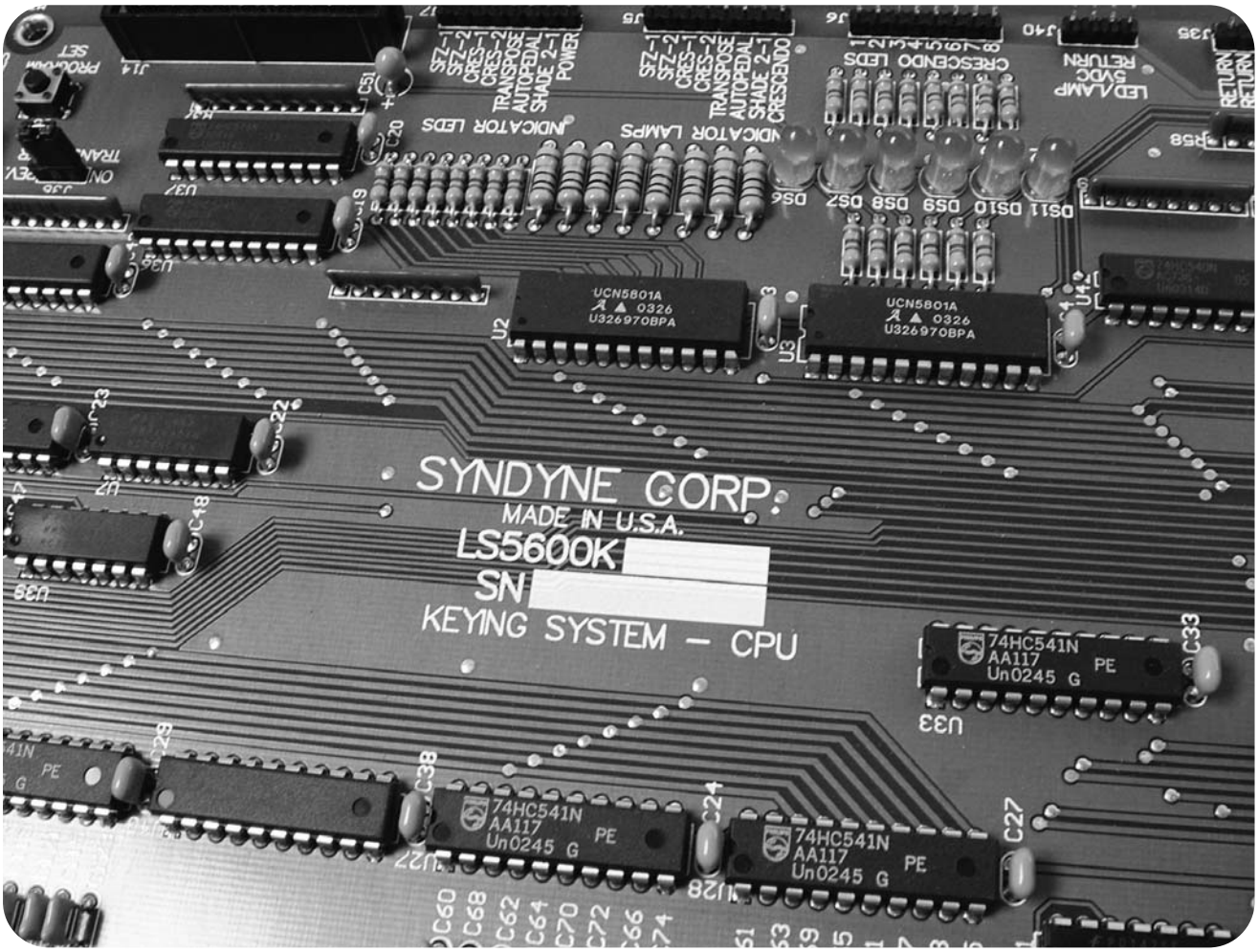
LS2400K KEYING SYSTEM MANUAL



THIS MANUAL COVERS THE INSTALLATION AND PROGRAMMING OF A FULLY FEATURED SYNDYNE LS2400K KEYING SYSTEM.

Control System Installed By _____ Date Installed _____
Installer Telephone _____ Email _____ Fax _____

Control System Maintained By _____
Maintenance Telephone _____ Email _____ Fax _____

Rev.(07-01-05)

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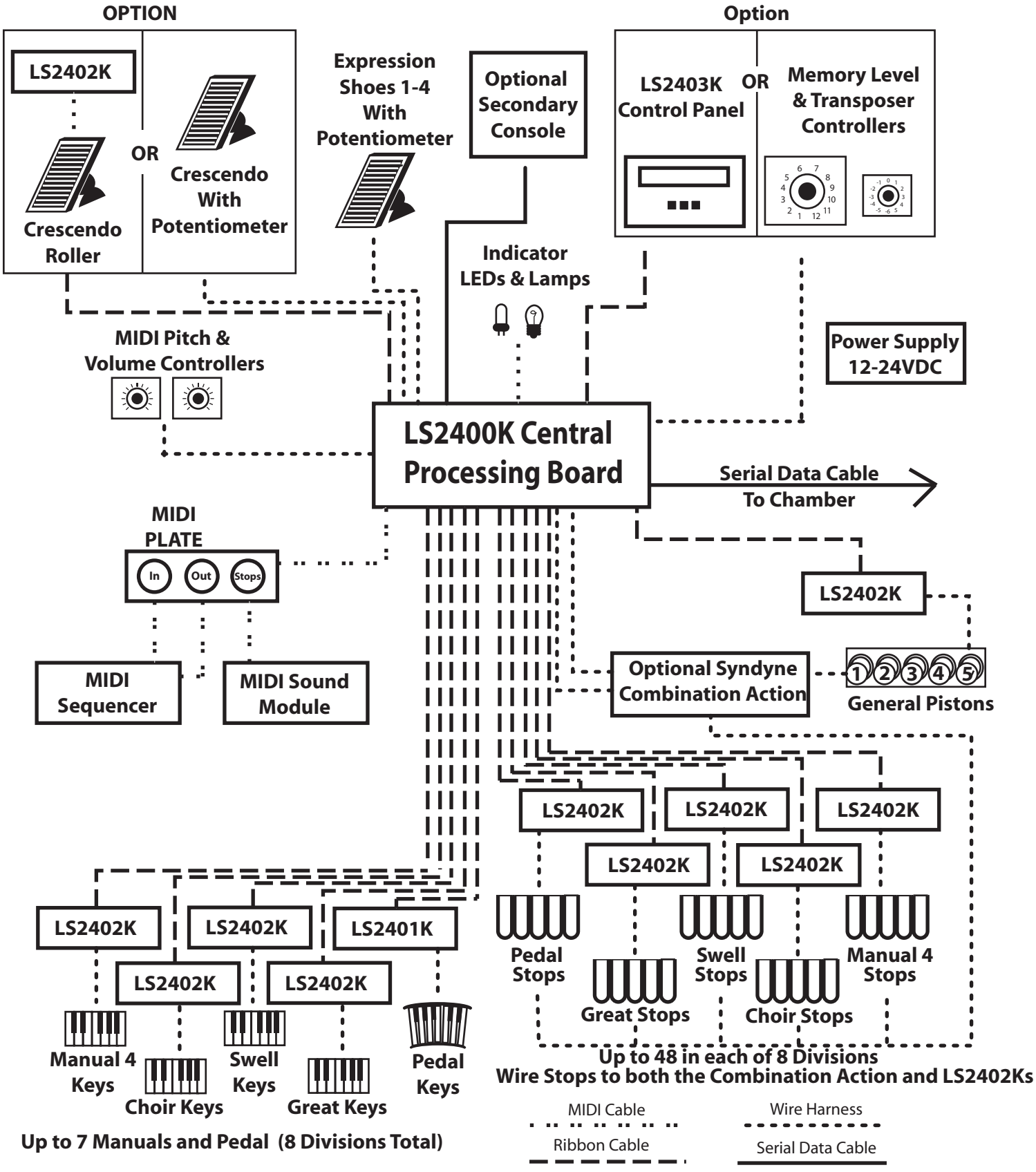
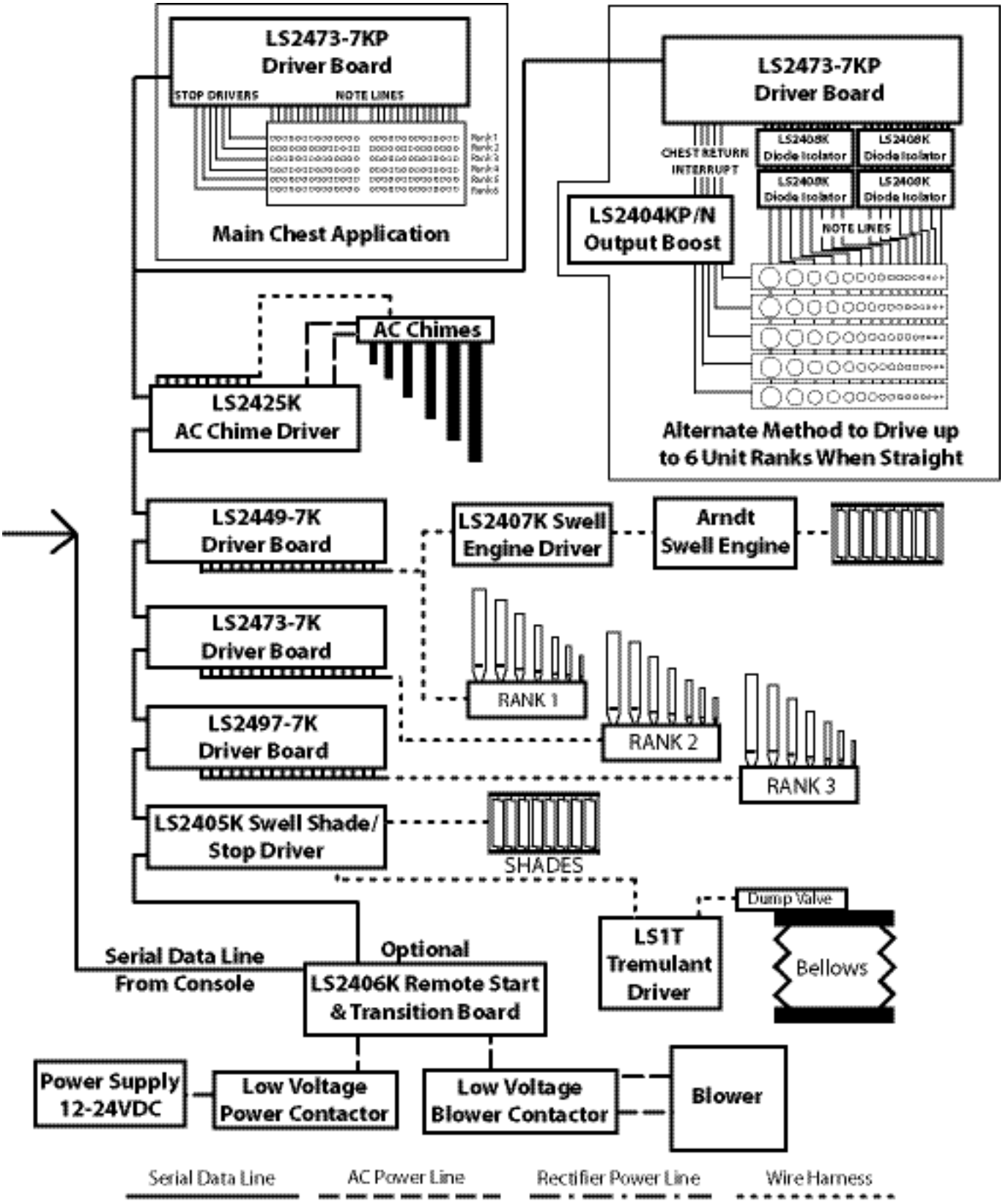
SYSTEM OVERVIEW

CONSOLE BLOCK DIAGRAM:



Not all equipment depicted is available from Syndyne

CHAMBER BLOCK DIAGRAM:



Not all equipment depicted is available from Syndyne

WARRANTY

The Seller, Syndyne Corporation, does hereby warrant that Syndyne Organ Products manufactured by it are free of defects in materials or workmanship. This warranty shall extend to the original purchaser only and cover Products as follows:

5 Year Warranty

Written notice of all claimed defect(s) must be given within thirty (30) days after such defect is first discovered. The seller's obligation under this warranty is limited to, at its option, repairing or replacing the Syndyne Products or any defective component part that is proved to be other than as herein warranted. Transportation charges covering defective material under warranty shall be at the buyer's expense.

This warranty shall not extend to any Syndyne Product or component part which has been subject to misuse, improper installation, maintenance or application, nor does it extend to any part which has been repaired or altered outside the seller's plant, unless authorized in writing by the seller.

This warranty is expressly in lieu of any other expressed or implied warranties, including any implied warranty of merchantability or fitness for a particular purpose, and of any other obligation on the part of the seller. In no event will the seller be liable for incidental or consequential damages.

UNPACKING AND HANDLING:

STATIC WARNING:

The Syndyne LS2400K System contains electrical components that are susceptible to damage by static discharge. To avoid damage, use antistatic handling materials and make sure you are well grounded at all times. It is recommended that all electrical components be kept in their original packaging until installed.

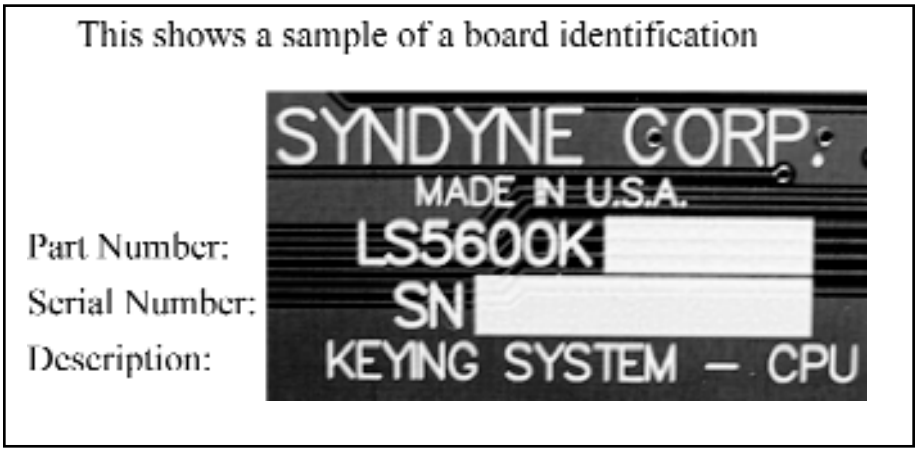
BENDING OR ROUGH HANDLING:

Use care when handling the products. Dropping or other rough handling can result in the products becoming damaged. Electrical components may also break if excessive bending occurs.

BOARD IDENTIFICATION:

For Identification Purposes each component is labeled with a part number, a serial number, and a name/description.

This shows a sample of a board identification



LS2400K System Components:

LS2400K Keying System Controller Board

Features:

- 5 year warranty
- Firmware is not custom and is easily upgradeable for future enhancements
- No battery back-ups
- Configurable by organ technician
- MIDI-IN / MIDI-OUT ports for record and play back
- MIDI STOPS port for sound modules
- 16 programmable MIDI STOPS, one per MIDI Channel
- MIDI Pitch
- MIDI Volume
- MIDI Expression (with addition of LS2403K control panel)
- MIDI Sustain
- Settable MIDI On Velocity (with an LS2403K control panel)
- GM2 Bank Select compliant (with an LS2403K control panel)
- Program Changes settable on General Pistons (with addition of LS2403K control panel)
- Multiple consoles
- 2 programmable Crescendos each with 60 stage
- 2 programmable Sforzandos
- 384 Stop Inputs, 48 Stops per division
- 4 expression shoe inputs
- Programmable couplers
- Non-coupling stops available
- Autopedal
- 12 step transposer (with LS2412TC rotary switch or LS2403 control panel)
- Lamp/LED outputs for reversible pistons
- 8 stage LED output for Crescendo display
- 8 stage LED outputs for Expression displays
- Transposer settable on General Pistons
- Negative/Positive Keys, Pistons & Stops (installer config ured with jumpers)
- Built-in Fuse protection
- 12-24VDC operation

Design Intent:

The LS2400K is a feature rich central processor board for the console and is suitable for moderate to large organs. All organ controls pass through the LS2400K before being sent into the organ via a 4-wire data cable. The LS2400K will work with most other combination actions and ideally with Syndyne's LS2464 Modular Combination Action.

Mechanical:

Length 21-1/2"
Width 7-3/4"
Height 1-3/4"

Mounting:

PCB standoffs are provided for screw mounting using a #6 screw.

Electrical:

A standard regulated DC power supply between 12-24 volts is required. Use a supply with adequate current capacity.

Current draw:

- Without Control Panel, Lamps or LEDs: approximately 0.150Amps
- With Control Panel: add an additional 0.100Amps
- Remote Start circuit is fused at 0.500Amps
- Each Lamp Output can sink 0.120Amps
- Each LED output can sink 0.020Amps

Connections:

Connectors, Jacks and Terminal Blocks are provided for all connections.

Key Inputs:

Each key contact is directly connected to a pin on an input board (LS2401K/Pedal and one LS2402K/Manual) which are in turn connected to the LS2400K via ribbon cables. Key feeds are not multiplexed and can be either negative or positive polarity. Once the key contacts are wired the key feed polarity is simply selected at each input board by moving a jumper to the appropriate polarity. See page 2-4 in the Console Wiring Section for wiring instructions.

Stop Sense Inputs:

There are 384 stop inputs (8 divisions with 48 stops per division). Once the stops are wired the Stop Sense polarity is simply selected by moving the STOP FEED jumper to the appropriate polarity. Any of these stops can be programmed as a coupler and/or MIDI Stop. See page 2-6 in the Console Wiring Section for wiring instructions. See page 5-3 in the Chamber Programming Section for Programming Instructions

Tremulants & Accessory Stops:

Six additional stop inputs are available to turn on 4 Tremulants and 2 Accessories. They operate on a negative stop feed only. Their corresponding outputs are available on all LS2405K shade driver boards. See page 2-6 in the Console Wiring Section for wiring instructions. See page 5-7 in the Chamber Programming Section for programming instructions.

Couplers:

No special wiring or boards are required to produce any coupler. Any stop input can be programmed, by an organ builder, to become a coupler. Couplers can be simply added, removed or changed by programming through the LS2403K control panel or from DIP switches located on the LS2400K Circuit board. Syndyne's ever growing coupler list currently comprises 135 different couplers. See page 3-4 in the Console Programming Section or LS2403K manual for programming instructions.

Crescendos:

There are two 60 step crescendos operated from a single shoe. Crescendo-1 and Crescendo-2 can be selected using a reversible piston. Each crescendo is programmable from either the Control Panel (LS2403K) or programming switches on the LS2400K. A shoe equipped with a 5K or 10K ohm potentiometer can be directly connected to the LS2400K or roller contacts can be wired to an LS2402K input board and then connected to the LS2400K via a ribbon cable. There are lamp and LED outputs available for a lit reversible piston and there are 8 LED drivers available for an 8-stage LED bar graph. See page 2-8 to 2-9 in the Console Wiring Section for wiring instructions. See page 3-7 in the Console Programming Section for programming instructions.

Expression:

Four shoes equipped with 5K or 10K ohm potentiometers, or with resistors soldered across roller shoe contacts, can be directly connected to the LS2400K. LS2405K driver boards located in the chamber can drive up to 16 stages of expression. Consult Syndyne for applications in which more than 16 stages of expression are desired. A lit reversible piston (lamp or LED) is available for an "All Swells to Swell." The "All Swells to Swell" couples the last 3 expression shoes to the first shoe. See page 2-8 in the Console Wiring Section for wiring instructions.

Transposer:

A 12 step transposer (-6/+5) can be controlled from either the Control Panel (LS2403K) or rotary switch (LS2412TC). The transposer pitch can be preset and then the transposer activated by a reversible piston, or it can be active all the time. A jumper on the LS2400K is provided to select between these two modes. There are lamp and LED outputs available for a lit reversible piston. It is also possible to set the transposer onto General Pistons. To enable this feature set the DIP switch labeled TRANSP ON GENS to ON. See page 2-10 in the Console Wiring Section for wiring instructions.

Sforzandos:

Two settable Sforzandos are controlled individually by reversible pistons. There is a configuration DIP switch that, when turned on, will cause the two Sforzandos to step (cancels previous Sforzando). There are lamp and LED outputs available for lit reversible pistons. See page 2-7 in the Console Wiring Section for wiring instructions. See page 3-8 in the Console Programming Section for programming instructions.

Ventils:

Two settable Ventils are controlled individually by reversible pistons. The Ventils allow the captured stops to play only when the Ventil is on. Using the LS2403K there is a utility to have the Ventils cancel the captured stops when the Ventil is on. There are lamp and LED outputs available for lit reversible pistons. See page 2-7 in the Console Wiring Section for wiring instructions. See page 3-8 in the Console Programming Section for programming instructions.

Utility Reversibles:

Two additional reversible piston inputs are available to control utility equipment. They operate on a negative feed only. Their corresponding outputs are available on all LS2405K shade driver boards. See page 2-7 in the Console Wiring Section for wiring instructions.

Autopedal:

The Autopedal (Pedal to Great melody coupler) can be activated by a reversible piston or programmed as a coupler. There are lamp and LED drivers available for a lit reversible piston. A DIP switch on the LS2400K "AUTOPEDAL-LOW" configures the Autopedal to play only in the lowest octave of the Pedal. The melody note will sustain until a new key is pressed or all keys are released and notes that drop below low C, as when transposing, will wrap up one octave. See page 3-3 in the Console Programming Section for programming instructions.

Recording & Playback:

There are two MIDI jacks, MIDI-IN and MIDI-OUT, available for the purpose of recording and playback by connecting a MIDI filer or sequencer to the organ. Note that the organ is fully playable during playback. All organ functions are automatically transmitted as they occur on the following MIDI Channels.

- Pedal Keys and Stops on MIDI Channel-2
- Great Keys, Stops and Expression-2 (7MSBs) on MIDI Channel-3
- Swell Keys, Stops and Expression-1 (7MSBs) on MIDI Channel-4
- Division 4 Keys, Stops and Expression-3 (7MSBs) on MIDI Channel-5
- Division 5 Keys, Stops and Expression-4 (7MSBs) on MIDI Channel-6
- Division 6, Stops (7MSBs) on MIDI Channel-7
- Division 7, Stops (7MSBs) on MIDI Channel-8
- Division 8, Stops (7MSBs) on MIDI Channel-8
- Tremolos Accessory Stops and Utility Reversibles on MIDI Channel-9
- Expression least significant bits (LSBs) on MIDI Channel-7

MIDI Sound Modules:

The MIDI STOPS jack is available to connect MIDI Sound modules. As many as 16 MIDI Stops, one per MIDI Channel, can be programmed from any of the stop inputs. MIDI Stops can be simply added, removed or changed by programming through the LS2403K control panel or from DIP switches located on the LS2400K Circuit board. See page 3-6 in the Console Programming Section or LS2403K manual for programming instructions. A shoe or knob equipped with a 5 or 10K ohm potentiometer can be directly connected to the LS2400K to control MIDI volume and pitch. DIP switches on the LS2400K MIDI-VOLUME ON, MIDI-PITCH ON, MIDI-PATCH ON are provided to enable/disable these features. Momentary MIDI Sustain and MIDI Panic inputs are available and operate on a negative feed polarity. When an LS2403K control panel is added to the LS2400K a number of additional MIDI features become available.

- Octave Transpose
- On Velocity per MIDI Stop
- Expression Shoes can be individually assigned to each MIDI Stop and have a settable minimum expression level.
- General MIDI-2 Bank Select Sound options
- Program Changes are settable on General Pistons
- A special Utility that will convert MIDI Expression to MIDI Channel Volume; for those sound modules that only respond to MIDI Channel Volume.

Serial-In & Serial-Out:

The main console is connected to the organ, or a second console, via the Serial-In and Serial-Out connections. The data cable is a 4-wire twisted pair category-5 cable and can extend to lengths of hundreds of feet. Three Serial-Out ports are provided for additional data cables. Data from the console is continuously refreshed 140 times/Second. Each stream of data is tested for integrity and if data is interrupted for more than 0.050 seconds all chamber outputs will turn off to prevent ciphering. See page 2-3 in the Console Wiring Section for wiring instructions. See figure 2.2 "Data Cable Connections," on page 2-3 in the Console Wiring Section for a connection diagram.

Remote Start:

A 0.5Amp fused circuit is provided through the Serial-Out port to turn on the LS2406K Remote Start/Transition Board. The Remote Start board is ideal for installations where there is a need to turn on a second power supply in the chamber and/or a blower from the console, see page 4-6 in the Chamber Wiring Section for wiring instructions.

LS24/49/73/97-7K Pipe Driver Boards

Features:

- 5 year warranty
- Firmware is not custom and is easily upgradeable for future enhancements
- No battery back-ups
- Installer configurable
- Serial data cable daisy chains between driver boards
- Three board sizes: 49 note, 73 note and 97 note
- Standard outputs can drive a 20 ohm magnet from a 15VDC power supply
- Negative or Positive Output Drivers available as standard on each board
- 7 programmable Stop, Trap Line or Expression outputs on each board
- 35 different programmable pitches per stop
- 12 different programmable mixtures per stop
- Resultants
- Thunder
- Can drive Multiple 12/24 Note Offset Chests
- Dichromatic Scale Outputs
- Power Indicator
- Serial Data Indicator
- Built-in Fuse protection for circuitry
- 12-24VDC operation
- Multiple outputs can drive the same magnet
- Each Output has fly-back protection

Design Intent:

The LS24/49/73/97-7K driver boards are designed to drive pipe valve magnets and are typically mounted in the organ chamber. For magnets requiring more current than the standard output is capable of delivering an LS2404K Boost Board is available See page 1-10 in the System Overview Section for more information on the LS2404K. All console controls information is sent from the LS2400K into the organ via a 4-wire data cable. The data cable is daisy chained from driver board to driver board. Driver boards are programmed with DIP switches to play any stop from any division at any of the available pitches. Programs can be easily changed added and removed using this method, see page 5-3 to 5-6 in the Chamber Overview Section for programming instructions. Only one driver board is needed for each set of primary magnets. However, if wiring two boards to the same magnets is necessary for added flexibility, the boards will not interact or damage each other.

Mechanical:

LS2449-7K

Length 15-1/4"
Width 3-1/2"
Height 1-1/4"

LS2473-7K

Length 19-3/8"
Width 3-1/2"
Height 1-1/4"

LS2497-7K

Length 23-3/8"
Width 3-1/2"
Height 1-1/4"

Mounting:

1/4” high PCB standoffs are provided for screw mounting using a #6 screw.

Electrical:

- A standard regulated DC power supply between 12-24 volts is required.
- Current draw with all outputs off is approximately 0.100Amps.
- Each output is capable of switching 0.600Amps at a maxi mum voltage of 28VDC.
- optional "H" outputs are capable of switching 2Amps at a maximum voltage of 28VDC.

Connections:

Connectors, Jacks or Terminal Blocks are provided for all connections.

Note Outputs:

Each Note output has a built in fly-back diode to suppress reverse voltage spikes that are generated when a magnet is de-energized. See page 4-4 in the Chamber Wiring Section for wiring instructions. See page 5-4 in the Chamber Programming Section for programming instructions.

Stop Line Outputs:

Each Stop output has a built in fly-back diode to suppress reverse voltage spikes that are generated when a magnet is de-energized. See page 4-4 in the Chamber Wiring Section for wiring instructions. See page 5-3 in the Chamber Programming Section for programming instructions.

Serial Data Cable Connections:

The data cable is a 4-wire twisted pair category-5 cable and can extend to lengths of hundreds of feet. Data from the console is continuously refreshed 140 times/Second. Each stream of data is tested for integrity and if data is interrupted or looses integrity for more than 0.05 seconds all chamber outputs will turn off to prevent ciphers. See page 4-3 in the Chamber Wiring Section for wiring instructions. All Serial Data Cables greater than 2’ in length should be made from a shielded category-5 cable. See figure 4.1 “Data Cable Connections,” on page 4-3 in the Chamber Wiring Section for a connection diagram. No special device connection is required at the end of the data cable.

LS2401K Pedal Input Board

Features:

- 5 year warranty
- Input Test Indicator
- Negative/Positive Inputs (installer configured with jumper)
- Removable from Pedal key board

Design Intent:

The LS2401K input board is typically mounted in the organ console and is designed to multiplex the pedal keys into the LS2400K. A 20-pin ribbon cable 5' in length connects between the LS2401K and the LS2400K. The pedal key feed can be routed through the large D connector to make it easy to disconnect and reconnect the pedal key board.

Mechanical:

Length 5"
Width 4"
Height 3/4"

Mounting:

1/4" hing PCB standoffs are provided for screw mounting using a #6 screws.

Electrical:

- Power for this board is supplied through its ribbon cable from the LS2400K mounted in the console.
- Input signal polarity is configured by positioning an on-board shunt (jumper) for the appropriate signal feed.

Connections:

- Connectors are provided for all connections. See page 2-5 in the Console Wiring Section for wiring instructions.
- A Pedal Key Feed terminal block is provided for routing the key feed through the large D connector.

LS2402K Keying/Stop Input Board

Features:

- 5 year warranty
- Input Test Indicator
- Negative/Positive Inputs (installer configured with jumper)
- Stackable by using spacers between boards

Design Intent:

The LS2402K input board is typically mounted in the organ console and is designed to multiplex manual keys, stop senses, General Piston and/or Crescendo Roller contacts into the LS2400K. A 20-pin ribbon cable 4' in length connects between the LS2402K and the LS2400K.

Mechanical:

Length 10-3/8"
Width 3-1/2"
Height 3/4"

Mounting:

1/4" high PCB standoffs are provided for screw mounting using #6 screws.

Electrical:

- Power for this board is supplied through its ribbon cable from the LS2400K mounted in the console.
- Input signal polarity is configured by positioning an on-board shunt (jumper) for the appropriate signal feed.

Connections:

- Connectors are provided for all connections. See page 2-4 in the Console Wiring Section for wiring instructions.

LS2403K System Control Panel

The LS2403K System Control Panel has an extensive list of features, Refer to the separate LS2403K Manual for a full explanation.

LS2404K Output Boost Board

Features:

- 5 year warranty
- Each output is fused and will switch 4 amps
- 12-24VDC operation
- Outputs can be in parallel for greater output current
- Available for Negative or Positive Inputs/Outputs
- Each Output has fly-back protection

Design Intent:

The LS2404K Output Boost board is designed for situations in which there is a need for a higher current drive than standard driver outputs can provide. Each fused output has an indicator LED that turns on when the output is active.

The following configurations are available:

- Positive-In - Positive-Out
- Positive-In - Negative-Out
- Negative-In - Negative-Out
- Negative-In - Positive-Out

Mechanical:

Length 10-1/4"
Width 5-1/2"
Height 1-1/4"

Mounting:

- 1/4" high PCB standoffs are provided for screw mounting using a #6 screw.

Electrical:

- A standard regulated DC power supply between 12-24 volts is required to power the board.
- Each fused output is capable of switching 4Amps and can be paralleled for even greater output.

Connections:

- Connectors or terminal blocks are provided for all connec tions. See page 4-4 in the Chamber Wiring Section for wiring instructions.

LS2405K Expression/Stop Driver Board

Features:

- 5 year warranty
- Firmware is not custom and is on-sight upgradeable for future enhancements
- No battery back-ups
- Installer configurable
- Serial data cable daisy chains between driver boards
- Built-in Fuse protection for DC circuitry
- 24 Stops or 16 stage expression plus 4-Tremolo, 2-Accessory and 2-Utility Outputs
- Power Indicator
- Serial Data Indicator
- 12-24VDC operation
- Multiple outputs can drive the same magnet
- Each Output has fly-back protection

Design Intent:

The LS2405K driver board is typically mounted in the organ chamber and is designed to drive up to 16 stages of expression plus provide 8 miscellaneous output circuits or 24 Stops from any one division. The expression action can be inverted with a DIP switch if it operates backward. All console control information is sent from the LS2400K into the organ via a 4-wire data cable. The data cable is daisy chained from driver board to driver board. The LS2405K is configured, and easily reconfigured, with DIP switches, See page 5-7 in the Chamber Programming Section for programming instructions.

Mechanical:

Length 7"
Width 3-7/8"
Height 1-1/4"

Mounting:

1/4" high PCB standoffs are provided for screw mounting using a #6 screws.

Electrical:

- A standard regulated DC power supply between 12-24 volts is required to power the board.
- Current draw with all outputs off is approximately 0.100Amps.
- Each output is capable of switching 0.240Amps at a maxi mum voltage of 28VDC.

Connections:

Connectors, Jacks or Terminal Blocks are provided for all connections. See page 4-6 in the Chamber Wiring Section for wiring instructions.

Outputs:

Each output has a fly-back diode to suppress reverse voltage spikes that are generated when an energized magnet is released. See page 4-6 in the Chamber Wiring Section for wiring instructions.

Serial Data Cable Connections:

The data cable is a 4-wire, twisted pair, category-5 cable and can extend to lengths of hundreds of feet. Data from the console is continuously refreshed 140 times/Second. Each stream of data is tested for integrity and if data is interrupted or looses integrity for more than 0.05 seconds all chamber outputs will turn off to prevent ciphering. See figure 4.1 "Data Cable Connections," in the Chamber Wiring Section for a connection diagram.

LS2406K Remoter Start/Transition Board

Features:

- 5 year warranty
- Serial data cable daisy chains to each driver board
- Serial Data Indicator
- 12VDC operation
- Two 20Amp N.O. or two 10Amp N.C. contacts at up to 240VAC
- 3 second delay turn on between relays
- Easy transition from serial data cable to flat leaded data cables

Design Intent:

The LS2406K remote start board is typically mounted in the organ chamber and is designed to turn on a power contactor for a DC power supply and blower motor. When the LS2400K is energized in the console it will, through a fused circuit, activate the LS2406K. All organ controls are sent from the LS2400K into the organ via a 4-wire data cable. The data cable is daisy chained from any driver board to remaining driver board.

Mechanical:

Length 5-1/2"
Width 3"
Height 2"

Mounting:

1/4" PCB standoffs are provided for screw mounting using #6 screws.

Electrical:

- Power for this board is supplied through the data cable from the LS2400K mounted in the console.
- Current draw at 15VDC is approximately 0.200Amps.
- Each relay is capable of switching resistive loads up to 20Amps for the N.O. contact and up to 10Amps for the N.C. contact at up to 240VAC.

Connections:

- Connectors, Jacks or Terminal Blocks are provided for all connections.
- Each relay has a normally open (N.O.) and a normally closed (N.C.) contact with a single common. The relay contact connections are on top of each relay in the form of three 1/4" spade style terminals. See page 4-6 in the Chamber Wiring Section for wiring instructions.

LS2407K Expression Digital to Analog Converter

Features:

- 5 year warranty
- 8-bit digital to analog conversion
- Up to 256 steps of resolution
- Adapts to the Arndt Swell Engine
- 12-24VDC operation

Design Intent:

The LS2407K was designed specifically to convert 7-bits of expression data from a Syndyne driver board into an analog voltage suitable for the Arndt Organ Supply swell engine. However the LS2407K is flexible enough to potentially operate other analog input devices (consult with Syndyne Engineering for unique applications).

Mechanical:

Length 4-1/2"
Width 2-1/2"
Height 1-1/4"

Mounting:

1/4" long PCB standoffs are provided for screw mounting using a #6 screw.

Electrical:

- A standard regulated DC power supply between 12-24 volts is required to power the board.
- Current draw with all outputs off is approximately 0.050Amps.

Connections:

Connectors or Terminal Blocks are provided for all connections. See page 4-6 in the Chamber Wiring Section for wiring instructions.

LS2408K Diode Isolator Board

Features:

- 5 year warranty
- Plugs directly onto driver boards
- Each board Diode Isolates 3 ranks of 32 notes
- Expandable up to 6 ranks of 64 notes
- Available for Negative or Positive outputs

Design Intent:

The LS2408K Diode Isolator board is typically mounted in the organ chamber with the LS2473-7KH (high current driver) and the LS2404K Output Boost board as a means of driving up to 6 straight ranks from a single driver board. The Diode Isolator board will plug directly on to the outputs of the driver board and will also plug end to end into each other, making them expandable out to 6 ranks.

Mechanical:

Length 5-1/2"
Width 4"
Height 1"

Mounting:

- 1/4" high PCB standoffs are provided for screw mounting using a #6 screw.
- Plugs directly onto a pipe driver board.

Electrical:

- Each diode is capable of conducting 1Amp

Connections:

- Connectors are provided for all connections. See page 4-4 in the Chamber Wiring Section for wiring instructions.

LS2410K Serial Repeater

Features:

- Expand Serial Data cable range or add a third plug-in for movable consoles
- Two Serial Data Output drivers
- Three Serial Data Inputs
- Powered by 2.1mm 9-24VDC 200mA wall pack power or sourced from the LS2400K Remote Start circuit
- 5 year warranty

Design Intent:

The LS2410K Serial-Repeater is designed to provide a convenient way of creating three Serial Data plug-in locations for a movable console. Should the need arise it could also be used to extend a data cables length. Two Serial Output Connectors are available for convenient signal distribution to two different chambers. For a diagram of the LS2410K see figure 4.4 “LS2410K Serial Repeater” on page 4-3 in the Chamber Programming

Mechanical:

Length 4-1/2"
Width 3-1/2"
Height 1"

Mounting:

1/4” high PCB standoffs are provided for screw mounting using #6 screws.

Electrical:

Power can be sourced through the serial data cable from the Remote Start circuit of the LS2400K board. A 2.1mm power jack is also available for a wall jack power supply (200mA 9-12VDC).

Connections:

DB-9 connectors are provided for all Serial Data cable connections.

LS2412TC Rotary 12 Note Transposer Control

Features:

- 5 year warranty
- 6 steps down 5 steps up
- Brass plate with black lettering

Design Intent:

The LS2412TC 12 step transposer is designed to mount through most name boards and is supplied with a cable that plugs directly into the LS2400K (keying system CPU board).

Mechanical:

Printed Circuit Board
Height 2-3/4"
Width 2-1/2"
Depth 1/2" (behind a ¾" name board)

Mounting Plate

Height 2"
Width 1-3/4"
Depth Knob extends approximately ¾" beyond mounting plate.

Mounting:

There are four mounting holes in both the PCB and mounting plate for attachment with screws.

Electrical:

Power for this board is supplied through its cable from the LS2400K.

Connections:

- Connectors are provided for all connections. See page 2-10 in the Console Wiring Section for wiring instructions.

LS1T Tremulant Driver Board

Features:

- 5 year warranty
- Fused 4Amp output
- 12VDC operation
- Negative or Positive Stop control
- Adjustable Rate from 0.4 - 40 cycles/Second
- Adjustable Depth from 1 - to 99%

Design Intent:

The LS1T Tremulant Driver board is designed to drive a pneumatic dump valve with adjustable rate and depth controls.

Mechanical:

Length 3"
Width 3-1/2"
Height 2"

Mounting:

1/4” long PCB standoffs are provided for screw mounting using a #6 screw.

Electrical:

- A standard regulated DC power supply between 12-16 volts is required to power the board.
- The output is capable of switching 4Amps.

Connections:

A connector is provided for all connections, including magnet feed and return. See page 2-6 in the Console Wiring Section for wiring instructions.

LS2425-7K AC Chime Driver Board

Features:

- 5 year warranty
- Firmware is not custom and is upgradeable for future enhancements
- No battery back-ups
- Installer configurable
- Serial data cable daisy chains to each driver board
- Built-in Fuse protection for DC circuitry
- 25 fused AC note outputs will switch 1-5 amps each
- 7 programmable Stop, Trap Line or Expression outputs - DC
- Power Indicator
- Serial Data Indicator
- Up to 36VAC operation of outputs
- 12-24VDC operation

Design Intent:

The LS2425-7K driver board is designed to drive AC chime magnets and is typically mounted in the organ chamber. All organ controls are sent from the LS2400K into the organ via a 4-wire data cable. The data cable is daisy chained from driver board to driver board. The LS2425-7K driver boards can be programmed with DIP switches to play chimes from any division. See page 4-6 in the Chamber Wiring Section for wiring instructions.

Mechanical:

Length 14-1/4"
Width 4-1/4"
Height 1-1/4"

Mounting:

1/4" high PCB standoffs are provided for screw mounting using #6 screws.

Electrical:

- A standard regulated DC power supply between 12-24 volts is required to power the board.
- Current draw with all outputs off is approximately 0.100Amps.
- The fused AC outputs are capable of switching 1.5 Amps at up to 36VAC.
- Each DC Stop output is capable of switching 0.600Amps at a maximum voltage of 28VDC.

Connections:

Connectors, Jacks or Terminal Blocks are provided for all connections.

Chime Outputs:

Chime outputs are fused in 6 groups of 4 and 1 group of 5. There is a separate terminal block for the AC common connection. See page 4-6 in the Chamber Wiring Section for wiring instructions. See page 5-4 in the Chamber Programming Section for programming instructions.

Stop Outputs:

Each Stop output has a fly-back diode to suppress reverse voltage spikes that are generated when an energized magnet is released. See page 4-6 in the Chamber Wiring Section for wiring instructions. See page 5-3 in the Chamber Programming Section for programming instructions.

Serial Data Cable Connections:

The data cable is a 4-wire twisted pair category-5 cable and can extend to lengths of hundreds of feet. Data from the console is continuously refreshed 140 times/Second. Each stream of data is tested for integrity and if data is interrupted or looses integrity for more than 0.05 seconds all chamber outputs will turn off to prevent ciphering. See figure 4.1 "Data Cable Connections," in the Chamber Wiring Section for a connection diagram.

LS24ECD Electronic Crescendo Display

Features:

- 5 year warranty
- 8 segment red LED bar graph display
- Adjustable Display height
- Brushed brass plate with black lettering

Design Intent:

The LS24ECD is designed to mount through most name boards and is supplied with a cable that will plug directly into the LS2400K (keying system CPU board).

Mechanical:

Hole Cut-Out

Height 2"
Width 1-3/8"

Printed Circuit Board

Height 2-1/2"
Width 1-1/2"
Display Height 9/16" - 7/8" (adjustable for different name board thicknesses)

Mounting Plate

Height 2"
Width 1-3/4"

Mounting:

There are four mounting holes in both the PCB and mounting plate for attachment with screws.

Electrical:

Power for this board is supplied through its cable from the LS2400K.

Connections:

A 6' cable with connectors are provided for all connections.

LS24MP 3-Jack MIDI Plate

Features:

- 5 year warranty
- MIDI-IN, MIDI-OUT & MIDI-STOPS jacks on a single mounting plate
- Brushed brass plate with black lettering

Design Intent:

The LS24MP is designed to mount through most consoles and includes three cables that will plug directly into the LS2400K (keying system CPU board) MIDI Jacks.

Mechanical:

Hole Cut-Out

3 - 1" diameter holes on 1-1/4" centers"

Mounting Plate

Height 2"
Width 4-3/8"
Depth 1"

Mounting:

There are six mounting holes in the mounting plate for attachment with small brass screws.

Connections:

Three 6' MIDI cables are provided for all connections.

LS24POT Shoe Mountable Slide Potentiometer

Features:

- 2 1/4" of travel
- Adjustable shoe bracket
- Adjustable linkage rod from 12"-21"
- Plugs right into Expression or Crescendo inputs on the LS2400K CPU board
- 5 year warranty

Design Intent:

The LS24POT is intended to provide a simple yet reliable means of adding a potentiometer to an existing roller type shoe. For a diagram and wiring instructions see page 2-8 in the Console Wiring Section

Mechanical:

Shoe Bracket

Height 1”
Width 1”
Length 2”
Linkage rod position is adjustable by ± 1/2"

Potentiometer Bracket

Height 1"
Width 1 1/2"
Length 4 3/4"

Linkage Rod

Length is adjustable from 12-21"

Potentiometer

Travel 2 1/4"
Resistance 5000 Ohms

Mounting:

There are four mounting holes in both the shoe bracket and the potentiometer bracket for attachment with #6 screws. The shoe bracket mounts to the underside of the shoe and the potentiometer bracket mounts to the floor of the console.

Electrical:

Power for this board is supplied through the cable and from the LS2400K.

Connections:

An 8' cable with connector are provided.

Ribbon Cable

Features:

- 5 year warranty
- Convenient means of connecting between circuit boards

Design Intent:

The ribbon cable is intended to provide a quick convenient means of making a large number of connections between circuit boards.

Mechanical:

Cable Dimensions

Length 4', 5' or custom
Width 1"
28 AWG - Flat Ribbon

Connections

A polarized 20 pin Insulation Displacement Connector is placed at both ends of the ribbon cable.

Mounting

The cable can be bundled and tied back as desired.

Flat Lead Cable

Features:

- 5 year warranty
- Convenient means of connecting the Serial Data Cable between circuit boards

Design Intent:

The flat lead is intended to provide a quick convenient means of daisy chaining the Serial Data Cable from one driver board to the next. Standard telephone cords should not be used in place of syndyne flat leads as they may cause data polarity problems.

Mechanical:

Cable Dimensions:

Length 1' or custom (maximum length is 2')
Width 1/4"
26 AWG, 6-wire, Flat cable

Connections:

An RJ11 (phone jack) connector is placed at both ends of the cable.

Mounting:

The cable can be bundled and tied back as desired.

Data Cable

Features:

- 5 year warranty
- Convenient means of connecting the Serial Data Cable between circuit boards

Design Intent:

The Data Cable is intended to provide a quick convenient means of connecting console equipment to chamber equipment.

Mechanical:

Cable Dimensions:

Length 10' or custom
Width 1/4"
26 AWG, 6-wire, Flat cable

Connections:

An RJ11 (phone jack) connector is placed at the chamber end, and a DB9 serial connector is placed at the chamber end.

Mounting:

The cable can be bundled and tied back as desired.

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CONSOLE WIRING

OVERVIEW

This section explains the wiring done within the console. The picture below depicts the portions of the LS2400K that will be referenced throughout the console wiring section. Syndyne strongly recommends reading Section 1: "System Overview," completely and the operation of each board be understood before proceeding with this section. After mounting the boards in suitable locations route power, feeds, and returns then wire the inputs and outputs per design requirements. Compliance with local codes and NEC (National Electric Code) guidelines in determining wire sizes is strongly recommended. Additional consideration maybe necessary to eliminate excessive voltage drops in wiring. See Appendix A "Soldering Tips" for soldering techniques.

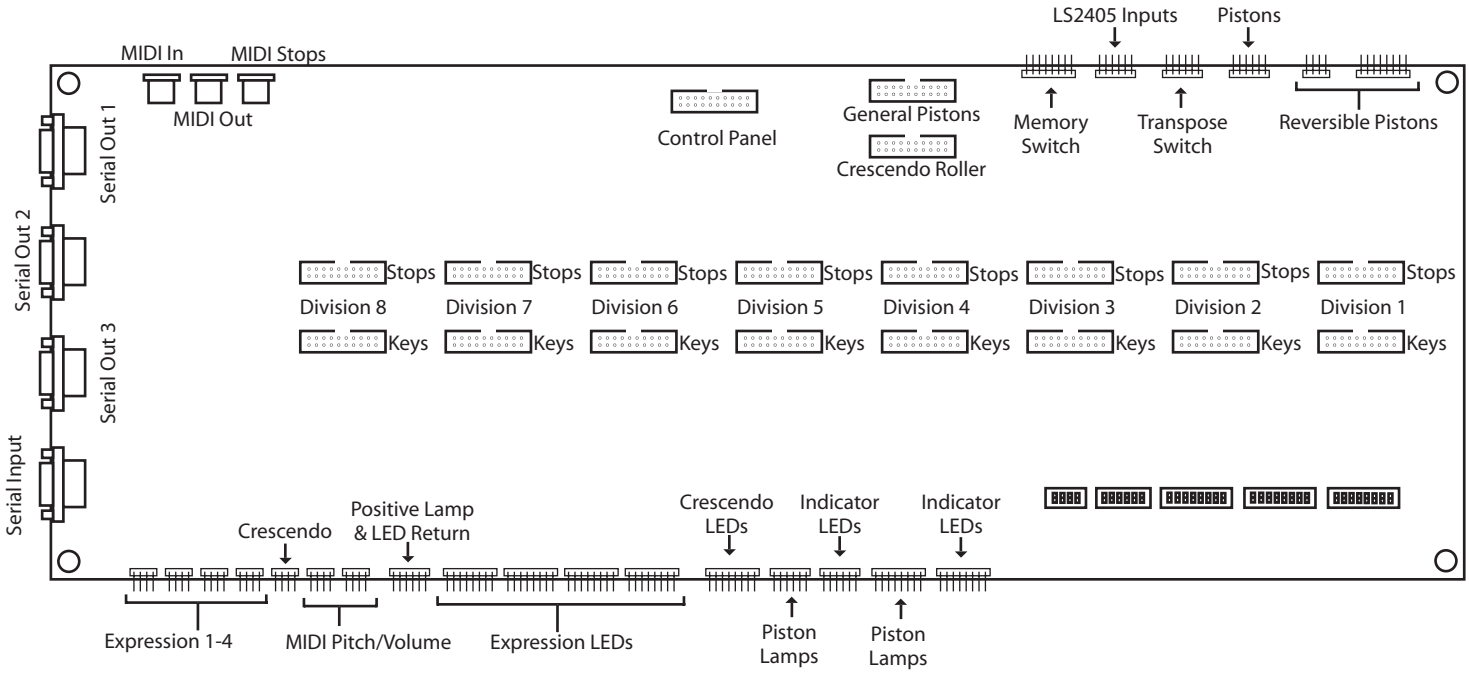

Figure 2.1 "LS2400K Connectors"

POWER:

- Only clean regulated 12-24VDC power supplies should be used.
- It is acceptable to use multiple power supplies such as one in the console and another in the chamber. The negative sides of each power supply must be connected together. There is a common negative that runs through the serial data cable and is usually suitable for this purpose. A separate negative wire is required when large currents are passing between the power supplies. It is not recommended to have more than one power supply's negative terminal tied to earth ground. If it is permissible with local codes we recommend not connecting any negative terminals to earth ground; this is to minimize the risk of damage due to a direct lightning strike.
- Daisy chaining of power connections is not recommended. Each board's power and chest returns should be routed individually to a common buss.
- **Due to risk of accidental shorting wires should not be routed beneath boards.**

FUSING:

The use of fuses to protect all electrical circuits from accidental shorting and compliance with local codes and NEC (National Electric Code) guide lines is highly recommended.

BOARD LAYOUT SUGGESTIONS

Syndyne system boards can be mounted in many different locations, with different spacings and layouts. Syndyne offers wiring solutions that prewire boards to customer specifications. The majority of these installations follow similar specifications. The syndyne wiring team studied these similarities to offer suggestions on board layout. Syndyne suggests that all boards be spaced at least 1/2" between edges without connectors and at least 2" between edges with connectors. This will leave sufficient room for wiring to be placed between boards. It also provides enough room in the event that additional wires must be added after original wiring has been completed. Providing enough room prevents mistakes such as routing wires underneath boards.

Data Cable:

Data Cable is used to transfer note, stop, expression and other information from the console to the organ chamber. It can travel 500 feet or more without loosing integrity. All Data cables greater than 2' in length should be made from a CAT-5 26 AWG cable. See figure 2.2 “Data Cable Connections” for a connection diagram. If an LS2406K Remote Start Board is being used, the data cable must first be plugged into the LS2406K and can then daisy chain through the driver boards. For more information on the LS2406K see page 1-11 in the System Overview Section

Multiple Consoles

The Serial-In connection on the LS2400K board is available for the operation of two separate consoles on the same organ. The Serial-Out from the LS2400K in the first console is connected to the Serial-In of the LS2400K in the second console. The Serial-Out from the second console is then connected to the Chamber. Organ stops, shade and tremolo controls that are shared between the consoles must be connected identically to each LS2400K board.

“T” Connections

Never create a "T" connection when making a data cable. Instead, use two data cables, see figure 2.3 “T Connection,” or use wall jacks at both ends of the chamber data cable so that the console can be plugged into two different locations, see figure 2.4 “Multiple Connections.” It is necessary to have a Remote Start Board (LS2406K) for each data cable plug-in location when using the remote start feature with multiple console locations. For more information on the LS2406K see page 1-11 in the System Overview Section. If a third wall jack is required an LS2410K repeater board can be used to create the three jacks without creating a T connection, see figure 2.5 “LS2410K Serial Repeater” and page 1-12 on the LS2410K in the System Overview Section for further detail.

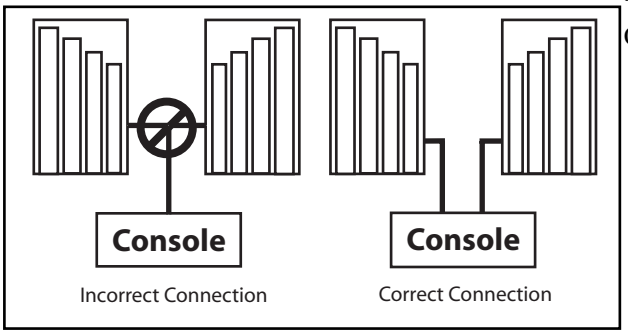

Figure 2.3 “T Connection”

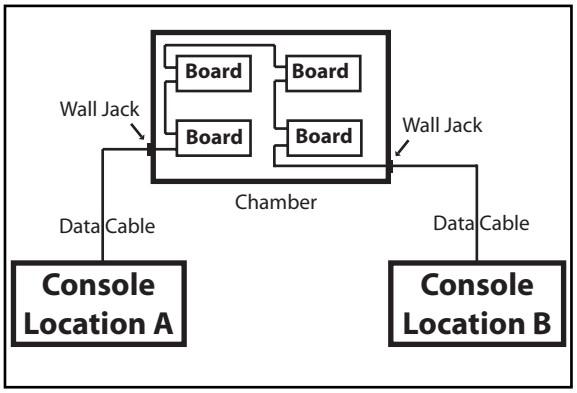

Figure 2.4 “Multiple Connections”

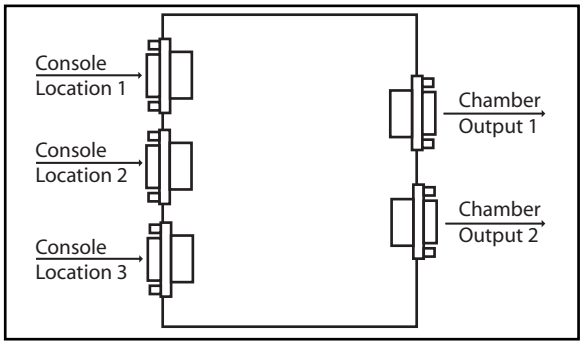

Figure 2.5 “LS2410K Serial Repeater”

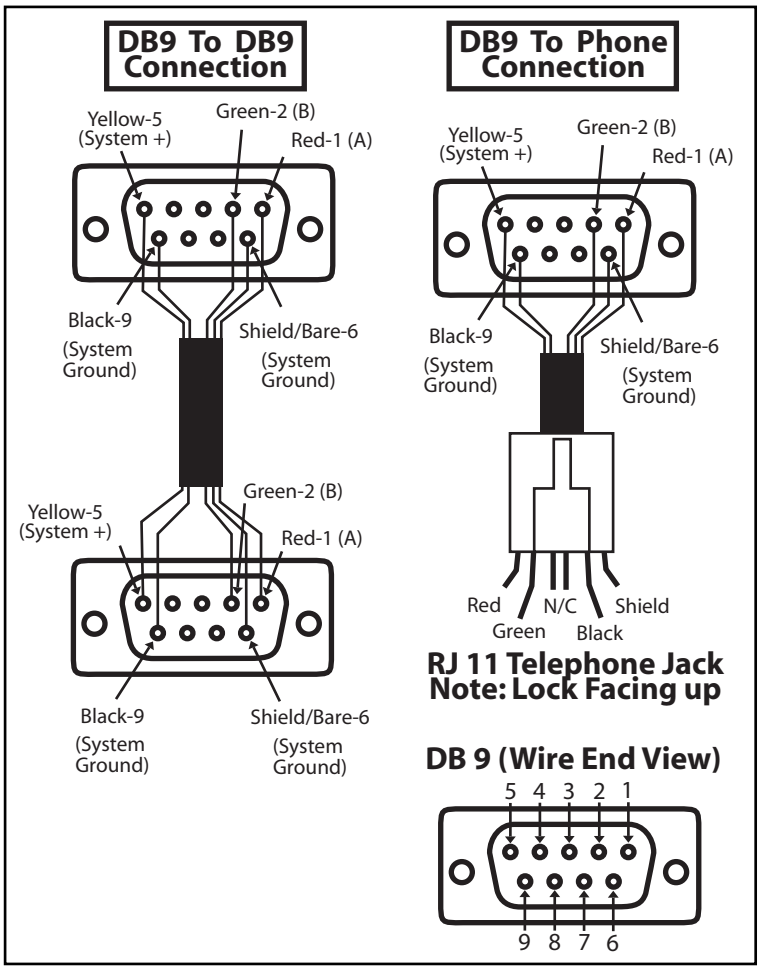

Figure 2.2 “Data Cable Connections”

Wiring Keys and Setting Feed (Common) Polarity

Overview

The LS2402K Input boards allow keying information to be transfered from the keys to the LS2400K board. Figure 2.6 "Wiring Keys" shows a basic diagram of how the Keys, LS2402Ks, LS2401K, and LS2400K all come together. If a removable pedal is desired, the LS2401K Pedal Input board is used to wire the Pedal keys. With the LS2401K board the Key Feed (Common) is passed through the key input connector.

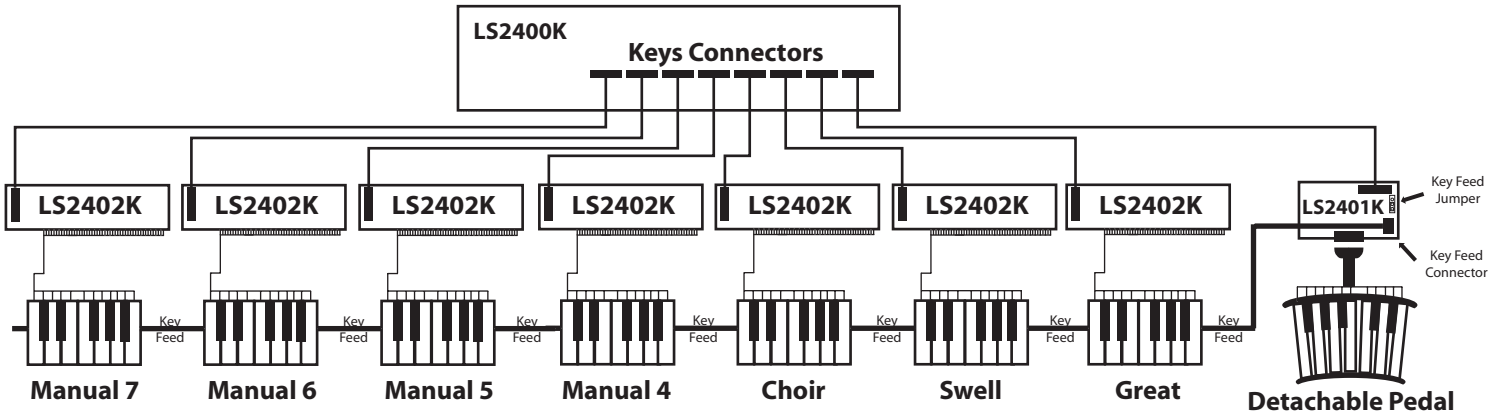

Figure 2.6 "Wiring Keys"

Wiring Keys

Once the LS2402K Boards are mounted, wire the key contacts to the Pins on the LS2402K connectors starting with note one on pin one and ending with the 61st note on pin 61, see figure 2.7 "LS2402K Connectors." The additional pins are not used when wiring keys. When you have completed wiring the keys to the pins, run a ribbon cable from the ribbon connector on the LS2402K to the corresponding ribbon cable connector on the LS2400K.

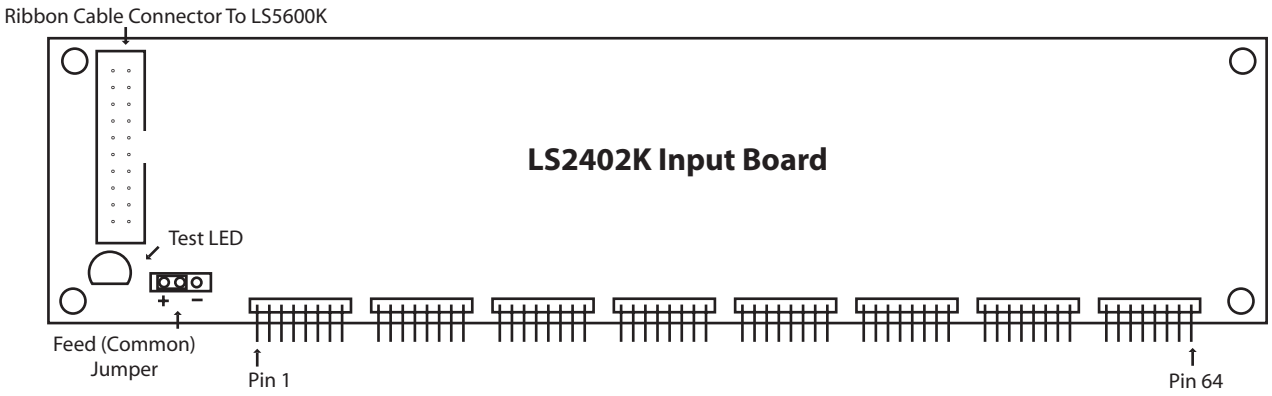

Figure 2.7 "LS2402K Connectors"

Setting Key Feed (Common)

Do not forget to set the feed (common) polarity by setting the jumper, see figure 2.8 "Setting Key Feed."

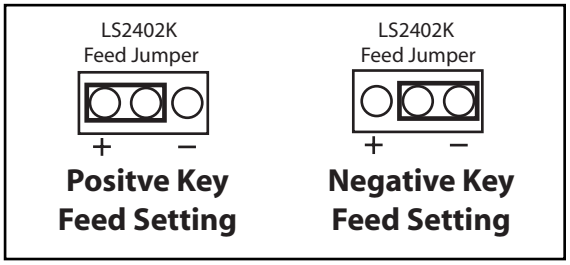

Figure 2.8 "Setting Key Feed"

Wiring Pedal Keys

When wiring the pedal there can be two types of installations. One using the LS2401K Pedal Input Board where the pedal can be removable, and another using the LS2402K Input Board with no option to remove the pedal. When wiring the pedal with the LS2402K wire the Pedal Key contacts to the LS2402K inputs starting with Key contact 1 on Pin 1, see figure 2.7 "LS2402K Connectors." Also, wire the key feed (common) directly to the pedal contacts.

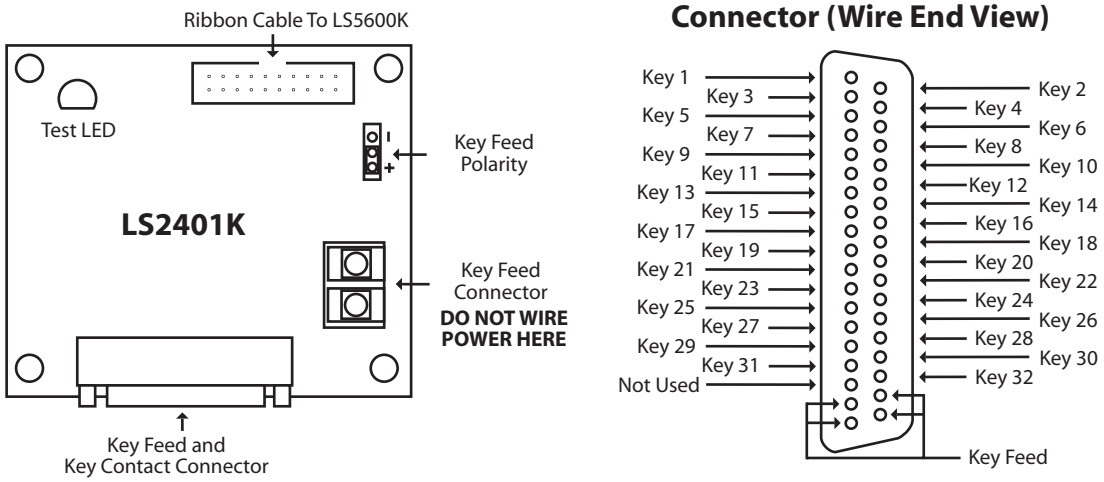

Figure 2.9 "LS2401K Connectors"

When wiring the pedal with the LS2401K for the option to remove the pedal board, the key feed is wired through the LS2401K board. This allows the key feed and key contacts to be wired through a removable connector. See figure 2.9 "LS2401K Connectors," for a pin out diagram of the LS2401K Removable connector. To ensure a good connection there are four pins designated to carry the key feed to the pedal board. Connect the key feed to the LS2401K board through either terminal of the Key Feed Connector and set the Key Feed Polarity Jumper to positive or negative. Wire the Pedal key contacts to the connector, see figure 2.9 "LS2410K Connectors." Run a ribbon cable from the ribbon connector on the LS2401K to the Pedal ribbon connector on the LS2400K. For more information on the LS2401K see page 1-9 in the System Overview section.

WARNING DO NOT WIRE BOTH POSITIVE AND NEGATIVE TO THE KEY FEED CONNECTOR ON THE LS2401K. THIS WILL SHORT OUT THE POWER SUPPLY CAUSING DAMAGE!

Wiring Stops and Setting Feed (Common) Polarity

Overview

The LS2402K Input boards allow stop information to be transfered from the stops to the LS2400K board see figure 2.11 "Wiring Stops" shows a basic diagram of how the Stops, LS2402Ks, and LS2400K all come together.

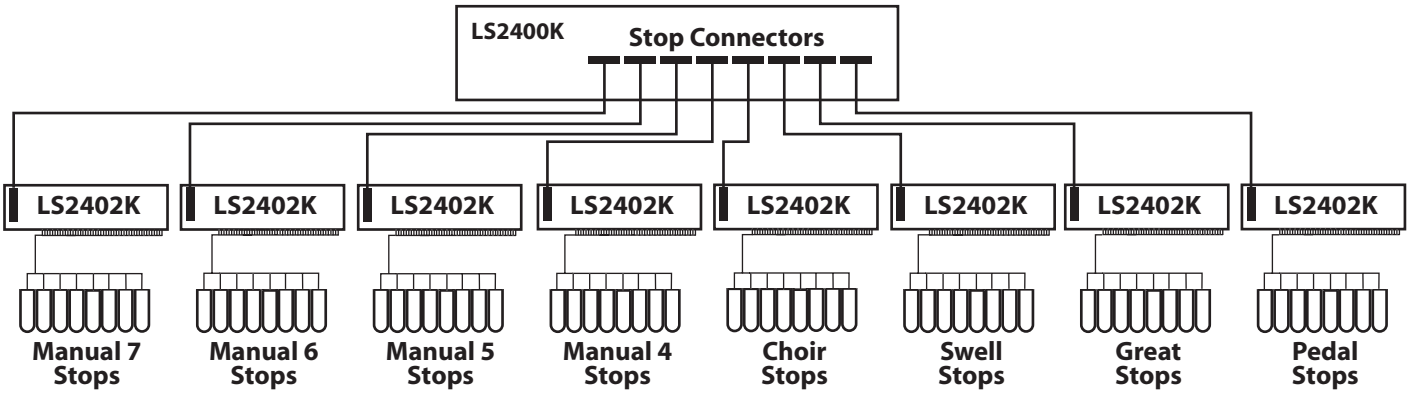

Figure 2.11 "Wiring Stops"

Wiring Stops

The LS2400K is limited to 384 stops, 48 stops per division in 8 divisions. Wire the stop inputs from each division into an LS2402K Input Board. See figure 2.12 "LS2402K Connectors. Start by wiring stop 1 to pin 1 and end by wiring the last stop used in that division to its corresponding input. If less then 48 stops are needed in any division, the additional pins are unused. Connect the LS2402K to the corresponding stop ribbon cable connector on the LS2400K.

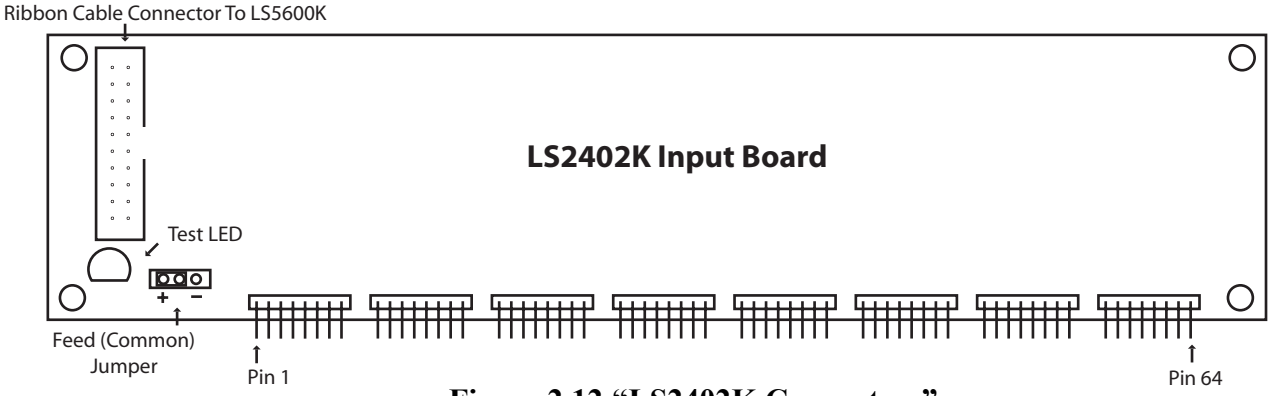

Figure 2.12 "LS2402K Connectors"

Setting Stop Feed (Common)

Do not forget to set the feed (common) polarity by setting the jumper, see figure 2.13 "Setting Stop Feed."

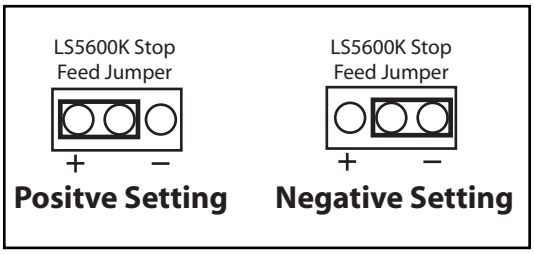

Figure 2.13 "Setting Stop Feed"

Tremelo and Accessory stop Inputs

Four tremelo and two accessory stop inputs are provided on the LS2400K board, between the Transposer and Memory Switch Connectors.

WIRING PISTONS

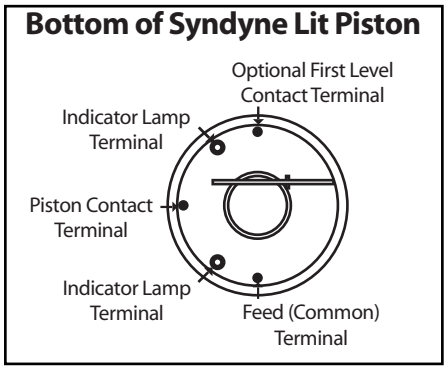

Figure 2.14 "Syndyne Piston"

SYNDYNE PISTONS

Syndyne Lit Pistons have five different terminals. They have two lamp terminals, one feed terminal, and two contact terminals. Unlit syndyne pistons do not include the two lamp terminals. Figure 2.14 "Syndyne Piston" contains a diagram of a syndyne lit piston.

INSTALLATIONS WITH AN LS2400K KEYING SYSTEM MUST BE WIRED WITH NEGATIVE PISTON FEED

WIRING PISTON CONTACTS

Syndyne Pistons have two levels of contact. The first level is activated when the piston is lightly pressed, and the second level is activated when the piston is pressed all the way down. If only one contact is needed, it is recommended that the second contact be used. Wire the piston contact terminal to the respective terminal on the LS2400K Board. The available pistons are shown in figure 2.15 "Piston Contacts." Wire the piston feed (common) to the negative side of the power supply. Figure 2.16 "Set Piston" shows an example using the Set Piston. The two "RETURN" terminals on the LS2400K can be used as the piston feed.

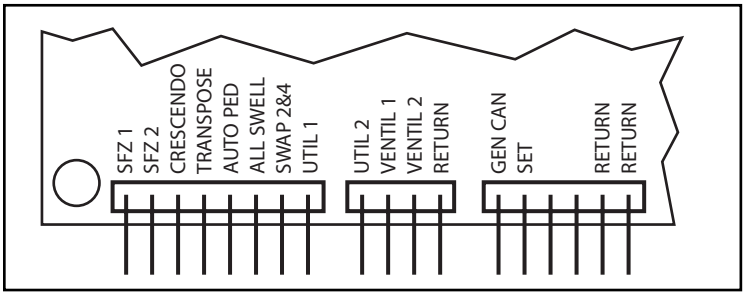

Figure 2.15 "Piston Contacts"

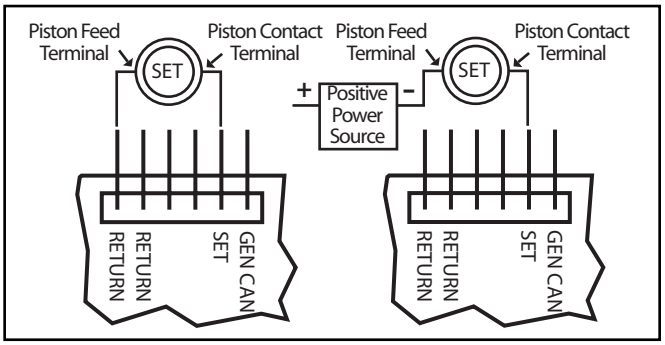

Figure 2.16 "Set Piston"

PISTON LAMPS

Syndyne lit pistons come with either a 5 Volt (white wire) or 14 Volt (red wire) lamp.

5 Volt Lamp: Connect one piston lamp terminals to its respective indicator lamp terminal on the LS2400K. Connect the other piston lamp terminal to the "LED/LAMP 5VDC Return" connector on the LS2400K.

14 Volt Lamp: Connect one piston lamp terminal to its respective indicator lamp terminal on the LS2400K. Connect the other piston lamp terminal to the positive terminal on the 14 VDC console power supply.

Figure 2.17 "Piston Lamps" shows an example of wiring a 5 and 14 volt piston

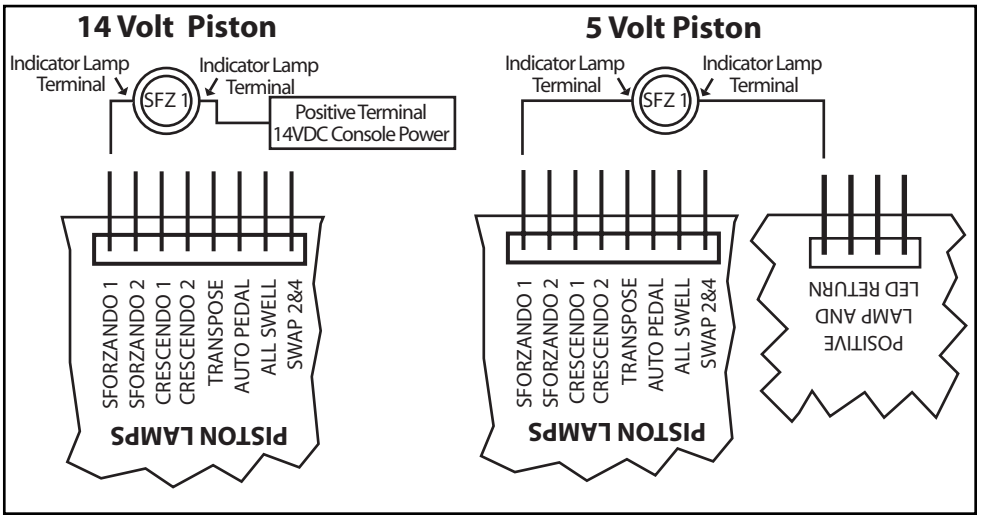

Figure 2.17 "Piston Lamps"

GENERAL PISTONS:

An LS2402K Input Board is used to wire the general pistons into the LS2400K. Wire General Piston 1 to pin 1 on the LS2402K, General Piston 2 to pin 2, and continue until all General Pistons are wired (up to 16). Connect a ribbon cable between the LS2402K Input Board and the General Pistons Ribbon Cable Connector on the LS2400K.

WIRING POTENTIOMETER (ANALOG) INPUTS

DEVICE CONNECTIONS

There are connectors on the LS2400K board that provide inputs for the crescendo, expression 1-4, midi pitch, and midi volume. Figure 2.18 "Analog Inputs" depicts these connectors.

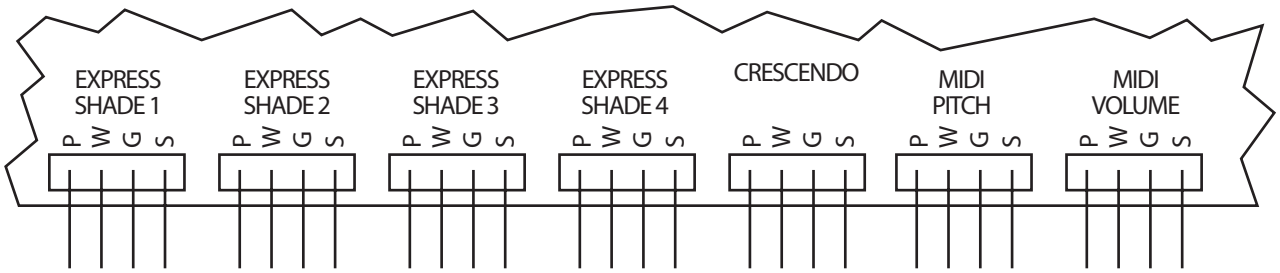

Figure 2.18 "Analog Inputs"

ROTARY AND SLIDER POTENTIOMETERS

The center terminal of a typical rotary potentiometer is the wiper "W" contact. Wire the wiper contact to the "W" terminal of the appropriate connector on the LS2400K. The "P" terminal on the appropriate connector is for 5VDC and the "G" terminal is for Ground. Wire the "P" and "G" terminals to the other two terminals of the Potentiometer. As the shoe is moved down the voltage or resistance between "W" and "G" should increase. If the shoe or device action is backwards, then swap the "P" and "G" wires. The "S" terminal is provided as a shield connection to power supply negative. It is recommended that shielded cable always be used when wiring to analog inputs. Figure 2.20 "Slide Potentiometer" depicts an example of a slide potentiometer and rotary potentiometer. The expression inputs are designed to be used with the LS2405K or the LS2407K in the Chamber. For more information on the LS2405K see page 1-10 in the System Overview Section. For more information on the LS2407K see page 1-11 in the System Overview Section.

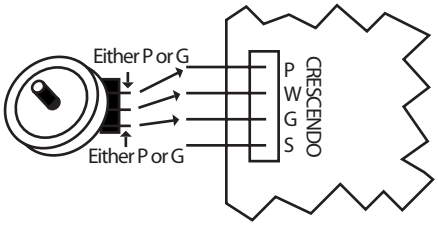

Figure 2.19 "Potentiometer"

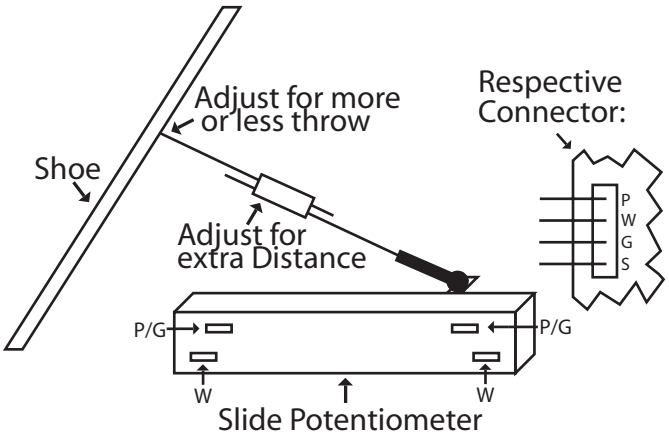

Figure 2.20 "Slide Potentiometer"

All Potentiometers must be either a 5k or 10k Ohm.

EXPRESSION SHADES USING STOP SENSE INPUTS

The stop sense inputs on the LS2400K can be used to wire an Expression Shoe. Simply wire the Shoe contacts to any unused stop sense inputs on the LS2400K. These Inputs can be distributed among any of the divisions. The 7 stop line outputs available on each pipe driver board can be configured to turn on with these inputs. For more information on wiring the stop line outputs, see 4-4 in the Chamber Wiring Section. When this method is used, the expression displays will not operate and the expression shoes cannot be assigned to a MIDI-Stop, see 5-3 in the Chamber Programming Section.

This method is not recommended if an LS2403K control Panel is being used because the Expression Features within the LS2403K will not be functional.

EXPRESSION SHOES WITH RESISTORS

Resistors can be used with an expression shoe to simulate a potentiometer. See figure 2.21 "Expression Shoe Resistors" for connection information. See Table 2.1 "Resistor Sets" and Table 2.2 "Resistor Values" for resistor set and value information.

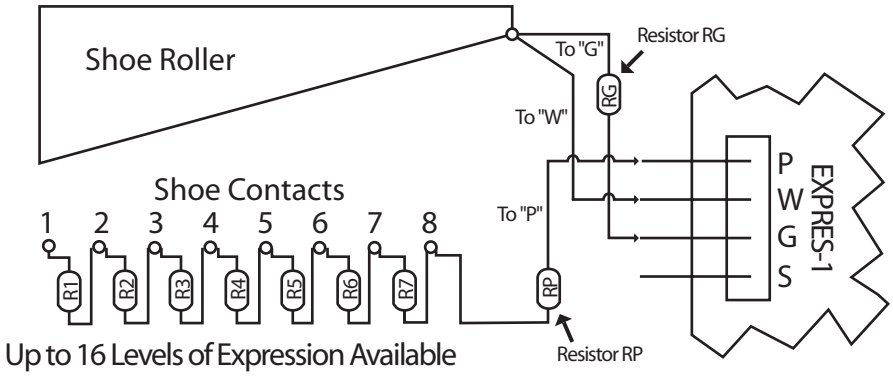

Figure 2.21 "Expression Shoe Resistors"

Use shielded cable and connect the cable shield to the "S" terminal. Resistor "RG" is wired between terminal "G" and the shoe roller. Resistor "RP" is wired between terminal "P" and the last shoe contact. When all 16 steps of expression are used, do not include resistor "RP". Wire directly from the 16th shoe contact to terminal "P." For applications that require more than 16 stages of expression, either use a 5K potentiometer or the stop terminals on the LS2400K.

	6	7	8	9	10	11	12	13	14	15	16
Resistor Position	Stage Swell	Stage Swell	Stage Swell	Stage Swell	Stage Swell	Stage Swell	Stage Swell	Stage Swell	Stage Swell	Stage Swell	Stage Swell
RG	348	348	348	348	348	348	348	348	348	348	348
R1	2740	2740	2740	2740	2740	2740	2740	2740	2740	2740	2740
R2	909	909	909	909	909	909	909	909	909	909	909
R3	453	453	453	453	453	453	453	453	453	453	453
R4	274	274	274	274	274	274	274	274	274	274	274
R5	182	182	182	182	182	182	182	182	182	182	182
R6	NONE	130	130	130	130	130	130	130	130	130	130
R7	NONE	NONE	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6
R8	NONE	NONE	NONE	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8
R9	NONE	NONE	NONE	NONE	60.4	60.4	60.4	60.4	60.4	60.4	60.4
R10	NONE	NONE	NONE	NONE	NONE	49.9	49.9	49.9	49.9	49.9	49.9
R11	NONE	NONE	NONE	NONE	NONE	NONE	41.2	41.2	41.2	41.2	41.2
R12	NONE	NONE	NONE	NONE	NONE	NONE	NONE	35.7	35.7	35.7	35.7
R13	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	30.1	30.1	30.1
R14	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	26.1	26.1
R15	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	22.6
RP	576	442	340	267	205	158	115	78.7	48.7	22.6	NONE

Table 2.1 "Resistor Sets"

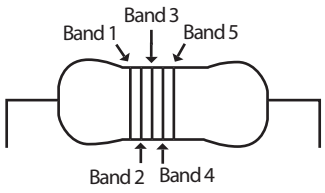

Figure 2.22 "Resistor"

VALUE IN OHMS	COLOR BAND 1	COLOR BAND 2	COLOR BAND 3	COLOR BAND 4	COLOR BAND 5
2740	RED	VIOLET	YELLOW	BROWN	BROWN
909	WHITE	BLACK	WHITE	BLACK	BROWN
576	GREEN	VIOLET	BLUE	BLACK	BROWN
453	YELLOW	GREEN	ORANGE	BLACK	BROWN
442	YELLOW	YELLOW	RED	BLACK	BROWN
340	ORANGE	YELLOW	BLACK	BLACK	BROWN
267	RED	BLUE	VIOLET	BLACK	BROWN
274	RED	VIOLET	YELLOW	BLACK	BROWN
205	RED	BLACK	GREEN	BLACK	BROWN
182	BROWN	GREY	RED	BLACK	BROWN
158	BROWN	GREEN	GREY	BLACK	BROWN
130	BROWN	ORANGE	BLACK	BLACK	BROWN
115	BROWN	BROWN	GREEN	BLACK	BROWN
97.6	WHITE	VIOLET	BLUE	GOLD	BROWN
78.7	VIOLET	GREY	VIOLET	GOLD	BROWN
76.8	VIOLET	BLUE	GREY	GOLD	BROWN
60.4	BLUE	BLACK	YELLOW	GOLD	BROWN
49.9	YELLOW	WHITE	WHITE	GOLD	BROWN
48.7	YELLOW	GREY	VIOLET	GOLD	BROWN
41.2	YELLOW	BROWN	RED	GOLD	BROWN
35.7	ORANGE	GREEN	VIOLET	GOLD	BROWN
30.1	ORANGE	BLACK	BROWN	GOLD	BROWN
26.1	RED	BLUE	BROWN	GOLD	BROWN
22.6	RED	RED	BLUE	GOLD	BROWN

Table 2.2 "Resistor Values"

Wiring Indicators

The LS2400K Board provides outputs for indicator LED's and Lamps. Figure 2.23 "Indicator Connectors" depicts the connectors used when wiring Indicators.

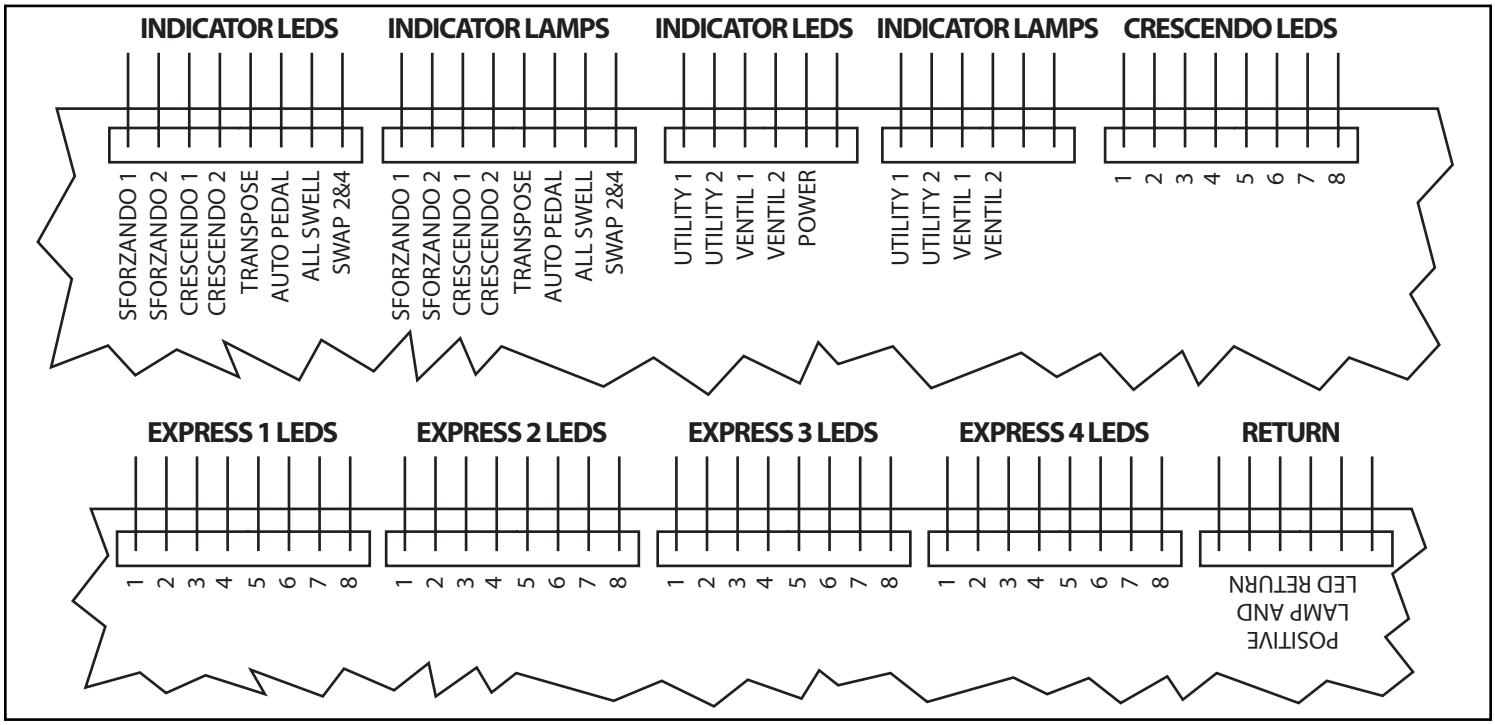

Figure 2.23 "Indicator Connectors"

Lamps

Wire one side of the lamp to the respective indicator lamp output on the LS2400K board. If the lamp is 5 volts attach the other side to one of the terminals on the "POSITIVE LAMP AND LED RETURN" connector. If the lamp has a different voltage, connect this side to the positive terminal on a power supply of the same voltage as the Lamp. For more information on wiring Piston Lamps see page 2-7.

LEDs

Wire the Cathode (-) side of the LED to the respective indicator LED output on the LS2400K board. Wire the Anode (+) side of the LED to the "LED/LAMP 5VDC RETURN" connector on the LS2400K. Figure 2.25 "LED" shows an LEDs connections.

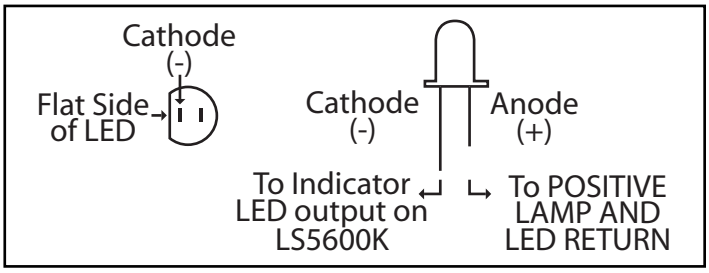

Figure 2.25 "LED"

Crescendo LEDs

The "CRESCENDO LEDS" connector provides outputs for an 8 stage LED bar graph.

Use only LEDs without built in resistors.

Wiring Transposer Rotory Switch

Connect the LS2412TC to the LS2400K "TRANSPOSE SWITCH" Connector as shown in figure 2.24 "Transposer Connector." For more information on the LS2412TC see page 1-12, in the System Overview Section.

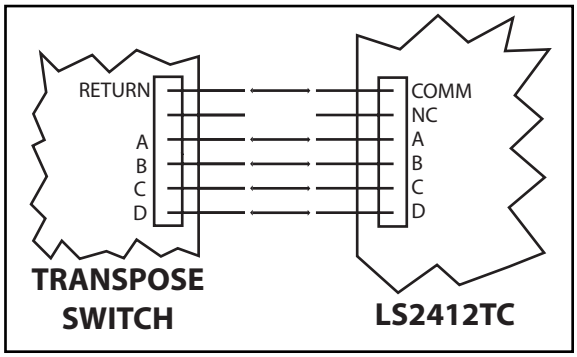

Figure 2.24 "Transposer Connector"

CONSOLE PROGRAMMING

Programming with Binary Numbers

The LS2400K System uses DIP Switches to perform programming with binary numbers. Binary is the basic language used by computers. The world we know generally uses the decimal system which uses numbers 0-9 while binary uses only 1 and 0. In a decimal system each place in a number is ten times greater then the place to the right. In the binary system each place is two times greater then the place to the right. Two hundred thirty one in decimal is a 2 in the hundreds place, 3 in the tens place, and 1 in the single place, or 231. In binary, two hundred thirty would be 11100111, or 1 + 2 + 4 + 32 + 64 + 128 = 231. In order to make conversion from decimal to binary numbers two examples are given below.

Example 1:

An easy method of binary programming is the subtraction method. When programming 218 in binary, turn on the largest binary switch that is less then 218. This means turning on 128. Next subtract 128 from 218, which leaves 90. Next, turn on the largest binary switch that is less then the remainder 90, which is 64. Subtract 64 from 90, which leaves 26. Continuing the process select the largest binary switch that is less then the remainder 26, which is 16. Subtract 16 from 26, which leaves 10. Turn on the largest binary number that is less then the remainder 10, which is 8. Subtract 8 from 10, which leaves 2. The process is ended by turning on the binary switch which equals the remainder, which in this case is turning on switch 2. Subtract 2 from 2, which leaves no remainder. In summary, the binary switches turned on to equal 218 are: 128 + 64 + 16 + 8 + 2 = 218. Figure 3.1 “Binary Switches 218” shows a set of DIP Switches set to 218.

218
− 128 ← ON
90

90
− 64 ← ON
26

26
− 16 ← ON
10

10
− 8 ← ON
2

2
− 2 ← ON
0

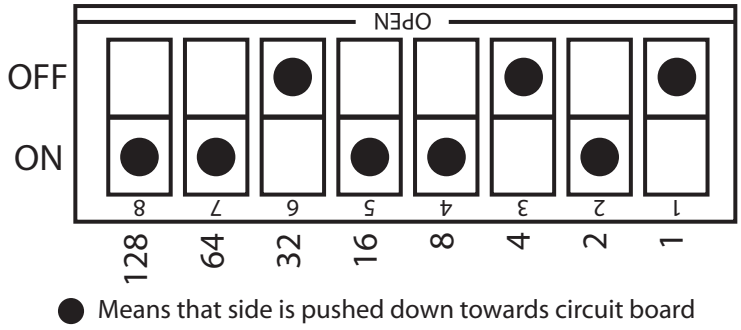

Figure 3.1 “Binary Switches 218 ”

Example 2:

Here is another example of using the subtraction method. When programming the number 62, turn on the largest binary switch that is less then 62, which is 32. Subtract 32 from 62, which leaves 30. Turn on the largest binary switch that is less then the remainder 30, which is 16. Subtract 16 from 30, which leaves 14. Turn on the largest binary switch less then the remainder 14, which is 8. Subtract 8 from 14, which leaves 6. Turn on the largest binary switch less then the remainder 6, which is 4. Subtract 4 from 6, which leaves 2. Turn on the binary switch that is equal to the remainder, which is 2. Subtracting 2 from 2 leaves no remainder. In summary, the binary switches turned on to equal 62 are: 32 + 16 + 8 + 4 + 2 = 62. Figure 3.2 “Binary Switches 62” shows a set of DIP Switches set to 62.

62
− 32 ← ON
30

30
− 16 ← ON
14

14
− 8 ← ON
6

6
− 4 ← ON
2

2
− 2 ← ON
0

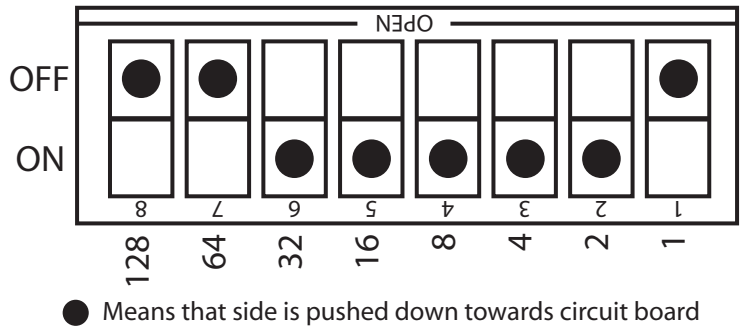

Figure 3.2 “Binary Switches 62”

PROGRAMMING THROUGH THE LS2403K CONTROL PANEL:

Syndyne offers a Control Panel which not only has an expanded set of features, but also simplifies programming the LS2400K. For information on how to program the LS2400K System with the LS2403K Control Panel, please see the LS2403K Installation Instructions Manual. The LS2403K Installation manual can be downloaded at our website, www.syndyne.com.

LS2400K PROGRAMMING DIP SWITCHES:

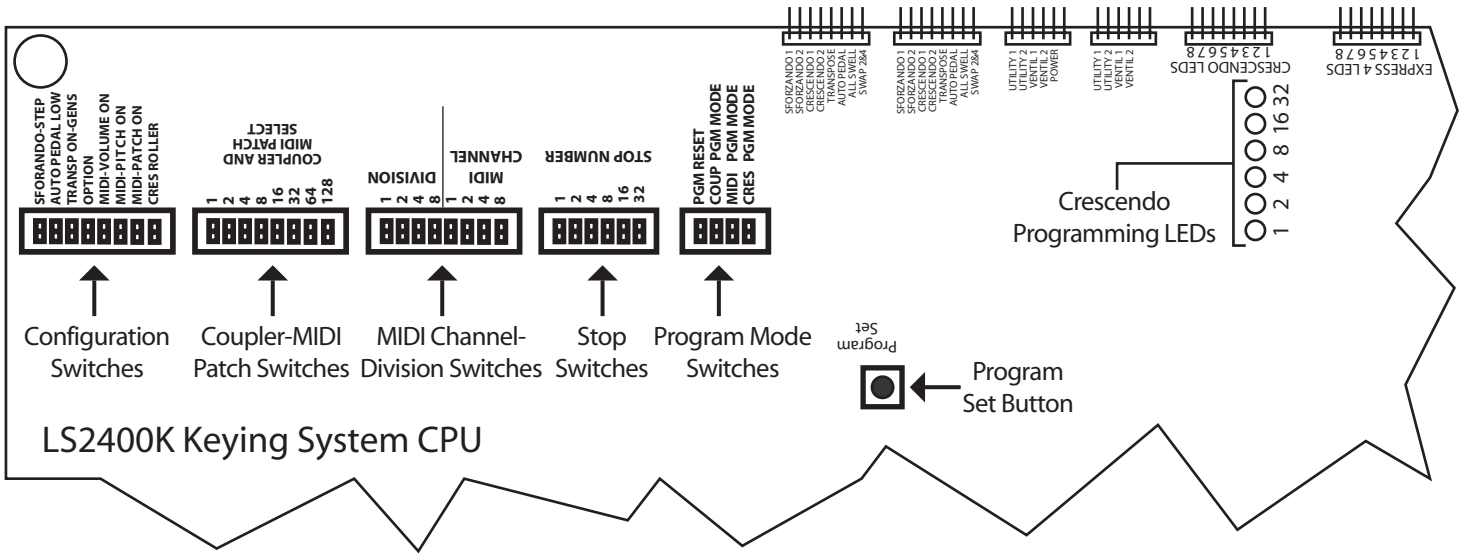

Figure 3.3 "LS2400 DIP Switches"

CONFIGURATION SWITCHES:

- SFORZANDO STEP
  When set ON the two Sforzando pistons will step, permitting only one sforzando to be active at any time.
- AUTOPEDAL-LOW
  When set ON the Autopedal coupler will only play in the bot tom octave.
- TRANSP ON GENS
  When set ON permission is granted to set the Transposer onto the General Pistons.
- OPTION
  This is reserved for Future Use
- MIDI-VOLIME ON
  When set ON permission is granted to transmit MIDI Volume messages with all active MIDI Stops.
- MIDI-PITCH
  When set ON permission is granted to transmit MIDI Pitch messages with all active MIDI Stops.
- MIDI-PATCH
  When set ON permission is granted to transmit MIDI Program Change (Patch Change) messages with all active MIDI Stops.
- CRES ROLLER
  When set ON the Crescendo Roller option is selected instead of a potentiometer.

PROGRAMMING COUPLERS:

Any Stop in the console can be programmed as a Coupler. Each Coupler's program can be documented using the System Configuration and Organ Specification Form in the Forms Section of this manual.

Things to remember:

- *To enter numbers through the DIP switches set the switches ON that will add up to equal the desired number.*
- *References to Stop Numbers are referring to the numbered Stop Sense inputs of the LS2402K input boards*
- *The System Coupler List can be found on page 3-5*
- *For more information on Binary Programming See page 3-2*

Procedure:

1. Turn on the organ.
2. On the Program Mode Switches, set PGM COUPLER to ON. PGM CRES, PGM MIDI STOP and RESET must be OFF (open).
3. (optional) To clear all Coupler memory set the PGM RESET switch to ON and press the PROGRAM SET button. Set the PGM RESET switch to OFF, wait approximately 2 seconds for the Coupler memory to be cleared and then proceed to the next step.
4. Set the Stop Number Switches, to the desired stop number.
5. Set the Division DIP switches to equal the division number that the Coupler Stop is in (Pedal/Divison-1; Great/Division-2; Swell/Division-3).
6. Set the Coupler/MIDI Patch Switches to the desired Coupler number. For a List of Couplers Numbers see the Coupler Programming List on page 3-5.
7. Press the Program Set Button.
8. Repeat steps 4-8 until all couplers are programmed.
9. On the Program Mode Switches, set the PGM COUPLER switch to OFF; programming is complete.

To clear/remove a single coupler Re-program the coupler using coupler number zero.

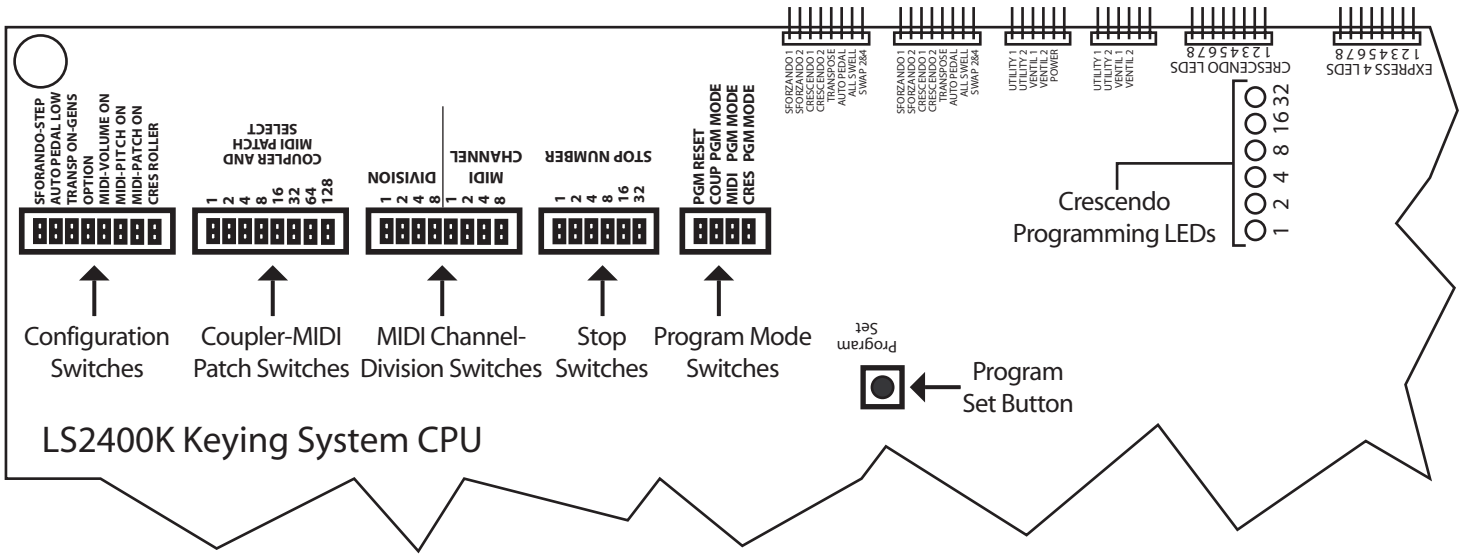

Figure 3.4 "LS2400 DIP Switches"

Coupler Programming List

0	No Coupler Assigned	43	Division 5 to Swell 8'	86	Division 7 to Division 7 4'
1	Pedal to Pedal 4’	44	Division 6 to Swell 8'	87	Swell to Division 7 8'
2	Great to Pedal 8’	45	Division 7 to Swell 8'	88	Choir to Division 7 8'
3	Great to Pedal 4’	46	Division 8 to Swell 16'	89	Division 5 to Division 7 8'
4	Swell to Pedal 8’	47	Division 8 to Swell 8'	90	Division 6 to Division 7 8’
5	Swell to Pedal 4’	48	Division 8 to Swell 4'	91	Division 8 to Division 7 8’
6	Choir to Pedal 8’	49	Choir to Choir 16'	92	Division 8 to Division 8 16’
7	Choir to Pedal 4’	50	Choir Unison Off	93	Division 8 Unison Off
8	Division 5 to Pedal 8’	51	Choir to Choir 4'	94	Division 8 to Division 8 4'
9	Division 5 to Pedal 4’	52	Great to Choir 8'	95	Swell to Division 8 8'
10	Division 6 to Pedal 8’	53	Swell to Choir 16'	96	Choir to Division 8 8'
11	Division 6 to Pedal 4’	54	Swell to Choir 8'	97	Division 5 to Division 8 8'
12	Division 7 to Pedal 8'	55	Swell to Choir 4'	98	Division 6 to Division 8 8'
13	Division 7 to Pedal 4'	56	Division 5 to Choir 16'	99	Division 7 to Division 8 8'
14	Division 8 to Pedal 8'	57	Division 5 to Choir 8'	100	Great to Division 5 8'
15	Division 8 to Pedal 4'	58	Division 5 to Choir 4'	101	Great To Division 6 8'
16	Great to Great 16'	59	Division 6 to Choir 16'	102	Great to Division 7 8'
17	Great Unison Off	60	Division 6 to Choir 8'	103	Great to Division 8 8’
18	Great to Great 4'	61	Division 6 to Choir 4'	104	Choir to Swell 4’
19	Swell to Great 16'	62	Division 7 to Choir 16'	105	Great to Swell 16
20	Swell to Great 8'	63	Division 7 to Choir 8’	106	Great to Swell 4
21	Swell to Great 4'	64	Division 7 to Choir 4’	107	Choir to Swell 16
22	Choir to Great 16'	65	Division 8 to Choir 16'	108	No Couplers Assigned Yet 108-127
23	Choir to Great 8'	66	Division 8 to Choir 8'	127	No Couplers Assigned Yet 108-127
24	Choir to Great 4’	67	Division 8 to Choir 4'	128	Swap Great & Choir Key Inputs
25	Division 5 to Great 16'	68	Division 5 to Division 5 16'	129	Turn Pedal Stops 25-32 Off
26	Division 5 to Great 8'	69	Division 5 Unison Off	130	Turn Great Stops 25-35 Off
27	Division 5 to Great 4'	70	Division 5 to Division 5 4'	131	Turn Swell Stops 25-32 Off
28	Division 6 to Great 16'	71	Swell to Division 5 8'	132	Turn Choir Stops 25-32 Off
29	Division 6 to Great 8'	72	Choir to Division 5 8'	133	Expression 3 to Express. 2
30	Division 6 to Great 4'	73	Division 6 to Division 5 8'	134	Expression 4 to Experss. 3
31	Division 7 to Great 16'	74	Division 7 to Division 5 8'	135	Melody Swell to Great
32	Division 7 to Great 8'	75	Division 8 to Division 5 8'	136	Melody Choir to Great
33	Division 7 to Great 4'	76	Division 6 to Division 6 16'	137	Division 1 Sustain
34	Division 8 to Great 16'	77	Division 6 Unison Off	138	Division 2 Sustain
35	Division 8 to Great 8'	78	Division 6 to Division 6 4'	139	Division 3 Sustain
36	Division 8 to Great 4'	79	Swell to Division 6 8'	140	Division 4 Sustain
37	Pedal to Great 8'	80	Choir to Division 6 8'	141	Division 5 Sustain
38	Swell to Swell 16'	81	Division 5 to Division 6 8'	142	Division 6 Sustain
39	Swell Unison Off	82	Division 7 to Division 6 8'	143	Division 7 Sustain
40	Swell to Swell 4'	83	Division 8 to Division 6 8'	144	Division 8 Sustain
41	Great to Swell 8'	84	Division 7 to Division 7 16'	145	Melody Swell to Great on Division 7
42	Choir to Swell 8'	85	Division 7 Unison Off	146	Autopedal (Pedal to Great Melody)

PROGRAMMING MIDI STOPS:

Any Stop in the console can become a MIDI Stop but there can only be one MIDI Stop assigned to each MIDI Channel; limiting the maximum number of MIDI Stops to 16. Each MIDI Stop's program can be documented using the System Configuration and Organ Specification Form in the Forms Section of this Manual.

Things to remember:

- *To enter numbers through the DIP switches set the switches ON that will add up to equal the desired number.*
- *References to Stop Numbers are referring to the numbered Stop Sense inputs of the LS2402K input boards.*
- *For more information on Binary Programming see page 3-2*

Procedure:

1. Turn on the organ.
2. On the Program Mode Switches, set the PGM MIDI STOP switch to ON. PGM CRES, PGM COUPLER and RESET must be OFF (open).
3. (optional) To clear all MIDI Stop memory set the PGM RESET switch to ON and press the PROGRAM SET button. Set the PGM RESET switch to OFF, wait approximately 2 seconds for the MIDI Stop memory to be cleared and then proceed to the next step.
4. Set the Stop Number Switches to the desired stop number.
5. Set the DIVISION DIP switches to equal the division number that the MIDI Stop is in (Pedal/Divison-1; Great/Division-2; Swell/Division-3).
6. Set the MIDI CHANNEL DIP switches to equal desired MIDI channel. Note that the MIDI CHANNEL DIP switches number from 0-15 which cor responds to MIDI Channels 1-16.
7. Set the MIDI PATCH DIP switches to desired MIDI Patch number.
8. Press the PROGRAM SET button.
9. Repeat steps 4-9 until all MIDI Stops are programmed.
10. On the Program Mode Switches set the PGM MIDI STOP switch to OFF; programming is complete.

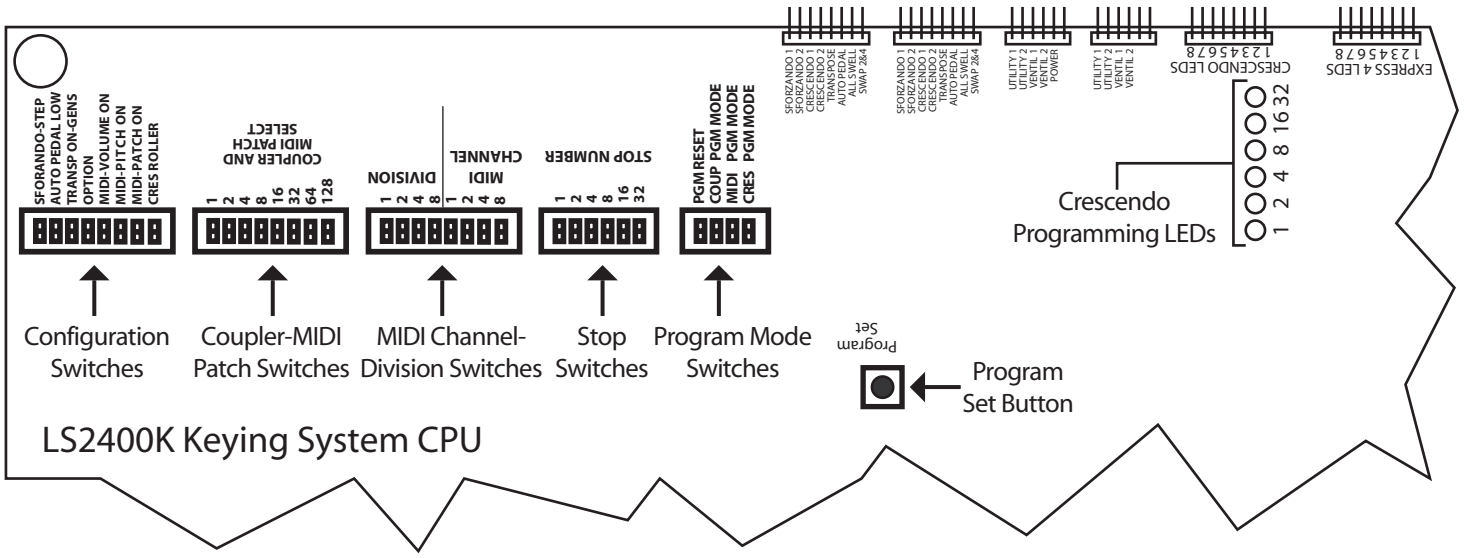

Figure 3.5 "LS2400 DIP Switches"

PROGRAMMING CRESCENDO

In order to test the Crescendo during programming it is necessary that all stops, couplers and keying be fully operational. Therefore it is recommended that this procedure be postponed until the previous Console Programming and Chamber Programming is accomplished.

Crescendo-1 is by default the active crescendo at power-up. If Crescendo-2 is not used then there is no requirement for a reversible piston to activate the crescendos. Each Crescendo is programmed individually. Crescendo-1 is active at power-up and can be programmed by follow the programming procedure to select Crescendo-2 a reversible piston must be connected to the CRESCENDO piston input, see page 2-7 in the Console Wiring Section. When the LS2400K has been placed into the Crescendo Program mode the 6 LEDs will count each of the 60 steps using a binary equivalent number. Each LED is labeled with its binary equivalent as follows 32, 16, 8, 4, 2, 1. Simply add the illuminated numbers up to determine which step the crescendo is currently on. Each Crescendo's program can be documented using the System Configuration and Organ Specification Form in the Forms Section of this Manual.

Things to remember:

- *To enter numbers through the DIP switches set the switches ON that will add up to equal the desired number.*
- *For more information on Binary Programming see page 3-2*

Procedure:

1. Turn on the organ.
2. Select the Crescendo to be programmed using the reversible piston. If only Crescendo-1 is being used this step is not necessary.
3. On the Program Mode Switches set the PGM CRES switch to ON. PGM MIDI STOP,PGM COUPLER and RESET must be OFF (open).
4. (optional) To clear the Crescendo memory set the PGM RESET switch to ON and press the PROGRAM SET button. Set the PGM RESET switch to OFF, wait approximately 12 seconds for the crescendo memory to be erased and then proceed to the next step.
5. Move the crescendo shoe so that the step to be programmed is solidly lit. The Crescendo LEDs on the LS2400K board will light up to equal the activated crescendo step in binary.
6. Turn on the desired stops for current step.
7. Press the PROGRAM SET button.
8. Repeat steps 5-7 until all of the crescendo steps are programmed.
9. If there are more then one crescendi to be programmed go back to step 2, select the next crescendo, and repeat steps 3-7.
10. On the Program Mode Switches, set the PGM CRES switch to OFF; programming is complete.

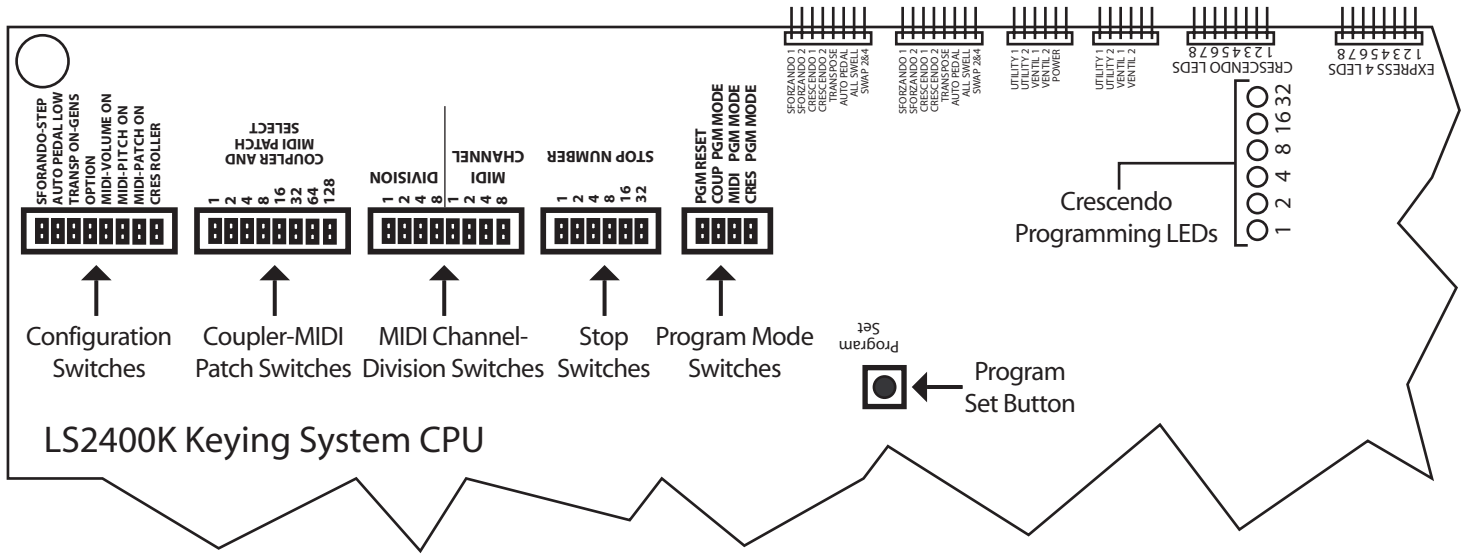

Figure 3.6 "LS2400 DIP Switches"

Setting Sforzando 1 & 2

Turn on all Stops that are to be set on the Sforzando Piston. Press and hold the Set Piston then press the Sforzando Piston then release both pistons; Set complete.

Setting Ventils 1 & 2

Turn on all Stops that are to be set on the Ventil Piston. Press and hold the Set Piston then press the Ventil Piston then release both pistons; Set complete.

Transpose on General Pistons.

- Select desired memory level.
- Set the Transposer to the desired position.
- Activate the Transposer (If on a Reversible Piston).
- Press and hold the Set Piston
- Press the applicable General Piston
- Release both pistons
- Set complete.
- Repeat as appropriate for each General Piston and Memory Levels.

CHAMBER WIRING

Overview

This section explains the wiring done within the chamber. We strongly recommend reading the System Overview Section in this manual completely and the operation of each board be understood before proceeding with this section. After mounting the boards in suitable locations, route power, feeds, and returns then wire the inputs and outputs per design requirements. Compliance with local codes and NEC (National Electric Code) guidelines in determining wire sizes is strongly recommended. Additional consideration maybe necessary to eliminate excessive voltage drops in wiring. See Appendix A “Soldering Tips” for soldering techniques.

Power:

- Only clean regulated 12-24VDC power supplies should be used.
- It is acceptable to use multiple power supplies such as one in the console and another in the chamber. The negative sides of each power supply must be connected together Note there is a common negative that runs through the serial data cable and is usually suitable for this purpose. A separate negative wire is required when large currents are passing between the power supplies. It is not recommended to have more than one power supply's negative terminal tied to earth ground. If it is permissible with local codes we recommend not connecting any negative terminals to earth ground; this is to minimize the risk of damage due to a direct lightning strike.
- Daisy chaining of power connections is not recommended. Each board's power and chest returns should be routed individually to a common buss.
- **Due to risk of accidental shorting wires should not be routed beneath boards.**

Fusing:

The use of fuses to protect all electrical circuits from accidental shorting and compliance with the local NEC (National Electric Code) guide lines is highly recommended.

Board Layout Suggestions

Syndyne system boards can be mounted in many different locations, with different spacings and layouts. Syndyne offers wiring solutions that prewire boards to customer specifications. The majority of these installations follow similar specifications. We studied these similarities to offer suggestions on board layout. We suggest that all boards be spaced at least 1/2” between edges without connectors and at least 2” between edges with connectors. This will leave sufficient room for wiring to exist between boards without lack of room. It also provides enough room in the event that additional wires must be added after original wiring has been completed. Providing enough room prevents mistakes such as routing wires underneath boards.

DATA CABLE:

Data Cable is used to transfer note, stop, expression and other information from the console to the organ chamber. It can travel 500 feet or more without loosing integrity. All Data cables greater than 2' in length should be made from a CAT-5 26 AWG cable. See figure 4.2 “Data Cable Connections” for a connection diagram. If an LS2406K Remote Start Board is being used, the data cable must first be plugged into the LS2406K and can then daisy chain through the driver boards. For more information on the LS2406K see page 1-11 in the System Overview Section

MULTIPLE CONSOLES

The Serial-In connection on the LS2400K board is available for the operation of two separate consoles on the same organ. The Serial-Out from the LS2400K in the first console is connected to the Serial-In of the LS2400K in the second console. The Serial-Out from the second console is then connected to the Chamber. Organ stops, shade and tremolo controls that are shared between the consoles must be connected identically to each LS2400K board.

“T” CONNECTIONS

Never create a "T" connection when making a data cable. Instead, use two data cables, see figure 4.3 “T Connection,” or use wall jacks at both ends of the chamber data cable so that the console can be plugged into two different locations, see figure 4.4 “Multiple Connections.” It is necessary to have a Remote Start Board (LS2406K) for each data cable plug-in location when using the remote start feature with multiple console locations. For more information on the LS2406K see page 1-11 in the System Overview Section. If a third wall jack is required an LS2410K repeater board can be used to create the three jacks without creating a T connection, see figure 4.5 “LS2410K Serial Repeater” and page 1-12 on the LS2410K in the System Overview Section for further detail.

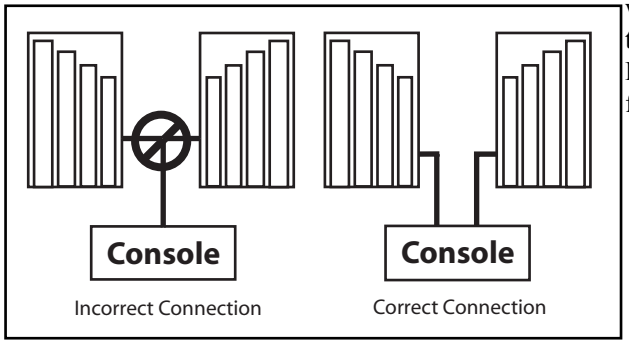

Figure 4.2 “T Connection”

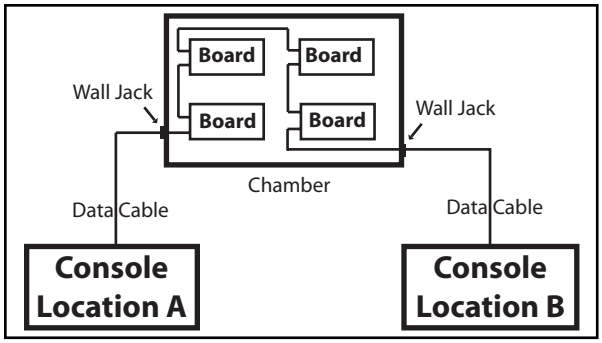

Figure 4.3 “Multiple Connections”

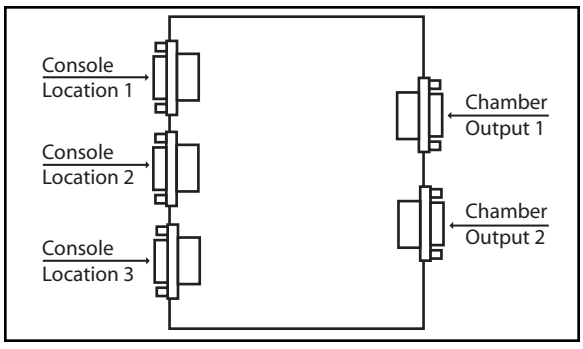

Figure 4.4 “LS2410K Serial Repeater”

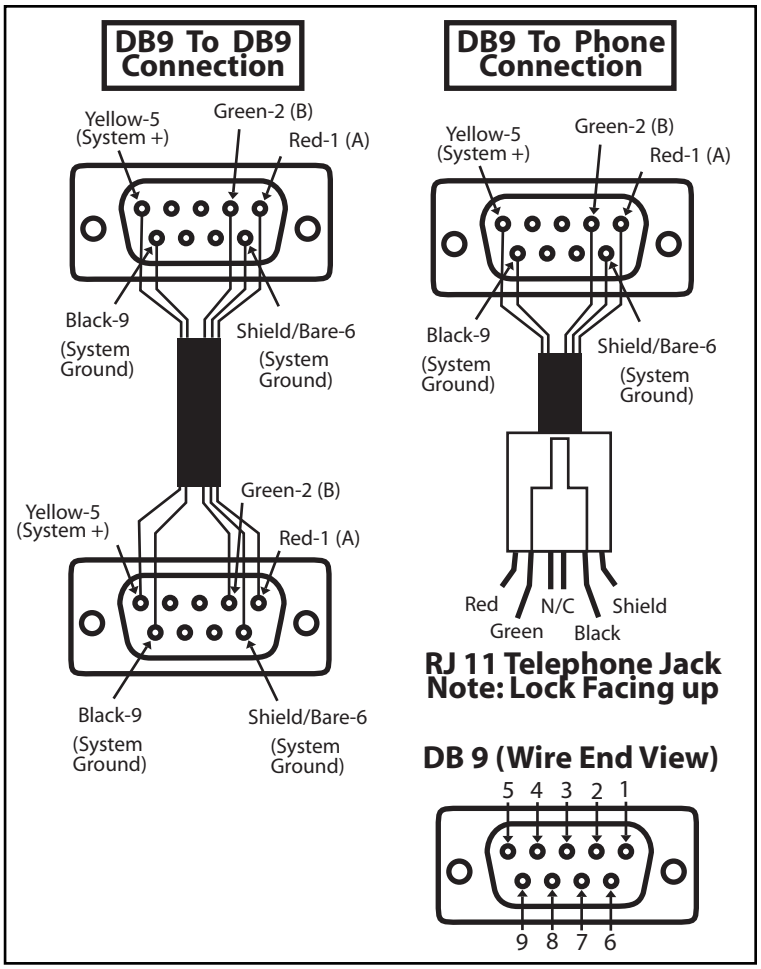

Figure 4.1 “Data Cable Connections”

Wiring Standard Ranks And Chests

When wiring Ranks and Chests, there are three pipe driver boards offered by Syndyne. The LS2449K is for ranks of 49 notes or less. The LS2473K is for ranks from 50 notes to 73 notes. The LS2497K is for ranks from 74 notes to 97 notes. Syndyne also offers an LS2425K specifically for driving AC chimes. See page 4-6 for more information on wiring chimes.

The wiring technique is the same for each of these boards when wiring standard ranks and chests. Wire the lowest note to pin 1 on the driver board and the second lowest note to pin 2. Continue wiring in this fashion until all pipes are wired into the driver board. Seven stop line drivers labeled S1-S7 are available on each driver board to turn on various devices such as stop lines. Borrowing, unifying, and coupling are usually accomplished in system programming. This means that each rank can have its own individual driver board, eliminating the need to wire ranks to multiple driver boards. For more information on programming see the Chamber Programming Section.

Wiring Ranks And Chests for Specific Uses

Syndyne has developed these boards to support an easy and less expensive installation for many different types of ranks and chests. The following information explains wiring to these different types of chests.

Wiring Offset Chests

When wiring an Offset Chest, Syndyne driver boards can be programmed to partition outputs into one and/or two octave sections. See section labeled "Chamber Programming" for Offset Chest Programming Information. Each section of outputs can be used to drive a different offset chest, using different stops and division of keying. Wire each offset chest to their respective section of outputs starting with the lowest pitch from the chest on the first output in that section and end with the highest pitch wired to the last used output in that chests section. If the offset has fewer pipes then outputs in that section, the higher outputs from that section are left unconnected.

Wiring Primaries on a Main Chest

A main chest has multiple ranks of pipes with one primary note magnet for each pitch and a stop line driver for each rank. Syndyne systems can drive Main chests that are pitman, slider or other actions. The LS2473-7K has seven programmable outputs, labeled S1 - S7 that can be used to operate stop line magnets, see figure 4.5 “Main Chests” for a diagram. See section Chamber Programming for programming information. See also page 1-8 in the System Overview Section for more information on Syndyne driver boards.

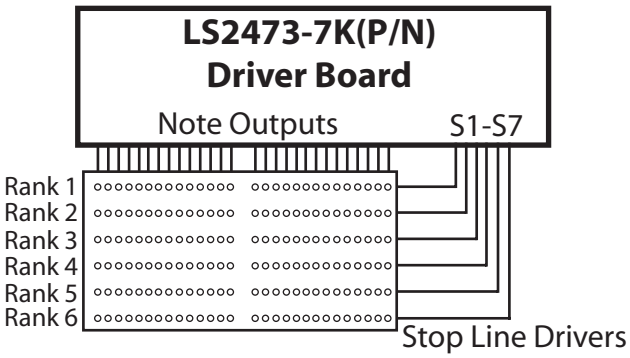

Figure 4.5 “Main Chests”

Wiring Unit Ranks as a Main Chest

It is possible to use an LS2473-7KH to drive up to 6 unit ranks of note magnets when all ranks are only used as straight ranks (no borrowing or unification). This lowers equipment cost. The LS2473-7KH driver board is capable of driving 2 Amps per output (instead of our standard 0.6 Amp outputs) which equates to 6 each 40 ohm magnets on a 15VDC supply. In addition to one LS2473-7KH board you will need 4 of our LS2408K diode isolator boards (2 required for each 3 ranks). The LS2408K boards are plugged onto the outputs of the LS2473-7KH board. Controlling an LS2404K Output Boost Board with 6 of the 7 stop outputs on the LS2473-7HK board provides a way to switch chest returns to operate as stop line drivers, see figure 4.6 “Straight Ranks” for a diagram. Each of the LS2404K outputs are capable of switching 4Amps and can be paralleled together to further increase their current switching capacity. For more information on the LS2404K see page 1-10 in the System Overview Section. For more information on the LS2408K see page 1-11 in the System Overview Section.

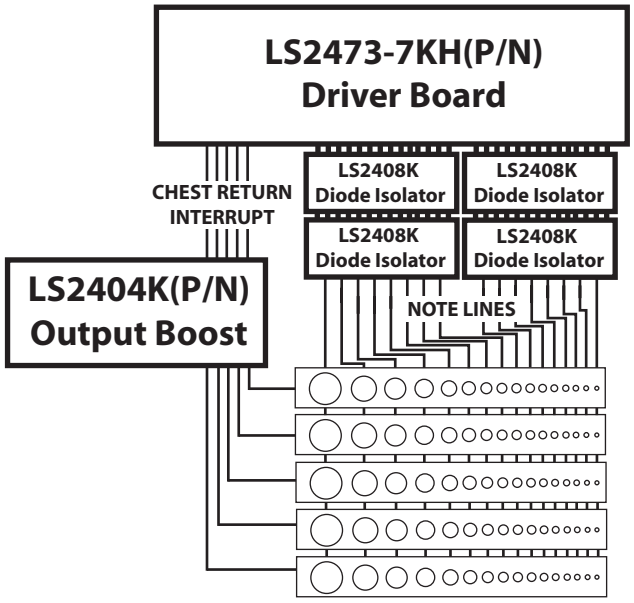

Figure 4.6 “Straight Ranks”

Wiring a Dichromatic Chest

Customers requested an easier method for wiring a dichromatic rank. Now syndyne driver boards support wiring dichromatic in two ways. The driver board can be wired just as with any other rank, with the lowest pitch wired to the first output and the highest pitch wired to the highest used output. The driver board can also be wired using Auxiliary Programming Unit # 13. See page 5-6 in the Chamber Programming Section for more information on Auxilary programming Unit 13.

Auxiliary Programming Unit-13 reassigns the driver board output order into two sections, even notes and odd notes. The lower half of outputs plays the even numbered notes and the upper half plays the odd numbered notes. See example and figure 4.7 “Dichromatic” for a diagram showing individual note assignments. Note that this Auxiliary unit does not select the pitch to be played. It only rearranges the outputs to simplify wiring to a dichromatic rank. Every stop programmed to play on this rank will have to be programmed twice, once for the pitch and then once in Auxilliary Mode #13.

- LS2449-7K even notes on outputs 1-24 & Odd notes on outputs 25-49
- LS2473-7K even notes on outputs 1-36 & Odd notes on outputs 37-73
- LS2497-7K even notes on outputs 1-48 & Odd notes on outputs 49-97

Example-1 LS2449-7K (49 note driver) at Unison pitch.
Output-25 - CCC
Output-1 - CCC#
Output-26 - DDD
Output-2 - EEEb
Output-27 - FFF
Output-3 - FFF#
Output-28 - GGG
Output-4 - AAA
Output-29 - BBBb
Output-5 - BBB
Output-30 - CC . . .

Example-2 LS2473-7K (73 note driver) at Unison pitch.
Output-37 - CCC
Output-1 - CCC#
Output-38 - DDD
Output-2 - EEEb
Output-39 - FFF
Output-3 - FFF#
Output-40 - GGG
Output-4 - AAA
Output-41 - BBBb
Output-5 - BBB
Output-42 - CC . . .

Example-3 LS2497-7K (97 note driver) at Unison pitch.
Output-49 - CCC
Output-1 - CCC#
Output-50 - DDD
Output-2 - EEEb
Output-51 - FFF
Output-3 - FFF#
Output-52 - GGG
Output-4 - AAA
Output-53 - BBBb
Output-5 - BBB
Output-42 - CC . . .

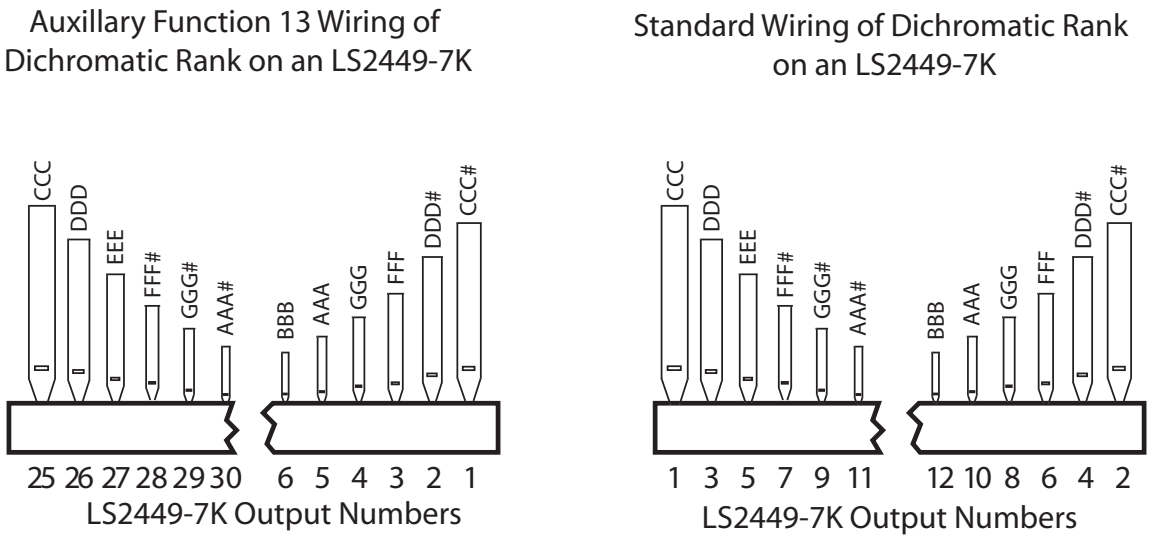

Figure 4.7 “Dichromatic”

Wiring Shades

Expression Using The LS2405K Swell Shade Driver

The LS2405K Shade/Stop Driver Board has twenty-four outputs that can be programmed to drive either a 16 Stage Swell Engine, 4-Tremolos, 2-Accessory Stops and 2-Utility outputs, or 24 Stop lines. When using the LS2405K wire each shade stage to the shade number outputs on the LS2405K. If an expression shoe is equipped with a Potentiometer and there are less than 16 stages in the swell engine then it is necessary to skip some of the Expression outputs in order get the full range out of the expression shoe. For more information on the LS2405K see page 1-10 in the System Overview Section.

Expression Using The LS2407K and Arndt Swell Engine

Wire power to the large terminal block on the LS2407K Wire the Digital Inputs 2 through 8 to the S1-S7 Outputs on any one of the pipe driver boards (Wire S1 to Digital Input 2, Wire S2 to Digital Input 3, ... Wire S7 to Digital Input 8). Wire the "A" terminal of the Arndt control board to the "P" terminal of the LS2407K. Wire the "B" terminal of the Arndt control board to the "G" terminal of the LS2407K. Wire the "C" terminal of the Arndt control board to the "W" terminal of the LS2407K. For more on the LS2407K see page 1-11 in the System Overview Section.

The LS2407K was designed specifically for the Arndt Swell Engine, but it is flexible enough to potentially operate other analog input devices. Consult with the factory for your unique application.

Wiring Chimes

The LS2425-7K has two terminal blocks for connection to both AC and DC power. Connect DC Power to the connector labeled "12-28 VDC." Connect AC **COMMON only** to the connector labeled "AC-COMMON 36VAC MAX." **DO NOT** connect both sides of the AC transformer to the "AC-COMMON 36VAC MAX," connector. Doing so will short the AC transformer causing possible damage to either the transformer or other equipment. After Connecting AC and DC to the LS2425-7K, connect the lowest pitch chime to the first output on the LS2425-7K. Connect the chimes until you reach the highest pitch on the highest ouptut used on the LS2425-7K. In some cases it may be necessary to skip some of the lower outputs when using chimes with less than 25 notes. For more information on the LS2425-7K see page 1-13 in the System Overview Section.

DO NOT Connect both sides of the AC Power supply to the "AC-COMMON 36VAC MAX," connector. Doing so will short the AC power supply causing possible damage to either the transformer or other equipment.

Wiring Remote Start

The LS2406K Remote Start Board has two 20 Amp relays which are energized 3 seconds apart upon powering the console. Simply wire the two relays to the devices you want to start at console power up. Attach the Remote start to the Data Cable entering the chamber. The LS2406K must be connected to the Serial Data line from the console before any other boards are connected to the Serial Data Line. It may be necessary to use more than one LS2406K board if there are multiple console plug-ins. Refer to page 4-3 for more information on working with Serial Data Cables. For more information on the LS2406K see page 1-11 in the System Overview Section.

CHAMBER PROGRAMMING

Programming with Binary Numbers

The LS5600K System uses DIP Switches to perform programming with binary numbers. Binary is the basic language used by computers. The world we know generally uses the decimal system which uses numbers 0-9 while binary uses only 1 and 0. In a decimal system each place in a number is ten times greater then the place to the right. In the binary system each place is two times greater then the place to the right. Two hundred thirty one in decimal is a 2 in the hundreds place, 3 in the tens place, and 1 in the single place, or 231. In binary, two hundred thirty would be 11100111, or 1 + 2 + 4 + 32 + 64 + 128 = 231. In order to make conversion from decimal to binary numbers two examples are given below.

Example 1:

An easy method of binary programming is the subtraction method. When programming 218 in binary, turn on the largest binary switch that is less then 218. This means turning on 128. Next subtract 128 from 218, which leaves 90. Next, turn on the largest binary switch that is less then the remainder 90, which is 64. Subtract 64 from 90, which leaves 26. Continuing the process, select the largest binary switch that is less then the remainder 26, which is 16. Subtract 16 from 26, which leaves 10. Turn on the largest binary number that is less then the remainder 10, which is 8. Subtract 8 from 10, which leaves 2. The process is ended by turning on the binary switch which equals the remainder, which in this case is turning on switch 2. Subtract 2 from 2, which leaves no remainder. In summary, the binary switches turned on to equal 218 are: 128 + 64 + 16 + 8 + 2 = 218. Figure 5.1 “Binary Switches 218” shows a set of DIP Switches set to 218.

218
− 128 ← ON
90

90
− 64 ← ON
26

26
− 16 ← ON
10

10
− 8 ← ON
2

2
− 2 ← ON
0

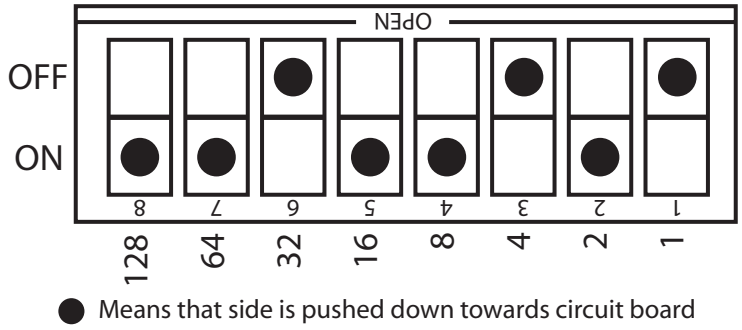

Figure 5.1 “Binary Switches 218 ”

Example 2:

Here is another example of using the subtraction method. When programming the number 62, turn on the largest binary switch that is less then 62, which is 32. Subtract 32 from 62, which leaves 30. Turn on the largest binary switch that is less then the remainder 30, which is 16. Subtract 16 from 30, which leaves 14. Turn on the largest binary switch less then the remainder 14, which is 8. Subtract 8 from 14, which leaves 6. Turn on the largest binary switch less then the remainder 6, which is 4. Subtract 4 from 6, which leaves 2. Turn on the binary switch that is equal to the remainder, which is 2. Subtracting 2 from 2 leaves no remainder. In summary, the binary switches turned on to equal 62 are: 32 + 16 + 8 + 4 + 2 = 62. Figure 5.1 “Binary Switches 62” shows a set of DIP Switches set to 62.

62
− 32 ← ON
30

30
− 16 ← ON
14

14
− 8 ← ON
6

6
− 4 ← ON
2

2
− 2 ← ON
0

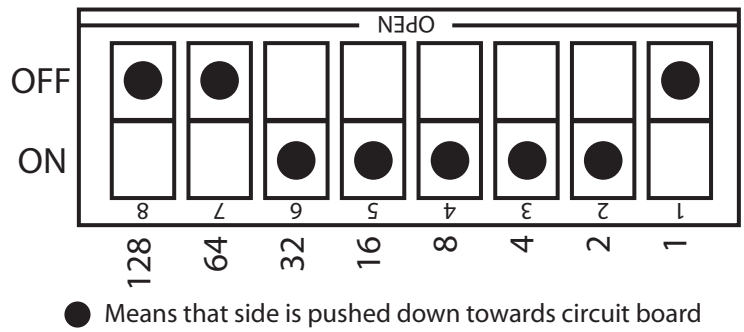

Figure 5.2 “Binary Switches 62”

Programming Stop Outputs On The LS2425/49/73/97-7K Driver Boards

Stop Outputs S1-S7 can be programmed to operate in several different modes, see table 5.1 “Stop Unit Type” for detail.
Each Driver Board's programming can be documented using the Pipe and Rank Information Form in the Forms Section of this Manual

Things to remember:

- *To enter numbers through the DIP switches set the switches ON that will add up to equal the desired number.*
- *References to Stop Numbers are referring to the numbered Stop Sense inputs of the LS5600K.*
- *For more information on Binary Programming See page 5-2*

Procedure:

1. Turn on the organ.
2. On the Program Mode Dip Switches, see figure 5.3 “Driver-Board-Programming-DIPs,” set the STOPS Switch to ON(closed) The AUX., NOTES and RESET Switches must be OFF (open).
3. (optional) To clear all Stop memory set the RESET switch to ON and press the Program Set Button. Set the PGM RESET switch to OFF, wait approximately 5 seconds for the Stop memory to be erased and then proceed to the next step.
4. Set the Division Number Dip Switches to equal the division number that the Console Stop is in (Pedal/Divison-1; Great/Division-2; Swell/Division-3 and Choir/Division-4 …).
5. Set the Stop Number Dip Switches to desired Stop number.
6. Set the Unit Number Dip Switches to desired Unit number. For a list of Stop Unit Numbers see table 5.1 “Stop Unit Type.”
7. Press the PROGRAM SET button.
8. Repeat steps 4-7 until all applicable Stops are programmed.
9. On the Program Mode DIP Switches, set the STOPS switch to OFF; programming is complete.

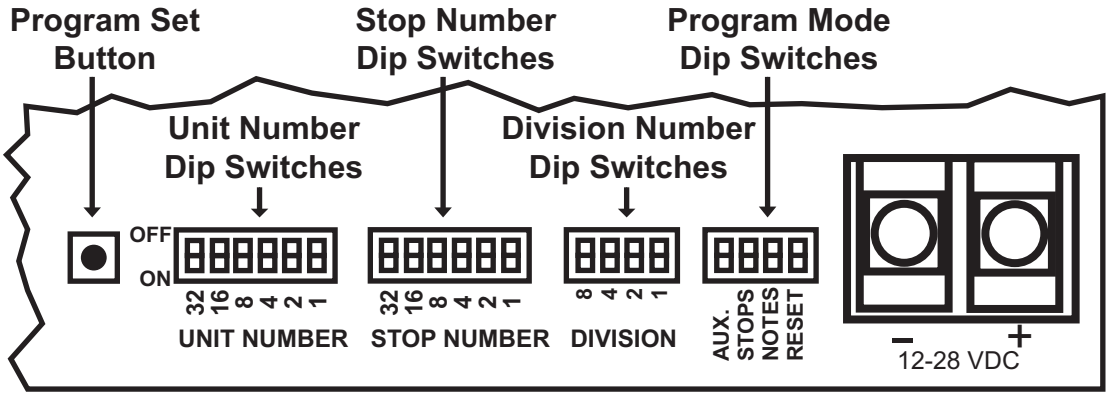

Figure 5.3 “Driver-Board-Programming-DIPs”

Stop Unit Type Program Functions Table

Unit #	Description:
0	Undefined
1	Stop Output-1 (S1)
2	Stop Output-2 (S2)
3	Stop Output-3 (S3)
4	Stop Output-4 (S4)
5	Stop Output-5 (S5)
6	Stop Output-6 (S6)
7	Stop Output-7 (S7)

* Each Output (S#) Assignable to any/all organ stops.
* One Output (S#) per organ Stop

Unit #	Description:
8	Undefined
9	Trap Output-1 (S1)
10	Trap Output-2 (S2)
11	Trap Output-3 (S3)
12	Trap Output-4 (S4)
13	Trap Output-5 (S5)
14	Trap Output-6 (S6)
15	Trap Output-7 (S7)
16-63	Undefined

Table 5.1 “Stop Unit Type”

Expression Unit Type Program Functions Table with Division # & Stop # Set To Zero

Unit #	Description:
8	Undefined
9	Expression-1
10	Expression-2
11	Expression-3
12	Expression-4

* Stop Outputs Become a 7 bit binary Expression Output

Table 5.2 “Expression Unit Type”

Programming Note Outputs On The LS2425/49/73/97-7K Driver Boards

Each Driver Board can be programmed to play any/every stop in the organ console at any of the specified pitches, see Table 5.3 “Notes Unit Type” on page 5-5 for more details. Each Driver Board's programming can be documented using the Rank and Stop Information Form in the Forms Section of this manual.

Things to remember:

- *To enter numbers through the DIP switches set the switches ON that will add up to equal the desired number.*
- *References to Stop Numbers are referring to the numbered Stop Sense inputs of the LS5600K.*
- *For more information on Binary Programming See page 5-2*

Procedure:

1. Turn on the organ.
2. On the Program Mode Dip Switches set the NOTES switch to ON (closed). The AUX., STOPS and RESET Switches must be OFF (open).
3. (optional) To clear all Note memory set the RESET switch to ON and press the Program Set Button. Set the RESET switch to OFF, wait approximately 5 seconds for the Note memory to be erased and then proceed to the next step.
4. Set the Division Number Dip Switches to equal the division number that the Stop is in (Pedal/Divison-1; Great/Division-2; Swell/Division-3 and Choir/Division-4 …).
5. Set the Stop Number Dip Switches to desired Stop number.
6. Set the Unit Number Dip Switches to the desired Unit number. For a list of Note Unit Numbers see table 5.3 “Note Unit Types” on page 5-5.
7. Press the Program Set Button.
8. Repeat steps 4-7 until all applicable Stops are programmed.
9. Set the NOTES switch to OFF; programming is complete.

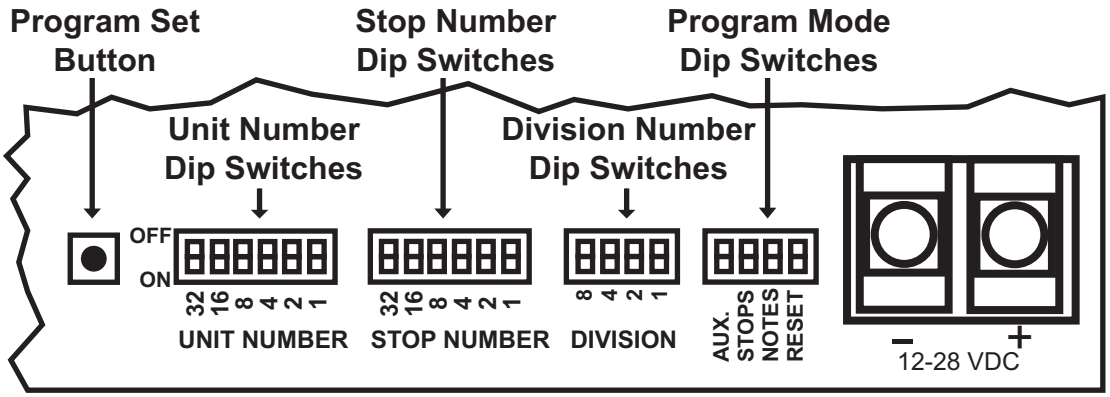

Figure 5.4 “Driver-Board-Programming-DIPs”

Note Unit Type Table

Unit #	Description:
0	Erase Unit From Stop Number
1	Sub Unison T.C.
2	Unison T.C.
3	Unison
4	Unison - Bottom Octave Only
5	Fifth
6	Fifth - Bottom Octave Only
7	Eighth (Octave)
8	Tenth
9	Twelfth
10	Fifteenth
11	Seventeenth
12	Nineteenth
13	Twenty First
14	Twenty Second
15	Twenty Fourth
16	Twenty Sixth
17	Twenty Eight
18	Twenty Ninth
19	Mixture Unisons from 8' Rank
20	Mixture Unisons from 8' Rank
21	Mixture Unisons from 8' Rank
22	Mixture Unisons from 8' Rank
23	Synthetic Mixture 5ths from 8' Rank

Unit #	Description:
24	Synthetic Mixture 5ths from 8' Rank
25	Synthetic Mixture 5ths from 8' Rank
26	Synthetic Mixture 5ths from 8' Rank
27	Mixture 5ths from 2-2/3' Rank
28	Mixture 5ths from 2-2/3' Rank
29	Mixture 5ths from 2-2/3' Rank
30	Mixture 5ths from 2-2/3' Rank
31	Eighth - Bottom Octave Only
32	Thirteenth & 1/2
33	Sixteenth
34	Sixth & 1/2
35	Ninth
36	Third
37	Unison 2nd Octave Only
38	Mixture for 2-2/3' Rank
39	Mixture for 2' Rank
40	Sub 12th
41	Resultant, Unison & fifth - Bottom Octave & Sub - Unison from T.C.
42	Resultant, fifth - Bottom Octave & Sub - Unison from T.C.
43	Resultant, Unison & Bottom Octave & Sub - Unison from T.C.
44	Thunder Bottom 5 Notes

Unit #	Description:
45	15th Bottom Octave Only
46	Unison from C# 5
47	Sub - Unison from C# 5
48	Undefined
49	Undefined
50	Undefined
51	Undefined
52	Undefined
53	Undefined
54	Undefined
55	Undefined
56	Undefined
57	Undefined
58	Undefined
59	Undefined
60	Undefined
61	Undefined
62	Undefined
63	Undefined

* If Stop Number is set to 0, driver will play without a stop

Table 5.3 "Notes Unit Type"

Mixture Unisons Derived from 8' Rank

Binary #	1-12 Notes	13-24 Notes	25-36 Notes	37-48 Notes	49-61 Notes
19	15th	8th & 15th	8th	Unison & 8th	Unison
20	15th & 22nd	15th	8th & 15th	8th	Unison & 8th
21	22nd	15th & 22nd	15th	8th & 15th	8th
22	22nd & 29th	22nd	15th & 22nd	15th	8th & 15th

Synthetic Mixture Fifths Derived from 8' Rank

Binary #	1-12 Notes	13-24 Notes	25-36 Notes	37-48 Notes	49-61 Notes
23	12th & 19th	12th	5th & 12th	5th	Sub 5th & 5th
24	19th	12th & 19th	12th	5th & 12th	5th
25	19th & 26th	19th	12th & 19th	12th	5th & 12th
26	26th	19th & 26th	19th	12th & 19th	12th

Mixture Fifths Derived from 2-2/3' Rank

Binary #	1-12 Notes	13-24 Notes	25-36 Notes	37-48 Notes	49-61 Notes
27	Unison & 8th	Unison	Unison & Sub 8th	Sub 8th	Sub 8th & Sub 15th
28	8th	Unison & 8th	Unison	Unison & Sub 8th	Sub 8th
29	8th & 15th	8th	Unison & 8th	Unison	Unison & Sub 8th
30	15th	8th & 15th	8th	Unison & 8th	Unison

Synthetic Mixture Derived from 2-2/3' Rank at Uneven Intervals

Binary #	1-12 Notes	13-24 Notes	25-36 Notes	37-48 Notes	49-61 Notes
27	Unison	Unison & 8th	8th	Unison	Unison & Sub 8th

Programming Auxiliary Functions On The LS2425/49/73/97-7K Driver Boards

Auxiliary Units are special Note Output Units and can be programmed to play any (every) stop in the organ console and in conjunction with regular Note Units, see table 5.4 "Auxillary Unit Type" for more details. Each Driver Board's programming can be documented using the Rank and Stop Information Form in the Forms Section of this Manual.

Things to remember:

- *To enter numbers through the DIP switches set the switches ON that will add up to equal the desired number.*
- *References to Stop Numbers are referring to the numbered Stop Sense inputs of the LS5600K.*
- *For more information on Binary Programming See page 5-2*

Procedure:

1. Turn on the organ.
2. On the Program Mode DIP Switches set the AUX. switch to ON(closed). The STOPS, NOTES and RESET Switches must be OFF (open).
3. (optional) To clear all Aux. memory set the RESET switch to ON and press the PROGRAM SET button. On the Program Mode DIP Switches set the RESET switch to OFF, wait approximately 5 seconds for the Aux memory to be erased and then proceed to the next step.
4. Set the Division Number Dip Switches to equal the division number that the Console Stop is in (Pedal/Divison-1; Great/Division-2; Swell/Division-3 and Choir/Division-4 …).
5. Set the Stop Number Dip Switches to desired Stop number.
6. Set the Unit Number Dip Switches to desired Unit number. For a list of Auxillary Function Unit Types see table 5.4 "Auxillary Unit Types."
7. Press the PROGRAM SET button.
8. Repeat steps 4-7 until all applicable Stops are programmed.
9. On the set the AUX switch to OFF; programming is complete.

Auxillary Unit Type Table

Unit #	Description:
0	Erase Unit From Stop Number
1	Unison 1st Octave Only (12 Notes)
2	8th - 2nd Octave Only (12 Notes)
3	15th - 3rd Octave Only (12 Notes)
4	22nd - 4th Octave Only (12 Notes)
5	Unison 1st & 2 Octaves Only (24 Notes)
6	15th - 3rd & 4th Octaves Only (24 Notes)
7	29th - 5th Octave Only (12 Notes)
8	36th - 6th Octave Only (12 Notes)
9	43rd - 7th Octave Only (12 Notes)
10	50th - 8th Octave Only (13 Notes)
11	Foldback notes above 97 - 1 Octave
12	Foldback notes above 97 - 2 Octaves
13	Dichromatic - Even numbered keys play Outputs: (LS2449K)1-24, (LS2473K)1-36, (LS2497K)1-48. Odd Numbered keys play Outputs: (LS2449K)25-49, (LS2473K)37-73, (LS2497K)49-97
14	Foldback Notes above 73 - 1 Octave
15	Foldback Notes above 61 - 1 Octave
16	Foldback Notes above 49 - 1 Octave
17	36th-1/2 - 6th Octave Only
18-63	Undefined

* Assignable to any Stop in any Division
* Last offset Octave of Board is 13 notes.

Table 5.4 "Auxillary Unit Type"

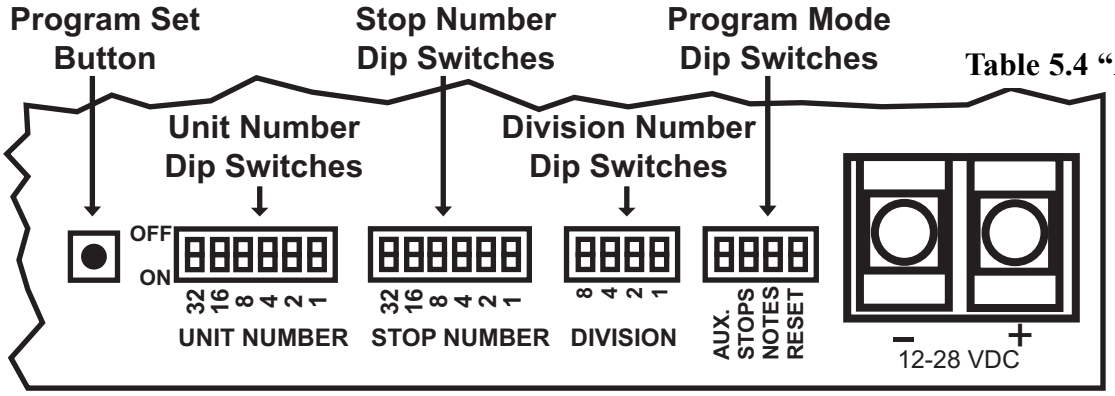

Figure 5.5 "Driver-Board-Programming-DIPs"

LS2405K Shade/Stop Driver Board

The LS2405K Shade/Stop Driver Board has twenty-four outputs that can be programmed to drive either 24 Stop lines or a 16 Stage Swell Engine, 4-Tremolos, 2-Accessory Stops and 2-Utility outputs. The 24 Stop outputs have to all be in the same division and have to be either Stops 1-24 or Stops 25-48.

Things to remember:

- To enter numbers through the DIP switches set the switches ON that will add up to equal the desired number.
- References to Stop Numbers are referring to the numbered Stop Sense inputs of the LS5600K.

Procedure to configure as a Shade Driver Board:

1. Turn on the organ.
2. Set all switches to the OFF (open) position.
3. Set the SHADE ADDRESS to one of the following combinations
   a. 1 for Expression-1
   b. 2 for Expression-2
   c. 3 for Expression-3
   d. 4 for Expression-4
4. Configuration is complete.

Note: If the shade action is backward the
INVER SHADE ACTION switch can be set to ON to invert the shade action.

Procedure to configure as a Stop Driver Board:

1. Turn on the organ.
2. Set all switches to the OFF (open) position.
3. Turn ON the MODE switch - select Stop Driver mode.
4. Set the DIVISION ADDRESS to one of the following combinations:
   a. 1 for Division-1
   b. 2 for Division-2
   c. 3 for Division-3
   d. 4 for Division-4
   e. 5 for Division-5
   f. 6 for Division-6
   g. 7 for Division-7
   h. 8 for Division-8
5. To select Stops 25-48 turn the STOPS switch to ON.
6. Configuration is complete.

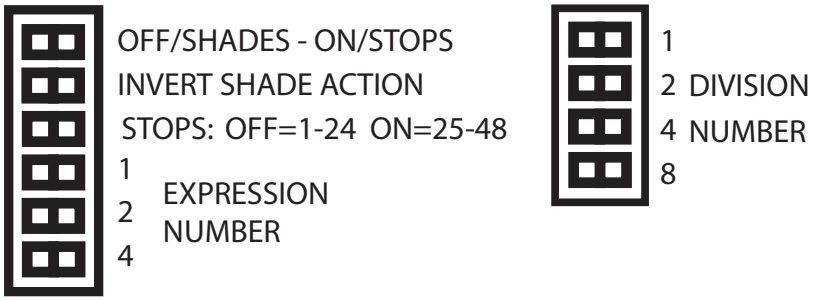

Figure 5.6 “LS2405K Programming”

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SYSTEM FORMS

SYNDYNE SYSTEM FORMS OVERVIEW

The forms included in this section are meant to simplify the installation and programming process. The forms will also provide a reference for the installation of this Syndyne System. If any questions arise at this installation or there are requests for additions to this installation these forms will simplify future additions and troubleshooting. These forms will also simplify any questions or help you may need from Syndyne. Syndyne suggests copies of these forms be left at the installation site and with the parties responsible for the service and additions to this installation, as well as the originals being kept for the Builders records..

INSTALLATION SITE AND SYSTEM INFORMATION FORM

Company Information

Company Name: _____ _____
Builder Name: _____ _____
Address: _____ _____
_____ _____
_____ _____
City/State/Zip: _____ _____ _____
Phone: _____ Fax: _____ Email: _____

Customer Information

Company Name: _____ _____
Builder Name: _____ _____
Address: _____ _____
_____ _____
_____ _____
City/State/Zip: _____ _____ _____
Phone: _____ Fax: _____ Email: _____

Project Information

Opus #: _____ Quote #: _____ P.O. Number: _____
New Project: □ Rebuild Project: □ Addition: □
Other: □
Project Description: _____ _____
_____ _____
_____ _____
Total Number of Divisions _____ *Total Number of Stops _____
Division 1 (Name) _____ *Number of Stops _____
Division 2 (Name) _____ *Number of Stops _____
Division 3 (Name) _____ *Number of Stops _____

*This number includes Couplers

SYSTEM SERIAL NUMBER REFERENCE FORM

This form provides a quick reference and record of all Syndyne equipment at this installation site. In the case of questions arising from future service or additions to this installation, this form will ensure a speedy reference process. Having the serial number and part number in a convenient location will increase the speed and efficiency of any correspondence with Syndyne regarding this installation.

Part #:		Serial #:		Part #:		Serial #:	
Part #:		Serial #:		Part #:		Serial #:	
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Part #:		Serial #:		Part #:		Serial #:	
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SYSTEM CONFIGURATION AND ORGAN SPECIFICATION FORM

Rank Name / Stop Name	Notes	Low Note	Division #	Stop Input #	Unit/ Coupler #	Crescendo Step C1	Crescendo Step C2	Remarks

For an explanation of this form, please see page 6-14

SYSTEM CONFIGURATION AND ORGAN SPECIFICATION FORM

Rank Name / Stop Name	Notes	Low Note	Division #	Stop Input #	Unit/ Coupler #	Crescendo Step C1	Crescendo Step C2	Remarks

For an explanation of this form, please see page 6-14

SYSTEM CONFIGURATION AND ORGAN SPECIFICATION FORM

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For an explanation of this form, please see page 6-14

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Rank Name / Stop Name	Notes	Low Note	Division #	Stop Input #	Unit/ Coupler #	Crescendo Step C1	Crescendo Step C2	Remarks

For an explanation of this form, please see page 6-14

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For an explanation of this form, please see page 6-14

SYSTEM CONFIGURATION AND ORGAN SPECIFICATION FORM

Rank Name / Stop Name	Notes	Low Note	Division #	Stop Input #	Unit/ Coupler #	Crescendo Step C1	Crescendo Step C2	Remarks

For an explanation of this form, please see page 6-14

SYSTEM CONFIGURATION AND ORGAN SPECIFICATION FORM

Rank Name / Stop Name	Notes	Low Note	Division #	Stop Input #	Unit/ Coupler #	Crescendo Step C1	Crescendo Step C2	Remarks

For an explanation of this form, please see page 6-14

SYSTEM CONFIGURATION AND ORGAN SPECIFICATION FORM

Rank Name / Stop Name	Notes	Low Note	Division #	Stop Input #	Unit/ Coupler #	Crescendo Step C1	Crescendo Step C2	Remarks

For an explanation of this form, please see page 6-14

SYSTEM CONFIGURATION AND ORGAN SPECIFICATION FORM

Rank Name / Stop Name	Notes	Low Note	Division #	Stop Input #	Unit/ Coupler #	Crescendo Step C1	Crescendo Step C2	Remarks

For an explanation of this form, please see page 6-14

SYSTEM CONFIGURATION AND ORGAN SPECIFICATION FORM

Rank Name / Stop Name	Notes	Low Note	Division #	Stop Input #	Unit/ Coupler #	Crescendo Step C1	Crescendo Step C2	Remarks

For an explanation of this form, please see page 6-14

System Configuration and Organ Specification Example Form

Rank Name / Stop Name	Total Notes	Low Note	Division (#)	Stop Input #	Unit/ Coupler #	Crescendo Step C1	Crescendo Step C2	Remarks
[1] Principal 8'	**[3]** 73	**[4]** CC						Unit Rank Located in the Great Organ
[2] Principal 8'			**[5]** Great (2)	**[6]** 1	**[7]** U 3	**[8]** 1-60	1-60	
Octave 4'			Great (2)	2	U 7	41-60	41-60	
Subbass 16'	97	CCC						
Subbass 16'			Pedal (1)	1	U 3	51-60	51-60	Electro-Pneumatical Main Chest
Gedeckt 8'			Pedal (1)	2	U 7	41-60	41-60	Located in the Great Organ
Koppelflote 4'			Pedal (1)	3	U 10	21-60	21-60	Resultant Derived from single rank
Resultant 32'			Pedal (1)	4	U 41	51-60	51-60	
Gedeckt 8'			Great (2)	3	U 7	31-60	31-60	
Koppelflote 4'			Great (2)	4	U 10	21-60	21-60	
Waldflote 2'			Great (2)	5	U 14	11-60	11-60	
Gemshorn 8'	85	CC						
Gemshorn 8'			Swell (1)	1	U 3	31-60	31-60	Slider Chest
Nasat 1-1/3'			Swell (1)	2	U 12	1-60	1-60	Located in the Swell Organ
Chimes	22	AA#	**[9]** Great (5)	6	U 40			Low note starts at output number 4 Plays from Division 5 (non-coupling mirror of division 2 keys and stops)
Couplers								
Great to Pedal 8'			Pedal (1)	5	C 2			
Swell to Pedal 8'			Pedal (1)	6	C 4			
MIDI on Great	**[10]**	**[11]**	Pedal (1)	7	**[12]**			
Harpsichord	64 OV	+1 Oct	Great (2)	7	121, 0, 7	51-60	51-60	Expression Shoe 2, Minimum Expression =0

[1] Name of the Rank of Pipes [2] Name of the Stop as engraved [3] Total Notes in Rank [4] Lowest Note in Rank [5] Division Name and Number
[6] Stop Input Number on Board [7]U=Unit # C=Coupler #; These reference the programming number [8] Steps of Crescendo where the Stop is ON
[9] For non-coupling stops the Division keying is mirrored to a different division number [10] MIDI On-Velocity [11] MIDI Transposed
[12] Program Change # MSB, LSB, PC
This Example Form is for reference only and does not represent an actual installation. This form is meant for future reference and convenience in servicing Syndyne Systems.

APPENDIX A: SOLDERING TIPS

Wiring the LS2400K can be quick and easy if the proper technique becomes familiar. Although there are many ways to make a solder joint, the wiring team at Syndyne has found a simple method that provides a quality connection as quickly as possible. It is important to remember that as with anything else in life, soldering becomes easier with practice, so it is best not to become discouraged if the process seems difficult in the beginning. Here is the syndyne wiring team's suggested soldering method.

1. Strip the wire or wires that will be used in the solder joint.
2. Place shrink tube on the wire(s) as far away from the bare end of the wire as possible. When soldering, the wire heats up close to the solder joint, and this heat can shrink the shrink tube before it is ready to cover the joint.
3. Use a damp sponge to clean any old solder from the tip of the soldering iron before tinning.
4. Apply some solder to the tip of the soldering iron and place the solder from the tip of the iron to both the bare end of the wire(s) and the connector terminal. This process is called pretinning and is highly recommended for increased speed, accuracy, and joint integrity.
5. Use a damp sponge to clean any old solder from the tip of the soldering iron.
6. Apply solder to the tip of the soldering iron.
7. If single soldering, hold the pretinned wire on the pretinned connector terminal.
   If double soldering, hold both pretinned wires parallel with eachother. Hold both wires on the pretinned connector terminal.
8. Place the tip of the iron on the connector end of the bare wire(s).
8. Once the solder flows over the connection, run the iron over the wire up to the shielded end of the stripped wire. Do not touch the wire shielding with the iron or it may melt.
9. Let the solder joint cool and test its integrity by pulling lightly on both the connector and the wire in opposite directions.
10. Do not pull shrink tube over the solder joint at this time. First, complete all wiring to the connector then pull up and heat the shrink tube for each solder joint all at the same time. Otherwise, the shrink tube from one wire can get in the way when solder ing the wire next to the shrink tube.