

M=BUS PRO LAB

Modular data acquisition systems for stand alone applications such as pedestrian safety.

- | Independent stationary data acquisition system developed for lab, pedestrian safety and firing devices applications
- | Compatible with M=BUS Pro and In-Dummy DAS
- | Modular from 8 to 56 analog channels (in steps of 8 channels)
- | Sensor input channels available via individual Lemo connectors with non-volatile data buffer able to record up to 3h @ 20 kHz
- | Digital input module with 16 channels
- | Fire and measurement module with 4 or 8 channels
- | With built in 10/100 BaseT Ethernet or USB 2.0 gateway
- | 19" or 11" width rack available
- | Including CrashSoft 3 software



Figure 1: M=BUS Pro LAB

DESCRIPTION

M=BUS is a single wire BUS system which is available for InDummy, Onboard and Offboard (laboratory) use. All applications are controlled by a Gateway, which is the interface between the M=BUS System, the trigger, power supply and the PC.

M=BUS Pro LAB represents the offboard system. Different modules are available to acquire data from resistive transducers, digital signals or to fire and/or measure firing devices.

As such, the user is able to configure an efficient system tailored to the specific testing requirements.

The M=BUS Pro LAB units are designed to work with strain-gauge and other piezo-resistive sensors. Digital signals can be easily recorded and airbags can be deployed at a desired time.

APPLICATIONS FOR STATIC TESTS

- | Dummy calibration
- | Airbag deployment tests
- | Drop tower tests

Main Features

- | With the modular M=BUS Pro LAB System you will have more flexibility in utilizing only the necessary amount and type of modules for your tests.
- | Always be ready for future developments due to the state-of-the-art components as well as the concept of future orientation.
- | Up to 7 DAS modules and one FAM/FIRE module can be fixed side by side in the 19" rack.

SYSTEM COMPONENTS

Analog Module

This M=BUS LAB Analog device is designed to acquire 8 channels of data from any conventional resistive type transducer.

Digital Module

The M=BUS Pro LAB Digital unit is designed to acquire digital events from such sources as a trigger or contact switches. The 16 available channels are paired in 8 groups, which are galvanically isolated. Each LEMO connection provides an auxiliary voltage of 5 Volts (up to 12V per channel). To acquire digital events very accurately, the unit sampling rate can be programmed up to 1 MHz.

M=BUS Pro FAM/FIRE Module

The ignition time of airbags and pre-tensioners can be programmed and measured with the M=BUS Pro FAM/FIRE Unit.

Ethernet Gateway Module

The M=BUS Ethernet Gateway is the standard interface device for all complex test setups. The Gateway covers your needs with two external M=BUS lines. 1 line is used to connect up to 7 internal LAB boards. 2 lines are remaining which can be used to connect crashproof M=BUS Pro modules or in Dummy loggers.

USB Gateway Module

It connects the M=BUS LAB data loggers via USB 2.0 directly to a host PC. The USB Gateway supports max. 7 M=BUS Pro LAB boards

CrashSoft Operating Software

Including the following features:

- | M=BUS Tool Software
- | M=BUS Executor
- | CrashSoft3 Workshop
- | Reporting module

EXAMPLE OF A M=BUS PRO LAB UNIT



Figure 2: M=BUS Pro LAB

No.	Description
1	M=BUS Pro Lab FAM/FIRE Module
2	M=BUS Pro Lab or Ethernet Gateway Module
3	M=BUS Pro Lab Analog Module
4	M=BUS Pro Lab Digital Module
5 - 9	M=BUS Pro Lab Analog Module

M=BUS PRO ANALOG MODUL

8 channel unit for acquiring analog signals from any resistive transducer



Figure 3: M=BUS Pro LAB Analog Module

- | Complete signal conditioning for strain gauges
- | 16 bit resolution
- | Max. 100 kHz sampling rate
- | 3 hours recording time with 8 channels @ 20 kHz
- | High voltage measurement / sense input
- | Internal shunt resistors
- | Sensor resistor check
- | Internal bridge completion
- | Bridge current measurement
- | Single ended and differential voltage measurement

DESCRIPTION

The M=BUS Pro LAB Analog modules are independent 8 channel units designed to acquire data from resistive transducers connected over LEMO 1B connectors. Two different pin assignments are available; a standard pin assignment and a NA3x pin assignment. The analog frontend is programmable to adapt the full range of existing sensors and is specially protected against over voltage and short circuits. For the highest level of data security the DAS is equipped with a 4 GB Flash memory.

The new MultiSwitch technology on one hand provides the opportunity to enable a bridge completion on one of both signal inputs. On the other hand it can switch a shunt resistor to the positive excitation voltage and ground respectively for each channel. High voltage measurement between -50 V and +50V possible. To take advantage of the complete measurement range and optimum gain, the 16 Bit high resolution hardware offset adjustment of the M=BUS Pro Analog module is able to compensate the sensors offset over the full input voltage range.

PIN ASSIGNMENT

M=BUS Pro 8 channel - 4 GB Analog - 4BB-D21-1

Standard Pin Assignment of Analog Channels (socket view): Use this plug: LEMO FGG 1B 307 ...



Figure 4: Pin Assignment M=BUS Pro LAB Analog Input standard pinning

Pin	Description
1	Not connected
2	ID-module
3	Positive sensor input
4	Positive excitation (+5 V)
5	Negative excitation (GND)
6	Negative sensor input
7	-50 V ... +50 V input

The socket housing is connected to ground

M=BUS Pro 8 channel - 4 GB Analog - 4BB-D21-2

NA3x Pin Assignment of Analog Channels (socket view): Use this plug: LEMO FGG 1B 307 ...



Figure 5: Pin Assignment M=BUS Pro LAB Analog Input NA3x pinning

Pin	Description
1	Positive excitation (+5 V)
2	Negative excitation (GND)
3	Positive sensor input
4	Negative sensor input
5	-50 V ... +50 V input
6	ID-module
7	Not connected

The socket housing is connected to ground

TECHNICAL SPECIFICATIONS OF ANALOG MODULE 4BB-D-21

General:

Supported channels	8
Power consumption	< 2 W
Trigger	System trigger
Conformity	SAE-J211, ISO6487

Signal Conditioning:

Sample rate	20 kHz / 100 kHz
Analog bandwidth (-3 DB)	>60 kHz @ gain 2,000
Resolution	16 bit
Recording time	up to 3 hours with 8 channels and 20 kHz (4 GByte Memory)
Antialiasing filter	Digital 2.5 kHz @ 20 kHz / 12.5 kHz @ 100 kHz passband ripple 0.001 dB
Bridge excitation voltage	5 V \pm 0.1 % (short circuit protection) max. 25 mA
Sensor Input voltage	\pm 1.25mV/V... \pm 500 mV/V
High voltage measurement	-50V...+50 V
Offset adjustment	0...5 V with 16 Bit resolution
Single ended	0...5 V with 16 Bit resolution
Minimal bridge resistance	200 Ω per channel (short circuit protection)
Shunt	Internal shunt resistor for positive and negative signal input
Bridge completion	Half bridge completion for positive or negative signal input
Bridge current measurement	Separate current measurement for each bridge
ID-Module	Dallas ID over separate pin
Supported instrumentation	All resistive transducers, active sensors up to (5 V / 17 mA)

M=BUS PRO DIGITAL MODUL

16 channel unit for acquiring digital events with individually programmable switching thresholds.



- | 16 channel data acquisition unit
- | 4 GB memory
- | Max. 1MHz sampling rate
- | 1.5 hours recording time with 16 channels @ 20 kHz
- | Sensor supply current voltage measurement

Figure 6: M=BUS Pro LAB Digital Module

DESCRIPTION

The M=BUS Pro Digital module is designed to acquire digital events like trigger or contact switches. The 16 channels are paired in 8 groups (2 channels per LEMO 1B connector A: 0...5 V / B: 0...15 V). To acquire events accurately the sampling rate can be programmed up to 1 MHz.

The M=BUS Pro Digital module can also acquire unipolar analog signals with a resolution of 12Bit. A digital switching threshold is individually programmable. One channel of each module provides an auxiliary voltage of 12 V and enables therefore the supply of one light barrier as well.

PIN ASSIGNMENT

Pin Assignment of Digital (plug 1): Use this plug: LEMO FGA 1B 307 ...

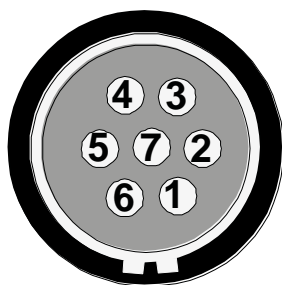


Figure 7: Pin Assignment M=BUS Pro LAB Digital Input Plug 1

Pin	Description
1	Positive excitation (+12 V)
2	Negative excitation (GND)
3	Dig. INA (+5 V)
4	Dig. INB (+15 V)
5	ID-module
6	Not connected
7	Not connected

The socket housing is connected to ground

M=BUS Pro 8 channel - 4 GB Digital

Pin Assignment of Digital (plug 2 - 8): Use this plug: LEMO FGG 1B 307 ...



Figure 8: Pin Assignment M=BUS Pro LAB
Digital Input

Pin	Description
1	Positive excitation (+12 V)
2	Negative excitation (GND)
3	Dig. INA (+5 V)
4	Dig. INB (+15 V)
5	ID-module
6	Not connected
7	Not connected

The socket housing is connected to ground

TECHNICAL SPECIFICATIONS OF DIGITAL MODUL 4BB-D-22

General:

Supported channels	16 (2 channels per LEMO connector)
Power consumption	< 2 W
Trigger	System trigger
Conformity	SAE-J211 / ISO 6487

Signal Conditioning:

Sample rate	20 kHz/100 kHz (12 Bit mode)/ 1MHz (1bit mode)
Recording time	Up to 1.5 hours with 16 channels and 20 kHz (4GByte Memory)
Input Voltage	Input A 0..5 V (over voltage protection up to ± 48 V) for 8 channels Input B 0..15 V (over voltage protection up to ± 48 V) for 8 channels
Switching threshold	Programmable Input A: 0..5 V (over voltage protection up to ± 48 V) for 8 channels Programmable Input B: 0..15 V (over voltage protection up to ± 48 V) for 8 channels
Pull Resistors	Programmable: Pullup, Pulldown or open for channels A (0..5V)

M=BUS PRO LAB FAM OR FIRE UNIT

An innovative and highly precise programmable timer for firing devices such as airbags or pretensioners.



Figure 9: M=BUS Pro LAB FAM or Fire unit

- | Available with 4 or 8 individually programmable timers for firing airbags, belt tensioners, etc.
- | Available as fire and measurement unit and also as fire unit
- | with the same features without measurement
- | 0 to 65 s delay in steps of 0.01 ms
- | DC or AC ignition modes
- | Adjustable firing current
- | 100Mbit/s Ethernet interface
- | Autonomous device (independent of the other M=BUS PRO LAB boards)

DESCRIPTION

The M=BUS Pro LAB FAM or FIRE unit is designed to ignite pyrotechnical devices like inflators for airbags or belt pretensioners. The energy to ignite the pyrotechnical device is stored in capacitors. Both AC and DC ignition modes are supported. The four respectively eight channels are isolated from each other in order to fire independently. A high speed data recorder stores the igniting current and voltage signals

with a sampling rate of 400 kHz and an accuracy of 16Bit.

A feature for preventing faulty unit triggering is a safety key, which only releases the firing energy after it is activated.

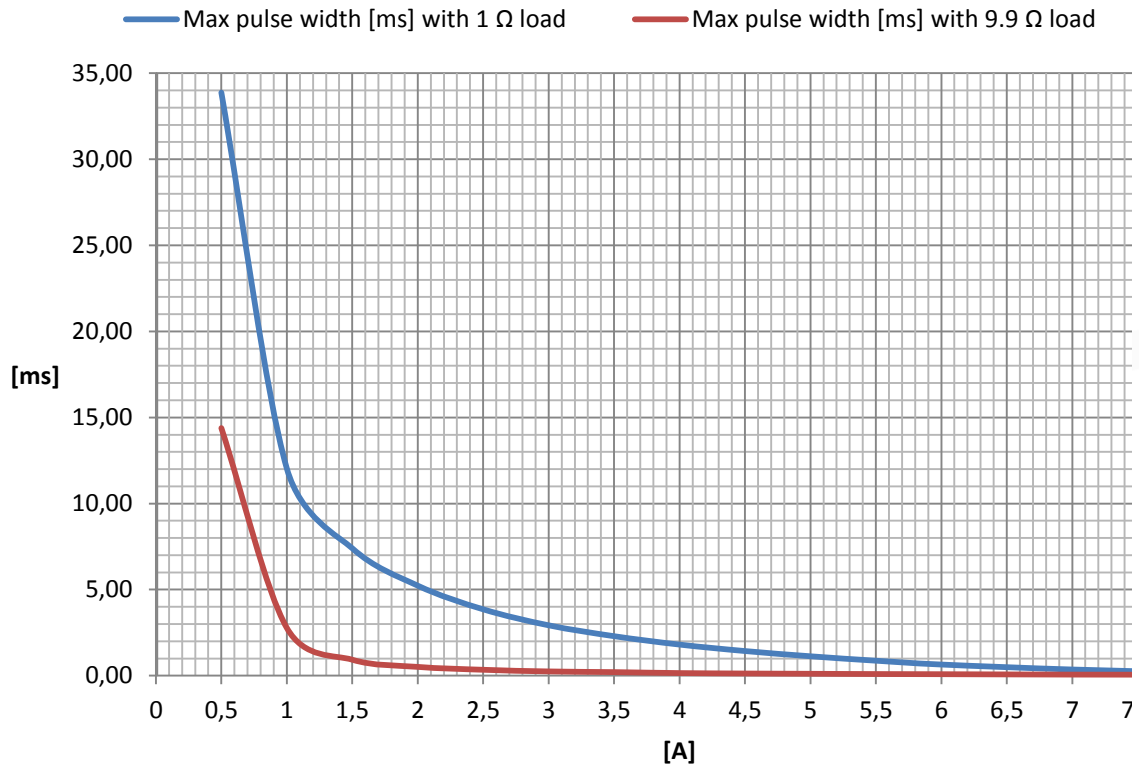
Constant current

The charged capacitor is connected to the output connector. Active feedback is used to regulate the output current to the programmed value. The current may be set between 0.1 and 8.0 amps @ 1Ω load in 0.1 amp steps.

resistance of the connected load and the current setting.

The duration that each FAM Channel is able to deliver the preselected current is dependent upon the

The following diagram shows the typical maximum pulse width at the set current for 1Ω or 9.9 Ω loads:



Maximum pulse width at the set current for 1Ω or 9.9 Ω load

PIN ASSIGNMENT

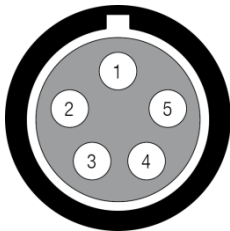


Figure 10: Socket, ignition channel 1 ... 8

Pin	Description
1	Fire In / Out -
2	Fire Sense -: Sense line to the - connection of the ignition tablet to measure the ignition voltage.
3	Fire Out + : + connection of the ignition tablet
4	Fire Sense+ -: Sense line to the + connection of the ignition tablet (to measure the ignition voltage)
5	Fire in +

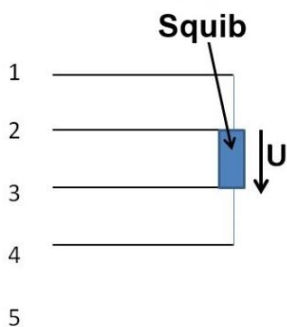


Figure 11: Connection of the squib

Pin	Description
1	Fire In / Out -
2	Fire Sense -: Sense line to the - connection of the squib to measure the ignition voltage.
3	Fire Out + : + connection of the squib
4	Fire Sense+ -: Sense line to the + connection of the squib (to measure the ignition voltage)
5	Fire In +

Connections for Release Connector

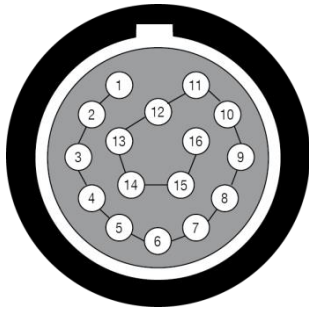


Figure 14: M=BUS Pro system socket

Pin	Description	No.	Description
1	Network TX+	9	485 A
2	Network TX-	10	485 B
3	Network RX+	11	Supply +22 V
4	Network RX-	12	Supply +22 V
5	Trigger 5 V / 120 mA	13	Supply +22 V
6	Trigger signal B	14	Ground
7	Trigger signal A	15	Ground
8	Trigger, insulated ground	16	Ground

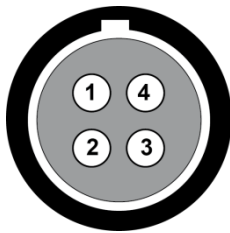


Figure 12: Socket, Fire

Pin	Description
1	+ for anode of the LED in the release connector
2	- for cathode of the LED in the release connector
3	Release input via bridge in the release connector
4	Release input via bridge in the release connector

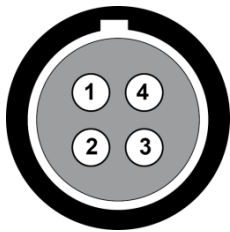


Figure 13: Socket, Safe

Pin	Description
1	+ for anode of the LED in the release connector
2	- for cathode of the LED in the release connector
3	Not connected
4	Not connected

M=BUS System Connection

Figure 13 shows the pin assignment of the LEMO 2B receptacle to connect the FAM/FIRE board with power supply, trigger bus and network. The receptacle has the same pinning and is used to connect the M=BUS

PRO LAB Ethernet Gateway and provide with power supply, trigger bus and network to the gateway...

Adapter Cable

To connect the M=BUS PRO LAB FAM system to the M=BUS PRO LAB Ethernet Gateway please use the provided M=BUS Ethernet Gateway adapter (see Figure

14) to connect the gateway with power supply, trigger bus and network.



Figure 15: M=BUS Pro LAB Ethernet Gateway Adapter

Pin	Description
1	M=BUS system connector
2	Trigger connection
3	Network
4	Voltage supply

TECHNICAL SPECIFICATIONS OF M=BUS PRO LAB FAM/FIRE MODULE

General:		FAM	Fire
Supported channels	4 or 8	✓	✓
Power consumption	< 13 W	✓	✓
Trigger	System trigger	✓	✓
Conformity	SAE-J211 / ISO6487	✓	✓
Ignition Unit:			
DC-Ignition	12 V adjustable current: 0.1...8 A in steps of 0.1 A @ 1Ω	✓	✓
AC-Ignition	12 Vpp 16 ignition frequencies can be set between 4.88 Hz and 160 kHz	✓	✓
Ignition energy	108 mJ	✓	✓
Timing	Delay: 0..65.5 s in steps of 0.01 ms Pulse duration: 0.1 ms..65.5 s in steps of 0.01 ms	✓	✓
Special features	- protective circuit to avoid mis-ignition - squib recognition - resistance measuring - mechanical and electrical interlock	✓ ✓ ✓ ✓	✓ ✓ ✗ ✓
Recording Unit:			
Sample rate	400 kHz fixed	✓	✗
Resolution	16 bit	✓	✗
Recording duration	300 ms 60 ms pre (Trigger+ Delay) 240 ms post (Trigger+ Delay)	✓	✗
Backup System:			
Storage of data	Non-volatile	✓	✗

M=BUS PRO LAB ETHERNET GATEWAY

The Ethernet gateway is the standard interface for bus lines.



- | Support of 1 internal M=BUS lines with up to 7 participants
- | Support of 2 external M=BUS lines
- | Very low current consumption
- | Temperature and M=BUS voltage monitoring

Figure 16: M=BUS Pro LAB Ethernet Gateway



Figure 17: M=BUS Pro LAB with Ethernet Gateway

DESCRIPTION

The M=BUS PRO LAB Ethernet Gateway is the standard interface for the bus lines. One line is used to connect up to 7 M=BUS Pro LAB units internally in the M=BUS Pro Lab housing. 2 lines can be applied directly to other M=BUS Systems like shockproof M=BUS Pro units or M=BUS In-dummy Loggers.

The M=BUS connects the bus participants in a daisy chain manner by a single Ø2.5 mm coax cable as the

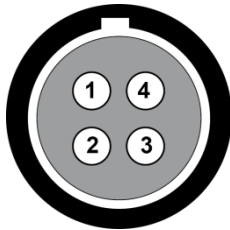
umbilical cord to support the M=BUS Loggers with power and the trigger signal.

It also grants a bidirectional communication between Gateway and Logger that allows an easy controlling by the supplied M=BUS software tool. The system trigger is recorded and stored in a non-volatile memory.

PIN ASSIGNMENT

Power Supply

Pin assignment of the 4 pin Lemo 2B free receptacle (red bend relief). Frontal view of free receptacle (PHG.2B.304.CYMD.62.ZR)

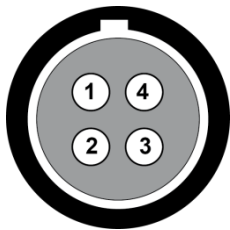


Pin	Description
1	Supply +22 V
2	Ground
3	485 A
4	485 B

Figure 18: M=BUS Pro LAB system socket

Trigger Bus

Pin assignment of the 4 pin Lemo 1B free receptacle (black bend relief). Frontal view of free receptacle (PHG.1B.304.CYMD.42.ZN)

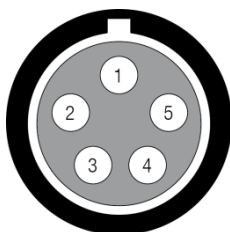


Pin	Description
1	Trigger 5 V / 120 mA
2	Trigger Signal B
3	Trigger Signal A
4	Trigger isolated ground

Figure 19: Pin Assignment M=BUS Pro LAB
Ethernet Gateway Trigger

Network

Pin assignment of the 5 pin Lemo 1B free receptacle (orange bend relief). Frontal view of free receptacle (PHG.1B.305.CYMD.42.ZS)



Pin	Description
1	Network TX+
2	Network TX-
3	Network RX+
4	Network RX-
5	not connected

Figure 20: Pin Assignment M=BUS Pro LAB
Ethernet Gateway network

TECHNICAL SPECIFICATIONS OF ETHERNET MODULE 4BB-D

General:

4BBD11	1 internal M=BUS line, 2 lines for external M=BUS modules
Power supply	18 V - 22 V
Power consumption	Gateway: 120 mA, max. 1 A per M=BUS Line
Trigger	Digital or Trigger-Bus
Communication	Ethernet 100 Mbit/s, TCP/IP, DHCP, TELNET, FTP
Conformity	SAE-J211 / ISO6487

Environmental Characteristics:

Humidity range	10...70 % rH
Temperature range	0...50° C

M=BUS PRO LAB USB MODULE



- | USB 2.0
- | Support of up to 5 M=BUS Pro Lab boards
- | Very low current consumption

Figure 21: M=BUS Pro LAB USB Module



Figure 21: M=BUS Pro LAB with USB Gateway

DESCRIPTION

The M=BUS PRO LAB USB Gateway connects the M=BUS PRO LAB data boards via USB 2.0 directly to a host PC. Up to 5 M=BUS Pro LAB Analog or Digital Modules can be used with the M=BUS PRO LAB USB Gateway.

PIN ASSIGNMENT

USB Connection

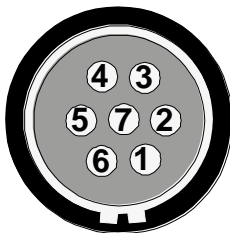


Figure 22: Socket, USB connection

Pin	Description
1	+5V
2	Ground
3	Data +
4	Data-
5	Not connected
6	Not connected
7	Not connected

Trigger Bus

Pin assignment of the 4 pin Lemo 1B free receptacle (black bend relief) Frontal view of free receptacle (PHG.1B.304.CYMD.42.ZN)

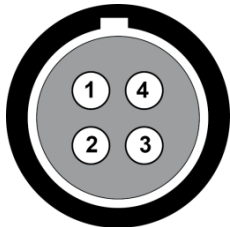


Figure 23: Socket, trigger bus

Pin	Description
1	Trigger 5 V / 120 mA
2	Trigger Signal B
3	Trigger Signal A
4	Trigger isolated ground

Power Supply

Pin assignment of the 4 pin Lemo 2B free receptacle (red bend relief) Frontal view of free receptacle (PHG.2B.304.CYMD.62.ZR)

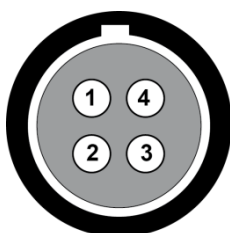


Figure 24: Socket, power supply

Pin	Description
1	Supply +22 V
2	Ground
3	Not connected
4	Not connected

TECHNICAL SPECIFICATIONS OF USB MODULE 4BB-D

General:

Supported M=BUS lines	1 for connection of up to 5 M=BUS Pro LAB Boards
External power supply	18 V – 22 V (compatible to NA3x)
Power consumption	Gateway: 120 mA, max. 1 A per M=BUS line
Trigger	Digital or trigger bus (compatible to NA3x)
Communication	USB 2.0 (connector type A)
Conformity	SAE-J211

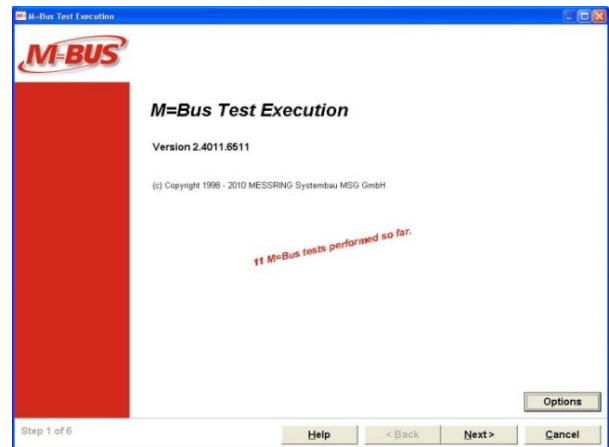
Environmental Characteristics:

Humidity range	10...70 % rH
Temperature range	0...50° C

CRASHSOFT3 M=BUS PACKAGE

- | M=BUS Tool Software
- | M=BUS Executor
- | CrashSoft3 Workshop
- | Reporting Module

Figure 25: CrashSoft3 M=BUS Software



Description

The required software comes for free as an up to date online download. The CrashSoft 3 M=BUS Package is not only a basic tool to operate the system. The bundle contains all the necessary features for a complete system preparation. Test execution and professional data evaluation as well as for the perfect finish of your data. Following features are included.

M=BUS Tool Software

- | System check-up
- | TEDS editing
- | Enhanced sensor test functions
- | Online channel view
- | Calibration
- | Assignment of user rights

M=BUS Executor

- | Step-by-step test preparation and execution

CrashSoft3 Workshop

- | Comprehensive test data evaluation
- | Curve-to-curve comparison
- | Curve-to-video comparison
- | Multi-channel math control
- | Data analysis and script editor
- | Data export to all common file types

Reporting

- | CrashSoft3 Download Manager
- | Manual logger data download
- | Manual to determination