



Technical Info | Application Note

# Evaluation of inductive sensors

|          |                               |
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KEB Automation KG  
Suedstrasse 38, D-32683 Barntrup  
Germany  
Tel: +49 5263 401-0 • Fax: +49 5263 401-116  
E-Mail: [info@keb.de](mailto:info@keb.de) • URL: <https://www.keb.de>

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## 1 Preface

The application notes describe solved application cases. They serve designers and developers as an approach for designing their own applications. However, they are considered for information only without responsibility. The selection with regard to their suitability for the intended use can only be made by the user.

**The use of our devices in the target products is beyond of our control and therefore exclusively the responsibility of the machine manufacturer, system integrator or customer.**

This document is not legally part of the certified device documentation. The functions described in the current KEB documentation must always be given priority. The enclosed documents correspond to conditions valid at printing. Misprint, mistakes and technical changes reserved.

## 2 General

### Function

Evaluation of inductive sensors of the type PNP.

### Validity

Device series S6-P, F6-P from version 2.9

### Description

The evaluation is similar the same as with TTL/HTL encoders, except no encoder breakage detection is running. Invalid signals are not detected with these sensors. Furthermore, no zero signal is evaluated.

For this purpose, parameter ec35 has been extended in such a way that, for example, a simple encoder system can be build up with two sensors shifted by 90° or that only edges of a sensor can be counted.

If an RS485 signal is connected to a TTL input (or a differential HTL signal to an HTL input), its edges can also be counted.

## 3 Setting the parameters

### 3.1 ec16 encoder type (encoder type)

For the evaluation of the inductive sensors, encoder type ec16 of channel B must be set to value 21 "Inductive sensors" by way that no encoder breakage detection is active.

### 3.2 ec35 pos. calc. mode (mode position calculation)

The new bits 3...5 are the extensions of ec35 for the evaluation of inductive sensors.

The setting is only possible when evaluating inductive sensors, i.e. only with ec16 = 21 "Inductive sensors".

| Index            | Id-Text | Name            | Function   |
|------------------|---------|-----------------|--|
| 0x2823<br>0x4823 | ec35    | pos. calc. mode | Defines different settings for position calculation. |

This parameter is bit-coded:

| ec35  | pos. calc. mode  |       |  |
|-------|--|-------|--|
| Bit   | Function   | Value | Function                                       |
| 0     | Evaluation high-resolution<br>(at 1Vss signals)  | 0     | High-resolution is evaluated.                  |
|       |  | 1     | High-resolution is not evaluated.              |
| 1     | Rotation of the position and<br>speed  | 0     | not inverted                                   |
|       |  | 2     | inverted                                       |
| 2     | Resolver evaluation compatibil-<br>ity mode  | 0     | Improved resolver evaluation<br>(from V2.6)    |
|       |  | 4     | Previous resolver evaluation (up<br>to V2.5)   |
| 3...4 | Evaluation of signal tracks (for<br>HTL and TTL signals)<br>(only for F6P and S6P devices) | 0     | Tracks A (Cos) and B (Sin) are<br>evaluated    |
|       |  | 8     | Only track A (Cos) is evaluated<br>(1)         |
|       |  | 16    | Only track B (Sin) is evaluated <sup>(1)</sup> |
| 5     | Display of signal levels<br>(only for F6P and S6P devices)                                 | 0     | no display of signal levels                    |
|       |  | 32    | Display of signal levels <sup>(2)</sup>        |

(1) When evaluating only one track, please note the following:

The direction of rotation can no longer be detected, i.e. the displayed speed is always positive.

The values in the position parameters, e.g. ru33, ru38, st33 etc. do not correspond to the current position of the rotor with revolutions and position within one revolution.

The number of counted signal edges is displayed in ru33 if the value 32768 is set in the signal periods in ec29.

Switching which signals are to be evaluated is possible during operation, but this results in speed peaks.

(2) When displaying the signal levels, note the following:

The levels of the incremental signals (1 or 0) are displayed in ec17 next to the encoder type. The values of ec17 for this are 120...123.

Depending on the device, the displayed levels can be 100 ms and older.

The signal levels cannot be measured directly, but are derived from the counted signal edges. This means, under certain circumstances (e.g. EMC or loose contact) it could be possible that the displayed signal levels disagree with the real measured signal levels.

However, changes in the signal level (i.e. edges of the signal) are safely displayed.

It is not possible to differentiate whether the signal is connected to the HTL or TTL input of channel B because both are connected in parallel. Therefore, "TTL-/HTL..." is always displayed for this in ec17.

## 4 Connection of the sensors

### 4.1 External wiring

The connection of inductive sensors is only possible at channel B. This requires external wiring of the signal inputs to generate the voltage difference necessary for the differential inputs.

The following shows a possible circuit example for connecting a PNP type sensor with an output voltage range of 15...30 V at signal input A/COS.

PNP sensors only switch the supply voltage to their output, i.e. at logic 0 level (when the sensor does not detect an object) the signal is switched off and the output is open.

It is decisive for the function of the circuit that there is a voltage difference of at least 200 mV between RS485+ and RS485-, because the RS485 receiver components connected here evaluate the signals. I.e. at least -200 mV must be for logic 0 level and +200 mV for logic 1 level. The value range between +200 mV and - 200 mV is invalid.

The higher the voltage difference, the greater the interference distance.

A maximum of 7 V is allowed as voltage difference and a maximum of 12 V between RS485+ and GND or RS485- and GND.

The right area of the picture shows the input circuit of the encoder evaluation on the device. The left area shows the external wiring and the sensor.



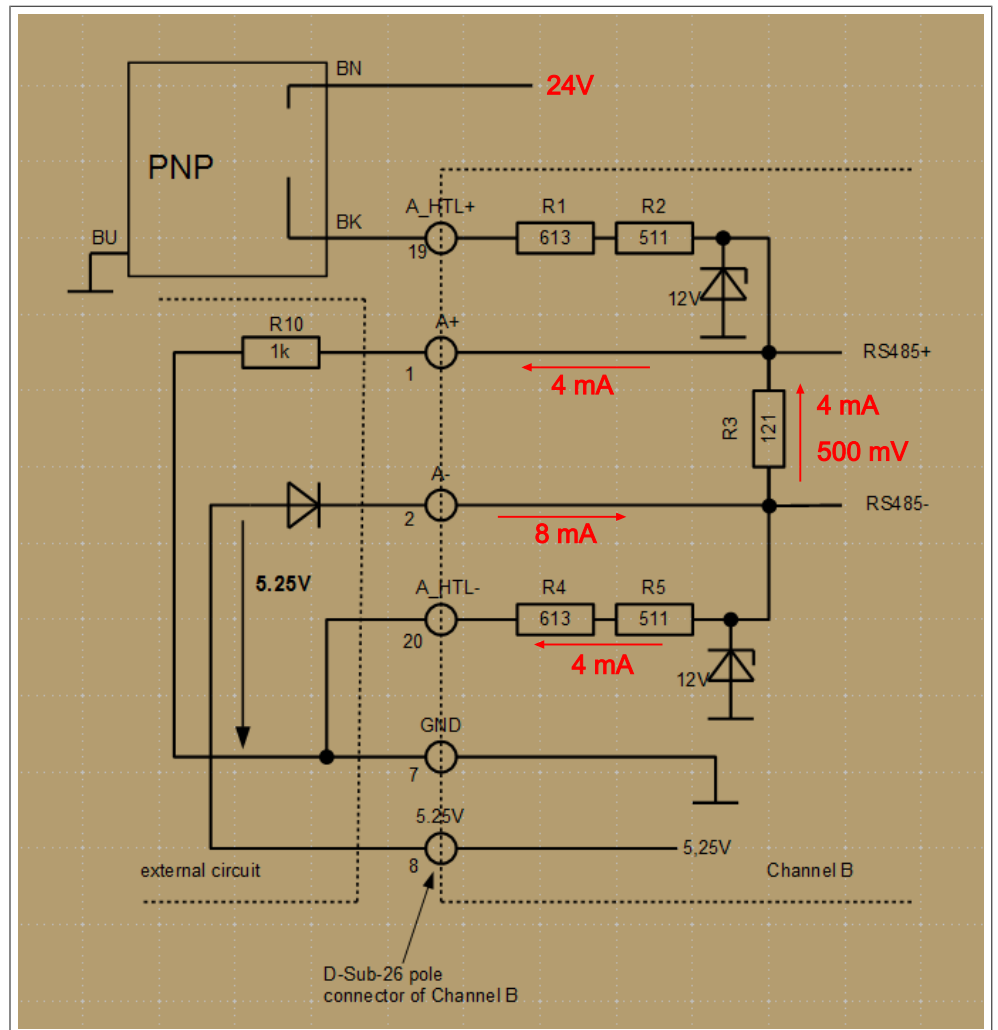


Figure 1: Case 1: Sensor does not detect an object; switch is open (logic 0 level)

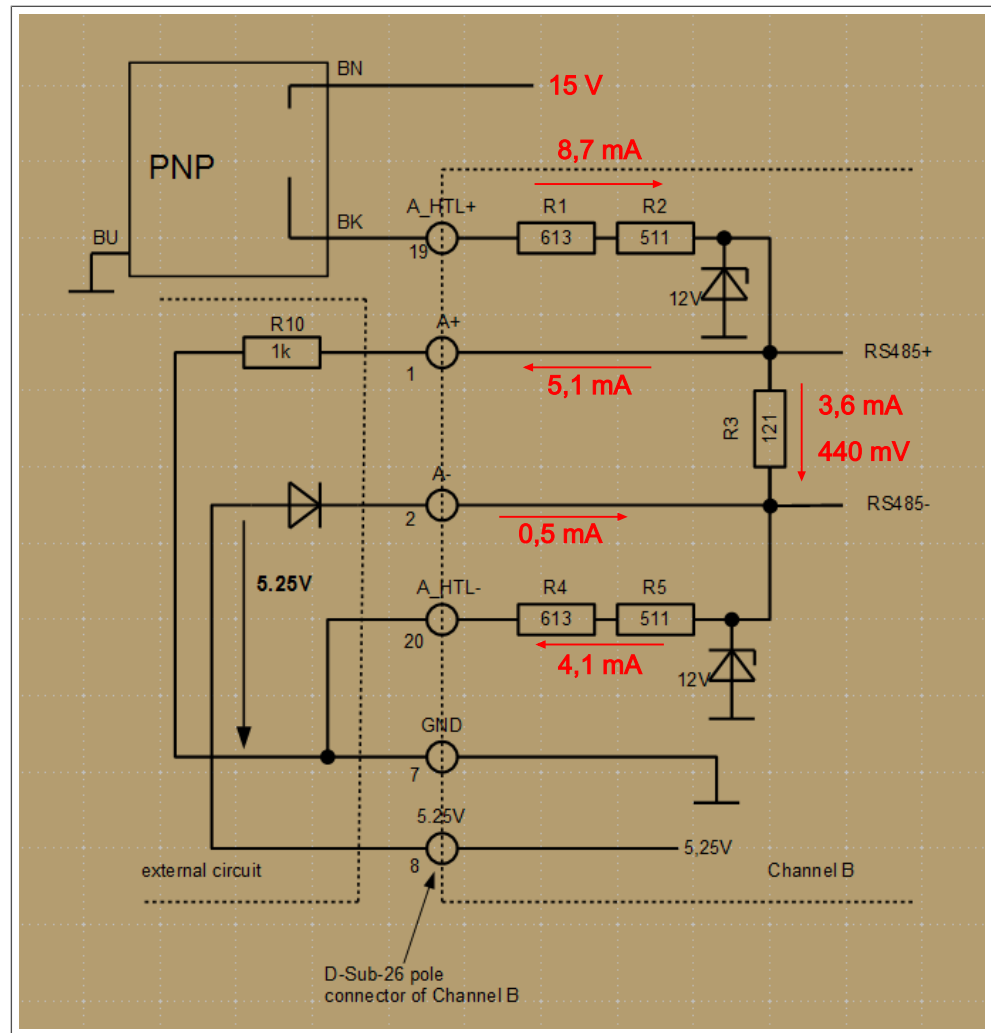


Figure 2: Case 2: Sensor detects object; Switch in sensor is closed (logic 1 level); supply voltage of the sensor is 15 V)

It must also be ensured that the maximum power dissipation of the resistors of 200 mW is not exceeded on the input circuit of the encoder evaluation, especially in the following case 3.

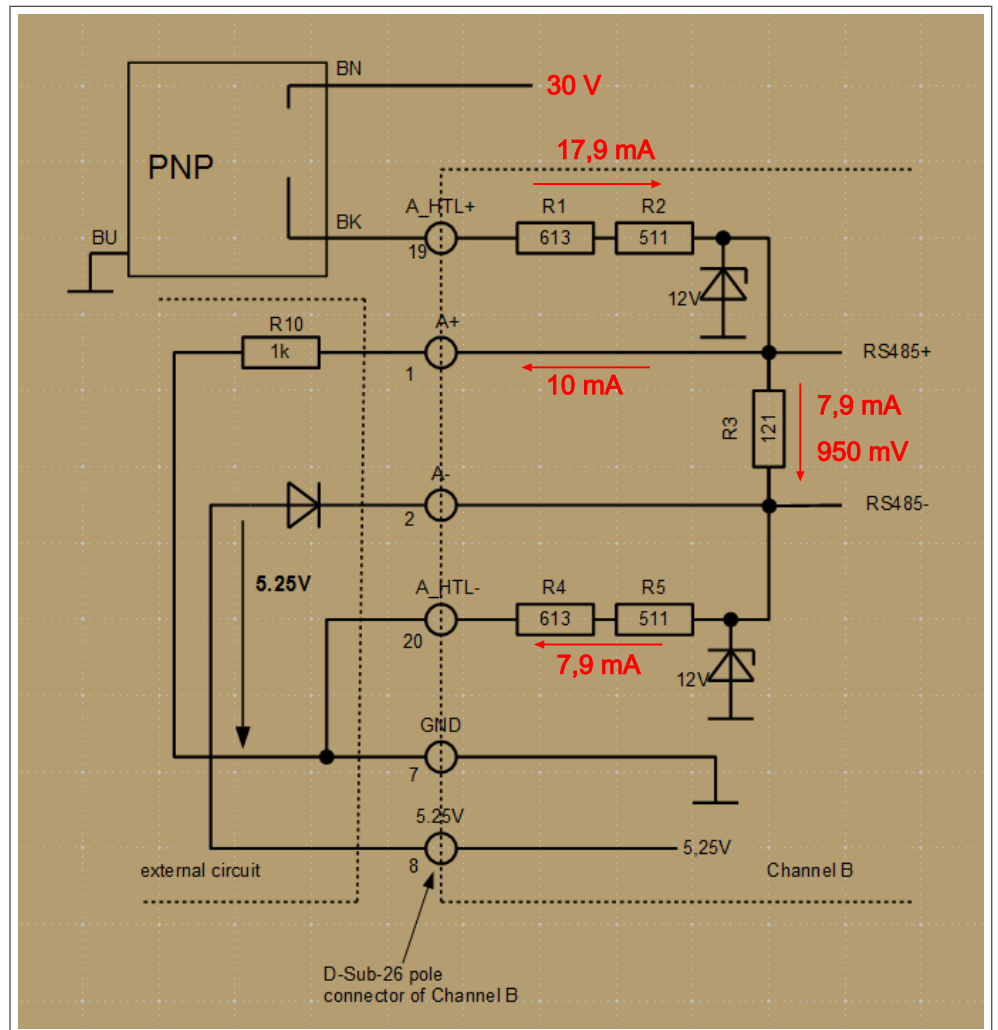


Figure 3: Case 3: Sensor detects object; Switch in sensor is closed (logic 1 level); Supply voltage of the sensor is 30 V

## 4.2 Further information

If two sensors shall be used for a simple encoder system, the signals must be phase-shifted by 90° to one another. The more the phase shifting deviates from these 90°, the greater the fluctuation of the speed value determined from it.





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**[www.keb.de](http://www.keb.de)**

KEB Automation KG • Suedstrasse 38 • D-32683 Barntrup • Tel: +49 5263 401-0 • E-Mail: [info@keb.de](mailto:info@keb.de)