

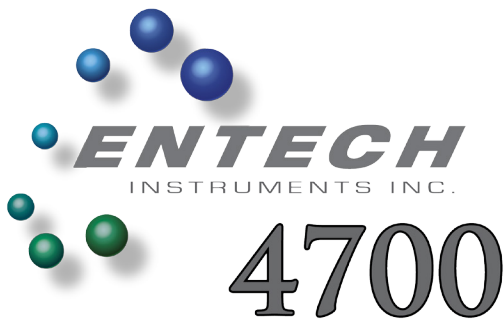


ENTECH
INSTRUMENTS INC.

4700

High-Precision Static Dilution
Standards Preparation System





Theory of Operation

Building on the success of its predecessor, the Entech 4600A, your new Entech 4700 is powered by the latest state of the art, digitally controlled static dilution technology, which sets new standards for precision, performance, reliability and repeatability. Offering all the features of the Entech 4600A, the Entech 4700 features all new user interfaces, offering six easy to use operating modes, six discreet input channels, simple yet powerful method configuration, a seamlessly embedded interactive dilution calculator, real-time status monitoring, analysis and reporting.

The Entech 4700 permits the precise metering-in of up to 5 cylinder standards into 0.5 to 15L canisters. The dedicated front panel Re-Dilute Port enables precise redilution to achieve reliable sub-PPB levels from original PPM level cylinders. With an extremely short, Silonite-D coated flow path, the Entech 4700 eliminates transfer losses while allowing fast cleanup.

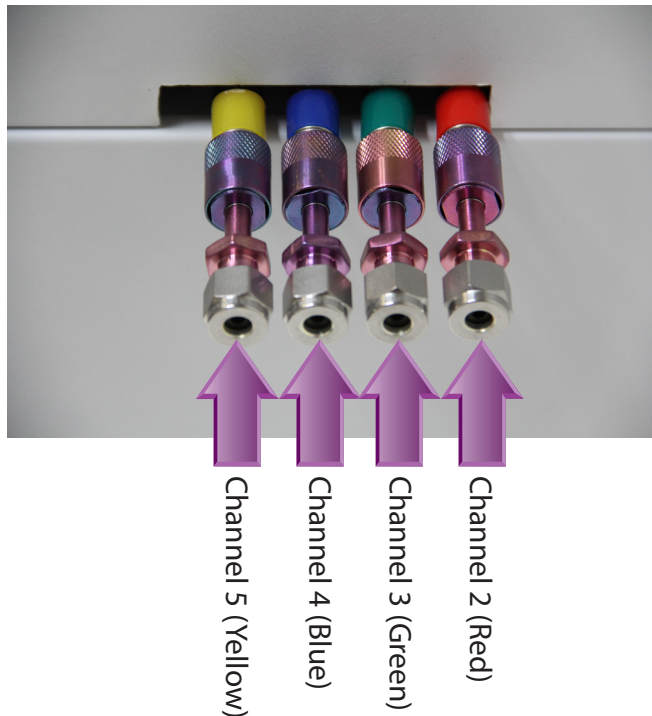
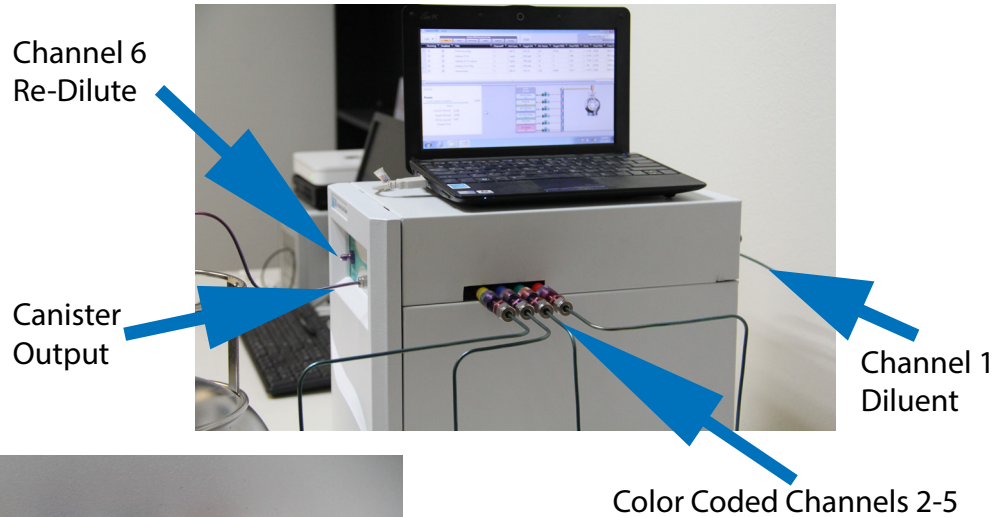
Unlike other automated sample preparation systems, based on digital flow controllers and dynamic dilution technology, the heart of the Entech 4700 is a proprietary Smart Lab 2 technology with an all new high-resolution pressure monitoring circuit, measuring and recording every step of the dilution process. The Entech 4700 is the first device in an all new generation of Entech products, designed from the beginning to support and facilitate the ever increasing demands of the latest methods, implementing good laboratory practices (GLP), with enhanced operational integrity and process documentation for superior instrument calibration and canister testing.

Thank you for choosing the Entech 4700, and congratulations on selecting the most precise, flexible and efficient standard preparation system on the market. For more than 20 years, Entech Instruments has been dedicated to setting and raising industry standards and best practices for whole air sampling and high-precision air analysis.

The Entech 4700 perfectly compliments the Entech product line by supporting the preparation of trace level standards for calibrating EPA Method TO15 laboratory analysis and by creating an economical means of testing sampling canisters for full range recovery.

Input Ports and Connections

The Entech 4700 can be simultaneously connected to up to six inputs and a single output.



Input Channel 1:

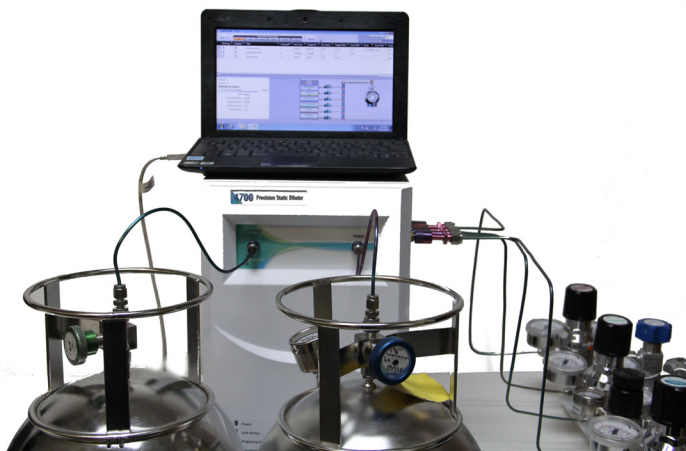
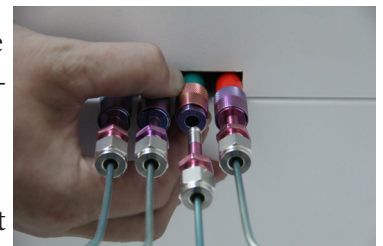
Located on the rear of the Entech 4700, Channel 1 is designated as the Diluent Input and has a larger diameter valve than the other inputs. The diluent is typically UHP Nitrogen or Zero Air, but can also be Helium to support Helium Diffusion Sampling (HDS).

Input Channels 2-5:

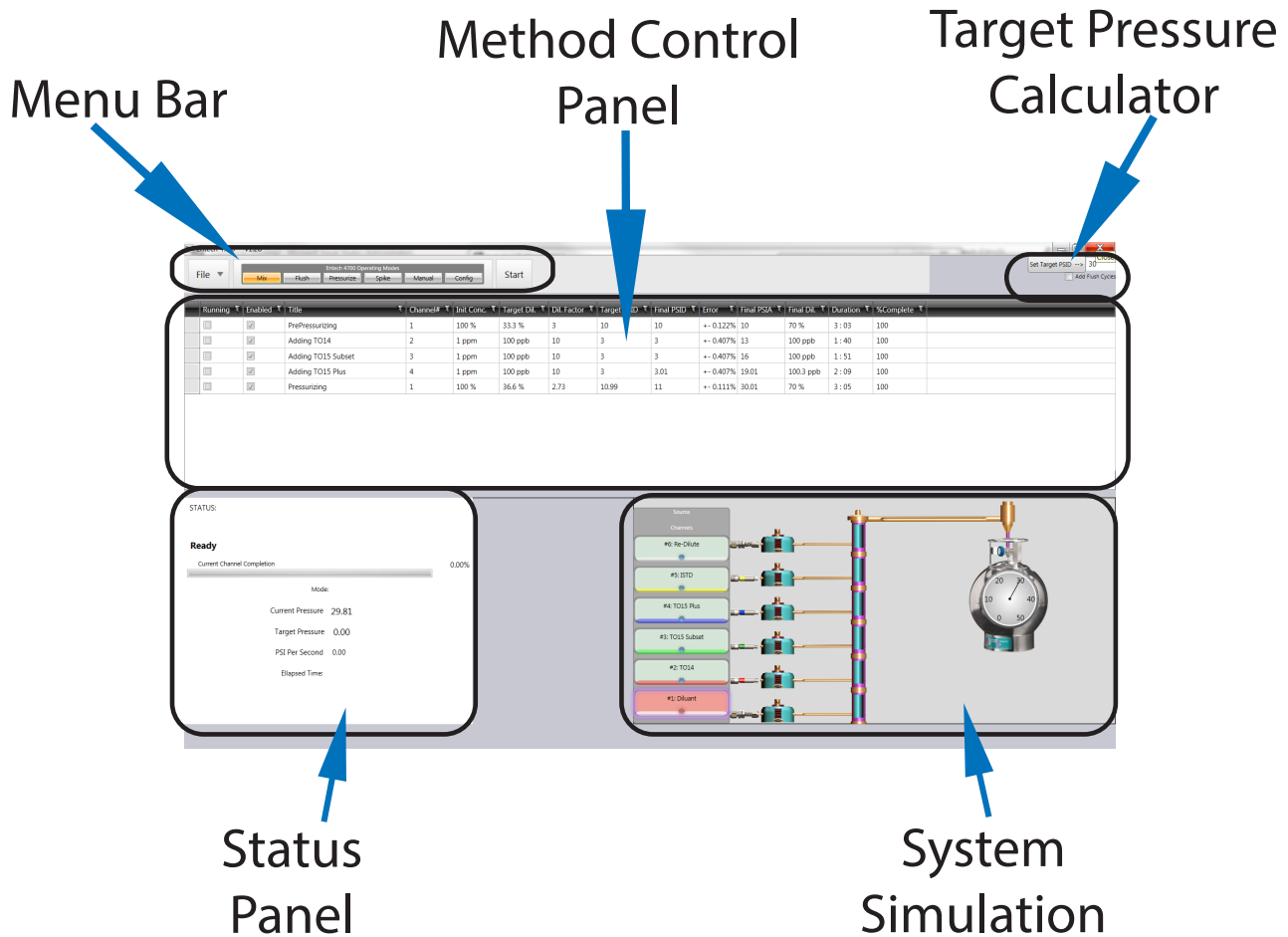
Emerging from the side panel of the Entech 4700, Channels 2-5 feature color coded sleeves and Silonite-D coated micro-valve connectors for secure and easy connection and disconnection of standards' cylinders. This makes it easy to support more than five different standard cylinders.

Input Channel 6:

Located on the front panel, to the left of the Canister Output port, Channel 6 is designated as the re-dilute channel. Channel 6's convenient placement on the Entech 4700's front panel makes it easy to quickly relocate a canister from the output port to the re-dilute input port simplifying the rapid completion of multi-pass dilution processes. This allows accurate preparation of a 0.1 ppb level standard from a 1 ppm level standard using two stages of 100x dilution.



Entech 4700 User Interface



Menu Bar:

Use the Menu Bar near the top-left corner of the screen to switch between operating modes; to clear, load or save methods; and to start or stop method execution.

Method Control Panel:

The controls and layout of the Method Control Panel change based on the current operating mode. The Method Control Panel contains most of the user entry fields and controls for any Entech 4700 operation.

Status Panel:

The Status Panel indicates the current process, operation, canister pressure, flow rate, elapsed time and other real-time status information.

Target Pressure Calculator:

Use the Target Pressure Calculator Panel to view, set and recalculate the target PSI for any mixture method. The Target Pressure Calculator Panel also contains a simple check-box which automatically inserts a flush cycle between each channel in a mixture operation.

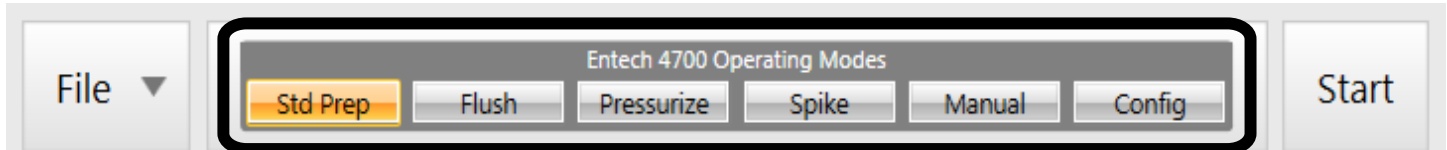
System Simulation Window:

The System Simulation Window shows at a glance the current state of the entire Entech 4700 system. This animated viewport provides a virtual window into the current internal operation and condition of the Entech 4700's manifold, channels and valves.

Six Modes of Operation

The Entech 4700 features six modes of operation. Modes can be selected using the Mode Buttons on the Menu Bar at the top of the Entech 4700 screen.

Each mode offers its own set of controls, which appear in the Method Control Panel area directly below the Menu Bar.



Std Prep Mode:

Standards Preparation Mode allows you to easily define, manage, save, load and execute dilution methods.

Flush Mode:

Flush Mode provides a simple interface to pre-flush all or some of the Entech 4700's six input channels.

Pressurize Mode:

Pressurize Mode offers an easy way to add a set amount of diluent to help pressurize, top-off or precisely dilute the contents of an already prepared standard or sample canister.

Spike Mode:

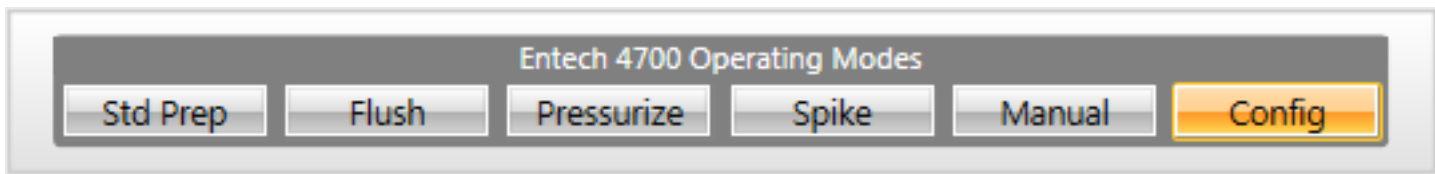
Spike Mode is similar to Pressurize Mode, but is optimized to easily and accurately add a surrogate mix to sample canisters prior to analysis. The surrogate mix can be connected to any one of the Entech 4700's six input channels.

Manual Mode:

Manual Mode permits the user to directly monitor, open, adjust and close any of the Entech 4700's six input channels.

Config Mode:

The Entech 4700 requires very little calibration, configuration or adjustment. Configuration Mode allows you to identify and redefine input port connections, and instantly access the Gain and Zero adjustment parameters for your Entech 4700's high-resolution multi-sampled pressure sensor. It also allows you to easily name, annotate or customize the Entech 4700's automatically generated printed dilution reports and canister labels.



Config Mode

Configuring the Entech 4700 is very simple, and in daily operation is primarily limited to identifying the standards and canisters connected to the Entech 4700's various input channels, and editing the canister identification information, notes and footnotes that will appear on any Entech 4700 generated label or report.

Config Mode also permits the calibration of the Entech 4700's internal high-precision multi-sampled pressure sensor, for any fine adjustments in zero and gain values, and provides a single check-box which allows the operator to force the Entech 4700 to display all target and final concentration data in units of Parts Per Billion, "PPB".

Channel Configuration:

| Channel# | Name | Init. Conc. | |
|----------|-------------|-------------|--|
| 2 | TO14 | 1 ppm | |
| 3 | TO15 Subset | 1 ppm | |
| 4 | TO15 Plus | 1 ppm | |
| 5 | ISTD | 1 ppm | |
| 6 | Re-Dilute | 50 ppb | |

Lock Channel Settings

Units: Force concentration units to PPB

Canister Report:

Canister ID: Can# 16843 Canister Notes: Use before 10/31/14

Report Footer: From the Entech R&D Lab

Pressure Sensor Calibration:

Pressure Gain: 1185 Pressure Zero: 2.1

Channel Configuration:

Lock Channel Settings:

The Lock Channel Settings check-box is normally checked to prevent the operator from inadvertently changing the cylinder names or initial concentration information assigned to each input channel. Unchecking this box, allows you to edit and modify the Channel Configuration Table.

Channel #:

The Channel# fields in each row of the Channel Configuration table identify the corresponding Channel Input Port, ranging from #2-#6.

Name:

The Name fields in each row of the Channel Configuration table allow you to view and change the names representing the standards, cylinders, samples and/or canisters connected to each input port.

Init. Conc.:

The Initial Concentration fields in each row of the Channel Configuration table allow you to view and change the level of initial concentration set for each connected standard, cylinder, sample or canister.

Choosing Input Channels

All Entech 4700 Precision Static Diluters come configured with all 6 input channels installed and operational. Although Micro-QT Valve Quick Connectors are provided to allow any number of cylinders to be swapped in and out, it is recommended that the internal standard channel be dedicated only for your internal standard cylinder.

Since 1PPM levels are common in commercially available cylinder mixes, and laboratories are often required to make standards into the sub-PPB range, there is a chance of a 1 part in 2,000-10,000 carry-over from any given cylinder inlet. This could result in a 0.1PPB-0.5PPB introduction of target compounds into the internal standard if its channel is shared. The only exception is that the surrogate cylinder may be used in the internal standard position if both are shared in every analysis.

Such a carry-over is not an issue when swapping out calibration standards with other calibration standards.

The screenshot displays two main sections of the software interface. On the left, the 'Channel Configuration' window features a table with columns for Channel#, Name, and Init. Conc., and a checkbox for 'Lock Channel Settings'. Below this is a 'Units' section with a checkbox for 'Force concentration units to PPB'. On the right, the 'Canister Report' section includes fields for 'Canister ID' (Can# 16843), 'Canister Notes' (Use before 10/31/14), 'Report Footer' (From the Entech R&D Lab), and 'Pressure Sensor Calibration' with fields for 'Pressure Gain' (1185) and 'Pressure Zero' (2.1).

| Channel# | Name | Init. Conc. |
|----------|-------------|-------------|
| 2 | TO14 | 1 ppm |
| 3 | TO15 Subset | 1 ppm |
| 4 | TO15 Plus | 1 ppm |
| 5 | ISTD | 1 ppm |
| 6 | Re-Dilute | 50 ppb |

Units Option:

Force Concentration Units to PPB

When the Force Concentration Units to PPB check-box is checked, the Entech 4700 will display all concentration values in units of Parts Per Billion.

This option instructs the Entech 4700 to automatically assume a default unit of Parts Per Billion for any user input concentration values where another unit base is not specified. The operator may always override this default by manually typing a valid unit of their choosing. Valid units include PPT, PPB, PPM, PPK, and %. For more information, see the section entitled “Specifying Dilution Values”.

Canister Report Parameters:

CanisterID:

Use the CanisterID field to identify the specific output canister, bottle or sample. This field will print at the top of any label or report, and usually will contain a canister’s serial number or batch number.

Canister Notes:

The Canister Notes field allows you to notate or add any necessary comments or clarifications to a Entech 4700 generated label or report.

Report Footer:

The contents of the Report Footer field will appear at the bottom of any Entech 4700 generated label or report. This field is commonly used to identify the system, department, laboratory or technician.

Pressure Sensor Calibration Parameters:

Gain:

Adjust this value to control the gain multiplier applied to your Entech 4700’s internal pressure sensor.

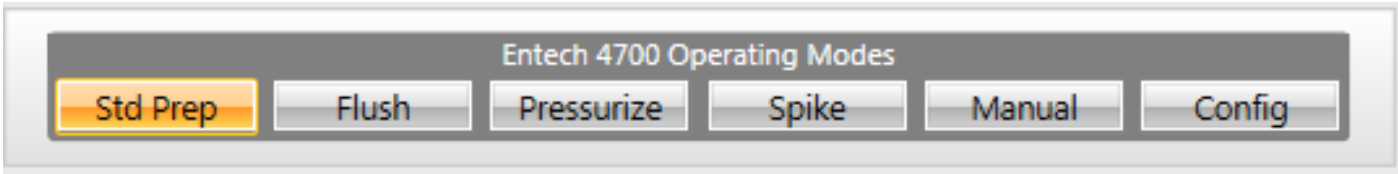
Zero:

Adjust this value to offset the zero position of your Entech 4700’s internal pressure sensor.

Reliability without Sensor Calibration

Small inaccuracies in the zero and gain settings should not impact or offset the precision of your Entech 4700’s standard dilutions.

The Entech 4700 bases its calculations and dilution operations on the use of pressure differentials and ratios, which can mathematically cancel out any errors in zero and gain values respectively .



Std Prep Mode

The primary function of the Entech 4700 is the precision dilution of standards and samples to produce both accurate and documented canister dilutions.

| Running | Enabled | Title | Channel# | Init Conc. | Target Dil. | Dil. Factor | Target PSD | Final PSD | Error | Final PSA | Final Dil. | Duration | %Complete |
|--------------------------|-------------------------------------|--------------------|----------|------------|-------------|-------------|------------|-----------|-----------|-----------|------------|----------|-----------|
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | PrePressurizing | 1 | 100 % | 33.3 % | 3 | 10 | 10 | -- 0.122% | 10 | 70 % | 3 : 03 | 100 |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Adding TO14 | 2 | 1 ppm | 100 ppb | 10 | 3 | 3 | -- 0.407% | 13 | 100 ppb | 1 : 40 | 100 |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Adding TO15 Subset | 3 | 1 ppm | 100 ppb | 10 | 3 | 3 | -- 0.407% | 16 | 100 ppb | 1 : 51 | 100 |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Adding TO15 Plus | 4 | 1 ppm | 100 ppb | 10 | 3 | 3.01 | -- 0.407% | 19.01 | 100.3 ppb | 2 : 09 | 100 |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Pressurizing | 1 | 100 % | 36.6 % | 2.73 | 10.99 | 11 | -- 0.111% | 30.01 | 70 % | 3 : 05 | 100 |

STATUS: Ready

Current Channel Completion: 0.00%

Mode:

Current Pressure 29.81

Target Pressure 0.00

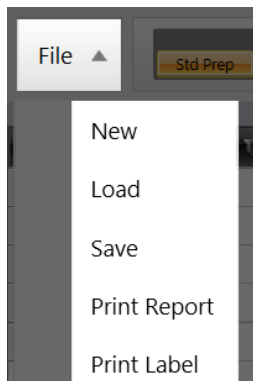
PSI Per Second 0.00

Elapsed Time:

In Standard Preparation Mode, the Method Control Panel presents a large grid or display table that allows you to adjust and define the current standard preparation method or process (A).

Each row (running left to right) of the method table represents a different step in the mixing process. Columns (running top to bottom) are labeled from above and hold specific details of each step in the process. (B)

File Menu



The File Menu at the far left-hand side of the Menu Bar rolls down to reveal the following commands:

New:

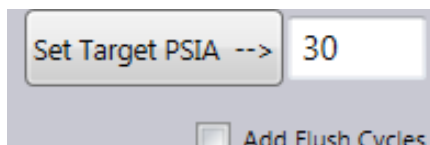
The New Command clears the current method or process and creates a new process with a blank step assigned to every channel. The Channel Names and Initial Concentrations will be inherited from the last method, but can be easily changed by clicking and editing their table entries.

Load:

The Load Command allows you to select and reload previously saved methods. Upon loading, a method file will update and replace all of the data currently in the Std Prep method table. In addition to saving the steps and target dilutions for each channel in the current process, the method files also record the title of each step, which may or may not match the cylinders which are currently configured and connected. Whenever a recorded step title differs from a currently configured cylinder, the current cylinder name will appear in parentheses after the original title.

| | |
|-----------------------------|---|
| Adding Carbonyl (TO15 Plus) | 4 |
|-----------------------------|---|

The saved target PSI value is automatically reloaded as well, but, for safety and to assure the integrity of the method, the Entech 4700 requires the user to verify the target PSI and automatically recalculate the method before enabling the Start button. This is easily accomplished by simply clicking the Set Target PSIA button on the PSI Calculator Panel near the top right of the screen.



Save:

The Save Command, saves the currently defined process to a method file, which can later be reloaded using the Load Command. The Save Command prompts you to choose a file name and location for your method file. Method files may be stored on any hard drive and may be named any name that is supported by your operating system.

Print Report:

The Print Report command sends a printed report of the current process results to a local or network printer.

Print Label:

The Print Label command sends a smaller version of a printed report to a local or network printer. These miniature reports contain all of the information from the full page report, but our formatted to easily fit onto any canister tag with an area larger than 1.75" x 2.75".

| Can# 16843 | Use before 10/31/14 | | | |
|-----------------|---------------------|------------|-------------|------------|
| 0.00 Total PSIA | 9/2/2013 2:50 PM | | | |
| Standard | Target Dil. | Final Dil. | Target PSID | Final PSID |
| TO14 | 20 ppb | | 0.36 | |
| TO15 Subset | 20 ppb | | 0.36 | |
| TO15 Plus | 20 ppb | | 0.36 | |

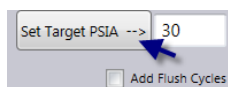
| Running | Enabled | Title | Channel# | Init Conc. | Target Dil. | Dil. Factor | Target PSID | Final PSID | Error | Final PSIA | Final Dil. | Duration | %Complete |
|--------------------------|-------------------------------------|--------------------|----------|------------|-------------|-------------|-------------|------------|------------|------------|------------|----------|-----------|
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | PrePressurizing | 1 | 100 % | 33.3 % | 3 | 10 | 10 | + - 0.122% | 10 | 70 % | 3 : 03 | 100 |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Adding TO14 | 2 | 1 ppm | 100 ppb | 10 | 3 | 3 | + - 0.407% | 13 | 100 ppb | 1 : 40 | 100 |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Adding TO15 Subset | 3 | 1 ppm | 100 ppb | 10 | 3 | 3 | + - 0.407% | 16 | 100 ppb | 1 : 51 | 100 |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Adding TO15 Plus | 4 | 1 ppm | 100 ppb | 10 | 3 | 3.01 | + - 0.407% | 19.01 | 100.3 ppb | 2 : 09 | 100 |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Pressurizing | 1 | 100 % | 36.6 % | 2.73 | 10.99 | 11 | + - 0.111% | 30.01 | 70 % | 3 : 05 | 100 |

The method table, above, demonstrates a simple three part standards preparation process. In this example, three different standards cylinders, connected to input ports #2, #3 and #4, are mixed and diluted in equal parts to fill a 30 PSI canister with a combined 10:1 dilution of TO14, TO15 Subset and TO15 Plus standards.

In this example, the operator has defined the initial concentration of each standard's cylinder to be 1ppm, and has asked the Entech 4700 to automatically regulate the dilution process by introducing the partial pressure from each cylinder to create the final 100ppb combined standard.

The operator could easily modify this method by simply clicking and manually changing many of the fields in the method table. Steps (usually representing channels) may be added or removed from the method table by selecting a row and right-clicking to reveal a pop-up context menu. Steps may also be omitted and removed from the process by deselecting (unchecking) the small check-box labeled Enabled towards the far left of each row.

Simply click on the Set Target PSIA button, found on the Target Pressure Calculator Panel (located near the top right-hand corner of the screen) to automatically organize, recalculate, and recalibrate the current method to accommodate the desired target pressure, as well as the current starting pressure in the output canister.



The Set Target PSIA button must always be pressed to enable or re-enable the Start button, after changing, loading or in any way modifying any parameter of the standard preparation process. The calculations take into account the current pressure in the output canister, so be sure to recalculate after evacuating and reconnecting canisters.

If a method cannot be accurately achieved, under the current circumstances, the Target Pressure Calculator will temporarily disable the Start button to prevent any inadvertent waste of standards.

Method Table Parameters

Running:

The Running check-box, indicates whether a step in the process is currently executing.

Enabled:

If the Enabled check-box is checked, then the specific step will be included in the target pressure calculations and will be executed by the Entech 4700. Otherwise the step will be disabled and removed from the process.

Title:

The Title field, identifies the purpose and contents of each step. This field is set automatically based upon the input channel selected in the Channel# field, but may be changed by the user. Whenever the title of a step does not include the name of the currently connected standard, as defined in the Config Mode, then the standard name will appear in parantheses following the user modified title.

Channel#:

The Channel# field contains a number between 1 and 6, representing the channel number of the input source assigned to each step. Changing the Channel# field will automatically update the Title and Initial Conc. fields accordingly.

Init. Conc.:

The Init. Conc. field represents the initial concentration of the standard in the cylinder connected to the current input channel. This field is set automatically based on the Channel# field, and may only be changed by unlocking and editing the Channel Configuration table in Config Mode.

| Running | Enabled | Title | Channel# | Init Conc. | Target Dil. | Dil. Factor | Target PSID | Final PSID | Error | Final PSIA | Final Dil. | Duration | %Complete |
|--------------------------|-------------------------------------|--------------------|----------|------------|-------------|-------------|-------------|------------|-----------|------------|------------|----------|-----------|
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | PrePressurizing | 1 | 100 % | 33.3 % | 3 | 10 | 10 | +- 0.122% | 10 | 70 % | 3 : 03 | 100 |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Adding TO14 | 2 | 1 ppm | 100 ppb | 10 | 3 | 3 | +- 0.407% | 13 | 100 ppb | 1 : 40 | 100 |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Adding TO15 Subset | 3 | 1 ppm | 100 ppb | 10 | 3 | 3 | +- 0.407% | 16 | 100 ppb | 1 : 51 | 100 |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Adding TO15 Plus | 4 | 1 ppm | 100 ppb | 10 | 3 | 3.01 | +- 0.407% | 19.01 | 100.3 ppb | 2 : 09 | 100 |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Pressurizing | 1 | 100 % | 36.6 % | 2.73 | 10.99 | 11 | +- 0.111% | 30.01 | 70 % | 3 : 05 | 100 |

Interactive Automatic Dilution Calculation

The following three fields are all monitored, linked and interconnected by the Entech 4700's automatic Target Dilution/Pressure Calculator and are dependent upon each other and also dependent upon the value of the Init. Conc. field, which is predefined in Config Mode.

Typically the operator will only enter one of these three values, and the others will be automatically updated to achieve the desired results.

Target Dil.:

The Target Dil. field specifies the desired output target dilution for the specific process step. This value may be set directly by the user, or it will be instantly and automatically calculated by the Entech 4700 based upon the initial concentration and any new values entered into either the Dil. Factor or Target PSID fields.

Dil. Factor:

The Dil. Factor field specifies the requested dilution factor (divisor) required to achieve the desired output target dilution for the specific process step. This value may be set directly by the user, or it will be instantly and automatically calculated by the Entech 4700 based upon the initial concentration and any new values entered into either the Target Dil. or the Target PSID fields.

Target PSID:

The Target PSID field specifies the precise pressure differential by which the output canister shall be increased throughout this step of the dilution process. This value may be set directly by the user, or it will be instantly and automatically calculated by the Entech 4700 based upon the initial concentration and any new values entered into either the Target Dil. or Dil. Factor fields.

Specifying Dilution Values

Dilution values play an important part in the definition, evaluation and documentation of most standards based method, test or calibration processes.

Several fields within the Entech 4700's method tables require concentration values to be entered.

The automatic dilution calculation system, which is integrated throughout the Entech 4700's user interface, makes it very simple and intuitive to specify and describe target concentrations and final concentrations between 100% and 1 part per trillion.

Within the Entech 4700 concentrations are presented and may be entered using any of the following standard notations:

| Suffix | Meaning | Example |
|---------------|-------------------------|----------------|
| ppt | Parts Per Trillion | 50 ppt |
| ppb | Parts Per Billion | 50 ppb |
| ppm | Parts Per Million | 50 ppm |
| ppk | Parts Per Thousand | 50 ppk |
| % | Percent (Parts Per 100) | 50% |

$$0.1\% = 1\text{ppk} = 1000\text{ppm} = 1000000\text{ppb} = 1000000000\text{ppt}$$

When displaying values for the user, the Entech 4700 will try to choose the unit of measurement that most efficiently, yet precisely, represents a given dilution value. There is a check-box located on the Units subpanel in Config Mode, that, when selected, will force all displayed values to appear in units of Parts Per Billion, and make PPB the default unit for data entry.

Entech 4700 operators may enter dilution values using the unit and suffix of their choice, and all values will automatically be converted to a common base within the Entech 4700.

| Running | Enabled | Title | Channel# | Init Conc. | Target Dil. | Dil. Factor | Target PSID | Final PSID | Error | Final PSIA | Final Dil. | Duration | %Complete |
|--------------------------|-------------------------------------|--------------------|----------|------------|-------------|-------------|-------------|------------|------------|------------|------------|----------|-----------|
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | PrePressurizing | 1 | 100 % | 33.3 % | 3 | 10 | 10 | + - 0.122% | 10 | 70 % | 3 : 03 | 100 |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Adding TO14 | 2 | 1 ppm | 100 ppb | 10 | 3 | 3 | + - 0.407% | 13 | 100 ppb | 1 : 40 | 100 |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Adding TO15 Subset | 3 | 1 ppm | 100 ppb | 10 | 3 | 3 | + - 0.407% | 16 | 100 ppb | 1 : 51 | 100 |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Adding TO15 Plus | 4 | 1 ppm | 100 ppb | 10 | 3 | 3.01 | + - 0.407% | 19.01 | 100.3 ppb | 2 : 09 | 100 |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Pressurizing | 1 | 100 % | 36.6 % | 2.73 | 10.99 | 11 | + - 0.111% | 30.01 | 70 % | 3 : 05 | 100 |

Method Table Result Fields

The remaining fields of the method table are read-only fields, updated automatically by the Entech 4700 as it processes a method.

These fields display, track and record the actual achieved results of each step of the dilution process.

Final PSID:

The Final PSID field records the actual pressure differential in the output canister between the start and the final completion of each process and step.

Error:

The Error field indicates the level of precision and certainty which was achieved and recorded in the last execution of a specific step.

Final Dil.:

The Final Dil. field displays the precisely measured final dilution of the standard, sample or diluent gas added from this source channel. The Final Dil. data for every channel is continuously monitored and updated throughout the dilution process, so that it always presents an accurate instantaneous snap shot of the current concentration in the output canister.

Duration:

The Duration field measures and records the total running time which was required to complete the last execution of a specific step.

%Complete:

The %Complete field indicates how much of the specified process step has been completed.

Saving and Printing Dilution Results

Once a process has completed, the final table data can be saved and later reloaded using the commands on the File Menu.

The Print Report and Print Label commands, also on the File Menu, can print a hardcopy report showing the precalculated "target" and measured "final" PSID and Dilution values. Notes, labels and other metadata may be added to the printed report. Use the Config Mode to edit and update this additional data.

Changing and Editing Channel Sources

The name and/or initial concentration of any Channel Source cannot be changed from the Standards Prep Mode.

These settings may only be modified by unlocking and edit the Channel Configuration Table, which is only accessible through Config Mode.

Although a step's Title may be edited in Standards Prep Mode, changing the Title of a step in the Standards Prep Method Table will not change the data contained in the Channel Configuration Table.

The information contained in the Channel Configuration Table is always used internally for the purposes of concentration calculations and any printed labels and reports.

Channel Configuration: Lock Channel Settings

| Channel# | Name | Init. Conc. |
|----------|-------------|-------------|
| 2 | TO14 | 1 ppm |
| 3 | TO15 Subset | 1 ppm |
| 4 | TO15 Plus | 1 ppm |
| 5 | ISTD | 1 ppm |
| 6 | Re-Dilute | 50 ppb |

Std Prep Method Execution

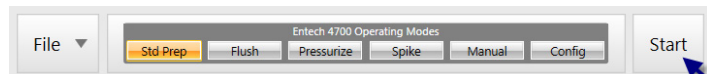
Install and secure an appropriately evacuated output canister to the Entech 4700's output port and turn its T.O. Valve to the open position.

Connect your diluent to the Channel #1 port on the rear panel of your Entech 4700. Set its regulator to no more than 52 PSI and open any necessary valves on the diluent line or tank.

Connect any necessary standards or other cylinders to the input channel ports as designated in the method table.

Check the final PSI shown in the Target PSI Calculator panel and click on the button labeled Set Target PSIA.

After the method table has updated and been validated, and all the PSIDs are properly calculated, then you may click on the large Start button on the Menu Bar.



If the Start button is disabled, missing or "grayed out" then recheck your method, your desired target pressure and the current pressure already in your output canister.

The results fields of the method table, along with the Status Panel and System Simulation Window which make up the lower half of the Entech 4700's user interface, monitor and display the ongoing dilution process as it progresses in real-time.



Disconnecting Cylinders

When performing an Internal Standard Dilution it is best to disconnect any Calibration Standards. Likewise, disconnect the Calibration Cylinders when making a redilution or an Internal Standard mix. The Micro QT Valve Quick Connectors on Channels 2-5 make this very easy.



Once method execution has begun, the Start button changes into an Abort button, which can be clicked to immediately terminate method execution.

Diluent Flush

It is always recommended to clear the manifold by performing a diluent flush before starting any dilution process. The Entech 4700's Flush Mode makes it very easy to perform such a flush.

Standards Preparation Process

The following tutorial demonstrates the process of defining a completely new standards preparation method.

For the purposes of our example, we will ask the Entech 4700 to dilute three different calibration standards into an evacuated canister that should ultimately contain 20ppb of each standard with a final output pressure of 30 PSI.

Recommended Target Pressures

Entech recommends that operators select a final target pressure that is no higher than 30 PSIA when planning to attach these standards directly to any Entech Preconcentration System (including Models 7000, 7100, 7200, 7150, Omni-Sampler or Omni-Sampler Plus)

Higher pressures, up to 50 PSIA, can be achieved using the Entech 4700, but then an ultra clean stainless steel regulator (Entech Part Number # 40-03000) should be used to regulate this down to approximately 20 PSIA.

All pressures in this manual are given in PSI Absolute, when measured within 1000 feet of sea level.

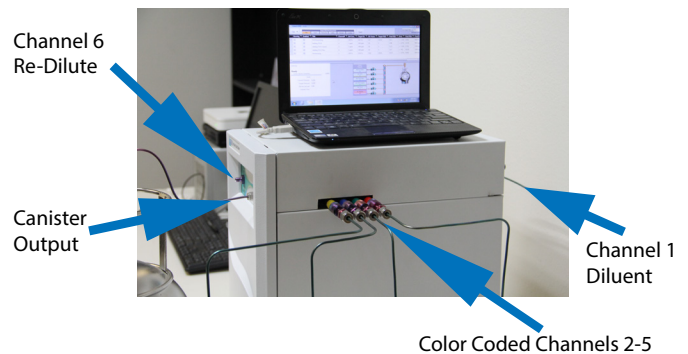
$$\text{PSIG} = \text{PSIA} - 14.6$$

$$20 \text{ PSIA} = 5.4 \text{ PSIG}$$

Most cylinder regulators will measure pressure in units of PSIG, so regulate any higher pressure canister down to about 5 PSIG, before attaching to your Entech Preconcentration System.

To setup for our example:

1. Connect your a 1PPB TO14 cylinder to the red colored Micro QT Quick Connector, Channel #2, on the side of the your Entech 4700.
2. Connect your a 1PPB TO15 Subset cylinder to the green colored Micro QT Quick Connector, Channel #3, on the side of the your Entech 4700.
3. Connect your a 1PPB TO15 Plus cylinder to the blue colored Micro QT Quick Connector Channel #4, on the side of the your Entech 4700.
4. Connect an evacuated canister to the output port on the front panel of your Entech 4700.
5. Be sure your diluent is securely connected to channel 1 on the back panel of your Entech 4700 and that its regulator is set below 52 PSIA.

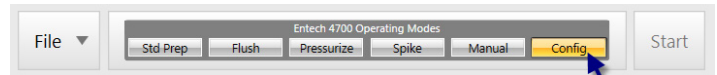


Before creating your new Std Prep Method, verify that the standards are properly configured and labeled, and that the proper initial concentrations are displaying for each standard.

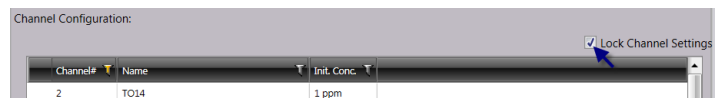
In the screen shot, to the right, you will notice that Channel #4, is indicating a 1 ppm Carbonyl solution. Our example calls for a combination of TO14, TO15 Subset and TO15 Plus, so we will replace Carbonyl with TO15 Plus in our Channel Configuration Table.

| Running | Enabled | Title | Channel# | Init Conc. | Target Dil. | Dil. Factor | Target PSID |
|---------|-------------------------------------|---------------------------|----------|------------|-------------|-------------|-------------|
| > | <input checked="" type="checkbox"/> | PrePressurizing (Diluant) | 1 | 100 % | 33.3 % | 3 | 6 |
| | <input checked="" type="checkbox"/> | Adding TO14 | 2 | 1 ppm | 20 ppb | 50 | 0.36 |
| | <input checked="" type="checkbox"/> | Adding TO15 Subset | 3 | 1 ppm | 20 ppb | 50 | 0.36 |
| | <input checked="" type="checkbox"/> | Adding Carbonyl | 4 | 1 ppm | 20 ppb | 50 | 0.36 |
| | <input checked="" type="checkbox"/> | Pressurizing (Diluant) | 1 | 100 % | 60.2 % | 1.66 | 10.84 |

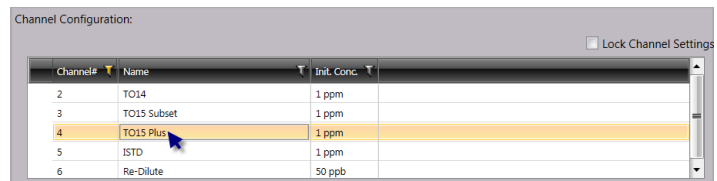
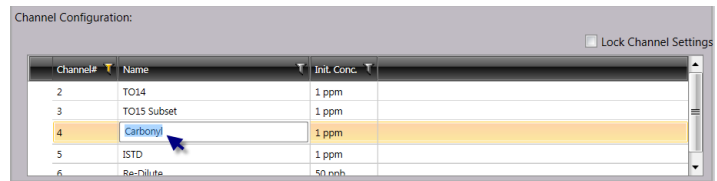
Click the Config Mode button on the Main Menu.



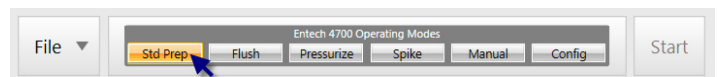
Unlock the Channel Configuration Table by clicking and unchecking the “Lock Channel Settings” check-box, above the top-right corner of the Channel Configuration Table.



Click in the Name column for Channel #4 and change the name to TO15 Plus. In our example session, the initial concentration is already set to 1 ppm, but depending upon your previous configuration you may also need to change the Initial Conc. settings here, as well.

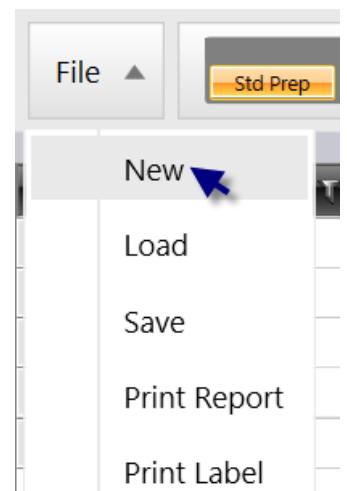


Click on the Std Prep Mode button on the Main Menu, to exit Config Mode and return to Std Prep Mode.



Select New from the File Menu, to the far left-side of the Main Menu. The Entech 4700 will create a new empty method, with a blank row for each input channel.

| Enabled | Title | Channel# | Init Conc. | Target Dil. | Dil. Factor | Target PSID |
|-------------------------------------|--------------------|----------|------------|-------------|-------------|-------------|
| <input checked="" type="checkbox"/> | Adding TO14 | 2 | 1 ppm | 0% | Infinity | 0 |
| <input checked="" type="checkbox"/> | Adding TO15 Subset | 3 | 1 ppm | 0% | Infinity | 0 |
| <input checked="" type="checkbox"/> | Adding TO15 Plus | 4 | 1 ppm | 0% | Infinity | 0 |
| <input checked="" type="checkbox"/> | Adding ISTD | 5 | 1 ppm | 0% | Infinity | 0 |
| <input checked="" type="checkbox"/> | Adding Re-Dilute | 6 | 50 ppb | 0% | Infinity | 0 |



Individual dilution steps may be defined in several different ways. For the purposes of demonstration, we will edit a different field in each of our three steps below. All three of these entry methods produce the same result.

Click on the Target Dil. entry for the row containing TO14, Channel #2. Set the target dilution to 20ppb, then select any other box in the table, or press the Tab or Enter keys on your computer keyboard.

Notice how the Dil. Factor and Target PSID fields are automatically calculated to deliver the requested final concentration.

| Enabled | Title | Channel# | Init Conc. | Target Dil. | Dil. Factor | Target PSID |
|-------------------------------------|--------------------|----------|------------|-------------|-------------|-------------|
| <input checked="" type="checkbox"/> | Adding TO14 | 2 | 1 ppm | 20 ppb | 50 | 0.6 |
| <input checked="" type="checkbox"/> | Adding TO15 Subset | 3 | 1 ppm | 0% | Infinity | 0 |
| <input checked="" type="checkbox"/> | Adding TO15 Plus | 4 | 1 ppm | 0% | Infinity | 0 |
| <input checked="" type="checkbox"/> | Adding ISTD | 5 | 1 ppm | 0% | Infinity | 0 |
| <input checked="" type="checkbox"/> | Adding Re-Dilute | 6 | 50 ppb | 0% | Infinity | 0 |

Click on the Dil. Factor entry for the row containing TO15 Subset, Channel #3. Set the dilution factor to 50, representing a 50:1 dilution ratio, then select any other box in the table, or press the Tab or Enter keys on your computer keyboard.

Notice how the Target Dil. and Target PSID fields are automatically calculated to deliver the requested final dilution ratio.

| Enabled | Title | Channel# | Init Conc. | Target Dil. | Dil. Factor | Target PSID |
|-------------------------------------|--------------------|----------|------------|-------------|-------------|-------------|
| <input checked="" type="checkbox"/> | Adding TO14 | 2 | 1 ppm | 20 ppb | 50 | 0.6 |
| <input checked="" type="checkbox"/> | Adding TO15 Subset | 3 | 1 ppm | 20 ppb | 50 | 0.6 |
| <input checked="" type="checkbox"/> | Adding TO15 Plus | 4 | 1 ppm | 0% | Infinity | 0 |
| <input checked="" type="checkbox"/> | Adding ISTD | 5 | 1 ppm | 0% | Infinity | 0 |
| <input checked="" type="checkbox"/> | Adding Re-Dilute | 6 | 50 ppb | 0% | Infinity | 0 |

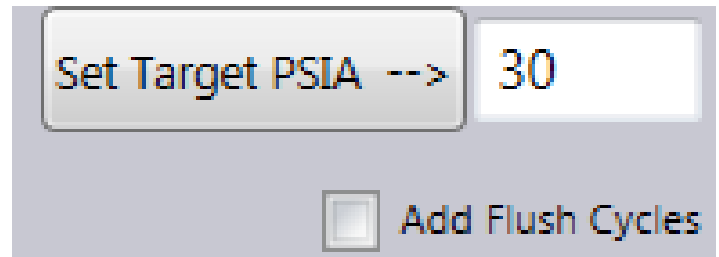
Click on the Target PSID entry for the row containing TO15 Plus, Channel #4. Set the Target PSID to 0.6, then select any other box in the table, or press the Tab or Enter keys on your computer keyboard.

Notice how the Target Dil. and Dil. Factor fields are automatically calculated to match the requested final pressure differential.

| Enabled | Title | Channel# | Init Conc. | Target Dil. | Dil. Factor | Target PSID |
|-------------------------------------|--------------------|----------|------------|-------------|-------------|-------------|
| <input checked="" type="checkbox"/> | Adding TO14 | 2 | 1 ppm | 20 ppb | 50 | 0.6 |
| <input checked="" type="checkbox"/> | Adding TO15 Subset | 3 | 1 ppm | 20 ppb | 50 | 0.6 |
| <input checked="" type="checkbox"/> | Adding TO15 Plus | 4 | 1 ppm | 20 ppb | 50 | 0.6 |
| <input checked="" type="checkbox"/> | Adding ISTD | 5 | 1 ppm | 0% | Infinity | 0 |
| <input checked="" type="checkbox"/> | Adding Re-Dilute | 6 | 50 ppb | 0% | Infinity | 0 |

We are only using three standards in this example, so we can simply ignore the empty entries in the other rows of the table.

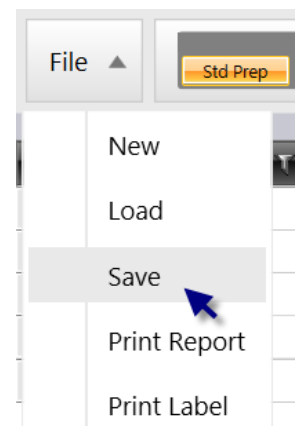
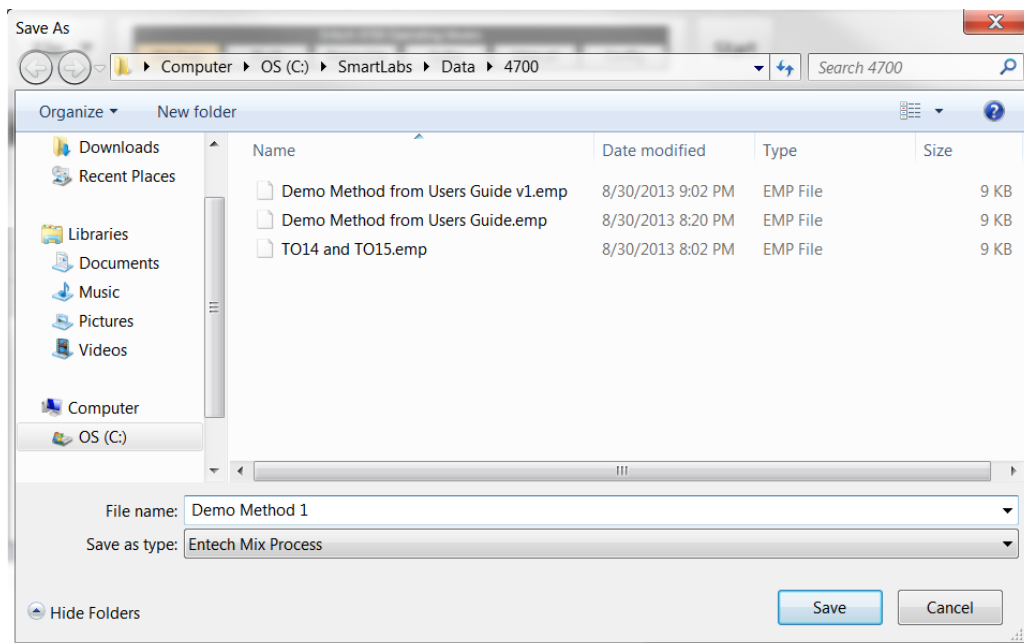
Type the number 30 into the Set Target PSIA box, on the Target Pressure Calculation Panel, and click the Set Target PSIA button. The Entech 4700 will adjust and recalculate the remaining fields of the Std Prep method, taking into account the current pressure contained in any attached output canister.

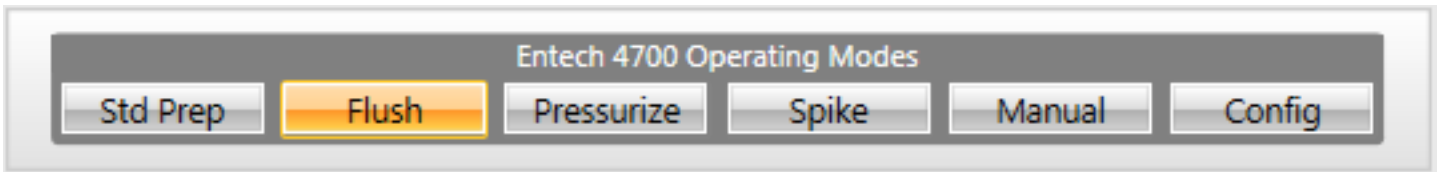


| | Running | Enabled | Title | Channel# | Init Conc. | Target Dil. | Dil. Factor | Target |
|---|--------------------------|-------------------------------------|---------------------------|----------|------------|-------------|-------------|--------|
| > | <input type="checkbox"/> | <input checked="" type="checkbox"/> | PrePressurizing (Diluant) | 1 | 100 % | 45.3 % | 2.21 | 13.57 |
| | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Adding TO14 | 2 | 1 ppm | 20 ppb | 50 | 0.6 |
| | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Adding TO15 Subset | 3 | 1 ppm | 20 ppb | 50 | 0.6 |
| | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Adding TO15 Plus | 4 | 1 ppm | 20 ppb | 50 | 0.6 |
| | <input type="checkbox"/> | <input checked="" type="checkbox"/> | Pressurizing (Diluant) | 1 | 100 % | 48.7 % | 2.05 | 14.63 |

Notice how the Entech 4700 disables and removes any rows representing unused channels, and how it automatically adds and distributes any required pressurizing steps into the method.

Our new method can now be saved, using the Save command on the File Menu. Select Save from the File Menu, and enter a new file name, as shown below.





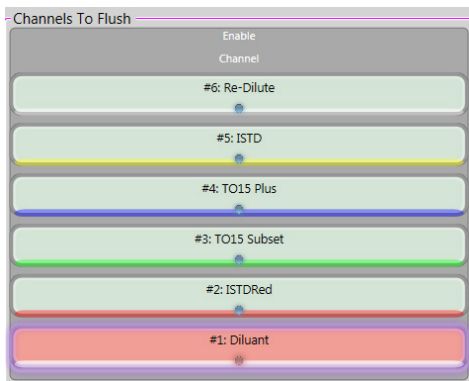
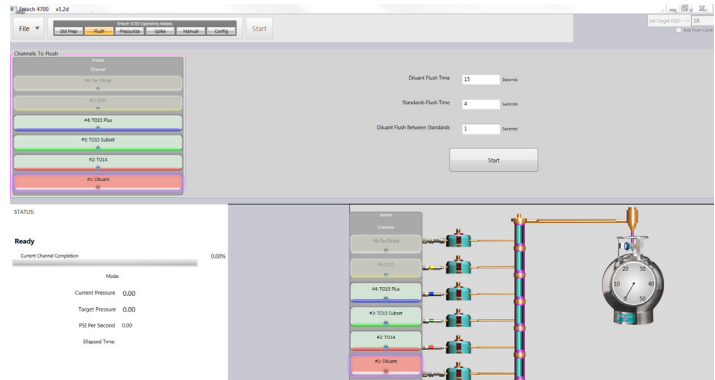
Flush Mode

The Entech 4700’s manifold and input channels are coated with Silonite-D and were carefully designed to minimize the flow path and greatly reduce the possibilities of carry-over or cross-contamination.

After changing, moving or reconnecting canisters and cylinders to any input port, it is still considered good laboratory practice to “prime” or “flush” the input lines, further reducing any unwanted gases or contaminant retention.

Flush Mode automates and simplifies this process.

Upon entering Flush Mode, the method table disappears and a new set of simple controls appear in the Method Control Panel. To the left of Flush Mode’s Method Control Panel, you will see a list of channel markers, which mirror the channel indicators in the System Simulation Window below.



Disabled flush channels, appear faded and “grayed out”, and will be skipped-over during the flush process.

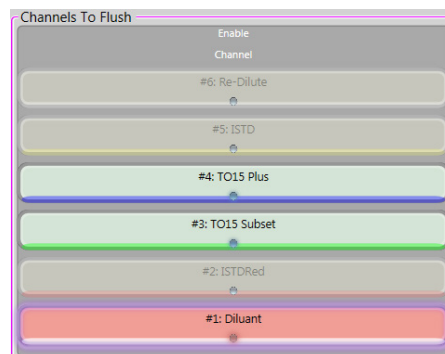
In the screen image to the right, you can see that Channel #3 and Channel #4 are enabled and are ready to be flushed. Channels #2, #5 and #6 are disabled and will be omitted from the next flush process.

Channel #1 of course is always selected in Flush Mode. It will be the first and last channel to flush.

Click on any input channel listed in the Flush Mode’s “Channels To Flush” list to alternately disable or re-enable a specific channel.

Notice that Channel #1, the pre-designated Diluent channel remains at all times enabled and selected when configuring channels in Flush Mode.

A flush process in the Entech 4700 will always begin and end with a flush of diluent through the manifold. Depending upon your selected settings, additional diluent flushes may occur between the flush of each enabled input channel.



Diluant Flush Time 15 Seconds

Standards Flush Time 4 Seconds

Diluant Flush Between Standards 1 Seconds

The Flush Mode Method Control Panel contains three edit boxes, to adjust the timing of the flush process.

Each edit box control represents a value in seconds, indicating how long each channel's valves shall be held open during the flush process.

Each Flush Mode parameter has its own unique minimum and maximum settings which are automatically enforced. Do not over-flush Channels #2-6 as this can unnecessarily waste standard.

The following list describes the three Flush Mode time parameters:

Diluent Flush Time:

The Diluent Flush Time parameter sets the diluent flow time for the first and last diluent flush cycles, which always occur at the start and end of any flush process.

Standards Flush Time:

The Standards Flush Time parameter determines how long the valve for each individual input channel #2-#6 shall be held open during its flush cycle. One by one, each enabled channel, as indicated in the "Channels To Flush" list, will be opened for this amount of time. Any disabled channels will be skipped.

Diluent Flush Between Standards

If the Diluent Flush Between Standards parameter is greater than 0, then an extra diluent flush cycle will be added between each other input channel cycle. This optional feature, allows an extra margin of safety by further reducing any risk of carry-over or cross-contamination.

Once the desired channels have been enabled, and the Flush Mode time parameters are set appropriately, simply remove any output canister from the Entech 4700 and click the large "Start" button on the Method Control Panel, beneath the Flush Mode time parameters to begin the flush process.

Carefully Capture, Vent and/or Exhaust your Entech 4700 in Flush Mode

Flush Mode will attempt to flush or vent a short burst of each enabled input channel's contents to an appropriate ventilation line or directly into the room or workspace.

A line can be connected to the Output Port, on the Entech 4700's front panel, to send the flush gas to a proper vent, containment device or fume hood.

It is strongly recommended that operators carefully consider the chemical contents of their cylinders and canisters, and connect a safe and appropriate capture, exhaust or ventilation line to the Canister Output port on the front panel of the Entech 4700 before commencing a flush process.

Please exercise caution and professional discretion when choosing how to properly and safely capture, exhaust and/or ventilate your materials, samples and standards. Improper application of capture, exhaust and ventilation procedures are not covered and may void the warranty of your Entech 4700, and could potentially result in conditions that may cause carry-over and contamination and may be hazardous, unsafe, unsanitary and/or illegal.

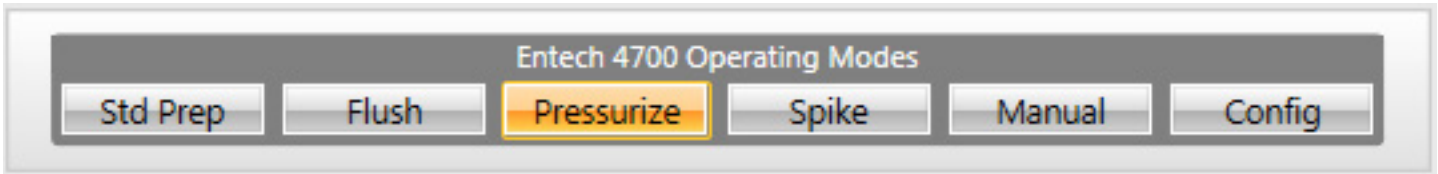
Diluant Flush Time

Standards Flush Time

Diluant Flush Between Standards

Start

Once the flush process has begun, the Flush Mode's "Start" button will change into an "Abort" button which may be clicked at any time to immediately terminate the flush process.



Pressurize Mode

Pressurize Mode makes it easy to directly inflate, top-off or precisely dilute the pressure in an existing canister or sample.

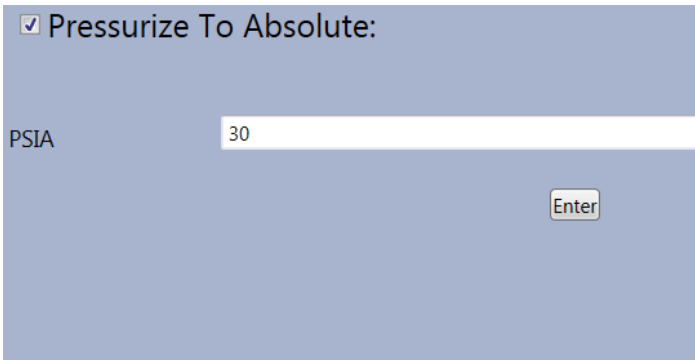
In Pressurize Mode, the Method Control Panel is divided into two separate and exclusively selectable panes. Each pane represents one of the two different common application scenarios for canister pressurization. In the screen shot to the right, notice that the Pressurize By Factor pane is active and visible, while the Pressurize To Absolute pane is unchecked and partially obscured behind a large dark shutter panel.



Check the appropriate check-box near the top of the panel, or click inside the dark semi-transparent shutter box to activate and reveal the control pane that is currently disabled.

The Pressurize To Absolute pane simply contains a single value representing the desired final PSI to which to raise the output canister. To use this mode just enter an appropriate value and click the “Start” button near the bottom of the Method

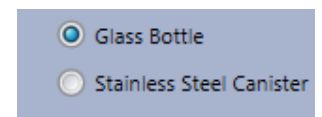
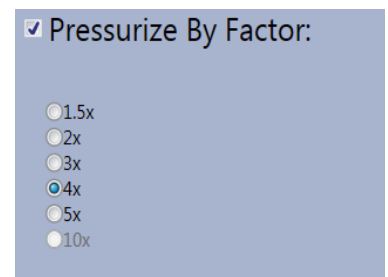
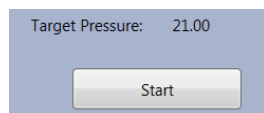
To help reduce the risk of damage or injury from over-pressurization of glass bottles, the Entech 4700 automatically limits pressurization targets in Pressurize Mode and Spike Mode to not exceed 21 PSIA, unless the operator has manually selected the Stainless Steel Canister option. The default container type, Glass Bottles, should be automatically reselected whenever you enter either of these modes, but always verify that your desired pressure target is safe for the container you are using.

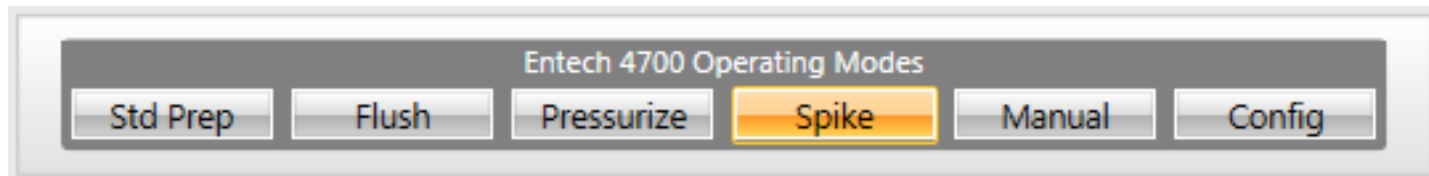


The Pressurize By Factor pane, lists a series of multipliers or factors by which the Entech 4700 can precisely increase the output canister’s pressure.

As seen here, only the valid and possible multiplier values are selectable at any time. In the screen image to the right, 1.5x to 5x are all selectable, but 10x has been temporarily disabled to prevent over-pressurization, when a final value of over 50 PSIA for steel canisters or 22 PSIA for glass bottles would result.

The final target pressure is displayed just above the “Start” button at the bottom of the Method Control Panel.



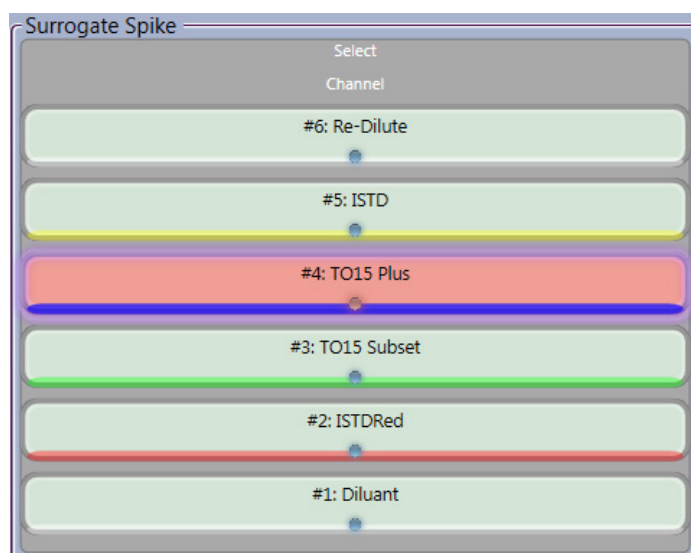
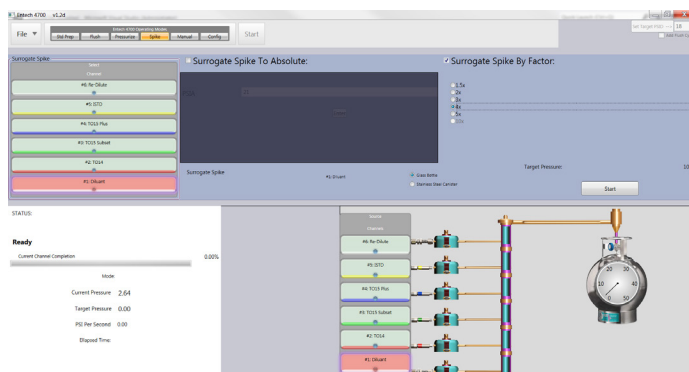


Spike Mode

Spike Mode looks much like Pressurize Mode, but adds an input channel selection list at the far left of the Method Control Panel.

Like the Pressurize Mode, you may configure the surrogate spike operation by either an absolute PSI or by a relative factor using either the Pressurize To Absolute of Pressurize By Factor panes.

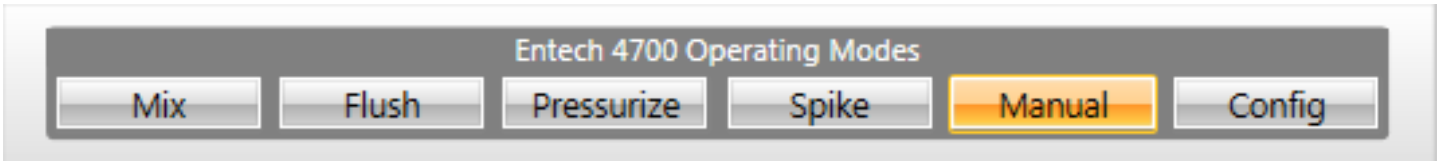
Unlike the Pressurize Mode, however, which always uses Channel #1, as the designated diluent channel, Spike Mode lets the operator specify any of the six input channels, including Channel #6, the front panel re-dilute channel, as its pressurization supply for your Surrogate Spike operation.



Just click on any channel designator in the Select Channel list on the left-hand side of the Spike Mode's Method Control Pane to select a different input source for your Surrogate Spike operation.

In the screen image to the right, notice that Channel #4, labeled TO15 Plus, is selected and highlighted in red on the display. To prevent cross-contamination, only one channel may ever be selected at any given time.

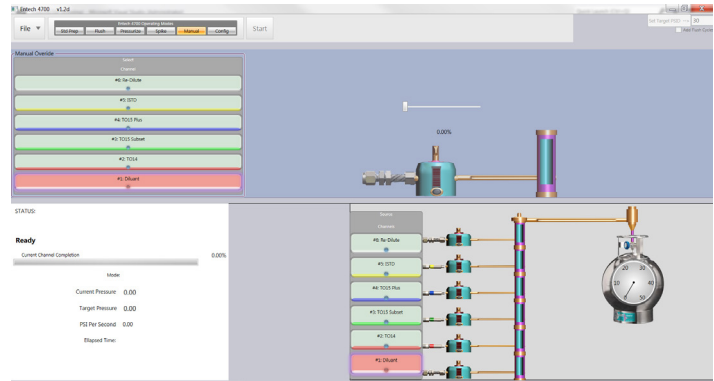
The Entech 4700 will allow the you to choose any possible channel, regardless of its connection state or current pressurization, so be sure to select a channel that is connected and at a high enough pressure to complete your desired operation, before clicking the start button near the bottom of the Method Control Panel.



Manual Mode

The Entech 4700 uses six high-precision digitally controlled proportional valves to carefully regulate the gas flow throughout its dilution and pressurization processes.

Manual Mode allows the operator to select any channel and take direct control of its governing valve. Though this mode is primarily intended for system evaluation, cleaning and maintenance operations. It may if desired be used to enable advanced user controlled dilution and pressurization operations.



Select an input channel from the Select Channel list on the left-hand side of the Manual Mode's Method Control Panel. The selected channel will be highlighted in the channel list, and will glow red or green depending upon its valve opening. To prevent cross-contamination only one input channel may ever be selected or open at any given time.

Note that the magnified simulated cross-section showing the input port, valve and manifold segment update to match the currently selected channel.

Use the slider near the center of the Method Control Panel to manually adjust open and close the selected channel.

