Figure 1 Images and models of different parts and accessories of S1-HT-101 MTPS & TPS system of thermal characterization of solid, liquids and powders.

DESCRIPTION

The S1-HT-101 Thermal Conductivity Measurement Equipment is an advanced, fully integrated system designed for precise and reliable measurement of thermal conductivity and associated thermal properties for a wide range of materials both liquid, powders and solids, including concrete, cementitious materials, and geological samples. This system employs both the Modified Transient Plane Source (MTPS) and Transient Plane Source (TPS) testing methods to offer flexibility in testing, providing accurate results across different sample types and conditions.

The equipment is a portable, benchtop solution that can be easily installed in a standard laboratory setting, with no need for additional hardware. Its design allows for measurements at various temperatures, pressures, and sample sizes, making it suitable for diverse applications in research and industry.

SYP Technologies has engineered this system to meet stringent international standards for laboratory equipment, ensuring top-tier performance, safety, and compliance with modern laboratory requirements.

The Modified Transient Plane Source (MTPS) technique measures the thermal conductivity and effusivity of materials using a single-sided, interfacial sensor. This sensor applies a short heat pulse to the sample, typically for 1 to 4 seconds and measure the temperature profile at the interface of sensor and tested material to accurately determine thermal properties. The technique directly measures thermal conductivity and effusivity, offering a comprehensive view of the sample's heat transfer properties.

FEATURES

Versatile Testing Capabilities:

- Supports Modified Transient Plane Source (MTPS) for single-sided testing, ideal for various solid and geological samples.
- Supports Transient Plane Source (TPS) testing, allowing for testing between two identical sample pieces.

Wide Thermal Range:

- Operates across a broad temperature range from -50°C to 200°C for MTPS, and up to 80°C for TPS.
- Capable of handling extreme thermal conductivity ranges from 0.03 to 100 W/mK and thermal diffusivity from 0.01 to 50 mm²/s.

High Precision and Accuracy:

- Delivers a minimum of ±2% precision and ±5% accuracy, meeting the stringent repeatability and reliability requirements of modern laboratories.

Pressure Handling:

- The system can measure thermal conductivity under pressures ranging from atmospheric to 13.78 MPa using special designed pressure chamber, suitable for simulating real-world conditions.

Sample Versatility:

- Can measure solids, pastes, and powders for a range of sample sizes. Maximum sample size is determined by material properties and laboratory setup.

Portable and Integrated Design:

- Compact, benchtop system that is fully portable. It includes all necessary components, interfaces, and wiring to function in a typical laboratory environment.
- Designed with durability in mind, featuring protective housings to withstand routine relocations and operations in different laboratories.

Electrical Compliance:

- All electrical components are enclosed and compliant with the international wiring regulations, ensuring safety and reliability in laboratory conditions.
- Built-in indicator lights for status monitoring and fault indications.
- Certification of electrical safety will be provided.

Interfaces:

- Suitable for connection to external monitors, network, mouse, and keyboard for enhanced functionality and data access.

User Training and Support:

- Comprehensive training provided to staff for operation, calibration, and maintenance of the system.
- Includes detailed user manuals and maintenance guides.
- 1-year full warranty with the option for extended service agreements, ensuring long-term support and cost-effective maintenance.

Installation and Commissioning:

- SYP Technologies provides on-site installation, commissioning, and initial calibration, ensuring the equipment is fully operational and ready for immediate use.
- Tailored installation services based on the specific laboratory setup and requirements.

SPECIFICATION

MTPS (Modified Transient Plane Source) Capability: Fully Compliant

Our MTPS system is in compliance with the required specifications reproduced here for reference.

The equipment must be able to perform single-sided MTPS tests on concrete, cementitious materials, and geological samples. Ensure the equipment can measure these with a precision of ±2% and an accuracy of ±5%, with a temperature range of -50°C to 200°C.

TEST METHOD	TEMPERATURE RANGE (°C)	THERMAL CONDUCTIVITY RANGE (W/mK)	THERMAL DIFFUSIVITY RANGE (mm^2/s)	SPECIFIC HEAT CAPACITY (J/Kg-K)	THERMAL EFFUSIVITY RANGE ($W\sqrt{s}/m^2K$)	PRECISION (%)	ACCURACY (%)
MTPS (MODIFIED TRANSIENT PLANE SOURCE)	-50 to 200	0.03 to 100	0.01 to 50	250 to 2500	20 to 20000	±2	±5
TPS (TRANSIENT PLANE SOURCE)	-50 to 80	0.03 to 100	0.01 to 50	250 to 2500	Not applicable	±2	±5

Pressure Conditions:

The equipment should be capable of performing thermal conductivity measurement on a sample at elevated confining pressures (ambient temperatures).

Equipment should handle pressures from atmospheric to 15 MPa at ambient temperatures.

Sample Types: Solids, pastes, and powders, including concrete and geological materials.

PARAMETER	PERFORMANCE SPECIFICATION
PRESSURE RANGE (MPA)	Atmospheric to 15
TEMPERATURE RANGE (°C)	Ambient to 50
HIGH-PRESSURE CHAMBER	Provided for subjecting samples to desired pressure during measurement of thermal properties

UTILITY REQUIREMENTS

Power: 220-240V AC, 50 Hz
Ventilation: Standard lab ventilation; no additional utilities needed.

DIMENSIONS

L x W xH: 600mm x 500mm x 400 mm Approx.

Weight: 25 kg Max. Approx.

Package Handling:

L x W x H: 750 mm x 650 mm x 550 mm (Package Dimensions) Approx.

Shipping Weight: 30 kg
The system will be delivered in a secure, shock-proof crate. No special handling is required.

STANDARDS COMPLIANCE

The SYP Technologies S1-HT-101 Thermal Conductivity Measurement Equipment, utilizing the Modified Transient Plane Source (MTPS) method, complies with the following standards:

Modified Transient Plane Source (MTPS) Standards:

- ISO 22007-2: This standard specifies the general requirements for the MTPS method for measuring thermal conductivity and thermal diffusivity.
- ISO 22007-7: This standard outlines the requirements and test methods for the MTPS technique, ensuring accuracy and reliability in measurement.

Transient Plane Source (TPS) Standards :

- ISO 22007-7: Also applicable for the TPS method, this standard sets out the requirements for the transient plane source technique, ensuring compliance with international measurement practices.

ACCESSORIES

- **TPS Sensor**: For two-sided thermal conductivity testing.
- **MTPS Sensor:** Primary single-sided testing sensor for quick measurements.
- **Liquid/Powder Cell**: For secure testing of liquids and powders.
- **High-Pressure Cell**: Tests under pressures up to **15 MPa**.
- **Specimen Weights**: Ensures uniform pressure on samples.
- **Reference Material**: Calibrates equipment for accurate results.
- **Control Unit**: Monitors and controls test conditions in real-time.
- **Thermal Chamber**: Enables temperature-controlled testing down to **-50°C**.
- **Laptop with Software**: Pre-installed software for data collection and analysis.

SOFTWARE & DATA LOGGING

Perpetual Software License:

- The S1-HT-101 comes with a perpetual software license, ensuring full access to all features and functionalities for the lifetime of the equipment. This allows continuous, uninterrupted operation and maintenance of the system without the need for annual renewals or additional license fees.
- Software datapack will be provided

User-Friendly Interface:

- The software is designed with a user-friendly interface that simplifies operation. Users can easily configure tests, monitor system performance, and interact with the equipment in real-time. The interface allows for quick adjustments, test setup, and smooth data collection.

Real-Time Data Logging:

- Equipped with advanced real-time data logging, the software records essential test parameters such as:
  - Temperature vs. Time

- Power input values
- Thermal conductivity
- Thermal diffusivity
- Heat Capacity

All recorded data is stored and organized for easy retrieval, further analysis, and reporting.

Raw Data Access:

- The system provides direct access to raw data collected by the sensors, enabling in-depth analysis of each test. This is particularly useful for research purposes, where detailed thermal property data is crucial. Users can export data in standard formats for use in other analysis tools or software.

Data Export and Reporting:

- The software supports data export in a variety of formats, including CSV, Excel, and PDF, for easy sharing and integration into reports. It includes customizable reporting templates to streamline the process of generating comprehensive test reports.

Customizable Test Configuration:

Users can customize test parameters according to their specific requirements, including:

- Temperature range
- Sample type
- Test duration

This flexibility allows the system to adapt to a variety of materials and test conditions.

Remote Monitoring and Control:

- The software includes remote monitoring capabilities, allowing users to control and monitor the equipment from any location via a secure network connection. This feature is especially valuable for off-site data access and system supervision.

Compatibility and Integration:

- The software is designed to integrate seamlessly with external systems and platforms. It also offers potential for integration with open-source licenses, allowing users to customize the software or connect it with other laboratory management systems as required.

Maintenance Alerts and Updates:

- The system provides automatic maintenance alerts for scheduled calibration, servicing, or software updates. This ensures the equipment remains in optimal working condition, and users are kept informed of any necessary actions to maintain performance.

DELIVERY, INSTALLATION AND COMMISSIONING

Delivery:

The S1-HT-101 will be delivered directly to the specified laboratory location by the agreed date. Delivery will be completed under **Delivered At Place Unloaded (DPU)** terms, ensuring that SYP Technologies will handle all aspects of transportation, including insurance. Our courier services will provide the necessary offloading and transportation equipment, such as tailgate ramps and trolleys, to ensure smooth delivery.

Installation:

The **installation** of the S1-HT-101 will be conducted by skilled technicians from SYP Technologies. The process includes:

a. **Unpacking and positioning** the system in the laboratory.
b. Ensuring all **components, cables, and interfaces** are properly connected for immediate operation.
c. **Calibrating the equipment** for initial setup, ensuring the system is ready to function as per the university's requirements.
d. Handling any **special installation requirements**, such as electrical or utility connections, in compliance with the latest international wiring and safety regulations.

Commissioning:

After installation, SYP Technologies will fully **commission the equipment** to verify its operation according to the specified performance parameters. Commissioning includes:

a. **Functional testing** of all system components.
b. **Calibration verification** to ensure precise readings across the full thermal conductivity range.
c. Demonstrating **data logging** and **software functionality** to the satisfaction of the laboratory research and technical staff.
d. **Testing under operating conditions**, ensuring the equipment meets all performance criteria outlined in the tender, including temperature, pressure, and sample type testing.

Training and Demonstration:

As part of the commissioning process, **comprehensive training** will be provided to university staff. This includes :

a. Training on equipment operation, including both MTPS and TPS methods.
b. Data management training, covering data logging, interpretation, and exporting test results.
c. Instructions on equipment maintenance, dismantling, and reassembly to ensure safe handling and operation in different laboratory settings.
d. Customization training, allowing the university's technical staff to adapt the equipment's software and hardware for future research needs.

Delivery, installation and commissioning must be carried out during normal hours and must not affect the day-to-day operations of your laboratory.

Documentation and Support:

Upon installation, SYP Technologies will provide full **documentation** of the S1-HT-101, including:

a. **User manuals** with step-by-step operating instructions.
b. **Maintenance guides** for scheduled servicing and calibration.
c. **Electrical schematics** and system diagrams for further technical reference.
d. Detailed documentation in English of delivered equipment (incl. schematics and circuit descriptions); iits operation, maintenance and service must be included and supplied on delivery. SYP Technologies will also offer **ongoing support** and be available for any questions or additional services following installation and commissioning.

WARRANTY, AFTER-SALES SERVICE, AND MAINTENANCE

Warranty:

The S1-HT-101 comes with a **comprehensive 1-year full warranty** from the date of final acceptance testing. This warranty includes:

a. **Full coverage** for all parts, labor, and service costs related to equipment malfunctions or defects, excluding consumable items.
b. **Free technical support** during the warranty period, ensuring swift resolution of any operational issues.
c. **On-site repairs** and service, when required, with response times aligned with the university's operational needs.
d. The option to extend the warranty beyond the 1-year period, with **cost transparency** provided for extended coverage.

Extended Warranty Options:

SYP Technologies offers the opportunity to extend the warranty beyond the initial period. Extended warranty packages include:

a. **Fixed-cost service contracts** for up to 5 years, providing clear visibility into future maintenance costs.
b. Priority access to **spare parts** and **on-site service visits**, ensuring minimal downtime.
c. **Preventive maintenance visits**, included within the extended warranty, to help maintain the equipment in optimal working condition.

After-Sales Service:

SYP Technologies provides robust **after-sales support** to ensure the long-term performance of the S1-HT-101:

a. **Technical support**: Our dedicated support team is available to troubleshoot any issues or answer operational questions.

b. **Remote diagnostics**: The equipment's software allows remote access for troubleshooting and system diagnostics, enabling rapid identification and resolution of issues without requiring on-site visits.
c. **Spare parts availability**: We maintain a readily available stock of critical components, ensuring quick replacement and repair.

Maintenance Services:

Regular maintenance is key to ensuring optimal performance of the S1-HT-101. Our **maintenance plan** includes:

a. **Scheduled preventive maintenance** to perform system health checks, recalibration, and any required tune-ups.
b. **Detailed maintenance reports** after each visit, outlining the condition of the equipment, work performed, and any recommendations for future service.
c. **Calibration services**: Regular calibration checks are included to maintain the equipment's precision and accuracy, meeting all required operational standards.
d. **Service alerts**: The system's software includes built-in reminders for upcoming maintenance tasks, ensuring the system stays in peak operating condition.

Completed the Warranty and Maintenance Schedule in the ITT Response Document.

Service Response Times:

SYP Technologies ensures that **service response times** are designed to minimize equipment downtime:

Failure to repair the Equipment within 5 working days

a. **On-site visits** are typically conducted within 5 depending on the urgency and location.
b. **Remote diagnostics** will be initiated within 12 hours of the first service request, providing immediate attention to the problem.

DETAIL OF CONTRACTOR

SYP Technologies will handle the delivery, installation, and commissioning of the S1-HT-101 in-house.

Competence Statement:

SYP Technologies' team of skilled engineers and technicians has over 20 years of experience in manufacturing and installing laboratory equipment. If required, all subcontractors will be selected based on relevant certifications.

Method Statement and Risk Assessment:

A site-specific Method Statement will be prepared after the site visit. It will cover equipment delivery, installation, and setup. A Risk Assessment will address potential hazards, including electrical safety and equipment handling.

Public Liability Insurance:

A copy of SYP Technologies' public liability insurance certificate will be included, covering all installation activities.