



Class 1

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TECHNICAL PRODUCT DATASHEET

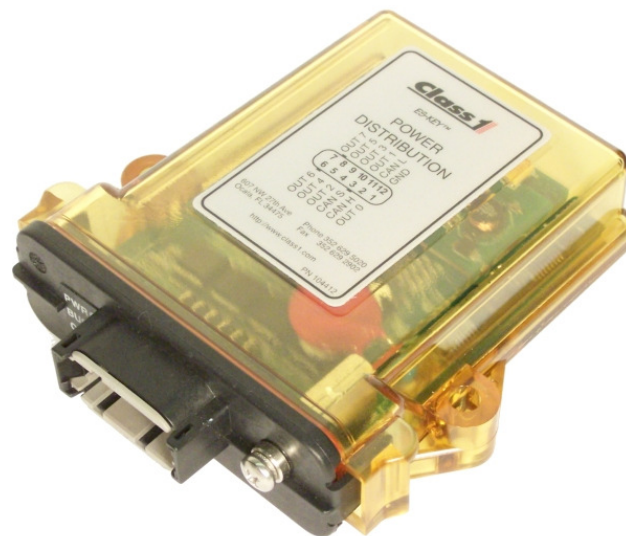
ES-Key Power Distribution Module (PDM)


P/N 104434 (8 output without open circuit detection)

P/N 118680 (8 output)


P/N 104528 (6 output, 2 input)

P/N 104529 (4 output, 4 input)




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1. Revision Log

Rev	Date	Changes
1.00	5-3-2006	Initial requirements
1.10	8-26-2008	Added part number 118680 for PDM 8 with open circuit ("no-load") detection, 104434 (revision E and higher) no longer have "no-load" detection

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2. Module Overview

2.1. Scope

The Power Distribution Module (PDM) is an ES-Key™ node designed to allow a designer the ability to utilize the product within the ES-Key™ electrical system network. The module responds to commands to activate its physical outputs and reports the state of its inputs back to the network. There are three types of PDMs available: 8 outputs, no inputs (p/n 104434, p/n 118680 – “no-load” detection), 6 outputs, 2 inputs (p/n 104528), 4 outputs, 4 inputs (p/n 104529).

2.2. Selectable polarity inputs (p/n 104528 and p/n 104529)

The module has digital inputs that can be configured for either positive or ground input polarity (see section 2.2.1). An input is flagged as ACTIVE in the ES-Key database when the voltage level of the input is within the required range (refer to the table below).

Input Polarity	Input requirement
Positive	Input is flagged as ACTIVE when its voltage is greater than 60% of supply power.
Ground	Input is flagged as ACTIVE when its voltage is less than 40% of supply power.

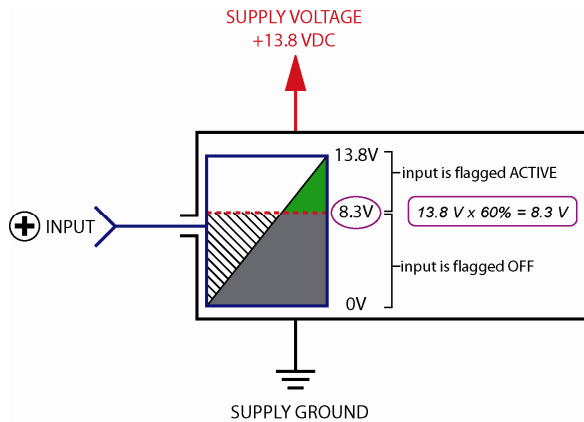


Figure 1. Positive input example.

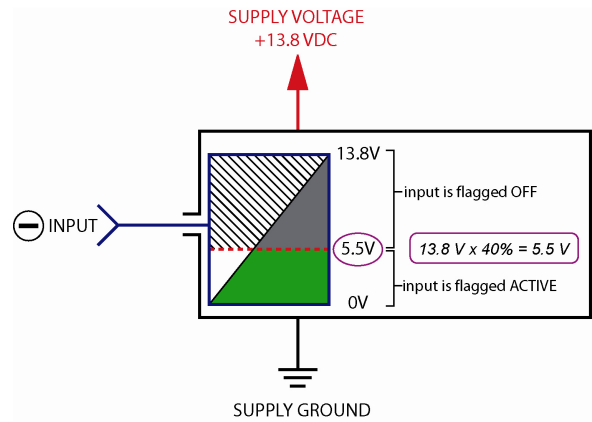



Figure 2. Ground input example.

The examples above illustrate the voltage range required for an input to be flagged as ACTIVE to the ES-Key database. The voltage range is based on the polarity of the input (positive or ground) and the voltage level of the supply voltage. In figure 1 the input is a positive polarity type, the supply voltage is 13.8 VDC, and the valid voltage range for the input is 8.3 VDC and greater (less than 8.3 VDC flags the input as OFF).

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2.2.1. Input polarity selection

The polarity of each input is selected by setting the polarity jumpers (located inside of the case) to the desired positions. The jumpers are labeled 0 through 3 (0 and 1 for p/n 104528) and are directly related to the physical inputs. Each switch can be placed in the POS (positive) or NEG (ground) position.

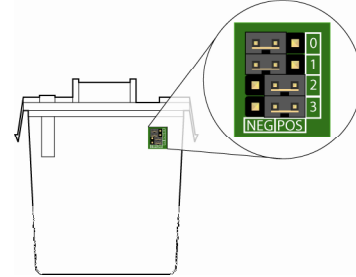


Figure 3. Input polarity selection jumpers.

2.3. Solid State Outputs

Each output of the PDM utilizes solid state, fully protected high-side drivers that feature overload protection, current limitation, open load detection and transient protection. These output drivers replace the requirement of a relay and circuit breaker.

High Current Rating. Each of the high current outputs is capable of supplying 7.5 Amps continuously on all outputs at 85° Celsius.

Circuit Protection/Breaker. If output current exceeds 8 Amps nominal the output will automatically turn off. The module will attempt to connect the output to the load two more times at 5 second intervals. If the output is still overloaded, then it will remain off.

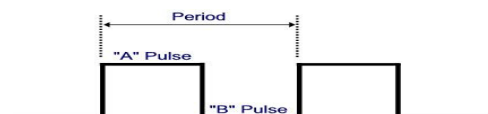
The "circuit breaker" feature can be reset (or reinitialized) by de-activating the output through the ES-Key™ network - in the distributed network, any number of switches may be configured to deactivate the particular output. When the output is turned back on, the over current tests will be initiated. When an output switch is in an over current situation, a fault is logged to the USM and data logger. The system fault light will be activated while any over current situation exists.


Circuit Activation Detection/Diagnostics. **[Not applicable for p/n 104434 revision E and higher]** When an output driver is intended to be ON, and a load is not detected at the output, the system will generate a network tag to indicate open circuit ("no-load") for the specific output. The tag can be used by the ES-Key™ network for diagnostics or indication. The minimum load current to activate this tag is 4 amps nominal. During an over current shutdown condition, this tag will be active for the particular output. Likewise, a separate tag is generated to indicate that a load is operating within the proper limits (see section 2.5).

2.3.1. Flash outputs

The PDM outputs have the capability to flash at two flash periods: 150 Hz and 75 Hz. Output memory spaces 12 - 19 control the output flash feature and output memory space 20 controls the flash period (see section 2.5). Activate an outputs flash output (output memory space 12-19) to begin flashing the output. The physical output (output memory space 0-7) should be OFF.

Outputs 0 - 3 flash on the "A" pulse, and outputs 4 - 7 flash on the "B" pulse. The period length is determined by the flash rate. This logic makes implementing alternating flashers quite simple.



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When the physical output is ON and its flash output is ON the flash occurs on the opposite pulse. For example, output 1 normally flashes on the “A” pulse, but when its flash output (output memory space 13) and its physical output (output memory space 1) are activated together the output flashes on the “B” pulse.

Output memory space 0	Output memory space 12	Result
OFF	OFF	Physical output 0 (pin 1) is OFF
ON	OFF	Physical output 0 (pin 1) is ON
OFF	ON	Physical output 0 (pin 1) is flashing on the “A” pulse
ON	ON	Physical output 0 (pin 1) is flashing on the “B” pulse

Output memory space 4	Output memory space 16	Result
OFF	OFF	Physical output 4 (pin 5) is OFF
ON	OFF	Physical output 4 (pin 5) is ON
OFF	ON	Physical output 4 (pin 5) is flashing on the “B” pulse
ON	ON	Physical output 4 (pin 5) is flashing on the “A” pulse

2.3.2. Pulse Width Modulate (PWM) outputs

Any output can be controlled ON at reduced power by activating its PWM output (see section 2.5).

Output memory space 0	Output memory space 24	Result
OFF	OFF	Physical output 0 (pin 1) is OFF
ON	OFF	Physical output 0 (pin 1) is ON
OFF	ON	Physical output 0 (pin 1) is ON at 60% PWM
ON	ON	Physical output 0 (pin 1) is ON (no PWM)

For example, as shown in the table above, if the output and PWM are activated the load for a physical output will be ON. To set the physical output to PWM (reduced power) mode it is necessary only to shed the primary output address for the desired output.

2.4. Module type and address

The PDM is recognized by the ES-Key Professional software as a *Power Module* (device type 0).

The module address is selected by rotating the address switch to the desired value.

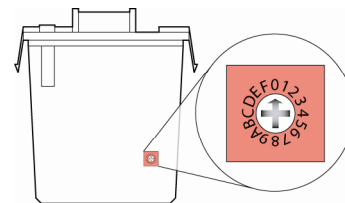



Figure 4. Address switch.

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2.5. Input/output memory space

The PDM uses standard ES-Key defined input and output memory space. The polarity selectable inputs are mapped into the input space (p/n 104528 and p/n 104529 only), and the outputs are mapped into the output space.

INPUT MEMORY SPACE	
INPUT	DESCRIPTION
0	Physical input 0 ⁽¹⁾ ⁽²⁾
1	Physical input 1 ⁽¹⁾ ⁽²⁾
2	Physical input 2 ⁽²⁾
3	Physical input 3 ⁽²⁾
4	<i>reserved</i>
5	<i>reserved</i>
6	<i>reserved</i>
7	<i>reserved</i>
8	Output 0 active tag
9	Output 1 active tag
10	Output 2 active tag
11	Output 3 active tag
12	Output 4 active tag
13	Output 5 active tag
14	Output 6 active tag
15	Output 7 active tag
16	<i>reserved</i>
17	<i>reserved</i>
18	<i>reserved</i>
19	<i>reserved</i>
20	Output 0 circuit open tag ⁽⁶⁾
21	Output 1 circuit open tag ⁽⁶⁾
22	Output 2 circuit open tag ⁽⁶⁾
23	Output 3 circuit open tag ⁽⁶⁾
24	Output 4 circuit open tag ⁽⁶⁾
25	Output 5 circuit open tag ⁽⁶⁾
26	Output 6 circuit open tag ⁽⁶⁾
27	Output 7 circuit open tag ⁽⁶⁾
28	<i>reserved</i>
29	<i>reserved</i>
30	<i>reserved</i>
31	<i>reserved</i>

OUTPUT MEMORY SPACE	
OUTPUT	LOCATION
0	Physical output 0
1	Physical output 1
2	Physical output 2
3	Physical output 3
4	Physical output 4 ⁽⁴⁾
5	Physical output 5 ⁽⁴⁾
6	Physical output 6 ⁽⁴⁾ ⁽⁵⁾
7	Physical output 7 ⁽⁴⁾ ⁽⁵⁾
8	<i>reserved</i>
9	<i>reserved</i>
10	<i>reserved</i>
11	<i>reserved</i>
12	Flash output 0 ⁽³⁾
13	Flash output 1 ⁽³⁾
14	Flash output 2 ⁽³⁾
15	Flash output 3 ⁽³⁾
16	Flash output 4 ⁽³⁾ ⁽⁴⁾
17	Flash output 5 ⁽³⁾ ⁽⁴⁾
18	Flash output 6 ⁽³⁾ ⁽⁴⁾ ⁽⁵⁾
19	Flash output 7 ⁽³⁾ ⁽⁴⁾ ⁽⁵⁾
20	Flash period (ON = 150Hz, OFF = 75Hz)
21	<i>reserved</i>
22	<i>reserved</i>
23	<i>reserved</i>
24	PWM output 0
25	PWM output 1
26	PWM output 2
27	PWM output 3
28	PWM output 4 ⁽⁴⁾
29	PWM output 5 ⁽⁴⁾
30	PWM output 6 ⁽⁴⁾ ⁽⁵⁾
31	PWM output 7 ⁽⁴⁾ ⁽⁵⁾

⁽¹⁾ These inputs are available for 6 output, 2 input PDM (p/n 104528)


⁽²⁾ These inputs are available for 4 output, 4 input PDM (p/n 104529)

⁽³⁾ The flash rate of these outputs is configured with the "flash period" located in output memory space 20.

⁽⁴⁾ These outputs are not available with the 4 output, 4 input PDM (p/n 104529)

⁽⁵⁾ These outputs are not available with the 6 output, 2 input PDM (p/n 104528)

⁽⁶⁾ These inputs ("no-load") are not available with the 8 PDM (p/n 104434 revision E and higher)

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3. Connector Description

The module has one connector and one power input stud. The following definitions apply:

3.1. 8 output (p/n 104434 and p/n 118680)

Mating connector: Deutsch DTM06-12SA (GRAY)		
Mating sockets: 0462-201-20141		
Wedge lock: WM12S		Recommended wire gage: 18-24 AWG

PIN	CIRCUIT	DESCRIPTION
1	Output 0	Digital output (positive polarity, 7.5A)
2	CAN High	ES-Key CAN, SAE J1939 Proprietary, 250 kbits/S
3	CAN Shield	ES-Key CAN, SAE J1939 Proprietary, 250 kbits/S
4	Output 2	Digital output (positive polarity, 7.5A)
5	Output 4	Digital output (positive polarity, 7.5A)
6	Output 6	Digital output (positive polarity, 7.5A)
7	Output 7	Digital output (positive polarity, 7.5A)
8	Output 5	Digital output (positive polarity, 7.5A)
9	Output 3	Digital output (positive polarity, 7.5A)
10	Output 1	Digital output (positive polarity, 7.5A)
11	CAN Low	ES-Key CAN, SAE J1939 Proprietary, 250 kbits/S
12	Supply -	Module supply (vehicle ground)

Mating terminal: #10 ring terminal		
Recommended wire gage: 8 AWG (for maximum load on the 8 outputs)		

PIN	CIRCUIT	DESCRIPTION
STUD	Supply +	Module supply (+9VDC...+32VDC)

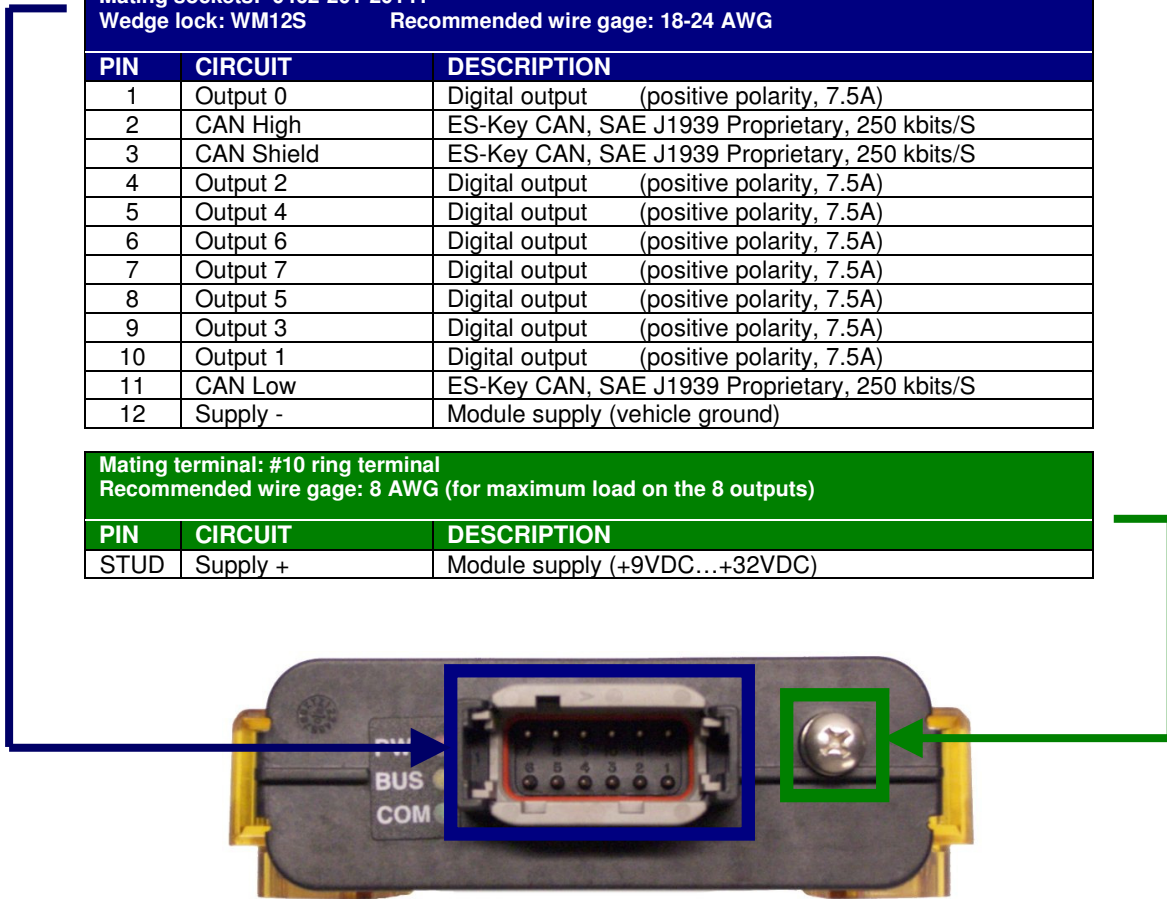



Figure 5. Connector identification.

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3.2. 6 output, 2 input (p/n 104528)

Mating connector: Deutsch DTM06-12SA (GRAY) Mating sockets: 0462-201-20141 Wedge lock: WM12S Recommended wire gage: 18-24 AWG		
PIN	CIRCUIT	DESCRIPTION
1	Output 0	Digital output (positive polarity, 7.5A)
2	CAN High	ES-Key CAN, SAE J1939 Proprietary, 250 kbits/S
3	CAN Shield	ES-Key CAN, SAE J1939 Proprietary, 250 kbits/S
4	Output 2	Digital output (positive polarity, 7.5A)
5	Output 4	Digital output (positive polarity, 7.5A)
6	Input 1	Digital input (polarity selectable)
7	Input 0	Digital input (polarity selectable)
8	Output 5	Digital output (positive polarity, 7.5A)
9	Output 3	Digital output (positive polarity, 7.5A)
10	Output 1	Digital output (positive polarity, 7.5A)
11	CAN Low	ES-Key CAN, SAE J1939 Proprietary, 250 kbits/S
12	Supply -	Module supply (vehicle ground)

Mating terminal: #10 ring terminal Recommended wire gage: 10 AWG (for maximum load on the 6 outputs)		
PIN	CIRCUIT	DESCRIPTION
STUD	Supply +	Module supply (+9VDC...+32VDC)

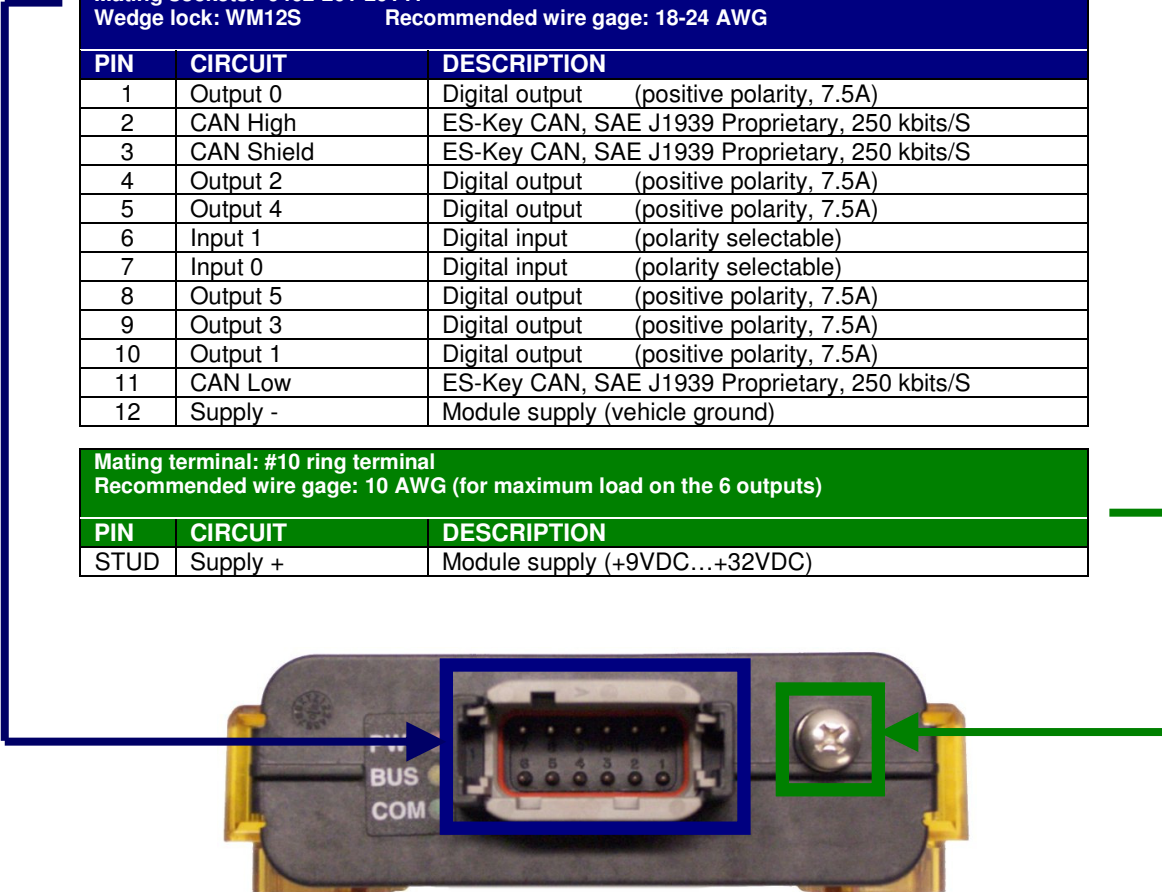



Figure 6. Connector identification.

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3.3. 4 output, 4 input (p/n 104528)

Mating connector: Deutsch DTM06-12SA (GRAY)		
Mating sockets: 0462-201-20141		
Wedge lock: WM12S Recommended wire gage: 18-24 AWG		
PIN	CIRCUIT	DESCRIPTION
STUD	Supply +	Module supply (+9VDC...+16VDC)
1	Output 0	Digital output (positive polarity, 7.5A)
2	CAN High	ES-Key CAN, SAE J1939 Proprietary, 250 kbits/S
3	CAN Shield	ES-Key CAN, SAE J1939 Proprietary, 250 kbits/S
4	Output 2	Digital output (positive polarity, 7.5A)
5	Input 3	Digital input (polarity selectable)
6	Input 1	Digital input (polarity selectable)
7	Input 0	Digital input (polarity selectable)
8	Input 2	Digital input (polarity selectable)
9	Output 3	Digital output (positive polarity, 7.5A)
10	Output 1	Digital output (positive polarity, 7.5A)
11	CAN Low	ES-Key CAN, SAE J1939 Proprietary, 250 kbits/S
12	Supply -	Module supply (vehicle ground)

Mating terminal: #10 ring terminal		
Recommended wire gage: 12 AWG (for maximum load on the 4 outputs)		
PIN	CIRCUIT	DESCRIPTION
STUD	Supply +	Module supply (+9VDC...+32VDC)

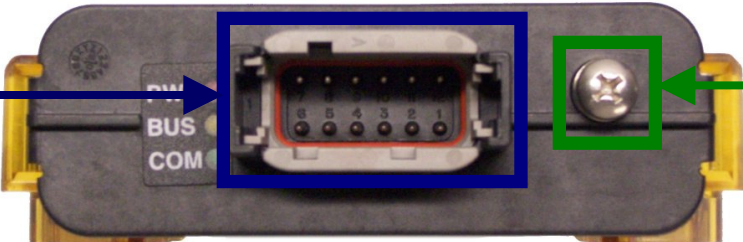



Figure 7. Connector identification.

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4. Mounting

4.1. Mounting dimensions

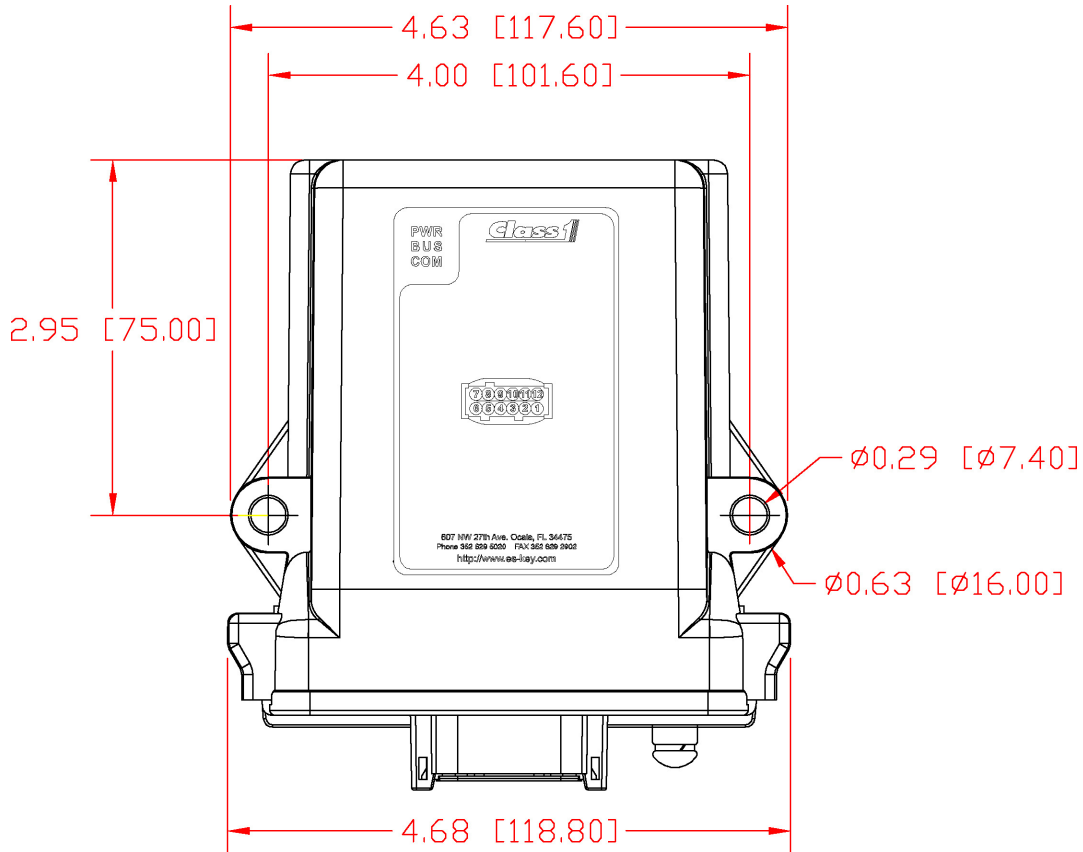


Figure 8. Mounting dimensions – inches [millimeters].

4.2. Mounting notes

When mounting the module vertically, make certain the connector is pointed down so as to eliminate the possibility of standing water in the connector.

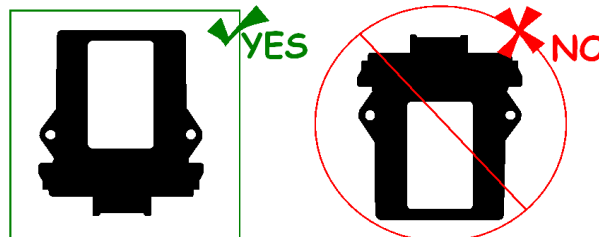



Figure 9. Vertical mounting requirement.

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5. Diagnostics

5.1. Diagnostic LEDs

The Power Distribution Module has 3 LEDs which are viewable between the two connectors.

PWR - +5VDC logic power
BUS - +9...+32VDC Module power
COM - Module status indicator

The COM LED indicates the module's CAN communication status.

On Solid
 Module on-line

Flashing slow (2Hz)
 CAN bus okay, but device not recognized or configured for the network.

Flashing fast (8Hz)
 CAN bus error, no communications or not connected.



Figure 10. Diagnostic LEDs.

6. Technical details

Product category	ES-KEY
Voltage range	+9VDC...+32VDC
Power consumption	Supply+ input (stud)
@13.8VDC	41mA ⁽¹⁾
@27.6VDC	49mA ⁽¹⁾
Output current capability	7.5A per output
Input current draw	2mA per input (positive or ground polarity)
Operational temperature range	-40°C...+85°C
Environmental range	IP 67
CAN specification	SAE J1939 proprietary, 250 Kbits/second
Protection	Reverse voltage protection (stud and pin 12)
	CAN buses protected to 24V
	ESD voltage protected to SAE J1113 specification for heavy duty trucks (24V)
	Transient voltage protected to SAE J1113 specification for heavy duty trucks (24V)
	Load dump voltage protected to SAE J1113 specification for heavy duty trucks (24V)
Dimensions (W x L x H) in inches [mm]	Outputs protected for short circuit and thermal overload
	4.680 [118.80] x 5.240 [133.10] x 1.420 [36.07]

⁽¹⁾ Does not include current draw due to outputs connected to external loads.