DEIF

-power in control

CE

INSTALLATION INSTRUCTIONS

Anti Knocking System, AKR 3

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

Document no.: 4189340792B
SW version:

1. General information

2. General product information

3. Mounting

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.

The English version of this document always contains the most recent and up-to-date information about the product. DEIF does not take responsibility for the accuracy of translations, and translations might not be updated at the same time as the English document. If there is a discrepancy, the English version prevails.

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.

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.

1.2 About the Installation Instructions

1.2.1 General purpose

These Installation Instructions mainly include general product and hardware information, mounting instructions, terminal strip descriptions, I/O lists and wiring descriptions.

The general purpose of this document is to give the user important information to be used in the installation of the unit.

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

These Installation Instructions are mainly intended for the person responsible for the design and installation. In most cases, this would be a panel builder 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 dual-fuel and gas engines.

2.1.2 Type of product

The AKR 3 is a microprocessor-based unit containing all necessary functions to detect engine knocking 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).

2.2 Standard functions

Engine knocking detection, based on piezo electric knocking sensor signal (Bosch automotive type).

For further information, please refer to the Designer's Reference Handbook.

2.3 Optional functions

Misfire detection based on the firing noise for each individual cylinder. Please note that the option is not available for all engine types. Contact DEIF for further information.

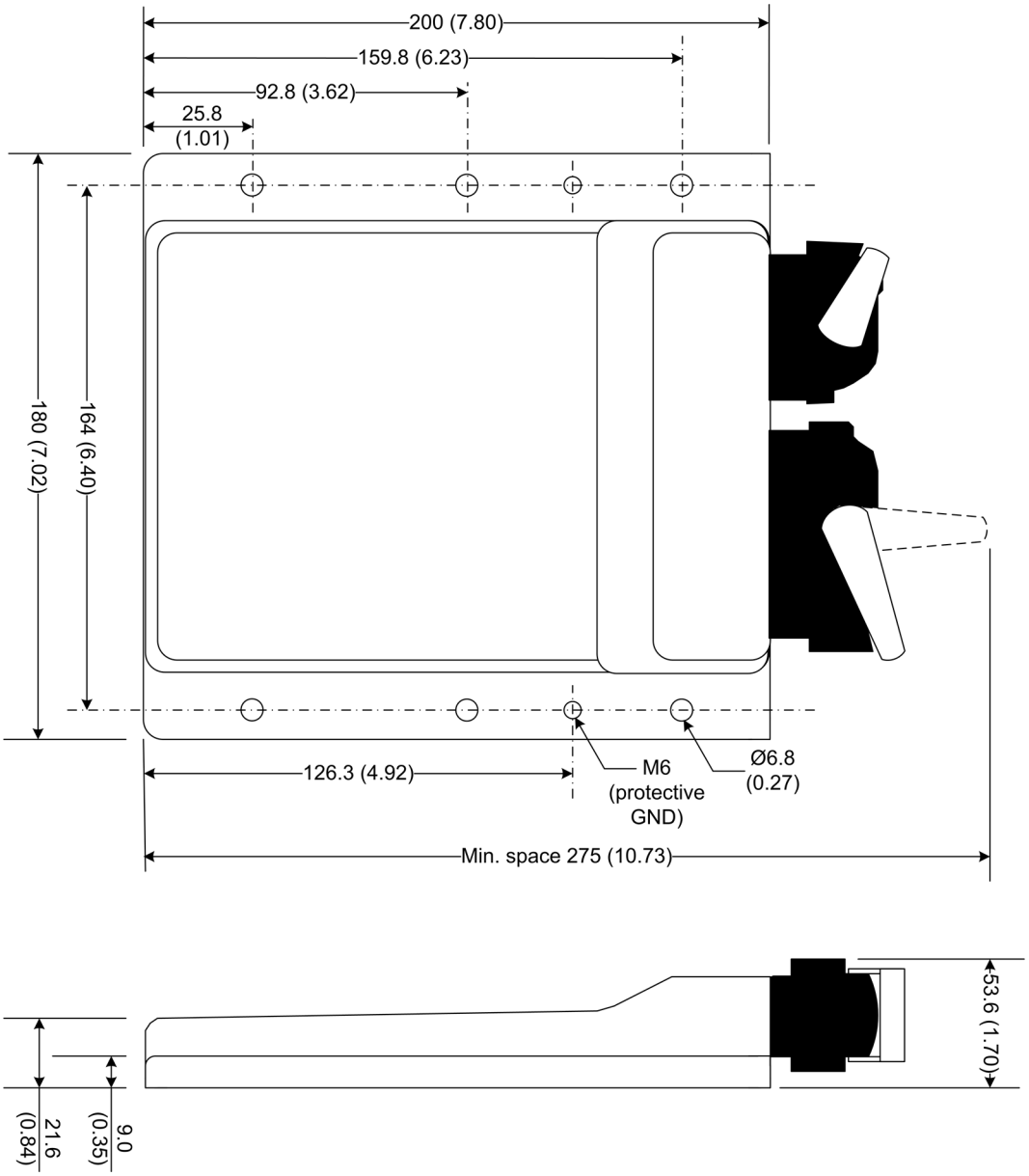
3. Mounting

3.1 AKR 3 mounting

3.1.1 Mounting instructions

The unit is fastened with screws to the base plate of the panel. There are 6 × Ø6.8 mm (0.27 in) screw holes in the unit.

Dimensions in mm (in):

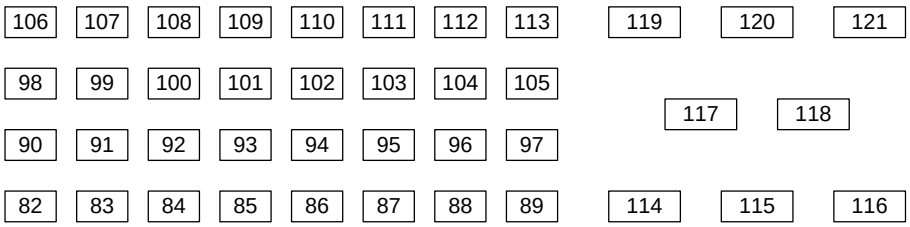


3.1.2 AKR 3 connections

The AKR 3 must be solidly grounded to the engine ground.

The AKR 3 is supplied with two AMP connectors. The connector pin layouts are as follows:

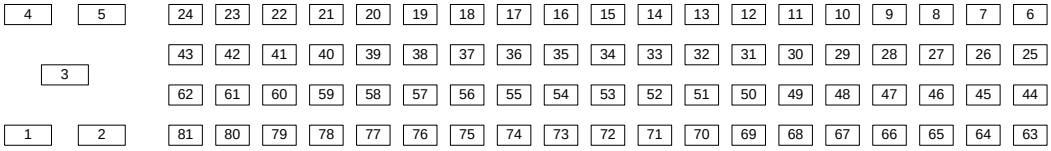
40-pin AMP connector



Pin	Signal	Note
83, 84, 91, 92	Do not use	
85, 86, 87, 88	PE	Internally connected. Use for wire shield.
93	GND Camshaft sensor	Transistor output sensor type recommended. This sensor must be fitted.
100	Speed sensor +12 V	
101	Camshaft sensor signal	
94	GND Crankshaft sensor	Transistor output sensor type or inductive sensor.
108	Speed sensor +12 V	
102	Crankshaft sensor signal	
98	OUT 1, status OK	Open collector output, NPN transistor, max. 50 mA, max. 32 V Refers internally to +24 V DC
99	OUT 2, load reduction	
106	OUT 3, shutdown (heavy knocking)	
104	CAN 1 L	To engine control/ignition system.
112	CAN 1 H	
96	CAN 1 GND	Internally connected to 96.
103	CAN 2 L	Not used.
111	CAN 2 H	
95	CAN 2 GND	Internally connected to 95.
105	TXD RS-232 (DB 9 pin 2)	PC interface (DEIF use only).
113	RXD RS-232 (DB 9 pin 3)	
97	GND RS-232 (DB 9 pin 5)	
90	Debug	Timing output (DEIF use only).
82	GND	
107	+4 to 20 mA output	Refers to 0 V DC 4-20 mA ~ 0-10 ° firing retard command.
109	Optocoupler input 1 or alternative camshaft sensor	Refers to 0 V DC Input 1: Low = Release knock monitoring.
110	Optocoupler input 2 or alternative crankshaft sensor	Refers to 0 V DC Input 2: Low = Release sensor error monitoring.
114, 115, 116, 117, 118	0 V DC	Power supply, 18 to 32 V DC Consumption 400 mA @ 24 V DC
119, 120, 121	24 V DC +	

CAN bus requires 120 Ω end terminal resistor across H and L.

81-pin AMP connector



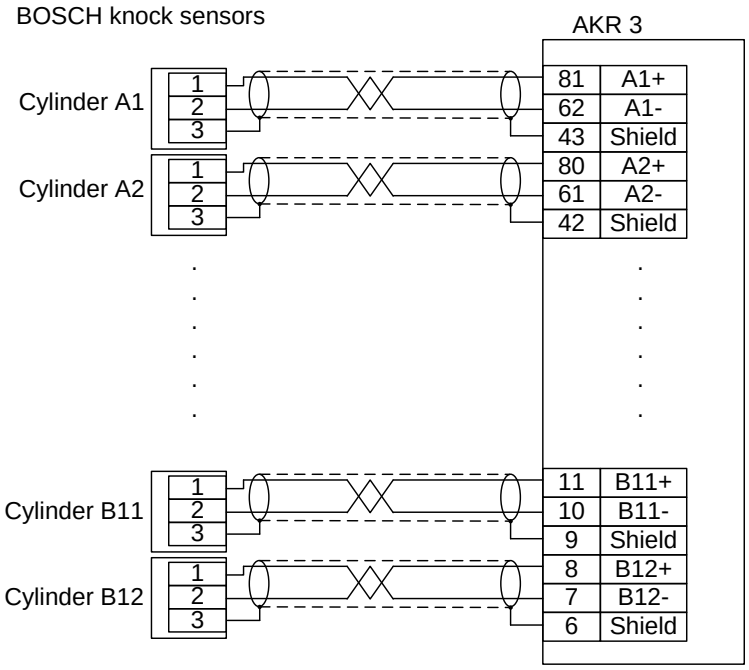
Pins 1 to 5 and 15, 34, 53 and 72 are not connected. Do not use.

Knock sensor connections

BANK A				BANK B			
PIN	**Signal**	**PIN**	**Signal**	**PIN**	**Signal**	**PIN**	**Signal**
81	A1+	75	A7+	71	B1+	65	B7+
62	A1-	56	A7-	52	B1-	46	B7-
43	Shield	37	Shield	33	Shield	27	Shield
80	A2+	74	A8+	70	B2+	64	B8+
61	A2-	55	A8-	51	B2-	45	B8-
42	Shield	36	Shield	32	Shield	26	Shield
79	A3+	73	A9+	69	B3+	63	B9+
60	A3-	54	A9-	50	B3-	44	B9-
41	Shield	35	Shield	31	Shield	25	Shield
78	A4+	24	A10+	68	B4+	14	B10+
59	A4-	23	A10-	49	B4-	13	B10-
40	Shield	22	Shield	30	Shield	12	Shield
77	A5+	21	A11+	67	B5+	11	B11+
58	A5-	20	A11-	48	B5-	10	B11-
39	Shield	19	Shield	29	Shield	9	Shield
76	A6+	18	A12+	66	B6+	8	B12+
57	A6-	17	A12-	47	B6-	7	B12-
38	Shield	16	Shield	28	Shield	6	Shield

References A and B are for cylinder banks, for example A12 is bank A cylinder no. 12.

3.1.3 Wiring diagram, knock sensors

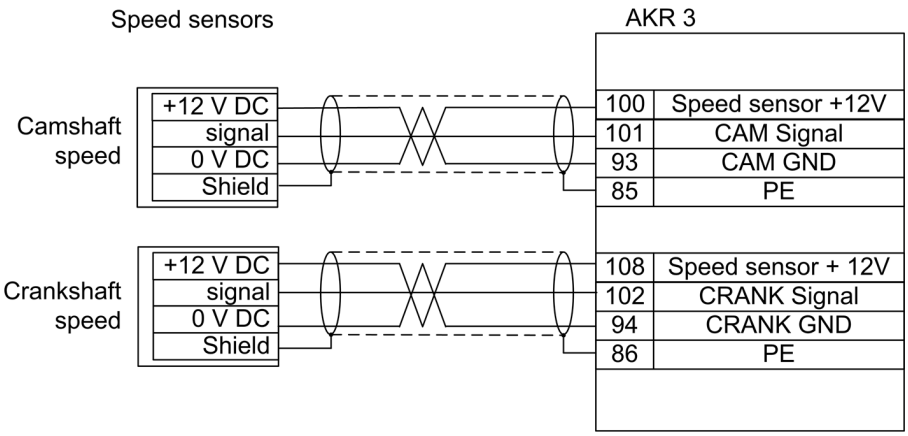


It is very important that the cable screen is connected correctly.

The cables must be 2-wire, shielded, twisted cable for each individual sensor (no multi core cables). The cables must be low capacitance cable able to withstand the environment in which they are mounted.

3.1.4 Wiring diagram, speed sensors

The preferred sensor type is Hall element sensor, push-pull transistor output, 12 V DC supply.



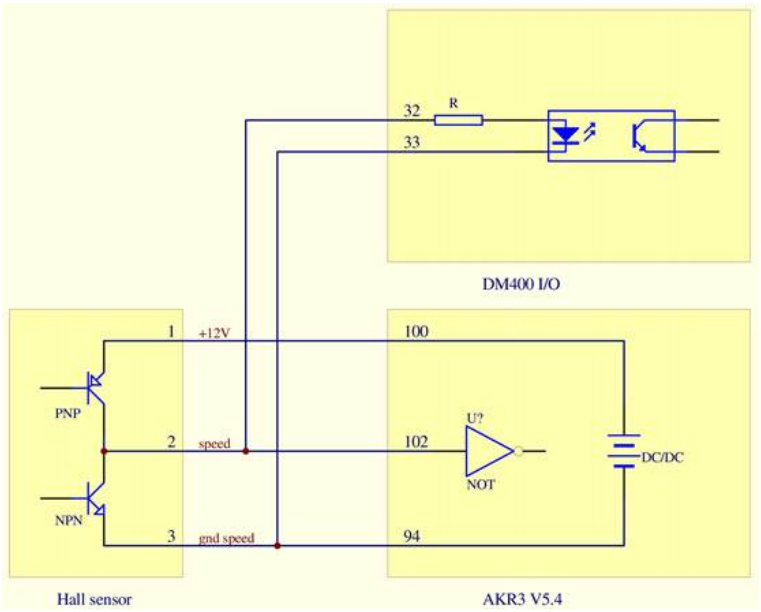
Camshaft trigger wheel: X-1 teeth type, X range 12-360.

Preferred configuration: Hall effect sensor push-pull connected to the internal 12 V.

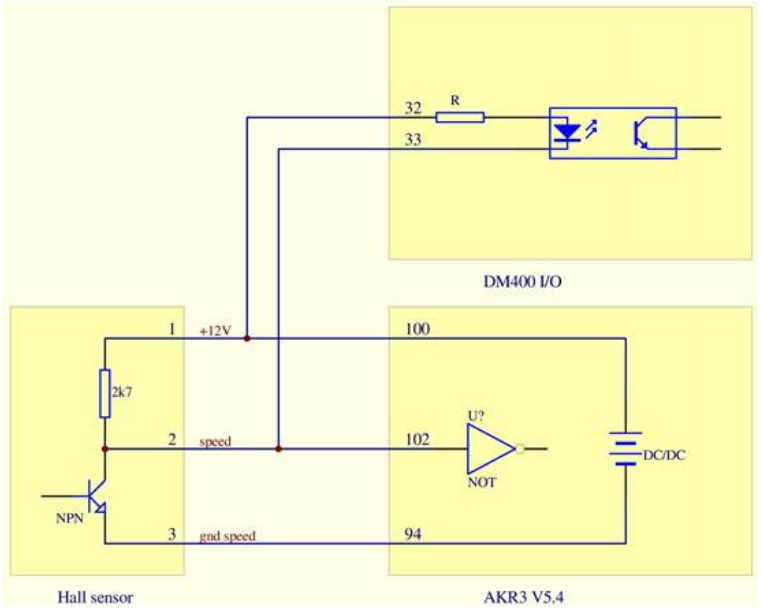
Alternative configuration: Hall effect sensor NPN with pull-up resistor connected to the internal 12 V. Not recommended in electrically noisy environment.

Pickup type	Frequency range	Output voltage	Comment
Inductive pickup	300 Hz to 5 kHz 300 Hz to 20 kHz	Min. 10 Vpp Min. 20 Vpp	
Hall effect sensor push-pull	0 Hz to 5 kHz 300 Hz to 20 kHz 0 Hz to 200 kHz	12 V to 32 V 12 V to 32 V 12 V to 32 V	Use 100 nF decoupling capacitor Use optocoupler input
Hall effect sensor NPN output	0 Hz to 5 kHz	12 V to 32 V	Use 2k7 pull-up resistor
Hall effect sensor PNP output	0 Hz to 20 kHz	12 V to 32 V	Use optocoupler input

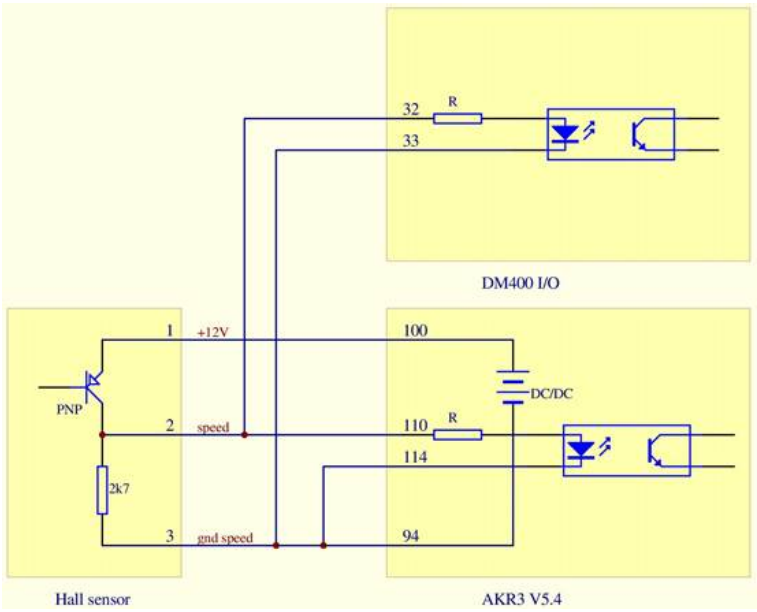
Camshaft and crankshaft sensor input threshold level: 2.1 V/2.9 V
Camshaft and crankshaft sensor maximum input level: -100 V/+100 V
Camshaft and crankshaft optocoupler input threshold level: 9 V
Camshaft and crankshaft optocoupler maximum input level: -32 V/+32 V



AKR 3 input and Delomatic 400 with push-pull type Hall effect sensor.



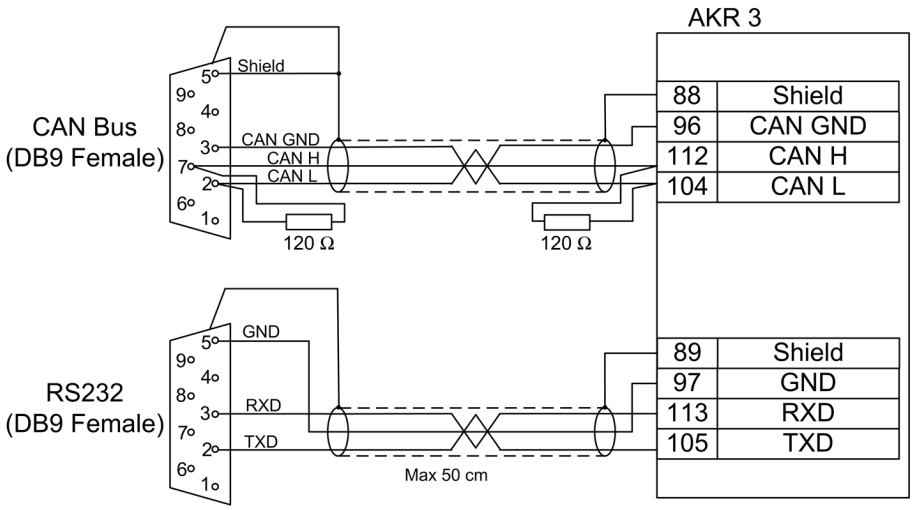
AKR 3 and Delomatic 400 with NPN type Hall effect sensor.



AKR 3 and Delomatic 400 with PNP type Hall effect sensor.

3.1.5 Camshaft trigger wheel example

3.1.6 Wiring diagram, communication

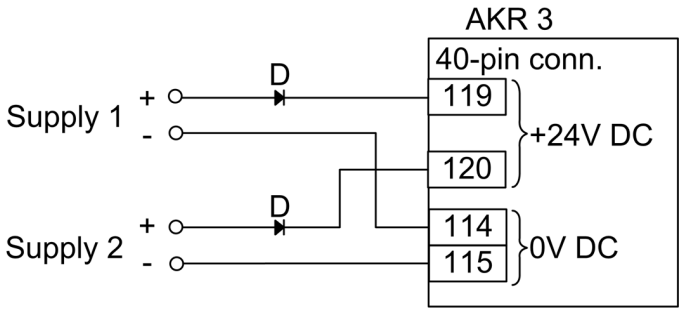


CAN bus requires 120 Ω end terminal resistor across H and L.

CAN bus GND can be omitted. Do NOT connect GND to ground.

3.1.7 Wiring diagram, double power supply

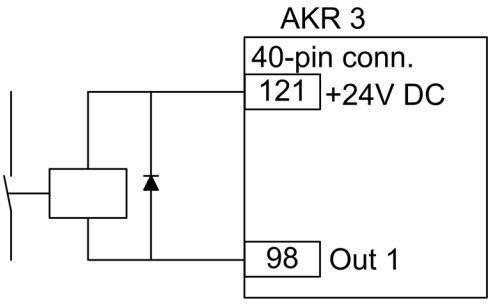
In case a double power supply (primary and backup) is required, the following circuit can be used:



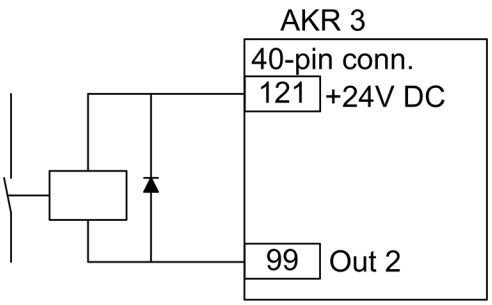
Diodes D: Any make and type capable of carrying 40 V DC, 1 A can be used.

3.1.8 Relay output

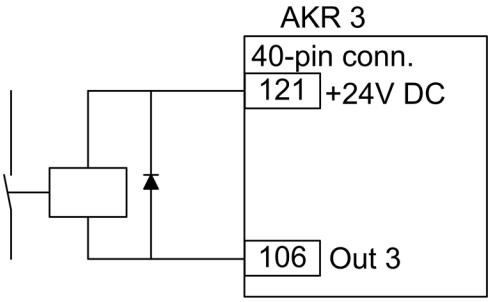
Status OK (OUT 1):
Relay driver OUT 1 can be connected to, for example, the safety chain to stop the engine if the AKR 3 fails. During normal operation the output is active and the relay contact is closed. Maximum sink current of OUT 1 is 50 mA.



Load reduction (OUT 2):
Relay driver OUT 2 indicates medium knocking. This function is optional. The output can be used for engine load reduction or shutdown in case of knocking. During normal operation the output is passive and the relay contact is open. Maximum sink current of OUT 2 is 50 mA.

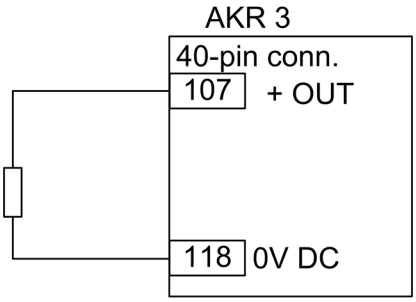


Shutdown (OUT 3):
Relay driver OUT 3 indicates heavy knocking. This function is optional. The output can be used for engine load reduction or shutdown in case of heavy knocking. During normal operation the output is passive and the relay contact is open. Maximum sink current of OUT 3 is 50 mA.



3.1.9 4 to 20 mA output

The 4 to 20 mA output is an option for global ignition firing retard control. It is not recommended for new systems.



3.2 Other hardware

3.2.1 Mounting of knocking sensors

Bosch vibration sensor, Bosch type 0-261-231-019 is recommended.

Use M8 × 25 bolts to fit the knocking sensor. Mounting torque 20 +/-5 Nm.

Surfaces must be machined according to Bosch specifications, completely clean and free of coating residues.

It may cause incorrect knocking detection if the above sensor mounting instructions are not followed!

3.2.2 Knocking sensor cable

Twisted pair shielded low capacitance cable with the following specifications:

Temperature range:	-50 to 150 °C
Voltage range:	600 V
Over-voltage:	2500 Veff
Isolation:	1500 MΩ
Characteristics:	Double isolated, low halogen
Fire-retardant:	Self-extinguishing according to DIN 0482 part 265

Recommended cable: Raychem SPEC 44 (part no. 44A1121-20-0/9-9) or equivalent.

Max. cable capacitance 2000pF for each sensor.

3.2.3 Connectors and accessories

Type	Description	DEIF item no.	Producer item no.
Connectors			
Accessory for AKR 3	Tyco Electronics Micro Quadlock Receptable contacts, 0.2-0.74 mm^2		
Accessory for AKR 3	Tyco Electronics Junior Power Timer Receptable contacts, 0.5-2.5 mm^2		
Accessory for AKR 3	Tyco Electronics MQS REC 81P Assembly		1473244-1
Accessory for AKR 3	Tyco Electronics MQS 81P Lever(R) Assembly		1473247-1
Accessory for AKR 3	Tyco Electronics MQS Retainer housing for 81P Assembly		368382-1
Accessory for AKR 3	Tyco Electronics MQS REC 40P Assembly		1473252-1
Accessory for AKR 3	Tyco Electronics MQS 40P Lever(L) Assembly		1473255-1
Accessory for AKR 3	Tyco Electronics MQS Retainer housing for 40P Assembly		368388-1
Knock sensors and parts			
Accessory for AKR 3	Bosch vibration sensor, cable length 930 mm	1030810003	0-261-231-019
Accessory for AKR 3	Bosch Retainer for Junior Timer Contacts		1-928-402-579
Accessory for AKR 3	Bosch protective cap		1-280-703-022
Accessory for AKR 3	Bosch optional single wire seals		1-928-300-599
Accessory for AKR 3	Tyco Electronics Junior Power Timer Receptable contacts, 0.5-1.0 mm^2		929 941
Accessory for AKR 3	Tyco Electronics Junior Power Timer Receptable contacts, 1.5-2.5 mm^2		929 937

Receptable contacts: Producer order number is dependent on the selected cable size.