A New Generation of Flash Transfer Relays for the Next Generation ATC Cabinets

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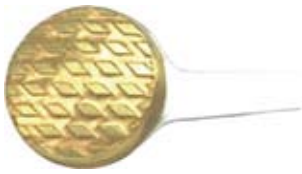
After the shift away from Tungsten filament incandescent light bulbs to energy saving all LED intersections, the existing Traffic Cabinet and internal components are large and over designed for today's technology. It's time for a change.

The original Flash Transfer Relays (FTR) designed for 120 VAC, by Struthers-Dunn (Series 21- with rectifier diode) and Midtex (Series 136 – with pole shader) (136 is now supplied by Struthers-Dunn) decades ago, were both designed with long blades and large silver/palladium contacts. These were designed to switch 120 VAC Tungsten lamp loads reliably at 20 Amps. The cold filament inrush current can also be 8 – 10 times that. The overall length of the contact support blades and hence height of the relay also had a purpose. The FTR can stay open for long periods of time before activation and hence dirt or corrosion can build up on the surface of the open contacts. The over-travel of the long blades caused a wiping action on the contacts, which together with the high initial inrush current of an unheated tungsten filament lamp, allowed much of the contamination to be wiped, or burned off. This design has led to many many years of a very reliable Flash Transfer Relay.

21 Series Flash Transfer Relay.

With the energy saving design of an all LED intersection, the total current draw for the entire intersection can be under 5 Amps. Frequently the FTR switches less than one Ampere. An intermediate design of an FTR using a "serrated" gold diffused contact has been offered by Struthers-Dunn for some time, to help prevent low current problems during the transition to LED lamps. [The gold is diffused into the contact, is not "flashed" on and will not burn off. The serrations give the low current, multiple high current density "hotspots" which will burn off any oxides/dirt on the contact.] However, the cabinet is still working on 120VAC. The FTR coil is supplied with 120 VAC voltage AND the contacts still switch at 120 VAC, just at a lower current. This is an upgrade for FTRs switching LED lamps in the current generation cabinets.



Serrated gold contact used in FTR for low currents.

The next generation ATC cabinet will work internally on 48 VDC. Two have already been introduced at the July IMSA Conference in Phoenix, AZ by McCain Inc. and Intelight Inc. One version can be retrofitted immediately to existing intersections, as it continues to switch at 120 VAC. Other versions are intended to also switch LED lamps directly with 48 VDC, when the intersection is converted to 48 VDC LED Lamps, or is newly installed with a working voltage of 48 VDC.

A new FTR is therefore needed for these new applications and Struthers-Dunn has been working on the concept.

New McCain ATC cabinet, showing new High Density Flash Transfer Relays

The first step was to do a survey of major users of the old FTR for any concerns or complaints. Most all agreed that it has been an incredibly reliable relay with very few problems. A few considerations raised were: condensation inside the relay in high humidity areas, salt water corrosion near oceans, ant nesting problems inside the relay (mainly in TX, NM) and freezing of condensation inside the relay in winter, in very cold areas.

A small "high density" relay would not allow long blades with a wiping action. To solve all of the above problems in a compact relay, a metal can, hermetically sealed relay; back filled with dry nitrogen was chosen. A technique that Struthers-Dunn uses for high reliability relays in the oil/gas and aerospace industries. Traffic signals must now be considered essential high reliability items and must keep working to move traffic in the event of natural disasters such as hurricanes, earthquakes and other events which may cause power outages. The much lower current draw of LEDs operating at 48 VDC with UPS battery back-up now allows this, efficiently. The FTR must be just as reliable.

Additionally, since its introduction, the FTR version with an LED as voltage indication has been very popular and simplifies trouble shooting – how to keep this feature in a hermetic metal can? First a hermetic lens was designed above the enclosed LED. Second, due consideration was given as to the purpose of the light. The LED is normally across the coil and only shows that "voltage has been applied" to the coil. During trouble shooting, most technicians will also look and see if the armature has transferred and the relay has operated. (Note: with a burned-out open-circuit coil for example, a relay LED will glow, but the relay has not switched). The armature cannot be visually observed in a metal can relay. The answer was to use a 3-pole relay internally. Two changeover Form C contacts are required for the FTR function, the third pole is used to switch the LED. This means that the relay LED is actually showing that the relay has operated

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and contacts have transferred. A true innovation.

The new contacts were also tested at over 100,000 operations, switching both 120 VAC and 48 VDC at 10 Amps and down to 100 mA and have proven reliable; meaning that the same relay can be used for either the AC or DC switching application.

The new 48 VDC High Density FTR – Series 21H - is born!

New High Density Flash Transfer Relay - 21H Series

Main Contactor

The "Main Contactor" in the Traffic Cabinet has traditionally been an MDR (Mercury Displacement Relay). Mercury devices are now banned in many states and they also had many disadvantages. For example, they had to be mounted vertically, the cabinet could not be laid down for shipping, the mercury would frequently stick and then the relay might not turn on or off. However, they also had many advantages, which is why they were chosen. For example, long life with many millions of switching operations, quick recovery from voltage spikes or current surges without welding. Some DOTs have already replaced this device with a solid-state relay. However, neither a solid-state, or an electromechanical relay alone will replace all the good characteristics of a mercury relay and be as reliable.

Some years ago Struthers-Dunn introduced a "hybrid" relay (Series 418) as a replacement for the MDR. By combining an electromechanical and a solid-state relay in parallel, with a control circuit, in a single relay, it uses the best features of both devices. This has been very successful and highly reliable. It was similar in size and with the same mounting holes as an MDR, to be a drop-in retrofit replacement. This has now been redesigned (Series 428 – AC switching and Series 429 – DC switching), with a reduced size, IP20 "touchproof" output wire terminations and screwless input terminals for quick and vibration resistant input wiring - specifically for the next generation ATC cabinets.

As stated, two versions are available, both with a 48 VDC input, but outputs switching either 120 VAC, or 48 VDC for both new styles of ATC cabinets.

Main Contactor "Hybrid" relay – 428/429 Series

IMSA