# User's Guide to the AALBORG
XFM LabVIEW Drivers
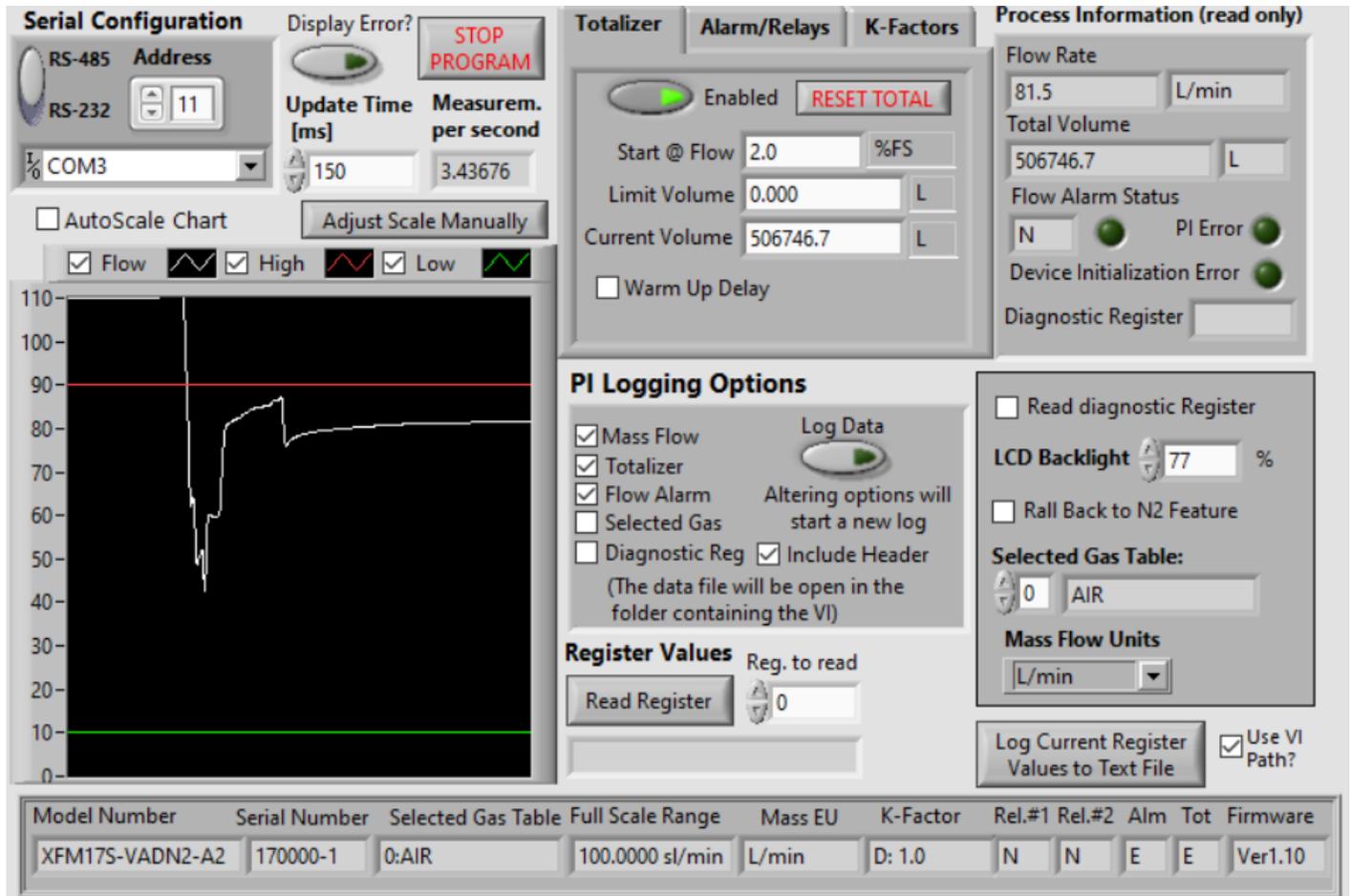
AALBORG

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1. Introduction

The AALBORG XFM LabVIEW drivers were designed to make communication with XFM instruments using LabVIEW much easier, and include all supported ASCII commands which are organized as easy to use sub-VI's. These drivers will work on any XFM instrument that is configured for RS-232 or RS-485 interface and connected to the instrument's digital communication interface (pins 8,15 and 9 on the instrument's 15 pins D-connector).

In the most basic form, the XFM LabVIEW drivers are establishing a VISA session to an active COM port to which XFM devices are connected. Once the communication has been initialized, the sub-VI's can be called which send serial ASCII commands to the XFM instruments over the opened VISA session and parse the ASCII data string that is returned from the device. The initialization should be done with the ***Initialize COM Port*** sub-VI, and the VISA session should be closed using a ***VISA Close*** VI (included in LabVIEW) when ending the program. In the following pages, each of the VI's included in the XFM LabVIEW driver set has a brief description of the function and of the input and output terminals. When operating multiple devices on a single COM port (using RS-485 interface), each serial command or sub-VI must be called sequentially. This can be achieved by ensuring that a VISA session wire on the block diagram always has one source and one sink, and does not branch to multiple sinks. This applies to a single VISA session wire on the block diagram associated with a given COM port, multiple XFM instruments can be operated in parallel through the use of multiple COM ports (and each of those VISA sessions' wires should not branch to multiple sinks).

2. Known Issues

The string-to-number conversions performed in the data parsing VI's uses the system default decimal format. In some regions, this can cause issues due to LabVIEW expecting a comma for a decimal point instead of the period that will be present in the XFM instrument reply data frame.

To overcome this issue, one can either change the Windows localization settings to use a period for the decimal point or the sub-VI's that are causing the errors can be edited to fix the issue. For the string-to-number sub-VI's, there should be an input for "use system decimal" that can be set to false to force a period to be used; for the "scan from string" sub-VI, changing the format specifier from %f or %.3f to %.;%f or %.;%.3f should work.

3. AALBORG XFM VI Tree

The AALBORG XFM VI Tree's block diagram contains all of the VI's included in the driver library, visually organized by category. To view these files, simply view the block diagram. When viewing the block diagram, you can hover over the VI's with the context help active to view the description of the VI.

4. Sub-VI's

4.1 Initialization

These sub-VI's are used to open a VISA session with the configuration settings required by XFM instruments and to initialize key instrument parameters according to data in the instrument's EEPROM memory.

4.1.1 Initialize COM Port

Initialize COM Port (SubVI).vi

Communication Settings ▭▭▭▭▭ [INITIALI COM PORT (SUBVI)] ▭▭▭▭▭ VISA Session Out
error in (no error) ▭▭▭▭▭ Address String
error out
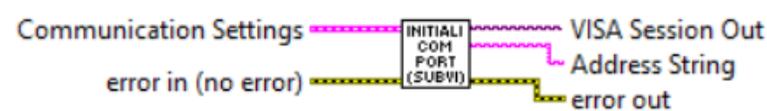
Initializes the serial connection to a selected COM port. Baud rate for XFM instruments is fixed to 9600 and cannot be changed. If multiple instruments are connected to the same COM port, ensure that XFM instruments configured for RS-485 interface and they all have unique RS-485 Addresses.

Inputs:

Communication Settings is a cluster that contains the Instrument Address (string with two hexadecimal characters), Interface Type (boolean TRUE for RS-485) and VISA Session In representing COM Port Number used for establishing communication with device. NOTE: Address is not required when instrument is connected over RS-232 interface (in this case interface type should be set to RS-232 which is boolean "FALSE").

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

Address String is the output string which contains start character and two hexadecimal characters of the device address prefix for RS-485 interface option. If RS-232 interface is selected this string is empty.

VISA Session Out is the opened VISA session reference that needs to be used for all subsequent XFM VI which are using communication commands. Please note: only one sub-VI can execute at a given time referencing a given VISA session. If the VISA session wire is split to several sub-VI's for parallel execution, and error will occur. To operate multiple XFM commands to separate addresses in parallel, separate COM ports need to be used and initialized separately.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.1.2 Read Firmware Version

Read Firmware Version (SubVI).vi
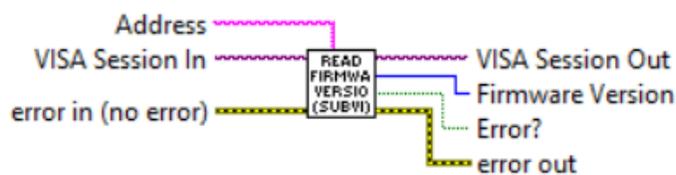
Reads instrument's firmware version and returns unsigned 32 bits integer which represents last to digits of the firmware revision (e.g. 9 for device with firmware version of 1.09). The firmware revision can be used to determine if instrument supports additional ASCII commands which were added to Ver. 1.10 of the XFM firmware.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Firmware Version is an unsigned 32 bits integer which represents last to digits of the XFM instrument's firmware revision.

Error? is the boolean output that is triggered when communication error occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.1.3 Read Register

Read Register (SubVI).vi
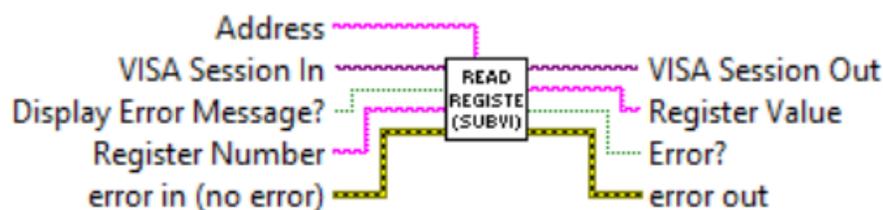
Reads single EEPROM register. Valid values for decimal string wired to the "Register Number" terminal are from 0 to 50 and from 100 to 134. Returns response as a string (unedited) which represent EEPROM register value.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

<u>Address</u> is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

<u>Display Error Message?</u> is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

<u>Register Number</u> (unsigned 32-bit integer) is a required input and should contain the configuration EEPROM register that is to be read out from the instrument. The valid Register Numbers are from 0 to 50 and from 100 to 134.

<u>Error In</u> is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

<u>VISA Session Out</u> is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

<u>Register Value</u> is a returned string which represents the value stored in the specified EEPROM configuration register.

<u>Error?</u> is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

<u>Error Out</u> is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

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4.1.4 Send Command

Send Command (SubVI).vi
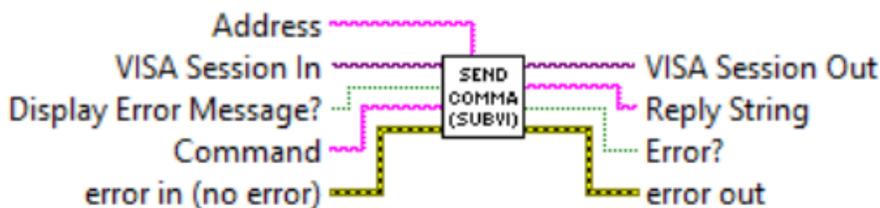
Sends the specified ASCII command to the instrument. Returns response as a string (unedited) which represent instrument's response for particular ASCII command (see Paragraph 8.3 in the XFM operating manual for the list of supported ASCII commands). **WARNING: Use "MW" (EEPROM register write command) carefully, can cause unit to malfunction (Note: Some addresses are write protected).**

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Command is a string with ASCII command to be sent to the XFM instrument (see Paragraph 8.3 in the XFM operating manual for the list of supported ASCII commands).

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Response String is a string (unedited) which represent instrument's response for submitted ASCII command.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.1.5 Update Instrument Information Cluster

Update Instrument Information Cluster (SubVI).vi
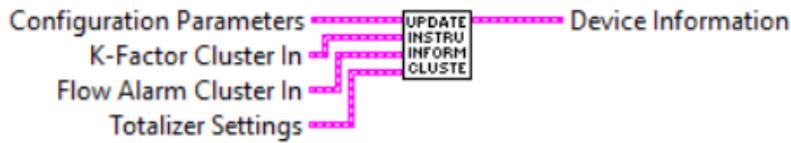
Takes key instrument configuration parameters from device "*Configuration Parameters*" "*K-Factor", "Flow Alarm" and "Totalizer"* clusters and combines them in to the "*Device Information*" cluster. This sub-VI can be run at the beginning of a program outside the main loop and should be re-run every time the instrument address is changed (for RS-485 interface).

Inputs:

K-Factor is a cluster of strings containing the information regarding instrument's K-Factor parameters.

Flow Alarm is a cluster of strings containing the information regarding instrument's Flow Alarm parameters.

Totalizer Settings is a cluster of strings containing the information regarding instrument's Totalizer parameters.

Configuration Parameters is a cluster of strings containing the information regarding instrument's configuration parameters.

Outputs:

Device Information is a cluster of strings containing the information regarding instrument's information parameters.

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4.2 Device Configuration

These sub-VI's are used for accessing instrument configuration parameters such as: active gas table, active mass flow engineering units, gas density and relay assignments values. They also provide means to read some information parameters which are stored in the instrument's EEPROM memory: the model number, serial number and instrument's full scale range (in SLPM units of measure).

4.2.1 Process Gas Table Command

Process Gas Table Command (SubVI).vi
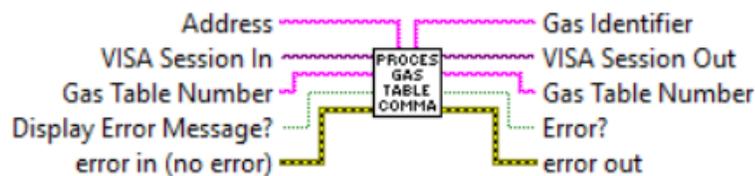
Sets/Reads currently selected Gas Table Number. When "*Gas Table Number*" terminal is empty this Sub-VI performs "Read" function. Valid values for "*Gas Table Number*" parameter are decimal strings from 0 to 9.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Gas Table Number is the numerical string with index of the currently selected gas table. Valid values are from 0 to 9.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Gas Table Number is a string that contains instrument's currently selected gas index (0-9).

Gas Identifier is a string that contains instrument's currently selected gas name.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.2.2 Process Roll Back to N2 Command

Process Roll Back to N2 Command (SubVI).vi
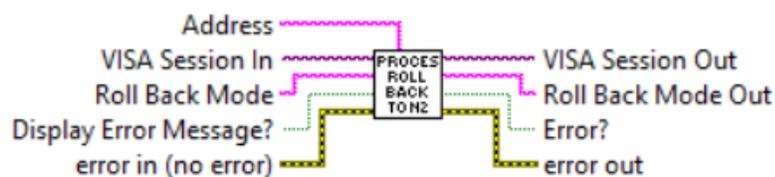
Sets/Reads currently selected "Roll Back to N2 Mode" parameter. When "Roll Back to N2 Mode" terminal is empty this Sub-VI performs "Read" function. Valid values for "Roll Back to N2 Mode" parameter are "E" or "D" strings.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Roll Back Mode is the one character string with desired Roll Back mode value (E or D).

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Roll Back Mode Out is a string that contains instrument's currently selected Roll Back to N2 mode ("E" or "D").

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.2.3 Process Relay Action Command

Process Relay Action Command (SubVI).vi
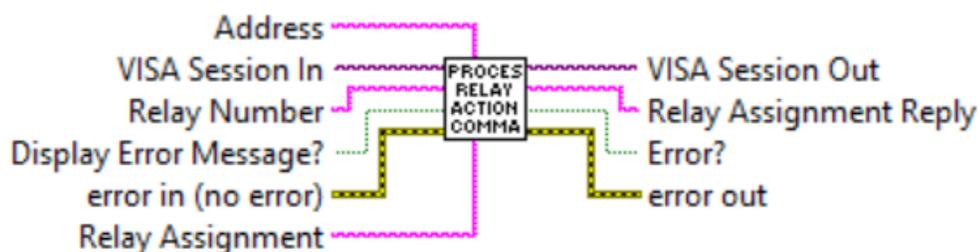
Reads and writes instrument's Relays assignment parameter. Refer to XFM ASCII commands set (Paragraph 8.3 in the XFM operating manual) to determine valid values for "Relay Number" and "Relay Assignment" input terminals.

"Relay Number" terminal valid settings: decimal string with 1 or 2 value.

"Relay Assignment" terminal valid settings: N,T,H,L,R,M,S.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Relay Number is the one character decimal string with desired relay number value. Valid settings are: 1 or 2.

Relay Assignment is the one character string with desired relay assignments value. Valid settings are:

> N - No Action (relay disabled);
>
> T - Totalizer volume exceeded limit;
>
> H - High Flow Alarm;
>
> L - Low Flow Alarm;
>
> R - Range between High and Low Alarm settings;
>
> M - Manual Relay On override;
>
> S - Read current relay assignment status.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Relay Assignment Reply is a one character string that contains selected relay current assignment value: N,T,H,L,R,M.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.2.4 Read Gas Density

Read Gas Density (SubVI).vi
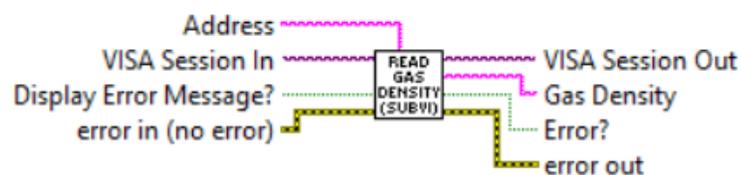
 Reads from currently selected Gas Table gas Density at standard conditions (14.696 PSIA and 70F).

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and   *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Gas Density is the instrument's currently selected Gas Table gas Density value (floating point string) in g/l units of measure.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.2.5 Read Instrument Configuration
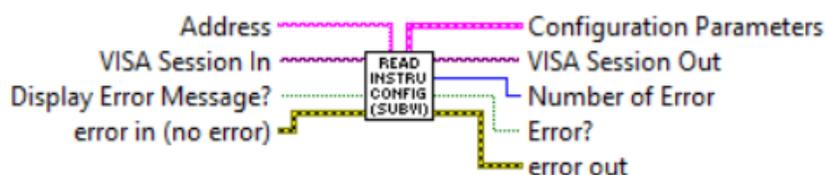
Reads instrument configuration parameters in to the "Configuration Parameters" cluster. This sub-VI can be run at the beginning of a program outside the main loop, and should be re-run every time the instrument address is changed (for RS-485 interface).

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and   *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Configuration Parameters is a cluster of strings that contains instrument's configuration parameters retrieved from instrument's EEPROM memory.

Number of Error is unsigned long 32 bit integer representing number of errors which occurred during reading configuration parameters from the instrument.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.2.6 Read Full Scale Range

Read Full Scale Range (SubVI).vi
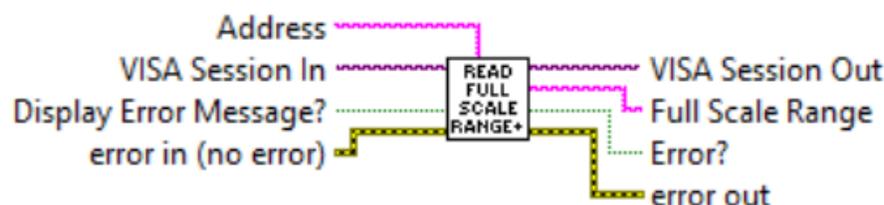
Reads instrument full scale range in SLPM. The full scale range value always based on selected gas table.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Full Scale Range is a string that contains instrument full scale range in SLPM units.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.2.7 Read Model Number

Read Model Number (SubVI).vi
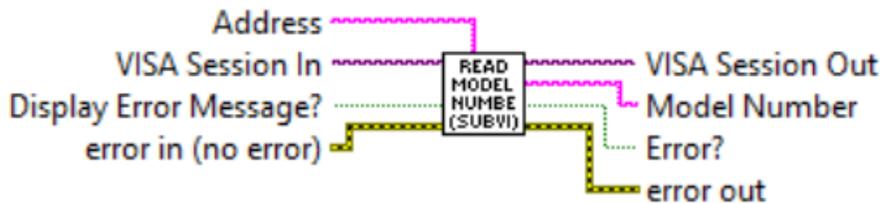
Reads instrument model number.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Model Number is a string that contains instrument model number.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.2.8 Read Serial Number

Read Serial Number (SubVI).vi
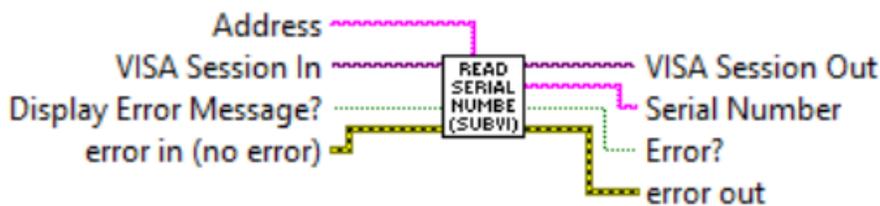
Reads instrument serial number.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and   *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Serial Number is a string that contains instrument serial number.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.3 Diagnostic

These sub-VI's are used for collecting instrument diagnostic parameters stored in instrument's volatile memory (SRAM) registers such as: sensor raw and average counts, sensor zero adjustment counts, analog output counts, sensor compensated counts. In order to get access to SRAM registers the instrument's back door access must be opened using "Open Back Door Command" Sub-VI.

4.3.1 Open Back Door Command

Open Back Door Command (SubVI).vi
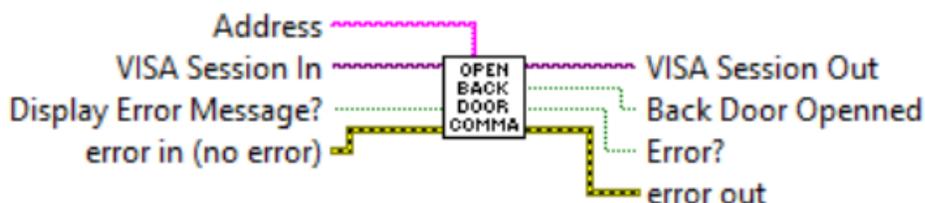
Opens Back Door for accessing instrument's diagnostic volatile memory (SRAM) registers.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Back Door Opened is the boolean output that is set to "TRUE" when back door was opened successfully.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.3.2 Read SRAM Register

Read SRAM Register (SubVI).vi
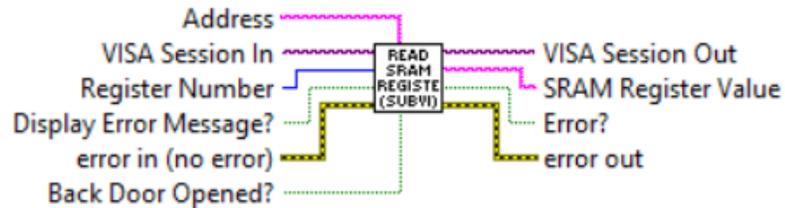
Reads instruments SRAM registers. Use this Sub-VI for diagnostic purposes. If "*Back Door Opened?*" terminal is set to "False" this Sub-VI performs "Open Back Door" commands first and then read requested SRAM register. To improve response time user may issue "Open Back Door" command in advance and then set "*Back Door Opened?*" terminal value to "True". Valid numbers for SRAM diagnostic registers are:

0 - Read ADC[0] counts (Sensor raw counts)

1 - Read ADC[1] counts (Sensor Resistance counts)

2 - Sensor Average counts (1.5 second delay)

3 - Zero Adjustment DP Wiper position counts

4 - DAC[0] counts (DRC adjustment control)

5 - DAC[1] counts (analog output signals control)

6 - DAC[2] counts

7 - Sensor Average Compensated counts (after DRC filter)

8 - Sensor PFS average expressed in PFS (0 - 100% notation)

9 - CPU Temperature Read.

10 - Sensor Compensated Average counts.

11 - Sensor PFS (uncompensated) in normalized notation (0.0 - 1.0)

Inputs:

<u>VISA Session In </u>is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

<u>Address</u> is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and   *Address* controls.

<u>Register Number</u> (unsigned 32-bit integer) is a required input and should contain the SRAM register number that is to be read out from the instrument.

<u>Display Error Message</u>? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

<u>Error In</u> is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Back Door Opened? is a Boolean input stating whether this Sub-VI performs "*Open Back Door*" commands first and then read requested SRAM register (if set to FALSE).

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

SRAM Register Value is a returned string which represents the value stored in the specified SRAM register.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.3.3 Process Diagnostic Command

Process Diagnostic Command (SubVI).vi
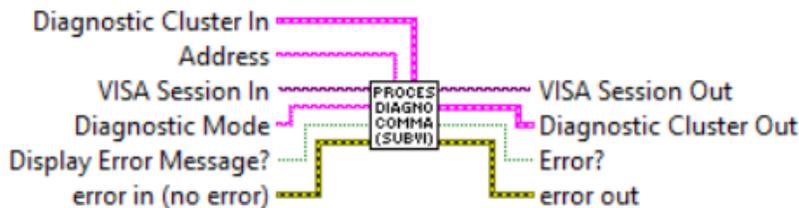
Enable / Disable LCD Diagnostic messages (only for LCD option) when "*Diagnostic Mode*" terminal is set to "E" or "D". When "*Diagnostic Mode*" terminal is empty this Sub-V reads the bitwise Diagnostic events code, Status LED state and LCD diagnostic mode (enabled/ disabled).

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and   *Address* controls.

Diagnostic Mode is the one character decimal string with desired Diagnostic mode ("E" or "D").

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Diagnostic Cluster In is a cluster of strings with current Diagnostic parameters: bitwise Diagnostic events code (0X0 - 0x9), Status LED state (0-9) and LCD diagnostic mode ("E"/"D").

Outputs:
VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.
Diagnostic Cluster Out is a cluster of strings with updated Diagnostic parameters: bitwise Diagnostic events code (0X0 - 0x9), Status LED state (0-9) and LCD diagnostic mode ("E"/"D").

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.3.4 Read Back Door Status Command

Read Back Door Status Command (SubVI).vi
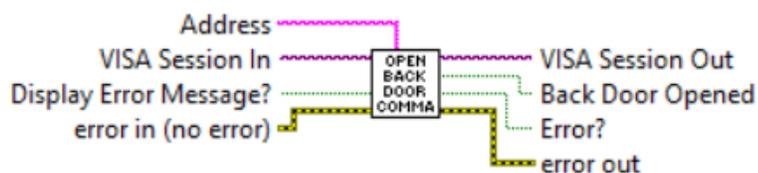
Reads Back Door status for accessing instrument's diagnostic SRAM registers. If Back Door is opened returns "TRUE" value on the "Back Door Opened" terminal. When XFM "Back Door" is opened user can use "READ" and "WRITE" ASCII command to read and write instrument's SRAM registers to troubleshoot instrument behavior.
NOTE: "WRITE" ASCII command may be distractive. Use carefully, can cause device to malfunction! If you need assistance please contact AALBORG at 845-770-3000 or info@aalborg.com

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Back Door Opened is the boolean output that is set to "TRUE" when back door is opened successfully.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.4 Process Information

These sub-VI's are used for collecting instrument's process information parameters such as: Mass Flow Rate, Totalizer reading, Flow Alarm status and Diagnostic Register value.

4.4.1 Read Flow Rate

Read Flow Rate (SubVI).vi

Reads the instrument's Mass flow reading value (floating point string) in currently selected mass flow units of measure.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Flow Rate is the instrument's mass flow reading value (floating point string) in currently selected mass flow units of measure.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.4.2 Read PI Data

Read PI Data (SubVI).vi
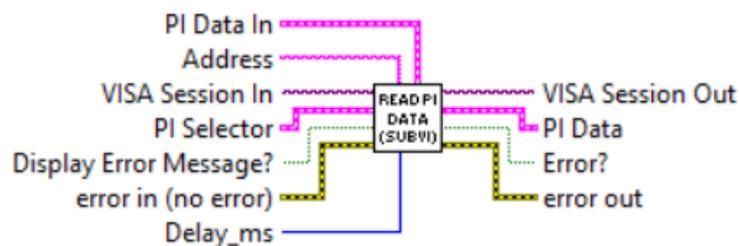
Reads the instrument's Process Information parameters: Mass Flow Rate, Totalizer reading and Flow Alarm status and composes the cluster of string representing following parameters: Mass Flow Rate (MEU), Totalizer value (MEU), Flow Alarm Status [N,H,L] and Diagnostic Register value.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

<u>PI Selector</u> is a cluster of Booleans. Each Boolean is either True or False, depending on whether the corresponding parameter must be acquired from the instrument.

<u>Error In</u> is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

<u>Delay_ms</u> is an unsigned 32-bit integer, representing minimum delay time in milliseconds between successive parameters readings. For RS-485 interface it is recommended not to use delays below 50 milliseconds.

<u>PI Data In</u> is a cluster containing the instrument's current process information parameters.

Outputs:

<u>VISA Session Out</u> is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

<u>PI Data</u> is a cluster of strings with instrument's updated process information parameters values.

<u>Error?</u> is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

<u>Error Out</u> is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

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4.5 Engineering Units

4.5.1 Convert Mass Flow EU to Totalizer EU

Convert Mass Flow EU to Totalizer EU (SubVI).vi

Mass Flow EU ~~~~~~~~~~ [CONVER MASS FLOW EU TO] ~~~~~~~~~~ Totalizer EU

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Converts time based mass flow units of measure name to the corresponding volumetric/mass (not time based) units of measure name used in Totalizer reading.

Inputs:

Mass Flow EU is a string which represents mass flow units of measure name (time based).

Outputs:

Totalizer EU is a string which represents volumetric/mass (not time based) units of measure name.

4.5.2 Convert PFS to Mass Flow EU

Convert PFS to Mass Flow EU (SubVI).vi

EU Name — PFS Value In — Full Scale SLPM — Gas Density — K-Factor Cluster → CONVER PFS TO MASS FLOW EU → Mass EU Value Out
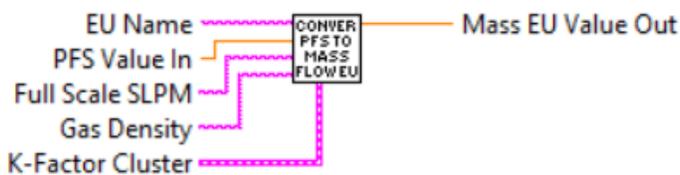
Converts mass flow PFS @ Factory STD conditions ([0.0-100.0%] notation) to the engineering units (STP conditions) which are wired to the "EU Name" terminal. This VI has to be run in the beginning of the instrument initialization and each time the instrument selected gas table or mass flow EU are changed.

Inputs:

EU Name is string with mass flow units of measure name which represents mass flow units of measure to which you want to convert "*PFS Value In*" (required input).

Full Scale SLPM is a floating point string with instrument's full scale range value expressed in SLPM units of measure (required input). Instrument full scale range parameter can be obtained with "Read Full Scale Range" sub-VI.

 Gas Density is a floating point string input which provides the density (in g/l units at STD conditions) of the gas in currently selected *Gas Table*.

K-Factor Cluster is a cluster with currently selected K-Factor value.

PFS Value In is the value (double) expressed in the percent of full scale (%FS) mass flow units of measure to be converted to value expressed in the mass flow units of measure wired to the "*EU Name*" terminal (required input).

Outputs:

Mass EU Value Out is mass flow value (double) converted to value expressed in the mass flow units of measure wired to the "*EU Name*" terminal.

4.5.3 Process Engineering Units Command

Process Engineering Units Command (SubVI).vi
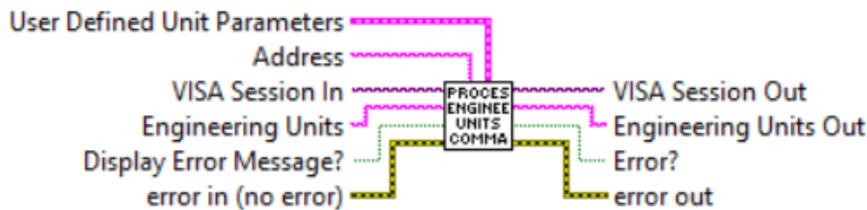
Sets/Reads currently selected mass flow units of measure. When "*Engineering Units*" terminal is empty this Sub-VI performs "*Read*" function. "*User Defined Unit Parameters*" cluster only required to set "USER" mass flow units. See XFM user manual Paragraph 8.3 for the list of supported mass flow units of measure.

Inputs:

User Defined Unit Parameters is a cluster of strings with current "*User Defined Unit*" parameters.

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and   *Address* controls.

Engineering Units is string with mass flow units of measure name which represents mass flow units of measure you want to select.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Engineering Units Out is a string that contains instrument's currently selected mass flow units of measure.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.5.4 Read User Defined Unit Parameters
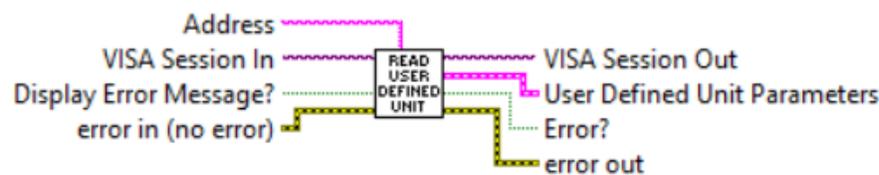
Reads current User Defined Unit parameters. If successful returns "User Defined Unit Parameters" cluster of strings containing floating point "Conversion Factor" to l/min value, "Time Base" string [M, H, S] and "Use Density" string [Y, N].

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

User Defined Unit Parameters is a cluster of strings that contains parameters of the instrument's currently selected "*User Defined Unit*" of measure: "Conversion Factor" to l/min floating point string, "Time Base" string [M, H, S] and "Use Density" string [Y, N].

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.6 Data Logging

4.6.1 Data Log Make Header

Data Log Make Header.vi
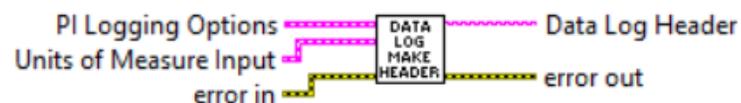
Generates a header string for use with data logging. Output will be a comma delimited string containing labels of the variables (and the units of measure, if selected) for the data logging options selected. This is for use with AALBORG LabVIEW's examples which utilize Data Log feature.

Inputs:

PI Logging Options is a required input cluster that represents the desired data logging options.

Units of Measure Input is a cluster containing the currently selected units of measure strings for each PI variable supported by the instrument.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

Data Log Header is a comma delimited string containing the data column headers for each PI variable selected with the "*PI Logging Options*" input.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.6.2 Log EEPROM Registers Values

Log EEPROM Registers Values (SubVI).vi
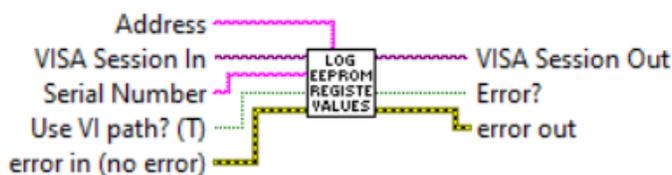
Reads the value of each EEPROM configuration register [0-50 and 100 - 134], and stores the values in a text file. Generates file name as a time-stamp (by default saves it to the current working directory).

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Serial Number is a string with instrument's serial number to be included in the auto-generated file name. If left open then only time stamp will be included in the auto-generated file name.

Use VI path? (T) is a Boolean control that determines if the sub-VI will use an auto-generated file name (with the serial number and a time stamp) and save it in the folder from which it was run (TRUE), or if user action is needed to specify a file name and path (FALSE).

Outputs:

VISA Session Out is the output VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.6.3 PI Log Make Data String

PI Log Make Data String.vi
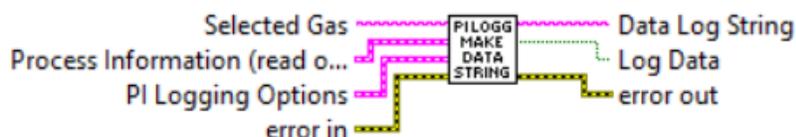
Generates a comma delimited string from the data based on the logging options selected. This is for use with AALBORG LabVIEW's examples which utilize *Data Log* feature.

Inputs:

PI Logging Options is a required input cluster that represents the desired data logging options.

Process Information is a required input cluster containing all of the measurement data that is output from the "*Read PI Data*" sub-VI.

Selected Gas is a string with instrument's currently selected gas name.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

Data Log String is a comma delimited data string containing the variables selected with the "*PI Logging Options*" input.

Outputs:

Log Data returns the boolean value located in the *"PI Logging Options"* input for ease of use (to avoid needing to unbundle the cluster) and can be used to determine whether or not to log the output *Data Log String* string to a data file.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.7 Flow Alarm

4.7.1 Process Flow Alarm Command

Process Flow Alarm Command (SubVI).vi
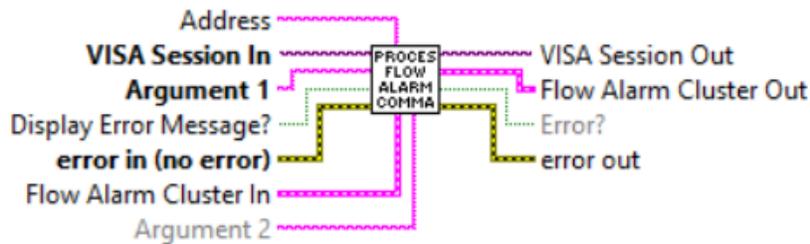
Reads and writes Flow Alarm parameters. Refer to ASCII commands set in the XFM operating manual for proper values of the strings wired to the Argument#1 and Argument#2 inputs. This Sub-VI parsing output data frame and updates corresponding parameters of the Flow Alarm cluster.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Flow Alarm Cluster In is a cluster of 5 elements containing the information regarding instrument's Flow Alarm parameters.

Argument#1 is the (string with one ASCII character) specifying the Flow Alarm parameter that you would like for the instrument to read or to change to.

Argument#2 is the (string) specifying the value for particular Flow Alarm parameter that you would like for the instrument to change to.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the output VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Flow Alarm Cluster Out is a cluster of 5 elements containing the updated information regarding instrument's Flow Alarm parameters.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.7.2 Read Flow Alarm Status
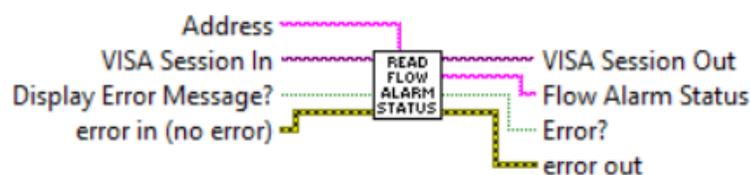
Reads instrument Flow Alarm Status. Returns one character string:

"H" - High Flow Alarm,

"L" - Low Flow Alarm,

"N" - No Flow Alarm.

Iputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.
Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:
VISA Session Out is the output VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.
Flow Alarm Status is a one character strings with current Flow Alarm status [H,L,N].
Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.
Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.8 K-Factors

4.8.1 Disable K-Factor Command
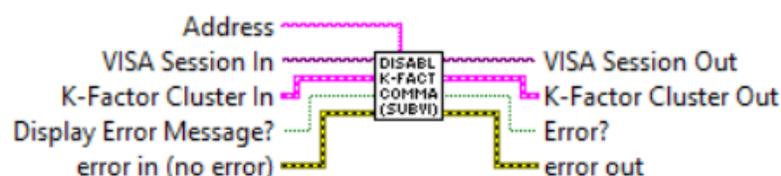
Disables K-Factor applied to currently selected Gas Table. If successful changes "*K-Factor Cluster*" parameters "*K-Factor Mode*" to "Disable" and "*K-Factor Value*" to 1.0
Inputs:
VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.
Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.
K-Factor Cluster In is a cluster of 4 elements which represents K-Factor parameters to be updated.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

K-Factor Cluster Out is a cluster of 4 elements which represents updated K-Factor parameters.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.8.2 Process Internal K-Factor

Process Internal K-Factor (SubVI).vi
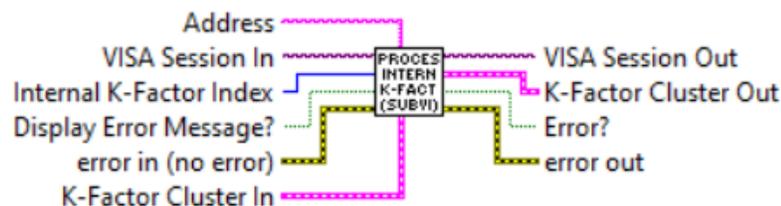
Applies Internal K-Factor to currently selected Gas Table. If successful returns "*K-Factor Index*", "*Gas Name*" and floating point number with "*K-Factor Value*" in the K-Factor cluster. K-Factor does not work with %FS engineering unit. Valid Internal K-Factor Indexes are from 0 to 35. To apply currently selected Internal K-Factor Index set "*Internal K-Factor Index*" terminal value to -1.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Internal K-Factor Index is a required (unsigned 32-bit integer) input and should contain the Internal K-Factor index that is to be written to the instrument's nonvolatile memory. The valid values are from 0 to 35.

K-Factor Cluster In is a cluster of 4 elements which represents K-Factor parameters to be updated.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution. Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

K-Factor Cluster Out is a cluster of 4 elements which represents updated K-Factor parameters.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.8.3 Process User Defined K-Factor

Process User Defined K-Factor (SubVI).vi
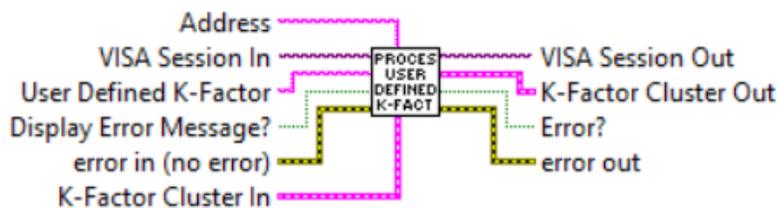
Applies "*User Defined K-Factor*" to currently selected Gas Table. If successful returns K-Factor Index, floating-point number with K-Factor value in the K-Factor cluster. K-Factor does not work with %FS engineering unit. Valid User Defined K-Factor Values are from 0.1 to 1000. To apply currently selected User Defined K-Factor Value leave "*User Defined K-Factor*" terminal empty.

Inputs:

<u>VISA Session In</u> is a required input, and is initially generated from the Initialize COM Port sub-VI.

<u>Address</u> is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and   *Address* controls.

<u>User Defined K-Factor</u> is a required (floating point string) input and should contain the "*User Defined K-Factor*" value that is to be written to the instrument's nonvolatile memory.

<u>K-Factor Cluster In</u> is a cluster of 4 elements which represents K-Factor parameters to be updated.

<u>Display Error Message?</u> is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

<u>Error In</u> is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

<u>VISA Session Out</u> is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

<u>K-Factor Cluster Out</u> is a cluster of 4 elements which represents updated K-Factor parameters.

<u>Error?</u> is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

<u>Error Out</u> is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.8.4 Read K-Factor Command

Read K-Factor Command (SubVI).vi

Address
VISA Session In ——————— VISA Session Out
K-Factor Cluster In — READ K-FACT COMMA (SUBVI) — K-Factor Cluster Out
Display Error Message? — Error?
error in (no error) — error out
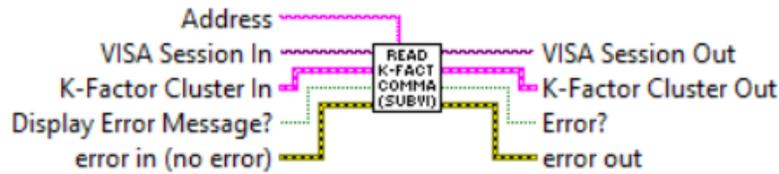
Reads currently selected K-Factor Mode and Value. If Internal K-Factor is selected "K-Factor Out" cluster also updated with Internal K-Factor index and Gas Name.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

K-Factor Cluster In is a cluster of 4 elements which represents K-Factor parameters to be updated.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

K-Factor Cluster Out is a cluster of 4 elements which represents updated K-Factor parameters.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.9 Totalizer

4.9.1 Process Totalizer Mode Command

Process Totalizer Mode Command (SubVI).vi
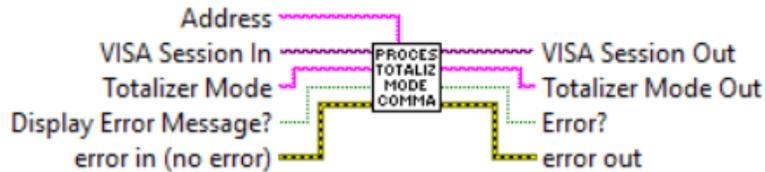
This Sub VI sets instrument's Totalizer Mode:

"E" - "Enabled",

"D" - "Disabled.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Totalizer Mode is an one character string which represents desired "*Totalizer Mode*". Valid values: E or D.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Totalizer Mode Out is a string with instrument's *Totalizer Mode* value ("E" or "D").

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.9.2 Read Totalizer Configuration

Read Totalizer Configuration (SubVI).vi

```
                  Address ∿∿∿⌐      ⌐∿∿∿ Tot Status String
          VISA Session In ∿∿∿⌐ READ ∿∿∿ VISA Session Out
   Display Error Message? ∙∙∙⌐ TOTALIZ ├∙∙∙ Totalizer Settings
                                CONFIG
      error in (no error) ▪∙∙⌐ (SUBVI) ∙∙∙ Error?
                                 ▪▪▪∙∙ error out
```
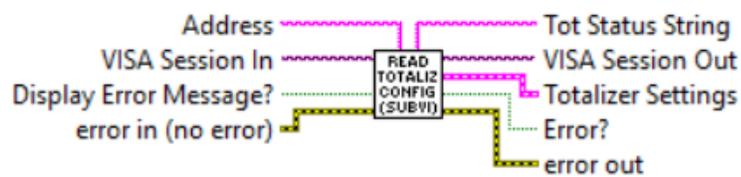
Queries instrument's Totalizer parameters, parses data frame received from the instrument and populates data in to the Totalizer Settings cluster. "*Totalizer Settings*" cluster represents actual Totalizer parameters it was initialized with. This sub-VI can be run at the beginning of a program outside the main loop, and should be re-run every time the instrument address is changed (for RS-485 interface).

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Tot Status Strung is a string representing coma delimited Totalizer configuration parameters.

Totalizer Settings is a cluster of 4 strings containing updated information regarding instrument's Totalizer parameters.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.9.3 Read Totalizer Volume Command

Read Totalizer Volume Command (SubVI).vi
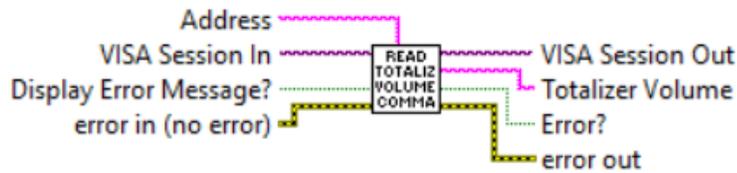
Reads current Totalizer volume in currently selected (not time based) mass flow units of measure.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Totalizer Volume is a floating point string with instrument's current Totalizer volume reading in currently selected (not time based) mass flow units of measure.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.9.4 Reset Totalizer to Zero

Reset Totalizer to Zero (SubVI).vi

Address ~~~~~~~~~
VISA Session In ~~~~~~~~   RESET   ~~~~~ VISA Session Out
Display Error Message? --------   TOTALIZ   ----- Response string
error in (no error) ■-   TO ZERO   Error?
                                   (SUBVI)   error out
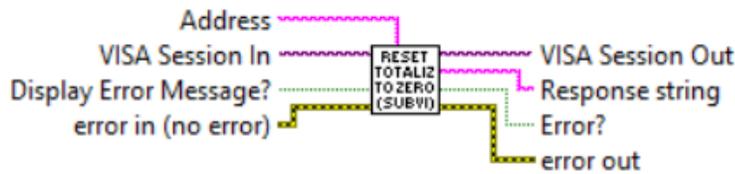
Performs a reset of the Totalizer reading. If successful returns "TZ" string.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Response String is a string with instrument's reply message to be evaluated.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.9.5 Start Totalizer At Flow Command

Start Totalizer At Flow Command (SubVI).vi
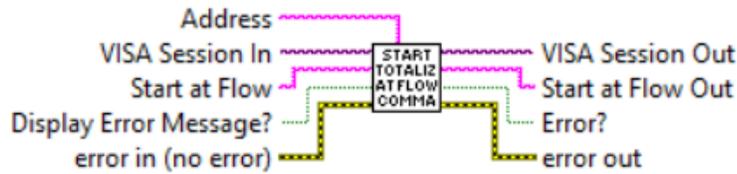
Sets Totalizer "*Start At Flow*" parameter. Wire floating point string with values between 0 and 100%FS to "*Start at Flow*" input terminal to select desired Totalizer "*Start At Flow*" parameter. Refer to XFM ASCII commands set (Paragraph 8.3 in the XFM operating manual) to determine valid values for "Start @ Flow" input terminal.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and   *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Start at Flow Rate is a floating point string representing flow rate value (in % of full scale flow units) at which Totalizer will start.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Start at Flow Out is a floating point string representing flow rate value (in % of full scale flow units) at which Totalizer will start.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.9.6 Totalizer Limit Volume Command

Totalizer Limit Volume Command (SubVI).vi
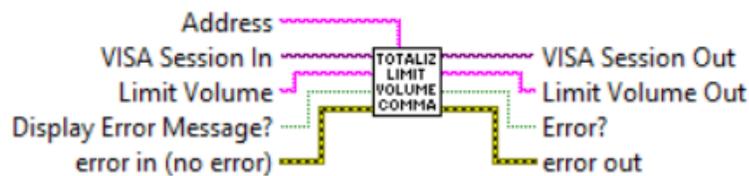
Sets Totalizer "*Limit Volume*" parameter. Wire floating point string to "*Limit Volume*" input terminal to set desired Totalizer "*Limit Volume*" parameter. The Totalizer *"Limit Volume"* value must be in currently selected (not time based) units of measure. Refer to XFM ASCII commands set (Paragraph 8.3 in the XFM operating manual) to determine valid values for "*Limit Volume*" input terminal.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Limit Volume is a floating point string representing Totalizer "*Limit Volume*" value (in currently selected not time based mass flow units) at which Totalizer will stop.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Limit Volume Out a floating point string representing updated Totalizer "*Limit Volume*" value (in currently selected not time based mass flow units) at which Totalizer will stop.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.9.7 Set Totalizer Warm Up Delay Mode

Set Totalizer Warm Up Delay Mode (SubVI).vi
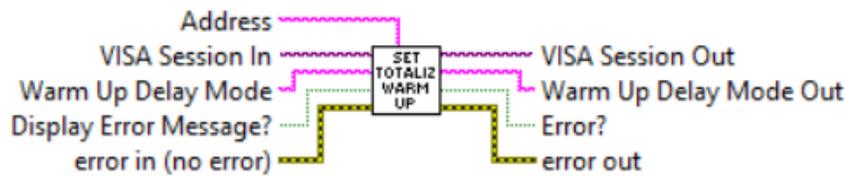
Sets instrument's Totalizer Warm Up Delay Mode:

"E" - "Enabled",

"D" - "Disabled.

If "*Warm Up Delay Mode*" is set to "E" (enabled) the Totalizer will not totalize the flow during first 6 minutes after power up event.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Warm Up Delay Mode is one character string representing instrument's Totalizer "Warm Up Delay Mode" (E or D).

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Warm Up Delay Mode Out is one character string representing instrument's updated Totalizer "Warm Up Delay Mode" (E or D).

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.10 Utilities

4.10.1 Comm Error Check1

Comm Error Check1 (SubVI).vi

Checks instrument reply message (must be wired to the "Reply string" input terminal) and looking for "ERROR#" string. If error is found set "Error?" boolean output to "TRUE" and provides Error Code (32 bit integer number).

Inputs:

Reply string is a string with instrument's reply message to be evaluated.

Outputs:

Error Code is a 32 bit integer with communication error code number.

Error? is the boolean output that is triggered when communication error occurred during communication with the instrument.

4.10.2 Comm Error Notify

Comm Error Notify (SubVI).vi
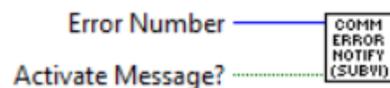
Displays Communication Error Message based on input Error code number generated by "Comm Error Check1" Sub-VI.

NOTE:This Sub-VI will block program execution if instrument replies with error message and "*Activate Message?*" input is connected to "TRUE". If your application should not be interrupted connect "*Activate Message?*" input to "FALSE".

Inputs:

Error Number is a 32 bit integer with communication error code number generated by *"Comm Error Check1"* Sub-VI.

Activate Message? is the boolean input stating whether the message with description of the "Communication Error" must be activated.

4.10.3 Process Auto Zero Command

Process Auto Zero Command (SubVI).vi
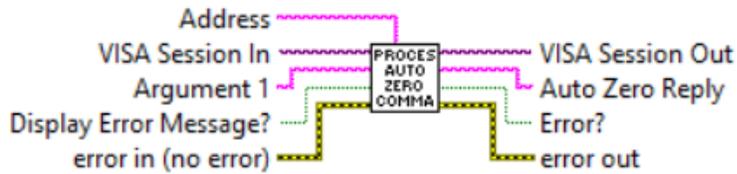
Performs Auto Zero function for the XFM instruments. Refer to XFM ASCII commands set (Paragraph 8.3 in the XFM operating manual) to determine valid values for "Argument 1" input terminal.

WARNING: Make sure absolutely no flow through the instrument during Auto Zero procedure. For best result make sure inlet and outlet fittings are open to the atmosphere!
WARNING: To prevent EEPROM burning, avoid executing "Save Auto Zero" command ("Z,W") more often than one time per 10 minutes.
**NOTE: Do Zero Now command "Z,N" may take several minutes to complete. Instrument will not respond on other commands except "Z,S" status command when this is in progress. To stop Auto Zero process immediately, send "Z,STOP" command.**

Inputs:
VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.
Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and   *Address* controls.
Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.
Argument#1 is the string with one ASCII character specifying the Auto Zero command you would like to execute. Refer to XFM ASCII commands set (Paragraph 8.3 in the XFM operating manual) to determine valid values for "Argument 1" input terminal.
Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.
Outputs:
VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Auto Zero Reply is a string with instrument's reply message to be evaluated. Refer to XFM ASCII commands set (Paragraph 8.3 in the XFM operating manual) to determine valid values for "*Auto Zero Reply*" output terminal.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.10.4 Process Maintenance Timer Command

Process Maintenance Timer Command (SubVI).vi
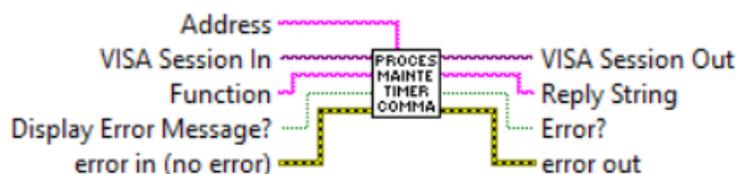
Reads/Resets instrument's maintenance timer. When "R" string is wired to the "Function" input terminal the instrument replies with floating point string representing current maintenance timer value in hours. When "C" string is wired to the "Function" input terminal the maintenance timer is set to zero and instrument replies with "CC" string.

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

Function is the string with one ASCII character specifying the Maintenance Timer command you would like to execute. Refer to XFM ASCII commands set (Paragraph 8.3 in the XFM operating manual) to determine valid values for "Function" input terminal.

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Reply String is a string with instrument's reply message to be evaluated. Refer to XFM ASCII commands set (Paragraph 8.3 in the XFM operating manual) to determine valid values for "*Reply String*" output terminal.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.10.5 Convert Alarm PFS to EU Values

Convert Alarm PFS to EU Values (SubVI).vi

Converts High and Low Alarms PFS (percent of full scale) values to the currently selected mass flow units of measure values.
This sub-VI Is used in the examples VI where Flow Alarm function is utilized.

Inputs:

Configuration Parameters is a required cluster of string input which holds all instruments configuration parameters.

Flow Alarm Cluster In is a required cluster of string input which holds "Flow Alarm" parameters.

K-Factor Cluster is a required cluster of string input which holds "K-Factor" parameters.

Outputs:

Alarm High EU Value is a floating point output with converted to currently selected units of measure Alarm High Value.

Alarm Low EU Value is a floating point output with converted to currently selected units of measure Alarm Low Value.

4.10.6 Process LCD Back Light Command

Process LCD Back Light Command (SubVI).vi
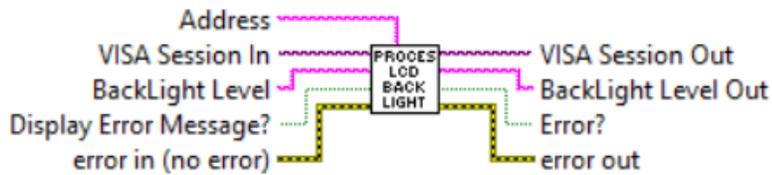
Sets/Reads LCD Back Light level parameter. Valid values for "Back Light Level" terminal are from 0 to 100% When setting new Back Light level the instrument response is in counts [0 to 4095]. When reading current Back Light level (*BackLight Level* terminal is empty) the instrument response is in % [0 to 100].

Inputs:

VISA Session In is a required input, and is initially generated from the *Initialize COM Port* sub-VI.

Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.

Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.

BackLight Level is the floating point string with desired LCD Back Light level (0 - 100%).

Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

BackLight Level Out is a string with instrument's updated LCD Back Light level value.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

4.10.7 Write EEPROM Register

Write EEPROM Register (SubVI).vi

Address
VISA Session In
Display Error Message?
Register Number
error in (no error)
Register Value
Enable EEPROM Write?

VISA Session Out
Register Value Out
Error?
error out
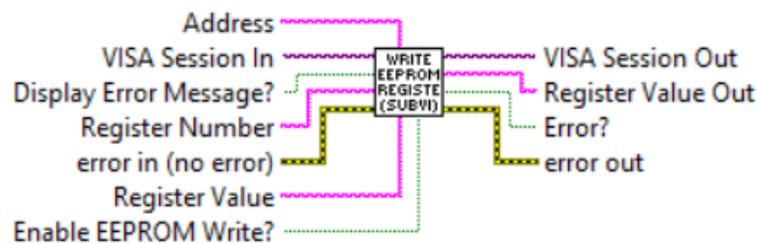
Writes specified value to the to the instruments corresponding EEPROM register .
Returns response as a string (unedited) which represent EEPROM register value.
WARNING: Use MW (EEPROM register write command) carefully, can cause unit to malfunction (Note: Some addresses are write protected).
The instrument EEPROM parameters were set on the factory to keep best performance. Do not change EEPROM parameters unless instructed by factory technical support representative.
WARNING: To prevent EEPROM burning, avoid writing the same EEPROM register number more often than one time per 5 minutes.
Register writes can be disabled by wiring boolean FALSE constant to the "*Enable EEPROM Write?*" terminal, and can be enabled by wiring a boolean TRUE constant to the "*Enable EEPROM Write?*" terminal.
Inputs:
VISA Session In is a required input, and is initially generated from the *Initialize COM Port* Sub-VI.
Address is input string which represents instrument address. When wired to the "*Address String*" output terminal of the *Initialize COM Port* sub-VI the address prefix will be automatically created based on values of the *Interface Type* and *Address* controls.
Display Error Message? is a Boolean input stating whether the Error Message should be displayed when communication error arises. If set to "TRUE" and communication error or time out occur the "Communication Error Message" will block program execution.
Register Number (unsigned 32-bit integer) is a required input and should contain the configuration EEPROM register that is to be written in to the instrument. The valid Register Numbers are from 0 to 50 and from 100 to 134.
Error In is the error cluster input, and should be connected to this VI from the error output of the previously called VI.

Register Value is a string with register value to be written to the instrument EEPROM.

Enable EEPROM Write? is a boolean input which allows to Enable or Disable writing to the EEPROM registers. Connect this terminal to TRUE constant to enable EEPROM writing.

Outputs:

VISA Session Out is the opened VISA session reference which should be wired to the *VISA Session In* terminals of subsequent AALBORG sub-VI's.

Register Value Out is a returned string which represents the value stored in the specified EEPROM configuration register.

Error? is the boolean output that is triggered when communication error or time out occurred during communication with the instrument.

Error Out is the error cluster output, and contains information on the errors (if any) that occurred when executing this sub-VI. This terminal should be connected to the error input of the next called sub-VI.

5. Example Programs

5.1 XFM Simple Read PI Driver Example

Simple example program which allow user to select interface type, instrument address (only applicable for RS485 interface), initialize COM port, continuously read instrument *Process Information* (PI) data. Once COM port is initialized the program reads instrument configuration information in to "Device Information" cluster and then it continuously reads PI data and displays the waveform chart for Mass flow rate.

NOTE: The Interface Type (RS232 or RS485), RS485 Address and COM port parameters must be selected before start of the program. Changes made to these parameters during run time will not have any effect.

This example is a good starting point for creating ether new program or integrating XFM instruments in to the existing program.

NOTE: The Interface Type (RS232 or RS485), RS485 Address and COM port parameters must be selected before start of the program. Changes made to these parameters during run time will not have any effect.

This example is a good starting point for creating ether new program or integrating XFM instruments in to the existing program.

To connect to XFM instrument, simply select the appropriate COM port that the instrument is connected to and ensure that the *Interface Type* (*RS-232 or RS-485*) and *Address* controls are set to match the values on the XFM instrument that you would like to talk to.

NOTE: XFM instrument has fixed 9600 baud rate. For stable operation do not decrease "*Update Time*" parameter below 150 ms.

If "*Display Error?*" control is enabled (set to TRUE), any error during program execution will block the program with message which descibes the source of the error. If your program should not be interupted make sure you disable "*Display Error?*" control.

5.2 XFM Extended Driver Example with Data Log

This example program utilizes almost all VI's included in the *AALBORG XFM LabView Driver Library*. In addition to the simple program example it provides access to the PI data Waveform Chart, Totalizer, Alarm, Relay Assignment, K-Factor, Diagnostic Events and Process Information data logging settings and features of the XFM instruments. It also allow to change active *Gas Table*, select desired *Mass Flow* units of measure and read instrument's EEPROM registers.

If you have questions regarding ASCII commands used in this example please refer to the "*AALBORG XFM Operating Manual*" (available on the AALBORG website). If you still have questions please contact AALBORG at 845-770-3000 or info@aalborg.com

NOTE: Address is not required when instrument is connected over RS-232 interface.

XFM was originally designed to operate in *Master/slave* model of an asymmetric communication where one device (the "master") controls one or more other devices or processes (the "slaves") and serves as their communication hub. This example VI will continually try opening the COM port and querying for a connected instrument response. If no XFM instrument is connected that matches these settings, the program will close the COM port, wait for a given amount of time and retry.

Once a connection to an XFM instrument is established, the program reads instrument configuration information from instrument's EEPROM memory in to "*Configuration Parameters*" cluster, initializes instrument, populates the VI's controls and "Instrument Information" cluster. During instrument's initialization phase, a text box will appear with the message to indicate that the connection is established and that the VI panel is populating with the device information.

Possible Issues

- When communicating with instruments over RS-485 interface and "*Read Diagnostic Register*" check box is selected some times it is possible to get "*Communication Error*" message when low (< 150 ms) *"Update Time"* settings are selected.
- Do not use "*Update Time*" settings with values below **100 ms**. Doing so may result in communication error.

5.3 XFM Multiple Devices Driver Example

Serial Configuration

RS-485 Address

RS-232 11

COM3

In order to communicate with multiple devices, all XFM instruments connected to RS485 network must be configured for RS485 interface.

Display Error?

STOP PROGRAM

Initialization Error

Active Device 11

Update Time [ms] 150

Measurem. per sec. 6.19876

Device Address to Include Total Devices: 1

01 02 03 04 05 06 07 08
09 0A 0B 0C 0D 0E 0F 10
☑11 12 13 14 15 16 17 18
19 1A 1B 1C 1D 1E 1F 20

Device Addresses have to to be selected before running software! Process Information is displaied only for selected device.

Process Information (read only)

Flow Rate
56.5 L/min
Total Volume
6276.3 L
Flow Alarm Status
D PI Error
Device Initialization Error
Diagnostic Register

Read Totalizer
Read Flow Alarm
Read Diagnostic Register

| Model Number	Serial Number	Selected Gas Table	Full Scale Range	Mass EU	K-Factor	Rel.#1	Rel.#2	Alm	Tot	Firmware
XFM17S-VADN2-A2	170000-1	0:AIR	100.0000 sl/min	L/min	D: 1.0	N	N	E	E	Ver1.10

Simple example program initializing the COM port, determining the instruments configuration data for up to 32 XFM instruments, (configuration data will be collected only for instrument addresses which are selected in the "*Device Address to Include*" control cluster), acquiring the data of the same number of instruments, displaying the data only for the one with the selected "*Active Device*" address.
This example will work only for XFM instruments with digital communication interface configured for RS-485 interface option.
When developing the program for multiple XFM instruments connected to the same single RS-485 COM port without the use of for loops with shift registers, ensure that each ASCII command is executed sequentially. Make sure each device connected to the RS-485 network has unique address.

5.4 XFM Simple Terminal Interface
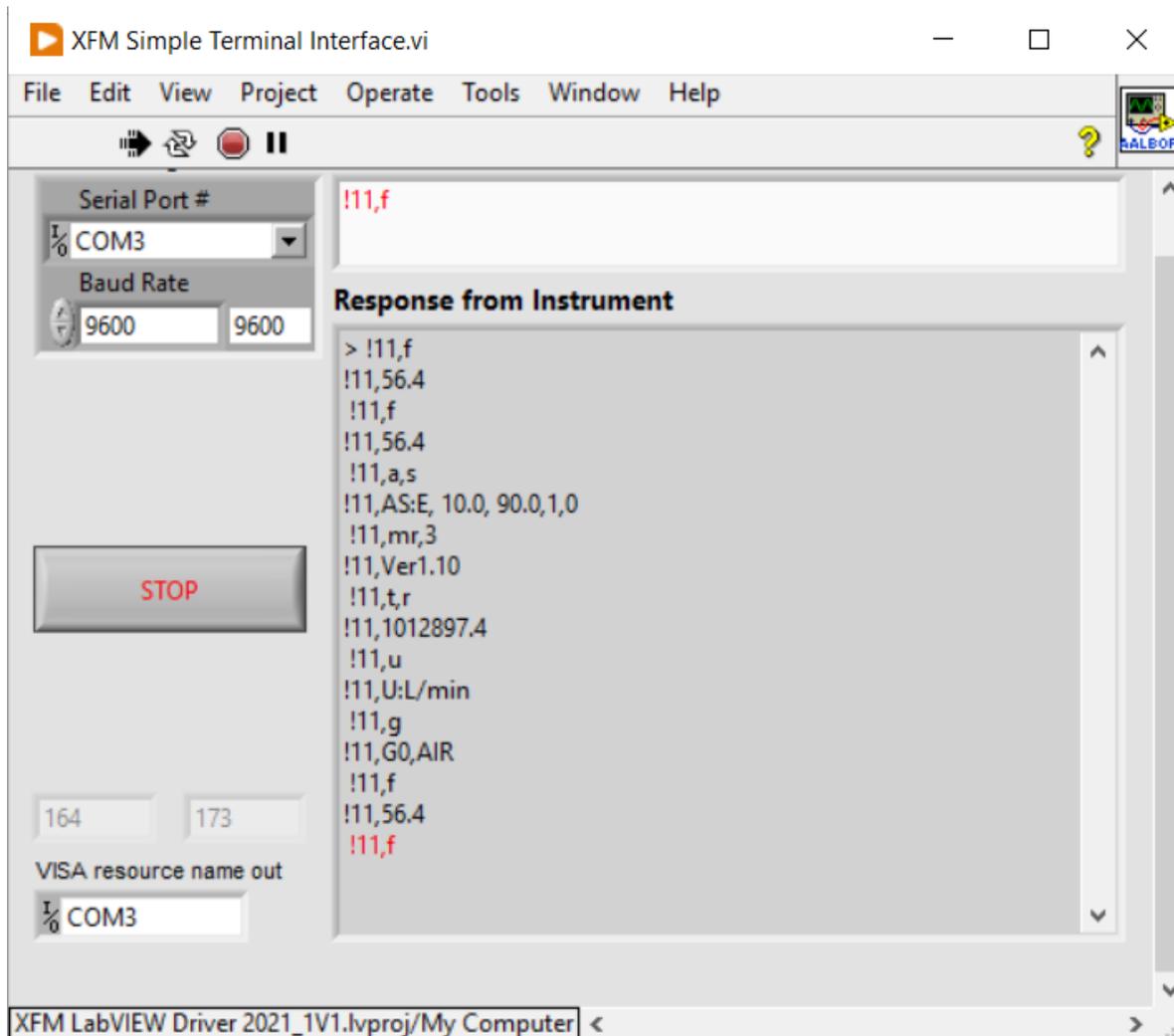
Example VI for communicating with AALBORG XFM instruments via serial communication interface using ASCII commands set (see XFM instrument operating manual for complete list of supported commands). For RS485 interface the start character is always ! and two characters of address with coma delimiter in the end must be submitted before each command (see example below).

!11,F

For the RS232 interface, the start character ! and two hexadecimal characters for the address must be omitted. For all interfaces the command string is terminated with the equivalent of a carriage return; line feeds are automatically stripped out by the XFM instrument.

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