

Pilot's Operating Handbook

Sixty|Two

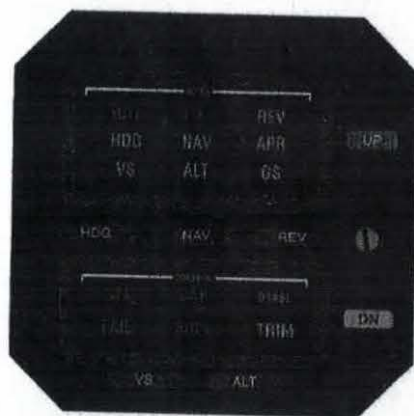
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SECTION 1 OVERVIEW

1.1 Document Organization

Section 1 Overview

Section 2 Pre-Flight Procedures

Section 3 In-Flight Procedures

Section 4 Operating Parameters

Section 5 Glossary

1.2 Purpose

This Pilot's Operating Handbook (POH) provides Pre-Flight and In-Flight operating procedures for the S-TEC System Sixty Two Autopilot (AP).

Note:

This POH must be carried in the A/C and made available to the pilot at all times. It can only be used in conjunction with the Federal Aviation Administration (FAA) approved Aircraft Flight Manual (AFM) or Aircraft Flight Manual Supplement (AFMS). Refer to the applicable AFM or AFMS for A/C specific information, such as unique ground tests, limitations, and emergency procedures.

Note:

The System Sixty Two autopilot is a tool provided to aircraft owners, that serves to assist them with cockpit workload management. The ability of the autopilot to provide optimum assistance and performance is directly proportional to the pilot's knowledge of its operating procedures. Therefore, it is highly recommended that the pilot develop a thorough understanding of the autopilot, its modes, and operating procedures in Visual Meteorological Conditions (VMC), prior to using it under Instrument Flight Rules (IFR).

1.3 General Control Theory

The System Sixty Two is a rate based autopilot. When in control of the roll axis, the autopilot senses turn rate, as well as closure rate to the selected course, along with the non-rate quantities of heading error, course error, and course deviation indication. When in control of the pitch axis, the autopilot senses vertical speed, acceleration, and closure rate to the selected glideslope, along with the non-rate quantities of altitude and glideslope deviation indication. These sensed data provide feedback to the autopilot, which processes them in order to control the aircraft through the use of mechanisms coupled to the control system. In most aircraft, the roll servo is coupled to the ailerons. The pitch servo is coupled to the elevator. Activation of roll axis control must always precede activation of pitch axis control.

The optional autotrim function senses when the aircraft needs to be trimmed about the pitch axis, and responds by driving the trim servo in the proper direction to provide trim. The trim servo is coupled to the elevator trim tabs.

S-TEC

The optional yaw damper senses excessive adverse yaw about the yaw axis, and responds by driving the yaw servo in the proper direction to provide damping. The yaw servo is coupled to the rudder.

The optional flight director is a display of the flight profile

1.4 Modes of Operation

1.4.1 Roll Axis Control

Heading (HDG) Mode

Used to Turn onto a Selected Heading and Hold it

Navigation (NAV) Mode

Used to Intercept and Track a VOR Course

Navigation Approach (NAV APR) Mode

Used to Intercept and Track a LOC Front Course Inbound

Reverse (REV) Mode

Used to Intercept and Track a VOR Back Course Inbound

Reverse Approach (REV APR) Mode

Used to Intercept and Track a LOC Back Course Inbound

1.4.2 Pitch Axis Control

Altitude Hold (ALT HOLD) Mode

Used to Hold Altitude

Vertical Speed (VS) Mode

Used to Hold Vertical Speed

Glideslope (GS) Mode

Used to Intercept and Track Glideslope

1.5 Block Diagram

The System Sixty Two Block Diagram is shown in Fig. 1-1.

The Yaw Damper Block Diagram is shown in Fig. 1-2.

The Flight Director Block Diagram is shown in Fig. 1-3.

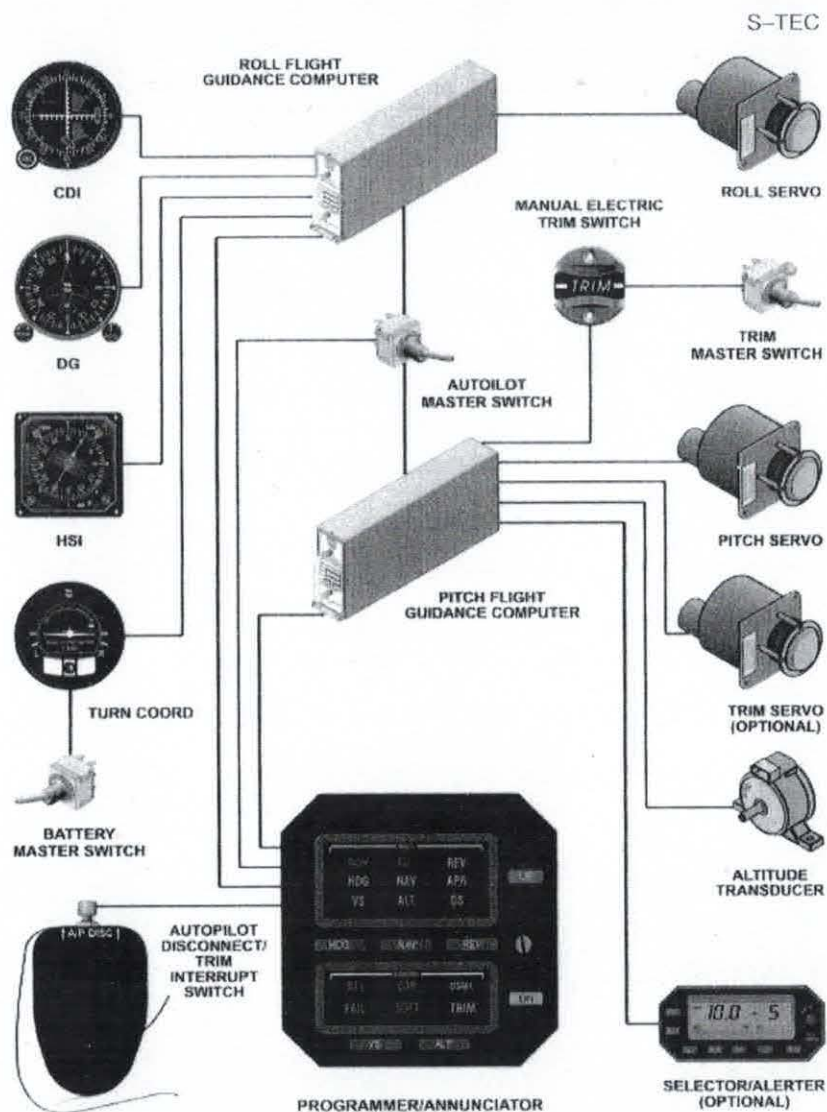


Fig. 1-1. System Sixty Two Block Diagram

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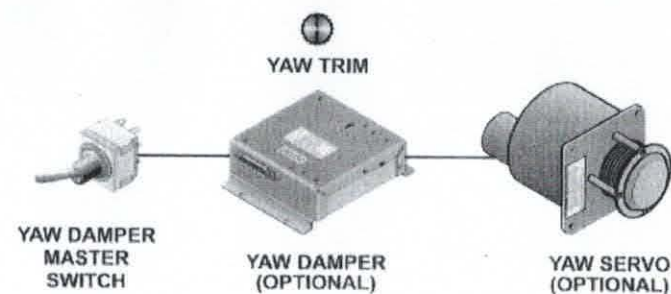


Fig. 1-2. Yaw Damper Block Diagram

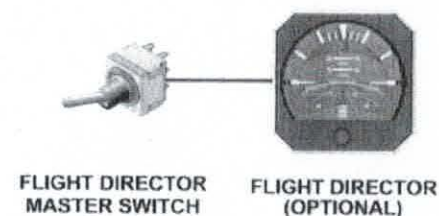


Fig. 1-3. Flight Director Block Diagram

SECTION 2 PRE-FLIGHT PROCEDURES

2.1 Pre-Flight Test

Prior to takeoff and with engine running, perform the actions shown in Table 2-1. For each action, verify the corresponding response where applicable.

Table 2-1. Pre-Flight Test (continued on page 2-5)

ACTION	RESPONSE
<i>Note:</i> <i>If a Flight Director is installed, then the FD annunciation appears on the AP display whenever one (or both) of the following conditions exist:</i> <i>Autopilot Master Switch in ON position</i> <i>Flight Director Master Switch in ON position</i> <i>For the purpose of brevity, this Pre-Flight Test precludes the installation of a Flight Director. The pilot should make allowance for this exception accordingly, if a Flight Director is installed.</i>	
1. Set Yaw Damper Master Switch to OFF position (if installed).	-----
2. Set Trim Master Switch to OFF position (if installed).	-----
3. Set Battery Master Switch to ON position.	-----
4. Set Avionics Master Switch to ON position.	-----
5. Set Autopilot Master Switch to ON position.	RDY annunciation only appears on AP display within 3 minutes, as shown in Fig. 2-1.
<i>Note:</i> <i>Should a Turn Coordinator failure be detected, the RDY annunciation will not appear as shown in Fig. 2-2, and the autopilot will not operate.</i>	

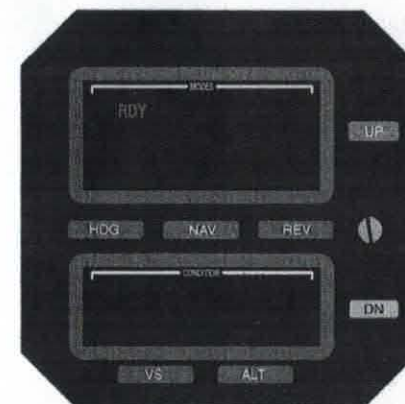


Fig. 2-1. AP Display, RDY for Operation



Fig. 2-2. AP Display, Turn Coordinator Failure, RDY Does Not Appear

Table 2-1. Pre-Flight Test (continued from page 2-3)

ACTION	RESPONSE
6. Set Autopilot Master Switch to TEST position.	The following annunciations all appear on AP display, as shown in Fig. 2-3: RDY FD REV HDG NAV APR VS ALT GS SEL CAP DSABL FAIL SOFT TRIM UP switch and DN switch lamps are both illuminated on AP display.
7. Set Heading Bug under Lubber Line.	-----
8. Move A/C Control Wheel left and right, to sense its freedom of movement about roll axis.	-----
9. Press HDG mode selector switch to engage heading mode.	-----
10. Attempt movement of A/C Control Wheel left and right.	A/C Control Wheel's reduced freedom of movement indicates that Roll Servo is engaged. Roll Servo can be overridden. If not, set Autopilot Master Switch to OFF position and do not use.
11. Move A/C Control Wheel forward and aft, to sense its freedom of movement about pitch axis.	-----
12. Press ALT mode selector switch to engage altitude hold mode.	-----

Table 2-1. Pre-Flight Test (continued from page 2-5)

ACTION	RESPONSE
13. Attempt movement of A/C Control Wheel forward and aft.	A/C Control Wheel's reduced freedom of movement indicates that Pitch Servo is engaged. Pitch Servo can be overridden. If not, set Autopilot Master Switch to OFF position and do not use.
14. Press/Hold UP switch, while maintaining a grasp on A/C Control Wheel.	Pitch Servo disengages after ½ second, as sensed by the increased freedom of A/C Control Wheel movement about pitch axis.
15. Release UP switch, while maintaining a grasp on A/C Control Wheel.	Pitch Servo immediately re-engages, as sensed by the reduced freedom of A/C Control Wheel movement about pitch axis.
16. Press/Hold DN switch, while maintaining a grasp on A/C Control Wheel.	Pitch Servo disengages after ½ second, as sensed by the increased freedom of A/C Control Wheel movement about pitch axis.
17. Release DN switch, while maintaining a grasp on A/C Control Wheel.	Pitch Servo immediately re-engages, as sensed by the reduced freedom of A/C Control Wheel movement about pitch axis.
18. Set Autopilot Master Switch to ON position.	All annunciations except RDY are extinguished. UP switch and DN switch lamps are extinguished.
19. Press HDG mode selector switch to engage heading mode.	HDG annunciation only appears on AP display, as shown in Fig. 2-4.
20. Turn Heading Bug to the left side of Lubber Line.	A/C Control Wheel turns to the left.



Fig. 2-3. AP Display, All Annunciations Appear



Fig. 2-4. AP Display, HDG Mode Engaged

Table 2-1. Pre-Flight Test (continued from page 2-6)

ACTION	RESPONSE
21. Turn Heading Bug to the right side of Lubber Line.	A/C Control Wheel turns to the right.
22. Set Heading Bug under Lubber Line.	A/C Control Wheel stops.
<i>Note:</i> If it is not possible to select a local VOR frequency on Navigation Receiver, then proceed to step 36. Otherwise, proceed to step 23.	
23. Select local VOR frequency on Navigation Receiver.	-----
<i>Note:</i> Proceed to either step 24 (HSI) or step 30 (DG).	
24. Turn Course Pointer until CDI needle is centered.	-----
25. Turn A/C until Course Pointer is under Lubber Line, to null course error input to autopilot.	-----
26. Press NAV mode selector switch to engage navigation mode.	NAV and SOFT annunciators only appear on AP display, as shown in Fig. 2-5.
27. Turn Course Pointer left until CDI needle deflection is 2 dots right of center.	A/C Control Wheel turns to the right.
28. Turn Course Pointer right until CDI needle deflection is 2 dots left of center.	A/C Control Wheel turns to the left.
29. Turn Course Pointer left until CDI needle deflection is centered.	A/C Control Wheel stops.

Table 2-1. Pre-Flight Test (continued from page 2-8)

ACTION	RESPONSE
<i>Note: Proceed to step 35.</i>	
30. Turn OBS until CDI needle is centered.	-----
31. Press NAV mode selector switch to engage navigation mode.	NAV and SOFT annunciations only appear on AP display, as shown in Fig. 2-5.
32. Turn OBS until CDI needle deflection is 2 dots right of center.	A/C Control Wheel turns to the right.
33. Turn OBS until CDI needle deflection is 2 dots left of center.	A/C Control Wheel turns to the left.
34. Turn OBS until CDI needle is centered.	A/C Control Wheel stops.

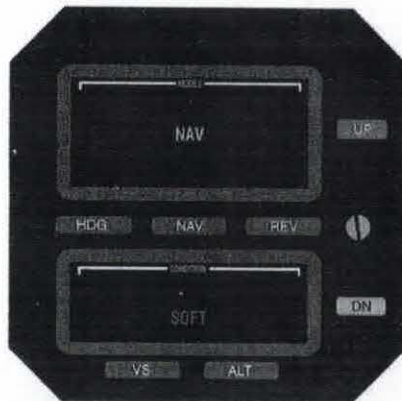


Fig. 2-5. AP Display, NAV Mode Engaged, SOFT Condition

Table 2-1. Pre-Flight Test (continued from page 2-9)

ACTION	RESPONSE
35. Press HDG mode selector switch to engage heading mode.	HDG annunciation only appears on AP display.
36. Press ALT mode selector switch to engage altitude hold mode.	HDG and ALT annunciations only appear on AP display, as shown in Fig. 2-6.
37. Move A/C Control Wheel until elevator is in neutral position.	-----
38. Press/Hold UP switch.	A/C Control Wheel moves in aft direction.
39. Release UP switch.	A/C Control Wheel continues moving in aft direction.
40. Press/Hold DN switch.	A/C Control Wheel slows to a stop in aft direction, and then moves in forward direction.
41. Release DN switch.	A/C Control Wheel continues moving in forward direction.
42. Press VS mode selector switch to engage vertical speed mode.	A/C Control Wheel stops. HDG and VS annunciations only appear on AP display, as shown in Fig. 2-7.
43. Press/Hold UP switch.	A/C Control Wheel moves in aft direction.
44. Release UP switch.	A/C Control Wheel continues moving in aft direction.



Fig. 2-6. AP Display, HDG and ALT HOLD Modes Engaged



Fig. 2-7. AP Display, HDG and VS Modes Engaged

Table 2-1. Pre-Flight Test (continued from page 2-10)

ACTION	RESPONSE
45. Press/Hold DN switch.	A/C Control Wheel slows to a stop in aft direction, and then moves in forward direction.
46. Release DN switch.	A/C Control Wheel continues moving in forward direction.
47. Press ALT mode selector switch to engage altitude hold mode.	A/C Control Wheel stops. HDG and ALT annunciations only appear on AP display.
<i>Note:</i> <i>If autopilot is equipped with autotrim, then proceed to step 52. Otherwise, proceed to step 48.</i>	
48. Move A/C Control Wheel as far forward as possible.	After 3 seconds, TRIM annunciation appears on AP display as shown in Fig. 2-8, UP switch lamp becomes illuminated, and audible alert sounds a steady tone. After 7 seconds, TRIM annunciation flashes, UP switch lamp flashes, and audible alert becomes periodic.
49. Move A/C Control Wheel aft until TRIM annunciation is extinguished.	UP switch lamp is extinguished, and audible alert is squelched.
50. Move A/C Control Wheel as far aft as possible.	After 3 seconds, TRIM annunciation appears on AP display as shown in Fig. 2-8, DN switch lamp becomes illuminated, and audible alert sounds a steady tone. After 7 seconds, TRIM annunciation flashes, DN switch lamp flashes, and audible alert becomes periodic.

Table 2-1. Pre-Flight Test (continued from page 2-12)

ACTION	RESPONSE
51. Move A/C Control Wheel forward until TRIM annunciation is extinguished.	DN switch lamp is extinguished, and audible alert is squelched.
<i>Note: Proceed to step 67.</i>	
52. Set Trim Master Switch to ON position.	-----
53. Move A/C Control Wheel as far forward as possible.	After 3 seconds, Elevator Trim Wheel begins to run nose up with increasing speed.
54. Move A/C Control Wheel aft until Elevator Trim Wheel stops.	-----

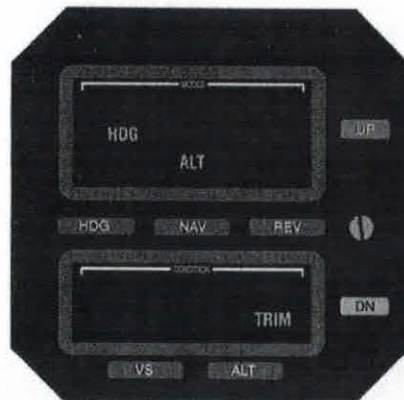


Fig. 2-8. AP Display, HDG and ALT HOLD Modes Engaged, Trim Required

Table 2-1. Pre-Flight Test (continued from page 2-13)

ACTION	RESPONSE
55. Move A/C Control Wheel as far aft as possible.	After 3 seconds, Elevator Trim Wheel begins to run nose down with increasing speed.
56. Move A/C Control Wheel forward until Elevator Trim Wheel stops.	-----
57. Press either forward or aft on both segments of Manual Electric Trim Switch.	Autopilot disconnects as follows: RDY annunciation appears flashing, while all other annunciations are extinguished. After 5 seconds, RDY annunciation stops flashing but remains.
58. Press/Hold either forward or aft on only one segment of Manual Electric Trim Switch, but not both.	Elevator Trim Wheel does not begin to run.
59. Press/Hold forward on both segments of Manual Electric Trim Switch.	Elevator Trim Wheel runs nose down at full speed, and TRIM annunciation appears flashing on AP display.
60. Press/Hold AP DISC / TRIM INTR Switch.	Elevator Trim Wheel stops.
61. Release AP DISC / TRIM INTR Switch.	Elevator Trim Wheel resumes running nose down at full speed.
62. Release Manual Electric Trim Switch.	Elevator Trim Wheel stops. TRIM annunciation is extinguished.

Table 2-1. Pre-Flight Test (continued from page 2-14)

ACTION	RESPONSE
63. Press/Hold aft on both segments of Manual Electric Trim Switch.	Elevator Trim Wheel runs nose up at full speed, and TRIM annunciation appears flashing on AP display.
64. Press/Hold AP DISC / TRIM INTR Switch.	Elevator Trim Wheel stops.
65. Release AP DISC / TRIM INTR Switch.	Elevator Trim Wheel resumes running nose up at full speed.
66. Release Manual Electric Trim Switch.	Elevator Trim Wheel stops. TRIM annunciation is extinguished.
<i>Note:</i> If autopilot is equipped with a Yaw Damper, then proceed to step 68. Otherwise, proceed to step 77.	
67. Press AP DISC / TRIM INTR Switch.	Autopilot disconnects as follows: RDY annunciation appears flashing, while all other annunciations are extinguished. After 5 seconds, RDY annunciation stops flashing but remains.
<i>Note:</i> If autopilot is equipped with a Yaw Damper, then proceed to step 68. Otherwise, proceed to step 77.	

Table 2-1. Pre-Flight Test (continued from page 2-15)

ACTION	RESPONSE
68. Actuate A/C Rudder Pedals alternately in succession, to sense their freedom of movement about yaw axis.	-----
69. Set Yaw Damper Master Switch to ON position.	-----
70. Turn Yaw Trim Knob until A/C Rudder Pedals stop.	-----
71. Attempt actuation of A/C Rudder Pedals alternately in succession.	A/C Rudder Pedals' reduced freedom of movement indicates that Yaw Servo is engaged. Yaw Servo can be overridden. If not, set Yaw Damper Master Switch to OFF position, and do not use.
72. Turn Yaw Trim Knob fully CCW.	Left A/C Rudder Pedal slowly moves forward.
73. Turn Yaw Trim Knob fully CW.	Right A/C Rudder Pedal slowly moves forward.
74. Turn Yaw Trim Knob CCW until A/C Rudder Pedals stop.	-----
75. Set Yaw Damper Master Switch to OFF position.	-----
76. Actuate A/C Rudder Pedals alternately in succession.	A/C Rudder Pedals' increased freedom of movement indicates that Yaw Servo is disengaged.
77. Trim A/C for takeoff.	-----

SECTION 3 IN-FLIGHT PROCEDURES

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3.1 Normal Operating Procedures

3.1.1 Heading (HDG) Mode

Set the Heading Bug to the desired heading on the compass card (HSI or DG), and then press the HDG mode selector switch to engage the heading mode. The HDG annunciation will appear as shown in Fig. 3-1, to acknowledge that this mode is engaged. The autopilot will turn the aircraft onto the selected heading and hold it. A new heading can be subsequently selected by setting the Heading Bug to it.



Fig. 3-1. AP Display, HDG Mode Engaged

3.1.2 Navigation (NAV) Mode

Select the VOR frequency on the Navigation Receiver.

Heading System HSI

Set Course Pointer to desired course on compass card.

Heading System DG

Set Heading Bug and OBS to desired course on each respective compass card.

Press the NAV mode selector switch to engage the navigation mode. The NAV annunciation will appear as shown in Fig. 3-2, to acknowledge that this mode is engaged.



Fig. 3-2. AP Display, NAV Mode Engaged

If the Course Deviation Indication (CDI) is at full scale (100%) needle deflection from center, then the autopilot will establish the aircraft on a 45° intercept angle relative to the selected course. Even if CDI needle deflection is less than 100%, the autopilot may still establish an intercept angle of 45°, provided that the aircraft's closure rate to the selected course is sufficiently slow. Otherwise, the intercept angle will be less than 45°.

As the aircraft approaches the selected course, the autopilot senses the corresponding rate at which CDI needle deflection approaches center (closure rate), in order to initiate the aircraft's turn onto the course at the proper point, and thereby prevent overshoot. The point at which this turn begins is variable, being further from the course at faster closure rates, and closer to the course at slower closure rates. Although closure rate is principally a function of groundspeed, the distance of the aircraft from the VOR station also has an effect. Nevertheless, the turn will always begin between 100% and 20% CDI needle deflection.

During this stage of the intercept sequence, the autopilot operates at maximum gain and sensitivity to closure rate. In addition, it limits the aircraft's turn rate to 90% of a standard rate turn, although for some higher performance (turboprop) aircraft this is 75%.

When the aircraft arrives at 15% CDI needle deflection, the course is captured. At that instant, a step reduction in autopilot gain occurs, so that the Course Pointer (HSI) or Heading Bug (DG) has sufficient authority to complete the intercept. In addition, the sensitivity to closure rate is reduced. The overall authority of the autopilot during this stage of the intercept sequence is called the CAP condition, which is acknowledged by the appearance of the CAP annunciation as shown in Fig. 3-3.

Fifteen seconds after course capture, a second step reduction in autopilot gain occurs, to limit the aircraft's turn rate to 45% of a standard rate turn, although for some higher performance (turboprop) aircraft this is 37.5%. In addition, the sensitivity to closure rate is reduced again. The overall authority of the autopilot during this stage of the intercept sequence is called the CAP SOFT condition, which is acknowledged by the appearance of the SOFT annunciation as shown in Fig. 3-4.



Fig. 3-3. AP Display, NAV Mode Engaged, CAP Condition

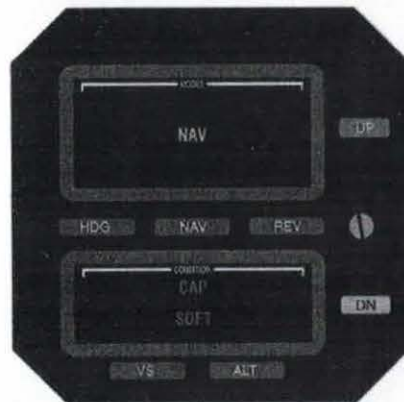


Fig. 3-4. AP Display, NAV Mode Engaged, CAP SOFT Condition

Thirty seconds after course capture, the autopilot establishes the required crosswind correction angle.

Seventy five seconds after course capture, a third step reduction in autopilot gain occurs, to limit the aircraft's turn rate to 15% of a standard rate turn, although for some higher performance (turboprop) aircraft this is 12.5%. In addition, the sensitivity to closure rate is reduced once more. This is acknowledged by the extinguishment of the CAP annunciation, as shown in Fig. 3-5. It marks the end of the intercept sequence, and the beginning of tracking. The overall authority of the autopilot during tracking is called the SOFT condition.

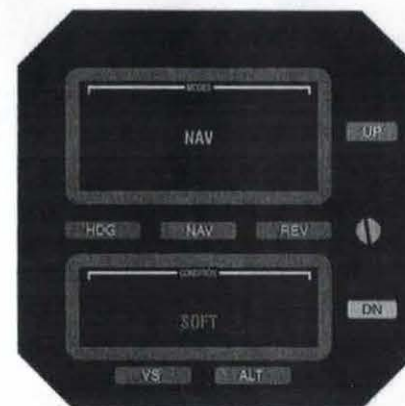


Fig. 3-5. AP Display, NAV Mode Engaged, SOFT Condition

The pilot should make speed, distance, and time considerations during the 75 second period from course capture to the beginning of tracking, to account for the aircraft's position. For example at 115 kts, a distance of 2.4 nautical miles will be traveled in 75 seconds.

If it should happen that the Course Pointer (HSI) or Heading Bug (DG) is already within 5° of the selected course, and CDI needle deflection is less than 10%, then the autopilot will immediately establish the SOFT condition upon engagement of the navigation mode.

While tracking in the SOFT condition, the autopilot ignores short term CDI needle deflections (excursions), to thereby inhibit aircraft scalloping during VOR station passage. Should CDI needle deflection exceed 50% for a period of 60 seconds, the autopilot will revert to the CAP SOFT condition as a means to re-establish the aircraft on course.

The NAV annunciation will flash whenever CDI needle deflection exceeds 50%, or the NAV Flag is in view. In the latter event, the FAIL annunciation will also appear.

3.1.2.1 Pilot Selectable Intercept Angle

To select an intercept angle other than 45°, set the Heading Bug to the desired intercept heading on the compass card, such that the difference between this heading and the desired course is the intercept angle. Then set the Course Pointer (HSI) or OBS (DG) to the desired course. Press and hold the HDG mode selector switch, and then press the NAV mode selector switch to engage the heading mode and arm the navigation mode. The HDG and NAV annunciations will appear as shown in Fig. 3-6, to acknowledge this.

The autopilot will establish the aircraft on the selected intercept angle (heading), until it must turn the aircraft onto the selected course to prevent overshoot. At that point in the intercept sequence, the HDG annunciation will extinguish to indicate engagement of the navigation mode.

If the selected intercept angle is greater than 35°, then the HDG annunciation will extinguish at 90% CDI needle deflection. However, if the selected intercept angle is less than 35°, then the HDG annunciation will extinguish at 20% CDI needle deflection. In addition, the course is captured at one of the following points:

15% CDI needle deflection (Roll Computers with Mod Code K and below)

20% CDI needle deflection (Roll Computers with Mod Code L and above)

If the heading system is a DG, at the moment the HDG annunciation extinguishes, immediately set the Heading Bug to the course in order to input a course error to the autopilot. Otherwise, the autopilot will lack sufficient authority to turn the aircraft onto the course.



Fig. 3-6. AP Display, HDG Mode Engaged, NAV Mode Armed

3.1.3 Altitude Hold (ALT HOLD) Mode

The altitude hold mode can only be engaged if a roll mode (HDG, NAV, NAV APR, REV, REV APR) is already engaged. With a roll mode engaged and the aircraft at the desired altitude, press the ALT mode selector switch to engage the altitude hold mode. The ALT annunciation will appear as shown in Fig. 3-7, to acknowledge that this mode is engaged. The autopilot will hold the aircraft at its current (captured) absolute pressure altitude.

This altitude may be modified for barometric pressure changes, by pressing and holding either the UP switch for an increase in altitude, or the DN switch for a decrease in altitude. The altitude changes 20 feet for each second the respective switch is pressed and held. The range is ± 200 feet from the original captured altitude.



Fig. 3-7. AP Display, HDG and ALT HOLD Modes Engaged

3.1.4 Vertical Speed (VS) Mode

Caution:

The vertical speed mode is used to establish and hold a PILOT selected vertical speed. Since the autopilot receives no airspeed information, it is the responsibility of the pilot to ensure that the vertical speed selection is within the operating limits of the aircraft's capabilities. Selection of a vertical speed beyond the capability of the aircraft can create a condition of reduced airspeed, and possibly lead to a stall condition.

The vertical speed mode can only be engaged if a roll mode (HDG, NAV, NAV APR, REV, REV APR) is already engaged. With a roll mode engaged and the aircraft at the desired vertical speed, press the VS mode selector switch to engage the vertical speed mode. The VS annunciation will appear as shown in Fig. 3-8, to acknowledge that this mode is engaged. The autopilot will hold the aircraft at its current (captured) vertical speed.

This vertical speed may be modified by pressing and holding either the UP switch or the DN switch. In a climb, pressing and holding the UP switch increases the climb rate, whereas pressing and holding the DN switch decreases the climb rate. In a descent, pressing and holding the DN switch increases the descent rate, whereas pressing and holding the UP switch decreases the descent rate.

The vertical speed changes 160 FPM for each second the respective switch is pressed and held. The range is ± 1600 FPM from the original captured vertical speed.

During a climb, should the aircraft become unable to hold the captured vertical speed for a period of fifteen seconds, the VS annunciation will flash as an alert to the potential for an impending stall condition. In that event, immediately increase the aircraft's thrust if possible, reduce the commanded vertical speed using the DN switch, or both, until the VS annunciation stops flashing.

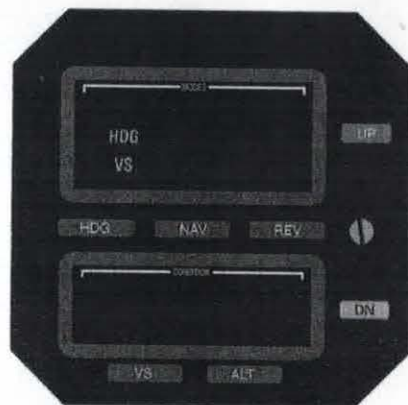


Fig. 3-8. AP Display, HDG and VS Modes Engaged

3.1.5 Elevator Trim

3.1.5.1 Manual Elevator Trim

If the autopilot is not equipped with autotrim, or is so equipped but the Trim Master Switch is in the OFF position, and a pitch mode (ALT HOLD, VS, GS) is engaged, then the autopilot will provide an annunciation whenever it is necessary to manually trim the aircraft about the pitch axis using the Elevator Trim Wheel.

Should the pitch servo loading exceed a preset threshold for a period of three seconds, the TRIM annunciation will appear as shown in Fig. 3-9, and either the UP or DN switch lamp will illuminate, as a prompt to trim the aircraft in the indicated direction. In addition, an audible alert will sound a steady tone. If no action is taken after four more seconds, then both the TRIM annunciation and illuminated switch lamp will flash, and the audible alert will become periodic. Once the aircraft has been sufficiently trimmed, such that the pitch servo loading is below the preset threshold, the TRIM annunciation and switch lamp will extinguish, and the audible alert will be squelched.

3.1.5.2 Automatic Elevator Trim

If the autopilot is equipped with autotrim, the Trim Master Switch is in the ON position, and a pitch mode (ALT HOLD, VS, GS) is engaged, then the autopilot will automatically trim the aircraft about the pitch axis.

Should the pitch servo loading exceed a preset threshold for a period of three seconds, the trim servo will become active, and so the Elevator Trim Wheel will run either nose up or nose down with increasing speed. Once the aircraft has been sufficiently trimmed, such that the pitch servo loading is below the preset threshold, the trim servo will become inactive and so the Elevator Trim Wheel will stop.



Fig. 3-9. AP Display, Manual Trim Prompt

3.1.5.3 Manual Electric Elevator Trim

If the autopilot is equipped with autotrim, then there will also be the Manual Electric Trim Switch located on the Control Wheel. This switch can be used to trim the aircraft about the pitch axis from the RDY, or when only a roll mode (HDG, NAV, NAV APR, REV, REV APR) is engaged, provided that the Trim Master Switch is in the ON position.

To trim the aircraft nose up, press aft and hold both segments of the Manual Electric Trim Switch. The TRIM annunciation will appear flashing as shown in Fig. 3-10, and the Elevator Trim Wheel will run nose up at full speed. Upon release of this switch, the TRIM annunciation will extinguish and the Elevator Trim Wheel will stop.

To trim the aircraft nose down, press forward and hold both segments of the Manual Electric Trim Switch. The TRIM annunciation will appear flashing as shown in Fig. 3-10, and the Elevator Trim Wheel will run nose down at full speed. Upon release of this switch, the TRIM annunciation will extinguish and the Elevator Trim Wheel will stop.

Should the Manual Electric Trim Switch ever be actuated when a pitch mode (ALT HOLD, VS, GS) is engaged, the autopilot will disconnect.



Fig. 3-10. AP Display, Manual Electric Trim in Progress

3.2 Precision Approach Procedures

3.2.1 Straight-In ILS Approach

Execute a straight-in intercept and track of the FRONT INBOUND LOC course (reference section 3.3.3), while holding the approach altitude. The NAV, APR, ALT, CAP, and SOFT annunciations will appear as shown in Fig. 3-11.

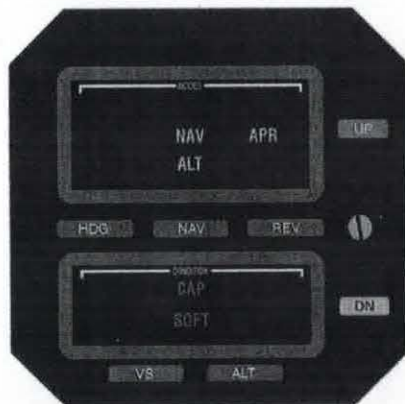


Fig. 3-11. AP Display, NAV APR and ALT HOLD Modes Engaged

Once the following conditions have existed simultaneously for a period of ten seconds, the GS annunciation will appear to acknowledge that the glideslope mode has automatically armed, as shown in Fig. 3-12:

1. NAVAPR mode engaged
2. ALT mode engaged
3. NAV Flag out of view
4. GS Flag out of view
5. LOC frequency selected
6. A/C within 50% CDI needle deflection of LOC centerline
7. A/C more than 60% Glideslope Deviation Indication (GDI) needle deflection below GS centerline

If the last condition cannot be met because the aircraft is too near the GS centerline, then manual arming of the glideslope mode can be instantly achieved by pressing the ALT mode selector switch.

The armed glideslope mode can be subsequently disabled by pressing the NAV mode selector switch. The GS annunciation will flash, and the DSABL annunciation will appear to acknowledge this, as shown in Fig. 3-13. To then re-arm the glideslope mode, press the NAV mode selector switch again. The GS and DSABL annunciations will immediately extinguish, but the GS annunciation will re-appear after ten seconds.

With the glideslope mode armed, once the aircraft arrives at 5% GDI needle deflection below the GS centerline, the ALT annunciation will extinguish to indicate engagement of the glideslope mode, as shown in Fig. 3-14.

Note:

If the approach positions the aircraft slightly above the GS centerline, then manual engagement of the glideslope mode can be instantly achieved by pressing the ALT mode selector switch.

Caution:

Manual engagement of the glideslope mode above the GS centerline will result in the aircraft moving aggressively toward the GS centerline. Do not manually engage the glideslope mode if GDI needle deflection is greater than 10% above the GS centerline.

The GS annunciation will flash whenever GDI needle deflection exceeds 50%, or the GS Flag is in view. In the latter event, the FAIL annunciation will also appear.

At the Decision Height (DH), disconnect the autopilot to execute either a landing or go-around (GA).

A pictorial of this procedure is shown in Fig. 3-15.

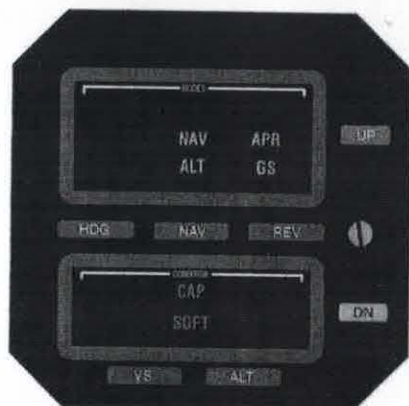


Fig. 3-12. AP Display, NAV APR and ALT HOLD Modes Engaged, GS Mode Armed

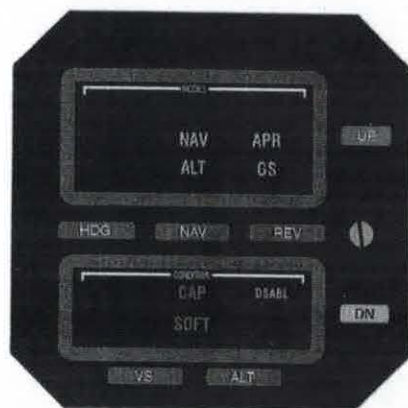


Fig. 3-13. AP Display, NAV APR and ALT HOLD Modes Engaged, GS Mode Disabled

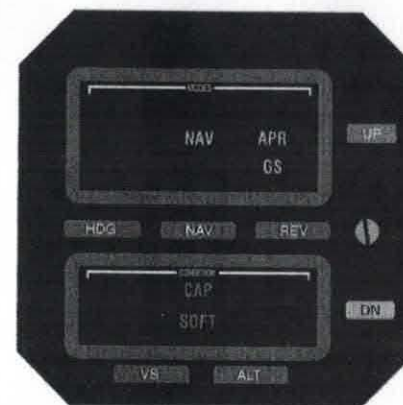


Fig. 3-14. AP Display, NAV APR and GS Modes Engaged

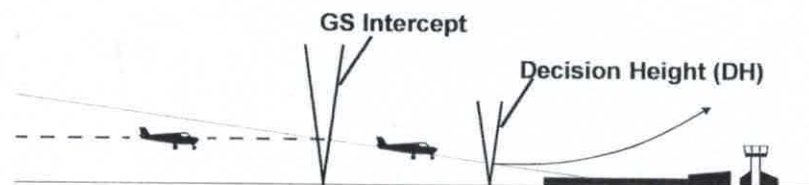


Fig. 3-15. Straight-In ILS Approach

3.2.2 ILS Approach with Procedure Turn

Execute a procedure turn intercept and track of the FRONT INBOUND LOC course (reference section 3.3.5) above the approach altitude, just until the aircraft is established on the FRONT INBOUND PROCEDURE TURN heading, with the heading mode still engaged. Establish the desired vertical descent speed, and then press the VS mode selector switch to engage the vertical speed mode. Upon reaching the approach altitude, press the ALT mode selector switch to engage the altitude hold mode. Press the NAV mode selector switch to engage the navigation approach mode, such that the autopilot will execute a straight-in intercept and track of the FRONT INBOUND LOC course (reference section 3.3.3). Execute a straight-in intercept and track of the glideslope (reference section 3.2.1).

3.3 Non-Precision Approach Procedures

3.3.1 Straight-In Back Course Approach

Select the LOC frequency on the Navigation Receiver.

Heading System HSI

Set Course Pointer to FRONT INBOUND LOC course on compass card.

Heading System DG

Set Heading Bug to BACK INBOUND LOC course on compass card.

Press the REV mode selector switch to engage the reverse approach mode. The REV and APR annunciators will appear as shown in Fig. 3-16, to acknowledge that this mode is engaged. The autopilot will intercept and track the BACK INBOUND LOC course. To ensure that it has sufficient overall authority, the autopilot will track this course in the CAP SOFT condition, which is acknowledged by the appearance of those respective annunciators as shown in Fig. 3-17. If the heading system is a DG, then the autopilot will fly the aircraft in the direction opposite to that of CDI needle deflection.

The REV annunciation will flash whenever CDI needle deflection exceeds 50%, or the NAV Flag is in view. In the latter event, the FAIL annunciation will also appear.

A summary pictorial of this procedure is shown in Fig. 3-18.

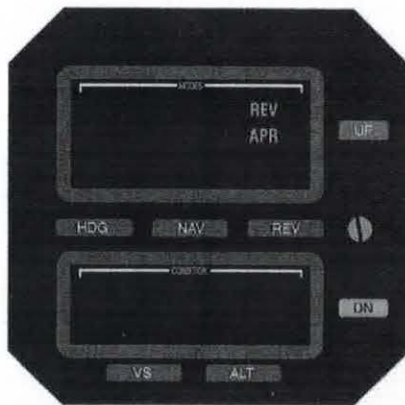
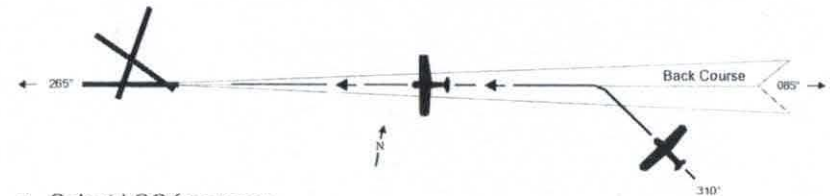


Fig. 3-16. AP Display, REV APR Mode Engaged, Before LOC Back Course Intercept



Fig. 3-17. AP Display, REV APR Mode Engaged, Track LOC Back Course Inbound



- Select LOC frequency.
- Heading System HSI
Set Course Pointer to FRONT INBOUND LOC course.
Heading System DG
Set Heading Bug to BACK INBOUND LOC course.
- Press REV mode selector switch to engage reverse approach mode.
- Intercept and track BACK INBOUND LOC course.

Fig. 3-18. Straight-In Back Course Approach

3.3.1.1 Pilot Selectable Intercept Angle

To select an intercept angle, set the Heading Bug to the desired intercept heading on the compass card, such that the difference between this heading and the BACK INBOUND LOC course is the intercept angle. If the heading system is an HSI, set the Course Pointer to the FRONT INBOUND LOC course on the compass card.

Press and hold the HDG mode selector switch, and then press the REV mode selector switch to engage the heading mode and arm the reverse approach mode. The HDG, REV, and APR annunciators will appear as shown in Fig. 3-19, to acknowledge this.

The autopilot will establish the aircraft on the selected intercept angle (heading), until it must turn the aircraft onto the BACK INBOUND LOC course to prevent overshoot. At that point in the intercept sequence, the HDG annunciation will extinguish to indicate engagement of the reverse approach mode. At the moment this occurs, if the heading system is a DG, immediately set the Heading Bug to the BACK INBOUND LOC course, in order to input a course error to the autopilot. Otherwise, the autopilot will lack sufficient authority to turn the aircraft onto the course.



Fig. 3-19. AP Display, HDG Mode Engaged, REV APR Mode Armed

3.3.2 Back Course Approach with Procedure Turn

Select the LOC frequency on the Navigation Receiver.

Heading System HSI

Set Course Pointer to FRONT INBOUND LOC course on compass card.

Heading System DG

Set Heading Bug to FRONT INBOUND LOC course on compass card.

Press the NAV mode selector switch to engage the navigation approach mode. The NAV and APR annunciators will appear as shown in Fig. 3-20, to acknowledge that this mode is engaged. The autopilot will intercept and track the BACK OUTBOUND LOC course. To ensure that it has sufficient overall authority, the autopilot will track this course in the CAP SOFT condition, which is acknowledged by the appearance of those respective annunciators as shown in Fig. 3-21.

At the appropriate time, set the Heading Bug to the BACK OUTBOUND PROCEDURE TURN heading, and then press the HDG mode selector switch to engage the heading mode. Hold this heading until the point at which it is time to turn the aircraft again. At that point, turn the Heading Bug in two successive 90° increments, to establish the aircraft on the BACK INBOUND PROCEDURE TURN heading.

Heading System HSI

Course Pointer remains unchanged on compass card.

Heading System DG

Set Heading Bug to BACK INBOUND LOC course on compass card.

Press the REV mode selector switch to engage the reverse approach mode. The REV and APR annunciators will appear as shown in Fig. 3-22, to acknowledge that this mode is engaged. The autopilot will intercept and track the BACK INBOUND LOC course. To ensure that it has sufficient overall authority, the autopilot will track this course in the CAP SOFT condition, which is acknowledged by the appearance of those respective annunciators as shown in Fig. 3-23. If the heading system is a DG, then the autopilot will fly the aircraft in the direction opposite to that of CDI needle deflection.

A summary pictorial of this procedure is shown in Fig. 3-24.

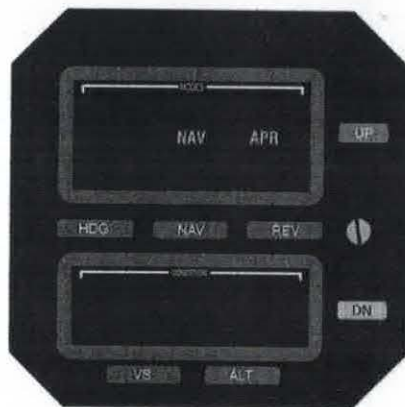


Fig. 3-20. AP Display, NAV APR Mode Engaged, Before LOC Back Course Intercept



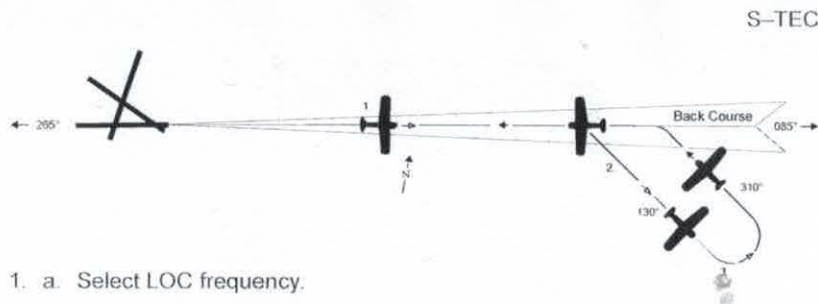
Fig. 3-21. AP Display, NAV APR Mode Engaged, Track LOC Back Course Outbound



Fig. 3-22. AP Display, REV APR Mode Engaged, Before LOC Back Course Intercept



Fig. 3-23. AP Display, REV APR Mode Engaged, Track LOC Back Course Inbound



1. a. Select LOC frequency.
b. Heading System HSI
Set Course Pointer to FRONT INBOUND LOC course.
Heading System DG
Set Heading Bug to FRONT INBOUND LOC course.
- c. Press NAV mode selector switch to engage navigation approach mode.
- d. Intercept and track BACK OUTBOUND LOC course.
2. a. At appropriate time, set Heading Bug to BACK OUTBOUND PROCEDURE TURN heading.
b. Press HDG mode selector switch to engage heading mode.
3. a. Turn Heading Bug in two successive 90° increments, to establish aircraft on BACK INBOUND PROCEDURE TURN heading.
b. Heading System HSI
Course Pointer remains unchanged.
Heading System DG
Set Heading Bug to BACK INBOUND LOC course.
- c. Press REV mode selector switch to engage reverse approach mode.
- d. Intercept and track BACK INBOUND LOC course.

Fig. 3-24. Back Course Approach with Procedure Turn

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3.3.3 Straight-In LOC Approach

Select the LOC frequency on the Navigation Receiver.

Heading System HSI

Set Course Pointer to FRONT INBOUND LOC course on compass card.

Heading System DG

Set Heading Bug to FRONT INBOUND LOC course on compass card.

Press the NAV mode selector switch to engage the navigation approach mode. The NAV and APR annunciators will appear as shown in Fig. 3-25, to acknowledge that this mode is engaged. The autopilot will intercept and track the FRONT INBOUND LOC course. To ensure that it has sufficient overall authority, the autopilot will track this course in the CAP SOFT condition, which is acknowledged by the appearance of those respective annunciators as shown in Fig. 3-26.

A summary pictorial of this procedure is shown in Fig. 3-27.



Fig. 3-25. AP Display, NAV APR Mode Engaged, Before LOC Front Course Intercept

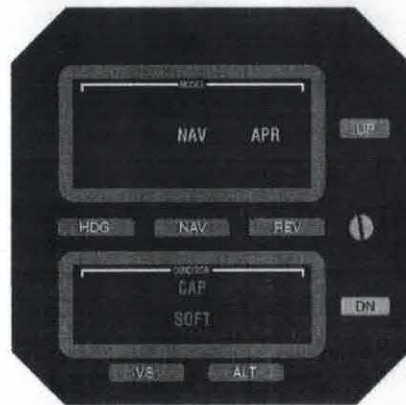
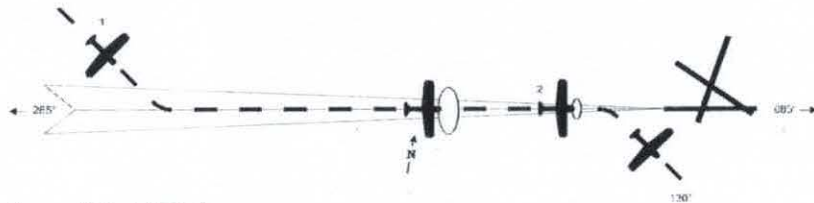


Fig. 3-26. AP Display, NAV APR Mode Engaged, Track LOC Front Course Inbound



1. a. Select LOC frequency.
- b. Heading System HSI
Set Course Pointer to FRONT INBOUND LOC course.
- Heading System DG
Set Heading Bug to FRONT INBOUND LOC course.
- c. Press NAV mode selector switch to engage navigation approach mode.
- d. Intercept and track FRONT INBOUND LOC course.
2. a. At middle marker, if missed approach is declared, disconnect autopilot.
- b. Stabilize aircraft.
- c. Set Heading Bug to missed approach heading.
- d. Press HDG mode selector switch to engage heading mode.

Fig. 3-27. Straight-In LOC Approach

3.3.4 Straight-In VOR Approach

Select the VOR frequency on the Navigation Receiver.

Heading System HSI

Set Course Pointer to FRONT INBOUND VOR course on compass card.

Heading System DG

Set Heading Bug and OBS to FRONT INBOUND VOR course on each respective compass card.

Press the NAV mode selector switch to engage the navigation mode. The NAV annunciation will appear as shown in Fig. 3-28, to acknowledge that this mode is engaged. The autopilot will intercept and track the FRONT INBOUND VOR course. It will track this course in the SOFT condition, which is acknowledged by the appearance of that annunciation and the extinguishment of the CAP annunciation, as shown in Fig. 3-29.

A summary pictorial of this procedure is shown in Fig. 3-30.



Fig. 3-28. AP Display, NAV Mode Engaged, Before VOR Front Course Intercept

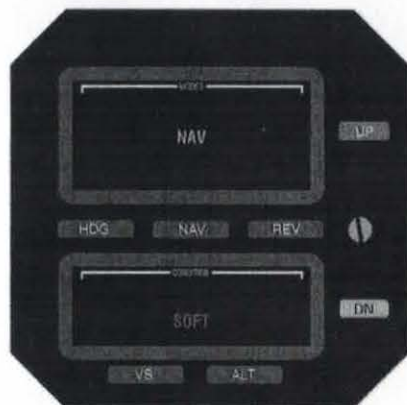
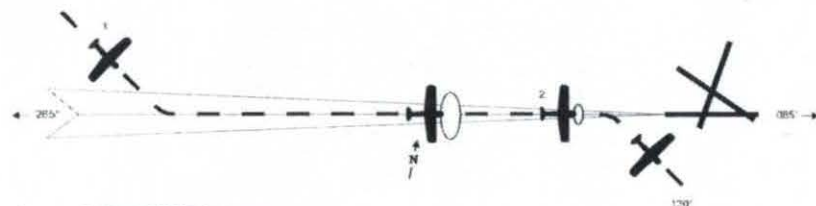


Fig. 3-29. AP Display, NAV Mode Engaged, Track VOR Front Course Inbound



1. a. Select VOR frequency.
- b. Heading System HSI
Set Course Pointer to FRONT INBOUND VOR course.
Heading System DG
Set Heading Bug and OBS to FRONT INBOUND VOR course.
- c. Press NAV mode selector switch to engage navigation mode.
- d. Intercept and track FRONT INBOUND VOR course.
2. a. At middle marker, if missed approach is declared, disconnect autopilot.
- b. Stabilize aircraft.
- c. Set Heading Bug to missed approach heading.
- d. Press HDG mode selector switch to engage heading mode.

Fig. 3-30. Straight-In VOR Approach



Fig. 3-31. AP Display, REV APR Mode Engaged, Before LOC Front Course Intercept



Fig. 3-32. AP Display, REV APR Mode Engaged, Track LOC Front Course Outbound

3.3.5 LOC Approach with Procedure Turn

Select the LOC frequency on the Navigation Receiver.

Heading System HSI

Set Course Pointer to FRONT INBOUND LOC course on compass card.

Heading System DG

Set Heading Bug to BACK INBOUND LOC course on compass card.

Press the REV mode selector switch to engage the reverse approach mode. The REV and APR annunciators will appear as shown in Fig. 3-31, to acknowledge that this mode is engaged. The autopilot will intercept and track the FRONT OUTBOUND LOC course. To ensure that it has sufficient overall authority, the autopilot will track this course in the CAP SOFT condition, which is acknowledged by the appearance of those respective annunciators as shown in Fig. 3-32. If the heading system is a DG, then the autopilot will fly the aircraft in the direction opposite to that of CDI needle deflection.

At the appropriate time, set the Heading Bug to the FRONT OUTBOUND PROCEDURE TURN heading, and then press the HDG mode selector switch to engage the heading mode. Hold this heading until the point at which it is time to turn the aircraft again. At that point, turn the Heading Bug in two successive 90° increments, to establish the aircraft on the FRONT INBOUND PROCEDURE TURN heading.

Heading System HSI

Course Pointer remains unchanged on compass card.

Heading System DG

Set Heading Bug to FRONT INBOUND LOC course on compass card.

Press the NAV mode selector switch to engage the navigation approach mode. The NAV and APR annunciators will appear as shown in Fig. 3-33, to acknowledge that this mode is engaged. The autopilot will intercept and track the FRONT INBOUND LOC course. To ensure that it has sufficient overall authority, the autopilot will track this course in the CAP SOFT condition, which is acknowledged by the appearance of those respective annunciators as shown in Fig. 3-34.

A summary pictorial of this procedure is shown in Fig. 3-35.



Fig. 3-33. AP Display, NAV APR Mode Engaged, Before LOC Front Course Intercept



Fig. 3-34. AP Display, NAV APR Mode Engaged, Track LOC Front Course Inbound

- Fig. 3-35. LOC Approach with Procedure Turn**

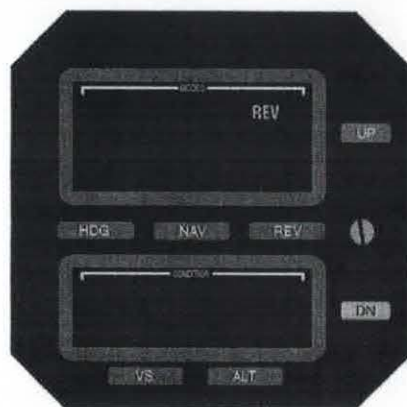


Fig. 3-36. AP Display, REV Mode Engaged, Before VOR Front Course Intercept



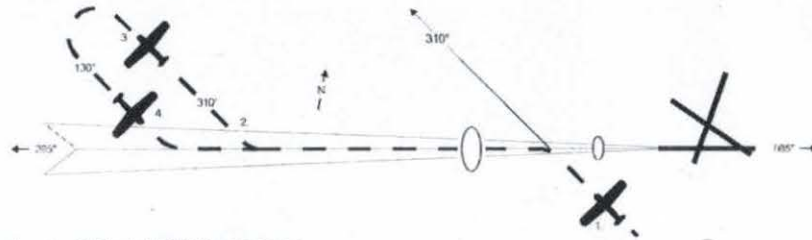
Fig. 3-37. AP Display, REV Mode Engaged, Track VOR Front Course Outbound



Fig. 3-38. AP Display, NAV Mode Engaged, Before VOR Front Course Intercept



Fig. 3-39. AP Display, NAV Mode Engaged, Track VOR Front Course Inbound



1. a. Select VOR frequency.
- b. Heading System HSI
Set Course Pointer to FRONT INBOUND VOR course.
Heading System DG
Set Heading Bug and OBS to BACK INBOUND VOR course.
- c. Press REV mode selector switch to engage reverse mode.
- d. Intercept and track FRONT OUTBOUND VOR course.
2. a. At appropriate time, set Heading Bug to FRONT OUTBOUND PROCEDURE TURN heading.
- b. Press HDG mode selector switch to engage heading mode.
3. a. Turn Heading Bug in two successive 90° increments, to establish aircraft on FRONT INBOUND PROCEDURE TURN heading.
4. a. Heading System HSI
Course Pointer remains unchanged.
Heading System DG
Set Heading Bug and OBS to FRONT INBOUND VOR course.
- b. Press NAV mode selector switch to engage navigation mode.
- c. Intercept and track FRONT INBOUND VOR course.
- d. At middle marker, if missed approach is declared, disconnect autopilot.
- e. Stabilize aircraft.
- f. Set Heading Bug to missed approach heading.
- g. Press HDG mode selector switch to engage heading mode.

Fig. 3-40. VOR Approach with Procedure Turn

3.4 Flight Director Operation

The optional Flight Director (FD) is a display of the flight profile. It is commanded by the autopilot. A pair of Steering Command Bars and an Aircraft Reference Symbol (ARS) are the principal FD components of interest. The position of the Steering Command Bars can be adjusted by the pilot, using the Parallax Adjustment shown in Fig. 3-41. The FD operates in either the FD/AP mode or the FD mode.



Fig. 3-41. FD Parallax Adjustment

3.4.1 FD/AP Mode

Set the Autopilot (AP) Master Switch to the ON position, as shown in Fig. 3-42. The position of the FD Master Switch does not matter. The FD annunciation will appear as shown in Fig. 3-43, to acknowledge that the FD is powered-up. Engage a roll mode (HDG, NAV, NAV APR, REV, REV APR) and a pitch mode (ALT HOLD, VS, GS). The autopilot will steer the aircraft toward the Steering Command Bars, until the ARS is tucked into them. The FD provides a visual indication of how accurately the autopilot is tracking its own roll and pitch commands. A typical view of the FD with the FD/AP mode engaged is shown in Fig. 3-44.

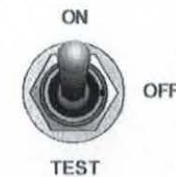


Fig. 3-42. AP Master Switch in ON Position

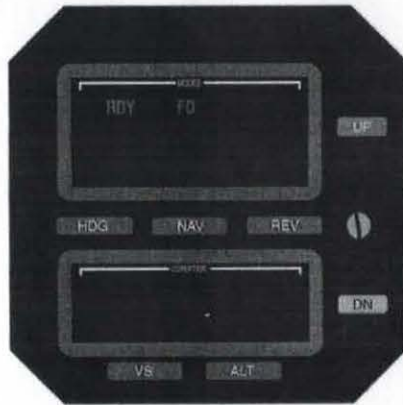


Fig. 3-43. AP Display, FD Powered-Up

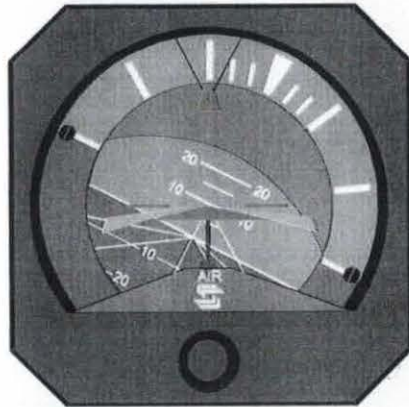


Fig. 3-44. FD Display, FD/AP Mode Engaged

3.4.2 FD Mode

With a roll mode (HDG, NAV, NAV APR, REV, REV APR) and a pitch mode (ALT HOLD, VS, GS) engaged, set the FD Master Switch to the ON position, as shown in Fig. 3-45. Set the AP Master Switch to the OFF position, as shown in Fig. 3-46. This disengages both the roll servo and pitch servo, although the previously engaged roll mode and pitch mode annunciations will still appear on the AP display, along with the FD annunciation. The pilot must steer the aircraft toward the Steering Command Bars, until the ARS is tucked into them. The FD provides a visual indication of how accurately the pilot is tracking the autopilot's roll and pitch commands. A typical view of the FD with the FD mode engaged is shown in Fig. 3-47.



Fig. 3-45. FD Master Switch in ON Position



Fig. 3-46. AP Master Switch in OFF Position

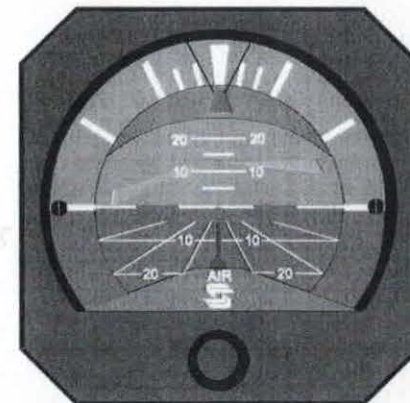


Fig. 3-47. FD Display, FD Mode Engaged

3.5 Yaw Damper Operation

The optional Yaw Damper serves to dampen excessive adverse yaw. It operates in either the AUTO mode or ON mode, depending upon the position of the Yaw Damper Master Switch shown in Fig. 3-48.



Fig. 3-48. Yaw Damper Master Switch

The Yaw Damper Trim Knob, shown in Fig. 3-49, is used to center the slip/skid ball when the yaw servo is engaged.

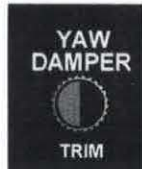


Fig. 3-49. Yaw Damper Trim Knob

3.5.1 AUTO Mode

With the Yaw Damper Master Switch in the AUTO position, the yaw servo will become automatically engaged whenever a roll mode (HDG, NAV, NAV APR, REV, REV APR) is engaged.

3.5.2 ON Mode

With the Yaw Damper Master Switch in the ON position, the yaw servo will be engaged at all times, entirely independent of autopilot operation.

3.5.3 Yaw Damper Trim

With the yaw servo engaged, rotate the Yaw Damper Trim Knob to center the slip/skid ball.

3.6 Autopilot Disconnect

The autopilot can be disconnected by any of the following means:

1. Press AP DISC / TRIM INTR Switch typically located on Control Wheel.
2. Press either forward or aft on both segments of Manual Electric Trim Switch located on Control Wheel, whenever a pitch mode (ALT HOLD, VS, GS) is engaged.
3. Set AP Master Switch to OFF position.
4. Pull AP Circuit Breaker.

3.7 Automatic Trim Disable

In the event of a trim runaway, the automatic trim function can be disabled by executing the following sequence:

1. Press/Hold AP DISC / TRIM INTR Switch typically located on Control Wheel.
2. Set Trim Master Switch to OFF position.
3. Pull Trim Circuit Breaker.

SECTION 4 OPERATING PARAMETERS

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4.1 Roll Axis Limits

Turn Rate

Piston A/C:

90% Standard Rate Turn (HDG, NAV, NAV APR, REV, REV APR Modes)

Turboprop A/C:

75% Standard Rate Turn (HDG, NAV, NAV APR, REV, REV APR Modes)

All A/C:

4.2 Pitch Axis Limits

Altitude

32,000 FT

Vertical Force Due to Acceleration

0.60 g

Vertical Speed

1600 FPM Climbing or Descending

Modes

A pitch mode (ALT HOLD, VS, GS) can only be engaged after a roll mode (HDG, NAV, NAV APR, REV, REV APR) has been engaged.

SECTION 5 GLOSSARY

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GLOSSARY

Term	Meaning
A/C	Aircraft
ADJ	Adjustment
ALT	Altitude
AP	Autopilot
APR	Approach
ARS	Aircraft Reference Symbol
CAP	Capture
CCW	Counter-Clockwise
CDI	Course Deviation Indication
CRS	Course
CW	Clockwise
DG	Directional Gyro
DH	Decision Height
DISC	Disconnect
DSABL	Disable
FAA	Federal Aviation Administration
FD	Flight Director
FPM	Feet-per-Minute
FT	Feet
GA	Go Around
GDI	Glideslope Deviation Indication
GS	Glideslope
HDG	Heading
HSI	Horizontal Situation Indicator
IFR	Instrument Flight Rules
ILS	Instrument Landing System
INTR	Interrupt
KTS	Knots
LOC	Localizer
MAP	Missed Approach Point
NAV	Navigation
NM	Nautical Miles
OBS	Omnibearing Selector
PFGC	Pitch Flight Guidance Computer
PLX	Parallax
PN	Part Number
POH	Pilot's Operating Handbook
RDY	Ready
REV	Reverse
RFGC	Roll Flight Guidance Computer
SEL	Selector
VMC	Visual Meteorological Conditions
VOR	Very High Frequency Omnidirectional Radio Range
VS	Vertical Speed
YD	Yaw Damper

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Page 3 of 3

Pilot's Operating Handbook

GPSS



List of Effective Pages

* Asterisk indicates pages changed, added, or deleted by current revision.

Record of Revisions

Retain this record in front of handbook. Upon receipt of a revision, insert changes and complete table below.

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SECTION 1 OVERVIEW

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1.1 Document Organization

Section 1 Overview

Section 2 Pre-Flight Procedures

Section 3 In-Flight Procedures

Section 4 Operating Parameters

Section 5 Glossary

1.2 Purpose

This Pilot's Operating Handbook (POH) provides Pre-Flight and In-Flight operating procedures for the S-TEC ST-901 Global Positioning System Steering (GPSS) Converter.

Note:

This POH must be carried in the A/C and made available to the pilot at all times. It can only be used in conjunction with the Federal Aviation Administration (FAA) approved Aircraft Flight Manual (AFM) or Aircraft Flight Manual Supplement (AFMS). Refer to the applicable AFM or AFMS for A/C specific information, such as unique ground tests, limitations, and emergency procedures.

Note:

The GPSS Converter is a tool provided to aircraft owners, that serves to assist them with cockpit workload management. The ability of the GPSS Converter to provide optimum assistance and performance is directly proportional to the pilot's knowledge of its operating procedures. Therefore, it is highly recommended that the pilot develop a thorough understanding of the GPSS Converter and its operating procedures in Visual Meteorological Conditions (VMC), prior to using it under Instrument Flight Rules (IFR).

1.3 General Control Theory

The GPSS Converter can be used with the following S-TEC autopilots:

System Twenty / Thirty

System Forty / Fifty

System Fifty Five

System Sixty Two

System Sixty Five

It has the following modes of operation:

HDG Mode - Used to turn onto a Selected Heading and Hold it

GPSS Mode - Used to Laterally Steer along a Course defined by Waypoints, that have been programmed into the GPS Navigator

Pressing the HDG / GPSS Selector Switch will alternately engage the HDG mode and GPSS mode. This switch is shown in Fig. 1-1. As indicated, when the HDG mode is engaged, the HDG lamp is illuminated and the GPSS lamp is extinguished, but when the GPSS mode is engaged, the GPSS lamp is illuminated and the HDG lamp is extinguished.

The GPSS Converter is internally configured to be compatible with the particular AC or DC Heading System installed in the aircraft, be it a Directional Gyro (DG) or Horizontal Situation Indicator (HSI). The output of the Heading System will be either an AC or DC Heading Error Signal. When the GPSS Converter's HDG mode is engaged, the GPSS Converter processes the AC or DC Heading Error Signal at its input, to produce a proportional DC Heading Error Signal at its output. This signal is sent to the input of the autopilot's heading error channel. When the autopilot's HDG mode is also engaged, the autopilot will turn the aircraft onto the selected heading and hold it.

The GPS Navigator is programmed with a sequence of waypoints, as a means to define a course. This course is realized at the output of the GPS Navigator in the form of two digital signals, the Bank Angle Signal and Ground Speed Signal. When the GPSS Converter's GPSS mode is engaged, the GPSS Converter processes the Bank Angle Signal and Ground Speed Signal at its input, to produce a DC Turn Rate Signal at its output. This signal is sent to the input of the autopilot's heading error channel. When the autopilot's HDG mode is also engaged, the autopilot will laterally steer the aircraft along the course defined by the waypoints.

1.4 Block Diagram

The GPSS Converter Block Diagram is shown in Fig. 1-2.



a. HDG Mode Engaged



b. GPSS Mode Engaged

Fig. 1-1. HDG / GPSS Selector Switch

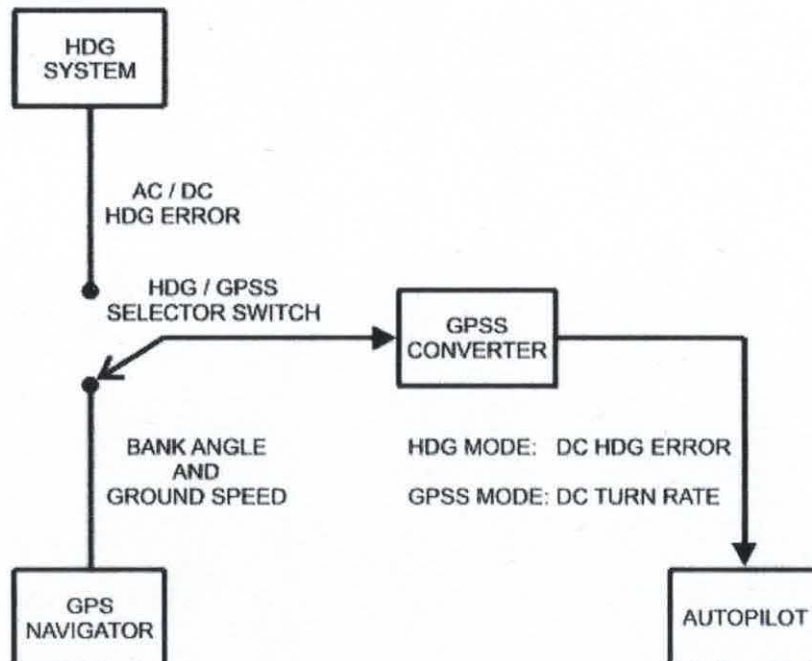


Fig. 1-2. ST-901 GPSS Converter Block Diagram

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SECTION 2 PRE-FLIGHT PROCEDURES

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2.1 Pre-Flight Test

Prior to takeoff and with engine running, perform the actions shown in Table 2-1. For each action, verify the corresponding response where applicable.

Table 2-1. Pre-Flight Test (continued on page 2-4)

ACTION	RESPONSE
1. Set Battery Master Switch to ON position.	-----
2. Set Avionics Master Switch to ON position.	-----
3. Set Autopilot Master Switch to ON position.	HDG lamp is illuminated and GPSS lamp is extinguished on HDG / GPSS Selector Switch, as an indication that GPSS Converter's HDG mode is engaged. This is shown in Fig. 2-1a.
4. Set Heading Bug under Lubber Line.	-----
5. Engage autopilot's HDG mode.	-----
6. Turn Heading Bug to the left side of Lubber Line.	A/C Control Wheel turns to the left.
7. Turn Heading Bug to the right side of Lubber Line.	A/C Control Wheel turns to the right.
8. Set Heading Bug under Lubber Line.	A/C Control Wheel stops.
9. Program GPS Navigator with a valid waypoint.	-----

Table 2-1. Pre-Flight Test (continued from page 2-3)

ACTION	RESPONSE
10. Press HDG / GPSS Selector Switch.	GPSS lamp is illuminated and HDG lamp is extinguished on HDG / GPSS Selector Switch, as an indication that GPSS Converter's GPSS mode is engaged. This is shown in Fig. 2-1b.
11. Turn Heading Bug to the left side and right side of Lubber Line.	A/C Control Wheel does not respond.
<i>Note: The GPSS mode cannot be tested since there is no groundspeed.</i>	
12. Disconnect autopilot.	-----



a. HDG Mode Engaged



b. GPSS Mode Engaged

Fig. 2-1. HDG / GPSS Selector Switch

SECTION 3 IN-FLIGHT PROCEDURES

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3.1 Normal Operating Procedures

3.1.1 Heading (HDG) Mode

Set the Heading Bug to the desired heading on the compass card (HSI or DG).

Engage the GPSS Converter's HDG mode.

Engage the autopilot's HDG mode.

The autopilot will turn the aircraft onto the selected heading and hold it. The turn rate will be limited to 90% of a standard rate turn, although for some higher performance (turboprop) aircraft this is 75%.

A new heading can be subsequently selected by setting the Heading Bug to it.

3.1.2 Global Positioning System Steering (GPSS) Mode

Set the Heading Bug under the Lubber Line.

Engage the GPSS Converter's HDG mode.

Engage the autopilot's HDG mode.

Program the GPS Navigator with a sequence of waypoints, as a means to define the desired course.

Engage the GPSS Converter's GPSS mode.

The autopilot will begin to laterally steer the aircraft along the course (i.e., track the course).

The turn rate will be limited to 90% of a standard rate turn, although for some higher performance (turboprop) aircraft this is 75%.

If it should happen that the GPS Navigator has not been programmed with a sequence of waypoints upon attempted engagement of the GPSS mode, then the autopilot will hold the aircraft at wings level, and the GPSS lamp will flash on the HDG / GPSS Selector Switch to acknowledge this condition.

Engaging any autopilot roll mode other than HDG (i.e., NAV, APR, REV, STB, LO TRK, HI TRK) will decouple the autopilot from the GPSS mode.

With the GPSS mode engaged, the autopilot will not respond to the Heading Bug or Course Pointer.

Note:

It is not possible to simultaneously engage the HDG mode and arm the GPSS mode. Consequently, there does not exist the capability to execute a dual mode, pilot selectable intercept angle of the course.

3.2 Approach Procedures

3.2.1 Standard Approach

Set the Heading Bug under the Lubber Line.

Engage the GPSS Converter's HDG mode.

Engage the autopilot's HDG mode.

Program the GPS Navigator with the desired approach.

Engage the GPSS Converter's GPSS mode.

The autopilot will begin tracking to the Initial Approach Fix (IAF).

To execute any required procedure turn or holding pattern, proceed as follows:

1. Engage the GPSS Converter's HDG mode.
2. Lead the aircraft around the procedure turn or holding pattern using the Heading Bug.
3. Once established on the inbound course, engage the GPSS Converter's GPSS mode.
4. Complete the approach.

3.2.2 GPS Overlay of VOR / DME-A Approach

Refer to Fig. 3-1.

3.2.3 GPS-T Approach

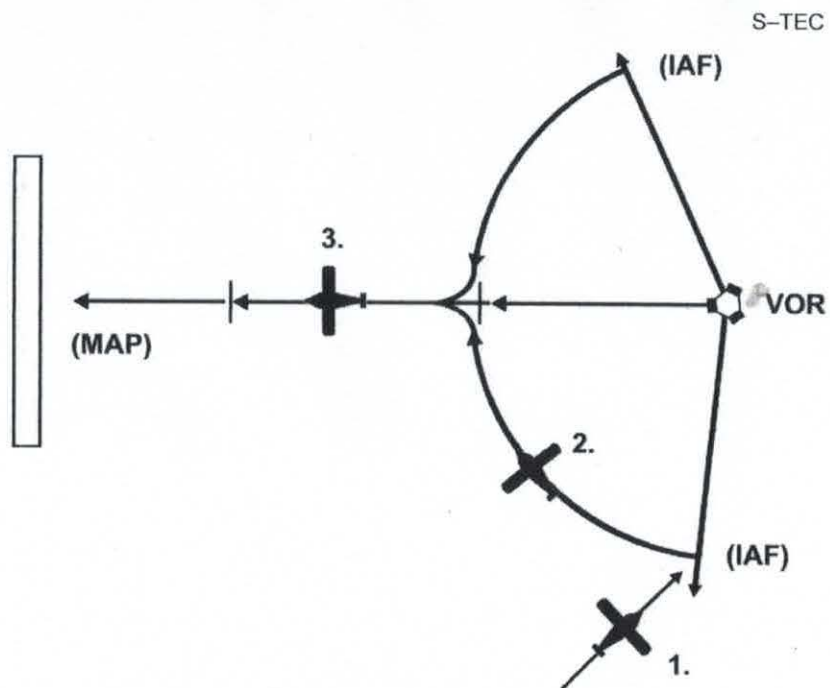
Refer to Fig. 3-2.

3.2.4 GPS Approach with Holding Pattern

Refer to Fig. 3-3.

3.2.5 GPS Overlay of VOR Approach with Procedure Turn

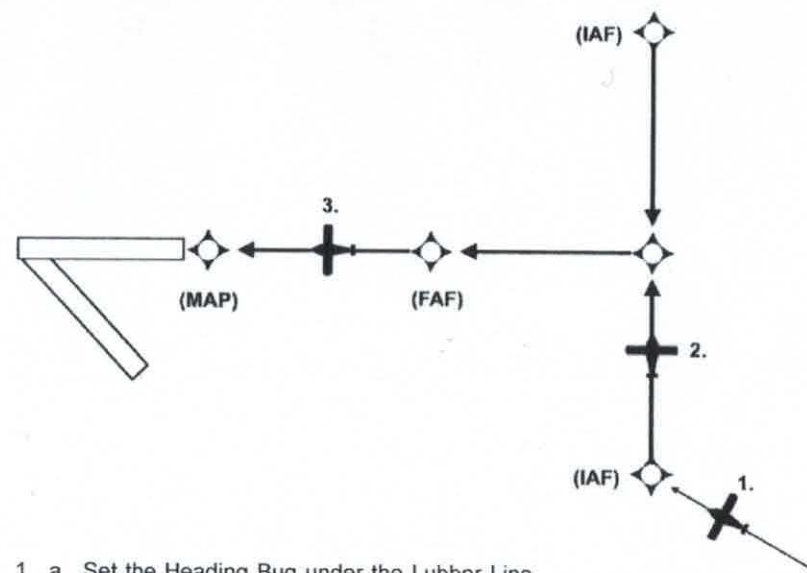
Refer to Fig. 3-4.



1. a. Set the Heading Bug under the Lubber Line.
b. Engage the GPSS Converter's HDG mode.
c. Engage the autopilot's HDG mode.
d. Program the GPS Navigator with the desired approach.
e. Engage the GPSS Converter's GPSS mode.
f. The autopilot begins tracking to the Initial Approach Fix (IAF).
2. a. The autopilot intercepts the IAF, and then tracks around the arc.
3. a. The autopilot becomes established on the inbound course.
b. At the Missed Approach Point (MAP), disconnect the autopilot for a landing or go-around, as required.

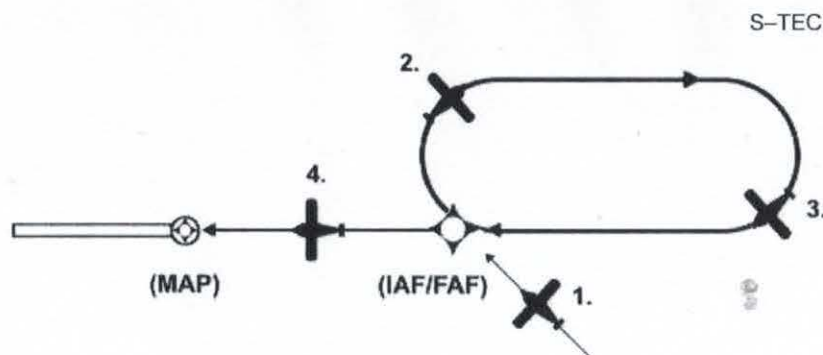
Fig. 3-1. GPS Overlay of VOR / DME-A Approach

S-TEC



1. a. Set the Heading Bug under the Lubber Line.
b. Engage the GPSS Converter's HDG mode.
c. Engage the autopilot's HDG mode.
d. Program the GPS Navigator with the desired approach.
e. Engage the GPSS Converter's GPSS mode.
f. The autopilot begins tracking to the Initial Approach Fix (IAF).
2. a. The autopilot intercepts the IAF, then makes a 90° turn, and begins tracking to the Final Approach Fix (FAF).
3. a. The autopilot becomes established on the inbound course.
b. At the Missed Approach Point (MAP), disconnect the autopilot for a landing or go-around, as required.

Fig. 3-2. GPS-T Approach



1. a. Set the Heading Bug under the Lubber Line.
- b. Engage the GPSS Converter's HDG mode.
- c. Engage the autopilot's HDG mode.
- d. Program the GPS Navigator with the desired approach.
- e. Engage the GPSS Converter's GPSS mode.
- f. The autopilot begins tracking to the Initial Approach Fix (IAF).

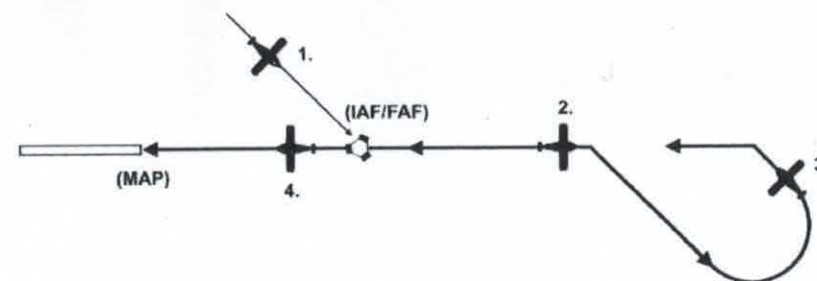
Note:

Perform steps 2-3 only for those GPS Navigators that do not have the capability to execute a holding pattern.

2. a. Engage the GPSS Converter's HDG mode.
- b. Lead the aircraft around the outbound leg of the holding pattern in 90° increments, using the Heading Bug.
3. a. Engage the GPSS Converter's GPSS mode.
- b. The autopilot begins tracking to the Final Approach Fix (FAF).
4. a. The autopilot becomes established on the inbound course.
- b. At the Missed Approach Point (MAP), disconnect the autopilot for a landing or go-around, as required.

Fig. 3-3. GPS Approach with Holding Pattern

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1. a. Set the Heading Bug under the Lubber Line.
- b. Engage the GPSS Converter's HDG mode.
- c. Engage the autopilot's HDG mode.
- d. Program the GPS Navigator with the desired approach.
- e. Engage the GPSS Converter's GPSS mode.
- f. The autopilot begins tracking to the Initial Approach Fix (IAF).

Note:

Perform steps 2-3 only for those GPS Navigators that do not have the capability to execute a procedure turn.

2. a. Engage the GPSS Converter's HDG mode.
- b. Lead the aircraft around the procedure turn in 90° increments, using the Heading Bug.
3. a. Engage the GPSS Converter's GPSS mode.
- b. The autopilot begins tracking to the Final Approach Fix (FAF).
4. a. The autopilot becomes established on the inbound course.
- b. At the Missed Approach Point (MAP), disconnect the autopilot for a landing or go-around, as required.

Fig. 3-4. GPS Overlay of VOR Approach with Procedure Turn

3.3 Emergency Procedures

In the event of a GPSS Converter malfunction, proceed as follows:

1. Disconnect the autopilot.
2. Regain control of the aircraft.
3. **Do Not** attempt to use the GPSS Converter's HDG mode or GPSS mode.
4. **Do Not** attempt to use the autopilot's HDG mode.

Note:

It may be possible to use other autopilot roll modes (i.e., NAV, APR, REV, STB, LO TRK, HI TRK).

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SECTION 4 OPERATING PARAMETERS

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4.1 Roll Axis LimitsTurn Rate

Piston A/C:

90% Standard Rate Turn

Turboprop A/C:

75% Standard Rate Turn

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SECTION 5 GLOSSARY

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Term	Meaning
AC	Alternating Current
A/C	Aircraft
AFM	Aircraft Flight Manual
AFMS	Aircraft Flight Manual Supplement
APR	Approach
DC	Direct Current
DG	Directional Gyro
DME	Distance Measuring Equipment
FAA	Federal Aviation Administration
FAF	Final Approach Fix
GPS	Global Positioning System
GPSS	Global Positioning System Steering
HDG	Heading
HI TRK	High Track
HSI	Horizontal Situation Indicator
IAF	Initial Approach Fix
IFR	Instrument Flight Rules
LO TRK	Low Track
MAP	Missed Approach Point
NAV	Navigation
POH	Pilot's Operating Handbook
REV	Reverse
STB	Stabilizer
VMC	Visual Meteorological Conditions
VOR	Very High Frequency Omnidirectional Radio Range

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CESSNA R172K:- VH-YPM
Serial No: -R1723306**Approved Supplement****Flight Manual Supplement****For****Operations with Garmin GTN 650 system****In the CESSNA R172K****VH-YPM, Serial number R1723306**

This Supplement is to be inserted into the Flight Manual when the aircraft is modified by installation of Garmin GTN 650 GPS/SBAS Navigation System in accordance with **AMARDC** EI 8348.

NOTE: This system conforms to TSO 145/146.

This Supplement describes the capabilities of the system as installed in accordance with **AMARDC** EI 8348. Operators must be aware that some of the capabilities of the system may be degraded or non-operational in Australia and other countries due to the lack of suitable data or that the particular option is not installed.

The information contained herein supplements the information of the Basic Flight Manual. For limitations, procedures and performance data not contained in this Supplement, refer to the Basic Flight Manual.

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CESSNA R172K:- VH-YPM
Serial No: -R1723306**Approved Supplement****Flight Manual Supplement****For****Operations with Garmin GTN 650 system****In the CESSNA R172K****VH-YPM, Serial number R1723306****Log of Pages**

Page	Revision	Date
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3	0	22-May-13
4	0	22-May-13
5	0	22-May-13
6	0	22-May-13
7	0	22-May-13
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13	0	22-May-13
14	0	22-May-13
15	0	22-May-13
16	0	22-May-13
17	0	22-May-13

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CESSNA R172K:- VH-YPM

Serial No: -R1723306

Approved Supplement

SECTION 1 - General

1.1 This Supplement specifies the limitations and procedures for operations with the Garmin GTN 650 GPS/NAV system installed.

The GTN 650 System is a GPS system with a Satellite Based Augmentation System (SBAS), comprised of a Garmin TSO-C146c GTN 650, navigator and a Garmin approved GPS/SBAS antenna. The GTN navigation system is installed in accordance with AC 20-138A.

GTN system functions are shown in Table 1.

GPS SBAS Navigation:	
• Oceanic, enroute, terminal, and non-precision approach guidance	X
• Precision approach guidance (LP, LPV)	
VHF Com Radio, 118.00 to 136.990, MHz, 8.33 or 25 kHz increments	X
VHF Nav Radio, 108.00 to 117.95 MHz, 50 kHz increments	X
LOC and Glideslope non-precision and precision approach guidance for Cat 1 minimums, 328.6 to 335.4 MHz tuning range	X
Moving map including topographic, terrain, aviation, and geopolitical data	X
Display of datalink weather products, SiriusXM, FIS-B, Connex (all optional)	X
Control and display of airborne weather radar (optional)	
Display of terminal procedures data (optional)	
Display of traffic data, including ADS-B (optional)	X
Display of StormScope® data (optional)	X
Display of marker beacon annunciators (optional)	
Remote audio panel control (optional)	
Remote transponder control (optional)	X
Remote audio entertainment datalink control (optional)	X
TSO-C151b Class B TAWS (optional)	X
Supplemental calculators and timers	X
Control of GSR 56 Iridium Satellite Phone and SMS Text	X

Table 1 – GTN 650 Functions

CESSNA R172K:- VH-YPM

Serial No: -R1723306

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The GPS navigation functions and optional VHF communication and navigation radio functions are operated by dedicated hard keys, a dual concentric rotary knob, or the touchscreen.

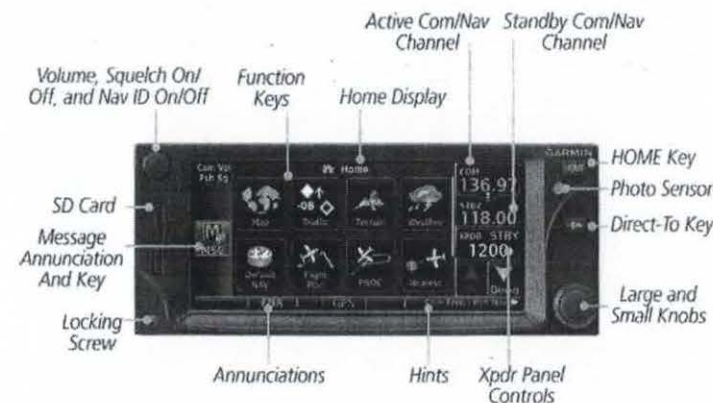


Figure 1 - GTN 650 Control and Display Layout

The GPS navigation functions and optional VHF communication and navigation radio functions are operated by dedicated hard keys, a dual concentric rotary knob, or the touchscreen.

1.2 The GTN system and associated navigation interface in this aircraft have the following capabilities, in addition to the core multifunction display capability:

VHF Communication Radio
 Primary VHF Navigation
 Primary GPS Navigation (Enroute) and Approach Capability (LP/LNAV) – See below

GPS/SBAS TSO-C146c Class 3 Operation

The GTN complies with AC 20-138A and has airworthiness approval for navigation using GPS and SBAS (within the coverage of a Satellite Based Augmentation System complying with ICAO Annex 10) for IFR en route,

CESSNA R172K:- VH-YPM

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terminal area, and non-precision approach operations (including those approaches titled "GPS", "or GPS", and "RNAV (GPS)" approaches). The Garmin GNSS navigation system is composed of the GTN navigator and antenna, and is approved for approach procedures with vertical guidance including "LPV" and "LNAV/VNAV" and without vertical guidance including "LP" and "LNAV," within the U.S. National Airspace System.

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-105 and meets the equipment performance and functional requirements to conduct RNP terminal departure and arrival procedures and RNP approach procedures without RF (radius to fix) legs. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-100A for RNAV 2 and RNAV 1 operations. In accordance with AC 90-100A, Part 91 operators (except subpart K) following the aircraft and training guidance in AC 90-100A are authorized to fly RNAV 2 and RNAV 1 procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

The Garmin GNSS navigation system has been found to comply with the navigation requirements for GPS Class II oceanic and remote navigation (RNP-4) in accordance with AC 20-138A and FAA Order 8400.33. The Garmin GNSS navigation system can be used without reliance on other long-range navigation systems. Additional equipment may be required to obtain operational approval to utilize RNP-4 performance. This does not constitute an operational approval.

The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for P-RNAV operations in accordance with JAA Administrative & Guidance Material Section One: General Part 3: Temporary Guidance Leaflets, Leaflet No 10 (JAA TGL-10 Rev 1). The GNSS navigation system has one or more TSO-C146c Class 3 approved Garmin GTN Navigation Systems. The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system

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functions required for B-RNAV operations in accordance with EASA AMC 20-4. The Garmin GNSS navigation system complies with the equipment requirements for P-RNAV and B-RNAV/RNAV-5 operations in accordance with AC 90-96A CHG 1. This does not constitute an operational approval.

Garmin International holds an FAA Type 2 Letter of Acceptance (LOA) in accordance with AC20-153 for database integrity, quality, and database management practices for the navigation database. Flight crew and operators can view the LOA status at FlyGarmin.com then select "Type 2 LOA Status."

Navigation information is referenced to the WGS-84 reference system.

Note that for some types of aircraft operation and for operation in non-U.S. airspace, separate operational approval(s) may be required in addition to equipment installation and airworthiness approval.

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1.3 Definitions

The following terminology is used in this document :-

ADF: Automatic Direction Finder	LPV: Localizer Performance with Vertical Guidance
ADS-B: Automatic Dependent Surveillance Broadcast	MLS: Microwave Landing System
AEG: Aircraft Evaluation Group (FAA)	NOTAM: Notice to Airmen
APR: Approach	OBS: Omnibearing Select
CDI: Course Deviation Indicator	RAIM: Receiver Autonomous Integrity Monitoring
DME: Distance Measuring Equipment	RMT: Remote
EFB: Electronic Flight Bag	RNAV: Area Navigation
EHSI: Electronic Horizontal Situation Indicator	RNP: Required Navigational Performance
FIS-B: Flight Information Services Broadcast	SBAS: Satellite Based Augmentation System
GNSS: Global Navigation Satellite System	SD: Secure Digital
GPS: Global Positioning System	SDF: Simplified Directional Facility
GPSS: GPS Roll Steering	SUSP: Suspend
GTN: Garmin Touchscreen Navigator	TACAN: Tactical Air Navigation System
HSI: Horizontal Situation Indicator	TAS: Traffic Awareness System
IAP: Instrument Approach Procedure	TAWS: Terrain Awareness and Warning System
IFR: Instrument Flight Rules	TCAS: Traffic Collision Avoidance System
ILS: Instrument Landing System	TFR: Temporary Flight Restriction
IMC: Instrument Meteorological Conditions	TIS: Traffic Information Service
LDA: Localizer Directional Aid	VHF: Very High Frequency
LNAV: Lateral Navigation	VFR: Visual Flight Rules
LNAV+V: Lateral Navigation with advisory Vertical Guidance	VLOC: VOR/Localizer
L/NAV: Lateral/Vertical Navigation	VMC: Visual Meteorological Conditions
LOC: Localizer	VOR: VHF Omnidirectional Range
LOC-BC: Localizer Backcourse	WAAS: Wide Area Augmentation System
LP: Localizer Performance	WFDE: WAAS Fault Data Exclusion

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SECTION 2 - Limitations

2.1 General

The Garmin GTN 650 Cockpit Reference Guide, P/N 190-01004-04 Rev C (or later revisions), *must* be immediately available to the flight crew whenever navigation is predicated on the use of the GTN.

The Pilot's Guide P/N 190-01004-03 Rev C does not need to be immediately available to the flight crews.

This Supplement does not grant approval for IFR operations where the aircraft is limited to VFR operations.

The GTN 650 must interface with a fully functional HSI in order to be used for primary navigation during IFR operations.

2.2 Flight planning

For flight planning purposes, in areas where SBAS coverage is not available, the flight crew must check RAIM availability. For operations within Australia this may be accomplished by using the Garmin WFDE Prediction program.

This RAIM availability requirement is not necessary if SBAS coverage is confirmed to be available along the entire route of the flight. The route planning and WFDE prediction program may be downloaded from the Garmin website on the internet. For information on using the WFDE Prediction program refer to Garmin WAAS Prediction program P/N 190-00643-01.

Whenever possible the RNP and RNAV routes, including Standard Instrument Departures (SIDs), standard Terminal Arrival (STAR) and enroute RNAV "Q" and RNAV "T" routes should be loaded into the flight plan from the database in their entirety, rather than loading route waypoints from the data base into the flight plan individually. Selecting and inserting individual named fixes from the database is permitted, provided all fixes along the published route to be flown are inserted. Manual entry of waypoints using latitude/longitude or place /bearing is prohibited. It is not acceptable to flight plan a required alternate airport based on RNAV (GPS) LP/LPV or LNAV/VNAV approach minimums. The required alternate airport must be flight planned using an LNAV approach minimums or available ground-based approach aid.

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Navigation information is referenced to the WGS-84 reference system, and should only be used where the Aeronautical Information Publication (including electronic data and aeronautical charts) conform to WGS-84 or equivalent.

The HSI display is the only approved sources of course guidance. The moving map and CDI depiction on the GTN display are for situational awareness only and are not approved for course guidance.

2.3 Applicable System software

This AFMS/AFM is applicable to the software versions shown in Table 2.

The Main and GPS software versions are displayed on the start-up page immediately after power-on. All software versions displayed in Table 2 can be viewed on the System – System Status page.

Software Item	Software Version (or later FAA Approved versions for this STC)
Main SW Version	3.00
GPS SW Version	5.0
Com SW Version	2.10
Nav SW Version	6.02

Table 2 - Software Versions

2.4 SD Card

It is required that the SD card be present in the unit at all times.

2.5 Navigation Database

GPS/SBAS based IFR enroute, oceanic, and terminal navigation is prohibited unless the flight crew verifies and uses a valid, compatible, and current navigation database or verifies each waypoint for accuracy by reference to current approved data.

“GPS”, “or GPS”, and “RNAV (GPS)” instrument approaches using the Garmin navigation system are prohibited unless the flight crew verifies and uses the current navigation database. GPS based instrument approaches must be flown in accordance with an approved instrument approach procedure that is loaded from the navigation database.

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Discrepancies that invalidate a procedure should be reported to Garmin International. The affected procedure is prohibited from being flown using data from the navigation database until a new navigation database is installed in the aircraft and verified that the discrepancy has been corrected. Navigation database discrepancies can be reported at FlyGarmin.com by selecting “Aviation Data Error Report.” Flight crew and operators can view navigation database alerts at FlyGarmin.com then select “NavData Alerts.”

If the navigation database cycle will change during flight, the flight crew must ensure the accuracy of navigation data, including suitability of navigation facilities used to define the routes and procedures for flight. If an amended chart affecting navigation data is published for the procedure, the database must not be used to conduct the procedure.

2.6 Ground Operations

Do not use SafeTaxi or Chartview functions as the basis for ground manoeuvring. SafeTaxi and Chartview functions do not comply with the requirements of AC 20-159 and are not qualified to be used as an airport moving map display (AMMD). SafeTaxi and Chartview are to be used by the flight crew to orient themselves on the airport surface to improve flight crew situational awareness during ground operations.

2.7 Approaches

Instrument approaches using GPS guidance may only be conducted when the GTN is operating in the approach mode. (LNAV, LNAV+V, L/VNAV, LPV, or LP)

When conducting instrument approaches referenced to true North, the NAV Angle on the System -Units page must be set to **True**.

The navigation equipment required to join and fly an instrument approach procedure is indicated by the title of the procedure and notes on the IAP chart. Navigating the final approach segment (that segment from the final approach fix to the missed approach point) of an ILS, LOC, LOC-BC, LDA, SDF, MLS, VOR, TACAN approach, or any other type of approach not approved for GPS, is not authorized with GPS navigation guidance. GPS guidance can only be used for approach procedures with GPS or RNAV in the procedure title. When using the Garmin VOR/LOC/GS receivers to fly the final approach segment, VOR/LOC/GS navigation data must be selected and presented on the CDI of the pilot flying.

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Advisory vertical guidance deviation is provided when the GTN annunciates LNAV + V. Vertical guidance information displayed on the VDI in this mode is only an aid to help flight crews comply with altitude restrictions. When using advisory vertical guidance, the flight crew must use the primary barometric altimeter to ensure compliance with all altitude restrictions.

Not all published Instrument Approach Procedures (IAP) are in the navigation database. Flight crews planning to fly an RNAV instrument approach must ensure that the navigation database contains the planned RNAV Instrument Approach Procedure and that approach procedure must be loaded from the navigation database into the GTN system flight plan by its name. Users are prohibited from flying any approach path that contains manually entered waypoints.

IFR approaches are prohibited whenever any physical or visual obstruction (such as a throw-over yoke) restricts pilot view or access to the GTN and/or the CDI.

2.8 Autopilot Coupling

The flight crew may fly all phases of flight based on the navigation information presented to the flight crew; however, not all modes may be coupled to the autopilot. All autopilots may be coupled in Oceanic (OCN), Enroute (ENR), and Terminal (TERM) modes.

This installation is limited to Lateral coupling only for GPS approaches. Coupling to the vertical path for GPS approaches is not authorized.

2.9 Terrain Proximity Function (All Units)

Terrain and obstacle information appears on the map and terrain display pages as red and yellow tiles or towers, and is depicted for advisory use only. Aircraft manoeuvres and navigation must not be predicated upon the use of the terrain display. Terrain and obstacle information is advisory only and is not equivalent to warnings provided by TAWS.

The terrain display is intended to serve as a situational awareness tool only. By itself, it may not provide either the accuracy or the fidelity on which to base decisions and plan manoeuvres to avoid terrain or obstacles.

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NOTE

Terrain and TAWS are separate features, mutually exclusive and TAWS is not installed in this system

2.10 Flight Planner/Calculator Functions**CAUTION**

When using the Density Altitude / True Airspeed / Winds page, all data must be entered into the calculator before the calculated data is used. Calculated data may not be correct prior to entering all data.

The Fuel Planning page uses Fuel on Board or Fuel Flow as received from an on board fuel totaliser, as entered by the pilot at system start-up, or as entered by the pilot when on the Fuel Planning page. This *is not* a direct indication of actual aircraft fuel flow or fuel on board and those values are only used for the Fuel Planning page. The fuel required to destination is only a calculated and predicted value based on the data entered into the planner. It is not a direct indication of how much fuel the aircraft will have upon reaching the destination. Certain approach leg types will result in the fuel burn incorrectly calculated as zero.

2.11 Glove Use / Covered Fingers

No device may be used to cover fingers used to operate the GTN650 unless the Glove Qualification Procedure located in the Pilot's Guide/Cockpit Reference Guide has been successfully completed. The Glove Qualification Procedure is specific to a pilot / glove / GTN 650 combination.

2.12 Demo Mode

Demo mode may not be used in flight under any circumstances.

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SECTION 3 - Abnormal Procedures

3.1 Loss of GPS/SBAS Navigation Data

When the GPS/SBAS receiver is inoperative or GPS navigation information is not available or invalid, the GTN will enter one of two modes: Dead Reckoning mode (DR) or Loss Of Integrity mode (LOI). The mode is indicated on the GTN by an amber "DR" or "LOI".

If the Loss Of Integrity annunciation is displayed, revert to an alternate means of navigation appropriate to the route and phase of flight.

If the Dead Reckoning annunciation is displayed, the map will continue to be displayed with an amber 'DR' overwriting the ownship icon. Course guidance will be removed on the CDI. Aircraft position will be based upon the last valid GPS position, then estimated by Dead Reckoning methods. Changes in true airspeed, altitude, heading, or winds aloft can affect the estimated position substantially. Dead Reckoning is only available in Enroute and Oceanic modes. Terminal and Approach modes do not support Dead Reckoning.

If Alternate Navigation Sources (ILS, LOC, VOR, DME, ADF) Are Available:

Navigation.....USE ALTERNATE SOURCES

If No Alternate Navigation Sources Are Available:

DEAD RECKONING (DR) MODE:

Navigation.....USE GTN

NOTE

All information normally derived from GPS will become less accurate over time.

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LOSS OF INTEGRITY (LOI) MODE:

Navigation **FLY TOWARDS KNOWN VISUAL CONDITIONS**

NOTE

All information derived from GPS will be removed.

NOTE

The airplane symbol is removed from all maps. The map will remain centered at the last known position. "NO GPS POSITION" will be annunciated in the center of the map.

3.2 GPS approach downgrade

During a GPS LPV, LNAV/VNAV, or LNAV+V approach, if GPS accuracy requirements cannot be met by the GPS receiver, the GTN will downgrade the approach. The downgrade will remove vertical deviation indication from the VDI and change the approach annunciation accordingly from LPV, L/VNAV, or LNAV+V to LNAV. The approach may be continued using the LNAV only minimums.

During a GPS approach in which GPS accuracy requirements cannot be met by the GPS receiver for any GPS approach type, the GTN will flag all CDI guidance and display a system message "ABORT APPROACH-GPS approach no longer available". Immediately upon viewing the message, the unit will revert to Terminal navigation mode alarm limits. If the position integrity is within these limits lateral guidance will be restored and the GPS may be used to execute the missed approach, otherwise alternate means of navigation must be utilized.

3.3 Data source – pressure altitude source inoperative or connection to GTN lost message

Without a barometric altitude source to the GTN, the following features will not operate:

Automatic leg sequencing of legs requiring an altitude source. The flight crew must manually sequence altitude legs, as prompted by the system.

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SECTION 4 – Normal Procedures

4.1 General

Refer to the Cockpit Reference Guide or Pilot's Guide defined in Section 2.1 of this document for normal operating procedures and a complete list of system messages and associated flight crew actions. This includes all GPS operations, VHF communication and navigation, traffic, data linked weather, StormScope®, TAWS, and Multi-Function Display information.

The GTN requires a reasonable degree of familiarity to avoid becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid in VMC. Garmin provides training tools with the Pilot's Guide and PC based simulator. Pilots should take full advantage of these training tools to enhance system familiarization.

4.2 Unit Power On

Database..... **REVIEW EFFECTIVE DATES**Self Test **VERIFY OUTPUTS TO NAV INDICATORS**

Self Test - GPS Remote Annunciator:

VLOC.....	ILLUMINATED
GPS.....	ILLUMINATED
LOI or INTG.....	ILLUMINATED
TERM.....	ILLUMINATED
WPT.....	ILLUMINATED
APR.....	ILLUMINATED
MSG.....	ILLUMINATED
SUSP or OBS.....	ILLUMINATED

4.3 Before Takeoff

System Messages and Annunciators..... **CONSIDERED**

4.4 HSI and EHSI Operation

If an HSI is used to display navigation data from the GTN the pilot should rotate the course pointer as prompted on the GTN.

CAUTION

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The pilot must verify the active course and waypoint for each flight plan leg. The pilot must verify proper course selection each time the CDI source is changed from GPS to VLOC.

4.5 Autopilot Operation

The GTN may be coupled to an optional autopilot, if installed in the aircraft, when operating as prescribed in the LIMITATIONS section of this manual.

Autopilots coupled to the GTN system in an analog (NAV) mode will follow GPS or VHF navigation guidance as they would with existing VOR receivers.

Autopilots that support GPSS or GPS Roll Steering in addition to the analog course guidance will lead course changes, fly arcing procedures, procedure turns, and holding patterns if coupled in GPSS mode.

CAUTION

The GTN cannot provide course deviation to the autopilot for heading legs. Some autopilots do not allow the use of GPSS when course deviation is not provided.

For autopilot operating instructions, refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

4.6 Coupling the Autopilot during approaches

CAUTION

When the CDI source is changed on the GTN, autopilot mode may change. Confirm autopilot mode selection after CDI source change on the GTN. Refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

Analog only autopilots should use APR mode for coupling to LNAV approaches. Autopilots which support digital roll steering commands (GPSS) may utilize NAV mode and take advantage of the digital tracking during LNAV only approaches.

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To couple an approach:

Once established on the final approach course with the final approach fix as the active waypoint, the GTN will issue a flashing message indication.

Flashing Message Button **PRESS**

"Enable APR Output" Button **PRESS**

The installation does **not** support any vertical capture or vertical tracking

SECTION 5 - Performance

Refer to the Basic Flight Manual.

SECTION 6 - Weight and Balance

Refer to the Basic Flight Manual.

KCS 55A Compass System

KCS 55A Compass System

The KCS 55A Compass System, which includes the KA 51B Slaving Control and Compensator Unit, the KMT 112 Magnetic Slaving Transmitter and the KG 102 Directional Gyro as well as the KI 525A Pictorial Navigation Indicator is an optional part of the KFC 225 Flight Control System.

The panel-mounted KI 525A HSI combines the display functions of both the standard Directional Gyro and the Course Deviation Indicator's VOR/LOC/Glideslope information to provide the pilot with a single presentation of the complete horizontal navigation situation. This greatly simplifies course orientation, interception and tracking, while eliminating the need for scan coordination between two separate indicators.



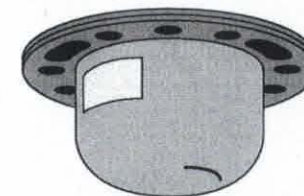
KA 51B



KI 525A



KG 102A



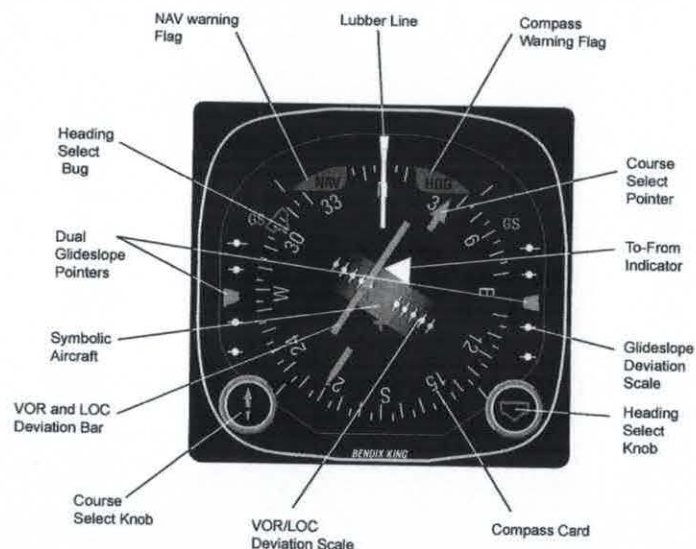
KMT 112

KCS 55A Compass System

KI 525A Indicator

The KI 525A Pictorial Navigation Indicator is the panel display for the KCS 55A Compass System. It replaces the standard Directional Gyro and Course Deviation Indicator (CDI) in the aircraft's panel, combining slaved

heading and VOR/LOC/Glideslope information into one compact display. By providing a simple, comprehensive visual presentation of the aircraft's heading and position in relation to a desired course, the pilot's navigation workload is considerably reduced.



KI 525A Pictorial Navigation Indicator

Description of Indicator and Display Functions

Compass Card - Responding to the input from the slaved directional gyro, this card rotates within the display so that the aircraft heading is always at the top, under the lubber line.

Lubber Line - A fixed white marker at the top of the display that indicates aircraft magnetic heading on the compass card.

Symbolic Aircraft - A fixed representation of the actual aircraft. This miniature aircraft always points toward the top of the display and the lubber line.

Selected Course Pointer - On this two-part arrow, the "head" indicates the desired VOR or Localizer course and the "tail" indicates the reciprocal. This pointer is set by rotating the course select knob.

Course Select Knob - Used to rotate the course pointer to the desired course on the compass card. This knob corresponds to the Omni Bearing Selector (OBS) on standard NAV indicators.

VOR/RNAV and LOC Deviation - This bar corresponds to the "left/right" needle on standard course deviation indicators. When the aircraft is precisely on the VOR radial or Localizer course, it forms the center section of the selected course pointer and will be positioned under the symbolic aircraft. When off course or approaching a new course, it will move to one side or the other. Since the entire VOR and Localizer display rotates with the compass card, the angular relationship between the deviation bar and the symbolic aircraft provides a pictorial symbolic display of the aircraft's position with respect to the selected course.

Deviation Scale - When tuned to a VOR frequency, each white dot represents two degrees of deviation left or right of course. When tuned to a Localizer, the deviation is 1/2 degree per dot. (When GPS data is selected for presentation, refer to the Pilot's Guide for the GPS receiver.)

Heading Select Bug - A movable orange marker on the outer perimeter of the display, used primarily to select the desired heading you wish to fly. This desired heading is coupled to the KFC 225 Flight control system to provide the "Heading Select" function.

Heading Select Knob - Used to rotate the heading select bug to a desired point on the compass card.

To-From Indicator - A white triangle near the center of the display that indicates, with reference to the OBS setting, whether the course selected is "to" or "from" the selected VOR station and/or RNAV waypoint.

Dual Glideslope Pointers - Chartreuse triangular pointers on either side of the display drop into view when a usable glideslope signal is received and retract out of view when the glideslope signal becomes marginal. During an ILS approach, these pointers represent the vertical orientation of the aircraft with respect to the center of the glideslope beam. When on glideslope, the pointers will align with the center markers on the glideslope scale.

Glideslope Deviation Scale - White dots on each side of the display which, in conjunction with the glideslope pointers, indicate either "above", "below", or "on glideslope" during an ILS approach.

Compass Warning Flag - A red flag labeled "HDG" becomes visible in the upper right quadrant of the display whenever the electrical power is inadequate or the directional gyro is not up to speed. Compass failures can occur which will not be annunciated by the "HDG" flag. Therefore, periodic comparison with the standby compass is advised.

NAV Warning Flag - A red flag labeled "NAV" becomes visible in the upper left quadrant of the display whenever a usable signal is not being received.

Slaving Meter (KA 51B)

This meter indicates any difference between the displayed heading and the magnetic heading. Right or up deflection indicates a clockwise error of the compass card. Left or down deflection indicates a counterclockwise error of the compass card. Whenever the aircraft is in a turn and the card rotates, it is normal for this meter to show a full deflection to one side or another.

NOTE: During level flight it is normal for the meter needle to continuously move from side to side and to be fully deflected during a turn. If the needle stays fully deflected, left or right, during level flight, the free gyro mode can be used to center it, as follows:



KA 51B Slaving Meter

Slave and Free Gyro Switch - When the switch is in the AUTO position, the system is in the slaved gyro mode. When the switch is in the MAN position, the system is in the free gyro mode.

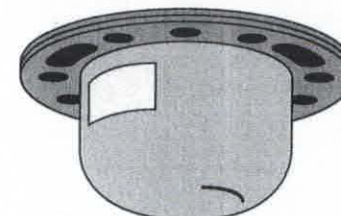
Clockwise Adjustment - When the system is in the free gyro mode, holding the manual heading switch to the CW position will rotate the compass card to the right to eliminate left compass card error.

Counterclockwise Adjustment - When the system is in the free gyro mode, holding the manual heading switch to the CCW position will rotate the compass card to the left to eliminate right compass card error.

The KA 51B Slaving Control and Compensator Unit is a small slaving accessory which can be used in installations where panel space is limited. The KA 51B can be mounted either vertically or horizontally.

KMT 112 Magnetic Slaving Transmitter

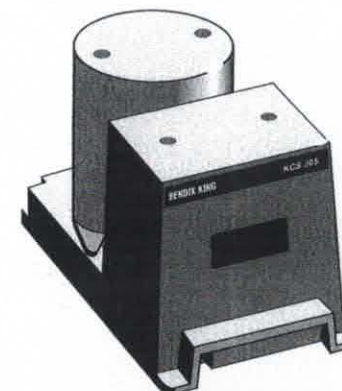
This unit senses the direction of the earth's magnetic field and continuously transmits this information through the slaving circuitry to the directional gyro which is automatically corrected for precession or "drift". This sensor is mounted remotely - usually in a wingtip - to eliminate the possibility of magnetic interference.



KMT 112 Magnetic Slaving Transmitter

KG 102A Directional Gyro

The directional gyro provides gyro stabilization for the system and contains the slaving circuitry necessary for operation of the system. Power may be for either 14 or 28 volts DC. This sensor is also remote mounted.



KG 102A Directional Gyro

Operating Instructions

1. Until power is applied to the KCS 55A System, and the directional gyro is up to speed, a red flag labeled "HDG" will be visible in the upper right quadrant of the KI 525A Indicator. In operation, this warning flag will be visible whenever the power being supplied is inadequate or the gyro is not up to speed.
2. With the application of power to the KCS 55A System, and gyro up to operating speed, the red "HDG" flag should disappear from view.
3. If the KCS 55A System is in the slaved gyro mode, the compass card will automatically fast slave at the rate of 180 degrees per minute toward the aircraft's magnetic heading. (Immediately after applying power, this compass card movement should be quite visible.) It will continue to fast slave until the proper magnetic heading is indicated, after which it will slave at a constant rate of three degrees per minute to keep the system aligned with the earth's magnetic field.

Under some conditions it is possible for the system to stop slaving exactly 180 degrees from the correct heading. If this should occur, move the "Slave" switch on the KA 51B to the unslaved (free) position. Rotate the compass card ± 10 degrees from the incorrect heading by using the manual rotation switch and then return the system to slaved operation. The system will then slave to the correct heading.

4. For the free gyro operation, check the magnetic compass to determine the correct magnetic heading. Then use the manual slave switch to align the system with the earth's magnetic field. Periodic checks with the standby compass are recommended to check and correct for gyro precession.
5. Until a usable navigation signal is being received by the NAV system, a red flag labeled "NAV" will be visible in the upper left quadrant of the KI 525A Indicator. In operation, this warning flag should be visible whenever an inadequate navigation signal is being received.
6. For normal navigation to or from a VOR or VORTAC, set the NAV receiver to the desired VOR or VORTAC frequency and the red navigation flag (NAV) should disappear from view if a usable signal is being received.
7. Rotate the course select knob to position the course pointer to the desired VOR course.
8. The VOR deviation bar represents the selected course, and the relationship of this bar to the symbolic aircraft in the center of the instrument visually presents the actual relationship of the selected course to your aircraft heading. (In other words, if the symbolic aircraft on the display indicates approaching the deviation bar at 45 degrees, that is the angle at which your aircraft is actually approaching the selected course.
9. To prepare for an ILS approach, tune the NAV receiver to the desired Localizer frequency. If a usable Localizer signal is being received, the NAV warning flag will disappear.
10. For a front or back course approach, rotate the course select knob to set the course pointer on the inbound Localizer course. As with normal navigation (#6 above), the LOC deviation bar represents the desired course. The relationship between this bar and the symbolic aircraft gives a true picture of your aircraft's position with respect to the Localizer course. Always setting the course pointer to the inbound Localizer course provides the correct deviation bar sensing whether flying a front or back course approach.
11. The glideslope deviation pointers should become visible on both sides of the display when a usable glideslope signal is received. If they do not come into view, a usable glideslope signal is not being received.

12. The glideslope pointers indicate the relative position of the glideslope path with respect to the aircraft. (In other words, if the pointers are above the center marker, the aircraft is below the glideslope.)

Abnormal Circumstances

If the Warning Flag (HDG) appears during operation, the compass card indications will be in error. Power may be removed from the KG 102A Directional Gyro by pulling the appropriate circuit breaker. The Selected Course, VOR/LOC Deviation Bar, the NAV flag, and the To/From Indicator will remain in operation.

If the Navigation Warning Flag (NAV) appears during operation, there are several possibilities: (1) the NAV receiver is not turned on, (2) the NAV receiver is improperly tuned, (3) the ground VOR or LOC station is malfunctioning, (4) the aircraft is out of range of the selected ground station, or (5) the aircraft NAV receiver has malfunctioned. (The compass card will continue to display the aircraft heading even if a usable NAV signal is not being received.

If the glideslope pointers remain out of view during a front course ILS approach, with the aircraft glideslope receiver or the ground station glideslope transmitter is malfunctioning. Glideslope is usually not available during a back course approach. (The VOR and LOC course display will continue to

function normally even if a usable glideslope signal is not being received.)

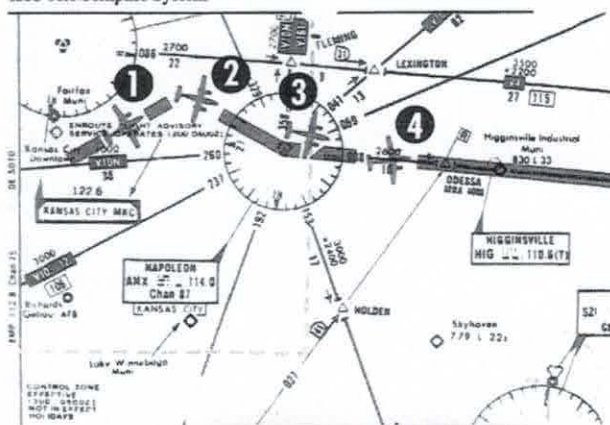
A continuous large deflection of the slaving meter or large discrepancies between the magnetic compass and the KI 525A compass card may indicate a failure in the slaving system. If a slaving failure should occur, the Slave/Free Switch should be moved to select the free gyro mode. Then, by using manual clockwise or counterclockwise corrections, the compass can be rotated to the correct heading as indicated on the standby compass. The KCS 55A system should continue to function normally except the heading information will be solely derived from the KG 102A Directional Gyro. There will be no automatic heading correction and periodic adjustments must be made manually to correct for precession by reference to the standby magnetic compass, as with any directional gyro.

Note: It is desirable to disconnect the autopilot under the following conditions:

1. HDG flag comes into view.
2. System is in fast slave.
3. During manual slaving.

The system has the capability to supply the autopilot with an automatic disconnect signal under these conditions.

Note: For system limitations in your particular aircraft type, refer to your Flight Manual Supplement.



Flight Procedures with the KCS 55A

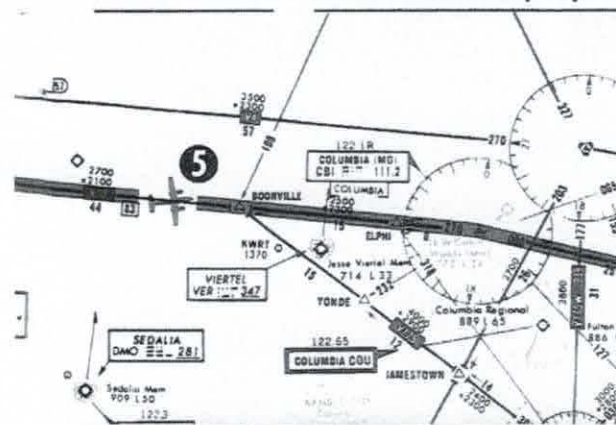
The next few pages depict a normal flight departure from MKC enroute to STL via Victor Airway V-12. (The charts shown here are for illustration purposes only, not to be used for navigation.) Careful study of these illustrations of the KI525A HSI should give you a better idea of how simple and comprehensive the display is.



1. Vectors to Intercept a Radial
After takeoff from Kansas City, we select a heading of 060° with the heading bug to intercept the 110° course to Napoleon (ANX) VOR. Selected course pointer is set on 110° with the course knob. The KI 525A HSI conveniently and accurately displays the intercept angle.



2. The VOR deviation bar begins to center as we approach the 110° course to Napoleon. The KI 525A HSI makes it possible to intercept the course smoothly, without overshooting or bracketing. One method of doing this is to adjust your heading so that the top of the deviation bar always touches the lubber line. As your aircraft heading approaches the new course, the deviation bar will swing towards the center and the angle of intercept will decrease.



3. Turn to Intercept a Victor Airway
The "TO" indicator starts to swing to "FROM" as you fly over the Napoleon VORTAC station. At this time, set the selected course pointer on the V-12 course of 088°.

As you begin your left turn to track V-12, notice that the KI525A HSI continuously displays an accurate picture of the relationship between your aircraft and the ANX 088 radial. Once again, you can make a precise, coordinated course interception by adjusting your heading to keep the top of the deviation bar touching the lubber line.



4. When the deviation bar is centered and aligned with the course arrow, you are on course. Notice that correction for wind drift - in this case, a 080° heading on a 088° course - is completely automatic as long as you keep the deviation bar centered.



5. About midway between Napoleon and Columbia (CBI), you switch to the CBI VOR and the TO/FROM indicator immediately swings to "TO". Also note the course arrow should be moved from 088° to 090° which is the V-12 inbound course to CBI.

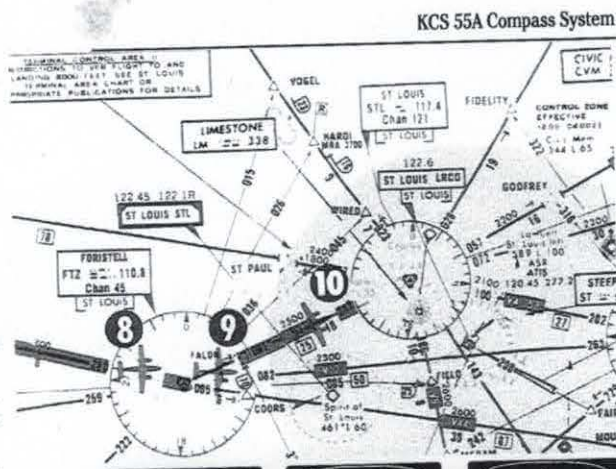
KCS 55A Compass System



6. As you fly over the Columbia station, the TO/FROM indicator changes to "FROM". Since the outbound course for V-12 from Columbia to Foristell (FTZ) is 098°, you now set the selected course pointer on 098° and fly to keep the deviation bar centered.



7. Near the Herman intersection you switch to Foristell VORTAC and move the course arrow to 100°, which is the V-12 inbound course to FTZ. The TO/FROM indicator changes to "TO".



8. Airway Interception
Your clearance is V-12 to Foristell, then V-14 to the St. Louis (STL) VORTAC, direct Lambert Field. Approaching the FTZ station, the heading bug is on 100° as a reference for the V-12 course or as heading command for the autopilot, if used. Select the St. Louis VORTAC on the NAV receiver and set the course pointer on the STL 062° course.



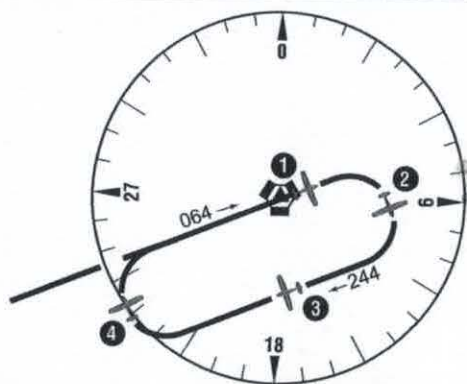
9. As you cross the Foristell VORTAC, the deviation bar will align with the course arrow. Now set the heading bug to 062° and turn left to follow V-14 to the STL VORTAC.



10. You are now established on V-14, flying to the STL VORTAC. Once again, if you fly to keep the deviation bar centered, correction for wind drift will automatically be accomplished.

Note: For system limitations refer to your Flight Manual Supplement.

HOLDING PATTERN



1. Approaching the STL VORTAC, the controller asks you to hold southwest of the VORTAC on the 244° radial, right turns. You are now over the station with a 064° course selected (the TO/FROM indicator has swung to "FROM"). Set your heading bug to the reciprocal or outbound heading of 244° for easy reference and begin your right turn holding pattern.



2. Halfway through the outbound turn, the KI 525A display shows the deviation bar behind the symbolic aircraft. You know, therefore, that you must eventually fly back to the radial in order to be on course during the inbound leg of the holding pattern.



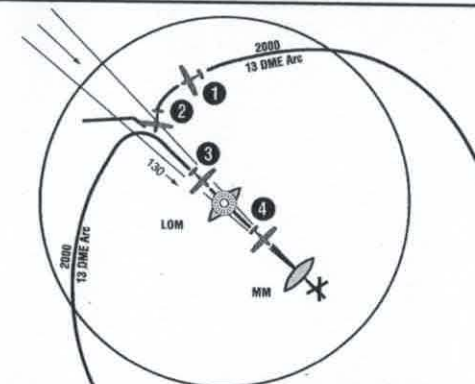
3. Outbound, you are using the heading bug as reference for 244°. The 244° radial is off the right wing and parallel to your outbound course.



4. Halfway through your turn to the inbound 064° course, the KI 525A shows the symbolic aircraft approaching the deviation bar at a right angle. By keeping the top of the deviation bar on the lubber line, you can complete your turn and roll out precisely on course.

Note: For system limitations refer to your Flight Manual Supplement.

ILS APPROACH- FRONT COURSE



1. You are vectored from the holding pattern to the 13 DME arc. The aircraft is turning, with the heading bug set on 170° to intercept the localizer. You have already set the selected course pointer on the inbound ILS course 130° and the KI 525A shows the localizer course is directly ahead. The glideslope pointers came into view when the ILS frequency was tuned, since a usable glideslope signal is being received.



3. The KI 525A shows you that you have intercepted the localizer course. The glideslope pointers have started to center, although the display indicates your aircraft is still below the glidepath at this point.



2. Capturing the ILS course can be accomplished without overshooting or bracketing with the same technique you used in intercepting an enroute course. Simply keep the top of the deviation bar on the lubber line and coordinate your turn until the bar is centered with the course arrow. Each dot on the LOC deviation scale represents 1/2 degree of deviation when tuned to an ILS frequency.

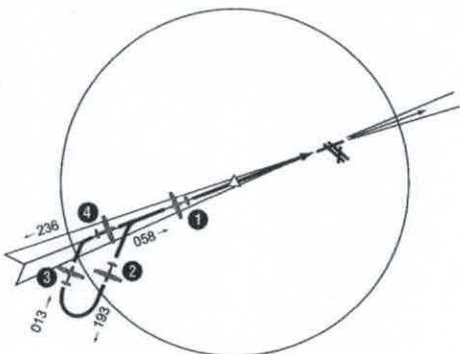


4. You are now centered on the localizer and the glideslope. Once again, the KI 525A shows your aircraft is crabbed about 5° to the right to maintain the localizer course.

Note: For system limitations refer to your Flight Manual Supplement.

**BACK COURSE
APPROACH - (REV)**

If a back course approach is required, it can be accomplished as easily as a front course approach. The course arrow should always be set on the front course inbound localizer course. This will result in conventional pictorial deviation sensing even on back course. The KI 525A display gives you an accurate picture of where you are at all times during the approach and procedure turn.



1. You are outbound on the back localizer course, having already set the course pointer to the inbound front course at 238°. The heading bug is preset at 193° for the procedure turn. (Since there is usually no glideslope signal on a back course, the glideslope pointers are out of sight.)



2. During the procedure turn outbound, the deviation bar shows pictorially that the aircraft (as represented by the symbolic aircraft in the center of the KI 525A) is flying away from the localizer centerline at a 45° angle when the heading bug is under the lubber line. Note that left-right deviations of the course bar give "fly-to" indicators, just as on the front course.



3. Now you've reset the heading bug to 013° and made a 180° turn to this heading. This 013° heading will intercept the back course. The KI 525A clearly pictures the course you are to intercept and the angle of interception.



4. You have smoothly intercepted the back course. Since the course arrow is set on the front course (238°), the KI 525A shows a true picture of the situation - flying inbound on the back course. You may reset the heading bug to 058° for easy reference.

Note: For system limitations refer to your Flight Manual Supplement.

General Emergency Procedures**Autopilot Malfunction**

An autopilot, autopilot trim or manual electric trim malfunction may be recognized as an uncommanded deviation in the airplane flight path or when there is abnormal control wheel or trim wheel motion. The primary concern in reacting to an autopilot or trim malfunction, or to an automatic disconnect of the autopilot, is in maintaining control of the airplane. Immediately grasp the control wheel and press and hold down the A/P DISC/TRIM INTER switch throughout the recovery. Manipulate the controls as required to safely maintain operation of the airplane within all of its operating limitations.

CAUTION: Refer to the Airplane Flight Manual or the Airplane Flight Manual Supplement for your particular aircraft for pertinent emergency procedures.

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Garmin GTX330/33 with ADSB out
For installation in Cessna R172K
Aircraft Radio EO501071R(0)

CASA Approved
AIRPLANE FLIGHT MANUAL SUPPLEMENT
GTX 330/33 with ADS-B Out

REGISTRATION VH-YPM

SERIAL NUMBER -R1723306

This document serves as a CASA Approved Airplane Flight Manual Supplement when the GTX 330/33 with ADS-B Out is installed in accordance with Aircraft Radio engineering order 501071R(0). This document must be incorporated into the Approved Airplane Flight Manual.

The information contained herein supplements the approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the approved Airplane Flight Manual, markings, or placards.

Approved By
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Persuant to CASR 21.006A, 21.009(1)(f) & subpart 21.437
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Signed  Date 30/1/2015

CASAA Approved Airplane Flight Manual Supplement

for

GARMIN GTX 330/33 with ADS-B Out

List of Effective Pages

Original issue 30 January 2015

Page	Date	Revision No.
1	30 January 2015	0
2	30 January 2015	0
3	30 January 2015	0
4	30 January 2015	0
5	30 January 2015	0
6	30 January 2015	0
7	30 January 2015	0
8	30 January 2015	0
9	30 January 2015	0
10	30 January 2015	0
11	30 January 2015	0

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Section 1. General

1.1 GTX 330/33 ES

The GARMIN GTX family consists of the GTX 330 and GTX 33 (Non-Diversity Mode S Transponders) and the GTX 330D and GTX 33D (Diversity Mode S Transponders). The ES option of any of the transponders provides ADS-B extended Squitter functionality.

All GARMIN GTX transponders are a radio transmitter/receiver that operates on radar frequencies, receiving ground radar or TCAS interrogations at 1030 MHz and transmitting a coded response of pulses to ground-based radar on a frequency of 1090 MHz. Each unit is equipped with IDENT capability and will reply to ATCRBS Mode A, Mode C and Mode S All-Call interrogation. Interfaces to the GTX 330/33 are shown in the following block diagrams.

Figure 1. GTX 330 or GTX 330D Interface Summary

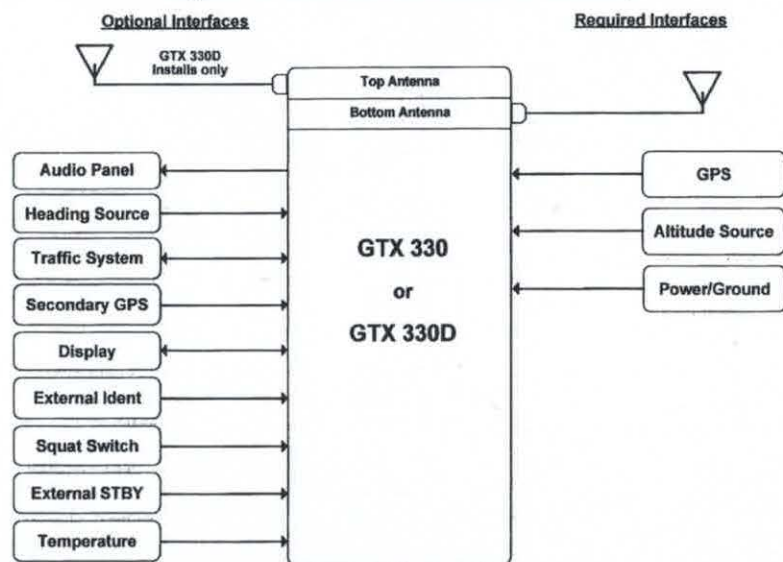
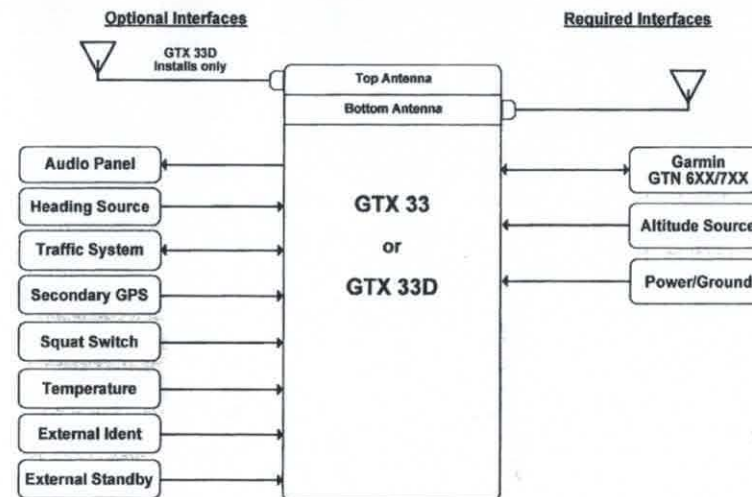


Figure 2. GTX 33 or GTX 33D Interface Summary



The GTX 330/33 performs the following ADS-B Out functions:

- Transmission of ADS-B out data on 1090 extended squitter (1090ES) (1090 MHz)
- Integration of data from internal and external sources to transmit the following data per 14 CFR 91.227:
 - GPS Position, Altitude, and Position Integrity
 - Ground Track and/or Heading, Ground Speed, and Velocity Integrity
 - Air Ground Status
 - Flight ID, Call Sign, ICAO Registration Number
 - Capability and Status Information
 - Transponder squawk code, IDENT, and emergency status
- Pressure Altitude Broadcast Inhibit

1.2 Capabilities

The GARMIN GTX 330/33 with ADS-B Out functionality as installed in this aircraft has been shown to meet the equipment requirements of 14 CFR § 91.227.

1.3 Installation Configuration

This aircraft is equipped with a GTX 330/33 with ADS-B Out system with the following interfaces/features:

Equipment Installed:

- | | |
|--|-------------------------------------|
| ☒ #1 GTX 330 | ☐ #1 GTX 33 |
| ☐ #1 GTX 330D | ☐ #1 GTX 33D |
| ☐ #2 GTX 330 | ☐ #2 GTX 33 |
| ☐ #2 GTX 330D | ☐ #2 GTX 33D |

Interfaced GTN 6XX/7XX or GNS 4XX/5XX Position Source(s):

Transponder (#1 or #2)	Transponder (#1 or #2)	Transponder (#1 or #2)
☐ GTN 725	☐ GNS 430AW	☐ GNS 530AW
☐ GTN 750	☐ GNS 430W	☐ GNS 530W
☐ GTN 625	☐ GNC 420AW	☐ GPS 500W
☐ GTN 635	☐ GNC 420W	
☒ GTN 650	TXP #1	☐ GPS 400W

1.4 Definitions

The following terminology is used within this document:

- ADS-B:** Automatic Dependent Surveillance-Broadcast
AFM: Airplane Flight Manual
AFMS: Airplane Flight Manual Supplement
ATCRBS: Air Traffic Control Radar Beacon System
CFR: Code of Federal Regulations
ES: Extended Squitter
GNSS: Global Navigation Satellite System
GNS: XXXX Navigation System
GPS: Global Positioning System
GTX: XXXX Transponder
GTN: XXXX Touchscreen Navigator
ICAO: International Civil Aviation Organization
LRU: Line Replaceable Unit
PABI: Pressure Altitude Broadcast Inhibit
POH: Pilot Operating Handbook
SBAS: Satellite-Based Augmentation System
SW: Software
TCAS: Traffic Collision Avoidance System
TX: Transmit

Section 2. Limitations

2.1 Minimum Equipment

The GTX 330/33 with ADS-B Out must have the following system interfaces fully functional in order to be compliant with the requirements for 14 CFR 91.227 ADS-B Out operations:

Table 1. Required Equipment

Interfaced Equipment	Number Installed	Number Required
Uncorrected Pressure Altitude Source	1	1
GPS SBAS Position Source	1 or more	1
GTN series navigator (for aircraft equipped with GTX 33/33D only)	1 or more	1

2.2 ADS-B Out

The GTX 330/33 only complies with 14 CFR 91.227 for ADS-B Out when all required functions are operational. When the system is not operational, ADS-B Out transmit failure messages will be present on the GTN control interface, or GTX 330 display.

2.3 Applicable System Software

This AFMS/AFM is applicable to the software versions shown in Table 2.

The Main GTX software version is displayed on the splash screen during start up, for the GTX 330, and the external LRU page on the GTN for the GTX 33.

Table 2. Software Versions

Software Item	Software Version (or later FAA Approved versions for this STC)
Main SW Version	7.02

2.4 Pressure Altitude Broadcast Inhibit (PABI)

Pressure Altitude Broadcast Inhibit shall only be enabled when requested by Air Traffic Control while operating within airspace requiring an ADS-B Out compliant transmitter, per 14 CFR 91.227. PABI is enabled by selecting the GTX to ON mode.

Section 3. Emergency Procedures

3.1 Emergency Procedures

None

3.2 Abnormal Procedures

3.2.1 Abnormal Indications

The loss of an interfaced input to the GTX 330/33 may cause the transponder to stop transmitting ADS-B Out data. Depending on the nature of the fault or failure, the GTX may no longer be transmitting all of the required data in the ADS-B Out messages.

For GTX 330 installations:

If the GTX 330 detects any internal faults or failures with the ADS-B Out functionality, the GTX 330 will announce this event via the NO ADSB annunciator on the GTX 330 display screen. When the GTX 330 announces the NO ADSB annunciation, one of the following failures or faults have occurred:

- Loss of adequate GPS position data
- ADS-B TX (transmit) is selected OFF

When the GTX 330 announces FAIL to the flight crew, the GTX 330 has detected an internal failure and no transponder data is transmitted.

When a GTX 330 NO ADSB, or FAIL annunciation is received, verify proper operation of all interfaced equipment (refer to Section 1.3) as the failure of one of these devices could be the cause of the abnormal indication.

For GTX 33 installations:

Reference Display Device documentation for applicable annunciations.

3.2.2 Loss of Aircraft Electrical Power Generation

Loss of electrical power generation **REMOVE POWER FROM GTX**

If the GTX should be load shed due to a loss of electrical power generation, ADS-B Out data will no longer be available.

NOTE

This guidance is supplementary to any guidance provided in the POH or AFM for the installed aircraft for loss of power generation.

3.2.3 Loss of GPS/SBAS Navigation Data

When the GPS/SBAS receiver is inoperative or GPS position information is not available or invalid, the GTX will no longer be transmitting ADS-B Out data.

For GTX 330 installations:

NO ADSB annunciator illuminated:

Interfaced GPS position sources.....**VERIFY VALID POSITION**

For GTX 33 installations:

Reference Display Device documentation for applicable annunciation:

Interfaced GPS position sources.....**VERIFY VALID POSITION**

Section 4. Normal Procedures

The procedures described below are specific only to the GTX 330. Cockpit Reference Guides and Pilot Guides for interfaced displays will provide additional operating information specific to the displays or other traffic systems.

ADS-B Out functionality resides within the GTX transponders thereby providing a single point of entry for Mode 3/A code, Flight ID, IDENT functionality and activating or deactivating emergency status for both transponder and ADS-B Out functions. Details on performing these procedures are located in the GTX 330/330D Pilot's Guide.

4.1 Unit Power On

NO ADSB **CONSIDERED**

NOTE

The NO ADS-B Annunciation (or associated display annunciations) may illuminate as the unit powers on and begins to receive input from external systems, to include the SBAS position source.

4.2 Before Takeoff

NO ADSB **EXTINGUISHED**

NOTE

The NO ADS-B Annunciation (or associated display annunciations) must be **EXTINGUISHED** for the system to meet the requirements specified in 14 CFR 91.227. This system must be operational (NO ADSB annunciator **EXTINGUISHED**) in certain airspaces after January 1, 2020 as specified by 14 CFR 91.225.

Section 5. Performance

No Change

Section 6. Weight and Balance

See current Weight and Balance data

Section 7. Systems Description

The GARMIN GTX 330 Pilot's Guide, part number and revision listed below, contain additional information regarding GTX system description, control, and function. Pilots Guides for interfaced displays, part number and revision listed below, provide additional operating information for the

GARMIN GTX 33.

<u>Title</u>	<u>Part Number</u>	<u>Revision</u>
GTX 330 Pilot's Guide	190-00207-00	Rev G (or later)
XXXX GTN 725/750 Pilot's Guide	190-01007-03	Rev. E (or later)
XXXX GTN 625/635/650 Pilot's Guide	190-01004-03	Rev. E (or later)

Section 8. Handling, Service, and Maintenance

No Change



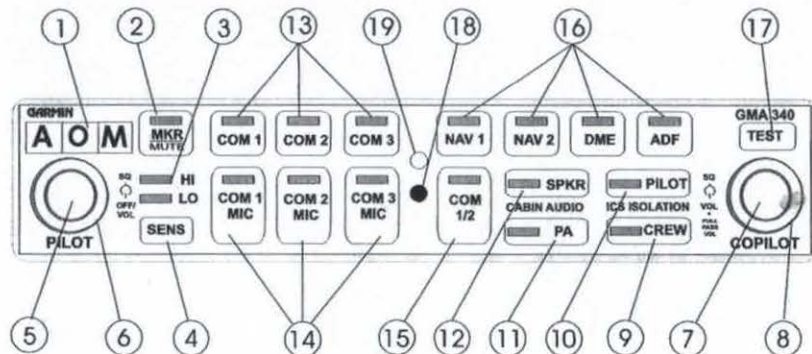
GMA 340

Audio Panel

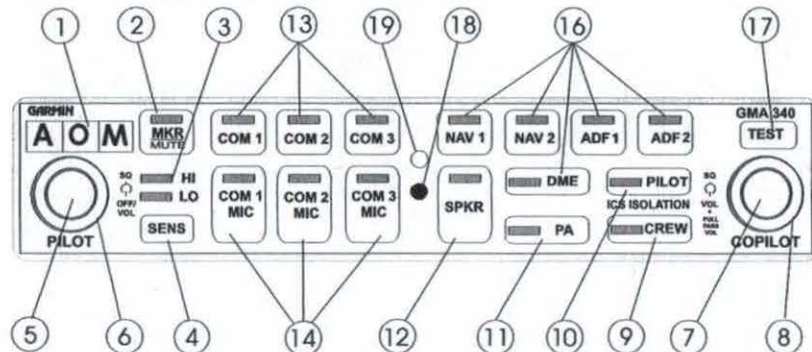


pilot's guide

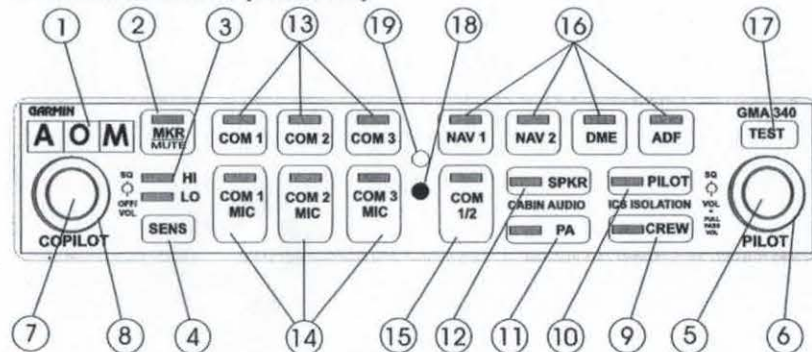
Front Panel Controls (GMA 340)



Front Panel Controls (GMA 340 Dual ADF)



Front Panel Controls (GMA 340H)



Function Selection Switches

The left small knob (5, 7) on all units controls ON/OFF function.

MKR BCN

1. Marker Beacon Lamps
2. Marker Beacon Receiver Audio Select/Mute Button
3. Marker Beacon Receiver Sensitivity Indicator LED's
4. Marker Beacon Receiver Sensitivity Selection Button

ICS

5. Pilot Intercom System (ICS) Volume (Also Passenger Volume on 340H)
6. Pilot ICS Voice Activated (VOX) Intercom Squelch Level
7. Copilot and Passenger ICS Volume Control (Pull out for Passenger Volume)
8. Copilot and Passenger VOX Intercom Squelch Level
9. Crew Isolation Intercom Mode Button
10. Pilot Isolation Intercom Mode Button
11. Passenger Address (PA) Function Button
12. Speaker Function Button

COM/ NAV

13. Transceiver Audio Selector Buttons (COM 1, COM 2, COM 3)
14. Transmitter (Audio/Mic) Selection Buttons
15. Split COM Button (Not Available in Dual ADF)
16. Aircraft Radio Audio Selection Buttons (NAV 1, NAV 2, DME, ADF 1, ADF 2)
17. Annunciator Test Button
18. Locking Screw Access
19. Photocell—Automatic Annunciator Dimming

On, Off, and Failsafe Operation

The GMA 340 is powered off when the left small knob (5, 7) is rotated fully CCW into the detent. To turn the unit on rotate the knob clockwise past the click. The left small knobs also functions as the pilot or copilot's ICS volume control on the appropriate unit. A failsafe circuit connects the pilot's headset and microphone directly to COM 1 in case the power is interrupted or the unit is turned off.

Lighting

LED Button annunciator and marker beacon lamp intensity are controlled automatically by a built-in photocell on the front panel. Nomenclature backlighting is controlled by the aircraft dimmer buss.

Transceivers



Audio level is controlled by the selected COM radio volume control.

Selection of either COM 1, COM 2, or COM 3 (13) for both MIC and audio source is accomplished by pressing either COM 1 MIC, COM 2 MIC, or COM 3 MIC (14). The active com audio is always heard on the headphones.

Additionally, each audio source can be selected independently by pressing COM 1, COM 2, or COM 3 (13). When selected in this way, they remain active as audio sources regardless of which transceiver has been selected for microphone use.

When a microphone is keyed, the active transceiver's MIC button LED blinks approximately once per second to indicate that the radio is transmitting.

Split COM (Not Available on Dual ADF)

Pressing the COM 1/2 button (15) activates the Split COM function. When this mode is active, COM 1 is dedicated solely to the pilot for MIC/audio while COM 2 is dedicated to the copilot for MIC/audio. The pilot and copilot can simultaneously transmit in this mode over separate radios. Both pilots can still listen to COM 3, NAV 1, NAV 2, DME, ADF, and MKR as selected. The Split COM mode is cancelled by pressing the COM 1/2 button a second time.

When in the Split COM mode the copilot may make PA announcements while the pilot continues using COM 1 independently. When the PA button is pressed after the Split COM mode is activated, the copilot's mic is output over the cabin speaker when keyed. A second press of the PA button returns the copilot to normal Split COM operation.



If the COM radios utilize a "transmit interlock" system, the Split COM function may require that this feature is enabled. Refer to the radio's installation manual for guidance. GARMIN makes no expressed or implied guarantees regarding the suitability of the Split COM feature in a given installation.

Com Swap Function

The GMA 340 allows the use of a remote mounted switch (typically on the yoke) to alternately transfer the active microphone back and forth between COM 1 and COM 2. Pressing the remote switch will have no affect if COM 3 is the active transceiver. Ask your installing agency for details.

Aircraft Radios & Navigation



Audio level is controlled by the selected NAV radio volume control.

Pressing NAV 1, NAV 2, DME, ADF 1, ADF 2(16), or MKR (2) (see MKR Beacon Receiver, page 8) selects each audio source. A second button press deselects the audio.

In addition, the GMA 340 provides inputs for an unswitched aircraft radio (TEL RINGER) and an unmuted, unswitched aircraft radio (ALT WRN).

Speaker Output

Pressing the SPKR button (12) selects aircraft radios over the cabin speaker. The speaker output is muted when a COM microphone is keyed. The GMA 340 speaker output level can be adjusted by your installing agency.

PA Function

The PA mode is activated by pressing the PA button (11). Then, when either the pilot's or copilot's microphone is keyed, the corresponding mic audio is heard over the cabin speaker. If the SPKR button is also active, then any selected speaker audio is muted while the microphone is keyed. The SPKR button does not have to be previously active in order to use the PA function. Pilot and copilot PA microphone speaker levels are adjustable by your installing agency.

Auxiliary Entertainment Inputs

The GMA 340 and 340H provide two stereo entertainment inputs: MUSIC 1 and MUSIC 2. The 340 Dual ADF has only MUSIC 1. MUSIC 1 is soft-muted during all aircraft radio activity and normally during ICS activity. MUSIC 2 is a non-muted input. These inputs are compatible with popular portable entertainment devices such as cassette tape or CD players. The headphone outputs of these devices are used and plugged into MUSIC 1 or MUSIC 2. Two 3.5 mm stereo phone jacks should be installed in a convenient location for this purpose. MUSIC 1 and MUSIC 2 have characteristics that are affected by the active intercom mode. Refer to the table on page 7.

Intercom System (ICS) (Pilot and Copilot functions are reversed on the 340H)

Intercom volume and squelch (VOX) are adjusted using the following front panel knobs:

- **LEFT SMALL KNOB** — Unit ON/OFF power control and Pilot ICS volume. Full CCW DETENT position is OFF.
- **LEFT LARGE KNOB** — Pilot ICS mic VOX squelch level. CW rotation increases the amount of mic audio (VOX level) required to break squelch. Full CCW is the "hot mic" position.
- **RIGHT SMALL KNOB** — IN position: Copilot ICS volume. OUT position: Passenger ICS volume.
- **RIGHT LARGE KNOB** — Copilot and passenger mic VOX squelch level. CW rotation increases the amount of mic audio (VOX level) required to break squelch. Fully CCW is the "HOT MIC" position.

Each of the six microphone inputs have dedicated VOX circuits ensuring that only the active microphone(s) is/are heard when squelch is broken. This represents a vast improvement over the party-line systems and reduces the amount of background noise in the headphones during cockpit communications. After the operator has stopped talking, the intercom channel remains momentarily open to avoid closure between words or normal pauses.

The GMA 340 provides three intercom modes: PILOT, CREW and ALL. The mode selection is accomplished using the PILOT and/or CREW buttons.

Pressing a mode button activates the corresponding ICS mode. Pressing again deactivates the mode. The operator can switch directly from PILOT to CREW or from CREW to PILOT by pressing the other mode button. The ALL mode is active when neither PILOT nor CREW LED are lit. To switch from PILOT to CREW mode, press the CREW button; from CREW to PILOT, press the PILOT button. An LED ON indicates the isolation mode is active.

- **PILOT mode** isolates the pilot from everyone else and dedicates the aircraft radios to the pilot exclusively. The copilot and passengers share communication between themselves but cannot communicate with the pilot or hear the aircraft radios.
- **CREW mode** places the pilot and copilot on a common ICS communication channel. The passengers are on their own intercom channel and can communicate with each other, but cannot communicate with the crew or hear the aircraft radios.
- **ALL mode** allows full intercom communication between everyone plugged in to the GMA 340. Aircraft radios are heard by all.
- **MUSIC 1 and MUSIC 2** stereo entertainment inputs are affected by the intercom mode selected.

The following table summarizes the ICS operation for the different modes supported by the GMA 340:

MODE	PILOT HEARS	COPILOT HEARS	PASSENGER HEARS	MUSIC 1 MUTING TRIGGERED BY
PILOT (LED LIT)	Selected Radios. Pilot.	Copilot. Passengers. MUSIC 1.	Passengers. Copilot. MUSIC 1.	Copilot or passenger ICS activity.
CREW (LED LIT)	Selected Radios. Pilot. Copilot. MUSIC 1.	Selected Radios. Copilot. Pilot. MUSIC 1.	Passengers. MUSIC 2. (MUSIC 1 in Dual ADF)	Aircraft radio activity. MKR activity. Pilot or Copilot ICS activity.
ALL LED's OFF)	Selected Radios. Pilot. Copilot. Passengers. MUSIC 1.	Selected Radios. Pilot. Copilot. Passengers. MUSIC 1.	Selected Radios. Pilot. Copilot. Passengers. MUSIC 1.	Aircraft radio activity. MKR activity. ICS activity.

MUSIC 1 is normally muted during ICS activity. However an installation option is available to disable ICS MUTE. Then muting of MUSIC 1 will not occur due to ICS activity. A panel mounted switch may be installed for this function. The MUSIC 1 mute trip level is adjustable by the installing agency.

Mono/Stereo Headset

The use of stereo headsets is highly recommended.



If monaural headsets are plugged into stereo jacks that do not have a switch installed, the unit will not be damaged.



If the pilot uses a monaural headset in a stereo jack, no audio will be heard during failsafe operation. When using a monaural headset the pilot's jack must be equipped with a stereo/mono switch and it must be set to the 'mono' position for proper failsafe operation.

A person listening on a monaural headset will hear only the left channel from the GMA 340 in both ears. If a monaural headset is used at one of the passenger positions, any other passenger listening on a stereo headset will hear audio in their left ear only, unless their headset has a stereo/mono switch and it is set for mono.

Marker Beacon Receiver

The marker beacon is used as part of an ILS approach, and in certain instances, to identify an airway. In addition to the normal marker beacon functions, the GMA 340 provides an audio muting function. The lamps illuminate, and an associated keyed-tone is heard when MKR audio is selected, when the aircraft passes over a 75 MHz marker beacon transmitter.

Audio Frequency	Audio Keying	Lamp Actuated
400 Hz	■ ■ ■ ■ ■ ■ ■ ■	Blue (Outer)
1300 Hz	● ■ ● ■ ● ■ ● ■	Amber (Middle)
3000 Hz	● ● ● ● ● ● ● ●	White (Airway/Inner)

The lamp and audio keying for ILS approach operation are summarized below:

The marker beacon audio level is aligned at the factory to produce its rated audio output. However, the output level is adjustable by your avionics installing agency.

The GMA 340's marker beacon receiver controls are located on the left side of the front panel (1 through 4). The SENS button selects either high or low sensitivity as indicated by the HI or LO LED being lit. Low sensitivity is used on ILS approaches while high sensitivity allows operation over airway markers or to get an earlier indication of nearing the outer marker during an approach.

The marker audio is selected initially by pressing the MKR/mute button (2). If no marker beacon signal is received, then pressing again will deselect the marker audio. This operation is similar to selecting any other audio source on the GMA 340. However, if the second button press occurs while a marker beacon signal is received, then the marker audio is muted but not deselected. The button's LED will remain lit to indicate that the source is still selected.

The GMA 340's **SmartMute™** function then monitors the marker signal and automatically unmutes the audio when the current marker signal is no longer being received.

In all cases, the marker beacon lamps operate independently of any audio selection and cannot be turned off. The GMA 340 can drive external marker lamps if required.

Limited Warranty

GARMIN Corporation warrants this product to be free from defects in materials and workmanship for one year from the date of purchase. GARMIN will, at its sole option, repair or replace any components which fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor. The customer is, however, responsible for any transportation costs. This warranty does not cover failures due to abuse, misuse, accident or unauthorized alteration or repairs.

THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING ANY LIABILITY ARISING UNDER WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, WHICH MAY VARY FROM STATE TO STATE.

IN NO EVENT SHALL GARMIN BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE OR INABILITY TO USE THIS PRODUCT OR FROM DEFECTS IN THE PRODUCT. SOME STATES DO NOT ALLOW THE EXCLUSIONS OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

To obtain warranty service, call the GARMIN Customer Service department (913/397.8200) for a returned merchandise tracking number. The unit should be securely packaged with the tracking number clearly marked on the outside of the package, and sent freight prepaid and insured to a GARMIN warranty service station. A copy of the original sales receipt is required as the proof of purchase for warranty repairs. GARMIN retains the exclusive right to repair or replace the unit or software or offer a full refund of the purchase price at its sole discretion. SUCH REMEDY SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

J.P. INSTRUMENTS
PO BOX 7033
HUNTINGTON BEACH CA 92646

Airplane/Rotorcraft Flight Manual
Supplement No. 1
EGT-701 Rev B

FAA APPROVED
AIRPLANE/ROTORCRAFT FLIGHT MANUAL SUPPLEMENT OR
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL (INCLUDING POH AND FAA AFM)
(FOR THOSE AIRCRAFT WITHOUT A BASIC AIRPLANE FLIGHT MANUAL)

EGT-701 TEMPERATURE INDICATOR
FOR

Single and Twin Reciprocating Engine Powered Aircraft as listed
on Master Eligibility List of

STC SA2586NM.

REG. NO. VH-9PM

SER. NO. R1723306

This Supplement must be attached to the FAA Approved Airplane/Rotorcraft Flight Manual when the J.P. Instruments EGT-701 is installed in accordance with Supplemental Type Certificate SA 2586NM. For those airplanes without a basic Airplane Flight Manual, the Supplemental AFM must be in the aircraft when the EGT-701 is installed.

The information contained in this Airplane/Rotorcraft Flight Manual Supplement/ Supplemental Aircraft Flight Manual supplements or supersedes the basic manual/ placards only in those areas listed. For limitations, procedures and performance information not contained in this supplement, consult the basic Airplane Flight manual, Markings and Placards.

FAA APPROVED:



Manager, Flight Test Branch, ANM-160L
Federal Aviation Administration
Los Angeles Aircraft Certification Office
Transport Airplane Certification Directorate

Date: Nov. 12, 1992

JPI 701 EGT

Revision No.	Description	Affected Pages	Approval
Original	Complete Flight Manual Supplement for EGT-701	1 thru 4	<i>Donald Armstrong</i> Mgr. Flt. Test Br. ANM-160L FAA, LA ACO Transport Airplane Directorate Date <u>11-12-92</u>
A	Added Fuel Flow features & Switch.	2 thru 4	<i>Donald Armstrong</i> Mgr. Flt. Test Br. ANM-160L FAA, LA ACO Transport Airplane Directorate Date <u>12-13-96</u>
B	Added RPM and Manifold Pressure features	2 thru 4	<i>Donald Armstrong</i> Mgr. Flt. Test Br. ANM-160L FAA, LA ACO Transport Airplane Directorate Date <u>6-12-99</u>

1-GENERAL

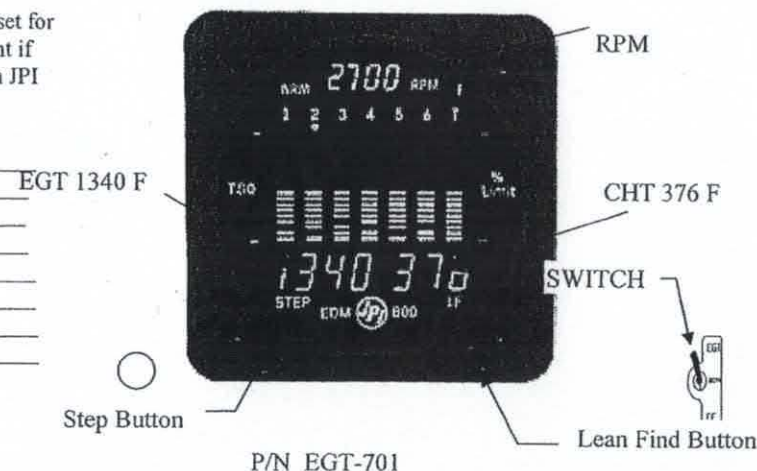
The EGT-701 temperature indicator displays temperature digitally and in analog format. The EGT as displayed is based on probes located near the exhaust outlet for each cylinder and the TIT probe, if installed, is adjacent to the turbo charger. These probes are not necessarily collocated with the primary probes therefore, EGT-701 may not indicate the same as the aircraft primary instruments. The analog display is an electronic bar graph (vertical columns, one per cylinder) of EGT & TIT temperatures presented as a percentage of 1650°F. Below the vertical columns the specific value for EGT and CHT are displayed digitally. The dot over the column indicates which cylinder's digital information is presently displayed. The missing bars at the base of the columns indicates the hottest and coldest Cylinder Head temperature trend. During Lean Find mode the leanest cylinder is displayed along with the fuel flow (optional) at that time. Depressing the LF and STEP button simultaneously brings up the adjustable scan rate function, OAT in °C or °F. Depress the LF button will change the value of the rate or OAT in °C or °F. Exit by Depressing STEP.

If the EGT-701 buttons are not depressed for 10 minutes the system will start scanning automatically. Depressing the STEP button will stop the automatic scan and index through all the functions available. During constant power cruise, if the LF button is depressed for five seconds the bargraph will level at mid scale. The leveled bars represent the peaks of each column. Each bar represents 10 °F and now acts as an EGT & TIT trend monitor, quickly showing an increase or decrease in temperature. Depress again to return to normal; nothing else is affected. With the fuel flow option there is a three position toggle switch. The positions are: 1) EGT, digital and bargraph display of temperatures, 2) FF, digital display of GPH, REM and USED Fuel. Temperature bargraph remains. 3) Both, cycles through everything installed. The data port output, sends RS232 serial data every 6-sec.

Options of Fuel Flow, TIT, OAT, IAT (induction air temp.), OIL, BAT (voltage) and are only displayed digitally with headlines after the number, as "230 OIL" or "14 GPH". A large value (50+) of "CLD" indicates shock cooling usually associated with rapid descents at low power. Optional functions not installed will not display. RPM is displayed constantly in the upper display with no alarms. MAP is shown in the scan display.

Alarm limits set for this instrument if different from JPI limits.

CH1 _____
OIL _____
TIT _____
DIF _____
CLD _____
BAT _____
TECH _____
(E _____



GENERAL (cont.)

An alarm causes the digital function to flash as soon as the particular limit is exceeded. Factory set alarm limits for CHT (450°F) and OIL (230°F) are lower than the actual aircraft limits and not to be set by the pilot. The values may be adjusted to suit individual preference by a qualified technician. Other factory set alarm limits are: "BAT" Voltage 15.5/11.0 or 31.0/22.0 Hi/Lo as appropriate; "DIF" (differential Hi/Lo EGT) 500°F; "TIT" 1650°F Hi; "OIL" 10 90°F; "CLD" (Rate of change of cylinder head temperature in degrees per minute) -60 degrees/minute. The pilot should be aware of the setting of each alarm for his particular aircraft. An alarm is "Canceled" by holding the step button in for 5 seconds and seeing the word "OFF". Then, only that particular alarm is canceled. Canceled alarms will not appear again until the power has been removed and reapplied to the EGT-701. The entire display dims automatically depending on the ambient lighting.

The Cylinder Head with the Gasket probe and oil temperature will indicate generally higher temperatures than instruments provided by the aircraft manufacturer because the EGT-701 sensing thermocouples are not collocated with the primary instrument sensing probes. Therefore, airplane flight manual limitations based on primary instrument indication take precedence over those of the EGT-701

II OPERATING LIMITATIONS

- A. The EGT-701 may not replace any existing instrument or indicator required by the aircraft type design or operating limits.
- B. The EGT-701 display may not be used in lieu of, or to supersede, engine operating limitations established by the airframe or engine manufacturer during certification.

III. EMERGENCY PROCEDURES

No change

IV. NORMAL PROCEDURES

CAUTION

Comply with manufacturer's Airplane
Flight Manual leaning procedure.
Do not exceed applicable engine
or aircraft limitations.

After establishing desired cruise power depress the LF button to activate the Lean Find Mode. As the mixture is leaned, one column on the EGT-701 display will begin blinking, indicating the exhaust gas temperature for that cylinder has peaked showing digital value along with the fuel flow (option) at that time. Continue with the leaning procedure as recommended by the aircraft manufacturer while monitoring the primary engine instruments and the EGT-701 display. Once the leaning procedure has been completed, depress the Step button briefly to exit the Lean Find Mode and enter the Monitor Mode.

Supplemental Type Certificate

Number SA00432SE

This certificate, issued to

J. P. Instruments
P.O. Box 7033
Huntington Beach, CA 92646

certifies that the change in the type design for the following product with the limitations and conditions therefor as specified hereon meets the airworthiness requirements of Part 21 of the Regulations.

Original Product—Type Certificate Number:

*See attached FAA Approved Model List (AML)

Make:

No. SA00432SE for a list of approved airplane

Model:

models and applicable airworthiness regulations.

Description of the Type Design Change: Fuel flow transducer installed in accordance with J.P. Instruments (JPI) Fuel Flow Installation Manual, Report No. 503, Revision B, dated March 14, 1997, and manufactured in accordance with JPI Drawing List Report No. 500 Revision B, dated March 14, 1997.

Note: This STC requires the installation of either:

1. JPI Fuel flow option with the EGT-701 temperature indicating system per STC SA2586NM; or
2. JPI FS-450 fuel flow indicating system per STC SA00861SE.

Limitations and Conditions: Approval of this change in type design applies to the aircraft models listed on the AML only. This approval should not be extended to other aircraft of these models on which other previously approved modifications are incorporated unless it is determined that the relationship between this change and any of those other previously approved modifications, including changes in type design, will introduce no adverse effect upon the airworthiness of that aircraft. A copy of this certificate, and FAA Approved Model List (AML) No. SA00432SE must be maintained as part of the permanent records for the modified aircraft.

If the holder agrees to permit another person to use this certificate to alter the product, the holder shall give the other person written evidence of that permission.

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application: January 3, 1997

Date received:

Date of issuance: May 2, 1997

Date amended: December 18, 2000



By direction of the Administrator
Adrian P. ...
(Signature)

Acting Manager, Seattle Aircraft
Certification Office

(Title)

Any alteration of this certificate is punishable by a fine of not exceeding \$1,000, or imprisonment not exceeding 3 years, or both.

This certificate may be transferred in accordance with FAR 21.47.

FAA Form 8130-2(10-94)

Subject: Permission to use STC.
To Whom It May Concern:

J.P. Instruments holder of STC SA00432SE and STC SA00861SE grants to the purchaser of the EDM-700 series (PN EGT-701) or the (FS-450) PN 450000 Series FUEL FLOW INSTALLATION permission to use the STC SA00432SE, or SA00861SE

Signed

Supplemental Type Certificate

Number SA00861SE

This certificate, issued to J. P. Instruments
P.O. Box 7033
Huntington Beach, CA 92646

certifies that the change in the type design for the following product with the limitations and conditions therefor as specified hereon meets the airworthiness requirements of Part 21 of the Regulations.

Original Product—Type Certificate Number: *See attached FAA Approved Model List (AML)
Make: No. SA00861SE for a list of approved airplane
Model: models and applicable airworthiness regulations.

Description of the Type Design Change: Installation of J.P. Instruments (JPI) fuel flow indicating system in accordance with JPI Installation Manual FS-450, Report No. 400, Revision -, dated August 16, 2000, or later FAA approved revision.

Limitations and Conditions: Approval of this change in type design applies to the aircraft models listed on the AML only. This approval should not be extended to other aircraft of these models on which other previously approved modifications are incorporated unless it is determined that the relationship between this change and any of those other previously approved modifications, including changes in type design, will introduce no adverse effect upon the airworthiness of that aircraft. A copy of this Certificate, FAA Approved Model List (AML) No. SA00861SE, and Airplane Flight Manual Supplement No. 1, dated December 18, 2000, or later FAA approved revision, must be maintained as part of the permanent records for the modified aircraft.

Note: This STC requires the installation of a fuel flow transducer per STC SA00432SE; or aircraft listed on the FAA approved AML SA00432SE and that have been previously modified with a fuel flow indication system that utilizes the Flowscon fuel flow transducer, P/N: 201-A, 201-B, 201-C or 231 are eligible for installation for the FS-450. This certificate does not constitute installation approval of the fuel flow transducer.

If the holder agrees to permit another person to use this certificate to alter the product, the holder shall give the other person written evidence of that permission.

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application: April 7, 2000
Date of issuance: December 18, 2000

Date received:
Date amended:



By Direction of the Administrator
Edmund J. ...
Acting Manager, Seattle Aircraft
Certification Office
(Title)

Any alteration of this certificate is punishable by a fine of not exceeding \$1,000, or imprisonment not exceeding 3 years, or both.

This certificate may be transferred in accordance with FAR 21.47.

FAA Form 0110-2(10-00)



U.S. Department
of Transportation
Federal Aviation
Administration

Transport Airplane Directorate
Los Angeles Aircraft
Certification Office
3960 Paramount Boulevard
Lakewood, California 90712-4137

DEC - 1, 2000

J.P. Instruments
Mr. Joseph Polizzotto
3402-1 West MacArthur
Santa Ana, California 92704

Dear Mr. Polizzotto:

J.P. Instruments, Fuel Flowmeters;
Technical Standard Order C44b

Your application dated November 29, 2000, requesting the issuance of a Technical Standard Order (TSO) authorization in accordance with the procedural requirements of 14 Code of Federal Regulations (14 CFR) Part 21, Subpart O, has been reviewed. Based upon your data and statement of conformance certifying your article(s) has met the requirements of 14 CFR Part 21, Subpart O, and the minimum performance standards of TSO C44b (Ref. 14 § 21.305, authorization is hereby granted for the following.

MODEL NO.

FS-450

DESCRIPTION

450000() Fuel Flowmeter

The technical data submitted with your application have been accepted to fulfill the requirements for your TSO authorization and will be retained in our files. For your information the conditions and tests required for TSO authorization are minimum performance standards. The article(s) may be installed on or within a specific type or class of aircraft only if further evaluation by the user/installer documents an acceptable installation that is approved by the Administrator.

The quality control procedures contained in your quality control manual, currently on file at the Los Angeles Manufacturing Inspection District Office, and your statement that those procedures will be applied to the manufacture of the subject articles at the above address, are considered adequate in accordance with 14 CFR § 21.143.

Effective this date, your authorization to use TSO procedures is extended to include the subject article(s). You may identify this article(s) with the applicable TSO markings as required by TSO C44b.

TSO-C44b Report No 440

11/26/00

2) Scope	Regulation	Method of Compliance
	Types: Type I Type II	Type II – Counter type instrument that indicates both fuel consumed and quantity remaining.
3) General Requirements	3.1.1 materials	
	3.1.2 Workmanship	
	3.2 Identification	
	3.3 Environmental	See section 5, 6, 7
	3.3.1 Temperature	Instrument Location: Power Plant Compartment PASSED
	3.3.2 Humidity:	PASSED
	3.3.3 Vibration	Power Plant Mounted: PASSED
	3.3.4 Altitude	PASSED
	3.4 Radio Interference	PASSED Additional testing see section 6.0
	3.5 Magnetic Effect	PASSED
	4.0 Detail Req.	
	4.1.1 Indicating Method	Type II instrument with a counter to indicate both fuel consumed and quantity remaining.
	4.2 Dial Markings	
	4.2.1 Finish	PASSED
	4.2.2 Numerals	PASSED
	4.2.3 Graduations	PASSED
	4.2.4 Counters	PASSED
	4.2.5 Visibility	PASSED
	4.3 Flow Direction	PASSED
	4.4 fuel Characteristics	All transmitters are specifically designed to operate with all aviation fuel.
	4.5 Power Variations	PASSED
	4.6 Safety Provision	PASSED
	5.0 to 5.5	PASSED.
	6.0 Individual performance req. Additional testing: DO-160D,	Tested to Category "M". This category may be suitable for equipment and associated interconnecting wiring located in the electronic bay of an aircraft. Section 21.3 Conducted RF Emission a). Passed category M b). Passed category M Section 21.4 Radiated RF Emission Passed category M
	Section 21, Emission of Radio Frequency Energy	
	6.1 Scale Error	PASSED
	6.2 Dielectric	
	6.2.1 Insulation res.	Not Applicable
	6.2.2 Overpotential	Not Applicable
	6.2.2.1 Hermetically sealed	Not Applicable
	6.3 Leak test	PASSED
	7.1 Low and High temperature	PASSED
	7.2 Extreme Temperature Exposure	PASSED
	7.3 Magnetic Effect	PASSED
	7.4 Humidity	PASSED
	7.5 Vibration	PASSED
	7.5.1 Resonance:	
	7.5.2 Cycling:	PASSED
	7.6 Locked rotor	PASSED

J.P.INSTRUMENTS FAA APPROVED MODEL LIST (AML) FOR :

- 1- INSTALLATION OF THE EGT 701 SERIES FUEL FLOW TRANSDUCER NO SA00432SE
2- INSTALLATION OF THE (FS-450) 450000 SRIES STC SA 00861SE
FUEL FLOW INSTRUMENT and TRANSDUCER

1.	Aerostar (Piper)	PA-60-600, 601, 601P PA-60-602P, -700P	A17WE	FAR 23	12/18/09
2.	Aerostar (Piper)	650, 680, 700, 700A, 700CR	A17WE	FAR 23	12/18/09
3.	Aero Commander	100-180	1A21	CAR 3	12/18/00
4.	American Champion Aircraft Corp.	8KCAB	A21CE	FAR 23	12/18/09
5.	American Champion Aircraft Corp.	7GCBC, 7ECA, 7GCB, 7GCA, 7KCAB	A-759	CAR 4a	12/18/09
6.	American Champion Aircraft Corp.	8GCBC	A21CE	FAR 23	4/9/02
7.	American General Aircraft Holdings, Grumman	AA-5, AA-5A, AA-5B	A16EA	FAR 23	12/18/09
8.	American General Aircraft Holdings, Grumman	AG-5B	A16EA	FAR 23	12/18/09
9.	American General Aircraft Holdings, Grumman	AA-1, AA-1A, AA-1B, AA-1C	A11EA	FAR 23	4/9/02
10.	American General Aircraft Holdings, Grumman	GA-7 Twin	A17SO	FAR 23	12/18/00
11.	Aviat Aircraft Inc.	A-1, A-1A, A-1B	A22NM	FAR 23	4/9/02
12.	Beagle (DeHavilland Support Ltd.) (British Aerospace)	B121 series 1 and 2, 3	A22EU	FAR 21.29 FAR 23	2/9/04
13.	Beech	D-17S	A-649	CAR 3	11/30/05
14.	Beech Twin	D18S, D18C, E18S, C-45G, TC-45G, C-45H, TC-45H, TC-45J or UC-45J (SNB-5), RC-45J (SNB-5P), G18S, JRB- 6, 3N, 3NM, 3TM, P & W Wasps Jr.	A-765	CAR 3	12/18/00
15.	Beech Twin	E18S-9700	A-765	CAR 3	7/6/09
16.	Beech	35-C33A, E33A, E33C	3A15	CAR 3	12/18/00
17.	Beech	(YT-34) 45, (T-34A, B-45) A45, (T-34B) D45 Cont. E-225-8	5A3	CAR 3	12/18/09
18.	Beech	19A, M19A, A23-19, B19 C24R, B24R	A1CE	CAR 3	2/9/04
19.	Beech	B23, C23	A1CE	CAR 3	12/18/09
20.	Beech	35, A35, B35, C35, D35, E35, F35, G35, 35R	A-777	CAR 3	12/18/09
21.	Beech	H35	3A15	CAR 3	7/6/09
22.	Beech	J35, K35, M35, N35, V35, V35A, V35B, 35-33, 35-A33, 35-B33, 35-C33, 35-C33A, S35, P35, N35 E33, F33, F33A, F33C, G33, 36, A36, A36TC, B36TC	3A15	CAR 3	12/18/09
23.	Beech	V35, V35A, V35B	3A15	CAR 3	12/18/00
24.	Beech	G36	3A15	CAR 3	7/6/09
25.	Beech	B50, C50, D50	A1CE	CAR 3	7/6/09
26.	Beech	56TC, A56TC	3A16	CAR 3	7/6/09
27.	Beech	58, 58A	3A16	CAR 3	12/18/09
28.	Beech	58P, 58PA, 58TC, 58TCA	A23CE	FAR 23	12/18/09
29.	Beech	95-55, -A55, -B55, -B55A, -C55, C55A, D55, D55A, E55, E55A	3A16	CAR 3	12/18/09
30.	Beech	B95A, D95A, E95, 95-B55B	3A16	CAR 3	12/18/00
31.	Beech	G58	3A16	CAR 3	7/6/09
32.	Beech	60, A60, B60	A12CE	FAR 23	1/27/03
33.	Beech	65-80, 65-A80, 65-A80-8800, 65-88, 65-B80	3A20	CAR 3	7/6/09
34.	Beech	76	A29CE	FAR 23	1/27/03
35.	Beech	95, B95	3A16	CAR 3	12/18/09
36.	Bellanca	14-19-2	1A3	CAR 3	4/9/02
37.	Bellanca	17-30	1A3	CAR 3	12/18/09

J.P. INSTRUMENTS FAA APPROVED MODEL LIST (AML) FOR :

- 1 INSTALLATION OF THE EGT 701 SERIES FUEL FLOW TRANSDUCER NO SA00432SE
2- INSTALLATION OF THE (FS-450) 450000 SRIES STC SA 00861SE

FUEL FLOW INSTRUMENT and TRANSDUCER

38	Bellanca	17-30A, 17-31, -A,	1A3	FAR 23	2/9/04
39	Bellanca	17-31ATC	1A3	FAR 23	2/9/04
40	Boeing Stearman	75, A75, E75, A75L300, A75, B75, A75N1, A75J1	A-743	CAR 4a	12/18/09
41	Boeing (Stearman)	A75L3 IB75A, E75N1, B75N1, D75N1	A-743	CAR 4a	7/6/09
42	Cessna	120, 140,	A-768	CAR 3	12/18/00
43	Cessna	140A	5A2	CAR 3	12/18/00
44	Cessna	150, 150A, B, C, D, E, F, G, H, J, K, L, M, A150K, A150L, A150M, 152, A152	3A19	CAR 3	4/9/02
45	Cessna	170, 170A, B	A-799	CAR 3	12/18/09
46	Cessna	172, 172A, B, C, D, E, F, G, H,	3A12	CAR 3	12/18/09
47	Cessna	172 I, K, L, M, N, P, Q	3A12	CAR 3	12/18/09
48	Cessna	172R	3A12	FAR 23	12/18/09
49	Cessna	172S	3A12	FAR 23	12/18/09
50	Cessna	172RG, R172E, F, G, H, J, K, 175, 175A, B, C, P172D	3A17	CAR 3	12/18/09
51	Cessna	177, 177A, 177B	A13CE	FAR 23	12/18/09
52	Cessna	177RG	A20CE	FAR 23	12/18/09
53	Cessna	180, 180A, B, C, D, E, F, G, H, J, K	5A6	CAR 3	12/18/09
54	Cessna	182, 182A, B, C, D, E, F, G, H, J, K, L, M, N, P, Q, R	3A13	CAR 3	12/18/09
55	Cessna	182T, T182T	3A13	CAR 3	12/18/09
56	Cessna	182 Series, Air Planes Corp.	3A13	CAR 3	12/18/09
57	Cessna	182S	3A13	FAR 23	12/18/09
58	Cessna	R182, T182, TR182	3A13	CAR 3	12/18/09
59	Cessna	185, 185A, B, C, D, E, A185E, A185F	3A24	CAR 3	12/18/09
60	Cessna	188, 188A, 188B, A188, A188A, A188B, T188C	A9CE	FAR 21	12/18/09
61	Cessna	195, -A, -B	A-790	CAR 3	12/18/09
62	Cessna	206, P206, P206A, B, C, D, E, TP206A, B, C, D, E, U206, U206A, B, C, D, E, F, G, TU206A, B, C, D, E, F, G	A4CE	CAR 3	12/18/09
63	Cessna	206H	A4CE	FAR 23	12/18/09
64	Cessna	207, 207A, T207, T207A	A16CE	FAR 23	12/18/09
65	Cessna	210, 210A, B, C, D, E, F, 210-5, 210-5A, T210F, T10G, T210G, 210H, T210H, 210J, T210J, T210K, 210L, T210L, 210M, T210M, 210N, P210N, T210N, 210R, 210R, T210R	3A21	FAR 23	12/18/09
66	Cessna	T303	A34CE	FAR 23	12/18/09
67	Cessna	310, 310A, B, C, D, E, F, G, H, E310H, E310J, 310I, J, K, L, N, P, Q, R 310J-1, T310P, Q, R, T310Q, 310R, T310R	3A10	CAR 3	12/18/09
68	Cessna	320, A, B, C, D, E, F, 320-1, 335, 340, 340A	3A25	CAR 3	12/18/09
69	Cessna	336	A2CE	CAR 3	12/18/09
70	Cessna	337, 337A, B, C, D, E, F, G, H, T337B, C, D, E, F, G, H, M337B, P337H, T337H-SP	A6CE	CAR 3	12/18/09
71	Cessna	401, 401A, B, 402, 402A, B, C, 411, 411A, 414, 414A, 421, 421A 421B, 421C	A7CE	CAR 3	12/18/09
72	Cessna	404	A25CE	FAR 23	2/9/04
73	Cessna (Columbia)	LC41-550FG)	A00003 SE	FAR-23	7/6/09
74	Chaparral Motors (Great Lakes)	27-1A-1, -2	A18EA	AERO BULL 7-A FAR 23	7/6/09
75	Cirrus	SR-20	A00009 CH	FAR 23	12/18/00
76	Cirrus	SR-22	A00009 CH	FAR 23	12/18/09
77	Commander (Gulfstream America)	112, B, TC, TCA, 114, A, B, TC	A12SO	FAR 23	12/18/09
78	Consolidated		1A13	CAR 3	7/6/09

J.P. INSTRUMENTS FAA APPROVED MODEL LIST (AML) FOR :

- 1 INSTALLATION OF THE EGT 701 SERIES FUEL FLOW TRANSDUCER NO SA00432SE
2- INSTALLATION OF THE (FS-450) 450000 SRIES STC SA 00861SE

FUEL FLOW INSTRUMENT and TRANSDUCER

	Aeronautical (LanShe)	LAKE 250			
79	De Havilland	DHC-2 Mk. I	A806	CAR 3	7/6/09
80	Enstrom Helicopter	F-28A	H1CE	CAR 6	7/6/09
81	EXTRA FLUGZEUGBAU	EA-300, S, L, EA-300/200	A67EU	FAR 21.29 FAR 23	12/18/09
82	EXTRA FLUGZEUGBAU	EA-400	A43CE	FAR 23	4/9/02
83	GENERAL AVIA	F20	A38EU	CAR 3	12/18/09
84	GENERAL AVIA	F22B F22C	A75EU	FAR 23	12/18/09
85	Grumman (Dennis Buehn)	HU-16C	A23NM	FAR 21.25	1/27/03
86	Grumman	G-44, G44A,	A-734	CAR 4A	11/30/05
87	Helio (Alliance Aircraft)	H-295, HT-295, H-395	1A8	CAR 3	1/27/03
88	Helio (Alliance Aircraft)	H-391B	1A8	CAR 3	2/9/04
89	Helio (Alliance Aircraft)	H-391, H-800	1A8	CAR 3	11/30/05
90	Hughes Helicopter (Schweizer)	269A, 269A-1, 269B, 269C	4H12	CAR 6	7/6/09
91	Jobmaster Company	DGA-15P (Army UC-70, Navy GH-1, GH-2, GH-3, NH-1)	A-717	CAR 4a	12/18/09
92	Lancair	LC40-550FG	A00003 SE	FAR-23	12/18/00
93	LanShe Aerospace LLC. (Micco)	MAC-145B	3A1	FAR23	2/9/04
94	Maule	MX-7-180, A, B MXT-7-180, A, B	3A23	CAR 3	12/18/09
95	Maule	MXT-7-160	3A23	CAR 3	1/27/03
96	Maule	M-7-260	3A23	CAR 3	12/18/09
97	Maule	M-7-260C, MT-7-260,	3A23	CAR 3	4/9/02
98	Maule	M-4-210, C, S, T, M-5-210C	3A23	CAR 3	12/18/09
99	Maule	M-5-180C, MX-7-180C, MX-7-235, -235C; M-4-220	3A23	CAR 3	7/6/09
100	Maule	M-5-200	3A23	CAR 3	2/9/04
101	Maule	M-5-235C	3A23	CAR 3	12/18/09
102	Maule	M-4-220C	3A23	CAR 3	12/18/00
103	Maule	M-4-220S,T, M5-235,	3A23	CAR 3	11/30/05
104	Maule	M-6-235, MX-7-180AC	3A23	CAR 3	4-19-2002
105	Maule	M-7-235A, B, C, MT-7-235	3A23	CAR 3	4/9/02
106	Prop-Jet Inc. (Meyers)	200B, C, D	3A18	CAR 3	4/9/02
107	Micco Aircraft Co.	MAC-145A,B	3A1	CAR 4a	7/6/09
108	Moravan (Zlin)	Z 143 L	A76EU	FAR 23	4/9/02
109	Moravan (Zlin)	Z 242 L	A76EU	FAR 23	11/30/05
110	Revo Inc. LAKE	LA-4, LA-4-200 Lake Model -250	1A13	CAR 3 FAR 23	12/18/09
111	Mooney	M20A, B, C, D, E, F, G, J, K, M, R	2A3	CAR 3	12/18/09
112	Mooney	M20S	2A3	CAR3	4/9/02
113	Mooney	M20L	2A3	CAR 3	11/30/05
114	Mooney	M22	A6SW	CAR 3	12/18/09
115	Piper	PA-12, -12S	A-780	CAR 3	4/9/02

J.P. INSTRUMENTS FAA APPROVED MODEL LIST (AML) FOR :

- 1 INSTALLATION OF THE EGT 701 SERIES FUEL FLOW TRANSDUCER NO SA00432SE
2- INSTALLATION OF THE (FS-450) 450000 SRIES STC SA 00861SE

FUEL FLOW INSTRUMENT and TRANSDUCER

116	Piper	PA-18, PA-18S, PA-18 "105" (Special), PA-18S "105" (Special) PA-18A, PA-18 "125" (Army L-21A) PA-18S "125", PA-18AS "125", PA-18 "135" (Army L-21B), PA-18A "135", PA-18S "135", PA-18AS "135", PA-18 "150", PA-18A "150", PA-18S "150", PA-18AS "150", PA-18A "150", PA-18S "150", PA-18AS "150", PA-18A "150", PA-18S "150", PA-18AS "150"	1A2 AR-7	CAR 3 CAR 8.10b	12/18/00
11	Piper	PA20, PA20S, PA20"115", PA20S"115", PA20"135", PA20S"135"	1A4	CAR 3	12/18/09
11	Piper	PA22, PA22-108, PA22-135, PA22S-135, PA22S-150, PA22-160, PA22S-160	1A6	CAR 3	12/18/09
11	Piper	PA-22-150	1A6	CAR 3	2/9/04
12	Piper	PA 23, PA23-160, PA23-250, -E23-250	1A10	CAR 3	12/18/09
12	Piper	PA 23-235	1A10	CAR 3	4/1/00
12	Piper	PA24, PA24-250, PA24-260	1A15	CAR 3	12/18/09
12	Piper	PA24-400	1A15	CAR 3	12/18/09
12	Piper	PA25-235, PA-25-260	2A8	CAR 3	2/9/04
12	Piper	PA28-140, -150, -151, -160, -161, -180, PA-28S-180, PA-28S-160 PA28R-180	2A13	CAR 3	12/18/09
12	Piper	PA28-181, PA28R-200, PA28R-201, -201T, PA28-201T, PA28RT-201, PA28RT-201T	2A13	CAR 3	12/18/09
12	Piper	PA28-235, -236	2A13	CAR 3	12/18/09
12	Piper	PA30, PA39, PA40	A1EA	CAR 3	12/18/09
12	Piper	PA31-350	A20SO	CAR 3 FAR 23	12/18/09
13	Piper	PA31-325	A20SO	CAR 3	12/18/09
13	Piper	PA31	A20SO	CAR 3	1/27/03
13	Piper	PA31P	A20SO	CAR 3	11/30/05
13	Piper	PA32-300, PA32S-300, PA32R-301, PA32R-300, PA32-301	A3SO	CAR 3	12/18/09
13	Piper	PA32RT-300	A3SO	CAR 3	12/18/09
13	Piper	PA32-260, PA32RT-300T, PA32-301T	A3SO	CAR 3	12/18/09
13	Piper	PA32R-301T	A3SO	CAR 3	7/6/09
13	Piper	PA34-200, PA34-200T, -220T	A7SO	FAR 23	12/18/09
13	Piper	PA-38-112	A18SO	FAR 23	7/6/09
13	Piper Twin	PA44-180, -180T	A19SO	FAR 23	12/18/09
14	Piper	PA46-350P, PA46-310P	A25SO	FAR 23	12/18/09
14	Robinson Helicopter Co.	R22, R22 ALPHA, R22 BETA, R22 MARINER	H10W E	FAR 27	12/18/09
14	Robinson Helicopter Co.	R44	H11NM	FAR 27	12/18/09
14	Robinson Helicopter Co.	R44 II	H11NM	FAR 27	7/6/09
14	Sky Enterprises (Republic)	RC-3	A-769	CAR 3	12/18/09
14	Navion Aircraft Company LTD (Thompson)	Navion, Navion A, B with IO-470 Series eng.	A-782	CAR 3	12/18/09
14	Navion Aircraft Company LTD (Thompson)	Navion, Navion A, B, C, D, E	A-782	CAR 3	12/18/09
14	Navion Aircraft Company LTD (Thompson)	Navion F, G, H	A-782	CAR 3	12/18/09
14	S.O.C.A.T.A. Aerospatiale	TB10, TB20, TB21, 200	A51EU	FAR 21.29	12/18/09
14	S.O.C.A.T.A. Aerospatiale	TB9	A51EU	FAR 21.29	2/9/04
15	Siai-Marchetti	F.260, F.260B, F.260C, F.260D, F.260E, F.260F	A10EU	FAR 23 CAR 10	12/18/09

J.P. INSTRUMENTS FAA APPROVED MODEL LIST (AML) FOR :

- 1 INSTALLATION OF THE EGT 701 SERIES FUEL FLOW TRANSDUCER NO SA00432SE
2- INSTALLATION OF THE (FS-450) 450000 SRIES STC SA 00861SE
FUEL FLOW INSTRUMENT and TRANSDUCER

15	Siai-Marchetti	F20	A38EU	FAR 23 CAR 10	12/18/09
15	y International (Pitts)	S-2B	A8SO	FAR 23	7/6/09
153	Univair Aircraft Corp. (Stinson)	108, 108-1, -2, -3, -5	A-767	CAR 3	7/6/09
154	Swift	GC-1B	766	CAR 4a	7/6/09
155	Twin Commander Aircraft Corp.	500-A, 685	6A1 2A4	CAR 3	12/18/09
156	Twin Commander Aircraft Corp.	500-B; 500-B, S, U with Merlyn STC SA01142SE or SA1212SE	6A1	CAR 3	11/30/05
15	VARGA Augustair, Inc.	2150A	4A19	CAR 3	7/6/09
15	Waco	F5, F5C	ATC 542	AERO BULL 7-A	7/6/09

Issue Date: May 2, 1997

Revisions: June 23, 1997 (Rev B), October 9, 1997 (Rev C), July 16, 1999 (Rev D), June 5, 2000 (Rev E), May 31, 2001 (Rev F), April 19, 2002 (Rev G), January 27, 2003 (Rev H), February 9, 2004 (Rev I), November 30, 2005 (Rev J), July 6 2009 Rev

Issue Date: December 18, 2000

Revisions: May 31, 2001 (Rev A), April 9, 2002 (Rev B), January 27, 2003 (Rev C), February 9, 2004 (Rev D), Nov 30, 2005 (Rev E), July 6 2009 Rev F

FAA Approved

Manager, Seattle Aircraft Certification Office

Approval Date JUL - 6 2009

United States Of America
Department of Transportation - Federal Aviation Administration

Supplemental Type Certificate

Number SA2586NM

This Certificate issued to J. P. INSTRUMENTS
PO Box 7033
Huntington Beach, CA 92646

certifies that the change in the type design for the following product with the limitations and conditions therefor as specified hereon meets the airworthiness requirements of Part 3 of the Civil Aviation Regulations, including respective Amendments as specified in the attached Approved Model List.

Original Product Type Certificate Number: * See attached FAA Approved J.P. Instruments

Make: * Master Eligibility List No. SA2586NM for list

Model: * of approved aircraft models and applicable TCDS

Description of Type Design Change:

Installation of J. P. Instruments temperature monitoring systems in accordance with FAA Approved J. P. Instruments Drawing List Report No. 100, Revision D, dated December 19, 1996, or later FAA approved revisions. FAA Approved Airplane/Rotorcraft Flight Manual Supplement No. 1 for EGT-701 temperature indicator, Revision A, dated December 13, 1996, or later FAA approved revisions.

Limitations and Conditions: The approval of the change in type design applies to the basic airplane of the specific models that are otherwise unmodified. This approval should not be extended to other specific airplanes of these models on which other previously approved modifications are incorporated, unless it is determined that the interrelationship between this installation and any previously approved configuration will not introduce any adverse effect upon the airworthiness of that airplane. If the holder agrees to permit another person to use this certificate to alter the product, the holder shall give the other person written evidence of that permission. (See continuation sheet)

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application: December 31, 1984

Date of issuance: August 14, 1985

Date revised:

Date amended: July 13, 1987, November 13, 1992, December 19, 1996, May 15, 1998, June 17, 1999

By direction of the Administrator



(Signature)
Manager, Propulsion Branch
Los Angeles Aircraft Certification Office

(Title)

Any alteration of this certificate is punishable by a fine of not exceeding \$1,000, or imprisonment not exceeding 3 years, or both.

Supplemental Type Certificate
(Continuation Sheet)

Number SA2586NM

Limitations and Conditions - continued

Cylinder head, oil, turbine inlet and/or exhaust gas temperature, fuel flow equipment, tachometer instruments, and manifold pressure instruments required by the original type design, or if required by other FAA approval, must remain installed and operable.

Aircraft listed on the FAA approved Master Eligibility List SA2586NM and that have been previously modified with a fuel flow indication system that utilizes the Flowsan fuel flow transducer (P/N: 201-A, 201-B, 201-C, or 231 or equivalent as listed on page 4 of the FAA Approved Installation Instructions, Drawing 103) are eligible for installation of the EGT-701 fuel flow option.

This certificate does not constitute installation approval of the fuel flow transducer.

EGT-701 temperature indicator with tachometer (rpm) and manifold pressure options are eligible for the 4 cylinder and 6 cylinder engines listed on the Master Eligibility List (MEL) SA2586NM only.

FAA Approved Airplane/Rotorcraft Flight Manual Supplement No. 1, Revision A, dated December 13, 1996 or later FAA approved revision, is required with the installation of the EGT-70 system.

Eligible dash numbers for the EGT-701 are listed on MEL SA2586NM.

A copy of this certificate must be maintained as part of the permanent records of the modified aircraft.

-END-



MASTER ELIGIBILITY LIST

NO. SA2586NM

INSTALLATION OF THE EGT 100, 200 SERIES AND 701 SERIES TEMPERATURE
INDICATORS,
FOR

EXHAUST GAS, CYLINDER HEAD TEMPERATURE MONITORING SYSTEM.

STC NUMBER: SA2586NM

DATE: AUGUST 14, 1985

REV 14
DATE: July 20, 2008

FAA Approved

AUG 22 2008

Los Angeles Aircraft
Certification Office
ANM 140 L *SA*

Any alteration of this certificate is punishable by a fine of not exceeding \$1,000, or imprisonment not exceeding 3 years, or both.

TO FAA APPROVED MASTER ELIGIBILITY
LIST NO. SA2586N

Part Number

T.C.D.S. (See P. 11 for Series)

REVISION DATE NO. APPROVED	REVISION DESCRIPTION	SHEET 2
NC 8-14-85	Initial Release;	Sheets 1 thru 5
-1 9-23-85	Addition of: Cessna Models 320, 336, 340 and Piper Models PA-38, PA-44, PA-60 series; Sheet 6 Form changes and typing corrections Omission of "Approval Date" column on sheet 6 and subsequent sheets	
-2 7-22-86	Addition of: Gulfstream American 112, 114, AA-5, 560 and 680; Beech 50, 60, 65, 76, Series; Bellanca 14-13 and 14-19 Series; Cessna 185, 188, and 321 Series; Maule M-4, M-5 and M-6 Series; Piper PA-22, PA-32-301 Series; Republic RC-3; Swift GC-1A and GC-1B Series; Sheets 5, 6 and 7	
-3 7-13-87	Addition of: Piper PA-46-310P (Malibu), PA-31P (Navajo) Suffix (O), added to instrument part number indicating Oil temperature PMA'd probe, P/N 400505, L-C. Applicable to all Lycoming and Continental direct drive piston engines. Suffix (T) added to instrument part number indicating turbine inlet temperature with probe P/N M-111 Parenthesis () added to any instrument part number, will indicate: "None, Any or All" of the options in parenthesis are applicable. Reorganized	Sheets ALL
-4 5-23-90	Addition of: Enstrom Helicopter F-28, -28A, -28C, -28F, 280, 280C, 280F; Hughes Helicopter 269A, 269B, 269C; Robinson Helicopter R22, R22-Alpha, R22-Beta, R22-Mariner; Mooney Aircraft M20L, M20R; Sial-Marchetti S.205-18/F, -18/R, -20/F, -20/R, 22/R, S.208, S.208A, F.260, F.260B, F.260C; S.O.C.A.T.A TB10, TB20, TB21; Partenavia Costruzioni P68, P68B, P68C, P68C-TC, P68TC, AP68TP 300. Piper PA-46-350P. Sheets 2, 5, 6, 8	
-5 11-11-92	Addition of: EGT-701 (series) approved aircraft having for 4 or 6 cylinder engines only. Deleted aircraft model: Beech, all 90 series; Piper, PA-31T, -31T1, -31T2, -31T3. Sheets 2, 3, 7	
-6 11-09-95	Addition of: GENERAL AVIA Costruzioni Aeronautiche F22B, F22R, F22C & F20; Mooney M20R; Air Tractor AT-300, -301; Ayres Corp. 600S-2D, S-2R, S2R-R1340; Avions Pierre Robin R2160. Sheets 3, 6.	
-7 12-19-96	Addition of: Added sheet 9 & 10 model designation system and Eligible Part Numbers. Revised all Part Numbers, all sheets. Added Fuel Flow suffix to P/N. Removed note "EGT-701 approved for 4 & 6 cylinder engines only". Added Cessna 170A, B, 172R. Bellanca 17-30A series. AERO COMMANDER B-1, B-1A, De Havilland, DHC-2 Mk. series, North American T-28A series, WACO series and Beech 45 series. Sheets ALL	
-8 07-14-98	Addition of: Extra EA-300, S, L, EA-300/200. Maule MX-7-180C, MXT-7-180A, M-7-235, A, B, C, M-7-260, MT-7-260. Cessna 182S, 206H. Sial-Marchetti F.260D, E, F. Piper PA23-250 Sheets 4, 5, 6, 8	
-9 01-13-99	Addition of: Meyers (PROP-JETS, INC) 200, 200A, B, C, D. Gulfstream American GA-7. Beech Model D17S, SD17S, D17R, D17A, C17R, G17S. Piper PA-18 Series. Robinson R44 VARGA Series. Grumman G21. Corrected P/N. Was EGT-710 to EGT-701	Sheets 3, 5, 6, 7, 8
-10 06-17-99	Addition of: RPM & MAP to identification list for EGT-701	Sheet ALL
-11 05-02-00	Addition of: American Champ 8KCAB, 7GCBC, 7ECA, 7GCBA, 7GCAA, 7KCAB. Beech 95-58, Cessna T206H. Gulfstream American 114 B, TC. Maule MXT-7-180 A, B. Mooney (Rocket Conv. Per STC SA 00472SE & STC SA 5691NM) M20K, M20J. Pitts (Aviat) S-1S, S-1T, S-2, S-2A. Christen (Aviat) A-1, S-2B. Mooney M-22, M20S. Jobmaster Comp DGA-15P. Weatherly 620, A, B. Thompson Navion C. Cessna U206A, B, C, D, E, F, G. (conv. Per STC 2123NM) Sheets 3, 5, 6, 7, 8	
-12 06-11-01	Addition of: American General GA-7 • Beech V35, A, B (STC SA1035WE) • Beech 58, 76 • Lance, LC40-550FG • Cessna 140 (STC SA547EA) • 172, S, T • 182T, RS, T182T • 182E-Q (STC SA3825SW) • Cirrus SR-20 • Piper PA-18, 18A, "150" (STC SA682AL, STC SA00035NY) • Piper PA-24-200 Sheets 1-4	
-13 04-18-03	Addition of: Beech 77 • Cirrus 22 • Cessna T303 • Diamond Aircraft DA20-A1, DA20-C1, DA40 • Extra Flugzeugbau EA-400 • Slingsby T67M260, T67M260-T3A • Wilga 80, Wilga 2000, "Hello (Alliance Aircraft) H-295, HT-295, H-395, H-391, H-391B, H-700, H-800	Sheets 5, 6
-14 07-20-08	Addition of: American Champion Aircraft Corp., 8GCBC • Beagle (DeHavilland Support, Ltd.) B121 series, 1, 2, 3 • Cessna F182P, Q, FR182 • Chaparral Motors, 2T-1A, -1, -2 • Maule, MXT-7-160, MX-7-180AC, M-5-200, M-7-260, M-4-220C, M-4-220S, T, MT-7-235, M5-235C • Micco Aircraft Co, MAC-145, 145A, B • Mooney M20TN • Moravan Inc. Z-242L, Z-143L • Pilatus Aircraft PC6/350, PC6/350-H1, H2 • Piper, PA-12, -12S, PA-22-150 • Univair Aircraft Corp, 108, 108-1, -2, -3, 5 • WACO YMF (F5, F5C) Sheets 2, 3, 4, 5, 6, 7	

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MAKE	AIRCRAFT MODEL	T.C.D.S. (See P. 11 for Series)	Part Number
1. Air Tractor	AT-300, AT-301	A9SW	(9), (E)
2. Avions Pierre Robin	R2160.	A48EU	(4), (A)
3. Ayres Corp.	600 S-2D, S-2R, S2R-R1340 S2R-R3S	A3SW	(9), (E)
AERO COMMANDER	B-1, B-1A 100-180	A8WE A8WE	(8), (D) (4), (A)
5. American Champion Aircraft Corp.	8KCAB	A21CE	(4), (A)
6. American Champion Aircraft Corp.	8GCBC	A21CE	(4), (A)
7. American Champion Aircraft Corp.	7GCBC, 7ECA, 7GCBA, 7GCAA, 7KCAB	A-759	(4), (A)
8. American General Aircraft Holdings, Grumman	GA-7 Twin	A17SO	(6T*), (BT*)
9. Beagle (DeHavilland Support Ltd.) (British Aerospace)	B.121 Series 1, 2, 3	A22EU	(4), (A)
10. Beech	D18S, D18C, E18S, C-45G, TC-45G, C-45H, TC-45H, TC-45J or UC-45J (SNB-5), RC-45J (SNB-5P), E18S-9700, G18S, JRB-6, 3N, 3NM, 3TM, P7W Wasps Jr.	A-765	(9), (E)
11. Beech	Model D17S, SD17S, D17R, D17A, C17R (Army UC-43E) G17S,	A-649 ATC-713 ATC-604 ATC-779	(9), (E) (9), (E) (9), (E) (9), (E)
Beech	23, A23, A23A, A23-19, 19A, B19, M19A, A23-24, B23, C23, A24, A24R, B24R, C24R	A1CE	(4), (A)
13. Beech	(YT-34) A45, (T-34A, B-45) A45, (T-34B) D45 Cont. E-225-8	5A3	(6), (B)
14. Beech	35, A35, B35, C35, D35, E35, F35, G35, 35R	A-777	(6), (B)
15. Beech	H35, J35, K35, M35, N35, P35, S35, V35, V35A, V35B, 35-33, 35-A33, 35-B33, 35-C33, 35-C33A, E33, E33A, E33C, F33, F33A, F33C, G33, 36, A36, A36TC, B36TC	3A15	(6), (B)
16. Beech	V35, V35A, V35B with Optional engine TS10-520 per STC SA1035WE	3A15	(6), (B)
17. Beech	50, B50; D50, A, B, C, E, E-5990; E50, F, G, H, J	5A4	(6T), (BT)
18. Beech	58, 58P, 58PA, 58TC, 58TCA	A23CE	(6T*), (BT*)
19. Beech	60, A60, B60	A12CE	(6T*), (BT*)
20. Beech	65, 65-80, 65-A80, 65-A80-8800, 65-88, 65-B80, A65 A65-8200, 70,	3A20	(6T), (BT)
21. Beech	76	A29CE	(4T), (AT)
22. Beech	77	A30CE	(4), (A)
23. Beech	95, B95, B95A, D95A, E95,	3A16	(4T), (AT)
24. Beech	95-55, -A55, -B55, -B55A -C55, -C55A D55, D55A, E55, E55A, 56TC, A56TC, 58, 58A, 95-58	3A16	(6T*), (BT*)
25. Bellanca	14-13, 14-13-2, -3, -3W	A773	(6), (B)
26. Bellanca	14-19, 19-2, -3, -3A	1A3	(6), (B)

Part Number

T.C.D.S. (See P. 11 for Series)

MAKE	AIRCRAFT MODEL	T.C.D.S. (See P. 11 for Series)	Part Number
	17-30,-A, 17-31,-A, 17-31TC,-A,		
27. Boeing	(STEARMAN) A75L3,75,A75,	A-743	(9), (E)
Boeing	B75, E75, A75, A75L300,	A-743	(7), (C)
	IB75A, E75N1 A75J1, A75N1, B75N1, D75N1	3A43	(4), (A)
28. Cessna	140	A-768	(4), (A)
29. Cessna	120, 140, with 0-200 Conversion per STC-SA547EA	A-5A2	(4), (A)
	140A, with 0-200 Conversion per STC-SA547EA	3A19	(4), (A)
30. Cessna	150,A,B,C,D,E,F,G,H,J,K		
	A150K, 150L, A150L, 150M,		
	A150M, 152, A152	A-799	(6), (B)
31. Cessna	170, 170A, 170B	3A12	(6), (B)
32. Cessna	172, 172A,B,C,D,E,F,G,H,		
	172L,K,L,M,N,P,Q,R,S,T	3A12	(4), (A)
	172RG, P172D	3A17	(4), (A)
	R172E,F,G,H,J,K,175,175A,B,C	3A17	(6), (B)
33. Cessna	177, 177A, 177B	A13CE	(4), (A)
	177RG	A20CE	(4), (A)
34. Cessna	180, 180A,B,C,D,E,F,G,H,J,K	5A6	(6), (B)
	182, 182A,B,C,D,E,F,G,H,J,K, 182L,M,N,P,Q,R, S, T R182,	3A13	(6), (B)
	T182, TR182, 182RS, T182T,		
35. Cessna	182 Series STC SA00152WI	3A13	(6), (B)
36. Cessna	182E,F,G,H,J,K, L, M, N, P, Q(Peterson, STC SA3825SW)	3A13	(6), (B)
37. Cessna	F182P, Q, FR182	A42EU	(6), (B)
38. Cessna	185, 185A,B,C,D,E,A185E,A185F	3A24	(6), (B)
39. Cessna	188, 188A, 188B, A188, A188A,	A9CE	(6*), (B*)
	A188B, T188C		
40. Cessna	195, 195A, 195B	A-790	(7), (C)
	190	A-790	(9), (E)
41. Cessna	206,H P206,P206A,B,C,D,E, H	A4CE	(6*), (B*)
	TP206A,B,C,D,E,		
	U206,U206A,B,C,D,E,F,G,		
	TU206A,B,C,D,E,F,G		
	T206H		
42. Cessna	U206,U206A,B,C,D,E,F,G, (Conv. Per STC 2123 NM)	A4CE	(6*), (B*)
43. Cessna	207,207A,T207,T207A	A16CE	(6*)
44. Cessna	210,210A,B,C,D,E,F	3A21	(6*), (B*)
	210-5,210-5A,T210F,210G,		
	T210G,210H,T210H,210J,T210J,		
	T210K,210K,210L,T210L,210M,		
	T210M,210N,P210N,T210N,210R P210R,T210R		
45. Cessna	310,310A,B,C,D,E,F,G,H, E310H,310I,J,K,L,N,P,Q,R	3A10	(6T*), (BT*)
	310J-1,E310J,T310P,Q,R		
	T310Q,310R,T310R		
46. Cessna	321	3A11	(6T), (BT*)
47. Cessna	320,A,B,C,D,E,F,320-1,335, 340,(340A	3A25	(6T*), (BT*)
48. Cessna	336	A2CE	(6T), (BT)
49. Cessna	T303	A34CE	(6T*), (BT*)
50. Cessna	337, 337A,B,C,D,E,F,G,H	A6CE	(6T*), (BT*)
	T337B,C,D,E,F,G,H,		
	M337B,P337H,T337H-SP		
51. Cessna	401, 401A,B, 402,402A,B,C,	A7CE	(6T*), (BT*)

Part Number

T.C.D.S. (See P. 11 for Series)

MAKE	AIRCRAFT MODEL	T.C.D.S. (See P. 11 for Series)	Part Number
	411,411A, 414,414A 421,421A		
	421B,421C		
52. Chaparral Motors	2T-1A, 2T-1A-1, -2	A18EA	(4), (A)
(Great Lakes)			
Cirrus	SR-20	A00009CH	(6), (B)
Cirrus	SR-22	A00009CH	(6), (B)
55. Consolidated	LAKE C-1,-2, LA-4,LA-4A,LA-4P,	1A13	(4), (A)
Aeronautical	LA-4-200		
	LAKE 250	1A13	(6*), (B*)
56. Diamond Aircraft Ind.	DA20-A1, DA20-C1	TA4CH	(4), (A)
57. Diamond Aircraft Ind.	DA40, HK36, HK36TC,TS,TTC,TTC-ECO	A47CE	(4), (A)
58. De Havilland	DHC-2 Mk. I	A-806	(9), (E)
	DHC-2 Mk. II		
	DHC-3 P&W Wasp. R-1340	A-805	(9), (E)
59. ERA	EA-300 EA-300S EA-300L EA-300/200	A67EU	(6), (B)
FLUGZEUGBAU			
60. EXTRA	EA-400	A43CE	(6*), (B*)
FLUGZEUGBAU			
61. Enstrom Helicopter	F-28,-28A,-28C,-28F, 280, 280C, 280F	H1CE	(4*), (A*)
62. GENERAL AVIA	F22B, F22R, F22C	A75EU	(4*), (A*)
Costruzioni			
Aeronautiche	F20	A38EU	(6T), (BT)
63. Grumman	AA-1, -1A, -1B, -1C	A11EA	(4), (A)
Grumman	AA-5,-5A,-5B AG-5B	A16EA	
64. Grumman	G21, G21A	654	(9), (E)
Gulfstream American	112,112TC,112B,112TCA,	A12SO	(4), (A)
66. Gulfstream American	114, 114A, B, TC	A12SO	(6), (B)
67. Gulfstream American	GA-7	A17SO	(4T), (AT)
American General Aircraft Holding Co.,			
68. Gulfstream	AA-5, AA-5A, AA-5B	A16EA	(4), (A)
69. Gulfstream	500, 500-A, B, U, S, 520,	6A1	(6T), (BT)
American	560, 560A, -E,		
70. Gulfstream American	560F, 680, 680-E, F, 680FL,	2A4	(6T*), (BT*)
	680-FL(P), 685		
71. Helio (Alliance Aircraft)	H-295, HT-295, H-395, H-391, H-391B, H-700	1A8	(6*), (B*)
	H-800	1A8	(8), (D)
72. Hughes Helicopter	269A, 269A-1, 269B, 269C	4H12	(4*), (A*)
73. Jobmaster Company	DGA-15P (Army UC-70; Navy GH-1, GH-2,GH-3, NH-1	A-717	(7), (E)
74. Lancair	LC40-550FG	A00003SE	(6*), (B*)
75. Maule	M-5-180C, -200, -210TC	3A23	(4*), (A*)
	M-6-180		
	MXT-7-180, A, B MX-7-180,A,B,C		
76. Maule	Bee Dee M-4, M-4,-4C,-4S,-4T	3A23	(6*), (B*)
	M-4-210,C,S,T, M-4-220C,S,T		
	M-4-180C,S,T, M-4-220,		
	M-5-210C,-220C,-235C, M-6-235 MX-7-235,A,B,C		
	M-7-235, A,B,C M-7-260, MT-7-260		
77. Maule	MXT-7-160, MX-7-180AC, M-5-200	3A23	(4), (A)
78. Maule	M-7-260, M-4-220C, M-4-220S,T, MT-7-235, M5-235C	3A23	(6), (B)
79. Micco Aircraft Co	MAC-145, 145A,B	3A1	(6*), (B*)
80. Mooney	M20, M20A,B,C,D,E,F,G,J	2A3	(4), (A)

Part Number

MAKE	AIRCRAFT MODEL	T.C.D.S. (See P. 11 for Series)	Part Number
	M20K, L, M, R, S	2A3	(6*), (B*)
81. Mooney	M20TN	2A3	(6*), (BT*)
82. Mooney	M22	A6SW	(6T*), (BT*)
83. Mooney Rocket Eng. Conv.	M20K Rocket 305 (per STC SA 5691NM)	2A3	(6T*), (BT*)
84. Mooney Rocket Eng. Conv.	M20J Missile (per STC SA 00472SE)	2A3	(6T*), (BT*)
85. Moravan Inc. (ZLIN)	Z-242L, Z-143L	A76EU	(4), (A)
86. Meyers PROP-JETS, INC.	200, 200A, B, C, D	3A18	(6*), (B*)
87. North American	AT-6 (SNJ-2,-7), -6A,B,C,D,E,F, T-6G	A-2-575	(9), (E)
	NA-260 (USAF T-28A)	1A18	(9), (E)
	T-28A, B,C,D Wright R-1300-1A NA-260 (T-28A Conversion)	AR-30 1A18	(9), (E)
88. Partenavia Costruzioni Aeronautiche	P68, P68B, P68C, P68C-TC, P68TC, AP68TP 300	A31EU	(6T*), (BT*)
89. Pilatus Aircraft Limited	PC6/350, PC6/350-H1,-H2	7A15	(6*), (B*)
90. Piper (FS2003 Corp.)	PA-12, -12S	A-780	(4), (A)
91. Piper	PA-18, PA-18S, PA-18 "105" (Special), PA-18S "105" (Special) PA-18A, PA-18 "125" (Army L-21A) PA-18S "125", PA-18AS "125", PA-18 "135" (Army L-21B), PA-18A "135", PA-18S "135", PA-18AS "135", PA-18 "150", PA-18A "150", PA-18S "150", PA-18AS "150",	1A2	(4), (A)
92. Piper	PA-18A-"150" PA-18-"150" (Crosswinds STOL STC SA682AL) or (Penn-Yan, STC SA00035NY)	AR-7 1A2	(4), (A)
93. Piper	PA-20,-20S,20-"115",20S-"115" PA-20-"135", -20S-"135"	1A4	(4), (A)
94. Piper	PA-22, -22-108,-22-135, -22S-135, PA-22S-150,-22-160,-22S-160	1A6	(4), (A)
95. Piper	PA-22-150	1A6	(4), (A)
96. Piper	PA-23,-23-160	1A10	(4T), (BT)
	Piper PA-23-235, PA-250, E23-250, 23-250	1A10	(6T), (BT)
97. Piper	PA-24	1A15	(4), (A)
Piper	PA-24-250, -24-260	1A15	(6), (B)
Piper	PA-24-400	1A15	(8), (D)
98. Piper	PA-25	2A8	(4), (A)
	Piper PA-25-235, -260	2A8	(6), (B)
99. Piper	PA-28-140,-150,-151,-160,-161, PA-28-180,-28S-160 PA-28S-180,-28R-180,-28-181, PA-28R-200, PA-28-236,-28-235 PA-28R-201,-28R-201T -28-201T, PA-28RT-201,-28RT-201T,-28-201	2A13 2A13	(4) (6*), (B*)
100. Piper	PA-30, PA-39, PA-40	A1EA	(4T), (AT)
101. Piper	PA-31,-31-300,-31-325,-31-350	A20SO	(6T), (BT)
102. Piper	PA-31P,31P-350	A8EA	(6T*), (BT*)

Part Number

MAKE	AIRCRAFT MODEL	T.C.D.S. (See P. 11 for Series)	Part Number
103. Piper	PA-32-260,-32-300,-32S-300 PA-32R-300,-32RT-300,-32RT-300T, PA-32R-301,-32R-301T, PA-32-301,-32-301T	A3SO	(6*), (B*)
104. Piper	PA-34-200	A7SO	(4T), (AT)
Piper	PA-34-200T,-220T	A7SO	(6T*), (BT*)
105. Piper	PA-38-112	A18SO	(4), (A)
106. Piper	PA-44-180,-44-180T	A19SO	(4T*), (AT*)
107. Piper	PA-46-310P,-350P	A25SO	(6T*), (BT*)
108. Piper	PA-60-600,-60-601,-60-700P, A, CR PA-60-601P, PA-60-602P, PA-60-650	A17WE	(6T*), (BT*)
109. Republic	RC-3	A-769	(6), (B)
110. Robinson Helicopter	R22, R22 ALPHA, R22 BETA, R22 MARINER R44	H10WE H11NM	(4), (A) (6), (B)
111. Siai-Marchetti	S.205-18/F, -18/R, -20/F, -20/R, -22/R, S.208, S208A	A9EU	(4), (A)
	F.260, F.260B, F.260C, F.260D,, F.260E,, F.260F,	A10EU	(6*), (B*)
112. Slingsby	T67M260, T67M260-T3A	A73EU	(6), (B)
113. S.O.C.A.T.A Aerospaziale	TB9,10, TB20, TB21,200	A51EU	(4), (A) (6*), (B*)
114. Univair Aircraft Corp, Stinson	108,108-1,-2,-3,-5	A-767	(6), (A)
115. Swift	GC-1A	766	(4), (A)
116. Swift	GC-1B	766	(6), (B)
117. Thompson	Navion, A, B, C, D, E, F, G, H	A782	(6), (B)
118. VARGA Augustair, Inc.	2150, 2150A, 2180	4A19	(4), (A)
119. WACO	YMF, YKC, YKC-S, YKS-6, ZKS-6 UPF-7 VPF-7	ATC542 A-533 A-642	(7), (C) (7), (C) (7), (C)
120. WACO	YMF (F5, F5C modification per STC SA1000GL)	ATC 542	(7), (C)
121. PITTS (AVIAT) White Inter.Ltd.	S-1S, S-1T, S-2, S-2A, S-2S, S-2B	A8SO	(4), (A) (6), (B)
122. Christen (AVIAT) White Inter./ Sky Inter.	A-1, A, B	A22NM	(4), (A)
Weatherly	620, A, B	A26WE	(9), (E)
124. Wilga	PZL-104 Wilga 80 PZL-104M Wilga 2000	A55EU	(9), (E) (6), (A)

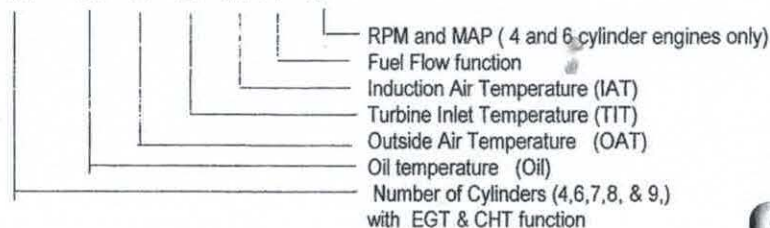
MAKE

AIRCRAFT MODEL

T.C.D.S. (See P. 11 for Series)

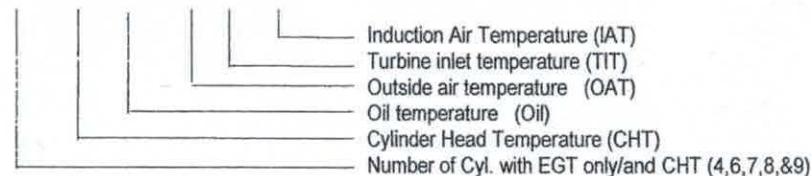
Model designation system by part number for EGT-701

EGT-701- [] C - O [] - A [] - T [] - I [] - F [] - R/M



Model designation system by part number for EGT-100

EGT-100- [] - C [] - O [] - A [] - T [] - I []



Example: EGT-701 - (6COAI R/M) is indicated as such on the TSO label

EGT-701 - 6C - 0 [♦] - A [♦] - T [] - I [♦] - F [] - R/M [♦]

EGT 701 Model

- 6 Cylinder
- Oil Temperature function
- OAT, Outside Air function
- IAT, Induction Air function
- RPM & MAP function

MAKE

AIRCRAFT MODEL

T.C.D.S. (See P. 11 for Series)

ELIGIBLE PART NUMBERS for EGT-701

Note (1) suffix "T" designates twins, two instruments required.

Note (2) suffix "*" denotes turbocharged engines.

Part number Series

4	4	6	6	7	8	9	TIT
4 Cylinder with RPM & MAP	4 Cylinder	6 Cylinder with RPM & MAP	6 Cylinder	7 Cylinder	8 Cylinder	9 Cylinder	
EGT-701- ()	EGT-701- ()	EGT-701- ()	EGT-701- ()	EGT-701- ()	EGT-701- ()	EGT-701- ()	
4C R/M	4C	6C R/M	6C	7C	8C	9C	
4COR/M	4CO	6CO R/M	6CO	7CO	8CO	9CO	
4CA R/M	4CA	6CA R/M	6CA	7CA	8CA	9CA	
4CT R/M	4CT	6CT R/M	6CT	7CT	8CT	9CT	*
4CI R/M	4CI	6CI R/M	6CI	7CI	8CI	9CI	
4CF R/M	4CF	6CF R/M	6CF	7CF	8CF	9CF	
4COA R/M	4COA	6COA R/M	6COA	7COA	8COA	9COA	
4COT R/M	4COT	6COT R/M	6COT	7COT	8COT	9COT	*
4COI R/M	4COI	6COI R/M	6COI	7COI	8COI	9COI	
4COF R/M	4COF	6COF R/M	6COF	7COF	8COF	9COF	
4COAT R/M	4COAT	6COAT R/M	6COAT	7COAT	8COAT	9COAT	*
4COAI R/M	4COAI	6COAI R/M	6COAI	7COAI	8COAI	9COAI	
4COAF R/M	4COAF	6COAF R/M	6COAF	7COAF	8COAF	9COAF	
4COATI R/M	4COATI	6COATI R/M	6COATI	7COATI	8COATI	9COATI	*
4COATF R/M	4COATF	6COATF R/M	6COATF	7COATF	8COATF	9COATF	*
4COTI R/M	4COTI	6COTI R/M	6COTI	7COTI	8COTI	9COTI	*
4COTF R/M	4COTF	6COTF R/M	6COTF	7COTF	8COTF	9COTF	*
4COIT R/M	4COIT	6COIT R/M	6COIT	7COIT	8COIT	9COIT	*
4COTIF R/M	4COTIF	6COTIF R/M	6COTIF	7COTIF	8COTIF	9COTIF	*
4COAIF R/M	4COAIF	6COAIF R/M	6COAIF	7COAIF	8COAIF	9COAIF	
4CATIF R/M	4CATIF	6CATIF R/M	6CATIF	7CATIF	8CATIF	9CATIF	*
4CAT R/M	4CAT	6CAT R/M	6CAT	7CAT	8CAT	9CAT	*
4CAI R/M	4CAI	6CAI R/M	6CAI	7CAI	8CAI	9CAI	
4CAF R/M	4CAF	6CAF R/M	6CAF	7CAF	8CAF	9CAF	
4CATI R/M	4CATI	6CATI R/M	6CATI	7CATI	8CATI	9CATI	*
4CATF R/M	4CATF	6CATF R/M	6CATF	7CATF	8CATF	9CATF	*
4CAIF R/M	4CAIF	6CAIF R/M	6CAIF	7CAIF	8CAIF	9CAIF	*
4CTIF R/M	4CTIF	6CTIF R/M	6CTIF	7CTIF	8CTIF	9CTIF	*
4CTI R/M	4CTI	6CTI R/M	6CTI	7CTI	8CTI	9CTI	*
4CTF R/M	4CTF	6CTF R/M	6CTF	7CTF	8CTF	9CTF	*
4CIF R/M	4CIF	6CIF R/M	6CIF	7CIF	8CIF	9CIF	*
4COATIF R/M	4COATIF	6COATIF R/M	6COATIF	7COATIF	8COATIF	9COATIF	*

ELIGIBLE PART NUMBERS for EGT-100- () and EGT-200- ()

Note (1) suffix "T" designates EGT-200 () series for twins

Note (2) suffix "*" denotes for turbocharged engines.

Part number Series

A	B	C	D	E	TIT
cylinder	6 cylinder	7 cylinder	8 cylinder	9 cylinder	
EGT-100- ()	EGT-100- ()	EGT-100- ()	EGT-100- ()	EGT-100- ()	
4	6	7	8	9	
4C	6C	7C	8C	9C	
4CO	6CO	7CO			
4CA	6CA	7CA			
4CT	6CT	7CT			
4CI	6CI	7CI			
4COA	6COA	7COA			
4COT	6COT	7COT			
4COI	6COI	7COI			
4COAT	6COAT	7CAT			
4COAI	6COAI	7CAI			
4COATI	6COATI	7CTI			
4COIT	6COIT				
4CAT	6CAT				
4CAI	6CAI				
4CATI	6CATI				
4CTI	6CTI				

Example: see page 5

Cessna 310 (6T*)

6 = any PN in that column except * items in TIT column

T = Requires two instruments

* = Includes TIT (turbocharged a/c only)

MAKE

AIRCRAFT MODEL

T.C.D.S. (See P. 11 for Series)

3/20/08

Subject: Permission to use STC.

To Whom It May Concern:

J.P. Instruments holder of STC SA2586NM
grants to the purchaser of the
EDM-700 series (PN EGT-701) and the
Classic Scanner (PN EGT-100)
permission to use the STC.

Signed 

U.S. Department
of Transportation
Federal Aviation
Administration

TRANSPORT AIRPLANE DIRECTORATE
AIRCRAFT CERTIFICATION SERVICE
LOS ANGELES AIRCRAFT CERTIFICATION OFFICE
3229 EAST SPRING STREET
LONG BEACH, CA 90806-2425

NOV 10 1992

J P Instruments
3402-1 West MacArthur
Santa Ana, California 92704

Gentlemen:

J P Instruments, Temperature Indicator;
Technical Standard Order C43b

Your application dated August 24, 1992, requesting the issuance of a Technical Standard Order (TSO) authorization in accordance with the procedural requirements of Federal Aviation Regulation (FAR) Part 21, Subpart O, has been reviewed. Based upon your data and statement of conformance certifying your articles have met the requirements of FAR Part 21, Subpart O, and the minimum performance standards of TSO C43b (Ref. FAR 21.305(b)), authorization is hereby granted for the following:

MODEL/PART NO.DESCRIPTION

EGT-701()

Exhaust Gas Temperature Indicator

The technical data submitted with your letter, have been accepted as fulfilling the requirements for your TSO authorization and will be retained in our files.

The quality control procedures contained in your quality control manual, currently on file at the Los Angeles Manufacturing Inspection District Office, and your statement that those procedures will be applied to the manufacture of the subject article at the above address, are considered adequate in accordance with FAR 21.143.

Effective this date, you are authorized to use TSO procedures for the subject temperature indicator. You may identify this article with the applicable TSO markings as required by TSO C43b.

As recipient of this TSO authorization, except as provided in FAR 21.3(d), you are required to report any failure, malfunction, or defect in any product or part manufactured by you or your contracted suppliers, and which you have determined has resulted or could result in any of the occurrences listed in FAR 21.3(c). The report should be communicated initially by telephone to the Manager, Technical and Administrative Support Staff,

TSO Compliance	Aeronautical Standard	Scope
TSO-C43b Temperature Instruments	8005	Thermocouple, Class IC

TYPE/MODEL EDM-700/800

TSO NUMBER TSO-C43b

MANUFACTURER: J.P.INSTRUMENTS

ADDRESS: 3402-I West Mac Arthur Blvd. Santa Ana CA 92704

REVISION & CHANGE NUMBER OF DO-160C

CONDITIONS	SECTION	DESCRIPTION OF TEST CONDUCTED AND PASSED
Temperature and Altitude	4.0	Equipment tested to Categories B1
Low Temperature	4.5.1	
High Temperature	4.5.2 & 4.5.3	
In-Flight Loss of Cooling	4.5.4	Equipment identified as Category X no test performed.
Altitude	4.6.1	Equipment tested to Categories B1
Decompression	4.6.2	
Overpressure	4.6.3	Equipment tested to note 2
Temperature Variation	5.0	Equipment tested to Category B.
Humidity	6.0	Equipment tested to Category A.
Operational Shock and Crash Safety	7.0	Equipment tested to Category B.
Vibration	8.0	Equipment tested with our shock mounts to Category M,N, and B. Table 8-1
Explosion	9.0	Equipment identified as Category X, no test performed.
Waterproofness	10.0	Equipment identified as Category X, no test performed.
Fluids Susceptibility	11.0	Equipment identified as Category X, no test performed.
Sand and Dust	12.0	Equipment identified as Category X, no test performed.
Fungus	13.0	Equipment tested to Category F.
Salt Spray	14.0	Equipment identified as Category X, no test performed.
Magnetic Effect	15.0	Equipment is Category C
Power Input	16.0	Equipment tested to Categories B.
Voltage Spike	17.0	Equipment tested to Category B
Audio Frequency Susceptibility	18.0	Equipment tested to Category B
Induced Signal Susceptibility	19.0	Equipment tested to Category A
Radio Frequency Susceptibility	20.0	Equipment tested for conducted susceptibility to Category A.
Radio Frequency Emission	21.0	Equipment tested to Category A
Lightning Induced Transient Susceptibility	22.0	Equipment identified as Category X, no test performed.
Lightning Direct Effects	23.0	Equipment identified as Category X, no test performed.
Icing	24.0	Equipment identified as Category X, no test performed.
Other Tests		Fire resistance tests were conducted in accordance with Federal Aviation Regulations Part 25, Appendix F.