User Guide

Power Distribution Module
(PDM – 735000)

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1. Introduction

This user guide will introduce the Vansco Power Distribution Module (PDM) and describe its use in a typical vehicular electrical system. The aim of the document is to supply a full specification for the PDM and allow the reader enough insight to use the PDM to its full potential.

2. PDM Module Description

The PDM is a general-purpose high current switch device for 12V or 24V vehicles. It is designed to take power in through two power cables (called bus bars) and distribute this power to pins on the output connector. The PDM is a solid state device with no electromechanical components. Two stage electronic fusing provides fast short circuit protection and slower over current protection. It mimics a fuse operation and allows for inrush currents without nuisance tripping. The solid state design is more robust than electromechanical designs because there are no physical contacts that wear.

The PDM also offers two low current bidirectional outputs that behave like single pole, single throw (SPST) relays.

The PDM has 20 diagnostic LEDs that act as quick visual indicators of module faults such as short circuits or absence of proper input signals. Please refer to the overlay drawing in section 6.3 for the location of the diagnostic LEDs.

The PDM is analog in nature and contains no microprocessors or firmware/software. The enable inputs are designed to drive the appropriate outputs directly when external signals are applied to the enable inputs. There is no user programming required. No diagnostics are available through a network such as J1939.

3. PDM Hardware

The PDM can be described as four functional blocks:

High Side Outputs 1-6
High Side Outputs 7-12
Solid State Relay 1 (SSR1)
Solid State Relay 2 (SSR2)

3.1 High Side Outputs 1-6

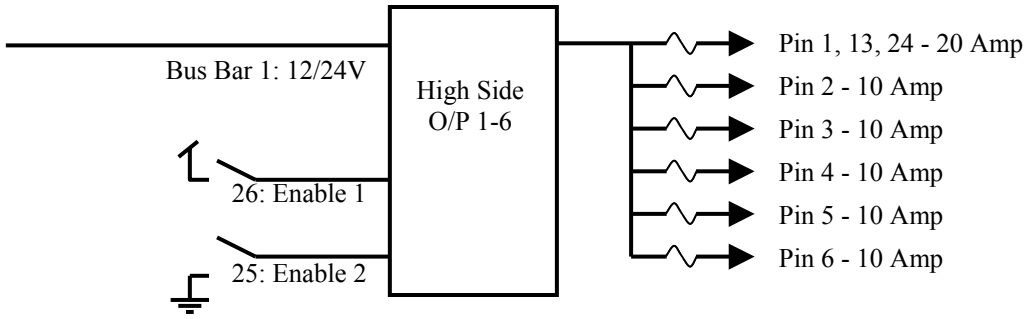
3.1.1 Inputs

High Side Outputs 1-6 are all turned on at the same time by one of two input enables. Enable+ is asserted when it is switched to battery. Enable- is asserted when it is switched to ground. The enables are fed into an OR circuit. The outputs will be turned on when Enable+ OR Enable- is asserted (Pin 26 OR Pin 25).

3.1.2 Outputs

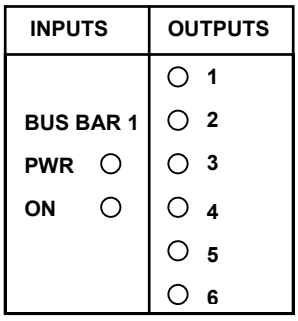
Outputs 1-6 are six individual High Side Outputs. They act as a switch to battery. When the inputs are asserted, they connect the voltage on Bus Bar 1 to the output pins 1-6. High side outputs typically drive power to vehicle loads such as bulbs, motors, solenoids and switch-to-battery signal inputs on ECMs.

Each output is protected with two stage electronic fusing that provides fast short circuit protection and slower over current protection. Each output will sustain its rated output of 10A or 20A. If current draw rises above this for approximately 1 second, the output will turn off. In the event of a short circuit, current rises very rapidly. If the current rises above 42 Amps the output will shut off within 5 milliseconds. To reset an output from a protected state, the enables must be removed and reapplied.



3.1.3 LED Diagnostics

Outputs 1-6 have 8 LEDs for diagnostics. These are located on the housing overlay.



PWR LED is lit when power is applied to Bus Bar 1
ON LED is lit when the outputs are enabled
(Enable+, or Enable-)
O/P1-6 LEDs are lit when power is being delivered to the load. If the ON LED is lit and one or more of the OUTPUT LEDs are not lit, then an output fault has been detected and the output has been turned off.

3.2 High Side Outputs 7-12

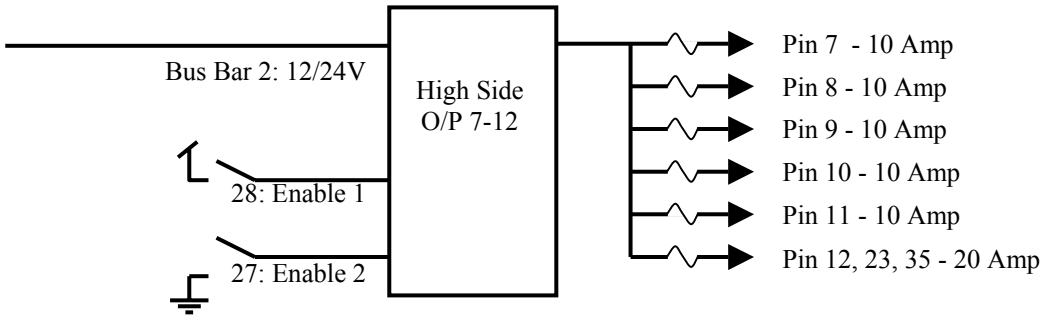
3.2.1 Inputs

High Side Outputs 7-12 are all turned on at the same time by one of two input enables. Enable+ is asserted when it is switched to battery. Enable- is asserted when it is switched to ground. The enables are fed into an OR circuit. The outputs will be turned on when Enable+ OR Enable- is asserted (Pin 28 OR Pin 27).

3.2.2 Outputs

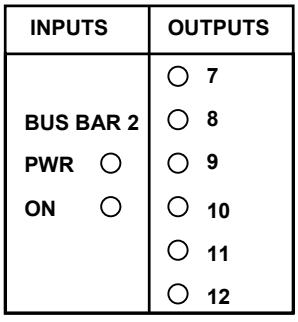
Outputs 7-12 are six individual High Side Outputs. They act as a switch to battery. When the inputs are asserted, they connect the voltage on Bus Bar 1 to the output pins 7-12.

Each output is protected with two stage electronic fusing that provides fast short circuit protection and slower over current protection. Each output will sustain its rated output of 10A or 20A. If current draw rises above this for approximately 1 second, the output will turn off. In the event of a short circuit, current rises very rapidly. If the current rises above 42 Amps the output will shut off within 5 milliseconds. To reset an output from a protected state, the enables must be removed and reapplied.



3.2.3 LED Diagnostics

Outputs 7-12 have 8 LEDs for diagnostics. These are located on the housing overlay.



PWR is lit when power is applied to Bus Bar 2
ON is lit when the outputs are enabled.
(Enable+, or Enable-)
O/P 7-12 are lit when power is being delivered to the load. If the ON LED is lit and one or more of the OUTPUT LEDs are not lit, then an output fault has been detected and the output has been turned off.

3.3 Solid State Relay 1 (SSR1)

3.3.1 Inputs

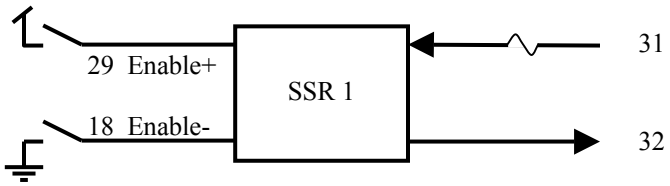
Enables for SSR1 operate like the connections to a SPST relay coil. The Enable+ input (pin 29) must be connected to battery and the Enable- input (pin 18) must be connected to a ground to energize the "coil" and close the "contacts" (pin 31 and 32). Either the Enable+ or the Enable- can be switched in and out to turn the solid state relay ON or OFF.

3.3.2 Outputs

The SSR1 outputs behave in the same manner as a pair of SPST relay contacts. They are not a switch-to-ground or a switch-to-battery. The SSR1 outputs are bi-directional. They allow current to flow in either direction through the circuit. The SSR1 output can be used to switch high side, low side, or low-level signals.

When the output of SSR1 is enabled (Enable+ switched to battery AND Enable- Switched to ground) the contacts will close and allow current to flow between pins 31 and 32. The SSR1 Output has a current sense circuit that monitors the current and disconnects the relay when current exceeds 6 amps in either direction.

SSR1 has short circuit and over current protection. Short circuit protection occurs at approximately 20A and will cause the faulted output to turn off in less than 5 milliseconds. Over current protection occurs at 6A with a turn-off time of approximately 1 second. To reset an output from a protected state, one of the enables must be removed and reapplied.



3.3.3 LED Diagnostics

SSR1 has 2 LEDs for diagnostics. These are located on the housing overlay.

INPUTS	OUTPUTS
SSR1 ○	○ 13
SSR 2 ○	○ 14

SSR1 is lit when Enable+ is HI and Enable– is LO
The coil is energized; the contacts should be closed.
O/P 13 is lit whenever the SSR1 LED is on (contacts closed).
If it is not, then an output fault has been detected.

3.4 Solid State Relay 2 (SSR2)

3.4.1 Inputs

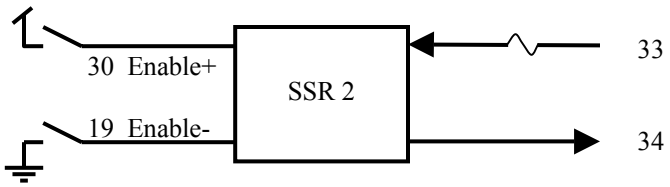
Enables for SSR2 operate like the connections to a SPST relay coil. The Enable+ input (pin 30) must be connected to battery and the SSR1 Enable- input (pin 19) must be connected to a ground to energize the "coil" and close the "contacts" (pin 33 and 34). Either the Enable+ or the Enable- can be switched in and out to turn the solid state relay ON or OFF.

3.4.2 Outputs

The SSR2 outputs behave in the same manner as a pair of SPST relay contacts. They are not a switch-to-ground or a switch-to-battery. The SSR2 outputs are bi-directional. They allow current to flow in either direction through the circuit. The SSR2 output can be used to switch high side, low side, or low-level signals.

When the output of SSR2 is enabled (Enable+ switched to battery AND Enable- switched to ground) the contacts will close and allow current to flow between pins 33 and 34. The SSR2 Output has a current sense circuit that monitors the current and disconnects the relay when current exceeds 6 amps in either direction.

SSR2 has short circuit and over current protection. Short circuit protection occurs at approximately 20A and will cause the faulted output to turn off in less than 5 milliseconds. Over current protection occurs at 6A with a turn-off time of approximately 1 second. To reset an output from a protected state, one of the enables must be removed and reapplied.



3.4.3 LED Diagnostics

SSR2 has 2 LEDs for diagnostics. These are located on the housing overlay.

INPUTS	OUTPUTS
SSR1 ○	○ 13
SSR 2 ○	○ 14

SSR2 is lit when Enable+ is HI and Enable– is LO
The coil is energized; the contacts should be closed.
O/P 14 is lit whenever the SSR1 LED is on (contacts closed).
If it is not, then an output fault has been detected.

3.5 Summary & Notes

The following table summarizes the inputs and outputs available on the PDM.

Pin #	Input Name	Input Function	O/P Affected	Pin #
26	Enable O/P 1-6	Turns on O/P 1-6 when switched to battery	1-6	1-6, 13, 24
25	/Enable O/P 1-6	Turns on O/P 1-6 when switched to ground	1-6	1-6, 13, 24
28	Enable O/P 7-12	Turns on O/P 7-12 when switched to battery	7-12	7-12, 23, 35
27	/Enable O/P 7-12	Turns on O/P 7-12 when switched to ground	7-12	7-12, 23, 35
29	SSR1 Enable+	Turns on SSR1 when switched to battery AND SSR1 Enable – is switched to ground.	SSR1	31, 32
18	SSR1 Enable-	Turns on SSR1 when switched to battery AND SSR1 Enable + is switched to ground.	SSR1	31, 32
30	SSR2 Enable+	Turns on SSR2 when switched to battery AND SSR2 Enable – is switched to ground.	SSR2	33, 34
19	SSR2 Enable-	Turns on SSR2 when switched to battery AND SSR2 Enable + is switched to ground.	SSR2	33, 34

Many vehicle electrical systems have two batteries connected in series. This arrangement results in two voltage potentials available to drive loads: 12V (regulated to 14V) and 24V (regulated to 28V). The bus bar power inputs on the PDM are designed so that they can be connected to two different voltages at the same time. A PDM can have both bus bars connected to 12V, both connected to 24V, or one of each (12V and 24V).

Outputs can be wired in parallel to create a combined output with greater current potential. Caution should be exercised when doing this. One output may conduct more current due to small differences in resistance of the individual circuits.

Outputs 1 and 12 have multiple contacts and are rated for 20 amps. At least 2 contacts must be used when drawing more than 10 amps. (3 preferred).

4. PDM Setup and Use

4.1 Power Considerations

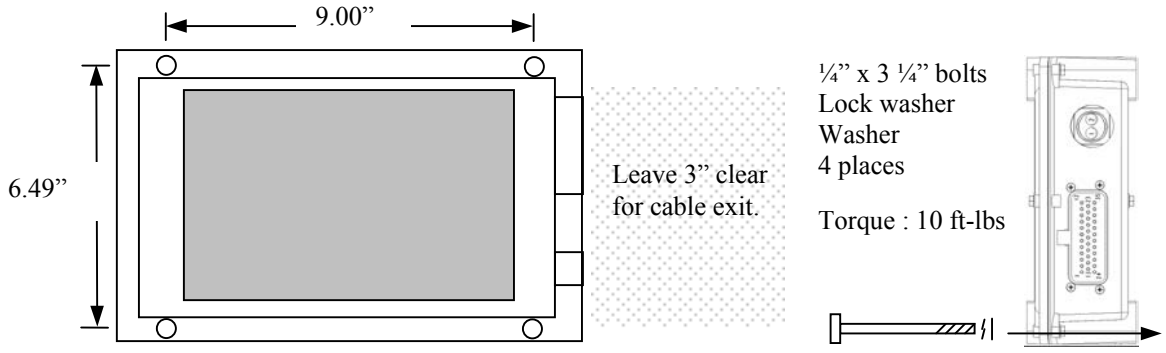
The internal circuits of the high side outputs and the SSR circuits are powered from the bus bars. You must have bus bar voltage for the solid state relays to operate.

Bus bar power can be very high in some applications. The PDM bus bars can draw more than 50 amps of continuous current. Appropriate fuse and cable size must be selected to handle this current. Wire size should be rated to reduce voltage drops at the bus bar input during short circuit conditions that could affect short circuit protection. Each PDM bus bar should be fused with a 75 Amp fuse or breaker as close to the battery as possible. AWG 8 wire should be used to run power from the fuse to the PDM.

Note: One of the following pins 14, 15, 16 or 17 must be Grounded in order to establish a current flow to ground for the internal logic circuits.

4.2 Mounting

The PDM should be mounted using four ¼"-20 x 3¼" hexagonal cap screw, plated. Bolt holes spacing is 6.49" x 9.00". The bolts should be torqued to 10 ft-lbs. A ¼"x½" flat washer and ¼" helical spring lock washer should be used to ensure that the bolts do not loosen. The bolt hole pattern is shown in the following diagram.



5. PDM Specifications

5.1 Electrical/Environmental

The PDM was designed to meet the requirements of SAE J1455 (Joint SAE/TMC Recommended Environmental Practices For Electronic Equipment Design (for a 24V System). Please refer to this standard for full details.

General (+25°C unless otherwise stated):

	MIN	NOM	MAX	UNIT
Operating Voltage	7.5	28	32	V
Operating Over Voltage for 5 minutes	-	48	-	V
Output Current bus bar 1	-	-	60	A
Output Current bus bar 2	-	-	60	A
Output Current per module	-	-	108	A
Operating Temperature	-40	-	+85	°C
Storage Temperature	-55	-	+125	°C

INPUTS (+25°C unless otherwise stated):

	MIN	NOM	MAX	UNIT
Total # of Inputs	-1	8	-	-
# Active Low Enable Inputs	-	2	-	-
# Active High Enable Inputs	-	2	-	-
# SSR Enable Inputs	-	4	-	-
Voltage on Input pin[1]	0	-	32	V

OUTPUTS (+25 °C unless otherwise stated):

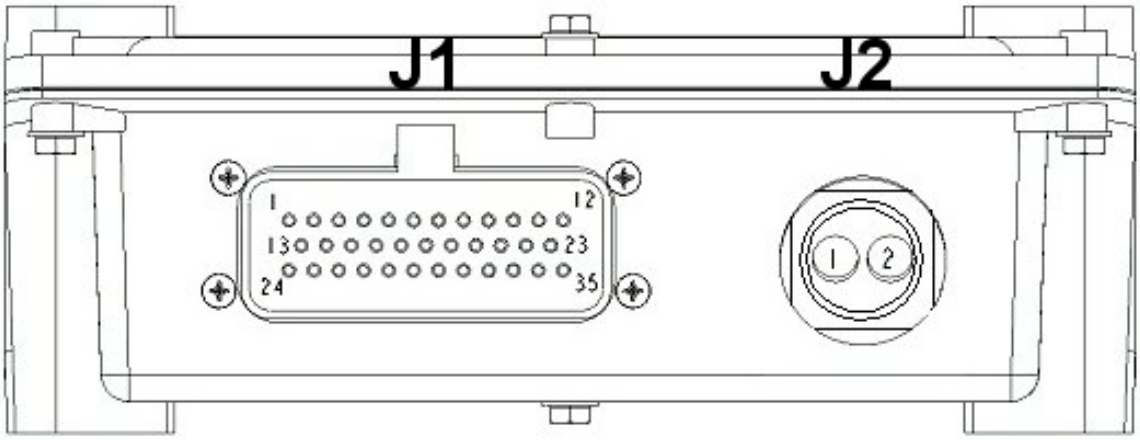
	MIN	NOM	MAX	UNIT
# High Side Outputs Total	-	12	-	-
# High Side Outputs on Busbar 1	-	6	-	-
# High Side Outputs on Busbar 2	-	6	-	-
# Bidirectional SSR Outputs	-	2	-	-
High Side Voltage[1]	7.5	-	32	V
Bidirectional Voltage	7.5	-	32	V
High Side Current (outputs 1 and 12)	0	-	20	A
High Side Current (remaining outputs)	0	-	10	A
Bidirectional Current	0	-	4	A
High Side short cct trip point	-	42	-	A
Bidirectional short cct trip point	-	20	-	A
Short cct trip time (outputs 1 and 12)	-	-	30	ms
Short cct trip time (remaining outputs)			15	ms
High Side over current trip (O/P 1 and 12)	-	25	-	A
High Side over current trip (remaining)	-	12	-	A
Bidirectional over current trip	-	6	-	A
Over current trip time	0.5	1	4	s
High Side reverse battery protection[2]	-	-	32	V
Bidirectional reverse battery protection	-	-	32	V

[1] Inputs and outputs are protected against 48V over voltage, load dump/inductive load transients (SAE J1455), ESD transients (SAE J1455) and reverse battery connection (SAE J1455)

[2] High side reverse battery protection turns all outputs ON. In this state short circuit and over current protection is not operational.

6. PDM Footprint and Pinouts

6.1 Connectors



J1 : 35 Pin PDM Connector: AMPSEAL WHITE P/N 1-776163-2
Mating Connector: AMPSEAL WHITE P/N 776164-2
Mating Terminals: AMPSEAL P/N 770854-3

Pin #	Pin Function	Output Bus Bar
1	Output 1A	1
2	Output 2	1
3	Output 3	1
4	Output 4	1
5	Output 5	1
6	Output 6	1
7	Output 7	2
8	Output 8	2
9	Output 9	2
10	Output 10	2
11	Output 11	2
12	Output 12A	2
13	Output 1B	1

Pin #	Pin Function	Output Bus Bar
19	SSR2 Enable-	N/A
20	Reserved CAN Shld	N/A
21	Reserved CAN+	N/A
22	Reserved CAN-	N/A
23	Output 12B	2
24	Output 1C	1
25	/Enable Outputs 1-6	N/A
26	Enable Outputs 1-6	N/A
27	/Enable Outputs 7-12	N/A
28	Enable Outputs 7-12	N/A
29	SSR1 Enable+	N/A
30	SSR2 Enable+	N/A
31	SSR1 Contact1	N/A

14	Ground	N/A
15	Ground	N/A
16	Ground	N/A
17	Ground	N/A
18	SSR1 Enable-	N/A

32	SSR1 Contact2	N/A
33	SSR2 Contact1	N/A
34	SSR2 Contact2	N/A
35	Output 12C	2

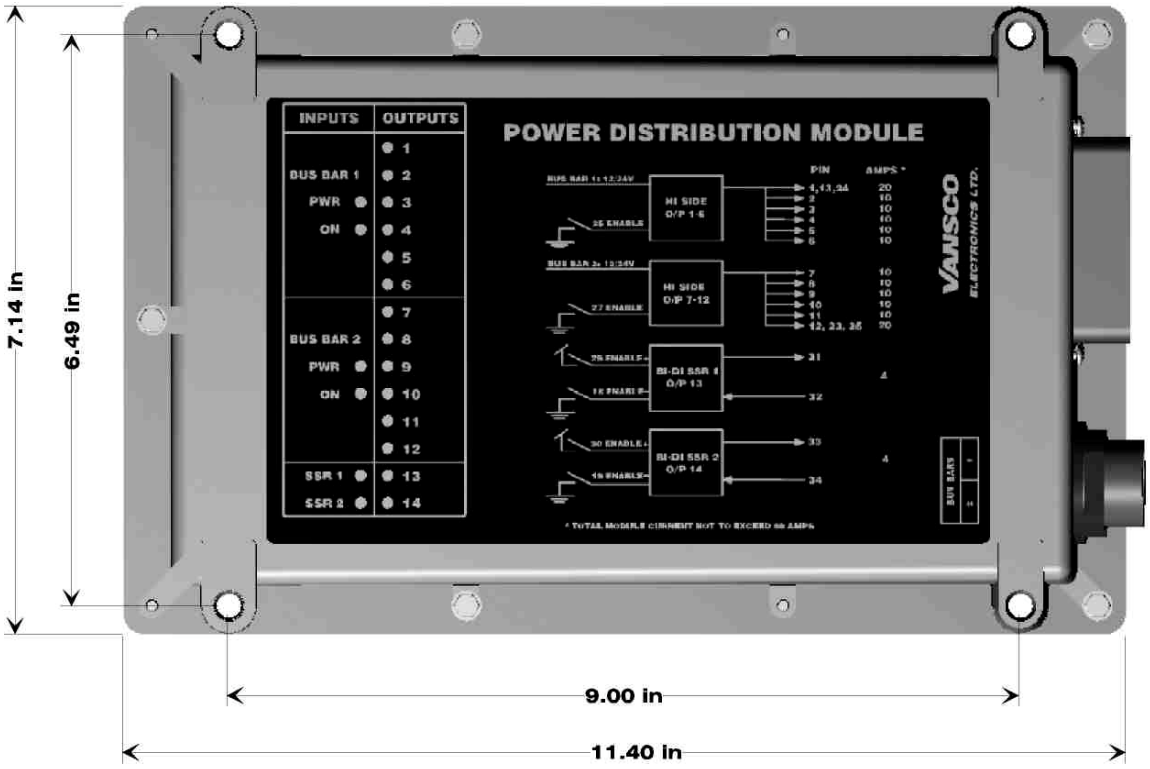
Note: Some models of the PDM may be available with J1 as a Black Connector
35 Pin PDM Connector: AMPSEAL BLACK P/N 1-776163-2
Mating Connector: AMPSEAL BLACK P/N 776164-1

J2 : 2 Pin PDM Connector:	ITT CANON P/N 121583-0027
Mating Connector:	121583-0025
Mating Terminals (AWG 6):	031-8646-003 (AWG 6)
Mating Terminals (AWG 8):	031-8646-002 (AWG 8)
Wire Seals (AWG 6):	351-8697-008
Wire Seals (AWG 8):	351-8697-007
Strain Relief:	217-8516-010

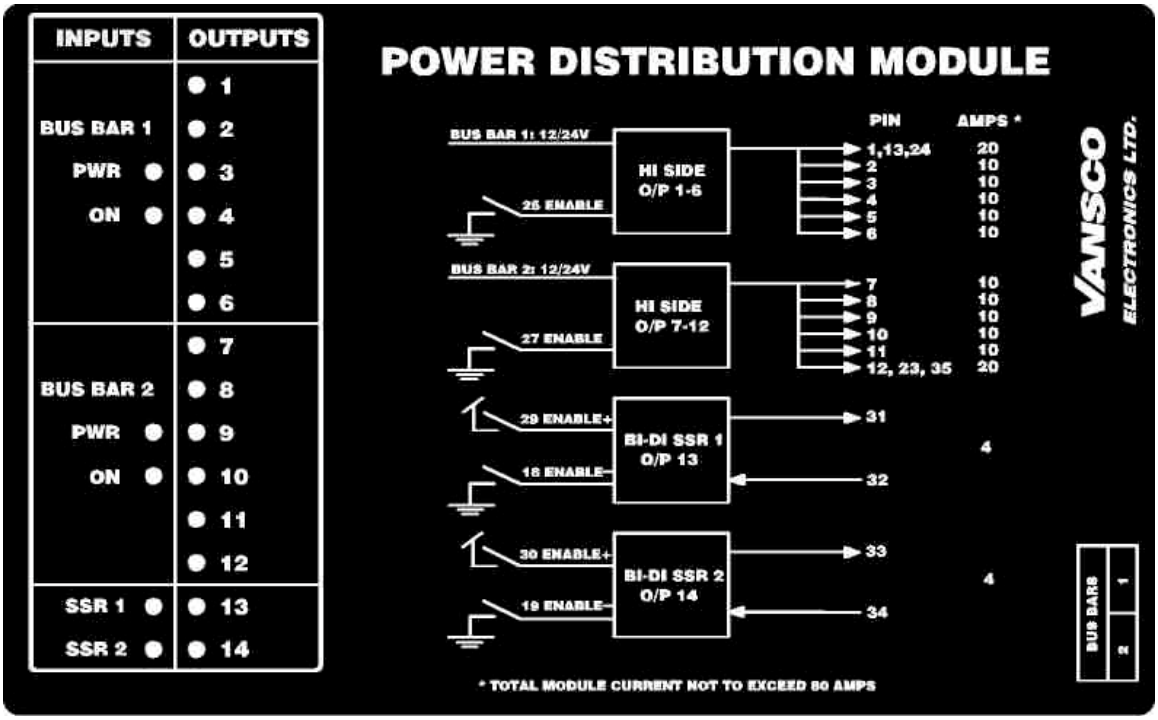
Pin #	Pin Function
1	Bus bar for outputs 1 to 6
2	Bus bar for outputs 7 to 12

Connector part numbers were valid when this manual was created.
Please check manufacturer website for updates

6.2 Physical Dimensions



6.3 Overlay



Note: Enable+ is not shown on the overlay.

7. Appendix 1

7.1 Standard Warranty

VANSCO WARRANTY & SERVICE AGREEMENT

Vansco Electronics Ltd. warrants to the original purchaser that, if any part of the product proves defective in material or workmanship within one year from the date of purchase, and is returned to Vansco within 30 days after the defect is discovered, Vansco will (at its option) repair or replace said part. Product shipped to Vansco freight prepaid will be returned freight prepaid. Product shipped to Vansco freight collect will be returned freight collect.

LIMITATIONS:

Warranty does not apply to parts or products that are damaged as a result of misuse, neglect, accident or fire, or of lightning, flooding or other acts of God, or by improper installation or maintenance, of which Vansco will be the sole judge. Warranty does not apply to parts or products that have been modified by an unauthorized party that has in Vansco's judgment affected their performance or reliability. Warranty does not apply if the part or product substantially fulfills the performance specifications.

EXCLUSION OF OTHER WARRANTIES AND REMEDIES:

THIS WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES EITHER EXPRESS OR IMPLIED BY OPERATION OF LAW OR OTHERWISE. THE SOLE AND EXCLUSIVE REMEDY AGAINST VANSCO SHALL BE FOR THE REPAIR OR REPLACEMENT OF DEFECTIVE PARTS AS PROVIDED, AND NO OTHER REMEDY (INCLUDING BUT NOT LIMITED TO INCIDENTAL, SPECIAL, INJURY TO PERSONS OR PROPERTY, OR ANY OTHER LOSS) SHALL BE AVAILABLE. Vansco neither assumes nor authorizes anyone to assume for it any other obligation or liability in connection with said part or product.

SERVICE

Out of warranty service is available through Vansco or Vansco authorized and trained warranty & service depots.