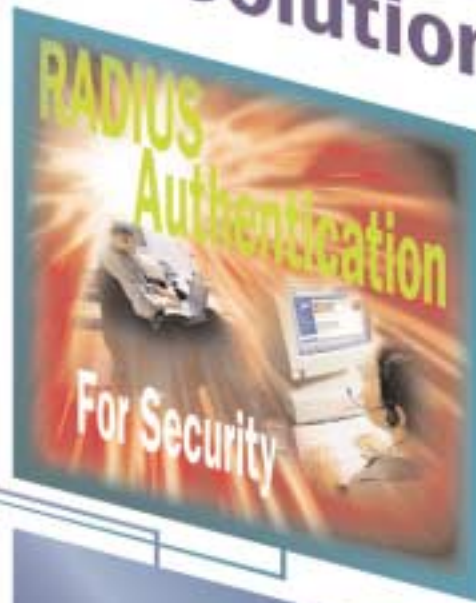
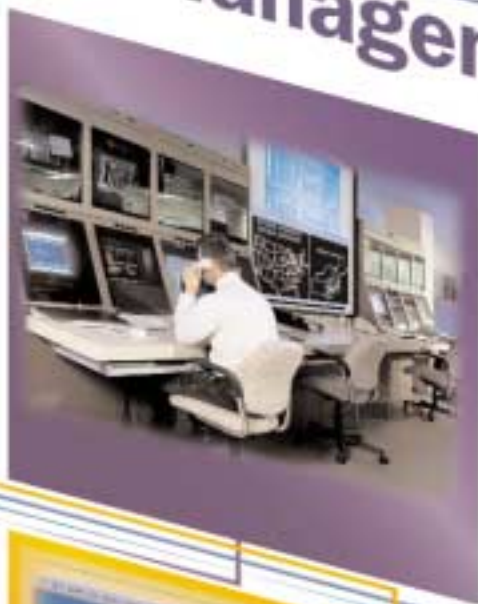


Out-of-Band Remote Management Solutions



General DataComm



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OVERVIEW

In today's dynamic and distributed internet-working environments, service providers, carriers and private network operators require secure, remote management access to equipment at the Central Office (CO) or Point-of-Presence (POP). The ability to quickly and efficiently provision and maintain services without any service interruption is a key element to maintaining a quality business operation with satisfied customers.

Deployment

Managing, monitoring and maintaining devices in a regional, national or international network infrastructure requires tools and devices that allow remote management and monitoring. Today the standard approach to deployment of remote management capabilities includes both in-band and out-of-band methods.

Backup — Secondary Management

In order to provide the utmost in network uptime, network operators typically implement primary network management as “in-band” or “always on.” However, this approach has a fundamental flaw: it relies on the very network it is supposed to monitor as its only means of communication. If a switch or router fails and network connectivity is lost, traffic has no way to get between the managed device and the management workstation, which renders in-

band management useless.

So, as a back-up — or “disaster recovery” — method, network operators must deploy “out-of-band” management as well. Out-of-band network management allows remote dial-up access to critical network elements or devices. Using this type of management, network administrators can communicate with routers, DSU/CSUs, files servers or other network hardware with TIA/EIA ports — using standard modems and POTS lines.

Console Port Connectivity

Another limitation of completely in-band management solutions is that, in some cases, complete configuration of a device is not possible through a network connection. And, products still exist that do not have LAN ports. These legacy devices include PBX systems, UPS systems and power or temperature controllers. The only possible method of managing these devices is via their serial console port.

GDC offers several solutions that enable network operators to avoid and reduce downtime, as well as to diagnose the cause of the problem and configure remote equipment. This paper examines a variety of the out-of-band management solutions offered by GDC.

DEFINITION OF OUT-OF-BAND

Throughout this paper, the term out-of-band is used extensively. Traditionally, out-of-band management transmission occurs through an external physical data connection designed for network management traffic only — such as modem dial-up methods. Many service providers, however, simply consider out-of-band management to mean that the management data does not travel on the customer-billable backbone regardless of the actual data path. In the service provider definition, a separate or overlay router network keeps the management traffic off the billable backbone, and is considered out-of-band. In this paper, the term out-of-band is used to mean dial-around or via a separate physical connection.

SOLUTION REQUIREMENTS

To maximize revenues in today's competitive service provisioning environment, the ideal management access system at the POP must deliver:

Cost-effectiveness — a convenient package that does not put a burden on the cost of initial equipment investment, installation, or maintenance.

Maximum Density in a Small Footprint — support for the highest density of ports without sacrificing the compactness needed in a crowded common equipment room.

Security — several layers of security are required to protect the network from “hackers.” This would now include RADIUS Security — the industry standard for authentication of user names and passwords.

Room for Expansion — a compact equipment solution that has the capacity for high growth.

NEBS Compliance — Level III to satisfy carrier collocation regulations.

DC Power Redundancy — to ensure reliability in difficult-to-service remote sites.

The SpectraComm family is one of the few NEBS Level III Compliant network products on the market that can deliver all of the essential provisioning requirements for today's service providers. SpectraComm is a comprehensive product family that includes analog and digital plug in cards that address switched network, private line, async/sync, DDS, T-1, DSL and T3 solutions at data rates from 0 to 45 Mbps. These elements can be intermixed in a common high density shelf to meet the diverse objectives of the most discriminating user, carrier and service provisioning clientele.

NEBS COMPLIANCE

A requirement for Central Office equipment located in U.S. Public Switched Network centers, the rigorous NEBS (Network Equipment Building Standards) are a universal measure of network product excellence for carriers. NEBS includes criteria for operational continuity, protection of property, and personnel safety. Telcordia — formerly Bellcore — has grouped the criteria into three functional groups or levels. Less than Level III compliance can restrict deployment in certain carrier environment applications. By meeting the Level III requirements, GDC products can be deployed in all carrier central office environments.



APPLICATIONS

Line-by-Line Dial-In Solutions

Dial-in Management Access for Up to Four Devices

Figure 1 shows the simplest form of remote network management. Two GDC SC Dual V.34 modem cards enable direct supervisory access to up to four devices via the serial port. One SC 2000 — occupying one rack unit (1.75”) of space at the POP — is all that is needed to support dial-up management access to up to four DSLAMs and/or voice switches. When a remote dial-up connection is made to a modem, administrators at the Network Operations Center (NOC) have direct access to the DSLAM for remote control, monitoring, and diagnostics.

Reducing Line Costs

To keep costs down, often a port switch is deployed. The port switch allows one POTS line to control multiple devices.

In GDC’s configuration, one SpectraComm V.34 4-Port modem provides the connection to

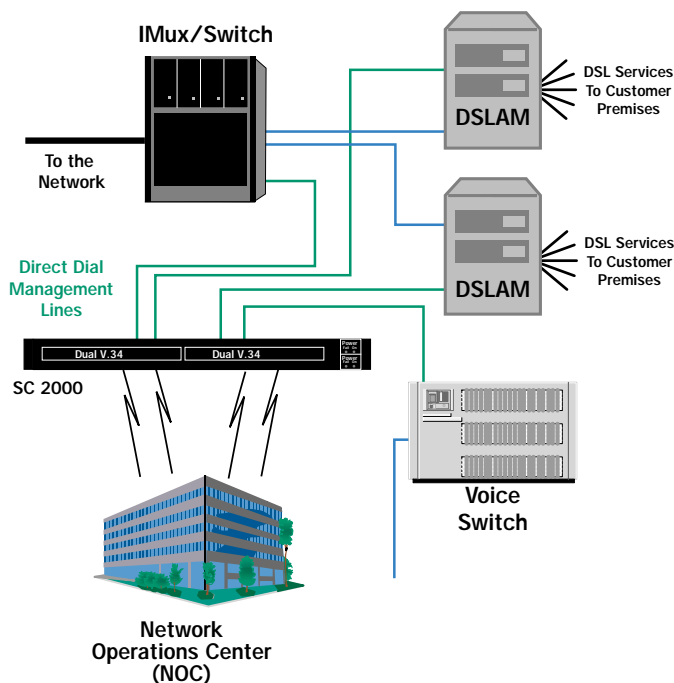


FIGURE 1 – ONE SERIAL MANAGEMENT PORT PER DEVICE

four different devices (Figure 2). The SC V.34 4-Port acts as a four port terminal server, reaching four devices via TIA/EIA-561 DTE connectors, managing a single device per dial-up management session.

The V.34 4-Port allows an authorized user to select one of four ports. Access to the 4-Port function is protected by call password security or RADIUS security authentication.

In both of these scenarios, all of the management connections are direct-dialed between the NOC and the serial port on the DSLAMs or other craft ports, which eliminates the possibility that the hub or router will fail and not allow access. Certain key configuration parameters are only available through the serial port, setting the IP address, for example.

LAN Connected Out-of-Band Management

In Figure 3, the SpectraComm 2000 shelf is configured with one V.34 modem and one SpectraComm Manager (SCM) card. The SCM provides a management interface to the Ethernet LAN, enabling remote management of all the devices through the network.

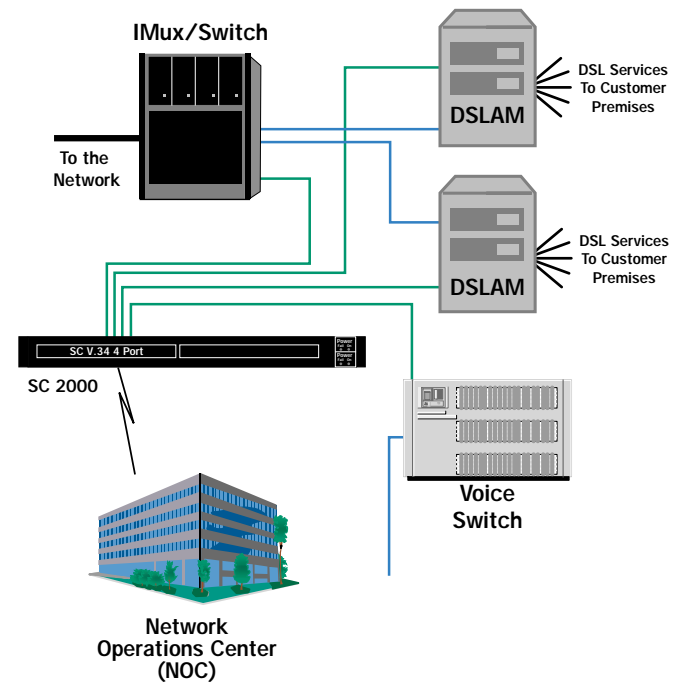


FIGURE 2 — REDUCED LINE COSTS: MANAGING FOUR DEVICES WITH ONE MODEM AND ONE DIAL-UP LINE

A single call from the NOC to the remote POP provides access to the manageable devices. This link puts the network operator directly in contact with the Ethernet LAN, enabling them to access and manage multiple devices via one IP connection.

By utilizing a common Ethernet hub, this configuration uses less equipment overall and requires fewer dial-in lines.

Best Of Both Worlds

For optimal management access, both primary LAN and secondary dial-in connections can easily be configured. In Figure 4, the network is set up to allow LAN-connected access during normal network operation, with fail-safe dial-in connections for disaster recovery. The SpectraComm 2000 houses the SCM and a SpectraComm V.34 4-Port modem, allowing the dial-in connection to be established with either the LAN or directly to the equipment via a serial port connection.

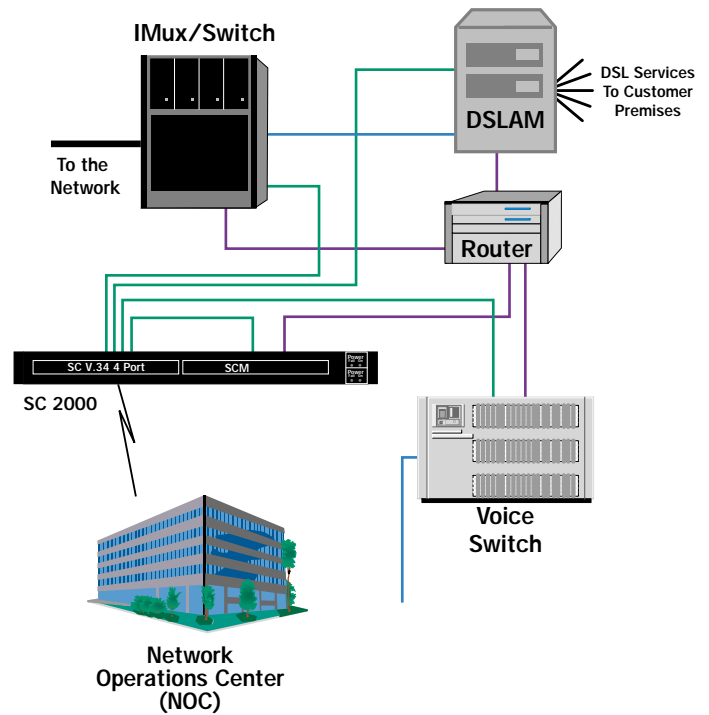


FIGURE 4 — BEST OF BOTH WORLDS

An Added Benefit

When the service provider uses a router-based network for data transmission, T1 and T3 backhaul can be added to the application by expanding to the SpectraComm high density shelf and adding the appropriate data sets (Figure 5).

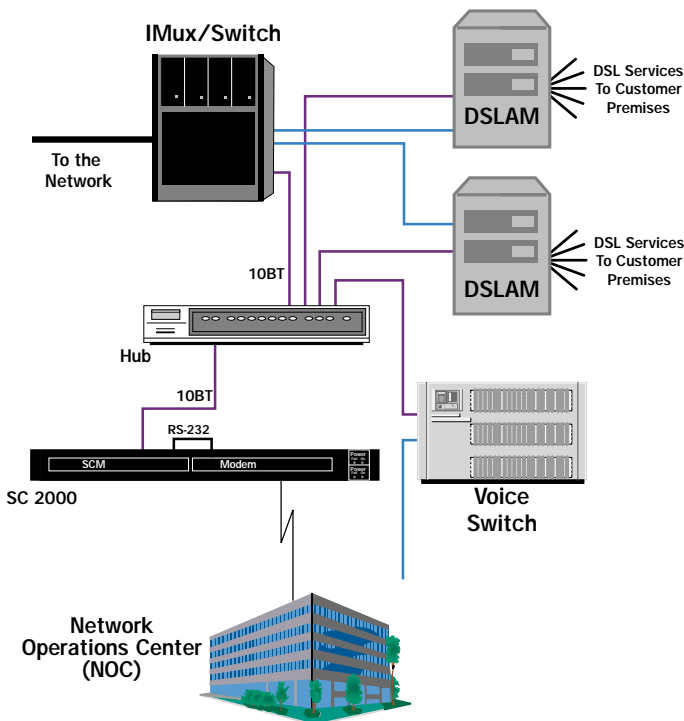


FIGURE 3 — ONE PORT REACHES ALL DEVICES

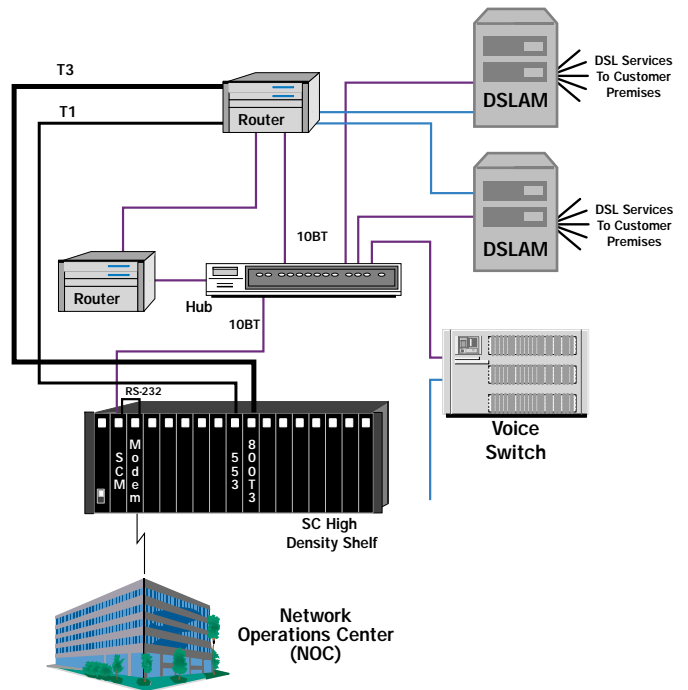


FIGURE 5 — BACKHAUL OPTION

GDC'S SOLUTIONS

GDC's SpectraComm products are available in several different configurations designed specifically for dial-in management access at the carrier's POP. Each of these packages allows the service provider to deploy economical supervision and control of routers, servers, switching and access equipment.

Line-by-Line Solution

Combining GDC's rackmounted modems and the compact SC 2000 enclosure provides a cost-effective dial-in solution for up to eight ports in a small, NEBS Level III compliant unit.

LAN-Attached Access

The unique SpectraComm solution gives network operators access to multiple devices with only a single dial-in link. GDC is the only manufacturer who can package a V.34 class modem with three levels of password security in the modem, Radius Security, and the SCM LAN interface card in a very small NEBS Level III compliant shelf, meeting all the requirements for installation in a service provider's CO.

Network operators simply initiate a modem call from the Network Operations Center (NOC) to gain secure, remote access to routers, DSLAMs, muxes, switches, servers and other soft-optionable or intelligent devices. Through a single dial-in link, SpectraComm puts the network operator directly in touch via an Ethernet LAN so they can diagnose, manage, configure and control multiple devices via IP (i.e. Telnet).

Both the Dial-in and the LAN-Attached solution provide support for a wide variety of network management packages, as well as Telnet. In effect, any existing network management system will work with GDC's remote management solutions.

Solution Components

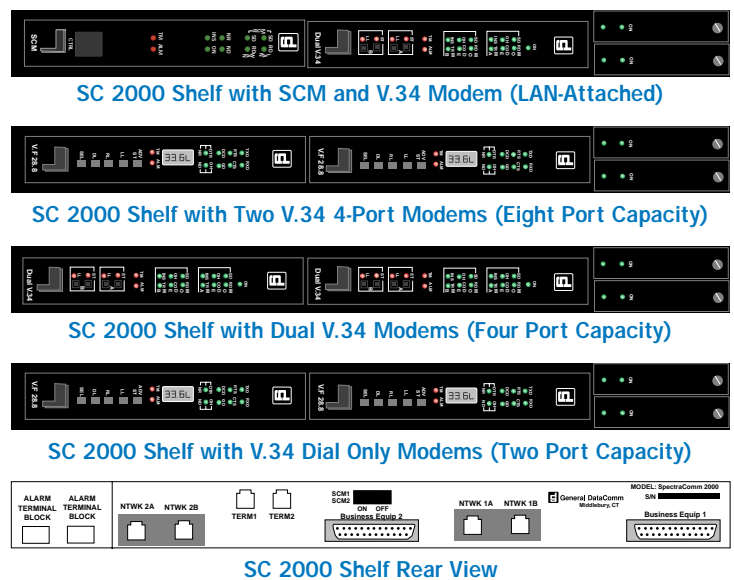
Packaging

The SpectraComm 2000 Enclosure For compact installations, the SpectraComm 2000 supports a maximum of two SpectraComm plug-in cards (Figures 6 and 7). The SC 2000 is one Rack Unit (1RU): 19 inches (482.6 mm) wide X 1.75 inches (44.45 mm) high X 10.6 inches (269.2 mm).

The SpectraComm MS-2 High Density Shelf For larger installations and expanded reach, the 16-slot High Density SpectraComm MS-2 Shelf can be deployed (Figure 8). The high density model occupies only 7 inches (178 mm) of rack height and a shallow 12 inches (305 mm) of depth, with the standard 19 inches (482.6 mm) width.



FIGURE 6 — SPECTRACOMM 2000



SC 2000 Shelf Rear View

FIGURE 7 — SPECTRACOMM OUT-OF-BAND CONFIGURATIONS



FIGURE 8 — SPECTRACOMM HIGH DENSITY SHELF

Common features include:

- Hot-swappable modules, allowing service or hardware upgrades without interrupting system operation.
- A single power supply or two independent power supplies, supporting 115 VAC, 230 VAC, and -48 VDC input options. The SC 2000 also supports 24 VDC. The twin power supplies perform load sharing during normal operation and one supply will power the whole shelf if the other fails. Replacement of a failed power supply can be done without service interruption.
- Mounting per TIA/EIA-310E specifications, with a choice of front or center-of gravity rackmounting. The SC 2000 also features a wallmount option.
- Front panels with status indications and easy to read connect speed display for modems
- Conveniently located rear panel DCE, DTE and WAN connectors

Modem Cards

Dial-up management access is supplied by a SC 2000 Shelf or a High Density SpectraComm Shelf equipped with one or more of the following:

SpectraComm V.34 4-port — A combination of hardware and software features that allow the SC V.F 28.8 /33.6 platform to act as a four port terminal server and provide four TIA/EIA-561 DTE interfaces.

SpectraComm Dual V.34 — Delivering two, high performance, high reliability V.34 modems on a single card for a total of four modems per SC 2000 Shelf.

SpectraComm V.F 28.8/33.6 — A single port V.34 modem for lower density requirements.

Both the Dual V.34 and the V.F 28.8/33.6 can transmit synchronous or asynchronous data at speeds up to 33.6 kbps. With advanced compression techniques, they can achieve an effective throughput of up to 64 kbps in synchronous and 128 kbps in asynchronous applications.

Security

GDC's Steadfast Security® offers protection from "hackers" through three levels of first line security:

- Handshake Security — In this mode, only another modem with GDC's patented Handshake Security can connect to the network, providing hardware verification as the first line road block.
- On-Line Security — In this mode, any brand modem that calls is prompted for a password.
- Dial Back Security — Authenticates the password and calls back the dial-in user.

RADIUS security features are also available when used in conjunction with an SCM card. In this scenario, the customer provides a security database, and the SCM gates the access for authentication and access through a RADIUS server.

In addition to these outstanding access features, all modems are NEBS Level III compliant, the most stringent of the NEBS certification levels.

DSU/CSUs

In addition to modems, the SpectraComm family includes NEBS Level III compliant, SNMP managed DSU/CSUs which can provide digital access with dial backup and T1/T3 backhaul.

SpectraComm Manager (SCM)

The SCM allows TCP/IP-based connectivity, providing the management interface to multiple network elements. The SCM can be configured to provide access to LAN-connected network elements at the POP, enabling remote data set configuration, alarms, performance monitoring, diagnostic testing and network restoral. In addition, the SCM acts as the client

for RADIUS security features. For added resiliency, a redundant SCM configuration is available in the high density SpectraComm shelf.

Centralized SNMP Management

Depending upon the existing management system and the degree of control and sophistication required at the central site, the service provider can use a number of SNMP-based remote management approaches. Since the V.34 modems support SNMP, and contain GDC enterprise MIBs, any SNMP MIB browser can be used on the central management station, or the administrator can gain access via a Telnet session.

CONCLUSION

Combining both in-band and out-of-band management technology provides complete infrastructure management capability. When the network and devices connected to it are working, in-band SNMP management provides invaluable information critical to the operation of the network. However, when a device fails or a network connectivity problem occurs, SNMP and in-band management tools become useless. You must use out-of-band management to correct the problem. Having both types of monitoring will provide a cohesive overall solution to management and monitoring in the network environment.

Service providers know better than anyone that network outages will happen. GDC's out-of-band management solutions deliver the tools that enable network operators to remain proactive during a network outage — which is key to maintaining a growing client-base — and stay one step ahead of any fault that may occur in the network.

If the network suffers a severe interruption, the network operator is equipped to find and fix the problem quickly while keeping customers and users informed, even when the main data link goes down. Many times, the network operator is able to correct the problem on-line without sending a truck or technician, therefore reducing maintenance time and cost.

GDC is the only manufacturer that delivers complete solution that meets all of the critical requirements for collocation. This is accomplished by delivering redundant DC powered, NEBS Level III compliant shelves coupled with a V.34 class modem with multiple levels of security and a LAN interface card — all in a very small form factor. And we've proven this solution with several service providers.

CORPORATE OVERVIEW

General DataComm (GDC) is a leader in the design, development, and manufacture of reliable and standards-compliant network access equipment for service provider, government, and enterprise networks. GDC builds, improves, and supports the infrastructure that delivers high quality voice, video and data services. Founded in 1969, GDC has a proven track record for innovation. With 1250 patents to its credit, the Company is responsible for a number of data communication industry firsts.

GDC offers a broad range of NEBS-compliant, carrier-class network access products including integrated access systems for T1/T3, xDSL, DDS and analog services; modems/CSUs/DSUs; frame relay probes and monitors; and network management systems

GDC's customers include leading service providers, government and business enterprises in North America, Europe, Asia and Latin America. These relationships have been forged over 30 years in the business. Known for the quality and reliability of its products, GDC provides wide area networking solutions for their mission critical applications. GDC's products support the transport of critical signaling information within the public telephone network, provide network access for wireless and wireline infrastructures, support IP to the CO, secure remote network management and the convergence of voice, video and data services. GDC's "Telco Tough" products meet worldwide regulatory and industry standards including NEBS Level III.

GDC is an ISO 9001 certified manufacturer headquartered in Middlebury, Connecticut. The Company has a global network of distributors, partners and resellers. Annual revenues in 2000 were \$167 million.

GLOSSARY

| | | | |
|--------------------|--|------------------------|--|
| CO | Central Office | NOC | Network Operations Center |
| DSL | Digital Subscriber Line | Out-of-Band Management | A network management scenario that utilizes a separate, external physical data connection to pass management data. |
| DSLAM | Digital Subscriber Line Access Multiplexer | POP | Point-of-Presence |
| DSP | Digital Signaling Processor | POTS | Plain Old Telephone Service |
| IMUX | Intelligent Multiplexer | SCM | SpectraComm Manager |
| In-Band Management | A network management scenario where the management data travels the same path as the network data and is considered “always on.” | TCP | Transmission Control Protocol |
| IP | Internet Protocol | TIA/EIA-310E | Electronics Industries Association standard for racks, panels and associated equipment |
| NEBS | Network Equipment Building Standards | | |



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