

LABase V1.0 Operation Notes (C. Wendt, 2022-06-14)

The LABase operation is the same as MDOM MicroBase, with the following exceptions and notes:

- The jumper at J5 was not originally installed, but it could be convenient to install it. If the jumper is installed, the MCU will start up in "user mode" and accept commands immediately.
- If the jumper is not installed, the STM32CubeProgrammer software must be used (at power up time) to issue a "bootloader" command that switches into "user mode" (or a newly compiled firmware version can be loaded this way). For example, the command line interface to STM32CubeProgrammer could require a command that looks something like this:

```
/Users/chwendt/STM32Cube/STM32CubeProgrammer/STM32CubeProgrammer.app/  
Contents/MacOs/bin/STM32_Programmer_CLI -c port=usb1 --start 0x08000000
```

- o (I haven't fully explored the bootloader command options in USB mode, so some experimentation may be required... or just install the jumper J5 to avoid dealing with it.)
- The LABaseV1.0 hardware configuration interfaces directly to a PC or laptop with a USB cable, without any RS232 serial converter. However, on the PC, the LABase interface will appear as a USB type serial port or COM port.
 - o (It's possible to install a 10-pin ribbon cable connector at J3 on the LABaseV1.0 to match the hardware interface like MDOM MicroBase, but that also requires changing several 0-ohm resistors on the board. If this is desired, please ask for detailed advice.)
- With the direct USB communication, all commands should be entered without the "U" at the beginning. (This "U" was needed in the MDOM version, and was used to determine the baud rate for each command; but the baud rate setting does not affect the direct USB communication so we don't need the "U" anymore.)
- The commands to turn on the HV are the same as MDOM MicroBase. For example, simply "quickscan 65" to set 65 volts per stage, giving a gain of something like $1e7$ for one sample R7081-02 (based on first tests of one board). The total voltage for LABaseV1.0 has been measured about 20.3 times the single stage voltage, so 65 volts corresponds to 1320 volts total.
- Commands to monitor status are also the same as MDOM MicroBase: "status", "reportavg" etc.
- Unfortunately, setting the voltage to zero, or doing a second "quickscan", may

cause a "trip" condition that needs to be reset before the voltage can be ramped up again: see next point. To avoid this problem entirely, use the command "trip_mode 0" at the beginning of each session after turning on the power.

- The dynamics of turning on and off the voltage have parameters that were optimized for the MDOM MicroBase, and they will need to be re-optimized for the LABase. Since this has not been done yet, the settling time will be longer after commanding a new voltage, and there may also be a problem with expected current limits being violated and causing a "trip" condition that shuts down the output, especially when setting the voltage to zero or starting a new "quickscan" when the HV is already on. The "tripped" condition can be seen by the response to a "status" command. If the base is tripped off, the condition needs to be reset with the command "trip_reset". Or just use "trip_mode 0" at the beginning to avoid all this trouble until the firmware is updated.

LABase firmware can be found in github:

- The firmware is in the branch "usb-comms" of the MicroBase github repository "uBase-stm32",
<https://github.com/WIPACrepo/uBase-stm32>
and therefore one should first clone that repository and then select the "usb-comms" branch. A github "pull" operation may be required after that to obtain the latest code in the branch. (The MDOM version is in the "master" branch of this same repository.)
- The compiled binary file is in the "Release" subdirectory, and has the name "uBase-stm32.bin".
- The latest version name is "20220407-1738", that is the response from the command "get_version".
- If the firmware needs to be changed and recompiled, note that there are a number of #define statements in the file "include/boards.h" which configure the firmware at compile time. In this version of the usb-comms branch, the "boards.h" file is already set up to work with the LABaseV1.0 board. For example, there are defines like "USB_CDC_SERIAL" and "POSITIVE_HV" as well as some numerical values like "HVMON_SENSE" specific to this board.