

# $\mu$ LC测试系统

## $\mu$ LC Test System



得益于紧凑的尺寸设计17 cm x 11 cm x 6 cm, 该新型硬件在环测试系统HIL -  $\mu$ LC测试系统适用于包括移动场景在内的多种应用。因为系统简单化设置, 初始化设置过程只需不到10分钟。

它是一个紧凑的开环测试系统, 用于ECU开发过程的质量验证, 并将所有典型的汽车传感器的仿真和通信协议整合在一起。其人机界面友好, 易于操作和评估。

$\mu$ LC测试系统主要用于具有传感器和总线系统的典型接口的车辆控制单元, 如模拟或数字输入输出、PWM信号、SENT、CAN、LIN和速度传感器。

The new and modern hardware-in-the-loop test system  $\mu$ LC Test System is suitable for mobile application, measuring a compact 17 cm x 11 cm x 6 cm. Initial test setup typically takes under ten minutes, since the system allows for a simple test setup.

It is a compact open-loop test system for quality assurance of control unit development and combines the simulation of all typical automotive sensors and communication protocols in one unit. Its interface is user-friendly and enables an easy operation and evaluation.

The  $\mu$ LC Test System is especially used for automotive control units with typical interfaces for sensors and bus systems such as analogue or digital inputs and outputs, PWM signals, SENT, CAN, LIN and speed sensors.

### 功能 Functions

#### 发动机速度模拟

- 最大20,000 rpm
- 支持的传感器类型: 霍尔行, 电磁感应型, DG23i, TL4953
- 最多2个曲轴, 4个凸轮轴
  - 每个都可独立配置
  - 副轴
  - -180 到 180°凸轮轴调整
- 示波器触发信号, 便于监控
- EPM故障模拟

#### Engine Speed Simulation

- Up to 20,000 rpm
- Supported sensors: Hall, inductive, DG23i, TL4953
- Up to 2 crankshafts, up to 4 camshafts
  - each is independently configurable
  - auxiliary shaft
  - -180 to 180° camshaft adjustment
- Oscilloscope trigger signal for easier monitoring
- Error simulation for engine position management EPM

#### 汽车总线

- 2条CAN线, 最大1 MBit/s 总线终端电阻 (120欧姆) 可替换
- 主/从动装置
- SENT J2716 2012 4路输出, 可替换为PWM输出

#### Vehicle Busses

- 2 \* CAN, up to 1 MBit/s switchable 120 Ohm CAN bus terminator
- LIN Master/Slave
- SENT, full J2716 Jan. 2012 standard 4 Outputs, alternative to PWM output

#### 模拟接口

- 8路10比特DAC, 0V到5V, 最大5mA, 供应内部或外部
- 4路12比特DAC, 0V到5V, 最大5mA
- 6路12比特DAC, 0V到40V, 接地参考

#### Analogue Interfaces

- 8 \* 10 bit DAC 0 to 5 V, max. 5 mA Internal or external supply
- 4 \* 12 bit DAC 0 to 5 V, max. 5 mA
- 6 \* 12 bit ADC 0 to 40 V, GND reference

#### 数字接口

- 6路数字输出, 最大总电流200mA 输出模式: 接地, 12V, 高阻抗
- 2个继电器, 最大电流10A, 独立的ECU电源和ECU主继电器传感器
- 2路PWM输入, 8 Hz 到20 kHz
- 4路PWM输出, 最大总电流90mA, 0.1 Hz 到20 kHz, 输出电压: 12V, 5V, 接地
- 具有子信号的复杂PWM, 在频率, 占空比和脉冲数方面均独立可调

#### Digital Interfaces

- 6 \* Digital Out, max. 200 mA in total Output modes: Ground, 12 V, High impedance
- 2 \* Relays, max. 10 A, separate ECU power supply possible and incl. main relay sensing
- 2 \* PWM input, 1 Hz to 20 kHz
- 4 \* PWM output, max. 90 mA in total, 0.1 Hz to 20 kHz, Output voltages: 12 V, 5 V, GND
- Complex PWM with sub signals, each separately adjustable in frequency, duty cycle and pulse count

**附加特性**

- 节气门体仿真
- 缸内压力模拟，一个装置最多可模拟8个气缸,可在多个设备上扩展
- 完全电流解耦的USB连接
- 所有输入输出均有短路和静电保护
- 电磁兼容性测试通过
- 包含额外硬件的扩展板
- 支持发动机速度信号的多设备同步

**Additional Features**

- Throttle body simulation
- Cylinder pressure simulation , Up to 8 cylinders with one device, Expandable with multiple devices
- USB connection completely galvanic decoupled
- All in- and outputs short-circuit protected and ESD protected
- EMC tested
- Expansion boards for additional HW features
- Multi device support with sync option for engine speed signals

**技术规格**

工作电压	12 V 直流
电流消耗	典型 < 1 A
ECU 电压	12V/24V 直流
ECU 电流	10 A
允许的操作温度	0°C - 40°C
外壳材料	铝
外形尺寸	175 mm x 107 mm x 61 mm
重量	690 g

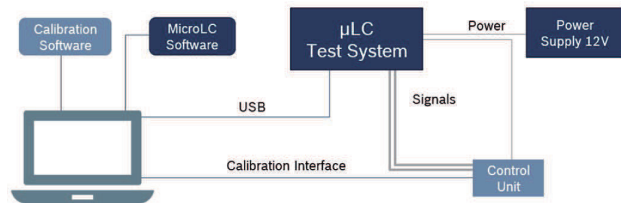
**材料属性**

- 外壳材料: 铝
- PCB板: FR4, 铜, 焊锡 (不含铅)
- 螺丝钉: 钢

**Material properties**

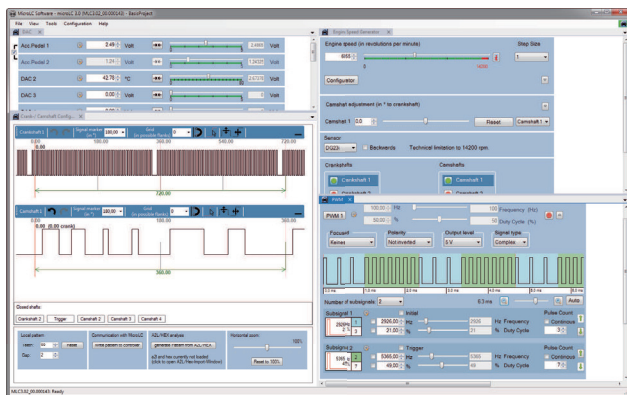
- Housing material: aluminum
- Printed circuit boards: FR4, copper, solder (lead-free)
- Screws: steel

**测试搭建 Test Setup**



**Technical Specifications**

Operating voltage	12 V DC
Current consumption	typ. < 1 A
ECU voltage	12 V / 24 V DC
ECU current	10 A
Permissible operation temperature	0°C to 40°C
Housing material	Aluminum
Dimensions	175 mm x 107 mm x 61 mm
Weight	690 g



截图显示为 $\mu$ LC测试系统软件

The screenshot shows the MicroLC Software with analog outputs, crank-/ camshaft, RPM and complex PWM.

**订购信息**

**$\mu$ LC测试系统**

订购号码: **F 02U V02 303-02**

**Ordering Information**

**$\mu$ LC Test System**

Order number **F 02U V02 303-02**

**Represented by:**

**Europe:**  
Bosch Engineering GmbH  
Motorsport  
Robert-Bosch-Allee 1  
74232 Abstatt  
Germany  
Tel.: +49 7062 911 9101  
Fax: +49 7062 911 79104  
motorsport@bosch.com  
www.bosch-motorsport.de

**North America:**  
Bosch Engineering North America  
Motorsport  
38000 Hills Tech Drive  
Farmington Hills, MI 48331-3417  
United States of America  
Tel.: +1 248 876 2977  
Fax: +1 248 876 7373  
motorsport@bosch.com  
www.bosch-motorsport.com

**Latin America:**  
Robert Bosch Ltda  
Motorsport  
Av Juscelino Kubitschek de Oliveira  
11800  
Zip code 81460-900 Curitiba - Parana  
Brazilia  
Tel.: +55 41 3341 2057  
Fax: +55 41 3341 2779

**Japan:**  
Bosch Engineering Japan K.K.  
Motorsport  
18F Queen's Tower C, 2-3-5 Minato  
Mirai Nishi-ku, Yokohama-shi  
Kanagawa 220-6218  
Japan  
Tel.: +81 45 650 5610  
Fax: +81 45 650 5611  
www.bosch-motorsport.jp

**Australia, New Zealand and South Africa:**  
Robert Bosch Pty. Ltd  
Motorsport  
1555 Centre Road  
Clayton, Victoria, 3168  
Australia  
Tel.: +61 (3) 9541 3901  
motor.sport@au.bosch.com

**China:**  
Bosch Trading (Shanghai) Co. Ltd.  
Bosch Engineering - Motorsport  
333 Fuquan (N.) Road  
Shanghai 200335  
P.R. CHINA  
Tel.: +86 21 2218 1116  
BEG.China@cn.bosch.com  
www.bosch-motorsport.com