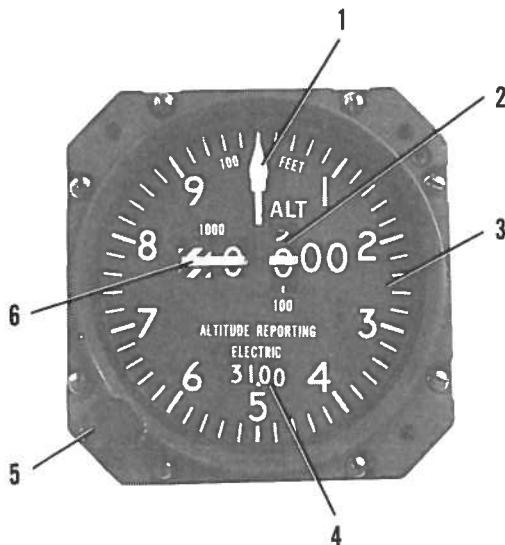
The altitude alerter is a panel-mounted unit which includes all of the operating controls and indicators and the preselector logic circuits. Altitude information for use in the altitude alerter is supplied electronically from the encoding altimeter. Three Minilever switches, mounted on the front panel of the unit, are used to select any altitude between 100 feet and the aircraft's maximum service ceiling in 100-foot increments; the selected altitude is displayed on a digital readout. The preselector control and indicators and an ALERT indicator are also included on the front panel of the unit. All controls and indicators for the altitude alerter are shown in Figure 2.

The altitude capture function is selected by a white pushbutton switch (ARM) which energizes the preselector logic circuits. For altitude capture function operation, the Integrated Flight Control System must be turned on but not engaged in a vertical mode (altitude hold or glide slope coupled). When the Minilever switches are set to the desired altitude and the white ARM pushbutton is pushed in, an amber ARMD panel lamp lights to indicate that the function is "armed." When the airplane reaches the selected altitude, the amber ARMD lamp turns off, and a green CPLD panel lamp on the alerter and the altitude hold (ALT) lamp on the flight director mode selector lights to indicate that altitude hold mode is operational. If the Minilever switches are repositioned after the preselector has been armed but before altitude hold is engaged, the logic circuits are reset and must be rearmed by again pushing in the ARM switch.

The alert function consists of a three-lamp display and an associated one-second aural tone. The green indicator lamp (ALERT) lights when the airplane altitude is within  $\pm 300$  feet of the selected altitude. When the airplane enters an altitude band from 300 to 1000 feet above or below the selected altitude, the amber HI ALERT or LO ALERT lamp lights and simultaneously, a one-second tone is heard. The one-second aural annunciation is only activated whenever the amber altitude band is entered, or the green altitude band is departed. There is no audible annunciation when the green band is entered, or when the amber altitude band is departed.

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1. ZERO-TO-THOUSAND FOOT ALTITUDE DISPLAY POINTER - Directly indicates airplane altitude between 0 and 1000 feet; for altitudes above 1000 feet, indicates last three digits of altitude (ones, tens, and hundreds).
2. ALTITUDE READOUT - Displays altitude above 100 feet on three-section counter in increments of 10,000, 1000, and 100 feet. When altitude is below 10,000 feet, a diagonally striped flag appears in 10,000-foot window.
3. ZERO-TO-THOUSAND FOOT ALTITUDE DISPLAY DIAL - Calibrated in 10 numerical graduations which represent increments of 100 feet; the subdivisions of each graduation represent increments of 20 feet.
4. ALTIMETER SETTING SCALE - Indicates selected altimeter setting in the range of 27.9 to 31.0 inches of mercury on the standard altimeter or 950 to 1050 millibars on the optional altimeter.
5. BAROSET KNOB - Used to set in local altimeter setting; clockwise rotation increases setting, counterclockwise rotation decreases setting.
6. POWER-OFF WARNING FLAG - Appears across altitude readout when power is removed from altimeter to indicate that readout is not reliable.

Figure 1. Cessna 800 Encoding Altimeter Indicator (Type EA-801A)



1. ALTITUDE SELECTOR AND DISPLAY - Three minilever switches select desired altitude between 100 feet and the aircraft's maximum service ceiling in 100-foot increments. Digital readout displays selected altitude. Black/white flag in first window, when visible, indicates selected altitude is less than 10,000 feet.
2. ALTITUDE CAPTURE CONTROL AND INDICATORS - Selector switch and two-lamp indicator which operate as follows:

**ARM Pushbutton Switch** - Arms altitude capture function of Alerter, provided Integrated Flight Control System is turned on and not already engaged in a vertical mode (altitude hold or glide slope coupled), and altitude selector switches are set to desired altitude.

**ARMD AMBER LAMP** - Lights when ARM pushbutton switch is pushed in to indicate that altitude capture function of flight director is engaged; remains lighted until altitude is captured.

**CPLD Green Lamp** - Lights when airplane reaches selected altitude and Integrated Flight Control System altitude hold mode is automatically engaged.

3. ALTITUDE ALERT INDICATOR - Three-lamp indicator which operates within a preestablished alert range on either side of the selected altitude, as follows:

**ALERT Green Lamp** - Lights when airplane altitude is within about 300 feet of the selected altitude.

**HI ALERT Amber Lamp** - Lights when airplane altitude is about 1000 feet above the selected alert altitude during descent or when deviating by about 300 feet above alert altitude after reaching altitude.

**LO ALERT Amber Lamp** - Lights when airplane altitude is about 1000 feet below the selected alert altitude during climb or when deviating by about 300 feet below alert altitude after reaching altitude.

#### NOTE

A one-second aural tone is heard when the airplane enters either amber band from above or below the altitude alert range, or departs from the green band.

Figure 2. Cessna 800 Altitude Alerter Indicator (Type AA-801A)

## SECTION 2 LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, the encoding altimeter used in this installation does have a limitation that requires a standard barometric altimeter be installed as a back-up altimeter. Also, the altitude alerter must not be used to identify the MDA (Minimum Descent Altitude) or DH (Decision Height) during an instrument approach.

## SECTION 3 EMERGENCY PROCEDURES

### ENCODING ALTIMETER FAILURE (WARNING FLAG SHOWING):

1. Encoding Altimeter Circuit Breaker -- CHECK IN.
2. If warning flag is still showing, use the standby barometric altimeter.

## SECTION 4 NORMAL PROCEDURES

### ALTIMETER OPERATION:

1. Baroset Knob -- TURN as necessary to set readout to local altimeter setting.
2. Power-off Warning Flag -- VERIFY that flag is not in view.

### WARNING

Do not attempt to use altimeter indication for flight information if warning flag is in view. Flag indicates that power has been removed from altimeter.

3. Altitude Display -- Below 1000 feet read altitude on display pointer and dial. Above 1000 feet, read altitude on altitude readout plus pointer and dial indication (for example, for an altitude of 12,630 feet, read 12,600 feet on readout; read 630 feet on pointer and dial).

### ALTITUDE ENCODING AND ACCESSORY OPERATION:

Operation of the altitude encoding and accessory information functions of the altimeter is completely automatic as soon as power is applied

to the altimeter and the warning flag is out of view. However, for transmission of the altitude information to the ground controller, the MODE C (ALT) function must be selected on the transponder.

**ALTITUDE ALERT:****NOTE**

The altitude alerter must be used with a properly functioning 800 encoding altimeter for all operation. The altitude preselect function is usable only when the airplane is equipped with the Integrated Flight Control System.

During flight, altitude alert operation of the altitude alerter is automatic within the preestablished alert range. Operation may be verified on the ground as follows:

1. Turn on airplane master and avionics power switches. Altimeter power-off warning flag should disappear.

**NOTE**

When using the encoding altimeter to simulate altitude inputs, no altitudes below 100 feet shall be used for testing. If the combination of station altitude (near sea level) and pressure presents a below 100 foot situation, then preset lowest obtainable altitude (above 100 feet) on altimeter and perform the upper range of the test specified in steps 5 and 6. Following this test, preset the altitude alerter for 1100 to 1500 feet above the previous preset altitude, and then perform steps 3 and 4 for the lower altitude portion of the test.

2. Set altitude selector switches to slightly more than 1000 feet above altitude indicated on the encoding altimeter. Altitude is displayed on readout.
3. Begin to turn altimeter baroset knob to set altimeter reading to agree with selected altitude. When altitude reading reaches about 1000 feet below selected altitude, a one-second tone is heard and amber LO ALERT lamp lights.
4. Continue to turn baroset knob toward selected altitude. When altitude reading is within about 300 feet of selected altitude, the LO ALERT lamp goes out and the green ALERT lamp lights.
5. Continue to turn baroset knob for altitude above selected altitude by about 300 feet. Green lamp goes out, one-second tone is heard, and amber HI ALERT lamp lights.
6. Continue to turn baroset knob until altitude reading reaches about

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1000 feet above alert range. Just as altitude leaves alert range, the HI ALERT lamp goes out.

7. Turn baroset knob to reset altimeter as required.
8. Turn off power, power-off warning flag appears.

**ALTITUDE CAPTURE:**

Altitude capture operation may be verified on the ground as follows:

1. Turn on airplane master and avionics power switches. Power-off warning flag on altimeter should disappear.
2. Turn on Integrated Flight Control System by pushing in the FD button on the mode selector and verify that ALT HOLD is not selected.
3. Set altitude selector switches to desired altitude; altitude is displayed on readout.
4. Push in ARM pushbutton switch. Amber ARMD lamp lights.
5. Turn altimeter baroset knob to set altimeter reading to displayed alerter altitude. When altimeter reaches approximate selected altitude, ARMD lamp goes out and green CPLD lamp lights. The altitude hold indicator lamp on the flight director mode selector will also light.
6. Turn baroset knob to reset altimeter as required.
7. Turn off power switches. Power-off warning flag appears and all indicator lamps go out.

**ALTITUDE CAPTURE OPERATING NOTES:****CAUTION**

The altitude alerter used in this system is not designed to identify the MDA (Minimum Descent Altitude) or DH (Decision Height) while making an instrument approach. Therefore, the alerter should never be used during an instrument approach to identify the MDA or DH.

1. If the altitude selector switches are moved to a new position after the ARM pushbutton has been pushed in but before the altitude is captured, the alerter logic is reset and the ARM pushbutton must be pushed again to enable the new altitude.
2. After altitude capture, and altitude hold mode is established; if the airplane leaves the selected altitude, the green CPLD lamp will remain lit. The altitude deviation will be indicated by the altitude ALERT lamps and the discrepancy between the selected altitude displayed on the alerter and the airplane altitude displayed by the altimeter.
3. If the altitude selector switches are set to a different altitude after altitude capture, the Integrated Flight Control System will remain

in the altitude hold mode but the green CPLD lamp will go out to indicate that the altitude displayed is not the altitude at which the airplane is being held.

4. If the altitude hold is manually selected on the flight director mode selector prior to automatic altitude capture, the ARMD lamp will go out, the CPLD lamp will not light, and the capture logic circuits will have to be reset for the next use. The function may be reset after altitude hold is disengaged.

## **SECTION 5**

### **PERFORMANCE**

There is no change to the airplane performance when this avionic equipment is installed.