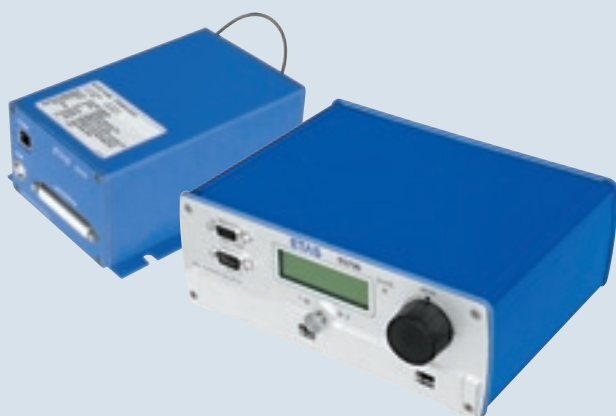


## The ES730 Product Family Drive Recorder Series for Fleet Testing



### Functions at a Glance

- Autonomous systems for in-vehicle endurance measuring applications
- CAN bus and K-Line interfaces for recording vehicle-specific data
  - Fault memory read access
  - Script-driven communications
- Battery voltage acquisition (terminals 15 and 30)
- Integration of external measurement modules (Ethernet/ES400, CAN, SMB)
- Extensive triggering functions
- GPS integration
- Wireless communications by WLAN and GSM/GPRS



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The drive recorders of the ES730 series are high-performance measuring systems for long-term endurance trials. They are specifically designed for in-vehicle applications in conjunction with electronic control units (ECUs).

System-specific measurement data is acquired through the onboard network interfaces, i.e., CAN bus and K-Line.

The various types of drive recorder applications encompass both passenger cars and utility vehicles, covering the range from test bench operation to fleet trials. The latter benefit especially from the support provided through the systems' wireless communications interfaces.

The ES730 series consists of the following drive recorders:

- ES730 – Drive Recorder NG
- ES735 – Drive Recorder Compact
- ES736 – Drive Recorder Compact GPS
- ES737 – Drive Recorder Compact GPS/GSM

The ES730 series is augmented by two hardware add-ons serving as separate WLAN and mobile radio interfaces:

- ES731 – Mobile Drive WLAN
- ES732 – Mobile Drive GSM

In terms of operating power and thanks to their rugged mechanical construction and wide operating temperature range, the members of the ES730 family are ideally suited to automotive applications.

## Application

The ES730 series drive recorders are typically deployed as a measure of quality control in fleet testing prior to SOP (commencement of series production) on the one hand, and for the purpose of investigating intermittent or non-reproducible faults in electronic systems.

To facilitate the recording of system behavior, cyclical or event-driven acquisition of measurement data is possible. This permits, for example, the behavior monitoring of functions related to control and diagnostics of a new system component, such as a diesel particulate filter. As an option, measurement values can be grouped together in the form of histograms, e.g., for evaluating collective loads.

## System Overview

Figure 1 provides an overview of the signal and device interfaces featured on the drive recorders. Regardless of their individual configuration, the construction of all ES730 family members adheres to common principles.

For recording ECU and vehicle bus signals and for connecting external measurement devices, all modules are equipped with CAN bus interfaces. The serial RS-232 interface accommodates a PC, an ES732 module acting as a mobile radio interface, a GPS receiver or SMB measurement module, such as an LA4 Lambda Meter. In addition to a straight cable connection to a PC, the 10 Mbit/s Ethernet interface onboard the drive recorders provides for a wireless WLAN connection by means of an ES731 module. Thanks to the shared support of the XCP-on-Ethernet protocol, the miniaturized Ethernet measurement modules of the ES400 product family are also integrated with the drive recorders. In a relevant hardware configuration, the ES600 Network Module handles the adaptation to the 100 Mbit/s Ethernet bandwidth native to the ES400 modules, which can be installed in the immediate proximity of sensors being measured, e.g., in the engine compartment.

The drive recorders tap into the battery voltage on terminals 15 and 30 and provide the same for additional functions. For example, the voltage signal on terminal 15 can be used to activate the drive recorders by virtue of switching on the ignition. The devices feature boot intervals of less than 2 seconds and typically 1 second. An optional handheld push-button or digital signals (TTL) issued by contacts installed throughout the vehicle may be used as external triggers for the data acquisition.

## ES730 Drive Recorder

To handle complex measuring tasks, the ES730 Drive Recorder NG can be extended by four CAN interfaces and two K-Line interfaces. To this end, CAN and K-Line extensions are available (Figure 2).

The K-Line extension features two ISO 9141 communication interfaces. Both can be separately configured and support baud rates up to 185 kBaud and 9-data byte operation.

The CAN extension is available with either two high-speed or two low-speed CAN interfaces. It is therefore equipped with high-speed (TJA1041) or low-speed transceivers (TJA1054).

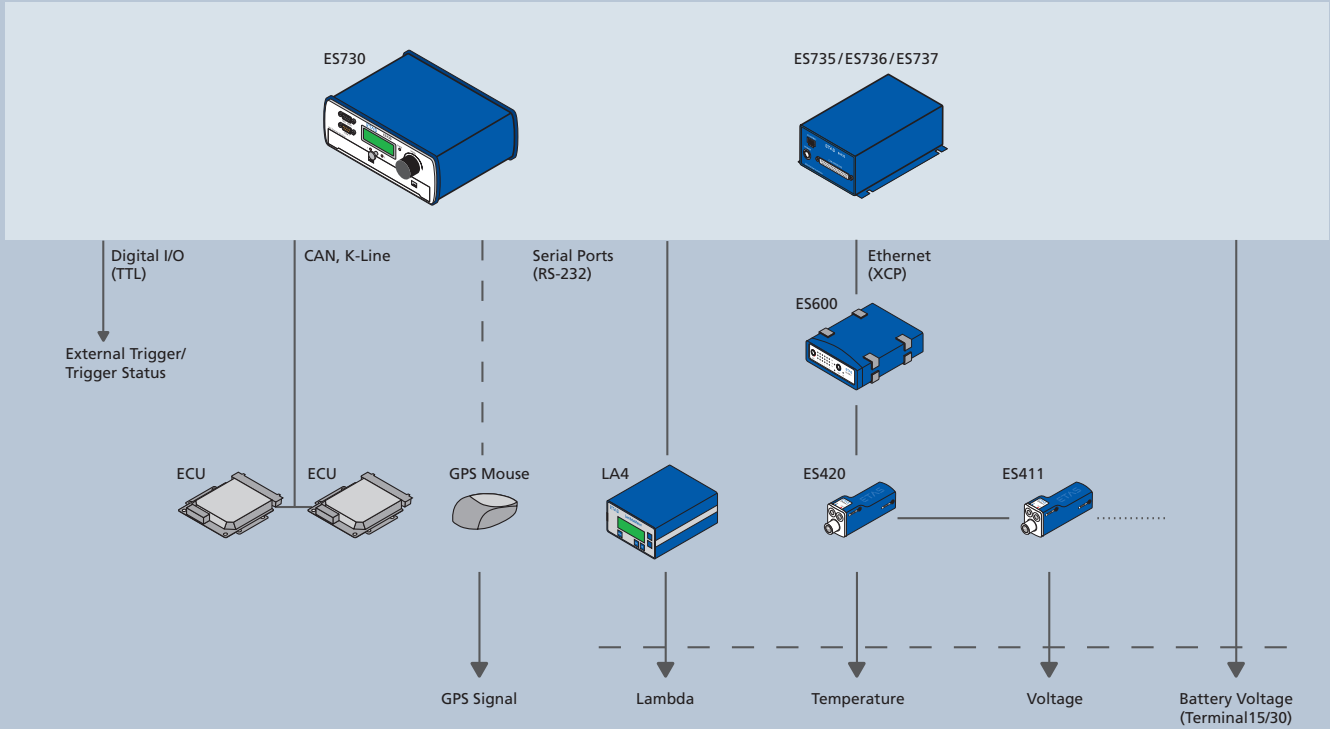
The menu-driven measurement status query is accomplished by means of a jog dial and an LCD display on the front panel of the ES730 module.

## ES735, ES736, and ES737 Compact Modules

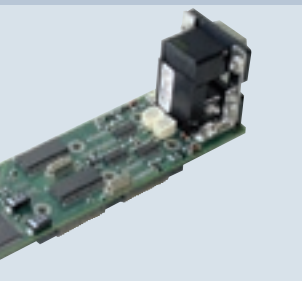
With a dimension of (H x W x D) 65 x 105 x 168 mm / 2.6 x 4.1 x 6.6 in., the ES735, ES736, and ES737 compact drive recorders are as high and deep but only half as wide as the ES730.

The pre-configured bus interfaces on the compact drive recorders share the same connecting socket. The devices are equipped with four high-speed CAN interfaces, one K-Line connection, and eight integrated analog inputs. The ES736 and ES737 feature a built-in GPS receiver. The ES737 Drive Recorder Compact boasts an additional GSM/GPRS mobile radio interface.

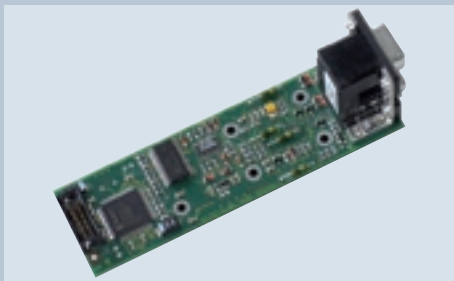




**Figure 1:**  
 The ES73x drive recorders are installed as autonomous systems in the vehicle or on the test bench. Using a variety of interfaces, they are capable of recording both digital and analog signals of the system being monitored.

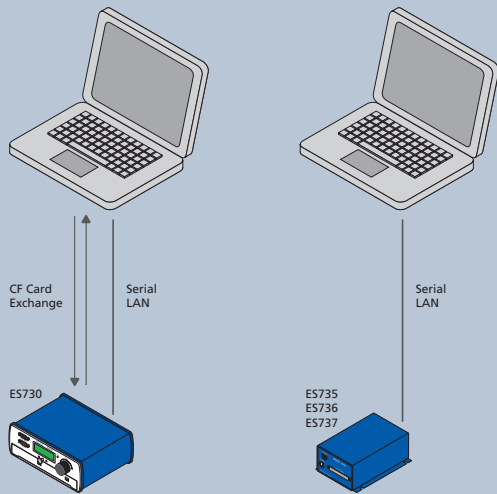


**CAN extension**

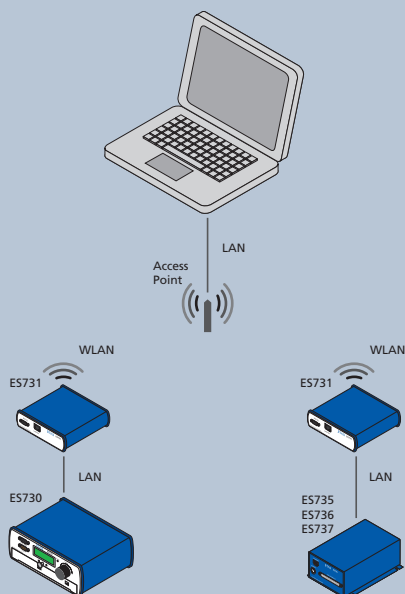


**K-Line extension**

**Figure 2:**  
 If desired, the ES730 Drive Recorder NG can be equipped with two CAN extension modules and one K-Line extension. Each extension module provides two interfaces of the same type.



**Figure 3:**  
Local access to drive recorders through the LAN or by swapping Compact Flash (CF) cards.



**Figure 4:**  
Drive recorders are accessed through a WLAN at the access point. The E5731 module connected to the drive recorders functions as a WLAN interface.

## Configuration and Measurement Data Transfer

To configure the measuring task, update the device firmware, upload the measurement files, and monitor measurements online, data must be exchanged with a PC.

On the E5730 Drive Recorder NG, this is accomplished in the simplest case by swapping out two Compact Flash (CF) memory cards, which can be accessed without opening the housing (Figure 3). The CF cards provide the required mass storage capacity for device configuration and measurement data. For high-end applications, the E5737 Drive Recorder Compact GPS/GSM provides an integrated GSM/GPRS mobile radio interface. It facilitates the permanent monitoring of measurements during fleet testing (Figure 5, see back side).

In addition, the following interfaces and modules are available as options for the data transfer between drive recorders and PC (Figures 3, 4, and 5):

- Serial interface
- Ethernet interface (LAN)
- E5731 WLAN module for wireless data transmission
- E5732 GSM module serving as mobile radio interface

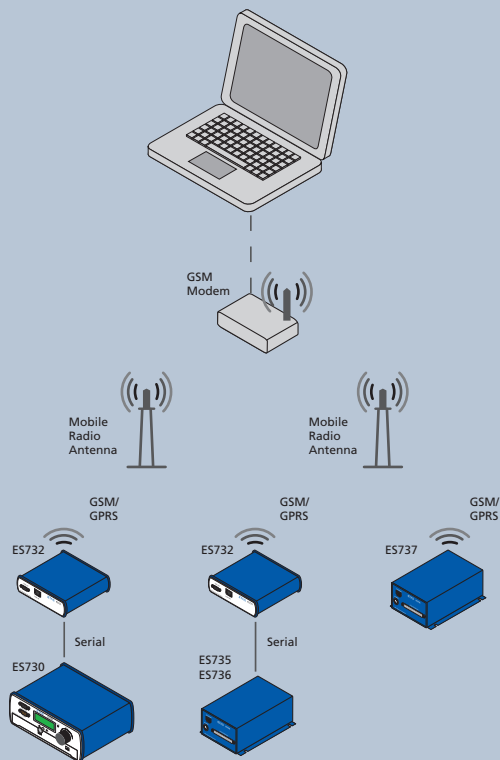
Measuring tasks are created and manipulated with the use of an intuitive Windows application on the PC. This includes the selection of interface parameters and measuring channels. Measurement signals acquired by ECUs by means of the K-Line and CAN bus, can be drag-and-drop selected from label lists imported from A2L and CAN-DB description files. The measurement configuration thus created is stored in an XML file and transferred to the drive recorder.

For the purpose of data acquisition, either a ring buffer mode ("Flight Recorder") or triggered operation can be selected. Using the ring buffer mode causes data to be stored and overwritten continuously, which always ensures the availability of the most recent measurement data for evaluation purposes.

Triggering a data acquisition is ensured by extensive trigger logics. It enables the definition of several trigger conditions, along with their assignment to individual measuring groups. The measured values obtained from each measuring group are stored in separate measurement data files. Depending on the complexity of a measuring task, up to 15 measuring groups (typically 5) can be processed at the same time. A differentiation is made between four different measuring groups (see back side).

## Specifications

Component	Property	ES730	ES735/ES736/ES737
General	Dimensions (H x W x D)	74 x 210 x 150 mm / 2.9 x 8.3 x 5.9 in.	65 x 105 x 168 mm / 2.6 x 4.1 x 6.6 in. (without mounting ears)
	Weight	1.6 kg / 3.53 lbs (without interface modules)	0.8 kg / 1.76 lbs (ES735) 1.1 kg / 2.43 lbs (ES737)
	Operating temperature range	-10 °C to +70 °C / +14 °F to +158 °F -20 °C to +80 °C / -4 °F to +176 °F (with use of CF cards in specified temperature range)	-40 °C to +85 °C / -40 °F to +185 °F (basic unit) -20 °C to +65 °C / -4 °F to +149 °F (GSM deployment) -20 °C to +50 °C / -4 °F to +122 °F (WLAN deployment)
	Indicators	LCD indicator (measurement status) LED (operating status) 2 LEDs (memory card status)	LED (operating status) LED (GSM status)
	Memory	2 x CF card (max. 1 GB, external swap access)	1 x CF card (max. 1 GB, permanently installed)
Power supply	Operating voltage	6.5 V to 50 V Reverse polarity protection	6.5 V to 50 V Reverse polarity protection
	Current draw, operating	< 250 mA at 13.8 V	< 250 mA at 13.8 V < 350 mA at 13.8 V (with GSM or WLAN burst)
Data transfer	Serial	RS-232 (COM1, COM2)	RS-232 (COM1)
	Ethernet	10 Mbit/s	10 Mbit/s
	WLAN	With ES731 Mobile Drive WLAN add-on module	Integrated or through ES731 Mobile Drive WLAN add-on module
	GSM/GPRS	With ES732 Mobile Drive GSM add-on module	Integrated in ES737, otherwise through ES732 Mobile Drive GSM add-on module
Interfaces	CAN	2 x High-speed (basic unit) 4 x High-/low-speed (extension)	4 x High-speed
	CAN protocols	ISO 15765, TP2.0, GMLAN, KWP2000,	UDS, CCP V2.0/2.1, XCP V1.0
	K-Line	2 x ISO 9141 (Extension)	1 x ISO 9141
	K-Line protocols	KWP2000, KWP1281 (KW71), McMess	KWP2000, KWP1281 (KW71), McMess
	GPS	RS-232 (COM1, COM2), NMEA 0183 protocol	Integrated in ES736 and ES737, otherwise via RS-232 (COM1), NMEA 0183 protocol
	External measurement modules	XCP-on-Ethernet SMB (COM2) CAN	XCP-on-Ethernet SMB (COM1) CAN
Input	Handheld push-button with LED as recording control for manually stopping/starting a measurement	Optional	Optional
	Acquisition of battery voltage on terminals 15 (ignition) and 30 (positive)	2 x A/D converter (10-bit resolution)	2 x A/D converter (10-bit resolution)
	Universal analog inputs	none	8 channels (10 kΩ input resistance, 10-bit resolution, 0 V to 41 V, 2 ms scan rate)
	Digital input for external triggering	4 channels (TTL, Schmitt trigger, short-circuit proof)	4 channels (TTL, Schmitt trigger, short-circuit proof)
Outputs	Digital outputs for trigger status display of measuring groups 1 through 4	4 channels (TTL, short-circuit proof)	4 channels (TTL, short-circuit proof)



**Figure 5:** Drive recorders are accessed through a mobile radio network (GSM/GPRS). The E5732 module connected to the E5730 module functions as the GSM/GPRS interface.

## Measuring Groups

- Event groups record selected channels once a predefined starting condition has been met. To optimize memory requirements, it is possible to record the measured variables of a given event group only if their value is found to have changed. As an alternative, measuring channels can be scanned at a fixed rate of between 0.1 Hz and 100 Hz.
- Log groups record all messages transmitted on one or more CAN buses in the form of raw data.
- Script groups provide the option to launch the services of a diagnostic or calibration protocol by means of a predefined trigger. All communications queries and responses are stored in the measurement data file.

- During classing, the frequency of the occurrence of a given measured variable is recorded. Up to six measurement signals can be classified.

To display measured data while a measurement is ongoing, a simple Windows-based application provides an online data display. To this end, the drive recorder requires a serial connection with the PC via cable, GSM, or Ethernet.

To ensure flexible measurement data evaluation, a suitable conversion tool is shipped together with the drive recorder software. It converts the recorded measurement data files to CSV (ASCII) or MDF files. These file formats ideally lend themselves for evaluation by means of the standard application or evaluation tools, such as INCA, for example.

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