



# APS Series Fire Alarm Power Supply Technical Reference Manual



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**Intended use**

Use this product only for the purpose it was designed for; refer to the data sheet and user documentation for details.

**FCC compliance**

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

**EU directives**

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2012/19/EU (WEEE directive): Products marked with this symbol cannot be disposed of as unsorted municipal waste in the European Union. For proper recycling, return this product to your local supplier upon the purchase of equivalent new equipment, or dispose of it at designated collection points. For more information see: [www.recyclethis.info](http://www.recyclethis.info).

**Contact information**

For contact information, see [www.edwardsfiresafety.com](http://www.edwardsfiresafety.com).

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# Important information

## Regulatory information

This product has been designed to meet the requirements of NFPA 72 *National Fire Alarm and Signaling Code*, UL 864 *Standard for Control Units and Accessories for Fire Alarm Systems*, and CAN/ULC-S527-11 *Standard for Control Units for Fire Alarm Systems*.

**Note:** All references to Access Control applications and associated modules in this document are for repair and replacement units only. As of December 2, 2018, the products covered in this Manual are not listed to the UL 294 Standard for use in access control applications.

## Limitation of liability

To the maximum extent permitted by applicable law, in no event will Carrier be liable for any lost profits or business opportunities, loss of use, business interruption, loss of data, or any other indirect, special, incidental, or consequential damages under any theory of liability, whether based in contract, tort, negligence, product liability, or otherwise. Because some jurisdictions do not allow the exclusion or limitation of liability for consequential or incidental damages the preceding limitation may not apply to you. In any event the total liability of Carrier shall not exceed the purchase price of the product. The foregoing limitation will apply to the maximum extent permitted by applicable law, regardless of whether Carrier has been advised of the possibility of such damages and regardless of whether any remedy fails of its essential purpose.

Installation in accordance with this manual, applicable codes, and the instructions of the authority having jurisdiction is mandatory.

While every precaution has been taken during the preparation of this manual to ensure the accuracy of its contents, Carrier assumes no responsibility for errors or omissions.

## Advisory messages

Advisory messages alert you to conditions or practices that can cause unwanted results. The advisory messages used in this document are shown and described below.

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**WARNING:** Warning messages advise you of hazards that could result in injury or loss of life. They tell you which actions to take or to avoid in order to prevent the injury or loss of life.

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**Caution:** Caution messages advise you of possible equipment damage. They tell you which actions to take or to avoid in order to prevent the damage.

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**Note:** Note messages advise you of the possible loss of time or effort. They describe how to avoid the loss. Notes are also used to point out important information that you should read.

## FCC compliance

This equipment can generate and radiate radio frequency energy. If the equipment is not installed in accordance with this manual, it may cause interference to radio communications. This equipment has been tested and found to comply with the limits for Class A computing devices pursuant to Subpart B of Part 15 of the FCC Rules. These rules are designed to provide reasonable protection against such interference when this equipment is operated in a commercial environment. Operation of this equipment is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.



# Introduction

This installation manual is intended for use by installers and field technicians. It provides the installation procedures, wiring diagrams, DIP switch settings, etc. required to install and set up APS Series fire alarm power supplies.

## Models covered

The following table lists the APS Series fire alarm power supply models that are covered in this manual.

Catalog number	Description
APS6A	Power supply, 120 V, 50/60 Hz, 6.5 A max. output
APS6A/230	Power supply, 240 V, 50/60 Hz, 6.5 A max. output
APS10A	Power supply, 120 V, 50/60 Hz, 10 A max. output
APS10A/230	Power supply, 240 V, 50/60 Hz, 10 A, max. output

## Compatibility

The sense input circuits on APS Series fire alarm power supplies can be connected to 12 VDC or 24 VDC systems.

For details about device compatibility, refer to *Remote Booster Power Supply Compatibility List* (P/N 3100656).

# Installation procedure checklist

Follow these steps to install and set up the APS Series power supply.

- ☐ Verify that all power and field wiring are de-energized before proceeding.
- ☐ Unpack the equipment
- ☐ Review “Getting started” on page 3.
- ☐ Review “Applications” on page 49 to determine how you want to use the APS Series power supply.
- ☐ Prepare the site. Make sure the installation location is free from construction dust and debris, and extreme temperature ranges and humidity.
- ☐ Install the enclosure. See Figure 3 on page 9 for cabinet dimensions.
- ☐ Install option modules, if required. See “Installing Signature modules in the enclosure” on page 10.
- ☐ Install the 3-TAMP tamper switch, if required. See “Installing the 3-TAMP tamper switch” on page 38.
- ☐ Set the jumpers. See “Setting the jumpers” on page 15.
- ☐ Set the DIP switches. See “Setting the DIP switches” on page 19.
- ☐ Review wire routing. See Figure 21 on page 25.
- ☐ Check field wiring for shorts, opens, and grounds.

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**WARNING:** Make sure that the AC power circuit breaker is off before connecting wires to the terminal block.

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- ☐ Connect the field wiring. See “Connecting the field wiring” on page 26.
- ☐ Turn on the AC mains power.

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**Caution:** Turn on AC power before connecting the batteries.

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- ☐ Connect the standby batteries.
- ☐ Verify that the status LEDs do not indicate any faults.
- ☐ Test the system for proper operation.



# Getting started

## Description

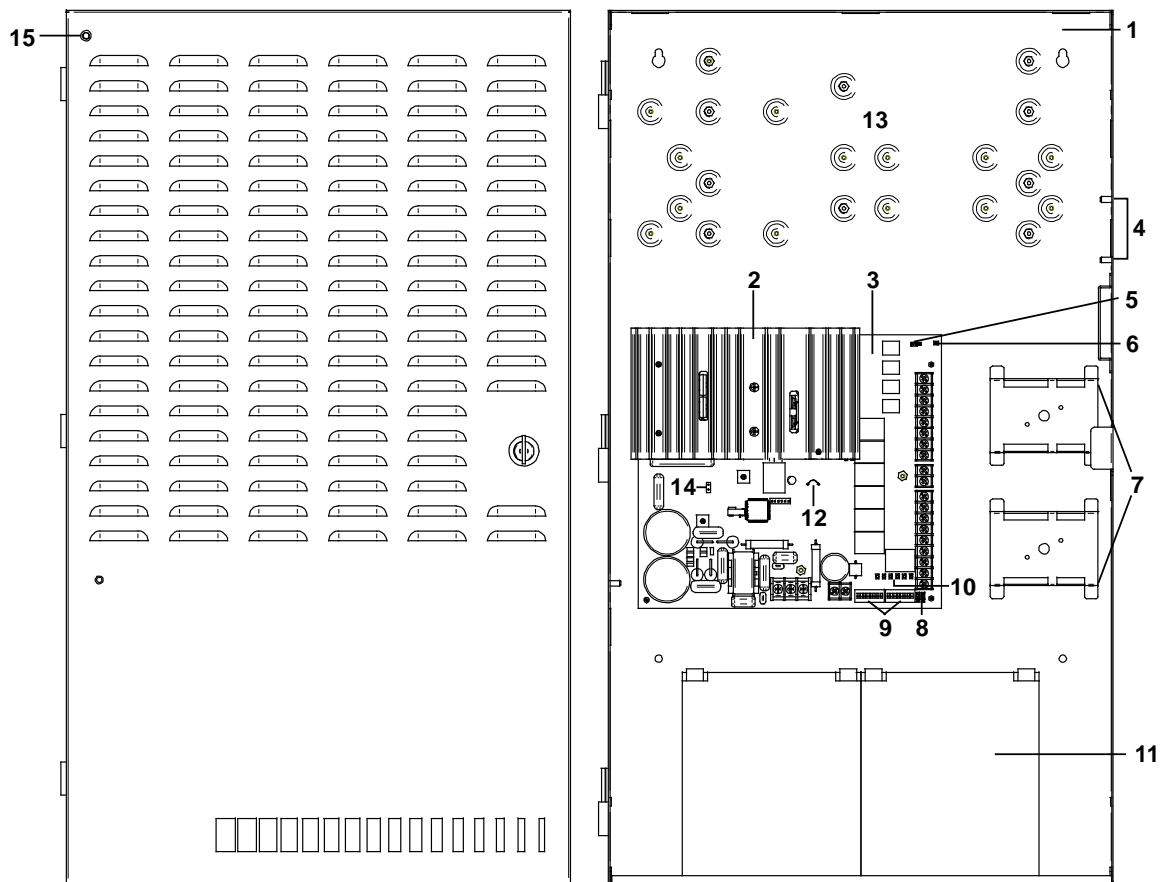
APS Series power supplies are designed to extend the signaling capacity of a fire alarm, security, or access control system. They can also be used to power additional devices, such as amplifiers, releasing modules, etc. The APS Series power supply has four outputs that are field-configurable as notification appliance circuits (NACs) or as auxiliary (AUX) power circuits, and a trouble relay. The NACs are supervised and can either pass or generate Genesis synchronization signals for synchronized notification appliances.

**Note:** All references to Access Control applications and associated modules in this document are for repair and replacement units only. As of December 2, 2018, the products covered in this Manual are not listed to the UL 294 Standard for use in access control applications.

## Component descriptions

Figure 1 below shows the location of APS Series power supply components.

Figure 1: APS Series power supply components



Component	Description
1	Enclosure: Houses the electronics and two standby batteries
2	Heat sink: Distributes heat away from the circuit board
3	Circuit board: Provides connections for all circuits [1]
4	Tamper switch standoffs: 3-TAMP mounting standoffs
5	Jumper JP3: Ground fault enable or disable option
6	AC LED: AC power on
7	Mounting brackets: Option module mounting brackets
8	Jumpers JP1 and JP2: Class A or Class B NAC option
9	DIP switches: Two eight-position DIP switches used for configuration
10	Circuit LEDs: NAC, battery, and ground fault trouble LEDs
11	Battery compartment area: Up to two 24 Ah batteries fit in the enclosure. For larger batteries, use an external battery cabinet (BC-1 or BC-2).
12	Jumper JP4: Battery charging jumper
13	Option module mounting area
14	Remote LED wiring harness connection
15	Remote LED: Indicates AC power is on

[1] Power supply circuit board cover (catalog number: BPS-CVR) ordered separately, if needed. For installation instructions, see *BPS-CVR Power Supply Cover Installation Sheet* (P/N 3102686).

## Specifications

AC line voltage	
6.5 amp models	120/240 VAC, 50/60 Hz, 390 watts
10 amp models	120/240 VAC, 50/60 Hz, 580 watts
Sense input circuits	
Voltage	6 to 45 VDC (FWR and unfiltered DC)
Current	6 mA at 24 VDC, 3 mA at 12 VDC, 12 mA at 45 VDC
NAC output voltage (special application circuit)	18.20 to 26.40 VDC <b>Note:</b> All NAC output circuits are supervised. Refer to <i>Remote Booster Power Supply Compatibility List</i> (P/N 3100656) for the maximum number of devices that can be used on a NAC output circuit.
AUX output voltage (special application circuit)	19.1 to 26.48 VDC
NAC/AUX output current	3.0 A max. per circuit with 0.35 power factor 6.5 A or 10 A max. total if all NAC/AUX outputs are configured as NACs 6 A or 8 A max. total if one or more NAC/AUX outputs are configured as AUX power outputs
NAC/AUX capacitive loading	10,000 $\mu$ F max. for continuous NAC output circuits 2,200 $\mu$ F max. for coded rate NAC output circuits 2,200 $\mu$ F max. for AUX power output circuits
Wiring class	
NACs	Class A or Class B
AUX power	Class B
Wire size	18 to 12 AWG (0.75 to 2.5 sq mm)

NAC EOLR	UL: 15 k $\Omega$ P/N EOL-15 ULC: Use P/N EOL-P1 and select the 15 k $\Omega$ resistor
Auxiliary output (continuous)	1 dedicated unsupervised, unswitched 200 mA auxiliary output Voltage range: 19.49 to 26.85 VDC
Common trouble relay	Form C, 1 A, 30 VDC (resistive)
Battery requirements	
Quantity	2
Size	6.5 to 24 Ah
Type	Sealed lead acid only
Rechargeable battery circuit [1]	
Voltage	24 VDC
Charging current	1.2 A or 2.1 A, field configurable
Charging capacity	24 Ah, max
Operating voltage	20.4 V, min
Battery capacities [2]	6.5 to 24 Ah for ECS/MNS/LSS applications 6.5 to 24 Ah for Security/Access Control applications 10 Ah maximum in power supply enclosure applications
Dimensions	See Figure 3 on page 9
Ground fault impedance	10 k $\Omega$
Operating environment	
Temperature	32 to 122 °F (0 to 50 °C)
Relative humidity	0 to 93%, noncondensing
Environmental class	Indoor, dry

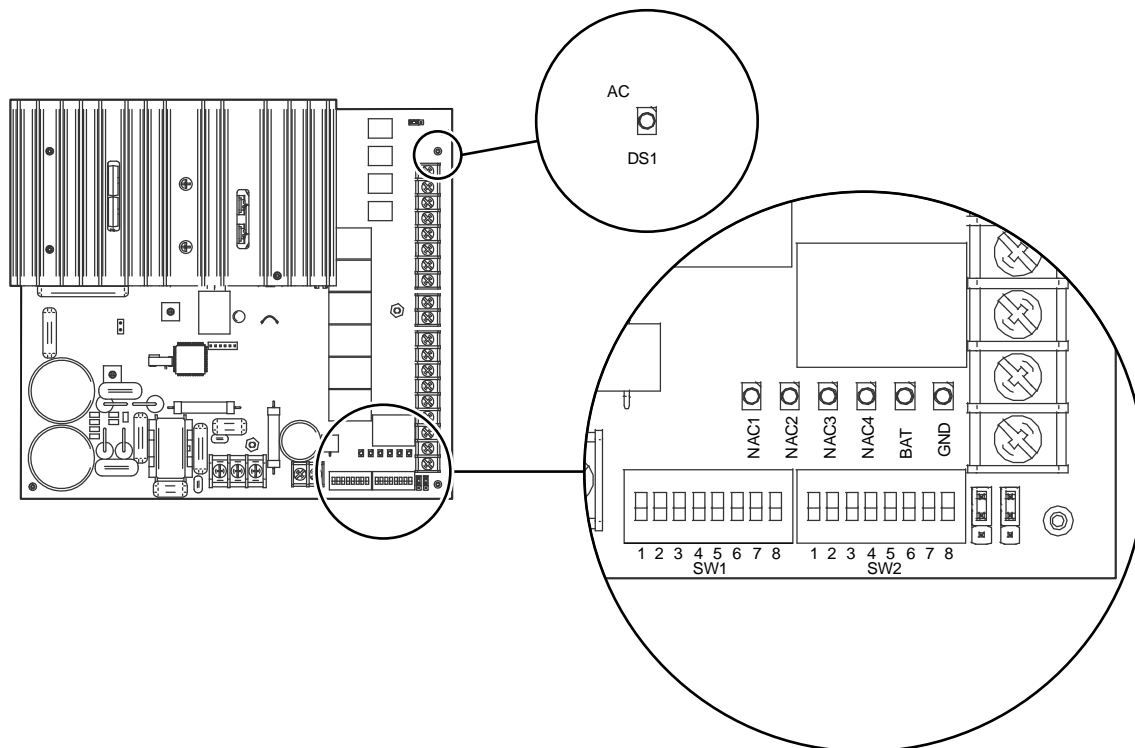
[1] The battery charger circuit is automatically turned off when the unit is activated by either of its sense inputs and will not charge the standby batteries.

[2] All references to Access Control applications and associated modules in this document are for repair and replacement units only. As of December 2, 2018, the products covered in this Manual are not listed to the UL 294 Standard for use in access control applications.

## LED indicators

Figure 2 below shows the location of the LED status indicators on the APS Series power supply circuit board. The cabinet door also has an LED to indicate whether the APS Series power supply is operating on AC power.

Figure 2: APS Series power supply status indicators



LED	Color	Description
AC	Green	AC power on
NAC1	Yellow	NAC1/AUX1 trouble [1]
NAC2	Yellow	NAC2/AUX2 trouble [1]
NAC3	Yellow	NAC3/AUX3 trouble [1]
NAC4	Yellow	NAC4/AUX4 trouble [1]
BAT	Yellow	Battery trouble. Indicates that the battery level has fallen below acceptable levels.
GND	Yellow	Ground fault. Indicates that a ground fault has been detected on the field wiring.

[1] The NAC LEDs indicate a trouble with the load or external wiring on the NAC/AUX circuit. For circuits configured as NACs, this could be an open circuit trouble, short circuit trouble, or an overload trouble.

For short circuit troubles, the NAC does not activate until the short circuit condition is removed.

For overload troubles, an active NAC is shutdown. After shutdown, if there is no short circuit condition, the NAC reactivates after 30 seconds checking to see if the overload condition still exists.

For AUX circuits, the trouble indicates an overload condition. The AUX circuit is shutdown for 30 seconds and then is reactivated to see if the overload condition still exists.

## **Trouble indicating and reporting**

When the trouble relay is not dedicated to AC power loss reporting (DIP switch SW2-6 OFF), the trouble conditions listed in the table above are reported through the trouble relay. Other internal troubles that do not have an associated LED are also reported via the trouble relay. Other internal troubles include: DIP switch read trouble, RAM failure, code checksum failure, A to D failure, and battery charger failure.

All troubles are also reported through both sense circuits.

# Installing the enclosure

When installing the APS Series power supply, be sure to follow all applicable national and local fire alarm codes and standards.

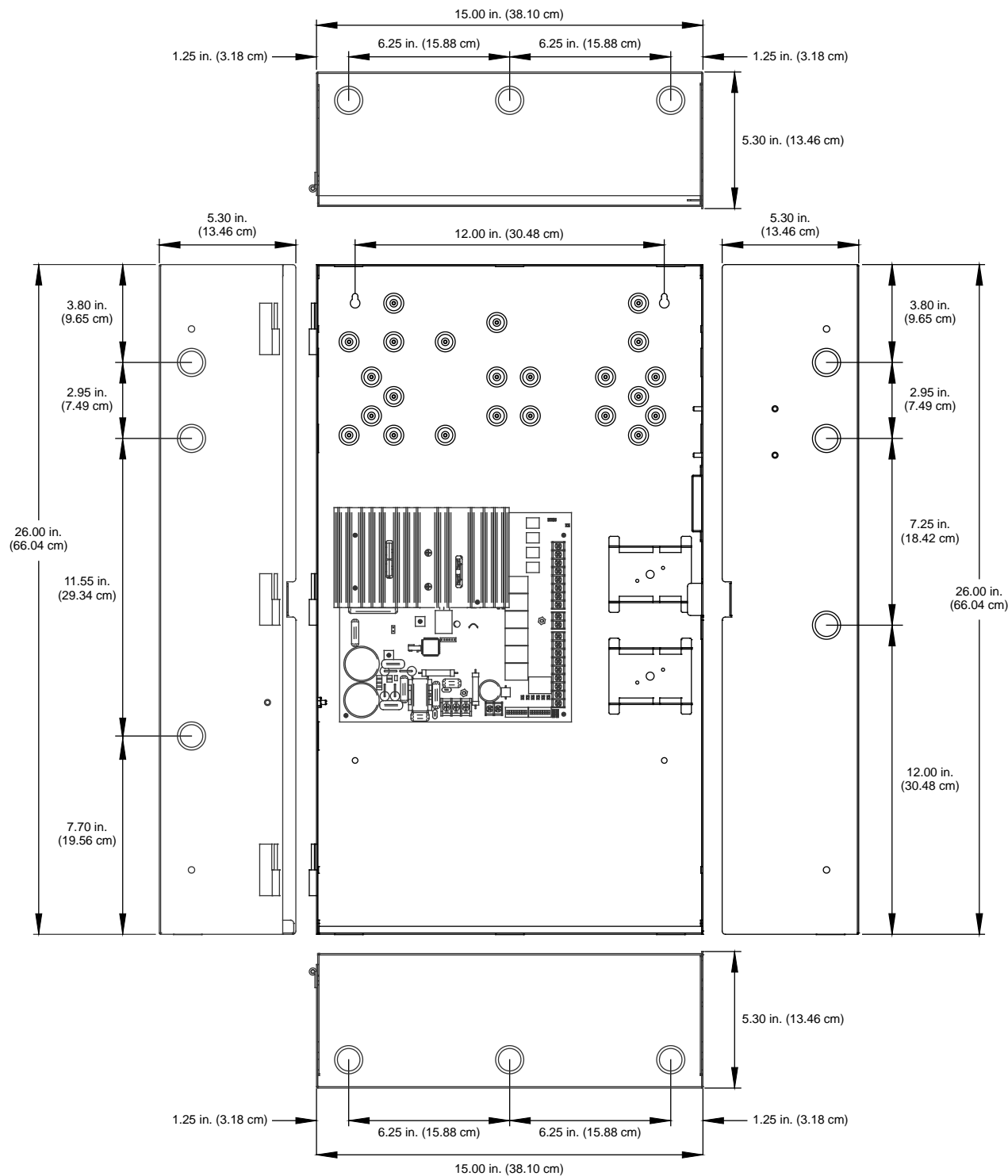
The metal conduit is the main path for earth grounding of the enclosure. Use UL Listed conduit connectors designed for painted surfaces.

For cabinet dimensions, see Figure 3 on page 9.

## **To mount the enclosure:**

1. Position the enclosure on the finished wall surface.
2. Fasten the enclosure to the wall surface where indicated.
3. Install all conduit to manufacturer's specifications and pull all wiring into the enclosure before proceeding.
4. Verify the connection between the enclosure and earth ground with an ohmmeter.

Figure 3: Cabinet dimensions



# Installing Signature modules in the enclosure

Signature modules can be installed on the mounting brackets inside the enclosure or on an MP2L mounting plate at the top of the enclosure. The top of the enclosure also provides mounting holes for installing Signature audio amplifiers, Signature releasing modules, and Signature universal input/output motherboards.

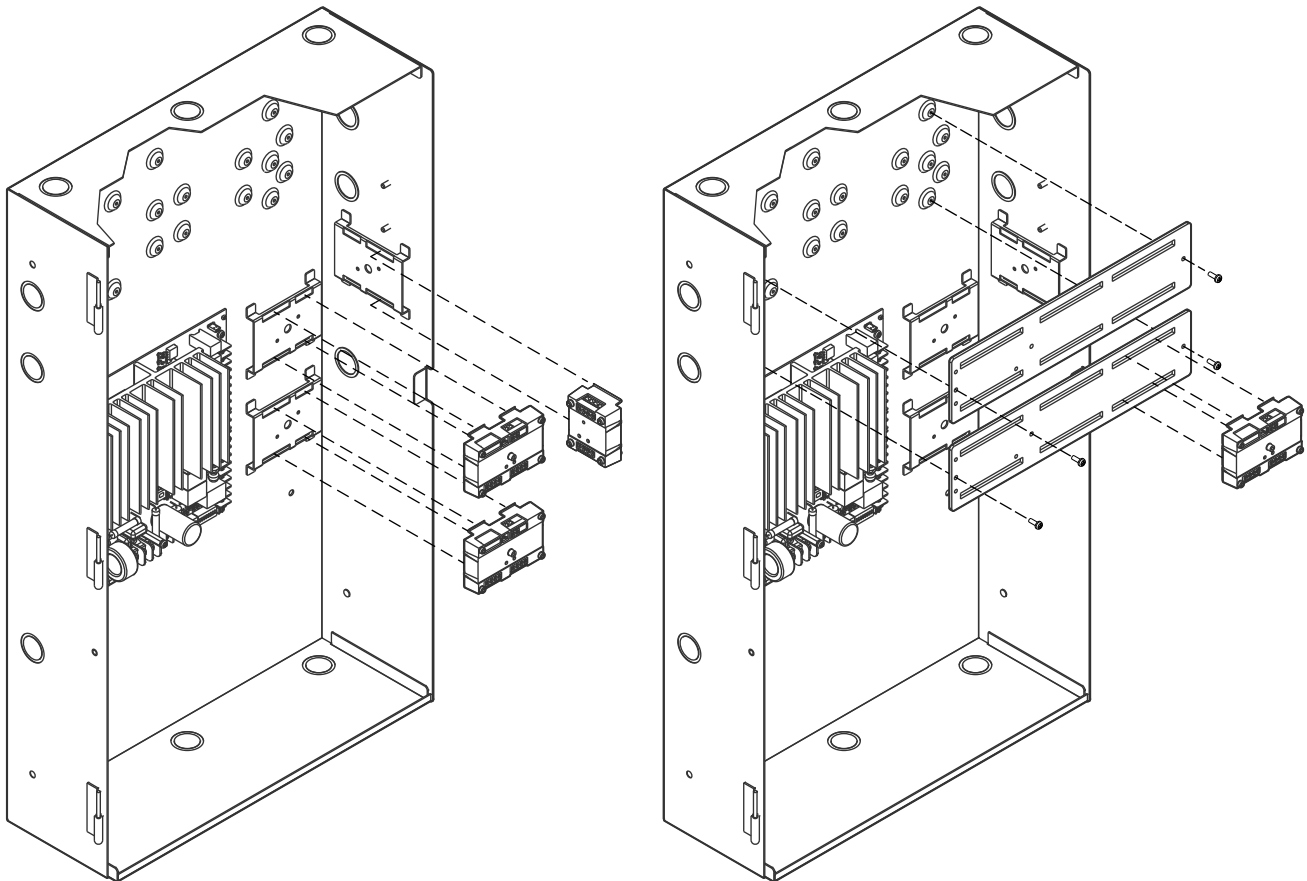
**Note:** For mounting MN-NETRLY4 modules, refer to *MN-NETRLY4 Network Relay Module Installation Sheet* (P/N 3101827).

## Installing standard Signature modules

The APS Series power supply provides three brackets for installing standard single-gang or double-gang Signature modules inside the cabinet. You can also install standard Signature modules inside the cabinet by mounting Signature MP2L mounting plates in the area above the circuit board. See Figure 4 below.

Position the MP2L mounting plate over the enclosure screw holes and then use the two #6 machine screws provided with the mounting plate to attach it to the cabinet.

**Figure 4: Installing standard Signature modules inside the cabinet**



### Notes

- To make wiring easier, install and wire the module on the top mounting bracket first, then the module on the middle bracket, and then the module on the bottom bracket.
- Route the wiring around the perimeter of the enclosure. Do not route wires across the circuit board.



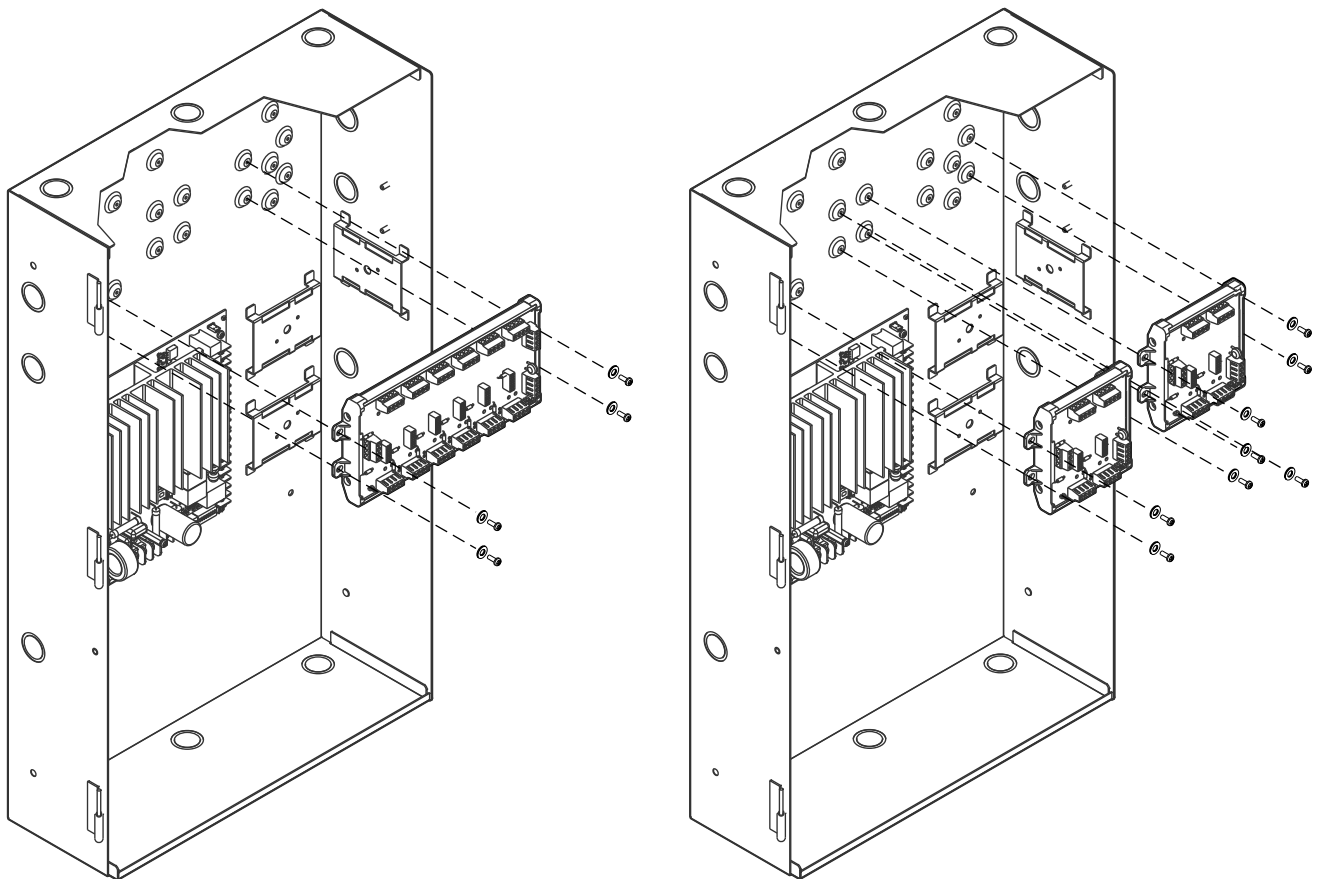
### To install Signature modules:

1. Insert the top tabs into the top slot on the mounting bracket, and then insert the bottom tabs into the bottom slot until you feel it snap in place.
2. Connect the field wiring. Refer to the module's installation sheet for wiring information.

## Installing M Series Signature modules

You can install M Series Signature modules inside the cabinet by mounting Signature universal input/output motherboards in the area above the circuit board. You can mount one UIO6 or UIO6R motherboard, or two UIO2R motherboards. See Figure 5 below.

Figure 5: Installing M Series Signature modules inside the cabinet



### To install universal input/output motherboards:

1. Position the universal input/output motherboard over the enclosure screw holes and then use the four #6 machine screws and washers provided with the motherboard to attach it to the cabinet.
2. Connect the field wiring. Refer to the installation sheets for the M Series modules you are installing and the following:

*SIGA-UIO2R Universal Input/Output Motherboard Installation Sheet (P/N 387349)*

*SIGA-UIO6(R) Universal Input/Output Motherboard Installation Sheet (P/N 387473)*

*GSA-UIO2R Universal Input/Output Motherboard Installation Sheet (P/N3102463)*

*GSA-UIO6(R) Universal Input/Output Motherboard Installation Sheet (P/N3102464)*

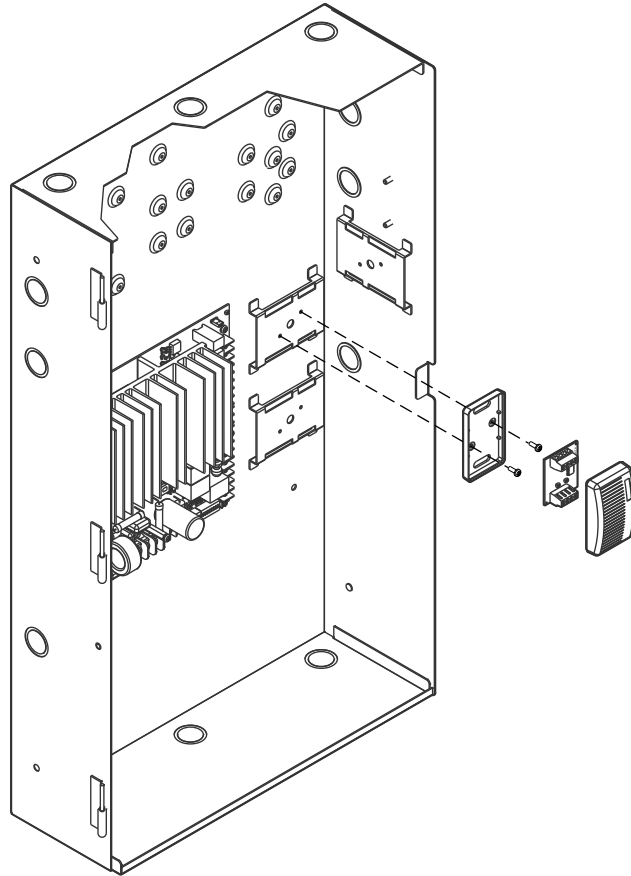
## Installing SIGA-SEC2 modules

You can install a SIGA-SEC2 module on any one of the three mounting brackets inside the APS Series power supply cabinet. See Figure 6 below. Typically, the SIGA-SEC2 module is installed directly below the 3-TAMP.

For installation and wiring instructions, see *SIGA-SEC2 Security Loop Module Installation Sheet* (P/N 387632).

**Figure 6: Installing SIGA-SEC2 modules inside the cabinet**

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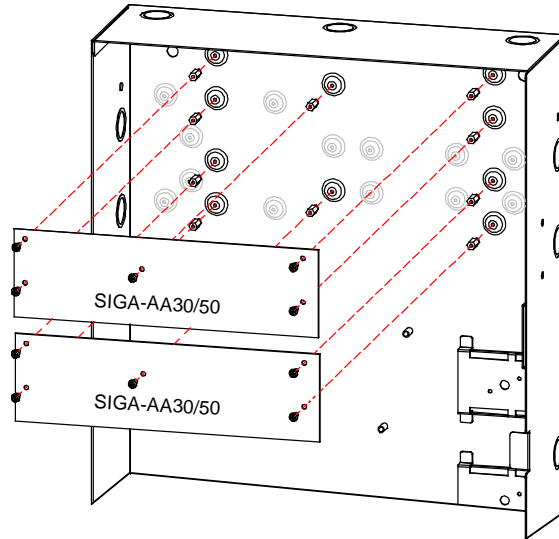


**Note:** Route the wiring around the perimeter of the enclosure. Do not route wiring across the circuit board.

## Installing SIGA-AA30/50 amplifier modules

You can install up to two SIGA-AA30 or SIGA-AA50 amplifier modules in the area at the top of the APS Series power supply cabinet. See Figure 7 below.

**Figure 7: Installing SIGA-AA30/50 amplifier modules inside the cabinet**



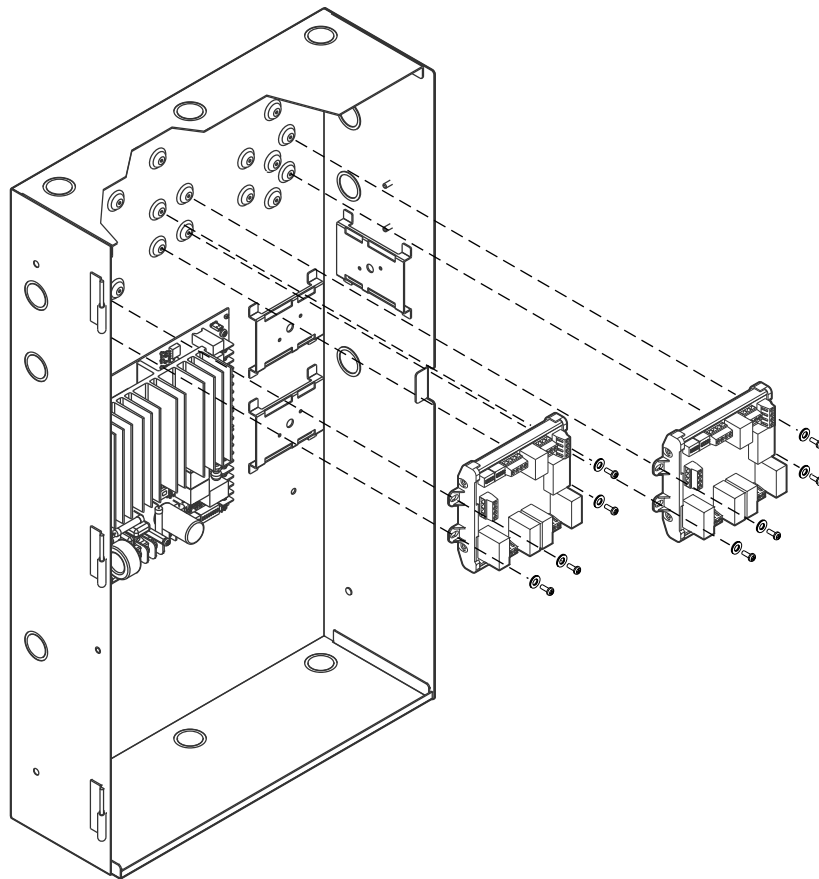
### To install a SIGA-AA30/50 amplifier module:

1. Position the amplifier module over the enclosure screw holes and then use the four #6 machine screws provided with the amplifier module to attach it to the cabinet.
2. Wire the amplifier module to an AUX circuit. See “AUX power circuit wiring” on page 30.
3. Connect the field wiring. Refer to *SIGA-AA30 and SIGA-AA50 Installation Sheet* (P/N 387343).

## Installing Signature releasing modules

You can install up to two Signature releasing modules in the area at the top of the APS Series power supply cabinet. See Figure 8 below.

**Figure 8: Installing Signature releasing modules inside the cabinet**



### To install Signature releasing modules:

1. Position the releasing module over the enclosure screw holes and then use the four #6 machine screws and washers provided with the releasing module to attach it to the cabinet.
2. Wire the releasing module to an AUX power circuit. For more information, see “AUX power circuit wiring” on page 30.
3. Connect all wiring. Refer to *SIGA-REL Technical Reference Manual* (P/N 387348) or *GSA-REL Technical Reference Manual* (P/N 387515).

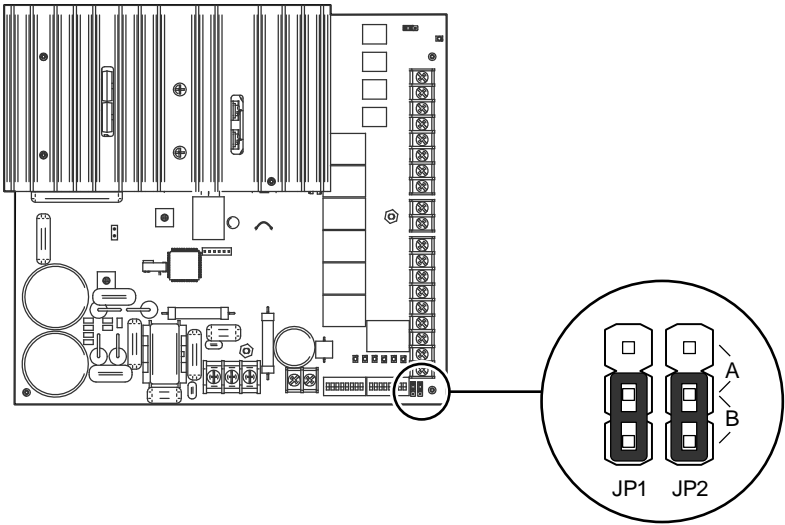
# Setting the jumpers

## NAC wiring class jumpers (JP1 and JP2)

JP1 and JP2 determine whether NACs are wired Class A or Class B. This setting applies to all NACs. See Figure 9 below.

**Note:** The settings for JP1, JP2, and SW2-8 must all match.

Figure 9: NAC wiring class jumpers (JP1 and JP2)



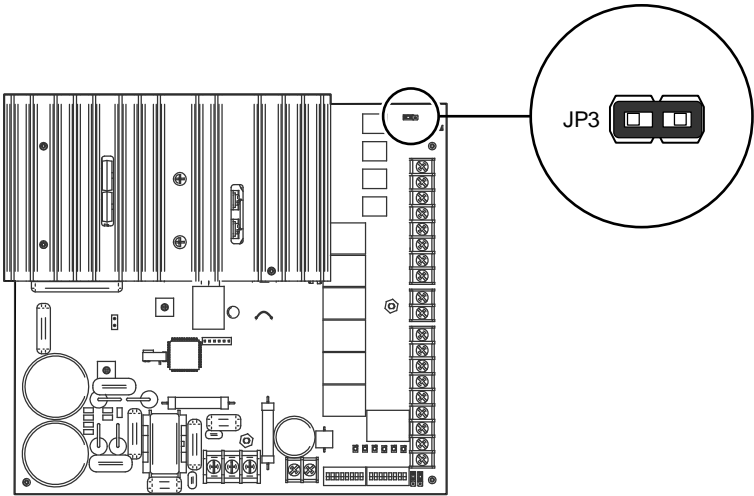
JP1 and JP2	Description
Position A	All NACs are wired Class A
Position B	All NACs are wired Class B (default)

## Ground fault detection jumper (JP3)

JP3 determines whether ground fault detection on all NAC/AUX outputs is turned on or off. The sense inputs are always isolated from the power supply ground fault circuits. See Figure 10 on page 16.

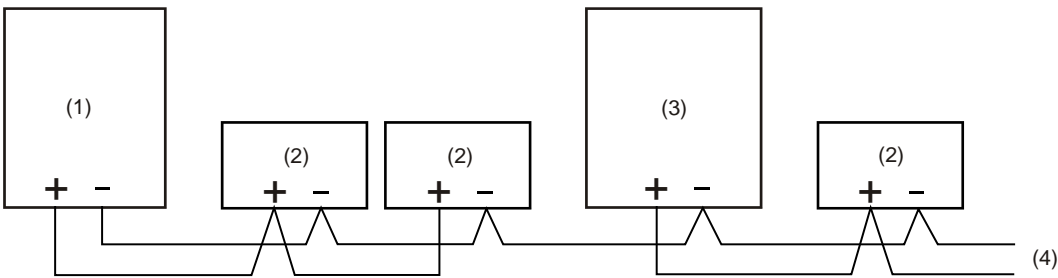
**Note:** Ground fault detection is required for all fire and security applications. It is recommended that systems, in which ground fault detection is turned off be tested after installation.

Figure 10: Ground fault detection jumper (JP3)



JP3	Description
Installed	The APS Series power supply performs ground fault detection. This is the <i>default</i> position.
Removed	The APS Series power supply does not perform ground fault detection. Ground fault detection is provided by the control unit.

Disable the APS Series power supply’s ground fault detection if the host control unit is detecting system ground faults. Disabling ground fault detection removes the ability of the APS Series power supply to detect ground faults and isolates the APS Series power supply from earth ground. This is what allows the control unit to do the system’s ground fault checking. If you do not disable ground fault detection when connecting powered devices as shown in the diagram below, you may get excessive ground faults on your system or ground faults on your system may fail to be reported.

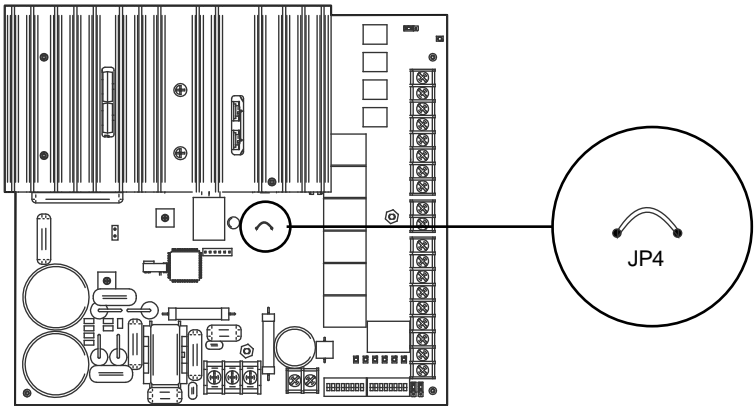


- (1) The control unit is responsible for ground fault detection when your system is wired in this fashion.
- (2) Powered device.
- (3) APS Series power supply. Remove the power supply’s ground fault jumper. See “Ground fault detection jumper (JP3)” on page 15.
- (4) To next device or end-of-line supervision circuit

# Battery charging circuit jumper (JP4)

JP4 determines the amount of current that the battery charging circuit uses to charge the standby batteries. See Figure 11 below.

Figure 11: Battery charging circuit jumper (JP4)



JP4	Description
Open (cut)	Battery charging current is 1.5 A. Use to charge standby batteries that are 10 Ah and smaller.
Shorted (uncut)	Battery charging current is 3.0 A. Use to charge standby batteries that are larger than 10 Ah.

# UL 864 programming requirements

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## NOTICE TO USERS, INSTALLERS, AUTHORITIES HAVING JURISDICTION, AND OTHER INVOLVED PARTIES

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This product incorporates field-programmable options. In order for the product to comply with the requirements in the Standard for Control Units and Accessories for Fire Alarm Systems, UL 864, certain programming features or options must be limited to specific values or not used at all as indicated below.

Programmable feature or option	Permitted in UL 864? (Y/N)	Possible settings	Settings permitted in UL 864
NAC audible synchronization delay [1]	N	ON: 4 second delay OFF: 1 second delay	OFF
AC power delay	Y	ON: 3 hour delay, no dedicated AC power failure contact OFF: No delay	ON

[1] This option is controlled by switch SW1-4. See “Synchronization delay (SW1-4)” on page 22.



# Setting the DIP switches

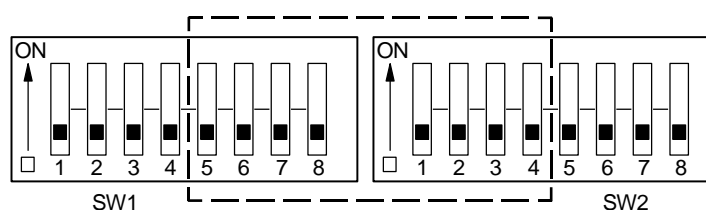
Two eight-position DIP switches are used to configure the APS Series power supply. The following sections show the DIP switch settings for the various input and output configurations.

**Note:** As shipped from the factory, all switches are in the OFF position.

## Output circuit type (SW1-5 to 8 and SW2-1 to 4)

Switches SW1-5 to SW1-8 and SW2-1 to SW2-4 determine whether the APS Series power supply output circuits are notification appliance circuits (NACs) or are auxiliary (AUX) power circuits. See Figure 12 below.

Figure 12: Output circuit type switches SW1-5 to 8 and SW2-1 to 4



	NAC1/AUX1		NAC2/AUX2		NAC3/AUX3		NAC4/AUX4	
Operating mode [1]	SW1-5	SW1-6	SW1-7	SW1-8	SW2-1	SW2-2	SW2-3	SW2-4
Sense Follow NAC	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Continuous NAC	OFF	ON	OFF	ON	OFF	ON	OFF	ON
Temporal NAC	ON	OFF	ON	OFF	ON	OFF	ON	OFF
AUX power	ON	ON	ON	ON	ON	ON	ON	ON

[1] See the descriptions below for operation details

### Sense Follow NACs

Sense Follow NACs output a signal that follows the signal applied to the sense inputs. The outputs activate one or four seconds after the sense input activates to allow time for Genesis strobes on the NAC side to synchronize with the signal on the sense side. The sense input signal may be continuous, 120 pulses per minute, temporal, or coded.

### Notes

- The four-second delay does not comply with UL 864. For more information, see “Synchronization delay (SW1-4)” on page 22.
- Sense Follow must be used when the sense circuit is connected to a compatible Genesis synchronized signal source.

### Continuous NACs

Continuous NACs output a 24VDC continuous (steady) signal for connecting conventional or Genesis strobes temporal horns, and temporal horn/strobes. They activate one or four seconds after the sense input activates and restore seven seconds after the sense input restores.

The output signal may be unsynchronized, synchronized, or synchronized with audible on/off control. For more information, see “Genesis signal synchronization for Continuous NACs (SW2-5)” on page 22.

**Note:** The four-second delay does not comply with UL 864. For more information, see “Synchronization delay (SW1-4)” on page 22.

### Temporal NACs

Temporal NACs output an unsynchronized 24VDC temporal signal for connecting compatible horns that are designed or configured for a steady (continuous) horn signal output. They activate one or four seconds after the sense input activates and restore seven seconds after the sense input restores.

**Note:** The four-second delay does not comply with UL 864. For more information, see “Synchronization delay (SW1-4)” on page 22.

### AUX power

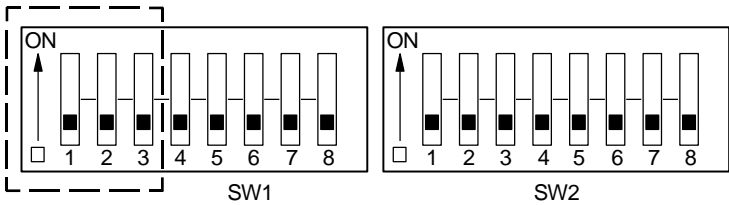
AUX power outputs turn on during power up. AUX power circuits can be configured to stay active during a power fail or load shed on a power fail (after a 30 second delay). For more information, see “AUX power standby operation (SW2-7)” on page 23.

**Note:** AUX circuits are load shed when the system reaches low battery to prevent deep discharge of the batteries.

### NAC modes (SW1-1 to SW1-3)

Switches SW1-1, SW1-2, and SW1-3 determine the operation of APS Series power supply outputs configured as notification appliance circuits (NACs). See Figure 13 below.

Figure 13: NAC operating mode switches (SW1-1 to SW1-3)



Operating mode [1]	SW1-1	SW1-2	SW1-3
Correlate mode	OFF	–	–
Genesis Master mode	ON	OFF	ON
Nondelayed mode	ON	ON	–

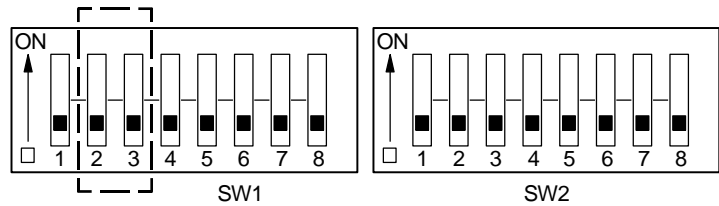
[1] See the descriptions below for operation details

### Correlate mode

In Correlate mode, APS Series power supply NACs turn on and off based on their assigned sense inputs. Switches SW1-2 and SW1-3 determine which NACs the Sense 1 and Sense 2 input circuits activate. See Figure 14 on page 21.

**Note:** These switch settings do not affect AUX power outputs.

Figure 14: Sense circuit-to-NAC correlation switches – Correlate mode (SW1-2 and SW1-3)



		Class B NACs		Class A NACs	
SW1-2	SW1-3	Sense 1 activates	Sense 2 activates	Sense 1 activates	Sense 2 activates
OFF	OFF	1, 2, 3, 4	1, 2, 3, 4	1/2, 3/4	1/2, 3/4
OFF	ON	1	2, 3, 4	1/2	3/4
ON	OFF	1, 2	3, 4	–	–
ON	ON	1, 2, 3	4	–	–

Genesis Master mode

In Genesis Master mode, the APS Series power supply provides Genesis sync signals for connecting Genesis horns, strobes, and horn/strobes. Continuous NACs in Genesis Master mode also provide Genesis audible on/off control signals for silencing Genesis horns while leaving Genesis strobes active.

In Genesis Master mode applications, connect Sense 1 inputs to a visible signal riser and connect Sense 2 inputs to an audible signal riser.

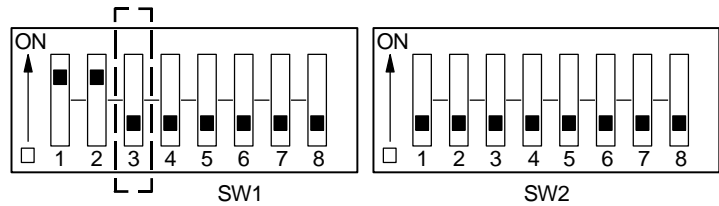
Nondelayed mode

Nondelayed mode is intended to support coders. In this mode, there is no delay between activation of the sense input and activation of the NAC.

In Nondelayed mode, switch SW1-3 determines which NACs the Sense 1 and Sense 2 input circuits activate. See Figure 15 below.

**Note:** These switch settings do not affect AUX power outputs.

Figure 15: Sense circuit-to-NAC correlation switch – Nondelayed mode (SW1-3)



		Class B NACs		Class A NACs	
SW1-3		Sense 1 activates	Sense 2 activates	Sense 1 activates	Sense 2 activates
OFF		1, 2, 3, 4	1, 2, 3, 4	1/2, 3/4	1/2, 3/4
ON		1, 2	3, 4	1/2	3/4

Continuous NACs in Nondelayed mode, generate Genesis sync pulses in accordance with SW2-5. For more information, see “Genesis signal synchronization for Continuous NACs (SW2-5)” on page 22.

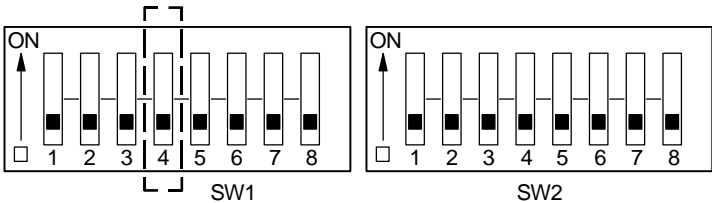
This supports applications that include Genesis strobes and conventional audibles. For this operation, the NACs for the audible signals must be configured Sense Follow NACs. There is no delay for either the visibles or the audibles.

### Synchronization delay (SW1-4)

Switch SW1-4 -determines whether NAC signals synchronize after a 1-second or 4-second delay. See Figure 16 below. For more information, see “Understanding Genesis signal synchronization” on page 46.

**Note:** SW1-4 is ignored when NAC operation is set for Nondelayed mode.

Figure 16: NAC audible synchronization delay switch (SW1-4)

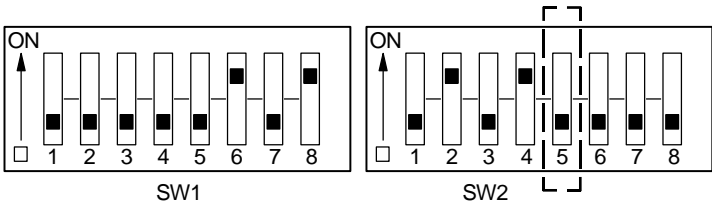


SW1-4	Description
ON	NACs turn on four seconds after their sense input is activated (e.g. Genesis NACs sync with the second round of the temporal signal) <b>Note:</b> The 4-second delay setting (SW1-4: ON) does not comply with UL 864.
OFF	NACs turn on one second after their sense input is activated (e.g. the Genesis NACs sync with the second flash of the Genesis strobes)

### Genesis signal synchronization for Continuous NACs (SW2-5)

Switch SW2-5 determines whether Continuous NACs provide Genesis signal synchronization. See Figure 17 below.

Figure 17: Genesis signal synchronization for Continuous NACs switch (SW2-5)

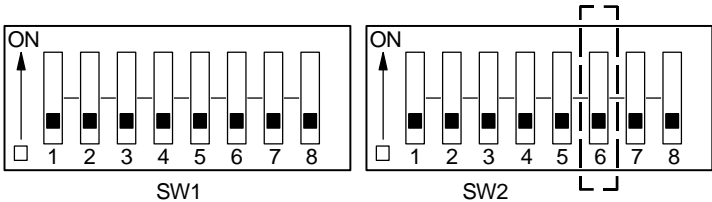


SW2-5	Description
ON	Continuous NACs generate Genesis synchronization signals. Continuous NACs in Genesis Master mode, generate Genesis synchronization signals and Genesis audible on/off control signals.
OFF	Continuous NACs do not provide Genesis signal synchronization.

# Trouble relay operation (SW2-6)

Switch SW2-6 determines whether the APS Series power supply’s trouble relay operates as a common trouble relay or as a dedicated AC power fail relay. See Figure 18 below.

Figure 18: Trouble relay operation switch (SW2-6)



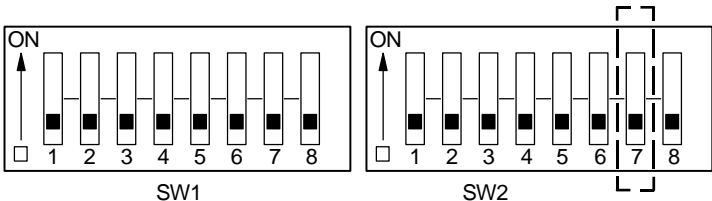
SW2-6	Description
ON	The trouble relay contacts change over within 20 seconds of losing or regaining AC power. The sense circuit integrated fault relays immediately open on all NAC faults and on all power supply faults other than loss of AC power. For AC power loss faults, the relays open after a 3-hour delay provided there are no other power supply faults and AC power has not been restored.
OFF	The trouble relay contacts immediately change over on any power supply fault, including loss of AC power. The sense circuit integrated fault relays only open on all NAC faults for their respective NACs and for all power supply faults other than loss of AC power.

# AUX power standby operation (SW2-7)

Switch SW2-7 determines when AUX power outputs turn off while the APS Series power supply is on battery power (i.e, loses AC power). See Figure 19 below.

**Note:** The 200 mA continuous AUX power circuit is not affected by AC power loss.

Figure 19: AUX power operation switch (SW2-7)



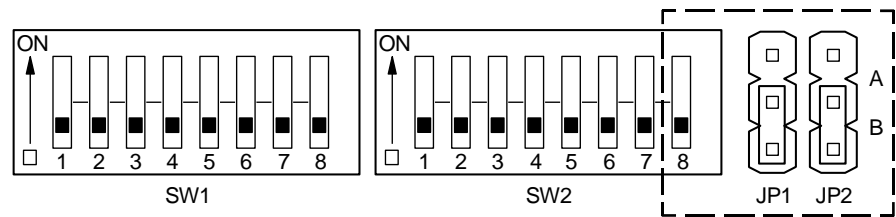
SW2-7	Description
ON	AUX power outputs turn off 30 seconds after losing AC power
OFF	AUX power outputs stay on after losing AC power until battery power is less than 18.4 VDC

# NAC wiring class (SW2-8)

Switch SW2-8 determines whether NACs are wired Class A or Class B. See Figure 20 below.

**Note:** Jumpers JP1 and JP2 must be set to match the operation of this switch.

Figure 20: NAC wiring class switch (SW2-8)



SW2-8	Description
ON	Class A NACs
OFF	Class B NACs

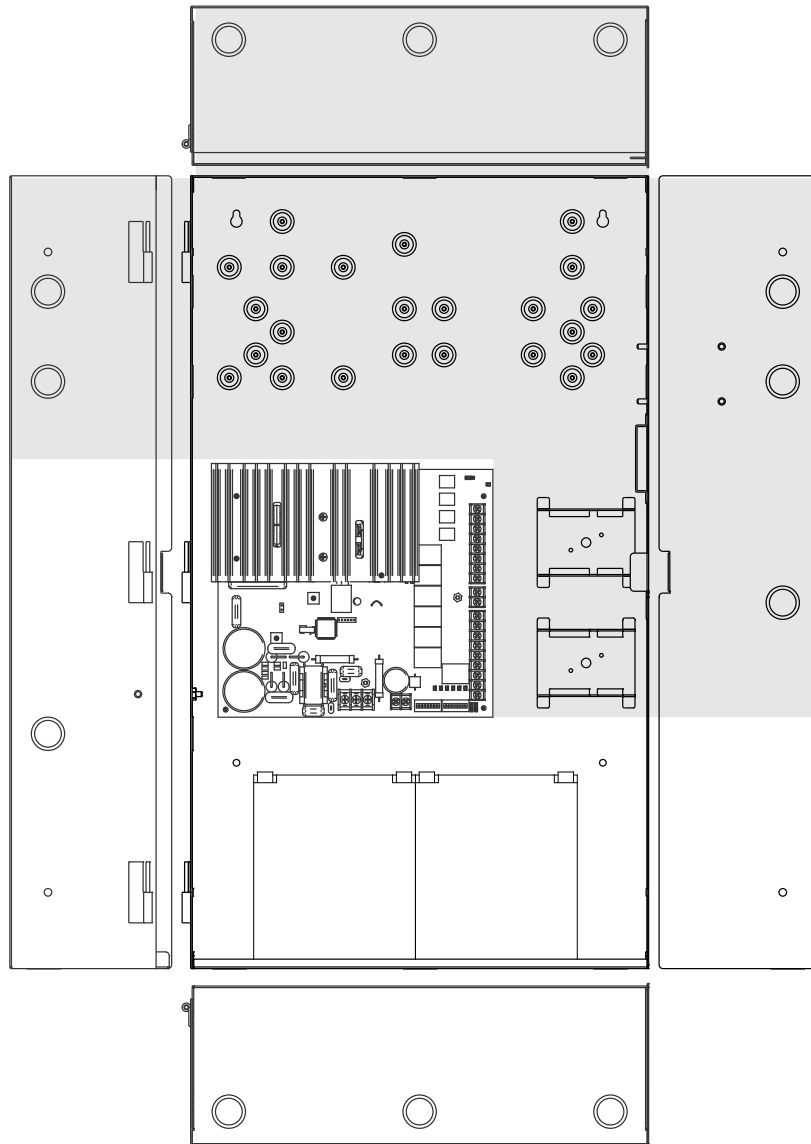
# Wire routing

Maintain 1/4-inch spacing between power-limited and nonpower-limited wiring at all times. Keep power-limited wiring in the shaded area and nonpower-limited wiring in the unshaded area as shown in Figure 21 below.

Do not route wiring across the circuit board.

Do not use the bottom knockouts if batteries are placed in the battery compartment area. Position the battery terminals towards the door.

**Figure 21: Wire routing**



## Notes

- NAC circuits are power-limited and supervised for opens, shorts, and overcurrents. When configured as auxiliary power circuits, they are power-limited and supervised for shorts and overcurrents.
- Source must be power-limited. Source determines supervision.

# Connecting the field wiring

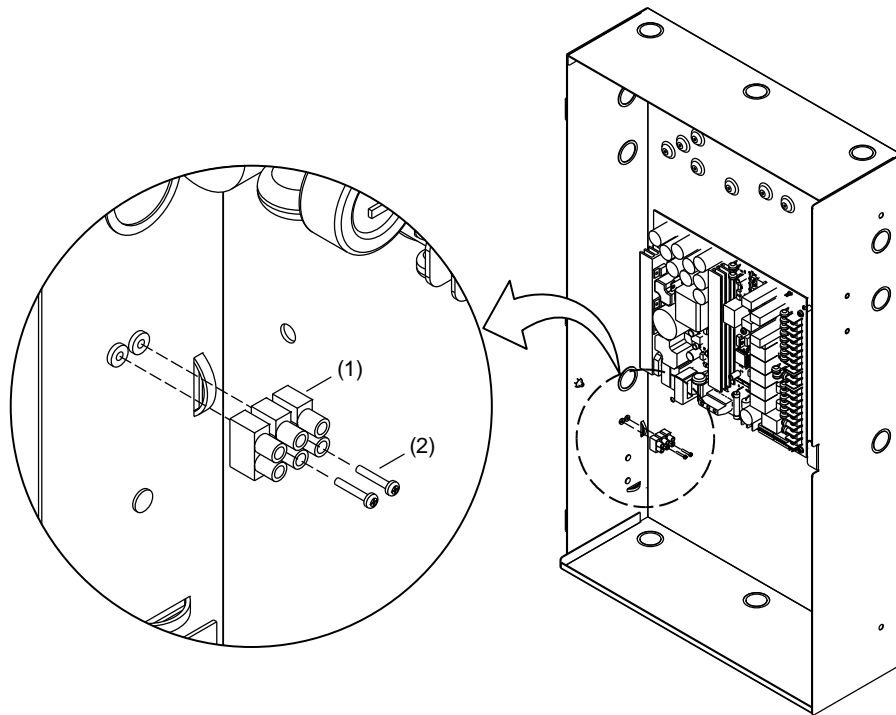
**Caution:** Break the wire run at each terminal connection to provide proper connection supervision. Do not loop wires under the terminals.

## AC power wiring

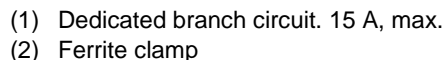
Connect the AC power wiring as shown in Figure 22 and Figure 23 on page 27.

**Note:** AC power wiring is nonpower-limited.

**Figure 22: AC terminal block installation**







Two backup batteries are required with the APS Series power supply. The largest batteries that can fit in the power supply enclosure are 24 Ah. When using batteries larger than 24 Ah, they must be installed in a BC-1 or BC-2 battery cabinet.

- Batteries should be replaced every five years, or as required by local codes. Refer to local and national codes for battery maintenance requirements.
- Position the battery terminals towards the door.
- Battery wiring is nonpower-limited.



## NAC Class B wiring

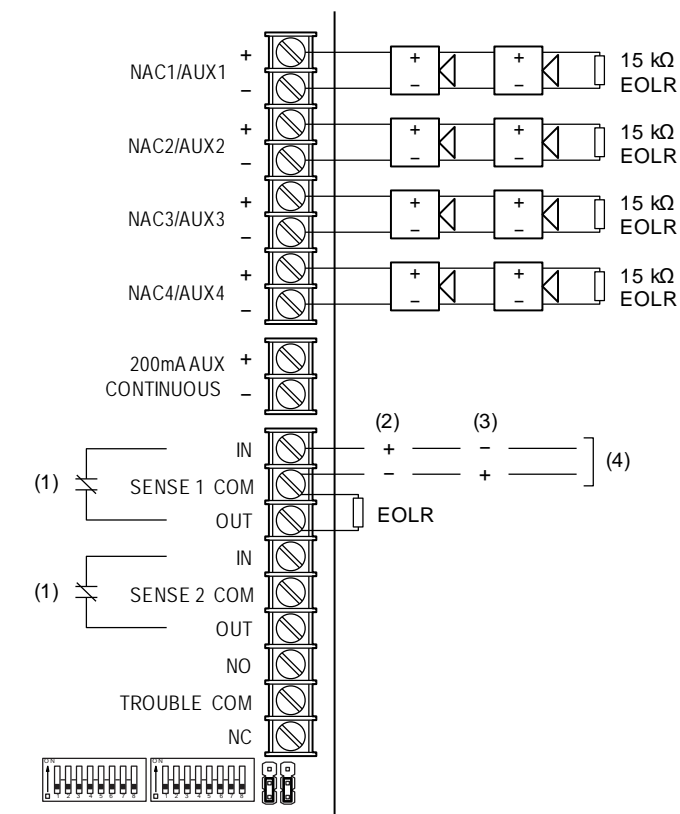
Figure 25 below shows the wiring for NAC/AUX circuits configured as Class B notification appliance circuits.

For Class B NACs, set SW2-8 to the OFF position, and set JP1 and JP2 to the B position. For other NAC configuration settings, see “Setting the DIP switches” on page 19.

For NAC wire distances, see “Notification appliance circuit calculations” on page 41.

**Note:** NAC wiring is supervised and power-limited.

**Figure 25: Class B NAC wiring**



- (1) Sense circuit integrated fault relay
- (2) Signal polarity when the sense circuit riser is active
- (3) Signal polarity when the sense circuit riser is not active
- (4) Conventional or addressable sense circuit riser source. The source determines the EOLR value.

## NAC Class A wiring

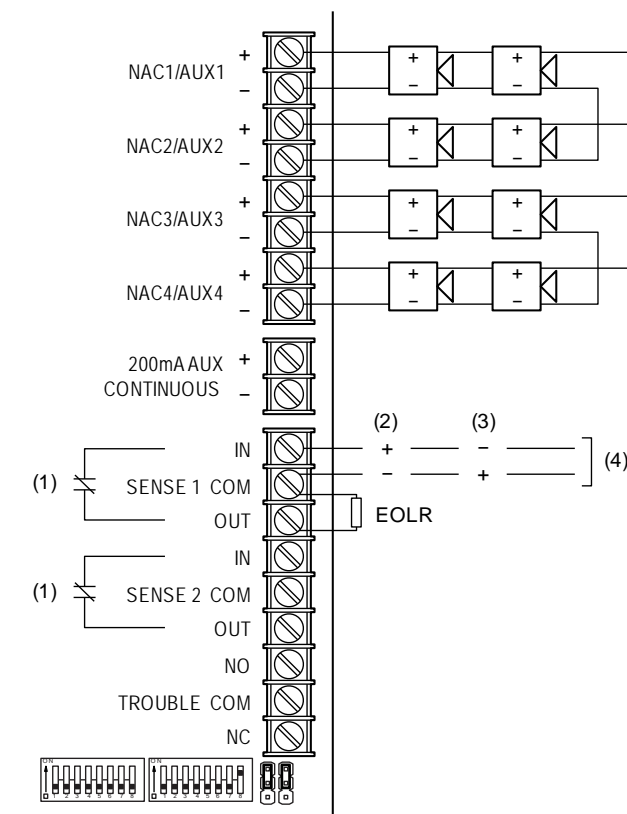
Figure 26 below shows the wiring for NAC/AUX circuits configured as Class A notification appliance circuits.

For Class A NACs, set SW2-8 to the ON position, and set JP1 and JP2 to the A position. For other NAC configuration settings, see “Setting the DIP switches” on page 19.

For NAC wire distances, see “Notification appliance circuit calculations” on page 41.

**Note:** NAC wiring is supervised and power-limited.

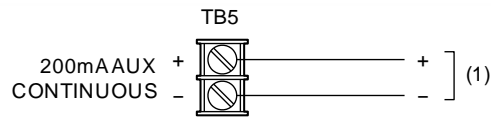
**Figure 26: NAC Class A wiring**



- (1) Sense circuit integrated fault relay
- (2) Signal polarity when the sense circuit riser is active
- (3) Signal polarity when the sense circuit riser is not active
- (4) Conventional or addressable sense circuit riser source. The source determines the EOLR value.

## Dedicated 200 mA AUX power wiring

Figure 27: Dedicated 200 mA AUX power wiring



(1) To powered devices

### Notes

- Dedicated 200 mA AUX power wiring is unsupervised and power-limited.
- The dedicated 200 mA AUX power wiring requires a UL Listed end-of-line supervision relay (e.g., PAM1, 6254A-003, 73402A, or equivalent) unless the wiring remains in the cabinet, or in the same room within 20 ft. (6.1 m) and enclosed in conduit or equivalent protection against mechanical injury.

## AUX power circuit wiring

Figure 28 on page 31 shows the wiring for NAC/AUX circuits configured as AUX power circuits.

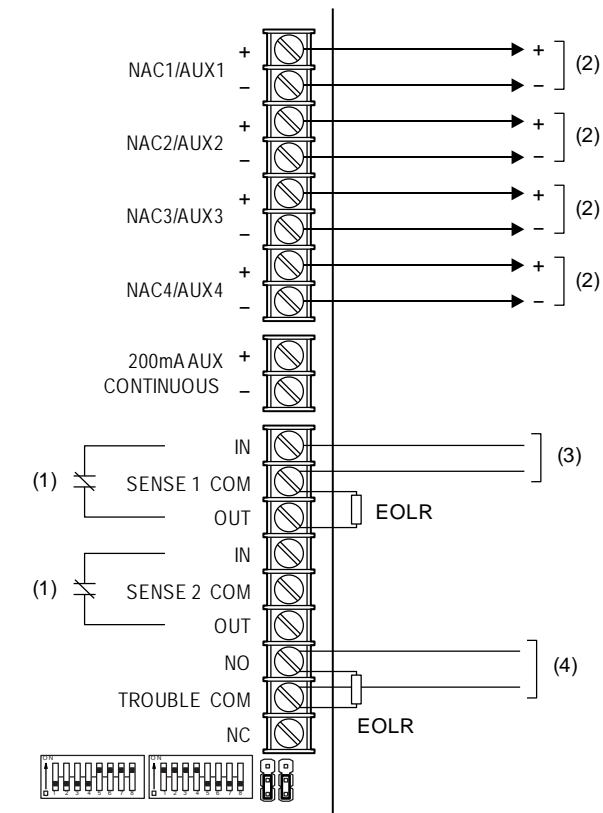
For configuration settings, see, “Output circuit type (SW1-5 to 8 and SW2-1 to 4)” on page 19 and “AUX power standby operation (SW2-7)” on page 23.

This auxiliary configuration is compatible with fire alarm, security, and access control applications, which can be combined in a single system, if all of the devices are listed.

### Notes

- All references to Access Control applications and associated modules in this document are for repair and replacement units only. As of December 2, 2018, the products covered in this Manual are not listed to the UL 294 Standard for use in access control applications.
- AUX power wiring is unsupervised and power-limited.
- AUX power circuits require a UL Listed end-of-line supervision relay (e.g., PAM1, 6254A-003, 73402A, or equivalent) unless the wiring remains in the cabinet, or in the same room within 20 ft. (6.1 m) and enclosed in conduit or equivalent protection against mechanical injury.
- When all four NAC/AUX circuits are configured as AUX power circuits and DIP switch SW2-6 is set to the ON position, use two conventional or addressable system inputs to monitor both the Sense 1 integrated fault relay contacts and the trouble relay contacts.

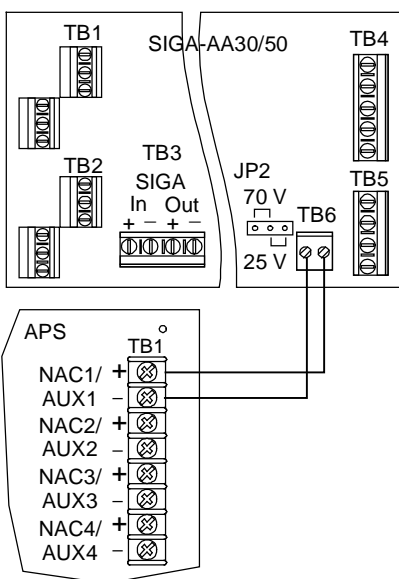
**Figure 28: AUX power wiring**



- (1) Sense circuit integrated fault relay
- (2) To control unit accessories
- (3) Conventional or addressable common trouble supervision circuit
- (4) Conventional or addressable AC power fail supervision circuit

### Wiring a SIGA-AA30/50 to AUX power

A SIGA-AA30/50 can be installed in the enclosure and can be wired to an available AUX circuit for power.

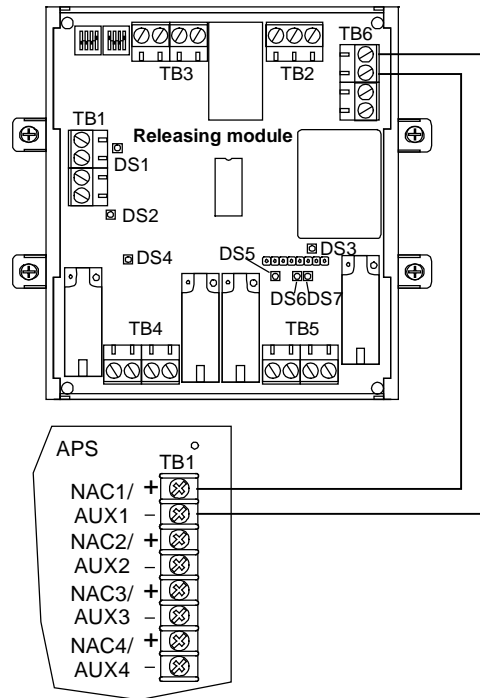


## Notes

- This diagram shows wiring using AUX1. Any available AUX circuit can be used.
- The appropriate DIP switches must be in the ON position for the circuit to operate in auxiliary mode. For more information, see “Setting the DIP switches” on page 19.
- For detailed wiring information, refer to *SIGA-AA30 and SIGA-AA50 Installation Sheet* (P/N 387343).

## Wiring a SIGA-REL to AUX power

A SIGA-REL can be installed in the enclosure and can be wired to an available AUX circuit for power.



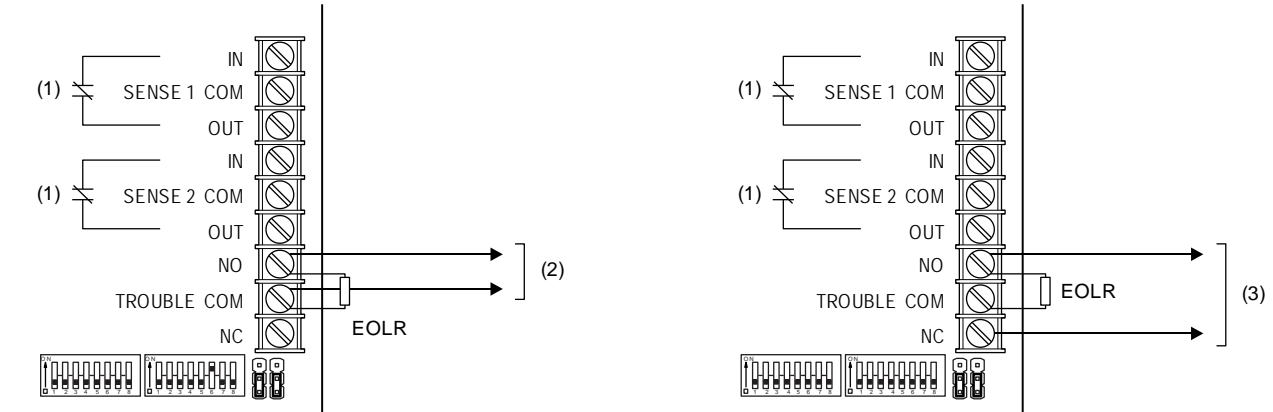
## Notes

- This diagram shows wiring using AUX1. Any available AUX circuit can be used.
- The appropriate DIP switches must be in the ON position for the circuit to operate in auxiliary mode. For more information, see “Setting the DIP switches” on page 19.
- For detailed wiring information, refer to *SIGA-REL Technical Reference Manual* (P/N 387348).

## Trouble relay wiring

Figure 29 on page 33 shows the wiring for the APS Series power supply's trouble relay. The trouble relay is field-configurable for use as a dedicated AC power fail relay (SW2-6: ON) as shown on the left or as a common trouble relay (SW2-6: OFF) as shown on the right. For more information, see “Trouble relay operation (SW2-6)” on page 23.

**Figure 29: Trouble relay wiring**



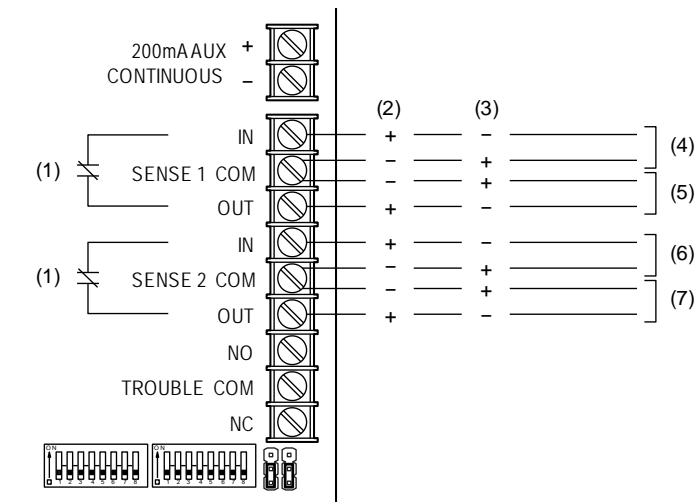
- (1) Sense circuit integrated fault relay
- (2) Conventional or addressable AC power fail supervision circuit (SW2-6 set to the ON position)
- (3) Conventional or addressable common trouble supervision circuit (SW2-6 set to the OFF position)

## Sense circuit wiring

The APS Series power supply has two sense circuits for activating NACs. Sense circuit operation is controlled by the APS Series power supply's DIP switches. Sense activation of existing NAC circuits reports a trouble condition to the control panel using these circuits.

**Note:** Any APS Series power supply trouble opens the sense circuit's integrated fault relay, which sends a trouble signal to the control unit, indicating that a trouble exists on that circuit.

**Figure 30: Sense circuit wiring**



- (1) Sense circuit integrated fault relay
- (2) Signal polarity when the sense circuit riser is active
- (3) Signal polarity when the sense circuit riser is not active
- (4) Conventional or addressable sense circuit riser signal source
- (5) To next APS Series power supply Sense 1 input or to end-of-line resistor (EOLR). The sense circuit riser signal source determines the EOLR value.
- (6) Conventional or addressable sense circuit riser signal source

- (7) To next APS Series power supply Sense 2 input or to end-of-line resistor (EOLR). The sense circuit riser signal source determines the EOLR value.

When using sense circuits as common trouble relays, APS Series power supplies operate as described below.

#### **Scenario 1: Trouble on any non-AC power fault**

Result:

- Sense 1 opens.
- An AC power failure closes the trouble contact at 20 seconds and activates Sense 1 at three hours.

For a wiring example, see Figure 28 on page 31.

#### **Scenario 2: Sense 1 activates all four NAC circuits**

Result:

- Sense 1 opens.
- An AC power failure closes the trouble contact at 20 seconds and activates Sense 1 at three hours.

For a wiring example, see Figure 32 on page 36.

#### **Scenario 3: Sense 1 and Sense 2 are operating with multiple CC1 modules**

Result:

- A fault on NAC 1 or NAC 2 causes Sense 1 to open.
- A fault on NAC 3 or NAC 4 causes Sense 2 to open.
- A panel-related fault other than an AC failure (e.g., ground fault or battery fault) causes Sense 1 and Sense 2 to open.
- An AC power failure closes the trouble contact at 20 seconds and activates Sense 1 at three hours

For a wiring example, see Figure 33 on page 37.

## **Tests for opens, shorts, and ground faults,**

The following are testing procedures for ground fault, open circuit, and short circuit indications.

**NAC open circuit test:** Remove the EOL resistor from the last device on the circuit. The trouble LED must light.

**NAC short circuit test:** Place a short across each NAC output individually. The individual NAC LED must light.

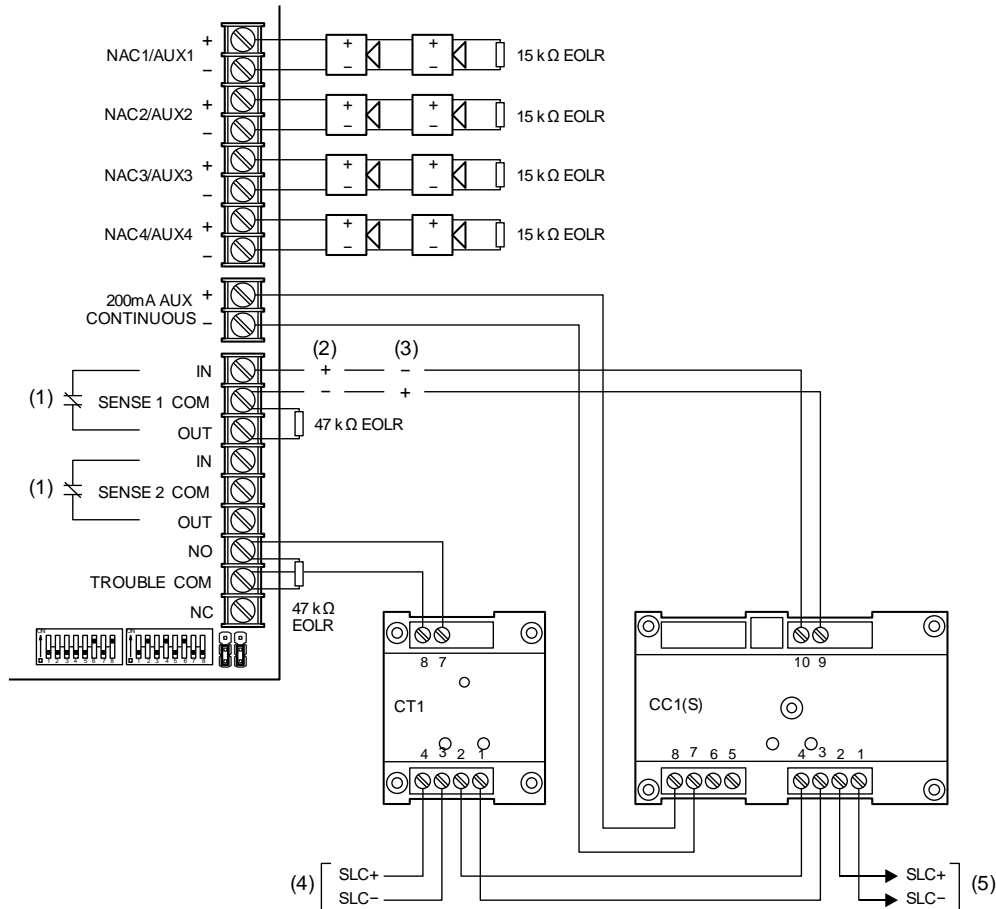
**Ground fault test:** Directly short one leg of the circuit to chassis ground. The ground fault and trouble fault LEDs must light.



# NAC wiring using CC1(S) modules

The following wiring diagrams show Signature Series CC1(S) module connections. However, other Signature Series modules can be used. Typically, the Signature Series modules are located inside the APS Series power supply cabinet.

**Figure 31: Using Sense 1 and 200 mA continuous AUX power to activate NACs**

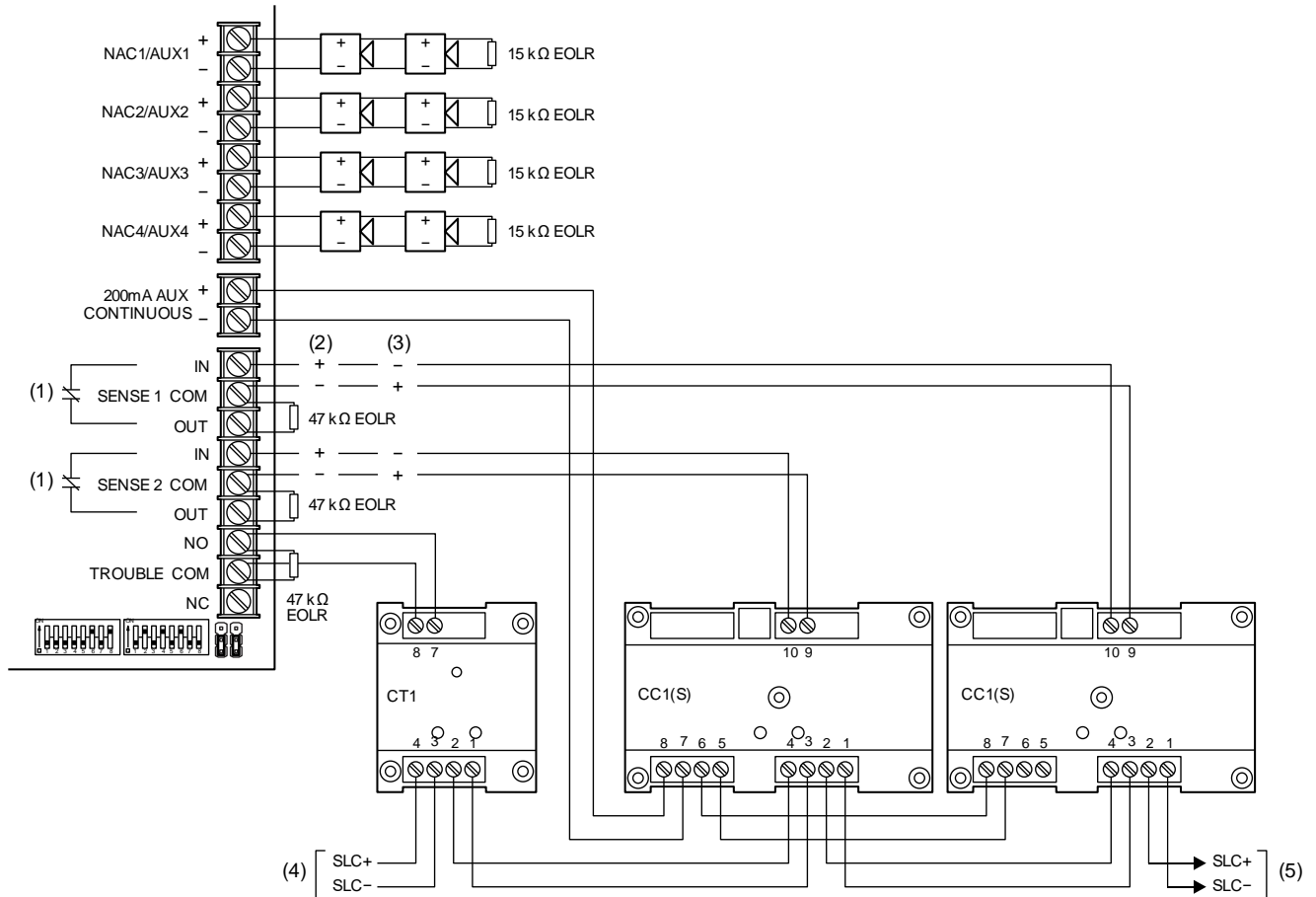


- (1) Sense circuit integrated fault relay
- (2) Signal polarity when the sense circuit riser is active
- (3) Signal polarity when the sense circuit riser is not active
- (4) From previous device on the signaling line circuit (SLC)
- (5) To next device on the signaling line circuit (SLC)

## Notes

- Signature Series modules must be wired and programmed on the Signature controller for proper operation.
- When DIP switch SW2-6 is in the ON position, the CC1(S) module immediately signals NAC faults and power supply faults other than AC power failures. AC power faults are delayed for three hours. The CT1 module signals AC power failures after a 20-second delay.
- The 200 mA AUX circuit wiring must remain inside the cabinet, or in the same room within 20 ft (6.1 m) and enclosed in conduit or equivalent protection against mechanical injury. If not, you must use a UL Listed end-of-line supervision relay (e.g., PAM1, 6254A-003, 73402A, or equivalent) to supervise the wiring.

**Figure 32: Using Sense 1, Sense 2 and 200 mA continuous AUX power to activate NACs**

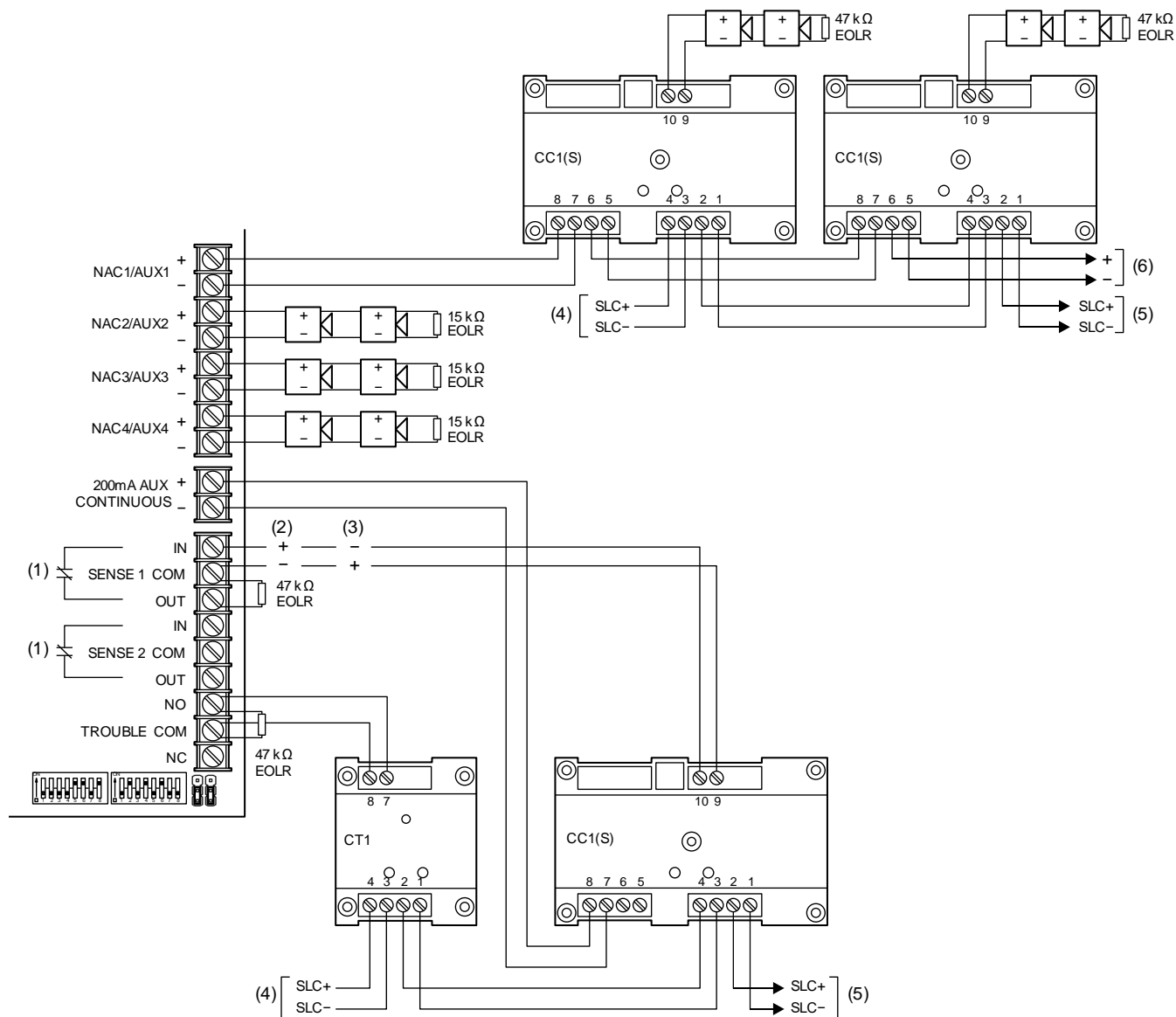


- (1) Sense circuit integrated fault relay
- (2) Signal polarity when the sense circuit riser is active
- (3) Signal polarity when the sense circuit riser is not active
- (4) From previous device on the signaling line circuit (SLC)
- (5) To next device on the signaling line circuit (SLC)

## Notes

- Signature Series modules must be wired and programmed on the Signature controller for proper operation.
- When DIP switch SW2-6 is in the ON position, the CC1(S) modules immediately signal NAC faults and power supply faults other than AC power failures. AC power faults are delayed for three hours. The CT1 module signals AC power failures after a 20-second delay.
- The 200 mA AUX circuit wiring must remain inside the cabinet, or in the same room within 20 ft (6.1 m) and enclosed in conduit or equivalent protection against mechanical injury. If not, you must use a UL Listed end-of-line supervision relay (e.g., PAM1, 6254A-003, 73402A, or equivalent) to supervise the wiring.

**Figure 33: Multiple CC1(S) modules using a NAC/AUX circuit as a signal riser**



- (1) Sense circuit integrated fault relay
- (2) Signal polarity when the sense circuit riser is active
- (3) Signal polarity when the sense circuit riser is not active
- (4) From previous device on the signaling line circuit (SLC)
- (5) To next device on the signaling line circuit (SLC)
- (6) To next device or UL Listed riser supervision circuit

#### Notes

- APS Series power supply outputs programmed as AUX power circuits require a UL Listed end-of-line supervision relay (e.g., PAM1, 6254A-003, 73402A, or equivalent) to supervise the wiring.
- APS Series power supply outputs programmed as notification appliance circuits require a 15 kΩ EOL resistor to supervise the wiring.

# Installing the 3-TAMP tamper switch

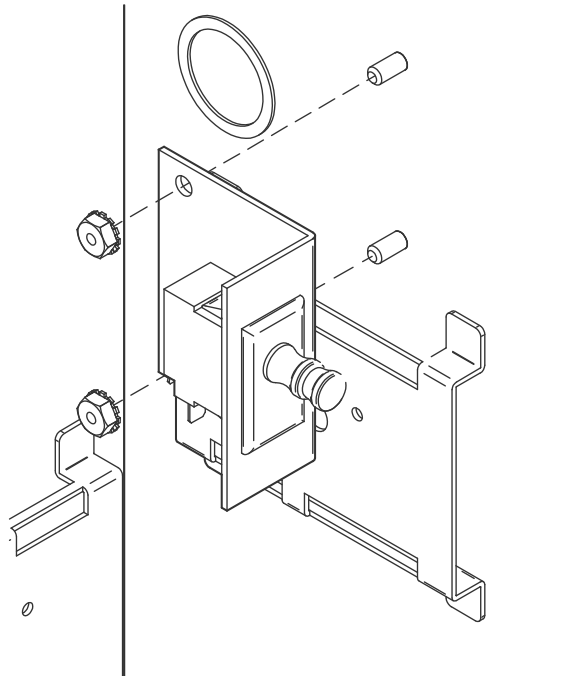
The 3-TAMP tamper switch is used to detect an open enclosure door for security purposes.

**Note:** The 3-TAMP tamper switch *must* be used for security applications and connected to a SIGA-SEC2 module mounted in the enclosure.

## To install the tamper switch:

1. Install an EOL resistor on the 3-TAMP. Refer to *3-TAMP Installation Sheet* (P/N 387422) for more information.
2. Position the tamper switch over the mounting standoffs. See Figure 34 below.
3. Use the two locking nuts provided to secure the tamper switch. See the diagram below.
4. Connect all wiring to the tamper switch. Refer to *3-TAMP Installation Sheet* (P/N 387422) for details on wiring the tamper switch.

Figure 34: 3-TAMP installation



# Battery calculation worksheet

## Supervisory (AUX1, AUX2, AUX3, AUX4)

Note: Only add auxiliary current if SW2-7 is OFF. Auxiliary outputs stay on after AC power failure.

Device type	Quantity	Current (mA)	Total/device
Total AUX current [1]			mA (A)
Number of circuits set to AUX		35 mA (per AUX circuit)	mA (B)

## 200 mA AUX

Device type	Quantity	Current (mA)	Total/device
Total 200 mA AUX current			mA (C)

Rated base power supply supervisory current			70 mA (D)
Total supervisory current (A + B + C + D)			mA (E)
Hours of supervisory			Hrs (F)
Supervisory mAh required (E × F)			mAh (G)

## Alarm (NAC1, NAC2, NAC3, NAC4)

Device type	Quantity	DC current (mA, RMS)	Total/device
Total NAC current			mA (H)

Rated base APS alarm current			270 mA (J)
Total alarm current (E + H + J)			mA (K)
Minutes of alarm			Min (L)
Hours of alarm (L/60)			Hr (M)
Alarm mAh required (K × M)			mAh (N)

Total battery mAh required (N + G)			mAh (O)
Total battery Ah required (O/1000)			Ah (P)
Total battery Ah required with 20% safety factor (P × 1.20)			Ah (Q)
Supervisory battery current (E/1000)			A (R)

[1] 0 if switch SW2-7 is off; 6 A max. if APS6A; 8 A max. if APS10A

To use the load current table below: First, select the column where the load is greater than or equal to (R). Second, select the row from that column where the capacity is greater than or equal to (Q). Third, select the corresponding battery size.

Battery size	Load current (amps)													
	0.2	0.4	0.6	0.8	1	2	3	4	5	6	7	8	9	10
6.5 Ah	5.4	5.3	5.2	5.0	4.8	4.3	3.9	3.6	3.3	3.0	2.8	2.6	2.5	2.3
10 Ah	8.3	8.3	8.1	7.9	7.7	7.1	6.6	6.2	5.8	5.5	5.2	5.0	4.7	4.5
17 Ah	14.1	14.1	14.1	14.1	13.5	12.8	12.3	11.8	11.3	10.9	10.5	10.1	9.8	9.5
24 Ah	20.0	20.0	20.0	20.0	20.0	18.7	18.1	17.5	17.0	16.5	16.0	15.6	15.2	14.8

# Notification appliance circuit calculations

## Introduction

This topic shows you how to determine the maximum cable length of a notification appliance circuit (NAC) for a given number of appliances.

Two methods are presented: worksheet and equation. The worksheet method is simpler, but your installation must meet the criteria listed on the worksheet. If your installation does not meet these criteria, you need to use the equation method.

The methods given here determine cable lengths that work under all operating conditions. The calculations ensure that the required operating voltage and current will be supplied to all notification appliances. To do this, we assume these two worst-case conditions:

- The voltage at the NAC terminals is the minimum provided by the power supply
- The notification appliances are clustered at the end of the NAC cable

Other, more detailed methods that distribute the appliance load along the NAC cable may indicate that longer cable runs are possible.

## What you'll need

### Appliance and cable values

Whether you use the worksheet method or the equation method, you'll need to know:

- The minimum operating voltage required for the appliances
- The maximum operating current drawn by each appliance
- The resistance per unit length of the wire used ( $\Omega/\text{ft}$ )

This information can be found on the appliance installation sheets and on the cable specification sheet.

### Power supply values

For either method, you'll need some fixed or calculated operating values for your specific power supply. The fixed values are:

- Maximum voltage = 26.3 V
- Source voltage = 19.7 V
- Load factor = 0.50 V/A
- Power type = DC (filtered/regulated)

The *maximum voltage* is the highest voltage measured at the NAC terminals. This value is not used in the calculations, but is given so you can ensure appliance compatibility.

The *source voltage* is the theoretical operating minimum for the power supply, and is calculated as 85% of 24 volts minus the diode drop.

The *load factor* is a measure of how the power supply voltage reacts when a load is applied. The load factor measures the additional voltage drop per ampere of current drawn by the load.

The *power type* reflects the type of power supplied to the NAC terminals at minimum voltage. The current draw of notification appliances can vary substantially with the type of power supplied: full-wave rectified (VFWR) or direct current (VDC). It is important to know the power type at minimum terminal voltage.

You'll need to calculate the following values relating to your power supply and to the NAC circuit current. These are:

- Minimum voltage
- Voltage drop

The *minimum voltage* is the lowest voltage measured at the NAC terminals when the power supply is under the maximum load for that circuit (i.e. for the appliances that constitute the NAC.)

The *voltage drop* is the difference between the minimum voltage and 16 V. This value is for use with the worksheet only.



## Worksheet method

Use this worksheet to determine the maximum cable length of a notification appliance circuit for a given number of appliances.

Use this worksheet only if all the appliances are regulated. That is, they must have a minimum operating voltage of 16 V. For other appliances, use the equation method described in the next section.

### Worksheet 1: NAC cable length

		NAC1	NAC2	NAC3	NAC4	
Total operating current [1]		<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	A
Load factor	×	<input type="text" value="0.50"/>	<input type="text" value="0.50"/>	<input type="text" value="0.50"/>	<input type="text" value="0.50"/>	V/A
Load voltage drop	=	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	V
Source voltage		<input type="text" value="19.7"/>	<input type="text" value="19.7"/>	<input type="text" value="19.7"/>	<input type="text" value="19.7"/>	V
Load voltage drop	−	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	V
Minimum voltage	=	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	V
Regulated appliance voltage	−	<input type="text" value="16.0"/>	<input type="text" value="16.0"/>	<input type="text" value="16.0"/>	<input type="text" value="16.0"/>	V
Voltage drop [2]	=	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	V
Total operating current	÷	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	A
Maximum resistance	=	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	Ω
Wire resistance (Ω/ft) [3]	÷	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
Maximum wire length	=	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	ft
	÷	<input type="text" value="2"/>	<input type="text" value="2"/>	<input type="text" value="2"/>	<input type="text" value="2"/>	
<b>Maximum cable length</b>	=	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	ft

[1] Total of the maximum operating currents for all appliances as specified for DC power. See the appliance installation sheets for operating currents.

[2] This voltage drop is valid for regulated notification appliances only. For special application appliances, use the equation method described in the next section.

[3] Use the manufacturer's published wire resistance (expressed in ohms per foot) for the applicable temperature rating. For typical values, see Table 1 on page 44.

## Equation method

### Appliance operating voltage and current

Regulated notification appliances have an operating range from 16 V to 33 V. Use 16 V as the minimum appliance voltage when using regulated notification appliances.

When using special application appliances, refer to the installation sheets to determine the minimum appliance voltage required.

What if there are different types of appliances in the NAC, and each type has a different minimum operating voltage? In this case, use the *highest* minimum voltage required by any appliance.

The total current requirement for the appliances will be the sum of the individual maximum currents drawn by each appliance when using DC power. Use the maximum current for the appliance over the 16 V to 33 V range.

If all appliances draw the same maximum current, the total current is the maximum current multiplied by the number of appliances. If different appliance types have different maximum currents, the total current is the sum of the maximum current for each appliance type multiplied by the number of appliances of that type.

### Wire resistance

Typical wire resistances are shown in the following table.

Table 1: Typical wire resistances

Wire gauge (AWG)	Resistance 1-strand uncoated copper		Resistance 7-strand uncoated copper	
	Ω per foot	Ω per meter	Ω per foot	Ω per meter
12	0.00193	0.00633	0.00198	0.00649
14	0.00307	0.01007	0.00314	0.01030
16	0.00489	0.01604	0.00499	0.01637
18	0.00777	0.02549	0.00795	0.02608

**Note:** When performing these calculations, always refer to the actual cable supplier documentation and use the actual Ω/ft (or Ω/m) for the cable being used.

### Calculating cable length

To calculate the maximum NAC cable length:

1. Calculate the total current ( $I_{tot}$ ) as the sum of the maximum operating currents for all the appliances.

$$I_{tot} = \sum I_a$$

Where:

$I_a$  = appliance maximum current

See the appliance installation sheets for  $I_a$ . Remember to use the maximum operating current specified for DC power.

2. Calculate the minimum voltage ( $V_m$ ).

$$V_m = V_s - (I_{tot} \times K)$$

Where:

$V_s$  = source voltage

$I_{tot}$  = total current (from above)

$K$  = load factor

For the power supply,  $V_s$  is 19.7 V and  $K$  is 0.50 V/A.

3. Calculate the allowable voltage drop ( $V_d$ ) between the power supply and the appliances.

$$V_d = V_m - V_a$$

Where:

$V_m$  = minimum voltage (from above)

$V_a$  = appliance minimum voltage

For regulated notification appliances,  $V_a$  is 16 V. For special application appliances,  $V_a$  is the lowest operating voltage specified on the appliance installation sheet.

4. Calculate the maximum resistance ( $R_{max}$ ) for the wire.

$$R_{max} = V_d / I_{tot}$$

Where:

$V_d$  = voltage drop

$I_{tot}$  = total current

5. Calculate the maximum length of the cable ( $L_c$ ), based on the maximum resistance allowed, the resistance of the wire, and the number of wires in the cable (two).

$$L_c = (R_{max} / R_w) / 2$$

Where:

$R_{max}$  = maximum resistance

$R_w$  = wire resistance factor

**Example:** You're using regulated notification appliances. Assume that the maximum operating current for each appliance is 100 mA for DC power, and that 20 appliances will be placed on the NAC. The cable is 12 AWG wire, and the manufacturer specifies a wire resistance factor of 0.002  $\Omega$ /ft.

$$\begin{aligned} I_{tot} &= S I_a \\ &= 20 \times 0.1 \text{ A} \\ &= 2 \text{ A} \end{aligned}$$

$$\begin{aligned} V_m &= V_r - (I_{tot} \times K) \\ &= 19.7 \text{ V} - (2 \text{ A} \times 0.50 \text{ V/A}) \\ &= 19.7 \text{ V} - 1.0 \text{ V} \\ &= 18.7 \text{ V} \end{aligned}$$

$$\begin{aligned} V_d &= V_m - V_a \\ &= 18.7 \text{ V} - 16.0 \text{ V} \\ &= 2.7 \text{ V} \end{aligned}$$

$$\begin{aligned} R_{max} &= V_d / I_{tot} \\ &= 2.7 \text{ V} / 2.0 \text{ A} \\ &= 1.35 \Omega \end{aligned}$$

$$\begin{aligned} L_c &= (R_{max} / R_w) / 2 \\ &= (1.35 \Omega / 0.002 \Omega/\text{ft}) / 2 \\ &= 675 \text{ ft} / 2 \\ &= 337.5 \text{ ft} \end{aligned}$$

So the maximum wire run for this NAC would be 337.5 ft (rounded down for safety).

# Understanding Genesis signal synchronization

When using Genesis devices, the activation of visible and audible output circuits on APS Series power supplies is determined by how the power supplies are connected. No matter how they are connected, their outputs are “in sync” but there is an output activation delay of either one or four seconds. This section details how APS Series power supply NAC outputs work based on how they are connected.

## Connection of power supplies

Multiple APS Series power supplies can be connected in parallel. How you connect the power supplies affects the synchronization of your system’s outputs.

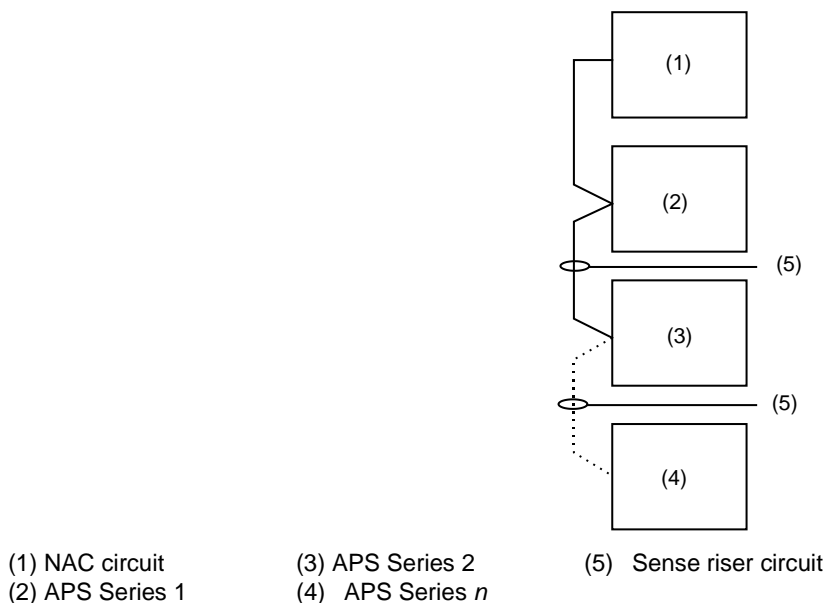
APS Series power supplies can be connected in parallel using their sense circuits. When connected via the sense circuits, all power supply NAC outputs have either a one- or four-second delay from the time the driver NAC turns on to the time the power supply NACs turn on.

The four-second delay does not comply with UL 864. The amount of delay is controlled by SW1-4. For more information, see “Synchronization delay (SW1-4)” on page 22.

### Notes

- The quantity of APS Series power supplies that you can connect is limited by wire run length and available current.
- To ensure all APS Series power supplies are synchronized in a Genesis application, the driving NAC must provide the Genesis synchronization pulse. Therefore, the power supply must not be set to Genesis Master mode.

**Figure 35: APS Series power supplies connected in parallel with sense circuits**



### Notes

- To ensure all APS Series power supplies are synchronized in a Genesis application, the driving NAC must provide the Genesis synchronization pulse. Therefore, the APS Series power supplies must not be set to Genesis mode.
- The quantity of APS Series power supplies that can be connected is limited by wire run length and available current.

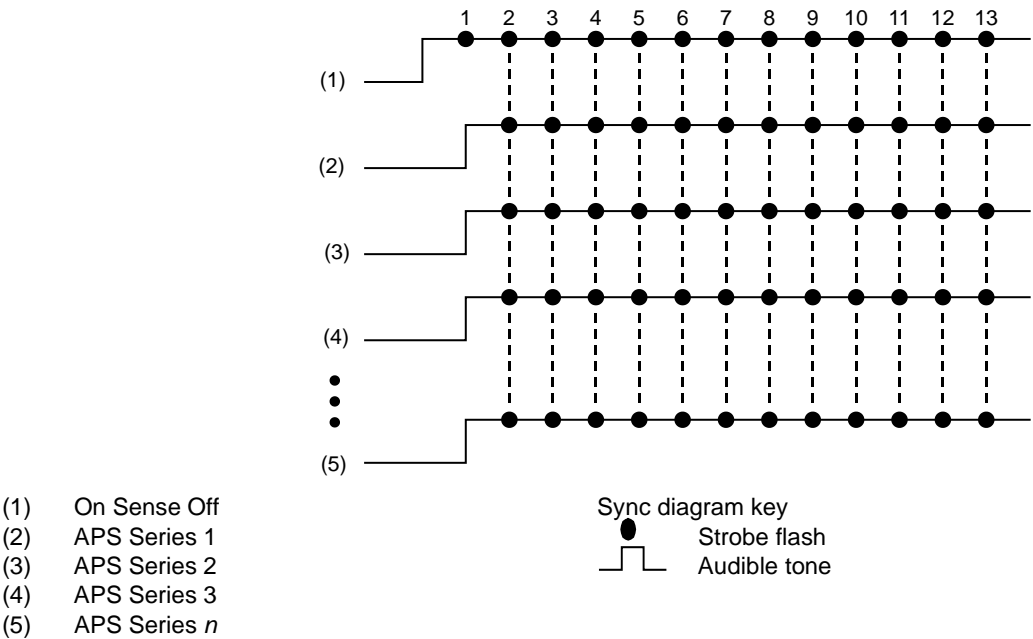
# Synchronization of visible outputs

In Figure 36 below, all visible output circuits on each APS activate with a one second delay. This requires that the APSs be connected in parallel through their sense circuits.

Sync diagrams key for figures below:

- = Strobe flash
- ▬ = Audible tone

Figure 36: Synchronization with a one second output activation delay



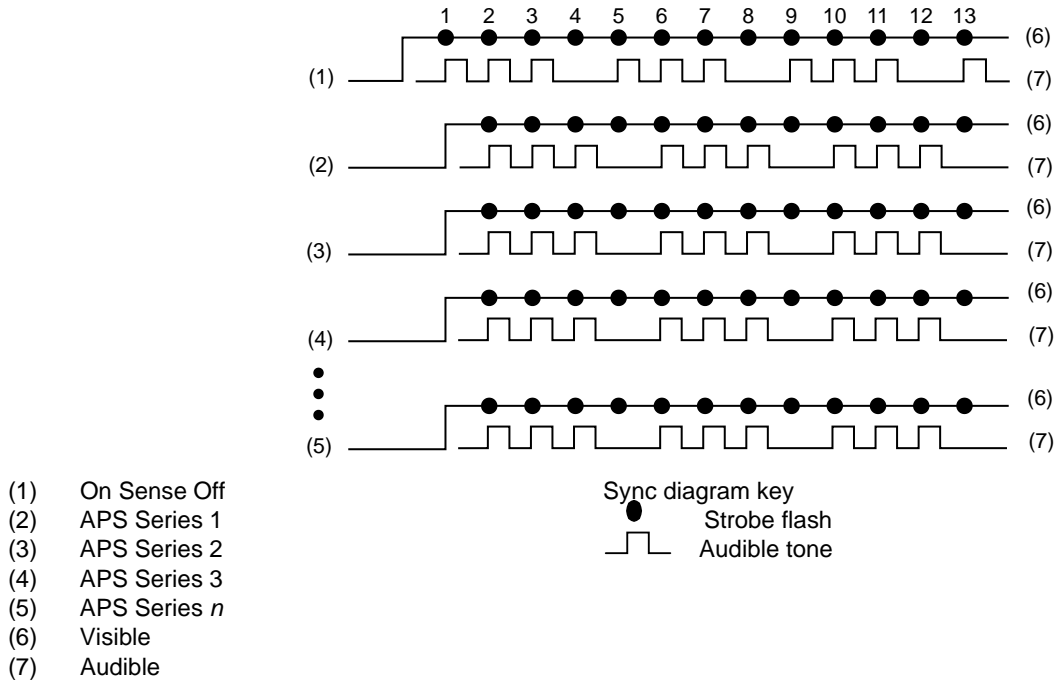
# Synchronization of visible and audible outputs

## One-second delay of outputs

In Figure 37 on page 48, all visible and audible circuits are synchronized with a one second output activation delay when the APSs are connected in parallel through their sense circuits.

**Note:** Delay time is controlled by DIP switch SW1-4. For more information, see “Synchronization delay (SW1-4)” on page 22.

**Figure 37: APS Series power supply with sense circuits connected in parallel (1-second delay)**

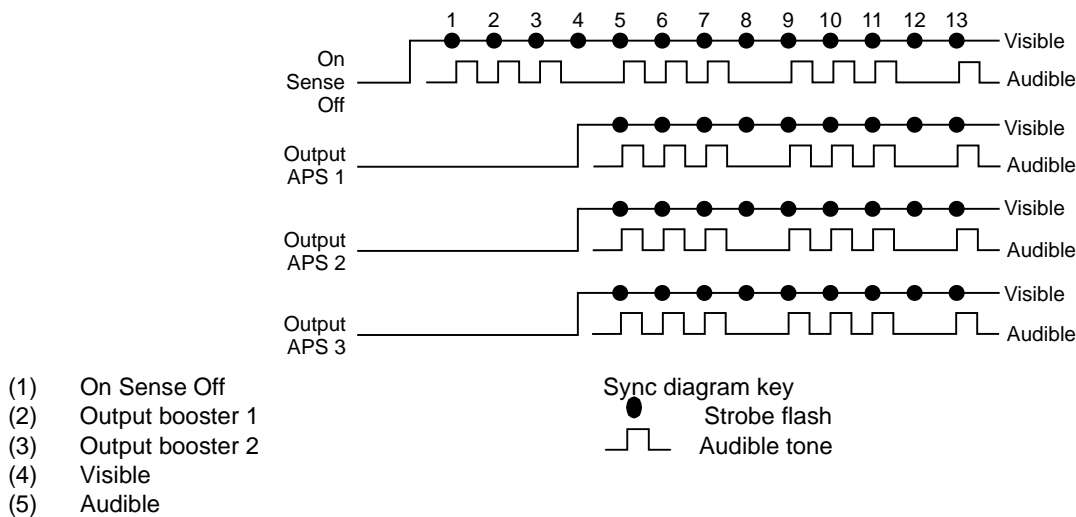


#### Four-second delay of outputs (temporal setting)

In Figure 38 below, all visible and audible circuits are synchronized with a four second output activation delay when the APSs are connected in parallel through their sense circuits.

**Note:** Delay time is controlled by DIP switch SW1-4. For more information, see “Synchronization delay (SW1-4)” on page 22.

**Figure 38: APS Series power supply with sense circuits connected in parallel (4-second delay)**








# Applications

**Disclaimer:** The applications in this section are shown in general terms. It is the responsibility of the installer and designer to adhere to the local and national codes when applying and installing the APS.

## Key

The following symbols and notations are found on the application diagrams in this section.

### Device labels

Symbol	Description
	Visible device
	Audible device
	Genesis visible/audible device
	Visible or audible device
	Device generating the Genesis sync pulse <b>Note:</b> When this symbol appears on an APS, the Genesis sync pulse is controlled by DIP switch SW2-5.

### APS modes (controlled by DIP switch)

Notation	Description
COR	Correlate mode
GM	Genesis Master mode
ND	Nondelayed mode

### NAC settings (controlled by DIP switch)

Notation	Description
SF	Sense follow
CONT	Continuous
TEMP	Temporal
AUX	Auxiliary

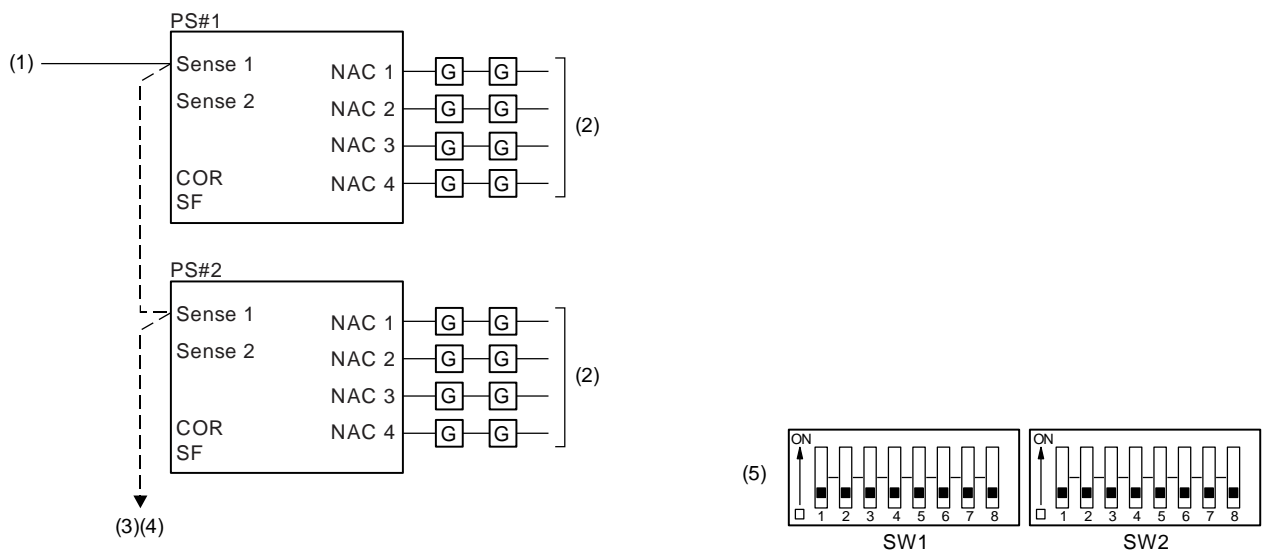
## Genesis circuit notification

This application uses the Sense 1 input to turn all four NACS on and off. The common Genesis synchronized signal source provides signal synchronization across all APS Series power supplies connected to the riser.

For this application:

- Set the output circuit type switches on each APS Series power supply for Sense Follow NACs. See Figure 12 on page 19.
- Set the NAC operating mode switches on each APS Series power supply for Correlated mode. See Figure 13 on page 20.
- Set SW2-5 to the OFF position.
- Connect Genesis horns, strobes, or combination horn/strobes to the NAC outputs.

**Figure 39: Genesis circuit notification**



- (1) Genesis synchronized signal source
- (2) To next device or 15 kΩ EOLR
- (3) To next APS Series power supply sense circuit or EOL resistor. EOLR value is determined by the signal riser source
- (4) The maximum number of APS Series power supplies that you can connect on a single sense circuit signal riser is determined by the signal riser's available current and wire run length. See "Specifications" on page 4 for sense input circuit current ratings.
- (5) DIP switch settings. Use the same settings for each power supply. If other options are required, see "Setting the DIP switches" on page 19.



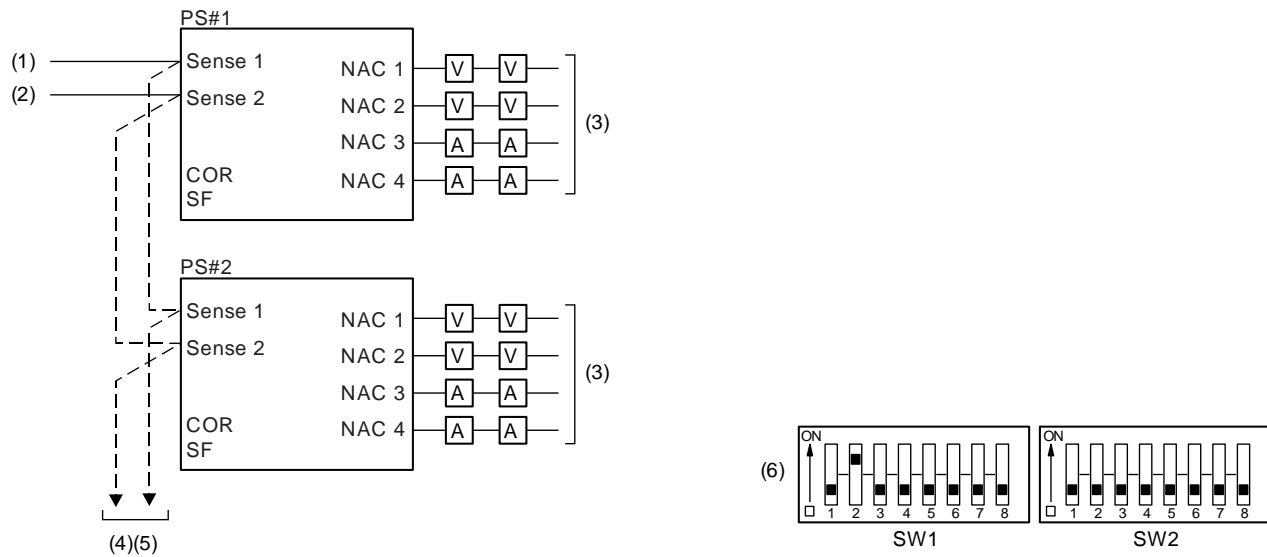
## Conventional visible and audible circuit notification

This application uses a common visible signal riser on Sense 1 and a common audible signal riser on Sense 2 to turn on the NAC outputs on one or more APS Series power supplies. See Figure 40 below.

For this application:

- Set the output circuit type switches on each APS Series power supply for Sense Follow NACs. See Figure 12 on page 19.
- Set the NAC operating mode switches on each APS Series power supply for Correlate mode with Sense 1 activating NACs 1 and 2, and Sense 2 activating NACs 3 and 4. See Figure 13 on page 20 and Figure 14 on page 21, respectively.
- Connect conventional strobes to NACs 1 and 2. Connect conventional temporal horns to NACs 3 and 4.

**Figure 40: Conventional visible and audible circuit notification**

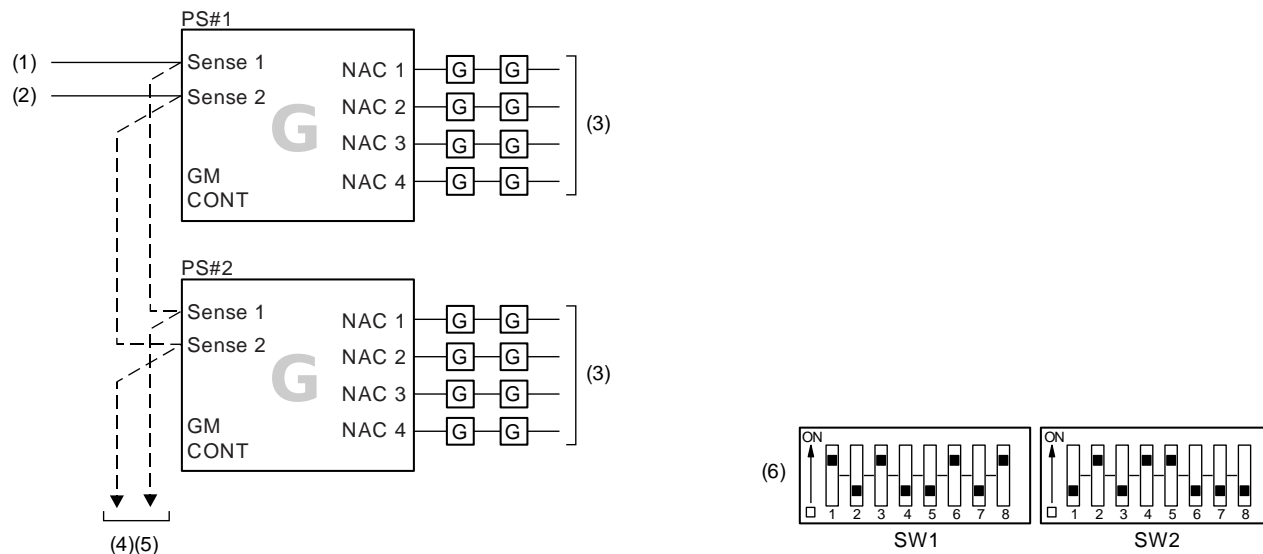


- (1) Conventional visible signal riser source
- (2) Conventional audible signal riser source
- (3) To next device or 15 kΩ EOLR
- (4) To next APS Series power supply sense circuit or EOL resistor. EOLR value is determined by the signal riser source.
- (5) The maximum number of APS Series power supplies that you can connect on a single sense circuit signal riser is determined by the signal riser's available current and wire run length. See "Specifications" on page 4 for sense input circuit current ratings.
- (6) DIP switch settings. Use the same settings for each power supply. If other options are required, see "Setting the DIP switches" on page 19.

## Conventional visible and audible circuit to Genesis notification

This application uses the Sense 1 input to turn all four NACS on and off and the Sense 2 input to silence audible signals while leaving visible signals on. The APS Series power supply provides signal synchronization and the audible on/off controls. Signal synchronization is on a per power supply basis.

**Figure 41: Conventional visible and audible circuit to Genesis notification**

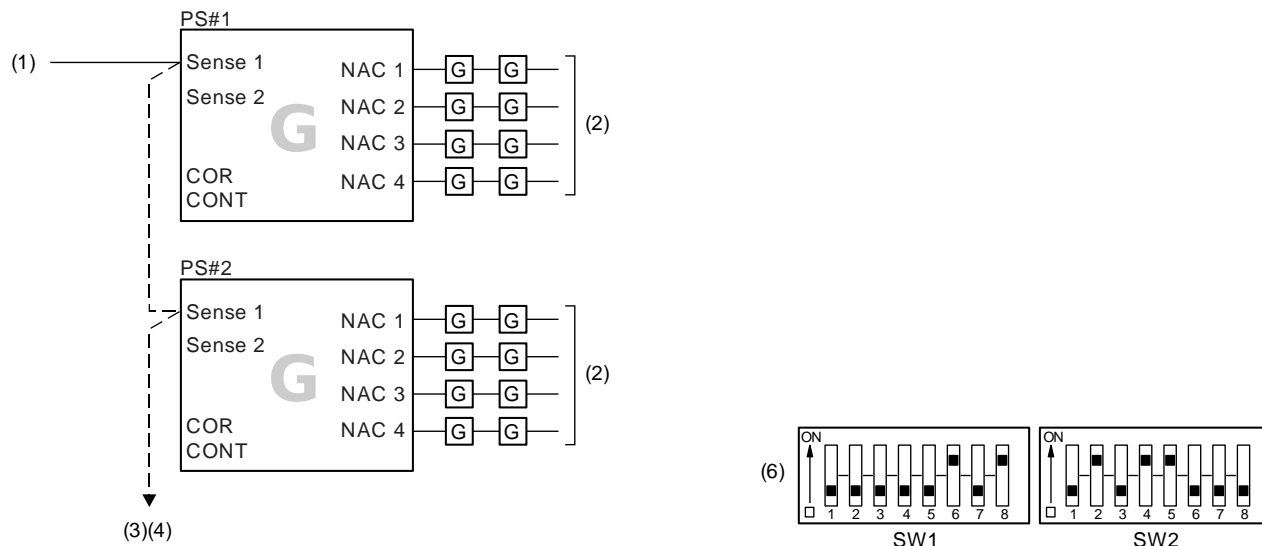


- (1) Conventional visible signal riser source
- (2) Conventional audible signal riser source
- (3) To next device or 15 k $\Omega$  EOLR
- (4) To next APS Series power supply sense circuit or EOL resistor. EOLR value is determined by the signal riser source.
- (5) The maximum number of APS Series power supplies that you can connect on a single sense circuit signal riser is determined by the signal riser's available current and wire run length. See "Specifications" on page 4 for sense input circuit current ratings.
- (6) DIP switch settings. Use the same settings for each power supply. If other options are required, see "Setting the DIP switches" on page 19.

## Conventional audible or visible circuit to Genesis notification

This application uses the Sense 1 input to turn all four NACS on and off at the same time. The APS Series power supply provides signal synchronization but does not provide audible on/off controls. Signal synchronization is on a per power supply basis.

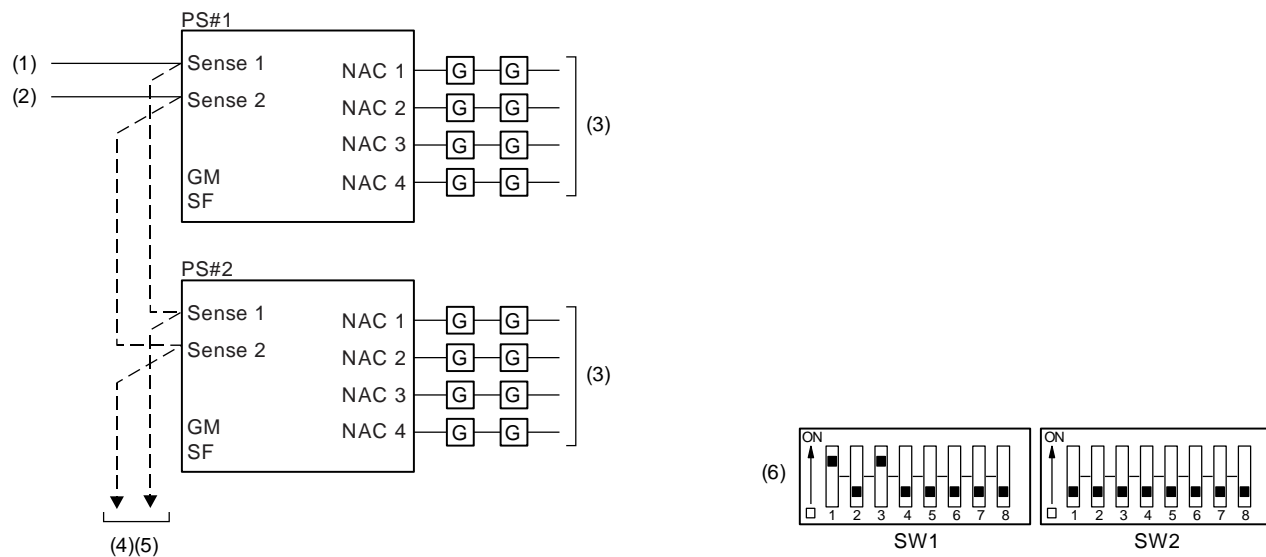
**Figure 42: Conventional audible or visible circuit to Genesis notification**



- (1) Visible or audible signal riser source
- (2) To next device or 15 k $\Omega$  EOLR
- (3) To next APS Series power supply sense circuit or EOL resistor. EOLR value is determined by the signal riser source.
- (4) The maximum number of APS Series power supplies that you can connect on a single sense circuit signal riser is determined by the signal riser's available current and wire run length. See "Specifications" on page 4 for sense input circuit current ratings.
- (5) DIP switch settings. Use the same settings for each power supply. If other options are required, see "Setting the DIP switches" on page 19.

## Genesis visible circuit and conventional audible circuit to Genesis notification

**Figure 43: Genesis visible circuit and conventional audible circuit to Genesis notification**

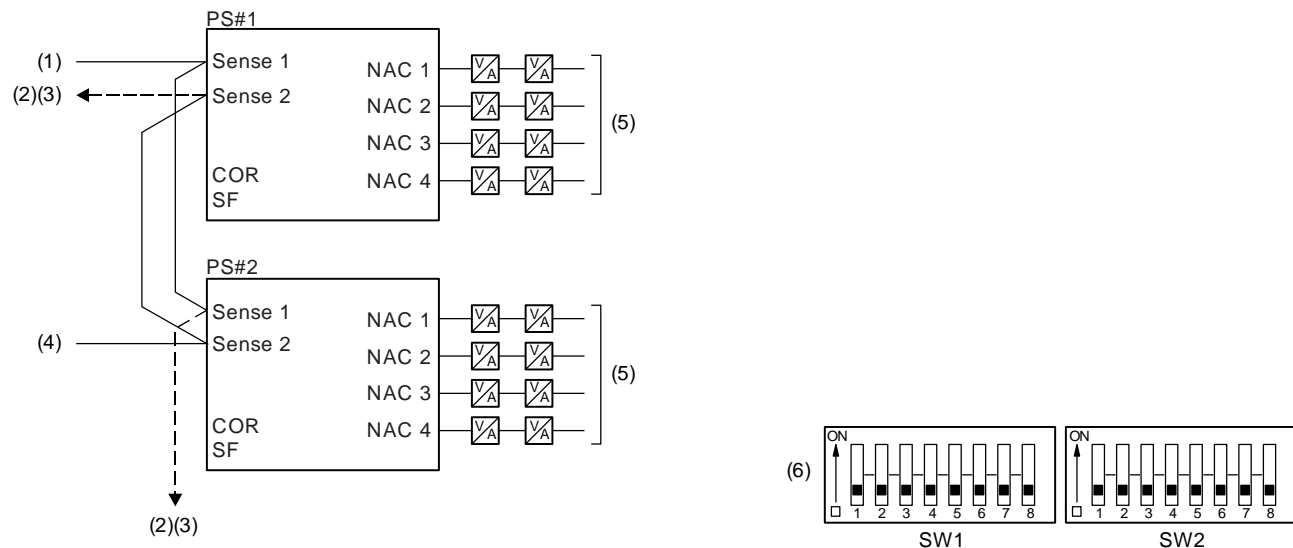


- (1) Gensis visible signal riser source
- (2) Conventional audible signal riser source
- (3) To next device or 15 kΩ EOLR
- (4) To next APS Series power supply sense circuit or EOL resistor. EOLR value is determined by the signal riser source.
- (5) The maximum number of APS Series power supplies that you can connect on a single sense circuit signal riser is determined by the signal riser's available current and wire run length. See "Specifications" on page 4 for sense input circuit current ratings.
- (6) DIP switch settings. Use the same settings for each power supply. If other options are required, see "Setting the DIP switches" on page 19.

## Conventional split mode circuit with fault tolerance notification

**Note:** Fault tolerance can be increased by using Class A wiring

**Figure 44: Conventional split mode circuit with fault tolerance**

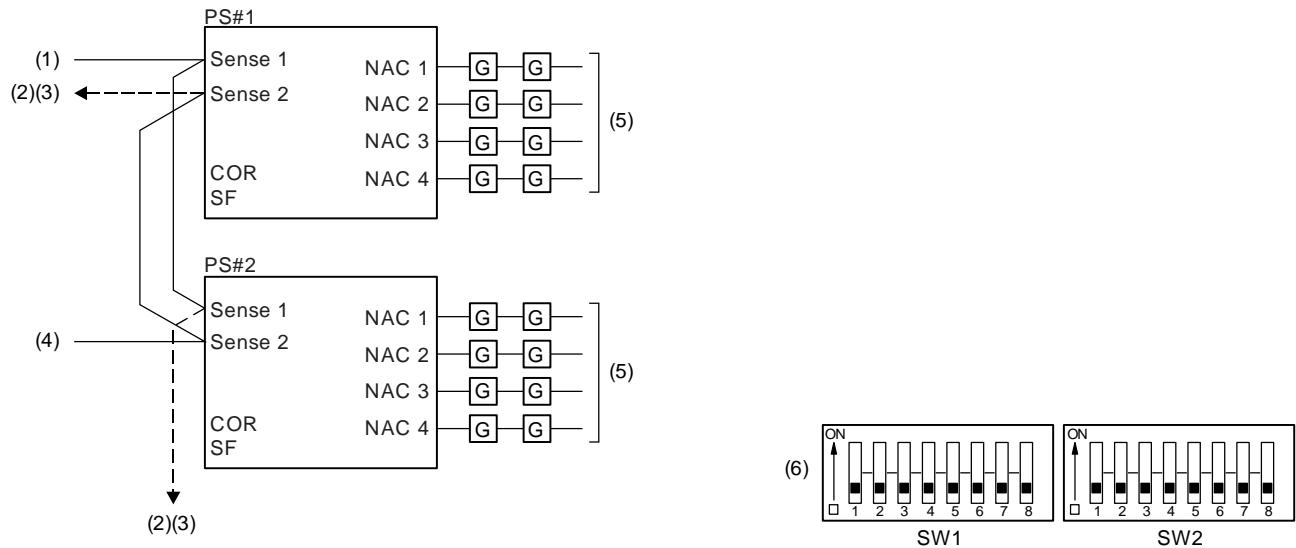


- (1) Primary conventional audible or visible signal riser source
- (2) To next APS Series power supply sense circuit or EOL resistor. EOLR value is determined by the signal riser source.
- (3) The maximum number of APS Series power supplies that you can connect on a single sense circuit signal riser is determined by the signal riser's available current and wire run length. See "Specifications" on page 4 for sense input circuit current ratings.
- (4) Secondary (redundant) conventional audible or visible signal riser source
- (5) To next device or 15 kΩ EOLR
- (6) DIP switch settings. Use the same settings for each power supply. If other options are required, see "Setting the DIP switches" on page 19.

## Genesis split mode circuit with fault tolerance notification

**Note:** Fault tolerance can be increased by using Class A wiring

**Figure 45: Genesis split mode circuit with fault tolerance**

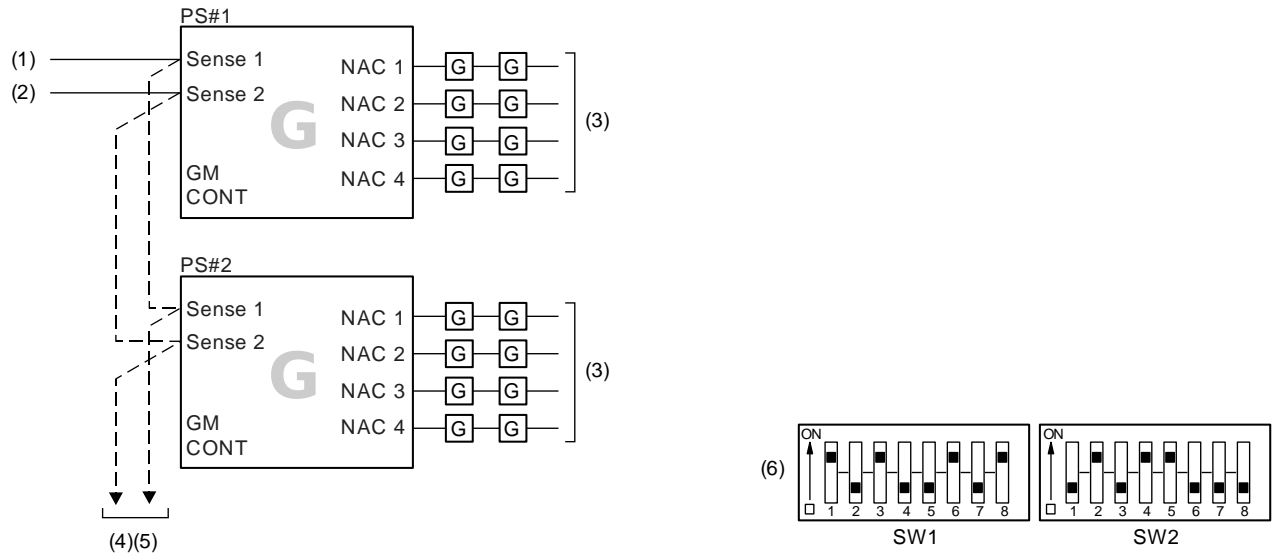


- (1) Primary Genesis audible or visible signal riser source
- (2) To next APS Series power supply sense circuit or EOL resistor. EOLR value is determined by the signal riser source.
- (3) The maximum number of APS Series power supplies that you can connect on a single sense circuit signal riser is determined by the signal riser's available current and wire run length. See "Specifications" on page 4 for sense input circuit current ratings.
- (4) Secondary (redundant) Genesis audible or visible signal riser source
- (5) To next device or 15 kΩ EOLR
- (6) DIP switch settings. Use the same settings for each power supply. If other options are required, see "Setting the DIP switches" on page 19.

## CDR-3 Coder to Genesis notification

In this application, use Genesis horns that are designed or configured for a steady (continuous) horn signal output.

**Figure 46: CDR-3 Coder to Genesis notification**

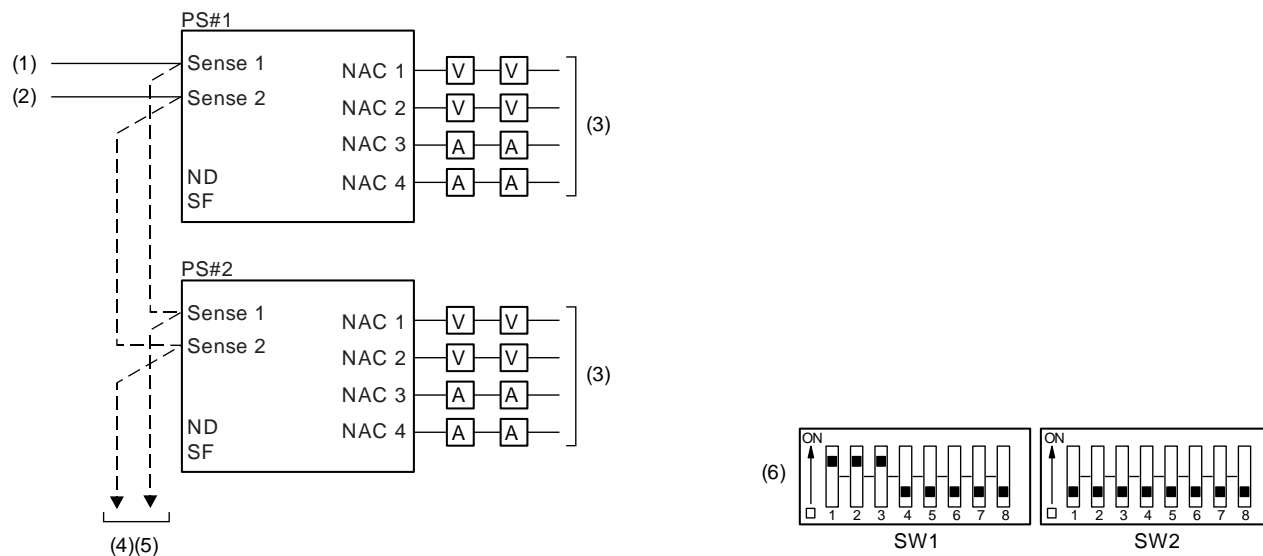


- (1) Conventional visible signal riser source
- (2) CDR-3/conventional audible signal riser source
- (3) To next device or 15 kΩ EOLR.
- (4) To next APS Series power supply sense circuit or EOL resistor. EOLR value is determined by the signal riser source.
- (5) The maximum number of APS Series power supplies that you can connect on a single sense circuit signal riser is determined by the signal riser's available current and wire run length. See "Specifications" on page 4 for sense input circuit current ratings.
- (6) DIP switch settings. Use the same settings for each power supply. If other options are required, see "Setting the DIP switches" on page 19.

## CDR-3 Coder to conventional notification

In this application, use compatible horns that are designed or configured for a steady (continuous) horn signal output.

**Figure 47: CDR-3 Coder to conventional notification**



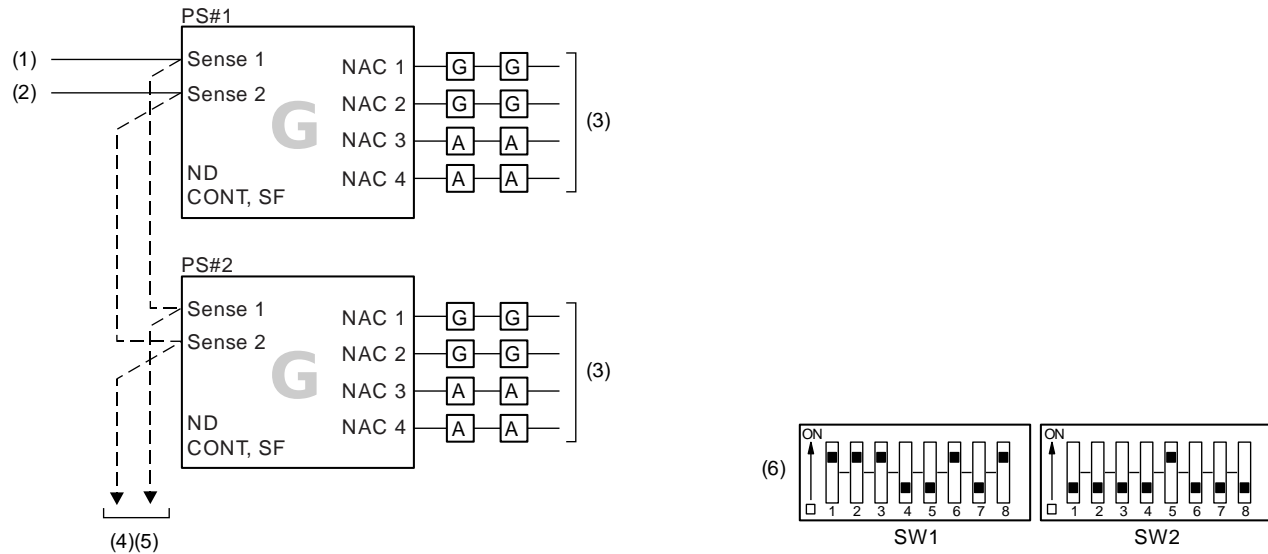
- (1) Conventional visible signal riser source
- (2) CDR-3/conventional audible signal riser source
- (3) To next device or 15 kΩ EOLR
- (4) To next APS Series power supply sense circuit or EOL resistor. EOLR value is determined by the signal riser source.
- (5) The maximum number of APS Series power supplies that you can connect on a single sense circuit signal riser is determined by the signal riser's available current and wire run length. See "Specifications" on page 4 for sense input circuit current ratings.
- (6) DIP switch settings. Use the same settings for each power supply. If other options are required, see "Setting the DIP switches" on page 19.



## CDR-3 Coder to Genesis visibles and conventional audibles

In this application, NAC1 and NAC2 are configured for Continuous mode. NAC3 and NAC4 are configured for Sense Follow mode. SW2-5 is set to generate a sync pulse on the continuous-mode circuits.

**Figure 48: CDR-3 Coder to Genesis visibles and conventional audibles**

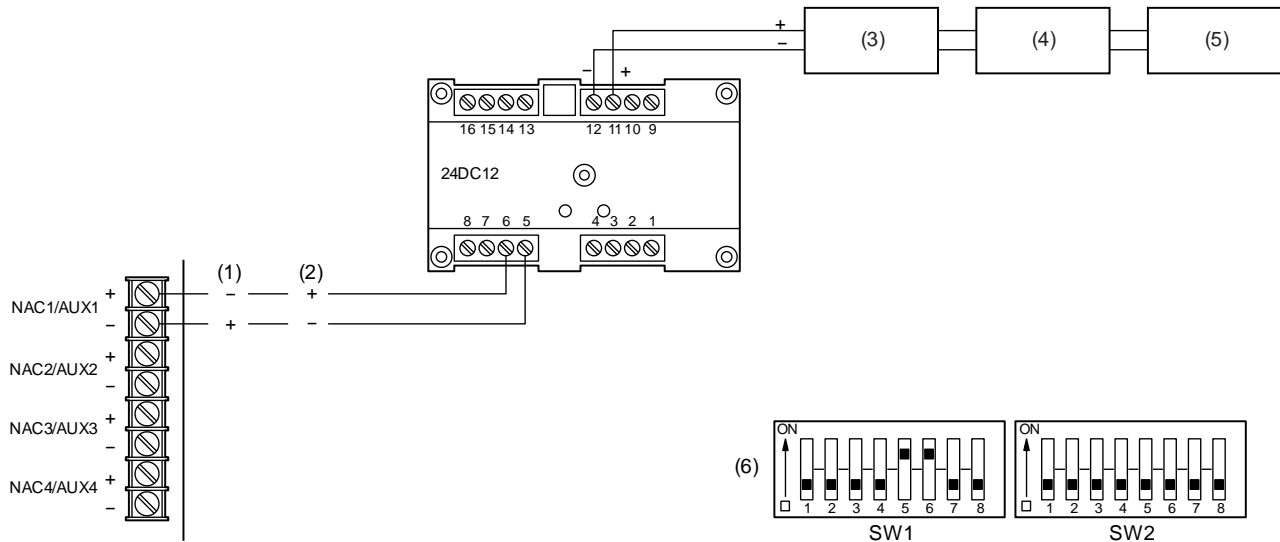


- (1) Conventional visible signal riser source
- (2) CDR-3 audible signal riser
- (3) To next device or 15 kΩ EOLR
- (4) To next APS Series power supply sense circuit or EOL resistor. EOLR value is determined by the signal riser source.
- (5) The maximum number of APS Series power supplies that you can connect on a single sense circuit signal riser is determined by the signal riser's available current and wire run length. See "Specifications" on page 4 for sense input circuit current ratings.
- (6) DIP switch settings. Use the same settings for each power supply. If other options are required, see "Setting the DIP switches" on page 19.

## Security

In this application, 24 VDC is converted to 12 VDC for use with security devices.

**Figure 49: Security 24VDC to 12VDC**

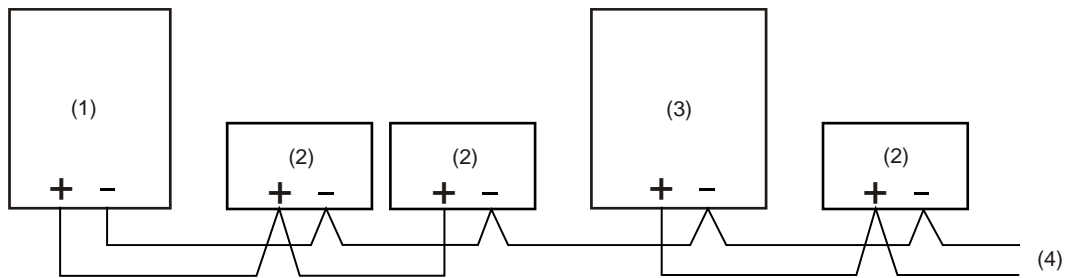


- (1) Signal polarity when circuit is not active
- (2) Signal polarity when circuit is active
- (3) First security device
- (4) Last security device
- (5) End-of-line supervision circuit
- (6) DIP switch settings. If other options are required, see “Setting the DIP switches” on page 19.

## Access control power supply

**Note:** All references to Access Control applications and associated modules in this document are for repair and replacement units only. As of December 2, 2018, the products covered in this Manual are not listed to the UL 294 Standard for use in access control applications.

**Figure 50: Access control power supply**



- (1) Control unit
- (2) Card reader controller
- (3) APS Series power supply. Remove the power supply's ground fault jumper. See “Ground fault detection jumper (JP3)” on page 15.
- (4) To next device or end-of-line supervision circuit