# Workbench®

All in one solution.
A single platform.

Workbench is a platform solution that comprises measurement, I/O, automated test, user interfaces, Real–Time multitasking and embedded control system development with the benefits of fully compatibility with Matlab® and Simulink®, as well Embedder Coder® as an option for fully autonomous mode operation.

It's the first Simulink supported platform designed for both academia or research usage, and mass production ready. It´s I/O roughness virtually makes the platform student–safe while maintaining the needed operational performance that engineers and scientists need to build their measurement and control systems with the high level programming approach provided by Simulink®
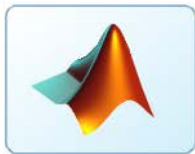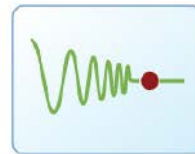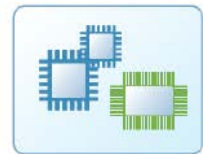
Designed for Simulink®	At first time Matlab® independent high-performance user interface executables could be created as Simulink® diagrams, ideal solution for automated tests	Measurement and I/O are extremely easy to integrate due to the vast analogue and digital Workbench provided ports:	State of the art computational system enables several Real-Time based tasks with 10 microseconds as minimal step time
Take advantage of Matlab® potential. M code is suitable to being used in Simulink®		ADC , DAC, PWM outputs, PWM inputs, I2C, SPI, parallel digital, RS-485, RS-232, CAN bus, USB, timers, Ethernet, WiFi, Bluetooth	Double floating point support via hardware
Added libraries provide continuous-time support, you don´t need to discretize your models in order to run them on target platform			

Program the way you think

Block diagram

Work better, faster and easier using a high abstraction approach instead on waste time on low-level details

User Interface

Created standalone user interfaces from Simulink® diagrams

Deployment targets

Use the Workbench® platform directly from basic Simulink® as a powerful I/O device, or automatically deploy the generated code for running as standalone on Workbench® or Rad-Hard Workbench®

I/O and prototype powering

Connect commercial or custom sensor devices into the Workbench® provided analogue and digital ports. As well Workbench® provides with common voltage power rails in order to bring life to your prototypes and sensors

Requirements
and operation modes

MS3 Research® is awareness of software prerequisites; instead other Matlab® and Simulink® enabled systems, Workbench® platform can be operated from most basic Simulink® installation, it doesn't require as mandatory any additional toolboxes such as Matlab Coder®, Simulink Coder®, Embedder Coder® or Instrument Control® toolboxes. Matlab®/Simulink® software support is provided by MS3 Research® proprietary Beyond Control blockset® software, suitable for Matlab® version from 2011 to 2020. Support for past Matlab® versions is guaranteed.

Additionally it requires Embedder Coder® for autonomous mode operation. The deployment is performed automatically.

Workbench® is ready to be used by basic academic Matlab® campus license to more completed, as well expensive, campus licenses.
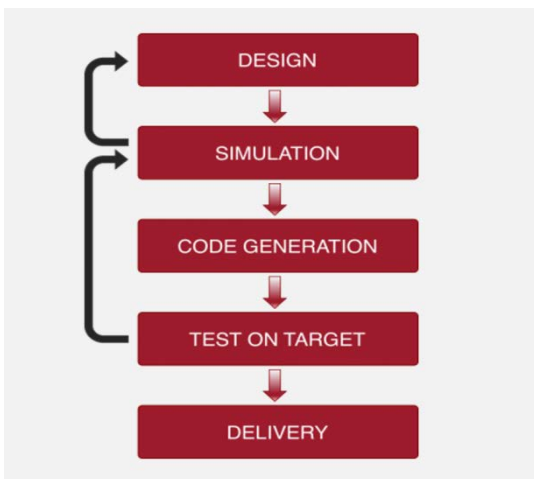

Autonomous mode

This approach requires Embedder Coder® in order to generate MISRA C compliance code for Workbench® target deployment.

The result is an autonomous system which smaller step time is 10 microseconds

Autonomous mode is more suitable for research and professional usage that requires a self-running system or best controller performance, or mass production needs
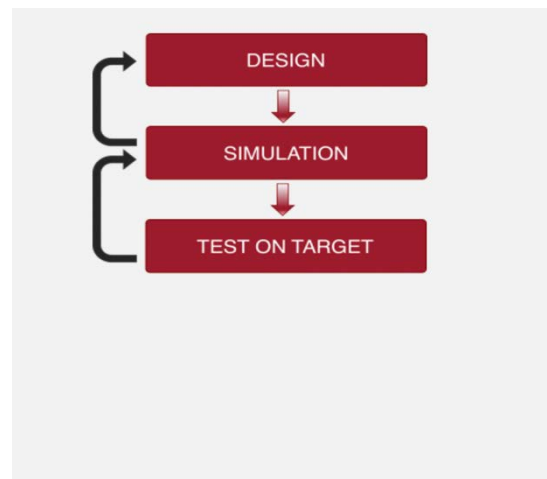
Connected mode

This approach only requires Matlab® and Simulink®

Workbench® can be used as a powerful and low cost I/O and measurement device that provides Simulink® blockset for easy usage

Minimal step time depends upon host computer performance, typically 2 KHz can be achieved. Suitable for academia, research and professional usage

Workbench® models

Workbench® platform is available in two models.

The first one is based on a state of the art, and commercially available at low cost, computational system that provides a vast analogue and digital front-end ports. Its computational power deliver on hardware double floating point precision suitable for up to 5 Real-Time tasks, suitable for safe critical scenarios that requires MISRA C compliance coding. Minimal step time is 10 microsecond. This is the typical system for academia, research and professional usage. A commercially available controller can be used instead Workbench® system, losing some interfaces and the roughness of course.
CE and FCC testing are performed and granted.

The second available model is more special, is built around the most state of the art and **low cost radiation hardened controller** technology suitable for extreme hazardous on-Earth environments. As well it could be used as deep space exploration development and testing platform. The used Rad-Hard controller provides enough computational power for up to 3 Real-Time tasks. Also the generated code is fully MISRA C compliance.
This is the first low cost Matlab® and Simulink® enabled Rad-Hard platform, suitable for prototyping and mass production.
CE and FCC testing are performed and granted, flight model qualification is actually pending. Rad-Hardening is ensured by component selection, Space grade components are the selected ones.

Workbench® technical specs

Workbench® specifications

- CPU based on 32 bits ARM-Cortex M7 running at 480 MHz
- Double floating point support
- 2 MB program memory – 1 MB RAM memory
- 16x 16 bits analog inputs; 8x (0 up to 3 volts) and 8x (-10 to 10 volts)
- 16x 12 bits analog outputs; 8x (0 up to 3 volts) and 8x (-10 to 10 volts)
- 8x 12 bits PWM outputs; up to 20 mA per output rated at 5 volts
- 4x Quadrature Encoder Inputs or 4x PWM inputs, selectable function
- 8x Digital Inputs or External Interrupt events, selectable function
- 6x Digital Outputs, PWM outputs can be used as more Digital Outputs
- 2x SPI interfaces
- 1x I2C interface, suitable for 100, 400 and 1000 KHz
- 1x 10 Mbits/s RS 485 interface
- 1x 256Kbaud RS 232 interface
- 1x CAN2.0B, tested up to 1,25 MBits/s . (A second CAN bus is optional)
- 2x USB interfaces, one guaranteed at 12 MBits/s and second one at 2 MBits/s
- 1x 10/100M Ethernet interface
- 1x Bluetooth (optional)
- 1x Wifi (optional)

Rad-Hard Workbench® specifications

- CPU based on 32 bits ARM-Cortex M4F running at 100 MHz
- Single floating point support
- 128 KB program memory – 384 KB RAM memory with EDAC (2 MB optional)
- 16x 12 bits analog inputs
- 2x 12 bits analog outputs
- 8x 12 bits PWM outputs
- 4x Quadrature Encoder Inputs or 4x PWM inputs, selectable function
- 8x Digital Inputs or External Interrupt events, selectable function
- 8x Digital Outputs,
- 2x SPI interfaces
- 2x I2C interfaces, suitable for 100, 400 and 1000 KHz
- 1x 10 Mbits/s RS 485 interface
- 1x 256Kbaud RS 232 interface
- 1x CAN2.0B
- 1x FireWire interface