Built-in Purge Control Functions

Why clean a sensor?

Since the velocity sensor was calibrated clean, operating it clean also preserves the best calibration. Any build up of material on a thermal sensor tends to insulate it and will cause it to lose less heat to the process fluid so it will read lower than when it was calibrated clean. Operating the sensor dirty, then field calibrating with a correction factor to read the proper flow rate can be done, but tends to be unstable. After a process stops and cools down, the sensor build up tends to contract and often will crack and flake off. When the process restarts the sensor will now read higher. So the pre and post shutdown data at the same operating point will not match since the dirt which was partly insulating the sensor has now flaked off. This problem can be largely avoided with an automatic cleaning system.

The purge version of the product is designed to provide an automated cleaning method with high velocity gas on the velocity sensor to shear off as much deposit as possible. The purge method is very effective at increasing the intervals between manual cleaning and in many cases may eliminate the need for manual cleaning and significantly reduce the cost of ownership. The purge gas can be at ambient temperature or heated to the process temperature. The heated versions have the advantage of not condensing any of the process gas on the sensor in the middle of cleaning which could act to “cement” the dirt on the sensor instead of blowing it off.

Integrated Purge Controller

A version of the MFT B-Series hardware is available for single point or multi point applications which have a purge control timer and data hold function built-in to the flow transmitter. An example is the model 454PFTB. It is designed to directly drive a solenoid (up to 12 W at 24 VDC) to provide the compressed gas cleaning to the sensor.

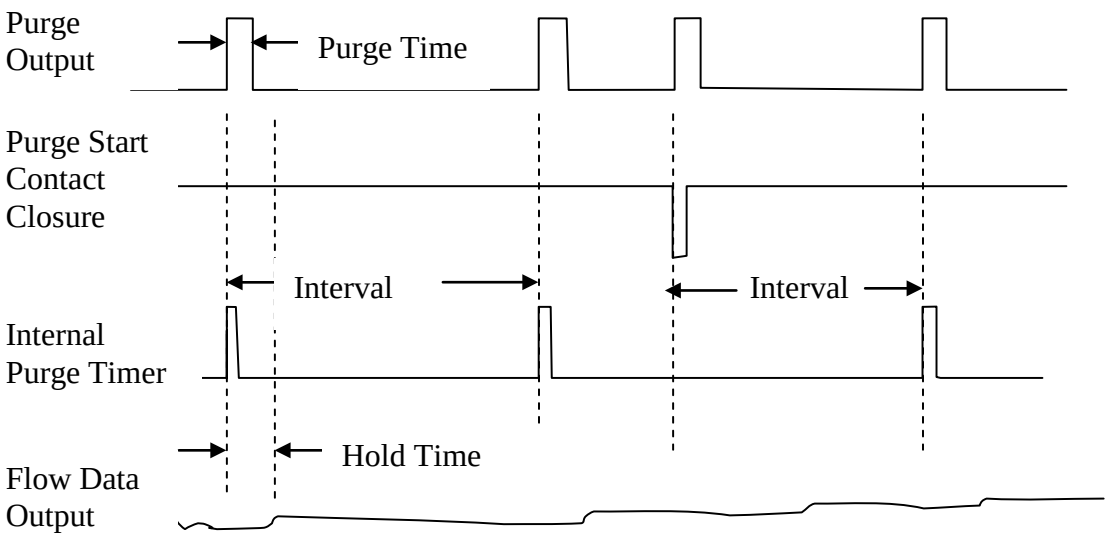
The cleaning sequence can be initiated from:

- Internal flow meter timer
- External contact closure
- Write Coil command via Modbus.
- HART command

Since the data is held during the cleaning cycle, this makes it easier to have the cleaning control asynchronous with the process operation (use its internal timer which is independent of the process operation). For applications that need a tighter control of the operation, the contact closure initiated from outside the meter is the best approach. The only verification that the cleaning cycle is on is

by querying a status register through Modbus (Register 1XXXX - coil status #8). The meter's process variables (flow, velocity, and temperature) are held at their values prior to the start of the purge. If the sensor was dirty and then cleaned by the purge cycle, you will see a spike in the flow rate and velocity when the purge cleaning cycle completes.

For the K-BAR 2000PB, only one of the sensor control boards needs to have the solenoid drive modifications as all units will respond to the external trigger command at the same time and mask the purge blast from the output data.



Purge Controller Wiring

The purge controller setup is a matter of connecting a 24 VDC 12 W max. solenoid to the DO2 or solid state relay channel #2. Pin # TB6-1 is +24 VDC and TB6-2 is the GND connection. See field wiring diagram 342038, sheet 3 and 795038 for an example of the solenoid wiring. The wiring gage and length is not critical for this connection and will generally be short for this application. We recommend 18 AWG (1.02 mm) wire.

> *Note, the above wring information only works for the purge version, model 454PFTB-16.*

To activate the purge with an external contact closure: The contact closure is on pins TB6-8 or digital input 1 (DI1) and GND, TB6-5. The activation is a pulse whose width must be at least 25 ms long and the purge will start on the leading edge (or falling from logic high to low).

Purge Relay Assignment

To use the sensor purge cleaning feature of the meter, relay #2 must be assigned to 'PURGE OUTPUT'. The setup is outlined below.

Enter *Program Mode*, press **P**, the **654321** access code, and **E**. Press **2** to invoke the *Quick Jump* option entry method and select **Option #8** for the Relay Assignment menu. The meter will prompt for a Relay #. Press **2** and **E** to begin configuration of Relay #2.

```
SELECT RELAY #
> 2
```

The meter will next prompt for a function to assign to Relay #2. Use the **^** or **v** key to change the selection to 'PURGE OUTPUT' then press **E** to accept the selection.

```
ASSIGN RELAY TO
>PURGE OUTPUT ^v
```

Relay #2 is now assigned to the purge output function.

If the screen displays

```
RELAY IS USED!!
CHANGE IT>NO
```

then relay #2 is being used by another function. Change the response to 'YES' by pressing the **^** or **v** key and press **E** to accept the selection. The meter will reassign Relay #2 to the PURGE OUT function and deassign the previously assigned function and turn it OFF, when applicable.

The meter will advance to the Setup Sensor Purge menu (alternatively, from the Quick Jump option entry, **Option #12** will invoke the **Setup Sensor Purge menu**).

Purge Controller Configuration Changes

The first item that the meter will prompt for in the Setup Sensor Purge menu, is the ON/OFF state of the PURGE TIMER. When this parameter is set to ON, the sensor purge cleaning sequence will be initiated by an internal timer in the flow meter. Use the **^** or **v** key to change the selection to 'ON' then press **E** to accept

the selection. Note, the PURGE TIMER does not need to be ON for the Purge to be initiated via Modbus, HART, or the external contact closure.

```
PURGE TIMER
>ON              ^v
```

If the screen displays

```
DO2 IS USED!!
CHANGE IT>NO
```

then relay #2 is being used by another function. Change the response to 'YES' by pressing the **^** or **v** key and press **E** to accept the selection. The meter will automatically reassign Relay #2 to the PURGE OUT function and deassign the previously assigned function. It is recommended, if Relay #2 is assigned to another function, the user go through the Relay Assignment menu so that a previous configuration is not inadvertently changed, see section above (PURGE RELAY ASSIGNMENT).

After the PURGE TIMER is turned on, the meter will confirm the relay assignment as follows:

```
PURGE OUTPUT
ASSIGNED to DO2
```

Press **E** or **P** to continue. Next the meter prompts for the PURGE TIME. The PURGE TIME is the length of time the purge solenoid is held open.

```
PURGE TIME MSEC
>500
```

Using the numeric keys, type in the number of milliseconds to hold the purge solenoid open during the purge. A short blast generally works best. Press **E** to accept the value.

To allow the sensor to recover from the purge, a HOLD TIME can be configured. The HOLD TIME applies to the update of the flow rate, velocity and temperature values with respect to the 4-20mA output, Modbus output and the LCD display. The HOLD TIME is used to mask off the large flow spike following the purge. The HOLD TIME may be a function of the purge gas temperature compared to the temperature of the process gas being measured. The larger the temperature difference between these two variables, a longer HOLD TIME may be needed. Also, lower flow rates tend to need more recovery time following a purge than

higher flow rates. Note, the readings will change following a purge since the sensor is cleaner, regardless of what hold time is used. Additionally, the rate at which the shift occurs is filtered by the meter time constant setting.

The HOLD TIME entered is the total time for the entire purge cycle (eg, a HOLD TIME of 2000 milliseconds with a PURGE TIME of 500 milliseconds means that the Purge Relay will be pulsed for 500 milliseconds, followed by an additional 1500 milliseconds of idle time to allow for sensor recovery). Therefore, the entered HOLD TIME must be greater than or equal to the entered PURGE TIME. Using the numeric keys, type in the number of milliseconds for the desired HOLD TIME. Press **E** to accept the value.

```
HOLD TIME MSEC
>2000
```

The meter will next prompt for the PURGE INTERVAL in minutes. The PURGE INTERVAL is used to set the frequency of the purge cycle when it is triggered by the internal timer. For example, a PURGE INTERVAL of 60 minutes will trigger one purge per hour. Using the numeric keys, type in the number of minutes for the desired PURGE INTERVAL. The meter will accept a PURGE INTERVAL between 1 and 1440 minutes. Press **E** to accept the value.

```
PURGE INTV MIN
> 60
```

If the internal timer and the external purge contact closure are both used to start the purge, set the PURGE INTERVAL to a value higher than will be used by the external closure to prevent the internal timer from purging too soon after the last externally commanded purge.

Modbus operation and monitoring of the purge cleaning

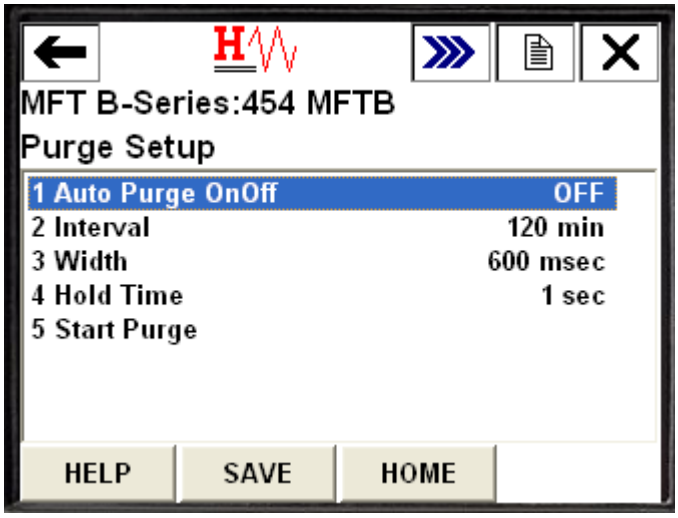
The purge sequence can be triggered by writing a 1 to the Modbus coil #8 (Register 0X). This operation does not require that the purge timer be turned on, however, Relay #2 must be assigned to the PURGE OUT function. Once started, it will ignore additional purge commands. The Modbus purge trigger, is independent of the internal timer. So if the purge interval is configured for 60 minutes, extra purge commands on Modbus will be performed without affecting the internal timer purge sequence.

The status of the purge via Modbus is provided at coil status #8, (Register 1X). A value of 1 indicates it is in the middle of a purge cycle, 0 indicates it is idle.

NOTE: If a purge sequence that was initiated through HART is in progress when another purge sequence is initiated through Modbus, the purge sequence initiated through Modbus will be ignored.

Purge Cleaning Setup and Initiation through HART

The parameters to setup the purge sequence can be changed through the HART interface. Device specific commands 137, 138, 139 are used for the MFTB Purge Cleaning through the HART Master. The MFT B-Series Field Device Specification describes the format of these commands. For HART Masters using the MFTB Device Description, a Purge Setup Menu and Purge Method is available. Follow this link to the HART Interface Guide which covers the MFTB DD Menu Organization. The figure below is a screen shot from an Emerson 475 handheld communicator showing the Sensor Purge Cleaning menu. The user can setup the various Purge parameters as well as initiate a Sensor Purge Cleaning cycle.



If the Purge Timer has been turned ON, the purge cycle intiated through the HART interface will not affect the purge sequence controlled by the internal timer.

NOTE: If a purge sequence that was initiated through Modbus is in progress when another purge sequence is initiated through HART, the purge sequence initiated through HART will be ignored.

Interaction with Drift Check

The sensor purge and the Zero-Mid-Span Drift checks are two MFT B-Series features that can be configured to automatically trigger on a user configured interval. When the timers for these two features are both operational and both are scheduled to initiate at the same time, the meter will start only one activity and start the next activity when the first one completes.