| REV | ACTION | DRAWN | CHECKED | APPROVED | DATE |
|---|---|---|---|---|---|
| AA | L12040 | NORFLEET | SHORT | HOLLAND | 01/12/21 |
| AB | D13722 | NORFLEET | JOHNSON | LANGBEIN | 02/08/05 |
| AC | D14351 | NORFLEET | JOHNSON | BUSHNELL | 03/03/03 |
| AD | D15935 | NORFLEET | COUCH | BUSHNELL | 04/06/14 |
| AE | D16303 | COUCH | COUCH | BUSHNELL | 04/10/07 |

## APPLICATION INFORMATION FOR

# TOTALFLOW MODBUS PROTOCOL

## AND

# PRINTER / CONSOLE FOR BTU-XMTR

**TABLE OF CONTENT:**



| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PRODUCT LINE<br>TOTALFLOW® | LEVEL<br>3 | ABB | | | TOTALFLOW PRODUCTS | | | | |
| DESIGN<br>NORFLEET | DATE<br>01/12/21 | APPLICATION INFORMATION<br><br>AI – MODBUS AND PRINTER CONSOLE<br>MODBUS | | | | | | | |
| DRAWN<br>NORFLEET | 01/12/21 | | | | | | | | |
| CHECKED<br>SHORT | | | | | | | | | |
| APPROVED | | SCALE | SIZE | TYPE | DRAWING NO. | REV | SHEET | | |
| HOLLAND | | NONE | A | AI | 2100666 | AE | 1 | OF | 64 |

## I. Purpose

This paper describes the Modbus communications protocol for Totalflow Model 8000 BTU Transmitters.

## II. Modbus Description

The Modbus protocol is described in the document entitled "Modicon Modbus Protocol Reference Guide" produced by AEG Schneider Automation, Part Number PI-MBUS-300 Rev. G, 1994.

Modbus uses the master, slave communications concept. Slave devices speak only when spoken to by the master. Each slave is identified by an unsigned, one byte number ranging from 1 to 247 (inclusive). A slave must send a single response to a master's request for data.

The BTU Transmitter supports the ASCII message frame format and the RTU message frame format.

**Modbus ASCII message frame format:**

| Clear | BOF | Packet | LRC | EOF | Ready |
|---|---|---|---|---|---|
| 0xff | : | 2 x Number of bytes in Modbus packet | 8-bits | CR | LF |

Clear: This character is an extension used by Totalflow to assist in clearing the communications link of noise and to help certain hardware devices to be able to receive BOF without errors. The Clear Byte can be disabled if required.

BOF: A colon (:) character is used to indicate beginning of frame.

Packet: The packet field consists of hexadecimal ASCII characters representing the Modbus packet being sent or received. The number of characters is twice the number of bytes in the Modbus packet because each packet byte is converted into two hexadecimal ASCII characters ('0'-'9','A'-'F'.)

LRC: The error check field consists an 8 bit longitudinal redundancy check calculated over the length of the packet field before it is converted to hexadecimal ASCII. The LRC is calculated by adding together successive 8-bit bytes of the message, discarding any carries, and then two's complementing the result.

EOF/Ready: A carriage return and line feed are used to delineate end of frame.

The communications parameters for the ASCII format are fixed at 7 data bits, even parity and 1 stop bits.

**Modbus RTU Message Frame Format:**

| BOF | Packet | CRC | EOF |
|---|---|---|---|
| T1-T2-T3-T4 | Number of bytes in Modbus packet | 16-bits | T1-T2-T3-T4 |

BOF: Represents 3.5 character times of silence with a minimum of 20 milliseconds.

Packet: The packet field consists of hexadecimal binary characters representing the Modbus packet being sent or received.

CRC: The error check field consists a 16-bit cyclical redundancy check calculated over the length of the packet field before it is converted to hexadecimal ASCII. The CRC is calculated according to the procedure outlined in the

EOF/Ready: Represents 3.5 character times of silence with a minimum of 20 milliseconds.

***Note:*** *The design of the BTU Transmitter does not allow strict compliance with the timing requirements of the RTU protocol. RTU Protocol might not work with some hardware. In this case, use ASCII.*

The communications parameters for the RTU format are fixed at 8 data bits, no parity and 1-stop bits.

***Note:*** *Total message frame length cannot exceed 256 bytes.*

## III. Communications Setup

The following items can be set from the Printer/Console mode:

- Modbus Slave Address: 1-247
- BaudRate: 1200, 2400, 4800, 9600, 19200

## IV. Totalflow BTU Transmitter Modbus Implementation

Totalflow Modbus supports the following subset of the Gould (Modicon) Modbus defined functions:

| Code | Function | Description |
|---|---|---|
| 03 | Read Registers | Reads group of registers |
| 06 | Set Single Register | Sets a single register (Prom Rev AG2015644-005 or above and all 2100528 and 2100986 part numbers) |
| 08 | Diagnostics | Return Query Data – subfunction 00 only. |
| 16 | Set Multiple Registers | Set multiple registers Byte count greater than 128 may cause transmitter failure. |

Broadcast commands are not supported.

**Packet formats:**

Read Registers

| Address | Function | Register | Quantity (N) |
|---|---|---|---|
| 8-bits | 8-bits (0x03) | 16-bits | 16-bits |

Read Registers Response by BTU Transmitter

| Address | Function | Byte Count | Data |
|---|---|---|---|
| 8-bits | 8-bits (0x03) | 8-bits | N registers |

Set Multiple Registers

| Address | Function | Register | Quantity | Byte Count | Data |
|---|---|---|---|---|---|
| 8-bits | 8-bits (0x10) | 16-bits | 16-bits | 8-bits | N registers |

Set Multiple Registers Response by BTU Transmitter

| Address | Function | Register | Quantity (N) |
|---|---|---|---|
| 8-bits | 8-bits (0x10) | 16-bits | 16-bits |

Set Single Register

| Address | Function | Register | Data |
|---|---|---|---|
| 8-bits | 8-bits (0x06) | 16-bits | 16-bits |

Set Single Register Response by BTU Transmitter

| Address | Function | Register | Data |
|---|---|---|---|
| 8-bits | 8-bits (0x06) | 16-bits | 16-bits |

Address: The address field contains the slave address of the transmitter intended to receive the packet. Each transmitter must be assigned a unique address in the range of 1 to 247.

Function: The function code field contains a code that tells the transmitter what to do or what data to send. The high order bit in this field may be set by the transmitter in the response packet to indicate an error response.

Register: The register field contains the starting register number of the transmitter data item to fetch or set.

Quantity: The quantity field contains the number of consecutive registers to fetch or set. This field is not present in all packets (only read and set multiple queries).

Byte Count: The byte count field contains the number of bytes of data being transferred. This field is not present in all packets (only read response and set multiple registers).

Data: The data field contains the actual data values being transferred. This field is not present in all packets. The size and format of the data values depend on the register group being accessed. The byte order of data items is high to low (MSB first, LSB last). The word order when transmitting 32 bit data items can be modified with the xxPFLG command.

## V. Register Group Configuration

Registers are grouped by data type. The grouping is fixed. The register group assignments are:

| Base | Type | Description |
|---|---|---|
| 3001 | INTEGER | 16 Bit Integer Group |
| 5001 | LONG INTEGER | 32 Bit Long Integer Group |
| 7001 | FLOATING POINT | 32 Bit IEEE Floating Point Group |

The long integer and floating point registers can be accessed in two ways. Thirty-two (32) bit access is used to interface to the Analyzer Interface Unit (AIU) or to Daniels Modbus compatible equipment. Sixteen (16) bit access is used to interface with equipment compatible with Modicon Modbus or word swapped Modbus. These capabilities are accessed through the xxPFLG command. Cycle, Hourly, Daily or Monthly data is also available by writing xxPFLG. Stream #4 is not directly available in 16 bit modes.

## VI. Short Integer Register Group

| Register | Access | Description |
|---|---|---|
| 3001 | Read Only | Component Table #1 Component Index #1 |
| 3002 | Read Only | Component Table #1 Component Index #2 |
| 3003 | Read Only | Component Table #1 Component Index #3 |
| 3004 | Read Only | Component Table #1 Component Index #4 |
| 3005 | Read Only | Component Table #1 Component Index #5 |
| 3006 | Read Only | Component Table #1 Component Index #6 |
| 3007 | Read Only | Component Table #1 Component Index #7 |
| 3008 | Read Only | Component Table #1 Component Index #8 |
| 3009 | Read Only | Component Table #1 Component Index #9 |
| 3010 | Read Only | Component Table #1 Component Index #10 |
| 3011 | Read Only | Component Table #1 Component Index #11 |
| 3012 | Read Only | Component Table #1 Component Index #12 |
| 3013 | Read Only | Component Table #1 Component Index #13 |
| 3014 | Read Only | Component Table #1 Component Index #14 |
| 3015 | Read Only | Component Table #1 Component Index #15 |
| 3016 | Read Only | Component Table #1 Component Index #16 |
| 3017 | Read Only | Component Table #2 Component Index #1 |
| 3018 | Read Only | Component Table #2 Component Index #2 |
| 3019 | Read Only | Component Table #2 Component Index #3 |
| 3020 | Read Only | Component Table #2 Component Index #4 |
| 3021 | Read Only | Component Table #2 Component Index #5 |
| 3022 | Read Only | Component Table #2 Component Index #6 |
| 3023 | Read Only | Component Table #2 Component Index #7 |
| 3024 | Read Only | Component Table #2 Component Index #8 |
| 3025 | Read Only | Component Table #2 Component Index #9 |
| 3026 | Read Only | Component Table #2 Component Index #10 |
| 3027 | Read Only | Component Table #2 Component Index #11 |
| 3028 | Read Only | Component Table #2 Component Index #12 |
| 3029 | Read Only | Component Table #2 Component Index #13 |
| 3030 | Read Only | Component Table #2 Component Index #14 |
| 3031 | Read Only | Component Table #2 Component Index #15 |
| 3032 | Read Only | Component Table #2 Component Index #16 |

NOTE: Unless 255 is retrieved as a component index code, add 100 to get the true component index code. Then use the true component index code to find out the component represented in each area (Mole %, GPM, 24 hour average, etc.).

| Register | Access | Description |
|---|---|---|
| 3033 | Read Only | Analysis Time (in 1/30ths of 1 second) |
| 3034 | Read/Write | Current Stream |
| 3035 | Read Only | Mask of streams associated with Component Table 41 (Bit 2^(n-1) implies stream n included) |
| 3036 | Read/Write | Current Month (1-12) |
| 3037 | Read/Write | Current Day (1-31) |
| 3038 | Read/Write | Current Year (0-99) |
| 3039 | Read/Write | Current Hour (0-24) |
| 3040 | Read/Write | Current Minutes (0-59) |
| 3041 | Read Only | Cycle Start Time Month (1-12) |
| 3042 | Read Only | Cycle Start Time Day (1-31) |
| 3043 | Read Only | Cycle Start Time Year (0-99) |
| 3044 | Read Only | Cycle Start Time Hour (0-24) |
| 3045 | Read Only | Cycle Start Time Minutes (0-59) |
| 3046 | Read/Write | Bit Flags Transmitter |
| 3047 | Read/Write | Bit Flags Transmitter |
| 3048 | Read Only | Bit Flags Stream #1 Low |
| 3049 | Read Only | Bit Flags Stream #1 High |
| 3050 | Read Only | Bit Flags Stream #2 Low |
| 3051 | Read Only | Bit Flags Stream #2 High |
| 3052 | Read Only | Bit Flags Stream #3 Low |
| 3053 | Read Only | Bit Flags Stream #3 High |
| 3054 | Read Only | Bit Flags Stream #4 Low |
| 3055 | Read Only | Bit Flags Stream #4 High |
| 3056 | Read Only | Bit Flags Stream #5 Low - Unused |
| 3057 | Read Only | Bit Flags Stream #5 High - Unused |
| 3058 | Read/Write | New Data Flag (Set upon completion of calculations) |
| 3059 | Read Only | Cal/Analysis Flag (Set = 1 if analysis data, 0 if calculation data(Not Used)) |

NOTE: Component indices in registers 3001 through 3032 above correspond to the component code minus 100.

Methane - Component Code 100 Component = Index 0

Carbon Dioxide - Component Code 117 Component = Index 17

Unused component table entries contain Component Index = 255.

**VII. Totalflow Short Integer Extended Registers Group**

This register group is provided as an extension to the standard register set to allow further control over the BTU transmitter over a MODBUS communications link. Refer to the Printer/Console Document for more information on the values that each of these commands can have.

As an example, assume that the BTU Transmitter needs to be put into hold mode and later back into run mode. Referring to the Printer/Console document under NSTATE (which refers to CSTATE), the code to put the Transmitter into Hold mode is 01 and the Run code is 02. So the MODBUS master should be programmed to set register 3061 to 01 to enter hold mode and 02 to get running again.

These registers are defined in PROM revisions of AH.1 (Not AH) and greater and all 2100528 and 2100986 part numbers.

| Register | Access | Description | Printer/Console Command |
|---|---|---|---|
| 3060 | Read Only | Read the Current State | CSTATE |
| 3061 | Read/Write | Set the Next State | NSTATE |
| 3062 | Read/Write | Auto Calibration During Startup | ACAL |
| 3063 | Read/Write | Auto Peak Detection During Startup | APEAK |
| 3064 | Read/Write | Auto Run after Startup | ASTART |
| 3065 | Read/Write | Number of Calibration Cycles | CALCYC |
| 3066 | Read/Write | Number of Calibration Cycles to Average | CALAVG |

| Register | Access | Description | Printer/Console Command |
|---|---|---|---|
| 3067 | Read/Write | Low Carrier Mode | LOWCAR |
| 3068 | Read/Write | Low Power Mode | LOWPOW |
| 3069 | Read/Write | Pre-Purge Selection | PP |
| 3070 | Read Only | Normal Status | DIOS |
| 3071 | Read Only | Fault Status | DIOS |
| 3072 | Read Only | Carrier Bottle Low (DI) | DIOS |
| 3073 | Read Only | Calibration Bottle Low (DI) | DIOS |
| 3074 | Write Only | Manually Update Response Factors | MAN |
| 3075 | Read/Write | Auto Update Response Factors Selection | AUTO |
| 3076 | Read/Write | Disable Stream Switching | DISSEL |
| 3077 | Read Only | Transmitter Current Warning | 04CWARN |
| 3078 | Read Only | Transmitter Current Fault | 04CFAULT |
| 3079 | Read Only | Transmitter Initial Warning | 04IWARN |
| 3080 | Read Only | Transmitter Initial Fault | 04IFAULT |
| 3081 | Read Only | Stream #1 Current Warning | 00CWARN |
| 3082 | Read Only | Stream #2 Current Warning | 01CWARN |
| 3083 | Read Only | Stream #3 Current Warning | 02CWARN |
| 3084 | Read Only | Stream #4 Current Warning | 03CWARN |
| 3085 | Read Only | Stream #1 Current Fault | 00CFAULT |
| 3086 | Read Only | Stream #2 Current Fault | 01CFAULT |
| 3087 | Read Only | Stream #3 Current Fault | 02CFAULT |
| 3088 | Read Only | Stream #4 Current Fault | 03CFAULT |
| 3089 | Read Only | Stream #1 Initial Warning | 00IWARN |
| 3090 | Read Only | Stream #2 Initial Warning | 01IWARN |
| 3091 | Read Only | Stream #3 Initial Warning | 02IWARN |
| 3092 | Read Only | Stream #4 Initial Warning | 03IWARN |
| 3093 | Read Only | Stream #1 Initial Fault | 00IFAULT |
| 3094 | Read Only | Stream #2 Initial Fault | 01IFAULT |
| 3095 | Read Only | Stream #3 Initial Fault | 02IFAULT |
| 3096 | Read Only | Stream #4 Initial Fault | 03IFAULT |
| 3097 | Read/Write | Stream #1 Skip Flag | 00SKIP |
| 3098 | Read/Write | Stream #2 Skip Flag | 01SKIP |
| 3099 | Read/Write | Stream #3 Skip Flag | 02SKIP |
| 3100 | Read/Write | Stream #4 Skip Flag | 03SKIP |
| 3101 | Read/Write | Port #1 Report Flags | 02PFLG |
| 3102 | Read/Write | Port #2 Report Flags | 03PFLG |
| 3103 | Read/Write | Port #3 Report Flags | 04PFLG |
| 3104 | Read/Write | Port #4 Report Flags | 05PFLG |
| 3105 | Read/Write | Modbus C6+ Component Index Mode | C6IDX |

**VIII. Long Integer Register Group**

| Register (32) | Register (16) | Access | Description |
|---|---|---|---|
| 5001 | 5001 | Read/Write | Cycle Time (in 1/30ths of 1 second) |
| 5002 | 5003 | Read Only | Calibration Cycle Time (in 1/30ths of 1 second) |
| 5003 | 5005 | Read Only | Detector 0 Value |
| 5004 | 5007 | Read Only | Detector 1 Value |

**IX. Floating Point Register Group - Current Stream**

| Register (32) | Register (16) | Access | Description |
|---|---|---|---|
| 7001 | 7001 | Read Only | Mole % - Component #1 |
| 7002 | 7003 | Read Only | Mole % - Component #2 |
| 7003 | 7005 | Read Only | Mole % - Component #3 |
| 7004 | 7007 | Read Only | Mole % - Component #4 |

| Register (32) | Register (16) | Access | Description |
|---|---|---|---|
| 7005 | 7009 | Read Only | Mole % - Component #5 |
| 7006 | 7011 | Read Only | Mole % - Component #6 |
| 7007 | 7013 | Read Only | Mole % - Component #7 |
| 7008 | 7015 | Read Only | Mole % - Component #8 |
| 7009 | 7017 | Read Only | Mole % - Component #9 |
| 7010 | 7019 | Read Only | Mole % - Component #10 |
| 7011 | 7021 | Read Only | Mole % - Component #11 |
| 7012 | 7023 | Read Only | Mole % - Component #12 |
| 7013 | 7025 | Read Only | Mole % - Component #13 |
| 7014 | 7027 | Read Only | Mole % - Component #14 |
| 7015 | 7029 | Read Only | Mole % - Component #15 |
| 7016 | 7031 | Read Only | Mole % - Component #16 |
| 7017 | 7033 | Read Only | GPM - Component #1 |
| 7018 | 7035 | Read Only | GPM - Component #2 |
| 7019 | 7037 | Read Only | GPM - Component #3 |
| 7020 | 7039 | Read Only | GPM - Component #4 |
| 7021 | 7041 | Read Only | GPM - Component #5 |
| 7022 | 7043 | Read Only | GPM - Component #6 |
| 7023 | 7045 | Read Only | GPM - Component #7 |
| 7024 | 7047 | Read Only | GPM - Component #8 |
| 7025 | 7049 | Read Only | GPM - Component #9 |
| 7026 | 7051 | Read Only | GPM - Component #10 |
| 7027 | 7053 | Read Only | GPM - Component #11 |
| 7028 | 7055 | Read Only | GPM - Component #12 |
| 7029 | 7057 | Read Only | GPM - Component #13 |
| 7030 | 7059 | Read Only | GPM - Component #14 |
| 7031 | 7061 | Read Only | GPM - Component #15 |
| 7032 | 7063 | Read Only | GPM - Component #16 |
| 7033 | 7065 | Read Only | BTU - Dry |
| 7034 | 7067 | Read Only | BTU - Saturated |
| 7035 | 7069 | Read Only | Specific Gravity |
| 7036 | 7071 | Read Only | Compressibility |
| 7037 | 7073 | Read Only | WOBBE Index |
| 7038 | 7075 | Read Only | Total UN-normalized mole |
| 7039 | 7077 | Read Only | Total GPM |
| 7040 | 7079 | Read Only | Ratio #1 - Unused |
| 7041 | 7081 | Read Only | Ratio #2 - Unused |
| 7042 | 7083 | Read Only | Ratio #3 - Unused |
| 7043 | 7085 | Read Only | Ratio #4 - Unused |
| 7044 | 7087 | Read Only | Ratio #5 - Unused |
| 7045 | 7089 | Read Only | Rolling Average #1 - Unused |
| 7046 | 7091 | Read Only | Rolling Average #2 - Unused |
| 7047 | 7093 | Read Only | Rolling Average #3 - Unused |
| 7048 | 7095 | Read Only | Rolling Average #4 - Unused |
| 7049 | 7097 | Read Only | Rolling Average #5 - Unused |
| 7050 | 7099 | Read Only | Rolling Average #6 - Unused |
| 7051 | 7101 | Read Only | Rolling Average #7 - Unused |
| 7052 | 7103 | Read Only | Rolling Average #8 - Unused |
| 7053 | 7105 | Read Only | Rolling Average #9 - Unused |
| 7054 | 7107 | Read Only | Rolling Average #10 - Unused |
| 7055 | 7109 | Read Only | 24 Hour Average for Component #1 |
| 7056 | 7111 | Read Only | 24 Hour Average for Component #2 |
| 7057 | 7113 | Read Only | 24 Hour Average for Component #3 |
| 7058 | 7115 | Read Only | 24 Hour Average for Component #4 |
| 7059 | 7117 | Read Only | 24 Hour Average for Component #5 |
| 7060 | 7119 | Read Only | 24 Hour Average for Component #6 |
| 7061 | 7121 | Read Only | 24 Hour Average for Component #7 |
| 7062 | 7123 | Read Only | 24 Hour Average for Component #8 |

| Register (32) | Register (16) | Access | Description |
|---|---|---|---|
| 7063 | 7125 | Read Only | 24 Hour Average for Component #9 |
| 7064 | 7127 | Read Only | 24 Hour Average for Component #10 |
| 7065 | 7129 | Read Only | 24 Hour Average for Component #11 |
| 7066 | 7131 | Read Only | 24 Hour Average for Component #12 |
| 7067 | 7133 | Read Only | 24 Hour Average for Component #13 |
| 7068 | 7135 | Read Only | 24 Hour Average for Component #14 |
| 7069 | 7137 | Read Only | 24 Hour Average for Component #15 |
| 7070 | 7139 | Read Only | Previous 24 Hour Average for Component #1 |
| 7071 | 7141 | Read Only | Previous 24 Hour Average for Component #2 |
| 7072 | 7143 | Read Only | Previous 24 Hour Average for Component #3 |
| 7073 | 7145 | Read Only | Previous 24 Hour Average for Component #4 |
| 7074 | 7147 | Read Only | Previous 24 Hour Average for Component #5 |
| 7075 | 7149 | Read Only | Previous 24 Hour Average for Component #6 |
| 7076 | 7151 | Read Only | Previous 24 Hour Average for Component #7 |
| 7077 | 7153 | Read Only | Previous 24 Hour Average for Component #8 |
| 7078 | 7155 | Read Only | Previous 24 Hour Average for Component #9 |
| 7079 | 7157 | Read Only | Previous 24 Hour Average for Component #10 |
| 7080 | 7159 | Read Only | Previous 24 Hour Average for Component #11 |
| 7081 | 7161 | Read Only | Previous 24 Hour Average for Component #12 |
| 7082 | 7163 | Read Only | Previous 24 Hour Average for Component #13 |
| 7083 | 7165 | Read Only | Previous 24 Hour Average for Component #14 |
| 7084 | 7167 | Read Only | Previous 24 Hour Average for Component #15 |
| 7085 | 7169 | Read Only | Normal Density |
| 7086 | 7171 | Read Only | Water – If Available |
| 7087 | 7173 | Read Only | Hydrogen Sulfide – If Available |
| 7088 | 7175 | Read Only | (Inferior) WOBBE |
| 7089 | 7177 | Read Only | Previous 24 Hour Average for C9 |
| 7090 | 7179 | Read Only | Previous 24 Hour Average for Real CV |
| 7091 | 7181 | Read Only | Previous 24 Hour Average for Wet CV |
| 7092 | 7183 | Read Only | Previous 24 Hour Average for Real Specific Gravity |
| 7093 | 7185 | Read Only | Previous 24 Hour Average for Compressibility |
| 7094 | 7187 | Read Only | Previous 24 Hour Average for WOBBE |
| 7095 | 7189 | Read Only | Previous 24 Hour Average for Un-normalized Total |
| 7096 | 7191 | Read Only | Previous 24 Hour Average for GPM |
| 7097 | 7193 | Read Only | Previous 24 Hour Average for Normal Density |
| 7098 | 7195 | Read Only | Previous 24 Hour Average for (Inferior) WOBBE |
| 7099 | 7197 | Read Only | Methane Number |
| 7100 | 7199 | Read Only | Previous 24 Hour Average for Methane Number |

**X. Floating Point Register Group - Transmitter**

| Register (32) | Register (16) | Access | Description |
|---|---|---|---|
| 7200 | N/A | Read Only | Ground Reference |
| 7201 | 7401 | Read Only | Power |
| 7202 | 7403 | Read Only | Mandrel Temp |
| 7203 | 7405 | Read Only | Regulator Pressure |
| 7204 | 7407 | Read Only | Auxiliary Pressure |
| 7205 | 7409 | Read Only | Analog Input #6 - Spare |
| 7206 | 7411 | Read Only | Ambient Temp |
| 7207 | 7413 | Read Only | Voltage Reference |
| 7209 | 7417 | Read/Write | Calibration Standard - Component #1 – Not Indexed |
| 7210 | 7419 | Read/Write | Calibration Standard - Component #2 – Not Indexed |
| 7211 | 7421 | Read/Write | Calibration Standard - Component #3 – Not Indexed |
| 7212 | 7423 | Read/Write | Calibration Standard - Component #4 – Not Indexed |
| 7213 | 7425 | Read/Write | Calibration Standard - Component #5 – Not Indexed |
| 7214 | 7427 | Read/Write | Calibration Standard - Component #6 – Not Indexed |

| Register (32) | Register (16) | Access | Description |
|---|---|---|---|
| 7215 | 7429 | Read/Write | Calibration Standard - Component #7 – Not Indexed |
| 7216 | 7431 | Read/Write | Calibration Standard - Component #8 – Not Indexed |
| 7217 | 7433 | Read/Write | Calibration Standard - Component #9 – Not Indexed |
| 7218 | 7435 | Read/Write | Calibration Standard - Component #10 – Not Indexed |
| 7219 | 7437 | Read/Write | Calibration Standard - Component #11 – Not Indexed |
| 7220 | 7439 | Read/Write | Calibration Standard - Component #12 – Not Indexed |
| 7221 | 7441 | Read/Write | Calibration Standard - Component #13 – Not Indexed |
| 7222 | 7443 | Read Only | Calibration Standard - Component #14 – Not Used |
| 7223 | 7445 | Read Only | Calibration Standard - Component #15 – Not Used |
| 7224 | 7447 | Read Only | Calibration Standard - Component #16 – Not Used |
| 7225 | 7449 | Read Only | Response Factor - Component #1 |
| 7226 | 7451 | Read Only | Response Factor - Component #2 |
| 7227 | 7453 | Read Only | Response Factor - Component #3 |
| 7228 | 7455 | Read Only | Response Factor - Component #4 |
| 7229 | 7457 | Read Only | Response Factor - Component #5 |
| 7230 | 7459 | Read Only | Response Factor - Component #6 |
| 7231 | 7461 | Read Only | Response Factor - Component #7 |
| 7232 | 7463 | Read Only | Response Factor - Component #8 |
| 7233 | 7465 | Read Only | Response Factor - Component #9 |
| 7234 | 7467 | Read Only | Response Factor - Component #10 |
| 7235 | 7469 | Read Only | Response Factor - Component #11 |
| 7236 | 7471 | Read Only | Response Factor - Component #12 |
| 7237 | 7473 | Read Only | Response Factor - Component #13 |
| 7238 | 7475 | Read Only | Response Factor - Component #14 |
| 7239 | 7477 | Read Only | Response Factor - Component #15 |
| 7240 | 7479 | Read Only | Response Factor - Component #16 |

**XI. Floating Point Register Group - Stream #1**

| Register (32) | Register (16) | Access | Description |
|---|---|---|---|
| 7400 | N/A | Read Only | Registers 7400-7599 are for stream #1 |
| 7401 | 7801 | Read Only | Mole % - Component #1 |
| 7402 | 7803 | Read Only | Mole % - Component #2 |
| 7403 | 7805 | Read Only | Mole % - Component #3 |
| 7404 | 7807 | Read Only | Mole % - Component #4 |
| 7405 | 7809 | Read Only | Mole % - Component #5 |
| 7406 | 7811 | Read Only | Mole % - Component #6 |
| 7407 | 7813 | Read Only | Mole % - Component #7 |
| 7408 | 7815 | Read Only | Mole % - Component #8 |
| 7409 | 7817 | Read Only | Mole % - Component #9 |
| 7410 | 7819 | Read Only | Mole % - Component #10 |
| 7411 | 7821 | Read Only | Mole % - Component #11 |
| 7412 | 7823 | Read Only | Mole % - Component #12 |
| 7413 | 7825 | Read Only | Mole % - Component #13 |
| 7414 | 7827 | Read Only | Mole % - Component #14 |
| 7415 | 7829 | Read Only | Mole % - Component #15 |
| 7416 | 7831 | Read Only | Mole % - Component #16 |
| 7417 | 7833 | Read Only | GPM - Component #1 |
| 7418 | 7835 | Read Only | GPM - Component #2 |
| 7419 | 7837 | Read Only | GPM - Component #3 |
| 7420 | 7839 | Read Only | GPM - Component #4 |
| 7421 | 7841 | Read Only | GPM - Component #5 |
| 7422 | 7843 | Read Only | GPM - Component #6 |
| 7423 | 7845 | Read Only | GPM - Component #7 |
| 7424 | 7847 | Read Only | GPM - Component #8 |
| 7425 | 7849 | Read Only | GPM - Component #9 |
| 7426 | 7851 | Read Only | GPM - Component #10 |

| Register (32) | Register (16) | Access | Description |
|---|---|---|---|
| 7427 | 7853 | Read Only | GPM - Component #11 |
| 7428 | 7855 | Read Only | GPM - Component #12 |
| 7429 | 7857 | Read Only | GPM - Component #13 |
| 7430 | 7859 | Read Only | GPM - Component #14 |
| 7431 | 7861 | Read Only | GPM - Component #15 |
| 7432 | 7863 | Read Only | GPM - Component #16 |
| 7433 | 7865 | Read Only | BTU - Dry |
| 7434 | 7867 | Read Only | BTU - Saturated |
| 7435 | 7869 | Read Only | Specific Gravity |
| 7436 | 7871 | Read Only | Compressibility |
| 7437 | 7873 | Read Only | WOBBE Index |
| 7438 | 7875 | Read Only | Total UN-normalized mole |
| 7439 | 7877 | Read Only | Total GPM |
| 7440 | 7879 | Read Only | Ratio #1 - Unused |
| 7441 | 7881 | Read Only | Ratio #2 - Unused |
| 7442 | 7883 | Read Only | Ratio #3 - Unused |
| 7443 | 7885 | Read Only | Ratio #4 - Unused |
| 7444 | 7887 | Read Only | Ratio #5 - Unused |
| 7445 | 7889 | Read Only | Rolling Average #1 - Unused |
| 7446 | 7891 | Read Only | Rolling Average #2 - Unused |
| 7447 | 7893 | Read Only | Rolling Average #3 - Unused |
| 7448 | 7895 | Read Only | Rolling Average #4 - Unused |
| 7449 | 7897 | Read Only | Rolling Average #5 - Unused |
| 7450 | 7899 | Read Only | Rolling Average #6 - Unused |
| 7451 | 7901 | Read Only | Rolling Average #7 - Unused |
| 7452 | 7903 | Read Only | Rolling Average #8 - Unused |
| 7453 | 7905 | Read Only | Rolling Average #9 - Unused |
| 7454 | 7907 | Read Only | Rolling Average #10 - Unused |
| 7455 | 7909 | Read Only | 24 Hour Average for Component #1 |
| 7456 | 7911 | Read Only | 24 Hour Average for Component #2 |
| 7457 | 7913 | Read Only | 24 Hour Average for Component #3 |
| 7458 | 7915 | Read Only | 24 Hour Average for Component #4 |
| 7459 | 7917 | Read Only | 24 Hour Average for Component #5 |
| 7460 | 7919 | Read Only | 24 Hour Average for Component #6 |
| 7461 | 7921 | Read Only | 24 Hour Average for Component #7 |
| 7462 | 7923 | Read Only | 24 Hour Average for Component #8 |
| 7463 | 7925 | Read Only | 24 Hour Average for Component #9 |
| 7464 | 7927 | Read Only | 24 Hour Average for Component #10 |
| 7465 | 7929 | Read Only | 24 Hour Average for Component #11 |
| 7466 | 7931 | Read Only | 24 Hour Average for Component #12 |
| 7467 | 7933 | Read Only | 24 Hour Average for Component #13 |
| 7468 | 7935 | Read Only | 24 Hour Average for Component #14 |
| 7469 | 7937 | Read Only | 24 Hour Average for Component #15 |
| 7470 | 7939 | Read Only | Previous 24 Hour Average for Component #1 |
| 7471 | 7941 | Read Only | Previous 24 Hour Average for Component #2 |
| 7472 | 7943 | Read Only | Previous 24 Hour Average for Component #3 |
| 7473 | 7945 | Read Only | Previous 24 Hour Average for Component #4 |
| 7474 | 7947 | Read Only | Previous 24 Hour Average for Component #5 |
| 7475 | 7949 | Read Only | Previous 24 Hour Average for Component #6 |
| 7476 | 7951 | Read Only | Previous 24 Hour Average for Component #7 |
| 7477 | 7953 | Read Only | Previous 24 Hour Average for Component #8 |
| 7478 | 7955 | Read Only | Previous 24 Hour Average for Component #9 |
| 7479 | 7957 | Read Only | Previous 24 Hour Average for Component #10 |
| 7480 | 7959 | Read Only | Previous 24 Hour Average for Component #11 |
| 7481 | 7961 | Read Only | Previous 24 Hour Average for Component #12 |
| 7482 | 7963 | Read Only | Previous 24 Hour Average for Component #13 |
| 7483 | 7965 | Read Only | Previous 24 Hour Average for Component #14 |
| 7484 | 7967 | Read Only | Previous 24 Hour Average for Component #15 |

| Register (32) | Register (16) | Access | Description |
|---|---|---|---|
| 7485 | 7969 | Read Only | Normal Density |
| 7486 | 7971 | Read Only | Water – If Available |
| 7487 | 7973 | Read Only | Hydrogen Sulfide – If Available |
| 7488 | 7975 | Read Only | (Inferior) WOBBE |
| 7489 | 7977 | Read Only | Previous 24 Hour Average for C9 |
| 7490 | 7979 | Read Only | Previous 24 Hour Average for Real CV |
| 7491 | 7981 | Read Only | Previous 24 Hour Average for Wet CV |
| 7492 | 7983 | Read Only | Previous 24 Hour Average for Real Specific Gravity |
| 7493 | 7985 | Read Only | Previous 24 Hour Average for Compressibility |
| 7494 | 7987 | Read Only | Previous 24 Hour Average for WOBBE |
| 7495 | 7189 | Read Only | Previous 24 Hour Average for Un-normalized Total |
| 7496 | 7991 | Read Only | Previous 24 Hour Average for GPM |
| 7497 | 7993 | Read Only | Previous 24 Hour Average for Normal Density |
| 7498 | 7995 | Read Only | Previous 24 Hour Average for (Inferior) WOBBE |
| 7499 | 7997 | Read Only | Methane Number |
| 7500 | 7999 | Read Only | Previous 24 Hour Average for Methane Number |

**XII. Floating Point Register Group - Stream #2**

| Register (32) | Register (16) | Access | Description |
|---|---|---|---|
| 7600 | N/A | Read Only | Registers 7600-7799 are for stream #2 |
| 7601 | 8201 | Read Only | Mole % - Component #1 |
| 7602 | 8203 | Read Only | Mole % - Component #2 |
| 7603 | 8205 | Read Only | Mole % - Component #3 |
| 7604 | 8207 | Read Only | Mole % - Component #4 |
| 7605 | 8209 | Read Only | Mole % - Component #5 |
| 7606 | 8211 | Read Only | Mole % - Component #6 |
| 7607 | 8213 | Read Only | Mole % - Component #7 |
| 7608 | 8215 | Read Only | Mole % - Component #8 |
| 7609 | 8217 | Read Only | Mole % - Component #9 |
| 7610 | 8219 | Read Only | Mole % - Component #10 |
| 7611 | 8221 | Read Only | Mole % - Component #11 |
| 7612 | 8223 | Read Only | Mole % - Component #12 |
| 7613 | 8225 | Read Only | Mole % - Component #13 |
| 7614 | 8227 | Read Only | Mole % - Component #14 |
| 7615 | 8229 | Read Only | Mole % - Component #15 |
| 7616 | 8231 | Read Only | Mole % - Component #16 |
| 7617 | 8233 | Read Only | GPM - Component #1 |
| 7618 | 8235 | Read Only | GPM - Component #2 |
| 7619 | 8237 | Read Only | GPM - Component #3 |
| 7620 | 8239 | Read Only | GPM - Component #4 |
| 7621 | 8241 | Read Only | GPM - Component #5 |
| 7622 | 8243 | Read Only | GPM - Component #6 |
| 7623 | 8245 | Read Only | GPM - Component #7 |
| 7624 | 8247 | Read Only | GPM - Component #8 |
| 7625 | 8249 | Read Only | GPM - Component #9 |
| 7626 | 8251 | Read Only | GPM - Component #10 |
| 7627 | 8253 | Read Only | GPM - Component #11 |
| 7628 | 8255 | Read Only | GPM - Component #12 |
| 7629 | 8257 | Read Only | GPM - Component #13 |
| 7630 | 8259 | Read Only | GPM - Component #14 |
| 7631 | 8261 | Read Only | GPM - Component #15 |
| 7632 | 8263 | Read Only | GPM - Component #16 |
| 7633 | 8265 | Read Only | BTU - Dry |
| 7634 | 8267 | Read Only | BTU - Saturated |
| 7635 | 8269 | Read Only | Specific Gravity |
| 7636 | 8271 | Read Only | Compressibility |

| Register (32) | Register (16) | Access | Description |
|---|---|---|---|
| 7637 | 8273 | Read Only | WOBBE Index |
| 7638 | 8275 | Read Only | Total UN-normalized mole |
| 7639 | 8277 | Read Only | Total GPM |
| 7640 | 8279 | Read Only | Ratio #1 - Unused |
| 7641 | 8281 | Read Only | Ratio #2 - Unused |
| 7642 | 8283 | Read Only | Ratio #3 - Unused |
| 7643 | 8285 | Read Only | Ratio #4 - Unused |
| 7644 | 8287 | Read Only | Ratio #5 - Unused |
| 7645 | 8289 | Read Only | Rolling Average #1 - Unused |
| 7646 | 8291 | Read Only | Rolling Average #2 - Unused |
| 7647 | 8293 | Read Only | Rolling Average #3 - Unused |
| 7648 | 8295 | Read Only | Rolling Average #4 - Unused |
| 7649 | 8297 | Read Only | Rolling Average #5 - Unused |
| 7650 | 8299 | Read Only | Rolling Average #6 - Unused |
| 7651 | 8301 | Read Only | Rolling Average #7 - Unused |
| 7652 | 8303 | Read Only | Rolling Average #8 - Unused |
| 7653 | 8305 | Read Only | Rolling Average #9 - Unused |
| 7654 | 8307 | Read Only | Rolling Average #10 - Unused |
| 7655 | 8309 | Read Only | 24 Hour Average for Component #1 |
| 7656 | 8311 | Read Only | 24 Hour Average for Component #2 |
| 7657 | 8313 | Read Only | 24 Hour Average for Component #3 |
| 7658 | 8315 | Read Only | 24 Hour Average for Component #4 |
| 7659 | 8317 | Read Only | 24 Hour Average for Component #5 |
| 7660 | 8319 | Read Only | 24 Hour Average for Component #6 |
| 7661 | 8321 | Read Only | 24 Hour Average for Component #7 |
| 7662 | 8323 | Read Only | 24 Hour Average for Component #8 |
| 7663 | 8325 | Read Only | 24 Hour Average for Component #9 |
| 7664 | 8327 | Read Only | 24 Hour Average for Component #10 |
| 7665 | 8329 | Read Only | 24 Hour Average for Component #11 |
| 7666 | 8331 | Read Only | 24 Hour Average for Component #12 |
| 7667 | 8333 | Read Only | 24 Hour Average for Component #13 |
| 7668 | 8335 | Read Only | 24 Hour Average for Component #14 |
| 7669 | 8337 | Read Only | 24 Hour Average for Component #15 |
| 7670 | 8339 | Read Only | Previous 24 Hour Average for Component #1 |
| 7671 | 8341 | Read Only | Previous 24 Hour Average for Component #2 |
| 7672 | 8343 | Read Only | Previous 24 Hour Average for Component #3 |
| 7673 | 8345 | Read Only | Previous 24 Hour Average for Component #4 |
| 7674 | 8347 | Read Only | Previous 24 Hour Average for Component #5 |
| 7675 | 8349 | Read Only | Previous 24 Hour Average for Component #6 |
| 7676 | 8351 | Read Only | Previous 24 Hour Average for Component #7 |
| 7677 | 8353 | Read Only | Previous 24 Hour Average for Component #8 |
| 7678 | 8355 | Read Only | Previous 24 Hour Average for Component #9 |
| 7679 | 8357 | Read Only | Previous 24 Hour Average for Component #10 |
| 7680 | 8359 | Read Only | Previous 24 Hour Average for Component #11 |
| 7681 | 8361 | Read Only | Previous 24 Hour Average for Component #12 |
| 7682 | 8363 | Read Only | Previous 24 Hour Average for Component #13 |
| 7683 | 8365 | Read Only | Previous 24 Hour Average for Component #14 |
| 7684 | 8367 | Read Only | Previous 24 Hour Average for Component #15 |
| 7685 | 8369 | Read Only | Normal Density |
| 7686 | 8371 | Read Only | Water – If Available |
| 7687 | 8373 | Read Only | Hydrogen Sulfide – If Available |
| 7688 | 8375 | Read Only | (Inferior) WOBBE |
| 7689 | 8377 | Read Only | Previous 24 Hour Average for C9 |
| 7690 | 8379 | Read Only | Previous 24 Hour Average for Real CV |
| 7691 | 8381 | Read Only | Previous 24 Hour Average for Wet CV |
| 7692 | 8383 | Read Only | Previous 24 Hour Average for Real Specific Gravity |
| 7693 | 8385 | Read Only | Previous 24 Hour Average for Compressibility |

| Register (32) | Register (16) | Access | Description |
|---|---|---|---|
| 7694 | 8387 | Read Only | Previous 24 Hour Average for WOBBE |
| 7695 | 8389 | Read Only | Previous 24 Hour Average for Un-normalized Total |
| 7696 | 8391 | Read Only | Previous 24 Hour Average for GPM |
| 7697 | 8393 | Read Only | Previous 24 Hour Average for Normal Density |
| 7698 | 8395 | Read Only | Previous 24 Hour Average for (Inferior) WOBBE |
| 7699 | 8397 | Read Only | Methane Number |
| 7700 | 8399 | Read Only | Previous 24 Hour Average for Methane Number |

**XIII. Floating Point Register Group - Stream #3**

| Register (32) | Register (16) | Access | Description |
|---|---|---|---|
| 7800 | N/A | Read Only | Registers 7800-7999 are for stream #3 |
| 7801 | 8601 | Read Only | Mole % - Component #1 |
| 7802 | 8603 | Read Only | Mole % - Component #2 |
| 7803 | 8605 | Read Only | Mole % - Component #3 |
| 7804 | 8607 | Read Only | Mole % - Component #4 |
| 7805 | 8609 | Read Only | Mole % - Component #5 |
| 7806 | 8611 | Read Only | Mole % - Component #6 |
| 7807 | 8613 | Read Only | Mole % - Component #7 |
| 7808 | 8615 | Read Only | Mole % - Component #8 |
| 7809 | 8617 | Read Only | Mole % - Component #9 |
| 7810 | 8619 | Read Only | Mole % - Component #10 |
| 7811 | 8621 | Read Only | Mole % - Component #11 |
| 7812 | 8623 | Read Only | Mole % - Component #12 |
| 7813 | 8625 | Read Only | Mole % - Component #13 |
| 7814 | 8627 | Read Only | Mole % - Component #14 |
| 7815 | 8629 | Read Only | Mole % - Component #15 |
| 7816 | 8631 | Read Only | Mole % - Component #16 |
| 7817 | 8633 | Read Only | GPM - Component #1 |
| 7818 | 8635 | Read Only | GPM - Component #2 |
| 7819 | 8637 | Read Only | GPM - Component #3 |
| 7820 | 8639 | Read Only | GPM - Component #4 |
| 7821 | 8641 | Read Only | GPM - Component #5 |
| 7822 | 8643 | Read Only | GPM - Component #6 |
| 7823 | 8645 | Read Only | GPM - Component #7 |
| 7824 | 8647 | Read Only | GPM - Component #8 |
| 7825 | 8649 | Read Only | GPM - Component #9 |
| 7826 | 8651 | Read Only | GPM - Component #10 |
| 7827 | 8653 | Read Only | GPM - Component #11 |
| 7828 | 8655 | Read Only | GPM - Component #12 |
| 7829 | 8657 | Read Only | GPM - Component #13 |
| 7830 | 8659 | Read Only | GPM - Component #14 |
| 7831 | 8661 | Read Only | GPM - Component #15 |
| 7832 | 8663 | Read Only | GPM - Component #16 |
| 7833 | 8665 | Read Only | BTU - Dry |
| 7834 | 8667 | Read Only | BTU - Saturated |
| 7835 | 8669 | Read Only | Specific Gravity |
| 7836 | 8671 | Read Only | Compressibility |
| 7837 | 8673 | Read Only | WOBBE Index |
| 7838 | 8675 | Read Only | Total UN-normalized mole |
| 7839 | 8677 | Read Only | Total GPM |
| 7840 | 8679 | Read Only | Ratio #1 - Unused |
| 7841 | 8681 | Read Only | Ratio #2 - Unused |
| 7842 | 8683 | Read Only | Ratio #3 - Unused |
| 7843 | 8685 | Read Only | Ratio #4 - Unused |
| 7844 | 8687 | Read Only | Ratio #5 - Unused |
| 7845 | 8689 | Read Only | Rolling Average #1 - Unused |
| 7846 | 8691 | Read Only | Rolling Average #2 - Unused |

| Register (32) | Register (16) | Access | Description |
|---|---|---|---|
| 7847 | 8693 | Read Only | Rolling Average #3 - Unused |
| 7848 | 8695 | Read Only | Rolling Average #4 - Unused |
| 7849 | 8697 | Read Only | Rolling Average #5 - Unused |
| 7850 | 8699 | Read Only | Rolling Average #6 - Unused |
| 7851 | 8701 | Read Only | Rolling Average #7 - Unused |
| 7852 | 8703 | Read Only | Rolling Average #8 - Unused |
| 7853 | 8705 | Read Only | Rolling Average #9 - Unused |
| 7854 | 8707 | Read Only | Rolling Average #10 - Unused |
| 7855 | 8709 | Read Only | 24 Hour Average for Component #1 |
| 7856 | 8711 | Read Only | 24 Hour Average for Component #2 |
| 7857 | 8713 | Read Only | 24 Hour Average for Component #3 |
| 7858 | 8715 | Read Only | 24 Hour Average for Component #4 |
| 7859 | 8717 | Read Only | 24 Hour Average for Component #5 |
| 7860 | 8719 | Read Only | 24 Hour Average for Component #6 |
| 7861 | 8721 | Read Only | 24 Hour Average for Component #7 |
| 7862 | 8723 | Read Only | 24 Hour Average for Component #8 |
| 7863 | 8725 | Read Only | 24 Hour Average for Component #9 |
| 7864 | 8727 | Read Only | 24 Hour Average for Component #10 |
| 7865 | 8729 | Read Only | 24 Hour Average for Component #11 |
| 7866 | 8731 | Read Only | 24 Hour Average for Component #12 |
| 7867 | 8733 | Read Only | 24 Hour Average for Component #13 |
| 7868 | 8735 | Read Only | 24 Hour Average for Component #14 |
| 7869 | 8737 | Read Only | 24 Hour Average for Component #15 |
| 7870 | 8739 | Read Only | Previous 24 Hour Average for Component #1 |
| 7871 | 8741 | Read Only | Previous 24 Hour Average for Component #2 |
| 7872 | 8743 | Read Only | Previous 24 Hour Average for Component #3 |
| 7873 | 8745 | Read Only | Previous 24 Hour Average for Component #4 |
| 7874 | 8747 | Read Only | Previous 24 Hour Average for Component #5 |
| 7875 | 8749 | Read Only | Previous 24 Hour Average for Component #6 |
| 7876 | 8751 | Read Only | Previous 24 Hour Average for Component #7 |
| 7877 | 8753 | Read Only | Previous 24 Hour Average for Component #8 |
| 7878 | 8755 | Read Only | Previous 24 Hour Average for Component #9 |
| 7879 | 8757 | Read Only | Previous 24 Hour Average for Component #10 |
| 7880 | 8759 | Read Only | Previous 24 Hour Average for Component #11 |
| 7881 | 8761 | Read Only | Previous 24 Hour Average for Component #12 |
| 7882 | 8763 | Read Only | Previous 24 Hour Average for Component #13 |
| 7883 | 8765 | Read Only | Previous 24 Hour Average for Component #14 |
| 7884 | 8767 | Read Only | Previous 24 Hour Average for Component #15 |
| 7885 | 8769 | Read Only | Normal Density |
| 7886 | 8771 | Read Only | Water – If Available |
| 7887 | 8773 | Read Only | Hydrogen Sulfide – If Available |
| 7888 | 8775 | Read Only | (Inferior) WOBBE |
| 7889 | 8777 | Read Only | Previous 24 Hour Average for C9 |
| 7890 | 8779 | Read Only | Previous 24 Hour Average for Real CV |
| 7891 | 8781 | Read Only | Previous 24 Hour Average for Wet CV |
| 7892 | 8783 | Read Only | Previous 24 Hour Average for Real Specific Gravity |
| 7893 | 8785 | Read Only | Previous 24 Hour Average for Compressibility |
| 7894 | 8787 | Read Only | Previous 24 Hour Average for WOBBE |
| 7895 | 8789 | Read Only | Previous 24 Hour Average for Un-normalized Total |
| 7896 | 8791 | Read Only | Previous 24 Hour Average for GPM |
| 7897 | 8793 | Read Only | Previous 24 Hour Average for Normal Density |
| 7898 | 8795 | Read Only | Previous 24 Hour Average for (Inferior) WOBBE |
| 7899 | 8797 | Read Only | Methane Number |
| 7900 | 8799 | Read Only | Previous 24 Hour Average for Methane Number |

**XIV. Floating Point Register Group - Stream #4**

| Register (32) | Register (16) | Access | Description |
|---|---|---|---|
| 8000 | N/A | Read Only | Registers 8000-8199 are for stream #4 |
| 8001 | N/A | Read Only | Mole % - Component #1 |
| 8002 | N/A | Read Only | Mole % - Component #2 |
| 8003 | N/A | Read Only | Mole % - Component #3 |
| 8004 | N/A | Read Only | Mole % - Component #4 |
| 8005 | N/A | Read Only | Mole % - Component #5 |
| 8006 | N/A | Read Only | Mole % - Component #6 |
| 8007 | N/A | Read Only | Mole % - Component #7 |
| 8008 | N/A | Read Only | Mole % - Component #8 |
| 8009 | N/A | Read Only | Mole % - Component #9 |
| 8010 | N/A | Read Only | Mole % - Component #10 |
| 8011 | N/A | Read Only | Mole % - Component #11 |
| 8012 | N/A | Read Only | Mole % - Component #12 |
| 8013 | N/A | Read Only | Mole % - Component #13 |
| 8014 | N/A | Read Only | Mole % - Component #14 |
| 8015 | N/A | Read Only | Mole % - Component #15 |
| 8016 | N/A | Read Only | Mole % - Component #16 |
| 8017 | N/A | Read Only | GPM - Component #1 |
| 8018 | N/A | Read Only | GPM - Component #2 |
| 8019 | N/A | Read Only | GPM - Component #3 |
| 8020 | N/A | Read Only | GPM - Component #4 |
| 8021 | N/A | Read Only | GPM - Component #5 |
| 8022 | N/A | Read Only | GPM - Component #6 |
| 8023 | N/A | Read Only | GPM - Component #7 |
| 8024 | N/A | Read Only | GPM - Component #8 |
| 8025 | N/A | Read Only | GPM - Component #9 |
| 8026 | N/A | Read Only | GPM - Component #10 |
| 8027 | N/A | Read Only | GPM - Component #11 |
| 8028 | N/A | Read Only | GPM - Component #12 |
| 8029 | N/A | Read Only | GPM - Component #13 |
| 8030 | N/A | Read Only | GPM - Component #14 |
| 8031 | N/A | Read Only | GPM - Component #15 |
| 8032 | N/A | Read Only | GPM - Component #16 |
| 8033 | N/A | Read Only | BTU - Dry |
| 8034 | N/A | Read Only | BTU - Saturated |
| 8035 | N/A | Read Only | Specific Gravity |
| 8036 | N/A | Read Only | Compressibility |
| 8037 | N/A | Read Only | WOBBE Index |
| 8038 | N/A | Read Only | Total UN-normalized mole |
| 8039 | N/A | Read Only | Total GPM |
| 8040 | N/A | Read Only | Ratio #1 - Unused |
| 8041 | N/A | Read Only | Ratio #2 - Unused |
| 8042 | N/A | Read Only | Ratio #3 - Unused |
| 8043 | N/A | Read Only | Ratio #4 - Unused |
| 8044 | N/A | Read Only | Ratio #5 - Unused |
| 8045 | N/A | Read Only | Rolling Average #1 - Unused |
| 8046 | N/A | Read Only | Rolling Average #2 - Unused |
| 8047 | N/A | Read Only | Rolling Average #3 - Unused |
| 8048 | N/A | Read Only | Rolling Average #4 - Unused |
| 8049 | N/A | Read Only | Rolling Average #5 - Unused |
| 8050 | N/A | Read Only | Rolling Average #6 - Unused |
| 8051 | N/A | Read Only | Rolling Average #7 - Unused |
| 8052 | N/A | Read Only | Rolling Average #8 - Unused |
| 8053 | N/A | Read Only | Rolling Average #9 - Unused |
| 8054 | N/A | Read Only | Rolling Average #10 - Unused |
| 8055 | N/A | Read Only | 24 Hour Average for Component #1 |
| 8056 | N/A | Read Only | 24 Hour Average for Component #2 |

| Register (32) | Register (16) | Access | Description |
|---|---|---|---|
| 8057 | N/A | Read Only | 24 Hour Average for Component #3 |
| 8058 | N/A | Read Only | 24 Hour Average for Component #4 |
| 8059 | N/A | Read Only | 24 Hour Average for Component #5 |
| 8060 | N/A | Read Only | 24 Hour Average for Component #6 |
| 8061 | N/A | Read Only | 24 Hour Average for Component #7 |
| 8062 | N/A | Read Only | 24 Hour Average for Component #8 |
| 8063 | N/A | Read Only | 24 Hour Average for Component #9 |
| 8064 | N/A | Read Only | 24 Hour Average for Component #10 |
| 8065 | N/A | Read Only | 24 Hour Average for Component #11 |
| 8066 | N/A | Read Only | 24 Hour Average for Component #12 |
| 8067 | N/A | Read Only | 24 Hour Average for Component #13 |
| 8068 | N/A | Read Only | 24 Hour Average for Component #14 |
| 8069 | N/A | Read Only | 24 Hour Average for Component #15 |
| 8070 | N/A | Read Only | Previous 24 Hour Average for Component #1 |
| 8071 | N/A | Read Only | Previous 24 Hour Average for Component #2 |
| 8072 | N/A | Read Only | Previous 24 Hour Average for Component #3 |
| 8073 | N/A | Read Only | Previous 24 Hour Average for Component #4 |
| 8074 | N/A | Read Only | Previous 24 Hour Average for Component #5 |
| 8075 | N/A | Read Only | Previous 24 Hour Average for Component #6 |
| 8076 | N/A | Read Only | Previous 24 Hour Average for Component #7 |
| 8077 | N/A | Read Only | Previous 24 Hour Average for Component #8 |
| 8078 | N/A | Read Only | Previous 24 Hour Average for Component #9 |
| 8079 | N/A | Read Only | Previous 24 Hour Average for Component #10 |
| 8080 | N/A | Read Only | Previous 24 Hour Average for Component #11 |
| 8081 | N/A | Read Only | Previous 24 Hour Average for Component #12 |
| 8082 | N/A | Read Only | Previous 24 Hour Average for Component #13 |
| 8083 | N/A | Read Only | Previous 24 Hour Average for Component #14 |
| 8084 | N/A | Read Only | Previous 24 Hour Average for Component #15 |
| 8085 | N/A | Read Only | Normal Density |
| 8086 | N/A | Read Only | Water – If Available |
| 8087 | N/A | Read Only | Hydrogen Sulfide – If Available |
| 8088 | N/A | Read Only | (Inferior) WOBBE |
| 8089 | N/A | Read Only | Previous 24 Hour Average for C9 |
| 8090 | N/A | Read Only | Previous 24 Hour Average for Real CV |
| 8091 | N/A | Read Only | Previous 24 Hour Average for Wet CV |
| 8092 | N/A | Read Only | Previous 24 Hour Average for Real Specific Gravity |
| 8093 | N/A | Read Only | Previous 24 Hour Average for Compressibility |
| 8094 | N/A | Read Only | Previous 24 Hour Average for WOBBE |
| 8095 | N/A | Read Only | Previous 24 Hour Average for Un-normalized Total |
| 8096 | N/A | Read Only | Previous 24 Hour Average for GPM |
| 8097 | N/A | Read Only | Previous 24 Hour Average for Normal Density |
| 8098 | N/A | Read Only | Previous 24 Hour Average for (Inferior) WOBBE |
| 8099 | N/A | Read Only | Methane Number |
| 8100 | N/A | Read Only | Previous 24 Hour Average for Methane Number |

## XV. COMPONENT DATA TABLES

These tables are used in conjunction with registers 3001 through 3032 above to determine the mapping of components to component #'s. These tables and their constants are examples only and might not match the latest standards.

| COMPONENT CODE | COMPONENT NAME | BTU-DRY | GPM FACTOR | √ bi | SP. GR. IDEAL | MOLECULAR WEIGHT |
|---|---|---|---|---|---|---|
| 100 | METHANE | 1012.0 | 0.0000 | 0.01160 | 0.5539 | 16.04 |
| 101 | ETHANE | 1773.7 | 0.2673 | 0.02390 | 1.0382 | 30.07 |
| 102 | PROPANE | 2522.1 | 0.2751 | 0.03440 | 1.5225 | 44.10 |
| 103 | I-BUTKNE | 3260.5 | 0.3270 | 0.04580 | 2.0068 | 58.12 |
| 104 | N-BUTANE | 3270.1 | 0.3151 | 0.04780 | 2.0068 | 58.12 |
| 105 | IPENTANE | 4011.1 | 0.3659 | 0.05810 | 2.4911 | 72.15 |
| 106 | NPENTANE | 4016.2 | 0.3622 | 0.06310 | 2.4911 | 72.15 |
| 107 | NEO C5 | 3993.8 | 0.3830 | 0.05774** | 2.4911 | 72.15 |
| 108 | C 6 + (47,35,17) | 5288.8 | 0.4462 | 0.09100 | 3.3127 | 95.96 |
| 109 | C 6 + (50,50,0) | 5141.2 | 0.4362 | 0.08730 | 3.2174 | 93.19 |
| 110 | C 6 + (50,25,25) | 5328.2 | 0.4488 | 0.09210 | 3.3383 | 96.70 |
| ***111 | C 6 + (57,28,14) | 5194.6 | 0.4398 | 0.08900 | 3.2521 | 94.19 |
| *112 | HYDROGEN | 324.9 | 0.0000 | | 0.0696 | 2.02 |
| *113 | HELIUM | 0.0 | 0.0000 | -.00452++ | 0.1382 | 4.00 |
| *114 | NITROGEN | 0.0 | 0.0000 | 0.00440 | 0.2672 | 28.01 |
| *115 | C 0 | 321.3 | 0.0000 | 0.00530 | 0.9671 | 28.01 |
| *116 | OXYGEN | 0.0 | 0.0000 | 0.00730 | 1.1048 | 32.00 |
| *117 | C 0 2 | 0.0 | 0.0000 | 0.01970 | 1.3195 | 44.01 |
| 118 | N 2 0 | 0.0 | 0.0000 | 0.00000 | 0.0000 | 44.02 |
| 119 | N 0 2 | 0.0 | 0.0000 | 0.00000 | 0.0000 | 46.00 |
| 120 | Octane (was N 0) | 6248.9 | | 0.11370 | 3.9441 | 118.17 |
| 121 | ETHYLEN | 1603.4 | 0.0000 | 0.02054** | 0.9686 | 28.05 |
| 122 | ACTYLEN | 1476.2 | 0.0000 | 0.02259** | 0.8990 | 26.04 |
| 123 | PROPENE | 2339.1 | 0.2554 | 0.03258** | 1.4529 | 42.08 |
| 124 | PROPDIEN | 2254.2 | 0.0000 | 0.03195** | 1.4110 | 40.07 |
| 125 | PROPYNE | 2246.2 | 0.0000 | 0.03195** | 1.4110 | 40.07 |
| *126 | AIR | 0.0 | 0.0000 | 0.00522** | 1.0000 | 28.96 |
| 127 | I-BUTENS | 3oa8.9 | 0.2960 | 0.04600** | 1.9372 | 56.11 |
| 128 | BUTENE-1 | 3087.8 | 0.2956 | 0.04488** | 1.2372 | 56.11 |
| 129 | C4-1 | 3078.4 | 0.2958 | 0.04548** | 1.9372 | 56.11 |
| 130 | T-C4=2 | 3075.3 | 0.2914 | 0.04796** | 1.9372 | 36.11 |
| 131 | C-C4=2 | 3000.2 | 0.2835 | 0.04803** | 1.9372 | 56.11 |
| 132 | BTITENES | 3078.0 | 0.2944 | 0.04674** | 1.9372 | 56.11 |
| 133 | BUTANES | 3265.3 | 0.3111 | 0.04652** | 2.0068 | 58.12 |
| 134 | 1,3-C4@ | 2887.7 | 0.2732 | 0.04980** | 1.8676 | 54.09 |
| 135 | 1,2-C4== | 2946.8 | 0.2604 | 0.04593** | 1.8676 | 54.09 |
| 136 | ETHYL OX | 1459.4 | 0.0000 | 0.00000 | 1.4900 | 44.CS |
| 137 | PENTEN-1 | 3835.7 | 0.3441 | 0.05534** | 2.4215 | 70.14 |
| 138 | MTHMERCP | 0.0 | 0.0000 | 0.00000 | 0.0000 | 49.10 |
| 139 | HEXANE | 4767.0 | 0.4111 | 0.08020 | 2.9754 | 86.18 |
| *140 | H 2 S | 638.6 | 0.1367 | 0.0253 | 1.1767 | 34.09 |
| 141 | C S 2 | 1267.0 | 0.0000 | 0.00000 | 2.629 | 76.14 |
| 142 | c 0 s | 0.0 | 0.0000 | 0.00000 | 0.0000 | 60.08 |
| 143 | S 0 2 | 0.0 | 0.1453 | 0.00000 | 2.2117 | 64.06 |
| *144 | WATER | 30.4 | 0.0571 | 0.06230 | 0.6220 | 16.02 |
| 145 | HEPTANE | 5515.4 | 0.4613 | 0.09440 | 3.4596 | 100.21 |
| *146 | ARGON | 0.0 | 0.0000 | 0.00710 | 1.3793 | 39.95 |
| 147 | C 3 + | 2522.1 | 0.2751 | 0.0344 | 1.5225 | 44.10 |
| 148 | C 4 + | 3270.1 | 0.3151 | 0.04780 | 2.0068 | 58.12 |
| 149 | C 5 + | 4019.2 | 0.3622 | 0.06310 | 2.4911 | 72.15 |

+Special equation is used for H2 in accordance with GPA 2172 ++GPA Pseudo √ bi He <1%.
*AGA Non-hydrocarbons **Derived using GPA compressibility data
***The transmitter uses this code since no method was available to get more detailed split information in a compatible manner. For total analysis calculate Decane+ = C6+(111) - Hexane(139) – Heptane(145) – Octane(120) – Nonane(161)

NOTE: The values in this table are examples only. Refer to the latest GPA, ISO or AGA publications for exact values.

## XVI. OTHER COMPONENT CODES

The following component codes are provided for completeness and to serve as a reference to use with other Totalflow Products such as the Analyzer Interface Unit. The transmitter uses component code 161 as no other method of gaining access to Nonane was available.

| COMPONENT CODE | COMPONENT NAME | BTU-DRY | GPM FACTOR | √ bi | SP. GR. IDEAL | MOLECULAR WEIGHT |
|---|---|---|---|---|---|---|
| 150 | METHANE | 1012.3 | 0.0000 | 0.01160 | 0.3539 | 16.04 |
| 151 | ETHANE | 1773.7 | 0.2675 | 0.02390 | 1.0382 | 30.07 |
| 152 | PROPANE | 2521.9 | 0.2756 | 0.03440 | 1.5226 | 44.10 |
| 153 | I-BUTANE | 3259.4 | 0.3271 | 0.04580 | 2.0068 | 59.12 |
| 154 | N-BUTANE | 3269.8 | 0.3153 | 0.104780 | 2.0068 | 58.12 |
| 155 | NEO C5 | 3993.8 | 0.3830 | 0.05774 | 2.4912 | 72.15 |
| 156 | IPENTANE | 4010.2 | 0.3659 | 0.05910 | 2.4912 | 72.15 |
| 157 | NPENTANE | 4018.2 | 0.3622 | 0.06310 | 2.4912 | 72.15 |
| 158 | C 6 + | 5288.7 | 0.4463 | 0.09100 | 3.3132 | 95.97 |
| 159 | NITROGEN | 0.0 | 0.0000 | 0.00440 | 0.9672 | 26.01 |
| 160 | C 0 2 | 0.0 | 0.0000 | 0.01970 | 1.5196 | 44.01 |
| 161 | NONANE | 6996.5 | | 0.13310 | 4.4284 | 128.258 |

| COMPONENT CODE | COMPONENT NAME |
|---|---|
| 162 | BTU-DRY |
| 163 | BTU-SAT |
| 164 | S.G. |
| 165 | z |
| 166 | WOBBE |
| 167 | TOTURRML |
| 183 | 24 Hour Average for Component #1 |
| 184 | 24 Hour Average for Component #2 |
| 185 | 24 Hour Average for Component #3 |
| 186 | 24 Hour Average for Component #4 |
| 187 | 24 Hour Average for Component #5 |
| 188 | 24 Hour Average for Component #6 |
| 189 | 24 Hour Average for Component #7 |
| 190 | 24 Hour Average for Component #8 |
| 191 | 24 Hour Average for Component #9 |
| 192 | 24 Hour Average for Component #10 |
| 193 | 24 Hour Average for Component #11 |
| 194 | 24 Hour Average for Component #12 |
| 195 | 24 Hour Average for Component #13 |
| 196 | 24 Hour Average for Component #14 |
| 197 | 24 Hour Average for Component #15 |
| 198 | Previous 24 Hour Average for Component #1 |
| 199 | Previous 24 Hour Average for Component #2 |
| 200 | Previous 24 Hour Average for Component #3 |
| 201 | Previous 24 Hour Average for Component #4 |
| 202 | Previous 24 Hour Average for Component #5 |
| 203 | Previous 24 Hour Average for Component #6 |
| 204 | Previous 24 Hour Average for Component #7 |
| 205 | Previous 24 Hour Average for Component #8 |
| 206 | Previous 24 Hour Average for Component #9 |
| 207 | Previous 24 Hour Average for Component #10 |
| 208 | Previous 24 Hour Average for Component #11 |
| 209 | Previous 24 Hour Average for Component #12 |
| 210 | Previous 24 Hour Average for Component #13 |
| 211 | Previous 24 Hour Average for Component #14 |
| 212 | Previous 24 Hour Average for Component #15 |
| 213 | TOTALGPM |

## XVII. Bit Flags Registers 3046 through 3055

| INDEX \ Bit Pos. | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit Weight | 16384 | 8192 | 4096 | 2048 | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 3046 | XMTR FAIL | | | | | | | | | | | | | | |
| 3047 | | | | | | | | | | | | | | RF % DEV | POWER FAIL |
| 3048 | Stream #1 Comp #15 LOW | Comp #14 LOW | Comp #13 LOW | Comp #12 LOW | Comp #11 LOW | Comp #10 LOW | Comp # 9 LOW | Comp # 8 LOW | Comp # 7 LOW | Comp # 6 LOW | Comp # 5 LOW | Comp # 4 LOW | Comp # 3 LOW | Comp # 2 LOW | Stream #1 Comp #1 LOW |
| 3049 | Stream #1 Comp #15 HIGH | Comp #14 HIGH | Comp #13 HIGH | Comp #12 HIGH | Comp #11 HIGH | Comp #10 HIGH | Comp # 9 HIGH | Comp # 8 HIGH | Comp # 7 HIGH | Comp # 6 HIGH | Comp # 5 HIGH | Comp # 4 HIGH | Comp # 3 HIGH | Comp # 2 HIGH | Stream #1 Comp #1 HIGH |
| 3050 | Stream #2 Comp #15 LOW | Comp #14 LOW | Comp #13 LOW | Comp #12 LOW | Comp #11 LOW | Comp #10 LOW | Comp # 9 LOW | Comp # 8 LOW | Comp # 7 LOW | Comp # 6 LOW | Comp # 5 LOW | Comp # 4 LOW | Comp # 3 LOW | Comp # 2 LOW | Stream #2 Comp #1 LOW |
| 3051 | Stream #2 Comp #15 HIGH | Comp #14 HIGH | Comp #13 HIGH | Comp #12 HIGH | Comp #11 HIGH | Comp #10 HIGH | Comp # 9 HIGH | Comp # 8 HIGH | Comp # 7 HIGH | Comp # 6 HIGH | Comp # 5 HIGH | Comp # 4 HIGH | Comp # 3 HIGH | Comp # 2 HIGH | Stream #2 Comp #1 HIGH |
| 3052 | Stream #3 Comp #15 LOW | Comp #14 LOW | Comp #13 LOW | Comp #12 LOW | Comp #11 LOW | Comp #10 LOW | Comp # 9 LOW | Comp # 8 LOW | Comp # 7 LOW | Comp # 6 LOW | Comp # 5 LOW | Comp # 4 LOW | Comp # 3 LOW | Comp # 2 LOW | Stream #3 Comp #1 LOW |
| 3053 | Stream #3 Comp #15 HIGH | Comp #14 HIGH | Comp #13 HIGH | Comp #12 HIGH | Comp #11 HIGH | Comp #10 HIGH | Comp # 9 HIGH | Comp # 8 HIGH | Comp # 7 HIGH | Comp # 6 HIGH | Comp # 5 HIGH | Comp # 4 HIGH | Comp # 3 HIGH | Comp # 2 HIGH | Stream #3 Comp #1 HIGH |
| 3054 | Stream #4 Comp #15 LOW | Comp #14 LOW | Comp #13 LOW | Comp #12 LOW | Comp #11 LOW | Comp #10 LOW | Comp # 9 LOW | Comp # 8 LOW | Comp # 7 LOW | Comp # 6 LOW | Comp # 5 LOW | Comp # 4 LOW | Comp # 3 LOW | Comp # 2 LOW | Stream #4 Comp #1 LOW |
| 3055 | Stream #4 Comp #15 HIGH | Comp #14 HIGH | Comp #13 HIGH | Comp #12 HIGH | Comp #11 HIGH | Comp #10 HIGH | Comp # 9 HIGH | Comp # 8 HIGH | Comp # 7 HIGH | Comp # 6 HIGH | Comp # 5 HIGH | Comp # 4 HIGH | Comp # 3 HIGH | Comp # 2 HIGH | Stream #4 Comp #1 HIGH |

As an example, if on Stream #1 a Low alarm was signaled on components #2(4), #5(32) and #10(1024), then add together the weights of those bits to get the value returned as 4+32+1024=1060.

# BTU Transmitter Printer/Console Commands

# BTU Transmitter Printer/Console Commands

## Introduction

This document describes the commands that are available through the printer/console port on the BTU Transmitter.

## Set/Retrieve/Command Protocol

The protocol used is a very simple command response protocol. An example of setting a variable in the Transmitter can be illustrated with the OK command. The format is OK <CR>. The transmitter will respond with the requested data if allowed by the security codes. In this case the response would be Y <CR> <LF>. To set a variable, give the proper command followed by an equal sign, and then the data. An illustration of this is the CODE command. The format is CODE= xxxx <CR>. Some commands that set fixed format data through Port D do not require the ending <CR>. The transmitter responds with: <CR><LF>. If an invalid command is given or access is not allowed, either the data is not returned or the variable is not set. An error setting a variable may also be indicated by not having both the <CR> and the <LF> returned.
Some commands are prefaced with xx. These commands are for array type access to the variables in question. All array values start at 00.

## Totalflow Connect Commands

These commands are always responded to regardless of security codes in effect or the position of security code override switches. These have been around forever and are always supported by Totalflow products.

### OK - Access Allowed

The OK command is used to find out if any access is granted. OK will respond with N if no access is allowed. The response will be Y if some or all access is allowed.

### CODE - Get Access

The CODE command is used to gain access to the transmitter. The format is CODE=XXXX where XXXX is the desired security code for the type of access desired, r/o or r/w.

## Totalflow Security Commands

The following relate to Totalflow product security. Most of these have been around forever and are supported by most Totalflow products.

### SC - Set Level 2 Security Code

This command sets the security code for level 2 or r/w access. The format is SC=XXXX. In printer/console mode, these commands normally have an equals sign (=) as part of the command to set a parameter.

### sc - Set Level 1 Security Code

This command sets the security code for level 1 or r/o access. The format is sc=XXXX. In printer/console mode, these commands typically are those that are allowed to be set with an equals sign (=), but are read from the transmitter by pressing the enter key instead of the equals.

### Sc - Set Operate Level Security Code

This command sets the security code for operation access. The format is sc=XXXX. In printer/console mode, these commands typically are those that do not allow an equals sign to set a parameter. See the OP command for examples of which commands may be used with this security level.

### OP – Set Operation Level Security Bits

This command is used in conjunction with the Sc command to set which operating commands to apply to the operation level security code. The default is 0x0026 (hex) which enables hold, run and calibration to be performed at the operation security level. If a bit is not set, then r/w access must be granted to allow operation of that command.

| Bit | State | Explanation |
|---|---|---|
| 00 | Other | Applies to operation commands not provided for specifically (i.e. this applies to xxSAMPSTR, xxSELSTRM and xxBALDR). |
| 01 | Hold | Allows operator to enter hold mode. |
| 02 | Run | Allows operator to enter run mode. |
| 03 | Single Cycle | Allows operator to run a single cycle. |
| 04 | Abort | Allows operator to abort a calibration or startup sequence. |
| 05 | Calibrate | Allows operator to initiate a calibration. |
| 06 | Startup | Allows operator to initiate a startup sequence with peak detect and calibration if enabled. |
| 07 | Manual Update | Allows operator to manually update response factors after calibration. |

## Totalflow System Commands

The following are Totalflow System Commands. Most of these have been around forever and are supported by most Totalflow products.

### dSL - Dump/Retrieve Station List

The dSL command uploads or downloads a data structure to support several Flow Computers connected in a station configuration. Normally, an AIU would be configured with the Station List so that analysis data could be downloaded to some or all Flow Computers in the list. This command is not currently implemented. This command will eventually be required to support local bus.

### Td - Time and Date

This command sets or retrieves the Time and Date from the Transmitter. The format to set is Td=mm/dd/yy hh:mm. Retrieving the time and date returns a string in the same format.

### Id - Analyzer Id Command

This command sets the 10 character Id that is used to access the Transmitter from the remote protocol. This command or function is generally available only through the local protocol.

### L - Location Command

This command sets the 24 character Location factor. This can be used to further describe where the transmitter is or its function in a system.

### Rev - Read Revision Information

This command reads the software revision codes. The format returned is: XXYYYYYYY-ZZZ where XX is the two-character software revision, YYYYYYY is the software part number, and ZZZ is the prom version code.

### AN - Analyzer Number

This command sets the analyzer number. This is used in communications with an AIU. The format is XX. The analyzer number is primarily used in MODBUS communications. The actual address is one more than what this command is set to.

## Transmitter Mode Commands

The following commands are used to set the operating mode of the transmitter. Depending on what is happening at the time, there may be a delay in the transmitter actually switching to the selected mode. These commands and their functionality are subject to change.

### RUN - Run Command

This command tells the transmitter to begin running analysis cycles. This will continue until told to do otherwise at intervals specified by the CTIME and CUNITS commands. The RUN command is not accepted when the transmitter is in START.

### START - Start Command

This command causes the transmitter to begin running cycles. The exact sequence of events is very dependent upon any prior activity. Generally speaking, the transmitter will stabilize, run self-test 1 & 2, find peaks (APEAK), calibrate (ACAL, AUTO, CALBLEND), and run (ASTART).

### HOLD - Hold Command

This command tells the analyzer to stop running analysis cycles when the current cycle is complete.

### ABORT - Abort Command

This command tells the analyzer to abort a calibration or startup sequence.

### CYCLE - Run Single Cycle Command

This command tells the analyzer to run one cycle. The CYCLE command is not accepted when the transmitter is in START.

### CAL - Calibrate Command

This command tells the analyzer to run a calibration sequence. The number of cycles run is specified with the CALCYC command and the number of cycles used in determining the response factors is specified with the CALAVG command. At the end of the calibrate sequence, the response factors will be automatically updated if the AUTO flag is set.

If this command is used when the analyzer is in run mode, a calibration sequence will be initiated as soon as possible. The analyzer returns to the run mode when calibration is complete. The CAL command is not accepted when the transmitter is in START.

### CSTATE - Current State

This command returns the current running state of the analyzer.

| Code | State | Explanation |
|---|---|---|
| 01 | Hold | Does not run cycles |
| 02 | Run | Continuously runs cycles as configured |
| 03 | Single Cycle | Runs one cycle, then goes to hold state |
| 04 | Abort | Ends Calibration or Startup in progress |
| 05 | Calibrate | Sets response factors |
| 06 | Startup | Runs diagnostics, Sets peak timing |

### NSTATE - Next State

This command returns the next expected running state of the analyzer. The code has the same interpretation as in the CSTATE command.

## Component Commands

The following commands are used to read component concentrations and set up component parameters. Components are identified by index number. The transmitter directly measures real components. Carbon components are calculated as a percentage of the C6+ real component. The real components and the carbon-split components have their own sequence as follows.

### Real Component Indexes

In each case the real components have the following ordering.

| Real Component Index | Real Component Description |
|---|---|
| 00 | C3 |
| 01 | IC4 |
| 02 | NC4 |
| 03 | Neo-C5 |
| 04 | IC5 |
| 05 | NC5 |
| 06 | C6+ |
| 07 | N2 |
| 08 | C1 |
| 09 | CO2 |
| 10 | C4+ |
| 11 | C3' |
| 12 | C2 |

### Carbon Split Component Indexes

In each case the carbon components have the following ordering.

| Carbon Component Index | Carbon Component Description |
|---|---|
| 00 | C6 |
| 01 | C7 |
| 02 | C8 |
| 03 | C9 |
| 04 | C10+ |

### xxHILIMyy - Concentration High Limit

This command sets the concentration high limit for stream xx, component yy. This is expressed as a fraction, e.g. 100%=1. A concentration high warning is generated if the concentration is above this value with the concentration low limit being below the high limit. A concentration range warning is generated if the concentration is above this value and the concentration is below the low limit with the concentration hi limit being above the low limit.

### xxLOWLIMyy - Concentration Low Limit

This command sets the concentration low limit for stream xx, component yy. This is expressed as a fraction, that is 100%=1. A concentration low warning is generated if the concentration is below this value with the concentration hi limit being above the low limit. A concentration range warning is generated if the concentration is below this value and the concentration is above the high limit with the concentration hi limit being below the low limit.

The two commands, xxHILIMyy and xxLOWLIMyy, work together as follows:

High/Low Mode

| | |
|---|---|
| | High Limit Warning |
| High Limit > Low Limit | |
| | No Warning |
| Low Limit < High Limit | |
| | Low Limit Warning |

Range Mode

| | |
|---|---|
| | No Warning |
| Low Limit > High Limit | |
| | Range Warning |
| High Limit < Low Limit | |
| | No Warning |

### xxCONCyy - Read Measured Concentration
This command reads the measured concentration for stream xx component yy. The returned concentration is expressed as a fraction, e.g. 100%=1.

### xxCByy - Read Measured Carbon Split Concentration
This command reads the measured concentration for stream xx carbon split component yy. The returned concentration is expressed as a fraction, e.g. 100%=1. The range of yy is from 00 to 04.

## Calibration Control Commands
The following gives parameters that are used to control calibration.

### CALHM - Calibration Hourly Mode
This command sets the resolution of the automatic calibration timing. The transmitter will always wait until the time specified by CALHR and CALMIN to initiate the first calibration after setting CALSET=01. Then if CALHM=01, the transmitter will delay the number of hours specified by CALNHR before initiating the next calibration. If CALHM=00, the transmitter will delay the specified # of days (CALDAY) before initiating the next calibration. The default is 00.

### CALDAY - Calibrate Day
This command sets the # of days until automatic calibration will be initiated. The format is XX. The default is 07 days.

### CALHR - Calibrate Hour
This command sets the hour of the day that automatic calibration will be initiated. The format is XX. The default is midnight (00).

### CALNHR - Calibrate Delay Hours
This command sets the # of hours to delay between calibrations when CALHM=01.

### CALMIN - Calibrate Minute
This command sets the minute of the hour that automatic calibration will be initiated. The format is XX. The default is the top of the hour (00).

### CALSET - Enable Timed Automatic Calibration
This command enables or disables timed automatic calibration. Calibration is disabled when set to 00 and calibration is enabled when set to 01. This will change to -1 (0xff) when the timer is set. The default is 00.

### ACAL - Enable Startup Automatic Calibration
This command enables or disables automatic calibration at startup. Startup calibration is disabled when set to 00 and enabled when set to 01. The default is 00.

### AUTO - Auto Update Mode
This command sets whether to automatically set response factors after a calibration sequence.

### MAN - Manually Update Response Factors
This command is used to manually move the newly calculated response factors to be used to calculate concentrations.

### LIMIT - Response Factor Change Limit
This command sets the limit value associated with the change in response factors from one calibration to the next. The default is 0.00 meaning that the calibration will occur regardless of the deviation of the response factors. A positive limit value will reject calibrations that generate any response factor deviations greater than the limit. A negative limit value will reject calibrations if all response factor deviations are less than the absolute value of the limit. If a calibration is rejected, a fault is generated and the error counter is incremented. The next action is dependent on the error count (ECT) and error count limit (ECL) commands.

## TPAP - Total Peak Area Percent Limit

This command enables checking for total peak area drift. The default value of 0.00 will cause the total peak area of all components to be recorded in memory at the end of a calibration. The TPAP command would then be used to set a limit value of, as an example, 30% or 0.30. Subsequent calibrations would then compare the total peak area with the recorded one and if they differed more than the percent limit, then an fault alarm would occur and the error counter is incremented. NOTE: the transmitter must be calibrated once with this command set to 0.00 before this command would be effective. The next action is dependent on the error count (ECT) and error count limit (ECL) commands.

## LCL - Last Cal BTU Limit

This command sets the last calibration BTU limit. The default is 0.00, which means to not check the limit value. If a non-zero value of, as an example, 30% or 0.30 is entered, the BTU value of the current calibration is compared with the value recorded at the end of the last successful calibration. If the two values differ by more than the limit, a fault alarm is generated and the error counter is incremented. The next action is dependent on the error count (ECT) and error count limit (ECL) commands.

## ECL - Error Count Limit

This command sets the error count limit. This is used in conjunction with the LIMIT, TPAP, and LCL commands. The default value is 0000, which means that no error count limit is used. When this value is non-zero, the error count as incremented above is compared to the error count limit. When this limit is exceeded, the transmitter will be taken out of run mode and go into hold mode. If the limit is not exceeded, the transmitter will go into run mode.

## ECT - Error Count

This command reads out the current error count. This value is incremented if an fault occurs as a result of the usage of the LIMIT, TPAP, or LCL commands. Successful completion of a calibration will result in the error count being reset to zero. The capability of the ECT and ECL commands can be used to preclude a slow creep over a few weeks of the transmitter using automatic timed calibration.

## PCTBTU - Startup Percent BTU Window

This command is used during startup to verify that the transmitter is able to verify the calibration sample BTU value. The default is 1% or 0.01. This is used only in the case of an unexpected power outage that is then restored. After all of the basic diagnostics are complete, two dummy cycles are run on the calibration stream. After the calculations are complete on the second run, its BTU value is compared to the BTU value calculated on the calibration sample values entered into the transmitter. If the values do not match within the deviation window specified, a warning is generated and the transmitter will attempt a calibration if the ACAL flag is set. If all of the required peaks during the calibration runs are not found, the transmitter will attempt automatic peak detection if the APEAK flag is set. After successful completion of these events, the transmitter will go back to run mode.

## CALSTR - Set Calibration Stream

This command will set which stream will be the calibration stream. The format is XX. The default is 03.

## CALCYC - Set Number of Cal Cycles

This command sets the number of calibration cycles that will be taken when automatic or manual calibration is initiated. The format is XXXX. The default is 05 cycles.

## CALAVG - Set Number of Cal Cycles to Average

This command sets the number of calibration cycles that will be used when automatic or manual calibration is initiated. The format is XXXX. The default is 03 cycles.

## MO - Methane Offset

This command sets the Methane Offset. The default MO is -0.08 representing -8%. Methane Offset is used to compensate for a slight non-linearity in methane's response curve that is due to Methane's typically high concentration in the process stream. To calculate Methane offset, two calibration blends are needed. Blend #1 should be approximately 90% methane and blend #2 should be approximately 70%. The transmitter does not need to be calibrated before running these blends. Several cycles should be run on each blend. Record and average the peak area for methane for the last cycles run. As an example, run 5 cycles, then record and average methane's peak area for the last 3 cycles. Also record with each set of runs the Methane Fraction. As an example if Methane in blend #1 were 90%, then Methane Fraction #1 would be 0.9. Then calculate:

$$MO = MethaneFraction\#2 - MethanePeakArea\#2 * \frac{MethaneFraction\#1 - MethaneFraction\#2}{MethanePeakArea\#1 - MethanePeakArea\#2}$$

After entering the Methane Offset into the transmitter, calibrate normally. Recalculation of the Methane Offset should not be done as often as calibration. The transmitter will have the correct methane offset entered after factory calibration.

## xxFACTOR - Manually Set Response Factor

This command sets the response factor associated with component xx. Normally a calibration sequence with an automatic or manual factor update should be used instead. Factors 0-12 are individual component factors. Factors 13-21 are Gas Chromatogram Module Coefficients (GCMC). Factors 0-12 and 13-16 are always used. Factors 17-22 are only used during a GCMC startup

| Factor | Description | 45/68 Module | 59/60 Module |
|---|---|---|---|
| 00 | C3 | 5.68e-9 | 4.50e-9 |
| 01 | IC4 | 4.85e-9 | 4.20e-9 |
| 02 | NC4 | 4.79e-9 | 4.17e-9 |
| 03 | NEOC5 | 4.40e-9 | 3.28e-9 |
| 04 | IC5 | 4.38e-9 | 3.26e-9 |
| 05 | NC5 | 4.19e-9 | 3.14e-9 |
| 06 | C6+ | 2.80e-9 | 1.90e-9 |
| 07 | N2 | 1.95e-8 | 1.43e-8 |
| 08 | C1 | 2.59e-8 | 1.91e-8 |
| 09 | CO2 | 1.78e-8 | 1.30e-8 |
| 10 | C4+ | 1.18e-8 | 7.80e-9 |
| 11 | C3' | 6.90e-7 | 7.46e-7 |
| 12 | C2 | 1.55e-8 | 1.17e-8 |
| 13 | C3-NC5 Amplitude - Primary is C3 | 1.00 | 1.00 |
| 14 | C6+ Amplitude | 1.00 | 1.00 |
| 15 | N2, C1, CO2 Amplitude - Primary is C1 | 1.00 | 1.00 |
| 16 | C4+, C3', C2 Amplitude - Primary is C3' | 1.00 | 1.00 |
| 17 | Operating Carrier Pressure - sets NC5 PT | | |
| 18 | C1 Peak Time @ Operating Carrier Pressure | | |
| 19 | C3' Peak Time @ Operating Carrier Pressure | | |
| 20 | SV1 Adjust Time | | |
| 21 | NC5 PT | | |
| 22 | C3 PT | | |

## CALBLEND - Set Calibration Blend

This command sets the calibration blend:

| Blend | Description |
|---|---|
| 01 | Standard Blend - Calibration adjusts Factors 0-12 & Sets Factors 13-16 to 1 |
| 02 | Standard Blend with Magic Module Coefficients - Calibration adjusts Factors 13-16 |
| 03 | Validation Blend with Magic Module Coefficients - No Adjustment, Warning if shifted |
| 04 | Future or No Blend Connected |

## xxSAMPLE - Set Sample Concentration

This command sets the sample concentration for component xx. The data is entered as a free format floating point number such that 100%=1, .99%=0.0099, etc.

## xxPCTCH - Retrieve % Factor Change

This command retrieves the % by which component xx factor changed during last calibration.

## BTU Transmitter Parameters

The following are some of the parameters that affect operation.

### ASTART - Autostart command

This command sets the autostart flag. During power up, the flag may be used to determine whether to run or not after power up. The format is XX. If unit was not in RUN on last power down and ASTART=01, the analyzer will start running cycles after all other startup activities have been completed successfully. If unit was running when power was interrupted, this flag is ignored, and unit will return to running with old parameters if no fault alarms occur on power up.

### APEAK - Autopeak Detect command

This command sets the APEAK flag. During power up, the flag may be used to determine how the peak times are determined. The format is XX.

| Value | Meaning |
|---|---|
| 00 | No Detection of Peak Times |
| 01 | Automatic Peak Time Detection |
| 02 | Magic Module Factors 17-22 sets Carrier Pressure and Peak Times during startup |

### CTIME - Cycle Interval

This command sets the cycle interval. The format is XXXX. The default is 600 seconds. To set cycle interval to 180 seconds type 'CTIME=0180'.

### CUNITS - Cycle Interval Units

This command sets the cycle interval units. The default is seconds. The allowed values are:

| Value | Meaning |
|---|---|
| 01 | System Ticks |
| 02 | Seconds |
| 03 | Minutes |

### CLOCK - Read Current Cycle Tick Counter

This command reads the current cycle tick counter. The format returned is XXXX.

### CTYPE - Calculation Type

This command sets the calculation type. The default is 01.

| CTYPE | Calculation | xxPB Units | xxTB Units |
|---|---|---|---|
| 00 | AGA5 | PSIG | Degrees F |
| 01 | NGPA | PSIG | Degrees F |
| 02 | ISO | kPA | Degrees C |
| 03 | GOST | kg | Degrees C |
| 04 | GPA96 | PSIG | Degrees F |
| 05 | ISOM | kPA | Degrees C |

CTYPE will convert xxPB and xxTB to the default values in compatible units as necessary.

### PEAKDEV - Retention Peak Time Deviation Factor

This command sets the size of the retention time window that peaks are expected to be within. This is expressed as a fraction relative to the current value. The default is 0.075.

## xxSIDELIM - Side to Side Warning Limit

This command sets the side-to-side warning limit. This is expressed as a fraction away from 1.000. The default is 0.10.

NOTE: This parameter will cause a warning or fault alarm only if cross correction is enabled.

## Communications Commands

The following commands set communications modes and parameters.

## XF - Start X-Frame Protocol

This command starts the X-Frame Protocol. X-Frame is used to collect larger blocked data structures. These include event log, alarm log, current results, history files, stored chromatograms, peak tables, and diagnostic files. Until X-Frame is killed by command or the local device is disconnected, local protocol commands will not be accepted.

WARNING: Since this command switches the protocol to a binary blocked protocol, this command should only be used in conjunction with the local MMI.

## xxPORT - Port Protocol

This command sets the protocol to be used on port xx. Ports 00 and 01 are internal ports and are not available. The following ports and protocols are available or planned.

| Port | Location | Default Protocol | Hardware Capability |
|---|---|---|---|
| (0) | (internal) | (none) | (none) |
| (1) | (internal) | (none) | (none) |
| 2 | I.S. Term PCBA, J3 | Local | RS-232-C |
| 3 | RS232/PWR PCBA, J3 | Printer/Console | RS-232-A |
| 4 | I.S. Term PCBA, J2 | Modbus | RS-422 |
| 5 | I.S. Term PCBA, J1 | Remote | RS-485 |

| Code | Protocol |
|---|---|
| 00 | (none) |
| 01 | Local |
| 02 | Printer/Console |
| 03 | HCIA (One Only) |
| 04 | Modbus |
| 05 | Remote |
| 06 | PGC PTB Printout |
| 07 | DSfG Adapter |

## xxPFLG - Selective Printout Flag

This command sets the automatic or selective printout flag for each port. xx is the port number to set. The parameter is bit weighted to indicate to print based on end of cycle, top of hour, top of day or top of month. This command also sets whether to send a clear byte (0xff) before the message frame in MODBUS or HCIA protocols. The bit weightings are as follows:

| Bit | Meaning |
|---|---|
| 00 | End of Cycle |
| 01 | Top of Hour |
| 02 | Top of Day |
| 03 | Disable Clear Byte. Applies only to MODBUS and HCIA protocols. |
| 04 | 16 Bit Modbus Modes (vs Daniels Modbus) (effective in MODBUS protocol) |
| 05 | Modicon Modbus (vs word swap) (effective if bit 04 is set) |
| 06 | Top of Month |
| 07 | End of Calibration |

This command will affect printouts for the Printer/Console, PGC PTB Printout, and DSfG Adapter protocols.

## C6IDX – Modbus C6+ Component Index Mode

This command selects how C6+, C6, C7, C8 and C9 are represented to external devices in modbus registers 3001-3032. This command does not modify the actual floating-point values in registers 7000-8999. This mode can be set to one of six values. The allowed values are:

| Mode | Meaning |
|---|---|
| 00 (00) | Totalflow Default: actual value of C6+, C7, C8 and C9. REQUIRED for Totalflow devices. |
| 108 (6C) | 47.466% C6, 35.340% C7, 17.194% C8. |
| 109 (6D) | 50% C6, 50% C7, 0% C8. |
| 110 (6E) | 50% C6, 25% C7, 25% C8. |
| 111 (6F) | 57.143% C6, 28.572% C7, 14.285% C8. |
| 255 (FF) | C6+ is not reported; C6, C7, C8 and C9 are. |

NOTE: When entering the code using printer/console mode, the hexadecimal value in parenthesis in the table above must be entered. Illegal values will cause C6+ to not be represented properly.

The current method of using the manually entered carbon split will still be used for all other purposes. Therefore, depending upon which C6+ index mode is selected, it is required to manually enter the appropriate carbon split shown in the table above in the stream setup menu for the transmitter to correctly compute and report accurately. As an example with the 2100528-003 firmware, the different C6+ index modes will cause a modbus master device to see the following effects on the integer registers 3001-3032 (registers 3017-3032 mirrors registers 3001-3016):

| | | C6IDX | | | | | |
|---|---|---|---|---|---|---|---|
| Component | Register | 0 | 108 | 109 | 110 | 111 | 255 |
| C3 | 3001(17) | 02 | 02 | 02 | 02 | 02 | 02 |
| IC4 | 3002(18) | 03 | 03 | 03 | 03 | 03 | 03 |
| NC4 | 3003(19) | 04 | 04 | 04 | 04 | 04 | 04 |
| NEOC5 | 3004(20) | 07 | 07 | 07 | 07 | 07 | 07 |
| IC5 | 3005(21) | 05 | 05 | 05 | 05 | 05 | 05 |
| NC5 | 3006(22) | 06 | 06 | 06 | 06 | 06 | 06 |
| **C6+** | **3007(23)** | **11** | **08** | **09** | **10** | **11** | **255** |
| N2 | 3008(24) | 14 | 14 | 14 | 14 | 14 | 14 |
| C1 | 3009(25) | 00 | 00 | 00 | 00 | 00 | 00 |
| CO2 | 3010(26) | 17 | 17 | 17 | 17 | 17 | 17 |
| C4+ | 3011(27) | 48 | 48 | 48 | 48 | 48 | 48 |
| **C9** | **3012(28)** | **61** | **255** | **255** | **255** | **255** | **61** |
| C2 | 3013(29) | 01 | 01 | 01 | 01 | 01 | 01 |
| **C6** | **3014(30)** | **39** | **255** | **255** | **255** | **255** | **39** |
| **C7** | **3015(31)** | **45** | **255** | **255** | **255** | **255** | **45** |
| **C8** | **3016(32)** | **20** | **255** | **255** | **255** | **255** | **20** |

These modes are compliant with the Daniels C6+ comp codes 108, 109, 110, 111 and 255. Note that all codes except that unused code is offset by 100. Once this is done, the modbus master device would only receive a C6+ mole percent concentration via register 3007. This allows resolution of the issue of "doubling" the C6+ concentration and allows the flow computer to perform its own AGA8 Detail calculations. NOTE: Using codes 108 through 111 will cause the individual C6, C7, C8 and C9 index codes to not be available.

### xxBR - Baud Rate

This command sets the remote protocol's baud rate. xx is the port number to set. The allowed values are:

| Value | Meaning |
|---|---|
| 00 | 1200 Baud |
| 01 | 2400 Baud |
| 02 | 4800 Baud |
| 03 | 9600 Baud |

### xxWT - Listen Cycle Time

This command sets the remote protocol's listen cycle time. This command along with the baud rate command controls period and duty cycle for the remote protocol to listen for communications through a radio. The allowed values are:

| Value | Meaning |
|---|---|
| 00 | 4 Second Cycle |
| 01 | 2 Second Cycle |
| 02 | 1 Second Cycle |
| 03 | 0 Second Cycle, a.k.a. Magic Mode 0 |

## Stream Commands

The following is available to work with streams.

### STRST - Step to Next Stream

This command steps to the next stream.

### STREAM - Select Stream

This command sets the next stream to process in hold mode or returns the stream currently being processed. The format is XX. Valid entries are 00-03.

### NXTSTR - Next Stream

This command sets the next stream to process in hold mode or returns the stream that is, at this instant, to be processed next. The format is XX. Valid entries are 00-03.

### NSTREAM - Set Number of Streams

This command sets the number of streams. The format is XX. Valid entries are 00-04. The default is 01.

NOTE: This parameter is no longer used by the transmitter, but is provided for backward compatibility.

### DISSEL - Disable Stream Select

This command disables stream selection. 00 enables stream selection and 01 disables stream selection (analyzer runs current stream continuously).

## NSTRIDX - Number of Stream Indexes

This command sets the number of entries in the stream index table. The format is XX. The default is 0A to allow stream indexes to control sequencing.

## xxSTRIDX - Stream Indexes

This command sets the stream index table entries. xx indicates which entry to set in the range of 00 to 09. The format is XX. Default index table is 00, 01, 02, FF, FF ---- to run stream 0, 1, and 2 in sequence. An entry can be set to 03 to run stream 03.

## xxSKIP - Skip Stream

This command skips stream xx in the stream index table. Set to 00 to process stream and 01 to skip stream. During startup, the transmitter may set streams to be skipped if sample pressure is low. Even though the startup diagnostics always checks all streams, the transmitter will not re-enable a stream automatically.

## xxMAMAX - Set Moving Average Cycle for Reported Results

This command sets the moving average cycle for stream xx. Results will be averaged on a moving basis for the specified number of cycles. All reports and histories will be based on this moving average. The format is XX. The default is 01.

## xxCBPCTyy - Carbon Split Factor

This command sets the carbon-split factor for stream xx. For C6, yy=00 and for C10+, yy=04. The default is .57 C6 and .43 C7.

## xxTB - Temperature Base

This command sets the temperature base for stream xx. Temperature base is used in calculations for Wet CV and Dry CV as required. Always set the appropriate calculation type(CTYPE) before setting a custom temperature base.

## xxPB - Pressure Base

This command sets the pressure base for stream xx. Pressure base is used in calculations for Wet CV and Dry CV as required. Always set the appropriate calculation type (CTYPE) before setting a custom pressure base.

## xxBTULOW - Set BTU Low Limit

This command sets the low limit for the BTU value. A BTU low warning is generated if the BTU value is below this value with the BTU hi limit being above the low limit. A BTU range warning is generated if the BTU value is below this value and the BTU value is above the high limit with the BTU hi limit being below the low limit.

## xxBTUHI - Set BTU Hi Limit

This command sets the high limit for the BTU value. A BTU high warning is generated if the BTU value is above this value with the BTU low limit being below the high limit. A BTU range warning is generated if the BTU value is above this value and the BTU value is below the low limit with the BTU low limit being above the high limit.

The two commands, xxBTULOW and xxBTUHI, work together as follows:

High/Low Mode

| | |
|---|---|
| | High Limit Warning |
| High Limit > Low Limit | |
| | No Warning |
| Low Limit < High Limit | |
| | Low Limit Warning |

Range Mode

| | |
|---|---|
| | No Warning |
| Low Limit > High Limit | |
| | Range Warning |
| High Limit < Low Limit | |
| | No Warning |

### xxXCORR - Cross Correction Enable
This command enables or disables cross correction for stream xx. At cold start this is initialized to 00 to disable cross correction. Set to 00 to disable cross correction. When cross correction is disabled, reports will show the actual cross correction computation enclosed in parentheses.

### xxUNL - Un-Normalized Total Concentration Limit
This command sets the un-normalized total concentration limit for stream xx. The default is 0, which turns this feature off. Setting this to a value of 0.03 or 3% will cause a total concentration falling outside of a window of +- 3% from 100% will cause a fault alarm.

### xxRTd - Get Date/Time Stream was Last Run
This command returns the date and time that a completed analysis was run on stream xx. Specifying stream 05 gets the date and time for the last calibration cycle. Any other value returns the latest available analysis run.

## Chromatograms
The following commands are used to work with Chromatograms. Chromatograms are dumped in the following format:

| Column | Meaning |
|---|---|
| 1 | Cycle Time (Seconds) |
| 2 | Detector 1 Mark |
| 3 | Detector 1 Value |
| 4 | Detector 2 Mark |
| 5 | Detector 2 Value |

The Marks has the following format:

| Indicator | Meaning |
|---|---|
| (Blank) | No Mark |
| + | Positive Mark; Gate On, Detector Balance, Autoslope Start |
| - | Negative Mark; Gate Off, Autoslope Stop |

### xxXGRAM - Dump Stored Chromatogram
This command dumps the last stored chromatogram for stream xx. Chromatograms are stored at 20 points per second.

### xxIGRAM - Dump I/O Mode Chromatogram
This command dumps chromatogram data. The next xx points are output. If xx is 00, the output is continuous until a key is pressed. The dump proceeds at 10 points/second.

## Alarm Commands
The following commands are used to interact with alarms.

### ALARM - Get Transmitters Alarm State
This command gets the current Alarm State. A bit that is set indicates that condition exists on some stream. Each bit returned is weighted as follows:

| Bit | State |
|---|---|
| 0 | Current Warning |
| 1 | Current Fault |
| 2 | Initial Warning |
| 3 | Initial Fault |

### xxIWARN - Retrieve Initial Warning
This command retrieves the initial warning code. The code is expressed in hex.

## xxCWARN - Retrieve Current Warning
This command retrieves the current warning code. The code is expressed in hex.

## xxIFAULT - Retrieve Initial Fault
This command retrieves the initial fault code. The code is expressed in hex.

## xxCFAULT - Retrieve Current Fault
This command retrieves the current fault code. The code is expressed in hex.

## LW - Log Warnings
This command sets whether to log warnings is the alarm log. This is on by default. Set to 01 to log warnings or 00 to not log warnings, i.e. only log faults. The initial and current warning are still available in all other reports and are logged with the history.

## ALARMLOG - Dump Alarm Log
This command dumps the alarm log. Issuing the command ALARMLOG= clears the log. Clearing the log requires r/w security access.

## Alarm Codes
Codes 0-63 are used for warning codes. Codes 64-127 are used for fault codes. The following table summarizes the meaning of all of the codes.

| Code | Meaning | Explanation |
|---|---|---|
| 1 | Detector Balance Failed | This warning indicates that the detector signal could not be balanced within 1000 detector counts (approx. 1.192 mV) of zero. |
| 2 | Low Power | This warning occurs if the battery voltage drops below 12.00 volts. The warning is re-enabled if power rises to above 12.25 volts. |
| 3 | Low Carrier | This warning may occur during start-up or normal cycling. Start-up tests to within 1 PSIG and cycles test to 1.5 PSIG. Carrier is tested to within 5 PSIG during pre-inject. This warning also occurs if the DI for the carrier bottle is closed. |
| 4 | Low Oven Temperature | This warning occurs if the oven temperature at cycle start is more than 2 Degrees F lower than the oven set-point. |
| 5 | Low Oven Change Rate | This warning is not currently used. |
| 6 | Low Carrier Pressure | This warning is not currently used. |
| 7 | Unknown Peak Detected | This warning occurs when component peaks do not fall within the peak deviation windows. Extra components, module shifts or a need to perform automatic peak detection cause this warning. |
| 8 | Sample Pressure Low | This warning occurs if the stream pressure does not build to over 4 PSIG. |
| 9 | High Carrier Pressure | This warning may occur during normal cycling. Pre-inject tests to within 5 PSIG and cycle tests to within 1.5 PSIG. |

| Code | Meaning | Explanation |
|---|---|---|
| 10 | High Oven Temperature | This warning occurs if the oven temperature is more than 2 Degrees F over the set point. |
| 11 | Concentration Above High Limit | This warning occurs if the concentration of a component is more than the high limit set for that component and stream. |
| 12 | Concentration Below Low Limit | This warning occurs if the concentration of a component is more than the low limit set for that component and stream. |
| 13 | Peaks not found in sample | This warning is not currently used. |
| 14 | Peaks not found in sample - auto-start | This warning occurs if all peaks are not properly found in the calibration sample following a power on restart. Transmitter would have previously been running and power was off more than 20 seconds. |
| 15 | Calculated BTU does not match Measured BTU | This warning occurs if the measured BTU does not match the calculated BTU based on the calibration sample. Transmitter would have been power cycled and would have previously been running and power was off more than 20 seconds. |
| 16 | Pressure Regulator Module Out Of Spec | This warning occurs if after three attempts the measured standard deviation of the carrier pressure is more than 0.1 PSIG but less than 0.25 PSIG. |
| 17 | Carrier Out of Spec | This warning occurs if the measured standard deviation of the carrier pressure is more than 0.2 PSIG. |
| 18 | Oven Temperature not Stable | This warning occurs if the measured standard deviation of the mandrel temperature is more than 0.5 Degrees F. |
| 19 | Sample Pressure not Stable | This warning occurs if the sample pressure is not 15 +- 3 PSIG with the stream valve full open and the sample shut off valve closed. |
| 20 | Auto-start Delayed for Temperature Stabilization | This warning occurs if the mandrel temperature is not within 3 Degrees F of the oven set point while starting off automatic peak detection. |
| 21 | Communications Failure | This warning occurs if the transmitter doesn't receive an OK signal while sending data with HCI-A protocol. |
| 22 | Side to Side Correction Factor out of Limits | This warning occurs if the C3 and C3' un-normalized concentrations don't match up within this value. The default range is 10%. |
| 23 | Calibration not updated - Results disagree with sample | This warning occurs if the magic module coefficients don't match on C6+, NC5, CO2 or C3. Components are tested to 15% or 5% if tested after failing 15% and auto-started. |
| 24 | Calibration not updated - Peaks Missing | This warning occurs if expected peaks are not found in the calibration sample. If the peaks are indeed missing, set their calibration sample concentration for those peaks to zero and try again. Otherwise, perform automatic peak finding. |
| 25 | New RF limit exceeded - No longer used | This warning occurs if the percentage change of the response factor of a component is more than a user specified limit and automatic response factor update is not enabled. |
| 26 | Calibration Pressure Low (DI) | This warning occurs if the digital input from an external switch closes to indicate low calibration bottle pressure. The bottle should be replaced soon with fresh carrier. |
| 27 | Low Ambient Temperature | This warning occurs if the ambient temperature is below 32 Degrees F while starting a calibration sequence. |
| 28 | BTU High | This warning occurs if the BTU value of the sample is above a user specified value. |
| 29 | BTU Low | This warning occurs if the BTU value of the sample is below a user specified value. |

| Code | Meaning | Explanation |
|---|---|---|
| 30 | BTU Range Error | This warning occurs if the BTU value is outside of the user specified range. |
| 31 | Concentration Range Error | This warning occurs if the concentration of a component is outside of a user-specified range. |
| 32 | Side to Side Auto Disable | This warning occurs if the Side to Side Correction is disabled automatically due to either propane being zero or near over-ranged or not recognized. |
| 33 | Calculation Error | This warning occurs when an AGA8 calculation error occurs. Exceeding the maximum number of iterations due to non-convergence or pressure having a negative density derivative will cause this. |
| 34 | Un-Normalized Concentration Error | This warning occurs if the un-normalized concentration falls outside of a band. |
| 64 | Analog to Digital Converter Calibration Failure | This fault occurs if the converter can't be calibrated during start-up. The problem lies in the converter itself or its power supply. |
| 65 | Sample System Failure | This fault occurs if a holding pressure is not maintained in the sample system. A positive drop more than 0.5 PSIG indicates a leak after the quad solenoid valve. A negative drop more than 0.5 PSIG indicates a leak with the quad solenoid valve. |
| 66 | No Carrier Pressure | This fault occurs if carrier pressure is 5 PSIG less than the set point while the set point is more than 10 PSIG. The occurrence of this fault prevents a cycle from actually happening. |
| 67 | Partition System Failure | The occurrence of this fault indicates a serious problem. An immediate cold start is recommended. |
| 68 | Task Start Failure | The occurrence of this fault indicates a serious problem. An immediate warm start is recommended. If the condition does not improve, a cold start is recommended. |
| 70 | Low Sample Flow | This fault occurs if the flow through the module as indicated by a drop in sample pressure is inadequate. |
| 71 | Detector Range Exceeded | This fault occurs if the detector value exceeds +-4000000 counts (approx. 4.75 volts). |
| 72 | Replace Carrier Regulator Module | This fault occurs if an impossible carrier pressure is detected. |
| 73 | No Pressure Detected at Carrier Regulator Module | This fault occurs if little or no carrier pressure is detected. |
| 74 | Carrier Vent Blocked | This fault occurs if the carrier pressure doesn't bleed off. |
| 75 | Replace Pressure Regulator Assembly | This fault occurs if the carrier pressure is not 40 +- 5 PSIG after setting 40 PSIG and waiting 10 seconds for stabilization. |
| 76 | Replace Pressure Regulator Board | This fault occurs if the carrier pressure standard deviation is not within 0.25 PSIG. |
| 77 | Low Carrier Flow Rate | This fault is not currently used. |
| 78 | Detector 0 Std Deviation out of Spec | This fault occurs if the detector 0 standard deviation is not within 1000 counts (approx. 1.192 mV). |
| 79 | Detector 1 Std Deviation out of Spec | This fault occurs if the detector 1 standard deviation is not within 1000 counts (approx. 1.192 mV). |
| 80 | Column 0 Valve did not switch | This fault occurs if the column 0 reverse valve did not switch from forward mode to reverse mode. |
| 81 | Column 1 Valve did not switch | This fault occurs if the column 1 reverse valve did not switch from forward mode to reverse mode. |

| Code | Meaning | Explanation |
|---|---|---|
| 82 | No Calibration Blend Specified | This fault occurs if the no calibration blend is specified and automatic calibration is requested during start-up. |
| 83 | Std Sample Flow Failure | This fault occurs if the flow through the module as indicated by a drop in calibrate pressure is inadequate. |
| 84 | Std Sample Pressure Failure | This fault occurs if the calibrate stream pressure does not build to over 4 PSIG. |
| 85 | Oven Temperature Runaway | This fault occurs if the mandrel temperature exceeds the set point by more than 20 Degrees F. The oven is shut down if this happens. |
| 86 | Oven Temperature Failure | This fault occurs if the mandrel temperature is not making progress toward the set-point temperature, if the mandrel temperature exceeds 190 Degrees F, or if the mandrel temperature is more than 3.5 Degrees F from the set point at the start of the cycle. |
| 87 | Data Lost - Multi-tasking Overload | This fault occurs if data is lost because all detector readings are not integrated into the peak area. A warm start is recommended. |
| 88 | Stream Valve Leak | This fault occurs if the quad solenoid valve is leaking. |
| 89 | Carrier > 2 PSIG from set-point | This fault occurs if the carrier pressure at the start of a cycle is more than 2 PSIG from the set point. |
| 90 | CO2 Not Found on Column 0 | This fault occurs if CO2 can't be identified during automatic peak detection. |
| 91 | NC5 Not Found on Column 1 | This fault occurs if NC5 can't be identified during automatic peak detection. |
| 92 | Ambient Temperature out of range | This fault occurs if the ambient temperature at the start of a cycle is not between 5 and 135 Degrees F. This prevents a cycle from being run. The transmitter waits the user specified cycle time and then will try again. |
| 93 | Side to Side limit is ridiculous | This fault occurs if the cross correction factor (ratio) between C3 and C3' is not in the range of 1 +- 0.5. Automatic peak detection and calibration ignore this fault. |
| 94 | No Sample Pressure | This fault occurs if the sample pressure is less than 1 PSIG. |
| 95 | Replace GC Module | This fault occurs if detector 0 peaks can't be matched up during automatic peak detection. |
| 96 | Detector 1 PT Match | This fault occurs if detector 1 peak times can't be matched up during automatic peak detection. |
| 97 | C4+ problem | This fault occurs if C4+ front to back ratio is outside 30% during automatic peak detection. |
| 98 | Detector 1 2nd half PT | This fault occurs if detector 0 peak times can't be matched up during automatic peak detection on the reverse side (C4+, C3', C2). |
| 99 | Peak Area Difference | This fault occurs if the total peak area differs by more than a preset amount. |
| 100 | Last Calibration Limit Exceeded | This fault occurs if the Btu value from the last calibration attempt is outside the cal limit window centered on the last good calibration within a fractional window defined by LCL command. |
| 101 | New RF limit exceeded | This fault occurs if the percentage change of the response factor of a component is more than a user specified limit and automatic response factor update is not enabled. |
| 102 | Un-Normalized Concentration Fault | This fault occurs if the un-normalized concentration falls outside of a band. |
| 103 | Alternate DI Triggered Fault | This fault occurs when the transmitter is in alternate DI mode 1 and the trigger fault DI is triggered. |
| 104 | Manual Calibration Request | This fault occurs when the transmitter has gone through a calibration cycle without auto update. The transmitter is suggesting to manually update calibration factors. |

## Event Commands

Events are used to tell about operation changes associated with the transmitter. The following commands interact with the event log.

## Event Codes

The following event codes are reserved.

| Code | Meaning |
|---|---|
| 0 | No Event |
| 1 | Date and Time Changed |
| 5 | Contract Hour Changed |
| 13 | Watchdog Time-out Occurred |
| 15 | Security Code Changed |
| 77 | Temperature Base Changed |
| 78 | Pressure Base Changed |
| 116 | Software Changed |
| 147 | Event Log Full |
| 148 | Event Log Collected |
| 152 | Analog to Digital Converter Failed |
| 500 | Log Interval Changed |
| 501 | Cycle Units Changed |
| 502 | Low Carrier Mode Changed |
| 503 | Auto-start Mode Changed |
| 504 | Low Power Mode Changed |
| 505 | Calibrate Start Hour Changed |
| 506 | Calibrate Day Changed |
| 507 | Calibrate Start Minute Changed |
| 508 | Auto Factor Update Mode Changed |
| 509 | # of Streams |
| 510 | Calibrate Stream |
| 511 | Calculation type |
| 512 | # of Calibration Cycles |
| 513 | # of Calibration Cycles in Average |
| 514 | Analyzer Number Changed |
| 515 | Disable Stream Select Changed |
| 516 | # of Stream Indexes Changed |
| 517 | Stream Index Changed |
| 518 | Stream Skip Changed |
| 519 | Cycle Time Changed |
| 520 | Moving Average Changed |
| 521 | Gate Time Changed |
| 522 | Valve Time Changed |
| 523 | Analog Output Scale Multiplier Changed |
| 524 | Peak Time Deviation Changed |
| 525 | Response Factor Change Limit Changed |
| 526 | Response Factor Manually Changed |
| 527 | Sample Concentration Changed |
| 528 | Retention Time Changed (Detector 1) |
| 529 | Retention Time Changed (Detector 0) |
| 530 | Port Changed |
| 531 | Oven Temperature Changed |
| 532 | Carrier Pressure Changed |
| 533 | Response Factor Auto Update |
| 534 | Calibration Blend Changed |
| 535 | Side to Side Limit Changed |
| 536 | Concentration Low Limit Changed |
| 537 | Concentration High Limit Changed |
| 538 | Carbon Split Factor Changed |
| 539 | Calibration Hourly Mode |
| 540 | Calibration Hour Changed |
| 541 | Calibration Time Set Changed |
| 542 | Auto Startup Calibration Mode |
| 543 | Auto Peak Detect Flag Changed |
| 544 | BTU Low Limit Changed |
| 545 | BTU High Limit Changed |
| 546 | Error print flag (Printer-Console) |
| 547 | Cross Correction |
| 548 | Pre Purge |
| 549 | Alternate DI Mode |
| 550 | Alternate DO Mode |
| 551 | Log Warnings Mode |
| 552 | Detector #2 Minimum Peak Area |
| 553 | Log Response Factor Auto Updates |
| 554 | Response Factor Update |
| 555 | Test Value (Primary) Entered |
| 556 | Test Value (Carbon) Entered |
| 557 | Specific Gravity of Air |
| 558 | Mass of Air |
| 559 | Btu Percent Range |
| 560 | Selective Port Print Flags |
| 561 | Port Baud Rate |
| 562 | Port Listen Cycle |
| 563 | Total Peak Area Percent Difference |
| 564 | Error Count Limit |
| 565 | Last Cal Limit |
| 566 | Un-normalized concentration limit |
| 567 | Back-Peak Ratio |
| 568 | C6+ Minimum Peak Area |
| 569 | Peak Baseline Adjustment Code |
| 570 | Common Gas Factor |
| 571 | Carbon Common Gas Factor |

| | |
|---|---|
| 572 | NGPA Gas Factor |
| 573 | Carbon NGPA Gas Factor |
| 574 | ISO Gas Factor |
| 575 | ISO Carbon Gas Factor |
| 576 | ISO Inferior Gas Factor |
| 577 | ISO Inferior Carbon Gas Factor |
| 578 | GOST Gas Factor |
| 579 | GOST Carbon Gas Factor |
| 580 | GOST Inferior Gas Factor |
| 581 | GOST Carbon Inferior Gas Factor |
| 582 | On Threshold |
| 583 | Off Threshold |
| 584 | Trigger Method |
| 585 | Force C3 vs C3/C3' auto select |
| 586 | Force 16 Bit MMI Compatibility Mode |
| 587 | Raw Component Filter |
| 588 | Carbon Component Filter |
| 589 | Column Filter |
| 590 | Normalized Total Setpoint |
| 591 | Pressure Setpoint #2 |
| 592 | Sum NeoC5 and IsoC5 |
| 593 | Purge Seconds |
| 594 | Up Carrier Trigger Time |
| 595 | Sample Equalization |
| 570 | (Not Used) |
| 571 | (Not Used) |
| 572 | (Not Used) |
| 573 | (Not Used) |
| 574 | (Not Used) |
| 575 | (Not Used) |
| 578 | (Not Used) |

| | |
|---|---|
| 579 | (Not Used) |
| 596 | (Not Used) |
| 597 | GPM Gas Factor |
| 598 | GOST Compressibility Gas Factor |
| 599 | ISO Ideal BTU Gas Factor |
| 600 | NGPA Ideal BTU Gas Factor |
| 601 | Carbon GPM Gas Factor |
| 602 | Carbon NGPA Ideal BTU Gas Factor |
| 603 | ISO Carbon Ideal BTU Gas Factor |
| 604 | GOST Carbon Ideal BTU Gas Factor |
| 605 | Specific Gravity Gas Factor |
| 606 | Carbon Specific Gravity Gas Factor |
| 607 | NGPA Compressibility Gas Factor |
| 608 | Carbon NGPA Compressibility Gas Factor |
| 609 | ISO Compressibility Gas Factor |
| 610 | ISO Carbon Compressibility Gas Factor |
| 611 | GOST Ideal BTU Gas Factor |
| 612 | GOST Carbon Compressibility Gas Factor |
| 613 | Key Peaks |
| 614 | Methane Offset |
| 615 | Modbus C6+ Component Index Code |

## LRFU - Log Response Updates

This command sets whether to log response factor updates from automatic calibrations. The default is to not log updates. 00 sets to not log updates, else log updates.

NOTE: This command will cause the event log to roll older events off quickly with frequent calibrations.

## EVENTLOG - Dump Event Log

This command dumps the event log. Issuing the command EVENTLOG= clears the log. Clearing the log requires r/w security access.

## Reports

Reports are available to report the analysis results on a cycle basis, hourly, daily and monthly. Calibration and raw results reports are also available. Reports can have any or all components filtered out or can have any or all columns filtered out.

### xxREPORT - Display Analysis Results

This command displays the calculated results. For each stream the latest results, the last hour's results, or the last day's results are available. xxCD affects when last day's results are wrapped up. Refer to the following table for values for xx.

| xx | Meaning |
|---|---|
| 00 | Stream 0 Latest Results |
| 01 | Stream 1 Latest Results |
| 02 | Stream 2 Latest Results |
| 03 | Stream 3 Latest Results |
| 04 | Stream 0 Hourly Results |
| 05 | Stream 1 Hourly Results |
| 06 | Stream 2 Hourly Results |
| 07 | Stream 3 Hourly Results |
| 08 | Stream 0 Daily Results |
| 09 | Stream 1 Daily Results |
| 10 | Stream 2 Daily Results |
| 11 | Stream 3 Daily Results |
| 12 | Latest Available Results Regardless of Stream and faults |
| 13 | Latest Available Calibration Results |
| 14 | Stream 0 Monthly Results |
| 15 | Stream 1 Monthly Results |
| 16 | Stream 2 Monthly Results |
| 17 | Stream 3 Monthly Results |

### xxCLF - Column Filter

This command allows filtering a column out of the Printer/Console report. This command operates on both real components and carbon components simultaneously. The default of 00 turns off the filter.
(Ex. 01CLF=01 will omit the response factor from the printer console report)

| xx | Column |
|---|---|
| 00 | Name |
| 01 | Response Factor |
| 02 | Un-normalized Concentration |
| 03 | Normalized Concentration |
| 04 | Peak Area |
| 05 | Peak Height |
| 06 | Peak Time |
| 07 | Liquid Content |
| 08 | Ideal BTU/CV |
| 09 | Relative Density |

## xxRCF - Real Component Filter

This command allows filtering a component out of the Printer/Console report. The default of 00 turns off the filter. Any other value turns the filter on. The component to have the filter set on is indicated by xx.
(Ex. 01RCF=01 will omit IC4 from the printer console report)

| xx | Component |
|---|---|
| 00 | C3 |
| 01 | IC4 |
| 02 | NC4 |
| 03 | NEOC5 |
| 04 | IC5 |
| 05 | NC5 |
| 06 | C6+ |
| 07 | N2 |
| 08 | C1 |
| 09 | C02 |
| 10 | C4+ |
| 11 | C3' |
| 12 | C2 |

## xxCCF - Carbon Component Filter

This command allows filtering a carbon split component out of the Printer/Console report. The default of 00 turns off the filter. Any other value turns the filter on. The carbon component to have the filter set on is indicated by xx. (Ex. 01CCF=01 will omit C7 from the printer console report)

| xx | Carbon Split Components |
|---|---|
| 00 | C6 |
| 01 | C7 |
| 02 | C8 |
| 03 | C9 |
| 04 | C10+ |

## Efficiency Commands

The following commands are used to improve the efficiency or use of the consumables used during periods of infrequent use.

### LOWCAR - Low Carrier Mode

This command sets low carrier mode. Carrier pressure will drop to 5 PSIG during low carrier mode. The format is XX. Normal mode is selected with 00 and low carrier mode is selected with 01.

### LOWPOW - Low Power Mode

This command sets low power mode. Oven Temperature will drop to ambient during low power mode. The format is XX. Normal mode is selected with 00 and low carrier mode is selected with 01. When in low power mode, the oven will start to come back up to the proper operating temperature 1 hour before the time of the next cycle.

### PP - Pre-Purge Mode

This command sets pre-purge mode. 00 (the default) opens the stream solenoid valve only during sampling prior to beginning the analysis cycle. 01 also opens the valve during the back half of the analysis cycle. The format for this command is XX. This pre-purging allows the stream solenoid and a portion of the flow paths to be flushed with sample from the next stream. This is useful if analyzing sample mixtures with widely varying component concentrations such as high C6+ to no C6+.

NOTE: This command will cause process gas usage to go up dramatically.

### UPC – Up Carrier Trigger Time

This command sets the amount of time in seconds allowed for the basic pre-cycle preparations. Included within this time allowance is carrier stabilization, 18 second allowance for basic purging, 4.5 second bleed and final bleed down to 1 PSIG. UPC defaults to 28 seconds. This time could be adjusted lower to cause a module that samples very fast and has a total cycle time of less than 180 seconds to be corrected to a 180 second cycle time.

WARNING: Setting this time higher than 28 seconds without a corresponding increase in cycle time will cause the sampling for the next cycle to overlap active detector operations and may cause sporadic peaks or noise on the detector signals.

### PSEC – Purge Seconds

This command sets the number of seconds to purge the sample loops. The default of zero or any value between zero and twenty (20 or 0x14) will cause the transmitter to purge the loops for 20 seconds. Values greater than this in increments of ten seconds will cause the loops to be purged for the additional time. This value is specified in hex format. UPC accounts for the first 20 seconds.

NOTE: This command will cause process gas usage to go up proportionately.

WARNING: Setting this time higher than 20 seconds without a corresponding increase in cycle time will cause the sampling for the next cycle to overlap active detector operations and may cause sporadic peaks or noise on the detector signals.

### SE – Sample Equalization

This command sets the amount of time to allow in seconds to bleed the sample loop down from 1 PSIG to 0 PSIG. The default is 10 seconds.

## History File

The following is used to interact with the historical file.

### xxINTERVAL - Set History File Interval

This command sets the history file interval for stream xx. Hourly update is specified as 00 and daily update as 01. Every cycle update is specified as 02. The default is 00.

### xxHISTORY - Dump History File

This command dumps the historical file for stream xx.

### xxCD - Contract Hour

This command sets the contract hour. Contract Hour determines when averages for daily numbers are wrapped up and stored in the historical file (and also for last day reports). xxCD affects the historical file when daily update is used. Contract Hour also affects when last day's results are done. The format is XX. xx indicates the stream to set. The default is 00 (midnight).

## Gas Constant Commands

The following commands set parameters that the transmitter uses to calculate calorific value and other items. The indexes for the analyzed components range from 00 to 12. The indexes for carbon split components range from 00 to 04. The commands are separated into sections for AGA/GPA and for ISO.

### AGA/GPA Gas Constants

The following commands set gas constants according to GPA 2145-95. In all cases, the default values are referenced to 60 Degrees F and 14.696 PSIG (15.56 Degrees C and 1013.25 mbar). The default values are specified for US units. This standard does also contain values for SI units. The method used for the actual calculation is specified in GPA-2172-86.

#### xxNFHS - GPA Ideal Gross Heating Value

This command sets the GPA ideal gross heating value used by component xx. This contribution is multiplied by the component concentration and then summed up to get the ideal gross heating value for the gas mixture. The units used are BTU per cubic foot.

#### xxFSPGR - GPA Specific Gravity Contribution

This command sets the specific gravity or density of gas contribution used by component xx. This contribution is multiplied by the component concentration and then summed up to get the specific gravity for the gas mixture. The values used are referenced relative to air.

#### xxFGPM - GPA Liquid Content Contribution

This command sets the liquid content (GPM) or volume contribution used by component xx. This contribution is multiplied by the component concentration and then summed up to get the GPM for the gas mixture. The units used are cubic foot of ideal gas per gallon of liquid.

#### xxNFSUM - GPA Summation Factor

This command sets the GPA summation factor used by component xx. This contribution is multiplied by the component concentration and the result is used to calculate the compressibility factor for the gas mixture. These values are from GPA 2172-86 table 4.

#### xxCBTU - Carbon Split GPA Ideal Gross Heating Value

This command sets the GPA ideal gross heating value used by carbon component xx. This contribution is multiplied by the component concentration and then summed up to get the ideal gross heating value for the gas mixture. The units used are BTU per cubic foot.

#### xxCSPGR - Carbon Split GPA Specific Gravity Contribution

This command sets the specific gravity or density of gas contribution used by carbon component xx. This contribution is multiplied by the component concentration and then summed up to get the specific gravity for the gas mixture. The values used are referenced relative to air.

#### xxCGPM - Carbon Split GPA Liquid Content Contribution

This command sets the liquid content (GPM) or volume contribution used by carbon component xx. This contribution is multiplied by the component concentration and then summed up to get the GPM for the gas mixture. The units used are cubic foot of ideal gas per gallon of liquid.

### xxCNGPA - Carbon Split GPA Summation Factor

This command sets the GPA summation factor used by carbon component xx. This contribution is multiplied by the component concentration and the result is used to calculate the compressibility factor for the gas mixture. These values are from GPA 2172-86 table 4.

## ISO Gas Constants

The following commands set gas constants according to ISO 6976-1983. Prom revisions later than AE2015644-003 implement ISO 6976-1995-12-01 upon cold start.

### xxIFSUM - ISO Summation Factor

This command sets the ISO summation factor used by component xx. This factor is multiplied by the component concentration and the result is used to calculate the compressibility factor for the gas mixture. These values are from table 2 referenced to 288.15 K.

### xxIFHS - ISO Superior Ideal Calorific Value

This command sets ISO the superior ideal calorific value used by component xx. This factor is multiplied by the component concentration and then summed up to get the superior (dry) ideal calorific value for the gas mixture. These values are from table 5.

### xxIHI - ISO Inferior Ideal Calorific Value

This command sets ISO the inferior ideal calorific value used by component xx. This factor is multiplied by the component concentration and then summed up to get the inferior (wet) ideal calorific value for the gas mixture. These values are from table 5.

### xxICNGPA - ISO Carbon Split Summation Factor

This command sets the ISO summation factor used by carbon component xx. This factor is multiplied by the component concentration and the result is used to calculate the compressibility factor for the gas mixture. These values are from table 2 referenced to 288.15 K.

### xxICBTU - ISO Carbon Split Superior Ideal Calorific Value

This command sets ISO the superior ideal calorific value used by carbon component xx. This factor is multiplied by the component concentration and then summed up to get the superior (dry) ideal calorific value for the gas mixture. These values are from table 5.

### xxICHI - ISO Carbon Split Inferior Ideal Calorific Value

This command sets the ISO inferior ideal calorific value used by carbon split component xx. This factor is multiplied by the component concentration and then summed up to get the inferior (wet) ideal calorific value for the gas mixture. These values are from table 5.

### xxICSPGR - ISO Carbon Split Ideal Relative Density Factor

This command sets the ISO ideal relative density factor used by carbon component xx. This factor is multiplied by the component concentration and the result is used to calculate the compressibility factor for the gas mixture. These values are from table 2.

### xxICGPM - ISO Carbon Split Liquid Content Contribution

This command sets the liquid content (GPM) or volume contribution used by carbon component xx. This contribution is multiplied by the component concentration and then summed up to get the GPM for the gas mixture. The units used are cubic foot of ideal gas per gallon of liquid. The values are from GPA 2145-95 Volume. To adjust the liquid content contribution for the analyzed components, use the xxFGPM command.

## Setup Commands

The following commands are used to help set up the transmitter.

### ADI - Auxiliary Digital Input Operation

This command sets and/or displays what the digital inputs mean to the transmitter. The following codes are valid:

| Code | Meaning |
|---|---|
| 00 | DI#1 indicates Carrier Bottle Pressure Low.<br>DI#2 indicates Calibration Bottle Pressure Low. |
| 01 | DI#1 indicates top of hour and to set clock rounding to nearest top of hour.<br>DI#2 triggers an Alternate DI fault. |

### ADO - Auxiliary Digital Output Operation

This command sets and/or displays what meaning the digital outputs convey. The following codes are valid:

| Code | Meaning |
|---|---|
| 00 | Normal Mode |
| 01 | Marquis Mode |
| 02 | Flashing Mode |

If Normal mode is selected:

| Normal DO | Fault DO | Meaning |
|---|---|---|
| Asserted | De-asserted | No warnings or faults. |
| Asserted | Asserted | Warning alarm |
| De-asserted | Asserted | Fault alarm |
| De-asserted | De-asserted | Powered off |

If Marquis mode is selected:

| DO | Meaning if Asserted |
|---|---|
| Normal | Calibration in progress |
| Fault | Fault alarm – Except Alternate DI for Validation Blend |

If flashing mode is selected:

| Mode | DO Fault, Normal Status |
|---|---|
| Hold | Asserted, Flashing |
| Fault | Opposite |
| Warning | Together |
| Run | De-asserted, Flashing |
| Single | Flashing, De-asserted |
| Calibrate/Start | Flashing, Asserted |

### xxCPEAKS - Display Current Peak Table

This command displays the current peak table for detector xx. This table will build on the fly during a cycle. During a cycle an incomplete table may be displayed. For this reason, it may be more appropriate to use xxPPEAKS to display peak tables.

### xxPPEAKS - Display Previous Peak Table

This command displays the previous peak table for detector xx. This can be used to tune the peak retention times.

## SV1 - Set Sample Valve 1 Actuation Time

This command sets the actuation time for sample valve 1. The units for this command are in detector samples, i.e. 2 seconds is 0040 detector samples. This command may adjust other values in the gate valve table as appropriate. Normally, this command will take on the values of 0040, 0140, and 0230.

## xxDMP - Detector 1 Front Half Minimum Peak Area

This command sets the minimum peak area used during peak detection. This command should be used if the process gas contains a component such as H2S or C3= which is interfering with the transmitters ability to correctly identify propane.

| xx | Detector Path | Default |
|---|---|---|
| 00 | Detector 0 Front Half | 4000 |
| 01 | Detector 0 Back Half | 4000 |
| 02 | Detector 1 Front Half | 3000 |

WARNING: Setting this number lower than 3000 may result in an increased number of false detection's that may overflow the peak table.

## xxONT - Gate On Threshold

This command sets the threshold level for detecting the start of a peak. Refer to xxDMP command for an explanation of xx.

## xxOFT - Gate Off Threshold

This command sets the threshold level for detecting the end of a peak. Refer to xxDMP command for an explanation of xx.

Setting a gate off threshold less than 5 is likely to cause some peaks to never end.

## xxTRIG - Trigger Method

This command sets the trigger method. When the trigger method is set to the default of 00 for edge triggered method, the current detector reading must exceed the previous detector reading by the amount defined by the gate on threshold to start integrating a peak. When the trigger method is set to 01 for slope triggered method, the current detector reading must exceed the detector value read 100 ms ago (5 readings) by the amount defined by the gate on threshold to start integrating a peak. Refer to xxDMP command for an explanation of xx.

## C6MP - C6+ Minimum Peak Area

This command sets the minimum peak area for the C6+ peak. The default is 0. The action for this command can also be described as the zero concentration area.

## BPR - Back-Peak Ratio

This command sets the maximum Back-Peak Ratio. The default is 0.50 or 50%. This ratio is the difference of the back height and the front height divided by the difference of the peak height and the front height. Peaks that are well formed will exhibit low back-peak ratios. Separating iC4 from nC4 when nC4 is much larger than iC4 may require adjusting this ratio towards 100%.

## FC3 - Force C3 Usage

During normal operation, if Propane is not indicated or is outside of the range of 0.1 to 3 percent, C3' is used instead. This command forces Propane (C3) to be used.

## DSM – Detector Smoothing Method

This command affects how the chromatogram is smoothed. The format of this command is xx. The first level of smoothing is a 4-point "boxcar". The boxcar is performed by the firmware interrupt service routines and can't be changed. The second level of smoothing which this command affects can be changed from no smoothing to several levels of moving average and finally using the Savitsky-Golay algorithm. The various levels implement include:

| xx | Description |
|---|---|
| 01 | Raw (no averaging) |
| 02 | 2 point moving average |
| 04 | 4 point moving average |
| 08 | 8 point moving average |
| 11 | Savitsky-Golay (5-1-5) |
| 00 | Savitsky-Golay (5-1-5) |
| Anything else | Savitsky-Golay (5-1-5) |

Savitsky-Golay implements a DSP (Multiply-Accumulate) algorithm. The algorithm uses the 5 preceding detector readings, the current reading and the next 5 readings. This causes the chromatogram to be shifted 5 points. The algorithm's magic comes from the derivation of the 11 weighting constants. Savitsky-Golay has been used since the EFR hardware came into production, but can cause momentary negative diversions in the chromatogram due to the way the weighting constants are derived. For this reason, on non-EFR hardware, DSA may need to be set to an 8 point moving average to prevent false detector peaks.

## SNI – Sum NeoC5 and IsoC5 Normalized Concentrations

This command is provided to allow the summation of the NeoC5 and IsoC5 normalized concentrations into a composite Neo/Iso C5 normalized concentration. The default is to not sum NeoC5 and IsoC5.

NOTE: The transmitter will always separate NeoC5 and IsoC5. Certain calculation standards do not explicitly recognize NeoC5 since this does not show up in nature, but only after human processing operations. Gas parameters for NeoC5 in these instances have been interpolated or calculated based on any other available data.

## MMI - Set MMI Operating Mode

This command sets the MMI Operating Mode. The default of 00 selects 32-bit mode. Setting this to 01 selects 16-bit mode. 16-bit mode is a work in progress and may not be fully functional.

## xxPKC - Baseline Reference Peak Codes

This command sets the baseline reference peak codes. The peak to be used is indicated by xx. These codes determine how the peak area will be adjusted for baseline corrections. The applicable codes are:

| Code | Meaning |
|---|---|
| 0 | Baseline referenced to the local baseline measurement |
| 1 | Baseline referenced to the peak's front height |
| 2 | Baseline referenced to the peak's back height |
| 3 | Baseline referenced to the peak's front and back height. This method draws a line between front height and back height and uses that as the reference. |

## xxRTy - Set Retention Time

This command sets the retention time of peak xx on detector y.

Detector 0

| Peak | Name | Default Retention Time (45/68 Module) | Default Retention Time (59/60 Module) |
|---|---|---|---|
| 00 | N2 | 21.0 | 27.7 |
| 01 | C1 | 23.4 | 30.8 |
| 02 | CO2 | 32.0 | 41.7 |
| 03 | C4+ | 64.8 | 78.1 |
| 04 | C3' | 75.0 | 91.2 |
| 05 | C2 | 101.0 | 123.1 |

Detector 1

| Peak | Name | Default Retention Time (45/68 Module) | Default Retention Time (59/60 Module) |
|---|---|---|---|
| 00 | (C1) | 12.7 | (not used) |
| 01 | (C2) | 15.1 | 8.6 |
| 02 | C3 | 19.9 | 12.6 |
| 03 | IC4 | 28.4 | 17.9 |
| 04 | NC4 | 31.8 | 20.1 |
| 05 | NEOC5 | 40.6 | 25.7 |
| 06 | IC5 | 53.9 | 34.0 |
| 07 | NC5 | 63.1 | 39.8 |
| 08 | C6+ | 108.0 | 78.0 |

The transmitter during automatic peak detection may vary the actual retention times.

## xxGT - Gate Timing

This command sets the gate timing. This value is the number of detector samples into the cycle to operate the gate (20 samples/second). The following is the position of the various gate events for 59/60 modules:

| Event | Description | Seconds | Detector Samples |
|---|---|---|---|
| 00 | Detector 2 Balance | 3.5 | 70 |
| 01 | Auto-gate Detector 2 On (C2-, C3, IC4, NC4, NEOC5, IC5, NC5) | 6 | 120 |
| 02 | Detector 1 Balance | 10 | 200 |
| 03 | Local Baseline Measurement Detector 1 | 12 | 240 |
| 04 | Auto-gate Detector 1 On (N2, C1, CO2) | 13.5 | 270 |
| 05 | Auto-gate Detector 1 Off | 56.85 | 1137 |
| 06 | CO2 Timed gate On | 56.85 | 1137 |
| 07 | CO2 Timed Gate Off | 56.9 | 1138 |
| 08 | Auto-gate Detector 2 Off | 56.9 | 1138 |
| 09 | Pre-purge On | 61 | 1220 |
| 10 | Detector 1 Balance | 64 | 1280 |
| 11 | Detector 2 Balance | 65 | 1300 |
| 12 | Gate Detector 1 On C4+, 2nd C3, C2 | 67 | 1340 |
| 13 | Gate Detector 2 On C6+ | 71 | 1420 |
| 14 | Gate Detector 2 Off C6+ | 132 | 2640 |
| 15 | Local Baseline Measurement Detector 2 | 133 | 2660 |
| 16 | Gate Detector 1 Off C2 | 150 | 3000 |
| 17 | Local Baseline Measurement Detector 1 | 150.5 | 3010 |
| 18 | Pre-purge Off | 153.5 | 3070 |

NOTE: The CO2 timed gates are provided to allow ultra-low CO2 measurement on the order of 100 PPM. Normally, these should be left at the default. If this type of measurement is required, then the gates will have to be set by hand. Also, any calibration should be done using a certified blend near the levels of CO2 and C1 that are expected.

### xxVT - Valve Timing

This command sets the valve timing. This value is the number of detector samples into the cycle to operate the valve (20 samples/second). The format is XXXX. The following is the position of the various valve events for 45/68 modules:

| Event | Description | Seconds (45/68 Module) | Detector Samples (45/68 Module) | Seconds (59/60 Module) | Detector Samples (59/60 Module) |
|---|---|---|---|---|---|
| 00 | Sample Valve 2 On | 1 | 20 | 1 | 20 |
| 01 | Sample Valve 1 On | 2 | 40 | 2 | 40 |
| 02 | Sample Valve 2 Off | 6 | 120 | 57 | 1140 |
| 03 | Sample Valve 1 Off | 7.8 | 156 | 58 | 1160 |
| 04 | Reverse Valve 1 On | 45 | 900 | 59 | 1180 |
| 05 | Reverse Valve 2 On | 68 | 1360 | 60 | 1200 |
| 06 | Reverse Valve 1 Off | 139 | 2780 | 152 | 3040 |
| 07 | Reverse Valve 2 Off | 140 | 2800 | 154 | 3080 |

## Diagnostic File Commands

The following commands are used to manage the diagnostic file.

### DIAG - Dump Diagnostic File

This command dumps the diagnostic file.

### xxKPK - Key Peaks

This command set the identity of the key peaks that are stored in the diagnostic file. The diagnostic file includes the peak area and the retention time for each of four key peaks. The key peaks are initially set to store N2 (07), C2 (11), NC5 (05) and C6+(06). xx=00-03. This command does not do anything to alter header lines on reports. If the key peaks are changed from their defaults, it may become difficult to verify diagnostic file contents.

## Maintenance Commands

The following commands are used to help maintain the transmitter.

### xxAO - Set AO

This command sets analog output xx. The ordering of analog inputs is as follows:

| Analog Output | Meaning |
|---|---|
| 1 | Detector 1 |
| 2 | Detector 2 |
| 3 | Detector 1 Balance |
| 4 | Detector 2 Balance |
| 5 | Oven Temperature Set-point |
| 6 | Carrier Pressure Set-point |

Generally speaking, the only values that should be used are the oven temperature and carrier pressure set points.

### xxAOSCALE - Set AO Multiplier

This command sets the detector xx multiplier for the analog outputs. The format is XXXX. The default is 25.

## DIOS - Display Digital Input / Output Status

This command displays the digital input/output status. The format is XX. The bits displayed are as follows:

| Bit | Meaning |
|---|---|
| 0 | (Unused) |
| 1 | (Unused) |
| 2 | (Security Switch) |
| 3 | Transmitter State 1 - See CSTATE command - Normal |
| 4 | Transmitter State 2 - See CSTATE command - Fault |
| 5 | Carrier O.K. |
| 6 | Sample O.K. |
| 7 | Pass through Mode Status |

## AIL - Monitor Analog Inputs

This command continuously monitors analog inputs. Every second the inputs are read and displayed in proper engineering units until a key is pressed. Each line contains raw ground voltage, power, mandrel temperature, carrier pressure, sample pressure, spare, and lower platform temperature. If a cycle is not running, the voltage reference voltage is output after the lower platform temperature. This command is generally used to monitor warm up, stream or carrier pressure decay, or for detecting conditions that may cause the analog multiplexer to over-range such as damaged pressure sensors.

## xxAI - Read AI

This command displays the current value of analog input xx. The ordering of analog inputs is as follows:

| Analog Input | Meaning |
|---|---|
| 1 | Ground Channel |
| 2 | Primary Power |
| 3 | Oven Temperature |
| 4 | Carrier Pressure |
| 5 | Sample Pressure |
| 6 | (Spare -2.5 to +2.5 V Range) (Barometric Pressure) |
| 7 | Ambient Temperature |
| 8 | (2.5V Voltage Reference) (not measured during active part of analysis cycle) |

## HTRDUTY - Display Heater Duty Cycle

This command displays the cumulative heater duty cycle. This command resets the accumulation. A running analysis cycle also reads and resets accumulators, so this command should not be used while analysis cycles are being run. This command also requires a board modification to be useful.

## xxDET - Get Current Detector Value

This command returns the current detector value for detector xx. The value returned is a long integer and is balance and zero adjusted.

## xxBALDR - Balance Detector

This command balances detector xx. This process takes 2 seconds.

## SSOC - Close SSO Valve

This command closes the sample shut off (SSO) valve.

## SSOO - Open SSO Valve

This command opens the sample shut off (SSO) valve.

### SSO - Read/Set SSO

This command operates the SSO valve. Setting this to 01 closes the SSO valve. Setting this to 00 opens the valve.

### BLKP - Block Valve Pulsing Operation

This command blocks the normal pulsing operation of the column valves and the sample system valves. Setting a bit to a one blocks automatic deactivation of the valve. The bit weights are as follows:

| Bit | Meaning (when set to one) |
|---|---|
| 0 | Block Stream Valve Automatic Operation |
| 1 | Block Column Valve Automatic Operation |

The affected valve will return to its normal state within 300 ms after resetting the proper bit.

### xxSAMPSTR - Sample Stream

This command samples stream xx. This process usually takes less than 30 seconds.

### xxSELSTRM - Select Stream

This command quickly samples stream xx. Only one pulse is applied. The BLKP command can be used to continuously purge a stream.

### xxVALVE - Actuate Solenoid Valve

This command actuates an internal solenoid valve according to the following table.
As an example, to set reverse valve #2 on, enter 03VALVE=00.

| xx | Description |
|---|---|
| 00 | Reverse Valve #1 |
| 01 | Sample Valve #2 |
| 02 | Sample Valve #1 |
| 03 | Reverse Valve #2 |

| yy | Action |
|---|---|
| 00 | On |
| 01 | Off |

NOTE: Repeated use of this command should allow one second between uses to avoid valve mid-shifting. Valve mid-shifting may completely empty a carrier bottle within a matter of hours.

### VALVES - Actuate Solenoid Valves

This command sets or reads the state of all valves.

| Bit | Action |
|---|---|
| 00 | Reverse Valve #1 |
| 01 | Sample Valve #2 |
| 02 | Sample Valve #1 |
| 03 | Reverse Valve #2 |

The actions are the same as above. This command will read and write the state of all valves. Multiple valves are actuated with a one second delay between individual valve actuations. These delays will cause the protocol on this port to go inactive during the approximately 4 seconds that it will take to complete this operation.

## Test Commands

The following commands are used to run preprogrammed tests on the transmitter. These tests should only be used with the transmitter in hold. These commands are invoked directly from the printer/console mode. This means that once a test is started, the printer/console will no longer respond to any commands until that test is finished. For this reason, it may be better to invoke these tests through the START command. All of these commands make entries into the startup log as necessary unless otherwise noted.

### TEST1 - Run Self-Test 1

This command runs Self-Test 1. This test will make an initial test of the pressure regulator module and carrier flow. This test is also run at power up and with the START command. This test does not leave any entries in the start log.

## TEST2 - Run Self-Test 2

This command runs Self-Test 2. This test runs three sub-tests. They are the Regulator Test, Sample System Test, and Analysis Module Test. These three tests may be run individually with the appropriate commands. This test is also run at power up and with the START command.

## TESTREG - Test Pressure Regulator Module

This command tests the Pressure Regulator Module. These tests are in more detail than those in self-test 1. This test tests ability to set and maintain proper carrier pressure. This test is also run at power up, with the START command, and with the TEST2 command.

## TESTSS - Test Sample System Module

This command tests the Sample System Module. Proper pressure and flow through each stream are tested. SSO operation is checked. Leak checks are performed. This test is also run at power up, with the START command, and with the TEST2 command. Any streams that are found to be failing are marked as skipped. Streams that subsequently pass will not be un-skipped.

## TESTMOD - Test Analysis Module

This command tests the Analysis Module. This test will check the standard deviation of both detectors, pressure and temperature in forward and reverse flow. Checks are also made to verify that the flow does reverse. This test is also run at power up, with the START command, and with the TEST2 command.

## TESTPK - Set Peak Times

This command sets up to identify peaks. If APEAK=01, the carrier pressure is adjusted until NC5's peak time is approximately 50 seconds. The peaks expected peak times are ratioed to set new times. If APEAK=02, Factors 15 through 18 are used to set carrier pressure and to ratio peak times. In this mode and with Factors 13-16 set and CALBLEND=04, a calibration blend does not need to be on-site.

## NOISE - Measure Detector Noise

This command measures the noise level on both detectors. This test takes approximately 100 seconds. The noise level is calculated by calculating the pooled standard deviation of the detectors' readings using 50 pools with 2 seconds (40 samples) of data per pool. The noise level is output as the number of detector counts. During this test, no other commands will be accepted and no other analysis activity should be taking place. As each pool is started, a greater than sign (>) is output to the port as an indication that the test is proceeding. The noise level for detector 0 and then detector 1 will follow the last (>). Generally will be < 20 after warming up.

## xxCALCNOW - Force Calculation Now

This command forces a recalculation of the results in the stream buffer from the concentration of the gas and the carbon split values. Generally, one must set all variables that affect the calculation including setting test concentrations with xxCONCyy and xxCByy, setting calculation type with CTYPE, setting pressure and temperature base with xxPB and xxTB, and gas constants. Then issue xxCALCNOW where xx is 00 to 03. The results can now be read using xxREPORT where xx is again in the range of 00 to 03. This command will not cause logging or accumulation of results.

## STARTLOG - Startup Log Report

This command dumps the startup log. This log contains information about the results of the diagnostic tests performed the last time that the transmitter was started or commanded to run diagnostics. An example log follows:

| | | | | | |
|---|---|---|---|---|---|
| Purge: | | | | | Passed |
| WarmUp: | Purge | Forward | Stream | 0 | Passed |
| WarmUp: | Temp Set | 140 | Current | 140.86 | Passed |
| WarmUp: | Status | | | | Passed |
| PRM: | Pres | 26.01 | Std Dev | 0.05 | Passed |
| PRM: | Status | | | | Passed |
| SSM: | Resting | -0.07 | | | Passed |
| SSM: | Quad Valve Leak Ref | 0.15 | End | 0 | Passed |
| SSM: | #0 Pres High | 7.66 | Ratio | 0.04 | Passed |
| SSM: | #0 Pres Max | 15.08 | Drop | -0.01 | Passed |
| SSM: | #1 Pres High | 7.8 | Ratio | 0.04 | Passed |
| SSM: | #1 Pres Max | 15.47 | Drop | -0.03 | Passed |
| SSM: | #2 Pres High | 7.66 | Ratio | 0.03 | Passed |
| SSM: | #2 Pres Max | 15.33 | Drop | -0.01 | Passed |
| SSM: | #3 Pres High | 7.38 | Ratio | 0.03 | Passed |
| SSM: | #3 Pres Max | 14.9 | Drop | 0.03 | Passed |
| SSM: | Status | | | | Passed |
| GCM: | Avail Pres | 49.98 | | | Passed |
| GCM: | Carr Pres | 25.97 | Std Dev | 0.04 | Passed |
| GCM: | Mod Temp | 140.29 | Std Dev | 0.32 | Passed |
| GCM: | Det 0 | 72 | Std Dev | 7.57 | Passed |
| GCM: | Det 1 | 123 | Std Dev | 5.61 | Passed |
| GCM: | Valve Chg Det 0 | -36478 | Det 1 | -40851 | Passed |
| GCM: | Carr Pres | 25.89 | Std Dev | 0.04 | Passed |
| GCM: | Mod Temp | 140.29 | Std Dev | 0.36 | Passed |
| GCM: | Det 0 | -23 | Std Dev | 3.93 | Passed |
| GCM: | Det 1 | 112 | Std Dev | 9.01 | Passed |
| GCM: | Status | | | | Passed |
| Auto: | NC5 PT | 43.05 | @ | 27.82 | Passed |
| Auto: | CO2 PT | 50.65 | @ | 27.82 | Passed |
| Auto: | C2 PT | 126.1 | @ | 27.82 | Passed |
| Auto: | Status | | | | Passed |

## Debugging Commands

The following commands are used to assist with debugging. These commands should be used with care or under advisement from Totalflow Development.

### TASKS - Dump Task Table

This command dumps the kernel task table. This command should be used only under advisement from Totalflow Development. An example is shown below.

| tskptr | q_link | task | stack | sp | data | queue | pri | slot |
|---|---|---|---|---|---|---|---|---|
| 009f4c | 000000 | 437c | 0783e | 7b27 | 0000 | 00002 | 000 | 0001 |
| 009f5c | 009fac | 4258 | 06407 | 64dd | 0001 | 00006 | 255 | 0002 |
| 009f6c | 009f4c | 4254 | 06509 | 65f1 | 0000 | 00002 | 001 | 0003 |
| 009f7c | 00a03c | 4174 | 08540 | 8774 | 0020 | 0000c | 200 | 0004 |
| 009f8c | 009fec | 4304 | 067cf | 6949 | 0001 | 00004 | 210 | 0005 |
| 009f9c | 009f7c | 4078 | 06993 | 6b31 | 0015 | 0000c | 200 | 0006 |
| 009fac | 00a04c | 4338 | 089f4 | 8bc0 | 0095 | 00006 | 230 | 0007 |
| 009fbc | 00a08c | 4318 | 06d7f | 6f31 | 0024 | 0000c | 235 | 0008 |
| 009fcc | 009fec | 42f8 | 06f75 | 7138 | 0024 | 0000c | 220 | 0009 |
| 009fdc | 009f9c | 42d4 | 07b40 | 7d0c | 0020 | 0000c | 205 | 0010 |
| 009fec | 00a00c | 4360 | 07d36 | 7efe | 000b | 0000c | 205 | 0011 |
| 009ffc | 009fdc | 4298 | 07f2c | 812a | 0020 | 0000c | 205 | 0012 |
| 00a00c | 00a01c | 4278 | 08154 | 8316 | 000b | 0000c | 205 | 0013 |
| 00a01c | 009ffc | 42fc | 0834a | 8510 | 000c | 0000c | 205 | 0014 |
| 00a02c | 009f6c | 4074 | 0879a | 88c0 | 001b | 00002 | 199 | 0015 |
| 00a03c | 000000 | 4220 | 06b57 | 6d33 | 0028 | 0000c | 200 | 0016 |
| 00a04c | 000000 | 426c | 08e76 | 900c | 0063 | 00006 | 228 | 0017 |
| 00a06c | 00a07c | 42d0 | 0903a | 91f9 | 0024 | 0000c | 225 | 0019 |
| 00a07c | 009fcc | 42cc | 09262 | 9421 | 0024 | 0000c | 225 | 0020 |
| 00a08c | 00a06c | 4284 | 08bea | 8e32 | 0024 | 0000c | 230 | 0021 |

### xxCHKRES - Check Resource

This command tells which task has resource xx. This command should be used only advisement from Totalflow Development.

### COLD - Force Cold Start

This command forces a cold start the next time power is removed and applied. All parameters will return to their default conditions. All calibration constants and conditions will be lost. Communications will revert back to default. Security codes will be immediately wiped out and reconnection will be required. Power cycling will be required to complete the cold start. NOTE: There is no way to undo this command.

NOTE: This command is obsolete in prom 2100528-006 and later. Use BOOT=08 instead.

## BOOT – Restart the Transmitter

This command restarts the transmitter. The format of the command is BOOT=xx. The following table defines the options that are available:

| xx | Action |
|---|---|
| 00 | Flash Boot |
| 01 | PROM Boot |
| 02 | Flash from RS-232A port |
| 03 | (unused) |
| 04 | Flash from RS-232C port |
| 05 | Flash from RS-232A port |
| 06 | Flash from RS-422 port |
| 07 | Flash from RS-485 port |
| 08 | Cold Boot |
| 09 | Warm Boot |
| 0A | Test Flash Memory |

## TRAP - Display/Clear TRAP Area

This command displays, then clears, the trap area. The trap area contains information that may be useful to Totalflow Development in the event of an unexpected processor reset. The trap area includes: 1) stack pointer, 2) INT/TRAP register, 3) task slot, 4) task control block address, 5) task address and 6) stack area address.

## MEMORY - Display Memory Status

This command displays internal memory pool status. A low or fragmented memory pool may cause system tasks such as gates to not operate properly.

## IDLE - Display Idle Time

This command displays the remaining kernel available idle time as a percentage of total available idle time measured during initial startup. This command has been removed.

## RELDT - Display Release Date and Time

This command displays the release date and time as encoded in the firmware. This is designed to automatically indicate when the last build was done.

## ERRPRNT - Error Print

This command sets a flag to print the raw result table or the result table that would have printed normally. Set this to 00 to print normally. Set to 01 to print the raw result table. The default is 00.

## Example Command Sequences

### Cold Start Command Sequence

The following command sequence will serve as one example of getting the transmitter up and running.

| Command | Description |
|---|---|
| CODE=0000 | Request security access |
| OK | Access granted? |
| Td=06/07/95 10:05 | Set date and time |
| 02INTERVAL=02 | Capture every cycle in history file |
| AUTO=01 | Set automatic factor update after calibration. |
| ACAL=01 | Enable automatic calibration. |
| APEAK=01 | Enable automatic peak detection |
| CALBLEND=01 | Set Blend to Full Blend |
| 00AOSCALE=25 | Set analog output multiplier |
| 01AOSCALE=25 | Set analog output multiplier |
| 03CBPCT00=.2 | Set carbon split percentage for C6 to 20% |
| 03CBPCT01=.8 | Set carbon split percentage for C7 to 80% |

### MMF Cold Start Command Sequence

| Command | Description |
|---|---|
| CODE=0000 | Request security access |
| OK | Access granted? |
| Td=06/07/95 10:05 | Set date and time |
| CALBLEND=04 | Set Blend to No Blend |
| APEAK=02 | Enable MMC Peak Detection |
| 13FACTOR= | Set MMC Amplitude Factor - C3, IC4, NC4, NeoC5, IC5, NC5 |
| 14FACTOR= | Set MMC Amplitude Factor - C6+ |
| 15FACTOR= | Set MMC Amplitude Factor - N1, C1, CO2 |
| 16FACTOR= | Set MMC Amplitude Factor - C4+, C3', C2 |
| 17FACTOR= | Set Operating Carrier Pressure |
| 18FACTOR= | Set C1 Peak Time @ Operating Carrier Pressure |
| 19FACTOR= | Set C3' Peak Time @ Operating Carrier Pressure |
| 20FACTOR= | Set SV1 Adjust Time @ Operating Carrier Pressure |
| 21FACTOR= | Set NC5 Peak Time @ Operating Carrier Pressure |
| 22FACTOR= | Set C3 Peak Time @ Operating Carrier Pressure |
| 00AOSCALE=25 | Set analog output multiplier |
| 01AOSCALE=25 | Set analog output multiplier |

## Test Limits

| Test | Desc1 | Item1 | Low Limit | High limit | Desc2 | Item2 | Low Limit | High Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Purge: | | | | | | | | | |
| WarmUp: | Temp Set | 140 | | | Current | 141.26 | last | 160 | fail low limit 3 consecutive times before abort |
| WarmUp: | Status | | | | | | | | |
| PRM: | Pressure | 29.06 | Set - 5 | Set + 5 | Std Dev | 0.03 | | 0.25 | |
| PRM: | Status | | | | | | | | |
| SSM: | Resting | -0.06 | -0.5 | 3 | | | | | |
| SSM: | Quad Valve Leak Ref | 0.07 | | 0.25 | End | 0 | | | |
| SSM: | #0 Pressure High | 7.28 | 4 | | Ratio | 0.04 | | 0.6 | |
| SSM: | #0 Pressure Max | 13.9 | 12 | 18 | Drop | 0.02 | -0.5 | 0.5 | |
| SSM: | #1 Pressure High | 6.66 | 4 | | Ratio | 0.04 | | 0.6 | |
| SSM: | #1 Pressure Max | 13.9 | 12 | 18 | Drop | 0.03 | -0.5 | 0.5 | |
| SSM: | #2 Presure High | 7.13 | 4 | | Ratio | 0.04 | | 0.6 | |
| SSM: | #2 Pressure Max | 13.98 | 12 | 18 | Drop | 0.01 | -0.5 | 0.5 | |
| SSM: | #3 Pressure High | 7.62 | 4 | | Ratio | 0.04 | | 0.6 | |
| SSM: | #3 Pressure Max | 15.04 | 12 | 18 | Drop | 0.01 | -0.5 | 0.5 | |
| SSM: | Status | | | | | | | | |
| GCM: | Available Pres | 49.98 | 49 | 51 | | | | | |
| GCM: | Carrier Pres | 29.06 | | | Std Dev | 0.03 | | 0.2 | |
| GCM: | Module Temp | 140.22 | | | Std Dev | 0.44 | | 0.75 | |
| GCM: | Detector 0 | 92 | | 1000 | Std Dev | 5.28 | | 30 | fail 15 consecutive times before abort |
| GCM: | Detector 1 | 45 | | 1000 | Std Dev | 5.42 | | 30 | fail 15 consecutive times before abort |
| GCM: | Valve Chg Det 0 | -36964 | -105000 | -5000 | Det 1 | -41646 | -105000 | -5000 | |
| GCM: | Carrier Pres | 29.06 | | | Std Dev | 0.04 | | 0.2 | |
| GCM: | Module Temp | 140.79 | | | Std Dev | 0.49 | | 0.75 | |
| GCM: | Detector 0 | -97 | | 1000 | Std Dev | 8.97 | | 30 | fail 15 consecutive times before abort |
| GCM: | Deector 1 | -17 | | 1000 | Std Dev | 2.89 | | 30 | fail 15 consecutive times before abort |
| GCM: | Status | | | | | | | | |
| Auto: | NC5 PT | 43.05 | 41 | 50 | Car Pres | 27.82 | | | |
| Auto: | CO2 PT | 50.65 | 41 | 50.8 | Car Pres | 27.82 | | | |
| Auto: | C2 PT | 126.1 | | | Car Pres | 27.82 | | | |
| Auto: | Status | | | | | | | | |

## Command Index