



Solutions for the Solar Power Generation Industry

**Belden® Products Have
Been Designed To Meet
the Specific Needs of the
Power Generation Industry.**



Belden 'Connects' with the Power Generation Industry

If a Cabling system component or Ethernet switch fails in a power generation facility, disruptions in the flow of information or control signals in any type of power generation plant could lead to power outages.

The use of Belden switches, connectivity and cabling products in your coal, natural gas, petroleum, nuclear, hydroelectric, solar, wind or geothermal plant can help ensure that component failure and downtime problems do not occur.

Belden products have a proven reliability factor of 99.999% in all types of industrial settings.

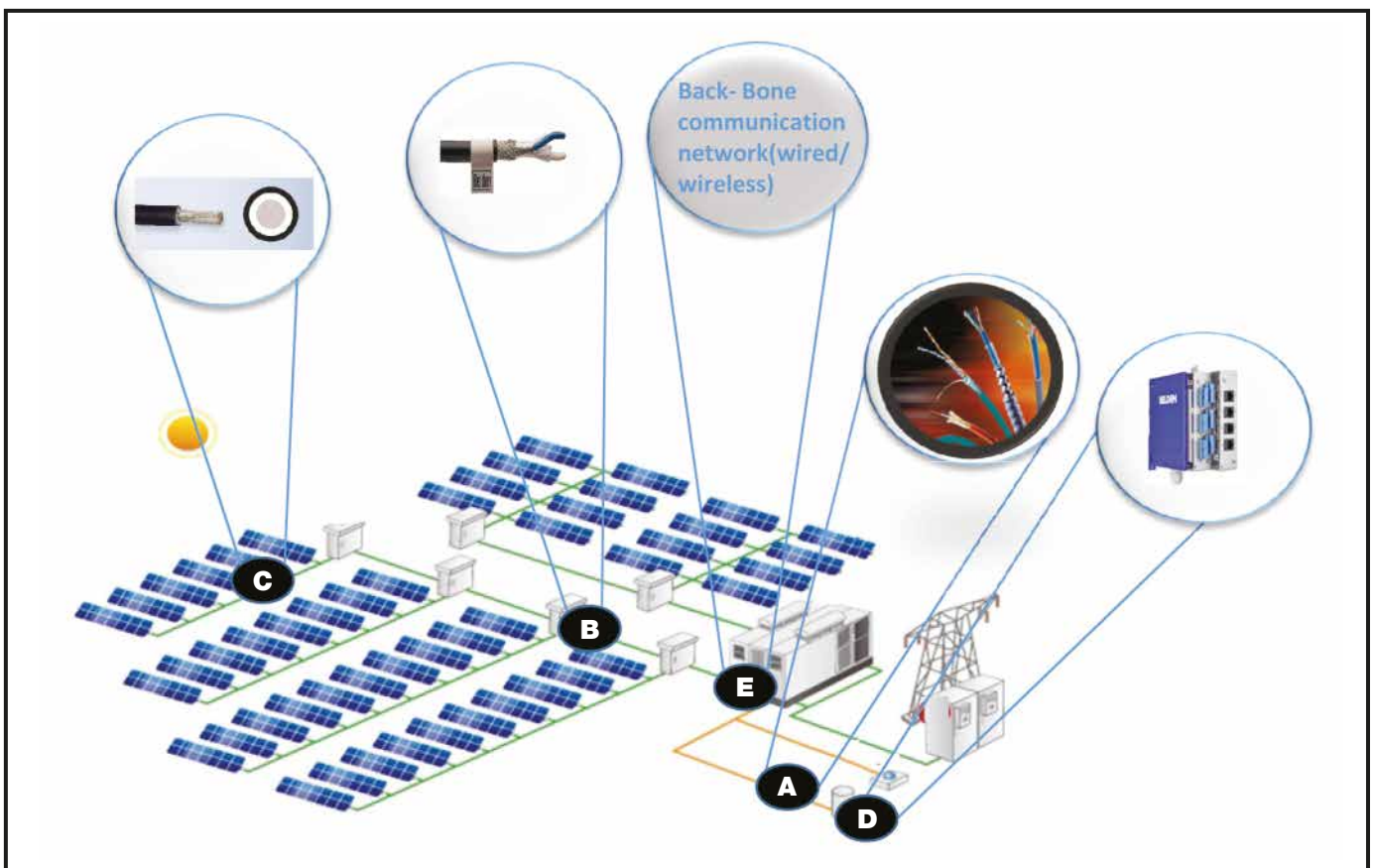
At one time or another, many switches and cabling systems in power generation installations may have to withstand the potentially destructive effects of extreme temperatures, humidity or moisture, dust, mud, oil and solvents, corrosive chemicals, abrasion, vibration and ultraviolet radiation from strong sunlight. These stressors can wreak havoc on the mission-critical networks tasked with conveying signals between measuring instruments and control devices.

To provide complete peace of mind, you need the type of reliability that only Belden can provide. Belden products are designed, manufactured and tested for

especially harsh or mission-critical environments. They are designed to give you maximum uptime and maximum peace of mind.

Belden provides an integrated solution for solar applications which includes:

- RS 485 Cable
- Solar DC Cables
- Industrial Ethernet networking products
- Fiber Optic, Industrial Grade UTP / STP Cables & Connectivity



A Belden-Fiber Cables



Belden Outdoor Rated Loose Tube Armored Fiber Optic Cables for Backbone communications.

Product Details

- Multi-mode (OM1, OM2, OM3 and OM4) and Singlemode (OS1, OS2) options
- Central Loose Tube and Multi Loose Tube Options
- LSZH and PE jacketed options with both Single Jacket and Double Jacket options
- CSTA / SWA / Interlocking (Armor) options which provides high Mechanical and Full Rodent Protection
- Jelly filled cable has special Non-Dripping and Silicon-Free Jelly. Multi Loose Tube cable has Dry Core
- Indoor / Outdoor Rated Cables with Operating Temperature Ranging from -30 to +70 Deg C
- Very High Tensile Strength up to 8000N (Installation) and Crush Resistance of 22kN/m (Installation)
- Belden standard warranty with more than 30 years of life

B Belden-RS485-Modbus Cable



Belden RS485 Communication cables for interfacing the String Monitoring Boxes.

Product Details

- Available in 1, 1.5, 2, 3, and 4 Pair options in 22 AWG and 0.50 sqmm
- Special Insulation to reduce capacitance to achieve longer run lengths and better Velocity of Propagation (78%)
- Beldfoil Shield (foil shield, 100% coverage) and TC Braid Shield to protect against RFI and EMI
- Armor option: Steel Wire, Corrugated Steel Tape, Steel Interlock, Aluminum Interlock, Continuous Corrugated
- UV resistant
- 120 Ohm Impedance as required for RS 485 Communications to achieve outstanding Return Loss characteristics
- Temperature range of -30 to +80 Deg C

C Belden-Solar DC Cables

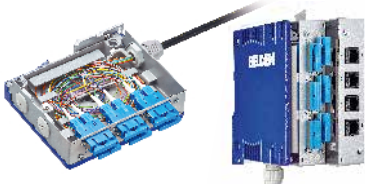


Belden Solar Cables interconnect solar panels and other electrical components of a Photovoltaic system.

Product Details

- Tinned Copper conductors as per IEC 60228, Class 5. Electron Beam Cross linked Polyolefin Insulation and Jacket
- Halogen Free Polyolefin compound to reduce toxic gases
- Fire Resistance: As per IEC 60332-1
- Smoke Density: As per IEC 61034; EN 50268-2
- TUV 2 PfG 1169 / 08.2007 (PV1-F) approved
- Voltage rating of U_o / U DC 900 / 1500 V and Maximum Permissible Operating Voltage (Conductor to Conductor) - DC 1800 V
- Wide Temperature Range: -40°C to +120°C
- Predicted life Time of more than 25 Years

D Belden-Modular Industrial Patch Panel (MIPP)



Belden's MIPP™ connects with Hirschmann industrial compact managed Ethernet switches and power plant controllers used in the field with individual devices.

Product Details

- Robust design of light weight, high strength metal housing
- Allows termination and patching of:
 - Up to 72 optical fibers
 - Up to 24 copper cables
- Option of all LC / SC / ST Fiber Connectors and Ethernet Copper Cat5e / Cat6 / Cat6A Shielded and Unshielded Jacks / Couplers fully loaded with adapter strips, splice tray and pigtails
- DIN rail (TS35 in EN 60715) or Wall Mount Plate as option
- Temperature range from -20°C to +70°C
- Predicted lifetime > 30 years
- UL 1863 certified

E BACK-BONE NETWORK- Conventional Wired Communication

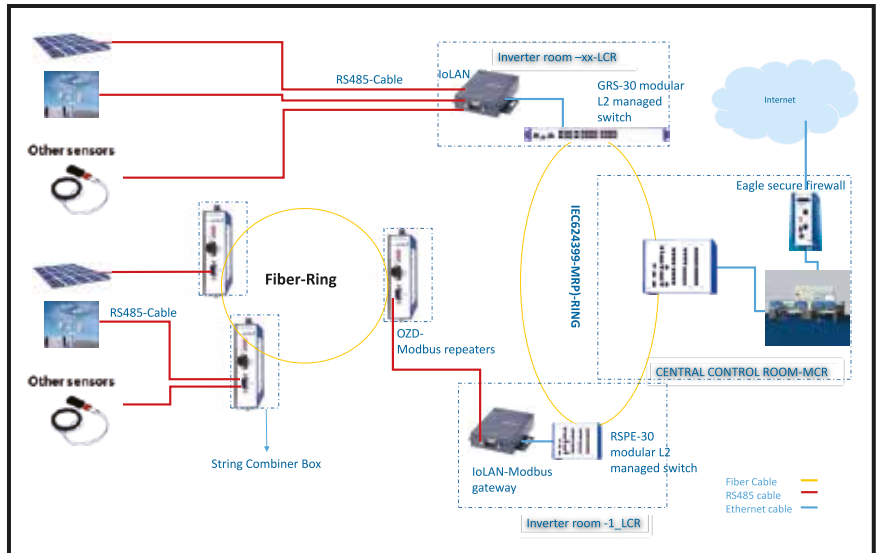
Hirschmann (A Belden Brand) Industrial Ethernet Switches integrate field level controllers, PLCs and other devices to the SCADA.

Hirschmann Industrial HiVision not only allows managed switches from Hirschmann to be monitored, but in fact any SNMP enabled device, irrespective of the manufacturer. In addition, the MultiConfig function enables multiple networks nodes to be configured quickly and consistently.

IO LAN Series of Hirschmann Product Range enable reliable connection of end devices with a serial interface to Ethernet networks.

OZD 485 repeaters by Hirschmann come with high fiber optic transmission capacity and remote maintenance function. These devices warn you before any malfunction occurs in your fiber optic network and constantly monitor status of the Network.

You may not be attacked by a serious hacker, but conventional control networks are extremely vulnerable to simple day to day security issues. Hirschmann Eagle Firewall helps to protect your control system against network problems and cyber threats.



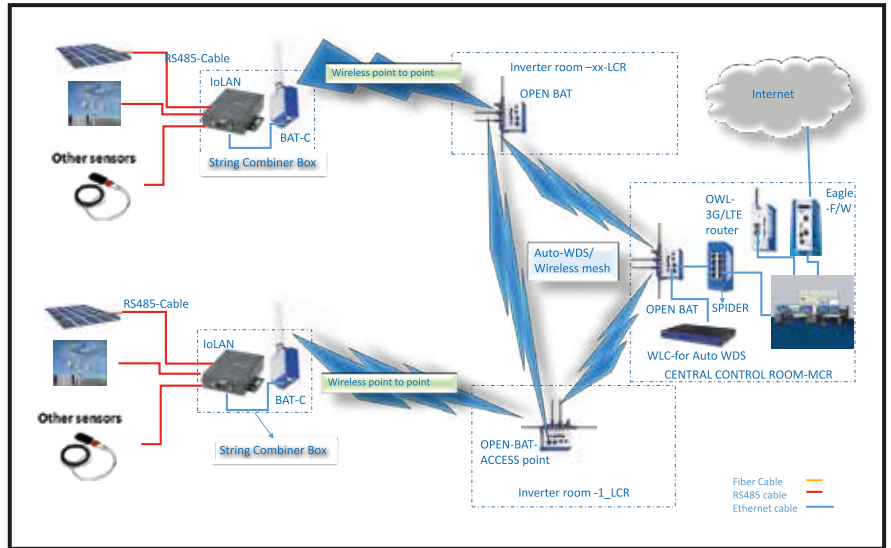
Conventional Wired Communication

E BACK-BONE Network - Wireless Solution

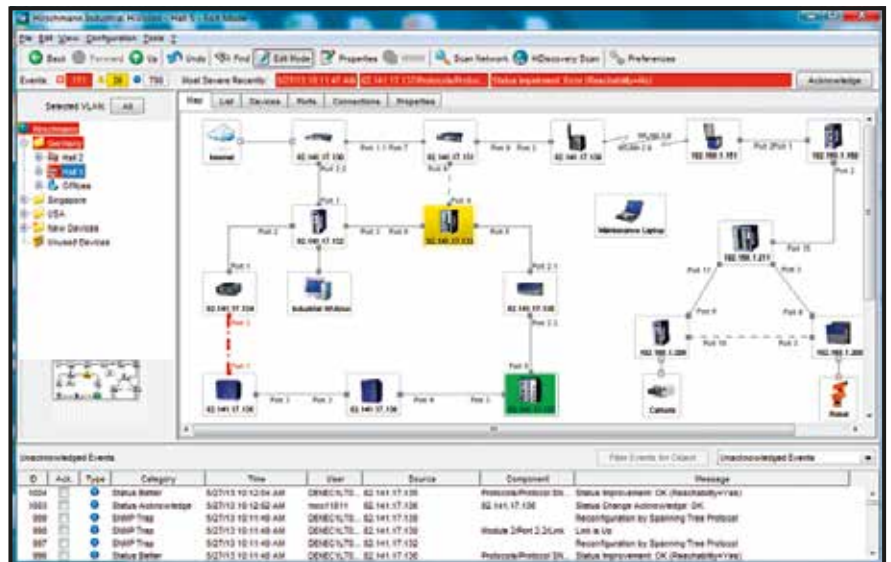
Hirschmann wireless products integrate field level devices to SCADA and maximize the use of wireless technology as a reliable, robust and secure network option.

Wireless Radios - Hirschmann OPEN-BAT & BAT-C

- BAT-family support latest wireless standards 802.11n which provide high bandwidth over wireless (150mbps by BAT-client & 450mbps by OPEN-BAT)
- HiLCOS - operating system provides secure wireless communication
- Automatic wireless distribution system (AutoWDS) provide high available mesh network over wireless
- Support PRP over wireless - High Reliable P2P Communication
- Wireless intrusion detection system & protective management frame (IEEE 802.11w) make sure secure connectivity over wireless
- HiLCOS has series of security features like WIDS, PMF and OKC
- State full packet inspection, VPN Firewall
- Series of approvals which includes IEC61850-3 approval. A mandatory approval for power generation & distribution.



Wireless Solution



Optional Hirschmann Industrial HiVision Network Management Software

Product Details

Layer 2 and Layer 3 Switches - RSPx & Greyhound Managed Switches



- Compact in size, Modular open slots for future proof design
- Protection against MAC Spoofing-Dynamic Port Security
- Dynamic Port Security
- DHCP Snooping
- Dynamic ARP Inspection
- IP Source Guard
- LDAP authentication mechanism
- ACLs (per Port or per VLAN) & Storm-Control (limiting Broadcast / Multicasts)
- Automatic Denial-of-Service Prevention
- RADIUS VLAN / Policy Assignment and Guest / Unauthenticated VLAN / MAC based VLAN assignment
- ACL flow based limiting
- < 5 msec recovery time by having DLR-ring technology
- Supports various Industrial Protocols - Modbus TCP, Profinet, Ethernet IP, IEC 61850. MMS Server exclusively for substation automation systems
- Support various redundancy protocols RSTP / MRP (IEC62439) / PRP / HSR (IEC62439-3) which are standard open protocols

Serial to Ethernet Converters - Hirschmann IOLAN



- Compact in size
- One device multiple applications (RS232 / 422 / 485 to Ethernet, Modbus gate way)
- EN61000 & EN55024 immunity protection class
- Different mounting options available

Modbus / RS485 Fiber Repeaters - Hirschmann OZD-485 devices



- Creates a ring and provides path redundancy in field level
- Fiber port supports both Multimode & Single mode fiber
- Rugged design to meet harsh environmental condition

Firewall - Hirschmann Eagle Series



- Product configuration via Serial Port or SSH, Web Interface, SNMP v3
- Routing functions: Static routing: Redundancy procedures: VRRP
- Security mechanisms: Stateful inspection, Packet filtering rules, Content inspection
- Operating temperatures: -40°C to +85°C
- Substation: EN 61850-3, IEEE 1613
- Safety: EN 60950-1, UL 60950-1, EN 61131-2 (Class 1 Equipment)
- Hazardous Locations: ISA-12.12.-01 Class 1 Div. 2
- Traffic Controllers: NEMA TS 2
- Radio Equipment: CE, FCC
- Hazardous Locations: ISA-12.12.-01 Class 1 Div.2

Industrial Cellular Router - OWL 3G



- Offering routing and secure remote access capabilities
- 2 x LAN ports 10 / 100BaseTX, RJ45
- 2 x SIM Card holders
- Web interface
- Open Linux platform

Cost Analysis – Wired vs Wireless

> Illustration of 15MW Plant <

String Combiner Boxes	110 Nos
Inverters	22 Nos
No of Inverter Rooms	6 Nos
No Of Control Rooms for Monitoring	1 Nos
Weather Station and Other Devices	

BOM – Wired Solution	Approximate Qty	BOM – Wireless Solution	Approximate Qty
24 Port Managed Ethernet Switches @ Control Room	7 Nos	Wireless Access Points	7
Serial to Ethernet Converters	110 Nos	Wireless Clients	15
Modbus Cable	15 km	Accessories	Antennas, Antenna Cables etc
No of LIU's	7 Nos	8 Port Switch	11Nos
Armored FO Cable, MM	2.5 km	Modbus Cable	5 km Approx
HDPE Conduct	2.5 km		

Savings up to 40% with Wireless

Benefits of Wireless Solution

- Replace all the field wiring like OFC cables, Ethernet cables that runs to your control room.
- No investment in conduits and accessories for communication cables, no costs for laying of cable & conduits and reduced time of installation.
- No need to invest on RS 485 repeaters if the distances are beyond 300-400 meters.
- No need to invest on fiber repeaters if the distances are beyond 700-800 meters.
- No fiber cable, No LIU and No splicing.
- No EMI / RFI problems and no packet drops on RS-485 communication with wireless solution.
- Control and monitor your complete plant network on wireless.
- IP 67 rugged industrial products designed to perform in any weather conditions.
- Proven solution for outdoor and harsh environments.

Why Belden??

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