

GDU 10XX Environmental Qualification Form

Nomenclature:

GDU 10XX Control Display Unit Equipment

Type/Model/Part Number:

GDU 1045 Control Display Unit, 010-00279-(), Includes 011-00819-() (See Note 7)

GDU 1040 Control Display Unit, 010-00337-(), Includes 011-00972-() (See Note 7)

GDU 1040A Control Display Unit, 010-00320-(), Includes 011-00916-()

GDU 1042 Control Display Unit, 010-00367-(), Includes 011-01080-()

GDU 1043 Control Display Unit, 010-00366-(), Includes 011-01079-()

GDU 1044 Control Display Unit, 010-00365-(), Includes 011-01078-()

GDU 1044B Control Display Unit, 010-00471-(), Includes 011-01274-()

TSO Number:

TSO C113 (See Install Manual for other applicable TSO's)

Manufacturer's Specification And/Or Other Applicable Specification:

004-00121-00

Manufacturer:

Garmin Ltd. or its subsidiaries

Address:

1200 East 151st Street

Olathe, Kansas 66062

U.S.A.

Date Tested :

Testing Started May, 2003

Testing Completed March, 2004

Additional testing in January 2009

RTCA DO-160D Conditions	DO-160D Section and Date of Issue	Description of Conducted Tests
Temperature and Altitude	4.0	Equipment tested to Categories A 1 F 1 (See Note 1.) Equipment tested to Category W
Ground Survival Low/Operating Low	4.5.1	
Ground Survival High/Short-Time Operating High	4.5.2	
Operating High Temperature	4.5.3	
In-Flight Loss of Cooling	4.5.4	
Altitude	4.6.1	
Decompression	4.6.2	
Overpressure	4.6.3	Equipment tested to Category B
	(Issued 07/29/97)	
Temperature Variation	5.0	Equipment tested to Category A
	(Issued 07/29/97)	
Humidity	6.0	
	(Issued 07/29/97)	

RTCA DO-160D Conditions	DO-160D Section and Date of Issue	Description of Conducted Tests
Operational Shocks & Crash Safety Sustained Crash Safety	7.0 7.3.2 (Issued 07/29/97)	Equipment tested to Category B Equipment tested for Aircraft Type 5, Test Type R
Vibration	8.0 (Change No. 1 Issued 12/14/2000)	Equipment tested to Category S2, Test Curve B 2 and Category S, Test Curve M. (See Note 2.)
Explosion Proofness	9.0 (Issued 07/29/97)	Equipment identified as Category X, no test performed
Waterproofness	10.0 (Issued 07/29/97)	Equipment identified as Category X, no test performed
Fluids Susceptibility	11.0 (Issued 07/29/97)	Equipment identified as Category X, no test performed
Sand and Dust	12.0 (Issued 07/29/97)	Equipment identified as Category X, no test performed
Fungus Resistance	13.0 (Issued 07/29/97)	Equipment identified as Category X, no test performed
Salt Spray	14.0 (Issued 07/29/97)	Equipment identified as Category X, no test performed
Magnetic Effect	15.0 (Issued 07/29/97)	Equipment tested to Category Z
Power Input Average Voltage Ripple Voltage Momentary Power Interruption Normal Surge Voltage Engine Starting Under Voltage Steady State Voltage Low Voltage Momentary Under Voltage Abnormal Surge Voltage	16.0 16.5.2.1 16.5.2.2 16.5.2.3 16.5.2.4 16.5.2.5 16.5.4.1 16.5.4.2 16.5.4.3 16.5.4.4 (Change No. 2 Issued 6/12/2001)	Equipment tested to Categories A () B (See Note 3.) Equipment tested to Categories B Z Equipment tested to Categories B Z (during Section 18) Equipment tested to Categories A () B Equipment tested to Categories B Z Equipment tested to Categories B Z Equipment tested to Categories B Z Equipment tested to Categories B Z Equipment tested to Categories B Z Equipment tested to Categories B Z Equipment tested to Categories B Z
Voltage Spike	17.0 (Issued 07/29/97)	Equipment tested to Category A
Audio Frequency Conducted Susceptibility — Power Inputs	18.0 (Change No. 2 Issued 6/12/2001)	Equipment tested to Categories B Z
Induced Signal Susceptibility	19.0 (Issued 07/29/97)	Equipment tested to Category Z
Radio Frequency Susceptibility (Radiated and Conducted)	20.0 (Change No. 1 Issued 12/14/2000)	Equipment tested to Category T (See Note 8.)
Emission of Radio Frequency Energy	21.0 (Issued 07/29/97)	Equipment tested to Category M
Lightning Induced Transient Susceptibility	22.0 (Change No. 3 Issued 12/05/2002)	Equipment tested to Categories: Pin Injection: AZ (See Note 4) Cable Bundle: Single Stroke: E3 for part numbers listed in Note 6 Multiple Stroke & Burst: X Additional Testing Performed Per Notes 5 & 8

RTCA DO-160D Conditions	DO-160D Section and Date of Issue	Description of Conducted Tests
Lightning Direct Effects	23.0 (Issued 07/29/97)	Equipment identified as Category X, no test performed
Icing	24.0 (Issued 07/29/97)	Equipment identified as Category X, no test performed
Electrostatic Discharge (ESD)	25.0 (Issued 07/29/97)	Equipment tested to Category A (See Note 7.)

Notes and Remarks:

1. The GDU 10XX may require up to a 30 minute warm-up in stagnant air at -40C.
The GDU 10XX may require up to a 15 minute warm-up in stagnant air at -30C.

All Loss of Cooling testing was performed at the specified temperature in stagnant air. In addition to Category W Loss of Cooling test, testing was also performed at 50C for 120 minutes.
2. Vibration Test Curve M was increased as follows: 0.1 inches pk-pk double amplitude from 15Hz to 17Hz and 1.5g pk from 17Hz to 55Hz.
3. For DO-160D Section 16, it is assumed that Categories A () and Z are applicable at 28V only, and Category B is applicable for both 14V and 28V equipment operating voltages. Testing was conducted for the Categories and operating voltages with the most stringent requirements for each test as noted below.

The GDU 10XX meets Category Z except for the one second interrupt in Section 16.5.2.3. This requirement corresponds to Test Condition Numbers 8 and 15 in Table 16-1A referenced by Sections 16.5.2.3 and 16.5.1.4.b.

DO-160D allows abnormal levels be used to cover both Section 16.5.2.1 and Section 16.5.4.1. Category B abnormal steady state voltage for 14V equipment (10.25V) was used for the minimum voltage test. Category Z abnormal steady state voltage for 28V equipment (32.2V) was used for the maximum voltage test. Since the emergency operation voltage for 28V equipment is within the range of normal operating voltages for the unit, only the Category B emergency operation voltage for 14V equipment was tested. The voltage level was 9.0V for this test.

DO-160D Section 16.5.2.3.b requires the tests from Section 16.5.1.4.b to be run for this equipment since it contains digital circuitry and/or memory devices. Categories A () and B were tested which include operating voltages of both 14V and 28V. Category Z waveforms 5-8 and 11-15 were tested at 28V for additional coverage to ensure full functionality after a 1 second interrupt. The unit does not reset for Category A () and B (200 mS max) interrupts, but does reset for Category Z (1 second max) interrupts. TSO-C129a requirements are only met for Categories A () and B since a unit reset takes longer than 10 seconds to display valid information. Therefore only Categories A () and B are claimed for this requirement.

DO-160D Section 16.5.2.4 Category Z was tested for 28V requirements (50V and 12V). Category Z requirements divided by two were used for 14V requirements (25V and 6V). Note only Category B applies for 14V requirements (23.5V and 8.5V), but more severe levels were used for extra coverage.

DO-160D Section 16.5.2.5 Categories B and Z apply at 28V only and require an undervoltage condition of 10.0V. Category A () is not applicable to this section. For extra coverage, the unit was also tested at this level divided by two (5.0V) for 14V aircraft. The unit does reset under this condition but was tested to ensure the unit fully recovers after returning to rated voltage.

DO-160D Section 16.5.4.2 applies to 28V and 14V Category B equipment.

DO-160D Section 16.5.4.3 applies to 28V Category A () Z, and 28V/14V Category B equipment. The test for 14V equipment will cause a unit reset. A deviation has been approved for TSO-C129a to allow a unit reset for Section 16 abnormal operation conditions tests.

DO-160D Section 16.5.4.4 for 28V Category Z equipment is the most severe, thus only that test was performed.

4. DO-160D Section 22.5.1 pin injection tests were conducted using the Category A waveform set for aperture coupling. All connector pins were tested to Category A3 (Level 3, Waveforms 3 and 4) . In addition, all power input pins were tested to Level 4 using Waveform 3 only. Reserved pins and Configuration Module pins were not tested for pin injection. The Category A testing applies to all GDU10XX part numbers.
5. In addition to the DO-160D Section 22.5.1 Category A pin injection tests described in Note 4, all Ethernet pins, ARINC 429 pins, Lighting Bus pins, and Discrete Input pins (CDU System ID 1/2/3, Reversionary Mode 1/2, Fan Monitor Valid, Demo Mode) also meet Category B3 (Waveforms 3, 5A). The Category B testing applies only to the following GDU10XX part numbers:

GDU 1040	011-00972-1()
GDU 1040A	011-00916-1()
GDU 1040A	011-00916-25 through 011-00916-29
GDU 1040A	011-00916-35 through 011-00916-39
GDU 1042	011-01080-1()
GDU 1043	011-01079-1()
GDU 1044	011-01078-1()
GDU 1044B	011-01274-1()
GDU 1045	011-00819-1()
6. DO-160D Section 22.5.2 Category E3 Cable Bundle testing applies only to the following GDU10XX part numbers:

GDU 1040	011-00972-00 through -09
GDU 1040A	011-00916-00 through -09
GDU 1040A	011-00916-20 through 011-00916-24
GDU 1040A	011-00916-30 through 011-00916-34
GDU 1042	011-01080-00 through -09
GDU 1043	011-01079-00 through -09
GDU 1044	011-01078-00 through -09
GDU 1044B	011-01274-00 through -09
GDU 1045	011-00819-00 through -09
7. Dash numbers -00 and -01 for the GDU 1045 (011-00819-()) and GDU 1040 (011-00972-()) do not meet Section 25 requirements, which is required for ETSO-2C112b (EUROCAE ED-73B Section 4.23). All other GDU 10XX part numbers do meet Section 25 requirements.
8. Qualification to additional levels and configurations are shown in Garmin Report 005-00329-06 Supplemental Qualification Summary.