



## Grayhill Inc. Quality Assurance Lab's On-Site Testing Capability & Equipment

Environmental Tests		
Test Name	Specification/Method	Description
<b>Salt Spray (corrosion)</b>	Mil-STD-202G/Method 101D IEC 68-2-11	Test products are subjected to a fine mist of salt solution for a specified period of time.
<b>Humidity (steady state)</b>	Mil-STD-202G/Method 103B IEC 68-2-3	The products are placed in a chamber and subjected to a high relative humidity and temperature for a specified period for time.
<b>Immersion</b>	Mil-STD-202G/Method 104A IEC 144	A liquid bath under ambient air pressure is used to determine the effectiveness of the seal component parts.
<b>Barometric Pressure (reduced)</b>	Mil-STD-202G/Method 105C IEC 68-2-13	Products are placed inside a chamber where all entrapped air is escaped according to specified test procedures.
<b>Moisture Resistance</b>	Mil-STD-202G/Method 106F IEC 68-2-38	In an accelerated manner, the resistance of component parts and constituent materials is evaluated after the deteriorative effects high humidity and heat conditions typical of tropical environments
<b>Thermal Shock</b>	Mil-STD-202G/Method 107G* IEC 68-2-14	Products are subjected to cold temperature for a specified time then hot temperature for a specified time to complete 1 cycle. The number of cycles is specified.
<b>Thermocycling (Change Of Temperature)</b>	IEC 68-2-33	Products are subjected to alternate periods at a high and at a low temperature with well defined transitions from one temperature to the other.
<b>Flammability (external flame)</b>	Mil-STD-202G/Method 111A UL – 94VO	A flame is applied to the product for a specified time. Upon removal of the flame, the time of burning of visible flame on the product is recorded.
<b>Contrast Ratio</b>	Response Time: Production Test Specification SQC2769, SQC2770	Measuring the time of change from an "ON" pixel to an "OFF" pixel and Vice Versa. The rise and fall times and high and low voltages will be captured as a waveform using an Oscilloscope and the spectra spot-meter.
	Chromaticity: Production Test Specification SQC2770	Measure the color of the display using the spectra scan software and camera. The units display should fall within the "NVIS Green" section of the Chromaticity diagram.
<b>Seal</b>	Mil-STD-202G/Method 112E NEMA 4 NEMA 12 IEC 144 (IP Rating)	This test method determines the effectiveness in a liquid bath under low air pressure of the seal of a component part, which has an internal cavity, which is either evacuated or contains air or gas.



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Physical Characteristic Tests		
Test Name	Specification/Method	Description
<b>Vibration</b>	Mil-STD-202G/Method 204D IEC 68-2-6	Products are vibrated on 3 planes, (x,y,z), for a specified time per plane
<b>Mechanical Shock (specified pulse)</b>	Mil-STD 202G/Method 213B IEC 68-2-27	The suitability of parts and subassemblies of electronic components to shocks, typical of rough handling and transportation, is determined.
<b>Life (rotational)</b>	Mil-STD/Method 206	The rotational life expectancy is verified by a specified number of cycles. A cycle consists of rotation of the shaft from one stop position to the other stop position and return to the original position
<b>Solderability</b>	Mil-STD/Method 208H IEC 68-2-54	Flux is applied by a suitable method and allowed to drain. The products' terminals are dipped in molten solder for a specified time.
<b>Resistance To Soldering Heat</b>	Mil-STD-202G/Method 210E IEC 68-2-20	It is determined whether wire and other components can withstand the effects of heat they are subjected to during the soldering process.
<b>Terminal Strength</b>	Mil-STD-202G/Method 211A IEC 68-2-21	Terminals are tested by methods specified, pull test, terminal bend, lead bend test, twist test, and torque test. Test conditions to perform the terminal-strength test depend on the type of terminal to be used.
<b>Resistance to Solvents</b>	Mil-STD-202G/Method 215J	Products are immersed in solution for a specified period of time. Each product is brushed with normal hand pressure in a forward motion for ten strokes. After brushing, the above procedure is repeated two more times.
<b>Plating (Coating) Thickness</b>	X-Ray Fluorescence (XRF) method	PCB's or other parts with standard plating materials are scanned with an XRF spectrometer to measure plating thickness



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Electrical Characteristic Tests		
Test Name	Specification/Method	Description
<b>Dielectric Withstanding Voltage</b>	Mil-STD 202G/Method 301 UL 508	Products are subjected to a test voltage of the magnitude and nature specified. Voltage shall be maintained for a specified time.
<b>Insulation Resistance</b>	Mil-STD 202G/Method 302	Insulation resistance is measured between mutually insulated points or between insulated points and ground.
<b>Contact Resistance</b>	Mil-STD 202G/Method 307	The resistance offered to a flow of current, during its passage between the electrical-contacting surfaces of the connecting components, is determined.
<b>Contact-Chatter Monitoring</b>	Mil-STD 202G/Method 310	Monitoring is conducted for detecting contact-chatter in electrical and electronic components having movable electrical contacts.
<b>Life (Low-Level Switching)</b>	Mil-STD 202G/Method 311	Each pair of contacts is operated for the number of cycles specified at the specified cycling rate with the required applied test load.
<b>EMC Testing</b>	Emissions: CISPR11/EN 55011 conducted* CISPR22/EN 55022 conducted* CFR47, Part 15 (ANSI C63.4) - conducted* MIL-STD-461E conducted MIL-STD-461E radiated ANSI C63.4 radiated exploratory*	It is verified that the device's generated Electro-magnetic interference does not exceed a specified level over various frequency ranges
	Immunity: EN 61000-6-1,2,3,and -4* EN/IEC 61000-4-6 conducted* EN/IEC 61000-4-3 radiated* EN/IEC 61000-4-8 magnetic* EN/IEC 61000-4-2 ESD* EN/IEC 61000-4-4 fast transient/burst* EN/IEC 61000-4-5 surge*	It is verified that the device is functional to a specified level of received Electro-magnetic interference

**\* ACCREDITED TEST**

- **Quality Assurance Laboratory has Reliability software including, Reliasoft's Alta (accelerated life testing) and Weibull++ (life data analysis).**
- **Quality Assurance Laboratory also has automated testing capabilities that include LabVIEW, Borland C, and Visual Basic programming software.**



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Grayhill Quality Assurance Labs On-Site Testing Equipment		
Test/Testing Device	Model Number/Controller	Manufacturer
<b>Salt Spray:</b> Salt spray chamber	17920A	Associated Environmental Systems
<b>Humidity</b> (steady state): Cyclic humidity chambers	T10RC, T20RC-4, SM-8, SM-8-3800	Tenny Environmental, Thermotron
<b>Immersion:</b> Blue M water seal chamber	MW-1110A-1	Blue M Electric Company
<b>Barometric Pressure</b> (reduced): Altitude chamber	B4805	Merium Instrument Co.
<b>Moisture Resistance:</b> Cyclic humidity chambers	T10RC, T20RC-4, SM-8, SM-8-3800	Tenny Environmental, Thermotron
<b>Thermal Shock:</b> Temperature cycling chambers	T20C-4, TS2-02-10V	Tenny Environmental
<b>Thermocycling:</b> Temperature cycling chambers	2 SE-600-3-3's, 2 S-1.2's, T10RC, T20C-4	Thermotron Industries, Tenny Environmental
<b>Flammability</b> (external flame)	Flame Torch	Unknown
<b>Contrast Ratio</b> (Oscilloscope, Spectra Scan Camera, Spectra Spot-Meter)	PR-714, PR-1500, TDS-420A	Tektronics Inc, Photo Research
<b>Seal:</b> Blue M water seal chamber	C10E	Blue M Electric Company
<b>Vibration:</b> Vibration machine	B4805 Controller: DVC 4000	MB Electronics
<b>Mechanical shock:</b> half-sine, sawtooth	1616 (100) PA-MP	MRAD Corp
<b>Life</b> (rotational): 40 life cycling motors	RPM: 24 Voltage: 120 Vac Current: .4A Torque: 580 oz. in. Voltage: 120 Vac Current: .4A Torque: 580 oz. in.	Superior Electronics
<b>Life</b> (high-speed rotational): 10 life cycling motors	RPM: 5 at 5K, 5 at 8K Voltage: 120 Vac	Parker Hannifin Corp
<b>Solderability:</b> 2 molten solder pots	1 lead, 1 lead-free	
<b>Resistance To Soldering Heat:</b> Molten solder pot		
<b>Terminal Strength:</b> Chatillon force gauge	Model Number: UTSM	John Chatillon & Sons
<b>Resistance To Solvents:</b> "A" - 1 part Isopropyl Alcohol, 3 parts Mineral Spirits "C" - Bioact, EC-7R Turpene "D" - 42 parts water, 1 part Butyl Cellosolve, 1 part Monoethanolamine		
<b>Dielectric Withstanding Voltage:</b> Dielectric Hy-Pot	5560DT, 5450DT	Associated Research Lab



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Grayhill Quality Assurance Labs On-Site Testing Equipment (continued)		
Test/Testing Device	Model Number/Controller	Manufacturer
<b>Insulation Resistance:</b> Insulation tester	1865	Quad tech
<b>Contact Resistance:</b> 30 Vdc, 3A power supplies Hewlett Packard Multimeter (34401A)		
<b>Contact-Chatter Monitoring:</b> Contact-chatter box	DCM1012	Matrons
<b>Life (Low-level switching):</b> Pushbutton actuators Dip switch actuators		Dayton Electric Manufacturing Co.
<b>EMC Testing:</b> 3-meter full anechoic chamber	Fact-3	Lindgren RF Enclosures, Inc
<b>Surge Voltage:</b> 2Kv	PSURGE 4010	Haefely
<b>Electrostatic Discharge:</b> 25 Kv gun	Series 2000	KeyTek
<b>Fast Transient Burst:</b> 4 Kv	PEFT-Junior	Haefely
<b>Plating (Coating) Thickness</b>	CMI900 XRF spectrometer	Oxford Instruments