SolarTrac® System

The WindowManagement® solution for daylighting

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

MechoSystems
Design with light.®

SolarTrac System

An advanced, scientific, automated-shading system, SolarTrac is designed to maximise 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 that they:

- Have the potential to deliver significant reductions in energy-peak demands over a project's lifetime.
- Adjust to various positions on the window appropriate to the sun's position in the sky, microclimatic sky conditions, and the building's location, orientation, and geometry.
- Raise when windows are in shadow to maximise daylight and view.
- Lower when the sun is bright to increase comfort.
- Provide a view to the outside, even when lowered.
- Maximise daylight opportunities, while providing a view to the outside when direct solar penetration occurs.
- Operate in tandem with other manufacturers' electric lighting controls, which make light-level adjustments 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 following participants in the project provided invaluable insights:

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

The New York Times Headquarters Cafeteria, New York. Photography: Bernstein Associates.

Optimised 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 programme adjusts the shades to one of the specified positions on the window in order to manage both the distance direct sunlight can enter a space and the kilowatts per square meter on the glass.

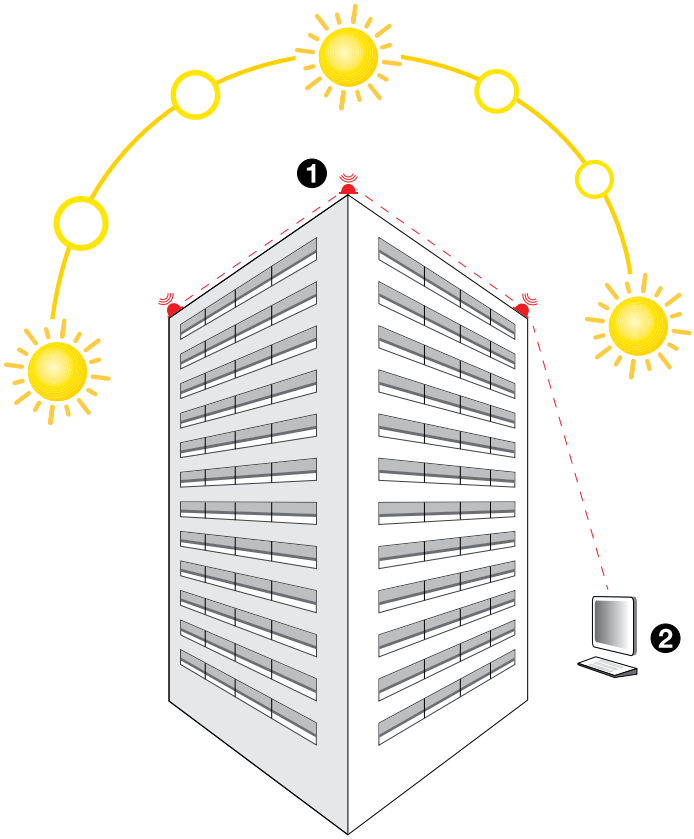
Has the ability to determine solar angle and sky conditions

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

Solar path

Specialised solar radiometers (sun sensors, see the diagram below) collect real-time sky data. Using this information, SolarTrac creates a sky model of the microclimatic condition of one particular moment and also over a sustained period of time.

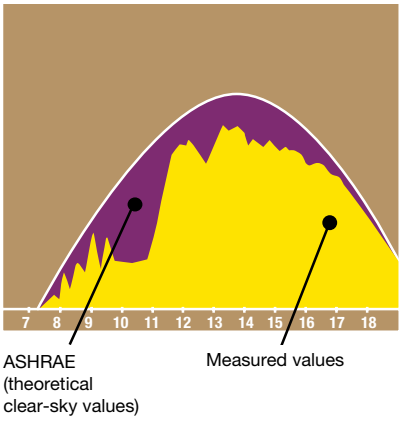
1. Three roof-mounted radiometers monitor sky conditions in real time.
2. SolarTrac utilises proprietary algorithms, which translate raw solar-sensor data to determine the sky condition—clear or cloudy. When cloudy, the shades are raised. When clear, the shade bands' positions are adjusted according to the sun's angle in the sky.



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.



Shade-system protocol

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

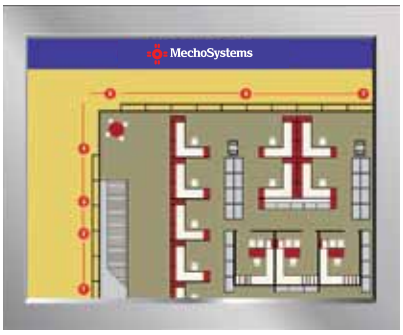
- Robust design.
- Two-way communication.
- Free topology, which decreases wiring costs.
- Intelligent, encoded two-way communication motors.
- Individual addressability of each motor.
- Motors with ability to store multiple addresses, enabling the overlapping of control zones.

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:

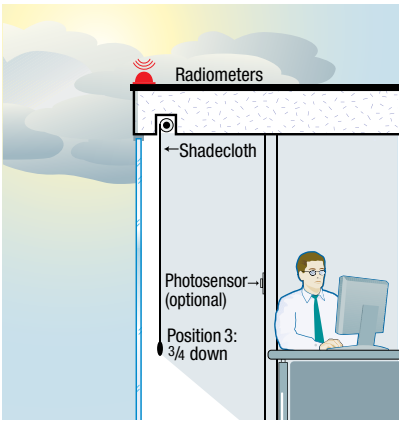
- Manually override the position of any individual shade or shade zone.
- Easily locate and select a shade and adjust its settings.
- Access the system's database to analyse solar data, zone brightness, and the history of shade movements.



Example of MechoSystems' touch screen.

Brightness-Override Module (optional)

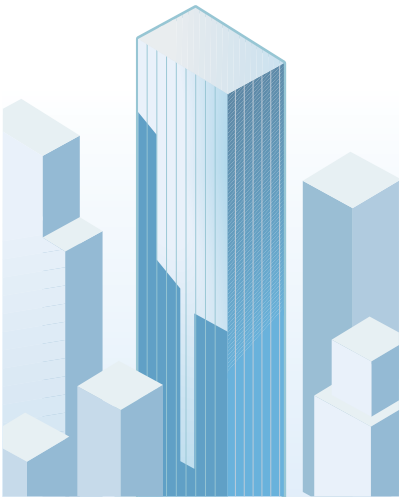
This module optimises comfort by alleviating undesirable sky brightness or glare when these conditions exceed specified IES (Illuminating Engineering Society of North America) luminance levels. In the event of excessive glare, such as when it's overcast but bright (see diagram, middle right), the photosensors alert the system. SolarTrac then adjusts the shades to satisfy occupant comfort while still permitting the entrance of daylight and views to the outside.



Example of brightness/overcast-sky condition.

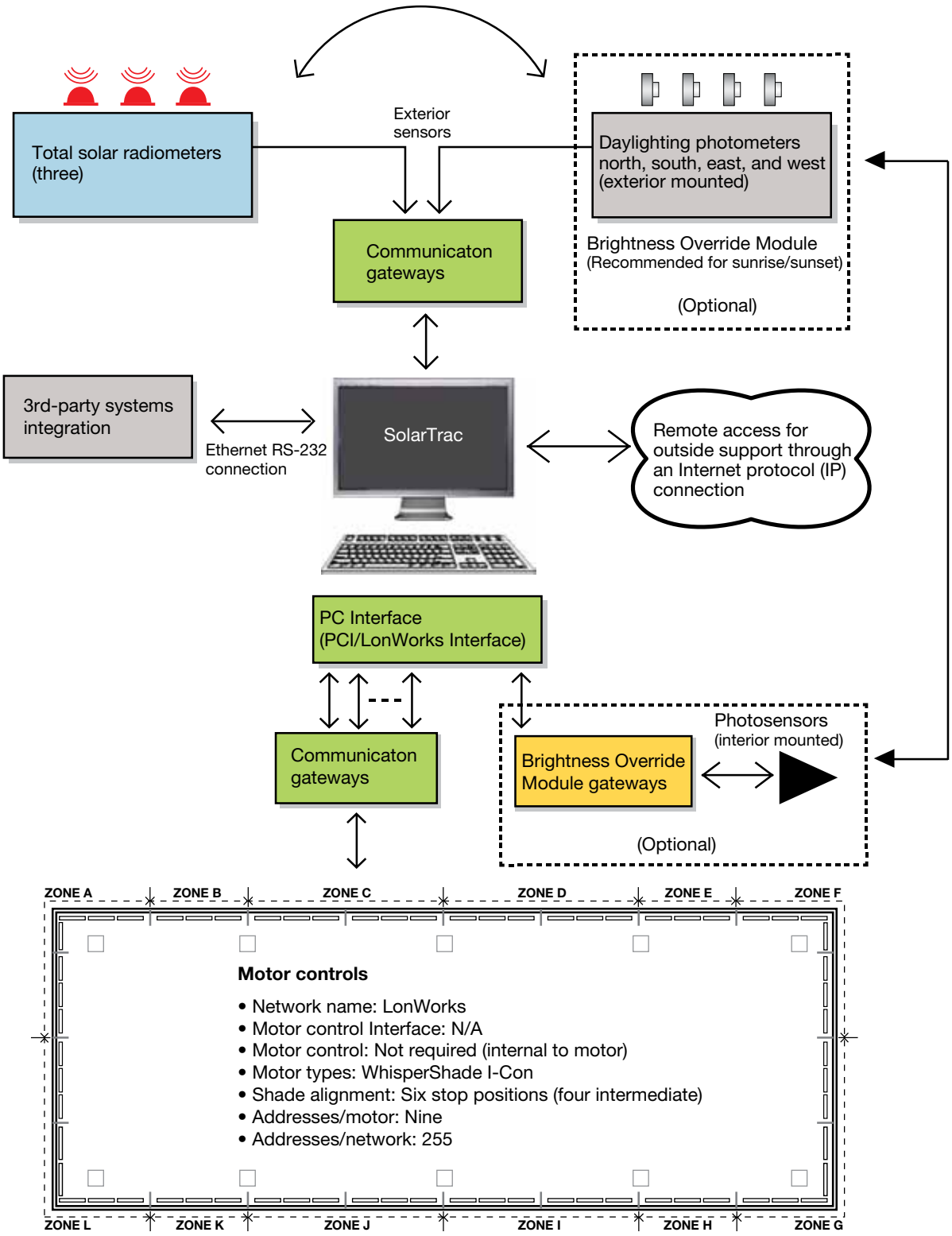
Shadow-Override Module (optional)

This module raises shades in zones that are in shadow. Utilising a 3-D model (see diagram, bottom 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, eg: for 15–30 minutes (time frame to be determined by the user), the system raises the shade bands. And, in turn, daylight is harvested and views are maximised.



Example of shadow condition.

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



The New York Times Building research study

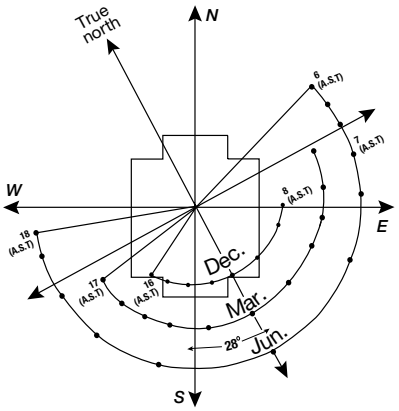
The New York Times Headquarters was designed by Renzo Piano Building Workshop, in association with FXFOWLE Architects and with interiors by Gensler.

Prior to construction, The New York Times built a highly sophisticated 418 sq. m (4,500 sq. ft.) mock-up facility in Queens, N.Y., 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.

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

Following the construction of the building, a 70% total energy savings was realised, 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, three-quarters down. Shades on the west elevation (background of image) are adjusted to the 1st position, one-quarter 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, three-quarters 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.

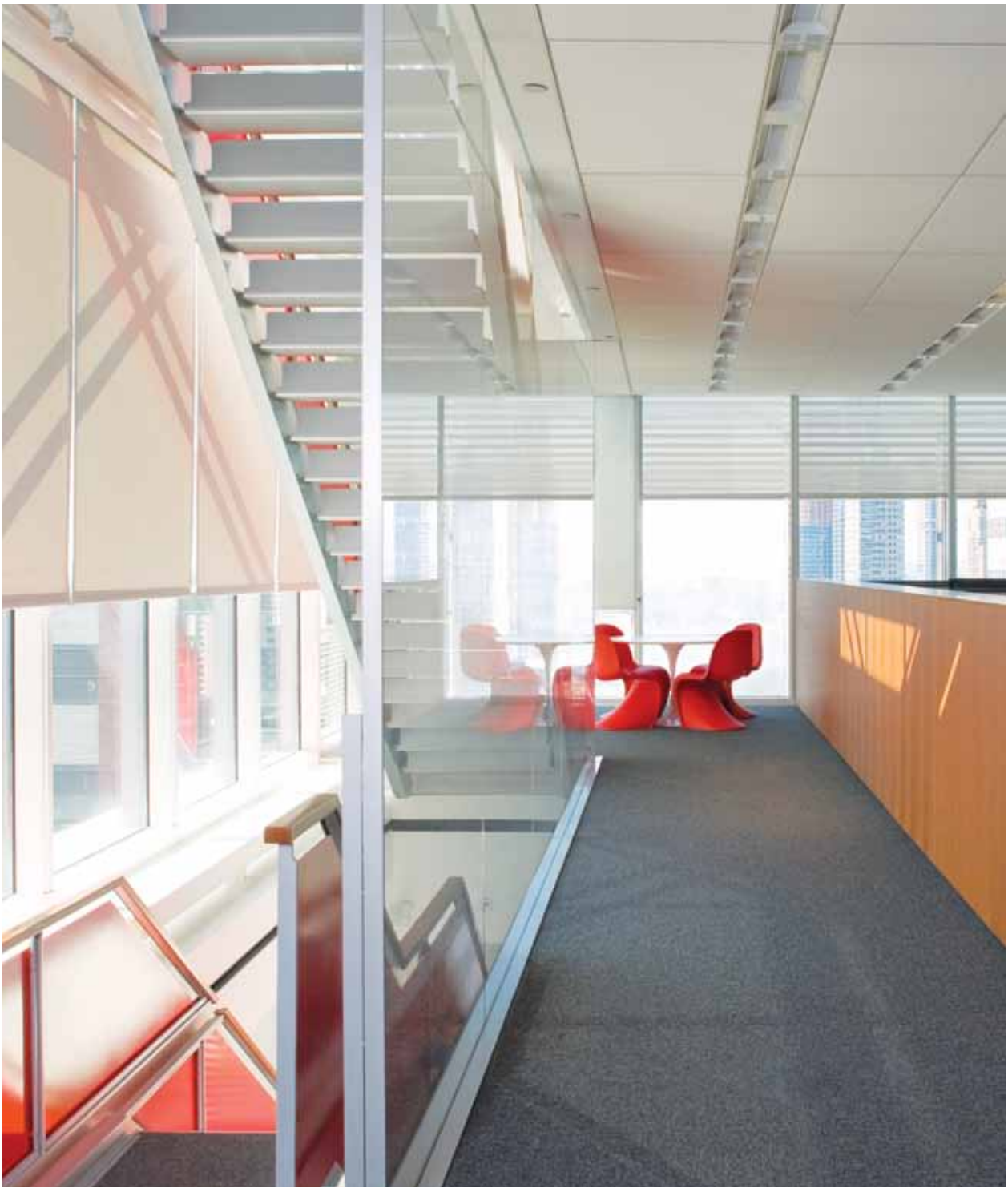
4:35 p.m.

SolarTrac—in reaction to the solar-gain and glare conditions that occur at sunset—lowers the shade bands 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, three-quarters 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 shade bands 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 band 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 maximised.

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

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

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