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Data_Link 2000

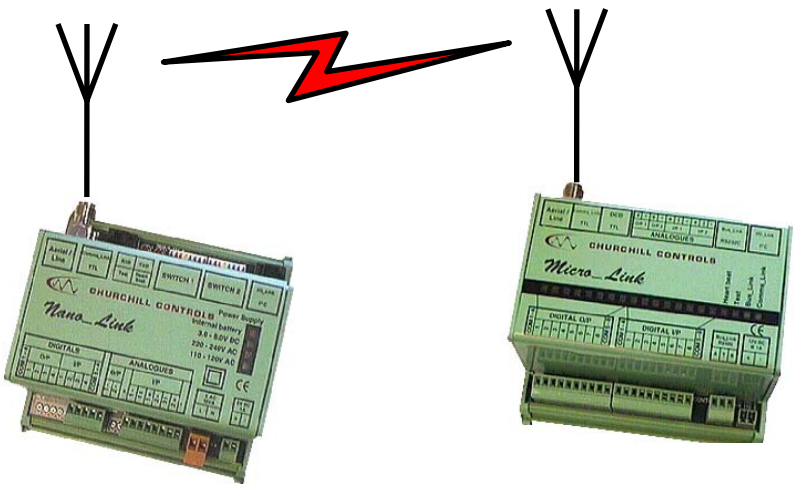
APPLICATION NOTE AN002

Measuring Flow Rate from Totalising Flow Meters

Summary

Although some flow meters give an analogue output proportional to flow rate, most give only a pulse output counting the total volume that has passed through them. A typical example is a turbine flow meter which drives a volt-free contact from a gear train lined to the turbine. These have the obvious advantage that they don't need a power supply, but they lose linearity at low flow rates.

This Application Note describes how a *Micro_Link* base-station can be configured to give analogue outputs proportional to flow rate from *Nano_Link* or *Micro_Link* outstations connected to a turbine flow meter. It applies to both battery-powered *Nano_Link*'s (which offer the obvious advantage that they can be fitted to sites using turbine flow meters without the need to provide a power supply), and to mains-powered outstations.



Detail:

On both ***Nano_Link*** and ***Micro_Link*** outstations the first 4 digital inputs each have a 16-bit counter associated with them. This allows them to be used to monitor either status contacts or totalised flow meters, depending how the base-station is configured to process the data.

As well as allowing the data to be passed to SCADA systems or PLC's via the ***Bus_Link*** interface, the base-station can also copy the data to digital and/or analogue outputs, and provide data processing.

The base-station can process counts in various ways:

1. They can be replicated on specific digital outputs. If any totalised count is copied to a single digital output, that output will pulse to reproduce the total number of counts read by the outstation. (Note this only applies to the digital outputs built into a ***Micro_Link*** base-station, plus the first 8 digital outputs on the first expansion modules (if fitted).
2. They can be copied to an array of digital outputs in BCD format.
3. They can be process to generate an analogue value proportional to the pulse rate, which can then be copied to any analogue output(s).

The processing required to produce an analogue value applies the following calculation:

$$Output = \frac{New\_Count - Last\_Count}{Scale\_Factor} * (4000 - Offset) + Offset$$

Where *New_Count* is the latest count read from the outstation and *Last_Count* is the reading taken some time earlier. *Scale_Factor* is the number of pulses counted between successive readings required to give full-scale output (i.e. 4000). Note that the calculated output value will be in the range *Offset*…4000. If this is copied to an analogue output the resulting current will be in the range (*Offset*/20)…20mA.

To achieve a reasonable resolution the time between successive updates should be long enough to accumulate a significant number of pulses, but it needs to be short enough to track varying flow rates relatively accurately. A reasonable compromise is to update the reading every 15 minutes, and use a flowmeter that gives more than 100 pulses in 15 minutes at the highest flow rate.

For example, if the flowmeter gives one pulse for every 10L, and the analogue output is required to be 20mA for a flow of 10000L/hour, then if updating every 15 minutes the Scale_Factor will be 250. If the output is to read 4mA when the flow rate drops to zero the value for Offset will be 800.

If using battery-powered outstations the time between successive updates will be the Low Power Scan Rate, which would typically be set to 15 minutes to conserve battery life.

If using permanently powered outstations the time between successive updates is defined by including a Pulse Average Time (mins) in the data routing table. **Note:** Requires Micro_Link firmware V3.21 or later and DCD Configuration software V2.19 or later.

The calculated flow rate is stored in Result (x) of the outstation, where (x) is the digital input used to count the pulses (in the range 1…4), and can be copied to any required analogue output.

If the data is not updated exactly when expected (e.g. if re-tries are needed to retrieve the data, or there is an intermittent comms fail) the base-station will automatically adjust the calculation based on the actual time between updates.

Example:
Suppose a ***Micro_Link*** base-station interrogates an outstation (set to address 10). If the outstation is battery-powered the poll rate will be defined by the Low Power Outstation Scan Rate set in the base-station configuration. If the outstation is not battery-powered the base-station will poll it at a rate defined by the Normal Scanning Window and the number of outstations being polled, but would usually be less than 5 minutes. The following lines could be included in the base-station data routing table:

Scale Factor = 250	→	Outstation Address 10 Count 1
Scale Factor = 50	→	Outstation Address 10 Count 2
Offset = 800	→	Outstation Address 10 Count 1 - 2
Pulse Average Time (mins) = 15	→	Outstation Address 10 Count 1 - 2
Outstation Address 10 Result 1 - 2	→	Local Analogue Output 1 - 2
Value on Comms Fail = 4000	→	Outstation Address 10 Result 1

The line defining the Pulse Average Time is only required for non-battery outstations. Analogue output 1 at the base-station will give a reading of 4…20mA for a pulse rate of 0…250 pulses on digital input 1 at the outstation between successive updates. Analogue output 2 will give a reading of 4…20mA for a pulse rate of 0…50 pulses on digital input 1 at the outstation between successive updates. The update rate will be defined by the Low Power Outstation Scan Rate (if the outstation is battery-powered) or else the Pulse Average Time. In the event of a communications failure the calculated flow rate for count 1 will be forced to full scale, while that for count 2 will freeze at the last valid value.

Note that only one Pulse Average Time can be set for any given outstation, regardless how many pulse counts are being used. The count output at the base-station will only be updated each time the calculated pulse rate is updated, but any counts that are not configured to give pulse rate outputs will be updated each time the outstation is polled.

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