Automotive
Energy & Power Analysis
Aerospace & Defense
Transportation
General Test & Measurement

CA-RIE-360/720 encoder

Technical reference manual

Re-inventing Data Acquisition

worldwide
DEWETRON
www.dewetron.com

Content

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Warranty Information

A copy of the specific warranty terms applicable to your DEWETRON product and replacement parts can be obtained from your local sales and service office.

Support

For any support please contact your local distributor first or DEWETRON directly.

For Asia and Europe, please contact:

DEWETRON Ges.m.b.H.
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Fax: +43 316 307090
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The telephone hotline is available
Monday to Friday between
08:00 and 17:00 CET (GMT +1:00)

For the Americas, please contact:

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Printing History

Please refer to the page bottom for printing version.

Safety instructions

Safety symbols in the manual

	*Indicates hazardous voltages.*

WARNING	*Calls attention to a procedure, practice, or condition that could cause bodily injury or death.*

CAUTION	*Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.*

WARNINGS

The following general safety precautions must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. DEWETRON Elektronische Messgeraete Ges.m.b.H. assumes no liability for the customer's failure to comply with these requirements.

All accessories shown in this document are available as option and will not be shipped as standard parts.

Safety instructions for all DEWETRON systems

- The DEWETRON data acquisition systems may only be installed by experts.
- Read your manual before operating the system.
- Observe local laws when using the instrument.
- Ground the equipment: For Safety Class 1 equipment (equipment having a protective earth terminal),a non interruptible safety earth ground must be provided from the mains power source to the product input wiring terminals or supplied power cable.
- DO NOT operate the product in an explosive atmosphere or in the presence of flammable gases or fumes.
- DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to a DEWETRON sales and service office for service and repair to ensure that safety features are maintained.
- Keep away from live circuits: Operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers or shields are for use by service-trained personnel only. Under certain conditions, dangerous voltages may exist even with the equipment switched off. To avoid dangerous electrical shock, DO NOT perform procedures involving cover or shield removal unless you are qualified to do so.
- No modifications are allowed at the instrument. The fuse in the power module has to be replaced by the same type. For continued protection against fire, replace the line fuse(s) only with fuse(s) of the same voltage and current rating and type. DO NOT use repaired fuses or short-circuited fuse holder labels and print on the power module may not be removed.
- DO NOT service or adjust alone. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.
- DO NOT substitute parts or modify equipment: Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to a DEWETRON sales and service office for service and repair to ensure that safety features are maintained.
- Before opening the instrument (experts only) or exchanging the fuse in the power module disconnect power!
- Don’t touch internal wiring!
- Don’t use higher supply voltage than specified!
- Use only original plugs and cables for harnessing.
- Install filler-panels in unused slots.
- The power-cable and -connector serve as Power-Breaker. The cable must not exceed 10 feet, disconnect function must be possible without tools.
- Safety of the operator and the unit depend on following these rules.

General System Information

Environmental Considerations

Information about the environmental impact of the product.

Product End-of-Life Handling

Observe the following guidelines when recycling a DEWETRON system:

System and Components Recycling

Production of this components required the extraction and use of natural resources. The substances contained in the system could be harmful to your health and to the environment if the system is improperly handled at it's end of life! Please recycle this product in an appropriate way to avoid an unnecessary pollution of the environment and to keep natural resources.

This symbol indicates that this system complies with the European Union’s requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). Please find further informations about recycling on the DEWETRON web site www.dewetron.com

Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment, and is outside the scope of the 2002/95/EC RoHS Directive. This product is known to contain lead.

General

- Solid aluminium housing with high vibration and shock resistance
- Prepared for DEWE-CA, Rotational-Torsionalvibration, Ordertracking
- 2 marker discs with 1° or 0.5° resolution available
- Customized marker disc (for Torsional Vibration)
- Up to 0.1° resolution with optional DEWE-CRANKANGLE-CPU
- Easy mounting
- Wide temperature range -20 to 90°C

Specifications

	CA-RIE-360/720 Encoder
Power supply:	5 .. 12 V_{DC} (5 V standard)
Current consumption at no load:	45 mA @ 5 V, 65 mA @ 12 V
Logic level:	TTL
Switching frequency:	125 kHz
Load current per channel max.:	±20 mA source/sink
Output Amplitude:	4.4 V high, 0 V low @ 5 V_{CC}, 5 V high, 0 V low @ V_{CC} > 6 V
Protection:	against wrong supply polarity, Output short
Rise time:	100 V/µs
Operation Temperature:	-20 .. 90 °C
Cable:	10 m
Dimensions (W x D x H):	39.5 x 47.5 x 25.5 mm (1.6 x 1.9 x 1 in.)
Weight:	about 90g without cable (0.19 lbs)

CA-RIE 360/720 Encoder

Device overview

The CA-RIE-360/720 encoder was specifically developed for rugged applications, such as combustion engine test and rotating machine analysis where vibration has often been the source of problems for existing encoders. The encoder can safely be mounted between the engine and brake shaft for Tortional Vibration analysis.

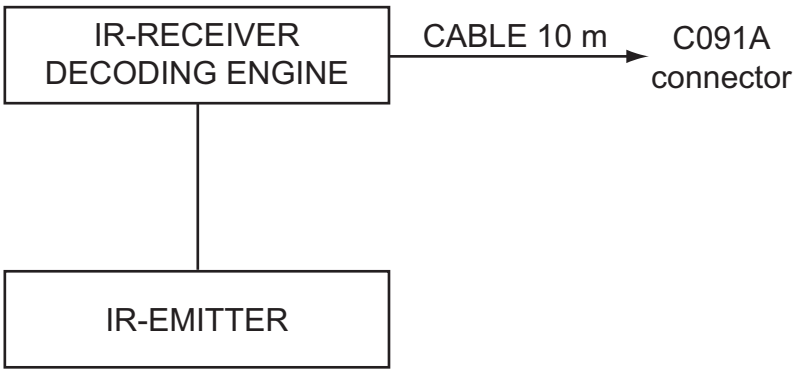
The sensor provides a TTL output signal that can be directly connected to any DEWETRON combustion analyser or torsional vibration analyser.
The principle of operation of the CA-RIE-360/720 is based on the transmission of light. An infrared beam is emitted and received at the sensor unit. A marker disk (with slits) is mounted between the sensors gate. The slits will interrupt the infrared beam and the receiver transforms the light to voltage.

Two models are available:

360 Slits= 1° resolution (outer diameter 120mm)
720 Slits= 0.5° resolution (outer diameter 230mm)

In conjunction with the DEWE-CRANKANGLE-CPU the resolution can be increased up to 0.1°. This module is already integrated in any DEWE-xxxx-CA-PROF system, or can be used as a stand-alone unit for any other system!

Internal signal processing



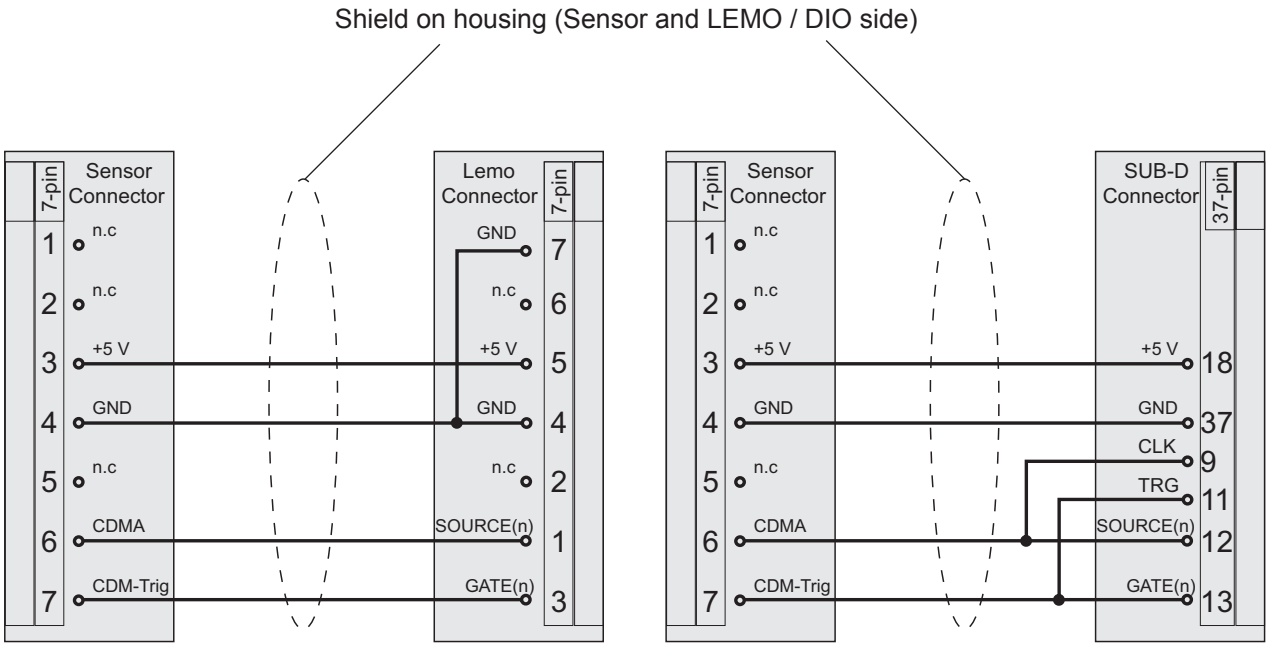
Pin assignment of the CA-RIE-360

The pin assignment of the CA-RIE-360 connector is prepared for our DEWE-CA measurement systems. So it is possible to connect it directly to the system, without having any adapter cable.

C091A connector
(male)

Pin 1: n.c
Pin 2: n.c
Pin 3: +5 V (yellow)
Pin 4: GND (green)
Pin 5: n.c
Pin 6: CDMA (white)
Pin 7: CDM-Trig (brown)

Internal wiring of lemo and SUBD adapter for ORION Counter Series



C091A connector
(female)

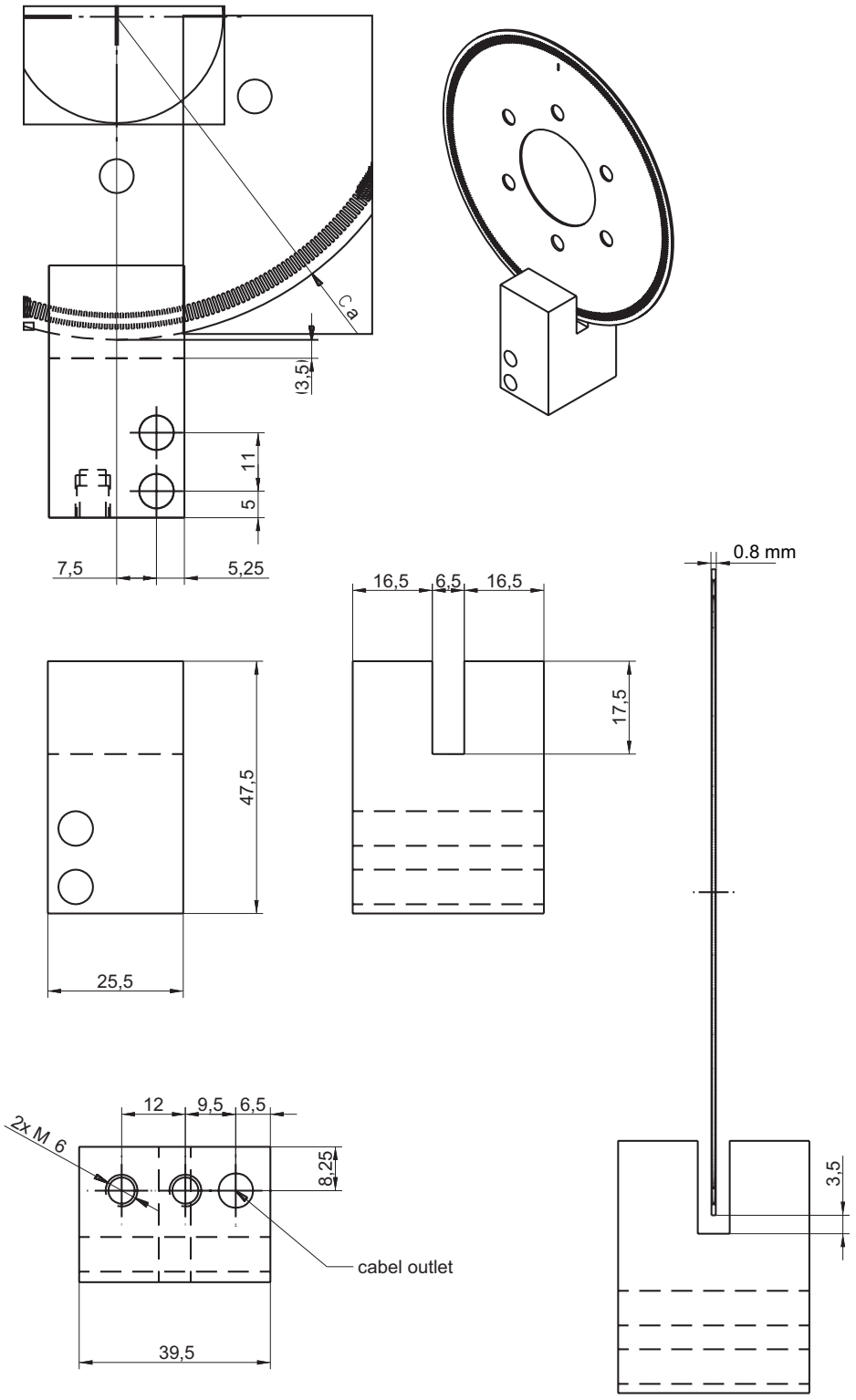
7 pin lemo connector
(FGG.1B.307.CLAD52Z)

C091A connector
(female)

37-pin male SUBD
connector

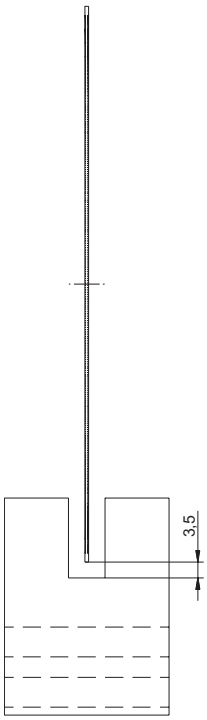
Dimensions*

Sensor



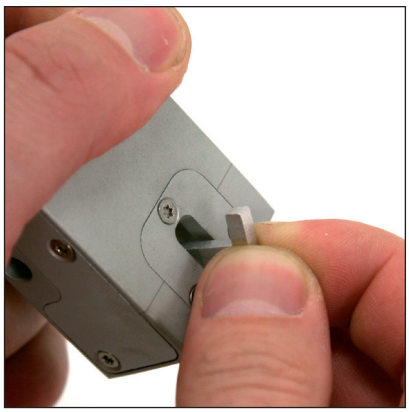
To avoid any incorrect measurements or failure (caused by vibrations and movement of the engine), the sensor must be mounted at the engine. If you fix the encoder on the test pad, the marker disc will move out of the operation area (3.5 mm ±1 mm tolerance) due to movements of the engine.

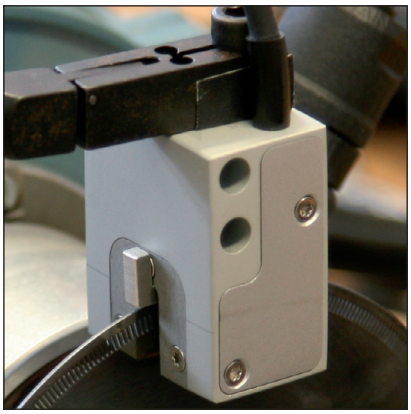
* Dimensions in mm
(1 inch = 25.4 mm)



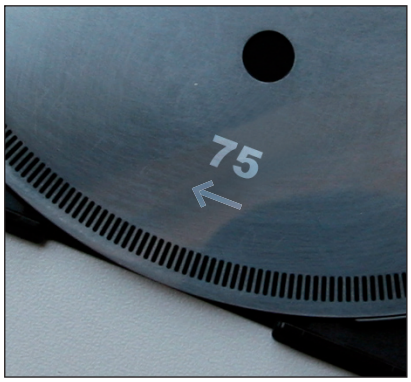
The sensor has to be mounted 3.5 mm above the marker disc. An indication marker on the sensor indicates the 3.5 mm distance. The included spacer will help to install it in correct position. Place the spacer between the marker disc and the sensor like shown in the pictures below. Adjust the sensor and tighten it, afterwards remove the spacer from the sensor.

NOTE: Do not forget to remove the spacer! Otherwise this could seriously damage the marker disc and the sensor.





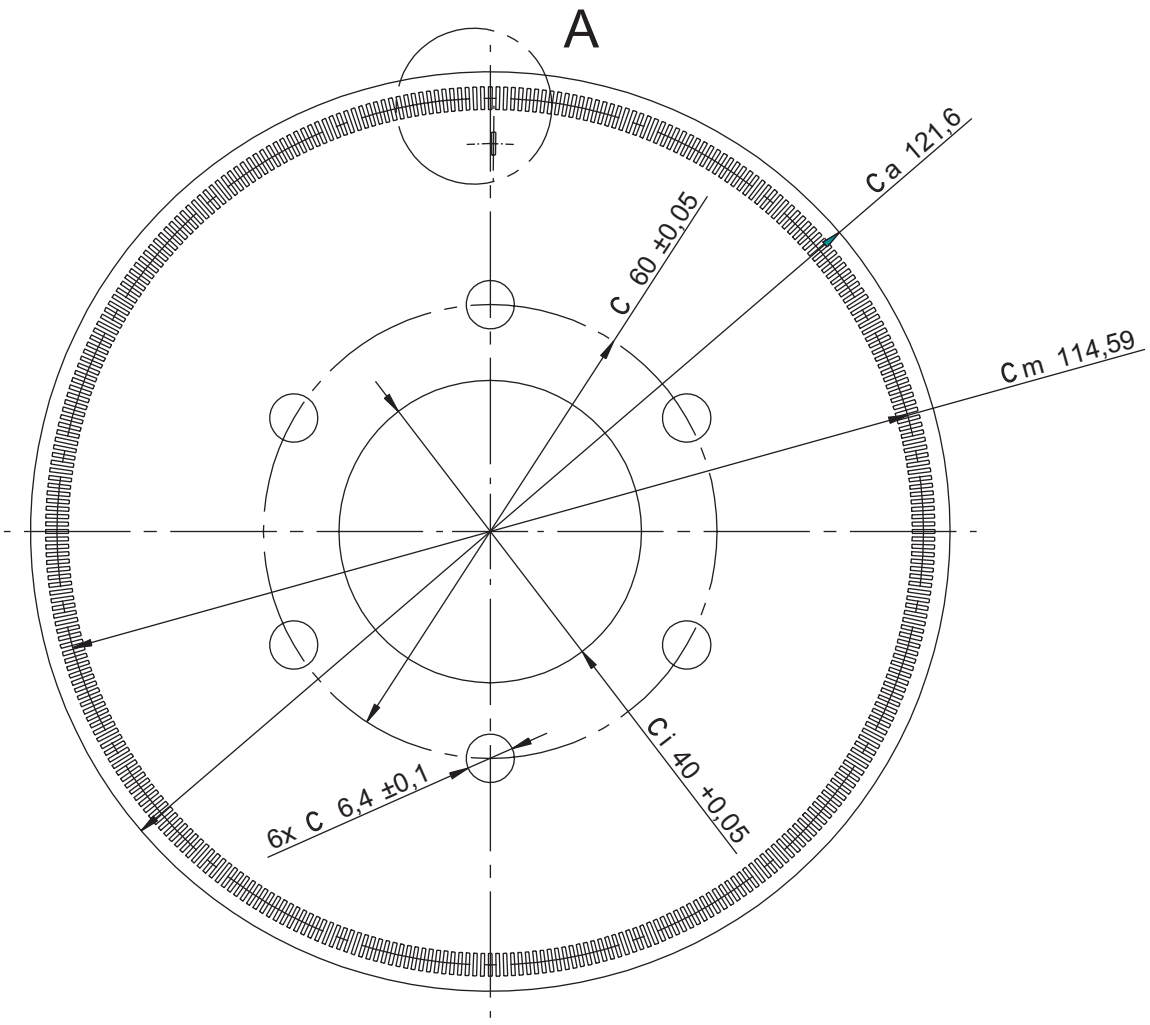
Each marker disc was checked for accuracy to get the best result. The direction of movement is indicated on the marker disc.



Accuracy: _____

Serial number: _____

CA-RIE-360 marker disc

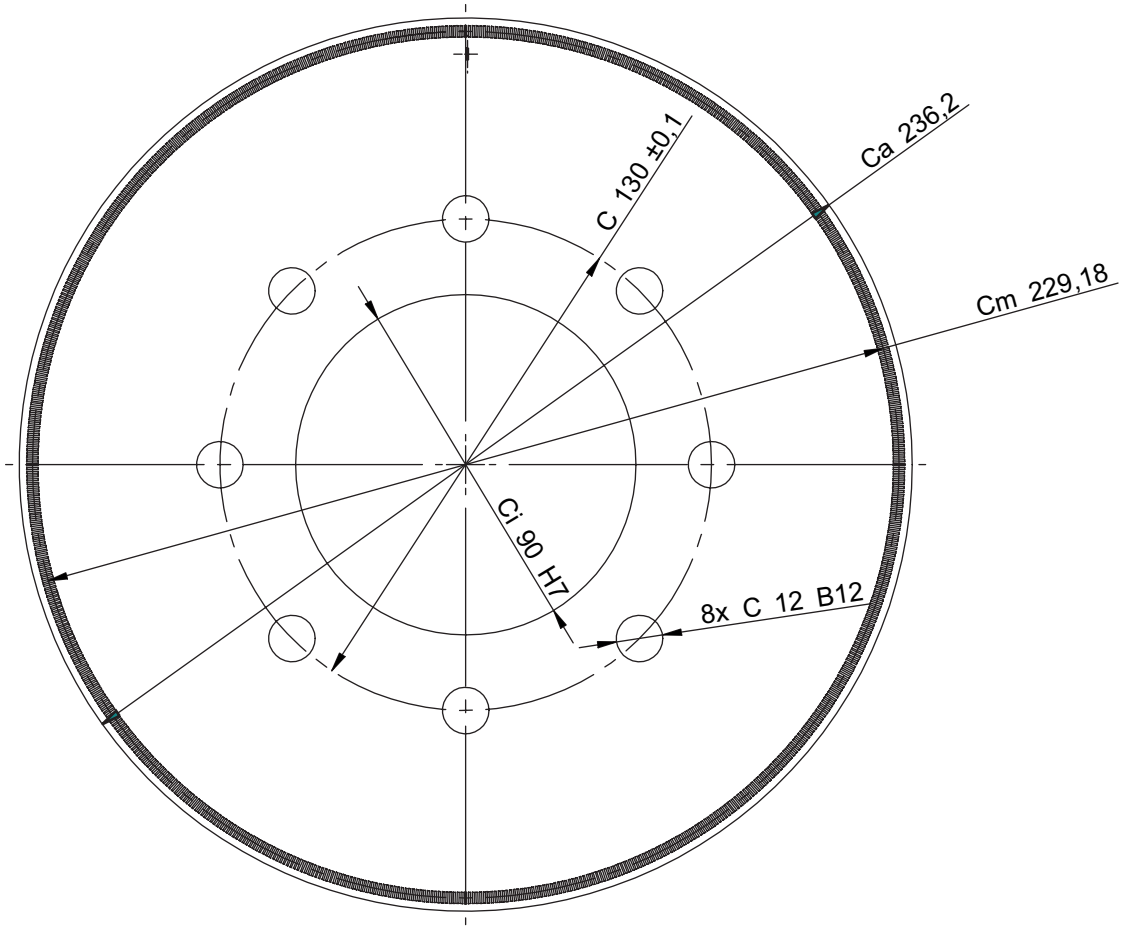


Sensor plate 360 Slits 0.5 mm wide
0.8 mm thick

* Dimensions in mm
(1 inch = 25.4 mm)

Mass moment of inertia: 123.7 kg mm²

CA-RIE-720 marker disc



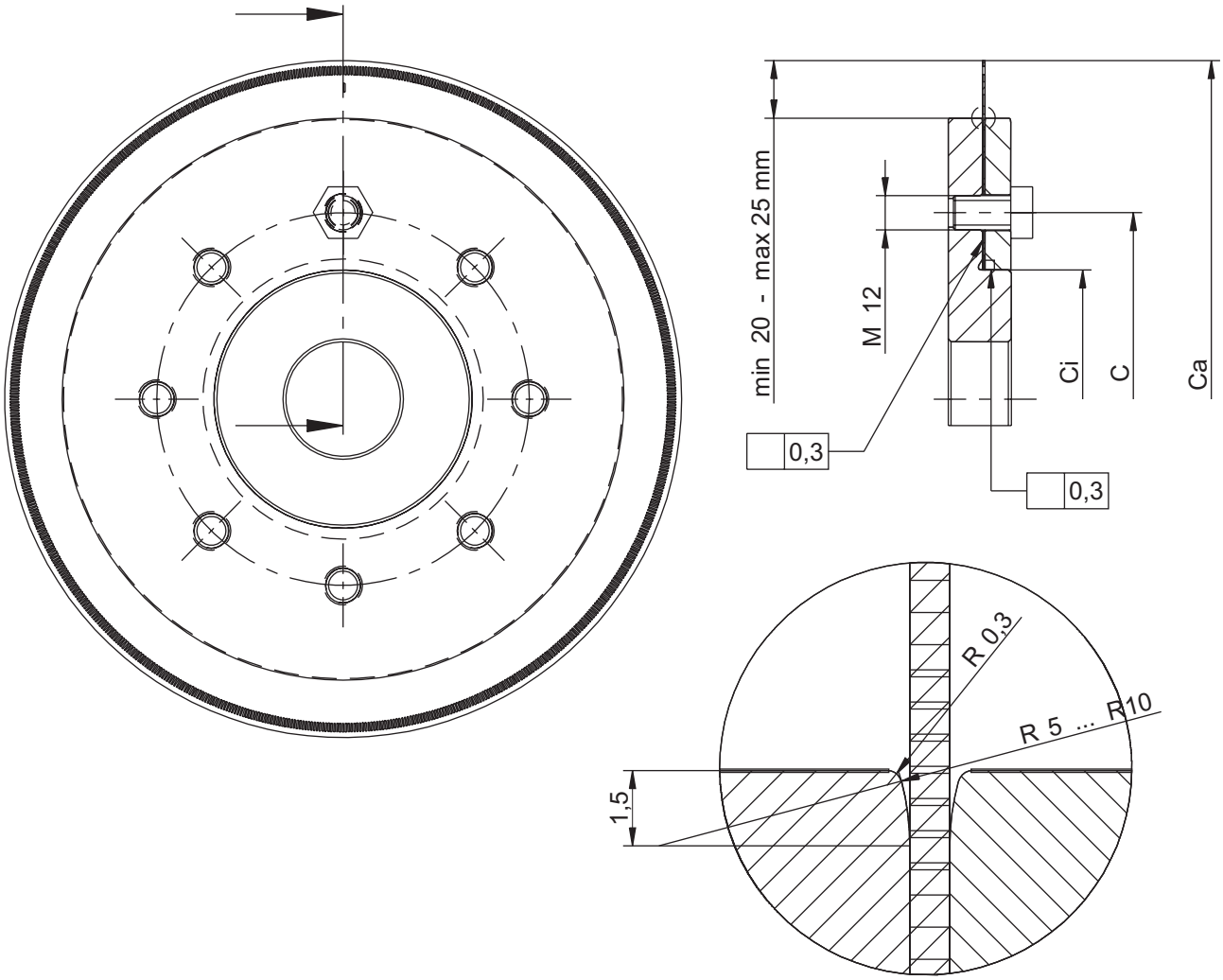
Sensor plate 720 Slits 0.5 mm wide
0.8 mm thick

* Dimensions in mm
(1 inch = 25.4 mm)

Mass moment of inertia: 1803.9 kg mm²

Installation of the marker disc

For assembling the marker disc it is necessary to build an adapter which will be mounted on the free end of the crankshaft or on the V-belt pulley of the engine. The drawing below shows how to fix the marker disc on the adapter.



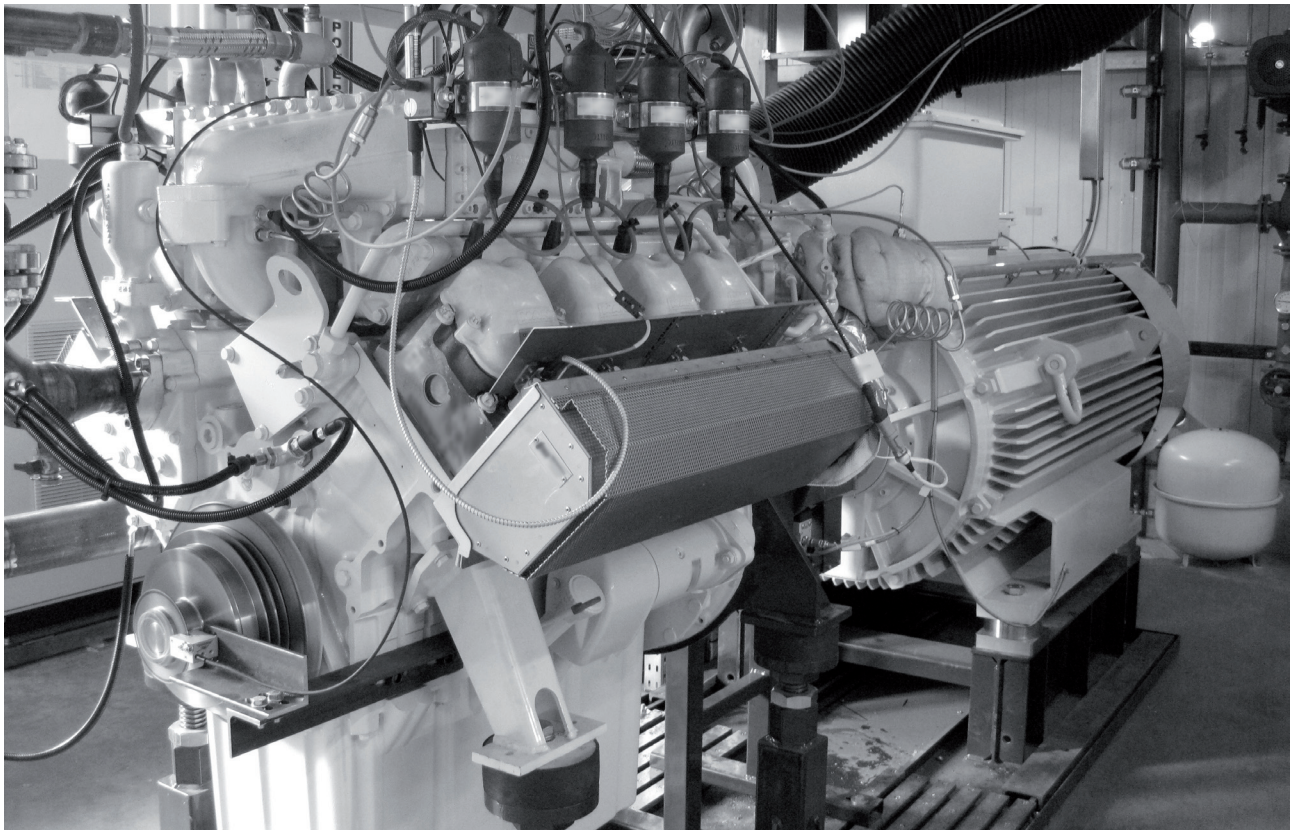
* Dimensions in mm
(1 inch = 25.4 mm)

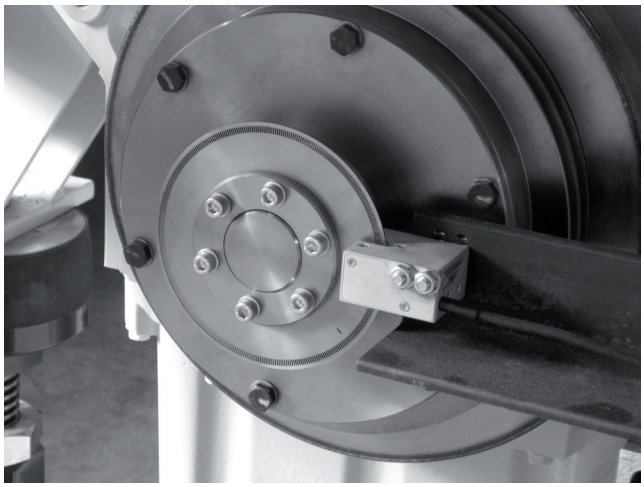
Fixing the CA-RIE-360 Encoder with the optional quick mounting kit

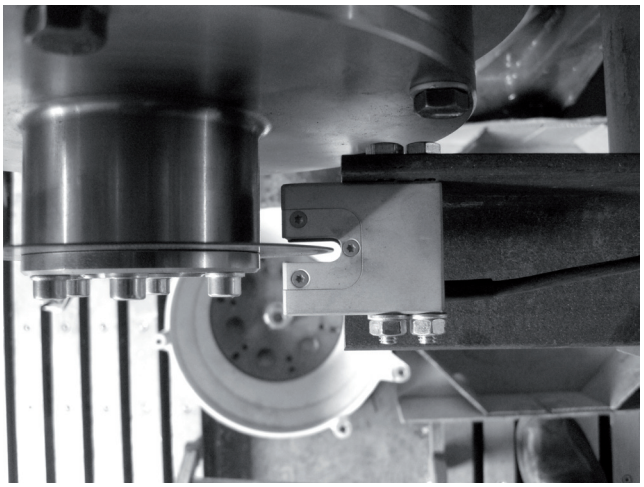
WARNING: The optional magnetic "Quick Mounting Kit" for test installation will minimize the setup time. Use this only for test installation - for real measurements it has to be mounted stiff and secure at the engine.

WARNING: Dewetron is not responsible for any damage,personal injury or measurement error caused by the incorrect installation of the CA-RIE sensor and marker disc. Please refer to page 11 of the manual for the correct fitting instructions and safety precautions.

Typical mounting example







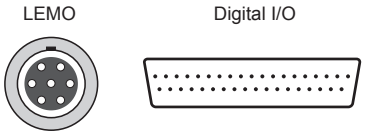
Adjusting/Checking of sensor installation

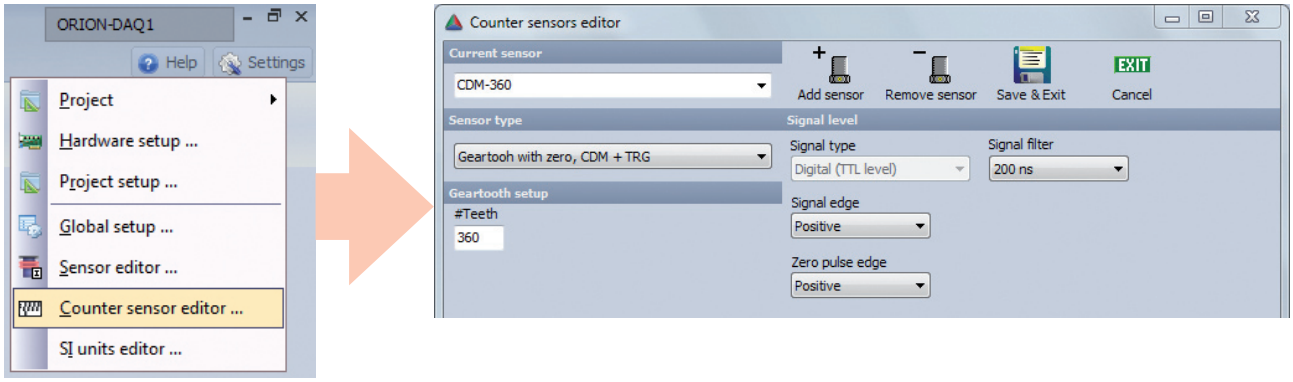
There are two possibilities:

- Sensor is connected to the encoder input of the CA-CPU
- Sensor is connected to a counter input directly.

1) Connected to counter input

First we have to define the CDM-360/720 if they are not available in the counter setup of DEWESoft! It can be added in the Counter Sensor Editor via "Settings" > "Counter sensor editor".





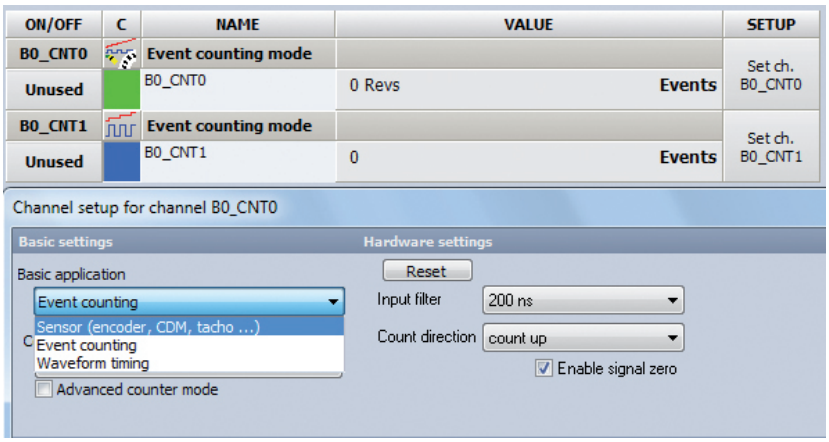
Here we add the new counter sensor to the sensor list.

- "Add Sensor"
- Rename it to "CDM-360 / CDM-720"
- Choose "Geartooth with zero, CDM + TRG"
- Specify the teeth according to the sensor (360/720)
- Also set the edge of signal and zero pulse to "POSITIVE" and set the filter to "200 ns"
- Exit with "SAVE & EXIT" button.

Within a new installation, the CDM-360 / CDM-720 are preinstalled so upper procedure is not needed.

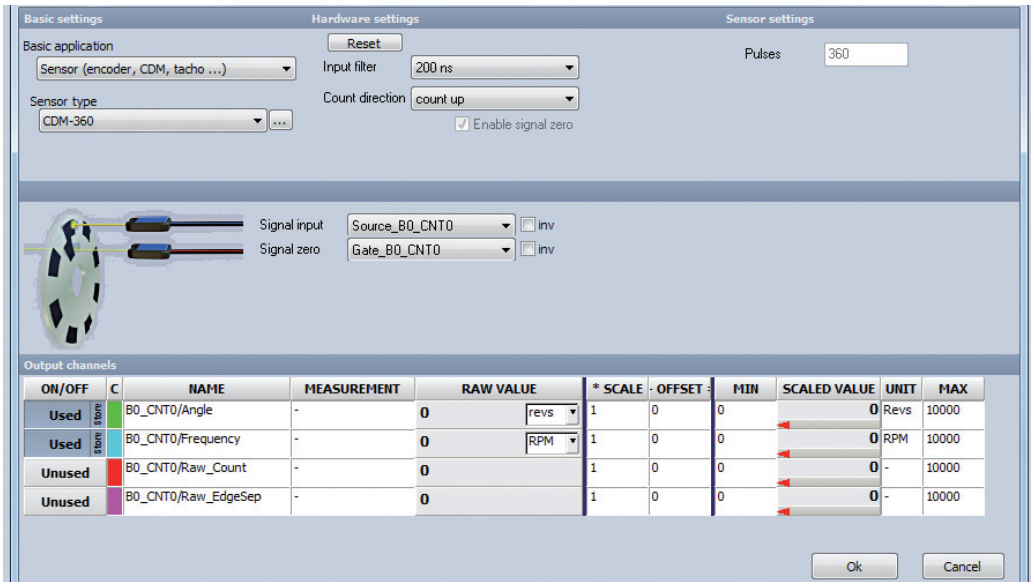
Now connect the sensor with the included adapter cable to a counter input.

CA-RIE 360/720 Encoder



Select "SENSOR (encoder, CDM, tacho..)" mode.

Note: If you can not find this particular mode you have to choose the previous or next counter, due to the internal counter structure.

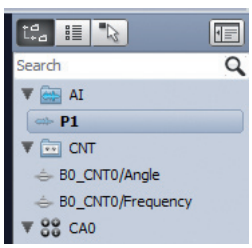


Now the counter is set to sensor mode where we get predefined channels.
We only have to select the Sensor type which will be either:

- RIE_360 or
- RIE_720

and angle and frequency channels will be available.

RAW_Count and RAW_EdgeSep channels are used for special purpose and are not needed for standard applications.



In the measurement screen angle and frequency channel will be available to check now the installation of the RIE-sensor. Please proceed on page 22 -> " 3) Check output signals of RIE sensor".

2) Connected to CA input (encoder input)

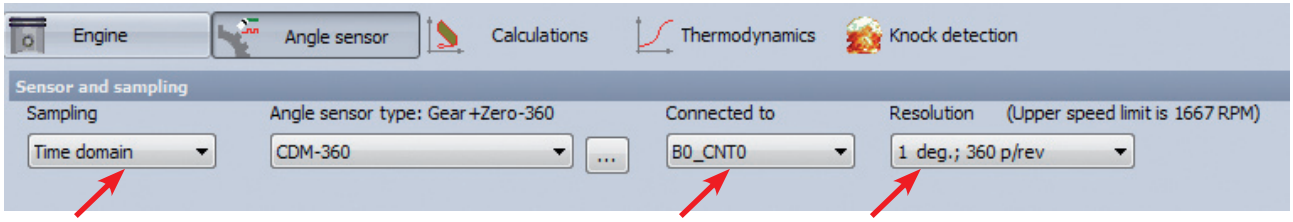
If a sensor is connected to encoder input (CA-CPU) of a DEWE-CA instrument, the CA-module has to be used to check RIE installation.

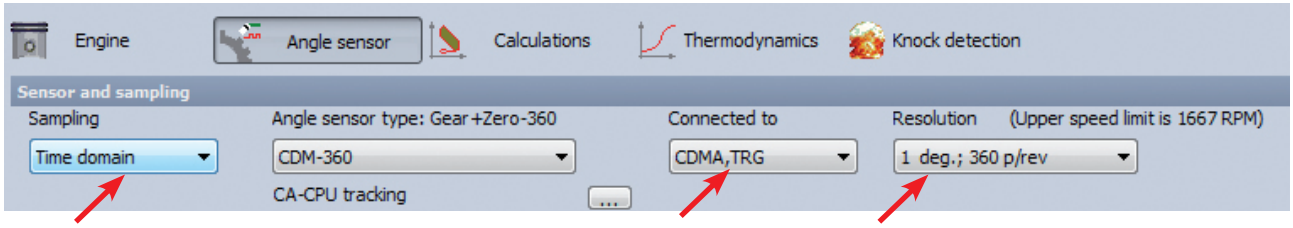
For checking the CA module must be set to time domain sampling.

Time domain

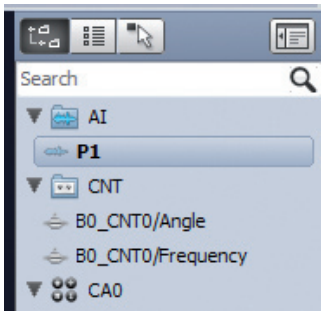
Select the CDM-360, CDM-720 for the angle sensor type, and select the connection either

- B0_CNT0 if no CA-CPU is installed (picture below)
- CDMA, TRG if CA-CPU is installed and set the resolution to 1 degree.

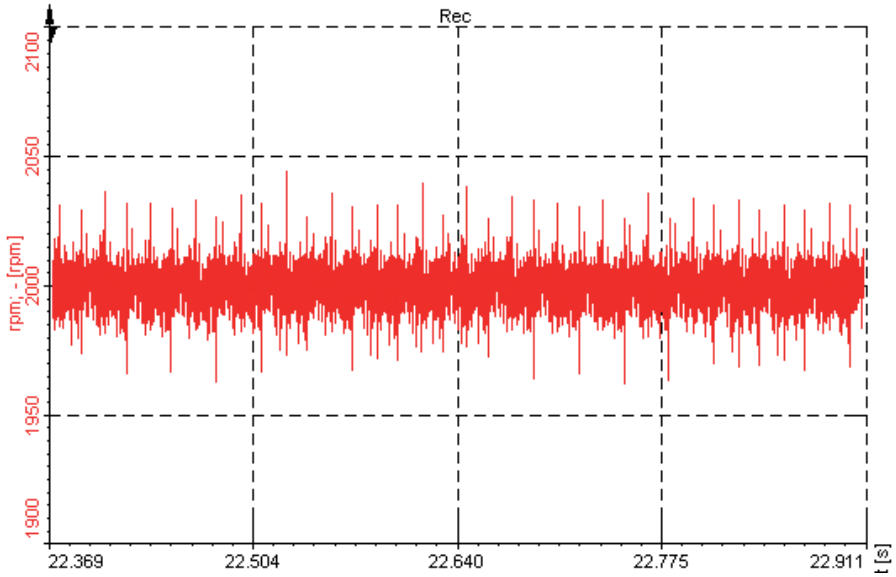




In the measurement screen angle and frequency channel will be available to check now the installation of the RIE-sensor. Please proceed on page 22 -> "3) Check output signals of RIE sensor".



3) Check output signals of RIE-sensor



Deviation:

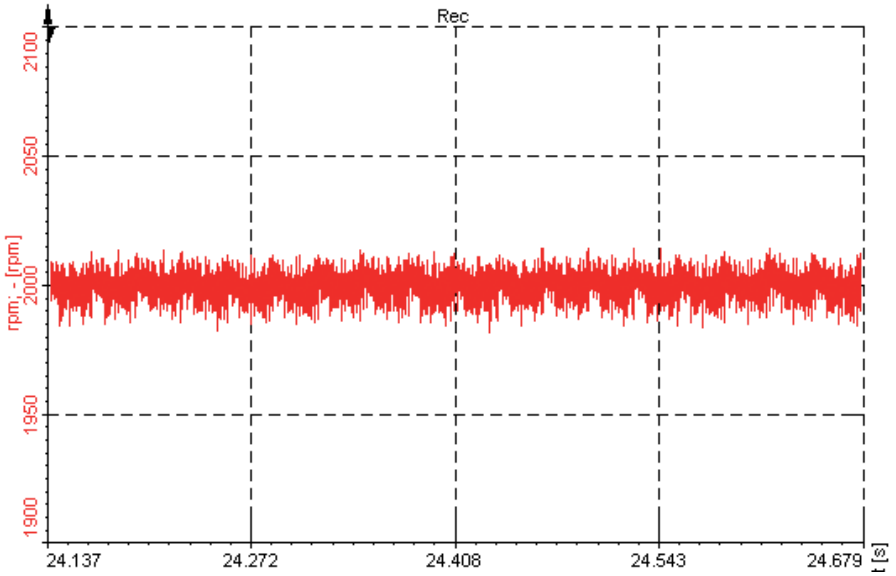
±40 rpm
±2 %

The picture above reflects the rpm over the time. We can also see peaks on top of the rpm signal. These peaks are related to the sensor mounting and also to the accuracy of the marker disc. The sensor should be adjusted that these peaks are at a minimum.
To adjust it:

- Stop the engine
- unscrew the sensor - adjust it (move it ±0.5 mm) - fix the sensor again.
- start the engine and check the rpm signal again.

Repeat the upper steps until the peaks reach a minimum.

WARNING: Do not adjust the sensor while the engine is running.

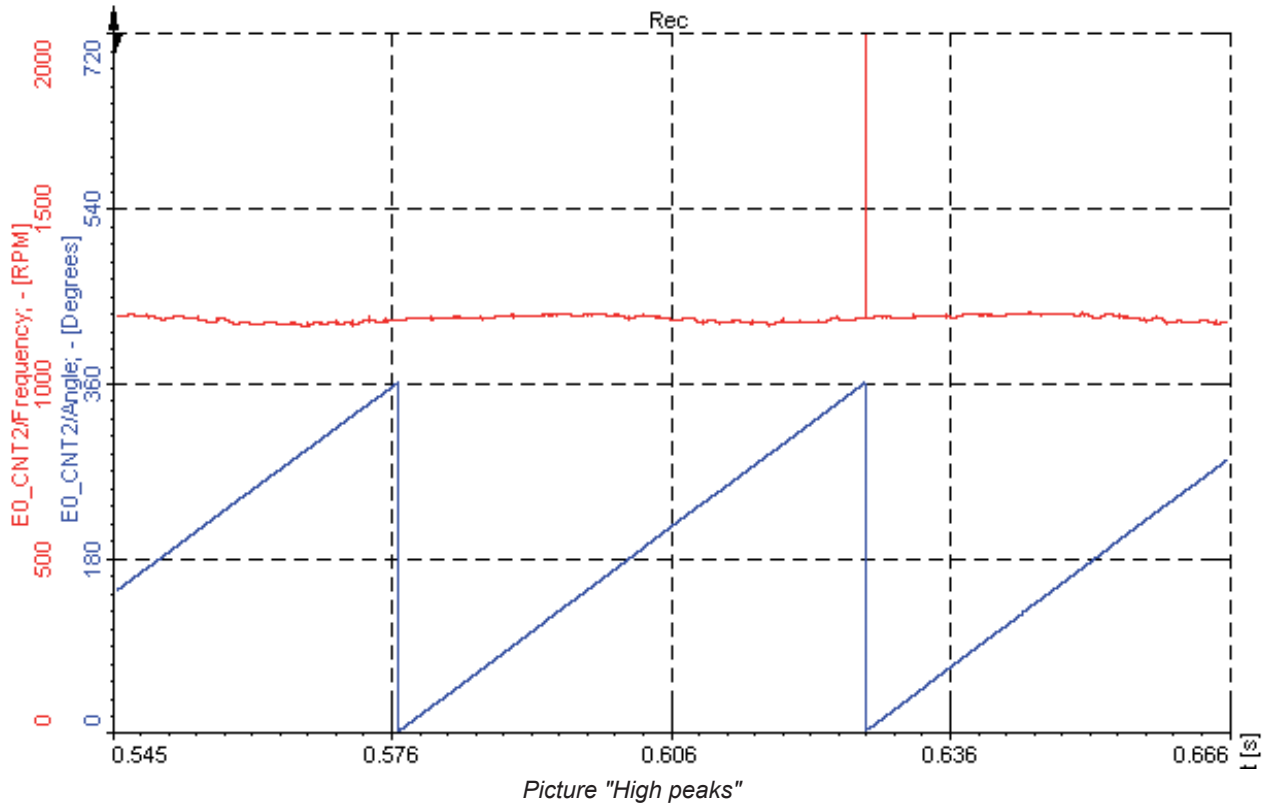


Deviation:

±10 rpm
±0.5 %

The picture above reflects a perfect adjusted sensor.

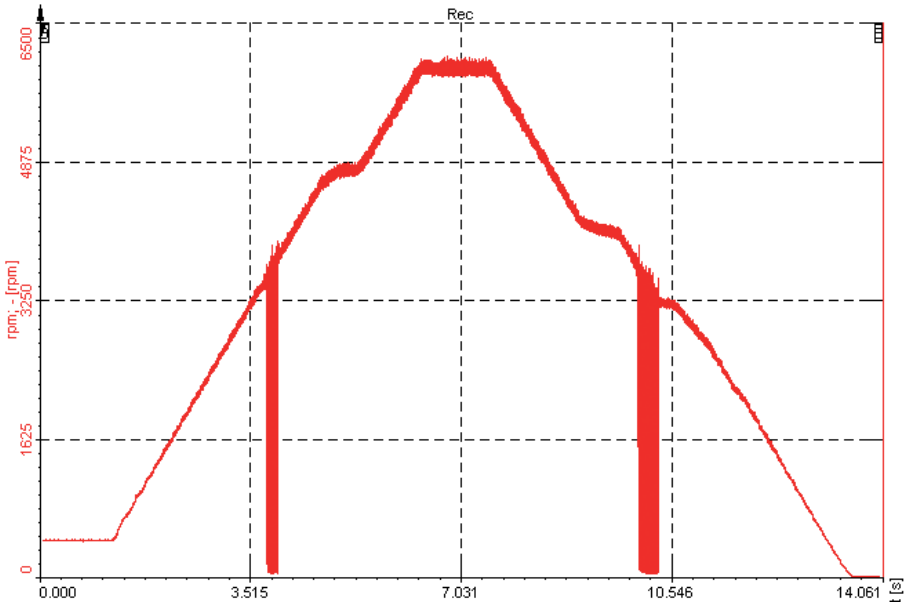
Note: The sensor should be adjusted that the peaks are below ±4 % of reading. Typically: ±2.5 %



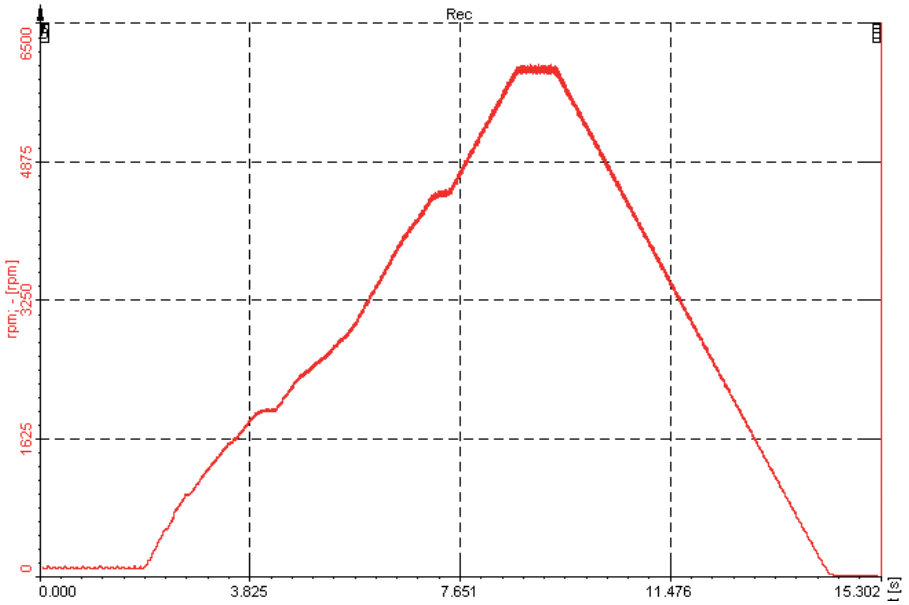
Picture "High peaks"

The picture above shows a high rpm spike after one revolution. This is caused because the zero pulse of the sensor is sometimes not detected in the right position, which will give 361 or 721 pulses per revolution which causes this rpm peak.

Readjustment of the sensor is needed.



Also perform a run-up and coastdown over the rpm range and check the rpm signal in the recorder. The picture above shows drop outs on run-up and coastdown. This could be caused by wrong mounting or high vibration of the sensor. In this case the sensor has to be adjusted again. In case of high vibration on the sensor (~ 1 mm) the fixing must be changed to prevent vibration.



This graph above shows a perfect test run.

Additional errors caused by mounting

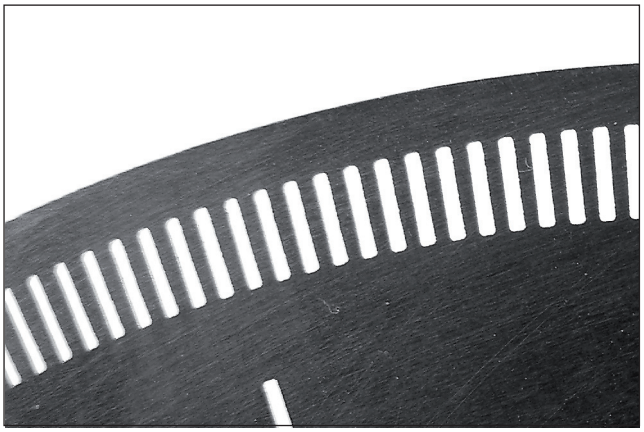
If the disc is not mounted centered this will also show a rpm deviation.

Example:

RIE-360 (114 mm) uncentered 0.5 mm equals 114.5/114*100 = 0.8 %

Maintenance

To ensure proper and correct measurements it is needed to clean the marker disc and the sensor. Make sure that all marker disc slits are free of all types of impurities otherwise it can cause wrong measurement. It is recommended to use compressed air to clean your marker disc.



The inner side of the sensor also needs to be cleaned. Do this with a soft cloth or a cotton stick.

Notes

CE-Certificate of conformity

Manufacturer:

Address:

DEWETRON Elektronische Messgeraete Ges.m.b.H.

Parkring 4
A-8074 Graz-Grambach Austria

Tel.: +43 316 3070 0
Fax: +43 316 3070 90
e-mail: sales@dewetron.com
http://www.dewetron.com

Name of product:

CA-RIE-360/720 ENCODER

Kind of product:

Sensor / Encoder

The product meets the regulations of the following EC-directives:

73/23/EEC
"Directive on the approximation of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits amended by the directive 93/68/EEC"

89/336/EEC
"Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility amended by the directives 91/263/EEC, 92/31/EEC, 93/68/EEC and 93/97/EEC

The accordance is proved by the observance of the following standards:

LV	**Safety**	IEC/EN 61010-1:1992/93 IEC/EN 61010-2-031	IEC 61010-1:1992/300 V CATIII Pol. D. 2 IEC 1010-2-031
EMC	**Emissions**	EN 61000-6-4	EN 55011 Class B
	Immunity	EN 61000-6-2	Group standard

Graz, October 14, 2008

Place / Date of the CE-marking

Dipl.-Ing. Roland Jeutter / Managing director

Notes