# Bypassing with CCP

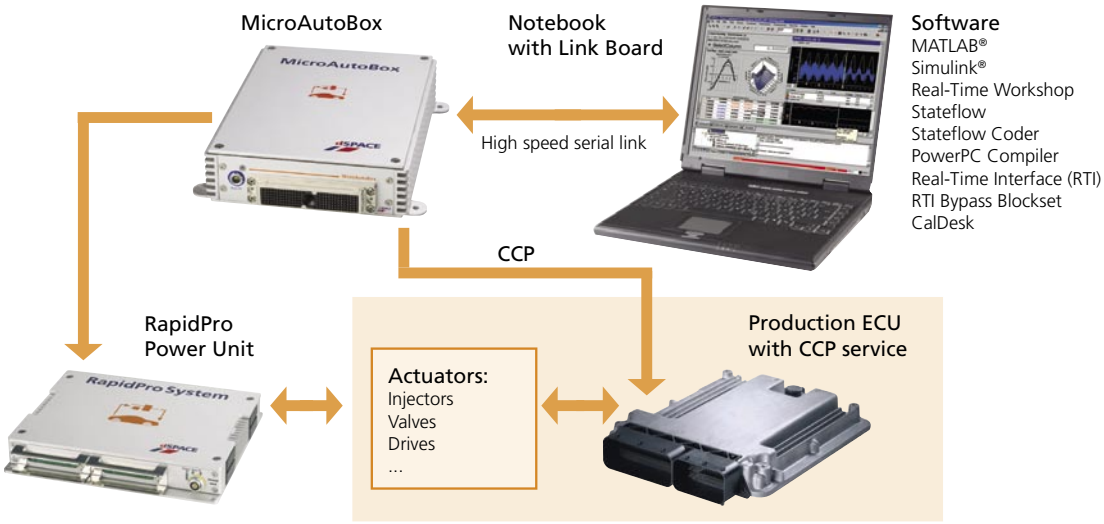
- Bypassing with CCP ECUs
- Minimum implementation work
- Real-time data capture in ECU tests

Electronic control units (ECUs) frequently have a CCP implementation (CAN Calibration Protocol) for measurement and calibration tasks. With the new Real-Time Interface (RTI) Bypass Blockset 2.2 from dSPACE, an existing CCP implementation can also be used for function bypassing. Only minor modifications to the ECU code are required for this, or even none at all. Due to its minimized implementation effort, bypassing via CCP is a cost-effective approach, particularly where a bypass scenario does not need the performance with regard to latencies between ECU and prototyping system that would be provided, for example, by XCP on CAN.

Used together with the new RTI Bypass Blockset 2.2 from dSPACE, an existing CCP implementation in an ECU opens up a wide range of application options:

## Function bypassing with minimum modifications to ECU code

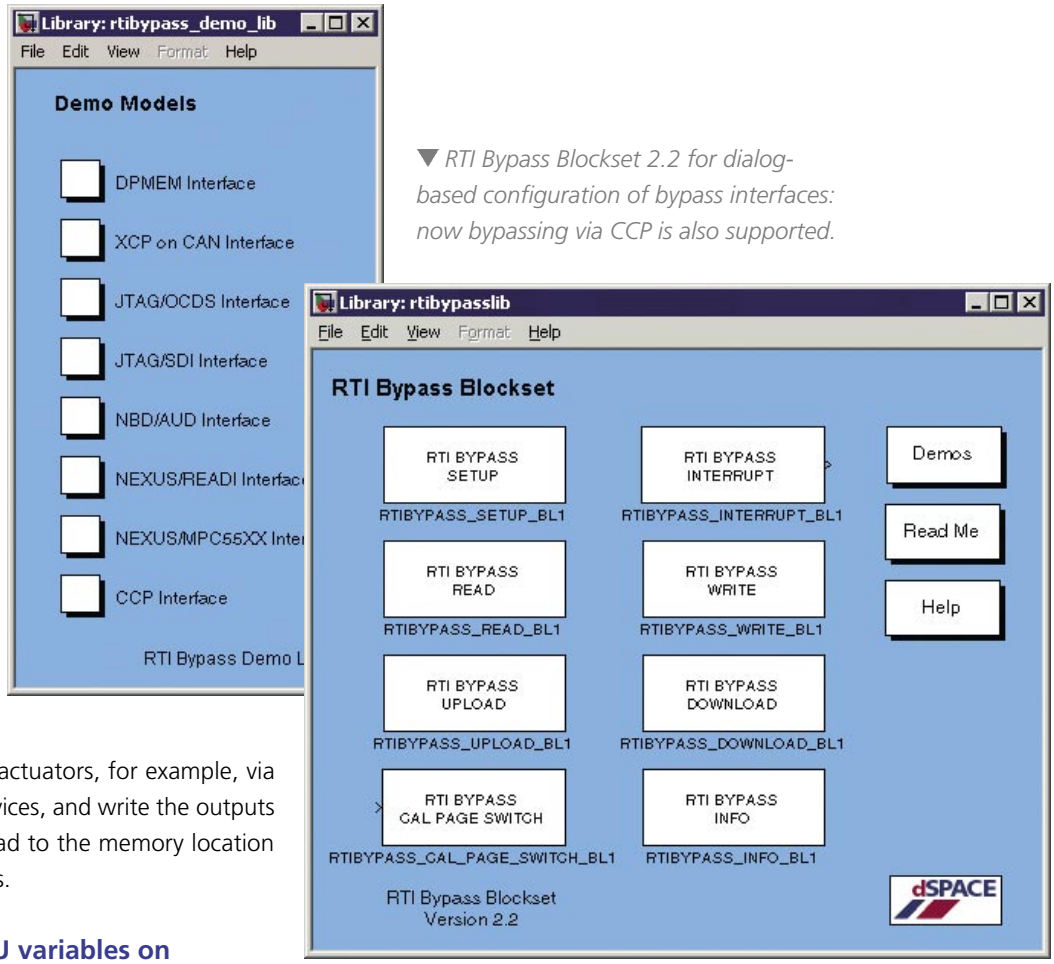
To prepare certain functions in the ECU code for bypassing, only small code modifications are necessary to guarantee the consistency of data written to the ECU. No service implementation is needed. The prototyping system, for example, MicroAutoBox, can capture the input variables of the functions to be bypassed from the ECU via CCP upload or CCP DAQ mechanisms. The prototyping system executes the bypass functions in real time and writes the values of the function outputs back to the ECU via CCP download. The consistency of the downloaded data can be ensured by appropriate modifications to the ECU code. dSPACE provides an example implementation for this.




▲ *Function bypassing with no modifications to ECU code. Inputs to the bypass function are captured via the CCP DAQ mechanism, and the outputs are connected directly to the actuators via RapidPro.*

## Function bypassing with no modifications to ECU code

A typical approach to developing new ECU functions is to capture the input variables of the bypass function on the ECU via the DAQ mechanism, then calculate the function in real time on the prototyping system, and couple the function outputs directly with the corresponding actuators in the vehicle via power stages in a RapidPro Power Unit. An alternative is to open up the ECU-internal signal path for controlling the actuators, for example, via dedicated diagnostic services, and write the outputs directly via CCP download to the memory location of the actuating variables.




▼ *RTI Bypass Blockset 2.2 for dialog-based configuration of bypass interfaces: now bypassing via CCP is also supported.*

## Measurement of ECU variables on real-time platforms in ECU tests

RTI Bypass Blockset 2.2 supports a variety of real-time platforms (MicroAutoBox, DS1005, DS1006) and I/O boards (DS4302) from dSPACE. Support for DS2202 and DS2211 is under development. Thus, it will become possible to capture ECU-internal data on hardware-in-the-loop (HIL) systems in real time via CCP.

## Features of CCP

CCP is particularly suitable for bypass scenarios whose latency requirements are not so tough, or that do not permit modification to the ECU code. Unlike XCP on CAN, which provides the data stimulation method (STIM), CCP has no options within the protocol for transmitting data to the ECU synchronously. With CCP, every single value needs a CCP download instruction to be transmitted, and an acknowledgement from the ECU is required each time. This causes – compared to XCP on CAN – higher latencies in writing the output values from the bypass function to the ECU. However, if a CCP implementation is already available on the ECU, it is usually unnecessary to integrate another service for the bypass task, so that time and costs can be saved.

## Glossary

**Bypass service –**
Software modifications in an ECU that make the input variables for the bypass function available to the RCP system, and that trigger the calculation of the bypass function. When the RCP system returns the function output variables, the bypass service feeds them back into the ECU's program sequence.

**DAQ mechanism –**
Method of synchronous capture of measurement data in an ECU. Has a low protocol overhead, as no address data has to be transmitted with the measurement data during a running measurement.