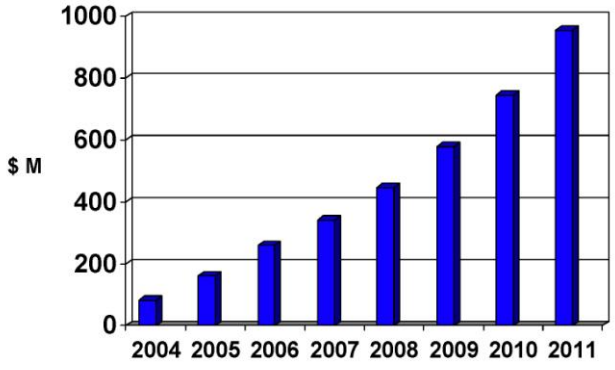
N-TRON

THE INDUSTRIAL NETWORK COMPANY

N-Tron Corporation

- N-Tron, Founded in Sept. 1999, is the #1 manufacturer of Industrial Ethernet Switches in North America
- Headquartered in Mobile, AL with operations in the U.S., Canada, EMEA, India and the Pacific Rim
- 500 Resellers & over 30,000 End Users in 75 Countries Worldwide
- Inc. 500|5000 ranks N-Tron as #36 of the top 100 high growth manufacturing companies in the U.S.
- N-Tron has been voted #1 provider of Customer Service for Industrial Network Switches by Control Design Magazine Readers (Putman Media).

Growth of the Industrial Ethernet Market



Source: ARC Advisory Group

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N-TRON's Target Vertical Markets

- Automotive
- Government/Military
- Metals and Mining
- Security
- Wastewater Treatment
- Marine
- Packaging
- Wind Turbine (#1 market Share)
- Food and Beverage
- Pulp & Paper
- Oil and Gas
- Manufacturing
- Power and Energy
- Chemical
- Warehousing & Distribution
- Transportation

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The N-TRON Difference

Specifications	Typical Commercial Switch with Fan Cooling	Typical Industrial Switch and Field Devices	Typical N-Tron Switch
MTBF Hours	25K	200K	2M
Vibration/Shock	1/5G	5/10G	50/200G
ESD/Overvoltage Protection	2KV	4KV to 6KV	16KV
Operation Temp	0°to 45°	-20° to 60°	-40° to 85°

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N-Tron IEEE 802.11 Industrial Wireless

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702 Wireless

- 40 to 70° C

1M Hour MTBF

200 G Shock/
50 G Vibration

Class I Div 2

16KV ESD Protection on
the RJ45 port

Dual 20-49 VDC or
PoE Input with 600
Watt Surge Protection

**Manufactured
in the USA**

802.11a,b,g,n
Up to 300Mbps

3x3 MIMO
Operation

AP or Station & Bridge
or Router Modes

Highest Power
& Performance

DHCP Server

WEP, WPA, WPA2
Security

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702 Wireless

- 40 to 70° C

1M Hour MTBF

200 G Shock/
50 G Vibration

Class I Div 2

16KV ESD Protection
on the M12 port

Dual 20-49 VDC or
PoE Input with 600
Watt Surge Protection

IP67 Rated Enclosure

**Manufactured
in the USA**

802.11a,b,g,n
Up to 300Mbps

3x3 MIMO
Operation

AP or Station & Bridge
or Router Modes

Highest Power
& Performance

DHCP Server

WEP, WPA, WPA2
Security

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802.11 Wireless
The N-TRON Difference

Specifications	Typical Commercial Wireless	Typical Industrial Wireless	N-Tron Industrial Wireless
Transmit Power	50mW	90mW	**250mW**
Receive Sensitivity	-66dBm	-82 dBm	**-97 dBm**
IEEE802.11 a,b,g,n	Yes	No	**Yes**
Operation Temp (°C)	0°to 40°	-20° to 55°	**-40° to 70°**
Regulatory Approvals	UL 1950 (Appliance)	UL 1604	**UL 1604, Class 1, Div 2,ABCD IEEE 1613 for Substation NEMA TS1/TS2 for Traffic Control**

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IEEE 802.11 Wireless Local Area Network Standards

Protocol	Release Date	Operating Frequency	Throughput Typical	Data Rate Maximum	Modulation Technique	Range (Radius Indoor) Depends, # and type of walls	Range (Radius Outdoor) Loss includes one wall
802.11a	1999	5.X GHz	23 Mbit/s	54 Mbit/s	OFDM	~35 meters	~120 meters
802.11b	1999	2.4 GHz	4.3 Mbit/s	11 Mbit/s	DSSS	~38 meters	~140 meters
802.11g	2003	2.4 GHz	19 Mbit/s	54 Mbit/s	OFDM	~38 meters	~140 meters
802.11n	2009	2.4 GHz 5.X GHz	74 Mbit/s	248 Mbit/s	MIMO SDM	~70 meters	~250 meters

OFDM = Orthogonal Frequency-Division Multiplexing
DSSS = Direct-Sequence Spread Spectrum Multiplexing
MIMO/SDM = Multiple-Input Multiple-Output / Spatial Division Multiplexing

Note 1 - 802.11g is backward compatible with 802.11b
Note 2 – 802.11n is backward compatible with 802.11a,b,g

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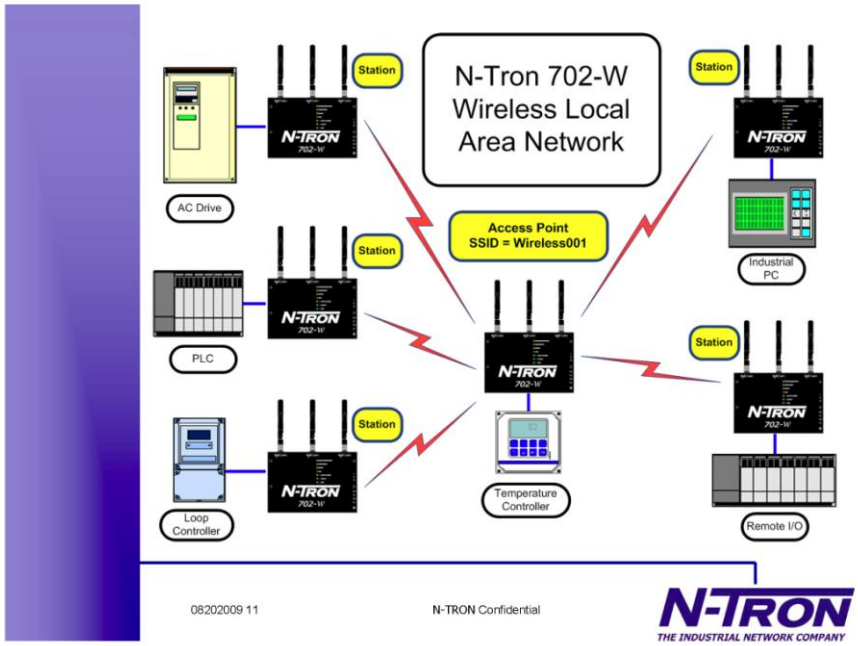
N-Tron 702-W
Wireless Local
Area Network
Access Point
SSID = Wireless001
Station
Station
Station
Station
Station
AC Drive
PLC
Loop
Controller
Temperature
Controller
Industrial
PC
Remote I/O
08202009 11
N-TRON Confidential
N-TRON
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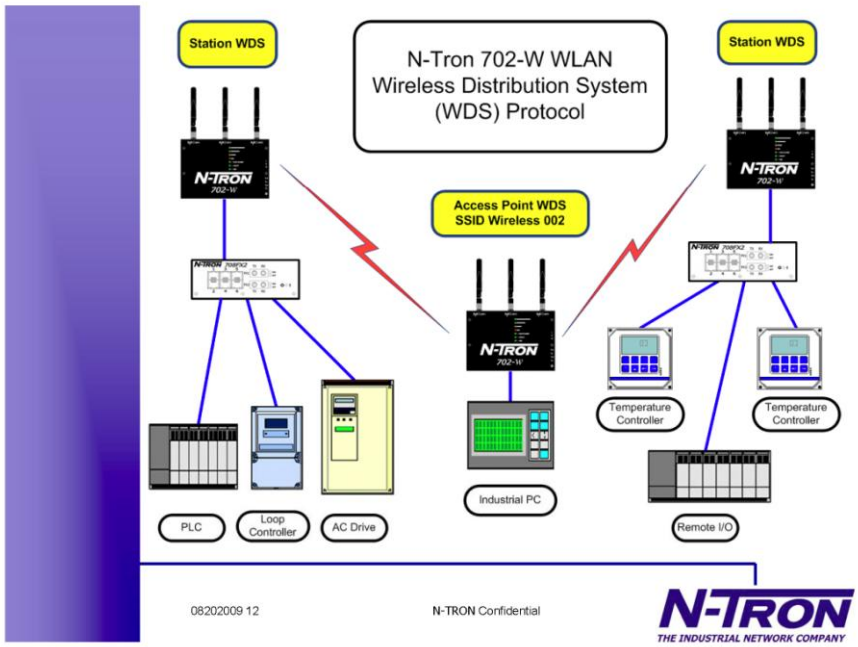
N-Tron 702-W WLAN
Wireless Distribution System
(WDS) Protocol
Access Point WDS
SSID Wireless 002
Station WDS
Station WDS
PLC
Loop
Controller
AC Drive
Industrial PC
Temperature
Controller
Temperature
Controller
Remote I/O
08202009 12
N-TRON Confidential
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Frequency Comparison 2.4GHz to 5.8GHz

Compare	2.4GHz	5.8GHz
Interference	Many devices use these Frequencies	Fewer devices use these frequencies
	Frequency spread between channels is small which leads to interference	Wider frequency spread between channels causes less interference
Maximum Radius Walled Office, Standard Antennas	~ 40 Meters	~ 20 Meters
Maximum Radius Open Room, Standard Antennas	~ 60 Meters	~ 30 Meters
Maximum Radius Outdoors, Standard Antennas	~ 200 Meters	~ 100 Meters
Maximum Radius Outdoors, Omni Antennas	~ 600 Meters	~ 280 Meters

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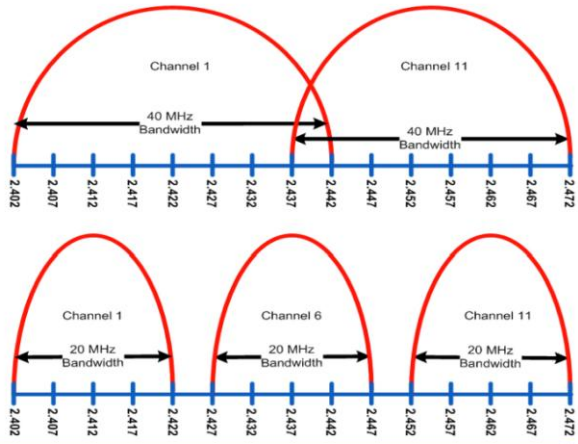
2.4 GHz Channel Allocation at 20MHz and 40MHz Bandwidth



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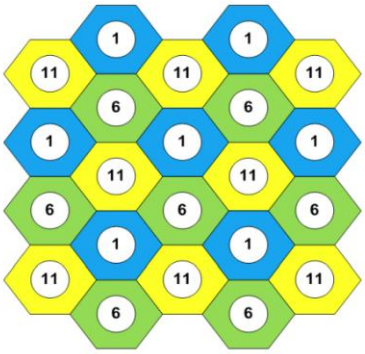
Two Dimensional Access Point Channel Planning Layout for a 2.4GHz Wireless Extended Service Set

Channel Number	Frequency (GHz)
Channel 01	2.412
Channel 02	2.417
Channel 03	2.422
Channel 04	2.427
Channel 05	2.432
Channel 06	2.437
Channel 07	2.442
Channel 08	2.447
Channel 09	2.452
Channel 10	2.457
Channel 11	2.462
802.11b,g,n 20 or 40 MHz Channel Separation	

Coverage Area 20 MHZ Separation



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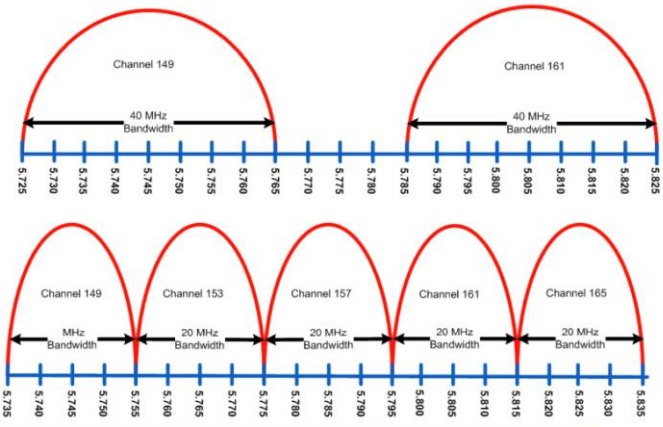
5.8 GHz Channel Allocation at 20MHz and 40MHz Bandwidth



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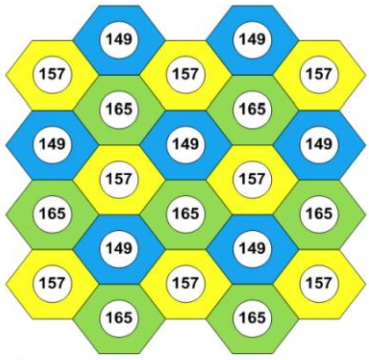
Two Dimensional Access Point Channel Planning Layout for a 5.8GHz Wireless Extended Service Set

Channel Number	Frequency (GHz)
Channel 149	5.745
Channel 153	5.765
Channel 157	5.785
Channel 161	5.805
Channel 165*	5.825
802.11a,n 20 or 40 MHz Channel Separation	

* Channel 165 is not available if 40MHz band width is used.

Coverage Area 20 MHZ Separation



Note - Channel 36,40,44,48,52,56,60,64 are not supported by N-Tron

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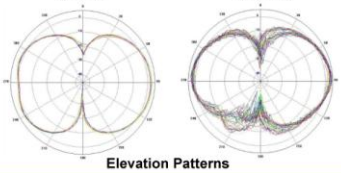
Omni Directional Antenna Range & Radiation Patterns

Range Estimates *

	2.4 GHz		5.8 GHz	
Antenna Gain	2dBi	2dBi	4dBi	4dBi
Throughput	26MBps	100MBPS	26MBps	100MBPS
Distance (Miles)	1.35	0.12	0.81	0.07
Distance (kilometers	2.18	0.194	1.3	0.116
TX Power	22dBm	15dBm	22dBm	15dBm
Receive Sensitivity	-91dBm	-77dBm	-90dBm	-76dBm
Number of Antennas	2	2	2	2

* Range estimates are theoretical

2.4GHz 5.8GHz



Elevation Patterns

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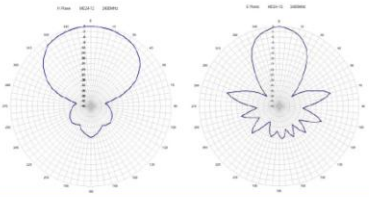
Directional Antenna
Range & Radiation Patterns

2.4 GHz Mini Directional

Range Estimates *

Throughput	26Mbps	100Mbps
Distance (Miles)	4.37	0.82
Distance (kilometers)	7.04	1.32
Tx Power	20dBm	15dBm
Receive Sensitivity	-88dBm	-77dBm
Number of Antennas	1	2

* Range estimates are theoretical



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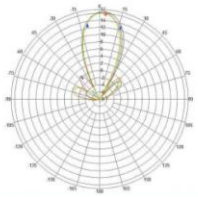
Directional Antenna
Range & Radiation Patterns

2.4 GHz Flat Panel

Range Estimates *

Throughput	26Mbps	100Mbps
Distance (Miles)	6.9	2.05
Distance (kilometers)	11.15	3.31
Tx Power	20dBm	15dBm
Receive Sensitivity	-88dBm	-77dBm
Number of Antennas	1	2

* Range estimates are theoretical



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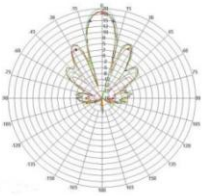
Directional Antenna
Range & Radiation Patterns

5.8 GHz Flat Panel

Range Estimates *

Throughput	26Mbps	100Mbps
Distance (Miles)	7.7	1.2
Distance (kilometers)	12.41	1.96
Tx Power	20dBm	15dBm
Receive Sensitivity	-87dBm	-76dBm
Number of Antennas	1	2

* Range estimates are theoretical



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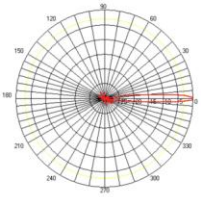
Directional Antenna
Range & Radiation Patterns

5.8 GHz Parabolic

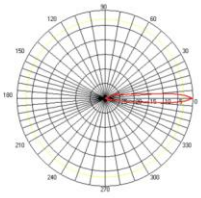
Range Estimates *

Throughput	26Mbps	100Mbps
Distance (Miles)	36.74	14.63
Distance (kilometers)	59.12	23.53
Tx Power	20dBm	15dBm
Receive Sensitivity	-87dBm	-76dBm
Number of Antennas	1	2

* Range estimates are theoretical



EPlane – Vertical / Elevation



HPlane – Horizontal / Azimuth

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Wireless Industrial Network Applications Examples

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1) Automotive Assembly Parts Delivery & 2) Wind Energy Topologies

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Case Study: Automotive Industry

The automotive industry has begun to deploy wireless technology in their plants and is beginning to reap its inherent benefits, including:

- Cabling cost reduction
- Ease of installation
- Real time data requirement
- Equipment mobility

Case Study: Automotive Industry

In a recent installation a major automotive manufacturer selected the N-TRON 702-W wireless Ethernet radio to establish communication between the factory production and scheduling systems, the warehouse parts delivery system, and the automatic guided vehicles used to deliver parts to the assembly line.

REV 05/24/2010

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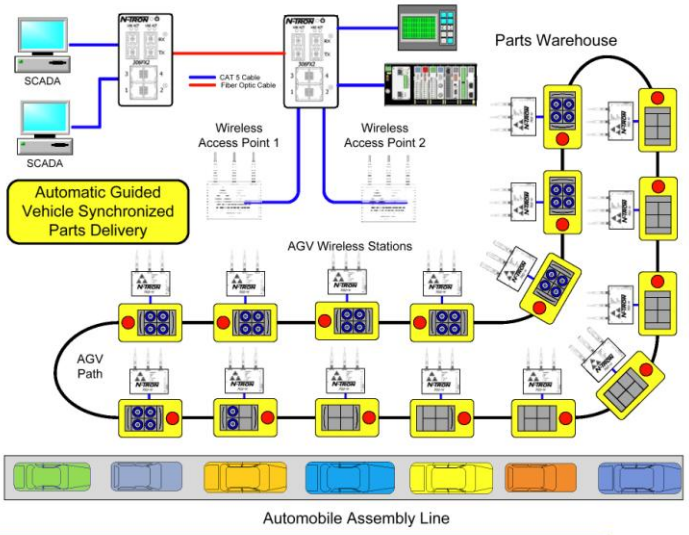

REV 05/24/2010

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Case Study: Automotive Industry

The electrical noise, extreme vibration and temperature requirements, along with the data bandwidth requirements of this application are well beyond the capacities of most wireless equipment currently available in the market. The N-TRON 702-W IEEE 802.11n wireless device with three antennas Multiple-Input Multiple-Output / Spatial Division Multiplexing (MIMO/SDM), however, was able to handle both the environmental and bandwidth requirements of this application.

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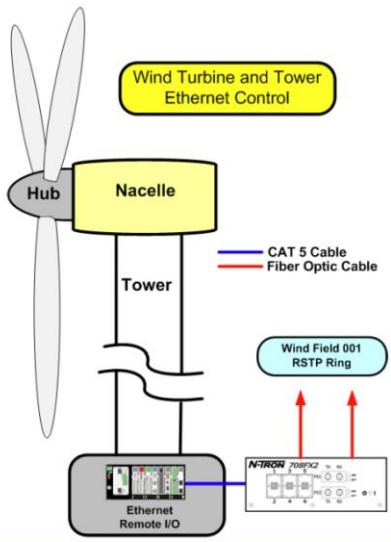
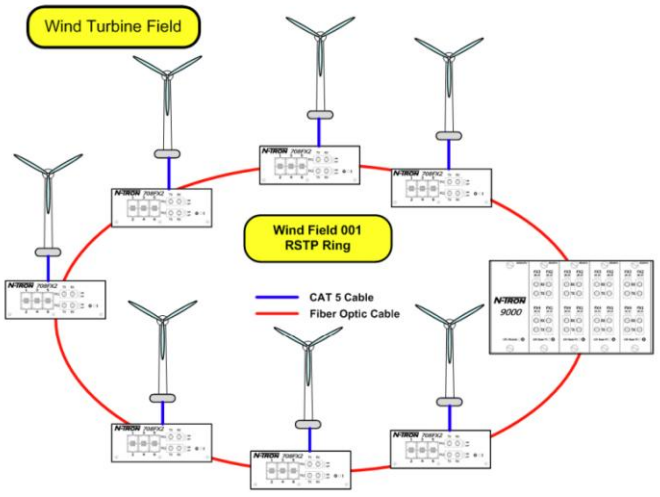
Wind Energy Topologies





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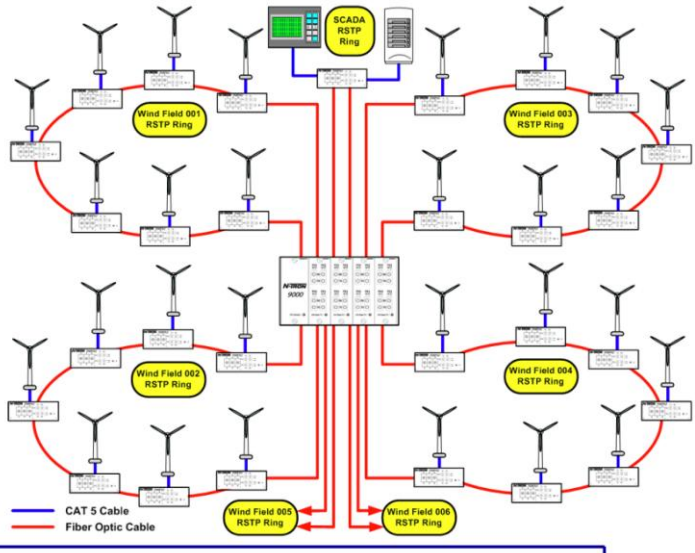

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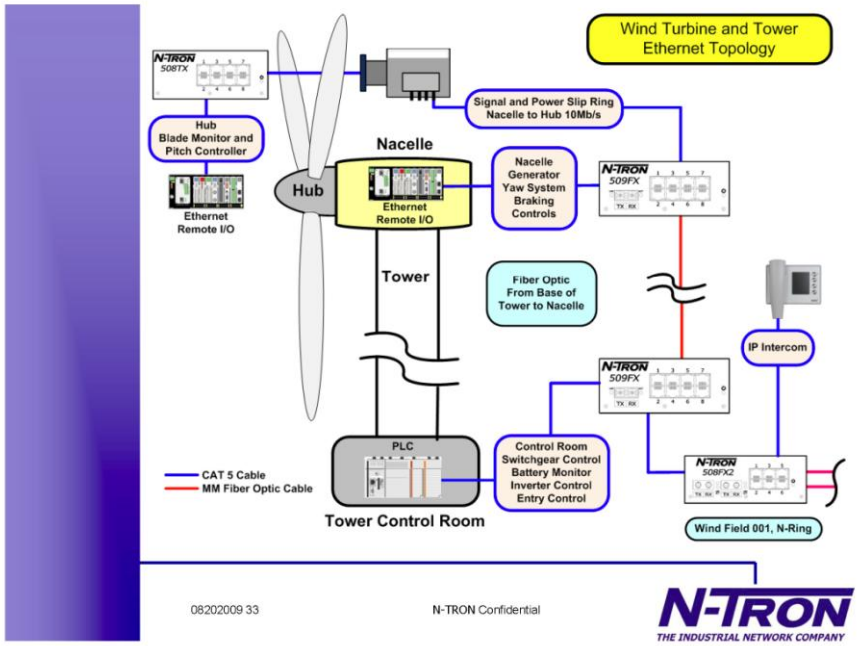
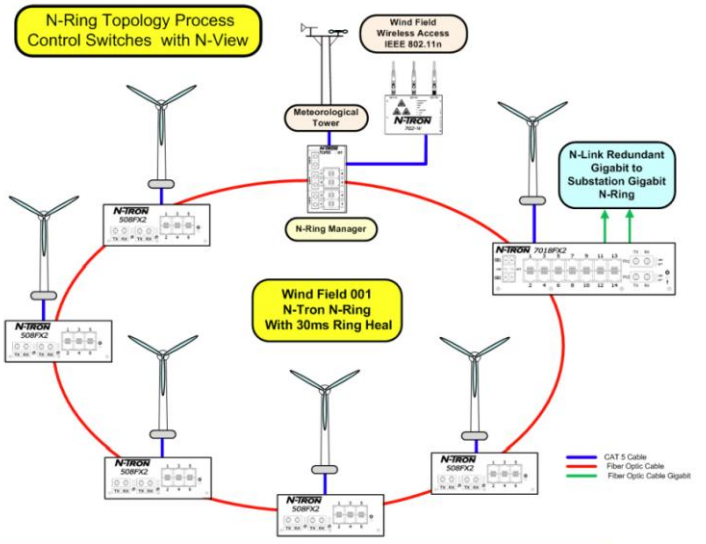
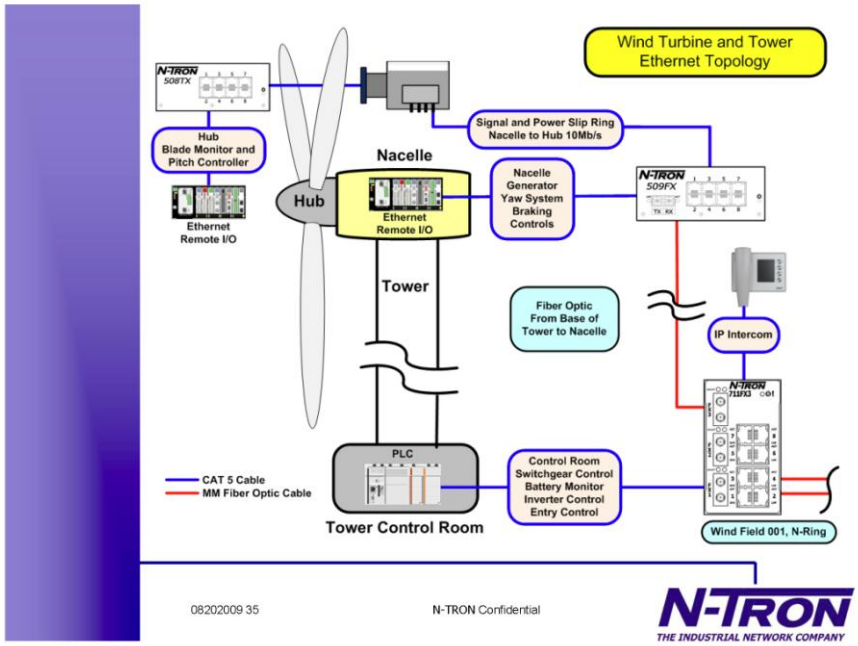

Wind Turbine and Tower Ethernet Topology
N-TRON 508TX
Hub Blade Monitor and Pitch Controller
Ethernet Remote I/O
Hub
Nacelle
Ethernet Remote I/O
Signal and Power Slip Ring Nacelle to Hub 10Mb/s
Nacelle Generator Yaw System Braking Controls
N-TRON 509FX
Tower
Fiber Optic From Base of Tower to Nacelle
IP Intercom
N-TRON 509FX
N-TRON 508FX2
PLC
Control Room Switchgear Control Battery Monitor Inverter Control Entry Control
CAT 5 Cable
MM Fiber Optic Cable
Tower Control Room
Wind Field 001, N-Ring


N-Ring Topology Process Control Switches with N-View
Wind Field Wireless Access IEEE 802.11n
Meteorological Tower
N-Ring Manager
N-Link Redundant Gigabit to Substation Gigabit N-Ring
Wind Field 001 N-Tron N-Ring With 30ms Ring Heal
N-TRON 508FX2
CAT 5 Cable
Fiber Optic Cable
Fiber Optic Cable Gigabit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Control Room Switchgear Control Battery Monitor Inverter Control Entry Control
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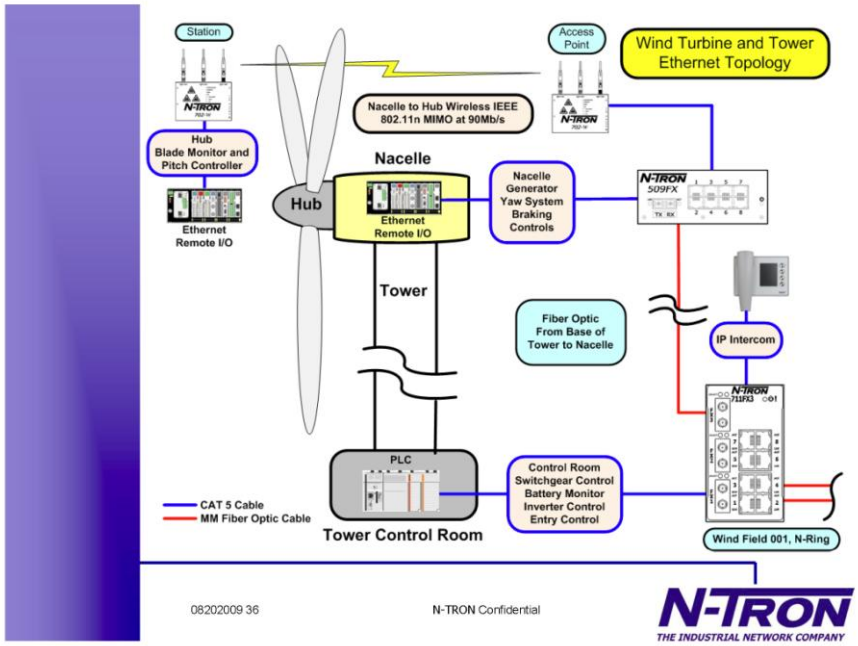
Wind Field 001, N-Ring


Station
Access Point
Wind Turbine and Tower Ethernet Topology
Nacelle to Hub Wireless IEEE 802.11n MIMO at 90Mb/s
Hub Blade Monitor and Pitch Controller
Ethernet Remote I/O
Nacelle
Hub
Ethernet Remote I/O
Nacelle Generator Yaw System Braking Controls
N-TRON 509FX
Tower
Fiber Optic From Base of Tower to Nacelle
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Control Room Switchgear Control Battery Monitor Inverter Control Entry Control
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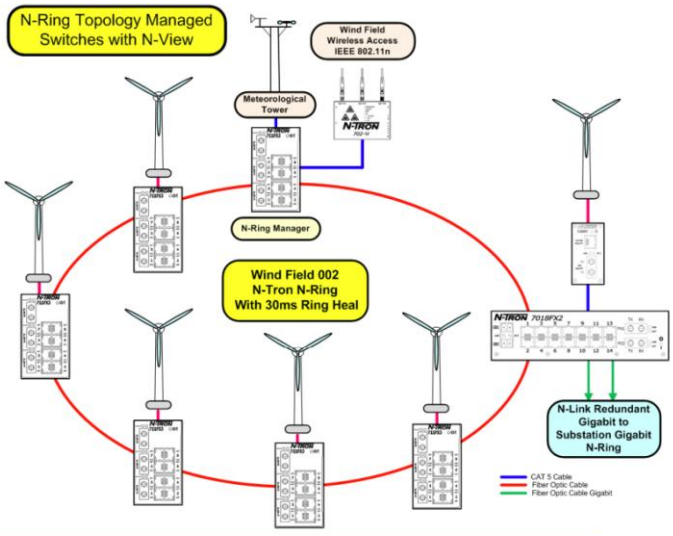
Tower Control Room
Wind Field 001, N-Ring



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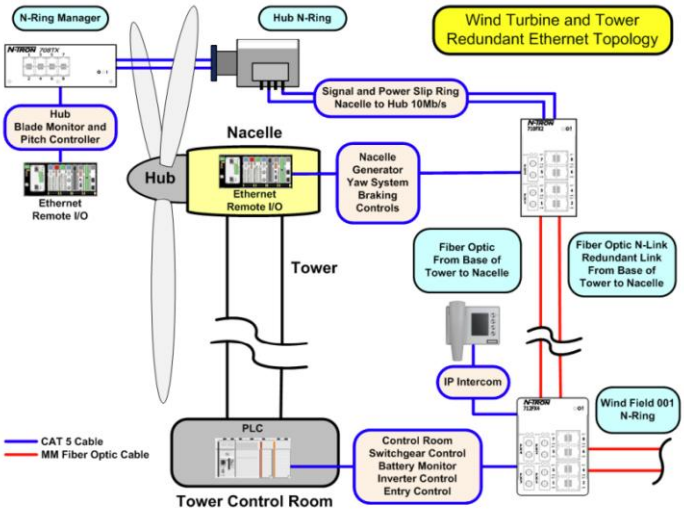

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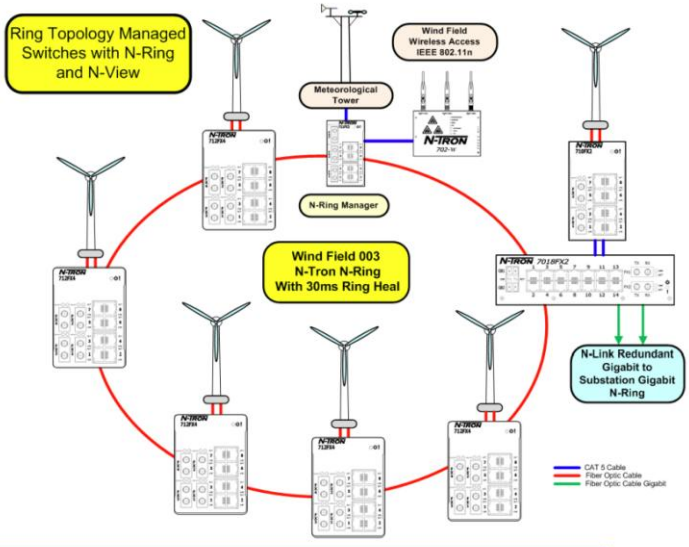
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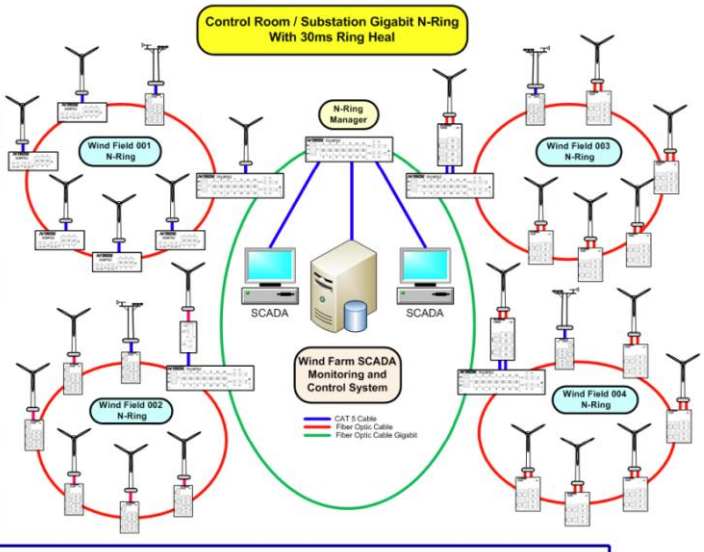
Control Room / Substation Gigabit N-Ring With 30ms Ring Heal
N-Ring Manager
Wind Field 001 N-Ring
Wind Field 003 N-Ring
Wind Field 002 N-Ring
Wind Field 004 N-Ring
SCADA
SCADA
Wind Farm SCADA Monitoring and Control System
CAT 5 Cable
Fiber Optic Cable
Fiber Optic Cable Gigabit

Why use N-TRON?

SUPERIOR:

- Products
- Support
- Value