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Data_Link 2000

APPLICATION NOTE AN009

Using Potentiometric Transducers

Summary

Some simple transducers use a potentiometer to give an indication of the position of a rotating shaft. They are not generally as accurate as other types, and may not travel over their complete span, but since they are relatively low cost, they can be used for applications where accuracy is not critical.

This application note describes the method of interfacing them to *Nano_Link* and *Micro_Link* outstations, and the method of correcting errors to improve accuracy.

Outline

Potentiometric transducers might typically be used to show the relative position of a valve which can be left in a partially-open state. They provide a three-wire interface whereby a reference voltage is applied across the two ends of the potentiometer, and the voltage from the wiper is monitored on the third wire. The ratio of the monitored voltage to the energising voltage is proportional to the shaft position.

Potentiometers used in transducer are typically in the range 1KΩ...10KΩ. If the value is lower than this unnecessary power is dissipated. If the value is significantly higher there is a risk of non-linearity due to the input resistance of the circuit used to measure the sense voltage.

Micro_Link, ***Nano_Link*** and analogue input expansion modules all provide a means of energising potentiometer inputs, but the connection method differs. The remainder of this document described the method of connection.

Nano_Link

The analogue inputs of ***Nano_Link*** are calibrated for an input of nominally 0…100mV, with a differential input resistance of 27KΩ. A 5Ω resistor can be linked across each input if required to provide a 0…20mA range.

Nano_Link provides an energising voltage of about 10V to power transducers. It measures the output from the transducer relative to a stable reference voltage, if the common-mode level of the inputs is close to one of these supply rails. However, if the common-mode level is around the mid-rail voltage it measures the inputs relative to the energising supply voltage. This provides compatibility with both strain gauge transducers and with potentiometers, both of which provide an output relative to their energising supply.

When using a potentiometer, a 7023-1 interface adaptor is required. This passes the energising voltage from ***Nano_Link*** to the potentiometer, and converts the level received from the wiper to a 0…100mV signal, centred on the mid-rail voltage. The interface adaptor also provides a span and offset adjustment which are factory-set to correctly calibrate a 'perfect' potentiometer (i.e. one which travels completely from end to end).

If the transducer is not 'perfect', the user can adjust the span and offset until the ***Nano_Link*** reads 0…100%. This is most easily achieved using an Alphanumeric Display Module connected to the ***I/O_Link*** socket. Set the transducer to the high end and adjust Span for a reading of 100%. Then set the transducer to the low end and adjust Offset for a reading of 0. Repeat this sequence as necessary.

Alternatively, if the outstation is being interrogated by a ***Micro_Link*** base-station the correction can be made within the configuration of the relevant analogue output at the base-station, as described in section 6.6 of the ***Data_Link 2000*** Technical Manual. Set the transducer to the low end and note the reading (a) received by ***Micro_Link***, using DCD Diagnostics. Then repeat with the high end, calling the reading (b). Let the required high value be (H) and low value (L) (e.g. for 4…20mA H=4000, L=800). Then set

Multiplier = (H - L)
Divisor = (b – a)
Offset = (Lb – Ha)/(b – a).

Micro_Link

The analogue inputs of ***Micro_Link*** are calibrated for an input of 0…5V into 550KΩ if no link is fitted, or 0…20mA into 100Ω if the 'I' terminal is linked to the '-' terminal.

Potentiometer inputs require the use of a 7023-3 interface adaptor, with no link fitted. This generates a stable 5VDC energising voltage for the potentiometer, and passed the level received from the wiper to the analogue input. The unit is automatically calibrated for a 'perfect' potentiometer (i.e. one which travels completely from end to end). Imperfect transducers can be corrected as described later.

Analogue Input Expansion Module

Inputs on this module are calibrated for an input of 0…5V into 550KΩ if no link is fitted, or 0…20mA into 100Ω if the 'I' terminal is linked to the '+' terminal. This module also provides a stable 5V reference output which can be used to energise potentiometers. The potentiometer should be connected across this supply, with the wiper connected to the relevant '+' input terminal (no link to 'I'). The '-' input terminal should be connected to the negative side of the reference output.

Calibrating *Micro_Link* & Analogue Input Expansion Modules

If the raw values read from the potentiometer are not those required, the relevant analogue inputs can be calibrated as described in section 6.5 of the ***Data_Link 2000*** Technical Manual. Set the transducer to the low end and note the reading (a) on the relevant analogue input, using DCD Diagnostics. Then repeat with the high end, calling the reading (b). Let the required high value be (H) and low value (L) (e.g. for 4…20mA H=4000, L=800). Then set

Multiplier = (H - L)
Divisor = (b – a),
Offset = a - L * (b – a)/(H – L).

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