

What is claimed is:

1. A self-contained mass flow controller (MFC) comprising:

a first flow meter constructed and arranged to measure flow rate of mass of gas through the mass flow controller in real time during the running of a process, and to produce a first flow measurement signal representing a measured flow rate through the MFC;

a second flow meter constructed and arranged to measure flow rate of mass of gas through the mass flow controller in real time during the running of a process, and to produce a second flow measurement signal representing a measured flow rate through the MFC, wherein the first and second flow meters measure the flow rate of mass simultaneously;

a control valve constructed and arranged so as to control the flow rate of mass of gas through the mass flow controller in response to a control signal generated as a function of the flow rate as measured by one of the flow meters in real time during the running of a process; and

a system controller constructed and arranged to receive the first and second flow measurement signals produced by the first and second flow meters, respectively, and to generate the control signal, and to provide an alarm signal indicating when a difference between the first and second flow measurement signals exceeds a predetermined threshold;

wherein the system controller includes:

(i) a flow control unit operative to receive the two signals produced by the first and second flow meters, and to use one of those signals for the control signal for the control valve;

(ii) a comparator operative to receive the first and second flow measurement signals produced by the first and second flow meters, respectively, and to produce as an output a difference signal representing the difference between the first and second flow measurement signals; and

(iii) a threshold detector operative to compare the difference signal to a predetermined threshold value, and to produce the alarm signal when the difference signal exceeds the predetermined threshold value; and

~~wherein the first flow meter is configured to measure flow upstream of the control valve generate the control signal, and to provide an indication when a difference between the flow rate of mass as measured by the first flow meter and the flow rate of mass as measured by the second flow meter exceeds a threshold.~~

2. A mass flow controller according to claim 1, wherein the first and second flow meters are of the same type.

3. A mass flow controller according to claim 1, wherein the first and second flow meters are of different types.

4. A mass flow controller according to claim 1, wherein at least one of the flow meters is a differential pressure flow meter.

5. A mass flow controller according to claim 1, wherein at least one of the flow meters is a thermal mass flow meter.

6. A mass flow controller according to claim 5, wherein the other of the flow meters is a differential pressure flow meter.

7. A mass flow controller according to claim 1, wherein at least one of the flow meters is a Coriolis flow meter.

8. A mass flow controller according to claim 1, wherein at least one of the flow meters is a magnetic flow meter.

9. A mass flow controller according to claim 1, wherein at least one of the flow meters is an ultrasonic flow meter.

~~10. A mass flow controller according to claim 1, wherein the first and second flow meters are respectively upstream and downstream of the control valve.~~

~~11. A mass flow controller according to claim 1, wherein the first and second flow meters are both positioned upstream of the control valve.~~

~~12.~~ A mass flow controller according to claim ~~1~~, wherein the first and second flow meters are both positioned downstream of the control valve.

~~13~~10. A mass flow controller according to claim ~~1~~, wherein the control signal is generated as a function of the flow rate as measured by a thermal mass flow meter.

~~14~~11. A mass flow controller according to claim ~~13~~10, wherein the other flow meter is a differential pressure flow meter.

~~15~~12. A mass flow controller according to claim ~~1~~, wherein the control signal is generated as a function of the flow rate as measured by a differential pressure flow meter.

~~16~~13. A mass flow controller according to claim ~~15~~12, wherein the other flow meter is a thermal mass flow meter.

~~17~~14. A mass flow controller according to claim ~~1~~, wherein the threshold is user set.

~~18~~15. A mass flow controller according to claim ~~1~~, wherein the threshold is factory set.

~~19~~16. A mass flow controller according to claim ~~1~~, wherein the threshold is set as a function of permissible tolerance in mass flow for the process with which the controller is used to deliver gas.