

TORC

ROBOTIC BUILDING BLOCKS™

*Drive-By-Wire
Platform*

*Safety
Systems*

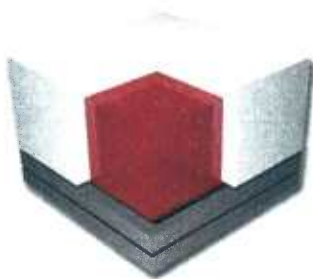
*Power
Distribution*

*Navigation
& Autonomy*

*Operator
Control*



ROBOTIC BUILDING BLOCKS



TORC enables engineers to rapidly integrate robotic systems through a suite of modular, customizable products. TORC's Robotic Building Block products are used by leading academic, commercial and government organizations to shorten the development process, lower costs and mitigate risks. These products have been used on over a hundred mobile robots ranging from 15 pounds to 15 tons.

TORC provides solutions for drive-by-wire conversion, emergency stop, power management, autonomous navigation, and operator control. The ByWire XGV, a drive-by-wire Hybrid Escape with integrated SafeStop safety and PowerHub distribution systems, provides an integration-ready base platform for autonomous system development.

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ByWire™

Rapid Drive-By-Wire Conversion



Drive-By-Wire
Platform

Safety
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Power
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Navigation
& Autonomy

Operator
Control

The ByWire is a rapid drive-by-wire conversion which converts any ground vehicle platform into a remote controlled unmanned ground vehicle (UGV). The ByWire kit has been integrated onto a variety of platforms including Ackerman and skid-steer vehicles. The ByWire features environmentally sealed distributed modules for steering, throttle, braking and shifting, providing reliable and responsive functionality. The ByWire features open loop and closed loop control modes, which can be commanded through Ethernet, RS-232, or CAN interfaces.

- Flexible Vehicle Interface
- Closed-loop Steering & Speed Control
- Auxillary Controls
- Real-Time Vehicle Monitoring
- JAUS Interoperable

Control Inputs

- Open Loop
 - Throttle
 - Steering
 - Brake
 - Shifter
- Closed Loop
 - Desired Speed
 - Desired Acceleration
 - Curvature
 - Rate of Curvature Change

Devices

- Vehicle Start / Disable
- Left / Right Turn Signals
- Hazards
- Horn
- Low Beam Headlights
- High Beam Headlights
- Fog Lights
- Parking Lights

Feedback

- Vehicle Speed
- Individual Wheel Speeds
- Steering Angle
- Throttle Percentage
- Brake Percentage
- Shifter Position
- "Ready-to-Drive"
- Left / Right Turn Signals
- Low Beam Headlights
- High Beam Headlights
- Fog Lights
- Parking Lights
- Door Status
- Errors

ROBOTIC BUILDING BLOCKS

Example ByWire™ Conversions

High Mobility Multipurpose Wheeled Vehicle



Ford Escape Hybrid



Polaris MVR6 6x6

SafeStop™

Wireless Emergency Stop System



Drive-By-Wire
Platform

Safety
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& Autonomy

Operator
Control

- Multi-Level Control Provides Pause and Stop Functionality
- Available in Multiple Frequencies
340-400 MHz, 900 MHz, 1.3 GHz, & 2.4 GHz
- Independent Encrypted Communication
over Spread Spectrum Radio
- Long Range Operation and Extended
Battery Life
- Convenient Handheld Design is
Lightweight and Portable
- Ability to Pair Multiple Transmitters
with a Single Receiver

Leading Emergency Stop System for Unmanned Ground & Surface Vehicles

Safety is an essential requirement for fielding and testing unmanned systems, which is why every unmanned vehicle should be equipped with an independent, fail-safe emergency stop system. The SafeStop is capable of remotely pausing or disabling unmanned ground and surface vehicles from a safe location. This ensures that humans and expensive equipment are protected from the inherent dangers of unmanned vehicle system operation.

The SafeStop transmitter features a handheld design, audible and visual operator feedback, an internal rechargeable battery with up to 12 hours of continuous operation, and line of sight operation of up to 6 miles. Optional external buttons can be mounted anywhere on the unmanned vehicle to further ensure the safety of operators and bystanders.

The SafeStop receiver unit is integrated into the unmanned vehicle and is capable of disabling the unmanned vehicle with hardware contacts or pausing vehicle operation with software messages passed over ethernet or serial interfaces.