

ASD-120

SEQUENCED POWER DISTRO, 120A



ASD-120 – SEQUENCED POWER DISTRO

Congratulations on your purchase of a Furman ASD-120 Sequenced Power Distro. Please read this manual completely before installing your ASD-120, or at the very least review the quick start pages.

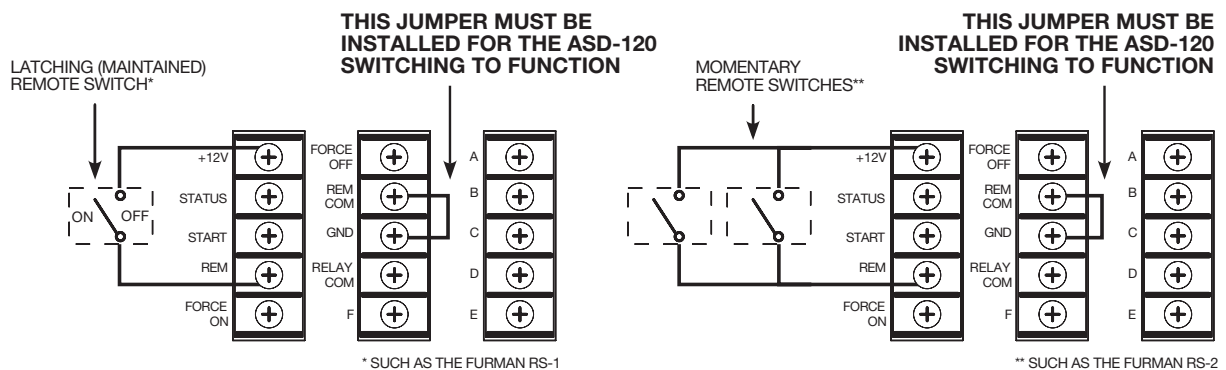
QUICK START

READ THIS FIRST!

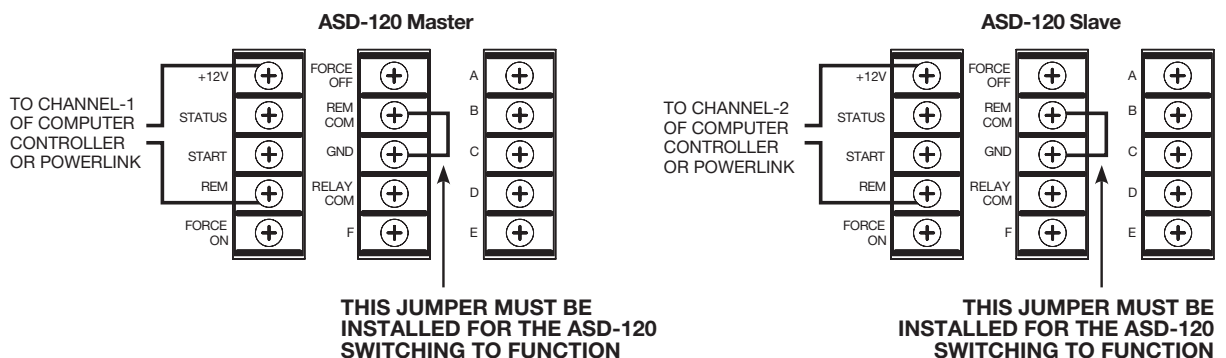
IMPORTANT: DO NOT RACKMOUNT THIS UNIT UNTIL ALL JUMPERS AND WIRING HAVE BEEN INSTALLED. MANY INSTALLATIONS WILL REQUIRE TEMPORARILY REMOVING THE TOP COVER FOR ADJUSTMENTS.

The instructions provided in this manual are insufficient for completing a working ASD-120 installation. While the subject of attaching a supply cable to the ASD-120 is covered, the connection of the far end (pigtail end) of that cable to a power source is not. Because of the many configurations that 120 amp or larger electrical services can take and the numerous connector types that may be used, it is not possible to adequately describe every situation that may be encountered. **Therefore, it is strongly recommended that the selection of the ASD-120 supply cable, and the connections to both ends of it, be done by a licensed electrician who is familiar with the available electrical service. Wiring of electrical input is covered on pages 6 through 8.**

SWITCHING/SEQUENCING CONNECTIONS FOR ASD-120



EMPLOYING TWO OR MORE ASD-120's.

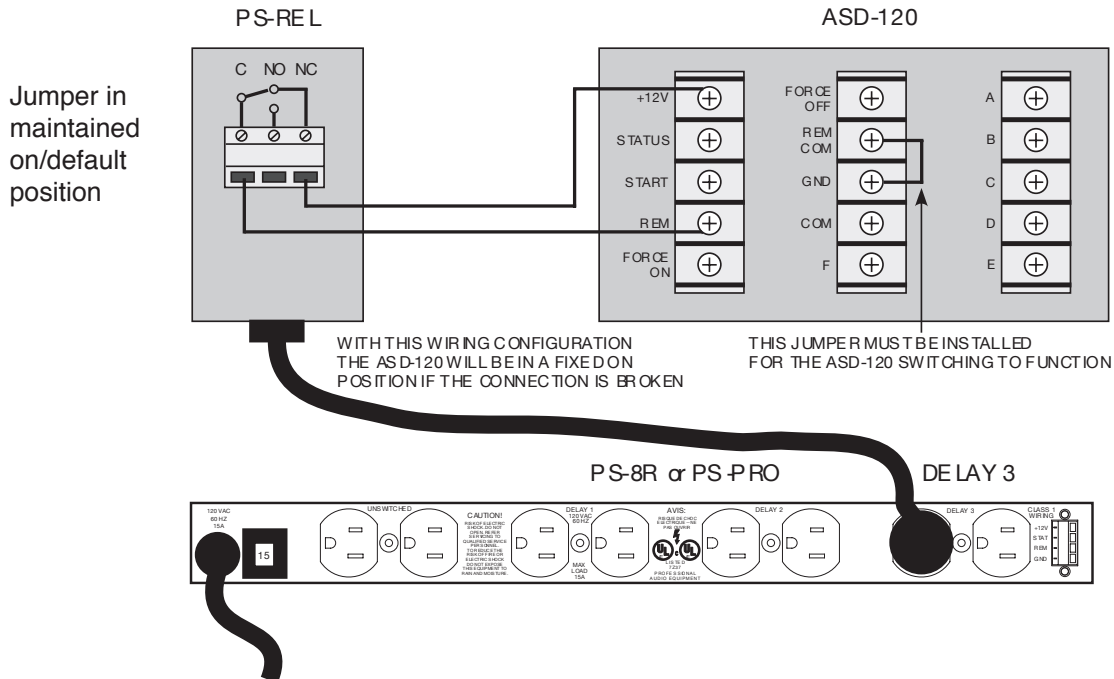


QUICK START

REMOTE INSTALLATION OF AN ASD-120

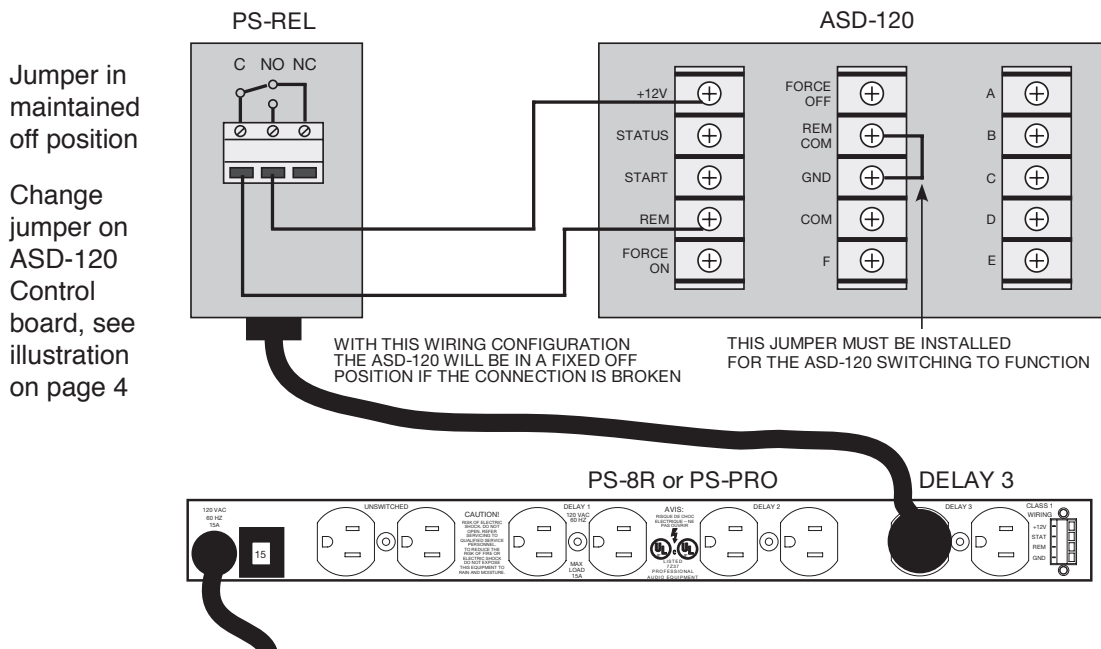
SCENARIO - 1 TYPICAL PROFESSIONAL INSTALLATION

REMOTE ASD-120 TRIGGERED BY HOUSE PS-8R, PS-PRO ACTIVATED BY PS-REL



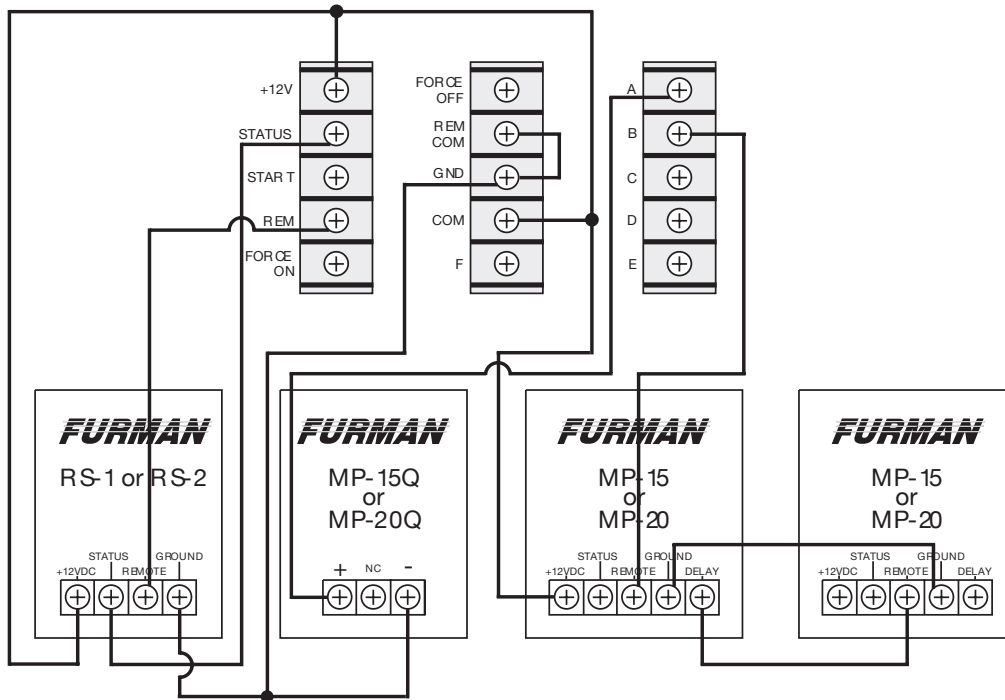
SCENARIO - 2 TYPICAL PROFESSIONAL INSTALLATION

REMOTE ASD-120 TRIGGERED BY HOUSE PS-8R, PS-PRO ACTIVATED BY PS-REL



QUICK START

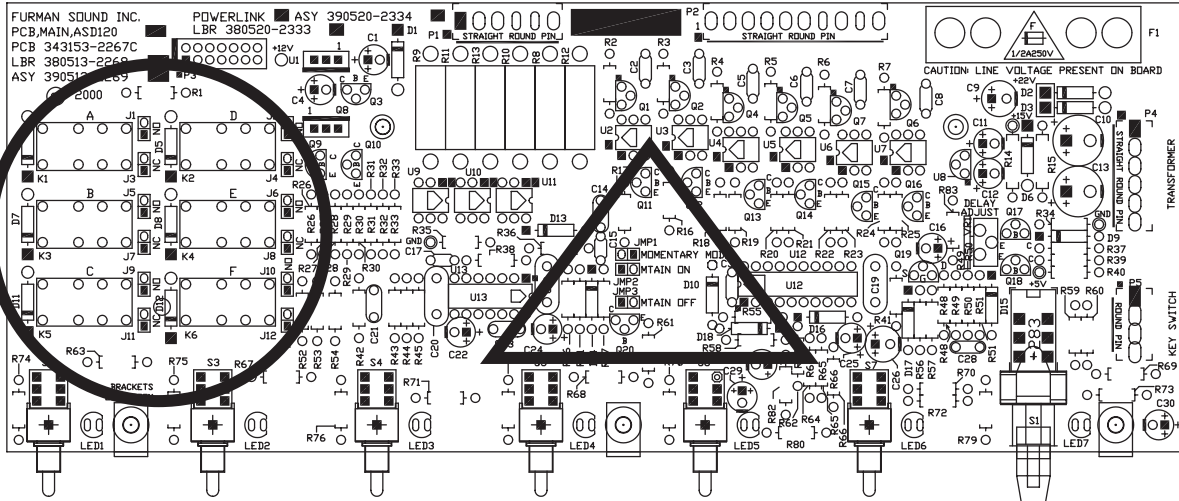
SCENARIO 3 - TYPICAL PROFESSIONAL INSTALLATION



The above diagram shows examples of using Furman remote products in conjunction with one another. With this configuration, you will be turning on an MP-20Q first, then the MP-20 (1) and using the delay feature of the MP-20 (1) to turn on a second MP-20 (2). This whole sequence will be triggered with the RS-1, RS-2, or computer controller.

- If you are using the RS-1, no modifications will need to be made.
- If you are using the RS-2, you will need to open the top cover of the ASD-120 and change the suitcase jumper from JMP2 to JMP1 – which is located at the center of the circuit board. Please refer to the area highlighted by the triangle on the Circuit Board illustration (see next page).
 1. On the A sequence, it will trigger the MP-Q
 2. On the B sequence, it will trigger the MP-20 (1)
- With the MP-20 series, you will need to change the suitcase jumper from J5 (NO) to J7 (NC). Please refer to the area highlighted by the circle on the Circuit Board illustration (next page). This has to be done with all MP-20's that will be triggered by the ASD-120.
 3. Once the MP-20 (1) is triggered by sequence B, the Delay will trigger the MP-20(2).

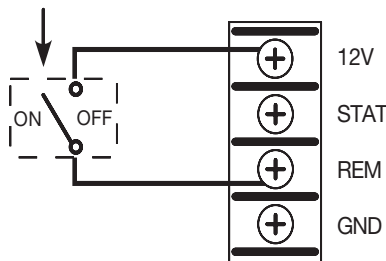
QUICK START



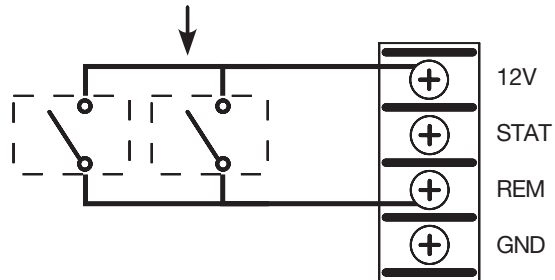
FURMAN SOUND REMOTE TERMINALS

All Furman remote terminals share the same labeling. For remote control only one contact closure is required for triggering the units. The status and ground terminals are strictly for an indicator LED (Light Emitting Diode). For a single remote location use a maintained switch (Furman default).

LATCHING (MAINTAINED)
REMOTE SWITCH

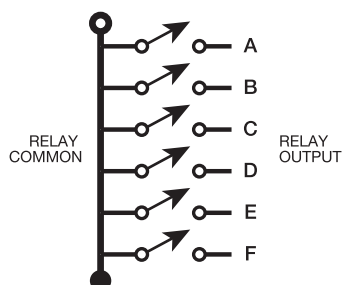


MOMENTARY REMOTE SWITCHES



For multiple remote locations, momentary switches are required. The ASD-120 will have to be opened and a jumper must be moved. JMP2 must be moved to JMP1.

RELAY



Relay can be set with jumpers either normally open or normally closed. The factory default is normally open. For Crestron or AMX type controllers, maintain mode is recommended.

The location of the normally open/normally closed relays is in the upper left corner of the control PCB.

FEATURES

- 120 amp total load
- Six 20 amp, 120 volt circuits, each with a STATUS indicator
- Four buss design accommodates 120/240V single phase, or 208V three phase power
- Six 20A duplex outlets on rear panel
- Front panel key switch for remote security
- Sequence on/off can be initiated from unit or remotely using almost any type of control wires
- Three position ON/SEQ/OFF switch per circuit allows each circuit to be part of the power sequencing, or to be switched on/off independently
- Outlets are powered up and down in sequence
- Six separate, low level relays provide contact closure (or opening) to control and sequence other units, such as additional ASD-120's, PowerPorts, MiniPorts, Power-Links and the PS-8R and PS-PRO Power Sequencers
- Six LEDs on the front panel show status of each circuit
- STATUS indicators for each incoming phase
- Basic MOV spike and surge suppression
- Compact two rack space package

DESCRIPTION

The ASD-120 is an extremely compact, low cost rackmount power distribution system that is ideal for touring PA systems, touring musical and theatrical acts, mobile recording facilities, on-location film

and video shoots, etc. — any situation where AC power must be distributed to multiple circuits and a hard-wired, built-in system is missing, inadequate, or impractical. Use of a Power Distro is cost-effective, both in terms of the convenience it offers and the elimination of bulky and expensive parallel feeds and related connectors.

The ASD-120 is a Sequenced Power Distro. It can handle up to 120 amps of incoming power, distributing it to six 20 amp, 120V circuits. Each circuit has a front panel STATUS indicator that lights up when it is turned on, and a 20 amp duplex outlet on the rear panel. The ASD-120 allows you to sequentially power up and down its six rear panel duplex outlets, each of which is protected by a 20-amp thermal breaker. The delay interval is user-adjustable via an internal trimpot.

Power sequencing is needed whenever various kinds of equipment must be powered up or down in groups, rather than all simultaneously. In audio systems, sequenced powering is often necessary to allow turn-on transients from low level amplifiers and processors to settle down before any power amps are turned on, because simultaneous powering would result in a loud, annoying, and potentially destructive “pop” reaching the speakers. And in any large system whose components present a large inrush load to the AC line (including electric motors, power supplies, and power amplifiers of all kinds), sequenced powering can avoid excessive inrush currents that cause circuit breakers to trip even though the steady-state currents are not excessive.

The ASD-120's front panel provides a three-position ON/SEQ/OFF switch for each circuit that allows each circuit to be part of the power up/down sequence, or to remain on or off independent from the sequence.* An LED adjacent to the ON/SEQ/OFF switch indicates when either the power-up or power-down sequence is in progress. The sequence can be initiated with either momentary or maintained switches, locally or remotely. A duplex outlet is provided for each delay step. A locking switch with a removable key is provided for maximum security (remote operation).

The sequence can also be controlled by input terminals on the rear panel, so one or more ASD-120's may be installed in remote locations and operated via low-voltage control wiring. As the ASD-120 sequences on, it turns on high power relays that allow power to flow to the rear panel outlets, and, in the same sequence, it turns on low level relays that provide contact closures

* Note: The sequencing can be defeated by the toggle switches.
Use a security cover if necessary.

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(or openings) that can be used to control Furman PowerPorts, MiniPorts, PowerLinks, PS-PRO and PS-8R Power Sequencers, or any other circuits that need to know when their particular time delay has elapsed. Using one or more ASD-120's can provide the capability of controlling power and power sequencing for an entire system. Detailed information is provided in the Remote Control section of this manual.

The ASD-120 has no line cord or master breaker, and is designed to be permanently wired to a single phase 120/240V source with 60 amps per side capacity, or to a three phase 120V source with at least 40 amps per phase capacity.

The ASD-120's design incorporates four busses, allowing wiring for 120/240V single phase, or 208V three phase power. A strain relief clamp is provided that can accommodate a cable or wire bundle up to 1.5 inches in diameter. Cable termination is a simple process of breaking out and stripping the individual conductors and connecting them with set screws, and then tightening the strain relief clamp.

The user-supplied mains supply wiring connects to an internal buss assembly. As shipped, the unit is configured for 3-phase power. Outlets A and D are supplied by the X phase input, outlets B and E are supplied by the Y phase input, and outlets C and F are supplied by the Z phase input. 120/240V input can be accommodated by connecting outlets A, C, and E to X, and B, D, and F to Y. The Z input is not used. Fast-on connections to the power input buss allow easy reconfiguration.

Please read the Wiring Instructions section of this manual to guide you through the process of selecting and terminating the supply cable.

WIRING INSTRUCTIONS

Prior to use, the ASD-120 must be fitted with a proper supply cable, which must then be connected to an adequate power source and disconnect. The following instructions will guide you through the selection and connection process. All steps should be done while the unit is disconnected from power and is not mounted in a rack. Begin by removing the four screws that hold the top cover, and the phillips screw on the upper front panel and put the screws and cover aside.

1. Determine the power source. In North America, there are generally two possibilities: 120/240V single phase, or 208V three phase. The first alternative requires only four[†] conductors, but they will need to be heavy to avoid voltage drop in the cable, making the cable less flexible. 120/240V power is available in most residential and some commercial sites. The second alternative, three phase, will require five[†] conductors which can be lighter gauge, but 3 phase power may not be available in every building.
2. Select a cable and determine its length. If the ASD-120 is installed in a permanent or semi-permanent location, it is possible to connect it with flexible metal-jacketed conduit. However, rubber-jacketed (type S) or neoprene-jacketed (type SO) cable will usually be preferable in portable use because of its flexibility and ease of coiling for storage. Another possibility is to use individual wires (such as welding cable) bundled together every foot or two with plastic ties. The gauge and number of conductors depends on the supply voltage and cable or wire bundle length.

The "Current Carrying Conductor" and "Ground Conductor" columns give the minimum recommended AWG size for cable lengths of 100 feet or less. Note that while it is acceptable for the

Consult table 1 below to select the cable type best suited for your application:

	# Conductors Including Ground	Current Carrying Conductors	Ground Conductor
240V**	4	6 AWG	10 AWG
208V 3-ph***	5	8 AWG	12 AWG

Table 1, Required wire gauges

ground conductor to be a smaller gauge than the current-carrying conductors, many cables have all conductors the same size. If they are all the same size, it must be the size specified in the table for the current-carrying conductors.

The ASD-120's strain relief clamp can accommodate a cable up to 1.5 inches in diameter. For reference, a 4 conductor, 2 AWG type S or SO portable cord's diameter is 1.28 inches.

[†] Including ground, assuming the system neutral must be kept separated from the safety (chassis) ground.

** Assumes three 20-amp loads on one conductor and three 20-amp loads on the other conductor.

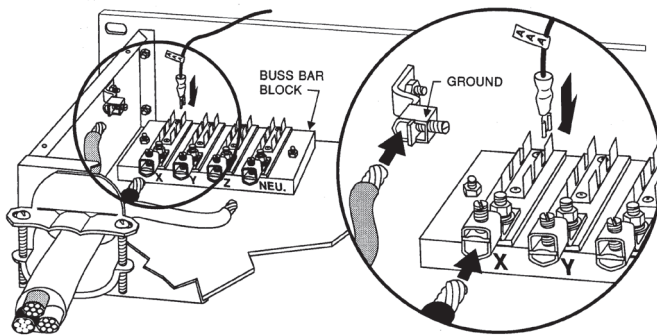
*** Assumes two 20-amp loads on each of the conductors.

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If the cable is to be moved from location to location frequently, we suggest you make it at least a few yards longer than the length needed for the most distant location. This is because the source end will often be left as “pigtails”—that is, with the outer jacket stripped off a few feet and no connectors attached. When the electrician makes the connection to the power source, he or she will often cut a few inches off each conductor to expose clean copper to assure a reliable connection. In this way, the cable will become slightly shorter with each use.

3. Prepare and connect the cable: The supply cable will be connected to the ASD-120's buss bars via terminals that secure the individual conductors with set screws. These can accept wires as large as 2 AWG. Strip one end of the cable to expose the wires. When removing the outer jacket, be careful not to nick or cut into the insulation of the individual conductors. When stripping the individual conductors, be careful not to cut through any of the copper strands. All of the individual conductors should be stripped one-half inch. Please see table below for individual wire lengths.

For 3 phase wiring, the following conductors are needed: Ground = Green or Green with Yellow Stripe. X, Y, Z phases: There is no standard that matches colors to letters, but X = Black, Y = Red, and Z = Blue can be used as a reference. W= Neutral and is always white. For 240V Single phase,



ASD-120 Buss Bar Block

Color of Wire	Wire End Stripped	Wire Length
WHITE (NEU)	.5 inch	6.0 inches
BLUE (Z)	.5 inch	5.0 inches
RED (Y)	.5 inch	4.0 inches
BLACK (X)	.5 inch	4.0 inches
GREEN (Ground)	.5 inch	4.0 inches

Table 2, Suggested cable strip lengths

Ground = Green or Green with Yellow Stripe, X = Black (hot), Y = Red (hot), W = White (neutral). 120V/120A service is not expected to be used much, if at all, with this product, however, Ground, X, and W are used just as in 240V Single phase.

After threading the cable end through the strain relief clamp, connect the stripped conductors to the buss bar block. Be sure to put each wire in the lower part of its terminal, so that it is compressed above and below by copper rather than by the set screw itself. Tighten the set screws securely.

4. Divide the load: Since there is more than one hot wire, the six 20 amp loads must be split among them and balanced as well as possible. This is done by reconnecting the wires from the buss bars to the six circuits. There are two wires to each circuit, a hot (black) and a neutral (white). Only the black wires may be moved. All white wires must connect to the NEU (neutral) buss bar.

Each black wire is labeled with a letter (A, B, C, D, E, or F) corresponding to the circuit it goes to. The connections are made by Fast-On terminals on the buss bars.

To reconnect a wire, grasp it by the terminal and pull straight up. Then reposition it over an unused Fast-On male terminal on the appropriate buss bar and push down firmly. Wire the loads in accordance with Table 3.

5. Tighten clamp and close unit: Tighten the cable strain relief clamp firmly. If you are using a cable, make sure about a half inch of the outer jacket extends beyond the clamp into the unit. If you are using a wire bundle, it is a good idea to wrap the

	Input Color Cable	Buss Bar	Circuits
120V or 240V	Black	X	A, C, E
	Red	Y	B, D, F
208V 3-ph	Black	X	A, D
	Red	Y	B, E
	Blue or Orange	Z	C, F

Table 3, Dividing the load

bundle with several layers of heat shrink tubing or other sturdy material at the point where the clamp tightens, to minimize the likelihood that the clamp will cut into the insulation of the individual wires. Review your remote control options and set control jumpers as required (see Table 3). Replace the top

cover. This completes the internal wiring of the ASD-120.

6. Terminate source end of cable or wire bundle: As mentioned in item 2 (on page 6), the most common cable termination is to break the ends out as pig-tails and leave its hookup to the house electrician in each venue. In some circumstances, a suitable connector may be provided at the power source and the cable can be terminated with a mating connector. Often these will be Cam-Lok® or similar connectors for each individual conductor.

If you want to provide a way to disconnect the cable from the ASD-120 for separate storage or shipment, one good way is to permanently attach a very short cable to the ASD-120 and terminate it with Cam-Lok, Meltric, or similar high-current connectors. A long cable with mating Cam-Loks would then be prepared which could easily be disconnected and stored. A good source for custom made high power cables is “J” Custom Supply, telephone 1-800-226-5657 (1-800-CAM-LOKS).

7. Set internal jumpers to suit your application: See Table 4 on page 9.

CONTROLLING ON/OFF SEQUENCE: ADVANCED

The quick start section at the front of the manual is adequate for typical use. The following is an advanced tutorial and description for those who are so inclined.

A normal, time-delayed on or off sequence may be initiated in either of two ways: locally, via the front panel key switch, or remotely, via a remotely located maintained or momentary switch connected to the ASD-120's rear panel terminal strip. In addition, the behavior of any individual circuit may be overridden by its corresponding front panel ON/SEQ/OFF toggle switch.

The ASD-120's control circuits turn on the outlets in order from A to F when sequencing on, and turn the outlets off in the reverse order from F to A when sequencing off. The time for each step is internally

adjustable with a trim pot, with a range of 0.2 to > 12 seconds per step. (Total time for the entire sequence is from 1 second to > 1 minute).

Local control: Turning the key to the ON (or possibly REM) position initiates an on sequence. Please note that in the absence of any signal applied to the remote input, the REM position defaults to on. (If the ASD-120 has been changed from the factory-preset Maintained Mode to Momentary Mode, you must also press the START ON/OFF SEQUENCE button. However, for purely local control, you should leave the mode set to Maintained.)

When the unit is turned on with the key switch, the ASD-120 will stay on if all outlets are already on, or, if all outlets are off, will begin turning on outlets starting with outlet A, then B, etc. until all outlets are on. If the unit was in the middle of sequencing off and had not yet turned off all outlets, the lowest outlet that was currently off will go on, so the sequence reverses without ever deactivating the outlets that had not yet gone off. The lowest off outlet turns on within 0.2 seconds, regardless of the setting of the delay time trimpot. The next and all following outlets turn on at intervals controlled by the trimpot. The factory default setting is approximately 8 seconds per step.

When the unit is turned off with the key switch, the ASD-120 will stay off if all outlets are already off, or, if all outlets are on, will begin turning off outlets starting with outlet F, then E, etc. until all outlets are off. If the unit was in the middle of sequencing on and had not yet turned on all outlets, the highest outlet that is currently on will go off, so the sequence reverses without ever activating the outlets that had not yet turned on. The highest on outlet turns off within 0.2 seconds, regardless of the setting of the internal delay time trimpot. The next and all following outlets turn off at intervals controlled by the trimpot.

Remote Control: In the REM position, an on or off sequence is initiated by one or more switches connected to the rear panel inputs, or, in Momentary mode, also by the START ON/OFF SEQUENCE button. The ASD-120 responds exactly as it does as described in the preceding section on local control. See the next section for a discussion of Remote Operating Modes.

When the key is in either the ON or OFF position, the ASD-120's sequencing circuits will not respond to the rear panel remote control inputs. If the key switch is later returned to the REM position, the signals supplied to the rear panel remote inputs will again control the unit.

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Overriding a sequence: The ASD-120 outlets are turned on and off by high power relays. The relays are controlled by drivers that can be activated either by the internal control circuits, or directly by a three-position toggle switch. The six ON/SEQ/OFF toggle switches (one per outlet) can override the sequencing circuits, and are intended as a secondary means of control to allow individual on/off control of each outlet for diagnostic purposes. Following are the three positions of each ON/SEQ/OFF toggle switch. Up: Outlet is on regardless of state of sequence control circuits. Center: Outlet is controlled by the sequence circuits (the normal position). Down: Outlet is off regardless of state of sequence control circuits. The center position is the normal operating position, and allows control by the sequencing circuits.

Signal relays: The ASD-120 also has six low level signal relays, accessible by the rear panel terminals labeled A through F, that are powered by the same drive that turns on the AC power relays for the six duplex outlets. These signal relays have an isolated common (labeled RELAY COM) that is independent of the chassis and signal grounds of the ASD-120, for easy interfacing to virtually any other device that could act as a slave to follow the ASD-120.

There is an internal jumper for each signal relay that allows selection of the normally closed or normally open contacts between each of the A to F terminals and RELAY COM. The factory default is that the contacts are closed when the associated outlet is off (normally closed).

The relay contacts may be easily converted to normally open operation by moving six “suitcase” jumpers on the ASD-120’s circuit board. To do this, first disconnect the unit from AC power. Remove the four screws that secure the top cover and the phillips screw on the upper front panel. There are twelve small two-pin

connectors labeled J1 through J12, located near the left side of the largest circuit board. Six of the twelve are joined by small black suitcase jumpers. To change the mode, gently pull them up and reposition them in accordance with Table 4 on the left. Replace the top cover and screws.

REMOTE OPERATING MODES

If the ASD-120 will be controlled locally only, you may skip this section and the next section of the manual.

There are three remote operating modes available: Maintained Mode/Normally On, which is the default, Maintained Mode/Normally Off, and Momentary Mode.

The Momentary Mode on the ASD-120 shares the same characteristics as the Momentary Mode on the Furman PowerPort, MiniPorts, PowerLink and PS-PRO and PS-8R Power Sequencers. Remote inputs (REM, FORCE ON, FORCE OFF) are controlled by applying at least 5 VDC or 6 VAC between the input and the REM COM terminal.

This is the default control logic on all of our existing and past power products. However, the ASD-120’s inputs are enhanced in the following ways: (1) They are polarity independent, and work with positive, negative or AC control signals. (2) They are optically isolated. The remote control inputs have a floating common. (3) They safely accept up to 130 VAC, for direct control from mains supply.

MAINTAINED MODE/ NORMALLY ON (DEFAULT)

In the absence of any signal applied to the remote input, the ASD-120 will sequence on as soon as power is applied, and the key switch is turned to REM or ON. This is Maintained Mode/Normally On. In this mode, voltage must be continually applied to the REM input to keep the ASD-120’s outlets off, when the key switch is in the REM position. This mode is compatible with all other Furman products’ REM inputs.

Internal jumpers allow selection of either of two other optional modes, as described below. Please also see Table 4, Internal User Settable Jumpers.

Table 4: Internal user settable jumpers

JMP1	Momentary Mode
JMP2	Maintained Mode, Normally ON*
JMP3	Maintained Mode, Normally OFF

NOTE: Connect only one jumper of the JMP1-JMP3 group at a time.

J 1, 2, 5, 6, 9, 10	Normally Open jumper positions for signal (low level) relays A, D, B, E, C, F respectively
J 3, 4, 7, 8, 11, 12	Normally Closed jumper positions for signal relays A, D, B, E, C, F respectively*

NOTE: Connect one set of six jumpers of the J1-J12 group at a time.

* Factory Default

MAINTAINED MODE/ NORMALLY OFF

This mode is just the reverse of the Maintained Mode/ Normally On mode. The ASD-120's outlets stay off until voltage is applied to the REM input. Voltage must be continually applied to keep the unit on, when the key switch is in the REM position. This setting will be useful to interface to other brands of controller that have positive control logic (i.e. they put out a signal to indicate that attached gear should turn on). In addition, since the REM inputs are optically isolated, and designed to accept up to 130 VAC, this mode allows the ASD-120 to sequence on if some other source of AC line voltage is turned on.

MOMENTARY MODE

In Momentary Mode, the ASD-120 has “memory”— it only needs a momentary signal to change its state from on to off, or off to on. When first plugged in (or after power is lost and reapplied for any reason) the “memory” state is off. It will stay off until sequenced on by the front panel START ON/OFF SEQUENCE push-button or a momentary connection of the REM IN terminal to a voltage source of at least ± 5 VDC or 6 VAC (130V max). The sequence starts on the rising edge of the signal. The rear panel +12V output may be used as a trigger source. This is further explained in the following section “Setup for Remote Operation”.

Once the ASD-120 is on (or is sequencing on), applying voltage momentarily to the REM input starts switching the ASD-120 off, in descending sequence. Pushing the START ON/OFF SEQUENCE button on the front panel is effectively the same as applying a signal to the REM input (although the actual connection is applied to an internal node, not to the REM terminal on the rear barrier strip).

In Momentary Mode there are two additional inputs that are not required, but may be useful where multiple ASD-120's are controlled from remote locations. Please see the section “Compatibility with Other Furman Products” later in this manual.

SETUP FOR REMOTE OPERATION

The barrier terminal strip on the ASD-120 rear panel allows a switch (or switches) to be connected to turn the unit on and off at a distance, and provides various power, status and relay closure outputs. In the most basic configuration, only two Class 2 wires and an SPST switch are needed to initiate an on or off sequence. The switch may be either a momentary or maintained-contact type. An LED may also be installed at the remote end to indicate power is on, but will require a third wire.

MOMENTARY VS. MAINTAINED CONTACT SWITCHING

An on-off switch of either kind may be used to actuate the ASD-120's remote operation. Maintained switches, such as most toggle switches and push-on/push-off button switches, and including the Furman RS-1 wall mount key lock switch, are open until actuated, then stay closed until actuated again. Momentary switches, including the Furman RS-2 switch, are usually push-button types that are normally open and stay closed only as long as the button is pressed.

Maintained switches are generally most convenient when there is only one remote location. When more than one location is required, momentary switches offer the advantage that either the turn-on or the turn-off sequence may be started from any location.

The ASD-120 is shipped factory-set for maintained operation. It may be easily converted to momentary operation by moving a jumper plug on the ASD-120's circuit board. To do this, first disconnect the unit from AC power. Remove the four screws that secure the top cover and the phillips screw on the upper front panel. There are three small two-pin connectors near the center of the largest circuit board. (See Quick Start triangle on page 4). A small black suitcase jumper can be moved to set the mode. (Please see Table 4 on page 9 for jumper numbers and function description.)

MAINTAINED MODE/ NORMALLY ON

A simple connection of the REM terminal to the +12V terminal initiates an OFF sequence. Disconnecting it initiates an on sequence. If the cable run is long, it is recommended that the REM wire be tied to the ASD-120's GND terminal during on operation rather than leaving it floating. This will require the use of a third conductor and a double-throw switch. NOTE: The REM COM is floating with respect to the ground of the +12V source. To use the +12V with the REM input, the

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REM COM terminal must be connected to the adjacent ground terminal on the rear barrier block. In Maintained Mode, do not use the START ON/OFF SEQUENCE button on the front panel. If you do press the button, the ASD-120, if on, will start an off sequence that will last only until you release the button.

MAINTAINED MODE/ NORMALLY OFF

A simple connection of the REM terminal to the +12V terminal initiates an on sequence. Disconnecting it initiates an off sequence. The other instructions are identical to those in the Maintained Mode/Normally On section above. Again, do not use the START ON/OFF SEQUENCE button on the front panel. If you do press the button, the ASD-120, if off, will start an on sequence that will last only until you release the button.

MOMENTARY MODE

A momentary connection of the REM terminal to the +12V terminal will start the ASD-120's on/off sequence. The +12V output on the rear barrier strip can be used to trigger the REM input. As in Momentary mode, the REM COM must be connected to the adjacent GND terminal. This mode also requires only two wires in the simplest case, +12V and REM. You may wire any number of momentary switches in parallel. In this mode the START ON/OFF SEQUENCE button can also be used to trigger an up/down sequence.

STATUS OUTPUT

In all models, the STATUS terminal is an output that may be used to illuminate an LED at the remote location to indicate that power is available at the ASD-120's outlets. If it is high (+12V), the unit is on (or at least in the process of sequencing on); if low, the unit is off (or sequencing off). Simply connect the indicator LED between STATUS and GND (a series resistor is not required). If the LED does not light when the switch is in the ON position, check the polarity and reverse the LED leads if it is wrong. If a Furman RS-1 is the controlling switch, contact Furman's Tech Support department for the proper wiring diagrams. The STATUS output is a 12V source, current limited to 10 mA. If you wish to use the STATUS output as a voltage signal to some monitoring device, and also wish to light a status LED on a remote panel, put a 1 K Ohm 1/4-watt resistor in series with the LED.

MULTIPLE UNITS

You can use more than one ASD-120 to handle loads that exceed 120 amps. To control them remotely with one or more remote switches, connect the REM and REM COM terminals of all units together. You might need to connect the +12V or GND terminals. Be sure that the mode (momentary or maintained) of all units is set the same. Connect a single maintained switch or one or more momentary switches to the nearest ASD-120, as discussed in the sections above. To avoid tripping house breakers, the power input for each ASD-120 should come from a separate service. If you are unsure whether your building wiring can accommodate multiple fully-loaded ASD-120's, consult a qualified electrician.

Because the trigger sources provided on the rear of the ASD-120 (START and +12V) have a GND that is isolated from the REM COM, it may be necessary to connect GND to REM COM on all units. This will usually be needed. The GND and REM COM would be left isolated if the ASD-120(s) are to be signalled by some other source of voltage, such as the AC line, or a third party controller. The +12V output or the START output on a single ASD-120 has enough output current to switch dozens of REM inputs simultaneously, however, it is harmless to parallel the +12V outputs.

If multiple ASD-120's are controlled by one or more momentary remote switches, they will all change state (from on to off or vice versa) on each rising edge of the voltage on the REM input terminal. Pushing the START ON/OFF SEQUENCE button will affect only the local ASD-120 unless the START terminal on the rear barrier strip of each unit is connected to the REM terminal directly below it. To keep all units in sync, please be sure to make this connection on all units. Once the START and REM terminals are connected on all units, any remote switch and any of the START ON/OFF SEQUENCE button on any unit's front panel will toggle all the units. The key switch on each unit's front panel will turn off (or on) any individual unit without affecting the other units.

The STATUS lines work the same in either mode. Each reflects the true state of the sequence control circuit of its unit, and is affected by both the "memorized" state and by the front panel key switch. A separate LED must be used to indicate the status of each ASD-120. NOTE: The STATUS line will not reflect changes caused by the ON/SEQ/OFF mini-toggle override switches. The STATUS output only indicates if the sequencing control circuits are set to on or off.

To take care of the special (hopefully rare) case of having several ASD-120's in parallel that somehow get out of sync such that every time a remote button is pushed, some units turn on and others turn off, there is a special feature of the REM signal line: Pushing the "START ON/OFF SEQUENCE" button and holding it down for four seconds, or holding the REM line high for at least 4 seconds will force all units to the off state, which will put them back in sync. This may be the only way to re-sync units other than disconnecting AC power to all the units. Remember — operating the front panel key switch does not affect the stored state of the unit, even though it does temporarily turn the outputs off. Please refer to the following section "COMPATIBILITY WITH OTHER FURMAN PRODUCTS," for another way to keep ASD-120's in sync.

ADDITIONAL REMOTE FEATURES:

- STATUS output signal on the rear panel allows remote indication of whether the unit is on or off (high indicates the unit is on or sequencing on, low that the ASD-120 is off or sequencing off)
- +12V output terminal on rear has 40 mA capacity to power many external devices
- +12V supply and STATUS terminals are true voltage sources, with current limiting circuits that prevent damage if the output is heavily loaded or shorted. This allows direct connection of an LED to the STATUS output, or if a voltage is desired from the STATUS output, an external resistor in series with the LED (at least 1K) will allow the STATUS output to rise to 12 VDC while simultaneously lighting the LED.
- A START output on the rear goes to +12V (with a 1K source impedance) when the front panel momentary START ON/OFF SEQUENCE push button is pushed. This allows the ASD-120 to send a signal to other units

that can be turned on and off by a momentary voltage signal. Note: This start function is merged with the REM input on other Furman products.

COMPATIBILITY WITH OTHER FURMAN PRODUCTS

The ASD-120's remote control features are similar to those on the PS-8R and PS-PRO Series with the following enhancements: A separate LED (next to the front panel START ON/OFF SEQUENCE button and labeled REM ON) shows the "memorized" state. This LED will be on whenever the remote control circuits are set to turn the unit on, off if the remote control circuits are trying to turn the unit off. (Other Furman products blink one of their status lights to indicate the remote status.)

Because the remote control inputs are optically isolated, they have a separate "ground" from the chassis and control logic. In some cases this "ground," labeled REM COM, may need to be connected to the signal ground GND. The ASD-120 has three remote input terminals. The REM input is used in both Momentary and Maintained modes, as described in the previous sections on remote operating modes. FORCE ON and FORCE OFF work only in momentary mode, and are the same as the ON and OFF inputs of the PowerPort. If the unit is off, applying power momentarily to the FORCE ON input will set the memorized state to on, which will start the on sequence. Applying further control signals (of any duration) to this input will have no effect. If the unit is on (or sequencing on) applying power momentarily to the FORCE OFF input will set the memorized state to off, which will start the off sequence. Applying further control signals (any duration) to this input has no effect.

FORCE ON/FORCE OFF OPERATION

The FORCE ON and FORCE OFF inputs provide an assured method of controlling multiple ASD-120's, with no possibility that the units will get out of sync with each other, as can happen when using the regular REM toggle input. These two inputs also make the ASD-120 directly compatible with the PowerPort. As is the case with the PowerPort, the disadvantage of using the separate ON and OFF inputs instead of the single REM toggle input is that two momentary switch-

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es (and at least three wires) are required at every remote control location.

Where a single ASD-120 is controlled from multiple remote locations there is no advantage to using the separate ON and OFF inputs, unless the switch location makes it difficult for you to tell whether the system is currently on or off.

LIMITED 3 YEAR WARRANTY

Furman Sound, LLC., having its principal place of business at 1690 Corporate Circle, Petaluma, CA 94954 ("Manufacturer") warrants its ASD-120 (the "Product") as follows:

Manufacturer warrants to the original Purchaser of the Product that the Product sold hereunder will be free from defects in material and workmanship for a period of three years from the date of purchase. The Purchaser of the product is allowed fifteen days from the date of purchase to complete warranty registration by mail or on-line at the Furman website. If the Product does not conform to this Limited Warranty during the warranty period (as herein above specified), Purchaser shall notify Manufacturer in writing of the claimed defects. If the defects are of such type and nature as to be covered by this warranty, Manufacturer shall authorize Purchaser to return the Product to the Furman factory or to an authorized Furman repair location. Warranty claims should be accompanied by a copy of the original purchase invoice showing the purchase date; this is not necessary if the Warranty Registration was completed either via the mailed in warranty card or on-line website registration. Shipping charges to the Furman factory or to an authorized repair location must be prepaid by the Purchaser of the product. Manufacturer shall, at its own expense, furnish a replacement Product or, at Manufacturer's option, repair the defective Product. Return shipping charges back to Purchaser will be paid by Manufacturer.

THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Manufacturer does not warrant against damages or defects arising out of

improper or abnormal use of handling of the Product; against defects or damages arising from improper installation, against defects in products or components not manufactured by Manufacturer, or against damages resulting from such non-Manufacturer made products or components. This warranty shall be cancelable by Manufacturer at its sole discretion if the product is modified in any way without written authorization from Furman Sound. This warranty also does not apply to Products upon which repairs have been affected or attempted by persons other than pursuant to written authorization by Manufacturer.

THIS WARRANTY IS EXCLUSIVE. The sole and exclusive obligation of Manufacturer shall be to repair or replace the defective Product in the manner and for the period provided above. Manufacturer shall not have any other obligation with respect to the Products or any part thereof, whether based on contract, tort, strict liability or otherwise. Under no circumstances, whether based on this Limited Warranty or otherwise, shall Manufacturer be liable for incidental, special, or consequential damages. Manufacturer's employees or representatives' ORAL OR OTHER WRITTEN STATEMENTS DO NOT CONSTITUTE WARRANTIES, shall not be relied upon by Purchaser, and are not a part of the contract for sale or this limited warranty. This Limited Warranty states the entire obligation of Manufacturer with respect to the Product. If any part of this Limited Warranty is determined to be void or illegal, the remainder shall remain in full force and effect.

SERVICE

Before returning any equipment for repair, please be sure that it is adequately packed and cushioned against damage in shipment, and that it is insured. We suggest that you save the original packaging and use it to ship the product for servicing. Also, please enclose a note giving your name, address, phone number and a description of the problem. NOTE: All equipment being returned for repair must have a Return Authorization (RA) Number. To get an RA Number, please call the Furman Service Department, (707) 763-1010, Ext. 120 or 121, between 8 am and 5 pm U.S. Pacific Time. Please display your RA Number prominently on the front of all packages.

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ASD-120 SPECIFICATIONS

VOLTAGE AND CURRENT	Input Current: 120 amps Input Voltage: 120/240V single phase, or 208V 3-ph. Output: Six identical 20 amp, 120V circuits
CIRCUIT BREAKERS	Thermal, 20A
POWER SEQUENCING	Delay Interval: 0.2 to 10 seconds per step (adjustable with internal trimpot)
REM CONTROL INPUTS	Optically isolated, AC or DC drive, 12K ohm input impedance. Operates at 5 VDC or 6-130 VAC. Max 130 VAC from REM COM to chassis
SIGNAL RELAY OUTPUTS	Common isolated from chassis and control ground. 130 VAC max from relay common to chassis. Relay can switch 1/2 amp max @ 125 VAC, or 1/2 amp max @ 24 VDC.
SPIKE/SURGE PROTECTION	Spike Protection Mode: Line to neutral on each circuit. Clamping Voltage: 200V peak. Response Time: 1 nanosecond. Maximum Surge Current: 6,500 amps. Maximum Spike Energy: 80 joules per circuit.
OTHER	Mechanical: Weight: 20 lbs (9.1 kg). Dimensions: 3.5" H x 19" W x 9 5/8" D (8.9 x 48.3 x 24.4 cm) Construction: Steel chassis, zinc chromate plating; .125" brushed and black anodized aluminum front panel. Power Consumption at 130 VAC: 23 watts Safety Information: All current-carrying components

FURMAN

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