

# CASE STUDY

## CASTING FRESH LIGHT ON OLD MASTERS

First published: November 2009

London's National Gallery is now better equipped to present its old masters in the best possible light – quite literally. The site's Trend building management system has begun implementing a new strategy for controlling gallery roof blinds, one that will allow the collections to be viewed in natural lighting for longer periods, whilst protecting them from direct sunlight. As well as enhancing the viewer's appreciation of a painting, the use of daylight to provide illumination reduces the need for artificial lighting, thus saving energy.

The Trend BMS provides close control and monitoring of environmental conditions throughout the National Gallery's main building. In doing so it plays a vital role in preserving the Gallery's priceless collection of 13th – 19th century Western European paintings, which include masterpieces from virtually all the great artists. Most of the building's 40 plus galleries have glazed roofs and here the system regulates the light levels through coordinated control of the picture lighting and the rooflight window blinds.

The galleries' individual Trend IQ controllers will only switch on the artificial lighting if the optimum illumination level cannot be achieved by natural light alone, through control of the blinds. Generally, a gallery has two tracklight circuits, one comprising blue lights that simulate daylight and the other made up of conventional clear lamps. The first are brought on if the average light level falls to a preset value, and if this is not sufficient the second set is switched on as well.

When modulating the motorised blinds to achieve the light level setpoint, the controllers must ensure that no direct sunlight is admitted. In most galleries there was previously just a maximum opening angle for each season of the year, with no account being taken of the sun's movement during the day. As a consequence, blinds were often not opened as far as they could have been, which unnecessarily restricted the amount of natural light allowed into the galleries.



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Photo: Howard Hall

The new blind control program overcomes this limitation by using the time and date to continually calculate the changing position of the sun. From this it repeatedly computes maximum and minimum safe opening limits for each set of blinds, taking into account their orientation and slope. The limits for each set are updated in rotation every two to three minutes. Calculations are made to a resolution of less than 1° although blind movements are made in increments of 2.5 or 5°.

The BMS also incorporates an external lux sensor that shows whether it is sunny or overcast. When it is overcast, the output from the max/min angle algorithm is overridden and the blinds can move to their fully open position. This happens too if the program determines that the rooflight will be in shadow from an adjacent building or another part of the roof structure. Since the blinds need to be closed during the hours of darkness, the program also calculates sunset and sunrise times.

Light levels in each gallery are

measured by several sensors, the gallery controller working from an average of their readings taken over the previous minute. It also reacts to high or low instantaneous values, by disabling or enabling the artificial lighting. In addition, it uses these values to calculate cumulative light exposure levels, which should not exceed 12,500 lux-hours per week.

The new blind control strategy was devised by building services consultant Andrew Reid & Partners who, like Trend, has worked with the National Gallery for many years. It has been installed into an IQ3xcite XNC controller, which has sufficient software capacity to carry out the extensive trigonometric calculations. This communicates with the galleries existing controllers via the BMS network.

The program, which was tested using an architectural software package that includes solar simulation, is initially being applied in seven galleries. It is expected to be rolled out to the remainder early next year, which will require

the installation of a second IQ3xcite XNC controller. Together, the two controllers will calculate and supply settings for around 100 sets of blinds of varying design and orientation. The energy savings that result could be significant.

Another crucial task performed by the Trend system is control of gallery temperature and humidity. Maintaining stable conditions is particularly important for picture preservation. Close collaboration between Trend and Andrew Reid & Partners has resulted in a number of strategy changes and control refinements to maintain environmental stability.

The first elements of the National Gallery's Trend BMS were installed more than twenty years ago. Today it incorporates over 100 IQ controllers, all operating within a single fully integrated system. A number of graphics-based supervisors provide the Gallery engineering staff with access to control settings and system monitored data. A touch-screen operated supervisor is used by the gallery staff and maintenance personnel to manually switch lighting as required and check environmental conditions.

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SA107083 Issue 1

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