Potential State Diagram for UPAMD/P1823
201103221100

Multiple Power Sources

State 300

V Pin > 3V

No Device Detected

Dumb Device 20W

State 100

V Pin < 3V

Dumb device detected

Port Classes

Class 1(0-F1) = Adapter, or Source of power.
Class 10 = Default Adapter/Source Class
Class 2(0-F2) = Device, or Power sink.
Class 20 = Non-Negotiable power sink/Device (Dumb Device)
Class 200 = Bidirectional power flow, capable of being sink or source.
Class 30 = Bidirectional power port
Class 32 = Bidirectional power port acting as power source
Class 34 = Power Distribution Hub and Docking stations
Class 5(0-F5) = Intermittent Sources – Solar, Wind, Human powered

Priority

Range 0.055 High to Low
Normal Priorities established by function.
Adapters/Sources start Priority 120
Priorities adjusted based on conditions

Available Power Message

Byte 0 = Max Power 0-255W
Byte 1 = Current Available Power 0-255W
Byte 2-3 = Available Power 0-65535 Watt Hours
Byte 4 = Priority Level
Byte 5 = Max Avail Voltage 0-63V 1/4V steps
Byte 6 = Port Class
Byte 7 = Request Message Number x

Requested Power Message

Byte 0 = Max Requested Power 0-255W
Byte 1 = Current Request Power Request 0-255W
Byte 2 = Minimum Power 0-255W
Byte 3 = Minimum Voltage Required 0-63V
Byte 4 = Priority Level
Byte 5 = Voltage Request 0-63V 1/4V steps(20Vnom)
Byte 6 = Port Class
Byte 7 = Request Message Number x

HeartBeat Message

Bytes 0-3 = Time stamp in IETF RFC 5905 NPT Short Timestamp format.
Byte 4 = Priority level (0-255)
Byte 5 = unused set to 00
Byte 6 = Device Class
Byte 7 = Message number request.

Message Numbers

0 = Fault message – 8 Bytes
1 = Available Power – 8 Bytes
8 = Requested Power – 8 Bytes
3 = Data Transfer Request – 5 Bytes
4 = Data Transfer – 8 Bytes
5 = Vendor Identification – 8 Bytes
6 = Model Number – 8 Bytes
7 = Device Serial Number – 8 Bytes
8 = Unique Identifier – 8 Bytes
9 = Manufacturer Date – 7 Bytes
10 = Software Version – 8 Bytes
11 = Firmware Version – 8 Bytes
12 = Heartbeat – 8 Bytes
13 = Timestamp NTP – 8 bytes
14 = UPAMD Version message – 8 Bytes
15 = Null message – 0 Bytes
16 = Load device power state – 8 bytes
17 = 31 Reserved for Future use

Class 1x, Device Set up Testing for attached devices goto State 4
Class 3x, 4x, 5x ports, if not attached, probe on 1 second basis
If attached to source capable device goto state 300; else continue goto state 4
Assume device disconnected.
Goto State 1
If CANH current between +/- 5ma and +/-30ma normal device attached,
Continue to State 5
If VCANH current >50ma set DumbDevice, Goto State 100
Supply communications power
Set Voltage to 12V (10-14V)
Set current limit to 25ma
Enable power
Wait 1 Second for device power control boot
Measure current usage
If Current <5ma set No Device goto State 1
If current >25ma = device shorted goto State 1
If 5ma <current>25ma = device attached goto State 6
Send power available message
//Set Current and Output Voltage/
// if (Requested Power <= Maximum Available Power)
& Max Avail Voltage >= Voltage Request { Current Available Power = Requested Power; Voltage Out = Voltage Request; Enable Power Out; Goto STATE9; } else if (Minimum Power > Maximum Available Power) { send NAK;

STATE 10 = Normal power delivery STATE. Responds to disconnect and power change requests.

While (Disconnect) { // Disconnect detected by no current in CANH line/method 2
If (OutputCurrent > (1.1*CurrentLimit)) // Over current condition possible short
BREAK; // Kill output and go back to STATE 1
}
Else If (CurrentPowerRequest != CurrentAvailablePower) {
NegotiateSourcePower(); // request changes in device power per source need
Continue; // Continue in White loop.
}
Else if (CurrentPowerRequest != LastPowerRequest) {
NegotiateSinkPower(); // determine new power demand from load device
LastPowerRequest = CurrentPowerRequest; // update last power request
Continue; // Continue in White loop.
}
Else if (VoltageRequest != CurrentVoltage) { // voltage request from device
NegotiateVoltage(); // if capable, meet device need – printer/workstation etc.
Continue; // Continue in White loop.
}
Else if (CurrentPowerRequest = 0) { // Device requesting timeout
Break; // end loop and kill output then to STATE 1
}
Else if (CurrentPowerRequest != 1) { // Device requesting sleep state
OutputCurrent = LowEnergyCurrent; // Set output current limit to 25ma
OutputVoltage = LowEnergyVoltage; // Set output voltage to 12V
Continue; // loop in current while loop state.
}
}
}
OutputCurrent = 0; // Set output current to zero
OutputVoltage = 0; // set output voltage to zero
DisableOutput(); // Kill the output
STATE100 = 20W mode power = 20V at 1A max.
OutputVoltage = LowPowerVoltage; // Set voltage to 20V
CurrentLimit = LowPowerCurrent; // Set current limit to 1A
EnableOutput(); // Turn on power
While (!Disconnect) // Disconnect detected by no current in CANH line (method 2)
    If (OutputCurrent > (1.1*CurrentLimit)) // Over current condition possible short
        BREAK; // Kill output and go back to STATE1
    
OutputCurrent = 0; // Set output current to zero
OutputVoltage = 0; // set output voltage to zero
DisableOutput(); // Kill the output
Goto STATE1; // goto starting state.

State100

Detected 20W Device

State1

Back to IDLE state

State4

Dumb Device Detection

State100

Input from State4

POWER APPLIED

State300

Switch Mode

State200

PWR ON

State201

State203

PWROK

State204

State205

State206

State207

State208

PowerAvailable < MinimumOperationalPower

PowerAvailable >= MinimumOperationalPower

Is Power OK?

Main Power Delivery Loop

Device/Sink Start
Determine CANH and CANL pin orientation and adjust
Entered when Communications power detected or
Entered when change in power direction from State300
Send power request message to source
If ACK received Goto State 201
If NAK received Goto State 200

Receive power available message from source.
Determine if power available is sufficient
for minimum operation of the device.
If yes device determines the use of the
available power and enables that power.
If no device sends message with minimum required
power and notifies user of insufficient power.
Wait for power available message from Source
Send ACK

Power Available > Minimum Power Required
Negotiate for higher voltage or power
Decide if able to operate
Start power converters in device

Exchange Device Information
Request Vendor ID
Request Model Number
Request Serial Number
Request Software Version
Request Firmware Version
Request EUI

Priority Level check
If My priority > Source Priority
    Continue to State206
If My priority <= Source Priority
    Goto State207

If Device Disconnect Request
Stop power converters
Request 0 power
Goto State205
If Device sleep/standby Request
Request 1 power
Goto State205

Device Requests More Power
Send requested power message
Receive available power message
If Available power <= current power
    Request power up to available power
    else if Max power is more than requested power avail
        Raise priority
        Request power and negotiate power
        use power granted
        continue

Make Power Available
Send power request message with lower power
Continue
Bidirectional Power Determination

State 300 Bidirectional

State 301

State 302

State 06 Source Entry

State 203 Sink Entry

Bidirectional Sink/Source
Entry from States 2 or States 3
Send Power Request Message
Send Power Available Message
Request Power Request message
If no response go to State 1
Compare Priorities
If local priority <= far end priority Goto state 301
If local priority > far end priority Goto State 302

Far End priority higher
determine status of far end
Adapt to need:
Change to source mode if needed
Change to sink mode for dynamic source
Enter source mode at State 6
Enter sink mode at State 203

Priority established - me
Determine need:
Direct priority need
Fill storage?
Standby?
Request device class change to other end.
Enter State 303

Become Sink to charge resources

Become Source

From finding safety power already applied or
from being a potential power supplier Class 010, 030, 031, 040

Send Power Request Message
Send Power Available Message
Request Power Request message
If no response go to State 1
Compare Priorities
If local priority <= far end priority Goto state 301
If local priority > far end priority Goto State 302