

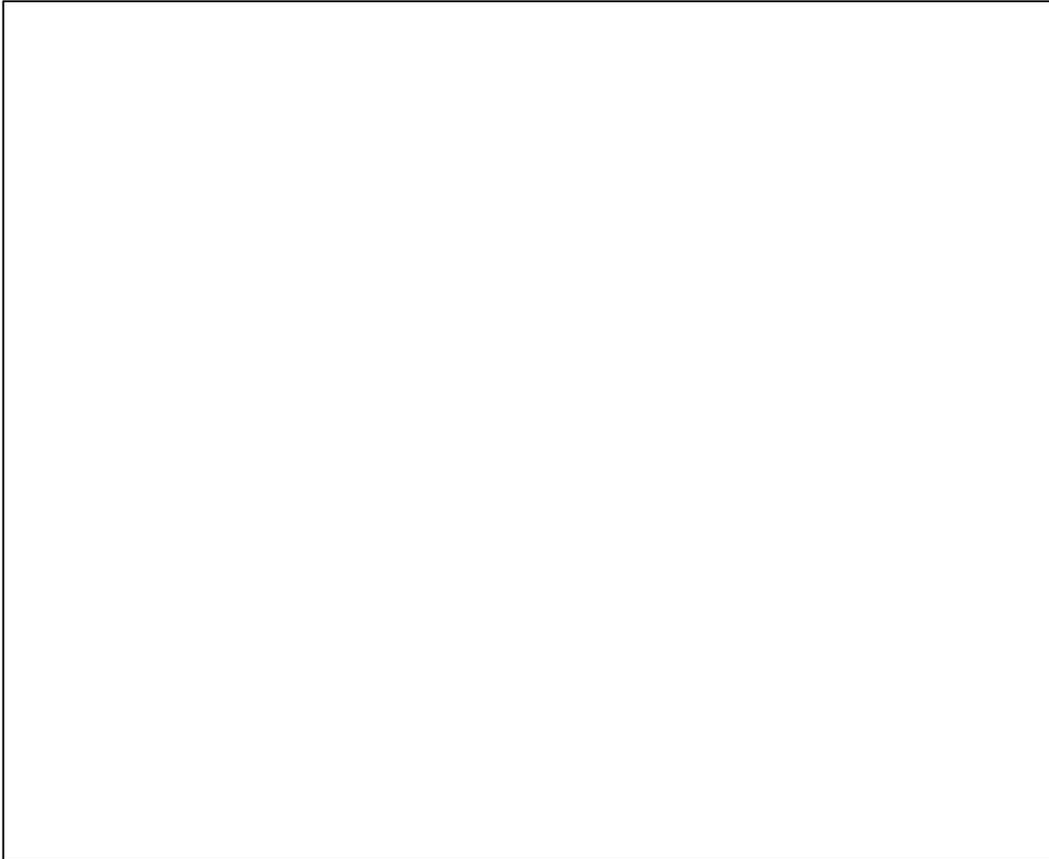


# C O N G O



Technical Training  
Service / Repair / Maintenance

13/06/2005





## Topics Today

- Hardware / Names / Acronyms
- How to open the Console
- The PCBs and their Functions
- Signal Flow
- Indications, Tests and Calibration
- Hardware Cheats
- Firmware Update
- Hands On
- Q & A



-Rear View

-The Various I/O connectors from the I/O Board:

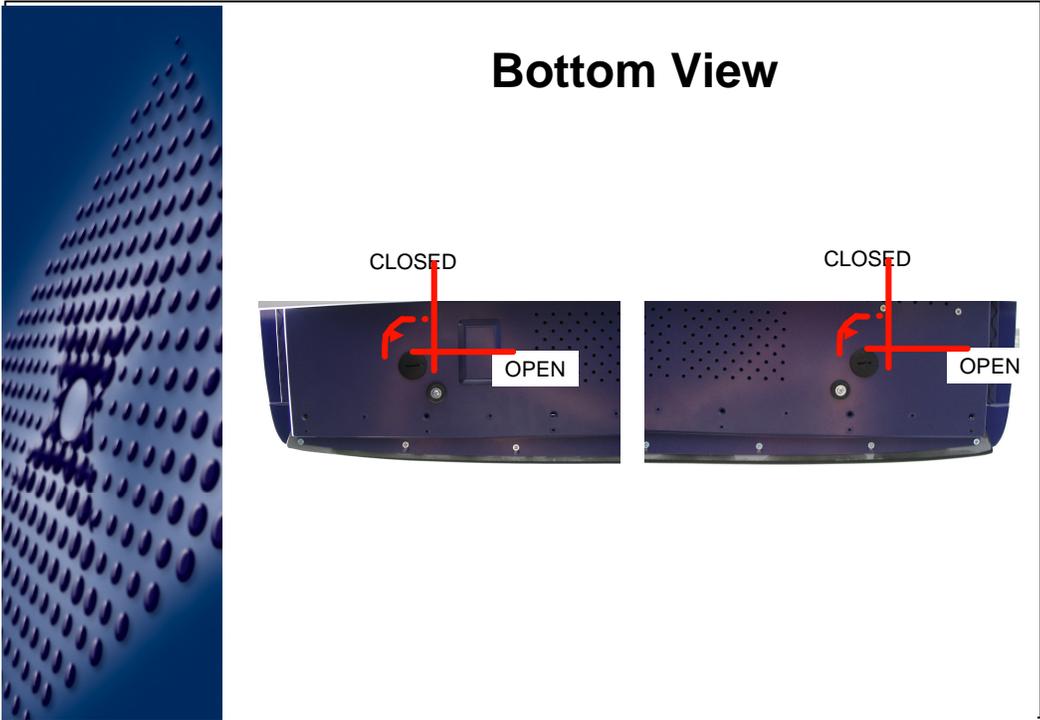
- RFU  $\neq$  Standard ETC RFU
- DMX 1 / 2 (LEDs are real indication of the output)
- MIDI in / out (LEDs are real indication of the output)
- Remote trigger (same as express without Relay output)
- Telephone Remote (auto sensing: Switchboard and Phone)
- APN (Avab Peripheral Network = CAN Bus)

-The Transition Board connectors

- Audio Microphone In
- Headset / Speaker out (extension to intercom app)
- 4x USB (Keyboard / Mouse / Memory-Stick)
- HD Led
- Reset Button
  
- 3 x VGA (careful to use the correct outlet, primary monitor on outlet 1 (To be confirmed) )
- Network 10/100 Mbit (Extension planned for 4-port POE switch)
- Floppy drive (USB Stick drive supported).

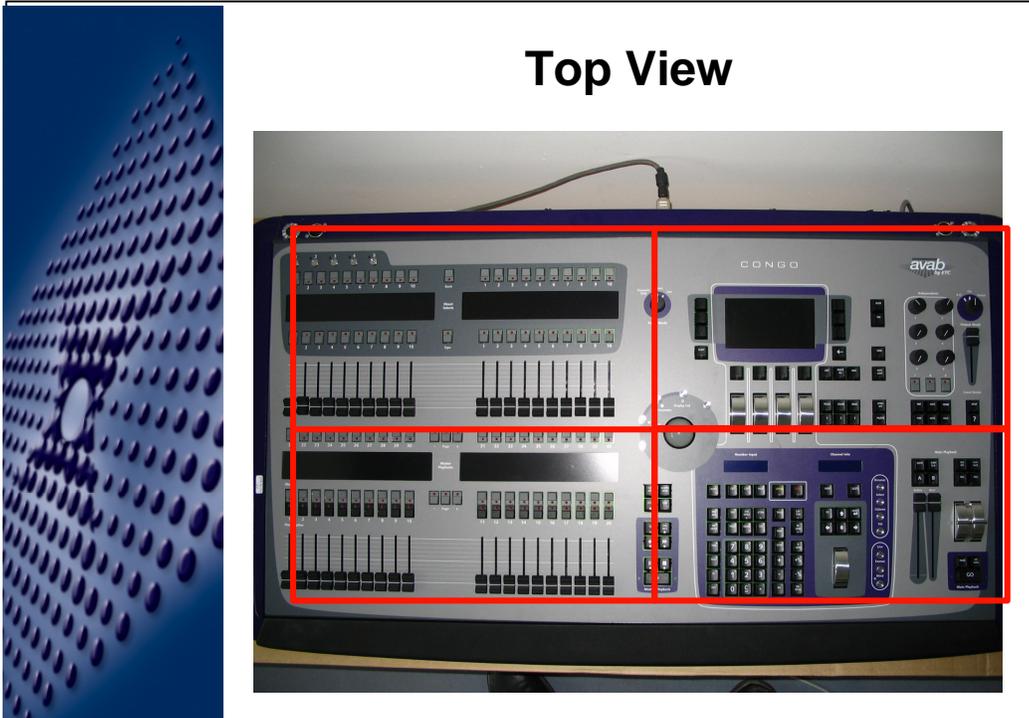
-Power input

- Universal voltage / internal battery buffer for shutdown.



This is where / how you open the thing (e.g. Coins)

If the screw does not turn, hold down the face panel to make it turn



- Top View
  - The different sections of the front panel
    - Upper Master
    - Lower Master
    - Moving Light section
    - Function / programming section
  
  - Little Lights
  - Monitor Arms
  
- Mouse and Keyboard active during Windows start-up

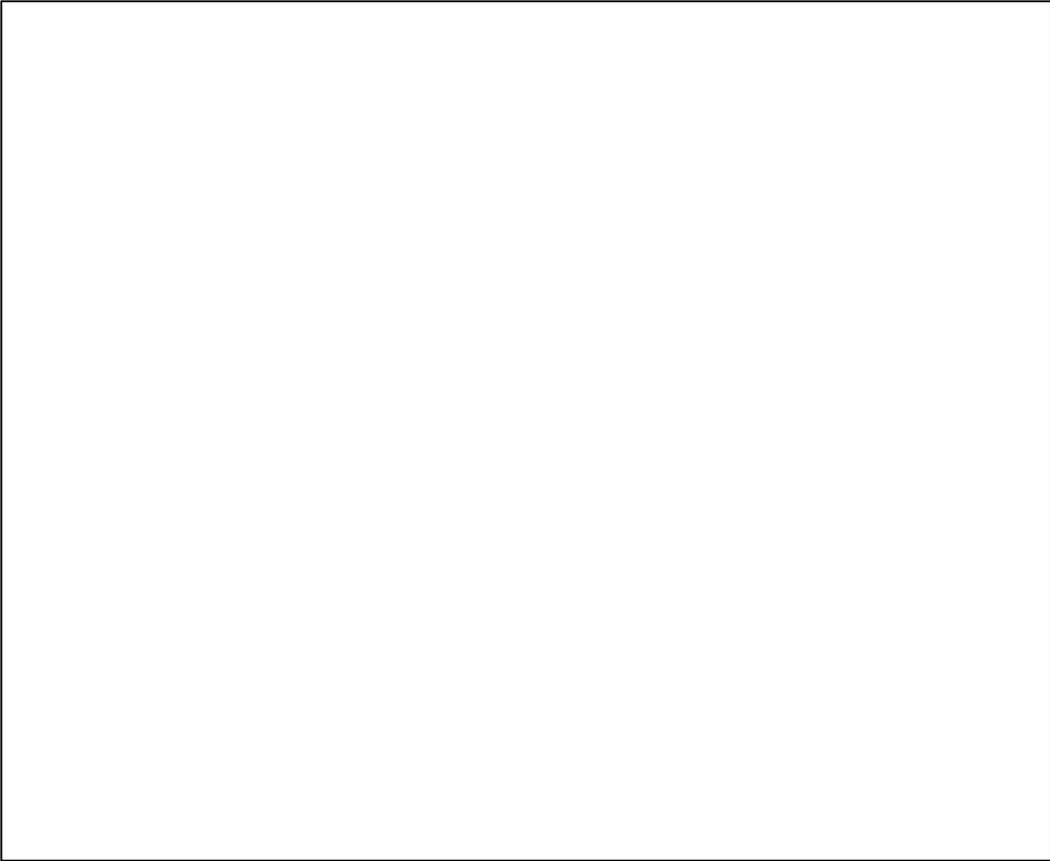
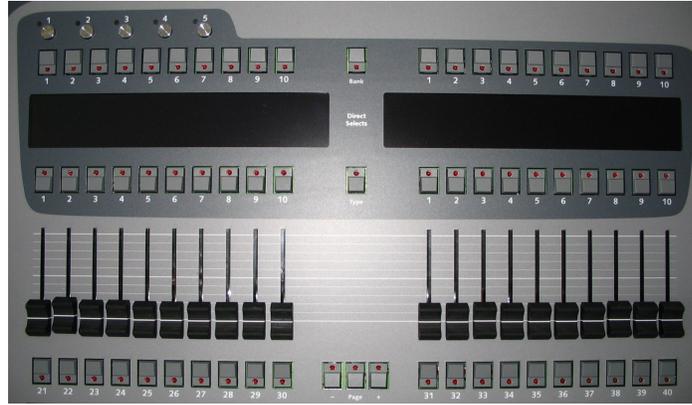
## Face Panel



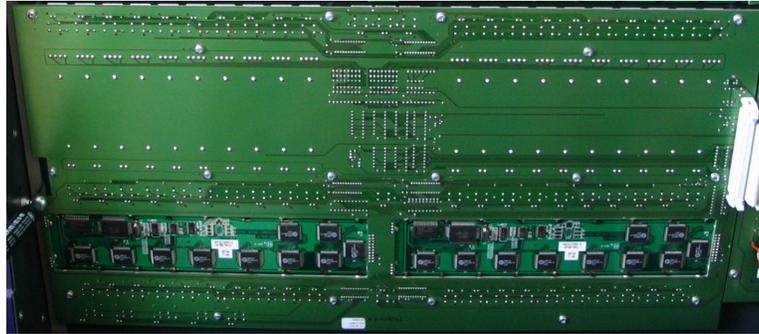
- Only Cables going to the face panel is +5V Power and USB.
- All Boards are connected via a 50 Pin Flat ribbon Cable.



# Upper Master board



## Upper Master board

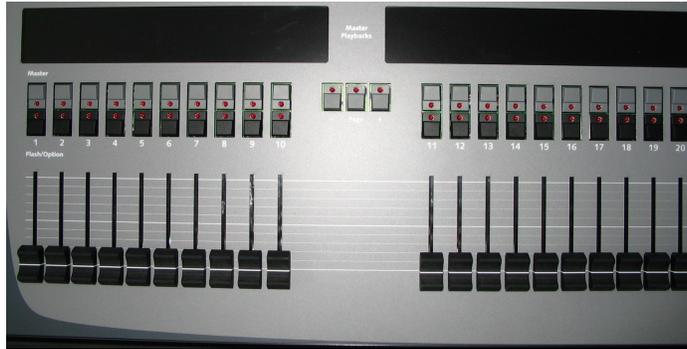


To Replace a board:

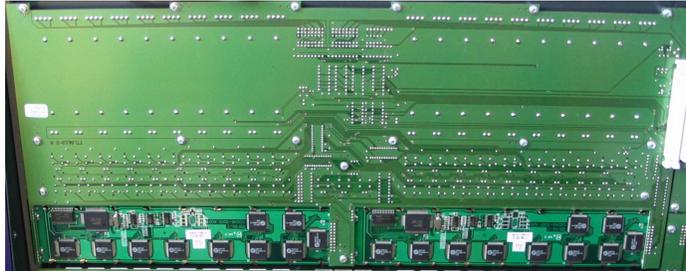
-Remove all Fader Knobs

-Remove all screws (caution ⚠ All metric hardware ⚠ Don't loose screws !)

# Lower Master board



## Lower Master board

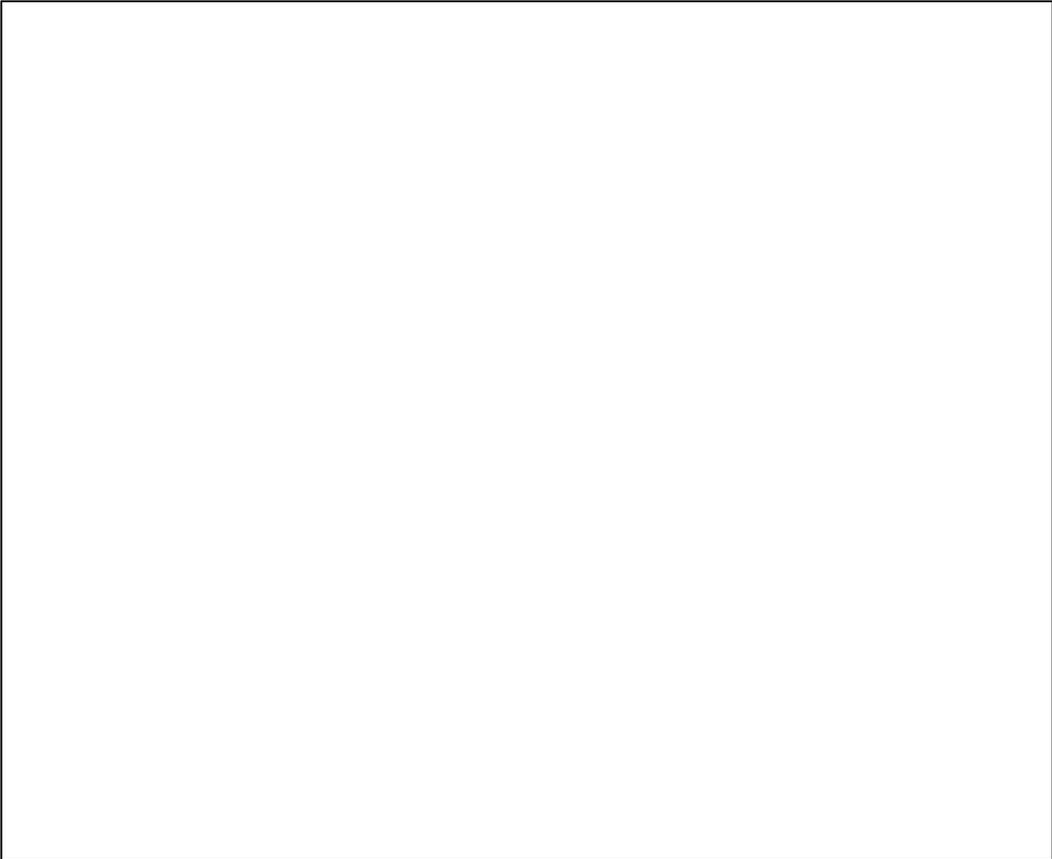


To Replace a board:

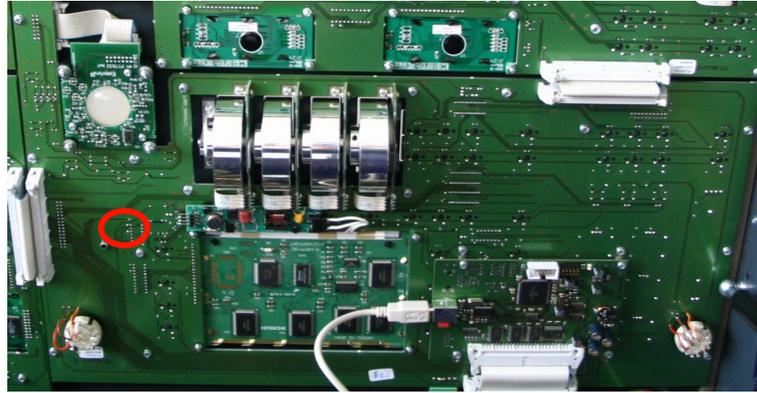
-Remove all Fader Knobs

-Remove all screws (caution ⚠ All metric hardware ⚠ Don't loose screws !)

# Moving Light board



## Moving Light board



To Replace a board:

- Remove all Fader Knobs

- Remove Rotary Knobs (caution ⚠ metric hardware, caution ⚠ 2 different diameter shafts (Switches / Pots) )

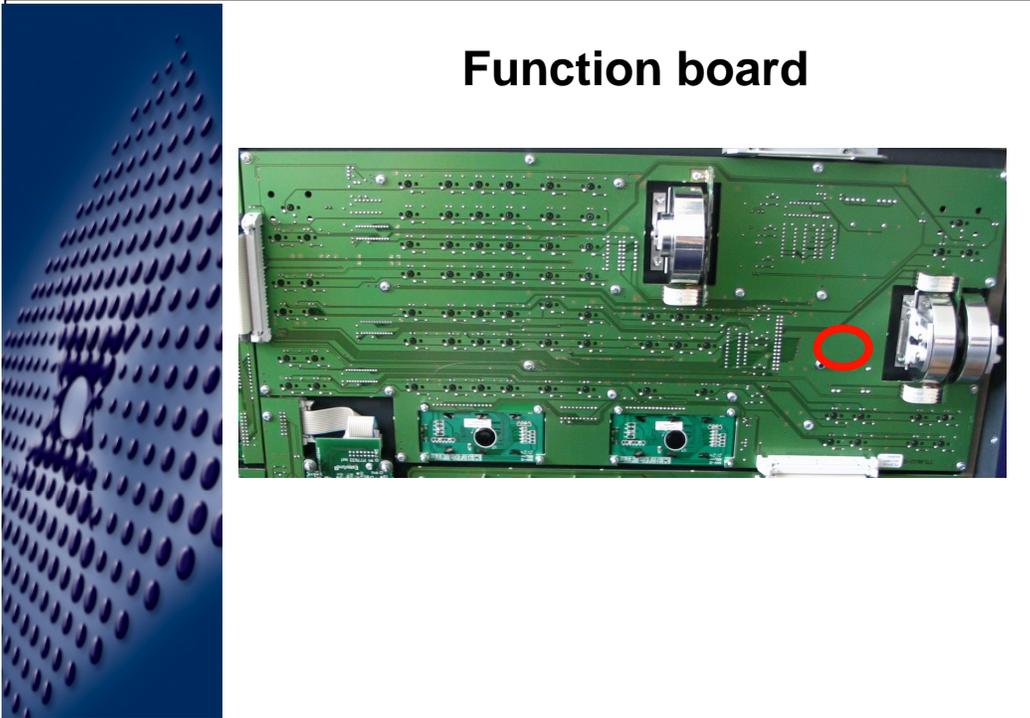
- DO NOT remove the nut (This holds a piggy back board to this PCB).

- Remove all screws (caution ⚠ All metric hardware ⚠ Don't loose screws !)

- When you remove the board be careful that you don't break off / scratch the Opto devices on the opto bridges



## Function board



To Replace a board:

- Remove all Fader Knobs

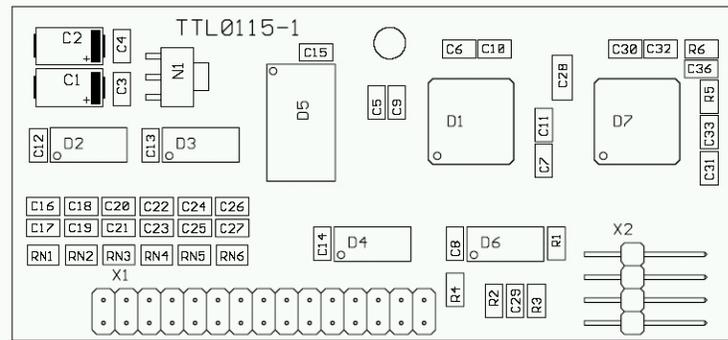
- DO NOT remove the nut (This holds a piggy back board to this PCB.

- Remove all screws (caution ⚡ All metric hardware ⚡ Don't loose screws !)

- When you remove the board be careful that you don't break off / scratch the Opto devices on the opto bridges



## “Piggy Back” board



- Contains a couple of CPLDs, that contain counters for the wheels.
- Needs to be programmed once at manufacturing.



## I-O board



- only internal connection is USB, +5v and +12V (RFU / remote go / little lights).
- DMX ports have galvanic isolation from internal circuitry, telephone and APN (CAN) bus.
- Bi-Directional DMX Ports (RDM-Ready).
- DMX-Out indication LED (Real indication of driver failure, also fed back to Console).
- RFU is compatible to standard ETC RFU (Expression ((Obsession)) RRFU).
- Standard MIDI in and out port
- MIDI in and out indication LEDs will be real indications (Do not light up if driver failed). To Be implemented at the next software rev. (currently out LED goes active, when data is sent).
- Remote Go has the same Pinout as the Express consoles (only in, no Relay out contacts).
- The APN (AVAB Peripheral Network) is a CAN bus based system, and can connect a variety of peripherals to Congo.
  
- The Orange “Event” LED will flash upon: Phone action (Pickup / DTMF-Tone), RFU Buttons, Remote-Go changes



## I-O board



- Telephone can be used as a remote control.
- Congo can act as a switchboard or as a normal telephone.
  - Switchboard:
    - A normal, off the shelf telephone (wireless or wired) can be plugged into Congo & Congo acts as a switchboard.
    - Congo will detect if the telephone is off or on hook, and will detect DTMF tones as control signals.
    - Congo will send back beeps to the telephone if a user command has been received (not implemented yet).
  - Telephone:
    - Congo can be plugged into a analog building telephone system.
    - Congo will act as a normal telephone
    - Users can “Call” Congo from any telephone on that system (Or any telephone worldwide if that system is hooked up to the public telephone system).
    - Congo is “Pin-Code” protected.
    - Congo will “pick-up” an incoming call and is ready to receive DTMF tones as commands.
    - Congo will send back Beeps upon command reception (not implemented yet).

## Transition board



-The internal connections to this board are USB, +5V and +12V (not used), Audio in (Microphone) and out (Speaker), Hard Drive LED, and PC-Reset Signal.

-The “Transition board” is basically a 7 Port USB hub and a Audio Amplifier.

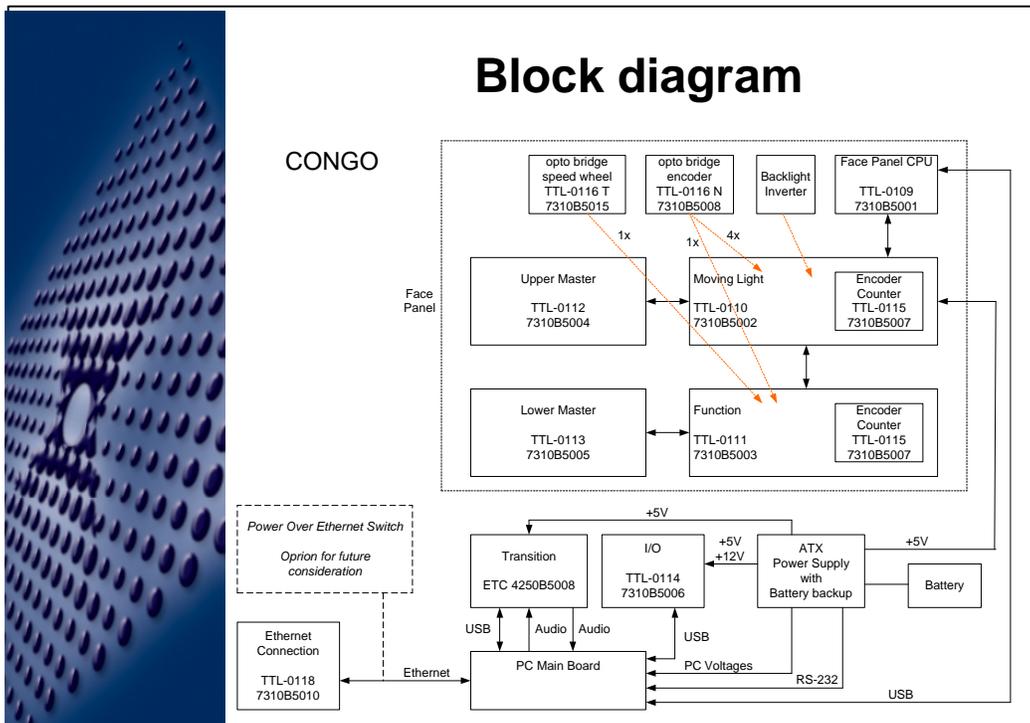
-There are 4 external USB Ports.

-There is one on board USB Port (Used for the Dongle).

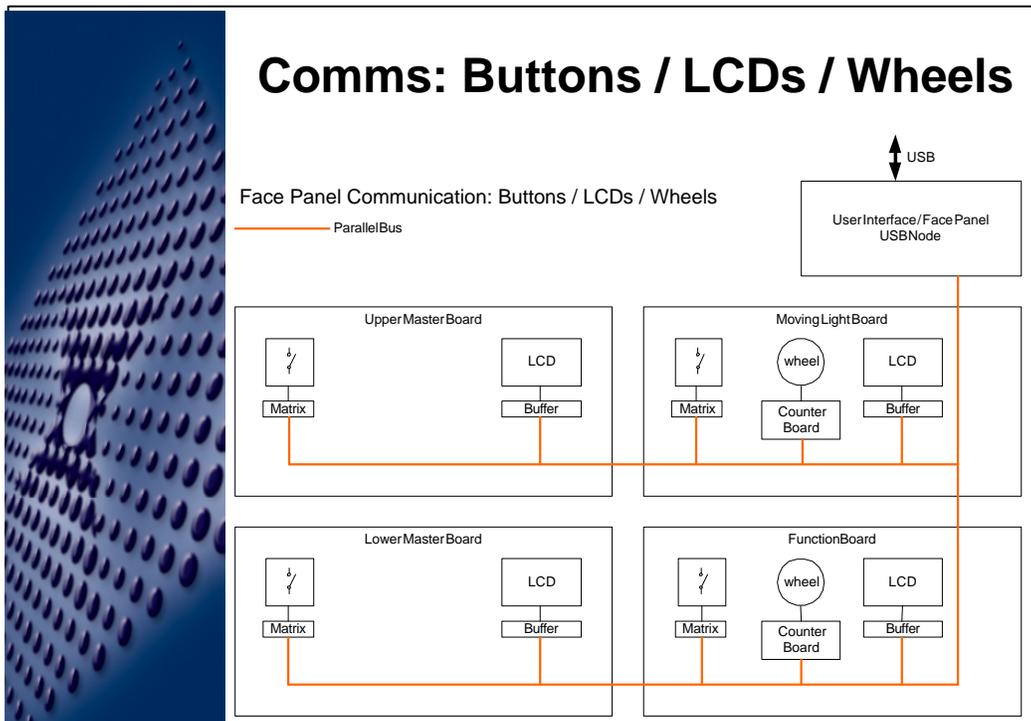
-There are 2 additional USB Ports on an internal header (currently not used).

-CAUTION: The HD-LED / RESET Header has the same type of header than the 2 spare USB Ports. Cross-Plugging causes “interesting” results (worst case hardware destruction)...

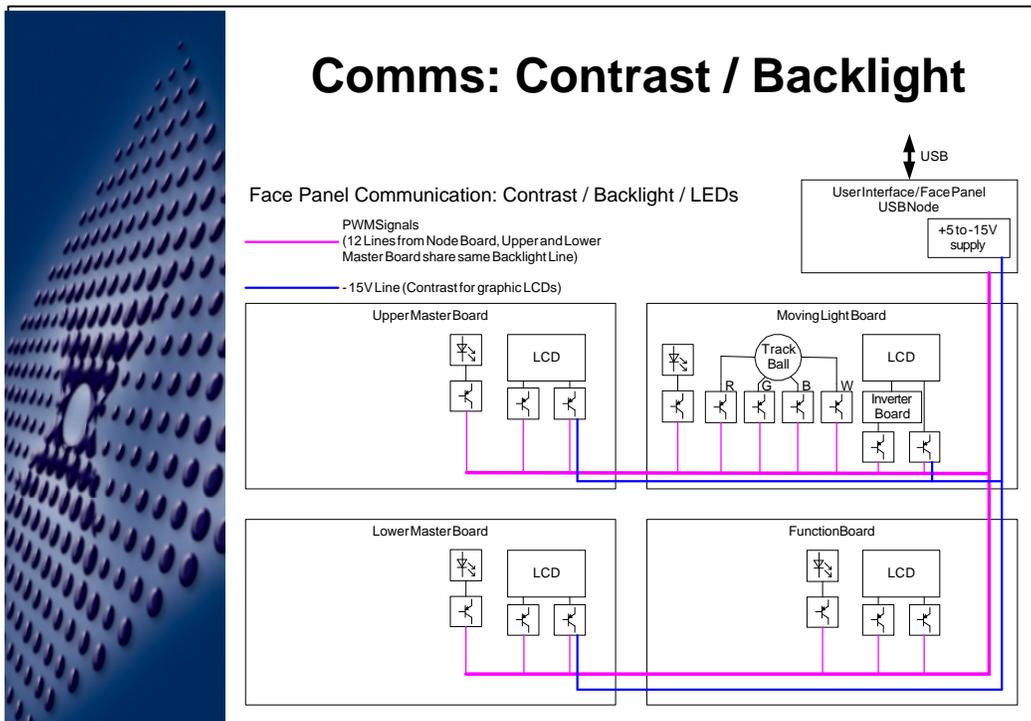
-There are several indication LEDs, 2 per port: Device connected (GREEN) / speed (Orange = High Speed).



- The core of the System is an industrial PC mainboard.
- The mainboard communicates to the face panel node via USB.
- The mainboard communicates to the I/O Board via USB.
- The Power supply communicates with the PC via RS-232 (power fail / battery low).
- Reset / HD-LED / USB and Audio I/O are connected to the “Transition board”.



- The U/I Node PCB communicates to the various U/I boards (Master / Function / ML) via a variety of communication lines.
- Each board is supplied with the same signals via a 50-pin flat ribbon cable.
- Each U/I board can be plugged directly into the U/I node for testing (but ML and F board not with every board connector !!).
- The buttons, LCDs and Wheels are supplied by a standard parallel address / 8 Bit data bus (similar Obsession 1).
- All PCBs share the same parallel bus.
- If single items do not work (e.g. one LCD), it is likely that the fault is local to this board.
- If “nothing” works, it is either the CPU board has a fault, or there is a problem somewhere on the way (short / open circuit / bad connector).
- Start to isolate each board with a longer 50 pin flat ribbon cable.
- Either swap faulty U/I board or U/I node board.



-The LCD contrasts, LCD backlights, LED global intensity, Trackball intensity / color is directly controlled from the U/I node via 12 PWM control signals.

-All master displays have only one backlight setting.

-Upper and lower master displays have individual contrast settings.

-Function displays have backlight and contrast settings.

-ML display has backlight and contrast setting.

-The trackball has 4 intensity settings (Red / Green / Blue / White).

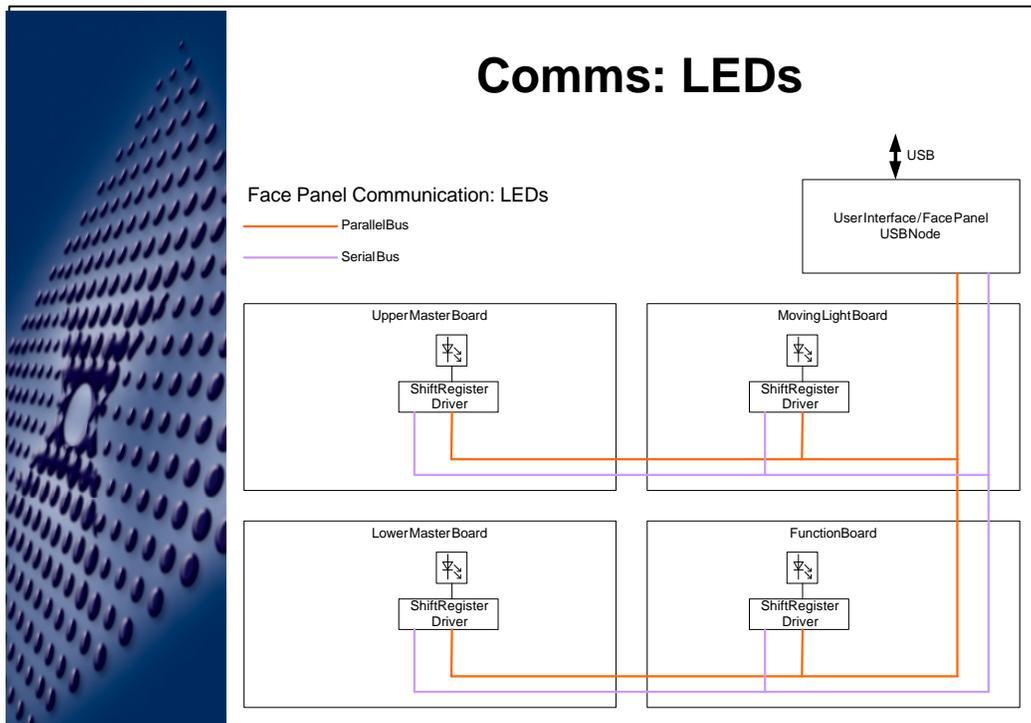
-If one of these intensities / contrasts does not work, it can be one of the following items:

- Device broken (check if other devices controlled from the same level are working (e.g. Master Backlight) ).

- Short or open circuit on one of the PCBs (start swapping PCBs).

- Missing or or bad cable connection

- Bad U/I Node



-The Led are controlled by a “Serial Bus” (SPI) and the parallel data bus and the global LED intensity.

-The driver chips on the U/I PCBs usually supply 16 LEDs at a time.

-These chips get the “which LEDs to turn on” via the serial bus (all chips connected to the same bus)

-The parallel bus tells these chips which one should accept the data that was just sent

-The global LED intensity tells these chips how bright they should be.

-If there is a problem:

-No LED works:

-Is the global intensity working and actually turned on ?

-Is the serial bus working ?

-Isolate individual boards to narrow down the “bad” board

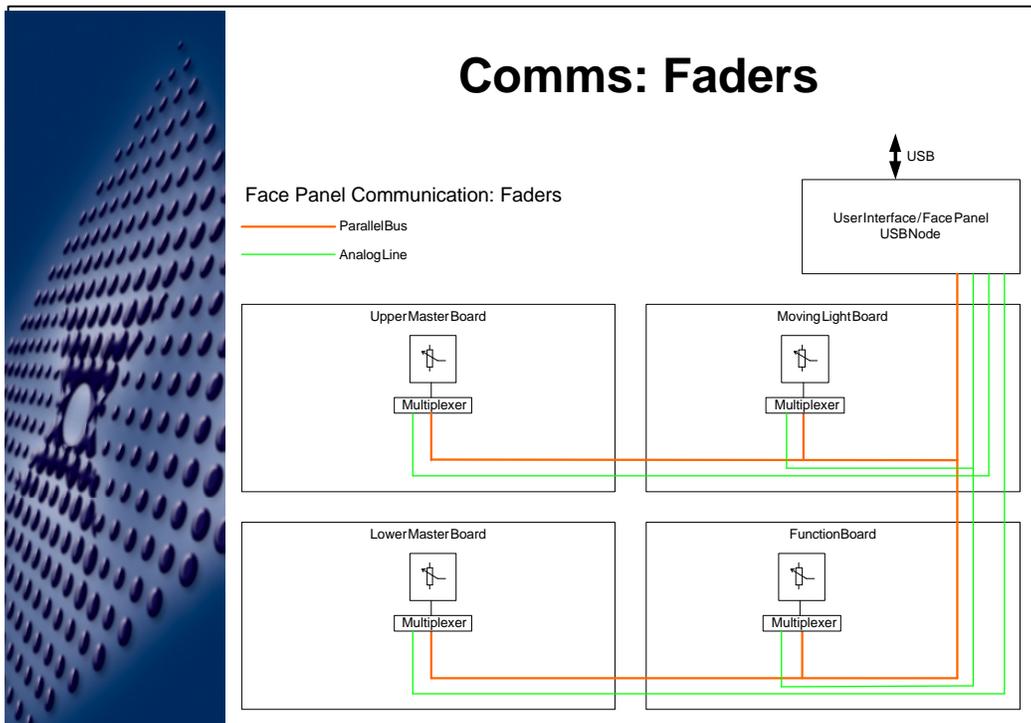
-Is the parallel bus working (LCDs / Buttons / ...)

-Some LEDs are not working

-Is it one complete U/I board ? (⚡ bad connector / open circuit)

-Is a group of 16 LEDs not working ? (bad driver chip).

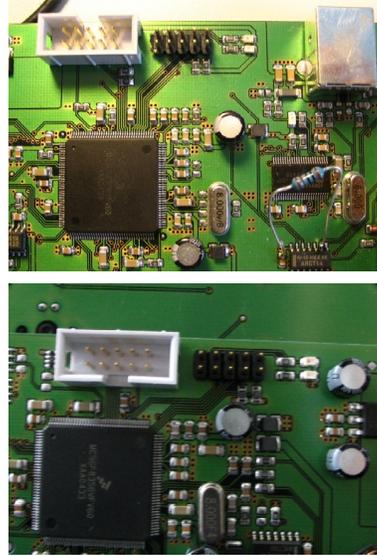
-Are individual LEDs not working ? (broken / short / inserted incorrectly)



- The faders are read out one after another per board.
- There are 3 Analog lines that go back to the U/I Node that contain the selected fader levels
  - 1 = Upper Master board
  - 2 = lower Master board
  - 3 = Moving Light and Function board.
- The parallel bus selects the fader that is read on each respective board via an analog multiplexer.
- If a fader readout does not work:
  - Is it an individual fader and all others work ? (broken fader, short on the respective trace / broken multiplexer).
  - Is it a group of 8 faders ? (broken multiplexer).
  - Is it an entire board (the respective analog line has a short or open circuit, bad connection).
  - Is it the entire system (Does the parallel bus work (keys / LCDs).



## The Diagnostics LEDs



The LEDs

-Green LED

-Heartbeat: blinks once per second.

-Green USB LED:

-Off = no USB connection.

-On = USB is connected

-On / flashing off = A USB packet has been sent / received.

-Orange LED = Input Received, flashes on:

-Button: every actuation (press / release)

-Fader movement

-Wheel movement

-Remote Go trigger

-RFU Button

-Telephone Button

-If green LED is on and Orange LED blink very slowly ( once every ~3 seconds), the board is in Bootloader mode and is waiting for new firmware.



## Built in Test application

- Hold Down the “?” key at power-up
- Software Version
- General Test
- Wheel Calibration (“Setup”-key)
- LED Test
- LCD Test
- Firmware Upgrade



-Test Software activation on User Interface:

-Button

- This only works on the user Interface (Face Panel).
- Hold down the “?” button during power up.
- Hold until version numbers are visible (the versions will contain: firmware version / USB protocol version / Hardware revision).
- Release the “?” button.

-Software

- Start the “UI\_Test\_Mode.exe” program.
- This will trigger the test-mode.

-The first test is a general test, that can be used to test all:

- Buttons
- Faders
- Wheels
- LEDs
- Contrasts and Backlights



## Built in Test application

- Hold Down the “?” key at power-up
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- LED Test
- LCD Test
- Firmware Upgrade



### -In the first test

-The contrast and backlight of the ML display can be adjusted with the independent 1 and 2 pots.

-The R / G / B / W intensities of the trackball can be adjusted with the independent 3,4,5 and 6 pots.

-The contrast and backlight of the function display can be adjusted with the independent playback faders.

-The contrast and backlight of master boards can be adjusted with the 23<sup>rd</sup> and 24<sup>th</sup> fader of each board (backlight will be set on both master boards).

-Adjust the contrast and backlight of the ML and Function board so that the content is readable.

-The display will show information about the last user action:

-The number of the button / fader / wheel that was last touched.

-The value of the last action (level / up / down).

-The number of the last action (counts from 00 to 100 and then wraps around).



## Built in Test application

- Hold Down the “?” key at power-up
- Software Version
- General Test
- Wheel Calibration (“Setup”-key)
- LED Test
- LCD Test
- Firmware Upgrade



- If a button has a LED, this LED will blink once this button is pressed and will be turned off, once the button is released.

- If a fader is moved and its level is not 0, the LEDs of the respective master buttons are turned on.

-Quick Master button test:

-Move all faders up  $\neq$  all master button LEDs are on.

-Press all master buttons.

-If all buttons worked, all leds should be off.

-press the “?” button to proceed to the next test.

-Wheel calibration (see later).

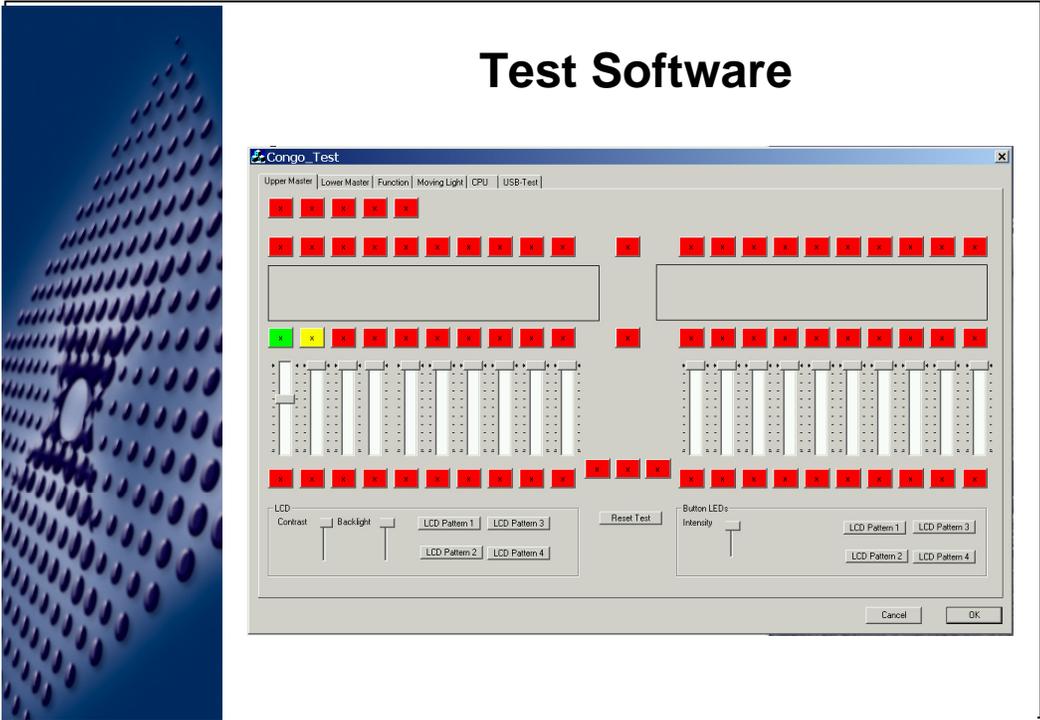
-LED test (all leds on)

-LCD test

-Press the “?” key to start various different LCD test pattern.

-Firmware upgrade (see later).

# Test Software



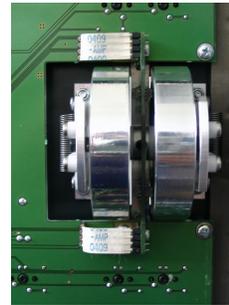
The will be a more advanced test software for the IO and UI boards, once it is done.

This will help to automatically check the board in production / test and service (might be part of the Congo hard-drive image, tbd.).



## Wheel calibration

- Check for zero detection (“\*”).
- Set Maximum and Minimum levels
- Check is levels are within range
- Store Values



-If a wheel doesn't work anymore, it might be several things.

-~~✓~~ in a “dark” room, check if the optical devices are “glowing” red (if not, flat ribbon disconnected, dropper resistor broken (this happened a lot in production), optical device broken. ~~✓~~ get out the multi-meter).

-The opto-bridge (= PCB that holds the optical devices) got out of adjustment (~~✓~~ move the PCB closer to / further away from the wheel).

-The optical disc got dirty (clean disc with a cloth or a non aggressive solvent).

-Meter the Signals of this PCB with a scope, until you have good results.

-If this still doesn't work, replace the opto bridge PCB (careful with handling these PCBs so that the opto devices don't get scratched).

-If this still doesn't work replace the wheel.

-For the time wheel calibration, start the self test and go to the time wheel calibration menu.

-When time wheel is in middle position, a \* should be displayed next to the level

-~~✓~~ Indication that middle position detection works.

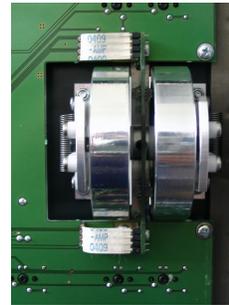
-Before the first movement, the last stored maximum, minimum value is displayed

-After wheel is moved, the actual value is shown



## Wheel calibration

- Check for zero detection (“\*”).
- Set Maximum and Minimum levels
- Check is levels are within range
- Store Values

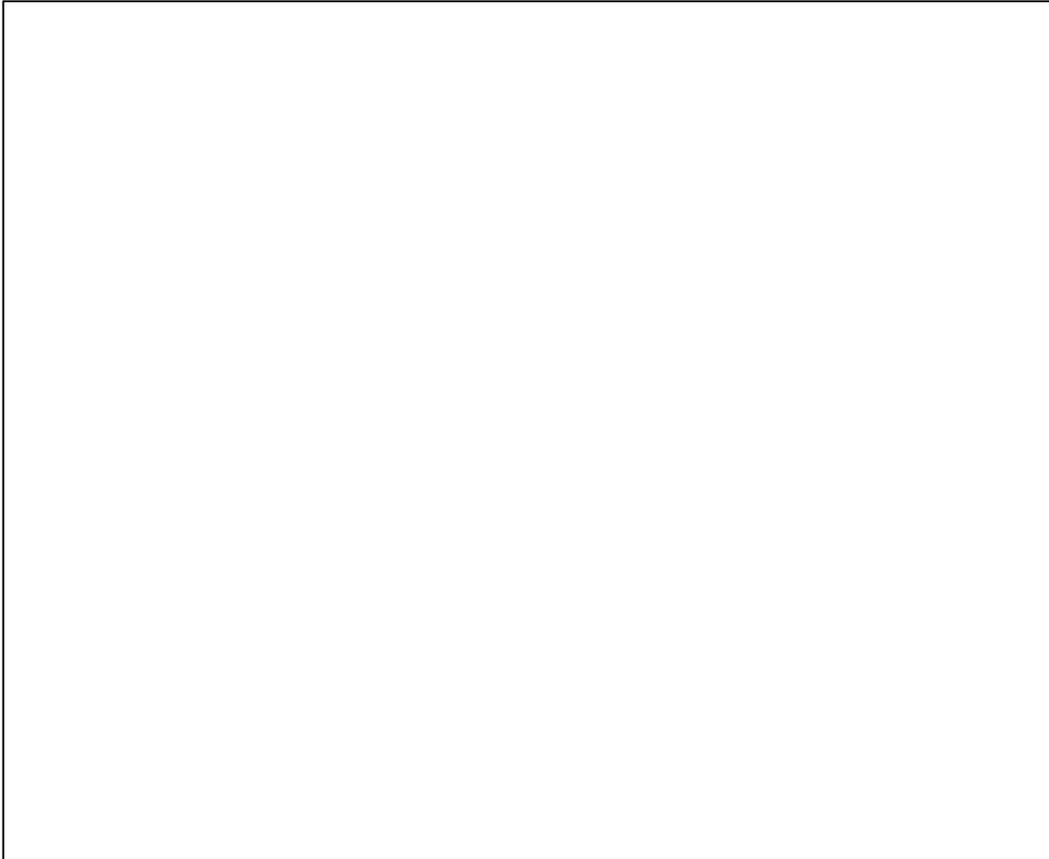


- Move to positive maximum and hit “?” key
- Move to negative maximum and hit “?” key
- Same with next wheel
- Store Values (hit the “setup” key to change from “NO” to “YES” at the “STORE VALUES” question, and then hit the “?” key to confirm this.
  
- Positive and negative values should be between 85 and 100.
  - If out of range, re-calibrate opto bridge (move it “left” / “right” until a better readout is possible).
  - If values do not improve, clean optical disc on wheels.
  - If calibration is not possible, replace opto bridge.
  - If calibration is still not possible, replace wheel assembly.



## Hardware Cheats

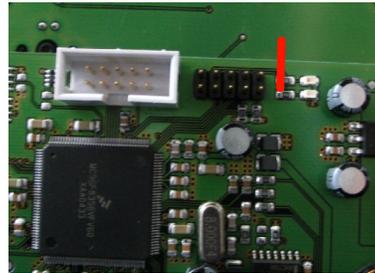
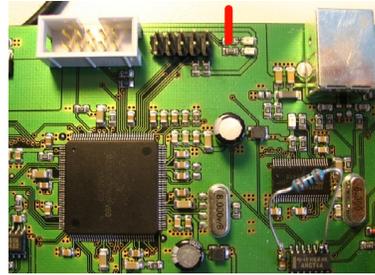
- DMX driver chips can be swapped with RFU driver chips.





## Update / Bootloader Activation

- Button
- Jumper
- Software



### -Boot Sequence:

-On Boot: Enter Bootloader

-Bootloader checks main application against checksums

-Bootloader checks (and resets) Message from main application.

-Only if Checksum is ok, main application is started

### -Bootloader Message

-Main application can send a message to the bootloader, to wait for a new firmware at next boot.

-Main application then reboots the node.

### -Bootloader timeout

-The bootloader waits for about a minute to connect to a firmware update program.

-If no program wants to connect, and the main application is still intact (checksums pass), the main application is started

- even if the bootloader is started by accident, nothing is destroyed !!

### -Firmware update

-Once the update software starts to send data, the main application will be overwritten.

-In this moment, the checksums will be invalid.

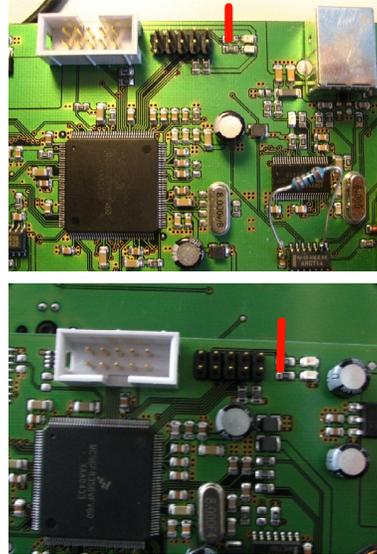
-At the end of the upload a new checksum is calculated, compared with the checksum of the firmware file, and then written to the checksum

memory



## Update / Bootloader Activation

- Button
- Jumper
- Software



-Bootloader Activation:

-Button

- This only works on the user Interface (Face Panel).
- Hold down the “?” button during power up.
- Hold until version numbers are visible.
- Step through self tests until Firmware update menu.
- Change “update Firmware ?” from “NO” to “YES” by pressing the “Setup” key.
- Acknowledge selection by pressing “?” key again.

-Jumper

- Short out pins x and y of header z before power up
- Power up the system

-Software

- Start the “UI\_Firmware\_Update.exe” or “IO\_Firmware\_Update.exe” program
- This will trigger the bootloader.

After either of the above:

- User interface node will reboot and will wait for new firmware for ~1minute.
- Start firmware download program and start downloading firmware.
- If no new firmware has been received, Node will boot into old firmware



## Firmware Download

- Only update one Node at a time !
- Start downloader Software on PC
- Check if correct node is in bootloader mode.
- Download the **CORRECT** firmware for the respective node.

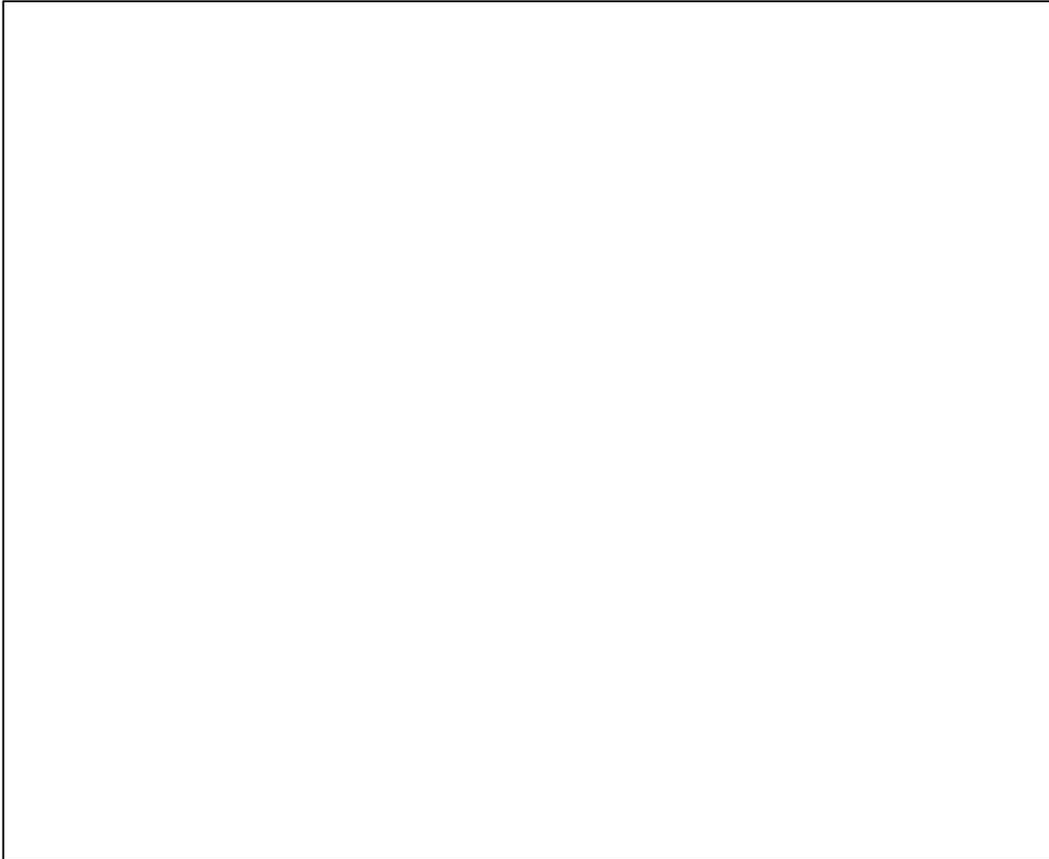


- Start PC Software within a minute of bootloader activation.
- The PC Software will automatically find the connected device which is in bootloader mode.
- The PC Software will display “Hardware Name” (e.g. Congo IO Node), Bootloader Version Number, Hardware Version String
- After these strings are displayed, the “File” button gets enabled
- Select the CORRECT file for the connected node (File has an “\*.src” extension).
  - Any \*.src file can be uploaded (SmartFade / SmartPack / IO / UI / ...)
  - If a wrong file has been uploaded, all sort of things could happen (best case: Erratically flashing LEDs / worst case: Destruction of Hardware)
  - A incorrectly updated board can be re-animated by either the “UI-Firmware\_Update.exe” file or by the means of the Firmware\_Update\_Jumper.
- After the file opened ok and the “Download” buttons gets enabled.
- After pressing the “Download” button, the firmware gets downloaded, and a progress bar shows the progress.
- There might be a short CRC-error message in the beginning, but the download usually retries and continues.
- Don’t interrupt this process, don’t disconnect any cables, don’t turn off power during this process
- If something happened during the upgrade process, the application is usually



## **Update the bootloader re-animate a dead board**

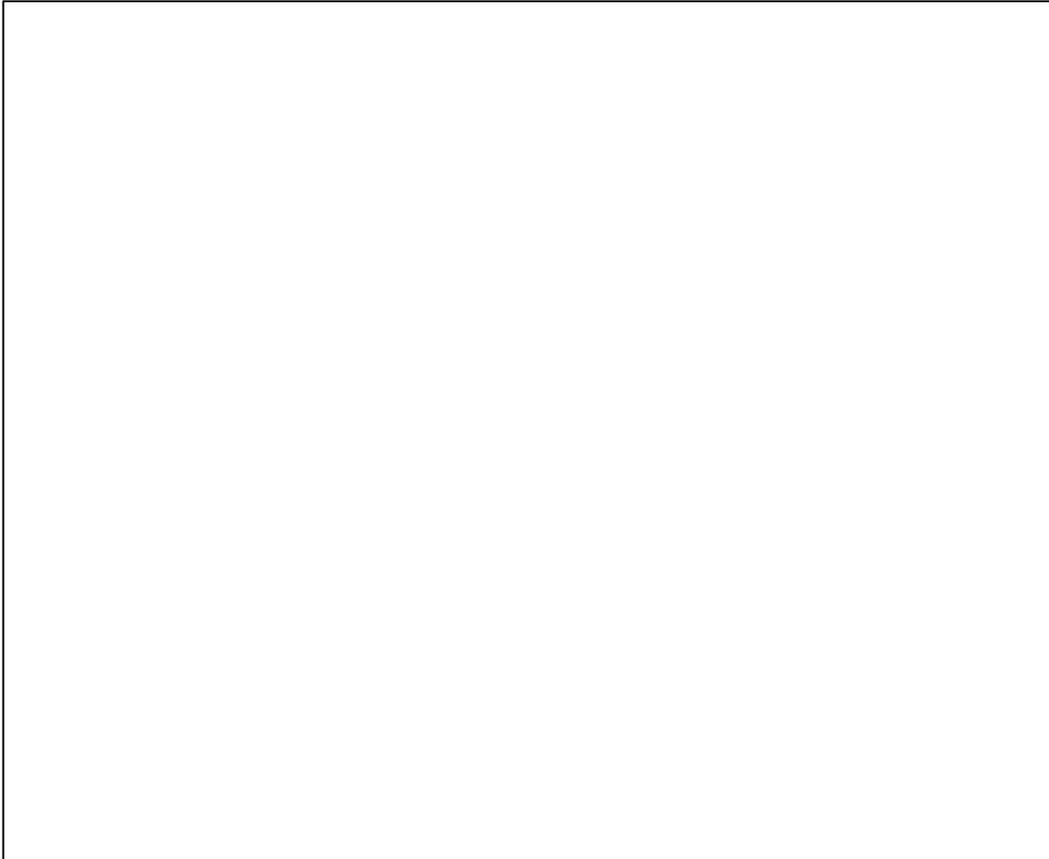
- **Use the JTAG board**
- **Use the JTAG application**





## Display Firmware Versions

- Go to the “About” section of the browser in the Congo application.





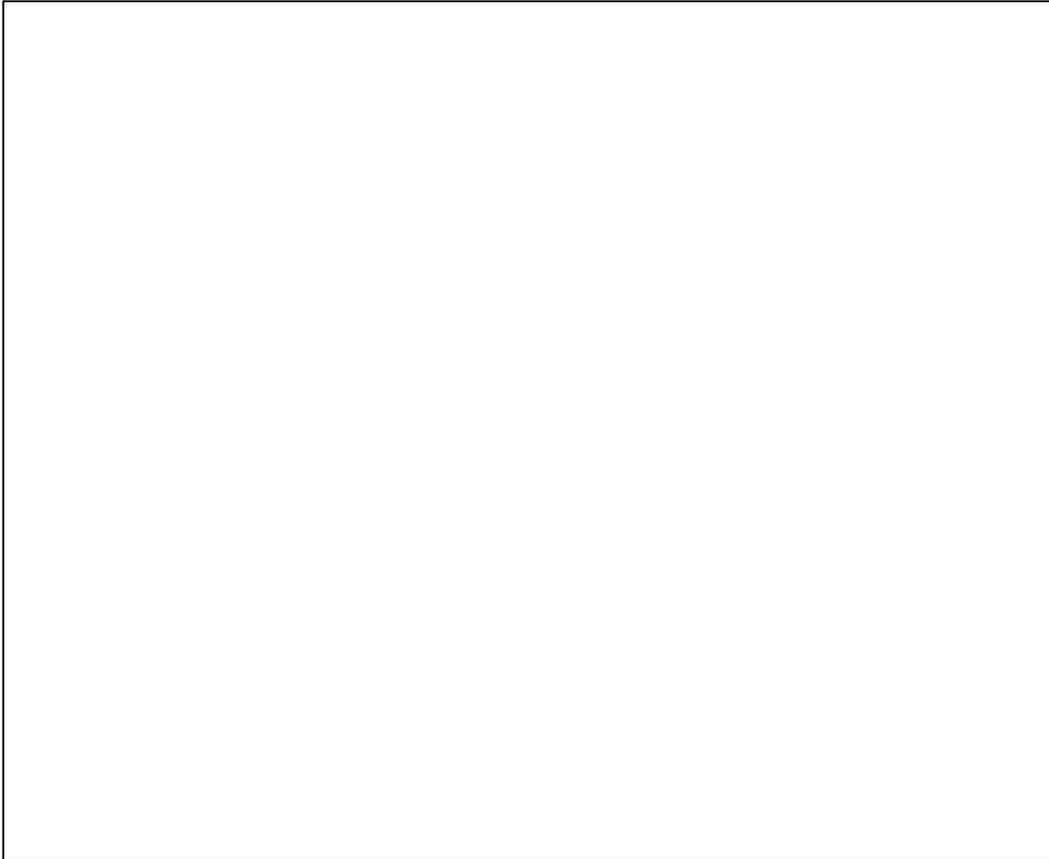
## Network Set-Up

- Go to the Setup option before the Congo application is started.
- IPX = AVAB protocol (Used with E-Gates and Visualisation (Capture)).
- ETC-Net-2: Network Number = Blocks of ~6000 EDMX channels.



## Hands on ✍️ Test Hardware

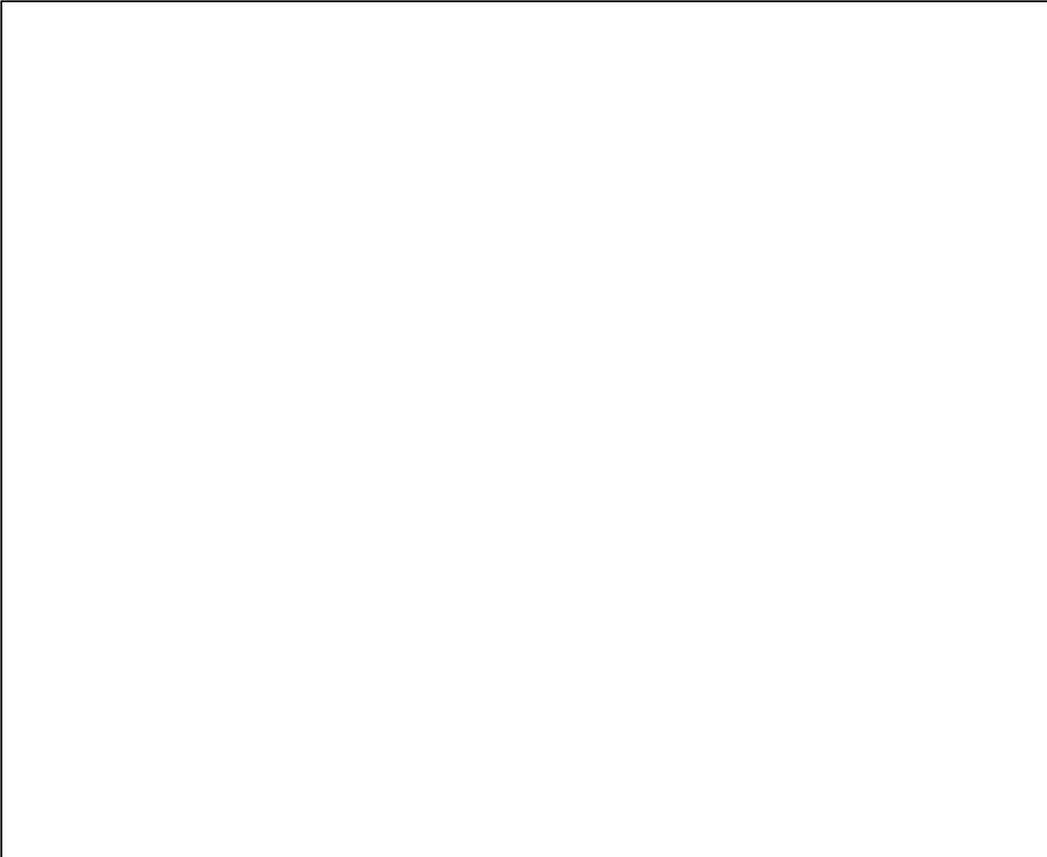
- Activate the test mode
- Set up backlight and contrast
- Test buttons, faders, wheels
- Monitor Orange LED





## Hands on ✍️ Download Firmware

- Activate the bootloader (manual / jumper / software).
- Start the firmware program.
- Download code.





## Questions

???

