USING THE AUTOMATION

Introduction

SPIRIT AUTO offers the budget studio owner a sophisticated automated mixing capability. This allows the kind of mix control that is a familiar feature in today's top end recording studios.

Automation of the console's faders and switches has very real benefits for mixing because instead of having to get a mix right in one pass as you do when mixing manually, automation allows you to approach the mix in a methodical manner. Fine tuning and tweaks can be added with each pass until the perfect mix is reached. Automation also permits complicated mixes, which would normally require the engineer to be assisted by other people, to be created entirely by the engineer. Automation puts control back into the hands of the user with the result that fewer compromises need to be made and options can be kept open for longer.

SPIRIT AUTO allows the automation of tape tracks to be integrated alongside and together with the MIDI automation of synth parameters, such as pan and timbre control in one intelligent and accessible package.

SPIRIT AUTO permits all dynamic Channel fader positions, all Channel On switches and all Monitor On switches to be recorded as events against time and played back at will.

Each Channel fader uses a high quality dBX VCA (Voltage Controlled Amplifier) which controls the level of the signal in the channel. The channel signal is converted to MIDI data by an Analogue to Digital Convertor (ADC) which allows it to be sent to, and read by a controlling computer. Signals generated from the CHANNEL ON and MONITOR ON switches are also converted in this fashion.

Modes of Operation

With any sequencer

Because **SPIRIT AUTO** automation data can be sent by the console as MIDI messages, mixes can be written to and played back from any sequencer.

With optional Steinberg software

Steinberg has custom-written optional automation software specifically for **SPIRIT AUTO** on Atari computers. The program uses an enhanced 8-bit form of MIDI which doubles fader resolution in a package that significantly enhances the automation possibilities of **SPIRIT AUTO**.

With optional J.L.. Cooper software

J.L. Cooper's 'Softmix' package provides dedicated automation software for Apple Macintosh computers. This package also uses an enhanced 8-bit form of MIDI which improves **SPIRIT AUTO**'s performance during automated mixing.

As an unautomated standard mixing console

When not connected to a sequencer, **SPIRIT AUTO** functions as a normal **SPIRIT STUDIO** console. **SPIRIT AUTO** is not reliant on MIDI for its basic functions, such as EQ, or fader levels.

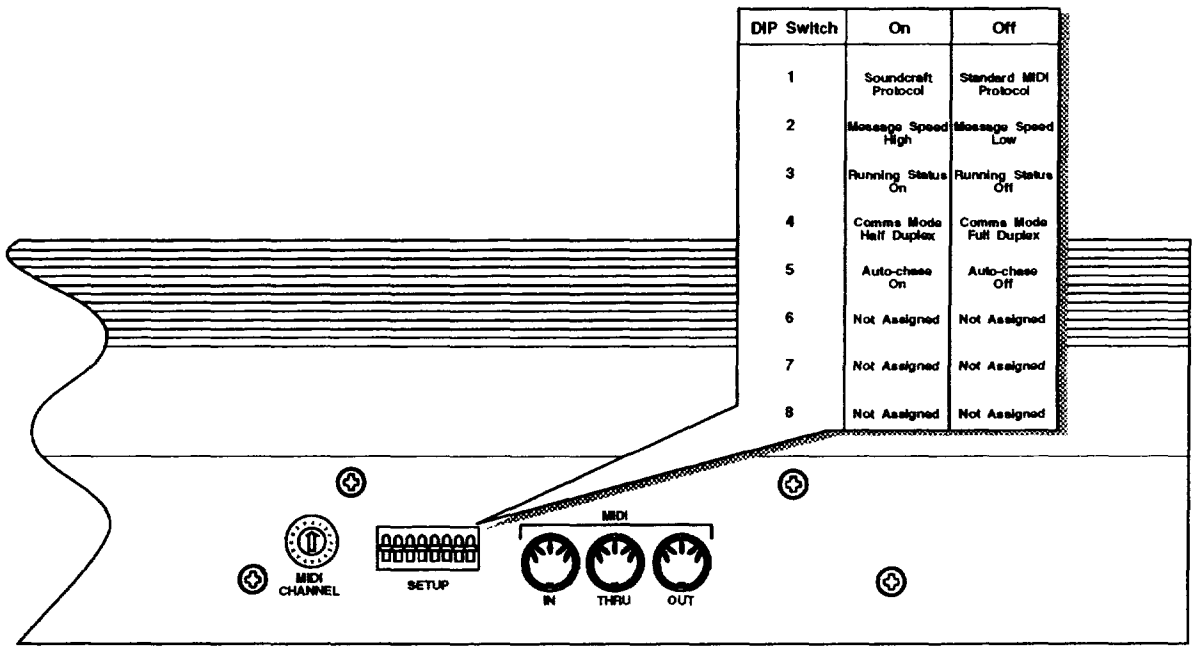
Connections

SPIRIT AUTO's automation capabilities connect to the outside world via MIDI sockets located under the desk's armrest. The MIDI out socket sends MIDI data generated by the console's faders and switches and should be plugged in to the MIDI in of the receiving device, such as an Atari computer. **SPIRIT AUTO**'s MIDI in socket receives data that controls the faders and switches on the desk remotely and should be connected to the MIDI out of the controlling device, such as an Atari computer or MIDI expander.

A MIDI THRU socket is also available, should you want to 'daisy-chain' MIDI equipment without a MIDI expander.

When using timecode being read from a tape track to allow tape synchronised mixing to be performed, SPIRIT AUTO's MIDI out should be merged through your timecode reader. This enables the automation data to be time-referenced to positions on the tape in a manner that is identical to recording keyboard parts into a sequencer when the sequencer is locked to tape. Consult your timecode unit's manual to determine how this is best achieved.

The eight DIP switches positioned next to the MIDI sockets under the armrest regulate how **SPIRIT AUTO** responds to various MIDI functions and decide whether the desk is operating in normal MIDI mode - for use with sequencers - or whether it is running on the Soundcraft protocol that is required when using the optional Steinberg **SPIRIT** Automation program or J.L. Cooper's Softmix. Any changes to the position of these switches only become active when the desk is powered up. The switch functions are shown in the diagram below (switch numbers from the right) :-



To use **SPIRIT AUTO** with a sequencer, all switches (numbered 8 to 1 from left to right) should be Off or down except for switch 4 which should be On. Steinberg **SPIRIT** Automation or J.L. Cooper Softmix program users should set switches 1 - 3 to On and the rest to Off.

DIP Switch Functions

PROTOCOL (switch 1) selects either MIDI protocol or Soundcraft protocol which is required when the console is used with the optional Steinberg **SPIRIT** Automation program or J.L. Cooper's Softmix. In all other cases it should be set to Standard MIDI protocol. When Steinberg's SPIRIT Automation program is loaded **SPIRIT AUTO** recognises the Soundcraft protocol regardless of the DIP switch position.

MESSAGE SPEED (switch 2) dictates how quickly messages are sent out from **SPIRIT AUTO** - when lots of data is a being generated simultaneously there is a risk of clogging up the receiving computer. Use LOW speed with a sequencer unless you encounter timing problems.

RUNNING STATUS (switch 3) increases data transmission speed by leaving out redundant MIDI information in the following way:

MIDI information consists of 3 bytes; a status byte (which describes the message type) and two data bytes. If MIDI messages of the same type, for example NOTE ON/NOTE OFF follow each other in sequence, the status byte is often unnecessary until a new type of message arrives (e.g. MIDI control change message). While **SPIRIT AUTO** can always receive data at its MIDI IN with Running Status the same is not true of all sequencers. Set Running Status OFF with a sequencer unless you detect timing problems. (see glossary on MIDI messages and Running Status.

HALF DUPLEX and **FULL DUPLEX** (switch 4) communications modes are **SPIRIT AUTO**'s equivalent of a keyboard's Local On and Local Off mode respectively. In Half duplex, **SPIRIT AUTO**'s faders and switches respond directly to movements of the desk controls and to incoming MIDI data for instances where the computer's MIDI THRU function is disabled. Full duplex relies on the controlling computer's MIDI THRU function to be On. In this fader and switch movements on **SPIRIT AUTO** pass to the computer, through it and back again in exactly the same way that you would play the sound module of a Local Control Off synth being used as a master keyboard. Please read appendix B and the glossary for fuller details.

When **AUTOCHASE** is On, **SPIRIT AUTO** emits a desk Snapshot every 2 seconds. This allows sequencers that are not able;e to chase Controller data to pick-up mix data quickly when scrolling through a sequence or when winding the timecode source tape to different points in a mix. Running status Half and Full Duplex and Autochase affect both Soundcraft and Standard MIDI protocols. When Steinberg's Automation programme is loaded it automatically switches **SPIRIT AUTO** to 'Full Duplex' and 'Autochase Off'.

SPIRIT AUTO's **MIDI TRANSMIT/RECEIVE CHANNEL** is adjusted on a rotary switch placed to the left of the DIP switches and is read at power up. The default setting for the rotary switch is Channel 16. The position of the switch is ignored when used in Soundcraft Protocol with the optional Steinberg **SPIRIT** Automation or J.L. Cooper Softmix programs.

HARDWARE REQUIREMENTS

Users intending to run Cubase with the optional Steinberg **SPIRIT** Automation program on an Atari ST will require a minimum of 2Meg of on-board memory. The Automation program will need to be installed under MROS so consult your Steinberg Cubase manual on how to do this. Users will also require Steinberg's Midex or Midex + key expanders. Because the Steinberg **SPIRIT** Automation programme uses non-standard MIDI messages **SPIRIT AUTO** must be connected to its own dedicated MIDI port with this programme. With **SPIRIT AUTO**'s potential for generating vast quantities of MIDI data, users should consider investing in some form of output port expansion, such as C-Lab's Export for Creator/Notator, if they haven't already done so. This will provide a dedicated MIDI output for **SPIRIT AUTO** which avoids any timing problems that may ensue when large amounts of data are forced down one MIDI connection to feed numerous devices.

Users of J.L. Cooper's Softmix should also note that **SPIRIT AUTO** should communicate with it via dedicated MIDI ports. This is becausen the software also uses 8-bit MIDI messages. If you are using a sequencer package with Softmix you will need a MIDI expander such as MOTU MIDI Timepiece.

MIDI AND SPIRIT AUTO

Each Channel fader and Channel and Monitor On switch generates MIDI continuous controller information when activated. This is the same type of data that is generated when a synth's Modulation wheel is turned (This corresponds to Continuous Controller 1). **SPIRIT AUTO**'s Channel fader 7, for example, generates MIDI Continuous Controller 7 information and the same Channel's On switch 7 generates Continuous Controller 39. See the appendix A for a list of controller numbers and their implementation. When run with a MIDI sequencer, **SPIRIT AUTO**'s faders have a resolution of MIDI's 7-bit 128 steps (0-27). While this will be adequate for the majority of applications, it is worth pointing out that using the desk with the optional Steinberg **SPIRIT** Automation software or J.L. Cooper's Softmix doubles this resolution through using by a special Soundcraft 8-bit protocol.

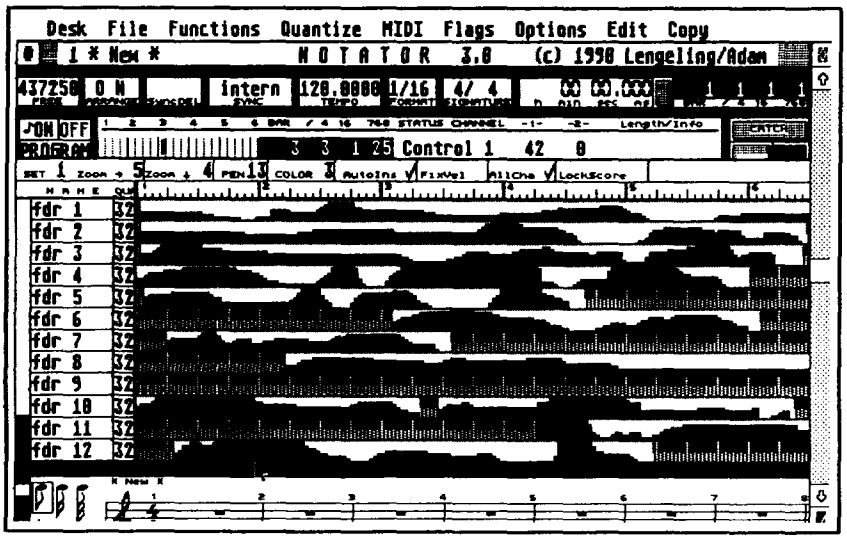
Running **SPIRIT AUTO** with a MIDI sequencer allows all the automation data to be recorded and edited in the same way that you can manipulate data derived from synths and samplers. Consequently the more adept you are at getting the most out of your sequencer the more power you will be able to extract from **SPIRIT AUTO**.

If you are comfortable editing MIDI Continuous Controller data in your sequencer then you will embrace **SPIRIT AUTO** all the more easily. If you are concerned about your editing abilities or would prefer to run audio automation separately, investigate the Steinberg **SPIRIT** Automation software or J.L. Cooper's Softmix.

Included are some guidelines for using **SPIRIT AUTO** with the two most popular Atari sequencing packages: C-Lab Creator/Notator and Steinberg Cubase. **For further detail consult your sequencer software manual.**

C-Lab Creator/Notator

C-Lab users will gain **SPIRIT AUTO** operational ease particularly from the **Hyper Edit** page and the Real Time MIDI generator (**RMG**) page in addition to the program's other control functions. Hyper Edit will give a graphical and easy to understand depiction of fader and switch changes while the RMG page, ;through the creation of a P-User Events template, will give a visual representation of fader movements and switch changes on screen.



For recording automation data into Creator/Notator follow the same procedures as you would for any other MIDI source (see Connections). Added value can be gleaned by harnessing the visuals of Hyper Edit.

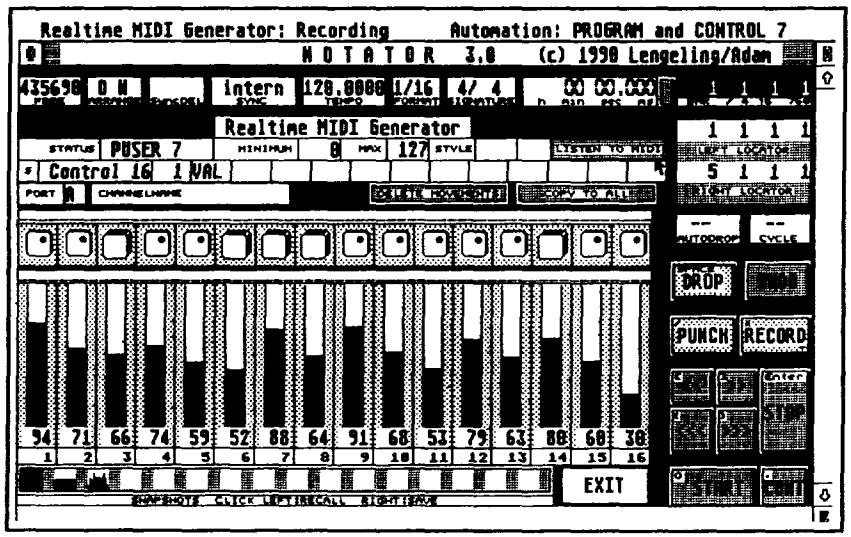
- Select 'Hyper Display' from the Edit window and enter Edit for the recorded automation track. There are 8 'sets' of 16 'instruments' available

which can be custom-configured to display whatever type of MIDI data you want. Consequently 'sets' can be arranged to show Continuous Controller data which corresponds to Channel fader and switch movements in a logical and clear manner.

An Instrument can be specified quickly by giving it 'undefined' status and then dragging the pertinent Controller data from the Event list dropping it in on top of an Instrument. Dragging a Controller 7 event onto the first Instrument in Set 1, for example, will confer that Instrument's Hyper Display as showing Channel fader 7 movement. You are free to arrange Instruments in any manner giving, for example, Set 1's 16 Instruments Channel Fader Hyper Display, Set 2 the 16 Monitor ONs of a 16 channel console or these in any combination.

Among other things, Hyper Edit permits fader contours to be drawn for fade in and outs and single switch events to be inserted.

The RMG gives a visual representation of actual fader positions as vertical bars and switch positions as switch graphics when assembled in a P-User template. Setting up a P-User RMG can be achieved quickly by using the 'Listen to MIDI' function.



- Enter the RMG page and select P-User in the Status window.
- Click on fader 1 with the mouse, click on 'Listen to MIDI' and move **SPIRIT AUTO**'s Channel 1 fader. This RMG fader now corresponds to **SPIRIT AUTO**'s Channel 1 fader.
- Select the display block directly above the RMG fader 1, click to tick the Style box - the block becomes a Switch graphic - click on the display block again then click 'listen to MIDI' and press **SPIRIT AUTO**'s Channel 1 On switch a few times. This RMG switch now corresponds to SPIRIT AUTO's Channel 1 On switch. Click the switch by mouse on screen and watch the desk's On switch change accordingly.

To visualise incoming fader and switch movements from **SPIRIT AUTO** on-screen in real time, use Real Time Transform to convert this data to the P-User events in the RMG page you have assembled. Bear in mind that the 'Result' Channel should be the data byte and the Result first data byte should be the P-User number. Remember also to enter the Transform Set number on the relevant input in the Input Handling page. **For more details consult your Notator/Creator manual.**

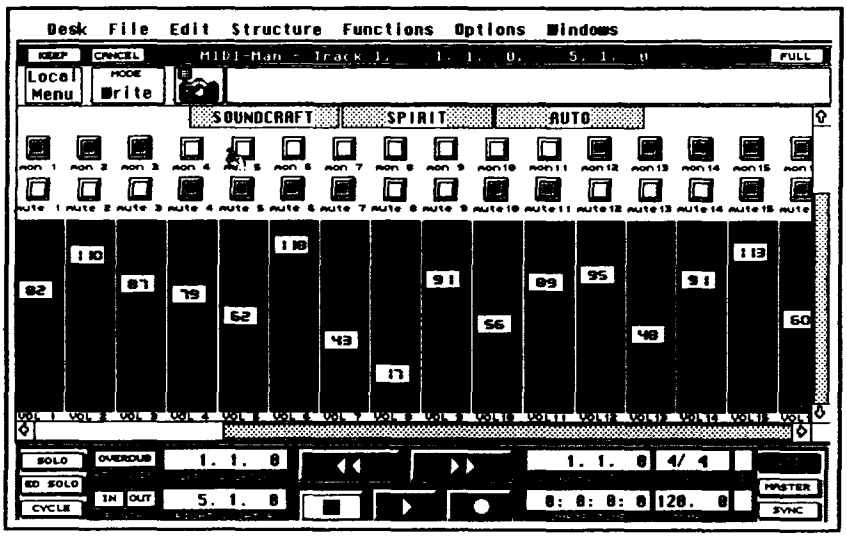
Hyper Edit can be configured to show P-User data in the same way that it can for the Controller data.

Creator/Notator's RMG P-User template can thus be configured in any way you choose. Controllers can be named, faders can be grouped on screen, the Snapshots can be created. Combining Hyper Edit and RMG gives the **SPIRIT AUTO** user extremely fine control and visualisation of mix data.

Steinberg Cubase

Cubase users will benefit from the program's MIDI Manager page which can be configured to represent the **SPIRIT AUTO**'s Channel faders and Channel and Monitor On switches.

- To assemble your own, create a MIDI Mix part and select an untitled (blank) MIDI mixer map. Double clicking on the part enters the MIDI mixer page.



- Draw in as many 'Objects' as you feel you will need using the 'New Tool' from the Toolbox - use faders for **SPIRIT AUTO**'s Channel faders and switches for the Channel and Monitor .

- Enter the dialogue box for each Object by double clicking on it and use the 'Learn' function to assign continuous Controllers to Objects - for a Fader 'object', move a Channel fader on the **SPIRIT AUTO** and click 'Learn'. Note the controller status displayed and adjust the Remote Controller display from its drop down window accordingly.

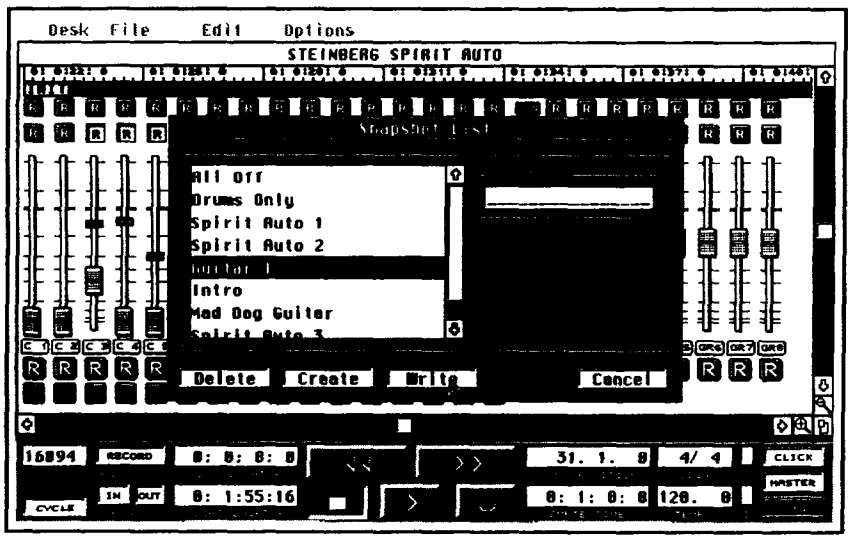
- Back in the MIDI Manager page, move the **SPIRIT AUTO** fader and watch the screen fader follow.

By assembling an approximation of **SPIRIT AUTO**'s automated features, a real-time display of fader and switch activity can be graphically depicted. Provided you adhere to the Cubase rules concerning Local, Write and Replace status on the MIDI Mixer page you will be able to alter and drop in and out values accurately.

You can also avail yourself of Cubase's editing functions as you would with any other MIDI data. Snapshots can be created, Objects can be named and faders can be Grouped in a number of different ways in the MIDI Manager page. **Please consult the MIDI Mixer section of your Cubase manual for further details.**

SNAPSHOTS, GENERAL MIXING AND MEMORY CONSERVATION

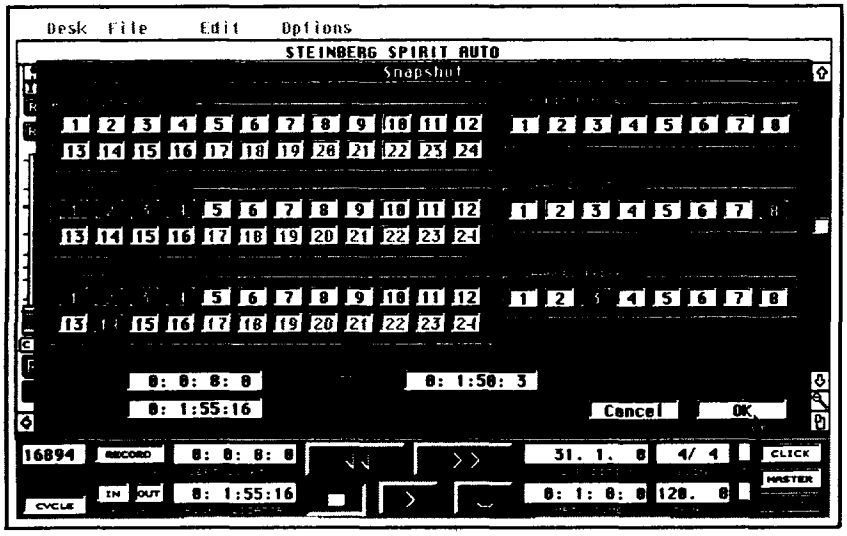
The Snapshot button at the bottom right hand corner of **SPIRIT AUTO** can be used creatively and practically.



At the beginning of a mix a Snapshot of the desk's initial condition at the beginning of the song should be recorded by pressing the Snapshot button into the sequencer to create a basic level from which to work.

Because MIDI Continuous controller data (when used in large amounts) can be very memory intensive - for example in a mix with a lot of simultaneous fader movements - it is in your best interests to be frugal with fader movements when using a sequencer, particularly when computer memory is tight.

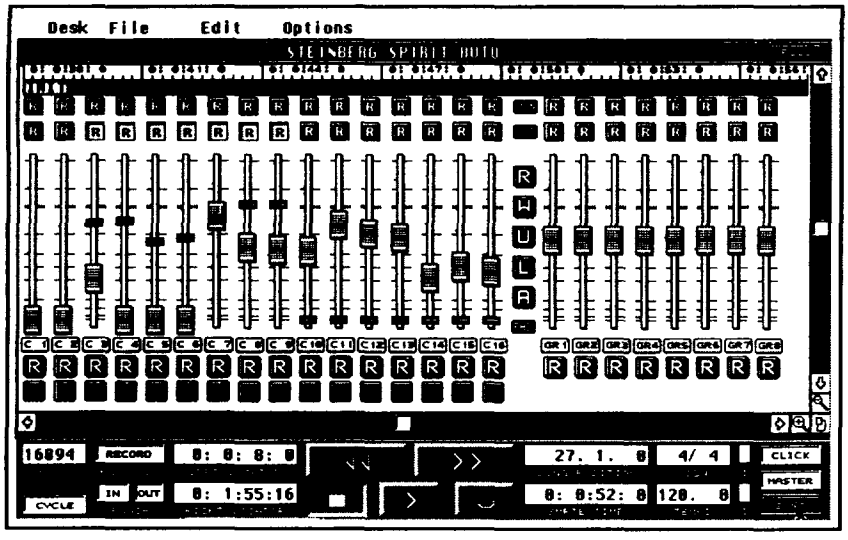
As an example of computer memory conservation, individual Snapshots of the desk could be recorded into the sequencer in isolation at important points in a mix where fader levels, for example, change markedly. Careful use of the Channel and Monitor On switches can also conserve memory over pulling a fader to zero. Once the Snapshots have been entered smooth transitions between them with any necessary Channel fader movements can be made.



As a suggested general guide send a Snapshot at the beginning of a mix to set the desk up, then record switch movements to mute inputs that are not required or to silence those that are not active. Then record fader Snapshots at all the dynamically important parts of the mix and finally fine adjust fader movements to complete the mix. However, the beauty of automation is that it allows you to balance in any way you wish and by combining your sequencer's editing capabilities and your operator prowess, very fine degrees of control are available - memory permitting.

Steinberg Spirit Automation package

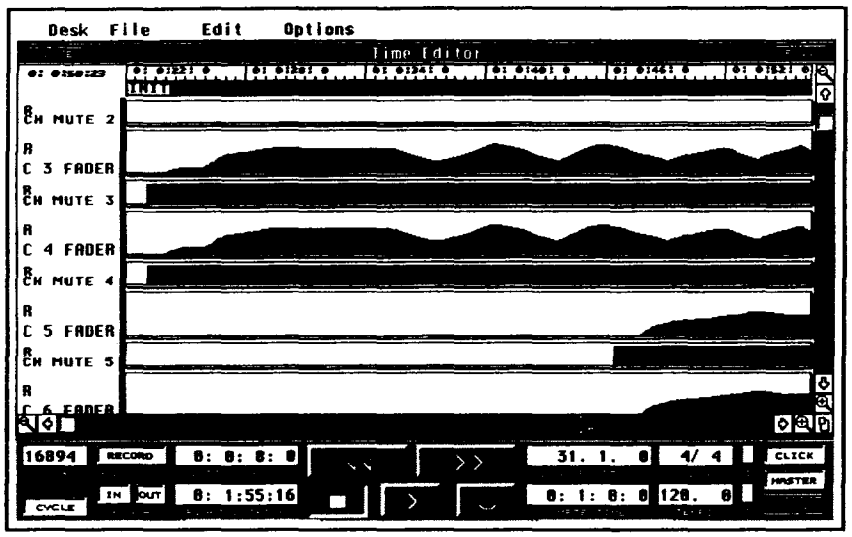
This optional program uses a Soundcraft MIDI protocol that operates at a resolution twice that of normal MIDI. Steinberg's Automation software enhances the power and flexibility of **SPIRIT AUTO** considerably.

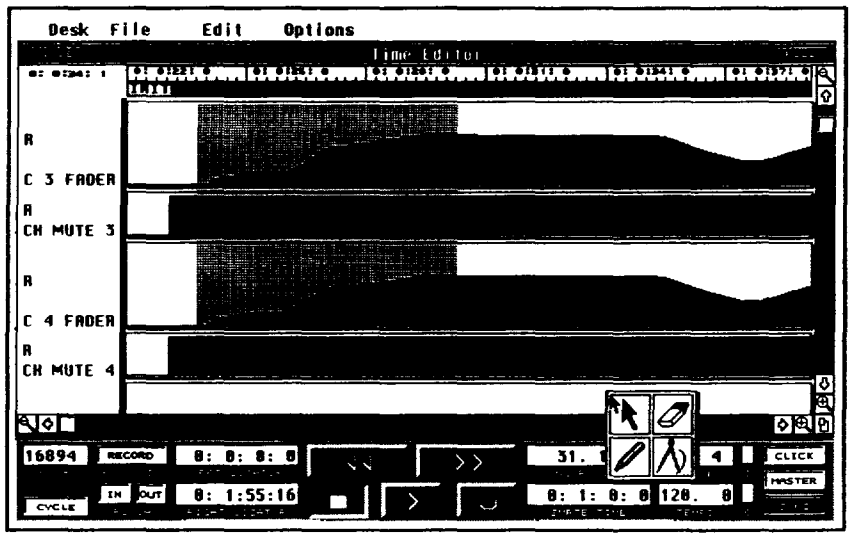


Based around a main screen representation of **SPIRIT AUTO**'s automatable Channel faders and Channel and Monitor On switches, mix data can be sectionalised at the recording stage to allow the recording of just a few faders or all the Monitor On switches at once, for example. The approach is comparable to that used in many top-end professional automation systems and uses the well understood concepts of Write to record automation data, Read to playback recorded automation data, and Update to alter recorded automation data in a relative way using **SPIRIT AUTO**'s faders.

Automation data can be punched in and out with presentable ramping in and out of the record mode to ensure smooth transitions between existing and added sections.

Faders can be grouped and operated by a Channel fader master or by a virtual group master on-screen and these grouping functions also apply to Channel and Monitor On switches if desired.





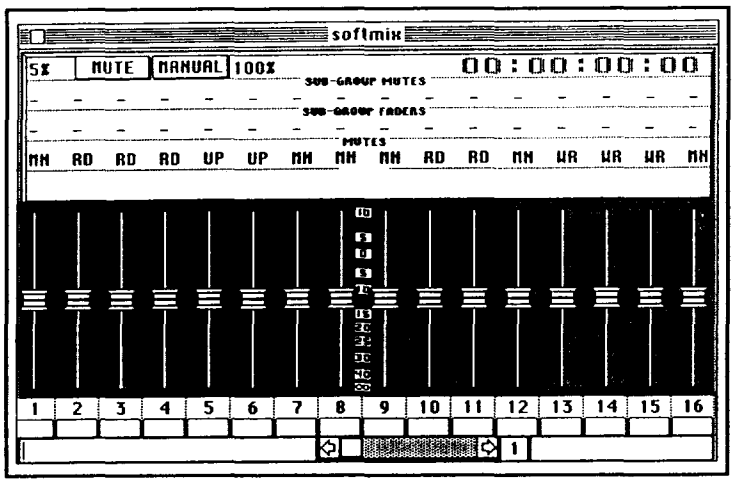
Editing is comprehensive and presents fader movements as horizontally scrolling 'contours' that can be altered, adjusted and drawn using a Tool box. Smooth fade in and outs can be executed across single faders or across whole banks of faders.

The Editor also permits Cut, Copy and Paste operations to be performed in a similar manner to that of the Cubase sequencer. Snapshots can be constructed on screen and preset to fire at a predetermined time or entered on-the-fly using the desk's Snapshot button.

Steinberg **SPIRIT** Automation software can be installed alongside Cubase through MROS or can be run in isolation on its own dedicated computer. Consult your dealer for more details.

J.L. Cooper's Softmix

This optional program for the Apple Macintosh also offers enhanced fader resolution with a moving fader graphic display, accurate off-line editing (with full cut/copy/paste editing capability) and SMPTE display. Unlike a sequencer Softmix allows true READ, WRITE and UPDATE modes, which let you make subtle alterations to your mix in real time, with commands executed on the console instantly reflected on the Mac screen.

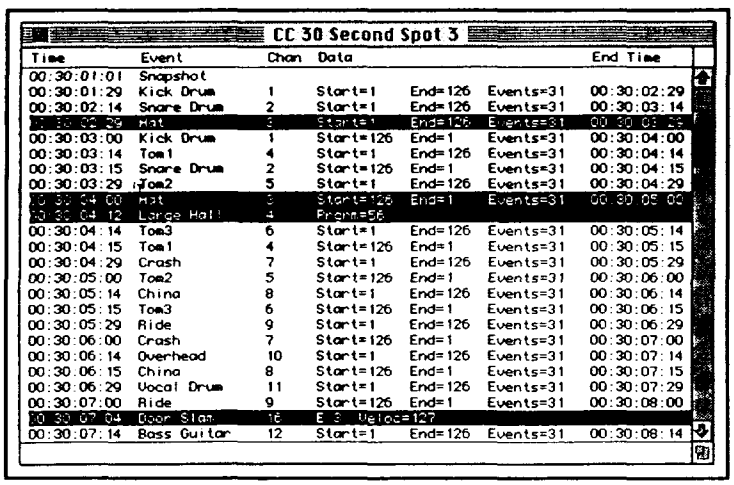


Softmix controls the level of all channel faders, mutes and monitor paths with SMPTE-locked precision,and stores your mixes on hard disc for easy retrieval.

Softmix allows seamless real time editing with the AUTO PUNCHfeature, whilst HIT mode may be used for spotting film or video cues.

Sixteen soft fader and mute subgroups are included, and the AUTO ARCHIVE facility provides simple backup of each mix to disk.

The package requires an Apple Macintosh with a minimum of 2MB of RAM and a hard disk for satisfactory operation. **Please consult your dealer for further details.**



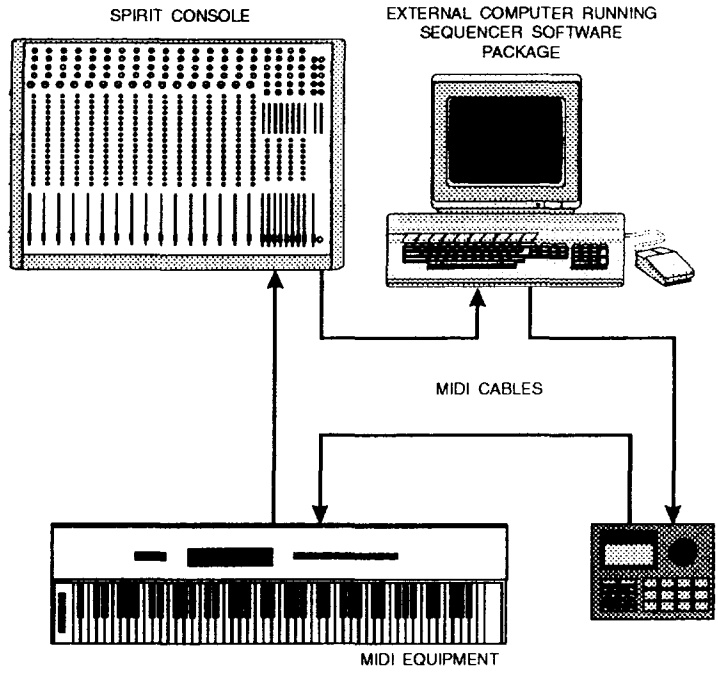
Automation - Applications

SPIRIT AUTO has been designed to be used in a variety of ways to suit different budgets and levels of sophistication. You can create automated mixes using any sequencer software for Atari, Mac or IBM PC, or even a hardware sequencer.

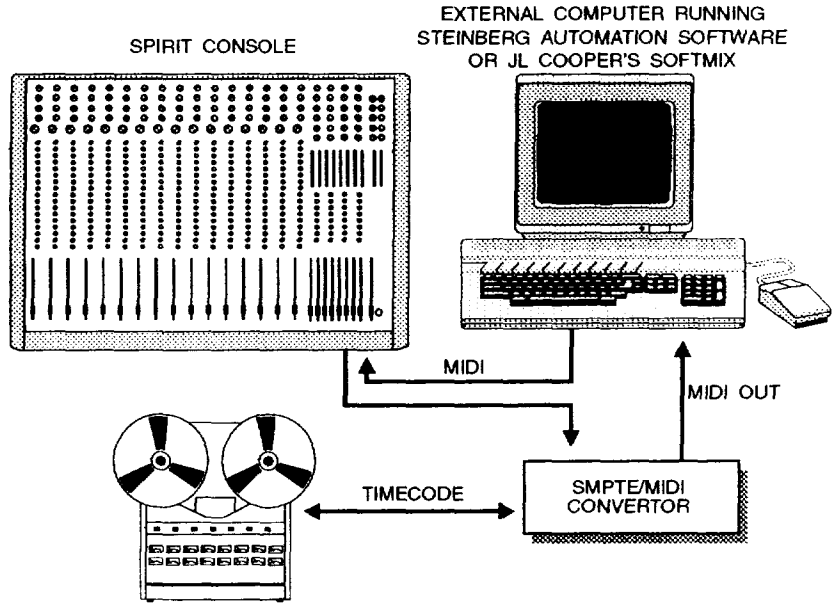
When operating under standard MIDI protocol, each mute and fader is assigned to a MIDI control message. At the simplest level, mixes can be recorded in their own sequencer tracks using only one MIDI port, without interfering with note information. Alternatively many sequencer packages, such as Cubase's MIDI Manager have Mixer pages which can be customised to respond to **SPIRIT AUTO**.

The following three examples demonstrate the flexibility of the system:

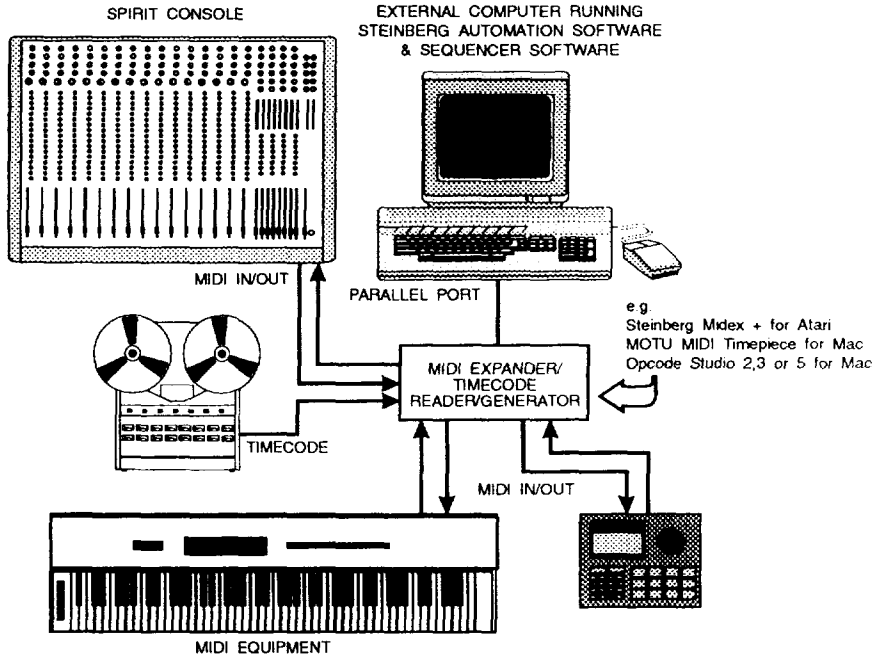
Sequencer Software package - with a single MIDI port (Mix Down only)



Dedicated Automation Software - Stand Alone



Dedicated Automation Software - with a Sequencer



CARE OF YOUR MIXER

General Precautions

Avoid storing or using the mixer in conditions of excessive heat or cold, or in positions where it is likely to be subject to vibration, dust or moisture.

Keep the mixer clean using a soft dry brush, and an occasional wipe with a damp cloth or ethyl alcohol. Do not use any other solvents which may cause damage to paint or plastic parts.

Avoid placing drinks or smoking materials on or near the mixer. Sticky drinks and cigarette ash are frequent causes of damage to faders and switches.

Regular care and inspection will be rewarded by a long life

Glossary

auxiliary send — an output from the console comprising a mix of signals from channels and groups derived independently of the main stereo/group mixes. Typically the feeds to the mix are implemented on rotary level controls.

autochase — when autochase is ON, a snapshot of the automated faders and switches on the console is sent out automatically every 2 - 3 seconds. This allows sequencers with no chasing ability to read mix data accurately from any start point in the mix.

balance — the relative levels of the left and right channels of a stereo signal.

channel path — the section of the input channel which accepts normal input sources and feeds them to selected groups or stereo mix under the control of the linear channel fader.

clipping — the onset of severe distortion in the signal path, usually caused by the peak signal voltage being limited by the circuit's power supply voltage.

D to A converter — (Digital to Analogue Convertor) a device which receives a digital signal as its input and converts this signal to a variable analogue output.

dB (decibel) — a ratio of two voltages or signal levels, expressed by the equation $dB=20Log_{10}(V1/V2)$. Adding the suffix 'u' denotes the ratio is relative to 0.775V RMS.

DI(direct injection)	the practice of connecting an electric musical instrument directly to the input of the mixing console, rather than to an amplifier and loudspeaker which is covered by a microphone feeding the console.
equaliser	a device that allows the boosting or cutting of selected bands of frequencies in the signal path.
feedback	the 'howling' sound caused by bringing a microphone too close to a loudspeaker driven from its amplified signal.
foldback	a feed sent back to the artistes via loudspeakers or headphones to enable them to monitor the sounds they are producing.
frequency response	the variation in gain of a device with frequency.
full duplex	the mode in which the desk controls have no local effect, but the fader and switch movements are fed out to the controlling computer and transparently echoed back to the desk. (equivalent to LOCAL OFF on a keyboard)
(sub) group	an output into which a group of signals can be mixed.
half duplex	the mode in which the desk faders and switches respond to local movements of the desk controls or to incoming MIDI data. (equivalent to LOCAL ON on a keyboard)
headroom	the available signal range above the nominal level before clipping occurs.
hyper edit	an edit window in C-Lab's Notator.
key expander	allows two or more key protected pieces of software to be loaded in a computer together and to run concurrently. An example of this is Steinberg's MIDEX +, which allows both Cubase and Steinberg's Automation software to run at the same time, on Atari.
line level signals	at a nominal level of -10 to +6dBu, usually coming from a low impedance source.
MIDI	stands for **M**usical **I**nstrument **D**igital **I**nterface - a standard set up at the beginning of the 1980's by different manufacturers allowing their instruments to communicate with each other.
MIDI control change message	a type of MIDI message that can be configured to control a MIDI device. Under standard MIDI protocol MIDI controllers affect **SPIRIT AUTO**'s channel faders, mutes and monitor mutes.
MIDI Manager page	a configurable 'mixer' page in Steinberg's Cubase sequencer software. Also known as MIDI Mixer page in version 3.

Mix-down	the operational mode in which pre- recorded tracks on the multitrack tape machine are replayed and mixed to create a final Stereo master recording.
Monitor Path	the section of the input channel which is normally fed by the tape machine outputs, and feeds to the stereo mix under the control of a rotary fader to create a Monitor mix.
Overdubbing	the operational mode in which one or more tracks can be recorded or modified as other tracks are played back.
pan (pot)	abbreviation of 'panorama': controls levels sent to left and right outputs.
peaking	an equaliser response curve affecting only a band of frequencies i.e. based on a bandpass response.
PFL (pre-fade listen)	a function that allows the operator to monitor the pre-fade signal in a channel independently of the main mix.
protocol	the communications 'language' which is used for transmitting and receiving fader and switch data.
Realtime MIDI Generator	a 'mixer' page in C-Lab's Notator software
rolloff	a fall in gain at the extremes of the frequency response.
running status	a mode whereby transmission speed is increased by omitting redundant MIDI data . Note that some sequencers may not be able to read data using running status.
shelving	an equaliser response affecting all frequencies above or below the break frequency i.e. a highpass or lowpass derived response.
spill	acoustic interference from other sources.
talkback	the operator speaking to the artistes or to tape via the auxiliary or group outputs.
timecode	a universal standard 'clock' used to precisely identify automation data to enable synchronising during subsequent editing. The most commonly used formats are MIDI and SMPTE (Society of Motion Picture & Television Engineers). There are 4 frame rates: 24,25, 29.97 (drop & 30 frames/sec)
transient	a momentary rise in the signal level.
trim control	a variable control which gives adjustment of signal level over a limited and predetermined range usually for calibration purposes.
VCA	(Voltage Controlled Amplifier) a device which acts as a variable audio attenuator controlled by an external d.c. voltage.

Selectable Options

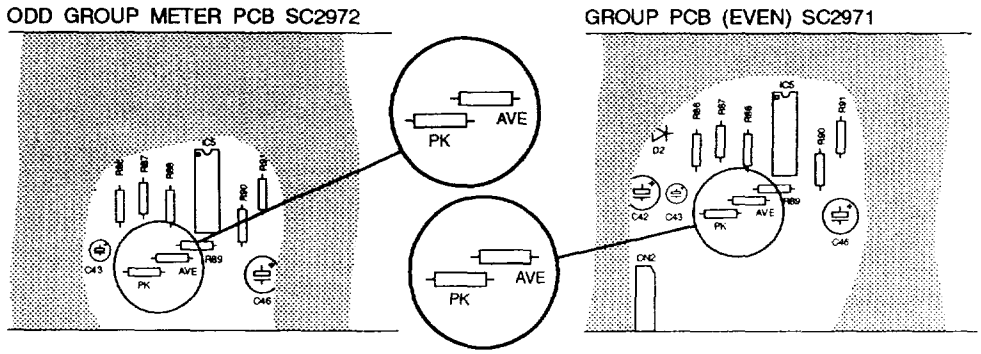
Selecting Average Response on Bargraphs

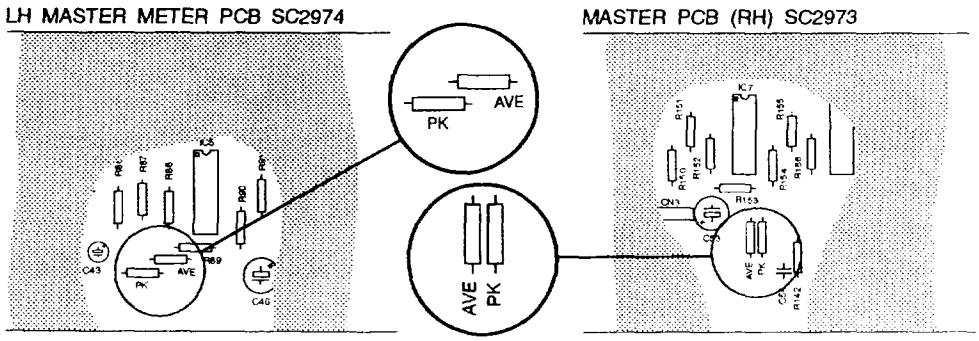
The Bargraph Meters on your **SPIRIT AUTO** are capable of two modes of operation: PEAK and AVERAGE.

In Peak mode the meter responds rapidly to initial signal transients and decays slowly, making it easy to detect overload. In Average mode the bargraph takes on the characteristics of a VU meter with evenly fast attack and decay times. All meters are factory-set to PEAK characteristic, but may be changed to AVERAGE response by moving a link from **PeaK** to **AVErage** positions on the appropriate PCB as shown below. To select AVERAGE response, remove the PCB from the console and carefully unsolder the link in the PK position using the minimum of heat to avoid the possibility of tracks lifting on the PCB. Replace the link in the AVE position.

This operation should only be carried out by competent technicians who possess the necessary soldering skills.

Note: All odd Group and the LH Master meters are situated on 'daughter' boards mounted on the adjacent even Group and RH Master PCBs. All meter circuits must have either the PK or AVE link fitted for correct operation.

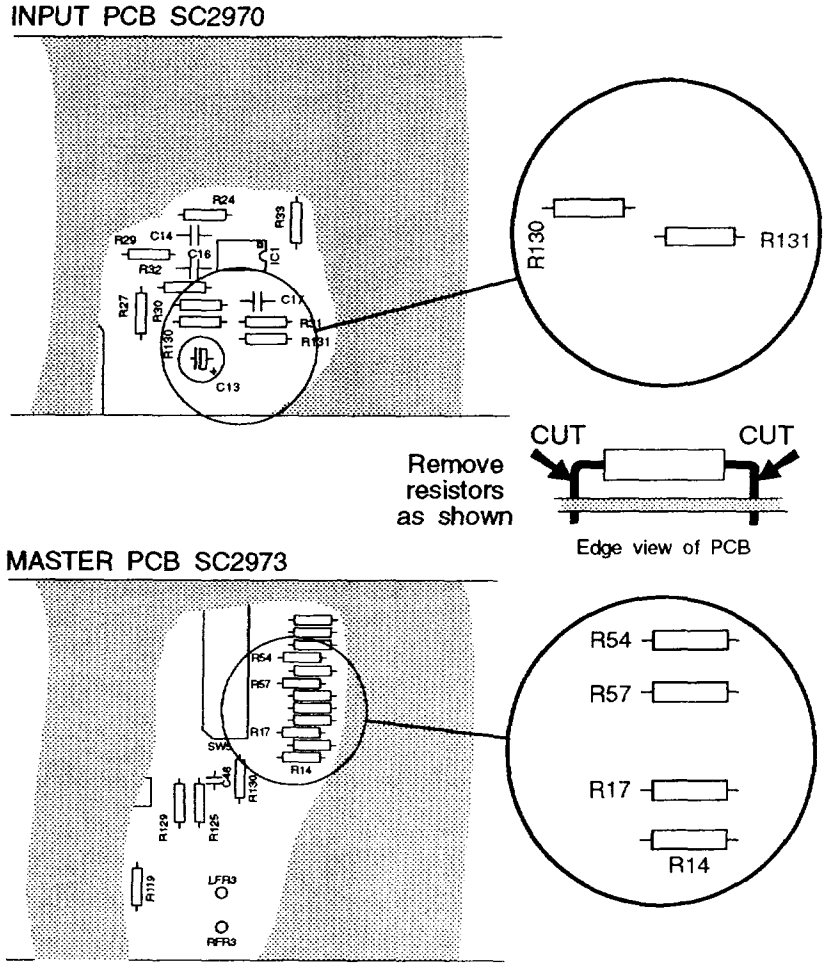




Modification of Tape Sends & 2 Track Return Level

All input Tape Sends are factory set to suit -10dBV equipment. If a level of +4dBu is required the output level may be changed by removing resistors R130/R131 from the Input PCB SC2970. This can be done without removing the PCB by carefully cutting the leads of the resistor above the board at the points marked as shown below.

The Master 2-Track Return can similarly be changed to suit +4dBu euipment by removing resistors R14/R17/R54/R57 from the Master PCB Sc2973 as shown below. The PCB will need to be removed from the console for this modification.



Specifications

Noise	Measured RMS, 22Hz to 22kHz Bandwidth		
Buss Noise:		**Masters Down**	**Masters Up, 24 Ch. Routed**
	Mix Left	-98dBu	-80dBu
	Mix Right	-98dBu	-80dBu
	Group	-95dBu	-82dBu
	Aux	-100dBu	-85dBu
	FB	-98dBu	-83dBu
Mix Noise		**24 Monitors ON, Vol Down**	
	Mix Left	-79dBu	
	Mix Right	-79dBu	
		24 Monitors ON & Channels Routed	
	Mix Left	-77dBu	
	Mix Right	-77dBu	
		24 Monitors & Channels Routed & 'ON'	
	Mix Left	-72.5dBu	
	Mix Right	-72.5dBu	
E.I.N.	Microphone Input. Maximum Gain, Terminated 150R		-129dBu
C.M.R.R.	Measured at 1kHz		
	Microphone Input at Maximum Gain		-90dB
	Line Input at Unity Gain		-55dB
Distortion	Typical THD Measured 1kHz at +20dBu, 20Hz to 20kHz Bandwidth		
	Line in to Mix out		< 0.035%
	Line in to Group out		< 0.035%
	Line in to Aux out		< 0.035%
	Line in to FB out		< 0.035%
	Tape Send with +20dBu @ Group out		< 0.035%

Crosstalk	Measured 1kHz sine wave	
	Routing Isolation (Mix L/R & Group)	> 100dB
	Max. Fader Attenuation	> 100dB Typical
	Max. Aux Send Attenuation	> 89dB Typical
	Channel Pan to Group Isolation	> 76dB
	Channel 'ON' Switch Isolation	> 100dB
	Monitor 'ON' Switch Isolation	> 100dB
	FX Return to Mix	> 100dB
	FX Return to Group	> 85dB
Frequency Response	Measured 20Hz to 20kHz Bandwidth, Relative to 1kHz	
	Mix Left/Right Outputs	+/- 0.5dB
	Group Outputs	+/- 0.5dB
	Aux Outputs	+/- 0.5dB
Input & Output Impedances		
	Microphone Input	2kΩ
	Line Input	10kΩ
	Insert Sends	75Ω
	Insert Returns	10kΩ
	Outputs	75Ω
Input & Output Levels	Mic Input Maximum Level	+10dBu
	Line Input Maximum Level	+30dBu
	Mix Out Maximum Level	+21dBu
	Mono Out Maximum Level	+21dBu
	Aux Out Maximum Level	+21dBu
Metering	16 Segment LED Bargraph	
	Selectable 'PEAK' or 'AVERAGE' Reading	
	Accuracy Relative to '0dB'	+/- 1dB

APPENDIX A
- Midi Protocol Technical Information

Control Change Mapping

When standard MIDI protocol is selected, the console will transmit and respond to the following Control Change messages on the selected MIDI channel:

16 Channel Console		*Decimal*	*Hex*
	Channel 1 Fader	1	01
	Channel 2 Fader	2	02
	Channel 3 Fader	3	03
	Channel 4 Fader	4	04
	Channel 5 Fader	5	05
	Channel 6 Fader	6	06
	Channel 7 Fader	7	07
	Channel 8 Fader	8	08
	Channel 9 Fader	9	09
	Channel 10 Fader	10	0A
	Channel 11 Fader	11	0B
	Channel 12 Fader	12	0C
	Channel 13 Fader	13	0D
	Channel 14 Fader	14	0E
	Channel 15 Fader	15	0F
	Channel 16 Fader	16	10
	Channel 1 ON	33	21
	Channel 2 ON	34	22
	Channel 3 ON	35	23
	Channel 4 ON	36	24
	Channel 5 ON	37	25
	Channel 6 ON	38	26
	Channel 7 ON	39	27
	Channel 8 ON	40	28
	Channel 9 ON	41	29
	Channel 10 ON	42	2A
	Channel 11 ON	43	2B
	Channel 12 ON	44	2C
	Channel 13 ON	45	2D
	Channel 14 ON	46	2E
	Channel 15 ON	47	2F
	Channel 16 ON	48	30

	Decimal	*Hex*
Monitor 1 ON	65	41
Monitor 2 ON	66	42
Monitor 3 ON	67	43
Monitor 4 ON	68	44
Monitor 5 ON	69	45
Monitor 6 ON	70	46
Monitor 7 ON	71	47
Monitor 8 ON	72	48
Monitor 9 ON	73	49
Monitor 10 ON	74	4A
Monitor 11 ON	75	4B
Monitor 12 ON	76	4C
Monitor 13 ON	77	4D
Monitor 14 ON	78	4E
Monitor 15 ON	79	4F
Monitor 16 ON	80	50

24 Channel Console

Console Function	MIDI Controller Number	
	Decimal	*Hex*
Channel 1 Fader	1	01
Channel 2 Fader	2	02
Channel 3 Fader	3	03
Channel 4 Fader	4	04
Channel 5 Fader	5	05
Channel 6 Fader	6	06
Channel 7 Fader	7	07
Channel 8 Fader	8	08
Channel 9 Fader	9	09
Channel 10 Fader	10	0A
Channel 11 Fader	11	0B
Channel 12 Fader	12	0C
Channel 13 Fader	13	0D
Channel 14 Fader	14	0E
Channel 15 Fader	15	0F
Channel 16 Fader	16	10
Channel 17 Fader	17	11
Channel 18 Fader	18	12
Channel 19 Fader	19	13
Channel 20 Fader	20	14
Channel 21 Fader	21	15
Channel 22 Fader	22	16
Channel 23 Fader	23	17
Channel 24 Fader	24	18

	Decimal	*Hex*
Channel 1 ON	33	21
Channel 2 ON	34	22
Channel 3 ON	35	23
Channel 4 ON	36	24
Channel 5 ON	37	25
Channel 6 ON	38	26
Channel 7 ON	39	27
Channel 8 ON	40	28
Channel 9 ON	41	29
Channel 10 ON	42	2A
Channel 11 ON	43	2B
Channel 12 ON	44	2C
Channel 13 ON	45	2D
Channel 14 ON	46	2E
Channel 15 ON	47	2F
Channel 16 ON	48	30
Channel 17 ON	49	31
Channel 18 ON	50	32
Channel 19 ON	51	33
Channel 20 ON	52	34
Channel 21 ON	53	35
Channel 22 ON	54	36
Channel 23 ON	55	37
Channel 24 ON	56	38
Monitor 1 ON	65	41
Monitor 2 ON	66	42
Monitor 3 ON	67	43
Monitor 4 ON	68	44
Monitor 5 ON	69	45
Monitor 6 ON	70	46
Monitor 7 ON	71	47
Monitor 8 ON	72	48
Monitor 9 ON	73	49
Monitor 10 ON	74	4A
Monitor 11 ON	75	4B
Monitor 12 ON	76	4C
Monitor 13 ON	77	4D
Monitor 14 ON	78	4E
Monitor 15 ON	79	4F
Monitor 16 ON	80	50
Monitor 17 ON	81	51
Monitor 18 ON	82	52

Monitor 19 ON	83	53
Monitor 20 ON	84	54
Monitor 21 ON	85	55
Monitor 22 ON	86	56
Monitor 23 ON	87	57
Monitor 24 ON	88	58

32 Channel Console

Console Function	MIDI Controller Number	
	Decimal	*Hex*
Channel 1 Fader	1	01
Channel 2 Fader	2	02
Channel 3 Fader	3	03
Channel 4 Fader	4	04
Channel 5 Fader	5	05
Channel 6 Fader	6	06
Channel 7 Fader	7	07
Channel 8 Fader	8	08
Channel 9 Fader	9	09
Channel 10 Fader	10	0A
Channel 11 Fader	11	0B
Channel 12 Fader	12	0C
Channel 13 Fader	13	0D
Channel 14 Fader	14	0E
Channel 15 Fader	15	0F
Channel 16 Fader	16	10
Channel 17 Fader	17	11
Channel 18 Fader	18	12
Channel 19 Fader	19	13
Channel 20 Fader	20	14
Channel 21 Fader	21	15
Channel 22 Fader	22	16
Channel 23 Fader	23	17
Channel 24 Fader	24	18
Channel 25 Fader	25	19
Channel 26 Fader	26	1A
Channel 27 Fader	27	1B
Channel 28 Fader	28	1C
Channel 29 Fader	29	1D
Channel 30 Fader	30	1E
Channel 31Fader	31	1F
Channel 32 Fader	32	20

	Decimal	*Hex*
Channel 1 ON	33	21
Channel 2 ON	34	22
Channel 3 ON	35	23
Channel 4 ON	36	24
Channel 5 ON	37	25
Channel 6 ON	38	26
Channel 7 ON	39	27
Channel 8 ON	40	28
Channel 9 ON	41	29
Channel 10 ON	42	2A
Channel 11 ON	43	2B
Channel 12 ON	44	2C
Channel 13 ON	45	2D
Channel 14 ON	46	2E
Channel 15 ON	47	2F
Channel 16 ON	48	30
Channel 17 ON	49	31
Channel 18 ON	50	32
Channel 19 ON	51	33
Channel 20 ON	52	34
Channel 21 ON	53	35
Channel 22 ON	54	36
Channel 23 ON	55	37
Channel 24 ON	56	38
Channel 25 ON	57	39
Channel 26 ON	58	3A
Channel 27 ON	59	3B
Channel 28 ON	60	3C
Channel 29 ON	61	3D
Channel 30 ON	62	3E
Channel 31 ON	63	3F
Channel 32 ON	64	40
Monitor 1 ON	65	41
Monitor 2 ON	66	42
Monitor 3 ON	67	43
Monitor 4 ON	68	44
Monitor 5 ON	69	45
Monitor 6 ON	70	46
Monitor 7 ON	71	47
Monitor 8 ON	72	48
Monitor 9 ON	73	49
Monitor 10 ON	74	4A

Monitor 11 ON	75	4B
Monitor 12 ON	76	4C
Monitor 13 ON	77	4D
Monitor 14 ON	78	4E
Monitor 15 ON	79	4F
Monitor 16 ON	80	50
Monitor 17 ON	81	51
Monitor 18 ON	82	52
Monitor 19 ON	83	53
Monitor 20 ON	84	54
Monitor 21 ON	85	55
Monitor 22 ON	86	56
Monitor 23 ON	87	57
Monitor 24 ON	88	58
Monitor 25 ON	89	59
Monitor 26 ON	90	5A
Monitor 27 ON	91	5B
Monitor 28 ON	92	5C
Monitor 29 ON	93	5D
Monitor 30 ON	94	5E
Monitor 31 ON	95	5F
Monitor 32 ON	96	60

Control Change Data Values

Switches

The Channel and Monitor switches transmit the following values:

Switch OFF: 0 (0 hex)

Switch ON: 127 (7F hex)

The Channel and Monitor ON switches operate when the following values are received:

Switch OFF: 0 - 63 (0 - 3F hex)

Switch ON: 64 - 127 (40 - 7F hex)

Faders

The Channel faders transmit and receive the following range of data values:

Fully OFF:	0 (0 hex)
+10dB of gain:	127 (7F hex)

The gain scaling is:

+10dB	127 (7F hex)
0dB	91 (56 hex)
-10dB	52 (34 hex)
-20dB	32 (20 hex)
-30dB	9 (9 hex)
OFF	0 (0 hex)

MIDI Channel Select

The rotary "MIDI CHANNEL" switch on the console uses hexadecimal notation for the console's MIDI channel number; this is set using a base number of 0, whereas most sequencers use express channel numbers starting from 1.

Switch Setting	MIDI Channel Number
0	1
1	2
2	3
3	4
4	5
5	6
6	7
7	8
8	9
9	10
A	11
B	12
C	13
D	14
E	15
F	16

APPENDIX B - Recommended Settings

For use with Steinberg SPIRIT AUTO software:

Switch 1	ON (Soundcraft protocol)
Switch 2	ON (Message speed high)
Switch 3	ON (Running status on)
Switch 4	OFF (Full duplex)
Switch 5	OFF (Autochase OFF)
Switch 6	OFF
Switch 7	OFF
Switch 8	OFF

For use with MIDI Sequencers

Switch 1	OFF (MIDI protocol)
Switch 2	OFF (Message speed low)
Switch 3	OFF (Running status off)
Switch 4	ON (Half duplex)
Switch 5	OFF (Autochase OFF)
Switch 6	OFF
Switch 7	OFF
Switch 8	OFF

These settings are highly dependent on the individual sequencer used - they should be correct if used with CUBASE and the supplied MIDI Mixer/Manager Maps.