

# Data\_Link 2000

## **APPLICATION NOTE AN019** **Monitoring Rotating Filter Beds**

### Summary

European legislation specifies that all waste water treatment plants are monitored to minimise pollution due to equipment failures. Many small unmanned sites use rotating filter beds to treat the water. These rely on a rotating arm to distribute the water evenly over a circular bed. The arm is usually powered by the water pressure. If it stops rotating for any reason the filtering will become ineffective so there is a risk of polluting the watercourse into which the plant discharges.

There is thus a need to monitor the arm to confirm that it is rotating. This can be achieved easily by installing a battery-powered *Nano\_Link*, fitted with a rotation sensor, on the arm. No other installation work is required. The *Nano\_Link* constantly monitors the sensor and will radio an alarm if it stops rotating. It also counts the total number of revolution of the arm, and measures the rotation speed. Both of these parameters can also be transmitted by radio if required.

The rotation sensor uses one analogue input and two totalised counts within *Nano\_Link*. The remaining I/O capacity is available for any other use that may be required.

### Method of Operation

The rotation sensor incorporates an extremely sensitive magnetic sensor that acts as an electronic compass. The sensor output peaks when the unit is pointing north and is a minimum when pointing south. The signal level will thus increase when the unit is moving towards north and decrease when it is moving towards south. By sampling the signal at regular intervals *Nano\_Link* can deduce the direction of movement and hence calculate from it the time per revolution and the total number of revolutions. Every half revolution the *Nano\_Link* re-calculates the speed and adjusts the sample rate if necessary. If the arm slows to less than one fifth of its previous speed *Nano\_Link* assumes it has stopped and transmits an alarm. When movement resumes the alarm is cleared.

## Installation

The Rotation Sensor is mounted in the same enclosure as the *Nano\_Link* and is polarised such that its direction of maximum sensitivity is from the left to the right when viewed from the front of the unit. The unit must therefore be mounted either vertically or flat on its back.

Internally the sensor is connected to analogue input 2 which is obviously not available for normal use.

The configuration switches S2 poles 6, 7 and 8 should be set to 111 (i.e. all ON). This will configure *Nano\_Link* to operate as a low power outstation, and to process analogue input 2 as a rotation sensor. The remaining configuration switches should be set as required.

## Base-station Configuration

An outstation equipped with a rotation sensor generates a rotation alarm flag in the location allocated for the *Bus\_Link* alarm flag. Since *Nano\_Link* doesn't have a *Bus\_Link* port this alarm flag was not previously used.

Count 1 from the *Nano\_Link* records the total number of revolutions completed by the rotation sensor. Count 2 registers the time taken for the revolution, in seconds. If the unit stops rotating Count 2 is forced to 0xFFFF (65535).

The base-station can be configured to read whichever of these flags and registers it needs. No special configuration is needed in the base-station.

Since count 1 and count 2 are used by the rotation sensor when configured in this mode, digital inputs 1 & 2 cannot be used to count pulses, but can still monitor status conditions. Digital inputs 3 & 4 and analogue input 1 operate as normal in this mode.

## Specifications

Maximum rotation period:	4 seconds
Minimum rotation period:	512 minutes
Maximum rotation period change (decrease):	Period halves within half revolution
Maximum rotation period change (increase):	No limit
Alarm Threshold:	5 x current period (e.g. if rotation period is 1 minute, alarm will be raised if no movement is detected for 5 minutes)