

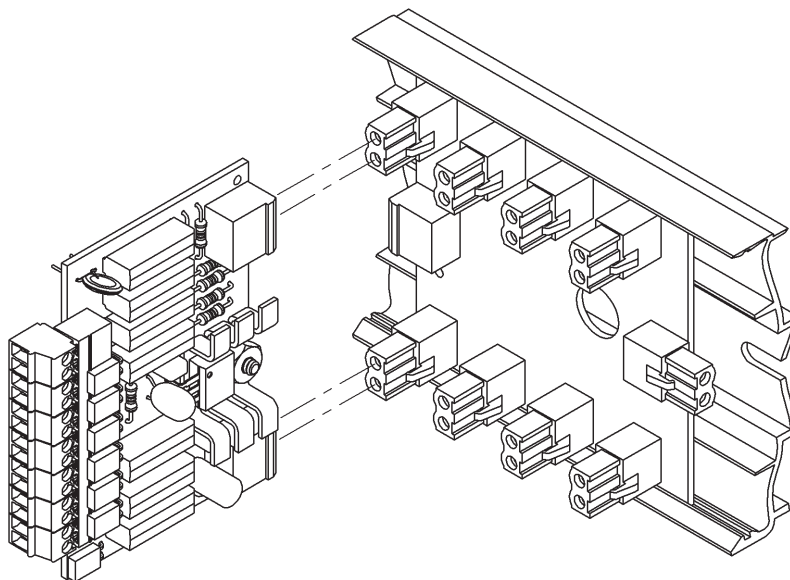
Overview

The DS6R plugs into the BP2, BP4 or BP8 backplane. The DS6R monitors six dry switch closure devices and provides one resistive output to the controller. Each switch closure subtracts a precise resistance from 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 troubleshooting.

Mounting

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

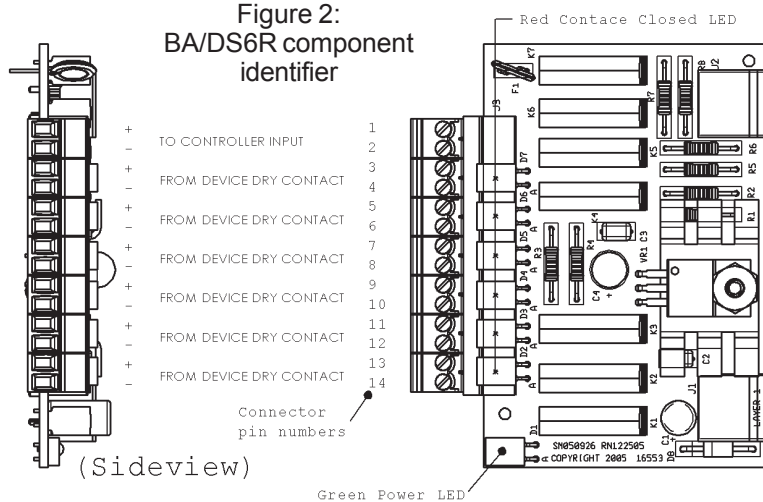
Figure 1:
DS6R plugging into a
BP4 Backplane



Termination

The switch inputs that the DS6R monitors are dry contacts isolated from other circuits. The switch circuits on the DS6R module provide 10 mA sealing current at an open circuit voltage of 5 VDC. Carefully check the specifications on the external switches for proper operation at these sealing current levels.

Figure 2:
BA/DS6R 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
Analogue output resistance	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 29.505KΩ as shown in Table 1 at right and in the chart on page 3.

As indicated in the chart, if switches 1, 2 and 5 are closed, the output resistance is $29.505K\Omega - 15K\Omega - 7.5K\Omega - 931\Omega = 6.074K\Omega$.

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

Table 1: Output Resistance

Circuit	Subtraction from Output Resistance
1	15KΩ (±1%)
2	7.5KΩ (±1%)
3	3.74KΩ (±1%)
4	1.87KΩ (±1%)
5	931Ω (±1%)
6	464Ω (±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 30980

Yes.....Go to Step 3

No.....Go to Step 9 (END)

Step 3. Is the value of Rin < 14750

Yes.....Switch 1 = Closed or On.

No.....Switch 1 = Open or Off.

Rin2 = Rin. Go to Step 4.

Rin2 = Rin - 15000

Step 4. Is the value of Rin2 < 7250

Yes.....Switch 2 = Closed or On.

No.....Switch 2 = Open or Off.

Rin3 = Rin2. Go to Step 5.

Rin3 = Rin2 - 7500

Step 5. Is the value of Rin3 < 3515

Yes.....Switch 3 = Closed or On.

No.....Switch 3 = Open or Off.

Rin4 = Rin3. Go to Step 6.

Rin4 = Rin3 - 3740

Step 6. Is the value of Rin4 < 1645

Yes.....Switch 4 = Closed or On.

No.....Switch 4 = Open or Off.

Rin5 = Rin4. Go to Step 7.

Rin5 = Rin4 - 1870

Step 7. Is the value of Rin5 < 714

Yes.....Switch 5 = Closed or On.

No.....Switch 5 = Open or Off.

Rin6 = Rin5. Go to Step 8.

Rin6 = Rin5 - 931

Step 8. Is the value of Rin6 < 250

Yes.....Switch 6 = Closed or On.

No.....Switch 6 = Open or Off

Go to Step 9.

Step 9. END



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	29505Ω	35.59°F	1.99°C	31.97°F	-0.01°C
Open	Open	Open	Open	Open	Closed	29041Ω	36.16°F	2.31°C	32.59°F	0.33°C
Open	Open	Open	Open	Closed	Open	28574Ω	36.73°F	2.63°C	33.22°F	0.68°C
Open	Open	Open	Open	Closed	Closed	28110Ω	37.32°F	2.96°C	33.86°F	1.03°C
Open	Open	Open	Closed	Open	Open	27635Ω	37.93°F	3.30°C	34.52°F	1.40°C
Open	Open	Open	Closed	Open	Closed	27171Ω	38.54°F	3.64°C	35.18°F	1.77°C
Open	Open	Open	Closed	Closed	Open	26704Ω	39.17°F	3.98°C	35.86°F	2.15°C
Open	Open	Open	Closed	Closed	Closed	26240Ω	39.80°F	4.33°C	36.55°F	2.53°C
Open	Open	Closed	Open	Open	Open	25765Ω	40.47°F	4.70°C	37.27°F	2.93°C
Open	Open	Closed	Open	Open	Closed	25301Ω	41.13°F	5.07°C	37.99°F	3.33°C
Open	Open	Closed	Open	Closed	Open	24834Ω	41.80°F	5.45°C	38.73°F	3.74°C
Open	Open	Closed	Open	Closed	Closed	24370Ω	42.49°F	5.83°C	39.48°F	4.15°C
Open	Open	Closed	Closed	Open	Open	23895Ω	43.21°F	6.23°C	40.26°F	4.59°C
Open	Open	Closed	Closed	Open	Closed	23431Ω	43.93°F	6.63°C	41.04°F	5.02°C
Open	Open	Closed	Closed	Closed	Open	22964Ω	44.67°F	7.04°C	41.84°F	5.47°C
Open	Open	Closed	Closed	Closed	Closed	22500Ω	45.42°F	7.46°C	42.66°F	5.92°C
Open	Closed	Open	Open	Open	Open	22005Ω	46.25°F	7.92°C	43.56°F	6.42°C
Open	Closed	Open	Open	Open	Closed	21541Ω	47.04°F	8.35°C	44.41°F	6.90°C
Open	Closed	Open	Open	Closed	Open	21074Ω	47.85°F	8.81°C	45.30°F	7.39°C
Open	Closed	Open	Open	Closed	Closed	20610Ω	48.68°F	9.27°C	46.20°F	7.89°C
Open	Closed	Open	Closed	Open	Open	20135Ω	49.55°F	9.75°C	47.15°F	8.42°C
Open	Closed	Open	Closed	Open	Closed	19671Ω	50.43°F	10.24°C	48.10°F	8.94°C
Open	Closed	Open	Closed	Closed	Open	19204Ω	51.33°F	10.74°C	49.08°F	9.49°C
Open	Closed	Open	Closed	Closed	Closed	18740Ω	52.26°F	11.25°C	50.09°F	10.05°C
Open	Closed	Closed	Open	Open	Open	18265Ω	53.23°F	11.79°C	51.14°F	10.63°C
Open	Closed	Closed	Open	Open	Closed	17801Ω	54.21°F	12.34°C	52.21°F	11.23°C
Open	Closed	Closed	Open	Closed	Open	17334Ω	55.22°F	12.90°C	53.31°F	11.84°C
Open	Closed	Closed	Open	Closed	Closed	16870Ω	56.26°F	13.48°C	54.43°F	12.46°C
Open	Closed	Closed	Closed	Open	Open	16395Ω	57.35°F	14.09°C	55.63°F	13.13°C
Open	Closed	Closed	Closed	Open	Closed	15931Ω	58.46°F	14.70°C	56.83°F	13.79°C
Open	Closed	Closed	Closed	Closed	Open	15464Ω	59.61°F	15.34°C	58.08°F	14.49°C
Open	Closed	Closed	Closed	Closed	Closed	15000Ω	60.80°F	16.00°C	59.37°F	15.20°C
Closed	Open	Open	Open	Open	Open	14505Ω	62.10°F	16.72°C	60.79°F	15.99°C
Closed	Open	Open	Open	Open	Closed	14041Ω	63.38°F	17.43°C	62.17°F	16.76°C
Closed	Open	Open	Open	Closed	Open	13574Ω	64.71°F	18.17°C	63.62°F	17.57°C
Closed	Open	Open	Open	Closed	Closed	13110Ω	66.08°F	18.93°C	65.11°F	18.40°C
Closed	Open	Open	Closed	Open	Open	12635Ω	67.55°F	19.75°C	66.71°F	19.28°C
Closed	Open	Open	Closed	Open	Closed	12171Ω	69.04°F	20.58°C	68.33°F	20.18°C
Closed	Open	Open	Closed	Closed	Open	11704Ω	70.61°F	21.45°C	70.03°F	21.13°C
Closed	Open	Open	Closed	Closed	Closed	11240Ω	72.24°F	22.36°C	71.81°F	22.12°C
Closed	Open	Closed	Open	Open	Open	10765Ω	73.99°F	23.33°C	73.71°F	23.17°C
Closed	Open	Closed	Open	Open	Closed	10301Ω	75.79°F	24.33°C	75.66°F	24.26°C
Closed	Open	Closed	Open	Closed	Open	9834Ω	77.69°F	25.38°C	77.73°F	25.41°C
Closed	Open	Closed	Open	Closed	Closed	9370Ω	79.69°F	26.49°C	79.90°F	26.61°C
Closed	Open	Closed	Closed	Open	Open	8895Ω	81.85°F	27.69°C	82.26°F	27.92°C
Closed	Open	Closed	Closed	Open	Closed	8431Ω	84.09°F	28.94°C	84.69°F	29.27°C
Closed	Open	Closed	Closed	Closed	Open	7964Ω	86.50°F	30.28°C	87.31°F	30.73°C
Closed	Open	Closed	Closed	Closed	Closed	7500Ω	89.05°F	31.69°C	90.09°F	32.27°C
Closed	Closed	Open	Open	Open	Open	7005Ω	91.98°F	33.32°C	93.27°F	34.04°C
Closed	Closed	Open	Open	Open	Closed	6541Ω	94.94°F	34.97°C	96.50°F	35.83°C
Closed	Closed	Open	Open	Closed	Open	6074Ω	98.18°F	36.77°C	100.03°F	37.79°C
Closed	Closed	Open	Open	Closed	Closed	5610Ω	101.69°F	38.72°C	103.85°F	39.92°C
Closed	Closed	Open	Closed	Open	Open	5135Ω	105.65°F	40.91°C	108.16°F	42.31°C
Closed	Closed	Open	Closed	Open	Closed	4671Ω	109.93°F	43.30°C	112.83°F	44.90°C
Closed	Closed	Open	Closed	Closed	Open	4204Ω	114.77°F	45.98°C	118.10°F	47.83°C
Closed	Closed	Open	Closed	Closed	Closed	3740Ω	120.23°F	49.02°C	124.05°F	51.14°C
Closed	Closed	Closed	Open	Open	Open	3265Ω	126.68°F	52.60°C	131.09°F	55.05°C
Closed	Closed	Closed	Open	Open	Closed	2801Ω	134.12°F	56.73°C	139.21°F	59.56°C
Closed	Closed	Closed	Open	Closed	Open	2334Ω	143.19°F	61.77°C	149.11°F	65.06°C
Closed	Closed	Closed	Open	Closed	Closed	1870Ω	154.56°F	68.09°C	161.53°F	71.96°C
Closed	Closed	Closed	Closed	Open	Open	1395Ω	170.20°F	76.78°C	178.63°F	81.46°C
Closed	Closed	Closed	Closed	Open	Closed	931Ω	193.04°F	89.46°C	203.57°F	95.32°C
Closed	Closed	Closed	Closed	Closed	Open	464Ω	236.25°F	113.47°C	250.69°F	121.49°C
Closed	Closed	Closed	Closed	Closed	Closed	0Ω				

This table defines the output resistances for the BAPI BA/DS6R. 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 temperature and ±0.7°F (±0.39°C) at the high equivalent temperatures.

BAPI does not warranty the suitability of these outputs for your particular application. After connecting the BA/DS6R 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.



Troubleshooting

POSSIBLE PROBLEMS:

Power LED D2 does not light

Improper output resistance

Switch LED does not light when switch is closed

POSSIBLE SOLUTIONS:

- Check to see that the DS6R 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

- Check to see if the output connector is plugged into the correct position.
- Recheck which LEDs are on, and recalculate the expected output resistance.

- 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	70 mA maximum DC 2.4 VA maximum AC
Switch Voltage	5 VDC
Switch Current	10 mA
Output Resistance	Less than 30Ω (All switches closed) 29.505KΩ (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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