UNDERSTANDING COMMERCIAL DOOR OPERATORS

How to avoid "chain-reaction replacement"

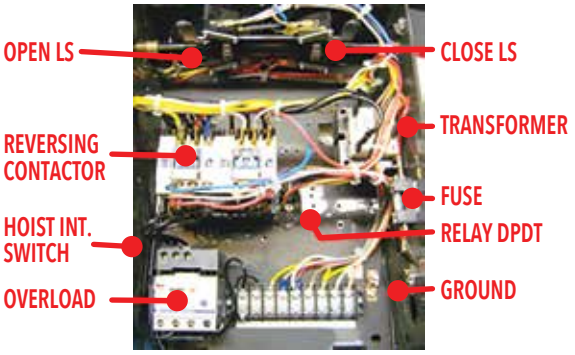
By Roy G. Bardowell, CDDC

To efficiently troubleshoot a commercial door operator (CDO), you need to know about the electrical and mechanical components that make up the operator. Sometimes, you can easily tell if a component has failed, as when it's visibly burned due to an overload. When that happens, it's the responsibility of the technician to investigate why.

If you replace a burned part without determining the cause, the new component will likely burn out as well. I call this "chain-reaction replacing."

The top three

Of all the components of a CDO, the three most likely to be subject to chain-reaction replacement are transformers, brake solenoids, and relays. First, let's look at some of the electrical components.

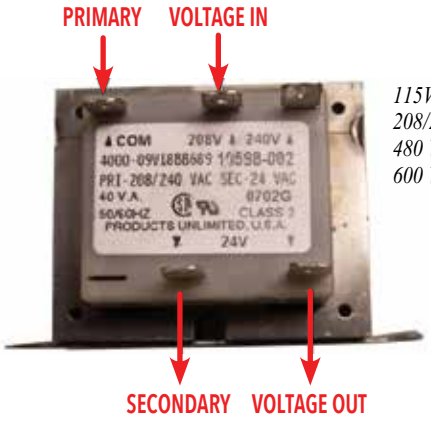


This picture depicts most of the electrical components found in a commercial door operator, excluding the motor and brake solenoid.

#1 TRANSFORMERS

Transformers are the number one most commonly replaced components that fall "victim" to chain-reaction replacing. Therefore, it is critical to be well-versed on all types of transformers to prevent this from happening.

The transformer used in most CDOs is a one-voltage component, meaning it can only accept the one voltage it is designed for. For example, a 120-volt transformer is used in every 120-volt commercial operator. The transformer label on this operator may read "Primary-120V/Secondary 24V/40VA."



115VAC to 24VAC
208/24VAC to 24VAC
480 VAC to 24VAC
600 VAC to 24VAC

The primary is the input voltage and, in most cases, the highest voltage option available. The secondary is the output voltage, and it is typically a low voltage such as 24 volts. The output/lower voltage is sometimes referred to as the load, because it powers devices that require low voltage to operate. The volt-amps (VA), or capacity, is generally the same as the wattage (watts, or W).

Most CDOs will have a secondary of 24 volts with a 40VA capacity. 40VA is typically enough for the average commercial garage door operator. All other upgrades are optional and must be ordered at extra cost. If you intend on wiring multiple 24-volt devices, add another transformer and dedicate it to the additional accessories.

Voltage specifics

A 120-volt 24V/40VA transformer is made for an input voltage of 120 volts and is only rated for a 120-volt power source. If a lower voltage is connected to the primary, there will be no damaging effect. However, if a higher voltage is applied to the primary, the transformer will burn up.

This is when a voltmeter becomes essential. If a transformer burns out, you should first check the voltage connected to the primary connections before replacing it. If you see more than 120 volts, you must correct that. To avoid chain-reaction replacement when troubleshooting CDO electrical components, always verify the correct voltage is being applied.

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Testing the power limits

The transformer is not designed to power an infinite number of accessories; it has limitations. If the transformer's secondary power is at 40VA, you cannot exceed this capacity.

For example, if you are installing a radio receiver that needs 20VA and a 24-volt loop detector that requires 25VA, a 40VA-capacity transformer will not provide enough power. The secondary of the transformer will overheat and burn out within an hour or two. Savvy technicians will order an operator with a larger capacity transformer with a 50-, 75-, or 100VA output to prevent this issue. The larger capacity can power multiple 24-volt devices.

Manufacturers consider the transformer large enough if it can successfully energize the reversing contactor coil, the circuit board, and the radio receiver and can connect 24-volt power to the required photo-sensors.

When ordering the operator, make sure it has the appropriate-sized transformer for the job and recognize when additional devices are needed. If you are uncertain about the transformer output, consult the operator manufacturer. They may advise you to purchase a transformer with a larger VA. A bigger transformer may require a larger enclosure or junction box.

Changing times

Until 1970, most external devices required 120 volts AC to be energized. Back then, an electrician was required to run the proper power to the accessory. Over the years, manufacturers began building accessories that operate on 24VAC/VDC. This trend placed the onus of determining the proper amount of power on the operator manufacturers.

Summing up transformers

A transformer primary circuit can burn out if too high a voltage is applied. A transformer secondary circuit can burn out if the capacity is exceeded. Some manufacturers supply a 2-amp inline fuse to protect the transformer secondary from burning out if it's overloaded.

However, a ground short can overload the secondary if one of the 24-volt legs contacts the ground. This can happen if a coil-cord's insulation is torn and the copper conductor touches the metal door track when the door is in motion. There should be no continuity between the secondary wires of the transformer and the ground. You can verify this with an ohm meter.

#2 BRAKE SOLENOIDS

Brake solenoids are the second most commonly replaced part after the transformer. As with transformers, incorrect voltage can also be the issue when brake solenoids and relay coils stop working. If you exceed the primary voltage when powering outside devices, the secondary winding will overheat and fail.

Most manufacturers use the Dormeyer solenoid for the standard electric power-off brake. Although the same solenoid is used industry wide, the braking method is brand specific.

The most common type includes a set of aluminum die-cast brake shoes that clamp around an aluminum drum when the solenoid is at rest. Other types include a disc brake system or a band brake. Regardless of the brake method, if the brake is adjusted correctly, it should work for a very long time.

Brake strain pains

The brake solenoid cannot strain in any way to open a brake, or it will eventually fail. In most cases, the brake system can be adjusted for minimum force. A loud buzzing sound from the solenoid indicates it is straining. This tension will eventually cause the solenoid to fail.

Troubleshooting a brake system in the field is very challenging. It is important to visit a factory before installation to get hands-on instructions for the system.

The most important thing to remember is that the brake system must release with minimal force to prevent the solenoid from becoming overstressed. Remember, if a solenoid has difficulty opening the set of brake shoes, it will produce a loud buzzing noise. This noise is your warning that a lower-than-specified voltage was applied and that the solenoid is going to burn out.

Correct voltage is key

As is the case with the transformer, never exceed the rated voltage for a solenoid or it will burn out. Connecting 230 volts to a 120-volt solenoid is a guaranteed killer. Likewise, connecting 460 volts to a 230- or 120-volt solenoid will cook it for sure!

Learning by example

Once a building owner called and asked me if it was normal to change a brake solenoid every two weeks. I explained that it is far from normal and began to walk him through the troubleshooting process.

First, we used a voltmeter to test the operator voltage at the two solenoid terminals. We discovered the incoming power to the operator was 460-volt, 3- phase. Then, I asked him to expose the brake solenoid and read the voltage requirements on the label; it read 230 volts.

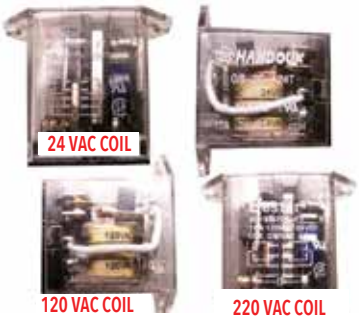
Standard solenoids come in 120, 230, 460, and 575 volts, and they are connected within the run circuit. When the voltage is sent to run the motor, the solenoid receives the same power. When the power is interrupted, the motor and solenoid will lose energy simultaneously. This motor-solenoid connection applies to almost all commercial door operators.

In this case, the 230-volt solenoid was connected to a 460-volt run circuit, which caused the solenoid to burn out over and over again and cost the homeowner $750 to repair every 10 days. After replacing the system with a 460-volt solenoid, the problem never happened again. This is a perfect example of chain-reaction replacement stopped dead in it tracks.

#3 RELAYS

Another voltage-specific component is the relay. As of 1986, all commercial operators had one 24-volt relay dedicated to reversing the operator when a safety edge is activated.

There are a few types of relays to be aware of, including the double-pull-double-throw relay (DPDT). The type of relay used indicates how many independent contacts are designated as normally open and normally closed. Consult the CDO technical support team to confirm the correct relay replacement.



Evolution of the relay

In 1972, Stanley-Vemco created a circuit for 120- and 230-volt single-phase door operators that included an additional relay that linked to the motor starting switch. The relay coil had to be the same voltage as the motor voltage, and it prevented an operator from being forced in the other direction.

The Vemco circuit provided reversing without the need for an expensive instant reversing motor. This technology was copied by most CDO manufacturers. Vemco closed in early 1974, but its revolutionary circuit design is still heavily used today.

Call, email, or text a photo, and I can assist you with most CDO application questions. Contact Roy Bardowell at (480) 506-9729 or roythedoorman@gmail.com. ■