# F8794

# CS144 INTERFACE MODULE TECHNICAL PRESENTATION

## PART NUMBER
## S1825501-01 / S1825501-02

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**CS144 INTERFACE MODULE**
**TECHNICAL PRESENTATION**

# LIST OF REVISIONS

| Rev | Date | Pages | Description of modifications |
|---|---|---|---|
| A | NOV 02/14 | | Preliminary issue |
| B | JAN 03/03 | 22-23 | Decoded protocol description |
| C | FEB 03/14 | 15-16 | J1 - J2 Functions |
| D | APR 03/14 | 13, 25 - 29 | Environmental characteristics - MTBF - Qualification - Parts Lists - Marking - Qualification certificates |
| E | JUN 03/25 | 20 | First power up modification |
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**CS144 INTERFACE MODULE**
**TECHNICAL PRESENTATION**

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# CS144 INTERFACE MODULE
# TECHNICAL PRESENTATION

## 1. GENERAL

### 1.1. Background

*1.1.1. COSPAS-SARSAT system*

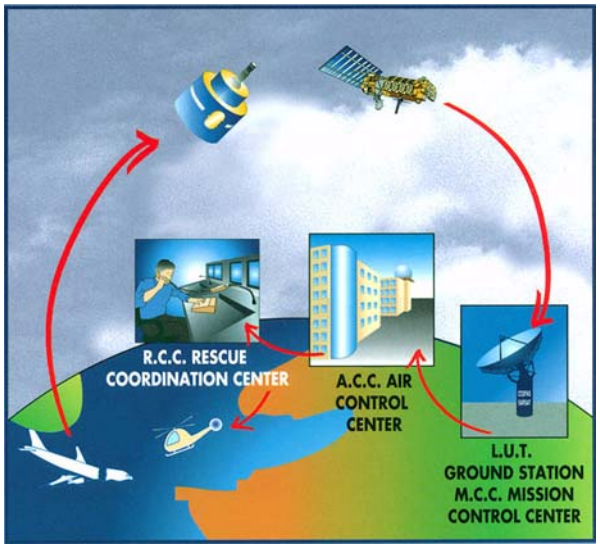
Launched in the early eighties by the four founder countries (Canada, France, Russia, USA), the COSPAS-SARSAT system provides satellite aid to search and rescue (SAR) operations for maritime, aeronautical and terrestrial vehicles anywhere in the world.

It uses distress beacons fitted on mobiles and a constellation of LEO and GEO satellites which relay the 121.5 / 243 MHz signals and process the 406 MHz signal to ground stations (LUT) where the beacon positions are determined (with a precision of 10 NM with 121.5 / 243 signals and less than 2 NM with 406 signals).

Several types of beacons are designed to match the various applications of the COSPAS-SARSAT system:

- EPIRB (Emergency Position Indicating Radio Beacon) for maritime applications.
- ELT (Emergency Locator Transmitter) for aeronautical applications.
- PLB (Personal Locator Beacon) for land expeditions.

Figure 1: COSPAS-SARSAT system




*1.1.2. CS144 Interface Module and digital message*

One of the major improvement of the new generation of ELTs is the transmission of the identification code (112 bits) of the aircraft in distress in the 406 MHz digital message.

Furthermore, the KANNAD 406 ELTs are capable of transmitting the aircraft position in a 144 bit message according to the "LOCATION PROTOCOLS" described in COSPAS-SARSAT document C/S G005.

The purpose of the CS144 Interface Module is to combine the aircraft identification with the aircraft position to generate the "long message".

Every minute, the CS144 Interface Module updates an internal memory module (SMM) that contains either the short or the long message.

This memory is read when the ELT is activated and regularly every 20 minutes.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The aircraft position is given either by:

- a NAV equipment via an RS232 or RS422/485 link,
- a NAV equipment via an ARINC 429 link.

*1.1.3. ELT system (with CS144 Interface Module Option)*

The ELT system is composed of 6 Line Replaceable Units (LRU) :

(1) transmitter,

(2) mounting bracket,

(3) remote control panel,

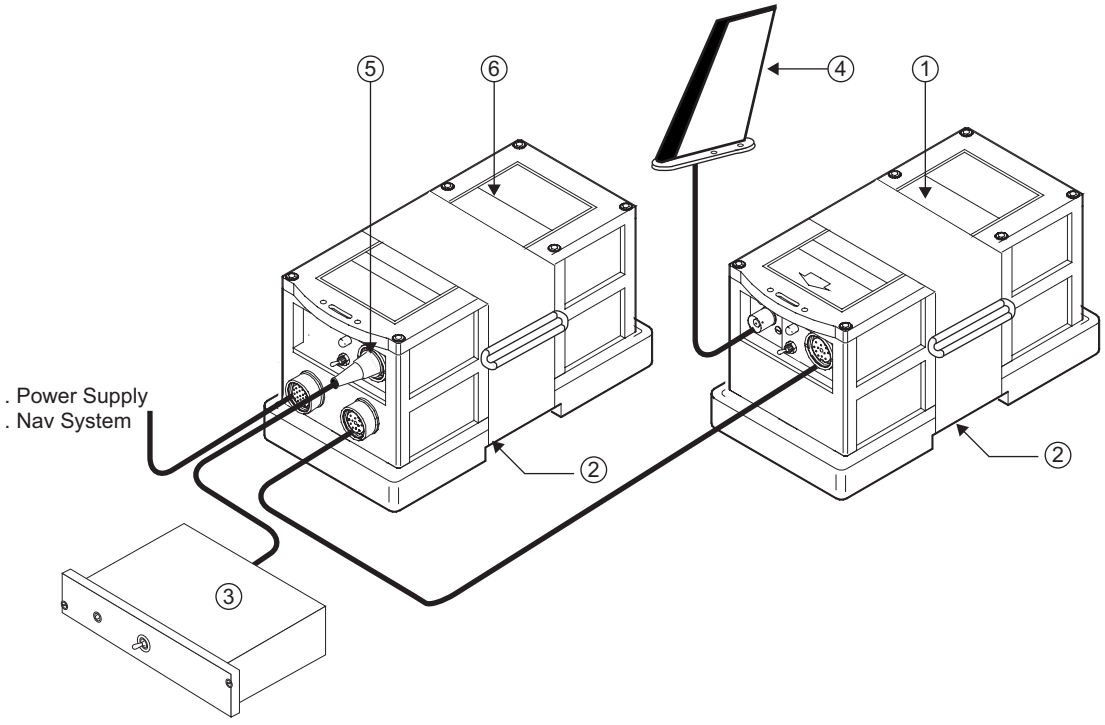
(4) outside antenna,

(5) "Programming Dongle" for pin-programming function,

(6) CS144 Interface Module.

The transmitter, bracket, Programming Dongle and CS144 Interface Module are installed in the aircraft near the tail. The outside antenna is mounted on the fuselage near the tail. The CS144 Interface Module is connected to the ELT transmitter (distance < 0.45 m). The remote control panel is installed in the cockpit and connected to the CS144 Interface Module with a 4 or 5 wire bundle.

Figure 2: ELT system description




This Technical Presentation details the following versions of the CS144 Interface Module:

- CS144-RS (P/N S1825501-01).
- CS144-A (P/N S1825501-02).

IMPORTANT NOTICE:
This equipment can only be installed on board an aircraft together with a KANNAD 406 ELT (Refer to 7. Compatibility).
S1825501-XX, CS144 Interface module contains S1825502-XX (CS144 Interface) and S1825503-01 (CS144 to ELT cable) but not S1820511-01 (Mounting bracket, 1 strap) that must be ordered separately.

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### 1.2. List of acronyms

A/C ..... Aircraft
AC ..... Alternative Current
DC ..... Direct Current
DGAC ..... Direction Générale de l'Aviation Civile (France)
BCH ..... Bose-Chaudrui-Hocquenghem code
BCH-1 ..... First BCH error correcting field
BCH-2 ..... Second BCH error correcting field
CS ..... Cospas-Sarsat
DONGLE ..... "Pin programming" connector
ELT ..... Emergency Locator Transmitter
FH ..... Flight Hours
GPS ..... Global Positioning System
LSB ..... Least Significant Bit
MSB ..... Most Significant Bit
NMEA ..... (National Marine Electronics Association)
PS ..... Power Supply
NAV ..... On board Navigation equipment
N/C ..... Not Connected
NPDF ..... Not Protected Data Field
PDF-1 ..... First Protected Data Field
PDF-2 ..... Second Protected Data Field
RCP ..... Remote Control Panel
SMM ..... Serial Memory Module
TBD ..... To Be Determined

NOTE: On this document, NAV refers to any equipment used to determine the aircraft position (GPS, inertial navigation system, Loran, etc.).

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## 2. APPLICABLE DOCUMENTS

| Reference | Title |
|---|---|
| RTCA DO-182 | "Emergency Locator Transmitter (ELT) Equipment Installation and Performance" |
| RTCA DO-183 | "MOPS for Emergency Locator Transmitters. Automatic Fixed, Automatic Portable, Automatic deployable, Survival Operating on 121.5 and 243.0 Megahertz" |
| RTCA DO-204 | "MOPS 406 MHz Emergency Locator Transmitters (ELT)" |
| RTCA DO-160D<br>EUROCAE ED14D | "Environmental conditions and test procedures for airborne equipment" |
| RTCA DO-178B | "Software considerations in airborne systems and equipment certification" |
| FAA TSO-C91a | "Emergency Locator Transmitter (ELT) equipment" |
| FAA TSO-C126 | "406 MHz Emergency Locator Transmitter (ELT)" |
| EUROCAE ED62 | "MOPS for aircraft Emergency Locator Transmitters (121,5/243 MHz and 406 MHz)" |
| COSPAS-SARSAT<br>C/S T.001 | "Specification for COSPAS-SARSAT 406 MHz distress beacons" |
| COSPAS-SARSAT<br>C/S G.005 | "COSPAS-SARSAT guidelines on 406 MHz beacon coding, registration and type approval" |
| COSPAS-SARSAT<br>C/S G.004 | "COSPAS-SARSAT glossary" |

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## 3. DESIGN FEATURE

### 3.1. General

The CS144 Interface Module is designed to be connected between the ELT and the dongle (that is part of the wiring to the RCP).

The CS144 Interface Module is made of moulded plastic with excellent mechanical resistance (ASA/PC). It is color compound (light yellow).

The front panel of CS144 Interface Module has the following features:

(1) ON/OFF switch,

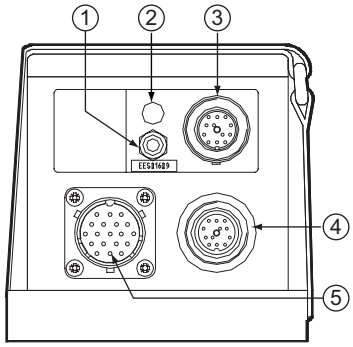
(2) control LED,

(3) female DIN 12 connector used to connect the CS144 to the dongle and the RCP,

(4) male DIN 12 connector used to connect the CS144 to the ELT,

(5) male 19 connector used to power the CS144 and to connect it to the NAV system.

Figure 3: CS144 Interface Module, description.

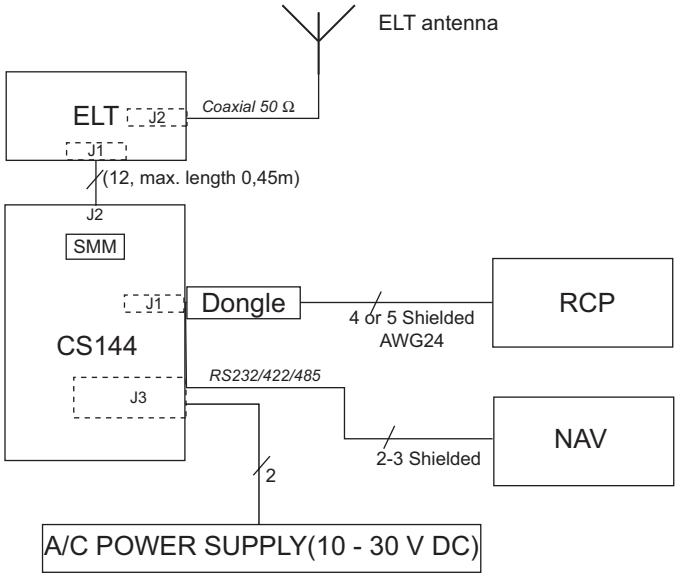



### 3.2. Architecture

*3.2.1. CS144-RS*

The CS144-RS is connected to a NAV equipment by RS232, RS422 or RS485 link.

Figure 4: CS144-RS block diagram

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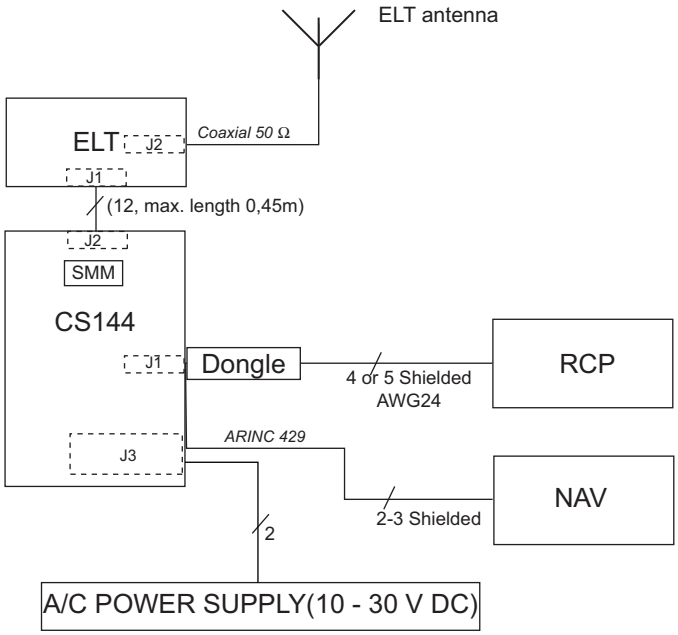
*3.2.2. CS144-A*

The CS144-A is connected to the NAV equipment of the aircraft via an ARINC 429 link.

Figure 5: CS144-A block diagram

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### 3.3. Working principle

The CS144 Module constantly computes a long message by combining:

(1) the short message (112 bits): identification information available in the Dongle.

(2) the aircraft position available from the NAV equipment installed on board the aircraft.

Combination of short message and aircraft position data gives the following long message format:

Figure 6: Fields of Short and Long Message Formats

(1) Short Message Format

| Synchronization | First Protected Data Field (PDF-1) | Checksum | NPDF |
|---|---|---|---|
| | Country + Identification Data | BCH-1 Code | |
| 1 24 | 25 85 | 86 106 | 107 112 |

(2) Long Message Format

| Synchronization | First Protected Data Field (PDF-1) | Checksum | 2nd PDF (PDF-2) | Checksum |
|---|---|---|---|---|
| | Country + Ident. Data (Aviation User Protocol)<br>Country + Ident. + Posit Data (for the other Protocols) | BCH-1 Code | Position Data | BCH-2 Code |
| 1 24 | 25 85 | 86 106 | 107 132 | 133 144 |

For each type of Short Message programmed in the dongle, the CS144 Interface Module computes a Long Message according to the table hereunder:

| Short message protocol | Long message protocol | Position resolution |
|---|---|---|
| Aviation User Protocol (T/N) | User Location Protocol | 4 min. (4 NM) |
| Serial User Protocol (S/N, TTT = 000) | User Location Protocol | 4 min. (4 NM) |
| Serial User Protocol (ICAO, TTT = 011) | Standard Location Protocol<br>Bits 37 to 40 = 0011 | 4 sec. (125 meters) |
| Serial User Protocol (AOD, TTT = 001) | Standard Location Protocol<br>Bits 37 to 40 = 0101 | 4 sec. (125 meters) |
| Test User Protocol | Standard Location Protocol | 4 sec. (125 meters) |

- TTT = 000: ELT with serial number.
- TTT = 011: ELT with 24-bit aircraft address.
- TTT = 001: ELT with aircraft operator designator and serial number.

With Long message structure as follows:

Figure 7: Structure Location Protocols

| User Location Protocol | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | Identification Data (44 bits) | | 21-Bit BCH Code | | Posit. data to 4 min Resolution (25 bits) | | 12-Bit BCH Code | |
| | 27 39 | 40 | 83 | 86 | 106 | 108 | 132 | 133 | 144 |

| Standard Location Protocol | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | Identification Data (24 bits) | | Posit. Data to15 mn Resol. (25 bits) | | 21-Bit BCH Code | Sup. Data | Posit. data to 4 sec resolution (20 bits) | 12-Bit BCH Code |
| | 27 40 | 41 | 64 | 65 | 85 | 86 106 | | 113 132 | 133 144 |

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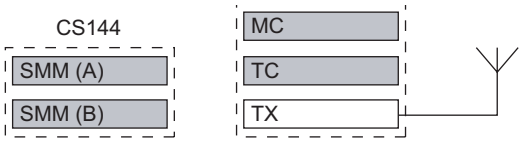
This long message is stored in a SMM (Serial Memory Module) that is accessible to both CS144 Interface Module and ELT with priority to ELT. The SMM is located in the CS144 Interface Module and, in case of complete loss of CS144 Interface Module function, can be powered by the ELT.

In the event of a crash, this long message is downloaded into the ELT (in the same way that the short message of a Dongle) and transmitted on 406 MHz.

*3.3.1. Memory organization and data transfer between CS144 and ELT*

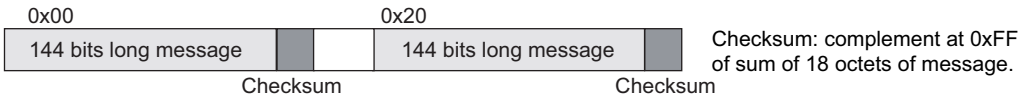
The internal memory of the ELT is split in 3 areas:

- MC: EEPROM that contains the maintenance code ("SI" + 5 last digits of the CSN),
- TC: EEPROM that contains the code to be transmitted,
- TX: RAM that contains the code transmitted once the ELT is activated.




The SMM is duplicated into two segments with a checksum to verify integrity of the data:

- SMM (A),
- SMM (B).




*3.3.2. Data Transfer Algorithm*

NOTE: The following operation are performed:
- During Self-Test,
- Before first transmission after ELT activation,
- Every 20 minutes after ELT activation.

(1) The ELT tries to read a Serial Memory Module by testing the synchronous serial link. If a maintenance dongle is detected, the contents of MC is copied into TC:

The ELT self-test is OK when TC ≠ MC, it is not OK when TC = MC.

(2) If a programming dongle is detected, its content is copied into TC.

(3) In any case, TC is finally copied into TX.

(4) If a long message is detected, TX will be overwritten with the data provided by the CS144 Interface Module.

(5) At the end of the cycle, the data contained in TX (112 bits with short message or 144 bits with long message) are transmitted on 406 MHz in the digital message.

*3.3.3. Validity of Data Transmitted*

**Failure Effect Analysis**

| Failure | Failure mode | Consequence | Message transmitted |
|---|---|---|---|
| DONGLE | 1st segment reading error | 2nd segment transferred to CS144 and ELT | Long |
| DONGLE | 2nd segment reading error | 1st segment transferred to CS144 and ELT | Long |

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| Failure | Failure mode | Consequence | Message transmitted |
|---|---|---|---|
| DONGLE | 1st & 2nd segments reading error | Self-test failed | See note below |
| SMM | 1st segment reading error | CS144 2nd segment transferred to ELT | Long |
| SMM | 2nd segment reading error | CS144 1st segment transferred to ELT | Long |
| SMM | 1st & 2nd segments reading error | Used of code stored in ELT's EEPROM(*) | Short |
| Power Supply | 1st segment writing error | Older message (2nd segment) transferred to ELT | Long with older position (60 s. delay) |
| Power Supply | 2nd segment writing error | CS144 1st segment transfered to ELT | Long |
| Power Supply | CS144 non operational | Used of code stored in ELT's EEPROM(*) | Short |
| ELT - CS144 connection | 1st & 2nd segments writing error | Used of code stored in ELT's EEPROM(*) | Short |
| CS144 - NAV connection | No position Data | Used of code stored in ELT's EEPROM(*) | Short |

(*) Transmission of message already present in the ELT

NOTE: owing to the fact that the ELT can only be installed with a self-test OK, the short code will always be loaded into ELT's EEPROM after installation. An eventual dongle fault will have no effect on ELT operation.

**Conclusion**

(1) If a valid long message is present, it will be transmitted (last position).

(2) If the first segment of the long message is not readable or if the data is altered and the second segment is valid, this last will be transmitted.

(3) If both segments are not readable or altered, the short message (already present in the ELT) will be transmitted.

**Whatever the failure mode, a valid data is transmitted.**

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### 3.4. Working modes

Each working mode of the CS144 Interface Module has a specific LED behavior ( Refer to 5.1. Controls and connectors for LED chronogram):

*3.4.1. Init*

During "Init mode", the CS144 Interface Module reads the Dongle and reproduces the dongle memory in the SMM.

*3.4.2. Transparent*

This mode lasts approximately 60 seconds and during the whole duration, a short message is present in the SMM.

The CS144 Interface Module acts as the dongle that is connected to it.

If an unprogrammed ELT is switched to "ARM" while the CS144 Interface Module is in "Transparent" mode, the short message will be transferred in the internal memory of the ELT.

Consequently, should the CS144-ELT harness be damaged during the crash, the ELT will - at least - transmit the identification data (short message).

*3.4.3. Acquisition*

The CS144 Interface Module is listening to the data sent by the NAV equipment.

*3.4.4. Update position*

Every 60 seconds (in line with C/S T001) the SMM is updated to make the long message available to the ELT in case of activation.

*3.4.5. Waiting mode*

This mode lasts 60 seconds, it is a time-out between the writing of the long message and another position acquisition.

*3.4.6. Error mode*

This mode is displayed if one of the following errors occurs:

- no access to SMM,
- No data link with NAV,
- Bad NAV frame.

After about 3 minutes, the CS144 reboots.

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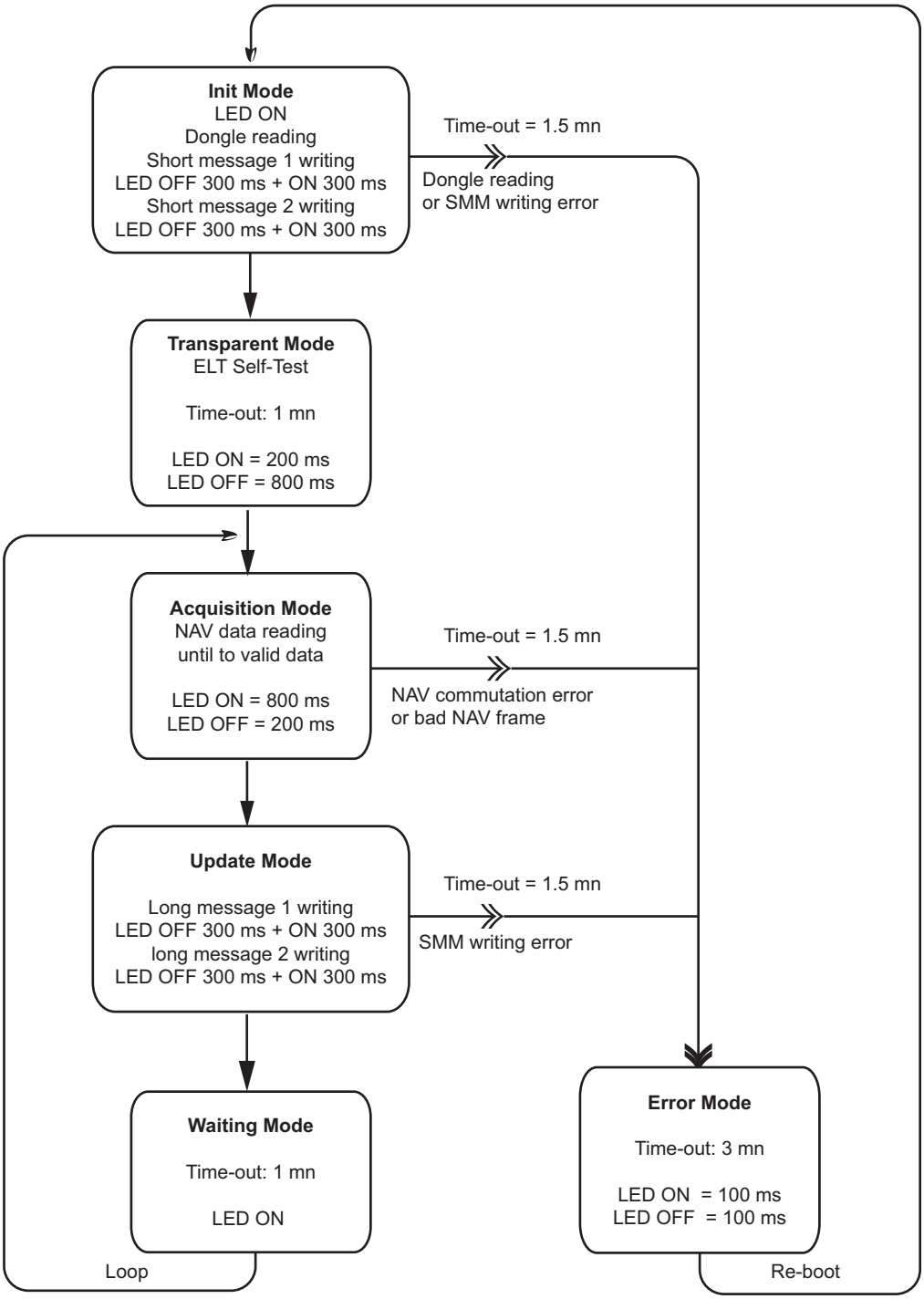
Figure 8: Working mode

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# 4. TECHNICAL CHARACTERISTICS

## 4.1. Mechanical characteristics

The material and design of the CS144 Interface Module housing is identical to that of the ELT.

It is to be installed on a Mounting Bracket, 1 strap (P/N S1820511-01).

*4.1.1. Material*

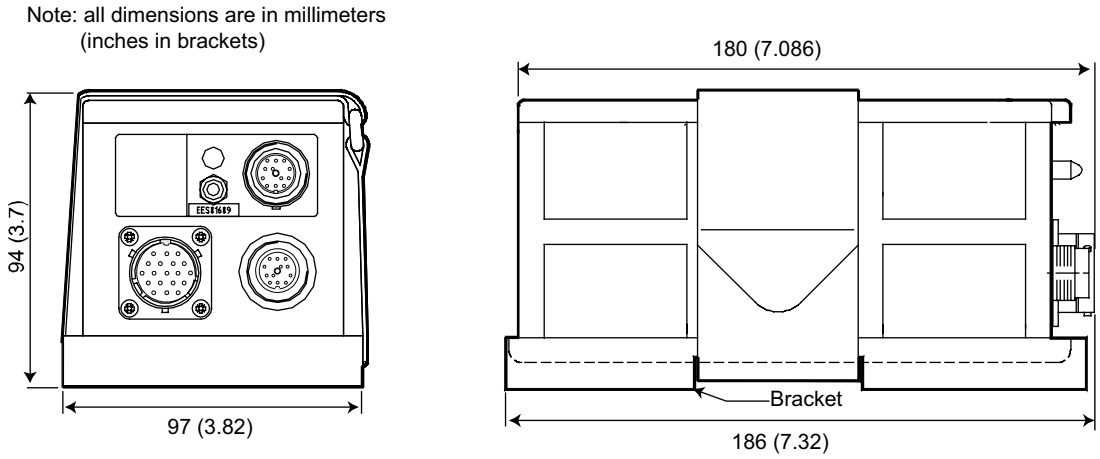
- Material: Plastic ASA-PC LURAN SKR2867 CWU.
- Treatment: Light yellow color compound (RAL 1018), Fire classification M0.
- Tightness: 2 O-rings.

*4.1.2. Overall dimensions*

Outline dimensions (CS144 only): 82 x 82 x 180 mm.

Outline dimensions (with mounting bracket): 186 x 97 x 94 mm.

Figure 9: CS144 Interface Module, overall dimensions




*4.1.3. Weight*

| | Typical | Max |
|---|---|---|
| CS144 only | 650 gr. (1.433 lb) | 700 gr. (1.543 lb) |
| CS144 with mounting bracket | 823 gr. (1.814 lb) | 873 gr. (1.924 lb) |

## 4.2. Electrical characteristics

- Power Supply voltage: 10-30 V
- Power consumption: 12.5 mA ± 1 mA @28V (with dongle connected).

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### 4.3. Environmental characteristics

| Environmental | Value | Reference |
|---|---|---|
| Temperature & Altitude<br>- Operating temperature<br>- Storage temperature<br>- Altitude | <br>- 55°C to + 70°C<br>- 55°C to + 85°C<br>35000ft | DO160D / ED-14D section 4 category C2 |
| Temperature variation | 5°C per minute | DO160D / ED-14D section 5 category B |
| Humidity | | DO160D / ED14D Section 6 category B |
| Operational Shocks and Crash Safety | 20G for 11 ms each axis | DO160D / ED-14D section 7 category C |
| Vibration | 4.77 grms | DO160D / ED-14D section 8 category U |
| Explosion Proofness | | DO160D / ED14D section 9 category A |
| Waterproofness | | DO160D / ED14D section 10 category W |
| Magnetic effect | 1° variation, less than 30 cm of equipment | DO160D / ED14D section 15 category Z |
| Power input | | DO160D / ED14D section 16 category B |
| Voltage spike | | DO160D / ED14D section 17 category B |
| Audio Frequency Induced Susceptibility - Power inputs | | DO160D / ED14D section 18 category B |
| Induced signal susceptibility on CS144 - ELT link | Not applicable (length < 1.5 m.) | DO160D / ED14D section 19 catergory Z |
| Radio Frequency susceptibility | 20 V/m CW and SW | DO160D / ED14D section 20 category U |
| Equipment radiation | | DO160D / ED14D section 21 category L |
| Lightning induced transient susceptibility | See (1) below | DO160D / ED14D section 22 category A1 |
| Electrostatic Discharge | | DO160D / ED14D section 25 category A |

(1) *Lightning tests according to DO160D Section 22, show that CS144 will continue to operate after lightning until the end of the flight as only the Input / Outputs to/from the dongle (J1) are damaged. However, the CS144 will show a failure when powered again for a next flight.*

### 4.4. Reliability

4.4.1. MTBF

799.148 hours acording to UTEC 80-810.

NOTE: The environment and mission Profile used for the prediction is " Military Cargo" with the associated environmental factors, operating and non-operating periods and switching cycles . (For detailed definitions refer to UTE C 80-810 Chapter 8).

*4.4.2. Scheduled Maintenance*

The SMM must be replaced after 16000 FH. This operation must be carried out in the workshop and does not require any specific tools.

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## 5. INTERFACES

### 5.1. Controls and connectors

The following elements are to be found on the CS-144 Interface Module front panel:

(1) J1: DIN 12 connector for RCP/dongle connection,

(2) J2: DIN 12 connector for ELT connection,

(3) J3: 19 connector for navigation system and power supply connection,

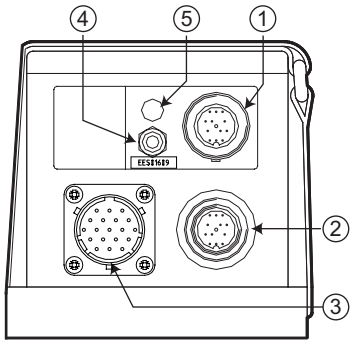
(4) ON/OFF switch,

(5) LED used to monitor the power and to display the CS144 Interface Module working modes (position information availability).

According to the different working modes (Refer to 3.4. Working modes), the blinking modes of the LED are the following:

| Phase | LED ON | LED OFF | Chronogram |
|---|---|---|---|
| Update mode | 300 ms | 300 ms | |
| Transparent mode | 200 ms | 800 ms | |
| Acquisition mode | 800 ms | 300 ms | |
| Waiting mode | Yes | No | |
| Error mode | 100 ms | 100 ms | |

Figure 10: CS144 Interface Module front panel

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### 5.2. Electrical interface

5.2.1. J1

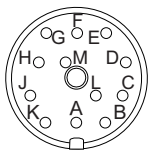
This connector is dedicated for connection to a dongle or the RCP. The cable bundle between CS144 Interface Module and RCP requires to be shielded. The required wires are AWG24.

| Receptacle | |
|---|---|
| Standard designation | DIN 45321 - Female - 12 Pts |
| Number of contacts | 12 |
| Supplier / Reference | BINDER / 680-4-09-0332-80-12 |

| Mating connector type | |
|---|---|
| Standard designation | DIN 45321 - Male - 12 Pts |
| Number of contacts | 12 |
| Type of contacts | Soldered |
| Supplier / Reference | SERPE / S1820514-XX (refer to compatibility list) |

Refer to Technical Presentation for relevant RCP precise information.

Table 1: J1 Pin-Out

| J1 | PIN | Signal name | Destination | I/O |
|---|---|---|---|---|
| Viewed from back face of mating connector   | J1-A | RCP TEST/RESET | RCP | I |
| | J1-B | DONGLE Rx | DONGLE | I |
| | J1-C | DONGLE Cs | DONGLE | O |
| | J1-D | DONGLE SK | DONGLE | O |
| | J1-E | DONGLE Tx | DONGLE | O |
| | J1-F | DONGLE ALE2P | DONGLE | O |
| | J1-G | RCP COMMON | RCP | O |
| | J1-H | RCP BUZZER | RCP | O |
| | J1-J | RCP LED | RCP | O |
| | J1-K | RCP ON | RCP | I |
| | J2-L | DONGLE GND | DONGLE | O |
| | J1-M | N/C | - | - |

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*5.2.2. J2.*

This connector is dedicated for connection to the ELT.

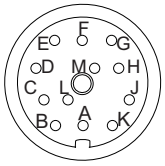
| Receptacle | |
|---|---|
| Standard designation | DIN 45321 - Male - 12 Pts |
| Number of contacts | 12 |
| Supplier / Reference | BINDER / 680-09-0331-80-12 |

| Mating connector type | |
|---|---|
| Standard designation | DIN 45321 - Female - 12 Pts |
| Number of contacts | 12 |
| Supplier / Reference | BINDER / 680-09-0330-00-12 |

The cable bundle between CS144 Interface Module and ELT has a maximum length of 0.45 meter (17.71 inches). This cable is part of the CS144 Interface Module.

IMPORTANT: Any modification of the cable or use of any third party invalidates the manufacturer guarantee.

Table 2: J2 Pin-Out

| J2 | PIN | Signal name | Destination | I/O |
|---|---|---|---|---|
| Viewed from back face of mating connector   | J2-A | RCP TEST/RESET | ELT | O |
| | J2-B | DONGLE Rx | ELT | O |
| | J2-C | DONGLE Cs | ELT | I |
| | J2-D | DONGLE SK | ELT | I |
| | J2-E | DONGLE Tx | ELT | I |
| | J2-F | DONGLE ALE2P | ELT | I |
| | J2-G | RCP COMMON | ELT | I |
| | J2-H | RCP BUZZER | ELT | I |
| | J2-J | RCP LED | ELT | I |
| | J2-K | RCP ON | ELT | O |
| | J2-L | DONGLE GND | ELT | I |
| | J2-M | N/C | - | - |

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*5.2.3. J3*

This connector is dedicated for connection to a navigation system and for connection to the A/C power supply. The cable bundle requires to be shielded.

| Receptacle | |
|---|---|
| Standard designation | NAS1599 - Male - 19 Pts |
| Number of contacts | 19 |
| Supplier / Reference | FCI SOURIAU / 851 02 R 1419 P50 |

| Mating connector type | |
|---|---|
| Standard designation | NAS1599 - Female - 19 Pts |
| Number of contacts | 19 |
| Type of contacts | Crimped |
| Supplier / Reference | FCI SOURIAU / 851 06 R 1419 S50 |

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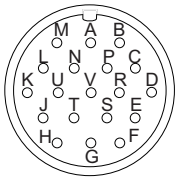
Table 3: J3 Pin-Out

| J3 | PIN | Signal name | Destination | I/O |
|---|---|---|---|---|
| Viewed from back face of mating connector   | J3-A | RS Tx1 | Nav equipment | O |
| | J3-B | RS Tx2 | Nav equipment | O |
| | J3-C | RS GND | Nav equipment | O |
| | J3-D | PWR GND | A/C PS | I |
| | J3-E | PROTOCOL GND(1) | J3-F | |
| | J3-F | PROTOCOL(1) | J3-E | |
| | J3-G | I1(2) | | I |
| | J3-H | I2 | | I |
| | J3-J | I3(3) | | I |
| | J3-K | ARINC Rx1 (Positive input) | Nav equipment | I |
| | J3-L | ARINC Rx2 (Negative input) | Nav equipment | I |
| | J3-M | PWR Vdc | Nav equipment | I |
| | J3-N | I4 | | I |
| | J3-P | ARINC PARITY | Nav equipment | I |
| | J3-R | ARINC PARITY GND | Nav equipment | I |
| | J3-S | RS Rx1 | Nav equipment | I |
| | J3-T | RS Rx2 | Nav equipment | I |
| | J3-U | TER RS41 | Nav equipment | I |
| | J3-V | TER RS42 | Nav equipment | I |

(1) RS version

- RS232: PROTOCOL (J3-F) is strapped to PROTOCOL GND (J3-E). Data are received on RS Rx1 (J3-S) and transmitted on RS Tx1 (J3-A). The reference ground is RS GND (J3-C).
- RS422: PROTOCOL (J3-F) and PROTOCOL GND (J3-E) are not strapped. Data are received on RS Rx1 (J3-S) / RS Rx2 (J3-T) and transmitted on RS Tx1 (J3-A) / RS Tx2 (J3-B).

(2) I1: ELT activation (if connected to ground).

(3) I3: ELT test or reset (if connected to ground).

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## 6. INSTALLATION AND OPERATION PROCEDURE

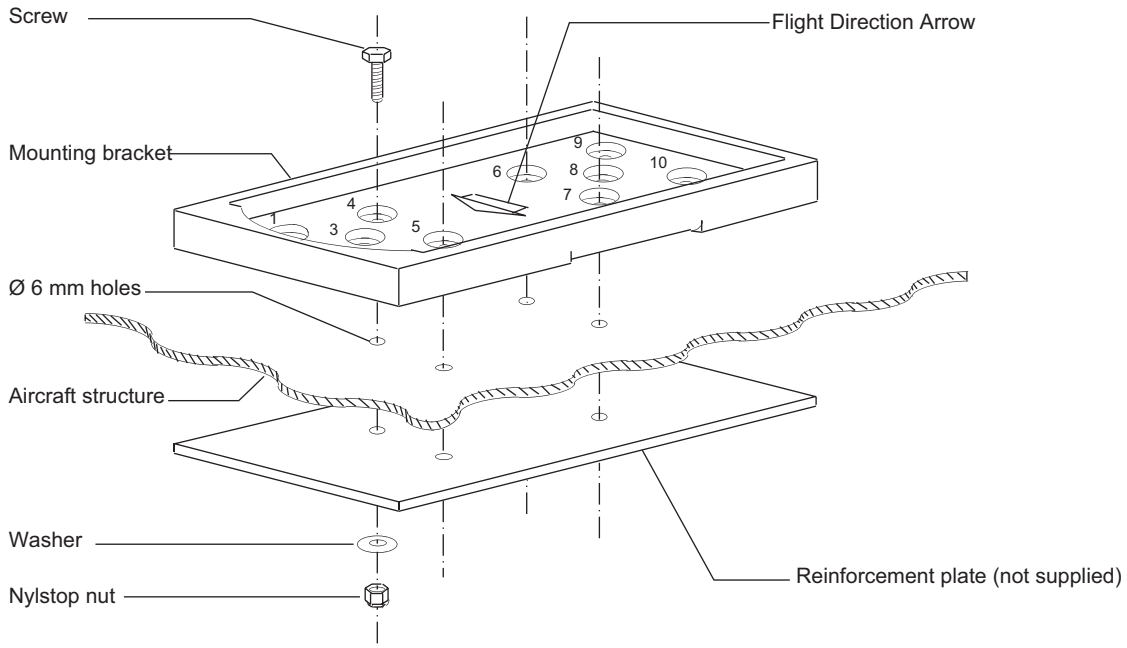
NOTE: For ELT installation procedure, refer to relevant installation manual.

### 6.1. Installation

*6.1.1. Bracket*

- Determine the location of the CS144 close to the ELT.
  - Distance between the ELT front face and the CS144 front face must be less than 45 cm (17.71 in).
  - Ensure that the bundle to the RCP is long enough to be connected to the CS144.
- Unlike the ELT, the CS144 Interface Module can be installed irrespective of direction of flight.
- Drill 4 holes Ø 6 mm in the aircraft structure according to "Drilling mask". Holes 4,5,6,7 shall be preferred.
- Fix the bracket with the 4 screws and nylstop nuts supplied.
- Mount the CS144 Interface Module on the bracket.
- Fasten the Velcro® strap tightly.

Figure 11: CS144 Interface Module, mounting bracket




*6.1.2. Connection*

- Connect CS144 (J2) to ELT (J1) with cable supplied.
- Connect dongle to CS144 (J1).

NOTE: the CS144 Interface Module bypasses the RCP signals.

- Connect aircraft power supply and NAV to CS144 (J3).

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### 6.2. Operation

*6.2.1. First power up*

- Perform ELT self-test (switch to position ARM) without connecting the ELT to CS144.
- Self-test result should be "ELT not programmed" (3+4 flashes).
- Switch ELT back to OFF.
- Connect ELT to CS144.
- Switch CS144 On.
- CS144 LED should flash every second during one minute (short flash).
- During this period, switch ELT to ARM.
- Self-test should be OK (one long flash).
- At the end of the this period, check that CS144 LED stops blinking and remains ON.

> NOTE: This procedure must be carried out for any new installation and in case of ELT replacement.

*6.2.2. Power ON/OFF*

The A/C power supply can be switched off and on (circuit breaker) without any prior action on CS144 ON/ OFF switch.

In case of power failure, the CS144 Interface Module will automatically reboot when power is back.

### 6.3. Trouble shooting

- Should the CS144 Interface Module be faulty (fast LED blinks),
  - check that NAV equipment is working correctly,
  - check connection to NAV equipment,
  - check connection to ELT.

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## 7. COMPATIBILITY

### 7.1. ELT system

| ELT | | |
|---|---|---|
| KANNAD 406 ATP | S1819502-02 | SERPE-IESM |
| KANNAD 406 ATP-M | S1818502-02 | SERPE-IESM |
| KANNAD 406 AP | S1820502-02 | SERPE-IESM |
| KANNAD 406 AF | S1821502-02 | SERPE-IESM |
| KANNAD 406 AF-H | S1822502-02 | SERPE-IESM |
| KANNAD 406 AF (6D) | S1821502-06 | SERPE-IESM |

| Remote control panels | | |
|---|---|---|
| RC100 (Kit) | S1820513-03 | SERPE-IESM |
| RC110 (Kit) | S1820513-06 | SERPE-IESM |
| RC150 (Kit) | S1820513-07 | SERPE-IESM |
| RC160 (Kit) | S1820513-08 | SERPE-IESM |
| RC200 | S1820513-11 | SERPE-IESM |
| RC200-NVG | S1820513-14 | SERPE-IESM |
| RC300 | S1820513-09 | SERPE-IESM |
| RC300-NVG | S1820513-10 | SERPE-IESM |
| RC400 | S1820513-05 | SERPE-IESM |
| RC500-320 | S1820513-02 | SERPE-IESM |

| Dongles | | |
|---|---|---|
| Programming dongle | S1820514-01 | SERPE-IESM |
| Programming dongle A320 | S1820514-04 | SERPE-IESM |
| Programming dongle A330 A340 | S1820514-05 | SERPE-IESM |

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### 7.2. NAV equipment

*7.2.1. CS144-RS*

Hardware

- RS232 (J3-S; J3-C; J3-A).
- RS422 (J3-S; J3-T; J3-A; J3-B).
- Without parity check (8 bits of data).

Decoded Protocol (software)

- NMEA 0183 (label GPGGA).

  The NMEA 0183 Standard defines electrical signal requirements, data transmission protocol, timing and specific sentence formats for a 4800 baud serial data bus.

  NMEA is a standard protocol for interfacing navigational devices, e.g. GPS and DGPS receivers. It is based on the RS232 interface.

  NMEA informations are transmitted from a 'talker' device to a 'listener' device in 'sentences' with a maximum length of 80 characters. Each NMEA sentence starts with '$' and ends with [CR][LF]. The GPGGA frame is used and detailed in the example hereunder.

  The following table contains the values for the following example:

  **$GPGGA**,**161229.487**,**3723.2475**,**N**,**12158.3416**,**W**,**1**,**07**,**1.0**,**9.0**,**M**, , , ,**0000*18**

| Name | ASCII String | | Units | Description |
|---|---|---|---|---|
| | Format | Example | | |
| Message ID | string | $GPGGA | | GGA protocol header |
| UTC Time | hhmmss.sss | 161229.487 | | Current time |
| Latitude | dddmm.mmmm | 3723.2475 | | Degrees + minutes |
| N/S Indicator | character | N | | N = north or S = south |
| Longitude | dddmm.mmmm | 12158.3416 | | Degrees + minutes |
| E/W indicator | character | W | | E = east or W = west |
| Position Fix indicator | 1digit | 1 | | See (1) hereunder |
| Satellites Used | numeric | 07 | | Range 0 to 12 |
| HDOP | numeric | 1.0 | | Horizontal Dilution of Precision |
| MSL Altitude | numeric | 9.0 | meters | |
| Units | character | M | | Stands for "meters" |
| Geoid Separation | blank | | | Not used |
| Units | blank | M | | Stands for "meters" |
| Age of Differential Corrections | numeric | | second | Blank (Null) fields when DGPS is not used |
| Diff. Reference Station ID | numeric | 0000 | | |
| Checksum | hexadecimal | *18 | | |
| <CR> <LF> | | | | End of message |

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(1) GGA position fix indicator:

- 0: Fix not available or invalid.
- 1: GPS SPS Mode. Fix Valid.
- 2: Differential GPS. GPS SPS Mode. Fix Valid.
- 3: GPS PPS Mode. Fix Valid.

- ARNAV format (Label A and B)

  Data messages begin with an ASCII Start of Text (STX) character and end with an End of Text (ETX) character. A single alphabetic character preceeds each data element. The data output format is as follows:

  <STX> <id> <dddd> <it> <id> <dddd> <it> ... <id> <dddd> <it> <ETX>

  where:

  - STX = ASCII Start of Text character
  - id = Item Designator
  - dddd = Item Data
  - it = Item terminator (CR) or (CR) (LF)
  - ETX = ASCII End of Text character

| Item Designator | Item Data | | | | | | | | | | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | |
| A | s | | d | d | | m | m | h | h | | Current latitude, where<br>s - N (north) or S (south)<br>dd - degrees<br>mm - minutes<br>hh hundredths of minutes |
| B | s | | d | d | d | | m | m | h | h | Current longitude, where<br>s - E (east) or W (west)<br>ddd - degrees<br>mm - minutes<br>hh hundredths of minutes |

CS144 has been tested with the following GPS receivers:

- HONEYWELL KLN90/KLN94.
- GARMIN GNS430/GNS530.
- TRIMBLE TNL2101 I/O Approach Plus.

*7.2.2. CS144-A*

- ARINC Bus

  ARINC 429 is a point to point protocol. There can be only one transmitter on a wire pair. The transmitter is always transmitting either 32-bit data words or the NULL state. There is at least one receiver on a wire pair; there may be up to 20.

  In most cases, an ARINC message consists of a single data word. The label field of the word defines the type of data that is contained in the rest of the word.

- Speed

  The CS144 Interface Module automatically high and low speed.

- ARINC 429 word format

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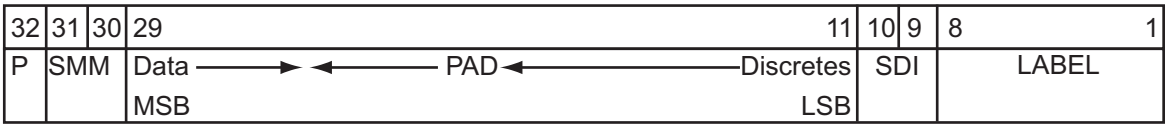
ARINC data words are always 32 bits and typically use the format shown below which includes five primary fields, namely Parity, SMM, Data, SDI, and Label. ARINC convention numbers the bits from 1 (LSB) to 32 (MSB).

Figure 12: Generalized ARINC Word Format




**Parity**

The MSB is always the parity bit for ARINC 429. Parity is normally set to odd except for certain tests.

**SSM**

Bits 31 and 32 contain the Sign/Status Matrix (SSM). This field contains hardware equipment condition, operational mode, or validity data content.

**Data**

Bits 29 through 11 contain the data (latitude and longitude).

**SDI**

Used as data for labels 310 and 311.

**Label**

Bits 8 through 1 contain a label identifying the data type and the parameters associated with it.

The labels used by the CS144 Interface Module are:

- Octal label 310: Present Position Latitude.
- Octal label 311: Present Position Longitude.

- Hardware
  - ARINC 429 (J3-K and J3-L).
  - Low speed / High speed selection : automatic.
  - Parity check:
    - Without parity: strap between J3- P and J3-R.
    - Odd parity: no strap.
- Software
  - Label 310: Latitude.
  - Label 311: Longitude.

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### 7.3. Evolution

| Type | P/N | Amdt | Description of modification |
|---|---|---|---|
| CS144-RS | S18225501-01 | A | First issue |
| | | B | Add of ESD protection |
| | | C | ESD protection modification |
| | | D | Embedded software update |
| | | | |
| CS144-A | S18225501-02 | A | First issue |
| | | B | Add of ESD protection |
| | | C | ESD protection modification |
| | | D | Embedded software update |

## 8. QUALIFICATION

This issue is written for J-TSO application to DGAC (French notified Airworthiness Authorities).

Subsequently, the manufacturer will apply for recognition of the J-TSO approval in other countries.

### 8.1. Test reports

The table hereunder gives references to the test reports carried out with the CS144 Interface Module.

| Index | Laboratory | Date | Ref. | Title |
|---|---|---|---|---|
| BA | SERPE-IESM | 17/10/2002 | DOC02357 | Functional tests |
| BB | SERPE-IESM | 17/10/2002 | DOC02358 | Environmental test - Shocks and vibrations |
| BC | SERPE-IESM | 17/10/2002 | DOC02359 | Environmental test - Power input |
| BD | EMITECH | 11/10/2002 | RQ-02-10501 | EMC Test Report |
| BE | EMITECH | 18/09/2002 | RQ-02-60717/A | Climatical Test Report |
| BF | SERPE-IESM | 15/11/02 | DOC02369 | Magnetic influence |
| BG | SERPE-IESM | 18/11/02 | DOC02370 | Software Description |
| BJ | EMITECH | 25/03/03 | RQ-03-60250 | Complementary Climatical Test Report |
| BK | TR-030301 | 31/03/03 | Relex Software Continental Europe GmbH | Reliability Prediction Report |
| BM | EMITECH | 10/10/03 | RM-03-10653 | Lightning induced transient susceptibility report |
| BN | EMITECH | 10/10/03 | RM-03-10653 | Electrostatic Discharge report |

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### 8.2. Qualification tests

| ENVIRONMENTAL CONDITIONS | ED62 | ED14D/DO160 | Index |
|---|---|---|---|
| Temperature and altitude tests | § 4.4.1 | Section 4 | BE/BJ |
| Decompression(1) | § 4.4.2 | | H |
| Overpressure(1) | § 4.4.3 | Section 4.6.3 | H |
| Vibrations | § 4.4.4 | Section 8 | BB |
| Magnetic influence | § 4.4.5 | Section 15 | BF |
| Power supply | § 4.4.6 | Section 16 | BA |
| Voltage sub transient | § 4.4.7 | Section 17 | BD |
| Acoustic frequency susceptibility test | § 4.4.8 | Section 18 | BD |
| Induced signal susceptibility test | § 4.4.9 | Section 19 | BD |
| Radio frequency susceptibility test | § 4.4.10 | Section 20 | BD |
| Emission of radio frequency energy test | § 4.4.13 | Section 21 | BD |
| Lightning induced transient susceptibility | § 4.4.11 | Section 22 | BM |
| Electrostatic Discharge | | Section 25 | BN |
| Explosion test(1) | § 4.4.14 | Section 9 | L |
| Humidity test | § 4.5.1 | Section 6 | BE |
| Shock test | § 4.5.7 | Section 7 | BB |
| Penetration test(1) | § 4.5.8 | | M |
| Crush test(1) | § 4.5.10 | | J |
| Flame test(1) | § 4.5.11 | | S |
| Immersion test(1) | § 4.5.13 | | S |
| Low temperature | § 4.6.1 | Section 4 | BE/BJ |
| High temperature | § 4.6.2 | Section 4 | BE/BJ |
| Temperature variations | § 4.6.3 | Section 5 | BE/BJ |
| Thermal shocks | § 4.6.4 | Section 5 | BE/BJ |
| Performances | § 4.7.2 | | BA |

(1) Tests already carried-out with KANNAD 406 AP (the housing of the CS144 Interface being identical to that of the KANNAD 406 AP, resistance and tightness properties are identical).

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## 9. MANUFACTURING

### 9.1. Quality insurance

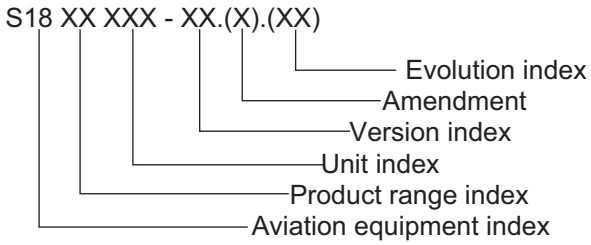
All aviation equipment manufactured by SERPE-IESM are covered by the PART21-Sub part G Production Agreement number F.G.132 delivered by the French Civil Aviation Authority. It is GSAC's responsibility to control periodically compliance of the production process with Production Agreement Specifications.

The Quality Control integrity of the equipment is attested by the issuance of the Certificate of Airworthiness for export (JAA Form 1).

### 9.2. P/N structure

All series equipment are described in the production management system by an assembly number including sub-assemblies or components.

The assembly numbers are designated as follows:




The "Part Number" (P/N) corresponds to the first 10 digits of the assembly number.

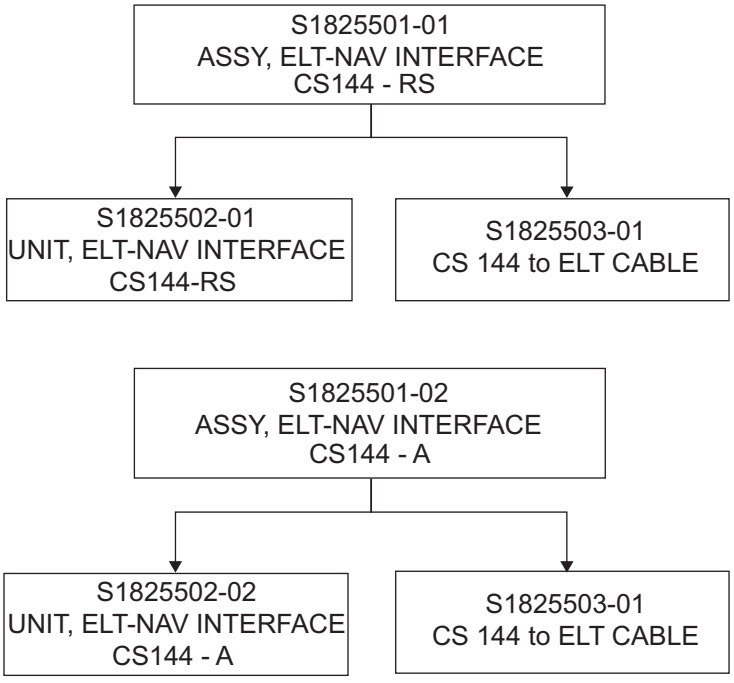
S18 XX XXX - XX

In case of equipment evolution, if "Form Fit Function" is altered, the Version index is modified.

If not, either Amendment or evolution index will be increased depending on the level of demonstration required by the Airworthiness Authority to validate the modification.

**As a consequence, all series equipment having the same Part Number are fully interchangeable.**

9.3. Parts List

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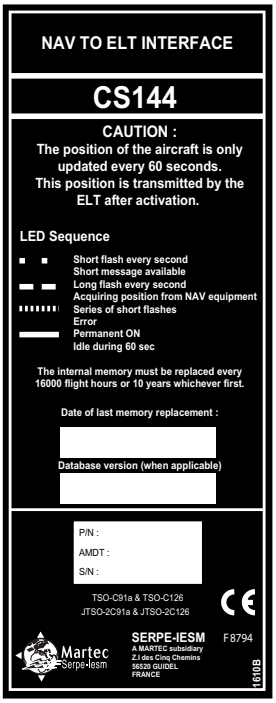
### 9.4. Marking

*9.4.1. Name plate*

A label is stuck on the upper side of the housing. It gives information on:

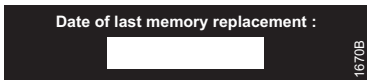
- Part Number (P/N),
- Amendment (AMDT),
- Serial Number (S/N),
- Qualification Certificates (references of),
- Manufacturer name,
- Manufacturer code,
- Manufacturer details,
- Data Base / Software version,
- Brief description of LED sequence.




*9.4.2. Memory replacement*

A label stuck on the rear side of the housing gives information on the date of last memory replacement when applicable (Refer to 10. Maintenance policy).

Figure 13: memory replacement label

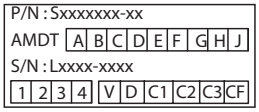



*9.4.3. Production stamp*

This marking, stuck on the lower part of the name plate, enables to determine the status of the equipment and some of it sub-assemblies. It gives information on (from top to bottom):

- P/N,
- Amendment,
- S/N: Serial number including year of production release (H=2000, J=2001, K=2002, L=2003 …), batch number, serial number in that batch,
- The number of evolutions since the production release,
- Control Status (V = visual inspection, D = burn-in, C..= control according to procedure XXX, CF = final control),

Figure 14: Example of production stamp




## 10. MAINTENANCE POLICY

The periodic inspection can only be carried out by an accredited maintenance station with valid agreement for KANNAD ELTs maintenance.

The CS144 Interface Module should be serviced periodically: scheduled maintenance every 16000 FH.

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## 11.RELATED DOCUMENTATION

### 11.1. Files

| Document | Reference | Distribution |
|---|---|---|
| Declaration of Design and Performance | DOC02368 | ATTACHED |
| Production file | S1825501-01<br>S1825501-02<br>S1825501-03 | INTERNAL ONLY |
| Production Agreement Specifications (MOP) | DOC00025 | INTERNAL & GSAC |
| Component Maintenance Manual with Illustrated Parts List | 25-63-50 | WITH MAINTENANCE TRAINING |
| Sales leaflet | TBD | ON REQUEST |

### 11.2. Drawings

| Document | Reference | Distribution |
|---|---|---|
| Outline drawing CS144-RS / CS144-A | S18 25 8 10 | ATTACHED |
| Drilling mask | S18 20 1 32 | ATTACHED |
| Wiring diagram CS144-RS (RS422) | S18 25 4 10 | ATTACHED |
| Wiring diagram CS144-RS (RS232) | S18 25 4 11 | ATTACHED |
| Wiring diagram CS144-A (ARINC) | S18 25 4 12 | ATTACHED |
| Markings: instructions & nameplate | 010 11 6 10 | ON REQUEST |
| Markings : bracket | 010 11 3 36 | ON REQUEST |
| Cable (CS144 to ELT) | S18 25 4 04 | ON REQUEST |

### 11.3. Qualification certificates

| Document | Reference | Distribution |
|---|---|---|
| Production Agreement certificates (FR.21G) | 0132 | ON REQUEST |
| JTSO Authorization | F.O. 100 (JAN 17/2003) | ON REQUEST |

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