





## Getting Started with WinTXS

1. Work within WinTXS is organized around **projects**. When you start the program it will create a new empty project. Projects can be saved as separate files with XPF extensions, in order to be modified in later use or adopted as templates for other projects.
2. WinTXS stores geometric and technical information about extruders in an encrypted **extruder database**, and physical properties and other material parameters in **material databases**. You cannot modify the extruder database, but you can review, change, add or delete materials specifications in the material databases using the **Material Editor** (menu) included in WinTXS.
3. Action in WinTXS is mostly sequential. To develop a new project you must:
  - **Configure** the extruder.
  - Set the **Processing Conditions**.
  - **Simulate**.
  - Look at the **Results**.

The simulation itself is an internal process and doesn't have a user interface. The other three steps (configure the extruder, set the processing conditions, look at the results) take place each in one of the three main windows of WinTXS: **Configure**, **ProCon** (short of Processing Conditions), and **Results**.

The **Configuration** window is opened automatically each time you start WinTXS or load an existing project, and the **Results** window is opened each time you perform a successful simulation. To set the processing conditions or to simulate a project you must use the menu or the toolbar:

- To open the **Configuration** window: 
- To open the **ProCon** windows: 
- To simulate the project: 
- To open the **Results** window: 

Most WinTXS windows are tabbed and you should proceed (until you master the software) through all tabs sequentially from left to right.

### 4. Configuring the extruder

You also proceed sequentially:

- **Select an extruder**. Choose from a list of available machines.
- **Select a shaft**. Also from a list. This will provide the screw and barrel length you need to configure. If none of the presets provided by WinTXS satisfy you, make your own custom shaft.
- **Configure the screw and the barrel**. This proceeds in a graphical fashion in a window divided in two parts: on top you have a **selection palette** of available components (and a list), on the bottom an **assembly panel** with the shafts.

You **add** items to the sequence by double-clicking on an icon of the component in the selection palette; you watch the screw and barrel configurations growing in an assembly panel. This is all very simple and graphical, analogous to assembling a real extruder by fitting screw elements one by one onto the shafts.

You must learn at least how to **switch** between barrel and screw configuration (switch tabs) and how to **delete** unwanted components from the sequence (double-clicking on them in the assembly panel, not in the palette).

- **Configure the head** (optional). Choose head adapter, breaker plate and die plate from lists of available components. If don't like the offerings, design your own custom breaker plate and die plate. You may also assemble a screen pack, selecting items from a list.

WinTXS has many useful features and tricks to help you configure the extruder, visualize the configuration, and manage your collection of machine configurations. You could learn them by reading the Mini-Manual (forthcoming), or through trial and error by playing with the program, or through a combination of both (our recommendation).

In order to go to the next step you must have a **complete** screw barrel configuration (configuring a head is optional). That is, you must have a barrel and a pair of screws of the proper length. WinTXS will “cap” your screws when they are complete by adding automatically an **end plug** to them.

## 5. Setting the Processing Conditions

Setting the **ProCon** proceeds in another window (click on the toolbar), also divided in two parts: on top you have a series of tabs to select the materials, input the operating conditions, etc. You work by selecting items from lists and/or entering numbers in input boxes. On the bottom there is a graphical representation of the extruder and its operating conditions.

- In the first (**General**) tab you select several options. For the time being, stick to the defaults. Still, you must select at least the number of solid and liquid additives (otherwise, the interface to select them will not be available in the other tabs).
- In the second (**Polymer**) tab you select the polymer resin to process from a list of available items, decide if are going to feed it as solid or as melt, and enter the feed rate (kg/hr). The feed rate corresponds to the polymer only and is the total, wherever you feed it.
- The third tab (**Additives**) is available only if you set their number to something different than zero in the first tab. , Select each solid and liquid additive from a list of available materials and set their feed rates (kg/hr).
- In the fourth tab (**Operating Conditions**) you enter the screw speed (rpm), the barrel temperature profile (barrel by barrel, from a list of barrels) and set the ports. This includes pressure and temperature for all feed and liquid injection ports, as well as pressure for all vent ports (port by port, from a list of ports). You also must enter the head pressure, or, if you have configured a head and wish to simulate the extruder and the head jointly, the head temperature.

- You also may set the operating conditions through the graphical view of the extruder on the bottom panel, by entering data in the corresponding boxes. Notice that, once you select the polymer and the state of the feed (solid or melt), many operating conditions are assigned default values (that you may change).
- Finally, if you have more than one feed opening configured, the fifth tab (**Feed Protocol**) allows you to distribute the feed (polymer and additives) among the existing feed ports.

## 6. Simulating

Once you have set all processing conditions (you know that all conditions are set if you see the **Ready to Simulate** item checked ✓ in the **ProCon Status** panel within the **General** tab of **ProCon**), you may simulate the process (by clicking on the toolbar). You must save the project before simulation (only saved projects can be simulated). If there is a problem with your project, WinTXS will let you know. Otherwise, the next window will open.

## 7. Results

WinTXS presents the results of a process simulation in several ways, selected through tabs in the **Results** windows.

- A **Summary** of results includes the predicted global parameters of the process: exit temperature, fill factor, residence time, specific energy input, etc.
- A series of **Axial Plots** show in graphical form the variation of important processing variables along the extruder: pressure, temperature, etc. You can access the precise numerical values of the processing variables at any point along the extruder (and the differences between any two points) using a **Local Values** mini-box.

If you simulated a head, WinTXS will also show:

- A **Head Simulation Results** table with pressure drop, temperature rise, etc., in each of the configured head components (adapter, screen pack, die, etc).

Advanced features allow you to access a **Mixing Analysis** that includes processing parameters related to extensive and intensive mixing (shear rate and stress, number of material passes over the tips or through the intermesh region between the screws, etc) in each of the fully-filled zones of the extruder, and the residence time distribution (**RTD** tab) in the extruder.

## 8. Comparing Projects

WinTXS allows you to work with several projects simultaneously, each one in its own set of windows. You may compare the configuration, processing conditions, and results of several projects by switching between them.

However, there is a more practical way to compare the results of projects based on the same screw/barrel configuration. The feature is so useful – according to most users – that it may be worth describing it in some detail, even in a *Getting Started* doc.

To compare projects you must *keep* (we don't call this "save" because the data is not permanently saved) the processing conditions and results of the projects you wish to compare. To begin, before

you simulate the first project, check the **Keep ProCon Sets** item in the **Options** menu. Then, set the processing conditions and simulate the process. In the **Summary** tab that opens automatically after a successful simulation, click on the **Keep Set** button on the bottom-left corner, and enter a representative name for the *set*. Pronto: you have kept (or temporarily saved) your first set. Repeat this procedure (setting the processing conditions, simulating, keeping the set) with up to five different projects, *all based on the same screw/barrel configuration* (you may change the head, but if you touch the screw or barrel, the kept sets will be erased and you will have to start all over again). Once all the sets are kept, go to **Axial Plots** in the results window. You see a list of kept sets on the right; you may select up to three projects whose profiles will be displayed in the same plot. You may later print or export this *multi-plot* graphic. The **ProCon** display corresponds to the current set (normally, the last simulated); if you wish to review the data of another kept set, use the **Manage ProCon Sets** button on the **General** tab of **ProCon** to change the current set.

## 9. Saving, Printing, Exporting

As we have mentioned, WinTXS projects can be saved into encrypted files with an XPF extension; saved projects may be loaded and edited (modified) at any time. You can **print** images: the screw/barrel configuration (with or without component names, with or without project information), the processing condition graphic panel, any axial plot (including multi-plots). You may also **export** these images into bitmap files, which may be inserted into documents and presentations. You can also export a text summary of the configuration, processing conditions and results to a text file that may be edited with any word processing software.

## 10. Options

The **Options** menu includes many settings that change the way WinTXS performs most of its functions, adding new functionality and enormous versatility to the software. Options go from cosmetic (changing the colors of the screw components in the configuration screen) to fundamental (options that affect the process model used to simulate the extruder or the parameters of the numerical procedures used by the WinTXS simulation engine. A discussion of the many options available to the user is beyond the scope of the document.

## 11. Materials

To simulate a process, WinTXS requires a complete set of physical properties and material parameters for all materials involved in the process: polymer resins, solid additives and liquid additives (for the forthcoming *Blending* and *Devolatilization* modules, materials will include binary blends and volatile impurities). Material specifications, stored in material databases, can be reviewed and edited (modified, added, deleted) using the WinTXS **Material Editor** that you access through the **Materials** menu item. You may also create your own databases and transfer materials specifications between databases.