

\$5.00 U.S.

**Pilot's Guide
for the
*Traffic Alert and Collision
Avoidance System I*
Model TCAS791**



BFGoodrich
Aerospace

BFGoodrich Avionics Systems, Inc.

Eyes That Never Blink™

Early TCAS

In the early days of flight, when air traffic was light and slower moving, pilots were equipped with all they needed for effective collision avoidance—a sharp pair of eyes to scan the horizon.

Even today, visual contact is still the surest means of identifying intruder aircraft. But with more traffic in closer proximity and at higher speeds, today's pilots need all the help they can get.

For large commercial airliners, this need led to the development of TCAS II (Traffic Alert and Collision Avoidance System II). But that technology has proved to be too expensive and complex for most regional airlines, business, and general aviation aircraft.

TCAS I

BFGoodrich Avionics Systems, Inc. recognized the need for a viable alternative and developed their TCAS I. The TCAS791 provides most of the capabilities of TCAS II, but at a significantly lower cost making it practical for regional airlines, business, and general aviation aircraft. Unlike a TCAS II system, the TCAS791 does not require a mode S transponder and does not issue recommendations to climb or descend.

The FAA has mandated TCAS I for all part 135 turbine aircraft seating 10 to 30 passengers. As a result of TCAS791's effectiveness, it is becoming the system of choice for business and general aviation pilots who want the enhanced peace of mind that TCAS brings.

Proven Experience

BFGoodrich Avionics Systems, Inc. has been involved in the development of collision warning programs since the early 1980's. In 1985, Avionics Systems began development of an enhanced collision warning system for the U.S. Navy which awarded Avionics Systems a contract for more than 234 systems to be installed in T-34C training aircraft.

Based largely on the success of the Navy project, Avionics Systems was selected to validate the specifications for TCAS I under an ARINC contract with the FAA. The completion of this contract represented yet another first for the TCAS791; it was the first TCAS I to be TSO'd, first to receive a full, unrestricted STC, first to fly, and first to be delivered.

The TCAS791 meets or exceeds all FAA TCAS I requirements and exceeds FAA TCAS I & II specifications for range and bearing accuracy.

This success continues the BFGoodrich tradition of aerospace innovation dating to the earliest days of powered flight when BFG supplied tires for the Glenn Curtiss pusher. Since then, BFGoodrich has developed a wide range of aerospace products and services including flight instrumentation and avionics.

Pilot's Guide for the *Traffic Alert and Collision Avoidance System I* Model TCAS791



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Software Version Information

All references in this guide to standby, look up/look down, altitude display modes (above, below, and normal), and transmitting from the ground are functions of all TCAS791 systems that have software version 1.3 or higher in their Transmitter Receiver Computer (TRC). Ignore these references if your TRC has an earlier version of software. (The software version is identified on a tag attached to the back of the TRC.)

Safety Summary

The following warnings and cautions appear in this guide and are repeated here for emphasis:

WARNING (pages 2-8 & 2-15)

The TCAS791 alone does not ensure safe flight. You must still visually scan the airspace around your aircraft frequently. The TCAS791 relies on information obtained from transponders in nearby aircraft. The TCAS791 does not detect or track aircraft which are not equipped with an operating ATCRBS transponder.

WARNING (page 2-15)

Do not attempt evasive maneuvers based solely on traffic information shown on the TCAS791 display. Information shown on the display is provided to the aircrew only as an aid in visually acquiring traffic which may impose a collision threat. It is not a replacement for ATC and the See & Avoid concept.

CAUTION (page 2-8)

Optimum TCAS791 performance is realized when intruder aircraft are reporting their altitude (via a mode C or other altitude reporting transponder).

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Chapter 1

System Description

General Description

The **BFGoodrich Avionics Systems, Inc.** TCAS791 is an airborne Traffic alert and Collision Avoidance System (TCAS I). It monitors the airspace around your aircraft and advises the flight crew where to look for nearby transponder-equipped aircraft that may pose a collision threat. The TCAS791 is intended for use by regional airlines and corporate and general aviation aircraft. [Figure 1-1](#) shows the major components of the TCAS791.

The TCAS791 displays traffic information on the CD605 Control Display Unit (CDU) or on a compatible EFIS or IVSI/TCAS display and generates aural announcements on the cockpit sound system. Traffic information on the display consists of color-coded symbols and text. The type of information displayed depends on the type of intruder aircraft, but generally includes the relative range, bearing, and altitude of intruder aircraft as well as its vertical speed direction.

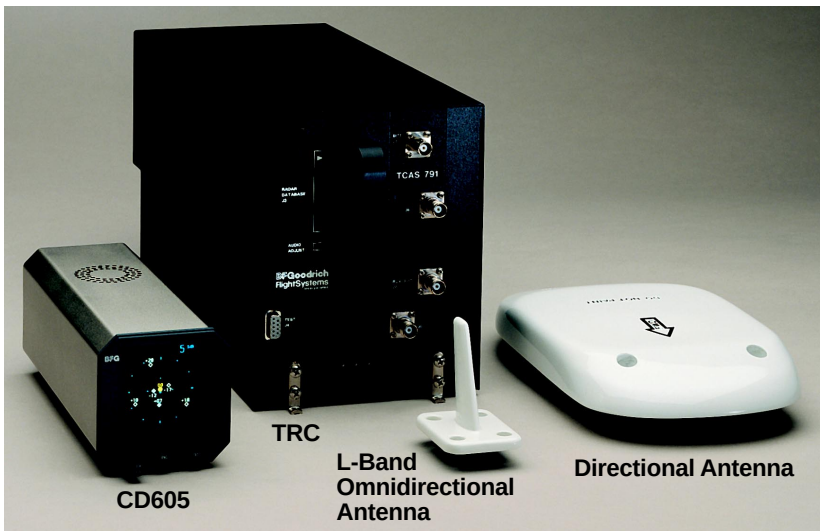


Figure 1-1. TCAS791 Major Components

Major Components

The TCAS791 consists of four major components as described below.

Directional Antenna

The directional antenna transmits omnidirectional transponder interrogations and is used as a directional antenna for receiving transponder replies.

L-Band Omnidirectional Antenna

The L-band omnidirectional antenna receives transponder replies.

Transmitter Receiver Computer (TRC)

The TRC is the primary unit of the TCAS791. It contains the circuitry necessary to convert inputs into aural and visual advisories of intruding aircraft. The TRC can track up to 35 intruder aircraft simultaneously. If the TRC is tracking more than eight intruder aircraft, to reduce clutter, it will only display the eight most threatening ones. If the TRC is tracking eight or fewer intruder aircraft, it will display all the intruders. The TRC also contains Built-In Test Equipment (BITE) which can detect faults or failures and verify that the TCAS791 is operating properly.

Control Display Unit (CDU)

The CD605 is a self-contained unit that provides display and control functions. The display is a high resolution Cathode Ray Tube (CRT). The CRT displays data in three colors: white, cyan (blue), and amber (yellow) on a black background. (See figure 1-2.)

You may choose to display TCAS information on a compatible EFIS or IVSI/TCAS display in lieu of, or in addition to the CD605. The alternate displays provide display functions similar to the CD605, but require discrete switches mounted in the cockpit.



Figure 1-2. Typical Screen on the CD605 Control Display Unit (CDU)

Interaction of Major Components

Figure 1-3 shows how the major components of the TCAS791 connect to each other and to other aircraft systems.

Notes on Figure 1-3:

1. You can use the TCAS791 without a radio altitude input, but when you're flying at low altitudes, you may see more

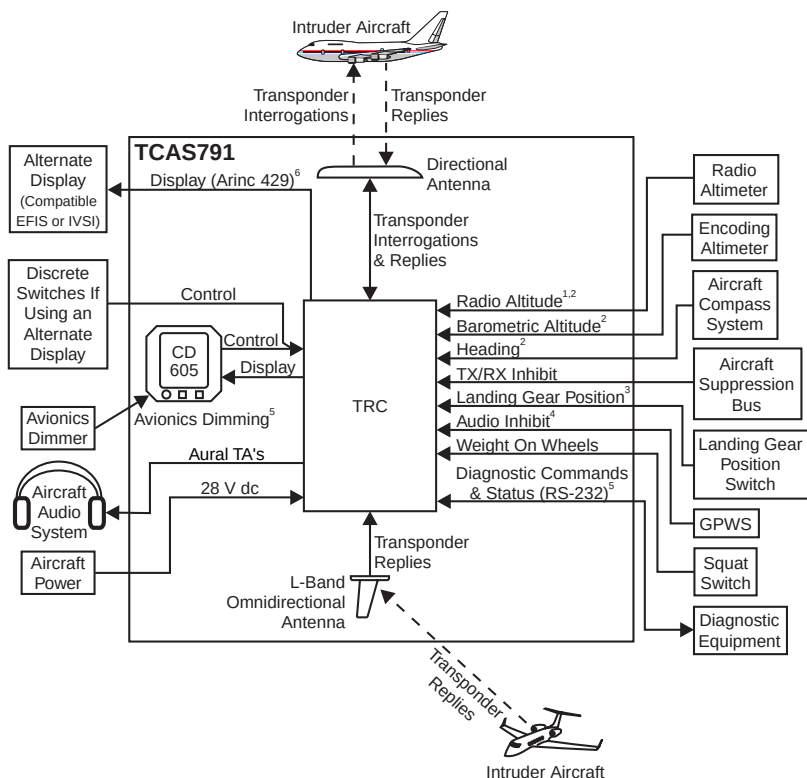


Figure 1-3. TCAS791 Simplified Functional Diagram

nuisance traffic alerts (from aircraft on the ground that have their transponders on).

2. An air data computer, LNAV system, GPS, or other Arinc 429 output device may replace individual analog sensors for supplying radio and barometric altitude, and heading.
3. The TCAS791 may be installed on an aircraft with a fixed landing gear. The only operational difference occurs when you don't have a radio altitude input. In that case, the TCAS791 defaults to using the highest TA sensitivity level regardless of your phase of flight.
4. This audio inhibit input is only required if you have a Ground Proximity Warning System installed.
5. The avionics dimming input and the diagnostic RS-232 input/output are not required for normal TCAS791 operation.
6. The Arinc 429 display output is only used if you connect the TRC to an alternate display.

Functional Description

The TCAS791 is an active system that operates as an air-to-air or ground-to-air interrogation device. The TCAS791 interrogates transponders in the surrounding airspace similar to ground-based radars. When replies to these interrogations are received, the responding aircraft's range, bearing, relative altitude, and closure rate are computed to plot traffic location and to predict collision threats.

Figure 1-4 shows the TCAS791 protection zones around your aircraft and the corresponding traffic symbols that appear on the display when intruding aircraft enter one of those zones.

The solid amber circle is the visual part of the visual and aural Traffic Advisory (TA) that the TCAS791 generates when it predicts that an intruder aircraft may present a collision threat. The aural part of the TA, "traffic, traffic," is annunciated over a cockpit speaker or headset. A solid white diamond on the CD605 is called a proximity advisory and an open white diamond represents other traffic. (Symbol color may vary on alternate displays.)

The TCAS791 uses either sensitivity level A (SLA) or sensitivity level B (SLB) to determine when to display a TA. In general, SLB is used during the cruise phase and SLA is used during takeoff and landing. Sensitivity levels, interference limiting, and other factors affecting the display of traffic symbols are discussed in detail in chapter 3, Principles of Operation. Look up, look down, and normal altitude display modes are described in chapter 2, Operating Instructions.

Features

- Tracks up to 35 intruder aircraft (displays the 8 most threatening aircraft of those tracked)
- Monitors a horizontal range of 27 nmi (nominal), 35 nmi (max) and a relative altitude range of $\pm 10,000$ ft
- Displays data in several ranges on all displays including 5, 10, and 20 nmi on the CD605
- Does not require a mode S transponder
- Look up/look down altitude display modes simplify intruder aircraft identification (look up/look down is not available on some alternate displays)
- Generates a visual *and* aural advisory of intruding aircraft on a collision course with your aircraft
- Automatic and pilot-initiated self test functions
- Three-color display: amber, cyan, and white on a black background
- Ground target filtering, sensitivity levels, and audio inhibit functions to limit nuisance TA's
- Transmits interrogations from the ground as well as from the air

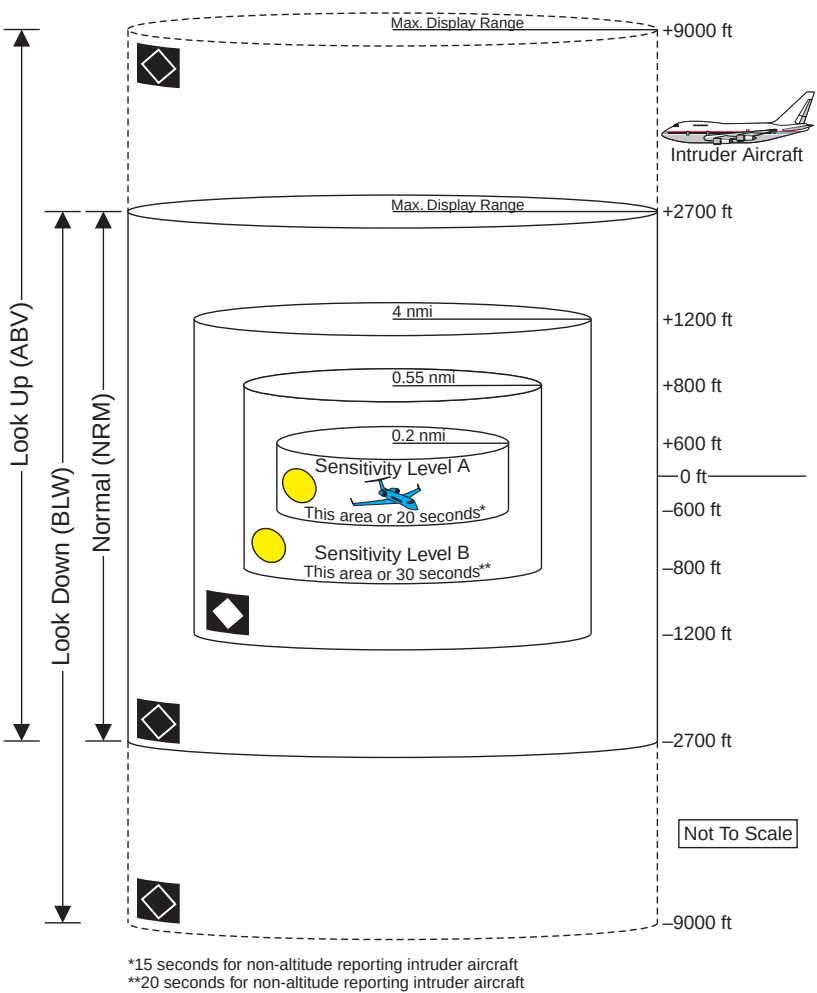


Figure 1-4. Protection Zones

Chapter 2

Operating Instructions

Controls and Indicators

Figure 2-1 calls out all the major controls and indicators for the TCAS791. Table 2-1 describes the TCAS791 controls and indicators. The number column refers to items on figure 2-1.

Notes

Some alternate displays do not display traffic symbols, range rings, or the own aircraft symbol unless an intruder aircraft has been detected within the selected display range.

The color of traffic symbols and the color, position, and format of status messages, indicators, and other items on the display may vary on alternate displays.

Refer to chapter 3, Principles of Operation, for a description of other factors that may affect the display of traffic symbols.

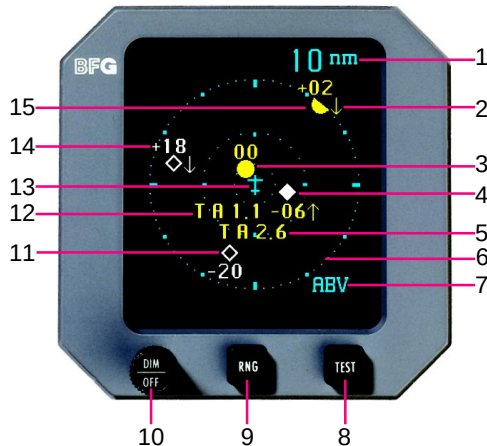


Figure 2-1. Controls and Indicators

Table 2-1. Controls and Indicators

No	Description
1	Display Range Indicator 10 nm This indicator displays the numerical value of the currently selected display range. Figure 2-2 lists the CD605 display ranges. (Display ranges on alternate displays may vary.)

Table 2-1. Controls and Indicators (Continued)

No	Description
2	Vertical Trend Arrow  A vertical trend arrow indicates that the intruding aircraft is descending (down arrow) or ascending (up arrow) at a rate greater than 500 fpm. No arrow is shown for non-altitude reporting aircraft.
3	Traffic Advisory (TA)  A TA consists of a visual symbol on-screen and an aural “traffic, traffic” message over a cockpit speaker or headset. When an intruder aircraft that meets the TA criteria described in chapter 3 is within the displayed range (inside or outside of the selected altitude display mode), the corresponding visual symbol is this solid amber circle located at a position on the screen that indicates the relative bearing and range of the intruder aircraft. In general, a TA will occur when an intruder aircraft is detected within 15–30 seconds of a possible collision, or within 0.2–0.55 nmi and ±600 ft to ±800 ft of your aircraft.
4	Proximity Advisory (PA)  PAs indicate the relative location of any traffic not generating a traffic advisory but which is within 4 nautical miles (nmi) and ±1,200 ft of your aircraft. Non-altitude reporting aircraft are considered to be at the same altitude as your aircraft.
5	No-Bearing No-Altitude Traffic Advisory  If bearing and altitude are not available for an intruder aircraft that meets the TA criteria described in chapter 3, the TA takes the form of this amber line of text consisting of the letters TA and the intruder aircraft’s range.
6	Range Rings The range rings indicate distance from your aircraft. Figure 2-2 lists the distances of the range rings on the CD605. On the CD605, the range rings are centered on the own aircraft symbol in the middle of the screen. On some alternate displays, the aircraft symbol is located at the lower center of the screen which causes clipping of the TCAS display range area. (See figure 2-3.) On these displays, the 12:00 position on or near the outer range ring represents the selected range, but as you move around to the 6:00 position on the outer range ring, the range displayed decreases to 60 percent or lower of the selected range depending on the display.

Table 2-1. Controls and Indicators (Continued)

No	Description
7	Altitude Display Mode Indicator  On the CD605, this indicator displays the currently selected altitude display mode: ABV (above, or look up), BLW (below, or look down), or NRM (normal). Some alternate displays do not display the NRM indicator. Other alternate displays do not display any altitude display mode indicators because they do not support any altitude display modes other than normal. In the <i>above</i> display mode, traffic detected within +9,000 ft and –2,700 ft of your aircraft is displayed. In the <i>below</i> display mode, traffic within +2,700 ft and –9,000 ft of your aircraft is displayed. In the <i>normal</i> display mode, traffic detected within ±2,700 ft of your aircraft is displayed.
8	Test Button  The test button is on the front of the CD605. If you're using an alternate display, a discrete button in the cockpit serves as the test button. If you are using the CD605 with an alternate display, you can use both test buttons. The avionics dimming input from your aircraft controls the brightness of the light inside the test button on the CD605. Pressing the test button when in standby starts a TCAS791 self test. Pressing the test button repeatedly when <i>not</i> in standby toggles the altitude display mode in the following order: above, normal, below, normal, above, etc. (Repeatedly pressing the test button with an alternate display that does not support the <i>above</i> and <i>below</i> display modes has no effect.) Pressing <i>and holding</i> the test button when in standby will run the test, and if the test passes, will hold the test screen on the CD605 or the final test screen on an alternate display. When you release the button, the display will go back to its standby screen. Holding the test button in will not hold the test screen on the display if the test fails. In this case, the CD605 goes to its TCAS FAILED screen and the alternate display goes to its TCAS FAIL screen or to its standby screen, depending on the display model.

Table 2-1. Controls and Indicators (Continued)

No	Description
9	Range Button  The range button (labeled RNG) is on the front of the CD605. If you’re using an alternate display, display range selection is usually controlled from a discrete button in the cockpit. If you are using the CD605 <i>and</i> an alternate display, you can use both range buttons. The avionics dimming input from your aircraft controls the brightness of the light inside the range button on the CD605. Pressing the range button when in standby switches the TCAS791 out of standby and into the 10 nmi range and the <i>above</i> display mode. (Alternate displays may switch into some other range and altitude display mode.) Pressing the range button repeatedly when <i>not</i> in standby toggles the display through the available display ranges. Figure 2-2 lists the CD605 display ranges. (Display ranges on alternate displays may vary.) The selected range is indicated on the screen. Pressing <i>and holding</i> the range button when on the ground and not in standby changes the range and then switches the TCAS791 into standby. Pressing and holding the range button in flight has no effect other than changing the range.
10	Power/Brightness Control  Rotating the DIM/OFF knob on the CD605 clockwise turns on the CD605 and the TRC and increases the brightness of the display. If you’re using an alternate display, you’ll use a discrete TCAS ON/OFF switch to turn on the TRC. Some alternate displays have a built-in photocell that automatically controls the display’s brightness. (See figure 2-3.) Other alternate displays use the cockpit dimming input to control display brightness. Other alternate displays have no display dimming controls.
11	Other Traffic  This symbol represents traffic within the selected display range and altitude display mode that is not proximate traffic nor traffic generating a TA. Non-altitude reporting intruder aircraft are considered to be at the same altitude as your aircraft. On some alternate displays, <i>other traffic</i> symbols will disappear when a TA occurs and will reappear (if still in range) once the TA goes away. Some alternate displays can also be strapped to filter out all <i>other traffic</i>.

Table 2-1. Controls and Indicators (Continued)

No	Description
12	No-Bearing Traffic Advisory  If bearing is not available for an intruder aircraft that meets the TA criteria described in chapter 3, the TA takes the form of this amber line of text beginning with the letters TA and including the intruder aircraft's range, a data tag, and a vertical trend arrow.
13	Own Aircraft  This symbol represents your aircraft.
14	Data Tag  These two digits indicate, in hundreds of feet, the relative altitude of the intruder aircraft. A positive data tag is displayed above the traffic symbol to emphasize that the intruder aircraft is above your aircraft. Similarly, a negative data tag is displayed below the traffic symbol. If the intruder is at the same altitude as your aircraft, 00 will be displayed above the traffic symbol if the intruder closed from above, or below the symbol if the intruder closed from below. The data tag for a vertically out of range TA remains at the maximum or minimum altitude number for the current altitude display mode until the intruder aircraft comes within the altitude limits of the selected altitude display mode. The TCAS791 only displays data tags for altitude reporting aircraft.
15	Out of Range Traffic Advisory  When an intruder aircraft that meets the TA criteria described in chapter 3 is beyond the displayed range, the corresponding TA symbol is this solid amber semicircle located at a position along the outer range ring that indicates the relative bearing of the intruder aircraft. Range is the only factor that determines whether a TA is represented by a circle or a semicircle. For example, if a TA is within the display range but outside of the selected altitude display mode, it's still represented by a circle instead of a semicircle.
–	Audio Alert Adjustment Screw This 1-turn potentiometer inside the data card access door on front of the TRC adjusts the volume of aural messages. If the volume level preset at the factory is not appropriate for your installation, use a small screwdriver to turn the screw clockwise to increase the volume or counterclockwise to decrease the volume. Use extreme caution if you adjust this screw. Applying too much pressure will break the plastic adjustment screw housing off of the circuit board.

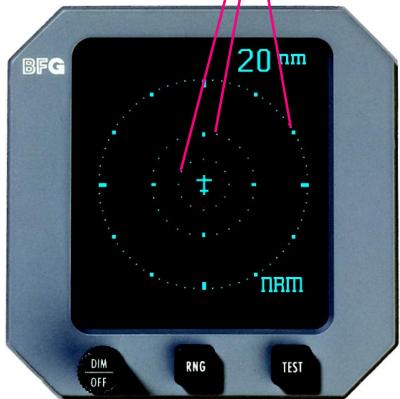
Table 2-1. Controls and Indicators (Continued)

No	Description
–	Auto/Man Switch This discrete toggle switch is only required for some alternate displays. This switch allows you to select TCAS auto mode or TCAS manual mode. TCAS auto mode allows a non-TCAS display page to be automatically interrupted when a TA occurs. TCAS information will pop up on the display and remain displayed until several seconds after the traffic is no longer a threat. The display will then revert to the function that was selected before the TA occurred. TCAS manual mode prevents the display from being interrupted by TCAS information. When a TA occurs, the aural message will still be announced, but the visual TCAS information will not be displayed (unless TCAS was already selected on the display).
–	TA ONLY Indicator Whenever the TCAS791 is on and not displaying a failure and not in standby, some of the alternate displays will display the TA ONLY indicator on the screen. This indicator means that the display is either connected to a TCAS I system or to a TCAS II system in TA ONLY mode. In both cases, the implication is that no resolution advisories will be issued. On some alternate displays, when an active TA is detected, the background color of the TA ONLY indicator changes from white to amber.
–	TCAS FAILED or TCAS FAIL Indicator The CD605 will display the message TCAS FAILED when the TCAS791 detects a failure and after an operator-initiated self test failure. On some alternate displays, the message TCAS FAIL will be displayed whenever the TCAS791 is not powered up. These alternate displays will continue to display TCAS FAIL for several seconds after the TCAS791 is turned on. The TCAS FAIL message may also appear on the alternate displays if there's a TCAS failure, or if the TCAS791 fails a self test. It is also possible for an alternate display to display TCAS OFF instead of TCAS FAIL after a self test failure on the ground.
–	TCAS OFF Indicator The TCAS OFF indicator is displayed on some alternate displays. It indicates that the TCAS791 is in standby. It does <i>not</i> mean that the TCAS791 has been turned off.

Table 2-1. Controls and Indicators (Continued)

No	Description
–	OFF SCALE Indicator Some alternate displays display the words OFF SCALE when an out of range TA occurs. This indicator is in addition to an out of range TA symbol (amber semicircle).
–	“Traffic Traffic” This aural component of a traffic advisory is announced once over the cockpit speakers or headset when a TA aircraft is first detected.
–	“TCAS Test Passed” This message is announced over the cockpit speakers or headset after the TCAS791 has passed an operator-initiated self test.
–	“TCAS Test Failed” This message is announced over the cockpit speakers or headset after the TCAS791 has failed an operator-initiated self test.

Available Display Ranges*		Range Rings	Distance From Own Aircraft to Range Ring
On The Ground	In The Air		
5 nmi	5 nmi	inner	2 nmi
		outer	5 nmi
10 nmi	10 nmi	inner	2 nmi
		middle	5 nmi
		outer	10 nmi
	20 nmi	inner	5 nmi
		middle	10 nmi
		outer	20 nmi



*When used with an alternate display, the CD605 will take on the display ranges of the alternate display.

Figure 2-2. Display Ranges on the CD605

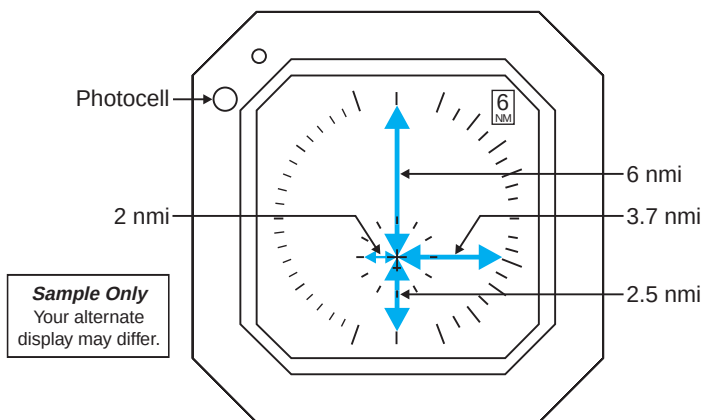


Figure 2-3. An Alternate Display w/Photocell & Off-Center Aircraft Symbol

Operating Instructions

The procedures in this section are organized into tasks. You should perform all the tasks at least once after your TCAS791 is first installed; that way you will be familiar with how to use the features before you actually *need* to use them. Refer to table 2-1 for an explanation of the controls and indicators mentioned in these procedures.

WARNING

The TCAS791 alone does not ensure safe flight. You must still visually scan the airspace around your aircraft frequently. The TCAS791 relies on information obtained from transponders in nearby aircraft. The TCAS791 does not detect or track aircraft which are not equipped with an operating ATCRBS transponder.

Caution

Optimum TCAS791 performance is realized when intruder aircraft are reporting their altitude (via a mode C or other altitude reporting transponder).

Note

Federal Aviation Regulations require that, if installed, TCAS equipment be turned on during all flight operations. As such, the TCAS791 may be turned off only when it is inoperable or when, in the opinion of the pilot-in-command, continued operation would be more appropriately assured with the TCAS791 turned off.

Note

The TCAS791 must be turned off if ATC advises the flight crew to disable transponder altitude reporting.

Preflight Instructions

Turn On the TCAS791

- If you're using a display other than the CD605, turn on that alternate display system and set it to display TCAS information.
- If you're using an alternate display that requires a discrete TCAS Auto/Man switch, make sure the switch is set to the desired mode.
- Rotate the DIM/OFF knob on the CD605 clockwise about 180 degrees. If you're using an alternate display, move the discrete TCAS ON/OFF switch to the ON position.

The TCAS791 will begin its power-up and initialization routine. During this power-up and initialization, the CD605 will display the startup screen as shown in figure 2-4. The startup screen lists the firmware version numbers. After about 35 seconds, the TCAS791 will go into standby and the CD605 will display the standby screen as shown in figure 2-5.



Figure 2-4. Startup Screen



Figure 2-5. Standby Screen

Some alternate displays will not display the startup and standby screens as shown; instead, they will display the message TCAS FAIL until the TCAS791 completes its power-up and initialization routine, then they will display a different standby screen, such as TCAS OFF.

Run the Operator-Initiated Self Test

You should run the operator-initiated self test before the first flight of the day or as specified in the specific Aircraft Operating Manual (AOM). The self test function is inhibited unless the aircraft is on the ground and the TCAS791 is in standby.

- Set the pilot's barometric altimeter to 29.92 and make note of the indicated pressure altitude.

- b. With the TCAS791 in standby, press the test button in one of the following two ways:

- 1) Press and *release* the test button.

Pressing and *releasing* the test button allows the display to automatically revert to the standby screen after briefly displaying the test screen and any status screens.

- 2) Press and *hold* the test button.

Pressing and *holding* the test button holds the resulting test screen on the CD605 or the final status screen on an alternate display until you release the test button. (This holding feature does not work if the test fails.)

The TCAS791 will begin its self test and the CD605 will display a test screen similar to that shown in figure 2-6. An alternate display may display a different test screen.



Figure 2-6. Test Screen

Upon *successful* completion of the self test, you should hear the “TCAS Test Passed” message and the CD605 should revert to the standby screen. An alternate display may display one or more status screens before reverting to its standby screen (TCAS OFF).

Upon *unsuccessful* completion of the self test, you should hear the “TCAS Test Failed” message and the CD605 should display the TCAS Failed screen as shown in figure 2-7. The TCAS791 will revert to standby (so that you can press the test button again and run the test again) but the TCAS Failed screen will remain on the display. An alternate display may display a TCAS FAIL message instead of a TCAS Failed screen, or it may revert to its standby screen (TCAS OFF).



Figure 2-7. TCAS Failed Screen

- c. If the altitude displayed at the bottom of the test screen on the CD605 is not within ± 250 ft of the altitude indicated on the barometric altimeter, turn off the TCAS791 and schedule it for corrective maintenance as soon as possible.
- d. If you hear the “TCAS Test Failed” message or see a TCAS Failed screen or a TCAS FAIL message, turn off the TCAS791 and schedule it for corrective maintenance as soon as possible.
- e. If you hear the “TCAS Test Passed” message without seeing the test screen on the CD605, turn off the TCAS791 and schedule the CD605 for corrective maintenance as soon as possible.
- f. If you hear the “TCAS Test Passed” message but a maintenance code appears at the bottom of the standby screen on the CD605 (figure 2-8), continue to use the TCAS791, but schedule it for corrective maintenance as soon as possible.

Refer to the section on maintenance codes later in this chapter for more information.

- g. When you’re done with the self test, reset the barometric altimeter to the current barometric setting.

Switch Out of Standby

You must manually switch out of standby using the following procedure if you want the TCAS791 to display traffic information while you’re still on the ground. If you do not *manually* switch out of standby, the TCAS791 will *automatically* switch out of standby 8 to 10 seconds after takeoff and into the *above* display mode and 10 nmi range on the CD605 (display mode and range may vary on alternate displays). The ability to switch out of standby on the ground in conjunction with the *above* display mode is especially helpful when you’re getting ready to take off from an airstrip that doesn’t have an ATC tower to tell you what traffic is above and around you.



Figure 2-8. Standby Screen with Maintenance Code

- a. Press the range button.

The TCAS791 will switch out of standby and into the *above* display mode and 10 nmi range. (See figure 2-9.) An alternate display may switch into some other altitude display mode and range. The TCAS OFF message (displayed on some alternate displays) will go away and may be replaced by the TA ONLY message.



Figure 2-9. Above Display Mode, 10 nmi Range

Switch Into Standby

Use this step if you need to go back into standby while you're still on the ground. (The TCAS791 will not go into standby while airborne, but will automatically go into standby 24 seconds after landing.)

- a. Press and hold the range button.

The range will change, the TCAS791 will go into standby, and the display will switch back to its standby screen (figure 2-5 for the CD605). The TA ONLY message (displayed on some alternate displays) will change to TCAS OFF.

Select the Range

You can select from the available display ranges when your aircraft is on the ground and the TCAS791 is not in standby, or when your aircraft is in the air. The shortest range should typically be used during departure, climbout, and descent to reduce traffic clutter.

- a. Press the range button repeatedly until the desired range is displayed.

With each press of the range button, the screen changes to display the traffic detected within the next available display range. The range indicator will also change to display the numerical value of the selected range.

The sequence of ranges is from longest to shortest then back up to the longest. Figure 2-2 lists the display ranges on the CD605. Display ranges on alternate displays may vary.

Intruder aircraft within the TCAS791 tracking range but outside of the current display range will continue to be tracked even though they're not displayed in the current display range.

The TCAS791 will continue to track up to 35 intruder aircraft within a maximum horizontal radius of 35 nmi regardless of the display range selected.

Select the Altitude Display Mode

You can select an altitude display mode when your aircraft is on the ground and the TCAS791 is not in standby, or when your aircraft is in the air. The *above* mode typically should be set just prior to takeoff to look for traffic during departure and climbout. The *normal* mode is recommended for the cruise phase. The *below* mode should typically be set prior to initiating a descent from cruise altitude.

- a. Press the test button repeatedly until the desired altitude display mode is displayed.

With each press of the test button, the TCAS791 switches into the next altitude display mode and displays the traffic detected within the corresponding altitude display range. (See figure 2-10.)

The altitude display mode indicator will also change to display the abbreviated name of the selected altitude display mode (ABV, NRM, or BLW).

Up to 35 intruder aircraft within 10,000 ft above or below your aircraft will continue to be tracked regardless of the altitude display mode selected.

In-Flight Instructions

Switch the Range and Altitude Display Mode

Once you're at cruise altitude, you may want to switch to the *normal* display mode and one of the longer display ranges. When you're ready to initiate a descent, you may want to switch to the *below* display mode

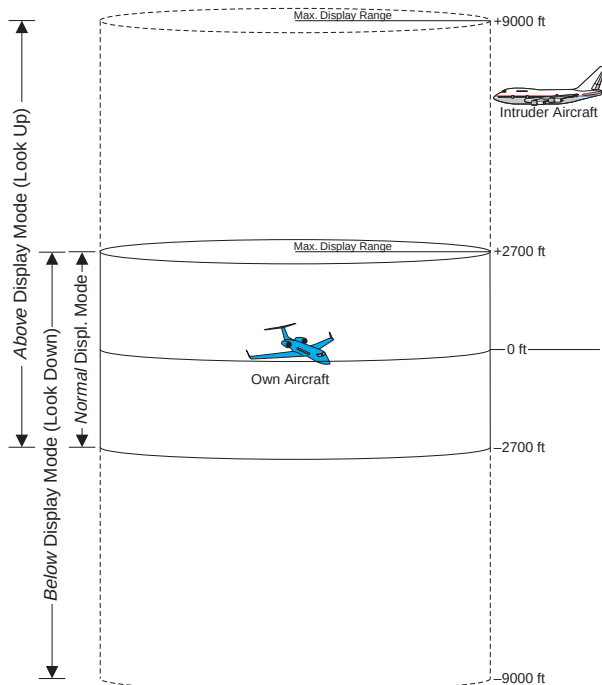


Figure 2-10. Altitude Display Modes

and one of the shorter display ranges. The procedures for selecting the altitude display mode and display range are the same as those listed previously under preflight instructions.

Observe the Display

Monitor the activity of any traffic displayed. Keep in mind the following points when watching traffic on the display:

- **Traffic Prioritizing** – The TCAS791 can track up to 35 intruder aircraft simultaneously, but to reduce clutter, it displays only the 8 most threatening aircraft of those tracked.
- **Traffic symbols** may occasionally disappear and reappear due to traffic prioritizing (see above), interference limiting, antenna shielding, or reception of low power transponders (see chapter 3).
- **Ground Target Filtering** – If your aircraft has a compatible radio altimeter connected to the TCAS791, TAs, PAs, and *other* traffic symbols will not be issued for traffic detected under 380 ft AGL when your aircraft is below 1,700 ft AGL.
- On some alternate displays, *other* traffic symbols will disappear when a TA occurs and will reappear (if still in range) once the TA goes away.

- Some alternate displays can be strapped to filter out *other* traffic.
- Refer to chapter 3 for a description of the TA criteria and other factors that affect the display of traffic symbols.

Respond to Traffic Advisories

WARNING

Do not attempt evasive maneuvers based solely on traffic information shown on the TCAS791 display. Information shown on the display is provided to the aircrew only as an *aid* in visually acquiring traffic which may impose a collision threat. It is not a replacement for ATC and the See & Avoid concept.

WARNING

The TCAS791 alone does not ensure safe flight. You must still visually scan the airspace around your aircraft frequently. The TCAS791 relies on information obtained from transponders in nearby aircraft. *The TCAS791 does not detect or track aircraft which are not equipped with an operating ATCRBS transponder.*

When the TCAS791 issues a TA, look outside for the intruder aircraft. If you can't see it, you may want to contact ATC for additional traffic information. When you spot an intruder aircraft, use normal right-of-way procedures to maintain separation. Begin evasive maneuvers only in response to visual contact with the intruder aircraft.

Turn On the TCAS791 While in Flight

This section describes a scenario in which your TCAS791 was not turned on prior to takeoff, but must now be turned on during flight. The procedures for turning on the TCAS791 during flight are the same as those listed previously under preflight instructions except that instead of going into standby and displaying the standby screen after the startup screen, the TCAS791 goes directly into the 5 nmi range, *normal* display mode after the startup screen. (See figure 2-11.) An alternate display may switch into some other altitude display mode and range.

The TCAS FAIL message displayed on some alternate displays during startup may change to TCAS OFF momentarily before changing to TA ONLY.

Post-Flight Instructions

The TCAS791 will automatically switch into standby once you've landed and have been on the ground for at least 24 seconds. (This delay allows the TCAS791 to remain out of standby during a touch-and-go maneuver.) Once on the ground in standby, you can manually switch back out of standby to monitor traffic above and around you, or you can stay in standby. In either case, you can turn off the TCAS791 as described below. You may want to



Figure 2-11. Normal Display Mode, 5 nmi Range

leave the TCAS791 on after landing until you have had a chance to see if there's a maintenance code on the CD605. A maintenance code will only show up when you're on the ground, and only on the CD605. (Refer to the section on maintenance codes later in this chapter.)

Turn Off the TCAS791

- a. Rotate the DIM/OFF knob on the CD605 counterclockwise until the switch turns off. If you're using an alternate display, move the discrete TCAS ON/OFF switch to the OFF position.
- b. If you're using an alternate display, turn it off.

Error Messages

The TCAS791 displays two types of error messages: TCAS Failed screens, and maintenance codes. (Some alternate displays do not display maintenance codes and display a TCAS FAIL message instead of a TCAS Failed screen.)

TCAS Failed Screens

A TCAS Failed screen can show up at any time on the ground or in the air. There is a TCAS Failed screen for TCAS failures and a TCAS Failed screen for barometric input failures.

TCAS Failures

The TCAS791 will display the TCAS Failed screen (figure 2-7) and aurally announce "TCAS test failed" when the TCAS791 fails the operator-initiated self test. Any other time the TCAS791 fails, the TCAS791 will display the TCAS Failed screen but will not aurally announce the failure. The TCAS791 will attempt to recover, but if the TCAS Failed message remains on the screen for more than 5 minutes, turn off the TCAS791 and schedule it for maintenance as soon as possible.

Barometric Input Failures

The TCAS791 will display the TCAS Failed/Barometric Input screen (figure 2-12) and will stop transmitting interrogations when it fails to detect barometric altitude (e.g. input from an encoding altimeter). The TCAS791 can not operate without a barometric altitude input. Most barometric input failures will more than likely be due to the failure of equipment external to the TCAS791. If the TCAS Failed/Barometric Input screen appears, do not turn off the TCAS791. When the barometric altitude input is restored, the TCAS791 will automatically return to normal operation.



Figure 2-12. TCAS Failed/Barometric Input Screen

Maintenance Codes

A maintenance code can only show up when your aircraft is on the ground. Figure 2-8 shows a maintenance code on the standby screen. Figure 2-13 shows a maintenance code with the aircraft on the ground but not in standby. The TCAS791 can be used when a maintenance code is displayed, but should be scheduled for maintenance as soon as possible.

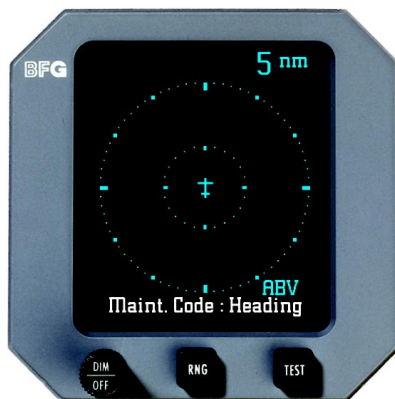


Figure 2-13. Maintenance Code When on the Ground but Not in Standby

Chapter 3

Principles of Operation

Introduction

This chapter is divided into two sections: TA Criteria, and Other Factors That Affect the Display of Traffic Symbols.

Traffic Advisory (TA) Criteria

This section focuses on the most important function of the TCAS791: issuing TAs. Table 3-1 summarizes the criteria that must be met before the TCAS791 will display a TA. Figure 3-1 illustrates the TA protection zones for an aircraft with a radio altimeter.* The remainder of the section describes in detail the criteria for issuing a TA.

Table 3-1. Ten Situations in Which a Traffic Advisory Will Occur

No.	The TCAS791 Will Issue a Traffic Advisory...				
	If Your Aircraft...	And Your Aircraft's Altitude Is...	And Your Landing Gear Is...	And An Intruder Aircraft Is Detected...	
1	has a radio altimeter*	below 2000 ft AGL		within a 0.2 nmi horizontal radius and a ±600 ft relative altitude	
2				within 15–20 sec. of CPA	
3		above 2000 ft AGL		within a 0.55 nmi horizontal radius and a ±800 ft relative altitude	
4				within 20–30 sec. of CPA	
5	does not have a radio altimeter*		down	within a 0.2 nmi horizontal radius and a ±600 ft relative altitude	
6				within 15–20 sec. of CPA	
7				up	within a 0.55 nmi horizontal radius and a ±800 ft relative altitude
8				within 20–30 sec. of CPA	
9				fixed	within a 0.55 nmi horizontal radius and a ±800 ft relative altitude
10			within 20–30 sec. of CPA		

Sensitivity Level A

Sensitivity Level B

* Having a radio altimeter means having a radio altimeter that is compatible with the TCAS791, wired to the TCAS791, and providing valid altitude information.

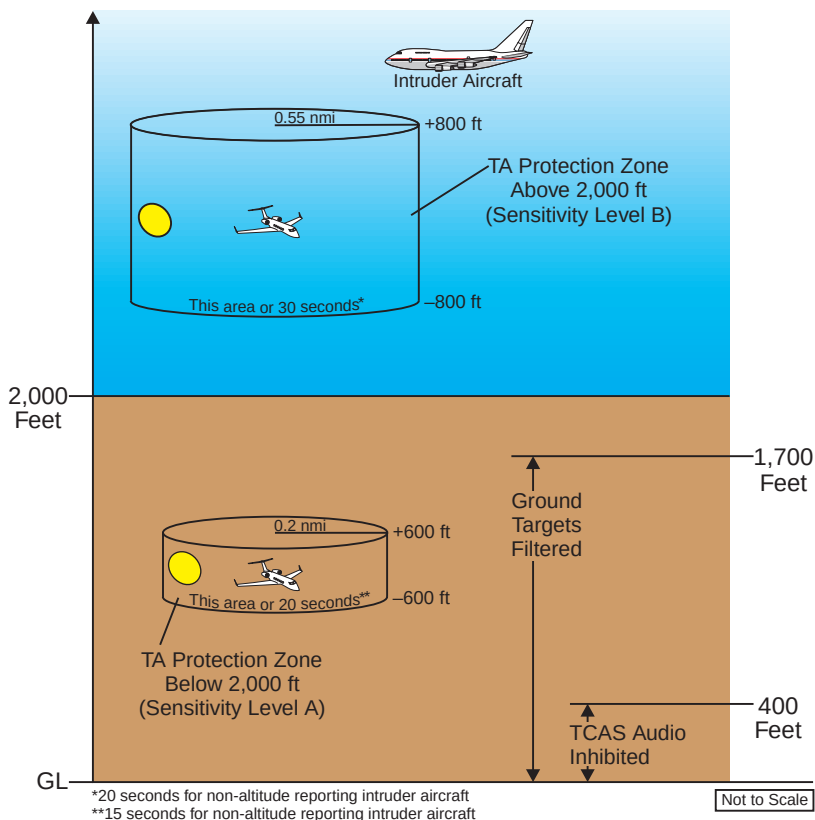


Figure 3-1. TA Protection Zones if Your Aircraft Has a Radio Altimeter

Sensitivity Levels

The TCAS791 uses one of two sensitivity levels, A or B, to determine when to display a TA. Having two sensitivity levels allows the TCAS791 to reduce the number of nuisance TAs during takeoff and landing (sensitivity level A), and to maximize the detection of TAs during the cruise phase of your flight (sensitivity level B). This section defines the sensitivity levels and describes the conditions under which each one is used.

Sensitivity Level A

Definition

Sensitivity level A consists of two criteria for displaying a TA:

- The intruder aircraft enters into a hockey puck shaped area surrounding your aircraft defined by a 0.2 nmi horizontal radius and a height of ± 600 ft from your aircraft. (See figure 3-1.)

OR...

- The intruder aircraft approaches your aircraft on a collision course that will intercept your aircraft within 15 or 20 seconds (within 15 seconds for a non-altitude reporting intruder aircraft; within 20 seconds for an altitude reporting intruder aircraft).

When It's Used

The TCAS791 uses sensitivity level A in the following situations:

- Your aircraft has a radio altimeter and is below 2,000 ft AGL.
- Your aircraft does not have a radio altimeter but its retractable landing gear is in the down position.

Sensitivity Level B**Definition**

Sensitivity level B consists of two criteria for displaying a TA:

- The intruder aircraft enters into a hockey puck shaped area surrounding your aircraft defined by a 0.55 nmi horizontal radius and a height of ± 800 ft from your aircraft. (See figure 3-1.)

OR...

- The intruder aircraft approaches your aircraft on a collision course that will intercept your aircraft within 20 or 30 seconds (within 20 seconds for a non-altitude reporting intruder aircraft; within 30 seconds for an altitude reporting intruder aircraft).

When It's Used

The TCAS791 uses sensitivity level B in the following situations:

- Your aircraft has a radio altimeter and is above 2,000 ft AGL.
- Your aircraft does not have a radio altimeter but its retractable landing gear is in the up position.
- Your aircraft does not have a radio altimeter and has fixed landing gear.

Audio Inhibit, TCAS791

This audio inhibit feature prevents the aural part of TAs, “traffic traffic,” from being announced during takeoff and landing in order to minimize pilot distraction. The corresponding TA symbols will still be displayed.

When It's Used

The TCAS791 uses this audio inhibit feature in the following situations:

- Your aircraft has a radio altimeter and you're below 400 ft AGL.
- Your aircraft does not have a radio altimeter but its retractable landing gear is in the down position.

Audio Inhibit, GPWS

If your aircraft has a Ground Proximity Warning System (GPWS) and a GPWS alarm occurs, the TCAS791 will sense the alarm and delay the aural “traffic, traffic” component of any TAs issued during the GPWS alarm until the alarm clears.

TA Symbol Duration

The TA symbol remains on screen for a minimum of 8 seconds even if the intruder aircraft no longer meets the TA criteria as long as the TCAS791 continues to track the aircraft.

No-Bearing TAs

Intruder aircraft detected only with the omnidirectional antenna will not be displayed unless they become TA's. The omnidirectional antenna does not detect the bearing of intruder aircraft. The TCAS791 tracks the intruder, but without bearing, it can't display a traffic symbol. If the intruder aircraft eventually meets the TA criteria, the no-bearing TA message provides a vehicle for display of the intruder aircraft.

Other Factors That Affect the Display of Traffic Symbols

This section lists factors that affect the display of traffic symbols otherwise defined in table 2-1.

Ground Target Filtering

Ground target filtering reduces the clutter of visual symbols and aural announcements that would otherwise be generated for intruder aircraft that are typically present on or near the ground near airports. This section defines ground target filtering and when it's used.

Definition

Ground target filtering prevents the issuing of Traffic Advisories (TAs), Proximity Advisories (PAs), and *other* traffic symbols for intruder aircraft determined to be below 380 ft AGL.

When It's Used

The TCAS791 uses ground target filtering only if your aircraft has a radio altimeter and you're below 1,700 ft AGL.

Interference Limiting

To assure that all interference effects from active TCAS I equipment are kept to a minimum, the FAA requires TCAS equipment to “interference limit,” i.e. reduce its transmit power, when it is operating in congested airspace. This limiting function is based on the number of TCAS interrogators detected via mode S broadcast reception and the reply rate of your transponder. Interference limiting reduces the effective surveillance range of the TCAS equipment and is independent of the display range selected; therefore, selecting a display range of 20 nmi does not guarantee a 20 nmi surveillance range when operating in high density areas.

Chapter 4

Display Interpretation

Introduction

This chapter explains the meaning of several sample screens on a CD605. The corresponding screens on alternate displays may vary.



Figure 4-1. Traffic Advisory and Other Traffic

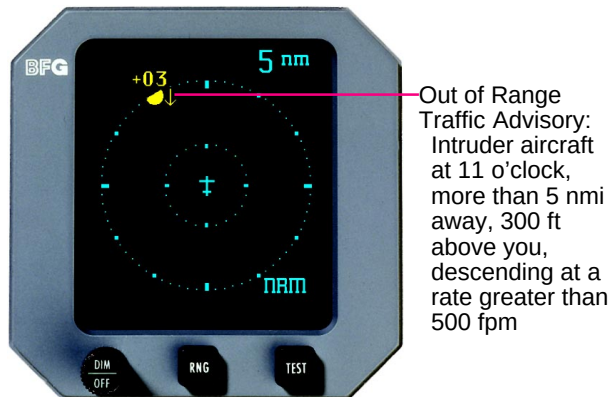
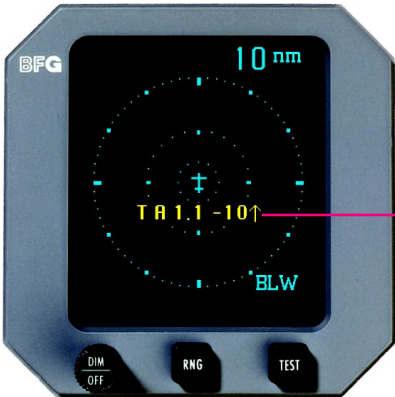
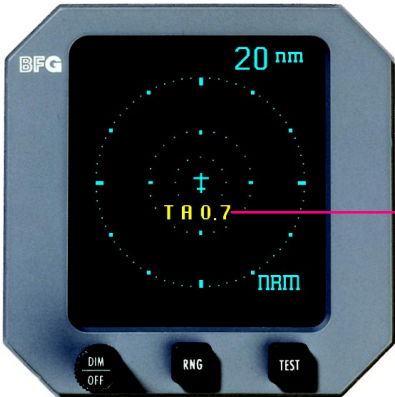


Figure 4-2. Out of Range Traffic Advisory



No-Bearing
Traffic Advisory:
Intruder aircraft
1.1 nmi away,
1,000 ft below
you, climbing at
a rate greater
than 500 fpm

Figure 4-3. No-Bearing Traffic Advisory



No-Bearing
No-Altitude
Traffic Advisory:
Intruder aircraft
0.7 nmi away (no
bearing or
altitude available)

Figure 4-4. No-Bearing No-Altitude Traffic Advisory



Proximity Advisory:
Intruder aircraft
at 10 o'clock,
4 nmi away,
200 ft above you,
descending at a
rate greater than
500 fpm

Figure 4-5. Proximity Advisory



This message is displayed any time the TCAS791 detects a failure. It also appears if the TCAS791 fails the operator-initiated self test. If this message remains on the screen for more than 5 minutes, turn off the TCAS791.

Figure 4-6. TCAS Failed Screen



This message indicates that the TCAS791 has failed to detect barometric altitude. If the barometric input is restored, The TCAS791 will return to normal operation.

Figure 4-7. TCAS Failed/Barometric Input Screen



This message will only be displayed when your aircraft is on the ground. When in standby, the TCAS791 does not transmit interrogations or track intruder aircraft.

Instructions for switching out of standby and beginning TCAS processing (press the RNG button)

Figure 4-8. Standby Screen



Instructions for switching into standby and stopping TCAS processing (press and hold the RNG button). This message will only appear when your aircraft is on the ground.

Figure 4-9. Out of Standby on the Ground

Chapter 5

Specifications

Tables 5-1 through 5-4 list the specifications for the major components of the TCAS791. Specifications are subject to change without notice.

Table 5-1. Transmitter Receiver Computer (TRC) Specifications

Part Number Definition:

805-10001-004 – TRC791
805-10001-024 – TRC791A
805-10001-025 – TRC791A Rotorcraft

Size:

7.62 in (19.35 cm) high
6.39 in (16.23 cm) wide
15.08 in (38.30 cm) deep

Weight:

18 lb 13 oz (8.53 kg) not including mounting tray
20 lb 3 oz (9.15 kg) including mounting tray

Tracking Capability:

Up to 35 intruder aircraft
Tracks intruder aircraft to a maximum closure rate of 1200 knots

Surveillance Range:

Nominal 27 nmi; maximum 35 nmi

Display Range:

5, 10, & 20 nmi when used with the CD605

Range Accuracy:

±0.05 nmi (typical)

Bearing Accuracy:

5° RMS (typical); 30° peak error

Altitude Accuracy:

±200 ft

Power Input Requirements:

20 to 32.2 V dc, 120 W (maximum)

Transmitter Power Output:

200 W peak (nominal)

Receiver Sensitivity:

-74 dBm

Operating Temperature:

-55 to +70 °C (-67 to +158 °F)

Storage Temperature:

-55 to +85 °C (-67 to +185 °F)

Operating Altitude:

55,000 ft maximum

Cooling:

Internal fan

TSO Compliance:

C118

RTCA Compliance:

DO-160C Category F2-BA(NBM)XXXXXXBABAUAUXXXXXX

Table 5-2. CD605 Control Display Unit Specifications

Part Number Definition:

- 805-10007-005 – 2-button, white/cyan/amber CRT, black faceplate, +5 V backlighting
- 805-10007-006 – 2-button, white/cyan/amber CRT, gray faceplate, +5 V backlighting
- 805-10007-007 – 2-button, white/cyan/amber CRT, black faceplate, +28 V backlighting
- 805-10007-008 – 2-button, white/cyan/amber CRT, gray faceplate, +28 V backlighting

Size:

- 3.26 in (8.15 cm) high
- 3.26 in (8.15 cm) wide
- 8.81 in (22.03 cm) deep
- 3AT1 envelope with 0.25 in bezel protrusion

Weight:

- 3 lb 1 oz (1.39 kg)

Viewing Angle:

- 35° horizontal, 45° top, 20° bottom

Power Input Requirements:

- 20 to 32.2 V dc, 20 W $\pm$ 10%

Operating Temperature:

- 20 to +55 °C (-4 to +131 °F)

Storage Temperature:

- 55 to +70 °C (-67 to +158 °F)

Operating Altitude:

- 55,000 ft maximum

Cooling:

- Internal fan

TSO Compliance:

- C113

RTCA Compliance:

- DO-160C Category DO-160C F1-CA(NBM)XXXXXXXXZBABAUAUXXX

Table 5-3. NY156 TCAS Directional Antenna Specifications

Part Number:

- 805-10003-001

Height:

- 1.3 in (3.25 cm)

Weight:

- 2.3 lb (1.04 kg)

Speed:

- Rated to 600 knots (0.9 Mach) @ 25,000 ft

Frequency:

- 1,030-1,090 MHz

TSO Category:

- C118

Environmental Category:

- DO-160C F2-AC(CLM)XSFDXSXXXXXXXXL(2A)X

Finish:

- Gloss white Skydrol resistant polyurethane paint

Table 5-4. NY152 L-Band Antenna Specifications

Part Number: 805-10005-001
Height: 2.68 in (6.70 cm)
Weight: 0.3 lb (0.14 kg)
Speed: Rated to 600 knots (0.9 Mach) @ 25,000 ft
Frequency: 960-1,220 MHz
TSO Category: C66b, C74c
Environmental Category: DO-160A, AE1/A/JXXXXXXXXXX
Finish: Gloss white Skydrol resistant polyurethane paint

Chapter 6

Warranty Information

Introduction

The TCAS791 is warranted for 2 years from the date of installation (not to exceed 30 months from the date of shipment from BFGoodrich Avionics Systems, Inc.) subject to the following limitations.

Warranty Statement

BFGoodrich Avionics Systems, Inc. (hereinafter called BFGAS) warrants each item of new equipment manufactured or sold by BFGAS to be free from defects in material and workmanship, under normal use as intended, for a period of 30 months from date of shipment by BFGAS to an authorized facility, or 24 months from date of installation by an authorized facility, whichever occurs first. No claim for breach of warranties will be allowed unless BFGAS is notified thereof, in writing, within thirty (30) days after the material or workmanship defect is found.

The obligation of BFGAS shall be limited to replacing or repairing at its factory the equipment found defective under terms of this warranty certificate; providing that such equipment is returned in an approved shipping container, transportation charges prepaid, to BFGAS, Grand Rapids, Michigan, or such other location as BFGAS may authorize. BFGAS reserves the right to have necessary repairs performed by an authorized agency.

This warranty shall not apply to any unit or part thereof which has not been installed or maintained in accordance with BFGAS instructions, or has been repaired or altered in any way so as to adversely affect its performance or reliability, or which has been subjected to misuse, negligence or accident.

This warranty is exclusive and is accepted by buyer in lieu of all other warranties or warranties express or implied, including without limitation the implied warranties of merchantability and fitness for a particular purpose. Buyer agrees that in no event will BFGAS liability for all losses from any cause, whether based in contract, negligence, strict liability, other tort or otherwise, exceed buyer's net purchase price, nor will BFGAS be liable for any special, incidental, consequential, or exemplary damages.

BFGAS reserves the right to make changes in design or additions to or improvements in its equipment without the obligation to install such additions or improvement in equipment theretofore manufactured.

A Subsidiary of The BFGoodrich Company

Related Policies and Procedures

- a. If the original registered owner of a TCAS791 sells the aircraft in which the TCAS791 is installed during the warranty period, the remaining warranty may be transferred. Written notification of the transaction must be submitted by the initial recipient of the warranty to:

ATTENTION: WARRANTY ADMINISTRATOR
BFGoodrich Avionics Systems, Inc.
5353 52nd Street, S.E.
Grand Rapids, MI 49588
U.S.A.

- b. Equipment must be installed by a BFG Avionics Systems, Inc. authorized dealer or installer. Installation of equipment by facilities not specifically authorized will void the equipment warranty.
- c. Notice of a claimed product defect must be given to BFG Avionics Systems, Inc. or a designated BFG Avionics Systems, Inc. service agency within the specified warranty period.
- d. A product which is defective in workmanship and/or material shall be returned to BFG Avionics Systems, Inc. via any authorized dealer with transportation charges prepaid. After correction of such defects, the equipment will be returned to the dealer, transportation prepaid by BFG Avionics Systems, Inc. via surface transportation. Any other means of transportation must be paid by the customer.

The risk of loss or damage to all products in transit shall be assumed by the party initiating the transportation of such products. All items repaired or replaced hereunder shall be warranted for the unexpired portion of the original warranty.

- e. BFG Avionics Systems, Inc. is in no way obligated or responsible for supporting or participating in the costs of the installation warranty. The entire responsibility lies with the BFG Avionics Systems, Inc. authorized dealer making the installation. BFG Avionics Systems, Inc. is only responsible for the product warranties outlined in the warranty statement.
- f. BFG Avionics Systems, Inc. cannot authorize warranty credit for troubleshooting of other systems in the aircraft in order to reduce noise interference with the TCAS791.

Record of Important Information

Dealer Information

Name _____

Address _____

City, State, Zip _____

Telephone _____

Equipment Information

Date of purchase _____

Installation Date from FAA form 337 _____

TRC

Model Number _____

Part Number _____

Serial Number _____

Firmware Version _____

CDU

Model Number _____

Part Number _____

Serial Number _____

Directional Antenna

Model Number _____

Part Number _____

Serial Number _____

L-Band Omnidirectional Antenna

Model Number _____

Part Number _____

Serial Number _____

Note

To ensure that a new or repaired TCAS791 meets the FAA TSO, gets foreign government approval, and meets BFGoodrich Avionics Systems, Inc. performance standards, your TCAS791 must be installed and tested by a BFG-authorized TCAS791 dealer.



009-10025-001 (Rev. F, 3/9/99)

BFGoodrich Avionics Systems, Inc.
5353 52nd Street, S.E.
P.O. Box 873
Grand Rapids, MI, 49588-0873 USA
(800)253-9525

TCAS791