TA Instruments Q800 to DMA 850 Transition Guide

Overview

For users upgrading from the Q Series™ Q800 DMA to the new Discovery DMA 850 Dynamic Mechanical Analyzer, this guide outlines the key changes between the two instruments and provides details on the information needed for a smooth transition to the DMA 850.

Test Setup and Procedures

Test procedures could be setup and accessed on the Q800 by selecting an operating mode such as "DMA Multi-strain" and then accessing the tests within that mode. In each operating mode, a number of tests were available - this included pre-programmed standard tests as well as the option to customize the test procedure through the Custom mode. The DMA 850 expands on this tradition of easy to use interfaces through the introduction of DMA Express and the DMA Unlimited procedures - two new and intuitive interfaces for user interaction.

DMA Express procedures contain all the pre-programmed tests previously available on the Q800 neatly packaged into single step procedures. This mode, ideal for performing simple tests that do not require customization, is designed specifically to get new users up and running on the DMA as fast as possible. Each test form has been optimized for maximum efficiency with all the key parameters needed to run the test presented in a logical and sequential format.

DMA Unlimited procedures expand on the fundamental test modes available in DMA Express by allowing access to additional conditioning steps and the ability customize test methods. In addition, it also introduces the new capability to sequence DMA procedures that can mix and match different operating modes within a single test. For example, tests containing both oscillation and transient (creep, stress relaxation) steps can now be programmed on the DMA 850 thanks to this advanced mode of operation, a capability that was not available with previous generations.

The fundamental test blocks that are needed to program the test are common to both procedures - all the tests are laid out in one of four operating modes. A summary of the available test modes in DMA Express and DMA Unlimited are given below:

- Oscillation
    1. Frequency Sweep
    2. Strain Sweep
    3. Stress Sweep
    4. Temperature Sweep

5 Temperature Ramp

6 Time Sweep

7 Temperature Sweep (Multifrequency)

8 Fatigue Test

9 Temperature Ramp (Multifrequency)

10 Temperature Ramp (Multistep)

- Strain Control

  1 Stress Relaxation

  2 Stress Relaxation TTS

  3 IsoStrain

- Stress Control

  1 Creep

  2 Creep Recovery

  3 Creep TTS

  4 IsoStress

- Rate Control

  1 Strain Ramp

  2 Stress Ramp

If you are upgrading to the Discovery DMA 850 from the Q Series, use the information presented in the table below to determine the DMA 850 mode that is equivalent to the tests used for the Q800.

Standard DMA Tests–DMA Express, DMA Unlimited.

Q800 Test		Equivalent DMA 850 Test			Comments
Mode	**Test**	**Mode**	**Test**	**Controlled Test Parameter**	
DMA Multi-Strain	Strain Sweep	Oscillation	Strain Sweep	Amplitude or Strain	
DMA Multi-Stress	Stress Sweep	Oscillation	Stress Sweep	Force or Stress	
DMA Multi-Frequency Strain	Isothermal Temp/Freq Sweep	Oscillation	Frequency Sweep	Amplitude or Strain	
DMA Multi-Frequency Strain	Temp Ramp/ Freq Sweep	Oscillation	Temperature Ramp	Amplitude or Strain	Single frequency

Q800 Test		Equivalent DMA 850 Test			Comments
Mode	**Test**	**Mode**	**Test**	**Controlled Test Parameter**	
DMA Multi-Frequency Strain	Temp Ramp/ Freq Sweep	Oscillation	Temperature Ramp (Multifrequency)	Amplitude or Strain	Multiple frequencies
DMA Multi-Frequency Strain	Temp Ramp/ Freq Sweep	Oscillation	Temperature Sweep	Amplitude or Strain	Single frequency
DMA Multi-Frequency Strain	Temp Ramp/ Freq Sweep	Oscillation	Temperature Sweep (Multifrequency)	Amplitude or Strain	Multiple frequencies
DMA Multi-Frequency Stress	Isothermal Temp/Freq Sweep	Oscillation	Frequency Sweep	Forece or Stress	
DMA Multi-Frequency Stress	Temp Ramp/ Freq Sweep	Oscillation	Temperature Ramp	Force or Stress	Single frequency
DMA Multi-Frequency Stress	Temp Ramp/ Freq Sweep	Oscillation	Temperature Ramp (Multifrequency)	Force or Stress	Multiple frequencies
DMA Multi-Frequency Stress	Temp Step/ Freq Sweep	Oscillation	Temperature Sweep	Force or Stress	Single frequency
DMA Multi-Frequency Stress	Temp Step/ Freq Sweep	Oscillation	Temperature Sweep (Multifrequency)	Force or Stress	Multiple frequencies
N/A		Oscillation	Time Sweep	Amplitude, Strain, Force, or Stress	New test, Oscillation test at isothermal temperature, constant test conditions
		Oscillation	Fatigue	Amplitude, Strain, Force, or Stress	New test, Oscillation test at isothermal temperature, constant test conditions
		Oscillation	Temperature Ramp (MultiStep)	Amplitude, Strain, Force, or Stress	New test, DMA Express only: Allows the sequencing of multiple temperature ramps in the same test, such as heat-cool-heat
DMA Creep	Creep	Stress Control	Creep	Force or Stress	Only creep step, no recovery

Q800 Test		Equivalent DMA 850 Test			Comments
Mode	**Test**	**Mode**	**Test**	**Controlled Test Parameter**	
DMA Creep	Creep	Stress Control	Creep Recovery	Force or Stress	Combines creep and recovery in a single step
DMA Creep	Creep TTS	Stress Control	Creep TTS	Force or Stress	
DMA Controlled Force	Temp Ramp/ Controlled Force	Stress Control	Isostress	Force or Stress	
DMA Stress Relaxation	Stress Relaxation	Strain Control	Stress Relaxation	Displacement or Strain	
DMA Stress Relaxation	Stress Relaxation TTS	Strain Control	Stress Relaxation TTS	Displacement or Strain	
DMA Iso-Strain	Isostrain	Strain Control	IsoStrain	Displacement or Strain	
DMA Controlled Force	Stress/Strain	Rate Control	Stress Ramp	Force or Stress	
DMA Strain Rate	Strain Ramp	Rate Control	Strain Ramp	Displacement or Strain	

Customized DMA Tests & Sample Conditioning – DMA Unlimited

In addition to the standard DMA tests, DMA Unlimited procedures also have sample conditioning blocks that be sequenced together to generate customized multi-step procedures similar to the Custom tests available within each mode on the Q800. All basic DMA tests – Oscillation, Strain Control, Stress Control, Rate Control – are available in this mode as well.

Custom tests on the Q800 were limited to the selected DMA mode only - however, this is not a limitation with the DMA 850 since the DMA Unlimited procedures support the sequencing of tests from multiple operating modes within a single procedure. The individual segments available through the Custom tests on the Q800 can be found within the Conditioning mode on the DMA 850.

The information presented in the table below summarizes the DMA 850 modes that are equivalent to segments available on the Q800.

Q800 Custom Segments	Equivalent DMA 850 Test			
Segment	**Mode**	**Test**	**Option/ Controlled Test Parameter**	**Comments**
Jump	Conditioning	Temperature	Jump	
Equilibrate	Conditioning	Temperature	Equilibrate	
Initial temperature	Conditioning	Temperature	Initial	
Ramp (temperature)	N/A			Ability to ramp temperature is available within individual tests in each control mode
Isothermal	N/A			Ability to perform isothermal tests is available within individual tests in each control mode
Increment temperature	Conditioning	Repeat		
Repeat	Conditioning	Repeat		
Reepat until	N/A			Repeat blocks can be terminated through Limit Checking available within individual tests in each control mode
Motor drive	Conditioning	Other	Motor	
Step (temperature)	N/A			Ability to perform temperature steps (sweeps) is available within individual tests in each control mode
Abort next segment	N/A			Steps can be terminated through Limit Checking available within individual tests in each control mode
Sample interval	N/A			Data sampling intervals are directly set within individual tests in each control mode
External event	Conditioning	Other	External Event	
Data Storage	Conditioning	Data	Data Storage	
Fill cooler	Conditioning	GCA		
Heater PID	Conditioning	Other	Override Heater PID	

Q800 Custom Segments	Equivalent DMA 850 Test			
Segment	**Mode**	**Test**	**Option/ Controlled Test Parameter**	**Comments**
Frequency sweep	Oscillation	Frequency sweep	Amplitude, Strain, Force, or Stress	
Strain sweep	Oscillation	Strain Sweep	Amplitude or Strain	
Displace/Recover	Stress Control	Creep Recovery	Force or Stress	
Force	Conditioning	Stress	Force or Stress	
Ramp force	Rate Control	Stress Ramp	Force or Stress	
Increment force	Conditioning	Stress	Force or Stress	
Isostrain	Strain Control	IsoStrain	Displacement or Strain	
Set strain	Conditioning	Strain	Displacement or Strain	
Ramp strain	Rate Control	Strain Ramp	Displacement or Strain	
Ramp displacement	Rate Control	Strain Ramp	Displacement or Strain	
Stress	Conditioning	Stress	Force or Stress	
Ramp Stress	Rate Control	Stress Ramp	Force or Stress	
Humidity	Conditioning	Humidity	Set RH	
Increment humidity	Conditioning	Humidity	Increment RH	
Step humidity				

Importing Q800 Data and Signal Mapping

The capability to natively import Q800 data is available within TRIOS versions 4.3 or later. When a Q800 file is opened in TRIOS, a large number of signals are presented with the same variable name as the Q800.

However, a limited number of signals are mapped to the newer DMA 850 variable names in the interest of consistency between the two instruments. This provides the ability to directly overlay Q800 data with DMA 850 data within TRIOS. Note that the DMA 850 data can also be exported and opened within Universal Analysis for backward compatibility.

The information presented in the table below summarizes the Q800 signals and the corresponding name used for imported data in TRIOS.

Common Signals

Q800 Signal	Imported Name in TRIOS	Units	Comments
Time	Time/Step time	s or min	Time and step time are the same in imported Q800 data; the DMA 850 reports individual step times in the DMA Unlimited mode
Temperature	Temperature	°C	

Signals not listed above are imported and mapped to the same name as the Q800 - examples include Storage Modulus, Loss Modulus, tan(δ), etc.

Oscillation Signals

Q800 Signal	Imported Name in TRIOS	Units	Comments
Drive force	Oscillation Force (drive)	N	Force amplitude applied to the DMA motor to produce the commanded oscillation displacement/ force
Force/Dynamic Force	Oscillation Force	N	Force exerted by the clamp on the sample when oscillating at the commanded oscillation displacement/ force
Static Force	Axial Force	N	Absolute force applied by the DMA motor on the sample to maintain contact with the sample (compression) or hold the sample in tension (film)
Displacement	ΔL	mm	Refers to the change in the drive position of the DMA shaft during the test
Length	Position	mm	Refers to the position signal visible on the DMA 850 user interface- this signal corresponds to the sample length in tension and the sample thickness in compression testing (see note below)
Position	Drive-position	mm	Refers to the absolute position of the DMA drive shaft (see note below)
Amplitude	Oscillation Displacement	µm	
Stress	Oscillation Stress	N	
Strain	Oscillation Strain	%	
N/A	Pretension ration	%	Refers to the ratio of the axial force to the oscillation force

Signals not listed above are imported and mapped to the same name as the Q800 - examples include Storage Modulus, Loss Modulus, tan(δ), etc.

Non-Oscillation Signals (All transient tests such as Creep, Stress Relaxation, IsoStrain, etc.)

Q800 Signal	Imported Name in TRIOS	Units	Comments
Static Force	Total Force	N	Total force applied on the sample
N/A	Force	N	Refers to the force applied on the sample during the current step, after subtracting the preload force (static force)
Displacement	Displacement	µm	(see note below)
Position	Drive position		Refers to the absolute position of the DMA drive shaft (see note below)
Length	Position/ Lenght	mm	Refers to the position signal visible on the DMA 850 user interface–a separate length signal is also available in film, compression clamp data (see note below)
Strain	Strain	%	
Stress	Stress	MPa	Refers to the additional stress on the sample after subtracting the preload force– Creep, Stress Relaxation, IsoStrain, IsoStress tests only
Stress	Total Stress	MPa	Refers to the total stress on the sample, including the preload force - Stress Ramp, Strain Ramp only
Strain Recovery	Recovered Strain	%	Only available in creep tests
Relaxation Modulus	Modulus	MPa	Available in all transient tests except creep

Notes (all variable names refer to the Imported Name in TRIOS):

1 The Q800 reported a zero value for the Position signal in all clamps except film/fiber tension and compression. In such cases (cantilever, 3-point bending, shear sandwich), it is recommended to plot the ΔL signal instead.

2 The Q800's Drive position reference was 0 mm at the top of travel, while the DMA 850's 0 mm reference is at the bottom of the travel. While overlaying data from the Q800, the trend for this signal will likely be opposite to that of the DMA 850. It is recommended to plot the Position or the Length signal in such cases.

3 For compression clamp data, the Displacement signal is negative on the Q800 while the DMA 850 uses positive notation for displacement in all tests. To overlay data, it is recommended to plot the absolute values of the displacement signal in TRIOS.