SENTEK DYNAMICS

SELECTION & INSTALLATION OF SENTEK DYNAMICS' THV SERIES ENVIRONMENTAL TEST SYSTEMS

The selection of a THV system is essential to ensure quality and reliable testing at various environmental conditions for ESS (Environmental Stress Screening). Primarily, the application will determine the type of system that is required. Knowing the size of the test article and the test conditions that it is subjected to will also help in selecting the best suited system.

The THV Series environmental test systems are designed to work with Sentek Dynamics' air and water-cooled Electrodynamic shakers in vertical only, mono-base and multi-axis configurations, and can accommodate other manufacturer's shakers.

Selection Criterias:

1. Chamber volume
2. Force rating
3. Temperature ramp rates for heating and cooling of the DUT (Device Under Test)
4. Type of Controller and its functions
5. Accessories and options

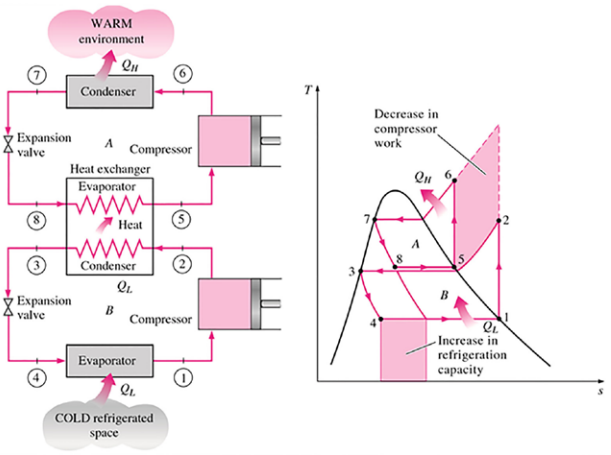
Sentek Dynamics' THV Systems

The table below identifies the range of configurations of chamber sizes (internal chamber volume), maximum force shaker model and maximum slip table size. The maximum force shaker model and slip table size represent the largest/highest capacity vibration system that can be combined with the listed chamber model. Sentek Dynamics' standard THV systems offer a temperature range of -70°C to +150°C and temperature ramp rates of 5, 10, 15°C. Upon request, we can provide systems operating at temperatures as high as +180°C. The THV systems provide a complete and reliable environmental test system to meet the changing test requirements for a wide-range of industries including aerospace, automotive, electronics and medical.

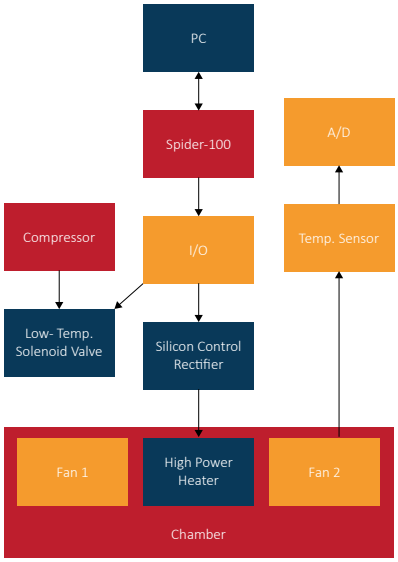
Chamber Model	Volume ft^3 (L)	Maximum Force Shaker Model	Rated Force kN (lbf)	Maximum Slip Table Size mm (in)
THV-600	21 (600)	M2232A	22 (4840)	600 (23.6)
THV-1200	42 (1200)	M3240A	32 (7040)	800 (31.5)
THV-2200	78 (2200)	H8044A	80 (17,600)	1200 (47.2)
THV-3300	117 (3300)	H8044A	80 (17,600)	1200 (47.2)
THV-6000	212 (6000)	H12056A	120 (26,400)	1500 (59.1)
THV-8000	283 (8000)	H12056A	120 (26,400)	1500 (59.1)
THV-10000	353 (10,000)	E30076A	300 (66,000)	1500 (59.1)
THV-12000	424 (12,000)	E40086A	400 (88,000)	1800 (70.9)

Temperature

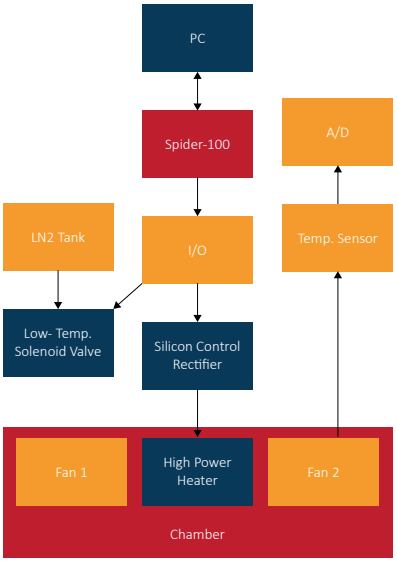
Temperature regulation is established via temperature cooling sub-systems and a heating system. For cooling, mechanical cascade vapor-compression refrigeration and liquid nitrogen cooling are utilized. Based on the temperature ramp rate, methods of cooling can utilize the cascade vapor-compression refrigeration system or liquid nitrogen system. The heating system consists of high-power resistance wire heating. These methods are applied to an optimized high-volume airflow system for controllability within the chamber to minimize temperature gradients across the device under test. A benefit of using Liquid Nitrogen & Compressor cooling systems combined with better airflow, temperature change rates are accelerated while maintaining excellent temperature control.



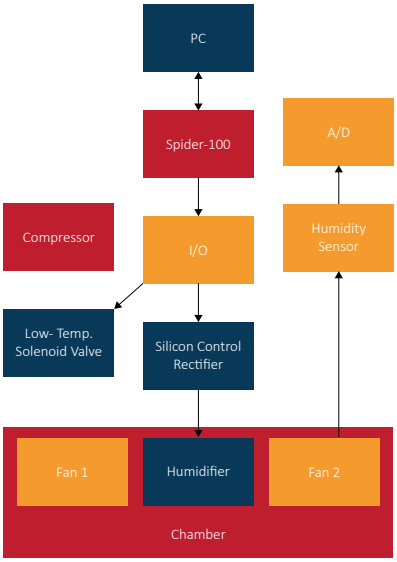
Method 1: Compressor Cooling



Method 2: Liquid N_2 for Cooling



Method 3: Liquid N2 & Compressor Hybrid



Cascade Refrigeration

The THV chamber incorporates a two-stage cascade refrigeration cycle. The two cycles are connected through the heat exchanger which serves as the evaporator for the topping cycle and the condenser for the bottoming cycle. Cascade refrigeration allows for increased refrigeration capacity with reduction in individual compressor work to improve the coefficient of performance (COP) of the system.

Liquid Nitrogen Cooling

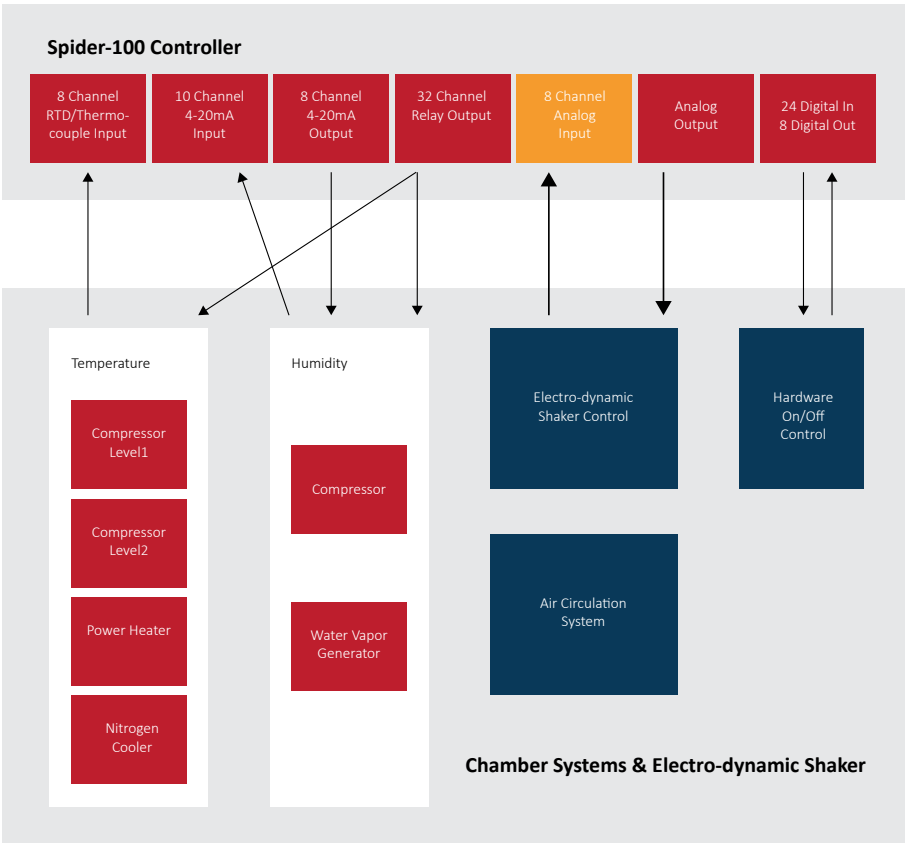
Liquid Nitrogen Cooling Liquid nitrogen cooling is used to produce extremely low temperatures. Incorporated to work in conjunction with the cascade refrigeration system, liquid nitrogen cooling assists in providing enhanced chamber temperature performance.

Cooling Unit

THV chamber cooling is highly efficient and reliable due to its advanced design and application of cascade refrigeration along with liquid nitrogen cooling. Features include low-noise compressors, environmentally friendly refrigerants (R404a, R23), nitrogen protected oxidation-free welding, and pneumatic, hydraulic and evaporation temperature adjustment for extended life span.

Humidification

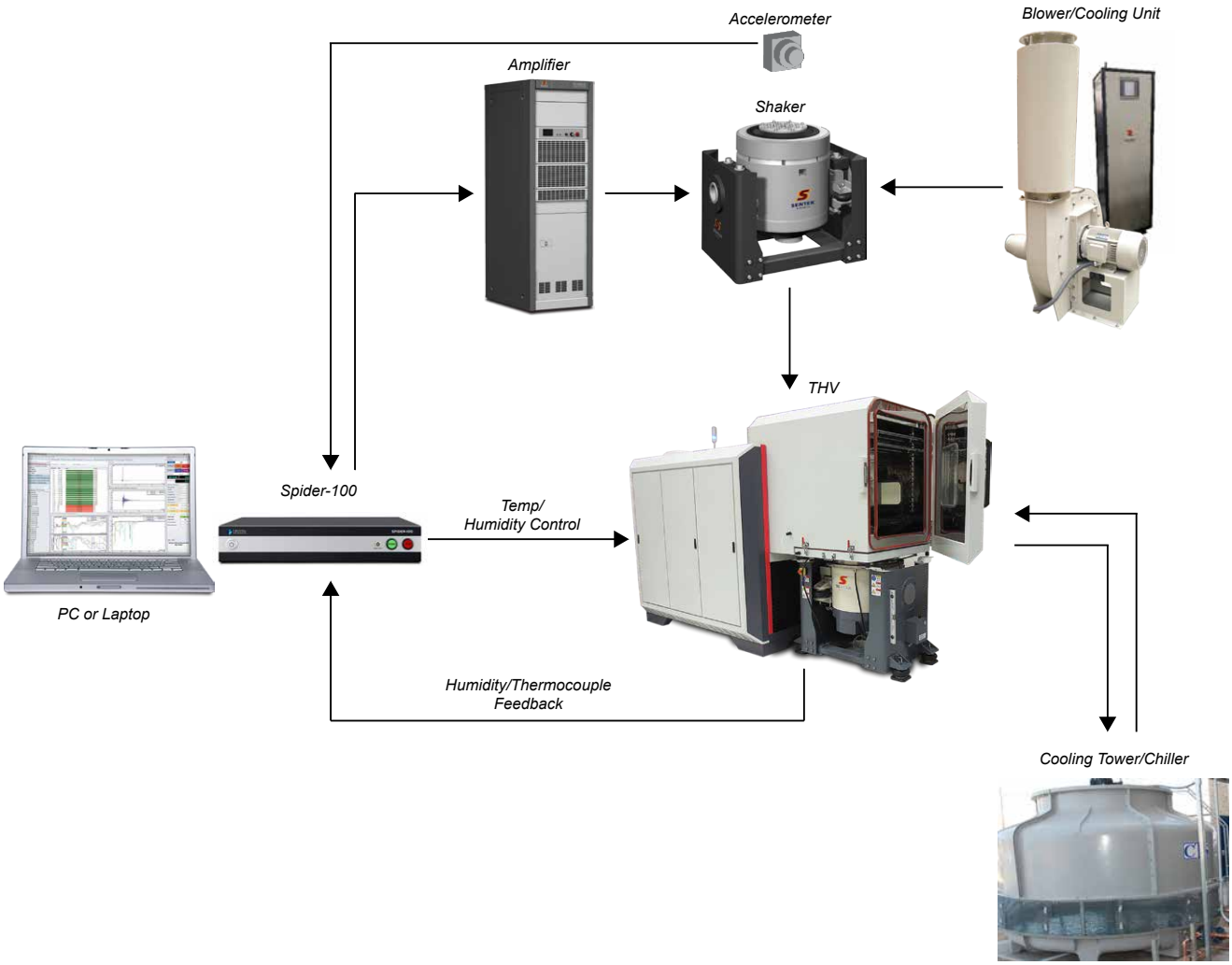
Humidification is achieved by injecting steam into the chamber. This steam is generated when the is heated by a wire heating furnace. A water level interlock and automatic water control delivery system is also part of the humidification sub-system. Dehumidification results from application of the desiccation principle, where air is cooled to a temperature below the dew point so that the moisture content is greater than the saturated water vapor condensation precipitation, thus lowering the humidity. Water purifier is listed as an option which softens and purifies water for the humidification and dehumidification processes.



Control

One of the many advantages of a Sentek Dynamics' THV Series system is that it incorporates the SPIDER-100 controller which can control temperature, humidity and vibration control simultaneously. Using Multiple Input Multiple Output (MIMO) PID decoupled control, simultaneous control of individual environmental testing systems to high accuracy is accomplished. Due to enhanced control design, the DUT is able to experience prescribed vibratory motion of sinusoidal, random or transient form (or a combination of any of these) while being exposed to a specific user-defined temperature and humidity environment. The Spider-100 controller supports Crystal Instruments' versatile Environment Data Management (EDM) vibration control software (VCS) and dynamic signal analyzer (DSA) software.

The Spider-100 is specially developed for combined temperature, humidity and vibration testing where the device under test (DUT) is subjected to simultaneous temperature cycling, variable humidity and vibration. The unique capability of simultaneous control for combined testing is made possible by excellent control design which allows for control of a shaker, refrigeration units, electric heating elements and humidification components.


Accelerometer
Blower/Cooling Unit
Amplifier
Shaker
THV
Spider-100
Temp/
Humidity Control
PC or Laptop
Humidity/Thermocouple
Feedback
Cooling Tower/Chiller

General THV System Facility Installation Preparation Guidelines

Once you have identified the ideal THV system for your testing requirements, the next steps in the process will be to evaluate your facility for suitability, establish the optimum placement of your equipment, and verification of facility services.

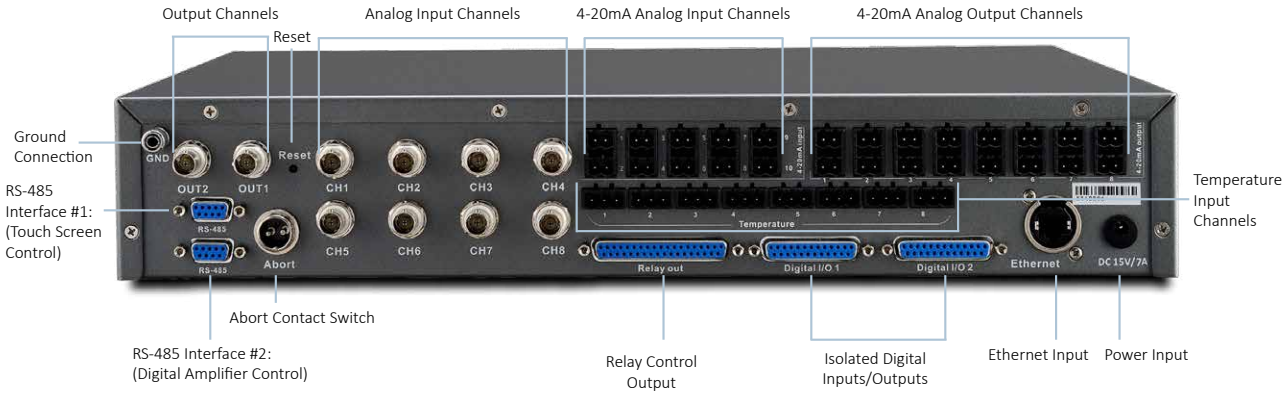
Facility Sizing and Component Placement

One of the most crucial factors when determining the suitability of your potential test site will be ensuring the chosen location provides sufficient floor space for not only the THV system but also the human component of your laboratory.

When analyzing the size requirements for your lab some key points to consider will be:

Component placement – The main components of your THV system will be:

- THV chamber
- Shaker in either vertical only or mono-base vertical/ horizontal configuration
- Amplifier(s)
- Cooling equipment – Blower for air cooled systems or cooling unit for water cooled systems
- Hydraulic Power Supply (HPS) – For high-pressure slip-tables only
- Operator's control area or room
- Required length of interconnections between each piece of equipment
- Ability to maintain a minimum of 1m/3ft of clearance around all components when installed.



Movement – The chamber will move in two axes.

- When moving vertically, consideration must be taken to ensure that there will be sufficient clearance between the chamber in the full vertical position and the laboratory ceiling.
- Depending on the model of shaker chosen for your THV system, the chamber will move horizontally to either two or three distinct positions. 1. Maintenance position – This will be the position used for chamber only or vibration only testing and performing any required maintenance to the THV system. 2. Vertical combined testing. 3. Horizontal combined testing if using a shaker with a mono-base slip-table.
- In any of these possible horizontal movement positions, sufficient room will be required for: movement of personnel, opening of chamber door, opening of THV access panels, and loading/unloading of any fixtures and/or DUTs including movement of any equipment required to do so.

Installation access – Your THV system will arrive at your facility with each individual component crated and fully assembled. The largest item will be the THV chamber itself. Entryway and path of travel large enough to accommodate the THV chamber and the equipment being used to facilitate its movement must be provided.

Facility Supply Requirements
Your facility must have certain features and services to properly install and operate your THV system.

- The floor will need to be level, capable of supporting the weight and operation of the equipment, and suitable for the installation of anchors to attach the THV guide rails.
- The area around the shaker will need to be free of any ferromagnetic particles.
- Adequate and compliant incoming electrical power and appropriate disconnects for each piece of equipment will be needed. Each THV system is unique and these requirements will be provided to you by our Sentek Engineering Team.
- Adequate and compliant cooling water supply for the THV chamber and shaker cooling unit if equipped will be required. Each THV system is unique and these requirements will be provided to you by our Sentek engineering team.
- Compressed air supply for shaker payload support, trunnion isolation, isolation feet, and if equipped, the THV purge system.
- LN^2 or CO^2 compressed gas supply and method of exhaust if required for your system's configuration. Each THV system is unique and these requirements, if needed, will be provided to you by our Sentek engineering team.
- Floor drain or drain pan system to capture any chamber condensate.
- Sufficient air conditioning capacity for maintaining the laboratory working environment while equipment is in use.
- Sufficient laboratory make-up air flow for air-cooled systems when blower unit is located outside of the testing area.

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