

# Electrohydraulic Braking

## Overview

Electrohydraulic braking (EHB) systems are designed to allow electronic control of vehicle braking while retaining a reduced hydraulic system. The hydraulic system functions as a reserve in the event of a failure in the electronic control.

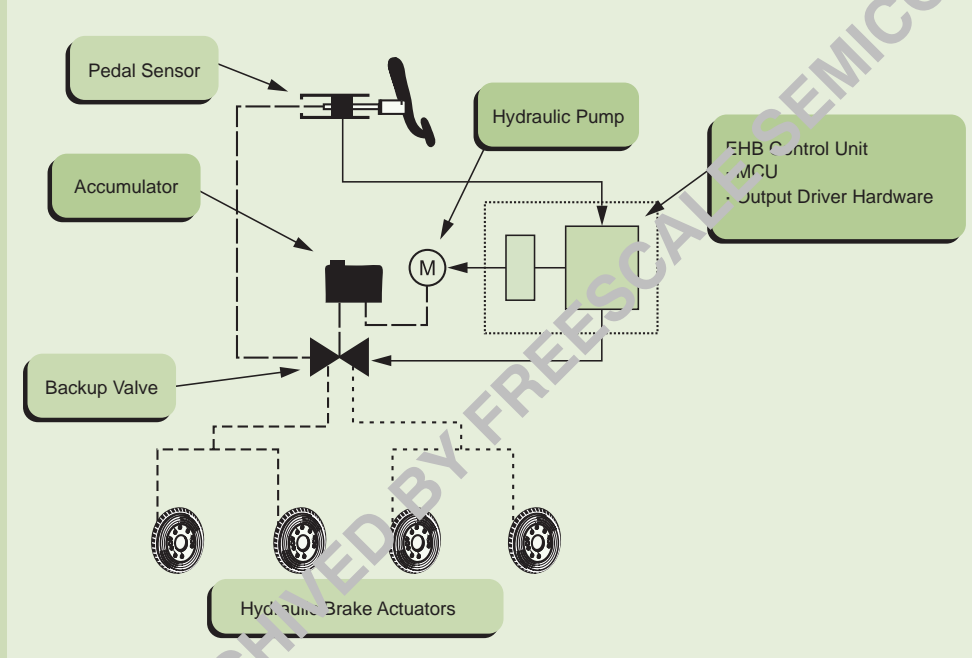
The EHB control unit receives inputs from sensors connected to the brake pedal. In

normal operation, a backup valve is closed and the controller activates the brakes of the wheel through an electric motor driven hydraulic pump. When the controller goes into a fail-safe mode, the backup valve is opened, which allows the brakes to be controlled through a conventional hydraulic circuit.

## Key Benefits

- > Reuses hydraulic system technology while incrementally building on the development of advanced electronic systems, such as electronic stability programs (ESP), traction control, and brake assist
- > Uses software updates to simplify the calibration process by adjusting brake response and pedal feel
- > Improves connectivity with other emerging systems, such as adaptive cruise control
- > Removes the large vacuum servo to allow flexible installation
- > Features an anti-lock braking system (ABS) without feedback from the pedal

ELECTROHYDRAULIC BRAKING BLOCK DIAGRAM



## Freescale Ordering Information<sup>1</sup>

Part Number	Product Highlights	Additional Information
MPC500	32-bit microcontrollers	www.freescale.com <sup>2</sup>
SMARTMOS	Integrated circuits	www.freescale.com/analog

### Notes:

- Contact your Freescale Semiconductor sales representative for complete information about existing products and custom solutions.
- Search on the listed part number.

### Design Challenges

Electrohydraulic braking is based on existing ABS systems with the addition of several enhancements. The inclusion of analog electrohydraulic valves requires closed-loop, current-controlled pulse width modulation (PWM) outputs from the electronic control unit (ECU).

An EHB system is required to incorporate a fail-safe state in the event of a fault occurring. To correctly initiate the fail-safe state, the system relies on its electronic components to provide a high level of operational fault coverage.

### Freescale Semiconductor Solution

An EHB system requires mid-range performance MPC500 microcontrollers for system control with SMARTMOS companion chips for functions such as load driving, sensor interfacing, voltage regulation, and system watchdog operation.

Freescale Semiconductor has gained experience developing many of the specific aspects required for the implementation of an EHB system. Because of its extensive experience in the development of fail-safe

microcontrollers, braking-specific modules such as the wheel speed timer, and a software center including drivers, tools, and operating systems, Freescale Semiconductor has proven its ability to develop the right solutions in collaboration with its customers.

## Development Tools

Vendor	MPC555	MPC561	MPC562	MPC563	MPC564	MPC565	MPC566	TPU
<b>Metrowerks</b>								
CodeWarrior for Embedded PowerPC ISA	•	•	•	•	•	•	•	
CodeWarrior for OSEK RTOS	•	•	•	•	•	•	•	
CodeWarrior Development Systems	•					•		
OSEKturbo (RTOS)		•		•		•		
TPU Low-Level Driver Library								•
Flash Programming — CodeWarrior for Embedded PowerPC ISA	•			•	•	•	•	
Flash Programming — CodeWarrior for OSEK RTOS	•			•	•	•	•	
<b>Wind River Systems</b>								
BDM Debugger — SingleStep	•	•		•		•		
BDM Debugger — SingleStep with Vision	•	•		•		•		
Flash Programming — SingleStep	•			•		•		
BDM Debugger — VisionCLICK	•	•		•		•		
Nexus Debugger — VisionCLICK		•		•		•		
Nexus Debugger — SingleStep with Vision		•		•		•		
Flash Programming — VisionCLICK	•			•		•		
Compiler — DiabData	•	•	•	•	•	•	•	
MATRIX	•	•		•		•		
Simulator — SingleStep	•	•	•	•	•	•	•	

## Development Tools (continued)

Vendor	MPC555	MPC561	MPC562	MPC563	MPC564	MPC565	MPC566	TPU
<b>Lauterbach</b>								
BDM Debugger Trace32	•	•	•	•	•	•	•	•
Nexus Debugger Trace32		•	•	•	•	•	•	•
Code Trace (with Bus access)	•	•	•	•	•	•	•	
Code Trace (Nexus)	•	•	•	•	•	•	•	
<b>Axiom Manufacturing</b>								
Low-Cost Evaluation Board	•	•						
Mid-Range Evaluation Board	•	•						
Full-Feature Evaluation Board	•	•	•	•	•	•	•	
<b>Ashling Microsystems</b>								
BDM Debugger — Opella, Genia, and Vitra	•	•	•	•	•	•	•	
Nexus Debugger — Vitra (w/trace)		•		•				•
Nexus Debugger — Opella, Genia		•		•		•		
<b>Green Hills Software</b>								
IDE, Debugger — Multi	•	•		•		•		
Compiler — C/C++/EC++	•	•		•		•		
<b>P&amp;E Microcomputer Systems</b>								
Low-Cost Debugger	•	•				•		
Flash Programming Tools	•					•		
<b>GNU</b>								
Compiler/Debugger	•	•		•		•		
<b>ASH WARE</b>								
TPU Simulator								•
<b>ETAS</b>								
ErCOSEK	•	•		•		•		
Calibration Tools (ETK)	•	•		•		•		
Calibration Tools (ETK) Nexus	•	•		•		•		
<b>dSPACE</b>								
TargetLink	•	•		•		•		
<b>dli</b>								
Logic Analyzer	•	•		•		•		
<b>Agilent Technologies</b>								
Logic Analyzer	•	•		•		•		
Inverse Assembler, Source Correction	•	•		•		•		
Emulation Probe (BDV)	•	•		•		•		
<b>Tektronix</b>								
Logic Analyzer	•	•		•		•		
<b>Abatron AG</b>								
BDM Support	•	•		•		•		
<b>Accelerated Technology</b>								
Nucleus (RTOS)	•	•		•		•		

### Third Party Support

Vendor	Contact Information
Metrowerks	800-377-5416 ( <a href="http://www.metrowerks.com">www.metrowerks.com</a> )
Axiom Manufacturing	972-926-9303 ( <a href="http://www.axman.com">www.axman.com</a> )
Wind River Systems	800-872-4977 ( <a href="http://www.windriver.com">www.windriver.com</a> )
Green Hills Software	805-965-6044 ( <a href="http://www.ghs.com">www.ghs.com</a> )
Lauterbach	508-303-6812 ( <a href="http://www.lauterbach.com">www.lauterbach.com</a> )
Accelerated Technology	800-468-6853 ( <a href="http://www.acceleratedtechnology.com">www.acceleratedtechnology.com</a> )
Ashling Microsystems	408-732-6490 ( <a href="http://www.ashling.com">www.ashling.com</a> )
ASH WARE	503-533-0271 ( <a href="http://www.ashware.com">www.ashware.com</a> )
GNU	617-542-5942 ( <a href="http://www.gnu.org">www.gnu.org</a> )
ETAS	888-382-7462 ( <a href="http://www.etasinc.com">www.etasinc.com</a> )
dSPACE	248-567-1300 ( <a href="http://www.dspace.com">www.dspace.com</a> )
P&E Microcomputer Systems	617-353-9206 ( <a href="http://www.pemicro.com">www.pemicro.com</a> )

### Online Topics

Description	Location
MPC500	<a href="http://www.freescale.com">www.freescale.com</a>
Analog and Mixed Signal	<a href="http://www.freescale.com">www.freescale.com</a>
32-Bit Development Tools	<a href="http://www.freescale.com">www.freescale.com</a>

### Related Product

Product Number	Product Name	Contact Information
MPXV6115V	High temperature accuracy integrated silicon pressure sensor — small outline package	<a href="http://www.freescale.com">www.freescale.com</a> <sup>Note</sup>

Note: Search on the listed part number.

**Learn More:** Contact the Technical Information Center at +1-800-521-6247 or +1-480-768-2130.  
For more information about Freescale products, please visit [www.freescale.com](http://www.freescale.com).