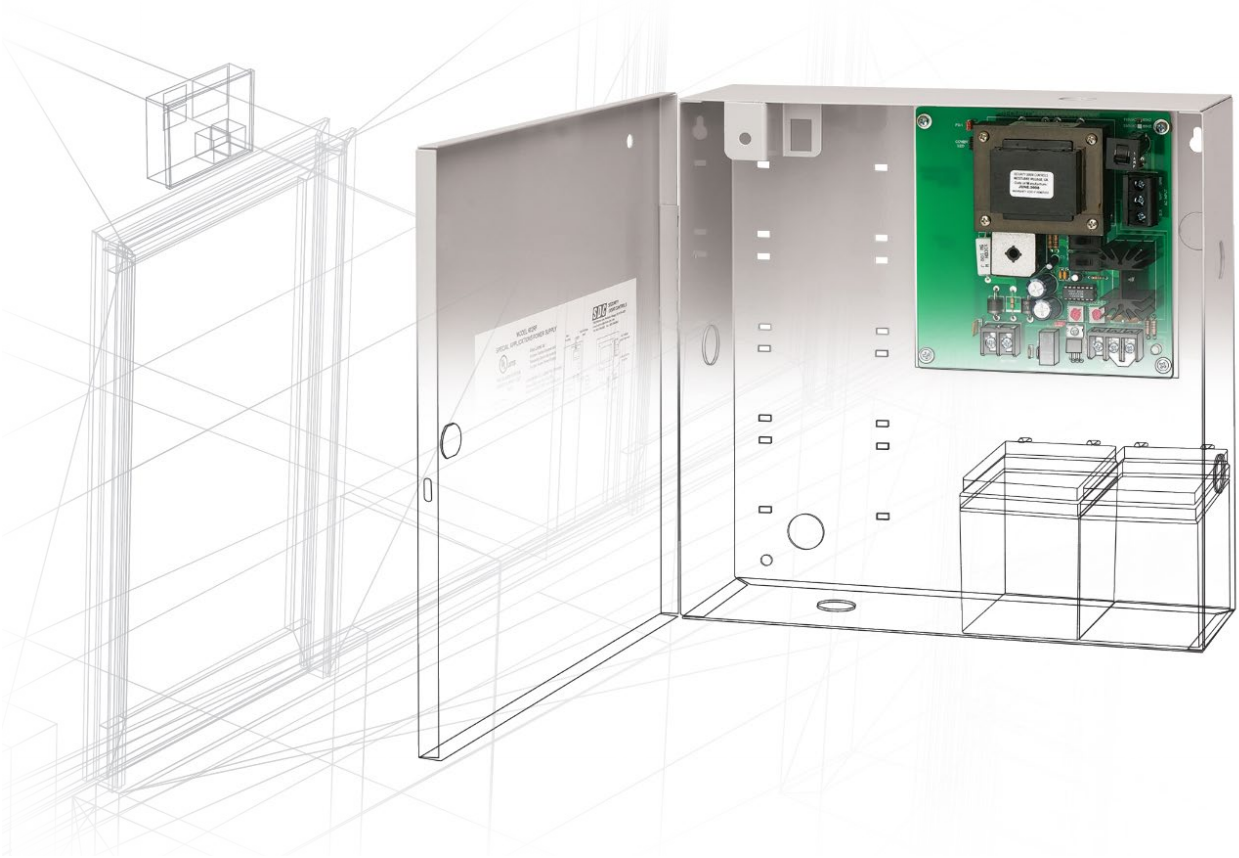
ACCESS CONTROL POWER GUIDE



Avoiding Problems In The Real World

the lock behind the system

SDC
Security Door Controls

HOW TO AVOID ACCESS CONTROL POWER PROBLEMS IN THE REAL WORLD

A Practical Guide for Building/Facility Managers, End-Users, Dealers, Installers and System Integrators

All power is not created equal, especially when designing and installing electrified access control hardware and systems in new or retrofit applications. This guide is designed to help avoid real world access control power problems.

Why? **75-85% of access control operating problems and technical support calls are due to power issues.*** Typical issues include:

- Dead systems - door problems, locks failing
- Malfunctioning locks or intermittent operation of accessories, controllers
- Locking devices that won't respond reliably

This guide provides an overview on:

- How to eliminate utility power problems
- How to plan your power supply configuration to properly power your access system
- Understanding basic electricity and troubleshooting power problems
- Why access control system power requirements are uniquely different from other systems

How will you benefit?

- System integrators, dealers, installers:
  - Eliminate costly callbacks, warranty and liability issues
- Building/facility managers, end users:
  - Reduce possibility of system failures, business interruption, staff frustration

**SDC technical support logs.*

MAIN CAUSES OF ACCESS CONTROL POWER PROBLEMS

- Unreliable utility power resulting in underpowered access control systems
- Incorrect voltage and amperage for the application

WHY WE NEED "CLEAN" POWER

Clean power is an important requirement for a reliable operation of access control systems. The DC power provided should be of adequate capacity and free of high frequency generated by poorly filtered power supplies or transient spikes generated by inductive loads such as solenoid driven locks. Not installing wiring over noise generating devices (such as fluorescent lighting) or installing the wiring in conduit is also important for providing clean power.

Although noise and spikes on the DC power line will not harm a simple device such as an electric strike, electronic access controls, door controllers and electronically controlled locks or panic bars can be affected. "Dirty" power can cause malfunctions, erratic and unreliable operation, or actual damage to the device itself.

Access control panels require clean power and surge suppression:

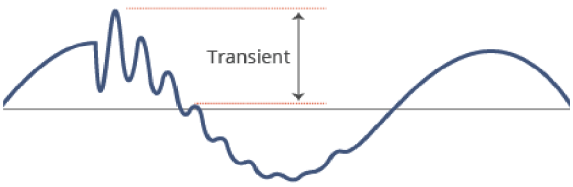
- Control panels contain the system configuration
- Transients and voltage spikes often disable access control panels and connected devices
- Printed circuit boards are vulnerable to damage from dirty power and nearby lightning strikes

With the introduction of motorized door locking devices, motors are being substituted for solenoids or coils and require clean power with surge suppression to protect motor control board components and motors from damage. Power coming from the power company can range from 90 - 120 volts, causing brown outs, power fluctuations, downed lines, surges, and lightning coming in over AC lines.

POWER TRANSIENTS

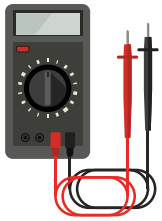
Power transients are a type of power surge or spike that cost U.S. companies $26 billion annually in damage to electric/electronic equipment. Transient events can include lightning strikes, restoration of power after a failure, static discharge and coil kickback cause by door locking devices. Coil kickback can occur when the door locking device has a built up charge of power and sends that charge back to the control panel. If the panel is not protected, the output can damage the panel.

- 60% of transient events occur inside the facility
- Up to 75% of integrated circuit failures can be attributed to power transients



SIMPLE SOLUTIONS

1. Always put some type of surge protection in before the power supply and a UPS (Uninterrupted Power Supply) or battery backup to protect against transient events. The key is to provide the system with good grounding.
2. Start by testing for voltage and current at the door:
    - Locks are designed to operate at certain voltage and amperage values
    - Amperage is the 'motor under the hood'
    - Know how to use a voltmeter and settings
    - Know how to read current/amperage
    - Understand voltage, current calculations



Visit **www.sdcsec.com/multimeter** for a quick video about measuring voltage, continuity and current on a lock.

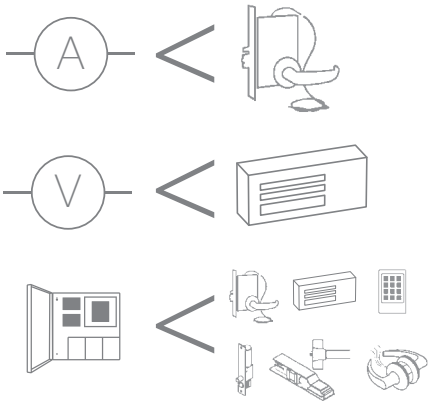
TROUBLESHOOTING A DEAD, MALFUNCTIONING OR INTERMITTENT LOCK DEVICE

Sometimes the quickest way to solve a suspected locking device problem is to isolate it to eliminate or confirm the device is the issue. Start by disconnecting it from its power source and then providing some DC power to it to see if it works or not. 12VDC alarm batteries and a wired lead are useful for this testing. Use one battery for 12VDC. Two batteries in series provide 24VDC.

SDC has prepared a video about how you can assemble your own inexpensive, portable power test kit, using simple, store-bought components to save yourself loads of time and hassle troubleshooting on your next install or callback. Go to the *Cool Tools* page on our website at **www.sdcsecurity.com/toolbox**, and play the *Power Test Kit* video.

LOOK FOR CAUSES OF LACK OF POWER

- Not enough amperage present at the powered device (power supply does not have adequate capacity)
- Not enough voltage present at the powered device, caused by failure to calculate voltage drop and/or using the wrong wire gauge (too small)
- Too much equipment connected to each supply - exceeding capacity



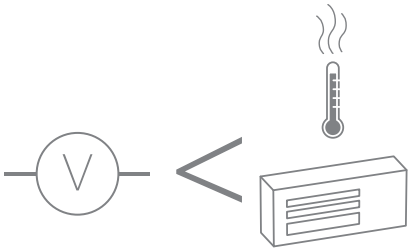
PROBLEMS CAUSED BY LACK OF POWER

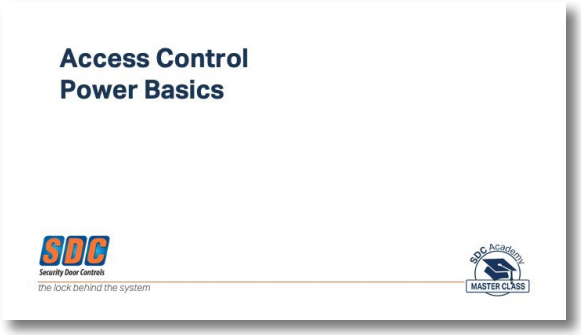
- Reduces product life and reliability, can cause overheating
- Operational failure throughout the system
- Microprocessors become unstable at low voltages, causing unpredictable operation – components fail to function
- Lack of power is an industry-wide problem - at many installations, access control hardware is not supplied by the same contractor who provided the power supply. No one takes responsibility.

...OR, LOOK FOR TOO MUCH POWER

SDC Technical Support gets calls for this more often than other issues. Too much power is generally defined as when voltage exceeds the device's rated input voltage by more than 10%, resulting in:

- Overheating (lock's coil or electronics)
- Unreliable operation
- Shorter life expectancy





Before going any further, make sure you're comfortable with basic access control power concepts. Many people with years of industry experience have never had any electrical training. With the increasing use of more sophisticated electronic systems and circuitry, it is important that you have a strong foundation to avoid creating problems down the road.

Check out *Introduction to Access Control Power Basics* for key electronic system terms and definitions at our website on the access control system calculators page at **www.sdcsecurity.com/calculators**

PLAN NOW TO AVOID TROUBLE LATER

Carefully evaluate your project to avoid common installation and operating problems.

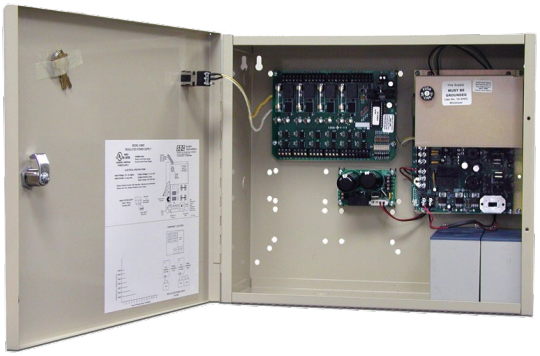
- Understand the power required and calculate the power available (if retrofitting)
- If retrofitting, what modifications have been done over the years affecting capacity of the power supply?
- Do all of the products really work together? Take responsibility to ensure all system components are compatible
- Code compliance - be aware of applicable regional and national codes
- Low voltage license - is one required in your jurisdiction?
- Protect your time, reputation and investment by recommending a quality system design
- Plan not to come back, do it right the first time
- Plan for future expansion - no one has ever needed less power for their facility's access control system requirements change

RETROFITS TAKE MORE SCRUTINY

Test and inspect –

- Are adequate wire gauges used?
- Is enough power/amperage being delivered to system components?
- Does the system meet regulatory and code requirements?
- Is adequate voltage/amperage present at power inputs of each reader, controller and locking device?
- Use a toner/probe set to verify and label wire connections

POWER SUPPLIES, CURRENT LOAD AND VOLTAGE DROP

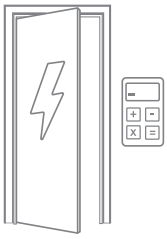


With few exceptions, talking about access control power concerns low-voltage. Unlike security camera/video systems typically deployed throughout a facility, access control locking hardware draws more current, especially during an access control event - such as the locking or unlocking of a device. Providing steady, low-voltage DC current requires a power supply to convert incoming AC voltage to DC.

Switching vs. Linear vs. Hybrid Power Supplies

- Switching power supplies are small, inexpensive and very efficient, but have trouble handling inductive loads produced by access control locking devices with coils or solenoids
- Switching power supplies all create AC noise voltage which affects performance of access control components
- Linear power supplies are AC noise free and can handle inductive loads, but are inefficient and generate heat
- Hybrid power supplies (like SDC's) combine the efficiency of switching supplies with the inductive load handling capability of linear supplies
- Hybrid power supplies feature extra filtering to provide clean-noise-free power

Current Load



Before selecting power supplies for your access control system, you must calculate the power load (current) required for each door opening.

- Use a door checklist like this example to fill in values and calculate the current load:

Locking Device	(_____ Amps)
+ Rex Button	(_____ Amps)
+ Control Panel	(_____ Amps)
+ In/Out Readers	(_____ Amps)
+ Annunciator	(_____ Amps)
Total	**(_____ Amps)**

- Add a 30% safety margin
- Add these values for an overall system total, as well as subtotals per floor or building. This will help you to:
  - Select and locate the appropriate power supply components
  - Determine wire gauge requirements based on load, cable distance and voltage drop

Current Load Per Door – Example Using SDC Components

Locking device – Z7800 lockset –	300 mA @ 24VDC
IPDSE door station	
+ IPDSE controller –	120 mA @ 12VDC
+ IPRW – reader –	40 mA @ 12VDC
+ MD31D – exit PIR –	26mA @ 12VDC
Total	**486 mA**

- Add a 30% safety margin for a total of 632 mA
- Use a SDC 602RF power supply (1 amp), set to 24VDC operation with a 12VR regulator to provide both 12VDC and 24VDC

Voltage Drop

- Power supply voltage will drop over long cable distances due to wire resistance
  - Operating access control devices with inadequate voltage makes them run hotter, wear out faster, operate erratically or not at all
  - Rule of thumb for access control devices is that voltage drop cannot exceed 5% of the supply voltage

SDC has a voltage drop calculator that allows you to enter the wire gauge, voltage, distance and load current (amps) to obtain a voltage drop calculation – **www.sdcsecurity.com/calculators**

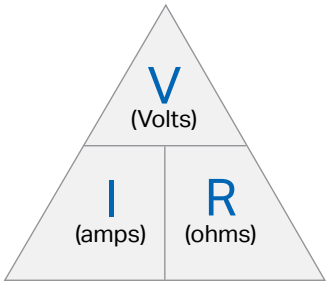
Using the Voltage Drop Calculator

To understand the voltage drop calculator, use the formula:

Vdrop = I x R

I = the calculated peak current draw

R = wire resistance for the number of feet used



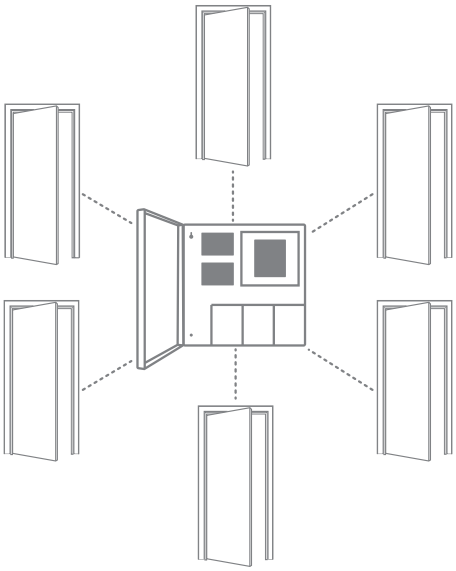
When using this formula, double the cable distance because two conductors are being used for + and – DC. Larger loads or longer wire distances require heavier gauge cable. Plug different variables into the SDC voltage drop calculator to see the effects **www.sdcsecurity.com/calculators**. When working on a retrofit project, the calculator is a good tool to troubleshoot long runs that could have a power issue.

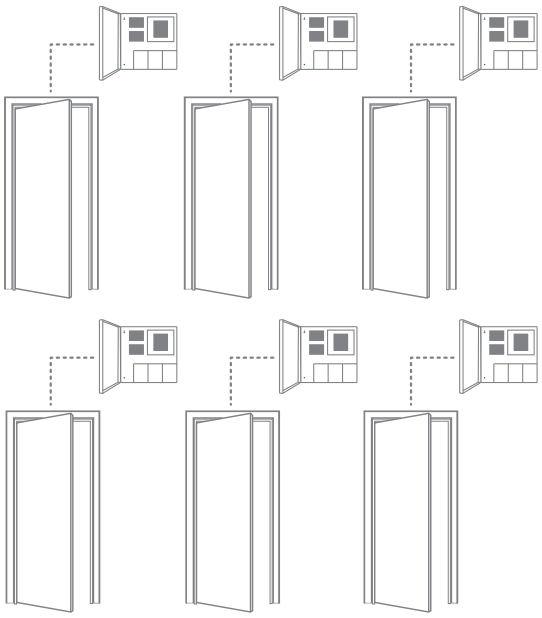
Allow for Expansion

Add more capacity to allow for future expansion when security requirements change. In competitive bidding situations you may have to meet the minimum requirements of a job with a 30% safety margin. Or, for more sophisticated customers with larger budgets, plan for the future with a 50- 100% margin, as customers may add more doors or more devices at existing doors in the future without checking system capacity.

Before proceeding, you'll need to consider what type of power system – centralized or distributed – is best for your installation as it will greatly affect your voltage drop calculations.

CENTRALIZED VS. DISTRIBUTED POWER





Centralized Power

Pros -

- Single power supply for multiple doors
- Lower cost per door (based on cable distance, labor costs)
- Easier to monitor/maintain power system
- Single location for fire system interface
- Power supply is protected from vandalism

Cons -

- Single point of system-wide failure (especially when using one large supply)
- Difficult to reconfigure for system expansion
- Longer, heavier cabling required for home runs

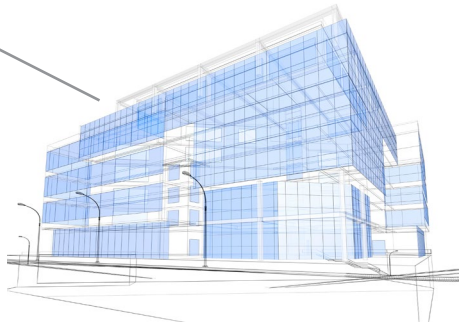
Distributed Power

Pros -

- Adequate power will be provided for each new door
- Easier to accommodate system expansion
- Shorter, lighter gauge cabling can be used

Cons -

- Higher cost per door



POWER CUSTOMIZATION

We recommend that you familiarize yourself with how to customize your access control power system. Frequently, new construction may require adaptation or upgrades to a planned power system due to design and build changes that normally occur on any project. In particular, being comfortable with power customization can be essential on retrofit projects where the challenge is ensuring power reliability after the addition of electronic access control components to an existing system.

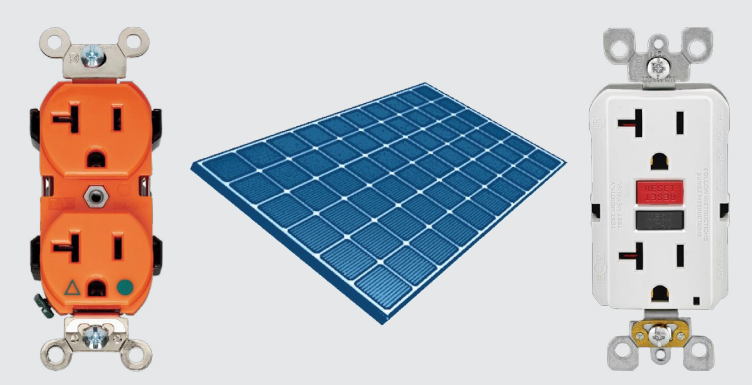
- Voltage drop (adjust wire gauge for farthest device)
  - After calculating voltage drop at farthest device, some power supplies allow the voltage to be adjusted higher
  - If possible, adjust power supply voltage to provide nominal 12VDC or 24VDC at farthest device
  - Be cautious with over voltage. Devices closest to power supply may receive too high a voltage
  - Never exceed +10% over voltage at any device
- Over voltage (issues and solutions)
  - Over voltage to any device can be destructive. It produces excessive heat within the device leading to non-operation or device failure
  - If a power supply voltage cannot be adjusted down, a few diodes in series will reduce voltage by 0.6V per diode
- Diodes (how and why used)
  - Diodes are basically a one-way valves that are used to rectify AC voltage to DC voltage. Diodes can be used to drop voltage. Each diode has a voltage drop of 0.6VDC. Multiple diodes can be put in series for additional voltage drop (3 diodes x 0.6V = 1.8VDC)
  - Diodes can also be used to prevent voltage spikes from electric strikes and solenoids. They limit the spike to 0.6V.
- MOV (where and how used)
  - MOV (Metal Oxide Varistor) is a surge suppressor device much like the surge suppressor used for electronic devices
  - MOV have a limit voltage that they let through. When there is a spike in a voltage line they limit the peak to protect the electronic equipment
  - MOV's are used in parallel across power leads of locking hardware with solenoids. Solenoids can generate large voltage spikes when turned off. The MOV will limit the spike to protect access control equipment
- How to install, solder or crimp (MOV's & diodes)
  - Diodes and MOV's can be crimped securely in place to device leads
  - They may also be soldered to electronic device power leads. Soldering is not as efficient in the field

TROUBLESHOOTING CHECKLIST

- Verify non-operation at problem door. Try access with prox card or keypad
- Look for obvious damage, misalignment or mechanical damage that may explain non-operation
- Check for loose or broken wires from access control to locking device
- Using a voltmeter, measure the voltage of access control and locking hardware wires at the door
- If voltage is not present at locking device when it should be powered, check power supply. Voltage at power supply should 12VDC +-10% or 24VDC +-10%
- If no DC voltage present at power supply, check AC input voltage with voltmeter. Should be 110-115VAC
- Repair or replace any non-operational product
- If necessary to verify non-operation of a locking device, isolate it to eliminate or confirm the device is the issue as recommended previously in this guide

A FINAL NOTE – BE AWARE OF WHAT YOU'RE PLUGGING INTO

- Non-traditional power sources
  - Orange sockets, typically at hospitals only for critical circuits
  - Use for access control system, only with owner's permission
- Solar energy (be careful: transients and surges typically present on these systems)
- GFCI receptacles



- Make sure the power source is not being used for something else - there's nothing like having a service call to find out your power supply was unplugged for someone to vacuum

SDC POWER SUPPLY PRODUCT FAMILY

SDC offers high quality 12/24VDC class 2 linear power supplies with various current output capabilities and enclosure sizes:

- **602RF Series** - 1 Amp, Power Supply (120VAC input)
- **631RF Series** - 1.5 Amp Power Supply (120VAC input)
- **632RF Series** - 2 Amp Power Supply (120VAC input)
- **634RF Series** - 4 Amp Power Supply (120VAC input)
- **636RF Series** - 6 Amp Power Supply (120VAC input)

602RF
with (2) optional
backup batteries

631RF
with (2) optional
backup batteries

632RF
with (2) optional
backup batteries

634RFA
with (4) optional
backup batteries

636RFA
with (6) optional
backup batteries

Features

- Field selectable 12 or 24VDC, regulated and filtered
- Auto resetting output circuit protection
- Isolated 13.5/27VDC battery charger
- Low battery disconnect
- Emergency release input
- Input, output and battery status LED's
- Choice of output and door control modules

CROSS REFERENCE GUIDE

1 – 6 Amp Power Supplies

SDC Security Door Controls	Altronix	ASSA ABLOY	LifeSafety Power	SCHLAGE
602RFxFB4 1 Amp, 12 OR 24 VDC, 4 Fused Outputs, Fire Interface	AL125UL, AL125ULX	AQD1-4F1, AQD1-4C1	FPO25-E5, FPO25-E1	PS902
631RF 1.5 Amp, 12 OR 24 VDC, Fire Interface	AL125UL, AL125ULX	AQD1	FPO25-E5, FPO25-E1	PS902
632RF 2 Amp, 12 OR 24 VDC, Fire Interface	AL175UL, AL175ULX	AQD2-1	FPO75-E5, FPO75-E1	PS902
632RF CR 2 Amp, 12 OR 24 VDC, 4 Fused Outputs, Fire Interface	AL300ULM, AL300ULACM4	AQD2-4C1, AQD2-4F1	FPO75-F8PE1, FPO75-D8E1	PS902
632RF 2CR 2 Amp, 12 OR 24 VDC, 8 Fused Relay Outputs, Fire Interface	AL300ULACM8	AQD2-8C8R1, AQD2-8F8R1	FPO75-D8E1	PS902
634RFA FB 4 Amp, 12 OR 24 VDC, 4 Fused Outputs, Fire Interface	AL400ULPD4	AQD4-4F1	FPO75-D8E1	PS904
634RFA 2FB 4 Amp, 12 OR 24 VDC, 8 Fused Outputs, Fire Interface	AL400ULPD8CB	AQD4-8C1	FPO75-D8PE1	PS904
634RFA 2CR 4 Amp, 12 OR 24 VDC, 8 Fused Relay Outputs, Fire Interface	AL400ULACM, AL400ULACMCB, AL400ULACMCBJ, AL400ULACMJ	AQD4-8C8R1, AQD4-8F8R1	FPO75-C8E1, FPO75-C8PE1, FPO75-CPE2, FPO75-C8E2	PS904
636RFA 2FB 6 Amp, 12 OR 24 VDC, 8 Fused Outputs, Fire Interface	AL600ULPD8CB	AQD6-8C2	FPO150-D8PE1	PS906
636RFA 2CR 6 Amp, 12 OR 24 VDC, 8 Fused Relay Outputs, Fire Interface	AL600ULACM, AL600ULACMCB, AL600ULACMCBJ, AL600ULACMJ	AQD6-8C8R2, AQD6-8F8R2	FPO150-C8E1, FPO150-C8PE1, FPO150-C8PE2, FPO150-C8E2	PS906

602RF

631RF

632RF

634RFA

636RFA

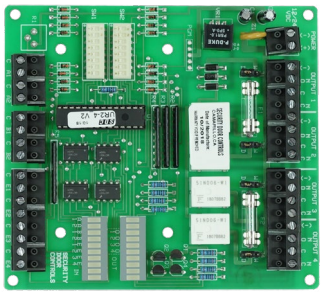
SDC POWER SUPPLY ADDITIONS

SDC offers a complete line of door control relay modules and backup batteries to ensure compatibility of access hardware components, to simplify system installation and troubleshooting and to provide continuous system operation during a power outage - **www.sdcsecurity.com/Door-Control-Relay-Modules.htm**

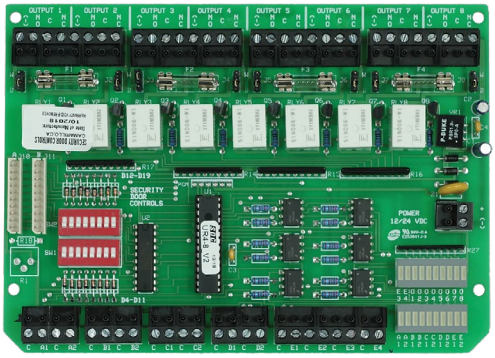
UR Series Universal Door Controllers

Use the same controller with centralized wiring for system components, on-board logic and easy troubleshooting for virtually all multi-door applications.

UR-1
Single Station Universal Door Controller



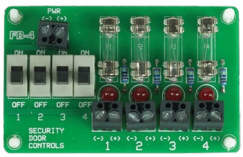
UR2-4
Two Station Universal Door Controller



UR4-8
Four Station Universal Door Controller

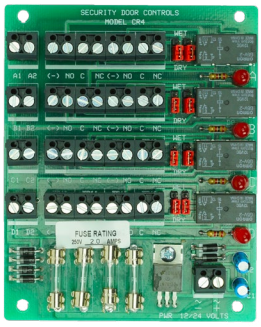
Door Control Relay Modules

Ensure compatibility of access hardware components and simplify system installation and troubleshooting. Different modules may be specified for one power supply. The isolated relay design allows trigger signals over small gauge cable runs of 22 gauge wire up to 1,000 feet from the trigger device to the module.

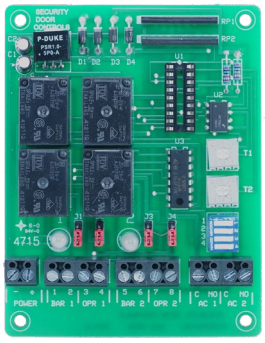


FB-4 - Power Distribution Module
Four 2 Amp Fuse Protected Outputs

ACM-1 - Access Control Module
Six Input Control Relay



CR4 - Four Station Relay Module
Four Station Control Relay



EMC - Exit Device Sequencer
Dual Channel Exit Device Sequencer Module

Voltage Power Convertors and Battery Backup

The need for separate power supplies for 12VDC and 24VDC requirements within the same system is eliminated with the addition of the 12VR module to a 600 series power supply. With the power supply set at 24VDC for locking devices, the 12VR module provides a separate 12VDC, 1 Amp output for 12VDC access controllers and readers or other devices.

SDC power supplies equipped with RB12V batteries provide continuous operation of access controls, locking devices and peripheral components during a power outage.

12VR - Voltage Power Convertor Module
Dual 12VDC and 24VDC Output

RB12V Series
Backup Batteries for Power Controllers

REFERENCE

Electrical Circuit Symbols