

# *Optimising your test method*

The ultimate guide  
for more efficient and  
accurate texture analysis

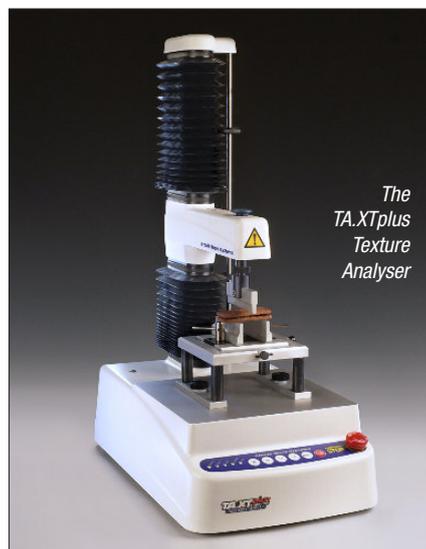
**Stable Micro Systems**

# OPTIMISING YOUR TEST METHOD

## INTRODUCTION

Once your Texture Analyser is installed and you understand the basis of how the Texture Analyser performs tests, you will soon wish to accelerate your understanding of texture analysis and how to obtain the best testing approach. You may already be a proficient user of the Texture Analyser, however, and just need to confirm your test protocols are optimised.

This document will help you in finding the most suitable texture analysis method, obtaining the most repeatable results and testing out your method's success. Critical points on sample preparation and testing environment are also covered so that you get the best information out of your available sample with the best possible accuracy.



The TA.XTplus Texture Analyser

## CHOOSING THE MOST SUITABLE TEST METHOD AND TEST ADVICE

### Which test, what settings?

By clicking on *Help > Education Zone*, you will see that you have a wealth of background information at your disposal (as shown below).

The Education Zone contents menu is divided into four main sections:

- TEST** (Select Test Method):
  - By Product Type
  - By Probe/Fixture
  - By Textural/Physical Property
  - According to a Standard Method (ISO)
  - Measure more than Force
- ANALYSE**:
  - Data Analysis Techniques
  - Sample Macros
  - Sample Projects
  - Sample Basic Scripts
  - Advanced Techniques
- LEARN**:
  - Introduction to Texture Analysis
  - Published Papers using the TA.XT2/TA.XTplus
  - Library Tests Available
  - Tutorials and User Tips
  - Frequently Asked Questions
- WATCH & REQUEST**:
  - Video Clip Library
  - YouTube Channel
  - Link to Website
  - Request Help
  - Request a Brochure

Typical pages shown include:

- APPLICATION GUIDE**: A grid of materials and products such as Adhesives, Cosmetics, Pharmaceuticals, Food, and Electronics.
- TEST METHODS FOR BAKERY**: A page with a 'Click here for an overview of Testing Attachments for Bakery Products' button.
- Application Study for TA.XTplus TA.HD.plus TA.XTExpress**: A detailed page for 'MAYONNAISE' with the objective 'Comparison of penetration forces and consistency of full-fat and low-fat mayonnaise using a cylinder probe'. It lists TA Settings (Mode: Measure Force In Compression, Pre-Test Speed: 1.0 mm/s, Test Speed: 1.0 mm/s, Post-Test Speed: 10.0 mm/s, Distance: 10mm, Trigger Type: Auto - 10g, Tare Mode: Auto, Data Acquisition Rate: 200pps) and an Accessory: 25mm Cylinder Probe (D75) using 5kg load cell.

Education Zone contents menu screen and typical pages

Your first priority might be to find a suitable method for your particular sample. If your company already has a Texture Analyser, we recommend that you contact the Texture Analyser operator to check whether there are any Company Standard procedures already developed for the product that you need to test.

Alternatively, if you are looking for guidance on setting up the testing of your sample for the first time choose 'Select a Test Method > By Product Type'.

This will bring up a window asking you to select the industry into which your sample fits, followed by a set of *Application Studies* that have been provided as a 'starting point'.

Within an *Application Study*, the

'Load Project' button will transfer all of the settings and analysis for your chosen test into *Exponent* ready for you to use.

You may also wish to search for methods that use a particular probe that you may have so 'Select a Test Method > By Probe/Fixture' or by the property that you wish to measure 'Select a Test Method > By Textural/Physical Property'.

## Standard Method

You may have been asked to follow a specific Standard Method to test your samples; e.g. ISO Gelatine Bloom Strength, AACC Bread Freshness, AACC Pasta Firmness, ASTM Petroleum Wax Firmness, ASTM Adhesive Peel Strength...

## Imitative test

If you're not bound by any existing constraints and are looking for the simplest testing solution, sometimes the easiest approach is to set up a test that closely imitates the way the product is evaluated in real life. This is called an 'Imitative Test' (typical examples are shown below). This type of test can sometimes make data interpretation easier for you to understand.

### STANDARD METHODS

The following Organisations have standard methods which refer to the use of a texture analyser/tensile testing machine.

- ▣ [AACC](#) (American Association of Cereal Chemists)
- ▣ [AIB](#) (American Institute of Baking)
- ▣ [ASTM](#) (American Standard Testing Methods)
- ▣ [FINAT](#) (International Organisation for the Self Adhesive Labelling Industry)
- ▣ [PSTC](#) (Pressure Sensitive Tape Council)
- ▣ [AFERA](#) (the European Association for the Self Adhesive Tape Industry)
- ▣ [EN/ISO](#) (European Norm/International Standards Organisation)
- ▣ [GMIA](#) (Gelatine Manufacturers Institute of America)

### FOOD STANDARDS



Imitative test examples: Upper row from left: Aerosol actuation force; Inhaler actuation force; Lipstick break strength; Toothpaste tube contents expulsion force. Lower row from left: Hair combing force; Syringe contents expulsion force; Bread softness (V Squeeze) test; Melted cheese extensibility test.

## Free online Test Advice

If you are still having difficulty choosing a suitable test method for your product, we can of course give you advice, which may be obtained either by clicking on 'Request Help' (in the Education Zone), clicking on 'Testing Advice Service' as you enter your Exponent software or by going directly to the Support section of our website: [www.stablemicrosystems.com](http://www.stablemicrosystems.com)

**Download a Texture Analysis Screensaver**

 <b>Newsletter Request</b>	 <b>Events &amp; Courses</b>
 <b>Request a Manual</b>	 <b>Testing Advice Service</b>
<a href="#">Link to Video Channel &gt;&gt;</a>	<a href="#">Join a User Network &gt;&gt;</a>
<a href="#">Poster/Article Request &gt;&gt;</a>	<a href="#">Brochure Request &gt;&gt;</a>

**Support**

**Testing Advice Request**  
Please check the appropriate form and fill in your details on the form below along with any other message you would like to send us.

Which software package are you currently using?

Exponent    
  Exponent Life    
  Exponent Life Express

Name:   
 Surname:   
 Company:   
 Product:   
 Address:   
 Phone:   
 Email:

Please note: All of the contact forms will be processed by your request to the website.  
 The email addresses for marketing purposes will not be provided to the Exponent website.

**Submit**

## CHOOSING THE BEST TEST TYPE

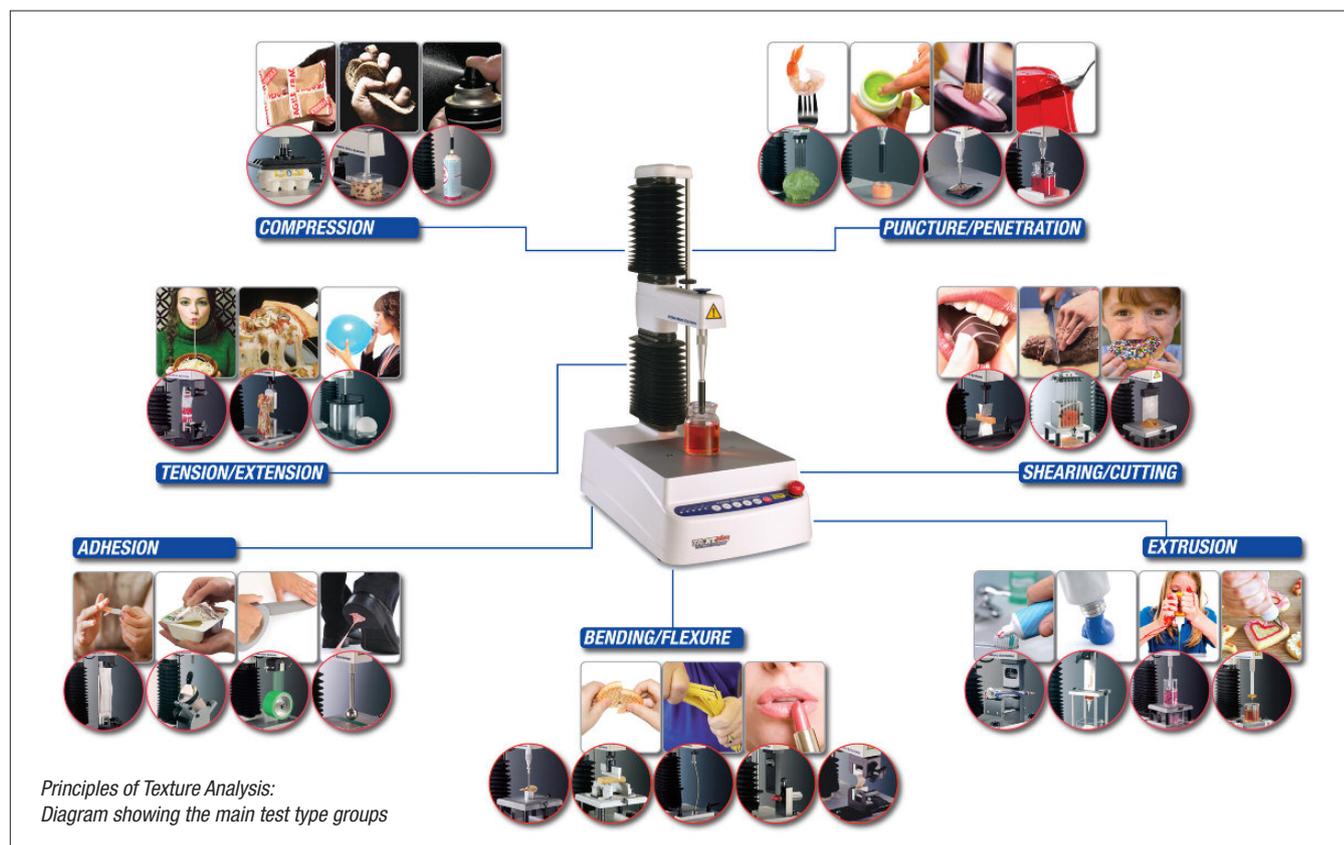
When deciding which test to use, ask yourself the following questions...

- What type of product is this – e.g. Self-supporting, semi-solid, homogeneous, multi-particulate?

Sample Characteristics	Example	Test Type
Regular friable solid	Cracker	Three point bend
Irregular friable solid	Potato crisp	Penetration
Irregular compliant solid	Vegetables	Shear
Homogeneous semi-solid	Gel	Penetration
Plastic solid	Butter	Penetration
Spongy solid	Bread	Compression
Viscous liquid	Syrup	Extrusion
Bulk friable solids	Crispies	Bulk compression
Bulk compliant solids	Meat pieces	Bulk shear

- Is the test trying to simulate/imitate an action – e.g. biting, pushing a finger into, bending, stretching?
- Does the test need to be destructive or not?
- Is sample preparation difficult/do perfect dimensions need to be considered?
- Does temperature need to be controlled?

Generally, the test that you choose to use will fall into one of the testing categories below. Once your test principle is chosen, you will probably have a number of fixture options within that principle to consider. For example, if you wish to perform a shearing test, you will need to consider whether you require a single blade or multiple blade – which would be necessary if your product is not homogeneous, so as to provide an average measurement over multiple regions of your product. You should also consider blade width, depth and thickness which will depend upon the width, height and consistency of your product.



Every one of these principles has been successful with some products, but no principle has been successful with all products. It is important to identify as early as possible the correct test principle that should be used for each particular application. Considerable time can be wasted if an incorrect test principle is used.

## POINTS TO NOTE ON METHOD CHOICE



### Testing Adhesive Products

In order to measure Adhesiveness, the product needs to be held down upon probe/fixture withdrawal, otherwise purely the weight of the product will be measured.

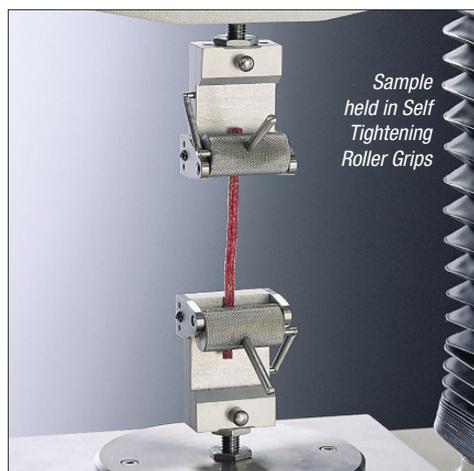
The *Confectionery Holder* provides one means of sample securing, but limits the test to penetration through a 10mm hole.

Alternative simple approaches are also recommended; e.g. glueing the sample to a disposable surface which can be held down, or setting the product (e.g. gel) to a self-adhesive backed velcro.

Occasionally the adhesion of a material to the sample needs to be measured. The *Flexible Substrate Clamp* provides a means of

supporting the material (e.g. sweet wrapper) whilst the slotted *Adhesive Indexing Plate* holds down the sample.

For more advice on adhesive property testing, request from us the document '*Tips & Tricks for Successful Adhesion Testing*' or '*Tips & Tricks for Successful Mucoadhesion Testing*' by contacting [app.support@stablemicrosystems.com](mailto:app.support@stablemicrosystems.com)



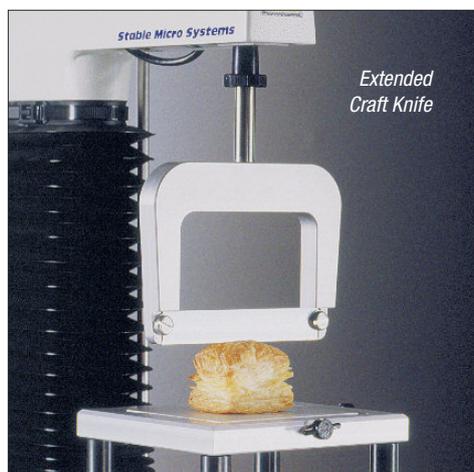
### Measuring Tensile Properties

In tensile experiments, the sample length should be at least twice the width.

When measuring tensile properties, the sample needs to fail in the exposed region of the test piece rather than where it is being clamped.

Protection of sample ends may be necessary by e.g. surrounding in other material onto which the grips clamp, or freezing sample ends in liquid nitrogen.

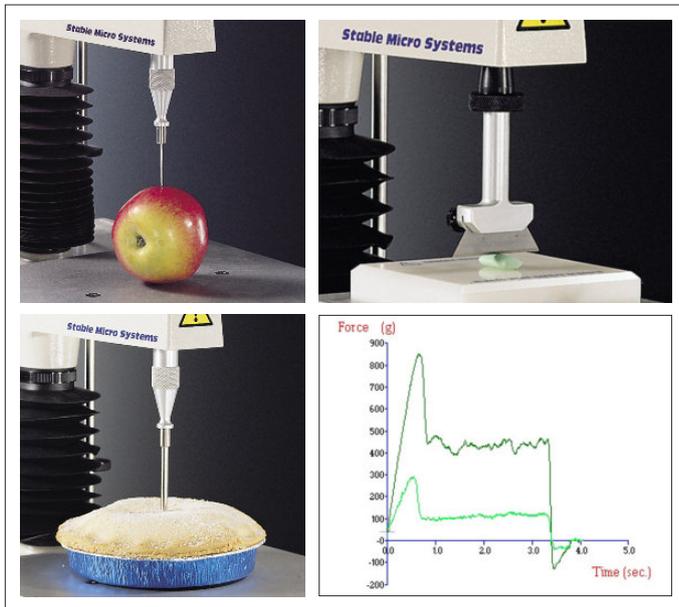
For more advice on tensile property testing, request from us the document '*Tips & Tricks for Successful Tensile Testing*' by contacting [app.support@stablemicrosystems.com](mailto:app.support@stablemicrosystems.com)



### Testing Brittle Products

When testing a brittle/laminated product e.g. puff pastry, a thin, sharp contact between the probe and product is necessary to avoid a compressive action and capture detail of the variable structure.

For more advice on fracturability property testing, request from us the document '*Tips & Tricks for Successful Fracturability Testing*' by contacting [app.support@stablemicrosystems.com](mailto:app.support@stablemicrosystems.com)



## Testing Products with a Shell, Crust or Skin

The collection of detail of a thin, brittle, laminated or multi-phased structure is best performed with a small diameter probe or thin, sharp fixture.

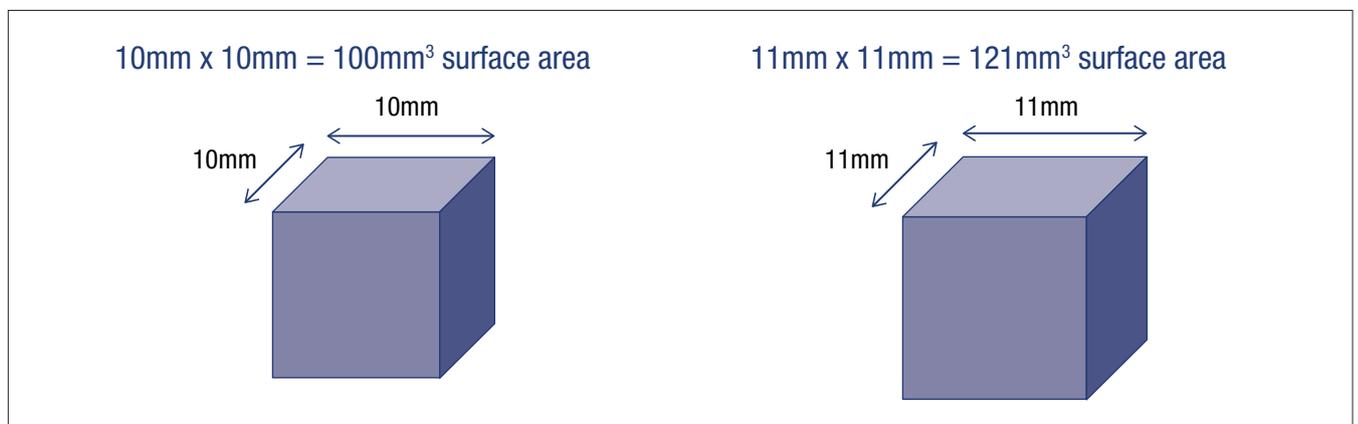
## SAMPLE PREPARATION GUIDELINES

As with all sample testing, attention to the repeatable preparation of your samples could make all the difference in the accuracy and repeatability of your results. Here are a few guidelines to consider:

- Choose representative samples (be aware of segregation particularly for multi particle samples). Samples with structural defects should be avoided or if tested, high variation in results must be expected.
- Multi-particulate samples are suited to bulk testing

to get an averaging effect particularly where the pieces differ in size and shape. If you would like more advice on 'Testing Non-Homogeneous and Non-uniform Products', please request this article by contacting [app.support@stablemicrosystems.com](mailto:app.support@stablemicrosystems.com)

- Semi-solid materials should be tested in their original container, where possible, to avoid structural changes before testing.
- Maintain controlled test conditions, particularly temperature, for comparison purposes. Samples such as gels and fats will require temperature control immediately prior to testing and in some cases temperature control may be necessary during testing (depending upon the sample's sensitivity, the ambient temperature and the duration of the test).
- If performing a penetration test, avoid penetrating the sample within the 'fracture zone' of another test site.
- Consider whether the sample has a 'direction'. For example, meat fibres are aligned in a particular direction, manufactured materials may have a rolling direction, fruits and vegetables are usually anisotropic. In these instances, the directional alignment and location of testing will need to be considered.
- A small difference in dimensions when performing certain tests, e.g. compression/cutting tests, can make a large difference in surface area which will have an immediate effect on the likely % variation in results. Larger samples have a lower effect on sample dimension differences. For example, if you are preparing a cube of surface area 10mm x 10mm and instead present for testing a cube of surface area 11mm x 11mm, this will result in a cross-sectional area increase of 10%. Subsequently, even before testing, you could expect to get a 20% higher result for this larger surface area – this is without any + or – error due to sample differences.



Various sample preparation tools, such as a *Core Borer* or *Twin Blade Sample Preparation Tool*, are available to assist in the repeatable preparation of samples.

Foods might be classed into two groups, depending on the relative ease with which texture can be controlled:

- **Native foods** are those foods in which the original structure of the agricultural commodity remains essentially intact. With these foods the food technologist has to take what nature provides in the form of fruit, fish, meat, poultry, vegetables, etc. and can only change the texture by processing methods such as heating, cooling, and size reduction. Usually there is almost no direct control over the composition of these foods, although with some of them it is possible to partially control the composition and texture by breeding, time of harvest, and cultural factors. These products have inherent variability and as such texture measurement results may be subject to large variations. Testing one strawberry on its own and then testing another from the same plant, picked on the same day, often gives surprisingly different results. For this reason, these types of products are most frequently recommended to be tested in 'bulk', i.e. where a certain weight or number of pieces of sample are included within one test, providing an averaging effect.
- **Formulated foods** are those foods that are processed from a number of ingredients to make a food product that is not found in nature. Many native foods are transformed into ingredients for formulated foods, but in doing so the native plant or animal structure and organisation is usually lost. Examples of this type of commodity are bread, ketchup, ice cream, jellies, mayonnaise, candy, cheese, margarine and sausage. With this class of commodity, it is possible to change the formulation by the number, amount, and quality of ingredients that are used in addition to processing variables. Hence there are more options available to control the texture of the finished product and to develop specified textures and structures not found in native foods.

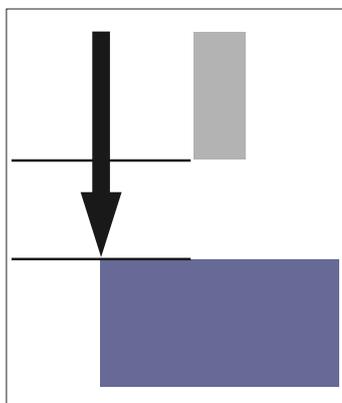
In summary, when something is manufactured, you are measuring the effects of ingredients, processing variables, storage effects, etc. When something is natural – it is what it is and if the variability of the results is high it is not to be confused with using the wrong method or settings, or measurement failure of your Texture Analyser.

## CHOOSING THE BEST TEST SETTINGS

### Pre-test Speed

The probe begins to move from its start point towards the sample at the pre-test speed.

T.A. Settings:- 1 RETURN TO START		
Sequence Menu (Click to see options)		
Caption	Value	Units
Test Mode	Compression	
Pre-Test Speed	1.00	mm/sec
Test Speed	2.00	mm/sec
Post-Test Speed	10.00	mm/sec
Target Mode	Distance	
Distance	5.0	mm
Trigger Type	Auto (Force)	
Trigger Force	5.0	g
Advanced Options	Off	

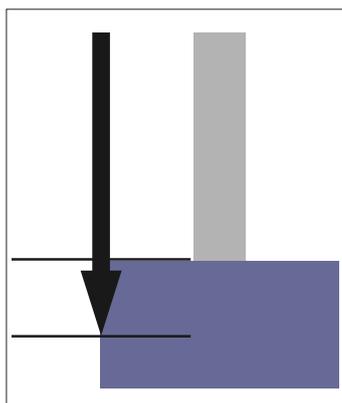


When trying to find a trigger force, your pre-test speed should really not exceed 3mm/sec for best initial data capture and the most accurate starting point. A fast approach can lead to a late trigger (or 'overshooting') with the probe entering the sample before data is being collected. Usually the pre-test speed is slower than the test speed.

### Trigger Force

When the probe registers a force equal to the trigger force, the speed changes to the test speed and the system starts to collect data. This should occur when the probe and product have full contact. The default value for trigger force is set to 5g, but may need to be adjusted.

T.A. Settings:- 1 RETURN TO START		
Sequence Menu (Click to see options)		
Caption	Value	Units
Test Mode	Compression	
Pre-Test Speed	1.00	mm/sec
Test Speed	2.00	mm/sec
Post-Test Speed	10.00	mm/sec
Target Mode	Distance	
Distance	5.0	mm
Trigger Type	Auto (Force)	
Trigger Force	5.0	g
Advanced Options	Off	



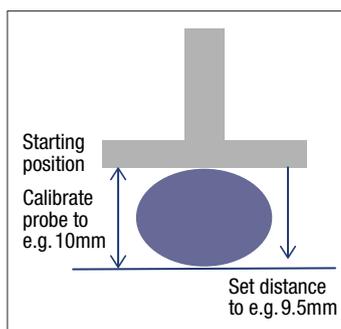
Trigger force depends on:

- Sample hardness – a very hard sample may require a slightly higher trigger force.
- Sample softness – a very soft sample probably needs a very low trigger force.
- Probe size – you will need to consider the increased contact area.
- Whether the sample has a flat surface or not – an uneven surface may cause an early trigger.
- The load cell that is installed in your Texture Analyser – this may have an effect on the success of trigger force you wish to find.

We suggest that you start with a trigger force set to 5g and test your softest sample first. As the test commences, watch to see if full contact between the probe and the sample is obtained before you ‘hear’ the change to the test speed.

### Using a button trigger

T.A. Settings:- 1 RETURN TO START		
Sequence Menu (Click to see options)		
Caption	Value	Units
Test Mode	Compression	
Test Speed	2.00	mm/sec
Post-Test Speed	10.00	mm/sec
Target Mode	Distance	
Distance	5.0	mm
Trigger Type	Button	
Advanced Options	Off	



A button trigger is often chosen when testing products of differing heights or very thin materials, e.g. granules, or bulk compression tests.

The probe/fixture should be calibrated and the starting point of the test must remain the same each time.

Choosing a button trigger avoids, for example, touching the base of the Texture Analyser when using a knife blade.

Tests are performed to the same distances of compression with respect to the surface against which you have calibrated the probe.

### How to use a button trigger?

Calibrate the probe and return to the required starting point of the test. You can save this position as Position 1 within the probe control window for quick positioning between tests.

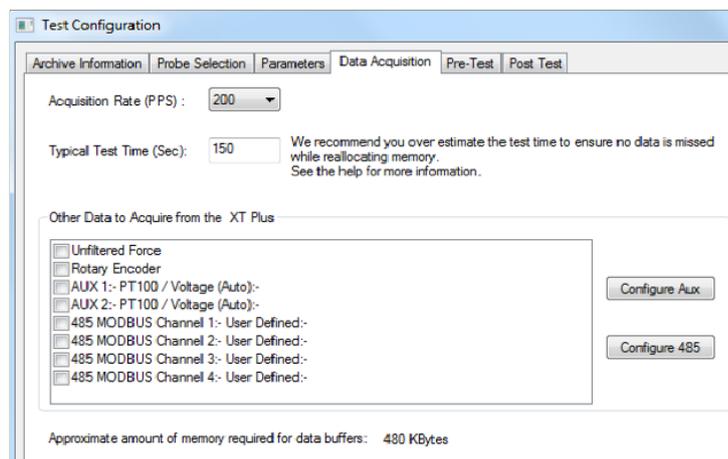
When choosing the distance of compression, choose a distance smaller than that between the base and the starting position (therefore the probe/blade will not overload by touching the base)

### Post-test speed:

T.A. Settings:- 1 RETURN TO START		
Sequence Menu (Click to see options)		
Caption	Value	Units
Test Mode	Compression	
Pre-Test Speed	1.00	mm/sec
Test Speed	2.00	mm/sec
Post-Test Speed	10.00	mm/sec
Target Mode	Distance	
Distance	5.0	mm
Trigger Type	Auto (Force)	
Trigger Force	5.0	g
Advanced Options	Off	

Once the target distance is achieved, the probe/fixture usually returns to its starting point at the post-test speed (i.e. Return to Start test). For the majority of samples (e.g. compression/puncture), the information from the withdrawal of the probe is irrelevant – in this case, it makes sense to return to the start at a high speed to save time between tests. However, when measuring parameters such as stickiness, consistency (in a back extrusion test), the post-test speed then needs to be considered. As a general rule, speeds of 10mm/s – 40mm/s encourage separation of ‘sticky’ products (where adhesiveness is to be measured) whereas 1-2mm/s is preferred for viscoelastic materials as it encourages flow (where consistency is to be measured).

## Data Acquisition Rate



Data Acquisition Rate is the speed at which data is collected during a test. High rates are important for fracture and adhesive tests as these tests are usually short or associated with events that occur very quickly.

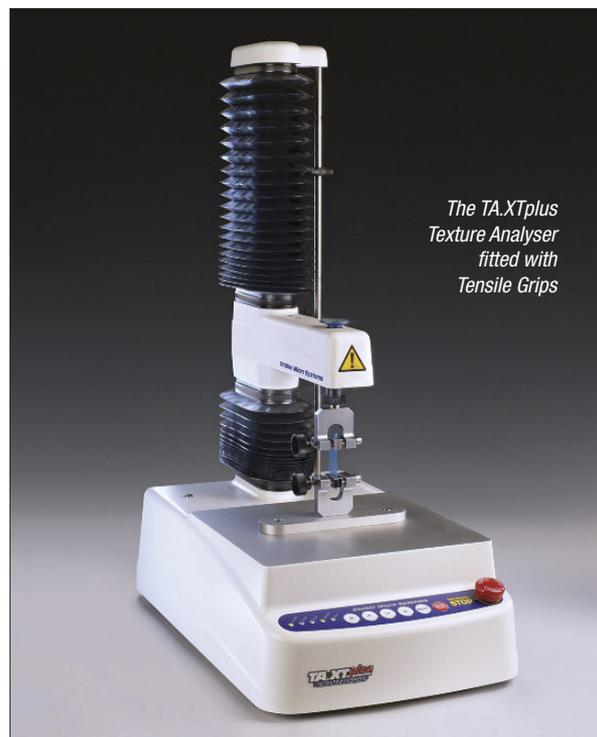
When an event occurs over a short period of time it is important to capture as many data points during the test as possible.

When measuring a break, fracture or brittle product we recommend you collect data at 500pps for maximum data detail.

## VERIFYING YOUR CHOSEN TEST METHOD

Once you have chosen your test settings, you need to verify that your chosen method is suitable and useful. Consider the following:

- When attempting to optimise test settings, it is suggested that the first tests are performed on the hardest samples to anticipate the maximum testing range required and ensure that the force capacity allows testing of all future samples.
- When viewing your results spreadsheet, it will include the average (mean) values, standard deviation and coefficient of variation. A low standard deviation or range indicates that the material in the sample has uniform properties (each of several specimens has nearly the same values for the measured properties) and that the test is producing consistent results. Conversely, a high standard deviation or range indicates that a problem of inconsistent material or testing exists and needs to be investigated.
- We recommend that you test three different versions of the same sample – e.g. a good vs. a bad or a known hard vs. soft. If differences cannot be measured by the Texture Analyser between samples that are known to be subjectively different, then further testing with this method is meaningless and you will need to reconsider what type of test is chosen, or whether your repeatability is being compromised by the wrong selection of settings. If the method cannot differentiate between two samples which are clearly different (as felt by the hand or other means), then it will certainly not be suitable to differentiate between samples that are different but closer in property. Likewise, if two samples are presented which do not appear or feel different, then there is a possibility that a Texture Analyser will also be unable to differentiate between samples.
- Once the extremes can be seen to clearly display markedly different curves or results, then you need to look at the 'within-test' repeatability. If repeated tests of the same product are not reproducible, future results will not allow confident assessment of differences between products (e.g. if the standard deviations of two products are so high and overlap each other, it is questionable whether they are 'different'). We suggest at least 10 samples should be tested to assess your 'within batch' repeatability.
- When reporting results, the test temperature and calibrated height (start point) should always be specified for the purpose of comparison.



## The Texture Analysis Professional Checklist

Once you have become a regular user of the Texture Analyser, the following serves as a checklist for those factors you need to consider for best laboratory practice and optimisation of your use.

Before testing, always ensure that:



✓ **The instrument is regularly calibrated...**

To be confident of your test results and maintain the accuracy of your instrument, it is vital that you should regularly calibrate and check your force measurement.



✓ **The tools you are using are well maintained...**

You will need to regularly check probes and fixtures to ensure they are not chipped, bent or blunt. Probes that require particular attention are cones and blades, as the tips/edges can be knocked off and sharpness deteriorate after repeated use of e.g. a craft knife blade. For the assessment of blades, you may wish to find a suitable repeatable substrate which you can test to make sure you are obtaining the same value. If not, it may be time to change your blade. If blade sharpness and replacement is of importance to your product testing, then you may wish to check that you have the most suitable blade for your testing. For more advice on choosing the most suitable blade: <http://bit.ly/28Y2fwS>



✓ **You are cleaning your probes and fixtures sufficiently between tests...**

This is of particular relevance when you are performing adhesive tests, as the accuracy of this measurement relies on very clean probes. Any residue remaining on a probe surface will affect the test result and any product stuck to a probe or fixture in any previous tests has the potential to affect the correct starting point of the next test sample.



✓ **Sample preparation is being performed consistently...**

Remember, particularly when performing a compression test, that the dimensions of your sample are crucial to the repeatability of your results. This is particular relevance when preparing small samples where a small change in product dimensions can produce a large surface area change – as opposed to a relatively small product dimension difference in a large sample.



✓ **The software you are using is up to date...**

Our software is updated regularly with new features and operating system compatibilities and is available to download free of charge to existing users. Updating your software will also update your availability of new sample projects and application studies. To check if there is a more up to date version of software ready to download, click on 'Help > About' (in Exponent software) and see if a new version number is available.



✓ **You've scouted out the other possible tests, probes and fixtures...**

Make sure you are using the best available methods for measuring the properties of your products. No other texture analyser manufacturer develops their range of tools available for texture analysis as frequently as we do – new methods, new analytical tools, new probes/fixtures, etc.

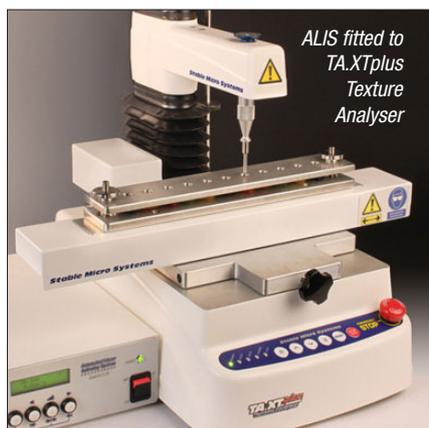


✓ **You're connected to our *Texture Analysis Professionals* network on LinkedIn**

This group is 'by invitation only' and is the meeting place for discussion of all texture analysis related topics and news with the most well-known and practised texture analyser users in the world. To join, go to: <http://bit.ly/TextureAnalysisProfessionals>

## SPEEDING UP YOUR TEXTURE ANALYSIS

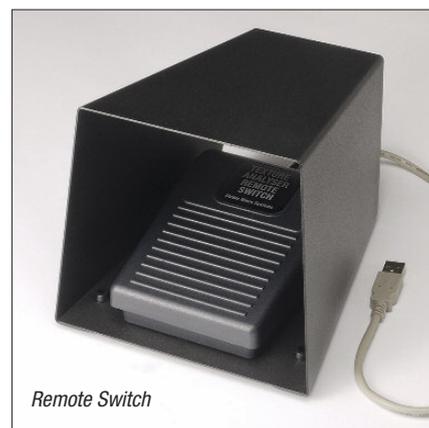
We have various solutions that can increase the sample throughput of your testing. For example:



ALIS fitted to  
TA.XTplus  
Texture  
Analyser



Barcode Scanner



Remote Switch

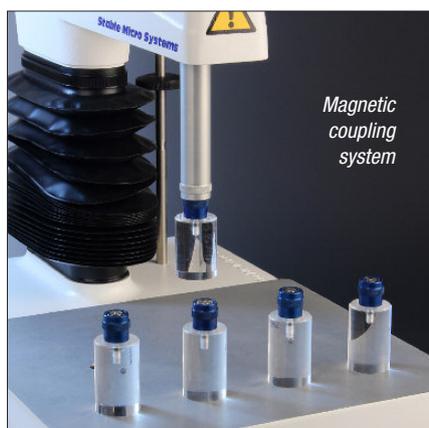
You can now experience the benefits of a texture analysis system which combines the facility for multiple loading of samples and their subsequent testing with 'walk-away' time for the duration of all the tests – *Automated Linear Indexing System (ALIS)*

With the aid of a *Barcode Scanner*, a product barcode can be obtained from your test specimen and a project automatically loaded ready to test that sample.

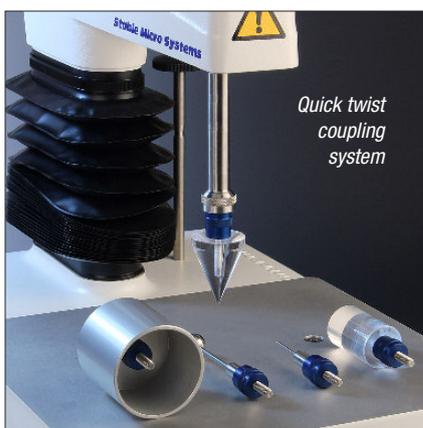
Do you sometimes wish you had an extra pair of hands when testing? A *USB User Programmable Remote Switch* is available which is able to replicate a key switch combination.

### Probe Adapters and Converters

Users can now choose to have a converter system fitted to their probes to allow for quick removal and replacement between tests.



Magnetic  
coupling  
system



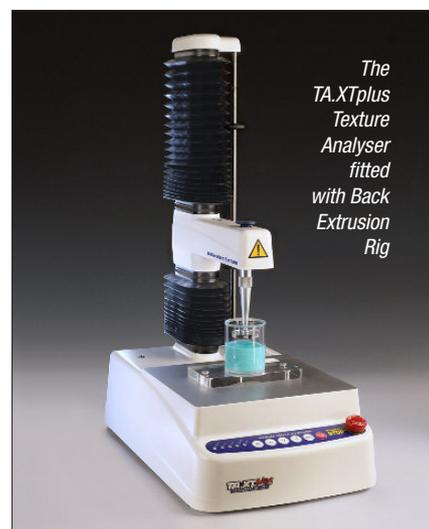
Quick twist  
coupling  
system

Either a 'magnetic' coupling or 'quick-twist' probe attachment option is available (in batches of 5). These quick probe removal and replacement options are the first of their kind in texture analysis and support the need for test procedures that have efficiency and/or convenience in mind.

Contact [sales@stablemicrosystems.com](mailto:sales@stablemicrosystems.com) if you would like more information on any of these products.

### CONCLUSION

Don't forget about the *Education Zone* in your software, with a wealth of application materials, an extensive library of technical information, published academic papers and valuable insights into the optimum choice of probes and fixtures. *Exponent* customers can access a free software upgrade, so that they can benefit from improved functionality of recent updates, by downloading from the *Software Download* page of our website.



The  
TA.XTplus  
Texture  
Analyser  
fitted  
with Back  
Extrusion  
Rig

For more detailed information of texture analyser settings, special calculations, specific sample preparation procedures and data analysis techniques on this and any of the above mentioned tests, please contact Stable Micro Systems: [app.support@stablemicrosystems.com](mailto:app.support@stablemicrosystems.com)

---

© 2017 Stable Micro Systems

**Stable Micro Systems**

Vienna Court, Lammas Road, Godalming, Surrey GU7 1YL, UK

Tel: \*44 1483 427345

Fax: \*44 1483 427600

Email: [sales@stablemicrosystems.com](mailto:sales@stablemicrosystems.com)

[app.support@stablemicrosystems.com](mailto:app.support@stablemicrosystems.com)

[tech.support@stablemicrosystems.com](mailto:tech.support@stablemicrosystems.com)

Web: [www.stablemicrosystems.com](http://www.stablemicrosystems.com)