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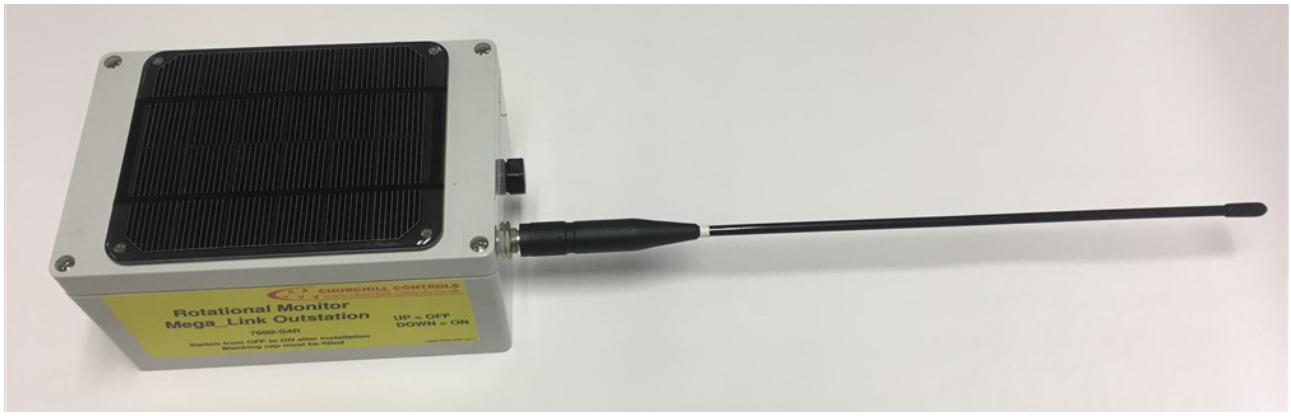
Mega_Link
Filter Bed Rotational Monitor
Telemetry System

Part Number: 7600-S4R-68



User Manual Issue 0.1

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Mega_Link Rotational Monitor

Overview

The Mega_Link Filter Bed Rotational Monitor Telemetry System can be used to monitor the operation of rotational filter beds typically found in a waste water treatment works. The rotation monitor unit is fitted to a rotating structure, such as the arm of a rotational waste water filter bed.

The rotation monitor unit operates as a Mega_Link outstation and is optimised for use in a PowerSave mode using a solar panel power supply and therefore can be used without the complication of passing electrical power to the structure through slip rings.

The rotational monitor incorporates a sensitive magnetic compass sensor and the Mega_Link outstation will briefly wake itself at regular intervals to read the compass bearing. It automatically regulates the rate to sample every 20 degrees of rotation. Each time it detects that the bearing passes North it increments an internal counter (which therefore records the total number of revolutions) and it also calculates the average time per revolution.

It generates a Rotation Fail alarm if the structure stops rotating.

All these parameters can be monitored by a standard Mega_Link basestation scanning via the normal 458MHz licence free radio. Outputs generated from the basestation will typically be passed on to a local telemetry PLC or SCADA system.

The basestation can also generate a count output of one pulse per rotation which could be used to increment an external counter or feed to a re-triggerable timer relay for hardware-based rotation failure monitoring purposes.

One Mega_Link basestation can be configured to work with multiple Rotational Monitor Mega_Link Outstations to monitor an array of filter beds.

Background

Legislation specifies that all waste water treatment plants should be 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 waste water evenly over a circular bed of bacterial filter media. The arm is usually powered by the water pressure. If it stops rotating for any reason the filtering will become ineffective and the bacterial media is in danger of drying out and therefore poses 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 Rotational Monitor Mega_Link Outstation onto the arm of each filter bed. No other installation work is required. The unit constantly monitors the state of rotation of the arm on which it is mounted and will radio an alarm if it stops rotating. It also transmits a count of the total number of revolutions of the arm and can measure the rotation speed.

Specifications

Maximum sample rate:	5 seconds
Minimum sample rate:	60 seconds
Maximum rotation rate:	20 seconds/revolution
Minimum rotation rate:	60 minutes/revolution
Default rotation fail alarm timeout:	4x the last valid rotation rate.
Solar panel:	P102C, 2.2W, 6.5V, Urethane, 136x112x5mm, IP67

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Batteries	4x AA R6 1.2V 2000mAh NiMH
Enclosure Specification:	Hammond 1554T2GY, 180x120x90mm, IP68
Weight:	1 kg

Operation

The Mega_Link within the Rotational Monitor unit is fitted with a 7505 Compass module in position COM1 and a standard 458MHz radio module in COM2. Along with a solar panel power supply inside an IP68 rated enclosure.

Rotation Fail Alarm

The Mega_Link generates a Rotation Fail alarm flag, which is shared with the Basestation Comms Fail alarm flag. This is allowable since the rotation compass sensor is intended for use only on outstations, so the Basestation Comms Fail alarm isn't applicable. To access this flag add an entry in the Basestation Data Routing Table like this:

XTP Address 10 Base-station Comms Fail >>> Local Digital Output 1

The base-station's first digital output will then be energised whenever the outstation is rotating and off when it stops. The state can be inverted as described in the Mega_Link Technical Manual.

The Rotation Fail Alarm can be derived in two alternative ways:

Pre-set Speed Limit

The outstation can be configured to generate an alarm if the speed of rotation falls below a pre-set limit. The limit is defined by the alarm threshold set for Count Input 4, which can be configured in the Base-station Data Routing Table. For example:

XTP Address 10 Count Input 4: Analogue Exception = 15

This will cause the outstation to generate a Rotation Fail alarm if the rotation stops or the time for a full rotation exceeds 15 minutes. The alarm will be cleared when the rotation time falls below 15 minutes.

Variable Speed Limit

If no pre-set speed limit is set the alarm will be generated from a variable limit. Each time a revolution is completed an alarm limit is set at four times the detected rotation time. If the time of the next rotation is greater than the alarm limit, or the rotation stops, then an alarm is generated. The alarm is cleared when a rotation is detected that is less than the alarm limit. This means that fluctuating speeds can be accommodated, but sudden major changes will generate an alarm.

Time of Day

There may be instances where it is permissible for the speed to drop (or even stop) at certain times of day. For example a rotating filter that is powered by the water flow may stop at night when demand is low. This can be accommodated by setting time limits for Count Input 3. The value is formed as (100 x Start Time) + Stop Time. For example:

XTP Address 10 Count Input 3: Analogue Exception = 619

This will activate the alarm from 6:00 hours until 19:00 hours (i.e. 6:00am – 7:00pm). Outside these hours the alarm will be suppressed

Rotation Parameters

Mega_Link initially samples the compass bearing every 5 seconds and deduces if it is moving towards or away from North. Each time it passes through north it adjusts the sample rate to minimise power consumption and updates the following parameters:

Total Revolutions

The total number of revolutions is saved as Count 3, which can be read by the base-station. It is retained through power interruptions and overflows from 9999 to 0.

Speed

Each time the sensor passes north it updates Count 4 with the time (in seconds) since it last passed north. If it detects a Rotation Fail condition the count is reset to 0, even if the Rotation Fail Alarm is suppressed as described above.

PowerSave Mode

The Mega_Link in the rotation monitor outstation is configured in PowerSave mode and should be used with a basestation at a recommended scan rate of 15 minutes.

IP68 Enclosure and User Controls

IP68 Enclosure
The unit is fitted within an IP68 enclosure with a sealed lid and a vent. There should be no requirement for the user to ever open the unit but if they do then new seal should be used.

On/Off

The unit is fitted with an IP68 rated on/off switch. It is very important that the unit must be switched on only after installation is complete and the arm is ready to rotate.

> *Note: if the Rotational Monitor Mega_Link Outstation is physically moved (other than by the normal rotation of the arm being monitored) it must be reset to re-initialise the compass sensor.*

DUCX Configuration Connector

The unit is fitted with an IP68 multiway connector. A special programming lead (part number TBA) is required to join to the USB port on a laptop for installing or modifying the Mega_Link configuration, e.g. radio channel and outstation address.

This connector also allows access to the rechargeable Ni-MH batteries in the unlikely event of external charging being required.

Obviously, the blanking plug must be refitted to maintain the IP68 environmental rating.

Installation

The IP68 enclosure is fitted with four feet for an external mounting arrangement and therefore there is no need to open the lid for access to any mounting screws.

After connecting the PUG/TNC aerial to the TNC bulkhead socket located at the top face of the unit, a few turns of self-amalgamating tape should be applied around the exposed metal areas to provide effective long term protection against exposure to corrosive elements.

Commissioning

It is very important that the unit must be finally switched off for at least 30 seconds and then finally on again only after all installation is complete and the arm is ready to rotate and rotational monitoring to begin.

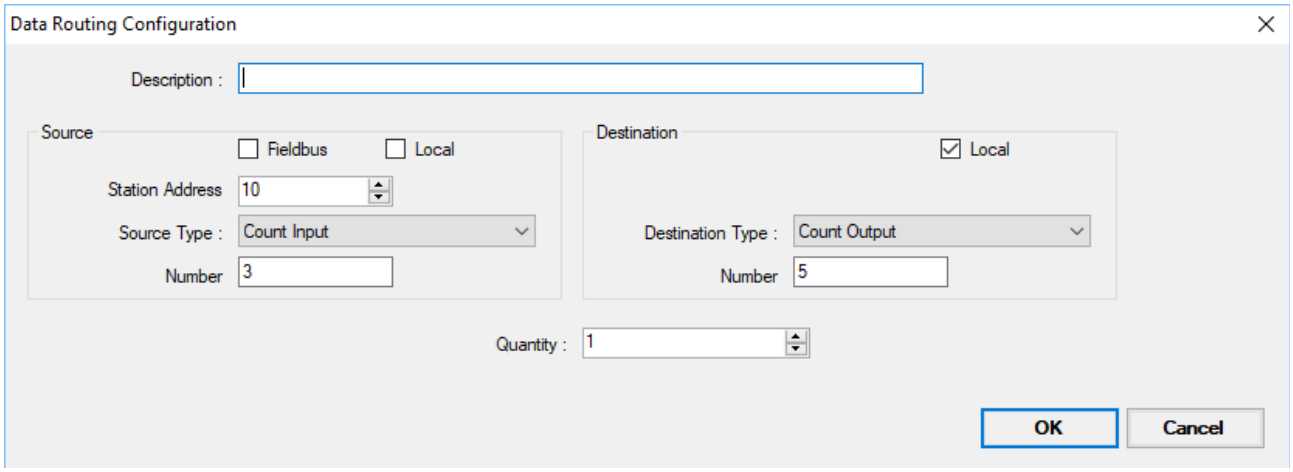
Database Usage

The following description assumes the reader is familiar with the internal database structure of Mega_Link, as described in the relevant Technical Manual:

Registers

The outstation saves the total number of revolutions in the register normally used as Count 3. This means that Digital Input 3 cannot be used as a pulse counter. As with the counter, it is 16-bit so overflows from 65535 to 0.

Count 3 can also be copied to a count output at the base-station which will then pulse each rotation, for example, the following could be included in the base-station configuration:



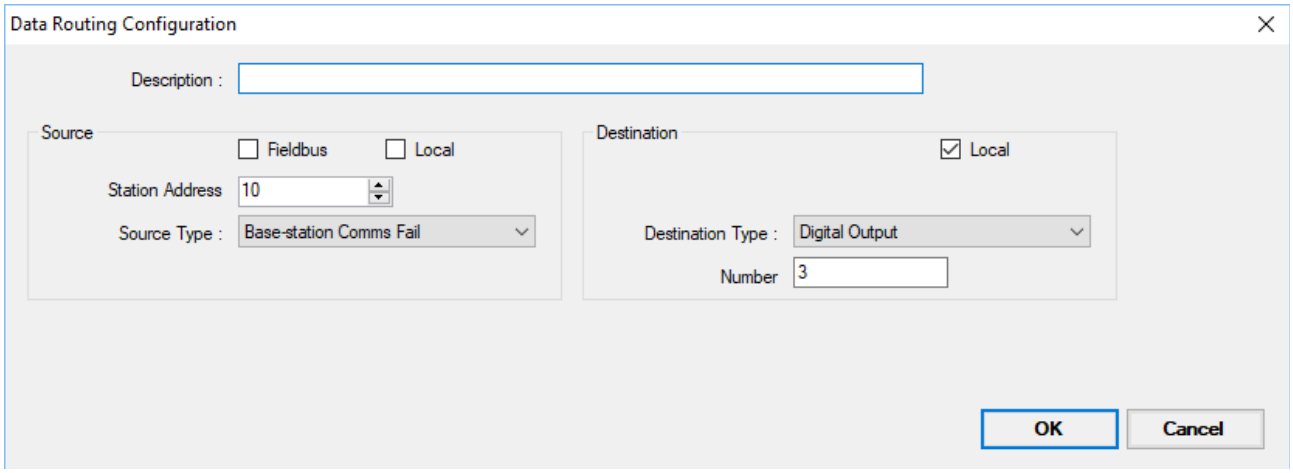
This will configure Digital Output 5 to act as a count output, and it will replicate the outstation counter.

The outstation saves the rotation rate, as seconds per revolution, in the register normally used as Count 4, so Digital Input 4 can't be used as a pulse counter. The value is damped so it is not susceptible to large fluctuation between rotations. If the rotation stops an alarm is raised and the rotation rate is set to 0.

The values in Count 3 and Count 4 can be copied via Fieldbus to an equipment such as a PLC or SCADA system for processing as required.

Alarm Detection

The Rotation Fail alarm flag occupies the position in the database that is normally allocated to the Base-station Comms Fail alarm (which is not used by an outstation). This alarm flag can be processed by the base-station as required. For example:

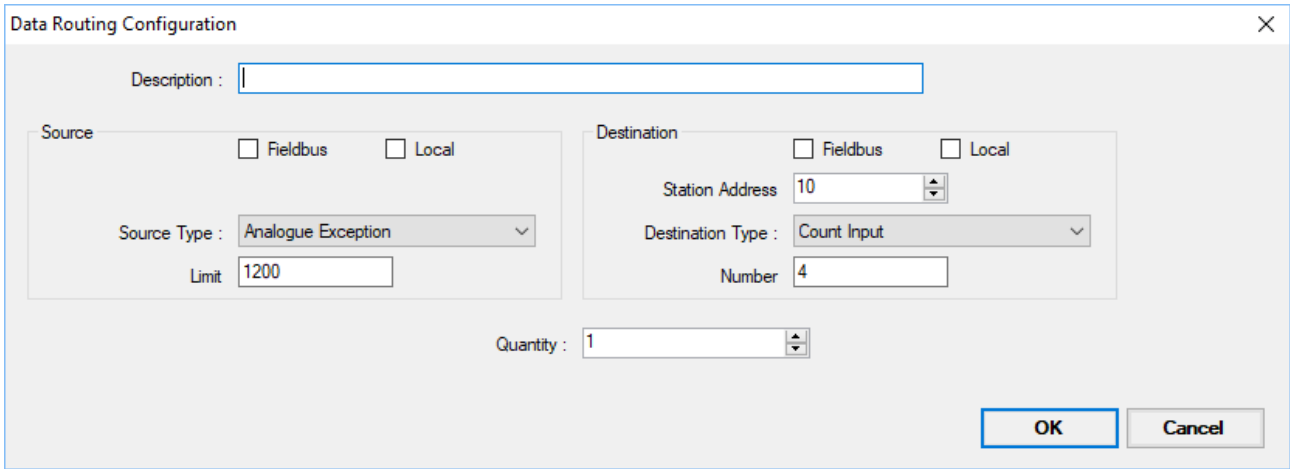


The alarm is intended to indicate that the device has stopped rotating. However, there can be occasions where it stops but it is not a fault. For example, a filter bed may stop rotating for several hours overnight if the flow rate is very low. There must therefore be a delay before the alarm is raised:

1. By default the alarm is raised if the device stops rotating for more than four times the previous rotation rate. For example, if it had been moving at a rate of 2 minutes per revolution then the alarm will be

raised if it stops for more than 8 minutes.

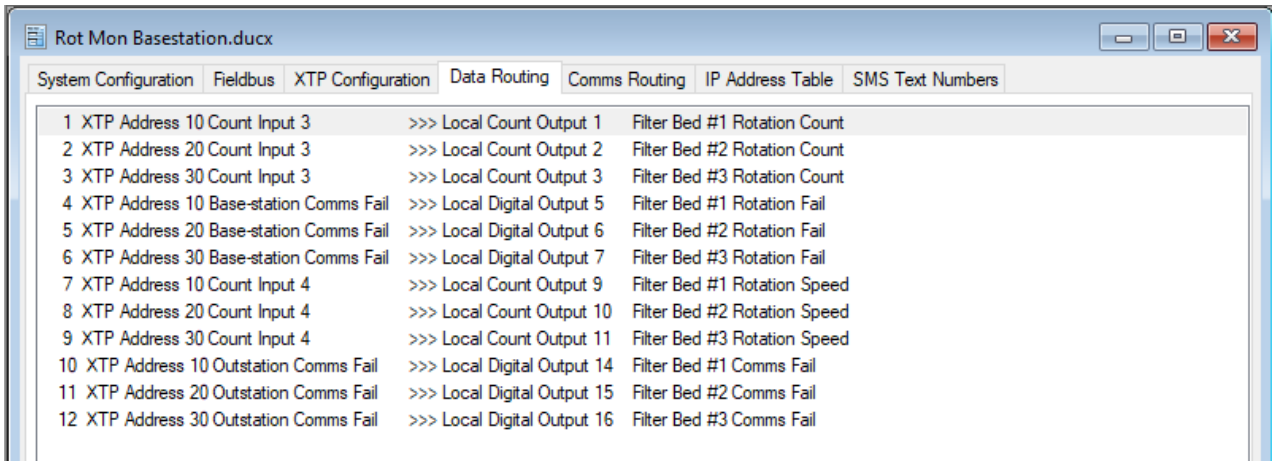
2. Alternatively the user can set a minimum rotation speed by configuring the base-station a specified value for Analogue Exception to Count 4, for example:



This will configure the outstation to raise a Rotation Fail alarm if device stops rotating for 1200 seconds, or 20 minutes.

Example Configuration

The following is an example Basestation for monitoring three filter beds monitored by Outstations #10, #20 & #30. Use of a PowerSave Scan Rate of 15 minutes is recommended.



Mounting Arrangement

The enclosure is fitted with a foot kit (Hammond 1554FT). As standard these are fitted vertically orientated. Please specify with your order if you require horizontal orientation.

Please contact us if you require a mounting bracket for clamping to the typical metal pole of a rotating arm.

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