GS-GC5K ISDN Commentary Mixer
South African Broadcasting
User Notes

Who Are Glensound?

Glensound have been designing and building broadcast equipment since 1966. The founder, Len Davis, is an ex BBC engineer, who left to concentrate on providing custom solutions to BBC technical requirements.

Over the last 45 years, we have designed equipment for many of the world's leading broadcasters. Glensound equipment is used on many leading world sports and events, and in broadcast facilities throughout the world. Examples include:

- 650 Glensound analogue and digital commentary systems being used by Host Broadcast Services for the 2010 Football World Cup in South Africa.

- 3000 ISDN codecs in use at the BBC
- The audio control systems for the UK Parliament in the House Of Commons and The House Of Lords.

As Glensound designs have evolved we have been responsible for many broadcast innovations and technologies. Highlights include:

- Invention of the first unitised broadcast mixer
- Invention of the telephone hybrid
- Invention of the worlds first assignable mixer
- Developed the concepts, and became the standard in broadcast commentary systems
- At the forefront of AES47 (audio over ATM) system development.

All this from a small company based in the centre of Maidstone, the county town of Kent, in the UK, about 35 miles south east of London.

Glensound are known for high quality, and industrial grade reliability. We know our broadcast products have a regular daily usage, can receive the odd bump, and have to continue performing. We are proud that mixers we built in 1983 are still in use on air at BBC Radio Essex – one example of many.

Ian Ferguson

Ian has been with Glensound since 1993 and is our Head Of ISDN. He oversees all ISDN developments, is responsible for the quality control and testing, and is the first point of contact for ISDN service. As Glensound have around 10,000 ISDN codecs in use throughout the broadcast world, this keeps Ian busy! He has

encountered every ISDN scenario and problem, and is an acknowledged ISDN expert in the broadcast industry.

Ian will be visiting SABC personally to show you the new GS-GC5K and take you on the tour of this excising new codec mixer.

The SABC Codec Tender

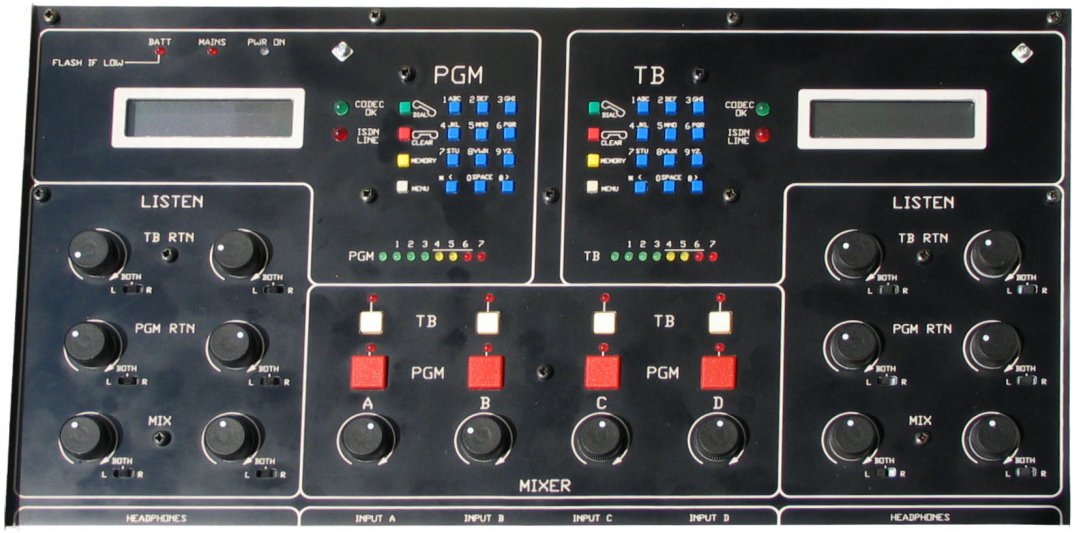
Glensound were invited by SABC to tender for a codec requirement in 2008. A tender is a lengthy process where we compete with other suppliers to provide the best solution as to the exact requirements in the tender document.

We designed the GS-GC5K as a bespoke development to meet the requirements as detailed in the tender. We are pleased to say, that SABC choose the GS-GC5K and Glensound to provide the units required.

Seventy six GS-GC5K ISDN codec mixers were delivered to SABC in the summer of 2009.

The Glensound GS-GC5K – Overview

The GC5K is a portable commentary mixer with built in ISDN codecs for remote reporting of news and sports.



Commentary Mixer
The mixer side provides connections for up to four separate commentators. Each has their own mic (or line) input which is selectable for dynamic or phantom power microphones, with gain adjust, mic 'on air' and talkback.

There are also four independent headphone connections. Each has three inputs to enable the commentator to create their own personal mix between:

- the programme / cue return,
- the talkback return, and
- the initial mixed output.

ISDN
There are two codecs on the GC5K both allowing you to use G722 or APTX. Each B channel of the ISDN line is located on its own dialer allowing one as your programme link and the other as the feedback link.

In More Detail

- **Power**
  The GC5K is mains or battery powered (fixed internal), and has a rear panel power switch.

  The first thing you should do with every system is plug it in and charge the batteries for at least 4 hours. The batteries are fully charged when the rear panel charging light stops flashing and goes out. Under a full charge the batteries should give you 4 hours of use, although of course this is variable. The front panel low battery light will flash when there is approximately ¾ hour of battery power remaining.

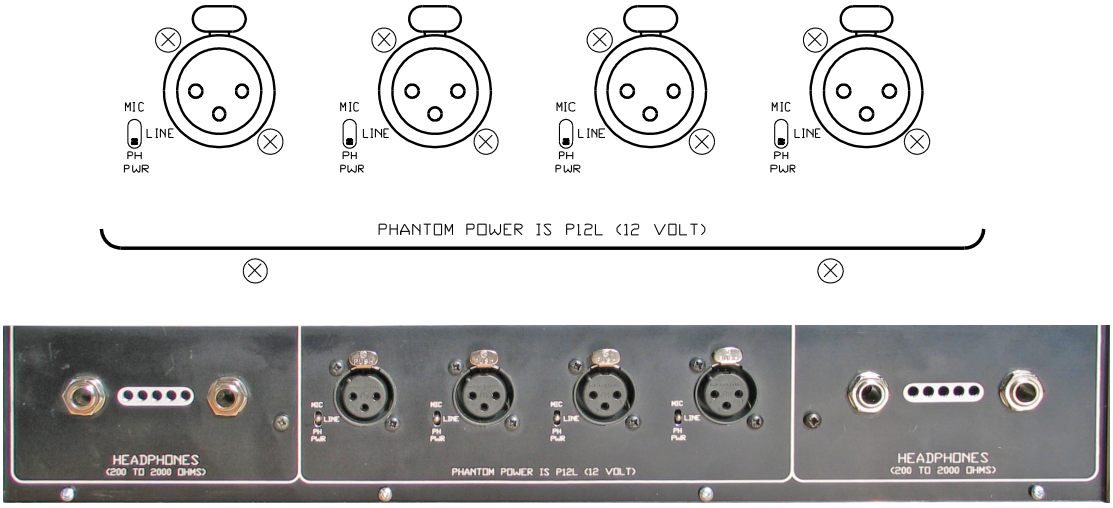
  If the mains power should fail, the unit will automatically switch to battery power without any loss of audio.

  The mains power supply operates on input voltages from 100V – 240v AC.

- **Audio Input**
  The GSGC5K has a 4 input mixer. Each of these inputs has a gain switch to select either Mic or Line level inputs and gain pot for adjusting the level of the input. Each input also has two routing switches to send the inputs to either the programme (PGM) mix, or the talkback (TB) mix.

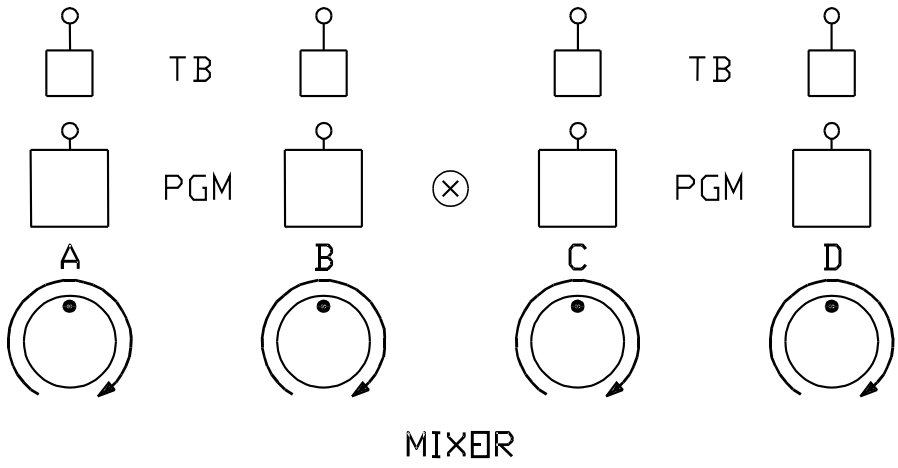
Two eight LED PPMs are provided to indicate the PGM and TB levels.

Front Panel



On the front panel there are 4 audio input XLRs.
To the left of each of these XLRs is a small recessed toggle switch. This switch has 3 positions and sets the gain/ function of the audio input circuit. The 3 positions are marked 'MIC', 'LINE', 'PH PWR'. When in the 'PH PWR' position the input is set to mic level and 12 volts phantom power is provided.

- **Mixer**



The 4 audio inputs can be switched to either the PGM or TB mix. This is done by pressing the red or white push buttons on the top panel. These switches as well as routing the audio also turn the

channels input on/off. A LED next to the push button indicates when a channel is on and routed.

Configuring The Operation Of The TB & PGM Buttons

The TB and PGM buttons can be configured in the following ways:

- To operate as a 4 channel PGM/TB system
- To operate as a 8 channel PGM system

Furthermore the key states can be configured as follows:

- To power on in a certain mode, for example, locked on, latching, lazy, etc
- The PGM button can link with the TB button when pressed.

Please contact an engineer to configure these functions.

Gain (Level) Controls & Level Metering

Each mic or line input has its own front panel rotary gain control. Turning these controls clockwise increases the channels input level and turning them anticlockwise decreases the channels input level. For the best possible performance it is important to set this level correctly before a broadcast.

Two eight LED PPM meters are provided to monitor the levels of each of the PGM & TB mixes. For normal use the input gains should be set so that meters read 4, 5 and very occasionally read 6. Read a sample passage before you go on air whilst adjusting the input gain to ensure you are at the optimum setting.

There is a compressor / limiter circuit on the inputs to prevent any unexpected high inputs levels from causing distortion.

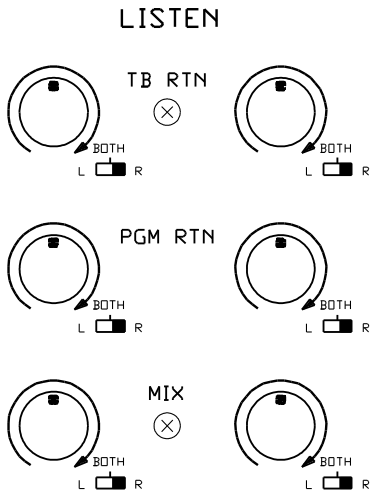
- **Headphone / Listen Circuits**

  There are four identical headphone circuits. Headphone connector jacks are located on the front of the unit. These jacks are standard 6.35mm stereo jack sockets and when new can accept either A or B gauge jack plugs.

  Each of the 4 headphone circuits has it's own 3 channel mixer. This mixer allows the levels off three different sources to be adjusted in relation to each other and then sent to the headphones. Beside each source level control are 3 position slide switches. These switches allow that source to be routed to the

Left side only, Right side only or Both sides of the headphone circuit.

You cannot turn these levels all the way down. On full left you will still be able to hear some audio. This is our 'DIM' function. Contact an engineer if this needs to be configured to cut the audio completely.



The three sources of the mixer are:

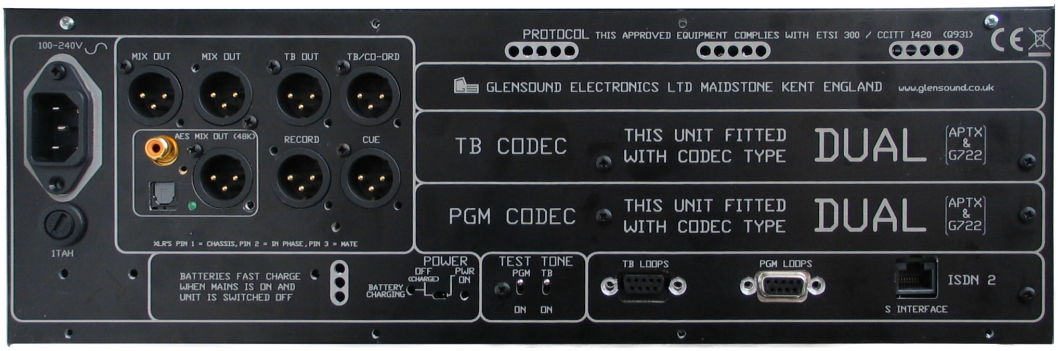
TB RTN:
This is the return audio from the TB codec

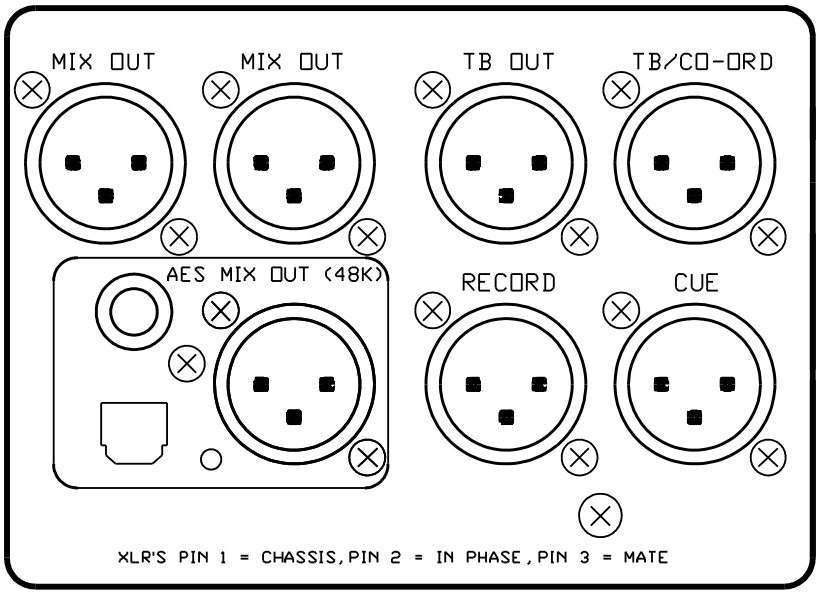
PGM RTN:
This is the return audio from the PGM codec

MIX:
This is the mix of all the inputs currently routed to the PGM codec

- **Test Tones**
  There are two test tone generators that can be switched on from the rear panel, one for the PGM output one for the TB output. When switched on they replace any current audio with a 1kHz test tone for line up purposes.

- **Audio Connections**
  There are 5 different audio outputs on the rear panel. With the exception of the AES MIX OUT these are all balanced analogue audio outputs on XLR plugs.





Mix Out (PGM)
There are three mix outputs. This is the mix of the all the inputs being routed to the PGM mix buss.
There are two analogue outputs and also a digital output of this mix.
The digital output has a fixed output sample rate of 48K. There are three digital outputs. On the XLR is an AES3 balanced digital audio output, on the phono socket there is S/PDIF domestic digital audio and on the optical connector there is TOS LINK domestic digital audio.

TB Out
This output is the output of all the inputs being routed to the TB mix buss.

Record Out
This is a mix of the inputs being routed to the PGM buss and the audio that is being received by the unit from the return of the PGM codec (this would normally be the whole programme going to air).

TB/CO-ORD Out
This is the return audio that is being received by the TB codec.

CUE Out
This is the return audio that is being received by the PGM codec.

ISDN CODECS

The GC5K contains a single interface for connection to an ISDN line, and this line contains two separate ISDN B channels that will have separate phone numbers associated with them.

- **Connecting to an ISDN Line**
  On the rear panel there is an RJ45 socket.

  An RJ45 cable (PC network type cable) should be connected from the ISDN socket to the ISDN circuit. Your ISDN provider should provide a line that conforms to the ISDN '2E' protocol, and is set point to multi-point.

  The ISDN line interface is an 'S' interface. There are only two types in the World the common one is the S interface and the far rarer type is 'U' interface. An 'S' to 'U' interface is available separately.

- **Two ISDN Circuits**
  Although there is only one physical interface to connect to the ISDN line, this interface carries two separate 64K bi-directional data channels allowing two independent ISDN calls to be made simultaneously.

- **ISDN Codec Type**
  Internally there are two codec cards, one for the PGM circuit and one for the TB circuit. Both of these codec cards are DUAL cards operating the G722 or APTX (64K) algorithms. These are widely used 'quality' settings. The important note with algorithms is that both codecs at either end of an ISDN call must both use the same algorithm. We include two for extra flexibility.

- G722
  The audio bandwidth (quality level) is 7 kHz – about double that of a normal phone call. It has a delay of 20ms. This makes it great for speech use as it has enough bandwidth, with a low enough delay for normal two way conversations. It is also the most widely used algorithm.

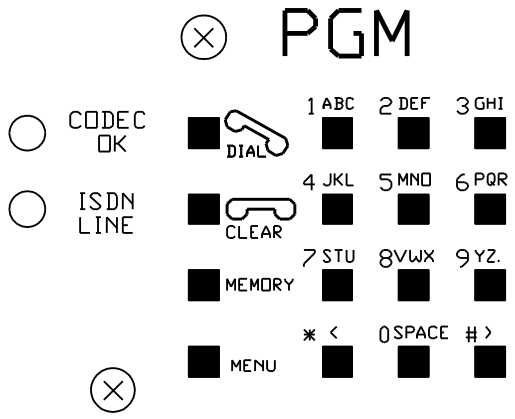
- APTX
  APTX is not used as widely, offers the same bandwidth as G722 but it offers the benefits of a very low delay of 4ms.

Each codec card only operates one of the two algorithms at any one time and will always automatically set itself to match the algorithm of the codec that it is connecting to (APTX or G722). It will try APTX first and then G722.

- **OPERATING THE ISDN CODECS**
  Internally there are 2 independent DUAL codecs. Each codec is controlled by it's own keypad and LCD display – one for programme (PGM) and the other for talkback (TB). The following information relates to either of the codecs.

Dialing & Memories

This unit has a standard phone keypad and four ISDN specific buttons. It also has a LCD display to prompt the user and to show various actions.



- **Keypad Operation**
  Each of the 0 to 9 keys has 3 or 2 letters of the alphabet printed next to them. When storing a number to memory, the keys are used to enter the description for the number entered. This is done with a single press to produce the number, 2 quick presses to produce the first letter of the group, 3 quick presses to produce the 2nd letter of the group or 4 quick presses to produce

the third. A further press reverts to the number. If you make an error while entering a number or a letter the 'CLEAR' key can be used to erase the last digit.

- **Making Calls Directly**
  It is only necessary to enter the required number, which will be displayed, and when complete press the 'DIAL' key. If the call is successful the red 'ISDN LINE' LED will illuminate and if you have called a number with a matching codec, after a few seconds the 'CODEC OK' LED will illuminate. If, for any reason the call is not successful, the display will show the reason for failure. A list of possible responses is shown later.

- **To Clear The Call**
  To clear the call it is necessary to press and hold the 'CLEAR' button for about 2 seconds.

- **To Redial The Last Number**
  To redial the last number used it is only necessary to press the 'DIAL' button.

- **To Dial A Number That Has Previously Been Stored**
  Press the 'MEMORY' button. You may directly enter the memory location (1-30) or use the '< and >' buttons to scroll through the memories. The display will show the name in the memory if it has been stored or else the number itself.
  When the correct memory has been found, press the 'DIAL' button to make the call.

- **To Answer An Incoming Call**
  It is possible to set this equipment to automatically answer an incoming call. If this has been done no action is required by the operator. If set for manual answer simply press the 'DIAL' button to answer the call.

- **Calling Number Identification (CLI)**
  If your ISDN circuit has CLI enabled on it, the display will indicate the calling party. This is done normally by displaying the incoming calling number, however this number is automatically compared with names in the memory and if a match is found, and a name has been given to that number, then the name will be displayed instead of the number.
  If a name or number is displayed, pressing the 'DIAL' button will call that number. This makes it very easy to call back. It is possible to clear this number by pressing the 'CLEAR' key.

- **To Store Numbers In Memory**
  It is possible to store up to 30 frequently used numbers in the non volatile memory. Each number can have associated with it an alphanumeric description or name. Each number can also have stored with it a note regarding the ISDN configuration. This would be whether it should dial as an ISDN64 call or as a SWITCH56, the codec encode mode required (G722/APTX) along with the sample rate required. This configuration is normally carried out by an engineer when storing the numbers.

  Press 'MEMORY' and use the < and > keys to locate the memory location that you wish to use. It is also possible to directly enter the number (1-30) of the memory you wish to use. Now press 'MENU'. After informing you to press the 'Grey' (MENU) key to proceed, the display will show you the stored name (if any). At this stage it is possible to edit or add the name which may contain up to 16 characters. After editing press the 'Grey' key.

  The display will now show the stored number, which may contain up to 20 figures. Edit this number and press the 'Grey' key to proceed.

  The display will now show if the number is required as ISDN64 or as SWITCH56. In South Africa this would be ISDN64 This again can be edited if using in a country with a different setting before pressing the 'Grey' key to proceed.

  The display will now show the codec encode mode. This has four options which can be scrolled using the '< >' keys. The options are Follow Decode, G722, MPEG, APTX. Please note that your units to not have MPEG.

  The above procedure can be repeated for the other 29 memory locations.

- **Engineering Set Up**
  There is a comprehensive, password protected, engineering set up mode that we will not cover here.

- **System Error Responses**
  Unsuccessful calls will normally give one of the following responses in the display. In addition the error number is also displayed.

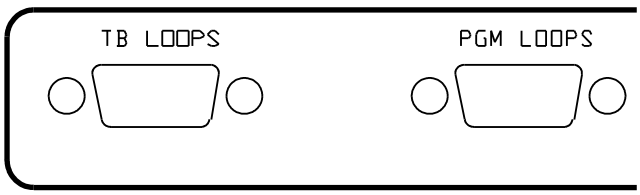
DISPLAY MESSAGE	REASON FOR FAILURE	ERROR NUMBERS
USER BUSY	User Engaged	17
NETWORK BUSY	Network Engaged	42
NO ANSWER	Called Number does not answer	18,19
INVALID NUMBER	Number not recognised	28
OUT OF ORDER	Network or Destination out of order	27,38,41
INCOMPATIBLE	Called Number not suitable for DATA	88
PROTOCOL ERROR	Protocol Error	111
CLEARED	Any other cause	ALL OTHERS

- **List Of Error Numbers Reported By The Terminal Adaptor**
  These may not mean anything to you, but please use this list to report the error code to an engineer.

0 S bus not responding
1 Unallocated number
2 No route to specified network
3 No route to destination
4 Channel unacceptable
6 Channel unacceptable
7 Call awarded and being delivered in an established channel
16 Normal call clearing
17 User busy
18 No user responding
19 No answer from user
21 Call rejected
22 Number changed
26 Non-selected user clearing
27 Destination out of order
28 Invalid number format
29 Facility rejected
30 Response to Status Inquiry
31 Normal, unspecified
34 No circuit/channel available
38 Network out of order
41 Temporary failure
42 Switching equipment congestion
43 Access information discarded
44 Requested circuit/channel not available
47 Resources unavailable

49 Quality of service unavailable
50 Requested facility not subscribed
57 Bearer capability not authorised
58 Bearer capability not available
63 Service or option not available
65 Bearer capability not implimented
66 Channel type not implimented
69 Requested facility not implimented
70 Only restricted digital information bearer capability is available
79 Service or option not implimented
88 Incompatible destination
111 Protocol error, unspecified
128 Line error

- **EXTERNAL CONTROL LOOPS**
  On the rear of the unit there are two 'D' 9 sockets, one labelled 'PGM LOOPS' and the other 'TB LOOPS'. These can be used for connecting to external equipment to control simple functions and to indicate current status.



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