



## X20 SERIES 20 WATT HIGH VOLTAGE DC/DC CONVERTERS

### FEATURES

- ▶ Customer Selects Output Voltage
- ▶ Ultra Wide Input Ranges  
(9-36Vdc, 20-60Vdc, 36-72Vdc)
- ▶ Efficiency 85% (typ.)
- ▶ Independently Isolated Outputs
- ▶ Six-Sided Shielded Case
- ▶ Remote On/Off Control
- ▶ Continuous Short Circuit Protection



The X20 Series of DC/DC converters accepts ultra wide input ranges of 9-36 Vdc, 20-60 Vdc, & 36-72 Vdc. Outputs are independently isolated. In the case of duals, up to 16 Watts may be taken from either output. All models will tolerate a short circuit indefinitely. Also included is a Pi input filter and remote on/off.

### ELECTRICAL SPECIFICATIONS

Voltage Accuracy .....	+/- 1%	Input Filter .....	Pi Network
Line Regulation .....	+/- 0.2 %	Efficiency .....	85% (typ.)
Load Regulation .....	+/- 0.3%	Short Circuit Protection .....	Continuous
Output Ripple .....	< 0.3% P-P	Switching Frequency .....	120 kHz
		Isolation (Input-Output(1)-Output(2)-Case) .....	1000 Vdc
		Input / Output Capacitance .....	< 160pF

### GENERAL SPECIFICATIONS

Temp. Stability .....	+/-0.02%/°C	Logic Shutdown .....	Logic 0 (on)
Temp. (Operating, Case) .....	-45 to +85°C	EMI/RFI .....	Six Sided Shield
Temp. (Storage) .....	-55 to +100°C	Derating .....	None
		Cooling .....	Free-Air Convection

### PHYSICAL SPECIFICATIONS

Dimensions .....	2.6 x 3.0 x 0.84 inches	Case Material .....	Nickel Plated Metal
Weight .....	8.4 Oz		(With Non-Conductive Base Plate)



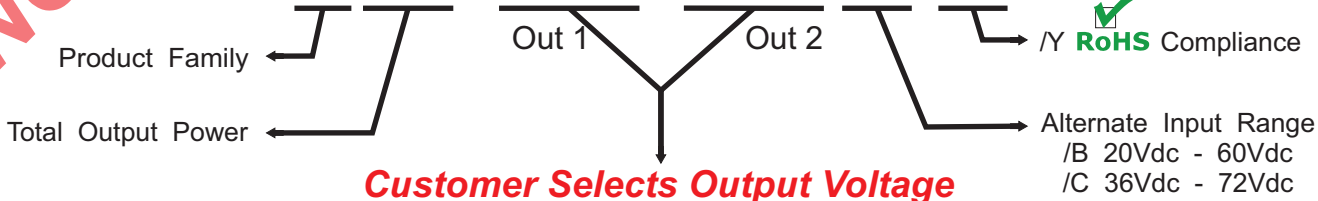
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### REPRESENTATIVE MODEL LISTING

OUTPUT SPECS				MODEL NUMBER / INPUT RANGE					
VOLTAGE		CURRENT		9-36VDC		20-60VDC		36-72VDC	
OUT #1	OUT #2	OUT #1	OUT #2	Non-RoHs	RoHs	Non-RoHs	RoHs	Non-RoHs	RoHs
24 Vdc	-	833 mA	-	X20-24	X20-24/Y	X20-24/B	X20-24/B/Y	X20-24/C	X20-24/C/Y
24 Vdc	24Vdc	416 mA	416 mA	X20-24/24	X20-24/24/Y	X20-24/24/B	X20-24/24/B/Y	X20-24/24/C	X20-24/24/C/Y
48 Vdc	-	416 mA	-	X20-48	X20-48/Y	X20-48/B	X20-48/B/Y	X20-48/C	X20-48/C/Y
48 Vdc	48Vdc	208 mA	208 mA	X20-48/48	X20-48/48/Y	X20-48/48/B	X20-48/48/B/Y	X20-48/48/C	X20-48/48/C/Y
50 Vdc	-	400 mA	-	X20-50	X20-50/Y	X20-50/B	X20-50/B/Y	X20-50/C	X20-50/C/Y
50Vdc	50 Vdc	200 mA	200 mA	X20-50/50	X20-50/50/Y	X20-50/50/B	X20-50/50/B/Y	X20-50/50/C	X20-50/50/C/Y
75Vdc	-	266 mA	-	X20-75	X20-75/Y	X20-75/B	X20-75/B/Y	X20-75/C	X20-75/C/Y
75 Vdc	75 Vdc	133 mA	133 mA	X20-75/75	X20-75/75/Y	X20-75/75/B	X20-75/75/B/Y	X20-75/75/C	X20-75/75/C/Y
100 Vdc	-	200 mA	-	X20-100	X20-100/Y	X20-100/B	X20-100/B/Y	X20-100/C	X20-100/C/Y
100 Vdc	100Vdc	100 mA	100 mA	X20-100/100	X20-100/100/Y	X20-100/100/B	X20-100/100/B/Y	X20-100/100/C	X20-100/100/C/Y
150 Vdc	-	133 mA	-	X20-150	X20-150/Y	X20-150/B	X20-150/B/Y	X20-150/C	X20-150/C/Y
150 Vdc	150 Vdc	66 mA	66 mA	X20-150/150	X20-150/150/Y	X20-150/150/B	X20-150/150/B/Y	X20-150/150/C	X20-150/150/C/Y
200 Vdc	-	100 mA	-	X20-200	X20-200/Y	X20-200/B	X20-200/B/Y	X20-200/C	X20-200/C/Y
200Vdc	200Vdc	50 mA	50 mA	X20-200/200	X20-200/200/Y	X20-200/200/B	X20-200/200/B/Y	X20-200/200/C	X20-200/200/C/Y
300 Vdc	-	66 mA	-	X20-300	X20-300/Y	X20-300/B	X20-300/B/Y	X20-300/C	X20-300/C/Y
300 Vdc	300 Vdc	33 mA	33 mA	X20-300/300	X20-300/300/Y	X20-300/300/B	X20-300/300/B/Y	X20-300/300/C	X20-300/300/C/Y
400Vdc	-	50 mA	-	X20-400	X20-400/Y	X20-400/B	X20-400/B/Y	X20-400/C	X20-400/C/Y
400Vdc	400 Vdc	25 mA	25 mA	X20-400/400	X20-400/400/Y	X20-400/400/B	X20-400/400/B/Y	X20-400/400/C	X20-400/400/C/Y
500 Vdc	-	40 mA	-	X20-500	X20-500/Y	X20-500/B	X20-500/B/Y	X20-500/C	X20-500/C/Y
500 Vdc	500Vdc	20 mA	20 mA	X20-500/500	X20-500/500/Y	X20-500/500/B	X20-500/500/B/Y	X20-500/500/C	X20-500/500/C/Y

NOT RECOMMENDED FOR NEW DESIGNS

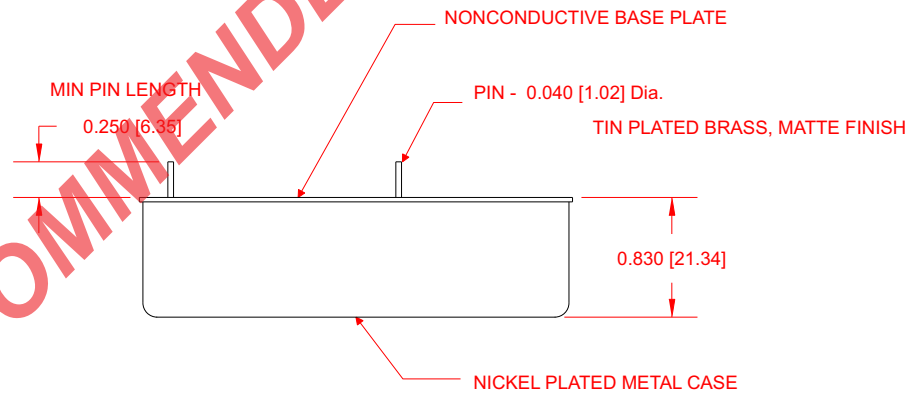
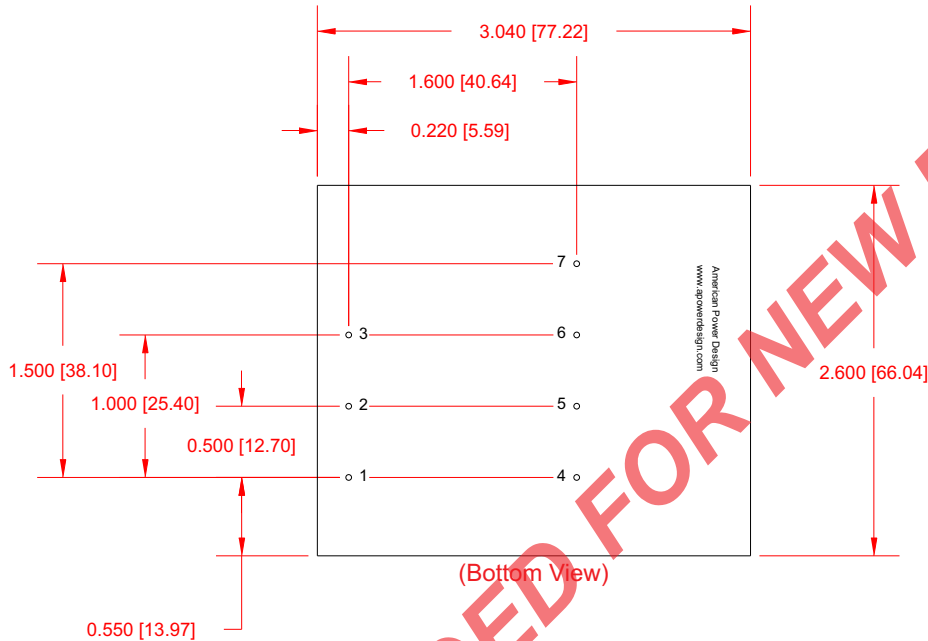
## X20-100/100/B/Y



The X20 Series are designed such that the customer may order any output voltage from 24Vdc to 500Vdc at no additional charge.



**X20 SERIES 20 WATT HIGH VOLTAGE DC/DC CONVERTERS**



PIN #	SINGLE	DUAL
1	- Input	- Input
2	On/Off	On/Off
3	+ Input	+ Input
4	No Pin	+ Output 2
5	No Pin	- Output 2
6	- Output 1	- Output 1
7	+ Output 1	+ Output 1

Dimensions are in Inches  
 [Metric equivalents in brackets]



## X20 SERIES 20 WATT HIGH VOLTAGE DC/DC CONVERTERS

### APPLICATION NOTES

#### INPUT AND OUTPUT IMPEDANCE

The X20 Series of power converters have been designed to be stable with no external capacitors when used in low inductance input and output circuits. However, in some applications, the inductance associated with the distribution from the power source to the input of the converter can affect the stability of the converter. The addition of a 100  $\mu\text{F}$  electrolytic capacitor with an ESR  $< 1$  Ohm across the input helps ensure stability of the converter. In many applications, the user has to use decoupling capacitance at the load.

#### SHORT CIRCUIT PROTECTION

The X20 Series is equipped with short circuit protection. The converter will fold-back the input power whenever a short circuit is applied to its output and automatically recover after the overload condition is removed.

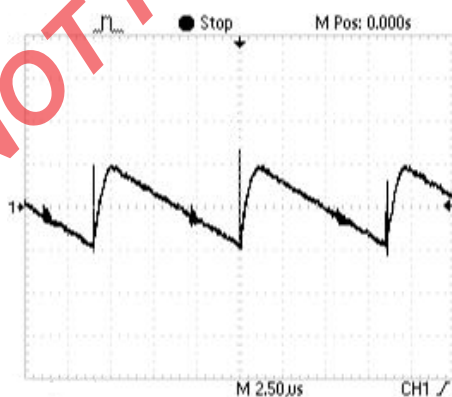
#### ISOLATION

The output(s) of the X20 Series is galvanically isolated from both the input and case, capacitance is  $< 160\text{pF}$  and resistance is  $> 10\text{G Ohm}$ .

In the case of dual's, the outputs are independently isolated from one another as well as the input and case.

#### RIPPLE AND NOISE

Figure below shows a typical output voltage ripple waveform, measured at full rated load current with no additional output filtering. External low ESR capacitors may be added across output to further reduce ripple.



#### STARTUP TRANSIENT

Figure below shows a typical output voltage during turn-on, measured at 20% load current with no additional output filtering.

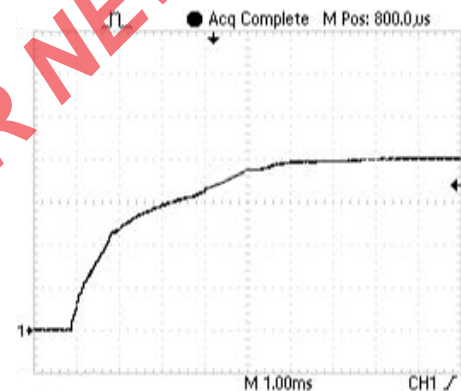
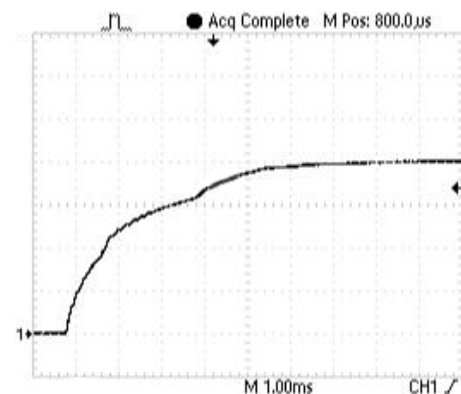


Figure below shows a typical output voltage during turn-on, measured at full rated load current with no additional output filtering.





## X20 SERIES 20 WATT HIGH VOLTAGE DC/DC CONVERTERS

### APPLICATION NOTES

#### INRUSH CURRENT

The inrush current of the X20 Series has been kept as low as possible. However, a series resistor may be inserted in the input line to limit this current further.

#### LOAD TRANSIENT

Figure below shows a typical output voltage response, measured during a transition from full rated load current to no load current with no additional output filtering.

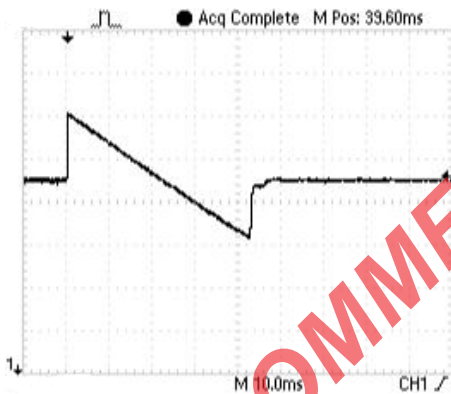
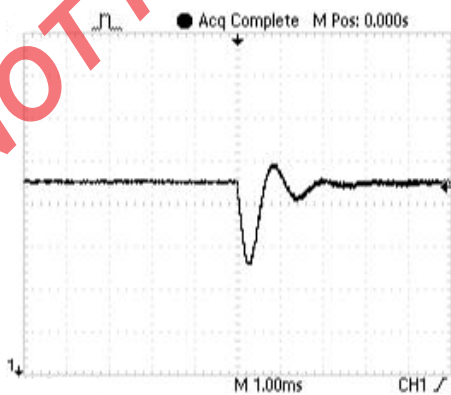


Figure below shows a typical output voltage response, measured during a transition from no load current to full rated load current with no additional output filtering.



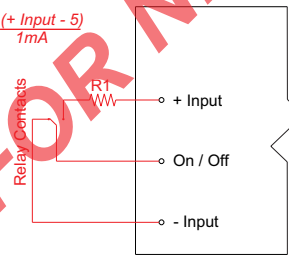
#### REMOTE ON/OFF CONTROL

The On/Off control pin allows the user to shut down the converter mechanically or logically using a relay or a TTL or CMOS logic signal.

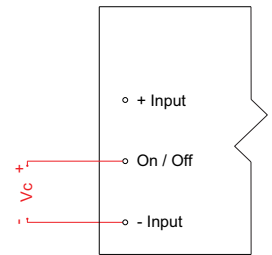
Connect Remote On/Off pin to -Input when not in use to ensure proper operation.

Resistor R1 can be calculated by:

$$R1 = \frac{(+ \text{ Input} - 5)}{1\text{mA}}$$



Converter Off:  $V_c > 3V_{dc}$   
 Converter On:  $V_c < 1.5V_{dc}$

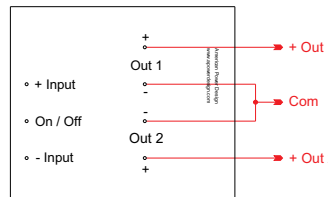


**NOTE:**  
 Do not exceed 6Vdc on remote On/Off, otherwise, the supply may be permanently damaged.

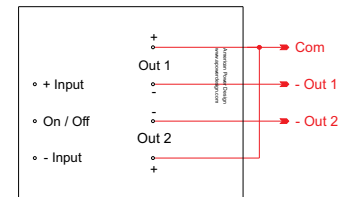
#### OUTPUT CONFIGURATIONS

Due to the unique independently isolated outputs of the X20 series both Output #1 and Output #2 may be connected in a wide variety configurations. The Figures below are some examples.

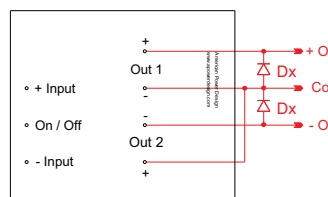
Dual Positive Output



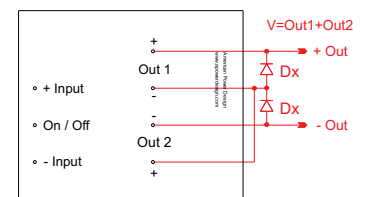
Dual Negative Output



Bipolar Output



Outputs > 500Vdc



**NOTE:**  
 The ratings of Dx should be 1.5 times the maximum current and voltage expected in each branch.

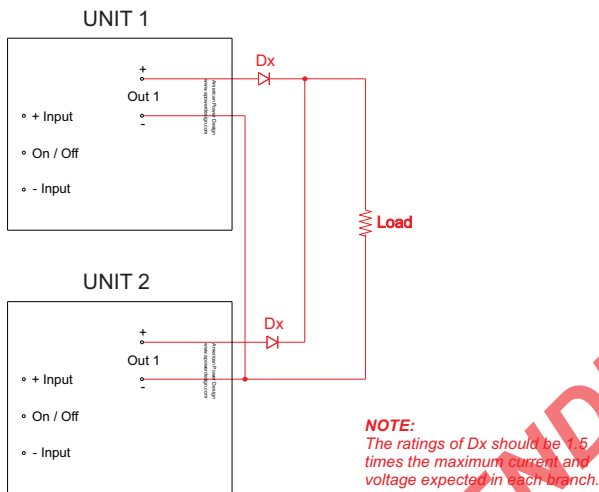


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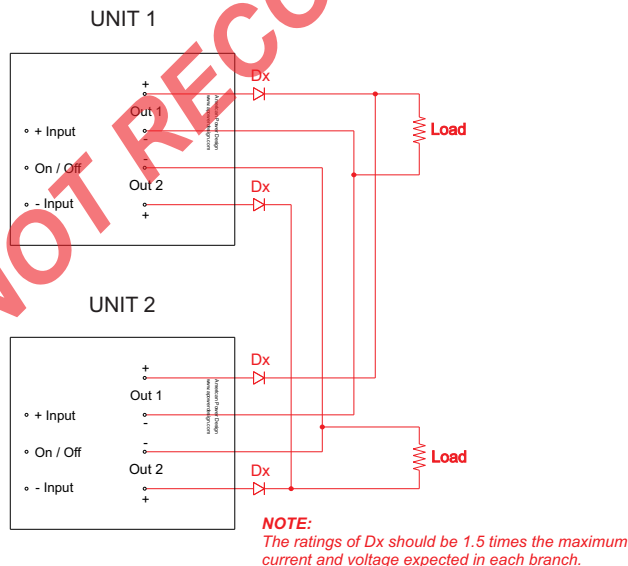
### APPLICATION NOTES

#### CONNECTION IN PARALLEL

The figure below shows how to connect several single output units with equal nominal output voltage in parallel.



The figure below shows how to connect several dual output units with equal nominal output voltage in parallel.



#### CONNECTION IN SERIES

When connecting units in series, the highest achieved output voltage should remain below the rated isolation voltage.

Figure below shows how to connect multiple single output units in series with the use of shunt diodes.

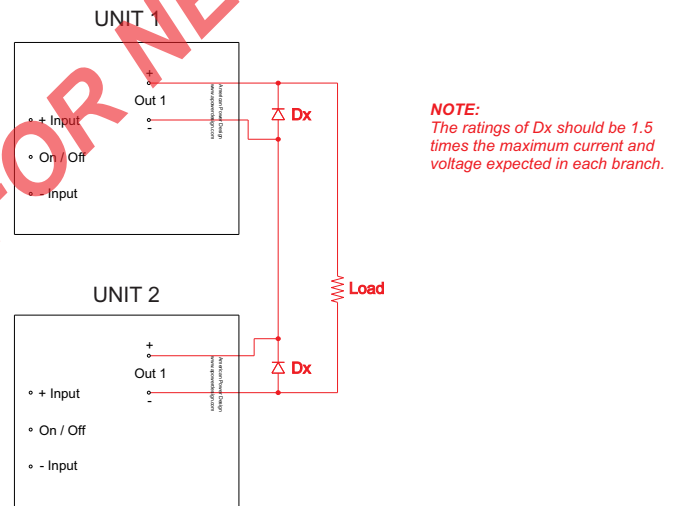
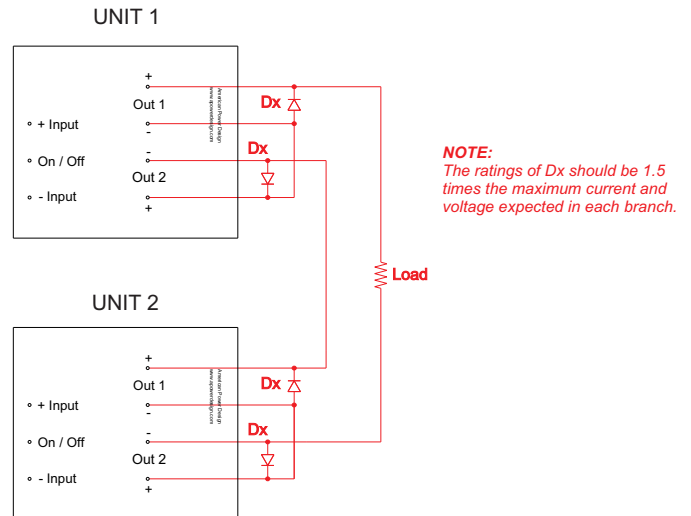


Figure below shows how to connect multiple dual output units in series with the use of shunt diodes.







## X20 SERIES 20 WATT HIGH VOLTAGE DC/DC CONVERTERS

### APPLICATION NOTES

#### CLEANING AGENTS

In order to avoid possible damage, any penetration of cleaning fluids must be prevented, since the power supplies are not hermetically sealed.

#### NUCLEAR AND MEDICAL APPLICATIONS

American Power Design products are not designed, intended for use in, or authorized for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems without the express written consent of American Power Design, Inc.

#### TECHNICAL REVISIONS

The appearance of products, including safety agency certifications pictured on labels, may change depending on the date manufactured. Specifications are subject to change without notice.

#### SAFETY REQUIREMENTS

The converters are designed to meet North American and International safety regulatory requirements per UL 60950-1/CSA 22.2 No. 60950-1-07 Second Edition, IEC 60950-1:2005, and EN 60950-1:2006. Basic Insulation is provided between input and output. To comply with safety agencies requirements, an input line fuse must be used external to the converter. The table below provides the recommended fuse rating for use with this family of products.

Input Voltage Range	Fuse Rating
9-36Vdc	4.5A
20-60Vdc	2A
36-72Vdc	1A

If one input fuse is used for a group of modules, the maximum fuse rating should not exceed 10A.

#### WARRANTY

All products manufactured by American Power Design, Inc. (APD) are warranted to be free of defects due to material or workmanship for a period of one year from date of shipment. At our option, APD will repair or replace any non-conforming product.

APD expressly disclaims any liability for consequential or incidental damages resulting from the use or misuse of its products by the purchaser or others.

This warranty is in lieu of all warranties expressed or implied, including the warranties of merchantability. No other warranties, obligations, or liabilities are expressed or implied.

All products being returned for repair require a return material authorization(RMA) assigned by APD prior to return shipment.