

MPX R1

Remote MIDI Controller

Service Manual

lexicon

Precautions

Save these instructions for later use.

Follow all instructions and warnings marked on the unit.

Always use with the correct line voltage. Refer to the manufacturer's operating instructions for power requirements. Be advised that different operating voltages may require the use of a different line cord and/or attachment plug.

Do not install the unit in an unventilated rack, or directly above heat producing equipment such as power amplifiers. Observe the maximum ambient operating temperature listed in the product specification.

Slots and openings on the case are provided for ventilation; to ensure reliable operation and prevent it from overheating, these openings must not be blocked or covered. Never push objects of any kind through any of the ventilation slots. Never spill a liquid of any kind on the unit.

This product is equipped with a 3-wire grounding type plug. This is a safety feature and should not be defeated.

Never attach audio power amplifier outputs directly to any of the unit's connectors.

To prevent shock or fire hazard, do not expose the unit to rain or moisture, or operate it where it will be exposed to water.

Do not attempt to operate the unit if it has been dropped, damaged, exposed to liquids, or if it exhibits a distinct change in performance indicating the need for service.

This unit should only be opened by qualified service personnel. Removing covers will expose you to hazardous voltages.

This triangle, which appears on your component, alerts you to the presence of uninsulated, dangerous voltage inside the enclosure... voltage that may be sufficient to constitute a risk of shock.



This triangle, which appears on your component, alerts you to important operating and maintenance instructions in this accompanying literature.

Notice

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designated to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment OFF and ON, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna
- Relocate the computer with respect to the receiver
- Move the computer away from the receiver
- Plug the computer into a different outlet so that the computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

"How to identify and Resolve Radio/TV Interference Problems."

This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock No. 004-000-00345-4.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la class B prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

Acknowledgements

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SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service and repair of this instrument. Failure to comply with these precautions, or with specific warnings elsewhere in these instructions violates safety standards of design manufacture and intended use of the instrument. Lexicon assumes no liability for the customer's failure to comply with these requirements.

GROUND THE INSTRUMENT

To minimize shock hazard the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor AC power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument.

DANGEROUS PROCEDURE WARNINGS

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

WARNING

Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing and adjusting.

SAFETY SYMBOLS

General definitions of safety symbols used on equipment or in manuals.



Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.



Indicates dangerous voltage. (Terminals fed from the interior by voltage exceeding 1000 volts must be so marked.)

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, condition or the like which, if not correctly performed or adhered to, could result in injury or death to personnel.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, condition or the like which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

NOTE:

The NOTE sign denotes important information. It calls attention to procedure, practice, condition or the like which is essential to highlight.



CAUTION

Electrostatic Discharge (ESD) Precautions

The following practices minimize possible damage to ICs resulting from electrostatic discharge or improper insertion.

- Keep parts in original containers until ready for use.
- Avoid having plastic, vinyl or styrofoam in the work area.
- Wear an anti-static wrist-strap.
- Discharge personal static before handling devices.
- Remove and insert boards with care.
- When removing boards, handle only by non-conductive surfaces and never touch open-edge connectors except at a static-free workstation.*
- Minimize handling of ICs.
- Handle each IC by its body.
- Do not slide ICs or boards over any surface.
- Insert ICs with the proper orientation, and watch for bent pins on ICs.
- Use anti-static containers for handling and transport.

*To make a plastic-laminated workbench anti-static, wash with a solution of Lux liquid detergent, and allow to dry without rinsing.

Notch



Pin 1

CAUTION

ICs inserted backwards will be destroyed. Incorrect insertion of ICs is also likely to cause damage to the board.



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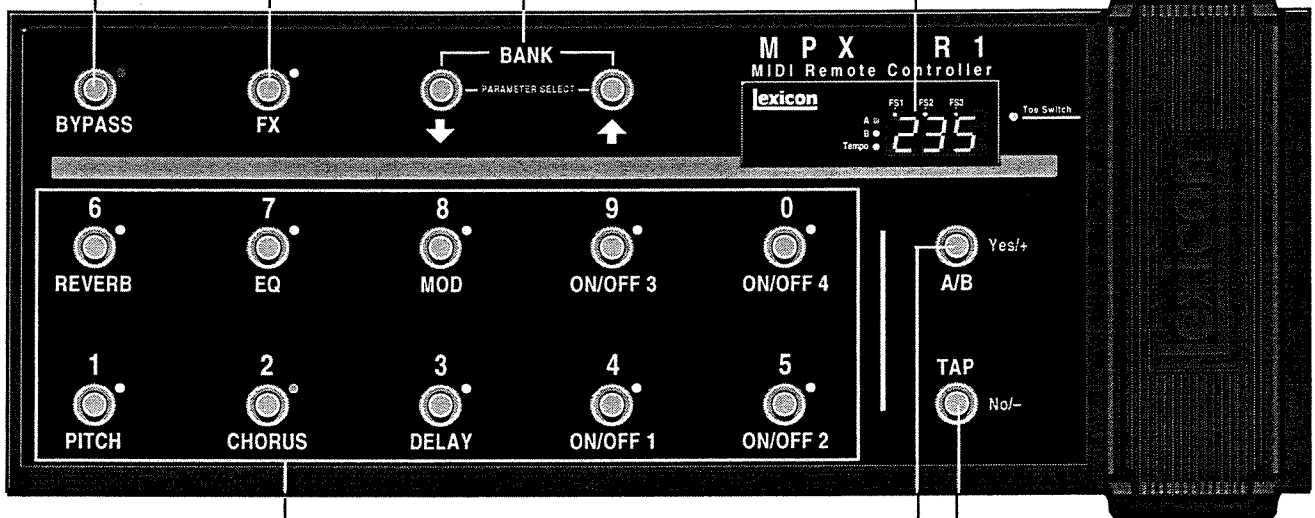
Product Overview The Front Panel

FX
Toggles between Program and FX Modes. LED off indicates Program Mode is active. LED on indicates FX Mode is active.

Bypass
Assignable switch sends a MIDI Controller value BYPASS ON=127; BYPASS OFF=0.

Bank/Parameter Select
Buttons increment and decrement program banks (0-25), or select adjustable parameters for editing. Pressing and holding either button activates fast scrolling.

Display
FS1, FS2 and FS3 LEDs light to indicate state of external foot switches.
3-Digit Display indicates ID number of currently loaded program.
Tempo LED flashes in time with current tempo rate when Tap is active.
A/B LEDs light to indicate A/B function is active.



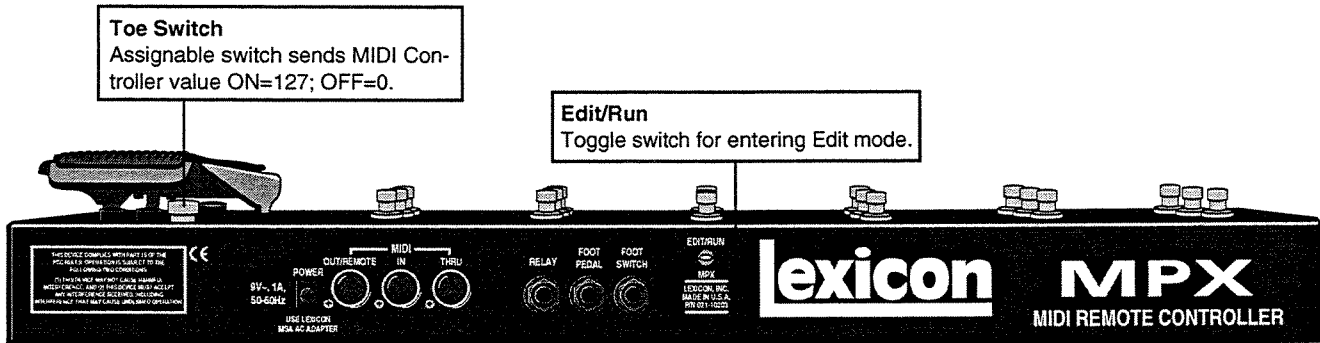
Switches (0-9)
Press to complete a Program Change message which consists of the current Bank number and the switch number (0-9). In FX mode, switches can be programmed to transmit any MIDI Controller, Clock commands, Relay settings or MIDI Program Change. Switches 0-9 are used for entering Program Change selections in Direct Access Mode.

A/B
Assignable switch, when used with the MPX 1, activates a variable glide between patched parameters.

Programmable Pedal
Operates as an assignable MIDI Continuous Controller. Toe Switch allows patched effects to be turned on and off.

Tap
When Tempo LED is flashing, sets tempo. (Press two or more times in rhythm to establish tempo rate.)

The Rear Panel



Toe Switch
Assignable switch sends MIDI Controller value ON=127; OFF=0.

Edit/Run
Toggle switch for entering Edit mode.

POWER
Use Lexicon MSA power adapter, or 9 VAC 1 amp equivalent. Jack is unused when powering the MPX R1 with the 7-pin DIN connector.

Foot Pedal
1/4" Tip/Ring/Sleeve phone jack provided for foot pedal with 10kΩ to 50kΩ impedance.

MIDI OUT/REMOTE
5-pin DIN connector for MIDI OUT or
7-pin DIN connector for MIDI OUT and bidirectional MIDI remote (for use with MPX 1).

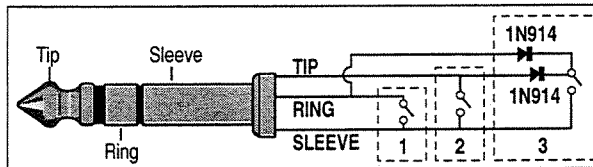
IN
5-pin DIN connector receives MIDI data from other equipment.

THRU
5-pin DIN connector passes any MIDI data received without change.

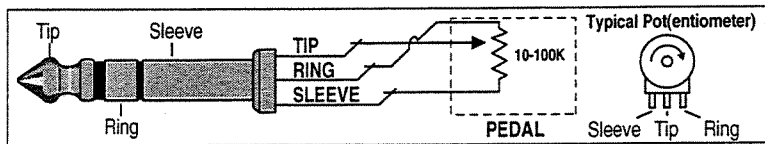
Relay
1/4" Tip/Ring/Sleeve phone jack software selectable as a momentary or latching switch.

Foot Switch
1/4" Tip/Ring/Sleeve phone jack for as many as three independent footswitches.

Foot Switch

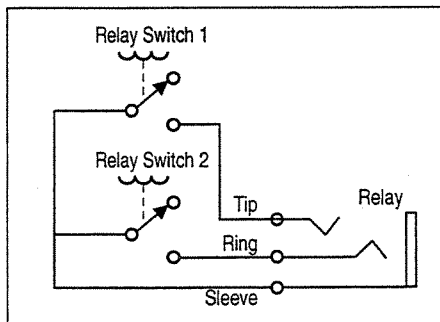


Foot Pedal



For control-voltage input, use a 1/4" stereo plug with Sleeve connected to ground, Tip connected to the control voltage, and Ring unconnected or shorted to ground..

Relay

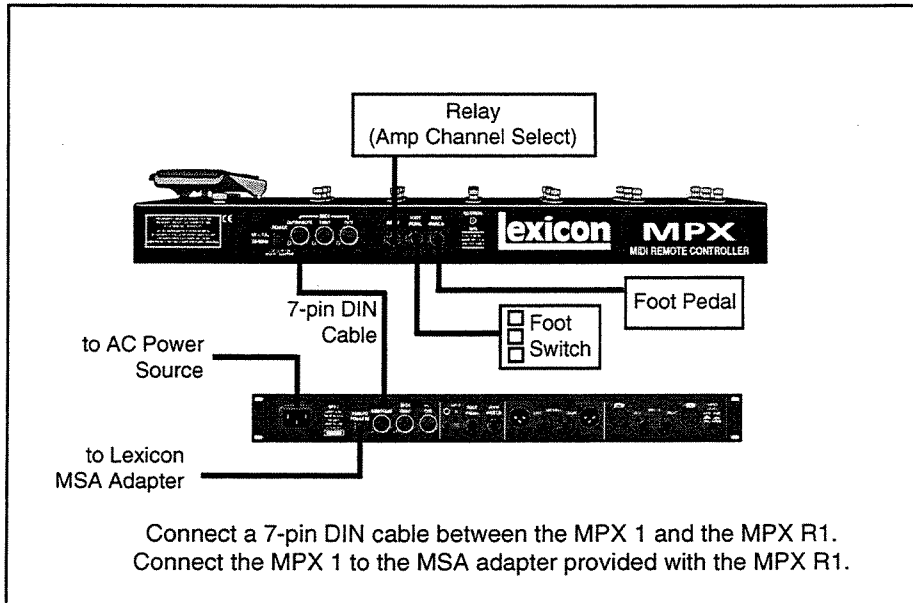


Installation Notes

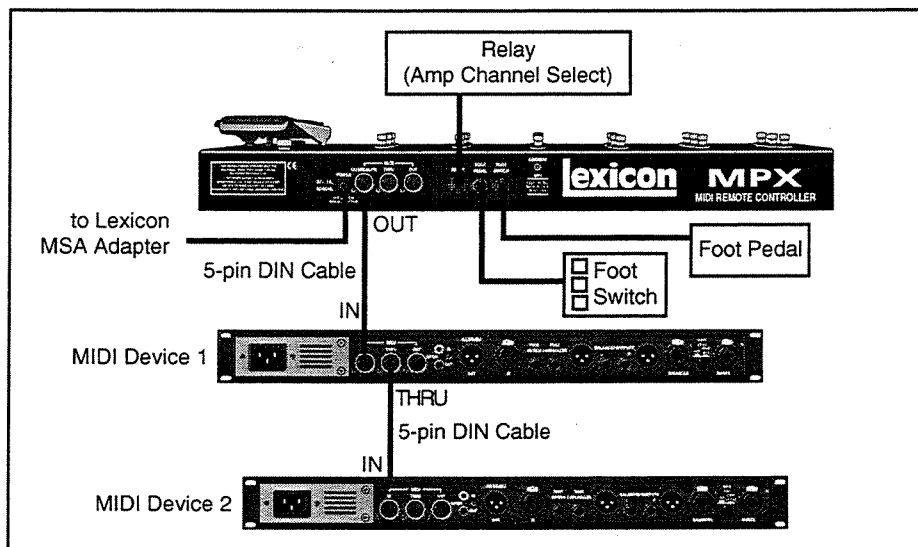
Use Lexicon MSA power adapter, or 9 VAC 1 amp equivalent.

Power Requirements

Connecting the MPX R1 to an MPX 1



Stand-alone Configuration



Periodic Maintenance

Under normal conditions the MPX 1 requires minimal maintenance. Use a soft, lint-free cloth slightly dampened with warm water and a mild detergent to clean the exterior surfaces of the unit.

Do not use alcohol, benzene or acetone-based cleaners or any strong commercial cleaners.

Avoid using abrasive materials such as steel wool or metal polish. If the unit is exposed to a dusty environment, a vacuum or *low-pressure* blower may be used to remove dust from the unit's exterior.

Ordering Parts

When ordering parts, identify each part by type, value and Lexicon Part Number. Replacement parts can be ordered from:

Customer Service
Lexicon, Inc.
3 Oak Park, Bedford MA 01730-1441
Telephone: 781-280-0300
Customer Service Fax: 781-280-0499
email: csupport@lexicon.com

Returning Units for Service

Before returning a unit for warranty or non-warranty service, consult with Lexicon to determine the extent of the problem, and to obtain Return Authorization. No equipment will be accepted without Return Authorization from Lexicon.

If you choose to return an MPX 1 to Lexicon for service, Lexicon assumes no responsibility for the unit in shipment from customer to the factory, whether the unit is in or out of warranty. All shipments must be well packed (using the original packing materials if possible), properly insured, and consigned to a reliable shipping agent.

When returning a unit for service, please include the following information:

- Name
- Company name
- Street address
- City, State, Zip Code, Country
- Telephone number (including Area Code)
- Serial number of unit
- Description of the problem
- Preferred method of return shipment
- Return Authorization #, both inside and outside of package

Please enclose a brief note describing conversations with Lexicon personnel and give the name and telephone number of the person directly responsible for maintaining the unit.

Do not include accessories such as manuals, cables, footswitches, etc. with the unit, unless specifically requested to do so by Lexicon Service personnel.

MPX R1 Specifications

Dimensions:	23 in x 8 in x 3 in (WHD) (58.42 cm x 20.32 cm x 7.62 cm)
Weight:	9.5 lbs (4.3 kg)
Construction:	All metal chassis, switches and expression pedal
External control inputs:	1 1/4" TRS jack supports up to 3 on/off switches 1 1/4" TRS jack for external expression pedal
Internal relays:	1 1/4" TRS jack connected to two internal programmable relays
MIDI:	MIDI OUT/REMOTE: 7-pin DIN connector (compatible with standard 5-pin MIDI) provides phantom power and two-way MIDI communication with the MPX 1 MIDI IN: standard MIDI IN can also be used to merge a second MIDI input stream when MIDI OUT/REMOTE is connected MIDI THRU: can be set to pass MIDI from either MIDI IN or REMOTE ports
Power:	9VAC, 1A wall transformer provided 25-foot 7-pin DIN cable for phantom power via MPX 1
Expression pedal:	vintage mechanical design, all steel construction, programmable toe switch
Display:	3-digit LED indicates program number and tempo rate
MIDI functions:	MIDI bank and program select for up to 300 programs Switches and pedal(s) can be individually set to transmit any controller. The status of each MIDI switch is indicated with a green LED. Tap tempo can be transmitted as MIDI Clock
Relay mapping:	Different relay states can be memorized for each of 990 MIDI program numbers Relays can operate as on/off 1–4 or as two independent on/off switches
MPX 1 functions*:	When connected to an MPX 1 via 7-pin cable, R1 LEDs automatically display the following each time a new program is loaded: Program number Master Bypass state A/B state Tempo rate State of each effect block (Pitch, Chorus, EQ, Mod, Delay, Reverb); effect on=green, effect bypassed=red, effect not active=off The state of any active effect can be instantly changed by pressing its associated switch Dedicated switches for control of A/B and Tap.

* MPX 1 requires V1.1 ROM upgrade

Internal Audio Data Paths	Conversion:	18 bit A/D, 20-bit D/A
	DSP:	32 bits
	S/PDIF I/O:	24 bits
Control Interface	MIDI:	7-pin DIN connector for MIDI IN/powered bidirectional remote 5-pin DIN connectors for MIDI THRU and OUT
	Footswitch:	1/4 inch T/R/S phone jack for 3 independent footswitches
	Foot pedal:	1/4 inch T/R/S phone jack (10k Ω min, 100k Ω max impedance)
	Remote	
	Power In:	2.5mm barrel for 9VAC remote power
General	Dimensions:	19.0"W x 1.75"H x 9.0"D (483 x 45 x 289mm) 19 inch rack mount standard, 1U high
	Weight:	Net: 6lbs 2oz (2.8kg)
		Shipping: 9lbs 3oz (4.2kg)
	Power	
	Requirements:	100-240VAC, 50-60Hz, 25W, 3-pin IEC power connector
	Environment:	Operating temperature: 32° to 104°F (0° to 40°C)
Storage temperature: -22° to 160°F (-30° to 70°C)		
Humidity: maximum 95% without condensation		
Electrical Approvals	Safety	
	Compliance:	UL1419 and CSA 22.2 No. 1-94 (UL and C-UL marks) EN60065 (TUV-GS and CE marking per Directive 73/23/EEC)
	EMC	
	Compliance:	FCC Class B EN55022 Class B and EN50082-1 (CE marking per Directive 89/336/EEC)

Specifications subject to change without notice.

Proof of Performance & Troubleshooting

Proof of Performance

To verify performance of the MPX R1, perform the following test and diagnostic procedures.

The +5 volt supply can be tested as follows without removing the main board from the chassis.

1. Remove the six screws attaching the bottom cover, and remove the cover.
2. Power up the MPX R1 with its 9 volt AC 1 amp power pack.
3. Set the DMM to measure VDC and check the regulated voltage for proper levels.

Supply	Location	Range
+5VD	U6 solder side of board Place negative probe on the mounting screw Place positive probe on pin 3	+4.95 to +5.25

With power disconnected from the MPX R1:

1. Set the DMM for DC voltage on the 20 volts scale.
2. Locate SRAM U8.
3. Place the negative probe on U8 pin 14
4. Place the positive probe on U8 pin 28
5. Verify a DMM measurement of >2.75VDC

With power disconnected from the MPX R1:

1. Set the DMM for DC voltage on the 2 volts scale.
2. Locate test points TP3 and TP4 near the battery.
3. Place the negative probe on TP3.
4. Place the positive probe on TP4.
5. Verify a DMM measurement of <.005VDC

The frequency counter will be required for this test, which verifies the clock crystal (Y1) for the Z80 (U11).

1. Power up the MPX R1 with its 9 volt AC 1 amp power pack.
2. Locate TP5 at Y1 (near U11).
3. Place the frequency counter probe on TP5.
4. Verify a frequency measurement of 20.00MHz

Power Supply

Required Equipment

- 1 DMM (Digital Multimeter)
- 1 Frequency Counter
- 100MHz oscilloscope (with 1x, 10x probes)

Battery Voltage

Battery Current

System Clock

Troubleshooting

The MXP R1 has two Diagnostic modes: Power On Diagnostics and Extended Diagnostics. Power On Diagnostics are executed automatically when the MXP R1 is first powered on. Extended Diagnostics are accessed by holding down the "1" button while the unit is being powered up.

Power On Diagnostics

When the MXP R1 is first powered up, all LEDs will light for approximately two seconds. LEDs 1-4 and 6-9 are bi-colored. These will first light green, then red. The remaining LEDs will remain lit for the two seconds.

The following sequence of diagnostic tests will then be run.

Test #	Name
01	Z180 CPU Test
02	ROM Checksum Test
03	SRAM Test

The rightmost character of the display will flash **1, 2, 3** before settling into display of the number of each test while it is run. Failure of any test is indicated by the display of an **E** on the leftmost display segment along with the test number.

For example a **01** flashing in the rightmost display indicates the CPU test is running. Failure of the CPU test will cause the display to show **E01**.

Power On Diagnostics Test descriptions

01 Z180 CPU Test

This test checks for stuck bits in the CPUs register. The Z180 (U11) sends values through its internal register and attempts to read the same information back. The values sent are 00h, 55h, AAh, and FFh.

02 ROM Checksum Test

This test takes the ROM checksum (a byte sized value stored in the last memory location of Bank 0) and adds it to the contents of the entire ROM (U9). The result should equal zero.

03 SRAM Test

This is a memory test which writes values into all the memory locations of the SRAM (U8), then reads them back to verify that the data received matches the data sent. The values sent are 55h, AAh, FFh, and 00h.

Error Reporting

When an error is displayed in any of the three Power Up Diagnostic tests, three options are available to address the problem reported:

1. Press the **FX** button to put the failed test into a continuous loop mode. In this mode a walking 1's pattern is active on both the Address and Data bus lines for troubleshooting the circuit.
2. Press the **BYPASS** button to continue the Power Up Diagnostics.
3. Press and hold the **1** button, then press **BYPASS** to access Extended Diagnostics.

Extended Diagnostics are used to give more extensive information when the MXP R1 fails Power On Diagnostics, or when the unit exhibits some other malfunction. Following is a list of the available tests .

Extended Diagnostics

Test #	Name
01	Z180 CPU Test
02	ROM Checksum Test
03	SRAM Test
04	Switch/LED/Relay Test
05	Display Test
06	MIDI Test
07	Internal Footpedal
08	External Footpedal
09	Burn In Loop Test
00	Initialize

To access Extended Diagnostics, press and hold down **1** while powering up the unit. When the display reads **04**, release the **1** button.

04 indicates the Switch/LED/Relay test. To select another test, press the button corresponding to the test number you want, or use the **BANK** buttons to scroll through the test numbers.

To execute the selected test, press the **FX** button.

While a test is running, the leftmost display segment will spin in a clockwise chase pattern. If the test passes, the chase pattern will be replaced with a **P**. If the test fails an **E** will be displayed.

When the test has finished and **P** or **E** is displayed, press the **FX** button to return to the Extended Diagnostics select mode, where you can select another test via the numbered buttons.

To exit Extended Diagnostics, press **BYPASS**.

01 Z180 CPU Test

This test checks for stuck bits in the CPU's register. The Z180 (U11) sends values through its internal register and attempts to read the same information back. The values sent are 00h, 55h, AAh, and FFh.

02 ROM Checksum Test

This test takes the ROM checksum (a byte sized value stored in the last memory location of Bank 0) and adds it to the contents of the entire ROM (U9). The result should equal zero.

03 SRAM Test

This is a memory test which writes values into all the memory locations of the SRAM (U8), then reads them back to verify that the data received matches the data sent. The values sent are 55h, AAh, FFh, and 00h.

Extended Diagnostics Test Descriptions

04 Switch/LED/Relay Test

This test requires the operator to manually press the front panel and external switches to verify the operation of the 18 switches, 2 footswitches, and 16 LEDs. The display reports the status of each switch as it is tested.

Front Panel Switches

When a switch is pressed, the leftmost display segments show the number of the switch and the rightmost segment shows a **P** to indicate that the switch has been pressed. If the switch is held, then released, an **h**, followed by an **r** is displayed

Switches that have bi-colored LEDs will initially light red, then light green when they are held down.

External Foot Switches

To test the External Foot switch, connect a 1/4" stereo phone plug cable between the A/B Relay jack (J3) and the External Foot switch jack (J1).

When the cable is connected, the **FS1** LED in the display will light, indicating that the relay RY1 is closed. Press and hold the **A/B** button to close the RY2 relay and light the **FS2** LED.

Toe Switch Test

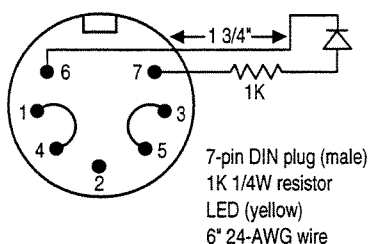
To test the Toe Switch, push the foot pedal all the way down until the switch clicks. The **Toe Switch** LED will light, the rightmost display segment will show a **P** to indicate that the switch has been pressed. Press the pedal all the way down again to release the switch and to display **r**.

05 Display Test

This tests the seven-segment LEDs in the display. When **FX** is pressed, all 24 of the LED segments will light. Press **A/B** to light only the leftmost bottom LED and to enable testing of each individual LED. Press **A/B** repeatedly to walk through each LED. Press **TAP** to reverse the direction in which the segments light. This test allows you to locate shorted lines which can cause more than one segment to be lit during normal operation.

06 MIDI Test

This test requires a Lexicon MIDI Wraparound Fixture shown below.



This test verifies that the MIDI IN, THRU, and OUT/Remote ports and their associated circuitry are working properly.

Testing the 7-pin MIDI jack (J7) requires the Lexicon MIDI Wraparound Fixture to be connected. Testing of the remaining ports requires a male-to-male 5-pin MIDI cable to be connected between the MIDI IN port (J6) and the MIDI THRU port (J5).

As with the other tests, a **P** indicates the test has passed. **E06** indicates failure of the MIDI OUT/Remote circuit. **E16** indicates failure of the MIDI In or THRU circuitry.

Optional MIDI THRU Test

This test option tests the MIDI inputs of the MPX R1. To use this function, press and hold down the **TAP** button while starting the MIDI test. (This places the MIDI test into a loop mode.) While the MIDI test is running, press the **A/B** button to toggle the Thru_Control signal that determines where MIDI information is directed via U5.

To exit and proceed to display of the next test, press the **FX** button.

07 Internal Footpedal Test

This test verifies operation of the internal footpedal circuitry. Once the test is selected, move the footpedal over its entire range (min to max) within 5 seconds after test selection. (If the pedal is not moved within 5 seconds of execution of the test, failure is assumed and displayed with an **E**.)

08 External Footpedal Test

This test requires a Lexicon Foot Controller Test Fixture (not available for sale).

Foot Controller Fixture

Lexicon uses a specially-designed test fixture for testing foot controllers. Following is a description of this fixture as well as a parts list and a reference drawing, in the event you want to build a similar fixture for your own use.

The Foot Controller Test Fixture provides an automatic 0 to +5V sweep for testing Lexicon products equipped with foot controller inputs. The fixture minimizes operator error when testing the controller inputs while still providing a thorough test.

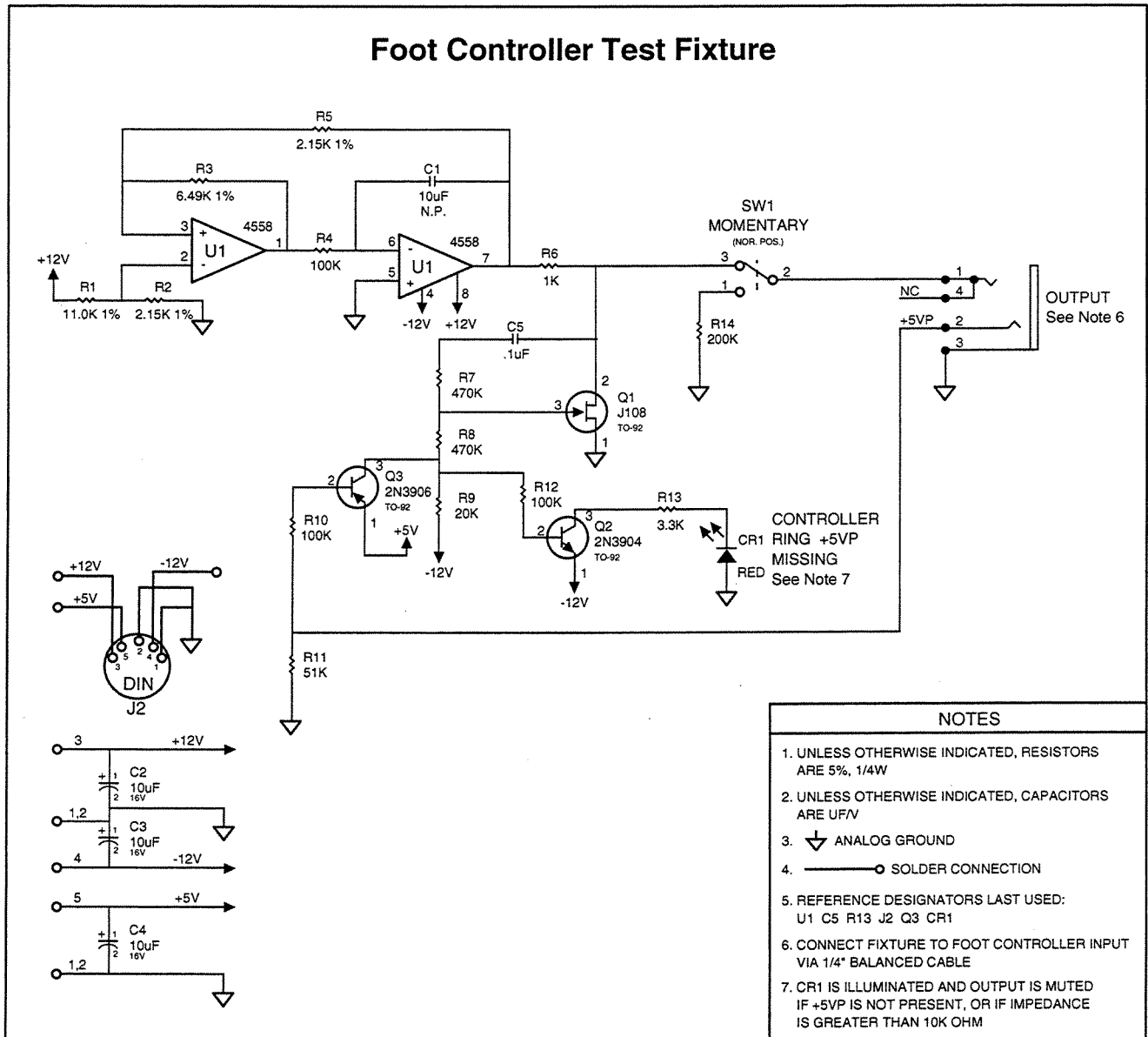
The fixture provides a triangle waveform to the Controller Inputs with a low frequency sweep rate of approximately .5Hz. When monitored by the Foot Controller, A/D Converter Test (OEH), the display will sweep from 00 to FF in hex with a short pause at each extreme.

The fixture also contains a circuit for detecting the presence of +5V at the ring of the controller input being tested. If the voltage at the ring is below 4V, the fixture output is muted and its LED will light.

Theory Of Operation

The fixture is powered by an external ELPK WM063, or equivalent, power supply module which provides $\pm 12V$ at 180MA each and +5V at 380MA. Power is fed into the fixture via a 5-pin DIN connector. The first half of U1 (a 4558 op amp) is configured as a low-frequency oscillator with R4 setting the rate. The output of U1 is routed through a 1k Ω resistor to SW1 which normally connects to the output of the fixture. When SW1 is pressed, the output of the fixture is connected to R14 (200K) which forms a resistive ladder with the internal pullup resistor.

When the fixture is connected to the unit, +5V will be fed from the ring of the controller input being tested to the ring on connector J1 of the fixture. This voltage is sent to the base of transistor Q3 through resistor R10. R10 combined with R11 enables the voltage and/or impedance of the +5V line to turn the transistor on or off. If voltage drops below 4V, Q3 turns on. This biases both Q1 and Q2 on, lighting the LED and muting the fixture output. This verifies that +5V is present at the ring of the controller input and also checks the value of the resistor feeding the ring of the controller input.



PART NO.	DESCRIPTION	QTY	REFERENCE
340-00740	IC, LINEAR, 4558	2	U1
520-00941	IC SCKT, 8 PIN, PC, LO-PRO	2	U1
202-00529	RES, CF, 5%, 1/4W, 1K OHM	1	R6
202-00538	RES, CF, 5%, 1/4W, 3.3K OHM	1	R13
202-00555	RES, CF, 5%, 1/4W, 20K OHM	1	R9
202-00564	RES, CF, 5%, 1/4W, 51K OHM	2	R11
202-00570	RES, CF, 5%, 1/4W, 100K OHM	2	R4, 10, 12
202-00576	RES, CF, 5%, 1/4W, 200K OHM	2	R14
202-00579	RES, CF, 5%, 1/4W, 470K OHM	3	R7, 8
203-00460	RES, MF, 1%, 1/8W, 2.15K OHM	1	R2, 5
203-00465	RES, MF, 1%, 1/8W, 6.49K OHM	3	R3
203-00474	RES, MF, 1%, 1/8W, 11.0K OHM	1	R1
240-00609	CAP, ELEC, 10uF, 16V, RAD	4	C2, 3, 4

Foot Controller Fixture Parts List

09 Burn In Loop

When executed, this test will continuously run the following 3 diagnostics tests.

Test #	Name
01	Z180 CPU Test
02	ROM Checksum Test
03	SRAM Test

The tests are run sequentially from 01 to 03. As each test is run the leftmost display segment will show a chase pattern followed by a **P** before proceeding to the next test. Press **FX** to exit.

00 Initialize

This test clears the SRAM, and sets the MXP R1 to its factory defaults. It is used to clear communications problems, lock ups, or malfunctions due to power surges or brown outs. It is also used to check calibrate the MPX R1 MIDI Remote Controller.

There are two ways to initialize the MXP R1. The first is as follows:

1. From Extended Diagnostics, press **0**, then press **FX**, as with selection of other tests. The display will show a value (0-255) read by the ADC circuit.
2. Move the footpedal to display a value greater than 160.
3. Press **FX** to complete the initialization.

The MPX R1 will store the new value, clear the SRAM and cycle through power up to normal operating mode.

If the circuit does not read a value greater than 160, or if the pedal is not moved before **FX** is pressed again, the display will show **CAL** for two seconds, and then resume display of the value of the footpedal's position

The MXP R1 can also be initialized as follows:

1. Press and hold the **0** button while powering on the MXP R1.
2. Continue to hold the **0** button down until all LEDs on the MXP R1 flash off and on at a constant rate. This indicates that the unit is armed for initialization.
3. Press **FX** to execute the initialization, clear the SRAM and run the MXP R1 through normal power up.

Press any button other than **FX** to cancel and return to normal operating mode.

This feature allows the following tests to be run continuously in a Pass/Fail mode. **Repeat Test Mode**

Test #	Name
01	Z180 CPU Test
02	ROM Checksum Test
03	SRAM Test
06	MIDI Test
07	Internal Footpedal
08	External Footpedal

This is very useful for troubleshooting intermittent or constant failures. When a test fails, use this function, by selecting the test number, then pressing **TAP** (instead of **FX**). This will cause the test to run continuously.

While the test is running, the leftmost display segment will display the chase pattern and **P** or **E** will be displayed briefly each time the test cycles.

Pres **FX** to stop the test repetition.

The pedal can be adjusted for easier toe switch activation by removing one or more washers from the two bumper feet beneath the pedal. To do this, remove bumper feet, then remove one (or both) of the washers. Replace the bumpers and press down on the pedal to check the switch activation.

Footpedal Adjustment

Theory of Operation

Architecture

Processor

A 10Mhz Z180 μ processor handles system software and all MIDI I/O.

Address Decoding

A programmable GAL performs all chip selects. It creates:

<code>_ROM_ENABLE</code>	chip select for the ROM U2
<code>_RAM_ENABLE</code>	chip select for the RAM U3
<code>_RD_STATUS</code>	gates the status register U5 onto the data bus
<code>_DISP_WRITE_1</code>	clocks the addressable latch U6
<code>_DISP_WRITE_2</code>	clocks the addressable latch U7
<code>_MIDI_THRU</code>	can route 1 of 2 MIDI in signals to MIDI thru
<code>_LCD_DATA</code>	used for software debug (not part of this product)
<code>_LCD_CONTROL</code>	used for software debug (not part of this product)

32k of memory is allocated for RAM usage. 128k is allocated for ROM usage. The memory map is commented in the GAL listing.

MIDI

Bidirectional MIDI communication is implemented using the on-board DUART inside the Z180. The 31.25k baud rate is generated internally using an internal counter timer port.

ROM

A 32k ROM (socketed) holds the code to run the Z180.

RAM

An 8k battery backed up SRAM is used to store the remote's internal parameters and System Exclusive messages on power down.

Schematic Walkthrough

Z180

The data bus is controlled by a 10Mhz Z180 μ processor (U1). The clock is obtained from the crystal Y1 grounded by two 18PF caps (C1-C2). The system clock runs at half this input clock, or 5Mhz. The Z180's 512 ms interrupt timer is internally set using the onboard counter/timer register.

ROM/RAM

The 32k ROM (U2) holds the code to run the Z180. The 8K SRAM (U3) is used for storage.

GAL

U4 is a 16V8R programmable GAL. Its program decodes the necessary memory addresses and signals to generate the memory map and all of the chip select signals for the display and status lines.

Control/Status IO The control/status IO portion of the remote contains the input buffer (U5) for the status signals along with the drivers for the switch/LED matrix.

U5, the status register, contains the following signals:

SWITCH_ROW_0	
through SWITCH_ROW_3	inputs from the switch matrix
FS_1 and FS_2	inputs from the two external footswitches
TOE	input from the Toe Switch underneath the pedal
PEDAL	input from the pedal's A/D (U11)

The switches and LEDs on the front panel, with the exception of the Toe Switch, are organized into a matrix consisting of 5 columns and 8 rows. The row signals are set low or high by the output of decoder U8 via latch U6 and driven by sinking transistors Q6-Q13. The column signals are set low or high by latch U6 and are driven by source transistors Q1-Q5.

The remaining signals for the relay, A/D chip select, A/D serial clock, and foot pedal multiplexer, are controlled by 4 pins on latch U6.

Front Panel UI The switch row matrix consists of 16 switches, 15 LEDs and a 3-digit display. The LEDs are laid out in common anode configuration. There are a total of 39 LEDs, counting the 3-digit display.

MIDI Circuit The MIDI interface utilized by the remote incorporates one 7-pin, female DIN connector (J2) for input, output, and 9V phantom power. MIDI IN is opto-coupled for ground isolation through U9 to pin 48 of the Z180 (MIDI IN on the DUART). The MIDI OUT signal is provided by pin 49 on the Z180 (MIDI OUT on the DUART) and is fed to the current loop driver Q20 to pin 5 on J2. FB1 and FB2 are used to reduce RFI radiation.

A 4053 switch is used to select the routing of 2 MIDI IN signals to a MIDI THRU port. The switch is controlled by the MIDI_THRU control line from the GAL.

Power Supply The power supply consists of a full-wave rectifier feeding one linear voltage regulator. U11 is a standard +5 volt regulator.

SRAM Battery Backup During power-up, U6 pin 1 pulls _RESET to ground until the voltage at pin 2 rises above approximately 4.3 volts. R50 and C30 form a power on delay. R50 charges C30, which keeps Q20 turned on until its base reaches VCC-1.2 volts. At that point, Q20 turns off, and U6 pin 1 goes to Vcc. This causes _RESET to go high.

D35 allows a quick response to loss of Vcc. When Vcc slips below 4.3 volts, D35 is reverse biased. D34 provides a quick discharge path for C30 to allow long resets in the event of a short loss of Vcc.

When Vcc is present, but _RESET is active, Q21 will be off, which keeps Q22 off as well. This keeps WRITE_PROTECT high, protecting the SRAM contents until the system is stable.

When Vcc is present and _RESET is off, Q21 is on, which brings WRITE_PROTECT low and turns on Q22, which couples Vcc to VRAM. D36 keeps Vcc from charging the battery, and R58 adds extra protection to the battery, as required by some regulating agencies.

J11 is the input from an external foot pedal. The external pedal is multiplexed with the on-board pedal via analog switch U12. The multiplexed signal is fed into the 8-bit A/D chip U11. The output of the A/D is connected to be read by the status register U5.

Foot Pedals

J12 is the stereo jack input for the external dual foot switch. The 2 signals FS_1 and FS_2 are fed to the status register U5.

External Footswitches

MAIN BOARD

Parts List

PART NO.	DESCRIPTION	QTY	REFERENCE
MAIN BOARD			
RESISTORS			
202-00514	RES,CF,5%,1/4W,100 OHM	8.00	R51,53,55,57,64,66,68,70
202-00515	RES,CF,5%,1/4W,150 OHM	1.00	R20
202-00518	RES,CF,5%,1/4W,220 OHM	3.00	R9,11,13
202-00520	RES,CF,5%,1/4W,270 OHM	2.00	R18,19
202-00526	RES,CF,5%,1/4W,680 OHM	7.00	R36,38,40,42,44,46,48
202-00529	RES,CF,5%,1/4W,1K OHM	25.00	R14,15,23-25,29,32-35,37,39,41,43, 45, 47, R49,50,52,54,56,63,65,67,69
202-00534	RES,CF,5%,1/4W,2.2K OHM	8.00	R8,10,12,30,58-61
202-00542	RES,CF,5%,1/4W,4.7K OHM	5.00	R6,7,21,22,27
202-00549	RES,CF,5%,1/4W,10K OHM	2.00	R26,31
202-00563	RES,CF,5%,1/4W,47K OHM	4.00	R16,17,28,62
240-00608	CAP,ELEC,2.2uF,50V,RAD	1.00	C26
240-12171	CAP,ELEC,3300uF,16V,20%	1.00	C21
241-00652	CAP,TANT,4.7uF,25V,RAD	1.00	C20
245-03609	CAP,CER,.1uF,50V,Z5U,AX	18.00	C11-19,22-25,28,31-34
245-07544	CAP,CER,18pF,100V,COG,10%,AX	2.00	C29,30
245-10757	CAP,CER,470pF,50V,10%,Y5P,.200	1.00	C27
270-00779	FERRITE,BEAD	1.00	FB9
300-01029	DIODE,1N914 AND 4148	16.00	D1,14-19,25-29,32-34,37
300-01030	DIODE,1N4004 AND 4005	6.00	D4-7,12,13
310-01007	TRANSISTOR,2N3904	4.00	Q3-5,7
310-01008	TRANSISTOR,2N3906	2.00	Q6,8
310-01646	TRANSISTOR,2N4403	7.00	Q9-15
310-01647	TRANSISTOR,2N4401	10.00	Q1,2,16-23
330-03581	IC,DIGITAL,74HC138	1.00	U13
330-03585	IC,DIGITAL,74HC14	1.00	U1
330-03611	IC,DIGITAL,74HC273	2.00	U12,15
330-07715	IC,DIGITAL,74HC541	1.00	U14
340-07270	IC,LINEAR,7805(LM340T-5),BENT	1.00	U6
340-09787	IC,LINEAR,MC34164,+5V MONITOR	1.00	U7
346-06896	IC,SS SWITCH,74HC4053	1.00	U5
350-08570	IC,SRAM,6264,8KX8,100NS,LO PWR	1.00	U8
350-11829	IC,ROM,27C256,MPXRG2,V1.00	1.00	U9
350-11830	IC,GAL,16V8,MPXRC,MEM,V1.00	1.00	U10
355-09954	ADC,TLC549,8 BIT,SERIAL	1.00	U4
365-11824	ICSM,uPROC,Z80180,10MHz,PLCC	1.00	U11

PART NO.	DESCRIPTION	QTY	REFERENCE
375-02247	IC,OPTO-ISOLATOR,6N138	2.00	U2,3
390-08959	CRYSTAL,20.00MHz	1.00	Y1
410-03584	RELAY,2P2T,LOW LEVEL,DIP,12V	2.00	RY1,2
430-11820	LED,DSPLY,7SEG,GRN,3DIG,56,SK	1.00	DISP1
430-11832	LED,T1-3/4,RED,9MM SPCR	1.00	D2
430-11833	LED,T1-3/4,GRN,9MM SPCR	7.00	D3,8-11,24,38
430-12172	LED,T1-3/4,RED/GRN,9MM SPCR	8.00	D20-23,30,31,35,36
453-09550	SW,PBM,1P1T,6MM SQ,PCRA,130GF	1.00	SW1
453-11821	SW,PBM,1P1T,12MMSQX4.3MM,130GF	16.00	SW2-17
460-04598	BATTERY,LITH,3V,FLAT	1.00	BAT1
510-11828	CONN,POST,156X045,PCRA,6MC	1.00	J11
520-01361	IC SCKT,20 PIN,PC,LO-PRO	1.00	U10
520-09077	IC,SCKT,PLCC,68 PIN	1.00	U11
520-09736	IC,SCKT,32 PIN,PC,TIN,LO-PRO	1.00	U9
520-11822	SCKT,STRIP,MACH,.100X6,.43H,EL	2.00	DISP1
600-12714	HEATSINK,CLIP,1.2WX.565H,SS	1.00	U9
680-11826	CABLE,RIB,20CX.079,2"L	1.00	J10 MAIN TO J9 RP
720-03571	TAPE,KAPTON,1/2"	0.00	C21

REAR PANEL BOARD

PART NO.	DESCRIPTION	QTY	REFERENCE
202-00518	RES,CF,5%,1/4W,220 OHM	4.00	R2-5
245-03609	CAP,CER,.1uF,50V,Z5U,AX	1.00	C10
245-03869	CAP,CER,100pF,100V,COG,10%,AX	4.00	C6-9
245-10756	CAP,CER,150pF,50V,10%,Y5P,.200	2.00	C1,2
245-10757	CAP,CER,470pF,50V,10%,Y5P,.200	1.00	C3
270-00779	FERRITE,BEAD	6.00	FB3-8
510-06042	CONN,DC POWER,PC,DJ005,2.5MM	1.00	J8
510-09790	CONN,DIN,5FC@180DEG,PCRA,SHLD	2.00	J5,6
510-11049	CONN,DIN,7FC@270DEG,PCRA,SHLD	1.00	J7
510-11087	1/4"PH JACK,PCRA,3C,SW-TR,G,FT	3.00	J1-3

CHASSIS/MECHANICAL

PART NO.	DESCRIPTION	QTY	REFERENCE
703-11865	PANEL,OVLY, TOP,MPXRG2	1.00	
530-11876	CLAMP,CABLE,3/8",BLK,NYL	1.00	
530-12360	STRAIN RELIEF,CABLE,MSA XFRMR	1.00	
541-11878	BUMPER,FEET,.468DIAX,.25H,BLK	3.00	CHASSIS TOP
541-11879	BUMPER,FEET,.75DIAX,.25H,BLK	6.00	CHASSIS BOTTOM
541-11880	PAD,FELT,1"DIAX1/8"THK,BLK,ADH	1.00	OVER PEDAL SW
600-11854	GEAR,32PITCH,14TEETH,.438PD,NY	1.00	POT/PEDAL ASSY
600-11855	RACK,32PITCH,1.722L,NYL	1.00	POT/PEDAL ASSY
600-11856	AXLE,PEDAL,.25DIAX3.02L	1.00	PEDAL AXLE ASSY
600-11881	PIN,COTTER,1/16"DIAX1"L,ZN	1.00	POT/PEDAL ASSY
625-11857	SPRING,.176IDX.88,10COIL	16.00	PLUNGER ASSY
625-11858	SPRING,.075IDX.385,10COIL	16.00	PLUNGER ASSY
630-12528	WSHR,FL,3/8CL,.5OD,.05,BLK,NYL	2.00	CHASSIS TOP (TOE SW BUMPERS)
630-12529	WSHR,FL,3/8CL,.56OD,.03,BL,NYL	2.00	CHASSIS TOP (TOE SW BUMPERS)
635-11877	SPCR,.25CLX.438,.5RD,BR/NI	2.00	PEDAL AXLE ASSY
635-12715	SPCR,.269ID,.405ODX1.65L	1.00	PEDAL AXLE ASSY
635-12716	SPCR,1/2CLX5/16,3/4RD,ST,ZN	1.00	TOE SWITCH
640-01710	SCRW,6-32X1/4,PNH,PH,ZN	8.00	MAIN BD TO CHASSIS
640-01721	SCRW,8-32X3/8,PNH,PH,ZN	7.00	CHASSIS BOTTOM TO TOP (6) PEDAL TO CHASSIS AND AXLE (1)
641-09699	SCRW,TAP,AB,#2X5/16,PNH,PH,ZN	3.00	DIN CONN TO CHASSIS
641-10989	SCRW,TAP,AB,4X3/8,PNH,PH,BZ	1.00	STRAIN RELIEF TO CHASSIS
641-12717	SCRW,TAP,B,#6X3/8,PNH,PH,ZN	7.00	FEET TO CHASSIS BOTTOM (6) CLAMP TO CHASSIS (1)
643-11859	NUT,1/2-32,HEX,PLUNGER	16.00	PLUNGER ASSY
644-02485	WSHR,FL,#8CLX.5ODX.05THK	1.00	PEDAL AXLE ASSY
644-08577	WSHR,INT STAR,#6,BLK	1.00	CLAMP TO CHASSIS
644-11882	WSHR,INT STAR,1/2CLX.88ODX.04	16.00	PLUNGER ASSY
650-05902	RING,RET,EXT,.025THX.225FREEID	1.00	GEAR TO POT
650-11883	RING,RET,EXT,.025THX.207FRID	1.00	
680-11885	CABLE,.156,6C,5",W/POT&SW	1.00	POT/SW TO MAIN BD
700-11860	PEDAL,MPXRC	1.00	
700-11861	CHASSIS, TOP,MPXRC	1.00	
700-11864	CHASSIS, BOTTOM,MPXRC	1.00	
720-11867	PAD,PEDAL,MPXRC	1.00	
720-12359	DUST BARRIER,MPXRC	1.00	
750-11850	SUBASSY,PLUNGER,MPXRG2	16.00	CHASSIS TOP

MISCELLANEOUS

PART NO.	DESCRIPTION	QTY	REFERENCE
470-09650	XFORMER,PLUG-IN,120V,9VAC,10mm	1.00	N.AMER ONLY
470-10162	XFORMER,PLUG-IN,9VAC,1A,MSA-E	1.00	EURO ONLY
680-12353	CABLE,7M-DIN/7M-DIN,25',BLK	1.00	

**Schematic
and Assembly
Drawing**

- 060-11818 Schematic, Main Board
- 060-11819 Schematic, RP Boards
Main Bd Component Layout

Lexicon, Inc.
3 Oak Park, Bedford MA 01730-1441
Tel: 781-280-0300
Customer Service Fax: 781-280-0499
e-mail: csupport@lexicon.com

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