Gerety / Chase

E-Roll Player System

Installation and Service Guide

Congratulations!

You have purchased the most advanced MIDI valve retrofit system for pneumatic players made today. Properly installed, this system will deliver unparalleled performance and long, trouble-free service. Every system component has been thoroughly tested prior to shipping. Each valve has been certified as meeting all specifications (repetition, sustained operation, leakage) over its entire operating range and complete function of every electronic component has been confirmed.

Please take the time to read this manual thoroughly before installing any components or software and make frequent reference to the relevant chapters during installation. If at any point you are not confident that you understand the directions thoroughly, please contact us for clarification before proceeding. We have designed the system to be as easy to install as possible, but occasionally questions arise. We will gladly offer telephone and/or e-mail assistance to help your installation go as smoothly as possible.

In this manual, the following symbols are used:

DO – the green check mark means "YES" or "DO" this. This is an essential step

DON'T – the red "X" means "NO" or "DON'T" do this. The system will not function or perform properly.

RECOMMENDED – Recommended items are marked "thumbs up!" We believe items marked this way are good ideas or good practice.

NOT RECOMMENDED items are marked "thumbs down!" Although your system may function, either performance or service life may be degraded

WARNING or DANGER - We cannot be responsible for any damage or system failures caused by failing to pay attention to warnings marked with this symbol.

Installation photos and tube charts can be found at the end of this manual

1 Package Contents

(may vary slightly with custom configurations and optional accessories)

☑ ***BEFORE DOING ANYTHING ELSE, CHECK YOUR PACKAGE CONTENTS AND BE SURE YOU HAVE EVERYTHING.***

Included with all systems:

- 6 valve blocks (each valve block has 16 valves)
- MIDI controller
- Data cable assembly
- Power supplies and low-voltage cable (1 or 2, depending upon configuration)
- Connection nipples (at least 16 per valve block)
- "Wye" tubing connectors (at least 16 per valve block)
- Blank hole plugs (at least 16 per valve block)
- Nipple installation tool (wooden golf tee)
- Self adhesive filter strips
- Installation and service guide (this document)
- Software CD
- Duo-Art Theme Valve "Silencers"
- Tracker Bar and Stop-Hole blocking strips

Optional items:

- Power connection module (may not be included in some configurations)
- Additional valve blocks (up to 16 total)
- Optional Pump Motor Relay Kit
- Optional expansion chassis for wire per note operation
- Optional Grand Piano installation kit.
- Optional "behind the spoolbox" upright installation kit

Photos of some included items…

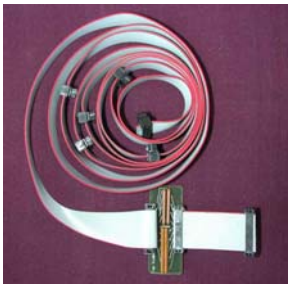
MIDI Controller

Valve Block

Nipples and "Wyes"

Duo-Art Theme Valve "Silencers"

Power Cable



Data Cable Assy.

Power Supplies/Cable

Filter Strips & Hole Plugs

2 WARNINGS – Please Read Before Installing

REVIEW THE FOLLOWING WARNINGS BEFORE PROCEEDING

2.1 To prevent overheating of your piano's pump motor

(risk of fire or instrument damage)

The Gerety/Chase E-Roll Player system enhances owners' enjoyment of their instruments to such an extent that many people find that they play them much more often and for longer periods of time than before they installed the system. Unfortunately, most of the electric pump motors in these instruments are over 70 years old and have not had the benefit of regular lubrication, cleaning and maintenance. When motors have not been regularly maintained, prolonged periods of usage may place greater stress on motors and electric wiring that were previously used only infrequently. Overheating and risk of fire or damage to your instrument may result.

This is *not* a flaw of the E-Roll Player system design. It is the result of an often-overlooked aspect of instrument maintenance and restoration, and is a fact of life when dealing with electrically operated antiques. The exact same risk exists without the E-Roll player system.

DO Be sure to have your electric pump motor and all associated wiring thoroughly checked by a competent small motor specialist, (preferably one with knowledge of mechanical musical instruments). Most original player motors were not thermally protected and may operate in excess of their design temperature if operated for extended periods. Have the motor and wiring serviced, repaired, replaced or rebuilt as recommended by your specialist.

DO Be sure to check all original electrical wiring in the piano especially where new connection are to be made. The original wire insulation was typically cloth-over-rubber. Practically all insulation of this type is dry and cracked today. Replacement of all original wiring is highly recommended. Be extremely careful when making connections or repairs to old wiring, as bare electrical is often exposed when old wiring is disturbed. In the interest of safety, it is better to remove and replace all original cloth-covered wire.

DON'T Do not install this system without taking the precautions listed above. If there is any doubt about the condition of the pump motor or wiring and their ability to play for extended periods without overheating, you run a high risk (even without the E-Roll Player System). We cannot assume responsibility for problems related to the condition your instrument, pump motor or wiring.

2.2 Handling static-sensitive electronic components

DON'T Handle static sensitive circuit boards and components without taking appropriate precautions. The valve block control boards contain circuitry that may be damaged by static discharge. They are internally protected and are unlikely to sustain

any damage once installed, but normal precautions should be taken when handling the boards during installation. Despite the fact that damage by static discharge is very unlikely, it does happen on rare occasion. It is best to take reasonable precautions, especially in high-static environments.

DO Use the same techniques as for handling computer components. If the humidity is low (below 45% relative humidity) it is best to run a humidifier to raise the humidity prior to working with sensitive electronics. If working in an environment with synthetic carpeting or other static generating materials, especially in low humidity conditions, it may be necessary to establish a static fee work place with grounded wrist straps and a tested ground to which discharge is achieved prior to handling boards. Hold circuit boards only by the edges.

DON'T touch circuit board traces (wiring) or components.

DO Place the valve blocks in a static-safe environment prior to opening. Touch a known ground connection to discharge yourself before removing the valve blocks from their anti-static bags or before handling the circuit boards.

2.3 Proper torque for fasteners

DON'T Over-torque fasteners

Do not over-tighten screws holding the printed circuit board to the valve body. Distortion of components and possible damage will result. When installing or servicing the valve blocks, tighten screws until they contact the circuit board lightly and then tighten an additional 1/6 to 1/4 turn and no more.

2.4 Proper installation of wiring and heat generating components

All line-voltage AC wiring must be installed in accordance with applicable codes and recommended practices. If you are not qualified to do this work yourself, be sure to obtain qualified assistance. It is best to hire an electrician who is familiar with restoration work and the wiring that is to be found in vintage electrical devices. Although the power supplies valve interface circuitry and power switch module are very efficient, they do generate a small amount of waste heat. Please install these components in well-ventilated surroundings and check for excess heating after extended play. Conditions vary from one installation to another so it is best to check for excess heat buildup after extended play on any new installation.

2.5 Environmental contamination and filtering

The magnetic components of the valve block are contained deep inside and are unlikely to attract magnetic particles except when disassembled. Filters (included) which adhere to the valve block and cover the vent port openings will keep contaminants from blocking the valve seats and from getting to the internal magnets. It is also possible to install the blocks in cloth filter bags made of a suitable lightweight filter material. This would be recommended only for commercial installations where dust is known to be a problem.

NEVER Connect or disconnect internal cables with power applied

Other than the serial port and/or MIDI connections on the face of the MIDI controller, cables should NEVER be connected or disconnected from any part of the E-Roll Player System while the power supplies are plugged in. Disconnect AC power at the wall socket

before performing ANY kind of service that requires disconnecting or connecting any power or data cable to any valve block or to the MIDI controller. Generally speaking, service and maintenance should be done with the main AC power disconnected. The only exception to this rule is that the 9 pin serial port cable and 5 pin MIDI cable connections to the MIDI controller on the face of the MIDI controller that has the four LED indicator lights) can be made with power applied.

☒ **NEVER work on or near the pump motor with power applied**

The pump motor can come on unexpectedly, causing serious personal injury or damage to your instrument if any part of your body or other foreign object should get caught in any part of the pump mechanism (belt, pulleys, etc.)

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3 Hardware installation

3.1 General Considerations

When planning the valve block installation, be sure to allow enough tubing to make future servicing of the system simple. It is best to use connector tubes that are long enough to allow the block to be dismounted and moved to a free location where it can be easily disassembled for cleaning or service. It the tubing will not be covered with a belly cloth, it may be necessary to use cord to prevent the tubes from hanging down visibly. They may be lightly bundled with small diameter shock cord and secured to any convenient location.

Be sure to locate the valve blocks where metallic components of the instrument will not contact the exposed circuit boards. Be sure that linkages and other moving parts do not contact the boards when moved to their extreme positions. Also make sure that the blocks are not free to move into contact with metallic objects. Test all screws and metal parts that may loosen and fall onto the boards. If in doubt, replace any such screws with new ones that will not loosen, or provide covering material that will prevent them from falling onto the boards.

Be sure to leave room for airflow/ventilation. Although the valve blocks don't require much airflow or cooling, be sure to leave at least a small amount of clearance around the vent slots on the sides of the valve blocks and around the circuit board. A small airspace is required to permit the valves to open properly and to prevent heat build-up. Severely restricted airflow acts much like kinked tubing and interferes with normal valve function.

In planning your valve block installation, be sure to take the valve block power and data cables into consideration. These cables are discussed in detail below. Also, pay attention to the block and valve numbering conventions (discussed in detail below under *"Data Cable Installation"* and *"Mapping"*.)

It is often helpful to "dry-fit" your system together on a table top to help in planning mounting locations for the various system components.

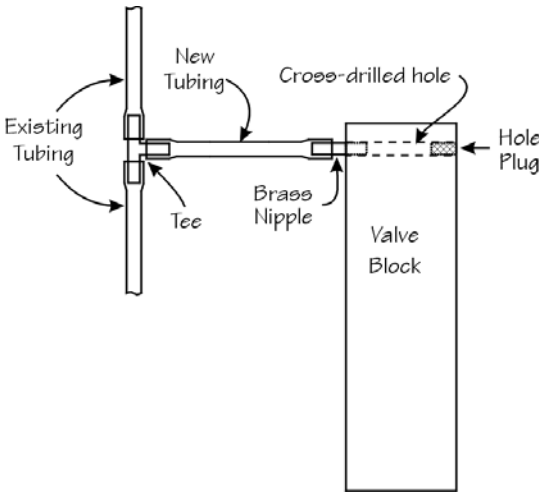
3.2 Choose a tubing connection style:

Valve blocks in the E-Roll Player System are designed to support two different basic styles of tubing connection: ***Single-side connection*** and ***Through-tee connection.*** Each valve opens into a cross drilled hole that extends completely through the block from one side to the other.

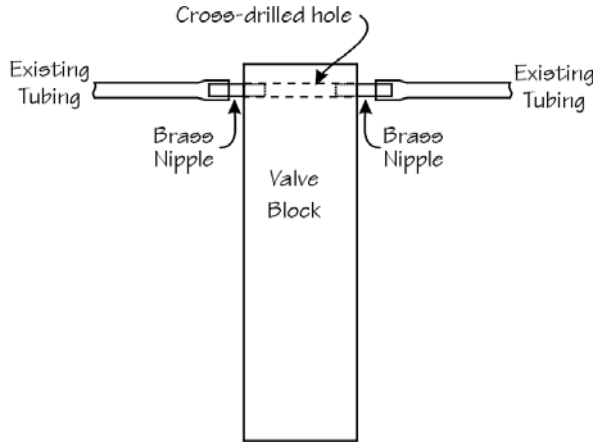
For **Single-side connections**, a brass nipple is inserted into one end of the cross-drilled hole and a hole plug is inserted into the other end of the same hole. The brass nipples need not all be installed on the same side of the block. They can be installed in an alternating pattern, or any other pattern that will help to simplify your tubing installation. Small brass or plastic "tees" or "wyes" are inserted into your instrument's existing tubing runs, and a short piece of new tubing is run from each "tee" to the appropriate brass nipple.

Through-tee connections are made by inserting brass nipples into *BOTH* ends of the cross-drilled holes in the valve blocks. In this case, no hole plug is used (although twice as many brass nipples are required). Then, your instrument's existing tubing connections are cut and the two cut ends of the existing tubing are connected to the brass nipples on opposite ends of a cross-drilled hole. The cut ends of the existing tubing can be extended by using brass nipples as connectors between the existing tubing and short pieces of additional tubing.

Examples of the two types of tubing connections are shown in the figures below:



Typical Single-side connection



Typical Through-tee connection

3.3 Installing Brass Nipples

To install the brass nipples into the cross-drilled holes in the valve blocks, press them straight in with the insertion tool (wooden golf tee) provided, or *lightly* tap them in with a small hammer such as a tack hammer. Be sure that they are perpendicular to the block, especially if using a hammer. Do not force them. They will press in easily if aligned correctly. Please note that the end holes on each end of the block are for mounting and will not accept nipples. The diameter is smaller to prevent installing nipples into them. Please note that pictures in this manual may show an older style of block without these extra holes.

After installing the nipples look through the cross drilled passages to see if a burr was raised in the insertion process. If so, is it recommended that you run a metal wire pipe cleaner (provided) through each of the drilled passageways to clear out any burrs. Then gently blow away any lint that might have been left from the pipe cleaner.

Tubes may be connected to either end of the cross-drilled holes as long as the opposite end is plugged (single-side connection style). Alternating sides may allow for easier tube alignment in certain installations. If using wye fittings, be sure that that both tubes from the tracker bar and the valve block "flow" toward the source of vacuum. (towards the stack in player systems.)

3.4 Installing rubber hole plugs

Rubber hole plugs are included in the E-Roll Player package. They are retained in a punched sheet and must be removed and inspected to be sure there is no lint or debris on them before inserting. Simply pop the plugs into the open ends of the cross-drilled holes with a pair of tweezers to ensure that they enter smoothly and without bunching. If you find a leak after tubing the block to your instrument, it is possible that a bunched up plug is the cause. If so, the hole plug will need to be straightened out to cure the leak. It is best to invest a little extra time making sure that the hole plugs are properly inserted in the first place to avoid a lot of "fiddling" with them later on.

Do not touch the hole plugs to the circuit board, as they may hold a static charge that could possibly damage sensitive electronic components. The likelihood of such damage is extremely remote, but caution is advised.

3.5 Installing Filter Strips

Filter strips are included in the E-Roll player package, and should be installed over the long vent slots on the sides of the valve blocks to prevent dirt, dust, or other debris from entering the valves. The filter strips are self-adhesive and should be applied after inserting the nipples to avoid blocking access to the cross-drilled holes. Simply peel off the protective liner from the adhesive and place the filter strips so as to completely cover the vent slot. Use one filter strip on each vent slot.

3.6 Power supplies and power cords

Power Supplies for the E-Roll Player System accept standard IEC line cords (the type used on most personal computers and printers). They are switching-type power supplies and operate on line voltages from 88 to 260 Volts AC (40 to 70 hertz) and therefore are compatible with mains voltages throughout the world. The system comes standard with an IEC "wye" power cord adapted for standard North American 3-prong power connections. Separate IEC cables (or adapters) with the proper wall receptacle plug may be needed in other locations.

Switching power supplies are very efficient and have very low idle current consumption. They may be left on indefinitely without concern for wastage of power. It is best, however, to disconnect the power supply when the system is not to be used for an extended period of time, such as when leaving for vacation. The main reason for this is to prevent damage to the E-Roll Player System in the event of lightning strikes or power surges, especially when power is restored after an outage. Low mains voltages are not likely to damage the system, but extreme voltage surges that result when power is erratic could conceivably cause damage. For this reason, it is recommended that you connect the E-Roll Player System's power supply cord to a switched outlet and to turn power off at the outlet when not in use.

If your household uses an alternative electrical power source, such as solar wind or micro-hydroelectric systems, be sure to check that the power inverters used by your electrical system produce "sine wave power". Some older inverters (especially those produced up until the mid 1990's) produce "square wave" power, or other high-frequency pulsed waveforms that may damage the switching supplies in the E-Roll Player System. inverter idle mode waveforms may damage the power supply circuitry.

If your inverter *does* produce non-sine-wave power, a linear supply may need to be substituted. However, linear supplies are much less efficient than switching supplies, and this is generally not recommended. It is best to acquire an inverter that is compatible with switching supplies and ideally a true sine wave model.

NEVER connect the E-Roll Player's AC power cord to a power inverter with square wave output.

The E-Roll Player's power supplies are compatible with power inverters that produce "sine wave" output.

The use of a surge protector is recommended.

DO NOT splice the E-Roll Player's AC power cable into the piano's internal AC wiring unless **ALL** of the piano's AC wiring has been completely replaced. Original piano wiring is generally unreliable. We cannot accept any responsibility for any problems or failures related to the condition of instrument wiring.

For the same reason:

DO NOT share AC power wiring between the E-Roll Player's power supplies and the pump motor, even if the piano's AC wiring has been completely replaced. The E-Roll Player system cannot be guaranteed to operate correctly if connected in this way. Surges and AC power line noise resulting from the motor starting or stopping can potentially cause misoperation of the E-Roll Player system.

3.7 Valve Block Low-Voltage Power Cables

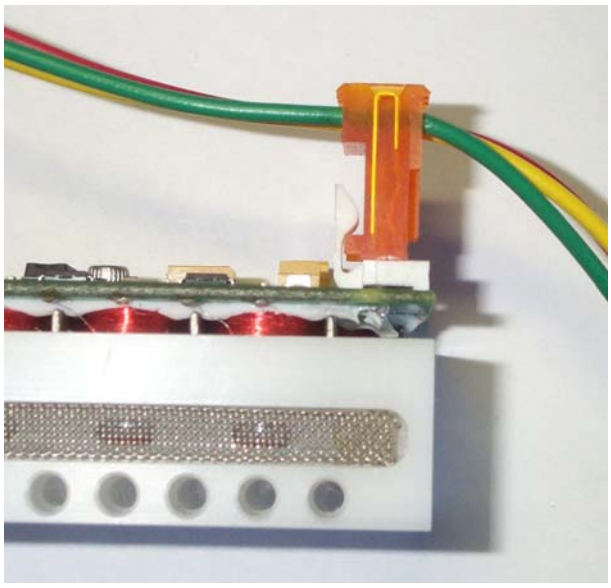
Power is supplied to the valve block via a 3-wire, low-voltage power cable. A set of 3-pin power connectors (0.156" pin spacing), one for each valve block in your system, is installed at various points along the power cable. These connectors mate with the large 3-pin vertical power connectors on your valve blocks. The connectors are spaced apart from one another by a distance designed to reach comfortably between valve blocks in most installations. Each connector carries the same power voltages: +5 volts on the red wire, +12 volts on the yellow wire, and ground on the green wire. There is no special order of connection; any 3-pin power connector may connect to any valve block.

IMPORTANT

The 3-pin power connectors are polarized to help avoid wiring errors. However, it is possible to force fit them incorrectly. When connected properly, they will appear as shown in the photo below. Before connecting power, check and double check that the power connectors are correctly installed and that the each connector is making contact with all three pins on the circuit board. If the connector is offset by one pin it will likely cause serious damage to the board which will not be covered under the E-Roll Player System warranty.

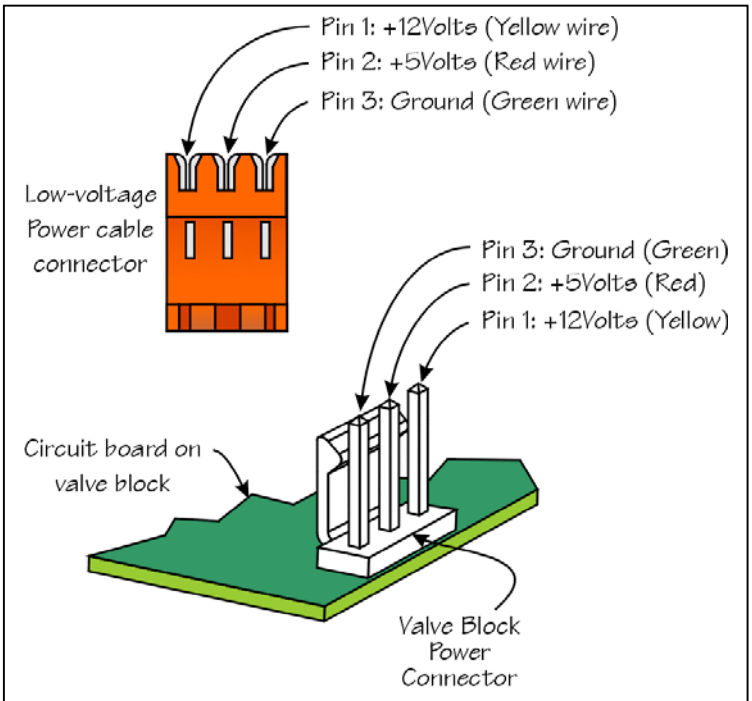
The low-voltage power cables are provided pre-assembled and were used to connect your valve blocks and power supplies in the final test phase of your system. These are "known-good" cables.

If you must modify or extend the low-voltage power cables, or if you choose to make your own cables, be sure to double-check polarity before using the cable to connect the valve blocks to the power supply. Measure voltages and mark the wires if this will help in proper assembly. See wiring chart below for identification of connector color codes.



Proper insertion of power connector

Incorrect wiring will result in damaged circuits and will void the system warranty. If you are not absolutely certain of wiring polarity, call and ask for assistance before connecting power to the valve blocks. If wiring has been disassembled, check with a voltmeter to be sure the correct voltages will be applied to the pins on the connector. By connecting the MIDI controller first, you can verify that the 12 volt supply is properly connected. It is not advisable to connect power to the valve blocks without connecting the MIDI controller first and connecting the blocks to the controller with the data cables.

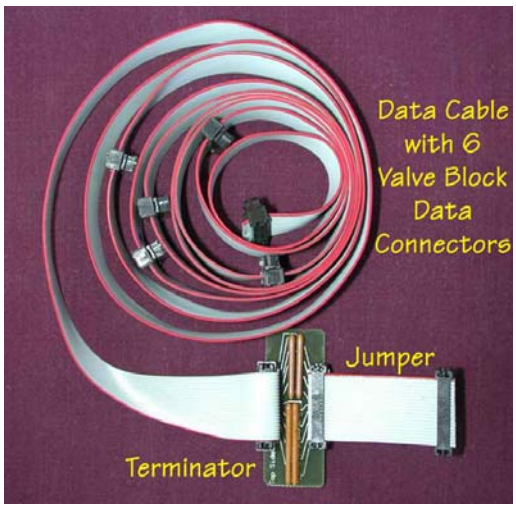


Low-Voltage Power Connector Wiring

12 Volt Power to the MIDI controller is supplied via a standard 2.5mm, center-positive power plug (see below) on the end of a thin power cable that extends from a terminal block in the low voltage power cable assembly. The power plug simply plugs into the socket on the controller's rear panel (see below). If this cable becomes disconnected from the terminal block in handling, please be sure to reinstall it in the correct polarity. To be sure, check that the inner terminal is positive with a voltmeter while the power supply is energized.

3.8 Data Cable Installation

The data cable assembly consists of three components: a terminator, a short ribbon jumper and a data cable. A photo is shown below:



Terminator block
The terminator block is installed between the data cable and the controller, with the short ribbon cable jumper being used to make the connection from the terminator to the controller. Connect the plug from the short cable to the controller on one end and to the terminator block on the other. The data cable to the blocks is connected to the other connector of the terminator. The terminator is both physically and electrically symmetrical, so either connector may be used for either cable connection.

☑ Data cables are polarized and cannot be inserted incorrectly. They have a "snap-lock" feature, so removal can be a little difficult. It is best to make the data cable connections to the valve blocks after the blocks are in their final position. This will help to avoid needless insertion and removal of the data cable connectors.

The data cable's connector spacing is designed to fit the majority of installations. One possible exception would be installations with very tightly spaced valve blocks where twisting of the cable to fit the blocks in not possible. In most cases, there is sufficient cable that folding and or looping will allow the connectors to reach each valve block comfortably. If your installation is one of the unusual installations where the spacing between the connectors is too great, too short, or otherwise disadvantageous, we will gladly provide custom cables with any required connector spacing, or we can instruct you in making your own custom data cables.

Please do not hesitate to contact us if you need custom cables. We have the facilities to assemble them and test them.

All cables should be installed and checked for firm connection before turning on power. In installations where wiring may be disturbed, it is advisable to secure the cables to keep the data cable connectors from pulling out of their sockets on the valve blocks.

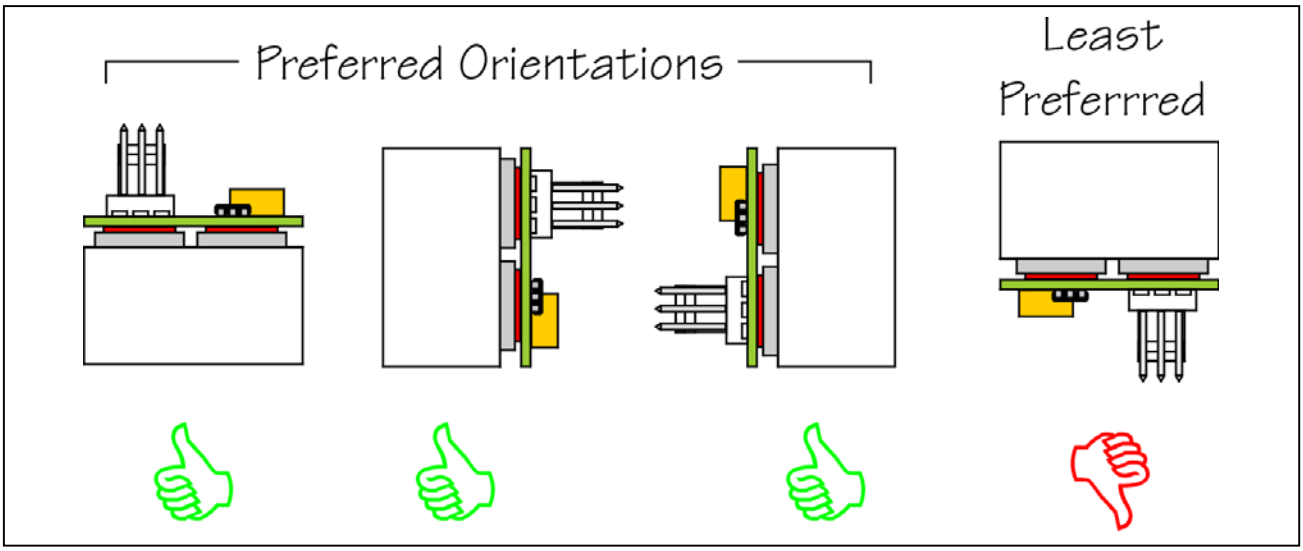
3.9 Mounting of Valve Blocks

The valve blocks may be mounted in many ways depending on the constraints of the instrument in which they are installed. The end through holes on each end of the block may be used by passing wire or cord through them and securing to convenient locations. This is the method used with the optional Grand Piano Installation Kit. The blocks may

be fastened with self adhesive velcro strips to any convenient location in the instrument but be aware that velcro does eventually tear loose if left under tension. Therefore it is only recommended for installations where the blocks are held to the velcro by gravity or other means. One convenient material for mounting the blocks is plastic drywall corner bead that is available at building supplies. The right angle material can be used to create a shelf for mounting the blocks with velcro. It is white in color but can be painted to match the surrounding materials with a spray paint that is approved for plastic.

The preferred orientation of the valve blocks is with the circuit board on top or to one side as shown below. Valve seating at the lowest vacuum levels is best in these positions. Upside down mounting (circuit board on the bottom) is recommended only when vacuum levels will not be less than 10 WCI, or where large bleeds are present. Although the valves will operate in the upside-down orientation, even at low vacuum levels, repetition rate and valve closing time may be adversely affected. At higher vacuum levels, the vacuum assists in keeping the valve firmly seated while closed, and upside-down mounting is more practical.

For best sealing at relatively light vacuum (3 to 6 inches) it is best to face the circuit board up. For mounting behind the spoolbox in an upright piano it will be best to orient the block with the nipples facing down from one side of the block. This will allow for the most flexibility in routing tubing to the tracker bar. The ***optional upright piano installation kit*** is recommended for this type of installation. It consists of a bracket that mounts to the back of the spoolbox, cross rods for holding the blocks and clips to connect the blocks to the rods.



DON'T locate valve blocks very close to magnetic materials (large iron brackets, castings, large screws – anything that is attracted by a magnet).

The valve blocks contain very strong permanent magnets and should not be mounted close to iron-bearing materials or other magnetic materials (known as ferromagnetic materials). The appropriate distance depends upon the size of the magnetic materials in question, but a couple of inches is sufficient clearance for screws and brackets. Valve block distance from large iron castings should be greater. Due to the magnetic shielding

in the valve blocks, magnetic influence is not likely to be a problem in most installations. Just keep this in mind when planning the installation.

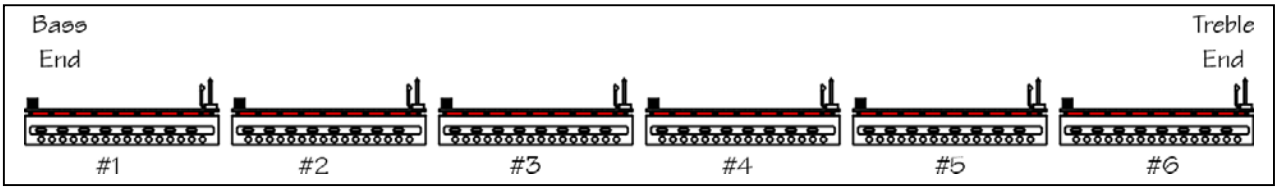
☒ **NEVER** place magnetic media (floppy disks, magnetic tapes, credit cards) on or near the valve blocks. The strong magnets in the valve blocks may erase them.

☑ Valve blocks may be suspended by their tubing alone if inserted into a well-supported tubing run. Ordinarily, however, it is best to brackets to support them. We can provide custom brackets upon request.

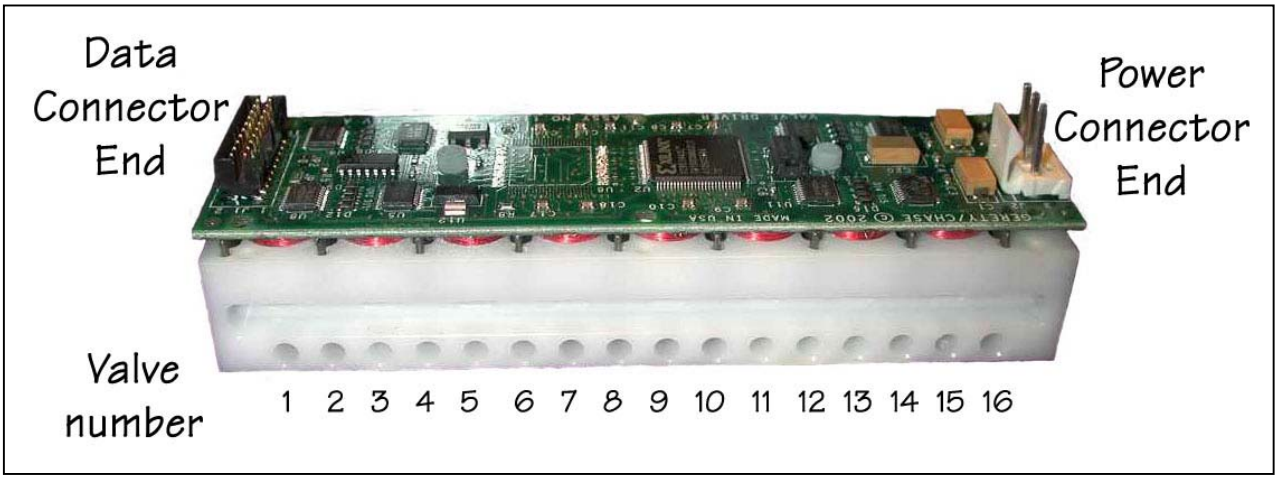
Noises will be minimized if the blocks are not placed in direct contact with rigid or resonant structures. It is best to hang the blocks from the hangers provided. If they are placed on a rigid or resonant surface they should be placed on a sound isolating material such as felt or sound deadening urethane foam.

3.10 Mapping

☑ If your E-Roll Player System was supplied with a pre-installed note map, the blocks will be numbered starting with 1. If so, then the valve blocks should be installed with the lowest numbered block at the bass end of the instrument in increasing block number order towards the treble end. The data connectors should all face the bass end. This orientation facilitates both tubing and cabling in pre-mapped systems. This is illustrated below:



☑ A variety of "standard" note maps (Duo-Art, Welte, Ampico A/B, etc.) are provided at the end of this manual. Please refer to these maps when making tubing connections to the valve blocks. Note that each note and expression tube has a specific valve block and valve number assignment. The valves on each valve block are numbered from 1 to 16, starting at the data connector end of the block. This is illustrated below:



If your system did not come pre-mapped, or if you find that you have made a mistake in tubing the valves, the mapping software that comes with the E-Roll Player System can be used to assign any note or expression tube to any valve on any block. This give you complete flexibility in choosing where to place your valve blocks and how to run your tubing.

3.11 Mounting the Power Supplies

Be careful when mounting power supplies and associated wiring to locate screws away from electronic components and power terminals. Please plan carefully before installation to be sure that there is sufficient cable to connect the controller, blocks and power supplies before mounting them. Custom cables may be ordered separately from us.

The standard power supply does not need to be mounted to the piano but it is recommended to anchor the output wiring to prevent it from pulling loose. If using the upgrade, box type power supplies, they should be mounted to the instrument frame.

3.12 Mounting the MIDI Controller

The midi controller may be placed anywhere within the limitations of data cable length, but should be secured so that it will not fall out of place.

3.13 Connection to computer

The MIDI controller is connected to your computer with a standard MIDI cable (5 pin DIN male both ends) to the MIDI output of a MIDI interface card, sound card or game port of the host computer. Up to 100 feet of high quality shielded cable is permitted. MIDI cables are available at most music stores that carry electronic instruments, and at many computer stores. If connecting to a PC 15 pin game port connection you must obtain the required Game Port MIDI adapter (available at many computer stores, such as CompUSA). Connect the MIDI OUT port from your computer to the MIDI IN port on the front of the MIDI controller.

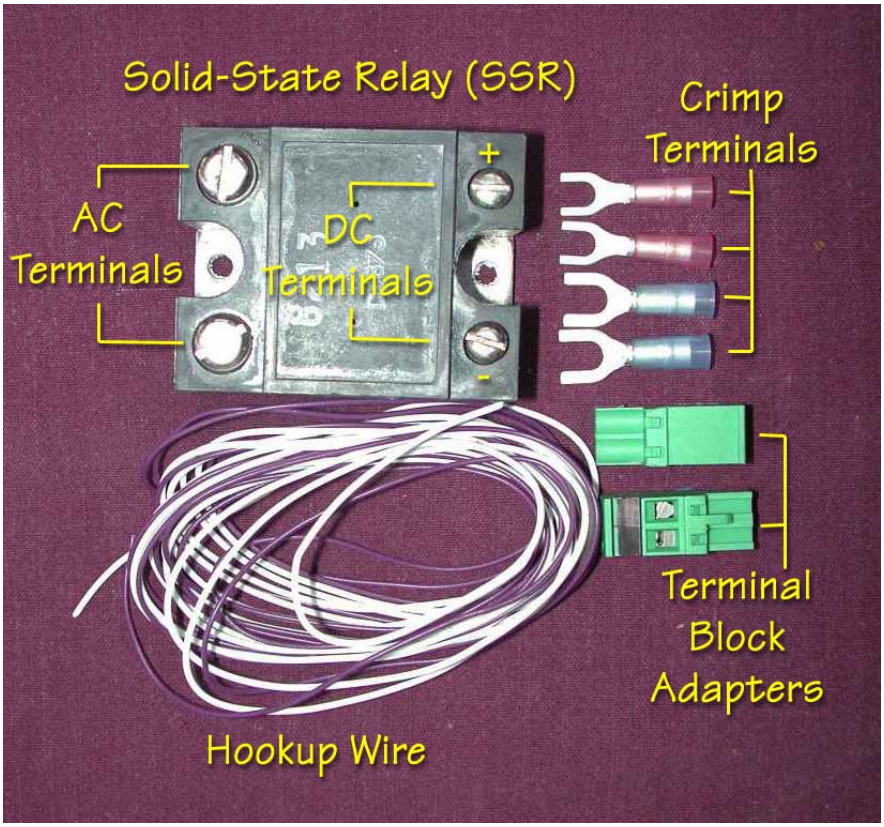
4 Optional Equipment and Accessories

4.1 Optional Pump Motor Relay Kit

An optional Pump Motor Relay Kit is available for controlling your instrument's pump motor, thereby allowing the pump motor to be turned on only when needed. The pump motor relay operates in tandem with your instrument's original pump motor switch, permitting the instrument to be switched on and off manually when the E-Roll Player is not being used.

The relay is controlled by MIDI activity. Upon sensing the first MIDI event from your computer, the MIDI controller signals the pump motor relay to turn on. After 20 seconds of complete inactivity (i.e., after a selection has finished playing), the MIDI controller signals the pump motor relay to turn off. All "Spencer's E-Rolls" MIDI files (and most others, as well) transmit a non-playing note (MIDI event) several seconds before the actual start of each song, allowing the pump sufficient time to develop the proper vacuum level.

The optional Pump Motor Relay Kit consists of a Solid-State Relay (SSR), four crimp-on terminals, low-voltage hookup wire, and two terminal block adapters (see photo below):

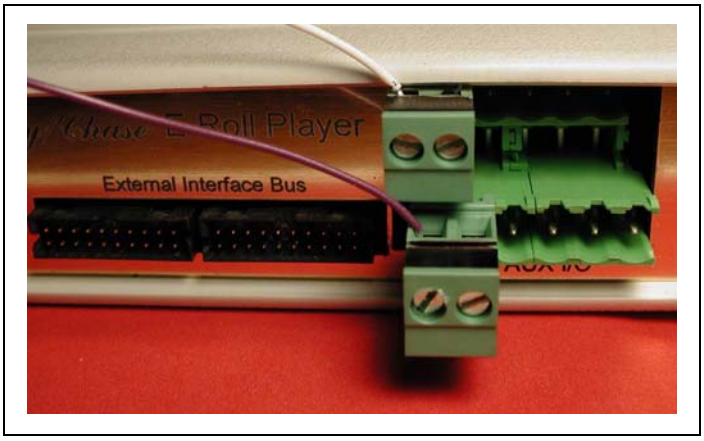


Optional Pump Motor Relay Kit

The SSR can be mounted anywhere convenient however, the relay may get warm and should not be placed next to combustibles or anything that would be damaged by heat. The included relay will switch current to any motor up to 1/2 HP without damage. If you are using an SSR other than the one provided by us, be sure to use one of sufficient rating and provide a heat sink if necessary. If it gets more than slightly warm to the touch, it should be mounted on a metal heat sink and not directly on a combustible surface.

A connection from the SSR to the MIDI controller is made with the included small gauge hookup wire, one white wire and one purple wire. To make this connection, perform the following steps.

1. Crimp one small terminal adapter onto one end of the white wire and crimp the other small terminal adapter onto one end of the purple wire.
2. Connect the terminal adapter on the purple wire to the SSR's DC "+" input terminal
3. Connect the terminal adapter on the white wire to the SSR's DC "-" input terminal.
4. Route the white and purple wires to the back of the MIDI controller (see photo below), and cut to a reasonable length. Allow sufficient extra wire for future service, if necessary.
5. Strip approximately 3/8" of insulation off of the cut ends of the white and purple wires.
6. Orient the terminal block adapters so that the slotted screw heads are facing you and so that the openings for receiving wires are facing upward. Open the leftmost wire receiving opening in both terminal adapters by turning the leftmost screw head counter-clockwise.
7. Connect the stripped end of the white wire to the leftmost wire opening in one terminal adapter. Secure it in place by turning the screw head clockwise.
8. Connect the stripped end of the purple wire to the leftmost wire opening in the other terminal block adapter in the same way.
9. Plug the terminal block adapters into the leftmost positions of the terminal block socket on the back of MIDI controller such that the terminal block adapter with the white wire is in the top position and the terminal block adapter with the purple wire is in the bottom position, as shown in the photo below:



10. Locate the existing pump motor switch, and verify that it is in series with the pump motor. ***(If you are not sure how to do this, contact a competent electrician or service technician for help with the remaining step)***
11. Connect wires from the two sides of the pump motor switch to the two AC terminals on the solid-state relay (SSR). Use the large crimp terminals to connect to the SSR.

IMPORTANT NOTES

1. **The A.C. terminals are connected across the original piano switch, in parallel and therefore allow the piano to be controlled by either the SSR or the original switch. Use extreme care in connecting to this wiring as it may be brittle with age. If in doubt, replace old wiring, terminals, plugs, etc. with new ones.**
2. **ALL AC power connections must be covered or insulated to minimize risk of electrocution. This is especially important where small children or pets might crawl under your instrument and gain access to the electrical wiring.**

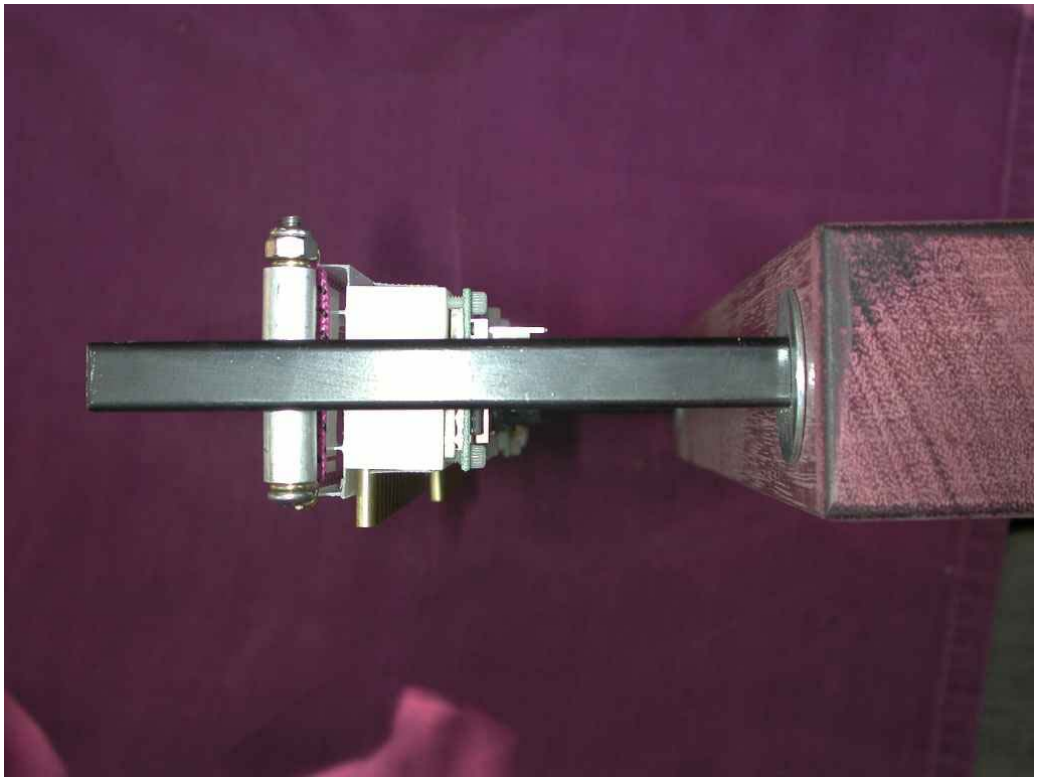
4.2 Optional Grand Piano Mounting System

The optional mounting kit includes the following components and can be used to mount the blocks in most grand pianos.

- 12 feet of strong mounting cord
- Two mounting stanchion assemblies
- Spring for tensioning the cord
- Screw eyes for mid-span support of cable
- Plastic covered wire for connecting blocks to cable runs, mid span supporting of the cord runs and for temporary support during installation

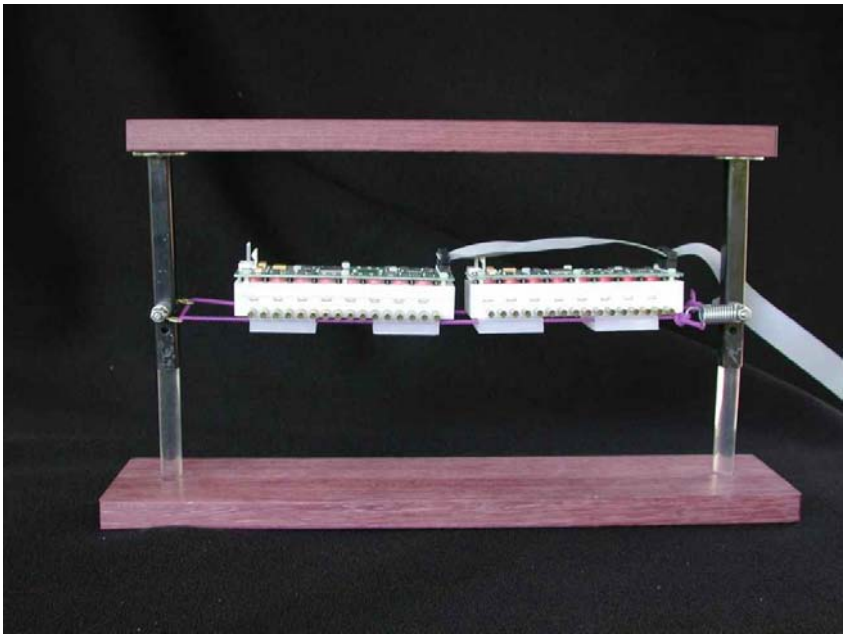
To install:

- Plan the installation carefully to allow the blocks to be mounted so that they do not contact any other piano parts. Contact will conduct noise to the frame of the piano. Contact of the circuit boards with metallic components may cause shorts and damage to the circuits
- Assemble the stanchion arms (hardware included) to the stanchions. The S-hooks (enclosed) attach to the ends of the arms. They should appear as shown in the installation photo below:



- Mount the two stanchions on opposite ends of the underside of the keybed. The spaced-apart S-hooks on the stanchion arms are used to string the cable. The S-hooks are laterally separated to support two parallel runs of cable approximately 1-1/4" apart. To mount the stanchions to the keybed:
  - drill a 3/16" hole at the desired location of each stanchion
  - screw the stanchions into the holes using a wrench. Make sure that the stanchion is tightened adequately. The stanchion should be perpendicular to the keybed when fully tightened even if the pilot hole was drilled slightly off axis.
  - If the keybed is very thin, use caution when drilling. It may be necessary to grind the points off of the screw ends of the stanchions in extreme cases.
- Secure the spring to an S-hook on one side of one stanchion. (Alternatively, the S-hook can be removed and the spring can be secured directly to the stanchion arm)
- Attach one end of the cable to the spring

- String the cable from the spring through the both S-hooks on the opposite stanchion, then back to the remaining S-hook on the stanchion with the spring to form two parallel runs of cable.
- Pull the cord taut to partially extend the spring and tension the cord before attaching the cord to the remaining S-hook.
- Insert lengths of plastic insulated wire through the end holes in the blocks and wrap this around the long cables to secure the blocks. Please note that the end holes are the ones that do not have nipples installed in them. The photos show a slightly older mounting system with plastic shelves stuck to the blocks. These are no longer needed with the extra holes in the blocks.
- Mount the screw eyes (included) into the underside of the keybed at appropriate points between the stanchions, in between planned locations of your valve blocks. (Loops of the plastic covered wire will be attached to these screw eyes and used later to support the cable runs mid-span.)
- When the final positions for the valve blocks are determined, the plastic-covered wire is used to provide additional vertical support to the cords. This is done by looping the plastic-covered wire around the two cable runs (between two blocks) and attaching the loop(s) of wire to the screw-eyes in the underside of the keybed. Since this support wire must be located between the blocks, it is best to be sure of their best position before installing it. It is also recommended that the slits in the bottoms of the polycarbonate shelves be covered with tape to prevent the cables from pulling out of the slots. When the installation is complete and the cables are fully supported, this tape may be removed to facilitate future service.



Grand Piano Mounting Kit (2 blocks shown in demonstrator frame)

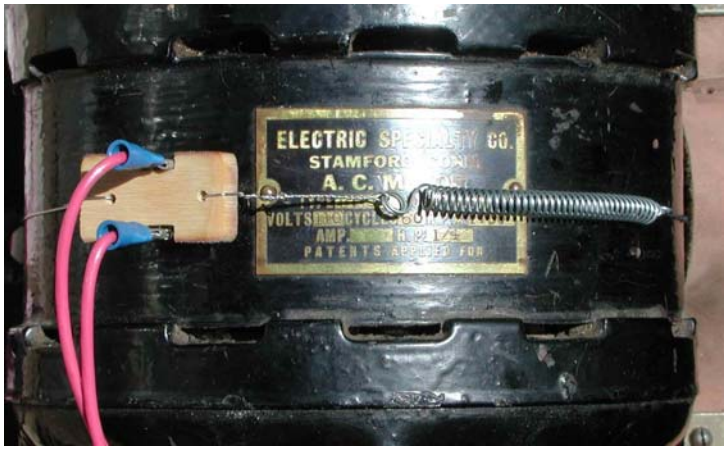
4.3 Optional Behind the Spoolbox Vertical Piano Installation Kit

This accessory kit contains a mounting bracket for mounting the valves with their nipples facing down, behind the spoolbox. Also included are standoff spacers and velcro self adhesive material for mounting the blocks to the brackets.

4.4 Optional Motor Overheat Protector Installation

This optional switch will shut off the motor at a predetermined temperature thereby protecting the motor from heat damage and lessening the chance of fire. It is for use with AC motors up to and including ¼ HP. It is intended as a safety and not a switch. It is not designed for frequent operation. **If the motor is cycling off frequently, there is a problem which must be remedied, as an unsafe condition exists against which the overheat protector is not designed to protect. With a ¼ HP motor, this switch is rated for 6000 cycles only. After that it may fail closed and no longer offer protection.**

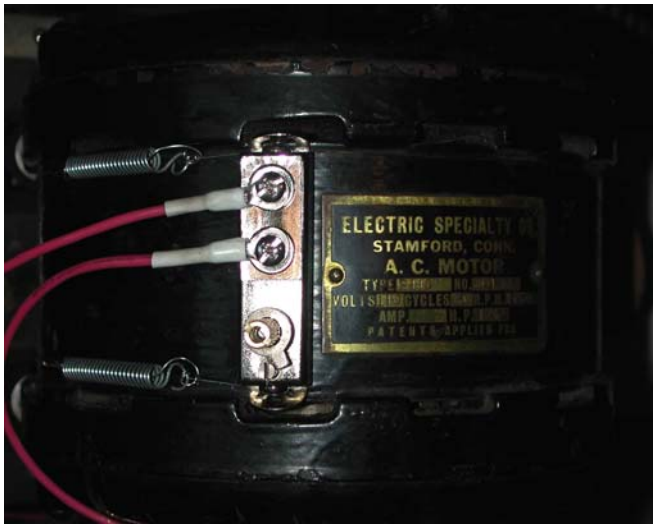
Two switches are offered, fixed and adjustable. The adjustable unit is installed with two spring loaded wires but the fixed one is installed with a single wire. The thermostatic switch is mounted to the motor as shown in the photographs below.



Fixed-Temperature Motor Thermal Protector

The thermostat element is held against the motor in the installed position as in the photograph. Be sure to position the switch so that the bottom is in firm contact with the motor housing. Do not install over nameplates or labels, only on a smooth metal or painted surface. Wrap each wire fully around the motor and through one of the bent tabs on either side of the thermostat, on the adjustable switch or through the hole in the insulating plate used with the fixed temperature switch. Loop the free end of the wire through the opposite end of the spring to which the other end of the wire is already attached. Pull it tight until the extended length of the spring is 3” and give it a sharp bend to hold it temporarily. Secure the wire by wrapping it through the open spring loop several times and then back around the wire. If the wire is too long to allow for stretching of the spring to 3”, cut off a portion of the long connecting length and reattach.

The thermostat is to be connected in series with the motor wiring. It may be necessary to cut one of the motor wires and to use the wire nuts (supplied) to make the connection.



Adjustable-Temperature Motor Protector

If you are not qualified to make this connection with line voltage wiring , please obtain the assistance of someone who is.

Once the switch is installed, check to make sure that there is a firm contact between the base of the sensing unit and the motor. For the fixed switch it is necessary to fill the space between the switch base and the motor with the thermal grease provided. Tilt the switch against the pull of the spring and squeeze the contents of the capsule onto the motor or the switch base and allow it to spring back. The adjustable switch does not need this compound as the sensing area is much larger. **Once the wires are installed, be sure that there is a firm contact between the switch and the motor or the shut off temperature may be elevated.**

The adjustable thermostat is calibrated such that the extreme clockwise rotation of the adjustment shaft will set it to shut off at a motor housing temperature of 160 degrees F. This is a safe setting for motors with cotton covered wiring as the wiring runs at a cooler temperature than the motor housing and the wire is rated for 190 degree F operation. To shut the motor off at a lower temperature, rotate the shaft counterclockwise. Each quarter turn will change the setting by about 30 degrees.

If you would like the thermostat calibrated to a maximum temperature, of your choice between 90 and 215 degrees F, please return it with the desired temperature specified.

Please be warned that high voltage is present at the wire connections to the thermostat. Do not touch these connections when the motor switch is on.. If the thermostat is installed in a position where it may be accessible, it is recommended that these connections be covered with either “liquid electrical tape” (available at electrical supplies and hardware stores) or with a good grade of silicone seal.

The following warning must be printed and installed in a conspicuous location in the vicinity of the motor.

Warning !!!!! This motor is thermally protected and may self-start after cooling from an overheat condition.

To avoid serious personal injury, always disconnect power when working in the vicinity of this motor

IMPORTANT

The optional motor overheat protector is intended only to offer a measure of protection against an overheating pump motor. It does not, however, correct or negate any pre-existing problems with your pump motor, nor does it prevent problems from developing after installation. Regular inspection and maintenance of the pump motor is necessary with or without the E-Roll Player System, and with or without the motor overheat protector. We cannot assume any responsibility for system failures or instrument damage due to faulty motors or motor wiring, nor do we warrant against such failures or damage.

5 Testing your installation

5.1 Use of Test Midi Files

The best way to test for operation of all valves and to determine that tubes are connected in the proper order is to use a MIDI sequencer with graphic display, such as "Cakewalk" or "Sonar". The Duo-Art Ampico and Welte test files play every valve used in the proper sequence to make troubleshooting easy. Please refer to the note map charts to identify valve functions. Not all systems use all notes. These test files play only the playing notes and expression functions for the reproducing formats. The 88 note test plays all keyboard notes as well as MIDI 18 for sustain pedal and MIDI 113 for soft pedal.

If a sequencer is not available, any MIDI player, such as the Windows Media Player or "VanBasco's Karaoke (older version called MIDI) Player" may be used. The files contain "marker chords" that will sound before each rank of notes. The ranks are aranged as follows:

Duo-Art: Sustain, Bass Theme // Accomp Levels // playing notes // Theme Levels // Treble Theme, Soft Pedal

Ampico: Bass End Expression and Pedal Functions // playing notes // Treble End Expression and Pedal Functions

Welte Licensee: Bass End Expression and Pedal Functions // playing notes // Treble End Expression and Pedal Functions

88 Note: Sustain pedal // playing notes // soft pedal

In addition to "marker chords" between ranks, there is also one marking each octave, just before the C Natural. This may be a little confusing as each reproducing scale begins the keyboard notes in a different place. Ampico Begins with B 0, Duo-Art with C# 1 and Welte with C 1. Therefore the Ampico is the most confusing as there is a marker at the beginning of the keyboard notes and then just a B and another marker before the beginning of the next octave.

To obtain the charts and test "rolls" please use the following web links (NOTE: links are case sensitive):

E-Roll System Information Home Page www.spencerserolls.com/MidiValve.htm

E-Roll System Installation Manual (The latest version of this document.)
www.spencerserolls.com/valvemanual.zip

Tubing Charts for Reproducing Pianos www.spencerserolls.com/tubecharts.zip

Test "Rolls" and Tubing Charts for Reproducing Pianos
www.spencerserolls.com/Charts&Tests.zip

6 Software installation and use

Installation and usage guides for the following software components of the E-Roll Player System are available separately on the distribution CD.

- Installing configuration utility and MIDI player
- Using configuration software
- Configuring MIDI adapter and Multimedia settings for PC computers
- Using MIDI player

7 Maintenance and Troubleshooting

Please note that most problems with missing notes, bad repetition or improper expression on reproducing pianos are the result of using incorrect file types. If you experience these types of problems, check with us to make sure you are using the correct type of file for your installation.

In case of irregular playing of any kind, try resetting the controller before taking any other action. This may be done by pressing and holding the reset switch for 5 seconds. It is actually easier to just remove power from the system for several seconds. Unplug the power cord and leave it unplugged for a minute to be sure. The controller and valve blocks contain sophisticated circuitry and occasionally get confused, usually due to a momentary interruption of power or corrupted input data. A reset will restore correct functioning.

7.1 Adjustment for custom configurations

Setting pick timing

The default pick period of 6.4 ms is suitable for virtually all installations. Quieter operation may be obtained with a shorter period in installations where the maximum vacuum is low. Longer pick periods allow for operation at higher vacuum levels. If you are experiencing erratic valve action at higher vacuum, you should consider a longer pick period. It is preferable to lengthen the pick period rather than to increase the pick and/or hold voltages. Modification of the pick period should always be tried before attempting to change the pick and/or hold voltages. If there are extended rapid repeats in the program, it is advisable to check for excessive valve block temperature after setting a higher pick period. This is only going to be a problem with extreme music programs or very high ambient temperature operation.

Adjusting pick and hold voltages

Power supplies are factory set and should not need adjustment except for special requirements. Do not attempt adjustment unless you have a voltmeter that you know to be accurate and are familiar with its use. Excessive voltage may damage circuitry when applied for extended periods of time. The adjustment range of the power supplies is limited and immediate damage will not result even if set to maximum. However a combination of excessive pick period and voltage may cause damage, especially with extended rapid repetition of notes in the music program. Extensive testing of the valve block design has been done with the default configuration and with note combinations and repetition cycles that far exceed any that is likely to occur in the lifetime of your system. However extreme combinations of excesses can result in heat buildup in coils and electronic components. Please consult us for recommendations if you intend to adjust voltages and pick periods away from factory default settings or if you are using the valves for programs with prolonged rapid repetition at high temperatures or elevated voltages.

Installation of upgraded and third party power supplies .

The power supplies included with your system have been tested with polyphony that exceeds all reasonable musical needs. It is not likely that a larger supply will be needed. If you feel you need a larger supply, please contact us for recommendations.

7.2 Cleaning & Lubrication

Without disassembly

☑ Most dust and small particles that interfere with valve operation can be removed by gently lifting the affected valve plunger with a toothpick through the side vent hole. Use a clean and un-splintered toothpick and gently lift the plunger. Gently blow to dislodge the particle or remove it with tweezers if it is large and wedged in place.

☒ Do not tear the red silicone washer or it will need to be replaced. In the event that the seal is damaged, it may be easily replaced with one of the spares provided, but disassembly of the block is necessary. It is therefore best to use care to not damage the seal. Do not use pressurized air or other propellants unless you know how to produce gentle pressure with these methods. Full pressure "air" from a can may cause damage as will high-pressure air from a compressor.

With Disassembly

Although the block will be easier to handle if the tubes are disconnected, it may be possible (depending on the particular installation) to simply remove the printed circuit board from the valve block while the unit is in place.

☑ Be sure to disconnect power from the system before any disassembly is performed. Remove the power and signal connectors first. Then remove the 8 socket head cap screws that retain the circuit board and gently lift it away from the block. Lift it straight up without tilting it excessively. If it seems to be stuck, gently pry it from several different points along the perimeter of the board to loosen. Do not insert any tools into the space between the circuit board and the block or you may damage coils and wiring. If the board does not remove with gentle persuasion, please return it to us for repair. Set the board aside for cleaning of the affected valve or valves and be sure to place it on a static protected surface. Avoid touching any component leads or circuit traces especially if the relative humidity is low or if there are synthetic carpets or other sources of static electricity. If you are working under low humidity or other conditions of high static potential it is best to use static protection techniques when handling circuit boards.

The plungers can be removed easily by attracting them, one by one, to an iron bearing tool such as a small screw driver. When lifting the plungers out, lift them straight up and avoid other plungers as thy will attract each other. **Be sure that there are no iron bearing chips on the tool or in the area you are working in or they will be attracted to the magnet in the plunger and can be very difficult to remove.**

The valve cavity may be cleaned with a dry cotton swab. Do not use any solvents unless necessary. If necessary, use only 99% isopropyl alcohol. Lubrication should not be necessary unless cleaning was done with alcohol. The only allowable lubricant is a light coating of dry teflon lube. Check to make sure that lint from the swab does not remain before reinserting the plunger. If the seal has dirt stuck on it, it maybe cleaned in the

same manner. The plunger can be gently wiped with a soft cloth dampened with alcohol. Be careful to not drop it where it may attract magnetic material or other dirt. If magnetic material does become stuck to the plunger, use a soft cloth and wipe the material off carefully. This will take some time and care as the magnetic dirt will be attracted to the magnet. Before returning the plunger to the block, give it a light dusting with common talc. No other lubrication is necessary.

When reassembling the printed circuit board to the delrin block be careful to locate the coils above their locating bosses and move the board and coils into contact with the block without allowing the coils to touch the metal shield pieces between the coils. They can damage the fine coil wires.

Troubleshooting Guide:

Problem	Possible Cause	Solution
Unit does not turn on	Not plugged in	Plug the unit in
Note or notes inoperative	Loose cables or connectors	Double-check connections, reseat connectors
	Foreign substance in valve	See "Cleaning" above
Notes staying on	Loose Signal Cable	Reseat all data cable connectors
	Bus Terminator not installed in data cable	Install bus terminator
	Foreign substance in valve	See "cleaning" above
Missing notes , repetitions or improper expression on reproducing pianos.	Incorrect MIDI file type. Type must be tracker bar image for the installed system	Check file type and replace if it is not the correct type. Contact distributor for information.
Unit does not turn off	MIDI File Player crashed	Re-open MIDI File Player and close normally
	Defective MIDI Controller	Replace
Excess Heating *(the E-Roll Player System does not generate much heat – this condition is extremely rare. If this condition occurs, you should call us to determine if repair or replacement is necessary)*	Extreme, prolonged repetition from music source	Stop playing, allow some time for valve(s) to cool before restarting
	Defective MIDI File or Player	Install latest software updates, replace MIDI File
	Pick Period set too high	Choose shorter pick period
	Pick or Hold Voltage set too high	Choose lower pick or hold voltage

8 Tips for Owners

8.1 Moving a piano with the valve system installed

It is important to prevent the valve blocks from damage during both local and long distance moving of the piano. Depending on the method used to mount the blocks and other components, it maybe necessary to provide temporary extra support. If this is not possible, it is recommended that the system be removed for shipping. Numbering of the tubes with a paint marker will make reassembly easier.

We have a "moving kit" available which consists of two perforated plastic tubes which are split so as to fit over the valve blocks. This allows them to be firmly secured to the piano with shock cord and or tape. Please contact us if this kit is needed. This kit will be most needed for installations in which the blocks are suspended from the legs and they are to be removed for moving.

Other components such as the midi controller and power supplies should be secured adequately or removed for moving.

8.2 System Specific Tips

Duo-Art Grand

Use of the optional Grand Piano Mounting Kit is strongly recommended.
The valves blocks may be mounted in front of the stack. They will show from a low sight line and should be covered with a "belly" cloth to improve appearance and to reduce noise. Mounting behind the stack is another possibility but will require longer tubing runs. . For easy access during installation , remove the lyre and pedal linkages to have easy access to the bleed rail.

Note valves
Connect the tubing wyes here just ahead of the rail. The first step is to identify the number of pneumatics in the stack. Some are 80 note and others are 88 note. It is easiest to connect to the 80 center notes only. If this is done on an 88 note stack, be sure to not connect to the first and last four tubes on the bleed rail. If these notes are to be used, the connection must be made on the tracker bar side of the cut off blocks in order to be able to switch from Duo-Art to 88 note operation. This will require routing tubes from the blocks around the key bed and frame. It is also possible that there may be 8 spare positions in the connection blocks that connect the notes tubes through the key bed. If present, these may be used.

Check to be sure the notes are connected in the correct order and mark the MIDI numbers (from the tubing chart) on the bleed rail fabric (or temporary tape applied to it) Run the tubes for the dynamic valves around the stack on both sides as well as for the sustain pedal. The theme valves may be connected at the pallet valves in the keyslip. Other connections will be made easily as follows:

Dynamic valves. Insert wyes in the tubing run on the way to the dynamic valve box at the rear of the piano. Whether there is an installed pump and how the tubes are routed will determine at what point the tubes become easily accessible. The tubes to the valve blocks can be run around the stack on either side.

Soft pedal. The easiest connection point for this is on the pallet valve for the modifying lever. This is the lever in the keyslip that has a position for soft playing. With the piano running and the tracker bar blocked off, operate the lever to determine which position operates the hammer rail lift or the una corda, whichever is chosen too operate from the roll. Then determine which pallet valve opens when this happens and identify the tube connected to it. This is the tube into which the wye for connection to the valve block should be inserted.

Sustain pedal. The easiest connection point is right at the pedal pneumatic / control valve unit. Just insert a wye into the signal tube to this unit.

Theme actuation valves (theme primaries). The easiest connection point is at the theme actuation levers pallet valves. These are the two small levers marked with a B and T. Locate the tub connecting to each pallet valve and insert a wye and the tube to the appropriate valve block.

After connecting the blocks in the vicinity of the pedal linkages, allow the blocks to hang from their tubing and carefully reinstall the pedal linkages. Be sure that the lever to the sostenuto pedal is above the lever end on the long linkage as it will be more difficult to correct after the blocks are installed. The remaining blocks should be placed so as to not

interfere with the mounting of the lyre. It may be best to test fit it a few times during the installation as there is some tubing congestion in this area.

Once the valve blocks are positioned it is advisable to place twisted wire on the cords to maintain their side to side positions to avoid contact with solid surfaces of the piano. The plastic covered wire, included with the mounting kit) is best for this. This will minimize sound conducted to the piano frame.

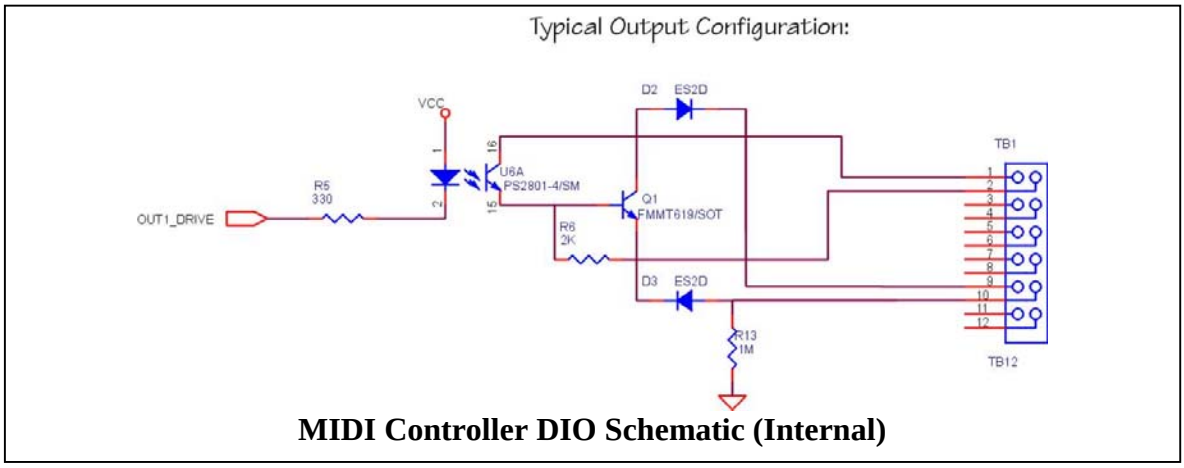
Duo-Art Upright

Due to the limited space behind the spool box careful planning and installation of tubing is necessary in order to prevent interference with the piano action. For new installations it is recommended to use only thin walled tubing. For retrofit installations, it may be necessary to rearrange the original tubing to make it more compact.

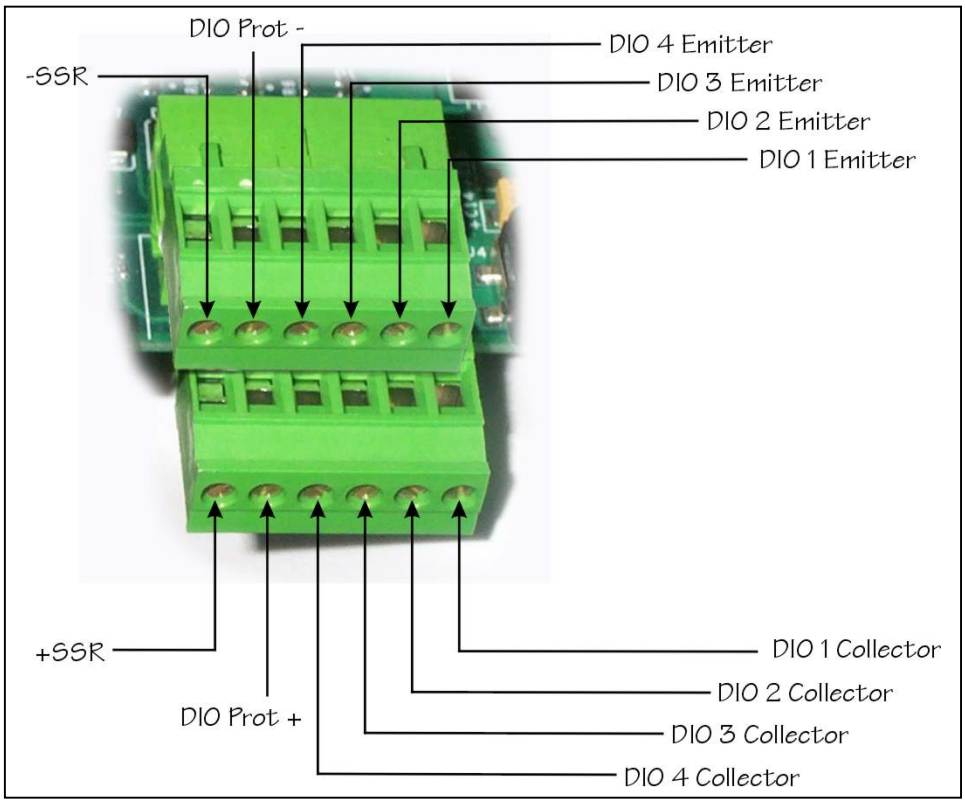
When cutting the signal tubes from the tracker bar to the stack for the purpose of inserting wyes, make sure to stagger the cuts vertically. If the wyes are not staggered it will be difficult to obtain clearance between the tubing and the piano action since the tubes will cross over each other numerous times and it will not be possible to press them down for clearance. They can be installed randomly or they can be installed in vertically spaced rows and these rows can be used to identify the tubes. For example, the tubes to each deck may be all located on one row. This will make it easier to trace the tubes when connecting to the valve blocks. It is recommended that the wyes not be installed in the horizontal run of the original signal tubing runs. It is difficult to add them here without causing interference with the piano action. In addition, it will require excess tubing to be used which is not good for accurate signal propagation.

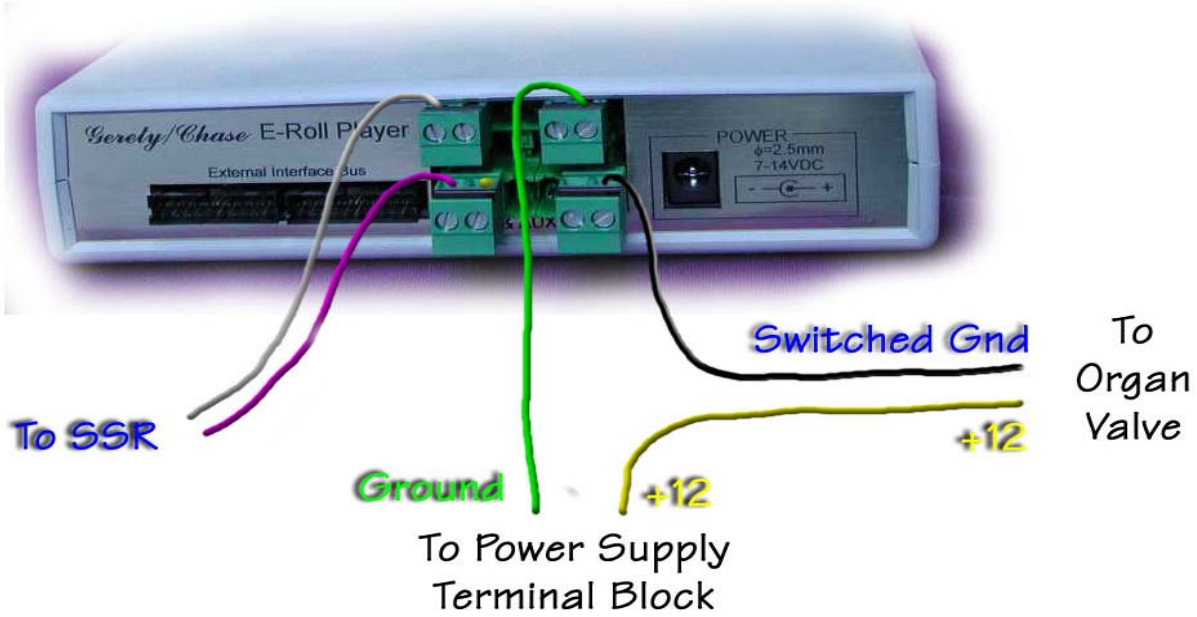
Ampico A/B

Ampico piano installations require 97 valves, which is one more valve than is available on 6 valve blocks. Rather than supply an additional valve block (leaving 15 of the 16 valves unused), it is generally preferred to use a single organ-type valve driven by the MIDI controller's DIO #1 to operate the (relative undemanding) soft-pedal pneumatic. In fact, the "standard" Ampico A/B mapping is set up for an organ valve on the soft pedal. We can supply the organ valve to you, if you want. Otherwise, contact us for recommendations about which organ valve to use. DIO wiring, terminal block configuration and Ampico A/B soft pedal valve wiring at the back panel of the MIDI controller are shown below:



MIDI Controller DIO Schematic (Internal)





Organ Valve Wiring for Ampico A/B Soft Pedal Valve (Older systems were wired differently. This diagram is only for currently shipped pre-wired valve.) Contact us if there is any question as to which valve you have as damage to controller will result with improper wiring

9 Features and Specifications

- **Small size: fits in tight spaces**
- **Modular design for flexibility of installation**
- **Self closing springless valves for all reliable operation**
- **Wide range of operating vacuum (2 to 85 Water Column Inches)**
- **Digitally addressable valves to simplify wiring.**
- **Full note/controller mapping capabilities**
- **Durable**
- **Easily serviced**
- **Supplied as a complete system, including controller, valve blocks, power supplies, cables and installation hardware**

Specifications

Valve Blocks:

- Dimensions: 1.25"*(h)* x 1.4"*(w)* x 5.0"*(l)* (32mm x 36mm x 127mm)
- Valves per block: 16
- Material: White Delrin Block, Aluminum/neodymium piston, silicone seal
- Performance: 20++ Hz rep. rate from 2" to over 80" vacuum (H_2O)
  positive pressures 5+" H_2O -- custom mods avail. for higher positive pressure
- Interface:
  - Pneumatic: 5/32" straight nipple (included)
  - Electrical: 2mm 20 conductor ribbon cable (included)
- Other: Integral "through-tee"
  - Variable pick/hold valve timing
  - In-system reprogrammable

Controller:

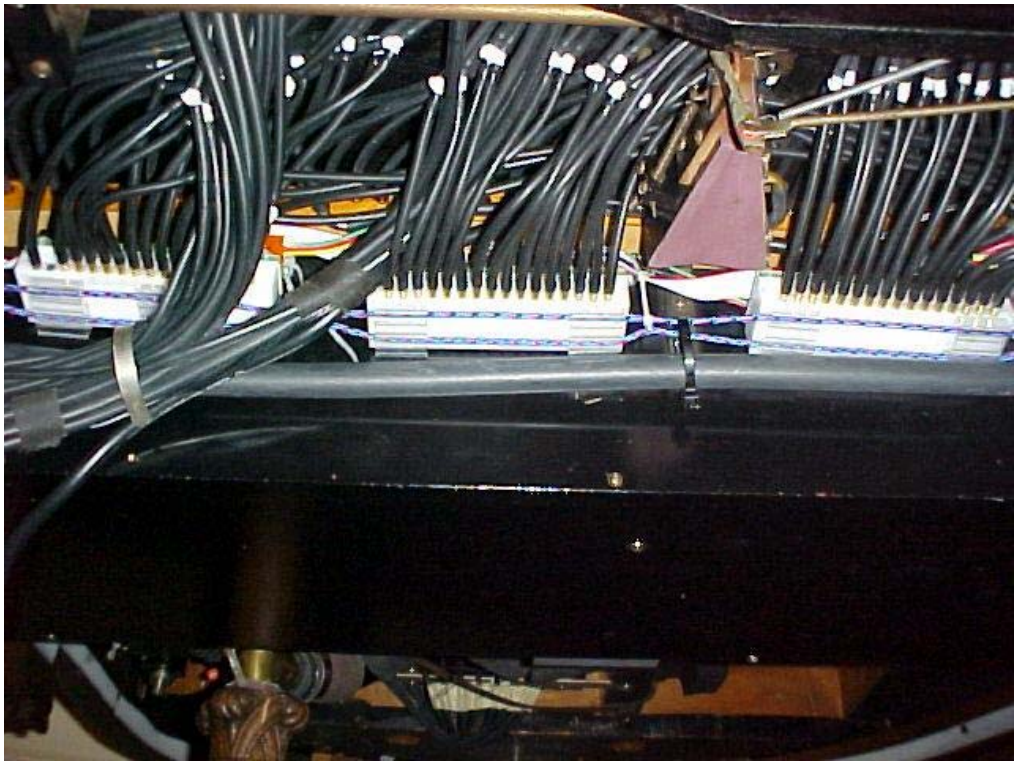
- Capacity: Each controller supports up to 16 valve blocks (256 valves total). Multiple controllers can be "ganged" for very large installations
- MIDI: 2 IN, 1 OUT, 1 THRU
- Valve Mapping: Individually mappable to any note, controller or combination on any channel
- Other outputs: 16 discrete digital I/O (*e.g.*, pump/blower control, etc.)
- Forward compatibility:
  - Compatible with optional external I/O modules, future Gerety/Chase products (digital expression regulators, etc.)

10 Installation Photographs

Duo-Art Grand Installed, Front View

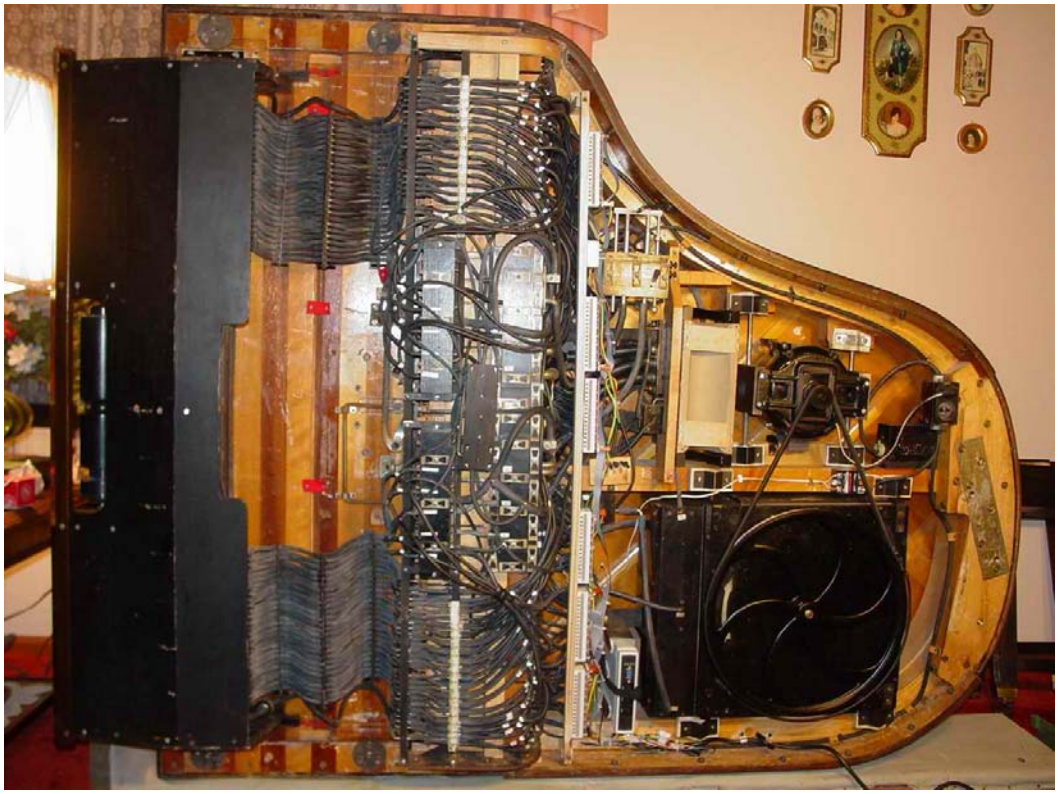
Duo-Art Grand Installed, shown with cover cloth down

Duo-Art Grand With System Installed

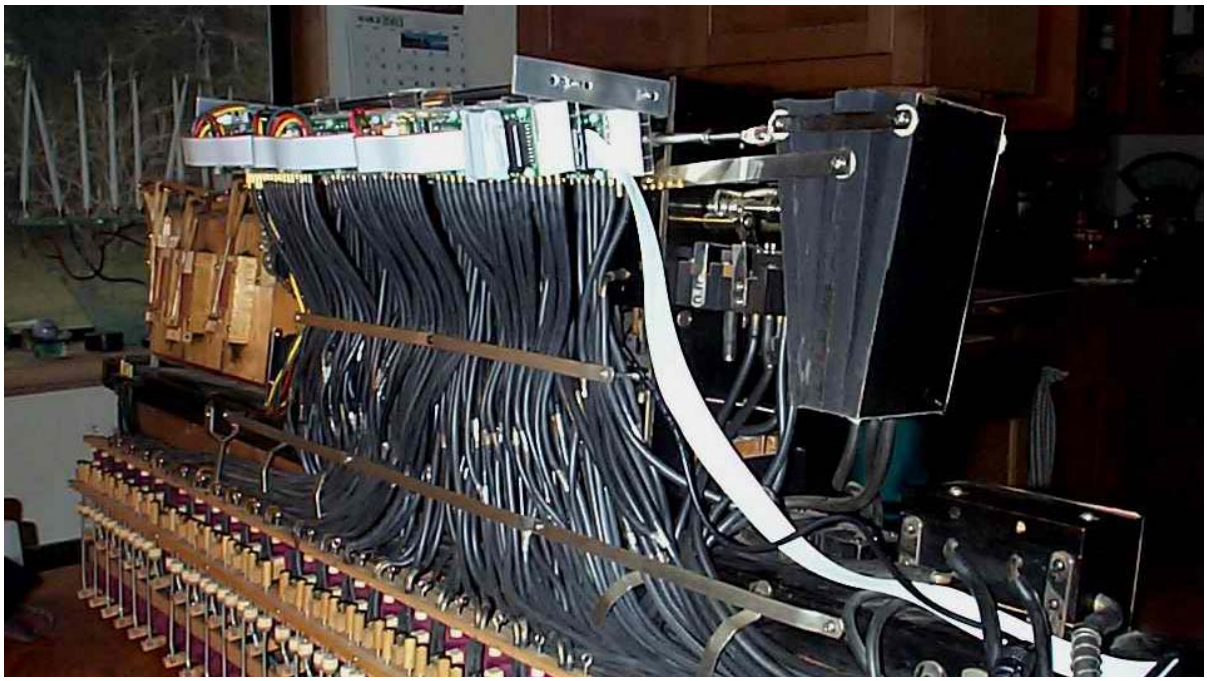


Detail of Block Installation (Duo-Art Grand above)

Ampico B with Stack Cover in place



Ampico B Blocks installed with Stack Cover Removed



Upright Duo-Art Behind the Spool Box Installation

11 Tubing Charts

Ampico A Tubing Chart

unit	block	midi	key/function	tracker		note		unit	block	midi	key/function	tracker	note
A	1	**16**	**Slow B Cres**	1				D	3	**66**	46	notes	f# 4
A	2	**17**	**Bass 2**	2				D	4	**67**	47	notes	g 4
A	3	**18**	**Sustain**	3				D	5	**68**	48	notes	g# 4
A	4	**19**	**Bass 4**	4				D	6	**69**	49	notes	a 4
A	5	**20**	**Fast B Cres**	5				D	7	**70**	50	notes	a# 4
A	6	**21**	**Bass 6**	6				D	8	**71**	51	notes	b 4
A	7	**22**	**Bass Cancel**	7				D	9	**72**	52	notes	c 5
A	8	**23**	3	notes		b 0		D	10	**73**	53	notes	c# 5
A	9	**24**	4	notes		c 1		D	11	**74**	54	notes	d 5
A	10	**25**	5	notes		c# 1		D	12	**75**	55	notes	d# 5
A	11	**26**	6	notes		d 1		D	13	**76**	56	notes	e 5
A	12	**27**	7	notes		d# 1		D	14	**77**	57	notes	f 5
A	13	**28**	8	notes		e 1		D	15	**78**	58	notes	f# 5
A	14	**29**	9	notes		f 1		D	16	**79**	59	notes	g 5
A	15	**30**	10	notes		f# 1		E	1	**80**	60	notes	g# 5
A	16	**31**	11	notes		g 1		E	2	**81**	61	notes	a 5
B	1	**32**	12	notes		g# 1		E	3	**82**	62	notes	a# 5
B	2	**33**	13	notes		a 1		E	4	**83**	63	notes	b 5
B	3	**34**	14	notes		a# 1		E	5	**84**	64	notes	c 6
B	4	**35**	15	notes		b 1		E	6	**85**	65	notes	c# 6
B	5	**36**	16	notes		c 2		E	7	**86**	66	notes	d 6
B	6	**37**	17	notes		c# 2		E	8	**87**	67	notes	d# 6
B	7	**38**	18	notes		d 2		E	9	**88**	68	notes	e 6
B	8	**39**	19	notes		d# 2		E	10	**89**	69	notes	f 6
B	9	**40**	20	notes		e 2		E	11	**90**	70	notes	f# 6
B	10	**41**	21	notes		f 2		E	12	**91**	71	notes	g 6
B	11	**42**	22	notes		f# 2		E	13	**92**	72	notes	g# 6
B	12	**43**	23	notes		g 2		E	14	**93**	73	notes	a 6
B	13	**44**	24	notes		g# 2		E	15	**94**	74	notes	a# 6
B	14	**45**	25	notes		a 2		E	16	**95**	75	notes	b 6
B	15	**46**	26	notes		a# 2		F	1	**96**	76	notes	c 7
B	16	**47**	27	notes		b 2		F	2	**97**	77	notes	c# 7
C	1	**48**	28	notes		c 3		F	3	**98**	78	notes	d 7
C	2	**49**	29	notes		c# 3		F	4	**99**	79	notes	d# 7
C	3	**50**	30	notes		d 3		F	5	**100**	80	notes	e 7
C	4	**51**	31	notes		d# 3		F	6	**101**	81	notes	f 7
C	5	**52**	32	notes		e 3		F	7	**102**	82	notes	f# 7
C	6	**53**	33	notes		f 3		F	8	**103**	83	notes	g 7
C	7	**54**	34	notes		f# 3		F	9	**104**	84	notes	g# 7
C	8	**55**	35	notes		g 3		F	10	**105**	85	notes	a 7
C	9	**56**	36	notes		g# 3		F	11	**107**	**Cancel T**	7	
C	10	**57**	37	notes		a 3		F	12	**108**	**Treble 6**	6	
C	11	**58**	38	notes		a# 3		F	13	**109**	**Fast T Cres**	5	
C	12	**59**	39	notes		b 3		F	14	**110**	**Treble 4**	4	
C	13	**60**	40	notes		c 4							
C	14	**61**	41	notes		c# 4		F	15	**112**	**Treble 2**	2	
C	15	**62**	42	notes		d 4		F	16	**113**	**Slow T Cres**	1	
C	16	**63**	43	notes		d# 4							
D	1	**64**	44	notes		e 4		G	1	**111**	**SOFT**	3	

Ampico B Tubing Chart

unit	valve	midi	key/function	tracker	note		unit	valve	midi	key/function	tracker	note
A	1	**15**	**Amplifier**	0			D	4	**68**	48	notes	g# 4
NC		**16**		1			D	5	**69**	49	notes	a 4
A	2	**17**	**Bass 2**	2			D	6	**70**	50	notes	a# 4
A	3	**18**	**Sustain**	3			D	7	**71**	51	notes	b 4
A	4	**19**	**Bass 4**	4			D	8	**72**	52	notes	c 5
NC		**20**	**motor off**	5			D	9	**73**	53	notes	c# 5
A	5	**21**	**Bass 6**	6			D	10	**74**	54	notes	d 5
A	6	**22**	**Bass Cancel**	7			D	11	**75**	55	notes	d# 5
A	7	**23**	3	notes	b 0		D	12	**76**	56	notes	e 5
A	8	**24**	4	notes	c 1		D	13	**77**	57	notes	f 5
A	9	**25**	5	notes	c# 1		D	14	**78**	58	notes	f# 5
A	10	**26**	6	notes	d 1		D	15	**79**	59	notes	g 5
A	11	**27**	7	notes	d# 1		D	16	**80**	60	notes	g# 5
A	12	**28**	8	notes	e 1		E	1	**81**	61	notes	a 5
A	13	**29**	9	notes	f 1		E	2	**82**	62	notes	a# 5
A	14	**30**	10	notes	f# 1		E	3	**83**	63	notes	b 5
A	15	**31**	11	notes	g 1		E	4	**84**	64	notes	c 6
A	16	**32**	12	notes	g# 1		E	5	**85**	65	notes	c# 6
B	1	**33**	13	notes	a 1		E	6	**86**	66	notes	d 6
B	2	**34**	14	notes	a# 1		E	7	**87**	67	notes	d# 6
B	3	**35**	15	notes	b 1		E	8	**88**	68	notes	e 6
B	4	**36**	16	notes	c 2		E	9	**89**	69	notes	f 6
B	5	**37**	17	notes	c# 2		E	10	**90**	70	notes	f# 6
B	6	**38**	18	notes	d 2		E	11	**91**	71	notes	g 6
B	7	**39**	19	notes	d# 2		E	12	**92**	72	notes	g# 6
B	8	**40**	20	notes	e 2		E	13	**93**	73	notes	a 6
B	9	**41**	21	notes	f 2		E	14	**94**	74	notes	a# 6
B	10	**42**	22	notes	f# 2		E	15	**95**	75	notes	b 6
B	11	**43**	23	notes	g 2		E	16	**96**	76	notes	c 7
B	12	**44**	24	notes	g# 2		F	1	**97**	77	notes	c# 7
B	13	**45**	25	notes	a 2		F	2	**98**	78	notes	d 7
B	14	**46**	26	notes	a# 2		F	3	**99**	79	notes	d# 7
B	15	**47**	27	notes	b 2		F	4	**100**	80	notes	e 7
B	16	**48**	28	notes	c 3		F	5	**101**	81	notes	f 7
C	1	**49**	29	notes	c# 3		F	6	**102**	82	notes	f# 7
C	2	**50**	30	notes	d 3		F	7	**103**	83	notes	g 7
C	3	**51**	31	notes	d# 3		F	8	**104**	84	notes	g# 7
C	4	**52**	32	notes	e 3		F	9	**105**	85	9	a 7
C	5	**53**	33	notes	f 3		F	10	**107**	**Cancel T**	7	
C	6	**54**	34	notes	f# 3		F	11	**108**	**Treble 6**	6	
C	7	**55**	35	notes	g 3		F	12	**109**	**Fast Cres**	5	
C	8	**56**	36	notes	g# 3		F	13	**110**	**Treble 4**	4	
C	9	**57**	37	notes	a 3			**NC**	**111**	**On unit G**		
C	10	**58**	38	notes	a# 3		F	14	**112**	**Treble 2**	2	
C	11	**59**	39	notes	b 3		F	15	**113**	**Slow Cres**	1	
C	12	**60**	40	notes	c 4		F	16	**114**	**Sub Intensity**	0	
C	13	**61**	41	notes	c# 4							
C	14	**62**	42	notes	d 4		G	1	**111**	**SOFT**	3	
C	15	**63**	43	notes	d# 4							
C	16	**64**	44	notes	e 4							
D	1	**65**	45	notes	f 4							
D	2	**66**	46	notes	f# 4							
D	3	**67**	47	notes	g 4							

Duo-Art Tubing Chart

unit	valve	midi	key/function	tracker	note		unit	valve	midi	key/function	tracker	note
A	1	**18**	**Sustain**	4			D	1	**66**	46	notes	f# 4
A	2	**NC**		5			D	2	**67**	47	notes	g 4
A	3	**20**	**Bass Theme**	6			D	3	**68**	48	notes	g# 4
A	4	**21**	**ACCOMP 1**	7			D	4	**69**	49	notes	a 4
A	5	**22**	**ACCOMP 2**	8			D	5	**70**	50	notes	a# 4
A	6	**23**	**ACCOMP 4**	9			D	6	**71**	51	notes	b 1
A	7	**24**	**ACCOMP 8**	10			D	7	**72**	52	notes	c 5
A	8	**25**	5	notes	c# 1		D	8	**73**	53	notes	c# 5
A	9	**26**	6	notes	d 1		D	9	**74**	54	notes	d 5
A	10	**27**	7	notes	d# 1		D	10	**75**	55	notes	d# 5
A	11	**28**	8	notes	e 1		D	11	**76**	56	notes	e 5
A	12	**29**	9	notes	f 1		D	12	**77**	57	notes	f 5
A	13	**30**	10	notes	f# 1		D	13	**78**	58	notes	f# 5
A	14	**31**	11	notes	g 1		D	14	**79**	59	notes	g 5
A	15	**32**	12	notes	g# 1		D	15	**80**	60	notes	g# 5
A	16	**33**	13	notes	a 1		D	16	**81**	61	notes	a 5
B	1	**34**	14	notes	a# 1		E	1	**82**	62	notes	a# 5
B	2	**35**	15	notes	b 1		E	2	**83**	63	notes	b 5
B	3	**36**	16	notes	c 2		E	3	**84**	64	notes	c 6
B	4	**37**	17	notes	c# 2		E	4	**85**	65	notes	c# 6
B	5	**38**	18	notes	d 2		E	5	**86**	66	notes	d 6
B	6	**39**	19	notes	d# 2		E	6	**87**	67	notes	d# 6
B	7	**40**	20	notes	e 2		E	7	**88**	68	notes	e 6
B	8	**41**	21	notes	f 2		E	8	**89**	69	notes	f 6
B	9	**42**	22	notes	f# 2		E	9	**90**	70	notes	f# 6
B	10	**43**	23	notes	g 2		E	10	**91**	71	notes	g 6
B	11	**44**	24	notes	g# 2		E	11	**92**	72	notes	g# 6
B	12	**45**	25	notes	a 2		E	12	**93**	73	notes	a 6
B	13	**46**	26	notes	a# 2		E	13	**94**	74	notes	a# 6
B	14	**47**	27	notes	b 2		E	14	**95**	75	notes	b 6
B	15	**48**	28	notes	c 3		E	15	**96**	76	notes	c 7
B	16	**49**	29	notes	c# 3		E	16	**97**	77	notes	c# 7
C	1	**50**	30	notes	d 3		F	1	**98**	78	notes	d 7
C	2	**51**	31	notes	d# 3		F	2	**99**	79	notes	d# 7
C	3	**52**	32	notes	e 3		F	3	**100**	80	notes	e 7
C	4	**53**	33	notes	f 3		F	4	**101**	81	notes	f 7
C	5	**54**	34	notes	f# 3		F	5	**102**	82	notes	f# 7
C	6	**55**	35	notes	g 3		F	6	**103**	83	notes	g 7
C	7	**56**	36	notes	g# 3		F	7	**104**	84	notes	g# 7
C	8	**57**	37	notes	a 3		F	8	**105**	**THEME 8**	9	
C	9	**58**	38	notes	a# 3		F	9	**106**	**THEME 4**	8	
C	10	**59**	39	notes	b 3		F	10	**107**	**THEME 2**	7	
C	11	**60**	40	notes	c 4		F	11	**108**	**THEME 1**	6	
C	12	**61**	41	notes	c# 4		F	12	**109**	**Treble Theme**	5	
C	13	**62**	42	notes	d 4		F	13	**NC**		NC	
C	14	**63**	43	notes	d# 4		F	14	**NC**		NC	
C	15	**64**	44	notes	e 4		F	15	**NC**		NC	
C	16	**65**	45	notes	f 4		F	16	**113**	**SOFT**	1	

Welte Licensee Tube Chart

unit	valve	midi	key/function	tracker	note		unit	valve	midi	key/function	tracker	note
A	1	**16**	B 1 MF off	1			D	1	**64**	44	notes	e 4
A	2	**17**	B2 MF on	2			D	2	**65**	45	notes	f 4
A	3	**18**	B3 CR off	3			D	3	**66**	46	notes	f# 4
A	4	**19**	B4 CR on	4			D	4	**67**	47	notes	g 4
A	5	**20**	B5 FZ off	5			D	5	**68**	48	notes	g# 4
A	6	**21**	B6 FZ on	6			D	6	**69**	49	notes	a 4
A	7	**22**	B7 Soft off	7			D	7	**70**	50	notes	a# 4
A	8	**23**	B8 Soft on	8			D	8	**71**	51	notes	b 4
A	9	**24**	4	notes	c 1		D	9	**72**	52	notes	c 5
A	10	**25**	5	notes	c# 1		D	10	**73**	53	notes	c# 5
A	11	**26**	6	notes	d 1		D	11	**74**	54	notes	d 5
A	12	**27**	7	notes	d# 1		D	12	**75**	55	notes	d# 5
A	13	**28**	8	notes	e 1		D	13	**76**	56	notes	e 5
A	14	**29**	9	notes	f 1		D	14	**77**	57	notes	f 5
A	15	**30**	10	notes	f# 1		D	15	**78**	58	notes	f# 5
A	16	**31**	11	notes	g 1		D	16	**79**	59	notes	g 5
B	1	**32**	12	notes	g# 1		E	1	**80**	60	notes	g# 5
B	2	**33**	13	notes	a 1		E	2	**81**	61	notes	a 5
B	3	**34**	14	notes	a# 1		E	3	**82**	62	notes	a# 5
B	4	**35**	15	notes	b 1		E	4	**83**	63	notes	b 5
B	5	**36**	16	notes	c 2		E	5	**84**	64	notes	c 6
B	6	**37**	17	notes	c# 2		E	6	**85**	65	notes	c# 6
B	7	**38**	18	notes	d 2		E	7	**86**	66	notes	d 6
B	8	**39**	19	notes	d# 2		E	8	**87**	67	notes	d# 6
B	9	**40**	20	notes	e 2		E	9	**88**	68	notes	e 6
B	10	**41**	21	notes	f 2		E	10	**89**	69	notes	f 6
B	11	**42**	22	notes	f# 2		E	11	**90**	70	notes	f# 6
B	12	**43**	23	notes	g 2		E	12	**91**	71	notes	g 6
B	13	**44**	24	notes	g# 2		E	13	**92**	72	notes	g# 6
B	14	**45**	25	notes	a 2		E	14	**93**	73	notes	a 6
B	15	**46**	26	notes	a# 2		E	15	**94**	74	notes	a# 6
B	16	**47**	27	notes	b 2		E	16	**95**	75	notes	b 6
C	1	**48**	28	notes	c 3		F	1	**96**	76	notes	c 7
C	2	**49**	29	notes	c# 3		F	2	**97**	77	notes	c# 7
C	3	**50**	30	notes	d 3		F	3	**98**	78	notes	d 7
C	4	**51**	31	notes	d# 3		F	4	**99**	79	notes	d# 7
C	5	**52**	32	notes	e 3		F	5	**100**	80	notes	e 7
C	6	**53**	33	notes	f 3		F	6	**101**	81	notes	f 7
C	7	**54**	34	notes	f# 3		F	7	**102**	82	notes	f# 7
C	8	**55**	35	notes	g 3		F	8	**103**	83	notes	g 7
C	9	**56**	36	notes	g# 3		F	9	**106**	T8 SU on	8	
C	10	**57**	37	notes	a 3		F	10	**107**	T7 SU off	7	
C	11	**58**	38	notes	a# 3		F	11	**108**	T6 FZ on	6	
C	12	**59**	39	notes	b 3		F	12	**109**	T5 FZ off	5	
C	13	**60**	40	notes	c 4		F	13	**110**	T4 CR on	4	
C	14	**61**	41	notes	c# 4		F	14	**111**	T3 CR off	3	
C	15	**62**	42	notes	d 4		F	15	**112**	T2 MF on	2	
C	16	**63**	43	notes	d# 4		F	16	**113**	T1 MF off	1	