

# TECH Talk

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## Electrified Architectural Hardware

The architectural hardware distributor meets new challenges every day. One of these challenges is the integration of electrified door hardware products.

Just as hardware must be coordinated to make an opening functional, so must these electrified products be selected for compatibility.

Supplying electrified hardware requires knowledge of: Products; Circuit design; Specification

### Products

New electrified hardware products come to the marketplace every day. It would be impossible to cover all currently available, let alone those that will be added as this document goes to print.

However, these products can be classified into specific groups for the purpose of discussion. By using one or more items from each of these groups, they can be combined into a functional circuit. These groups include:

**LOADS:** those items that act when electricity is applied. Typical loads would be electric strikes, magnetic locks, electrified locksets and horns. They normally operate at safe low voltage such as 6, 12 or 24 volts.

**POWER SUPPLY:** provide the electricity to operate the loads. Power supplies actually convert wall outlet electricity. 120 volts AC (alternating current) to a safe low voltage. These supplies use a transformer to change the 120 volts AC to a lower AC voltage. If the load requires DC (direct current) other components will be included in the power supply. DC provides smoother operation of the electrified hardware, and many electronic circuits require DC for operation. Power supplies may have supplemental batteries to "back-up" the supply of electricity in the event of a loss of the 120 volts to the building.

**SWITCHES** are used to control the flow of electricity from the power source to the load. Switches are used to control locks or actuate a monitoring device. Types of control switches include push buttons and key switches. Monitor switches would be items such as magnetic switches and hinges with door position switches.

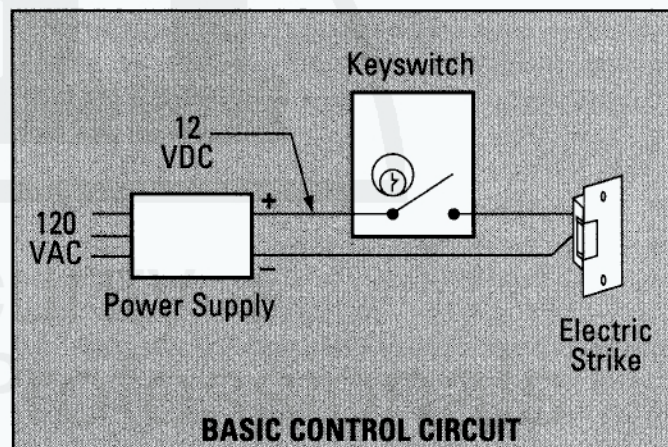
**CONDUCTORS** are the roadways between the load, power supply and switches. Conductors may include more than just wire. For example: feed through hinges or pivots are required

to run electricity from the frame to electrified products mounted on a swinging door.

### Circuit Design

This tech talk is not intended to turn one into an electrical engineer. To work with electrified hardware this is not essential. Most manufacturers have product bulletins and/or application notes that detail assembling their components into a circuit.

Just keep in mind, each circuit requires: a load to operate, a power source, a switch, and conductors to connect them (see figure 1).



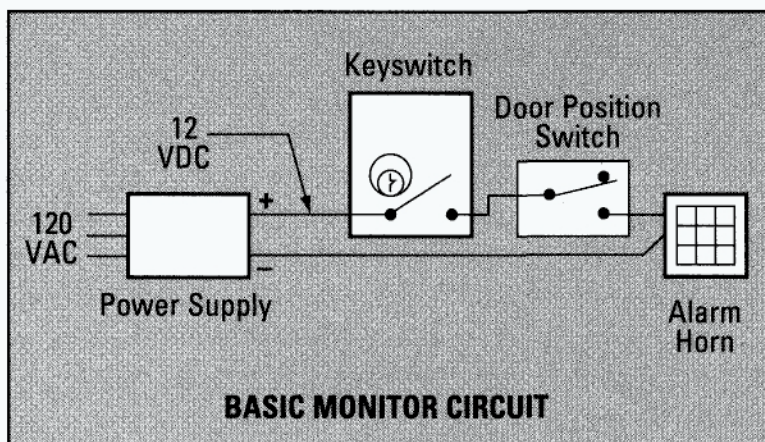
**Figure 1.** To operate this basic control circuit the correct key must be presented to the keyswitch. This closes the circuit and allows the electric strike to retract unlocking the door.

By using the basic circuit as a check list you can verify that you have enough equipment for a functional circuit. **ELECTRIC PRODUCT SELECTION:** The electrical compatibility of products from the various groups must be checked.

Loads are supplied with an operating voltage and current rating.

The voltage rating includes both a numerical value: such as 6, 12, or 24; as well as a type (AC or DC.) The current rating will be given in amperes or milliamperes (1/1000 of an ampere).





**Figure 2. OPERATION:** Opening door will close monitor switch, allowing current to horn; sounding alarm. Presenting correct key to key switch will open electrical circuit, allowing entry without sounding alarm.

Power supplies must have the same voltage rating as the load, both in value and type (AC or DC). The ampere rating of the power supply must be equal to or greater than the requirement of the load(s). To determine the requirements for multiple loads attached to the same supply, the current of each of the loads is added.

**EXAMPLE:** One power supply is to operate two single openings. One opening has an electric strike rated at 24 volts DC, 0.25 amperes. The second opening has an electromagnetic lock rated at 24 volts DC, 0.333 amperes, a horn rated at 24 volts AC/DC (will operate on either type), ½ ampere, and an indicating panel which requires 24 volts DC, 0.05 amperes. The power supply must be rated at 24 volts DC and at least 1.133 amperes ( $0.25 + 0.333 + 0.5 + 0.05$ ).

Switches are rated for maximum voltage and maximum current that they can withstand. This is normally not a serious problem in electric hardware applications. One or two typical electric strikes, magnetic locks or locksets normally will not require more than one ampere. The voltages typically are low. Most of the switches in the architectural hardware catalog are substantial enough to handle these loads.

The selection of wiring completes the design of the circuit. There are several factors to consider. The size (gauge) of the wire must be large enough to carry the current to the load with a minimum loss (voltage drop). A large voltage drop can prevent operation or cause erratic operation of some loads. As the length of the conductor increases, the voltage drop also increases. Codes and manufacturers' literature contain tables to select the correct gauge for various lengths and current requirements. Standard wire normally should be used to connect to electrified hardware. While solid wire is a little less expensive, it does not withstand the vibration of doors, frames and electromechanical equipment.

*One of the most often made mistakes is an incompatible load/power supply combination.*

*The areas for caution develop when multiple devices are hooked to one switch and the current rating may be exceeded. Caution also should be used when products other than architectural hardware are connected to these circuits.*

*This could include items such as key switches, which operate 120 volt automatic or overhead doors.*

## Specification

Many electromechanical hardware items have limited functions. Simply showing them in a schedule is sufficient to express how the circuit is to perform. On the other hand, some products or combinations of products have numerous ways they may be connected, and may therefore be configured to perform in two or more ways. Not only must the material be specified, but its operation and its mounting location may need to be detailed.

### SCHEDULE EXAMPLE (for figure 3):

#### SET 16:

- 2 Hinges
- 1 Feed through Hinge (PT)
- 1 Electric Unlocking Exit Device (LK)
- 1 Closer
- 3 Silencers
- 1 Magnetic Door Position Switch (MS)
- 1 Alarm Horn
- 2 Power Supply (24 VDC, 1.5 Amp)
- 1 Card Reader w/Cards and Timer Control

In addition to the standard hardware specification, those with electrical products should have:

1. An elevation (figure 3) of the electrified products about the door and the routing of the associated wiring.
2. An operational description outlining performance of the system.



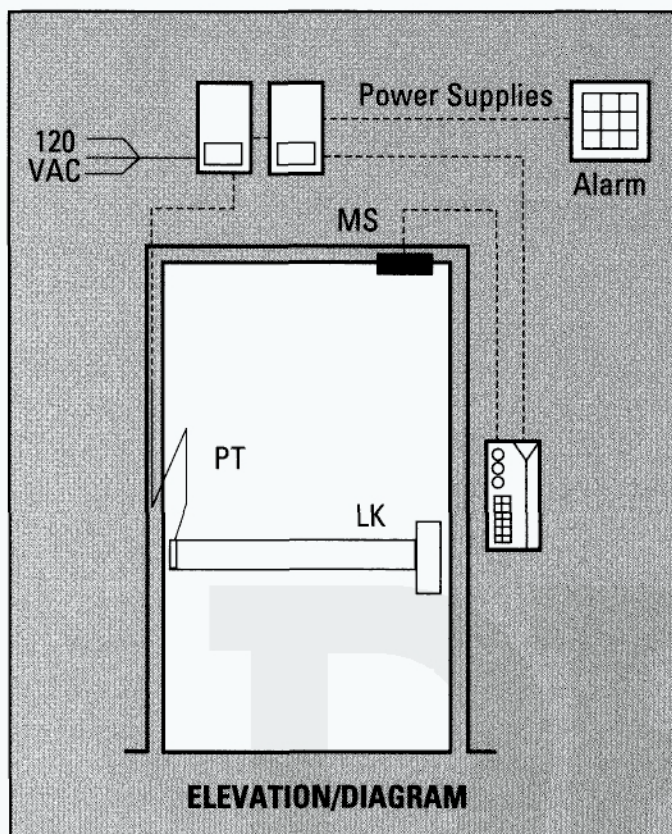


Figure 3.

*From the exterior, entry is gained by presenting correct access card to reader during authorized times. At other times and all others will be denied entry by electric lock. From the interior, depressing monitored exit device touchpad will inhibit alarm for exit. Forcing door from the exterior or holding door open for extended time will cause local horn to sound. Optional (alarm will also be displayed on monitor panel in security office) operational description.*

The elevation is used by the related trades to determine their involvement with the work. This not only includes the electrical work of supplying and installing wire and conduit, it may include supplying back boxes for the products to mount in. The location and installation may be the responsibility of or best provided by masonry or carpentry trade areas. Elevation drawings show location of items related to the opening both because of function and physical relationship. This includes the equipment and the interconnecting wiring. Legends are used to identify the equipment. Shorthand notation is used to identify the wire. The wire may be identified either by its content or by manufacturer's part number.

The physical description "3 x 16" indicates three number 16 gauge wires. Because of the location and application of the wiring, stranded wiring is required. Electronic equipment requires shielded wiring. This is identified with notes such as x shield, w/shield, etc. When manufacturers' part numbers are given, their use is strongly encouraged.

### Describing the Desired Operation

An operational description can be used in several ways:

- The **owner** can acknowledge this is the function wanted.
- The **designer** can check the system to see if it meets the

conditions required in total building operation.

- The **installer** can verify that the circuit is operating correctly.
- The **user** can go through the operation, familiarizing themselves with the equipment. New employees can use this to become acquainted with the building operation.

The hardware supplier also must accept the responsibility for familiarizing the owner with the equipment. This includes manuals that cover the equipment, hook-up, operation and maintenance. Also included is a walk-through and sign-off.

Many electrical products require that mounting enclosures be installed during early phases of construction. These must be identified, marked by part and opening number. They must be delivered to the contractor in time for installation.

Power supplies are normally mounted close to the load. Located above a false ceiling or in an equipment room, they are out of sight where they will not detract from appearance and where they will be less susceptible to tampering. This concealment of equipment is of great importance in contributing to the security to be provided by the system. It is just as important to make sure they are accessible for service.

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Use common sense in locating them at a reasonable height, and if in a false ceiling, they must, at least, be reached by a readily available ladder.

Wiring selection and installation can enhance, detract or destroy the security of an installation of electrified hardware. Following manufacturer's conductor or cable selection recommendations is just the first step. Using separate metal conduits and installing them in secure locations adds to the system's integrity. Identifying and marking wiring will ease both the installation and servicing of the equipment.

## Documentation

Specifying electrified hardware is based on the foundations that mechanical builders hardware use. There are however additional items that must be considered. Normally a specification would include:

1. General Requirements would include the Electrical Section in related trades.

Division 16 supplying and installing conduit (and wire or cable); Division 16 supplying and/or mounting back boxes; and, Division 16 marking each wire with number markers and testing for shorts, breaks and grounds.

2. References would also include electrical code(s). NFPA 70 (National Electrical Code)

3. Submittals would include all documentation. Done correctly, this would require: elevation drawings, wiring diagrams and operation descriptions for the systems.

The Execution portion provides a place to outline services such as coordination of providing, in a timely manner, drawings, manuals and installation assistance.

The supplier provides supervision to the installer along with the installation manual.

The owner's representative, using the approved system description manual, will be accompanied through each of the openings. Using the manual, the operation of each opening will be confirmed to meet the descriptions. The owner's representative will then sign off the acceptance and understanding of the system.

Sets would also list items such as power transfer hinges, junction boxes, power supplies, cables and wiring diagrams.

## Access Control

No discussion of electrified hardware would be complete without covering access control. The architectural

hardware professional should not be intimidated by access control. The selection of the various hardware items, the lock function and the design of keying systems are all related to "access control." A door that fails to close properly or that has an incorrect lock function is an example of poor "access control." When reviewing an opening for electrified hardware, the same questions are required that are used to select a lock function. These can be covered by four categories:

- What happens when an authorized person wants to go in this opening?
- What happens when an unauthorized person wants to go in opening?
- What happens when an authorized person wants to go out this opening?
- What happens when an unauthorized person wants to go out this opening?

These questions lead the designer through the selection process. There may be different "functions" required for one or more of these questions. It may be desirable to have a push-pull operation of an opening during regular business hours and then have night and weekend requirements for card access in one or both directions. There could be a card required to unlock the door from the exterior while the interior card would prevent an alarm. This is simple for some access control systems.

## Conclusion

By understanding the equipment operation, basic electrical circuits and the requirements for specifying electrified hardware, the distributor can get the right product to the building site. By providing a complete package with drawings, operational descriptions and consulting with the installers, the owner will have functional hardware that provides the security and safety that has been specified.