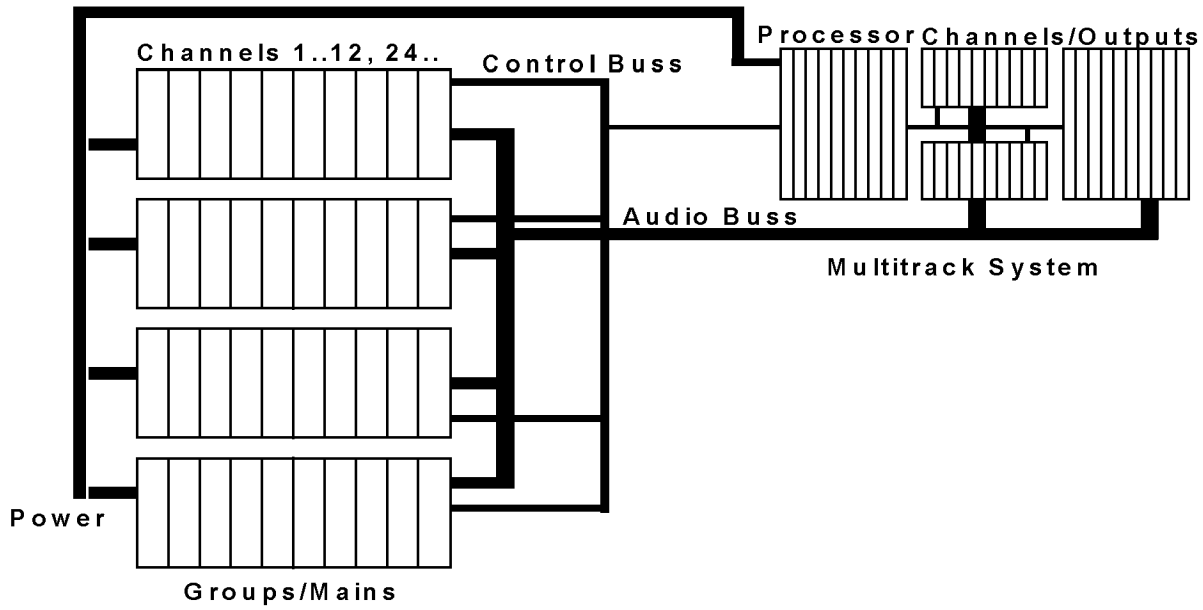
10 MULTITRACK - IN DETAIL

BACKPLANES OVERVIEW

Backplanes, Connections, Configurations, Channel Controls, Connections and Processing.

There are 4 classes of backplane: Channel, Group, Auxiliary and Multitrack (which consists of 3 types in a specific configuration). A simplified console structure looks like this:



MULTITRACK ROUTING BACKPLANES

The design of the Multitrack routing system requires a number of control and audio cards in addition to the backplanes and processor card. The Multitrack outputs backplane (HN3916) and the Processor Card Backplane (HN3914) must always be present. Use of either one or two extra HN3915's depends on the size of the console.

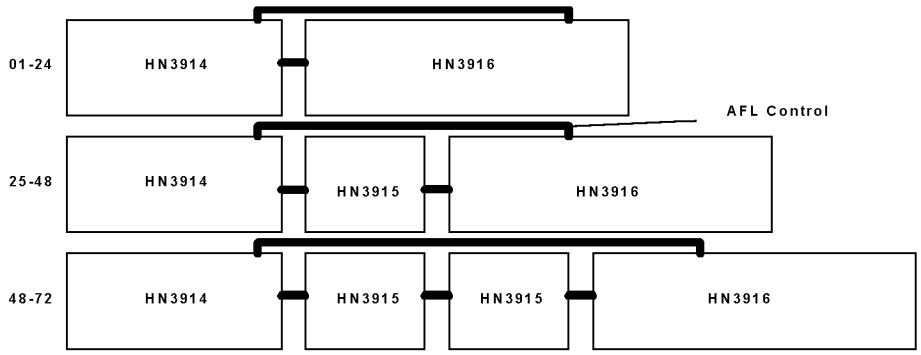
CHANNEL AND GROUP BACKPLANES

There will always be one Group backplane, but up to 5 channel backplanes, (with a combination of either mono and/or stereo channels). Each is linked by IDC20's and IDC50's.

CONFIGURATION

The number of Multitrack routing backplanes required depends on console size. For a 24 channel, 32 track console, only the HN3914 & HN3916 are required. From 25-48, add the HN3915, for anything larger, add a second HN3915. The backplanes can only be configured in set arrangements.

BACKPLANE CONFIGURATION



MULTITRACK ROUTING CHANNEL SELECT

Any one channel is selected as the current assign channel & it will be the owner of any Multitrack routing displays or control changes. If an MTR channel select button is pressed, this sets a latch (via the Processor Card) in the Function Cards (RY3696) and the system acknowledges the control change (via the MTR LED).

The RY3696 provides access to the LEDs and BUTTONS, and also interfaces to the Processor Card (UN3551). When a button is pressed, a bit in the processors memory is deasserted (made 0), and this data is passed to the processor via an *Octal Tristate Transceiver* or bi-directional buffer (the 245). The T225 Transputer receives this data when it polls the card (via its memory map) and determines which button was pressed. Since each RY3696 controls 3 sets of 8 buttons and LEDs, each button/LED is a single bit in the memory map, and the T225 can therefore determine the physical button pressed.

When an LED is required to be set, the reverse occurs. Data is written to the memory location (all 8 bits) and the RY3696 determines that it is to WRITE and not READ (P/W) and latches the LED appropriately (i.e. OFF or ON).

The GAL 20V8 (or PAL) performs the memory decoding and code plate detection. Each RY3696 has a code plate (via the backplane) and this is compared to the data address. The actual memory map is in reality a 32 byte area (repeated throughout T225 memory).

As any panel could be accidentally plugged into any backplane and there is no panel readback available for identification, should a module appear to have no response, check that it is connected to the correct points on the backplane.

DIGITAL CONTROL

The ROUTE matrix (the combinations of channels to/from tracks) is stored in the T400. The Matrix Cards (RX3651) implement the switching via latches. Each card controls 12 channels to 4 tracks. This means that all console configurations can be accommodated. The Processor Card (UN3551) is assumed to have a part in all activities.

It can be seen that the control changes are implemented solely by the RX3651 and RL3652 combination. It is probably more useful to use the names of the cards in this respect: RX3651 MATRIX Card, and RL3652 OUTPUTS Card. This helps in identifying possible faults in a general sense.

If a route is not made, e.g. the control signals do not change, then there may be a fault with the Function Card (between the 245, the GAL and the 541). If the route is set, but not made e.g. the control is recognised but not implemented, then the matrix card is at fault. If the route is made, but no audio passes, then the output card is suspect. If the output is seen (via a meter) but no LED sets to acknowledge, then the fault is likely to be the function card but at the LED end (574, GAL and 245). It is always worth reprogramming the GAL/PAL just to make sure.

MULTITRACK ROUTING CARDS

RY3696, The Function Card

The purpose of the card is to provide an interface for the T225 Transputer and the buttons and LEDs. It is a very simple card, but the complexity is hidden in the firmware of the GAL or PAL (whichever is used). This provides address and code plate decoding, and also direction control as the card will be written to and read from, with different circuits for each activity. The bi-directional buffer stores the data and places it on the appropriate data buss in each case.

The card is organised into 2 sections - the read and write sections. In each there are 3 sets of 8 latches and resistors. On the write circuit there are additional transistors to drive the LEDs.

The 74HC245 provides the data buffer. This depends on the direction state, and either reads or writes to the external data buss. If the card is in read mode, the GAL instructs the appropriate 74HC541 to copy its 8 bits of data to the data buss. This is then clocked out through the 245 to the external data buss.

On a write, the data at the 245 is clocked into the card, and sent to the appropriate 74HC574 to control the LEDs.

It should be noted that the address involved for reading and writing is the same. The GAL determines which operation is required.

The '574 is an Edge-triggered TriState Octal D-Type Flip-Flop.
The '541 is an Octal TriState non-inverting buffer.
The '245 is an Octal TriState transceiver.

The external data buss is connected directly to the processor card and the T225. There it is processed according to the above schema. Depending on which card and which button was set the software can then perform the state changes as appropriate.

RX3651, The Matrix Card

This card operates in a similar way to the RY3696. Its purpose is to set the latches ('574's) that switch the audio from the source to the destination. In this case, the source is any number of channels, and the destination is any number of tracks (up to the maximum).

There are two GALs and the first (IC47) performs address decoding. The second (IC48) performs the channel to track decoding for that card. Note that one card takes 12 [stereo] channel inputs and routes them to 8 tracks. The route matrix is therefore internal to the card.

RL3652, The Outputs Card

This card has no digital control, but takes 8 inputs (AFL, TRACK and TAPE REPLAY) and provides audio output and VCA control for the Multitrack Bargraphs. The Recording Level Control is situated on the Multitrack Bargraph panel.

AFL Control

Multitrack AFL control is provided in a slightly different manner to the Track Routing. In AFL mode the Multitrack Bargraph buttons provide AFL control of that particular track. This control is provided by dedicated RY3696's. Two cards are required for the full 32 tracks, and the RY3696's are output only. These drive the AFL controls on the RL3652 directly, through the long AFL control ribbon.

Fault Tolerance & Fault Rectification

In the S2 console, the Multitrack routing internal software should rectify most problems, such as failure to write to the FLASH. There are situations which the software cannot support, such as card failure or cards not present. The software attempts to use the cards, but makes no assumption about them.

The system has a reset facility and should be used to restart the system on a failure.

NOTE: Removing or replacing cards whilst the console is still powered is NOT recommended.

Reset

The top button (RESET) and LED combination on the Ancillary Functions panel is the Multitrack routing system reset and ERROR LED. When this button is pressed, the Multitrack routing system is immediately reset and brought to its power-up state. Under normal conditions, pressing this button restarts the Multitrack routing system program, reloading the last known routing settings, setting the console to this state and continuing as normal.

When the RESET button is pressed, the system does not store the current routing settings in the FLASH memory. Therefore, if the operator presses RESET, the system will revert to the settings last saved at power down.

The RESET button may be pressed at any time, however if it occured during the FLASH memory write process, this would result in data not being correctly written to the FLASH memory and may occasionally cause the system to generate a default route setting on subsequent restart.

Pressing RESET is therefore a ***LAST RESORT*** and should only be used when all other possible operations have been attempted and failed.

Errors

In the event of an error, the integral RESET LED illuminates to indicate the state of the Multitrack routing system. The operator must press the RESET button for the Multitrack routing system to restart itself. Failure to do this will prevent the Multitrack routing system from functioning as expected. This is the first indication of a possible problem for the operator to determine.

When the Multitrack routing system detects an irrecoverable error, the RED ERROR LED illuminates on the RESET button. This should only occur if there is a very serious problem. The Multitrack routing system will attempt to reconcile all possible operational errors through its internal logic. An example of an irrecoverable failure may be FLASH memory failure, but this would be a very unlikely event.

FLASH memory is a permanent type of memory that is utilised in Calrec Audio Parallel Processing Technology to provide data storage and recall. If there is a physical problem with these devices, then expert assistance should be called for further guidance.

Error Conditions & Rectification

There are a number of possible error conditions, which can be categorised under the types described below.

Operational Errors

These relate to the operator not performing the operation expected in the correct manner.

In most cases the software will present an intuitive interface. The system has been designed to anticipate as much conditional logic in operational terms as possible and should cater for every known eventuality. However, It is acknowledged that there might be some particular condition that has not been considered & in this case the system will be updated. It is important that should there be any problem, which is not an expected condition, then Calrec Audio Customer Support should be informed.

In most instances however, the operator may not realise immediately why the desired operation cannot be performed, or did not anticipate the response of the system, because, for example, they did not realise which mode the console was in at the time.

System Failures

Again, any problems should be reported to Calrec Audio Customer Support.

External Failures

These relate to conditions external to the console, such as power and environmental conditions.

The Multitrack routing system design has been designed to enable the system to respond to power failures quickly and efficiently. In the event of a power failure, the power status detection circuits instruct the Multitrack routing system that the power has FAILED. There is now a finite time period in which the system can interrupt its current operation and write the current routing configuration to FLASH memory. It will also invalidate any previous setting (or memory) saved so as not to cause conflict. Assuming that this process was completed, a verification process may start, pending complete power-failure. Once this process has also been completed the Multitrack routing system will illuminate the ERROR LED.

In the case of “Brown-Outs”, where the power fails momentarily, the Multitrack routing system will still perform its normal power-down procedure. Again, the ERROR LED will indicate that the data has been properly saved, and the system is ready to be rebooted. The operator will have to press RESET in order to restart the system. This will cause the latest settings (those at the time of the power glitch) to be immediately recalled and displayed.

The data stored will have its own verification and validation performed both at the time of storage and the time of reading, which will help guard against corruption during the save process. If the data is corrupt on power-up, then the system will generate a default system setting, as a precaution.

GLOSSARY

This glossary lists common expressions used within this document, and a brief explanation of their meaning.

AFL — After Fader Listen. A monitor point in the audio path, immediately post the fader.

DRAM — A volatile memory device that cannot store information without power and a processor refresh. However these devices are extremely fast and simple to use in computing, and therefore are used to store temporary programs and data during execution.

FLASH — A non volatile memory device that under certain conditions allows erasure and subsequent writing of user data. The longevity and security of these devices makes them ideal for embedded applications. These devices require special management software to be written to make efficient use of them in applications.

FLEXLOGIC — A programmable logic device that can replace discrete components. Can be programmed only once and is then permanent.

FROSTY — Calrec Audio's in house FLASH memory management 'Flash Rom Operating System'.

LINK ADAPTER CARD — A plug in card for a standard PC that enables communications between the host PC and the Transputer.

MULTITRACK — A device that enables recording, playback and monitoring of any number of channels (or paths) to and from a storage medium (e.g. tape)

PATH — The audio route from an input to an output in a mixing console. The path is linear and traceable, and allows various modules to perform tasks on the signal through the path.

TRANSPUTER — A microprocessor whose architecture is designed to implement parallel processing according to the "Concurrent Sequential Processing" model devised by Hoare, and implemented using Occam. (The transputer is the only type of microprocessor commercially available to be designed to implement a specific general purpose language).