



Whitepaper

Building a broadcast automation Ecosystem with AEQ's mixing consoles and Netbox AD MX with RTC Software

Description

This application note aims to describe how Radio Siljan and Mora Närradio have integrated the physical and virtual GPIO functionalities into an ecosystem of AEQ equipment. In this integration, a NETBOX 32 with an MX license has been used as the heart of the operations and is used in turn as an antenna "switcher", router and Matrix, as well as a "scheduler" executor and alarm manager and execution of emergency network connections. In reality, a large part of these functions could be done with the simple intercommunication of two AEQ consoles, but this installation includes, apart from a large number of signals that need management and routing, a shared talk-studio that requires the general signalling to be correct and that the monitoring signals and orders have their correct origin and destination. For this reason, a Netbox 32 AD MX matrix was chosen as the central part of the integration.

The basic requirements really flow from the operation of both stations and that either station could work on any control. Mora Närradio is typically local content, from the city, while Radio Siljan adds regional content with national connections for current affairs and news. Radio Siljan is also providing sports coverage like ice hockey and other major events, such as "Vasaloppet". This very popular Nordic ski event is 96 km between the towns of Sälen and Mora and with over 15,000 skiers. Both stations broadcast advertising and their music programs are different. Many hours of the stations are self-control, but for both there are occasions with many guests and therefore a talk-studio with a control is needed. This resource, the talk-studio, is shared, as well as the digital files of both music, recordings and news.

The personnel being more Talents/DJ's than audio technicians in charge of On-Air continuity, requires that all the states of the consoles and studios are well indicated on both consoles, red and green lights, etc. A legal aspect is added to the requirements, which is that, in Sweden, by law, electrical and electronic equipment that is not required for operation during, for example, the night or during automatic broadcast, has to be switched off. This means that all the switching and mixing load falls on the Netbox 32 AD MX when there is no one at either station. The automation and play-out computers are managed, and in turn manage, the Netbox 32 AD MX Matrix. The Netbox MX service is in charge of updating the status signalling when, for example, a Mixer is restarted for Auto-control in any of the two transmitters. It is therefore, a fully bidirectional system to control an audio matrix from the surface of the Forum or Capitol IP consoles or vice versa, that is, the matrix that gives way to one control or another, as well as the booth. Always signalling it for the users of the other control or the booth correctly. In some aspects, the Matrix even performs home automation functions, since, among other things, it is possible to lock and open doors to premises, controls and the booth from any of the consoles using programmed keys. Those keys send a Virtual GPO that is translated to a physical GPO on the Netbox 32.

The author, Urban Eriksson, from the Swedish company UE Teknik AB, uses AEQ Radio, consoles and audio matrices for many of his projects.



NETBOX 32



FORUM IP SPLIT

Environment

Radio Siljan is a local radio station in Mora, Sweden, in the north of Dalecarlia. It broadcasts on FM 94.1 and 89.1 MHz. Radio Siljan shares facilities and technical resources with Mora Närradio. Both stations can be heard on the web.

UE Teknik AB is a broadcast, audio, radio and data technology and consultancy company. It develops technical solutions for companies in the media industry such as radio stations and other companies that want to reach the public. They also work with TV production for events and sports.



The founder and Director of the Company is Urban Eriksson, and he decided to use AEQ audio consoles and matrices for Radio Sijan and Mora Närradio. He also envisaged and developed this application note on how to use the physical and virtual GPIOs of the AEQ equipment to automate operations at stations with several Controls and talk-studios.



Following a pioneering installation at the Radio Lidköping community Station, UE Teknik in Sweden decided to go for the AEQ Ecosystem for their next installation at the Radio Siljan and Mora Närradio (community station). Initially the job was to be accomplished in the latter part of 2020 but the Pandemic made the planning difficult and introduced delays. However, the Mora Närradio started the installation of their small Control and Studio as Planned, at the end of 2020. They fitted a FORUM Lite Console since the Main Control was going to be fitted with a FORUM IP Split, and the operators favoured the control surface layout being identical in both Studios/Controls.

The old build-out and studio fittings had to be torn out and this caused delays and on top of that the lease of the building expired. The Station decided to go with a new location and eventually began the fitout early March 2021. The original plans were to build a shared 7 mic Studio, allowing for both classical control-studio operation and self-controlled programming. Both controls should be able to command the broadcast at any time and also being able to hand-over and signal the actual control and status of the consoles and the broadcast.

System equipment and features to use

The Shared (between the two Radio Stations) talk-studio is equipped with a StudioBox for local signalling and a NetBox 4 MH to provide for the Necessary Microphone inputs with phantom Power and the Headphones outputs. Cabling is next to none since the Netbox is PoE+ Powered thus only requiring a couple of RJ45's for AoIP and Control.

Virtual GPIO's comes very handy when we want to trigger functions and Macros or Salvos in a Netbox MX licensed AoIP Routing Matrix. It is also possible to signal the status on the programmable keys of any of the AEQ Digital Mixing consoles. Such signalling is also useful when operating several studios and will also indicate what Studio is in control and going on-air with a program signal or any other function or feature that has been defined. At the same time as we are signalling the status, it is possible to "arm" the programmable key to either release or trigger commands remotely to a routing Matrix or other equipment in the system.

To do so, the system is built around the AEQ Consoles and also the AEQ Netbox 32 AD Audio Interface with MX Licensing. This converts the Netbox AD into a non-blocking 64x64 channel Automated Audio Matrix. Since all AEQ's equipment with AoIP Multichannel connectivity are featuring both Physical and a Virtual GPIO system, it becomes very simple to automate. Also, by using the Virtual GPIO system, the number of commands that one is able to generate and interpret becomes very large so consequently the level of automation becomes really impressive. The AEQ Mixing Consoles are packed with programmable keys and functions that allows to take the automation a step further than competitors.



The possibility to create a macro with Matrix connections and disconnections and to be able to trigger this from a single programmable key allows to simplify workflow that would require quite complex operations, such as voice-tracking or a talkback to any destination available to the system.

It is also necessary that if a Console is shut down at night and when the console is started the next morning, we need that the Console reflects the correct status on the Programmable Keys. This of course, is valid if the Netbox Cross-points are controlled from the Console through the remote triggering of the Netbox RTC macros or salvos.



Technical requirements to enable the operability of the system

Minimum requisites:

- ✓ Correct configuration of Macros and Virtual GPO's and GPI's.
- ✓ Netbox RTC Service is required to run correctly on the network.
- ✓ It is essential that we are using the same range of IP for control of all the equipment.
- ✓ FORUM IP, FORUM Split or CAPITOL IP, CPU FW Version minimum 1.87



Configuration: To take into account

We can not have diverse IP address ranges even if the NIC of the computer can read and use diverse IP addresses, in the case that attains us we have to be using all the equipment in the same range for control. In our example we are using 172.27.nnn.nnn with sub-mask 255.255.0.0 . What this means is that even if the Main IP address of the Network Interface Card - NIC - in this case was 172.26.4.32 and we have had to define that the Netbox RTC server, the Netbox 8 (Equipment) and the FORUM IP Split are all using the Network 172.27.nnn.nnn for control. In other words and for this to operate correctly we have had to configure an alternative IP Address on our NIC with IP address 172.27.34.10 .

As with all installations and configurations, it is essential to plan what we want to do in detail. This way we can troubleshoot more easily. In this simple three-way example we are using the following IP Addresses:

AEQ NETBOX MX	172.27.38.1
AEQ FORUM IP SPLIT	172.27.34.6
Computer with NetBox MX RTC Service	172.27.34.10

If we have FORUM/FORUM IP Split in the installation, we will also have to make sure that we are using the correct port of the FORUM/FORUM IP Split for the control and Virtual GPIO commands. On the FORUM IP Split it is the "ETH" port or the Upper port of the two ports available for Control.

To understand the principle of the operation of the Virtual GPIO's when used with the Netbox MX, it has to be explained that we are sending the commands to the Netbox MX but the Netbox will not execute these on its own but will notify the Netbox RTC Service that it has received a Virtual GPI number and form IP address. nnn.nnn.nnn.nnn.

The Service will then translate this from the database entries and request the Netbox to accomplish the related operation with regards to cross-points, salvoes or macros that are corresponding to this GPI and number.



Programming a couple of Macros

The following is an example where we have a couple of predefined Macros that are consisting in a Salvo with a series of Cross-points and that is also associated to one or several GPO activations. In this case the Predefined Macro will “take” or “release” the cross-points of the Salvo, i.e. make (take) the cross-points or remove (release) the same cross-points. At the same time, the GPO activation will either send an “ON” or “OFF” status to the programmable key of a mixing console. Once correctly programmed, this key will go “hot” and will allow for the manual Activation or deactivation of the Salvo as programmed for the Netbox. The Key can be activated or deactivated from for example, a third-party GPI command sent from for example a play-out application allowing for UDP commands to be sent to the LAN.



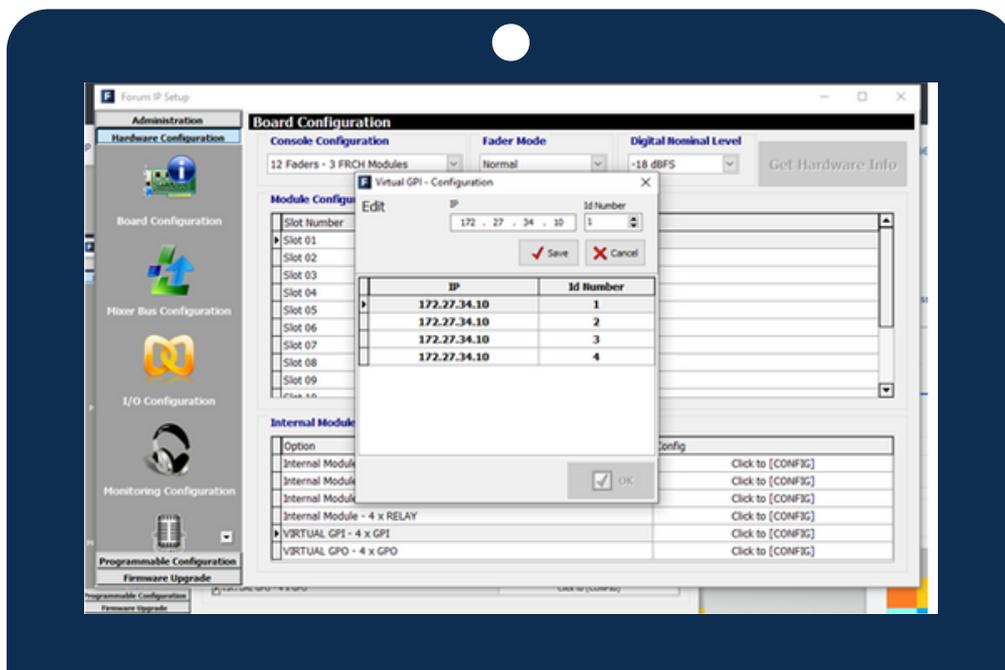
Definition of Virtual GPIO's for our Consoles

Now we need to define in the section for Virtual GPI's the ones that we are going to use and, in our case, it will be a Virtual GPI from the PC or generated from, for example, the Swiss file knife UDP SEND application. Following our planned IP's, the expected GPI's and the GPO's that we want to use are configured under the TAB Hardware and the option "Board Configuration" in the Setup SW. In our case we are using the FORUM IP Setup SW application. We go to the Internal Module/Virtual - Configuration list and the VIRTUAL GPI and VIRTUAL GPO. Here we define the Virtual GPI's that we may receive and that we want to associate and signal on a programmable button. It is important to remember that the NetBox MX will not send the Virtual GPI but the Service of the Netbox RTC Software will. So in this case we need to indicate that we will be expecting Virtual GPI numbers (nnn) from 172.27.34.10.

VIRTUAL GPI: allows you to configure the Virtual GPIs, General Purpose Inputs that arrive to the unit through an IP connection. Up to 246 virtual GPIs can be configured.

The advanced configuration menu of Virtual GPIs is accessed by clicking "Click to [CONFIG]" and then clicking again on the "CONFIG" button that will appear. The window that appears allows you to create and edit virtual GPIs. The available options of this configuration window are:

- + **IP:** optional field that allows you to edit the IP address in order to define the origin of the received orders.
- + **ID Number:** allows you to assign an order number to virtual GPI into the unit that must be less than 256. Id Number can not be duplicated.

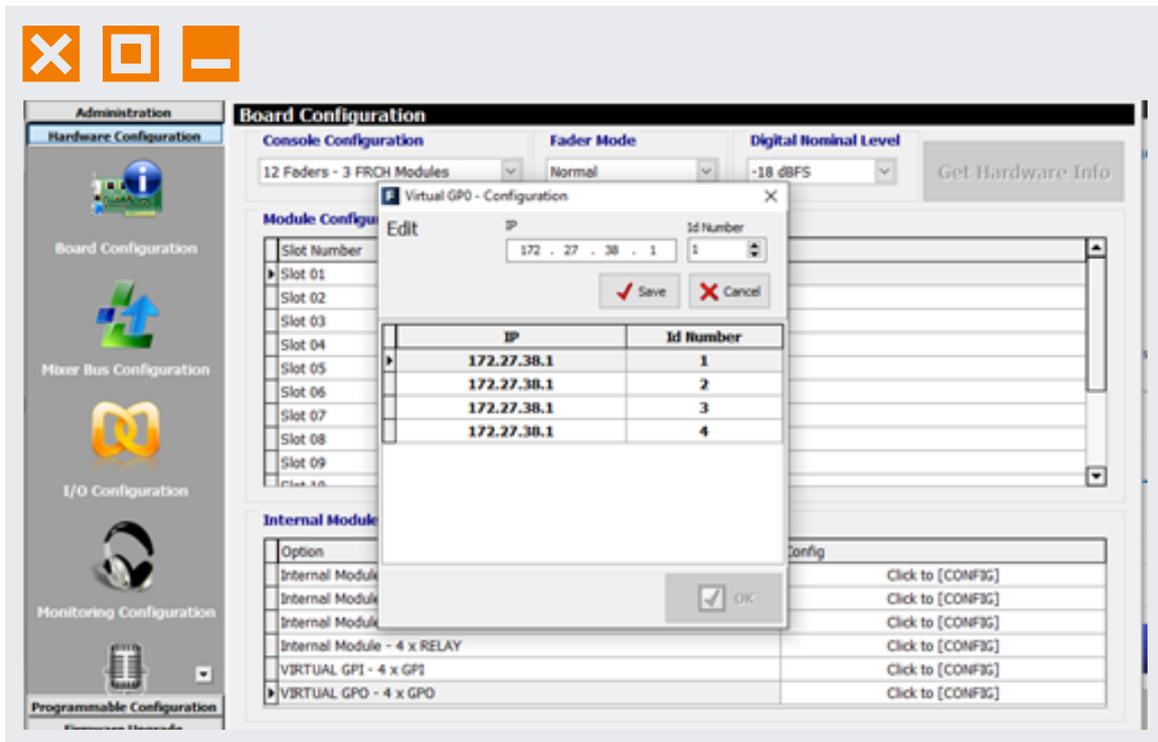


In the same way the GPO's that we are going to use to signal to the Netbox, will have to go directly to the Netbox device, in this case 172.27.38.1.

VIRTUAL GPO: allows you to configure the Virtual GPOs, General Purpose Outputs that are sent to other units through an IP connection. Up to 242 virtual GPOs can be configured. The advanced configuration menu of Virtual GPIs is accessed by clicking "Click to [CONFIG]" and then clicking again on the "CONFIG" button that will appear.

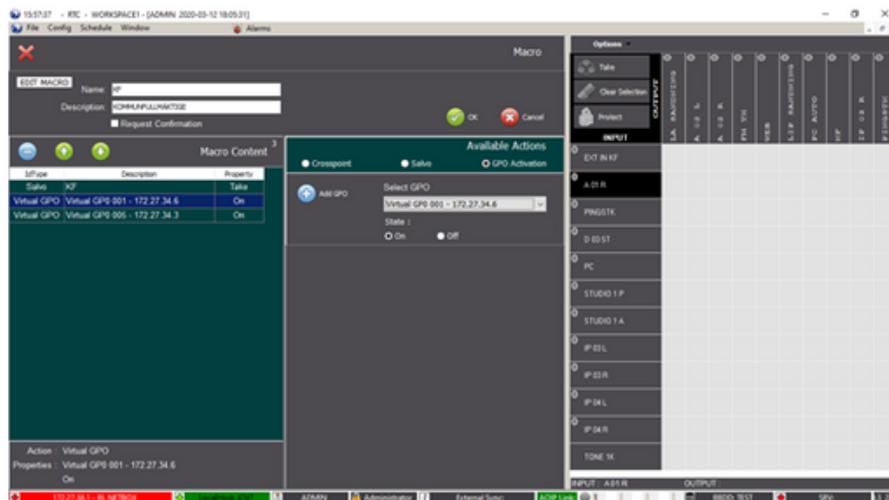
The window that appears allows you to create and edit virtual GPOs. The available options of this configuration window are:

- + **IP:** mandatory field that allows you to edit the IP address in order to define the destination of the generated orders.
- + **ID Number:** allows you to assign an order number to virtual GPO into the unit that must be less than 256. The same virtual GPO can be sent to different units; in that case the same Id Number must be assigned to different IP addresses.



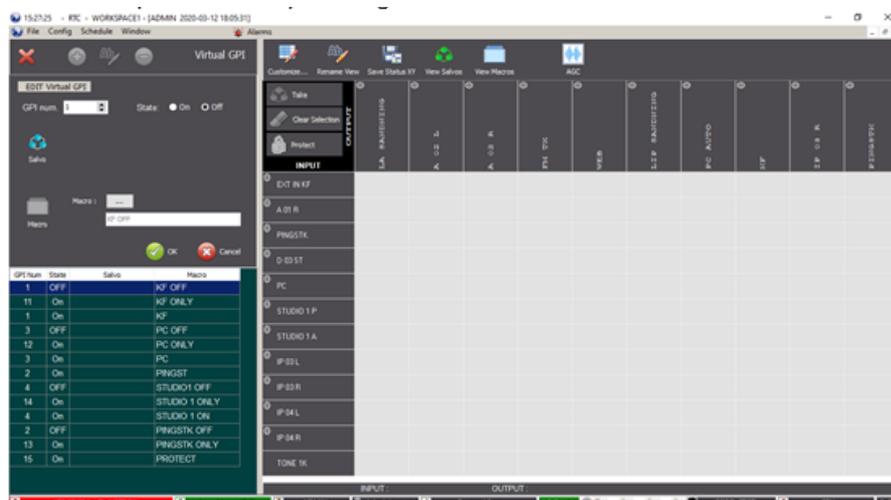
Definition of the SALVO to be executed by the matrix

Later, as per the picture hereunder, we need to define in the MACRO corresponding to KF (ON), that once the SALVO is executed, a virtual GPO is also sent to the FORUM IP Split at 172.27.34.6, and in this case the number "001". In reality, what we do is to say that this MACRO contains a GPO activation that contains the following information: IP Address of the Destination, The number order of the Virtual GPO and the Status that is accompanying this Virtual GPO, "ON" or "OFF" - in this case "ON".



Subsequently we need to define what MACRO corresponds to what VIRTUAL GPI Number order. What we are doing in essence is to tell the Netbox RTC that upon receiving a Virtual GPI, the Netbox RTC Service will execute the MACRO as defined. It doesn't matter from what IP address the Virtual GPI is coming, as long as it is in the List of Virtual GPI number order as defined for the MACROS as above.

The definition or editing of the Virtual GPI in this section allows us to associate a Virtual GPI to a Macro (or a Salvo) and the State accompanying the GPI: "ON" or "OFF". In this example we are only defining MACROS.



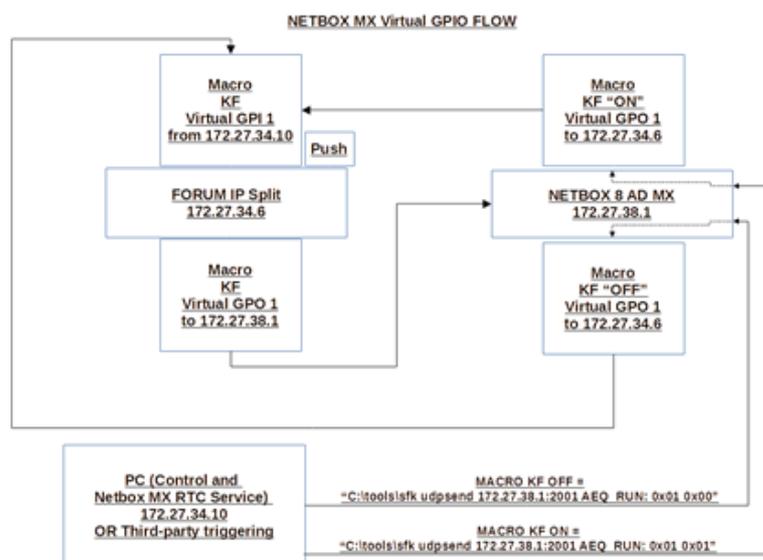
Third Party Triggering

If we want to add a third-party UDP triggering of the MACROS, then we need to define the destination as the Netbox (in our example 172.27.38.1) and the number of the MACRO as per our definition in the NETBOX MX RTC Software application. If we use for example a Swiss File Knife UDP Send application to emulate we would have to write a batch file that would need to comply with AEQ's Protocol for Virtual GPIO: it would typically look like this: "C:\tools\sfk udp send 172.27.38.1:2001 AEQ_RUN: 0x01 0x01"

Then we run the batch file written KF.bat - "C:\tools\sfk udp send 172.27.38.1:2001 AEQ_RUN: 0x01 0x01" This is in reality referring to the Virtual GPI number 001 of the NETBOX 8 that translates into "Run MACRO corresponding to GPI number 001" and that corresponds to "KF ON".

For OFF, we need to do exactly the same but inverse from Swiss File Knife, i.e. "C:\tools\sfk udp send 172.27.38.1:2001 AEQ_RUN: 0x01 0x00" and that in reality is referring to GPI number 001 of the NETBOX 8 and that translates into "Run MACRO corresponding to GPI number 001" that is "KF OFF".

Workflow



Imagine anything!!!
with an AEQ Equipment
Ecosystem it is possible

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