



New Zealand Technical Standard Order

NZTSO 2001

Time in Service Recorders

Revision 1

17/11/15

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NEW ZEALAND

Approved by
Manager Aircraft Certification

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1. PURPOSE

This New Zealand Technical Standard Order (NZTSO) prescribes the Minimum Performance Standards (MPS) for an aircraft tamper resistant Time in Service Recorder (TSR). It is intended for NZTSO Authorisation applicants under CAR Part 21, Subpart O planning to manufacture aircraft TSRs.

2. APPLICABILITY

2.1. This revision of the NZTSO is effective for new applications submitted after the effective date of this NZTSO.

2.2. This NZTSO relates specifically to CAR Part 91 Subpart F and Appendix A7.

3. DEFINITIONS

Time in service means the elapsed time from the aircraft leaving the surface until touching it again on landing.

Tamper means to interfere with the Time in Service Recorder or the system in which it is installed, in such a way as to alter the validity of the records.

Tamper resistant means to be designed and installed in such a way as to render the act of tampering difficult and evident.

4. ABBREVIATIONS

CAR means Civil Aviation Rule

NZTSO means New Zealand Technical Standard Order

RTCA means Radio Technical Commission for Aeronautics

TSR means Time in Service Recorder

5. REQUIREMENTS

5.1. Minimum Performance Standard

Models of TSR that are identified and manufactured on or after the effective date of this NZTSO must meet the MPS set forth in this section and Appendix 1.

5.2. Failure Condition Classification

(1) Loss of function has been determined to be a minor failure condition.

(2) Under-reporting and loss of data integrity (and the consequence on maintenance periodicity) have been determined to be a major failure condition. This may be reduced to Minor or No Safety Effect through formal mitigation.

(3) Design the system to, at least, the design assurance level applicable to these failure condition classifications. Design assurance levels should be based on the guidance of FAA ACXX.1309 as applicable to the aircraft type.

(4) Additional functions and features must be assessed for any additional failure conditions they create and designed accordingly.

5.3. Environmental Qualifications

The required performance of the airborne equipment shall meet or exceed the RTCA DO-160G (or equivalent) requirement for the applicable aircraft and operating environment.

5.4. Software Qualifications

If the article includes software, develop the software to RTCA Document DO-178C, "Software Considerations in Airborne Systems and Equipment Certification," dated December 13, 2011, or the latest version thereof, to at least the software level consistent with the failure condition classification defined in para 5.2.

5.5. Electronic Hardware Qualifications

If the article includes complex custom airborne electronic hardware, develop the component according to RTCA Document RTCA/DO-254, "Design Assurance Guidance for Airborne Electronic Hardware", dated April 19, 2000, or the latest version thereof, to at least the design assurance level consistent with the failure condition classification defined in para 5.2.

5.6. Deviations

Alternative or equivalent means of compliance to the requirements of this NZTSO can be applied for under the provisions of CAR 21.511

6. MARKING

To meet the requirements of Rule Part 21 Subpart O, articles manufactured under this NZTSO shall be marked as follows:

- 6.1. At least one major component must be permanently and legibly marked with all of the information required in CAR 21.621(5).
- 6.2. For each separate component that is easily removable (without hand tools), each interchangeable element, and each separate sub-assembly of the article that the manufacturer determines may be interchangeable must be permanently and legibly marked with at least the name of the manufacturer, manufacturer's subassembly part number, and the NZTSO number.
- 6.3. Nominal power input rating (voltage, AC power and frequency or DC current).
- 6.4. If a single part number for a component identifies the software and hardware configuration then that part number shall be displayed. If the item relies on having different part numbers to indicate the software and the hardware configuration, each part number shall be displayed. Alternatively, electronic means may be used to identify software.

7. DATA REQUIREMENTS

7.1. Application Data

To meet the requirements of Rule Part 21, Subpart O, the applicant shall furnish to the Manager Aircraft Certification, Civil Aviation Authority one copy each of the following technical data:

- 7.1.1. The applicant's analysis and/or test results showing compliance with the requirements of this NZTSO including qualification test procedures, test reports, and the applicant's NZTSO qualification report.
- 7.1.2. A requirements compliance matrix.
- 7.1.3. The data as specified in paragraph 7.2.
- 7.1.4. Technical data to define the equipment including drawings, specifications and wiring diagrams.
- 7.1.5. A list of components by part number, manufacturer, and specification that make up the equipment and system complying with this NZTSO.
- 7.1.6. A copy of all design and manufacturing specifications used.
- 7.1.7. Calibration and maintenance procedures.
- 7.1.8. Instructions and documentation, mathematics and logic required for reading data stored in the memory and retrieved via the interface or other means.
- 7.1.9. Readout information to demonstrate that the manufacturer has facilities capable of retrieving data from interface and directly from the memory.
- 7.1.10. Specifications and schematics for any special purpose data retrieval devices.
- 7.1.11. For each unique configuration of software and airborne electronic hardware:
 - (a) Software part number including revision and design assurance level;
 - (b) Airborne electronic hardware part number including revision and design assurance level; and,
 - (c) Functional description.
- 7.1.12. Any other data that the Director may require.

7.2. Furnished Data

- 7.2.1. One copy of the data specified in paragraphs 7.2.3 and 7.2.4 of this NZTSO and any other data that is necessary for continued airworthiness must go to each person receiving for use any articles manufactured under an authorisation of this NZTSO.
- 7.2.2. In addition, a note with the following statement must be included in installation procedures and limitations:

“The conditions and tests required for NZTSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the NZTSO standards. NZTSO articles must have separate approval for installation in an aircraft. The article may be installed only if performed under Rule Part 43.”
- 7.2.3. **Operation Instructions.** An operating manual shall be provided that contains instruction on how to operate the TSR. As a minimum it shall contain information on the following:

- 7.2.3.1. Performance specification and limitations.
- 7.2.3.2. Operation of controls. Where the controls are not an integral part of the recorder installation details of the equipment required for control shall be provided.
- 7.2.3.3. Data display, retrieval and interpretation. Where the displays are not an integral part of the recorder, installation details of the equipment required for displaying information shall be provided.
- 7.2.3.4. Tamper and failure annunciator interpretation.
- 7.2.3.5. Data retrieval via the interface including all information necessary for successful download and viewing of the data.
- 7.2.3.6. Calibration and time adjustment requirements, if applicable.
- 7.2.3.7. Pre-flight checks that will confirm the system is operating properly.

- 7.2.4. **Installation Instructions.** Installation instructions shall be provided that detail how to install the recorder in an aircraft. As a minimum it shall contain information on the following:
 - 7.2.4.1. Pre-installation equipment checks
 - 7.2.4.2. Location and mounting details
 - 7.2.4.3. Installation and environment limitations
 - 7.2.4.4. External sensor specifications and requirements
 - 7.2.4.5. Connections
 - 7.2.4.6. Typical installation schematics
 - 7.2.4.7. Installation tests including ground and flight tests for airworthiness, performance and evidential certification.
 - 7.2.4.8. Weight and dimensions
 - 7.2.4.9. Electrical load.

8. INSTALLATION CERTIFICATION

- 8.1. The installation tests required by 7.2.4.7 shall enable the system in which the recorder is installed, and the recorder itself, to be tested for evidential purposes.
- 8.2. Whilst the aircraft is on the ground the test shall determine the following:
 - 8.2.1. Whether or not each external sensor and the associated connections are functioning properly, and
 - 8.2.2. Whether or not the recorder is responding properly when the recorder inputs are stimulated.
- 8.3. Where the tests require special-to-type test equipment, the manufacturer shall supply a

certified test set, or supply information of sufficient detail to enable the test set to be constructed and calibrated to a known and accepted standard.

8.4. Any test set shall be portable.

9. AVAILABILITY OF REFERENCE DOCUMENTS

9.1. Copies of RTCA documents may be obtained from-

RTCA, Inc
1828 L Street, NW
Suite 805
Washington, DC 20036
UNITED STATES OF AMERICA

Telephone: (202) 833-9339
Facsimile: (202) 833-9434

<http://www.rtca.org/>

9.2. Copies of the New Zealand Civil Aviation Rules, Advisory Circulars, and other information can be obtained from-

The Civil Aviation Authority web site at <http://www.caa.govt.nz/>

or the-

Civil Aviation Authority of New Zealand
PO Box 3555
Wellington 6140
NEW ZEALAND

Phone: (04) 560 9400
Facsimile: (04) 560 9452

Approved by:

Shaun Johnson

Manager Aircraft Certification

APPENDIX 1: CIVIL AVIATION AUTHORITY MINIMUM PERFORMANCE STANDARD FOR A TIME IN SERVICE RECORDER

1 INTRODUCTION

This Appendix to NZTSO 2001 prescribes the general requirements and minimum performance standard for an aircraft tamper resistant Time in Service Recorder system. A manufacturer may include additional features within the equipment they supply, but those features and the related functionality must not adversely affect the performance of the Time in Service Recorder function.

2 GENERAL REQUIREMENTS

2.1 Material

2.1.1 Material shall be of a quality, which can be demonstrated to be suitable and dependable for use in the environment for which the equipment is qualified.

2.2 Workmanship

2.2.1 Workmanship shall be consistent with high-grade aircraft equipment manufacturing practices.

2.3 Accessibility

2.3.1 The connections to, and the controls and displays of the TSR shall be arranged in such a manner that they are readily accessible for operation, maintenance, and data retrieval.

2.4 Controls

2.4.1 Controls must be easily operable by pilot, maintenance, and regulatory authority personnel.

2.4.2 The controls need not be an integral part of the recorder installation.

2.4.3 No means shall be provided to prevent the recorder from recording the data under normal conditions.

2.4.4 All control markings shall be durable, clear, and in the English language.

2.5 Displays

2.5.1 The displays must be easily readable by pilot, maintenance, and regulatory authority personnel when the aircraft is on the ground.

2.5.2 The displays need not be an integral part of the recorder installation.

2.6 Data Retrieval

2.6.1 Data stored in the recorder shall be retrievable, either remotely or through external interface.

2.6.2 The manufacturer shall provide an alternative means of retrieving the data from the memory should the rest of the recorder be damaged in such a way that the normal method of data retrieval does not function.

2.7 Tamper Resistance

2.7.1 The recorder and the associated equipment shall be designed and installed in such a way as to be tamper resistant.

2.8 Tamper and Fault Reporting

- 2.8.1 Automatic means shall be provided to indicate system tampering and malfunctions that may cause data to be lost or improperly recorded.
- 2.8.2 Tampering and failures detected as described above shall be identifiable to the pilot, maintainer and/ or regulatory authority.
- 2.8.3 The inclusion of tampering and fault monitoring or self-test shall not degrade the performance of the recorder, recording system, or any system it is interfaced with.

2.9 Maintenance and Calibration

- 2.9.1 The maintenance and calibration tasks required to ensure the airworthiness and serviceability of the system shall be established.
- 2.9.2 The accuracy requirements stipulated in section 3 shall apply for the life of the equipment, otherwise the manufacturer shall specify a calibration period.

2.10 Airworthiness

- 2.10.1 The TSR and its associated sensors shall be located and installed in such a way that they reliably perform their intended function and do not, under any circumstances, impair the airworthiness of the aircraft.
- 2.10.2 Each recorder shall be permanently mountable to the aircraft.

2.11 Environment

- 2.11.1 The TSR shall perform its intended functions within the range of environmental conditions in which it is declared to operate.

3 FUNCTIONAL REQUIREMENTS

The TSR and its installed system shall record, as a minimum, the following data:

3.1 Time in Service

Requirement	Period	Definition	Range	Number of Records
3.1.1	Total Time in Service	The elapsed time between each landing and its associated take-off.	50,000 hours	1

3.1.2 Running Total

A running total of Total Time in Service shall be recorded on a flight-by-flight basis, even when any other records are overwritten.

3.1.3 Resolution

Each period shall be able to be retrieved with a resolution of 0.1 of an hour or less.

3.1.4 Record Accuracy

As compared to the TSR input, the retrieved period shall have an error of no more than $\pm 0.2\%$.

3.1.5 Installed Accuracy

As compared to the actual aircraft time in service, the retrieved period shall have an error of no more than $\pm 2\%$.

3.1.6 Latency

Each period type record shall be updated within 10 seconds of the actual landing event.

3.2 Take-off to Landing Cycles

Requirement	Cycle	Definition	Range	Number of Records
3.2.1	Total Take-off to Landings Cycles	The number of times each take-off to landing cycle has occurred.	600,000 Cycles	1

3.2.2 Running Total

A running total of Total Take-off to Landing Cycles shall be recorded on a flight-by-flight basis, even when any other records are overwritten.

3.2.3 Resolution

Each cycle shall be able to be retrieved with a resolution of one cycle.

3.2.4 Error Rate

For each cycle type listed, no less than 99.9% of the actual cycles shall be captured and recorded, and be able to be retrieved to meet the accuracy requirements below.

3.3 Latency

The cycle type record shall be updated within 10 seconds of the actual landing event.

3.4 Tamper Recording

Regardless of the method selected, the operator must be able to identify when a tamper event has occurred.

3.5 Fault Recording

Regardless of the method selected, the operator must be able to identify when the TSR ceases operating or when its performance is degraded below the expected requirements of this section.

3.6 Data Reset

The recording count for failure events and tamper events can only be reset by manufacturer or approved repair facility.

3.7 Sensors

3.7.1 Where sensors are not housed within the recorder housing or the sensors housed within the recorder housing can be foiled, more than one sensing method shall be used.

3.7.2 Where more than one sense method is required the sensors shall be sufficiently different and their sources sufficiently isolated that one successful attempt of tampering with the system is unlikely to disable both sensors. The remaining sensor shall continue to trigger the recording of information.

3.8 Automatic Operation

When installed the recorder shall automatically record all data as described above.

3.9 Erasure of Data

Except for the overwriting of the oldest data by new information, no means for the erasure of the recorded data shall be provided.

3.10 Data Storage Durability

- 3.10.1 The data storage memory shall be protected from damage by external inputs.
- 3.10.2 The data storage memory shall be capable of retaining information with external power removed for not less than two years.

4 DISPLAY**4.1 Displayed Information**

The recorder readout shall display continuously or on demand the following information:

Requirement	Displayed Information	Definition	Format
4.2	Total Time in Service	The Total Time in Service time recorded in accordance with para 3.1.	Hours, one decimal places
4.3	Take-off and Landing Cycles	The total Take-off to Landing Cycles recorded in accordance with para 3.2.	Cycles

4.4 Tamper Events

Regardless of the method selected, any occurrences of attempts to tamper with the TSR must be visible to the Operator, Maintainer and/or Regulator.

4.5 Fault Condition

At any stage the fault conditions from para 3.5 are triggered, there must be a visible means of reporting this to the operator.

4.6 Accuracy, Resolution, and Error Rate of Displayed Information

The accuracy, resolution, and error rate of the displayed information shall meet the requirements of the applicable section in section 3.

4.7 Indication of Displayed Information Type

From the indications on the display it shall be clear which displayed information type is being displayed.

4.8 Menus

It is not necessary to display all information at once. A system of menus is acceptable.