

Choosing ac Line Voltage and Cord Options for your Agilent Power Products

7 EASY STEPS FOR CHOOSING LINE CORD OPTIONS

Determine the voltage option			Line cords for low power products		Line cords for high power products		NOTE
STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7	
Go to table 1a. Find the model number of the product you are ordering. Note the standard line voltage. If it is correct you do not need to specify a line voltage option. Go to step 4	If the standard line voltage is not correct, use table 1b to determine which of the available options best matches the available line voltage.	Add the line voltage option to your purchase order.	Go to table 1a. Find the correct line cord option series for the product you are ordering. If your model # requires an 800 series, go to step 6.	If your model # requires a 900 series line cord, the correct one will automatically be shipped for the destination country on the purchase order. DONE!	If your model number requires an 800 series line cord, determine if there is a line cord with plug that matches your outlet receptacle in tables 3a and b.	If not, choose the appropriate unterminated line cord. Add the option number for the appropriate line cord to your purchase order. DONE!	If no line cord option is specified for products which require 800 series line cords, an unterminated line cord will be shipped automatically for the destination country on your purchase order.

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Power distribution systems, regulations, and connection techniques vary greatly among geographic regions as a result of local ac electrical standards. Most Agilent products, including power products which draw less than 500 watts of power from the ac line, can be readily adjusted to accept different line voltages or frequencies.

Line voltage and frequency for certain Power Products may not be field changeable. Choosing the correct voltage option for these products requires care. This is especially true for higher power products. Line voltage / frequency options and method of change are summa-

rized in Table 1a below. Voltages for Europe and Asia Pacific vary widely from country to country. Europe is moving toward harmonization, with countries standardizing on 230 Vac instead of 220 or 240 Vac. Some older products don't offer a 230 Vac option. For countries operating on 230 Vac, option 240 with a range of +6% / -13% (a range of 208 to 254 Vac) generally offers the best match. See table 1b for further information. The specifications listed for each product indicate the range of voltage and frequency that each option accommodates. If in doubt, contact your local Agilent Field Engineer for assistance.

TABLE 1A- AC LINE VOLTAGE/FREQUENCY OPTIONS

Model Number	Standard Line Voltage	Line Voltage Options	50 HZ Operation	Field Changeable; Method	Line Cord Series
6010A, 6011A, 6012A, 6015A	120	100, 220, 230, 240	Yes	Yes; internal board mounted switch and quick connect jumpers	800
6023A, 6028A	120	100*, 220, 240	Yes	Yes; internal board mounted switch and quick connect jumpers	900
6030A, 6031A, 6032A, 6035A	120	100*, 220, 240	Yes	Yes; internal board mounted switch and quick connect jumpers	800
6033A, 6038A	120	100*, 220, 240	Yes	Yes; internal board mounted switch and quick connect jumpers	900
605XA, 606XA	120	100*, 220, 240	Yes	Yes; internal switches	900
654XA	120	100, 220, 240	Yes	Yes; internal board mounted switches	900
655XA	120	100, 220, 230, 240	Yes	Yes; internal quick connect jumpers	900
657XA	230	200*	Yes	Yes; internal board mounted switch	800
66000A	100-240	none	Yes	Not necessary; automatic wide ranging input	800
6610XA	100-120, 200-240	none	Yes	Yes; bottom panel switch	n.a.
661XC	120	100, 220, 230	Yes	Yes; internal quick connect jumpers	900
662XA	120	100, 220, 230, 240	Yes	Yes; moveable insert on rear panel mounted line cord module	900
663XXA	120	100, 220, 230	Yes	Yes; internal quick connect jumpers	900
663XB	120	100, 220, 230	Yes	Yes; internal quick connect jumpers	900
664XA	120	100, 220, 230, 240	Yes	Yes; internal board mounted switch	900
665XA	120	100, 220, 230, 240	Yes	Yes; internal quick connect jumpers	900
667XA, E4356A	230	200	Yes	Yes; internal board mounted switch	800
668XA	220 3Ø	400 3Ø	Yes	Yes; internal connector mounted jumpers	3Ø; unterminated only
6811B	120	100, 230	Yes	Yes; internal connector mounted jumpers	900
6812B	120	100, 230	Yes	Yes; internal connector mounted jumpers	800
6813B	230	200	Yes	Yes; internal connector mounted jumpers	800
6814B, 6834B	230 3Ø	400 3Ø	Yes	NO! Board change required, 3 phase input; return to factory	3Ø; unterminated only
E3610A, E3611A, E3612A	115	ØE3 (230 V), ØE9 (100 V)	Yes	NO! Transformer change required; return to factory	line cord hardwired
E3614A, E3615A, E3616A, E3617A, E3620A, E3630A	115	ØE3 (230 V), ØE9 (100 V)	Yes	Yes; internal board mounted switch	
E3631A, E3632A, E3633A, E3634A	115	ØE3 (230 V), ØE9 (100 V)	Yes	Yes; moveable insert on rear panel mounted ac receptacle	
E364XA	115	ØE3 (230 V), ØE9 (100 V)	Yes	Yes; internal board mounted switch	

Notes: 100*, 200*: for Japan only; derating required, product see specifications

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TABLE 1B - LINE VOLTAGE COVERAGE OF VARIOUS SINGLE PHASE OPTIONS

Note: Consult specific product listing above for options availability.

Line Voltage Vac	80	90	100	110	120	170	180	190	200	210	220	230	240	250
		Opt OE9: 90 - 110 Vac		Std: 120: 104 - 127 Vac					Opt 200: 174 - 220 Vac				Opt 240: 209 - 254 Vac	
													Opt 230/OE3: 207 - 253 Vac	
														Std, Opt 220: 191 - 233 Vac

Low Power Products

For lower power products, a universal receptacle on the rear panel accepts a wide range of line cords to meet local regulatory requirements. Table 2 shows a range of standard line cords that Agilent offers, with option numbers and part numbers.

Part numbers are needed to order a line cord separately.

For products which use the 900 series line cords, the appropriate type is automatically selected at time of shipment, based on the country to which the product is being shipped. If you plan to use your power products in a different country or region than the country to which the product is being shipped, you will need to specify the appropriate line voltage and line cord options on your order, so that we can provide the appropriate configuration. Contact your local Agilent Field Engineer for assistance.

TABLE 2 - 900 SERIES LINE CORD OPTIONS

Available for low power products

Option # / Part No.	900 / 8120 - 1351C (8120 - 8605 for 6811B)	901 / 8120 - 1369C (8120 - 5412 for 655xA / 665xA, 8120 - 8606 for 6811B)	902 / 8120 - 1689C (8120 - 5413 for 655xA/665xA, 8120 - 8607 for 6811B)	903 / 8120 - 4383 (8120 - 4383 for 655xA/665xA, 8120 - 8609 for 6811B)
	United Kingdom	Australia, New Zealand	Europe	United States, Canada
Option # / Part No.	904 / 8120 - 0698C (8120 - 5421 for 665xA / 665xA, 8120 - 8610 for 6811B)	906 / 8120 - 2104C	912 / 8120 - 2956C (8120 - 8608 for 6811B)	917 / 8120 - 4211 (8120 - 5414 for 655xA, 665xA, 8120 - 8611 for 6811B)
	United States, Canada	Switzerland	Denmark	South Africa, India
Option # / Part No.	918 / 8120 - 4753C (8120 - 4383 for 655xA/ 665xA, 8120 - 8609 for 6811B)	919 8120 - 6800	920 8120 - 6869	921 8120 - 6980
	Japan	Israel	Argentina	Chile
Option # / Part No.	922 8120 - 8376 (8120 - 8800 for 6611B)	L = Line or Active Conductor (also called "live" or "hot") N = Neutral or identified Conductor E = Earth or Safety Ground		
	China			

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High Power Products

There are several factors which limit the amount of power which can be readily drawn from a normal branch circuit. For example, in the U.S., the typical 115/120 Vac branch circuit has a circuit breaker rated for 15 A. For industrial applications, 20 A service is commonly available. Current draw for an appliance is further restricted to 80% of the breaker rating unless the circuit is dedicated to only one appliance. The line cord can also represent a limiting factor based on the wire gauge used. Finally, the power supply with a rectifier and capacitive input filter represents a non-sinusoidal current load. Thus, the maximum input current drawn by the power supply is higher than if the input were a resistive load.

The practical result of this is that linear power supplies with outputs over 500 watts and switching supplies rated over 750 watts will generally exceed the capability of a 15 A branch circuit. Connecting power products above these power levels will require installing either a higher voltage or higher current service. Some practical examples are:

- standard line voltage for 2KW products such as the 667XA is 230 Vac; they can not be powered off a 120 Vac line
- the 1KW 601XA and 603XA products cannot be powered off a standard 15 A / 120 Vac circuit; they can operate off a 30 A / 120 Vac service, or they can be configured for 230 Vac operation
- the 66000A mainframe requires a 30 A / 120 Vac service or 230 Vac operation; although each module is 150 watts, the maximum input current is based on the total requirement of 8 modules.

Agilent offers a range of line cords for many higher power products to mate with the wall receptacles commonly specified for these higher power services. Refer to tables 3a, 3b and 3c to determine if there is a line cord for your product with a plug that meets the local requirements. If not, you must order an unterminated line cord. For the products in table 3a, you must specify a line cord option at the time you order your power product, or an unterminated line cord will be shipped.

Often, higher power products (over 1 kW) are hardwired, i.e. connected directly to a breaker panel or distribution box. The line cord may also be hard wired to the back of the power supply where a universal receptacle is impractical. Typically, a local electrician should be consulted to determine the best alternative to connect a high power product to the ac line. Consider the most appropriate option for your application based on local electrical codes.

TABLE 3A - 800 SERIES LINE CORD OPTIONS

Available for high power products. NOTE: If no line cord option is specified on the purchase order, an unterminated line cord will be shipped.

Power supply series	Option Number	601XA 603XA(1kW)	657XA 667XA E4356A	66000A	6812B 6841A	6813B 6842A
Unterminated: line cords without plugs	831	8120-5573	8120-5488	8120-5573	8120-5573	8120-5573
	832	n.a.	8120-5490	n.a.	n.a.	8120-6502
	833	8120-5568	n.a.	8120-5568	8120-5568	n.a.
	834	8120-5566	8120-5545	8120-5566	8120-5566	8120-5566
Terminated: line cords with plugs	841	8120-5572	8120-5491	8120-5572	8120-6505	8120-6505
	842	n.a.	8120-5489	n.a.	n.a.	8120-6506
	844	n.a.	8120-5546	n.a.	n.a.	8120-6507
	845	8120-5570	n.a.	8120-5570	8120-6508	n.a.
	846	8120-5565	n.a.	8120-5565	8120-5565	n.a.
	847	8120-5567	n.a.	8120-5567	8120-5567	n.a.
	848	8120-5569	n.a.	8120-5569	8120-6511	n.a.

TABLE 3B - UNTERMINATED LINE CORDS








(line cords without plugs)

Option 831	12 AWG, 3 wire; UL-listed, CSA-certified; unterminated. Suggested for use in North and South America. Note for 667XA series: intended for use on a dedicated branch circuit and not intended for use in Canada. Note for 603XA and 66000A series: intended for connection to 200-240 Vac service.	Option 833	1.5-mm ² wire size, 3 wire; harmonized cordage; unterminated. Suggested for use in Europe and other areas not listed. Note for 603XA and 66000 series: intended for connection to 200-240 Vac service.
Option 832	4-mm ² wire size, 3 wire; harmonized cordage; unterminated. Suggested for use in Europe and other areas not listed.	Option 834	10 AWG, 3 wire; UL-listed; CSA-certified; unterminated. Suggested for use in North and South America. Note for 603XA and 66000 series: intended for connection to 100-120 Vac service.

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TABLE 3C - TERMINATED LINE CORDS

(line cords with plugs)

Option 841	12 AWG; UL-listed, CSA-certified; with NEMA 6-20P, 20-A, 250-V plug. Suggested for use in North and South America and Japan. Note for 6670 and 6570 Series: Not intended for use in Canada. Intended for use on a dedicated branch circuit.		Option 845	1.5-mm ² wire size; harmonized cordage with IEC 309, 16-A, 220-V plug. Suggested for use in Denmark, Switzerland, Austria, China and other countries not listed.	
Option 842	4-mm ² wire size; harmonized cordage with IEC 309, 32-A, 220-V plug. Suggested for use in Europe and other areas not listed.		Option 846	10 AWG; UL-listed, CSA-certified; with NEMA L5-30P, 30-A, 120-V locking plug, suggested for use in North America.	
Option 844	10 AWG; UL-listed, CSA-certified; with NEMA L6-30P, 30-A, 250 V, locking plug. Suggested for use in North and South America.		Option 847	1.5-mm ² wire size; harmonized cordage with CEE 7/7, 16-A, 220-V plug. Suggested for use in continental Europe.	
			Option 848	1.5-mm ² wire size; harmonized cordage with BS 546, 15-A, 240-V plug. Suggested for use in India and South Africa.	

Note: Order the correct option according to local electrical codes. All line cords listed are 2.5 meters (approx. 8.2 ft) long.

Products with 3-Phase Inputs

Some of the higher power products exceed the capability of a single phase line. Agilent offers several power products which require 3-phase inputs, including the 5KW 668XA dc source family, the 6814B and 6834B ac Sources. For 3-phase power distribution up to the building, there are two different distribution systems in wide use: delta, predominantly used in the US; and wye predominantly used in Europe. However, for service inside the building, the 5 wire wye is the predominant configuration. Products which are delta loads, are compatible with either delta or wye.

As shown in table 4, the delta has only three current carrying conductors; there is no neutral. The wye configuration has four current carrying conductors. In general, the

neutral should carry no significant current. None of the Agilent power products use the neutral connection found on wye systems. Do not connect the neutral to ground.

In selecting the correct operating voltage for 3-phase products you need to distinguish between the line-to-line and the line-to-neutral voltages. The line-to-line voltage is the square root of 3 x the line-to-neutral voltage. It is the line-to-line voltage that is used to specify the input voltage to be applied to Agilent power products. For example, common 3-phase voltages and available options are shown in table 4.

All Agilent 3-phase power products are shipped with either a North American or harmonized unterminated line cord based on the destination country on the purchase order.

TABLE 4 - THREE PHASE ac INPUT SYSTEMS

6814B/6834B and 668XA	Delta	Wye		
				Delta Wye
Standard 180-235 volts (line-to-line)	180-235 volts (line-to-line)	180-235 volts (line-to-line)	104-136 volts (line-to-neutral)*	<p data-bbox="841 1843 1029 1892">These are the ONLY connections used when powering 6814B, 6834B and 668XA</p>
Option 400 360-440 volts (line-to-line)	360-440 volts (line-to-line)	360-440 volts (line-to-line)	208-254 volts (line-to-neutral)*	
*Note: Never connect to the Neutral line connection when powering an Agilent 3φ Product. Included as information ONLY. Standard: p/n 8120 - 6203 Opt 400: p/n 8120 - 6204				

For information on single-phase operation, see page 56 question 2.