LINC LETTER

INDUSTRIAL DATA COMMUNICATION NEWS & TECHNIQUES

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INTRODUCING OUR PREMIERE ISSUE!

Welcome to the premiere issue of *LINC LETTER*. I hope you find it—and future issues—both interesting and informative.

DATA-LINC's goal is to provide proven and highly reliable communication solutions for industrial automation systems. Our newsletter will explain the concepts behind emerging technologies, as well as their real-world application by actual DATA-LINC clients.

Of course, we'd also like *your* ideas for newsletter topics. If you have technical questions or suggestions for stories, please fill out and return the enclosed form.

Please accept my thanks for reading the premiere issue of our newsletter.

> *Sincerely,*
> *Mike Maes, President*
> *DATA-LINC GROUP*

New Wireless Ethernet Modem Boasts High-Noise Immunity

DATA LINC GROUP announces the latest addition to its line of industrial wireless modems—the SRM6200E Ethernet Radio Modem. With Ethernet emerging as a viable industrial PLC interface, the SRM6200E is an excellent solution for systems in which cable installation is either too expensive or impossible.

The modem transparently bridges remote Ethernet devices to segments up to 15 miles away (with line-of-sight). Interface options include 10Base-T (UTP) and 10Base-FL (fiber).

SRM6200E Ethernet Radio Modem

Based on the same robust RF technology employed by our popular SRM6000 model, the SRM6200E uses "frequency hopping" algorithms (see *The Spread Spectrum Transmission Debate,* page 3) to ensure error-free communications in high noise, industrial settings.

The SRM6200E operates in the 902-928 MHz spread spectrum band, with a 2.4 GHz version soon to be available.

Since our SRM6200E Ethernet Radio Modem doesn't require an FCC site license, you'll benefit from a reduction in both installation time and expense.

DATA-LINC Joins CSI Association

As a new associate member of the Control System Integrator Association (CSIA), DATA-LINC GROUP is ready to contribute its specialized expertise to CSIA in its continued support of the system integrator profession.

The CSIA network of technical firms helps companies modernize their facilities by tailoring today's sophisticated technology to their particular environment.

With the association's expanded involvement in the field, Control System Integrators are becoming increasingly responsible for communications and networking solutions across multi-vendor automation systems.

DATA-LINC is proud to join the CSIA team. As a communications developer, DATA-LINC can offer the solid technical advice needed to directly impact a company's productivity.

CSfA CONTROL SYSTEM INTEGRATORS ASSOCIATION

For membership info and details on association services, visit the CSIA website at www.controlsys.org.

DATA-LINC GROUP

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Racing Radios: As Tough As It Gets

In the world of motor sports, Unlimited Hydroplane Racing is in a class by itself. Thanks to its ability to ride on a cushion of air created by the body of the boat—which basically acts as a wing—an Unlimited Hydroplane is considered the fastest calm water boat in the world, cruising along at speeds exceeding 200 MPH.

That's One Rough Ride...

Because of the wear and tear incurred at such high speeds, the equipment on Hydroplanes doesn't last very long. In fact, most Hydroplanes are no longer equipped with instruments in the cockpit—not only because the driver doesn't have time to look at them, but also due to their expense and tendency to fail in action.

The DATA-LINC Solution

Luckily, there *is* a way around this problem—thanks to "radio telemetry," the latest trend in radio communications. For several years now, most racing teams have been using on-board computers to collect data and feed their crews information on the boat's performance, in the hopes that they could fine-tune the boat to gain an edge on the next guy. However, until recently, this valuable performance data could only be retrieved after the boat was brought back to shore. Now, with the help of DATA-LINC GROUP's SRM6000 Radio Modem, Hydroplane racing teams can monitor a boat's performance as it happens during the race or trial.

> *"...even at 200mph, and a range of 1.5 to 2 miles, the modem connection was rock solid."*

SRM6000: One Tough Cookie

Shock-mounted and encased in a special NEMA-4X enclosure, the SRM6000 is designed to take a beating. Naturally, the daredevils of the Hydroplane racing world were skeptical. The initial reaction of one crew chief: "It's nice, but don't be surprised if we break it...we usually do." He and his colleagues have been down this road before. Radio modems had been tested previously with little success. Obviously, nothing could stand up to the 10^+Gs of force that the boat is subjected to as it bounces across the water at over 200 MPH. Or so it seemed...

The **Pico American Dream** *cruises at speeds of 200* MPH

Seeing is Believing

Consider the *Pico American Dream*, built and operated by Lealand Unlimited, and the *Budweiser*, built and operated by Hydroplanes Northwest. The crews of these Unlimited Hydroplane racers are using the SRM6000 to obtain vital information from the onboard computer *on the spot*...so the results can be put to work and hopefully better the boat's chances of taking home a trophy at the next race.

With the DATA-LINC SRM6000 units installed on the *Pico American Dream* and *Budwiser,* our advanced technology was put to the test. As

the weekend of racing came to a close, we received a phone call from—who else—our skeptical crew chief. He told us that the SRM6000 worked flawlessly at 9600 BPS (later increased to 57.6 KBPS) and praised the modem as an invaluable tool for the crew team. The biggest surprise reported was the modem's unbelievable durability. The unit showed no signs of damage from the pounding endured from the rough waters plaguing all teams that weekend. And even at 200 MPH, and a range of 1.5 to 2 miles, the modem connection was rock solid.

Since then, the driver of the *Pico American Dream* has shifted to the Budweiser team. One of his first action items? The purchase a set of SRM6000 radio modems for the *Miss Bud*.

Leader of the Pack

Thanks to the racing experiment, we learned that our radio modem is indeed a leader in its field. And if the SRM6000 can withstand the relentless conditions of the Hydroplane racing world, it's more than capable of maintaining a reliable communications path in common industrial applications.

As the sport of Hydroplane racing gets more competitive, we will continue to take the technology to the next level—and have some more fun along the way.

The Spread Spectrum Transmission Debate:
Frequency Hopping vs. Direct Sequence

Spread spectrum radio modems typically use one of two spreading methods: Frequency Hopping or Direct Sequence. Choosing the best method for your application is an important step toward ensuring reliable data transmission.

In basic terms, Frequency Hopping takes incoming data and breaks it down into smaller individual packets that are then sent on separate frequencies (with each packet error-checked). Once the packets have been transmitted, the data is recompiled in its original form. If a packet *cannot* be successfully sent on a given frequency, it is re-sent on another. In the case of DATA-LINC's SRM6000 Radio Modem, the hopping occurs at a rate of 100 times a second in a predetermined algorithm (hopping pattern).

Conversely, with Direct Sequence, the information is continuously spread across a wide portion of the frequency band. If a frequency is *not* available—because the band is occupied by other equipment or there is too much noise—then that data is lost.

In a high-noise environment, the reliability of the data is dependent on the signal-to-noise ratio. The percentage of frequencies unavailable represents the percentage of data that will be lost. Direct Sequence is designed to deal with noise in its bandwidth; however, high noise is high noise. If

there is too much of it on a given frequency, nothing can be done.

With Frequency Hopping, corrupt data packets are automatically retransmitted at *different* frequencies, which greatly increases the probability of the data getting through. This method has inherently higher data reliability, but at a possible reduction in data rate.

> *"Frequency Hopping greatly increases the probability that the data will get through."*

With the SRM6000, the RF speed (the speed at which the units are passing data back and forth) is either 144 KBPS (default) or 188 KBPS. These wide bandwidths allow a lot of room in which to "hop around" to find a clear frequency. Even if the PLC sends at 115.2 Kbps, 25% of the frequency can be jammed and the device will still run without data loss or time out.
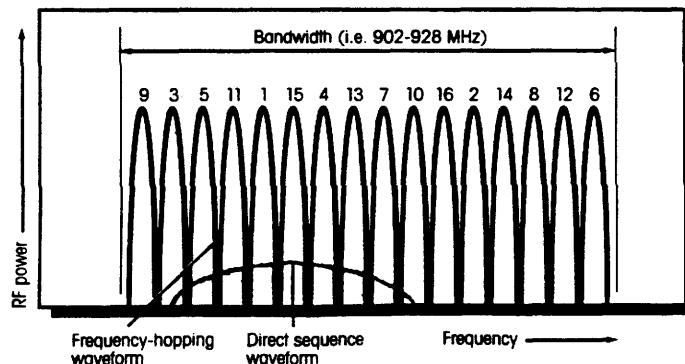
Another advantage of Frequency Hopping is its flexibility in allowing the receive sensitivity to be set very high. With this feature, the processor can distinguish valid data over noise because it can sample several frequencies and compare the data.

The placement of multiple radio modems in close proximity is also a key consideration. If two or more

systems are close together in a Direct Sequence system, they are destined to occupy the same frequencies. In a Frequency Hopper, however, the units can be set for *different* algorithms, which significantly reduces the odds that multiple systems will be hitting the same frequency at the same time. If they do, then they will hop to different frequencies and try again. This increases the number of units possible in a system, as well as the number of systems in a given area.

Although we have outlined some key advantages of Frequency Hopping, Direct Sequence certainly has its place—like in applications

Waveform Comparison

that demand high bandwidth, such as voice and video. However, for industrial data communications, where errors are not tolerated, we firmly believe Frequency Hopping is the best method. And experience has proven this to be the case.

What's new at DATA-LINC?
Find out at www.data-linc.com
New Developments section!

Ethernet Offers Great Potential for Automation Systems
But Beware of Office-Grade Component Limitations

Ethernet! To most, including industrial PLC users, it is a somewhat familiar term used regularly, yet rarely understood. No doubt, Ethernet is one of the more mysterious hi-tech buzzwords in use today. So let's take a closer look and unravel the mystery...

Ethernet is a communication standard, plain and simple. Since Ethernet is the most common standard for networking computers in an office environment, communication setup and hardware interfacing with Ethernet-capable devices is essentially the same from system to system.

Most PLC users, integrators and distributors were just getting used to serial RS232/485 communications when proprietary synchronous data highways came along. These highways, commonly referred to as Genius, Modbus+ and DH+, greatly extended the SCADA capabilities of PLC networks. Unfortunately, they also brought with them a myriad of data communication challenges.

After expending so much effort dealing with the complexities of the various data communication schemes, it's understandable if many people are slow to embrace yet another standard.

DATA-LINC GROUP and its PLC manufacturing partners believe that this reluctance will disappear quickly, once people become aware of the benefits offered by Ethernet. For starters, with Ethernet as a communications base, control engineers now have a flexible and open system architecture.

Motivated by customer demand, DATA-LINC has developed an Ethernet interface for both its radio and fiber optic modem lines. With the PLC Ethernet revolution just around the bend, DATA-LINC GROUP is fully prepared to provide the industry with reliable and uncomplicated connectivity.

Our new Ethernet interface products provide the same reliable operation that customers have come to expect from all DATA-LINC GROUP products. Industrially rated with a proven track record in the harshest of environments, DATA-

> *"With Ethernet, control engineers now have a flexible and open system architecture."*

LINC GROUP modems are a first choice for many automation engineers.

A word of caution to the PLC community: With the advent of Ethernet ports on PLCs, there will be a push to use radio systems designed for office network environments.

After performing extensive testing on several of these office-grade systems, our experts at DATA-LINC GROUP have found the potential for reliable industrial application to be very limited. Most of these systems employ the 2.4 gigahertz frequency range in order to increase data throughput. Inherently, this range has an adverse affect on reliable error free operation and effective range. However, this negative effect *can* be counteracted through the use of frequency hopping in the 902-928 MHz band to achieve high-noise immunity and long-range transmission.

We believe Ethernet will prove to be a popular communication medium. Keep in mind, though, that most current components are designed for office-grade systems. They are not up to the challenges encountered in industrial environments. DATA-LINC GROUP is committed to developing ultra-reliable Ethernet products geared *specifically* to the rugged conditions of an industrial environment.

USING ETHERNET IN AUTOMATION SYSTEMS	
ADVANTAGES	*DISADVANTAGES*
Open (non-proprietary) architecture	Limited experience (to date) in control system applications
High data rate to handle data-intensive applications	Office-grade products not designed for industrial environments
Flexible wiring schemes	May not be deterministic for real-time control
Easy integration into corporate information systems	

Frequently-Asked Questions: Exploring the SRM6000 Radio Modem

Q: *How can the SRM6000 Radio Modem be used on a DH+ or DH485 network?*

A: The SRM6000 supports asynchronous data formats in either a 10- or 11-bit word. In order to communicate DH+ or DH485, it is necessary to convert to DF-1 protocol. Allen-Bradley has several ways to do this and should be consulted as to the best method for a given application.

Q: *Do I need an RF site survey before installation?*

A: No. The SRM6000 RF technology is so robust that as long as line-of-sight is maintained, the modems will communicate. Sometimes it may be necessary to perform a visual survey to ensure line-of-sight by determining ideal antenna and repeater location. But this procedure is certainly much easier—and considerably less expensive—than an RF site survey.

Q: *What is the maximum number of slave radio modems a master can have on its network?*

A: There is no limit to the number of slave radio modems on a network. When an SRM6000 is set a multi-point master, it will broadcast out to any slave that has the master's call number in its address book. Only one slave can talk to a master at any given time, but the master is not limited to a certain number of slaves that it will talk to. Of course, the PLC protocol itself may have a limit, but the SRM6000 will in no way restrict network design.

Q: *Why does the SRM6000 require line of sight?*

A: It's not a limitation of the SRM6000 but rather a limitation of the 900 Mhz band employed by the SRM6000 Radio Modem. The higher a frequency, the less likely it is to reflect or pass through obstacles.

What's new at DATA-LINC? Find out at www.data-linc.com New Developments section!

Q: *Will the SRM6000 interface with other DATA-LINC GROUP modems?*

A: Yes. All of Data-Linc's modems have a standard RS232 interface port. Some are protocol transparent, and some require a 10- or 11-bit word. But they can all be linked to each other via their serial ports so that a network of wire modems with radio hops or radio modems with wire modem hops can be achieved.

Q: *What advantage do I get by using the SRM6000, whose range is over 20 miles, when all I need to achieve is 2 miles or less?*

A: It is true that most applications do not require long range and high speed (115.2 KBPS). But because the SRM6000 *can* accommodate very long ranges at high speeds, all with a high level of reliability, when the modem is used in shorter ranges with lower speeds, communications will achieve a significant level of tolerance. This gives the system a level of reliability that is unmatched. Basically, with the SRM6000 you get the best of both worlds.

Q: *Why does DATA-LINC GROUP pre-configure the SRM6000? Is it too complicated to configure in the field?*

A: DATA-LINC GROUP does provide pre-configuration on all of its modems, but not because it would be too complicated to do in the field. We pre-configure the units so that the end-user or installer does not have to deal with yet one more task during the installation of an automation system. By providing this service, we increase our level of support to you, our customer—and that's our #1 priority. As to specifically configuring the SRM6000, all it requires is a terminal program on a PC (or terminal) set for 19.2 KBPS in a 10-bit word format. You simply push a configuration button and a menu screen is downloaded to the terminal, where the changes can be made. (See SRM6000 instructions for more detail).

DATA-LINC GROUP manufactures the broadest line of industrial grade modems and networking solutions. Our products include radio modems (no site license required), dial-up/leased line modems, dedicated wire FSK modems, Bell 202 modems, fiber optic modems, discrete/analog signal multiplexers and intelligent remote management systems. All of our products are designed to interface with PLC systems and operate in harsh industrial environments.

What's new at DATA-LINC*? Visit www.data-linc.com New Developments Section*

The Ultra-Reliable Solution for Wireless Communications

▶ SRM6000 Radio Modem

- Superior noise immunity ensures ultra-reliable performance
- No site license needed—reduces installation time and expense
- Transparent operation provides easy PLC and RTU integration
- Point-to-point or multipoint operation
- Supports async speeds up to 115 KBPS
- Long-range support up to 20 miles (line-of-sight)

The **SRM6000 Radio Modem** offers the highest level of reliability and performance available for wireless data transmission. The unit is ideal for applications that demand dependable, secure communications, including those involving industrial automation, SCADA, and remote telemetry.

Using Frequency Hopping Spread Spectrum (FHSS) technology in the 900 MHz or 2.4 GHz bands, the modem supports communications up to 20 miles (10 miles in 2.4 GHz band) with line-of-sight antenna placement.

Installation is quick and inexpensive, since FCC site licenses are not required. Choose our standalone or PLC slot-mount versions to suit your configuration.

Industrial Ethernet Modem Ideal for Wireless PLC Communications

▶ SRM6200E Ethernet Radio Modem NEW!

- Connects Ethernet devices without wires, even in high-interference environments
- High data accuracy using 32-bit CRC error correction
- Transparent to LAN protocol with full TCP/IP support
- 10Base-T or 10Base-FL interface options
- Effective data throughput up to 100 KBPS
- Supports ranges up to 15 miles (line-of-sight)

The new **SRM6200E Ethernet Radio Modem** is based on the same robust RF technology applied to our SRM6000 Radio Modem. Our Ethernet model transparently bridges remote Ethernet devices and segments up to 15 miles away (with line-of-sight). Interface options include 10Base-T (UTP) and 10Base-FL (fiber).

Unlike office-grade wireless modems, the SRM6200E is specifically designed to operate in high-interference environments where PLCs typically are used. The device's superior transmission characteristics make it the best choice for wireless PLC communication. For your convenience, we offer both standalone and PLC slot-mount versions.

Avoid Headaches—Count on the Modem Designed for PLC Systems

▶ DLM4000 Dial-up/Leased Line Modem

- Communicates over dial-up or leased lines up to 19.2 KBPS
- Supports multiple standards including V.34, V.32bis, V.32, V24bis & Bell 212
- Accommodates RS232, RS485 and RS422 interfaces
- Custom factory pre-configured specifically for *your* application
- Rugged 18 AWG steel enclosure with mounting flanges

The **DLM4000 Dial-up/Lease Line Modem** is specifically designed for PLC and control systems. It offers high reliability and easy installation for SCADA, PLC programming, and system diagnostic applications.

Capable of speeds up to 28.8 KBPS (19.2 KBPS is typical for most PLC applications), the DLM4000 supports dial-up, leased and private lines. And choose from these flexible options: extended operating temperature (40 to +85C), cellular support, and standalone or PLC slot-mount versions.

Best of all, because of DATA-LINC's extensive knowledge of PLC technology, we can custom factory pre-configure units based on your specific PLC model and application parameters.

Like more information? Fill out the enclosed card or call us at 425-882-2206

Extend Transmission up to 8 Miles — Even in High EMI/RFI Environments

▶ MDL500 Dedicated Wire FSK Modem

- Supports transmission ranges up to 8 miles over dedicated wire
- Effectively utilizes high frequency FSK modulation for EMI/RFI immunity
- Transmits at data rates up to 9600 BPS, with protocol transparency
- Flexible AC/DC power options
- Accommodates a wide range of specialized applications

The **MDL500 Dedicated Wire Modem** offers long-range communication and superior noise immunity, even over two conductors. In applications involving PLC and other serial-based devices, the unit can support 4-wire communications up to 8 miles. Interface options include RS232, RS485 and RS422, and built-in isolation transformers eliminate ground loop problems.

The unique modulation technology of the MDL500 allows it to support a wide range of special applications, including superimposing of data over instrumentation lines, communication over sliding contacts, and data transmission over AC/DC power lines. *Please call for more information* about this highly flexible communications problem solver.

Voice-band FSK Modem Designed for Long-Range Communications

▶ LLM1000 Long Line Modem

- Voice band modulation supports unlimited transmission ranges over loaded leased lines; up to 20 miles over unloaded twisted-pair lines
- Supports Bell 202 and V.23 FSK modulations
- Transparent operation up to 1200 bps
- Available in 2-wire (half duplex) and 4-wire (full duplex) models

The **LLM1000 Long Line Modem** is a voice-band FSK modem with the flexibility to support both Bell 202 and V.23 modulation schemes. Count on the LLM1000 to extend serial communications over leased loaded lines or dedicated wires—or use the device as a standalone Bell 202T modem.

Interface options include RS232, RS485 and RS422. Operate the modem half duplex over 2 wires or full duplex over 4 wires. And, to suit your facility's set-up, choose between our standalone and PLC slot-mount versions.

Transmit at High Speeds and Long Range Over Fiber

▶ FDM7000 Fiber Optic Modem

- Accommodates transmission ranges up to 1.4 miles over two fibers (longer range models available)
- Supports transparent communication at speeds up to 115.2 KBPS
- Accommodates point-to-point and multi-point operation
- RS232, RS485 and RS422 interface options
- Extended temperature (-40 to +85C) feature

The **FDM7000 Fiber Optic Modem** is ideal for high-speed serial communications over two fibers. The unit provides a transparent communication link between RS232, RS485 or RS422 devices at speeds up to 115.2 Kbps.

Using multi-mode fiber, the FDM7000 can support transmission of up to 1.4 miles. We also offer a single-mode fiber model to support longer distances (up to 10 miles).

For Ethernet environments, consider our new FDM7000E Ethernet Fiber Modem specially designed for reliable remote Ethernet connectivity over fiber.

Additional DATA-LINC Product Lines

CCS9000 Remote Switching System

- Multiport management of remote serial devices
- Supports a wide range of communication types (dial-up, wireless RF, fiber, etc.)
- **CONNECT** PC software provides easy point-and-click operation

DDAA1000 Discrete/Analog Signal Mux

- Allows remote transmission of discrete and/or analog signals
- Supports up to 16 signals in each direction
- Point-to-point or multi-point operation

Special applications? Communication questions? Call us today!

DATA-LINC Radio Modems Perform at Exhibitions

Successfully demonstrating a PLC system at an exposition is an important step in gaining customer confidence. DATA-LINC is very proud that our PLC partners chose our radio modems for wireless communications throughout the ISA EXPO/98 and Rockwell Automation's Automation Fair '99.

Both our serial SRM6000 and Ethernet SRM6200E modems were put to the challenge of linking various PLC systems in the very high noise environment of the show floors. In one case, our radio modems communicated between two exhibition buildings—even with many obstacles including over twelve inches of concrete.

Again, our radio modems proved to perform in the harshest environments. Seeing is believing!

Coming Up

National Industrial Automation
March 15-18, 1999
Booth #5912
McCormick Place ● Chicago, IL
Information: www.manufacturingweek.com

ISA Pittsburgh Show
March 29-30, 1999
Pittsburgh Expo Mart ● Pittsburgh, PA
Information: www.nauticom.net/www/isa

About DATA-LINC GROUP

For over ten years now, *DATA-LINC GROUP* has provided state-of-the-art solutions for control systems that rely on smooth, error-free industrial data communications.

Our products are designed to withstand the relentless conditions associated with high-interference installations and severe environments. But superior products are only part of our offering. We also place great emphasis on servicing our customers in unique ways. For instance, we use our vast experience with PLC and RTU communication applications to perform free telephone systems analysis for our customers. And, to reduce time—and headaches—during installation, we pre-configure our products and cables prior to shipping.

Call us *today* to discuss your application…

DATA-LINC GROUP

The Industrial Data Communications Solution Center

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PRODUCTS

Radio Modems
Wireless Ethernet Modems
Dial-Up/Leased Line Modems
Dedicated Wire FSK Modems
Fiber Optic Modems
Analog/Discrete Signal Muxes
Intelligent Remote Switches
Standalone & PLC slot-mount models are available!

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