Specification
Mangold USB TTL Sync Cable

Type: One TTL Output

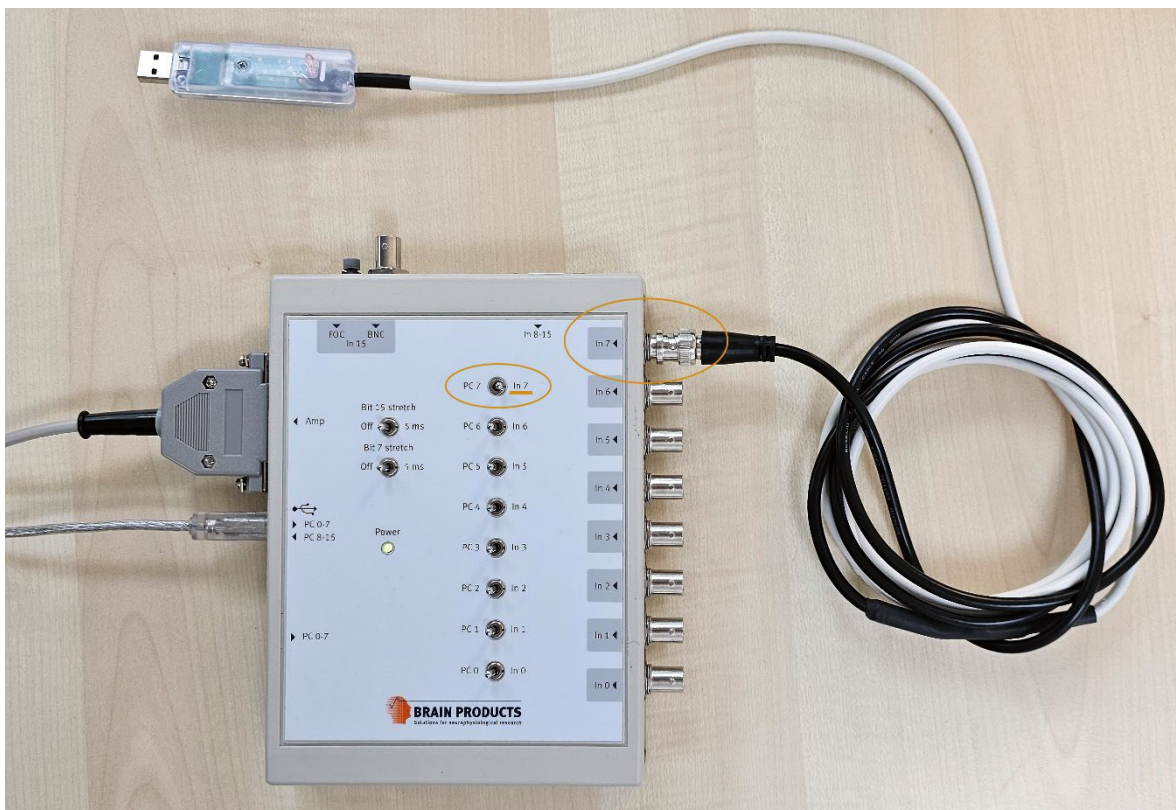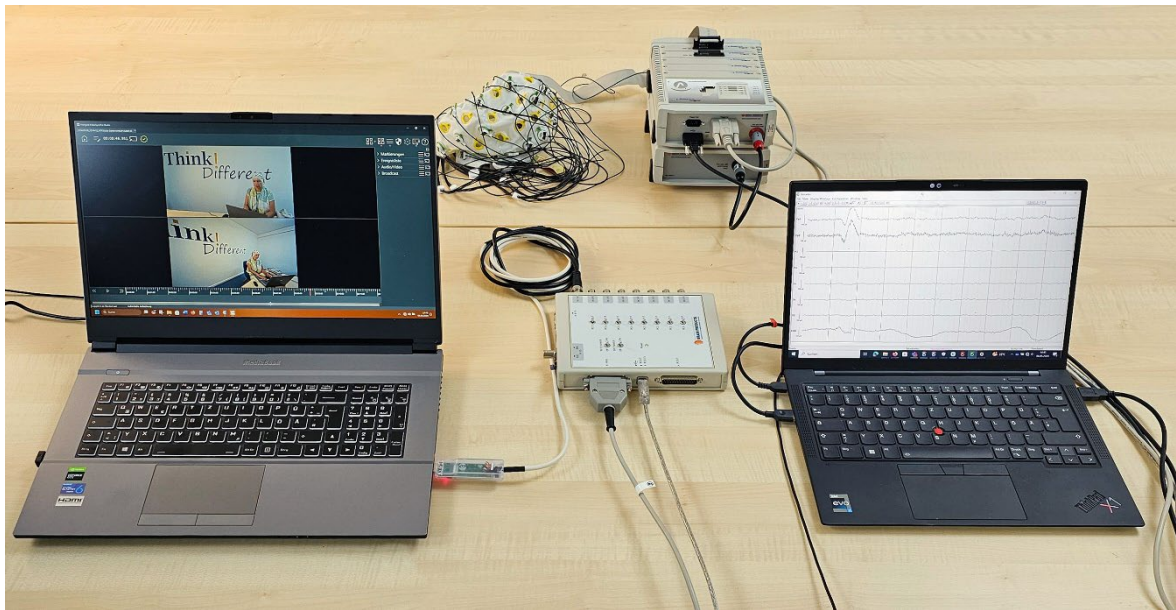|	
Supply voltage	+5V (via USB port)
Interface	USB 2.0 / USB 1.1
Access speed	Average access time from the PC to the module: 0.4 ms (Calculated with 1000 accesses)
Indicator	LEDs Indicates USB stick access
Inputs/outputs	Typically 1 max 8 5V TTL level / max 5mA / channel
Cable	Connection cable approx. 2.5 m
Operating temperature	+10°C to +50°C
USB connector dimensions	84.5 x 21 x 12.5/9.5 mm (without cable)

Overview

This cable is used to send a TTL Sync Signal from a Mangold software product to any device which can receive TTL signals (typically EEG/physiology recording systems).

The cable is typically configured as ONE TTL OUTPUT.

It can be configured by Mangold as 1 – 8 TTL Input and/or Output, which requires manufacturing and the appropriate Mangold software.

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Connection to Brain Products

To send a Start/Stop signal from the Mangold Software to the EEG system use the Brain Products Trigger Box. Connect the Mangold TTL Sync Cable to the HIGHEST input pin ("In 7") and set the switch to "In 7". This (binary) bit is represented as decimal number 128.

Only in this configuration all other pins will be available for other software sending trigger signals to the Sync Box on pin 0..6 (Binary). This configuration allows to receive 0 .. 127 other trigger (in fact decimal numbers 0..127 representing different trigger).

Select "High Active" in the Brain Products software Digital Port Settings.
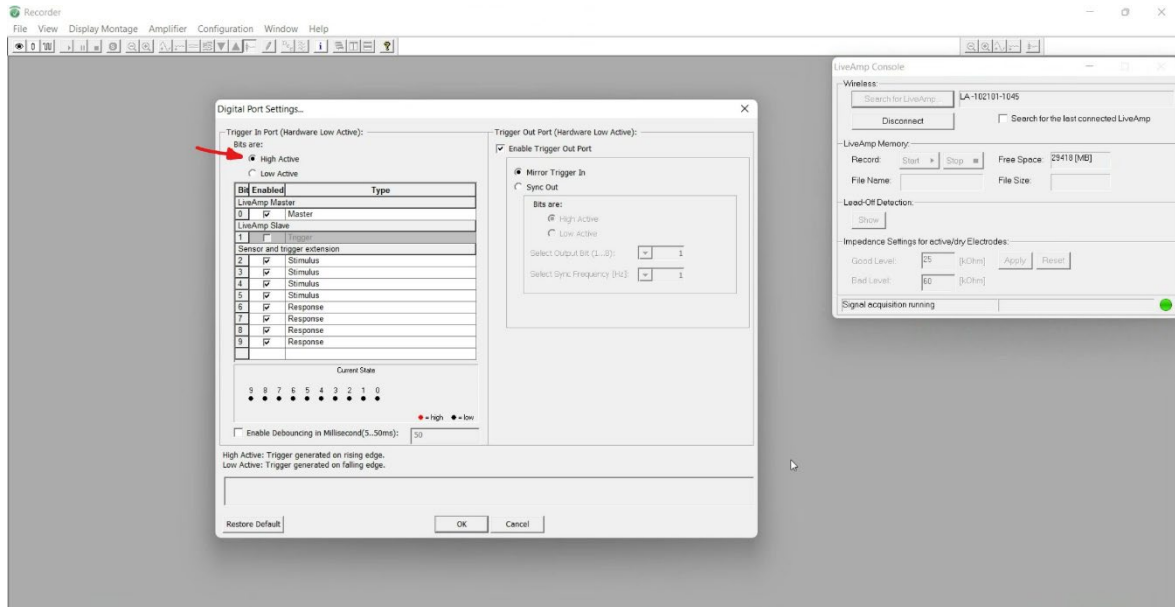
In this configuration all bits of the Trigger Box will be "high" (= 1).

The Mangold software typically sends a trigger "high" on start and on stop of the current operation (e.g. recording video).
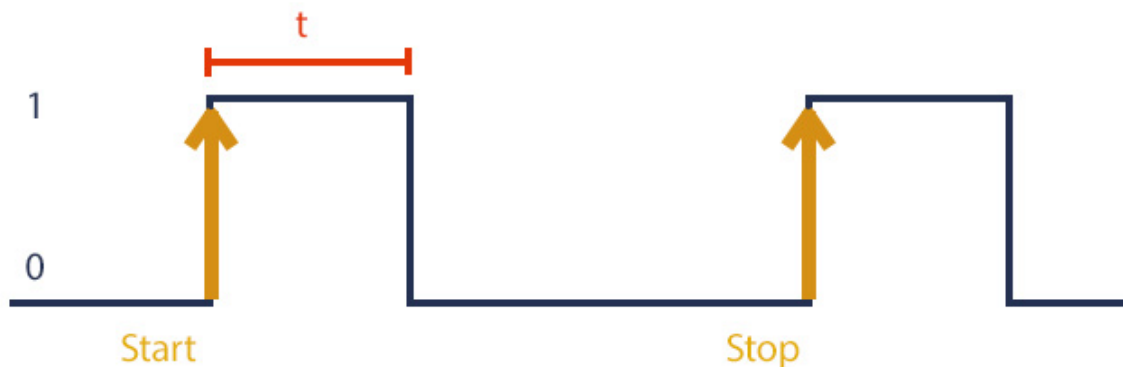
The Trigger Box sends a trigger value (decimal number) to the Brain Products recording software **in case the state of one of the bits changes.** Thus, the trigger value of the Brain Products Sync Box will be as follows (in case no other software uses the other trigger pins)

In / Bit	0	1	2	3	4	5	6	7	Decimal
Default: "High Active" –all bits are set to high. Mangold does not send a signal.	1	1	1	1	1	1	1	0	No trigger in BP, because nothing changed
Mangold sends "Start" => the trigger state changes.	1	1	1	1	1	1	1	1	= 255
After time **t** (as defined in the Mangold software) the Mangold sync signal goes to low again.	1	1	1	1	1	1	1	0	= 127
Mangold sends "Stop" => the trigger state changes.	1	1	1	1	1	1	1	1	= 255
After time **t** (as defined in the Mangold software) the Mangold sync signal goes to low again.	1	1	1	1	1	1	1	0	= 127

Thus, all EEG data values between the two "255" trigger are in sync to the recorded data (typically audio/video) in your Mangold software. The "127" trigger on the falling edge of the signal can be ignored.

Make sure the trigger "high" time (**t** in the above image) is long enough in relation to the EEG data sampling frequency to be recorded by the Brain Products software.

Just good to know!

If you would use "Low Active" the signal changes would be recorded on "falling edge" of the signal. In this case a correct start / stop could not be represented using those triggers because trigger up-time t would have to be added to the final data, which does not make any sense in practical use.

Also, the decimal trigger value would be different:

In / Bit	0	1	2	3	4	5	6	7	Decimal
Default: "Low Active" –all bits are set to low. Mangold does not send a signal.	0	0	0	0	0	0	0	0	No trigger in BP, because nothing changed
Mangold sends "Start" => the trigger state changes but is ignored (raising edge)	0	0	0	0	0	0	0	1	= 128
After time **t** the Mangold signal goes to low again. => The trigger state changes (falling edge)	0	0	0	0	0	0	0	0	= 0
Mangold sends "Stop" => the trigger state changes but is ignored (raising edge)	0	0	0	0	0	0	0	1	= 128
After time **t** the Mangold signal goes to low again. => The trigger state changes (falling edge)	0	0	0	0	0	0	0	0	= 0