

TECHNOLOGY



Smart Lighting, Smart House Control systems change the homeowner experience

BY GEOFF FERRELL

As the chief technology officer for Mandalay Homes, a production builder based in Prescott, Ariz., it's my job to keep my company on the cutting edge of advancing home technology. Our strategy is to make technology and affordability work together. At the same time we're building a better house that is more attractive to buyers, we're finding ways to contain or cut costs so that we can stay price-competitive in our midrange real-estate market segment.

I'm responsible for implementing a wide variety of specific solutions in our houses. For example, we've introduced AeroBarrier aerosol home sealing to our construction work flow (see "A Game Changer for Airtight Construction?" Mar/18), and we've

started equipping every new house in some of our neighborhoods with a battery system paired with photovoltaic rooftop panels (see "Grid-Optimized Solar-and-Battery Systems," May/18). Both of those advances add value for our customers while saving energy.

The scope of my responsibility also includes lighting and home automation. In this story, I'll describe how we use advanced control systems and advanced lighting to save energy costs for our homeowners, while at the same time enhancing their experience of living in the house.

In practice, smart lighting and smart home automation are closely connected, because the first upgrade after you've put the best modern lighting into a house is to put in the controls that help



Mandalay Homes installs LED downlights over garage doors, rather than traditional carriage lights flanking the doors. This helps comply with “dark sky” regulations, creates a pleasing light, and conserves energy.

the homeowner get the most utility out of those advanced lighting fixtures. In our case, we’ve made the switch to 100% LED lighting in our homes and, in most of the homes, control of that lighting is integrated into a Control4 home automation system (control4.com). But that’s just the beginning: The home automation system can control many other things besides just the lights.

LIGHTING: THE BASE PACKAGE

As I mentioned, our new houses now have a “solar plus storage” solution that collects power from the sun, stores it in batteries, and uses it to offset the home’s needs during peak power draw periods. There’s an up-front cost to the system, but it brings a bottom-line savings for our homeowners when power-bill savings are factored in. To do that trick cost-effectively, however, we need to shave down our homes’ power needs, which includes lighting. We’ve done that in part by phasing out compact fluorescent lights (CFLs) in favor of LED lights.

An Energy Star-rated compact fluorescent equivalent for a 60-watt incandescent bulb draws about 14 or 15 watts. A 60-watt equivalent LED-integrated luminaire uses 9 to 11 watts, and it supplies better quality light. What we’ve done is to transition away from fixtures that require screw-in or plug-in bulbs, and we’ve gone over entirely to integrated-LED luminaires. So instead of a standard line-voltage fixture with an LED bulb screwed into it, we’re installing a purpose-built, high-quality Energy Star-rated fixture, with the LEDs built in. Our typical house has about 25 recessed ceiling luminaires, and if the homeowners choose to add more fixtures, we offer them the same kind of integrated equipment.

One advantage to using integrated luminaires is that a future homeowner can’t go backward by installing a less-efficient replacement bulb. Although with these fixtures, the issue of replacement is unlikely to come up: The fixtures we install have a rated life of 50,000 hours. When you consider that Arizona gets a lot of high-quality natural daylight, and you think about how much a

Photos: Mandalay Homes



Inside the garages, Mandalay Homes has transitioned away from conventional 40-watt fluorescent tube overhead lights in favor of LED panel lights; the up-charge for those fixtures is mostly offset by their greater light output and improved light quality. An internet-controllable garage door opener from LiftMaster is also standard in the garage.

light is really used, these light fixtures are going to last 20 or 25 years before anybody has to think about replacing anything. Of course, nobody knows what sort of technology will be available in 25 years. But if a homeowner did have the need to replace an entire integrated fixture today, the light fixtures we install are readily available on the market as replacement units, both in home centers and from online vendors.

If you walked through one of the models that we are building right now as compared to a couple of years ago, you would see closer to 30 recessed can fixtures, instead of the maybe 12 or 15 in the old model. We've eliminated wall sconces, bar light fixtures over vanities, and fluorescent tube fixtures in the closets, laundry rooms, and garages. Instead, we have gone either to integrated-luminaire recessed fixtures or to a surface-mounted LED panel light—a much more efficient unit that puts out really great light. For recessed downlights, we spec Parmida dimmable retrofit fixtures and Nicor 4-inch Surefit LED fixtures.

So how has this change affected our costs? Compared with a recessed can with a screw-in bulb, the recessed integrated luminaires we've chosen cost the same. But it does cost us about \$7 or \$8 more per location to install one of these integrated luminaires than it would cost to do a wall sconce or a bathroom bar fixture. That cost differential varies case by case. In some places, we lose a little bit of money, and in other places, we make a little bit.

Transitioning from fluorescent tube fixtures over to LED panels in the garage did cost a bit more: The LED fixtures cost about three times as much per fixture. But whereas we used to put two fluorescent fixtures per garage bay, now we are installing only one of the LED panel fixtures, because they put out so much more light per fixture than the fluorescent did. So when you do the math (including labor), it's only about a 20% cost increase to provide that better light.

Quality of light is a factor in our selections. Light quality is defined by a metric called the Color Rendering Index (CRI). The



Mandalay Homes' basic home package includes internet-capable amenities such as a programmable Kwikset SmartCode door lock (above left) and a smartphone-controlled Rachio landscape irrigation timer (above right). In most homes, these elements can be programmed using the home's Control4 interface (see facing page).

lighting we install has a CRI of about 93 or 94, which is very high quality. As for color temperature, studies have shown that as people age, they are looking for brighter and bluer or whiter light, especially in task areas. That holds true for us: Most of our clients seem to prefer a 3,000K light source rather than a 2,700K light.

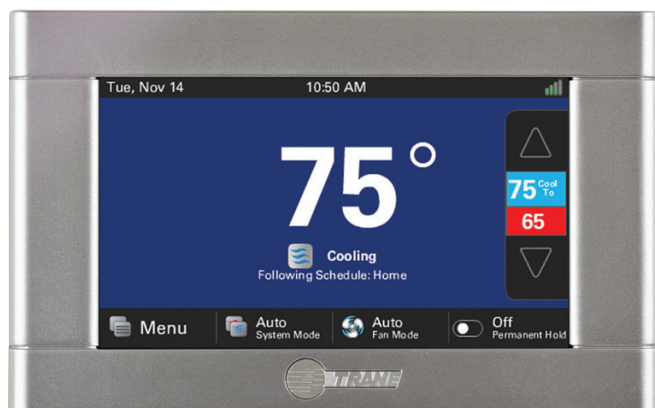
Light sources are one part of a lighting solution; the other part is controls. About 15% of our homes are basic workforce housing; these units don't come with home automation in the base package. In those houses, a lighting upgrade consists of advanced manual switches for the lights. All of the LED luminaires we install are dimmable. So instead of a simple on-off switch, the customer can select dimming switches. But in the houses with home automation, the lighting can be integrated into the home automation controller, which allows for a fully programmable lighting experience. In addition, the home automation system can be configured to integrate many other household amenities into a single centralized control center. Let's take a closer look.

CONTROLS: THE BASE PACKAGE

As I mentioned, our basic workforce housing doesn't come with a home automation controller. But we do supply a nice structured wiring package as standard equipment in every house. We include two RG6 coaxial cable connections at the service panel, in case the homeowner wants to use the local cable vendor for internet and wants a satellite dish for TV.

We also run two Cat6 connections to the panel, so the homeowner can access telephone and internet service from a local phone company provider.

Then inside the home, we allow six drops. The owner could choose coax and a Cat6 to the great room because they plan to plug in a smart TV; they could ask for coax in all three of the bedrooms because they want a cable box in each bedroom; they can put telephone service in for a home office; and so on. If homeowners want more than six drops, we charge by the drop. All of the hard wiring is handled by the low-voltage contractor.



Mandalay Homes' basic workforce housing includes a programmable, internet-capable thermostat supplied by Trane (top). But in most houses, a Control4 home automation interface takes over the job of the thermostat. This Control4 panel also manages lighting, audio, video, and more (above).

Those basic houses also include the following:

- a Wi-Fi router
- an internet-connected SmartCode 910 programmable door lock from Kwikset, controllable using Kwikset's SmartCode smartphone app
- an internet-connected garage door opener from LiftMaster with the MyQ control module included, also controllable using a smartphone
- a programmable Trane thermostat, the ComfortLink II XL850, capable of being remote-controlled with a smartphone through Trane's home automation system, Nexia
- a Generation 3 connected programmable landscape irrigation controller from Rachio

All of these modules are capable of being connected to the Control4 home automation system, but in the basic house, they're just controlled by the apps supplied by the manufacturers of the components. In most cases, those homeowners don't even have to use

the smartphone app unless they want to. They can control their garage door with an ordinary remote control, they can operate the thermostat by hand, and they can program the combination for their front-door lock by opening up a panel on the back of it. The Rachio landscape timer is the exception: It doesn't even have any buttons on the actual device. You cannot manually manipulate that timer at all—you need to use an app (either the Rachio app or the Control4 interface).

CONTROLS: THE UPGRADE

So our basic, entry-level house package has a lot of controllable elements. Most of our homes, however, also come with a Control4 controller installed as a standard feature. That way, the customers don't have to bite the \$1,000 bullet on the controller itself; when they come to the design center in the model home to make selections for their own house, they're just looking at all the cool things the controller can do. We've already made the investment in the controller for them.

Here's how it works: As part of the 60-day design process before we break ground on a new home, the buyers will have an appointment at our design studio where they can pick out the pretty stuff, like tile, countertops, flooring, and so on. While the buyers are at the studio, they also meet with our electrician representative and can talk about high-voltage upgrades, such as a spa circuit or an additional 220-volt outlet in the garage, in case they have some kind of hobby that requires one.

As part of that same appointment, the buyers also meet with a salesperson who specializes in low-voltage devices. That's when they get to choose from a suite of cool gizmos that the Control4 system can integrate: landscape fountain lights, security cameras, remote controls, distributed audio and video, and so forth. Because we've already made the investment in the controller, they don't have to get over that hurdle.

The controller lets us manage things that we don't even need the homeowner to be aware of. For example, we set the dimming controls on the LED lighting so that when the fixture is turned on, it ramps up to only 80% power. Studies have shown that the human eye can't tell the difference between 80% and 100%, but the lower setting saves energy and extends the service life of the fixtures.

In the future, we're waiting for the sensor technology to become available that will let us configure the Control4 controller to manage air quality in the home. Soon, we'll be able to program every home's ERV so that it boosts its air exchange volume any time there's a spike in CO₂, VOCs, humidity, or harmful particulates in the house. That serves our interest as a builder in the durability and livability of the house, as well as in the homeowner's health and comfort. Ideally, the home will automatically react to any indoor pollution signals, and start ventilating the home for the occupants while they are just carrying on, having a glass of wine, and enjoying their family. Everybody stays comfortable, healthy, and happy.

Geoff Ferrell is the chief technology officer for Mandalay Homes, in Prescott, Ariz.