



MICROCHIP



Motor Control

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Industry Trends: PMSM motors

- **Higher efficiency and environment friendly**
 - Energy efficiency regulations – appliances
 - Battery life – power tools, drones
- **Lower noise**
 - Consumer demand – appliances, HVAC, auto
- **Higher reliability**
 - Automotive applications
 - Reduced maintenance costs
- **Performance**
 - Higher speed & torque – drones, power tools
- **Smaller form factor, weight reduction**
 - Controller / motor integration, consumer applications

Microchip's Precision Motor Control

- **High-performance dsPIC® DSC and PIC32 MCU cores**

- DSP instruction enhancements
- Speed and torque control
- Field oriented control
- Sensorless control

Efficiency, Performance

Efficiency, Reliability

Efficiency, Low Noise

Lower BOM cost

- **Optimized peripherals & features**

- Flexible, high resolution PWMs
- Intelligent high-speed ADC
- Integrated op-amps and comparators
- Dual motor control capabilities
- Functional safety features & Class B SW

Efficiency, Low noise

Efficiency

Lower BOM cost

Lower BOM cost

System Reliability, BOM

- **Development tools, software algorithms and how-to**

- BLDC, PMSM, ACIM motor support
- Sensorless Field Oriented Control

Reduce time-to-market

Lower BOM cost

Motor Control Evolution

Increasing performance and integration

dsPIC33E

- 70 MIPS
- Improved PWM
- 12-bit ADC
- Op-Amps
- 32 – 512KB flash
- 5x5 mm package

dsPIC33C

- 100+ MIPS
- Improved MC PWM
- Dual dsPIC® DSC cores
- Integrated PGA
- Multiple high speed ADCs
>3 Msps
- 12-bit DAC
- Dead-Man Timer

PIC32MK

- 32-bit core
- 100MHz / 125 DMIPS
- DSP and FPU
- Improved MC PWM
- Op-amps
- Up to 7 12-bit ADCs,
>3 Msps
- 12-bit DAC

Motor Control Development Boards

Low Voltage Development Board

- Low voltage output , 48V/15A
- Single motor control with sensor input
- CAN, LIN, and UART ports



dsPICDEM MCLV-2 Development Board
(Part # DM330021-2)

High Voltage Development Board

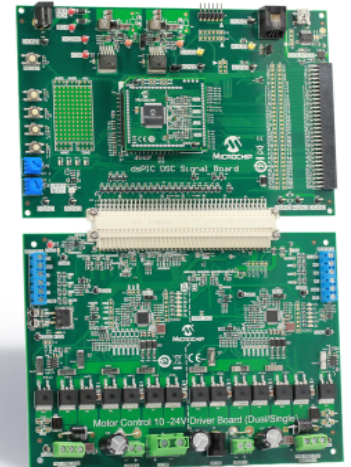
- 110/220VAC input, 1kWatt/400V
- Integrated PFC stage
- Single motor control with sensor input
- Isolated USB, UART, and programmer/debugger



dsPICDEM MCHV-2 Development Board
(Part # DM330023-2)

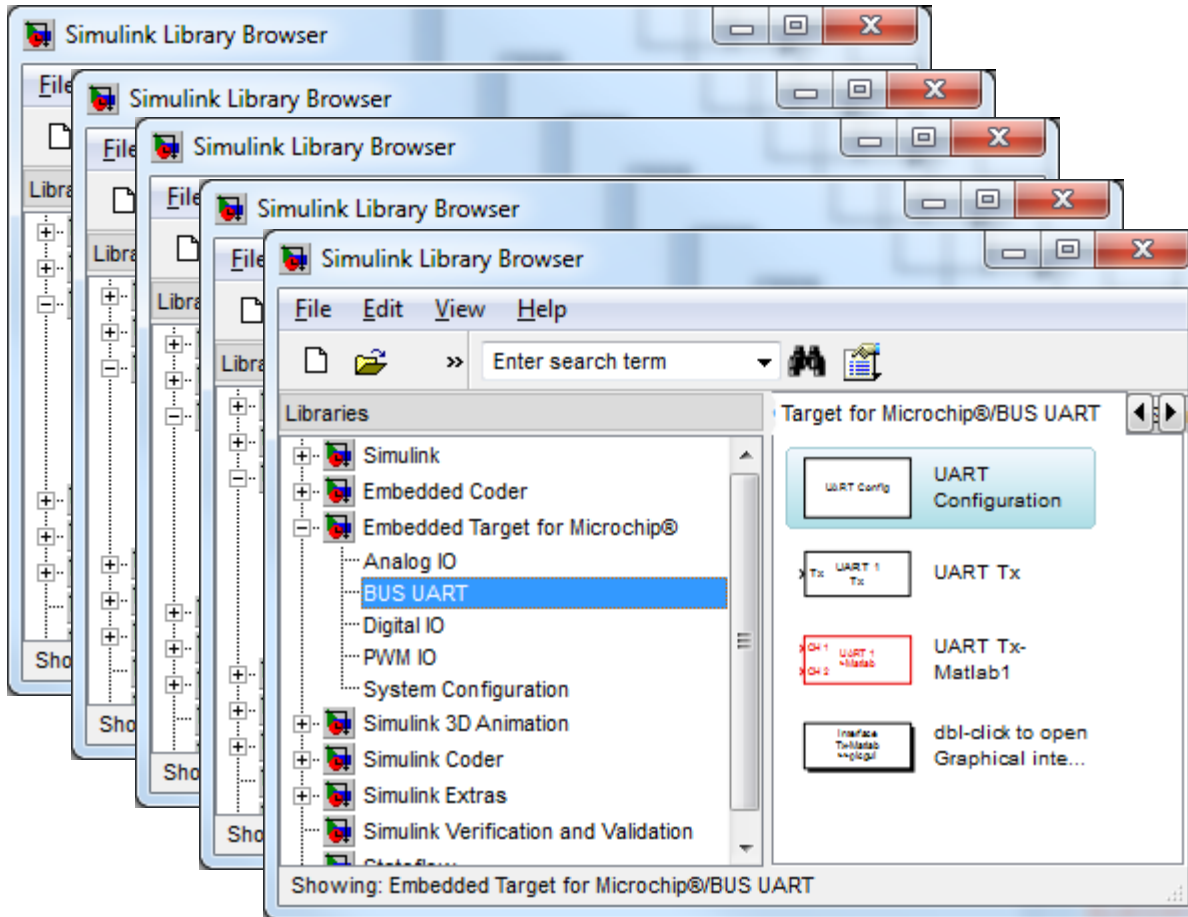
Low Voltage MC Bundle

- Separate control and power boards
- Allows for customer developed power boards
- Power board supports dual motor drive



Part # DV330100

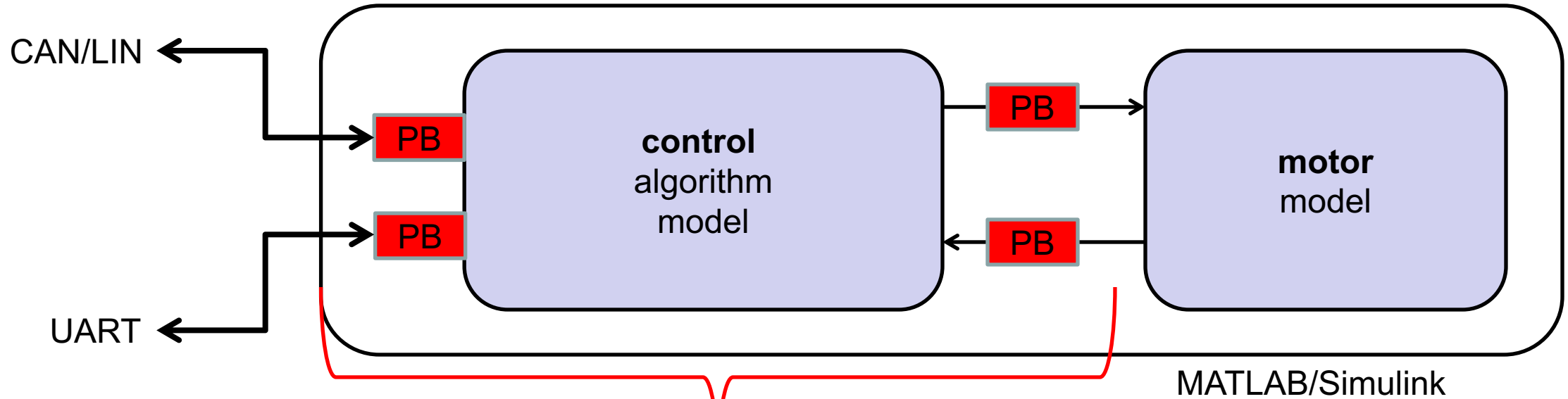
- **MPLAB[®] Device Blocks for dsPIC[®] DSC and PIC32MK**



Content
System Configuration
Digital IO
Analog IO
PWM IO
BUS UART

FREE VERSION
available
(limited to 8 IO pins)
dsPIC33EP256MC506 unlimited

Code Generation and Integration



A single model is used for simulation and code generation.
Environment Controllers select between Simulation and code generation.

Algorithm is developed in the datatype that is used on the uC.

Code Generation

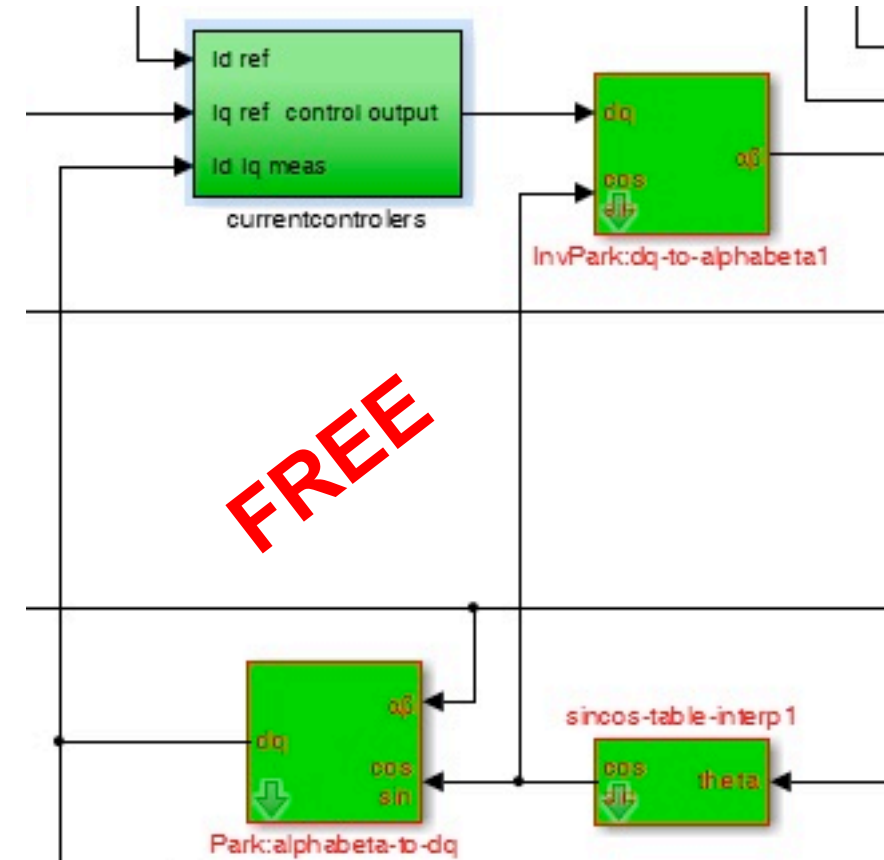


Motor Control Library

optimized MC library functions for FOC:

- transformations:
- park, clark, inv. clark, inv. park
- PI controller
- atan, sin, cos
- etc.

Simulink model for simulation and
ASM library for code generation
for maximum performance on the target



- **Simulation**

- control
- motor
- load

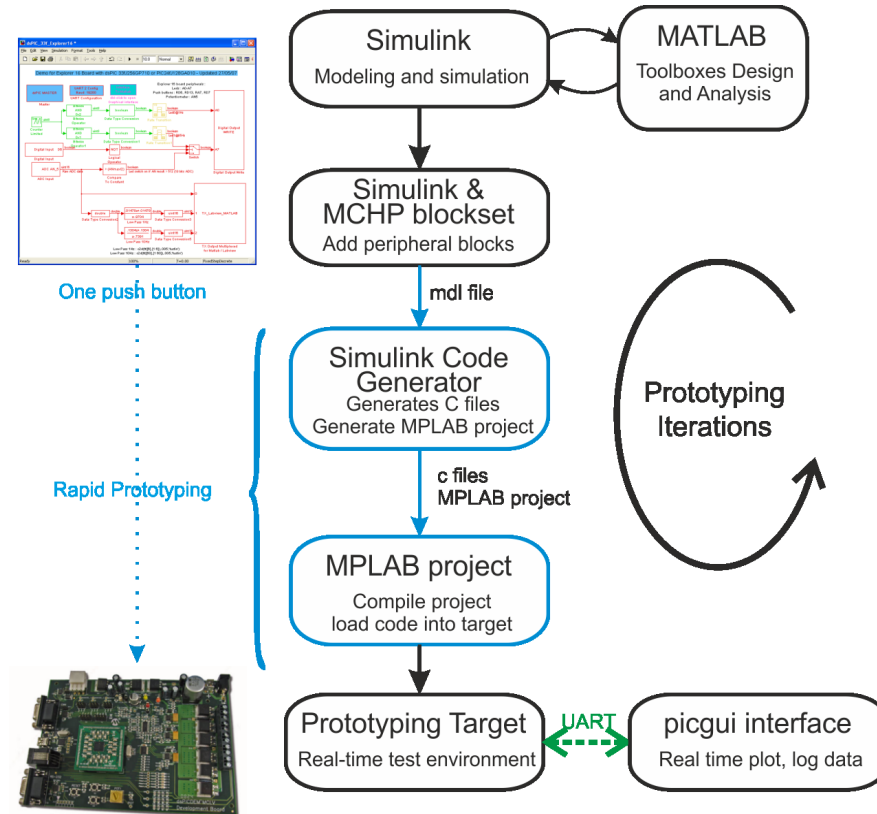
- **Code Generation**

- **Programing**

- **Validation**

- **Seamless integration in Simulink**

no additional IDE needs to be touched

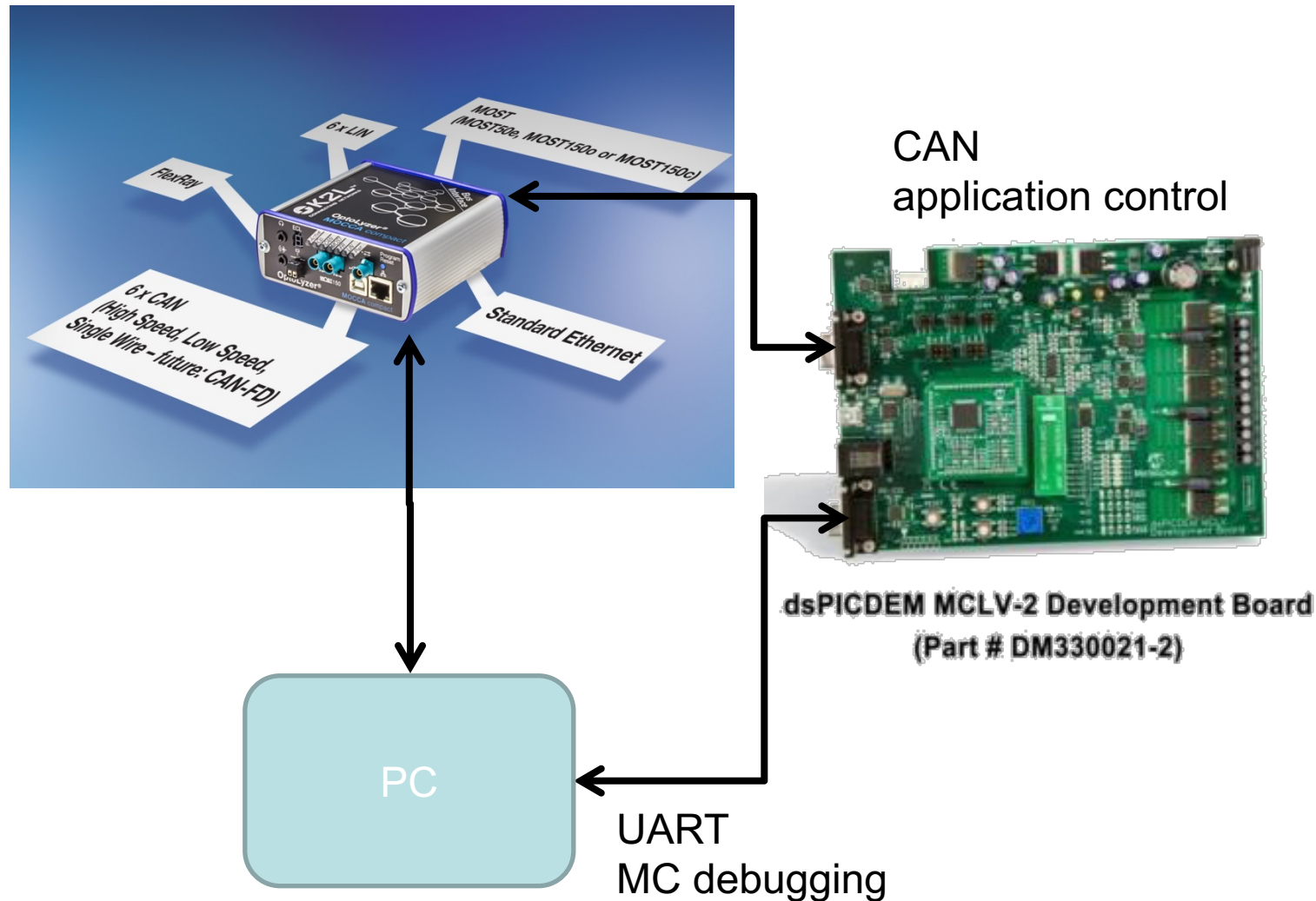


picgui:

high speed data visualisation
records up to 7 signal at 20kHz
realtime

Automotive Communication Interfaces

CAN/LIN support for MATLAB

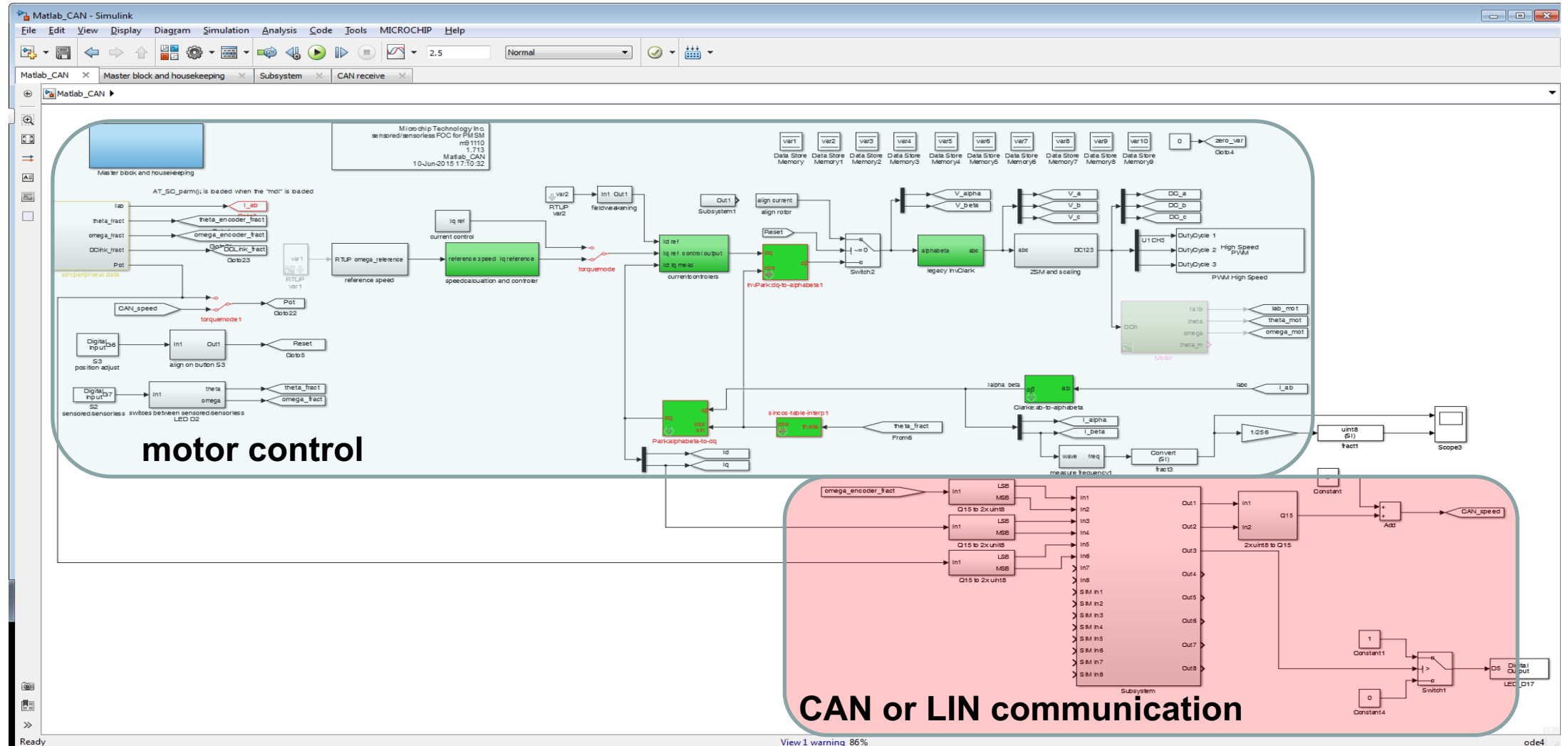


certified LIN Stack
from IHR (www.ihr.de)

Microchip CAN driver

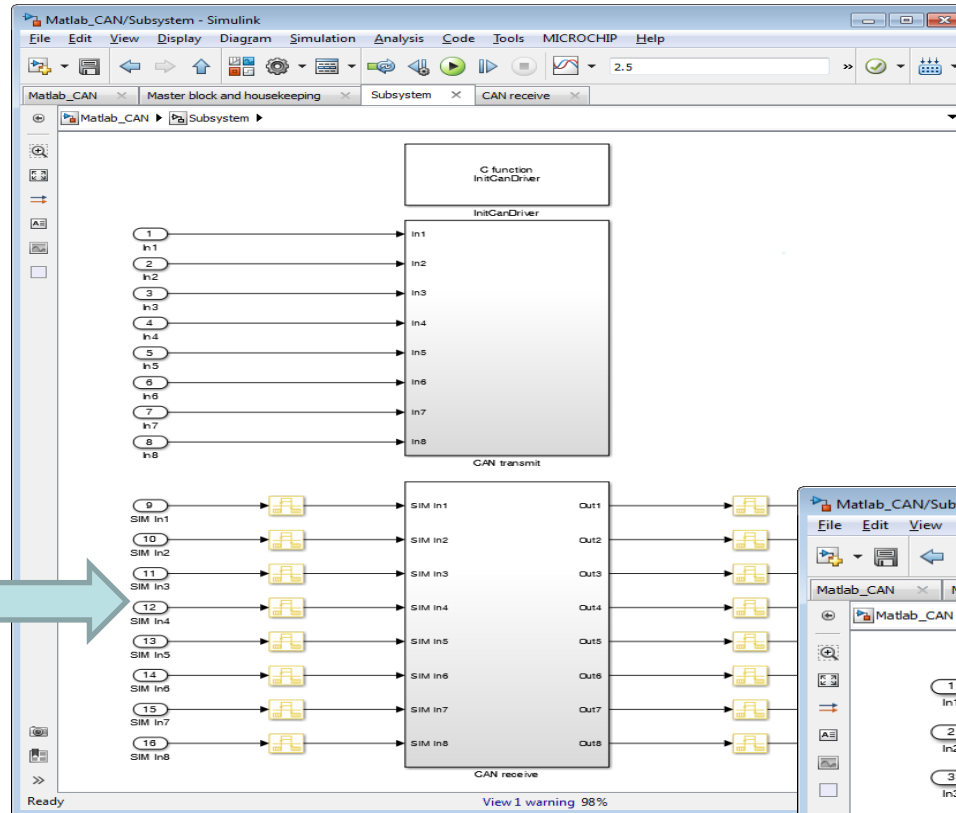
CAN/LIN debugtools:
K2L MOCCA box
(www.k2l.de)

CAN/LIN support for MATLAB



CAN/LIN support for MATLAB

simulatable
CAN/LIN
messages



Sink Block Parameters: C Function Call

C Function Call (mask) (link)

Function **Pins Configuration**

☒ Parse user file to list functions available (need to re-open this block GUI)

Functions found: `void CAN_PutData(uint8_t * data)`

Function Declaration:
`void CAN_PutData(uint8_t * data)`

☐ Add this function declaration in header file

execute function: `when block is updated (default)`

Block Input (coma separated function parameters)
`data`

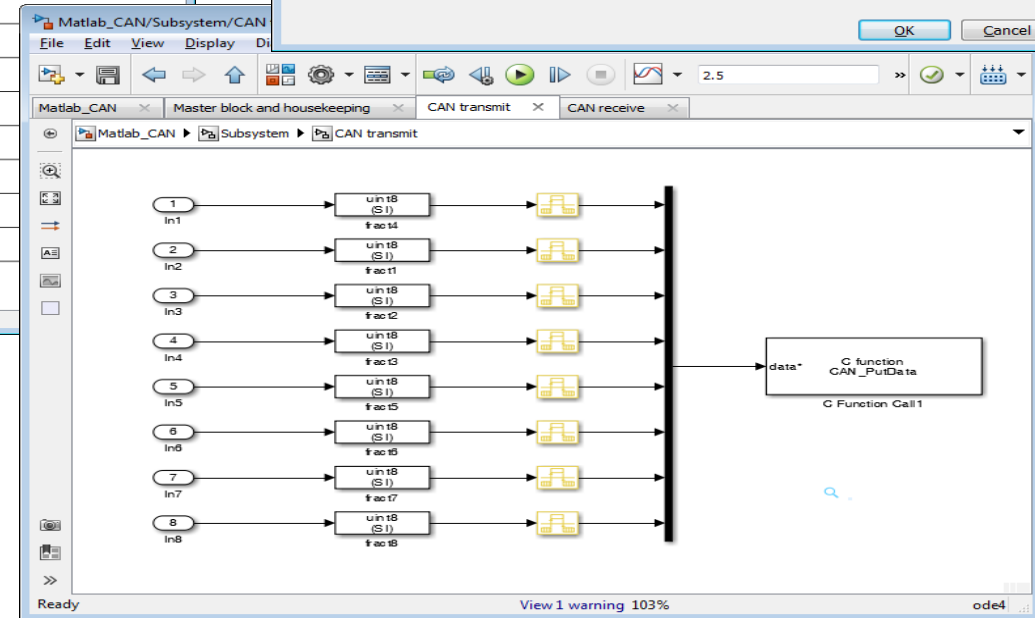
☐ Function returned value is a block output (return value must be a scalar or a struct)

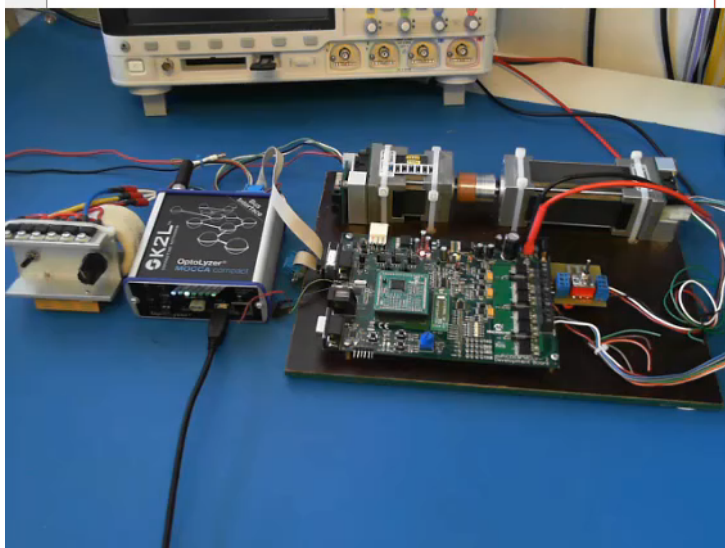
Block Output (coma separated function parameters)

Block execution ordering `None`

Sample Time
`-1`

OK Cancel Help Apply





Take aways

- **Rapid Prototyping incl. existing C-libraries**
- **Automotive application developement**
- **Seamless integration with Simulink environment**



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