Substation Cellular WAN Solution

Bay 1 with Ethernet IEDs
- Transformer 1
  - BAT 802.11 Wireless Access Point
    - 802.11a/b/g
    - Built in IP routing, fast roaming, firewall
- Feeder 1
- Transformer 2
- Feeder 2
- BAT 802.11

Bay 2 with Serial IEDs
- Transformer 2
- Feeder 3
- BAT 802.11
- Feeder 4

Substation Control House
- DX940 Router/Terminal Server
  - 2x GE copper/fiber
  - 4x 10/100 copper/fiber
  - 4x serial RS-232/422
  - T1 WAN
  - Verizon 3G
  - AC/DC support

Verizon Wireless Cellular 3G

Magnum 10K/12K Managed Switch
- 10K: IEEE-1588v2, 36 ports, dual hot swap PS
- 12K: 16xGE, L2/L3
- IEEE 1613, IEC 61850

Magnum 6K Managed Switch
- IEEE 1613, IEC 61850
- Up to 32 ports 10/100/1000
- Copper/Fiber

TrayOptic Fiber Optic Cable
(Process Bus w/GOOSE and SV)

Modular Industrial Patch Panels
- Mix fiber and copper
- Serves same function as terminal block, but for Ethernet
- Up to 6 modules x 6 copper/fiber

Belden TrayOptic Fiber Cables
- Industrial
- Loose tube or tight buffer
- Industrial grade
- Armored options
- 12 fiber / 24 fiber

Belden UL 1277 Type TC cables
- Up to 50 conductors
- 18AWG – 4/0
- Shielded & Unshielded
- Armored options

UL 1277 Type TC Control Cable

Magnum 6K/10K/12K

Verizon Wireless Cellular

Magnum 10C Substation Computer
- Exceeds IEC 61850 and IEEE 1613
- Embedded Linux or Windows
- Dual Hot Swap PS
- No moving parts

DYMEC Media Converter
- Serial copper/fiber
- IEEE 1613 compliant
- AC/DC support

BAT 802.11

Industrial HiVision Network Management Software
- Topology recognition, Monitoring of any vendor network device that supports SNMP
- Event generation and alarming
- Windows and Linux support

Wireless HiVision

Verizon Wireless Cellular

DX940 Router/Terminal Server

Magnum 10C Substation Computer

Belden TrayOptic Fiber Cables

Belden UL 1277 Type TC cables

TrayOptic Fiber Optic Cable
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<th>Description</th>
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<tr>
<td><strong>ETHERNET SWITCHES</strong></td>
<td><strong>ORDER NO.</strong></td>
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<tr>
<td>Magnum 12KX L2 Managed Switch</td>
<td>12KXR-1L1POE</td>
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<tr>
<td>Magnum 10KT L2 Managed Switch</td>
<td>10KTP-HSPLL-TF</td>
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<td>Magnum 6K Managed Switch</td>
<td>6K32F-48V</td>
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<td><strong>ROUTER / TERMINAL SERVER</strong></td>
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<td>DX940 Router/Terminal Server</td>
<td>DX940-4FXSFP-H</td>
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<td><strong>WIRELESS</strong></td>
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<td>BAT Wireless Access Point</td>
<td>BAT54-F FCC</td>
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<td><strong>MODULAR INDUSTRIAL PATCH PANEL (MIPP)</strong></td>
<td>MIPP-JD-2S1P</td>
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<td><strong>SUBSTATION COMPUTER</strong></td>
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<td>Magnum 10C Substation Computer</td>
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<td><strong>MEDIA CONVERTERS</strong></td>
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<td>Dymec Media Converters</td>
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<td><strong>TRAYOPTIC FIBER CABLE</strong></td>
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<td>TrayOptic fiber cable – 12 fiber 62.5 micron</td>
<td>I601255</td>
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<td>TrayOptic fiber cable – 24 fiber 62.5 micron</td>
<td>I602455</td>
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<td><strong>CONTROL CABLES</strong></td>
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<tr>
<td>Belden UL 1277 Type TC Control Cable</td>
<td>27330A</td>
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<td><strong>NETWORK MANAGEMENT SOFTWARE</strong></td>
<td></td>
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<tr>
<td>Industrial HiVision, 25 nodes</td>
<td>943 156-025</td>
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**About this Configuration**
Retrofit for substations with all Ethernet options complying with NERC-CIP IEC-61850 and IEEE-1588, while enabling connection to existing serial devices. All Ethernet products are high speed and high throughput with redundant / resilient options. The multitude of switch options and power of Ethernet enables you to use one switch for all functions in smaller substations scaling to the very largest multi-switch substations on a single or multiple Ethernet networks for maximum design flexibility and efficiency.

**About The Products**
All products listed are from Belden Inc., and include Belden, Hirschmann and GarrettCom brands designed for extreme environments and mission critical communications. Not all possible configurations, products or options are listed, so contact your local Belden representative or distributor to more exactly match your application needs.

**About Industrial HiVision**
Ideally suited for auditing and monitoring network connections and throughputs, Industrial HiVision permits users to have realtime feedback from multiple switches regarding the network and link status.

**About Magnum 6K/10K/12K Managed Ethernet Switches**
Magnum managed Ethernet switches are specifically designed for power utilities in Smart Grid, featuring high port counts, advanced port configurability, and IEEE 1588v2 precision timing synchronization.

**About DX940 Router/Terminal Server**
Magnum routers and terminal servers are ideal for connecting existing serial devices to an Ethernet IP network. Multiple options exist for WAN connection, including cellular and T1.

**About BAT Wireless 802.11 Access Point**
In cases where a hard-wired connection is not feasible, the BAT wireless Ethernet access point is an ideal solution, supporting 802.11a,b,g,h, and n.

**About Magnum 10C Substation Computer**
Designed for substations, the 10C is resilient to power surges and other extreme environmental issues, to ensure mission critical applications on Linux or Windows run reliably.

**About Media Converters**
GarrettCom provides a full line of media converters, from simple Dymec serial to fiber media converters to copper to fiber Ethernet switches to protect signal integrity across the substation yard.

**About Modular Industrial Patch Panels (MIPP)**
MIPP patch panels are an economical and space efficient way to reliably terminate both copper and fiber signals in a single panel.

**About Belden Cables**
Over 70% of all signal transmission issues occur in the physical layer. All Belden cables are engineered to meet the demand of harsh environments to ensure reliable signal transmission with no loss in performance over the years it will be in operation.