⚠ **WARNING** All health and safety procedures and recommendations must be followed as detailed in the Horizon Compact User Manual.
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Mechanical

Radio/Modem (no antenna)	12 x 23.6 x 23.6 cm; 4.8 kg 4.75 in x 9.3 in x 9.3in; 10.6 lbs
Antenna Wind Loading	112 kph (70 mph) Operational 200 kph (125 mph) Survival
Antenna Mount Adjustment	± 10° Azimuth; ± 25° Elevation

Power, Connections, Payload

Operating Temperature (SP)	-40°C to + 50°C (-40°F to +122° F)
Humidity	100 % Condensing
Input	-36 VDC to -60 VDC (-48 VDC nominal), 110/240 VAC (Opt.)
Consumption (per link end)	20 Watts (low power), 47 Watts (high power variant)
Power	-48V, Power on Ethernet (PonE) copper interface
Payload (+ Inband NMS)	Shielded RJ45 or optical LC, 1000/100/10 BaseT
NMS (when out-of-band)	Shielded RJ45
Latency 100 BT / GigE	**FastE:** <400μs, Typical <200μs **GigE:**<200μs, Typical 120μs
Frame Size	64 to 1600 Bytes, up 9600 (GigE Mode)
Flow Control	Yes (GigE mode only)
802.1p / 802.1q	Yes – 8 levels served by 4 queues / Yes
T1 / E1 / DS3	Yes – Using APX-104E (T1/E1)/APX-108E(T1/E1)/APX-DS3
Modulation Shifting	Current to Lowest – 1 – 2 seconds

Network Management (NMS)

SNMP	SNMP Traps, Enterprise MIB, SNMP v1, v2 and v3
EMS	Web Based Management System, SSL, HTTP,SSH, Radius

Throughput, Channel BW, Tx Power, Rx Sensitivity

Modulation	50 MHz			40 MHz		
	Throughput Mbps	TX Power dB	RX Sensitivity dB	Throughput Mbps	TX Power dB	RX Sensitivity dB
QPSK	67	17/27	-81	58	17/27	-81
16 QAM	110	14.5/24.5	-78	110	15/25	-75
32 QAM	171	14/24	-73	143	13/23	-74
64 QAM	215	12.5/22.5	-69	181	10.5/20.5	-70
128 QAM	271	11/21	-66	212	10/20	-67
256 QAM	322	11.5/21.5	-60			
256 QAM	371	9.5/19.5	-60	277	9.5/19.5	-61

Modulation	56/55 MHz			30 MHz		
	Throughput Mbps	TX Power dB	RX Sensitivity dB	Throughput Mbps	TX Power dB	RX Sensitivity dB
QPSK	65	17/27	-80			
16 QAM	111	14.5/24.5	-77	107	13/23	-75
32 QAM	216	11/21	-72	128	12.5/22.5	-72
128 QAM	290	10.5/20.5	-66	165	11/21	-68
256 QAM	385	9.5/19.5	-60	212	9.5/19.5	-62

Modulation	28 MHz			14 MHz		
	Throughput Mbps	TX Power dB	RX Sensitivity dB	Throughput Mbps	TX Power dB	RX Sensitivity dB
QPSK	37	17/27				
QPSK	48	13.5/23.5	-82	23	13.5/23.5	-85
16 QAM	71	13/23	-79	36	13/23	-82
32 QAM	100	11/21	-75	47	13/23	-78
128 QAM	144	10.5/20.5	-69	70	10.5/20.5	-72
256 QAM	190	9.5/19.5	-63	95	9.5/19.5	-66

Installation Requirements

Various installation kits are available. Use the following key to build the desired kit part number:
INK=Installation Kit; HCN=No Connectors or Cables; HCC=Copper Connectors, Out-of-Band Mgmt; HCI=Copper Connectors, In-band Mgmt; AC=Alternating Current; DC=Direct Current; AD=½AC ½DC; NA=N. America; EU=Europe; GL=Global; R1=Horizon Compact Release 1.

The following table lists examples of the most popular ordering configurations:

Part Number	Kit Description
A-INK-**HCN**-DC-GL-R1	DC Install Kit (Global), No connectors, No cables
A-INK-**HCC**-DC-GL-R1	DC Install Kit (Global), Out-of-band Mgmt Cables, 4 Glands, 8 shielded Enet connectors
A-INK-**HCN**-AC-NA-R1	AC Install Kit (N. America), No connectors, No cables
A-INK-**HCN**-AC-EU-R1	AC Install Kit (Europe), No connectors, No cables
A-INK-**HCI**-AC-NA-R1	AC Install Kit (N. America), In-band Mgmt Cables, 2 Glands, 4 shielded Enet connectors
A-INK-**HCI**-AC-EU-R1	AC Install Kit (Europe), In-band Mgmt Cables, 2 Glands, 4 shielded Enet connectors

Installation Requirements (Continued)

Installation kits include the following: 2 x PonE power/surge units
2 x Grounding Kits with cable and bolts
AC option – 2 x AC/DC power converter and cables
AC/DC Option – 1 x AC power adapter
In-band option – 2 x weather caps for unused Port 2

Cables

Shielded, outdoor rating, Cat5E cables are required. Recommended cable: Belden 7919A.

Cat5E cables may be supplied by the customer, or ordered from DragonWave.

Power cable: 2-wire 16 AWG
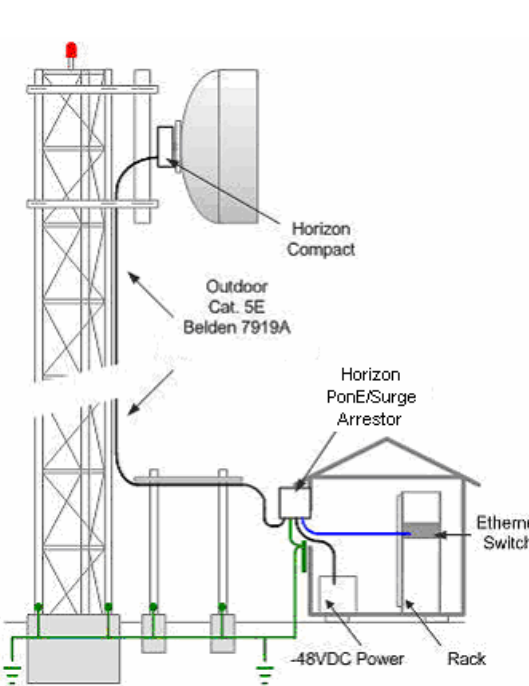
Mounting Masts and Twist & Sway

Minimim 2 3/8" OD thick walled (SKD-80) mast for 30 cm and 60 cm antennas.

Minimum 3" OD thick walled mast for 90 cm and 120 cm.

Minimum 4" OD thick walled mast for 180 cm.

Maximum twist is ½ of the beamwidth. +/- 1 degree for 30 and 60 cm antennas. +/- 0.5 degrees for larger antennas.

For more information on installation and cabling, refer to DragonWave Technical Note:
    HC-TN-001.0 Horizon PonE

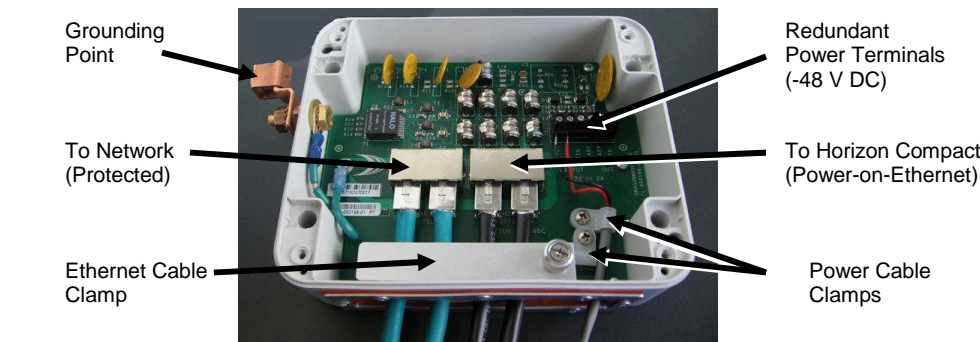## Grounding, Power and Lightning Protection

There are two grounding points available on each of the four sides of the Horizon Compact casing. Use 6 AWG wire (minimum) to connect the casing to ground.

Grounding points
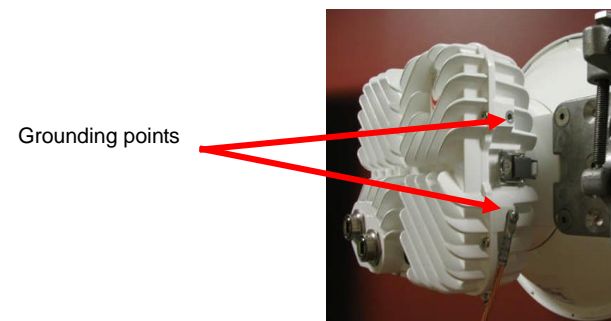
When configured with a copper interface, power and network connections are fed to the Horizon via a proprietary Power-on-Ethernet (PonE) power integrator and surge arrestor.

⚠ **WARNING** **DO NOT** connect the network to the RJ-45 connectors marked "TO HORIZON UNPROTECTED". Damage to switches or routers may result

The power integrator supports redundant -48 V DC power feeds and **protects the power supply and network from power transients created by lightning or other sources.**

Grounding Point
Redundant Power Terminals (-48 V DC)
To Network (Protected)
To Horizon Compact (Power-on-Ethernet)
Ethernet Cable Clamp
Power Cable Clamps

Ports

Port 1 carries traffic and optional in-band management, plus power when copper interface used.
Port 2 is for out-of-band management only, plus power feed when Port 1 has optical interface.
BNC Field strength monitoring port is for alignment purposes. Output is 1 mV DC per dB. Also used for redundancy switching applications.

Field strength Monitoring / redundancy switching port (BNC)
LED Indicators
Port 1 (DATA)
Port 2
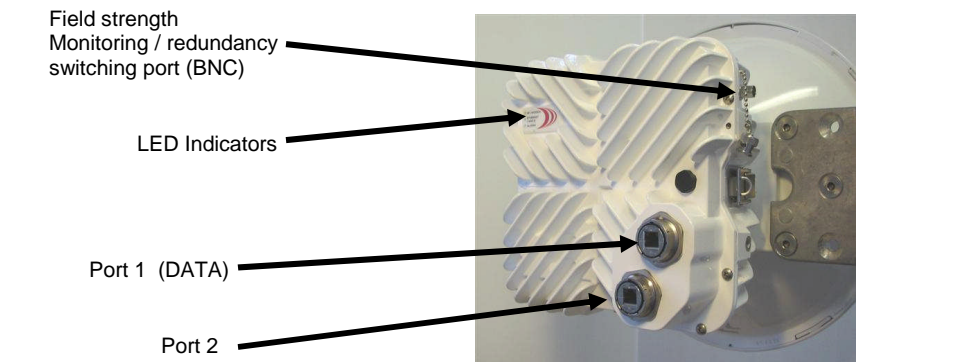
LED Indicators

Summary :	**Good Link** – all LED's GREEN (Ethernet 1 and 2 may be flashing GREEN)
	Loss of Sync – RF/Modem LED = RED blink
	Power off – RF/Modem LED = OFF

Details :
RF/Modem LED
OFF – No power
RED – Power on, system booting
Slow RED blink – RF off, no modem sync
Steady GREEN/Slow RED blink – RF on, no modem sync
Steady GREEN – RF on, modem in sync.
Ethernet 1 and 2
OFF – No network detected
Slow RED blink – Network detected on Port 2
Steady GREEN – Network detected on Port 1
Fast GREEN blink – Network detected on both Port 1 and Port 2
Alarm
OFF – No alarms
Slow RED blink – Active alarm

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Logging In

Super User: Default username is **energetic**   Default password is **wireless**.

Default IP Address**: 192.168.10.100** subnet mask 255.255.0.0

By default, management is through Horizon Compact Port 1 (in-band).

Configure your PC with the same IP address range and subnet.

Command Line Interface (CLI) Overview

The majority of commands begin with either **set** or **get**.

Context sensitive help: enter a partial command followed, or preceded, by "?".

Example 1: **set radio ?** returns a list of all commands that start with **set radio**

Example 2: **? radio** returns all commands that include the word "radio"

Pressing the Tab key after entering a partial command will complete that command

The up and down arrows (↑ and ↓) will recall previously input command lines (up to 20).

An unrecognized CLI entry will be acknowledged with **NAK**.

Once configuration changes have been completed, issue **save mib** command. Some changes require **reset system** to invoke changes. Resetting the system is traffic affecting.

Web Interface

Enter Horizon Compact IP address as the URL in Web browser to access Horizon Web interface.

Configuration Steps

1. Configure Radio Band   (example: fcc23_3_50 for 18 GHz Band 3. See Horizon label)
   a. **set radio band <radio band>**   (Web: Frequency and Port Configuration)
2. Configure System Mode   (channel bandwidth, speed, modulation)
   A limited selection of modes is available based on the radio band configured
   a. **set system mode <hcchannel bandwidth>_<speed >_<modulation>**
   b. Example: **set system mode hc50_110_16QAM**
3. **get system speed** to view current speed. **set system speed <speed>** to set different desired system speed
4. View available frequencies - **get frequency bank**
5. **Licensed installation** – Refer to regulatory license and configure assigned frequency
   Unlicensed installation – Configure either a "Go" or "Rt" frequency. One end of the link must be configured as "Go" and the other "Rt"
   a. **set programmed frequency <index>**
6. **Unlicensed only** – select antenna size (automatically sets the maximum allowed power)
   a. **get antenna size** to display available sizes and associated index
   b. **set antenna size <index>**
7. Set IP address, subnet mask, default gateway (for management of Horizon)
   a. **set ip address <nnn.nnn.nnn.nnn>**   (Web: IP Configuration)
   b. **set subnet mask <nnn.nnn.nnn.nnn>**
   c. **set default gateway <nnn.nnn.nnn.nnn>**
8. **save mib** then **reset system** – traffic affecting !

Advanced Configuration Parameters

There are a number of parameters that can be configured to provide advanced features:

Radius Server User Authentication	Adaptive Transmit Power Control	Timing Protocol (SNTP)
VLAN Tagging	Modem Authentication	Adaptive Modulation
802.1P Priority Tagging	Threshold Alarms	Radio Redundancy
Horizon Throughput Speed	Rapid Link Shutdown (RLS)	

For more information see the DragonWave Horizon Compact user manuals.

Antenna Alignment

Loosen the bolts clamping the mounting bracket to the post sufficiently to allow the mounting bracket assembly to be rotated on the post, or tower, by hand. Visually align with the far end installation. Use a compass or landmarks to verify the bearing where the opposite end is difficult to identify. When visually aligned, re-clamp the mounting assembly to the pole.

Elevation adjustment
Azimuth adjustment
Mounting clamp nuts
Lock nuts
Mounting clamp
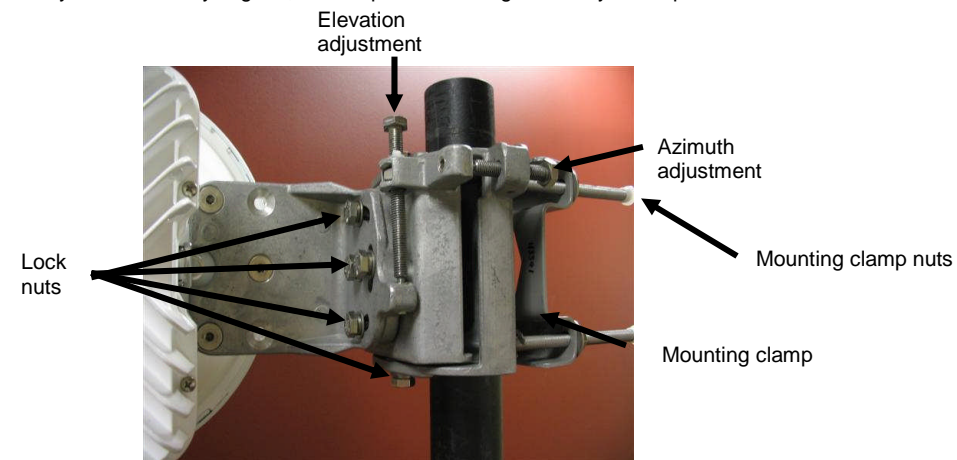
Enable BNC : **set alignment on** Enter

Loosen the antenna mount fine azimuth and elevation adjustment lock nuts.

Connect a voltmeter to the field strength monitoring port (BNC) and adjust the fine azimuth and elevation adjustments for a maximum signal.

Identify all side lobes plus the main lobe. Ensure that you are aimed at the main signal lobe.

The final received signal strength (RSL) should be within ±3 dB of the link budget figure.

Once alignment is achieved, tighten the lock nuts on the adjustment mechanisms.

Disable BNC : **set alignment off** Enter

Alignment Adjustment Sensitivity

When performing fine alignment adjustments it is important to **rotate the adjustment nuts 1/10th of a turn at a time between taking RSL readings.**

The beam width of a Horizon Compact system is no greater than 2 degrees. **One complete turn of a fine adjustment nut moves the system through more than 1 degree.** One complete turn can, therefore, move right through the peak signal position.

Indications of a Properly Operating Link

No alarms	– **get alarms**
RSL within ±3 dB of link budget figure	– **get modem statistics**
Eb/No ≥ 19 dB	– **get modem statistics**
Signal to Noise Ratio (SNR) ≥24 dB	– **get modem statistics**
Equalizer Stress typically 30 , but < 150	– **get modem statistics**
Modem Block Error Rate 0.00e+00	– **get traffic statistics**
All sections operational	– **get health**

Bandwidth Doubling

The Dual Polarity Radio Mount (DPRM) allows two Horizon Compact units to mount onto a single antenna, providing bandwidth doubling capabilities. One Horizon Compact is horizontally polarized and the second is vertically polarized.

For bandwidth doubling, each Horizon Compact is fed up to 400 Mbps from the network switch, enabling the wireless link to carry up to 800 Mbps, full duplex, of user traffic.
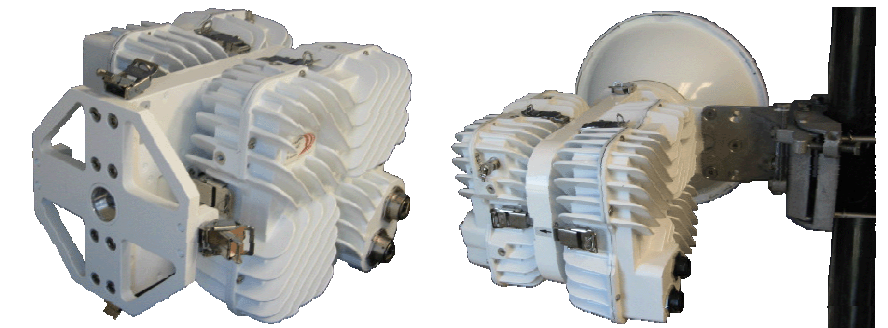
Troubleshooting

Alarms: Check alarms. No alarms should be present.

Modem Receiver Loss of Signal = no signal being received from the far end.

Radio Mismatch = incorrect radio band configured, TxH / TxL reversed, or incorrect radio

Ethernet Link Down = no connectivity on Ethernet link

Modem Hardware Fault = replace Horizon unit

Radio Power Amp = replace Horizon unit if alarm counts are increasing

Synthesizer Unlock = replace Horizon unit if alarm is consistent

RSL Issues:

Mismatched RSL between endpoints

- one endpoint at target RSL, other endpoint low RSL: use RF loopback feature to determine if Transmitter at one end, or Receiver at other end is at fault.
- Verify both ends are receiving DC power

Low RSL both endpoints

- Verify clear LOS exists
- Verify alignment
- Verify Transmit power at both ends
- Link fade?
- Polarization is the same at both ends?

Poor RF Signal Quality:

- See parameters in "Indications of a Properly Operating Link"

Packet Loss, Poor Throughput, Loss of IP Connectivity:

- check RF signal quality
- check for mismatched modulation between endpoints
- check Ethernet switch traffic statistics at both ends of the link
- verify Ethernet speed and duplex settings
- check COS/QOS settings
- check integrity of Ethernet cables

Merlin Utlities – Contact DragonWave Technical Support

- System diagnostics
- Reset to factory default settings (Super User etc.)
- IP address recovery
- Serial number retrieval
- Bulk software upgrades