

# KiBox® To Go

## Measurement and Evaluation System for Combustion Analysis in Vehicles and on Test Benches

Type 2893A... with KiBox Cockpit software

The KiBox is a complete combustion analysis system for mobile use on the road under extreme ambient conditions and on engine test benches.

### Special advantages of the KiBox To Go

- No external crank angle encoder required
- Time-based combustion analysis system
- Real-time calculation of combustion analysis parameters
- Limit value monitoring with data storage
- "Endless Measurement" capable
- Convenient integration with ETAS INCA®, VECTOR CANape and ATI VISION, or any environment supporting CAN data measurement
- Measurements and analyses can be configured extremely easily. Any error messages displayed are easy to understand
- The measurement data is analyzed in the KiBox, avoiding the need for a dedicated PC to be used for combustion analysis
- Standalone operation without a PC is also possible

### Description

The KiBox from Kistler enables the quality of combustion in the individual cylinders. The combustion parameters are conveniently integrated into the application system and synchronized with other measurement data and ECU control parameters via a PC software interface. This software interface is initially available for the widely used INCA® application software produced by ETAS. Alternatively, combustion analysis parameters can be output via a CAN port.



Fig. 1: KiBox® To Go Type 2893AK1 with integrated amplifiers Type 5064C12

### Application

The additional information regarding combustion, fuel injection, and ignition can be used to develop and optimize engine maps within the ECU application system. Alternatively, the KiBox can be used as a standalone system for combustion analysis in vehicles or on a test bench. Combustion diagnostics enable problems that arise in the vehicle on the road to be characterized and resolved efficiently. On engine test benches, the KiBox assists in the basic input of engine control data as well as in knock tuning. Used as a monitoring system, the KiBox detects any limit value violations, reports these to the automation system and saves the raw data along with a pre-event and post-event history. Data streaming enables a complete exhaust or fuel economy drive cycle to be recorded.

### System Components

Overview of the complete combustion analysis system:

1. 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 stock engine crank position sensor
4. Gb Ethernet connection to laptop with INCA or similar software
5. KiBox with amplifier modules

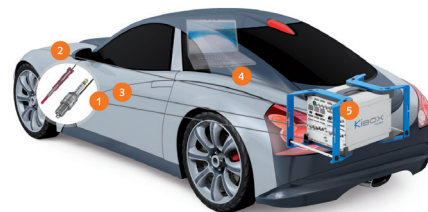


Fig. 3: Arrangement of the system components with connection to the laptop of an application engineer

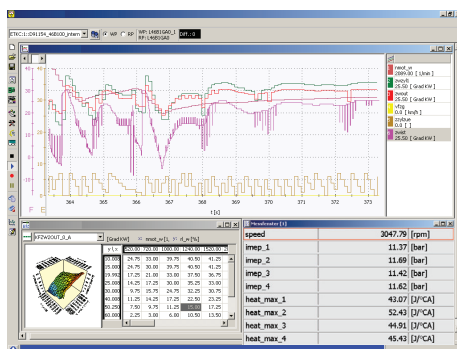


Fig. 2: Combustion analysis parameters on an application engineer's screen, integrated and synchronized in INCA

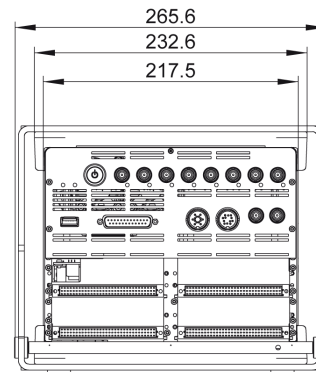
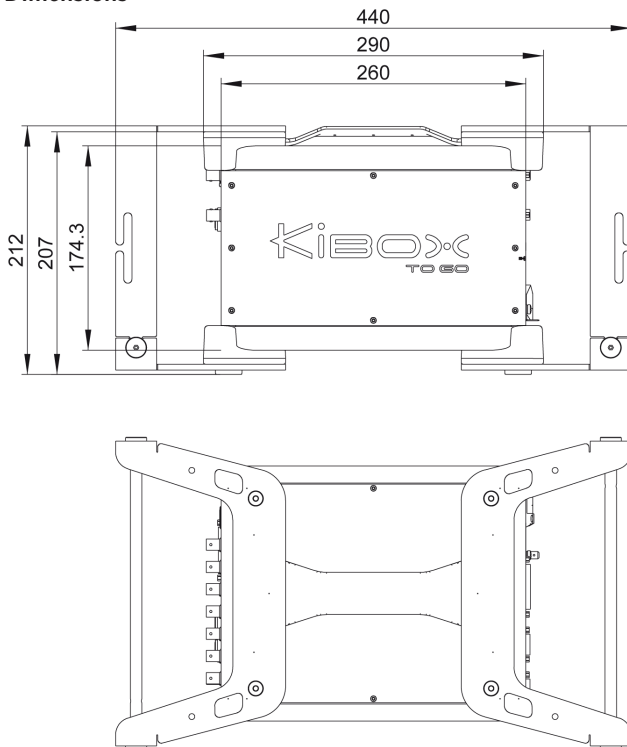
In addition to using INCA, the combustion analysis results can be displayed in separate windows of the KiBox Cockpit.

The information corresponds to the current state of knowledge. Kistler reserves the right to make technical changes. Liability for consequential damage resulting from the use of Kistler products is excluded.

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**Technical Data**

**Dimensions**



**Weight**

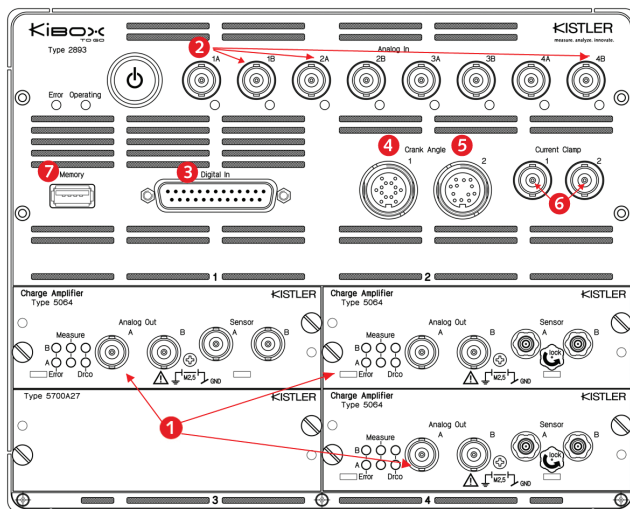
Basic system without amplifiers	approx. 6 kg
Basic system with amplifiers	approx. 8 kg max.

**Ambient Conditions**

Temperature range	-30 ... 50 °C (-20 ... 120 °F)
Relative humidity	0 ... 95 % non-condensing
Power supply	10 ... 36 VDC, 100 ... 250 VAC
Power consumption	approx. 60 W

Fig. 4: Dimensions of KiBox Type 2893AK1

**Connections on the Front Panel**

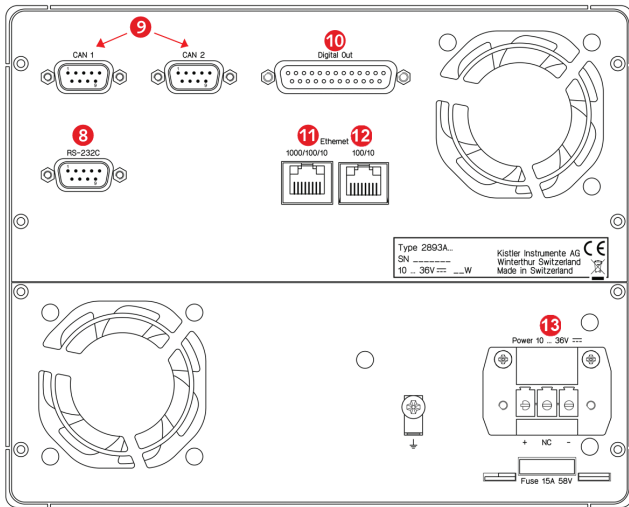


- 1 *Measuring amplifier slots*  
4, each with 2 channels, 8 channels in total  
(Kistler Type 5064C11, Type 5064C12, Type 5064C13)
- 2 *Analog inputs*  
8, BNC
- 3 *Digital inputs*  
1, 25-pin connector
- 4 *Crank and trigger input 1*  
1, for Kistler crank angle adapter set Type 2619A11
- 5 *Crank and trigger input 2*  
1, for optical crank angle encoders  
(Kistler Type 2614B..., AVL Type 365/720 or 365/360)
- 6 *Analog inputs for current clamps*  
2, BNC for current clamp Type 2103A11 or Type 2105A...
- 7 *USB port*  
1, for a memory stick or mass storage device

Fig. 5: Connections on the front panel

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**Connections on the Rear Panel**



- 8 RS-232C interface  
1, RS-232C (male)
- 9 CAN 1 & CAN 2 interface  
2, D-Sub 9-pin (male)
- 10 Digital outputs  
1, D-Sub 25-pin (female)
- 11 Ethernet 1000/100/10  
1, 1000 Base-T, standard KiBox – PC connection
- 12 Ethernet 100/10  
1, 10/100 Base-T
- 13 Power  
1, connection, 10–36 VDC

Fig. 6: Connections on the rear panel

**Input Channels**

A maximum of eight analog voltage signals can be recorded on the KiBox via the measuring amplifier slots or the BNC connectors located at the top of the front panel. Two analog inputs for current clamps are also available, as well as eight digital input channels.

Perfectly synchronized measurement data is generated, thanks to phase corrections applied to each charge amplifier and current clamp signal.

When Kistler sensors are used with PiezoSmart®, each measurement channel is adjusted to the sensitivity of the individual sensor, completely automatically.

**Measuring Amplifier Slots**

Amplifier slots	4 slots for a maximum of 8 amplifier channels
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**2-channel Charging Amplifier**

Number of channels	–	2
Frequency range (20 V <sub>pp</sub> )	kHz	≈0 ... >200
Measuring range	pC	±100 ... 100,000
Drift compensation operating range	1/min	≈100 ... 20,000

For amplifier specifications see separate data sheet on Type 5064C12 (doc. no. 5064C\_003-047).

**Analog Inputs for Any Voltage Signals**

Number	8 channels
Input voltage range	–10 ... 10 V
ADC resolution	16-bit
ADC sample rate	1.25 MHz (MS/s) per channel
Low-pass filter	Off/5/10/20/25/30/35/40 kHz

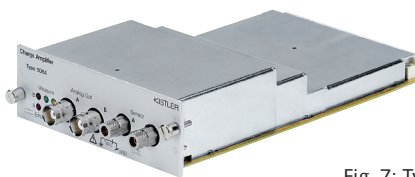


Fig. 7: Type 5064C12

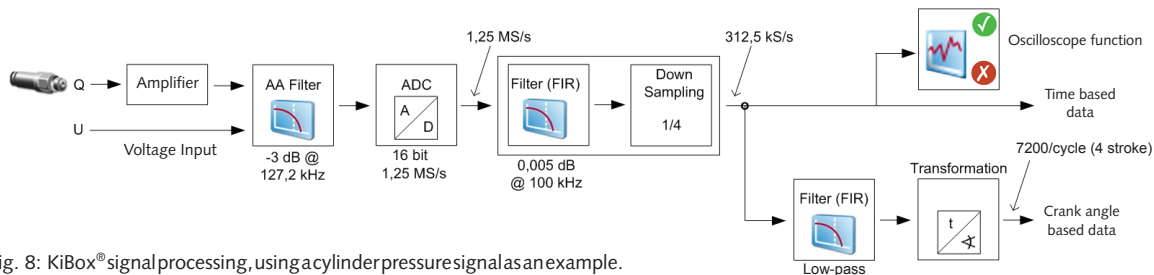


Fig. 8: KiBox® signal processing, using a cylinder pressure signal as an example. The system architecture simultaneously offers time-based and angle-based data with precise TDC reference

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**Analog Inputs for Current Clamps**

Number	2 channels
Input voltage range	-1 ... 1 V
ADC resolution	12-bit
ADC sample rate	2,5 MHz (MS/s) per channel
Bandwidth	125 kHz

**Current Clamps**

Suitable for timing measurements on gasoline and diesel engines

Type	2103A11	2105A30
Bandwidth	100 kHz	100 kHz
Power supply	9-V battery	external 9 ... 36 VDC
Voltage output	±1 V	30/20/40 mV/A
Weight	200 g	10 g

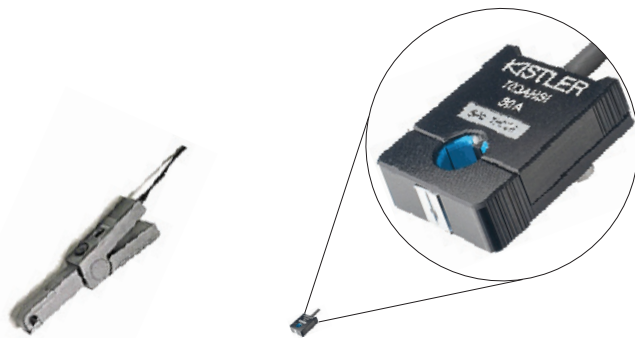


Fig. 9: Current clamp Type 2103A11 (left), Type 2105A30 (right)

For further information on Type 2105A... see separate data sheet doc. no. 2105A\_000-953.

The current clamp can be fitted onto the ignition or injector wire.

**Crank Angle Connections**

**Angle and Trigger Inputs**

Connection 1	Kistler crank angle adapter Type 2619...
Connection 2	Optical crank angle encoder (LVDS) - Kistler Type 2614B - other with 600 impulses/360°CA - other with 1 200 impulses/360°CA - AVL 365/360 - AVL 365/720
Sample rate	40 MHz

**Kistler Crank Angle Adapter Set Type 2619A11**

Analog crank angle signals are converted into a digital LVDS pulse train, for angle and TDC processing in a KiBox.



Fig. 10: Processing of the engine's stock crankshaft position sensor



Fig. 11: Crank angle adapter set Type 2619A11

Connectable sensor types	Trigger wheel with Hall or (inductive) VR sensor, invertible signal
Internal resistance	200 ... 250 kΩ
Input voltage range (Hall)	0 ... 100 V
Input voltage range (inductive)	-100 ... 100 V
Overload range	-200 ... 200 V
Supported number of crank angle marks	12-1, 24-1, 24-2, 30-2, 36-1, 36-2, 36+1, 60-1, 60-2, 90-1, 120-1, 120-2, 36-2-2, 60-1-1, 60-2-2, 60+1+1, 36-2-2-2, 60-1-1-1 60-2-2-2
Crank angle resolution	0,1 °CA
Resolution of TDC reference	0,01 °CA
Analog signal output	Analog sensor signal for diagnostic purposes with the KiBox oscilloscope function
Degree of protection	IP65 (dust-proof and splash-proof)

2893A\_000-724d-06.14

## Digital Input Channel

### Digital Inputs for Any Signals

Number	8 channels
Sample rate	2,5 MHz
Min. pulse duration	3,2 µs min.
Input circuit	electrically isolated, floating
Input voltage	max. ±30 V
Input level low	<1 V
Input level high	<4,5 V

### Laptop Requirements (Host PC)

PC operating systems	Windows®XP(SP2), Windows®Vista, Windows® Vista (SP1) or Windows® 7 (32/64 bit)
Min. available hard-disk space	1 GB
Min. RAM	2 GB
Min. screen resolution	1 280 x 1 024 pixels
PC interface	1 Gigabit Ethernet
Optical drive	CD drive for software installations

## Measurement and Processing Power

### Measurement and Processing Power

Resolution of measurement data	312,5 kHz and 0,1 °CA
Speed range	0 ... ≈15 624 1/min

### Local Memory for Measurement Data and Processed Results

RAM for measurement data	400 MB
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	Time data, angle data and results	Angle data and results
Manually saved	Up to 1 000 combustion cycles (1 signal, 2 000 1/min)	Up to 7 000 combustion cycles (1 signal, 2 000 1/min)
Automatically saved	500 combustion cycles and 30 s before engine started/after engine stopped	2 000 combustion cycles and 30 s before engine started/after engine stopped
Streaming mode (MDF4)	Continuous until USB data storage is full	Continuous until USB data storage is full

Table 1: Maximum durations of measurement recordings

## Result Interfaces to Application Systems

Interface	OHI 3 (ETAS software interface to INCA 6.1, 6.2.0, 6.2.1, 7.0). Kistler driver software for OHI3 is included as standard; Kistler driver software for other systems is available on request.
Data synchronization	Timestamp from the operating PC, assignment for each combustion cycle
Definition of timestamp	End of the combustion cycle
Uncertainty	approx. 1 ms (<< 1 combustion cycle)

## Testbed Interface

Type	AK-based ASCII Text Protocol
Interface	– RS232 – Ethernet
Multiple Clients	yes

## Data Files/File Format

Read/write	.open file (Kistler open binary file format) <sup>1</sup> Supported by Matlab, Uniplot, Turbolab, FlexPro and DIAdem
Write-only	MDF4 (streaming mode)
Data export	I file (AVL binary file format), MDF3.2, ASCII tables (comma separated values)

## CAN Interfaces

Number	2
Max. transmission rate	1 Mbit/s max.

## Digital Outputs

Number	8 channels
Output circuit	electrically isolated, floating

<sup>1</sup> See description of .open data format

**System Components and Type Numbers for the Vehicle Combustion Analysis System**

Scope of Delivery for Type 2893AK1	Type/Art. No.
KiBox signal processing platform	2893A121
Blind front panel	5700A27
5-port 10/100/1000 Ethernet switch	5.211.569
Connecting cable 2-pin, L = 2 m	5.590.314
Gigabit Ethernet cable 1:1, L = 1 m	1200A117A1
Gigabit Ethernet cable 1:1, L = 5 m	1200A117A5
Gigabit Ethernet cross cable, L = 5 m	1200A125A5
Power cable, L = 2 m	7.620.433
Power supply 100 ... 240 VAC; 50 ... 60 Hz	5781A4
Power cable	Z16687
D-Sub, 25-pin (m)	5.510.416
D-Sub, 25-pin (f)	5.510.427
Wheeled case for KiBox to Go	5.070.143
KiBox Cockpit software on CD	7.643.034

Accessories (Optional)	Type/Art. No.
Charge amplifier	5064C1...
Blind front panel	5700A27
Crank angle adapter set	2619A11
TTL to LVDS converter	Z21209
Current clamp set	2103A11
Voltage supply module and signal summer for current clamp Type 2105A30	2105A10
Amplifier module for current clamp Type 2105A30	2105A20
Current clamp, miniature version	2105A30
Power cable for Type 2105A10	2105A40
Piezosmart extension cable, L = 0,5 m	1987BN0,5
Piezosmart extension cable, L = 7 m	1987BN7
Piezosmart extension cable	1987BFT...
Extension cable, BNC pos. – BNC neg., L = 0,5 m	1603BN0,5
Extension cable, BNC pos. – BNC neg., L = 7 m	1603BN7
Coupling Triax pos. – BNC pos.	1704A4
Coupling Triax pos. – BNC neg.	1704A1
Tablet PC holder	KCD14539
12-V distribution box SMALL	12552
12-V distribution box BIG	11371
3-pin mains connection, coded	1599

**Optional Software for Offline Data Display (Third Party), Compatible with .open Files**

	Type
Uniplot	2843A1
Turbolab	2843A2
TIGER	2843A3

**Training**

KiBox level A (basic) user training	9941-E4
KiBox level B (expert) user training	9941-E5
Handling cylinder pressure sensors	9941-E1
Fundamentals of cylinder pressure measurement	9941-E3