

## Appendix H - VX-351 & VX-352 CV Expanders

Flash back to the late 60's: Back in the day, a synthesizer was a behemoth of panels and patch cords. They were known as modular synthesizers, because each function of the synthesizer was contained in a single module. A synthesizer was a collection of modules, and the instrument produced no sound until the proper connections were made between modules using patch cables. This approach afforded the synthesist serious creative flexibility, and the results of creative "what if?" thinking often yielded amazing results. The approach was not without its drawbacks, however, which include:

- Space – a modular synth can take up a lot of space.
- Time – creating sounds from scratch takes a lot of practice, patience, and time.
- Repeatability – documenting a sound is a tedious, labor-intensive process, and not always accurate
- Cost - a good modular synth takes serious money to assemble.

Enter the Minimoog™ – a portable synthesizer where the most musically useful connections are already in place and permanently wired. Sounds are created quickly and efficiently using the various knobs and switches of the well laid out front panel (no patch cords needed!). Also, sounds are easy to document using patch templates, and, due to its smaller size and weight, the synth can actually be carried to gigs without having to rely on a road crew. Finally, a serious synthesizer made for the working musician.

Flash forward to today: The Minimoog Voyager is based on the concept of the Minimoog. It is a portable analog synthesizer with all the basic connections for making great electronic sounds. From its front panel, the Voyager offers even more functions than the original Minimoog, and provides expansion capabilities through back panel connections that work just like the connections found on a modular synth. In fact, the Voyager can become the foundation of modular system. However, in order to take full advantage of this capability, you need a way to access all of the Voyager's control voltage signals, both incoming and outgoing.

Enter the VX-351 and VX-352...



The VX-351 and VX-352 Voyager CV Expanders are add-on products that expand your Voyager into a semi-modular synth. The VX-351 contains all of the Voyagers CV and Gate *outputs* on 1/4" jacks (19 CV outputs and 2 Gate outputs). In addition, there are two attenuators for reducing the strength of a CV signal, and two 4-way multiples ('Mults') for sending a single CV signal to multiple control destinations.



The VX-352 (exclusively for the RME) contains all of the Voyager *inputs* on 1/4" jacks (13 CV inputs and 5 Gate inputs), along with two active attenuators with offset and one 4-way multiple. Both the VX-351 and VX-352 connect to the Voyager's accessory ports with a supplied DB-25 style cable.

## Connecting the VX351 and VX-352:

Make all connections as described below with the Voyager powered OFF

1) If you are using the VX-351 with a Voyager keyboard, the first step is to install the VX-351 output adapter. Refer to the installation guide for this procedure. The output adapter **MUST** be installed in these units to ensure proper operation of the VX-351.



**The RME does not require the VX-351 output adapter to be installed.**

2) To connect the VX-351, locate the male end (the end with recessed pins) of the DB-25 cable - this is the end that plugs into the connector on the Voyager's back panel labeled "ACCESSORY PORT" (this is the "OUTPUT ACCESSORY PORT" on the RME). Align the cable properly and make the connection. Use the thumbscrews to lock the connection. Be careful not to force or cross thread the thumbscrews in the accessory port's female threads. Following this, connect the other end of the cable to the connector on the VX-351 labeled "FROM ACCESSORY PORT".

3) To connect the VX-352, locate the male end (the end with recessed pins) of the DB-25 cable - this is the end that plugs into the connector on the Voyager RME's back panel labeled "INPUT ACCESSORY PORT". Align the cable properly and make the connection. Use the thumbscrews to lock the connection. Be careful not to force or cross thread the thumbscrews in the accessory port's female threads. Following this, connect the other end of the cable to the connector on the VX-352 labeled "FROM ACCESSORY PORT".

Now let's start with a basic sound and see how the VX-351 and VX-352 can work with the Voyager:

- Power up the Voyager keyboard or RME
- Press the **EDIT** button.
- In the EDIT menu select 'INIT PARAMETERS', press **ENTER**, select 'YES' and press **ENTER** again. This loads the default Voyager sound.
- Using a ¼" patch cord, plug one end into the VX-351's LFO triangle output. Plug the other end into the Voyager keyboard Filter Control Input (or the Filter Cutoff jack if using the VX-352).
- Play a note on the Voyager and you will hear the LFO modulating the Filter's Cutoff. Adjusting the Voyager's **LFO RATE** control will change the rate that the Filter Cutoff moves up and down. This demonstrates a basic patch with the VX-351/VX-352.



**As you make CV and Gate connections, think of the output jacks as your Sources (like the LFO triangle wave in the above example), and the input jacks as your Destinations (like the Filter Control Input in the above example).**

- Now disconnect the cable from the Voyager's Filter Control (the Filter Cutoff jack if using the VX-352) and connect it to the IN of one of the VX-351 Attenuators. Set the Attenuator amount to zero. Using another ¼" cable, make a connection from the VX-351 Attenuator OUT to the Filter Control Input (or Filter Cutoff jack on the VX-352).
- Play a note and gradually increase the Attenuator amount. You will notice that the amount of modulation will increase. An Attenuator is used to set the amount of a CV Source that passes to the Destination.

This is a very basic use for the VX-351/VX-352, but it demonstrates the fundamental concept of how to use it: *a source always goes to a destination*. Using this fundamental concept, you can patch together additional modulations and get as complex as you like.

### VX-351 CV Output Expander - Description

The following is a description of the output signals and the various functions contained in the VX-351 CV Output Expander:

#### TOUCH

This group of outputs is generated from the Voyager keyboard's Touch Surface Controller. There are three control voltages (X,Y, and A) and one gate signal.

X: This is the CV generated by left to right (horizontal) position of contact with the touch surface.

Y: This is the CV generated by up and down (vertical) position of contact with the touch surface.

A: This is the CV generated by the amount of area covered on the touch surface.

GATE: This is a gate signal generated by contact with the touch surface. When contact is made, the Gate is ON and when no contact is made the gate goes OFF.

#### KBD

This group of outputs is generated from the Voyager's Keyboard. There are three control voltages (Pitch, Velocity and Pressure) and one gate signal.

PITCH: This is the CV determined by the note that is played on the Keyboard. It is the same voltage used for determining the pitch of the Voyager's Voltage Controlled Oscillators.

VEL: This is the CV determined by the velocity used to depress a key.

PRESS: This is the CV determined by how much pressure is exerted on a key after it is depressed.

GATE: This is the gate signal generated when a key is depressed.

#### WHEELS

This group of outputs is generated from the Voyager keyboard's Left Hand Controller Wheels.

PITCH: This is the CV generated from the Pitch Wheel.

MOD: This is the CV generated from the Mod Wheel.

#### PEDALS

This group of outputs is generated from the MOD1 and MOD2 jacks on the rear panel of the Voyager:

MOD1: This is the CV generated from the MOD1 input. The MOD1 Input is a CV input on the Voyager that determines how much of the PEDAL/ON Mod Bus Source goes to the PEDAL/ON Mod Bus Destination. With nothing plugged into the MOD1 jack, the voltage that's present at the MOD1 jack is +5V. When a CV is plugged in to the MOD1 input, that voltage replaces the +5 Volt signal at the MOD1 Input. The Voltage that appears at the MOD1 Input is duplicated at the MOD1 output.

MOD2: This is the CV generated from the MOD2 input. The MOD2 Input is a CV input on the Voyager that is an external modulation source for the Mod Busses. With nothing plugged into the MOD2 jack, the voltage that's present at the MOD2 jack is +5V. When a CV is plugged in to the MOD2 input, that voltage replaces the +5 Volt signal at the MOD2 Input. The Voltage that appears at the MOD2 Input is duplicated at the MOD2 output.

## LFO

This group of outputs is generated from the Voyager's LFO. There are two CV waveforms available here (triangle and square) and both can be used at the same time

TRIANGLE: This is the triangle wave output of the LFO.

SQUARE: This is the square wave output of the LFO.

## BUSSES:

This group of outputs is generated by the Mod Buss signals. They are the Modulation source after being shaped by the SHAPING signal at the level determined by the AMOUNT control and the MOD WHEEL or signal at the MOD I Input jack

WHEEL: This is the output of the Mod Wheel Mod Buss. It is the Mod Wheel SOURCE shaped by the SHAPING signal. The level is determined by the **AMOUNT** control and the MOD WHEEL.

PEDAL: This is the output of the Pedal/On Mod Buss. It is the Pedal/On SOURCE shaped by the SHAPING signal. The level is determined by the **AMOUNT** control and the signal at the MOD I Input jack.

## ENVS

This group of outputs is the output of the Envelope Generators.

FILTER: This is the CV output of the Filter Envelope Generator.

VOLUME: This is the CV output of the Volume Envelope Generator.

## S & H

This group of outputs is generated by the Sample and Hold Circuit.

STEP: This is the output of the Sample and Hold Circuit.

SMOOTH: This is the Smoothed output of the Sample and Hold Circuit.

## ATTENUATORS

The VX-351 contains two attenuators. An attenuator is used to reduce the amount of a CV signal. The attenuators have an input jack, an output jack, and a knob. The knob sets the amount of the signal present at the input jack that passes to the output jack. When the knob is set to fully clockwise, the full input signal passes to the output. When the knob is fully counter clockwise, no signal passes to the output

## MULT

The VX-351 contains two 4-way Mults (Multiples). A mult is used to distribute a single source to multiple destinations. An example is connecting the Voyager's LFO to the Volume, Filter and Pan Control Inputs. In this case, all three of those parameters will be controlled simultaneously by the LFO.



A Mult is NOT a mixer. Never apply more than one CV source to a mult! Combining two or more CVs in a Mult can cause them to add together in a way that can be damaging to some control inputs! If you wish to combine several CV's, you *must* use a CV mixer (like the CP-251 Control Processor's Mixer) to safely mix these signals.

The table below shows the effective ranges of the VX-351 Outputs.

SECTION	PARAMETER	EFFECTIVE RANGE
TOUCH	X	-5 to + 5V
	Y	-5 to + 5V
	A	-5 to + 5V
	GATE	+5V ON, 0V OFF
KBD	PITCH (Note 1)	-0.916V to 2.667V Nominal
	VEL	-5 to + 5V
	PRESS	-5 to + 5V
	GATE	+5V ON, 0V OFF
WHEELS	PITCH	-5 to +5V
	MOD	-5 to +5V
PEDALS	MOD1 (Note 2)	-5 to +5V
	MOD2 (Note 2)	-5 to +5V
LFO	TRIANGLE	+/- 2.5V
	SQUARE	0 to +3V
BUSSES	WHEEL	-4 to +4V Nominal
	PEDAL	-4 to +4V Nominal
ENVS	FILTER	0 - 5V
	VOLUME	0 - 5V
S&H	STEP	-2 to +2V Nominal
	SMOOTH	-2 to +2V Nominal
Noise	Noise	+/- 1V Nominal

### VX-351 CV Expander Outputs

Note 1: The voltages shown are the Keyboard Pitch voltage range when the Voyager's keyboard is played. The range will be different when MIDI Note-On messages are received. The Keyboard Pitch voltage output from the VX-351 changes by 1 volt per octave (internally adjustable).

Note 2: The MOD1 and MOD2 outputs default to +5V if nothing is connected to the MOD1 and MOD2 inputs.

## VX-352 CV Input Expander - Description

The following is a description of the inputs and the functions contained in the VX-352 CV Input Expander:

### TOUCH

This group of inputs allows you to apply an external signal to control the RME's Touch Surface parameters. Although the RME has no Touch Surface (TS), through Edit Mode you can program the TS inputs as modulation sources for the Mod Busses, modulation shaper sources, or as sources for specific TS routings. There are three control voltage input jacks (X,Y, and A) and one gate signal input jack. The X,Y and A jacks accept either a CV or expression pedal input, while the Gate jack accepts either a footswitch or CV gate input signal:

X: This is the CV input that corresponds to the X axis (horizontal position) of the touch surface.

Y: This is the CV input that corresponds to the Y axis (vertical position) of the touch surface.

A: This is the CV input that corresponds to the area of finger contact with the touch surface.

GATE: This is the gate signal that corresponds to the signal generated by contact with the touch surface.

### ENV

This group of inputs allows you to apply an external signal to control the RME's Envelope parameters for Rate, Release and Gate. Both Envelopes (Filter and Volume) are affected.

GATE: This input allows you to connect a footswitch or input a CV gate signal to remotely trigger both Envelope Generators. This input triggers the EG's only when the front panel ENV GATE switch is set to 'ON/EXT'. If the ENV GATE switch is set to 'KEYB', an input on the GATE jack is ignored.

RELEASE: This input allows you to connect a footswitch or input a CV gate signal. Pressing the footswitch or applying a gate signal (+5V) enables the Release phase of both Envelope Generators regardless of the setting of the software RELEASE function.

RATE: This input allows you to control of the Voyager's envelope time constants with either a CV or expression pedal. A positive CV will *decrease* the attack, decay and release times from the envelope panel knob settings, and a negative voltage will *increase* the attack, decay and release times from the panel knob settings.

### OSC

This group of inputs allows you to connect an external CV or expression pedal to control the Voyager's Pitch and Wave parameters

PITCH: This input affects the pitch all three oscillators. A positive CV will add to the oscillator dial settings, and a negative CV will subtract from the settings.

WAVE: This input affects the waveform of all three oscillators. A positive CV will add to the wave dial settings.

### FILTER

This input allows you to connect an external CV or expression pedal to control the Voyager's Filter Cutoff parameter

CUTOFF: This input affects the frequency cutoff of both filters. A positive CV will add to the cutoff dial setting, while a negative CV will subtract from the setting.

## OUT

This group of inputs allows you to connect an external CV or expression pedal to control the Voyager's Volume and Pan parameters.

**VOLUME:** This input affects the volume of both VCA's. The Voyager's **MASTER VOLUME** control sets the absolute maximum value. A positive CV will then adjust the volume up or down within the range set by the **MASTER VOLUME** control.

**PAN:** This input affects the panning between the left and right outputs. A positive control voltage will pan right while a negative voltage will pan left.

## LFO

This group of inputs allow you to connect an external signal to control the Voyager's LFO Rate and Sync parameters.

**RATE:** This input affects the LFO Rate. The LFO RATE jack accepts an expression pedal or a CV. A positive CV adds to the position of the **LFO RATE** control, while a negative voltage subtracts from the position of the **LFO RATE** control.

**SYNC:** This input affects the synchronization of the Voyager's LFO. The LFO SYNC jack accepts a footswitch or a +5V Gate input. Closing the footswitch or applying a gate retriggers the LFO waveform.

## MOD

This group of inputs allows you apply external modulation sources (MOD 2) and modulation control (MOD 1) to the Mod Busses.

**MOD 1:** The MOD 1 jack accepts an expression pedal or control voltage from 0 to 5 Volts. This input is used as the performance control for the PEDAL/ON Mod Bus. With nothing plugged into this jack, the voltage here is 5V (the 'ON' state). With an input applied, when the voltage is at 0, no modulation is sent to the PEDAL/ON Modulation Destination. When the Voltage at the MOD1 is at 5 Volts, the Modulation is sent to the destination at the level set by the PEDAL/ON AMOUNT control.

### MOD 2:

The MOD 2 jack allows you to apply an external modulation source into the modulation busses. The input accepts an expression pedal or a control voltage of -5 to +5V. With nothing plugged into this jack, the voltage here is 5 V (the 'ON' state). When the **SOURCE** panel control of either Modulation Bus is set to 'ON/MOD2', the voltage applied to this jack becomes the modulation source.

## S & H IN

This group of inputs allow you to connect external signals to control the Voyager's Sample and Hold Circuit.

S&H In : This is the input to the Voyager's Sample and Hold circuit. This jack accepts an expression pedal or a control voltage from -5 to +5V.

GATE: This input accepts a +5V gate input only.

## ATTENUATORS

The VX-352 contains two active attenuators with offset. An attenuator is used to reduce the amount of a CV signal. The attenuators have an input jack, an output jack, and an **AMOUNT** control. This control sets the amount of the signal present at the input jack that passes to the output jack. When the control is set to fully clockwise, the full input signal passes to the output. When the control is fully counter clockwise, an inverted version of the full output signal passes to the output. When the knob is set to the center (12 o'clock position) no signal passes to the output. The **OFFSET** control allows you to add an offset voltage to the output signal (up to +/-5V), but the total combined output voltage (Input plus Offset) will not exceed +/-7.5V.



An expression pedal can also be connected to an attenuator input. Normally, an expression pedal will only provide a positive voltage, but since the Attenuator's **AMOUNT** control is bi-directional, this allows you to get either positive or negative voltages using a pedal.

## MULT

The VX-352 contains a 4-way Mults (multiple). A mult is used to distribute a single source to multiple destinations. The jack at the top of the mult (indicated by a white ring) accepts an expression pedal input. When a pedal is connected here, the mult distributes the variable expression pedal signal to the other three mult jacks.



A Mult is NOT a mixer. Never apply more than one CV source to a mult! Combining two or more CVs in a Mult can cause them to add together in a way that can be damaging to some control inputs! If you wish to combine several CV's, you *must* use a CV mixer (like the CP-251 Control Processor's Mixer) to safely mix these signals.



The table below shows the effective ranges of the VX-352 Inputs. All non-gate inputs supply power, allowing you to connect either an expression pedal or a control voltage.

SECTION	PARAMETER	EFFECTIVE RANGE	JACK SUPPLIES POWER
TOUCH	X	-5 to +5V	Y
	Y	-5 to +5V	Y
	A	-5 to +5V	Y
	GATE	+5V ON, 0V OFF	N
ENV	RATE	-5 to +5V	Y
	RELEASE	+5V ON, 0V OFF	N
	GATE	+5V ON, 0V OFF	N
KBD	PITCH	-5 to +5V	Y
	WAVE (Note 1)	0 to +5V	Y
FILTER	CUTOFF	-5 to +5V	Y
OUT	VOL	0 to +5V	Y
	PAN (Note 2)	-2.5 to +2.5V	Y
LFO	RATE	-5 to +5V	Y
	SYNC	+5V ON, 0V OFF	N
MOD	MOD1	0 to +5V	Y
	MOD2	-5 to +5V	Y
S&H	S&H IN	-5 to +5V	Y
	GATE (Note 3)	+5V ON, 0V OFF	N

### VX-352 CV Expander Inputs

Note 1: The voltage range shown covers the full range of oscillator waveforms from Triangle (0V) to Pulse (+5V). All three oscillators are effected by the WAVE input, and voltage applied to this input adds to the oscillator dial settings.

Note 2: The voltage range shown covers the complete panning range from Full Left (-2.5V) to full Right (+2.5V).

Note 3: All GATE inputs will accept a footswitch except for the S&H GATE. A footswitch will have no effect on the S&H GATE input.

Documenting your work

One thing to keep in mind is that although the Voyager can remember the settings of the front panel controls as a preset, it cannot save the routings of patch cables or the positions of the attenuators. We recommend having a list of the Expander connections with space to document routings like so:

VX-351 CV OUTPUT EXPANDER	
SOURCE	DESTINATION
Touch X	
Touch Y	
Touch A	
Touch Gate	
KBD Pitch	
KBD Velocity	
KBD Pressure	
KBD Gate	
Pitch Wheel	
Mod Wheel	
MOD1	
MOD2	
LFO Triangle	
LFO Square	
Mod Wheel Mod Bus	
Pedal/On Mod Bus	
Filter Env	
Vol Env	
S&H Step	
S&H Smooth	
Noise	
ATTEN. 1/Amount	
ATTEN. 2/Amount	
Mult A1	
Mult A2	
Mult A3	
Mult A4	
Mult B1	
Mult B2	
Mult B3	
Mult B4	

VX-352 CV INPUT EXPANDER	
SOURCE	RME DESTINATION
	Touch X
	Touch Y
	Touch A
	Touch Gate
	ENV Gate
	ENC Release
	ENV Rate
	OSC Pitch
	OSC Wave
	FILTER Cutoff
	OUT Volume
	OUT Pan
	LFO Rate
	LFO Sync
	MOD Mod1
	MOD Mod2
	S&H Input
	S&H Gate
	ATTEN 1 In (Amount/Offset)
	ATTEN 2 In (Amount/Offset)
	ATTEN 1 Out
	ATTEN 2 Out
	Mult 1
	Mult 2
	Mult 3
	Mult 4

The following are some ways to use the VX-351 and VX-352 with the Voyager. Gather up some ¼" patch cords and try these suggestions:

### 1. Use the Mod Wheel to control the amount of both Mod Buss signals

This is a really useful way to use the Mod Wheel as a controller for more than one type of modulation. To try this out, perform the following steps:

- Initialize the Voyager's parameters by selecting 'INIT. PARAMETERS' in the Edit Menu. The initialization preset has the Mod Wheel configured to modulate the oscillator pitch with the LFO Triangle wave.
- Set the PEDAL/ON MOD BUSS controls as follows:
  - SOURCE:** Square wave
  - DESTINATION:** FILTER
  - SHAPING:** ON/PGM
  - AMOUNT:** 5
- Using a patch cord, connect the VX-351 Mod Wheel output to the Voyager's MOD1 Control Input.
- Play a note and move the Mod Wheel forward. You'll hear both triangle wave modulation of the pitch and square wave modulation of the filter fade in as the Mod Wheel is moved.

This is a useful patch that can be used on a variety of patches where you want two types of modulation to fade in by using the Mod Wheel.

### 2. Mod buss signal modulates more than one destination.

This is a way to use one Modulation signal to control more than one destination.

- Initialize the Voyager's parameters.
- Using a patch cord, connect the Mod Wheel Mod Buss output to the Voyager's FILTER input jack.
- Play a note and move the mod wheel forward. You'll hear the LFO triangle wave modulating both the Voyager's pitch and filter parameters.

A variation of this would be to insert an Attenuator between the Mod Wheel Mod Buss output and the Filter Input. This way you can adjust the amount of modulation that goes to the filter.

### 3. Pressure controls Pedal/On Mod buss amount.

Just as you can use an expression pedal plugged into the MOD1 input to control the Pedal/On Mod Buss, you can use another signal that varies in the same range to perform the same function. The Pressure signal from the Voyager's keyboard is a good example of this. Try the following:

- Initialize the Voyager's parameters.
- Set the PEDAL/ON MOD BUSS controls as follows:
  - SOURCE:** Square wave
  - DESTINATION:** FILTER
  - SHAPING:** ON/PGM
  - AMOUNT:** 5.
- Using a patch cord, connect the VX-351 KBD Pressure output to the Voyager's MOD1 Input.
- Play a note and press down the key you are playing. The Modulation of the filter should increase as you add pressure, and disappear when you're not pressing hard at all.

As a variation, switch the Pedal/On Mod Buss **SOURCE** to 'ON'. Now play a note – pressing down makes the filter brighter.

#### 4. LFO triggers Voyager's Envelopes

This is an alternative to triggering a sound from the Voyager by pressing a key. The last key pressed will determine the pitch, but the LFO will trigger the start of the envelopes.

- Using a patch cord, connect the VX-351 LFO square wave output to the Voyager's Envelope Gate (ENV GATE) Input.
- Switch the front panel **ENVELOPE GATE** switch to 'ON/EXTERNAL'. You should immediately hear a note repeating at the LFO rate.

#### 5. Using the Mults

Here is a simple example of using the Mults to distribute a modulation signal to multiple destinations.

- Initialize the Voyager's parameters
- Using a patch cord, connect the VX-351 Mod Wheel output to one of the Mults.
- Connect a second patch cord from the same Mult to the the Voyager keyboard's FILTER jack (or connect to the FILTER CUTOFF jack on the VX-352).
- Connect a third patch cord from the same Mult to the the Voyager keyboard's WAVE jack (or connect to the OSC WAVE jack on the VX-352)
- Play a note on and move the Mod Wheel forward, then back. You'll hear three modulations as the Mod Wheel is moved - the filter cutoff opening and closing, the oscillator waveform shifting, and the pitch modulating (pitch modulation is part of the initialization preset. - to hear the effects of the external connections alone, adjust the Mod Wheel Buss **AMOUNT** control, to '0'.)



Although it's possible to duplicate simple examples like these using Pot Mapping techniques, it's important to realize that Pot Mapping must be programmed for each preset individually, while any external patching using the VX-351 and VX-352 Expanders affects all presets globally. This means that you can use simple patch routings to play 'what if' games with modulation sources while you quickly move through the presets.