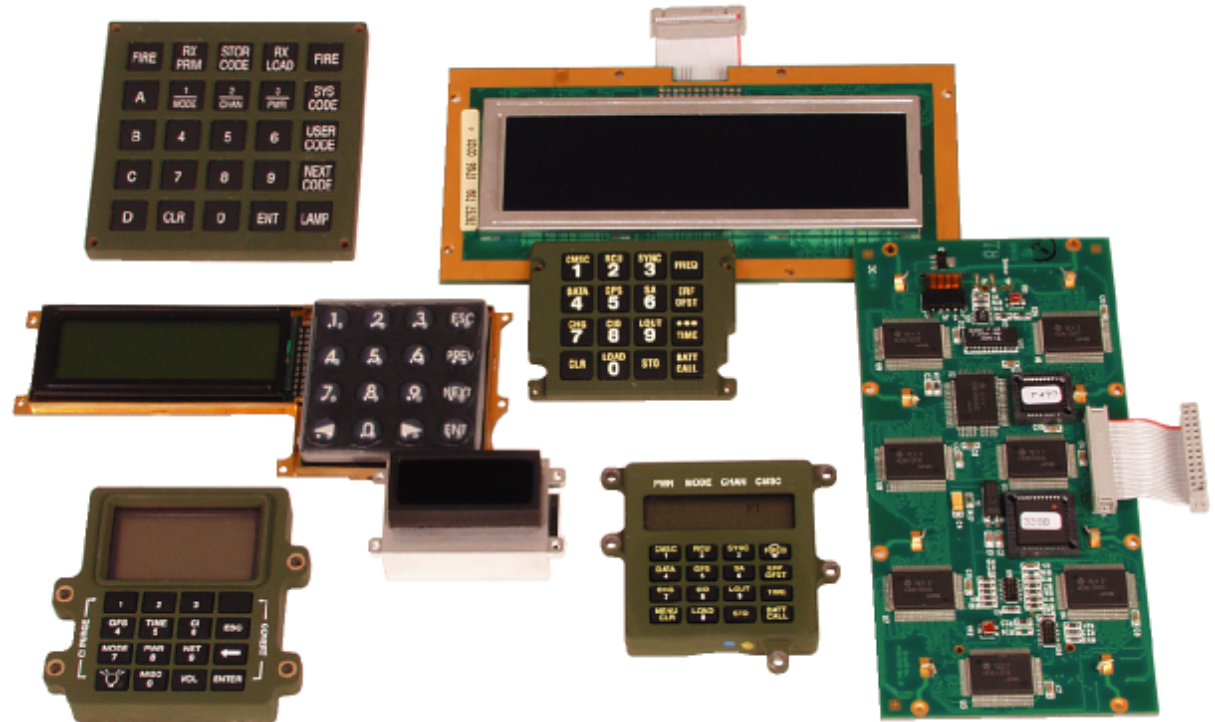
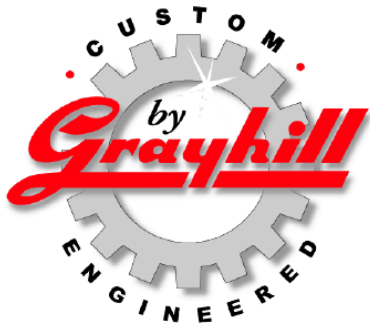
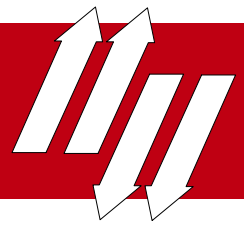
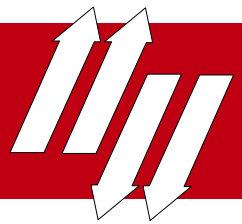


Military Keypads and Displays



***Designs, Prototypes, Qualifies, Manufactures, and Supports
Custom Military Display and Keypad assemblies***

Grayhill Background

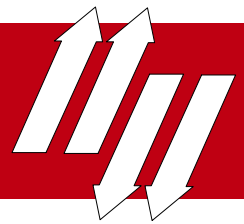


- Founded in 1943
- An ISO 9001 company
- Known as the premier supplier of Rotary Switches, Dip Switches and Industrial I/O Modules
- Design and Manufacturing in LaGrange IL (Just Outside of Chicago)
- Over 100,000 fielded Military Displays and/or Keypads



***Designs, Prototypes, Qualifies, Manufactures, and Supports
Custom Military Display and Keypad assemblies***

A Full Display/Keypad Solution



- Design Services
- Prototyping
- Qualification
- Manufacturing
- Product Support



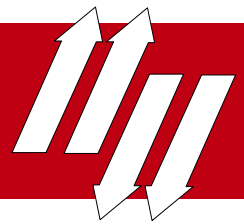
All Stages are Controlled by Grayhill's Unique Release to Production Process

Design ➡ Prototyping ➡ Qualification ➡ Manufacturing ➡ Support



***Designs, Prototypes, Qualifies, Manufactures, and Supports
Custom Military Display and Keypad assemblies***

Design Services



- Team Approach Includes
 - Mechanical Engineers, Electrical Engineers, Manufacturing Engineers, Purchasing and Sales
- Mechanical Design
 - Use Pro/E which allows for design verification, visualization and buy-in before any tooling is started
- Electrical Design
 - Power Logic and PADs
- Firmware
 - Such as 8-Bit microcontroller

*Grayhill's Early Involvement Assures
Optimal Design!*



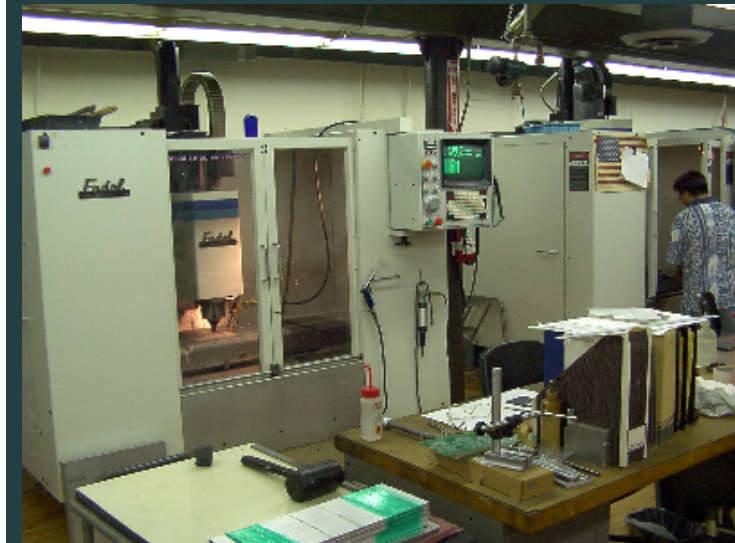
***Designs, Prototypes, Qualifies, Manufactures, and Supports
Custom Military Display and Keypad assemblies***

Prototyping



- Both Traditional Techniques and Cutting Edge Processes
 - Full toolroom with 2 CNC machines
 - In-house FDM
 - SLAs, Urethane castings, SLS, etc.
 - In-house pick and place for proto runs

*Ability to Prove the Design
in Record Time*



***Designs, Prototypes, Qualifies, Manufactures, and Supports
Custom Military Display and Keypad assemblies***

Qualification



- In-house Test Lab Includes
 - EMC Chamber
 - Vibration
 - Mechanical Shock
 - Thermal Shock
 - Salt Spray
 - Immersion
 - Spot Photometer
 - Measures Light Intensity
 - Spectrascan Spectral Radiometer
 - CIE color and Spectral response
 - Temperature chambers



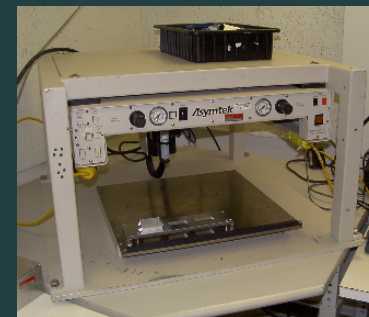
***Designs, Prototypes, Qualifies, Manufactures, and Supports
Custom Military Display and Keypad assemblies***

Manufacturing



- Three surface mount lines
 - Computer controlled screen printing, ICT, Optical Inspection
- Wave soldering machine
- Automated conformal coating
- Specialty Equipment
 - Snap dome assembly
 - LCD heat seal bonder
 - Computer controlled X-Y sealant dispensers

*All the Tools to Produce Your
Custom Display/Keypad Assembly*



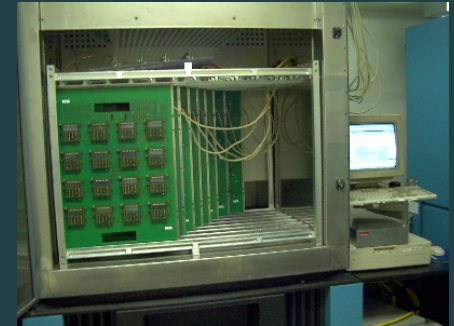
***Designs, Prototypes, Qualifies, Manufactures, and Supports
Custom Military Display and Keypad assemblies***

Manufacturing Testing



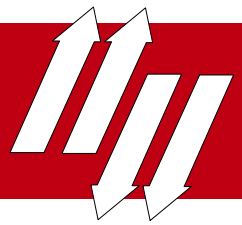
- Functional Testers
- Burn-In
- Seal Testing
- Etc.

*Grayhill functionally tests
100% of its products
before shipment*



***Designs, Prototypes, Qualifies, Manufactures, and Supports
Custom Military Display and Keypad assemblies***

Product Support



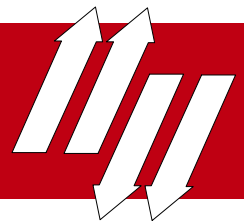
- Future enhancements
- Engineering support
- Warranty support
- Issue analysis

*Grayhill is still there as your partner
after the product ships*



***Designs, Prototypes, Qualifies, Manufactures, and Supports
Custom Military Display and Keypad assemblies***

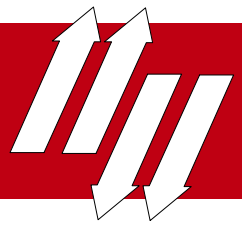
Proposal



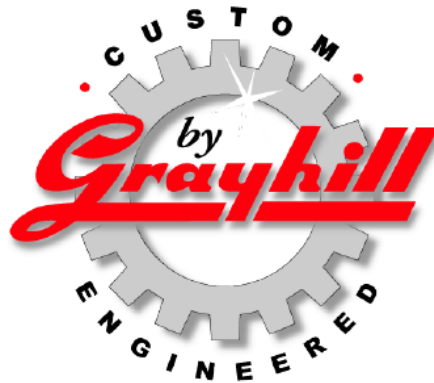
- Each Military Display/Keypad project is quoted using Grayhill's Proposal System
- Proposals Contain
 - Product Specification
 - Qualification Plan
 - Schedule
 - Development and Production Pricing
 - Terms and Conditions
- To kickoff a project, both Grayhill and the customer will sign the agreed upon proposal



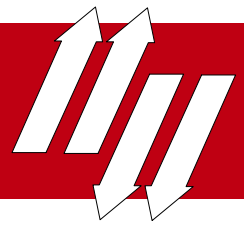
***Designs, Prototypes, Qualifies, Manufactures, and Supports
Custom Military Display and Keypad assemblies***



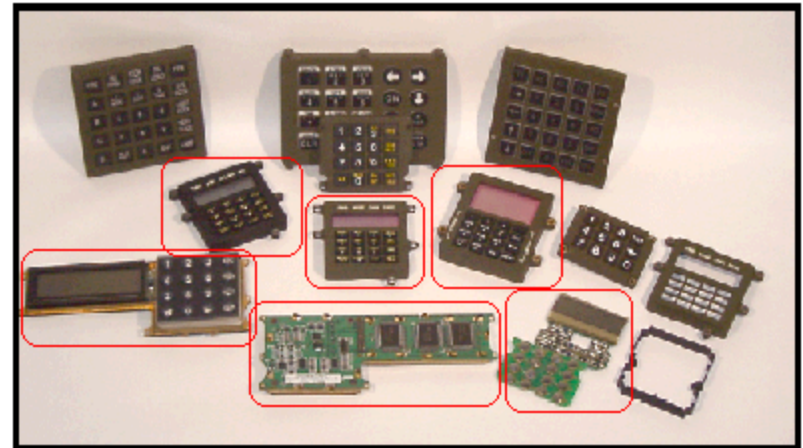
Military Display and Keypad Technology...



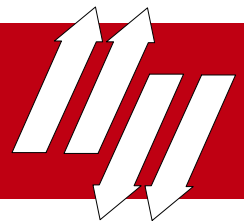
***Designs, Prototypes, Qualifies, Manufactures, and Supports
Custom Military Display and Keypad assemblies***



- Types of Custom LCDs
 - TN
 - STN
 - Dichroic
- Heaters
 - Allows for low temperature operation (such as -51 deg C)
 - Microprocessor controlled for minimal power usage
- Electrical/Software Interface
 - Usually proprietary protocol via a standard bus



Display Technology - Continued

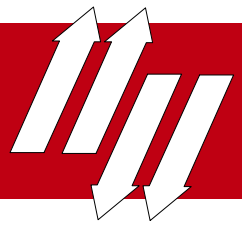


- LCD Driver Electronics
 - Integrated into Grayhill design
- Backlighting
 - LED, EL, Incandescent
 - NVIS Compatibility - Does not cause blooming
 - NVIS Compliance - Meets the Mil requirement for spectral emissions
- Graphics/Icons
- Thermal Blast Windows - To meet nuclear blast spec



***Designs, Prototypes, Qualifies, Manufactures, and Supports
Custom Military Display and Keypad assemblies***

Mechanical Packaging

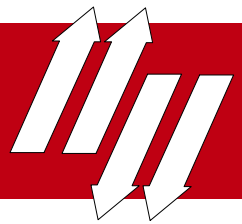


- Housings
 - Machined Aluminum
 - Die Cast
 - Plastic
- Fully Sealed
 - Rubber gaskets
 - RTV

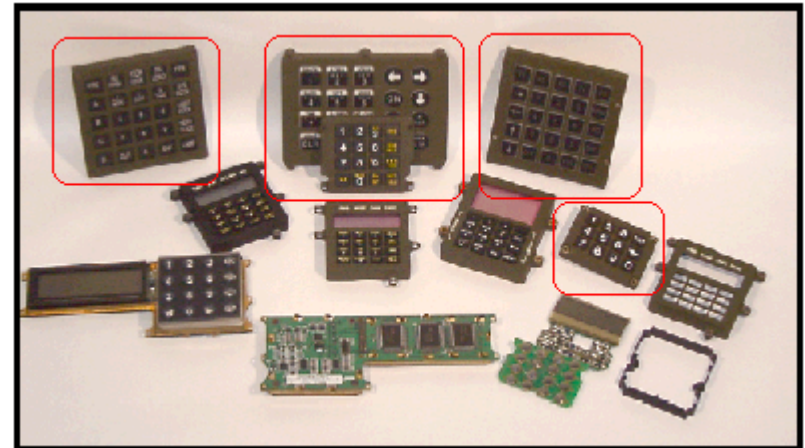


***Designs, Prototypes, Qualifies, Manufactures, and Supports
Custom Military Display and Keypad assemblies***

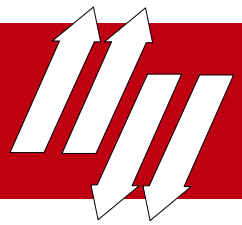
Keypad Technology



- Rubber Keypads
 - Legending via Silk Screening or Laser Etching
 - Hard coating to protect legends
- Backlighting
 - EL
 - LEDs
 - Incandescent
- Contact Technology
 - Gold Plated Domes
 - Conductive Rubber
 - Membrane
- Sealed assemblies per Mil specifications



*Designs, Prototypes, Qualifies, Manufactures, and Supports
Custom Military Display and Keypad assemblies*

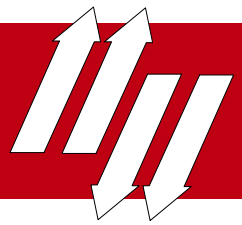


Military Display and Keypad Examples...



***Designs, Prototypes, Qualifies, Manufactures, and Supports
Custom Military Display and Keypad assemblies***

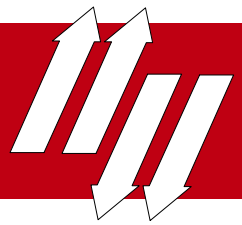
Example *Field Radio Display/Keypads*



- Extreme temperature LCD display (e.g. -51 to 85 deg C)
- Integrated electronics to scan keys, drive display and keypad backlights, control LCD heaters and communicate to main radio
- Fully sealed assembly



Example *Arabic Version*

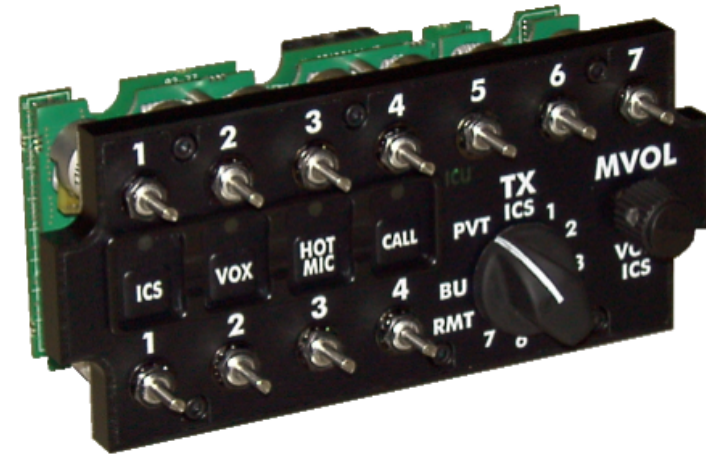


- Based on released platform
- Integrated electronics
“translate” over 80 typical display messages to Arabic equivalents and displays these Arabic versions
- Eliminated changes to main radio thereby saving Grayhill’s customer requalification time/cost and minimizing their risk

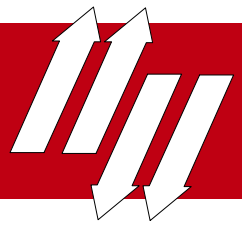


Example **Vehicle Mount Communication Radio**

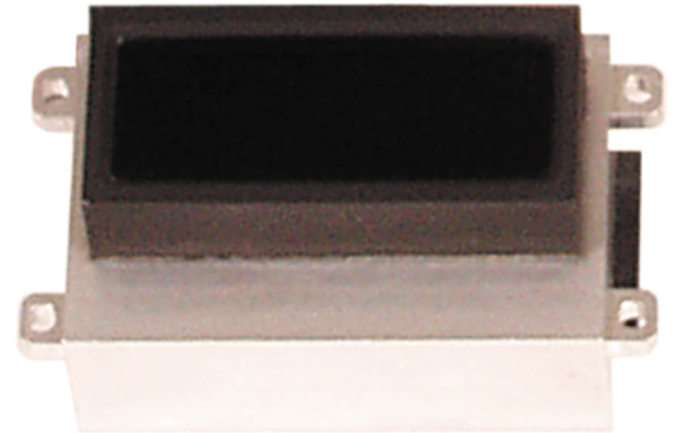
- Multiple rotary switch inputs
- Integrated electronics to scan inputs, drive indicators, control backlight
- Full NVIS Compliance
- Flexible Legending Options



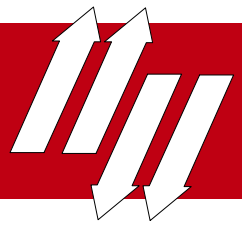
Example ***Airborne Communication Display***



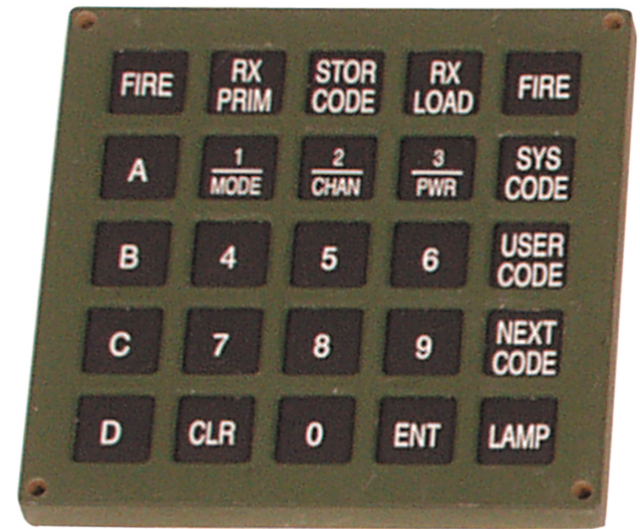
- Segmented LCD
- Optimized reverse TN LCD technology used to replace costly Dichroic technology
- Integrated electronics to control display, control backlight and communicate to main system
- Full NVIS Compliance



Example *Keypad Only*



- Uses Grayhill's gold plated domes for 3 million operations
- Laser etched rubber for backlighting
- Full NVIS Compliance
- Fully Sealed



*Designs, Prototypes, Qualifies, Manufactures, and Supports
Custom Military Display and Keypad assemblies*