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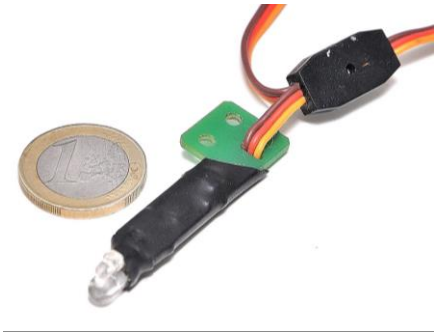
OPTICAL RPM METER

This cost effective, small size and simple to use RPM meter was initially developed for automotive cooling fan RPM measurement. It optically measures the RPM and sends the data via our simple BUS system. Extremely strong immunity against unintentional light reflections is achieved by powerful cascade analog and digital filtering. The RPM meters are compatible with all of our other sensors such as the Pressure Strips or the MCCA.



FEATURES

Optical measurement: The RPM meter features one LED diode and one phototransistor. Light is either reflected to or blocked from the phototransistor, its signal is differentiated, filtered and amplified. A peak detector then detects positive edges of light intensity and measures the elapsed time between two consecutive pulses.

Measurement setup: The light sensed by the RPM meter can be either reflected by a reflective surface (paint or sticker) as displayed on Figure 1. The length of the reflective surface should be around 40mm for reliable operation in the entire RPM range. The working range is approximately 1-5 mm. Trials should be made to tune the correct distance.

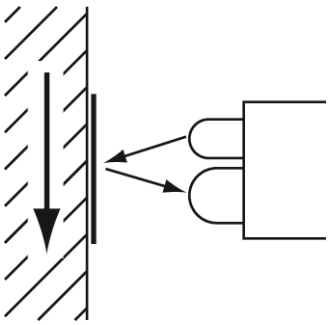


Figure 1: Reflective surface measurement

Another option is to point an external light source (DC operated LED or light bulb, daylight, another RPM meter) into the phototransistor. The system then works as an optical gate and the measured object rotates between the light source and the RPM meter (Figure 2). Tests need to be made to find the right light intensity for the particular application.

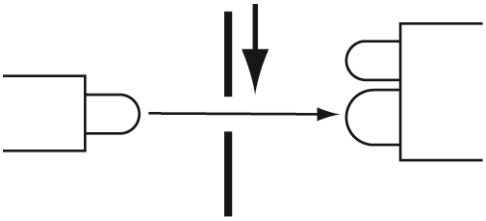


Figure 2: See through measurement

Data interface: The RPM meters feature a digital BUS interface for data readout. The use of a BUS allows the users to connect multiple RPM meters in any thinkable topology while reading all of their values through a single cable. The same BUS can be used for other sensors from our portfolio, such as the Pressure Strips.

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PROPERTIES

Filtering: The RPM meter was specifically tuned for automotive cooling FAN measurement with a single reflective tape. The application requires strong immunity against unintentional reflections off scratches and material non-homogenities on the surface. The filtering is therefore not only analogue but also digital implemented in the software. The RPM meter continuously buffers 16 time intervals between optical marks, chooses 2 median values and makes an average. This powerful filtering ensures extreme robustness in harsh conditions.

Accuracy: The accuracy of the RPM meter is mostly determined by the quality of the lightning source. Generally less than 0.1% in the entire RPM range is achieved.

Dynamic properties: Readout frequencies are given in the specifications table. The readout of actual RPM is asynchronous of the measurement pulses and therefore no assumptions on the dynamic properties of the device should be made based on those numbers. The RPM meter samples each optical mark and then applies filtering, therefore narrows down the bandwidth of the measurement. The intention of the device was measurement of stationary phenomena. Shall different properties be required please contact us.

RPM METER SPECIFICATIONS	
RANGE	
RPM range (one reflective mark)	3-70 RPM
Temperature range	0°C to 70°C
ACCURACY	
Accuracy over full temperature and RPM range	<0.1%
DYNAMIC PROPERTIES	
Sampling frequency	samples each optical mark
Filtering	16 samples moving median filter
Data readout frequency	
1 RPM meter on BUS	20Hz
2 RPM meters on BUS	10Hz
10 RPM meters on BUS	2Hz
ABSOLUTE MAXIMUM RATINGS	
Storage temperature	-40°C to 85°C
Operating temperature	-40°C to 85°C

No more than 10 devices on one BUS are suggested. If more RPM meters are needed it is suggested to use multiple Central Units and multiple BUS lines.

MECHANICAL PROPERTIES

Dimensions: The dimensions of the RPM meter are drawn in Figure 3, all dimensions are in *mm*. The construction of the device is made as small as possible. Two installation holes are provided for simple attachment.

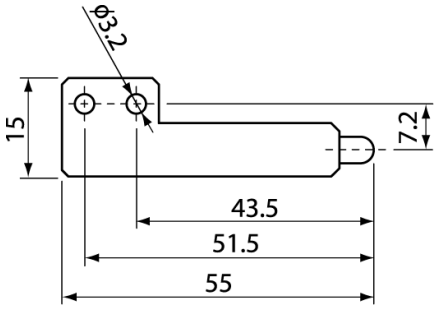

Figure 3: RPM meter dimensions

Figure 2: Outline dimensions of the Pressure Strips

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MEASUREMENT SYSTEM

Hardware connection: The connection of the sensors via the communication BUS is made as simple for the user as possible. A set of cables is available in various lengths with splitters to build custom network topologies. Up to 10 RPM meters (maximum suggested amount) can be connected together so that all of their values can be read through a single cable. Central Units with an ETHERNET interface are available for data readout - Figure 4.

Figure 4: Central Unit for data readout with an ETHERNET interface

Software User Interface: Once the hardware connections are finished the user starts a dedicated software that automatically searches for connected sensors – no setup is needed. The UI displays a preview of the sensors reading for instantaneous analysis. The software is licensed under CTU and comes free with the sensors.

Devices identification: Each RPM meter is issued a unique identification number at the end of the manufacturing process that helps its identification throughouht the installation, measurement and postprocessing process.

Postprocessing: An automatic postprocessing tool is available as a set of Matlab scripts and funcions. The user is responsible for licensing of the Matlab enviroment.

CONTACT

Please, contact 4Jtech, s.r.o. for more information. We will be happy to answer any of your questions.

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DOCUMENT REVISION HISTORY

Mar 17, 2016	Revision 00	Initial release