UPAMD™/P1823™ Potential Goals

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UPAMD™ Goals

- General Goals
- Connector Goals
  - Connector Options
- Communications Goals
  - Communications Options
- Power Goals
  - Power Options

UPAMD™ General Goals

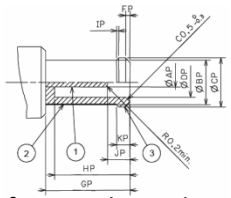
- Life expectancy of 10 years
- First adapter must work with last device and last adapter must work with first device, possibly with reduced capability.
    - Adapter<->Mobile Device communications required for safety.
    - Continuous communications growth to support growth of UPAMD.
- Must support non-battery powered devices
- Connector must not mate with any current designs – product Safety issue
- Consider future mobile device design options
  - Smaller profiles, headed for 10mm now 5mm later?
  - Different shapes: may not be on edge
- Must support changing battery storage technology.
  - Multiple battery technologies currently used and need to be considered.
  - Consider future power storage technologies
- Should UPAMD consider Adapter supply side issues
  - (input voltage/frequency safety standards, country specific issues?) – suggested as not being needed at this meeting.

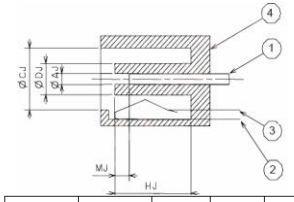
UPAMD™ Connector Goals

- Not compatible with any existing connector design
  - Equipment safety - Prevent damage
- Easy disconnect to prevent tripping – safety issue
  - What disconnect force as a function of angle?
- Capable of 10W to 130W
  - Contacts rated for currents to 9A?. Voltage Rated SELV?.
- Floating electrical connection, electrically isolated – Safety
  - No shock hazard under any conditions
- Very high connect – disconnect cycle capability – Many year usage
- Aesthetically pleasing
- Support lower profile devices
  - 10mm or less? iPad=13.4mm (to start with) 5mm goal?
  - other shapes and possibly flat surface connect
- Retention mechanism - Magnetic or Mechanical
  - Magnetic possibly good choice, Apple Patent 7,311,526 Needs LOA.
  - Several clip possibilities exist. New Ideas clearly welcome
- Positive and Negative connection with communication AC coupled
  - Assume multiple contacts for reliability and current sharing?
- Blind mate friendly - it possible
  - think of mating adapters and device alignment by feel in the dark
  - Easy docking station or charging station

UPAMD™ Connector Options

- Barrel Connector – TC100 proposed style
  - Advantages
    - Exists, History, IEC 61076-2-102 spec, cost?
  - Disadvantages
    - Big, not Aesthetically pleasing, No sources found, Safety trip hazard, moisture seal





AJ	CJ	HJ	DJ	MJ
1.45(+0.1)	7.0(+0.15)	8.0(-0.2)	4(-0.2)	1.5(+1.5,-1.0)

- Spring Loaded Contact Style – Adapter side

1.4(+0.1)	2.8(+0.1)	2.0(-0.3)	1.2(+-1.0)	2.2(+-1.0)	2.8	3.0(+-0.6)	2.8(+-0.1)	3.2(+0.1)	2.2(+-1.0)
Ab	Cb	Eb	Kb	Nb	Hb	Gb	Bb	Db	Ib

  - Advantages
    - Small Footprint, flat contact surface, good usage models, low cost to device, possible Flush mount on device, aesthetically pleasing, contact life >1,000,000 operations
  - Disadvantages
    - Latching mechanism, require pressure 300-500+ grams
- Edge Connector
  - Advantage
    - Direct extension of pc board, low cost edge connector
  - Disadvantages
    - Direct access to pcb, moisture seal, contact life
- Multi-pin Connector
  - Advantages
    - Separate power from control on different wires
  - Disadvantages
    - Cost, single orientation.
- Magnetic Induction coupling
  - Advantages
    - No contact coupling, no penetration of casing, cleanest design.
  - Disadvantages
    - Size of coil, position for good coupling. Field effect on surrounding parts at 130W, power transfer efficiency, modulation for communications. Interfere with other radio traffic from device.

UPAMD™ Communication Goals

- Use existing standards if possible.
  - CAN bus, RS422/RS485, USB, others?
- Differential signal communications
  - AC coupled on positive and negative power leads
  - Robust system – EMI, EMC, ESD
- Other communication schema?
- No Communications – No Power
  - Connector safe when disconnected – only communications signal present
  - No shock hazard, no possible damage to adapter
- Communications messages needed (starting thoughts)
    - "Any adapter present?" (probably connector pin)
    - "Who are you?": To adapter
    - "I am ___and my capability is ___": to device
    - "Supply power XX Volts YY mA max": to adapter
    - " Ready" or "not capable" : to device
    - " Start power": to adapter
    - "Status?": to adapter
    - "Status is ____" : to device
    - "STOP power supply": to adapter

UPAMD™ Communications Options

- Signaling
  - Extra wires with transformer coupling
  - Differential signals AC coupled to positive and negative power leads
- Protocols
  - CAN Bus
    - Advantages
      - Known protocol, very flexible, designed for control structures
      - Most small embedded controllers have it builtin
      - High growth potential
    - Disadvantages
      - Less well known
  - UART – RS422/RS485
    - Advantages
      - Low cost. Easy implementation, can support needed communications.
    - Disadvantages
      - Needs UART from host
      - Protocol development needed.
  - USB
    - Advantages
      - Ubiquitous, well known, many ports available.
    - Disadvantages
      - USB certification for modified protocols
      - Requires cooperation with USB-IF committee
      - Operation over differential power lines needs to be verified.
  - Ethernet – Ethernet over-power-line method
    - Advantages
      - Proven to work, also can connect for other communications
    - Disadvantages
      - Needs additional Ethernet port
      - Most expensive.
  - I2C/SMB; SPI; 1-Wire – probably difficult to implement
  - X-10 – not designed for DC

UPAMD™ Power Goals

- One connector fits all power needs
- Power Range 10W – 130W
- New Connector – Not inter-mateable with existing connectors – Safety issue for equipment
- Smart interconnect.
  - No power enabled without communications to adapter.

UPAMD™ Power Options

- 10 year Life Expectancy
  - Think ahead
  - Consider both as a battery charging and as a fixed power source
- Adjustable power Source
  - Adapter sets output voltage based on communications with device
  - Adapter sets maximum current limit based on communications with device
  - Good match for each user
  - Specify range from 5V to 45V. Power limited by connector current capacity.
    - Choice of 9A rated 0.050 spring loaded contacts with 2 per rail provides good margin 130W above 15V.
    - Possible options 5V, 12V, 13.75V, 20V, 24V, 36V, 42V, 48V.
    - Possible current limits: 1A, 3A, 5A, 10A. Or at specified mA rating 0-10000.
- Well regulated Fixed voltage
  - Tight regulation +/- 1-5% DC @ fixed voltage
    - consider cable losses and feedback loop
    - Battery chemistry driven?
    - No common voltage used.
      - 12V, 13.75V, 15V, 19V, 19.5V, 24V
      - Battery chemistry – NiCad, NiMH, Li-ion, Li-PO other exotics. New technology will probably be different
      - All devices seem to have internal regulators.
    - Battery voltages – laptops
      - 11.1 ,10.8, 14.8, 9.6, 14.4, 12, ……
- Semi-regulated bulk power
  - Bulk power ie 24V +/- 10 % (6A) or 45V +/- 10% (3A) @ 130W
    - Power delivery vehicle with point of use regulation
    - Regulator efficiency works
    - Lower Cost
    - Smaller wire size needed
    - Longer power cable allowed.
    - Higher voltage more efficient transfer.
    - Higher voltage smaller contacts.

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