GLIDING NEW ZEALAND INCORPORATED

ADVISORY CIRCULAR AC 3-19

INSTALLATION OF TRIG TT2x/TN-72

STAND-ALONE ADS-B SYSTEMS IN GLIDERS

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1 Introduction

From 31 December 2022, every aircraft operating in transponder mandatory controlled airspace must be equipped with and operate an ADS-B system that complies with CAA Notice NTC 91.258.

Installation of a Mode S transponder system with ADS-B out in a glider is a minor change in terms of CAR Part 21 because it is a single stand-alone communications system that simply transmits position reports. The only failures of such systems that may cause airworthiness issues with a given glider are related to such modes as overheating, smoke generation, or jamming of flight controls that could arise from wire routing, retention of system components etc. Such failures are managed by compliance with acceptable technical data (ATD) and standard aviation practice by qualified installers as set out in the following paragraphs.

Notice NTC-91.258 requires the system to be installed using ATD as defined in CAR Part 21. The purpose of this GNZ Advisory Circular is to provide the ATD for glider installations when approved by the Director pursuant to Part 21.503(a).

Glider installations must be carried out by qualified installers as set out in NTC-91.258 Section 4.

Post installation testing proves that the ADS-B system meets the required accuracy parameters specified in NTC-91.258.

2 Applicability

A Trig TT21 or TT22 Mode S transponder in combination with a Trig TN72 position source is an OEM recommended combination providing a compliant ADS-B system in terms of Notice NTC-91.258 paragraph 2.(g)(5)(ii).

This GNZ AC provides ATD for the installation of a Trig TT21 or TT22 Mode S transponder with a Trig TN-72 position source in any NZ registered glider to be operated VFR by day in transponder mandatory controlled airspace within the NZ FIR.

Note that the output power of the TT21 is insufficient to meet the ICAO ADS-B standards above an altitude of 15,000 ft (reference NTC-91.258 paragraph 3(b).)

3 Technical Instructions Part A – Installation of a Trig TT21 or TT22 Transponder and Antenna

3.1 If a Trig TT21 or TT22 transponder is already fitted to the glider, ensure that the installed software version is 2.12 or later and the TC20 controller software version is 1.14 or later. Contact a Trig dealer for a software upgrade if this is found to be necessary.

3.2 If a new transponder installation is required, determine a suitable location for the TC20 controller that is clearly viewable and accessible to the pilot in the normally seated position, the preferred location being on the glider instrument panel. Note that, while the TC 20 is splash proof, it is not waterproof. The TT21/TT22 must be securely mounted anywhere within the airframe where access can be gained for maintenance and is not likely to be damaged from loose objects during flight, knocked by persons entering/exiting the glider, or water ingress. Any mounting orientation is permissible for the transponder unit. The TT21/TT22 is powered from the glider batteries through a circuit protected by a 3-amp circuit breaker. The interconnecting cable between the TT21/TT22 transponder unit and the TC20 controller must be routed so it is protected from physical damage.

3.3 Any new transponder and antenna installation must be in accordance with Trig Avionics Limited TT21/TT22 Mode S Transponder Installation Manual Part Number 00560-00-AQ, dated 22 September 2017 (or later issue). Trig supplied or aircraft standard parts should be used. In the absence of glider OEM instructions, all new wiring is to be installed in accordance with practices documented in FAA AC 43.13-1B Chapter 11. Any TSO approved transponder antenna may be used. An existing successfully tested transponder antenna installation may be used. To maximise transmitted power, the antenna coax should be as per section 5.11.2 of the above-referenced TT21/TT22 installation manual with a length of less than 4m.

4 Technical Instructions Part B – Installation of a Trig TN72 Position Source

4.1 Install the position source in accordance with Trig Avionics Limited TN72 Position Source Installation Manual Part Number 01691-00-AI, dated 16 April 2018 (or later issue), Sections 5 and 6, using aircraft standard parts. In the absence of glider OEM instructions, wiring practices documented in FAA AC 43.13-1B Chapter 11 are to be used.

4.2 Install an undercarriage squat switch or an airspeed switch using aircraft standard parts and practices as above. A Peregrine ADS-B System Airspeed Switch is recommended.

4.3 The GPS antenna must meet TSO-C190. Either the Trig TA70 or the RAMI AV-801 may be used. Ensure that the connecting cable and connector complies with paragraphs 5.8.2 and 5.8.3 of the Trig TN72 Installation Manual.

4.4 Placement of the GPS antenna is critical for adequate ADS-B performance. It may be mounted internally but must have an unobstructed view of satellites as far as is possible all the way down to the horizon and should be as far away as possible from any transmitter antenna, preferably at least 1m. The antenna should be separated from the cockpit canopy to prevent case-to-case coupling, and from other GPS antennae preferably by at least 30cm. Mounting orientation is not critical and no additional ground plane is required if mounted on a composite airframe. Try to locate the antenna in an area that will keep the coaxial cable transmission line as short as possible to the GPS receiver. In the absence of glider OEM instructions, the general guidance of FAA AC 43.13-2B Chapters 1 & 3 for antenna installations should be followed.

5 System Configuration

5.1 Using the configuration mode on the TC20, enter the settings prescribed in the Trig TT21/TT22 Installation Manual Section 6.1 and the TN72 Installation Manual Section 6.1. For the GPS input, select SIL 3.

5.2 The aircraft registration is to be entered as flight ID without the ‘dash’, eg ZKGXX.

6 Post Installation Testing

6.1 Loads from single masses (EASA CS 22.597). Using a spring balance or other suitable means, apply the following (conservative) test loads separately in the forward, down and side directions for at least 3 seconds without failure:

TT21/TT22 transponder	8 kg_f (8 daN)
TC 20 controller	2.5 kg_f (2.5 daN)
TN72 position source	2.5 kg_f (2.5 daN)

6.2 Interference effects. With the transponder powered on, operate each of the other electrically operated glider systems to determine that no significant interference effects are present.

6.3 Leak test. To ensure that the installation of the TC20 Controller or the airspeed switch has not had an adverse effect on the primary altimeter, a static system leak test must be carried out in accordance with Part 43 Appendix D1.

6.4 Ramp test. A functional test of the system in accordance with Part 43 Appendix D3 and Appendix E and the above-referenced installation manuals for the TT21/TT22 and TN72 should be carried out (Section 7 in each installation manual).

6.5 Flight test. Paragraph 4.4 above gives general advice regarding the GPS antenna, however a flight test is necessary to establish adequate ADS-B performance. Appendix A sets out a suitable flight test to establish whether the antenna location is satisfactory. If flight testing fails to establish the required position integrity, the antenna needs to be repositioned and further flight testing carried out until a satisfactory result is achieved.

7 Manuals

7.1 Instructions for continued airworthiness. Other than for the biennial functional checks required by Part 91.605(e)(3), "on condition maintenance" of the Trig TT21/TT22 and TN72 is allowed. This means that that there are no periodic service requirements necessary to maintain continued airworthiness, and no maintenance is required until the equipment does not properly perform its intended function. When service is required, a complete performance test should be accomplished following any repair action. Repairs should only be carried out in accordance with Trig service procedures.

7.2 Normal operation is described in the TT21 and TT21 Mode S Transponder Operating Manual, Part Number 00559-00-AG dated 29 August 2017 (or later issue). A copy of this should be inserted in the AFM.

8 Documentation

8.1 Amend the glider weight and balance records in accordance with CAA AC 43-2.

8.2 Complete or update the electrical load analysis (ELA), retaining a copy with the glider maintenance records.

8.3 Amend the glider's form CAA 2129.

8.4 Complete form CAA 043-01 Modification Record with the following statement, retaining a copy with the glider maintenance records:

> *The installed ADS-B OUT system was shown to meet the equipment and performance requirements of CAA Notice of Requirements NTC 91.258.*

8.5 Make a certified statement of release to service in accordance with Part 43.105(a) as well as detailing the work carried out in conformity with the ATD in sections 3, 4 and 5 above of this GNZ AC 3-19. The results of the ramp test and flight test in accordance with section 6 above should be filed in the glider maintenance records.

8.6 Submit a copy of the ELA, form CAA 2129 and form CAA 043-01 to the CAA Airworthiness Unit.

Appendix A Flight Testing for ADS-B System Performance

To complete the post-installation testing of section 6, a flight test is required. An acceptable means of conducting this test and reporting the results is set out below:

1. The pilot must be the holder of at least a GNZ Cross-Country Pilot Certificate (XCP).

2. Before take-off, set the transponder to squawk 1300 and select ALT. Use the FN button to access the ADS-B position monitor to confirm that latitude and longitude is displayed. (If valid position information is not displayed, the lat/long display will be replaced by dashes and ADS-B position will not be transmitted.)

3. With the transponder display in position monitor mode, conduct the following flight in uncontrolled airspace with known good ADS-B coverage:

   a) Take off and climb to achieve a soaring flight of at least 60 minutes, if possible, but not less than 30 minutes.

   b) In free gliding flight, perform at least two left and two right 360 degree turns at bank angles of at least 30 degrees at a speed of about 1.4 V_s.

   c) Repeat the above turns at about 1.8 V_s.

   d) Descend in straight flight as fast as atmospheric turbulence and V_{ne} permits for at least 1 minute.

   e) Continue with normal soaring flight manoeuvres before returning to land.

4. Throughout the test flight, frequently check that the ADS-B monitor continues to display lat/long without warning messages, particularly during turns. (If such indications do occur, it may mean that the GPS antenna position is not satisfactory.)

5. Post-flight, use the replay function of an independent flight tracking service (such as Flight Radar 24) to view a screen capture of the recorded flight track and to download a file giving the technical data points received (typically a CSV file).[1]

6. Examine the screen capture and data file for any significant gaps or anomalies, bearing in mind that, although ADS-B transmissions must occur at least once per second, flight tracking service data feeds usually only display the data at longer and/or variable intervals (typically 3 or 4 seconds but often longer).

7. If the test results are satisfactory, compile a report on the results for the glider maintenance records, using the proforma on the following page.

[1] If technical assistance is required, contact the GNZ Executive Officer executive.officer@gliding.co.nz

ADS-B OUT Flight Test Report

Glider registration: ZK-G_____

Date & time of takeoff (UTC): _____

Date & time of landing (UTC): _____

Place of takeoff: _____

Place of Landing: _____

Name of flight tracking service used: _____

Number of ADS-B transmissions detected: _____ *(Nr of lines recorded in the CSV file)*

Comment on any data gaps or anomalies: _____

_____

_____

We certify that the results of the flight test described above indicate satisfactory ADS-B OUT performance.

Name of pilot: _____ XCP Nr: _____

Pilot signature: _____ Date: _____

Name of installer: _____ CAA or GNZ ID: _____

Installer signature: _____ Date: _____