



Eldridge Products, Inc.

Master-TouchTM and ValuMassTM

Operation Manual

Epi-ValTM with LiveZeroTM

Field Validation Firmware & Software

for

On-Site or In-Situ Validation

of

EPITM Thermal Mass Flow Meters

802003201 (Rev. 1)

Epi-Val™ With LiveZero™ Field Validation



***Eldridge Products, Inc. - Established in 1988
30 Years of Thermal Mass Flow Meter Design & Manufacturing Excellence***

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Epi-Val™ With LiveZero™ Field Validation

Epi-Val™ - EPI™ Thermal Mass Flow Meter Calibration Validation

Site Validation of EPI™ Master-Touch & ValuMass Flow Meter Products

Method 1 Epi-Val™ Air & Gas: Laboratory Sensor Test:

a) On-Site the User Validates the Flow Meter & Sensor, against a Factory Established **LiveZero™** (active sensor) mW test-point. This test is performed in ambient **Air** at room temperature and pressure, on User test bench (removed from process line). This is a **LiveZero™ Sensor calibration validation process**. This process allows User to save time and money in calibration related costs. When the **LiveZero™** data point is Validated, the Flow Sensor thermal heat transfer has not drifted and therefore retains its original calibration;

b) In-Situ (in place), User Validates the **LiveZero™** mW value, against a Factory **Calibration Gas LiveZero™** mW value, to be tested against Users **Process Gas** and conditions. These **Process Gas** and conditions must be the same as those of the **LiveZero™** mW Factory Calibration Gas test-point conditions (Factory conditions explained menu 241 section).

Note: Method 1 “b)” processes may be performed in combination with the gas flow isolation scheme of **Epi-Val™** Method 2 or Method 3 below.

Method 2 Field-Val™ Test Bench Ambient Air: In-Line or Insertion Probe Sensor Test:

On-Site the User establishes a **LiveZero™** mW reference value test-point. This is done on the Users test bench (removed from process line), prior to Flow Meter installation. This test-point may subsequently be checked against this newly established ambient **Air LiveZero™** mW reference value test-point.

Note: Any future **Epi-Val™** Validation tests must be performed at these same User established process conditions.

Method 3 Field-Val™ In-Situ Process Gas: In-Line or Insertion Probe Sensor Test:

In-Situ Validation is performed in the User Process Gas at the Users temperature, pressure and Gas composition. In Method 3, the User establishes an **LiveZero™** mW reference value test-point, that may subsequently be checked, at a later date, against the Users newly established Gas **LiveZero™** mW reference value test-point. Method 3, **a) Insertion Style Flow Meter** - the Process Gas flow is completely stopped at temperature and pressure, by retracting the Sensor up into an isolation ball valve; or **b) In-Line and Insertion Probe Style Flow Meters** - the Process Gas flow is bypassed around the Flow Meter assembly with a four-valve isolation scheme. The User bypass loop consists of isolation valves to direct the gas flow around the Flow Meter pipe run, of path #1, into the bypass loop of path #2. This type of bypass loop is typically used for maintenance or testing purposes and allows the process to continue running during Flow Meter testing or replacement.

Note: Any future **Epi-Val™** Validation tests must be performed at these same User established process conditions.

Overview - Epi-Val™

- Test Validates functionality of the Flow Meter sensor and associated circuitry.
- Test Validates thermal heat transfer properties of the sensor.
- Test Validates a thermal heat transfer of Factory **LiveZero™** test point at a no flow condition.
- Test Validates Flow Meter retains its original calibration.
- Test Validates Flow Meter heat transfer repeatability.
- Test Validation data, are stored in a User log showing Flow Meter – serial number, date, time, milliwatt (mW) heat transfer value, allowable error percentage, and pass or fail.
- Test Validating Flow Meter, save time and money in calibration related costs.
- Validation test log report is printable.

Overview - Field-Val™ On-Site and In-Situ Methods 2 & 3

- Method 2 – On test bench, User selects option to use **Field-Val™**, to establish on-site Users **LiveZero™** mW reference values, in place of the **Epi-Val™** Factory Established **LiveZero™** mW test-point.
- Method 3 - **In-Situ** At the time of installation, User selects option to use **Field-Val™**, to establish on-site Users **LiveZero™** mW reference values, in place of the **Epi-Val™** Factory Established **LiveZero™** mW test-point.
- User may test against User established milliwatt (mW) heat transfer value present with actual gas process conditions.
- User may establish a pass/fail error percentage value.

Eldridge Products, Inc. - Established in 1988

30 Years of Thermal Mass Flow Meter Design & Manufacturing Excellence

Epi-Val™ With LiveZero™ Field Validation

RELEASE 2018-01-06 - Epi-Val™ With LiveZero™

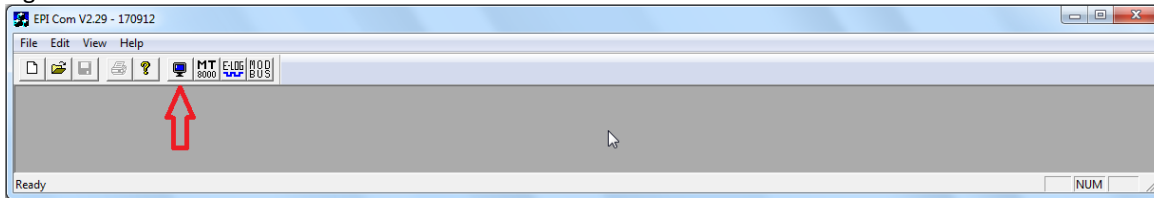
Field Validation - Using EPICommunicator™ & Printable Validation Test Report

(Note: Range 1 is to be used with validation for meters with multiple ranges)

Epi-Val™ Field Validation Firmware & Software for *On-Site or In-Situ Validation* of the stored LiveZero™ milliwatt (mW) test point value. The EPI™ Flow Meter maintains the LiveZero™ mW Validation test data, in onboard Firmware. Thermal Mass Flow Meters have an “Active” heat transfer or LiveZero™ test point unique to this technology. The test **Validates** sensor heat transfer stability at a no-flow condition, and thereby validates that the flow meter calibration is still valid. **Field-Val™** allows User established LiveZero™ test-points to be used.

The Validation test is performed against the Firmware test data by the EPI™ proprietary EPICommunicator™ (EPICom™). The most recent version of EPICom™ Software is available on our website. This EPI™ Software is free and may be downloaded on the internet at <http://www.epiflow.com/products/epicommunicator/> 1st step is to have EPICom™ active on your computer. Set up the EPICom™ communication port as required, see our manual. EPICom™ is pre-configured for RS485 communication and set to 19200 Baud, 1 start, 8 data, 1 stop, no parity. Additionally, EPICom™ is pre-configured for RS232 communication and set to 9600 Baud, 1 start, 8 data, 1 stop, no parity. **Field-Val™**

Figure 1



After EPICom™ is properly set-up as stated above, with the EPICom™ window open, select the


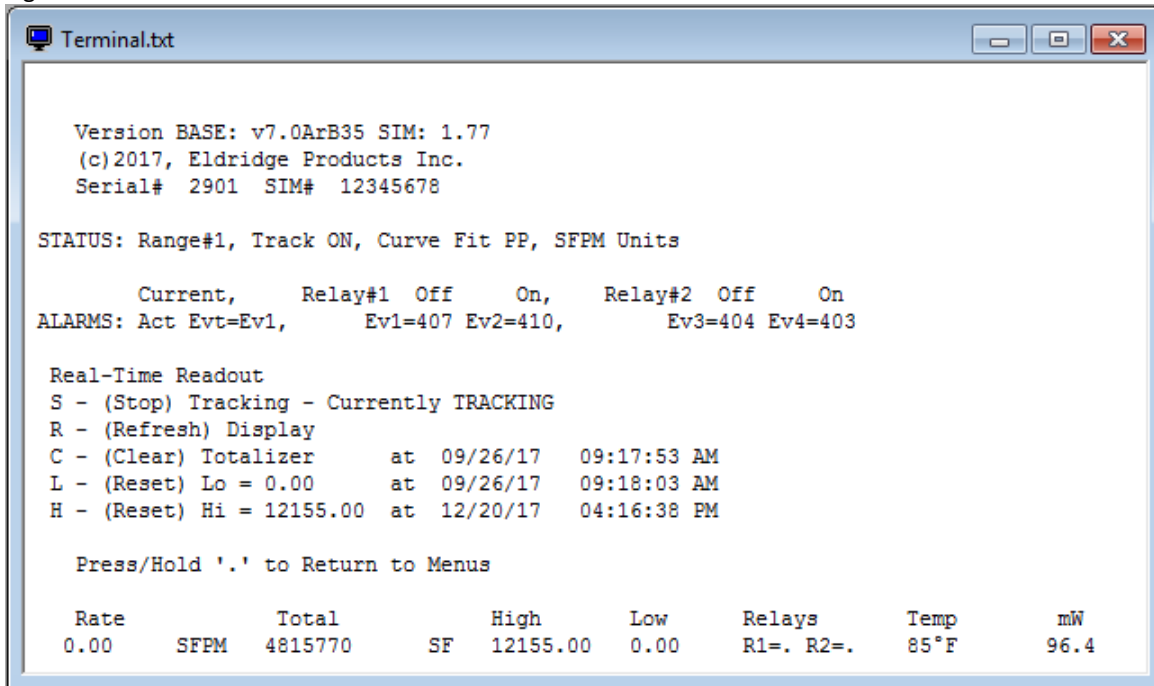
“Terminal”  Icon to open terminal mode. After unlocking and viewing Epi-Val™ stored values, and if no change is required, either type in the same value or type in a period ‘.’ (without quote marks) and press “Enter” on the keyboard, to retain the displayed value. See Figure 2 below.

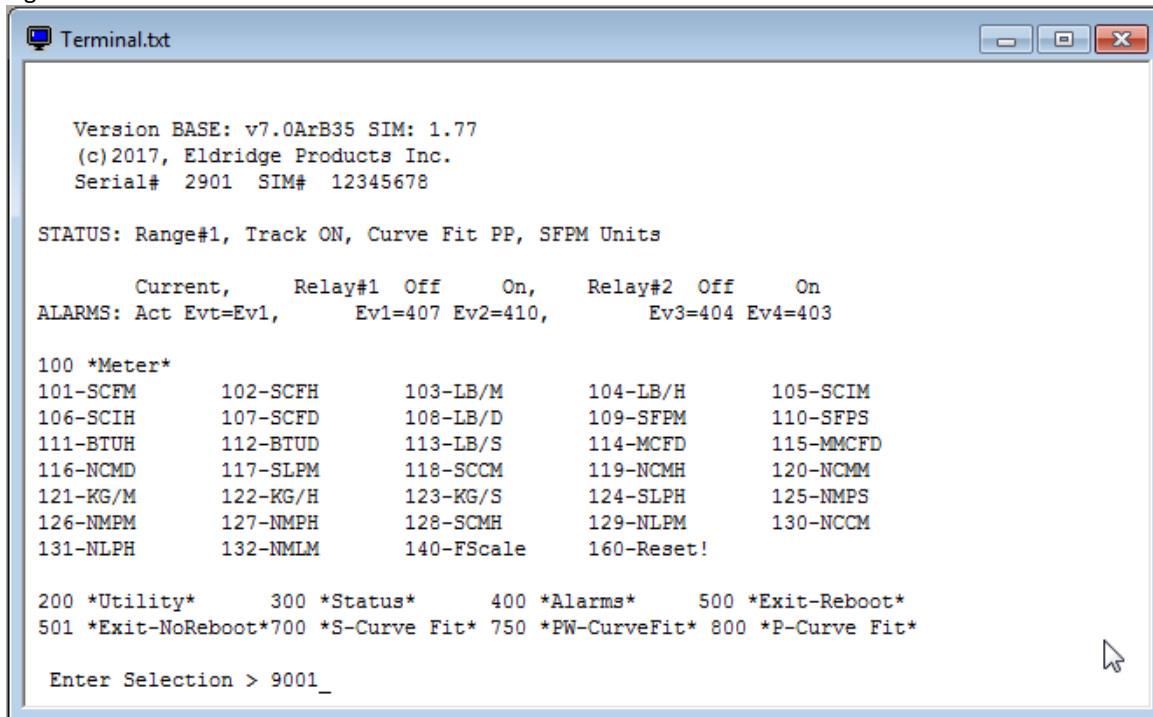
Figure 2



This window will be the normal “Run Mode” text and data. The mW value is read on the right side of the bottom line within the window. The mW value is read and used for **On-Site or In-Situ** alternate LiveZero™ values established by User. See Figure 6 below listing Command 241 selections and following paragraphs describing their use.

Epi-Val™ With LiveZero™ Field Validation

Figure 3



```
Terminal.txt

Version BASE: v7.0ArB35 SIM: 1.77
(c)2017, Eldridge Products Inc.
Serial# 2901 SIM# 12345678

STATUS: Range#1, Track ON, Curve Fit PP, SFPM Units

Current, Relay#1 Off On, Relay#2 Off On
ALARMS: Act Evt=Ev1, Ev1=407 Ev2=410, Ev3=404 Ev4=403

100 *Meter*
101-SCFM 102-SCFH 103-LB/M 104-LB/H 105-SCIM
106-SCIH 107-SCFD 108-LB/D 109-SFPM 110-SFPS
111-BTUH 112-BTUD 113-LB/S 114-MCFD 115-MMCFD
116-NCMD 117-SLPM 118-SCCM 119-NCMH 120-NCMM
121-KG/M 122-KG/H 123-KG/S 124-SLPH 125-NMPS
126-NMFM 127-NMPH 128-SCMH 129-NLPM 130-NCCM
131-NLPH 132-NMLM 140-FScale 160-Reset!

200 *Utility* 300 *Status* 400 *Alarms* 500 *Exit-Reboot*
501 *Exit-NoReboot*700 *S-Curve Fit* 750 *PW-CurveFit* 800 *P-Curve Fit*

Enter Selection > 9001_
```

Epi-Val™ Testing:

First step to unlock the flow meter: This will allow changing the settings, with the “Computer Keyboard”, type in three periods ... , then the “Enter Selection >” text will appear.

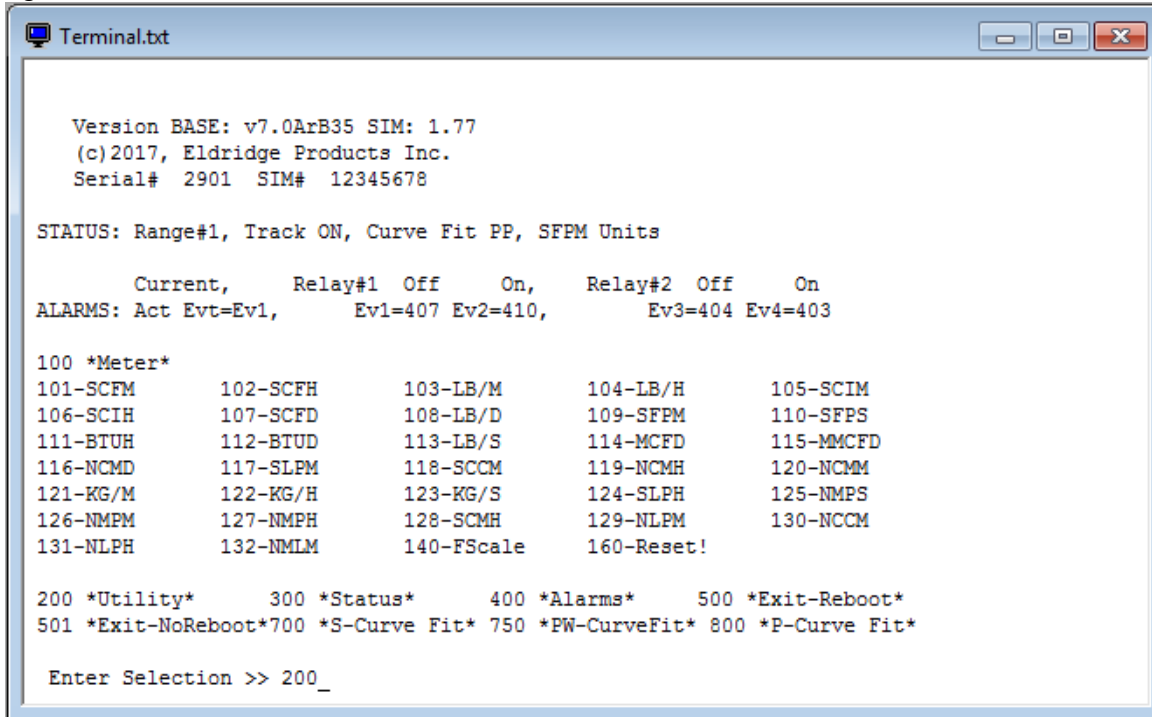
Second step to unlock flow meter: After “Enter Selection >” type in the factory password of 9001 (or subsequent User established password) and press “Enter” for unlocking the Flow Meter and for the next window to appear. If too much time lapses, the Flow Meter will time out, reset and lose changes. The process will then need to be repeated for desired input changes.

Note:

- 1) *“After” all of the Epi-Val™ flow meter command values are entered as detailed within this document. The various command value changes must be saved or they will be lost. To save the command changes and exit, type in 500 and press “Enter” to save the changes.*
- 2) *Once the new command values are saved, the Epi-Val™ sensor validation testing may be performed as stated herein by typing 500 and pressing “Enter” to save changed values and exiting into “Run Mode”.*
- 3) *After the flow meter is unlocked, the flow meter is designed to time out and reset when there is no User interaction for a period of time, typically 7 minutes.*

Epi-Val™ With LiveZero™ Field Validation

Figure 4



```
Terminal.txt

Version BASE: v7.0ArB35 SIM: 1.77
(c)2017, Eldridge Products Inc.
Serial# 2901 SIM# 12345678

STATUS: Range#1, Track ON, Curve Fit PP, SFPM Units

Current, Relay#1 Off On, Relay#2 Off On
ALARMS: Act Evt=Ev1, Ev1=407 Ev2=410, Ev3=404 Ev4=403

100 *Meter*
101-SCFM 102-SCFH 103-LB/M 104-LB/H 105-SCIM
106-SCIH 107-SCFD 108-LB/D 109-SFPM 110-SFPS
111-BTUH 112-BTUD 113-LB/S 114-MCFD 115-MMCFD
116-NCMD 117-SLPM 118-SCCM 119-NCMH 120-NCMM
121-KG/M 122-KG/H 123-KG/S 124-SLPH 125-NMPS
126-NMPM 127-NMPH 128-SCMH 129-NLPM 130-NCCM
131-NLPH 132-NMLM 140-FScale 160-Reset!

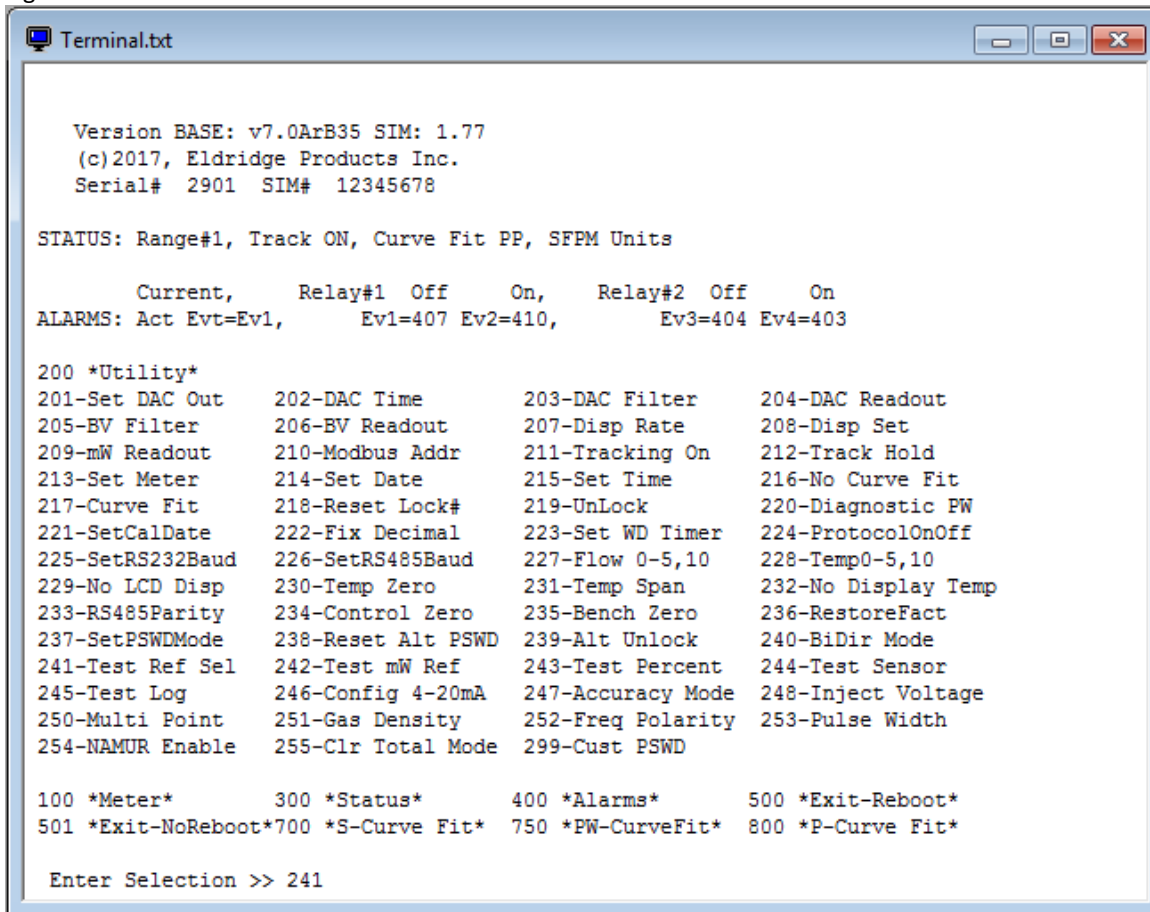
200 *Utility* 300 *Status* 400 *Alarms* 500 *Exit-Reboot*
501 *Exit-NoReboot*700 *S-Curve Fit* 750 *PW-CurveFit* 800 *P-Curve Fit*

Enter Selection >> 200_
```

When you see double >>, you are in edit mode and may change command values. After the >> type in 200 (see last line in this window) and press “Enter”. This action will bring up the 200’s Menu for visual reference.

Epi-Val™ With LiveZero™ Field Validation

Figure 5



```
Terminal.txt

Version BASE: v7.0ArB35 SIM: 1.77
(c)2017, Eldridge Products Inc.
Serial# 2901 SIM# 12345678

STATUS: Range#1, Track ON, Curve Fit PP, SFPM Units

Current, Relay#1 Off On, Relay#2 Off On
ALARMS: Act Evt=Ev1, Ev1=407 Ev2=410, Ev3=404 Ev4=403

200 *Utility*
201-Set DAC Out 202-DAC Time 203-DAC Filter 204-DAC Readout
205-BV Filter 206-BV Readout 207-Disp Rate 208-Disp Set
209-mW Readout 210-Modbus Addr 211-Tracking On 212-Track Hold
213-Set Meter 214-Set Date 215-Set Time 216-No Curve Fit
217-Curve Fit 218-Reset Lock# 219-UnLock 220-Diagnostic PW
221-SetCalDate 222-Fix Decimal 223-Set WD Timer 224-ProtocolOnOff
225-SetRS232Baud 226-SetRS485Baud 227-Flow 0-5,10 228-Temp0-5,10
229-No LCD Disp 230-Temp Zero 231-Temp Span 232-No Display Temp
233-RS485Parity 234-Control Zero 235-Bench Zero 236-RestoreFact
237-SetPSWDMode 238-Reset Alt PSWD 239-Alt Unlock 240-BiDir Mode
241-Test Ref Sel 242-Test mW Ref 243-Test Percent 244-Test Sensor
245-Test Log 246-Config 4-20mA 247-Accuracy Mode 248-Inject Voltage
250-Multi Point 251-Gas Density 252-Freq Polarity 253-Pulse Width
254-NAMUR Enable 255-Clr Total Mode 299-Cust PSWD

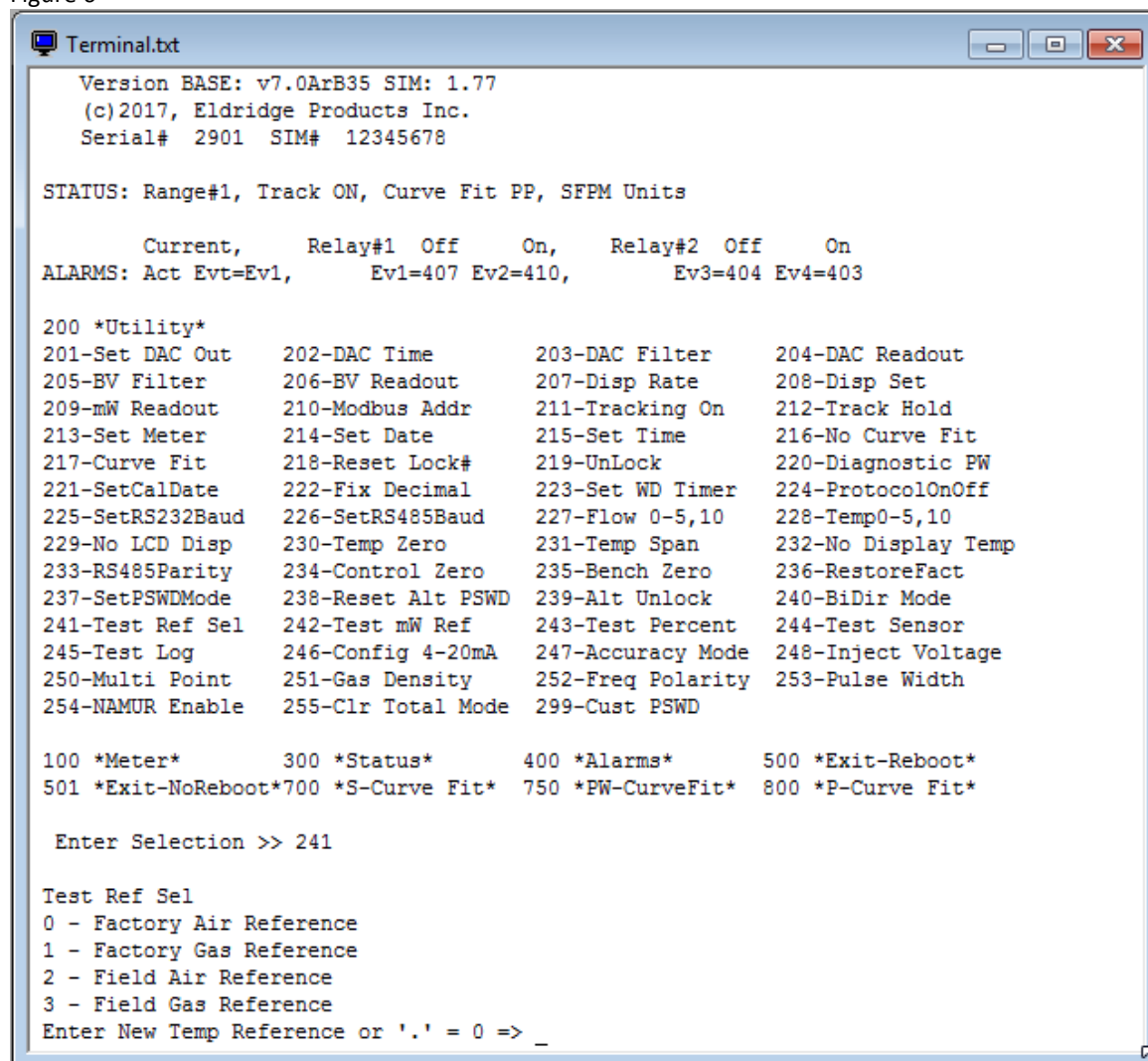
100 *Meter* 300 *Status* 400 *Alarms* 500 *Exit-Reboot*
501 *Exit-NoReboot*700 *S-Curve Fit* 750 *PW-CurveFit* 800 *P-Curve Fit*

Enter Selection >> 241
```

We are only concerned with the **Epi-Val™** command values. These consist of commands 241, 242, 243, 244, and 245, when performing the **Epi-Val™ Validation** processes.

Epi-Val™ With LiveZero™ Field Validation

Figure 6



```
Terminal.txt
Version BASE: v7.0ArB35 SIM: 1.77
(c)2017, Eldridge Products Inc.
Serial# 2901 SIM# 12345678

STATUS: Range#1, Track ON, Curve Fit PP, SFPM Units

Current, Relay#1 Off On, Relay#2 Off On
ALARMS: Act Evt=Ev1, Ev1=407 Ev2=410, Ev3=404 Ev4=403

200 *Utility*
201-Set DAC Out 202-DAC Time 203-DAC Filter 204-DAC Readout
205-BV Filter 206-BV Readout 207-Disp Rate 208-Disp Set
209-mW Readout 210-Modbus Addr 211-Tracking On 212-Track Hold
213-Set Meter 214-Set Date 215-Set Time 216-No Curve Fit
217-Curve Fit 218-Reset Lock# 219-Unlock 220-Diagnostic PW
221-SetCalDate 222-Fix Decimal 223-Set WD Timer 224-ProtocolOnOff
225-SetRS232Baud 226-SetRS485Baud 227-Flow 0-5,10 228-Temp0-5,10
229-No LCD Disp 230-Temp Zero 231-Temp Span 232-No Display Temp
233-RS485Parity 234-Control Zero 235-Bench Zero 236-RestoreFact
237-SetPSWDMODE 238-Reset Alt PSWD 239-Alt Unlock 240-BiDir Mode
241-Test Ref Sel 242-Test mW Ref 243-Test Percent 244-Test Sensor
245-Test Log 246-Config 4-20mA 247-Accuracy Mode 248-Inject Voltage
250-Multi Point 251-Gas Density 252-Freq Polarity 253-Pulse Width
254-NAMUR Enable 255-Clr Total Mode 299-Cust PSWD

100 *Meter* 300 *Status* 400 *Alarms* 500 *Exit-Reboot*
501 *Exit-NoReboot*700 *S-Curve Fit* 750 *PW-CurveFit* 800 *P-Curve Fit*

Enter Selection >> 241

Test Ref Sel
0 - Factory Air Reference
1 - Factory Gas Reference
2 - Field Air Reference
3 - Field Gas Reference
Enter New Temp Reference or '.' = 0 => _
```

Type in 241 and press “Enter”, to get to the command 241 selection list. Selections **0 & 1** may not be changed and are set at the factory as test values. In **Field-Val™ operation**, User may change selections **2 & 3** for **On-Site** or **In-Situ Validation** of sensor. Users sensor orientation & Gas conditions apply. The term “**Gas**” refers to all process gases, including Air.

Epi-Val™ Command 241 Test Reference Selections:

Epi-Val™ Command 241 Test Reference Selection 0 – **Factory Air Reference: Validation** testing will utilize the Factory stored no-flow **LiveZero™** mW value. Factory enters a “test bench” **Air** mW value at 70 °F (+/- 10 °F) & 0 PSIG. Factory establishes this value in the “Sensor Elements” pointing down orientation. Allows User to **Validate** the Factory established **Air LiveZero™** mW value On-Site, in Air, and in the Users own test lab/room. Testing must be performed at the same reference conditions and in the same orientation as established by the factory (70 °F (+/- 10 °F) & 0 PSIG).

Note: Validation must be performed at these same conditions. Insertion probe flow meters require a shielding tube over the probe/sensor assembly to prevent drafts. Inline flow meters require coverings over the flow body ends.

Epi-Val™ Command 241 Test Reference Selection 1 – **Factory Gas Reference Validation** testing will utilize the Factory **Calibration Gas** no-flow **LiveZero™** mW value. Factory enters the, “test bench” **Calibration Gas** mW value at 70 °F (+/- 10 °F) & at the User Stated Process PSIG. Factory establishes this value in the “Sensor Elements” pointing down orientation.

Allows User to **Validate** On-Site, the Factory established **Calibration Gas LiveZero™** mW value, **provided that the flow meter is installed in Users Process Gas & piping, with the same gas composition and at the same reference temperature & pressure conditions and in the same orientation as established by the Factory**. When the field process conditions or installation orientation differ from the factory, the User must go to **Command 241 Test Reference Selection 3**

Note: Validation must be performed at these same Factory conditions.

Epi-Val™ With LiveZero™ Field Validation

Field-Val™ Command 241 Test Reference Selection 2 – Field Air Reference: This option is provided for the User to establish Users own no-flow **LiveZero™** mW Air reference value, just prior to installation of the Flow Meter. User enters Users Air “test bench” mW value at Users Ambient °F (+/- 10 °F) & 0 PSIG. This value is established On-Site by User. Allows User to **Validate** against Users own acquired Air **LiveZero™** mW reference value (see figure 2), with flow sensor elements in User orientation.

Note: Validation must be performed at these same conditions. Insertion probe flow meters require a shielding tube over the probe/sensor assembly to prevent drafts. Inline flow meters require coverings over the flow body ends.

Field-Val™ Command 241 Test Reference Selection 3 – Field Gas Reference: This no-flow sensor **LiveZero™** milliwatt (mW) value is established **On-Site and In-Situ** by User, in Users **Process Gas** at the actual operating temperature and pressure. User must enter, Users “In-Situ” test reference Gas mW value at User temperature and pressure. User shall establish this value with the flow meter in the installed orientation. Allows User to **Validate** against Users own acquired Process Gas **LiveZero™** mW value (see figure 2), established **In-Situ** as a baseline, immediately after installation of the Flow Meter. If performed at a later date, this date becomes the baseline date for subsequent testing. This alternate **LiveZero™** milliwatt (mW) value **shall be required for installation orientation differing from the Factory sensor orientation**, or alternate Process Gas temperatures, or alternate Process Gas pressures, or a slightly different Gas composition, than was calibrated for at the factory.

Note: Validation must be performed at these same conditions.

Epi-Val™ & Field-Val™ require a “**No-flow**” **Validation** test and the Flow Meter to be positioned in the same orientation as it was when the **LiveZero™** mW value was obtained. The Flow Meter shall also be at the same established test pressure and temperature within +/- 10 °F of the associated reference temperature related to the flow meter **Validation** comparison data values.

Epi-Val™ With LiveZero™ Field Validation

Figure 7

```
Terminal.txt
221-SetCalDate      222-Fix Decimal    223-Set WD Timer   224-ProtocolOnOff
225-SetRS232Baud    226-SetRS485Baud   227-Flow 0-5,10    228-Temp0-5,10
229-No LCD Disp     230-Temp Zero      231-Temp Span      232-No Display Temp
233-RS485Parity     234-Control Zero   235-Bench Zero     236-RestoreFact
237-SetPSWDMODE     238-Reset Alt PSWD 239-Alt Unlock     240-BiDir Mode
241-Test Ref Sel    242-Test mW Ref    243-Test Percent   244-Test Sensor
245-Test Log        246-Config 4-20mA  247-Accuracy Mode  248-Inject Voltage
250-Multi Point     251-Gas Density    252-Freq Polarity  253-Pulse Width
254-NAMUR Enable    255-Clr Total Mode 299-Cust PSWD

100 *Meter*        300 *Status*      400 *Alarms*      500 *Exit-Reboot*
501 *Exit-NoReboot*700 *S-Curve Fit*  750 *PW-CurveFit*  800 *P-Curve Fit*

Enter Selection >> 242

Test mW Reference
Field Test mW Reference at Gas and PSI no Flow
AIR: mW Reference = 100.0 mW Pressure: 0.0 PSIG
GAS: mW Reference = 100.0 mW Pressure: 0.0 PSIG
Sample Duration = 2 Minutes

Enter new mW Air Reference or '.' => = Test mW Reference => 103

Enter new mW Air Pressure (PSIG) or '.' => 0

Enter new mW Gas Reference or '.' => 105

Enter new mW Gas Pressure (PSIG) or '.' => 100

Field Test mW Reference at Gas and PSI no Flow
AIR: mW Reference = 103.0 mW Pressure: 0.0 PSIG
GAS: mW Reference = 105.0 mW Pressure: 100.0 PSIG
Sample Duration = 2 Minutes

Enter 'C' to Change or '.' =>
```

Field-Val™ - To replace the factory default place holder **Field Air & Field Gas LiveZero™** mW **Validation** values for actual **User** values, type in 242 and press “Enter”. The sensor **LiveZero™** mW value is obtained through **EPICOM™** as discussed in Figure 2 window above. See Figure 6 above for command 241 Test Reference “Selection 2” – Field Air Reference; and command 241 Test Reference “Selection 3” – Field Gas Reference to place Epi-Val™ in the proper mode for setup and Validation data gathering.

Factory - Air Current Value: The “Test mW Reference” – Air: = 100.0 mW Pressure: 0.0 PSIG (must be 0)

Note: Example of Factory value in Figure 7 before change.

Factory - Gas Current Value: The “Test mW Reference” - Gas: = 100.0 mW Pressure: 0.0 PSIG (Calibration test PSIG)

Note: Example of Factory value in Figure 7 before change.

User test bench, Air mW Data values (see Figure 2 above) at ambient conditions and/or Gas mW Data values at Process temperature and pressure conditions, User is to enter the new replacement data as prompted within the window. Both a new mW value and a new pressure must be entered. If no change is required of the value, either type in the same value or type in a period ‘.’ (without quote marks) and press “Enter”, to retain the displayed value.

Field - Air Replacement Value: The “Test mW Reference” - Air: = 103.0 mW Pressure: 0.0 PSIG (must be 0)

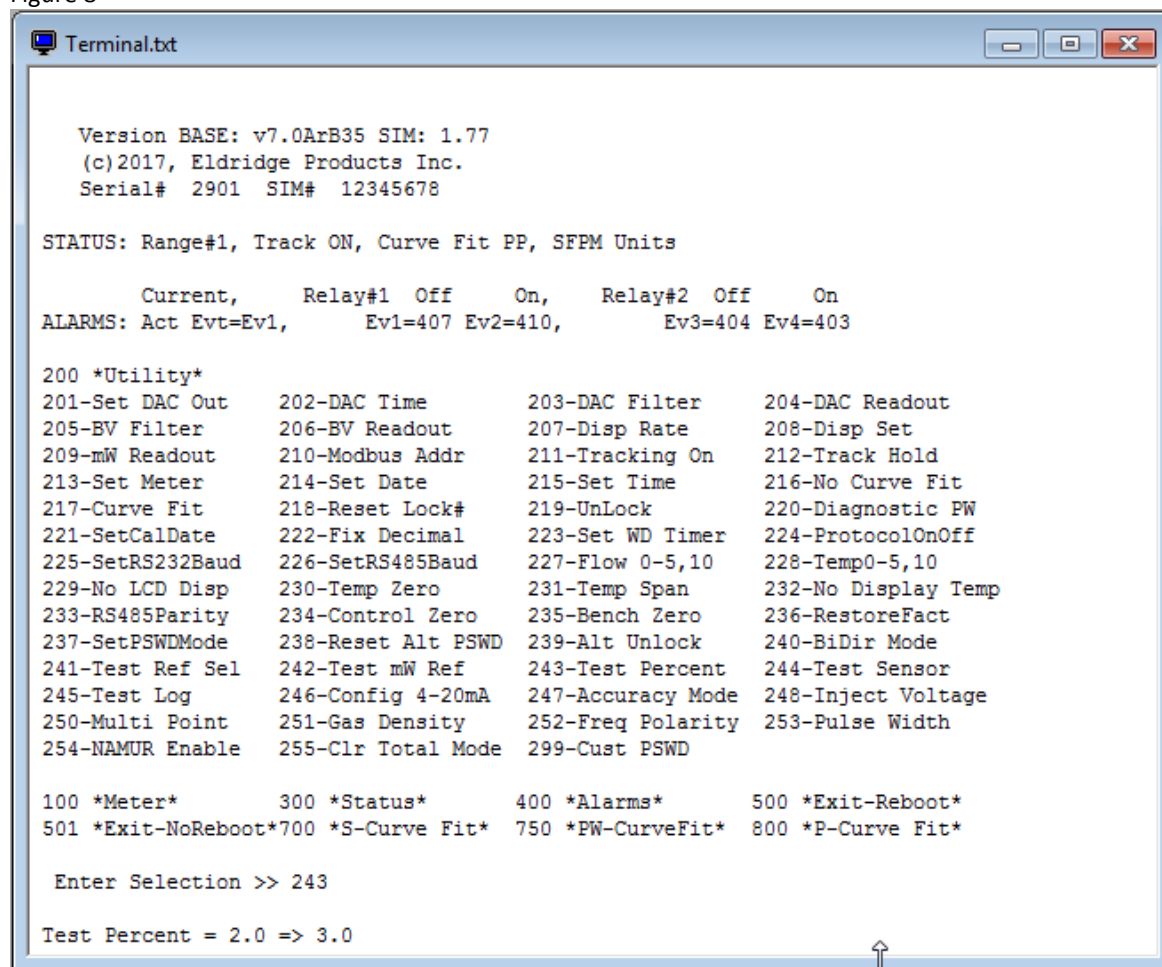
Note: User new value in Figure 7. This Field replacement value was obtained from the value located in Figure 2, with the flow sensor in ambient Air and in the ‘Users’ sensor orientation.

Field - Gas Replacement Value: The “Test mW Reference” - Gas: = 105.0 mW Pressure: 100.0 PSIG (Process test PSIG)

Note: User new value in Figure 7. This Field replacement value was obtained from the value located in Figure 2, with the flow sensor in the ‘Users’ actual Process Gas and in the ‘Users’ installed sensor orientation.

Epi-Val™ With LiveZero™ Field Validation

Figure 8



```
Terminal.txt

Version BASE: v7.0ArB35 SIM: 1.77
(c)2017, Eldridge Products Inc.
Serial# 2901 SIM# 12345678

STATUS: Range#1, Track ON, Curve Fit PP, SFPM Units

Current, Relay#1 Off On, Relay#2 Off On
ALARMS: Act Evt=Ev1, Ev1=407 Ev2=410, Ev3=404 Ev4=403

200 *Utility*
201-Set DAC Out 202-DAC Time 203-DAC Filter 204-DAC Readout
205-BV Filter 206-BV Readout 207-Disp Rate 208-Disp Set
209-mW Readout 210-Modbus Addr 211-Tracking On 212-Track Hold
213-Set Meter 214-Set Date 215-Set Time 216-No Curve Fit
217-Curve Fit 218-Reset Lock# 219-UnLock 220-Diagnostic PW
221-SetCalDate 222-Fix Decimal 223-Set WD Timer 224-ProtocolOnOff
225-SetRS232Baud 226-SetRS485Baud 227-Flow 0-5,10 228-Temp0-5,10
229-No LCD Disp 230-Temp Zero 231-Temp Span 232-No Display Temp
233-RS485Parity 234-Control Zero 235-Bench Zero 236-RestoreFact
237-SetPSWDMODE 238-Reset Alt PSWD 239-Alt Unlock 240-BiDir Mode
241-Test Ref Sel 242-Test mW Ref 243-Test Percent 244-Test Sensor
245-Test Log 246-Config 4-20mA 247-Accuracy Mode 248-Inject Voltage
250-Multi Point 251-Gas Density 252-Freq Polarity 253-Pulse Width
254-NAMUR Enable 255-Clr Total Mode 299-Cust PSWD

100 *Meter* 300 *Status* 400 *Alarms* 500 *Exit-Reboot*
501 *Exit-NoReboot*700 *S-Curve Fit* 750 *PW-CurveFit* 800 *P-Curve Fit*

Enter Selection >> 243

Test Percent = 2.0 => 3.0
```

The following **LiveZero™ Validation** data and values are established by the Factory and are retained in Firmware and the *User is not able to change these mW or PSIG data set values, however, User may change the pass/fail percent value -*

Epi-Val™ Reference Selections:

- 0 – **Factory Air** Reference: **Validation** testing will utilize the Factory stored **LiveZero™** mW value
- 1 – **Factory Gas** Reference: **Validation** testing will utilize the Factory stored **LiveZero™** mW value

Field-Val™ Reference Selections:

- 2 – **Field Air** Reference: **Validation** testing will utilize the User stored **LiveZero™** mW value
- 3 – **Field Gas** Reference: **Validation** testing will utilize the User stored **LiveZero™** mW value

To input the Field Air & Gas **LiveZero™** mW Validation **pass/fail test percent**, type in 243 as shown in Figure 8, and press “Enter” on the keyboard. If the test value is more or less than the test value error percent, the result will be “Fail”.

The current pass/fail test percent value, currently 2.0 as shown in Figure 8, will display. User may change the value to suit User requirements.

Enter a new “User” desired pass/fail error replacement value, as shown in Figure 8, such as 3.0 as shown and press “Enter” to accept new pass/fail percent value and exit. This alternate value may be required where the pressure or temperature of the Process Gas is fluctuating.

Epi-Val™ With LiveZero™ Field Validation

Figure 9



```
Terminal.txt

Version BASE: v7.0ArB35 SIM: 1.77
(c)2017, Eldridge Products Inc.
Serial# 2901 SIM# 12345678

STATUS: Range#1, Track ON, Curve Fit PP, SFPM Units

Current, Relay#1 Off On, Relay#2 Off On
ALARMS: Act Evt=Ev1, Ev1=407 Ev2=410, Ev3=404 Ev4=403

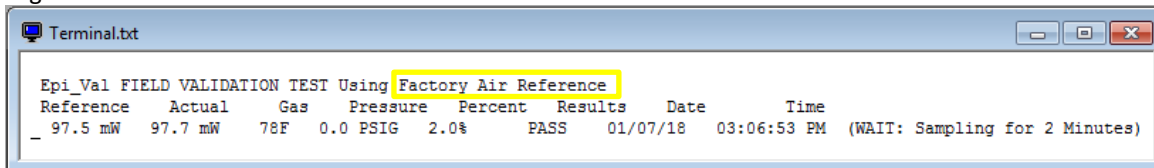
200 *Utility*
201-Set DAC Out 202-DAC Time 203-DAC Filter 204-DAC Readout
205-BV Filter 206-BV Readout 207-Disp Rate 208-Disp Set
209-mW Readout 210-Modbus Addr 211-Tracking On 212-Track Hold
213-Set Meter 214-Set Date 215-Set Time 216-No Curve Fit
217-Curve Fit 218-Reset Lock# 219-UnLock 220-Diagnostic PW
221-SetCalDate 222-Fix Decimal 223-Set WD Timer 224-ProtocolOnOff
225-SetRS232Baud 226-SetRS485Baud 227-Flow 0-5,10 228-Temp0-5,10
229-No LCD Disp 230-Temp Zero 231-Temp Span 232-No Display Temp
233-RS485Parity 234-Control Zero 235-Bench Zero 236-RestoreFact
237-SetPSWDMode 238-Reset Alt PSWD 239-Alt Unlock 240-BiDir Mode
241-Test Ref Sel 242-Test mW Ref 243-Test Percent 244-Test Sensor
245-Test Log 246-Config 4-20mA 247-Accuracy Mode 248-Inject Voltage
250-Multi Point 251-Gas Density 252-Freq Polarity 253-Pulse Width
254-NAMUR Enable 255-Clr Total Mode 299-Cust PSWD

100 *Meter* 300 *Status* 400 *Alarms* 500 *Exit-Reboot*
501 *Exit-NoReboot* 700 *S-Curve Fit* 750 *PW-CurveFit* 800 *P-Curve Fit*

Enter Selection >> 244_
```

To perform the **LiveZero™** mW Validation testing, type in 244 and press "Enter" on the keyboard. A new window will be opened with a dynamic test running. Although the sensor may have a stable **LiveZero™** mW value in less than 2 minutes, 2 minutes is the minimum time required from power-up or after a 500 save/reset is forced, for sensor balance to be achieved. A "**5 minute**" **sensor settling time** is suggested prior to performing the command 244 **Validation** test function.

Figure 10



```
Terminal.txt

Epi_Val FIELD VALIDATION TEST Using Factory Air Reference
Reference Actual Gas Pressure Percent Results Date Time
_ 97.5 mW 97.7 mW 78F 0.0 PSIG 2.0% PASS 01/07/18 03:06:53 PM (WAIT: Sampling for 2 Minutes)
```

This **LiveZero™** mW Validation testing is being performed with the **Factory mW Air** reference data which was selected via menu 241 prior to running the test (see Figure 6). Note the sampling time of 2 minutes wait time prior to test finalization. The test cannot be interrupted and must finish once started.

Epi-Val™ With LiveZero™ Field Validation

Figure 11

```
Terminal.txt

Version BASE: v7.0ArB35 SIM: 1.77
(c)2017, Eldridge Products Inc.
Serial# 2901 SIM# 12345678

STATUS: Range#1, Track ON, Curve Fit PP, SFPM Units

Current, Relay#1 Off On, Relay#2 Off On
ALARMS: Act Evt=Ev1, Ev1=407 Ev2=410, Ev3=404 Ev4=403

200 *Utility*
201-Set DAC Out 202-DAC Time 203-DAC Filter 204-DAC Readout
205-BV Filter 206-BV Readout 207-Disp Rate 208-Disp Set
209-mW Readout 210-Modbus Addr 211-Tracking On 212-Track Hold
213-Set Meter 214-Set Date 215-Set Time 216-No Curve Fit
217-Curve Fit 218-Reset Lock# 219-UnLock 220-Diagnostic PW
221-SetCalDate 222-Fix Decimal 223-Set WD Timer 224-ProtocolOnOff
225-SetRS232Baud 226-SetRS485Baud 227-Flow 0-5,10 228-Temp0-5,10
229-No LCD Disp 230-Temp Zero 231-Temp Span 232-No Display Temp
233-RS485Parity 234-Control Zero 235-Bench Zero 236-RestoreFact
237-SetPSWDMode 238-Reset Alt PSWD 239-Alt Unlock 240-BiDir Mode
241-Test Ref Sel 242-Test mW Ref 243-Test Percent 244-Test Sensor
245-Test Log 246-Config 4-20mA 247-Accuracy Mode 248-Inject Voltage
250-Multi Point 251-Gas Density 252-Freq Polarity 253-Pulse Width
254-NAMUR Enable 255-Clr Total Mode 299-Cust PSWD

100 *Meter* 300 *Status* 400 *Alarms* 500 *Exit-Reboot*
501 *Exit-NoReboot* 700 *S-Curve Fit* 750 *PW-CurveFit* 800 *P-Curve Fit*

Enter Selection >> 245_
```

The Epi-Val™ LiveZero™ mW Validation “Test Log” may be reviewed by inputting 245 and pressing “Enter”.

Epi-Val™ With LiveZero™ Field Validation

Figure 12

```
Terminal.txt
Serial Number 2901 SIM 12345678
Version BASE: v7.0ArB35 SIM: 1.77
CopyRight 2017, Eldridge Products, Inc.

Report Date: 01/07/18
Report Time: 03:08:42 PM

Test is performed against a -
1 - Factory Reference milliwatt (mW) sensor heat transfer Value or
2 - Field Reference milliwatt (mW) sensor heat transfer Value
3 - Validation Sample Test Duration is 2 Minutes
4 - Logs list the pressure that the gas must be at for the test, test does not read the PSIG value
Note: See Epi-Val FIELD mW VALIDATION TEST LOG below for reference used

Epi-Val METER DATE CHANGE LOG
No Date Changes Logged

Epi-Val FACTORY mW REFERENCE VALIDATION TEST LOG
Factory Air mW Reference: 97.5 mW 85F 0 PSIG Factory Percent: 2.0% 09/22/17 04:36:36 PM
Factory Gas mW Reference: 97.2 mW 85F 0 PSIG Factory Percent: 2.0% 09/22/17 04:37:16 PM

Epi-Val FIELD mW REFERENCE VALIDATION TEST LOG
Line 1: Factory Air mW Reference: 97.5 mW Actual: 97.9 mW 79F 0 PSIG Field Percent: 2.0% PASS 09/23/17 10:18:27 AM
Line 2: Factory Gas mW Reference: 97.2 mW Actual: 98.0 mW 79F 0 PSIG Field Percent: 2.0% PASS 09/23/17 10:18:40 AM
Line 3: Field Air mW Reference: 100.0 mW Actual: 98.1 mW 79F 0 PSIG Field Percent: 2.0% PASS 09/23/17 10:18:56 AM
Line 4: Field Gas mW Reference: 100.0 mW Actual: 97.7 mW 79F 0 PSIG Field Percent: 2.0% FAIL 09/23/17 10:19:29 AM
Line 5: Factory Air mW Reference: 97.5 mW Actual: 97.4 mW 85F 0 PSIG Field Percent: 2.0% PASS 01/04/18 04:33:46 PM
Line 6: Factory Air mW Reference: 97.5 mW Actual: 97.4 mW 76F 0 PSIG Field Percent: 2.0% PASS 01/07/18 12:26:33 PM
Line 7: Factory Air mW Reference: 97.5 mW Actual: 97.6 mW 78F 0 PSIG Field Percent: 2.0% PASS 01/07/18 03:08:38 PM

Delete a Test Line Item? (y/n) > _
```

Figure 12 reflects the window contents after issuing a 245 command to display the Factory reference data and the data generated through the Epi-Val™ Field Validation process, utilizing the LiveZero™ mW values.

Lines 1, 2, 5, 6, 7 reflect testing against the Factory Epi-Val™ values.

Lines 3, 4, reflect testing against the Factory Field-Val™ values.

The “Epi-Val™ FACTORY mW REFERENCE VALIDATION TEST LOG”, reflects Factory established test criteria and is used as a reference when testing against “Factory Air” or Factory “Gas”.

The “Epi-Val™ FIELD mW REFERENCE VALIDATION TEST LOG”, reflects User Field testing against either the Factory established test criteria or Factory “Gas” or the User established Field-Val™ “Field Air” or Field “Gas” test criteria.

Epi-Val™ With LiveZero™ Field Validation

Figure 13

```
Terminal.txt
Serial Number 2901 SIM 12345678
Version BASE: v7.0ArB35 SIM: 1.77
CopyRight 2017, Eldridge Products, Inc.

Report Date: 01/07/18
Report Time: 03:08:42 PM

Test is performed against a -
1 - Factory Reference milliwatt (mW) sensor heat transfer Value or
2 - Field Reference milliwatt (mW) sensor heat transfer Value
3 - Validation Sample Test Duration is 2 Minutes
4 - Logs list the pressure that the gas must be at for the test, test does not read the PSIG value
Note: See Epi-Val FIELD mW VALIDATION TEST LOG below for reference used

Epi-Val METER DATE CHANGE LOG
No Date Changes Logged

Epi-Val FACTORY mW REFERENCE VALIDATION TEST LOG
Factory Air mW Reference: 97.5 mW 85F 0 PSIG Factory Percent: 2.0% 09/22/17 04:36:36 PM
Factory Gas mW Reference: 97.2 mW 85F 0 PSIG Factory Percent: 2.0% 09/22/17 04:37:16 PM

Epi-Val FIELD mW REFERENCE VALIDATION TEST LOG
Line 1: Factory Air mW Reference: 97.5 mW Actual: 97.9 mW 79F 0 PSIG Field Percent: 2.0% PASS 09/23/17 10:18:27 AM
Line 2: Factory Gas mW Reference: 97.2 mW Actual: 98.0 mW 79F 0 PSIG Field Percent: 2.0% PASS 09/23/17 10:18:40 AM
Line 3: Field Air mW Reference: 100.0 mW Actual: 98.1 mW 79F 0 PSIG Field Percent: 2.0% PASS 09/23/17 10:18:56 AM
Line 4: Field Gas mW Reference: 100.0 mW Actual: 97.7 mW 79F 0 PSIG Field Percent: 2.0% FAIL 09/23/17 10:19:29 AM
Line 5: Factory Air mW Reference: 97.5 mW Actual: 97.0 mW 85F 0 PSIG Field Percent: 2.0% PASS 01/04/18 04:33:46 PM
Line 6: Factory Air mW Reference: 97.5 mW Actual: 97.4 mW 76F 0 PSIG Field Percent: 2.0% PASS 01/07/18 12:26:33 PM
Line 7: Factory Air mW Reference: 97.5 mW Actual: 97.6 mW 76F 0 PSIG Field Percent: 2.0% PASS 01/07/18 03:08:38 PM

Delete a Test Line Item? (y/n) > y
Enter Line Item to Delete? > 7
```

The **Epi-Val™** Log file with **LiveZero™** mW **Validation** Test Log lines, may have individual lines deleted by User, due to improper testing if needed. Note that all lines reflect “Pass”, except for line 4 reflects “Fail”. Also note the dates starting September 23, 2017 through January 4, 2018 with very tight correlation and given a **LiveZero™** mW **Validation** “Pass” rating.

To clear a logged line -

- 1) At the prompt - Type in a 'Y' as reflected in Figure 13 and press “Enter”.
- 2) At the prompt - Type in the line number to be deleted e.g. '7' and press “Enter”. The result is a deleted line 7. If a middle line is deleted, the lines move up to fill the gap and are renumbered in numerical order.

Epi-Val™ With LiveZero™ Field Validation

Figure 14

```
Terminal.txt
Serial Number 2901 SIM 12345678
Version BASE: v7.0ArB35 SIM: 1.77
CopyRight 2017, Eldridge Products, Inc.

Report Date: 01/07/18
Report Time: 03:08:42 PM

Test is performed against a -
1 - Factory Reference milliwatt (mW) sensor heat transfer Value or
2 - Field Reference milliwatt (mW) sensor heat transfer Value
3 - Validation Sample Test Duration is 2 Minutes
4 - Logs list the pressure that the gas must be at for the test, test does not read the PSIG value
Note: See Epi-Val FIELD mW VALIDATION TEST LOG below for reference used

Epi-Val METER DATE CHANGE LOG
No Date Changes Logged

Epi-Val FACTORY mW REFERENCE VALIDATION TEST LOG
Factory Air mW Reference: 97.5 mW 85F 0 PSIG Factory Percent: 2.0% 09/22/17 04:36:36 PM
Factory Gas mW Reference: 97.2 mW 85F 0 PSIG Factory Percent: 2.0% 09/22/17 04:37:16 PM

Epi-Val FIELD mW REFERENCE VALIDATION TEST LOG
Line 1: Factory Air mW Reference: 97.5 mW Actual: 97.9 mW 79F 0 PSIG Field Percent: 2.0% PASS 09/23/17 10:18:27 AM
Line 2: Factory Gas mW Reference: 97.2 mW Actual: 98.0 mW 79F 0 PSIG Field Percent: 2.0% PASS 09/23/17 10:18:40 AM
Line 3: Field Air mW Reference: 100.0 mW Actual: 98.1 mW 79F 0 PSIG Field Percent: 2.0% PASS 09/23/17 10:18:56 AM
Line 4: Field Gas mW Reference: 100.0 mW Actual: 97.7 mW 79F 0 PSIG Field Percent: 2.0% FAIL 09/23/17 10:19:29 AM
Line 5: Factory Air mW Reference: 97.5 mW Actual: 97.0 mW 85F 0 PSIG Field Percent: 2.0% PASS 01/04/18 04:33:46 PM
Line 6: Factory Air mW Reference: 97.5 mW Actual: 97.4 mW 76F 0 PSIG Field Percent: 2.0% PASS 01/07/18 12:26:33 PM

Delete a Test Line Item? (y/n) > _
```

The contents of Figure 14 window reflect that the line 7 is now removed. This log report (as per Figure 16 below) may be printed out for a permanent record of the testing to be retained in the Users records and/or Quality Management system.

Note: "After" all of the Epi-Val™ flow meter command values are entered as detailed within this document. The various command value changes must be saved or they will be lost. To save the command changes and exit, type in 500 and press "Enter" to save the changes.

Epi-Val™ With LiveZero™ Field Validation

Figure 15

```
Terminal.txt
Serial Number 2901 SIM 12345678
Version Number v7.0ArB32 SIM 1.76
CopyRight 2017, Eldridge Products, Inc.

Report Date: 09/09/17
Report Time: 16:18:38

Test is performed against a -
1 - Factory Reference milliwatt (mW) sensor heat transfer Value or
2 - Field Reference milliwatt (mW) sensor heat transfer Value
Note: See Epi-Val FIELD VALIDATION TEST LOG below for reference used

Epi-Val DATE CHANGE LOG
[09/09/16 : 08/31/16] [08/31/16 : 09/09/17]

Epi-Val FACTORY VALIDATION TEST LOG
Factory Air Reference: 97.6mW 89F, Factory Percent: 1.5%, 09/05/16 14:26:46
Factory Gas Reference: 97.2mW 89F, Factory Percent: 1.5%, 09/05/16 14:26:46

Epi-Val FIELD VALIDATION TEST LOG
Line 1: Factory Air Reference: 97.6mW, Actual: 97.8mW 90F, Factory Percent: 1.5, Results: PASS, 09/09/16 15:45:59
Line 2: Factory Air Reference: 97.6mW, Actual: 97.3mW 90F, Factory Percent: 1.5, Results: PASS, 09/09/16 16:07:34

Delete a Test Line Item? (y/n) > _
```

CAUTION:

There is never a need to reset the factory date. The date is maintained with a lithium battery that has a useful life of over 10 years.

Any attempt to backdate a test will become a permanent part of the “Test Log” record reflected in the “Epi-Val™ DATE CHANGE LOG”. The only way to clear the logged date requires that the Flow Meter be returned to the EPI™ Factory to be reset. There is an associated charge to reset the date and clear the “Epi-Val™ DATE CHANGE LOG”

Note: You will see the first starting date, and the associated back date, and then the reversal.

Epi-Val™ With LiveZero™ Field Validation

Figure 16

```
Terminal.txt
Serial Number 2901 SIM 12345678
Version BASE: v7.0ArB35 SIM: 1.77
CopyRight 2017, Eldridge Products, Inc.

Report Date: 01/07/18
Report Time: 03:08:42 PM


Test is performed against a -
1 - Factory Reference milliwatt (mW) sensor heat transfer Value or
2 - Field Reference milliwatt (mW) sensor heat transfer Value
3 - Validation Sample Test Duration is 2 Minutes
4 - Logs list the pressure that the gas must be at for the test, test does not read the PSIG value
Note: See Epi-Val FIELD mW VALIDATION TEST LOG below for reference used

Epi-Val METER DATE CHANGE LOG
No Date Changes Logged

Epi-Val FACTORY mW REFERENCE VALIDATION TEST LOG
Factory Air mW Reference: 97.5 mW 85F 0 PSIG Factory Percent: 2.0% 09/22/17 04:36:36 PM
Factory Gas mW Reference: 97.2 mW 85F 0 PSIG Factory Percent: 2.0% 09/22/17 04:37:16 PM

Epi-Val FIELD mW REFERENCE VALIDATION TEST LOG
Line 1: Factory Air mW Reference: 97.5 mW Actual: 97.9 mW 79F 0 PSIG Field Percent: 2.0% PASS 09/23/17 10:18:27 AM
Line 2: Factory Gas mW Reference: 97.2 mW Actual: 98.0 mW 79F 0 PSIG Field Percent: 2.0% PASS 09/23/17 10:18:40 AM
Line 3: Field Air mW Reference: 100.0 mW Actual: 98.1 mW 79F 0 PSIG Field Percent: 2.0% PASS 09/23/17 10:18:56 AM
Line 4: Field Gas mW Reference: 100.0 mW Actual: 97.7 mW 79F 0 PSIG Field Percent: 2.0% FAIL 09/23/17 10:19:29 AM
Line 5: Factory Air mW Reference: 97.5 mW Actual: 97.0 mW 85F 0 PSIG Field Percent: 2.0% PASS 01/04/18 04:33:46 PM
Line 6: Factory Air mW Reference: 97.5 mW Actual: 97.4 mW 76F 0 PSIG Field Percent: 2.0% PASS 01/07/18 12:26:33 PM

Delete a Test Line Item? (y/n) > _
```

From the “Run Mode” window, type in “...” and press “Enter” followed by typing in 245 and press “Enter” to get to the report as seen above. Unlocking is not necessary to view and print the report. Select the printer icon  to print the report. The report may be directly printed or printed as a User named “*.pdf” file and saved on Users computer and printed at any time thereafter.

This report is a record **Validating** that the sensor is clean, and maintains its original **LiveZero™** mW value heat transfer calibration to within the specified pass/fail tolerances.

An “screenshot” example of the **Epi-Val™ “Field Validation & Report”** as printed from **EPICom™**, follows on the next page.

Eldridge Products, Inc. (EPI)

Software Epi-Val(TM) with LiveZero(TM) Field Validation & Report

EPI Master-Touch(TM) & ValuMass(TM) Thermal Mass Flow Meter Products

Serial Number 2901 SIM 12345670
Version BASE: v7.0ArB35 SIM: 1.77
Copyright 2017, Eldridge Products, Inc.

Report Date: 01/07/18
Report Time: 03:54:49 PM

Test is performed against a -
1 - Factory Reference milliwatt (mW) sensor heat transfer Value or
2 - Field Reference milliwatt (mW) sensor heat transfer Value
3 - Validation Sample Test Duration is 2 Minutes
4 - Logs list the pressure that the gas must be at for the test, test does not read the PSIG value
Note: See Epi-Val FIELD mW VALIDATION TEST LOG below for reference used

Epi-Val METER DATE CHANGE LOG

No Date Changes Logged

Epi-Val FACTORY mW REFERENCE VALIDATION TEST LOG

Factory Air mW Reference: 97.5 mW 85F 0 PSIG Factory Percent: 2.0% 09/22/17 04:36:36 PM
Factory Gas mW Reference: 97.2 mW 85F 0 PSIG Factory Percent: 2.0% 09/22/17 04:37:16 PM

Epi-Val FIELD mW REFERENCE VALIDATION TEST LOG

Line 1: Factory Air mW Reference: 97.5 mW Actual: 97.9 mW 79F 0 PSIG Field Percent: 2.0% PASS 09/23/17 10:19:27 AM
Line 2: Factory Gas mW Reference: 97.2 mW Actual: 98.0 mW 79F 0 PSIG Field Percent: 2.0% PASS 09/23/17 10:19:40 AM
Line 3: Field Air mW Reference: 100.0 mW Actual: 99.1 mW 79F 0 PSIG Field Percent: 2.0% PASS 09/23/17 10:19:56 AM
Line 4: Field Gas mW Reference: 100.0 mW Actual: 97.7 mW 79F 0 PSIG Field Percent: 2.0% FAIL 09/23/17 10:19:29 AM
Line 5: Factory Air mW Reference: 97.5 mW Actual: 97.0 mW 85F 0 PSIG Field Percent: 2.0% PASS 01/04/18 04:33:46 PM
Line 6: Factory Air mW Reference: 97.5 mW Actual: 97.4 mW 76F 0 PSIG Field Percent: 2.0% PASS 01/07/18 12:26:33 PM
Line 7: Factory Air mW Reference: 97.5 mW Actual: 97.3 mW 75F 0 PSIG Field Percent: 2.0% PASS 01/07/18 12:35:20 PM