# ARIADNE

## Knock Control KC-01



✔ Protection against engine damage

✔ High efficiency

✔ Low emissions

✔ Cost effectiveness

✔ Monitoring of up to 20 sensors

✔ Suitable for all applications

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Energy requires Control

*Engine & Turbine Management*

# ARIADNE

## Knock control unit

Knocking is an uncontrolled combustion process that can occur in gas engines, generating high frequency pressure vibrations in the combustion chamber. This not only causes reduced engine performance and increased noise, but can also potentially lead to destructive engine damage.

Combustion knock is a major limiting factor on the available compression ratio, and means that the use of low methane number fuel gas must be restricted. Alongside misfiring, this is one of the major obstacles in delivering increased performance and development of improved engine designs.

Knock is a stochastic process, meaning that even under steady operational conditions the knock intensity will change from cycle to cycle and from cylinder to cylinder. This makes it necessary to analyse each cylinder individually to ensure the best performance.

The three factors described above illustrate the key role played by the knock control process in modern spark-ignition engine management systems.

The system must be able to accurately detect knock in each cylinder individually, and must maintain optimal operation under all conditions in order to protect the engine from damage.

Performance and protection: these concepts are at the heart of the design of ARIADNE, HEINZMANN's Knock Control System. With ARIADNE on board you can be sure that you have the best tools available in your quest for improved engine performance and avoidance of the threat of knock.

# ARIADNE Benefits

Used as part of a gas engine management system, ARIADNE offers advantages in terms of engine protection, performance and cost.

✔ **ARIADNE protects gas engines against damage caused by combustion knock.**

✔ **With ARIADNE on board, engines can safely be run close to the knock limit, leading to high efficiency and low emissions.**

✔ **ARIADNE allows variable quality fuel gas to be used.**

✔ **Less electronics on the engine: a single ARIADNE unit can monitor up to 20 knock sensors i.e. sufficient for a complete engine in most cases.**

✔ **ARIADNE monitors each cylinder on a cycle-by-cycle basis. This makes it possible to fine tune individual cylinders, thereby improving engine performance and reducing emissions.**

✔ **ARIADNE supports a low cost application option, with monitoring of several cylinders using a single sensor.**

✔ **ARIADNE is fully compatible with other HEINZMANN systems and the HEINZMANN advanced user interface DcDesk 2000.**

✔ **ARIADNE is available in 2 designs (IP 00 and IP 66) and can be mounted either on or off the engine.**

✔ **ARIADNE facilitates quick servicing using its integrated diagnostic display.**

✔ **ARIADNE provide a wide range of I/O options, making it suitable for all types of application, from use as a stand-alone unit to use as a highly integrated part of engine management system.**

# FUNCTIONAL OVERVIEW
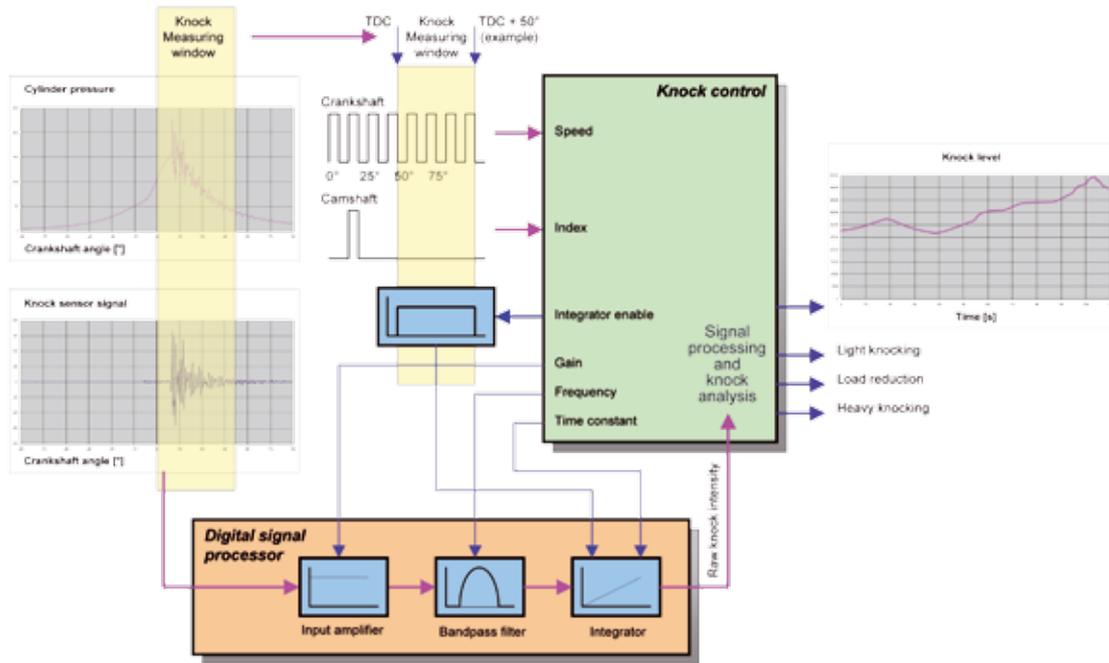


## APPLICATION

ARIADNE can monitor up to 20 vibration sensors placed on the engine structure. Depending on the configuration, a single sensor may be assigned to one or more cylinders.

Combustion knock produces high frequency pressure oscillations that cause increased vibration within the engine structure. The knock sensor is able to detect this vibration and will output a higher signal level at certain frequencies of oscillation.

By using a configurable bandpass filter, ARIADNE is able to monitor just this specific knock frequency, suppressing all normal engine vibration that is not related to knock.

In order to determine the time window where combustion knock is likely to occur on a cylinder-by-cylinder basis, ARIADNE also needs information relating to engine speed and phase (knock is usually measured just after cylinder top dead centre, for example between TDC and TDC+50° crank).

### Technical information

| Storage temperature | -40 °C up to +85 °C |
|---|---|
| Ambient temperature | -40 °C up to +80 °C |
| Air humidity | up to 98 % at 55 °C |
| Vibration | max. 2 mm with 10 up to 20 Hz, max. 0.24 m/s with 21 up to 63 Hz max. 7 g with 64 up to 2000 Hz |
| Shock | 50 g, 11 ms – half-sine wave |
| Protection grade | IP 00 or IP 66 |
| Isolation resistance | > 1 MOhm with 48 V DC |
| Weight | approx. 1 kg |
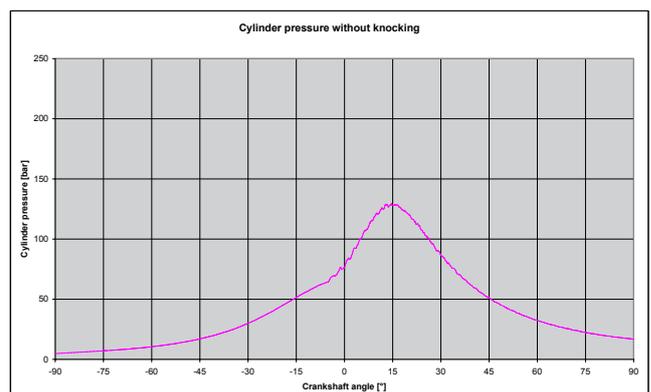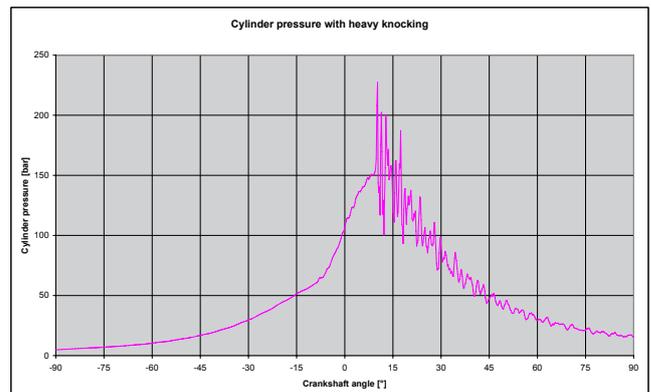
ARIADNE is particularly well suited to engines with the following characteristics:

➡ V- or inline gas engines
➡ Rated speed of 600 to 1800 rpm
➡ Rated load from 100 to 8000 kW
➡ Number of cylinders from 4 to 20

ARIADNE has been designed to suit all gas engine control system applications. In order to illustrate the range of possible applications, 2 typical configurations are described below in more detail.

## STAND-ALONE KNOCK CONTROL UNIT

When used as stand-alone unit, ARIADNE's analogue output can be wired directly to the ignition system, transmitting the knock severity measured on the engine (maximum knock level on all cylinders).

This 4-20 mA or 0-5 V signal is used to provide an offset to the nominal spark angle. When particularly heavy knocking is detected an engine stop signal will be sent using a digital output to the speed/load controller.

For more precise knock control, a load signal can also be connected to ARIADNE (for example an electrical load measurement or the output from a boost pressure sensor).

ARIADNE can also provide an optional load reduction signal using a digital output or the CAN bus.

## FULLY INTEGRATED KNOCK CONTROL UNIT

ARIADNE can also be configured as part of a highly integrated gas engine management system. This can be particularly useful in providing the means to fine tune each cylinder individually on systems that allow combustion and load to be controlled on a per cylinder basis.

In this type of application ARIADNE transmits and receives all necessary information using the CAN bus (cylinder knock levels and load measurements).

The knock levels can be used by other units, in combination with other information such as cylinder exhaust gas temperatures, to provide functionality such as control of ignition angle and gas injection time for individual cylinders (to have optimal cylinder balancing). The knock levels can also be used as inputs to derating algorithms for use when over temperature or combustion knock are detected.

Naturally, it is also possible to provide communication links to customer units or PLCs using the CAN bus (CANopen, DeviceNet, J1939, etc.) or Modbus interface.

HEINZMANN's optional advanced user interface, DcDesk2000, can also be used to communicate with all HEINZMANN devices over the CAN bus, making it possible to monitor all HEINZMANN gas engine control units simultaneously from the same PC.
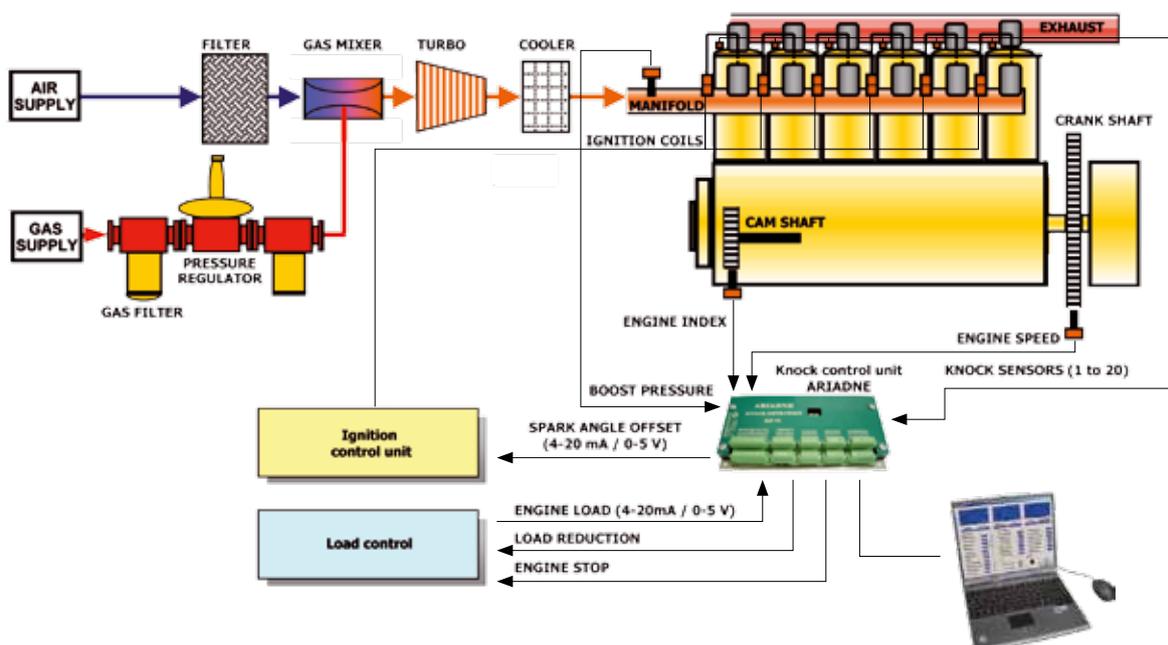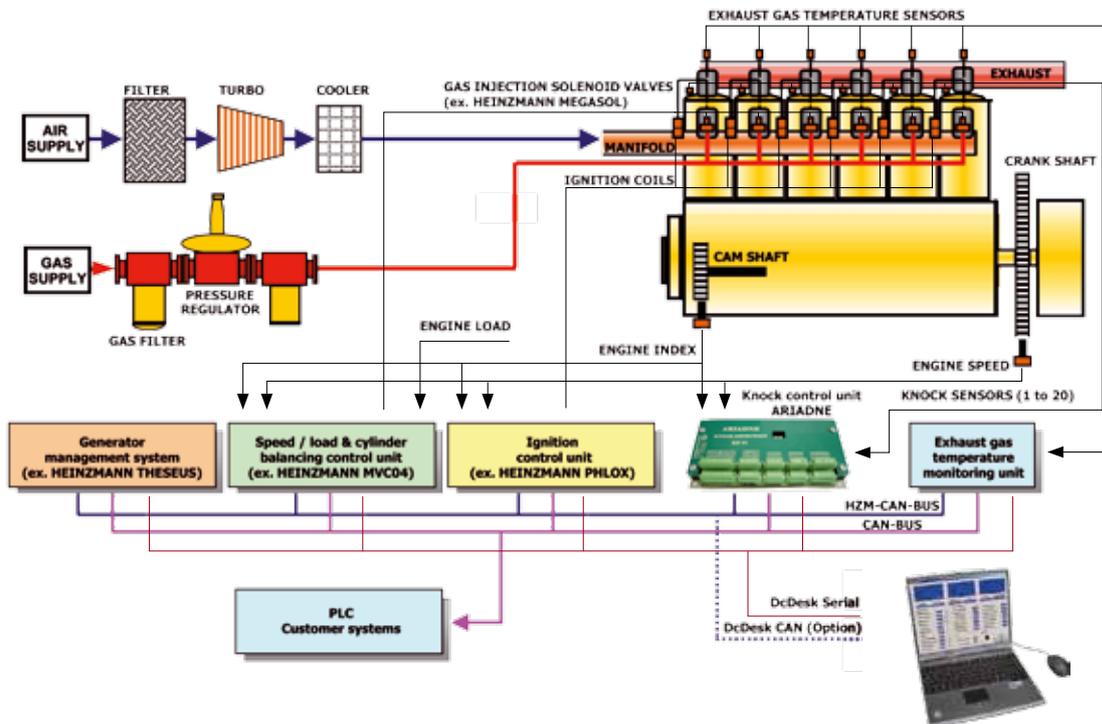
## Inputs and Outputs

The ARIADNE IP 00 version provides all inputs and outputs via terminal strips.

The IP 66 version provides all inputs and outputs via plug-in connectors.

All inputs and outputs feature reverse polarity protection and short circuit protection for positive and negative battery voltages.

### Inputs

- ➥ 1 speed sensor input
- ➥ 1 phase sensor input
- ➥ 1 analogue input
- ➥ 20 knock sensor inputs

### Outputs

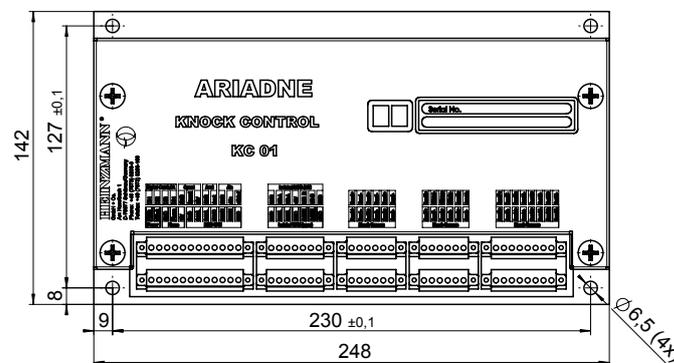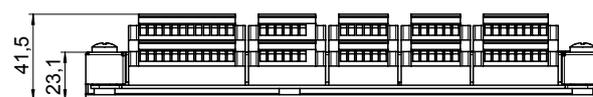- ➥ 1 analogue output
- ➥ 4 digital outputs

## Communication

- ➥ 2 CAN bus
- ➥ 1 ModBus
- ➥ 1 serial interface

## Power supply

- ➥ Operating voltage:       24 V DC
- ➥ Min. voltage:              18 V DC
- ➥ Max. voltage:             32 V DC
- ➥ Residual ripple:          max. 10 % with 100 Hz
- ➥ Current consumption:   max. 1 A
- ➥ External fuse protection: 6 A

## Dimensions



For further technical information please refer to the ARIADNE Manual

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TURBINE MANAGEMENT

GAS ENGINE MANAGEMENT

DUAL FUEL CONTROLS

SENSORS AND SOLENOIDS

COMMON RAIL

CONFIGURATION TOOLS
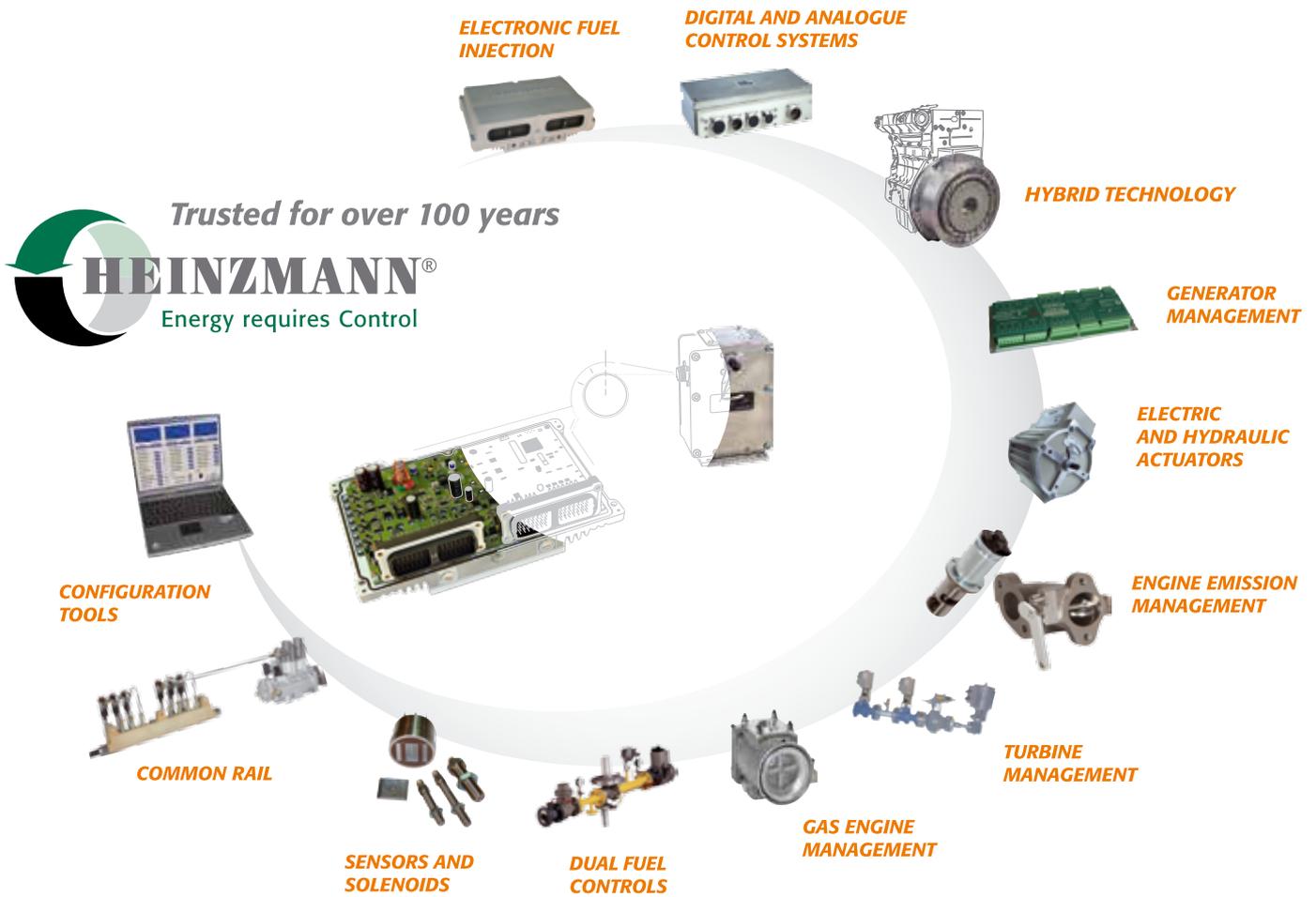
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