IEEE 802.3af DTE Power via MDI Detection and Signature Tutorial

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Outline

• Discovery Definition
• Basic Discovery Protocol
• Proposal Matrix
• Summary of Proposals
• Comparative Cost Matrix
Discovery Definition

Discovery =

Detection Mechanism at Power Source End

+ 

Unique Electronic Signature at Appliance Needing Power
Discovery Goals

- **Protect Equipment**
  - Legacy
  - New
  - 802.3af Sources and Appliances
    - Limit power to $I_{\text{min}}$, $I_{\text{max}}$
    - detect shorts, opens, some parallel loads

- **Serve 802.3af Equipment**
  - Provide power within expected limits
<table>
<thead>
<tr>
<th>Mode</th>
<th>AC</th>
<th>DC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Differential</strong></td>
<td>Modified Link Pulse vs FLP/NLP, Filtered,</td>
<td>-</td>
</tr>
<tr>
<td>(Transformer Coupled)</td>
<td>Binary Word Match[3]</td>
<td></td>
</tr>
<tr>
<td><strong>Common Mode</strong></td>
<td>Low-frequency Pulse, Binary Word Match[1,2]</td>
<td>-</td>
</tr>
<tr>
<td>(Transformer Coupled)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Common Mode</strong></td>
<td>Capacitor Voltage Ramp[7]</td>
<td>Resistor or Diode or Current Source[5,6]</td>
</tr>
<tr>
<td>(Direct Coupled)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Redesigned, keyed RJ-45 connectors were also proposed.[4]
Protocol at DTE and Source

**DTE:**

- **OFF**
  - Present Signature
  - \( V_L > V_{On} \)
- **ON**
  - \( V_L < V_{Off} \)
  - \( I_{min} < I < I_{max} \)

**Source:**

- **OFF**
  - Start
  - \( I > I_{max} \) or \( I < I_{min} \)
- **Probe**
  - Pass
  - \( I > I_{min} \) and \( I < I_{max} \)
- **On**
  - Reject
  - Imin< I< Imax

We make the things that make communications work.™
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Differential Mode, Transformer Coupled

Switch / DTE Detecting Station

End station DTE Requiring Power

Transmit

Rx

Receive

Tx

RC Filter

BROADCOM
Common Mode, Transformer Coupled
## Comparative Cost Matrix

<table>
<thead>
<tr>
<th></th>
<th>Differential AC</th>
<th>Common-mode AC</th>
<th>Direct Coupled</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inrush Limiting</strong></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td><strong>U-Controller</strong></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Imin/Imax limit</strong></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Opto-isolation</strong></td>
<td>Y/Y</td>
<td>Y/Y</td>
<td>Y/N</td>
</tr>
<tr>
<td><strong>C/R/L/Diodes</strong></td>
<td>5</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td><strong>Transformer</strong></td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td><strong>Relay</strong></td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>
Acknowledgments