

GENERAL PURPOSE THERMAL MASS FLOW METERS TSI® SERIES 5200/5300

ASCII COMMAND SET



P/N 6011697, REVISION A
April 2019



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China Tel: +86 10 8219 7688
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GENERAL PURPOSE THERMAL MASS FLOW METERS TSI® SERIES 5200/5300


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April 2019

**U.S. & INTERNATIONAL
Sales and Customer Service:**
(800) 680-1220 / +1(651) 490-2860
Fax:
+1(651) 490-3824

**TSI Instruments Ltd. (UK)
Sales and Customer Service:**
+44 (0) 1494 459200

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Address


TSI Incorporated, 500 Cardigan Road, Shoreview, MN 55126 USA


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	WARNING
	TSI flow meters employ a heated platinum sensor. They SHOULD NOT be used with flammable or explosive gasses or mixtures.

	Caution
	TSI flow meters ARE NOT medical devices under FDA 510k and in no situation should they be utilized for human respiration measurements.

	Information
	Refer to the 5300 or 5200 Series Operations Manuals for Warranty, Liability, and Service information.

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Chapter 1

Flow Meter Identification

Meter Front



Meter Back

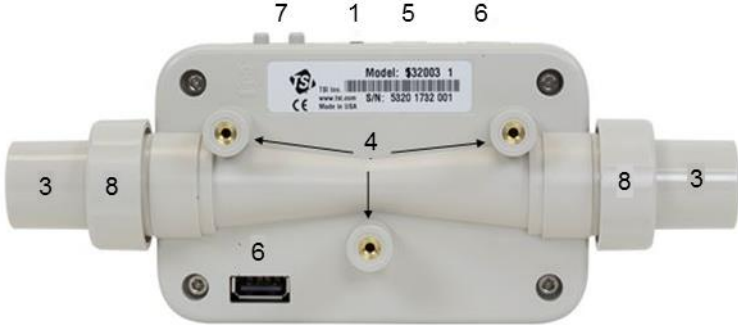


Figure 1-1. Series 5300 Mass Flow Meter

1. Power Button (On/Off)	5. USB-C Power/Communications Port
2. Color Touchscreen Display*	6. USB-A Ports (2)
3. Interchangeable Tube Ends	7. Low Differential Ports (5 x 10/5 x 20/5 x 30 models only)
4. Mounting Inserts (M3 thread size)	8. Collars

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Chapter 2

Connecting Computer to Flow Meter

The 5000 Series can establish communication with a computer over either a direct USB link utilizing a NDIS driver or over RS232 using a USB to RS232 converter.

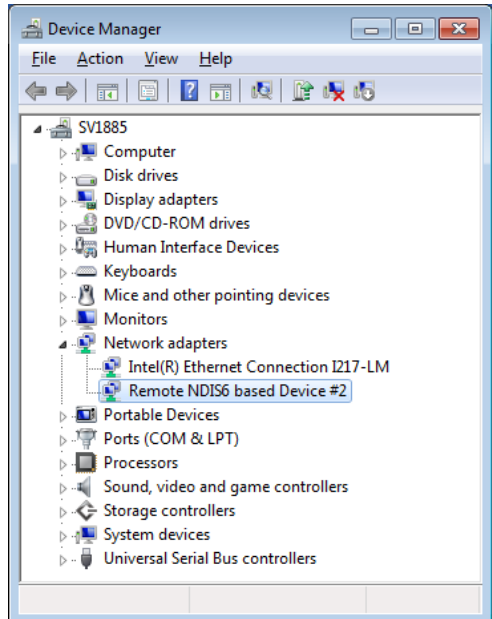
Direct USB NDIS Interface

Using the direct link USB interface is the preferred method to establish communication. This interface is fast and only requires a single USB cable between the meter and the computer. The same cable will both power and transfer data. This connection will utilize a standard USB driver called the NDIS driver.

For this connection to function, the NDIS driver needs to be loaded onto the computer. This can be easily accomplished by installing the free TSI Basic flow software package called FLO-Sight™. As part of the installation, the install package will place the NDIS driver on the computer. Refer to the main instrument manual for details on how to install free TSI FLO-Sight™ software.

Steps to Establish Communication over NDIS

The first step of establishing communication is to have an NDIS driver loaded on the computer as described above. Next, plug the GP Flow instrument into the computer using a USB C to A cable and allow it to boot. The USB C connection is on the flow meter side and the USB A connection is on the computer side. The driver will automatically load or you may need to press accept on a dialog that states a new NDIS device has been found.



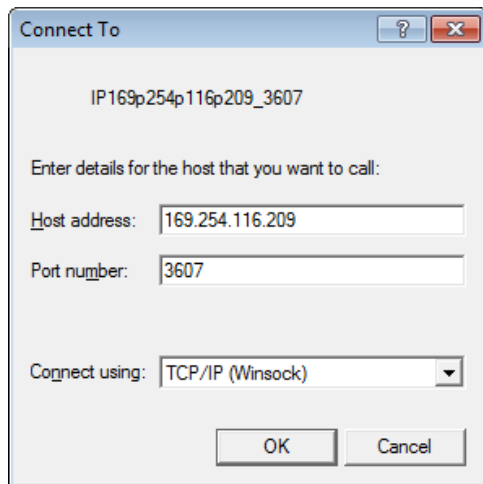
The driver function can be confirmed by looking into the computer's device manager. The instrument will show up as a Remote NDIS device under Network Adapters (see screen capture below).

The next step to test the communication is to open up a terminal program and establish a TCP/IP winsock connection. The example below is using HyperTerminal® Terminal program.

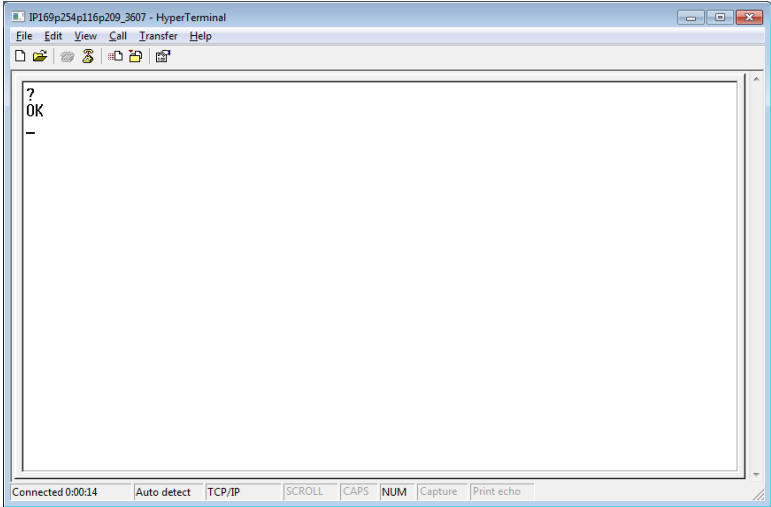
First, determine the device's IP address using the instrument screen by pressing the info tag. Each GP Flow instrument will have an unique IP address.



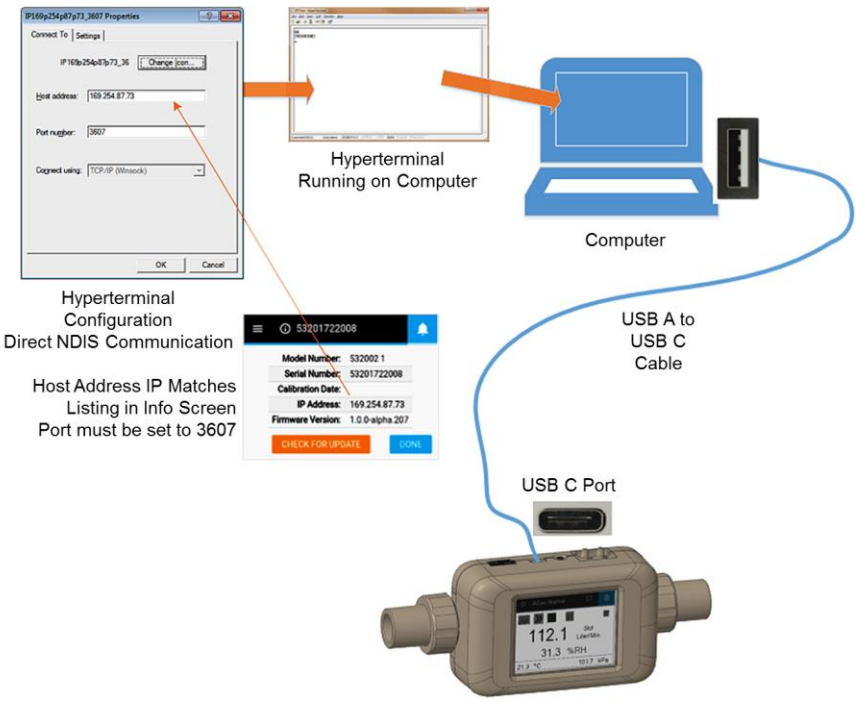
Next, enter the IP address into the terminal's connection dialog. Set the connection to TCP/IP and enter the port number of 3607. This is shown in the HyperTerminal® Connection dialog.



Now, commands typed into the terminal will be relayed to the instrument and responses presented in the terminal screen. If the connection is working, the meter will respond to a question mark command “?” with “OK”.



The graphic below shows the full system for connecting the instrument to the computer over NDIS.

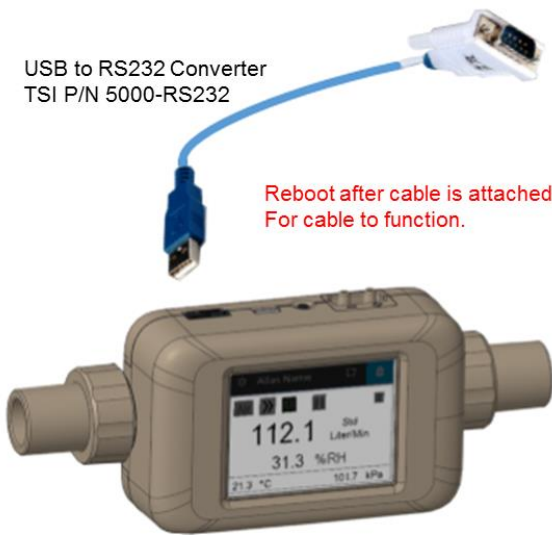


Hyperterminal
Configuration
Direct NDIS
Communication
Host Address IP Matches
Listing in Info Screen
Port must be set to 3607

RS232 Communication Utilizing a USB A to RS232 Adapter

Another method for communicating to the GP Flow instrument is to utilize a USB to RS232 adapter and then communicate to the computer using RS232 protocols.

The first step is to connect a USB to RS232 converter to the GP Flow instrument. The converter must be based on the FTD based drivers for it to function with the GP Flow instrument. TSI sells a converter tested to work with the instrument P/N 5000-RS232. After attaching the converter, the GP Flow instrument must be rebooted. See graphic below.



Information

The 5000 Series instrument **must** be rebooted after attaching the USB to RS232 adapter.

Once the meter has been rebooted, a DB9 Null modem serial cable can be attached to the computer.



Information

The serial cable between the GP Flow instrument and the computer **must** be a null modem cable.

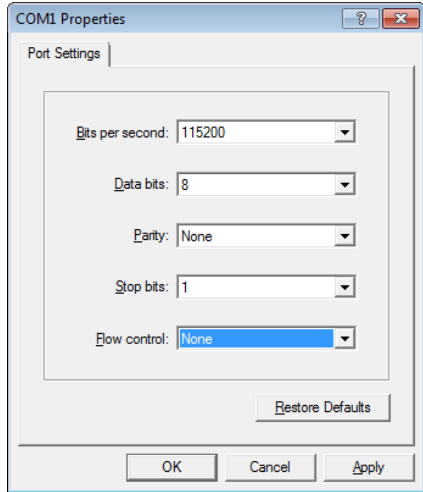
Once the RS232 connection has been created between the GP Flow instrument and the computer, that connection can be tested using a Terminal program.

The RS232 Settings to be entered into the terminal program are shown below.

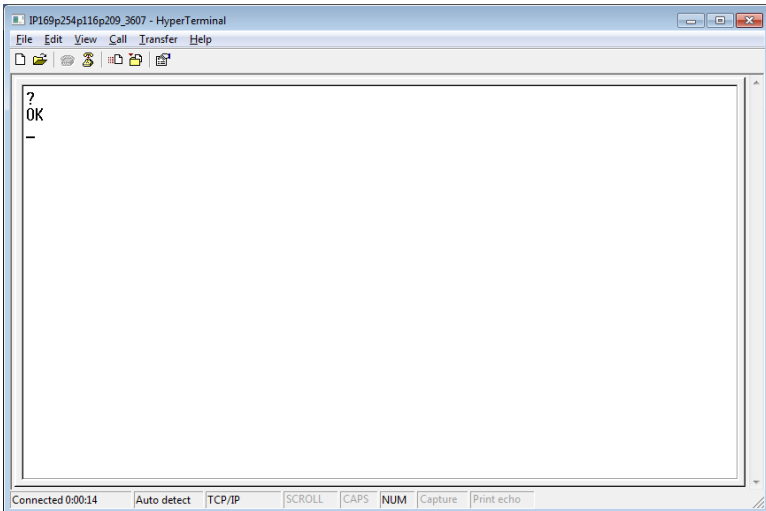
RS232 Settings:

Baud Rate 115,200 k
Data Bits 8
Parity None
Stop Bits 1
Flow Control None

Enter the RS232 settings into the terminal's connection dialog. This is shown in the HyperTerminal® Connection dialog shown at right.

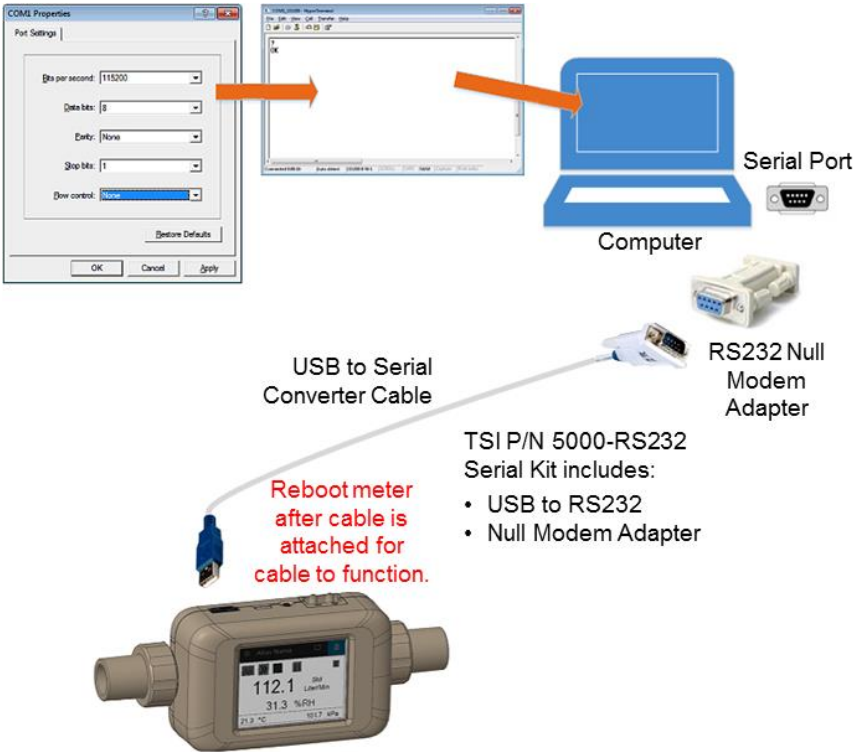


Now, commands typed into the terminal will be relayed to the instrument and responses presented in the terminal screen. If the connection is working, the meter will respond to a question mark command “?” with “OK”.



Note that the RS232 baud rate is factory set at 115,200. This rate can be changed to 38,400 to be backwards compatible with the 4000 Series instrument. See the baud rate commands in the manual for steps in changing the baud rate.

The graphic below shows the full system for connecting the instrument to the computer over RS232.



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Chapter 3

ASCII Protocol

Command Format

The serial interface commands in this manual are designated by the bold font (ex. **DmFTPnnnn**). The commands are case-sensitive. Upper case letters are used throughout the command set except as designated.

The TSI Series 5XXX use ASCII characters as the input command set. Each command sent to the flow meter must be terminated by a carriage return (CR = 0x0d). Line feeds (LF = 0x0a) are ignored.

Select commands allow you to choose either ASCII or binary format for the returned data. Binary data transfers allow for faster operation.

The TSI Series 5XXX flow meters send an acknowledge sequence to confirm that the command was received. For ASCII commands, the acknowledge sequence is “**OK**” <CR><LF>. For binary commands, a single byte, 0x00, is returned.

The ASCII command set for the Series 4000/4100 flow meters (4000-4100-RS-Command-Set P/N 1980340) is backwards compatible with the TSI Series 5XXX flow meters. This manual lists which commands also work with the Series 4000/4100 flow meters and also include additional commands specifically for the additional functions of the 5XXX series.

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Chapter 4

Command Set

Command Set Summary

Commands for Flow Rate, Temperature, Pressure, and Volume

Command	Description	Backward Compatible with 4000/4100 Series
DmFTPnnnn	Returns flow rate, temperature, and absolute pressure data at an interval equal to the sample rate.	Yes
DmFTPnHLInnn	Returns flow rate, temperature, absolute pressure, humidity, low pressure and totalizer data at an interval equal to the sample rate.	No
Vmnnnn	Returns a volume measurement by integrating flow rate over time.	Yes

Measurement Setup Commands

Command	Description	Backward Compatible with 4000/4100 Series
SBTx\pmnnnn.nn	Sets the begin-trigger level for starting data acquisition.	Yes
SETx\pmnnnn.nn	Sets the end-trigger level for stopping data acquisition.	Yes
CBT	Clears the begin-trigger level.	Yes
CET	Clears the end-trigger level.	Yes
SSRnnnn	Sets the sample rate at which the data is returned.	Yes

Command	Description	Backward Compatible with 4000/4100 Series
SGn	Sets the gas calibration to be used.	Yes
SGMmm	Selects the air/oxygen mixture concentration.	Yes
SUn	Selects either standard or volumetric units of flow.	Yes
SSTnn.nn	Sets user standard temperature.	Yes
SSPnnn.nn	Sets user standard pressure.	Yes
SDU2	Sets output flow units to Cubic Feet per Minute.	Yes
LPZ	Low pressure zero.	No
SCHx	Turn humidity correction off.	No
SCDx	Turn bi-directional sensor off.	No

Miscellaneous Commands

Command	Description	Backward Compatible with 4000/4100 Series
Rxx	Reads the current values of the changeable operating parameters.	Yes
DEFAULT	Restores the values of changeable operating parameters to factory default settings.	Yes
SN	Returns the serial number of the flow meter.	Yes
MN	Returns the model number of the flow meter.	Yes
REV	Returns the internal firmware revision of the flow meter.	Yes

Command	Description	Backward Compatible with 4000/4100 Series
HREV	Returns the internal hardware revision of the flow meter.	No
DATE	Returns the date of the last calibration.	Yes
?	Returns “OK” to tell if the flow meter is communicating.	Yes
SUSTRxxxxxxxx	Set user string.	Yes
RUSTR	Read user string.	Yes
SALIASxxxxxxx xxxxxxxxxxx	Set meter alias.	No
RALIAS	Read user string.	No
BREAK	Stop the current sending of data.	No
SBAUDnnnnnn	Set RS232 baud rate.	No
RBAUD	Read RS232 baud rate.	No

Display Commands

Command	Description	Backward Compatible with 4000/4100 Series
SURnnnn	Sets the update rate for the LCD display.	Yes

Command Set Detailed

DmFTPnnnn

Backwards compatible with Series 4000/4100 flow meters.

Returns Flow, Temperature, and Pressure data at an interval equal to the sample rate.

The data is returned in the order of Flow, Temperature, and Pressure. All three measurements may be requested or a combination of the three as indicated below.

D	Denotes data transfer.
m	Denotes data format: A = ASCII, B = binary, C = ASCII followed by CR and LF.
F	Requests a flow reading (replace with lower case “x” if a flow reading is not desired).
T	Requests a temperature reading (replace with a lower case “x” if a temperature reading is not desired).
P	Requests a pressure reading (replace with a lower case “x” if a pressure reading is not required).
nnnn	Denotes maximum number of samples to return, range is 1 to 1000. (“0500” denotes 500 readings, leading zeroes must be included).

Example 1) **DAFxP0250**

Requests 250 readings of flow and pressure data in ASCII format.

Example 2) **DBxTx1000**

Requests 1000 readings of temperature in binary format.

Flow data is returned in units of Std. L/min or L/min (see [SUn command](#)).

Temperature data is returned in units of °C.

Pressure data is returned in units of kPa.

Before initiating this command, the sample interval, gas calibration, and flow units should be set.

The sample interval between data points is set using the [SSRnnnn command](#).

The gas calibration is set using the [SGn command](#).

The units of standard or volumetric flow is set using the [SUn command](#).

The data can be returned in either ASCII or binary.

If ASCII mode is chosen, the acknowledge sequence is “**OK**” <CR><LF>. If the command generated an error, an error code “**ERRn**” <CR><LF> will be returned where n represents an error code 0 through 9. See [Appendix A](#) for a list of possible error codes. The readings returned are separated by commas and the termination sequence is a <CR><LF>. The Series 4000/5300 sends two decimal places, and the Series 4100/5200 sends three decimal places for flow rate.

If binary mode is chosen, a single byte, 0x00, will be returned as a command acknowledgment. If a command generated an error, a single byte will be returned in place of the acknowledgment byte. See [Appendix A](#) for a list of error codes. Each reading returns two bytes. The most significant byte is returned first. Flow rate data is returned as an unsigned integer (0 to 65535) that has been multiplied by 100 (for Series 4000) or by 1000 (Series 4100). Temperature data is returned as a signed integer (-32768 to 32767) that has been multiplied by 100. Pressure data is returned as an unsigned integer that has been multiplied by 100. To convert the returned data back to its original form, divide the data by 100. Binary transfers terminate by returning two bytes in the form 0xff. Check the first reading in each block of data returned (flow, temperature, and pressure) from the unit, for the terminating sequence. No termination sequence will be sent if an error condition occurred.

Special note: A temperature reading of -0.01°C would be transmitted as 0xff and could signal an early termination if flow readings were disabled.

If no begin-trigger is set, the data acquisition begins immediately upon processing of the command. If a begin-trigger is set (set with [SBTx++nnn.nn](#)), the data acquisition begins as soon as the begin-trigger condition is detected. If no end-trigger is set, then **nnnn** samples will be used in the data set. If an end-trigger is set (set with [SETx++nnn.nn](#)), then the acquisition will stop either when the end-trigger condition is detected or when **nnnn** samples have been acquired; whichever comes first. After the command is finished, a termination sequence is sent to signal the end of the transfer.

Example 3) **SSR0010**

Set sample rate to one average sample every 10 ms.

Flow meter returns **OK** <CR><LF>

SG1 Use the oxygen gas calibration.

Flow meter returns **OK <CR><LF>**

SBTF+001.00

Begin sample by triggering on increasing flow at 1.0 Std. L/min.

Flow meter returns **OK <CR><LF>**

DAFxx0005 Request 5 samples of flow in ASCII format.

Flow meter returns **OK <CR><LF>**

Flow meter returns flow data as follows.

1.10,1.20,1.25,1.23,1.20<CR><LF>

Example 4) **DBFxx0005**

Request 5 samples of flow in binary format.

An example of the data that could be returned is as follows.

0x00 0x33 0x09 0x33 0x1f 0x33 0x25 0x33 0x2d 0x33 0x2e 0xff 0xff

After conversion, the data would look like:

130.65 130.87 130.93 131.01 131.02

Example 5) **DCFTx0005**

Request five samples of flow and temperature in ASCII format but with <CR> and <LF> following each data set.

Returns data as follows.

1.10,23.45<CR><LF>

1.20,23.53<CR><LF>

1.25,23.48<CR><LF>

1.23,23.39<CR><LF>

1.20,23.50<CR><LF>

DmFTPHLInnnn

Returns Flow, Temperature, Absolute Pressure, Humidity, Low Pressure, and Totalizer data at an interval equal to the sample rate.

The data is returned in the order of Flow, Temperature, Absolute Pressure, Humidity, Low Pressure, and Totalizer. All six measurements may be requested or a combination of the three as indicated below.

D	Denotes data transfer.
m	Denotes data format: A = ASCII, B = binary, C = ASCII followed by <CR> and <LF>.
F	Requests a flow reading (replace with lower case "x" if a flow reading is not desired).
T	Requests a temperature reading (replace with a lower case "x" if a temperature reading is not desired).
P	Requests a pressure reading (replace with a lower case "x" if a pressure reading is not required).
H	Requests a Humidity reading (replace with lower case "x" if a flow reading is not desired).
L	Requests a low pressure reading (replace with a lower case "x" if a temperature reading is not desired).
I	Requests a totalizer reading (replace with a lower case "x" if a pressure reading is not required).
nnnn	Denotes maximum number of samples to return, range is 1 to 1000. ("0500" denotes 500 readings, leading zeroes must be included).

This command follows all the same rules documented in the [DmFTPnnnn command](#).

This command has the special case where setting the **nnnn** to 0000 will result in 30 seconds of streaming data. The total number of data points will be dependent on sample rate. For example, if the sample rate is 10 msec, then this command will stream out 300 readings over 30 seconds.

Vmnnnn

Backwards compatible with Series 4000/ 4100 flow meters.

Returns a volume measurement by integrating flow rate over time.

V	Denotes volume measurement
m	Denotes data format: A = ASCII, B = binary
nnnn	Denotes maximum number of flow samples to integrate, range is 1 to 9999 ("0500" denotes 500 readings, leading zeroes must be included)

Example 1) **VA2000**

Request a single volume reading by integrating a maximum of 2000 flow samples and return data in ASCII format.

Volume data is returned in units of standard liters or volumetric liters (see [SUn command](#)).

Before initiating this command, the sample interval, gas calibration, and volume units should be set.

The sample interval between data points is set using the [SSRnnnn command](#).

The gas calibration is set using the [SGn command](#).

The units of standard or volumetric is set using the [SUn command](#).

The most common units are volumetric liters.

The data can be returned in either ASCII or binary.

If ASCII mode is chosen, the acknowledge sequence is "OK" <CR><LF>. If the command generated an error, instead of "OK" <CR><LF> being returned an error code "ERRn" <CR><LF> will be returned where n represents an error code 0 through 9. See [Appendix A](#) for a list of possible error codes. The termination sequence is a <CR><LF>.

If binary mode is chosen, the acknowledge sequence is a single byte 0x00.

If the command generated an error, a single byte error code will be returned instead of 0x00. See [Appendix A](#) for a list of possible error codes. The reading is represented by 2 bytes. The most significant byte is returned first. The data is represented as an unsigned integer

(0 to 65535) that has been multiplied by 100 (Series 4000) or by 1,000 (Series 4100). Therefore, you must divide the integer that is returned by 100 or 1000 to get the correct result. The termination sequence for binary is 0xff 0xff.

If no begin-trigger is set, the data acquisition begins immediately upon processing of the command. If a begin-trigger is set (set with **SBTx±nnn.nn**), the data acquisition begins as soon as the begin-trigger condition is detected. If no end-trigger is set, then **nnnn** samples will be used in the integral. If an end-trigger is set (set with **SETx±nnn.nn**), the acquisition will stop either when the end-trigger condition is detected or when **nnnn** samples has been acquired; whichever comes first. After the command is finished, a termination sequence is sent to signal the end of the transfer.

Example 2) **VA1000**

Request volume measurement with at most 1000 samples, data returned in ASCII.

Returns volume data as follows: **OK <CR><LF> 130.651 <CR><LF>**

Example 3) **VB1000**

Request volume measurement with at most 1000 samples, data returned in binary.

Returns data as follows: 0x00 0x33 0x09 0xff 0xff

After conversion, the data would look like: 130.65

SBTx $\pm\pm$ nnn.nn (Series 5300)

SBTx \pm nn.nnn (Series 5200)

Backwards compatible with Series 4000/4100 flow meters.

Sets the begin-trigger level for starting the data acquisition.

SBT	Denotes set begin-trigger.
x	Denotes trigger source: F = flow (Std. L/min), P = pressure (kPa), L = low pressure (cmH ₂ O).
$\pm\pm$	First sign denotes positive or negative slope. Second sign denotes positive or negative trigger level. + = positive, - = negative.
nnn.nn	Set trigger level ("001.00" would denote 1.00 Std. L/min, leading and trailing zeroes must be included). Negative trigger levels can be set (" \pm 001.00" would denote -1.00 Std. L/min with positive slope).

The set trigger level stays in effect until cleared using the **CBT** command. The trigger level is also cleared when the flow meter is turned off or the [DEFAULT command](#) is initiated.

After the command is processed, an acknowledge sequence of "**OK**" <CR><LF> is sent. If the command generated an error, instead of "**OK**" <CR><LF> being sent an error code of "**ERRn**" <CR><LF> will be sent. See [Appendix A](#) for a list of possible error codes.

Example 1) **SBTF $\pm\pm$ 002.00**

Sets a begin-trigger level of 2.00 Std. L/min with positive slope.

Example 2) **SBTP \pm 110.00**

Sets a begin-trigger level of 110.0 kPa with negative slope.

SETx±nnn.nn (Series 5300)

SETx±nn.nn (Series 5200)

Backwards compatible with Series 4000/4100 flow meters

Sets the end-trigger level for stopping data acquisition.

SET	Denotes set end-trigger.
x	Denotes trigger source: F = flow, P = pressure.
±±	First sign denotes positive or negative slope. Second sign denotes positive or negative trigger level. + = positive, - = negative.
nnn.nn	Sets trigger level ("001.00" would denote 1.00 Std. L/min, leading zeroes must be included). Negative trigger levels can be set ("±001.00" would denote -1.00 Std. L/min with positive slope).

The set trigger level stays in effect until cleared using the [CET command](#). The trigger level is also cleared when the flow meter is turned off or the [DEFAULT command](#) is initiated.

After the command is processed, an acknowledge sequence of "OK" <CR><LF> is sent. If the command generated an error, instead of "OK" <CR><LF> being sent an error code of "ERRn" <CR><LF> will be sent. See [Appendix A](#) for a list of possible error codes.

Example 1) **SETF-+002.00**

Sets an end-trigger level of 2.00 Std. L/min with negative slope.

Example 2) **SETP++110.00**

Sets an end-trigger level of 110.0 kPa with positive slope.

CBT

Backwards compatible with Series 4000/4100 flow meters.

Clears the begin-trigger level. Begin-trigger function is disabled. The flow meter will return an acknowledge sequence of "OK" <CR><LF> as a response.

CET

Backwards compatible with Series 4000/4100 flow meters.

Clears the end-trigger level. End-trigger function is disabled. The flow meter will return an acknowledge sequence of "OK" <CR><LF> as a response.

SSRnnnn

Backwards compatible with Series 4000/4100 flow meters

Sets the sample rate for data returned through the serial port and also controls the update rate of the linearized analog flow output.

SSR	Denotes set sample rate.
nnnn	Denotes number of milliseconds per sample, range 1 to 1000. ("0005" denotes 5 milliseconds per sample, leading zeroes must be included).

Longer sample rates provide greater flow averaging; whereas, shorter sample rates provide greater frequency response.

After the command is processed, an acknowledge sequence of "OK" <CR><LF> is sent. If the command generated an error, an error code of "ERRn" <CR><LF> will be sent. See [Appendix A](#) for a list of possible error codes.

SGn

SGMmm (Series 53XX only)

Backwards compatible with Series 4000/4100 flow meters.

Sets the gas calibration to be used **or** sets the air/oxygen mixture concentration.

Models 53XX Only

SG	Denotes set gas calibration.
n	Denotes the gas calibration desired; range is 0 to 6 0 = Air, 1 = 100% O ₂ , 6 = 100% N ₂ , 2–5 are invalid in these models. NOTE: Only select gas calibration for gases in which the meter is calibrated. Consult the user manual for list of calibrated gases.
SGM	Denotes set air/oxygen mixture concentration.
mm	Denotes the amount of oxygen in air. Range is 21% to 99%. The display will indicate the current gas calibration, either air or O ₂ . For air/oxygen mixtures, the display will indicate both air and oxygen.

Models 52xx Only

SG	Denotes set gas calibration.
n	Denotes the gas calibration desired; range is 0, 1, 2, 6 0 = Air, 1 = 100% O ₂ , 2 = 100% N ₂ O, 6 = 100% N ₂ . The display will indicate the current gas calibration, either air, O ₂ , N ₂ , or N ₂ O. NOTE: Only select gas calibration for gases in which the meter is calibrated. Consult the user manual for list of calibrated gases.

After the command is processed, an acknowledge sequence of “**OK**” <CR><LF> is sent. If the command generated an error, instead of “**OK**” <CR><LF> being sent an error code of “**ERRn**” <CR><LF> will be sent. See [Appendix A](#) for a list of possible error codes.

SUn

Select either standard or volumetric units of flow for data displayed on the LCD display and for data received through the serial port.

SU	Denotes whether flow is measured in standard units or volumetric units.
n	Denotes which units. S = standard flow rate, V = volumetric flow rate, U = User conditions, UT = User temperature conditions, actual pressure, UP = User pressure conditions, actual temperature

This will control the units of measure for the gas reading over the communications port. To change the units of measure shown on the GUI screen, use the instrument’s touch screen (reference the user manual).

The Series 53XX and 52XX flow meters are designed to measure flow in units of standard L/min. When selecting volumetric flow rate, they perform a flow correction as shown below by measuring gas temperature and pressure. Flow output in volumetric L/min is less accurate due to additional uncertainties encountered when measuring gas temperature and pressure.

The following equation is based on applications of the ideal gas law.

$$\text{Volumetric Flow} = (\text{Standard Flow}) \left[\frac{273.15 + T_m}{273.15 + 21.11} \right] \frac{101.3}{P_m}$$

Choose **U** to select the user standard temperature (used in place of 21.11°C) and user pressure (used in place of 101.3 kPa).

Choose **UT** (User Temperature) to select the standard temperature and the pressure used is actual pressure.

Choose **UP** (User Pressure) to select the standard pressure and the temperature used is actual temperature.

Reference commands [SSTnn.nn](#) and [SSPnnn.nn](#) for how to set user standard temperature and pressure conditions.

After the command is processed, an acknowledge sequence of “**OK**” <CR><LF> is sent. If the command generated an error, instead of “**OK**” <CR><LF> being sent, an error code of “**ERRn**” <CR><LF> will be sent. See [Appendix A](#) for a list of possible error codes.

SSTnn.nn

Backwards compatible with Series 4000/4100 flow meters.

Set user standard temperature.

SST	Denotes the set standard temperature command.
nn.nn	Denotes the user standard temperature in degrees C.

Example: to set to 37 degrees C send SST37.00.

SSPnnn.nn

Backwards compatible with Series 4000 / 4100 flow meters.

Set user standard pressure.

SST	Denotes the set standard temperature command.
nnn.nn	Denotes the user standard pressure in kPa.

Example: to set standard pressure to 120kPa send SSP120.00

SDU2

Backwards compatible with Series 4000/4100 flow meters.

Outputs flow in Cubic Feet per Minute.

SSU2	Denotes set flow units to Cubic Feet per Minute.
-------------	--

This will control the units of measure for the gas reading over the communications port. To change the units of measure shown on the GUI screen, use the instrument's touch screen (reference the user manual).

LPZ

Zeroes the low pressure transducer

LPZ	Denotes set Low pressure zero command.
------------	--

This command will zero the low pressure transducer. It will reply "OK" if successful. It will reply "Err" if not successful. If the meter does not have a low pressure transducer, it will reply with an error.

SCHx

Turn on/off Humidity correction.

SCH	Denotes set Humidity compensation command.
x	Denotes to turn on or off Humidity compensation. x= 0 to turn off x= 1 to turn on

This will turn the humidity compensation on or off.

SCDx

Turn on/off flow direction sensor

SCD	Denotes set Flow direction command.
x	Denotes to turn on or off Humidity compensation. x= 0 to turn off x= 1 to turn on

This will turn the flow direction sensor on/off. If off then flow will always read positive independent of direction.

SCEx

Turn on/off half inch end correction

SCE	Denotes set half-inch End correction command.
x	Denotes to turn on or off half-inch End correction. x= 0 to turn off x= 1 to turn on

This will turn the half-inch End correction on or off.

Rxx

Partially backwards compatible with Series 4000/4100 flow meters.

Reads the current values for sample rate, gas calibration, standard/ volumetric flow units, trigger values, analog output scaling and display update rate.

R	Denotes read current values.	
xx	xx=SR	Denotes sample rate (returns 0 to 1000).
	xx=G	Denotes gas calibration (returns 0 to 6 for gas calibration, returns M21 to M99 for air/O ₂ mixture concentrations).
	xx=U	Denotes flow units (returns S, V, U, UT or UP).
	xx=BT	Denotes begin-trigger value (returns x±nnn.nn). If only one sign is returned, this is the sign of the slope. A positive trigger level's sign will not be returned, only a negative trigger level will return a sign (-).
	xx=ET	Denotes end-trigger value (returns x±nnn.nn). If only one sign is returned, this is the sign of the slope. A positive trigger level's sign will not be returned, only a negative trigger level will return a sign (-).
	xx=UR	Denotes display update rate (returns 50 to 5000).
	xx=ST	Denotes user standard temperature (returns 0–99.99).
	xx=SP	Denotes user standard pressure (returns 0-999.99).
	xx=CH	Denotes Humidity compensation (0 = off, 1 = on).
	xx=CD	Denotes Flow direction sensor (0 = off, 1 = on).
xx=CE	Denotes half-inch End correction (0 = off, 1 = on).	

Returns current settings in ASCII format. Leading zeroes are not returned.

After the command is processed, an acknowledge sequence of “**OK**” <**CR**><**LF**> is sent followed by the data. If the command generated an error, instead of “**OK**” <**CR**><**LF**> being sent an error code of “**ERRn**” <**CR**><**LF**> will be sent. See [Appendix A](#) for a list of possible error codes.

DEFAULT

Backwards compatible with Series 4000/4100 flow meters.

Returns the values for sample rate, calibration gas/gas mixture, standard/volumetric flow units, display update rate, display mode, analog zero, and full-scale scaling factors to the factory default settings. This command also clears both the begin- and end-trigger values. The default values for the Series 53XX/52XX operating parameters are listed in [Appendix B](#).

SN

Backwards compatible with Series 4000/4100 flow meters.

Returns the serial number of the flow meter in ASCII. The serial number is an alpha-numeric string terminated by a <CR><LF>. The string can be a maximum of 16 characters in length plus the terminating <CR><LF>.

Example: **53101816001**

MN

Backwards compatible with Series 4000/4100 flow meters.

Returns the model number of the flow meter in ASCII. The model number is an alpha-numeric string terminated by a <CR><LF>. The string can be a maximum of 12 characters in length plus the terminating <CR><LF>.

Example: **531001**

REV

Backwards compatible with Series 4000/4100 flow meters.

Returns the internal firmware revision of the flow meter in ASCII. The revision is an alpha-numeric string terminated by a <CR><LF>. The string can be a maximum of three characters in length plus the terminating <CR><LF>.

Example: **1.3**

HREV

Returns the internal hardware revision of the flow meter in ASCII. The revision is an alpha-numeric string terminated by a <CR><LF>. The string can be a maximum of three characters in length plus the terminating <CR><LF>.

Example: **A**

DATE

Backwards compatible with Series 4000/4100 flow meters

Returns the date of the last calibration in ASCII. The format of the string is "month/day/year". The date is an alpha-numeric string terminated by a <CR><LF>. The string can be a maximum of eight characters in length plus the terminating <CR><LF>.

Example: **12/24/18**

?

Backwards compatible with Series 4000/4100 flow meters

This is a ping command used to verify if the flow meter is communicating.

The flow meter will return an acknowledge sequence of "OK" <CR><LF> as a response. The serial communications indicator will flash once on the LCD display to indicate that the command was received.

SUSTRxxxxxxxx

Backwards compatible with Series 4000/4100 flow meters.

Set a user-defined string to be stored in the meter.

SUSTR	Denotes Set user string command.
xxxxxxxx	x = alphanumeric character

Must enter eight characters following the command

NOTE: User string is not reset when the [DEFAULT command](#) is used or during normal recalibration.

RUSTR

Backwards compatible with Series 4000/4100 flow meters.

Read the user-defined string to be stored in the meter.

RUSTR	Denotes read user string command.
--------------	-----------------------------------

Returns the 8 character user string.

SALIASxxxxxxxxxxxxxxxx

Set a user-defined string to be stored as the alias of the flow meter.

SUSTR	Denotes Set user string command.
xxxxxxxxxxxxxxxx	x = alphanumeric character (up to 16).

Must be up to 16 characters. String can be shorter.

NOTE: User string is not reset when the [DEFAULT command](#) is used or during normal recalibration.

RALIAS

Read the user-defined string to be stored as the alias of the flow meter.

RALIAS	Denotes read user string command.
---------------	-----------------------------------

Returns up to 16-character alias string.

BREAK

This command will stop the sending of data via the **D** commands (**DmFTPnnnn** or **DmFTPHLnnnn**). When received, the meter will stop sending data back via these commands. This command will also stop and active volume commands.

Use this command to halt a data or volume command prior to completion.

SBAUDnnnnnn

Sets the RS232 baud rate of the instrument, when using the USB to RS232 converter cable.

SBAUD	Denotes the Set Baud command.
nnnnnn	Denotes Baud Rate nnnnnn can equal 38400 or 115200.

The instrument needs to be rebooted for the new baud rate to take effect.

RBAUD

Reads the RS232 baud rate of the instrument, when using the USB to RS232 converter cable.

RBAUD	Denotes the Read Baud command.
--------------	--------------------------------

Returns a 5- or 6-character string denoting a baud rate of 38400 or 115200.

SCREENSHOT

Saves a screenshot of the current meter to a USB drive.

SCREENSHOT	Denotes the Screenshot command.
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Returns **"OK"** if the screenshot was successfully saved

"err4" if the USB flash drive cannot be found

"err8" if there is an internal error with the screenshot process

SURnnnn

Backwards compatible with Series 4000/4100 flow meters.

Sets the update rate for the LCD display.

SUR	Denotes the set update rate command.
nnnn	Denotes the number of milliseconds per update. Range is 50 to 5000. ("0050" denotes 50 milliseconds per update, leading zeroes must be included).

Data displayed on the LCD is averaged based on the update rate. If the display rate were set to 1000 ms, the data shown on the display would be averaged for 1 second. This command affects only the LCD display. The update rate for the linearized analog output and the serial output is controlled through the [SSRnnnn command](#).

After the command is processed, an acknowledge sequence of "OK" <CR><LF> is sent. If the command generated an error, instead of "OK" <CR><LF> being sent an error code of "ERRn" <CR><LF> will be sent. See [Appendix A](#) for a list of possible error codes.

Chapter 5

Troubleshooting

The table below lists the symptoms, possible causes, and recommended solutions for common problems encountered with the flow meter. If the symptom is not listed, or if none of the solutions solves the problem, please contact TSI Customer Support at 800-680-1220 or 651-490-2860.

Symptom	Possible Causes	Corrective Action
NDIS communication not working.	Driver not installed.	Install FLO-sight software. Next, after attaching meter confirm it shows up in device manager. See Chapter 2. Steps to Establish Communication Over NDIS.
	Cable not connected correction.	See Chapter 2. Steps to Establish Communication Over NDIS.
RS232 communication not working.	Compatibility issue with converter.	User TSI supplied USB to RS232 converter.
	Converter not detected.	The meter must be rebooted after connecting the USB to RS232 converter.
	Baud Rate Incorrect.	Baud by default from factory is 115200. Try both default and alternate baud rate of 38400.
	RS232 miss-configured.	See configuration parameters in Chapter 2. RS232 Communication Utilizing a USB A to RS232 Adapter.

Frequently Asked Questions

The table below lists frequently asked questions that may arise when establishing a connection to the flow meter.

Question	Response
Under NDIS mode does the meter always use the Link Local IP space (169.254.x.x/16) or will it allow the user to set a static IP?	The meter always uses the Link-Local IP address space. It does not allow you to set a static IP.
Can the meter set its IP from a DHCP server?	No , the meter does not get its IP address from a DHCP server.
When using NDIS and the Link Local address space is the IP address guaranteed to the same between meter and system reboots.	Yes , the meter will always self-assign the same Link-Local IP address.

Technical Contacts

If you have any difficulty installing the meter, or if you have technical or application questions about this instrument, contact an applications engineer at TSI Incorporated, (651) 490-2860 or contact answers@tsi.com.

If the Meter fails, or if you are returning it for service, visit our website at <http://rma.tsi.com> or contact TSI at:

TSI Incorporated

500 Cardigan Road
Shoreview, MN 55126 USA

Phone: +1-800-680-1220 (USA) or +1 (651) 490-2860

E-mail: answers@tsi.com

TSI GmbH

Neuköllner Strasse 4
52068 Aachen
GERMANY

Telephone: +49 241-52303-0

Fax: +49 241-52303-49

E-mail: tsigmbh@tsi.com

Web: www.tsiinc.de

TSI Instruments Ltd.

Stirling Road
Cressex Business Park
High Wycombe, Bucks
HP12 3ST
UNITED KINGDOM

Telephone: +44 (0) 149 4 459200

E-mail: tsiuk@tsi.com

Web: www.tsiinc.co.uk

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Appendix A

Error Codes

1	Unrecognizable command	The flow meter uses the length of the command and the first few letters (how many letters depends on the command) to recognize a valid command.
2	Number out of range	The number entered as the operand to a command was out of the specified range or unrecognizable.
3	Invalid mode	One or more requested options to a command were invalid.
4	Command not possible	The supplied operands describe a command that is beyond the functional capability of the flow meter.
8	Internal error	An internal failure was detected.

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Appendix B

Factory Default Parameters

Default factory parameter settings of the Series 5XXX flow meters.

Sample Rate	10 ms
Gas Calibration	0 = Air
Flow Units	Standard
Display Update Rate	500 ms
Humidity Compensation.....	On
Directional Sensor.....	On
Triggers	Disabled



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TSI Incorporated – Visit our website www.tsi.com for more information.

USA Tel: +1 800 680 1220

UK Tel: +44 149 4 459200

France Tel: +33 1 41 19 21 99

Germany Tel: +49 241 523030

India Tel: +91 80 67877200

China Tel: +86 10 8219 7688

Singapore Tel: +65 6595 6388

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