1100 - 2100 WATT MBH SERIES DC/DC CONVERTERS

Features

- Delivers up to 2100 Watts
- Efficiency up to 97%
- Groundbreaking low profile compact 9.0”L x 6.5”W x 1.25”H package
- Only 3.3 lbs
- No minimum load required
- Fixed frequency operation at 400 kHz
- Fully protected (OTP, OCP, OVP, UVLO)
- Auto Recovery
- Input reverse polarity protection
- High Reliability
- Made in USA
- 5 Year Warranty

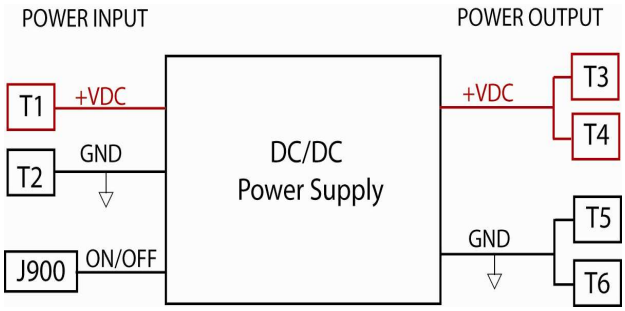
Description

The Calex 2100 Watt MBH DC/DC Converter series are high efficiency non-isolated dc/dc switched-mode single output converters specifically designed for both military and commercial mobile applications. This series is packaged in an unprecedented low profile 9.0”L x 6.5”W x 1.25”H mechanically enclosed package weighing only 3.3lbs making the unit ideal for harsh shock and vibration environments. The MBH series integrates high efficiency dc/dc converters with input transient and reverse polarity protection circuitry. The DC/DC Converters are designed with a wide operational temperature range and are well suited for a high temperature environment.

The MBH Series DC/DC converter’s high efficiency and high power density are accomplished through the use of high-efficiency synchronous rectification technology, advanced electronic circuitry, packaging and thermal design resulting in highly reliable product. The MBH series operates at a fixed switching frequency and follows conservative component de-rating guidelines. The converter is designed and manufactured in the USA and is backed by Calex’s 5 year warranty.

Model	Input Range VDC		Vout VDC	Iout ADC
	Min	Max		
13S28.40MBH	10	16	28	40
13S28.60MBH	10	16	28	60
13S28.75MBH	10	16	28	75

1. Designed to meet MIL-STD-810G for functional shock and vibration. The unit must be properly secured to the interface medium (PCB/Chassis) by use of the mounting holes of the unit.



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ON/OFF FUNCTION:

There are two connectors J900 and J901 that are used to implement the ON/OFF function.
Connector J900 has three contacts: BAT+, ON/OFF and BAT-. BAT+ is connected to the voltage after the input reverse protections circuit: without input power present there is a diode between +12Vin DC (Terminal T1) and BAT+. BAT- is internally connected to GND (Terminal T2). It is provided if two wire connections is used for ON/OFF.
Connector J901 has three pins: GND (pin1), ON/OFF (pin 2) and PULL-UP (pin 3). PULL-UP pin is connected via a 7.5K resistor to BAT+.
There are several ways to enable and disable the converter via connectors J900 and J901.

Connector J901 with no jumper:
To enable converter voltage needs to be applied across ON/OFF pin and BAT- pin of J900 connector, or ON/OFF pin is connected to BAT+ pin.
To disable converter the ON/OFF pin is connected to BAT- pin of J900 or left open.

Connector J901 with jumper:
Jumper between pin 1 and pin 2 – converter is disabled and ON/OFF pin is shorted to GND. **DO NOT use J900!**
Jumper between pin 2 and pin 3 – converter is enabled when J900 is not used, i.e ON/OFF pin of J900 is left open or connected to BAT+ pin. Converter is disabled when the ON/OFF pin is connected to BAT- pin on J900.

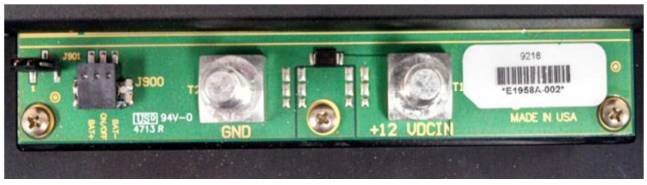

Figure 2. Input terminals and ON/OFF connector J900

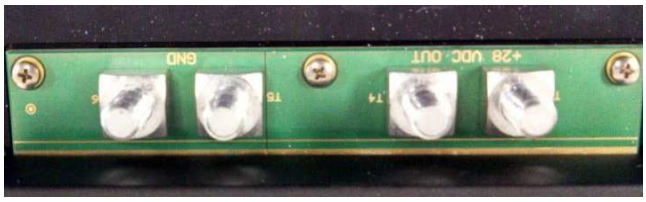

Figure 3. Output Terminals

1100 - 2100 WATT MBH SERIES DC/DC CONVERTERS

13S28.40MBH Specifications

Conditions: T_A=25ºC, V_{IN} = 12VDC, unless otherwise noted; not required to operate below 10V.

Input Parameter	Conditions	Min	Typ	Max	Units
Absolute Maximum Ratings					
Input Voltage					VDC
Non-Operating	Protected from reverse polarity on the input terminals	-20		30	VDC
Operating		10		16	VDC
Voltage at ON/OFF input pin		0		30	VDC
Input Characteristics					
Operating Input Voltage Range		10	13.2	16	VDC
Maximum Input Current	P_O = 1100W @ 10VDC in		115	118	A
Start-up Voltage	V_{IN}		9.5		VDC
Shut Down Voltage	V_{IN}		9.0		VDC
Input Stand-by Current	V_{IN} = 12V, converter disabled		1.25	3	mA
Input No load Current	V_{IN} = 12V, converter enabled		1.25	1.5	A

Output Parameter	Conditions	Min	Typ	Max	Units
Output Characteristics					
Output Voltage Set Point	V_{IN} = 12V, I_O = 30.5A	28.0	28.5	30.0	VDC
Output Regulation Over Line and Load			±80	±120	mV
Total Output Voltage Range	Over sample, line, load, temperature & life	27.6		29.3	VDC
Output Voltage Ripple and Noise Peak to Peak RMS	20MHz Bandwidth, 10 µF tantalum + 1 µF ceramic Full Load Resistive Full Load Resistive	 300 60		 500 100	 mV_{P-P} mV_{RMS}
Operating Output Current Range		0		40	A
Output DC Current Limit Inception	Non-Latching	44	48	56	A
Output DC Current Limit Shutdown	Output Voltage at which converter shuts down		22		VDC
Peak Short-Circuit Current	Non-Latching, Startup into 10mΩ		75		ADC
Peak Short-Circuit Pulse Duration	Non-Latching, Startup into Short		16		ms
RMS Short-Circuit Current	Non-Latching, Startup into Short		TBD		A_{RMS}
Dynamic Response					
Load Change 20A - 36A - 20A	V_S=12V, Di/Dt=0.1 a/µs, 6ft. input cable AWG 1/0, 6 ft load cable		±1.9		VDC
Load Change 20A - 36A - 20A	V_S=12V, Di/Dt=0.1 a/µs, 20ft. input cable AWG 1/0, 6 ft load cable		±2.3		VDC
Load Change 20A - 36A - 20A	V_S=13.2V, Di/Dt=0.1 a/µs, 6ft. input cable AWG 1/0, 6 ft load cable		±2		VDC
	* See Note 2 below for definition of Vs * See Note 4 for further cable length considerations and dynamic response				
Setting Time	To within 1% Vout nom		500	1000	µs
Output Over-Voltage Protection	Non-Latching	32.7	34.8	37	VDC
Efficiency 100% Load 50% Load			 96 96.55		 % %

Note 1: Input and output voltages are measured at input and output terminals of the converter

Note 2: Vs - voltage at external power supply used for testing. V_{IN} < Vs due to voltage drop in input cable.

Note 3: All protections are non-latching. Once protection (OVP, OCP, input UVLO) are tripped converter enters into auto restart mode with 500 ms off time.

Note 4: Consult the factory for input cable length and Dynamic Response requirements that differ from the conditions specified above. Some vehicle applications for DC/DC converters may require cable lengths of up to 30 feet. In such cases the voltage drop caused by cable resistance (steady state) and cable inductance during transients must be accounted for to ensure stable operation of the DC/DC converter. In such cases where additional external capacitance is required for stable operation, it is recommended to add the external capacitance to the load side of the converter, as this is where most of the transients occur.

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13S28.60MBH Specifications

Conditions: T_a=25ºC, V_{in} = 12VDC, unless otherwise noted; not required to operate below 10V.

Input Parameter	Conditions	Min	Typ	Max	Units
Absolute Maximum Ratings					
Input Voltage					VDC
Non-Operating	Protected from reverse polarity on the input terminals	-20		30	VDC
Operating		10		16	VDC
Voltage at ON/OFF input pin		0		30	VDC
Input Characteristics					
Operating Input Voltage Range		10	13.2	16	VDC
Maximum Input Current	P_O = 1700W @ 10VDC in		176	180	A
Start-up Voltage	V_{IN}		9.5		VDC
Shut Down Voltage	V_{IN}		9.0		VDC
Input Stand-by Current	V_{IN} = 12V, converter disabled		1.25	3	mA
Input No load Current	V_{IN} = 12V, converter enabled		1.25	1.5	A

Output Parameter	Conditions	Min	Typ	Max	Units
Output Characteristics					
Output Voltage Set Point	V_{IN} = 12V, I_O = 30.5A	28.0	28.5	30.0	VDC
Output Regulation Over Line and Load			±80	±120	mV
Total Output Voltage Range	Over sample, line, load, temperature & life	27.6		29.3	VDC
Output Voltage Ripple and Noise Peak to Peak RMS	20MHz Bandwidth, 10 µF tantalum + 1 µF ceramic Full Load Resistive Full Load Resistive	 300 60		 500 100	 mV_{P-P} mV_{RMS}
Operating Output Current Range		0		60	A
Output DC Current Limit Inception	Non-Latching	66	72	84	A
Output DC Current Limit Shutdown	Output Voltage at which converter shuts down		22		VDC
Peak Short-Circuit Current	Non-Latching, Startup into 10mΩ		112		ADC
Peak Short-Circuit Pulse Duration	Non-Latching, Startup into Short		16		ms
RMS Short-Circuit Current	Non-Latching, Startup into Short		TBD		A_{RMS}
Dynamic Response					
Load Change 30A - 54A - 30A	V_S=12V, Di/Dt=0.1 a/µs, 6ft. input cable AWG 1/0, 6 ft load cable		±1.9		VDC
Load Change 30A - 54A - 30A	V_S=12V, Di/Dt=0.1 a/µs, 20ft. input cable AWG 1/0, 6 ft load cable		±2.3		VDC
Load Change 30A - 54A - 30A	V_S=13.2V, Di/Dt=0.1 a/µs, 6ft. input cable AWG 1/0, 6 ft load cable		±2		VDC
	* See Note 2 below for definition of Vs * See Note 4 for further cable length considerations and dynamic response				
Setting Time	To within 1% Vout nom		500	1000	µs
Output Over-Voltage Protection	Non-Latching	32.7	34.8	37	VDC
Efficiency 100% Load 50% Load			 96.5 97.0		 % %

Note 1: Input and output voltages are measured at input and output terminals of the converter

Note 2: Vs - voltage at external power supply used for testing. $V_{IN} < V_S$ due to voltage drop in input cable.

Note 3: All protections are non-latching. Once protection (OVP, OCP, input UVLO) are tripped converter enters into auto restart mode with 500 ms off time.

Note 4: Consult the factory for input cable length and Dynamic Response requirements that differ from the conditions specified above. Some vehicle applications for DC/DC converters may require cable lengths of up to 30 feet. In such cases the voltage drop caused by cable resistance (steady state) and cable inductance during transients must be accounted for to ensure stable operation of the DC/DC converter. In such cases where additional external capacitance is required for stable operation, it is recommended to add the external capacitance to the load side of the converter, as this is where most of the transients occur.

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1100 - 2100 WATT MBH SERIES DC/DC CONVERTERS

13S28.75MBH Specifications

Conditions: T_a=25ºC, V_{in} = 12VDC, unless otherwise noted; not required to operate below 10V.

Input Parameter	Conditions	Min	Typ	Max	Units
Absolute Maximum Ratings					
Input Voltage					VDC
Non-Operating	Protected from reverse polarity on the input terminals	-20		30	VDC
Operating		10		16	VDC
Voltage at ON/OFF input pin		0		30	VDC
Input Characteristics					
Operating Input Voltage Range		10	13.2	16	VDC
Maximum Input Current	P_O = 2100W @ 10VDC in		223	227	A
Start-up Voltage	V_{IN}		9.5		VDC
Shut Down Voltage	V_{IN}		9.0		VDC
Input Stand-by Current	V_{IN} = 12V, converter disabled		1.25	3	mA
Input No load Current	V_{IN} = 12V, converter enabled		1.25	1.5	A

Output Parameter	Conditions	Min	Typ	Max	Units
Output Characteristics					
Output Voltage Set Point	V_{IN} = 12V, I_O = 30.5A	28.0	28.5	30.0	VDC
Output Regulation Over Line and Load			±80	±120	mV
Total Output Voltage Range	Over sample, line, load, temperature & life	27.6		29.3	VDC
Output Voltage Ripple and Noise Peak to Peak RMS	20MHz Bandwidth, 10 µF tantalum + 1 µF ceramic Full Load Resistive Full Load Resistive	 300 60		 500 100	 mV_{P-P} mV_{RMS}
Operating Output Current Range		0		75	A
Output DC Current Limit Inception	Non-Latching	83	90	105	A
Output DC Current Limit Shutdown	Output Voltage at which converter shuts down		22		VDC
Peak Short-Circuit Current	Non-Latching, Startup into 10mΩ		140		ADC
Peak Short-Circuit Pulse Duration	Non-Latching, Startup into Short		16		ms
RMS Short-Circuit Current	Non-Latching, Startup into Short		15		Arms
Dynamic Response					
Load Change 37.5A - 67.5A - 37.5A	V_S=12V, Di/Dt=0.1 a/µs, 6ft. input cable AWG 1/0, 6 ft load cable		±1.9		VDC
Load Change 37.5A - 67.5A - 37.5A	V_S=12V, Di/Dt=0.1 a/µs, 20ft. input cable AWG 1/0, 6 ft load cable		±2.3		VDC
Load Change 37.5A - 67.5A - 37.5A	V_S=13.2V, Di/Dt=0.1 a/µs, 6ft. input cable AWG 1/0, 6 ft load cable		±2		VDC
	* See Note 2 below for definition of Vs * See Note 4 for further cable length considerations and dynamic response				
Setting Time	To within 1% Vout nom		500	1000	µs
Output Over-Voltage Protection	Non-Latching	32.7	34.8	37	VDC
Efficiency 100% Load 50% Load			 96.0 96.8		 % %

Note 1: Input and output voltages are measured at input and output terminals of the converter

Note 2: Vs - voltage at external power supply used for testing. $V_{IN} < V_S$ due to voltage drop in input cable.

Note 3: All protections are non-latching. Once protection (OVP, OCP, input UVLO) are tripped converter enters into auto restart mode with 500 ms off time.

Note 4: Consult the factory for input cable length and Dynamic Response requirements that differ from the conditions specified above. Some vehicle applications for DC/DC converters may require cable lengths of up to 30 feet. In such cases the voltage drop caused by cable resistance (steady state) and cable inductance during transients must be accounted for to ensure stable operation of the DC/DC converter. In such cases where additional external capacitance is required for stable operation, it is recommended to add the external capacitance to the load side of the converter, as this is where most of the transients occur.

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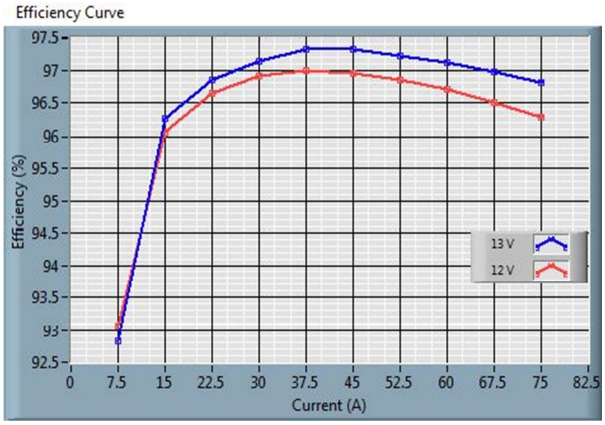
General Specifications					
Parameter	**Conditions**	**Min**	**Typ**	**Max**	**Units**
Switching Frequency			400		KHz
ON/OFF Control Converter ON Converter OFF	 Voltage at ON/OFF pin Voltage at ON/OFF pin	 8 0	12	 16 1.8	 VDC VDC
Turn-on Time					
From ON/OFF Control	Time from ON/OFF going high to Vo=90%V_{out}(NOM), Full Load (Resistive mode)	500	530	560	ms
By Input Voltage (ON/OFF=V_{in})	Time from V_{in} reaching UVLO threshold to Vo=90% V_{out} (NOM), Full Load (Resistive mode)	500	530	560	ms
Output Voltage Rise Time	Time from 10% to 90% V_{out} (NOM)		12		ms
Over Temperature Shutdown - OTP Base Plate Temperature	Non-Latching		100		ºC
OTP Restart Hysteresis	Measured on the PCB		10		ºC
Auto Restart Period			500		ms
Operating Surge Protection	100ms transient with 1msec rise time			30	VDC
Operating Temperature	At the top thermal interface Base Plate temperature	-40		95	ºC
Non-operating Temperature	Ambient Storage Temperature	-55		100	ºC
Connection Stud Torque			TBD		in lbs
Shock and Vibration	Designed to meet MIL-STD-810G for functional shock and vibration.				

Note 1: Input and output voltages are measured at input and output terminals of the converter
Note 2: Vs - voltage at external power supply used for testing. V_{in} < Vs due to voltage drop in input cable.
Note 3: All protections are non-latching. Once protection (OVP, OCP, input UVLO) are tripped converter enters into auto restart mode with 500 ms off time.

Curve for 13S28.75MBH



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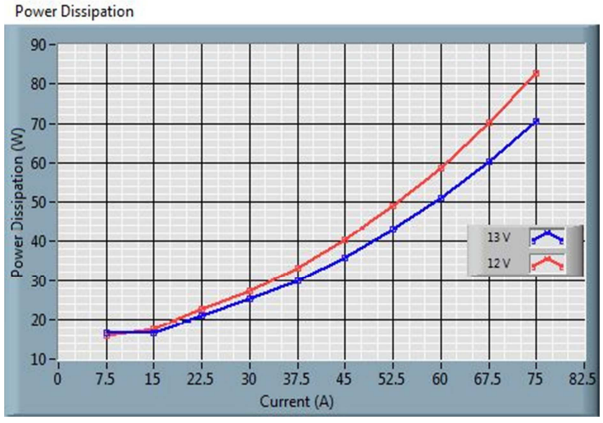

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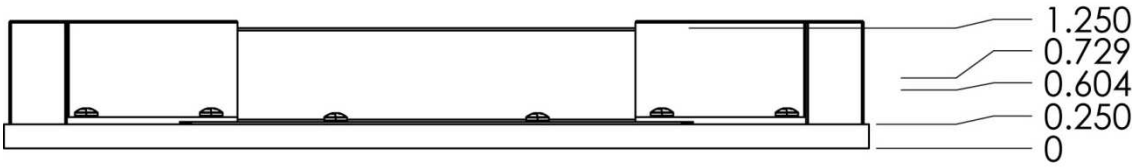
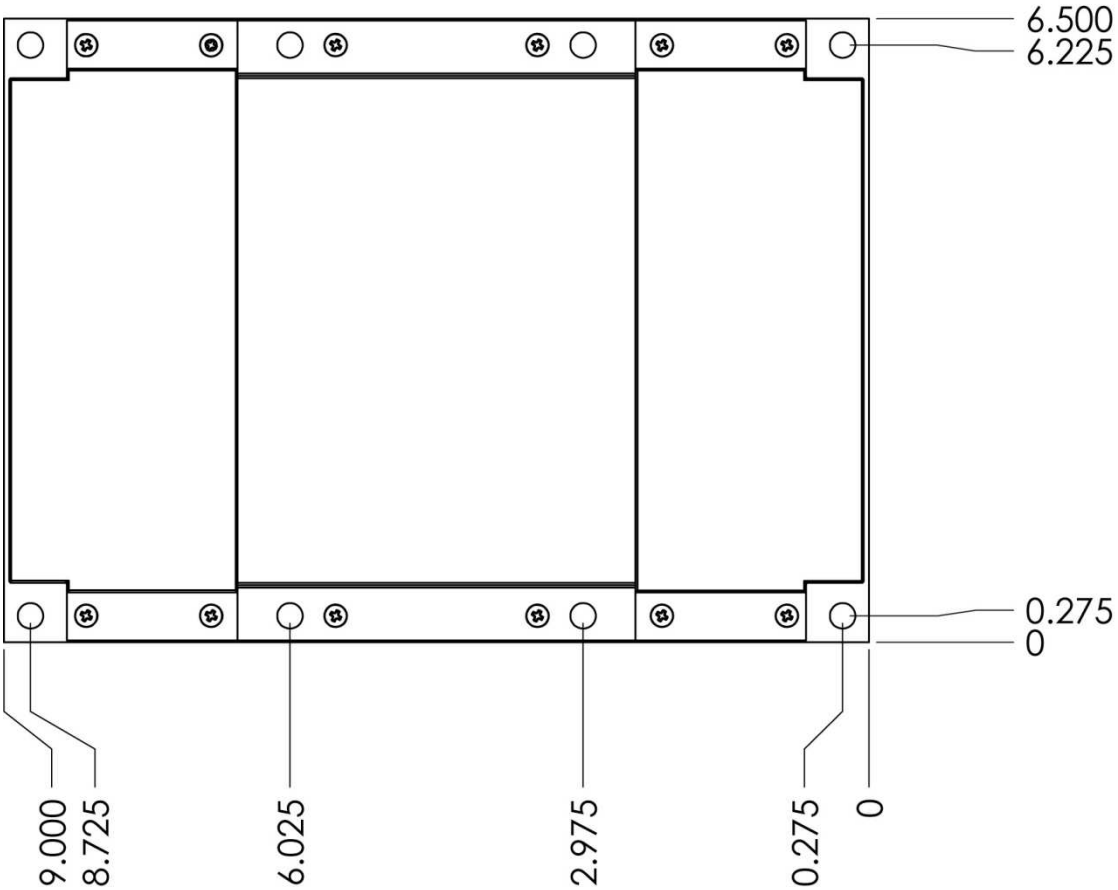
Case Mechanicals:

Dimensions L x W x H: 9.0” x 6.5” x 1.25”. Tolerance ±0.025”
Unit Weight: 3.3 lbs





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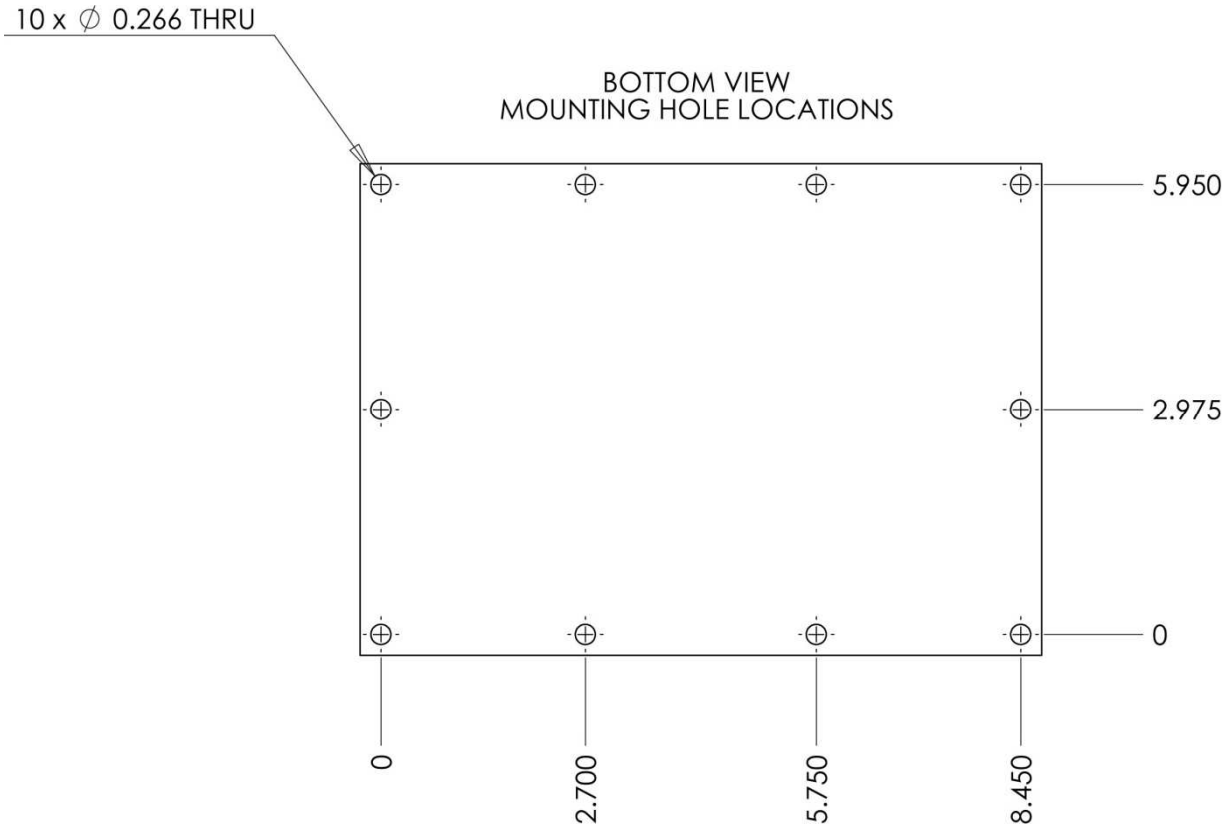

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