

APC Symmetra® PX 40K UPS Frame Installation Deviation and Selection of Input Circuit Breaker Ratings

By Al Warner

Abstract

The [APC Symmetra® PX](#) scalable UPS frames provide customers with unique UPS power level scalability. This document gives the specifications for permitted input circuit breaker sizes for use with the APC Symmetra PX 40K scalable UPS frame and a 208Y/120V, 60 Hz utility source. This Applications Note is applicable to only the following APC SKU's: [SY10K40F](#) , [SY20K40F](#), [SY30K40F](#), [SY40K40F](#), when configured as either standalone systems or with the InfraStruXure® PDU 40kW 208V/208V W/ MBPwD w/o transformer - [PDRPPNX10-M](#). This Applications Note does not apply to any configuration that includes the following APC InfraStruXure® PDU w/ MBPwD SKU's which include input isolation transformers: [PD40F6FK1-M](#) or [PD40G6FK1-M](#) or [PD40L6FK1-M](#).

Introduction

Most installations of the APC Symmetra PX 40K scalable UPS frame utilize the input current protection rating specified in the APC PX 10-40 kW 208V Installation Guide ([APC Doc. 990-4063F-001](#)). Using the specified 175A input current protection allows the UPS frame to operate up to the maximum rated input current and maximum 40kVA load rating for future growth.

Specifications



Caution: All electrical power and power control wiring must be installed by a qualified electrician, and must comply with local and national regulations for maximum power rating.



Note: All current values are based on a 40 kW maximum configuration of the UPS.

Input

Input voltage	3-Phase 208 V (166 V-240V)
Input current (nominal, per phase)	123 A
Maximum input current (continuous, at minimum mains voltage)	162 A
Input current protection (external to UPS, not supplied)	175 A *note 4
Input frequency	40-70 Hz

It is important to note that 175A is the largest input overcurrent protective device (OCPD) rating allowed per the product UL Listing. Use of a larger OCPD rating above 175A is prohibited by both the N.E.C, and the product UL Listing.

Permitted Input OCPD Deviations Based on UPS Frame Configurations

However, installations also can take advantage of the Symmetra PX 40K scalable UPS frame and safely use lower rated OCPD's. Especially where there may be limited power availability or the customer has chosen to install only a specific number of power modules (PM's). **Table 1** lists the permitted input OCPD rating deviations for specific Symmetra PX 40K scalable frame power module configurations and corresponding output kW ratings. The output power kVA ratings assume maximum output current at a load 1.0 power factor.

Table 1 – Capacity and N+1 system configurations

Symmetra PX 40K Frame Input Circuit Breaker Rating Chart					
Installed Qty of PM's	Capacity System				
	Output kVA	Input kVA ¹	Input Amperes @ 208Y/120V	CB Current x 1.25	CB Rating ^{2,3}
5	40	49.0	137.5	171.8	175
4	40	47.9	134.4	168.0	175
3	30	35.9	100.8	126.0	150
2	20	24.0	67.2	84.0	90
1	10	12.0	33.6	42.0	45
Installed Qty of PM's	N+1 System				
	Output kVA	Input kVA ¹	Input Amperes @ 208Y/120V	CB Current x 1.25	CB Rating ^{2,3}
5	40	49.0	137.5	171.8	175
4	30	37.1	103.9	129.9	150
3	20	25.1	70.3	87.9	90
2	10	13.1	36.7	45.9	50

Notes:

1. Input kVA includes Output kVA, full rated charging at 1kW per PM, and input PF of 0.99
2. Over Current Protective Device (OCPD) / CB rating is for Standard UL Listed circuit breakers rated at 80% continuous load.
3. If using a UL 100% rated CB or fused disconnect, use the values in the "Input Amperes" column to select the OCPD rating
4. Input conductors are to be sized and installed in accordance with local conditions, and any applicable Local or National Codes

Where the APC Symmetra PX 80K UPS is not part of a complete [APC InfraStruXure®](#) (ISX) configuration which also includes the APC InfraStruXure® PDU 80KW 208V/208V W/ MBP (APC SKU# [PDRPPNX10-M](#)). The user or installer must also provide both an appropriately sized output OCPD and bypass OCPD, and conductors whose ratings are based on the output kVA limits listed. The bypass (Q3) and output (Q2) OCPD's must provide 4-pole switching, i.e., switching of the neutral. See [PDRPPNX10-M](#) submittal drawings for additional MBP details.

Permitted Input OCPD Deviations Based on Available Power

Customers may also take advantage of the APC Symmetra PX 40K UPS where there may be limited power availability or where they desire to use an existing feeder. **Table 2** below shows permitted UPS frame power module rating configurations with respect to available input OCPD ratings and maximum permitted kVA load.

Table 2 – Available input supply and permitted Maximum kVA output ratings

Available Input 208Y/120V			Symmetra 40K UPS Frame Maximum kVA Load base on Qty of PM's Rating ⁴				
CB Rating ¹	Amps ²	kVA ³	5 ⁵	4	3	2	1
175	140	50.4	40	40	30	20	10
150	120	43.2	33.7	35.1	30	20	10
125	100	36.0	27.0	28.3	30	20	10
110	88	31.7	23.0	24.3	25.7	20	10
100	80	28.8	20.3	21.6	22.9	20	10
90	72	25.9	17.6	18.9	20.2	20	10
80	64	23.1	15.0	16.2	17.5	18.9	10
70	56	20.2	12.4	13.6	14.9	16.2	10
60	48	17.3		11.0	12.2	13.5	10
50	40	14.4			9.5	10.8	10
45	36	13.0			8.2	9.5	10
40	32	11.5				8.1	9.4

Notes:

1. UL marked circuit breaker trip rating
2. Maximum allowable continuous load amperes per the circuit breaker UL Listing @ 80%.
3. Maximum allowable kVA based on three-pole circuit breaker with 208Y/120V source.
4. Exceeding the maximum kVA values listed may result in unexpected loss of power to the load.
5. Maximum kVA load for 5 PM's is based on 40kVA UL output rating.

Where the APC Symmetra PX 80K UPS is not part of a complete [APC InfraStruXure®](#) (ISX) configuration which also includes the APC InfraStruXure® PDU 80KW 208V/208V W/ MBP (APC SKU# [PDRPPNX10-M](#)). The user or installer must also provide both an appropriately sized output OCPD and bypass OCPD, and conductors whose ratings are based on the output kVA limits listed. The bypass (Q3) and output (Q2) OCPD's must provide 4-pole switching, i.e., switching of the neutral. See [PDRPPNX10-M](#) submittal drawings for additional MBP details.

Monitoring the UPS Load

The user is responsible for monitoring the UPS loading conditions and ensuring that the maximum load ratings listed in **Table 3** are not exceeded. Failure to do so may result in the unexpected tripping of the supply overcurrent protective device (OCPD) and potential loss of power to the loads if the UPS shuts down from low battery supply.

The APC Symmetra PX 40K has a user settable “load” alarm feature. This alarm function is programmable in 5kVA increments, and the UPS will issue an alarm when the load exceeds the set value. See the [User Operation Manual](#) for complete details. Your APC Field Service Engineer can assist you in setting up this feature at the time of installation. APC also offers a variety of other [network management tools](#) to assist the user in monitoring their facility and critical infrastructure power and cooling systems.

Table 3 – Available input supply and permitted maximum percent of PM output ratings

Available Input 208Y/120V			Symmetra 40K UPS Frame Maximum Percent Load based on Qty of PM's Rating ⁴				
CB Rating ¹	Amps ²	kVA ³	5 ⁵	4	3	2	1
175	140	50.4	100%	100%	100%	100%	100%
150	120	43.2	84%	86%	100%	100%	100%
125	100	36.0	67%	71%	100%	100%	100%
110	88	31.7	57%	61%	86%	100%	100%
100	80	28.8	51%	54%	76%	100%	100%
90	72	25.9	44%	47%	67%	100%	100%
80	64	23.1	38%	41%	58%	95%	100%
70	56	20.2	31%	34%	50%	81%	100%
60	48	17.3		27%	41%	67%	100%
50	40	14.4			32%	54%	100%
45	36	13.0			27%	47%	100%
40	32	11.5				41%	94%

Notes:

1. UL marked circuit breaker trip rating
2. Maximum allowable continuous load amperes per the circuit breaker UL Listing @ 80%.
3. Maximum allowable kVA based on three-pole circuit breaker with 208Y/120V source.
4. Exceeding the maximum % listed may result in unexpected loss of power to the load.
5. Percent load for 5 PM's is based on 40kVA UL output rating.

Conclusion

The APC Symmetra PX 40K scalable UPS frame offers a large variety of permitted input overcurrent device rating options and output kVA power rating options. These provide the user with not only scalability, but also flexibility, and manageability features that are not readily available from other manufacturers of UPS systems.

About the Author:

Al Warner is a Senior Staff Engineer with Schneider Electric's Critical Power & Cooling Services Division. He is responsible for interfacing with customers and with authorities having jurisdiction to ensure acceptability of Schneider Electric products. He has over 25 years experience in the UPS industry with electrical engineering emphasis on both R+D, and critical power systems design in accordance with US Standards, International Standards and industry best practices. He has also participated in various industry standards development efforts including UL, NEMA, NFPA, IEEE, and IEC.