CC 3816

Digital 8x16 audio Matrix

CONTENTS

1   GENERAL TECHNICAL SPECIFICATIONS

The matrix has the following features:
- 8 audio analogue inputs
- 16 audio analogue outputs
- 8 logic inputs
- 16 logic outputs
- 1 x RS232 interface for use by "Matrix Control" configuration application
- 1 x dual RS485 interface for GX3016 console management
- 1 x RS232 interface for communication with external equipment.

The following digital audio processing can be applied to each audio input :
- level adjustment
- bass/treble
- adjustable noise gate
- mute

The following digital audio processing can be applied to each audio output:
- level adjustment
- 5 band parametric equaliser
- mute
- delay (up to 5s for each output)

2   GENERAL DESCRIPTION

The CC 3816 is a programmable digital audio routing matrix with a wide range of features and applications. The CC 3816 can be used to route 8 audio input channels to 16 audio output channels. Switching may be triggered in a number of ways including according to audio input priority levels. The CC 3816 also features audio signal processing such as sound detection, noise gate, tone adjustment and a 5 band parametric equaliser.

Two GX 3016 console buses can be connected to a single CC 3816 for broadcasting spoken announcements to one or more audio output channels. In addition, the matrix has 8 general purpose logic inputs (logic GPIs) and 16 general purpose logic outputs (logic GPOs). The logic GPIs provide dynamic switching control of the 8 audio input channels to the 16 audio output channels. The logic GPOs are used to provide information on the status of the matrix to other system equipment.

Internal processing and signal processing are fully digital, using SHARC© Digital Signal Processing (DSP) technology. DSP technology provides the CC 3816 matrix with a wide range of audio signal processing options and at the same time allows extremely flexible configuration. This product is designed for use in applications where several high quality audio sources need to be selected and broadcasted to several audio outputs.

All the CC 3816 matrix configuration parameters can be set through an RS232 link with "Matrix Control" configuration software for Windows.

This configuration software provides access to all the parameters for audio inputs, audio outputs, GX 3016 consoles and GPIs/GPOs. The software may also be used to monitor the status of the digital audio matrix, the GPIs and GPOs. All the configuration parameters may be saved and recalled allowing to quickly switch between different use cases.

The matrix is supplied either by 230V AC mains or 24V DC battery.

3   APPLICATIONS

The CC 3816 is a highly flexible system, making it suitable for use in both small and medium-sized audio Public Address installations. The CC 3816 provides a flexible solution for creating the ideal audio system with the option to dynamically switch audio input channels to audio output channels. As the CC 3816 already incorporates audio tone adjustment, noise gate and equaliser modules, there is no need to add any external audio processing modules. Typical applications include restaurants, theatres, hotels, supermarkets, railway and bus stations, etc.

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4   PRESENTATION

Contents of the CC 3816 matrix and operating software

The operating software (Matrix Control) can be downloaded via the following link:

https://www.bouyer.com/wp-content/uploads/2023/10/applications-bouyer.zip

The CC 3816 matrix is delivered complete with the following:
- One CC 3816 Matrix
- One 230 V AC mains power lead
- Twelve 6-pin audio connectors
- Six 5-pin GPI and GPO connectors
- One RS232 serial cable to USB for connection to a PC

Before using the CC 3816, first check that none of the items is missing from the package.

4.1 Front panel
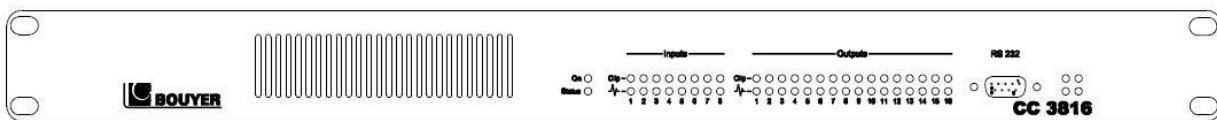
4.1.1 Ventilation grid

This allows the free air circulation inside the unit for electronics cooling.

4.1.2 Green power ON indicator

When lit, the unit is powered on.

4.1.3 Green STATUS indicator

When lit, this indicates that the digital signal processing and control functions of the CC 3816 matrix are working correctly.

4.1.4 Green input SIGNAL indicators

These indicators are on when an audio signal of more than -20 dBm is present at the corresponding input.

4.1.5 Red input CLIP indicators

These indicators are on when an audio signal of more than -6 dBFS (or 14 dBm) is present at the corresponding input. 0 dBFS is the absolute maximum acceptable level for the internal processing.

4.1.6 Green output SIGNAL indicators

These indicators are on when an audio signal of more than -20 dBm is present at the corresponding output.

4.1.7 Red output CLIP indicators

These indicators are on when an audio signal of more than -6 dBFS (or 14 dBm) is present at the corresponding output. 0 dBFS is the absolute maximum acceptable level for the internal processing.

4.1.8 RS232 socket

This 9-pin SUB-D female connector is used to connect a PC to the CC 3816 for configuration with « Matrix Control » configuration software. This connection is also used to update the CC 3816 firmware if necessary.

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4.2 Rear panel
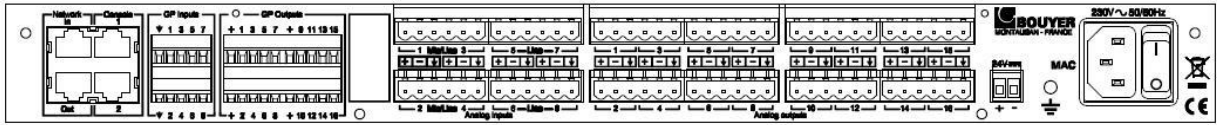
4.2.1 NETWORK connector

Not used on the CC 3816 matrix.

4.2.2 CONSOLE connector

The Console 1 and Console 2 RJ45 connectors are used to connect two GX 3016 type console buses to the unit.

The Console 2 connector also has an RS232 serial Data Link for connecting an additional control device.

4.2.3 GP Inputs connector block

The GP Inputs terminal block comprises 8 opto-isolated logic inputs.

4.2.4 GP Outputs connector block

The GP Outputs terminal block consists of 16 open-collector logic outputs.

4.2.5 Serial Number label

The label displays the serial number of the CC 3816.

4.2.6 Analogue Inputs 1 to 8

The analogue inputs terminal block consists of 8 balanced analogue audio inputs.

4.2.7 Analogue Outputs 1 to 16

The analogue outputs terminal block consists of 16 balanced analogue audio outputs.

4.2.8 24 V socket

This socket allows the unit to be powered using a 24V DC supply instead of a 230V AC mains supply.

4.2.9 MAC address

Not used on the CC 3816 matrix.

4.2.10   Ground terminal

Use this connector to ground the CC 3816 matrix to earth when fitting the unit inside a rack cabinet. In certain circumstances, earthing the unit considerably may reduce hum, noise and interference.

4.2.11   Mains block

The earthed mains block should be used to connect the CC3816 to a suitable 230V AC mains supply using the supplied cable.

4.2.12 ON / OFF switch

The ON/OFF switch on the mains block should be used to power the CC 3816 on and off.

⚠ Warning	To avoid damage to the system loudspeakers due to impulse noise caused by initial current surges, power up the system devices in the following order: audio sources, CC 3816 matrix and then finally the power amplifiers. Follow the reverse order when switching the equipment off.

5   INSTALLATION

The unit comes complete with everything needed to get it mounted it into a 19" rack. Only four M6 screws are needed to set the unit in place.

⚠ **Warning** ⚠	The CC 3816 must not be exposed to water (through splashing, from condensation, etc.). Ensure the front and rear ventilation grills are kept clear at all times and that air flow around the unit is not restricted. Ensure there is sufficient room at the rear of the unit (at least 100 mm) to connect the cables.

5.1 Block diagram of the CC 3816 audio channels

5.1.1 Mic/Line audio inputs (1 to 4)
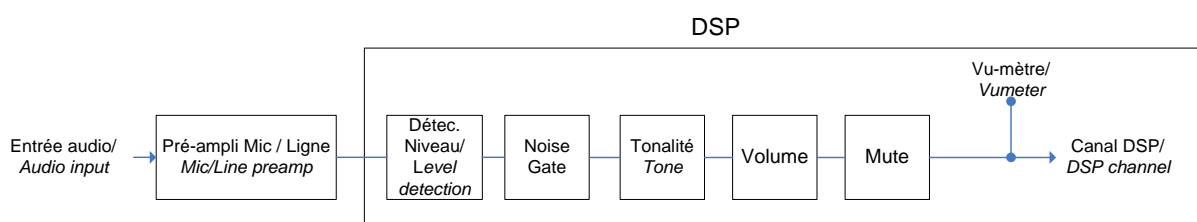
5.1.2 Line audio inputs (5 to 8)
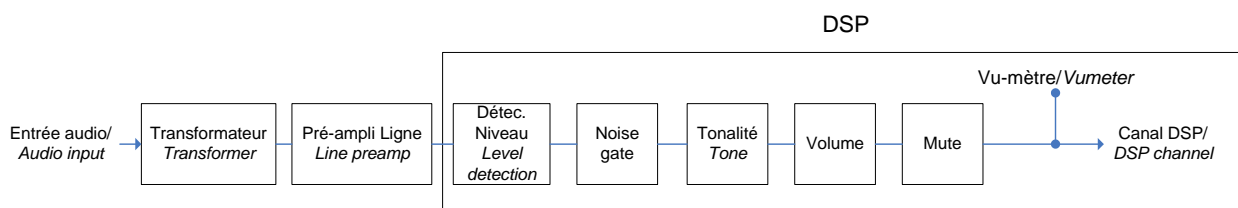
5.1.3 Audio outputs (1 to 16)

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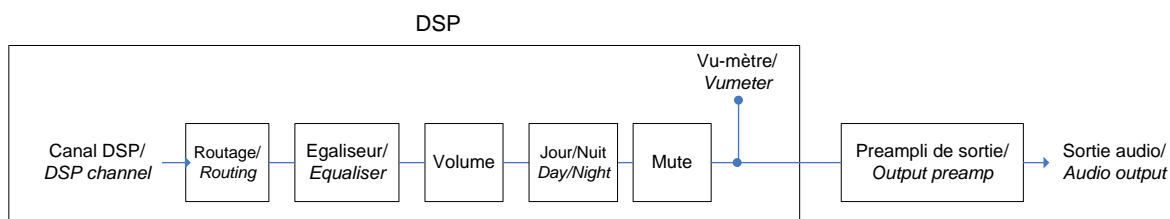
6 CABLING, CONNECTIONS AND STARTING UP THE CC 3816

6.1 Mains power connection

The CC 3816 is 230V AC mains powered using the power cable supplied.

6.2 +24 V power supply

The CC 3816 may also be powered using a 24 V d.c. 60 W (minimum) power supply connected to the +24 V two pin connector block.

6.3 Audio input and output connections

The balanced audio inputs and outputs on the CC 3816 matrix use three pin connections as shown below:
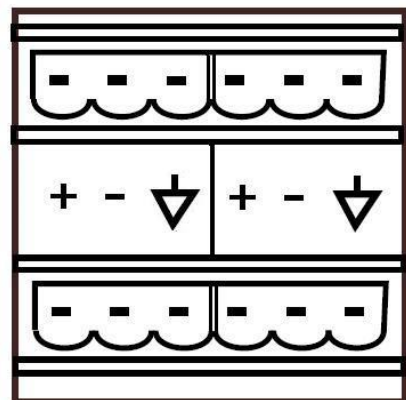
Signal **+** : positive

Signal **−** : negative

Signal ⏚ : ground

6.4 Connecting GX 3016 consoles and an RS232 serial control device

The GX 3016 microphone console is a PA console with zone selection. It handles general PA broadcasting plus broadcasts to up to 16 different zones. It is designed to operate using the RS485 bus architecture, meaning that several consoles can be used on the same installation.

Up to two GX 3016 console buses can be connected to the CC 3816. All the consoles on the same RS485 bus occupy just one audio channel. The consoles automatically arbitrate for the audio channel occupation.

Bus 1 of the CC 3816 uses audio input 5 and bus 2 uses audio input 6.

Up to thirty-two GX 3016 consoles can be connected to a single CC 3816 matrix. The RS485 serial link allows the consoles to be chained together up to a total maximum length of 1200 m without using a repeater. The GX 3016 consoles should be connected to either bus 1 or bus 2 depending on the type of application being implemented. For more information on installing and cabling the GX 3016 consoles, refer to the GX 3016 User Manual.
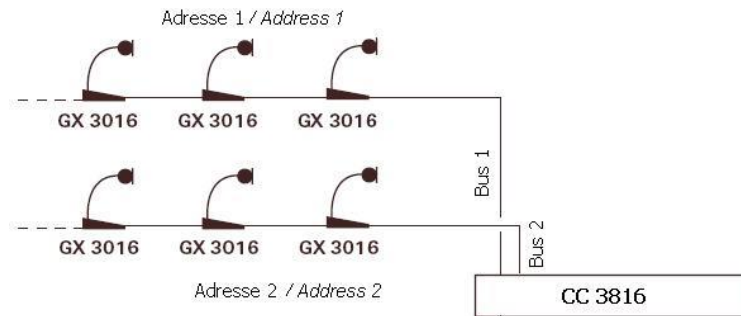
Adresse 1 / Address 1

The GX 3016 consoles connected to bus 1 must be set to address 1 and the consoles
connected to bus 2 to address 2 (see figure above). To set the addresses on the
GX 3016 consoles, refer to the GX 3016 User Manual. Use the RJ45 cable to connect up
the GX 3016 consoles (refer to the wiring details below).

RJ45 wiring details for the GX 3016:

1. Audio + (positive)
2. Audio – (negative)
3. RS232 Tx (RS232 device)
4. RS232 Rx (RS232 device)
5. 0 V
6. +24 V
7. RS485 data +
8. RS485 data –
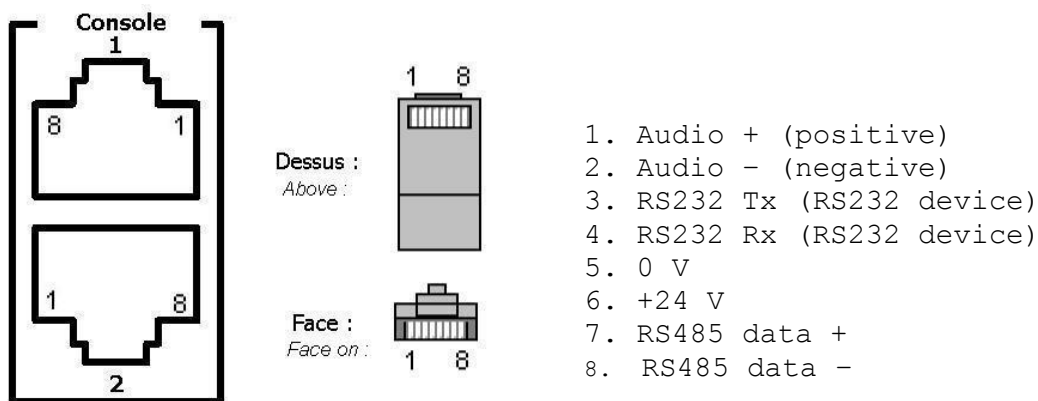
⚠ **Warning**	The CC 3816 can power up to eight GX 3016 consoles via the RJ45. If the installation consists of more than eight consoles, then an external power supply should be added, to be connected to the Jack socket on the consoles. Using GX 3016 consoles on bus 1 and/or 2 means that audio inputs 5 and/or 6 cannot be connected to any other sources, otherwise the system will not work correctly.

6.5 Connecting an RS232 serial control device to the Data Link

An RS 232 control device should be connected to pins 3 and 4 of the Console 2 socket.
Where both a control device and a GX 3016 need to be connected to the same socket, a
BOUYER EL 720 type adapter should be plugged into the RJ45 to enable the GX 3016 and
the control device to be connected together.

6.6 RS232 socket on the front panel

The CC 3816 matrix is fitted with an RS232 port so it can be connected up to a PC. Use the 9-pin SUB-D male-female connector supplied to connect the PC to the CC 3816 matrix.

RS232 pinout

2 : Signal out - Tx
3 : Signal in - Rx
GND : Ground

6.7 Logic GPI (General Purpose Input) wiring

The CC 3816 matrix has 8 opto-coupled logic general purpose inputs (or logic GPIs). Switches or relay contacts of external equipment may be connected directly to the GPIs to achieve the operation required.

The GPI connector block

1.	GPI 1 contact
2.	GPI 2 contact
3.	GPI 3 contact
4.	GPI 4 contact
5.	GPI 5 contact
6.	GPI 6 contact
7.	GPI 7 contact
8.	GPI 8 contact

↓ Ground for all GPIs

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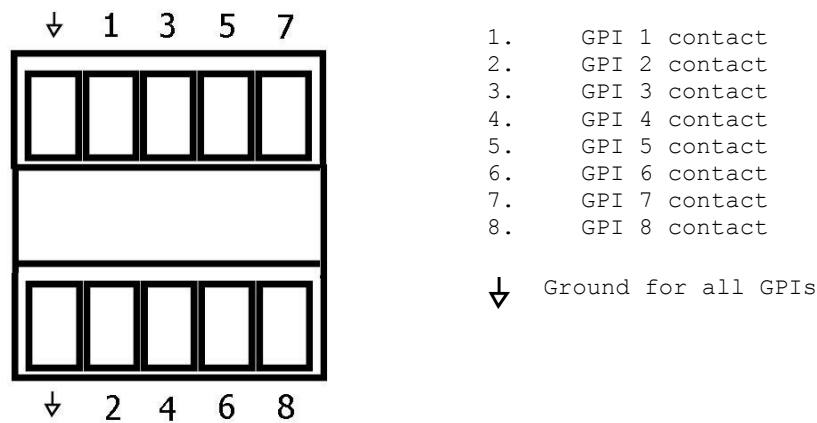
6.7.1 Using GPIs

To activate a logic GPI, a dry contact must be connected between a GPI and the ground pin on the GPI connector block. (Refer to the figure below):
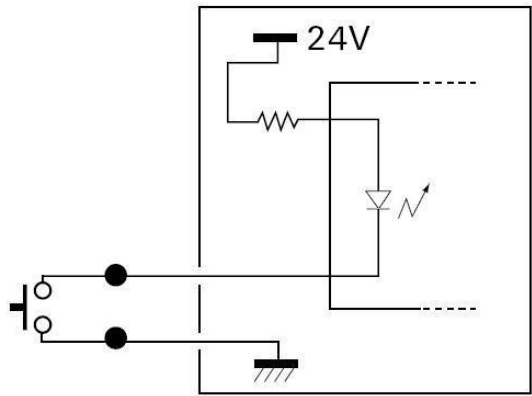
6.8 Logic GPO (General Purpose Output) wiring

The CC 3816 matrix has 16 logic open-collector transistor general purpose outputs (logic GPOs). The logic GPOs may be connected directly to the relay contacts of external equipment to provide them with information on the state of the matrix.

The GPO connector block
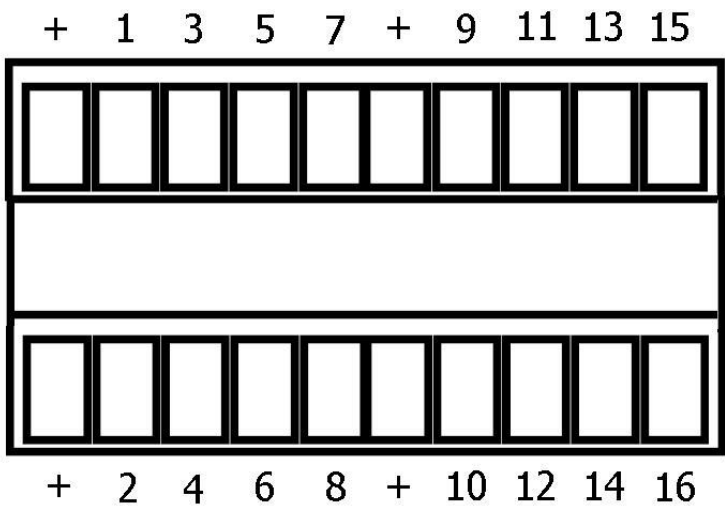
1. GPO 1
2. GPO 2
3. GPO 3
4. GPO 4
5. GPO 5
6. GPO 6
7. GPO 7
8. GPO 8
9. GPO 9
10. GPO 10
11. GPO 11
12. GPO 12
13. GPO 13
14. GPO 14
15. GPO 15
16. GPO 16

+ : +24 V common

6.8.1 Using GPOs

To drive a relay type load using a GPO, the load needs to be connected between the output terminal and the +24 V common on the GPO connector block.
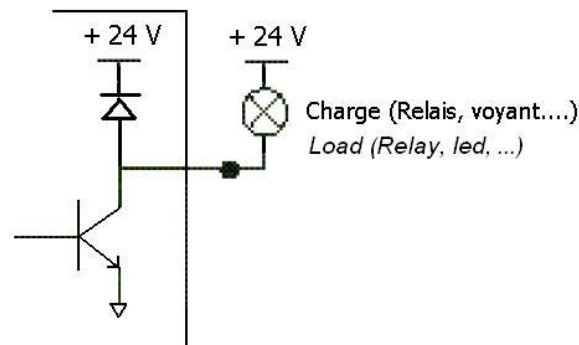
WARNING: The CC 3816 matrix supplies +24 V d.c. to power loads connected to the GPOs. The current is limited to 0.56 A. If a higher current load is required for the GPOs, then an additional external +24 V d.c. power supply should be used.

6.9 Starting up the CC 3816

Use the ON/OFF switch on the mains block on the rear panel to switch on the matrix unit.

The green ON indicator will light to show the unit is powered up.

Once the unit gets initialised (which takes less than a second), the matrix briefly displays its software version number using the green audio input and output SIGNAL diodes. The version number is displayed in the form x.y, where x corresponds to the audio input number that lights up, and y the audio output number that lights up. After the version number is displayed, the list of audio inputs and outputs in service on the matrix is displayed (corresponding leds are 'On') during 1s. During the display of the version and of the list of inputs and outputs in service, the green STATUS led is 'Off'.

After displaying the list of active inputs and outputs, the green STATUS indicator turns 'On': from that point, the matrix is fully operational.

7   CONFIGURING THE CC 3816

Configuring the CC 3816 is a 2 stage process that consists in configuring the hardware and then configuring the software.

Hardware configuration involves setting the physical characteristics of each of the audio inputs where possible (microphone or line input level, use of phantom power).

Software configuration is split into 2 parts: defining the unit's functionality and setting the parameters for digital processing. The software is configured using the « Matrix Control » application supplied. To install and use this program, refer to the software user manual (the CC3816.chm html Help file supplied with the software installation package).

This section explains the various different steps to follow to direct an input signal to one or more outputs.

The configuration steps are as following:

- Hardware configuration
  - Setting the audio input's physical parameters (Mic/Line, phantom power)
- Software configuration
  - Functional definition
    - > Types of source
    - > Priorities
    - > Declaration of groups
    - > Configuration of GX 3016 keys
    - > Use of GPIs
    - > Use of GPOs
  - Setting the digital process parameters
    - Per audio input
      - > Noise gate
      - > Bass/Treble
      - > Mute
      - > Volume
    - Per audio output
      - > 5 band parametric equaliser
      - > Volume
      - > Mute
      - > Delay

7.1 Hardware configuration: setting the physical parameters of the audio inputs

> ⚠ WARNING: These configuration instructions are for the attention of qualified personnel only. To reduce the risk of electric shock, do not undertake any operations other than those provided here. Switch off the CC 3816 and disconnect the power lead before carrying out any work.

The CC 3816 matrix input type on audio inputs IN 1 to IN 4 can be changed. This can be done using the configuration jumpers located on the interface board situated inside the matrix along the back plane.

The location of the various configuration jumpers on the interface board:
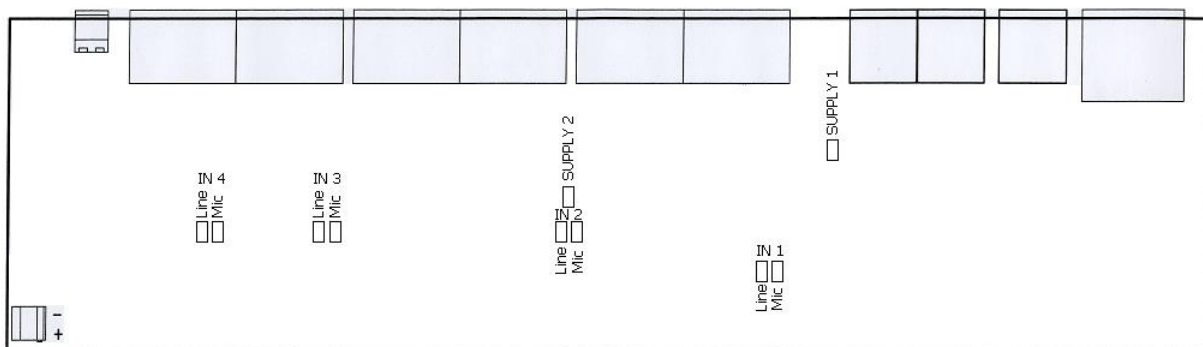
There are two possible configurations for inputs IN 1 to IN 4: Line input (0 dBm) or Micro input (-52 dBm). In addition, when audio inputs 1 and 2 are set to Micro, these can be supplied a phantom power supply for powering electret microphones. Whichever configuration is to be used, follow the procedure below to set the inputs according to the desired application.

To change the audio input type (IN 1, IN 2, IN 3 and IN 4), place the relevant jumper on the corresponding MIC or LINE pins as required. To enable a phantom supply (SUPPLY 1 and SUPPLY 2) on the corresponding inputs IN 1 or IN 2, fit the corresponding SUPPLY jumper:

- First ensure that the CC 3816 is switched off and that the power cable is unplugged before opening up the unit.

- To avoid electrostatic discharges, first ground yourself using an earthing lead before opening up the CC 3816.

- Open the cover by undoing the two screws on the rear panel.

- Locate the jumpers on the interface board located on the unit's rear plane and place them in the required positions.

Summary of possible configurations:

	IN 1		IN 2		IN 3		IN 4	
	Type	Jumper	Type	Jumper	Type	Jumper	Type	Jumper
Select Micro/Line	Mic Line	IN1 MIC IN1 LINE	Mic Line	IN2 MIC IN2 LINE	Mic Line	IN3 MIC IN3 LINE	Mic Line	IN4 MIC IN4 LINE
Phantom power	SUPPLY 1: YES/NO		SUPPLY 2: YES/NO		NO		NO	

> ⚠ IMPORTANT: As regards inputs IN 1 and IN 2, ensure that jumpers SUPPLY 1 and SUPPLY 2 are not fitted if the input is configured as a Line input, otherwise the unit will not operate correctly.
>
> N.B.: Audio inputs IN 5 to IN 8 are fixed Line inputs and cannot be changed.

7.2 Software configuration

7.2.1 Functional definition

This section covers all the parameters that need to be set to determine how the matrix should work.

7.2.1.1 Setting the audio input source parameters

These parameters can be set under the « **Sources Types** » tab.

An audio input signal can be directed (switched) to one of the audio output channels if the audio input channel has been activated. An audio input channel may be activated by several trigger signals which depend directly on the parameter set under the « **Sources Types** » tab. The various trigger types are:

- Modulation detection
- Data link
- Persistent
- GPI remote control
- GX 3016

In addition, each source type may be set to either « Speech » or Music. The complete range of source types available is therefore as follows:

- Speech type

    o Speech sound detection
    o GPI remote controlled speech
    o GX 3016
    o Data link
- Music type

    o Persistent music
    o Music sound detection
    o GPI remote controlled music

The concept of Speech and Music audio types exists so that, regardless of any priority levels set elsewhere, a « Speech » audio channel is always given priority over a « Music » audio channel.

7.2.1.1.1 Modulation detection

The modulation detection feature activates the option within the CC 3816 to detect a signal level. An input channel will be activated when the input signal level exceeds a preset trigger threshold. If the signal exceeds the trigger threshold on the input channel, it may then be directed to one of the output channels.

This type of source could, for example, be used to provide automatic noise level detection of a signal from such as a microphone. The input to which this microphone is connected will then be directed to an output if the signal level on this input exceeds the preset threshold. Accidental activation will be impossible so long as the input signal remains below this threshold.
Switching will then be deactivated once the input signal level drops below the predefined threshold.

7.2.1.1.2 DAS channel 1 and channel 2

The DAS feature allows an input channel to be selected and activated over the CC 3816's serial data link (for Digital Automatic System).

7.2.1.1.3 Persistent

The Persistent function is used to permanently activate an input channel. This feature should be used if an input signal needs to be available all the time for switching to one of the outputs. This configuration is especially useful in background (piped) music applications when combined with a CD player or satellite receiver.

7.2.1.1.4 GPI remote control

An input channel may be selected using a dry contact type logic GPI. A switch may be connected to one of the GPIs in order to switch an input channel to one of the audio outputs.

7.2.1.1.5 GX 3016

This source type is reserved exclusively for the CC 3816 matrix's audio inputs 5 and 6. Input channel 5 must be set to type GX 3016 if a set of GX 3016 consoles is to be connected to bus 1 of the switch matrix. Similarly, input channel 6 must be set to type GX 3016 if a set of GX 3016 consoles is to be connected to bus 2 of the matrix.

7.2.1.1.6 Modulation Detection parameters

The three parameters associated with this feature are Detection Threshold, Detection Time and Release Time, all of which are accessible under the « **Sources Types** » tab.

7.2.1.1.6.1 Detection threshold

This detection threshold is the level above which a Sound Detection-configured input channel is allowed to activate.

This threshold is adjustable from -50 to 0 dBm.

7.2.1.1.6.2 Detection time

This is the time duration from the moment the signal goes over the threshold to the moment the input channel is activated.

This time is adjustable from 10 to 100 ms.

7.2.1.1.6.3 Release time

This is the time duration from the moment the signal drops below the threshold to the moment the input channel is deactivated. This option prevents the channel from being

deactivated unnecessarily during pauses between music tracks when an input is configured to use Modulation Detection and an audio CD is being played over that channel.

This time is adjustable from 10 to 10,000 ms.

7.2.1.2 Prioritising audio inputs according to audio outputs

These parameters can be set under the « **Priorities** » tab.

A powerful priority level management algorithm is used to control the switching of the audio inputs to the outputs. Each audio input is assigned a priority level (from 0 to 15) which can be adjusted according to the audio output used. Level 1 is the highest priority level and 15 the lowest. Level 0 indicates that the audio input cannot access that particular audio output. Thus if two audio input channels are active at the same time on the same audio output, then the one with the highest priority will be switched to the corresponding audio output. Where both inputs have the same priority value, priority is assigned to the one that requested the output channel first.

In addition, regardless of the priority levels, a « Speech » audio channel always gets priority over a « Music » audio channel.

7.2.1.3 Setting the Group parameters

These parameters can be set under the « **Groups** » tab.

The CC 3816 includes the option of programming groups of outputs so that, for example, an audio input can be directed to a group of audio outputs. In applications involving sound and PA systems in public places, different groups of outputs may correspond to different geographical zones, where each zone has its own particular set of loudspeakers.

With the CC 3816 switching matrix, up to 16 groups of 1 to 16 outputs can be programmed.

7.2.1.4 Setting the GX 3016 console key parameters

These parameters can be accessed under the « **GX 3016 1 Keys** » and the « **GX 3016 2 Keys** » tabs. These tabs relate to the GX 3016 address 1 consoles (bus 1) and the GX 3016 address 2 consoles (bus 2) respectively. The programming of each of the keys (Zone Selection, Group Selection) of the consoles is valid for all the GX3016 console connected on this same bus.

Thus, each key on the GX 3016 address 1 console may be configured with an audio output to switch the audio input 5 (that of the GX 3016 1) to the chosen audio output. Similarly, each key on the GX 3016 address 2 console may be configured with an audio output to switch the audio input 6 (that of the GX 3016 2) to the chosen audio output.

In addition, each key on the GX 3016 address 1 console may be configured with a group of audio outputs to switch the audio input 5 (that of the GX 3016 1) to the audio outputs of the chosen group. And similarly, each key on the GX 3016 address 2 console may be configured with a group of audio outputs to switch the audio input 6 (that of the GX 3016 2) to the audio outputs of the chosen group.

For more information on operating GX 3016 consoles, refer to the GX 3016 User Manual.

7.2.1.5 Setting the GPI parameters

These parameters can be set under the « **GPIs** » tab.

The CC 3816's eight logic GPIs may be used for controlling the following three main functions: Remote Control, Day/Night and Mute.

7.2.1.5.1 Remote Control

The first function, « Remote Control », is used to switch an audio input to one or several audio outputs when the GPI is active. Under the « **GPIs** » tab, use the Function menu to first select the required audio input (from 1 to 8). Next choose an audio output (from 1 to 16) or a group of audio outputs.

7.2.1.5.2   Day/Night

The Day/Night function is used to reduce the selected audio outputs by −6 dB when the GPI is activated. Under the « **GPIs** » tab, use the Function menu to first select the Day/Night option. Next choose an audio output (from 1 to 16) or a group of audio outputs.

7.2.1.5.3   Mute

The third function, Mute, is used to mute the selected audio outputs by deactivating the audio output signal when the GPI is active. Under the « **GPIs** » tab, use the Function menu to first select the Mute option. Next choose an audio output (from 1 to 16) or a group of audio outputs.

7.2.1.6 Setting the GPO parameters

These parameters can be set under the « **GPOs** » tab.

The 16 logic GPOs may be used to carry out a range of applications such as generate data on a broadcast in progress, maximum level restoration, etc.

To configure a logic GPO requires that the following three parameters are set: a function code, the selection of one or more audio inputs and the selection of an audio output.

7.2.1.6.1   Broadcast in progress

A GPO configured with the function *Broadcast in Progress* will be activated when at least one of the inputs selected is switched to the chosen audio output.

7.2.2 Setting the digital process parameters

7.2.2.1 Input audio adjustments

The audio settings for the inputs are available under the « **Control** » tab.

7.2.2.1.1   Using Noise Gate on audio inputs

Each of the CC 3816's inputs incorporates a digital noise gate which may be very useful for eliminating earth hum, interference and other system background noises which may randomly occur. The noise gate feature uses a powerful dynamic processor that works like an automatic gate that lets through only the useful part of the signal. In fact, the noise gate function only lets the signal through if it exceeds a predefined level. It thus separates out the signal's useful component from any background noise that may be present on the input.

The noise gate threshold can be adjusted from −90 to 0 dBm.

7.2.2.1.2   Setting Bass/Treble on audio inputs

A standard Baxandall tone control circuit is incorporated on each of the CC 3816's inputs for digitally adjusting bass and treble. The mid-range frequency for adjusting the bass is 100 Hz while the midrange frequency for adjusting the treble is 10 kHz.

The gain for each of these two frequencies is adjustable from -18 to +18 dB.

7.2.2.1.3   Setting Mute on the audio inputs

Each input channel has its own Mute function. This is used to deactivate the input signal.

7.2.2.1.4   Adjusting Volume on the audio inputs

Once all the audio input settings have been adjusted, the general volume of each input needs to be set. The volume may be set from between –60 and +10 dB using the input volume potentiometer.

To get the maximum dynamic range from the signal processing processor, the input volume should be set so that the average value of the signal is between –3 and 0 dB on the Vu-meter.

7.2.2.2 Output audio adjustments

The audio settings for the outputs are available under the « **Control** » tab.

7.2.2.2.1 5 band parametric equaliser

Each of the CC 3816's output channels incorporates its own fully independent equaliser. Each of the output channel's equaliser sections can be used to make fine tone adjustments to the signal.

The equaliser section provides true 5 band parametric equaliser functionality including frequency adjustment Fc, quality factor Q and gain G for each band.

7.2.2.2.1.1 Frequency Fc

This is the centre frequency of the selected parametric equaliser band. The selected frequency determines the centre frequency that may be adjusted using Gain.

The frequency may be adjusted from 20 to 20,000 Hz.

7.2.2.2.1.2 Quality Factor Q

This is the frequency bandwidth around Fc. Setting Q to a high value can be used for example to produce a notch filter. With a notch filter, it is possible, for example, to attenuate the Larsen audio feedback effect (the resonant frequency sometimes produced by a microphone). A low Q value can be used to widen the frequency bandwidth affected.

Quality factor may be set to between 0.1 and 20.

7.2.2.2.1.3 Gain G

This determines the amount of gain or attenuation that can be applied to the selected frequency bandwidth.

Gain may be set to anywhere from +18 to –18 dB.

7.2.2.2.1.4 <u>N.B.</u>: The effect of equalisation on voice sounds

Central frequency	Effect on voice sounds
40 to 125 Hz	Sense of power for some singers with very low voices
160 to 250 Hz	Fundamentals of the voice
315 to 500 Hz	Important for the quality of the voice
630 to 1000 Hz	Important for the naturalness of the voice. $\Rightarrow$ Too much gain on the 315 to 1000 Hz frequency range produces a 'telephone'-type voice.
1250 to 4000 Hz	These frequencies are important for the intelligibility of the spoken word. $\Rightarrow$ Too much gain in the 2 to 4 kHz frequency range can mask some phonemes; for example, the 'm', 'b' and 'v' can become unintelligible. $\Rightarrow$ Too much gain in the 1 to 4 kHz can result in listener fatigue.
5000 to 8000 Hz	Accentuation of the voice. The 1.25 to 8 kHz range determines voice clarity
10,000 to 16,000 Hz	Too much gain in this frequency range can cause sibilance

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7.2.2.2.2   Setting Mute on the audio outputs

Each output channel has a Mute function associated with it that can be manually activated. The Mute function can be used to simply deactivate – or mute – the output signal. The audio output Mute function can also be activated by a logic GPI (cf. Setting the GPI parameters).

7.2.2.2.3   Adjusting Delay on the audio outputs

The delay function can be used to insert a delay on an audio output; this delay can be adjust from 0 to 5 seconds (equal to a delay from 0 to 1700 meters).

7.2.2.2.4   Adjusting Volume on the audio outputs

Once all the audio output settings have been adjusted, the general volume of each output needs to be set. The volume may be set from between –60 and +10 dB using the output volume potentiometer.

To get the maximum dynamic range from the signal processing processor, the output volume should be set so that the average value of the signal is between –3 and 0 dB on the Vu-meter.

8 MONITORING THE CC 3816 MATRIX STATUS

The various states of the matrix can be checked in real time either by directly observing the indicators on the CC 3816's front panel, or by using the « Matrix Control » software. The following paragraphs describe the various options available when using the software application.

8.1 Monitoring audio levels

The audio levels can be checked by observing the green SIGNAL and red CLIP indicators on the CC 3816's front panel.

However, a more precise indication of audio levels is provided by the matrix configuration software. Under the « **Control** » tab can be found an accurate -60 to +20 dBm digital Vu-meter for each audio input and output. In the case of the audio inputs, the Vu-meter shows the signal level after audio signal processing. In the case of the audio outputs, the Vu-meter shows the signal level after audio signal processing.

8.2 Verifying the CC 3816's switch matrix routing

Routing table data is available under the « **Routing** » tab.

The table shows which of the CC 3816's audio inputs are occupying each audio output. A green connection point shows that the audio output in question is occupied by the audio input in question, i.e. that the audio input concerned is switched to the audio output concerned.

8.3 Monitoring GPI status

GPI status data is provided under the « **Routing** » tab along the row labelled GPI Status. A green indicator means that the corresponding GPI is activated.

8.4 Monitoring GPO status

GPO status data is provided under the « **Routing** » tab along the column labelled GPO Status. A green indicator means that the corresponding GPO is activated.

9   SAMPLE APPLICATIONS

Below are two examples of applications that can be achieved using the CC3816. The first uses a factory configuration while the second application requires the parameter settings to be changed.
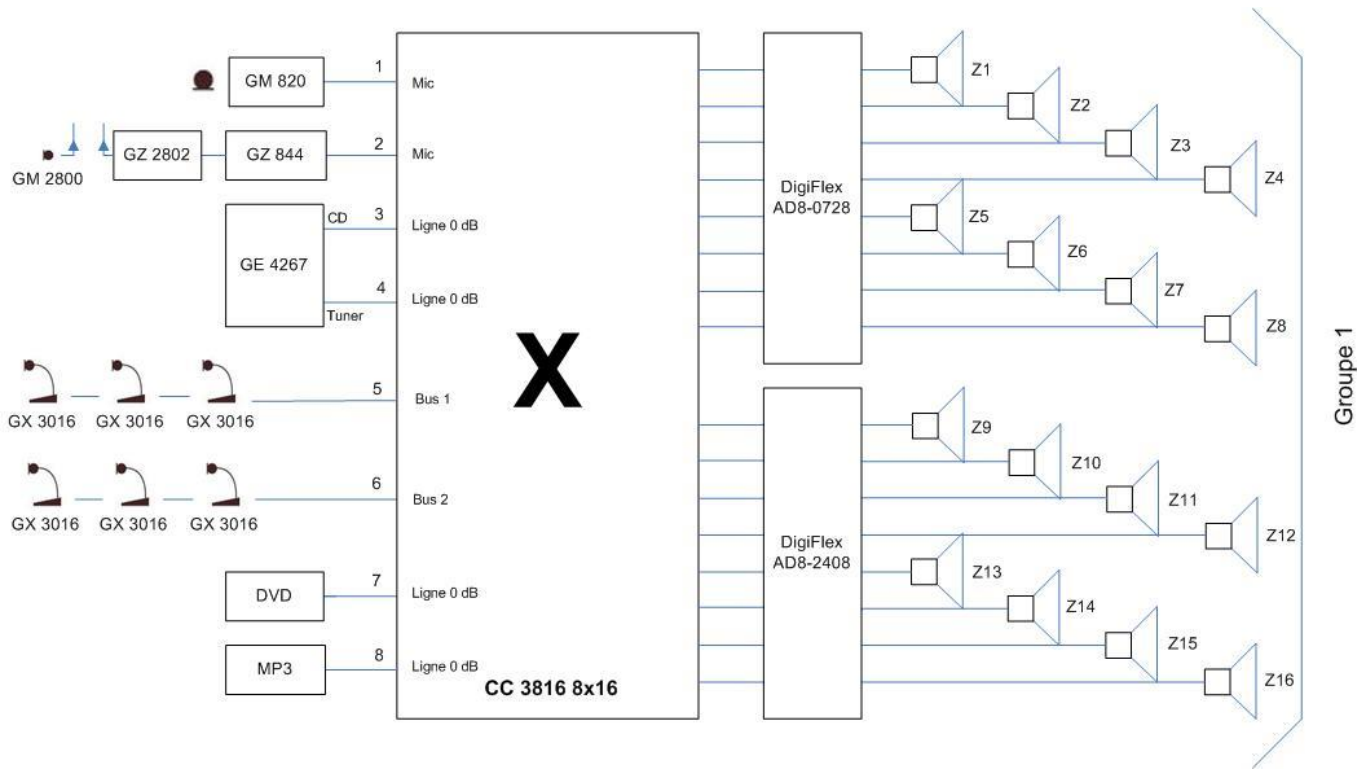
9.1   Application 1: factory configuration

The application described below uses the configuration in which the matrix is delivered, i.e. the factory configuration.

9.1.1 Summary of the factory configuration

| Audio input	Source type	Priority level	Zones	Level
1	Modulation Detection speech	1	All zones	Microphone
2	Modulation Detection speech	2	All zones	Microphone
3	Modulation Detection Music	5	All zones	Line
4	Modulation detection Speech	6	All zones	Line
5	GX 3016	3	Zone selection with console key (1 to 16)	Bus1
6	GX 3016	4	Zone selection with console key (1 to 16)	Bus2
7	Modulation Detection Music	7	All zones	Line
8	Permanent Speech	8	All zones	Line

9.1.2 Audio block diagram of a typical installation using the factory configuration

9.2 Application 2

This section presents a custom CC3816 configuration.

9.2.1 Application 2 audio block diagram
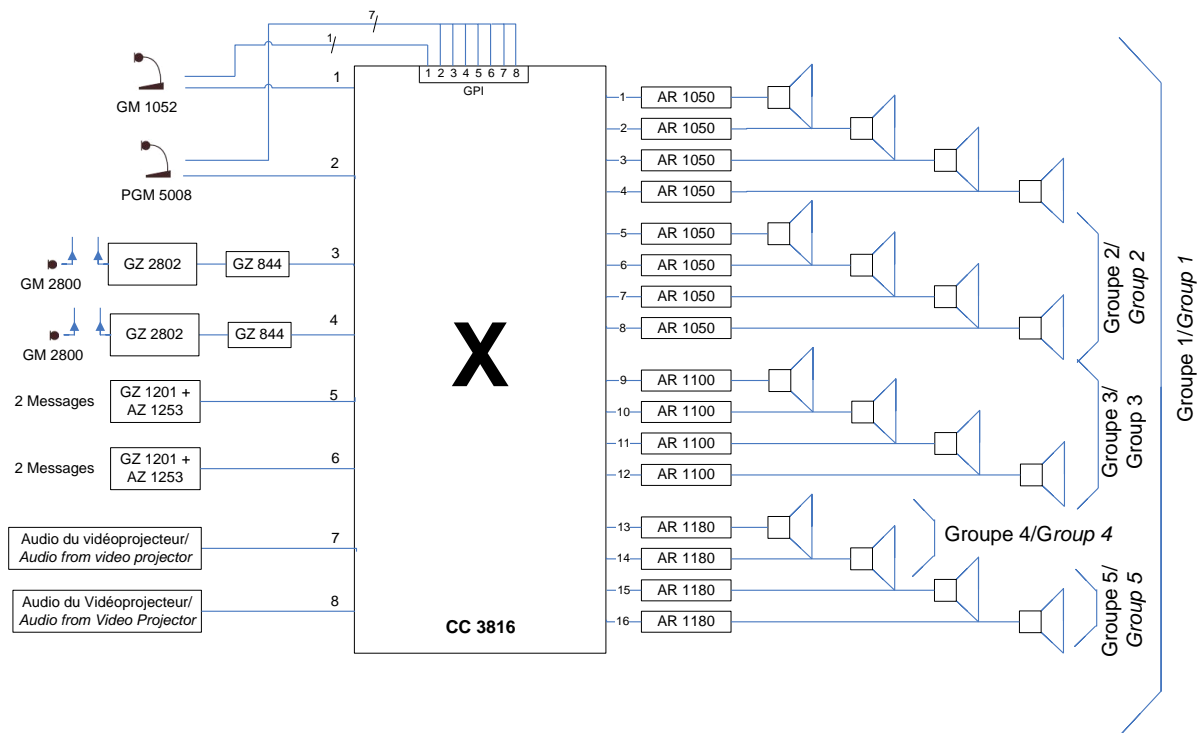
This section describes the various stages of configuring the CC 3816 to produce the second application illustrated in the block diagram above.

In this application, when the CC 3816 switch matrix is idle, none of the inputs are directed to any of the audio outputs.

Music sources and various microphones may be switched to the outputs depending on the various triggers.

The GM 1052 uses its integral push button to activate its remote control so it can be switched to the CC 3816's audio outputs.
The PGM 5008 provides seven remote control contacts via its push buttons in order to be switched to one of the seven required zones.
The messages pre-recorded on the AZ 1253 boards will be switched to the audio outputs immediately they are triggered using the « Modulation Detection Speech » feature.
The GM 2800 HF microphone on audio input IN 3 and the video projector on audio input IN 7 will be switched to the Group 4 audio outputs using the Sound Detection feature.
Similarly, the GM 2800 HF microphone on audio input IN 4 and the video projector on audio input IN 8 will be switched to the Group 5 audio outputs using the « Modulation Detection Speech » feature.

The decision to switch from one input to another is managed using the priority rules, according to the state of the triggers associated with each audio input.

With regard to priorities, the video projectors have the lowest priority, followed by the HF microphones, then the micro consoles (GM1052 and PGM5008), with finally the pre-recorded messages getting the highest priority.

9.2.2 Implementation

The switch matrix is configured for this application by following the configuration stages set out below:

9.2.2.1 Stage 1: configuration of the audio input types (Micro or Line)

Refer to Section 7.1 for additional details.

Connect the GM 1052 (Micro level) console to input IN 1 : input IN 1 must be configured as a Micro input, and the phantom power supply should be enabled.

Connect the microphone PGM console (Line level) to input IN 2 : Input IN 2 should be set to Line.

Connect the GZ 2802 HF receivers to inputs IN 3 and IN 4: both these inputs should be set to Micro.

9.2.2.2 Stage 2: configuration of the audio input source type

Refer to Section 7.2.1.1 for additional details.

Connect consoles with push buttons and remote controls to the inputs IN 1 and IN 2. Audio inputs 1 and 2 must be configured as « **Remote control speech** » types. Logic GPIs should also be linked to these to read the status of the remote controls issued by the consoles (refer to Stage 5).

GM 2800 HF microphones should be connected to audio inputs IN 3 and IN 4. These inputs should be configured as « **Modulation Detection Speech** » types.

The AZ 1253 circuit boards containing pre-recorded messages should be connected to audio inputs IN 5 and IN 6. These inputs should be configured as « **Modulation Detection Speech** » types.

To audio inputs IN 7 and IN 8 should be connected the audio outputs from the overhead projectors. These audio inputs should be configured as « **Modulation Detection Speech** » types.

Screen copies of Matrix Control application are shown to help for the explanation; they may vary depending on the software version.

9.2.2.3 Stage 3: configuration of the audio input priority levels

Refer to Section 7.2.1.2 for additional details.

The audio input priority levels for the audio outputs are configured as follows, according to the application required:

9.2.2.4 Stage 4: configuration of the groups

Refer to Section 7.2.1.3 for additional details.

Our application requires the creation of several audio output groups. Therefore, we created Groups 1, 2, 3, 4 and 5 which were made up as shown below:

Control | Routing | Sources Types | Priorities | **Groups** | GX 3016 1 Keys | GX 3016 2 Keys | GPIs | GPOs

Audio Outputs

	Out 1	Out 2	Out 3	Out 4	Out 5	Out 6	Out 7	Out 8	Out 9	Out 10	Out 11	Out 12	Out 13	Out 14	Out 15	Out 16
Group 1	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Group 2	☐	☐	☐	☐	☑	☑	☑	☑	☐	☐	☐	☐	☐	☐	☐	☐
Group 3	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑	☐	☐	☐	☐
Group 4	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐
Group 5	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑
Group 6	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Group 7	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Group 8	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Group 9	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Group 10	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Group 11	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Group 12	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Group 13	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Group 14	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Group 15	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Group 16	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Reset   Apply

9.2.2.5 Stage 5: configuration of the logic GPIs

Refer to Section 7.2.1.5 for additional details.

In Stage 2 we saw that the GM 1052 console activates a remote control when the integrated push button is pressed. This remote control acts as a trigger for activating the associated audio input IN 1 and switching it to the audio outputs.

Therefore the settings for a logic GPI need to be entered if the status of the GM 1052's remote control is to be read. The GPI 1 is assigned with the Select Input 1 function to select the audio input from the GM 1052. Next, Group 1 is selected to switch the GM 1052 to all the audio outputs belonging to Group 1.

In addition, the PGM 5008 console activates 7 remote controls when the zone selection buttons are pressed, in order to select zones Out 1, Out 2, Out 3, Out 4, Group 1, Group 2 and Group 3; these remote controls are triggers that activate associated audio input IN 2 and switch it to the corresponding audio outputs.
The parameters of the matrix's seven logic GPIs (2 to 8) therefore need to be set so that the status of the remote controls from the PGM 5008 can be read. The GPI 2 is assigned with the Select Input 2 function to select the audio input from the PGM 5008. Next, Group 1 is selected to switch the PGM 5008 to all the audio outputs belonging to Group 1. The operation is repeated in order to set the parameters of the remaining six GPIs as follows:

9.2.2.6 Stage 6: input audio adjustments

Refer to Section 7.2.2.1 for additional details.

Click on the « **Control** » tab to access and adjust the audio input parameters.

9.2.2.7 Stage 7: output audio adjustments

Refer to Section 7.2.2.2 for additional details.

Click on the « **Control** » tab to access and adjust the audio output parameters.

10 DETAILED TECHNICAL SPECIFICATIONS

10.1 Audio inputs

```
Number of inputs :        8
Inputs 1 to 4 :           Micro/Line, electronic balanced, RF filtered
Inputs 5 to 8 :           Line level inputs, balanced on transformer, RF filtered
Nominal micro level :     - 49 dbm
Nominal line level :      0 dbm
Headroom :                + 20 db
Input impedance :         > 9 kΩ
Phantom power supply :     + 15 V (inputs 1 and 2 in micro configuration, via 2k2Ω)
Connectors :              Euroblock removable terminal blocks
```

10.2 Audio outputs

```
Number of outputs:        16
Level:                    0 dbm
Type:                     Electronic balanced
Impedance:                220 Ω
Max. output level:        + 20 dBm
Connectors:               Euroblock removable terminal blocks
Delay value               from 0 to 5 seconds (from 0 to 1700 meters)
```

10.3 A to D converter specifications

```
Resolution:               24 bits
Dynamic:                  102 dB (105 dB 'A' weighted)
Sampling frequency:       48 kHz
```

10.4 D to A converter specifications

```
Resolution:               24 bits
Dynamic:                  104 dB (106 dB 'A' weighted)
```

10.5 Audio specifications

```
Distortion:               < 0.1%
THD+N (Line) :            < -70 dbm
THD+N (Micro) :           < -63 dbm
Frequency response:       50Hz – 20 KHz ± 3 dB
Crosstalk                 > 70db (@100Hz, @1Khz, @10Khz)
```

10.6 GPI Specifications

```
Number of inputs:         8
Type:                     opto-isolated
```

10.7 GPO Specifications

```
Number of outputs:        16 open-collector outputs
Max current per GPO:      30 mA
```

10.8 Mains Power Supply

```
Input voltage:            85-264 V AC, 50/60 Hz
Protection:               short circuit (protection by polyswitch) and over-voltage
Consumption max :         0.22 A (230VAC)
```

10.9 +24 Volt Power Supply

```
Input voltage:              +24 V DC ±10%
Protection:                 short circuit (protection by polyswitch)
Consumption:                1.8A max.
```

10.10 GX 3016 Power Supply

```
Output voltage:    + 24 V DC
Maximum current:   560 mA (8 x GX 3016)
Protection:        short circuit (protection by polyswitch)
```

10.11 Mechanical Specifications

```
Installation:    19" rack mounted
Material:        Metal
Colour:          Matt black
Weight:          3.340 kg
Dimensions:      482 x 345 x 45 mm
```

11 PREVENTIVES MEASURES

Please make sure to read carefully all following instructions

1- Take a look at all the warnings. Don't remove the security tags on the device or other information.
2- Use the device only for indicated applications, and in an appropriate way.
3- The use of this device is not recommended above 2000 meters above sea level.
4- Don't obstruct aeration openings with some objects.
5- Respect a minimal distance around the device to ensure enough aeration.
6- Don't expose the device to rain or moisture (except if the device is conceived for outdoor use – in this case, you must respect the instructions which come with it).
7- If your device doesn't work anymore, and if water or other objects enter inside, turn it off directly and unplug it. This device must be repaired by a qualified person.

   Devices plugged on mains power
8- Turn off the device before touching any conductive parts inside it.
9- Don't switch the device on-off several times in a row : you risk to reduce the longevity of its intern components.
10- Replace the fuse only by a fuse with the same type and the same caliber.
11- Warning, a power plug has three spindles, including a protection ground spindle. The third spindle ensures safety. Check if the protection ground spindle provided enters in the electrical outlet, otherwise, consult an electrician to replace the obsolete outlet.

Warnings symbols

Symbol	Description
⏚	Protection ground spindle
⏚	Ground spindle
---	Direct current or continuous voltage
∼	Alternating current or Alternating voltage
⚡	Dangerous voltage by touch, risk of electrification, even electrocution
⚠📖	Read carefully the joined document
⚠	Warning, hot surfaces, don't touch during operation, risk of burns

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Devices which are excessive thermal energy sources

Warning, hot surfaces, don't touch during operation, risk of burns

Product's disposal

At the end of product's life, if it is installed on the French territory (DOM-TOM included), please contact BOUYER to organize its destruction according to the WEEE directive. Otherwise, please follow country's local regulations to install the product.

12 APPENDICES

12.1 Factory Settings

The factory settings are the settings the CC 3816 switch matrix is configured with immediately before it leaves the factory.

12.1.1   Hardware Configuration

Audio input	Type	Microphone supply
IN 1	Line	No
IN 2	Line	No
IN 3	Line	
IN 4	Line	

12.1.2   Default configuration of the audio input source types

Audio input	Type
IN 1	Modulation Detection Speech
IN 2	Modulation Detection Speech
IN 3	Modulation Detection Music
IN 4	Modulation Detection Speech
IN 5	GX 3016
IN 6	GX 3016
IN 7	Modulation Detection Music
IN 8	Permanent Music

12.1.3   Default configuration of priority levels

		AUDIO INPUTS							
		IN 1	IN 2	IN 3	IN 4	IN 5	IN 6	IN 7	IN 8
A U D I O O U T P U T S	Out 1	1	2	5	6	3	4	7	8
	Out 2	1	2	5	6	3	4	7	8
	Out 3	1	2	5	6	3	4	7	8
	Out 4	1	2	5	6	3	4	7	8
	Out 5	1	2	5	6	3	4	7	8
	Out 6	1	2	5	6	3	4	7	8
	Out 7	1	2	5	6	3	4	7	8
	Out 8	1	2	5	6	3	4	7	8
	Out 9	1	2	5	6	3	4	7	8
	Out 10	1	2	5	6	3	4	7	8
	Out 11	1	2	5	6	3	4	7	8
	Out 12	1	2	5	6	3	4	7	8
	Out 13	1	2	5	6	3	4	7	8
	Out 14	1	2	5	6	3	4	7	8
	Out 15	1	2	5	6	3	4	7	8
	Out 16	1	2	5	6	3	4	7	8

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12.1.4   Default configuration of groups

Only group 1 is created: it is made up of all audio outputs.

Group	Audio outputs															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
G1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
G2																
G3																
G4																
G5																
G6																
G7																
G8																
G9																
G10																
G11																
G12																
G13																
G14																
G15																
G16																

12.1.5   Default configuration of the GX 3016 keys

Valid for two GX 3016 consoles (audio inputs 5 and 6)

Key	Function	Output or Group number
1	Select output	Out 1
2	Select output	Out 2
3	Select output	Out 3
4	Select output	Out 4
5	Select output	Out 5
6	Select output	Out 6
7	Select output	Out 7
8	Select output	Out 8
9	Select output	Out 9
10	Select output	Out 10
11	Select output	Out 11
12	Select output	Out 12
13	Select output	Out 13
14	Select output	Out 14
15	Select output	Out 15
16	Select output	Out 16

12.1.6 Default configuration of logic GPIs

		Function	Output / Group
GPIs	GPI 1	None	
	GPI 2	None	
	GPI 3	None	
	GPI 4	None	
	GPI 5	None	
	GPI 6	None	
	GPI 7	None	
	GPI 8	None	

12.1.7 Default configuration of logic GPOs

			Audio inputs								
		Function	1	2	3	4	5	6	7	8	Output n°
GPOs	GPO 1	Broadcast in progress	X	X	X	X	X	X	X	X	Out 1
	GPO 2										
	GPO 3										
	GPO 4										
	GPO 5										
	GPO 6										
	GPO 7										
	GPO 8										

This configuration is used to generate a "Broadcast in Progress" signal on GPO 1 by occupying output Out 1 with any one of 8 sources.

12.1.8 Default configuration of the sound detection parameters

Source type	Parameter	Value
Speech	Threshold	-20 dBm
	Detection time	30 ms
	Release time	3 s
Music	Threshold	-20 dBm
	Detection time	30 ms
	Release time	10 s

12.1.9   Default values of the audio signal processing parameters

The default values of the audio signal processing parameters are given in the table below:

Function	Parameter	Value	Comment
Input volume	Gain/Attenuation	0 db	For all inputs
Noise Gate	Status	Inactive	For all inputs
	Threshold	-90 dBm	
Input bass/treble	Gain/Attenuation	0 db	For all inputs
Output volume	Gain/Attenuation	0 db	For all outputs
Parametric filter n° 1	Frequency	150 Hz	For all outputs
	Q	5	
	Gain	0 db	
Parametric filter n° 2	Frequency	350 Hz	For all outputs
	Q	5	
	Gain	0 db	
Parametric filter n° 3	Frequency	1200 Hz	For all outputs
	Q	5	
	Gain	0 db	
Parametric filter n° 4	Frequency	3000 Hz	For all outputs
	Q	5	
	Gain	0 db	
Parametric filter n° 5	Frequency	8000 Hz	For all outputs
	Q	5	
	Gain	0 db	

12.1.10   Default values for the delay parameters

The default value of the delay parameters are 0 (milliseconds or meter) for the value and inactive for the state.