

MICRO MOTION, INC.

HART® - Smart Communications Protocol

2000 SERIES ANALOG MVD TRANSMITTER-SPECIFIC COMMAND SPECIFICATION

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REFERENCED DOCUMENTS

HART® Physical Layer Specification - Revision 8.1	HCF_SPEC-54
HART® Data Link Layer Specification - Revision 7.1	HCF_SPEC-81
HART® Command Summary Information - Revision 7.1	HCF_SPEC-99
HART® Universal Command Specification - Revision 5.2	HCF_SPEC-127
HART® Common-Practice Command Specification - Revision 7.1	HCF_SPEC-151
HART® Common Tables - Revision 11.0	HCF_SPEC-183
Appendix 1 - HART® Command-Specific Response Code Definitions - Revision 4.1	HCF_SPEC-307

1. EXPANDED DEVICE TYPE CODE

Manufacturer Identification Code = 31 (decimal)
Manufacturer's Device Type Code = 42 (decimal)

The merger of these two 8-bit codes forms the 16-bit Expanded Device Type Code.

Expanded Device Type Code = 7978

2. PHYSICAL LAYER INFORMATION

Field Device Category = C
Capacitance Number (CN) = 2.6

3. 2000 CONFORMANCE AND COMMAND CLASS SUMMARY

The Model 2000 implements the following HART commands. Future revisions of this transmitter will behave as much like the present version as is possible. Enhancements will be handled by implementing additional commands. No Transmitter-Specific Commands will be deleted from this transmitter.

- UNIVERSAL

- 0 Read Unique Identifier
- 1 Read Primary Variable
- 2 Read P.V. Current and Percent of Range
- 3 Read Dynamic Variables and P.V. Current
- 6 Write Polling Address
- 11 Read Unique Identifier Associated with Tag
- 12 Read Message
- 13 Read Tag, Descriptor, Date
- 14 Read Primary Variable Sensor Information
- 15 Read Primary Variable Output Information
- 16 Read Final Assembly Number
- 17 Write Message
- 18 Write Tag, Descriptor, Date
- 19 Write Final Assembly Number

- COMMON-PRACTICE

- 33 Read Transmitter Variables
- 34 Write Primary Variable Damping Value
- 35 Write Primary Variable Range Values
- 38 Reset Configuration Changed Flag
- 39 EEPROM Control
- 40 Enter/Exit Fixed Primary Variable Current Mode
- 41 Perform Transmitter Self Test
- 43 Set Primary Variable Zero
- 44 Write Primary Variable Units
- 45 Trim Primary Variable Current DAC Zero
- 46 Trim Primary Variable Current DAC Gain
- 48 Read Additional Transmitter Status
- 49 Write Primary Variable Sensor Serial Number
- 50 Read Dynamic Variable Assignments
- 51 Write Dynamic Variable Assignments
- 52 Set Transmitter Variable Zero
- 53 Write Transmitter Variable Units
- 54 Read Transmitter Variable Information
- 55 Write Transmitter Variable Damping Value
- 59 Write Number of Response Preambles
- 60 Read Analog Output and Percent of Range
- 61 Read Dynamic Variables and P.V. Analog Output
- 62 Read Analog Outputs
- 63 Read Analog Output Information
- 64 Write Analog Output Additional Damping Value
- 65 Write Analog Output Range Values

66	Enter/Exit Fixed Analog Output Mode
67	Trim Analog Output Zero
68	Trim Analog Output Gain
70	Read Analog Output Endpoint Values
107	Write Burst Transmitter Variables
108	Write Burst Mode Command Number
109	Burst Mode Control
123	Write Private Label Distributor

- TRANSMITTER-SPECIFIC

See Table of Contents for list of transmitter specific commands.

- TRANSMITTER-SPECIFIC, NON-PUBLIC

241	Perform Meter Fingerprint Action
199	Reset Inventory
247	Perform Temperature Y-Intercept Calibration
248	Perform Temperature Slope Calibration

4. ADDITIONAL RESPONSE CODE INFORMATION

FIRST BYTE

4.1 BUSY

Bit #5

The Busy Response Code will be returned in all cases where the command being requested cannot be executed because it was received during the execution of a command that continued after the command response. The command that will respond with this indication is #43. Even during execution of these commands, Commands #0, #1, #2, #3, #44, #48, #131 and #132 will all be processed normally and will not return the Busy Response Code. All other commands will return the Busy Response Code.

SECOND BYTE

4.2 ANALOG OUTPUT SATURATED

Bit #2

This flag is set whenever the output current saturates below 3.8 milliamperes and above 20.5 milliamperes

4.3 NON-PRIMARY VARIABLE OUT OF LIMITS

Bit #1

This flag is set whenever a non-Primary Variable (i.e. Temperature, Density, etc.) exceeds its pre-defined sensor limits.

4.4 PRIMARY VARIABLE OUT OF LIMITS

Bit #0

This flag is set whenever the Primary Variable exceeds the Sensor Limits returned with Command #14, Read Primary Variable Sensor Information.

5. GENERAL TRANSMITTER INFORMATION

5.1 COMMAND RESPONSE TIME

The preambles of a response packet will be sent within 256 milliseconds at 1200 baud (and a minimum of 30 milliseconds at 38400 baud) following the receipt of a command. The STX of response packet will be sent within 100 milliseconds following the receipt of a command. Therefore, more than 5 preambles may be sent by the transmitter in response to a command.

5.2 DAMPING IMPLEMENTATION

The 2000 Series implements damping on both the digital Primary Variable and the Analog Output current. The digital Primary Variable is damped to the Upper and Lower Sensor Limits of the transmitter. The analog current is calculated from the digital Primary Variable and will remain saturated as long as the damped Primary Variable remains beyond the Upper or Lower Range Values.

The 2000 Series has a limited selection of damping values for process variables. They are as follows:

Flow and Density: 0, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 12.8, 25.6, 51.2 seconds

Temperature: 0, 0.6, 1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 76.8 seconds

If the passed parameter does not match one of these standard values, the transmitter will truncate the value received and respond with the response code Set to Nearest Possible Value, #8.

5.3 NON-VOLATILE MEMORY DATA STORAGE

The Flag Byte of Command #0, referenced in the Universal Command Specification document, will have Bit #1 set to 0, indicating that all data sent to the transmitter will be saved automatically in the nonvolatile memory upon validation after being received with a Write or Set Command. Command #39, EEPROM Control, has not been implemented.

5.4 MULTIDROP OPERATION

The 2000 Series supports full Multidrop capabilities with the RS485 or HART[®] Physical Layer interfaces. The physical maximum number of transmitters connected to a multidrop network will vary from implementation to implementation depending on Capacitance Numbers (CN) of the devices and their other electrical properties. Typical numbers vary from 2 -15 when identifying devices by their polling address (nickname) using command 0. It is possible to have an almost unlimited number of devices (the actual number exceeds 10 trillion), given favorable physical characteristics as discussed above, when devices are identified by Tag using command 11.

Please note that Micro Motion extends the formal specification of HART to include the RS485 physical layer. Not all other manufacturers support the RS485 extension, so physical layer incompatibilities may be introduced into a multidrop system if RS485 is selected.

5.5 BURST MODE

This revision of the 2000 Series does support Burst Mode. The valid commands that will be supported are 1, 2, 3 and 33. The default burst command after performing a master reset of the device is command 2.

5.6 UNIT CONVERSIONS

The following conversions are performed by the 2000 Series transmitter. The conversion factors are for general reference only and are subject to change without notice.

MASS FLOW RATE CONVERSIONS

All units are converted from/to grams/second.

New Units = Grams/Second / Conversion Factor

Conv Fact	New Units
1.000000	grams/second
0.01666667	grams/minute
0.0002777778	grams/hour
1000.000	kilograms/second
16.66667	kilograms/minute
0.2777778	kilograms/hour
0.01157407	kilograms/day
16666.67	metric tons/minute
277.7778	metric tons/hour
11.5740741	metric tons/day
453.5924	pounds/second
7.559873	pounds/minute
0.1259979	pounds/hour
0.005249912	pounds/day
15119.75	short tons/minute
251.9958	short tons/hour
10.49983	short tons/day

MASS CONVERSIONS

All units are converted from/to grams.

New Units = Grams / Conversion Factor

Conv Fact	New Units
1.000000	grams
1,000.000	kilograms
1,000,000.0	metric tons
453.5924	pounds
907,185.0	short tons

VOLUMETRIC FLOW RATE CONVERSIONS

All units are converted from/to cubic centimeters/second.

New Units = Cubic Centimeters/Second / Conversion Factor

Conv Fact	New Units
3785.4116702	gallons/second
63.0901691	gallons/minute
1.0515013	gallons/hour
0.043812554	gallons/day
1,000.0	liters/second
16.6666667	liters/minute
0.2777777	liters / hour
4546.0813500	imperial gallons / second
75.7680225	imperial gallons/minute
1.2628004	imperial gallons/hour
0.0526167	imperial gallons/day
1,000,000.0	cubic meters/second
16,666.6666667	cubic meters/minute
277.7777778	cubic meters/hour
11.5740741	cubic meters/day
28,320.1322086	cubic feet/second
472.0022035	cubic feet/minute
7.866703393	cubic feet/hour
0.3277793	cubic feet/day
158,982.84	barrels/second
2649.714	barrels/minute
44.1619	barrels/hour
1.840079	barrels/day
117347.7618	beer barrels/second
1955.795242	beer barrels/minute
32.5965403	beer barrels/hour
1.358189174	beer barrels/day
11574.04166	Millions of Liters/day
43812.554	Millions of USGal/day
1,000.0	normal liter/second
16.6666667	normal liter/minute
0.2777777	normal liter/ hour
0.011574074	normal liter/day
1,000.0	standard liter/second

16.6666667	standard liter/minute
0.2777777	standard liter/hour
0.011574074	standard liter/day
1,000,000.0	normal cubic meter/second
16,666.6666667	normal cubic meter/minute
277.7777778	normal cubic meter/hour
11.5740741	normal cubic meter/day
28,320.1322086	standard cubic feet/second
472.0022035	standard cubic feet minute
7.866703393	standard cubic feet/hour
0.3277793	standard cubic feet/day
1,000,000.0	standard cubic meter/second
16,666.6666667	standard cubic meter/minute
277.7777778	standard cubic meter/hour
11.5740741	standard cubic meter/day

VOLUME CONVERSIONS

All units are converted from/to cubic centimeters.

New Units = Cubic Centimeters / Conversion Factor

Conv Fact	New Units
3,785.4417993	gallons
1,000.0	liters
4,546.0869991	imperial gallons
1,000,000.0	cubic meters
158,987.3	barrels
117348.6958	beer barrels
1,000,000,000.0	Millions of Liters
3,785,441,799.3	Millions of US Gallons
1,000.0	normal liter
1,000.0	standard liter
1,000,000.0	normal cubic meter
1,000,000.0	standard cubic meter
28,320.1322086	standard cubic feet

DENSITY CONVERSIONS

All units are converted from/to grams/cubic centimeter.

New Units = (Grams/Cubic Centimeter) / Conversion Factor

Conv Fact	New Units
1.0	specific gravity units
1.0	grams/cubic centimeter
1,000.0	kilograms/cubic meter
8.3445401	pounds/gallon
62.4352000	pounds/cubic foot

TEMPERATURE CONVERSIONS

All units are converted from/to degrees Centigrade.

New Units = (°C) / Conversion Factor + offset

Conv Fact	New Units
1.0 (+ 0)	°C
1.8 (+ 32)	°F
1.8 (+ 491.67)	°R
1.0 (+ 273.15)	°K

PRESSURE CONVERSIONS

All units are converted from/to psi.

New Units = (psi) / Conversion Factor

Conv Fact	New Units
27.6807	inches water at 68F
2.03602	inches Hg at 0C
2.306725	feet water at 68F
703.089	mm water at 68F
51.7149	mm Hg at 0C
1.0	pounds/sq.inch
0.0689476	bars
68.9476	millibars
70.306958	grams/sqcm
0.070306958	kg/sqcm
6894.78	pascals
6.89478	kilopascals
51.7149	torr at 0C
0.0680460	atmospheres

5.7 SENSOR FLOW CALIBRATION FACTOR FORMAT

The Sensor Flow Calibration Factor will include the information required to calibrate the specific sensor installed. This number will be 10 characters long and will have the following format:

x.xxxx.yy

x = Gain Factor for Flow Rate in grams/second/microsecond. The decimal point can be anywhere in the number.

y = Temperature Coefficient for Flow Rate in Percent/100 degrees Celsius. The decimal point can be anywhere in the number.

5.8 SENSOR TEMPERATURE CALIBRATION FACTOR FORMAT

The 2000 Series will accept a 14-character temperature calibration factor in the following format:

a.aaaaab.bbbbb

a = Calculated slope for a two-point temperature calibration. The decimal point can be anywhere in the number.

b = Calculated offset for a two-point temperature calibration. The decimal point can be anywhere in the number.

5.9 COMMAND SECURITY

The 2000 Series supports a hardware security switch used for Custody Transfer Applications. Access to the transmitter memory by using any supported HART® command can be denied when this switch is set, thus enabling Command Security. Once secured, attempting to write data to the transmitter will result in response code 16, Access Restricted.

The transmitter supports a software switch that provides a write-protect function. Write protect can be enabled and disabled using command 194 – Perform Diagnostic Action. When write protect is enabled or turned on, “write” and “command” commands are disabled (this includes resetting the totals). “Read” commands are still operational. Once enabled, sending a “write” or “command” command will result in response code 7, in write-protect mode.

6. ADDITIONAL UNIVERSAL COMMAND SPECIFICATIONS

This section contains information pertaining to those commands that require clarification.

6.1 COMMAND #3 READ ALL DYNAMIC VARIABLES AND CURRENT

Read the Current and four predefined Dynamic Variables. The Digital Current always matches the Primary Variable Analog Output current of the device including alarm conditions and set values.

6.2 COMMAND #6 WRITE POLLING ADDRESS

This command writes the Polling Address to the field device. The address is used to control Analog Output 1 and provide a means of device identification in Multidrop installations.

With HART Rev 6, the state of Analog Output 1 is configurable when the polling address is not 0. With HART Rev 5, Analog Output 1 was not active when the polling address was not 0. This device is adopting the HART Rev 6 version of the command; therefore, the state of Analog Output 1 is configurable.

Any other analog outputs will remain Active regardless of the polling address of the device.

When communicating over the RS485 physical layer, all Analog Outputs are Active regardless of the polling address of the device.

6.3 COMMAND #14 READ PRIMARY VARIABLE SENSOR INFORMATION

When the Sensor Serial Number is not applicable to the device or Primary Variable, it will be set to "0". The other parameters will be set to 7F A0 00 00, Not-a-Number, or "250", Not Used, when they are not applicable.

7. ADDITIONAL COMMON-PRACTICE COMMAND SPECIFICATIONS

The 2000 Series implements a subset of the Common-Practice Commands specified in the Common-Practice Command Specification document. This section contains information pertaining to those commands that require clarification.

7.1 COMMAND #34 WRITE PRIMARY VARIABLE DAMPING VALUE

The 2000 Series has a limited selection of damping values: 0, 1, 2, 4, 8 and 16 seconds. If the passed parameter does not match one of these standard values, the transmitter will truncate the value received and respond with Set to Nearest Possible Value, #8.

7.2 COMMAND #43 SET PRIMARY VARIABLE ZERO

A Set Primary Variable Zero cannot be performed unless Mass Flow Rate Volume Flow Rate has been selected as the Primary Variable. Any attempt to do so will result in a Command-Specific Response Code #6, Transmitter-Specific Command Error.

A Set Primary Variable Zero command will initiate a mechanical sensor zero. A mechanical zero operation may take several minutes to complete. During this operation Command #48, Read Additional Transmitter Status, will return Response Code #8, Warning: Update In Progress. The Calibration (Zero) in Progress bit will also be set.

7.3 COMMAND #44 WRITE PRIMARY VARIABLE UNITS

The Primary Variable unit codes for this command are listed in the applicable Transmitter Variable unit codes tables.

7.4 COMMAND #48 READ ADDITIONAL TRANSMITTER STATUS

This command returns the results of the Transmitter Self Test Command, #41, as well as other transmitter status information.

Byte #0 - Transmitter Critical Alarms

Bit #0	A000: Undefined
Bit #1	A001: EEprom Checksum Error (Core Processor)
Bit #2	A002: RAM Test Error (Core Processor)
Bit #3	A003: Sensor Not Responding (No Tube Interrupt)
Bit #4	A004: Temperature Sensor Out-of-Range
Bit #5	A005: Input Over-Range
Bit #6	A006: Transmitter Not Characterized
Bit #7	A007: Real-Time Interrupt Failure

Byte #1 - Transmitter Critical Alarms

Bit #0	A008: Density Outside Limits
Bit #1	A009: Transmitter Initializing/Warming Up
Bit #2	A010: Calibration Failure
Bit #3	A011: Excess Calibration Correction, Zero too Low
Bit #4	A012: Excess Calibration Correction, Zero too High
Bit #5	A013: Process too Noisy to Perform Auto Zero
Bit #6	A014: Transmitter Failed
Bit #7	A015: MA Readback Error

Byte #2 - Transmitter Critical Alarms

Bit #0	A016: "Line RTD" Temperature Out-Of-Range
Bit #1	A017: "Meter RTD" Temperature Out-Of-Range
Bit #2	A018: (E)EPROM Checksum Error (Xmtr)
Bit #3	A019: RAM Test Error (Xmtr)
Bit #4	A020: Calibration Factors Unentered
Bit #5	A021: Unrecognized/Unentered Sensor Type
Bit #6	A022: (E)EPROM Config. DB Corrupt (Core Processor)
Bit #7	A023: (E)EPROM Totals Corrupt (Core Processor)

Byte #3 - Transmitter Critical Alarms

Bit #0	A024: (E)EPROM Program Corrupt (Core Processor)
Bit #1	A025: Protected Boot Sector Fault
Bit #2	A026: Sensor/Xmtr Communication Error
Bit #3	A027: Security Breach
Bit #4	A028: Sensor/Xmtr Communication Failure
Bit #5	A029: Internal Communication failure
Bit #6	A030: Hardware/software incompatible
Bit #7	A031: Undefined

Byte #4 - Transmitter Critical Alarms

Bit #0	A032: Meter Verification - Outputs Fixed
Bit #1	A033: Sensor OK/Tubes Stopped by Process
Bit #2	A034: Meter Verification Failed
Bit #3	A035: Meter Verification Aborted
Bit #4	A036: Undefined
Bit #5	A037: Undefined
Bit #6	A038: Undefined
Bit #7	A039: Undefined

Byte #5 – Transmitter Non-Critical Alarms

Bit #0	A100: Primary mA Output Saturated
Bit #1	A101: Primary mA Output Fixed
Bit #2	A102: Drive Overrange/Partially Full Tube
Bit #3	A103: Data Loss Possible
Bit #4	A104: Calibration-In-Progress
Bit #5	A105: Slug Flow
Bit #6	A106: Burst Mode Enabled
Bit #7	A107: Power Reset Occurred

Byte #6 thru Byte #13 – Reserved

Byte #14 – Transmitter Non-Critical Alarms

Bit #0	A108: Event #1 Triggered
Bit #1	A109: Event #2 Triggered
Bit #2	A110: Frequency Output Saturated
Bit #3	A111: Frequency Output Fixed

Bit #4	A112: Xmtr Software Upgrade Recommended
Bit #5	A113: Secondary mA Output Saturated
Bit #6	A114: Secondary mA Output Fixed
Bit #7	A115: External Input Error

Byte #15 – Transmitter Non-Critical Alarms

Bit #0	A116: API Temperature Out-of-Limits
Bit #1	A117: API Density Out-of-Limits
Bit #2	A118: Discrete Output 1 Fixed
Bit #3	A119: Discrete Output 2 Fixed
Bit #4	A120: ED: Unable to fit curve data
Bit #5	A121: ED: Extrapolation alarm
Bit #6	A122: Discrete Output 3 Fixed
Bit #7	A123: Discrete Output 4 Fixed

Byte #16 – Transmitter Non-Critical Alarms

Bit #0	A124: Frequency Input Saturated
Bit #1	A125: Batch: Timeout
Bit #2	A126: Batch: Overrun
Bit #3	A127: Batch: Start without reset
Bit #4	A128: Batch: Start not OK
Bit #5	A129: Undefined
Bit #6	A130: Printer: Paper Out
Bit #7	A131: Meter Verification in Progress

Byte #17– Transmitter Non-Critical Alarms

Bit #0	A132: Simulation Mode Active
Bit #1	A133: Local Display Firmware Checksum Error
Bit #2	A134: Undefined
Bit #3	A135: Undefined
Bit #4	A136: Undefined
Bit #5	A137: Undefined
Bit #6	A138: Undefined
Bit #7	A139: Undefined

Byte #18– Transmitter Status

Bit #0	D1 Calibration In Progress
Bit #1	D2 Calibration In Progress
Bit #2	D3 Calibration In Progress
Bit #3	D4 Calibration In Progress
Bit #4	FD Calibration In Progress
Bit #5	Zero Calibration In Progress
Bit #6	Temperature Slope Calibration In Progress
Bit #7	Temperature Offset Calibration In Progress

Byte #19– Transmitter Status

Bit #0	Process Comparator 1 Active
Bit #1	Process Comparator 2 Active
Bit #2	Process Comparator 3 Active
Bit #3	Process Comparator 4 Active
Bit #4	Process Comparator 5 Active
Bit #5	Discrete Output 1 Active

Bit #6	Discrete Output 2 Active
Bit #7	Discrete Output 3 Active

Byte #20– Transmitter Status

Bit #0	Discrete Input 1 Active
Bit #1	Discrete Input 2 Active
Bit #2	Flow Rate Switch Active
Bit #3	Undefined
Bit #4	Undefined
Bit #5	Undefined
Bit #6	Undefined
Bit #7	Undefined

Byte #21 through Byte #24 – Transmitter Specific - Undefined

7.5 COMMAND #51: WRITE DYNAMIC VARIABLE ASSIGNMENTS

Assigns Transmitter Variables to the Primary, Secondary, Tertiary, and 4th Variables.

The Primary Variable is associated with Primary Analog Output and can be assigned to one of the following.

0	Mass Flow Rate
1	Temperature
3	Density
5	Line (Gross) Volume Flow Rate
15	API: Temp Corrected Density
16	API: Temp Corrected (Standard) Volume Flow
19	API: Batch Weighted Average Corrected Density
20	API: Batch Weighted Average Temperature
21	Concentration Measurement: Density At Reference
22	Concentration Measurement: Density (Fixed SG Units)
23	Concentration Measurement: Standard Volume Flow Rate
26	Concentration Measurement: Net Mass Flow Rate
29	Concentration Measurement: Net Volume Flow Rate
32	Concentration Measurement: Concentration
47	Drive Gain
53	External Pressure
55	External Temperature
56	Concentration Measurement: Density (Fixed Baume Units)
62	Gas Standard Volume Flow

The Secondary Variable (SV) is not associated with any physical output since the 2000 Series does not have a Secondary Analog Output. It can be assigned to one of the transmitter variables listed above in the Primary Variable assignments.

The Tertiary Variable is associated with Frequency Output and can be assigned to one of the following.

0	Mass Flow Rate
5	Line (Gross) Volume Flow Rate
16	API: Temp Corrected (Standard) Volume Flow
23	Concentration Measurement: Standard Volume Flow Rate
26	Concentration Measurement: Net Mass Flow Rate
29	Concentration Measurement: Net Volume Flow Rate
62	Gas Standard Volume Flow

The 4th Variable is not associated with a physical output. It can be assigned to one of the following.

0	Mass Flow Rate
1	Temperature
2	Mass Totalizer
3	Density
4	Mass Inventory Totalizer
5	Line (Gross) Volume Flow Rate
6	Line (Gross) Volume Totalizer
7	Line (Gross) Volume Inventory Totalizer
15	API: Temp Corrected Density
16	API: Temp Corrected (Standard) Volume Flow
17	API: Temp Corrected (Standard) Volume Total
18	API: Temp Corrected (Standard) Volume Inventory
19	API: Batch Weighted Average Corrected Density
20	API: Batch Weighted Average Temperature
21	Concentration Measurement: Density At Reference
22	Concentration Measurement: Density (Fixed SG Units)
23	Concentration Measurement: Standard Volume Flow Rate
24	Concentration Measurement: Standard Volume Total
25	Concentration Measurement: Standard Volume Inventory
26	Concentration Measurement: Net Mass Flow Rate
27	Concentration Measurement: Net Mass Total
28	Concentration Measurement: Net Mass Inventory
29	Concentration Measurement: Net Volume Flow Rate
30	Concentration Measurement: Net Volume Total
31	Concentration Measurement: Net Volume Inventory
32	Concentration Measurement: Concentration
33	API: CTL
46	Tube Frequency
47	Drive Gain
48	Meter Temperature (T-Series)
49	LPO Amplitude
50	RPO Amplitude
51	Board Temperature
53	External Pressure
55	External Temperature
56	Concentration Measurement: Density (Fixed Baume Units)
62	Gas Standard Volume Flow
63	Gas Standard Volume Total
64	Gas Standard Volume Inventory
69	Live Zero

7.6 COMMAND #52: SET TRANSMITTER VARIABLE ZERO

The Set Transmitter Variable Zero can only be performed on the Mass Flow Rate, and Volume Flow Rate. An attempt to Set Zero on any other Transmitter Variable will result in Response Code #2, Invalid Selection.

7.7 COMMAND #53: WRITE TRANSMITTER VARIABLE UNITS

The Transmitter Variable units for this command are listed in the following unit codes tables:

- Mass Flow Rate Unit Codes
- Temperature Unit Codes
- Density Unit Codes
- Volume Flow Rate Unit Codes
- Pressure Unit Codes
- Concentration Unit Codes

The units for Totalizer and Inventory will always be chosen by the transmitter and will be derived from the units selected for Transmitter Mass Flow Rate Volume Flow Rate. The unit codes which can occur are listed in the Mass Totalizer and Volume Totalizer Unit Codes Tables. An attempt to write units for Totalizer or Inventory Transmitter Variables will result in an Invalid Transmitter Variable Code, Response Code #11.

7.8 COMMAND #55: WRITE TRANSMITTER VARIABLE DAMPING VALUE

Refer to section 5, Damping Implementation, for allowable damping values.

7.9 COMMAND #108: WRITE BURST MODE COMMAND NUMBER

In addition to commands 1, 2, & 3 as directed by the HART specification, this device accepts command 33 as a burst mode command. The four burst variables used in command 33 can be assigned to any one of the transmitter variables listed in the Transmitter Variable Codes Table.

8. TRANSMITTER-SPECIFIC COMMANDS

8.1 COMMAND #128: READ STATIC DATA - MATERIAL AND SENSOR

This command returns static data about the sensor's physical construction.

Note: This command is slightly different from the RFT9739.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Flange Type Code	8-bit unsigned integer	Refer to Flange Type Codes Table
1 - 3	Reserved, set to 250	8-bit unsigned integer	Each byte must be set to 250 "Not Used" or response code 6 will be returned.
4	Liner Material Code	8-bit unsigned integer	Refer to Common Tables document, Table IV, Material Codes
5 - 16	Sensor Model	Packed ASCII	MSB in byte #5
17	Sensor Material Code	8-bit unsigned integer	Refer to Common Tables document, Table IV, Material codes
18	Sensor Type Code	8-bit unsigned integer	Refer to Sensor Type Code table

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.2 COMMAND #129: WRITE STATIC DATA - MATERIAL AND SENSOR

This Allows the user to change information to the transmitter about sensor material and construction.

Note: This command is slightly different from the RFT9739.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Flange Type Code	8-bit unsigned integer	Refer to Flange Type Codes Table
1 - 3	Reserved, set to 250	8-bit unsigned integer	Each byte must be set to 250 "Not Used" or response code 6 will be returned.
4	Liner Material Code	8-bit unsigned integer	Refer to Liner Material Codes Table
5 – 16	Sensor Model	Packed ASCII	MSB in byte #5
17	Sensor Material Code	8-bit unsigned integer	Refer to Sensor Material Codes Table
18	Sensor Type Code	8-bit unsigned integer	Refer to Sensor Type Code table

Note: The Sensor Model & Sensor Type Code are not validated by the transmitter.

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Flange Type Code	8-bit unsigned integer	Refer to Flange Type Codes Table
1 - 3	Reserved, always 250	8-bit unsigned integer	
4	Liner Material Code	8-bit unsigned integer	Refer to Liner Material Codes Table
5 – 16	Sensor Model	Packed ASCII	MSB in byte #5
17	Sensor Material Code	8-bit unsigned integer	Refer to Sensor Material Codes Table
18	Sensor Type Code	8-bit unsigned integer	Refer to Sensor Type Code table

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Invalid Flange Type Code
10	Invalid Liner Material Code
11	Invalid Sensor Material Code
12	Invalid Sensor Type Code
13 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.3 COMMAND #130: READ STATIC DATA - SPECIAL MASS UNITS

This command returns information about the transmitter's special mass units option.

Note: This command is slightly different from the RFT9739.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Base Mass Flow Units Code	8-bit unsigned integer	Refer to Common Tables document Table II, Unit Codes
1	Base Mass Time Units Code	8-bit unsigned integer	Refer to Common Tables document Table II, Unit Codes
2 - 5	Special Mass Flow Units Conversion Number	IEEE 754	unitless, MSB in byte #2
6 - 13	Special Units Mass Flow String,	Standard ASCII	MSB in byte #6
14 - 21	Special Units Mass Total String,	Standard ASCII	MSB in byte #14

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.4 COMMAND #131: READ STATIC DATA - SETUP PARAMETERS

This command returns data about the transmitter's setup parameters. Flow direction is used to correct for meters installed incorrectly.

Note: This command is slightly different from the RFT9739.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Flow Direction Configuration Code	8-bit unsigned integer	Refer to Flow Direction Configuration Codes Table
1 – 4	Density High Limit	float, IEEE 754	Slug flow. Units of g/cc. MSB in byte #1
5 – 8	Density Low Limit	float, IEEE 754	Slug flow. Units of g/cc. MSB in byte #5
9	Output Option Board	8-bit unsigned integer	Refer to Output Option Board Codes Table
10 – 13	Slug Duration	Float, IEEE 754	MSB in byte #10
14-17	Density Cutoff	float, IEEE 754	MSB in byte #14
18	Density Cutoff Units	8-bit unsigned integer	Refer to Common Tables document, Table II, Unit Codes
19	Custody Transfer Totalizer reset option	8-bit unsigned integer	Refer to Custody Transfer Totalizer Reset Codes Table

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.5 COMMAND #132: READ SENSOR FLOW/CALIBRATION NUMBER

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 9	Sensor Flow Calibration Number	Standard ASCII	MSB in byte #0

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 127	Undefined

8.6 COMMAND #133: WRITE DATA - SPECIAL MASS UNITS

This Command allows the user to write special units to the transmitter's main memory.

Note: This command is slightly different from the RFT9739.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Base Mass Flow Units Code	8-bit unsigned integer	Refer to Base Mass Flow Unit Codes Table
1	Base Mass Time Units Code	8-bit unsigned integer	Refer to Base Mass Flow Unit Codes Table
2 - 5	Special Units mass Conversion Number	IEEE-754	unitless, MSB in byte #2
6 - 13	Special Units Mass Flow	Standard ASCII	MSB in byte #6
14 - 21	Special Units Mass Total String	Standard ASCII	MSB in byte #14

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8 - 10	Undefined
11	Special Units Mass Conversion Number Out of Range
12	Invalid Base Mass Time Units
13	Invalid Base Mass Flow Units
14 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.7 COMMAND #134: WRITE DIRECTION CONFIGURATION

This allows the user to program the flow direction of the Series 2000. Flow direction is used to correct for meters installed incorrectly.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Flow Direction Configuration	8-bit unsigned integer	Refer to Flow Direction Configuration Codes Table.
1	Custody Transfer Totalizer reset option	8-bit unsigned integer	Refer to Custody Transfer Totalizer Reset Codes Table

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Selection
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Invalid Custody Transfer Totalizer Option
9-- 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.8 COMMAND #135: WRITE FREQUENCY OUTPUT FACTORS

This allows the user to change the frequency output factors. That is, the user may define the flow rate factor and/or frequency.

Note: This command is slightly different from the RFT9739.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Frequency Scaling Method	8-bit unsigned integer	Refer to Freq. Output Scaling Method Table
1 – 4	Frequency Setpoint	float, IEEE 754	Units of hertz; MSB in byte #1; Ignored if Frequency Scaling Method not “Freq=Flow”
5	Flow Rate Factor Units	8-bit unsigned integer	Refer to Flow Rate Unit Codes Table or Volume Flow Rate Unit Codes Table
6 – 9	Flow Rate Factor	float, IEEE 754	MSB in byte #6; Ignored if Frequency Scaling Method not “Freq=Flow”
10 – 13	Pulses/Unit	Float, IEEE 754	MSB in byte #10; Ignored if Frequency Scaling Method not “Pulses/Unit”
14 – 17	Units/Pulse	Float, IEEE 754	MSB in byte #14; Ignored if Frequency Scaling Method not “Units/Pulse”
18	Polarity	8-bit unsigned integer	Refer to Polarity Codes Table

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Selection
3 - 4	Undefined
5	Too Few Data Bytes Received

6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Frequency Out of Range
10	Flow Rate Factor Out of Range
11	Pulses/Unit Out of Range
12	Units/Pulse Out of Range
13	Polarity Out of Range
14 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.9 COMMAND #136: READ FREQUENCY OUTPUT FACTORS

This allows the user to read the frequency output factors.

Note: This command is newly created from the RFT9739.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Frequency Scaling Method	8-bit unsigned integer	Refer to Freq. Output Scaling Method Table
1 – 4	Frequency Setpoint	float, IEEE 754	Units of hertz; MSB in byte #1; Ignored if Frequency Scaling Method not “Freq=Flow”
5	Flow Rate Factor Units	8-bit unsigned integer	Refer to Flow Rate Unit Codes Table or Volume Flow Rate Unit Codes Table
6 – 9	Flow Rate Factor	float, IEEE 754	MSB in byte #6; Ignored if Frequency Scaling Method not “Freq=Flow”
10 – 13	Pulses/Unit	Float, IEEE 754	MSB in byte #10; Ignored if Frequency Scaling Method not “Pulses/Unit”
14 – 17	Units/Pulse	Float, IEEE 754	MSB in byte #14; Ignored if Frequency Scaling Method not “Units/Pulse”
18	Polarity	8-bit unsigned integer	Refer to Polarity Codes Table

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.10 COMMAND #137: READ MISCELLANEOUS HART PARAMETERS

This allows the user to read miscellaneous HART parameters that were left out of the Universal and Common Practice commands.

Note: This command is newly created from the RFT9739.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	HART Polling Address	8-bit unsigned integer	Written in command 6
1	HART Number of Preambles	8-bit unsigned integer	Written in command 59
2	HART Burst Variable #1	8-bit unsigned integer	Written in command 107
3	HART Burst Variable #2	8-bit unsigned integer	Written in command 107
4	HART Burst Variable #3	8-bit unsigned integer	Written in command 107
5	HART Burst Variable #4	8-bit unsigned integer	Written in command 107
6	HART Burst Command	8-bit unsigned integer	Written in command 108
7	Loop Current Mode	8-bit unsigned integer	Written in command 6

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.11 COMMAND #138: READ FLOW SWITCH SETPOINT

This allows the user to read the flow switch setpoint. This can be tied to a discrete output to indicate when mass flow rate reaches this setpoint. There is a hysteresis for this parameter where the event setpoint does not offer this.

Note: This command is newly created from the RFT9739.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 – 3	Flow Switch Setpoint	float, IEEE 754	Units of flow; MSB in byte #0
4	Flow Switch Units	8-bit unsigned integer	Refer to Flow Rate Unit Codes Table or Volume Flow Rate Unit Codes Table
5	Flow Switch Variable Assignment	8-bit unsigned integer	Refer to Tertiary Variable Assignment table in Command 51
6-9	Flow Switch Hysteresis	Float, IEEE 754	.1% - 10% Flow Switch Hysteresis; MSB in byte #6

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.12 COMMAND #139: WRITE FLOW SWITCH SETPOINT

This allows the user to change the flow switch setpoint. This can be tied to a discrete output to indicate when mass flow rate reaches this setpoint. There is a hysteresis for this parameter where the event setpoint does not offer this.

Note: This command newly created from the RFT9739.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Flow Switch Setpoint	float, IEEE 754	Units of flow; MSB in byte #0
4	Flow Switch Units	8-bit unsigned integer	Refer to Flow Rate Unit Codes Table or Volume Flow Rate Unit Codes Table
5	Flow Switch Variable Assignment	8-bit unsigned integer	Refer to Tertiary Variable Assignment table in Command 51
6 - 9	Flow Switch Hysteresis	Float, IEEE 754	.1% - 10% Flow Switch Hysteresis; MSB in byte #6

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Selection
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Flow Switch Out-of-Range
10	Invalid Flow Switch Variable Assignment
11 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.13 COMMAND #140: READ STATIC DATA - SPECIAL VOLUME UNITS

This command returns information about the transmitter's special units option.

Note: This command is slightly different from the RFT9739.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Base Volume Flow Units Code	8-bit unsigned integer	Refer to Common Tables document, Table II, Unit Codes
1	Base Volume Time Units Code	8-bit unsigned integer	Refer to Common Tables document, Table II, Unit Codes
2 - 5	Special Units Conversion Number	float, IEEE 754	unitless, MSB in byte #2
6 - 13	Special Units Vol. Flow String	Standard ASCII	MSB in byte #6
14 - 21	Special Units Vol. Total String	Standard ASCII	MSB in byte #14

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.14 COMMAND #141: WRITE STATIC DATA - SPECIAL VOLUME UNITS

This command allows the user to write special units information to transmitter's main memory.

Note: This command is slightly different from the RFT9739.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Base Volume Flow Units Code	8-bit unsigned integer	Refer to Common Tables document, Table II, Unit Codes
1	Base Volume Time Units Code	8-bit unsigned integer	Refer to Common Tables document, Table II, Unit Codes
2 - 5	Special Units Conversion Number	IEEE 754	unitless, MSB in byte #2
6 - 13	Special Units Vol. Flow String	Standard ASCII	MSB in byte #6
14 - 21	Special Units Vol. Total String	Standard ASCII	MSB in byte #14

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8 - 10	Undefined
11	Special Units Volume Conversion Number Out of Range
12	Invalid Base Volume Time Units
13	Invalid Base Volume Flow Units
14 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.15 COMMAND #142: READ DISPLAY PRECISION

This command returns the displayed precision of the requested process variable.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Process Variable Code	8-bit unsigned integer	Refer to Transmitter Variable Codes Table

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Process Variable Code	8-bit unsigned integer	Refer to Transmitter Variable Codes Table
1	Precision	8-bit unsigned integer	number of digits displayed to right of decimal point (0 to 5)

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error (Invalid Transmitter Variable Code)
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.16 COMMAND #143: WRITE DISPLAY PRECISION

This command allows the user to change the displayed precision of the requested process variable.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Process Variable Code	8-bit unsigned integer	Refer to Transmitter Variable Codes Table
1	Precision	8-bit unsigned integer	number of digits displayed to right of decimal point (0 to 5)

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error (Invalid Transmitter Variable Code)
7	In Write Protect Mode
8 - 10	Undefined
11	Invalid Precision
12 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.17 COMMAND #144: READ CONCENTRATION MEASUREMENT CURVE CONFIG

Read the configuration of the specified Concentration Measurement curve.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Curve Index	8-bit unsigned integer	Index of CM Curve to configure Refer to Concentration Measurement Curve Number Codes Table

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Curve Index	8-bit unsigned integer	Index of CM Curve to configure Refer to Concentration Measurement Curve Number Codes Table
1 - 4	Reference Temperature	float, IEEE 754	MSB in byte #1
5 - 8	Water Reference Temperature	float, IEEE 754	MSB in byte #5
9	CM Reference Temperature Units	8-bit unsigned integer	Ref. Temp. and Water Ref. Temp. Units - Refer to Temperature Unit Codes Table
10 - 13	Water Reference Density	float, IEEE 754	MSB in byte #10
14	CM Water Reference Density Units	8-bit unsigned integer	Refer to Density Unit Codes Table
15 - 18	Slope Trim	float, IEEE 754	MSB in byte #15
19 - 22	Slope Offset	float, IEEE 754	MSB in byte #19
23 - 26	Extrapolation Alarm Limit	float, IEEE 754	MSB in byte #23
27	Max Fit Order	8-bit unsigned integer	Between 2 - 5
28	Concentration Units Code	8-bit unsigned integer	Refer To Concentration Unit Codes table
29 - 36	Concentration Units String	Standard ASCII	8-Character Special Unit String, MSB in byte #29
37 - 48	Curve Name	Standard ASCII	12-Character Curve Name, MSB in byte #37
49	Curve Fit Results	8-bit unsigned integer	Refer to CM Curve Fit Results

50 – 53	Expected Accuracy	float, IEEE 754	Codes table Expected accuracy
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COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error (Invalid CM Curve Index)
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.18 COMMAND #144: READ CONCENTRATION MEASUREMENT CURVE CONFIG

Read the configuration of the specified Concentration Measurement curve.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Curve Index	8-bit unsigned integer	Index of CM Curve to configure Refer to Concentration Measurement Curve Number Codes Table

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Curve Index	8-bit unsigned integer	Index of CM Curve to configure Refer to Concentration Measurement Curve Number Codes Table
1 - 4	Reference Temperature	float, IEEE 754	MSB in byte #1
5 - 8	Water Reference Temperature	float, IEEE 754	MSB in byte #5
9	CM Reference Temperature Units	8-bit unsigned integer	Ref. Temp. and Water Ref. Temp. Units - Refer to Temperature Unit Codes Table
10 - 13	Water Reference Density	float, IEEE 754	MSB in byte #10
14	CM Water Reference Density Units	8-bit unsigned integer	Refer to Density Unit Codes Table
15 - 18	Slope Trim	float, IEEE 754	MSB in byte #15
19 - 22	Slope Offset	float, IEEE 754	MSB in byte #19
23 - 26	Extrapolation Alarm Limit	float, IEEE 754	MSB in byte #23
27	Max Fit Order	8-bit unsigned integer	Between 2 - 5
28	Concentration Units Code	8-bit unsigned integer	Refer To Concentration Unit Codes table
29 - 36	Concentration Units String	Standard ASCII	8-Character Special Unit String, MSB in byte #29
37 - 48	Curve Name	Standard ASCII	12-Character Curve Name, MSB in byte #37
49	Curve Fit Results	8-bit unsigned integer	Refer to CM Curve Fit Results

50 – 53	Expected Accuracy	float, IEEE 754	Codes table Expected accuracy
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COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error (Invalid CM Curve Index)
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.19 COMMAND #145: ENTER/EXIT FIXED FREQUENCY MODE

Place frequency at stated level. Level of "0" exits Fixed Frequency Mode.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Frequency Output	IEEE-754	Units of hertz, MSB in byte #0

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 2	Undefined
3	Passed Parameter too Large
4	Passed Parameter too Small
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Frequency Output Disabled
9 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.20 COMMAND #146: TOTALIZER CONTROL

The command allows the user to issue commands that will control the totalizer.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Totalizer Control Code	8-bit unsigned integer	Refer to Totalizer Control Codes Table

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Selection
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.21 COMMAND #150: READ DISCRETE INPUT ACTION ASSIGNMENT

This command allows the user to determine how the discrete inputs are configured. In this case, the term discrete inputs does not refer to the traditional hardware discrete inputs but the software discrete inputs such as process comparators. With this command, the user selects an action and the discrete input that is associated with that action is returned.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Discrete Input Action Code	8-bit unsigned integer	Refer to Discrete Input Action Codes

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Discrete Input Action Code	8-bit unsigned integer	Refer to Discrete Input Action Codes
1	Discrete Input Assignment	8-bit unsigned integer	Refer to Discrete Input Assignment Codes

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7	Undefined
8	Invalid Discrete Input Action Code
9 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.22 COMMAND #151: WRITE DISCRETE INPUT ACTION ASSIGNMENT

This command allows the user to specify how the discrete inputs will be configured. In this case, the term discrete inputs does not refer to the traditional hardware discrete inputs but the software discrete inputs such as process comparators. With this command, the user selects an action and associates a discrete input with that action. This structure allows a user to assign multiple actions to a single discrete input.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Discrete Input Action Code	8-bit unsigned integer	Refer to Discrete Input Action Codes
1	Discrete Input Assignment	8-bit unsigned integer	Refer to Discrete Input Assignment Codes

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Selection
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Invalid Discrete Input Action Code
9	Invalid Discrete Input Assignment Code
12 - 15	Undefined
16	Access Restricted
17-127	Undefined

8.23 COMMAND #155: WRITE SENSOR FLOW CALIBRATION NUMBER

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 9	Sensor Flow Calibration Number	Standard ASCII	MSB in byte #0

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8 - 11	Undefined
12	Incorrect Format
13 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.24 COMMAND #156: WRITE CONCENTRATION MEASUREMENT CURVE CONFIG

Write a new configuration to the specified Concentration Measurement curve.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Curve Index	8-bit unsigned integer	Index of CM Curve to configure Refer to Concentration Measurement Curve Number Codes Table
1 - 4	Reference Temperature	float, IEEE 754	MSB in byte #1
5 - 8	Water Reference Temperature	float, IEEE 754	MSB in byte #5
9	CM Reference Temperature Units	8-bit unsigned integer	Ref .Temp. and Water Ref. Temp. Units - Refer to Temperature Unit Codes Table. Must be equal to device unit code.
10 - 13	Water Reference Density	float, IEEE 754	MSB in byte #10
14	CM Water Reference Density Units	8-bit unsigned integer	Refer to Density Unit Codes Table. Must be equal to device unit code.
15 - 18	Slope Trim	float, IEEE 754	MSB in byte #15
19 - 22	Slope Offset	float, IEEE 754	MSB in byte #19
23 - 26	Extrapolation Alarm Limit	float, IEEE 754	MSB in byte #23
27	Max Fit Order	8-bit unsigned integer	Between 2 - 5
28	Concentration Units Code	8-bit unsigned integer	Refer To Concentration Unit Codes table. This unit code is configurable.
29 - 36	Concentration Units String	Standard ASCII	8-Character Special Unit String, MSB in byte #29
37 - 48	Curve Name	Standard ASCII	12-Character Curve Name, MSB in byte #37

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Concentration Units Code
3	Invalid Temperature Units Code
4	Invalid Density Units Code
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error (Invalid CM curve)
7	In Write Protect Mode
8	Undefined
9	Reference Temperature Out of Range
10	Water Reference Temperature Out of Range
11	Water Reference Density Out of Range
12	Slope Trim Out of Range
13	Slope Offset Out of Range
14	Extrapolation Alarm Limit Out of Range
15	Max Fit Order Out of Range
16	Access Restricted
17 – 127	Undefined

8.25 COMMAND #157: WRITE DENSITY LIMITS

This command writes the limits for the Slug Density.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Density High Limit	IEEE 754	Units in grams/cubic centimeter, MSB in byte #0
4 - 7	Density Low Limit	IEEE 754	Units in grams/cubic centimeter, MSB in byte #4
8 - 11	Slug Duration	Float, IEEE 754	MSB in byte #8
12-15	Density Cutoff	Float, IEEE 754	MSB in byte #12
16	Density Cutoff Units Code	8-bit unsigned integer	Refer to Common Tables document, Table II, Unit Codes

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Density High Limit Out of Range
10	Density Low Limit Out of Range
11	Slug Duration out of Range
12	Density Cutoff Out of Range
13	Invalid Units Code
14 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.26 COMMAND #162: READ MODBUS DATA VALUE

This command allows the user to read data from a MODBUS coil or a MODBUS register. The following MODBUS registers are supported: unsigned 16, unsigned 32 and floating point.

HART and MODBUS both use IEEE-754 floating point representations, but the order in which the bytes are transported is configurable for MODBUS. For this command, the order of the floating point bytes is the HART format (43_21).

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	MODBUS Data Type Code	8-bit unsigned integer	Refer to MODBUS Data Type Code Table (e.g., Coil, U16, U32, F32)
1 - 2	Coil Number or Starting Register Address	16-bit unsigned integer	The address is 1-based and corresponds to the addresses documented in the Micro Motion MODBUS document.

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	MODBUS Data Type Code	8-bit unsigned integer	Refer to MODBUS Data Type Code Table (e.g., Coil, U16, U32, F32)
1 - 2	Coil Number or Starting Register Address	16-bit unsigned integer	The address is 1-based and corresponds to the addresses documented in the Micro Motion MODBUS document.
3	Coil Value	8-bit unsigned integer	Value for coil data 0x00 = off 0x01 = on 0 if Data Type Code is not Coil.
4 - 5	U16 Value	16-bit unsigned integer	Value for Unsigned 16 data. 0 if Data Type Code is not Unsigned 16.
6 - 9	U32 Value	32-bit unsigned integer	Value for Unsigned 32 data. 0 if Data Type Code is not Unsigned 32.
10 - 13	Float Value	IEEE 754	Value for floating point data.

			0 if Data Type Code is not floating point.
14	Exception Code	8-bit unsigned integer	Refer to MODBUS Exception Codes table. 0 if no exception occurred.

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid selection (MODBUS Data Type Code)
3 - 5	Undefined
6	Transmitter-Specific Command Error
7	Undefined
8	Coil or Starting Register Out of Range
9	Undefined
10 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.27 COMMAND #163: WRITE MODBUS DATA VALUE

This command allows the user to write data to a MODBUS coil or a MODBUS register. Registers and Coils that can only be written from the Service Port will not be allowed to be written with this command. The following MODBUS registers are supported: unsigned 16, unsigned 32 and floating point.

HART and MODBUS both use IEEE-754 floating point representations, but the order in which the bytes are transported is configurable for MODBUS. For this command, the order of the floating point bytes is the HART format (43_21).

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	MODBUS Data Type Code	8-bit unsigned integer	Refer to MODBUS Data Types Table (e.g., Coil, U16, U32, F32)
1 - 2	Starting Coil Number or Register Address	16-bit unsigned integer	The address should be 1-based to match our documentation and make use easier.
3	Coil Value	8-bit unsigned integer	Value for coil data, 0 = off or 1 = on. Ignored if Data Type Code is not Coil.
4 - 5	U16 Value	16-bit unsigned integer	Value for Unsigned 16 data. Ignored if Data Type Code is not Unsigned 16.
6 - 9	U32 Value	32-bit unsigned integer	Value for Unsigned 32 data. Ignored if Data Type Code is not Unsigned 32.
10 - 13	Float Value	IEEE 754	Value for floating point data. Ignored if Data Type Code is not floating point.

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	MODBUS Data Type Code	8-bit unsigned integer	Refer to MODBUS Data Type Code Table (e.g., Coil, U16, U32, F32)
1 - 2	Coil Number or Starting Register Address	16-bit unsigned integer	The address is 1-based and corresponds to the addresses documented in the Micro Motion MODBUS document.

3	Coil Value	8-bit unsigned integer	Value for coil data, 0 = off or 1 = on. Ignored if Data Type Code is not Coil.
4 - 5	U16 Value	16-bit unsigned integer	Value for Unsigned 16 data. 0 if Data Type Code is not Unsigned 16.
6 - 9	U32 Value	32-bit unsigned integer	Value for Unsigned 32 data. 0 if Data Type Code is not Unsigned 32.
10 - 13	Float Value	IEEE 754	Value for floating point data. 0 if Data Type Code is not floating point.
14	Exception Code	8-bit unsigned integer	Refer to MODBUS Exception Codes table. 0 if no exception occurred.

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid selection (MODBUS Data Type Code)
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Coil or Starting Register Out of Range
9	Illegal Coil Value
10 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.28 COMMAND #164: READ T-SERIES PARAMETERS

This command allows the user to read the calibration parameters for the T-Series sensor

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Density Temperature Gradient Coefficient	IEEE 754	Unitless, MSB in byte #0
4 - 7	Density Frequency Coefficient #1	IEEE 754	Unitless, MSB in byte #4
8 - 11	Density Frequency Coefficient #2	IEEE 754	Unitless, MSB in byte #8
12 - 15	Flow Temperature Gradient Coefficient	IEEE 754	Unitless, MSB in byte #12
16 - 19	Flow Frequency Coefficient	IEEE 754	Unitless, MSB in byte #16

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.29 COMMAND #165: WRITE T-SERIES PARAMETERS

This command allows the user to read the calibration parameters for the T-Series sensor.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Density Temperature Gradient Coefficient	IEEE 754	Unitless, MSB in byte #0
4 - 7	Density Frequency Coefficient #1	IEEE 754	Unitless, MSB in byte #4
8 - 11	Density Frequency Coefficient #2	IEEE 754	Unitless, MSB in byte #8
12 - 15	Flow Temperature Gradient Coefficient	IEEE 754	Unitless, MSB in byte #12
16 - 19	Flow Frequency Coefficient	IEEE 754	Unitless, MSB in byte #16

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Density Temperature Gradient Constant Out of Range
10	Density Frequency Constant #1 Out of Range
11	Density Frequency Constant #2 Out of Range
12	Flow Temperature Constant Out of Range
13	Flow Frequency Constant Out of Range
14 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.30 COMMAND #166: READ METER VERIFICATION INDEXED DATA

This command allows the user to read the data associated with meter verification. This command returns the same data as command 246 but the floating point datasets are accessed using an index. This command reduces the number of response data bytes from 94 bytes to 35 bytes.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Dataset	8-bit unsigned integer	0 = Mean 1 = Standard Deviation 2 = Factory Cal of Air Means 3 =- Factory Cal of Water Means 4 = Running average data 5 = Std Error of the estimate

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Dataset	8-bit unsigned integer	0 = Mean 1 = Standard Deviation 2 = Factory Cal of Air Means 3 =- Factory Cal of Water Means 4 = Running average data 5 = Std Error of the estimate
1	Enable Meter Verification	8-bit unsigned integer	0=Disabled 1=Full Meter Verification (including current calibrations) 2=Factory Verification of Air 3=Factory Verification of Water 4=Special Debug Mode 5=Abort 6=Background Meter Verification (no current calibrations)
2	Output State during Meter Verification	8-bit unsigned integer	0=Last Value 1=Fault
3-6	Stiffness Limit Set Point	Float, IEEE 754	MSB in byte #2
7	Algorithm Progress	8-bit unsigned integer	Use command 252-8 to read algorithm progress.
8	Current Algorithm State	8-bit unsigned integer	1 through 18
9	Abort Code	8-bit unsigned integer	0=No error 1=Manual Abort 2=Watchdog Timeout 3=Frequency Drift 4=High Peak Drive Voltage

			5=High Drive Current Std Dev 6=High Drive Current Mean Value 7=Drive loop reported error 8=High Delta T Std Dev 9=High Delta T Value 10=State Running 11=Verification Complete 12=Wrong Verification Enable 13=No Factory Air Verification 14=No Factory Water Verification 15=Parameter Registers not Set
10	Algorithm State at Abort	8-bit unsigned integer	1 through 18
11-12	Meter Verification Validation Counter	16-bit unsigned integer	Indicates the number of times the Meter Verification routine has successfully completed
13	Is LPO Stiffness Out of Limits?	8-bit unsigned integer	0=No 1=Yes
14	Is RPO Stiffness Out of Limits?	8-bit unsigned integer	0=No 1=Yes
15-18	Dataset LPO Stiffness	Float, IEEE 754	MSB in byte #15
19-22	Dataset RPO Stiffness	Float, IEEE 754	MSB in byte #19
23-26	Dataset Damping	Float, IEEE 754	MSB in byte #23
27-30	Dataset LPO Mass	Float, IEEE 754	MSB in byte #27
31-34	Dataset RPO Mass	Float, IEEE 754	MSB in byte #31
35-38	Drive Current	Float, IEEE 754	
39-42	Delta T	Float, IEEE 754	
43-46	Temperature	Float, IEEE 754	
47-50	Density	Float, IEEE 754	
51-54	Drive Frequency	Float, IEEE 754	
55-58	LPO Filter	Float, IEEE 754	
59-62	RPO Filter	Float, IEEE 754	

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 – 5	Undefined
6	Dataset Out of Range
7 – 15	Undefined
16	Access Restricted
17 – 127	Undefined

8.31 COMMAND #167: READ ZEROING TIME

This command allows the user to read the zeroing time for the transmitter.

This is used to support low-noise environments where the necessary zeroing time can be much smaller than the Maximum Zero Value.

Note: This command is slightly different from the RFT9739.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 1	Maximum Zeroing Time	16-bit Unsigned Integer	Units of seconds, MSB in byte #0

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.32 COMMAND #168: WRITE ZEROING TIME

This is used to support low-noise environments where the necessary zeroing time can be much smaller than the Maximum Zero Value.

Note: This command is slightly different from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 1	Maximum Zeroing Time	16-bit Unsigned Integer	Units of seconds, MSB in byte #0

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Maximum Zeroing Time Out of Range
10 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.33 COMMAND #169: WRITE MAXIMUM PULSE WIDTH

This command allows the user to define a maximum frequency pulse width for the transmitter.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Maximum Pulse Width	IEEE 754	Units of seconds, MSB in byte #0

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Maximum Pulse Width Out of Range
10 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.34 COMMAND #170: READ MAXIMUM PULSE WIDTH

This command allows the user to read the maximum frequency pulse width for the transmitter.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Maximum Pulse Width	IEEE 754	Units of seconds, MSB in byte #0

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.35 COMMAND #171: READ DISCRETE OUTPUT STATE

This command allows the user to read the state of the discrete output.

Note: This command is newly created from the RFT9739.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Discrete Output Index	8-bit unsigned integer	Refer to Discrete Output Index Table

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Discrete Output Index	8-bit unsigned integer	Refer to Discrete Output Index Table
1	Discrete State	8-bit unsigned integer	0 = Off 1 = On

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 – 5	Undefined
6	Transmitter-Specific Command Error
7 – 8	Undefined
9	Discrete Output Index Out-of-Range
10	Discrete Output Disabled
11 – 15	Undefined
16	Access Restricted
17 – 127	Undefined

8.36 COMMAND #172: WRITE DISCRETE OUTPUT ASSIGNMENT

This command allows the user to specify how the discrete output will be configured.

Note: This command is newly created from the RFT9739.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Discrete Output Index	8-bit unsigned integer	Refer to Discrete Output Index Table
1	Discrete Output Function	8-bit unsigned integer	Refer to Discrete Output Function Table
2	Polarity	8-bit unsigned integer	Refer to Polarity Codes Table
3	Fault Indication	8-bit unsigned integer	Refer to Discrete Output Fault Codes Table

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Selection
3 - 5	Undefined
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	DO Index Out-of-Range
10	Polarity Invalid
11	Fault Indication Invalid
12 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.37 COMMAND #173: READ DISCRETE OUTPUT ASSIGNMENT

This command allows the user to determine how the discrete output is configured.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Discrete Output Index	8-bit unsigned integer	Refer to Discrete Output Index Table

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Discrete Output Index	8-bit unsigned integer	Refer to Discrete Output Index Table
1	Discrete Output Function	8-bit unsigned integer	Refer to Discrete Output Function Table
2	Polarity	8-bit unsigned integer	Refer to Polarity Codes Table
3	Fault Indication	8-bit unsigned integer	Refer to Discrete Output Fault Codes Table

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 8	Undefined
9	DO Index Out-of-Range
10 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.38 COMMAND #174: ENTER/EXIT FIXED DISCRETE OUTPUT MODE

Place discrete output at requested state. State of “255” exits Fixed Discrete Output Mode.

Note: This command is newly created from the RFT9739.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Discrete Output Index	8-bit unsigned integer	Refer to Discrete Output Index Table
1	Discrete State	8-bit unsigned integer	Refer to Discrete State Table

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 8	Undefined
9	Discrete Output Index Out-of-Range
10	Discrete Output State Out-of-Range
11	Discrete Output Disabled
12 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.39 COMMAND #175: READ SENSOR TEMPERATURE CALIBRATION FACTOR

This command allows the user to read the sensor temperature calibration factor.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 13	Sensor Temperature Calibration Number	Standard ASCII	MSB in byte #0

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.40 COMMAND #176: WRITE SENSOR TEMPERATURE CALIBRATION FACTOR

This command allows the user to write the sensor temperature calibration factor.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 13	Sensor Temperature Calibration Number	Standard ASCII	MSB in byte #0

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8 - 11	Undefined
12	Incorrect Format
13 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.41 COMMAND #177: ACKNOWLEDGE ALARM

This command allows the user to acknowledge the selected alarm.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Alarm Number	8-bit unsigned integer	Number of Alarm such as 26 for A26. See Alarm Codes Table for explanation of alarm numbers.

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Invalid Alarm Number
9 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.42 COMMAND #178: WRITE CURRENT ZEROING INFORMATION

This command allows the user to write the mechanical zeroing information.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Zero Offset Units Code	8-bit unsigned integer	Reserved, always 250
1 - 4	Zero Offset	IEEE 754	Units of microseconds, MSB in byte #5

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.43 COMMAND #179: READ CURRENT ZEROING INFORMATION

This command allows the user to read zeroing information. Zeroing information includes the standard deviation and the zero offset from the most recent successful or the present zeroing operation.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Standard Deviation	IEEE 754	Units of microseconds, MSB in byte #0
4	Zero Offset Units Code	8-bit unsigned integer	Reserved, always 250
5 - 8	Zero Offset	IEEE 754	Units of microseconds, MSB in byte #5
9 - 12	Factory Zero Offset	IEEE 754	Units of microseconds, MSB in byte #9

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.44 COMMAND #180: WRITE FAULT OUTPUT PARAMETERS

This command identifies the fault settings for each of the outputs. Each output (mA and Frequency) may be configured for different fault settings.

The Analog Fault Level may be used to set the mA output to the upscale or downscale milliamp setting for a fault condition. If the output type is frequency and the fault setting is upscale, the fault level may also be configured.

If the Output Type code is digital communications, the fault selection is only applicable for the Modbus protocol on the RS485 physical layer and not HART.

The Last measured Value Fault Timeout will have a default of 0 seconds. Setting this value to anything other than 0 will result in the output holding it's last measured value for that defined number of seconds. After the timeout period expires, the output will proceed to the configured fault level (i.e. upscale, downscale, etc.).

Note: This command is totally different from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Output Type	8-bit unsigned integer	Refer to Output Type Codes Table
1	Fault Selection	8-bit unsigned integer	Refer to Output Fault Codes Table
2 - 5	Analog Fault Level	IEEE 754	Tables 10.19 & 10.30 MA or Hz, MSB in byte #2, NaN if digital communications
6	Last Measured Value Fault Timeout	8-bit unsigned integer	Units of seconds (0 to 60)

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid selection
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode

8	Undefined
9	Analog Fault Level Out of Range
10	Fault Timeout Out of Range
11 - 14	Undefined
15	Invalid Output Code
16	Access Restricted
17 - 127	Undefined

8.45 COMMAND #181: READ FAULT OUTPUT PARAMETERS

This command reads what the state of the transmitter outputs will be in the event of an error condition that could invalidate the measurement. Each output (mA and Frequency) may be configured for different fault settings.

If the Output Type code is digital communications, the fault selection is only applicable for the Modbus protocol on the RS485 physical layer and not HART.

The Last measured Value Fault Timeout will have a default of 0 seconds. Setting this value to anything other than 0 will result in the output holding it's last measured value for that defined number of seconds. After the timeout period expires, the output will proceed to the configured fault level (i.e. upscale, downscale, etc.).

Note: This command is totally different from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Output Type	8-bit unsigned integer	Refer to Output Type Codes Table

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Output Type	8-bit unsigned integer	Refer to Output Type Codes Table
1	Fault Selection	8-bit unsigned integer	Refer to Output Fault Codes Table
2 - 5	Analog Fault Level	IEEE 754	Tables 10.19 & 10.30 MA or Hz, MSB in byte #2, NaN if digital communications
6	Last Measured Value Fault Timeout	8-bit unsigned integer	Units of seconds (0 to 60)

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.46 COMMAND #182: WRITE ALARM SEVERITY

This command allows the user to write the alarm severity information.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Alarm Number	8-bit unsigned integer	Number of Alarm such as 26 for A26. See Alarm Codes Table for explanation of alarm numbers.
1	Alarm Severity	8-bit unsigned integer	Refer to Alarm Severity Codes Table

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Invalid Alarm Number
9	Invalid Alarm Severity Code
10 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.47 COMMAND #183: READ ALARM INFORMATION

This command allows the user to read information about the selected alarm.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Alarm Number	8-bit unsigned integer	Number of Alarm such as 26 for A26. See Alarm Codes Table for explanation of alarm numbers.

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Alarm Number	8-bit unsigned integer	Number of Alarm such as 26 for A26. See Alarm Codes Table for explanation of alarm numbers.
1	Alarm Severity	8-bit unsigned integer	Refer to Alarm Severity Codes Table
2	Alarm Status	8-bit unsigned integer	bit #0 = active (0=no, 1=yes) bit #1 = unacknowledged (0=no, 1=yes)
3	Count	8-bit unsigned integer	represents inactive to active transitions
4-7	Last Posted	32-bit unsigned integer	seconds since January 1, 1996
8-11	Last Cleared	32-bit unsigned integer	seconds since January 1, 1996

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7	Undefined
8	Invalid Alarm Number
9 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.48 **COMMAND #184: STOP ZEROING**

This command forces the transmitter to stop zeroing

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

NONE

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.49 COMMAND #185: PERFORM SPECIFIED DENSITY CALIBRATION

This command will perform a density calibration for the point identified. Up to a 4pt density calibration can be implemented depending on the sensor installed.

Command #48, Read Additional Transmitter Status, may be issued to monitor the status of the calibration. Response Data Byte #2, Bit #0, Calibration Failure, will be set if the calibration was unsuccessful. Response Data Byte #2, Bit #6, Calibration in Progress, will be set during the calibration and cleared upon completion.

Note: This command is slightly different from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Density for calibration	IEEE 754	units of grams/cubic centimeter, MSB in byte #0
4	Point Code	8-bit unsigned integer	Refer to Density Point Codes Table

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Selection
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Density for Calibration Out of Range
10 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.50 COMMAND #186: READ ALARM HISTORY

This command allows the user to read information from the alarm history.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Alarm History Index	8-bit unsigned integer	Valid range is 0 to 49

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Alarm History Index	8-bit unsigned integer	
1	Alarm Number	8-bit unsigned integer	Number of Alarm such as 26 for A26 or 100 for A100.
2	Status Change	8-bit unsigned integer	1=posted, 2=cleared
3	Timestamp of status change	32-bit unsigned integer	power-on time in seconds

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7	Undefined
8	Invalid Alarm Number
9 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.51 COMMAND #187: PERFORM HIGH FLOW DENSITY CALIBRATION

This command will perform a flowing density calibration to calculate the FD value.

Command #48, Read Additional Transmitter Status, may be issued to monitor the status of the calibration. Response Data Byte #2, Bit #0, Calibration Failure, will be set if the calibration was unsuccessful. Response Data Byte #2, Bit #6, Calibration in Progress, will be set during the calibration and cleared upon completion.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Density for calibration	IEEE 754	units of grams/cubic centimeter, MSB in byte #0

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Density for Calibration Out of Range
10 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.52 COMMAND #188: READ FLOWING DENSITY PARAMETERS

This command reads the transmitter flowing density parameters.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Reserved	IEEE 754	All bytes set to 0
4 - 7	Flow Effect on Density Correction Factor (FD)	IEEE 754	unitless, MSB in byte #4

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.53 COMMAND #189: WRITE FLOWING DENSITY PARAMETERS

This command writes the transmitter density parameters.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Reserved	IEEE 754	All bytes set to 0
4 - 7	Flow Effect on Density Correction Factor (FD)	IEEE 754	unitless, MSB in byte #4

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	FD Value Out of Range
10 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.54 COMMAND #190: READ ADDITIONAL DENSITY PARAMETERS

This command reads the transmitter density parameters D3, D4, K3 and K4

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Density calibration constant D3	IEEE 754	Units of grams/cubic centimeter, MSB in byte #0
4 - 7	Density calibration constant K3	IEEE 754	Units of microseconds
8 - 11	Density calibration constant D4	IEEE 754	Units of grams/centimeter, MSB in byte #8
12 - 15	Density calibration constant K4	IEEE 754	Units of microseconds, MSB in byte #12

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.55 COMMAND #191: WRITE ADDITIONAL DENSITY PARAMETERS

This command writes the transmitter density parameters D3, D4, K3 and K4

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Density calibration constant D3	IEEE 754	Units of grams/cubic centimeter, MSB in byte #0
4 - 7	Density calibration constant K3	IEEE 754	Units of microseconds
8 - 11	Density calibration constant D4	IEEE 754	Units of grams/centimeter, MSB in byte #8
12 - 15	Density calibration constant K4	IEEE 754	Units of microseconds, MSB in byte #12

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	D3 Out of Range
10	D4 Out of Range
11	K3 Out of Range
12	K4 Out of Range
13 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.56 COMMAND #192: WRITE POLLING INFORMATION

This command allows the transmitter to setup the polling for external process variables from an external device.

Note: If the Poll Control Codes are setup for HART, both must be identical (e.g. either both Primary or both Secondary). If they are different, they will be set to Primary.

This command is structured different from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Polling Control Code #1	8-bit unsigned integer	Refer to Poll Control Codes Table
1	Polled Variable Code #1	8-bit unsigned integer	Refer to Transmitter Variable Polling Codes Table
2 - 7	Transmitter #1 Tag	Packed-ASCII	MSB in byte #2, n/a if Poll Control code #1 set to "Do Not Poll"
8	Polling Control Code #2	8-bit unsigned integer	Refer to Poll Control Codes Table
9	Polled Variable Code #2	8-bit unsigned integer	Refer to Transmitter Variable Polling Codes Table
10 - 15	Transmitter #2 Tag	Packed-ASCII	MSB in byte #10, n/a if Poll Control code #2 set to "Do Not Poll"
16	Must be 252 or response code 7 will be returned	8-bit unsigned integer	Changed to eliminate confusion between the polling variables and enabled features such as pressure compensation and API.

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Selection
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.57 COMMAND #193: READ POLLING INFORMATION

This command allows the transmitter to read the polling setup for external process variables from an external device.

This command is structured different from the RFT9739

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Polling Control Code #1	8-bit unsigned integer	Refer to Poll Control Codes Table
1	Polled Variable Code #1	8-bit unsigned integer	Refer to Transmitter Variable Polling Codes Table
2 - 7	Transmitter #1 Tag	Packed-ASCII	MSB in byte #2 Refer to Poll Control Codes Table
8	Polling Control Code #2	8-bit unsigned integer	Refer to Transmitter Variable Polling Codes Table
9	Polled Variable Code #2	8-bit unsigned integer	
10 - 15	Transmitter #2 Tag	Packed-ASCII	MSB in byte #10
16	Always returns 252	8-bit unsigned integer	Changed to eliminate confusion between the polling variables and enabled features such as pressure compensation and API.

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.58 COMMAND #194: PERFORM DIAGNOSTIC ACTION

The command allows the user to issue diagnostic commands.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Diagnostic Action Code	8-bit unsigned integer	Refer to Diagnostic Action Codes Table

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Selection
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.59 COMMAND #195: READ SPECIFIED LOW FLOW CUTOFF

This command allows the user to read the specified (analog output or transmitter variable) low flow cutoff (if the flow rate is less than or equal to that point, it is defined to be 0).

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Cutoff Type Code	8-bit unsigned integer	Refer to Cutoff Type Codes Table

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Cutoff Type Code	8-bit unsigned integer	Refer to Cutoff Type Codes Table
1	Low Flow Cutoff Units	8-bit unsigned integer	Refer to Common Tables Document, Table II, Unit Codes
2 - 5	Low Flow Cutoff	IEEE 754	MSB in byte #2

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7 - 12	Undefined
13	Invalid Cutoff Type Code
14 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.60 COMMAND #196: WRITE SPECIFIED LOW FLOW CUTOFF

This command allows the user to define the specified (analog output or transmitter variable) low flow cutoff (if the flow rate is less than or equal to that point, it is defined to be 0).

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Cutoff Type Code	8-bit unsigned integer	Refer to Cutoff Type Codes Table
1	Low Flow Cutoff Units	8-bit unsigned integer	Refer to Mass Flow Rate Unit Codes Table or Volume Flow Rate Unit Codes Table
2 - 5	Low Flow Cutoff	IEEE 754	MSB in byte #2

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Low Flow Cutoff Out of Range
10 - 11	Undefined
12	Invalid Units
13	Invalid Cutoff Type Code
14 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.61 COMMAND #197: READ PRESENT FREQUENCY

This command reads the transmitter's Present Output Frequency.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Present Output Frequency	IEEE 754	Units of hertz, MSB in byte #0

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.62 COMMAND #198: READ DENSITY PARAMETERS

This command reads the transmitter density parameters.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Density calibration constant D1 (i.e. air)	IEEE 754	Units of grams/cubic centimeter, MSB in byte #0
4 - 7	Density calibration constant K1 (i.e. air)	IEEE 754	Units of microseconds
8 - 11	Density calibration constant D2 (i.e. water)	IEEE 754	Units of grams/centimeter, MSB in byte #8
12 - 15	Density calibration constant K2 (i.e. water)	IEEE 754	Units of microseconds, MSB in byte #12
16 - 19	Temperature correction factor for density	IEEE 754	unitless, MSB in byte #16

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.63 COMMAND #199: WRITE DENSITY PARAMETERS

This command writes the transmitter density parameters.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Density calibration constant D1 (i.e. air)	IEEE 754	Units of grams/cubic centimeter, MSB in byte #0
4 - 7	Density calibration constant K1 (i.e. air)	IEEE 754	Units of microseconds
8 - 11	Density calibration constant D2 (i.e. water)	IEEE 754	Units of grams/centimeter, MSB in byte #8
12 - 15	Density calibration constant K2 (i.e. water)	IEEE 754	Units of microseconds, MSB in byte #12
16 - 19	Temperature correction factor for density	IEEE 754	unitless, MSB in byte #16

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	D1 Out of Range
10	D2 Out of Range
11	K1 Out of Range
12	K2 Out of Range
13	Temp Correction Factor Out of Range
14 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.64 COMMAND #200: READ EVENT PARAMETERS

This command allows the user to read the Event Type and Event Setpoint Value for a specified Event Number.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Event Number Code	8-bit unsigned integer	Refer to Event Number Codes Table

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Event Number Code	8-bit unsigned integer	Refer to Event Number Codes Table
1	Event Type Code	8-bit unsigned integer	Refer to Event Type Codes Table
2	Event Setpoint Units	8-bit unsigned integer	Refer to Event #1 or Event #2 Unit Codes Table
3 - 6	Event Setpoint	IEEE 754	MSB in byte #3

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Selection
3 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.65 COMMAND #201: WRITE EVENT PARAMETERS

This command allows the user to write the Event Type and Event Setpoint Value for a specified Event Number.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Event Number Code	8-bit unsigned integer	Refer to Event Number Codes Table
1	Event Type Code	8-bit unsigned integer	Refer to Event Type Codes Table
2	Event Setpoint Units	8-bit unsigned integer	Refer to Event #1 or Event #2 Unit Codes Table
3	Event Setpoint	IEEE 754	MSB in byte #3

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8 - 10	Undefined
11	Setpoint Out of Range
12	Invalid Event Number Code
13	Invalid Event Type Code
14	Invalid Setpoint Units
15	Undefined
16	Access Restricted
17 - 127	Undefined

8.66 COMMAND #202: WRITE EVENT VARIABLE ASSIGNMENT

This command allows the user to assign a transmitter variable to a specified Event Number.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Event Number Code	8-bit unsigned integer	Refer to Event Number Codes Table
1	Event Variable Code	8-bit unsigned integer	Refer to Event Variable Codes Table

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8 - 11	Undefined
12	Invalid Event Number Code
13	Invalid Event Variable Code
14 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.67 COMMAND #203: READ EVENT VARIABLE ASSIGNMENT

This Command allows the user to read which transmitter variable is assigned to a specified Event Number.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Event Number Code	8-bit unsigned integer	Refer to Event Number Codes Table

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Event Number Code	8-bit unsigned integer	Refer to Event Number Codes Table
1	Event Variable Code	8-bit unsigned integer	Refer to Event Variable Codes Table

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 11	Undefined
12	Invalid Event Number Code
13 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.68 COMMAND #204: WRITE PRESSURE COMPENSATION FACTORS

This command allows the user to write factors necessary in performing pressure compensation of flow and density. See Command #192 WRITE POLLING INFORMATION for enabling pressure compensation.

Note: This command is slightly different from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Flow Pressure Correction Factor	IEEE 754	unitless, MSB in byte #0
4 - 7	Density Pressure Correction Factor	IEEE 754	unitless, MSB in byte #4
8	Zero Pressure Correction Point Pressure Units	8-bit unsigned integer	Refer to Pressure Unit Codes Table
9 - 12	Zero Pressure Correction Point	IEEE 754	MSB in byte #9
13	Enable Pressure Correction	8-bit unsigned integer	Refer to Option Codes Table
14 - 17	Static Pressure Value	IEEE 754	MSB in byte #14
18	Static Pressure Units	8-bit unsigned integer	Refer to Pressure Unit Codes Table

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Units Code
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8 - 10	Undefined
11	Zero Pressure Correction Point Out-of-Range
12	Density Pressure Correction Factor Out-of-Range
13	Flow Pressure Correction Factor Out-of-Range
14	Invalid Option Code
15	Static Pressure Out-of-Range
16	Access Restricted
17 - 127	Undefined

8.69 COMMAND #205: READ PRESSURE COMPENSATION FACTORS

This command allows the user to read factors necessary in performing pressure compensation of flow and density. See Command #192 WRITE POLLING INFORMATION for enabling pressure compensation.

Note: This command is slightly different from the RFT9739

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Flow Pressure Correction Factor	IEEE 754	unitless, MSB in byte #0
4 - 7	Density Pressure Correction Factor	IEEE 754	unitless, MSB in byte #4
8	Zero Pressure Correction Point Pressure Units	8-bit unsigned integer	Refer to Pressure Unit Codes Table
9 - 12	Zero Pressure Correction Point	IEEE 754	MSB in byte #9
13	Enable Pressure Correction	8-bit unsigned integer	Refer to Option Codes Table
14 - 17	Static Pressure Value	IEEE 754	MSB in byte #14
18	Static Pressure Units	8-bit unsigned integer	Refer to Pressure Unit Codes Table

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.70 COMMAND #206: READ UPDATE RATE SETTINGS

This command allows the user to determine at what update rate the selected process variable will be refreshed from the sensor. All other variables will be updated at a slower rate.

Note that selecting 100 Hz should only be used when the device is to be used for proving applications or extremely short batch applications.

Note: This command is newly created from the RFT9739.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Process Variable Update Rate	8-bit unsigned integer	Refer to the Update Rate Codes table.
1	Transmitter Variable Code	8-bit unsigned integer	Refer to the 100HZ Variable Codes table.

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.71 COMMAND #207: WRITE UPDATE RATE SETTINGS

This command allows the user to determine at what update rate the selected process variable will be refreshed from the sensor. All other variables will be updated at a slower rate.

Note that selecting 100 Hz should only be used when the device is to be used for proving applications or extremely short batch applications.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Process Variable Update Rate	8-bit unsigned integer	Refer to the Update Rate Codes table.
1	Transmitter Variable Code	8-bit unsigned integer	Refer to the 100HZ Variable Codes table.

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Transmitter Variable Code Selection
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Invalid Update Rate Selection
10 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.72 COMMAND #208: WRITE METER FACTORS

This command allows the user to write a factor between 0.8 and 1.2 inclusive which is multiplied against the mass flow rate, volume flow rate or density.

Note: This command is slightly different from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Mass Rate Flow Factor	IEEE 754	unitless, MSB in byte #0
4 - 7	Density Factor	IEEE 754	unitless, MSB in byte #4
8 - 11	Volume Rate Flow Factor	IEEE 754	unitless, MSB in byte #8

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Undefined
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Mass Flow Rate Factor Out of Range
10	Density Factor Out of Range
11	Volume Flow Rate Factor Out of Range
12 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.73 COMMAND #209: READ METER FACTORS

This command allows the user to read the mass flow rate, volume flow rate or density meter factors.

Note: This command is slightly different from the RFT9739

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Mass Rate Flow Factor	IEEE 754	unitless, MSB in byte #0
4 - 7	Density Factor	IEEE 754	unitless, MSB in byte #4
8 - 11	Volume Rate Flow Factor	IEEE 754	unitless, MSB in byte #8

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.74 COMMAND #210: READ OUTPUT CHANNEL SETUP

This command allows the user to determine the output channel assignments for the output option board.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Channel A Assignment Code	8-bit unsigned integer	Refer to Output Type Codes Table
1	Channel B Assignment Code	8-bit unsigned integer	Refer to Output Type Codes Table
2	Channel C Assignment Code	8-bit unsigned integer	Refer to Output Type Codes Table

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.75 COMMAND #211: WRITE OUTPUT CHANNEL SETUP

This command allows the user to set the output channel assignments for the output option board.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Channel A Assignment Code	8-bit unsigned integer	Refer to Output Type Codes Table
1	Channel B Assignment Code	8-bit unsigned integer	Refer to Output Type Codes Table
2	Channel C Assignment Code	8-bit unsigned integer	Refer to Output Type Codes Table

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 – 5	Undefined
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Invalid Channel A Code
10	Invalid Channel B Code
11	Invalid Channel C Code
12 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.76 COMMAND #212: READ GAS STANDARD VOLUME PARAMETERS

This command allows the user to read the gas standard volume (GSV) feature setup.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Enable GSV	8-bit unsigned integer	Refer to Option Codes Table
1 – 4	Gas Density	IEEE 754	Gas Density Unit specified in byte 33
5	Gas Standard Volume Flow Unit	8-bit unsigned integer	Refer to Gas Standard Volume Flow Rate Unit Codes Table
6	Gas Standard Volume Total and Inventory Unit	8-bit unsigned integer	Refer to Volume Total Unit Codes Table
7	Special Units Base Volume Flow Units Code	8-bit unsigned integer	Refer to Common Tables document, Table II, Unit Codes
8	Special Units Base Volume Time Units Code	8-bit unsigned integer	Refer to Common Tables document, Table II, Unit Codes
9 – 12	Special Units Conversion Number	float, IEEE 754	unitless
13 – 20	Special Units Vol. Flow String	Standard ASCII	
21 – 28	Special Units Vol. Total String	Standard ASCII	
29 – 32	Gas Standard Volume Cutoff	float, IEEE 754	in Gas Standard Volume Flow Units
33	Gas Density Unit	8-bit unsigned integer	Refer to Density Unit Codes Table

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 – 5	Undefined
6	Transmitter-Specific Command Error
7 – 15	Undefined
16	Access Restricted
17 – 127	Undefined

8.77 COMMAND #213: WRITE GAS STANDARD VOLUME PARAMETERS

This command allows the user to set up gas standard volume (GSV) feature.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Enable GSV	8-bit unsigned integer	Refer to Option Codes Table
1 – 4	Gas Density	IEEE 754	Gas Density Unit specified in byte 32
5	Gas Standard Volume Flow Unit	8-bit unsigned integer	Refer to Gas Standard Volume Flow Rate Unit Codes Table
6	Special Units Base Volume Flow Units Code	8-bit unsigned integer	Refer to Common Tables document, Table II, Unit Codes
7	Special Units Base Volume Time Units Code	8-bit unsigned integer	Refer to Common Tables document, Table II, Unit Codes
8 – 11	Special Units Conversion Number	float, IEEE 754	unitless
12 – 19	Special Units Vol. Flow String	Standard ASCII	
20 – 27	Special Units Vol. Total String	Standard ASCII	
28 – 31	Gas Standard Volume Cutoff	float, IEEE 754	in Gas Standard Volume Flow Units
32	Gas Density Unit	8-bit unsigned integer	Refer to Density Unit Codes Table

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Gas Density Unit Code
3 – 4	Undefined
5	Undefined
6	Transmitter-Specific Command Error

7	In Write Protect Mode
8	Undefined
9	Gas Density Out of Range
10	GSV Flow Unit Out of Range
11	GSV Total unit Out of Range
12	Base Volume Flow Units Code Out of Range
13	Base Volume Time Units Code Out of Range
14	Special Units Conversion Factory Out of Range
15	GSV Cutoff Out of Range
16	Access Restricted
17 – 127	Undefined

8.78 COMMAND #214: READ TRANSMITTER TEST POINT DIAGNOSTIC

This command allows the user to read the test point diagnostic values from the transmitter. Values provided include the drive gain voltage, left and right pickoff voltage and tube frequency. Also available is the current flow rate without having the transmitter flow cutoff applied. The damping on this parameter is always 8 seconds. This flow variable is not used for flow and/or totalization calculations. It is strictly used for diagnostic purposes

Note: This command is slightly different from the RFT9739

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Tube Frequency	IEEE 754	Units of Hertz, MSB in byte #0
4 - 7	Left Pickoff	IEEE 754	Units of Volts, MSB in byte #4
8 - 11	Right Pickoff	IEEE 754	Units of Volts, MSB in byte #8
12 - 15	Drive Gain	IEEE 754	Units of Volts, MSB in byte #12
16 - 19	Mass Flow Rate	IEEE 754	units of mass, MSB in byte #16
20	Mass Flow Units	8-bit integer	Refer to Common Table document, Table II, Unit Codes
21 - 24	Core Processor Board Temp.	IEEE 754	In configured temp. units, MSB in byte 21

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.79 COMMAND #215: READ ADDITIONAL DIAGNOSTIC

This command allows the user to read diagnostic values from the transmitter.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 3	Case Temperature (T-Series)	IEEE 754	In configured temp. units, MSB in byte #0
4 - 7	Input voltage	IEEE 754	In units of Volts
8 - 11	Actual Target Amplitude	IEEE 754	In units of mV/Hz
12 - 15	Average sensor temp	IEEE 754	In units of deg C
16 - 19	Minimum sensor temp	IEEE 754	In units of deg C
20 - 23	Maximum sensor temp	IEEE 754	In units of deg C
24 - 27	Average electronics temp	IEEE 754	In units of deg C
28 - 31	Minimum electronics temp	IEEE 754	In units of deg C
32 - 35	Wire RTD resistance	IEEE 754	In units of ohms
36 - 39	Meter RTD resistance	IEEE 754	In units of ohms
40 - 43	Line RTD resistance	IEEE 754	In units of ohms
44 - 45	Power cycle count	16-bit unsigned integer	Set to 0 on master reset
46 - 49	Power on time	32-bit unsigned integer	Seconds since last reset
50-51	Value of Status Word 419	16-bit unsigned integer	Refer to Status Word 419 Table
52-53	Value of Status Word 420	16-bit unsigned integer	Refer to Status Word 420 Table
54-55	Value of Status Word 421	16-bit unsigned integer	Refer to Status Word 421 Table
56-57	Value of Status Word 422	16-bit unsigned integer	Refer to Status Word 422 Table
58-59	Value of Status Word 423	16-bit unsigned integer	Refer to Status Word 423 Table
60-61	Value of Status Word 424	16-bit unsigned integer	Refer to Status Word 424 Table
62-63	Value of Status Word 433	16-bit unsigned integer	Refer to Status Word 433 Table
64-65	Value of Status Word 434	16-bit unsigned integer	Refer to Status Word 434 Table

66-69	Maximum electronics temp	IEEE 754	In units of deg C
70-73	Drive Current	IEEE 754	In units of mA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.80 COMMAND #216: READ API CONFIGURATION

This command allows the user to determine how API is configured.

Note: This command is newly created from the RFT9739.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	API 2540 CTL Table Type	8-bit unsigned integer	Refer to CTL Codes (API) Table
1 - 4	API Thermal Expansion Coefficient	IEEE 754	MSB in byte #1
5 - 8	API Reference Temp	IEEE 754	MSB in byte #5
9	API Reference Temp Units and Thermal Expansion Coefficient Inverse Units	8-bit unsigned integer	Refer to Temperature Unit Codes Table
10 - 13	Correction of Temperature on a Liquid (CTL)	IEEE 754	unitless, MSB in byte #10
14	Enable API Calculations	8-bit unsigned integer	Refer to Option Codes Table

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.81 COMMAND #217: WRITE API CONFIGURATION

This command allows the user to specify how API will be configured.

Note: This command is newly created from the RFT9739.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	API 2540 CTL Table Type	8-bit unsigned integer	Refer to CTL Codes (API) Table
1 - 4	API Thermal Expansion Coefficient	IEEE 754	MSB in byte #1
5 - 8	API Reference Temp	IEEE 754	MSB in byte #5
9	API Reference Temp Units and Thermal Expansion Coefficient Inverse Units	8-bit unsigned integer	Refer to Temperature Unit Codes Table
13	Enable API Calculations	8-bit unsigned integer	Refer to Option Codes Table

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Invalid API 2540 CTL Table
10	API Thermal Expansion Coeff Out of Range
11	API Reference Temperature Out of Range
12	Invalid Units
13	Invalid Option Code
14 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.82 COMMAND #218: READ EXTERNAL TEMPERATURE CONFIGURATION

This command allows the user to determine how the external temperature input is configured.

Note: This command is newly created from the RFT9739.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Enable External Temperature Input	8-bit unsigned integer	Refer to Option Codes Table
1 - 4	Static Temperature	IEEE 754	MSB in byte #1
5	Static Temperature Units	8-bit unsigned integer	Refer to Temperature Unit Codes Table

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.83 COMMAND #219: WRITE EXTERNAL TEMPERATURE CONFIGURATION

This command allows the user to specify how the external temperature input will be configured.

Note: This command is newly created from the RFT9739.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Enable External Temperature Input	8-bit unsigned integer	Refer to Option Codes Table
1 - 4	Static Temperature	IEEE 754	MSB in byte #1
5	Static Temperature Units	8-bit unsigned integer	Refer to Temperature Unit Codes Table

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
2	Invalid Units Code
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8 - 10	Undefined
11	Invalid Option Code
12	Static Temperature Out-of-Range
13 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.84 COMMAND #220: READ LOCAL DISPLAY OPTION SETUP

This command allows the user to read the current LDO settings the user has configured.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Totalizer Reset Enable	8-bit integer	Refer to Option Codes Table
1	Auto Scroll Enable	8-bit integer	Refer to Option Codes Table
2	Offline Menu Enable	8-bit integer	Refer to Option Codes Table
3	Alarm Menu Enable	8-bit integer	Refer to Option Codes Table
4	Ack All Alarms Enable	8-bit integer	Refer to Option Codes Table
5	Offline Password Enable	8-bit integer	Refer to Option Codes Table
6 – 7	Offline Password	16-bit unsigned integer	Values range from 0 to 9999
8	Auto Scroll Rate	8-bit unsigned integer	Units of seconds
9	Process Variable #1	8-bit integer	Refer to Display Variable Codes Table
10	Process Variable #2	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none
11	Process Variable #3	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none
12	Process Variable #4	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none
13	Process Variable #5	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none
14	Process Variable #6	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none
15	Process Variable #7	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none
16	Process Variable #8	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none

17	Process Variable #9	8-bit integer	Refer to Display Variable Codes Table; "251" indicates none
18	Process Variable #10	8-bit integer	Refer to Display Variable Codes Table; "251" indicates none
19	Process Variable #11	8-bit integer	Refer to Display Variable Codes Table; "251" indicates none
20	Process Variable #12	8-bit integer	Refer to Display Variable Codes Table; "251" indicates none
21	Process Variable #13	8-bit integer	Refer to Display Variable Codes Table; "251" indicates none
22	Process Variable #14	8-bit integer	Refer to Display Variable Codes Table; "251" indicates none
23	Process Variable #15	8-bit integer	Refer to Display Variable Codes Table; "251" indicates none
24	Totalizer Start/Stop Enable	8-bit integer	Refer to Option Codes Table
25-26	Update Period	16-bit integer	In units of msec. Range is 100 – 10,000 msec.
27	Backlight Control	8-bit integer	0=off ; 1=on
28	Backlight Intensity	8-bit integer	0=off to 63=full on
29	Language	8-bit integer	0=English; 1=German; 2=French; 3=Katakana; 4=Spanish
30	LED Blinking Enable	8-bit integer	Refer to Option Codes Table
31	Alarm Screen Password Enable	8-bit integer	Refer to Option Codes Table

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.85 COMMAND #221: WRITE LOCAL DISPLAY OPTION SETUP

This command allows the user to configure the current LDO settings desired.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Totalizer Reset Enable	8-bit integer	Refer to Option Codes Table
1	Auto Scroll Enable	8-bit integer	Refer to Option Codes Table
2	Offline Menu Enable	8-bit integer	Refer to Option Codes Table
3	Alarm Menu Enable	8-bit integer	Refer to Option Codes Table
4	Ack All Alarms Enable	8-bit integer	Refer to Option Codes Table
5	Offline Password Enable	8-bit integer	Refer to Option Codes Table
6 – 7	Offline Password	16-bit unsigned integer	Values range from 0 to 9999
8	Auto Scroll Rate	8-bit unsigned integer	Units of seconds (1 to 10)
9	Process Variable #1	8-bit integer	Refer to Display Variable Codes Table
10	Process Variable #2	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none
11	Process Variable #3	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none
12	Process Variable #4	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none
13	Process Variable #5	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none
14	Process Variable #6	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none
15	Process Variable #7	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none
16	Process Variable #8	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none
17	Process Variable #9	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none
18	Process Variable #10	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none
19	Process Variable #11	8-bit integer	Refer to Display Variable Codes Table; “251” indicates none

20	Process Variable #12	8-bit integer	Table; "251" indicates none Refer to Display Variable Codes Table; "251" indicates none
21	Process Variable #13	8-bit integer	Refer to Display Variable Codes Table; "251" indicates none
22	Process Variable #14	8-bit integer	Refer to Display Variable Codes Table; "251" indicates none
23	Process Variable #15	8-bit integer	Refer to Display Variable Codes Table; "251" indicates none
24	Totalizer Start/Stop Enable	8-bit integer	Refer to Option Codes Table
25-26	Update Period	16-bit integer	In units of msec. Range is 100 – 10,000 msec.
27	Backlight Control	8-bit integer	0=off ; 1=on
28	Backlight Intensity	8-bit integer	0=off to 63=full on
29	Language	8-bit integer	0=English; 1=German; 2=French; 3=Katakana; 4=Spanish
30	LED Blinking Enable	8-bit integer	Refer to Option Codes Table
31	Alarm Screen Password Enable	8-bit integer	Refer to Option Codes Table

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid selection
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.86 COMMAND #222: READ RS485 DIGITAL COMMUNICATION SETUP PARAMETERS

This command allows the user to read the current RS485 digital communication setup parameters that are configured for the given protocol supported.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Digital Communication Protocol	8-bit integer	Refer to Digital Communication Protocol Table
1	Baud Rate	8-bit integer	Refer to Digital Communication Baud Rate Table
2	Parity	8-bit integer	Refer to Digital Communication Parity Table
3	Stop Bits	8-bit integer	1 or 2
4	Modbus Slave Address	8-bit integer	Only applicable if protocol is set to Modbus RTU or Modbus ASCII.

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.87 COMMAND #223: WRITE RS485 DIGITAL COMMUNICATION SETUP PARAMETERS

This command allows the user to set the current RS485 digital communication setup parameters for the given protocol supported.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Digital Communication Protocol	8-bit integer	Refer to Digital Communication Protocol Table
1	Baud Rate	8-bit integer	Refer to Digital Communication Baud Rate Table
2	Parity	8-bit integer	Refer to Digital Communication Parity Table
3	Stop Bits	8-bit integer	1 or 2
4	Modbus Slave Address	8-bit integer	Only applicable if protocol is set to Modbus RTU or Modbus ASCII.

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid selection
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.88 COMMAND #230: READ FEATURE KEY

This command allows the user to read the transmitter features. For example, custody transfer or batcher.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Feature Key	Bit Enumerated – 2 bytes	Refer to Feature Key Codes Table
2 – 3	CEQ Number	16-bit unsigned integer	
4	World Area for Weights and Measures Security	8-bit unsigned integer	0=NTEP 1=OIML
5 – 6	Core Processor CEQ Number	16-bit unsigned integer	
7 – 8	Core Processor Software Revision	16-bit unsigned integer	
9 – 10	Core Processor Device Type	16-bit unsigned integer	
11-13	Core Processor HART Device ID	24-bit unsigned integer	
14-17	Core Processor Firmware Checksum	32-bit unsigned integer	
18-21	Transmitter Firmware Checksum	32-bit unsigned integer	
22-23	W&M Software Version	16-bit unsigned integer	

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 – 5	Undefined
6	Transmitter-Specific Command Error
7 – 15	Undefined
16	Access Restricted
17 – 127	Undefined

8.89 COMMAND #235: READ CURRENT CONCENTRATION MEASUREMENT CURVE

This command allows the user to read the active Concentration Measurement curve.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Current Concentration Measurement Curve	8-bit unsigned integer	Currently Active CM Curve Refer to Concentration Measurement Curve Number Codes Table
1	Enable Concentration Measurement	8-bit unsigned integer	0 : CM Disabled 1 : CM Enabled
2	Enable Curve Lock	8-bit unsigned integer	0 : Lock disabled 1 : Lock enabled
3	Enable Density Low Extrapolation Limit	8-bit unsigned integer	0 : Disabled 1 : Enabled
4	Enable Density High Extrapolation Limit	8-bit unsigned integer	0 : Disabled 1 : Enabled
5	Enable Temp. Low Extrapolation Limit	8-bit unsigned integer	0 : Disabled 1 : Enabled
6	Enable Temp. High Extrapolation Limit	8-bit unsigned integer	0 : Disabled 1 : Enabled

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 – 5	Undefined
6	Transmitter-Specific Command Error
7 – 15	Undefined
16	Access Restricted
17 – 127	Undefined

8.90 COMMAND #236: WRITE CURRENT CONCENTRATION MEASUREMENT CURVE

This command allows the user to write the active Concentration Measurement curve.

Note: This command is newly created from the RFT9739

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Current Concentration Measurement Curve	8-bit unsigned integer	Currently Active CM Curve Refer to Concentration Measurement Curve Number Codes Table
1	Enable Concentration Measurement	8-bit unsigned integer	0 : CM Disabled 1 : CM Enabled
2	Enable Curve Lock	8-bit unsigned integer	0 : Lock disabled 1 : Lock enabled
3	Enable Density Low Extrapolation Limit	8-bit unsigned integer	0 : Disabled 1 : Enabled
4	Enable Density High Extrapolation Limit	8-bit unsigned integer	0 : Disabled 1 : Enabled
5	Enable Temp. Low Extrapolation Limit	8-bit unsigned integer	0 : Disabled 1 : Enabled
6	Enable Temp. High Extrapolation Limit	8-bit unsigned integer	0 : Disabled 1 : Enabled

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Curve selection
3 – 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Enable Concentration Measurement Code Out of Range
10	Enable Curve Lock Code Out of Range
11	Undefined

12	Enable Density Low Extrapolation Limit Code Out of Range
13	Enable Density High Extrapolation Limit Code Out of Range
14	Enable Temp. Low Extrapolation Limit Code Out of Range
15	Enable Temp. High Extrapolation Limit Code Out of Range
16	Access Restricted
17 – 127	Undefined

8.91 COMMAND #237: WRITE PROCESS COMPARATOR VARIABLE ASSIGNMENT

This command allows the user to write the process comparator variable assignments.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Process Comparator Index	8-bit unsigned integer	Refer to Process Comparator Index Codes Table
1	Process Variable Code	8-bit unsigned integer	Refer to Transmitter Variable Codes Table

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 – 4	Undefined
5	Undefined
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Process Comparator Index Out of Range
10	Process Variable Code Invalid
11 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.92 COMMAND #238: READ PROCESS COMPARATOR VARIABLE ASSIGNMENT

This command allows the user to write the process comparator variable assignments.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Process Comparator Index	8-bit unsigned integer	Refer to Process Comparator Index Codes Table

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Process Comparator Index	8-bit unsigned integer	Refer to Process Comparator Index Codes Table
1	Process Variable Code	8-bit unsigned integer	Refer to Transmitter Variable Codes Table

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Undefined
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Process Comparator Index Out of Range
10	Process Variable Code Invalid
11 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.93 COMMAND #239: WRITE PROCESS COMPARATOR PARAMETERS

This command allows the user to write the process comparator parameters.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Process Comparator Index	8-bit unsigned integer	Refer to Process Comparator Index Codes Table
1	Process Comparator Action	8-bit unsigned integer	Refer to Process Comparator Action Codes Table
2 - 5	Setpoint A	Float, IEEE 754	MSB in Byte #2
6 - 9	Setpoint B	Float, IEEE 754	MSB in Byte #6
10	Setpoint Units	8-bit unsigned integer	Refer to Unit Codes Table for Process Comparator Variable Assignment. Must be equal to current units.

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 4	Undefined
5	Undefined
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Process Comparator Index Out of Range
10	Undefined
11	Process Comparator Action Invalid
12	Setpoint A Out of Range
13	Setpoint B Out of Range
14	Setpoint Units Invalid
15	Undefined
16	Access Restricted
17 - 127	Undefined

8.94 COMMAND #240: READ PROCESS COMPARATOR PARAMETERS

This command allows the user to read the process comparator parameters.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Process Comparator Index	8-bit unsigned integer	Refer to Process Comparator Index Codes Table

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Process Comparator Index	8-bit unsigned integer	Refer to Process Comparator Index Table
1	Process Comparator Action	8-bit unsigned integer	Refer to Process Comparator Action Codes Table
2 - 5	Setpoint A	Float, IEEE 754	MSB in Byte #3
6 - 9	Setpoint B	Float, IEEE 754	MSB in Byte #7
10	Setpoint Units	8-bit unsigned integer	Refer to Unit Codes Table for Process Comparator Variable Assignment

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.95 COMMAND #241: PERFORM METER FINGERPRINT ACTION (NON-PUBLIC)

This command will perform the specified action on meter finger-printing as defined here:

Code 1: Save Factory Calibration Data

The Password is compared with the Final Assembly Number. When they match, the command will be executed. When they do not match, the Command Not Implemented Response Code will be returned. No other Response Code is returned until after the Password has matched.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 2	Password	24-bit unsigned integer	MSB in byte #0
3	Action Code	8-bit unsigned integer	

RESPONSE DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Selection
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.96 COMMAND #242: RESET INVENTORY (NON-PUBLIC)

The Password is compared with the Final Assembly Number. When they match, the command will be executed. When they do not match, the Command Not Implemented Response Code will be returned. No other Response Code is returned until after the Password has matched.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 2	Password	24-bit unsigned integer	MSB in byte #0

RESPONSE DATA BYTES

NONE

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.97 COMMAND #243: WRITE SIMULATION MODE PARAMETERS

This command allows the user to setup the simulation mode parameters. Simulation mode provides diagnostic capabilities while not connected to a sensor or for isolating the transmitter from the sensor when troubleshooting. The user can specify a fixed value or waveform for mass flow, temperature and density. If a power cycle occurs, simulation mode will be disabled.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Enable Simulation Mode	8-bit unsigned integer	Refer to Option Codes Table
1	Mass Flow Simulation Mode	8-bit unsigned integer	Refer to Simulation Modes Table
2 - 5	Mass Flow Fixed Value	Float, IEEE 754	Ignored if Mass Flow Simulation Mode is not Fixed Value
6 - 9	Mass Flow Minimum Amplitude of waveform	Float, IEEE 754	Ignored if Mass Flow Simulation Mode is Fixed Value
10-13	Mass Flow Maximum Amplitude of waveform	Float, IEEE 754	Ignored if Mass Flow Simulation Mode is Fixed Value
14-17	Mass Flow period of waveform	Float, IEEE 754	Ignored if Mass Flow Simulation Mode Codes is Fixed Value
18	Temperature Simulation Mode	8-bit unsigned integer	Refer to Simulation Modes Table
19-22	Temperature Fixed Value	Float, IEEE 754	Ignored if Temperature Simulation Mode is not Fixed Value
23-26	Temperature Minimum Amplitude of waveform	Float, IEEE 754	Ignored if Temperature Simulation Mode is Fixed Value
27-30	Temperature Maximum Amplitude of waveform	Float, IEEE 754	Ignored if Temperature Simulation Mode is Fixed Value
31-34	Temperature period of waveform	Float, IEEE 754	Ignored if Temperature Simulation Mode is Fixed Value
35	Density Simulation Mode	8-bit unsigned integer	Refer to Simulation Modes Table
36-39	Density Fixed Value	Float, IEEE 754	Ignored if Density Simulation Mode is not Fixed Value
40-43	Density Minimum Amplitude of waveform	Float, IEEE 754	Ignored if Density Simulation Mode is Fixed Value
44-47	Density Maximum Amplitude of waveform	Float, IEEE 754	Ignored if Density Simulation Mode is Fixed Value
48-51	Density period of waveform	Float, IEEE 754	Ignored if Density Simulation Mode is Fixed Value

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 – 4	Undefined
5	Undefined
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Simulation Mode out of range
10	Undefined
11	Fixed Value Out of Range
12	Minimum Amplitude Out of Range
13	Maximum Amplitude Out of Range
14	Period Out of Range
15	Undefined
16	Access Restricted
17-127	Undefined

8.98 COMMAND #244: READ SIMULATION MODE PARAMETERS

This command allows the user to read the simulation mode parameters.

REQUEST DATA BYTES
 NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Enable Simulation Mode	8-bit unsigned integer	Refer to Option Codes Table
1	Mass Flow Simulation Mode	8-bit unsigned integer	Refer to Simulation Modes Table
2 – 5	Mass Flow Fixed Value	Float, IEEE 754	Ignored if Mass Flow Simulation Mode is not Fixed Value
6 – 9	Mass Flow Minimum Amplitude of waveform	Float, IEEE 754	Ignored if Mass Flow Simulation Mode is Fixed Value
10-13	Mass Flow Maximum Amplitude of waveform	Float, IEEE 754	Ignored if Mass Flow Simulation Mode is Fixed Value
14-17	Mass Flow period of waveform	Float, IEEE 754	Ignored if Mass Flow Simulation Mode is Fixed Value
18	Temperature Simulation Mode	8-bit unsigned integer	Refer to Simulation Modes Table
19-22	Temperature Fixed Value	Float, IEEE 754	Ignored if Temperature Simulation Mode is not Fixed Value
23-26	Temperature Minimum Amplitude of waveform	Float, IEEE 754	Ignored if Temperature Simulation Mode is Fixed Value
27-30	Temperature Maximum Amplitude of waveform	Float, IEEE 754	Ignored if Temperature Simulation Mode is Fixed Value
31-34	Temperature period of waveform	Float, IEEE 754	Ignored if Temperature Simulation Mode is Fixed Value
35	Density Simulation Mode	8-bit unsigned integer	Refer to Simulation Modes Table
36-39	Density Fixed Value	Float, IEEE 754	Ignored if Density Simulation Mode is not Fixed Value
40-43	Density Minimum Amplitude of waveform	Float, IEEE 754	Ignored if Density Simulation Mode is Fixed Value
44-47	Density Maximum Amplitude of waveform	Float, IEEE 754	Ignored if Density Simulation Mode is Fixed Value
48-51	Density period of	Float, IEEE 754	Ignored if Density Simulation

| waveform

| Mode is Fixed Value

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.99 COMMAND #245: WRITE METER VERIFICATION DATA

This command allows the user to setup the meter verification parameters and execute or abort the meter verification routine. Command 246 – Read meter verification data is used to read the progress and result of the meter verification routine.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Enable Meter Verification	8-bit unsigned integer	0=Disable or Abort Verification 1=Normal Verification 2=Factory Verification of Air 3=Factory Verification of Water
1	Output State during Meter Verification	8-bit unsigned integer	0=Last Value 1=Fault
2-5	Stiffness Limit Set Point	Float, IEEE 754	MSB in byte #2

RESPONSE DATA BYTES

SAME AS REQUEST DATA BYTES

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 – 4	Undefined
5	Undefined
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Enable FCF Verification out of range
10	Output State Out of Range
11	Stiffness Limit Set Point Out of Range
12 - 15	Undefined
16	Access Restricted
17-127	Undefined

8.100 COMMAND #246: READ METER VERIFICATION DATA

This command allows the user to read the data associated with meter verification.

REQUEST DATA BYTES

NONE

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Enable Meter Verification	8-bit unsigned integer	0=Disable/Abort Verification 1=Normal Verification 2=Factory Verification of Air 3=Factory Verification of Water 0=Last Value
1	Output State during Meter Verification	8-bit unsigned integer	1=Fault MSB in byte #2
2-5	Stiffness Limit Set Point	Float, IEEE 754	
6	Algorithm Progress	8-bit unsigned integer	% Complete
7	Current Algorithm State	8-bit unsigned integer	1 through 18
8	Abort Code	8-bit unsigned integer	0=No error 1=Manual Abort 2=Watchdog Timeout 3=Frequency Drift 4=High Peak Drive Voltage 5=High Drive Current Std Dev 6=High Drive Current Mean Value 7=Drive loop reported error 8=High Delta T Std Dev 9=High Delta T Value 10=State Running 11=Verification Complete 12=Wrong Verification Enable 13=No Factory Air Verification 14=No Factory Water Verification 15=Parameter Registers not Set
9	Algorithm State at Abort	8-bit unsigned integer	1 through 18
10-11	Meter Verification Validation Counter	16-bit unsigned integer	Indicates the number of times the Meter Verification routine has successfully completed
12	Is LPO Stiffness Out of Limits?	8-bit unsigned integer	0=No 1=Yes
13	Is RPO Stiffness Out of Limits?	8-bit unsigned integer	0=No 1=Yes

14-17	Current LPO Stiffness, Mean	Float, IEEE 754	MSB in byte #14
18-21	Current RPO Stiffness, Mean	Float, IEEE 754	MSB in byte #18
22-25	Current Damping, Mean	Float, IEEE 754	MSB in byte #22
26-29	Current LPO Mass, Mean	Float, IEEE 754	MSB in byte #26
30-33	Current RPO Mass, Mean	Float, IEEE 754	MSB in byte #30
34-37	Current LPO Stiffness, Standard Deviation	Float, IEEE 754	MSB in byte #34
38-41	Current RPO Stiffness, Standard Deviation	Float, IEEE 754	MSB in byte #38
42-45	Current Damping, Standard Deviation	Float, IEEE 754	MSB in byte #42
46-49	Current LPO Mass, Standard Deviation	Float, IEEE 754	MSB in byte #46
50-53	Current RPO Mass, Standard Deviation	Float, IEEE 754	MSB in byte #50
54-57	LPO Stiffness, Factory Calibration of Air Mean	Float, IEEE 754	MSB in byte #54
58-61	RPO Stiffness, Factory Calibration of Air Mean	Float, IEEE 754	MSB in byte #58
62-65	Damping, Factory Calibration of Air Mean	Float, IEEE 754	MSB in byte #62
66-69	LPO Mass, Factory Calibration of Air Mean	Float, IEEE 754	MSB in byte #66
70-73	RPO Mass, Factory Calibration of Air Mean	Float, IEEE 754	MSB in byte #70
74-77	LPO Stiffness, Factory Calibration of Water Mean	Float, IEEE 754	MSB in byte #74
78-81	RPO Stiffness, Factory Calibration of Water Mean	Float, IEEE 754	MSB in byte #78
82-85	Damping, Factory Calibration of Water Mean	Float, IEEE 754	MSB in byte #82
86-89	LPO Mass, Factory Calibration of Water Mean	Float, IEEE 754	MSB in byte #86
90-93	RPO Mass, Factory Calibration of Water Mean	Float, IEEE 754	MSB in byte #90

COMMAND-SPECIFIC RESPONSE CODES

0 No Command-Specific Errors

1 - 5	Undefined
6	Transmitter-Specific Command Error
7 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.101 COMMAND #247: PERFORM TEMPERATURE OFFSET CAL (NON-PUBLIC)

This command, along with command #248 is used to calibrate the temperature RTD. When this command is issued, the temperature value is read and the temperature offset is changed so that the calculated temperature is equivalent to the entered temperature.

The Password is compared with the Final Assembly Number. When they match, the command will be executed. When they do not match, the Command Not Implemented Response Code will be returned. No other Response Code is returned until after the Password has matched.

Command #48, Read Additional Transmitter Status, may be issued to monitor the status of the calibration. Response Data Byte #2, Bit #0, Calibration Failure, will be set if the calibration was unsuccessful. Response Data Byte #2, Bit #6, Calibration in Progress, will be set during the calibration and cleared upon completion.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 2	Password	24-bit unsigned integer	MSB in byte #0
3	Measured Temperature Units Code	8-bit unsigned integer	
4 - 7	Measured Temperature	IEEE 754	MSB in byte #4

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Measured Temperature Units Code	8-bit unsigned integer	Refer to Transmitter Variable #1 Temperature Unit Codes Table
1 - 4	Measured Temperature	IEEE 754	MSB in byte #1

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Selection
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error

7	In Write Protect Mode
8	Undefined
9	Calibration Value Out of Range
10 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.102 COMMAND #248: PERFORM TEMPERATURE SLOPE CAL (NON-PUBLIC)

This command, along with command #247, is used to calibrate the temperature RTD. When this command is issued, the temperature value is read and the temperature slope is changed so that the calculated temperature is equivalent to the entered temperature. Command #247 should be issued to set the offset of the temperature correction before this command is issued.

The Password is compared with the Final Assembly Number. When they match, the command will be executed. When they do not match, the Command Not Implemented Response Code will be returned. No other Response Code is returned until after the Password has matched.

Command #48, Read Additional Transmitter Status, may be issued to monitor the status of the calibration. Response Data Byte #2, Bit #0, Calibration Failure, will be set if the calibration was unsuccessful. Response Data Byte #2, Bit #6, Calibration in Progress, will be set during the calibration and cleared upon completion.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0 - 2	Password	24-bit unsigned integer	MSB in byte #0
3	Measured Temperature Units Code	8-bit unsigned integer	
4 - 7	Measured Temperature	IEEE 754	MSB in byte #4

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Measured Temperature Units Code	8-bit unsigned integer	Refer to Transmitter Variable #1 Temperature Unit Codes Table
1 - 4	Measured Temperature	IEEE 754	MSB in byte #1

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1	Undefined
2	Invalid Selection
3 - 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode

8	Undefined
9	Calibration Value Out of Range
10 - 15	Undefined
16	Access Restricted
17 - 127	Undefined

8.103 COMMAND #250: READ CONCENTRATION MEASUREMENT CURVE MATRIX

Read 1 column of the specified Concentration Measurement Curve matrix. In order to reduce the number of bytes needed to transmit the Concentration Measurement matrix data via HART, all of the matrix data is indexed into columns of 6 floating point values. The data in this table is transmitted one column at a time.

	Data Index 0	Data Index 1	Data Index 2	Data Index 3	Data Index 4
Curve Data 0	X	Spec Conc.0	DensAtConc.0	Templso0	DensAtTemplso0
Curve Data 1	Concentration[0]	Spec Conc.1	DensAtConc.1	Templso1	DensAtTemplso1
Curve Data 2	Concentration[1]	Spec Conc.2	DensAtConc.2	Templso2	DensAtTemplso2
Curve Data 3	Concentration[2]	Spec Conc.3	DensAtConc.3	Templso3	DensAtTemplso3
Curve Data 4	Concentration[3]	Spec Conc.4	DensAtConc.4	Templso4	DensAtTemplso4
Curve Data 5	Concentration[4]	Spec Conc.5	DensAtConc.5	Templso5	DensAtTemplso5

Data Index 5	Data Index 6	Data Index 7	Data Index 8
DensAtTemplso6	DensAtTemplso12	DensAtTemplso18	DensAtTemplso24
DensAtTemplso7	DensAtTemplso13	DensAtTemplso19	DensAtTemplso25
DensAtTemplso8	DensAtTemplso14	DensAtTemplso20	DensAtTemplso26
DensAtTemplso9	DensAtTemplso15	DensAtTemplso21	DensAtTemplso27
DensAtTemplso10	DensAtTemplso16	DensAtTemplso22	DensAtTemplso28
DensAtTemplso11	DensAtTemplso17	DensAtTemplso23	DensAtTemplso29

A single column of this data can be read/written using commands #250 and #251. These commands require the index of the CM curve and the index of the column. In order to write the entire matrix, these commands must be called 9 times, once for every column.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Curve Index	8-bit unsigned integer	Index of CM Curve to configure
1	Data Index	8-bit unsigned integer	Index of CM data column [0- 8]

RESPONSE DATA BYTES

DATA	DESCRIPTION	DATA TYPE	NOTES
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BYTE			
0	Curve Index	8-bit unsigned integer	Index of CM Curve to configure
1	Data Index	8-bit unsigned integer	Index of CM data column [0- 8]
2 – 5	Curve Data 0	Float, IEEE 754	Refer to command description
6 – 9	Curve Data 1	Float, IEEE 754	Refer to command description
10 – 13	Curve Data 2	Float, IEEE 754	Refer to command description
14- 17	Curve Data 3	Float, IEEE 754	Refer to command description
18 – 21	Curve Data 4	Float, IEEE 754	Refer to command description
22 – 25	Curve Data 5	Float, IEEE 754	Refer to command description

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 – 5	Undefined
6	Transmitter-Specific Command Error
7 – 8	Undefined
9	Invalid Curve Index
10	Invalid Data Index
11 – 15	Undefined
16	Access Restricted
17 – 127	Undefined

8.104 COMMAND #251: WRITE CONCENTRATION MEASUREMENT CURVE MATRIX

Write 1 column of the specified Concentration Measurement Curve matrix. For additional information about the Concentration Measurement Matrix Data Format, refer to command #250.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Curve Index	8-bit unsigned integer	Index of CM Curve to configure
1	Data Index	8-bit unsigned integer	Index of CM data column [0- 8]
2 – 5	Curve Data 0	Float, IEEE 754	Refer to command description
6 – 9	Curve Data 1	Float, IEEE 754	Refer to command description
10 – 13	Curve Data 2	Float, IEEE 754	Refer to command description
14- 17	Curve Data 3	Float, IEEE 754	Refer to command description
18 – 21	Curve Data 4	Float, IEEE 754	Refer to command description
22 – 25	Curve Data 5	Float, IEEE 754	Refer to command description

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 – 4	Undefined
5	Too Few Data Bytes Received
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Invalid Curve Index
10	Invalid Data Index
11 – 15	Undefined
16	Access Restricted
17 – 127	Undefined

8.105 COMMAND #252: READ MULTI-TRANSACTION COMMAND

Read the specified transaction command.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Transaction Command Number	8-bit unsigned integer	Number of the transaction command to be used.
1- X	Transaction Command Data		Refer to transaction command specifications.

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Transaction Command Number	8-bit unsigned integer	Number of the transaction command to be used.
1- X	Transaction Command Data		Refer to transaction command specifications.

COMMAND-SPECIFIC RESPONSE CODES

REFER TO TRANSACTION COMMAND SPECIFICATIONS

8.106 COMMAND #253: WRITE MULTI-TRANSACTION COMMAND

Write the specified transaction command.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Transaction Command Number	8-bit unsigned integer	Number of the transaction command to be used.
1- X	Transaction Command Data		Refer to transaction command specifications.

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Transaction Command Number	8-bit unsigned integer	Number of the transaction command to be used.
1- X	Transaction Command Data		Refer to transaction command specifications.

COMMAND-SPECIFIC RESPONSE CODES

REFER TO TRANSACTION COMMAND SPECIFICATIONS

9. TRANSMITTER-SPECIFIC TRANSACTION COMMANDS

The commands described in this section are accessible only through the use of commands #252 and #253 (Read/Write Multi-Transaction Command). All read transactions use command #252 and all write transactions use command #253. Since there are separate commands for read and write, most read/write command pairs use the same transaction number.

9.1 TRANSACTION COMMAND #252-0: READ CONCENTRATION MEASUREMENT MODE

This command reads the configured Concentration Measurement mode.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Transaction Command Number	8-bit unsigned integer	0x00 – Transaction Command #0

RESPONSE DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Transaction Command Number	8-bit unsigned integer	0x00 – Transaction Command #0
1	Concentration Measurement Mode	8-bit unsigned integer	Refer to Concentration Measurement Mode Codes table

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 – 5	Undefined
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8 – 15	Undefined
16	Access Restricted
17 – 127	Undefined

9.2 TRANSACTION COMMAND #253-0: WRITE CONCENTRATION MEASUREMENT MODE

This command writes a new Concentration Measurement mode.

REQUEST DATA BYTES

DATA BYTE	DESCRIPTION	DATA TYPE	NOTES
0	Transaction Command Number	8-bit unsigned integer	0x00 – Transaction Command #0
1	Concentration Measurement Mode	8-bit unsigned integer	Refer to Concentration Measurement Mode Codes table

RESPONSE DATA BYTES

SAME AS REQUEST DATA

COMMAND-SPECIFIC RESPONSE CODES

0	No Command-Specific Errors
1 – 5	Undefined
6	Transmitter-Specific Command Error
7	In Write Protect Mode
8	Undefined
9	Invalid Concentration Measurement Mode Code
10 – 15	Undefined
16	Access Restricted
17 – 127	Undefined

10. TRANSMITTER-SPECIFIC TABLES

Refer to the Common Tables Document for all references in this section to 'Subset of Table'.

10.1 TRANSMITTER VARIABLE #0 / MASS FLOW RATE UNIT CODES

Subset of Table II; Unit Codes

70	grams / second
71	grams / minute
72	grams / hour
73	kilograms / second
74	kilograms / minute
75	kilograms / hour
76	kilograms / day
77	metric tons / minute
78	metric tons / hour
79	metric tons / day
80	pounds / second
81	pounds / minute
82	pounds / hour
83	pounds / day
84	short tons (2000 pounds) / minute
85	short tons (2000 pounds) / hour
86	short tons (2000 pounds) / day
87	Long tons (2240 pounds) / hour
88	Long tons (2240 pounds) / day
253	"Special"

10.2 TRANSMITTER VARIABLE #1 / TEMPERATURE UNIT CODES

Subset of Table II; Unit Codes

32	Degrees Celsius
33	Degrees Fahrenheit
34	Degrees Rankine
35	Kelvin

10.3 TRANSMITTER VARIABLE #2 / MASS TOTALIZER UNIT CODES

Subset of Table II; Unit Codes

60	grams
61	kilograms
62	metric tons
63	pounds
64	short tons (2,000 pounds)
65	Long tons (2,240 pounds)
241	"Special Mass Total"

10.4 TRANSMITTER VARIABLE #3 / DENSITY UNIT CODES

Subset of Table II; Unit Codes

90	specific gravity units
91	grams / cubic centimeter
92	kilograms / cubic meter
93	pounds / gallon
94	pounds / cubic foot
95	grams / millileter
96	kilograms / liter
97	grams / liter
98	pounds / cubic inch
99	short tons / cubic yard
102	Degrees Baume (heavy)
103	Degrees Baume (light)
104	degrees API

10.5 TRANSMITTER VARIABLE #4 / MASS INVENTORY UNIT CODES

Subset of Table II; Unit Codes

60	grams
61	kilograms
62	metric tons
63	pounds
64	short tons (2,000 pounds)
65	Long tons (2,240 pounds)
253	"Special"

10.6 TRANSMITTER VARIABLE #5 / VOLUME FLOW RATE UNIT CODES

Subset of Table II; Unit Codes

28	cubic meters / second
131	cubic meters / minute
19	cubic meters / hour
29	cubic meters / day
24	liters / second
17	liters / minute
138	liter / hour
26	cubic feet / second
15	cubic feet / minute
130	cubic feet / hour
27	cubic feet / day
22	gallons / second
16	gallons / minute
136	gallons / hour
235	gallons / day
137	imperial gallons / second
18	imperial gallons / minute
30	imperial gallons / hour
31	imperial gallons /day
132	barrels / second
133	barrels / minute
134	barrels / hour
135	barrels / day
23	Million gallons / day
25	Million liters / day
170	Beer bbl/sec
171	Beer bbl/min
172	Beer bbl/hour
173	Beer bbl/day
183	Normal cubic meter per sec
182	Normal cubic meter per min
121	Normal cubic meter per hour
181	Normal cubic meter per day
190	Standard cubic meter per sec
189	Standard cubic meter per minute
188	Standard cubic meter per hour
187	Standard cubic meter per day
176	Normal liter per sec
175	Normal liter per day
122	Normal liter per hour
174	Normal liter per day
180	Standard liter per sec
179	Standard liter per min
178	Standard liter per hour
177	Standard liter per day
186	Standard cubic feet per sec
123	Standard cubic feet per minute
185	Standard cubic feet per hour

184	Standard cubic feet per day
253	"Special"

10.7 TRANSMITTER VARIABLE #6 / VOLUME TOTALIZER UNIT CODES

Subset of Table II; Unit Codes

40	gallons
41	liters
42	imperial gallons
43	cubic meters
46	barrels
112	cubic feet
170	Beer bbl
166	Normal cubic meter
167	Normal liter
168	Standard cubic feet
171	Standard liter
172	Standard cubic meter
253	"Special"

10.8 TRANSMITTER VARIABLE #7 / VOLUME INVENTORY UNIT CODES

Subset of Table II; Unit Codes

40	gallons
41	liters
42	imperial gallons
43	cubic meters
46	barrels
112	cubic feet
170	Beer bbl
166	Normal cubic meter
167	Normal liter
168	Standard cubic feet
171	Standard liter
172	Standard cubic meter
253	"Special"

10.9 TRANSMITTER VARIABLE #53 / PRESSURE UNIT CODES

Subset of Table II; Unit Codes

1	inches H2O @ 68 degrees Fahrenheit
2	inches Hg @ 0 degrees Celsius
3	feet H2O @ 68 degrees Fahrenheit
4	millimeters H2O @ 68 degrees Fahrenheit
5	millimeters Hg @ 0 degrees Celsius
6	pounds / square inch
7	bars
8	millibars
9	grams / square centimeter
10	kilograms / square centimeter
11	pascals
12	kilopascals
13	torr @ 0 degrees Celsius
14	atmospheres

10.10 TRANSMITTER VARIABLE #32 / CONCENTRATION UNIT CODES

Subset of Table II; Unit Codes

100	Degrees Twaddell
101	Degrees Brix
105	Percent solids per weight (%mass)
106	Percent solids per volume (%volume)
107	Degrees Balling
108	Proof Per volume
109	Proof Per mass
160	Percent Plato
255	Special

10.11 TRANSMITTER VARIABLE CODES

0	Mass Flow Rate
1	Temperature
2	Mass Totalizer
3	Density
4	Mass Inventory Totalizer
5	Line (Gross) Volume Flow Rate
6	Line (Gross) Volume Totalizer
7	Line (Gross) Volume Inventory Totalizer
8 - 9	Undefined
10	Event 1
11	Event 2
12 - 14	Undefined
15	API: Temp Corrected Density
16	API: Temp Corrected (Standard) Volume Flow
17	API: Temp Corrected (Standard) Volume Total
18	API: Temp Corrected (Standard) Volume Inventory
19	API: Batch Weighted Average Corrected Density
20	API: Batch Weighted Average Temperature

21	Concentration Measurement: Density At Reference
22	Concentration Measurement: Density (Fixed SG Units)
23	Concentration Measurement: Standard Volume Flow Rate
24	Concentration Measurement: Standard Volume Total
25	Concentration Measurement: Standard Volume Inventory
26	Concentration Measurement: Net Mass Flow Rate
27	Concentration Measurement: Net Mass Total
28	Concentration Measurement: Net Mass Inventory
29	Concentration Measurement: Net Volume Flow Rate
30	Concentration Measurement: Net Volume Total
31	Concentration Measurement: Net Volume Inventory
32	Concentration Measurement: Concentration
33	API: CTL
34 – 45	Undefined
46	Tube Frequency
47	Drive Gain
48	Meter Temperature (T-Series)
49	LPO Amplitude
50	RPO Amplitude
51	Board Temperature
52	Input Voltage
53	External Pressure
54	Reserved
55	External Temperature
56	Concentration Measurement: Baume
62	Gas Standard Volume Flow
63	Gas Standard Volume Total
64	Gas Standard Volume Inventory
68	Flow Verification Zero
69	Live Zero
70 - 90	Reserved
91 – 249	Undefined
250	Reserved
251	Reserved
252	Reserved
253	Reserved
254	Reserved
255	Reserved

10.12 FLANGE TYPE CODES

0	ANSI 150
1	ANSI 300
2	ANSI 600
3	Undefined
4	Undefined
5	PN 40
6	Undefined
7	JIS 10K
8	JIS 20K

9	ANSI 900
10	Sanitary Clamp Fitting
11	Union
12	PN 100
...	...
249	Undefined
250	Reserved
251	"None"
252	"Unknown"
253	"Special"
254	Reserved
255	Reserved

10.13 LINER MATERIAL CODES

Subset of Table IV; Material Codes

10	PTFE (Teflon [®])
11	Halar
16	Tefzel
251	"None"
252	"Unknown"
253	"Special"

10.14 SENSOR MATERIAL CODES¹

Subset of Table IV; Material Codes

3	Hastelloy C TM
4	Monel
5	Tantalum
6	Titanium
19	316L Stainless Steel
23	Inconel
252	"Unknown"
253	"Special"

Teflon is a registered trademark of E.I. DuPont De Nemours Company.

Hastelloy C is a trademark of Cabot Corporation¹

Inconel is a registered trademark of International Nickel Company.

10.15 BASE VOLUME FLOW UNIT CODES

Subset of Table II; Unit Codes

40	gallons
41	liters
42	imperial gallons
43	cubic meters
46	barrels
112	cubic feet
170	Beer bbl
166	Normal cubic meter
167	Normal liter
168	Standard cubic feet
171	Standard liter
172	Standard cubic meter

10.16 BASE MASS FLOW UNIT CODES

Subset of Table II; Unit Codes

60	grams
61	kilograms
62	metric tons
63	pounds
64	short tons (2,000 pounds)
65	long tons (2,240 pounds)

10.17 BASE TIME UNIT CODES

Subset of Table II; Unit Codes

50	minutes
51	seconds
52	hours
53	days

10.18 FLOW DIRECTION CONFIGURATION CODES

0	Forward
1	Reverse
2	Bi-Directional
3	Absolute Value

4	Negate/Forward Only
5	Negate/Bi-Directional
6 - 249	Undefined
250 - 255	Reserved

10.19 TOTALIZER CONTROL CODES

0	Undefined
1	Start All Totalizers
2	Stop All Totalizers
3	Undefined
4	Reset All Totalizers
5	Reserved
6	Reset API Reference (Standard) Volume Total
7	Undefined
8	Reset Mass Total Only
9	Reset ED Reference (Corrected) Volume Total
10	Reset ED Net Mass Total
11	Reset ED Net Volume Total
12	Reset Gas Standard Volume Total
13	Reset Mass Inventory Only
14	Reset Volume Inventory Only
15	Reset API Reference (Standard) Volume Inventory Only
16	Reset Line Volume Total Only
17	Reset ED Reference (Corrected) Volume Inventory Only
18	Reset ED Net Mass Inventory Only
19	Reset ED Net Volume Inventory Only
20	Reset Gas Standard Volume Inventory Only
21 - 249	Undefined
250 - 255	Reserved

10.20 CUTOFF TYPE CODES

0	Analog Channel #1 (Primary Variable)
1	Internal Mass Flow (TV0)
2	Internal Volume Flow (TV5)
3	Undefined
...	...
249	Undefined
250	Reserved
251	Reserved
252	Reserved
253	Reserved
254	Reserved
255	Reserved

10.21 ANALOG OUTPUT FAULT CODES

0	Output Upscale value
1	Output Downscale value
2	Reserved
3	Output Internal Zero Value
4	None
5 - 249	Undefined
250 - 255	Reserved

10.22 OUTPUT TYPE CODES

0	Milliampere (Primary)
1	Frequency
2	Digital Communication
3	Reserved
4	Discrete Output
5	Reserved
6	None

10.23 ANALOG OUTPUT NUMBER CODES

Subset of Table XV; Analog Output Number Codes

1	Analog Output #1 / Primary Variable
---	-------------------------------------

10.24 FREQUENCY OUTPUT SCALING METHOD CODES

0	Frequency = Flow
1	Pulses/Unit
2	Units/Pulse

10.25 OPTION CODES

0	Disabled
1	Enabled

10.26 DIGITAL COMMUNICATIONS PROTOCOL

0	None
1	HART
2	Modbus RTU
3	Modbus ASCII
4 – 255	Undefined

10.27 DIGITAL COMMUNICATIONS BAUD RATE

0	1200
1	2400
2	4800
3	9600
4	19,200
5	38,400
6 – 255	Undefined

10.28 DIGITAL COMMUNICATIONS PARITY

0	None
1	Odd
2	Even
3 – 255	Undefined

10.29 OUTPUT OPTION BOARDS

0	None
1	Analog I/O (mA/FO/RS485)
2	Foundation Fieldbus/Profibus-PA (H1)
3	IS Output
4	2700 Config Input/Output
5	2500 Config Input/Output
6	3000 Series
7 - 255	Undefined

10.30 EVENT NUMBER CODES

0	Event #1
1	Event #2
2 - 255	Undefined

10.31 EVENT TYPE CODES

1	High Event
2	Low Event
3 - 255	Undefined

10.32 EVENT VARIABLE CODES

0	Mass Flow Rate
1	Temperature
2	Mass Totalizer
3	Density
4	Mass Inventory Totalizer
5	Line (Gross) Volume Flow Rate
6	Line (Gross) Volume Totalizer
7	Line (Gross) Volume Inventory Totalizer
15	API: Temp Corrected Density
16	API: Temp Corrected (Standard) Volume Flow
17	API: Temp Corrected (Standard) Volume Total
18	API: Temp Corrected (Standard) Volume Inventory
19	API: Batch Weighted Average Corrected Density
20	API: Batch Weighted Average Temperature
21	Concentration Measurement: Density At Reference
22	Concentration Measurement: Density (Fixed SG Units)
23	Concentration Measurement: Standard Volume Flow Rate
24	Concentration Measurement: Standard Volume Total
25	Concentration Measurement: Standard Volume Inventory
26	Concentration Measurement: Net Mass Flow Rate
27	Concentration Measurement: Net Mass Total
28	Concentration Measurement: Net Mass Inventory
29	Concentration Measurement: Net Volume Flow Rate
30	Concentration Measurement: Net Volume Total
31	Concentration Measurement: Net Volume Inventory
32	Concentration Measurement: Concentration
33	API: CTL
34 - 45	Undefined
46	Tube Frequency
47	Drive Gain
48	Meter Temperature (T-Series)
49	LPO Amplitude
50	RPO Amplitude
51	Board Temperature
52	Input Voltage
53	External Pressure
54	Reserved
55	External Temperature
56	Reserved
62	Gas Standard Volume Flow

63	Gas Standard Volume Total
64	Gas Standard Volume Inventory
69	Live Zero
70 – 249	Undefined
250 - 255	Reserved

10.33 PROCESS COMPARATOR INDEX CODES

0	Discrete Event #1
1	Discrete Event #2
2	Discrete Event #3
3	Discrete Event #4
4	Discrete Event #5
5 - 255	Undefined

10.34 PROCESS COMPARATOR ACTION CODES

0	Greater than Setpoint A
1	Less than Setpoint A
2	In Range (Setpoint A < Variable < Setpoint B)
3	Out of Range (Setpoint A > Variable or Setpoint B < Variable)
4 - 255	Undefined

10.35 DIGITAL COMMUNICATION OUTPUT FAULT CODES

0	Upscale (Hold at value greater than Upper Sensor Limit, stop totalizing)
1	Downscale (Hold at value less than Lower Sensor Limit, stop totalizing)
2	Internal Zero (Flow, Density & Temperature PVs go to 0)
3	NaN (Report IEEE NAN & stops totalizing)
4	Flow goes to Zero, Other PVs are Unaffected
5	None (Process variables report as measured)
6 - 255	Undefined

Note: Applicable to Modbus protocol on RS485 only

10.36 DENSITY POINT CODES

1	Point 1 (typically air)
2	Point 2 (typically water)
3	Point 3 (T-series only)
4	Point 4 (T-series only)

10.37 SENSOR TYPE CODES

0	Curved Tube Sensors (CMF, D, Basis, R-Series)
1	Straight Tube Sensors (T-Series)

10.38 DISPLAY VARIABLE CODES

0	Mass Flow Rate
1	Temperature
2	Mass Totalizer
3	Density
4	Mass Inventory Totalizer
5	Line (Gross) Volume Flow Rate
6	Line (Gross) Volume Totalizer
7	Line (Gross) Volume Inventory Totalizer
8 - 14	Undefined
15	API: Temp Corrected Density
16	API: Temp Corrected (Standard) Volume Flow
17	API: Temp Corrected (Standard) Volume Total
18	API: Temp Corrected (Standard) Volume Inventory
19	API: Batch Weighted Average Corrected Density
20	API: Batch Weighted Average Temperature
21	Concentration Measurement: Density At Reference
22	Concentration Measurement: Density (Fixed SG Units)
23	Concentration Measurement: Standard Volume Flow Rate
24	Concentration Measurement: Standard Volume Total
25	Concentration Measurement: Standard Volume Inventory
26	Concentration Measurement: Net Mass Flow Rate
27	Concentration Measurement: Net Mass Total
28	Concentration Measurement: Net Mass Inventory
29	Concentration Measurement: Net Volume Flow Rate
30	Concentration Measurement: Net Volume Total
31	Concentration Measurement: Net Volume Inventory
32	Concentration Measurement: Concentration
33	API: CTL
34 - 45	Undefined
46	Tube Frequency
47	Drive Gain
48	Meter Temperature (T-Series)
49	LPO Amplitude
50	RPO Amplitude
51	Board Temperature
52	Input Voltage
53	External Pressure
54	Reserved
55	External Temperature
56	Reserved
62	Gas Standard Volume Flow
63	Gas Standard Volume Total
64	Gas Standard Volume Inventory
68	Flow Verification Zero
69	Live Zero
70 - 249	Undefined
250 - 255	Reserved

10.39 POLL CONTROL CODES

0	Do Not Poll
1	Poll Transmitter: HART® Primary
2	Poll Transmitter: HART® Secondary
3 - 249	Undefined
250 - 255	Reserved

10.40 TRANSMITTER VARIABLE POLLING CODES

0 - 52	Undefined
53	Pressure
54	Undefined
55	Temperature
56 - 249	Undefined
250 - 255	Reserved

10.41 DISCRETE OUTPUT FUNCTION

102	Forward/Reverse Indication
103	Calibration In Progress
104	Fault Condition Present
10	Event 1 Active
11	Event 2 Active
100	Event 1 or Event 2 Active
101	Flow Switch

10.42 DISCRETE OUTPUT INDEX CODES

0	Discrete Output #1
1	Reserved

10.43 DISCRETE OUTPUT FAULT CODES

0	Upscale (high)
1	Downscale (low)
2-3	Reserved
4	None
5 - 255	Reserved

10.44 UPDATE RATE CODES

0	20 Hertz (Normal)
1	Reserved
2	100 Hertz (Fast)

10.45 100HZ VARIABLE CODES

0	Mass Flow Rate
1	Temperature
3	Density
5	Line (Gross) Volume Flow Rate

10	Event 1
11	Event 2

10.46 CTL CODES (API)

0 - 16	Undefined
17	Table 5A
18	Table 5B
19	Table 5D
20 - 35	Undefined
36	Table 6C
37 - 48	Undefined
49	Table 23A
50	Table 23B
51	Table 23D
52 - 67	Table 5A
68	Table 24C
69 - 80	Undefined
81	Table 53A
82	Table 53B
83	Table 53D
84 - 99	Undefined
100	Table 54C
101 - 255	Undefined

10.47 DISCRETE STATE CODES

0	Off
1	On
2 - 254	Undefined
255	Unfix Discrete Output

10.48 POLARITY CODES

0	Active Low
1	Active High

10.49 CONCENTRATION MEASUREMENT CURVE NUMBER CODES

0	Concentration Measurement Curve #1
1	Concentration Measurement Curve #2
2	Concentration Measurement Curve #3
3	Concentration Measurement Curve #4
4	Concentration Measurement Curve #5
5	Concentration Measurement Curve #6
6 - 255	Undefined

10.50 CONCENTRATION MEASUREMENT CURVE FIT RESULTS CODES

0	Good
1	Poor
2	Failed

3	Empty
4 – 255	Undefined

10.51 CONCENTRATION MEASUREMENT MODE CODES

0	Standard
1	DensAtRef
2	SG
3	MassConcDens
4	MassConcSG
5	VolConcDens
6	VolConcSG
7	ConcDens
8	ConcSG
9 – 255	Undefined

10.52 FEATURE KEY CODES

Bit #0	Custody Transfer
Bit #1	Flow Only Device
Bit #2	Density Only Device
Bit #3	API
Bit #4	Concentration Measurement
Bit #5	Batcher
Bit#6 – Bit#15	Undefined

10.53 ALARM CODES

0	A000: Undefined
1	A001: EEPROM Checksum Error (Core Processor)
2	A002: RAM Test Error (Core Processor)
3	A003: Sensor Not Responding (No Tube Interrupt)
4	A004: Temperature Sensor Out-of-Range
5	A005: Input Over-Range
6	A006: Transmitter Not Characterized
7	A007: Real-Time Interrupt Failure
8	A008: Density Outside Limits
9	A009: Transmitter Initializing/Warming Up
10	A010: Calibration Failure
11	A011: Excess Calibration Correction, Zero too Low
12	A012: Excess Calibration Correction, Zero too High
13	A013: Process too Noisy to Perform Auto Zero
14	A014: Transmitter Failed
15	A015: MA Readback Error
16	A016: "Line RTD" Temperature Out-Of-Range
17	A017: "Meter RTD" Temperature Out-Of-Range
18	A018: (E)EPROM Checksum Error (Xmtr)
19	A019: RAM Test Error (Xmtr)
20	A020: Calibration Factors Unentered
21	A021: Unrecognized/Unentered Sensor Type
22	A022: (E)EPROM Config. DB Corrupt (Core Processor)

23	A023: (E)EPROM Totals Corrupt (Core Processor)
24	A024: (E)EPROM Program Corrupt (Core Processor)
25	A025: Protected Boot Sector Fault
26	A026: Sensor/Xmtr Communication Error
27	A027: Security Breach
28	A028: Sensor/Xmtr Communication Failure
29	A029: Internal Communication failure
30	A030: Hardware/software incompatible
31	A031: Undefined
32	A032: Meter Verification Fault Alarm
33	A033: Sensor OK/Tubes Stopped by Process
34 - 39	A028 – A039: Undefined
40	A100: Primary mA Output Saturated
41	A101: Primary mA Output Fixed
42	A102: Drive Overrange/Partially Full Tube
43	A103: Data Loss Possible
44	A104: Calibration-In-Progress
45	A105: Slug Flow
46	A106: Burst Mode Enabled
47	A107: Power Reset Occurred
48	A108: Event #1 Triggered
49	A109: Event #2 Triggered
50	A110: Frequency Output Saturated
51	A111: Frequency Output Fixed
52	A112: Xmtr Software Upgrade Recommended
53	A113: Secondary mA Output Saturated
54	A114: Secondary mA Output Fixed
55	A115: External Input Error
56	A116: API Temperature Out-of-Limits
57	A117: API Density Out-of-Limits
58	A118: Discrete Output 1 Fixed
59	A119: Discrete Output 2 Fixed
60	A120: ED: Unable to fit curve data
61	A121: ED: Extrapolation alarm
62	A122: Discrete Output 3 Fixed
63	A123: Discrete Output 4 Fixed
64	A124: Frequency Input Saturated
65	A125: Batcher: Timeout
66	A126: Batcher: Overrun
67	A127: Batcher: Start without reset
68	A128: Batcher: Start not OK
69	A129: Undefined
70	A130: Printer: Paper Out
71	A131: Meter Verification Info Alarm
72	A132: Simulation Mode Active
73 – 79	A133 – A139: Undefined
80 – 255	Reserved

10.54 ALARM SEVERITY CODES

0	Ignore
1	Information
2	Fault

3 – 255 Undefined

10.55 DIAGNOSTIC ACTION CODES

0	None
1	Reset Alarm History
2	Acknowledge All Alarms
3	Reset Power On Time
4	Restore Factory Configuration
5	Reserved
6	Reserved
7	Reserved
8	Reset All Concentration Measurement Curve Information
9	Enable Write Protect
10	Disable Write Protect
11	Restore Factory Zero
12 – 255	Undefined

10.56 MODBUS DATA TYPES

0	Reserved
1	Coil
2	Unsigned 16
3	Unsigned 32
4	Floating Point
5 – 255	Undefined

10.57 MODBUS EXCEPTION CODES

0	No Exception
1	Illegal Function
2	Illegal Data Address
3	Illegal Data Value
4	Slave Device Failure
5	Acknowledge
6	Slave Device Busy
7	Negative Acknowledge
8	Memory Parity Error
9 – 255	Undefined

10.58 SIMULATION MODES

0	Reserved
1	Fixed Value
2	Triangular Wave
3	Sine Wave
4 – 255	Undefined

10.59 STATUS WORD 419

Bit #0 – Core EEPROM Checksum Error (Config, Powerdown, Program)
Bit #1 – Core RAM Test Error
Bit #2 – Real-Time Interrupt Failure
Bit #3 – Sensor Failure

-
- Bit #4 – Temperature Sensor Out-of-Range
 - Bit #5 – Calibration Failure (Autozero, Density, Temperature)
 - Bit #6 – Other Failure
 - Bit #7 – Transmitter Initializing/Warming Up
 - Bit #8 – PV Out-Of-Limits
 - Bit #9 – Non-PV Out-Of-Limits
 - Bit #10 – Simulation Mode Active
 - Bit #11 – Undefined
 - Bit #12 – Watchdog Error
 - Bit #13 – Cold Start (HART bit)
 - Bit #14 – Transmitter Configuration Changed (HART bit)
 - Bit #15 – Fault (Failure has occurred which affects accuracy)

10.60 STATUS WORD 420

- Bit #0 – Primary mA Output Saturated
- Bit #1 – Secondary mA Output Saturated
- Bit #2 – Primary mA Output Fixed
- Bit #3 – Secondary mA Output Fixed
- Bit #4 – Density Outside Limits
- Bit #5 – Drive Overrange/Partially Full Tube
- Bit #6 – PIC/Daughterboard Communication Failure
- Bit #7 – External Input Failure
- Bit #8 – Core EEPROM Checksum Error (Config, Powerdown, Program)
- Bit #9 – Core RAM Error
- Bit #10 – Sensor Not Responding (No Tube Interrupt)
- Bit #11 – Temperature Sensor Out-of-Range
- Bit #12 – Input Over-Range
- Bit #13 – Frequency Output Saturated
- Bit #14 – Transmitter Not Characterized (Flocal or Sensor Type)
- Bit #15 – Real-Time Interrupt Failure

10.61 STATUS WORD 421

- Bit #0 – Burst Mode Enabled
- Bit #1 – Power Reset Occurred
- Bit #2 – Transmitter Initializing/Warming Up (Low Power Fault)
- Bit #3 – Sensor/Xmtr Communication Failure (A28)
- Bit #4 – Paper Out
- Bit #5 – Event #2 Triggered
- Bit #6 – Event #1 Triggered
- Bit #7 – Sensor/Xmtr Communication Failure (A26)
- Bit #8 – Calibration Failure (Autozero, Density, Temperature)
- Bit #9 – Excess Calibration Correction, Autozero too Low
- Bit #10 – Excess Calibration Correction, Autozero too High
- Bit #11 – Process too Noisy to Perform Auto Zero
- Bit #12 – Transmitter Failed
- Bit #13 – Data Loss Possible (Totals+Inventories Questionable)
- Bit #14 – Calibration-In-Progress (Autozero, Density, Temperature)
- Bit #15 – Slug Flow

10.62 STATUS WORD 422

- Bit #0 – API.VCF: Temperature Outside Standard Range
- Bit #1 – API.VCF: Line Density Outside Standard Range
- Bit #2 – Line RTD Temperature Out-Of-Range
- Bit #3 – Meter RTD Temperature Out-Of-Range
- Bit #4 – Flow Direction (0=Forward/Zero, 1=Reverse)
- Bit #5 – Factory Configuration Data Is Invalid
- Bit #6 – Concentration Measurement: Unable to fit curve data
- Bit #7 – Last Measured Value Override Active
- Bit #8 – Concentration Measurement Extrapolation Alarm
- Bit #9 – Cal Factors Unentered (Flocal Mandatory)
- Bit #10 – 1000/2000/3000 EEPROM Checksum Error
- Bit #11 – 1000/2000/3000 RAM Test Error
- Bit #12 - Unrecognized/Unentered Sensor Type (K1 Mandatory)
- Bit #13 – Core configuration database corrupt
- Bit #14 – Core powerdown totals corrupt
- Bit #15 – Core program corrupt

10.63 STATUS WORD 423

- Bit #0 – Core Protected Boot Sector Fault (invalid/corrupt application)
- Bit #1 – 1000/2000/3000 Software Upgrade Recommended
- Bit #2 – Frequency Output Fixed
- Bit #3 – Primary mA Readback Failure
- Bit #4 – DO1 Status (0=OFF, 1=ON)
- Bit #5 – DO2 Status (0=OFF, 1=ON)
- Bit #6 – Dens T-Series D3 Calibration-in-Progress
- Bit #7 – Dens T-Series D4 Calibration-in-Progress
- Bit #8 – DO3 Status (0=OFF, 1=ON)
- Bit #9 – DO4 Status (0=OFF, 1=ON)
- Bit #10 – Temp Slope Calibration-in-Progress
- Bit #11 – Temp Zero Calibration-in-Progress
- Bit #12 – Dens FD Calibration-in-Progress
- Bit #13 – Dens D2 Calibration-in-Progress
- Bit #14 – Dens D1 Calibration-in-Progress
- Bit #15 – Mechanical Zero Calibration-in-Progress

10.64 STATUS WORD 424

- Bit #0 – Discrete Input 1 Status (0=OFF, 1=ON)
- Bit #1 – Discrete Input 2 Status (0=OFF, 1=ON)
- Bit #2 – Discrete Output 1 Fixed
- Bit #3 – Discrete Output 2 Fixed
- Bit #4 – Discrete Output 3 Fixed
- Bit #5 – Discrete Output 4 Fixed
- Bit #6 – Security Breach
- Bit #7 – Frequency Input Saturated
- Bit #8 – Discrete Event 1 Status
- Bit #9 – Discrete Event 2 Status
- Bit #10 – Discrete Event 3 Status
- Bit #11 – Discrete Event 4 Status
- Bit #12 – Discrete Event 5 Status

Bit #13 – Undefined
Bit #14 – Undefined
Bit #15 – Incorrect Board Type

10.65 STATUS WORD 433

Bit #0 – K1/FCF Combination Unrecognized
Bit #1 – Warming Up
Bit #2 – Low Power
Bit #3 – Sensor OK/Tubes Stopped by Process
Bit #4 – Meter Verification/Outputs in fault (A32)
Bit #5 – Meter Verification/Outputs at last value (A131)
Bit #6 – Undefined
Bit #7 – Undefined
Bit #8 – Undefined
Bit #9 – Undefined
Bit #10 – Undefined
Bit #11 – Undefined
Bit #12 – Undefined
Bit #13 – Undefined
Bit #14 – Undefined
Bit #15 – Undefined

10.66 STATUS WORD 434

Bit #0 – Bit #15 – Undefined

10.67 CUSTODY TRANSFER TOTALIZER RESET OPTION CODES

0	Not reset-able from display or digital communications
1	Reset-able from display only
2	Reset-able from digital communications only
3	Reset-able from display and digital communications
4 – 255	Undefined

10.68 DISCRETE INPUT ACTION CODES

0	None
1	Start Sensor Zero
2	Reset Mass Total
3	Reset Volume Total
4	Reset Corrected Volume Total
5	Reset all Totals
6	Reset ED Standard Volume Total
7	Reset ED Net Mass Total
8	Reset ED Net Volume Total
9	Start/Stop all Totals
10	Reserved
11	Reserved
12	Reserved
13	Reserved
14	Reserved

15	Reserved
16	Reserved
17	Reserved
18	Concentration Measurement: Increment Current Curve
19	Print Screen
20	Print Custody Transfer Screen
21	Reset Gas Standard Volume Total
22	Undefined
23	Start Meter Verification
24 - 255	Undefined

10.69 DISCRETE INPUT ASSIGNMENT CODES

57	Discrete Event 1
58	Discrete Event 2
59	Discrete Event 3
60	Discrete Event 4
61	Discrete Event 5
98	Reserved
99	Reserved
105	Reserved
106	Reserved
107	Reserved
108	Reserved
109	Reserved
110	Reserved
111	Reserved
251	None

10.70 TRIGGER INDEX CODES

0	Factory Zero Trigger
1	First Zero Trigger
2	Last Zero Trigger
3	User Trigger 1
4	User Trigger 2
5	User Trigger 3
6	User Trigger 4
7	User Trigger 5
8 - 255	Undefined

10.71 TRIGGER OPERATOR CODES

0	AND Operator
1	OR Operator
2 - 255	Undefined

10.72 TRIGGER STATUS CODES

0	Insufficient Memory
1	Awaiting
2	Complete
4	In Progress
5 - 255	Undefined

10.73 TRIGGER EVENT CODES

0	Process Variable > X
1	Process Variable < X
2	Process Variable = X (Use for status word comparisons, not really useful for floats)
3	X seconds Elapsed
4	Always
5	Factory Zero Commanded
6	First Zero Completed After Factory Zero
7	Any Zero Completed
8	Trigger X Complete
9	Transmitter Fault Condition
10 – 255	Undefined

10.74 TRIGGER PROCESS VARIABLE CODES

0	Mass Flow Rate
1	Temperature
2	Mass Totalizer
3	Density
4	Mass Inventory Totalizer
5	Line (Gross) Volume Flow Rate
6	Line (Gross) Volume Totalizer
7	Line (Gross) Volume Inventory Totalizer
8 – 11	Reserved
12	Status 1 (Status Words 419 and 420)
13	Status 2 (Status Words 421 and 422)
14	Status 3 (Status Words 423 and 424)
15 – 45	Reserved
46	Raw Tube Frequency
47	Drive Gain
48	Meter Temperature (T-Series)
49	Left Pickoff Amplitude
50	Right Pickoff Amplitude
51	Board Temperature
52	Input Voltage
53	External Pressure
54	Mechanical Zero
55	External Temperature
56	Reserved
57	Discrete Event 1
58	Discrete Event 2
59	Discrete Event 3
60	Discrete Event 4
61	Discrete Event 5
62	Gas Standard Volume Flow
63	Gas Standard Volume Total
64	Gas Standard Volume Inventory
65	Status 4 (Status Words 433 and 434)
66-68	Undefined
69	Live Zero
70 – 71	Undefined
72	Fault Alarm

73 – 96	Undefined
97	Transient Bubble Remediation
98	Discrete Input 1
99-100	Reserved
101	Flow Switch Indicator
102	Forward/Reverse Indication
103	Calibration in Progress
104	Fault Condition Indication
105-112	Reserved
113	Mass Flow 5-Minute Average
114	Mass Flow 5-Minute Max
115	Mass Flow 5-Minute Min
116	Mass Flow 5-Minute Std Dev
117	Volume Flow 5-Minute Average
118	Volume Flow 5-Minute Max
119	Volume Flow 5-Minute Min
120	Volume Flow 5-Minute Std Dev
121	Line Temp 5-Minute Average
122	Line Temp 5-Minute Max
123	Line Temp 5-Minute Min
124	Line Temp 5-Minute Std Dev
125	Meter Temp 5-Minute Average
126	Meter Temp 5-Minute Max
127	Meter Temp 5-Minute Min
128	Meter Temp 5-Minute Std Dev
129	Density 5-Minute Average
130	Density 5-Minute Max
131	Density 5-Minute Min
132	Density 5-Minute Std Dev
133	Tube Frequency 5-Minute Average
134	Tube Frequency 5-Minute Max
135	Tube Frequency 5-Minute Min
136	Tube Frequency 5-Minute Std Dev
137	Drive Gain 5-Minute Average
138	Drive Gain 5-Minute Max
139	Drive Gain 5-Minute Min
140	Drive Gain 5-Minute Std Dev
141	LPO Amplitude 5-Minute Average
142	LPO Amplitude 5-Minute Max
143	LPO Amplitude 5-Minute Min
144	LPO Amplitude 5-Minute Std Dev
145	RPO Amplitude 5-Minute Average
146	RPO Amplitude 5-Minute Max
147	RPO Amplitude 5-Minute Min
148	RPO Amplitude 5-Minute Std Dev
149	Electronics Temp 5-Minute Average
150	Electronics Temp 5-Minute Max
151	Electronics Temp 5-Minute Min
152	Electronics Temp 5-Minute Std Dev
153	Power 5-Minute Average
154	Power 5-Minute Max
155	Power 5-Minute Min

156	Power 5-Minute Std Dev
157-249	Reserved
250	Reserved
251	None
252 - 255	Reserved

10.75 TRIGGER STORAGE PROCESS VARIABLE CODES

0	Mass Flow Rate
1	Temperature
2	Mass Totalizer
3	Density
4	Mass Inventory Totalizer
5	Line (Gross) Volume Flow Rate
6	Line (Gross) Volume Totalizer
7	Line (Gross) Volume Inventory Totalizer
8 – 45	Reserved
46	Raw Tube Frequency
47	Drive Gain
48	Meter Temperature (T-Series)
49	Left Pickoff Amplitude
50	Right Pickoff Amplitude
51	Board Temperature
52	Input Voltage
53	External Pressure
54	Mechanical Zero
55	External Temperature
56-61	Reserved
62	Gas Standard Volume Flow
63	Gas Standard Volume Total
64	Gas Standard Volume Inventory
65-68	Undefined
69	Live Zero
70-112	Reserved
113	Mass Flow 5-Minute Average
114	Mass Flow 5-Minute Max
115	Mass Flow 5-Minute Min
116	Mass Flow 5-Minute Std Dev
117	Volume Flow 5-Minute Average
118	Volume Flow 5-Minute Max
119	Volume Flow 5-Minute Min
120	Volume Flow 5-Minute Std Dev
121	Line Temp 5-Minute Average
122	Line Temp 5-Minute Max
123	Line Temp 5-Minute Min
124	Line Temp 5-Minute Std Dev
125	Meter Temp 5-Minute Average
126	Meter Temp 5-Minute Max
127	Meter Temp 5-Minute Min
128	Meter Temp 5-Minute Std Dev
129	Density 5-Minute Average
130	Density 5-Minute Max
131	Density 5-Minute Min

132	Density 5-Minute Std Dev
133	Tube Frequency 5-Minute Average
134	Tube Frequency 5-Minute Max
135	Tube Frequency 5-Minute Min
136	Tube Frequency 5-Minute Std Dev
137	Drive Gain 5-Minute Average
138	Drive Gain 5-Minute Max
139	Drive Gain 5-Minute Min
140	Drive Gain 5-Minute Std Dev
141	LPO Amplitude 5-Minute Average
142	LPO Amplitude 5-Minute Max
143	LPO Amplitude 5-Minute Min
144	LPO Amplitude 5-Minute Std Dev
145	RPO Amplitude 5-Minute Average
146	RPO Amplitude 5-Minute Max
147	RPO Amplitude 5-Minute Min
148	RPO Amplitude 5-Minute Std Dev
149	Electronics Temp 5-Minute Average
150	Electronics Temp 5-Minute Max
151	Electronics Temp 5-Minute Min
152	Electronics Temp 5-Minute Std Dev
153	Power 5-Minute Average
154	Power 5-Minute Max
155	Power 5-Minute Min
156	Power 5-Minute Std Dev
157-249	Reserved
250	Reserved
251	None
252 - 255	Reserved