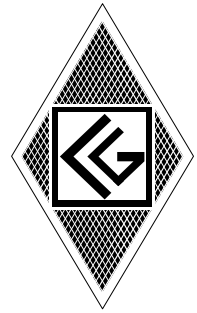




Modular

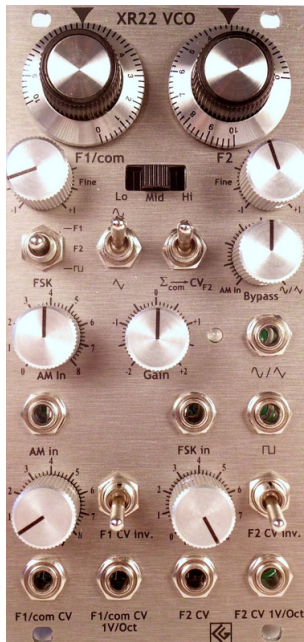
XR22 VCO FT

VCO with AM Input and FSK (Frequency Shift Keying)



I. Features

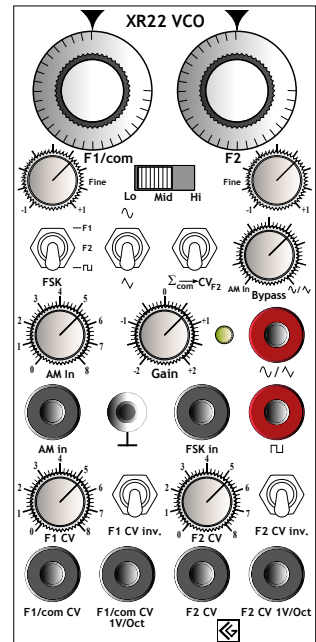
- AM (Amplitude Modulation) Input
 - Ring modulation
 - CV controllable sine/triangle volume
 - Advanced waveform generation through feedback
- FSK (Frequency Shift Keying)
 - Pulse and ramp generation
 - Switching between two different frequency CVs
 - Advanced waveform generation
- LFO/Bass/High Frequency Mode
- Available with banana or 3,5mm phone sockets
- Eurorack Module
- Width: 12 HP
- Dimensions: 128,5 mm x 60,6 mm
Depth: 40mm
- Supply Voltage: $\pm 12V$
- Current consumption: $\approx 70mA$



Minijack Version



Banana Version



Drawing





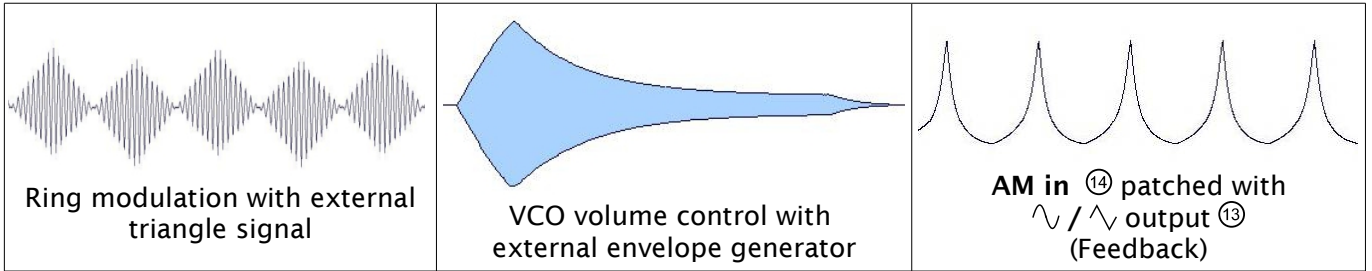
Modular

2. AM and FSK

2.1 AM (Amplitude Modulation)

The \sim/\sim output (13) amplitude varies linearly with the control voltage applied to "AM in" (14). The modulation amount can be adjusted with knob 'AM In' (10) (See chapter 3: "Functions"). Negative CVs will cause phase inversion of the \sim/\sim waveform.

Examples:



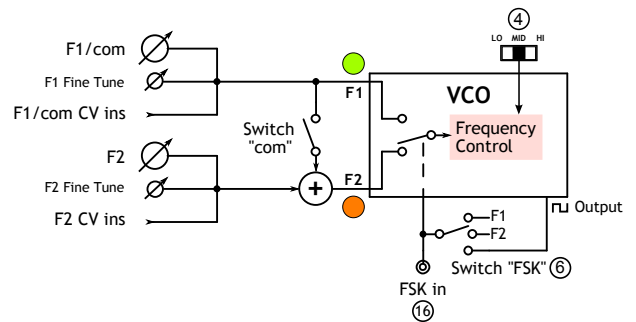
2.2 FSK (Frequency Shift Keying)

The frequency of the XR22 VCO is controlled by two independent frequency control sections F1 and F2 with independent manual frequency controls and CV ins; either one or the other of these routes can be activated by an external logic signal applied on socket "FSK in" (16), and/or by switch "FSK" (6).

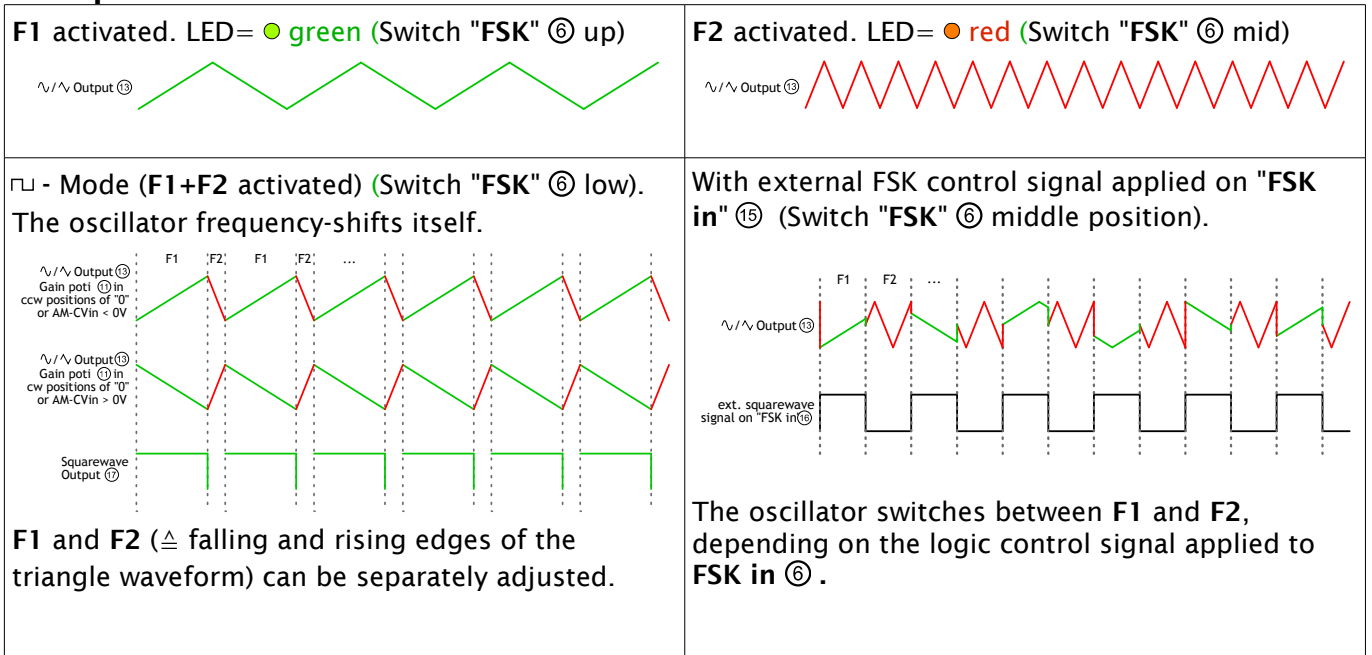
Switch "FSK" (6) selects the FSK mode: F1, F2 or self-switching by the VCO's \square -output.

In self-keying mode the rising and falling edges of the triangle waveform (and the hi/lo times of the square-wave) can be separately adjusted.

Switch "com" (8) is adding the F1-CVs to F2; this is to ensure 1V/oct. tracking if both routes are used e.g. in the self-frequency shifting \square - mode.

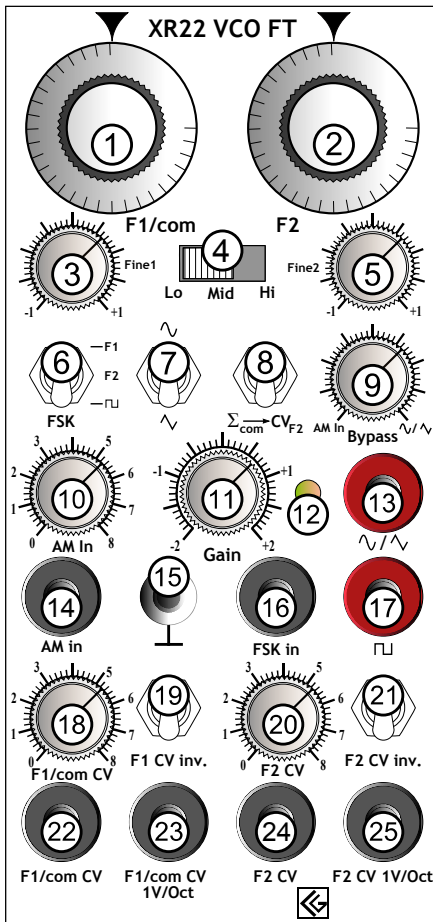


Examples:





Modular



Introduction

For better understanding it is recommended to read first about the control elements ⑥ and ⑫ :

⑥ FSK mode switch (frequency shift keying)

In upper position: Only F1 is active; LED= ● green

In middle position: Only F2 is active, LED= ● red

In lower position ("□") the □ (square) output of the VCO is internally connected to the FSK input and the oscillator automatically shifts itself between frequencies F1 and F2. In this mode, the oscillator produces ramp and pulse signals provided on output ⑬ (ramp) and ⑰ (pulse). The rising and falling time of the ramp edges (and also the duration of high and low levels on □-output ⑰) can be separately adjusted with the frequency knobs for F1 and F2 (and CVin's 1 and CVin's 2). (Also see chapter 2.2 about FSK and ⑧)

⑫ LED FSK mode.

● Green = F1, F1 CV ins (left half on the module panel).

● Red = F2, F2 CV ins (right half on module panel).

When "Com Mode" is active (⑧ in lower pos.), knob "F1/Fcom" ① and "com CVin's" ⑳ ㉑ work for both green and red leds.

① and "com CVin's" ⑳ ㉑ work for both green and red leds.

3. Functions

① **F1/com** Coarse manual control of frequency F1. Range is \approx 8 octaves. If switch "Com→F2" ⑧ is in lower position, this knob also affects frequency F2. See more under ⑧, ⑥.

② **F2** Coarse manual control of frequency F2. Range is \approx 8 octaves.

③ **F1 fine tuning** for frequency F1. Range is \approx two half notes.

④ **Frequency range selector** The value of the oscillator's timing capacitor, which is working for both FSK frequencies, can be changed by this switch. 3 different ranges are provided:

1. **Lo** (switch in left position) for LFO applications and/or tremolo-like sounds

2. **Mid** (switch in middle position) for bass or sub-bass sounds

3. **Hi** (switch in right position) for mid-range and high audio frequencies

Because the frequency CV-ins of the internal VCO chip are not linear over the entire audio range, it is recommended to use the 'Mid' position for bass sounds and the 'Hi' mode for higher frequencies (although it is possible to produce low frequencies in the 'Hi' mode too). This ensures better 1V/oct. tracking in the lower frequency regions.

⑤ **F2 fine tuning** for frequency F2. Range is \approx two half notes.





Modular

- ⑥ **FSK mode switch** *see above ("Introduction")*
- ⑦ \wedge/\wedge **Waveform selector F2 octave switch** switches between \wedge (sinewave) or \wedge (trianglewave) output on socket ⑬ .
- ⑧ **Common → F2 switch** changes the routing between the frequencies F1 and F2. In the upper position, both frequencies F1 and F2 work independently and can be controlled separately by their respective frequency knobs and/or CV inputs.
In the lower position, knob "F1/com" ① and sockets "F1/com CV" ② "F1/com CV 1V/Oct" ③ affect both F1 and F2. This coupling ensures that the ratio between F1 und F2 remains the same, and tracks 1V/oct. using both frequencies within the FSK option. The ratio can only be changed by the "F2" knob ④ or the F2 CV inputs ⑤, ⑥.
Note that in this mode the frequency range is expanded and that for F2 four independent CV inputs are now available.
- ⑨ **Bypass** Ratio between the "AM in" signal input ⑭ and the oscillator \wedge / \wedge output. The mixed signal is provided at socket ⑬.
- ⑩ **AM in level** Controls the input level from ⑭ for amplitude modulation of \wedge / \wedge .
- ⑪ **Gain adjustment** Primarily to suppress the oscillator frequency in ring modulation. The denter in middle position "0" may be used as orientation.
This knob regulates an internal offset voltage between ca. $\pm 2V$ which is added to the AM-input signal, adjusted by knob ⑩ . In counterclockwise positions of the potentiometer the \wedge / \wedge - phase will be inverted (See also "Examples" in chapter 2.2 "FSK").
In some applications the "Gain" knob may be used to alter the waveshape (by adding more or less voltage to your input signal); e.g. if you feedback the \wedge / \wedge output ⑬ to the AM-Input ⑭ and adjust ⑩ and ⑪ carefully, the oscillator generates very overtone-rich waveforms.
- ⑫ **FSK mode LED:** *see above ("Introduction")*
- ⑬ \wedge / \wedge **(sine/triangle) output** or *ramp waveforms* output when switch "FSK mode" ⑥ is in lowest position ("□").
The controller "Bypass" ⑨ adjusts the AM-Input/ \wedge / \wedge -oscillator output ratio. Fully clockwise: The \wedge / \wedge -oscillator output is 100%. Fully counterclockwise: The \wedge / \wedge -oscillator output is 0%, AM-input ⑭ is 100%. This is to mix the original to the "effect" signal (\triangle "dry/wet") when the oscillator is used as a ringmodulator.
 \wedge output voltage: 4Vpp without AM; max. 10Vpp with AM.
 \wedge output voltage: 8Vpp without AM; max. 14Vpp with AM.
In the banana version of the **XR22 VCO FT** the **red** sockets signalize *low impedance* outputs. These outputs may **not** be grounded or patched together! This may damage the module.



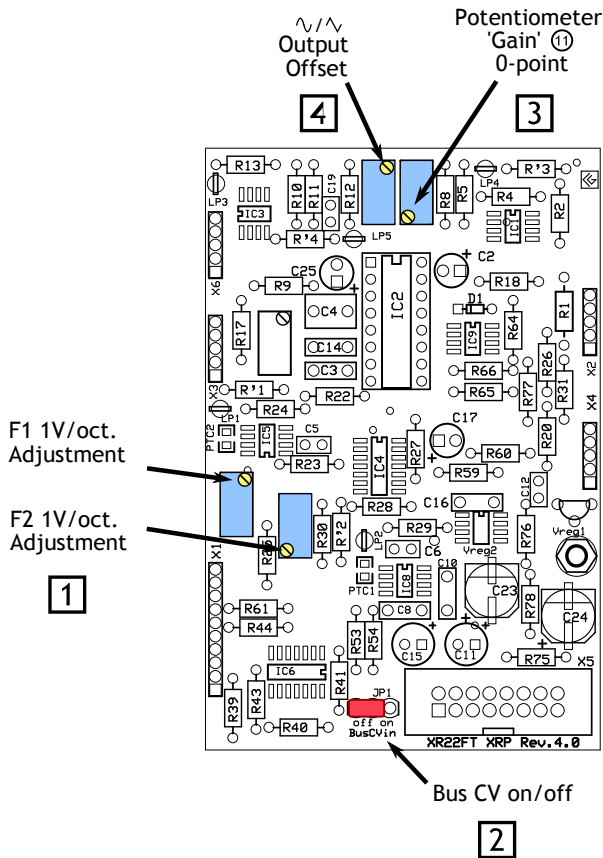


Modular

- ⑭ **AM input** Amplitude modulation input for the \wedge / \vee section of the VCO. The input amount can be adjusted with ⑩. Also, the input signal can be mixed to the waveform output ⑬ with **Bypass** controller ⑨ .
(also see chapter 2.1 about amplitude modulation)
- ⑮ **Ground** This socket only exists in the *banana* version of the **XR22 VCO FT**. The ground connection is required if the module is connected to external equipment, e.g. a mixer. Within the modular system the module is grounded through the power supply.
- ⑯ **FSK in** is a logic input. When the "FSK" ⑥ switch is in the middle position ("F2") and a voltage greater than $\approx +2V$ is applied to the FSK input (e.g. gate signal, squarewave), the internal switch will be switched from **F2** to **F1** (F2/ F2 CV (Led \rightarrow ● red) to F1/F1 CV (Led \rightarrow ● green) .
Note: If switch "Com" ⑧ is active, the "F1/com" knob ① and the inputs "F1/comCV" ⑳ and "F1/comCV 1V/Oct" ㉓ affect both frequency channels *F1 and F2*.
- ⑰ \square **Squarewave output** Level between $\approx 0V$ (GND) and +5V. In FSK mode " \square " (Switch "FSK" ⑥ lower position) pulse waveform output.
- ⑱ **F1/com CV** Manual control adjusts the input level of **F1/com CV in** ㉒ .
- ⑲ **F1/com CV inversion switch** Inverts the polarity of the signal on socket **F1/com CV in** ㉒ .
- ⑳ **F2 CV** Manual control adjusts the input level of **F2 CV in** ㉔ .
- ㉑ **F2 CV inversion switch** Inverts the polarity of the incoming signal on socket **F2 CV in** ㉔ .
- ㉒ **F1/com CV in** Frequency control voltage input for **F1/com**. Level can be adjusted by ⑱ and the polarity inverted by switch ⑲ . See also ⑧, ⑥.
- ㉓ **F1/com CV 1V/Oct in** 1V/Octave input for **F1/com**. See also ⑧, ⑥. (It may be necessary to readjust the tracking. See chapter 4 "Adjustment")
- ㉔ **F2 CV in** Frequency control voltage input for **F2**. Level can be adjusted by ⑳ and the polarity inverted by switch ㉑
- ㉕ **F2 1V/Oct in** 1V/Octave input for **F2** (It may be necessary to readjust the tracking. See chapter 4 "Adjustment").



4. Adjustment



1 1V/Octave Adjustment

The VCO is already carefully adjusted to 1V/Oct. If you realize that the XR22 VCO FT isn't in tune with your other analog synthesizer equipment, it may be necessary to adjust it.

Procedure (Suggestion):

1. Switch on your equipment and the XR22 VCO FT and wait 1/4 hour until the oscillator have the right temperature.
2. Put range switch ④ in right position 'Mid'. Adjust F1 & F2 knobs ① & ② to \approx middle position (\approx 3 – 5 on scale)
3. Connect a CV from a keyboard (or a similar CV source) both to your favorite VCO's 1V/oct. input and to the XR22 VCO F1/com 1V/oct. input ⑳. Put switch "com" ⑧ and switch "FSK" ⑥ in upper position ("F1").
4. Play a note on your keyboard in the middle range, e.g. "c", or "c1". The note should be

nearby to the tone you have adjusted on the XR22.

5. Adjust pot "F1" ① and fine tuning ③ until the pitch of the XR22 is the same like that of the 2nd VCO.
6. Play a note \approx 2 – 3 octaves higher. Adjust trimmer "F1 1V/oct" (see above) until the XR22 VCO is tracking to the 2nd VCO.
7. Go back to step "4" and repeat all other steps until both oscillators are in tune.
8. Repeat the same procedure with "F2" (with "FSK" ⑥ in middle position and F2 1V/Oct. Input ㉑). Alternatively, you can use the 1V/Oct input F1/com ㉒ for F2, too. Put switch 'com' ⑧ in lower position and the 1V/Oct input F1/com ㉒ is now working for both FSK frequencies. Put FSK switch ⑥ in middle position 'F2'. Adjust coarse poti F2 ② and fine tuning ③ until both frequencies are in tune.
9. Compare F1 and F2 by switching the FSK switch ⑥ from one frequency to the other; repeat the tuning and adjustment steps 1.– 8. until both frequencies are perfectly matching and in tune with the external keyboard/VCO.

2 Bus CV

- Jumper "JP1" in "on" position (on PCB): The Bus CV is controlling the XR22 VCO's frequencies.
- Jumper "JP1" in "off" position (on PCB): The Bus CV is not connected.



Modular

3 Potentiometer 'Gain' ⑪ 0-point adjustment

1. Turn knob 'Gain' ⑪ in middle position (center locked)
2. Adjust trimmer Tr7 ③ for minimum output amplitude on \sim / \sim output ⑬ (with no AM-Input signal applied on ⑭) .

4 \sim / \sim - Output DC-Offset

No DC offset voltage should overlay the oscillator's \sim / \sim - Output ⑬ (with the knob 'Gain' ⑪ in middle position, the knob 'AM-In Level' ⑩ turned fully left and knob 'Bypass' ⑨ turned fully right). Apply the \sim / \sim - Output to a frequency CV-input of a 2nd oscillator or to the AM-input of a 2nd XR22 VCO. There must occur no change of the 2nd oscillator's frequency or the 2nd XR22 VCO's loudness.

5.Contact & Support

cg-products.de/module/xr22-vco-ft/
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This is Rev.4

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