

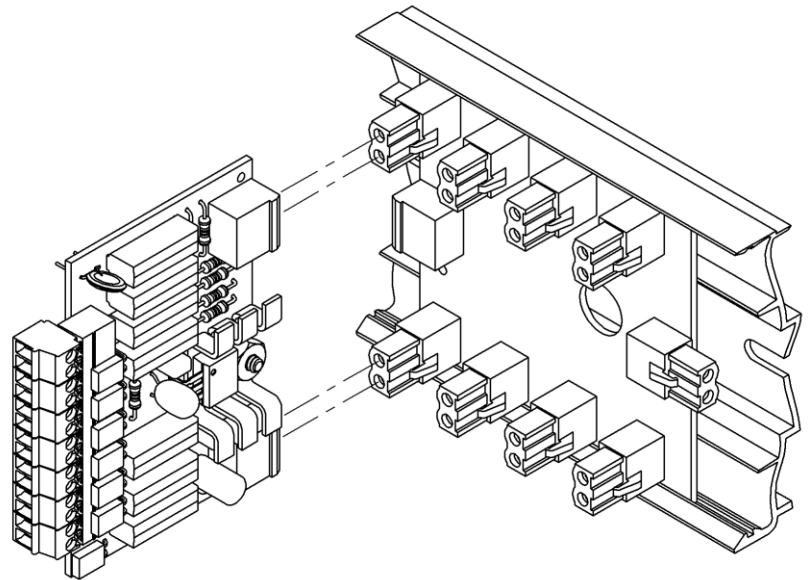
Overview

The BA/DS6R-10K plugs into the BA/BP2, BA/BP4 or BA/BP8 backplane. The BA/DS6R-10K monitors six dry switch closure devices and provides one resistive output to the controller. Each switch closure adds a precise resistance to the output so a simple subtraction algorithm decodes which switches are set. Each switch terminates on an independent plug on the front of the module and an LED associated with each input indicates switch closure for simple trouble shooting.

Mounting

The BA/DS6R plugs into a BA/BP2, BA/BP4 or BA/BP8 board as shown in figure 1.

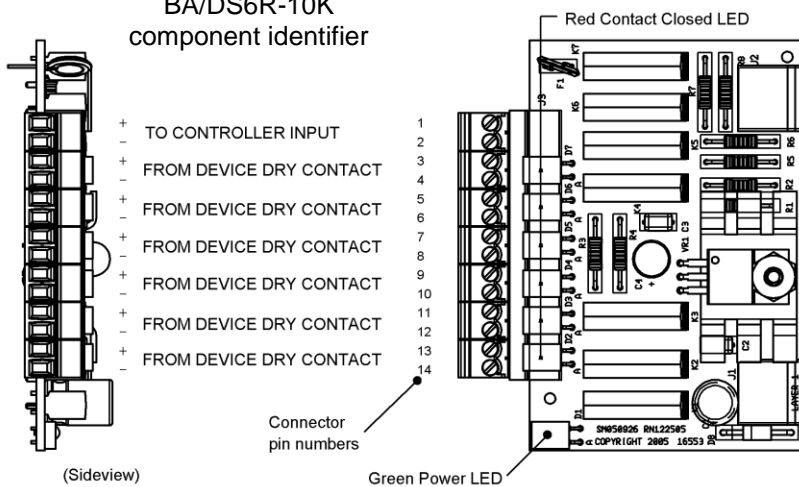
Figure 1: BAPI BA/DS6R-10K board plugging into a BA/BP4



Termination

The switch inputs that the DS6R-10K monitors are dry contacts isolated from other circuits. The switch circuits on the DS6R-10K module provide 10 mA sealing current at an open circuit voltage of 7 VDC. Carefully check the specifications on the external switches for proper operation at these sealing current levels.

Figure 2:
BA/DS6R-10K
component identifier



Circuit	Pin numbers
Switch input 1	13, 14
Switch input 2	11, 12
Switch input 3	9, 10
Switch input 4	7, 8
Switch input 5	5, 6
Switch input 6	3, 4
Analog output voltage	1-output resistance, 2-ground

Note: The male connectors that plug into the jacks on the board use a rising block screw terminal to hold the wires. It is possible for the block to be in a partially up position allowing the wire to be inserted under the block. Be sure that the male connector screws are turned fully counterclockwise before inserting the wire. Lightly tug on each wire after tightening to verify proper termination.

Specifications subject to change without notice.



Operation

Each switch input has an LED associated with it. When the switch is closed the LED will light. The LEDs are physically mounted to correspond with the connector location for that input.

Each switch closure subtracts a precise resistance from the total output resistance of 9.806KΩ as shown in Table 1 at right and in Table 2 on page 3.

As indicated in Table 1, If switches 1, 3 and 5 are closed the output resistance is 9.806KΩ - 4.99KΩ - 1.24KΩ - 309Ω = 3.267KΩ.

Note: Output resistors are 1/4 watt, be sure that your controller does not overpower them.

Table 1 Output Voltage	
Circuit	Subtraction from Output Resistance
1	4.99KΩ 0.1%
2	2.49KΩ 1%
3	1.24KΩ 1%
4	619Ω 1%
5	309Ω 1%
6	158Ω 1%

Decoding

The following algorithm in the controller will determine which of the five switches are closed or open. The variable name of Rin used in the following example may be any name that makes sense in your code.

- Step 1. Read the resistance from the analog input, save as a variable called Rin.
- Step 2. Is the value of Rin between 0 and 9806Ω
 - Yes.....Go to Step 3
 - No.....Go to Step 9 (END)
- Step 3. Is the value of Rin < 4933Ω
 - Yes.....Switch 1 = Closed or On. Rin2 = Rin. Go to Step 4.
 - No.....Switch 1 = Open or Off. Rin2 = Rin - 4990Ω
- Step 4. Is the value of Rin2 < 2416Ω
 - Yes.....Switch 2 = Closed or On. Rin3 = Rin2. Go to Step 5.
 - No.....Switch 2 = Open or Off. Rin3 = Rin2 - 2490Ω
- Step 5. Is the value of Rin3 < 1200Ω
 - Yes.....Switch 3 = Closed or On. Rin4 = Rin3. Go to Step 6.
 - No.....Switch 3 = Open or Off. Rin4 = Rin3 - 1240Ω
- Step 6. Is the value of Rin4 < 551Ω
 - Yes.....Switch 4 = Closed or On. Rin5 = Rin4. Go to Step 7.
 - No.....Switch 4 = Open or Off. Rin5 = Rin4 - 619Ω
- Step 7. Is the value of Rin5 < 242Ω
 - Yes.....Switch 5 = Closed or On. Rin6 = Rin5. Go to Step8.
 - No.....Switch 5 = Open or Off. Rin6 = Rin5 - 309Ω
- Step 8. Is the value of Rin6 < 50Ω
 - Yes.....Switch 6 = Closed or On. Go to Step 9.
 - No.....Switch 6 = Open or Off
- Step 9. END

Decoding continued on next page

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Decoding Continued

Table 2: Switch Closure and Output Resistance Values

Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Output Resistance in Ohms	10K-2 Temperature Fahrenheit	10K-2 Temperature Celsius	10K-3 Temperature Fahrenheit	10K-3 Temperature Celsius
Open	Open	Open	Open	Open	Open	9806Ω	77.81°F	25.45°C	77.86°F	25.48°C
Open	Open	Open	Open	Open	Closed	9648Ω	78.48°F	25.82°C	78.59°F	25.88°C
Open	Open	Open	Open	Closed	Open	9497Ω	79.13°F	26.18°C	79.30°F	26.28°C
Open	Open	Open	Open	Closed	Closed	9339Ω	79.82°F	26.57°C	80.05°F	26.70°C
Open	Open	Open	Closed	Open	Open	9187Ω	80.51°F	26.95°C	80.79°F	27.11°C
Open	Open	Open	Closed	Open	Closed	9029Ω	81.23°F	27.35°C	81.58°F	27.54°C
Open	Open	Open	Closed	Closed	Open	8878Ω	81.93°F	27.74°C	82.34°F	27.97°C
Open	Open	Open	Closed	Closed	Closed	8720Ω	82.68°F	28.16°C	83.16°F	28.42°C
Open	Open	Closed	Open	Open	Open	8566Ω	83.43°F	28.57°C	83.97°F	28.87°C
Open	Open	Closed	Open	Open	Closed	8408Ω	84.21°F	29.00°C	84.82°F	29.34°C
Open	Open	Closed	Open	Closed	Open	8257Ω	84.97°F	29.43°C	85.65°F	29.81°C
Open	Open	Closed	Open	Closed	Closed	8099Ω	85.78°F	29.88°C	86.54°F	30.30°C
Open	Open	Closed	Closed	Open	Open	7947Ω	86.59°F	30.33°C	87.41°F	30.78°C
Open	Open	Closed	Closed	Open	Closed	7789Ω	87.44°F	30.80°C	88.33°F	31.30°C
Open	Open	Closed	Closed	Closed	Open	7638Ω	88.27°F	31.26°C	89.24°F	31.80°C
Open	Open	Closed	Closed	Closed	Closed	7480Ω	89.16°F	31.76°C	90.21°F	32.34°C
Open	Closed	Open	Open	Open	Open	7316Ω	90.11°F	32.28°C	91.24°F	32.91°C
Open	Closed	Open	Open	Open	Closed	7158Ω	91.05°F	32.80°C	92.26°F	33.48°C
Open	Closed	Open	Open	Closed	Open	7007Ω	91.96°F	33.31°C	93.26°F	34.03°C
Open	Closed	Open	Open	Closed	Closed	6849Ω	92.95°F	33.86°C	94.33°F	34.63°C
Open	Closed	Open	Closed	Open	Open	6697Ω	93.92°F	34.40°C	95.39°F	35.22°C
Open	Closed	Open	Closed	Open	Closed	6539Ω	94.96°F	34.98°C	96.52°F	35.84°C
Open	Closed	Open	Closed	Closed	Open	6388Ω	95.97°F	35.54°C	97.62°F	36.46°C
Open	Closed	Open	Closed	Closed	Closed	6230Ω	97.07°F	36.15°C	98.82°F	37.12°C
Open	Closed	Closed	Open	Open	Open	6076Ω	98.17°F	36.76°C	100.01°F	37.78°C
Open	Closed	Closed	Open	Open	Closed	5918Ω	99.33°F	37.40°C	101.27°F	38.48°C
Open	Closed	Closed	Open	Closed	Open	5767Ω	100.47°F	38.04°C	102.52°F	39.18°C
Open	Closed	Closed	Open	Closed	Closed	5609Ω	101.70°F	38.72°C	103.86°F	39.92°C
Open	Closed	Closed	Closed	Open	Open	5457Ω	102.92°F	39.40°C	105.19°F	40.66°C
Open	Closed	Closed	Closed	Open	Closed	5299Ω	104.23°F	40.13°C	106.62°F	41.46°C
Open	Closed	Closed	Closed	Closed	Open	5148Ω	105.53°F	40.85°C	108.03°F	42.24°C
Open	Closed	Closed	Closed	Closed	Closed	4990Ω	106.94°F	41.63°C	109.56°F	43.09°C
Closed	Open	Open	Open	Open	Open	4816Ω	108.54°F	42.52°C	111.31°F	44.06°C
Closed	Open	Open	Open	Open	Closed	4658Ω	110.06°F	43.37°C	112.97°F	44.98°C
Closed	Open	Open	Open	Closed	Open	4507Ω	111.57°F	44.20°C	114.61°F	45.89°C
Closed	Open	Open	Open	Closed	Closed	4349Ω	113.21°F	45.11°C	116.39°F	46.89°C
Closed	Open	Open	Closed	Open	Open	4197Ω	114.85°F	46.03°C	118.18°F	47.88°C
Closed	Open	Open	Closed	Open	Closed	4039Ω	116.63°F	47.02°C	120.13°F	48.96°C
Closed	Open	Open	Closed	Closed	Open	3888Ω	118.41°F	48.00°C	122.06°F	50.04°C
Closed	Open	Open	Closed	Closed	Closed	3730Ω	120.35°F	49.09°C	124.19°F	51.21°C
Closed	Open	Closed	Open	Open	Open	3576Ω	122.34°F	50.19°C	126.36°F	52.42°C
Closed	Open	Closed	Open	Open	Closed	3418Ω	124.49°F	51.38°C	128.70°F	53.72°C
Closed	Open	Closed	Open	Closed	Open	3267Ω	126.65°F	52.58°C	131.06°F	55.03°C
Closed	Open	Closed	Open	Closed	Closed	3109Ω	129.04°F	53.91°C	133.66°F	56.48°C
Closed	Open	Closed	Closed	Open	Open	2957Ω	131.47°F	55.26°C	136.31°F	57.95°C
Closed	Open	Closed	Closed	Open	Closed	2799Ω	134.15°F	56.75°C	139.24°F	59.58°C
Closed	Open	Closed	Closed	Closed	Open	2648Ω	136.89°F	58.27°C	142.23°F	61.24°C
Closed	Open	Closed	Closed	Closed	Closed	2490Ω	139.95°F	59.97°C	145.57°F	63.09°C
Closed	Closed	Open	Open	Open	Open	2326Ω	143.37°F	61.87°C	149.30°F	65.17°C
Closed	Closed	Open	Open	Open	Closed	2168Ω	146.93°F	63.85°C	153.20°F	67.33°C
Closed	Closed	Open	Open	Closed	Open	2017Ω	150.64°F	65.91°C	157.24°F	69.58°C
Closed	Closed	Open	Open	Closed	Closed	1859Ω	154.87°F	68.26°C	161.87°F	72.15°C
Closed	Closed	Open	Closed	Open	Open	1707Ω	159.35°F	70.75°C	166.77°F	74.87°C
Closed	Closed	Open	Closed	Open	Closed	1549Ω	164.53°F	73.63°C	172.43°F	78.01°C
Closed	Closed	Open	Closed	Closed	Open	1398Ω	170.09°F	76.71°C	178.50°F	81.39°C
Closed	Closed	Open	Closed	Closed	Closed	1240Ω	176.70°F	80.39°C	185.72°F	85.40°C
Closed	Closed	Closed	Open	Open	Open	1086Ω	184.16°F	84.53°C	193.88°F	89.93°C
Closed	Closed	Closed	Open	Open	Closed	928Ω	193.22°F	89.57°C	203.78°F	95.43°C
Closed	Closed	Closed	Open	Closed	Open	777Ω	203.75°F	95.42°C	215.27°F	101.82°C
Closed	Closed	Closed	Open	Closed	Closed	619Ω	217.71°F	103.17°C	230.50°F	110.28°C
Closed	Closed	Closed	Closed	Open	Open	467Ω	235.83°F	113.24°C	250.22°F	121.24°C
Closed	Closed	Closed	Closed	Open	Closed	309Ω	264.14°F	128.97°C	280.98°F	138.32°C
Closed	Closed	Closed	Closed	Closed	Open	158Ω	313.75°F	156.53°C	333.58°F	167.54°C
Closed	Closed	Closed	Closed	Closed	Closed	0Ω				

This table defines the output resistances for the BAPI BA/DS6R-10K. The resistance outputs have been changed into equivalent temperatures for the 10K-2 and 10K-3 thermistors. The resistors that define the output resistance are precision units with ±1% uncertainties. Temperature accuracies are ±0.4°F (±0.22°C) at the low equivalent temperatures and ±2.8°F (±1.56°C) at the high equivalent temperatures.

BAPI does not warranty the suitability of these outputs for your particular application. After connecting the BA/DS6R-10K to your controller be sure to test all switch combinations for proper decoding.

An Excel file of this table is available from BAPI upon request.

Specifications subject to change without notice.

**Diagnostics**

- Power LED D2 does not light
- Check to see that the BA/DS6R-10K is firmly inserted into the backplane
 - Check to see if the power cable is firmly inserted into the backplane.
 - Check to see if the power supply is turned on and working correctly
- Improper output resistance
- Check to see if the output connector is plugged into the correct position.
 - Recheck which LEDs are on, and recalculate the expected output resistance.
- Switch LED does not light when switch is closed
- Check to see if the switch connector is plugged into the correct position.
 - Check switch for proper operation
 - Remove switch wiring from connector and replace with a shorted plug, LED should light.

Specifications

Power Voltage	10 to 42 VDC 20 to 26 VAC
Power Current	70mA maximum DC 2.4VA maximum AC
Switch Voltage	7VDC
Switch Current	10mA
Output Resistance	Less than 30 Ω (All switches closed) 9.806 K Ω (All switches open)

Note: the DS6R may be powered by the BAPI VC75, VC100, VC350, VC2700-STM, PS17 or PS17CB. Contact your BAPI representative for details.

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