

Tm Analysis System



Tm Analysis System

Tm analysis systems can accelerate the development process and improve the quality of oligonucleotide therapeutics. Control by LabSolutions™ software enables compliance with ER/ES-related regulatory requirements and improves the efficiency of analyzing the thermal stability (Tm analysis) of nucleic acids.

Reliability

Reliable Data Integrity

The Tm analysis system in conjunction with LabSolutions DB/CS can achieve the highest data integrity levels in the industry. Measurement parameters, audit trails, and results of data acquisition and analysis are managed in a database protected with user privilege settings and security policies to prevent unintended operations or data tampering by operators.

Versatility

Functionality for Satisfying Various Needs

In addition to trace measurement and high-sensitivity measurement capabilities required for Tm analysis, the system also satisfies a variety of other needs, including thermodynamic parameter analysis using functionality for automatically transferring data to an Excel® file.

Efficiency

Efficient Automated Workflow

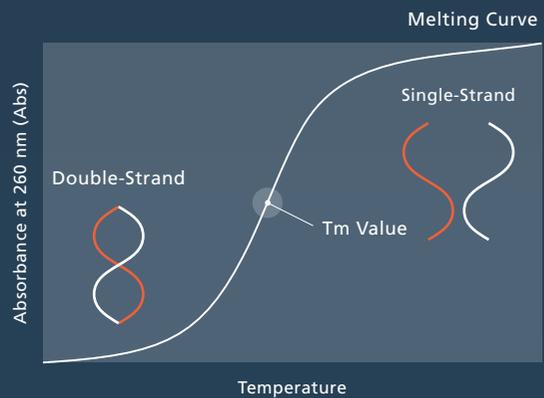
Tm analysis system dramatically decreases the time and trouble required for Tm analysis by automating all steps (particularly the time-consuming annealing and analysis steps).

Note: The photo on the right shows the UV-2600i ultraviolet-visible spectrophotometer with a TMSPC™-8i 8-cell thermoelectrically temperature-controlled cell holder connected. However, the TMSPC-8i can be also connected to either UV-1900i or UV-2700i models.



T_m Analysis

T_m analysis serves an important role in checking the thermal stability and sequence of nucleic acids. In T_m analysis, heat is applied to the nucleic acids in double-strands. Then, the change in absorbance (melting curve) that occurs as the temperature increases and the strands dissociate into single strands is measured. The melting temperature (T_m value) is determined as the temperature where the mole fractions of single and double strands are equal.



Reliable Data Integrity

System Configuration

T_m analysis system consists of the following.

- UV-Vis Spectrophotometer
- TMSPC-8i 8-cell thermoelectrically temperature controlled cell holder
- LabSolutions UV-Vis T_m software



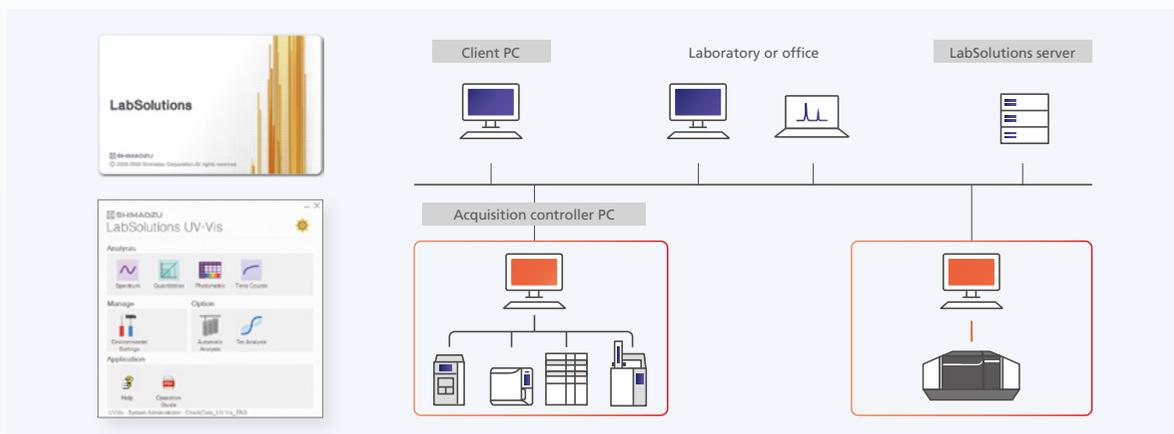
NEW TMSPC™-8i

UV-Vis

NEW LabSolutions™ UV-Vis T_m

Data Integrity

T_m analysis systems comprise a spectrophotometer, TMSPC-8i 8-cell thermoelectrically temperature-controlled cell holder, and LabSolutions UV-Vis T_m software. They can automatically determine T_m values based on melting curve measurements using the average method or derivative method. LabSolutions UV-Vis T_m can provide the industry's highest data integrity levels when linked to a LabSolutions DB/CS system, which has an extensive track record from use with LC, GC, and many other analytical instruments.



Note: LabSolutions DB UV-Vis: This is a stand-alone database management system which analysis software on a single PC.

LabSolutions CS system: A server, client, and acquisition controller are connected on the network. The data of all devices are centrally managed by the database built on the server. User and permission management is centrally managed with this system.

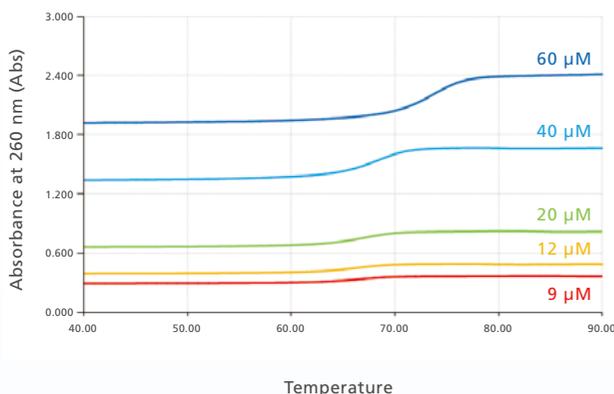
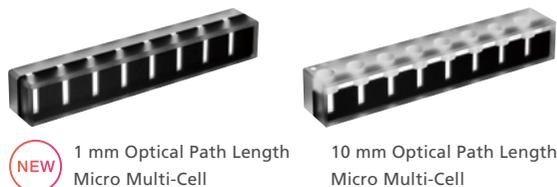
Functionality for Satisfying Various Needs

8-Cell Micro Multi-Cell

This micro multi-cell can be used to measure eight samples at the same time using the same measurement conditions.

In addition to previous micro multi-cell models with a 10 mm optical path length (with a 100 μL minimum sample volume) for satisfying high-sensitivity measurement needs, a new model with a 1 mm optical path length (with a 10 μL minimum sample volume) for measuring micro-quantities of expensive samples has been added to the lineup. Cells with a 1 mm optical path length can result in sample evaporation problems, but a new sealing method*, which suppresses the evaporation of samples by sealing the top side of the cell, enables reliable measurement of samples with high melting temperatures.

*The sealing method was supported by Professor Junji Kawakami (Department of Nanobiochemistry, Faculty of Frontiers of Innovative Research in Science and Technology (FIRST), Konan University, Japan). This was supported by AMED under Grant Number JP21ae0121022, JP21ae0121023, JP21ae0121024 (Project leader: Satoshi Obika).

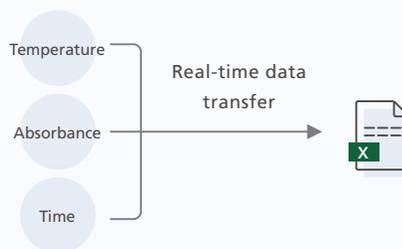


Melting Curve of Nucleic Acid (M13 Primer)
(Using Micro Multi-Cell with 1 mm Optical Path Length)

Real-Time Transfer Function and Thermodynamic Parameter Analysis

LabSolutions UV-Vis Tm can transfer temperature, absorbance, and time values to an Excel® file in real time during measurements.

By transferring Tm values obtained from samples with different concentration levels to commercial spreadsheet software, changes in Gibbs free energy values used as an index for drug activity levels or thermodynamic properties, such as entropy or enthalpy, can be analyzed easily.



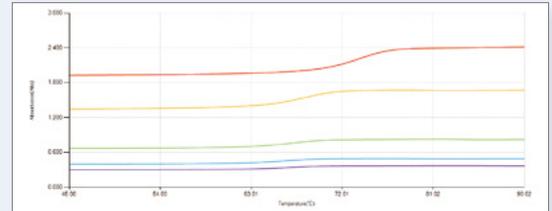
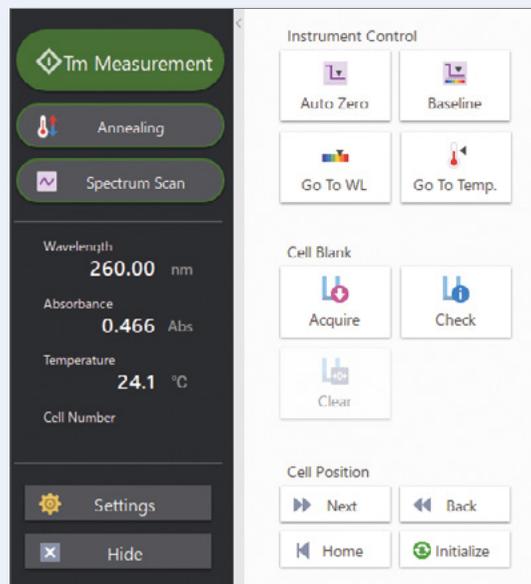
Temp	Abs	Time	Temp	Abs	Time	Temp	Abs	Time	Temp	Abs	Time	Temp	Abs	Time
15.42	0.00084	0	15.21	0.203406	5	15.2	0.340520	12	15.17	0.619082	18	15.17	1.133233	25
16	0.00045	379	16	0.207648	185	15.96	0.367148	140	15.86	0.638761	148	15.96	1.130213	205
17.01	0.00096	359	17.02	0.202895	396	17.01	0.361452	372	17	0.650837	379	16.99	1.130569	385
17.97	0.00025	540	18.03	0.20347	547	17.96	0.362355	553	17.88	0.658961	550	17.88	1.132794	566
18.99	0.00114	721	18.97	0.203275	726	18.96	0.362621	732	18.84	0.658269	738	18.91	1.131174	743
20.03	0.00047	894	20	0.202481	900	20	0.362747	906	20.01	0.659968	911	20.01	1.131278	917
20.99	0.00091	1068	20.98	0.203462	1074	20.99	0.362994	1079	21	0.659777	1080	20.99	1.132276	1081
21.99	0.00096	1242	22.02	0.20252	1247	21.99	0.362980	1253	21.99	0.660229	1250	21.99	1.131915	1264
23	0.00062	1416	22.98	0.203608	1422	22.98	0.362826	1428	23.01	0.660928	1438	23	1.131118	1439
24	0.00017	1590	23.99	0.203613	1596	24.01	0.361053	1602	23.99	0.660264	1607	23.99	1.133572	1613
24.99	0.00079	1765	25	0.203959	1771	25.01	0.361444	1776	25.01	0.660293	1782	24.99	1.133894	1788
25.99	0.00044	1939	26.01	0.204124	1945	26	0.361423	1951	25.99	0.660084	1956	25.99	1.133465	1962
26.99	0.00087	2113	27	0.204688	2119	26.98	0.361952	2125	27	0.660861	2131	27.01	1.134709	2136

Efficient Automated Workflow

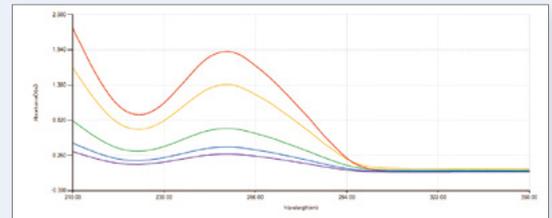
Conventional Tm analysis requires multiple steps, including checking the UV-Vis spectrum, annealing, measuring the melting curve, and analyzing data, with recording and data management performed separately. In contrast, LabSolutions UV-Vis Tm achieves a seamless workflow and efficient Tm analysis by performing time-consuming annealing, correction (background wavelength and temperature blank correction), and Tm value calculation (average or derivative methods) steps automatically.

NEW

Tm Analysis System



Melting Curve



UV-Vis Spectra

One Step



Measure spectrum

Anneal

Our conventional method

- ✗ Risk of switching samples during transition from spectral measurement to annealing/melting curve measurement steps
- ✗ Tedious data management because spectral and melting curve data are managed separately



Spectral measurement steps



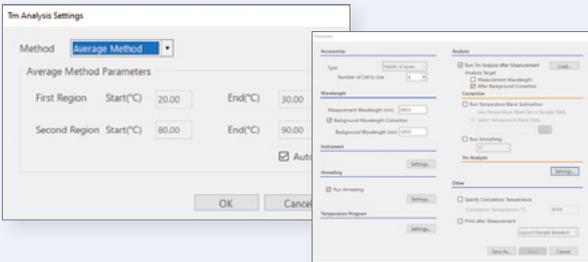
Annealing/melting curve measurement steps

- ✗ Annealing temperature must be manually each time
- ✗ No record of annealing execution
- ✗ No record of annealing temperature

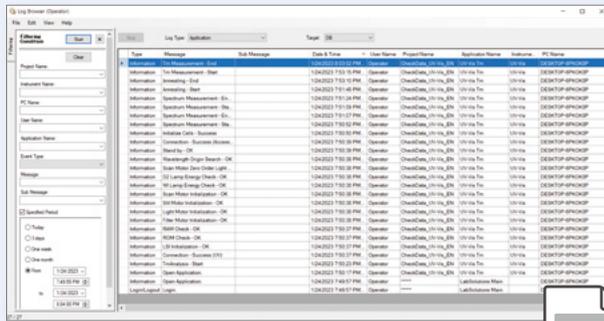
For more details, access here.



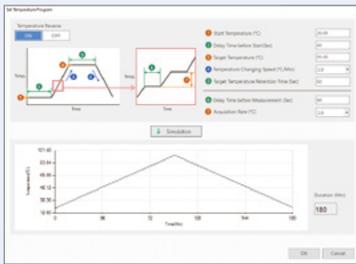
- Automated support functions utilizing digital technologies, such as M2M, IoT, and Artificial Intelligence (AI), that enable higher productivity and maximum reliability.
- Allows a system to monitor and diagnose itself, handle any issues during data acquisition without user input, and automatically behave as if it were operated by an expert.
- Supports the acquisition of high-quality, reproducible data regardless of an operator's skill level for both routine and demanding applications.



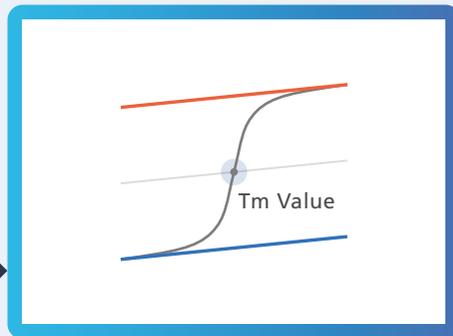
Tm Analysis Settings



Application log (LabSolutions DB)



Temperature Program Settings



Analysis

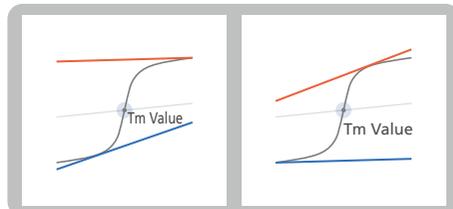
Measure Tm values and analyze data

Calculate Tm values

entered

✗ Lack of analysis process/parameter records prevents Tm value reproducibility

n is retained



ture is retained

✗ Analysis results can vary depending on the analyst

Models Compatible with the TMSPC-8i Cell Holder

Model	Measurement Wavelength Range and Detector	Resolution and Wavelength Accuracy	Monochromator
 UV-1900i	190 to 1100 nm Silicon photodiode	1 nm ± 0.1 nm (656.1 nmD2) ± 0.3 nm (for all regions)	Aberration correction Czerny-Turner mounted Diffraction grating with low stray light Single monochromator
 UV-2600i UV-2700i	185 to 900 nm Photomultiplier tube 220 to 1400 nm (UV-2600i + ISR-2600Plus) Electron multiplier + InGaAs photodiode	0.1 to 5 nm ± 0.1 nm (656.1 nmD2) ± 0.3 nm (for all regions)	UV-2600i Czerny-Turner mounted Diffraction grating with low stray light Single monochromator UV-2700i Littrow mounted Czerny-Turner mounted Diffraction grating with low stray light Double monochromator

In addition to the UV-VIS spectrophotometer, TMSPC-8i cell holder, and LabSolutions UV-Vis Tm software, the Tm analysis system also requires a constant temperature water circulator and N₂ (or dry air) purging gas.

For details about equipment requirements, contact a Shimadzu sales representative or distributor.

Tm Analysis and Oligonucleotide Therapeutics Application

For information about Tm analysis system and oligonucleotide therapeutics solutions, visit the following web pages.



Tm Analysis System
<https://www.shimadzu.com/an/products/life-science-lab-instruments/dnarna-analysis/tm-analysis-system/index.html>



Oligonucleotide Therapeutics
<https://www.shimadzu.com/an/industries/oligonucleotide-therapeutics/index.html>

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