

5.2.7.1. Response Line Termination

The Response Line Termination character(s) is (are) appended to each line returned from the Digital 300; the default is a Carriage Return, but this can be changed via S65 to one of the following:

For carriage-return (default), enter “S65=x0D”.

For line feed, enter “S65=x0A”.

For carriage-return linefeed, enter “S65 =x0D0A”.

5.2.7.2. RS485 Mode Responses

In RS485 mode, all responses and error messages from commands sent using the broadcast address (0x99) will be suppressed. The S5 command is an exception to this rule; when the device is the only Digital 300 on the bus, the command *99 S5 can be used to get the device’s address.

Other than the above behavior, responses will be no different than responses in RS232 mode. There will be no address in responses.

5.2.8. Commands

5.2.8.1. Flow Reporting Commands

F Flow

Returns the current flow in the units specified in G7.

FS % Full Scale Flow

Returns the current flow as a percent of full scale.

FR Flow Power

Returns the current bridge power differential reading.

F1 Start Flow Streaming

Causes flow readings to be output every 1/2 second.

F0 Stop Flow Streaming

Stops the 1/2 second flow reading output.

ZERO Set Flow Zero

Sets S15 UB Zero and S16 DB Zero to the current bridge power readings. The effect of this is the current flow reading becomes the zero flow point.

ZRO Alias for ZERO

For backward compatibility.

5.2.8.2. System State Commands

ENABLE / DISABLE Enable/Disable any of the following aspects (i.e. ENABLE RS485)

AUTOZERO, RATE, TRACKING, VERBOSE, RS485, PURGE, OVERRIDE, EXTERNAL, and SHUTDOWN

See S2 and V2 for more information

TERMINATORS485 Enable termination resistors on RS485 communications

NOTERMINATORS485 Disable termination resistors on RS485 communications

FLOK Enable/Disable Factory-Level Access

Resets the Factory Access Code, allows only customer-level changes.

Enables Factory-Level Access if the correct code entered, allows changes to everything.

LOCK Disable Expert-User-Level access

Disables Expert-User-Level Access (Unlock in command descriptions)

UNLOCK Enable Expert-User-Level access

Enables Expert-User-Level Access (Unlock in command descriptions)

TOFF DAC adjust complete

Write the D/A converter values to memory

TDAO DAC zero output

In calibrate mode, generate output voltage equivalent to the DAC zero code (S51)

TDAS DAC span output

In calibrate mode, generate output voltage equivalent to the DAC full scale code (S52)

TDAZ DAC zero count output

In calibrate mode, generate output voltage equivalent to 0 counts to the DAC

SS System State

Returns the current system state which can be one of the following:

1 = Initializing

4 = Normal Operation

6 = System Failure Mode Active, send STATUS command for reason

8 = Calibration Mode

SS1 Enter Initialize mode

Resets the system, simulates power-on, returns to the Initializing state.

SS4 Enter Normal Operation mode

Returns the system from Calibration Mode (SS8) to Normal Operations (SS4).

SS8 Enter Calibrate mode

Sets system state to Calibrate, allows calibration of the Analog I/O.

SFL System Full List

Returns all system variables for use in problem determination.

STATUS Current system error status

Returns the current System Status word; if in Verbose Output mode (S112=1), returns descriptions of the presently active errors.

The System Status word contains the following:

```
0x8000 CONTROL_BOARD_COMM_ERROR
0x4000 SENSOR_BOARD_COMM_ERROR
0x0080 UB_CURRENT_ERROR
0x0040 DB_CURRENT_ERROR
0x0008 VALVE_LATCH_ERROR
0x0004 TRACKING_ERROR
0x0002 GAS_HIGH_ALARM_ERROR
0x0001 GAS_LOW_ALARM_ERROR
```

ML Status Alias

This is an alias for the STATUS command for backward compatibility.

HISTORY System Error Status History

Returns any Status errors that have occurred since system reset

CLEAR HISTORY

Clears the Status History

FAIL CODES System Fail codes

Returns all System Status Failure codes which have occurred since the device left the factory or since the last time the CLEAR FAIL CODES command was sent

The Fail Codes contain the following:

```
0x8000 CONTROL_BOARD_COMM_ERROR
0x4000 SENSOR_BOARD_COMM_ERROR
0x0080 UB_CURRENT_ERROR
0x0040 DB_CURRENT_ERROR
```

CLEAR FAIL CODES (Factory Function)

Clears the Fail Codes

5.2.8.3. Sensor List Commands

SL Sensor List (Read Only)

Returns all items in the Sensor List

S1 Model (Read Only)

Returns the Model and Software Version of the device.

S2 MFM Config (Read/Write)

Mass Flow Meter Configuration Word. This is a hex value which configures the overall operation of the device. The possible settings are as follows:

Bit 15 (Mask 0x8000) Flow Rate Alarms:

If this bit is set, the GAS_HIGH_ALARM_ERROR bit in the System Status word will be set if the flow exceeds the value set in G10 and the GAS_LOW_ALARM_ERROR bit in the System Status word will be set if the flow falls below the value set in G12.

Bit 13 (Mask 0x2000) Auto Zero:

Valid only for Flow Controllers. If set, the system will reset the flow zero point after the sensor has stabilized and the set-point is zero.

Bit 11 (Mask 0x0800) Tracking Alarms:

Valid only for Flow Controllers. Reflects the setting of V18. If enabled, the TRACKING_ERROR bit in the System Status word will be set and the Flow LED will blink green at 1/2 second intervals if the flow varies from the set-point by the percent of full-scale flow specified by V17 for more than 2 seconds.

Bit 7 (Mask 0x0080) Verbose Replies:

If set, all commands will return descriptive information. If not set, only the List commands (SL, GL, VL) will return descriptive information.

Bit 0-2 (Mask 0x0007) Decimal Places:

Reflects the setting of S14. This is the number of digits following the decimal point in floating point number.

In addition to changing S2 directly, these fields can also be changed using the following methods:

The Decimal Places field can be changed via S14.

There are 4 items which can be Enabled or Disabled. In verbose mode, the S2 command returns the current settings with explanatory text. These four items have the main function capitalized - RATE, VERBOSE, AUTOZERO, and TRACKING. Each of these can be enabled or disabled by entering ENABLE or DISABLE followed by the capitalized word.

For example, to disable Auto-Zero, enter DISABLE AUTOZERO - case does not matter.

Verbose Replies can also be Enabled/Disabled via the S112 command.

S5 Device Address (Read/Write)

Address used for RS485 mode addressing. This is a hex number which accepts values from 0x01 to 0x98 and 0x9A to 0xFF; 0x99 is the BROADCAST ADDRESS - all devices process this message, but do not respond unless the command is S5.



NOTE: The command *99S5 should be used only with a single device attached to the

RS485 bus. The purpose of this command is to get the current address of a device when it is not known.

S6 Active Gas Instance (Read/Write)

The Gas Instance/Record currently being used for flow calculations. Valid values are 0 to 9.



NOTICE: For instruments with a display, Gas Record 9 is reserved for Custom Gas configuration. Modifying this record may result in unexpected displayed values.

S12 Total Flow Hours (Read/Factory Write)

The number of hours the device has been flowing 1% of Full-Scale or greater.

S14 Num Decimal Places (Read/Write)

The number of decimal places displayed for floating point values. Valid values are 0 to 7. This setting is reflected in the lower 3 bits of S2.

S15 UB Zero (Read/Factory Write)

The Upstream Bridge Zero value in watts

S16 DB Zero (Read/Factory Write)

The Downstream Bridge Zero value in watts

S17 Auto-Zero Temperature (Read Only)

The sensor board temperature at the last zero event

S18 Current Sensor Temperature (Read Only)

The current sensor board temperature

S19 Low-Pass Filter Decay Time (Factory Read/Factory Write)

Sensor response decay time in seconds, usually 0.05, which is 50 ms of averaging the raw sensor flow readings. If changed, the PID may need to be recalibrated.

S20 Mid-Term Filter Gain (Factory Read/Factory Write)

Sensor response gain value. If changed, the PID may need to be recalibrated.

S21 Mid-Term Filter Decay Time (Factory Read/Factory Write)

Sensor response mid-term filter decay time in seconds

S22 Short-Term Filter Gain (Factory Read/Factory Write)

Sensor short-term response gain value. If changed, the PID may need to be recalibrated.

S23 Short-Term Filter Decay Time (Factory Read/Factory Write)

Sensor response short-term filter decay time in seconds

S24 SetPoint A/D FS Code (Unlock Read/Unlock Write)

The Set Point A/D Full-Scale Code. Range is -32768 to 32767. If in CALIBRATE state (SS8), writes value to RAM only; otherwise, writes the value to RAM and FLASH.

S25 External In A/D FS Code (Unlock Read/Unlock Write)

The External Input A/D Full-Scale Code. Range is -32768 to 32767. If in CALIBRATE state (SS8), writes value to RAM only; otherwise, writes the value to RAM and FLASH.

S26 SetPoint A/D (Read Only)

The current Set Point A/D voltage or current.

S27 External In A/D (Read Only)

The current External Input A/D voltage or current.

S28 Sensor Span (Unlock Read)

The Sensor Span value in watts (should be around 0.017). Determined by S29 Sensor Type.

S29 Sensor Type (Read/Factory Write)

The Sensor Type, either 14, 17, or 26. Value also found on customer order and internal label.

S30 Num Avg Samples (Read/Write)

The number of samples used in calculating the flow average used for serial-port display and analog output. The system gets a new flow reading every 10 milliseconds; these raw flow readings are noisy because they have not been averaged. This number allows end-user adjustment of the noisiness of the output. Range is 1 to 100 which translates to 10 to 1000 ms of averaging. The factory default is 20 which is an average of 1/5th second of readings.

S35 Shunt Factor (Read/Factory Write)

This is the nominal range of the flow shunt in SLM.

S36 Analog Output (Zero Flow) (Read Only)

The Analog Output voltage or current value which is output when the flow is at 0% of full scale. This is controlled by S64 Product Config.

S37 Analog Output (FS Flow) (Read Only)

The Analog Output voltage or current value which is output when the flow is at 100% of full scale. This is controlled by S64 Product Config.

S40 UB Current (Factory Read Only)

The Sensor Upstream Bridge Current reading.

S41 UB Voltage (Factory Read Only)

The Sensor Upstream Bridge Voltage reading.

S42 DB Current (Factory Read Only)

The Sensor Downstream Bridge Current reading.

S43 DB Voltage (Factory Read Only)

The Sensor Downstream Bridge Voltage reading.

S46 UB Power (Factory Read Only)

The Sensor Upstream Bridge Power level.

S47 DB Power (Factory Read Only)

The Sensor Downstream Bridge Power level.

S51 DAC Zero Code (Unlock Read/Unlock Write)

The Analog Output D/A value used to represent 0% flow. If in CALIBRATE state (SS8), writes value to RAM and Sets the Analog Output to the level representing 0% flow; otherwise, writes value to RAM and FLASH

Range is 0 to 65535. Defaults are as follows:

0 to 5 V, 0 to 10V	32764
1 to 5 V	35742
0 to 20 mA	0
4 to 20 mA	10950

S52 DAC Full Scale Code (Unlock Read/Unlock Write)

The Analog Output D/A value used to represent 100% flow. If in CALIBRATE state (SS8), writes value to RAM and Sets the Analog Output to the level representing 100% flow; otherwise, writes value to RAM and FLASH

Range is 0 to 65535. Defaults are as follows:

0 to 5 V, 1 to 5V	47654
0 to 10 V	62545
0 to 20 mA, 4 to 20mA	54670

S54 Comment (Read/Write)

The Comment field. This allows the end user to add up to 63 characters of free-format text for their own use. WARNING, do not use the greater-than sign '>' in any text field because it could affect automated command response processing since it is used as the end-of-response character.

S62 Cal Date (Read/Factory Write)

The date the device was calibrated at the factory. This is a text field which accepts a maximum of 63 characters.

S63 Cal Temp (Read/Factory Write)

The temperature at which the device was calibrated at the factory. This is a text field which accepts a maximum of 63 characters.

S64 Product Config (Read/Factory Write)

The product configuration word. Valid settings are as follows:

0x00 = 0 to 5 Volt Flow Meter
0x02 = 0 to 10 Volt Flow Meter
0x08 = 1 to 5 Volt Flow Meter
0x14 = 0 to 20 milliamp Flow Meter
0x1C = 4 to 20 milliamp Flow Meter
0x01 = 0 to 5 Volt Flow Controller
0x03 = 0 to 10 Volt Flow Controller
0x09 = 1 to 5 Volt Flow Controller
0x15 = 0 to 20 milliamp Flow Controller
0x1D = 4 to 20 milliamp Flow Controller

When this command is executed, the system will automatically re-start.

S65 NextLine (Read/Write)

The Response Line Termination character(s) sent at the end of each line of a response.

For carriage-return (default), enter "S65=x0D".

For line feed, enter "S65=x0A".

For carriage-return linefeed, enter "S65 =x0D0A".

S68 Instrument ID (Read/Factory Write)

The Instrument's ID string. This is a text field which accepts a maximum of 63 characters.

S69 SetPoint A/D Offset (Unlock Read/Unlock Write)

The Set Point A/D Zero code. Range is -32768 to 32767. If in CALIBRATE state (SS8), writes value to RAM only; otherwise, writes the value to RAM and FLASH.

S70 External In A/D Offset (Unlock Read/Unlock Write)

The External In A/D Zero code. Range is -32768 to 32767. If in CALIBRATE state (SS8), writes value to RAM only; otherwise, writes the value to RAM and FLASH.

S75 Control Board Id (Factory Read Only)

The Hex ID and Software Version of the Control Board.

S76 Sensor Board Id (Factory Read Only)

The Hex ID and Software Version of the Sensor Board.

S112 Verbose Replies (Write Only)

Enables (Non-Zero value) or disables (0) Verbose Replies. This setting is reflected in bit 7 of S2.

5.2.8.4. Gas List Commands

GL Gas List (Read Only)

Returns all items in the Active Gas List (S6 specifies Active Gas).

GILx Gas List x (Read Only)

Returns all items in the Gas List for the Gas Record x. The valid values for x are 0 to 9.

GIxy Gas Item (Read/Factory Write Record 0, Unlock Write Records 1 - 9)

The current setting for item #y in Gas Record #x.

Used for viewing/changing any Gas Record item, especially items which are not in the Active Gas Record. See Active Gas Instance (S6).

e.g. GI410 returns the Gas High Alarm Limit for Gas Record 4.

GI410=85 sets the Gas High Alarm Limit for Gas Record 4 to 85%.

GICxy: (Factory Function)

Copies Gas Record x to Gas Record y. Does not copy to Gas Record #0.

G1 Gas Instance (Read Only)

The Gas Record/instance number being displayed.

G4 Gas Symbol (Read/Factory Write Record 0, Unlock Write 1 - 9)

The Gas Symbol, e.g. N2, is a text field which accepts a maximum of 63 characters.

G7 Units Symbol (Read/Factory Write Record 0, Unlock Write 1 - 9)

The Gas Units Symbol, e.g. SLM, is a text field which accepts a maximum of 63 characters.

G10 High Alarm Limit (Read/Write)

The High Alarm Limit in % of Full-Scale Flow. If Flow Rate Alarms are enabled in S2, the GAS_HIGH_ALARM_ERROR in the STATUS word will be set if the flow is greater than this value for more than 2 seconds. The alarm will be de-activated if the flow is 2% below this value for at least 2 seconds. The HISTORY command will report if the alarm has occurred at any time since reset.

G12 Low Alarm Limit (Read/Write)

The Low Alarm Limit in % of Full-Scale Flow. If Flow Rate Alarms are enabled in S2, the GAS_LOW_ALARM_ERROR in the STATUS word will be set if the flow is less than this value for more than 2 seconds. The alarm will be de-activated if the flow is 2% above this value for at least 2 seconds. The HISTORY command will report if the alarm has occurred at any time since reset.

G15 Volumetric Unit Select (Read/Factory Wr. Record 0, Unlock Wr. 1 - 9)

If the customer units are volumetric in nature (e.g. SLM, SCCM, SCFH), this is set to 1. In this case, reference temperature (G22) and pressure (G23) are considered in the flow calculation. If mass units are desired (e.g. k/s, g/s, lb/hour), this is set to 0 and temperature and pressure are not considered.

G16 Gas Conversion Factor (Read/Factory Wr. Record 0, Unlock Wr. 1 - 9)

The gas conversion factor (GCF) is the ratio of nitrogen sensor output to customer gas sensor output. Consult the factory website for gas conversion factors for various gases.

G17 Span Correction Factor (Read/Factory Wr. Record 0, Unlock Wr. 1 - 9)

This is used to make small adjustments to the instrument span. Value is usually close to 1.0

G18 Full Scale Flow (Read/Factory Write Record 0, Unlock Wr. 1 - 9)

This is the full scale value in the final customer units as reported digitally.

G19 Time Factor (Read/Factory Write Record 0, Unlock Wr. 1 - 9)

Factor used to convert from minutes to customer time units in time units per minute (e.g. 0.01667 hr/min).

G20 Volume Factor (Read/Factory Write GI 0, Unlock Wr. GI 1 - 9)

Factor used to convert from minutes to customer volume units in volume units per liter (e.g. 0.0353 ft³/L). In the case of a mass unit, this is the density in g/L and is used with G21 to get kilograms or pounds.

G21 Mass Factor (Read/Factory Write GI 0, Unlock Write GI 1 - 9)

Factor used to convert from grams to customer mass units in grams per mass unit (e.g. 1000 g/kg or 453.59237 g/lb). Used with G20 when it is a density.

G22 Reference Temperature (°C) (Read/Factory Wr. GI 0, Unlock Wr. GI 1 - 9)

This is the reference temperature of the customer standardized volumetric unit. It is used to convert from a standard temperature of 0 °C to the customer unit standard temperature. Used if G15 is 1.

G23 Reference Pressure (Torr) (Read/Factory Wr. Record 0, Unlock Wr. 1 - 9)

This is the reference pressure of the customer standardized volumetric unit. It is used to convert from a standard pressure of 760 Torr to the customer unit standard pressure. Used if G15 is 1.

G24 Linearization Coeff #1 (Read/Factory Wr. Record 0, Unlock Wr. 1 - 9)

This is the linear term of the equation used to fit the calibration data in order to improve accuracy. If no curve fit was required, this term will be 1 and the others 0.

G25 Linearization Coeff #2 (Read/Factory Wr. Record 0, Unlock Wr. 1 - 9)

This is the quadratic term of the equation used to fit the calibration data in order to improve accuracy.

G26 Linearization Coeff #3 (Read/Factory Wr. Record 0, Unlock Wr. 1 - 9)

This is the third-order term of the equation used to fit the calibration data in order to improve accuracy.

G27 Linearization Coeff #4 (Read/Factory Wr. Record 0, Unlock Wr. 1 - 9)

This is the fourth-order term of the equation used to fit the calibration data in order to improve accuracy.

G29 Full-Scale Power (Read Only)

This is the calculated full-scale sensor power value for this gas instance.

G31 Total Accumulated Flow (Read/Write)

This is the total amount of gas that has flowed through the device since the last time this total was set to zero. It is useful for tracking the total amount of gas that has flowed using this gas record.

5.2.8.5. Valve List Commands

VL Valve List (Read Only)

Returns all items in the Valve List.

V1 MFC Mode (Read/Write)

The Mass Flow Controller Mode Word - the current state of the Valve Control System.

0 = DEFAULT	Open or Closed According to V2 Bit 1
1 = AUTO	Flow Automatically Maintained at Rate Specified by V4/V5
2 = HOLD	Valve Drive Held at Current Voltage, must be in AUTO to change to HOLD.
3 = SHUT	Valve is Forced Closed
4 = PURGE	Valve is Forced Fully Open
5 = VARIABLE	Valve Drive Controlled by V28
6 = ERROR	System Failure Active, Valve at DEFAULT Position. Only the System can enter this state, command not allowed.

V2 MFC Config (Read/Write)

The Mass Flow Controller Configuration Word - controls valve operation using bit flags, with the following interpretation:

Bit 0	(Mask 0x0001)	DERIVATIVE ON ERROR	(Always 1, Enabled)
Bit 1	(Mask 0x0002)	DEFAULT VALVE POSITION	(0 = SHUT, 1 = PURGE)
Bit 2	(Mask 0x0004)	VALVE OVERRIDE	(0 = Disabled, 1 = Enabled)
Bit 4	(Mask 0x0010)	CONTROLLED VARIABLE	(0 = Flow, 1 = A/D Input)
Bit 7, 6	(Mask 0x00C0)	SETPOINT SOURCE	(10 = A/D Input, 01 = V4/V5)
Bit 8	(Mask 0x0100)	ONE PERCENT SHUTDOWN	(0 = Disabled, 1 = Enabled)

In addition to changing the value directly, these bits can also be set/cleared using the following method:

The four configurable items are the default valve position, valve override, controlled variable and 1% shutdown.

In verbose mode, the V2 command returns the current settings with explanatory text. The four configurable items have the main configurable function capitalized = PURGE, OVERRIDE, EXTERNAL, and SHUTDOWN. Each of these can be enabled or disabled by entering ENABLE or DISABLE followed by the capitalized word.

For example, to disable valve override, enter DISABLE OVERRIDE - case does not matter.

V3 Valve Position (Read Only)

The current Valve Position as a hex value with the following interpretation:

0x10	CLOSED	Valve drive is set to minimum, the valve is closed
0x20	PURGE	Valve drive is set to maximum, the valve is fully open
0x30	HOLD	Valve drive is held at a constant value.
0x40	VARIABLE	Valve drive is manually controlled by the value in V28

0x50 AUTO

Valve drive is being automatically adjusted

The above may be OR'd with the following modifiers. If any of these are active, the text (in Verbose mode) will show only these conditions.

0x01 OVERRIDE_SHUT

Valve Override is enabled in V2 bit 2 and the analog override input is below 0.4 VDC

0x02 1PERCENT_SHUTDOWN

The one percent shutdown is enabled in V2 bit 8 and the setpoint is less than 1%.

0x04 OVERRIDE_PURGE

Valve Override is enabled in V2 bit 2 and the analog override input is above 2.4 VDC

V4 SetPoint (in Units) (Read/Write)

The Flow Setpoint in Flow Units, e.g. SLM

V5 SetPoint (in % Full-Scale) (Read/Write)

The Flow Setpoint in % Full Scale.

V8 Implemented SetPoint (in Units) (Read Only)

The current Setpoint in Flow Units. Normally this will be the same as V4, but if SoftStart is active, it will be the Setpoint at the time the command is processed.

V9 Implemented SetPoint (in % Full-Scale) (Read Only)

The current Setpoint in % Full Scale. Normally this will be the same as V5, but if SoftStart is active, it will be the Setpoint at the time the command is processed.

V10 Controlled Variable (Read Only)

The Controlled Variable in % Full Scale. This is normally the Flow, but if bit 4 of V2 is set to 1, it will be the A/D input.

V12 SoftStart Enabled (Read/Write)

If non-zero, SoftStart is enabled. Softstart is enabled by default.

V13 SoftStart Rate (Read/Write)

The rate at which the implemented Setpoint will be ramped up or down in % of Full Scale per second.

V17 Tracking Alarm Limit (Read/Write)

The Tracking Alarm Limit in % of Full Scale. The default is 2%.

V18 Tracking Alarm Enabled (Read/Write)

If non-zero, enables Tracking Alarm, if zero, disables Tracking Alarm. If enabled, the TRACKING_ERROR bit in the System Status word will be set and the Flow LED will blink green at 1/8 second intervals if the flow varies from the Setpoint by the percent of full-scale flow specified by V17 for more than 2 seconds.

V24 PID Proportional (Read/Unlock Write)

The Valve-Control Proportional.

V25 PID Derivative (Read/Unlock Write)

The Valve-Control Derivative.

V26 PID Integral (Read/Unlock Write)

The Valve-Control Integral.

V27 Valve Drive (Read Only)

The current Valve Drive D/A value.

V28 Manual Valve Set (Read/Write)

The Valve Drive value used in V1=5, VARIABLE mode. Allows manual control of the Valve.

V29 Valve Cracking (Read/Unlock Write)

The Valve drive circuit's Control Bias (Cracking) value.

V30 Initial Setpoint (Read/Write)

When the device enters the OPERATE state, the MFC mode (V1) is set to AUTO and the valve control system will attempt to maintain the flow (or External Process Variable) at some setpoint. If digital flow commands are enabled, this item defines that setpoint; otherwise, the analog setpoint will be used.

If OPERATE mode is entered from the DEFAULT or ERROR mode, the valve position will be either OPEN or CLOSED according to the Default Valve Position specified in V2 bit 1. If V30 has not been changed, the default Initial setpoint will be 1000% if the Default Valve Position is OPEN and 0% if CLOSED

5.3. Alarm Limits

Gas instances/records keep upper and lower flow rate alarm limits. Limits are checked at 10 ms intervals against linearized, normalized and filtered flow measurements that have been converted to FS units. Alarms will be reported/cleared if the alarm condition is active/inactive for at least 2 seconds.

5.4. Flow and Flowing Time Integration

Values for integrated flow (total flow) and flowing hours are stored internally as the integral of %full-scale hours, accumulated every 10 seconds for the integrated flow (6 minutes for flowing hours) when flow rate is above 1% of present user full-scale.

Total flow is stored per gas instance. Values are reported based on the present flow rate units (e.g. if flow units are presently L/min, total flow will be reported/entered as nnn.nnn L). Since flow accumulation is kept in raw sensor units, it is not affected by changes to engineering unit type or range scaling.

Total flow is queried for gas instances using G31 or GI [d] 31 (for engineering units).

Flowing hours are maintained for the instrument (as opposed to per-gas-instance) and is queried using command S12.

Network commands to change the totals are unrestricted so users can change to other values. "Resetting" is done by changing to 0.0 (examples: GI 4 31=0.0 or S12=0.0).

Gas units, full-scale engineering units and full scale power difference values can be changed without destroying flow totalizer scaling. This is because flow totalizers are maintained in internal units of