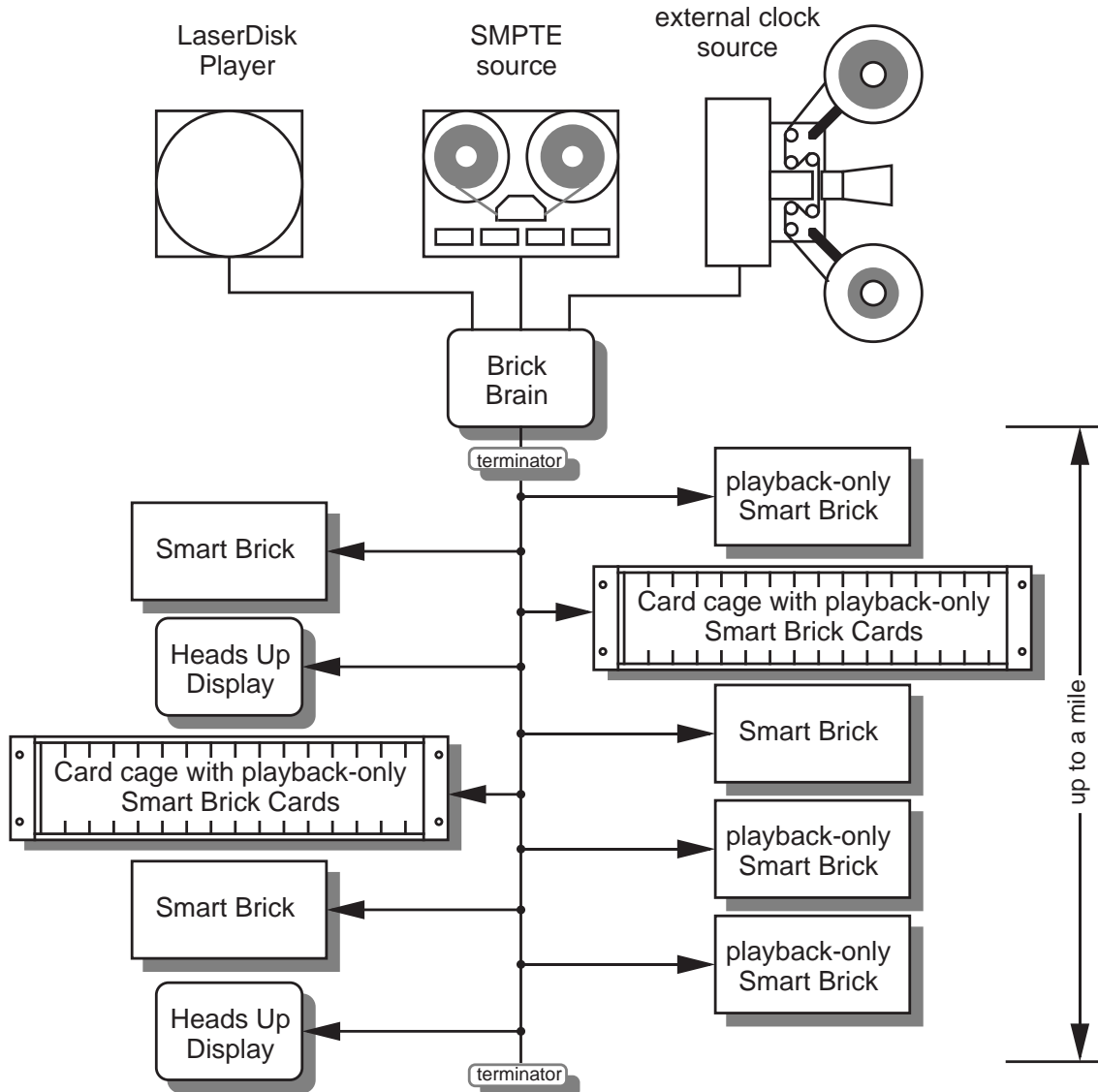


- Operating Instructions - - for the - - Smart Brick System-

June 10, 1999

The Smart Brick System is a modular Animation Control System which consists of One Brick Brain per installation, and any number of Smart Bricks and Heads Up Displays attached to it. Since the number of Smart Bricks attached to each Smart Brick Brain is unlimited, Animation Control Systems of any size to be assembled just by plugging them together.



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- The Parts of the Smart Brick System -

The **Brick Brain** is a small microprocessor controlled unit which can synchronize any number of Smart Bricks to a LaserDisk player, SMPTE time code, internal time base, or external time base. In addition it can control the LaserDisk player or tape deck and provide a countdown timer for the delay between shows. For all but the SMPTE time code, it can instantly randomly access any show stored in the system (SMPTE synchronized shows are slaved to whatever show the SMPTE time code is requesting). At the end of any show it can automatically jump to any other show, either with or without a user adjustable delay before playing this next show. If it is already playing a show and it gets a request for another show, it can be told to ignore the request, store it until done with the current show, or jump to it immediately.

Brick Brains are attached to the Smart Bricks and Heads Up Displays by up to a mile of 6 conductor modular telephone wire. (This is the same type of wire and connector as found on the standard Bricks, but is incompatible with the signals which they use.) Just about any number of Smart Bricks can be attached to a single Brain (If the wire runs are long and there are a lot of Smart Bricks attached, a repeater may be required in the line.) Make sure that this cable does not have its wires flipped from one end to the other. If the wire run is long, then a terminator should be installed at the two extreme ends of the line.

The **Smart Bricks** are available as record/playback Smart Bricks, playback-only Smart Bricks, or card cage mounted playback-only Smart Brick cards. Each Smart Brick can control up to four 8 bit channels. These can be used as 32 on/off 'digital' controls, as four 8 bit wide analog channels, or as any combination of the two. If one Smart Brick doesn't have enough outputs, you simply add more, stacking them until you have enough outputs to do the job. Analog resolutions greater than eight bits can easily be achieved by combining the outputs from more than a single channel.

The Smart Bricks can all be located at one or more central locations, or they can be built right into whatever it is they are controlling. This latter method allows you to wire an entire attraction by just stringing up a 6 conductor modular telephone line to connect all your figures. It also allows you to remove a figure's animation system along with the figure when it is removed for maintenance, and then run them both on a service bench away from the rest of the show for testing and adjustment. A Smart Brick System can consist of any combination of record/playback Smart Bricks, playback-only Smart Bricks and card cage mounted Smart Bricks.

Record/Playback Smart Bricks store the data as it is recorded into static RAM memory chips. These are protected from power outages and data loss by a nickel-cadmium battery. This battery is always on a trickle charge when the Smart Brick is plugged in, and should hold the data safe for years. A keyswitch on the front of each record/playback Smart Brick, as well as a small switch inside the Brick Brain, keep down the possibility of accidental or unauthorized tampering with recorded show data.

Playback-only Smart Bricks store their data in Eprom type memory chips. This is about the safest way known to store any type of data. One Eprom is used to store each individual eight bit wide channel, which means that when you have to perform a minor change in one output, you don't have to replace all the Eproms in the system.

Since the Smart Bricks don't have any frame counters on them, two styles of **Heads Up Display** are available for use in the Smart Brick System. One is a stand-alone unit, while the other is made to mount in a standard 19" rack. They will provide you with a large format display of the show time (SMPTE time code if using it), and frame number in the Smart Bricks being accessed. Additionally, they will display the countdown until the start of the next show if this feature is used. Like the Smart Bricks, any number of these Heads Up Displays can be placed anywhere in the system by simply plugging them into the same 6 conductor telephone line which connects the Smart Bricks with the Brick Brain. They can be installed as a permanent part of the system or temporarily for use while programming the show. The stand-alone Heads-Up-Display is not multiplexed, which allows it to appear on film or video without any flickering

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Quick Start:

When shipped, the Brick Brain is usually configured to start playing show number one when the 'manual start' push-button on its front is pressed. This show is set up to clock from the internal time base at 30 frames per second. To see the system work, attach some Smart Bricks and Heads Up Displays to the connector marked 'to smart bricks' on the Brick Brain and plug everything in. When you push the 'manual start' pushbutton, you should see the system start clocking through the frames. If you then attach a Micro Console to a record/playback Smart Brick, you should be able to turn on the key on Smart Brick's front and actually start recording show data. Each time you push the 'manual start' button, show number one should start over from its beginning.

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- Time Bases -

The Smart Brick System can be used with four normal time bases, as well as one special mode for use with an IBM Backup Box. As long as the frame rate being used is the same for all shows, you can use all of the time bases within the same system. The supported time bases are:

1) LaserDisk: The Smart Brick Brain has an RS-422 serial port on it which can be attached directly to the serial port on many professional quality LaserDisk players. The Brick Brain talks to the LaserDisk player to synchronize the entire system to the show being played. All control for the LaserDisk player is provided by the Brick Brain. Systems with LaserDisk players in them are limited to running either 15 or 30 Frames Per Second (FPS), as the latter is the frame rate at which the video signal from the player is reproduced. A Constant Angular Velocity (CAV) format LaserDisk has the capacity of 1/2 hour per surface, and so this usually serves as the show capacity limitation for the system. Show capacities of the Smart Bricks are as follows:

15 frames/second (show capacity of 1092 sec. for 16K Smart Brick, 4369 sec. for 64K Smart Brick)

30 frames/second (show capacity of 546 sec. for 16K Smart Brick, 2184 sec. for 64K Smart Brick)

As of this writing the Smart Brick Brain has not been tested for compatibility with PAL and SECAM video format LaserDisk players running at 25 Frames per second, so the operation with these can not be guaranteed. Capacity at this frame rate is:

25 frames/second (show capacity of 655 sec. for 16K Smart Brick, 2621 sec. for 64K Smart Brick)

The LaserDisk players which are currently supported are the Pioneer 'LD-' and Sony 'LDP-' series. The Pioneer LaserDisk code was developed and tested on an LD-V8000, which is Pioneer's top of the line unit. It should be compatible with all of the earlier models in this series as well. Current Pioneer LaserDisk models are:

LD-V8000 (recommended)

LD-V6000A

LD-V6000

LD-V3000

LD-V7820-3

The advantages of the LD-V8000 are: four audio channels (two analog and two digital), frame memory during random access, separate front panel controls, and faster access times than all of its predecessors.

The Sony LaserDisk code was developed and tested on an LDP-2000. It should be compatible with all of the other models in this series as well. Current Sony LaserDisk models are

LDP-180 (requires an IF-180 serial port option)

LDP-1000A

LDP-1500

LDP-2000

If more than a single LaserDisk is to be controlled from a single Smart Brick System, then a LaserDisk Multiplexer must be used. Each of these allow four LaserDisk players to be connected to the Smart Brick Brain. Each additional player requires an additional 'show' to hold the disk frame numbers used by that player. This lowers the total number of shows the system can support by half each time you add an additional LaserDisk player to be controlled.

LaserDisks are available in two different recording formats. These are Constant Angular Velocity (CAV) and Constant Linear Velocity (CLV). The only format which will work with the Smart Brick System is the CAV format. This is because the CAV format is the only one which can be used with all of the commands a LaserDisk player support. Capacity of CAV LaserDisk is up to 54,000 frames or 1/2 hour per side.

2) SMPTE: (pronounced "SIMP-T") is a time code which was developed by the Society of Motion Picture and Television Electronics for use in audio, film, and television production. It is normally recorded on a spare audio track on the medium being used (audio tape, video tape, or film), and then used to synchronize various pieces of compatible equipment together. As an industry standard, virtually every audio, video or film studio will have the equipment to lay down a SMPTE time code track.

SMPTE is usually recorded at 30 frames per second (although 25 frames per second is used in Europe and places where this is the normal television frequency, and 24 frames per second is occasionally used in film production). What this means is that 30 (or 24 or 25) times each second a number is recorded on the tape or film which represents the hours, seconds, minutes and frame (00:00:00.00) represented by this particular little stretch of medium. Since each little stretch is represented by a unique number, SMPTE is known as an 'absolute' time code. No matter where the tape is, the Brick Brain will instantly evaluate the numbers it gets from the SMPTE time code, and play the appropriate animation data.

With SMPTE synchronized shows, the SMPTE 'hour' is used to tell the Brick Brain which show it is actually running. The 'hours' SMPTE supports are 00 through 23 to give you 24 possible SMPTE synchronized shows (SMPTE hour '00' is mapped to show number '24' by the Smart Brick Brain, since 00 isn't a valid show number). Any individual show can be as long as an hour. When told to start running a SMPTE show, the Brick Brain will start listening for any SMPTE coming in. When it picks up a good SMPTE signal, it looks at the 'hour', and then checks to see if it is the number of a SMPTE synchronized show, and if so, plays it. Note that if the show number the Brick Brain expects to be played when it starts listening for the SMPTE is not the show number it actually receives, it will play the latter. If the show number it receives isn't assigned as a SMPTE show, then it will display an error message on the Heads Up Display and not play anything. For this reason random access commands for SMPTE synchronized shows are somewhat at the mercy of whatever SMPTE hour is actually received from the SMPTE source.

If more than 24 SMPTE synchronized shows are required, you can use an output from the animation system to stop the system 'mid show'. This technique can be used to break up a single long show into as many shorter sequences as you would like.

Since SMPTE is often provided by an audio or video tape deck, the Brick Brain has three outputs which can be programmed to send signals to the tape deck at the beginnings and ends of the shows. These are typically used to start, stop and rewind the tape deck. These outputs are simple relay closures, which can usually be attached directly to the remote control inputs on a tape deck.

Frame rates supported by the Brick Brain are 15 or 30 FPS when using SMPTE recorded at 30 FPS, 25 FPS when using SMPTE recorded at 25 FPS, and 12 or 24 FPS when using SMPTE recorded at 24 FPS. All type of SMPTE must be recorded 'non-drop frame' for compatibility with the Brick Brain. Show capacities for Smart Bricks are as follows:

- 12 frames/second (show capacity of 1365 sec. for 16K Smart Brick, 5461 sec. for 64K Smart Brick)
- 15 frames/second (show capacity of 1092 sec. for 16K Smart Brick, 4369 sec. for 64K Smart Brick)
- 24 frames/second (show capacity of 682 sec. for 16K Smart Brick, 2730 sec. for 64K Smart Brick)
- 25 frames/second (show capacity of 655 sec. for 16K Smart Brick, 2621 sec. for 64K Smart Brick)
- 30 frames/second (show capacity of 546 sec. for 16K Smart Brick, 2184 sec. for 64K Smart Brick)

SMPTE is a type of time code which is prone to minor errors. The Brick Brain automatically bridges over these until it gets a number of consecutive consistent SMPTE frames. You can set the size of this number when configuring the Brick Brain to anywhere from 1 to 256 consecutive frames.

3) Internal Time Base: If there is no need for synchronization to an audio or video source, you can use the crystal controlled time base in the Brick Brain to clock the entire system. This type of show is often used for chase sequences, test shows, when you just don't need to synchronize a show to anything else, or to keep the figures moving between the main SMPTE or LaserDisk synchronized shows. Frame rates supported are:

- 1 FPS (show capacity of 16,384 sec. for 16K Smart Brick, 65,536 sec. for 64K Smart Brick)
- 2 FPS (show capacity of 8192 sec. for 16K Smart Brick, 32,768 sec. for 64K Smart Brick)
- 4 FPS (show capacity of 4096 sec. for 16K Smart Brick, 16,384 sec. for 64K Smart Brick)
- 5 FPS (show capacity of 3276 sec. for 16K Smart Brick, 13,107 sec. for 64K Smart Brick)
- 8 FPS (show capacity of 2048 sec. for 16K Smart Brick, 8192 sec. for 64K Smart Brick)

- 10 FPS (show capacity of 1638 sec. for 16K Smart Brick, 6553 sec. for 64K Smart Brick)
- 12 FPS (show capacity of 1365 sec. for 16K Smart Brick, 5461 sec. for 64K Smart Brick)
- 15 FPS (show capacity of 1092 sec. for 16K Smart Brick, 4369 sec. for 64K Smart Brick)
- 16 FPS (show capacity of 1024 sec. for 16K Smart Brick, 4096 sec. for 64K Smart Brick)
- 20 FPS (show capacity of 819 sec. for 16K Smart Brick, 3276 sec. for 64K Smart Brick)
- 24 FPS (show capacity of 682 sec. for 16K Smart Brick, 2730 sec. for 64K Smart Brick)
- 25 FPS (show capacity of 655 sec. for 16K Smart Brick, 2621 sec. for 64K Smart Brick)
- 30 FPS (show capacity of 546 sec. for 16K Smart Brick, 2184 sec. for 64K Smart Brick)
- 32 FPS (show capacity of 512 sec. for 16K Smart Brick, 2048 sec. for 64K Smart Brick)
- 50 FPS (show capacity of 327 sec. for 16K Smart Brick, 1310 sec. for 64K Smart Brick)
- 60 FPS (show capacity of 273 sec. for 16K Smart Brick, 1092 sec. for 64K Smart Brick)
- 64 FPS (show capacity of 256 sec. for 16K Smart Brick, 1024 sec. for 64K Smart Brick)
- 75 FPS (show capacity of 218 sec. for 16K Smart Brick, 873 sec. for 64K Smart Brick)
- 100 FPS (show capacity of 163 sec. for 16K Smart Brick, 655 sec. for 64K Smart Brick)

4) External Time Base: This is generally used when you need to tie the Smart Brick System to an external clock. Typical uses of external time base sync are to lock the system to a mechanical device like a motion picture camera or projector so that it will follow at any speed, or to synchronize two incompatible systems so that data can be transferred between the two. Frame rates supported are from 1 to 100 FPS (this is simply the number of frames displayed on the Heads Up Display, as the actual rate will follow whatever clock rate is fed to the Brick Brain).

5) IBM Backup Box Mode: This is a special mode which is used only when using the IBM Backup Box with the Smart Brick System. It makes the Smart Brick System look to the IBM Backup Box more like a standard externally clocked Micro MACs system. It is entered by turning on SWITCH 8 in the dipswitch inside the Brick Brain. When in this mode, the hours, minutes, seconds, and frame numbers on the Heads Up Display will not be updated and the Smart Bricks will be treated as a single block of 16K or 64K bytes of memory. If you have broken up the memory into any separate 'shows', these will simply be ignored. These shortcuts are to save time so that the system can run at the higher speeds the IBM Backup Box wants to see. Even so, you may find that the Smart Brick System still isn't as fast as the IBM Backup Box wants to see it (a lot of this depends on how fast your IBM compatible runs). For this reason you may need to slow down the IBM Backup Box software by setting the 'Fast Forward Speed'. Larger numbers slow the Backup Box down, while smaller numbers run faster. To test the speed to determine the proper settings for the 'fast forward speed', do the following:

- 1) Connect the IBM backup Box to the Smart Brick System normally by:
 - a) connect the Smart Brick to the Micro Console and Brick Brain as you would normally.
 - b) run a 6 conductor telephone style cable between the 'J8 input' on the Brain and the 'J8 out' in the IBM Backup box.
 - c) connect the 1/4 J-6 for the channel you will be using to the IBM backup Box.
 - d) connect the parallel port from the IBM compatible you will be using to the IBM Backup Box.
- 2) Turn on dipswitch number 8 in the Smart Brick Brain.
- 3) Using the 'single step' command ("s") in the IBM Backup Box software, program in a simple and easily recognizable sequence in the first few frames of the Smart Brick
- 4) Write this data to the disk of the IBM compatible using the instructions in the IBM Backup Box manual.
- 5) Read this data back into the Smart Brick using the instructions in the IBM Backup Box manual.
- 6) Now single step through the first few frames of the reloaded data and see if they are the same as when you programmed them, and especially that the data is in the same frame numbers as they were when you programmed them.
- 7a) If the data has changed or has moved, then you need to use a larger number for the 'fast forward speed'. Enter the 'fast forward speed' and repeat this sequence starting at step 3 above again to make sure that the IBM Backup Box is now running slowly enough.

- 7b) If the data has not changed, then the two systems are staying in sync. You can use the current setting for the 'fast forward speed', or you can try speeding it up a bit by lowering the number in the 'fast forward speed', and repeat this sequence starting at step 3 to see if it is now too fast. You should leave a little bit of a safety margin over which the system won't run in sync to allow for longer wire runs and other factors which might slow the system down further.
- 8) Turn dipswitch 8 off if you are done with the IBM Backup Box to return the Smart Brick System to it's normal operating modes.

- Countdown Between Shows -

At the end of any show you can tell the Brick Brain to either stop, chain immediately to the next show, or start a countdown. At the end of this countdown, you can tell the system to start the next show, or just close one of the relay outputs which are normally used to control the tape deck if you need to trigger some other piece of equipment

The length of the countdown can be set at any time by setting a thumbwheel switch located on the front of the Smart Brick Brain. The positions set the delays as follows:

- | | |
|-------------------------|---|
| 1) 1 x 'delay reload' | (for 15 seconds delay when delay reload is set to 15 seconds) |
| 2) 2 x 'delay reload' | (for 30 seconds delay when delay reload is set to 15 seconds) |
| 3) 4 x 'delay reload' | (for 1 minute delay when delay reload is set to 15 seconds) |
| 4) 8 x 'delay reload' | (for 2 minutes delay when delay reload is set to 15 seconds) |
| 5) 20 x 'delay reload' | (for 5 minutes delay when delay reload is set to 15 seconds) |
| 6) 40 x 'delay reload' | (for 10 minutes delay when delay reload is set to 15 seconds) |
| 7) 80 x 'delay reload' | (for 20 minutes delay when delay reload is set to 15 seconds) |
| 8) 120 x 'delay reload' | (for 30 minutes delay when delay reload is set to 15 seconds) |
| 9) 240 x 'delay reload' | (for 1 hour delay when delay reload is set to 15 seconds) |
| 0) stops cycling shows | |

The '**DELAY RELOAD**' value is set in the configuration menu. A typical value is 15 seconds. This give you the delays shown above. If the value for the '**DELAY RELOAD**' were doubled, then the delays would also double. If it were set to a value of 90 seconds, the maximum delay would be 6 hours. If during the course of a countdown the Brick Brain gets any '**RESET**' command (either through the serial port or any of the hardware inputs) it will re-start the countdown from the initial value as set by the thumbwheel switch and '**DELAY RELOAD**' value.

At the end of the countdown, the Brick Brain again checks the value on the thumbwheel switch. If it is now set to '0', then the Brick Brain takes no further action. If it is set to anything else, then it treats the end of the countdown just like an input coming from one of the Brick Brain's switch inputs. You can tell the Brick Brain to do any of the following:

- 1) Reset
- 2) + Frame
- 3) Start
- 4) Start Looping (normal setting)**
- 5) Stop
- 6) Stop at end
- 7) a) close 'stop' relay output
b) close 'rewind' relay output
c) close 'play' relay output

Setting the '**Reset**', '**+ Frame**', '**Stop**', or '**Stop at End**' settings are fairly pointless in that there will be no shows running when the countdown ends, and so should never be needed. Setting the '**START**' command will start whatever the next show should be as set by the 'next show' entry in the configuration for the last show which was played (see the show configuration section of this manual). At the end of that show, however, nothing more will happen.

The normal setting for the end of the countdown is to '**START LOOPING**'. This tells the Brick Brain to start the 'next' show playing just as with the '**START**' command, but at the end of this show, it will check the configuration for the show to see if the '**IMMEDIATE**' or '**DELAY**' flags are set. If they are, then the next show or a new delay will be started as appropriate. The Smart Brick System can then continue cycling shows until it is told to stop. Any one of the tape deck output commands can be used by themselves or in conjunction with any of the other commands.

- Smart Brick Brain Dipswitches -

There is one eight position dipswitch located inside the cover of the Smart Brick Brain. Once set, it is not normally used again. Most of these settings are available through the menus on the Rack Smart Brick Brain.

SWITCH 1: not used

SWITCH 2: Bridge LaserDisk errors. When on, the Brick Brain will try to bridge over any dropouts in the communications with a LaserDisk player. This is used to bridge over the three or more seconds it takes a LaserDisk player to recover from a glitch.

SWITCH 3: Countdown Halt mode: When on, any input on the BLUE line will freeze the countdown between shows at the current value. When this input is released, the countdown will continue just as if nothing had happened.

SWITCH 4: Coin-Op mode. Turning this switch on puts the brick into a special mode used for coin operated games. A show will be started each time a start command comes in on the green input (A number of shows are normally set up so that a different show plays at each start). The countdown selects and plays show 3Fh each time it ends. If the RED input gets a closure, then show 3Eh will play.

SWITCH 5: This dipswitch is used to tell the Brick Brain how big the memory installed in the Smart Bricks is. This switch should be turned 'on' when using 64K Smart Bricks, and 'off' when using 16K Smart Bricks. When running at 15 frames per second, a 64K Smart Brick has a capacity of just over 72 minutes while a 16K one is around 18 minutes. At 30 frames per second the capacities are 36 minutes for a 64K Brick and 9 minutes for a 16K Brick.

SWITCH 6: This switch can be used to disable all of the 'Record Keyswitches' on all of the Smart Bricks in your installation. When this switch is 'on', it is possible to record data into the Smart Bricks. When it is 'off', there is no way to put the Smart Bricks into 'record' mode, even if the 'Record Keyswitch' on the Bricks is turned 'on'. The record LEDs on the front of the Smart Bricks will not even turn on if recording has been disabled in this way. After programming a show you should turn this switch 'off' to absolutely eliminate the possibility of someone turning on a Smart Brick's 'record' keyswitch and altering any data.

SWITCH 7: This switch is used to load the default values into the EEprom on the Brick Brain. You should never need to use this switch. What it does is sets the serial port to 9600 baud and the card address to number 00. This brings a new Brick Brain up far enough for us to load the remaining parts of the configuration and test it.

SWITCH 8: This switch should be turned 'on' when using an IBM Backup box with the Brick Brain. At all other times it should be left 'off'. If it is on, the Brick Brain will ignore any inputs on the PB or 1/4 J-6 inputs, and will only reset and step frames in response to inputs from the J-8 input.

- Brick Brain Connections -

There are 8 connections which can be made to the Smart Brick Brain. These are:

1) Power: This is a small 12 VDC wall mounted transformer which just needs to be plugged in to 117 VAC.

2) SMPTE Input: This is a female RCA jack which should be attached to the source of SMPTE time code being used (if any). This input has a 10 Kohm input impedance, and expects to see a SMPTE signal level of about 0 VU.

3) Tape Deck Control: This input is normally used to control any tape decks attached to the Brick Brain. The connections are as follows:

1) Ground

2) +5 VDC

3) Foil A: This is a non-optoisolated 5 volt logic level version of the BLUE input on the J-8 input. There is a 4.7 Kohm pullup resistor to 5 VDC on this input.

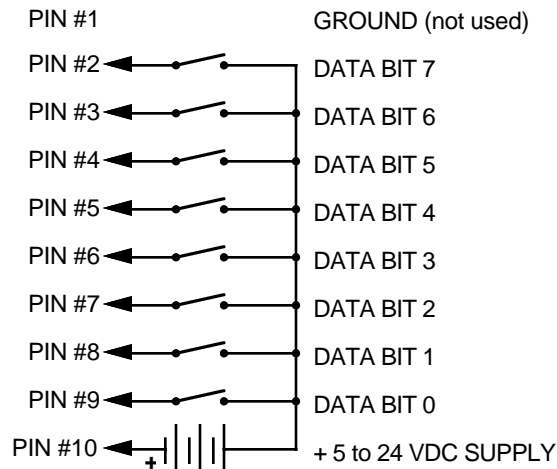
4) Foil B: This is a non-optoisolated 5 volt logic level version of the GREEN input on the J-8 input. There is a 4.7 Kohm pullup resistor to 5 VDC on this input.

5 & 6) Rewind Output: These are the relay outputs which close when a 'Rewind' command is encountered in a string being sent at the start or end of any show.

7 & 8) Play Output: These are the relay outputs which close when a 'Play' command is encountered in a string being sent at the start or end of any show.

9 & 10) Stop Output: These are the relay outputs which close when a 'STOP' command is encountered in a string being sent at the start or end of any show.

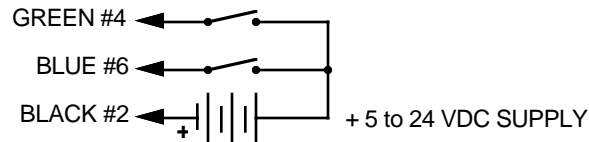
4) 1/4 J-6 input: This is a standard optically isolated 1/4 J-6 input which can be used to randomly access shows in the Smart Brick System. This input can be configured to operate in one of two ways. The first of these is a 'one-of-eight', in which each of the inputs can be used to select any of the first eight shows in the system (bit 0 selects show #1, bit 1 selects show #2, etc.). The second operation mode is used when you need to randomly access more than the first eight shows. In this mode you send the port a binary number to select any of the 63 possible shows stored in the system. The pin out for the 1/4 J-6 is as follows:



5) J-8 input: This input has two optically isolated inputs on it which can be used for starting, stopping, stepping, resetting, or a variety of other functions in the system. The exact function of these inputs is set when you configure the Smart Brick Brain. This input has the same pinout and polarity as the J-8 connections found on all of our normal Micro MACs Bricks. Facing the end of the plug with the latch upward, the order of these inputs is as follows:

	COLOR	SIGNAL NAME:
1)	WHITE:	not used
2)	BLACK:	common + 5 to 24 VDC (15 Volts nominal) input
3)	RED:	not used
4)	GREEN:	optically isolated input
5)	YELLOW:	not used
6)	BLUE:	optically isolated input

The Connections to the J-8 input are as follows. As these are feeding into an optoisolator, you must provide a voltage to the Brick Brain on the BLACK input line (#2):



6) J-8 output: Not used

7) To Smart Bricks: This is the start of the cable which runs to all of the Smart Bricks and Heads Up Displays installed in the system. All signals are compatible with RS-422 and RS-485 signal levels. Facing the end of the plug with the latch upward, the order of these outputs is as follows:

	pin #	COLOR	SIGNAL NAME:
(left)	1	WHITE	+ data output
	2	BLACK	- data output
	3	RED	+ clock output
	4	GREEN	- clock output
	5	YELLOW	+ strobe output
(right)	6	BLUE	- strobe output

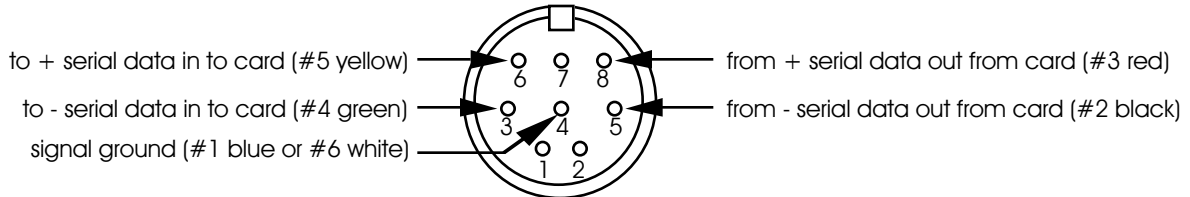
8) RS-422 Serial Port: This is the serial port which is used to send commands to the Smart Brick System or to connect a LaserDisk to the Smart Brick System. It must be connected to a terminal or computer running a modem or terminal emulation program for configuring the Smart Brick System. This is the same style of connector and pin out as is used on the AB-100 Digital Audio Repeaters, and can be attached to both Brick Brains and Digital Audio Repeaters simultaneously, just so long as their addresses don't conflict. Facing the end of the cable with the release latch upwards, its pin out is as follows:

	pin #	COLOR	SIGNAL NAME:
(left)	1	WHITE	signal ground
	2	BLACK	- serial data out from Brick Brains
	3	RED	+ serial data out from Brick Brains
	4	GREEN	- serial data in to Brick Brains
	5	YELLOW	+ serial data in to Brick Brains
(right)	6	BLUE	signal ground

To cross wire the RS-422 / RS-485 signals from the Smart Brick System to the RS-232 serial port of an IBM compatible or Pioneer LaserDisk player, cross connect the signals as follows:

IBM DB-25	IBM DE-9	Pioneer LaserDisk DB-15	SIGNAL	SIGNAL FROM/TO BRICK BRAIN
2	3	2	DATA OUT	- serial data in to Brick Brain (GREEN)
3	2	3	DATA IN	- serial data out from Brick Brain (BLACK)
7	5	1, 11 or 15	GROUND	signal ground (BLUE or WHITE)

Apple Macintosh computers have true RS-422 serial ports built in. To connect to the Smart Brick System, the pin out is as follows for a Macintosh mini-DIN-8:



- Smart Brick Configuration -

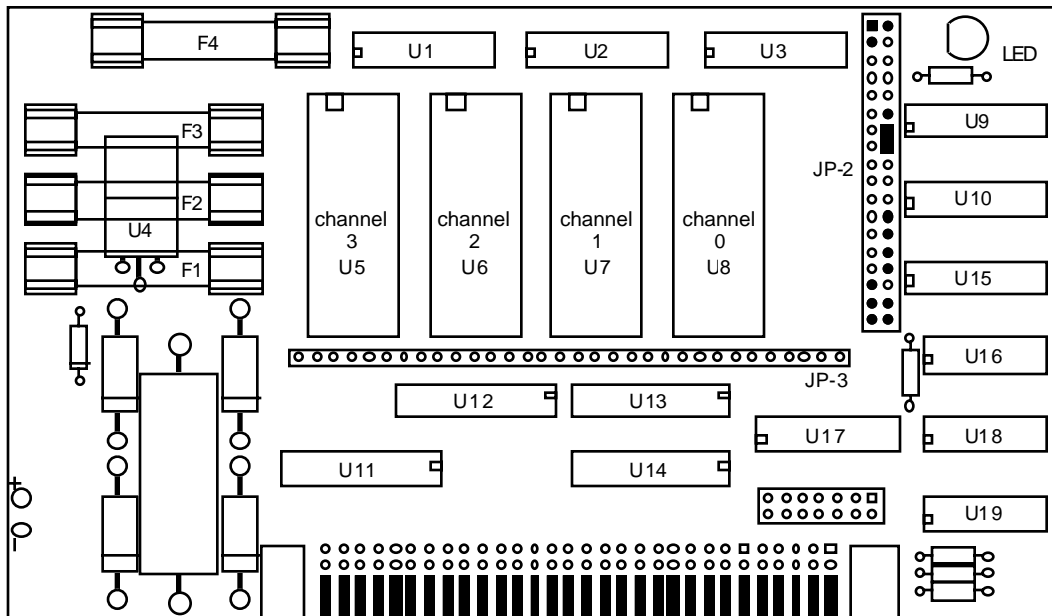
The majority of the configuration for the Smart Bricks is handled in the Brick Brain. The exceptions to this are those jumpers which set the size and type of memory used in each Smart Brick, and whether or not you would like the outputs from a Smart Brick to be disabled when ever the system is not advancing frames.

The one jumper which the Smart Bricks have on them retain the same callout as are used in the normal Micro MACs Bricks. All configuration is done on JP-2. The two things which Smart Bricks must be configured for are the memory size and type and the 'enable/disable when stopped'.

In all of the following drawings, the jumper pins are shown as circles contained within an outline of the header assembly. Pins which are used for a given configuration are shown as filled-in, while those which remain hollow are not being used. The jumper plugs (used for connecting adjacent pins) or wires (used for connecting pins which are not adjacent) which connect the pins are shown as black lines. Any pin which is shown filled in with black, but which does not have any wire or jumper plug shown on it, must have all wires and/or jumper plugs removed from it in the actual Smart Brick you are configuring.

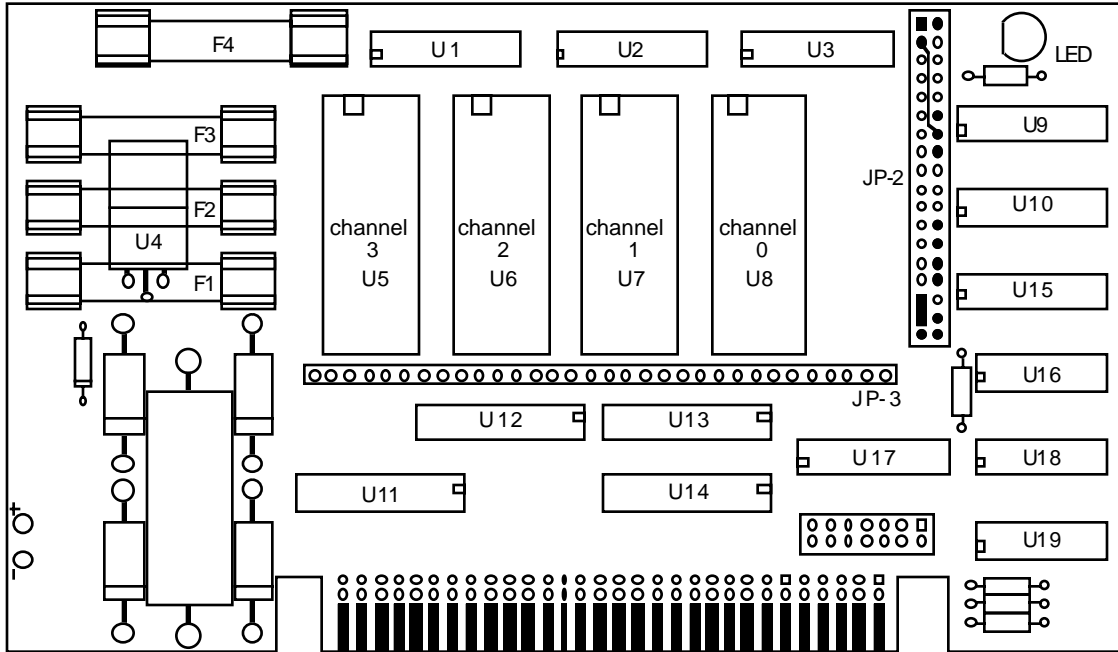
- 6264LP RAM -

To configure a Record/Playback Smart Brick for use with 6264LP static RAM Chips for a capacity of 16,384 (16K) frames.



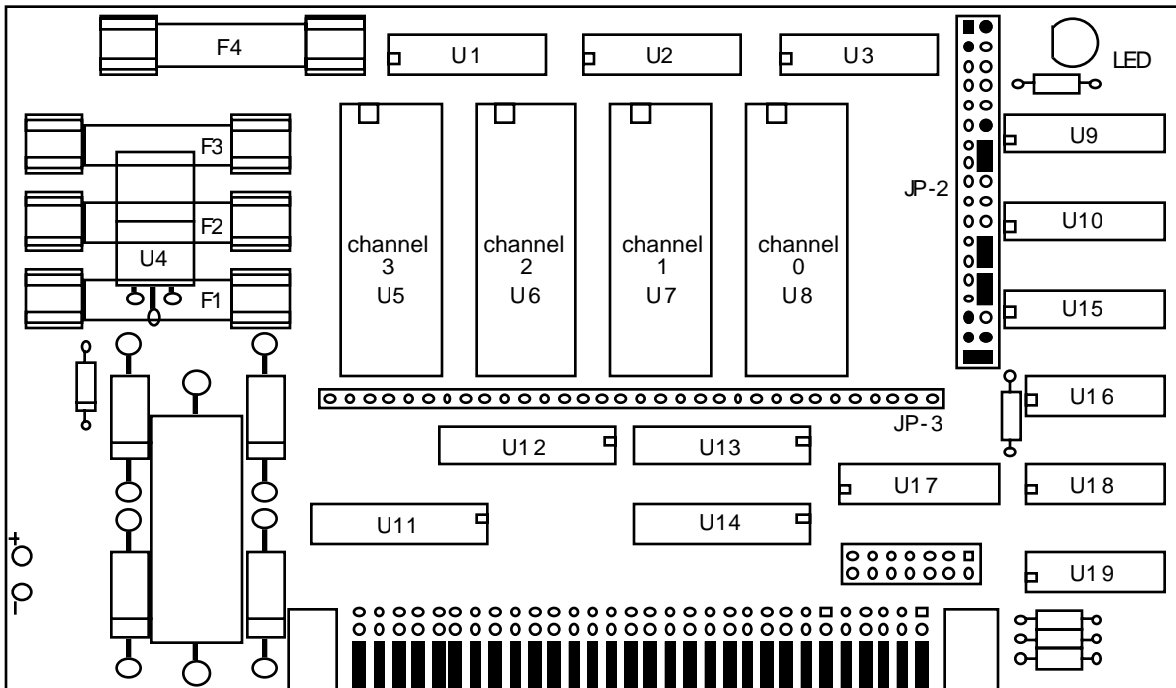
- 62256LP RAM -

To configure a Record/Playback Smart Brick for use with 62256LP static RAM Chips for a capacity of 65,536 (64K). (This is the only configuration which requires a wire wrapped jumper between two pins which aren't adjacent).



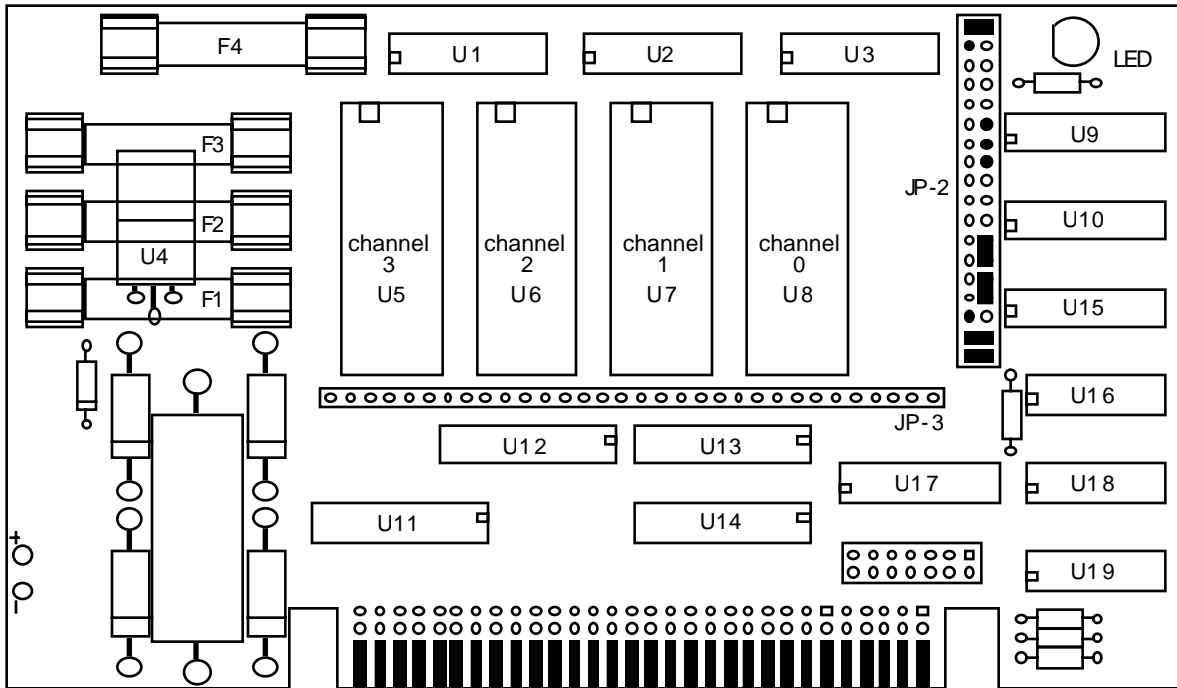
- 27C32 Eprom -

To configure a Playback-only Smart Brick for use with 27C32 Eprom Chips for a capacity of 4096 (4K) frames.



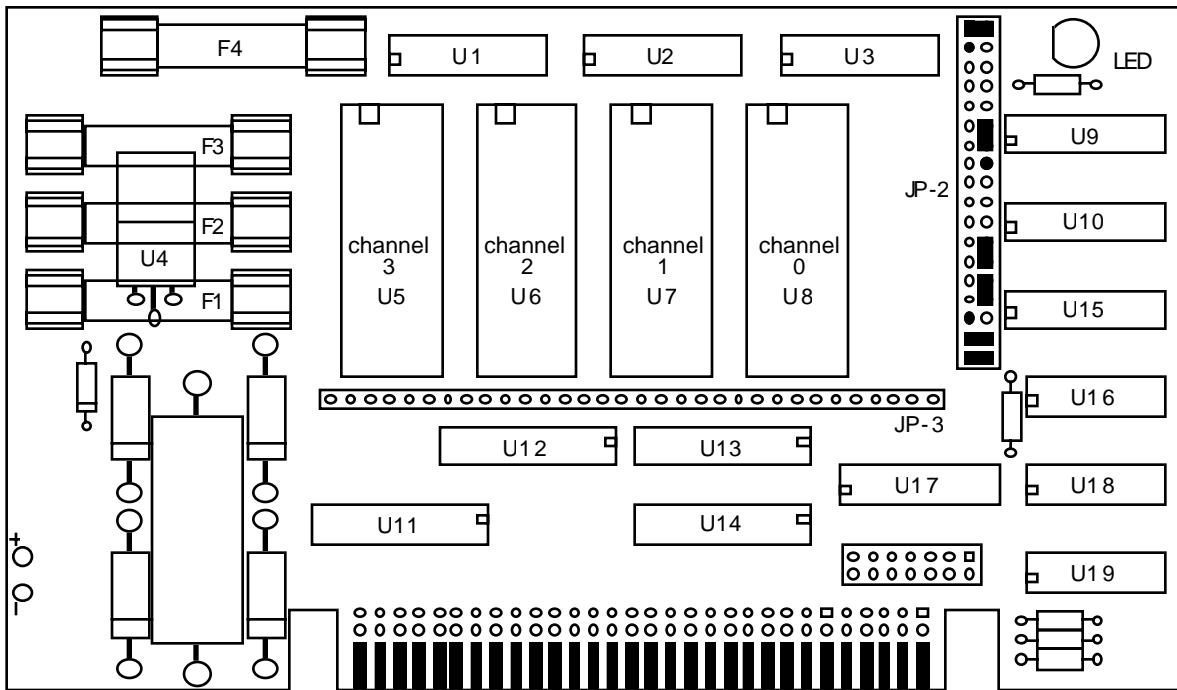
- 27C64 Eprom -

To configure a Playback-only Smart Brick for use with 27C64 Eprom Chips for a capacity of 8192 (8K) frames.



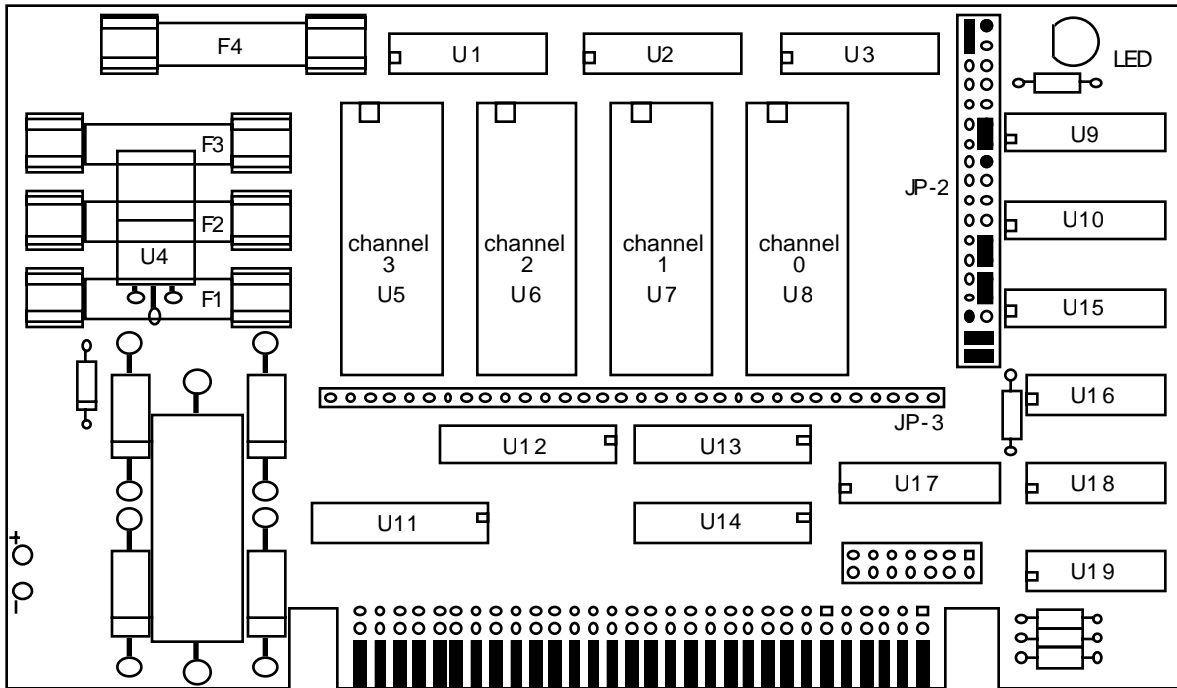
- 27C128 Eprom -

To configure a Playback-only Smart Brick for use with 27C128 Eprom Chips for a capacity of 16,384 (16K) frames.



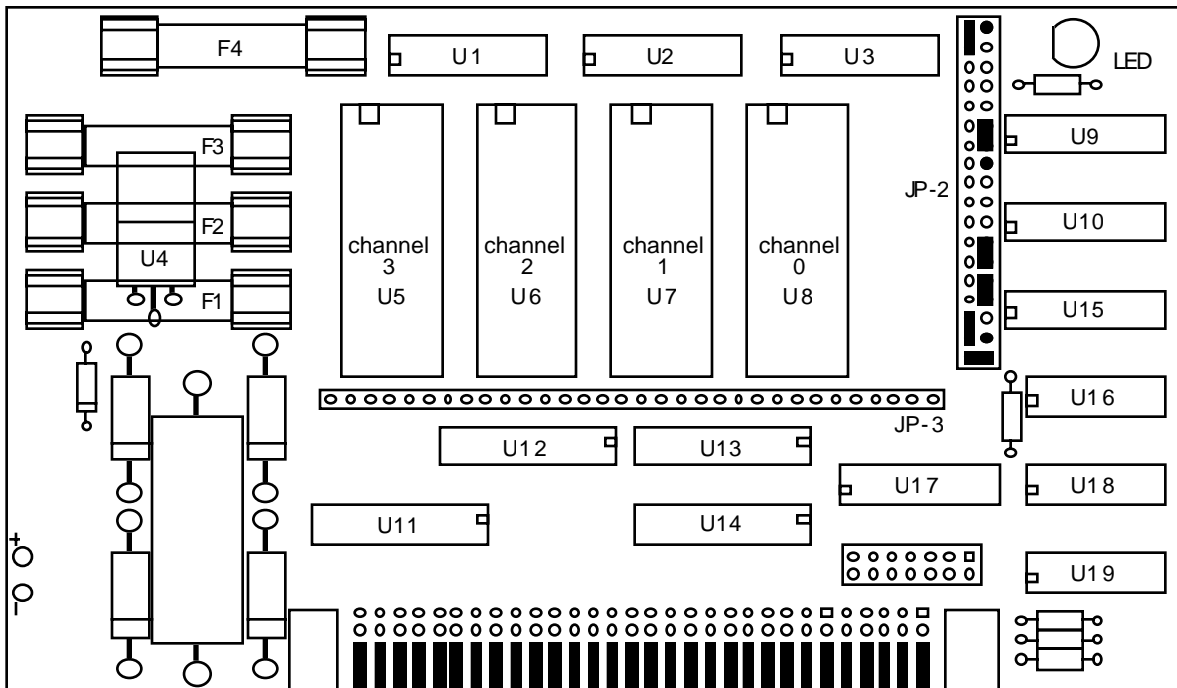
- 27C256 Eprom -

To configure a Playback-only Smart Brick for use with 27C256 Eprom Chips for a capacity of 32,768 (32K) frames.



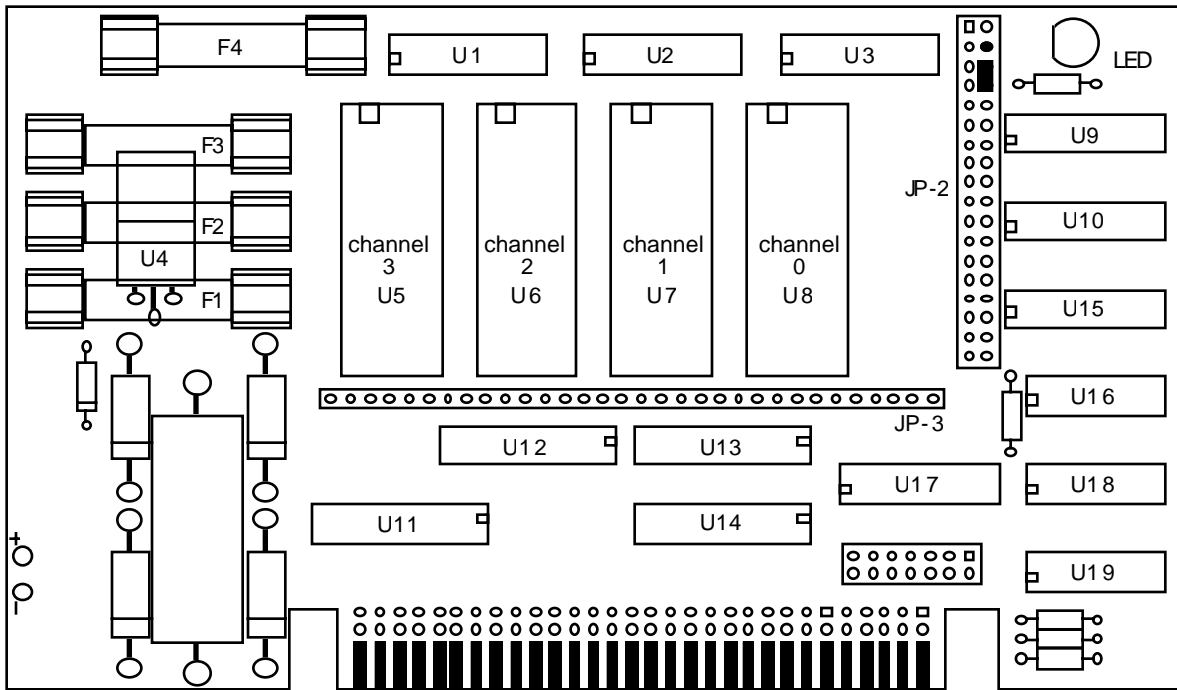
- 27C512 Eprom -

To configure a Playback-only Smart Brick for use with 27C512 Eprom Chips for a capacity of 65,536 (64K) frames



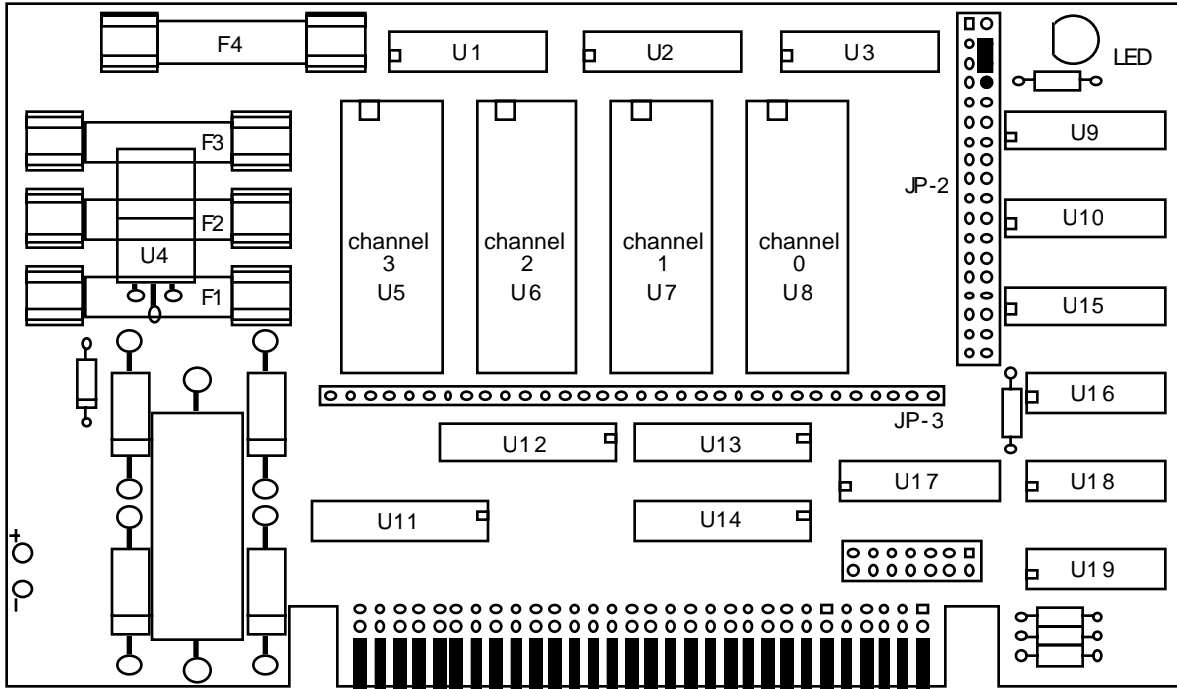
- Enabling the Outputs When Stopped -

This jumper plug must be installed for the Smart Brick to work. It has two possible positions. This position should be used if you want the outputs to be active at their programmed levels, even when the system is not advancing frames. This is used if you don't care that some outputs might stay on even when the system is no longer advancing frames. It is almost always used if there are any analog functions attached to a Smart Brick, as disabling the outputs which feed a D/A converter would cause it to slam to one of it's extremes.

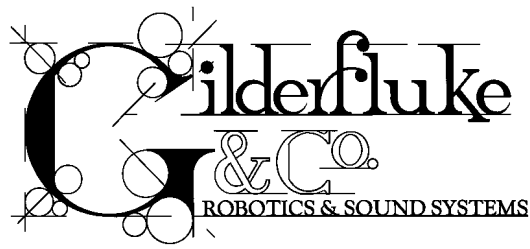


- Disabling the Outputs When Stopped -

This jumper plug must be installed for the Smart Brick to work. It has two possible positions. This position will cause all of the outputs to turn off whenever the Smart Brick System stops advancing frames and the 'running delay' counter has run out. This is useful if damage might result from leaving certain outputs in your system turned on indefinitely, as could occur if the system were stopped while those outputs were active.



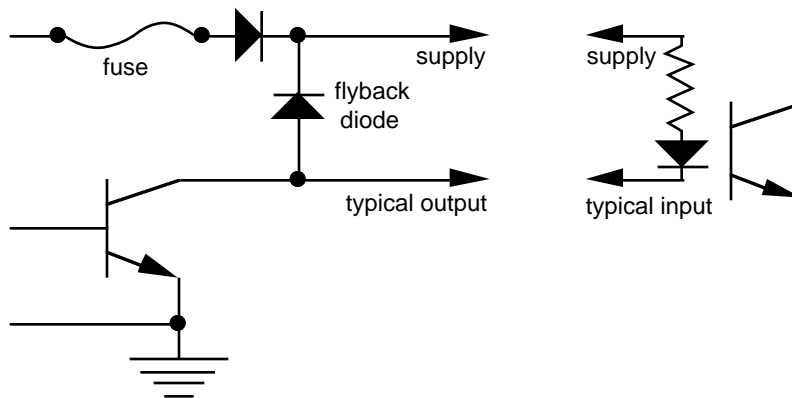
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- J-6 Digital Output Cables -

In all animation systems made by Gilderfluke & Company all input and output cabling on the Smart Bricks is through what we call 'J-6' standard output cables. These are 40 wire cables which are made up of four identical eight bit wide 'channels'. A J-6 cable is often split up into four individual channels. As each channel also includes a common power supply and ground wire, each '1/4 J-6' cable is made up of 10 wires, and can be used to control eight individual 'digital' (off/on) devices, or one eight bit wide 'analog' device.

In all animation systems made by Gilderfluke & Company, all outputs are open collector switches to ground, and all inputs are opto isolators. Flyback diodes are included in the outputs for driving inductive loads:



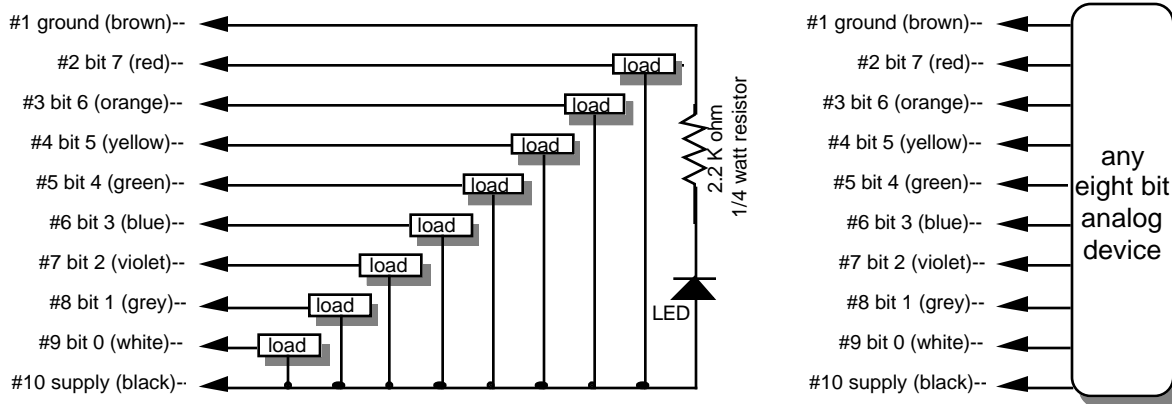
To simplify wiring to any MACs animation system, the connectors used on the J-6 cables are what are called 'insulation displacement connectors'. These simply snap on to an entire cable, automatically 'displacing' the wire insulation and making contact with the wires within. This means that an entire 40 wire cable can be terminated in seconds. All connectors are polarized, to keep them from being plugged in backwards. Although there are tools made specifically for installing these connectors, the tool we find works best is a small bench vise.

Each J-6 cable is arranged in the following order:

<u>wire number</u>	<u>color</u>	<u>wire function</u>
1	brown	circuit ground
2	red	channel 0 data bit 7
3	orange	channel 0 data bit 6
4	yellow	channel 0 data bit 5
5	green	channel 0 data bit 4
6	blue	channel 0 data bit 3
7	violet	channel 0 data bit 2
8	gray	channel 0 data bit 1
9	white	channel 0 data bit 0
10	black	+15 VDC unregulated power supply (fused for 1 amp)
11	brown	circuit ground
12	red	channel 1 data bit 7
13	orange	channel 1 data bit 6
14	yellow	channel 1 data bit 5
15	green	channel 1 data bit 4
16	blue	channel 1 data bit 3

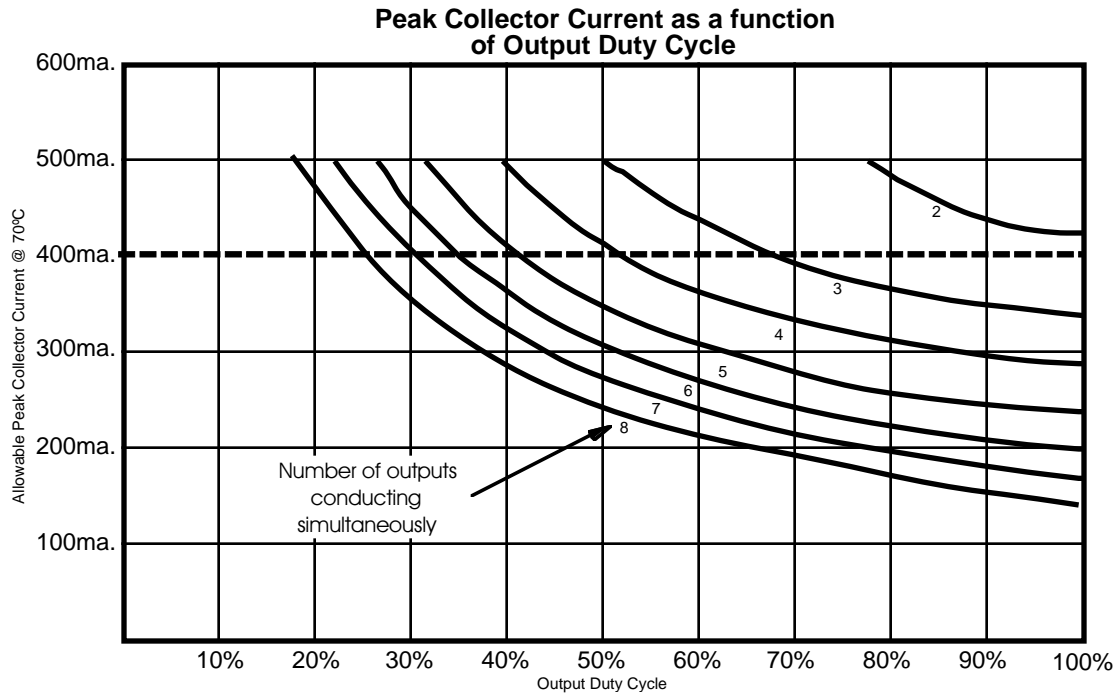
17	violet	channel 1 data bit 2
18	gray	channel 1 data bit 1
19	white	channel 1 data bit 0
20	black	+15 VDC unregulated power supply (fused for 1 amp)
21	brown	circuit ground
22	red	channel 2 data bit 7
23	orange	channel 2 data bit 6
24	yellow	channel 2 data bit 5
25	green	channel 2 data bit 4
26	blue	channel 2 data bit 3
27	violet	channel 2 data bit 2
28	gray	channel 2 data bit 1
29	white	channel 2 data bit 0
30	black	+15 VDC unregulated power supply (fused for 1 amp)
31	brown	circuit ground
32	red	channel 3 data bit 7
33	orange	channel 3 data bit 6
34	yellow	channel 3 data bit 5
35	green	channel 3 data bit 4
36	blue	channel 3 data bit 3
37	violet	channel 3 data bit 2
38	gray	channel 3 data bit 1
39	white	channel 3 data bit 0
40	black	+15 VDC unregulated power supply (fused for 1 amp)

Any eight digital devices or one eight bit analog device can be connected to any 1/4 J-6 cable as shown. The LED between the ground (pin #1 brown) wire and supply (pin #10 black) wire acts as an indicator which is lit if the fuse for that channel is OK:



The supply line for each 1/4 J-6 is fused for 1 amp. You should treat each 1/4 J-6 as an individual, and not cross the outputs or supply lines from one channel to the lines from any other channel. Doing this won't cause any damage, but can reduce the protection for the outputs that the fuses normally provide.

The current Output Capacity of a each output is as shown in the following chart:



Since it is unusual to have more than 50% of the outputs on at any one time, you can usually assume the system has a 250 ma output current capacity. If you are going to be turning on lots of heavy loads at the same time, you should derate this to 150 ma.. This is sufficient to drive the majority of loads which will be directly connected to the outputs of the animation system. If additional current capacity is needed, or if you need to drive higher voltage loads, you can connect relays as needed to the outputs of the animation system. Coincidentally, boards for doing this are available from Gilderfluke & Company. These include:

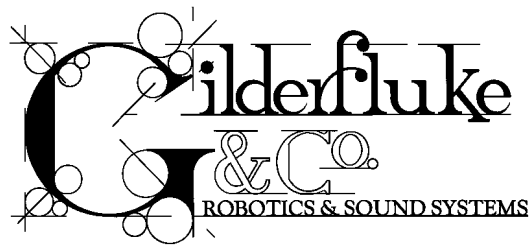
DPDT relay board: A set of eight electromechanical relays with double pole/double throw contacts rated at 5 amps each.

Reed relay board: A set of eight small electromechanical relays with normally open contacts rated at 150 ma each.

I/O module: A set of eight small solid state relays with normally open contacts rated at 3.5 amps each (AC and DC relays available).

Solid State Relay Fanning Strip: For connecting up to eight popular 'hockey puck' style relays to a 1/4 J-6 output cable. These are available with capacities of up to 75 amps each.

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- Programming -

Every Smart Brick has a capacity which is 32 bits wide. When controlling digital (on/off) functions, each of these 32 outputs can be used to turn on and off a single device. At eight bits of resolution, each analog (variable speed and position) function takes over eight of these digital outputs. Any combination of digital and analog functions can be controlled from a single Smart Brick. With eight bit resolution analog functions, the following show all the possible combinations:

- A) no analogs and 32 digital functions
- B) 1 analog and 24 digital functions
- C) 2 analogs and 16 digital functions
- D) 3 analogs and 8 digital functions
- E) 4 analogs and no digital functions

Playback-Only Bricks:

All Playback-only Smart Bricks have their data stored in Eproms. Burning data into Eproms is as close to 'chiseling in stone' as you can get in the world of computers. Short of being hit by lightning, anything which is programmed into one of these playback-only Bricks will last forever (unless you want to change it). The Eproms are programmed outside the bricks and then plugged into them. The program can be generated in one of several ways:

- A) The show is initially programmed using standard record-playback bricks. When the programming is completed, the show data is moved to an IBM compatible computer using the IBM Backup Box. It can then be burned into the Eproms using any commercially available Eprom programmer.
- B) The show is initially programmed using a full-sized MACs Animation Control System and then burned into the Eproms using any commercially available Eprom programmer
- C) The show is initially programmed from any other source and then burned into the Eproms using any commercially available Eprom programmer.

Record-Playback Bricks:

The only bricks which can be programmed directly are the record-playback bricks. Shows for these can also be programmed using ours or just about any other full-sized Animation Control System, and then downloaded to the record-playback Smart Bricks.

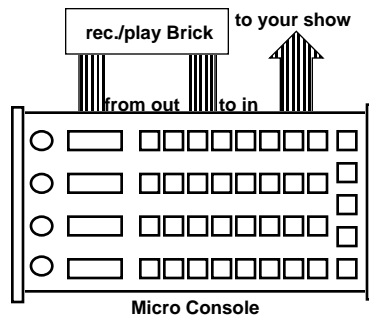
All Smart Bricks are real-time Animation Control Systems. What this means is that they are normally programmed as the show is going on. You do this by moving the controls (pots, joysticks, buttons, sliders, or whatever) which are connected to the figure through the control system and watching it move as the audio for the show (if any) is played. The bricks will remember exactly whatever you do on the controls and when you did it. Once programmed, this data will stay in the bricks until you want to change it again.

Normally only one or two functions are programmed at a time. On each pass through the show you add the programming for few additional channels while all previously recorded channels play back whatever you have already programmed into them. If you make a mistake on any pass, you can always go back and change the programming for the whole show, or just the area where it needs it. By repeating this process, you eventually have all of the movements programmed! It is exactly like building up a multi track recording in an audio studio.

Once programmed, the programming hardware can then be removed from the system.

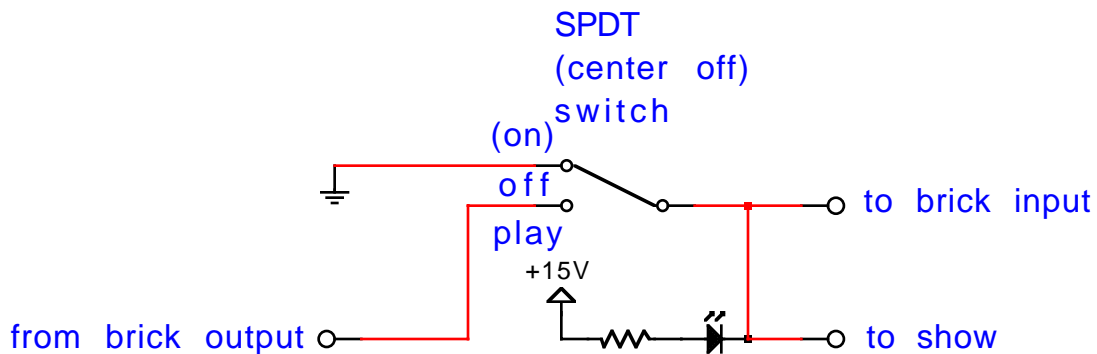
This programming hardware can be a standard Micro Console, or a console which has been made for your specific requirements. Additional optional hardware which can be used during programming are the IBM Backup Box and Heads-Up-Displays. The IBM Backup Box (with an IBM PC or compatible) can be used to random access specific frames within a show, program 'single step' on a frame-by-frame basis, or store a completed animation sequence to the disk of the IBM for archival use or burning into the Eproms which are plugged into the playback-only Smart Bricks. The Heads-Up-Display simply gives you a big readout to tell you where in a show you are at any instant.

Each Micro Console can be used to program one brick at a time. If more than one brick is used in your show, then you can move the console between the bricks as they are programmed, or use more than one console. The Micro Console has individual momentary and sustained switches for each of the 32 Bricks' possible outputs, as well as four pots for programming up to 4 eight bit analog functions. A Micro Console is attached to a Smart Brick as shown. Two cables run between the Micro Console and the Smart Brick while a third cable goes to whatever the system is controlling. After programming is completed, this third cable is plugged directly into the Smart Brick's 'output' connector.

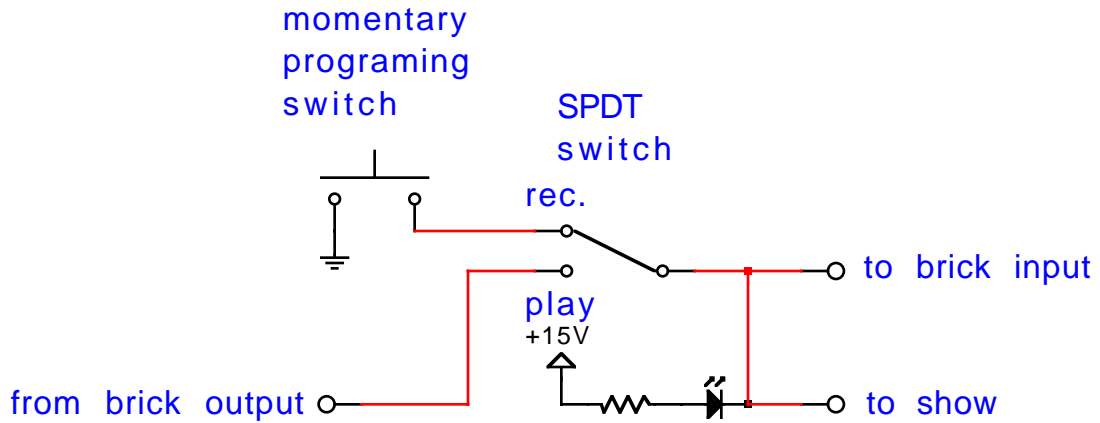


When building a programming console specific to your application, you can make it as simple or as complicated as you desire. Where a standard Micro Console can handle up to four 8 bit wide channels at one time, you can build your console to allow you to program just as many channels at a time as you want.

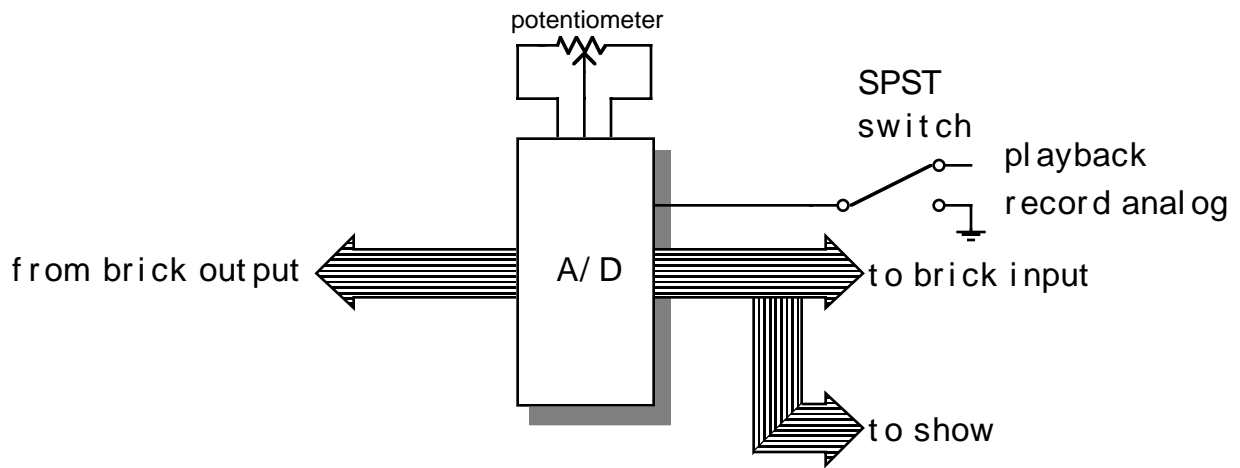
All that is required for programming a digital function is a simple switch for each brick output/input:



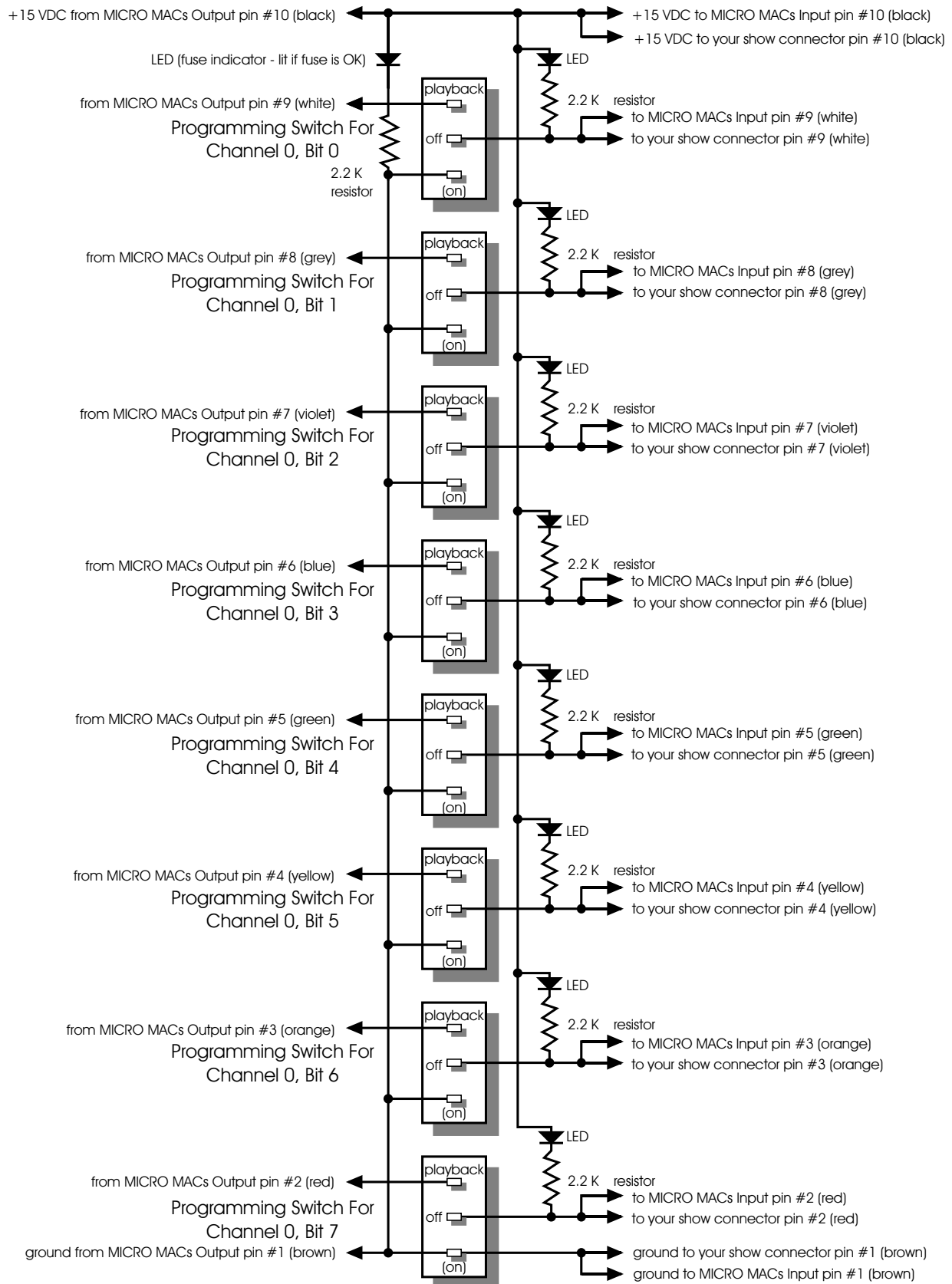
By adding a pushbutton switch to the connections shown above, you can make an easier to use programming console that has a separate 'programming enable' switch and pushbutton for turning on and off the output

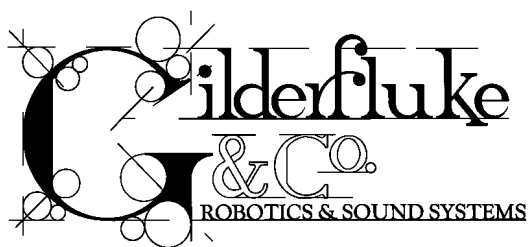


For building an analog programming console, we recommend you use our Analog to Digital (A/D) Converters. One is used for each analog function on your console. In this case the wires 'from brick output', 'to brick input', and 'to show' are actually eight wires (plus ground and + supply) that make up a 1/4 J-6 cable:



The following shows the entire wiring diagram for a simple digital-only programming console for one eight bit channel. Channel 0 pinouts shown on the 1/4 J-6 connectors. Add 10 to all pin numbers for channel 1, 20 for channel 2, and 30 for channel 3. All switches are Single Pole, Double Throw (SPDT) center off, (optionally momentary one side only). Rear view of actual switches is shown.





- Smart Brick System Commands -

The MACs Smart Brick System can be controlled by simple switch closures to start and stop playback or cycling, randomly select shows, and perform a variety of functions. In addition to this method of controlling it, you can talk to any combination of up to 256 Smart Brick Systems and Digital Audio Repeaters at one time through a serial data line from your computer, terminal, or control system.

This same serial port must be used to configure the features of any Smart Brick System, and is used by the system when it needs to talk to a LaserDisk player or any other serially controlled device. The latter limits the use of the serial port to those systems which are not controlling LaserDisk players.

All commands sent to the MACs Smart Brick System through its serial interface take the following format. All characters are sent in ASCII. All numeric values are sent in HEXadecimal (HEX for short), and consist of one or more ASCII characters (0-9, A through F). The case (as in upper and lower) of all input is important. A lower case 'a' signifies a command, while an 'A' is a numeric value. If the Smart Brick System receives another command while it is waiting for additional input needed to complete the previous command, it will abandon the previous command and start working on the new one.

In the following documentation any input you will send to the audio system is shown in outline. The response to a command is shown in italics.

If the Smart Brick System is in a mode where you expect to receive some response from it (generally in one of the echo modes), you must wait to receive all of the characters you are expecting before sending the system a new command. The reason for this is that you are actually talking to up to 256 microprocessors at a time, and if you issue a command which gives a response from one Brick Brain, and then a command which gives a response from a second Brick Brain before the first has finished, then the two may try and output data at the same time. This won't cause any damage, but may result in garbled data at the receiver.

It is also possible to overload the Smart Brick System with too many commands through the serial port. You don't want to take too much time away from the Brick Brain to service the serial port.

To communicate with the Smart Brick System through the serial port, you can use just about any computer or terminal which has a serial port on it. Most modern computer designs, like the Apple Macintosh, come with serial ports which are directly compatible with the RS-422 / RS-485 signal levels the Smart Brick System wants to see. These signal levels are close enough to be used with the RS-232 signal levels found on most old-fashioned computers (like IBMs and compatibles) with only a simple adapter cable, so long as the wire isn't too long and you don't have too many devices on the same line. To gain the full advantage of the RS-422 / RS-485 signal levels you will need to use a signal level adapter.

If you are using a computer as a terminal you will need to run a modem or terminal emulation program. Virtually any one should work. These will send everything you type on the keyboard out the serial port on your computer while printing on the screen anything which comes in from the Brick Brain through the serial port. A modem program will usually have the advantage over a terminal emulation program in that it will allow you to save data to your computer's disk drives and then send it back to the audio system at a later date. The Smart Brick System uses no screen control codes or ESCape sequences, so it will work on any machine with a 80 column by 24 line display. Machines with other display formats will also work, but may not look so neat on the screen.

When configuring your modem program, you should set it for 9600 baud, 8 data bits, one stop bit, and no parity. Higher or lower baud rates can be used if you configure the Brick Brain's serial port to run at a different speed. You should set your program not to insert an extra LineFeed (LF) character after each Carriage Return (CR) it receives. If you are going to be downloading configuration strings to the system (command 's'), you will also need to tell the modem program to put a slight delay between each character sent in order to not over run the Brick Brain's incoming data buffer.

If you have hooked up the Brick Brain to your computer and it still doesn't seem to respond to the keyboard, the first thing to check is that you are attached to the correct serial port. The easiest way to check this is to disconnect the Brick Brain and short between the Tx data out and Rx data in pins on the serial port connector on the back of your computer. On all IBMs and compatibles this means sticking a paper clip or similar tool between pins 2 and 3 on the 'Com.' connector. While still running the modem program, anything you type should be shown on the screen while this paper clip is in place, while nothing will appear when you remove it. If your computer passes this test, then you are using the right serial port and the problem is most likely the baud rate setting or in your wiring to the Brick Brain. If you get characters on the screen even with the paper clip removed from the serial port, it means you probably need to set the 'echo' mode to 'none' or 'full duplex' and try this test again.

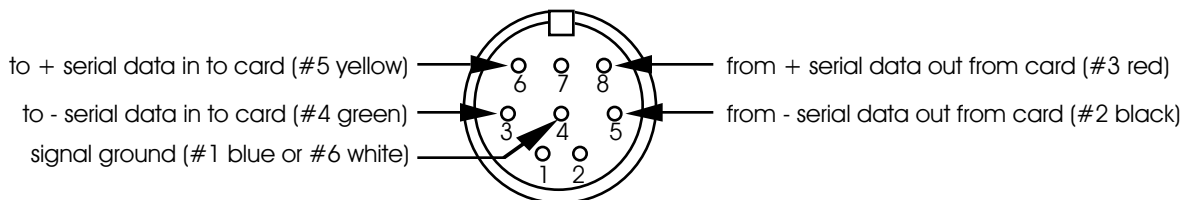
The Brick Brain uses a 6 position RJ-11 modular telephone style connector for the serial data. This is the same style of connector and pin out as is used on the AB-100 Digital Audio Repeaters. Facing the end of the cable with the release latch upwards, its pin out is as follows:

	pin #	COLOR	SIGNAL NAME:
(left)	1)	WHITE:	signal ground
	2)	BLACK:	- serial data out from Brick Brains
	3)	RED:	+ serial data out from Brick Brains
	4)	GREEN:	- serial data in to Brick Brains
(right)	5)	YELLOW:	+ serial data in to Brick Brains
	6)	BLUE:	signal ground

To cross wire the RS-422 / RS-485 signals from the Smart Brick System to the RS-232 serial port of an IBM compatible or Pioneer LaserDisk player, cross connect the signals as follows:

IBM DB-25	IBM DE-9	Pioneer LaserDisk DB-15	SIGNAL	SIGNAL FROM/TO BRICK BRAIN
2	3	2	DATA OUT	- serial data in to Brick Brain (GREEN)
3	2	3	DATA IN	- serial data out from Brick Brain (BLACK)
7	5	1, 11 or 15	GROUND	signal ground (BLUE or WHITE)

Apple Macintosh computers have true RS-422 serial ports built in. To connect to the Smart Brick System, the pin out is as follows for a Macintosh mini-DIN-8:



The Smart Brick System expects to see the serial data in the following format:

ONE START BIT
EIGHT DATA BITS
TWO STOP BITS

If the **ODD PARITY** is enabled, then the data appears in the following format:

ONE START BIT
SEVEN DATA BITS
ODD PARITY BIT
TWO STOP BITS

When the parity is enabled, any data with a parity error in it is simply ignored.

There are a number of methods which you can use to access a number of Brick Brains and Digital Audio Repeaters at the same time. If you are controlling the animation and audio systems through the serial input, you can use any or all of them as best suits your application. They are

1) Global - Any command of this type affects all of the Brick Brains in the system.

EXAMPLE: A '**START GLOBAL**' command will start all of the Smart Brick Brains and Digital Audio Repeaters in the system.

- 2) Track Specific** - Only the one Brick Brain addressed by the command is affected by this type of command. Each Brick Brain and Digital Audio Repeater card in the system must be configured to respond to different **TRACK NUMBER** address in order for the system to operate properly.

EXAMPLE: A '**START TRACK#**' command will start only the one Brick Brain or Audio Repeater card addressed by the **TRACK#** in the command.

- 3) Cocked** - You can set a flag on any number of different Brick Brains and Audio Repeater cards in the system which, when set, will cause those cards to respond to commands of this type. Once a cocked command is issued, the cocked flag on all the cards will be reset.

EXAMPLE: A '**START COCKED**' command will start only those Brick Brains and Digital Audio Repeaters which have had their '**COCKED**' flags set by the **COCK TRACK#** command.

- 4) Group (Rack Smart Brick Brain only)** - Any number of different Rack Smart Brick Brains and Audio Repeater cards in the system can be set to respond to one of sixteen different 'Groups'. Any of the group commands can access any number of cards simultaneously.

EXAMPLE: A '**START GROUP 5**' command will start only those Brick Brains and Digital Audio Repeaters which respond to group number 5.

- Commands -

“a” (track#) Enter Interactive Echo Mode:

This command puts the one Brick Brain addressed by the **TRACK#** into this mode while taking all other Brick Brains out of this mode. This is a special mode which lets you play with the command structure of the Smart Brick System and get an echo of all commands in plain English. This form of echo should normally be used only while manually manipulating the system as it can take a relatively long time to echo the 20 to 30 ASCII characters most commands will return when in this mode. During this response time, no additional commands should be given.

When in this mode, all commands are echoed by the one Brick Brain which was addressed by the **TRACK#** used when this mode was entered. This means that any command will be echoed, even if the command is being sent to a nonexistent Brick Brain.

EXAMPLE: to put Brick Brain 00 into **SETUP ECHO** mode:

a00

TRACK 00 Setup Mode Selected

EXAMPLE: a 'START GLOBAL' command will echo:

'GLOBAL START'

“b” Exit Interactive Echo Mode:

This command takes all Brick Brains in the system out of **SETUP ECHO MODE**.

EXAMPLE: to take any and all Brick Brains out of **SETUP ECHO** mode:

b

“c” (track#) Enter Global Echo Mode:

This command puts the one Brick Brain addressed by the **TRACK#** into this mode while taking all other Brick Brains out of it. The one Brick Brain which is in this mode will echo all non-track-specific commands accepted by the system. This type of echo can be used in an automated system to assure that the Smart Brick System has received any non-track-specific command. Note that since only one Brick Brain in the system is in this mode at a time, that this form of echo only verifies the operation of this one Brick Brain and no other parts of the system.

EXAMPLE: to put Brick Brain 00 into **GLOBAL ECHO** mode:

c00

EXAMPLE: a 'START GLOBAL' command 'u' will echo the actual character used to select it 'u'.

“d” Exit Global Echo Mode:

This command takes all Brick Brains in the system out of **GLOBAL ECHO MODE**

EXAMPLE: to take any and all Brick Brains out of **GLOBAL ECHO** mode:

u

“e” (track#) Enter Echo All Mode:

This command puts the one Brick Brain addressed by the **TRACK#** into this mode while taking all

other Brick Brains out of this mode. The one Brick Brain which is in **ECHO ALL MODE** echoes any and all characters sent to the Brick Brain through the serial port. This type of echo can be used to verify that the Smart Brick System has received all characters sent to it. Note that since only one Brick Brain in the system is in this mode at a time, that this form of echo only verifies the operation of this one Brick Brain and no other parts of the system.

EXAMPLE: to put Brick Brain 00 into **ECHO GLOBAL** mode:

e00

EXAMPLE: a typing random characters 'apiuryhqpfhnsdf'lauthf' will echo:

apiuryhqpfhnsdf'lauthf

“f” Exit Echo All Mode:

This command takes all Brick Brains in the system out of **ECHO ALL MODE**.

EXAMPLE: to take any and all Brick Brains out of **ECHO ALL MODE**:

f

“g” Enter Echo Mode:

This command puts all the Brick Brains in the system into **ECHO MODE**. When in this mode, the characters used to select all track-specific commands are echoed by the Brick Brain addressed by the command. This is the type of echo mode which best verifies the proper operation of all the Brick Brains in the Smart Brick System.

EXAMPLE: to put Brick Brain 00 into **ECHO MODE**:

g00

EXAMPLE: a 'START TRACK# 00' command will echo:

t00

“h” Exit Echo Mode:

This command takes all Brick Brains in the system out of **ECHO MODE**.

EXAMPLE: to take any and all Brick Brains out of **ECHO MODE**:

h

“i” (track#) Track Status Mode:

This command responds with a stream of ASCII HEX data containing the current status of the Brick Brain specified by the **TRACK#**:

BYTE 1 & 2 = BRICK BRAIN STATUS
BIT 0 = STORED START RECEIVED
BIT 1 = CYCLING SHOWS FLAG
BIT 2 = DOING DELAY BETWEEN SHOWS
BIT 3 = DOING SHOW END
BIT 4 = LaserDisk CLOCKED SHOW
BIT 5 = EXTERNALLY CLOCKED SHOW
BIT 6 = SMPTE CLOCKED SHOW
BIT 7 = INTERNALLY CLOCKED SHOW

BYTE 3 = SPACE
BYTE 4 & 5 = INPUT STATUS
BIT 0 = GREEN INPUT STATUS (1 = closed)
BIT 1 = BLUE INPUT STATUS (1 = closed)
BIT 2 = PB INPUT STATUS (1 = closed)
BIT 3 = not used
BIT 4 = THUMBWHEEL SWITCH BIT 0
BIT 5 = THUMBWHEEL SWITCH BIT 1
BIT 6 = THUMBWHEEL SWITCH BIT 2
BIT 7 = THUMBWHEEL SWITCH BIT 3
BYTE 6 = SPACE
BYTE 7 & 8 = CURRENT, OR MOST RECENT SHOW NUMBER
BYTE 9 = SPACE
BYTES 10 through 13 = CURRENT BRICK ADDRESS
BYTE 14 = SPACE
BYTE 15 & 16 = DISPLAY HOURS
BYTE 17 = COLON
BYTE 18 & 19 = DISPLAY MINUTES
BYTE 20 = COLON
BYTE 21 & 22 = DISPLAY SECONDS
BYTE 23 = PERIOD
BYTE 24 & 25 = DISPLAY FRAMES
BYTE 26 = SPACE
BYTE 27 & 28 = DIPSWITCH 1
BYTE 29 = SPACE
BYTE 30 & 31 = J-6 PORT
BYTE 32 = CARRIAGE RETURN
BYTE 33 = LINE FEED

EXAMPLE: to poll the status for Brick Brain 00:

10082 10 02 039D 02:00:05.08 30 00

This would tell you that the Brick Brain is running an internally clocked show, that the system is currently cycling shows, that the thumbwheel switch is set to '1', the show number is '02', the frame being addressed in the Smart Bricks is 039D, the time into the show is 5.08 seconds, that record is enabled and we are using 64K Smart Bricks, and that there is no input to the J-6 port.

“k” (track#) Brick Brain Status:

This command responds with the following information for the Brick Brain specified by the **TRACK#**:

BIT 0 = STORED START RECEIVED
BIT 1 = CYCLING SHOWS FLAG
BIT 2 = DOING DELAY BETWEEN SHOWS
BIT 3 = DOING SHOW END
BIT 4 = LaserDisk CLOCKED SHOW
BIT 5 = EXTERNALLY CLOCKED SHOW
BIT 6 = SMPTE CLOCKED SHOW
BIT 7 = INTERNALLY CLOCKED SHOW

EXAMPLE: to poll the status of the Brick Brain addressed at 00:

k0040

This would tell you that the Brick Brain is currently running a SMPTE clocked show.

.....

“l” (track#) Switch Status:

This command responds with the following information for the Brick Brain specified by the **TRACK#**:

- BIT 0 = GREEN INPUT STATUS (1 = closed)
- BIT 1 = BLUE INPUT STATUS (1 = closed)
- BIT 2 = PB INPUT STATUS (1 = closed)
- BIT 3 = not used
- BIT 4 = THUMBWHEEL SWITCH BIT 0
- BIT 5 = THUMBWHEEL SWITCH BIT 1
- BIT 6 = THUMBWHEEL SWITCH BIT 2
- BIT 7 = THUMBWHEEL SWITCH BIT 3

EXAMPLE: to poll the input switch status for Brick Brain 00:

l0037

This would tell you that the Brick Brain has the thumbwheel switch set to '3', and that there is an input present on the GREEN input.

.....

“m” (5AA5) (track#) Enter Setup Mode:

This command puts the Brick Brain specified by the **TRACK#** into the configuration mode. All other Brick Brains in the system are locked off from receiving any serial commands when there is even one Brick Brain in configuration mode. They will not accept any serial commands until they hear the commands to exit configuration mode being sent to the one Brick Brain which is in this mode. For details on the configuration mode, see the configuration section of this manual.

EXAMPLE: to put Brick Brain 00 into setup mode:

m5AA500

.....

“n” (track#) Memory Address Status:

This command responds with the address being sent to the Smart Bricks by the Brick Brain specified by the **TRACK#**. By polling this value, you can monitor the progress of any show.

EXAMPLE: to poll the memory address status for Brick Brain 00:

n000000

.....

“o” (track#) Dipsw1 Status:

This command responds with the current status of the dip switch 1 for the Brick Brain specified by the **TRACK#**.

EXAMPLE: to poll the dipswitch #1 status for Brick Brain 00:

o0000

.....

“q” (track#) J-6 Port Status:

This command responds with the current status of the J-6 PORT for the Brick Brain specified by the **TRACK#**.

EXAMPLE: to poll the J-6 PORT status for Brick Brain 00:

q0000

.....

“r” (track#) Configuration Dump:

This command responds with the current contents of the configuration EEprom for the Brick Brain specified by the **TRACK#**. This string of 1033 ASCII characters (65,315 for Rack Brains) is led off by the character string 's 5AA5'. As it happens, this is the lead in string for the **LOAD CONFIGURATION** command. This allows you to save the configuration of one or more Brick Brains (or other Smart Bricks and Digital Audio Repeaters) in your computer for later retrieval or archiving, and then simply and easily reload this data at any time. To save the data to the disk of your computer:

- 1) Turn off all echo modes.
- 2) Tell your computer to save all ASCII text received from the serial port.
- 3) Give this command to any Brick Brain (or other serial device) in the system.
- 4) When the download is finished, tell your computer to 'stop' saving ASCII text.

Step #3 above can be repeated for any number of Brick Brains (or other Smart Bricks and Digital Audio Repeaters) in the system. This stored file can then be played back to the Smart Brick System where it will be reloaded into the configuration EEproms of all the appropriate Brick Brains and other devices.

The data returned by this command is as follows:

```

BYTE 1 = 's'
BYTE 2 = '5'
BYTE 3 = 'A'
BYTE 4 = 'A'
BYTE 5 = '5'
BYTES 6 & 7 = TRACK# (00 to FFH) This is the address of the Brick Brain which is accepting the
               command.
BYTES 8 through 1031 = ASCII HEX DATA DUMP FROM CONFIGURATION EEprom
BYTE 1032 = CARRIAGE RETURN
BYTE 1033 = LINE FEED
    
```

EXAMPLE: to poll the configuration for Brick Brain 00:

```

r00
s5AA50000.....
    
```

.....

“s” (5AA5) (track#) (string) Load Configuration:

This command loads the string which follows it into the configuration EEprom for the Brick Brain specified by the **TRACK#**. This command is used to load the configuration from another source into one or more Brick Brains in the Smart Brick System. Since the **DUMP CONFIGURATION** command leads off its string with a 's 5AA5', data saved in the configuration dump command can be reloaded into the audio system by simply sending back to the Smart Brick System.

To do this:

- 1) Tell your modem program to delay slightly between characters so you don't over run the input buffer of the Brick Brain (or lower the baud rate 110 or so). **Rack Brain Only:** A delay is not necessary as long as you have set your computer to use ACK/NAK handshaking and it is fast enough to respond to this type of handshaking. The Rack Brain will report on the success or failure of the configuration upload on the LCD display (if installed) and on the screen of the computer. The standard Smart Brick Brain (and earlier revisions of the Rack Brain) will only report if Interactive mode has been turned on prior to issuing this command.
- 2) Tell your computer to send out the previously saved output string from the **CONFIGURATION DUMP** command.

.....

Start Commands

"t" (track#)	Start Track:
"u"	Start Global:
"v"	Start Cocked:
"w" (group)	Start Group (Rack Smart Brick Brain Only):

These commands start the animation playing on the Brick Brain(s) addressed by the command. The shows will always start from the beginning of the show being played. If an addressed Brick Brain is cycling shows, it will have its cycling mode reset. If the Brick Brain is already playing, it can be configured to do one of the following things:

- 1) IGNORE THIS EARLY START.
- 2) SAVE THE START UNTIL THE CURRENT SHOW FINISHES AND THEN DO IT.
- 3) JUMP TO THE START OF THE NEXT SHOW.
- 4) JUMP TO THE START OF THE CURRENT SHOW.

If the Brick Brain receives a start command after it has received a request for a specific show, it will play that show. Requests for specific shows can come from the serial port, J-6 PORT, and the jump forward and jump back internal show requests (lowest priority).

.....

Stop Commands

"x" (track#)	Stop Track:
"y"	Stop Global:
"z"	Stop Cocked:
"G" (group)	Stop Group (Rack Smart Brick Brain Only):

These commands stop the selected Brick Brain(s) unconditionally. The stop takes place at the current frame being played.

.....

Reset Commands

"H" (track#)	Reset Track:
"I"	Reset Global:
"J"	Reset Cocked:
"K" (group)	Reset Group (Rack Smart Brick Brain Only):

These commands reset the shows being played to their first frames on all addressed Brick Brain(s). This command is only valid for INTERNALLY and EXTERNALLY clocked shows, since both LaserDisk and SMPTE clocked shows are at the mercy of time code they are receiving. If the Brick Brain(s) are in the delay mode when the **RESET** is received (no matter the time code being used), then the Brain(s) will check their thumbwheel switches and reinitialize their countdown clocks upon receiving this command.

.....

"X" (track#) Cock Track:

This command sets the cocked flag on the Brick Brain specified by the **TRACK#**. Any Brick Brain which has been 'cocked' will respond to whatever the next 'cocked' commands that is received. This flag will be reset upon the receipt of any **COCKED** command, or by using one of the two following **RESET COCKED** commands.

EXAMPLE: to cock Brick Brain 00:

X00

.....

“Y” (track#) Un-Cock Track:

This command resets the cocked flag on the Brick Brain addressed by the **TRACK#**. After this flag is reset, the addressed Brick Brain will no longer respond to **COCKED** commands.

EXAMPLE: to un-cock Brick Brain 00:

Y00

.....

“Z” Un-Cock Global:

This command resets the cocked flag on all the Brick Brains in the system. After the cocked flags are reset, no Brick Brains in the system will respond to any **COCKED** commands.

EXAMPLE: to un-cock all Brick Brain in the system:

Z

.....

Loop Commands:

“!” (track#)	Loop Track:
““”	Loop Global:
“#”	Loop Cocked:
“\$” (group)	Loop Group (Rack Smart Brick Brain Only):

These command acts much like a **START** commands, except that they also set the '**LOOPING SHOWS**' flag. With the this flag set, it is possible to set a sequence of shows playing in any order. The shows can be played with no delay or with a preset delay between each. Since the 'next' show can be any show you ask for, one show can be played over and over again, or you can set up a sequence of shows which will be repeated until the Brick Brain is told to stop.

When the '**LOOPING SHOWS**' flag set, the Brick Brain will check to see if the '**IMMEDIATE CHAIN**' or '**DELAY**' flags are set when it has finished playing a show. If the show has a the '**IMMEDIATE CHAIN**' flag set, then it will immediately start playing the 'next' show, which you can set to be any show in the system. If the '**DELAY**' flag is set, then the Brick Brain will check to see if the thumbwheel switch on its front is set to anything other than 0. If it is, then it will then start this new delay countdown. At the end of the countdown, whatever 'Countdown end' actions are set will take place just as though a switch closure input had just happened. In most cases this will be another **LOOP** command, which will then start the next show. At the end of that show, the whole process will then start over.

.....

Stop at End Commands

“%” (track#)	Stop at End Track:
“&”	Stop at End Global:
“”	Stop at End Cocked:
“(” (group)	Stop at End Group (Rack Smart Brick Brain Only):

These commands reset the cycling mode in the selected Brick Brain(s) . What this dies is to stop them playing when the end of their current shows are reached. The **STOP** commands are used when you want to stop a show immediately. These commands are used when you want the shows to finish gracefully.

If the '**ALLOW CHAINS**' option has been selected on a Brick Brain, then any immediate jumps to whatever the next show is will take place even after the cycling mode has been stopped by using these commands

Select Show Commands

- "") (track#) (show#)** **Select Show Track:**
- **" (show#)** **Select Show Global:**
- +" (show#)** **Select Show Cocked:**
- /" (group)** **Select Show (Rack Smart Brick Brain Only):**

Up to 63 (255 with a Rack Smart Brick Brain) different animated shows can be stored on a single Smart Brick System. These commands can be used to select an individual show on the selected Brick Brain(s). Individual shows can be requested with SHOW# requests with a range of 01 to 3Fh (01 to FFh with a Rack Smart Brick Brain). Once a show is selected, it will be played on the next start (the start can come from a serial port command, a hardware input command, or at the end of the normal countdown between shows if the Brick Brain is cycling. When it has finished playing the requested show (or sequence of shows), you have the option of letting the Brick Brain return to what would have been the next show had there not been a special request made.

If a show selection has been made inadvertently, it can be cleared by sending a request for SHOW# 00 at any time before it begins playing. Show requests from the serial port have the highest priority in the Smart Brick System.

"" (track#) (Delay Reload) Set Delay:

This command allows the user to adjust the base time for the countdown function. The value entered as the **DELAY RELOAD** is the number of seconds (01 to 99) to be used as the base when starting delays. With the thumbwheel set to 1, the delay would be the exact number of seconds you entered as the **DELAY RELOAD**. With the thumbwheel set to '2', then the delay would be exactly double the time you entered. The multipliers for the various settings of the thumbwheel switch along with the delays you would get with a **DELAY RELOAD** of 15 seconds are as follows:

thumbwheel switch	delay multiplier	delay w/ 15 second reload
1	1	15 seconds
2	2	30 seconds
3	4	1 minute
4	8	2 minutes
5	20	5 minutes
6	40	10 minutes
7	80	20 minutes
8	120	30 minutes
9	240	1 hour
A	12	3 minutes
B	16	4 minutes
C	60	15 minutes
D	100	25 minutes
E	160	40 minutes
F	180	45 minutes

EXAMPLE: to set the BASE TIME on Brick Brain 00 to 60 seconds:

:0060

"=" (track#) (address) Set Brick Address:

The address being sent to the Smart Bricks from a Brick Brain can be altered by using this command. This can be used to send a specific address to all of the Smart Bricks to set all of the outputs to the values stored at this address, or to alter the address counters of an internally or externally clocked animated show while it is running. Using this command on LaserDisk or SMPTE clocked shows while they are running will have minimal effect, as the address will go back to what it should have been as soon as the next

frame of time code is received.

EXAMPLE: to set all of the Smart Bricks on Brick Brain 00 to address 1234:=
=001234

.....
“ ` ”

Advance One Frame:

“ ~ ”

Go Back One Frame:

These commands are uses as a test feature or to do a little single step programming. The first will advance the frame counters by 1 frame, while the second will subtract 1 frame from the current frame count. Be aware that the minutes, seconds and frame counters may not be incremented properly, and definitely won't be decremented at all. A Smart Brick will only accept and remember data while stepping forward into a new frame.

Summary of Commands

“a” (track#) “b”	Enter Interactive Mode: Exit Interactive Mode:
“c” (track#) “d”	Enter Global Echo Mode: Exit Global Echo Mode:
“e” (track#) “f”	Enter Echo All Mode: Exit Echo All Mode:
“g” “h”	Enter Echo Mode: Exit Echo Mode:
“i” (track#) “k” (track#) “l” (track#)	Track Status Report: Brick Brain Status: Switch Status:
“m” (5AA5) (track#)	Enter Setup Mode:
“n” (track#) “o” (track#) “p” (track#) “q” (track#)	Memory Address Status: Dipsw1 Status: Dipsw2 Status: J-6 Port Status:
“r” (track#) “s” (5AA5) (track#) (string)	Configuration Dump: Load Configuration:
“t” (track#) “u” “v”	Start Track: Start Global: Start Cocked:
“x” (track#) “y” “z”	Stop Track: Stop Global: Stop Cocked:
“H” (track#) “I” “J”	Reset Track: Reset Global: Reset Cocked:
“X” (track#) “Y” (track#) “Z”	Cock Track: Un-Cock Track: Un-Cock Global:
“!” (track#)	Cycle Track:

““”

Cycle Global:

“#”

Cycle Cocked:

“%” (track#)

Stop at End Track:

“&”

Stop at End Global:

“”

Stop at End Cocked:

“)” (track#) (show#)

Select Show Track:

“*” (show#)

Select Show Global:

“+” (show#)

Select Show Cocked:

”” (track#) (Delay Reload)

Set Delay:

“=” (track#) (address)

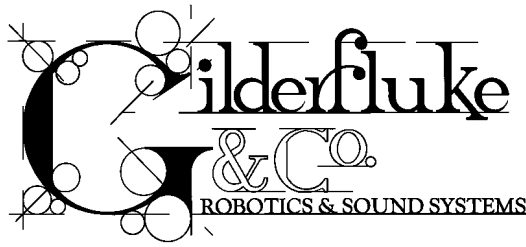
Set Brick Address:

“`”

Advance One Frame:

“~”

Go Back One Frame:



- Smart Brick Brain Configuration -

To configure the system you first need to connect the system just as you do for any serial communications (see the 'Smart Brick System Commands' section of the manual). The configuration mode is entered by the command:

"m" (5AA5) (track#)

Typically, the Smart Brick Brain is configured to respond when addressed as track '00', and so the string you send the Brick Brain is 'm5AA500'. The '5AA5' part of the string acts like a combination lock to keep random noise on the serial input lines from accidentally entering the configuration mode.

This command brings up the **Main Menu** from the Brick Brain which was addressed. (In this case this shows the default condition of a Smart Brick Brain as they are normally shipped.)

```

- MACs SMART BRICK BRAIN - rev 1.05 copyright 1991-1992 GILDERFLUKE & Co. DCM -

a) Channel number- 00      | f) Select from J6- yes   | k) Baud rate- 9600
b) Direct select- yes     | g) delay reload- 15 sec. | l) Early starts- Jmp Fwd
c) Odd parity- no        | h) tape deck pulse- 08   | m) more...
d) running delay- 08     | i) debounce- 08         | o) frame rate- 30 FPS
e) error count- 08       | j) allow chains- no     | p) player type- Pioneer
X) exit

                                STOP
INPUT and EDGE      RESET  +FRAME START  LOOP  STOP  at END TAPE DECK
O) green input Closing:  |  |  |  |  |  |  |
P) green input Opening: |  |  |  |  |  |  |
Q) blue input Closing:  |  |  |  |  |  |  |
R) blue input Opening:  |  |  |  |  |  |  |
S) PB input Closing:    |  |  |  | on  |  |  |
T) PB input Opening:    |  |  |  |  |  |  |
U) J6 input Closing:    |  |  |  | on  |  |  |
V) J6 input Opening:    |  |  |  |  |  |  |
W) countdown end:      |  |  |  | on  |  |  |

                                Enter command-
    
```

If the key and **TRACK#** match, the card addressed by the **TRACK#** will put a configuration menu on the screen. When this mode is entered by any Brick Brain or Digital Audio Repeater card on the same serial network, it disables all of the other serial commands on all the other cards in the system. As with the normal serial command mode, the upper and lower 'case' of all input is important. An 'a' is a command while an 'A' is a number. All numeric values are entered in HEX (0 - 9, A - F)

If another command is entered while the last command is waiting for additional input, the new command will be started. If at any point you enter a command in error and it is waiting for additional input, you can leave the command by entering an <ESC>ape key. With the exception of the GROUP ENABLE and STRING ENTRY commands, they will only be changed up to the point where you <ESC>aped

If you want to keep a hard copy printout of the current configuration of any screen, you should use the <ESC>ape key to redraw the screen while saving the data returned in the modem program running on your computer. This file can then be printed out at any time.

If you ever need to set the Brick Brain back to its default settings (9600 baud and address 00H), you can do so by powering down the card, and then turning on Dipswitch #7. When you power the card back up, the default configuration setting will be reloaded. If you intend to change any of the settings to anything other than the defaults, be sure to turn this switch back off before you power the card back down. Otherwise, it will reload the default values right over any changes you have made when you power the card back up.

.....

“a” Enter Track Number:

This command is used to tell the Brick Brain which addresses it should respond to from the serial commands. No two Brick Brains or Digital Audio Repeater Cards on the same serial network should have the same address assigned to them. When loaded with the default configuration, the address assigned to a card is 00. If more than one Brick Brain or Digital Audio Repeater card is used in the system, they should be plugged in one at a time to have their addresses changed. Once changed, each card can stay on line.

.....

“b” Direct Select:

This command is used to switch the 1/4 J6 Port over to selecting directly 1 of 8 shows, instead of using binary inputs for requesting up to 63 different shows. The **DIRECT SELECT** is useful when you have eight or less shows which need to be called up through the 1/4 J6 Port. The 1/4 J6 Port can be wired directly to up to eight different pushbuttons. When any of these buttons are pressed it will select the appropriate show. The first button pushed will be played at the next **START** or **START LOOPING** command, unless it is overridden by another show request from the serial ports. (The board can also be told to start playing the newly requested show immediately if you tell the Brick Brain to **START** or **START LOOPING** on the input to the 1/4 J-6 port.)

If this mode is off, then up to 63 different shows can be selected through the 1/4 J6 Port. The 1/4 J6 Port can be connected directly to the output of a computer or Animation Control System. If you need to connect it to pushbuttons, you will need to use diodes or a keyboard with an encoder (available from Gilderfluke & Company) to encode a binary number to be sent to the 1/4 J6 Port.

As with changes in inputs on the A, B, or PB input, changes on the 1/4 J6 Port can be used to start, stop, or whatever a Brick Brain. If the **DIRECT SELECT** option is 'on', then a rising edge is on any new arrival of a new closure, and a falling edge is when all input lines are opened. If the **DIRECT SELECTION** is 'off', then a rising edge is on any change in the 1/4 J6 Port except for when all of the inputs go open, which is considered to be a falling edge.

.....

“c” Odd Parity Toggle:

This toggle enables the **ODD PARITY** data check on the serial port for this Brick Brain. Parity is a method of confirming that the data sent to the audio system arrives intact. Any data that gets jumbled is ignored. If **ODD PARITY** is enabled, it must be enabled on all the cards in the system as well as on your computer or terminal. The default value for this command is off. This command doesn't take effect until you enter the eXit command.

.....

“d” Running Delay:

The running delay is the number of heartbeats after which the Smart Bricks stop advancing frames until it turns off the 'Advancing Frames' LED on the Heads Up Display and disables any Smart Brick outputs which have been configured to be 'disabled when stopped'.

.....

“e” Error Count:

In SMPTE synchronized shows, the error count is the number of consecutive good frames of SMPTE time code which must be received before the Brick Brain believes what it is hearing. This is used to bridge over short dropouts or bad SMPTE data received when the tape deck is just starting up.

In LaserDisk synchronized shows, the error count is the number of times the Brick Brain will try to start

a show by sending the LaserDisk player a 'search' string. It will display 'E6' error on the Heads Up Display during this period. If the LaserDisk player doesn't respond as expected for the 'error count' number of tries, then it will try to go into a 'startup' sequence to try and spin up the LaserDisk. The error message 'F2' will then be displayed as an attempt is being made to start up the LaserDisk player.

.....

"f" Select from J6:

If more than one show is stored on a single Smart Brick System, each one can be accessed individually and played back. Up to 63 of these shows can be stored on a single Smart Brick System. These requests can be made through the serial port or through the 1/4 J6 Port.

This toggle enables the 1/4 J6 Port for requesting the shows on this Smart Brick System. There are two methods of selecting shows from this port. Which one is used is selected by the **DIRECT SELECT** command.

.....

"g" Delay Reload:

The length of the countdown can be set at any time by setting a thumbwheel switch located on the front of the Smart Brick Brain. The positions set the delays as follows:

- | | |
|-------------------------|---|
| 1) 1 x 'delay reload' | (for 15 seconds delay when delay reload is set to 15 seconds) |
| 2) 2 x 'delay reload' | (for 30 seconds delay when delay reload is set to 15 seconds) |
| 3) 4 x 'delay reload' | (for 1 minute delay when delay reload is set to 15 seconds) |
| 4) 8 x 'delay reload' | (for 2 minutes delay when delay reload is set to 15 seconds) |
| 5) 20 x 'delay reload' | (for 5 minutes delay when delay reload is set to 15 seconds) |
| 6) 40 x 'delay reload' | (for 10 minutes delay when delay reload is set to 15 seconds) |
| 7) 80 x 'delay reload' | (for 20 minutes delay when delay reload is set to 15 seconds) |
| 8) 120 x 'delay reload' | (for 30 minutes delay when delay reload is set to 15 seconds) |
| 9) 240 x 'delay reload' | (for 1 hour delay when delay reload is set to 15 seconds) |
| 0) stops cycling shows | |

This command is used to set the base value for the **DELAY RELOAD** used for determining how long the delays between shows will be. Valid entries are from 1 to 99 seconds, although we would recommend you stick to even values for these entries (5, 10, 15, 30, 60, 90 seconds etc.) so that the delay lengths aren't too weird.

.....

"h" Tape Deck Pulse:

This command is used to set how long the pulse sent out through the '**STOP**', 'play', and 'rewind' relay outputs is. The length is the number of heartbeats the output will stay active after they are initially turned on. Valid entries are from 00H to FFH. A value of 00 latches the outputs on permanently when they are set.

.....

"i" Debounce:

This command is used to set the number of times the software in the Brick Brain will check the Blue, Green or 1/4 J6 inputs before actually believing them. Valid entries are from 00H to FFH. 00 gives a 256 count loop for the longest possible response, 01 gives the fastest possible response. Too small of an entry for the **DEBOUNCE** can cause problems with the inputs if they are noisy or tend to bounce. Too large a value will cause a delay before the Brick Brain responds to these inputs. The unit is shipped with a value of 08.

.....

“j” Allow Chains:

This toggle is used if you want to let the Brick Brain play consecutive shows which are tightly chained together (by having the **'IMMEDIATE'** flag set in the shows' configuration), even when the **LOOPING MODE** is off. This should be set if you are building longer shows out of a number of shorter shows, and you don't want the Brick Brain to stop right between any two segments if it receives a **'STOP AT END'** command.

.....

“k” Baud Rate:

All cards in the system must be set to the same baud rate. The default speed is 9600 baud. This command doesn't take effect until you enter the eXit command. The serial port on each Brick Brain can support any of the following baud rates:

- 1) 110
 - 2) 150
 - 3) 300
 - 4) 600
 - 5) 1200
 - 6) 2400
 - 7) 4800
 - 8) 9600 (default value)**
 - 9) 19,200
 - 10) 48,000
 - 11) 96,000
-

“l” Early Starts:

The user has the choice of what each Brick Brain does when it is still playing a show and receives a new 'start' or **'LOOP'** command. The options are:

- 1) DO NOTHING.
- 2) JUMP FORWARD to the next show.
- 3) JUMP BACKWARDS to the start of the current show.
- 4) BANK START so that it won't be acted upon until the current show finishes. Show requests will be banked up to 11 requests deep. Starts can be banked up to 256 deep.

The **JUMP FORWARD** and **JUMP BACKWARDS** commands have the lowest priority of all possible show requests. Any serial port or 1/4 J6 Port show request will take priority over these.

.....

“m” More.....:

This toggle leads you to the screen which is used to set up shows and the strings sent to the serial port. Details on this can be found in the next section of this manual.

.....

“o” Frame Rate:

This command is used to set the **Frame Rate** for all the shows in the Smart Brick System. This is the number of times each second which the Smart Brick System will update all of the outputs with new data.

- Valid frame rates for SMPTE synchronized shows are 12, 15, 24, 25, and 30 frames per second.
 - Valid frame rates for LaserDisk synchronized shows are 15, 25, and 30 frames per second.
-

Valid frame rates for Internally clocked shows are 1, 2, 4, 5, 8, 10, 12, 15, 16, 20, 24, 25, 30, 32, 50, 60, 64, 75, and 100 frames per second.

Valid frame rates for externally clocked shows are from 1 to 100 frames per second.

This entry will accept any value between 00 and 99. 00 is used to enter a 100 frames per second frame rate. If the entry isn't valid for the time code you are running, a 'E5' error will be displayed on the Heads Up Display when an attempt is made to start the show.

"p" Player Type:

For those shows which are running from a LaserDisk, this command toggles the Brick Brain between using the command format used by Pioneer brand LaserDisk players, and those from Sony. The only commands which are affected by this toggle are the 'SEARCH' and 'SPIN UP' commands which are sent to the players when a LaserSearch (01) is included in a start or end string, and the 'FRAME INQUIRY' commands sent to the player during a show. All of these happen transparently to the user once this toggle has been set.

	Input Triggering Commands
"O"	'GREEN' Input Closing Edge:
"P"	'GREEN' Input Opening Edge:
"Q"	'BLUE' Input Closing Edge:
"R"	'BLUE' Input Opening Edge:
"S"	'PB' Input Closing Edge:
"T"	'PB' Input Opening Edge:
"U"	1/4 J6 Port' Input Closing Edge:
"V"	1/4 J6 Port' Input Opening Edge:
"W"	Countdown End:

Each Smart Brick Brain has two opto-isolated external inputs, one push button input on the front, and one 1/4 J6 Port input. Additionally, the Brick Brain treats the end of a countdown just like it would treat any of the other inputs. These commands are used to select what actions will take place on each edge of each of these inputs. Note that both rising and falling edge actions are available to the user. This allows you to do things like start a show on a closing edge and then stop it on the opening edge of the same input.

The closing edge on the 'GREEN', 'BLUE', and 'PB' inputs are considered to be when a normally open push button or switch is closed. The opening edge is when that same switch or push button is opened. A closing edge on the 1/4 J6 Port is considered to be any of the eight inputs closing if the **DIRECT SELECT** option is 'on', or any change in the input (except going to all inputs open) if the **DIRECT SELECT** option is off. A opening edge on the 1/4 J6 Port is when all eight of the inputs go to an open condition.

The hardware for the 'GREEN', 'BLUE', and '1/4 J6 Port' inputs all need an external power source for the opto isolators to run. Connections for these are shown in the first section of this manual.

If you want the Smart Brick System to start playing shows as soon as it is powered up, you can set a **'START'** or **'START LOOPING'** command on the opening edge of any of the inputs. On power-up, the Brick Brain will check all of the inputs and find that the one you are using has just opened. It will then act upon any commands you have set for this edge. This would normally be a **'START'** command if you only want the Smart Brick System to play a single show, or a **'START LOOPING'** command if you want it to continue playing shows until it is told to stop. We normally use the 'PB opening' edge to start shows on power-up (you can use any of the 'opening' edges) and then put in a **'STOP'** or **'STOP AT END'** command on the 'PB closing' command so that we can stop the shows once they have started.

If multiple inputs to the system arrive simultaneously, they have the following priorities:

- 1) '1/4 J6 Port' INPUTS
- 2) 'A' input
- 3) 'B' INPUT

4) 'PB' INPUT

This will probably happen only on power-up.

The commands have the following effects:

Reset:

This command only has any effect when running an externally or internally clocked show, or during a countdown between shows. When running an internally or externally clocked show, this command causes the frame counters to be reset back to the start of the show. During countdowns, this command causes a new countdown delay to be started based on the current thumbwheel switch settings.

+ Frame:

This command enables an input to advance frames on either the rising or falling (or both) edges of an input when running an externally clocked show. During all other types of shows, this command has no effect.

Start:

This command causes the Brick Brain to start playing the next show in line. At the end of the show, the Brick Brain will stop unless the show which is played has the **IMMEDIATE CHAIN FLAG** set and the **ALLOW CHAINS** flag is also on. Under those circumstances, it will continue to play shows until those conditions are not met.

If the **'LOOPING SHOWS'** flag is set, sending any type of **'START'** command to the Brick Brain will reset this flag.

Loop:

This command acts much like a **START** command, except that it also sets the **'LOOPING SHOWS'** flag. With this flag set, it is possible to set a sequence of shows playing in any order. The shows can be played with no delay or with a preset delay between each. Since the 'next' show can be any show you ask for, one show can be played over and over again, or you can set up a sequence of shows which will be repeated until the Brick Brain is told to stop.

When the **'LOOPING SHOWS'** flag is set, the Brick Brain will check to see if the **'IMMEDIATE CHAIN'** or **'DELAY'** flags are set when it has finished playing a show. If the show has the **'IMMEDIATE CHAIN'** flag set, then it will immediately start playing the 'next' show, which you can set to be any show in the system. If the **'DELAY'** flag is set, then the Brick Brain will check to see if the thumbwheel switch on its front is set to anything other than 0. If it is, then it will then start this new delay countdown. At the end of the countdown, whatever 'Countdown end' actions are set will take place just as though a switch closure input had just happened. In most cases this will be another **LOOP** command, which will then start the next show. At the end of that show, the whole process will then start over.

Stop:

This command will stop any show which is playing immediately and unconditionally.

Stop at End:

This command resets the **'LOOPING SHOWS'** flag. This means that the shows will stop playing at the normal end of show and won't start a new countdown under any circumstances, and won't chain unless the **ALLOW CHAINS** flag is set and there is a request for an **IMMEDIATE CHAIN** at the end of the current show.

Tape Deck:

These allow you to trigger the START, STOP or REWIND relay outputs from one of the external inputs or end of countdown.

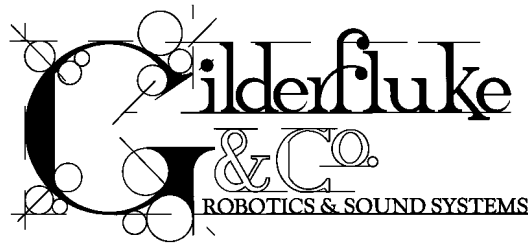
"x" or "X" eXit Setup Mode:

This command is used to exit the setup mode. If you hit this command in error, hitting an <ESC>ape

key will get you back to the setup mode. All of the setup commands which don't take effect immediately, take effect when the eXit command is entered. This includes things like the BAUD RATE, so you will have to change the baud rate of the terminal you are using at this time.

The eXit command asks you if you want to save the current setup permanently. If you answer 'Y', the EEprom will be written with the current configuration. If you answer 'N', the setup mode will be exited without writing to the EEprom. Any changes you have made will still be stored in RAM, and so will be used until the Brick Brain is started up again. When you answer 'Y' or 'N', the screen will remain unchanged, but you will be out of the configuration mode.

All other Audio Repeater cards and Brick Brains in the same serial network have their serial ports disabled while any card in the system is in setup mode. This is the only command to which they will respond. After the initial 'X', all of the other cards wait for a 'Y' or 'N' before they will start accepting other serial commands again. If you find that you are having trouble communicating with any of the cards in the system, try entering an 'XN' to trick it into thinking you have exited the configuration mode.



- Show and String Setup -

This screen is entered by using the MORE command from the main configuration screen. It is used to set up the 63 possible shows which a Smart Brick System can control, as well as the strings which can be sent at the start or en of any of the shows. Entering this screen will stop any show which is currently running, and keep any new shows from being started. It brings up a configuration screen that looks like this:

```

- MACs SMART BRICK BRAIN - rev 1.05 copyright 1991-1992 GILDERFLUKE & Co. DCM -

a) show- 01          | g) next show- 02
b) time code- SMPTE | h) immed.- no
c) brick start- 00000 | i) delay- yes
d) Brick end- 16382  |
e) start string- 0   | m) more...
f) end string- 0     | X) exit

      _01_|_02_|_03_|_04_|_05_|_06_|_07_|_08_|_09_|_10_|_11_|_12_|
O) string 1 - 01 | 50 | 4C | 0D | (52) | (0D) | 00 | 00 | 00 | 00 | 00 | 00 |
P) string 2 - 52 | 4A | 0D | (52) | (0D) | 00 | 00 | 00 | 00 | 00 | 00 |
Q) string 3 - 01 | 3A | (0A) | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
R) string 4 - 4F | (0A) | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
S) string 5 - 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
T) string 6 - 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
U) string 7 - 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
V) string 8 - 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
W) string 9 - 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |

enter command-
    
```

The commands at the top of the screen (commands 'a' through 'i') are used to set up the 63 possible individual shows. This part of the screen will show the details of the show number shown under the 'show' command.

The lower part of the screen is used to configure the nine possible strings which can be sent at the beginning or end of the different shows (commands 'O' through 'W'). The same nine strings are used for all the shows. This part of the screen won't change as you select different shows for configuration.

If the show being displayed is a LaserDisk show, the display is altered slightly as shown:

```

- MACs SMART BRICK BRAIN - rev 1.05 copyright 1991-1992 GILDERFLUKE & Co. DCM -

a) show- 01          | g) next show- 02
b) time code- LaserDisk | h) immed.- no
c) brick- 00000 to 16384 | i) delay- yes
d) LaserDisk start- 12345 |
e) start string- 1      | m) more...
f) end string- 2       | X) exit

      _01_ | _02_ | _03_ | _04_ | _05_ | _06_ | _07_ | _08_ | _09_ | _10_ | _11_ | _12_ |
O) string 1 - 01 | 50 | 4C | 0D | (52) | (0D) | 00 | 00 | 00 | 00 | 00 | 00 |
P) string 2 - 52 | 4A | 0D | (52) | (0D) | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
Q) string 3 - 01 | 3A | (0A) | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
R) string 4 - 4F | (0A) | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
S) string 5 - 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
T) string 6 - 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
U) string 7 - 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
V) string 8 - 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
W) string 9 - 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |

enter command-
    
```

“a” Show Number:

This command is used to select which show you want to set up. As there are 63 possible shows, valid entries are from 01H to 3FH. With most shows, all selections are through HEXadecimal numbers through the 1/4 J-6 and serial ports, and for this reason you must use HEX numbers when selecting shows to configure. Valid entries are:

- 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B, 0C, 0D, 0E, 0F
- 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 1A, 1B, 1C, 1D, 1E, 1F
- 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 2A, 2B, 2C, 2D, 2E, 2F
- 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 3A, 3B, 3C, 3D, 3Eh, 3Fh

When configuring SMPTE shows, the hour byte is used to select the shows. Since these actually come from the SMPTE ‘hours’, and this is a BCD number, valid show numbers for SMPTE shows are:

- 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16
- 17, 18, 19, 20, 21, 22, 23, and 24

Note that show number 24 is actually selected when the Brick Brain gets a SMPTE ‘hour’ of 00. any changes you have made in the current show’s configuration will be written into the EEprom when you select a new show number.

“b” Time Code:

This command toggles through the four possible time codes:

- LaserDisk
- SMPTE
- Internal time base
- External time base

.....

“c” Brick Start:

This command is used to select where in the memory of the Smart Bricks the show will start. Valid entries are made in 5 decimal numbers (yes, you must enter all five digits), ranging from 00000 to 65535. If you are using a 16K Smart Brick, the upper limit should be below 16,383

If you are setting up a LaserDisk show, this line will also show you the Smart Brick 'end frame' for the show. Because the EEprom storage space which is used for the Smart Brick 'End Frame' in all the other time codes is used for storing the location on the LaserDisk where the show is found, the Brick Brain gets the 'end frame' for this show by looking where the next show starts, and then subtracting one frame. As an example:

Show 25 is a LaserDisk show which starts at 10000 frames into the Smart Bricks.
Show 26 is a show which starts at 20000 frames into the Smart Bricks (any time code used for show 26).
This means that the 'end frame' is 19999 for show 25.

.....

“d” Brick End (non-LaserDisk shows only):

This command is used to select where in the memory of the Smart Brick the show will end if using SMPTE, Internal or external clocking. Valid entries are made in 5 decimal numbers (yes, you must enter all five digits), ranging from 00000 to 65535. If you are using a 16K Smart Brick, the upper limit should be below 16,383.

.....

“d” LaserDisk Start (LaserDisk shows only):

This command is used to select where on the LaserDisk the show is actually found. Valid entries are made in 5 decimal numbers (yes, you must enter all five digits), ranging from 00000 to 65535 (although Constant Angular Velocity (CAV) LaserDisks support a maximum 54,000 frames per side). At the start of a show, the special string character '01' will tell the Brick Brain to start the LaserDisk player (if needed) and search it for this frame number.

.....

“e” Start String:

This command is used to select which string will be sent at the start of a show. Although these strings are generally used when you are running a LaserDisk show, you can send them at the start of any type of show if you so desire. They can also be used to control other types of serially controlled devices other than LaserDisk players. If an entry of 0 is entered for the start string, no string will be sent at the start of this show. Valid numbers for accessing the strings are from one through seven. Strings eight and nine can only be accessed by running through from the preceding strings. See the section on string setups for additional details on strings and their habits.

.....

“f” End String:

This command is used to select which string will be sent at the end of a show. Although these strings are generally used when you are running a LaserDisk show, you can send them at the end of any type of show if you so desire. They can also be used to control other types of serially controlled devices other than LaserDisk players. If an entry of 0 is entered for the end string, no string will be sent at the end of this show. Valid numbers for accessing the strings are from one through seven. Strings eight and nine can only be accessed by running through from the preceding strings. See the section on string setups for additional details on strings and their habits.

.....
“g” Next Show:

This command is used to select which show will be played next if there were no other higher priority show requests made. Valid entries are from 00 to 3Fh. 01 through 3Fh select specific shows and any show number can be used. If the current show requests itself, then it will loop until a different show is requested.

Entering a **NEXT SHOW** value of 00 is how you tell the Brick Brain that you want it to drop back into the sequence of shows it had been playing before the last specific show request had been received. As an example:

- Shows 1 through 6 each request the next consecutive show in line
- Show 7 requests show number 1 at it's end
- Show 10 through 16 each request the next consecutive show in line
- Show 17 has a '00' entered for the next show at it's end
- Once started, the shows 1 through 7 will loop for ever
- A request comes in for show 10 while playing show 3
- Shows 10 through 17 are played
- At the end of show 17, the next show played will be show number 4

.....
“h” Immediate:

This toggles the **'IMMEDIATE CHAIN FLAG'** for this show. When set, the next show will be played immediately after this show ends as long as the system is currently looping shows. The next show can be a specifically requested 'next show', or a return from a specifically requested show if '00' is entered as the 'next show'. If the **ALLOW CHAINS** flag is set, then the next show will be played immediately, even if the system is not currently looping shows. This flag takes precedence over the **DELAY FLAG** below.

IMMEDIATE CHAINS can be used to build up longer shows from a number of shorter segments. You might want to do this if you are fixing a error in the show burnt onto a LaserDisk (skipping over a slow part of the show, for example), or to build up a show which runs continuously between the main shows, but has a number of 'seams' where it can branch to another show if one is specifically requested. You can program the animation at these 'seams' so that there will be no jumps when the other shows start and end.

.....
“i” Delay:

This toggles the **'DELAY FLAG'** for this show. When set, the countdown timer will be started after this show ends if the system is currently looping shows. What happens at the end of this countdown is up to what ever the Brick Brain is configured to do at countdown end.

.....
“m” More...:

This toggle saves any changes you have made in the currently displayed show, and gets you back to the main configuration menu.

.....
“x” or “X” eXit Setup Mode:

This command saves any changes you have made in the currently displayed show, and gets you directly to the exit command on the main configuration menu. When you answer 'Y' or 'N', the screen will remain unchanged, but you will be out of the configuration mode.

.....

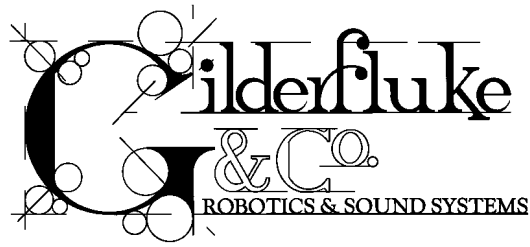
Setup String Commands

- “O” Setup String 1:**
- “P” Setup String 2:**
- “Q” Setup String 3:**
- “R” Setup String 4:**
- “S” Setup String 5:**
- “T” Setup String 6:**
- “U” Setup String 7:**
- “V” Setup String 8:**
- “W” Setup String 9:**

These commands are used to setup the strings which are sent out at the starts and ends of shows. These strings can contain ASCII characters which are sent to and received from the serial port, as well as special characters which can close the STOP, PLAY and REWIND relay outputs, send the search string for a LaserDisk player, or cause the Brick Brain to wait until it receives an input on the BLUE, GREEN or PB inputs, or a character from the serial port before continuing.

Full details on the Start and End Strings can be found in the next section of the manual.

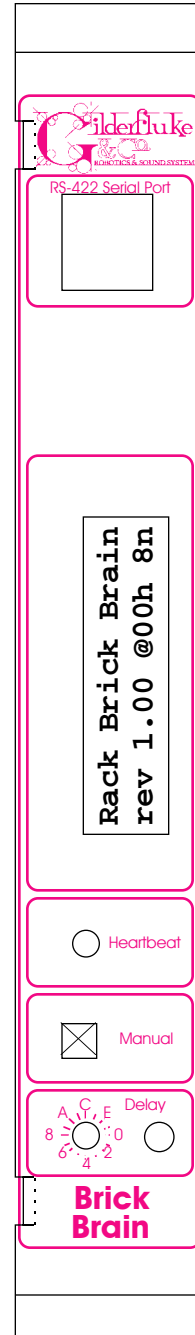
Think of all the trees that have given their lives for blank pages



- Rack Smart Brick Brain -

The Rack Mounted Smart Brick Brain is an extended version of the standard Smart Brick Brain. Features it adds to the standard Smart Brick Brain are:

- Plugs into standard Brick Card Cages
- It can control up to 255 different shows
- Supports Smart Bricks with up to 1,048,576 bytes of storage
- It can sequentially control up to seven LaserDisk Players
- Can be used with CLV (long play) as well as CAV LaserDisks
- Real Time Clock that can be used to schedule when shows play for up to a year in advance.
- Optional two line LCD display on its front can display the system and show status
- It can do a countdown between shows while running another show in the background
- Configuration can be burnt into Eprom for true nonvolatility



- Rack Smart Brick Brain Connections -

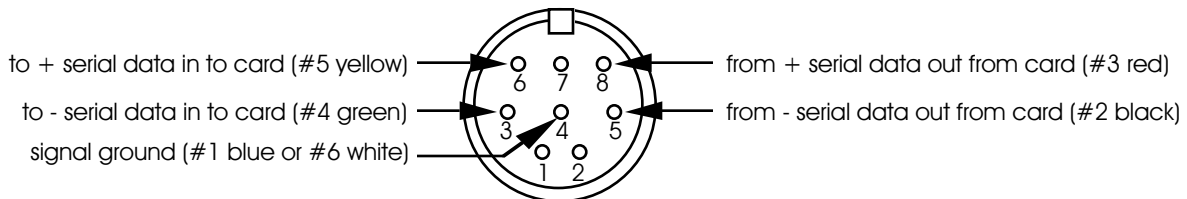
The only connection on the front is the the RS-422 serial port, which is also wired to the backplane. This serial port is used to send commands to the Smart Brick System or to connect LaserDisk players to the Rack Smart Brick Brain. It must be connected to a terminal or computer running a modem or terminal emulation program for configuring the Rack Smart Brick Brain. This is the same style of connector and pin out as is used on the AB-100 Digital Audio Repeaters, and can be attached to both Brick Brains and Digital Audio Repeaters simultaneously, just so long as their addresses don't conflict. Facing the end of the cable with the release latch upwards, its pin out is as follows:

	pin #	COLOR	SIGNAL NAME:
(left)	1	WHITE	signal ground
	2	BLACK	- serial data out from Brick Brains
	3	RED	+ serial data out from Brick Brains
	4	GREEN	- serial data in to Brick Brains
	5	YELLOW	+ serial data in to Brick Brains
(right)	6	BLUE	signal ground

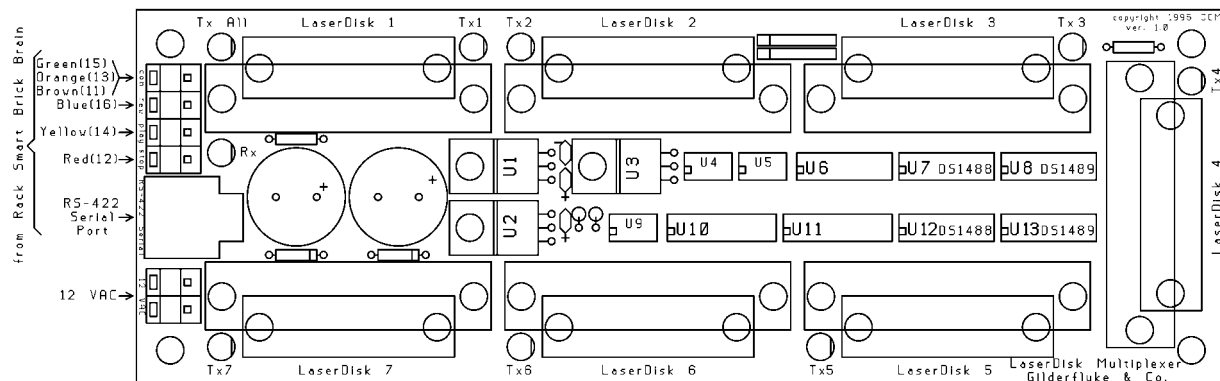
To cross wire the RS-422 / RS-485 signals from the Rack Smart Brick Brain to the RS-232 serial port of an IBM compatible or Pioneer LaserDisk player, cross connect the signals as follows:

IBM DB-25	IBM DE-9	Pioneer LaserDisk DB-15	SIGNAL	SIGNAL FROM/TO BRICK BRAIN
2	3	2	DATA OUT	- serial data in to Brick Brain (GREEN)
3	2	3	DATA IN	- serial data out from Brick Brain (BLACK)
7	5	1, 11 or 15	GROUND	signal ground (BLUE or WHITE)

Apple Macintosh computers have true RS-422 serial ports built in. To connect to the Smart Brick System, the pin out is as follows for a Macintosh mini-DIN-8:



The Rack Smart Brick Brain can sequentially control up to seven LaserDisk Players using the LaserDisk multiplexer (BS-LDMUX15 for Pioneer/Panasonic players or BS-LDMUX25 for Sony). This attaches to the Rack Smart Brick Brain through its relay outputs and RS-422 serial port as shown in the following drawing. The BS-LDMUX also converts the RS-422 ports on the Rack Smart Brick Brain to the RS-232 needed by the LaserDisk players. Indicator LEDs show serial data being sent to and received from the different LaserDisks. The serial ports on the LaserDisk Multiplexer are at RS-232 levels. Standard 15 (Pioneer or Panasonic) or 25 pin (Sony) cables can be used to attach the LaserDisks to it. A small 12 VAC power supply runs the LaserDisk Multiplexer. The Rack Smart Brick Brain's relay outputs can not be used for any other purpose when running multiple LaserDisk players.



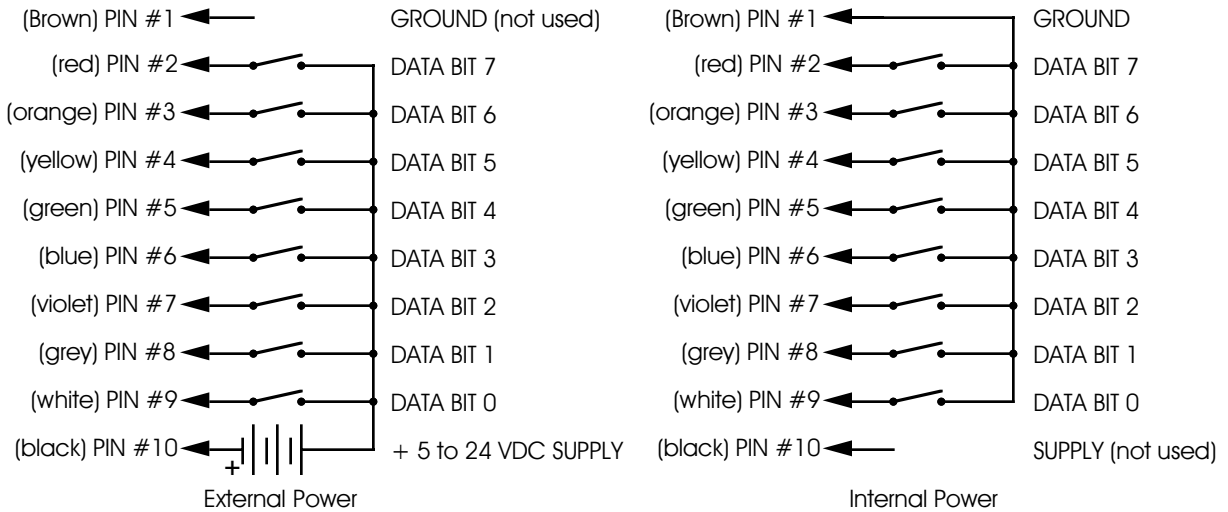
The majority of Backplane Connections are typically made through the 40 pin IDS connector on a Brick card cage:

output wire #	Edge pin #	color	wire function
Smart Brick net #2	1	black	- Smart Brick Network Data from Smart Brick Brain
Smart Brick net #1	2	white	+ Smart Brick Network Data from Smart Brick Brain
Smart Brick net #3	3	red	+ Smart Brick Network Clock from Smart Brick Brain
Serial Port #3	4	red	TxD + out from Smart Brick Brain
Smart Brick net #4	5	green	- Smart Brick Network Clock from Smart Brick Brain
Serial Port #2	6	black	TxD - out from Smart Brick Brain
Smart Brick net #5	7	yellow	+ Smart Brick Network Strobe from Smart Brick Brain
Serial Port #5	8	yellow	Rx + in to Smart Brick Brain
Smart Brick net #6	9	blue	- Smart Brick Network Strobe from Smart Brick Brain
Serial Port #4	10	green	Rx -in to Smart Brick Brain
#1	11	brown	1/4 J6 in Ground
#2	12	red	1/4 J6 in bit 7
#3	13	orange	1/4 J6 in bit 6
#4	14	yellow	1/4 J6 in bit 5
#5	15	green	1/4 J6 in bit 4
#6	16	blue	1/4 J6 in bit 3
#7	17	violet	1/4 J6 in bit 2
#8	18	gray	1/4 J6 in bit 1
#9	19	white	1/4 J6 in bit 0
#10	20	black	1/4 J6 in + Supply
#11	21	brown	Stop Relay contact closure
#12	22	red	Stop Relay contact closure
#13	23	orange	Play Relay contact closure
#14	24	yellow	Play Relay contact closure
#15	25	green	Rewind Relay contact closure
#16	26	blue	Rewind Relay contact closure
#17	27	violet	Green Input negative
#18	28	gray	Green Input Positive
#19	29	white	Blue Input negative
#20	30	black	Blue Input Positive
#21	31	brown	SMPTTE ground
#22	32	red	SMPTTE Input
#23	33	orange	not used
#24	34	yellow	not used
#25	35	green	not used
#26	36	blue	not used
#27	37	violet	not used
#28	38	gray	not used
#29	39	white	not used
#30	40	black	not used
#31	41	brown	not used
#32	42	red	not used
#33	43	orange	not used
#34	44	yellow	not used
#35	45	green	not used
#36	46	blue	not used
#37	47	violet	not used
#38	48	gray	not used
#39	49	white	not used
#40	50	black	not used
n/a	51	black	power supply ground
n/a	52	black	power supply ground
n/a	53	black	power supply ground
n/a	54	black	power supply ground
n/a	55	black	power supply ground
n/a	56	red	+ power supply input
n/a	57	red	+ power supply input
n/a	58	red	+ power supply input
n/a	59	red	+ power supply input
n/a	60	red	+ power supply input

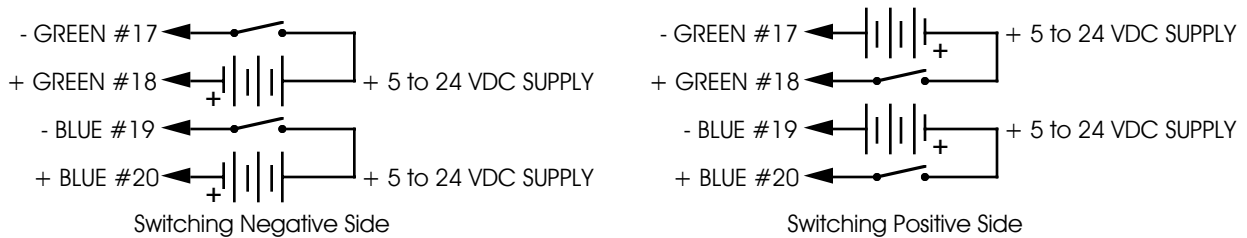
Pins 11 through 50 (second column in the above chart) are attached to pins 1 through 40 (first

column) of the 40 pin IDS connector. The first and last ten pins are bussed to all of the cards in the card cage.

The 1/4 J6 Input is optically isolated. It can be set to run from an external power source (default configuration) or the same power as the Rack Smart Brick Brain. This is selected by moving the two jumpers on JP-2 as shown on the board. Both jumpers to the left set the 1/4 J6 to internal power. Both jumpers to the right set the 1/4 J6 to external power.



The Connections to the J-8 input are as follows. These inputs are optoisolated. You must provide a voltage to them:

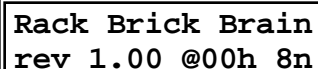


The J8 input has the same functionality as the J-8 connections found on all of our normal Micro MACs Bricks. Facing the end of the RJ-11 plug with the latch upward, the order of these inputs is as follows:

	COLOR	SIGNAL NAME:
1)	WHITE:	not used
2)	BLACK:	common + 5 to 24 VDC (15 Volts nominal) input
3)	RED:	not used
4)	GREEN:	optically isolated input
5)	YELLOW:	not used
6)	BLUE:	optically isolated input

- Rack Smart Brick Brain Messages -

The optional LCD display displays a variety of messages about the current state of the Rack Smart Brick Brain. When it first boots it displays:



Rack Brick Brain
rev 1.00 @00h 8n

This shows the revision number of the firmware, the card is addressed at 00h, the baud rate is set to 9600 (that is what the code number '8' means), and that no parity is enabled (that is the 'n').

The lower line of the display normally will show the current time as long as there is no show running, and the show time and frame number if a show is running. A variety of other messages will be displayed by the top line of the display. Some of these will flash by too fast to ever be read.

" **start string** ", " **end string** ", "**MultiDisk string**" : Sending a start, end, or MultiDisk string. The number of the string, the byte within that string, and the response to it will be displayed exactly as on a Heads Up Display.

" **waiting for PB** ", "**waiting for blue**", " **wait for green** ": These are displayed if a code was found in the start or end string that causes the Brick Brain to wait for a closure on any of these inputs.

" **at end of show** ": Normal end of show has been found.

" **invalid FPS** ": The Frame Rate has been set to a value which won't work with the type of time code selected.

"**int clocked show**", "**extern. clk show**", "**SMPT clock show**", " **LaserDisk show** ": The shows are actually running.

" **starting SMPTE** ": A SMPTE clocked show is being started, but the Rack Smart Brick Brain has yet to receive any time code.

"**invalid timecode**": This is displayed if the SMPTE hour received doesn't point to a show that has been configured to run from SMPTE timecode.

"**in configuration**", " **exited config.** ": These are displayed as you enter and exit the configuration mode.

"**+single stepping**", "**-single stepping**": Displayed in response to the single step serial port commands.

" **countdown hold** ": This is displayed when the countdown has been stopped by an external input.

" **countdown done** ": Displayed at the end of a normal countdown. About the only time you will actually see this is if you don't have anything configured to happen at the end of a countdown, or the countdown has been set to zero length during it.

"**countdown delay0**": The number of the countdown display is displayed during normal countdowns.

"**delay 0/play FFh**": This is displayed while running a background show while also doing a countdown delay. The number of the display, as well as the HEX number of the show are also displayed.

"**bridging dropout**": This is displayed while the Rack Smart Brick Brain is bridging over a gap in the incoming SMPTE or LaserDisk timecode.

"**startup lockout** ": This is displayed and most of the functions of the Rack Smart Brick Brain are disabled when the defaults have been forced to reload by pressing the 'manual' button as the Brain is powered up. It can only be cleared by entering and exiting setup mode.

" **response error** ": If a start or end string has within it a request for a specific character, but another character is received, this message will be displayed.

"**PioneerStart err**", "**Sony start error**": These will be displayed if there is an error encountered when trying to start a LaserDisk show. What this typically means is that the LaserDisk player needs to be spun up.

" **spinup Pioneer** ", " **Sony disk spinup** ": These are displayed while spinning up the LaserDisk player.

" **LaserLoop Error** ": Displayed if an error is encountered during a LaserDisk show.

" **LaserDisk early** ": This is displayed if we find ourselves before the start of the show on the LaserDisk.

" **frame reset cmnd** ": Displayed in response to this command.

" **call vendor** ": Displayed if error occurs that requires service from the vendor who installed your system.

" **no LD in config** ": Displayed if a LaserDisk-based show is attempted to be played while the Rack Smart Brick Brain is in Setup mode. As the serial port is being used for the terminal during Setup, it is impossible to play a LaserDisk-based show during Setup.

" **stop at end cmnd** ": Displayed in response to this command.

" **stop command** ": Displayed in response to this command.

- Rack Smart Brick Brain Configuration -

To configure the system you first need to connect the system just as you do for any serial communications (see the 'Smart Brick System Commands' section of the manual). The configuration mode is entered by the command:

"m" (5AA5) (track#)

Typically, the Smart Brick Brain is configured to respond when addressed as track '00', and so the string you send the Brick Brain is 'm5AA500'. The '5AA5' part of the string acts like a combination lock to keep random noise on the serial input lines from accidentally entering the configuration mode.

This command brings up the following menu from the Brick Brain which was addressed. (In this case this shows the configuration after the defaults are reloaded.)

```

- Gilderfluke & Co. Rack Smart Brick Brain - rev. 1.13 copyright 1991-1998 DCM -

a) brain address- __0 | i) InfraRed mode- no | s) frame rate- 30 FPS
b) baud rate- 9600 baud | j) coin op mode- no | t) brick rec. enable- yes
c) odd parity- no | k) select from J6- yes | u) early starts- jump fwd.
d) VT-52 mode- no | l) direct select- no | v) allow chains- no
e) numbers- Decimal | n) debounce- __8 | w) countdown hold- no
f) download config EPROM | p) running delay- __8 | y) player type- Pioneer
g) respond to group- 0 | q) tape deck pulse- __8 | z) LaserDisk time- no
h) set clock | r) error count- __8 | +) dropout protection- yes

                pause cont.                STOP
                [rtz] [inc] START LOOP STOP at END TAPE DECK
1) green input Closing: | | | | | | | stop |
2) green input Opening: | | | | | | | | |
3) blue input Closing: | | | | | | | play |
4) blue input Opening: | | | | | | | | |
5) PB input Closing: | | | | | on | | rew. |
6) PB input Opening: | | | | | | | | |
7) J6 input Closing: | | | | | on | | | |
8) J6 input Opening: | | | | | | | | |
9) countdown end: | | | | | on | | | |
                m) more... o) load defaults x) eXit

DST 17:33:49 Wednesday October 14, '98 enter command-
```

If the key and **TRACK#** match, the card addressed by the **TRACK#** will put a configuration menu on the screen. When this mode is entered by any Brick Brain or Digital Audio Repeater card on the same serial network, it disables all of the other serial commands on all the other cards in the system.

If at any point you enter a command and have yet to enter any other characters, you can leave the command by hitting the <ESC>ape or <RETURN> key. If you have already entered some characters, the <ESC>ape key can be used to erase all of the characters you have entered so far. The <DELETE> key can be used to erase just the last character entered. If you try to enter more characters than the command calls for, the extra keystrokes will 'roll' any additional input. Hitting the <RETURN> key will tell the Rack Smart Brick Brain to accept your entry as typed. If the entry is invalid, the Rack Smart Brick Brain will beep annoyingly and ask for the same input again.

The <ESC>ape key or <SPACE BAR> can be used to redraw the screen at any time. If you want to keep a hard copy printout of the current configuration of any screen, you should hit either of these keys while saving the text on your computer. This file can then be printed out at any time.

If you ever need to set the Brick Brain back to its default settings (9600 baud, address 00H, and no parity), you can do so by powering down the card, and then holding the 'MANUAL' button as you power it back up. The default configuration setting will be reloaded and the Rack Smart Brick Brain will wait for you to enter configuration and exit again before normal operation is restored.

The configuration of the Rack Smart Brick Brain can be locked at any time by simply removing JP-1 pin #1 to #2. The menu will warn you that changes will have no affect when the RAM memory is protected. If you want to make the configuration even more permanent, you can burn an Eprom and replace the configuration RAM.

.....

“a” Enter Track Number:

This command is used to tell the Brick Brain which addresses it should respond to from the serial commands. No two Brick Brains or Digital Audio Repeater Cards on the same serial network can have the same address assigned to them. When loaded with the default configuration, the address assigned to a card is 00. If more than one Brick Brain or Digital Audio Repeater card is used in the system, they should be plugged in one at a time to have their addresses changed. Once changed, each card can stay on line.

The Rack Smart Brick Brain will show the current address, baud rate and parity on its display when it first boots up.

.....

“b” Baud Rate:

All cards in the system must be set to the same baud rate. The default speed is 9600 baud. This command doesn't take effect until you enter the eXit command. The serial port on each Brick Brain can support any of the following baud rates:

- 1) 110
- 2) 150
- 3) 300
- 4) 600
- 5) 1200
- 6) 2400
- 7) 4800
- 8) 9600 (default value)**
- 9) 19,200 (not exact)
- 10) 48,000
- 11) 144,000

The Rack Smart Brick Brain will show the current address, baud rate and parity on its display when it first boots up.

.....

“c” Odd Parity Toggle:

This toggle enables the **ODD PARITY** data check on the serial port for this Brick Brain. Parity is a method of confirming that the data sent to the audio system arrives intact. Any data that gets jumbled is ignored. If **ODD PARITY** is enabled, it must be enabled on all the cards in the system as well as on your computer or terminal. The default value for this command is off. This command doesn't take effect until you enter the eXit command.

To indicate if parity is enabled, the Rack Smart Brick Brain will show a 'p' or 'n' after the baud rate code on its display when it first boots up.

.....

“d” VT-52 Mode:

When this toggle is enabled, the Rack Smart Brick Brain will use special escape sequences to clear the current line (<ESC>ape 'l'), or position the cursor (<ESC>ape 'Y' ROW COLUMN). When disabled, the Analog Smart Brick has to redraw the entire screen to change any value, so it can save a good deal of screen redraw time if you have a compatible display.

.....

“e” Numbers:

This toggles the Rack Smart Brick Brain between Decimal and Hexadecimal numbering systems.

.....

“f” Download Configuration Eprom:

This command is used to download an Intel HEX image of the current configuration of the Rack Smart Brick Brain. This can be burnt into a 27C256 Eprom using any commercial Eprom programmer. It then can be used to replace the normal 62256LP configuration RAM on the Rack Smart Brick Brain. By doing this you can make your configuration virtually indestructible.

The number of text characters that will be sent to your computer by this command must be exactly **92,173** bytes. You will need to burn this Hex file into an Eprom and before installing it:

- 1) Remove the jumper plug that shorts between JP-1 pin #1 to #2.
 - 2) Move this jumper plug to JP-1 pin #2 to #3.
 - 3) Cut the trace between pins #1 and #2 on JP3 (this is on the back of the PC board).
 - 4) Cut the trace between pins #1 and #2 on JP4 (also on the back of the PC board).
 - 5) Solder a jumper from pin #2 to #3 on JP3.
 - 6) Solder a jumper from pin #2 to #3 on JP4.
-

“g” Respond to Group:

Any Smart Brick Brain or Digital Audio Repeater can be configured to respond to one of sixteen possible 'group' commands issued through the serial port. This allows you to start several devices with only a single command. This menu selection is used to set which group this card will respond to. The allowable range for this entry is 09, A-F.

.....

“h” Set Clock:

This command is used to set the real time clock on the Rack Smart Brick Brain. If you select 'Automatic Daylight Savings Time', then the clock will automatically 'Spring forward' on the first Sunday in April (at 2:00 AM) and 'Fall back' on the last Sunday in October (again at 2:00 AM). If automatic Daylight Savings Time is enabled, the time will be preceded by 'DST' during the summer months.

.....

“i” InfraRed Mode:

This toggle turns on a special serial port mode on the Rack Smart Brick Brain which allows it to be used with the InfraRed Transmitter and Receiver. The IR Remote is typically used to trigger an animation or sound system mounted on a vehicle, turntable, or other installation where wires can't be used. All serial port commands except for 'm' (enter setup mode) are disabled when this toggle is ON.

The connections to the IR Remote Receiver are as follows (view is facing end of cable with latch up):

	NAME	COLOR	SIGNAL FUNCTION
LEFT	GROUND	WHITE	SIGNAL GROUND
	n/c	BLACK	no connection
	n/c	RED	no connection
	- TxD	GREEN	- DATA IN to Rack Smart Brick Brain
	+ TxD	YELLOW	+ DATA IN to Rack Smart Brick Brain
RIGHT	GROUND	BLUE	SIGNAL GROUND

In addition to these connections, the IR Receiver requires a 7 to 24 volt DC power supply connection. This is normally attached to the two pads marked "+" and "-" on the receiver. A jumper option allows you to bring this in through the blue wire on the RJ-11 connector.

The IR Transmitter has an eight position dipswitch which sets which show it selects. The lower nibble of the address are set with the first four switches, and the upper nibble is set with the last four. Valid show numbers are 01h through FFh:

<u>SWITCH #1</u>	<u>SWITCH #2</u>	<u>SWITCH #3</u>	<u>SWITCH #4</u>	<u>LOWER NIBBLE OF ADDRESS</u>
OFF	OFF	OFF	OFF	x0h
ON	OFF	OFF	OFF	x1h
OFF	ON	OFF	OFF	x2h
ON	ON	OFF	OFF	x3h
OFF	OFF	ON	OFF	x4h
ON	OFF	ON	OFF	x5h
OFF	ON	ON	OFF	x6h
ON	ON	ON	OFF	x7h
OFF	OFF	OFF	ON	x8h
ON	OFF	OFF	ON	x9h
OFF	ON	OFF	ON	xAh
ON	ON	OFF	ON	xBh
OFF	OFF	ON	ON	xCh
ON	OFF	ON	ON	xDh
OFF	ON	ON	ON	xEh
ON	ON	ON	ON	xFh

<u>SWITCH #5</u>	<u>SWITCH #6</u>	<u>SWITCH #7</u>	<u>SWITCH #8</u>	<u>UPPER NIBBLE OF ADDRESS</u>
OFF	OFF	OFF	OFF	0xh
ON	OFF	OFF	OFF	1xh
OFF	ON	OFF	OFF	2xh
ON	ON	OFF	OFF	3xh
OFF	OFF	ON	OFF	4xh
ON	OFF	ON	OFF	5xh
OFF	ON	ON	OFF	6xh
ON	ON	ON	OFF	7xh
OFF	OFF	OFF	ON	8xh
ON	OFF	OFF	ON	9xh
OFF	ON	OFF	ON	Axh
ON	ON	OFF	ON	Bxh
OFF	OFF	ON	ON	Cxh
ON	OFF	ON	ON	Dxh
OFF	ON	ON	ON	Exh
ON	ON	ON	ON	Fxh

When in this mode you must also set the baud rate to 1200 baud and the **'EARLY STARTS'** should be set to 'IGNORE'. Any binary show number received by the serial port for more times than the value stored in the **DEBOUNCE** variable will trigger that show. Typically the transmitters are placed along the path of the vehicle's travel to trigger the appropriate animation sequences at the appropriate times.

"j" Coin-Op Mode:

This toggle turns on a special mode that is typically used with animation systems that are installed in coin operated devices. When this toggle is switched ON:

- 1) If no other show is playing and we aren't in a delay countdown, the Rack Smart Brick Brain will start playing show 255/FFh. This can be stopped if there is a closure on the BLUE input.
- 2) The end of the delay countdown will always call up show 255/FFh.

Show 255/FFh is then programmed as the 'attract' mode for the installation. Other shows are typical-

ly called up randomly or sequentially by the coin acceptor switch.

.....

“k” Select from J6:

If more than one show is stored on a single Smart Brick System, each one can be accessed individually and played back. Up to 255 of these shows can be stored on a single Smart Brick System. These requests can be made through the serial port or through the 1/4 J6 Port.

This toggle enables the 1/4 J6 Port for requesting the shows on this Smart Brick System. There are two methods of selecting shows from this port. Which one is used is selected by the **DIRECT SELECT** command.

.....

“l” Direct Select:

This command is used to switch the 1/4 J6 Port over to selecting 1 of 8 shows directly, instead of using binary inputs for requesting up to 255 different shows. The **DIRECT SELECT** is useful when you have eight or less shows which need to be called up through the 1/4 J6 Port. The 1/4 J6 Port can be wired directly to up to eight different pushbuttons. When any of these buttons are pressed it will select the appropriate show. The first button pushed will be played at the next **START** or **START LOOPING** command, unless it is overridden by another show request from the serial ports. (The Brain can also be told to start playing the newly requested show immediately if you tell the Brick Brain to **START** or **START LOOPING** on the input to the 1/4 J-6 port.)

If this mode is off, then up to 255 different shows can be selected through the 1/4 J6 Port. The 1/4 J6 Port can be connected directly to the output of a computer or Animation Control System. If you need to connect it to pushbuttons, you will need to use diodes or a keyboard with an encoder (available from Gilderfluke & Company) to encode a binary number to be sent to the 1/4 J6 Port.

As with changes in inputs on the A, B, or PB input, changes on the 1/4 J6 Port can be used to **START**, stop, or whatever a Brick Brain. If the **DIRECT SELECT** option is 'on', then a rising edge is on any new arrival of a new closure, and a falling edge is when all input lines are opened. If the **DIRECT SELECTION** is 'off', then a rising edge is on any change in the 1/4 J6 Port except for when all of the inputs go open, which is considered to be a falling edge.

.....

“n” Debounce:

This command is used to set the number of times the software in the Brick Brain will check the Blue, Green or 1/4 J6 inputs before actually believing them. Valid entries are from 0 to 255 (00H to FFH). A zero entry gives a 256 count loop for the longest possible response, 01 gives the fastest possible response. Too small of an entry for the **DEBOUNCE** can cause problems with the inputs if they are noisy or tend to bounce. Too large a value will cause a delay before the Brick Brain responds to these inputs. The default value is eight.

.....

“p” Running Delay:

The running delay is the number of heartbeats after which the Smart Bricks stop advancing frames until it turns off the 'Advancing Frames' LED on the Heads Up Display and disables any Smart Brick outputs which have been configured to be 'disabled when stopped'.

.....

“q” Tape Deck Pulse:

This command is used to set how long the pulse sent out through the 'stop', 'play', and 'rewind' relay outputs is. The length is the number of heartbeats the output will stay active after they are initially turned on. Valid entries are from 0 to 255 (00H to FFH). A value of 0 latches the outputs on permanently when they are set.

.....

“r” Error Count:

In SMPTE synchronized shows, the error count is the number of consecutive good frames of SMPTE time code which must be received before the Brick Brain believes what it is hearing. This is used to bridge over short dropouts or bad SMPTE data received when the tape deck is just starting up.

In LaserDisk synchronized shows, the error count is the number of times the Brick Brain will try to start a show by sending the LaserDisk player a 'search' string. It will display 'E6' error on the Heads Up Display during this period. If the LaserDisk player doesn't respond as expected for the 'error count' number of tries, then it will try to go into a 'startup' sequence to try and spin up the LaserDisk. The error message 'F2' will then be displayed as an attempt is being made to start up the LaserDisk player.

.....

“s” Frame Rate:

This command is used to set the **Frame Rate** for all the shows in the Smart Brick System. This is the number of times each second which the Smart Brick System will update all of the outputs with new data.

Valid frame rates for SMPTE synchronized shows are 12, 15, 24, 25, and 30 frames per second.

Valid frame rates for LaserDisk synchronized shows are 15, 25, and 30 frames per second.

Valid frame rates for Internally clocked shows are 1, 2, 4, 5, 8, 10, 12, 15, 16, 20, 24, 25, 30, 32, 50, 60, 75, and 100 frames per second.

Valid frame rates for externally clocked shows are from 1 to 100 frames per second.

This entry will accept any value between 00 and 99. 00 is used to enter a 100 frames per second frame rate. If the entry isn't valid for the time code you are running, a 'E5' error will be displayed on the Heads Up Display when an attempt is made to start the show.

.....

“t” Brick Record Enable:

This toggle is used to globally enable and disable the 'Record' function on all Record/Playback Smart Bricks attached to this Rack Smart Brick Brain. When this toggle is OFF, then even when the RECORD KEY is turned to the ON position on the Smart Bricks, they won't go into record mode.

.....

“u” Early Starts:

The user has the choice of what each Brick Brain does when it is still playing a show and receives a new '**START**' or '**LOOP**' command. The options are:

- 1) DO NOTHING.
- 2) JUMP FORWARD to the next show.
- 3) JUMP BACKWARDS to the start of the current show.
- 4) BANK START so that it won't be acted upon until the current show finishes. Show requests will be banked up to 11 requests deep. Starts can be banked up to 256 deep.

The JUMP FORWARD and JUMP BACKWARDS commands have the lowest priority of all possible show

requests. Any serial port or 1/4 J6 Port show request will take priority over these.

.....

“v” Allow Chains:

This toggle is used if you want to let the Brick Brain play consecutive shows which are tightly chained together (by having the **'IMMEDIATE'** flag set in the shows' configuration), even when the **LOOPING MODE** is off. This should be set if you are building longer shows out of a number of shorter shows, and you don't want the Brick Brain to stop right between any two segments if it receives a **'STOP AT END'** command.

.....

“w” Countdown Hold:

When this toggle is ON, then the delay between shows countdown can be temporarily stopped by applying a signal to the GREEN input.

.....

“y” Player Type:

For those shows which are running from a LaserDisk, this command toggles the Brick Brain between using the command format used by Pioneer, Sony or Panasonic LaserDisk Players. The only commands which are affected by this toggle are the 'SEARCH' and 'SPIN UP' commands which are sent to the players when a LaserSearch (01) is included in a start or end string, and the 'FRAME INQUIRY' commands sent to the player during a show. All of these happen transparently to the user once this toggle has been set.

.....

“z” LaserDisk Time:

When this toggle is ON, LaserDisk clocked shows will display the actual frame being accessed on the LaserDisk instead of the show time. If a CAV disk is being used, then the frames will be in decimal numbers (00,001 to 54,000). If a CLV disk is being used, then the time will be displayed in a 'time' format. The show time is always displayed in a 'time' format.

.....

“+” Dropout Protection:

When this toggle is ON, the Rack Smart Brick Brain will bridge over any gap in the SMPTE or LaserDisk time code that lasts more than two frames. If the time code picks back up the Rack Smart Brick Brain will lock back onto it.

.....

“1”	'GREEN' Input Closing Edge:
“2”	'GREEN' Input Opening Edge:
“3”	'BLUE' Input Closing Edge:
“4”	'BLUE' Input Opening Edge:
“5”	'PB' Input Closing Edge:
“6”	'PB' Input Opening Edge:
“7”	'1/4 J6 Port' Input Closing Edge:
“8”	'1/4 J6 Port' Input Opening Edge:
“9”	Countdown End:

Each Rack Smart Brick Brain has two opto-isolated external inputs, one push button input on the front, and one 1/4 J6 Port input (8 optoisolated inputs). Additionally, the Brick Brain treats the end of a countdown just like it would treat any of the other inputs. These commands are used to select what actions will take place on each edge of each of these inputs. Note that both rising and falling edge actions are available to you. This allows you to do things like start a show on a closing edge and then stop it on the opening edge of the same input. This would make it into a 'run while' input.

The closing edge on the 'GREEN', 'BLUE, and 'PB' inputs are considered to be when a normally open push button or switch is closed. The opening edge is when that same switch or push button is opened. A closing edge on the 1/4 J6 Port is considered to be any of the eight inputs closing if the **DIRECT SELECT** option is 'on', or any change in the input (except going to all inputs open) if the **DIRECT SELECT** option is off. A opening edge on the 1/4 J6 Port is when all eight of the inputs go to an open condition.

The hardware for the 'GREEN', and 'BLUE', inputs need an external power source for the opto isolators to run. The 1/4 J-6 input can be jumpered on the Rack Smart Brick Card to use an external power supply or the internal power supply. Connections for these are shown elsewhere in this manual.

If you want the Smart Brick System to start playing shows as soon as it is powered up, you can set a '**START**' or '**START LOOPING**' command on the opening edge of any of the inputs. On power-up, the Brick Brain will check all of the inputs and find that the one you are using has just opened. It will then act upon any commands you have set for this edge. This would normally be a '**START**' command if you only want the Smart Brick System to play a single show, or a '**START LOOPING**' command if you want it to continue playing shows until it is told to stop. We normally use the 'PB opening' edge to start shows on power-up (you can use any of the 'opening' edges) and then put in a '**STOP**' or '**STOP AT END**' command on the 'PB closing' command so that we can stop the shows once they have started.

If multiple inputs to the system arrive simultaneously, they have the following priorities:

- 1) '1/4 J6 Port' INPUTS
- 2) 'GREEN' input
- 3) 'BLUE' INPUT
- 4) 'PB' INPUT

This will probably happen only on power-up.

The commands have the following effects:

Pause/Return to Zero (RTZ):

- a) **If running an Internally, Smple or LaserDisk clocked show:** This command causes the currently running show to be paused at the current frame. If the show is LaserDisk clocked, the string 'E' will be sent when the show is paused. This string is typically configured to pause the LaserDisk. A pause will be cleared if a new show is started, or the Continue command is used.
- b) **If running an Externally clocked show:** When running an internally clocked show, this command causes the frame counters to be reset back to the start of the show. During countdowns, this command causes a new countdown delay to be started based on the current thumbwheel switch settings.

Continue/Increment:

- a) **If running an Internally, Smple or LaserDisk clocked show:** This command clears a pause in the currently running show which was set by the Pause command. If a show

has been paused, then the show will continue from the current frame. If the show is LaserDisk clocked, then string 'F' will be sent when the show is continued. This string is typically configured to cause the LaserDisk to start playing from the current frame. If this command is issued and the show has not been paused, it will have no effect.

- b) If running an externally clocked show:** This command enables an input to advance frames on either the rising or falling (or both) edges of an input when running an externally clocked show.

Start:

This command causes the Brick Brain to start playing the next show in line. At the end of the show, the Brick Brain will stop unless the show which is played has the **IMMEDIATE CHAIN FLAG** set AND the **ALLOW CHAINS** flag is also on. Under those circumstances, it will continue to play shows until those conditions are not met.

If the **'LOOPING SHOWS'** flag is set, sending any type of **'START'** command to the Brick Brain will reset this flag.

Loop:

This command acts much like a **START** command, except that it also sets the **'LOOPING SHOWS'** flag. With the this flag set, it is possible to set a sequence of shows playing in any order. The shows can be played with no delay or with a preset delay between each. Since the 'next' show can be any show you ask for, one show can be played over and over again, or you can set up a sequence of shows which will be repeated until the Brick Brain is told to stop.

When the **'LOOPING SHOWS'** flag set, the Brick Brain will check to see if the **'IMMEDIATE CHAIN'** or **'DELAY'** flags are set when it has finished playing a show. If the show has a the **'IMMEDIATE CHAIN'** flag set, then it will immediately start playing the 'next' show, which you can set to be any show in the system. If the **'DELAY'** flag is set, then the Brick Brain will check to see if the thumbwheel switch on its front is set to anything other than 0. If it is, then it will then start this new delay countdown. At the end of the countdown, whatever 'Countdown end' actions are set will take place just as though a switch closure input had just happened. In most cases this will be another **LOOP** command, which will then start the next show. At the end of that show, the whole process will then start over.

Stop:

This command will stop any show which is playing immediately and unconditionally.

Stop at End:

This command resets the **'LOOPING SHOWS'** flag. This means that the shows will stop playing at the normal end of show and won't start a new countdown under any circumstances, and won't chain unless the **ALLOW CHAINS** flag is set and there is a request for an **IMMEDIATE CHAIN** at the end of the current show.

Tape Deck:

These allow you to trigger the START, STOP or REWIND relay outputs from one of the external inputs or end of countdown.

Additional options are available for the Green or Blue closing edges, or the countdown end. For each of these, you can select the edge to trigger shows Sequentially, Randomly or Normally. You can also select these same options for each individual input in the 1/4 J6 input (eight inputs total) on the J6 configuration menu. If you select:

- a) Sequentially: If you select this option, then you are asked for the range of shows that you want to play. Each time this edge is triggered, then the next show in this range will be played. As an example of this, if you select a range of shows of ten to twenty: Show ten will be played on the first on the first edge, show eleven on the next, etc.. After show twenty plays, then the next show will be show ten again. Each time this window is displayed, the 'next' show which will be played on each input which has been set for sequential operation will be displayed.

If the range of shows is just one show, then the text displayed will show that only a single show will be requested and played on this input.

- b) Randomly: If you select this option, then you are asked for the range of shows that you want to play on this input. Each time this edge is triggered, one of the shows within this range will be chosen at random and played. As an example of this, if you select a range of shows of ten to twenty: Show ?? will be played on the first on the first edge, show ?? on the next, etc.. The randomizer uses a separate counter for each of these inputs. This counts at ten Hertz from the first show selected through the last and then recycles. When the user selects an input which has been configured with this option, the Smart Brick Brain uses the current value of this counter to select and play a next show. If the randomizer played the same show the last time, it will spin the randomizer another time to try and select another show to play. If after this second spin, the same show comes up, then it will be played.
- c) Normally: The inputs will behave as described above. You can select whether the input will pause, continue, stop, stop at end, start, start looping, or trigger a tape deck output.

“m” More.....:

This command allows you to select from the other menus:

- 1) Main Menu. This brings you back to the main menu.
- 2) Show Setup. This will ask you which of the 255 possible shows you want to modify.
- 3) String Setup. This allows you to modify the strings used to control LaserDisks.
- 4) Delay. This allows you to set how long each of the sixteen possible countdown delays are.
- 5) Schedules. This is where you modify the ninety different possible schedules.
- 6) Calendar. This is where you select which schedule will be used on any day.

“o” Load Defaults:

This command is used to reload the default conditions for the variables set on the main menu of the Rack Smart Brick Brain.

“x” eXit Setup Mode:

This command is used to exit the setup mode. If you hit this command in error, hitting an <ESC>ape key will get you back to the setup mode. All of the setup commands which don't take effect immediately, take effect when the eXit command is entered. This includes things like the BAUD RATE, so you will have to change the baud rate of the terminal you are using at this time.

For compatibility with other products which might be on the same RS-422 serial network, this command asks you to enter a 'Y' or 'N'. This lets them know that the setup mode has been exited on this card. If you hit this command by mistake, then you can hit the <ESC>ape key to get back to where you were before.

All other Audio Repeater cards and Brick Brains in the same serial network have their serial ports disabled while any card in the system is in setup mode. This is the only command to which they will respond. After the initial 'X', all of the other cards wait for a 'Y' or 'N' before they will start accepting other serial commands again. If you find that you are having trouble communicating with any of the cards in the system, try entering an 'XN' to trick it into thinking you have exited the configuration mode.

- Rack Smart Brick Brain Show Menu -

This screen is entered through the MORE command from any other screen. It is used to set up the 255 possible shows which a Smart Brick System can control. There are 255 possible shows, valid entries are from 1 to 255 (01H to FFH). Selections through the serial port and 1/4 J6 port are in Hexadecimal binary numbers. If you are using decimal numbering when setting up shows, you can use the chart at the end of this manual to translate these to Hexadecimal values.

When configuring SMPTE shows, the hour byte is used to select the shows. Since these actually come from the SMPTE 'hours', and this is a BCD number, valid decimal show numbers for SMPTE shows are:

01, 02, 03, 04, 05, 06, 07, 08, 09, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 32, 33, 34, 35, and 36

The Hexadecimal equivalents for these show numbers are:

01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, and 24

Show number 00 is invalid for a Smart Brick Brain, but it is valid as a SMPTE hour number. For this reason show number 36 (24h) is actually selected when the Brick Brain gets a SMPTE 'hour' of 00. An error message will be displayed if the Rack Smart Brick Brain receives a SMPTE hour which refers to a show that is not configured for SMPTE.

Entering this screen will stop any LaserDisk clocked show which is currently running, and keep any new ones from being started.

The Show Setup screen looks something like this:

```

- Gilderfluke & Co. Rack Smart Brick Brain - rev. 1.13 copyright 1991-1998 DCM -

                               Show __1 Setup

b) time code- internal
c) Smart Brick start- ____0 00:00:00.00
d) Smart Brick end-  __65535 00:36:24.15
e) next show- __1    =__65535 00:36:24.15 show length
f) immediate- yes
g) delay- no
h) start string- 0
i) multi-disk string- 0
j) end string- 0
1) LaserDisk 1- ____1 00:00:00.01
2) LaserDisk 2- ____0 00:00:00.00
3) LaserDisk 3- ____0 00:00:00.00
4) LaserDisk 4- ____0 00:00:00.00
5) LaserDisk 5- ____0 00:00:00.00
6) LaserDisk 6- ____0 00:00:00.00
7) LaserDisk 7- ____0 00:00:00.00

n) next  1) last  k) kopy  m) more...  o) load defaults  x) eXit

                               enter command-
```

As a convenience, the Rack Smart Brick Brain calculates the 'time' equivalents for many of the inputs. It also calculates the show length by subtracting the show start from the show end. All entries are made in decimal or Hexadecimal values, depending on the setting on the main menu.

.....

"b" Time Code:

This command toggles through the four possible time codes:

- LaserDisk
- SMPTE
- Internal time base
- External time base

.....

“c” Brick Start:

This command is used to select where in the memory of the Smart Bricks the show will start. Valid entries are made in up to seven decimal numbers, ranging from 0 to 1,048,575. If you are using a 16K Smart Brick, the upper limit should be below 16,383. If using a 64K Smart Brick, the limit should be kept below 65,535 frames. The Rack Smart Brick Brain will automatically translate this number in to a 'time' value and display it next to the number you have entered. The **BRICK START** is also subtracted from the **BRICK END** time so that the show length is also displayed.

.....

“d” Brick End:

This command is used to select where in the memory of the Smart Brick the show will end if using SMPTE, Internal or external clocking. Valid entries are made in up to seven decimal numbers, ranging from 0 to 1,048,575. If using a 64K Smart Brick, the limit should be kept below 65,535 frames. The Rack Smart Brick Brain will automatically translate this number in to a 'time' value and display it next to the number you have entered. The **BRICK START** is also subtracted from the **BRICK END** time so that the show length is also displayed.

.....

“e” Next Show:

This command is used to select which show will be played next if there were no other higher priority show requests made. Valid entries are from 0 to 255 (00 to FFh). One through 255 select specific shows and any show number can be used. If the current show requests itself, then it will loop until a different show is requested.

Entering a **NEXT SHOW** value of 00 is how you tell the Brick Brain that you want it to drop back into the sequence of shows it had been playing before the last specific show request had been received. As an example:

Shows 1 through 6 each request the next consecutive show in line
Show 7 requests show number 1 at it's end
Show 10 through 16 each request the next consecutive show in line
Show 17 has a '00' entered for the next show at it's end
Once started, the shows 1 through 7 will loop for ever
A request comes in for show 10 while playing show 3
Shows 10 through 17 are played
At the end of show 17, the next show played will be show number 4

An exception to the rule above is made for shows 240 through 255 (0F0h through 0FFh). These shows are to be used for 'background' shows. It is show #255 that is called up when both the **IMMEDIATE CHAIN FLAG** and **DELAY FLAGS** are set for a single show. When any of these shows are playing, and another show is requested, show numbers from 240 through 255 won't be saved as the 'return' shows.

.....

“f” Immediate:

This toggles the **'IMMEDIATE CHAIN FLAG'** for this show. When set, the next show will be played immediately after this show ends as long as the system is currently looping shows. The next show can be a specifically requested 'next show', or a return from a specifically requested show if '00' is entered as the 'next show'. If the **ALLOW CHAINS** flag is set, then the next show will be played immediately, even if the system is not currently looping shows.

IMMEDIATE CHAINS can be used to build up longer shows from a number of shorter segments. You might want to do this if you are fixing a error in the show burnt onto a LaserDisk (skipping over a slow part of the show, for example), or to build up a show which runs continuously between the main shows, but

has a number of 'seams' where it can branch to another show if one is specifically requested. You can program the animation at these 'seams' so that there will be no jumps when the other shows start and end.

If both the **IMMEDIATE CHAIN FLAG** and **DELAY FLAGS** are set for the end of a show, then this sets up a special mode where the Rack Smart Brick Brain can actually play a string of shows while it is doing a countdown delay. If both flags are set (and the delay is longer than zero length), then show 255 (FFh) will be started immediately at the end of the show. At the end of the countdown, the show in the 'next show' will be played.

Any show between 240 and 255 (0F0h and 0FFh) can be played during the background shows. If any request comes in for another show, shows between 240 and 255 (0F0h and 0FFh) won't be forced as a return show if the requested show ends with a 'whatever is next' 00.

"g" Delay:

This toggles the '**DELAY FLAG**' for this show. When set, the countdown timer will be started after this show ends if the system is currently looping shows. What happens at the end of this countdown is up to what ever the Brick Brain is configured to do at countdown end.

If both the **IMMEDIATE CHAIN FLAG** and **DELAY FLAG** are set for the end of a show, then this sets up a special mode where the Rack Smart Brick Brain can actually play a string of shows while it is doing a countdown delay. If both flags are set (and the delay is longer than zero length), then show 255 (FFh) will be started immediately at the end of the show. At the end of the countdown, the show in the 'next show' will be played.

Any show between 240 and 255 (0F0h and 0FFh) can be played during the background shows. If any request comes in for another show, shows between 240 and 255 (0F0h and 0FFh) won't be forced as a return show if the requested show ends with a 'whatever is next' 00.

"h" Start String:

This command is used to select which string will be sent at the start of a show. Although these strings are generally used when you are running a LaserDisk show, you can send them at the start of any type of show if you so desire. They can also be used with serially controlled devices other than LaserDisk players. If an entry of 0 is entered for the start string, no string will be sent at the start of this show. Valid numbers for accessing the strings are from one through nine, A through F. See the section on string setups for additional details on strings and their habits.

"i" Multi-Disk String:

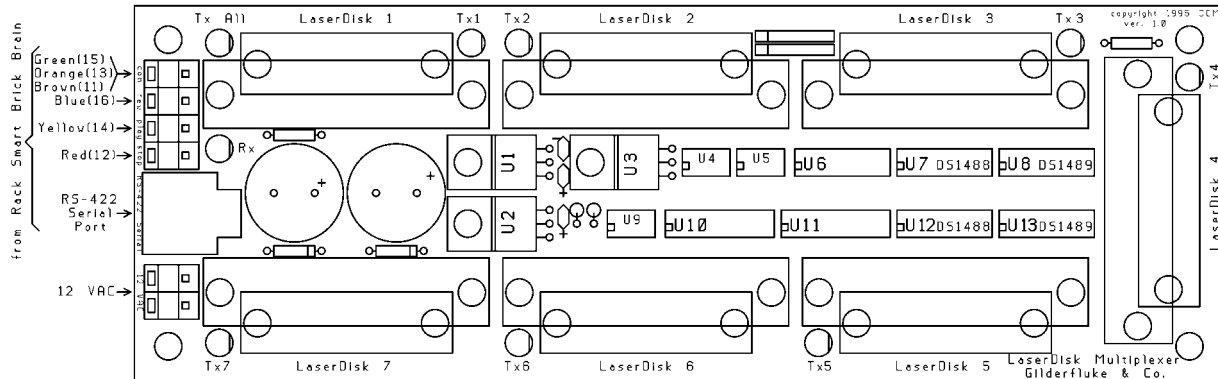
If not using the LaserDisk Multiplexer, this value should be left blank.

The Rack Smart Brick Brain can sequentially control up to seven LaserDisk Players using the LaserDisk multiplexer (BS-LDMUX15 for Pioneer/Panasonic players or BS-LDMUX25 for Sony). This attaches to the Rack Smart Brick Brain through its relay outputs and RS-422 serial port as shown in the following drawing. Indicator LEDs show serial data being sent to and received from the different LaserDisks. The serial ports on the LaserDisk Multiplexer are at RS-232 levels. Standard 15 (Pioneer or Panasonic) or 25 pin (Sony) cables can be used to attach the LaserDisks to it. A small 12 VAC power supply runs the LaserDisk Multiplexer. The Rack Smart Brick Brain's relay outputs can not be used for any other purpose when running multiple LaserDisk players.

The MultiDisk string will be sent to each of the LaserDisk players in turn. Typically the MultiDisk string is just a LaserStart special string character (01). This will position all of the LaserDisks to the selected frame and pause them. Players which can't search and then pause can not be used in MultiDisk applications. After the final player has been positioned, the Start String is sent to all of the players simultaneously. This

start string is just like the Start String you would use in any single LaserDisk application, except the LaserStart special string character (01) has been omitted. The LaserStart special string character (01) in a Start String would make all of the players try to find the frame number being used by the first LaserDisk player.

During the Start String, while running the show and again during the End String, the Rack Smart Brick Brain will be talking to all of the LaserDisks in parallel while only listening to the first one. All the players are started simultaneously and will continue to play in sync (especially if they are linked together using their 'genlock' inputs and outputs). Once started, any problem with players two through seven will be ignored.



This command is used to select which string will be sent to spin up multiple LaserDisks. If anything other than zero is entered, the selected string will be sent to each of the LaserDisk players in turn, starting with number seven and working down to number one. The Rack Smart Brick Brain will then send the Start String. Although multi-disk strings are generally used when you are running a LaserDisk show, you can send them at the start of any type of show if you so desire. They can also be used with serially controlled devices other than LaserDisk players. Valid numbers for accessing the strings are from one through nine, A through F. If not using the LaserDisk Multiplexer, this value should be left blank. See the section on string setups for additional details on strings and their habits.

.....

“j” End String:

This command is used to select which string will be sent at the end of a show. Although these strings are generally used when you are running a LaserDisk show, you can send them at the end of any type of show if you so desire. They can also be used with serially controlled devices other than LaserDisk players. If an entry of 0 is entered for the end string, no string will be sent at the end of this show. Valid numbers for accessing the strings are from one through nine, A through F. See the section on string setups for additional details on strings and their habits.

-
- | | |
|------------|---------------------|
| “p” | LaserDisk 1: |
| “q” | LaserDisk 2: |
| “r” | LaserDisk 3: |
| “s” | LaserDisk 4: |
| “t” | LaserDisk 5: |
| “u” | LaserDisk 6: |
| “v” | LaserDisk 7: |

This command is used to select where on the LaserDisk the show is actually found. Valid entries are made in 7 decimal numbers, ranging from 0 to 1,048,575. Constant Angular Velocity (CAV) LaserDisks support a maximum 54,000 frames per side. CLV LaserDisks support a maximum of 107,999 frames per side. At the start of a show, the special 'LaserSearch string character '01' will tell the Brick Brain to start the LaserDisk player (if needed) and search it for this frame number.

If a single LaserDisk is being used, its frame number must be entered in the LaserDisk first slot. LaserSearch commands which are located in the MultiDisk Strings will be searched starting with LaserDisk number seven. Any LaserDisk that has a zero entered will be skipped during MultiDisk searches.

.....

“n” Next Entry:

This command is used to switch to the next show's setup screen.

.....

“l” Last Entry:

This command is used to switch to the last show's setup screen.

.....

“k” Kopy Another Show:

This command allows you to copy the data found in any other show, and put that data into the show you are now displaying. As shows are often just about identical except for their start and end frames, this can save a great deal of time when setting up shows.

.....

“m” More.....:

This command allows you to select from the other menus:

- 1) Main Menu. This brings you back to this menu.
 - 2) Show Setup. This will ask you which of the 255 possible shows you want to modify.
 - 3) String Setup. This allows you to modify the strings used to control LaserDisks.
 - 4) Delay. This allows you to set how long each of the sixteen possible countdown delays are.
 - 5) Schedules. This is where you modify the ninety different possible schedules.
 - 6) Calendar. This is where you select which schedule will be used on any day.
-

“o” Load Defaults:

This command allows you to reload a single show, or all of the shows, with the default configuration settings shown in the menu above.

.....

“x” eXit Setup Mode:

This command is used to exit the setup mode. If you hit this command in error, hitting an <ESC>ape key will get you back to the setup mode. All of the setup commands which don't take effect immediately, take effect when the eXit command is entered. This includes things like the BAUD RATE, so you will have to change the baud rate of the terminal you are using at this time.

For compatibility with other products which might be on the same RS-422 serial network, this command asks you to enter a 'Y' or 'N'. This lets them know that the setup mode has been exited on this card. If you hit this command by mistake, then you can hit the <ESC>ape key to get back to where you were before.

All other Audio Repeater cards and Brick Brains in the same serial network have their serial ports disabled while any card in the system is in setup mode. This is the only command to which they will respond. After the initial 'X', all of the other cards wait for a 'Y' or 'N' before they will start accepting other serial commands again. If you find that you are having trouble communicating with any of the cards in

the system, try entering an 'XN' to trick it into thinking you have exited the configuration mode.

- Rack Smart Brick Brain String Setup Menu -

Strings are the ASCII characters that are send out from, or received by a Smart Brick Brain at the beginning or end of a show. Requesting the String Setup Menu brings up the following menu.

Each string can be up to ten characters long. If a longer string of characters is needed, it can be continued on the next line. A space with a zero in it tells the Smart Brick Brain that the end of a string has been found.

The menu as shown is the default for the Rack Smart Brick Brain. The first string is the start string which is typically used to start a Pioneer LaserDisk player. The second string is that which is used to stop a Pioneer LaserDisk player. The third string is used to start a Sony LaserDisk player, and the fourth is to stop one.

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String Setup

1) string 1		_1		_80		_76		_13		(.82)		(.13)		_		_		_		_
2) string 2		_83		_84		_13		(.82)		(.13)		_		_		_		_		_
3) string 3		_1		_58		(.10)		_		_		_		_		_		_		_
4) string 4	|	_79	|	(.10)	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_
5) string 5	|	_1	|	_2	|	_79	|	_80	|	_76	|	_3	|	(.6)	|	(.2)	|	(.79)	|	(.80)
6) string 6	|	(.76)	|	(.3)	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_
7) string 7	|	_2	|	_79	|	_80	|	_65	|	_3	|	(.6)	|	(.2)	|	(.79)	|	(.80)	|	(.65)
8) string 8	|	(.3)	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_
9) string 9	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_
A) string A	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_
B) string B	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_
C) string C	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_
D) string D	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_
E) string E	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_
F) string F	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_	|	_

m) more... o) load defaults x) eXit

enter command-

1-9, A-F Alter Strings:

The commands one through nine, a through F are used to alter the various strings. For details on these, refer to the String section of this manual.

“m” More.....:

This command allows you to select from the other menus:

- 1) Main Menu. This brings you back to this menu.
- 2) Show Setup. This will ask you which of the 255 possible shows you want to modify.
- 3) String Setup. This allows you to modify the strings used to control LaserDisks.
- 4) Delay. This allows you to set how long each of the sixteen possible countdown delays are.
- 5) Schedules. This is where you modify the ninety different possible schedules.
- 6) Calendar. This is where you select which schedule will be used on any day.

.....

“o” Load Defaults:

This command allows you to reload the default configuration settings shown in the menu above.

.....

“x” eXit Setup Mode:

This command is used to exit the setup mode. If you hit this command in error, hitting an <ESC>ape key will get you back to the setup mode. All of the setup commands which don't take effect immediately, take effect when the eXit command is entered. This includes things like the BAUD RATE, so you will have to change the baud rate of the terminal you are using at this time.

For compatibility with other products which might be on the same RS-422 serial network, this command asks you to enter a 'Y' or 'N'. This lets them know that the setup mode has been exited on this card. If you hit this command by mistake, then you can hit the <ESC>ape key to get back to where you were before.

All other Audio Repeater cards and Brick Brains in the same serial network have their serial ports disabled while any card in the system is in setup mode. This is the only command to which they will respond. After the initial 'X', all of the other cards wait for a 'Y' or 'N' before they will start accepting other serial commands again. If you find that you are having trouble communicating with any of the cards in the system, try entering an 'XN' to trick it into thinking you have exited the configuration mode.

- Rack Smart Brick Brain Delay Setup Menu -

This menu is used to set the sixteen possible different delays that can be accessed from the front panel rotary switch. Any of these delays can be set anywhere between 00:00:00 and 99:59:59. If at the start or end of a delay a length of zero is found, the delay will be stopped. If you want to disable all the displays, you can simply enter zero lengths for all sixteen possible entries.

```
- Gilderfluke & Co. Rack Smart Brick Brain - rev. 1.13 copyright 1991-1998 DCM -  
  
          Delay Setup  
  
          0) delay 0- 00:00:00  
          1) delay 1- 00:00:15  
          2) delay 2- 00:00:30  
          3) delay 3- 00:01:00  
          4) delay 4- 00:02:00  
          5) delay 5- 00:03:00  
          6) delay 6- 00:05:00  
          7) delay 7- 00:07:30  
          8) delay 8- 00:10:00  
          9) delay 9- 00:15:00  
          A) delay A- 00:20:00  
          B) delay B- 00:25:00  
          C) delay C- 00:30:00  
          D) delay D- 00:40:00  
          E) delay E- 00:45:00  
          F) delay F- 01:00:00  
  
          m) more...   o) load defaults   x) eXit  
  
          enter command-
```

0-9, A-F **Set Delays:**

These commands are used to set the length of each of the sixteen possible delays.

"m" **More.....:**

This command allows you to select from the other menus:

- 1) Main Menu. This brings you back to this menu.
 - 2) Show Setup. This will ask you which of the 255 possible shows you want to modify.
 - 3) String Setup. This allows you to modify the strings used to control LaserDisks.
 - 4) Delay. This allows you to set how long each of the sixteen possible countdown delays are.
 - 5) Schedules. This is where you modify the ninety different possible schedules.
 - 6) Calendar. This is where you select which schedule will be used on any day.
-

"o" **Load Defaults:**

This command allows you to reload the default configuration settings shown in the menu above.

"x" **eXit Setup Mode:**

This command is used to exit the setup mode. If you hit this command in error, hitting an <ESC>ape key will get you back to the setup mode. All of the setup commands which don't take effect immediately, take effect when the eXit command is entered. This includes things like the BAUD RATE, so you will

have to change the baud rate of the terminal you are using at this time.

For compatibility with other products which might be on the same RS-422 serial network, this command asks you to enter a 'Y' or 'N'. This lets them know that the setup mode has been exited on this card. If you hit this command by mistake, then you can hit the <ESC>ape key to get back to where you were before.

All other Audio Repeater cards and Brick Brains in the same serial network have their serial ports disabled while any card in the system is in setup mode. This is the only command to which they will respond. After the initial 'X', all of the other cards wait for a 'Y' or 'N' before they will start accepting other serial commands again. If you find that you are having trouble communicating with any of the cards in the system, try entering an 'XN' to trick it into thinking you have exited the configuration mode.

- Rack Smart Brick Brain 1/4 J6 Setup Menu -

This menu is used to configure the individual optically isolated inputs on the 1/4 J6 cable. The last two settings on the menu can also be set on the main menu. Because this menu shows a snapshot of the state of the 1/4 J6 input each time it redraws, it is also a useful tool for diagnosing wiring problems with this port.

```

- Gilderfluke & Co. Rack Smart Brick Brain - rev. 1.13 copyright 1991-1998 DCM -

                                1/4-J6 Input Setup

                                pause cont.                STOP
                                [rtz] [inc] START LOOP STOP at END TAPE DECK
INPUT and EDGE
a) J6 input Closing:  |_____|_____|_____|_on_|_____|_____|_____|
b) J6 input Opening: |_____|_____|_____|_____|_____|_____|_____|

0) bit 0 (now= open): Binary show select bit 0
1) bit 1 (now= open): Binary show select bit 1
2) bit 2 (now= open): Binary show select bit 2
3) bit 3 (now= open): Binary show select bit 3
4) bit 4 (now= open): Binary show select bit 4
5) bit 5 (now= open): Binary show select bit 5
6) bit 6 (now= open): Binary show select bit 6
7) bit 7 (now= open): Binary show select bit 7

                                c) select from J6- yes
                                d) direct select- no

                                m) more...    o) load defaults    x) eXit

                                enter command-
```

Input Triggering Commands:

“a”
“b”

'1/4 J6 Port' Input Closing Edge:
'1/4 J6 Port' Input Opening Edge:

Each Rack Smart Brick Brain has two opto-isolated external inputs, one push button input on the front, and one 1/4 J6 Port input. Additionally, the Brick Brain treats the end of a countdown just like it would treat any of the other inputs. These commands are used to select what actions will take place on each edge of each of these inputs. Note that both rising and falling edge actions are available to you. This allows you to do things like start a show on a closing edge and then stop it on the opening edge of the same input. This would make it a 'run while' input.

The closing edge on the 'GREEN', 'BLUE', and 'PB' inputs are considered to be when a normally open push button or switch is closed. The opening edge is when that same switch or push button is opened. A closing edge on the 1/4 J6 Port is considered to be any of the eight inputs closing if the **DIRECT SELECT** option is 'on', or any change in the input (except going to all inputs open) if the **DIRECT SELECT** option is off. A opening edge on the 1/4 J6 Port is when all eight of the inputs go to an open condition.

The hardware for the 'GREEN', and 'BLUE', inputs need an external power source for the opto isolators to run. The 1/4 J-6 input can be jumpered on the Rack Smart Brick Card to use an external power supply or the internal power supply. Connections for these are shown in the first section of this manual.

If you want the Smart Brick System to start playing shows as soon as it is powered up, you can set a **'START'** or **'START LOOPING'** command on the opening edge of any of the inputs. On power-up, the Brick Brain will check all of the inputs and find that the one you are using has just opened. It will then act upon any commands you have set for this edge. This would normally be a **'START'** command if you only want the Smart Brick System to play a single show, or a **'START LOOPING'** command if you want it to continue playing shows until it is told to stop. We normally use the 'PB opening' edge to start shows on power-up (you can use any of the 'opening' edges) and then put in a **'STOP'** or **'STOP AT END'** command on the 'PB closing' command so that we can stop the shows once they have started.

If multiple inputs to the system arrive simultaneously, they have the following priorities:

- 1) '1/4 J6 Port" INPUTS
- 2) 'GREEN' input
- 3) 'BLUE' INPUT
- 4) 'PB' INPUT

This will probably happen only on power-up.

The commands have the following effects:

Pause/Return to Zero (RTZ):

- a) **If running an Internally, Smpte or LaserDisk clocked show:** This command causes the currently running show to be paused at the current frame. If the show is LaserDisk clocked, the string 'E' will be sent when the show is paused. This string is typically configured to pause the LaserDisk. A pause will be cleared if a new show is started, or the Continue command is used.
- b) **If running an Externally clocked show:** When running an internally clocked show, this command causes the frame counters to be reset back to the start of the show. During countdowns, this command causes a new countdown delay to be started based on the current thumbwheel switch settings.

Continue/Increment:

- a) **If running an Internally, Smpte or LaserDisk clocked show:** This command clears a pause in the currently running show which was set by the Pause command. If a show has been paused, then the show will continue from the current frame. If the show is LaserDisk clocked, then string 'F' will be sent when the show is continued. This string is typically configured to cause the LaserDisk to start playing from the current frame. If this command is issued and the show has not been paused, it will have no effect.
- b) **If running an externally clocked show:** This command enables an input to advance frames on either the rising or falling (or both) edges of an input when running an externally clocked show.

Start:

This command causes the Brick Brain to start playing the next show in line. At the end of the show, the Brick Brain will stop unless the show which is played has the **IMMEDIATE CHAIN FLAG** set AND the **ALLOW CHAINS** flag is also on. Under those circumstances, it will continue to play shows until those conditions are not met.

If the **'LOOPING SHOWS'** flag is set, sending any type of **'START'** command to the Brick Brain will reset this flag.

Loop:

This command acts much like a **START** command, except that it also sets the **'LOOPING SHOWS'** flag. With this flag set, it is possible to set a sequence of shows playing in any order. The shows can be played with no delay or with a preset delay between each. Since the 'next' show can be any show you ask for, one show can be played over and over again, or you can set up a sequence of shows which will be repeated until the Brick Brain is told to stop.

When the **'LOOPING SHOWS'** flag is set, the Brick Brain will check to see if the **'IMMEDIATE CHAIN'** or **'DELAY'** flags are set when it has finished playing a show. If the show has the **'IMMEDIATE CHAIN'** flag set, then it will immediately start playing the 'next' show, which you can set to be any show in the system. If the **'DELAY'** flag is set, then the Brick Brain will check to see if the thumbwheel switch on its front is set to anything other than 0. If it is, then it will then start this new delay countdown. At the end of the countdown, whatever 'Countdown end' actions are set will take place just as though a switch closure input had just happened. In most cases this will be another **LOOP** command, which will then start the next show. At the end of that show, the whole process will then start over.

Stop:

This command will stop any show which is playing immediately and unconditionally.

Stop at End:

This command resets the **'LOOPING SHOWS'** flag. This means that the shows will stop playing at the normal end of show and won't start a new countdown under any circumstances, and won't chain unless the **ALLOW CHAINS** flag is set and there is a request for an **IMMEDIATE CHAIN** at the end of the current show.

Tape Deck:

These allow you to trigger the START, STOP or REWIND relay outputs from one of the external inputs or end of countdown.

1/4 J6 Input Triggering Commands:

- "0"** **Bit 0 Input Closing Edge:**
- "1"** **Bit 1 Input Closing Edge:**
- "2"** **Bit 2 Input Closing Edge:**
- "3"** **Bit 3 Input Closing Edge:**
- "4"** **Bit 4 Input Closing Edge:**
- "5"** **Bit 5 Input Closing Edge:**
- "6"** **Bit 6 Input Closing Edge:**
- "7"** **Bit 7 Input Closing Edge:**

Additional options can be set individually for the eight inputs on the 1/4 J6 cable. The current status of each of these inputs (either opened or closed) is also displayed. For each input, you can select the edge to trigger shows Sequentially, Randomly or Normally. If you select:

- a) Sequentially: If you select this option, then you are asked for the range of shows that you want to play. Each time this input is triggered, then the next show in this range will be played. As an example of this, if you select a range of shows of ten to twenty: Show ten will be played on the first on the first edge, show eleven on the next, etc.. After show twenty plays, then the next show will be show ten again. Each time this window is displayed, the 'next' show which will be played on each input which has been set for sequential operation will be displayed.
If the range of shows is just one show, then the text displayed will show that only a single show will be requested and played on this input.
- b) Randomly: If you select this option, then you are asked for the range of shows that you want to play on this input. Each time this edge is triggered, one of the shows within this range will be chosen at random and played. As an example of this, if you select a range of shows of ten to twenty: Show ?? will be played on the first on the first edge, show ?? on the next, etc.. The randomizer uses a separate counter for each of these inputs. This counts at ten Hertz from the first show selected through the last and then recycles. When the user selects an input which has been configured with this option, the Smart Brick Brain uses the current value of this counter to select and play a next show. If the randomizer played the same show the last time, it will spin the randomizer another time to try and select another show to play. If after this second spin, the same show comes up, then it will be played.
- c) Normally: The inputs will behave as described as set by the next two options. You can select whether the input will pause, continue, stop, stop at end, start, start looping, or trigger a tape deck output.

"c" **Select from J6:**

If more than one show is stored on a single Smart Brick System, each one can be accessed individually and played back. Up to 255 of these shows can be stored on a single Smart Brick System. These requests can be made through the serial port or through the 1/4 J6 Port.

This toggle enables the 1/4 J6 Port for requesting the shows on this Smart Brick System. There are two methods of selecting shows from this port. Which one is used is selected by the **DIRECT SELECT** com-

mand.

“d” Direct Select:

This command is used to switch the 1/4 J6 Port over to selecting 1 of 8 shows directly, instead of using binary inputs for requesting up to 255 different shows. The **DIRECT SELECT** is useful when you have eight or less shows which need to be called up through the 1/4 J6 Port. The 1/4 J6 Port can be wired directly to up to eight different pushbuttons. When any of these buttons are pressed it will select the appropriate show. The first button pushed will be played at the next **START** or **START LOOPING** command, unless it is overridden by another show request from the serial ports. (The Brain can also be told to start playing the newly requested show immediately if you tell the Brick Brain to **START** or **START LOOPING** on the input to the 1/4 J-6 port.)

If this mode is off, then up to 255 different shows can be selected through the 1/4 J6 Port. The 1/4 J6 Port can be connected directly to the output of a computer or Animation Control System. If you need to connect it to pushbuttons, you will need to use diodes or a keyboard with an encoder (available from Gilderfluke & Company) to encode a binary number to be sent to the 1/4 J6 Port.

As with changes in inputs on the A, B, or PB input, changes on the 1/4 J6 Port can be used to **START**, stop, or whatever a Brick Brain. If the **DIRECT SELECT** option is 'on', then a rising edge is on any new arrival of a new closure, and a falling edge is when all input lines are opened. If the **DIRECT SELECTION** is 'off', then a rising edge is on any change in the 1/4 J6 Port except for when all of the inputs go open, which is considered to be a falling edge.

“m” More.....:

This command allows you to select from the other menus:

- 1) Main Menu. This brings you back to this menu.
- 2) Show Setup. This will ask you which of the 255 possible shows you want to modify.
- 3) String Setup. This allows you to modify the strings used to control LaserDisks.
- 4) Delay. This allows you to set how long each of the sixteen possible countdown delays are.
- 5) Schedules. This is where you modify the ninety different possible schedules.
- 6) Calendar. This is where you select which schedule will be used on any day.

“o” Load Defaults:

This command allows you to reload the default configuration settings shown in the menu above. You can reload just the current schedule, or all of ninety of them.

“x” eXit Setup Mode:

This command is used to exit the setup mode. If you hit this command in error, hitting an <ESC>ape key will get you back to the setup mode. All of the setup commands which don't take effect immediately, take effect when the eXit command is entered. This includes things like the BAUD RATE, so you will have to change the baud rate of the terminal you are using at this time.

For compatibility with other products which might be on the same RS-422 serial network, this command asks you to enter a 'Y' or 'N'. This lets them know that the setup mode has been exited on this card. If you hit this command by mistake, then you can hit the <ESC>ape key to get back to where you were before.

All other Audio Repeater cards and Brick Brains in the same serial network have their serial ports disabled while any card in the system is in setup mode. This is the only command to which they will re-

spond. After the initial 'X', all of the other cards wait for a 'Y' or 'N' before they will start accepting other serial commands again. If you find that you are having trouble communicating with any of the cards in the system, try entering an 'XN' to trick it into thinking you have exited the configuration mode.

Is anyone keeping track of these blank pages?

- Rack Smart Brick Brain Schedule Setup Menu -

This menu is used to configure any of the ninety different schedules. Using the Calendar Setup Menu, any one of the ninety schedules can be selected to set the times that shows will run on any given day of the year. You can set which schedule will be used on what days up to one year in advance.

```

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                                Schedule __1 Setup
1)  none | 2)  none | 3)  none | 4)  none | 5)  none
6)  none | 7)  none | 8)  none | 9)  none | 10) none
11) none | 12) none | 13) none | 14) none | 15) none
16) none | 17) none | 18) none | 19) none | 20) none
21) none | 22) none | 23) none | 24) none | 25) none
26) none | 27) none | 28) none | 29) none | 30) none
31) none | 32) none | 33) none | 34) none | 35) none
36) none | 37) none | 38) none | 39) none | 40) none
41) none | 42) none | 43) none | 44) none | 45) none
46) none | 47) none | 48) none | 49) none | 50) none
51) none | 52) none | 53) none | 54) none | 55) none
56) none | 57) none | 58) none | 59) none | 60) none
61) none | 62) none | 63) none | 64) none | 65) none
66) none | 67) none | 68) none | 69) none | 70) none
71) none | 72) none | 73) none | 74) none | 75) none
76) none | 77) none | 78) none | 79) none | 80) none
81) none | 82) none | 83) none | 84) none | 85) none
86) none | 87) none | 88) none | 89) none | 90) none
a) alter entry  n) next  l) last  k) kopy  m) more...  o) load defaults  x) exit

                                enter command-
```

.....

“a” Alter Entry:

This command is used to set up the ninety individual entries in each of the ninety different schedules. This command will ask you for the show number you want to play, and the hours/minutes you want to play it at.

.....

“n” Next Entry:

This command is used to switch to the next schedule’s screen.

.....

“l” Last Entry::

This command is used to switch to the last schedule’s screen.

.....

“k” Kopy Entry:

This command is used to copy an entire different schedule and put it into the one you are working on. This is used when you have many schedules that are nearly identical.

.....

“m” More.....:

This command allows you to select from the other menus:

- 1) Main Menu. This brings you back to this menu.
- 2) Show Setup. This will ask you which of the 255 possible shows you want to modify.
- 3) String Setup. This allows you to modify the strings used to control LaserDisks.
- 4) Delay. This allows you to set how long each of the sixteen possible countdown delays are.
- 5) Schedules. This is where you modify the ninety different possible schedules.
- 6) Calendar. This is where you select which schedule will be used on any day.

“o”

Load Defaults:

This command allows you to reload the default configuration settings shown in the menu above. You can reload just the current schedule, or all of ninety of them.

“x”

eXit Setup Mode:

This command is used to exit the setup mode. If you hit this command in error, hitting an <ESC>ape key will get you back to the setup mode. All of the setup commands which don't take effect immediately, take effect when the eXit command is entered. This includes things like the BAUD RATE, so you will have to change the baud rate of the terminal you are using at this time.

For compatibility with other products which might be on the same RS-422 serial network, this command asks you to enter a 'Y' or 'N'. This lets them know that the setup mode has been exited on this card. If you hit this command by mistake, then you can hit the <ESC>ape key to get back to where you were before.

All other Audio Repeater cards and Brick Brains in the same serial network have their serial ports disabled while any card in the system is in setup mode. This is the only command to which they will respond. After the initial 'X', all of the other cards wait for a 'Y' or 'N' before they will start accepting other serial commands again. If you find that you are having trouble communicating with any of the cards in the system, try entering an 'XN' to trick it into thinking you have exited the configuration mode.

- Rack Smart Brick Brain Calendar Setup Menu -

This menu is used to set any of the twelve different possible calendars. These are used in combination with the schedule menu to schedule shows up to one year in advance.

```

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          January Calendar

1) none | 2) none | 3) none | 4) none | 5) none | 6) none | 7) none
8) none | 9) none | 10) none | 11) none | 12) none | 13) none | 14) none
15) none | 16) none | 17) none | 18) none | 19) none | 20) none | 21) none
22) none | 23) none | 24) none | 25) none | 26) none | 27) none | 28) none
29) none | 30) none | 31) none

                                32) Sunday   : none
                                33) Monday    : none
                                34) Tuesday   : none
                                35) Wednesday : none
                                36) Thursday  : none
                                37) Friday    : none
                                38) Saturday  : none

a) alter entry  n) next  l) last  k) kopy  m) more...  o) load defaults  x) eXit

                                enter command-
```

For each of the twelve months, you have thirty-one days per month, as well as the seven days of the week. The Rack Smart Brick Brain will first check today's month and day of month. If a schedule is found there, it will be used. If none is found, then the Rack Smart Brick Brain will check for today's day of the week. If it finds a schedule there, it will be used. If not, then there are no preprogrammed shows scheduled for today.

.....

“a” Alter Entry:

This command is used to set up the thirty one individual day and the seven day of the week entries in each of the twelve different months. This command will ask you for the schedule number you want to use.

.....

“n” Next Entry:

This command is used to switch to the next month's screen.

.....

“l” Last Entry:

This command is used to switch to the last month's screen.

.....

“k” Kopy Entry:

This command is used to copy an entire different calendar and put it into the one you are working on. This is used when you have many calendars that are nearly identical.

.....

“m” More.....:

This command allows you to select from the other menus:

- 1) Main Menu. This brings you back to this menu.
- 2) Show Setup. This will ask you which of the 255 possible shows you want to modify.
- 3) String Setup. This allows you to modify the strings used to control LaserDisks.
- 4) Delay. This allows you to set how long each of the sixteen possible countdown delays are.
- 5) Schedules. This is where you modify the ninety different possible schedules.
- 6) Calendar. This is where you select which schedule will be used on any day.

.....

“o” Load Defaults:

This command allows you to reload the default configuration settings shown in the menu above. You can reload just the current calendar, or all of twelve of them.

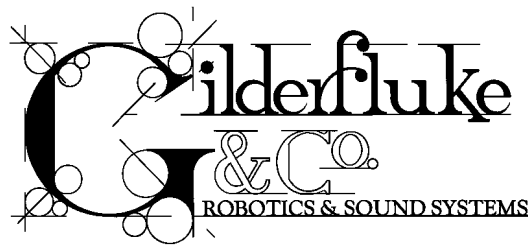
.....

“x” eXit Setup Mode:

This command is used to exit the setup mode. If you hit this command in error, hitting an <ESC>ape key will get you back to the setup mode. All of the setup commands which don't take effect immediately, take effect when the eXit command is entered. This includes things like the BAUD RATE, so you will have to change the baud rate of the terminal you are using at this time.

For compatibility with other products which might be on the same RS-422 serial network, this command asks you to enter a 'Y' or 'N'. This lets them know that the setup mode has been exited on this card. If you hit this command by mistake, then you can hit the <ESC>ape key to get back to where you were before.

All other Audio Repeater cards and Brick Brains in the same serial network have their serial ports disabled while any card in the system is in setup mode. This is the only command to which they will respond. After the initial 'X', all of the other cards wait for a 'Y' or 'N' before they will start accepting other serial commands again. If you find that you are having trouble communicating with any of the cards in the system, try entering an 'XN' to trick it into thinking you have exited the configuration mode.

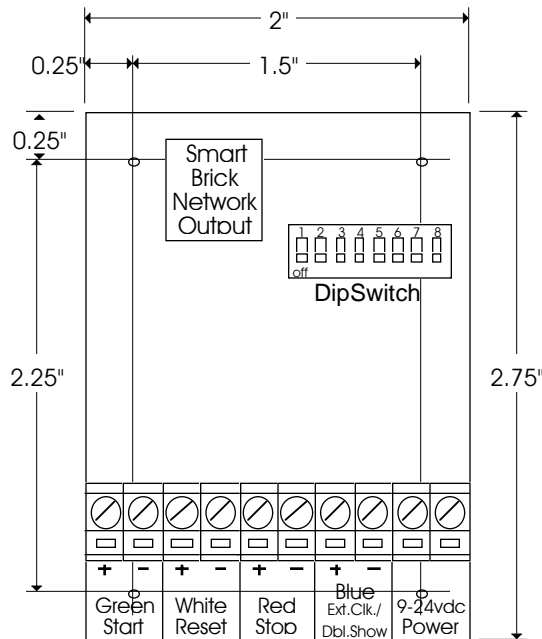


- Smart Brick MiniBrain -

The Smart Brick MiniBrain is a smaller version of our other Smart Brick Brains. As with all Smart Brick Brains, it can be used to control any number of Smart Bricks via a Smart Brick Network. It can be used when you need to run Smart Bricks, Analog Smart Bricks, or Electronic FeedBack (EFB) Smart Bricks in an installation which doesn't need to be synchronized to an external time code and/or doesn't need direct random access to multiple shows.

The Smart Brick MiniBrain can be used to control shows of up to 1 MByte in length. This translates into a show capacity of almost ten hours at 30 frames (updates) per second. The MiniBrain can divide the memory equally into two separate shows. These can be selected by an external input.

The MiniBrain is a small (2" x 2-3/4") circuit board. Holes (.156" dia.) at each corner allow it to be mounted on screw standoffs or it can be snapped into Augat 2-3/4" Snap Track:



The only indicator on the MiniBrain is the Heartbeat LED that shows that it is alive. It flashes at twice the normal rate when running a show. A Heads Up Display can be used if you need to see to see the location in the show. This will display the current time into the show.

There are four opto-isolated inputs on each MiniBrain. Any input can be triggered by applying a DC voltage between 12 and 24 volts to these screw terminals. The first three of these inputs are dedicated for starting, stopping, and resetting the MiniBrain. The fourth input can be used for either clocking the MiniBrain externally or selecting between two shows. The dipswitches determine the function of this input. The inputs can be used in various combinations. If you want to always start the show from the beginning, you can wire the Start and Reset inputs in parallel. In this way the MiniBrain will always start at the beginning. If you want the MiniBrain to reset when a show is stopped, then you wire the Stop and Reset inputs together.

If you need to stop or reset a show at a time before the end of the memory is reached, then you can program one or more digital bits on a Smart Brick and feed these output(s) into the appropriate MiniBrain input(s). In this way you can divide the memory into as many small 'sub-shows' as you wish, or

you can set a loop point at any point in the memory. If dividing the memory into multiple shows, the shows are accessed sequentially. When one show plays it ends at the start of the memory used by the next show. The MiniBrain then sits and waits for the next Start input before playing the next show. Note that the Smart Brick used to feed bits into the MiniBrain must not be configured to disable its outputs when stopped. The bit which stopped and/or reset the MiniBrain will go active again as soon as the next show is started and immediately re-stop/reset the MiniBrain.

If the inputs are to be enabled or disabled at different times during a show, a momentary button can be wired in series with a digital output from a Smart Brick and then into the inputs of the MiniBrain. This allows you to do things like disable starts/stops/resets while a show is playing by just not programming that bit during the show.

The power applied to the MiniBrain can be any voltage between 9 and 24 VDC. The MiniBrain is polarity protected, so you connect either supply lead to either screw terminal.

All configuration for the MiniBrain is done on an eight position dipswitch. These are used as follows:

SWITCH #1: BRICK MEMORY SIZE:

SWITCH #2: BRICK MEMORY SIZE:

SWITCH #3: BRICK MEMORY SIZE:

These three switches determine the size of the memory that the MiniBrain thinks the Smart Bricks have installed. The MiniBrain will always reset to the first frame each time the end of memory is reached. Unless the 'Run Continuous' switch is ON, the MiniBrain will also stop running when the end of memory is reached. If you don't need to use all of the memory installed on the Smart Bricks you can lie about the size of the memory installed. Setting these switches to a lower value will have NO adverse effect on the Smart Bricks. The size of the memory and the length of the shows at the supported frame rates are as follows. All times are rounded to the nearest whole second:

Switch #1	Switch #2	Switch #3	Memory Size	@15FPS	@16FPS	@30FPS	@32FPS
OFF	OFF	OFF	8192	9:06	8:32	4:33	4:16
ON	OFF	OFF	16,384	18:12	17:04	9:06	8:32
OFF	ON	OFF	32,768	36:24	34:08	18:12	17:04
ON	ON	OFF	65,536	1:12:49	1:08:16	36:24	34:08
OFF	OFF	ON	131,072	2:25:38	2:16:32	1:12:49	1:08:16
ON	OFF	ON	262,144	4:51:16	4:33:04	2:25:38	2:16:32
OFF	ON	ON	524,288	9:42:32	9:06:08	4:51:16	4:33:04
ON	ON	ON	1,048,576	19:25:05	18:12:16	9:42:32	9:06:08

SWITCH #4: DOUBLE SHOW:

When this switch is turned on, the MiniBrain will divide the installed memory on the Smart Bricks into two separate 'shows'. Which show is being played is selected using the 'Blue' input. When this input is active, the second bank is selected. When this option is selected, you can not also clock the MiniBrain externally. Both these functions use the Blue input. The capacities of each show will be as follows when switch #4 is ON:

Switch #1	Switch #2	Switch #3	Each Show	@15FPS	@16FPS	@30FPS	@32FPS
OFF	OFF	OFF	4096	4:33	4:16	2:16	2:08
ON	OFF	OFF	8192	9:06	8:32	4:33	4:16
OFF	ON	OFF	16,384	18:12	17:04	9:06	8:32
ON	ON	OFF	32,768	36:24	34:08	18:12	17:04
OFF	OFF	ON	65,536	1:12:49	1:08:16	36:24	34:08
ON	OFF	ON	131,072	2:25:38	2:16:32	1:12:49	1:08:16
OFF	ON	ON	262,144	4:51:16	4:33:04	2:25:38	2:16:32
ON	ON	ON	524,288	9:42:32	9:06:08	4:51:16	4:33:04

SWITCH #5: FRAME RATE:

SWITCH #6: FRAME RATE:

These two switches are used to select the frame rate being used by the MiniBrain. They are used as follows:

Switch #4	Switch #5	Switch #6	Frame rate
OFF or ON	OFF	OFF	15 FPS
OFF or ON	ON	OFF	16 FPS
OFF or ON	OFF	ON	30 FPS
OFF	ON	ON	External Clock through Blue Input
ON	ON	ON	32 FPS

The 32 FPS frame rate is unavailable unless the card is using the Blue input for selecting a second show. When external clock is selected, the frames displayed on a heads up display will carry into the seconds every thirty frames, no matter what rate the frames are actually arriving at the MiniBrain.

SWITCH #7: STOP ON GREEN OPENING:

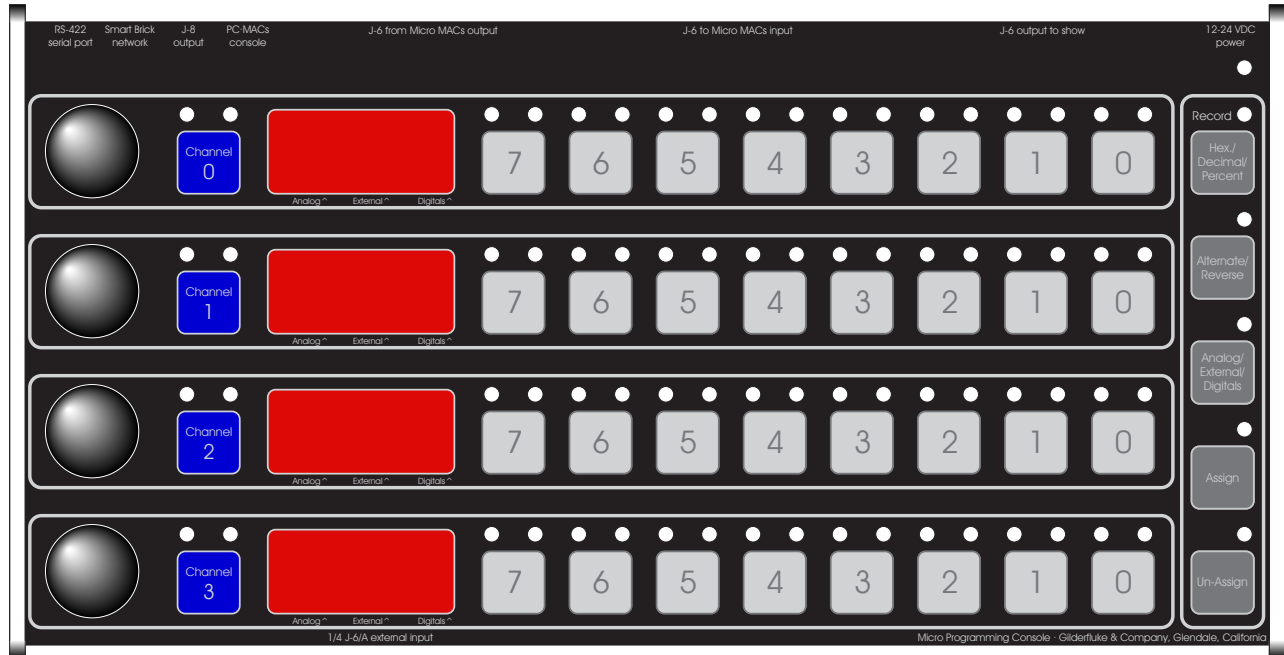
When this switch is turned on, the MiniBrain will stop when the Green input is opened. This switch is used when you would like the show to run AS LONG as the Green input is closed. The MiniBrain will start playing when the Green input is activated, and stop when the Green input is deactivated.

SWITCH #8: RUN CONTINUOUS

This switch works in parallel with the Green input. When it is ON, the MiniBrain will start playing. At the end of a show, the MiniBrain will reset back to the first frame and continue playing from the beginning of the show. This switch can be used to start a show playing, or if it is left ON the MiniBrain will start playing as soon as power is applied and will loop at the end of the show. Note that when this switch is left ON, the Green input is disabled.

Think of all the trees that have given their lives for blank pages

- Micro Console -

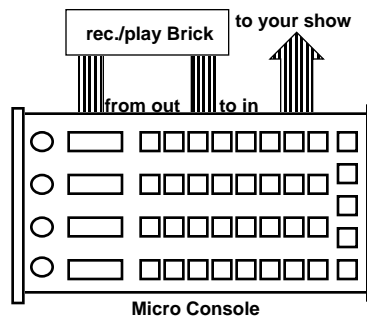


The Micro Console works with both PC-MACs and record/playback Brick Animation Control Systems. Up to four eight bit channels can be programmed at one time with the Micro Console. Each channel can be set to be used for eight digital inputs, the front panel eight bit resolution analog pots, or the external 0-10 VDC eight bit resolution analog inputs. A LED display shows the assignments and data on each channel.

The thirty-two digital inputs are arranged as four eight bit channels. You can assign any one bit of any channel, or all eight bits. The green LEDs above each digital button light to show which are active for programming. Any digital functions that aren't assigned will simply be played back even while you are recording a show.

The four eight bit analog input can come from the pots on the front of the console or the external 0-10 VDC inputs. The external analog inputs are protected from slightly higher voltages than 10 volts, but this can cause instability on the other analog inputs. See the section of this manual that covers the Analog Output Card for details on the pinouts for the 1/4 J6/A Analog Input Port.

When the Micro Console is used with a record/playback Micro MACs System two forty conductor ribbon cables need to be run between the Micro Console and the Brick to be programmed. The forty conductor cable that normally runs to the show from the Brick is then plugged into the Micro Console. The Micro Console will draw all the power it needs from the brick.



If you are backing up or testing a record/playback Smart Brick you will need to plug a six conductor RJ-11 modular telephone cable between the 'Smart Brick Network' output of the Micro Console and the Brick. If you are backing up or testing a record/playback Dumb Brick you will need to configure the Brick for external clock on the Blue input and start and reset on the Green input. You will then need to plug a six conductor RJ-11 modular telephone cable between the 'J8 output' output of the Micro Console and the 'J8 input' on the Dumb Brick.

While in 'J6' mode the Micro Console will transmit DMX-512 data through the 'PC·MACs console' connector. All 256 channels of data are transmitted, with the option of a sixteen bit checksum in the 257th and 258th bytes. The pinout for this connection is as follows (facing the end of the RJ-11 cable with the latch upwards):

DMX-512 Out (FM 5 pin XLR)	pin #	COLOR	SIG -
<u>NAL NAME:</u>			
ground	n/c (left)	1)	WHITE: signal
data in	n/c	2)	BLACK: - serial
al data in	n/c	3)	RED: + seri-
data out	2	4)	GREEN: - serial
al data out	3	5)	YELLOW: + seri-
ground	1 (right)	6)	BLUE: signal

When working with a PC·MACs system the Micro Console only needs a six conductor RJ-11 telephone connector and a small 9 to 24 VDC wall wart power supply. The RJ-11 cable needs to be run between the 'PC·MACs console' connector on the Micro Console and the 'Serial Console' connector on the PC·MACs Smpte card. This cable must be 'straight through'. Most commercially available cables have their conductors flipped as they pass through the cable.

As assignments are made on the programming console, PC·MACs will display the names you have given to the movements on the screen of your PC. To save time when starting to work on a new show, you have the option of creating outputs as they are first assigned on the console. Once console assignments have been made, you can save the current console setup, name it, and recall again it at any later time.

Micro Console Configuration:

The basic configuration of the Micro Console is done through its RS-422 Serial port. To do this, you need to connect the system to any computer (Mac or PC), or even a dumb terminal. Once set these adjustments will rarely need to be changed. They are stored permanently in a EEprom so that the console will return to the same settings each time it is turned on. Several commands for backing up and testing record/playback Micro MACs Bricks are also available through the serial port.

To communicate with the Micro Console through the serial port, you can use just about any computer or terminal that has a serial port on it. Some newer computer designs, like the Apple Macintosh, come with serial ports that are directly compatible with the RS-422/RS-485 signal levels the Micro Console wants to see. These signal levels are close enough to be used with the RS-232 signal levels found on most older computers (like all IBM PCs and compatibles). They can be attached with only a simple adapter cable, so long as the wire isn't too long. To gain the full advantage of the RS-422/RS-485 signal levels (multidrop networking, distances of up to a mile) you will need to use a signal level adapter.

If you are using a computer as a terminal you will need to run a modem or terminal emulation program. 'TERMINAL' that comes with Windows will work just fine. Z-Term for Macintoshes is a shareware program available for free or a nominal fee, as is BitCom for DOS. These will send everything you type on the keyboard out the serial port on your computer while printing on the screen anything that comes in from the audio system through the serial port.

A modem program will usually have the advantage over a terminal emulation program in that it will allow you to save data to your computer's disk drives and restore it later. Unless **VT-52 MODE** is turned ON, the Micro Console uses no screen control codes or <ESC>ape sequences, so it should work on any machine with a 80 column by 24 line display. Machines with other display formats will work, but may not look so neat on the screen.

When configuring your modem program, you should set it for 9600 baud, 8 data bits, one stop bit, and no parity. You should set your program not to insert an extra LineFeed (LF) character after each Carriage Return (CR) it receives, or else the menus will print 'double spaced'. If you are going to be uploading and downloading configuration strings to the system, you will also need to tell the modem program to use what is called 'ACK/NAK' or 'Xon/Xoff' handshaking. Otherwise it will over run the Micro Consoles' incoming data buffer.

If you have hooked up the Micro Consoles to your computer and it still doesn't seem to respond to the keyboard, the first thing to check is that you are attached to the right serial port. The easiest way to do this is to disconnect the Micro Console and short between the Tx data out and Rx data in pins on the serial port connector on the back of your computer. On all IBMs and compatibles this means sticking a paper clip or similar 'tool' between pins 2 and 3 on the 'Com.' connector. While still running the modem program, anything you type should appear on the screen while this paper clip is in place, while nothing will appear when you remove it. If your computer passes this test, then you are using the right serial port and the problem is most likely the baud rate setting or in your wiring to the Micro Consoles. If you get characters on the screen even with the paper clip removed from the serial port, it means you probably need to set the 'echo' mode to 'none' or 'full duplex'. Then you should repeat this test.

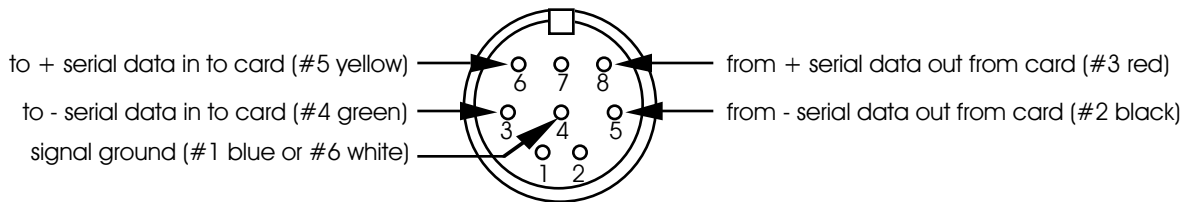
The serial data signals from the Micro Consoles are brought out on the six position RJ-11 (modular telephone style) connector labeled 'RS-422 Serial Port'. Facing the end of the cable with the release latch upwards, its pin out is as follows:

	pin #	COLOR	SIGNAL NAME:
(left)	1	WHITE	signal ground
	2	BLACK	- serial data OUT from Micro Console
	3	RED	+ serial data OUT from Micro Console
	4	GREEN	- serial data IN to Micro Console
(right)	5	YELLOW	+ serial data IN to Micro Console
	6	BLUE	signal ground

PC and Compatible Connection: To cross wire the RS-422/RS-485 signals from the Micro Console to the RS-232 serial port of an IBM compatible, cross connect the signals as follows:

DB-25	DE-9	SIGNAL	SIGNAL FROM/TO AUDIO SYSTEM
2	3	DATA OUT	- serial data IN to Micro Console (GREEN)
3	2	DATA IN	- serial data OUT from Micro Console (BLACK)
7	5	Ground	signal ground (BLUE or WHITE)

Apple Macintosh computers have true RS-422 serial ports built in. To connect to the Micro Console, the pin out is as follows for a Macintosh mini-DIN-8:



The Micro Console expects to see the serial data in the following format:

ONE START BIT
EIGHT DATA BITS
ONE BIT

Unlike most of the products made by Gilderfluke & Company, the Micro Console is NOT designed to operate on a multidrop serial network. For this reason it assumes it is the only device using the serial port. There is no configuration 'command' needed to bring up the menu. Just press the <space bar> or <ESC>ape key. This will bring up the following menu:

```

-Gilderfluke & Company - Micro Console - version 1.00 - copyright 1987-1996 DCM-

a) Micro Console mode- J6
b) numbering system- percentage
c) VT-52 mode- yes
d) DMX checksums- yes
e) assignment range- 0-63
f) dumb bricks- no
g) step forward
h) step backwards
i) go to frame-      .,.,.,.,.0
j) set start frame- .,.,.,.,.0
k) set end frame-   .,.,16,383
l) save Eprom
m) verify Eprom
n) restore Eprom
o) save archive
p) verify archive
q) restore archive
r) clear brick
s) restore default configuration
t) save current configuration
u) test brick

brick frame= .,.,.,.,.0      enter command-
    
```

a) Micro Console mode: This command is used to select which of two modes the Micro Console is operating in. These are 'PC·MACs' or 'J6' mode for working with record/playback Bricks.

If you need to switch between these two modes without using the serial port you can press and hold the 'unassign' button and then the 'assign' button.

You can tell if you are in PC·MACs mode without using the serial port. If it is the display will say 'no con to PC' when not connected to a PC·MACs Smppte card for a few seconds. Many of the following 'brick' commands are disabled when operating in PC·MACs mode.

b) Numbering System: This command is used to select which numbering system will be used by the Micro Console. The numbering system can also be selected using the 'Hex/decimal/percent' button on the front of the Micro Console. The numbering systems are:

HEXadecimal: Values are shown as '00h' to 'FFh'

Decimal: Values are displayed as '0' to '255'

Percent: Values are displayed as '0' to '100'

c) VT-52 mode: When this toggle is enabled, the Micro Console will use special escape sequences to clear the current line (<ESC>ape 'l'), or position the cursor (<ESC>ape 'Y' ROW COLUMN). When disabled, the Micro Console has to redraw the entire screen to change any value, so it can save a good deal of screen redraw time if you have a compatible display. Virtually all terminal programs will support VT-52 terminal emulation.

d) DMX Checksums: When this toggle is enabled, the Micro Console will insert a sixteen bit checksum into the DMX-512 data it transmits when it is operating in J6 mode. This checksum is used by other Gilderfluke & Co. equipment to verify that no errors

were found in the transmitted data before it is used to update their outputs. It should always be used if the Micro Console is being used to control any Gilderfluke & Co. Animation equipment.

- e) Assignment Range:** When assigning channels on the Micro Console you use the analog input knobs on the front of the Micro Console. These are eight bit resolution inputs, which can make them a little hard to select any one channel accurately. This command allows you to 'lower' the resolution of these inputs when making channel assignments. This is done by limiting your selection range. You will need to set this adjustment to a point where you can still access all of the channels you need to assign.
- f) Dumb Bricks:** This toggle is used to tell the Micro Console that it has Dumb Bricks attached to it. When ON, the Micro Console will insert some extra delays when accessing the bricks, and knows that it can't jump immediately to any brick frame as it can when controlling Smart Bricks. This command is unavailable if 'J6 mode' is not selected.
- g) Step Forward:** This command tells any Smart or Dumb Bricks to step forward by one frame. The Bricks must be connected to the Micro Console by the Smart Brick Network (for Smart Bricks) or J8 (for Dumb Bricks) for this command to work. The Dumb Brick must also be configured to accept start and reset on its Green Input and External Clock on the Blue. This command is unavailable if 'J6 mode' is not selected.
- h) Step Backward:** This command tells any Smart Bricks to step backward by one frame. The Smart Bricks must be connected to the Micro Console by the Smart Brick Network for this command to work. This command is unavailable if 'J6 mode' is not selected or the 'Dumb Bricks' toggle is ON.
- i) Go To Frame:** This command tells any Smart or Dumb Bricks to go to the frame selected. Smart Bricks will jump immediately to this frame. Dumb Bricks will need to first reset and then fast forward to the selected frame. The Bricks must be connected to the Micro Console by the Smart Brick Network (for Smart Bricks) or J8 (for Dumb Bricks) for this command to work. The Dumb Brick must also be configured to accept start and reset on its Green Input and External Clock on the Blue. This command is unavailable if 'J6 mode' is not selected.
- j) Set Start Frame:** This command sets the first frame that will be stored, restored, verified or tested when using these commands. This command is unavailable if 'J6 mode' is not selected.
- k) Set End Frame:** This command sets the last frame that will be stored, restored, verified or tested. If you are using a 16K Smart Brick, the last frame is at 16,383 frames. You should use 65,535 as a maximum for 64K Smart Bricks.

Dumb Bricks write data into their memory as they are stepping into a frame. For this reason the only way to write to frame zero of a Dumb Brick is to go to the very last frame in the brick and then step forward just one more frame. You can do this manually, or if you set the End Frame to 16,384 for 16K Dumb Bricks and 65,536 for 64K Dumb Bricks it will happen automatically.

This command is unavailable if 'J6 mode' is not selected.

1) Save Eprom:

This command is used to save the contents of one eight bit channel of the attached Brick to your computer as a text file.

It first asks which of the four possible channels you would like to save, then tells you to prepare your computer to receive a 'text' file. When prompted, the Micro Console will start sending out data starting at the **Start Frame**, and continuing to the **End Frame**.

When the download is complete, you will need to tell your computer to close the file that was being saved, and then hit an <ESC>ape to redraw the screen.

The format of these Eprom files is standard Intel 'HEX'. This can be sent directly to any commercially available Eprom burner. Intel HEX only supports files of up to 65,536 in size. If you are downloading a larger file than this your Eprom burner may have some trouble with it. If this is the case, you can save the Eprom into a number of files of less than 65,536 each.

The Bricks must be connected to the Micro Console by the Smart Brick Network (for Smart Bricks) or J8 (for Dumb Bricks) for this command to work. The Dumb Brick must also be configured to accept start and reset on its Green Input and External Clock on the Blue. This command is unavailable if 'J6 mode' is not selected. Your computer must be configured for 'ACK/NAK' or 'Xon/Xoff' handshaking to use this command.

2) Verify Eprom:

This command is used to compare the contents of one eight bit channel of the attached Brick a file that was previously saved to your computer using the **Save Eprom** command. It first asks which of the four possible channels you would like to verify, then tells you to send a file for comparison. The Micro Console will start comparing the data starting at the **Start Frame**, and continuing to the **End Frame**.

If there is an error the Micro Console will tell you the frame at which it occurred. The Green LEDs will show the data that was expected and the Red LEDs will show you what the Brick had in it. You will need to stop the file download **BEFORE** you hit the <ESC>ape key to clear the Micro Console.

If the comparison is successful you will need to hit an <ESC>ape to redraw the screen.

The Bricks must be connected to the Micro Console by the Smart Brick Network (for Smart Bricks) or J8 (for Dumb Bricks) for this command to work. The Dumb Brick must also be configured to accept start and reset on its Green Input and External Clock on the Blue. This command is unavailable if 'J6 mode' is not selected. Your computer must be configured for 'ACK/NAK' or 'Xon/Xoff' handshaking to use this command.

3) Restore Eprom:

This command is used to receive a file from your computer and store it in one eight bit channel of the attached Brick.

Normally this file was previously saved using the **Save Eprom** command. The Micro Console first asks which of the four possible channels you would like to restore, then tells you to send the file to put in this channel. The Micro Console will start saving the data in the Brick starting at the **Start Frame**, and continuing to the **End Frame**.

If there is an error the Micro Console will tell you the frame at which it occurred. You will need to stop the file download BEFORE you hit the <ESC>ape key to clear the Micro Console.

The Bricks must be connected to the Micro Console by the Smart Brick Network (for Smart Bricks) or J8 (for Dumb Bricks) for this command to work. The Dumb Brick must also be configured to accept start and reset on its Green Input and External Clock on the Blue. This command is unavailable if 'J6 mode' is not selected. Your computer must be configured for 'ACK/NAK' or 'Xon/Xoff' handshaking to use this command.

4) Save Archive:

This command is used to save the contents of all four eight bit channels of the attached Brick to your computer as a text file.

It first asks you to prepare your computer to receive a 'text' file. When prompted, the Micro Console will start sending out data starting at the **Start Frame**, and continuing to the **End Frame**.

When the download is complete, you will need to tell your computer to close the file that was being saved, and then hit an <ESC>ape to redraw the screen.

The format of these archive files is similar to Intel 'HEX'. The big difference is that it contains four channels worth of data. It will not work directly with any commercially available Eprom burners.

The Bricks must be connected to the Micro Console by the Smart Brick Network (for Smart Bricks) or J8 (for Dumb Bricks) for this command to work. The Dumb Brick must also be configured to accept start and reset on its Green Input and External Clock on the Blue. This command is unavailable if 'J6 mode' is not selected. Your computer must be configured for 'ACK/NAK' or 'Xon/Xoff' handshaking to use this command.

5) Verify Archive:

This command is used to compare the contents of all four eight bit channels of the attached Brick a file that was previously saved to your computer using the **Save Archive** command. It prompts you to send a file for comparison. The Micro Console will start comparing the data starting at the **Start Frame**, and continuing to the **End Frame**.

If there is an error the Micro Console will tell you the frame at which it occurred. The Green LEDs will show the data that was expected and the Red LEDs will show you what the Brick had in it. You will need to stop the file download BEFORE you hit the <ESC>ape key to clear the Micro Console.

If the comparison is successful you will need to hit an

<ESC>ape to redraw the screen.

The Bricks must be connected to the Micro Console by the Smart Brick Network (for Smart Bricks) or J8 (for Dumb Bricks) for this command to work. The Dumb Brick must also be configured to accept start and reset on its Green Input and External Clock on the Blue. This command is unavailable if 'J6 mode' is not selected. Your computer must be configured for 'ACK/NAK' or 'Xon/Xoff' handshaking to use this command.

6) Restore Archive: This command is used to receive a file from your computer and store it in all four eight bit channels of the attached Brick. Normally this file was previously saved using the **Save Archive** command. The Micro Console prompts you to send the file to put in the Brick. The Micro Console will start saving this data starting at the **Start Frame**, and continuing to the **End Frame**.

If there is an error the Micro Console will tell you the frame at which it occurred. You will need to stop the file download BEFORE you hit the <ESC>ape key to clear the Micro Console.

The Bricks must be connected to the Micro Console by the Smart Brick Network (for Smart Bricks) or J8 (for Dumb Bricks) for this command to work. The Dumb Brick must also be configured to accept start and reset on its Green Input and External Clock on the Blue. This command is unavailable if 'J6 mode' is not selected. Your computer must be configured for 'ACK/NAK' or 'Xon/Xoff' handshaking to use this command.

7) Clear Brick: This command is used to erase the all or part of the memory of the attached Brick. It will start clearing the memory at the **Start Frame**, and continue to the **End Frame**.

r) Restore Default Config.: This command is used to reload the default EEprom settings for the Micro Console. These settings are not permanently saved until you use the **Save Current Configuration** command.

s) Save Current Config.: This command is used to write all of the current settings on the Micro Console to the nonvolatile EEprom. All settings, including the assignments on the front of the Micro Console will be saved. Every time the Micro Console is turned on it will return to these settings. You can change these power-on defaults just by using this command again.

t) Test Brick: This command is used to test the operation of an attached record/playback Brick. Testing will start at the **Start Frame**, and continue to the **End Frame**. Data in the Brick between these two points will be erased.

This command prompts you for the number of times you would like it to perform each test. It then tests the inputs and outputs of the attached Brick. If it passes this test then it does first a 'walking ones' test, two 'checker board' tests, and ends by clearing the Brick's memory.

If there is an error the Micro Console will tell you the frame at which it occurred. The Green LEDs will show the data that was expected and the Red LEDs will show you

what the Brick had in it.

^ t) Test Playback-Only Brick: This command is used to test the operation of an attached Playback-only Brick. Testing will start at the **Start Frame**, and continue to the **End Frame**. The Brick to be tested must have a set of four Eproms installed that have the data for the 'walking ones' test in them.

This command prompts you for the number of times you would like it to perform each test. If there is an error the Micro Console will tell you the frame at which it occurred. The Green LEDs will show the data that was expected and the Red LEDs will show you what the Brick had in it.

To make an Eprom set that has the 'walking ones' test data in it you will need a record/playback Brick of the same size as the Playback-only Brick you are testing. We typically used a 64K file burned into four 27C512s. To generate the Eprom files:

- 1) Set the Brick Start Frame and Brick End Frame to cover the size Brick you are generating Eproms for.
- 2) Start testing the attached record/playback Brick. After the Micro Console writes the 'walking ones' test data, but before it writes the first 'checkerboard' test data, turn off the 'Record' keyswitch on the Brick. The Micro Console will continue testing the Brick and confirm that the 'walking ones' data is OK. It will then attempt to write the first checkerboard test data. It won't be able to write this test data because the 'Record' keyswitch is turned off. The verification will fail as soon as it starts checking the 'checkerboard' data. Don't worry, you want this to happen.
- 3) Use the 'Save Eprom' command above four times to save each of the four channels in the Record/Playback Brick.
- 4) Burn these four Eprom Files into Eproms.

Micro Console Buttons:

The Micro Console has four Blue 'Channel' buttons which represent the four eight bit channels you can use. Once any of the inputs has been assigned, it can temporarily be '**punched out**' (put into a **playback mode**, even if programming a show) or '**punched in**' (put back into active mode). You just momentarily press the blue 'Channel' key for any of the assigned inputs to punch it out. The green LED that shows that the input was assigned will then start to flash. To punch it back in, you press the blue Channel button again. If you punch any analog in or out while PC·MACs is recording a show and the AUTO INBETWEEN function has been turned 'ON', PC·MACs will automatically remove any jump that might have been created at the punch points.

The thirty-two white buttons are for programming digital functions. When they are active for programming, the Green LEDs on each button show that the individual button is active for programming. The Red LEDs show any data that has previously been programmed.

The five gray buttons are the command buttons. These are used as follows:

Hex/Decimal/Percent: This button is used to select which numbering system will be used by the Micro Console. The numbering system can also be selected using the 'Hex/decimal/percent' command on the menu accessed through the serial port. The numbering systems are:

HEXadecimal: Values are shown as '00h' to 'FFh'

Decimal: Values are displayed as '0' to '255'

Percent: Values are displayed as '0' to '100'

Alternate/Reverse.: This button is used to reverse any of the analog inputs or make any of the digital inputs into 'alternate' action (push 'ON'/push 'OFF') inputs.

Note that when you make any digital input port into alternate action, all eight bits in that port will be affected. If you are working with as PC·MACs System, you can use some bits on the same channel as momentary inputs by assigning the same output to another digital input channel. This port can then be used as your momentary inputs.

To use the **ALT./REV.** command key:

- 1) Momentarily press the **Alternate/Reverse** button. The yellow LED on this button will light to show that we are in **Alternate/Reverse mode**.
- 2) Choose which of the previously assigned channels you would like to reverse (for analogs) or make into 'alternate' action (for digital inputs). Momentarily press the blue 'channel' button for that input port. The yellow LED on it will light to show that it is now **Reversed** or in **Alternate Action mode**. The yellow LED on the **Alternate/Reverse** will turn 'OFF'.

If you need to remove the **Alternate/Reverse mode** from any of the programming console's inputs, just repeat the above two steps.

If you have pressed the **Alternate/Reverse** button and decide that you don't really want to **Alternate/Reverse** anything, it can be canceled by momentarily pressing the blue button for any unassigned channel. If no other buttons are pushed, this button will cancel itself after five seconds.

Analog/External/Digitals: This is the button you use to select which mode each of the four Micro Console channels will be operating in. The decimal points on the LED displays show the current mode. To use this command:

- 1) Press this button. The adjacent yellow LED will light to show that it has been pressed.
- 2) Press the blue 'Channel' button for the input you wish to change. The Decimal point LED for that channel will then shift to the next position to show the new mode.
- 3) Repeat steps #1 and #2 until the channel is in the mode you would like it to be in.

If you have pressed the **Analog/External/Digitals** button and decide that you don't really want to change anything, it can be canceled by momentarily pressing the blue button for any unassigned channel. If no other buttons are pushed, this button will cancel itself after five seconds.

Assign: This is the button you use when you want to assign any of the input channels on the Micro Console to one of the outputs attached to the system. In all the animation systems Gilderfluke & Company builds, a green LED on the input indicates that the input has been assigned and is active for programming. A flashing green LED indicates that the input has been assigned, but has been temporarily 'punched-out' (taken out of record mode). To assign any Micro Console input to any output:

- 1) Press and release the ASSIGN button. Its yellow LED will light and the LED displays will change to show the four currently assigned channel numbers. This shows that the console is now in assign mode.
- 2) Now you choose which channel you would like to assign. Press and hold the blue button that represents the Micro Console channel you would like to assign. The green LED on the button will light.

If operating in PC·MACs mode, a window will appear on the screen of your PC that shows the name you have given the output which this input is assigned. If the input wasn't previously assigned, then the most recently assigned or unassigned output will be displayed.

- 3) If programming record/playback Bricks, the Micro Console Channels are hardwired to the appropriate Brick channels so you can skip this step.

If operating with a PC·MACs system or using the DMX-512 output from the Micro Console, you will need to tell the Micro Console which output channel this input channel needs to be sent to. To select another output channel, use the pot for that channel. If you are working with a PC·MACs system, as you rotate the knob, the window on the screen of the PC will change to show the output channels as they pass.

- 4) If you are assigning a digital port, then you can now decide which of the eight bits within that port will be active for programming. You do this by pressing the individual white buttons that represent the individual bits on that port. As you do so, the GREEN LEDs on each key will toggle 'ON' and 'OFF'. A GREEN LED that is left 'ON' when you complete the assignment will be active for programming. All others will be left in **Playback mode** and any data already recorded on them won't be altered.

If attached to a PC·MACs System and MANUAL Mode is 'ON', these pushes will also be sent out the outputs as you make them.

- 5) To complete the assignment process, just release the BLUE button for the input you are assigning. You have been holding it all this

time, haven't you? The yellow LED on the ASSIGN button will turn 'OFF'.

If attached to a PC-MACs System and the '**Quick Channels**' option under the '**Preferences**' pulldown is 'ON', if the output channel you have selected has never before been used, it will be used to create a new eight bit analog or digital channel.

If you have pressed the ASSIGN button and decide that you don't really want to assign anything, it can be canceled by pressing either **ALT./REV.** or **Unassign** and then the blue 'assignment' button for any unassigned channel. If no other buttons are pushed, this button will cancel itself after five seconds.

Unassign: As you would probably expect, this button is used to clear an assignment you have previously made to any of the input ports on the console. To use it:

- 1) Momentarily press the **Unassign** button. Its yellow LED will light and the LED displays will change to show the assigned channel numbers. This shows that the console is now in **Unassign mode**.
- 2) Choose which of the previously assigned inputs you would like to clear. Momentarily press that input's blue button. Both the LEDs on the selected input's blue button and the yellow LED on the **Unassign** button will go out.

If you have pressed the **Unassign** button and decide that you don't really want to **Unassign** anything, it can be canceled by momentarily pressing the blue 'assignment' button for any unassigned input. If no other buttons are pushed, this button will cancel itself after five seconds.

Once you have the Micro Console assigned as you like it, you can take a 'snapshot' of the current configuration, name it, and save it for later retrieval. To do this, select the '**Save Console Preset**' command from the **RealTime pulldown** menu in PC-MACs. This will ask you for a name for this new preset (or you can use a name from the list of 'standard' names you have previously entered). To retrieve any console preset that you have saved, you can select it from the '**Current Console**' popup on the main screen or from the '**Load Console Preset**' command under the '**RealTime**' pulldown menu. Either of these will instantly load the console with your previously saved console preset.

The Micro Console is attached to PC-MACs through the Console Serial Port on the Smpte Card. This link runs at 250 Kbaud using RS-422 drivers and receivers. For most short wire lengths, standard RJ-11 modular telephone wire can be used. If the distance is great, then a shielded twisted pair cable may be needed. Please refer to the section of this manual covering the Smpte Card for details on this connection.

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- Togglodyte Animation Test Tool -



The Togglodyte is a small handheld unit which is typically used by service personnel to manipulate and move the animated figures that are attached to the Animation Control System. It can also be used as a simple programming console for generating animation data in real time.

The Togglodyte has a two line LCD display and sixteen keys on its front. It can run from an external power supply or its onboard battery.

The Togglodyte can attach to a PC-MACs system:

- 1) To the Serial Programming Console Connection on the Smpte Card. In this mode, the Togglodyte acts as a handheld single channel programming console. Any eight bit digital port

or single analog port can be selected on the Togglydye. Data can then be sent to the selected port just as if a full-sized PC·MACs Programming Console were attached to it. **Save Console Preset** and **Load Console Preset** commands from PC·MACs will treat the digital side of the Togglydye as 'Digital A', and the analog side as 'Encoder B'.

- 2) The Togglydye has an eight bit wide 1/4 J6 input and output. This allows it to be attached right to the outputs of a PC·MACs Digital Output Card (or the output of any of our other animation control systems) at the controlled device. Data coming from the animation system can be monitored, or modified. The selected eight bit port can be used as eight individual digital outputs or one eight bit wide analog port.
- 3) The Togglydye can work with DMX-512 in two different modes.
 - a) It can act as a source of DMX-512 data, transmitting a stream to any DMX-compatible device. The data in the selected eight bit digital channel or analog channel (any resolution) is included in the transmitted data stream.
 - b) It can receive a stream of DMX-512 compatible data and insert the selected eight bit digital channel or analog channel (any resolution) in the retransmitted data stream.

The command keys on the Togglydye are used as follows:

Assign: This is the button you use when you want to assign the input channel on the Togglydye to one of the outputs attached to the system. If the Togglydye is in Setup mode, or is currently running or recording a sequence, this command will be unavailable. It is used as follows:

- 1) Momentarily press the ASSIGN button. The word 'assign' will appear in the upper line of the LCD display to show that the Togglydye is now in assign mode. The current assignment of the analog or digital input will be shown on the lower line of the display. The name of the selected channel will appear on the screen of the PC.
- 2) To select another output channel, use the analog input to select it. As you rotate the analog, the window on the screen of the PC will change to show the output channels as they pass.
- 3) If you are assigning a digital port, then you can now decide which of the eight bits within that port will be active for programming. You do this by pressing the individual buttons that represent the individual bits on that port. As you do so, the bit numbers of each bit will toggle 'ON' and 'OFF' on the upper line of the display (If MANUAL Mode is 'ON', these pushes will also be sent out the outputs as you make them). A bit number which is left 'ON' when you complete the assignment will be active for programming. All others will be left in **Playback mode** and any data already recorded on them won't be altered.
- 4) To complete the assignment process, just press the ASSIGN button again. If the output channel you have selected has never before been used, it will be used to create a new eight bit analog or digital channel if the **'Quick Channels'** option under the **'Preferences'** pulldown is turned 'ON'.

When you complete the assignment of any channel of a Togglydye operating in Console mode, PC·MACs will send the name(s) for the selected channels it. These will then be shown on the lower line of the display (digital functions won't be shown until the individual bits become active). If you have assigned an analog function, PC·MACs will also send the Togglydye the resolution for the selected channel. Until this arrives, an 'err:' will be displayed on the lower line of the LCD display. The number represents the current value for the internal resolution byte. If you assign an analog to an invalid or nonexistent channel or a set of digitals, then PC·MACs will never send a resolution byte to the Togglydye, and the analog input will remain in the 'err' mode.

If you have pressed the ASSIGN button and decide that you don't really want to assign anything, it can be canceled by pressing ASSIGN again.

Alt./Rev.: This button is used to reverse the direction of the analog input, or make the digital inputs into 'alternate' action (push 'ON'/push 'OFF'). Note that when you make the digital input port into alternate action, all eight bits in that port will be affected. To use the **ALT./REV.** com-

mand key:

- 1) Momentarily press the **ALT./REV.** button. The word 'alt' will appear in the upper line of the display if the Togglydyte is in analog mode, or 'rev' if in digital mode.

If you need to remove the **alternate/reverse mode** from any of the programming console's inputs, just repeat the above step.

Analog/Digital: The Togglydyte can be used in either digital input or analog input modes. This button is used to toggle between these two modes. To use this command:

- 1) Momentarily press the **Analog/Digital** button. The display will change to reflect the new condition of the Togglydyte.

Punch in/Punch out: Once any of the inputs has been assigned, it can temporarily be 'punched out' (put into a playback mode, even if PC·MACs is programming a show) or 'punched in' (put back into active mode). When it is punched out, data will be fed through the Togglydyte from the programming console input (when operating in **Console Mode**), the 1/4 J6 input (when operating in **J6 mode**), or the incoming DMX-512 data stream (when operating in **DMX-512 mode**) to the outputs. In this way you can monitor the programmed data which is being sent to a figure. To use this command:

- 1) You just momentarily press the **Punch in/Punch out** to punch it in or out. The word 'Pout' will appear on the display to show that a channel has been punched out (a digital function will have it's assigned bit numbers changed to 'X's as well).

If you punch the analog in or out while PC·MACs is recording a show and the AUTO INBE-TWEEN function has been turned 'ON', PC·MACs will automatically remove any jump that might have been created at the punch points.

Setup: This button is used to adjust various settings used in the Togglydyte. This command is not available if the Togglydyte is already in **ASSIGN mode**, or if it is running the Sequencer. To use this command:

- 1) Press the Setup button. The currently setting to be adjusted will be shown on the the LCD display.
- 2) To select any other setting, rotate the analog input knob. The settings will scroll by as you do.
- 3) To actually adjust the settings, the **Setup: select next** and **Setup: select last** buttons are used¹.
- 4) To exit the Setup mode, just press the Setup button again.

The settings that can be adjusted through the **Setup mode** are:

- 1) **Operating Mode:**

- a) **Programming Console:** For use with a PC·MACs system. The Togglydyte acts as a single channel programming console. For the specifications of the 1/4 J6 cabling, see the other sections of this manual.
- b) **1/4 J6:** For use with smaller animation systems or connection right at the digital outputs from a PC·MACs system. The digital 1/4 J6 output from the animation system is attached to the 'input' on the Togglydyte (optionally), and the figure is attached to the 1/4 J6 output from the Togglydyte (optionally). DMX-512 is transmitted by the Togglydyte on each frame when operating in this mode. The wire between the Togglydyte and the PC·MACs system (specifically

¹ These same buttons are used for **Punch in/Punch out** and **Sequencer Start** when the Togglydyte is not in the **Setup Mode**.

the Smpte Card) is a standard straight-through RJ-11 telephone style connector.

- c) **DMX-512:** For use when receiving a DMX-512 data stream monitoring and/or modifying it, and then retransmitting it. This requires a special DMX-512 cable for connections to the Togglobyte. This is wired as follows:

DMX-512 In (Male 5 pin XLR)	DMX-512 Out (FM 5 pin XLR)	pin #	COLOR	SIGNAL NAME:
1	n/c	(left) 1)	WHITE:	signal ground
2	n/c	2)	BLACK:	- serial data in
3	n/c	3)	RED:	+ serial data in
n/c	2	4)	GREEN:	- serial data out
n/c	3	5)	YELLOW:	+ serial data out
n/c	1	(right) 6)	BLUE:	signal ground

2) **Sequencer mode:**

- a) **Record/Play Sequencer:** Allows a single eight bit channel to be recorded and played back repeatedly.
- b) **Two Phase Timer:** Pulses all of the digital bits together.
- c) **Four Phase Timer:** Pulses odd and even numbered bits alternately.

3) **Numbering System:** Allows you to select what type of numbering system will be used on the Togglobyte.

- a) **HEXadecimal** (0-F)
- b) **Decimal** (0-9)
- c) **Percentage** (0-100%)

4) **Normal Encoder Prescaler:** This allows you to set the divider used on the analog input when manipulating any analog function. A larger divisor lowers the sensitivity of the analog input. Ten different rates between /1 to /100 are available.

5) **Special Encoder Prescaler:** This allows you to set the divider used on the analog input when in **Assign** or **Setup modes**. A larger divisor lowers the sensitivity of the analog input. Ten different rates between /1 to /100 are available.

6) **Frame Rate:** This is the update speed used when operating in J6 mode (both of the other modes get their frame rate from the system to which they are attached). Ten different frame rates are available from 20 to 200 Frames Per Second.

7) **Digital Name:** This allows you to enable or disable the display of the names of digital functions when operating in the PC·MACs programming **Console mode**. You can select whether: 1) none, 2) all the names within an eight bit channel, or 3) only names of those bits which have been selected will be displayed on the Togglobyte.

8) **Digital Number:** This allows you to toggle on and off whether the numeric value for a digital port will be displayed.

9) **Analog Number:** This allows you to toggle on and off whether the numeric value for an analog port will be displayed. Values of analogs beyond eight bits can not be displayed in decimal mode, and will default to Hex numeric values.

10) **Timer A:**

11) **Timer B:**

12) **Timer C:**

13) **Timer D:** These allow you to modify the times used for the sequencer in

timer mode. The range of entry is from 0 to 9.9 seconds for each of these.

- 14) **Backlighting Stay On:** This allows you to set the amount of time the backlighting will stay on when the Togglodyte is being operated from batteries. The range of entry is from 0 to 9900 seconds, with 100 seconds resolution. If you want the backlighting to stay on forever once it is turned on, just set it to 0000.
- 14) **Battery Stay On:** This allows you to set the amount of time the Togglodyte will stay on when it is being operated from batteries. The range of entry is from 0 to 9900 seconds, with 100 seconds resolution. If you want the Togglodyte to stay on forever once it is turned on, just set it to 0000.
- 15) **Default to Digital/Analog Input:** This allows you to select which mode the Togglodyte will be in each time it is turned on.
- 16) **Default Digital Channel:** This allows you to set the channel number which will be used for the digital channel each time the Togglodyte is turned on.
- 17) **Digital Default Momentary/Alternate Action:** This allows you to set the input mode for the digitals each time the Togglodyte is turned on.
- 18) **Default Analog Channel:** This allows you to set the channel number which will be used for the analog channel each time the Togglodyte is turned on.
- 19) **Analog Default Normal/Reversed Direction:** This allows you to set the direction used by the analog input each time the Togglodyte is turned on.
- 20) **Default Analog Resolution:** This allows you to set the analog resolution which will be used each time the Togglodyte is turned on.
- 21) **DMX-512 Checksum:** This allows you to set whether the checksum used to verify the quality of DMX-512 data will be used by the Togglodyte on transmission, reception or both. This sixteen bit checksum is transmitted or received in the 257th and 258th time slots of the DMX-512 data stream. This is an extension to the DMX-512 standard which is unique to Gilderfluke & Company equipment.
- 22) **Write to EEprom/Read from EEprom:** Pressing the **Setup: select next** button will write the current settings to the Togglodyte's EEprom. These settings will then be loaded into the Togglodyte each time it is turned on. Pressing the **Setup: select last** button will read the saved settings from EEprom if you ever need to get them back after screwing something up really badly.

If you ever need to reload the default settings from the Eeprom into the Togglodyte, press and hold both the **Assign** and **Setup** buttons when you turn the Togglodyte on. This will load the defaults into the Togglodyte, but not write it to the EEprom (it also puts the Togglodyte into **Setup mode**). To save it permanently, you must select the **Write to EEprom/Read from Eeprom** setting and press the **Setup: select next** button.

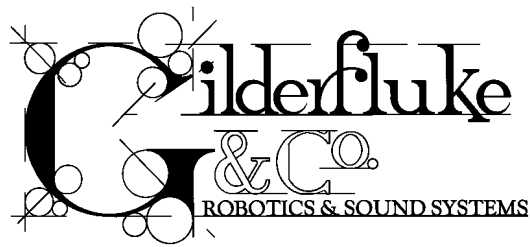
If the Togglodyte is running from batteries, it will normally shut off after the delay set by the **Battery Stay On** time. If you want to have the Togglodyte turn off immediately (well, almost immediately), press the **Setup** button to enter this mode, and then press the **Assign** button. The Togglodyte will turn off in about 5 seconds.

Light: Whenever the Togglodyte is running from an external power source, the LCD display's backlighting is always turned 'ON'. When running from the Togglodyte's internal battery, it must be turned 'ON' manually. This button is used to do this. The light will turn 'OFF' by itself after the time delay set under the **Setup** command. Time delays from 0 to 9900 seconds are available.

Sequencer Record: When the Togglodyte's sequencer **Record/Playback mode** has been selected under the **Setup** command, this button is used to prepare the Togglodyte for recording a sequence. When it is pressed, the word 'rec' will appear on the LCD display to show that the Togglodyte is ready to record. This will cancel itself out after approximately 5 seconds if no other button is pressed. When the **Start/Stop Sequencer** button is pressed, the 'rec' on the display will change to a 'REC' and any movements on the Togglodyte's analog or digital inputs (depending on the analog/digital mode) will be recorded. Recording is terminated by pressing the **Sequencer Start** button again, or when the Togglodyte runs out of memory (the recording capacity is approximately 6000 frames).

Start/Stop Sequencer: The Togglodyte's sequencer is used to send signals to the outputs of the animation system without having to manually operate the Togglodyte. This allows you to pulse a digital, or send a programmed sequence to an analog function while you set down the Togglodyte to work on the figure. This button starts the sequencer running the first time it is pressed, and stops it the second time. While the sequencer is running, entry into the **Assign** or **Setup modes** is disabled. There are two modes of operation for the sequencer:

- a) **Record/playback:** This allows you to record a sequence on any single eight bit channel (analog or digital) and play it back. The source of the recorded data can be your button presses and knob twisting on the Togglodyte, or it can record the data coming in from a preprogrammed sequence from the programming console input (when operating in **Console Mode**), the 1/4 J6 input (when operating in **J6 mode**), or the incoming DMX-512 data stream (when operating in **DMX-512 mode**). This allows you to record a short piece of a particularly troublesome show for playback and testing. When you write the configuration to the Togglodyte's EEPROM, the first 500 or so bytes of any recorded sequence will be saved permanently. This sequence will be available the next time the Togglodyte is turned on.
- b) **Timer:** This mode is typically used to test digital functions. It has two modes of operation:
 - 1) **Two Phase Mode:** All the digitals that are assigned will be turned on for the time period set by **Timer A** (all timers are adjustable from 0 to 9.9 seconds through the Setup mode). It then turns all of the digitals off for the period set by **Timer B** and repeats. This allows any of the digitals to be cycled on and off together.
 - 2) **Four Phase Mode:** Digitals 0, 2, 4 and 6 will be turned on for the time period set by **Timer A** if they are currently assigned. The Togglodyte then turns all of the digitals off for the period set by **Timer B**. Digitals 1, 3, 5 and 7 will be turned on for the time period set by **Timer C** if they are currently assigned. All of the digitals are then turned off again for the period set by **Timer D** and the whole sequence repeats. This allows pairs digital outputs to be cycled on and off alternately. All timers are adjustable from 0 to 9.9 seconds through the Setup mode.

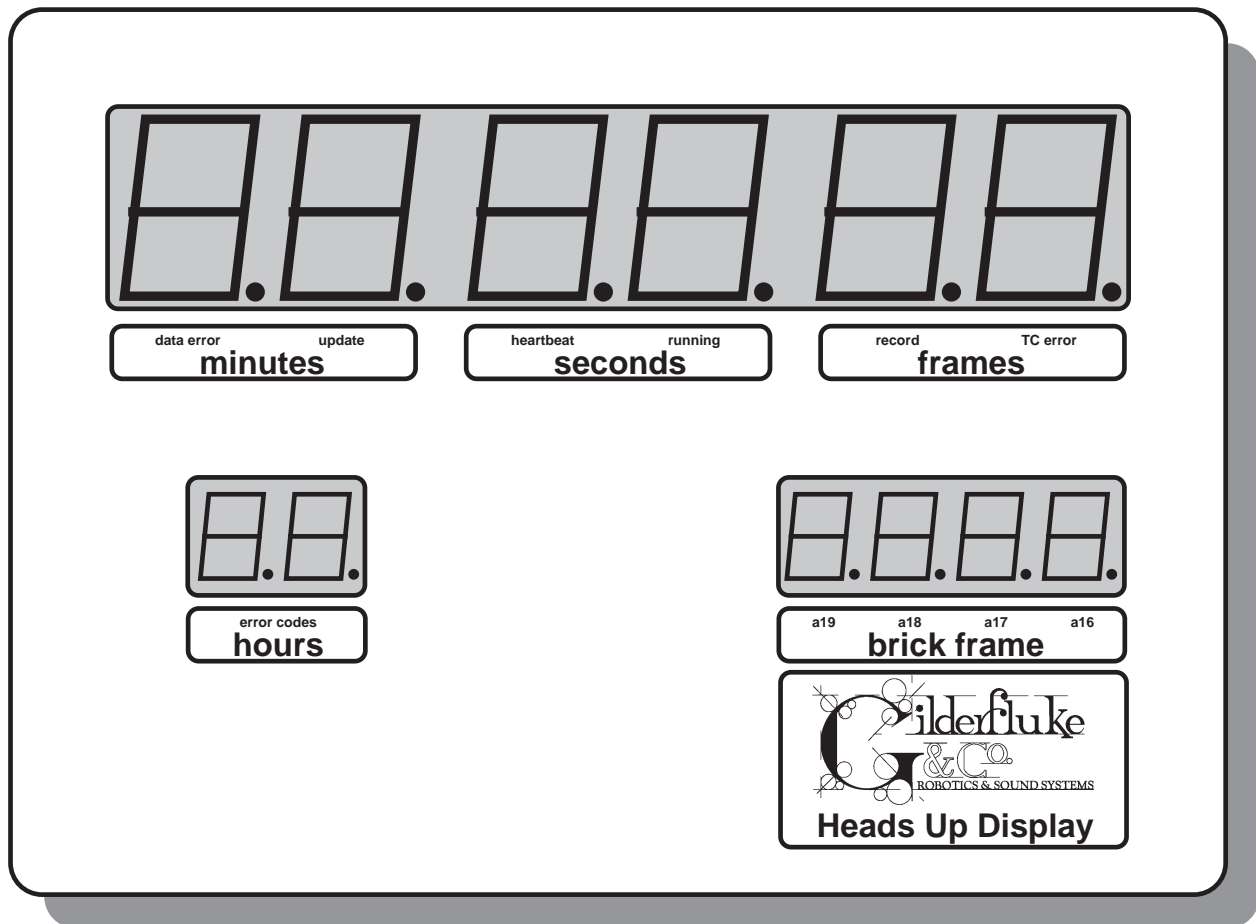


- Heads Up Display -

Heads-up-displays are available in two different styles:

- 1) 19" rack-mount.
- 2) Stand-alone.

The stand-alone model has a larger display than the 19" rack mount version. The rack-mount version fits into one 1-3/4" space in a 19" rack. Any number of Heads Up Displays can be attached to the Smart Brick system by simply plugging them into the wire which runs to all of the Smart Bricks from the Smart Brick Brain and plugging the power supply into a wall outlet. The display of the stand alone version front looks like this



The data displayed by the Heads Up Display changes slightly, depending on the time code being used. For all time bases except for LaserDisk, the 'Minutes/Seconds/Frames' show exactly what you would expect for the show being played, with the 'Hours' showing the current show number. In LaserDisk shows, the display shows the actual LaserDisk frame number right from the LaserDisk player. While running shows, the 'Hours' always shows the number of the show being played. The 'Smart Brick frame number' shows the actual address being accessed in all of the Smart Bricks.

During the countdown between shows, the 'hours/minutes/seconds' show the countdown time until the next show is played. The 'Frames' aren't used during countdowns.

General error and status conditions are displayed in the 'Hours' display in the front of the Heads Up Display. The meanings of these Error Messages are as follows:

- E1: Brick Overflow:** This indicates that the frame number requested is beyond the end of the memory installed in the Smart Bricks attached to the system. Dipswitch number 5 must have been set to tell the Brick Brain how big the Smart Bricks are for this function to work properly.
- E2: SMPTE Time Code Error:** This is displayed when the Brick Brain has started listening for a SMPTE time code, and the 'SMPTE Hour' byte of the incoming time code identified a show which wasn't a SMPTE time code show.
- E3: End Of Show:** This is not really an error condition, it just shows that the end of the show being played has been found
- E4: String Error:** This error condition is displayed when the string being sent requested a specific ASCII character to be returned by whatever is connected to the serial port, and a different character was returned.
- E5: Invalid Frame Rate:** This error condition is displayed when the frame rate set in the system is not valid for the time code of the show which is being started. An example of this would be if the frame rate were set to 16 frames per second and a SMPTE time code is being used. As this is not a valid frame rate for a SMPTE show, an 'E5' would be displayed.
- E6: LaserStart Error:** This is displayed when an attempt is made to start a LaserDisk show by sending it a 'search for frame number command'. After a number of tries (which can be set from 1 to 256 in the configuration of the Brick Brain), the Brick Brain will then try to start up the LaserDisk player (see 'F2' below).
- E7: LaserLoop Error:** This is displayed when an error is made in the response received from a LaserDisk player while it is running a LaserDisk show.
- E8: Start Error:** The only time this error is displayed is when the time code is asking for a show frame number which is actually before the first frame of the show being played. About the only way of getting the system into this condition is to use the manual controls on the front of the LaserDisk player to manually 'rewind' the show to a frame number before the start of the show.
- E9: Response Error:** This error is displayed when a string being sent at the start or end of a show has requested a character to be returned by whatever is attached to the serial port, and nothing has been returned within about 45 seconds. About the only time you will see this error is when the LaserDisk player is actually turned off when an attempt is made to start a LaserDisk clocked show.
- EA: Call Home:** If this error message ever appears in the 'hour' display, you should call the vendor who installed your show.
- F1: Sending String:** This code indicates that a string is being sent at the start or end of a show. When this code is displayed, the 'Minutes' will be showing the string number being sent out, the 'Seconds' showing the entry number in the string which is being sent out, and the 'Frames' showing what the entry is which is being sent. Normally this flashes by so fast that you can't read it, but is useful when there is a holdup of some sort in the string. Typical of these is if the LaserDisk doesn't respond to a command as expected, or when you have put an entry in the string which causes the Brick Brain to wait for a switch closure to come in on one of its inputs.
- F2: Starting LaserDisk:** After the Brick Brain has tried telling the LaserDisk player to search for the starting frame of the show for the number of times set in the configuration (an 'E6' is displayed while it is doing this), the Brick Brain will send a 'start-up' sequence of commands to try to tell the LaserDisk player to close the door and spin up the disk.

The decimal points on the 'Minutes/Seconds/Frames' display are used to show a variety of conditions in the Smart Brick System:

Data Error: This light will flash when the Heads Up Display receives a bad packet of data from the Smart Brick Brain. You should almost never see this one flash. If you do, it means that there is something wrong with the connection between the Smart Brick Brain and the Heads Up Display, and by implication, that the data getting to the Smart Bricks is also suspect.

Display Update: This flashes every time the Smart Brick Brain updates the entire system. If it is not flashing, then there is definitely something wrong with the connection between the Smart Brick Brain and the Heads Up Display, and by implication, that the data getting to the Smart Bricks is also suspect.

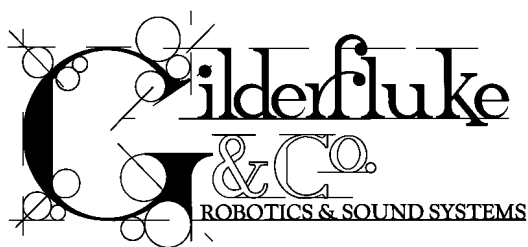
Heartbeat: This should flash in exact synchronization with the 'Heart' on the front of the Smart Brick Brain. If it doesn't, or if it flashes irregularly, then there is probably something wrong with the connection between the Smart Brick Brain and the Heads Up Display, and by implication, that the data getting to the Smart Bricks is also suspect.

Advancing Frames: This is lit whenever the Smart Brick System is advancing frames. If any of the Smart Bricks in the system are configured to 'disable the outputs when stopped', they will only have their outputs enabled when this LED is lit. The number of 'heartbeats' that this LED will stay on after the system stops running a show can be set when configuring the Smart Brick Brain to anywhere from 1 to 256 beats.

Global Record: This LED is lit only when Dipswitch #6 in the Brick Brain is 'ON' to enable recording on the Smart Bricks and the system is advancing frames. When this LED is off, it shows you that the reason the record LEDs on the Smart Bricks won't turn on is that you haven't enabled them in the Brick Brain.

Time Code Error: This LED will flash whenever the Brick Brain is correcting an error in the incoming time code. If it flashes too often, then there is a problem with the connection to the SMPTE source, or the level of the SMPTE getting to the Brick Brain is either too high or too low. Occasional errors in SMPTE time code aren't all that unusual, so don't be alarmed if this LED flashes occasionally. This indicates that the Brick Brain is doing it's job, and has detected and corrected an error. Generally these errors represent a glitch in the time code as it is recorded on the tape (or whatever medium is being used as the source for the SMPTE time code), and so will occur at the exact same instant in the show every time it is played.

Is this page blank enough to be considered *truly* blank?



- Start and End Strings -

STRINGS are the names of the list of commands which you can tell the Brick Brain send at the start or end of any show. They are used primarily to talk to LaserDisk players, although they can be used with any type of show to send and receive characters through the serial port, turn on the tape deck control outputs, or cause the Brick Brain to wait until it gets a switch closure on one of its inputs before continuing. They can also be used to send commands through the serial port to any other piece of show equipment that needs a serial input, or even just to print on a monitoring screen that a show has started or ended.

On the **Show and String Setup** menu, there are nine strings shown, each of which can hold up to 12 characters. If longer strings are needed, you just omit the special character which tells the Brick Brain that it has found the end of a string, and it will continue sending the next string, and the next, and the next, until it finds an 'end-o-string' special character or the last character of string 9. This is the only way to send the last two strings, as they can not be accessed directly as the first seven strings can.

Characters are entered into the strings as HEXadecimal ASCII characters. As an example of the using ASCII:

To send a letter "a", you enter the HEXadecimal value of 61.

If bit seven of any ASCII character is set to =1, then instead of sending the character out the serial port, the Brick Brain will wait until it receives this character through the serial port. As an example of using ASCII to receive a character:

To wait until the Brick Brain receives a letter "a", you enter a value of E1.

The Brick Brain has a limited supply of patience when waiting for a character to be returned from the serial port. If it hasn't heard anything within about 45 seconds, it will turn on the 'E9' error message on the Heads Up Displays.

When displayed on the STRING SETUP MENU, characters that the Brick will wait for are displayed in parenthesis and have their bit seven hidden. For this reason in the example above, although entered as 'E1', this entry would be displayed as **(61)**.

SPECIAL STRING CHARACTERS:

Within the strings there are eleven 'special characters' which can be used. They are defined as follows:

End-O-String: (00): This special character tells the Brick Brain that it has reached the end of the current string it is sending.

LaserSearch: (01): This character, when found by the Brick Brain in a string, causes it to send out a search command to the LaserDisk player to find the frame number found in the LaserDisk Start for the current show.

PB: (02): When found in a string, this character causes the Brick Brain just to sit and wait until it gets an input on the manual PB input. Be sure that there are no conflicting commands which this input may trigger when you activate it. (An example of this would be to have a command to wait for this input during a start string, and then have this input also stop any show when it is triggered. This would have the unfortunate effect of stopping the show before it has even started. This command is not available on Rack Smart Brick Brains when using Panasonic LaserDisk Players.

Blue: (03): When found in a string, this character causes the Brick Brain just to sit and wait until it gets an input on the BLUE input. Be sure that there are no conflicting commands which this input may trigger when you activate it. (An example of this would be to have a command to

wait for this input during a start string, and then have this input also stop any show when it is triggered. This would have the unfortunate effect of stopping the show before it has even started. This command is not available on Rack Smart Brick Brains when using Panasonic LaserDisk Players.

Green:(04): When found in a string, this character causes the Brick Brain just to sit and wait until it gets an input on the GREEN input. Be sure that there are no conflicting commands which this input may trigger when you activate it. (An example of this would be to have a command to wait for this input during a start string, and then have this input also stop any show when it is triggered. This would have the unfortunate effect of stopping the show before it has even started.

Stop: (05): When found in a string, this character causes the Brick Brain to close the STOP relay output. It will then reopen at a later time as set by the TAPE DECK PULSE setting. When running a tape deck from the Smart Brick System, this would normally be used to stop the tape deck at the end of each show.

Play: (06): When found in a string, this character causes the Brick Brain to close the PLAY relay output. It will then reopen at a later time as set by the TAPE DECK PULSE setting. When running a tape deck from the Smart Brick System, this would normally be used to start the tape deck at the beginning of each show.

Rewind: (07): When found in a string, this character causes the Brick Brain to close the REWIND relay output. It will then reopen at a later time as set by the TAPE DECK PULSE setting. When running a tape deck from the Smart Brick System, this would normally be used to rewind the tape deck at the end of the last show on the tape.

LaserSearch for CLV LaserDisks: (08): (Rack Smart Brick Brain only!) When found in a string, causes it to send out a search command to the LaserDisk player to find the frame number found in the LaserDisk Start for the current show. This command is for use with CLV players only. These use 'time' references rather than 'frame' numbers to access the disk, and can hold up to 1 hour worth of data.

LaserSearch for CLV LaserDisks: (09): (Rack Smart Brick Brain only!) As above, but searches for hour one, rather than hour zero.

Don't Care: (80h): This character is used when you need to get an ASCII character returned from the serial port, but just don't give a damn what it is that you receive. The Brick Brain will simply wait until it gets any character through the serial port. This is the only one of the 'special characters' which is used when receiving characters from the serial port.

The strings are up to 12 characters long. The first seven can be accessed directly at the start or end of any show. All the characters in a string will be sent until a '00' is encountered in the string. If no '00' is found, they will simply fall through to the start of the next string and start sending it as well. This allows you to send long strings made of several of the individual strings, or to access the last two strings. As an example of this:

If you needed to send a string 30 characters long, you could start by using string seven for the first twelve characters, and then string eight for the next twelve characters, while the last six characters would be found in string nine.

ASCII Characters to be Sent Out:

When sending ASCII characters to the serial port, they translate into HEXadecimal as follows. The first eight characters are special characters unique to the Smart Brick System:

<u>SENT</u>	<u>ASCII</u>	<u>HEX</u>	<u>SENT</u>	<u>ASCII</u>	<u>HEX</u>	<u>SENT</u>	<u>ASCII</u>	<u>HEX</u>	<u>SENT</u>	<u>ASCII</u>	<u>HEX</u>
end-o-string	00		DLE	10		SPACE	20		0	30	
LaserSearch	01		DC1	11		!	21		1	31	
pb	02		DC2	12		"	22		2	32	
blue	03		DC3	13		#	23		3	33	
green	04		DC4	14		\$	24		4	34	
stop	05		NAK	15		%	25		5	35	
play	06		SYN	16		&	26		6	36	
rewind	07		ETB	17		`	27		7	37	
CLV Search	08		CAN	18		(	28		8	38	
CLV Search	09		EM	19		)	29		9	39	
LF	0A		SUB	1A		*	2A		:	3A	
VT	0B		ESC	1B		+	2B		;	3B	
FF	0C		FS	1C		,	2C		<	3C	
CR	0D		GS	1D		-	2D		=	3D	
SO	0E		RS	1E		.	2E		>	3Eh	
SI	0F		VS	1F		/	2F		?	3Fh	

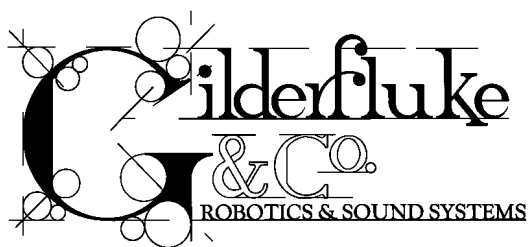
<u>SENT</u>	<u>ASCII</u>	<u>HEX</u>	<u>SENT</u>	<u>ASCII</u>	<u>HEX</u>	<u>SENT</u>	<u>ASCII</u>	<u>HEX</u>	<u>SENT</u>	<u>ASCII</u>	<u>HEX</u>
@	40		P	50		`	60		p	70	
A	41		Q	51		a	61		q	71	
B	42		R	52		b	62		r	72	
C	43		S	53		c	63		s	73	
D	44		T	54		d	64		t	74	
E	45		U	55		e	65		u	75	
F	46		V	56		f	66		v	76	
G	47		W	57		g	67		w	77	
H	48		X	58		h	68		x	78	
I	49		Y	59		i	69		y	79	
J	4A		Z	5A		j	6A		z	7A	
K	4B		[	5B		k	6B		{	7B	
L	4C		\	5C		l	6C		|	7C	
M	4D		]	5D		m	6D		}	7D	
N	4E		^	5E		n	6E		~	7E	
O	4F		_	5F		o	6F		del	7F	

ASCII Characters to be Received:

If you need to get a response from the serial port, you simply enter the character with bit seven set. These characters will be displayed on the menu with parentheses around them and bit seven hidden to show that they are response characters rather than ones which will be sent. The first character is a special character unique to the Smart Brick System. Response ASCII characters translate into HEX as follows:

RESPONSE		RESPONSE		RESPONSE		RESPONSE	
ASCII	HEX	ASCII	HEX	ASCII	HEX	ASCII	HEX
don't care	80	DLE	90	SPACE	A0	0	B0
SOH	81	DC1	91	!	A1	1	B1
STX	82	DC2	92	"	A2	2	B2
ETX	83	DC3	93	#	A3	3	B3
EOT	84	DC4	94	\$	A4	4	B4
ENG	85	NAK	95	%	A5	5	B5
ACK	86	SYN	96	&	A6	6	B6
BELL	87	ETB	97	'	A7	7	B7
BS	88	CAN	98	(	A8	8	B8
HT	89	EM	99	)	A9	9	B9
LF	8A	SUB	9A	*	AA	:	BA
VT	8B	ESC	9B	+	AB	;	BB
FF	8C	FS	9C	,	AC	<	BC
CR	8D	GS	9D	-	AD	=	BD
SO	8E	RS	9E	.	AE	>	BE
SI	8F	VS	9F	/	AF	?	BF

RESPONSE		RESPONSE		RESPONSE		RESPONSE	
ASCII	HEX	ASCII	HEX	ASCII	HEX	ASCII	HEX
@	C0	P	D0	`	E0	p	F0
A	C1	Q	D1	a	E1	q	F1
B	C2	R	D2	b	E2	r	F2
C	C3	S	D3	c	E3	s	F3
D	C4	T	D4	d	E4	t	F4
E	C5	U	D5	e	E5	u	F5
F	C6	V	D6	f	E6	v	F6
G	C7	W	D7	g	E7	w	F7
H	C8	X	D8	h	E8	x	F8
I	C9	Y	D9	i	E9	y	F9
J	CA	Z	DA	j	EA	z	FA
K	CB	[	DB	k	EB	{	FB
L	CC	\	DC	l	EC	|	FC
M	CD	]	DD	m	ED	}	FD
N	CE	^	DE	n	EE	~	FE
O	CF	_	DF	o	EF	del	FF



- PIONEER LaserDisk Commands -

The Pioneer LaserDisk players all share a common command format. A full description of the commands can be found in the technical publications available from Pioneer Communications of America. They can be reached at (408) 988-1702.

LaserDisks used with the Standard Smart Brick Brain must be recorded in the CAV format. This allows up to 1/2 hour per side. The Rack Smart Brick Brain supports both CAV and CLV format disks. CLV disks can hold up to 1 hour per side. Not all players will support the commands needed for using CLV disks in an animation control system. The player must be able to position the disk to a frame (and pause on that frame if it is to be used in a multiple LaserDisk installation).

The LaserDisk player must be configured for 9600 baud, 8 bit data, and 1 stop bit (4800 baud can also work in some applications). On the LD-V8000, you also must set the 'TxD Terminator' to '<C/R>'. Other data rates can be used, but lower baud rates can't get the data across fast enough for the Brick Brain while a show is running. Whatever the data rate used, you must set the Brick Brain, LaserDisk player, and the terminal or computer you are using to configure the system to the same speed. If parity is used, then you need to set the data word length to 7 bits, and the parity to 'odd'. You must also set the Brick Brain to recognize 'odd' parity as well. Connections are made as follows:

Pioneer LaserDisk	SIGNAL	SIGNAL FROM/TO BRICK BRAIN
DB-15		
2	DATA OUT	- serial data in to Brick Brain (GREEN)
3	DATA IN	- serial data out from Brick Brain (BLACK)
1, 11 or 15	GROUND	signal ground (BLUE or WHITE)

The electrical output from PC·MACs is at RS-422 voltage levels rather than the RS-232 that these LaserDisk players really want to see. If this causes a problem, or if the wire runs between PC·MACs and the LaserDisk player are long, then you may want to add a RS-232 to RS-422 converter to the LaserDisk player.

In general, you send a command to the LaserDisk player as two ASCII characters (with occasional variables), followed by a <carriage return> character (0D). The LaserDisk player will then respond when it has completed the task with a upper case 'R' followed by a <carriage return> character (0D). A number of different commands can be stacked together and then followed by a single <carriage return> character (0D) to get them all rolling. The LaserDisk player will go through all of these commands in the order they were entered and then return a 'R' followed by a <carriage return> character (0D) when it has finished the last command. This can save a lot of string space if you are sending complicated strings to the LaserDisk player.

The majority of commands which you might need to use are all pretty simple two or three character ones. The one complicated 'search' command is handled transparently to you when you insert a LaserSearch (01) character in the string being sent to the LaserDisk player (the Brick Brain must be told it is running a Pioneer player in the configuration screen). This string only performs a search for the starting frame of the show on the LaserDisk player. For this reason it is normally followed by a 'PL' (play) command in the same string.

A typical start string for a LaserDisk show is:

LaserSearch PL <CR> (R) (<CR>) end-o-string

Translated into HEX ASCII, this string becomes (this is what you would enter)

01 50 4C 0D D2 8D 00

and it would be displayed on the String Setup Menu as:

01 50 4C 0D (52) (0D) 00

Notice that after the LaserSearch command we have to then tell the LaserDisk to start playing, and that this command is followed by one <carriage return> character to be sent out. Following this we tell the Brick Brain to wait until it gets first an 'R', and then a <CR> back from the LaserDisk player. After this we have a '00' to tell the Brick Brain that it has found the end of the string.

A typical end string for a LaserDisk show is:

ST <CR> (R) (<CR>) end-o-string

Translated into HEX ASCII, this string becomes (this is what you would enter):

53 54 0D D2 8D 00

and it would be displayed on the String Setup Menu as:

53 54 0D (52) (0D) 00

The format of this string is pretty much like that of the startup string, except that there is no need to send the LaserSearch string as was done at the beginning of the show, and the PL command has been replaced by a ST (still frame) command for the LaserDisk player. This freezes the image to whatever the last image on the video disk was. Other commands are available for blanking out the video, ejecting the disk, or a variety of other things. You can even build up a string which will tell the LaserDisk player to search for another frame on the disk and freeze or start playing from that frame. If no command is given to the LaserDisk player at the end of a LaserDisk show, then the player will continue playing along until the end of the disk is reached or another command is received.

As an example of how you combine more than a single LaserDisk command in the same string, we will now show a sample of a string which sends two commands at the same time to the LaserDisk player.

A typical combined start string for a LaserDisk show is:

LaserSearch PL 1KP <CR> (R) (<CR>) end-o-string

Translated into HEX ASCII, this string becomes (this is what you would enter):

01 50 4C 30 4B 4C 0D D2 8D 00

and it would be displayed on the String Setup Menu as:

01 50 4C 30 4B 4C 0D (52) (0D) 00

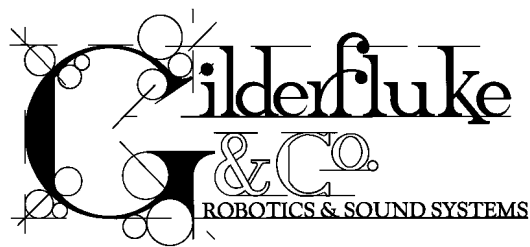
This string is just like the start string shown above, except that it sends a command to disable the front panel keypad on the LaserDisk player after it sends the command to start the show playing, but before it sends the <carriage return> that tells the LaserDisk player to start acting upon all the commands it has just received.

The following is a partial listing of the commands supported by Pioneer LaserDisk players. It is by no means a complete list of all of the commands available to you, but includes those common commands which you may actually need. Remember that you only need to send the <carriage return> (0D) (shown as the last character of all the commands) only if you aren't following the current command with any other command. The <carriage return> tells the LaserDisk player to start working on all of the commands it has received since the last <carriage return> was received.

COMMAND	MNEMONIC	1st	2nd	3rd	4th	RESPONSE	2ND
OPEN DOOR Stops the player if it is running and opens the door.	OP	4F	50	0D		D2	8D
REJECT Stops the player motor if it is running.	RJ	52	4A	0D		D2	8D
PLAY Starts the LaserDisk playing from the current position on the disk.	PL	50	4C	0D		D2	8D
PAUSE Stops the LaserDisk player and a blue (or black) screen appears.	PA	50	41	0D		D2	8D
STILL Freezes the output of the LaserDisk player at the current frame.	ST	53	54	0D		D2	8D
STEP FORWARD Steps the current video frame forward by one frame.	SF	53	46	0D		D2	8D
STEP BACKWARD Steps the current video frame backwards by one frame	SB	53	42	0D		D2	8D
VIDEO CONTROL Turns off the video output.	0VD	30	56	44	0D	D2	8D
VIDEO CONTROL Turns on the video output (default condition).	1VD	31	56	44	0D	D2	8D
CLOSE DOOR Closes the player's door if it was open.	CO	43	4F	0D		D2	8D
KEY LOCK Enables the buttons on the front panel of the LaserDisk player.	OKL	30	4B	4C	0D	D2	8D
KEY LOCK Disables the buttons on the front panel of the LaserDisk player.	1KL	31	4B	4C	0D	D2	8D
BEEP CONTROL Mix a 100 ms long 880 Hz beep into the audio channel at 6%.	0BP	30	42	50	0D	D2	8D
BEEP CONTROL Mix a 100 ms long 880 Hz beep into the audio channel at 10%.	1BP	31	42	50	0D	D2	8D
BEEP CONTROL Mix a 100 ms long 880 Hz beep into the audio channel at 20%.	2BP	32	42	50	0D	D2	8D
BEEP CONTROL Mix a 100 ms long 880 Hz beep into the audio channel at 40%.	3BP	33	42	50	0D	D2	8D

Please note that in many ways a LaserDisk player isn't very bright. If you send it a command to do something that is already done, it will return an error message. As an example, if you ask it to close the door with a CLOSE DOOR command and the door is already closed, it will return an error message 'E04 <CR>' instead of the 'R <CR>' you are expecting. This will cause the Brick Brain to display an error message on the Heads Up Display and stop sending the current string.

Blankness is a state of mind.



- SONY LaserDisk Commands -

The Sony LaserDisk players all share a more or less common command format. A full description of the commands can be found in the technical publications available from Sony or your Sony dealer. You should confirm the the usage of these commands for the specific player you are using.

LaserDisks used with the Standard Smart Brick Brain must be recorded in the CAV format. This allows up to 1/2 hour per side. The Rack Smart Brick Brain supports both CAV and CLV format disks. CLV disks can hold up to 1 hour per side. Not all players will support the commands needed for using CLV disks in an animation control system. The player must be able to position the disk to a frame (and pause on that frame if it is to be used in a multiple LaserDisk installation). Many Sony players can only position to a 'chapter' when playing CLV disks. They can not be used with CLV disks.

The LaserDisk player must be configured for 9600 baud, 8 bit data, and 1 stop bit (4800 baud can also work in some applications). Other data rates can be used, but lower baud rates can't get the data across fast enough for the Brick Brain while a show is running. Whatever the data rate used, you must set the Brick Brain, LaserDisk player, and the terminal or computer you are using to configure the system to the same speed. If parity is used, then you need to set the data word length to 7 bits, and the parity to 'odd'. If parity is used, then you must also set the Brick Brain to recognize 'odd' parity as well. Connections are made as follows:

Sony LaserDisk

<u>DB-25</u>	<u>SIGNAL</u>	<u>SIGNAL FROM/TO BRICK BRAIN</u>
2	DATA OUT	- serial data in to Brick Brain (GREEN)
3	DATA IN	- serial data out from Brick Brain (BLACK)
7	GROUND	signal ground (BLUE or WHITE)
4 to 5	RTS/CTS	connect these two lines
6 to 20	DSR/DTR	connect these two lines

The electrical output from PC·MACs is at RS-422 voltage levels rather than the RS-232 that these LaserDisk players really want to see. If this causes a problem, or if the wire runs between PC·MACs and the LaserDisk player are long, then you may want to add a RS-232 to RS-422 converter to the LaserDisk player.

In general, you send a command to the LaserDisk player as a single ASCII character. The LaserDisk player will then respond that it has received the command with a 'ACK' (0A). When it has completed the task it will sometimes respond with a 'COMPLETION CODE' (01 usually). Each command must be transmitted one at a time, after which you must wait for a return code(s) before you can send any additional commands.

The majority of commands which you might need to use are all pretty simple ones. The one complicated 'search' command is handled transparently to you when you insert a LaserSearch (01) character in the string being sent to the LaserDisk player (the Brick Brain must be told it is running a Sony player in the configuration screen). This string only performs a search for the starting frame of the show on the LaserDisk player. For this reason it is normally followed by a 'F-PLAY' (3A) command in the same string.

A typical start string for a LaserDisk show is:

LaserSearch F-PLAY <ACK> end-o-string

Translated into HEX ASCII, this string becomes (this is what you would enter):

01 3A 8A 00

and it would be displayed on the String Setup Menu as:

01 3A (0A) 00

Notice that after the LaserSearch command we have to then tell the LaserDisk to start playing, and that we tell the Brick Brain to wait until it gets an 'ACK' (0A) back from the LaserDisk player so we know that the command has been accepted. After this we have a '00' to tell the Brick Brain that it has found the end of the string.

A typical end string for a Sony LaserDisk show is:

STILL <ACK> end-o-string

Translated into HEX ASCII, this string becomes (this is what you would enter):

4F 8A 00

and it would be displayed on the String Setup Menu as:

4F (0A) 00

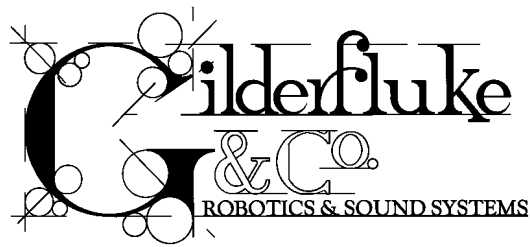
The format of this string is pretty much like that of the startup string, except that there is no need to send the LaserSearch string as was done at the beginning of the show, and the F-PLAY command has been replaced by a STILL command for the LaserDisk player. This freezes the image to whatever the last image on the video disk was. Other commands are available for blanking out the video, ejecting the disk, or a variety of other things. You can even build up a string which will tell the LaserDisk player to search for another frame on the disk and freeze or start playing from that frame. If no command is given to the LaserDisk player at the end of a LaserDisk show, then the player will continue playing along until the end of the disk is reached or another command is received.

The following is a partial listing of the commands supported by Sony LaserDisk players. It is by no means a complete list of all of the commands available to you, but includes those common commands which you may actually need. Not all Sony players support this full range of commands or respond in the same way to the commands sent to them. These particular commands are from a LDP-1500's manual, and so may not be applicable to all Sony players. The values shown are what you would actually enter into the strings.

<u>COMMAND</u>	<u>HEX CHARACTER SENT</u>	<u>POSITIVE RESPONSE</u>
AUDIO MUTE ON ² Stops the audio output from the player.	24	8A
AUDIO MUTE OFF ¹ Enables the audio output from the player.	25	8A
CH-1 ON Turns on Audio output from Channel 1 to 'LEFT' audio output connector.	46	8A
CH-1 OFF Turns off Audio output from CH 1 audio. CH 2 audio will go to both outputs if it is still enabled.	47	8A
CH-2 ON Turns on Audio output from Channel 2 to 'Right' audio output connector.	48	8A
CH-2 OFF Turns off Audio output from CH 2 audio. CH 1 audio will go to both outputs if it is still enabled.	49	8A
CLEAR ALL Stops any ongoing command and puts player into STILL mode.	56	
EJECT ³ Opens the disk compartment. Returns 8A immediately, 83 when task is completed.	2A	8A 83
EJECT ENABLE ² Enables the 'Eject' button on the front of the LaserDisk player.	74	8A
EJECT DISABLE ² Disables the 'Eject' button on the front of the LaserDisk player.	75	8A
F-PLAY Puts the player in normal play mode.	3A	8A
F-STEP and STILL ² Steps the LaserDisk forward by one frame and display still frame.	2B	8A
R-STEP and STILL ² Steps the LaserDisk backwards by one frame and display still frame.	2C	8A
FRAME # MODE Sets the player to 'frame' mode. This is the only mode which will work with the Brick Brain.	55	8A
MOTOR ON Turns the motor on if it is stopped. Returns the first 8A immediately, and the second after the motor is up to speed. Returns one NAK if the motor was already on.	62	8A 8A
MOTOR OFF Turns the motor off if it is running. Returns the first 8A immediately, and the second after the motor has wound down. Returns one NAK if the motor was already off.	63	8A 8A
NAK Code returned when the player doesn't like the command, as in the above two examples.		8B
STILL Sets the player to display a frozen picture.	4F	8A
STOP Stops all video and audio output.	3Fh	8A
VIDEO OFF ² Turns off video output.	26	8A
VIDEO ON ² Turns on video output.	27	8A

² Command not available on all Sony models³ Command not available on all Sony models

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- Panasonic LaserDisk Commands -

Panasonic LaserDisk players are supported on the Rack Smart Brick Brain ONLY. The only player that this code has been tested on as of this writing is the AG-LD-30. Other players from Panasonic are known to have mutually incompatible command formats, and so are not recommended. A full description of the commands can be found in the technical publications available from Panasonic or your Panasonic dealer. You should confirm the the usage of these commands for the specific player you are using.

The Panasonic LaserDisk player only supports disks recorded in the CAV format when used with the Rack Smart Brick Brain. This allows up to 1/2 hour per side.

The Panasonic LaserDisk player must be configured for 9600 baud, 8 bit data, and 1 stop bit (4800 baud might also work in some applications). Other data rates can be used, but lower baud rates can't get the data across fast enough for the Brick Brain while a show is running. Whatever the data rate used, you must set the Brick Brain, LaserDisk player, and the terminal or computer you are using to configure the system to the same speed. If parity is used, then you need to set the data word length to 7 bits, and the parity to 'odd'. You must also set the Brick Brain to recognize 'odd' parity as well. Connections are made as follows:

Panasonic LaserDisk

<u>DB-15</u>	<u>SIGNAL</u>	<u>SIGNAL FROM/TO BRICK BRAIN</u>
2	DATA OUT	- serial data in to Brick Brain (GREEN)
3	DATA IN	- serial data out from Brick Brain (BLACK)
1, 11 or 15	GROUND	signal ground (BLUE or WHITE)

The electrical output from PC·MACs is at RS-422 voltage levels rather than the RS-232 that these LaserDisk players really want to see. If this causes a problem, or if the wire runs between PC·MACs and the LaserDisk player are long, then you may want to add a RS-232 to RS-422 converter to the LaserDisk player.

In general, you send a command to the LaserDisk player as a very long series of characters. This consists of the command lead-in character (02h), the command to be sent, and finally the command lead-out character (03h). When it has completed the task the LaserDisk player will respond with an 'ACK' (06h), the command lead-in character (02h), the command which was sent, and finally the command lead-out character (03h). Multiple commands can be combined on a single line, separated by a semi-colon (;). The player will not always process the commands and echo them in the order in which you sent them, so you must test any multiple command you might want to use thoroughly. We recommend you only use the default string #5 (the start string) and #7 (the end string) when working with Panasonic LaserDisk Players.

The majority of commands which you might need to use are all pretty simple ones. The one complicated 'search' command is handled transparently to you when you insert a LaserSearch (01) character in the string being sent to the LaserDisk player (the Brick Brain must be told it is running a Panasonic player in the configuration screen). This string only performs a search for the starting frame of the show on the LaserDisk player. For this reason it is normally followed by a 'OPL' (play) command in the same string.

A typical start string for a Panasonic LaserDisk show is:

LaserSearch Lead-in Play Lead-out (ACK) (Lead-in) (Play) (Lead-out) end-o-string

Translated into HEX ASCII, this string becomes (this is what you would enter):

01h 02h 4Fh 50h 4Ch 03h 86h 82h CFh D0h CCh 83h 00h

and it would be displayed on the String Setup Menu as:

01 02 4F 50 4C 03 (06) (02) (4F) (50) (4C) (03) 00

Notice that after the LaserSearch command we have to then tell the LaserDisk to start playing, and that we tell the Brick Brain to wait until it gets all of the echoed characters back from the LaserDisk player so we know that the command has been accepted. After this we have a '00' to tell the Brick Brain that it has found the end of the string.

A typical end string for a Panasonic LaserDisk show is:

Lead-in Pause Lead-out (ACK) (Lead-in) (Pause) (Lead-out) end-o-string

Translated into HEX ASCII, this string becomes (this is what you would enter):

02h 4Fh 50h 41h 03h 86h 82h CFh D0h C1h 83h 00h

and it would be displayed on the String Setup Menu as:

02 4F 50 41 03 (06) (02) (4F) (50) (41) (03) 00

The format of this string is pretty much like that of the startup string, except that there is no need to send the LaserSearch string as was done at the beginning of the show, and the Play command has been replaced by a Pause command for the LaserDisk player. This freezes the image to whatever the last image on the video disk was. Other commands are available for blanking out the video, ejecting the disk, or a variety of other things. You can even build up a string which will tell the LaserDisk player to search for another frame on the disk and freeze or start playing from that frame. If no command is given to the LaserDisk player at the end of a LaserDisk show, then the player will continue playing along until the end of the disk is reached or another command is received.

<u>COMMAND</u>	<u>HEX CHARACTER SENT</u>	<u>POSITIVE RESPONSE</u>
PLAY (OPL) Starts the player advancing at normal play speed.	02h 4Fh 50h 4Ch 03h	86h 82h CFh D0h CCh 83h
PAUSE (OPA) Stops the playback without turning off the spindle motor. Displays a blank screen.	02h 4Fh 50h 41h 03h	86h 82h CFh D0h C1h 83h
EJECT (OEJ) Stops the playback and spits out the LaserDisk. A blank screen is displayed.	02h 4Fh 45h 4Ah 03h	86h 82h CFh C5h CAh 83h
STOP (OSP) Stops the playback, turns off the spindle motor and blanks the screen.	02h 4Fh 53h 50h 03h	86h 82h CFh D3h D0h 83h
STILL (OTL) Stops the playback at the current frame.	02h 4Fh 54h 4Ch 03h	86h 82h CFh D4h CCh 83h

I lied.

- HEXadecimal to Decimal to Percentage -

The following chart shows decimal, HEXadecimal, and a few percentage equivalents to aid you when you need to convert between numbering bases:

decimal	HEX	ASCII	%	decimal	HEX	ASCII	%	decimal	HEX	ASCII	%	decimal	HEX	ASCII	%
00	00	null	0	64	40	@	25%	128	80	(null)	50%	192	C0	(@)	75%
1	01	soh/^A		65	41	A		129	81	(soh)		193	C1	(A)	
2	02	stx/^B		66	42	B		130	82	(stx)		194	C2	(B)	
3	03	etx/^C		67	43	C		131	83	(etx)		195	C3	(C)	
4	04	eot/^D		68	44	D		132	84	(eot)		196	C4	(D)	
5	05	eng/^E		69	45	E		133	85	(eng)		197	C5	(E)	
6	06	ack/^F		70	46	F		134	86	(ack)		198	C6	(F)	
7	07	bell/^G		71	47	G		135	87	(bell)		199	C7	(G)	
8	08	bs/^H		72	48	H		136	88	(bs)		200	C8	(H)	
9	09	ht/^I		73	49	I		137	89	(ht)		201	C9	(I)	
10	0A	lf/^J		74	4A	J		138	8A	(lf)		202	CA	(J)	
11	0B	vt/^K		75	4B	K		139	8B	(vt)		203	CB	(K)	
12	0C	ff/^L		76	4C	L		140	8C	(ff)		204	CC	(L)	
13	0D	cr/^M		77	4D	M		141	8D	(cr)		205	CD	(M)	
14	0E	so/^N		78	4E	N		142	8E	(so)		206	CE	(N)	
15	0F	si/^O		79	4F	O		143	8F	(si)		207	CF	(O)	
16	10	dle/^P		80	50	P		144	90	(cls)		208	D0	(P)	
17	11	dc1/^Q		81	51	Q		145	91	(dc1)		209	D1	(Q)	
18	12	dc2/^R		82	52	R		146	92	(dc2)		210	D2	(R)	
19	13	dc3/^S		83	53	S		147	93	(dc3)		211	D3	(S)	
20	14	dc4/^T		84	54	T		148	94	(dc4)		212	D4	(T)	
21	15	nak/^U		85	55	U		149	95	(nak)		213	D5	(U)	
22	16	syn/^V		86	56	V		150	96	(syn)		214	D6	(V)	
23	17	etb/^W		87	57	W		151	97	(etb)		215	D7	(W)	
24	18	can/^X		88	58	X		152	98	(can)		216	D8	(X)	
25	19	em/^Y		89	59	Y		153	99	(em)		217	D9	(Y)	
26	1A	sub/^Z		90	5A	Z		154	9A	(sub)		218	DA	(Z)	
27	1B	ESC		91	5B	[		155	9B	(ESC)		219	DB	([)	
28	1C	FS		92	5C	\		156	9C	(FS)		220	DC	(\)	
29	1D	GS		93	5D	]		157	9D	(GS)		221	DD	(])	
30	1E	RS		94	5E	^		158	9E	(RS)		222	DE	(^)	
31	1F	VS		95	5F	_		159	9F	(VS)		223	DF	(_)	
32	20	SP	12.5%	96	60	`	37.5%	160	A0	(SP)	62.5%	224	E0	(`)	87.5%
33	21	!		97	61	a		161	A1	(!)		225	E1	(a)	
34	22	"		98	62	b		162	A2	(")		226	E2	(b)	
35	23	#		99	63	c		163	A3	(#)		227	E3	(c)	
36	24	\$		100	64	d		164	A4	(\$)		228	E4	(d)	
37	25	%		101	65	e		165	A5	(%)		229	E5	(e)	
38	26	&		102	66	f		166	A6	(&)		230	E6	(f)	
39	27	'		103	67	g		167	A7	(')		231	E7	(g)	
40	28	(		104	68	h		168	A8	((		232	E8	(h)	
41	29	)		105	69	i		169	A9	(i)		233	E9	(i)	
42	2A	*		106	6A	j		170	AA	(*)		234	EA	(j)	
43	2B	+		107	6B	k		171	AB	(+)		235	EB	(k)	
44	2C	,		108	6C	l		172	AC	(,)		236	EC	(l)	
45	2D	-		109	6D	m		173	AD	(-)		237	ED	(m)	
46	2E	.		110	6E	n		174	AE	(.)		238	EE	(n)	
47	2F	/		111	6F	o		175	AF	(/)		239	EF	(o)	
48	30	0		112	70	p		176	B0	(0)		240	F0	(p)	
49	31	1		113	71	q		177	B1	(1)		241	F1	(q)	
50	32	2		114	72	r		178	B2	(2)		242	F2	(r)	
51	33	3		115	73	s		179	B3	(3)		243	F3	(s)	
52	34	4		116	74	t		180	B4	(4)		244	F4	(t)	
53	35	5		117	75	u		181	B5	(5)		245	F5	(u)	
54	36	6		118	76	v		182	B6	(6)		246	F6	(v)	
55	37	7		119	77	w		183	B7	(7)		247	F7	(w)	
56	38	8		120	78	x		184	B8	(8)		248	F8	(x)	
57	39	9		121	79	y		185	B9	(9)		249	F9	(y)	
58	3A	:		122	7A	z		186	BA	(:)		250	FA	(z)	
59	3B	;		123	7B			187	BB	(;)		251	FB	(;)	
60	3C	<		124	7C			188	BC	(<)		252	FC	(<)	
61	3D	=		125	7D	|		189	BD	(=)		253	FD	(=)	
62	3E	>		126	7E	~		190	BE	(>)		254	FE	(~)	
63	3F	?		127	7F	del		191	BF	(/)		255	FF	(del)	100%