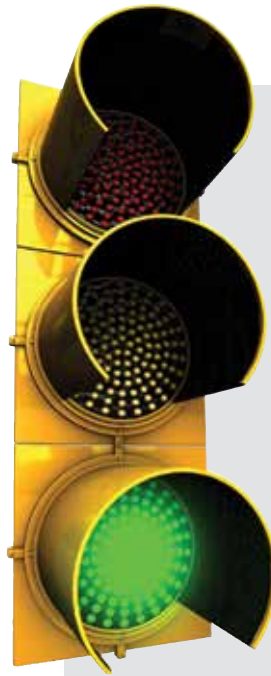


# Stack Lights

## Using Stack Tower Lights Effectively for Industrial Environments

*Stack tower lights are the first line of defense in communicating machine state & events to plant personnel. The main job of a stack light is to project an immediate message about machine performance with high visibility.*

*The effective implementation of visual communications with stack tower lights has a positive impact on production uptime and product quality. When considering a visual communication strategy, attention to a few details will help effectively use stack towers in manufacturing.*



### What is the Machine Trying to Tell You?

First, identify the important messages that are to be conveyed. Colors and flash patterns are associated with states of the machine or process.

Use the color coding definitions detailed in Chart 1 on the next page as a general guideline, noting that all of these can be varied (by definition and function) by the user to suite specific application requirements.



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# Using Stack Tower Lights Effectively for Industrial Environments

Chart 1. Industrial Guide to Color by Function

Color	Machine State or Function	Application Examples
<b>Red</b>	Equipment stopped or disabled	<ul style="list-style-type: none"><li>• Emergency stop system violated</li><li>• Motor fault or other machine protection monitoring has tripped</li><li>• Auxiliary equipment fault</li><li>• Part inspection failure condition</li><li>• Machine down</li></ul>
<b>Yellow</b>	Process warning or alarm condition active	<ul style="list-style-type: none"><li>• Temperature or pressure warning</li><li>• Low raw materials detected</li><li>• Over/under speed warning</li><li>• Machine initialization active</li><li>• Warning area violation when used with safety area scanners</li><li>• Press over-tonnage detected</li><li>• Part Inspection marginal condition</li></ul>
<b>Green</b>	Machine running or ready to run state; machine is safe to operate	<ul style="list-style-type: none"><li>• Normal operation</li><li>• OK to start</li><li>• Running at rate</li><li>• Part inspection passed condition</li><li>• All monitored conditions acceptable (temperature, pressure, etc.)</li></ul>
<b>Blue</b>	Specific condition; user-defined state or maintenance call required; conditions requiring mandatory action, etc.	<ul style="list-style-type: none"><li>• Any machine state not addressed with R/Y/G</li><li>• Service requiring attention (e.g. automatic lubricator reservoir empty)</li><li>• Awareness indication (e.g. laser active or area where lasers present)</li><li>• Machine maintenance or raw materials required</li></ul>
<b>White</b>	User-defined	<ul style="list-style-type: none"><li>• Any machine state not addressed with R/Y/G</li><li>• Display active mode of operation</li><li>• Supervisor or raw material call request</li></ul>

Reference sources: NFPA-79, Section 10.3.3 regarding color indicators; IEC 60073-2002

## Add Functionality to Color with Flash Patterns

Adding flash patterns to these colors provides an additional message. Examples include:

- Flashing **Red** is often used for an E-stop/reset required state
- Flashing **Yellow** can indicate a process is initializing or requires initialization, such as heaters coming up to temperature or a tank is filling. It may also warn that an unusual rate of product failure is being detected.
- Flashing **Green** can display a ready-to-run state or that a process is complete. A faster flash rate is sometimes used to let operators know the machine is running at or above the desired rate.
- Flashing **Blue** in conjunction with a timeout function will let supervisors & maintenance people know they haven't responded to a machine call within the desired amount of time.
- Flash patterns on **White** can visually display the mode of operation, such as:
  - solid on = automatic;
  - slow flash = manual single cycle
  - fast flash = manual step through



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## Direct Attention with Sound and Visuals

Adding a buzzer to the stack tower light will draw more immediate attention of the operator and is most effectively used with alarm or fault states.

In an area of high machine density where there are numerous stack tower lights with buzzers, it may be difficult to know which machine, or machines, has an active alarm even when the buzzer(s) go off. For this, Onyx Industries developed the LED illuminated buzzer cap option adding visual illumination to an active buzzer.



No alarm active —  
Buzzer is off and top cap  
is not illuminated



Alarm Active —  
Buzzer sounding and top  
cap is illuminated or flashing  
(Illuminated cap operates  
independent or in conjunction  
with the buzzer, and is available  
in all standard colors)

## Who Needs to Know What's Happening at the Machine?

Define who will be using the stack tower light.

Machine operators use them regularly because they can be most anywhere around a machine and know the state of the machines state with a quick glance or by the sound of an integrated buzzer.

But it may also need to be visible by supervisors, lead-hands, raw material suppliers, or maintenance technicians. This will help determine where the stack tower light is mounted.



By knowing who needs to see it from where, it's easy to decide on the mounting and physical size of the unit. Small machines and work stations can use small stack tower lights. A small machine run by a single operator may use a smaller diameter & profile stack tower light. A longer process or assembly line where there may be multiple operators, QC technicians, or supervisors will need a stack light that is visible from a greater distance.



Labeling on the stack  
tower lens provides further  
information so operators  
more clearly understand the  
message that the stack tower  
light is conveying

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## Six Good Reasons to Use a Stack Tower Light

1. In many instances, stack tower lights are an inexpensive means to provide a first line of defense to know what the state of a machine is. Pilot lights and HMI/touch-screens do a good job of providing specifics, however, their limitation is location — operators are not always at the control enclosure.

2. Operators quickly get used to what stack tower lights tell them about the machine. The typical use is machine state related — red is down or faulted; yellow is a warning condition; green is normal operation, etc.

However, it may also include flash patterns for functions like initialization procedures, e-stop recovery procedures, start-up sequences, etc. Operators can tell a lot about the machine state with a quick glance at the stack tower light.

3. In instances where operators can leave a machine untended or minimally tended, uptime can benefit from a very visible stack tower light & buzzer. Nothing is worse than an untended machine that is idle from a warning or fault where the state is only displayed at an HMI or with pilot lights at the control enclosure when operators are not expected to be with the machine.

Stack lights with buzzers call attention to this condition even when personnel are some distance away from the machine.

4. Another purpose for visual communications is for safety state indication.

It's common to post the red light on an stack tower when an e-stop is violated. In manual reset circuits, flashing the red segment can indicate that the safety circuit is now satisfied and ready for the operator to initiate reset.

5. Safety awareness applications communicate the existence of hazardous conditions to personnel.

Examples include areas of the plant where lasers are present and/or active, manual machine tools active with pinch points like plate rollers, and hot exposed surfaces.

2D safety area scanners can activate a warning light & buzzer when the programmed warning area has been violated. When they see the warning indication, they will ideally stop before entering the programmed hazardous area and causing a safety trip.

6. Lean manufacturing initiatives are well suited for stack lights to indicate processes and procedures that are defined for the equipment. This could be a article on its own, making it beyond the scope of this short summary document.



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## Design Considerations to Keep in Mind When Selecting a Stack Light

It's fairly easy to design a well thought out visual communications solution. Here's a few pointers to keep in mind:

- ***What is the size of the machine and the area in which the it needs to be visible?***

This will help determine the physical size of an appropriate stack tower light.

- ***What functions or machine states will it indicate? Does it need a buzzer?***

This will help with determining the number of color segments and what colors are required. Onyx Industries units are available up to 5 segments currently, with or without an illuminated buzzer cap, and in any color orientation from top to bottom that is desired.

- ***How and where will it be mounted?***

Most all manufacturers offer a variety accessories for mounting. In general, metal constructed units will last better than plastic constructed units in heavy industrial environments.

- ***Are temperature, condensation and/or wash-down environments a factor for consideration?***

- ***Should the device add to the appearance of the machine?***

Like HMIs, stack tower lights draw the attention of people. High end quality appearance enhances a machines presentation.

- ***LED or Incandescent Illumination light source?***

LEDs are long lasting, bright & have rich color tones. In general, LED based units offer the best performance & life span.

Incandescent bulbs will require periodic replacement, however in some instances, they can perform better in areas exposed to direct sunlight.

- ***What are the electrical requirements for voltage and current?***

In general, LED based units will require less current and last longer than incandescent units.

- ***Are there cabling requirements?***

Does the unit come with an integral cable? Is it long enough? Should it have a quick disconnect for shipping or easy replacement?

## Summary

The simple goal of maximizing machine throughput and uptime is enhanced with a visual & audible communication strategy.

It is the first line of defense in machine & operator interaction, augmenting HMI/touch-screens and control panel pilot lights.

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## About Onyx Industries

Onyx Industries is a manufacturer of machine controls systems and LED lighting products. All of our products are manufactured at our facility 20 minutes outside the Twin Cities in Minnesota. Our goals are simple:

- Offer high quality products suitable for harsh industrial environments
- Offer products that enhance the appearance of a machine
- Design products that are flexible and adaptable to customer requirements

With these goals in mind, our products are designed primarily with metal housings using plastics only for lenses & optics.



*"We design stack lights to endure."* Lee Clore, President



*Built to Order  
Delivered within Days*



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