This document is meant to inform the sophisticated user of our remote of some of the technical aspects, features and capabilities of our remote. Our User Guide provides the same information but in a simplified format. Remote owners that use this document, do so at their own risk as some use may achieve unintended results. Our Support personnel are not trained to explain these functions in the detail presented here.

1.1 Operational Features

1.1.1 Direct Code Setup

- Each code consists of five digits, with the leading digit defining the device group being setup. The remaining four digits are from 0 to 9 and are defined in the main data base.
- The leading digit device indicators are as follows:

0	Cable Device Group
1	TV Device Group
2	Video Device Group
3	Audio Device Group

The five-digit code obtained by the user from the product code list shall be programmed as follows:

[Mode] → <<SETUP>> → <Digit> → <Digit> → <Digit> → <Digit> → <Digit>

The single LED or current mode LED shall blink once upon each digit entry except for the last digit, where it shall blink two times to confirm that a valid code has been programmed. The unit shall turn off the LED, automatically exit the programming mode, return to the idle mode and restore the last preprogrammed codes under the following conditions:

- If any other key is pressed besides a digit key, the unit shall display one long blink, exit programming state, and restore the last preprogrammed code.

- Upon entry of an invalid key sequence or invalid code, the remote control shall display one long blink of the single LED or current physical mode LED and return to the last preprogrammed code.

The unit shall exit programming state and return to the last preprogrammed code if 10 seconds has elapsed between digit entries.

1.1.2 Library Search

In the event that the device code for a particular target unit is unknown, the user shall be able to cycle the remote through the available codes for that device mode and sample functions from each code in order to find the code, which properly operates the desired target device. All keys are available to be sampled, provided they are applicable to that device. The last function that was sampled before Ch up/Ch down key presses will be designated function to send for each Ch up/Ch down key press. Invalid key presses shall be ignored while in the programming state.

To cycle through each available device code and sample its functions:

[Mode] → <<SETUP>> → <9> → <9> → <1> → <Device group number> → [Function] → <Ch up/Ch down> → [Function] → <Ch up/Ch down> …..→ <SETUP>

Function keys are any valid keys except mode, setup, and Ch+/-.

The available FUNCTIONS within a code may be sampled as many times as desired until advancing to the next code by pressing the CH UP key or returning to the previous code by pressing the CH DOWN key. After sampling FUNCTIONS, the user can continue the search with the previous (CH DOWN) or next (CH UP) code which will send the FUNCTION that was last sampled.

The search functions initial "cold start" (when no code is programmed) begins with the most popular brand of equipment to the least popular. The single LED or current physical Mode LED will illuminate each time a function is sent (when picked with IR). If the search function is activated after a code has been programmed in, the search cycle begins with the current programmed ID. Pressing either the CH UP or CH DOWN key, will increment or decrement to the next table entry and transmit the power (or other) FUNCTION associated with currently selected table entry and wait for another CH UP or CH DOWN arrow key.

Scanning of the database will be circular. The single LED or current physical Mode LED shall illuminate 3 times without transmitting IR, once it reaches back to the original ID it will stay in the Library Search mode.

Pressing **<SETUP>** listed at the end of the sequence will store the device code, which was last sampled. The remote control exits library search mode with the current device code. The current physical Mode LED blinks twice in confirmation, the remote returns to normal operation.

- If no key is pressed before Ch up/Ch down then default function to be power.
- Upon entry of an invalid key sequence, the remote control's single LED or current physical Mode LED shall display one long blink and return to the last preprogrammed code.
- The unit shall exit programming state and return to the last preprogrammed code, if 10 seconds has elapsed between digit entries.

1.1.3 Device Code Blink Back

The device code for a mode shall be verified as follows:

[Mode] → <<SETUP>>→ <9> → <9> → <0> → <1>(count blinks) → <2>(count blinks)→ <3>(count blinks) → <4>(count blinks) → <5>(count blinks)

The number of blinks counted after pressing each digit **<1>, <2>, <3>, <4>, and <5>** key shall represent the 5 digit device code for the selected mode beginning with the left most digit. The delayed start of blink out shall be .5 seconds with a .5 second delay after each key press for digit **<1>,<2>, <3>, <4>, and <5>**. The remote shall exit the Code Verification state when, after performing the sequence <**9> → <9> →<0>,** the user presses any key other than digit 1. If the sequence of pressing digits **<1>, <2>, <3>, <4>, and <5>** for counting blinks is not maintained, the remote shall exit the Code Verification state.
Operation error and state exit shall be marked by the LED or current mode LED emitting a long blink.

- Upon entry of an invalid key sequence, the remote control's single LED or current physical mode LED shall display one long blink and return to normal operation.
- The unit shall exit programming state and return to normal operation if 10 seconds has elapsed between key presses.

1.1.4 ID Lock

After a valid code has been set, the code for a specific mode shall be locked and unlocked as follows:

[Mode] → <<SETUP>> → <9> → <8> → <2>

- The unit shall blink 2 times upon being locked and blink 4 times when unlocked.
- Upon entry of an invalid key sequence, the remote control shall display one long blink and return to normal operation.
- The unit shall exit programming state and return to normal operation if 10 seconds has elapsed between key presses.

Direct Code Setup, Search will not be allowed when the code has been locked.

1.1.5 Global Channel Lock (973)

Description:
Allows user to lock channel control to one mode across all modes available. Keys affected: Digits (0-9), Channel Up/Down, Enter and Last.

Programming Sequence:
The user can lock the Channel Control keys as follows:
<<SET-UP>> → <9> → <7> → <3> →<CHANNEL UP>→ <SOURCE> (LED will blink 2 times upon being locked)

LED User Feedback:

- The unit shall blink 2 times upon being locked.
- One blink if valid key is pressed
- Blink Error upon entry of an invalid key sequence and return to normal operation.
- The unit shall exit programming state, remain in the current mode and return to normal operation if 10 seconds has elapsed between key presses.

Additional Information:
Table 1: Illustrates Global Channel Control Lock to CBL mode

	Channel control under each mode			
	A	B	C	D
Channel Source	C	C	C	C

Channel Control will reset back to default by either 981 or 977 sequence.

Example:
To lock \Channel Control to the cable box:
<<SET-UP>> → <9> → <7> → <3> →<CHANNEL UP>→ <CBL>

1.1.6 Global Channel Un-lock

Description:
To unlock channel control.

Programming Sequence:
The user can reset the channel controls to be that of the original device mode as follows:
<<SET-UP>> → <9> → <7> → <3> → <CHANNEL DOWN> (Unit will blink 4 times upon being unlocked)

LED User Feedback:
- The unit shall blink 4 times upon being unlocked.
- One blink if valid key is pressed
- Blink Error upon entry of an invalid key sequence and return to normal operation.
- The unit shall exit programming state, remain in the current mode and return to normal operation if 10 seconds has elapsed between key presses.

Additional Information:
- The channel control function will follow the mode selected. If no channel control function exists for the current device it will follow the pick on the functional key-chart.
- When the Channel Lock feature is selected by the programmer, it will be stored in the FLASH so that it is retained permanently.

Table 2: Illustrates Global Channel Un-Lock

	Channel control under each mode			
	A	B	C	D
Channel Source	A	B	C	D

Example:
<<SET-UP>> → <9> → <7> → <3> → <CHANNEL DOWN>

1.1.7 Volume Lock

The user shall lock volume to one mode as follows (a.k.a. Global Volume Lock):

<<Setup>> → <9> → <9> → <3> → <Desired Mode>

The unit shall blink two times upon being locked.

The user shall reset the volume controls to be that of the original device code as follows (a.k.a. Global Volume Unlock):

<<Setup>> → <9> → <9> → <3> → <Volume Up>

The unit shall blink 4 times when unlocked.

If user wants to unlock volume for a specific mode (a.k.a. Individual Volume Unlock):

[**Mode**] **→ <<Setup>> → <9> → <9> → <3> → <Volume Down>**

The unit shall blink 4 times upon being unlocked.

Example:
<**TV> → <<Setup>> → <9> → <9> → <3> → <Volume Down>**

***The Default setting is Volume Unlocked**

- Upon entry of an invalid key sequence, the remote control shall display one long blink and return to normal operation.
- The unit shall exit programming state and return to normal operation if 10 seconds has elapsed between key presses.

1.1.8 Mode Independent Single Level Macro

A Mode Independent single level macro has one command sequence programmed by the user with up to 32 keystrokes in the sequence.

To program a command sequence onto a macro key, one command at a time:
<<SETUP>> → <9> → <9> → <5> → <Macro Key> → <Command…> → <<SETUP>>

To add an additional 250ms delay between a key stroke, press <Setup> twice.

To clear macro set up on a specific key:
<<SETUP>> → <9> → <9> → <5> → <Macro Key> → <<SETUP>>

The mode independent macro feature is not mode specific. The macro will end in the last mode specified in the macro sequence. All keys (including Mode keys) except the setup key are available for a macro to be programmed on.

- Upon entry of an invalid key sequence, the remote control shall display one long blink and return to normal operation.

- The unit shall exit programming state and return to normal operation if 10 seconds has elapsed between key presses.
- If a Mode Independent Single Level Macro and Mode Dependent Single Level Macro are programmed to the same key, the Mode Dependent Single Level Macro takes priority.
- If Macro on Mode key, it takes priority over mode key IR. The macro will end in the last mode of the macro sequence.

1.1.9 Mode Dependent Single Level Macro

A mode dependent single level macro has one command sequence programmed by the user with up to 32 keystrokes in the sequence.

To program a command sequence onto a macro key, one command at a time:
[Mode (physical)] →<<SETUP>> → <9> → <7> → <8> → <Macro Key> → <Command…> → <<SETUP>>

To add an additional 250ms delay between a key stroke, press <Setup> twice.

To clear macro set up on a specific key:
[Mode] →<<SETUP>> → <9> → <7> → <8> → <Macro Key> → <<SETUP>>

The mode dependent macro feature is mode specific. The macro will only execute from the programmed mode and key. The macro will end in the last mode specified in the macro sequence. All keys except the setup key and mode keys are available for a macro to be programmed on.

- Upon entry of an invalid key sequence, the remote control shall display one long blink and return to normal operation.
- The unit shall exit programming state and return to normal operation if 10 seconds has elapsed between key presses.
- If a Mode Independent Single Level Macro and Mode Dependent Single Level Macro are programmed to the same key, the Mode Dependent Single Level Macro takes priority.
- A mode dependent macro will overwrite a key moved or learned key, and vice versa, depending on what feature was programmed last.
- The shifted key mover or shifted key learner (i.e. <Setup> <Setup> <Digit>) can't be available in the macro playback because <Setup> <Setup> is used for adding an extra 250ms delay while <Setup> is used for Synthesizer

1.1.10 Learning

- Purpose:
  The Learning feature is used as a supplement to a standard pre-programmed library. In other words, the standard ROM library provides most of the functions needed, but the user can add a small number of additional functions of his choice.
    - Additional requirements:
    - Hardware IR receiver circuit for learning input
- Target key types for learning:

- Learned keys are mode specific.
- Can learn onto any primary or dedicated key. Cannot learn onto programming key type or Mode key.
- Learned keys can be used in macros, etc., like any other key.

- Learning capacity:

  Approximately 42 to 75 keys depending on code being learned. Learned functions are stored in a separate section of Flash memory and are independent of macro/key mover or upgrade capacity.

- Learning operation:

  To optimize success, the learning process should be conducted in an area where there is a low level of IR emission. High levels of "nature light" or energy efficient fluorescent lights could interfere with a learning event. The source and target (learner) remotes should be no more than 1 to 2 inches apart during a learning event and the IR LEDs of the two units should be aligned with each other. The learning operation is initiated as follows:

  Method A:

  1. **<<SETUP>> → <9>→ <7>→ <5>** initiates learning mode. (Double blink confirmation)
  2. Press **[mode] →[setup] → <key to be learned>** (time out if no key pressed in 10 seconds & backlight, if applicable, must be OFF)
  3. Visible LED or current mode LED flashes rapidly (time out if no received signal detected in 5 sec)
  4. Hold teaching remote close to IR LED and press key to be taught.
  5. Visible LED goes out. Continue to press teaching key until double blink from visible LED.
  6. Repeat steps 2 through 5 as often as desired (up to limit of memory)
  7. Exit learning mode by pressing **<<SETUP>>** or by time out (10 seconds).

  Method B:

  1. **<<SETUP>> → <9>→ <7>→ <5>** initiates learning mode. (Double blink confirmation)
  2. Press **[mode] → <key to be learned>** (time out if no key pressed in 10 seconds & backlight, if applicable, must be OFF)
  3. Visible LED flashes rapidly (time out if no received signal detected in 5 sec)
  4. Hold teaching remote close to IR LED and press key to be taught.
  5. Visible LED goes out. Continue to press teaching key until double blink from visible LED.
  6. Repeat steps 2 through 5 as often as desired (up to limit of memory)
  7. Exit learning mode by pressing **<<SETUP>>** or by time out (10 seconds).

  At step 5, one long blink indicates learning failure, which could be:

  Bad capture (try again)

  Memory full (delete some other function)

  Unlearn-able code.

At step 1, one long blink indicates low battery or faulty flash memory detected. (I.e. the unit will not go into learn mode if either of these conditions exist.)

1.1.11 Delete Learning

To delete a learned code, either overwrite it with a new code on the same key, or use the sequence:
Method A:

1. **<<SETUP>> → <9> → <7> → <6> →** initiates delete learning mode. (Double blink confirmation)
2. Press **[mode] → [setup] → <key to be deleted> → <key to be deleted> (2 blinks)**

Method B:

1. **<<SETUP>> → <9> → <7> → <6> →** initiates delete learning mode. (Double blink confirmation)
2. Press **[mode] → <key to be deleted> → <key to be deleted>** (2 blinks)

To delete all learned codes within a specific mode, use the sequence:
<<SETUP>> → <9> → <7> → <6> → <mode>→<mode> (2 blinks)

- Sending a key's original (preprogrammed) function:

If a function is learned onto a key, then <**SETUP> → <key>** will send the key's original function (as long as nothing else has been learned or key moved onto the "shifted" key as well.)

- Interaction of learned keys and key mover:
- If both a learned function and a key moved function are placed on the same key, whichever was programmed last will take precedence.
- A learned function cannot be used as a source for key mover; key mover always uses the key's original function as the source.
- Use of learned keys in macros:
- There are no particular restrictions on use of learned keys in macro sequences. However, functions which are unusually long (e.g. "record" on some Zenith VCRs) may not work because the learner is limited in the number of repeats it sends.
- If a learned function used in a macro is subsequently deleted, the macro will revert to sending the key's original function.
- Limitations on learning:
- There are certain device codes which are not learnable. These include multi-frequency codes (e.g. Telefunken), some high frequency codes, and other unusual formats.
- The learner will support IR codes with carrier frequency up to 135 KHz. Some higher frequency codes can be supported by a special software feature.
- The unit can learn only one code per key. It can't be taught a sequence of several keystrokes on one key. In order to perform a sequence, learn each function onto its own key and then program a macro to use them.
- The maximum code gap is 131,070 micro seconds.
- The placement of the IR LED in the source or target unit may make it difficult to correctly align these units. In some cases it may require the user to re-learn a code if it is not correctly learned.
- Source units which include a lens may require the user to re-learn a code if not correctly learned. When proper alignment is established, the target remote will correctly learn the source data.
- In general, it is not recommended to learn a function to the Record Key. The Record Key requires a double key press to send the record function in normal operation. The double key press is lost when the Record key is involved in most learning operations. This lack of consistency in operation generates a source of confusion for the user and is best to be avoided when possible.
- Upon entry of an invalid key sequence, the remote control shall display one long blink and return to normal operation.

- The unit shall exit programming state and return to normal operation if 10 seconds has elapsed between key presses.

1.1.12 General IR Key Punch Through

This feature is to allow the operator/programmer to configure the punch through of general IR keys assigned in one dedicated mode into any and all other modes. To set the General IR key Punch through:

<<Setup >> → <9> → <8> → <4> (LED or current physical mode LED will blink twice) **→ <Source Mode> → <IR Key> → <IR Key> → …. <Destination Mode> → <Destination Mode>→ …..<<Setup>>** (LED or current physical mode LED will blink twice)

Now, when in the destination modes selected during programming, the selected IR keys will punch through to the selected source mode.

To clear:
<<Setup >> → <9> → <8> → <4> (LED or current physical mode LED will blink twice) **→ <<Setup >> (**LED or current physical mode LED will blink twice)

- Upon entry of an invalid key sequence, the remote control shall display one long blink and return to normal operation.
- The unit shall exit programming state and return to normal operation if 10 seconds has elapsed between key presses.
- General IR key punch through will send the assigned IR data of the source mode the keys selected.

If General IR punch though is setup a second time, it will over ride the first one.

1.1.13 SIO Blink Back

<<Setup>> → <9>→ <8>→ <9> (2 blinks) → <Digit 1> (count blinks) → <Digit 2> (count blinks) → <Digit 3> (count blinks) → <Digit 4> (count blinks).

If 986 is not programmed into a unit, the 989 blink back will be invalid with a long blink, indicating that a SIO number has not been programmed (but doesn't mean a SIO file has not been created).

A long blink will be indicated when bad Flash while the SIO registration sequence 986 or recall sequence 989 is programmed.

- Upon entry of an invalid key sequence, the remote control shall display one long blink and return to normal operation.
- The unit shall exit programming state and return to normal operation if 10 seconds has elapsed between key presses.

1.1.14 Illuminated Keypad

Keypad illumination is driven by a software controlled pin on the chip. The backlight is always enabled; any key press shall cause the backlight to turn OFF as long as the key is held down, except in programming mode. Upon release, the backlight shall immediately turn ON and remain ON for 5 seconds, or until another key press, at which time the keypad will turn OFF. When released, the 5 second timer will start again. If in the programming mode, the keypad

shall remain lit for 10 seconds before extinguishing. When either the “Learner” or “Modem” feature is used, the light feature should be turned “off”. When the “Learner” operation is completed, the light feature should be returned to its previous operation.

1.1.15 Operational Reset

Clears all **SETUP** features not related to ID code **SETUP**. Namely, Macros, Key Mover, Volume Lock, and any Flash information related to these features. Does not reset the ID Lock, SIO Retention.

<<SETUP>> → <9> → <8> → <0>

- Upon entry of an invalid key sequence, the remote control shall display one long blink and return to normal operation.
- The unit shall exit programming state and return to normal operation if 10 seconds has elapsed between key presses.

The LED shall respond as outlined in this document: Visible LED - for User Feedback.

1.1.16 Basic User Reset

Clears all **SETUP** features including those related to ID code **SETUP.** The remote resets to the default Id but does not clear upgraded codes or SIO Retention.

<<SETUP>> → <9> → <7> → <7>

- Upon entry of an invalid key sequence, the remote control shall display one long blink and return to normal operation.
- The unit shall exit programming state and return to normal operation if 10 seconds has elapsed between key presses.

The LED shall respond as outlined in this document: Visible LED - for User Feedback.

1.1.17 Low Voltage Detection

When the microcontroller's VDD equals 2.0V (+/- 0.2V) writes to the Flash memory are inhibited. While in this state the remote will continue to operate normally down to the brown out voltage (Lowest operating voltage of the microcontroller), but will not allow the user to enter any programming sequences or codes. At or below this level, if the user presses and holds the SETUP key for more than 2.5 seconds, the red LED under the selected device shall error blink and flash 5 times and the remote will be fully operational. Also, at this voltage or below, the user LED under the selected mode will blink 5 times upon key release. The blinking sequence will be interrupt-able.