

KiBox2

Capability and measurement efficiency for the next generation vehicle powertrains

The KiBox2 is a complete, propulsion analysis solution that forms a hardware and software eco-system ready for all current and future powertrain development challenges.

Features of the KiBox2 system

- Simultaneous or independent time and angle-based data recording concept with flexible definition of acquisition frequency
- Crank-smart technology, "encoder less" operation
- Real-time calculation of standard combustion, electric power analyzer parameters and user defined formulas
- Limit value monitoring with highly configurable triggers and data storage concept
- "Endless Measurements" with complex multi-recorder concept
- Convenient integration with electronic control unit calibration tool chains via XCP and/or CAN
- Full connectivity with all common test bed automation systems via DCOM, Remote Control API, TCP/IP, WLAN
- Bi-direction CAN interface, full support of CAN-FD
- Scale-able channel count concept with cascade-able acquisition units and freely configurable measuring modules
- Wide range DC power supply options, optimized for in-vehicle measurement application
- "Headless" standalone operation without a host PC, with automated data synchronization
- KID (Knock Intensity Detection) according to Bosch method and workflow, for gasoline engine calibration
- Electric power analysis functions based on IEEE1459 with multi-phase support and high-dynamic cycle detection

Description

Engineers need to be able to produce efficient powertrains, that reach all design targets, with the minimum development time. The KiBox2 is a multi-dimensional measurement platform that is able to measure accurately and blend, measured data from multiple complex propulsion system devices, that typically require harmonizing and optimizing in a modern, efficient vehicle powertrain.

With the KiBox2, all measured data can be captured, aligned, and visualized in real-time for display and storage in order to fully understand the status and efficiency of the propulsion system under real time operating conditions, on a second-by-







second basis. Thus, facilitating the ability for the development engineer to make the right engineering decisions, at the right time in the development process.

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Type 2895A... with KiBox Cockpit Software

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Application

KiBox2 allows measurement and analysis of power flows within standard (ICE only) and complex powertrains such as MHEV, PHEV, BEV. Data is recorded and stored via the comprehensive array of input interfaces that the system provides, both analogue and digital. The data is fully time aligned with the possibility of applying subsequent standard or user-defined calculators, in real time, for "on-the-fly" analysis. The data can then be stored, viewed, and analyzed within the KiBox2 Cockpit software. For further processing using industry standard, offline analysis tools, a comprehensive number of industry standard file export formats are available.

In addition, the system can be interfaced to a host (typically a test bed automation system or control system application tool) Allowing data communication during measurement run-time for synchronization of KiBox2 data with other devices and/or the host. The KiBox2 tool interfaces deploy industry standard protocols and support remote control (as well as data transfer) when this is available on the host system.

The system supports wireless connectivity to allow equipment usage without needing interconnecting cabling to the host PC. In addition, full GPS location capability allows the user to integrate positionbased tracking data during on-the-road testing.

System components

Overview of the complete powertrain analysis system:

- Cylinder pressure sensors and adapters, e. g. measuring spark plugs or glow plug adapters
- 2 Current clamp for injection and ignition timing
- 3 Crank angle adapter for connecting to the OEM engine crank position sensor
- Oltage and current probes for AC machine analysis, and or DC system current flows
- 5 Flywheel, driveshaft or wheel torques
- 6 KiBox with measuring modules
- 7 KiBox Cockpit

Display of powertrain real-time data





Fig. 1: Arrangement of the system components with connection to the user laptop

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Technical data

Operating temperature range w/o		-40 70
data acquisition modules		-40 158
Humidity (not condensating)		0 95
	W	75
nom.	V	9 58
max.	V	6 60
	e w/o nom. max.	e w/o °C °F % W nom. V max. V

Voltage drop to 6 V during operation possible for 2 seconds, every 20 seconds

Number of data acquisition module	16
slots	
Number of digital inputs	8
Number of digital outputs	8
Number of CAN-FD interfaces	2
Number of crank angle inputs	3

Connections on the front panel



Fig. 2: Connections on the front panel variable configurable

Connections on the rear panel



	Description
1	WLAN – Antenna connector: Reverse-polarity SMA
	(RP-SMA), Status LED
2	GPS – SMA connector
3	Cascading IN/Out – RJ-45 connector
4	CAN 1& 2 – D-Sub 9 pin (male)
5	Crank Angle Inputs – Sensor Analog/RS-422/Encoder LVDS
6	Digital I/O – D-Sub 25 pin (male)
7	USB 1& 2 – future use
8	Ethernet – 1 000 Base-T, standard connection KiBox2 – PC
9	Status LED
10	On/Off – System is switched on by a short push. Short push
	of the button 5 sec. the KiBox2 will power down immediately.
0	Power supply – connection, 6 60 VDC

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Input channels

A KiBox2 system consists of at least one data acquisition unit which has the capability of 16 analogue channels, in addition to the available digital ports and interfaces. The number of analogue channels active in a device depends only on the number of measuring modules installed.

The KiBox devices are fully cascadable and multiple units can be connected together or used separately as required. A maximum of 4 devices can be connected giving the capability of 64 analogue channels (plus digital inputs/interfaces).





Fig. 4: Type 5075A2





Fig. 6: Type 4667A



Fig. 7: 5270B

Each analogue channel is accessed and configured with a measuring module.

PEAQ is used for piezo-electric charge signals, PRAQ is used for Piezo-resistive signal and VAQ is for general purpose voltage inputs. The measuring module is configured from the Cockpit software, the position of the unit in the KiBox is not restricted and fully movable or removable. Where no module is fitted to a channel a blanking plate can be used to prevent dirt or moisture ingress to the KiBox itself.

Measuring amplifier slots

Slots for measuring modules	16
Number of measuring channels per slot	1
Supported measuring modules	
Charge amplifier	Туре 5075А_
 Piezoresitive amplifier 	Туре 4667А_
 Voltage amplifier 	Type 5270A/B_

Type 5075A 1-Channel Charge Amplifier (PEAQ)

ADC resolution	Bit	18
Frequency range	kHz	≈0 >200
Measuring range	рС	±100 50 000
Drift compensation operating	1/min	≈50 20 000
range		
Error	%	< ±0.3

Type 4667A 1-Channel Piezoresistive Amplifier (PRAQ)

ADC resolution	Bit	18
Frequency range	kHz	≈0 >90
Max. voltage input	V	±7.5
Sensor supply (I ref)	mA	1
Error	%	< 0.5

Type 5270B 1-Channel Voltage Interface (VAQ)

ADC resolution	Bit	18
Frequency range	kHz	≈0 >800
Max. voltage input	V	±60
Input impedance	MOhm	>1
Error full range	%	< ±1.2
Error ±10V	%	< ±0.2

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Crank angle connections

Connection 1	Analog: Crank Angle sensor probe (2643A)	
	for connecting engine specific crank angle	
	encoders	
Connection 2	LVDS: Optical crank angle encoder	
	Type: Kistler 2614B/C/D	
	other with 600 ppr/1200 ppr/1800 ppr	
	AVL 364/365/366	
Connection 3	RS-422 ABZ input for using the Kistler encod-	
	er 2614DK2 or any generic ABZ encoder	

Analogue (2643A)

-		
Input voltage	V	±50
Bandwidth	kHz	>800
ADC resolution	Bit	16
Sampling rate	MHz	>10
LVDS		
Output voltage (5V)	V	≈5
Output current (5V)	mA	300
Output voltage (15V)	V	15
Output current (15V)	mA	120
RS422		
Input voltage	V	± 3.9
Bandwidth	kHz	>800
ADC resolution	Bit	16
Sampling rate	MHz	>10

Crank angle sensor probe 2643A

The crank angle sensor probe is the measurement adapter between the engine crank shaft position sensor (CPS) and the KiBox2 crank angle input. The differential crank angle signal is picked up by this high resistance probe in order to measure the signal with very high precision.

An appropriate driver inside the crank angle sensor probe transmits the analog signal to the KiBox2. The supply power for the probe is provided by the KiBox2 using the same cable. Analog-to-Digital conversion is done inside the KiBox2.



Fig. 10: Processing of the OEM crankshaft position sensor

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Digital input channel Digital inputs for any signals

Number of channels	No.	8
Maximum input frequency	MHz	10
Input voltage, max.	V	±30
Input level low	V	<2
Input level high	V	>4,5
Input circuit	Galvanic isolated between each other and the rest of the system	

Digital output channel Digital inputs for any signals

Number of channels	No.	8	
Maximum output frequency	MHz	10	
Output voltage, max.	V	5.5	
Output level low	V	<2	
Output level high	V	>4	
Output circuit	Digital outp have a com not galvanic other, but t galvanic iso the system.	Digital outputs are TTL-level and have a common ground. They are not galvanic isolated from each other, but the common ground is galvanic isolated from the rest of the system.	

CAN interfaces

Number of channels	No.	2, input and output
CAN Standard		CAN/CAN-FD
Maximum supported bit rate by hardware transceiver	MBit/s	8

WLAN interface

	CE/EFTA
	FCC/IC/Japan
	IEEE 802.11 b/g/n
	Single stream
MHz	2 400 – 2 480
mW	<100
	20
	1 11
	Station (STA)
	Micro-AP
1	8
	MHz mW



当該機器には電波法に基づく、技術基準適合証明等を受けた特定無線 設備を装着している。

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Measurement and processing power		
Nominal sampling	MHz	2.5
rate		
Resolution of	kHz	312.5/625/1 250/2 500
measurement data	° CA	0.025
Speed range	1/min	≈50 20 000

Performance of result interfaces to application systems

Interface	XCP/PTP is included in the standard
	scope of delivery. It is a standardized
	and independent interface between
	Cockpit Software and any 3rd party
	systems
Data synchronisation	Time stamp from the operating PC,
	assignment for each combustion cycle,
	support of Precision Time Protocol
	(PTP, IEEE 1588)
Definition of	End of the combustion cycle
timestamp	
Uncertainty PTP	<1ms

Input file formats	KiBox
	• .open Data file
	 .formula User formula
	KiBox2
	• .mf4 Data file
	 .k2p Parameter file
	 .k2c User calculator
	 .dbc CAN database file
Output file formats	KiBox2
	• .mf4 Data file
	 .k2p Parameter file
	 .k2c User calculator
	 .dbc CAN database file
	3 rd party
	 .csv Comma separated data file
	• .ifi AVL iFile
	• .a2l ETAS INCA

Test bench interface

Interface	KiBox API (extended Remote
	Control API)
	IndiCom DCOM
	XCP, PTP (IEEE1588)
Multi-client capability	yes

Software packages

Data files/file format

Applications	Combustion Analysis Basic
	Combustion KID Upgrade
	• E-Powertrain Analysis Basic

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System components and Type numbers for the combustion analysis system Type 2895AK1

Included accessories	Type/Art. No.
• KiBox base unit	2895A1
 Blind front panel complete, 1-channel 	5700A33
• Ethernet Switch 5-Port 10/100/1000BaseT	5211569
• Ethernet Switch power cable 2 pin, $I = 2 m$	5590314
• Gigabit Ethernet cable 1:1, l = 1 m	55258217
• Gigabit Ethernet cable 1:1, l = 5 m	55258218
• Power cable, I = 2 m	
• Power supply 100 240 VAC	5781B4
 Country specific power cable 	Z16687
• D-Sub, 25 pin (f)	5510427
 Crank Angle Sensor Probe to KiBox2 	2643A
 WLAN antenna with SMA cconnector 	

- GPS antenna incl. Cable and SMA connector
- USB mermory stick incl. operating instructions & Cockpit SW
- xAQ protection case
- Wheel case incl. inlay for KiBox2

Reduced accessories for KiBox2 test bench application

• KiBox2 base unit	2895A1
• Gigabit Ethernet cable 1:1, l = 1 m	55258217
• Gigabit Ethernet cable 1:1, l = 5 m	55258218
• Power cable, I = 2 m	
 Power supply 100 240 VAC 	5781B4
 Country specific power cable 	Z16687
• D-Sub, 25 pin (f)	5510427
 WLAN antenna with SMA connector 	55258218
 Membrane cushion packaging 	

Optional accessories	Type/Art. No.
• Blind front panel complete, 1-channel	5700A33
• 1-Channel Piezoresistive Amplifier (PRAQ) for KiBox2	4667A
• 1-Channel Voltage Interface (VAQ) for KiBox2	5270B
• 1-Channel Charge Amplifier (PEAQ) for KiBox2 (BNC)	5075A1
 1-Channel Charge Amplifier (PEAQ) for KiBox2 (Fischer) 	5075A2
 Crank Angle Sensor Probe to KiBox2 	2643A
 Crank angle encoder set 	2614DK2

Services

- KiBox calibration
- KiBox service on the road: planning, preparation and realization of on-site combustion measurements by a Kistler expert

(please contact Kistler for requests)

Services & training for the combustion analysis system

Training

- KiBox Level A (Basic) user training
- KiBox Level B (Experts) user training

Document folder

 Quick Start Guide/Safety Instructions 	002-963e
Calibration certificate	2895A

	Type/Art. No.
 Blind front plate, 4-channel 	5700A44
• TDC-Sensor System, Probe length 285,5mm	2629DK0
 Coupling Triax posBNC pos. 	1704A4
 Coupling Triax posBNC neg. 	1704A1
• 19" 2HE Mount. base cpl. 482,6x86,9x360 for KiBox2/SCP Slim	5736A
• Blind front panel for 19" Mount base	5748A4
 Cascading set KiBox2 (2-4 units) 	1200A247A1

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