Bourns Automotive Locations

- **Corporate Headquarters**
  - S = Sales Headquarters
  - R&D = Research and Development Centers
  - M = Manufacturing Centers

- **Locations**
  - Auburn Hills/MI: S, R&D
  - Chihuahua/MEX: M
  - Riverside/CA: S, R&D, M
  - Taufkirchen/D: S, R&D
  - Ajka/HU: M
  - Xiamen/CN: M
  - Taipei/TW: S
  - Veszprem/HU: S, R&D
  - Shenzhen/CN: S
  - Tijuana/MEX: M
  - Logan/UT: M
Bourns R&D Centers
Bourns R&D Centers
Sensing Concept Development

- Magnet simulations and measurements
- Close collaboration with magnet and ASIC suppliers for optimal performance
Bourns R&D Centers
Electrical Engineering

- Electrical design with Altium Designer
- PSpice circuit simulation
- EMC and ESD compliant design for passenger car and truck applications
- Design for safety critical systems
Bourns R&D Centers
Software Engineering

- MISRA 2012 compliant C-development
- Sensing algorithm for steering angle sensors
- Self-diagnosis and flow control for safety critical systems
- UDS or KWP compliant diagnostic interfaces over CAN
- White and black box testing including fault injection
- Enterprise Architect for design and modeling
• Development of high precision plastic components for highly accurate sensor applications
• Simulation of mold flow and fiber orientation (CADMOLD)
• FEM simulation and optimization of mechanical properties (ANSYS)
• CAD design with NX
Bourns R&D Centers
Functional Test Engineering

• High precision sensor reference system for performance measurements
• Calibration concept for prototypes and production
• Warranty and claim analysis
Bourns R&D Centers
Sample / Tool Shop

- Design and production of test fixtures
- Preparing mockups and A, B, C sample building
Bourns R&D Centers
Central Laboratory

- DV and PV tests for all product families
- Warranty and failure analysis
- Electrical function test, EMC Bulk Current Injection (BCI) and ESD tests
- Vibration and mechanical shock testing at ambient temperature
- Salt spray testing from ambient temperature up to 60 °C
- Rotational torque measurement at ambient temperature and with profile
- Linear and rotational sensor excitation profiles @ temperature cycles
Bourns R&D Centers
Central Laboratory

Temperature life cycle test with mechanical drive and data

Temperature shock chamber
Bourns R&D Centers
Central Laboratory

EMC BSI box

Salt spray chamber
Bourns R&D Centers
Central Laboratory

Vibration room
Decapsulation room
Bourns R&D Centers
Central Laboratory

Machine shop

Production development room
Bourns R&D Centers

Program Management

• Management of complete process from first technical concept until running a stable series production of a new product by using the Bourns C2C process
• C2C system consists of 9 gates in which the project is reviewed in detail until the team/management decide about the start of the next project phase
• C2C assures project management according to APQP standards
• C2C includes development according to ISO 26262
Bourns, Inc. – Logan/US
Ceramic components are formed in one of three main processes:

- **Green scoring**
- **Roll compaction**
- **Dry pressing**
Bourns, Inc. – Logan/US

Ceramic Manufacturing

Appling the three available processes of ceramic fabrication Bourns Ceramic is able to produce a variety of ceramic shapes and sizes to meet the specific demands of customers and the finished application.
Green ceramic parts are prepared to be sintered in high temperature kilns.

Stamping green plates

Dry press parts loaded to be fired

Loading green ceramic on to kiln cars
Inspection operations verify the density, camber flatness and dimensions of the sintered ceramic parts.

Fired plates are first cleaned and then checked for camber flatness.

Vision inspection verifies dimensional compliance fired.

Precision balance and laser measurements define the green density of the ceramic.
Laser operations after sintering is capable of accurate scribing, cutting, and drilling of the ceramic plates to meet the close tolerance requirements of final ceramic substrates.
Bourns Kft. – Ajka/HU
Bourns Kft. – Ajka/HU
Assembly Lines – Non-Contacting Sensors
Bourns Kft. – Ajka/HU
Assembly Lines – Transmission Sensors
Bourns Kft. – Ajka/HU
Assembly Lines – Throttle Position Sensors
Bourns Kft. – Ajka/HU
Additional Competencies

Ink production and developing

SMT technologies

Fuel card test lab
Bourns Kft. – Ajka/HU

Thick Film Manufacturing Processes

Ink mixing, screen printing

Curing, plasma treatment, laser trimming

Automated visual inspection and EOL testing
Bourns Kft. – Ajka/HU
Thick Film Processes (Laminates – Thermoset – Ceramics)
Bourns Kft. – Ajka/HU
Thick Film Technology / Printing

- Clean room ISO class 7
- Automatic feeding and positioning +/− 12 micron accuracy
- Laser trimming, adjustment
- Different ink systems (resistor and conductor, polymer based and cermet)
- Substrate materials: FR4, thermoset, ceramic
- Different curing, tempering processes (convection, IR, UV)
- Special ink mixing and technology know-how
- Automated optical inspection system
Bourns Kft. – Ajka/HU
Microelectronics Bonding / Clean Room

- Silver epoxy dispensing system
- Automated pick and place (ASIC – MR)
- Automated gold wire bond (1.0 & 1.5 mils wire)
- Clean room ISO class 7
  - Temperature controlled: 21 °C ± 3.5 °C
  - Humidity: 40-60 % rel.
- Full ESD protected area
- Automated optical inspection system
Bourns Kft. – Ajka/HU
Test Lab: Environmental and Warranty Analysis

- Requalification test
- Fuel card requalification
- Temperature and humidity cycle, high frequency continuous data monitoring, analog/digital technology, high frequency data recording
- Warranty analysis
- Failure analysis for production support
Bourns Kft. – Ajka/HU

Metrology Lab

- High accuracy dimension measurement
- 3D and 2D optical measurement
- Equipment calibration
Bourns Kft. – Ajka/HU
Injection Molding Production

- Insert and automatic molding
- Various plastics: PBT, PA, POM, etc.
- 15 various machines: 25 t – 110 t; H and V
- Built-in pressure sensor monitoring
- Average spec. for parts: ± 0.03 mm
- 2 bridge cranes
- Tool shop
Bourns Kft. – Ajka/HU

High Level Storage

- 1,000 sq. meters
- 1,250 palette place
- Separated hazardous material storage
- Truck docking stations
Bourns de Mexico – Tijuana/MX
Bourns de Mexico – Tijuana/MX
Assembly Lines – Chassis Level
Bourns de Mexico – Tijuana/MX
Assembly Lines – SMT
Bourns de Mexico – Tijuana/MX
Current Manufacturing Processes Fuel Cards

Surface treatment

Laser trimming

Fuel cards with cable assembly

Automatic selective solder

EOL
Bourns de Mexico – Tijuana/MX

Thick Film Processes

Heat treatment → Laser trimming → Plasma treatment

Final inspection & EOL testing ← Singulated PCB
Bourns de Mexico – Tijuana/MX
Torque Sensor Assembly Line
Bourns de Mexico – Tijuana/MX
Thick Film Technology / Printing

• Clean room environment
• Automatic and manual printing machines
• Automatic feeding and positioning
• Different ink systems (resistor and conductor, polymer based and cermet)
• Substrate materials: FR4, thermosets, ceramic
• Different curing, tempering processes (convection, IR, UV)
• Special ink mixing and technology know-how
Bourns de Mexico – Tijuana/MX
Microelectronics Bonding / Clean Room

- Silver epoxy dispensing system
- Automated pick and place (ASIC – MR)
- Automated gold wire bond (1.0 & 1.5 mils wire)
- Clean room ISO class 7
  - Temperature controlled: 21 °C ± 3.5 °C
  - Humidity: 40-60 % rel.
- Full ESD protected area
- Automated optical inspection system
Bourns de Mexico – Tijuana/MX
Laboratory, Analysis and PV Testing

- Laboratory tester
- Micro-probing station and optical inspection
- Leakage current measurement
- Silicon gel removal / aluminum etching room
- Full lifetime test according specification
  - Climate chamber, shock temperature chambers, etc.
- Endurance tester with/without movement
- Full product analysis
Bourns de Mexico – Tijuana/MX
Injection Molding Production

- Insert and automatic molding
- Various plastics: PBT, PA, POM, etc.
- 15 various machines: 25 t – 110 t; H and V
- Built-in pressure sensor monitoring
- Average spec. for parts: ± 0.03 mm
- 2 bridge cranes
- Tool shop
Bourns de Mexico – Chihuahua/MX
Bourns de Mexico – Chihuahua/MX
Production Area
Bourns de Mexico – Chihuahua/MX
Production Area
Bourns de Mexico – Chihuahua/MX
Production Area

- Wire cutting
- Wire stripping

KOMAX equipment
Bourns de Mexico – Chihuahua/MX
Production Area

Crimping station

Molding area
Bourns de Mexico – Chihuahua/MX
Production Area

Welding equipment

Zoom into the process
Bourns de Mexico – Chihuahua/MX
Production Area

- Functional test
- Components presence
- Print date code (laser stamping)
Bourns de Mexico – Chihuahua/MX

Production Area

Line 32 (new launch)
Bourns de Mexico – Chihuahua/MX
Production Area, Line 32

Magnet insert → Magnetized station → IC welding

Electrical test ↔ Bold insert station & screw installation ↔ Cure oven
Bourns Xiamen, Ltd. – Xiamen/China
Bourns Xiamen, Ltd. – Xiamen/China

PCB Assembly Line

SMT lines/ICT/AOI

Conformal coating
Bourns Xiamen, Ltd. – Xiamen/China

SMT

Connect assembly & coating

Test

BOURNS® Automotive Division
Bourns Xiamen, Ltd. – Xiamen/China
Steering Angle Sensor – Assembly Line
Bourns Xiamen, Ltd. – Xiamen/China
Torque Sensor – Molding, Cleanroom and Final Assembly Line

Molding

Clean Room

Final Assembly
Bourns Asia Pacific, Inc. – Taipei/Taiwan
Engineering Center for Circuit Protection Devices
Bourns Asia Pacific, Inc. – Taipei/Taiwan
Engineering Center for Circuit Protection Devices

Trimmer SMD Auto Line

Trimmer Through-hole Auto Line
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