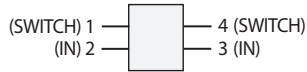




# SOLID STATE RELAY

## ELECTRONIC SWITCHING



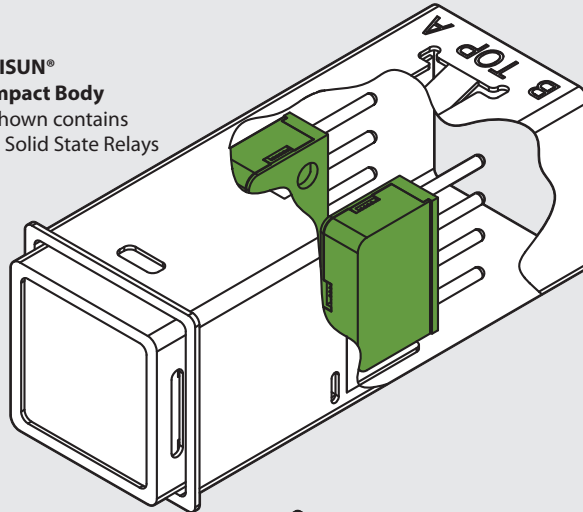
**SSR1H, SSR2H,  
SSR1M, SSR2M,  
SSR1L, SSR2L**

Solid State Relay (SSR) is a 4-pin electronic switching component developed as a part of NEXSYS® Component Technology. The SSR delivers the functionality of a normally open or normally closed relay without the challenges of external packaging encountered with a stand-alone relay. The Solid State Relay component can be configured inside a VIVISUN® Compact or High Capacity switch body or inside a stand-alone NEXSYS Module for use behind the panel. The Solid State Relay can also be combined with electromechanical switches and other NEXSYS components to create a custom configuration that uniquely addresses the designer's specific functional requirements. The SSR is designed and tested in accordance with MIL-PRF-22885 and DO-160.

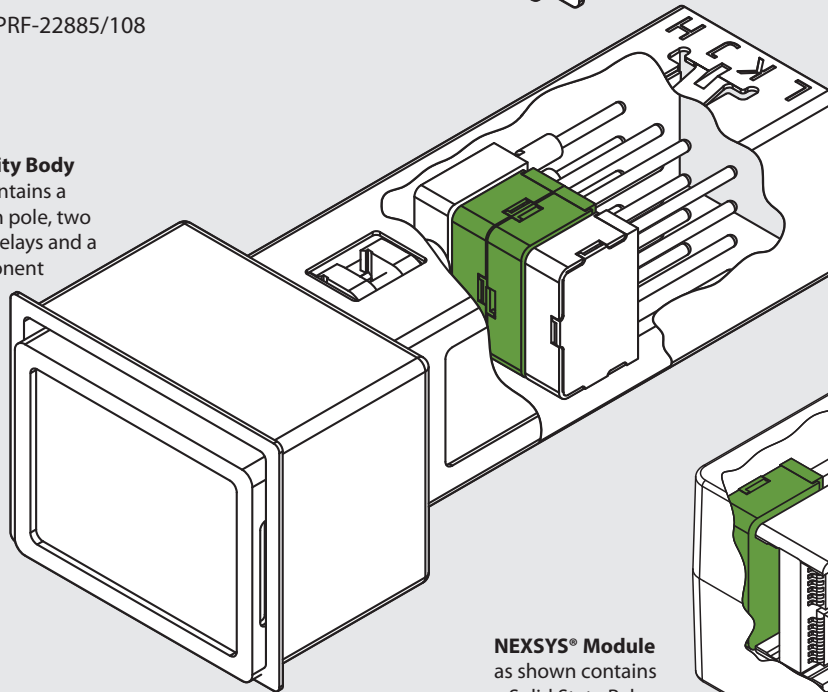
### Solid State Relay

- Normally open and normally closed versions available
- Source AC or DC current up to 0.75 A resistive normally open and 0.25 A resistive normally closed
- Use logic level input voltage to switch +28 VDC aircraft power
- Optical isolation between input and output circuits
- Signal polarity reversal (high to low or low to high)
- Three voltage input options available: H: +18 to +32 VDC, M: +8 to +18 VDC, and L: +4 to +6 VDC
- Output switching up to +32 VDC or 28 VAC rms
- Included in MIL-PRF-22885/108

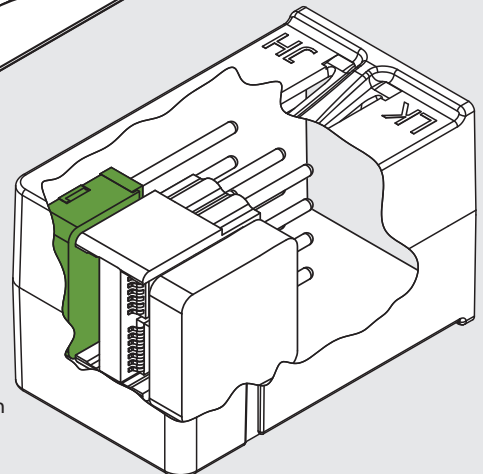
**VIVISUN®  
Compact Body**  
as shown contains  
two Solid State Relays



**VIVISUN®  
High Capacity Body**  
as shown contains a  
single switch pole, two  
Solid State Relays and a  
4-pin component



**NEXSYS® Module**  
as shown contains  
a Solid State Relay, an  
8-pin component  
and an open spacer



## Solid State Relay

The Solid State Relay (SSR) is a NEXSYS component designed to replace a typical relay and may be configured inside a VIVISUN switch body or NEXSYS Module to minimize design complexity and installation labor.

The SSR is available in six configurations:

- **SSR1H:** Normally open relay that closes when a voltage of +18 to +32 VDC is applied across the input.
- **SSR1M:** Normally open relay that closes when a voltage of +8 to +18 VDC is applied across the input.
- **SSR1L:** Normally open relay that closes when a voltage of +4 to +6 VDC is applied across the input.
- **SSR2H:** Normally closed relay that opens when a voltage of +18 to +32 VDC is applied across the input.
- **SSR2M:** Normally closed relay that opens when a voltage of +8 to +18 VDC is applied across the input.
- **SSR2L:** Normally closed relay that opens when a voltage of +4 to +6 VDC is applied across the input.

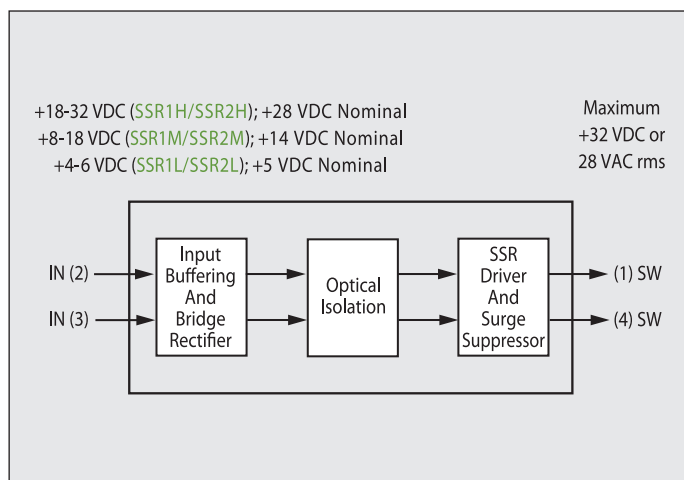
Each of the relays can provide output switching up to +32 VDC or 28 VAC rms. Input pins and switch pins are optically isolated (See *Figure 2*), with no electrical connection that could cause a sneak path. Refer to *Figure 1* and *Table 1* for Block Diagram and Operating Parameters. See *Table 6* for the Qualification Level Summary.

**Benefits:** The SSR is much more than a simple relay and has a broad range of application possibilities, including:

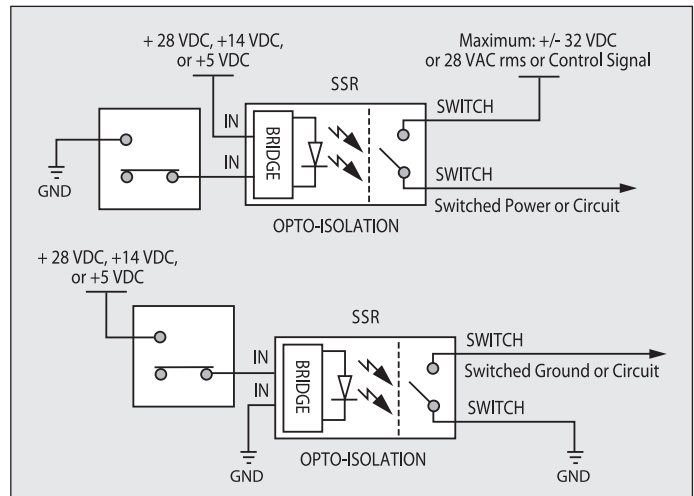
- Use logic level input voltage to switch +28 VDC aircraft power
- Signal polarity reversal (high to low or low to high)
- Source AC or DC current up to 0.75 amps resistive normally open and 0.25 amps resistive normally closed
- Electrical isolation correcting sneak paths
- Output switching up to +32 VDC or 28 VAC rms

**Applications:** *Figure 2* demonstrates signal polarity reversal. *Figure 3* demonstrates power circuit isolation. *Figure 4* demonstrates conditional relay (AND/OR) logic. The *Application Example* features a comprehensive audio controller application.

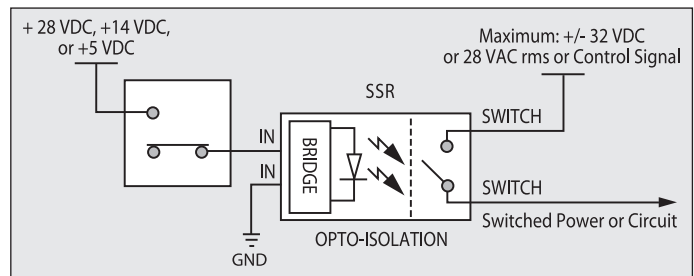
## Figure 1: Block Diagram



## Figure 2: Signal Polarity Reversal and Circuit Switching



## Figure 3: Isolated Power on Circuits

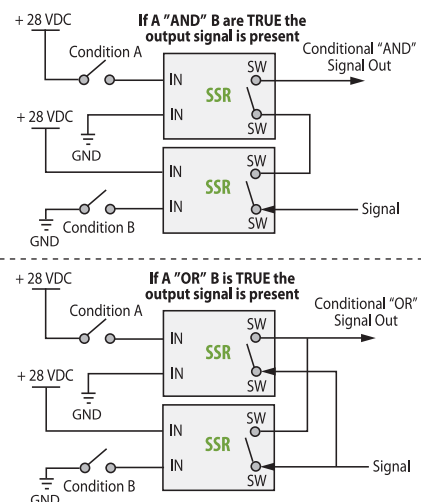


## Figure 4: Conditional Relay Logic

### Conditional "AND" and "OR" Relay Logic

Solid State Relays may be used to perform Relay Logic:

- Any number of SSRs may be connected together as a multiple input "AND"/"OR" function.
- The inputs may be configured as either active high (Power) or active low (Ground).
- Signal may be power, ground or other, such as audio.
- Example below uses SSR1H. Normally closed relays (**SSR2L**, **SSR2M**, and **SSR2H**) may be used to invert the logic.




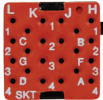
**Table 1: Operating Parameters**

| Description  | Parameters                              |  |              |
|--|---|--|--------------|
|  | +28 VDC Input                           | +14 VDC Input                          | +5 VDC Input |
| <b>Input/Output Parameters</b>                               |   |  |              |
| Maximum Voltage On   | +32 VDC                                 | +18 VDC                                | +6 VDC       |
| Nominal Voltage On   | +28 VDC                                 | +14 VDC                                | +5 VDC       |
| Minimum Voltage On   | +18 VDC                                 | +8 VDC                                 | +4 VDC       |
| Voltage Off (Maximum)  | +6 VDC                                  | +4 VDC                                 | +2 VDC       |
| Typical Operation Current                                    | 6.3 mA                                  | 6.2 mA                                 | 12.1 mA      |
| Typical Input Impedance                                      | 4,444 ohms                              | 2,258 ohms                             | 413 ohms     |
| Turn On Time Maximum   | 3 ms                                    | 3 ms                                   | 5 ms         |
| Turn Off Time Maximum  | 0.5 ms                                  | 0.5 ms                                 | 0.5 ms       |
| Maximum Output Voltage                                       | +32 VDC or 28 VAC rms                   |  |              |
| Minimum Output Voltage                                       | N/A                                     |  |              |
| <b>Output Load Capacity Tested to +85° C</b>                 |   |  |              |
|  | <b>SSR1H, SSR1M and SSR1L (NO)</b>      | <b>SSR2H, SSR2M and SSR2L (NC)</b>     |              |
| On Resistance  | Typical 0.35 ohm AC/DC, Maximum 0.5 ohm | Typical 1.0 ohm AC/DC, Maximum 2.5 ohm |              |
| Resistive  | 0.75 A                                  | 0.25 A                                 |              |
| Inductive  | 0.5 A (300 mH)                          | 0.25 A (300 mH)                        |              |
| Lamp   | 0.1 A (1 A, 10 ms. inrush)              | N/A                                    |              |
| Audio  | <600 ohms                               |  |              |
| <b>Temperature</b>   |   |  |              |
| Operating  | -55°C to +85°C                          |  |              |
| Non-Operating  | -55°C to +85°C                          |  |              |
| <b>Reliability<br/>MIL-HDBK-217F, Notice 2</b>               |   |  |              |
| Airborne Inhabited Cargo (AIC) at +40°C Continuous Operation | MTBF = 668,509 Hrs                      |  |              |

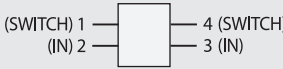
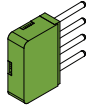
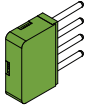
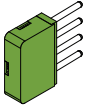
**Table 2: Solid State Relay Function**

| Signals     | Pins  | Logic Function<br>SSR1H, SSR1M, & SSR1L  | Logic Function<br>SSR2H, SSR2M, & SSR2L  | Comments   |
|-------------|-------|--|--|--|
| IN          | 2 & 3 | Input: Active when DC voltage applied across pins 2 and 3.   |  | DC Voltage can be applied in either direction.                                     |
| SWITCH (SW) | 1 & 4 | Output: Conductive between pins 1 and 4 in either polarity when Input is active. Output is high impedance when input is off. | Output: High impedance between pins 1 and 4 when Input is active. Output is conductive in either polarity when input is off. | Approximately 0.5 volt drop at 0.75 amp load between pins 1 and 4 when conducting. |

**Table 3: Connector Plug**

| VIVISUN Compact Body                         |  |   |
|--|--|---|
| A, B, C, D, F, G                             | Illumination Circuits  | <br>P/N 18-442 |
| A1-A4, B1-B4                                 | Switch Contacts or NEXSYS Component Contacts (incl. Solid State Relay) |   |
| VIVISUN High Capacity Body and NEXSYS Module |  |   |
| A, B, C, D, F, G                             | Illumination Circuits  | <br>P/N 18-440 |
| H1-H4, J1-J4, K1-K4, L1-L4                   | Switch Contacts or NEXSYS Component Contacts (incl. Solid State Relay) |   |

**Table 4: Solid State Relay (4-pin Component)**

|  |   |   |   |
|--|---|---|---|
| <br>(SWITCH) 1 — 4 (SWITCH)<br>(IN) 2 — 3 (IN) | <br><b>SSR1H (NO)</b><br><b>SSR2H (NC)</b> | <br><b>SSR1M (NO)</b><br><b>SSR2M (NC)</b> | <br><b>SSR1L (NO)</b><br><b>SSR2L (NC)</b> |
|  | Accepts input voltage from 18 to 32 VDC   | Accepts input voltage from 8 to 18 VDC  | Accepts input voltage from 4 to 6 VDC   |

**Table 5: NEXSYS Component Technology Overview**

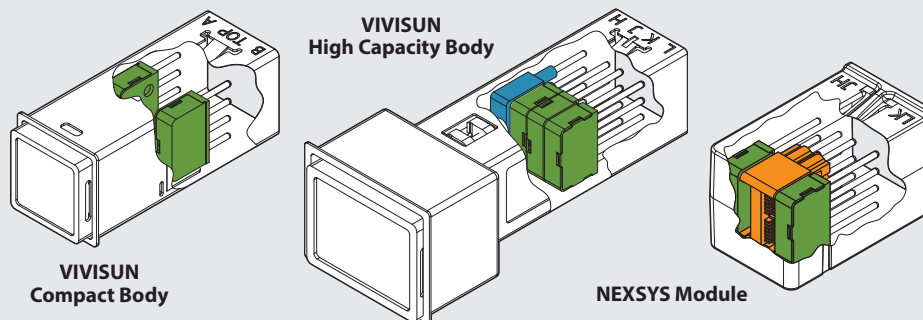
NEXSYS Component Technology from Applied Avionics was created to simplify operator interface and circuit complexity by providing the ability to mix-and-match innovative 8-pin and 4-pin components inside VIVISUN switch bodies and NEXSYS Modules. Component functionality includes:

- Electronic switching,
- Electronic sensing and detecting, and
- Logic/interface devices

When specified in a **VIVISUN switch body**, NEXSYS components can be utilized internally in thirteen distinct combinations, including incorporating electromechanical switch poles. NEXSYS components greatly expand the capabilities of a standard pushbutton switch or indicator.

When specified in a **NEXSYS Module**, there are seven distinct combinations of components available. The module has three mounting options, including Type 1 rail-mounting, for ease of access.

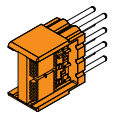
For complete descriptions of the possible combinations, see the *Part Configurator*, the *NEXSYS Component Technology Guide (DS-LCT-15)*, and the *NEXSYS Module Configuration Guide (DS-LM-13)*.



**Component Types**

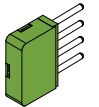
**{8-Pin} Components**

Electronic components, such as electronic latching, edge detectors, electronic rotary, and defined logic.



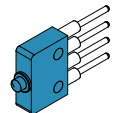
**{4-Pin} Components**

Electronic components, such as solid state relays and diode packs.



**{SW} Switch Poles**

High reliability MIL-PRF-8805/101 snap action switches.



**{0} Open Module**

"Open" spacer for unoccupied pole positions. No termination pins.



See [www.appliedavionics.com](http://www.appliedavionics.com) for all current NEXSYS component offerings.

**Table 6: Solid State Relay Qualification Level Summary**

| Test Description                             | Specification                               | Section                        | Category                 | Reference Levels   |
|--|---|--------------------------------|--------------------------|--|
| Altitude                                     | RTCA/DO-160<br>MIL-STD-202<br>MIL-STD-810   | 4<br>105C<br>500               | F2<br>B<br>Procedure II  | -15,000 feet, +55,000 feet   |
| Temperature                                  | RTCA/DO-160<br>MIL-STD-810                  | 4<br>501/502                   | F2<br>Procedure II       | -55°C and +85°C<br>(Illuminated Indicator rated at +71°C)  |
| Temperature Variation                        | RTCA/DO-160<br>MIL-STD-202<br>MIL-STD-810   | 5<br>107<br>503                | S2<br>A<br>Procedure I-C | 5 cycles -55°C /+85°C  |
| High Temperature Survival<br>(Non-operating) | MIL-STD-202                                 | 108A                           | A                        | +85°C, 96 hours (Switch or Module)<br>+125°C, 96 hours (Electronic Unit only)                          |
| Humidity                                     | RTCA/DO-160<br>MIL-STD-202<br>MIL-STD-810   | 6<br>106<br>507                | B<br>-<br>Procedure II   | 240 hours, +65°C, > 90% RH   |
| Operational Shock and Crash Safety           | RTCA/DO-160<br>MIL-STD-202<br>MIL-STD-810   | 7<br>213<br>516                | B<br>B<br>-              | 20 G Sawtooth,<br>75 G Half-Sine<br>20 G Acceleration  |
| Acceleration                                 | RTCA/DO-160<br>MIL-STD-202<br>MIL-STD-810   | 7<br>212<br>513                | B<br>A<br>Procedure III  | 20 G, 3 axis, Sinusoidal Equivalent  |
| Vibration                                    | RTCA/DO-160<br>MIL-STD-202                  | 8<br>204                       | R,U<br>B                 | 10-2,000 Hz, 10 G<br>10-2,000 Hz, 15 G   |
| Explosive Atmosphere                         | RTCA/DO-160<br>MIL-STD-202                  | 9<br>109                       | E<br>-                   |  |
| Waterproofness                               | RTCA/DO-160<br>RTCA/DO-160<br>MIL-PRF-22885 | 10<br>10<br>4.7.20             | R<br>Y/W<br>-            | Applies to Sealed Switches only<br>Applies to NEXSYS Module only<br>Applies to Sealed Switches only    |
| Sand and Dust                                | RTCA/DO-160<br>MIL-STD-202                  | 12<br>110A                     | D<br>-                   | Applies to both Sealed Switches<br>and NEXSYS Module   |
| Fungus Resistance                            | RTCA/DO-160<br>MIL-PRF-22885                | 13<br>3.5.2                    | F<br>-                   | Compliance by material selection   |
| Salt Fog                                     | RTCA/DO-160<br>MIL-STD-202                  | 14<br>101E                     | T<br>A                   | 96 hour test   |
| Magnetic Effect                              | RTCA/DO-160                                 | 15                             | Z                        | 1° deflection, < 0.3 m   |
| Power Input                                  | RTCA/DO-160<br>RTCA/DO-160<br>MIL-STD-704   | 16.6 and 16.7<br>16.6.1.3<br>- | A and B<br>A<br>-        | Momentary Power Loss 200 ms minimum  |
| Spike/Transient                              | RTCA/DO-160<br>MIL-STD-461                  | 17<br>CS115                    | A<br>-                   | Power, 600 V, 10 us, 50 ohm<br>30 ns, 5 amp  |
| Audio Frequency<br>Conducted Susceptibility  | RTCA/DO-160<br>MIL-STD-461                  | 18<br>CS101                    | Z<br>Curve 2             | Power Input, 4 V P-P, 0.01 - 150 KHz<br>126 dBuV, 30 Hz to 150 KHz                                     |
| Induced Signal Susceptibility                | RTCA/DO-160                                 | 19                             | CW                       | 10,000 V/m, 120 A/m, 350 - 800 Hz  |
| RF Conducted Susceptibility *                | RTCA/DO-160<br>MIL-STD-461                  | 20<br>CS114                    | Y<br>Curve 5             | 300 mA, 10 KHz - 400 MHz<br>109 dBuA, 10 KHz - 200 MHz   |
| RF Radiated Susceptibility *                 | RTCA/DO-160<br>MIL-STD-461                  | 20<br>RS103                    | Y<br>200 V/m             | 200 V/m, 2 MHz - 18 GHz  |
| Conducted RF Emissions                       | RTCA/DO-160<br>MIL-STD-461                  | 21<br>CE102                    | P<br>-                   | 150 KHz to 152 MHz<br>10 KHz to 10 MHz   |
| Radiated RF Emissions                        | RTCA/DO-160<br>MIL-STD-461                  | 21<br>RE102                    | P<br>-                   | 100 MHz-6 GHz<br>10 KHz-6 GHz  |
| Lightning Induced Transient *                | RTCA/DO-160<br>RTCA/DO-160<br>MIL-STD-461   | 22<br>22<br>CS116              | B3K3L3<br>B3K3L3<br>-    | Waveform 3, 600 V, 1 MHz, 10 MHz<br>Waveform 5 A, 300 V, 120 us<br>Damped Sinusoidal, 10 KHz - 100 MHz |
| Dielectric Withstanding                      | MIL-STD-202                                 | 301                            | -                        | 1,000 VAC  |
| Electrostatic Discharge                      | RTCA/DO-160<br>MIL-STD-461                  | 25<br>CS118                    | -<br>Level 4             | 15,000 V, 150 pf, 330 ohms   |

\* Stated EMC performance based on tests performed on an individually monitored component using unshielded cables as defined by the applicable EMC test document. The EMC performance of an installed system using NEXSYS components can be dependent on the actual installation environment and interconnection method.

## Application Example

The application example shown produces an Audio Controller with Crew Override panel using the Solid State Relay (SSR) in conjunction with other NEXSYS components. This provides a reliable customized application that is specifically tailored to the customer's needs.

**Application Details:** The Solid State Relays are used to switch between the different audio channels. When the desired channel is selected (On) all others channels are high impedance (Off). The system will power up with the audio system off.

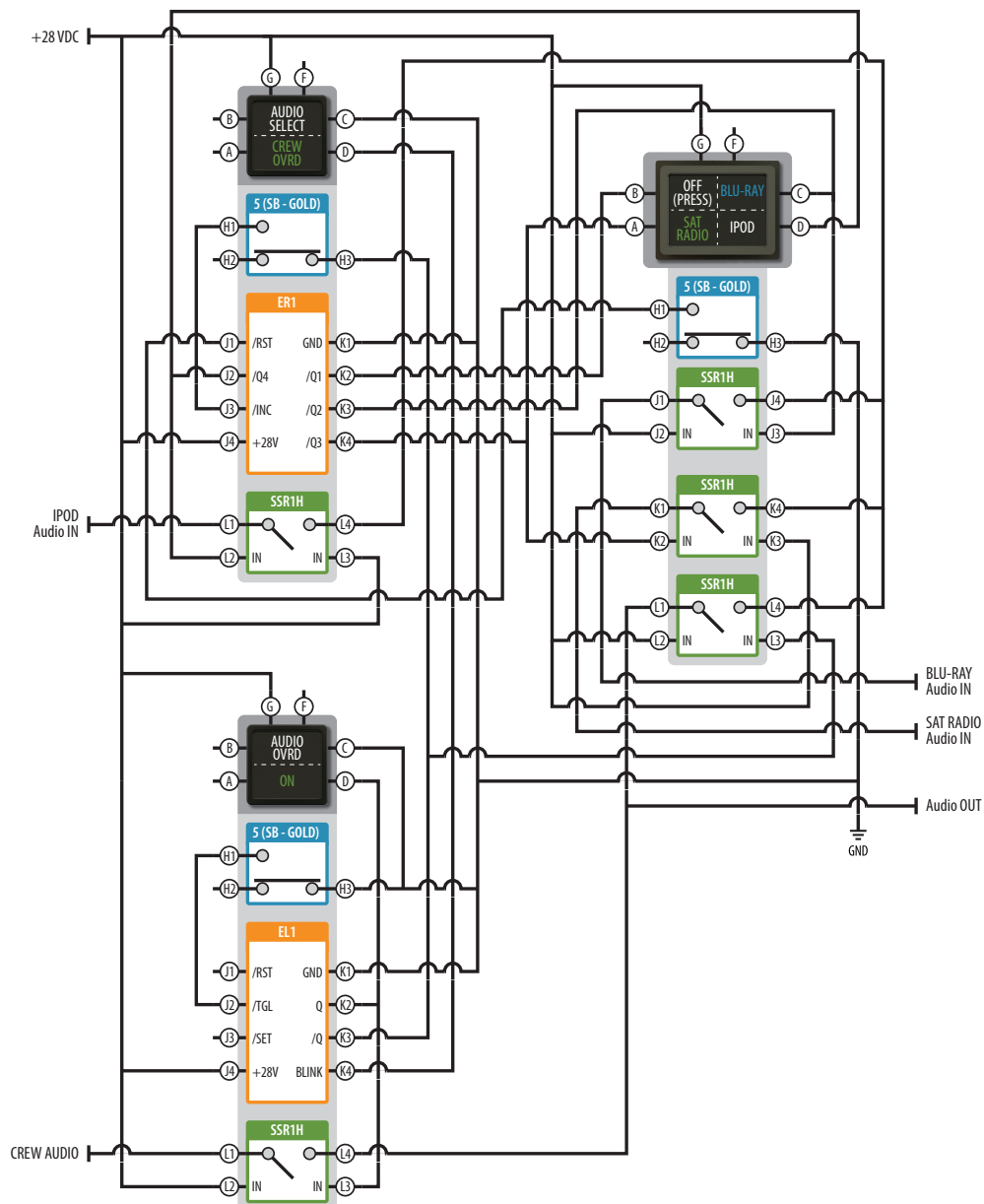
The selection of the audio channels is performed by the Electronic Rotary within the AUDIO SELECT switch. It will power up with /Q1 = Ground and all other outputs High Impedance. Each time the switch is pressed, the Electronic Rotary will ground the next output in sequence with the previously grounded output becoming High Impedance. Note: Only one output is Ground (LOW) at a time. This turns on the desired SSR switched audio output.

An additional Audio Override feature is implemented using a Electronic Latch in conjunction with two Solid State Relays. Pressing the AUDIO OVRD switch will toggle in the crew audio without changing the current audio selected.

The Reset feature of the Electronic Rotary allows the audio to be turned off with a simple press of the Audio channel indicator. This provides two methods of turning off the audio: cycling through the audio channels or by pressing the OFF switch. When CREW OVRD is active, AUDIO SELECT is disabled and will not change states.

*The attached circuit diagram is provided by Applied Avionics, Inc. as a general example only. The recipient is solely responsible for actual design, electrical wiring, validation, testing, applicability and functionality of the product in customer's specific application.*

**Audio Controller with Crew Override Capability**



## How To Order



We've made the accurate configuration of VIVISUN and NEXSYS products quick and easy.

Visit the Online Part Configurator at: [www.appliedavionics.com/configurator](http://www.appliedavionics.com/configurator)

Using the Online Part Configurator will ensure that the entire VIVISUN Body (including lens cap) or NEXSYS Module is configured properly by assigning the selected options into the proper pole positions. With the Part Configurator, you can e-mail complete part specifications and search part numbers. Registered users can also access a database of their previously configured parts.

For complete, manual part number configuration details on our VIVISUN switches and indicators, refer to the *NEXSYS Component Technology Guide (DS-LCT-15)*; the datasheets for either the LED- (3/4" square with LED lighting), the LR3- (1" x 1.2" rectangular with LED lighting) or the 95-Series (3/4" square with incandescent lighting); and the datasheets for the desired NEXSYS components.

For complete, manual part number configuration details on our behind-the-panel NEXSYS Module solutions, refer to the *NEXSYS Module Configuration Guide (DS-LM-13)* and the datasheets for the desired NEXSYS components.

For up-to-date information on all available NEXSYS components, visit [www.appliedavionics.com](http://www.appliedavionics.com)

| Full Sample Part Numbers  | Sample Descriptions  | Sample Circuit Diagrams | Connector Plugs  |
|---|--|-------------------------|--|
| <b>LED-FM-17-HE-E0XC3*</b><br><b>(1G2 SOLID, STATE, RELAY)</b><br><b>LB(SSR1L;0)</b>                                      | LED Compact Body; including (1) Low Solid State Relay, <u>without</u> a Connector Plug.  |                         | <b>FM</b> configurations require Connector Plug 18-442 to be ordered separately. Replacing <b>FM</b> with <b>GM</b> denotes a Compact Body part number with a Connector Plug included.       |
| <b>LR3-DM-11-DQ-E0XD8*</b><br><b>(4SA2 OFF, (PRESS); 5ST2 BLU-RAY; 6SG2 SAT, RADIO)</b><br><b>LB(5;SSR1H;SSR1H;SSR1H)</b> | LR3 High Capacity Body; including (1) single pole gold switch, and (3) High Solid State Relays, <u>without</u> a Connector Plug. |                         | <b>DM</b> configurations require Connector Plug 18-440 to be ordered separately. Replacing <b>DM</b> with <b>EM</b> denotes a High Capacity Body part number with a Connector Plug included. |

\* Refer to applicable Data Sheets for the LED-, LR3- and 95-Series for complete part number descriptions and options for the entire switch assembly.

| Configurations with 4-pin NEXSYS Components      |   |
|--|---|
| Position Schematic                               | Configuration Combinations  |
| <b>Compact Body</b>                              |   |
|  | <b>LB ( {4-pin};0 )</b> <b>LB ( {SW};{4-pin} )</b> <b>LB ( {4-pin};{4-pin} )</b> <p><i>Alternatively, these 3 configurations can be ordered as a High Capacity Body with two additional "open" positions.</i></p> |
| <b>High Capacity Body</b>                        |   |
|  | <b>LB ( {SW};{SW};{4-pin};{SW} )</b> <b>LB ( {SW};{4-pin};{4-pin};{SW} )</b> <b>LB ( {SW};{4-pin};{4-pin};{4-pin} )</b>   |
| <b>High Capacity Body - with 8-Pin Component</b> |   |
|  | <b>LB ( {SW};{8-pin};{4-pin} )</b> <b>LB ( {4-pin};{8-pin};0 )</b> <b>LB ( {4-pin};{8-pin};{4-pin} )</b>  |
| <b>NEXSYS Module</b>                             |   |
|  | <b>LM ( {4-pin};{8-pin};0 )</b> <b>LM ( {4-pin};{8-pin};{4-pin} )</b> <b>LM ( {4-pin};{4-pin};{4-pin};{4-pin} )</b>   |

Note: NEXSYS Components have specific position priorities inside of a VIVISUN Body or NEXSYS Module that must be determined using the Online Part Configurator.

### Headquarters & USA Sales Office

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 3201 Sandy Lane Fax: 1-817-654-3405  
 Fort Worth, TX 76112 Toll-Free: 1-888-848-4786  
 E-mail: [sales@appliedavionics.com](mailto:sales@appliedavionics.com)  
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See "Customer Support" at [www.appliedavionics.com](http://www.appliedavionics.com) for a current listing and complete contact information for our international sales network, or e-mail the specific country address below:

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