UM8-40 HIGH VOLTAGE MODULE

SPELLMAN HIGH VOLTAGE ELECTRONICS CORPORATION

- ***9 Voltage Ranges from 8kV to 40kV, Fixed Negative or Positive Polarity***
- ***Available Output Power Increments of 4, 15 and 30 Watts***
- ***Voltage/Current Regulation with Automatic Crossover Control***
- ***Voltage and Current Monitor Signals***
- ***Fully Arc and Short Circuit Protected***
- ***Precision +5V Reference Output***
- ***Comprehensive Standard Interface***
- ***CE listed and RoHS compliant***

Form, Fit and Function Design:
Spellman's UM Series of printed circuit board mountable, high voltage modules offer a form, fit and function replacement for presently available commercially made units, while providing additional features and benefits at competitive pricing. Utilizing proprietary power conversion technology and Spellman's six decades of high voltage experience, these SMT based high voltage modules provide improved performance/reliability and easier system integration at a lower cost when compared to the competition.

Advanced Power Conversion Topology:
UM converters use a proprietary zero voltage switching power conversion topology providing exceptional efficiency and inherent low noise and ripple. Radiated emissions are reduced compared to conventional switching topologies, minimizing or even eliminating the need to shield the unit from adjacent circuitry.

The high voltage output is generated using a ferrite core high voltage step up transformer which feeds a half wave Cockcroft-Walton voltage multiplier to obtain the specified high voltage output.

Due to the fixed, high frequency conversion rate the output capacitance is small resulting in minimal stored energy. Through the use of generously rated surge limiting resistors and a fast acting current loop, all units are fully arc and short circuit protected.

Control and Regulation:
The actual output voltage generated is sampled via a high impedance divider to create a voltage feedback signal. A current feedback signal is created via a current sense resistor in the low end return of the high voltage output circuitry. These two accurate ground referenced feedback signals are used to precisely regulate and control the units in addition to external monitoring purposes.

Due to the UM's unique converter topology it can provide full current into low impedance loads or even a short circuit. Standard units limit at 103% of maximum rated output current.

Standard Interface:
The Spellman UM Series interface provides current programming capability and positive polarity, buffered, low output impedance voltage and current monitor signals (zero to +4.64Vdc equals zero to full scale rated). A voltage programming input is provided where 0 to +4.64Vdc equals 0 to 100% of rated voltage.

Current programmability allows the user to set where the unit will current limit, anywhere from 0 to 100% of maximum rated current. This feature is beneficial where less than full output current is desired, like in the case of protecting a sensitive load.

The buffered low impedance voltage and current monitor signals can drive external circuitry directly, while minimizing loading and pickup effects. These features save the user the expense and implementation of external interface buffering circuitry while improving overall signal integrity.

This standard interface is made available via a row of 13 pins with 0.1″ pin spacing. A legacy interface (7 pins on a 0.2″ spacing) that is compatible with presently available commercially made units can be provided by ordering the "L" option.

Mechanical and Environmental Considerations:
The UM Series are solid encapsulated, printed circuit board mountable, plastic cased converters. All units are encapsulated using a silicon based potting material which is considerably lighter in weight than epoxy. Isolated, non grounded 2-56 machine screws thread into the module to securely mount it to the printed circuit board, relieving any stress on the interface pins. Mounting plates, brackets and flanged mounting options are also available. High voltage output is provided via a 36″ (914.4mm) minimum length of appropriately rated high voltage wire.

Regulatory Approvals:
Compliant to EEC EMC Directive. Compliant to EEC Low Voltage Directive. UL/CUL recognized, File E227588. RoHS Compliant.

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SPECIFICATIONS

Input Voltage:
12Vdc for 4W, 24Vdc for 15W and 30W

Nominal Voltage Range:
11Vdc to 30Vdc for 4W, 23Vdc to 30Vdc for 15W and 30W
4W units can operate at 24Vdc input with no deratings or damage to unit

Input Current: (typical)
Disabled: 10mA @ 24Vdc
Full output, no load: 160mA @ 24Vdc, 300mA @ 12Vdc
Full output, full load:
4 watt units: 330mA @ 24Vdc, 640mA @ 12Vdc
15 watt units: 850mA @ 24Vdc
30 watt units: 1590mA @ 24Vdc

Voltage Regulation:
Line: <0.01% Load: <0.01%

Current Regulation:
Line: <0.01% Load: <0.01%

Stability:
0.01% per 8 hours, 0.02% per day after 30 min. warmup

Accuracy:
2% on all programming and monitoring, except I Sense 10%

Temperature Coefficient: (typical)
Standard: 100ppm/°C
Optional: 25ppm/°C (T Option)

Environmental:
Temperature Range:
Operating: -40°C to 65°C case temperature
Storage: -55°C to 105°C, non operational
Humidity:
10% to 90%, non-condensing.

Cooling:
Convection cooled, typical. 30 watt units operating at full power might require additional cooling to maintain case temperature below 65°C. Methods may include: forced air cooling, use of heat sink or metal case, etc. It is the user's responsibility to maintain the case temperature below 65°C. Damage to the power supply due to inadequate cooling is considered misuse and repairs will not be covered under warranty.

Dimensions:
8kV-12kV:
3.700″L X 1.500″W X 0.990″H (93.98mm X 38.10mm X 25.03mm)
15kV-20kV:
4.700″L X 1.500″W X 0.990″H (119.38mm X 38.10mm X 25.03mm)
25kV-40kV:
6.960″L X 1.600″W X 1.14″H (176.78mm X 40.84mm X 28.87mm)

Weight:
8kV-12kV: 5.7 ounces (162 grams), typical
15kV-20kV: 7.2 ounces (204 grams), typical
25kV-40kV: 13.1 ounces (371 grams), typical

Output Cable:
UM8, UM10, UM12, UM15: TV20 (min. length, 36″(914.4mm)
UM20, UM25: TV30 (min. length, 36″(914.4mm)
UM30, UM35, UM40: TV40 (min. length, 36″(914.4mm)

UM 4W, 8kV TO 40kV SELECTION TABLE

Model Number	Output V	Output Current	Ripple(max) %Vp-p	Output Capacitance	Arc Limiting Resistance	I Sense Scaling Full Scale Signal	High Voltage Divider Resistance
UM8*4	0 to 8kV	0.5mA	0.05	6830pF	50kΩ	5V	200MΩ
UM10*4	0 to 10kV	0.4mA	0.05	4380pF	50kΩ	2.4V	300MΩ
UM12*4	0 to 12kV	0.333mA	0.05	4380pF	50kΩ	3.33V	300MΩ
UM15*4	0 to 15kV	0.266mA	0.05	3220pF	100kΩ	1.69V	400MΩ
UM20*4	0 to 20kV	0.2mA	0.05	2310pF	100kΩ	1.316V	550MΩ
UM25*4	0 to 25kV	0.16mA	0.05	1540pF	100kΩ	1.1V	800MΩ
UM30*4	0 to 30kV	0.133mA	0.05	1370pF	120kΩ	0.95V	900MΩ
UM35*4	0 to 35kV	0.115mA	0.05	1370pF	140kΩ	0.72V	900MΩ
UM40*4	0 to 40kV	0.1mA	0.05	1370pF	140kΩ	1.3V	900MΩ

UM 15W, 8kV TO 40kV SELECTION TABLE

Model Number	Output V	Output Current	Ripple(max) %Vp-p	Output Capacitance	Arc Limiting Resistance	I Sense Scaling Full Scale Signal	High Voltage Divider Resistance
UM8*15	0 to 8kV	1.875mA	0.05	6830pF	50kΩ	3.75V	200MΩ
UM10*15	0 to 10kV	1.5mA	0.05	4380pF	50kΩ	8.152V	300MΩ
UM12*15	0 to 12kV	1.25mA	0.05	4380pF	50kΩ	5V	300MΩ
UM15*15	0 to 15kV	1mA	0.05	3220pF	100kΩ	5.53V	400MΩ
UM20*15	0 to 20kV	0.75mA	0.05	2310pF	100kΩ	4.21V	550MΩ
UM25*15	0 to 25kV	0.6mA	0.05	1540pF	100kΩ	3.42V	800MΩ
UM30*15	0 to 30kV	0.5mA	0.05	1370pF	120kΩ	2.89V	900MΩ
UM35*15	0 to 35kV	0.429mA	0.05	1370pF	140kΩ	2.39V	900MΩ
UM40*15	0 to 40kV	0.375mA	0.05	1370pF	140kΩ	4.21V	900MΩ

UM 30W, 8kV TO 40kV SELECTION TABLE

Model Number	Output V	Output Current	Ripple(max) %Vp-p	Output Capacitance	Arc Limiting Resistance	I Sense Scaling Full Scale Signal	High Voltage Divider Resistance
UM8*30	0 to 8kV	3.75mA	0.05	6830pF	50kΩ	5.36V	200MΩ
UM10*30	0 to 10kV	3mA	0.05	4380pF	50kΩ	7.87V	300MΩ
UM12*30	0 to 12kV	2.5mA	0.05	4380pF	50kΩ	5V	300MΩ
UM15*30	0 to 15kV	2mA	0.06	3220pF	100kΩ	5.29V	400MΩ
UM20*30	0 to 20kV	1.5mA	0.06	2310pF	100kΩ	8.15V	550MΩ
UM25*30	0 to 25kV	1.2mA	0.06	1540pF	100kΩ	6.56V	800MΩ
UM30*30	0 to 30kV	1mA	0.06	1370pF	120kΩ	5.52V	900MΩ
UM35*30	0 to 35kV	0.857mA	0.05	1370pF	140kΩ	4.66V	900MΩ
UM40*30	0 to 40kV	0.75mA	0.05	1370pF	140kΩ	8.15V	900MΩ

Grayed text indicates Legacy interface signals.

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STANDARD INTERFACE

PIN	SIGNAL	PARAMETERS
1	Power Ground Return	+12Vdc or +24Vdc power return/HV return
1A	Signature Resistor	Unique Identifying resistor connected to ground
2	+ Power Input	+12Vdc or +24Vdc power input
2A	OT Output	+5Vdc @ 1mA = Over Temp fault
3	I Sense	See I Sense text and tables for details
3A	I Mon	0 to 4.64Vdc = 0 to 100% rated output. Zout < 10kΩ
4	Enable Input	Low (<0.7V, Isink@1mA)=HV OFF, High (open or >2V)=HV ON
4A	V Mon	0 to 4.64Vdc = 0 to 100% rated output. Zout < 10kΩ
5	Signal Ground	Signal Ground
5A	I Pgm	0 to 4.64Vdc = 0 to 100% rated output. Zin > 47kΩ Leave open for preset current limit @103% of rated output current
6	Remote Adjust	Positive Polarity Unit: 0 to +4.64VDC = 0 to 100% rated voltage, Zin >1MΩ Negative Polarity Unit: +5VDC to 0.36V = 0 to 100% rated voltage, Zin >100kΩ Leave open if pin 6A (VPgm) is used for programming
6A	V Pgm	0 to 4.64Vdc = 0 to 100% rated voltage. Zin > 100kΩ Leave open if pin 6 (remote adjust) is used for programming
7	+5V Reference Output	+5Vdc ±1%, 25ppm/°C. Zout =475Ω
8	HV Ground Return	HV Ground Return
9	E Out Monitor	1000:1 ratio. Polarity of Voltage Monitor signal equals polarity of unit. Accuracy is ±2%, 100ppm/°C. Calibrated with DVM with 10MΩ input impedance

Grayed out signals are provided for backward legacy compatability and their use is not required.

Power Ground Return, Signal Ground and HV Ground Return are connected internally. For best performance they should not be connected externally.

LEGACY INTERFACE (L OPTION)

PIN	SIGNAL	PARAMETERS
1	Power Ground Return	+12Vdc or +24Vdc power return
2	+ Power Input	+12Vdc or +24Vdc power input
3	I Sense	See I Sense text and tables for details
4	Enable Input	Low (<0.7V, Isink@1mA)=HV OFF, High (open or >2V)=HV ON
5	Signal Ground	Signal Ground
6	Remote Adjust	Positive Polarity Unit: 0 to +4.64VDC = 0 to 100% rated voltage, Zin >1MΩ Negative Polarity Unit: +5VDC to 0.36V = 0 to 100% rated voltage, Zin >100kΩ
7	+5V Reference Output	+5Vdc ±1%, 25ppm/°C. Zout =475Ω
8	HV Ground Return	HV Ground Return
9	E Out Monitor	1000:1 ratio. Polarity of Voltage Monitor signal equals polarity of unit. Accuracy is ±2%, 100ppm/°C. Calibrated with DVM with 10MΩ input impedance

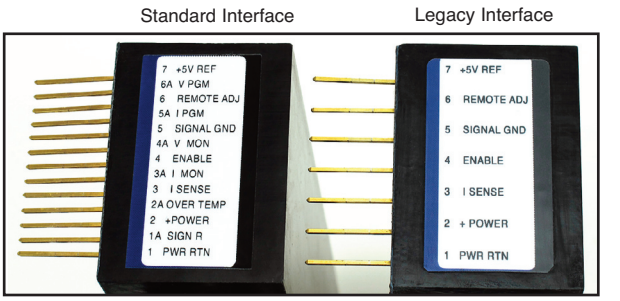
Power Ground Return, Signal Ground and HV Ground Return are connected internally. For best performance they should not be connected externally.

Standard Interface Connections

Fifteen (15) gold plated 0.025˝(0.64mm) square pins suitable for direct PCB mounting.

Legacy Interface Connections

Nine (9) gold plated 0.025˝(0.64mm) square pins suitable for direct PCB mounting.



See mechanical drawing for location and spacing details

Programming and Monitor Signals

Voltage and current programming is done via positive polarity, high input impedance, 0 to 4.64Vdc signals. Voltage and current monitors are positive polarity, buffered low output impedance 0 to 4.64Vdc signals.

I Mon

The I Mon signal is a true output current monitoring signal. All internal offsets due to feedback divider currents have been compensated for.

Signature Resistor

A unique identifying signature resistor for each type of unit is connected from Pin 1A to ground. Details if desired are available upon request.

I Sense Signal

The polarity of the I Sense signal is opposite of the polarity of the output voltage of the unit that generated it. So a positive output polarity unit creates a negative polarity current monitor signal; while a negative output polarity unit creates a positive polarity current monitoring signal. This signal is clamped to ground internally via a bidirectional transient protection device and the signal is made available via a series connected 47kΩ isolation resistor. Internal HV dividers create a small, linear offset voltage on this current monitor signal that can be compensated for.

OT Output

The unit is protected by an internal thermostat that will shut the unit off if the case temperature exceeds 65°C. The OT Output signal will change states indicating an over temperature fault has occurred. In order to clear the OT signal and re-enable the unit, the temperature has to drop below 55 degrees C and input power needs to be recycled. For details on unit cooling requirements and the OT Output signal please see the operator's manual.

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UM8-40 OPTIONS

T Option

Low Temperature Coefficient-

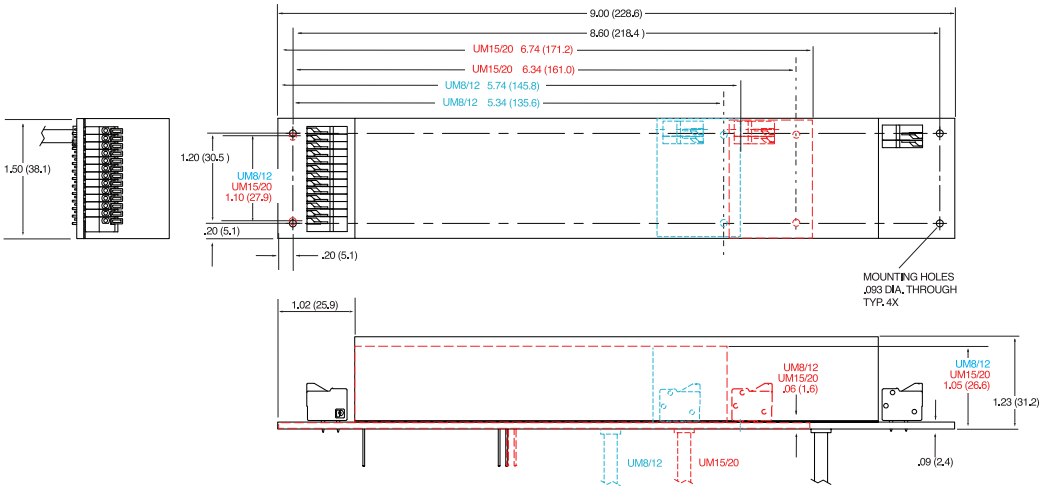
The T Option offers the UM with an improved temperature coefficient. The standard voltage feedback divider is replaced with one having a superior temperature coefficient, resulting in a unit with 25ppm/C° (typical) temperature coefficient.

PHYSICAL INTERFACING

B Option

Terminal Block-

The B Option provides terminal block connections for both the customer interface and high voltage output/return. This feature can be helpful in situations where frequent wiring changes are anticipated, as in a testing or prototype environment.

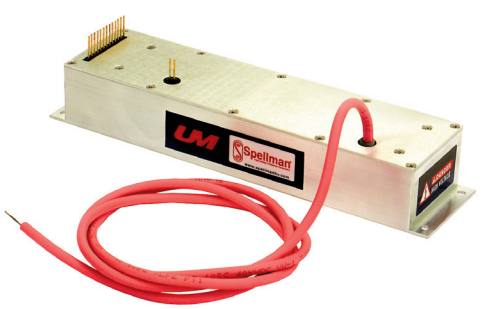


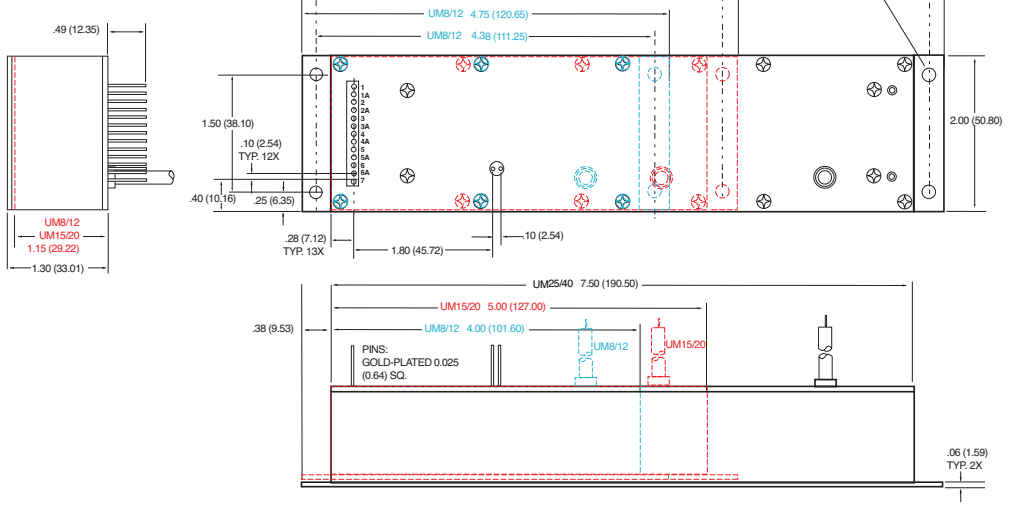
SHIELDING OPTIONS

S Option

RF Tight Shielded Can-

The S Option mounts the UM module inside of a flanged RF tight aluminum can.





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SHIELDING OPTIONS (CONT)

M Option

Mu Metal Shield-

UM modules can be fitted with an adhesive backed Mu Metal foil shield to help protect sensitive adjacent circuitry.

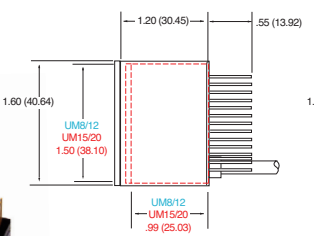
Same as standard unit.
See page 6 of 6 for dimensional drawings

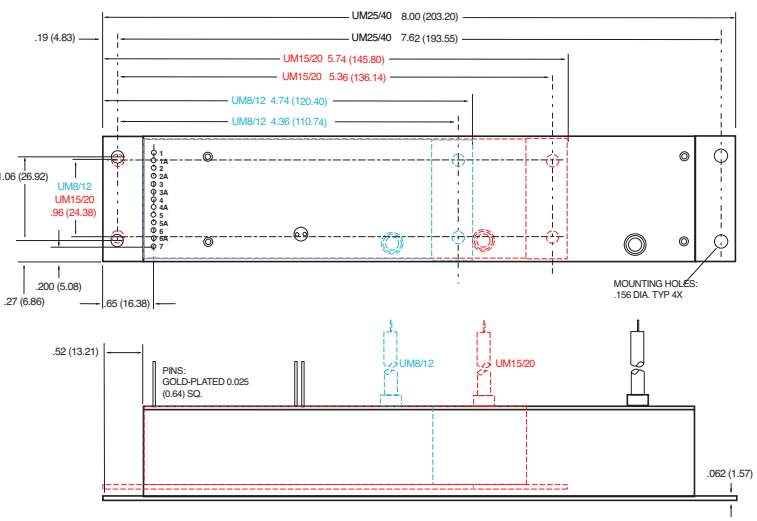
CHASSIS MOUNTING OPTION

E Option

Eared Mounting Plate-

An eared mounting plate is affixed to the top surface of the UM module allowing simple chassis mounting of unit.





ORDERING INFORMATION

Voltage	0 to 8kV	8
	0 to 10kV	10
	0 to 12kV	12
	0 to 15kV	15
	0 to 20kV	20
	0 to 25kV	25
	0 to 30kV	30
	0 to 35kV	35
	0 to 40kV	40
Polarity	Positive	P
	Negative	N
Power	Watts Output	4
	Watts Output	15
	Watts Output	30

STANDARD UNIT ORDERING EXAMPLE

UM30N30

Model
Voltage
Polarity
Power

OPTION ORDERING INFORMATION

OPTION	OPTION CODE
Legacy Interface	L
Low Temperature Coefficient	T
Mu Metal Shield	M
RF Tight Shielded Can	S
Eared Mounting Plate	E
Terminal Block	B

OPTION ORDERING EXAMPLE

UM25P15/L/E

Model
Voltage
Polarity
Power
Option
Option

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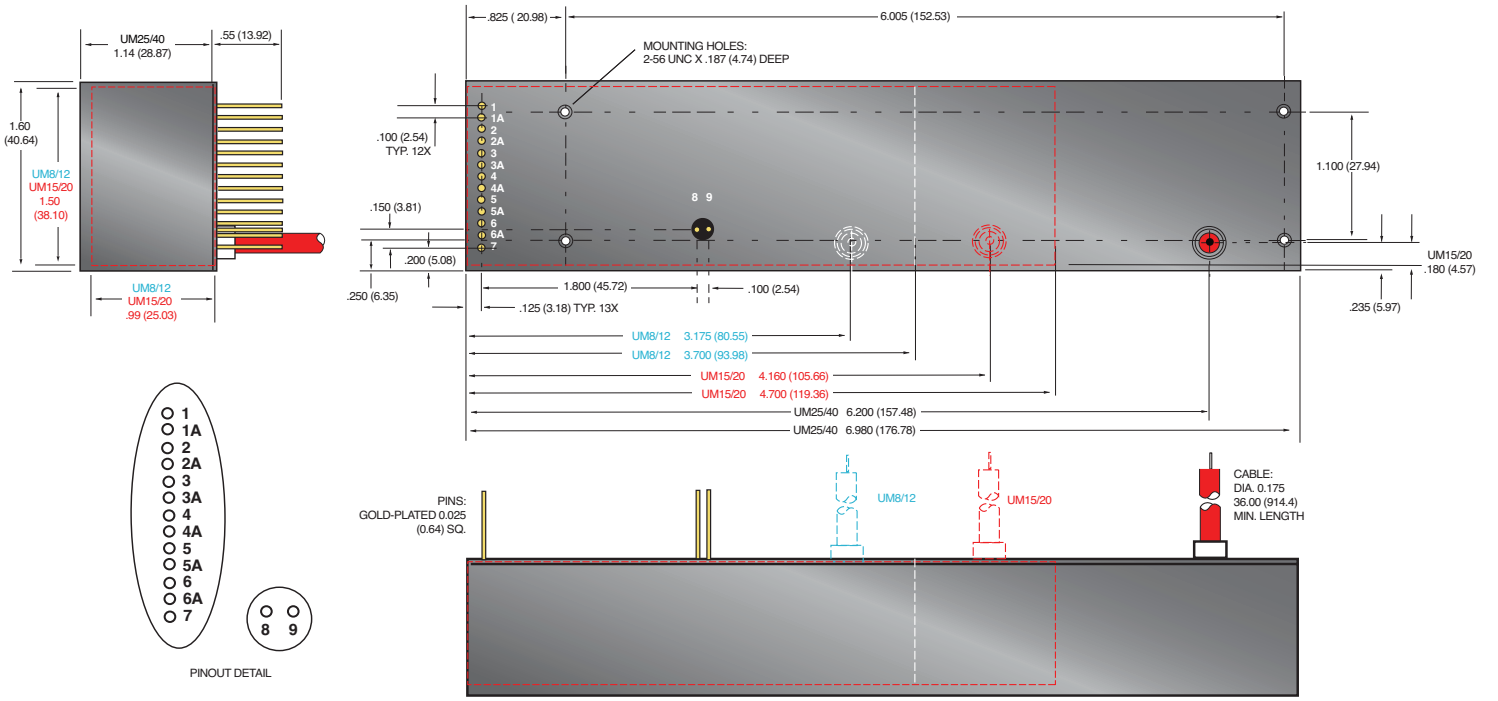
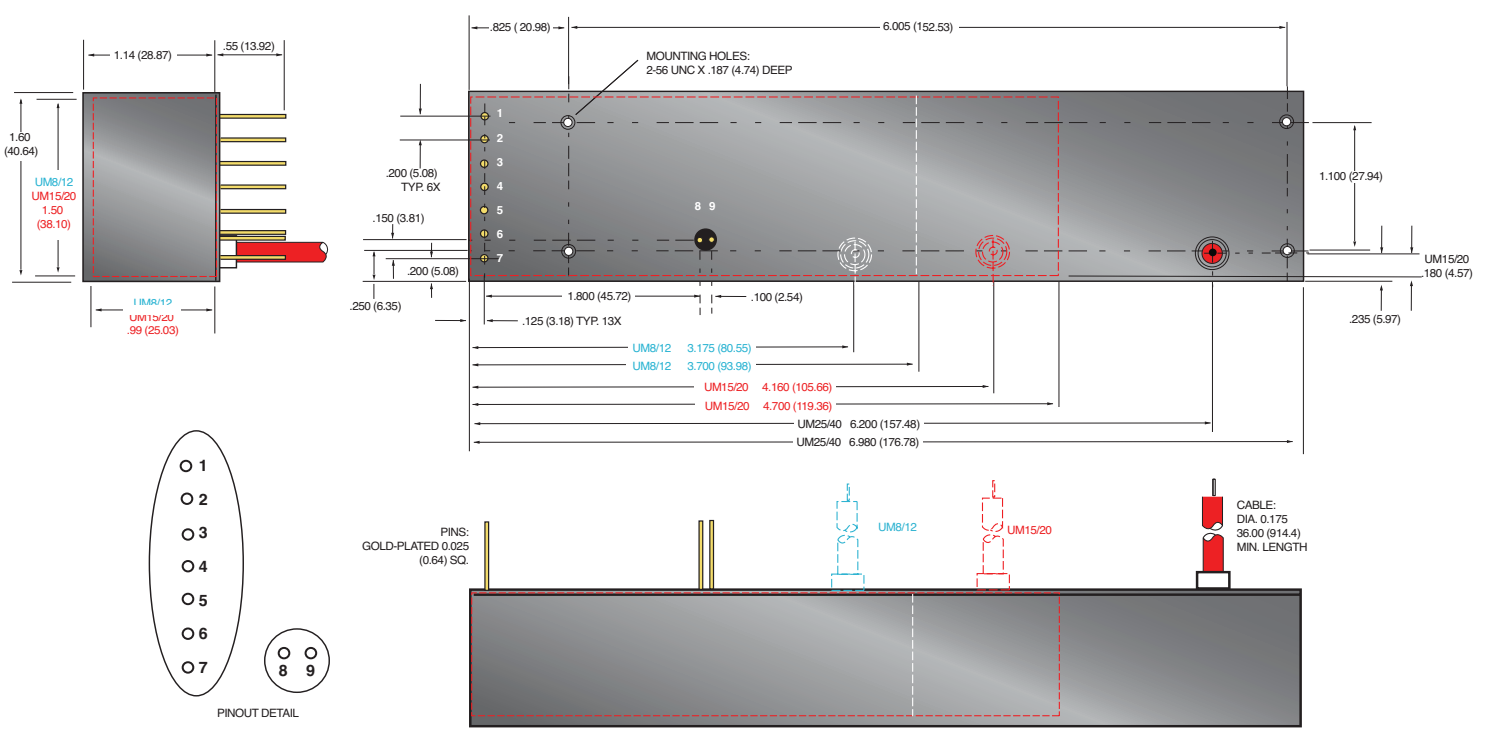
DIMENSIONS: in.[mm]

15 PIN - Standard Interface



9 PIN - Legacy Interface



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