Power Load Control
Over T1 Network To Daniels/Codan
MT4E Bases
Power Load Control Networks Basics:

• 1-way private paging networks constructed in the early 1990’s
  • Group Paging (1 to many) key feature
  • Typically - VHF Motorola NUC’s & PURC’s with Voting Simulcast

• Prevents Grid Overload by shutting off multiple devices for short periods of time.

• Ten’s of thousands of fixed placement switches control Air Conditioners, Water Heaters, Pool Pumps, etc..
  • Outdoor switches and indoor thermostats

• Analog & Digital Protocols
  • SA205, SA206, POSCAG

• Many Utility networks also support traditional devices
  • Pagers, Signage, Weather & Amber alerts

• Most Networks required to Narrowband
Problem Case:

- Replace a large Mid-Atlantic Power Utility’s 20+ year old, 75 site Motorola wideband paging transmitter network with modern components operating in narrowband.

- Replace and improve the existing Motorola voting simulcast system
  - Performed poorly due to aging components
  - Customer “timed” their network 2x per year due to uncertain outcome and random loss of site communication.
  - Known as “Auto Destruct Sequence” by Customer

- Maintain communications to the 1 million devices supported by the network during the entire process. **No Down Time!**

- Modernize Call Sign broadcasts to minimize network congestion
  - Improve network throughput wherever possible

- Required to use existing Link network (Microwave/Fiber) operating audio channel at -10dB

- Protocols supported:
  - SA205, GOLAY, POCSAG, FLEX
Transmitter Solution…

- Daniels 125 Watt VHF Transmitter:

  - Spectrum Instruments TM-4 GPS
  - Convex ADL
  - Zetron M66 Controller
  - Daniels Paging Modulator
  - Daniels MT4E Transmitter
  - Daniels System Regulator
  - Crescent PA
  - Daniels PS
Simulcast Solution...

- Convex CTU at Head end with Convex ADL’s at each transmitter site location.

- Provides **automatic timing synchronization** for all sites to a 1PPS signal generated by the CTU.
  - Each time the system is dormant for approx. 30 seconds, the ADL’s automatically re-sync to the CTU’s 1PPS signal

- CTU/ADL system provides auto-gain of +/-10dB of Link signal path.

- LAN port allows user to remotely monitor CTU/ADL performance, delay & other settings.

- Allows continuous behind-the-scene timing adjustments & optimization
Convex ADL Screenshot

<table>
<thead>
<tr>
<th>MAIN MENU</th>
<th>SETTING</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bulk Delay</td>
<td>4147 uS</td>
<td>300 to 700,000 uS</td>
</tr>
<tr>
<td>2. Automatic Delay</td>
<td>On</td>
<td>On / Off</td>
</tr>
<tr>
<td>3. Hold Delay</td>
<td>5000 uS</td>
<td>300 to 700,000 uS</td>
</tr>
<tr>
<td>4. Link Delay</td>
<td>853 uS</td>
<td>Measured</td>
</tr>
<tr>
<td>5. Threshold</td>
<td>+/- 5 uS</td>
<td>5.10 uS</td>
</tr>
<tr>
<td>6. Flat Gain</td>
<td>1.2 dB</td>
<td>-6.0 to +10.0 dB</td>
</tr>
<tr>
<td>7. Automatic Gain</td>
<td>On</td>
<td>On / Off</td>
</tr>
<tr>
<td>8. Level Ref.</td>
<td>-2.0 dBm</td>
<td>-20 to +4 dBm</td>
</tr>
<tr>
<td>9. Link Level</td>
<td>-2.2 dBm</td>
<td>Measured</td>
</tr>
<tr>
<td>10. Threshold</td>
<td>+/- 0.2 dB</td>
<td>0.1, 0.2 dB</td>
</tr>
<tr>
<td>11. Polarity</td>
<td>Normal</td>
<td>Normal / Inverted</td>
</tr>
<tr>
<td>12. Auto Polarity</td>
<td>On</td>
<td>On / Off</td>
</tr>
<tr>
<td>13. Input Level</td>
<td>Normal</td>
<td>Normal / High</td>
</tr>
<tr>
<td>14. Quiet</td>
<td>Normal</td>
<td>Normal / Quiet</td>
</tr>
<tr>
<td>15. Quiet Timeout</td>
<td>10 Min</td>
<td>None to 90 Minutes</td>
</tr>
<tr>
<td>Enter Menu Item to Change (1 to 15):</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
My Favorite Slide....
Results…

- All transmitters deployed with zero downtime
  - Used ADL with fixed delay settings to hold off Daniels and “sync” with existing Motorola transmitters.
  - Once all Daniels deployed – changed to “automatic” delay settings on ADL – and the system synced up beautifully.

- Drastically improved Simulcast Timing
  - Overlap coverage areas stronger
  - Overall network performance improved

- Narrowband accomplished without a problem
  - New narrowband pagers perform better on new system than wideband pagers on the old

- Was our Customer Pleased?
  - We received an order to build a second system with identical components
  - Replaced transmitters at their Nuclear Power Stations
  - We continue to work closely with customer…..and they keep buying!
Customer-Specific Innovations Developed For This Project:

- **Convex – 3 Firmware Updates**
  1. Add “Site Name” to ADL menu
  2. Add a Password for LAN access to ADL & CTU
  3. Improved LAN communications

- **Daniels/Codan**
  1. Developed a “Wideband / Narrowband” switch on Paging Modulator that allowed the unit to alternate from 25kHz to 12.5kHz at the flick of a switch.
     - Enabled quick field conversion to Narrowband
  2. Developed a “2-tone Trigger” that initiates required Station ID broadcasts from data stored within each transmitter rather than encoder.
     - Decreased ID Broadcast throughput by 95%

These Innovations Cost RFDS Zero Development $$
Mfr’s Now Offer These Innovations to Other Customers
Happy Customer Continues to Buy From Us!

Win/Win

***RF Demand Solutions, LLC***
Key Learning’s

• Convex
  • Take Care to ensure Data Polarity settings are consistent throughout network.
  • CTU 1pps test signal be set to send \(-1.0 \text{ dBm}\) test signal, and the gain of the link be adjusted to near 0 dB.
  • Ensure RF Design not too hot!
    • Insist on Propagation Map at project start
  • Don’t “over-poll” ADL/CTU performance. Units re-set and re-time each time you ask for status.
  • Use “Automatic” delay settings whenever possible

• Bring Manufacturer's into the Project
  • Requires a “trusting” relationship
    • Don’t allow Mfr’s to dictate Customer expectations
    • Ours DID NOT DICTATE– and everyone was happy
  • Produces best outcome for customer

• Partner with Customer
  • Make sure you’re exposed to all aspects of the project – even those that may not seem directly related to your equipment.
Manufacturer’s We Used In This Project:

• Daniels/Codan (transmitter, paging modulator)
• Convex/Simulcast Solutions (simulcast)
• Zetron (controller)
• Spectrum Instruments (GPS 10MHz Reference)
• Crescend (Power Amp)
• TPL (Power Amp)
• WiPath (Alarm Monitoring)
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Thank You