Smart Maintenance & Diagnostics

Bronkhorst®

Bronkhorst digital **Mass Flow Controllers and Meters** offer a range of parameters for extended measurement, control and diagnostics functionality. The internal microcontroller primarily supports the **flow measurement and control** purpose of the device including digital or analog communication. Additional parameters are implemented for the purpose of diagnostics.

Bronkhorst instrument parameters can provide valuable information for effective integration into maintenance systems, obtaining optimal **reliability** and providing the **lowest downtime**.

Currently, extensive **diagnostic information** is provided by Bronkhorst instrument parameters. The parameter list in this document is a limited selection of available instrument parameters. The full parameter list can be found in Manual RS232 Interface (9.17.027). The parameter list is extended regularly with new insights and requests from customers.

All instrument parameters are continuously available with any digital interface. Our implementation of digital interfaces is built up according standard profiles for ultimate compatibility and convenience.

User stories

◆ One customer directly improved product quality by using Bronkhorst instrument parameters. By measuring the device internal **temperature** and detecting temperature variations the customer was able to improve his processes.

◆ Several customers make use of the **response alarm** to monitor if an MFC reaches and maintains its setpoint within specified limits. This is helpful to know if an inlet pressure is too low, when a gas bottle is almost depleted, or to detect obstructions in the system.

◆ Quality issues with the applied fluid were detected by another customer. Through the **density measurement**, enabled by the Coriolis measurement principle, combined with the **batch dosing** feature, the customer identified that the concentration of the applied fluid was not according to specification.

◆ The **power-up alarm** message, in combination with the function to return to the last setpoint after a power failure, a Bioreactor user was happy that his process directly continued after a detected power dip.

◆ By following the relation between the values of **measure** and **valve out** over time, it can be detected if something has changed in the setup. This can be the inlet pressure, but can also be clogging or wear of components somewhere in the setup. Maintenance can be considered if such change is observed.

Application

The following measurement, control and diagnostic parameters are of interest to monitor process conditions and set instrument messages that indicate a potential issue in the overall system. The parameters can also be used as possible indicators for maintenance.

In the table below, some possible applications are suggested.

Parameter	Parameter no.	Description	Possible applications
Serial number	Par 92	Serial number	Asset identification & verification information
Response alarm message	Par 28	Monitor a maximum % deviation of measure to set point with delay up to 255 seconds	• Detect possible blockage • Pollution • Valve failure/wear & tear • Low input pressure • Empty gas bottle
Minimum and maximum alarm message	Par 28	Monitor a minimum and maximum flow measure limit in % of FS with delay up to 255 seconds	
Batch counter alarm message	Par 28 Par 124	Maximum of pre-set amount of e.g. total measured medium	Potential indicator for preventive maintenance
Power-up alarm message	Par 28	Alarm message directly after power up	Detection of time critical power failures
Hardware alarm message	Par 28 Par 61 Par 62	Alarm message in case a hardware issue is found	Detection of hardware issues and message for troubleshooting
Measure	Par 8	Measurement signal	• Detect possible blockage • Pollution • Valve failure/wear & tear • Low input pressure • Empty gas bottle • Back flow detection
Set point	Par 9	Set point controller	
Valve output	Par 55	Valve current	
Temperature	Par 142	Absolute temperature in °C	Monitoring process conditions
Density	Par 170	Coriolis instruments provide density measurement	Detect air bubbles in liquid, detect fluid quality issues
Fieldbus diagnostics	Par 202 Par 312	Diagnostics info of communication interfaces, implemented for each interface type and protocol	Detection of communication interface behaviour and message for troubleshooting
Operation hours	Par 95	Total amount of powered-up operation	Potential indicator for preventive maintenance
Calibration date	Par 172	Date of last calibration	Potential indicator for preventive maintenance