DEIF

-power in control

CE

DESIGNER'S REFERENCE HANDBOOK

Anti Knocking System, AKR 3

- Product information
- Functional description

DEIF A/S · Frisenborgvej 33 · DK-7800 Skive
Tel.: +45 9614 9614 · Fax: +45 9614 9615
info@deif.com · www.deif.com

Document no.: 4189340791A
SW version:

1. General information

1.1 Warnings, legal information and safety

1.1.1 Warnings and notes

Throughout this document, a number of warnings and notes with helpful user information will be presented. To ensure that these are noticed, they will be highlighted as follows in order to separate them from the general text.

Warnings

Warnings indicate a potentially dangerous situation, which could result in death, personal injury or damaged equipment, if certain guidelines are not followed.

Notes

Notes provide general information, which will be helpful for the reader to bear in mind.

1.1.2 Legal information and disclaimer

DEIF takes no responsibility for installation or operation of the generator set. If there is any doubt about how to install or operate the engine/generator fitted with the AKR 3 unit, the company responsible for the installation or the operation of the set must be contacted.

The AKR 3 unit is not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.

1.1.3 Safety issues

Installing and operating the AKR 3 unit may imply work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorised personnel who understand the risks involved in working with live electrical equipment.

Be aware of the hazardous live currents and voltages.

1.1.4 Electrostatic discharge awareness

Sufficient care must be taken to protect the terminal against static discharges during the installation. Once the unit is installed and connected, these precautions are no longer necessary.

1.1.5 Type label

The label indicates that this product must be disposed of according to national rules on the disposal of electrical and electronic waste.

1.2 About the Designer's Reference Handbook

1.2.1 General purpose

This Designer's Reference Handbook mainly includes general product handling, CAN bus J1939 protocol, etc.

The general purpose of this document is to provide important information to be used when designing the unit into an engine management system.

Please make sure to read this document before starting to work with the AKR 3 unit and the genset to be controlled. Failure to do this could result in human injury or damage to the equipment.

1.2.2 Intended users

This Designer's Reference Handbook is mainly intended for the person responsible for the engine management system design. In most cases, this would be a system designer. Naturally, other users might also find useful information in the document.

1.2.3 Contents and overall structure

This document is divided into chapters, and in order to make the structure simple and easy to use, each chapter will begin from the top of a new page.

2. General product information

2.1 AKR 3 product information

2.1.1 Introduction

The AKR 3 is a part of the DEIF product range intended for control and protection of gas and dual-fuel engines.

2.1.2 Type of product

The AKR 3 is a microprocessor-based unit containing all necessary functions to detect engine knocking, perform closed loop ignition control and transfer the information to the engine management system.

It contains all necessary knocking detection circuits, and all values are presented on digital communication line(s).

The AKR 3 is a control-critical component. A failure will lead to reduced maximum engine load.

2.2 Options

2.2.1 Options

Misfire detection.

3. Functional description

3.1 Standard functions

3.1.1 Knock sensing

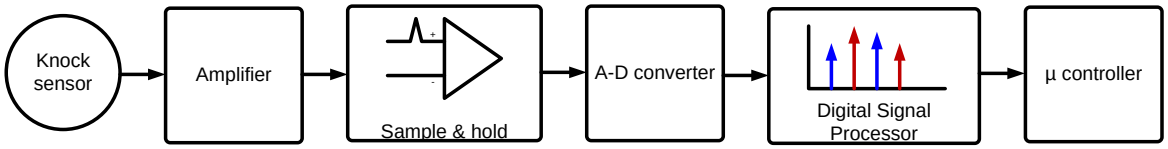
The anti knock control system is based on the measurement of the solid-borne combustion noise. The AKR analyses the solid-borne noise, which is transduced in the crankcase and all other engine components.

Conventional anti knock control systems use analogue filter technology for the preparation of the signal obtained by the knock sensors which operate according to the piezo electric sensor principle. Opposed to this technology, the AKR system digitises the signal, directly after running it only through an anti-aliasing filter. The digitised signal will then be digitally filtered and analysed in a Digital Signal Processor (DSP). These filtering and analysing methods make it possible to extract, with ultimate precision, those parts of the signal that are caused by engine knocking.

The most important advantage of this method is that it gives a much better detection of engine knocking. It will not muddle up loud, non-knocking cycles with engine knocking, and it will not fail to detect knocking cycles. The result of the signal analyses is used to determine the anti knock control parameters, that is spark retardation and load reduction, in order to suppress engine knocking.

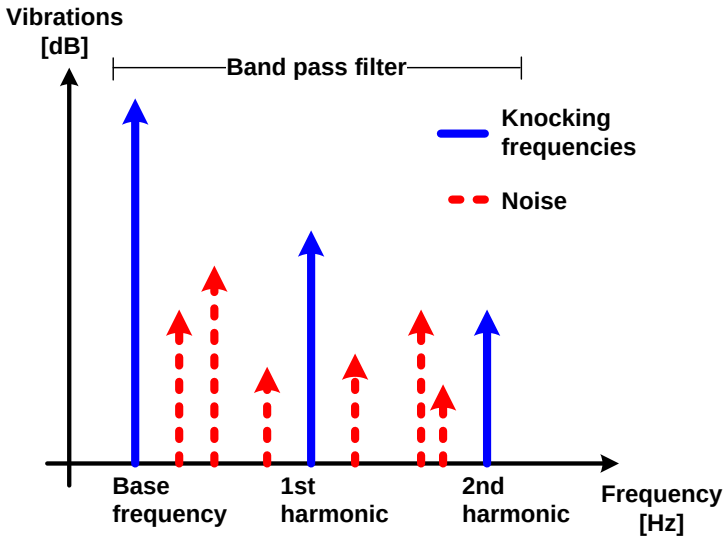
The AKR system creates a solid base for an engine protection system. It offers the possibility to increase the thermodynamic efficiency of the engine, and it reduces the loss in kWh output.

Working principle:



As part of the AKR process, a spectral analysis is made of the vibration signal. The results of the spectral analysis are highly informational inputs for the anti knock detection and the calculation of the knock amplitude. This AKR system, compared to the conventional ones with ordinary band pass filtering, is much better suited for filtering knock-relevant signals from the disturbing signals.

Distinction between knock signals and disturbance (noise):



Knock detection is based on an individual monitoring of each cylinder. Each knocking combustion cycle increments the knock integrator (ignition retard rate). During combustion cycles without knocking, the knock integrator decrements slowly back to normal (ignition advance rate). In closed loop operation, the AKR 3 will find equilibrium at the knock limit.

The resulting knock integrator value is used to calculate the ignition offsets. The AKR 3 transmits the effective ignition points via CAN to the engine management system or ignition system.

The AKR 3 sends messages continuously with the ignition timing information. In case of an AKR 3 system failure, the ignition system will be set to the maximum retard value (fail safe condition). In case the maximum ignition retard value is exceeded or in case of heavy knocking, the engine will shut down.

All status and failure indication is available through CAN. The connected engine management system handles the protocolling of all errors.

If the system is not released, then no errors will be detected. This means that the engine start can be performed without any problems. Measures to be taken in case of an error are listed in the paragraph "Troubleshooting".

3.2 Optional functions

3.2.1 Misfire detection

Based on the frequency pattern of the ignition of the fuel in the cylinder, misfire detection can be carried out. This is adjusted individually for each engine type when doing the initial knocking and noise filtering for the engine type in question

The misfire indication is sent via the CAN J1939 interface to the engine controller, if the function is active.

4. Troubleshooting and service

4.1 Troubleshooting

Number	Symptom	Failure	Solution
1	Knock sensor error	Wiring	Check wiring and exchange if damaged
2	Knock sensor error	Knock sensor	Change knock sensor
3	KW sensor error	Wiring	Check wiring and exchange if damaged
4	KW sensor error	KW sensor	Change KW sensor
5	NW sensor error	Wiring	Check wiring and exchange if damaged
6	NW sensor error	NW sensor	Change NW sensor
7	No communication	Wiring	Check wiring and exchange if damaged
8	No communication	No power	Supply system with power

4.2 Service

Normally, the AKR 3 system does not require any service!

All necessary operational parameters are set during the system installation.

However, the customer is responsible for the wiring, which is to be ordered at their own manufacturers'.

Damaged cables should always be replaced even if they still seem to function well!

In case of an AKR system breakdown, the system should be sent for repair together with the necessary (technical) information:

- Sender’s name (contact person)
- Sender’s address
- Sender’s telephone number
- Serial number of the AKR system concerned
- Location (address) of the engine/system
- Engine number
- Description of the defect/complaint
- Internal defect reference number (if available)
- DEIF A/S service order number. This can be obtained by contacting the nearest DEIF company

Send the damaged system to the following address:

DEIF A/S
Frisenborgvej 33
DK-7800 Skive
Denmark
Att.: Service Dept.
service@deif.com

DEIF A/S will not be able to supply the necessary service in case of a breakdown, if the above-mentioned information is incomplete or not available.