IntelliGain™

User Manual

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REVISION HISTORY

REVISION	DESCRIPTION	DATE
1.0	First Release	Nov 07
1.1	Updated VistaLINK® screenshots to reflect new controls (Hold Time, Audio Source Select).	July 09
1.2	Added “Noise Floor Threshold” parameter	Oct 09

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1. OVERVIEW

IntelliGain™ is a technology developed by Evertz to control the loudness of audio programs on the fly. More specifically, it calculates the perceived loudness of the input audio and modifies the audio to ensure that the long-term average loudness level is at the target level. IntelliGain™ works with mono, stereo and multi-channel audio per program and can handle up to 8 programs simultaneously. The objective loudness calculation is based on ITU Recommendation (ITU-R BS.1770), "Algorithms to measure audio program loudness and true-peak audio level". This recommendation provides equations for calculating loudness over mono, stereo and multi-channel audio programs. IntelliGain™ constantly calculates audio program loudness. When the loudness is over the target level, it reduces the gain; and when the loudness is below the target level, it increases the gain. The gain adjustment smoothness is user-controllable by setting attack and release times.

An important feature that IntelliGain™ possesses is its ability to automatically detect commercials/promos and normal programs. During commercial/promo periods, it uses one set of attack and release times, and during normal program periods, it uses another set of attack and release times. Both sets of attack and release times are definable by the user. In general, it is desirable to have faster attack/release times for commercial/promo periods and slower attack/release times for normal program periods. The level adjustment at the transition from one program/commercial to the next is almost instant, but it is not audible. While within a program or commercial, the adjustment is slow to maintain the dynamic range of the material.

Features:

- Normalize loudness of audio programs to a target level
- Peak limiting
- Automatic detection of loud commercials or programs
- Relatively constant gain within a program interval to preserve audio dynamic range
- Artifact-free transition between programs and commercials
- Automatic configuration of audio programs according to input Dolby E™ or AC-3™ stream
- Simultaneously process multiple multi-channel programs
- User adjustable attack and release times

2. TOP LEVEL INTELLIGAIN™ CONFIGURATION

The IntelliGain™ Configuration tab displays the top-level IntelliGain™ control interface. There are a number of parameters that control both the Intelligent leveler and the on-board dynamic processor (compressor, expander, limiter).

Table 2-1 provides a brief overview of the top level of the IntelliGain™ Configuration menu tree. The details of each of the menu items are described in sections 2.1 to 2.8.

Program Configuration Source	Defines how the audio channels are grouped together.
Commercial Attack Time	Defines the maximum integration time that is applied when loudness increases during a commercial period.
Commercial Release Time	Defines the maximum integration time that is applied when loudness decreases during a commercial period.
Program Attack Time	Defines the maximum integration time that is applied when loudness increases during a program period.
Program Release Time	Defines the maximum integration time that is applied when loudness decreases during a program period.
Compander Attack Time	Defines how quickly the compander reacts to an increase in the input loudness.
Compander Release Time	Defines how quickly the compander reacts to a decrease in the input loudness.
Detected Program Configuration Source	Indicates the detected program configuration by the internal IntelliGain™ program configuration parser.
Audio Source Select	Defines the audio channels that will be fed into the program audio channels.

Table 2-1: IntelliGain™ Configuration Options

Figure 2-1 shows the IntelliGain™ Configuration view from the VistaLINK® NMS.

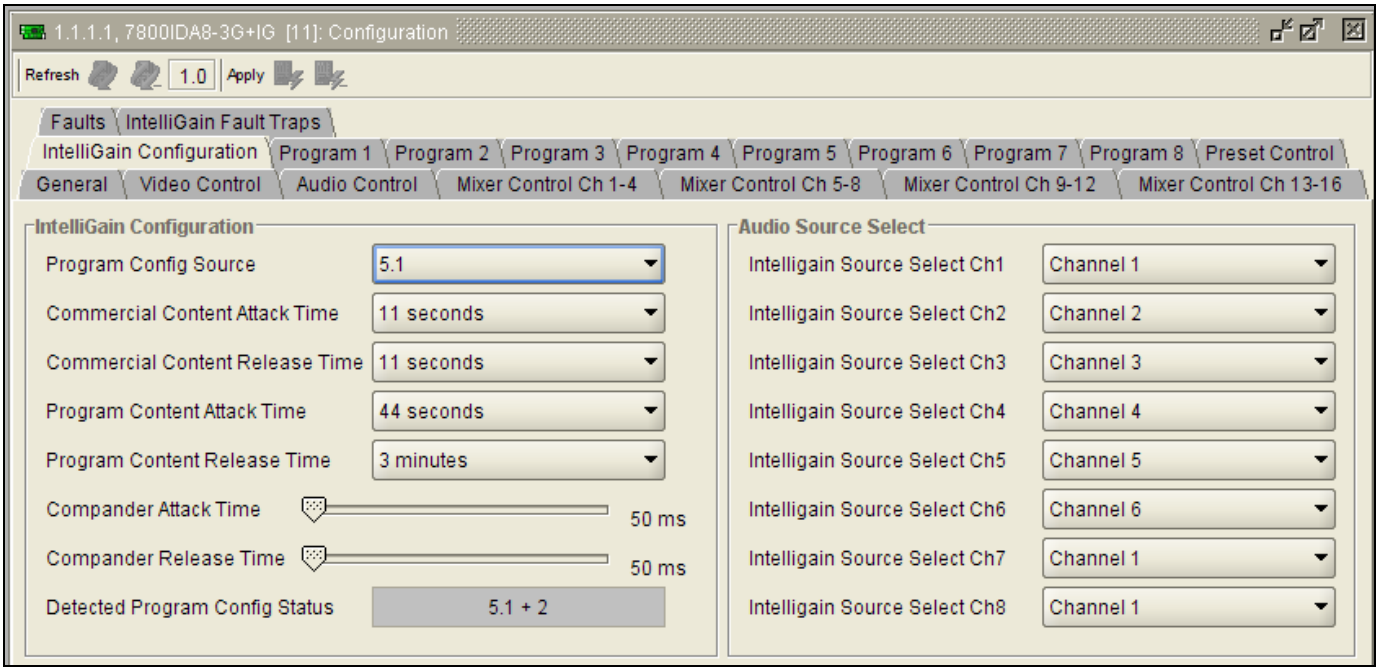

Figure 2-1: IntelliGain™ Configuration Screen

Sections 2.1 to 2.8 provide detailed explanations for each control available in the IntelliGain™ Configuration Source tab.

2.1. SETTING THE PROGRAM CONFIGURATION SOURCE

IntelliGain Configuration
Program Configuration Source
5.1+2
5.1 + 1 + 1
4 + 4
4 + 2 + 2
4 + 2 + 1 + 1
4 + 1 + 1 + 1 + 1
2 + 2 + 2 + 2
2 + 2 + 2 + 1 + 1
2 + 2 + 1 + 1 + 1 + 1
2 + 1 + 1 + 1 + 1 + 1
1 + 1 + 1 + 1 + 1 + 1 + 1 + 1
5.1
4 + 2
4 + 1 + 1
2 + 2 + 2
2 + 2 + 1 + 1
2 + 1 + 1 + 1 + 1
1 + 1 + 1 + 1 + 1 + 1
4
2 + 2
2 + 1 + 1
1 + 1 + 1 + 1
7.1
7.1 Screen
2 + 5.1
1 + 1 + 5.1
2 + 2 + 2 + 2 (p1, p2, p3, p4)
2 + 2 + 2 + 1 + 1 (p1, p2, p3, p4, p5)
2 + 2 + 2 (p1, p2, p3)

This parameter defines how the audio channels are grouped together. Up to eight channels can be grouped together in individual programs, where each program contains its own metadata. IntelliGain™ uses this parameter to configure multiple internal settings.

This control must be set to define the audio program provided as the input to IntelliGain™.

Note: It is important to follow the program to channel mapping guidelines, which are provided in Table 2-3. For example, Program Configuration Source 2 + 2 + 2 + 2 defines audio program 1 mapped to AES 1, audio program 2 mapped to AES 4, audio program 3 mapped to AES 2 and audio program 4 mapped to AES 3. Program Configuration Source 2 + 2 + 2 + 2 (p1, p2, p3, p4) has the audio program mapped sequentially.

If the audio program configuration is defined to be of this type, it is recommended to use this Program Configuration Source.

Table 2-3 provides a list of programs to channel mapping guidelines. For example, configuration 5.1+2, program 1 (P1) is mapped to channel CH1 to CH6 and program 2 (P2) is mapped to channel CH7 to CH8. Table 2-2 provides a list of abbreviations used:

Abbreviations	Description
P	Program
CH	Channel
L	Left or left front
R	Right or right front
C	Center or mono
LFE	Low frequency effect
Ls	Left surround
Rs	Right surround
Bsl	Back surround left
Bsr	Back surround right

Table 2-2: Abbreviations

Program Configuration	CH 1	CH 2	CH 3	CH 4	CH 5	CH 6	CH 7	CH 8
5.1+2	P1-L	P1-R	P1-C	P1-LFE	P1-Ls	P1-Rs	P2-L	P2-R
5.1 + 1 + 1	P1-L	P1-R	P1-C	P1-LFE	P1-Ls	P1-Rs	P2-C	P3-C
4 + 4	P1-L	P1-R	P1-C	P1-S	P2-C	P2-S	P2-L	P2-R
4 + 2 + 2	P1-L	P1-R	P1-C	P1-S	P3-L	P3-R	P2-L	P2-R
4 + 2 + 1 + 1	P1-L	P1-R	P1-C	P1-S	P3-C	P4-C	P2-L	P2-R
4 + 1 + 1 + 1 + 1	P1-L	P1-R	P1-C	P1-S	P4-C	P5-C	P2-C	P3-C
2 + 2 + 2 + 2	P1-L	P1-R	P3-L	P3-R	P4-L	P4-R	P2-L	P2-R
2 + 2 + 2 + 1 + 1	P1-L	P1-R	P3-L	P3-R	P4-C	P5-C	P2-L	P2-R
2 + 2 + 1 + 1 + 1 + 1	P1-L	P1-R	P3-C	P4-C	P5-C	P6-C	P2-L	P2-R
2 + 1 + 1 + 1 + 1 + 1	P1-L	P1-R	P4-C	P5-C	P6-C	P7-C	P2-C	P3-C
1 + 1 + 1 + 1 + 1 + 1 + 1 + 1	P1-C	P2-C	P3-C	P4-C	P5-C	P6-C	P7-C	P8-C
5.1	P1-L	P1-R	P1-C	P1-LFE	P1-Ls	P1-Rs	None	None
4 + 2	P1-L	P1-R	P1-C	P1-S	None	None	P2-L	P2-R
4 + 1 + 1	P1-L	P1-R	P1-C	P1-S	None	None	P2-C	P3-C
2 + 2 + 2	P1-L	P1-R	P3-L	P3-R	None	None	P2-L	P2-R
2 + 2 + 1 + 1	P1-L	P1-R	P3-C	P4-C	None	None	P2-L	P2-R
2 + 1 + 1 + 1 + 1	P1-L	P1-R	P4-C	P5-C	None	None	P2-C	P3-C
1 + 1 + 1 + 1 + 1 + 1	P1-C	P2-C	P3-C	P4-C	P5-C	P6-C	None	None
4	P1-L	P1-R	P1-C	P1-S	None	None	None	None
2 + 2	P1-L	P1-R	None	None	None	None	P2-L	P2-R
2 + 1 + 1	P1-L	P1-R	None	None	None	None	P2-C	P3-C
1 + 1 + 1 + 1	P1-C	P2-C	P3-C	P4-C	None	None	None	None
7.1	P1-L	P1-R	P1-C	P1-LFE	P1-Ls	P1-Rs	P1-Bsl	P1-Bsr
7.1 Screen	P1-L	P1-R	P1-C	P1-LFE	P1-Ls	P1-Rs	P1-Le	P1-Re
2 + 5.1	P1-L	P1-R	P2-L	P2-R	P2-C	P2-LFE	P2-Ls	P2-Rs
1 + 1 + 5.1	P1-C	P2-C	P2-L	P2-R	P2-C	P2-LFE	P2-Ls	P2-Rs
2 + 2 + 2 + 2 (p1, p2, p3, p4)	P1-L	P1-R	P2-L	P2-R	P3-L	P3-R	P4-L	P4-R
2 + 2 + 2 + 1 + 1 (p1, p2, p3, p4, p5)	P1-L	P1-R	P2-L	P2-R	P3-L	P3-R	P4-C	P5-C
2 + 2 + 2 (p1, p2, p3)	P1-L	P1-R	P2-L	P2-R	P3-L	P3-R	None	None

Table 2-3: Relationship between Audio Programs and Audio Channels

2.2. SETTING THE COMMERCIAL ATTACK TIME

IntelliGain Configuration
Commercial Attack Time
Less than 1 second
Less than 2 seconds
Less than 3 seconds
Less than 6 seconds
11 seconds
22 seconds
44 seconds
88 seconds
3 minutes
6 minutes
12 minutes
24 minutes

The *Commercial Attack Time* defines the maximum integration time that is applied when loudness increases during a commercial period. The actual integration time is content dependent. For more responsive results set the attack time to a smaller value.

2.3. SETTING THE COMMERCIAL RELEASE TIME

IntelliGain Configuration
Commercial Release Time
Less than 1 second
Less than 2 seconds
Less than 3 seconds
Less than 6 seconds
11 seconds
22 seconds
44 seconds
88 seconds
3 minutes
6 minutes
12 minutes
24 minutes

The *Commercial Release Time* defines the maximum integration time that is applied when loudness decreases during a commercial period. The actual integration time is content dependent. For more responsive results set the release time to a smaller value.

2.4. SETTING THE PROGRAM ATTACK TIME

IntelliGain Configuration
Program Attack Time
Less than 1 second
Less than 2 seconds
Less than 3 seconds
Less than 6 seconds
11 seconds
22 seconds
44 seconds
88 seconds
3 minutes
6 minutes
12 minutes
24 minutes

The *Program Attack Time* defines the maximum integration time that is applied when loudness increases during a program period. The actual integration time is content dependent. For more responsive results set the attack time to a smaller value.

2.5. SETTING THE PROGRAM RELEASE TIME

IntelliGain Configuration
Program Release Time
Less than 1 second
Less than 2 seconds
Less than 3 seconds
Less than 6 seconds
11 seconds
22 seconds
44 seconds
88 seconds
3 minutes
6 minutes
12 minutes
24 minutes

The *Program Release Time* defines the maximum integration time that is applied when loudness decreases during program period. The actual integration time is content dependent. For more responsive results set the release time to a smaller value.

2.6. SETTING THE COMPANDER ATTACK TIME

IntelliGain Configuration
Compander Attack Time
10ms to 2000ms (2 seconds)

The *Compander Attack Time* control defines how quickly the compander reacts to an increase in the input loudness.

2.7. SETTING THE COMPANDER RELEASE TIME

IntelliGain Configuration
Compander Release Time
10ms to 2000ms (2 seconds)

The *Compander Release Time* control defines how quickly the compander reacts to a decrease in the input loudness. The compander release time should be larger than or equal to the *Compander Attack Time*.

2.8. SETTING THE DETECTED PROGRAM CONFIGURATION SOURCE

- *IntelliGain Configuration*
  - *Detected Program Config Source*
    - 5.1 + 2
    - 5.1 + 1 + 1
    - 4 + 4
    - 4 + 2 + 2
    - 4 + 2 + 1 + 1
    - 4 + 1 + 1 + 1 + 1
    - 2 + 2 + 2 + 2
    - 2 + 2 + 2 + 1 + 1
    - 2 + 2 + 1 + 1 + 1 + 1
    - 2 + 1 + 1 + 1 + 1 + 1
    - 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1
    - 5.1
    - 4 + 2
    - 4 + 1 + 1
    - 2 + 2 + 2
    - 2 + 2 + 1 + 1
    - 2 + 1 + 1 + 1 + 1
    - 1 + 1 + 1 + 1 + 1 + 1
    - 4
    - 2 + 2
    - 2 + 1 + 1
    - 1 + 1 + 1 + 1
    - 7.1
    - 7.1 Screen
    - 2 + 5.1
    - 1 + 1 + 5.1
    - 2 + 2 + 2 + 2 (p1, p2, p3, p4)
    - 2 + 2 + 2 + 1 + 1 (p1, p2, p3, p4, p5)
    - 2 + 2 + 2 (p1, p2, p3)

This is a reader only control to indicate the detected program configuration by the internal IntelliGain™ program configuration parser.

2.9. SETTING THE AUDIO SOURCE CHANNELS

- *IntelliGain Configuration*
  - *Audio Source Select*
    - *Intelligain Source Select Channel 1*
      - Channel 1 - 16

This control sets the channel mappings for the audio program configuration. This audio configuration then feeds the program configuration sources. For simplicity only Channel 1 is shown.

3. INTELLIGAIN™ CONFIGURATION BY AUDIO PROGRAM

IntelliGain™ can individually process up to eight audio programs independently. An audio program defines how the audio is grouped together.

For example, a 5.1+2 program configuration mode is defined to have 2 audio programs. The first audio program is 5.1 and the second is 2.

Table 3-1 outlines the relationship between the program configuration mode and the number of audio programs.

Program Configuration	Number of Programs
5.1 + 2	2
5.1 + 1 + 1	3
4 + 4	2
4 + 2 + 2	3
4 + 2 + 1 + 1	4
4 + 1 + 1 + 1 + 1	5
2 + 2 + 2 + 2	4
2 + 2 + 2 + 1 + 1	5
2 + 2 + 1 + 1 + 1 + 1	6
2 + 1 + 1 + 1 + 1 + 1	6
1 + 1 + 1 + 1 + 1 + 1 + 1 + 1	8
4	1
2 + 2	2
2 + 1 + 1	3
1 + 1 + 1 + 1	4
7.1	1
7.1 Screen	1
2 + 5.1	2
1 + 1 + 5.1	3
2 + 2 + 2 + 2 (p1, p2, p3, p4)	4
2 + 2 + 2 + 1 + 1 (p1, p2, p3, p4, p5)	5
2 + 2 + 2 (p1, p2, p3)	3

Table 3-1: Relationship between Program Configuration Mode and Audio Programs

The internal IntelliGain™ engine will analyze the value of the *Detected Program Config Source.* This value will determine how many Program VistaLINK® tabs are to be accessible.

For example, if IntelliGain™ detects a program configuration source of 5.1 + 2, then 2 program configuration tabs will be user accessible. However, if IntelliGain™ detects a program configuration source of 1 + 1 + 1 + 1 then 4 program configuration tabs will be accessible.

Figure 3-1 identifies up to eight program configuration tabs that are accessible via the VistaLINK® NMS.

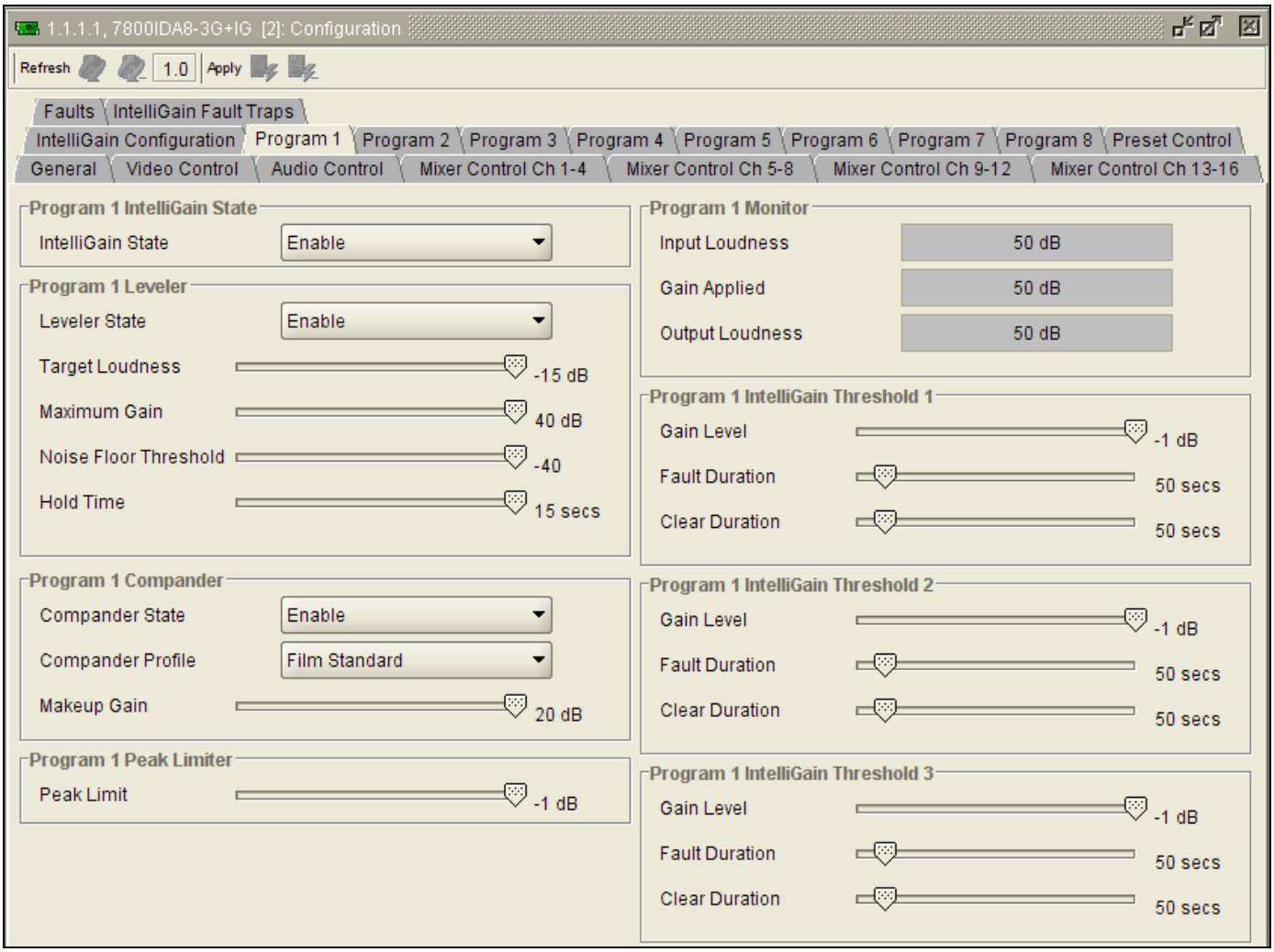

Figure 3-1: Program 1 Configuration View

3.1. PROGRAM CONFIGURATION CONTROL

As IntelliGain™ detects valid audio programs, the VistaLINK® program configuration tabs will become activated. The user interface and program configuration tabs are identical.

Sections 3.1.1 to 3.1.16 provide detailed explanations for each control available in the Program Configuration tab. Since each program configuration interface is identical, only Program 1 will be described.

3.1.1. Setting the IntelliGain™ State

Program 1 *IntelliGain State* *Enable* *Disable*	This control is the master switch for the IntelliGain™ processor, which is used for the given audio program. Set this control to *Enable* to initiate IntelliGain™ processing.

3.1.2. Setting the Leveler State

- *Program 1*
  - *Leveler State*
    - *Enable*
    - *Disable*

This control is used to activate the IntelliGain™ audio leveler. The leveler is used to level each individual audio channel to the target loudness level. Set this control to *Enable* to activate the IntelliGain™ audio leveler.

3.1.3. Setting the Target Loudness

- *Program 1*
  - *Target Loudness*
    - *–35 dBFs to –15dBFs*

This control is used to set the target loudness level for the given audio program. The IntelliGain™ processor will level the audio to this value. Note that if the compander is enabled, it is desirable to set the target loudness parameter to the range (–31 dB to –26 dB) and use *Makeup Gain* control to reach the final desired target loudness level.

3.1.4. Setting the Maximum Gain

- *Program 1*
  - *Maximum Gain*
    - *10 to 40 dBFs*

The *Maximum Gain* control is the total amount of gain that the IntelliGain™ engine will apply. For example, setting this control to 10 dBFS indicates that IntelliGain™ is not to add anymore than 10 dB of gain to the audio program, even if the audio program requires more gain to reach the target loudness level.

3.1.5. Setting the Noise Floor Threshold

- *Program 1*
  - *Noise Floor Threshold*
    - *–70 dBFs to –40 dBFs*

This control is used to set the threshold level for IntelliGain™ processing. Levels below this value will not have IntelliGain™ processing applied.

3.1.6. Setting the Hold Time

- *Program 1*
  - *Hold Time*
    - *Immediate*
    - *1 second – 14 seconds*
    - *Adaptive*

This control is used to set the hold time for the given audio program. The IntelliGain™ processor will wait this period of time to add/remove gain once the level goes below/above the target loudness. The adaptive setting will apply a faster hold time for levels further away from the target loudness, and a slower hold time for levels closer to the target loudness.

3.1.7. Setting the Compander State

- *Program 1*
  - *Compander State*
    - *Enable*
    - *Disable*

This control is used to activate the on-board compressor/expander, otherwise known as the compander. The use of the compander allows audio signals with a large dynamic range to be transmitted over facilities that have a smaller dynamic range capability. The compander works by compressing or expanding the dynamic range of the audio signal.

3.1.8. Setting the Compander Profile

- *Program 1*
  - *Compander Profile*
    - *Film Standard*
    - *Film Light*
    - *Speech*
    - *Music Standard*
    - *Music Light*
    - *Custom 1*
    - *Custom 2*
    - *Custom 3*

The compander profiles are used to define the dynamic range control of the compander. There are 5 default profiles and 3 custom profiles.

The *Film Standard* profile is used to compress/expand sporting events, and movies with a large dynamic range.
Max Boost: 6 dB (below –43 dB)
Boost Range: –43 to –31 dB (2:1 ratio)
Null Band Width: 5 dB (–31 to –26 dB)
Early Cut Range: –26 to –16 dB (2:1 ratio)
Cut Range: –16 to +4 dB (20:1 ratio)

The *File Light* profile is used to compress/expand light movies or program content such as dramas or content with less dynamic range.
Max Boost: 6 dB (below –53 dB)
Boost Range: –53 to –41 dB (2:1 ratio)
Null Band Width: 20 dB (–41 to –21 dB)
Early Cut Range: –26 to –11 dB (2:1 ratio)
Cut Range: –11 to +4 dB (20:1 ratio)

The *Speech* profile is used to compress/expand content such as news, documentaries or “talking head” type content.
Max Boost: 15 dB (below –50 dB)
Boost Range: –50 to –31 dB (5:1 ratio)
Null Band Width: 5 dB (–31 to –26 dB)
Early Cut Range: –26 to –16 dB (2:1 ratio)
Cut Range: –16 to +4 dB (20:1 ratio)

The *Music Standard* profile is used in most typical music environments such as concerts, music videos and music content with a wide dynamic range.
Max Boost: 12 dB (below –55 dB)
Boost Range: –55 to –31 dB (2:1 ratio)
Null Band Width: 5 dB (–31 to –26 dB)
Early Cut Range: –26 to –16 dB (2:1 ratio)
Cut Range: –16 to +4 dB (20:1 ratio)

The *Music Light* profile is used to compress/expand music content with a narrow dynamic range.
Max Boost: 12 dB (below –65 dB)
Boost Range: –65 to –41 dB (2:1 ratio)
Null Band Width: 20 dB (–41 to –21 dB)
Cut Range: –21 to +9 dB (2:1 ratio).

There are 3 custom compander profiles that are currently not available for use. These profiles will be enabled in a future release.

3.1.9. Setting the Makeup Gain

Program 1
Makeup Gain
0 to 20 dBFs

The *Makeup Gain* is used to add additional gain to the audio program. This control would be used if the final desired target loudness has not been reached.

3.1.10. Setting the Peak Limit

Program 1
Peak Limit
-15 to –1 dBFs

The *Peak Limit* is used within the audio program chain to provide an upper limit to peak program levels. Sometimes referred to as a "brick-wall" limiter. This control is used to maintain the upper limit of the peak levels.

3.1.11. Monitoring the Input Loudness

Program 1
Input Loudness
Read Only Monitor

The *Input Loudness* control will provide a real time value of the calculated input loudness value. This control is used for monitoring purposes only.

3.1.12. Monitoring the Gain Applied

Program 1
Gain Applied
Read Only Monitor

The *Gain Applied* control will provide a real time value indicating the amount of gain being applied by the IntelliGain™ system. Values can be either negative, indicating a gain reduction, or positive, indicating gain is being applied.

3.1.13. Monitoring the Output Loudness

Program 1
Output Loudness
Read Only Monitor

The *Output Loudness* control will provide a real time value of the calculated output loudness value. This control is used for monitoring purposes only. It is used to provide confidence monitoring.

3.1.14. Setting the Output Level Threshold (1, 2, 3)

Program 1
Output Level Threshold (1,2,3)
-65dBFs to –1dBFs

The *Output Level Threshold* control is used for real time monitoring and SNMP trap alarming. By defining the output level, the IntelliGain™ system will send an SNMP alarm to VistaLINK® if the output loudness level exceeds the defined output level. For example, by setting this control to –18 dBFs, if the calculated output loudness level exceeds –18 dBFS (for the specified fault duration) then an alarm will be sent to VistaLINK® for immediate operator notification. There are 3 levels of alarm thresholds. These can be setup as minor, major and critical alarming thresholds.

3.1.15. Setting the Fault Duration

Program 1
Fault Duration
0.5 to 240 seconds

The *Fault Duration* control defines the amount of time that the IntelliGain™ system detects the output level has been exceeded. For example, if this control is set to 25 seconds; this means that the output level has to be exceeded for a minimum of 25 seconds before an SNMP trap alarm is sent to VistaLINK®.

3.1.16. Setting the Clear Duration

Program 1
Clear Duration
0.5 to 240 seconds

The *Clear Duration* defines the amount of time that the IntelliGain™ system must be corrected to before a correction SNMP trap is sent to VistaLINK®. For example, if this control is set to 10 seconds; this means that the IntelliGain™ output level fault must be corrected for a minimum of 10 seconds before a correction alarm is sent to VistaLINK®. This control is primarily used to smooth out alarming for audio with a very wide dynamic range.

4. INTELLIGAIN™ FAULT TRAPS

The IntelliGain™ system can provide real time analysis and confidence monitoring with SNMP trap alarm notification. These alarms can be enabled and disabled on an individual audio program basis using the IntelliGain™ Fault Traps configuration tab.

To enable or disable an SNMP alarm notification, either check or un-check the defined control.

The system also provides real time trap status information. If a trap is sent by the IntelliGain™ system, the trap status box will change state indicating the real time value for that trap. For example, if the trap status box is the colour green, then the trap has not been sent. However, if the status box is the colour red, then the fault is in a current state of alarm. Once corrected, the status box will turn back to the colour green.

Table 4-1 identifies the VistaLINK® configuration view for the IntelliGain™ Fault Traps.

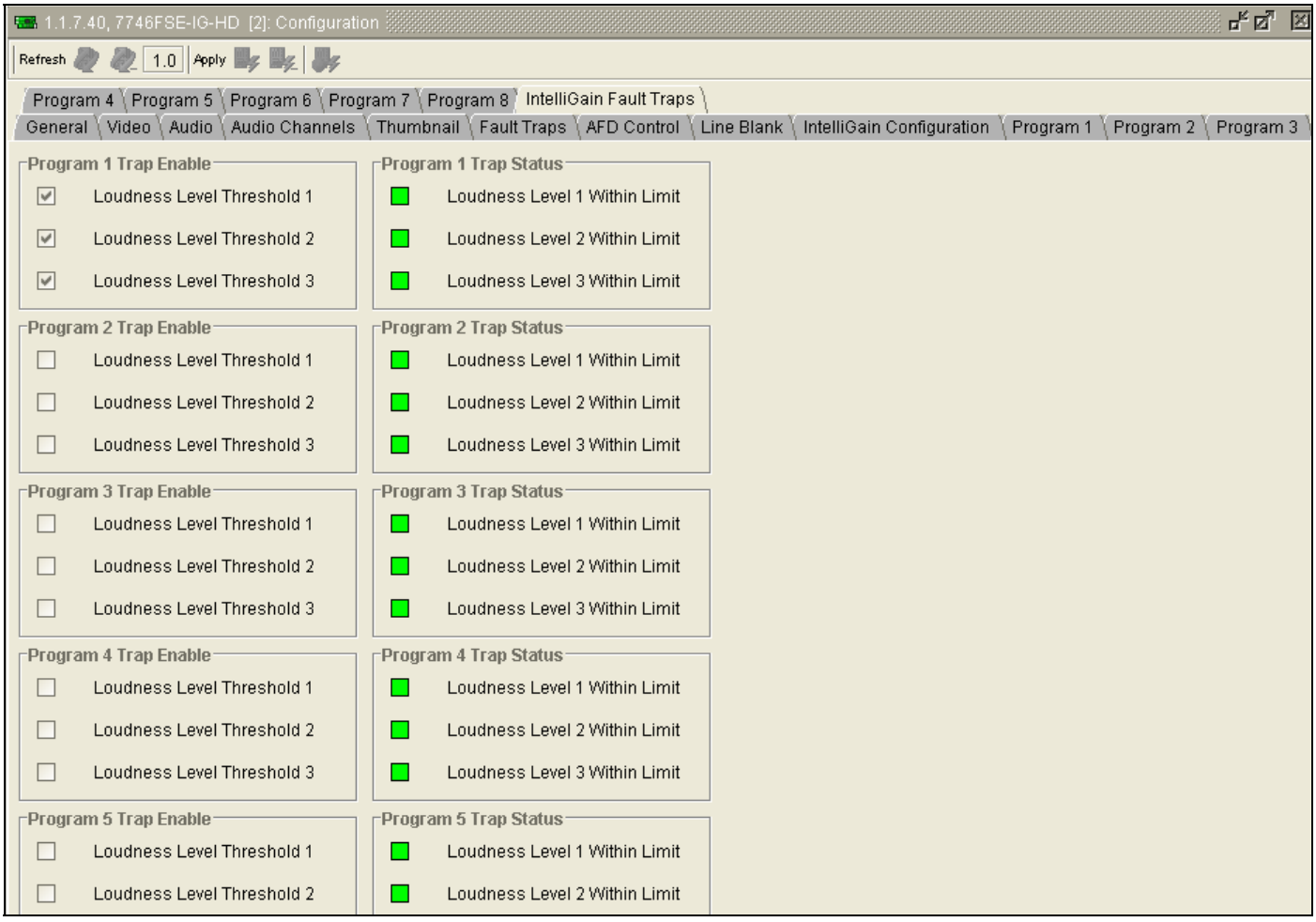

Table 4-1: IntelliGain™ Fault Traps

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