

**STM-CHRONOS****A Multifunctional Response and Stimulus Device**

Chronos is a powerful new USB-based response and stimulus device. Chronos allows the accurate collection and verification of tactile, auditory, visual, and analog responses along with the precise source of audio and generic analog output timing. The Chronos graphical user interface allows for user-friendly implementation of the system's wide range of features.

Chronos features millisecond accuracy and consistent sound output latencies across machines. Chronos includes 16 digital inputs and 16 digital outputs, eliminating the need for a parallel port. All responses collected are synchronous to the E-Prime time domain. Multiple Chronos devices can be connected to a single PC using E-Prime 3 or 2 Professional. Chronos also introduces a large set of Task Events to facilitate the design of basic to complex experiments without the use of script (E-Prime 3 or 2 Professional).

**Response Features****Keys**

- 5 buttons
- 16 digital inputs
- Voice key
- n-key rollover
- Programmable debounce intervals

**Audio Recording**

- Stream and save vocal responses
- Start recording at object onset OR when speaking begins

**Voice**

- Sound-activated response (voice key)
- Condenser or dynamic microphone compatible
- Configurable audio input gain
- Configurable threshold settings for incoming audio responses and recording
- Detect sound to silence (offset threshold/post-silence interval)

**Analog Input**

- 3 Analog Inputs (plus Photo Sensor) with configurable onset and offset thresholds

**Stimulus Presentation Features****LEDs**

- 5 LEDs with programmable RGB color values (>4,000 colors per LED)
- Assign color values as response mapping verification, stimuli, or as feedback based on accuracy

**Audio Output**

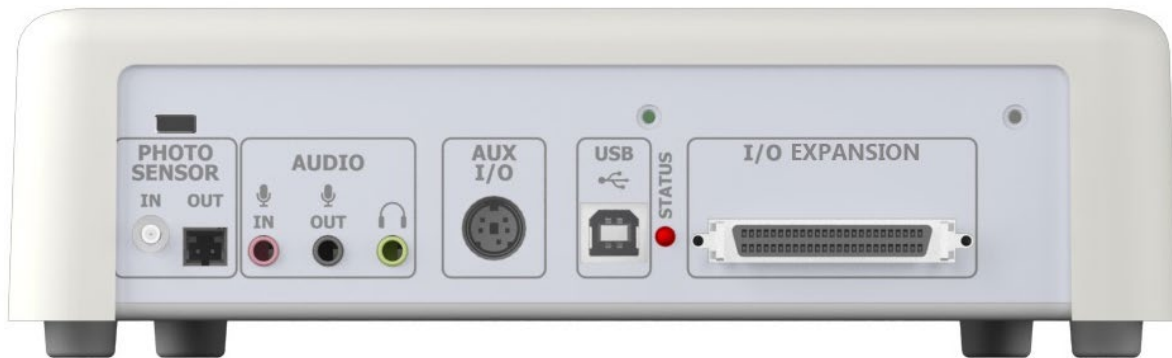
- Present auditory stimuli with accurate and precise sound output latencies of 1 ms (Mix Mode 1) or a fixed latency of 6 ms (Mix Mode 2) across different machine hardware
- Configurable onset and offset output thresholds per channel

**Analog Output**

- 4 Analog Outputs
- Generate sine, saw tooth, square, triangle, and custom waveforms

**Pulse Generator**

- Generate square waveforms of configurable frequency



Chronos Console   Chronos Photosensor   Chronos Microphone   Chronos USB Cable   Chronos I/O Expander

**STM-CHRONOS Systems Include:**

- Chronos Console (20.32 cm x 16.51 cm x 6.03 cm)
- Microphone (10.16 cm x 24.77 cm)
- Photo Sensor
  - The Photo Sensor accessory can be used on CRT, LCD, and projection displays to detect stimulus onset events, refreshes, and measure rise and fall times
  - High speed photodiode adapted to human eye sensitivity
- USB cable (1.8 m)
- BIOPAC Interface Cable—choose for Smart Center, MP36/36R, or STP100D
  - **STM-CHRONOS-1** Chronos with Smart Center cable (HDMI I/O to 8 tinned wires)
  - **STM-CHRONOS-2** Chronos with MP36/36R cable (DSUB25 to 8 tinned wires)
  - **STM-CHRONOS-3** Chronos with STP100D cable (DSUB25 to 8 tinned wires)
- Auxiliary I/O breakout cable assembly
  - 2 digital inputs, 2 digital outputs, 1 power (5 V), 1 digital ground, 1 analog input, and 1 analog ground
- I/O Expander
  - Provides access to 16 digital inputs, 16 digital outputs, 1 pulse generator, digital powers and grounds, 3 analog inputs, 4 analog outputs, analog grounds
- Demonstration Equipment
- Samples and Tutorials
- Kensington® lock support (lock not included)

## System Requirements

- Windows 8.1/8, 64-bit, Windows 7, 64 & 32-bit
- Pentium-compatible Dual-Core or Multi-Core processor, 2 Ghz
- 2 GB RAM
- USB 2.0, 3.0, or powered hub port
- E-Prime 3 or 2 Standard/Professional

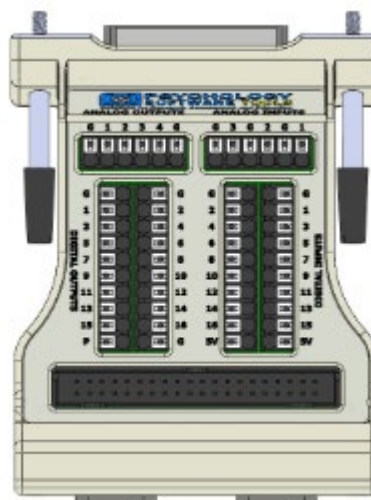
## Auxiliary I/O Breakout Cable Information

The Auxiliary I/O Breakout cable enables connection of up to two digital inputs, two digital outputs, and one analog input. The table below specifies the corresponding function and wire colors. Note that the outputs are zero-based while the inputs are one-based.

Pin	Color	Function	Description	Response Mapping (Pseudo Button)
1	Light Blue	+5V	+5V	n/a
2	Light Green	OUT14 (base 0)	Digital Output	n/a
3	Purple	OUT15	Digital Output	n/a
4	White	Digital Ground	Digital Ground	n/a
5	Orange	Analog Ground	Analog Ground	n/a
6	Yellow	IN16 (base 1)	Digital Input	G
7	Brown	IN15 (base 1)	Digital Input	F
8	Red	ADC1	Analog Input	9

## I/O Expander Pin Assignments

The I/O Expander Connector is used to facilitate communication with a variety of devices. The image below shows the location on the Push-in Terminal Block for the 16 digital outputs, 16 digital inputs, one pulse generator (see block labeled “P”), four analog outputs and three analog inputs. Note when using E-Prime, that the outputs are zero-based while the inputs are one-based. For example, digital output 7 is referenced in E-Basic script as Chronos.DigitalOut.SetBit 6. Users who purchase the Custom Expansion Kit may also communicate with the I/O external interfaces.

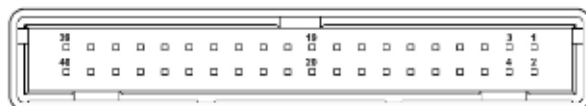


## I/O Expander 40-pin Header Pin Assignments

Users who purchase the Custom Expansion Kit may also communicate with the I/O Expander. In addition to the Push-in Terminal Blocks, the 40-pin header on the IO Expander can be used to connect Chronos digital inputs 1-16 and digital outputs 1-16 directly to the Custom Expansion Kit using the kit's included ribbon cable. This enables the 16 inputs and outputs to be configured with the LEDs and switches that can be ordered with the kit.



I/O Expander 40 Pin Assignments (1-20)	
PIN NUMBER	DESCRIPTION
1	5V @ 150 mA
2	Ground
3	Digital Input 1
4	Digital Input 2
5	Digital Input 3
6	Digital Input 4
7	Digital Input 5
8	Digital Input 6
9	Digital Input 7
10	Digital Input 8
11	Digital Input 9
12	Digital Input 10
13	Digital Input 11
14	Digital Input 12
15	Digital Input 13
16	Digital Input 14
17	Digital Input 15
18	Digital Input 16
19	5V @ 150 mA
20	Ground



I/O Expander 40 Pin Assignments (21-40)	
PIN NUMBER	DESCRIPTION
21	Ground
22	Ground
23	Digital Out 1
24	Digital Out 2
25	Digital Out 3
26	Digital Out 4
27	Digital Out 5
28	Digital Out 6
29	Digital Out 7
30	Digital Out 8
31	Digital Out 9
32	Digital Out 10
33	Digital Out 11
34	Digital Out 12
35	Digital Out 13
36	Digital Out 14
37	Digital Out 15
38	Digital Out 16
39	Ground
40	Ground