WIRELESS AUTOMATION CONTROL

CIRRONET

Wireless solution

After numerous requests to supply an economical radio suitable for industrial control, AUTOMATIONDIRECT chose as a partner Atlanta-based Cirronet, which has well over a decade of success in developing innovative wireless data networking and communications products for industrial, OEM and Internet access markets. Employing proprietary Frequency Hopping Spread Spectrum (FHSS) radio transmission technology, Cirronet's products offer reliable, long range performance and unparalleled immunity against jamming and interference. The new CR series serial and Ethernet radios were developed specifically for the industrial automation marketplace.

CR Series Radios feature:

- Transmission at 2.4 GHz, the only truly international unlicensed frequency band
- Frequency Skip feature that prevents interference with/from any co-located 802.11 wireless LANs
- Reliable data throughput using Cirronet's patented FHSS technology; assures reliable performance even in high-multipath and noisy RF environments. CRC error checking and ARQ (automatic repeat-request) schemes for auto-retransmission of bad packets assures errorless data reception.
- Long range with high speed (up to 1.23 Mbps total over-the-air bandwidth in point-to-point and multipoint applications), up to 1.5 miles (farther with high gain antenna)
- License-free operation avoids the hassles and expense of obtaining an FCC license
- Wide operating temperature range from 30 degrees Celcius to +70 Celcius
- Rugged packaging well suited to varied operating conditions; external radios are housed in NEMA 4X/IP 66 enclosures ideal for outdoor and harsh environments.
- Easy-to-understand configuration tools for quick setup
- Fully programmable setup to meet specific site and performance requirements
- UL 2279 listed and CE marked

What are FHSS, DSSD, and OFDM radios?

1.FHSS (Frequency Hopping Spread Spectrum): A FHSS radio signal is broadcast on very narrow band in very short bursts. The broadcast signal "hops" around within the channel frequency band. Both transmitter and receiver are synchronized to the same hopping pattern. FHSS provides only 3 Mbps capacity links, but it is a very robust technology, with excellent behavior in harsh environments characterized by large areas of coverage, multiple collocated cells, noises, multipath, Bluetoooth presence, etc.

2. DSSS (Direct Sequence Spread Spectrum) A DSSS data signal is combined with a higher-data rate data stream. The resulting signal is spread across at least 10x the bandwidth of the unspread signal. The wider data-stream provides redundancy for bits damaged in transmission. DSSS provides 11 Mbps capacity links, but it is sensitive to RF interference (collocation, multipath, near/far, Bluetooth). The most limiting factor, multipath, may be minimized by using the technology for short distances or in point to point applications.

3. OFDM (Orthogonal Frequency Division Multiplexing) spread spectrum technique distributes the data over a large number of carriers that are spaced apart at precise frequencies. This spacing provides the "orthogonality" in this technique, which prevents the demodulators from seeing frequencies other than their own. The benefits of OFDM are high spectral efficiency, resiliency to RF interference, and lower multipath distortion. OFDM is used by Digital Audio Broadcasting (DAB) standard in the European market and development is ongoing for wireless Local Area Networks - point-to-point and point-to-multipoint configurations.

Configurations

Point-to-point
Base (or master)   Remote (or slave)

Point-to-mulitpoint
Base (or master)   Remote (or slave)
Remote (or slave)   Remote (or slave)
Remote (or slave)

Why not use 802.11 wireless Ethernet for all my wireless communication?

1. 802.11b uses high speed, short range, DSSS radios. It is fine for transferring files in a home or office environment but offers a much less robust RF connection than FHSS radios.

2. 802.11b systems are often used for IT LAN, barcode systems, or other non-critical, short-range networks within industrial facilities. Using a non-802.11 technology isolates control network remains from other LANs and reduces the chance of a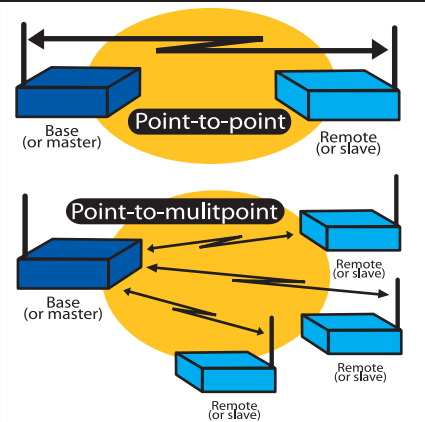dverse RF interaction. The CR series radios have a unique "Frequency Skip" feature that avoids the 802.11 WI-FI Ethernet channels. This means your control radios will not interfere with or suffer interference from co-located PC wireless networks.

3. Hackers expend considerable effort to pierce 802.11 data encryption and other software security schemes. Hackers aren't likely to be familiar with non-802.11 systems, nor are they likely to have radios compatible with a non-802.11 system.

Comm.

CR-SE SERIES ETHERNET RADIO MODEMS

CIRRONET

Wireless solution

AUTOMATIONDIRECT's new CR-SE series Ethernet radios are based on the same patented Cirronet radio technology as the CR-HN serial radios. These are low cost, 2.4 GHz frequency-hopping spread spectrum wireless data modems. They provide long range, high-speed wireless connectivity among Ethernet devices in industrial settings. The CR-SE radios have exceptional multipath fade rejection as well as immunity to jamming. AUTOMATIONDIRECT and Cirronet combined forces and repackaged Cirronet's popular SEM 24 radio modem to be the most practical wireless Ethernet solution for the industrial controls market. Typical CR-SE applications include wireless industrial automation and data collection, network bridging, PLC networking and SCADA. CR-SE radios can function as a high speed bridge to a distant Ethernet network node or a CR-SE radio base station can be connected to multiple remote CR-SE radios to build a wireless Ethernet network. The higher gain antennas increase the range up to 5 plus miles. All CR-SE models enable long range connectivity far beyond cabled Ethernet maximums.

Up to 16 separate CR-SE radio networks can be placed together with 63 remote units (slaves) per network. The HN series radios have a unique "Frequency Skip" feature to avoid the standard 802.11 wireless WI-FI Ethernet channels. This means your control radios will not interfere with or suffer interference from PC wireless networks that may be grouped together. Selectable transmit power levels of 10mW and 100mW allow the CR-SE series to be used worldwide. The CR-SE series radios support both point-to-point and point-to-multipoint networks. They are field proven performers that deliver robust, reliable performance in hostile industrial environments. The CR-SE series is UL, FCC and CE marked.

Choose from four models

Local Radio

The radio modem and a Network Interface unit are combined into one DIN-rail mountable module. A 2dB whip antenna, which is provided, can be attached directly to the unit or mounted externally to the enclosure via an optional CR-CBLxxN RF cable.

Remote Radio

For extended distances or in obstructed environments, higher gain and /or directional antennas are available. A Network Interface Unit (NIU) is housed in a enclosure and is connected via its terminal strip to the remote radio module located up to 300 feet away. The remote radio module, housed in a weatherproof NEMA 4X/IP 66 enclosure, mounts directly to the antenna mast or side of a building. A short, premanufactured, RF cable connects the antenna to the radio module. No need to hassle with expensive and troubling RF custom cables. Choose the proper CR-CBLx cable, in respect to the distance between the NIU and the radio module, and the proper antenna, both are ordered separately.

Features:

- 2.4 GHz Frequency Hopping Spread Spectrum Technology
- Unique "Frequency Skip" setting to avoid 802.11 Wireless Ethernet LANs
- 64 hopping patterns (for co-locating separate networks with up to 64 radios/network
- FCC Certified, UL listed and CE marked
- 2dB right angle whip antenna
- Web browser interface

Benefits:

- Exceptional immunity to multipath fading and jamming
- Grouping of multiple networks without interference
- No interference with/from 802.11 Wireless Ethernet networks
- License-free applications worldwide
- Cost-effective, simple installation
- Connects to any 802.3 Ethernet LANs
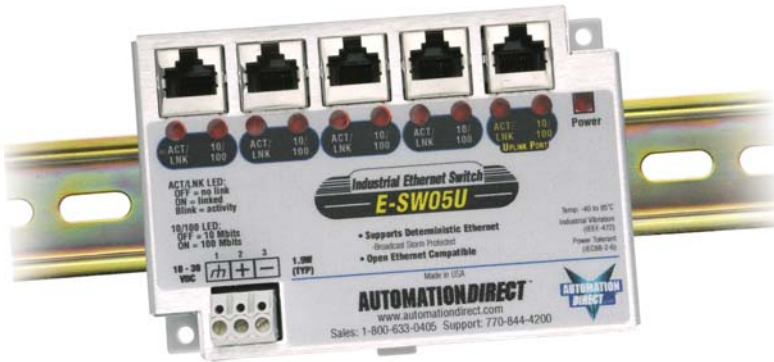- Point-to-point and point-to-multipoint

CR-SE Series Serial Radio Modems		
Part Number	**Description**	**Price**
CR-SEB	10/100 Base-T Ethernet radio bridge, 460Kbps with 2dB, Rt Angle, Omni antenna	check
CR-SEBX	10/100 Base-T Ethernet radio bridge, 460Kbps with external antenna connector	check
CR-SEH	High-speed, 10/100 Base-T Ethernet radio bridge, 1.23Mbps with 2dB, Rt. angle, Omni antenna	check
CR-SEHX	High-speed, 10/100 Base-T Ethernet radio bridge, 1.23Mbps with external antenna connector	check
CR-SEAP	Serial to Ethernet Access Point, enables serial devices on CR-HN radios to appear as nodes on an Ethernet network, 10/100 Base-T, 460Kbps with integral antenna	check
CR-OMN2409	9dB, 2.4 GHz, Omni Antenna	check
CR-CRN2409	9dB, 2.4 GHz, Corner Reflector Antenna	check
CR-PAR2418	18dB, 2.4 GHz, Parabolic Dish Antenna	check
CR-CBL24N	24" RF Cable, TNC to N connects an external antenna to a CR radio	check
CR-CBL60N	60" RF Cable, TNC to N connects an external antenna to a CR radio	check
CR-REPETR	Dual radio repeater with rechargeable lead-acid battery. Requires two CR series antennas and two series CR-CBLxxN RF cables. Non-stock item, 3 week delivery.	check
CR-CBLE1	External Antenna Cable Kit includes weatherproof radio connector on 100ft pigtail cable	check
CR-CBLE2	External Antenna Cable Kit includes weatherproof radio connector on 200ft pigtail cable	check
CR-CBLE3	External Antenna Cable Kit includes weatherproof radio connector on 300ft pigtail cable	check
CR-PSCN	Replacement Power Plug for all CR radios	check
CR-PSAC	Replacement AC Adapter for CR radios with plug	check

ETHERNET RADIO MODEM SPECIFICATIONS

CR-SEB

CR-SEBX

CR-SE Series Specification	
Electrical Specifications	
Frequencey Band	2.4 GHz
Licensing	Unlicensed under FCC Part 15, ETSI 300.328
Number of Channels	SEB - 75, SEH - 43 (USA); SEB - 75, SEH - 27 (Canada, France, Spain & Japan)
Hopping Patterns	User configurable, 64 patterns (networks) available
Data Throughput	SEB - 400 Kbps; SEH - 1.0 Mbps
RF Channel Rate	460Kbps/1.23Mbps
Line of Sight Range	> 1 Miles
RF Bandwidth	SEB - 750 KHz; SEH - 1.5 MHz
Modulation Type	GFSK
Output Impedance	50 Ω
Network Protocol	Dynamically Assigned TDMA with ARQ
Transmit Power	EIRP: +16dBm/+24dBm
Receive Sensitivity	SEB = - 93dBm; SEH = -90dBm
Power Requirements	9-30VDC (12-30VDC SEHX & SEBX), 160mA typical, 750mA surge
Ethernet Protocol	802.3, 10/100 Base-T (for SEB and SEH10/100)
Mechanical Specifications	
Antenna	CR-SEB & CR-SEH: 6", 2dB, Rt. angle, Dipole, Omni antenna CR-SEBX & CR-SEHX: ReverseTNC Male connector, requires CR series antenna
Case Materials	Polycarbonate, NEMA 4X
Dimensions (in)	5.5 x 4.5 x 1.78 (excl. flange)
Weight excl. cable	235g
Data Connector	RJ45
Configuration Connector	RJ11
Synchronization Connector	RJ11
Antenna (SEB & SEH only)	TNC Male
Transceiver (SEBX &SEHX only)	15 pin
Power Connector	2 Pin, plug-in, screw terminal
LED Indicators	Power, Tx, Rx, RF Link, Link
Environmental Specifications	
Temperature Range	-30°C to 70°C Network Interface Unit -40°C to 70° Radio enclosure (SEBX & SEHX only)
Humidity	95% at 40°C, Non-condensing
Approvals	
UL 508	
CE	

E-SW05U INDUSTRIAL ETHERNET SWITCH

Deterministic control

Ethernet for deterministic control? You bet! With an E-SW05U switching an isolated control LAN, your PLC won't miss a beat. At 10 or 100 Mbps Ethernet, your data will spend minimal "time-on the-wire" between your I/O and controller. The E-SW05U, an Ethernet switch, automatically determines and remembers the devices connected to each port and routes messages only through the appropriate port. When directly connected to a full duplex device, the E-SW05U port automatically adopts full duplex operation, potentially doubling the bandwidth to that device. The E-SW05U also provides broadcast storm protection with each node limited to no more than 25% of the available LAN bandwidth. Even a rogue node constantly broadcasting will not bring your network down. The E-SW05U eliminates message collisions, allowing for deterministic control for time-critical automation applications. Install E-SW05U switches and your Ethernet control network will maintain consistent cycle times even under heavy I/O and data exchange.

Open compatibility

The E-SW05U supports all standard IEEE 802.3 Ethernet protocols, so you won't need expensive protocol or media converters to connect with standard IT products (*as with many other Ethernet and Fieldbus products*).

Increased reliability

The E-SW05U Ethernet switch has been designed for the industrial environment. It will survive extreme temperatures, as well as dirty, unreliable industrial power. Meeting UL 1604 (Class I Div. 2) and the IEC68-2 standard for vibration resilience, the E-SW05U will provide years of reliable performance in applications too tough for commercial grade switches.

Message in from a device

Message is sent out only from the port connected to destination device

Ethernet Switch (switching hub)

Both Ethernet switches and hubs allow additional nodes and segments to be added to a network, but switches have many advantages over hubs for automation control. An Ethernet switch automatically determines and remembers the devices connected to each of its ports. When it receives a data packet, it verifies the packet integrity, identifies through which port the message should be transmitted, and sends the packet to the targeted device only. Non-valid packets are discarded, Network collisions are eliminated as each device communicates one-to-one with the switch. In identifying the packet destination and verifying the packet integrity, switches introduce some delay (latency) to each packet transmission. This slight delay is the trade-off for eliminating packet collisions. further reducing network traffic. Another advantage of switches segmenting the network is they allow larger network distances than hubs.

Use a switch for:

- Deterministic real-time control
- Segmenting a LAN into smaller LANs
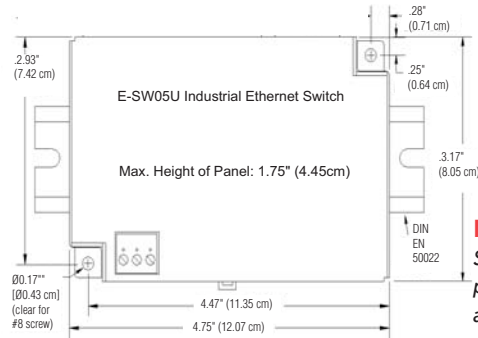- Isolating I/O communication from data exchange communication.

A hub works for:

- HMI to controller(s) communication (when separate from the I/O network)
- Configuration and data-exchange LANs
- Demonstration systems
- Single controller (master/slave) systems on an isolated LAN
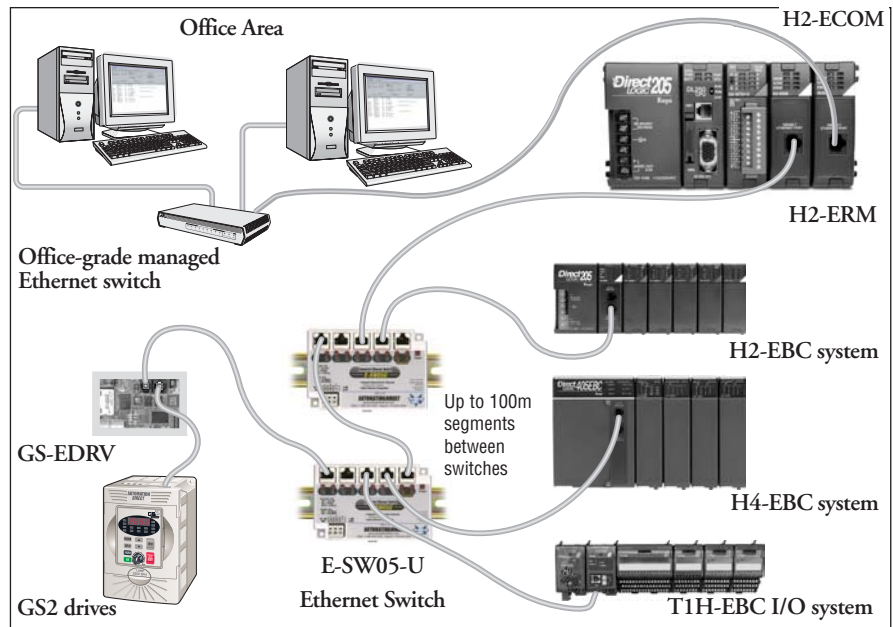
E-SW05U Specifications

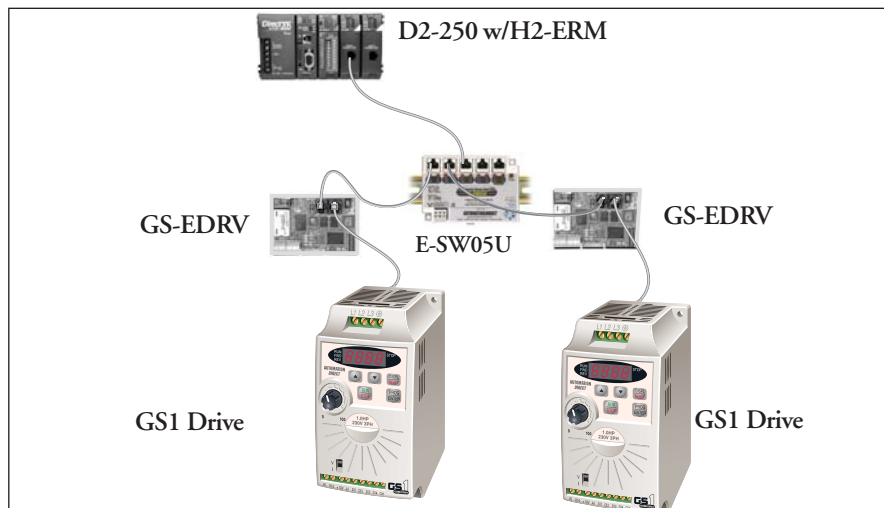| Performance Specifications	
Ethernet switch type	Unmanaged, store and forward
RJ45 ports (shielded)	10/100 Base T (x)
RJ45 speed (auto-negotiating)	10 Mbps or 100 Mbps
Ethernet protocols supported	All standard IEEE 802.3
Broadcast storm protection	25% of bandwidth
Memory bandwidth	1.4 Gbps
Completely compliant	IEEE 802.3 & IEEE 802.3u
Full or half duplex operation	Auto-sensing
MAC addresses supported	1 K (automatic learning, aging, and migration)
Ethernet isolation	1200 VRMS 1 minute
Required supply voltage	10-30 VDC
Power consumption (typical)	1.9 W
Operating and storage temp	-40 to +85°C
Humidity (non-condensing)	5 to 95% RH
Flammability	UL 94V-0 materials
Electrical safety	UL 508, CSA C22/14; EN61010-1 (IEC1010)
EMI emissions	FCC part 15 ICES 003, EN55022, Class B
EMC immunity	EN61326-1 (EN61000-4-2,3,4, and 6)
Surge withstand	IEEE-472 (ANSI C37.90)
Vibration	IEC68-2-6
Hazardous locations	UL 1604, CSA C22.2/213 (Class 1, Div.2), Cenelec EN50021 (Zone 2)

Mounting dimensions

.2.93" (7.42 cm)
.28" (0.71 cm)
.25" (0.64 cm)
.3.17" (8.05 cm)

E-SW05U Industrial Ethernet Switch

Max. Height of Panel: 1.75" (4.45cm)

DIN EN 50022

Ø0.17" [Ø0.43 cm] (clear for #8 screw)

4.47" (11.35 cm)
4.75" (12.07 cm)

Note:
Screw holes are provided as an alternative to DIN-rail mounting.

Typical Ethernet switch installations

Office Area
H2-ECOM
H2-ERM
Office-grade managed Ethernet switch
H2-EBC system
GS-EDRV
H4-EBC system
Up to 100m segments between switches
GS2 drives
E-SW05-U Ethernet Switch
T1H-EBC I/O system

Ethernet drive control network

D2-250 w/H2-ERM
GS-EDRV
E-SW05U
GS-EDRV
GS1 Drive
GS1 Drive

Complete documentation

Documentation can be downloaded from www.automationdirect.com.

OTHER ETHERNET COMMUNICATIONS PRODUCTS

Get your PC on Ethernet

These two PC Ethernet adapter cards are manufactured exclusively for us by Host Engineering. Both cards are fully Plug-and-Play compatible and use standard AMD PCNET II Family Ethernet Adapter drivers found in the Windows 98/2000/NT/XP operating systems.

HA-TADP

- RJ45 Port
- 10BaseT
- PCI connection
- 100m maximum cable length
- 10Mbps data transfer rate
- Complies with IEEE 802.2 and 802.3

HA-FTADP

- RJ45 and ST-style fiber ports (use either port, but not both)
- 10BaseT and 10Base FL
- PCI connection
- 2km maximum fiber length
- 10Mbps data transfer rate
- Complies with IEEE 802.2 and 802.3

If your network covers long distances (greater that 100m) or passes near sources of electrical noise, you should consider the use of fiber optics (up to 2km). This combination card gives you an RJ45 10BaseT port and an ST-style fiber optic port. You can use the 10BaseT port until you are ready to change to fiberoptics.

ECOM starter kits

The H2-ECOM-START and the H4-ECOM-START kits give you everything you need to make your first Ethernet to PLC connection simple to build. Each contains a PLC ECOM module and instruction manual, a network adapter card for your PC, a crossover cable, and a Showcase Demo CD.

RT-CNFGKIT

The Ethernet Configuration Kit includes a five-port 10BaseT Ethernet hub, four straight-through cables, and one crossover cable. (The cables are at least five ft. in length.) The kit provides a great convenience for configuring systems, demonstration systems or basic control projects using Ethernet.