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

SDC
Security Door Controls

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Why This Power Guide?

All power is not created equal, especially when designing and installing electrified access control hardware and systems in new or retrofit applications

1. 75-85% of access control operating problems and technical support calls are due to power issues*
    - Dead Systems
    - Malfunctioning Locks or intermittent operation of Accessories, Controllers
    - Locking Devices won't respond reliably

2. Access Control System Power requirements are uniquely different from other systems
    - Access Control Systems require steady low-voltage DC current
    - Access Systems generally draw higher current during access control-related events - readers, shunt and strike relays, door locking devices, gate operators, controllers and annunciators

* SDC Technical Support Logs

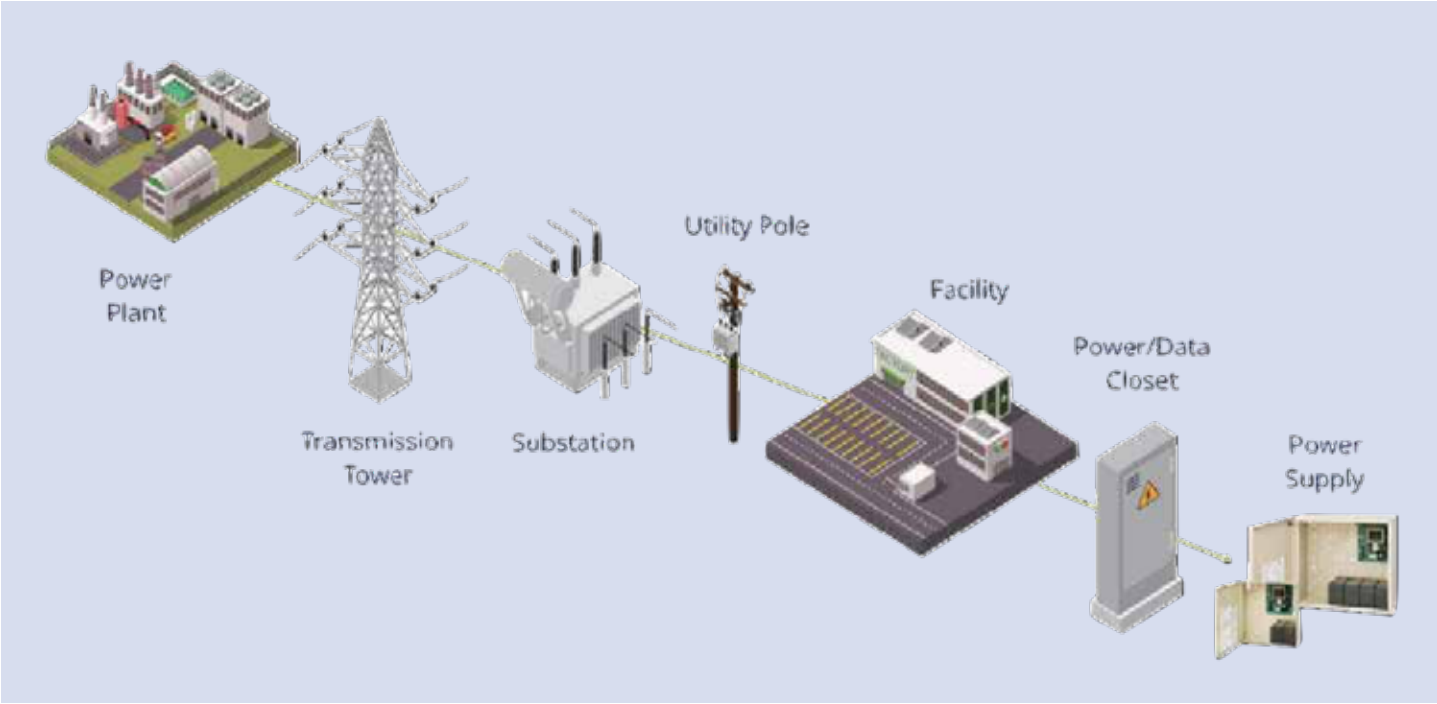
How Will You Benefit?

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

75-85% of access control problems are due to power issues

So, What's the Problem?



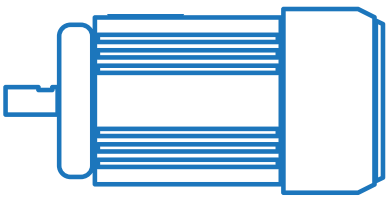
- *Unreliable Utility Power*
  - *Underpowered Access Control Systems*
- *Voltage & Amperage*

Why We Need Clean Power

1. 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

2. 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

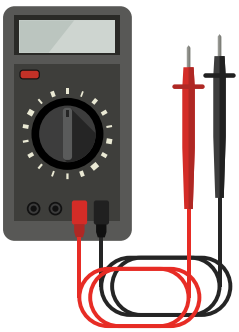
3. Power coming from the power company can range from 90 - 120 volts, causing brown outs, power fluctuations, downed lines, surges, and lightning coming in over AC lines



A Simple Solution

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 - lightning strikes, static discharge, restoration of power after a failure, coil kickback caused by door locking devices. The key is to provide the system with good grounding.

Start By Testing For Voltage & 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

60% of transient events occur inside the facility

• Up to 75% of integrated circuit failures can be attributed to power transients

Visit www.sdcsec.com/multimeter

for a quick video about measuring voltage, continuity and current on a lock

Troubleshooting a Dead, Malfunctioning or Intermittment Lock Device

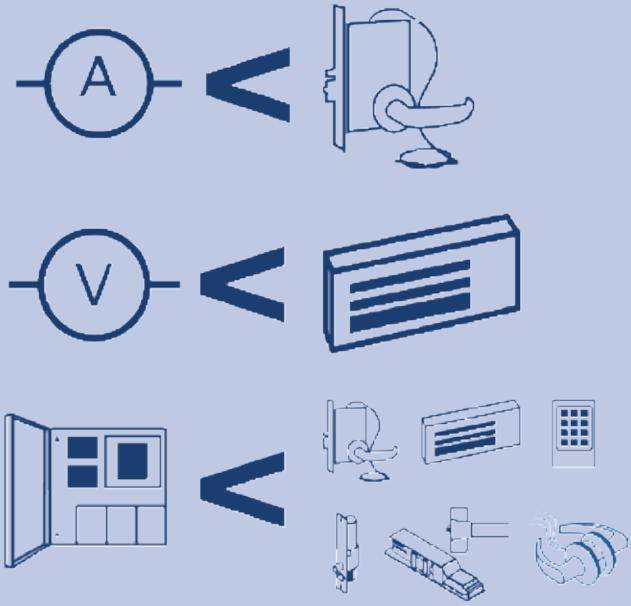
Sometimes, the quickest way to solve a suspected locking device problem is to isolate it to eliminate or confirm the device is the issue. Start by disconnecting it from its power source and then providing some DC power to it to see if it works or not. 12VDC alarm batteries and a wired lead are useful for this testing. (1) battery for 12VDC. (2) 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, and save yourself loads of time and hassle troubleshooting on your next install or callback. Go to the Access Control System Calculators page on our website at **www.sdcsecurity.com/calculators.htm**, and play the Portable Power Test Kit video.

Lack of Power

Look for Causes of Lack of Power

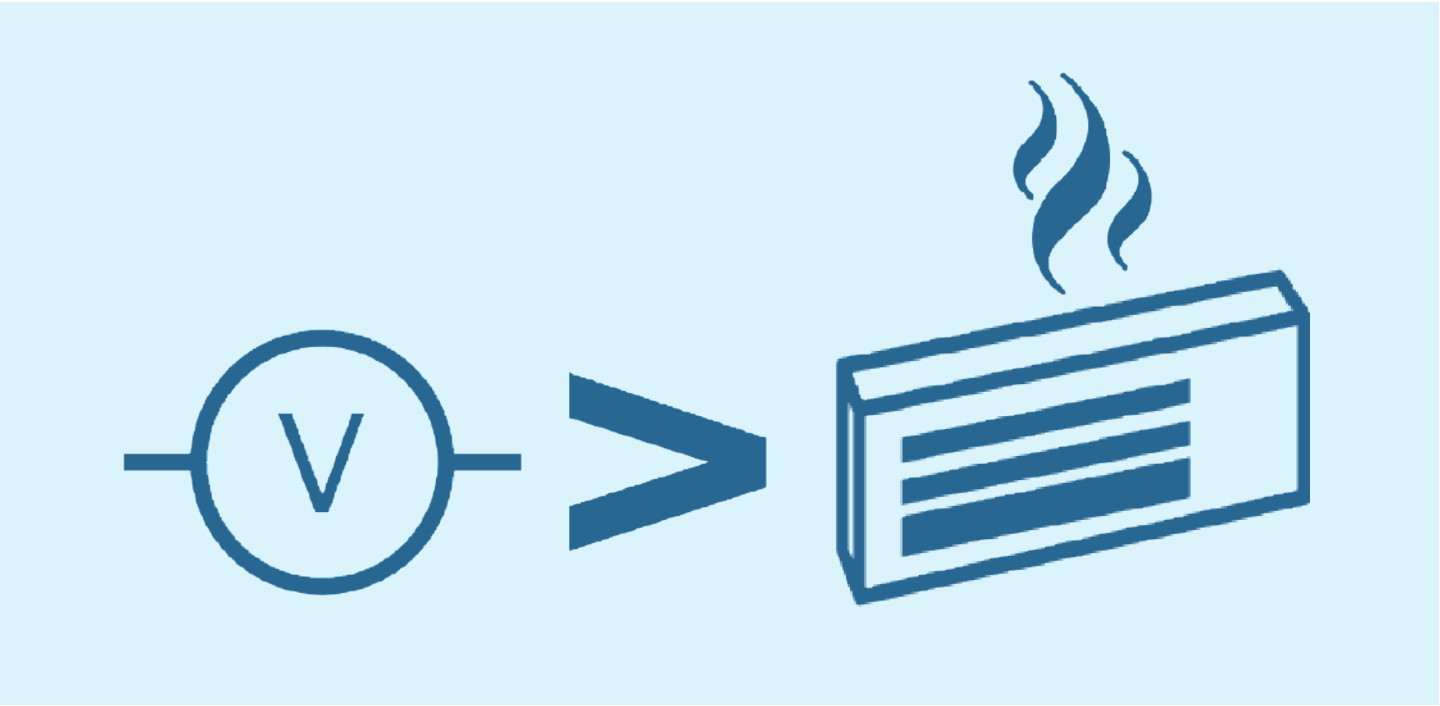
- *Not enough amperage present at the powered device (power supply does not have adequate capacity)*
- *Not enough voltage present at the powered device, caused by failure to calculate voltage drop and/or using the wrong wire gauge (too small)*
- *Too much equipment connected to each supply*



Problems Caused by Lack of Power

- *Reduces product life, 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*



- *Voltage exceeds device's rated input voltage by more than 10%*
  - *– Overheating (lock's coil or electronics)*
  - *– Unreliable Operation*
  - *– Shorter Life Expectancy*

Check out "Introduction to Access Control Power Basics" for key electronic system terms and definitions at our website on the Access Control System Calculators at **www.sdcsecurity.com/calculators.htm.**

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.

* SDC Technical Support gets calls for this more often than other issues

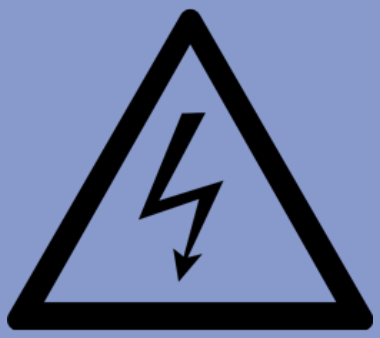
Plan Now to Avoid Trouble Later

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 (UL294 is one example)?
- 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



About 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, 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 supplies feature extra filtering to provide clean-noise-free power

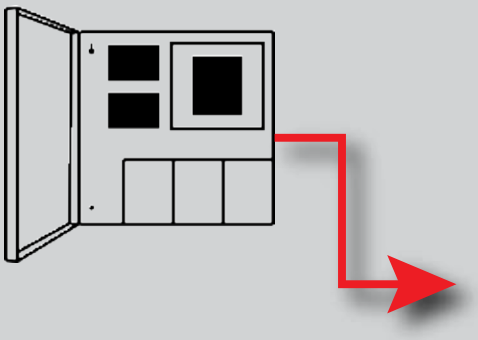
Current Load

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

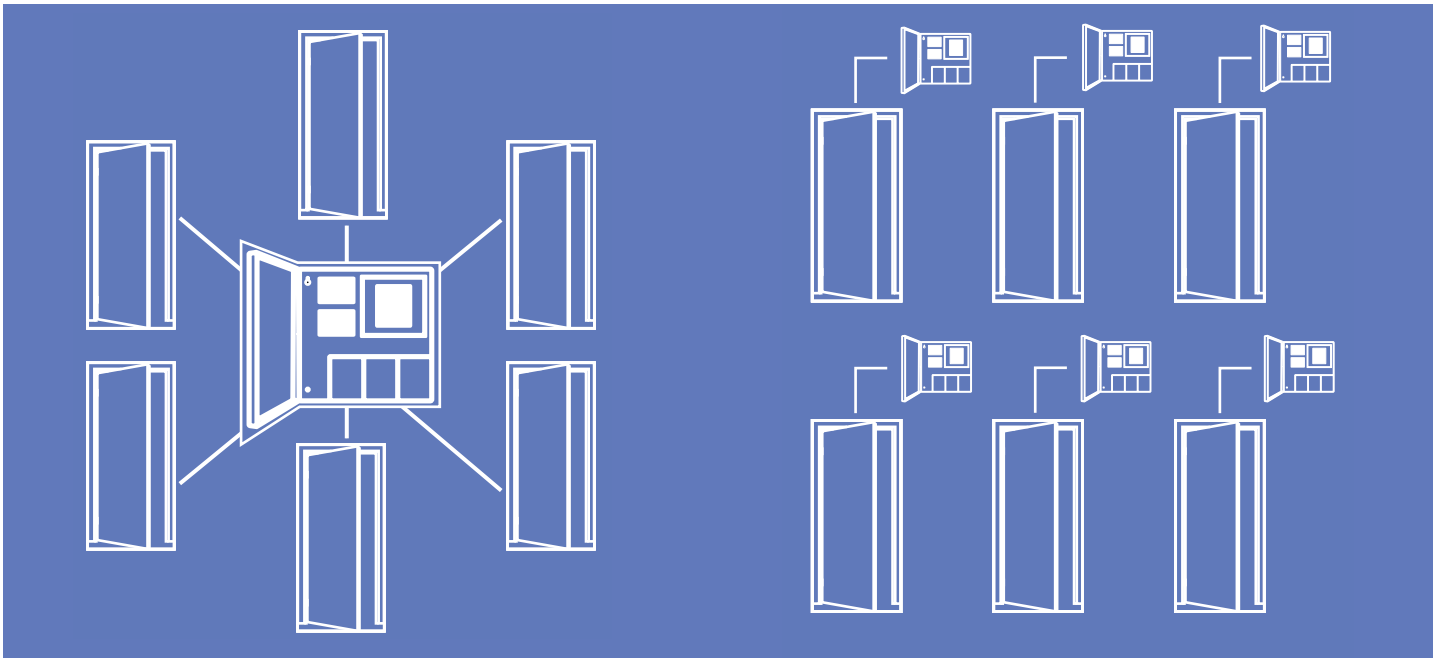
- Use a Door Checklist like this example to fill in values and calculate the current load:
  - Locking Device (_____ Amps)
  - Rex Button (_____ Amps)
  - Control Panel (_____ Amps)
  - In/Out Readers (_____ Amps)
  - Annunciator (_____ Amps)
  - **Total (_____ Amps)**
- Add a 30% safety margin
- Add 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 guage requirements based on load, cable distance and voltage drop

Voltage Drop

- Power supply voltage will drop over long cable distances due to wire resistance
  - Operating access control devices with inadequate or excess 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, load current (Amps) to obtain a voltage drop calculation - **http://sdcsecurity.com/Caluclators.htm**
- 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 -

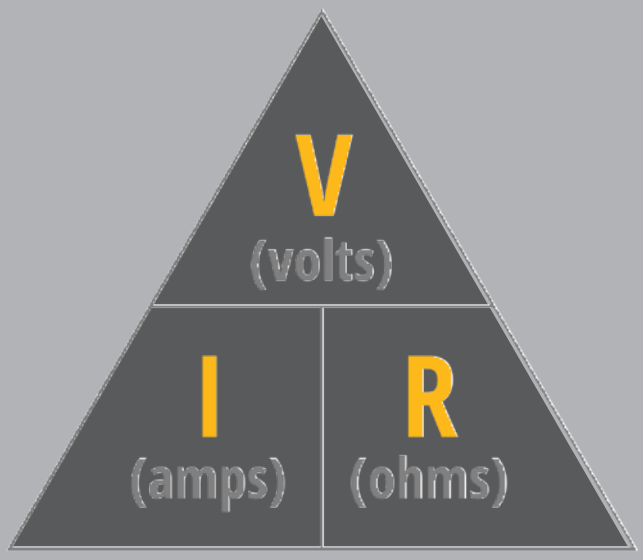
- Higher cost per door

Using the Voltage DropCalculator

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 - **http://sdcsecurity.com/Caluclators.htm**
- 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

Power Customization

- **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 valve
  They 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*

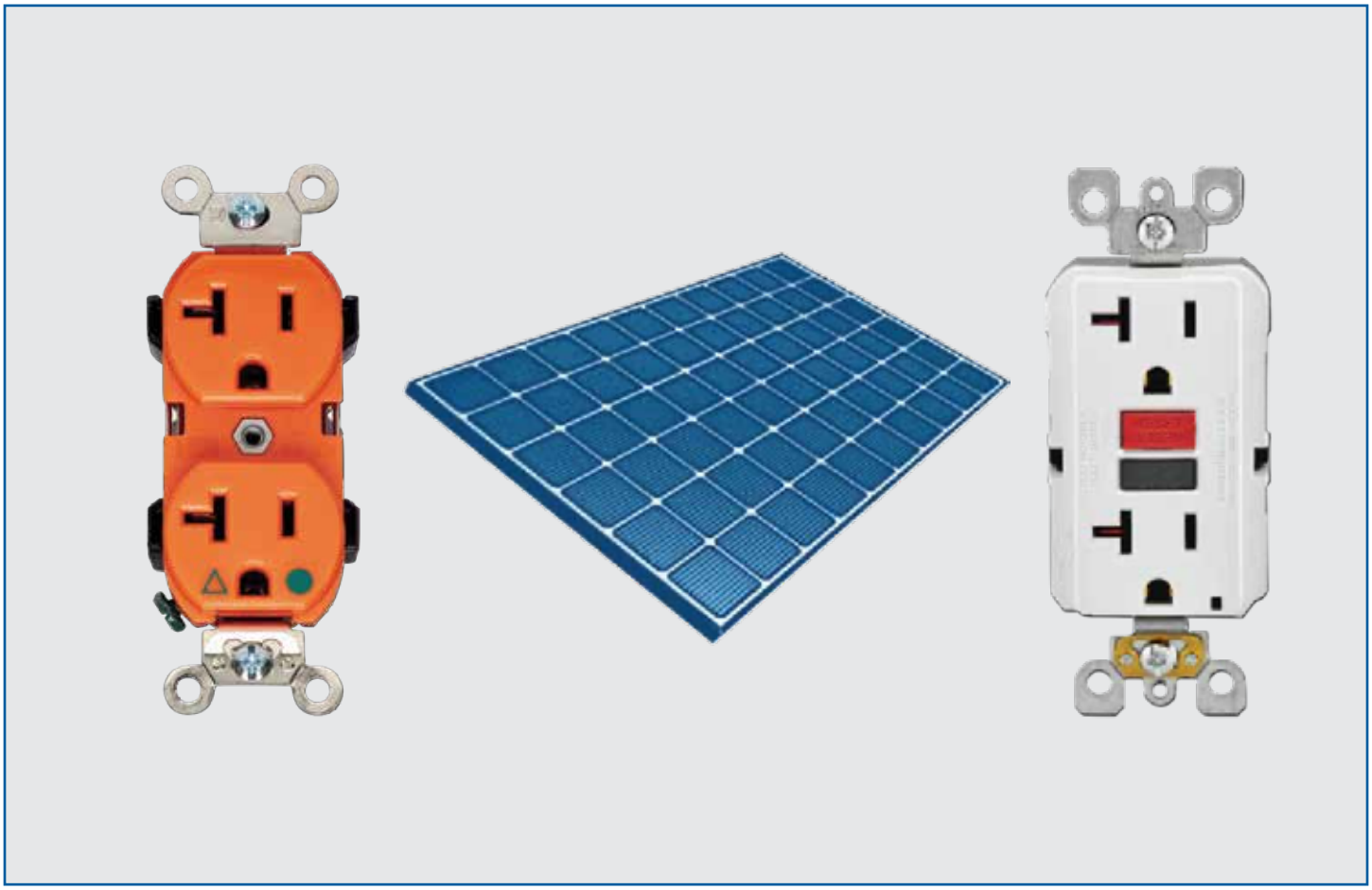
- *If voltage is not present at locking device when it should be powered, check power supply. Voltage at power supply should 12VDC +-10% or 24VDC +-10%*

- *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 on Page 6 of 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, like many industry manufacturers and trade associations, has training to assist you in your electrified door control endeavors. Send your name, address and email to: **power@sdcsecurity.com** to be notified when our ACCESS CONTROL POWER class – worth 2 CEU's - is coming to your region.

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)
- **621 Series** - 1 Amp Power Supply (24VAC Input)

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

602RF with (2) optional battery packs

631RF with (2) optional battery packs

632RF with (2) optional battery packs

634RF with (4) optional battery packs

636RF with (6) optional battery packs

621RF with (2) optional battery packs

1-6 Amp Power Supply

Cross Reference Guide

SDC	Altronix	ASSA ABLOY	LifeSafety Power	SCHLAGE
602RFXFB4XPSM 1 Amp, 12 OR 24 VDC, 4 Fused Outputs, Power Supply Monitor, Fire Relay	AL125UL, AL125ULX	AQD1-4F1, AQD1-4C1	FPO25-E5, FPO25-E1	PS902
632RFXPSM 2 Amp, 12 OR 24 VDC, Power Supply Monitor, Fire Relay	AL175UL, AL175ULX	AQD2-1R	FPO75-E5, FPO75-E1	PS902
632RFXFB4XPSM 2 Amp, 12 OR 24 VDC, 4 Fused Outputs, Power Supply Monitor, Fire Relay	AL300ULM, AL300ULPD4	AQD2-4C1, AQD2-4F1	FPO75-F8PE1, FPO75-D8E1	PS902
632RFX2CR4XPSM 2 Amp, 12 OR 24 VDC, 8 Fused Relay Outputs, Power Supply Monitor, Fire Relay	AL300ULDP8	AQD2-8C8R1, AQD2-8F8R1	FPO75-D8E1	PS902
634RFXFB4XPSM 4 Amp, 12 OR 24 VDC, 4 Fused Outputs, Power Supply Monitor, Fire Relay	AL400ULPD4	AQD4-4F1	FPO75-D8E1	PS904
634RFX2FB4XPSM 4 Amp, 12 OR 24 VDC, 8 Fused Outputs, Power Supply Monitor, Fire Relay	AL400ULPD8CB	AQD4-8C1	FPO75-D8PE1	PS904
634RFX2CR4XPSM 4 Amp, 12 OR 24 VDC, 8 Fused Relay Outputs, Power Supply Monitor, Fire Relay	AL400ULACM, AL400ULACMCB, AL400ULACMCBJ, AL400ULACMJ	AQD4-8C8R1, AQD4-8F8R1	FPO75-C8E1, FPO75-C8PE1, FPO75-CPE2, FPO75-C8E2	PS904
636RFX2FB4XPSM 6 Amp, 12 OR 24 VDC, 8 Fused Outputs, Power Supply Monitor, Fire Relay	AL600ULPD8CB	AQD6-8C2	FPO150-D8PE1	PS906
636RFX2CR4XPSM 6 Amp, 12 OR 24 VDC, 8 Fused Relay Outputs, Power Supply Monitor, Fire Relay	AL600ULACM, AL600ULACMCB, AL600ULACMCBJ, AL600ULACMJ	AQD6-8C8R2, AQD6-8F8R2	FPO150-C8E1, FPO150-C8PE1, FPO150-C8PE2, FPO150-C8E2	PS906

602RF

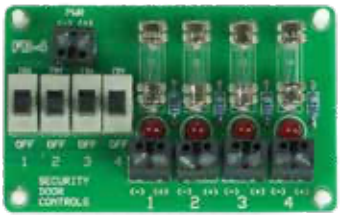
632RF

634RF

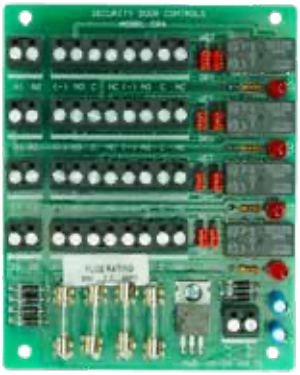
636RF

SDC Power Supply Accessories

SDC also offers a complete line of power supply accessories
– review and consider these for your application where appropriate



FB-4 Module, 4 Fused Outputs (Distributes the primary DC output of any 600 series power supply into four, individually fused class 2 outputs.)



CR4 Module, Control Relays, (4) NO Inputs, (4) Fused SPDT Outputs, (4) SPDT Dry Contact, 5 Amp. Distributes the primary DC output of any 600 series power supply into four, individually controlled relay DPDT outputs

UR-1 Universal Relay Module

ACM-1 Module, Control Relay, (4) NO, (4) NC Entry/REX Inputs, (1) SPDT Wet Output, (1) SPDT Dry Contact

EMC Electric Retraction Sequencer

ELECTRICAL CIRCUIT SYMBOLS