GILDERFLUKE & CO. · 205 SOUTH FLOWER ST. · BURBANK, CALIF. 91502-2102 · 818/840-9484 · FAX 818/840-9485

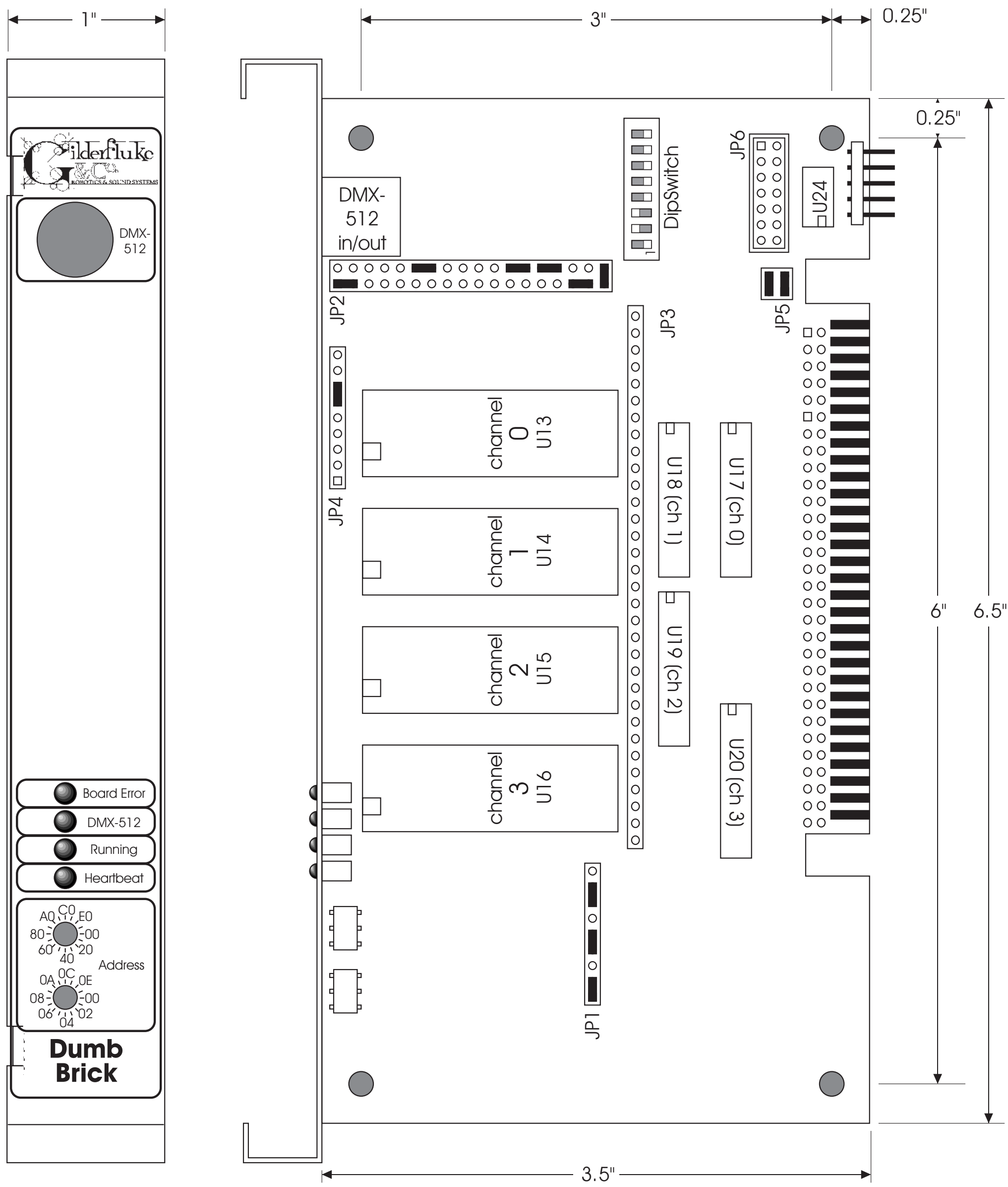
- Operating Instructions -

- for the -

- Micro MACs Brick System-

June 19, 1999

The Micro MACs Brick System is a modular Animation Control System which consists of any number of Micro MACs Bricks. Since the number of Micro MACs Bricks is unlimited, Animation Control Systems of any size can be assembled.



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- Micro MACs Brick Animation Control Systems Overview -

The **Micro MACs Brick Animation Control Systems** are the simplest Animation Control Systems offered by Gilderfluke & Company. They are used where ever you need an Animation Control System that will run continuously or when started by an external trigger. Typical applications are in rides and attractions where the vehicle entering the scene triggers the animation. At the end of the animation sequence, the Animation Control System will stop and wait for the next vehicle to enter the scene.

Micro MACs Bricks are available as record/playback or playback-only Animation Control Systems. All record/playback Bricks and many playback-only Bricks come in a case along with a power supply. These are complete Animation Control Systems which require only power to run.

Micro MACs Bricks are also available as card cage mounted playback-only cards. These can be plugged into one of the many card cages available from Gilderfluke & Company. They can also be mounted to a panel on screw standoffs and connected using a sixty position edge connector if you don't want to use a card cage.

The Micro MACs 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 prewire an entire attraction. The only field wiring needed is a wire to connect the figures to their trigger sources (if any). This also allows you to bring along a figure's Animation Control System with the figure when it is removed for maintenance. The figure can then be run on your service bench for testing and adjustment.

Standard Micro MACs 'Bricks' are commonly referred to as 'Dumb Bricks' to differentiate them from the 'Smart' Bricks in our Smart Brick Animation Control Systems. If you need to lock to a LaserDisk or Smpte Time Code, or if you need to randomly access many shows, we recommend you use our Smart Brick Animation Control Systems.

Record/Playback Micro MACs Bricks store the animation data in 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 Micro MACs Brick is plugged in, and should hold the data safe for years even when no power is applied. A keyswitch on the front of each record/playback Micro MACs Brick keeps down the possibility of accidental or unauthorized tampering with recorded show data.

Playback-only Micro MACs 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. This 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.

Playback-only Micro MACs Brick Animation Control Systems are programmed using a record/playback Animation Control system that is used only until the show programming is completed. In the past, one or more Record/Playback Micro MACs Bricks has often been used for programming shows. Once programmed, the data is downloaded to a computer and burnt into the Eproms using a Micro Console. Most shows now use a PC·MACs Animation Control System for programming. Many simple shows can even be programmed just by 'drawing' the animation sequence on the screen of any PC. No special hardware is required.

- Inputs and Outputs -

Each Micro MACs Brick can control up to four 8 bit channels. These can be used as thirty-two on/off 'digital' controls, as four eight bit wide analog channels, or as any combination of the two. If one Micro MACs Brick doesn't have enough outputs, you simply add more, stacking them until you have enough outputs to do your job. Analog resolutions greater than eight bits can easily be achieved by combining the outputs from more than a single channel.

Each Micro MACs Brick features four optically isolated inputs and one optically isolated status output. The four inputs are used as follows. The colors correspond to those found in six conductor 'modular' telephone wire:

A) Green 'Start' Input
B) Red 'Stop' Input
C) White 'Reset' Input
D) Blue 'External Clock' or 'Double Show' Input

The Yellow 'Running Status' output is active whenever the Brick has been Started. These Inputs and Outputs can be configured to use the same power supply as the rest of the Brick, or an external power supply can be used.

- DMX-512 Input -

The DMX-512 standard was developed by the United States Institute for Theatrical Technology (USITT) for a high speed (250 KBaud asynchronous) serial link. Although it was originally designed for controlling light dimmers, it is now supported by hundreds of suppliers throughout the world for controlling all kinds of theatrical equipment.

Playback-only Micro MACs Bricks are available which will receive DMX-512 data directly. This is the high speed serial data that PC·MACs outputs. This allows data from a PC·MACs system to be sent directly to a Micro MACs Brick System. Typically Bricks with the DMX-512 capability are used only during programming. They are replaced by other bricks once programming is completed.

Even though the DMX-512 standard calls for 512 channels of data, the DMX transmission from PC·MACs is limited to 256 eight bit wide channels. You can address DMX - capable Micro MACs Brick to respond to any address between 0 and 255. Addresses above the 256th are used in PC·MACs for transmitting a checksum. All Gilderfluke & Company DMX-512 compatible equipment can use this to verify that the data received from PC·MACs has no transmission errors in it. If you address a light dimmer or other DMX-512 device to addresses 256 or 257, you will see this verification data displayed as a flickering pattern.

- Time Bases -

Micro MACs Bricks can run from their own onboard crystal controlled time base at 15, 16, 30, or 32 frames per second[1] . If different frame rates are required, an external clock can be fed to Micro MACs Bricks. The Micro MACs Bricks will accept external clock rates from zero to approximately 1000 frames per second.

[1] Other frame rates are available as special orders.

- Show Capacity -

The Show length that can be stored on a Micro MACs Brick is only limited by the size of the memory installed and the number of updates per second you are using. With the largest Eproms you have a potential capacity of almost ten hours at 30 FPS. Record/Playback Micro MACs Bricks are available with either 16K (16,384 frames) or 64K (65,536) capacities.

Memory	# frames	15 FPS	16 FPS	30 FPS	32 FPS
27C32	4096	4.6 min.	4.3 min.	2.3 min.	2.1 min.
27C64	8192	9.1 min.	8.5 min.	4.6 min.	4.3 min.
27C128	16,384	18.2 min.	17.1 min.	9.1 min.	8.5 min.
27C256	32,768	36.4 min.	34.1 min.	18.2 min.	17.1 min.
27C512	65,536	72.8 min.	68.3 min.	36.4 min.	34.1 min.
27C010	131,072	145.6 min.	136.5 min.	72.8 min.	68.3 min.
27C020	262,144	291.3 min.	273.1 min.	145.6 min.	136.5 min.
27C040	524,288	582.5 min.	546.1 min.	291.3 min.	273.1 min.
27C080	1,048,576	1165.1 min.	1092.3 min.	582.5 min.	546.1 min.

- Micro MACs Brick Jumper Configuration -

The majority of the configuration for the Micro MACs Bricks is done on an eight position Dipswitch. The exceptions to this are those jumpers which set:

A) size and type of memory used
B) internal/external clock source and frame rate
C) Internal/External power for the J-8 Optoisolated inputs
D) Stop and/or end of memory jumpers needed in some configurations
E) Double show configuration (if used)

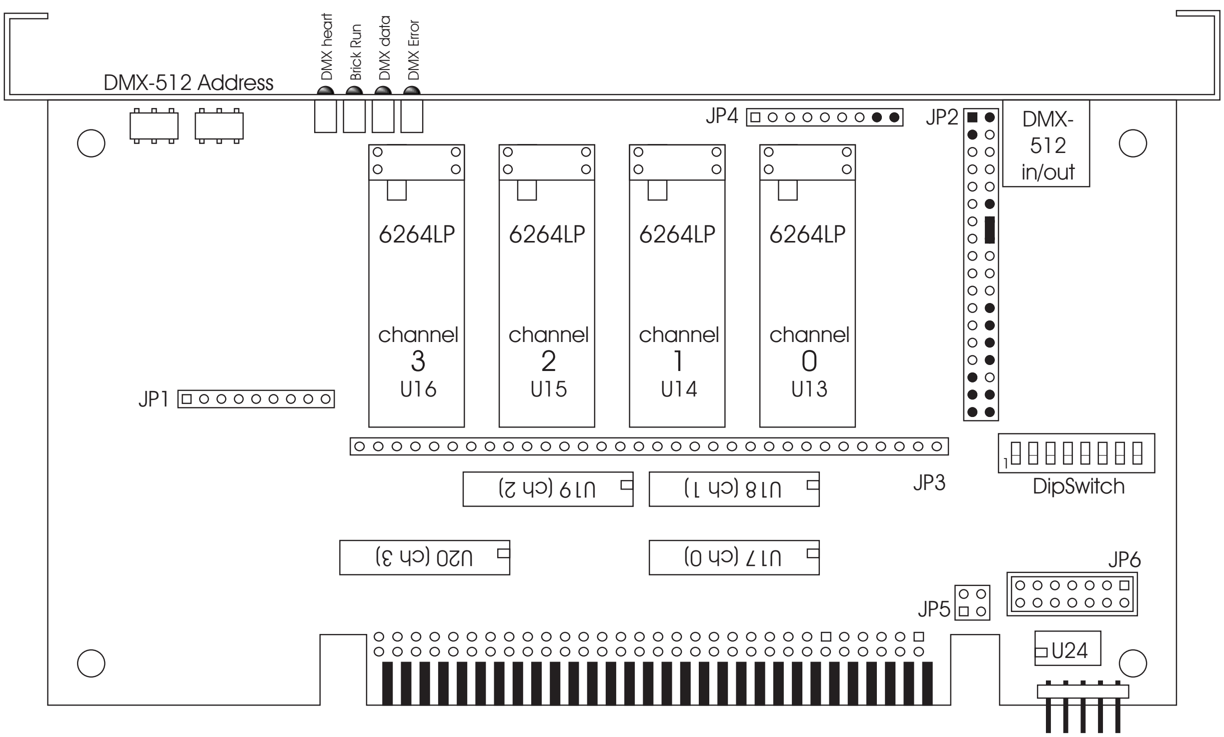
In all the following drawings, the jumper pins are shown as circles contained within an outline of the header assembly. Pins that are used for a given configuration are shown as filled-in, while those which remain hollow are not being used. The jumper plugs (used for connecting adjacent pins) or wires (used for connecting pins that 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 Micro MACs Brick you are configuring.

- Memory Configuration -

The type of memory to be used is set on JP2 and JP4. These jumpers must be set before you install your memory chips and power up the Micro MACs Brick. You shouldn't change any of the jumpers on the other headers when this setting is changed.

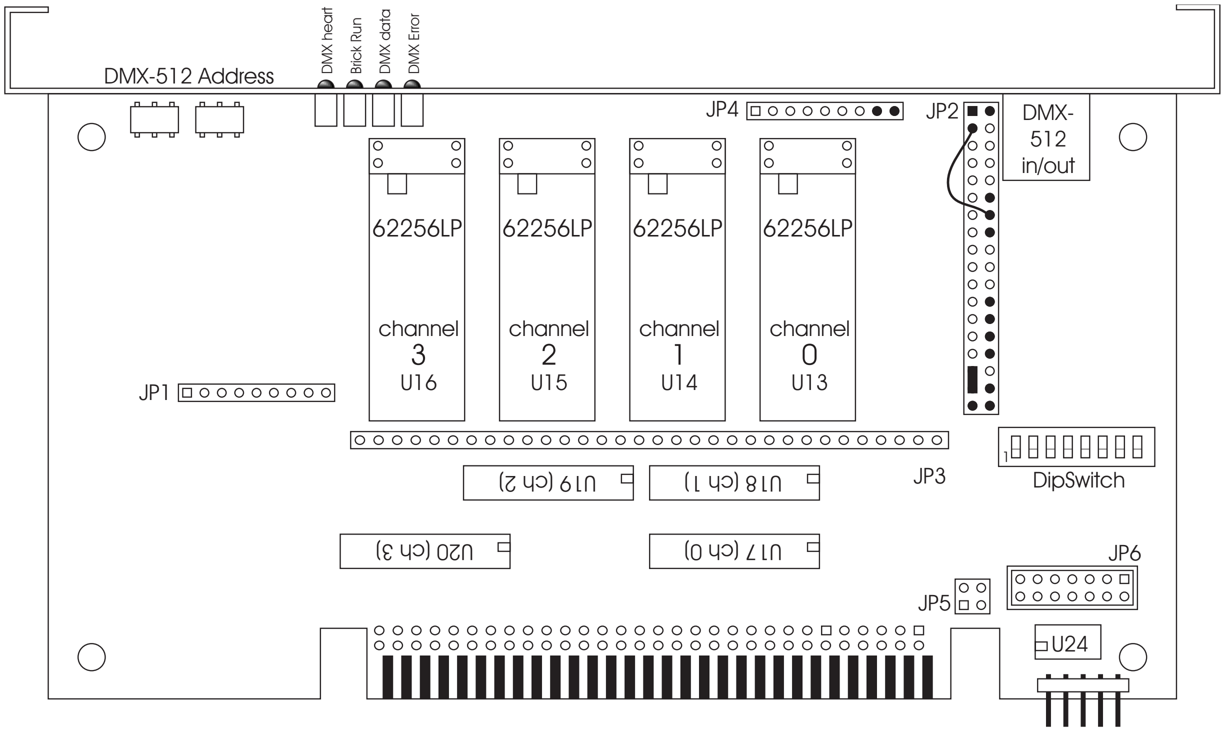
- 6264LP Ram -

To configure a Record/Playback Micro MACs Brick for use with 6264LP static Ram Chips for a capacity of 16,384 (16K) frames. The RAM chips must be 'South' justified, leaving four unused holes at the top of each socket.



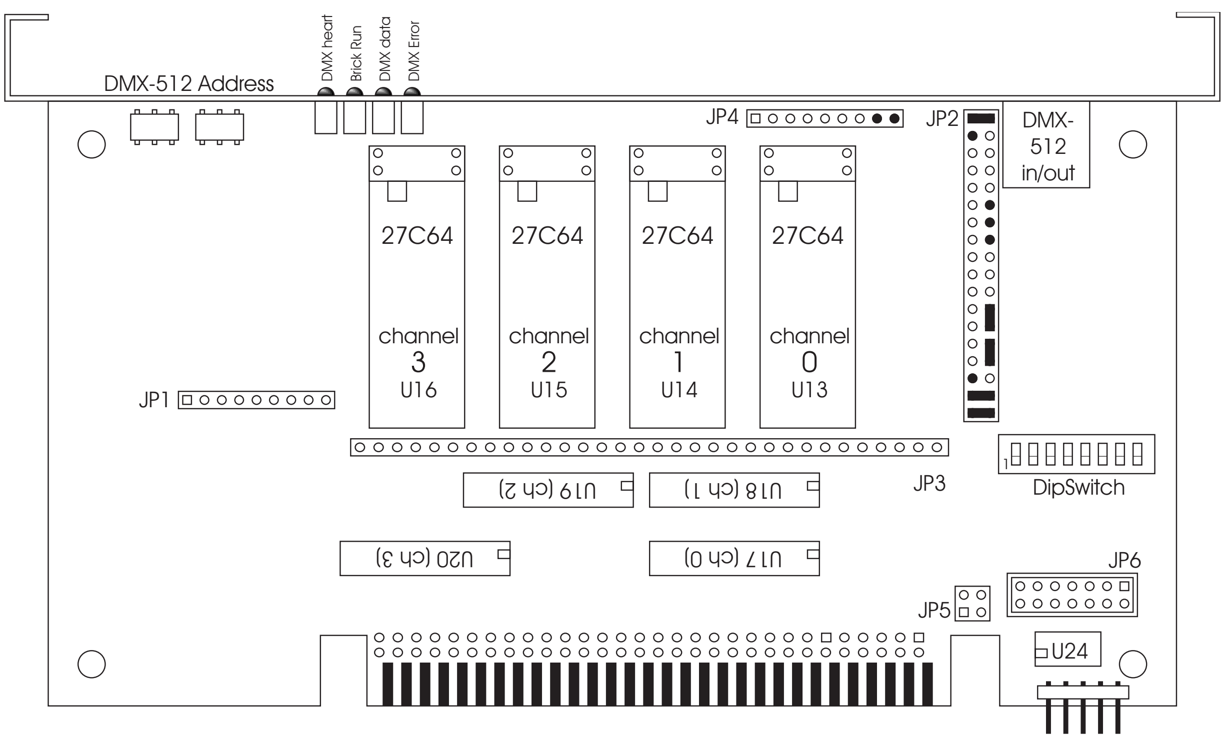
- 62256LP Ram -

To configure a Record/Playback Micro MACs Brick for use with 62256LP static Ram Chips for a capacity of 65,536 (64K). This is the only memory configuration which requires a wire wrapped jumper between two pins. The RAM chips must be 'South' justified, leaving four unused holes at the top of each socket.



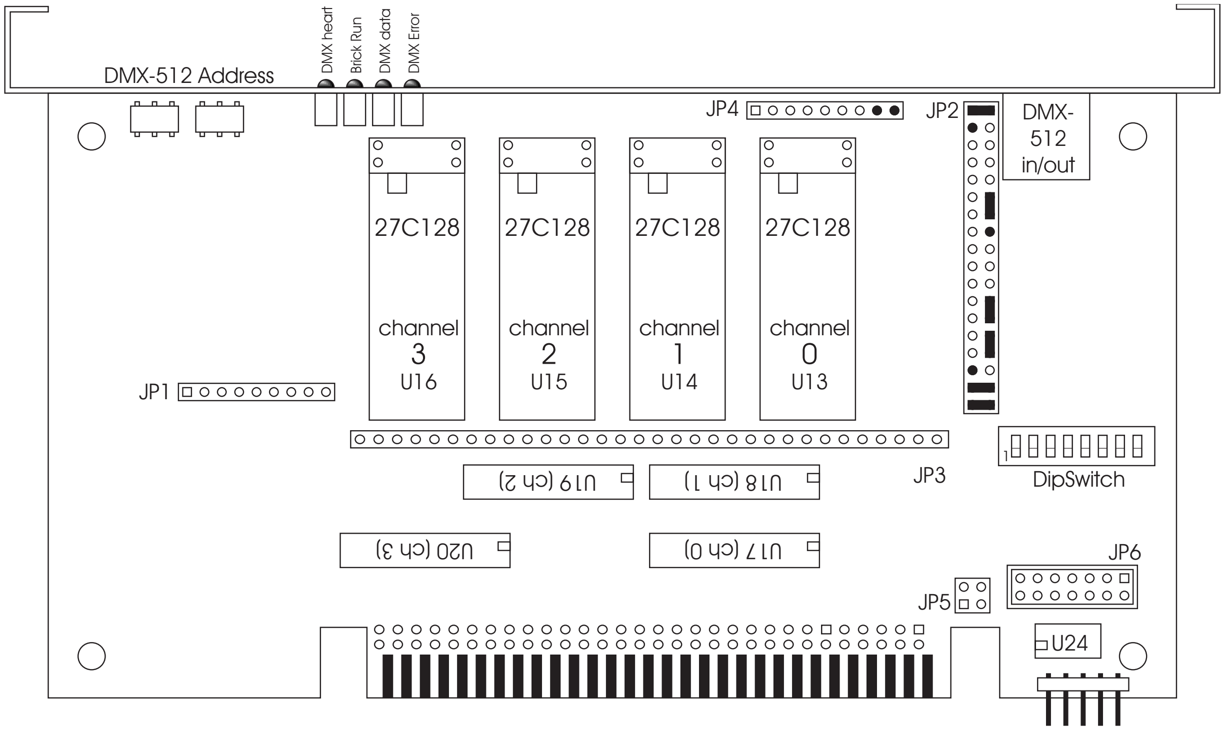
- 27C64 Eprom -

To configure a Playback-only Micro MACs Brick for use with 27C64 Eprom for a capacity of 8192 (8K) frames. The Eprom chips must be 'South' justified, leaving four unused holes at the top of each socket.



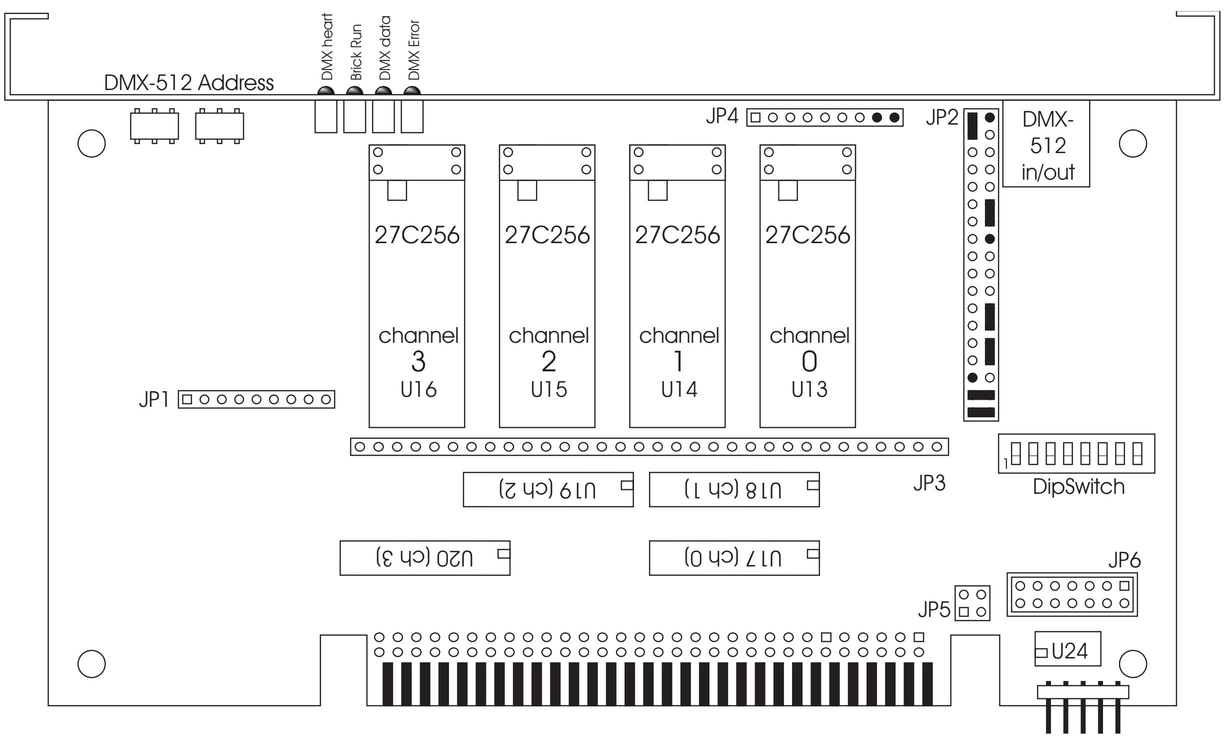
- 27C128 Eprom -

To configure a Playback-only Micro MACs Brick for use with 27C128 Eprom for a capacity of 16,384 (16K) frames. The Eprom chips must be 'South' justified, leaving four unused holes at the top of each socket.



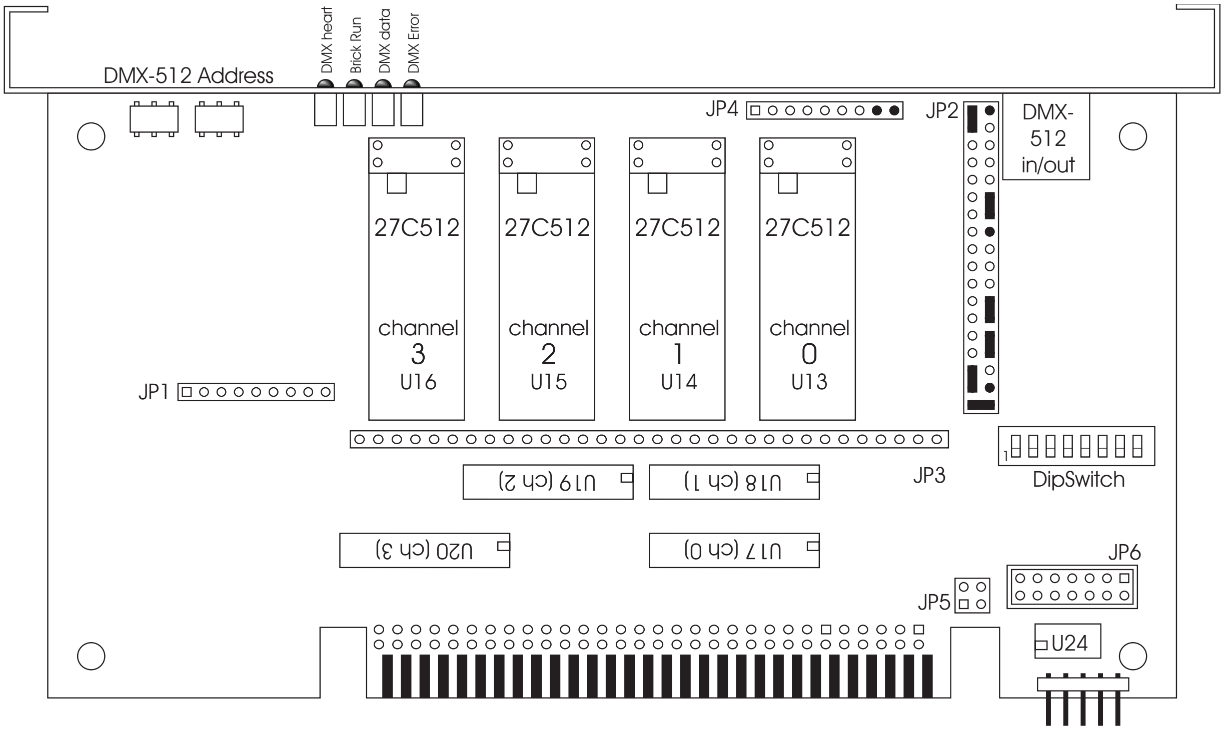
- 27C256 Eprom -

To configure a Playback-only Micro MACs Brick for use with 27C256 Eprom for a capacity of 32,768 (32K) frames. The Eprom chips must be 'South' justified, leaving four unused holes at the top of each socket.



- 27C512 Eprom -

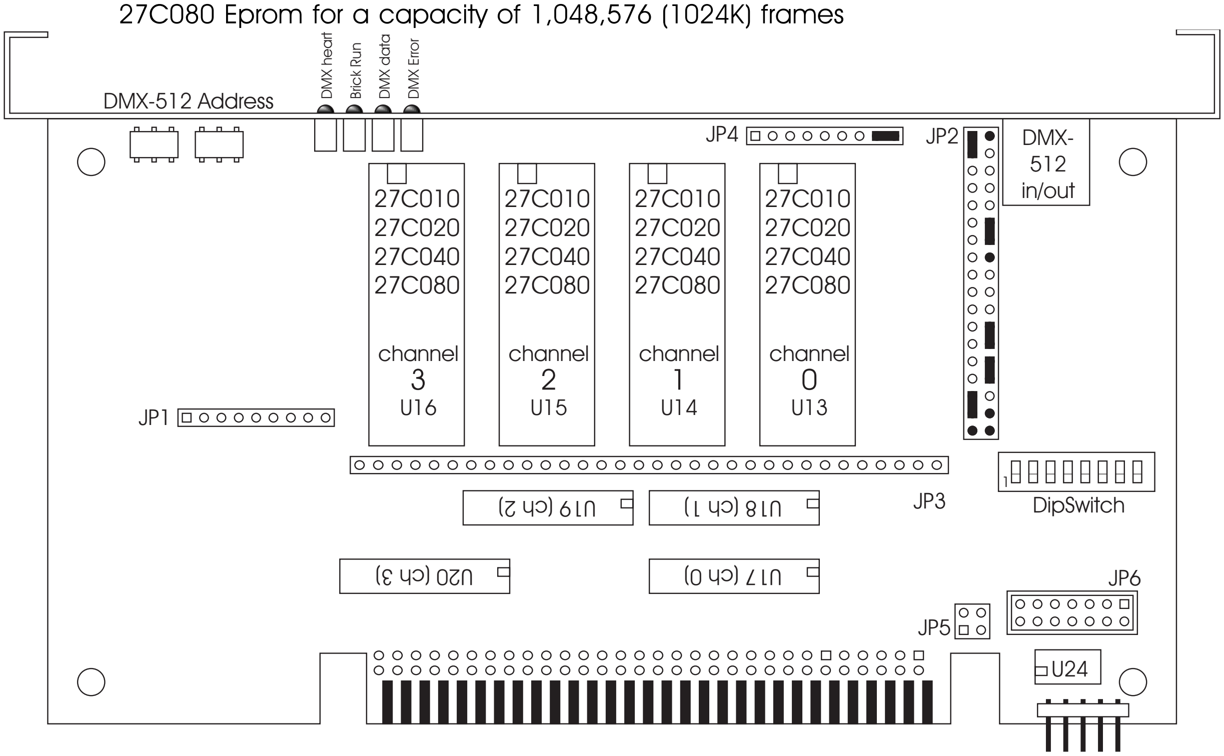
To configure a Playback-only Micro MACs Brick for use with 27C512 Eprom for a capacity of 65,536 (64K) frames The Eprom chips must be 'South' justified, leaving four unused holes at the top of each socket.



- 27C010, 27C020, 27C040 OR 27C080 Eprom -

To configure a Playback-only Micro MACs Brick for use with:

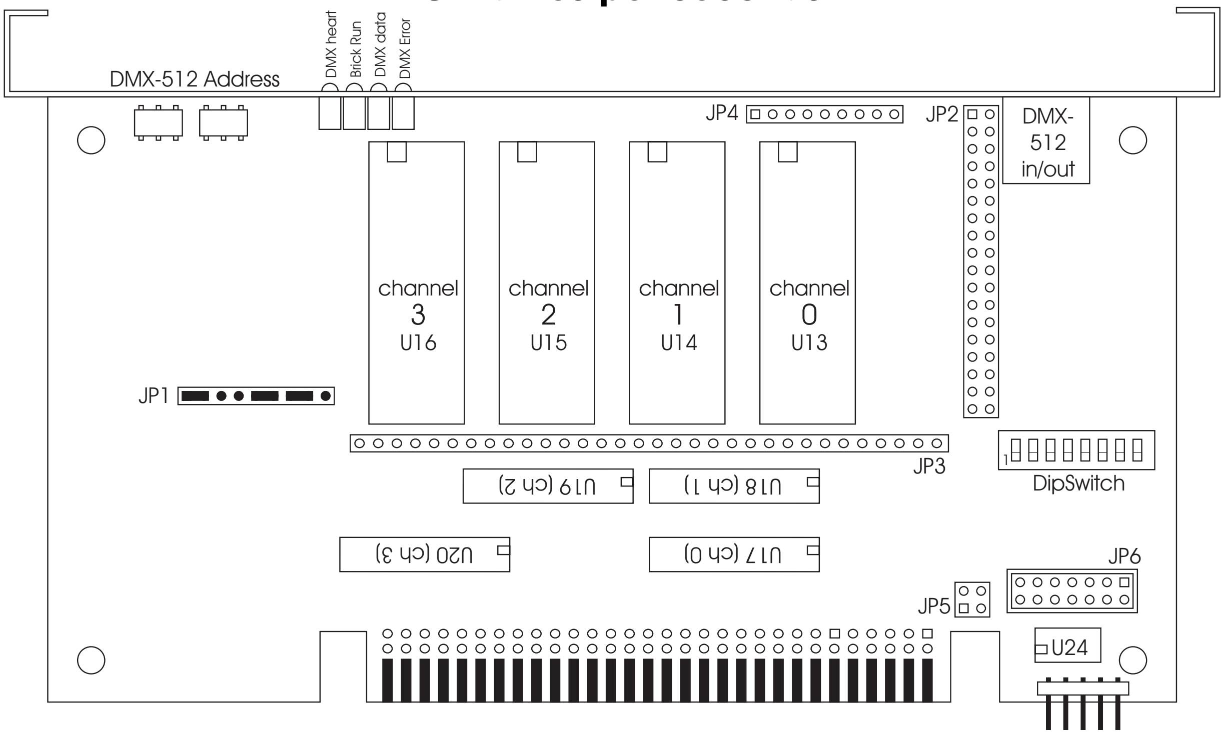
27C010 Eprom for a capacity of 131,072 (128K) frames
27C020 Eprom for a capacity of 262,144 (256K) frames
27C040 Eprom for a capacity of 524,288 (512K) frames
27C080 Eprom for a capacity of 1,048,576 (1024K) frames



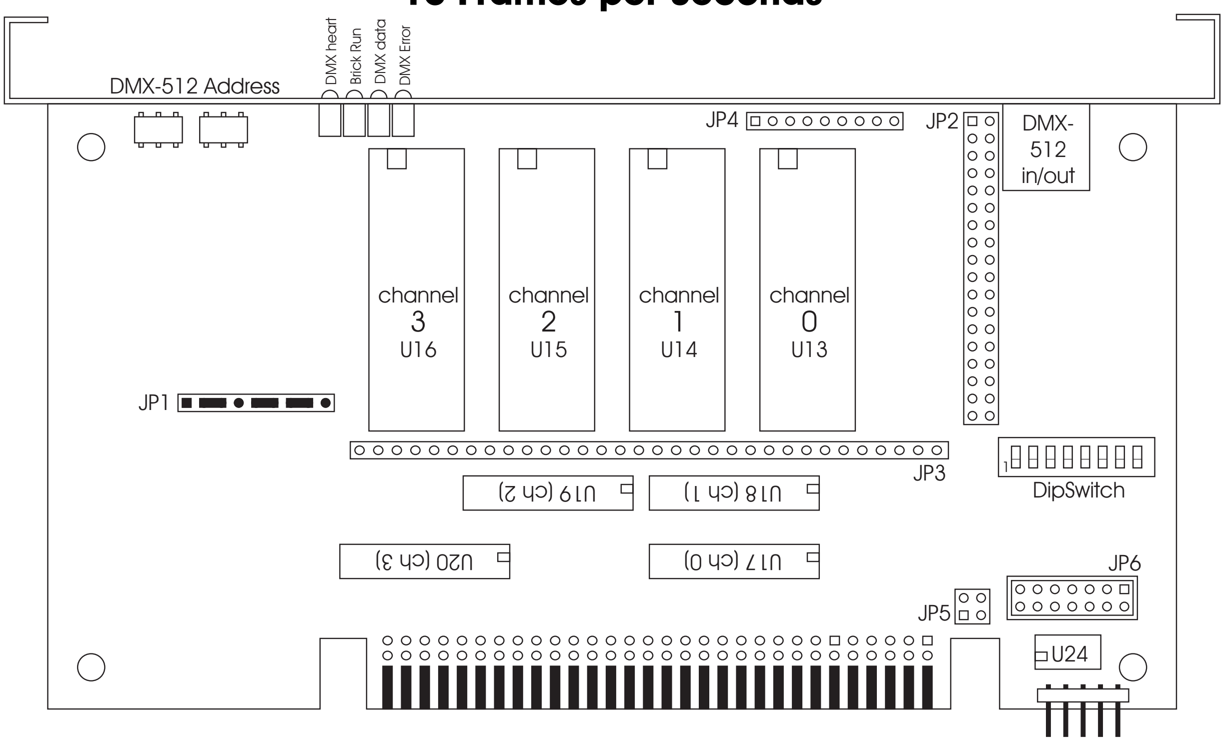
- Clock Rate Configuration -

The clock source and frame rate are set on JP1. If the standard frame rates are not to your liking, other frame rates may be available from the Gilderfluke & Company factory. You shouldn't change any of the jumpers on the other headers when this setting is changed.

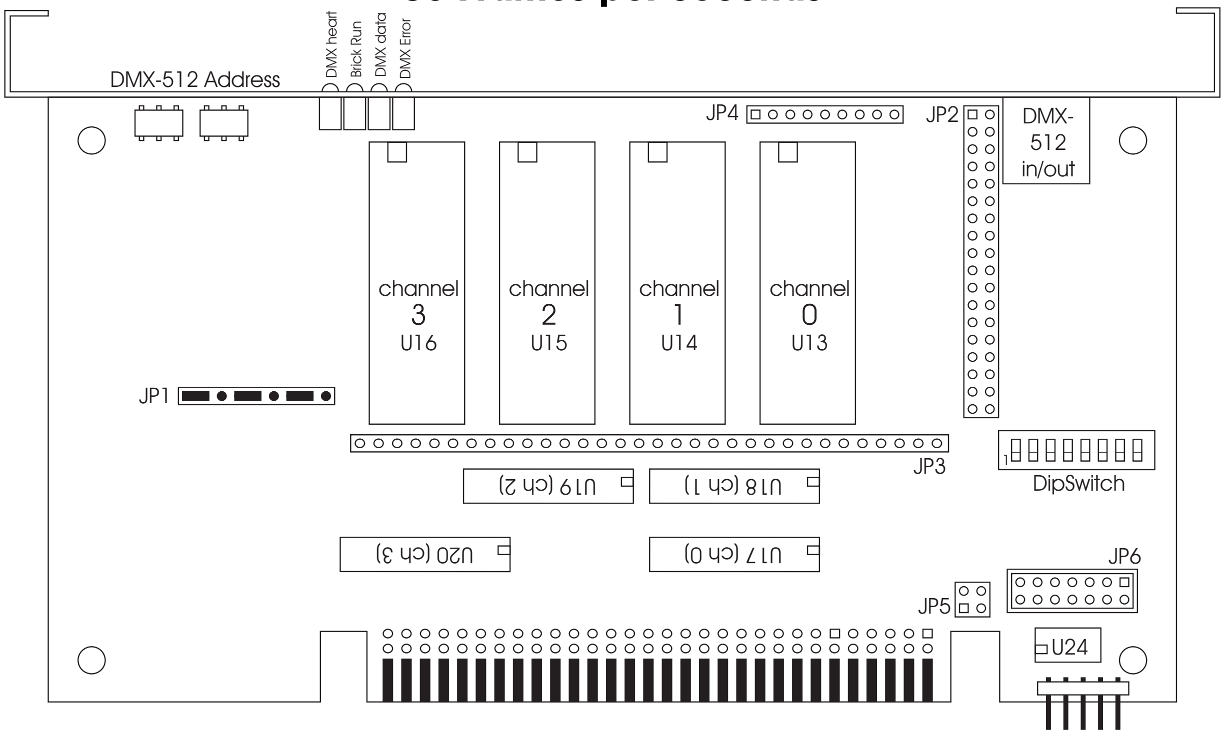
- 15 Frames per Seconds -



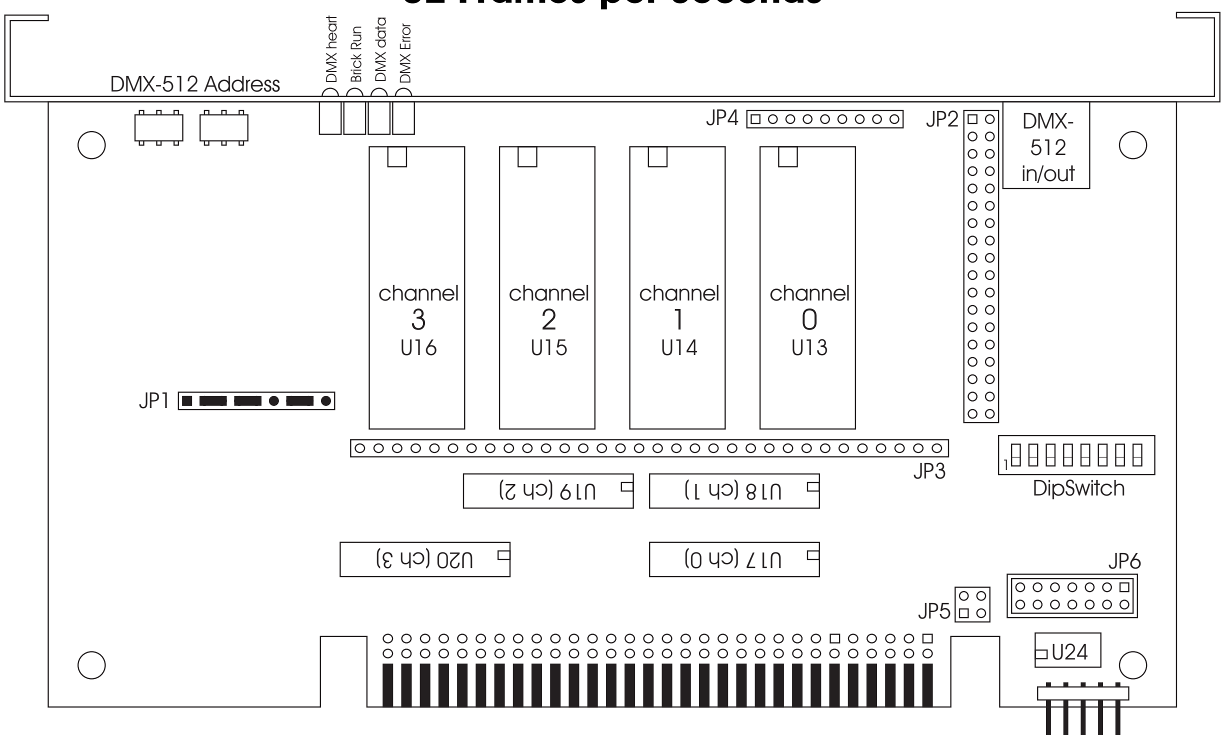
- 16 Frames per Seconds -



- 30 Frames per Seconds -

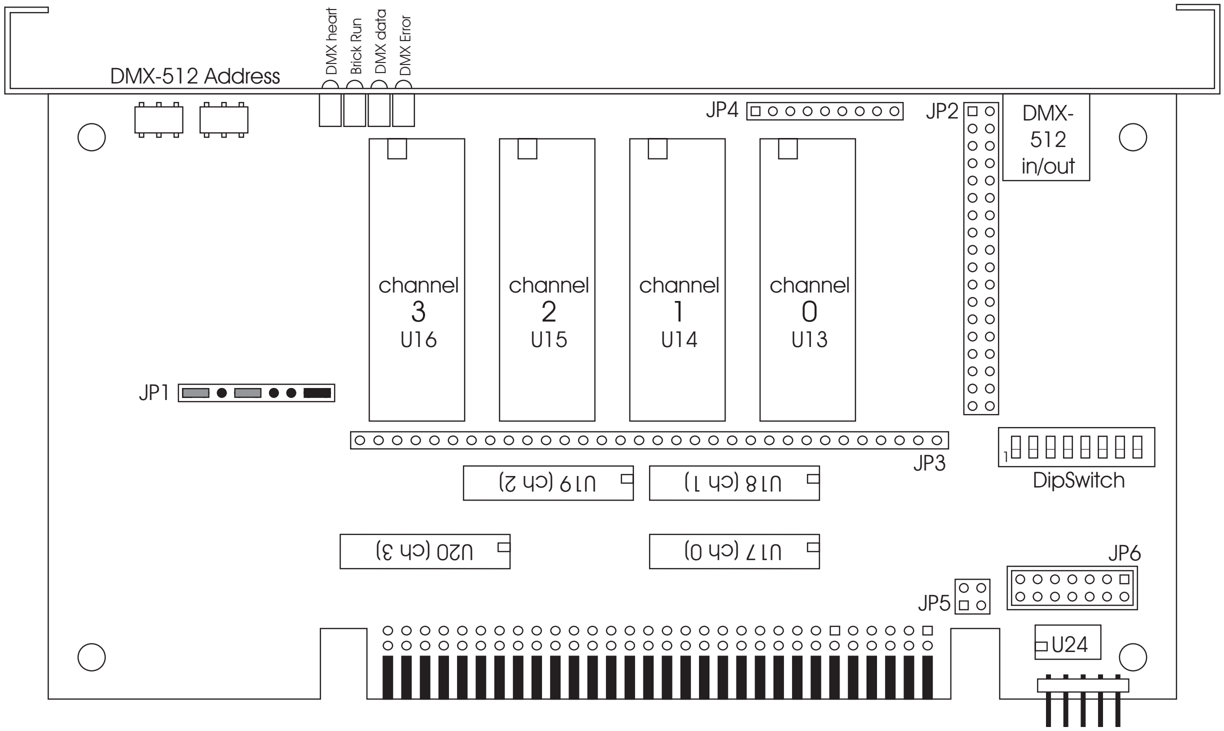


- 32 Frames per Seconds -



- External Clock -

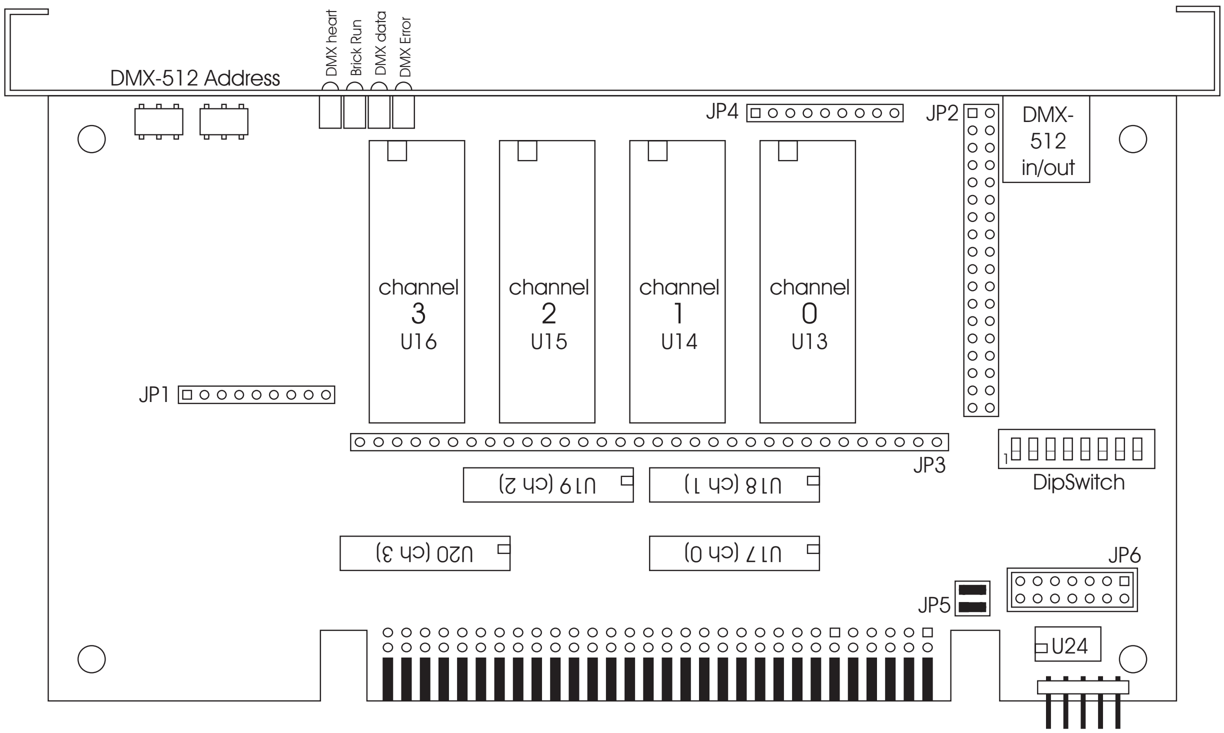
The internal clock is incompatible with the double show configuration. They both use the Blue Input.



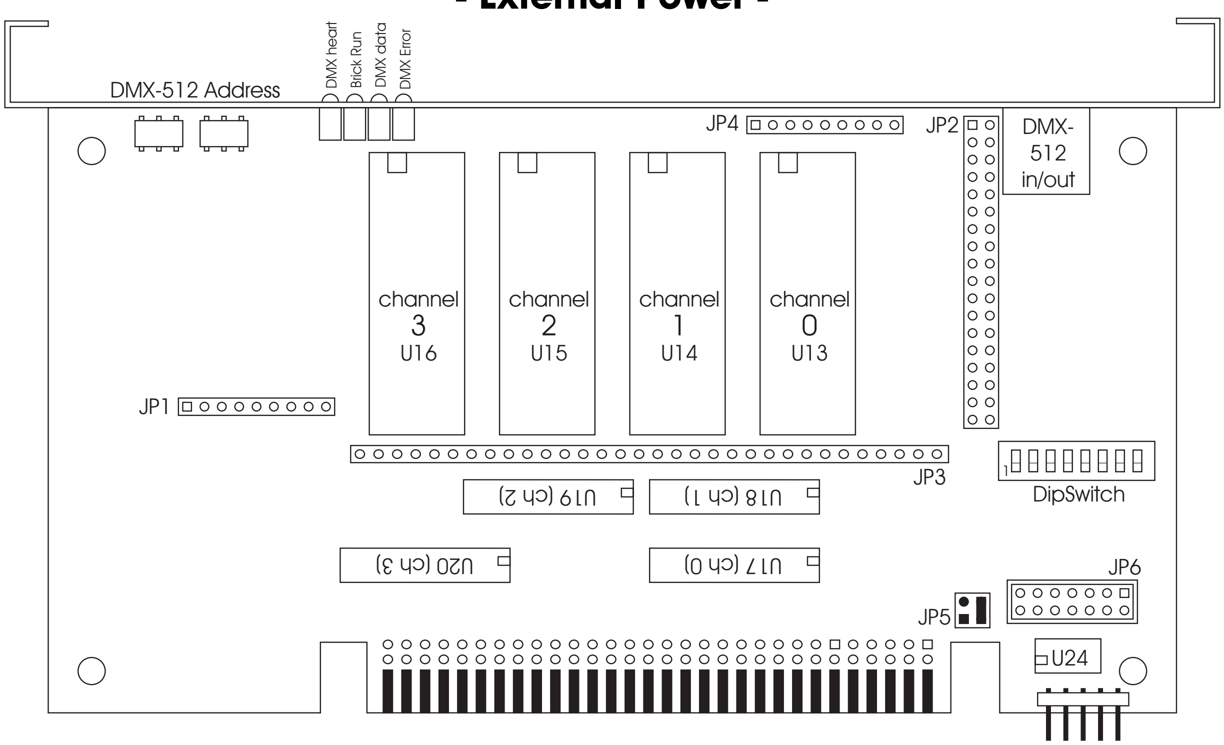
- J8 Power -

The source of power used for the J8 input/output is set using two jumpers on JP5. External power should be selected whenever possible. You shouldn't change any of the jumpers on the other headers when this setting is changed.

- Internal Power -



- External Power -



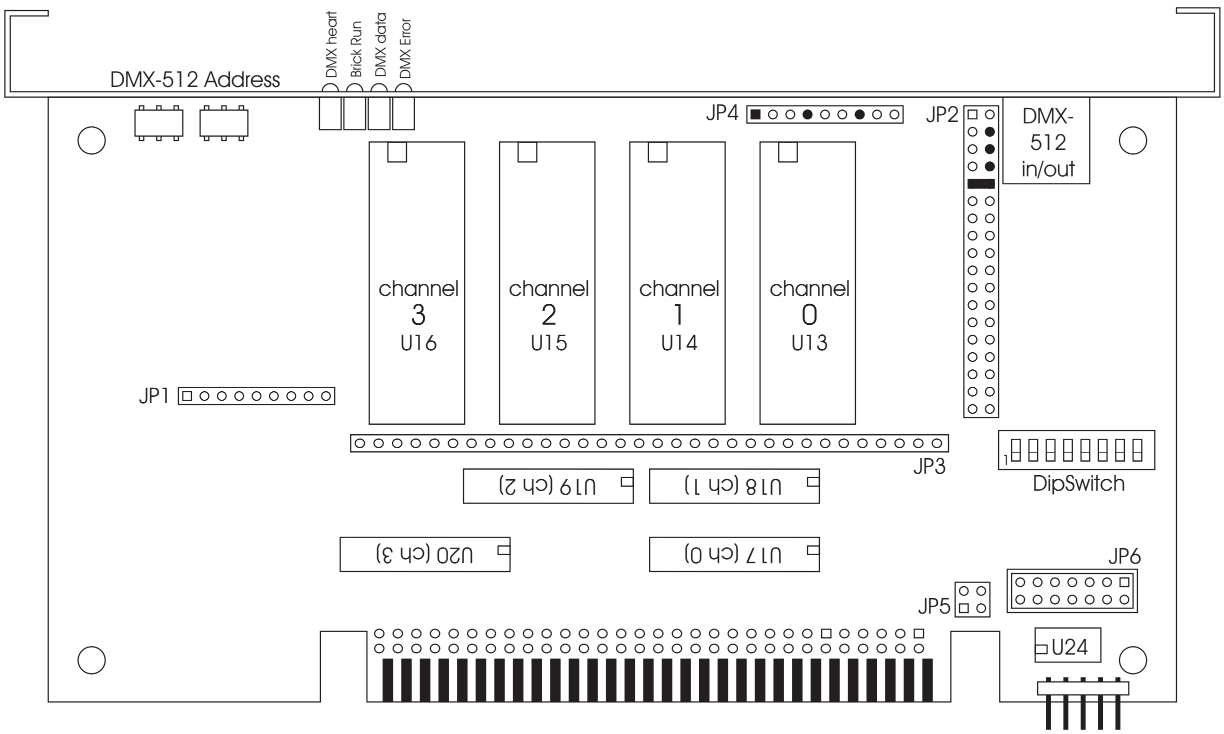
- Stop or End of Memory Flag -

The Micro MACs Brick has five wire -ORed inputs which can be jumpered to set the 'Stop or End of Memory' flag when all of these pins go to a high state (floating is also considered a 'high' state). The Dipswitches can be configured to stop and/or reset the Brick when this flag is set. The typical use for this input is to:

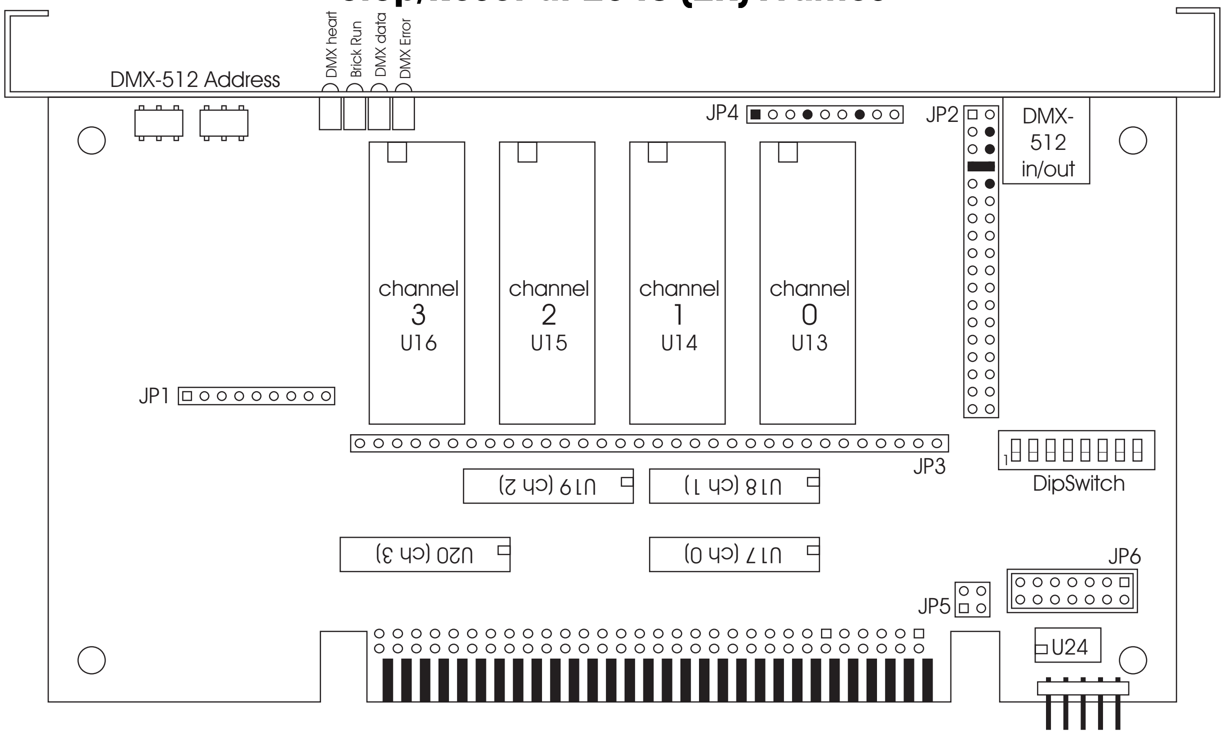
A) Set flag to stop or reset at the end of the installed memory
B) Set flag to stop or reset at a certain frame is reached in the show
C) Set flag to stop or reset when a certain combination of up to five data bits are set

To set this flag at the following frame numbers, install the jumpers as shown:

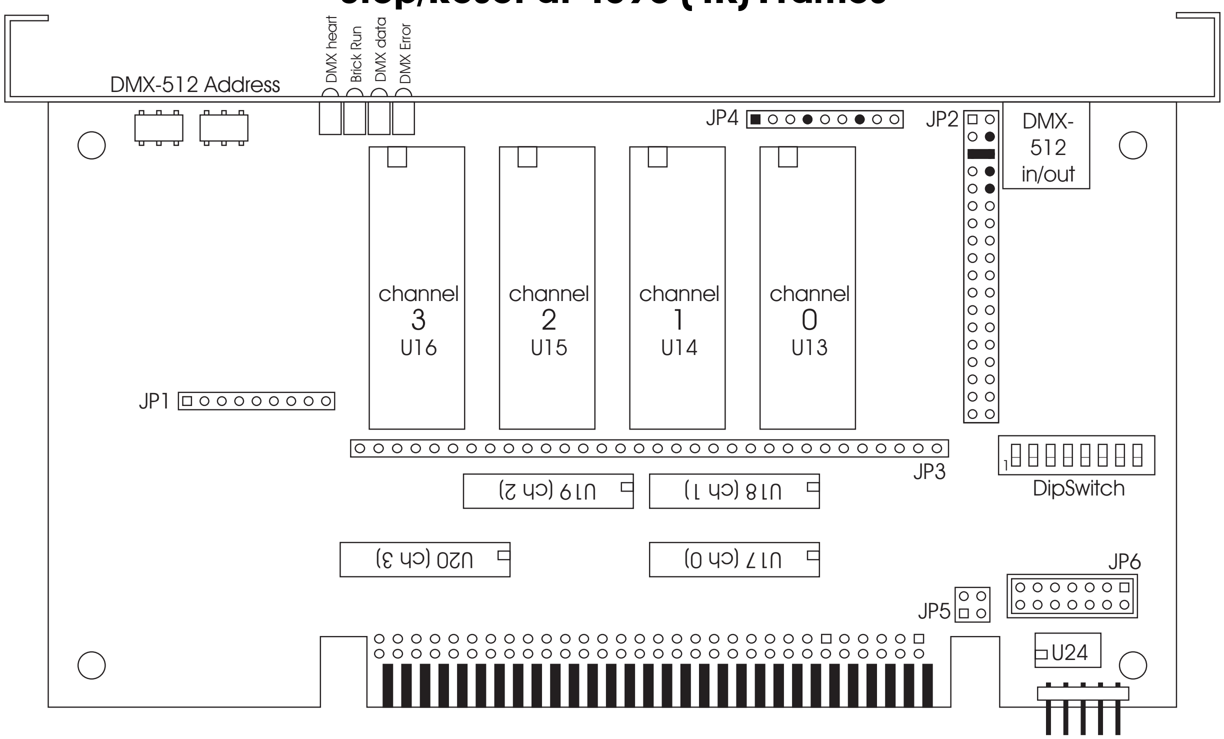
- Stop/Reset at 1024 (1K) Frames -



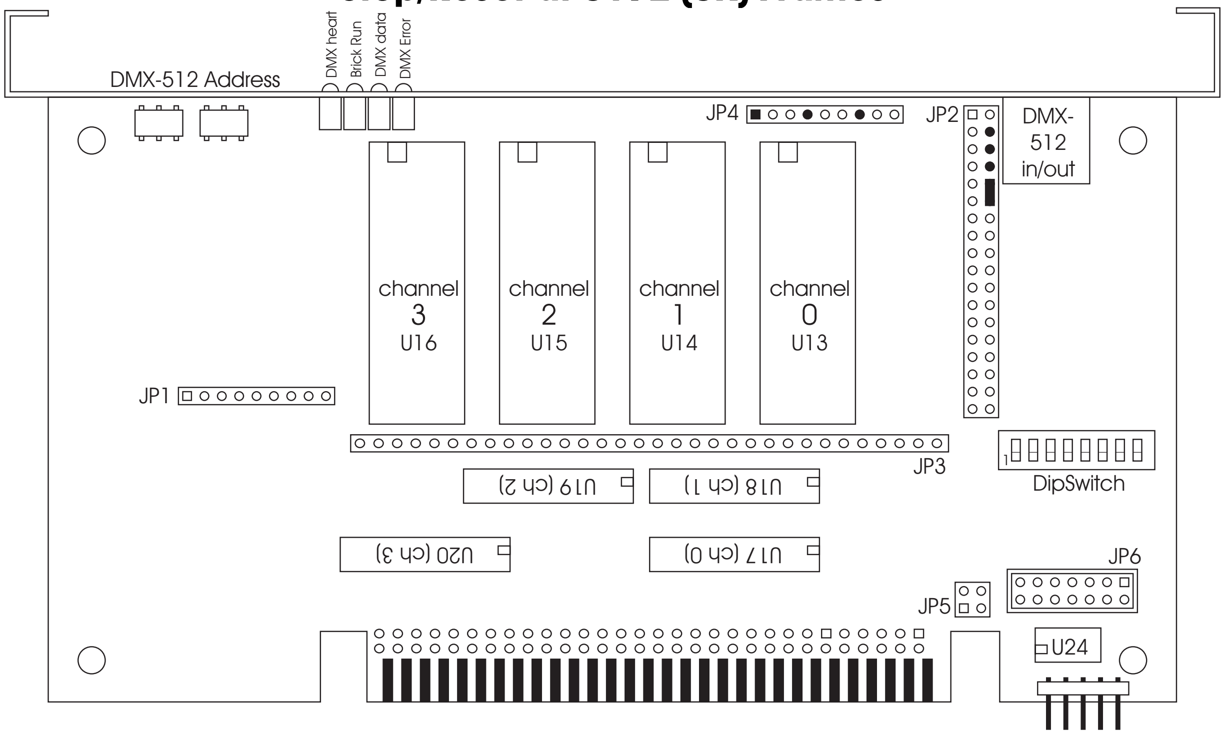
- Stop/Reset at 2048 (2K) Frames -



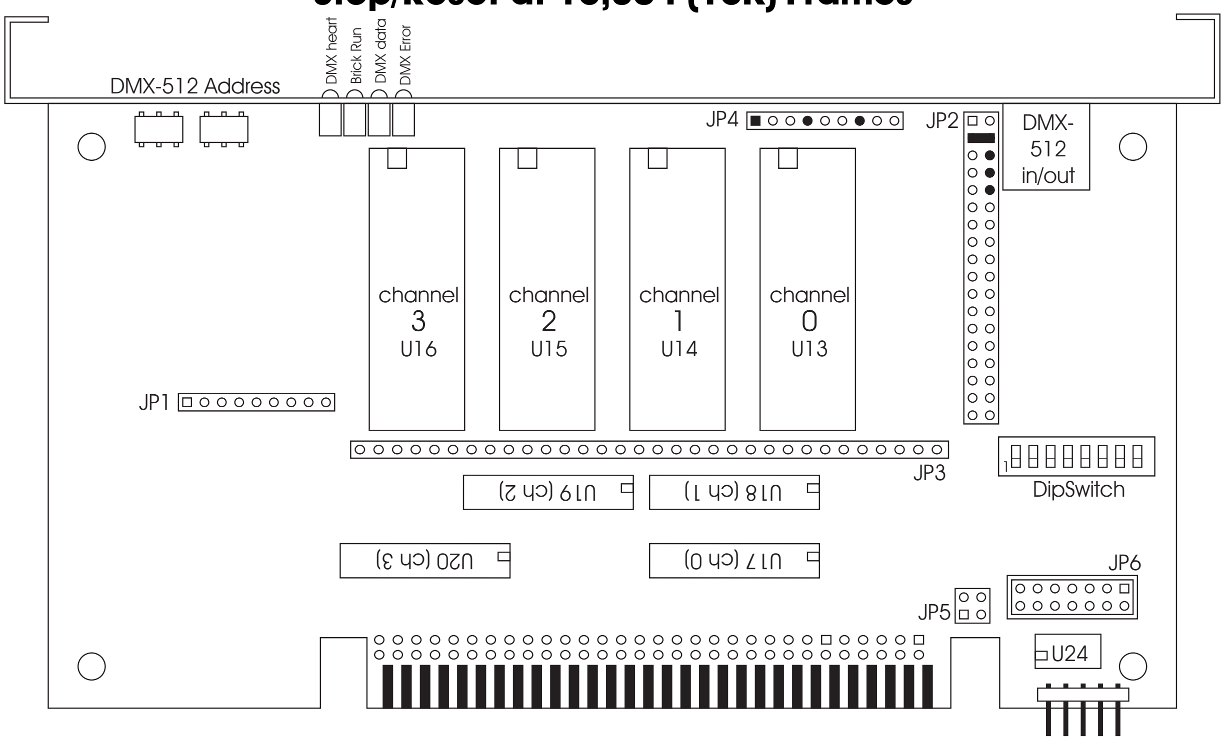
- Stop/Reset at 4096 (4K) Frames -



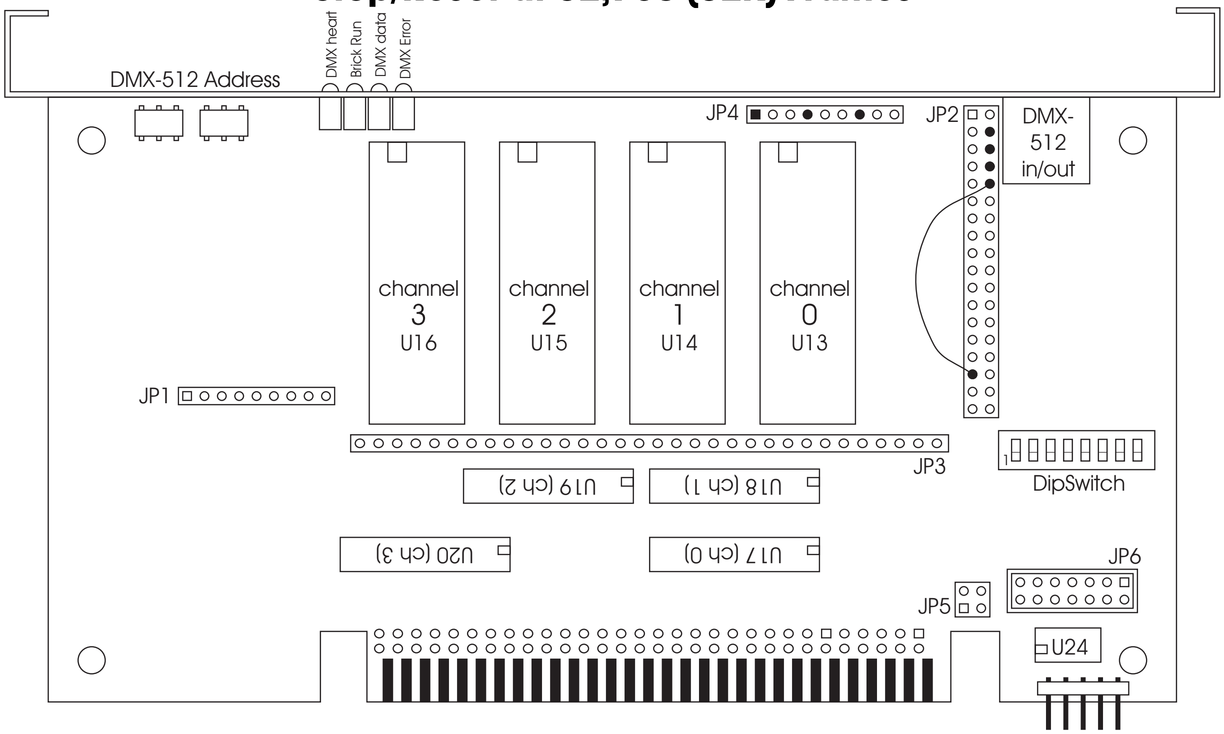
- Stop/Reset at 8192 (8K) Frames -



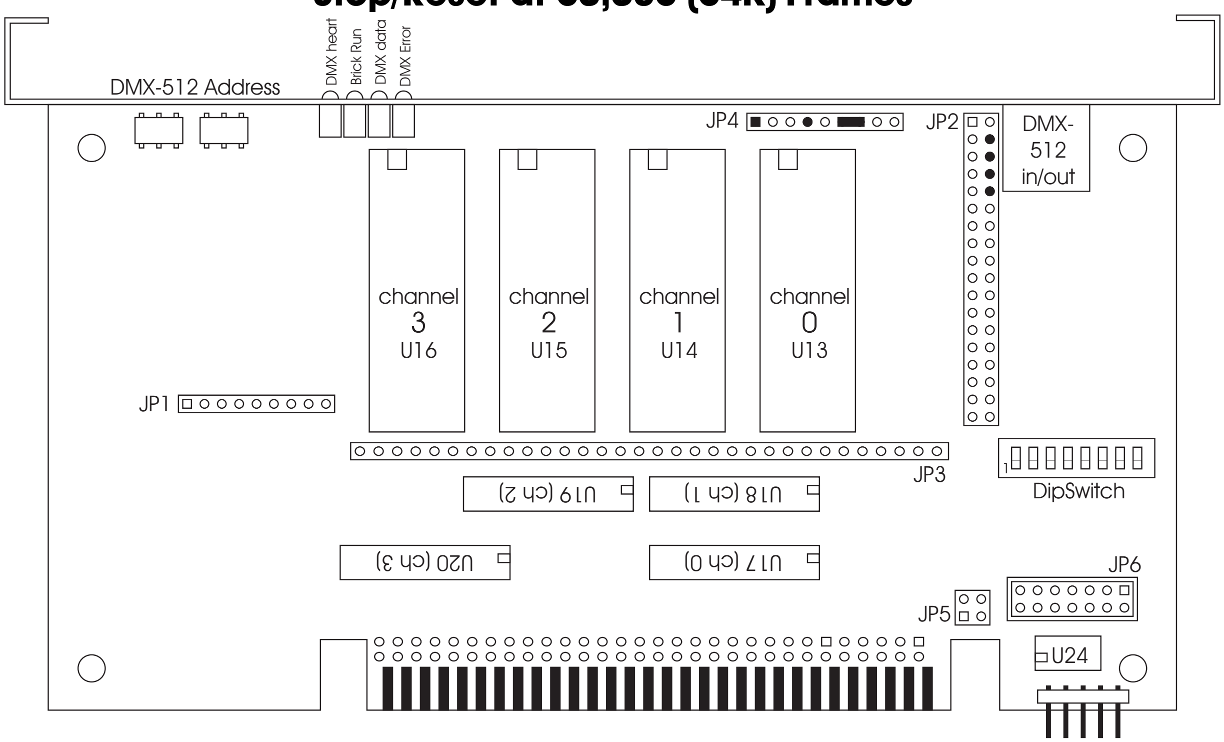
- Stop/Reset at 16,384 (16K) Frames -



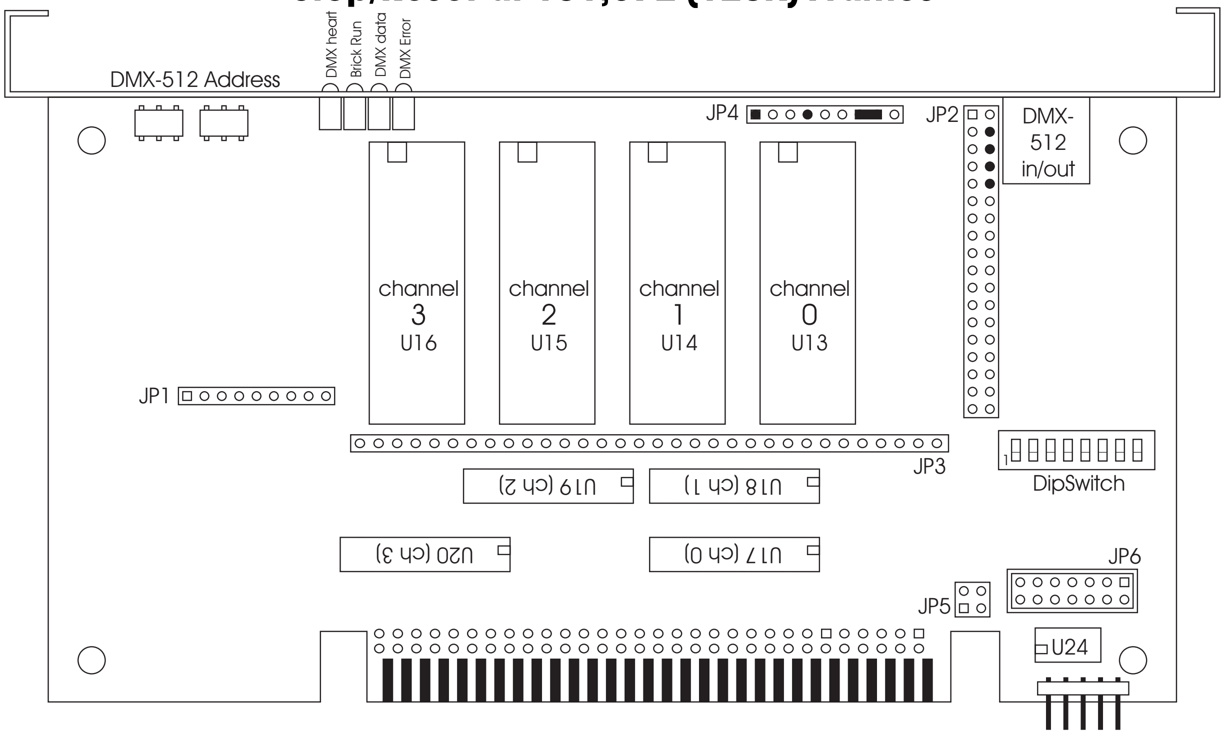
- Stop/Reset at 32,768 (32K) Frames -



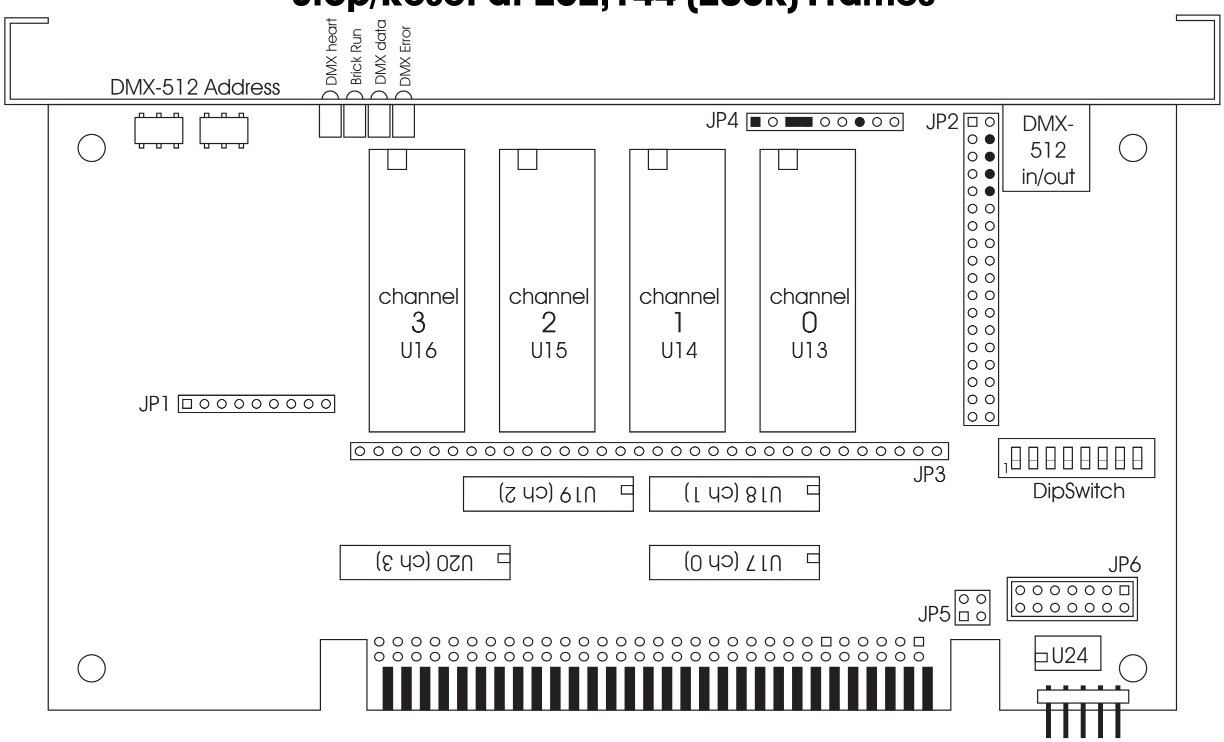
- Stop/Reset at 65,536 (64K) Frames -



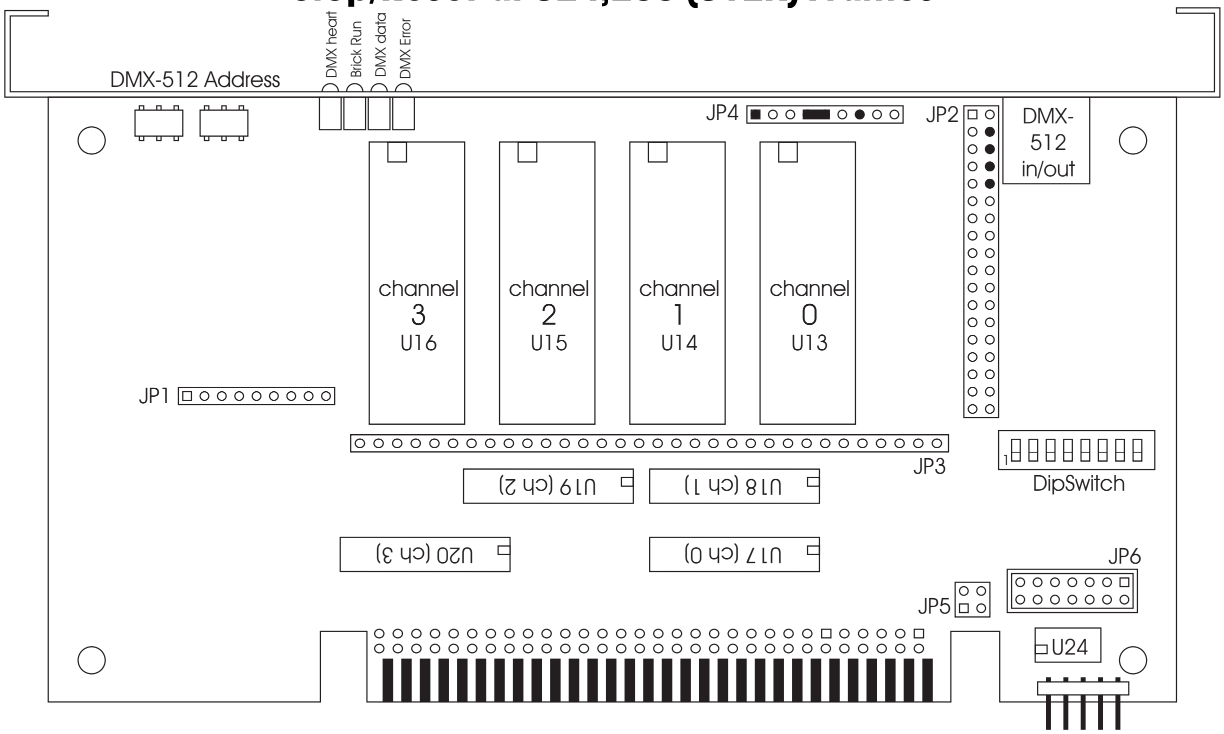
- Stop/Reset at 131,072 (128K) Frames -



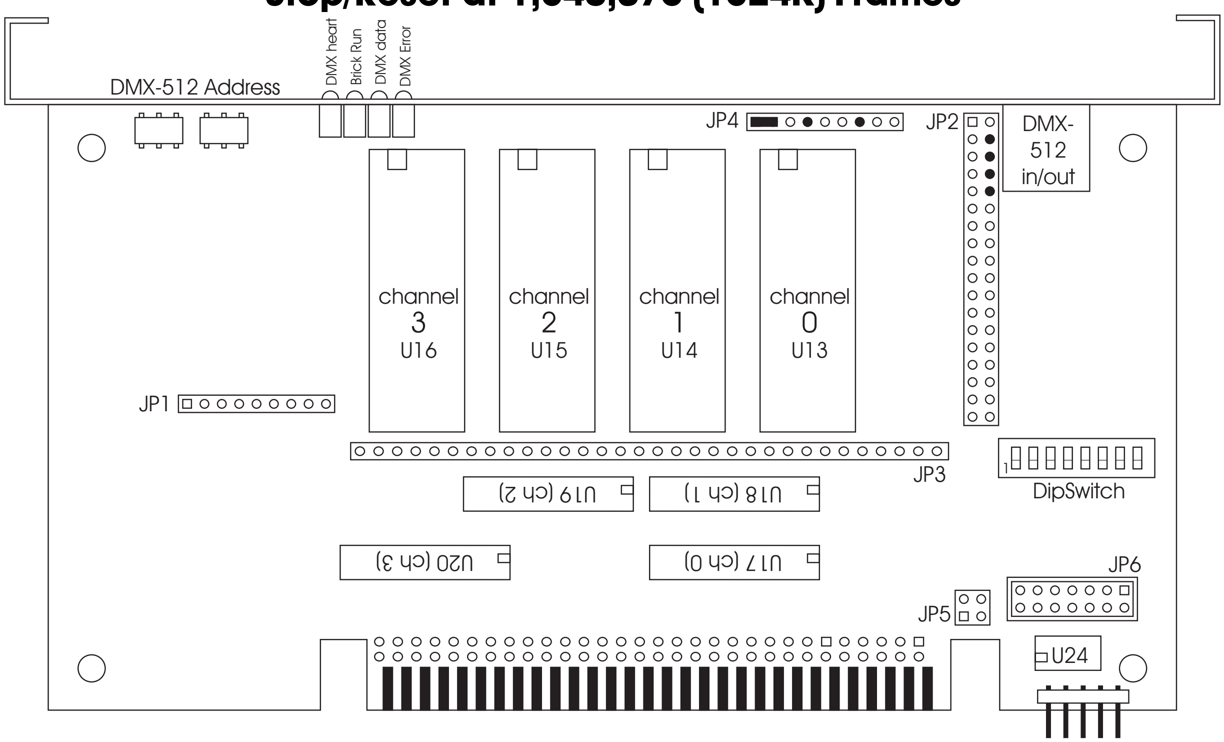
- Stop/Reset at 262,144 (256K) Frames -



- Stop/Reset at 524,288 (512K) Frames -



- Stop/Reset at 1,048,576 (1024K) Frames -



- Stop or Reset Using Address or Data Bits -

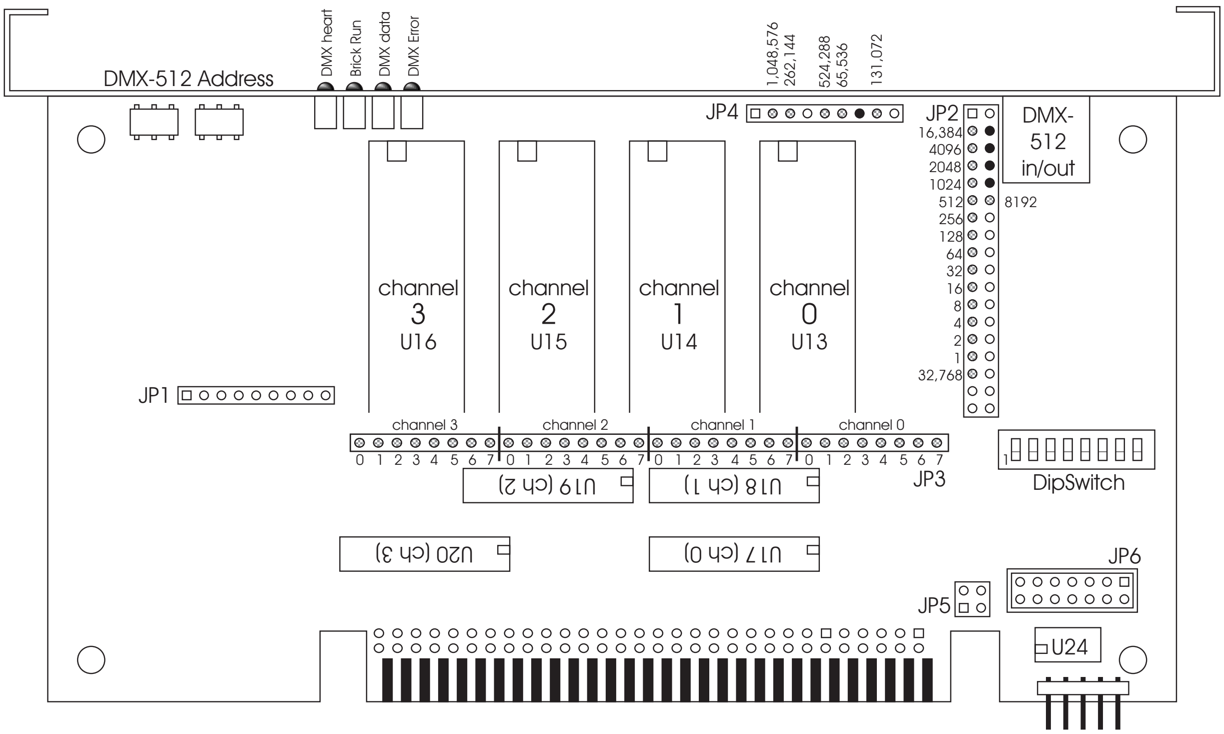
You can use between one and five bits of any address or data word to set the 'Stop or End of Memory' flag. To do this you will need to wire-wrap a connection from the appropriate data and/or address bits to one or more of the five pins that will set the Stop or End of Memory flag. These pins are shown in black in the following illustration. Any of these pins that are left unconnected assume a 'high' state.

To stop from one or more data bits:

A) select the data bit(s) you wish to stop from. All thirty-two bits appear on JP3 at the center of the board. If you use more than one data bit, then the Stop or End of Memory flag will not be set until all of the attached bits go to a high state simultaneously.

B) Wire wrap a connection between each of the selected data bits and one of the five pins that will set the Stop or End of Memory flag. Only one data bit can be attached to each of these pins.

The stops and resets can also be wired externally to the Brick card. You do this by running the output from the bit that will stop/reset the brick back into the stop or reset inputs to the card. This will work better for applications that use more than one card.



If you need to stop the MICRO MACs from the frame counter at some unique address, you must first determine the binary equivalent of that frame number. For example, suppose you want to stop the show at the end of one minute. Convert the running time (one minute) to seconds (60) and multiply that by the frame rate (in this case we will use 16 frames per second). This yields a required show length of 960 frames. To convert this 960 into a binary number, select the largest of the frame counter pins that will fit into 960. In this example it is 512. Subtract this number from the total number of frames.

$$\begin{array}{r} 960 \\ \underline{-512} \\ 448 \end{array}$$

The remainder is 448. Since you were able to subtract the number 512, make a note that you will be using the 512 frame counter pin. Repeat the process, starting with the remainder 448. Each time you find which is the largest frame counter pin that you can subtract, make a note that you are using that frame counter pin. Continue to repeat the process until the remainder is zero.

448

-256
192
-128
64
-64
0

Each frame counter pin you subtracted is then wired to one of the stop pins. Configured in this way, the MICRO MACs will run from the beginning to the 960th frame and then stop. (It will stop on the 960th frame).

If you used a calculator to convert the frame number into binary address then a "1" indicates a connection and a "0" does not. The right hand most digit stands for the "1" address counter pin, the 2nd from the right indicates the "2" pin, the 3rd indicates the "4" pin and so on, doubling the number associated with the pin each digit you move toward the left.

This example happens to use four of the five stop inputs. To get to the exact frame number might take more than the five available inputs. In this case, use the five most significant pins you found. If this doesn't get you close enough, then you should consider stopping from a show data bit.

When using this (frame counter) method of stopping or resetting a MICRO MACs, the show must start each time at the beginning. This can be assured by configuring the start and reset both on the same (J-8) input.

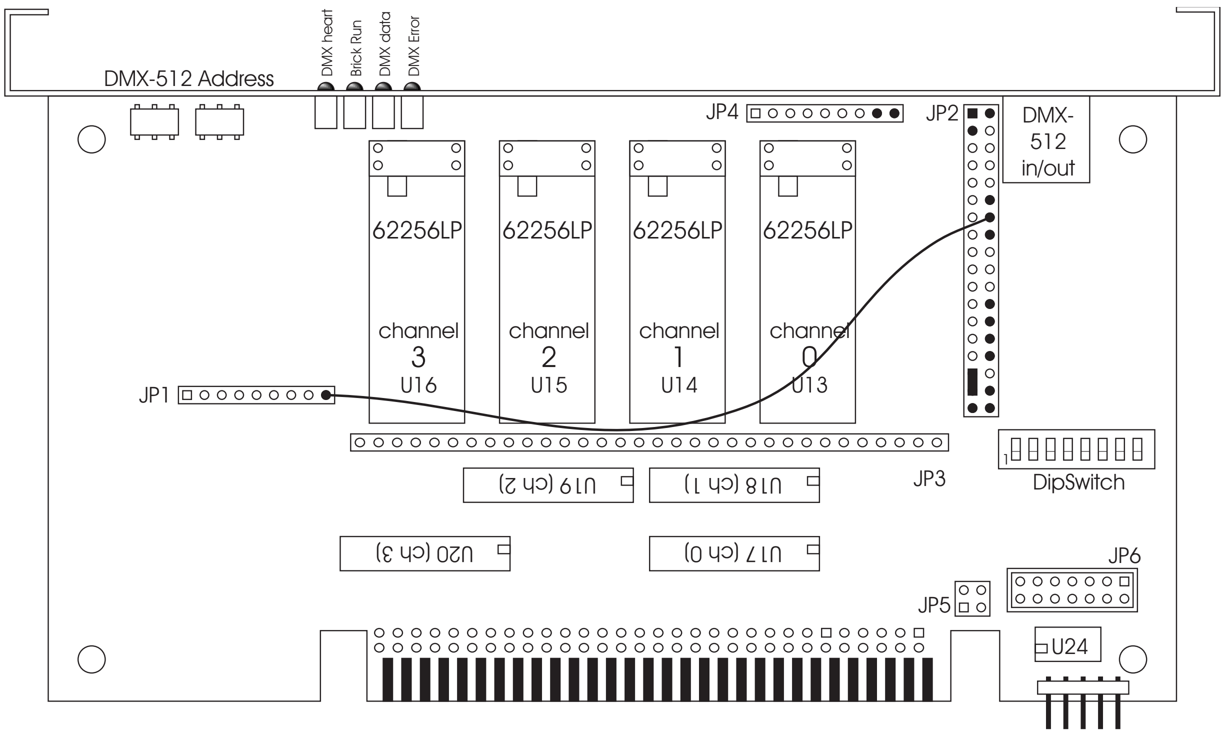
- Double Show Configurations -

Several memory types can be configured to divide the memory into two identical 'banks'. When the Micro MACs Brick is switched, the Brick will instantly find itself at the exact same frame on the other bank.

When using the double show configuration, the Blue Input is used to select between the two banks. This makes double show configurations incompatible with the external clock.

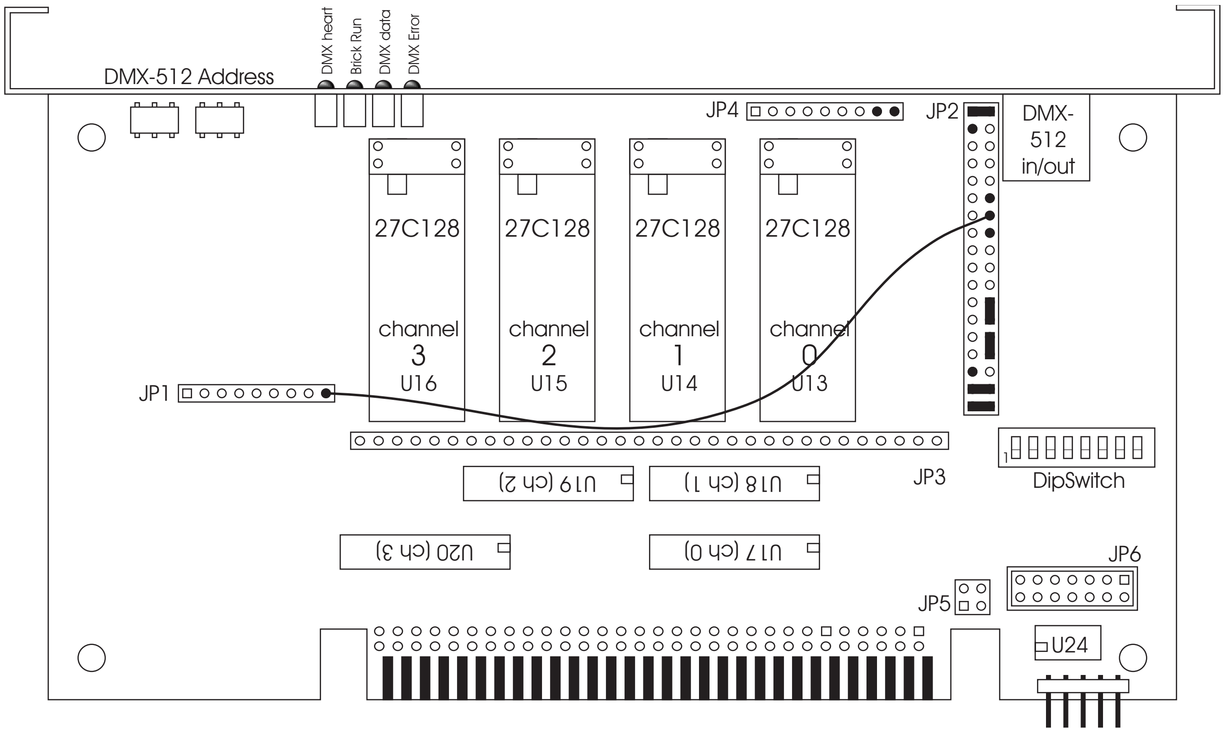
- Double Show using 62256LP Ram -

To configure a Record/Playback Micro MACs Brick for use with 62256LP static Ram Chips for a capacity of two 32,768 (32K) banks. The RAM chips must be 'South' justified, leaving four unused holes at the top of each socket.



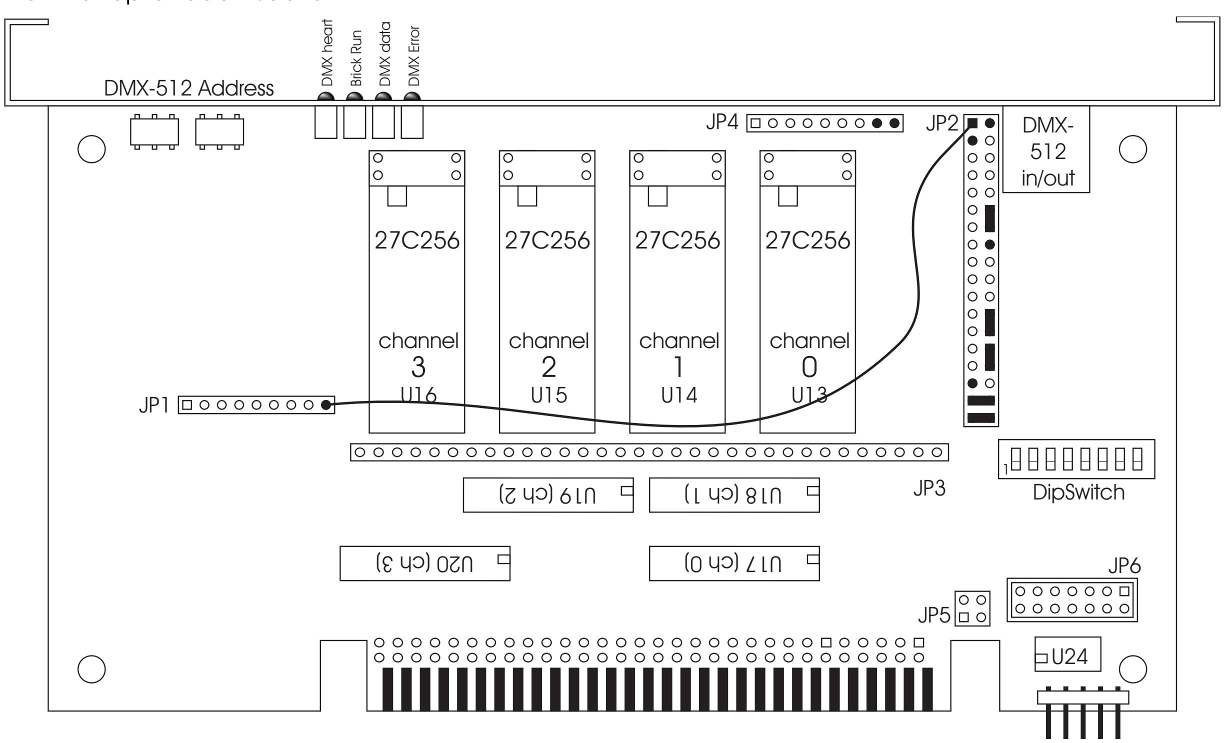
- Double Show using 27C128 Eprom -

To configure a Playback-only Micro MACs Brick for use with 27C128 Eprom Chips for a capacity of two 8192 (8K) banks. The Eprom chips must be 'South' justified, leaving four unused holes at the top of each socket.



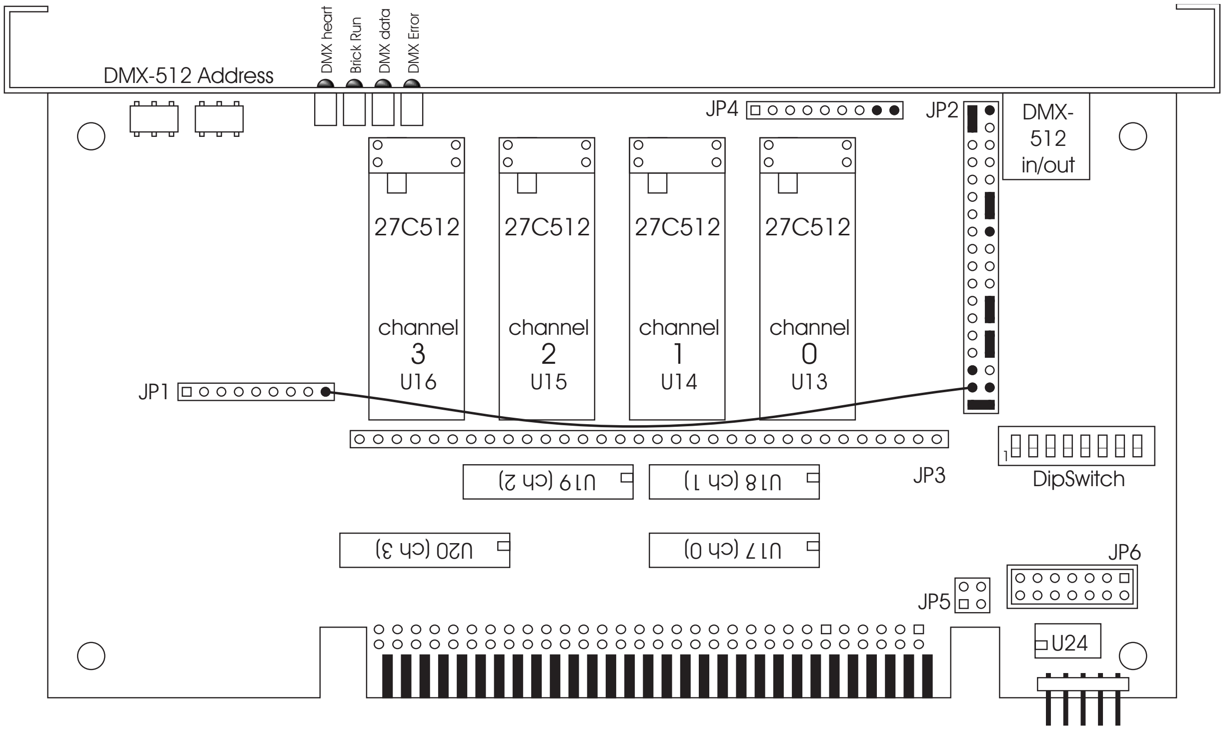
- Double Show using 27C256 Eprom -

To configure a Playback-only Micro MACs Brick for use with 27C256 Eprom Chips for a capacity of two 16,384 (16K) banks. The Eprom chips must be 'South' justified, leaving four unused holes at the top of each socket.



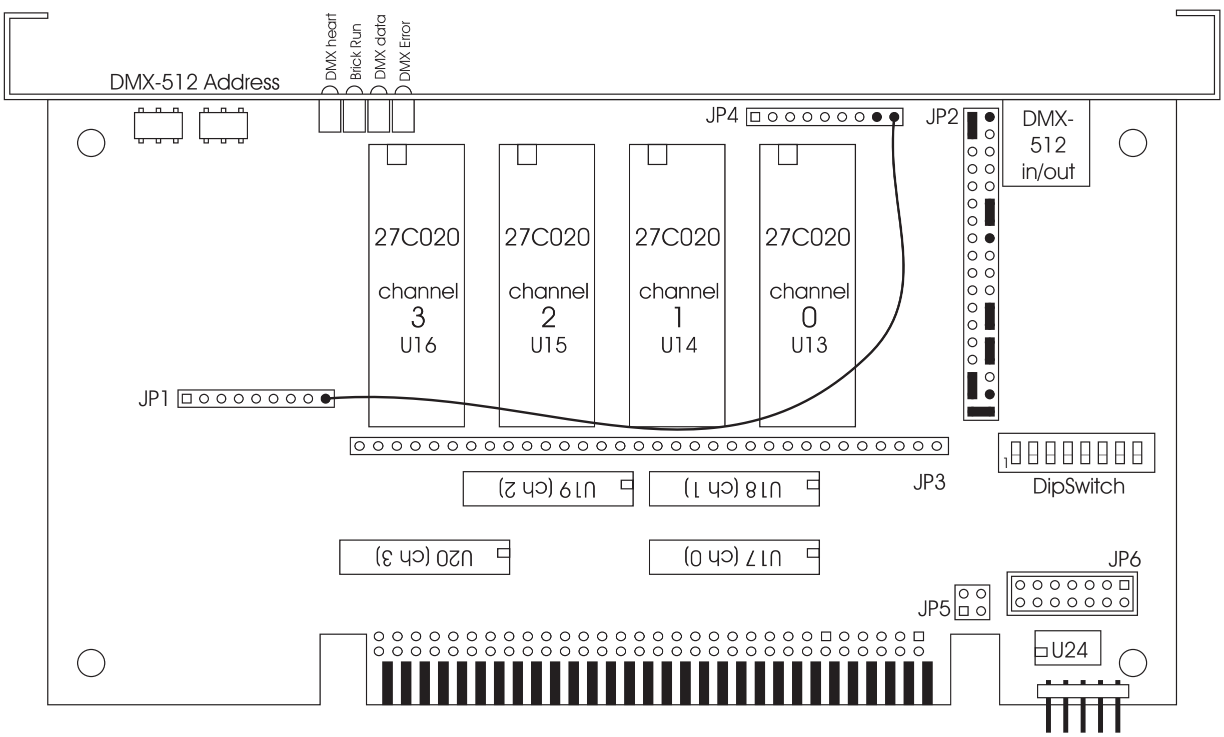
- Double Show using 27C512 Eprom -

To configure a Playback-only Micro MACs Brick for use with 27C512 Eprom Chips for a capacity of two 32,768 (32K) banks. The Eprom chips must be 'South' justified, leaving four unused holes at the top of each socket.



- Double Show using 27C020 Eprom -

To configure a Playback-only Micro MACs Brick for use with 27C020 Eprom Chips for a capacity of two 131,072 (128K) banks.



- Micro MACs Brick Dipswitch Configuration -

Dipswitch #1: Stop on Green Opening: The Green J8 input will always start the Micro MACs Brick. When this switch is ON, the Micro MACs Brick will stop when on the opening of the Green J8 input. This switch will have no effect if dipswitch #6 (run continuously) is ON. The Dipswitch #2 (Stop at End) and the Red (Stop) J8 input can still be used when this option is selected.

Dipswitch #2: Stop at End: The Red J8 input will always stop the Micro MACs Brick. When this switch is ON, then the Brick will be stopped when the five pins that will set the stop/reset flag all go high (or floating) at the same time. This is typically used to stop the Brick after the entire memory has played through once (or from the address and/or data bits). This switch will have no effect if dipswitch #6 (run continuously) is ON.

Dipswitch #3: Reset at End: The White J8 input will always reset the Micro MACs Brick back to the first frame of the show. When this switch is ON, the Brick will be reset when the five pins that will set the stop/reset flag all go high (or floating) at the same time. This is typically used where you want the brick to be started (and ignoring additional start inputs) and play through to the end (or to where the address and/or data bits set the stop/reset flag). At that point it will reset back to the first frame of the show. When this switch is ON and Dipswitch #2 (Stop at End) is OFF, the Brick will loop continuously once it is started. This switch can be used in conjunction with Dipswitch #4 (Reset when Stopped) if you don't want it to loop.

Dipswitch #4: Reset when Stopped: The White J8 input will always reset the Micro MACs Brick back to the first frame of the show. When this switch is ON, then the Brick will be reset whenever it is stopped, no matter what stopped the Brick. This is typically used where you want the brick to be started and play through to the end (ignoring additional start inputs), stop, and then wait for the next start input. If any stop command comes in during the play, the brick will stop and the brick will immediately reset to the first frame's data. It will then wait patiently for the next start input. This switch can be used in conjunction with Dipswitch #3 (Reset at End).

Dipswitch #5: No White J8 Input: The White J8 input will always reset the Micro MACs Brick back to the first frame of the show. Sometimes there is no separate reset J8 input. This switch is used to interconnect the Green and White J8 inputs. When it is ON, the Green (or White) J8 inputs will both start and Reset the Brick.

Dipswitch #6: Run Continuously: This switch forces the Micro MACs Brick to run all of the time. When it is ON, the only way to stop the brick is to unplug it. None of the Start or Stop Inputs will have any effect. The Reset inputs can be used as desired.

Dipswitch #7: Disable Outputs when Stopped: This switch must be left OFF if you want the outputs to remain at their programmed levels, even when the Micro MACs Brick 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 never used if there are any analog functions attached to a Micro MACs Brick. Disabling the outputs which feed a D/A converter would cause it to slam to one of its extremes.

This switch is turned ON if you want all of the outputs to be forced OFF when the Micro MACs Brick is not advancing frames. This is often used if there are any loads which might be damaged if they are left ON too long.

Dipswitch #8: DMX Forever!: This switch has no effect unless the DMX-512 option has been installed on the Micro MACs Brick. When this switch is OFF, the Brick will go back to using its normal onboard memory about 2-1/2 seconds after the DMX-512 data input is lost. When this switch is ON, the DMX-512 microcontroller will always disable the onboard Brick memory. If the DMX-512 data source goes away, the brick will output the last good DMX-512 data it received.

- Micro MACs 'Brick' Connections -

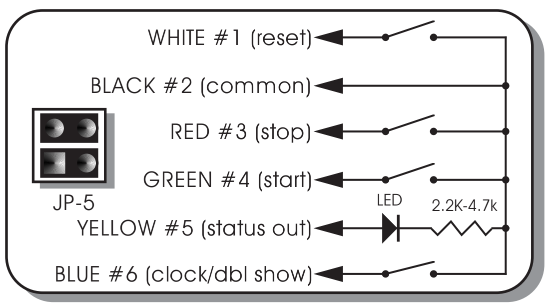
J-8 Input: Each Micro MACs Brick features four optically isolated inputs and one optically isolated status output. The four inputs are used as follows. The colors correspond to those found in six conductor 'modular' telephone wire:

A) Green 'Start' Input
B) Red 'Stop' Input
C) White 'Reset' Input
D) Blue 'External Clock' or 'Double Show' Input

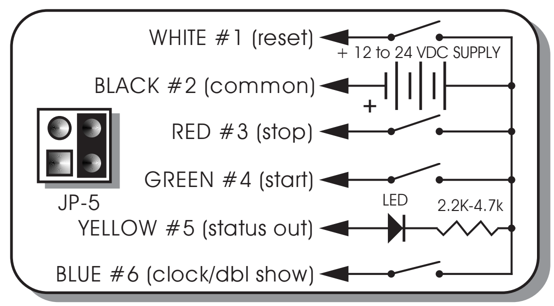
The Yellow 'Running Status' output is active whenever the Brick has been Started. It can be used as a remote 'show running' status indicator. These Inputs and Outputs can be configured to use the same power supply as the rest of the Brick, or an external power supply can be used.

All the inputs and the one output on the J8 connection are optoisolated. By changing the position of the jumpers on JP5, you can select whether these optoisolators are powered from the same power supply as the Brick, or if they are expecting to get power from outside. If they are running from the same power supply as the Brick, then a simple 'switch closure' between the desired input and the BLACK common line will trigger an input. The Micro MAC's power supply is protected by a 170 ma. PTC circuit breaker when using internal power.

The connections and jumper positions for the J8 port are as follows. As with all RJ-11 (6 conductor modular telephone wire) connections in this manual, all wire colors and numbers are referenced with you facing the end of the cable with the connector release upwards:



J8 with JP5 set for INTERNAL power



J8 with JP5 set for EXTERNAL power

If the J8 input is configured to run from an external power source, then you must provide a 12 to 24 VDC voltage to the BLACK common line. Inputs are then triggered by attaching them to the ground side of your power supply. This type of 'switch to ground' output is standard on most control equipment.

DMX-512: Five pin MiniDIN connector. This connection is available only if the DMX-512 option has been installed. The DMX-capable Micro MACs Brick will stop listening to the onboard memory whenever there is a DMX-512 signal present on this input. If Dipswitch #8 is ON, it will never enable the onboard memory and will always use the most recent DMX-512 data for its outputs.

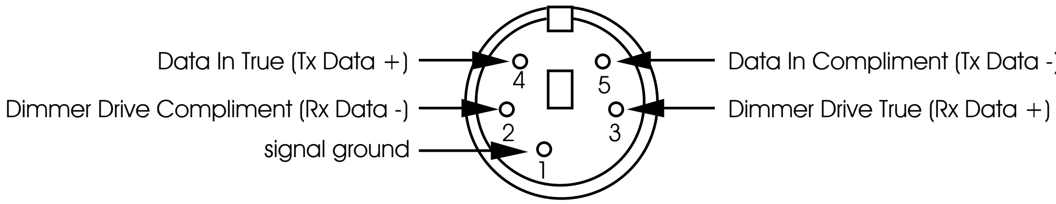
The DMX-512 standard was developed by the United States Institute for Theatrical Technology (USITT) for a high speed (250 KBaud) asynchronous serial data link. Although it was originally designed for controlling light dimmers, it is now supported by hundreds of suppliers throughout the world for controlling all kinds of theatrical equipment.

Even though the DMX-512 standard calls for up to 512 channels of data, the DMX transmission from PC·MACs is limited to 256 eight bit wide channels. You can address a DMX-capable Micro MACs Brick to respond to any address between 00 and 255 using the rotary switches on the front. Addresses above the 256th are used in PC·MACs for transmitting a checksum. The DMX-capable Micro MACs Bricks use this to verify that the data received from PC·MACs has no transmission errors in it. If you address a light dimmer or other DMX-512 device to addresses 256 or 257, you will see this verification data displayed as a flickering pattern. Note that at frame rates higher than forty FPS, not all 256 channels can be transmitted through the DMX-512 output.

The DMX-512 standard calls out a 5 pin XLR connector for all cabling. Unfortunately these connectors won't fit on a 1" wide card. For this reason we chose a 5 pin MiniDIN connector for this signal. the pinout is as follows:

MiniDIN pin #	**SIGNAL**[2]
1	Signal Common (shield)
2	Dimmer Drive compliment (Rx Data -)
3	Dimmer Drive True (Rx Data +)
4	Data In True (Tx Data +)
5	Data In compliment (Tx Data -)

Facing the end of the male end of a cable, the pins are located as shown:

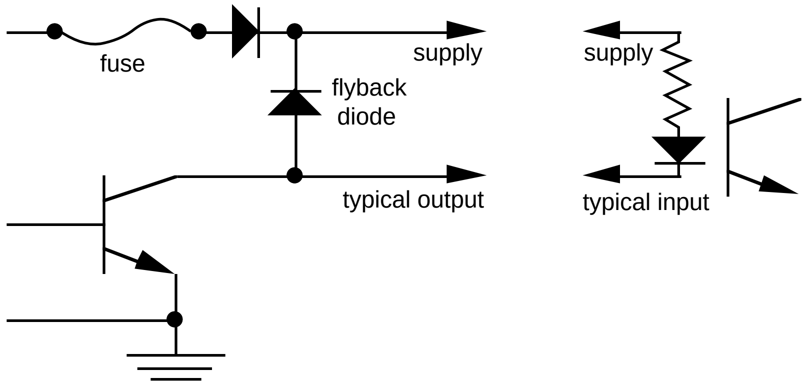


Data from a PC·MACs should be fed into pins #2 (-RxD) and #3 (+RxD). The shield should be connected to pin #1.

The DMX-capable Micro MACs Brick retransmits any DMX-512 data it receives. This data is unaltered from what came in.

J-6 Digital Output Cables: In all animation systems made by Gilderfluke & Company all input and output cabling 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. 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. Each group of ten wires also includes a common power supply and ground wire.

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:



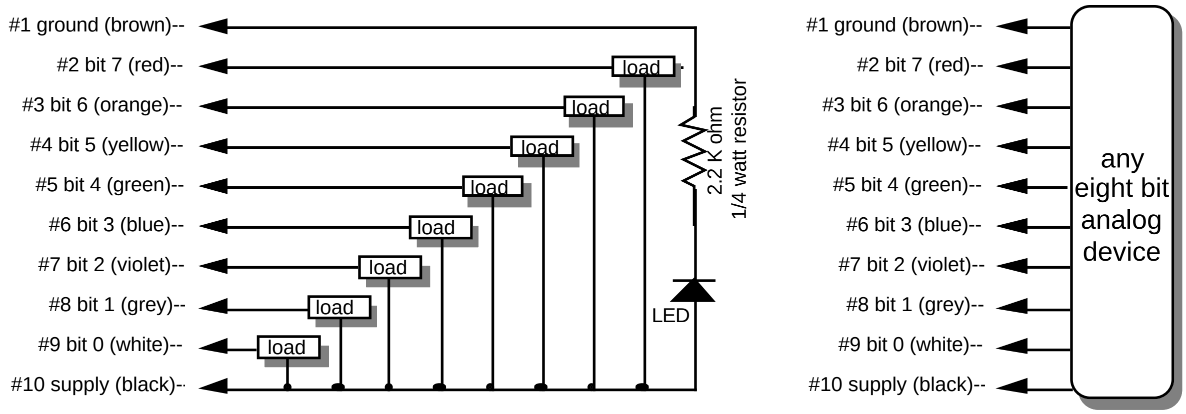
To simplify wiring to any MACs animation system, the connectors used on the J-6 cables are what are called 'insulation displacement connectors'. These simply snap on to an entire cable, automatically 'displacing' the wire insulation and making contact with the wires within. This means that an entire 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.

[2] Don't blame us for these names. These are directly from the USITT.

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

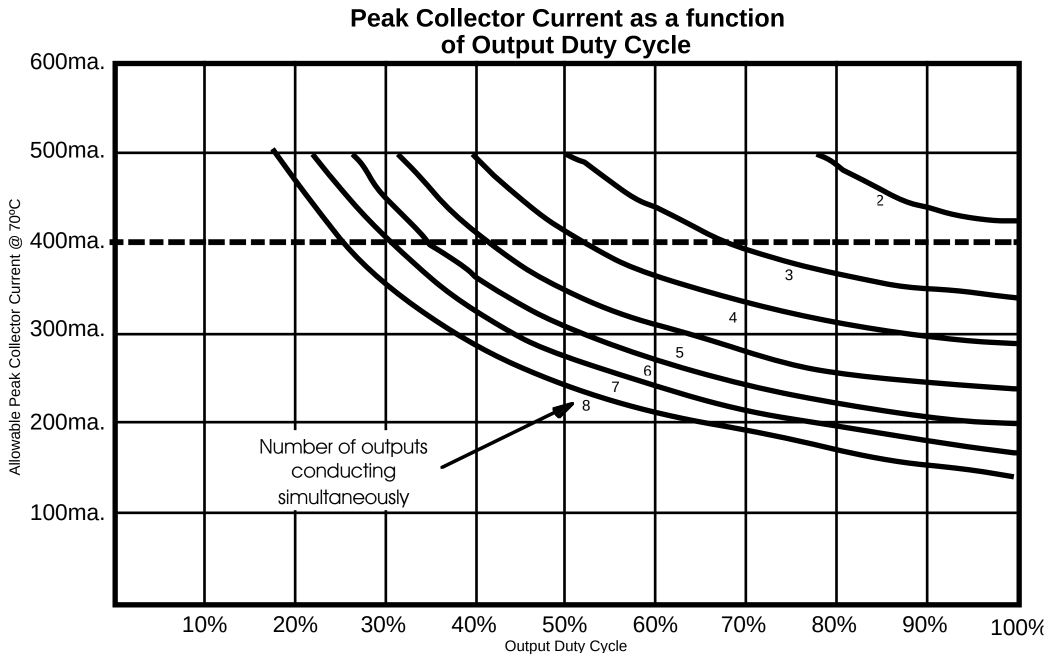
wire number	**color**	**wire function**
1	brown	circuit ground
2	red	channel 0 data bit 7
3	orange	channel 0 data bit 6
4	yellow	channel 0 data bit 5
5	green	channel 0 data bit 4
6	blue	channel 0 data bit 3
7	violet	channel 0 data bit 2
8	gray	channel 0 data bit 1
9	white	channel 0 data bit 0
10	black	+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 PTC 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.

Edge Connector: All of the connections to and from Playback-only Micro MACs Brick Cards are available on the 60 position edge connector. You can use an Insulation Displacement Edge (IDE) connector if you aren't going to be using one of our card cages:

output wire #	Edge pin #	color	wire function
J8 Black (common)	1	brown	Micro MACs J8 Common (black) input
J8 White (Reset)	2	red	Micro MACs J8 Reset (white) input
J8 Red (Stop)	3	orange	Micro MACs J8 Stop (red) input
Serial Port red #3	4	yellow	TxD + out from Smart Brick Brain
J8 Green (Start)	5	green	Micro MACs J8 Start (green) input
Serial Port Black #2	6	blue	TxD - out from Smart Brick Brain
J8 Yellow (Status Out)	7	violet	Micro MACs J8 Status Out (yellow) output
Serial Port Yellow #5	8	gray	Rx + in to Smart Brick Brain
J8 Blue (Clock/Dbl. Show)	9	white	Micro MACs J8 Clock/Double Show (blue) input
Serial Port green #4	10	black	Rx -in to Smart Brick Brain
#1	11	brown	J6 out channel 0 Ground
#2	12	red	J6 out channel 0 bit 7
#3	13	orange	J6 out channel 0 bit 6
#4	14	yellow	J6 out channel 0 bit 5
#5	15	green	J6 out channel 0 bit 4
#6	16	blue	J6 out channel 0 bit 3
#7	17	violet	J6 out channel 0 bit 2
#8	18	gray	J6 out channel 0 bit 1
#9	19	white	J6 out channel 0 bit 0
#10	20	black	J6 out channel 0 + Supply
#11	21	brown	J6 out channel 1 Ground
#12	22	red	J6 out channel 1 bit 7
#13	23	orange	J6 out channel 1 bit 6
#14	24	yellow	J6 out channel 1 bit 5
#15	25	green	J6 out channel 1 bit 4
#16	26	blue	J6 out channel 1 bit 3
#17	27	violet	J6 out channel 1 bit 2
#18	28	gray	J6 out channel 1 bit 1
#19	29	white	J6 out channel 1 bit 0
#20	30	black	J6 out channel 1 + Supply
#21	31	brown	J6 out channel 2 Ground
#22	32	red	J6 out channel 2 bit 7
#23	33	orange	J6 out channel 2 bit 6
#24	34	yellow	J6 out channel 2 bit 5
#25	35	green	J6 out channel 2 bit 4
#26	36	blue	J6 out channel 2 bit 3
#27	37	violet	J6 out channel 2 bit 2
#28	38	gray	J6 out channel 2 bit 1
#29	39	white	J6 out channel 2 bit 0
#30	40	black	J6 out channel 2 + Supply
#31	41	brown	J6 out channel 3 Ground
#32	42	red	J6 out channel 3 bit 7
#33	43	orange	J6 out channel 3 bit 6
#34	44	yellow	J6 out channel 3 bit 5
#35	45	green	J6 out channel 3 bit 4
#36	46	blue	J6 out channel 3 bit 3
#37	47	violet	J6 out channel 3 bit 2
#38	48	gray	J6 out channel 3 bit 1
#39	49	white	J6 out channel 3 bit 0
#40	50	black	J6 out channel 3 + Supply
black	51	brown	power supply ground
black	52	red	power supply ground
black	53	orange	power supply ground
black	54	yellow	power supply ground
black	55	green	power supply ground
red	56	blue	+ power supply input
red	57	violet	+ power supply input
red	58	gray	+ power supply input
red	59	white	+ power supply input
red	60	black	+ power supply input

- Programming -

Every Micro MACs 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 Micro MACs Brick. With eight bit resolution analog functions, the following show all the possible combinations:

A) no analogs and 32 digital functions
B) One analog and 24 digital functions
C) Two analogs and 16 digital functions
D) Three analogs and 8 digital functions
E) Four analogs and no digital functions

Playback-Only Bricks:

All Playback-only Micro MACs 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 that can be programmed directly are the record-playback bricks. Shows for these can also be programmed using our full-sized Animation Control System, and then downloaded to the record-playback Micro MACs Bricks.

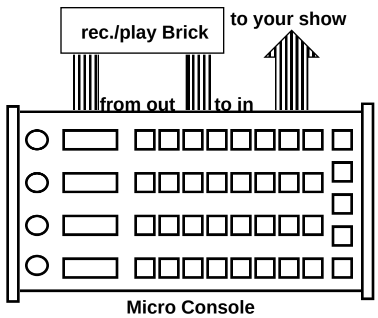
All Micro MACs Bricks are real-time Animation Control Systems. What this means is that they are normally programmed as the show is going on. You do this by moving the controls (pots, joysticks, buttons, sliders, or whatever) which are connected to the figure through the control system and watching it 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 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.

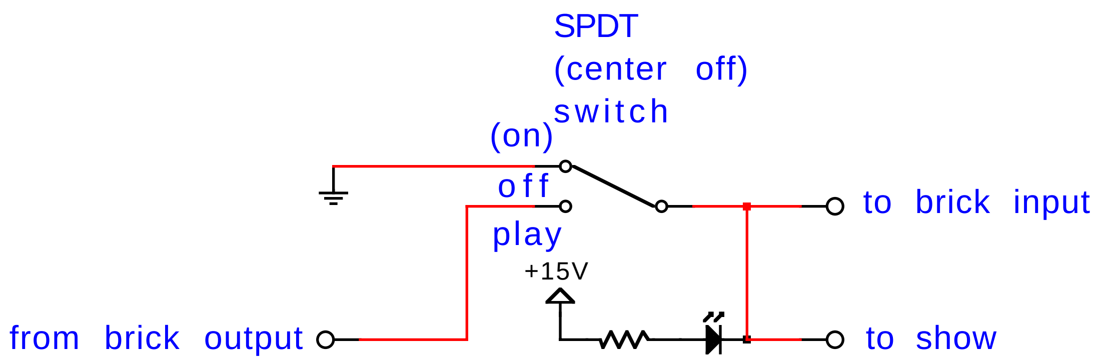
This programming hardware can be a standard Micro Console, or a console that has been made for your specific requirements.

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 or alternate action 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 Micro MACs Brick as shown. Two cables run between the Micro Console and the Micro MACs Brick while a third cable goes to whatever the system is controlling. After programming is completed, this third cable is plugged directly into the Micro MACs Brick's 'output' connector.

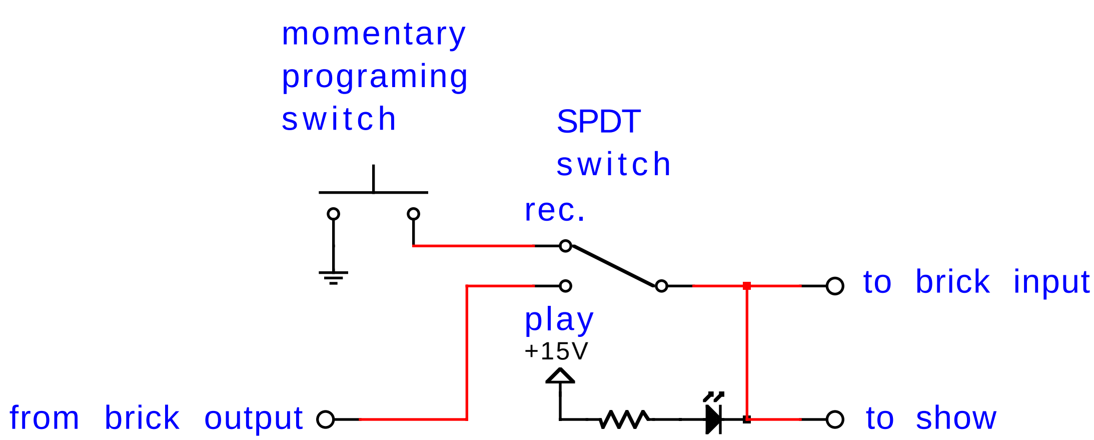


When building a programming console specific to your application, you can make it as simple or as complicated as you desire. Where a standard Micro Console can handle up to four 8 bit wide channels at one time, you can build your console to allow you to program just as many channels at a time as you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

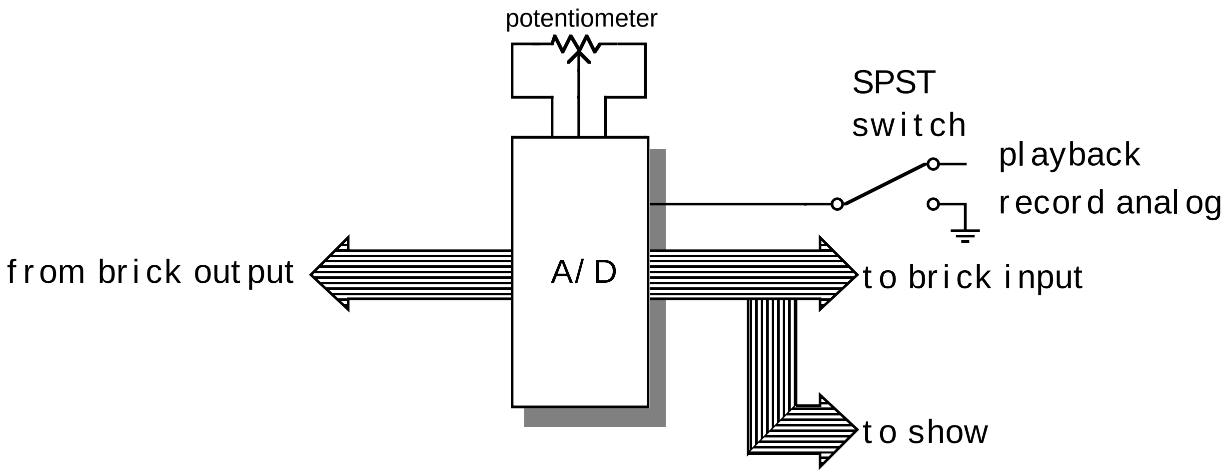
All that is required for programming a digital function is a simple switch for each brick output/input:



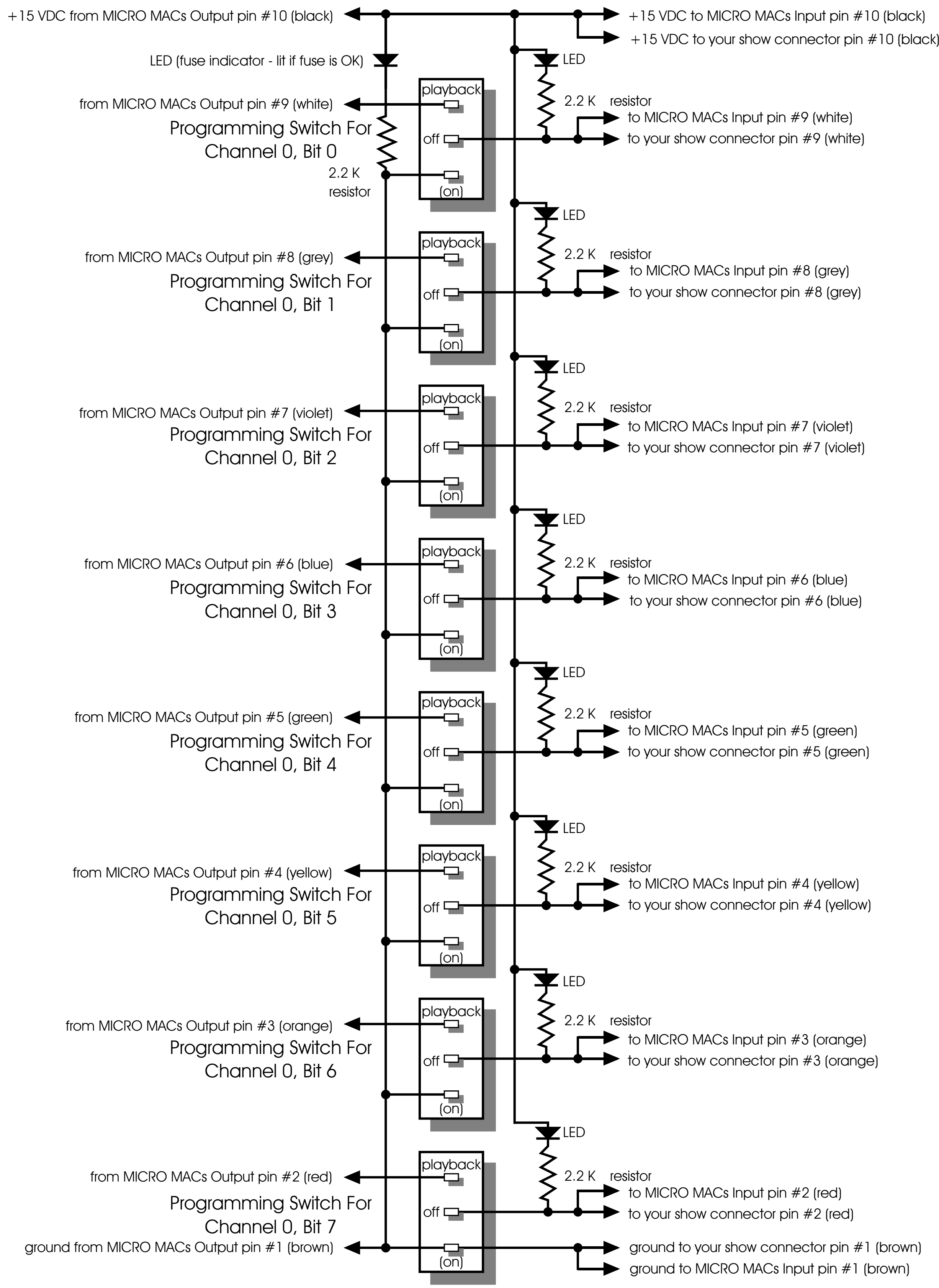
By adding a pushbutton switch to the connections shown above, you can make an easier to use programming console that has a separate 'programming enable' switch and pushbutton for turning on and off the output:



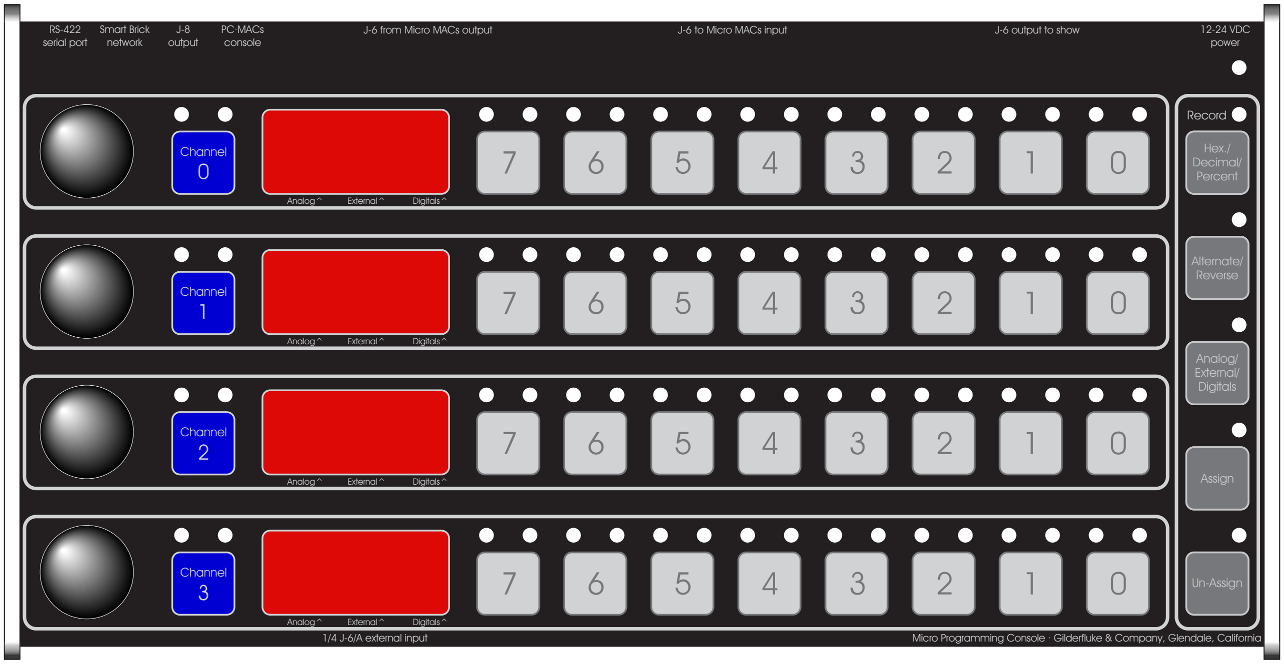
For building an analog programming console, we recommend you use our Analog to Digital (A/D) Converters. One is used for each analog function on your console. In this case the wires 'from brick output', 'to brick input', and 'to show' are actually eight wires (plus ground and + supply) that make up a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



- Micro Console -

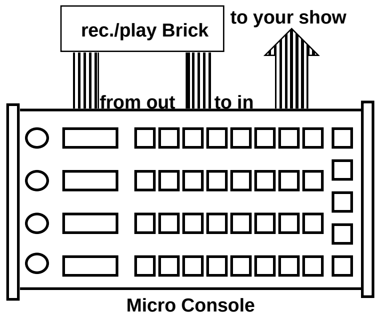


The Micro Console works with both PC·MACs and record/playback Brick Animation Control Systems. Up to four eight bit channels can be programmed at one time with the Micro Console. Each channel can be set to be used for eight digital inputs, the front panel eight bit resolution analog pots, or the external 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**	**SIGNAL NAME:**
n/c	(left)	1)	WHITE:	signal ground
n/c		2)	BLACK:	- serial data in
n/c		3)	RED:	+ serial data in
2		4)	GREEN:	- serial data out
3		5)	YELLOW:	+ serial data out
1	(right)	6)	BLUE:	signal ground

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 <u>not</u> 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.

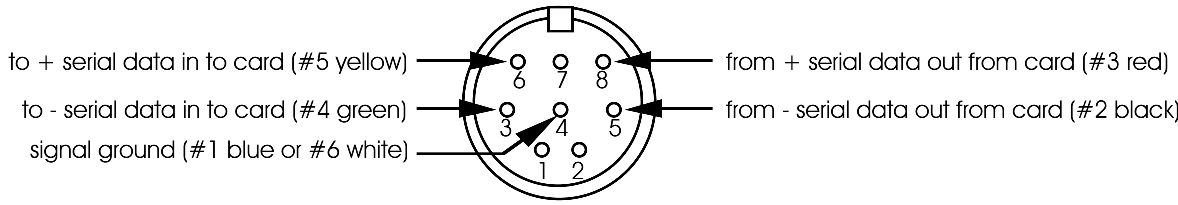
The serial data signals from the Micro Consoles are brought out on the six position RJ-11 (modular telephone style) connector labeled 'RS-422 Serial Port'. Facing the end of the cable with the release latch upwards, its pin out is as follows:

	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
	5	YELLOW	+ serial data IN to Micro Console
(right)	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 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
                         1) save Eprom
                         2) verify Eprom
                         3) restore Eprom
                         4) save archive
                         5) verify archive
                         6) restore archive
                         7) clear brick
                         r) restore default configuration
                         s) save current configuration
                         t) 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 Smpte 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 <u>hold</u> 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 Togglodyte. 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 Togglodyte as 'Digital A', and the analog side as 'Encoder B'.

2) The Togglodyte 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 Togglodyte 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 Togglodyte are used as follows:

Assign: This is the button you use when you want to assign the input channel on the Togglodyte to one of the outputs attached to the system. If the Togglodyte 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 Togglodyte 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 Togglodyte 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 Togglodyte 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 a invalid or nonexistent channel or a set of digitals, then PC·MACs will never send a resolution byte to the Togglodyte, 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**. command key:

1) Momentarily press the **ALT./REV**. button. The word 'alt' will appear in the upper line of the display if the Togglodyte 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 Togglodyte 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 Togglodyte.

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 Togglodyte 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 INBETWEEN 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 Togglodyte. This command is not available if the Togglodyte 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 used [3].
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 Togglodyte 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 Togglodyte (optionally), and the figure is attached to the 1/4 J6 output from the Togglodyte (optionally). DMX-512 is transmitted by the Togglodyte on each frame when operating in this mode. The wire between the Togglodyte and the PC·MACs system (specifically

[3] These same buttons are used for **Punch in/Punch out** and **Sequencer Start** when the Togglodyte 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 Togglodyte. 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 Togglodyte.

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 Togglodyte.

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 a 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 a 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 Eprom 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 the the EEprom (it also puts the Togglodyte into **Setup mode**). To save it permanently, you must select the **Write to EEprom/Read from Eprom** 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.

- 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	(dls)		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	())		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%