Sales Bulletin – Understanding Control of Emergency Lighting Circuits

The UL924 vs. UL1008 debate is clarified by UL
By Steve Terry

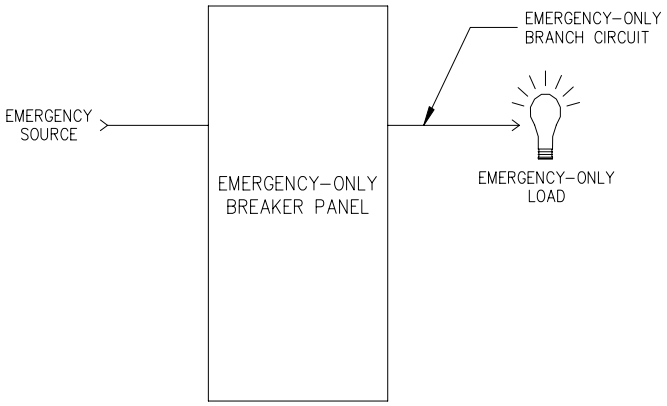
For some time, the proper control of emergency lighting circuits has been a topic of hot debate for manufacturers, systems integrators, and specifying electrical engineers. Much of the debate has centered around the proper application of the many codes and standards that have something to say about emergency lighting. These include:

- National Electrical Code Article 700—Emergency Systems
- NFPA 110—Standard for Emergency and Standby Power Systems
- NFPA 101—Life Safety Code
- UL924—Emergency Lighting and Power Equipment
- UL1008—Transfer Switch Equipment

Each of these standards concentrates on a specific area of emergency lighting, or describes a specific piece of equipment somewhere in the path of the emergency lighting circuit. However, it's not always easy to get certain application questions answered by searching these standards, since they often point at each other, creating a "circular" answer, or in many cases, lack of an answer. For the entertainment industry, one of the burning questions has been: "Where is it appropriate to use a UL1008 transfer switch, and where can a simpler UL924 Load Control Relay be used to energize an emergency lighting circuit?" In the early 1990's, industry veteran Steve Skirpan got together with ASCO, a major transfer switch manufacturer, and produced the first Branch Circuit Automatic Transfer Switch (BATS) In a brilliant stroke of marketing, Skirpan asked and answered the question about how to deal with emergency circuits on the output of dimmer systems. His solution, which has been frequently adopted by the industry in the last decade, was to transfer emergency circuits between a dimmer output and a separate emergency circuit using a listed UL1008 transfer switch. The ETC ELTS is the ideal product for this use.

Due to the relative cost and complexity of UL1008 transfer switches, for many years the industry kept asking whether such a switch was really necessary for dimmer branch circuits, especially since in all likelihood there was *another* UL1008 switch somewhere in the building, transferring a main feeder between normal and emergency power. The answer to this question is not a simple one, and it requires a review of the full spectrum of options in the emergency lighting toolbox, as well as a review of UL's recent clarifications on the subject. Each of the following cases has a place in the design of emergency lighting systems. It should be noted that these case drawings have been simplified to illustrate functionality, and do not contain every detail of the circuits they describe.

Case 1—Emergency-Only Lights on an Emergency-Only Circuit

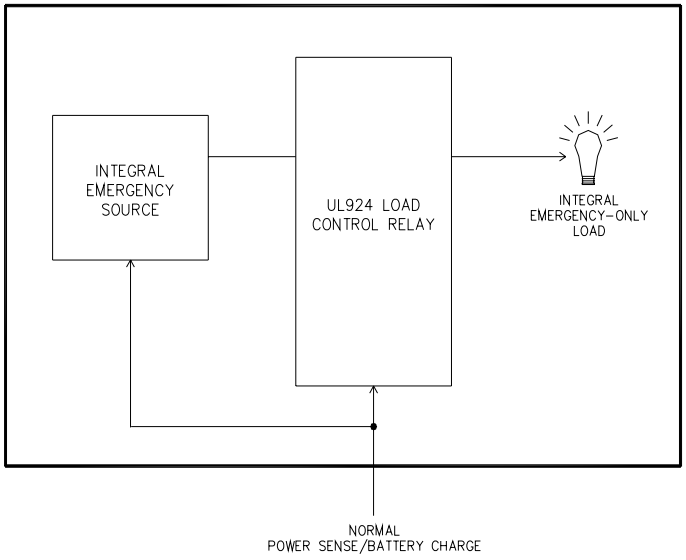


This arrangement is probably the simplest possible way to energize emergency lighting fixtures. A number of emergency-only fixtures are dedicated to providing the minimum illumination levels required by the Life Safety Code NFPA101 or local building codes. The fixtures are fed from a dedicated emergency-only breaker panel fed directly from the emergency power source, which may be a generator or UPS. When the source comes on line, the lights are energized without any switching or transfer equipment. The one disadvantage to this arrangement is that the emergency fixtures will be dark when normal power is present, and this may be a visually unacceptable

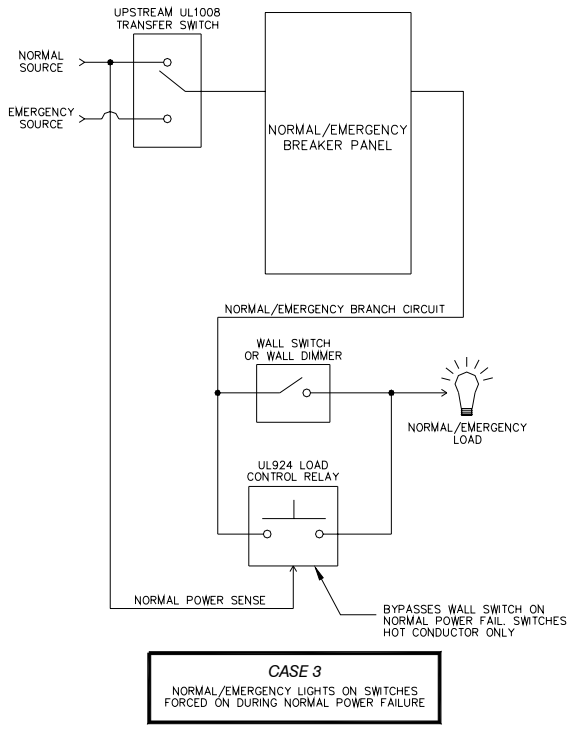
situation for the architect or lighting designer.

Case 2—Designated Emergency Lights with Self-Contained Power Source

Case 2 is familiar to anyone who has used self-contained "battery pack" emergency lights. These units are listed under UL924 and contain a power source (usually a battery), a charger, and a Load Control Relay. The unit is connected to normal power, which provides charging current for the battery. When normal power fails, the Load Control Relay energizes the load. When normal power returns, the load is extinguished. For many years, battery packs were the weapon of choice for emergency lighting. They are inexpensive, but battery maintenance and the "car headlight" look of the unit can be problematic.

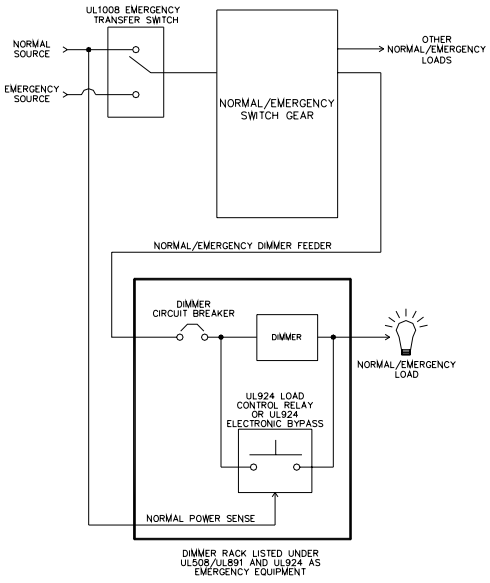


Case 3—Normal/emergency Lights on Switches or Wallbox Dimmers



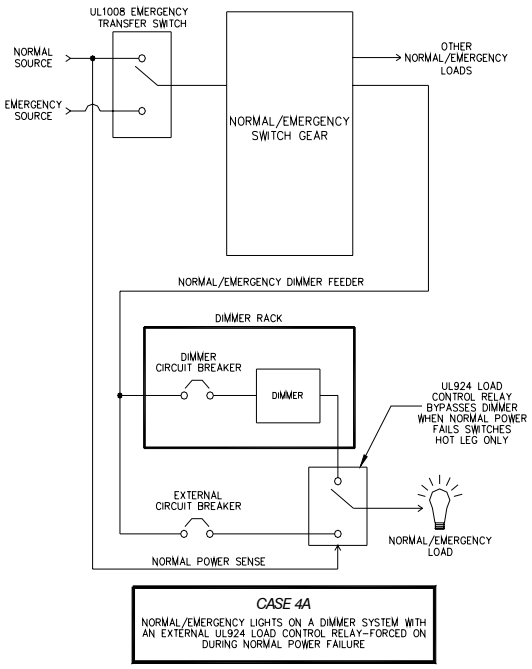
Case 3 introduces the concept of using the same fixture for both normal and emergency use. Normal/emergency lights are fed via a normal/emergency breaker panel and a wall switch or wallbox dimmer. When normal power fails, an upstream UL1008 Transfer Switch automatically transfers the feeder of the breaker panel to an emergency power source. At the same time, a UL924 Load Control Relay senses the loss of normal power and bypasses the switch or dimmer, forcing the load on, no matter what the position of the switch or dimmer Note that the UL924 Load Control Relay is not performing a transfer function, but merely a bypass function, and thus it is only required to switch the hot leg of the branch circuit. This arrangement relies on the upstream UL1008 transfer switch for the transfer function.

Case 4—Normal/Emergency Lights on a UL924-Listed Dimmer Rack



Case 4 extends the use of the same fixtures for both normal and emergency use, because the fixtures are fed by a dimmer rack that is listed for emergency use under UL924, as well as the more conventional UL508/UL891 listing. The Unison DR rack, with Bypass Option has recently achieved a UL924 listing for just this purpose. The dimmer rack contains a Load Control Relay, or in the case of the Unison DR rack, an electronic bypass method. When normal power fails, the entire feeder to the dimmer rack is transferred to an emergency source by an upstream UL1008 transfer switch, and the internal Load Control Relays or electronic bypass devices energize selected circuits by bypassing dimmers, and forcing loads on, no matter what the state of the dimmer control system. Note that the behavior of other circuits in the dimmer rack needs to be known when using this approach. If non-emergency circuits continue to respond to the control system when the rack is in emergency mode, then the size of the emergency source needs to accommodate these loads as well. A better solution is to use a UL924 dimmer rack with load-shedding capability. This will insure that non-emergency dimmers are forced into an OFF condition at the same time that emergency dimmers are forced into an ON condition when the rack is in emergency bypass mode. New software for the Unison DR Rack with Bypass Option is in the process of being released. This will provide load-shedding capability.

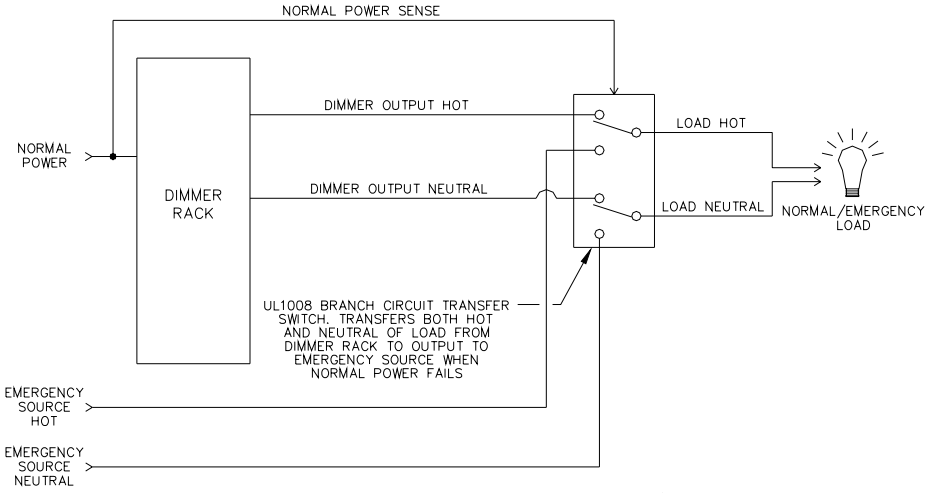
Case 4A—Normal/Emergency Lights on a Dimmer System with an External UL924 Load Control Relay



Recently, external UL924 Load Control Relays have become available for bypassing circuits in a dimmer rack that does not have a native UL924 listing. It is this case that generates the most confusion, because at first glance, the function performed by the relay looks like a transfer (which actually must be performed by a UL1008 switch), not a bypass. However, that is not the case, and here's why: In this case, the Load Control Relay switches the load between the dimmer output and an external circuit breaker connected to the *same phase and power source as the dimmer*. The single feeder to the dimmer rack is transferred by an upstream UL1008 transfer switch, making one feeder operate as both the normal and emergency source for the dimmer rack. Therefore, the UL924 Load control relay is providing a bypass rather than transfer function. As in case 4, the state of the non-emergency circuits in the dimmer rack must be forced to OFF when in emergency mode. If not, the emergency power source must accommodate the full load connected to the rack, not just the emergency bypassed circuits. In

practical terms, this gets tricky, because it requires interaction between the emergency system and the dimmer control system. A better solution may be found in Case 5.

Case 5—Normal/Emergency Lights on a UL1008 Branch Circuit Automatic Transfer Switch



CASE 5

NORMAL/EMERGENCY LIGHTS TRANSFERRED FROM DIMMER RACK OUTPUT TO EMERGENCY SOURCE WHEN POWER FAILS

Case 5 describes the design originated by Steve Skirpan and widely adopted by the industry. The dimmer rack is fed by normal power only, and shuts down during a normal power failure. For each normal/emergency load, both the neutral and the hot conductor are transferred to a separate emergency source via a UL1008 Branch Circuit Automatic Transfer Switc, the ETC ELTSThe switch is designed to insure that it can withstand the available fault current during transfer, and can never interconnect the normal and emergency power sources. In addition, the switch must work safely when the normal and emergency sources are on different phases and not synchronized. Case 5 is useful when a dimmer rack is fed by a very large feeder, but only a small portion of the branch circuits will be used for emergency. The use of the BATS allows those circuits to be selectively transferred to the emergency source without worrying about sizing the emergency source to deal with the full capacity of the dimmer rack feeder. The downside to Case 5 is the size, cost, and complexity of the UL1008 switch.

What Does UL Say About Emergency Circuits, UL924 and UL1008?

Recently, a number of manufacturers of UL924 Load Control Relays have produced products with installation manuals that suggested the relays could be used for Case 5 applications, where the load was transferred rather than bypassed. This prompted an exchange of letters with UL's Michael Shulman, Principal Engineer, Emergency Lighting and Power Equipment. The UL responses were also reviewed by John Kovacik, UL's representative on NEC Code Panel 13 (Article 700) and Paul Barnhardt, UL Principal Engineer for UL1008.
The following excerpts from the correspondence serve to clarify UL's position:

"Thank you for the continued dialogue and opportunity to reach greater clarity on this matter. We have had further discussions and review of the applicable Codes and Standards, as well as taken a second look at some of the product Listings UL has promulgated under the nomenclature of "Load Control Relays".

We can affirm that our program is NOT intended to have these devices switch a load between two separate, remote sources. They are intended to transmit power from the facility emergency panel to the load while monitoring power availability from another (non-emergency) panel. The facility emergency panel, in turn, would be connected downstream from a (UL 1008 Listed) transfer switch. So the load control relay itself, while connected to both the normal and emergency supplies, does not transfer the load from one to the other. Its function instead is to override any dimming or switch "off" position for the emergency luminaires if the normal power drops off."

Mike Shulman goes on to say:

"The load control relay needs to have provision for connection to both the normal and emergency branch circuits, as permitted by NEC 700.9(B)(3). Upon loss of normal power, the (UL 1008 Listed) transfer switch shifts the load over to the emergency source, and the load control relay concurrently overrides any dimmer settings as noted above. When normal power is restored, the load control relay brings the load back to its previously set position after the transfer switch returns to the normal power source.
In UL's opinion, load control relays described above do not function as transfer equipment as described in NEC 700.6. In applications with emergency power sources integral to a product containing a load control relay, they do serve as a transfer means (such as for unit equipment and for luminaires with integral or remote emergency battery packs). It should be emphasized that they will always reside on the load side of a transfer switch and an appropriately rated branch circuit protective device and do not perform any operation on these upstream devices."
As mentioned in our March 29 letter, we will take another look at the information presented on the web pages of certain UL Listed load control relay manufacturers, along with other advertising material and installation instructions. If this review suggests that applications are being recommended beyond the evaluated scope of the devices, we will work with the involved manufacturers towards clarification."

Just so that there would be absolutely no doubt about whether or not a UL1008 switch is required in a branch circuit transfer application, I asked Shulman the following:

*Question: "*In applications that must comply with NEC Article 700, and specifically section 700.17(1), does UL take the position that a UL1008 listed transfer switch is required for branch circuit transfer between a dimming system and an emergency power source? If not, what other UL standards might be applied to a branch circuit transfer switch in this application?"

Response – "*UL's opinion is that a Listed UL 1008 transfer switch is required to transfer branch circuits from normal (utility) power to alternative power, and back again upon restoration of normal power. Where the dimming system has dimmed the means of egress lighting, the minimum lighting level required by either the life safety code or the building code must be restored unless an alternative or additional lighting circuit provides the required egress lighting levels."*

Conclusion

From the above, it can be seen that there are a number of code-compliant methods for energizing emergency lighting circuits. Whatever method is used, the system must meet the following rules:

- When transferring a load between a normal and emergency power source, either in a feeder or branch circuit application, a listed UL1008 transfer switch like the ETC ELTS must be used.
- A dimming system with a dual listing under UL924 and UL508/UL891 may be used to energize emergency lights, and the Unison DR rack with Bypass Option provides this functionality.
- An external UL924 Load Control Relay may be used to bypass a switch or dimmer to energize emergency lights, but may never be used to transfer emergency lights between a normal and emergency power source.

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