

Technical Details A-100

The Principles of Voltage Control

What makes analogue synthesizers (and modular systems in particular) special is that the important parameters of the sound sources (VCO, noise, etc.) and modifiers (VCF, VCA, etc.) can be altered not just by hand, but by **voltage control**. This principle was turned into reality by the "father of the analogue synthesizer", Robert Moog, who produced the first commercially available synthesizer in the sixties. It gives vast flexibility and the potential to make sounds that have never been made before.

Fig. 1 shows the principle of voltage control, with examples of control voltages affecting a filter (VCF) and an oscillator (VCO).

In the case of the **VCF**, the parameter which is being voltage-controlled is the **Cut-Off Frequency f_c** . The amount of control voltage input present changes the cut-off frequency, and thus the frequency of the signal that the VCF lets through - see the shaded area in the diagram.

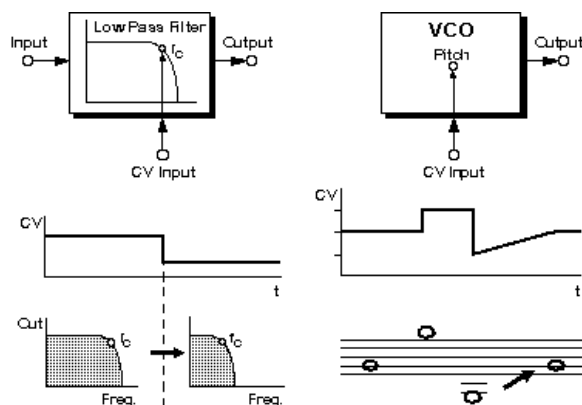


Fig.1: The principles of voltage control

In the case of the **VCO**, it's the **pitch** which is controlled by an external control voltage CV (Control Voltage): an increase of 1 volt corresponds to an increase of one octave in the pitch. With a sudden change of voltage, the pitch changes suddenly, while with a smoother, continuous change, portamento is created. Pay attention that CV is not an absolute but a relative parameter. A certain CV value (e.g. +1.0V) is not assigned to an absolute pitch! The resulting pitch of a VCO is the sum of several parameters. The external CV is only one of them. Other parameters that affect the pitch are the tune control (possibly separate coarse and fine tune), an octave switch, additional CV inputs with attenuators which do not follow the 1V/oct standard. Some VCOs are also equipped with controls and control inputs for linear frequency modulation which are also not 1V/oct. Some VCOs also have 2 or more CV inputs which follow the 1V/oct standard (one of these may be provided from the bus). The sum of all these parameters defines the pitch of the VCO.

As well as modules which can be affected by voltage control, there are other modules like the ADSR and LFO which themselves produce voltages to control other modules.

Usually, these modules need some kind of a **Trigger Signal** to bring them into action. For instance, a **GATE Signal**, corresponding to a key being pressed on a keyboard, can set off an ADSR, which then puts out its variable voltage "envelope" to affect other modules. The gate level +5V shown in the picture is only an example. Within the A-100 usually any voltage beyond about +3V is treated as "high" (e.g. +5V, +8V, +10V, +12V will work) and will trigger an ADSR or any other module with a Gate or Clock input (e.g. trigger delay, sequencer, clock divider, clock sequencer). Any voltage below 1V is treated as "low". If the specification of a module differs from this voltage standard it is mentioned in the description of the module in question.

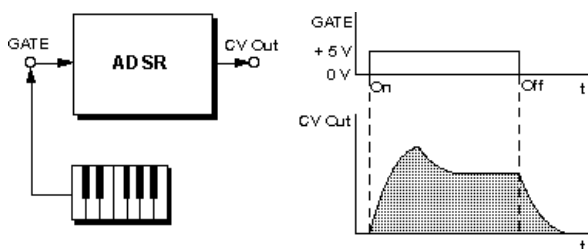


Fig. 2: The envelope generated by an ADSR

Signals in the A-100

In the System A-100 there are three types of signal:

- Audio Signals
- Control voltages
- Trigger voltages

Audio Signals are produced by the sound source Modules (such as VCO or NOISE), and are typically in the 10Vpp range (from -5 V to +5 V). In addition the signal levels are usually specified in the module description. The System A-100 can also let you use **external** Audio Signals (e.g. Microphone, Electric Guitar, Keyboard).

To interface satisfactorily, the level of **external Audio Signals** must be brought up to the A-100's operating level. Module **A-119 (External Input)**, is ideal for this job, having among other things an internal pre-amp, and two inputs of different sensitivity.

Control voltages, as produced by modulation sources like the LFO and ADSR, are typically from -2.5 V to +2.5 V (5 Vpp) for LFOs, and from 0 V to +8 V for ADSRs. In addition the signal levels are usually specified in the module description.

Trigger, Gate or Clock Signals, which start a process or function, are rectangle shaped signals with typical voltage levels of 0/+5 V. In case of a trigger application normally the **rising edge** of the signal used to trigger the event. But all A-100 modules will withstand gate/trigger/clock signals up to +12V. In addition the required level is usually specified in the module description. Only rectangle shaped waveforms should be used as Trigger, Gate or Clock sources (e.g. the rectangle output of an LFO or the gate/clock output of a midi interface). Signals with slowly rising or falling edges (e.g. triangle, sine,

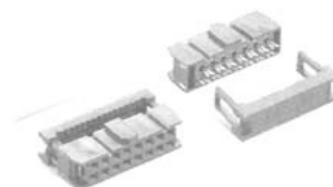
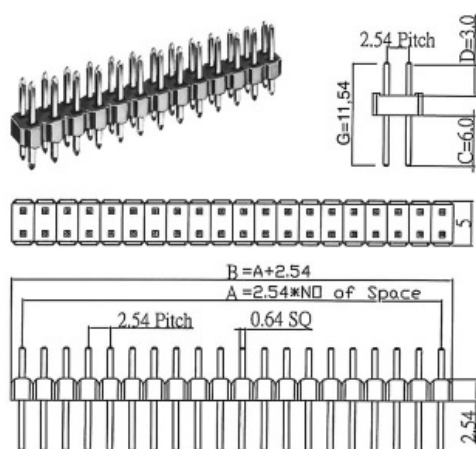
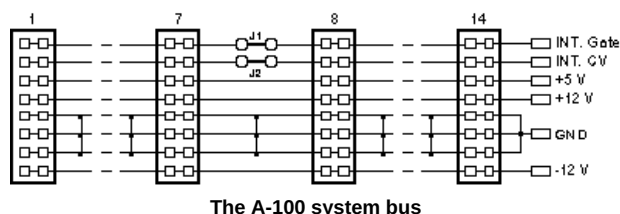
rising or falling sawtooth) are not suitable for this application !

These definitions of the various signals, and the distinctions between them - sound sources and modulation sources - are right in principle, but a modular system like the A-100 often makes a mockery of them. In a modular set-up, all of the modules produce voltages, and can be used as control voltages or triggers, thus blurring the distinction between the various types.

For example, the output from an LFO can be used as an audio signal, as a control voltage for a VCF or VCA, or as a trigger signals for a sequence. It's just about true to say that anything can be modulated by anything else, so that a modular system gives the musician extraordinary flexibility and individuality.

Power Supply and System Bus

The A-100's **System Bus**, i.e. the bus board(s), supplies power to the modules. The A-100 modules need the voltages +12V and -12V - some older modules additionally +5V (e.g. the old version of A-113, A-190-1, A-191). The bus also carries the internal control signals **GATE** and **CV** (details in the chapter below).



pin headers used on the bus boards and the modules
(unboxed headers only, without bowl/box and without code gap !)

female sockets (pressed to the ribbon cable that are used to connect the modules and the bus board)

connectors used for the A-100 bus connections

As a rule the -12V line is marked with a colored wire (typically **red**) and the colored wire has to be aligned to the bottom of the bus board where you find also the -12V imprint.

The voltages +12V and -12V are supplied by the **A-100 Power Supply** (see [A-100 accessories](#)). The power supply is built into the A-100 cases. Three versions of power supplies with different max. supply currents were used over the years:

- A-100NT12 (used in old systems before about 2000): +12V/650mA, -12V/650mA, 230V or 115V mains voltage version
- A-100PSU2 (used between about 2000 and end of 2015): +12V/1200mA, -12V/1200mA, 230V or 115V mains voltage version
- A-100PSU3 (used since end of 2015): +12V/2000mA, -12V/1200mA, +5V/4000mA, 110-240V mains voltage (wide range input, no need to modify the supply for another mains voltage)

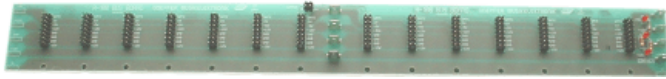
If a module requires +5V (e.g. old version of A-113, A-190-1) and A-100NT12 or A-100PSU2 are installed the +5V low cost adapter **A-100AD5** is required used to generate the additionally required +5V (see [A-100 accessories](#)). In this case the required current @+5V is taken from the +12V line. Of course there has to be a sufficient current reserve at +12V. In case that the A-100PSU3 is installed the +5V are available anyway and the additional A-100AD5 is not required.



A-100NT12

A-100PSU2

A-100PSU3



A-100 bus board



5V adapter A-100AD5

Important note: A-100-modules have to be connected only to original A-100 bus boards or 100% compatible bus boards of other manufacturers ! Particularly it's not allowed to use bus boards with polarized pin headers (boxed pin headers with code gap). These force the user to connect the bus cable in a certain direction which may be the wrong one ! This will destroy the module and the warranty is void ! In the A-100 the colored wire of the ribbon cable marks -12V and this wire has to point to the bottom under all conditions !

If you want to run only one or a few modules the [A-100 Miniature Power Supply](#) may be used instead of the A-100 standard power supply (see [A-100 accessories](#)). It supplies max. 200mA@+12V/-12V and additionally 50mA@+5V. We also offer the [A-100 Miniature Case](#) with built-in [A-100 Miniature Power Supply](#).



[A-100 Miniature Power Supply](#)
A-100MNT



[A-100 Miniature Case](#) A-100 MC
(with built-in [A-100 Miniature Power Supply](#) A-100MNT)

Meaning and usage of the bus signal CV and Gate

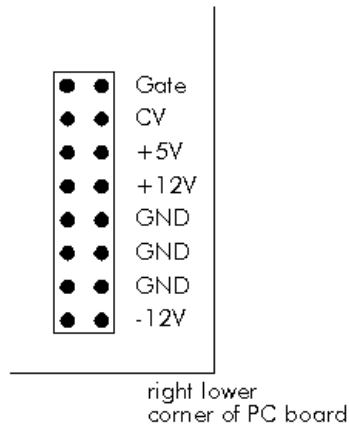
The A-100 system bus also carries the internal control signals **GATE** and **CV**. Some remarks concerning the usage of the internal CV and Gate lines of the A-100 bus:

- The main function of the bus is the power supply of the A-100 modules (-12V, GND, +12V and additional +5V for a few modules)
- in addition a **CV** and **Gate** line are available
- some modules can pick-up the **CV** signal (e.g. [A-110](#), [A-111-1](#), [A-111-5](#), [A-143-4](#)) from the bus depending on the jumper setting on the module
- some modules can pick-up the **Gate** signal (e.g. [A-140](#), [A-111-5](#)) from the bus depending on the jumper setting on the module
- but most of the A-100 modules have no access to the **CV** or **Gate** signal of the bus
- other modules may work as transmitter for the **CV** signal to the bus (e.g. [A-190-1](#), [A-190-2](#), [A-190-3](#), [A-190-4](#), [A-185-1](#), [A-185-2](#)) depending on the jumper setting on the module
- other modules may work as transmitter for the **Gate** signal to the bus (e.g. [A-190-1](#), [A-190-2](#), [A-190-3](#), [A-190-4](#), [A-185-1](#), [A-164-1](#)) depending on the jumper setting on the module
- pay attention that only ONE transmitter for **CV** and only ONE transmitter for **Gate** are allowed (otherwise modules may be damaged)
- but several modules may pick-up CV or gate from the bus (e.g. four [A-110](#) and three [A-140](#))
- using the internal **CV** and **Gate** lines of the bus is optional (one may also patch the required connections via the sockets at the front panels)
- but using the internal **CV** and **Gate** lines may simplify the patching at the front panels (e.g. if several VCOs have to be controlled by the same **CV**, in this case the [A-185-2](#) is recommended as **CV** transmitter to the bus, the [A-185-2](#) allows also common octave switching and common frequency modulation of all VCOs as well as CV summing, e.g. from a sequencer and CV keyboard or Midi-to-CV interface)
- if no CV transmitter is installed on a bus board we recommend to remove all bus jumpers of modules, which are able to pick-up CV from the bus (especially VCOs). The unused CV line of the bus board may work as "antenna" for undesired interference signals which affect the VCO pitch. Only if a CV transmitter has been installed on the bus (e.g. a Midi/USB interface A-190-x or a bus access module A-185-x), the jumpers for CV pick-up should be installed on VCO modules.
- both the **CV** and the **Gate** line can be interrupted in the middle of the bus board to establish two different CV/Gate areas. For this the corresponding jumper (J1 and J2 in the above picture) has to be removed.
- A special CV/Gate bus connection cable [A-100BC](#) is available. This cable can be used to connect the CV and/or Gate lines of two different bus boards. To connect the two boards the pin headers J1 and J2 of the two bus boards may be used. But it is also possible to connect the corresponding pins (INT.Gate or INT.CV) of other unused bus connectors (labelled 1...14 in the above picture).

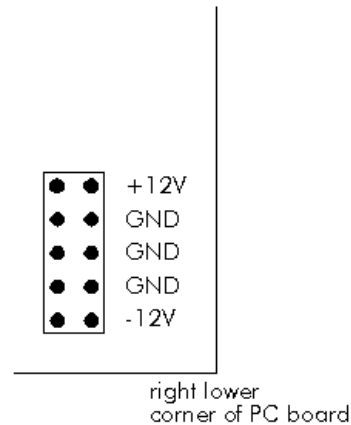
If you want to run single A-100 modules without using our bus board, power supply and frames here is the pin-out for module's bus connectors.

bus connectors of A-100 modules

16 pin version:



10 pin version:



pin out of the module's power supply connectors

As a rule the -12V line is marked with a colored wire (typically **red**) and the colored wire has to be aligned to the bottom of the bus board where you find also the -12V imprint.

Both the 10 pin and the 16 pin version of the bus connection have available the standard power supply (-12V, GND, +12V). In addition the 16 pin version of the bus connection has the three signals +5V, CV and Gate available at the module's connector (e.g. CV is used e.g. in the standard VCO A-110-1 or Gate is used in the envelope generator A-140). Modules that make no use of these additional signals normally use only the 10 pin version of the bus connection.

Pay attention that applying other than the described voltages or changing the polarity will result in the module's instant destruction !
For the connection of the bus cables to the bus the rule is "red strip down" !

If you use a Midi/CV-Interface in your system, when you press a key on your Midi keyboard, the gate and CV signals from the interface may be sent via the INT.GATE and INT.CV to all modules on the bus (depending upon the jumper settings of the interface module in question, please refer to the manual of the module in question).

The INT.GATE and INT.CV signal busses can be **split into two equal halves** by removing jumpers **J1** and **J2** on the bus board (see Fig. 3), so that for each whole bus, you can have two separate **CV/GATE subsystems**.

If on the other hand you'd like to have the same internal CV and gate available **on two busses at once**, you need to link the two together, with the special CV/gate leads, the A-100 BC.

This is how you go about it:

- Remove the A-100 from the electrical supply.
- Remove Jumpers **J1** and **J2** from the upper (see Fig. 4) and lower system bus boards (see Fig. 4).
- Replace the jumpers with the special CV / gate leads, A-100 BC (see Fig. 4).

A Make absolutely sure that you connect the leads correctly, joining up the upper INT CV with the lower INT CV, and the upper INT GATE with the lower, to avoid possible damage when you switch back on!

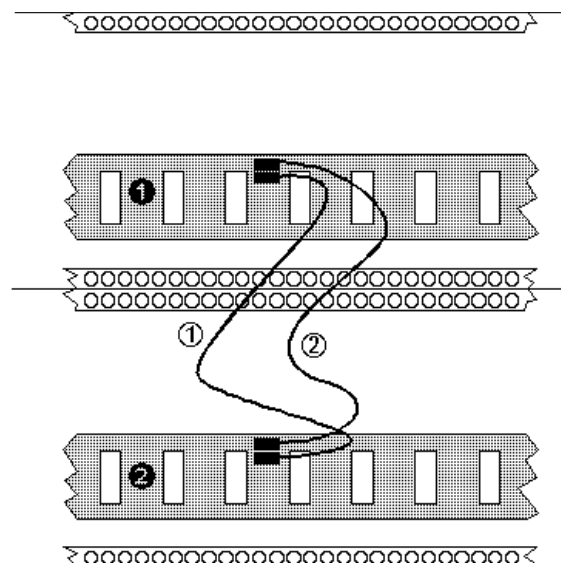


Fig. 4: Making a common INT.CV and INT.GATE signal path between the upper and lower busses.

If you use more than one frame we recommend the [A-185 Bus Access](#) module to interconnect CV and Gate between different frames. This module enables

the access to the system bus (CV and Gate) with active regeneration amplifiers for CV and Gate signals to compensate voltage losses which may occur if only passive connections are used.

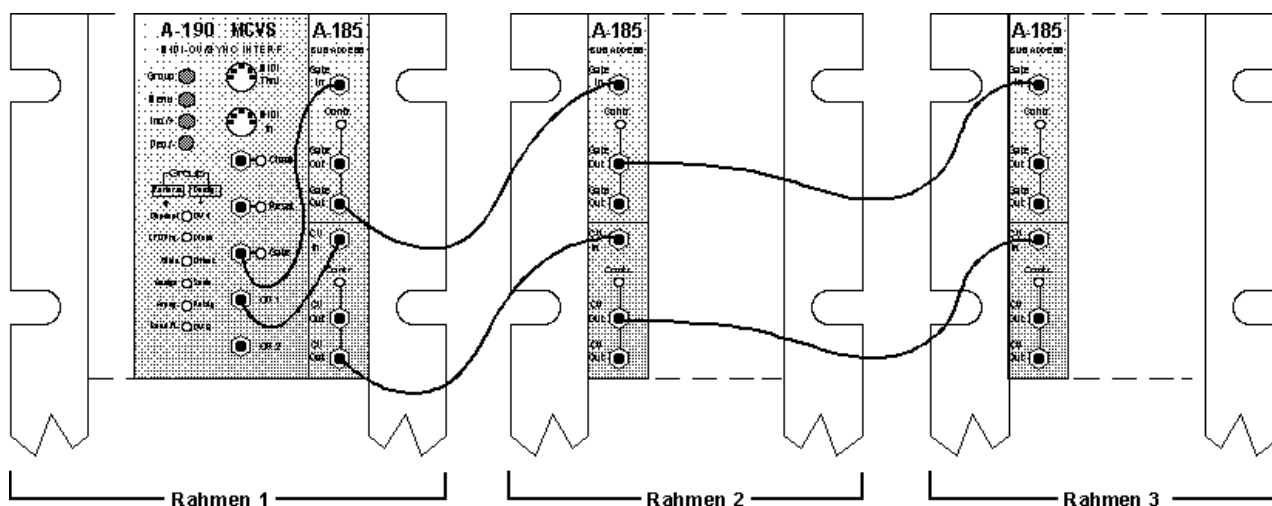


Fig 5: Making a common system bus when using different frames

Interconnecting modules

For connecting modules to each other, you need **mono miniature jack (Ø 3.5 mm) patch leads**. You can obtain patch leads from us in different lengths and colors: 15cm, 30cm, 50cm, 80cm and 120cm. For details see [A-100 accessories](#).

Integrating the A-100 with MIDI

To link the A-100 into a MIDI system, you can use one of our external MIDI interfaces like our [MCV4](#), [MSY2](#) or [Dark Link](#). The A-100 systems has the the MIDI interfaces [A-190-1](#), [A-190-2](#), [A-190-3](#), [A-190-4](#), [A-192-1](#), [A-192-2](#) and [A-190-8](#) available.

For example the **MIDI-CV/SYNC Interface [A-190-4](#)** has the following outputs available:

- CV 1
- CV 2
- Gate
- Clock
- Start / Stop

The A-190-4 is able to transmit pitch control CV and gate information on the INT.CV and INT.GATE busses.

The [A-192-1 CV-to-MIDI interface](#) enables the conversion of A-100 control voltages into MIDI controller messages (e.g. Theremin, Vocoder, A-119 envelope, Random, LFO usw.).

Analog sequencing can be provided e.g. by [A-155](#) or [Dark Time](#).

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