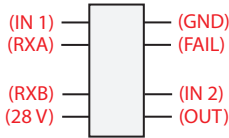




ARINC 429 CONVERTER

LOGIC & INTERFACE

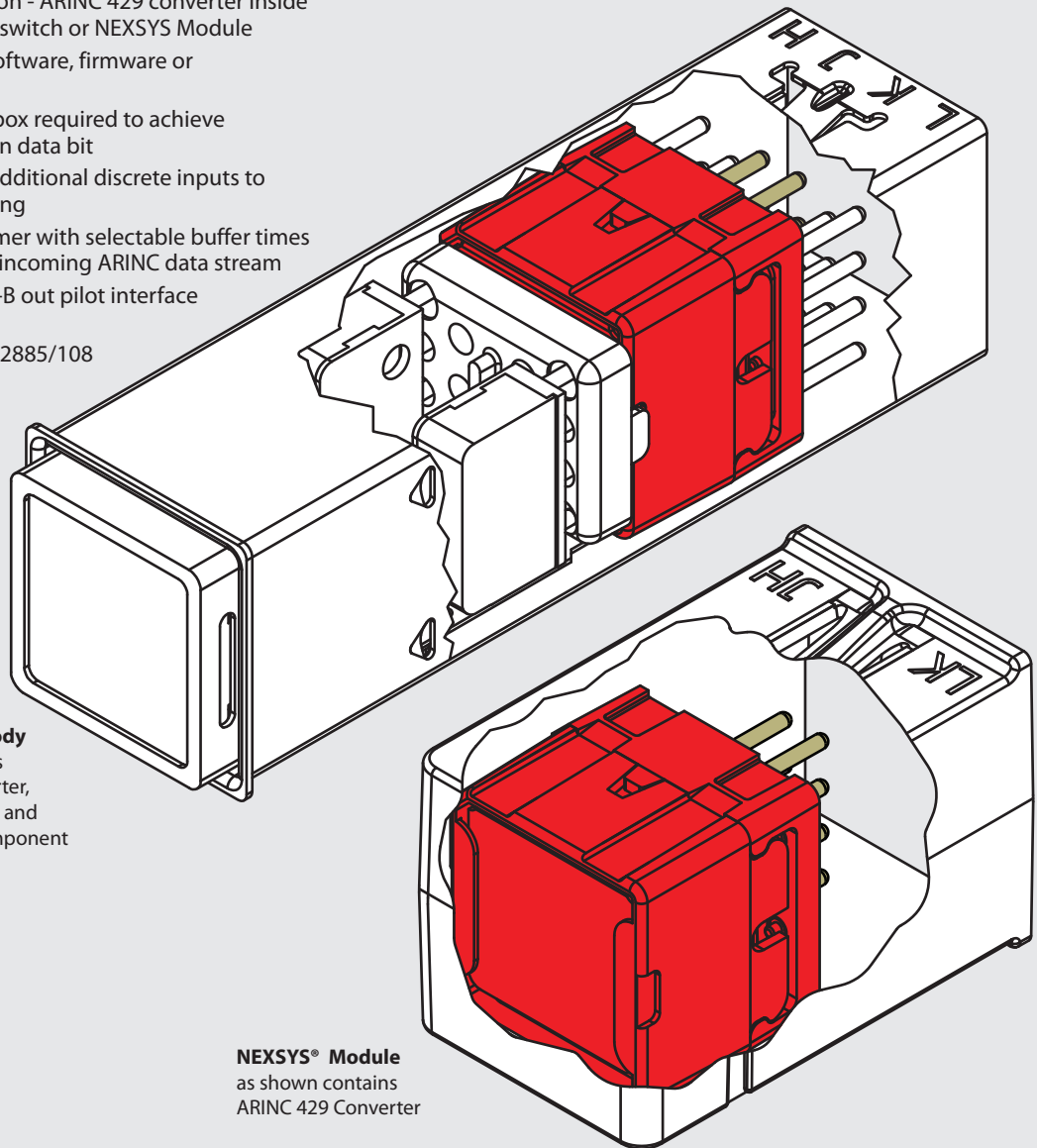


SR429/1M

The ARINC 429 Converter component is an 8-pin logic and interface device developed as a part of our NEXSYS® Component Technology. This single-bit, single-label ARINC 429 Converter can replace the need for a dedicated ARINC converter box. The ARINC 429 Converter can be configured inside a VIVISUN® High Capacity switch body or inside a stand-alone NEXSYS Module for use behind the panel. The ARINC 429 Converter can be combined with electromechanical switches and other NEXSYS components to create a custom configuration that uniquely addresses the designer's specific functional requirements. The ARINC 429 Converter is designed and tested in accordance with MIL-PRF-22885 and DO-160.

SR429/1M

- Industry first innovation - ARINC 429 converter inside VIVISUN annunciator, switch or NEXSYS Module
- Simple unit with no software, firmware or programmable logic
- No external decoder box required to achieve annunciation based on data bit
- Accommodates two additional discrete inputs to provide "fail" monitoring
- Includes watchdog timer with selectable buffer times to monitor validity of incoming ARINC data stream
- Ideally suited for ADS-B out pilot interface requirements
- Included in MIL-PRF-22885/108



VIVISUN® High Capacity Body
as shown contains
ARINC 429 Converter,
single switch pole and
4-pin NEXSYS component

NEXSYS® Module
as shown contains
ARINC 429 Converter

ARINC 429 Converter (SR429/1M)

The ARINC 429 Converter (SR429/1M) component can be configured inside a VIVISUN® annunciator, switch or NEXSYS® Module. While this can offer a wide range of application solutions, the FAA mandate requiring pilot ADS-B Out system status notifications make this product an economical solution to meet this important industry requirement.

Benefits: The SR429/1M provides the ability to convert a single data bit from an ARINC 429 data bus to a discrete signal within an annunciator, switch or NEXSYS Module.

- Can be specified for any single-bit on any single label
- Other options include ARINC transmission speeds, parity checking, and discrete output type (Active Low or Active Open)
- Device qualifies as simple and has no software or firmware, so no DO-178 or DO-254 issues exist
- Internal watchdog timer to monitor validity of incoming ARINC data stream
- Accommodates two additional external signal inputs with discrete output on “fail”
- Reduces circuit complexity, size, weight, and installation labor

Application: The SR429/1M is a single bit ARINC 429 converter, with additional inputs for up to two independent discrete analog signals.

The typical application for the SR429/1M is for failure indications, although the device can be used for a wide range of ARINC data to analog conversion situations. What makes the SR429/1M device unique is its ability to reside inside of an annunciator, switch or NEXSYS Module. See *Application Examples (pages 4 - 5)* for schematics of the following examples.

In Application 1, the SR429/1M is performing the ADS-B Out failure annunciation. Integrated SSRs are utilized to gate the signal between the two transponders, the two SR429/1Ms and the LED annunciators. In this situation, a discrete analog input (i.e. transponder health) is being monitored as well as the ARINC 429 data information. This affords dual redundancies by monitoring each of the transponders, with the “transponder select” switch determining which transponder status is being shown on the annunciators. The watchdog timer is being employed to monitor the validity of the ARINC data. This application takes advantage of a second (co-pilot) annunciator.

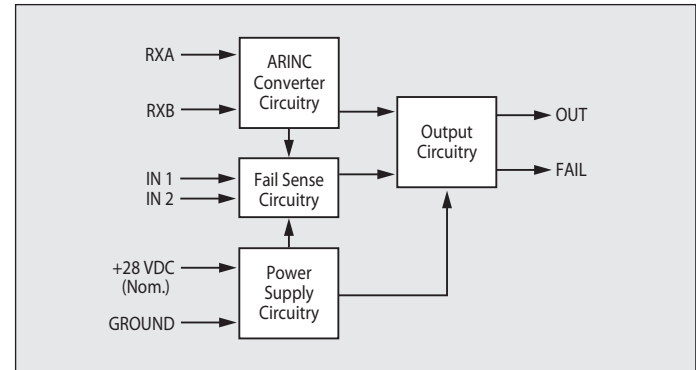
Application 2 is a simpler demonstration of the SR429/1M where the unit is used to provide a discrete annunciation of two states provided by the system controller. The internal watchdog timer is used to ensure proper performance of the SR429/1M converter and the validity of the data being received. Neither of the other optional inputs are being utilized in this example.

Application 3 demonstrates the SR429/1M device used as an in-line ARINC converter packaged inside a NEXSYS Module for situations where no annunciation is required. The single bit can be read off of the ARINC data bus and converted to either an Active Low (ground) or Active Open (high impedance) when the selected data bit is 1.

NEXSYS Component Technology Overview: The SR429/1M is a powerful addition to our innovative NEXSYS Component Technology designed to enhance avionics design flexibility. NEXSYS components include a wide variety of electronic switching, electronic sensing/detecting and logic/interface devices that allow designers to create mix-and-match solutions to address their system integration challenges.

The SR429/1M can be combined with up to two additional 4-pin NEXSYS components or electromechanical switches when packaged inside of a High Capacity switch or annunciator body with an illuminated lens cap. When used in the same body as an SR429/1M, all other NEXSYS components and electromechanical switches are limited to a maximum of 1.0 amp current on any pin. When used in a NEXSYS Module, the SR429/1M occupies the entire module with no additional capacity.

Figure 1: Block Diagram



ARINC Converter Circuitry: Inputs J2 and J3 supply the ARINC converter circuitry with the two wire ARINC signal input. The following options must be defined at the time of order:

- Any single ARINC Label (000 – 377)
- Any single data bit from selected label (11 – 31)
- ARINC transmission speed (High or Low)
- ARINC bit output type (Pin K4)
 - Can be specified to be Active Low or Active Open when selected data bit = 1. See *Table 2*
- Handling of SDI Bits (Bits 9 & 10)
- ARINC parity checking (On or Off)

Fail Sense Circuitry: The internal fail sense circuitry simultaneously monitors the operation of the internal ARINC converter and two optional external inputs and drives a single discrete output on Pin K2 (FAIL). Pin K2 (FAIL) will be normal ground and become Open (high impedance) upon a) a “fail” signal from the internal health monitor or b) an indication from either of the optional external inputs.

The following events would cause the internal health monitor to provide a “fail” signal and cause Pin K2 to go Open: a) failure of the ARINC converter, b) loss of power to the SR429/1M unit, or c) loss of valid ARINC data input. The health monitor includes a watchdog timer requiring a valid ARINC label to be received within a specified time buffer. Desired buffer time specification must be selected at time of order:

- Buffer Timing (0.5s, 1.0s, 1.75s, 2.5s, 5.0s, 10.0s, 15.0s)

Either of the optional external inputs can also provide a “fail” indication and cause Pin K2 (FAIL) to go Open. Pin J1 (IN 1) is pre-defined as Normal = Power or Open, Fail = Ground, therefore a Ground on Pin J1 (IN 1) would create an Open on Pin K2 (FAIL). Pin J1 can remain open if unused.

The second external input, Pin K3 (IN 2), must be specified at the time of order and must be connected, even if the second external input is not actively used. If the second external input is used, the specification of Pin K3 (IN 2) will be based on normal state of the input, with the following two possible normal states:

- Normal = Ground, Fail = Open or Power; removing Ground (normal state) from Pin K3 would create an Open on Pin K2 (FAIL)
- Normal = Power; Fail = Open or Ground; removing Power (normal state) from Pin K3 would create an Open on Pin K2 (FAIL)

If the second external input is not required, Pin K3 (IN 2) must have a continuous Ground applied (equivalent to a monitoring a system with Normal = Ground) and the part number (See *SR429/1M Part Numbering*) must include buffer timing options of E, G, J, L, N, R or V.

Output Circuitry: Pins K2 and K4 are open drain outputs. Pin K4 (OUT) is the decoded ARINC 429 output bit related directly to the ARINC converter circuitry. Pin K2 (FAIL) is the result of the fail sense circuitry, and is related to status of the internal health monitor and the status of Pin J1 (IN 1) and Pin K3 (IN 2).

Table 1: SR429/1M Pin-out

Name (Pin)	Pinout	Comments
IN 1 (J1)	Optional Fail Input 1 Use for inputs where: Fail = Ground Normal = Power or Open	Can remain open if unused.
RXA (J2)	ARINC A	
RXB (J3)	ARINC B	
+28 VDC (J4)	Power (+28 VDC Nominal)	See Table 4 for range.
GND (K1)	Unit Ground	Continuous ground required.
FAIL (K2)	Fail Output Normal = Ground Fail = Open	Fail signal output generated by either Internal Health Monitor, fail sensed from IN 1 (J1), or fail sensed from IN 2 (K3)
IN 2 (K3)	Optional Fail Input 2 Configuration option specified at time of order Use for inputs where: Normal = Ground Fail = Open or Power - or - Use for inputs where: Normal = Power Fail = Open or Ground	Continuous Ground required if unused. Continuous Power required if unused.
OUT (K4)	ARINC Bit Output Configuration option specified at time of order Active Low (Gnd when Bit = 1) - or - Active Open (Open when Bit = 1) See Table 2	Decode of selected bit from ARINC input on RXA (J2) and RXB (J3) See Table 2

Table 2: Output Level (Pin K4) by Configuration

ARINC Bit Output (Pin K4) From Table 1	Output Level *	
	ARINC 429 Word Data Bit = 0**	ARINC 429 Word Data Bit = 1 (Active)
Active Low Output Configuration	Open (High Impedance)	Ground
Active Open Output Configuration	Ground	Open (High Impedance)

* All outputs are open drain. Outputs have been inverted in Active Open configuration.
** Also represents power-up state.

Table 3: Connector Plug

Pins*	High Capacity Body	NEXSYS Module	Connector Plug
A, B, C, D, F, G	Illum. Circuits	N/A	 P/N 18-440
H1-H4, L1-L4	Switch Contacts -or- 4-Pin Contacts		
J1-J4, K1-K4	SR429/1M Converter Contacts		

Table 4: Operating Parameters

Description	Parameters
Operating Parameters	
Operating Voltage (Max./Nom./ Min.)	+32 VDC /+28 VDC/+18 VDC
Power Supply Input Current	8 ma maximum
Reset From Power Loss	5 second minimum @ +25°C
Hold Up On Power Loss	200 ms minimum
IN 1 and IN 2	
Input Timing	5 ms typical
Low Level Input Current (I _{IL})	1 mA maximum
Low Level Input Voltage (V _{IL})	< +6 VDC
High Level Input Voltage (V _{IH})	> +20 VDC
ARINC 429 inputs	Per ARINC 429 specification
Low Level Output Voltage @ 1A (V _{OL})	+0.4 VDC typical, +0.6 VDC Max
High Level Output Voltage (V _{OH})	Open Drain +32 VDC maximum pull-up allowed
Output Load Capacity	
Resistive / Inductive	1.0 A maximum / 0.5 A maximum
Temperature	
Operating	-55°C to +85°C
Non-operating	-55°C to +125°C
Reliability MIL-HDBK-217F, Notice 2	
Airborne Inhabited Cargo (AIC) at +40°C Continuous Operation	MTBF = 116,317 Hrs

SR429/1M Part Numbering

A SDI Disabled; Bits 9 and 10 used as data
E SDI Enabled; Bit 9 = 0, Bit 10 = 0
F SDI Enabled; Bit 9 = 0, Bit 10 = 1
G SDI Enabled; Bit 9 = 1, Bit 10 = 0
H SDI Enabled; Bit 9 = 1, Bit 10 = 1

Three digit ARINC 429 Label
000 - 377

Two digit Bit Number
11 - 31

SR429/1M / [] [] [] [] [] [] [] []

Pin K3 Option See Table 1
 Normal = Ground
E 0.5s buffer
G 1.0s buffer
J 1.75s buffer
L 2.5s buffer
N 5.0s buffer
R 10.0s buffer
V 15.0s buffer
 Normal = Power
F 0.5s buffer
H 1.0s buffer
K 1.75s buffer
M 2.5s buffer
P 5.0s buffer
S 10.0s buffer
W 15.0s buffer

A Active Low Output, (Pin K4), Parity On, High Speed
B Active Open Output, (Pin K4), Parity On, High Speed
C Active Low Output, (Pin K4), Parity Off, High Speed
D Active Open Output, (Pin K4), Parity Off, High Speed
E Active Low Output, (Pin K4), Parity On, Low Speed
F Active Open Output, (Pin K4), Parity On, Low Speed
G Active Low Output, (Pin K4), Parity Off, Low Speed
H Active Open Output, (Pin K4), Parity Off, Low Speed

The SR429/1M must be ordered as a part of a VIVISUN pushbutton switch/annunciator or NEXSYS Module. The SR429/1M component part number shown above is a portion of the complete part number that is required to specify all of the options available in a switch/annunciator or NEXSYS Module. As an example, the complete part number for one of the VIVISUN annunciators shown in Application 1 on page 4291M-4 of this brochure is:

LED-EM-17-HA1-PA00V
(1SY1 ADS-B, FAIL)
LB(SSR1H; SR249/1MG/353AE[20]; SSR2H)

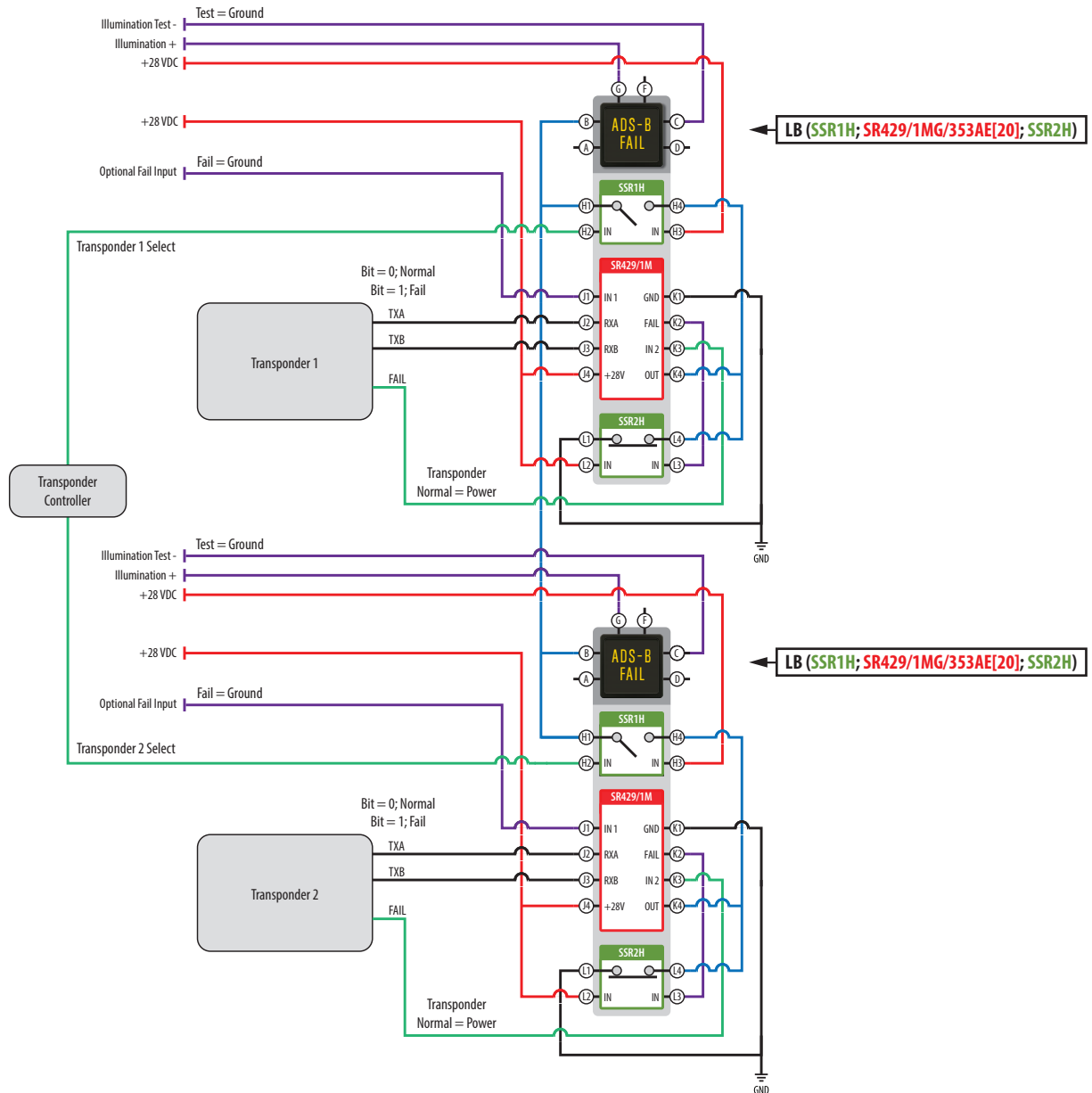
Our Part Configurator at www.appliedavionics.com/configurator will ensure that the entire VIVISUN pushbutton switch/annunciator (including lens cap) or NEXSYS Module is configured properly, including the options related to the SR429/1M component. The Part Configurator generates a final complete part number after all options have been specified. Once properly configured, only the first line (i.e. LED-EM-17-HA1-PA00V) is required for getting a quote or ordering.

4291M-3

Application Examples

Application 1 - ADS-B Annunciator

Schematics shown for LED illuminated caps.
SR429/1M not compatible with incandescent caps.



In this application, two identically configured annunciators each contain an SR429/1M ARINC converter (Active Low Configuration), a normally open SSR (SSR1H) and a normally closed SSR (SSR2H). Each transponder is being monitored independently by sending ARINC 429 data stream (Bit = 0; Normal, Bit = 1; Fail) and a discrete analog output for "transponder failure" (Normal = Ground, Fail = Open) to its respective SR429/1M.

The Transponder Controller determines which transponder is "active" by grounding Pin H2 of the top SSR1H to make Transponder 1 active or by grounding Pin H2 of the bottom SSR1H to make Transponder 2 active. If a failure exists on the "active" transponder, the status is displayed on both annunciators. The status of the "inactive" transponder is not reported on the annunciator legends.

Ground can be applied to Pin H4 of the "active" transponder, illuminating both legends, in three different ways:

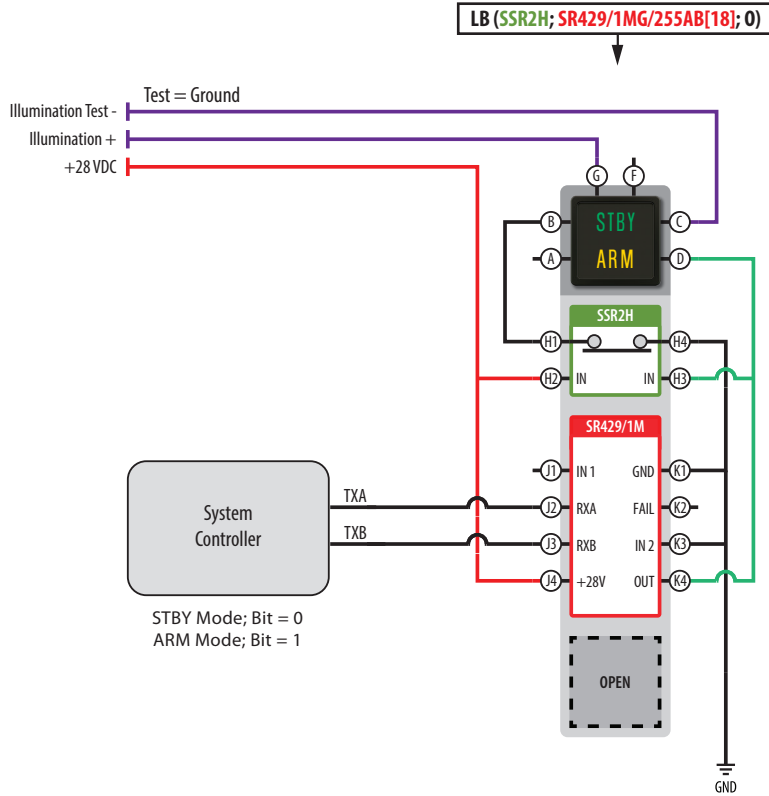
1. GPS failure is transmitted to SR429/1M as Bit = 1, creating a Ground output on OUT (Pin K4) due to this SR429/1M being configured as Active Low (Ground). Ground on Pin K4 is tied directly to Pin H4.
2. If transponder fails, IN 2 (Pin K3) is Open, creating an Open on output FAIL (Pin K2), and the SSR2H acts as a drop out relay and will close, passing a ground signal to Pin H4. If transponder is good, IN 2 (Pin K3) is Ground (normal), therefore K2 is ground (normal) and the normally closed SSR2H is held open and no signal is passed on.
3. If a valid ARINC message is not received by the SR429/1M within the specified buffer timing, or the SR429/1M unit loses power, FAIL (Pin K2) will become Open, the SSR2H acts as a drop out relay and will close, passing the ground signal to Pin H4.

Disclaimer: The configurations and diagrams shown above are 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 regards to the customer's specific application.

Application Examples

Application 2 - Dual State Annunciator

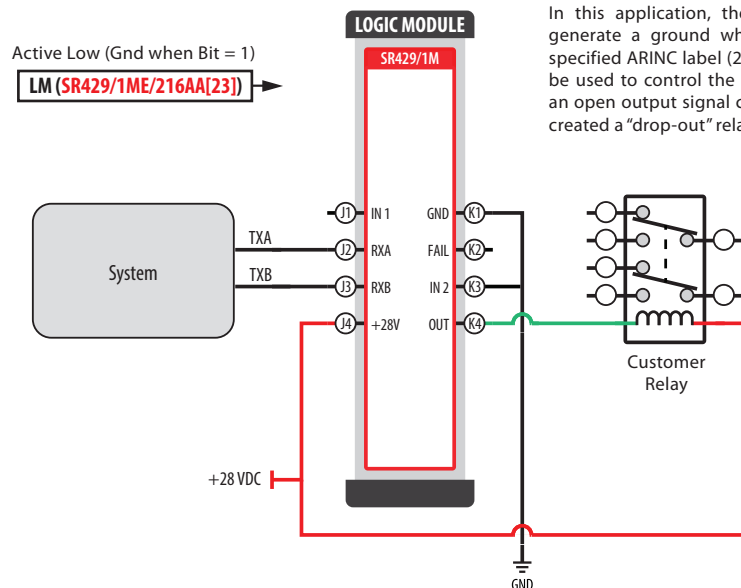
Schematics shown for LED illuminated caps. SR429/1M not compatible with incandescent caps.



In this application, the ARINC data bit from the system controller equals 0 in the STBY mode and the data bit equals 1 in the ARM mode. The SR429/1M specified in this application is an "Active Low" configuration (see Table 2) where the output on PIN K4 (OUT) is Open when the data bit equals 0 (equivalent to the STBY mode) and is Ground when the data bit equals 1 (equivalent to the ARM mode).

When system controller is in the STBY mode (ARINC bit = 0) the output of PIN K4 (OUT) of the specified SR429/1M component (specified as Active Low Configuration) is open, which illuminates the upper "STBY" legend through the normally closed SSR2H relay contacts. When system controller is in the ARM mode (ARINC bit = 1) the output of PIN K4 (OUT) becomes Ground, which will illuminate the "ARM" legend from PIN K4 (OUT) and extinguish the "STBY" legend by opening the normally closed SSR2H relay.

Application 3 - Smart Relay Controller



In this application, the SR429/1M component is being used to generate a ground when the selected bit (23) equals 1 on the specified ARINC label (216). As shown the output ground signal may be used to control the operation of an external relay. Alternatively, an open output signal could have been specified which would have created a "drop-out" relay driven by ARINC data.

The NEXSYS Module is used in this situation since no annunciation is required, and the output signal can be passed to any other system (the relay in this example) or device. When used in a NEXSYS Module, the SR429/1M occupies the entire module with no additional capacity.

Disclaimer: The configurations and diagrams shown above are 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 regards to the customer's specific application.

Table 5: SR429/1M Qualification Level Summary

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

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