Testing Your Instrument's Short-Term Repeatability

There are several tests you can perform periodically to ensure that your instrument is measuring as well as it should be. For spectrophotometers, the most common test is the green tile check, which checks that the instrument still yields approximately the same values in the middle reflectance range (green area) as the last time the green tile was read at the factory or during servicing. D25 colorimeters use a similar test, the color check, to confirm that the correct color values are obtained. For instruments that can measure transmittance (the ColorQuest XE, ColorQuest XT, UltraScan XE, UltraScan PRO, and UltraScan VIS), a didymium filter test can also be performed, which checks that the instrument's wavelength calibration has not shifted. For all these instruments, a short-term repeatability test (or stability check) may also be run. This test confirms that the measurement values output are consistent when making multiple readings of the same sample over a short period of time. This is a measure of the instrument's precision, and a successful test means that the instrumental measurements are not fluctuating more than is acceptable.

For each type of instrument, short-term repeatability is measured at the factory when the instrument is newly manufactured. It must meet HunterLab's repeatability specification for new instruments. Repeatability may then be periodically tested throughout the instrument's useful life, though specifications provided for in-service instruments are a bit looser than for new instruments to take into account environmental conditions and normal wear and tear.

The steps involved in testing short-term repeatability are discussed in the rest of this *Applications Note*.

1. Turn the instrument on if it was off and allow it to warm up for the amount of time indicated in the chart below. This period allows the instrument lamp and electronics to equilibrate to their normal operational level. If you are using a ColorFlex, the display may turn itself back off, but the instrument is still warming up.

Instrument	Warm-up Time Required
ColorFlex	2 hours
ColorQuest XE	2 hours
ColorQuest XT	2 hours
D25	2 hours
LabScan XE	2 hours

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Instrument	Warm-up Time Required
MiniScan XE Plus	2 hours
UltraScan XE	2 hours
UltraScan PRO	2 hours
UltraScan VIS	2 hours

2. While your instrument is warming up, clean the black glass (45°/0° instruments only) and white calibrated tile as described in your User's Manual. Allow the tiles to return to room temperature before continuing to the next step. If the tiles are not clean, dry, and at room temperature when the test is run, you will not know whether measurement changes are due to instrument variation or dirty, drying, and/or cooling tiles.

3. For the <u>ColorQuest XE with Touch Screen</u>, enter the repeatability diagnostic and follow the prompts given there using the white instrument standard tile. Then skip to Step 8. For the <u>ColorQuest XT</u>, enter the repeatability diagnostic and follow the prompts given there using air. Then skip to Step 8. If you are using <u>EasyMatch QC software version 3.70 or above</u>, choose the **Sensor** menu, **Diagnostics**, and then **Repeatability Test**. Follow the instructions given there. Then skip to Step 8. For all other instrument configurations, standardize the instrument as listed in the chart below.

Instrument	Standardization Mode	Area View	Port Size	UV Filter Position
ColorFlex	N/A	Standard port plate - no cover glass or UV filter		N/A
ColorQuest XE	RSIN	Large	1.00" (25.4 mm)	Nominal
D25	N/A	Standard port plate - no cover glass		Out
LabScan XE	N/A	1.75" (44.5 mm)	2.00" (50.8 mm)	Nominal
MiniScan XE Plus	N/A	Standard view port - no cover glass or UV filter		N/A
UltraScan XE	RSIN	Large	1.00" (25.4 mm)	Nominal
UltraScan PRO	RSIN	Large	1.00" (25.4 mm)	Nominal
UltraScan VIS	RSIN	Large	1.00" (25.4 mm)	Nominal

4. For the <u>D25 DP-9000 or D25LT</u>, enter the stability check in the diagnostics and follow the prompts given there. Then skip to Step 8. For all other instruments, configure your display to show the parameters indicated by the table below.

Instrument	Display Parameters
ColorFlex	DE* using D65/10°
ColorQuest XE	DE* using D65/10°
LabScan XE	DE* using D65/10°

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Instrument	Display Parameters
MiniScan XE Plus	DX, DY, DZ (XYZ differences) using D65/10°
UltraScan XE	DL*, Da*, Db* (CIELAB differences) using D65/10°
UltraScan PRO	DE* using D65/10°
UltraScan VIS	DE* using D65/10°

5. Center the instrument's white standard tile at the measurement port. Do not move or remove the tile for the remainder of the test.

6. Read the white tile as a standard.

7. If you are using Universal Software, EasyMatch Coatings, EasyMatch QC versions lower than 3.70, or EasyMatch Textiles, configure the timed read feature to automatically make 20 more measurements with a read interval of 7 seconds (10 seconds for UltraScan XE and UltraScan PRO) and then initiate reading of the tile as a sample. If you are using another software package, a DP-9000, or a ColorFlex or MiniScan not connected to a computer, manually make 20 readings of the tile as a sample at an interval of about 7 seconds (10 seconds for UltraScan XE), and write down or print each reading.

8. When all the measurements are complete, examine the results. The instrument passes the repeatability test as long as none of the delta values is greater than the value indicated in the chart below. Contact HunterLab Technical Support at (703) 471-6870 or helpdesk@hunterlab.com with your exact results if the instrument fails this test.

Instrument	Maximum Allowed Value for Configured Parameter(s) for In-Service Instruments
ColorFlex	0.04
ColorQuest XE	0.03
ColorQuest XT	0.05
D25	$\sigma \leq 0.02$ and p-p ≤ 0.04
D25LT	$\sigma \leq 0.05$ and p-p ≤ 0.10
LabScan XE	0.09
MiniScan XE Plus	0.18
UltraScan XE	0.02
UltraScan PRO	0.03
UltraScan VIS	0.03

For Additional Information Contact:

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