

HYDRA SEQUENCER KIT

From Orion Pyrotechnics, LLC

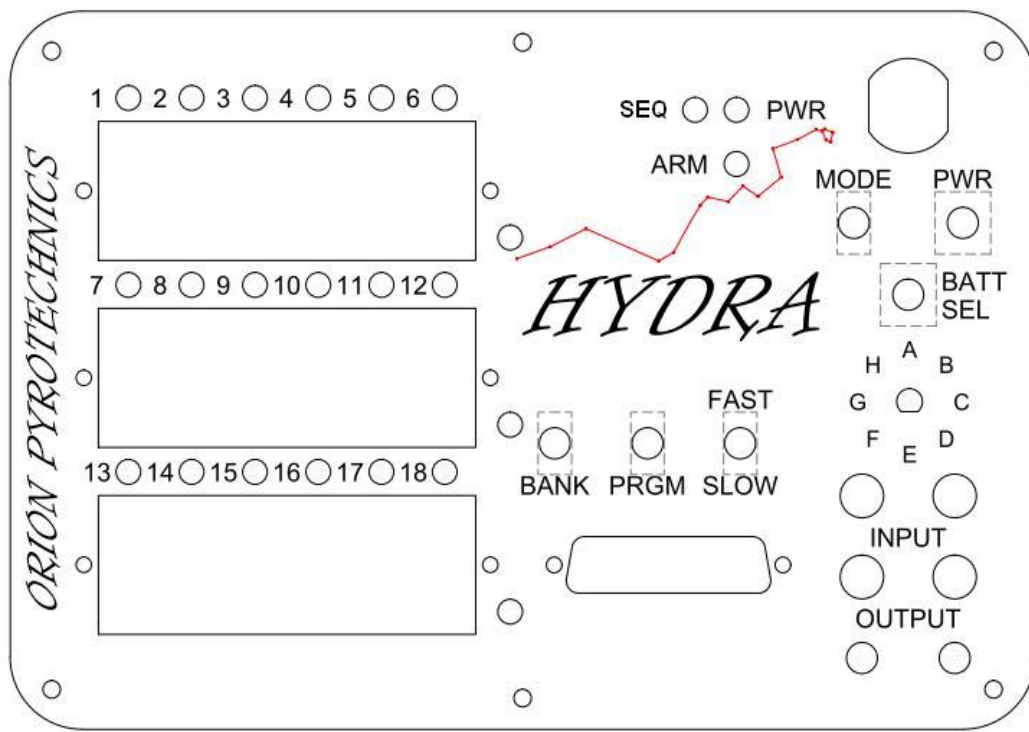
The Hydra Sequencer Kit is an easy to assemble, easy to modify and easy to use package designed for the serious amateur or professional pyrotechnician. Each kit provides an economical way to add 18 cues to an existing firing system.

FEATURES:

- **Stepper mode** – Use a single cue from your existing system to “step through” 18 cues. A pulse from the firing system fires a cue and advances to the next cue in line.
- **Improve firing speed** - Capable of firing sequences longer than 6 cues at 0.05s increments and capable of firing 6 cue sequences in any interval down to 0.001s
- **Standard DB25** – DB25 output compatible with COBRA™ Slats
- **Continuity Testing** – Built in continuity testing on cues and a resistive load across the stepper input. Input polarity does not matter.
- **Daisy chain** – An output terminal allows you to daisy chain more than one sequencer together.
- **Preset times** – Factory programmed with 15 default time steps for easy in-field programming
- **Advanced programming** – Use your computer to program custom sequences of any length and virtually any time step.



HYDRA SEQUENCER
18 CUES • PRECISION TIMING • STEPPER MODE



Getting Started:

The Hydra Sequencer is housed in a compact SE120 Seahorse case. The controls consist of a main power switch, a battery select switch, a mode switch, a key switch, a program switch, a fast/slow toggle and bank selection toggle switch. Additionally, there is an 8 position rotary switch, a pair of input and output PyroClips and banana jacks for an external battery.

Power on the unit by flipping the PWR switch. The PWR LED should illuminate. To use it immediately as a stepper, make sure that the MODE switch is in stepper mode (the SEQ LED should be off). Connect the input wire to the input PyroClips. Note that the polarity does not matter. Additionally, there is a resistor between the terminals so your firing system continuity test should indicate continuity when connected to the sequencer. The green LEDs labeled 1 through 18 will indicate continuity on cues. Next, turn the key switch to the ARM position. This will illuminate the red ARM LED and the continuity test LEDs will extinguish. The system will begin firing when a sufficiently large input pulse is provided to the input.

To operate it in the sequencer mode, flip the MODE switch to sequencer mode before arming the system. The SEQ LED should turn on. Now you may arm the system; input pulses will start any sequences that are stored in the internal memory. The factory default “sequence” is actually just stepper mode. See below for how to program sequences.



Programming in the field:

- Press and hold the PRGM switch as you power on the unit. Continue holding the PGRM switch until the bank select LEDs flash.
- Select whether you want 3 separate sequences or one continuous sequence via the MODE switch. In the “STEP” position, each bank of cues is treated as a separate sequence. This means that you will need to give the sequencer 3 input pulses to fire all three sequences. In the “SEQ” position, one input pulse will fire all 3 minisequences back-to-back.
- Next, select which bank of 6 cues you would like to program first. Your selection will be indicated by the bank-select LED; the illuminated LED is the bank you are currently programming.
- Next, you may select the time step for that bank by moving the rotary switch. You can toggle between the fast and slow ranges using the FAST/SLOW toggle switch.
- Once you have selected a time step, press and hold the PRGM switch until the LED goes out. If you need to edit this sequence, press and hold the PRGM switch again until the LED light re-illuminates.
- To exit program mode, you must input a time step for each of the 3 banks. This prevents accidental ignitions due to prior sequences that may have been stored.
 - You may choose “-1” for a time step, which puts that bank into stepper mode. Thus, if you need a 6 cue sequence followed by 12 cues in stepper mode, you would program your sequence on bank 1 and then program a time step of “-1” for the next two banks of cues.
 - The position of the MODE switch determines what value is stored for the time step between banks and need not be the same for each bank.
- Once you have programmed all 3 banks, the system will exit program mode after 6 seconds of inactivity. To re-enter program mode, you will have to cycle the power.



AVAILABLE TIME STEPS:

(Custom steps available)

POSITION	FAST (seconds)	SLOW (seconds)
A	0.05	1.25
B	0.10	1.50
C	0.15	1.75
D	0.20	2.00
E	0.25	2.50
F	0.50	3.00
G	0.75	5.00
H	1.00	-1

Advanced Programming via Computer:

The Hydra Sequencer has the ability to be programmed via a desktop or laptop computer via a USB connection. Located on the side of the case is a USB connection for this purpose. In order to communicate with the Hydra Sequencer, you will have to use software that allows your computer to communicate serially via a USB connection. In this manual, we will focus on a software package that is extremely easy to use: the Arduino IDE. This is a very user-friendly, open source integrated development environment that allows you to program and communicate with Hydra's microcontroller.

CAUTION: To prevent possible DAMAGE to your computer, always turn the sequencer OFF before making a USB connection!

To download the Arduino software package, go to the Arduino homepage: www.Arduino.cc/en. Once there, click on the "DOWNLOAD" tab, scroll down slightly and select the appropriate link for your operating system. You can then return to the Arduino webpage and click on the "GETTING STARTED" tab. This page will provide you with instructions on how to install and properly setup the software to communicate with the Hydra Sequencer. Open up the software by double clicking on Arduino.exe. The Hydra sequencer has an imbedded ATmega 328 microcontroller; for proper communication you will need to select "Arduino Nano w/ ATmega 328" under **Tools -> Board**. If your operating system does not automatically install the necessary drivers, see the GETTING STARTED page for instructions on how to install drivers manually. Once installed, unplug the sequencer and go to



Tools -> **Serial Port** and note what options are available. Now plug the sequencer back into the computer and return to **Tools** -> **Serial Port**. Select the new option to communicate with the sequencer.

Now that the software is setup and configured to communicate with the Hydra Sequencer, you can “hack” into its programming to set custom scripts and change the minimum dwell (the minimum time that cues remain on)*. To program your first custom sequence, make sure that the sequencer is plugged into the computer and that the Arduino software is running and properly configured. Click on **Tools** -> **Serial Monitor** or press **ctrl + shift + m**. This opens up a dialog box between you and the sequencer. The dialog box will prompt you with instructions.

Once the dialogue box has been opened, you have approximately 5 seconds to input a command. You may either chose to *enter a custom sequence* or *change the dwell time*. If no command is received during this startup time, the sequencer will proceed to stepper or sequencer mode depending on the position of the MODE switch and you will be unable to program it without resetting the device (by closing the serial monitor and reopening it).

Custom sequences are entered as 18 numbers in parenthesis separated by commas. Each of the 18 numbers corresponds to a time step in milliseconds. The first number corresponds to the time delay between when cue 1 is turned on and cue 2 is turned on. The last number in an 18 cue sequence corresponds to the time delay between when the last cue is turned on and when the output terminal is pulsed. **The output terminal is NOT for firing igniters!** Placing a high current load like an e-match on the output will permanently damage your sequencer. You may break up a sequence at any point by selecting a time step value of -1. In this case, the next cue will not fire until an additional input pulse is received. More details regarding allowable time step values and examples of sequences are on page 5.

Note: **The factory set dwell is 100 mS. This means that all cues are turned on for a minimum of 100 mS to ensure that there is adequate time to fire an e-match. This time can be changed using the computer connection. Be aware that the minimum time between banks of cues is equal to one-half of the dwell. Therefore, with a dwell of 100 mS, a sequence involving more than one bank of cues will have a delay of at least 50 mS (0.050 s) between the last cue of the first bank and the first cue of the second bank. Most e-match manufacturers recommend supplying current for a minimum of **40 mS**. Longer times are necessary for clip style igniters. Be aware that a longer dwell combined with an accidental short circuit could result in loss of power, which would reset the sequencer.*



CUSTOM SEQUENCES:

- Custom sequences may be entered via computer as 18 numbers, corresponding to time steps in milliseconds, separated by commas and bracketed by parenthesis. The user need not input all 18 values.
- Acceptable values range from 1 to 2147483647. Additionally, -1 is an acceptable input. However, for safety reasons, time steps should be kept relatively short.
 - Orion Pyrotechnics recommends no time steps greater than 5 seconds or 5000 mS. **The inherent danger of simple sequencers is that, once started, there is no way to deactivate them remotely.** In the event that you need to pause or abort your show, a sequencer with large time steps becomes a major hazard.
- Any time steps not entered will be set to the default value -1. A value of -1 means that the following cue will not be turned on until another input pulse is received; it effectively puts the cue into “stepper mode”.
- The time step between cues 6 and 7 and the time step between cues 12 and 13 must be equal to or greater than one-half of the dwell.
- Every additional input pulse received after all cues have been fired will generate an output pulse
- **Examples:**

(500,500,500,250,250,**250**,100,100,100,50,50,**50**,1,1,1,1,1,1) =

TIME	CUE	TIME	CUE
Input pulse received	1	0.1s after cue 9	10
0.5s after cue 1	2	0.05s after cue 10	11
0.5s after cue 2	3	0.05s after cue 11	12
0.5s after cue 3	4	0.05s after cue 12	13
0.25s after cue 4	5	0.001s after cue 13	14
0.25s after cue 5	6	0.001s after cue 14	15
0.25s after cue 6	7	0.001s after cue 15	16
0.1s after cue 7	8	0.001s after cue 16	17
0.1s after cue 8	9	0.001s after cue 17	18
		0.001s after cue 18	OUT



(500,500,500,-1,250,**250**,100,100,-1,50,50,**50**,1,1,1,1,1,-1) =

TIME	CUE	TIME	CUE
Input pulse received	1	Input pulse received	10
0.5s after cue 1	2	0.05s after cue 10	11
0.5s after cue 2	3	0.05s after cue 11	12
0.5s after cue 3	4	0.05s after cue 12	13
Input pulse received	5	0.001s after cue 13	14
0.25s after cue 5	6	0.001s after cue 14	15
0.25s after cue 6	7	0.001s after cue 15	16
0.1s after cue 7	8	0.001s after cue 16	17
0.1s after cue 8	9	0.001s after cue 17	18
		Input pulse received	OUT

(500,500,500,-1,250,**250**,100,100,-1,50,50,**50**) =

TIME	CUE	TIME	CUE
Input pulse received	1	Input pulse received	10
0.5s after cue 1	2	0.05s after cue 10	11
0.5s after cue 2	3	0.05s after cue 11	12
0.5s after cue 3	4	0.05s after cue 12	13
Input pulse received	5	Input pulse received	14
0.25s after cue 5	6	Input pulse received	15
0.25s after cue 6	7	Input pulse received	16
0.1s after cue 7	8	Input pulse received	17
0.1s after cue 8	9	Input pulse received	18
		Input pulse received	OUT

The bolded values are the time steps between banks. Note that these must either be -1 or greater than one-half the value of the dwell. Values less than one-half of dwell will be adjusted by computer.

Power Sources:

The sequencer is designed to be used with internal 9V batteries but also includes a battery selection switch and banana jacks. You may hook up an external battery box of up to 32 volts to the banana jacks. To fire from the external firing voltage, the battery select switch must be in the “external” position. If you require higher firing voltages, contact us for options. With some minor modifications, you may use a firing voltage up to 60V.

