SolarTrac® System

The WindowManagement® solution for daylighting

The New York Times Building. Image courtesy of: The New York Times Company, Forest City Ratner Companies, Renzo Piano Building Workshop, FXFowle Architects, photo Artefactory

MechoShade Systems
The Architect's Choice

SolarTrac® System

An advanced, scientific, automated shading system, SolarTrac® is designed to maximize natural daylight. This WindowManagement® system increases energy efficiency while providing occupants with a comfortable environment and views to the outside.

The WindowManagement® system:

- tracks the sun and sky conditions, automatically adjusting shades to protect against solar-heat gain, brightness, and glare.
- saves up to 70% in lighting costs when used with an appropriate daylighting system.
- increases opportunities for natural light, which reduces the need for artificial light.
- reduces solar-heat gain, which decreases air-conditioning needs.
- alleviates brightness and glare, which provides a more comfortable environment.

SolarTrac® automatically controls roller shades so they:

- have the potential to deliver significant reductions in energy-peak demands over a project's lifetime.
- adjust to various positions on the window, which are appropriate to the sun's position in the sky, microclimatic sky conditions, and the building location, orientation, and geometry.
- raise when windows are in shadow to maximize daylight and view.
- lower when the sun is bright to increase comfort.
- provide a view to the outside, even when lowered.
- maximize daylight opportunities while providing a view to the outside when direct solar penetration occurs.
- operate in tandem with other manufacturers' electric lighting controls, which adjust light levels based on the amount of daylight the shades allow into the space.

Saves up to 70% in lighting costs with an appropriate daylighting system

The SolarTrac® System was installed in the New York Times Headquarters (cafeteria shown left). The participants in the project, which provided valuable insights, were:

- The New York Times Company
- Lawrence Berkeley National Laboratory
- publicly funded agencies
- MechoShade Systems, Inc.

Optimized by scientific solar tracking

To effectively manage daylight, SolarTrac® continuously monitors sky conditions and the solar path.

The system calculates the sun's angle on each window in every zone. It takes into account a window's elevation, geometry, solar orientation, and profile. This includes structural elements such as balconies, overhangs, and fins that might block the sun.

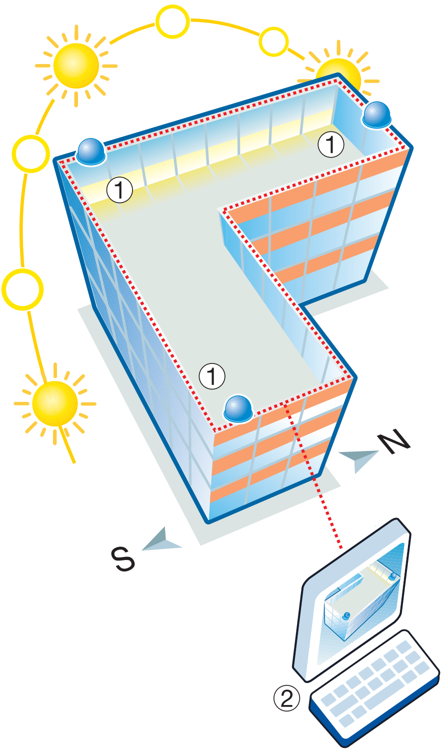
The program adjusts the shades to one of the specified positions on the window in order to manage the distance direct sunlight can enter a space and the BTU load on the glass.

Solar path

Specialized solar radiometers (sun sensors, see right) collect real-time sky data. Using this information, SolarTrac® creates a sky model of the microclimatic condition of the moment and also over time.

① Three roof-mounted radiometers monitor sky conditions in real time.

② SolarTrac® utilizes proprietary algorithms, which translate raw solar-sensor data to determine the sky condition—clear or cloudy. When cloudy, the shades are raised. When clear, the shades' position is adjusted according to the sun's angle in the sky.

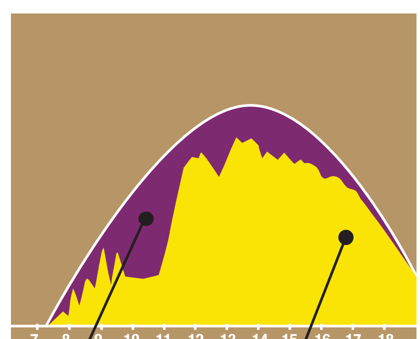


Has the ability to determine solar angle and sky conditions

Radiation curve

The sky model (see right) is compared to ASHRAE's theoretical radiation curve, indicated by the purple area. From this analysis, SolarTrac® is able to determine if the sky condition is clear or cloudy. This function will occur many times a minute throughout the day, 24/7/365.

When cloudy, the shades are raised. When sunny, the system adjusts each zone's shades according to the solar angle, any user-defined zone parameters, and other optional overrides.



The New York Times Building, New York City.
Photography: Eliane Vanderborght

Shade-system protocol

The New York Times Building incorporates MechoShade Systems' advanced SolarTrac® System. It utilizes the powerful I-Con® network with LonWorks® protocol developed by Echelon®. Its technologically advanced features include:

- robust design.
- two-way communication.
- free topology, which decreases wiring costs.
- intelligent, encoded two-way communication motors.
- individual addressability of each motor.
- motors with ability to store multiple addresses, enabling the overlapping of control zones.

Provides the scientific know-how to compensate for brightness, glare, and shadow

Manual-Override Module

For special requirements or needs, the feature makes it possible to:

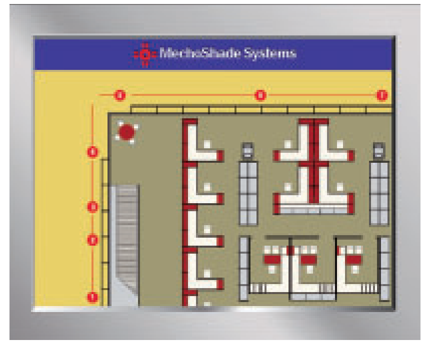
- manually override the position of any individual shade or shade zone.
- easily locate and select a shade and adjust its settings.
- access the system's database to analyze solar data, zone brightness, and the history of shade movements.

Brightness-Override Module (optional)

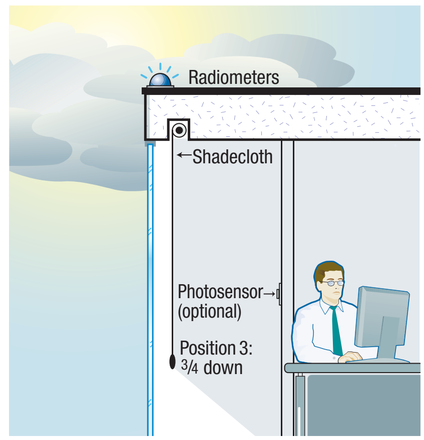
This module optimizes comfort by alleviating undesirable sky brightness or glare when these conditions exceed specified IES luminance levels. In the event of excessive glare, such as when it's overcast but bright, the photosensors alert the system. SolarTrac® then adjusts the shades to satisfy occupant comfort while still permitting the entrance of daylight and views to the outside.

Shadow-Override Module (optional)

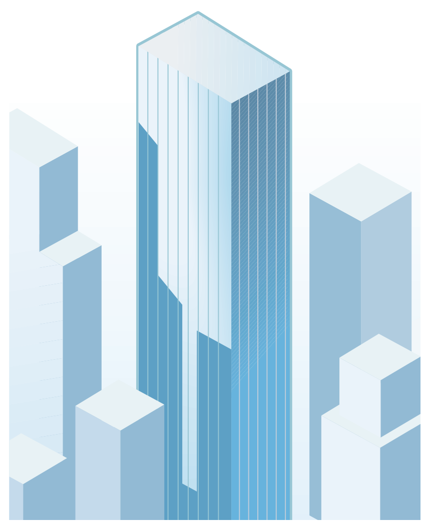
This module raises shades in zones that are in shadow. Utilizing a 3-D model (example right) of the surrounding cityscape, the module takes into account adjacent structures (buildings, trees, and other obstructions), that block the sun and cause shadows on the facade. When these conditions cause a facade to be in shadow for 15–30 minutes (time frame to be determined by the user), the system raises the shades. And, in turn, daylight is harvested and views are maximized.



Example of MechoShade Systems' touch screen

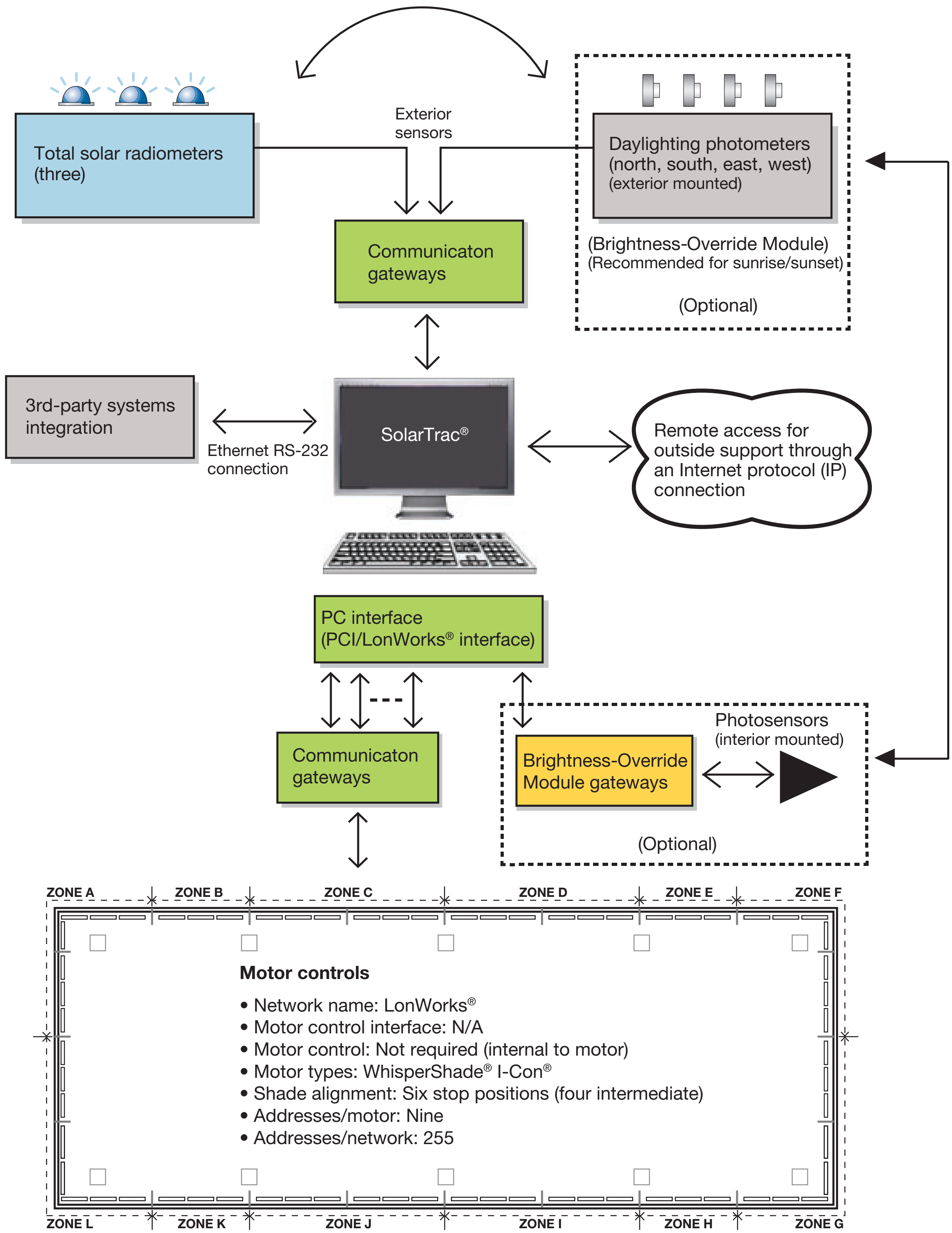


Example of brightness/overcast-sky condition



Example of shadow condition

SolarTrac® schematic
I-Con® Motor LonWorks® two-way communication network



The New York Times Building research study

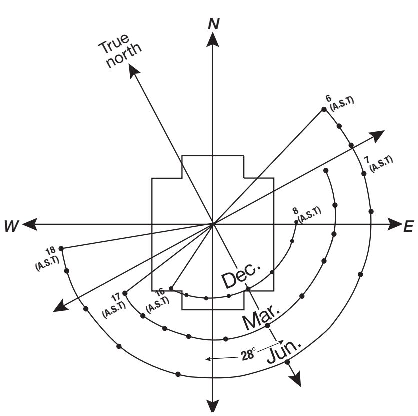
The New York Times Headquarters was designed by Renzo Piano Building Workshop in association with FXFOWLE Architects and interiors by Gensler.

Prior to construction, The Times built a highly sophisticated 4,500 sq. ft. (418 sq. m.) mock-up facility in Queens, New York, for an extensive energy study and systems evaluation.

The study was performed by Lawrence Berkeley National Laboratory (LBNL) with funding by the New York State Energy Research and Development Authority (NYSERDA). LBNL focused its attention on quantifying the synergistic benefits of using automated roller shades with daylight harvesting.

MechoShade Systems' unique SolarTrac® program and the dimmable lighting system were closely monitored and evaluated for nine months. The savings in lighting costs were 50–60% at 11 ft. (3m) from the west-facing windows and 25–40% at 14–25 ft. (4–8m) from windows oriented southwest and northwest.

Following the construction of the building, a 70% total energy savings was realized, which exceeded expectations based upon energy code requirements.



A.S.T. (Apparent Solar Time) footprint of The New York Times Building mock-up, rotated 28° east of north.

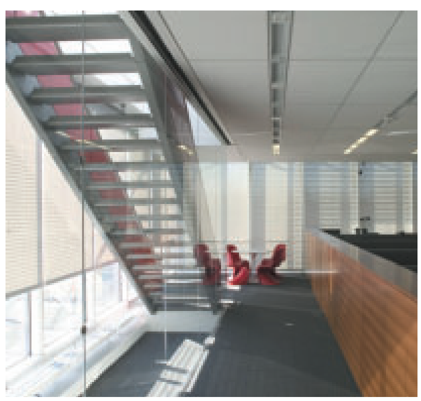
SolarTrac® System operating on a typical day

2:40 p.m.

SolarTrac® positions shades on the south elevation (left foreground of image) to the 3rd position, ¾ down. Shades on the west elevation (background of image) are adjusted to the 1st position, ¼ down. The light-dimming system senses enough daylight for the overhead lights to remain off.

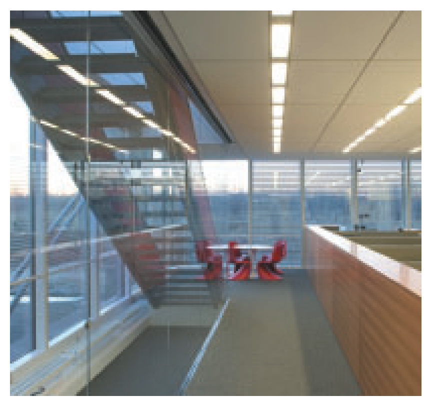
3:20 p.m.

SolarTrac® lowers the shades on the west elevation (background of image) to the 3rd position, ¾ down. Shades on the south elevation (left foreground of image) remain at position 3. Lights begin to turn on as the sun angle becomes lower in the west.



4:35 p.m.

SolarTrac®—in reaction to the solar-gain and glare conditions that occur at sunset—lowers the shades on the west elevation (background of image) to the full-down position. Shades on the south elevation (left foreground of image) stay at the 3rd position, ¾ down. In response to the light conditions, the light-dimming system turns on some of the lights while leaving others off.



5:45 p.m.

At about dusk, the sun is below the horizon. SolarTrac® reacts by raising the shades on the west elevation (background of image) and shades on the south elevation (left foreground of image) to the full-up position. This provides occupants with exterior views and allows natural daylight to enter the interior.

The New York Times Building mock-up, College Point, Queens, N.Y. Photography: David Joseph

One of the numerous features of the SolarTrac® System is its ability to adjust individual shade heights uniformly for a clean interior- and exterior-view aesthetic. It also offers solar protection with a view where needed.

Over time, the system can be increasingly fine-tuned to the lighting needs of the occupants—so that their comfort, view, and exposure to daylight are maximized.

The New York Times Building, New York City.
Photography: Bernstein Associates

Aligns multiple shades to meet the architect's intent of a uniform aesthetic

MechoShade Systems
The Architect's Choice

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