



**LocalNet™ 20
Overview**

Sytek, Inc.

Introduction

LocalNet™ is a low cost, high performance data communications network, based on a synergistic combination of analog, digital and data communications technologies. LocalNet is a major advance in network systems design. LocalNet will support over 20,000 simultaneous data communications users, utilizing industry standard broadband cable television

(CATV) distribution facilities. LocalNet's distributed network intelligence offers a transparent, high performance data communications system. This approach provides for the interconnection of a wide range of user equipments, end-to-end data security, configuration flexibility, and ease of installation.

LocalNet 20 meets the immediate and future needs of industry, government, education, aerospace and financial data communications applications. LocalNet 20 is implemented as a modular growth oriented family of network products. These products offer the data communication user clean and easy installation, maintainability, and flexibility to meet evolving network requirements.

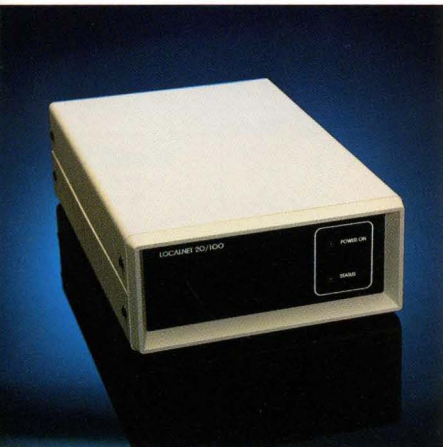
- **Cost.** LocalNet 20 offers a cost effective solution to both immediate and long-term network needs.

- **Installation.** LocalNet 20 products interface directly to low cost, easy to install CATV coaxial cable facilities.
- **Reliability.** An end-to-end error rate of less than one in 10^{13} bits is provided.
- **Security.** Optional end-to-end data encryption with electronic key distribution for data security.
- **Compatibility.** LocalNet 20 accommodates a broad range of user equipments and interface standards.
- **Expandability.** Additional users, long haul network gateways, and inter-facility connections can be configured through modular enhancements.
- **Coexistence with other broadband services.** At full network capacity, LocalNet 20 occupies less than one-third of the available cable spectrum in standard midsplit systems, and less than one-tenth in a dual

cable system. Other services (high-speed data links, voice and video) can reside on the same cable with LocalNet 20.

Major features incorporated into the design of LocalNet include:

- Distributed network intelligence for system reliability, easy expandability, and support for a wide variety of user devices.
- Remotely accessed diagnostics and automatic self-test facilities.
- Inherent end-to-end transmission speed conversion buffering, and automatic terminal speed determination.
- Frequency agile modems and intelligent packet level bridges provide the capabilities for the user to establish and control independent logical networks on a single cable facility.
- Industry standard interface connections.



- **Timesharing Networks**
- **Management Information Systems**
- **Industrial Control and Monitoring Systems**
- **Inter-Campus/Intra-City Distributed Processing Systems**
- **Integrated Office Communications**
- **Retail, Order, Reservation and Scheduling Systems**

LocalNet 20/100

LocalNet 20/100 is a microprocessor-based packet communications unit. It also contains a software controlled, frequency-agile broadband transceiver. Optional enhancements include various user interfaces and protocols, DES encrypted end-to-end secure operation, and operation with the LocalNet 50/100 NCC.

LocalNet 20/200

LocalNet 20/200 is a multiplexed PCU which provides eight user ports to the network. Each port functions in a manner equivalent to the LocalNet 20/100 PCU. The LocalNet 20/200 is typically used to interface multiple CPU ports to the network; it provides automatic port selection through a rotary function.

LocalNet 50/200

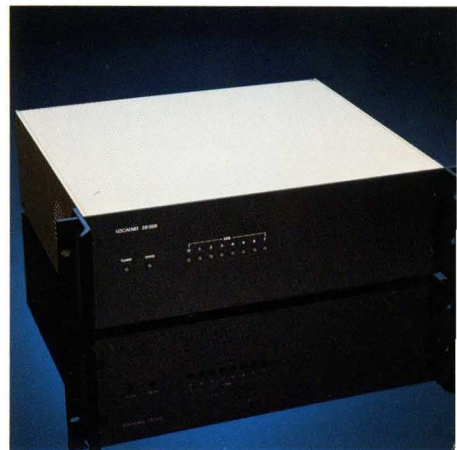
LocalNet 50/200 is a microprocessor-based store and forward packet switch used to logically connect up to eight LocalNet 20 channels. Multiple LocalNet 50/200's may be cascaded or paralleled to achieve any number of inter-channel connections and levels of redundancy.

LocalNet50/50

LocalNet 50/50 is a headend frequency translator utilized to provide translation of the transmitted data frequency spectrum to that required by the receiver section of the PCU. Only one LocalNet 50/50 is required to support a LocalNet cable system. For systems requiring headend redundancy, the LocalNet 50/55 automatic switch unit monitors condition of multiple LocalNet 50/50 units and will automatically activate a hot standby. An inexpensive manual switch unit, the LocalNet 50/60, is also available.

LocalNet 50/100

LocalNet 50/100 is an integrated Network Control Center, based on a 16 bit microprocessor, providing display, keyboard, and magnetic storage devices. The 50/100 provides a wide range of network management and support features; including resource management (logical addressing, access control, and so forth), digital monitoring (performance and statistics) and encryption services (key distribution and secure session establishment).



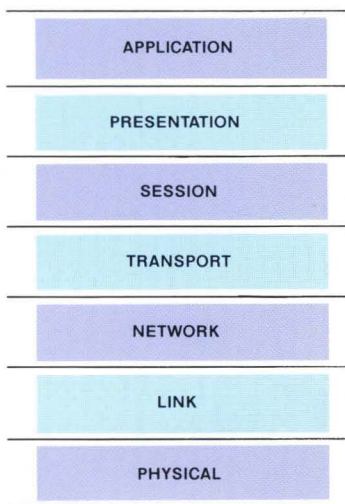
The LocalNet Solution

LocalNet is a family of devices used in configuring highly capable networks for data communications service in office, industrial or campus settings. The transmission backbone features the use of a broadband coaxial distribution system, capable of providing efficient service in areas of a few thousand square feet to hundreds of square miles and supporting thousands of data communication terminals and devices. The LocalNet 20/100 and 20/200 are packet communications units which are attached to this backbone. They support standard EIA RS-232C electrical interfaces for asynchronous terminals, synchronous terminals and host ports.

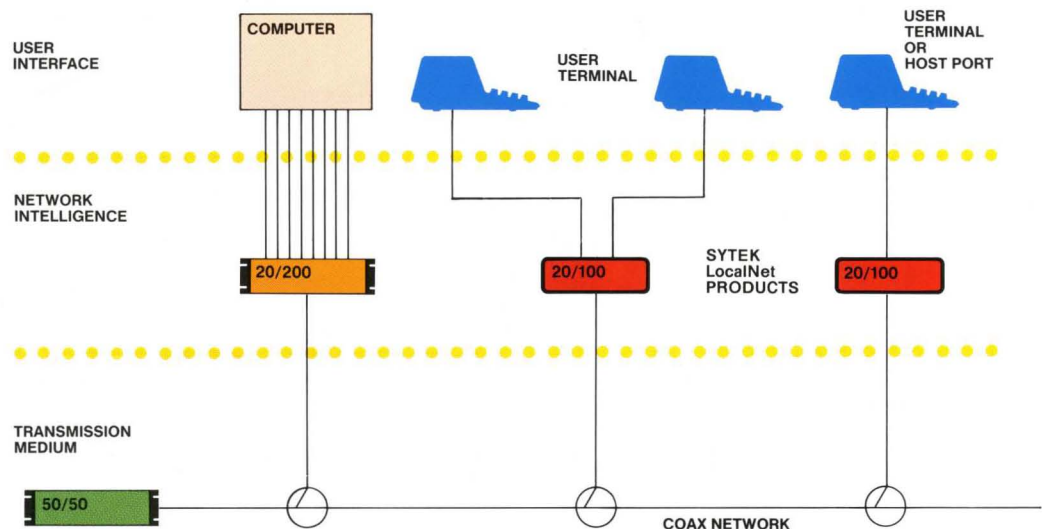
The LocalNet architecture is based upon a layered set of services. These layers follow the seven layer protocol model developed by ISO (International Standards Organization) and known as OSIA (Open Systems

Interconnection Architecture). The transmission layer corresponds to the OSIA physical and link layers. The network layer provides functions found in the OSIA network and session layers and the user interface provides functions analogous to the OSIA presentation layer.

ISO Layers



LocalNet Functional Layers



CATV Transmission Layer: The Medium and Its Use

LocalNet utilizes broadband coaxial cable as the physical communications medium. This medium provides high bandwidth (300 to 440 MHz) and the multidrop capability required for today's growing data communications requirements. Separate data channels are derived from the available bandwidth capacity of the cable. LocalNet 20 may use up to 120 contiguous 300 KHz channels, although the user need only allocate what is needed for the immediate applications.

LocalNet exploits the directional aspect of the cable TV network to achieve full connectivity. The LocalNet 20 channels are contained in two 36 MHz bands. The band from 70 to 106 MHz is used to transmit data from any packet communications unit to the headend frequency translator (LocalNet 50/50). The LocalNet 50/50 converts a selected portion of the 36 MHz lowband to a highband occupying 226 to 262 MHz for retransmission along the cable to the modem receive section of each packet communications

unit. This technique is totally compatible with midsplit and dual cable installation. LocalNet is also optionally available for subsplit operation.

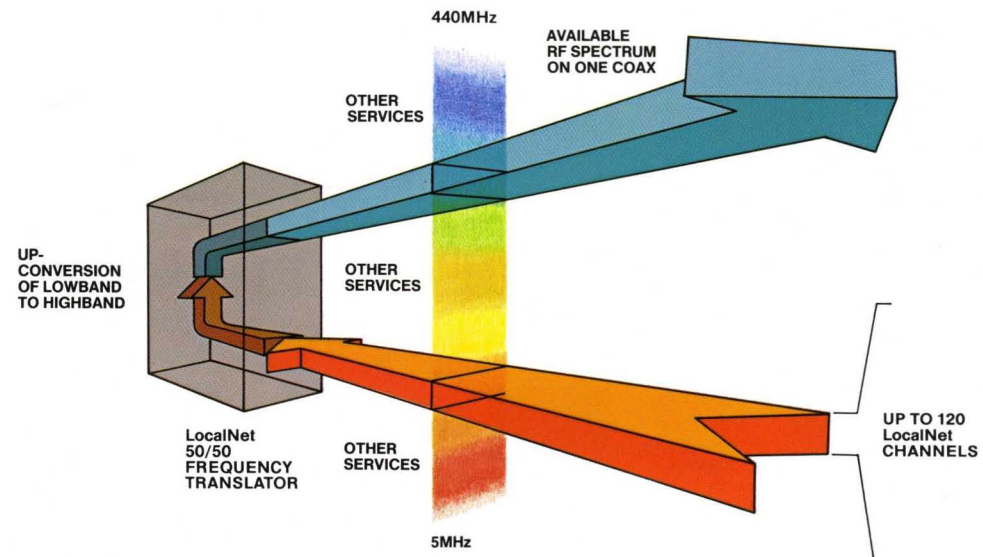
Each of the 120 LocalNet channels supports a 128 kilobit per second data rate. To use each channel to its fullest extent, a CSMA/CD (Carrier Sense Multiple Access/Collision Detect) access mechanism is employed. This allows each packet communications unit to contend for transmission access with other PCUs on the high-speed channels. This distributed access technique provides for high system reliability, low transmission delay and channel utilization in excess of 95%. This access technique, in addition to the protocols provided by the network layer, allows LocalNet 20 to support hundreds of active terminals on each of its 120 channels.

A simple coax outlet (F Fitting) in each area to be served provides an economical solution for today's data communications needs and provides the capacity for

tomorrow's new and growing requirements. The user may easily connect or disconnect the PCU, moving it, if necessary, from room to room with no wiring changes. Functional upgrades or the addition of new services, such as closed circuit teleconferencing, may be made without addition or change to the broadband cable transmission system.

- **Midsplit System**
5-110 MHz Reverse
160-440 MHz Forward
- **Subsplit System**
5-30 MHz Reverse
54-440 MHz Forward

LocalNet Use of the Broadband Medium



The Transport System The 20/100 or 20/200 Packet Communications Unit

The Network Layer adds the substantial power and efficiency of contemporary packet switching protocols to the capabilities of the Transmission Layer. The Network Layer is implemented in each LocalNet packet communications unit.

The LocalNet 20/100 is the basic component of LocalNet 20. This unit provides all the necessary media access, network intelligence and user interface functions. LocalNet 20/100 is designed to accept data from a terminal device or host port and to perform the following functions:

- Selects, under user or network management control, one of 20 logical

channels within one of six frequency groups on which it will operate.

- Establishes, maintains, and disconnects sessions between and among terminals and hosts.
- Formats and addresses packets for their destination using internal LocalNet data communications protocols.
- Controls the allocation of the channel bandwidth using CSMA/CD access mechanism.
- Controls the flow of data over the channel and supported sessions to prevent congestion and data loss, both local (at the terminal or host port) and global (aggregate traffic on the backbone channel).
- Detects errors through the use of Cyclic Redundancy Checks (CRC) and corrects errors through retransmission of lost or damaged packets.
- Supports optional value-added services including protocol and code conversion, directory services and end-to-end encryption.

- Exports these functions to the user equipment utilizing the presentation protocols provided by the User Interface Layer.

LocalNet 20/100 consists of two functional sections: an RF transceiver which connects to the 75 ohm coaxial cable via an inexpensive passive (CATV) tap, and a microprocessor section which implements the communication protocols and provides the user interface. The RF section consists of a frequency synthesized, full duplex FM transceiver with a 156.25 MHz offset spacing between the transmit and receive frequencies.

The microprocessor section of the LocalNet 20/100 performs data terminal interfacing, packet assembly and disassembly, data buffering and transceiver control, as well as protocol management on the cable system.

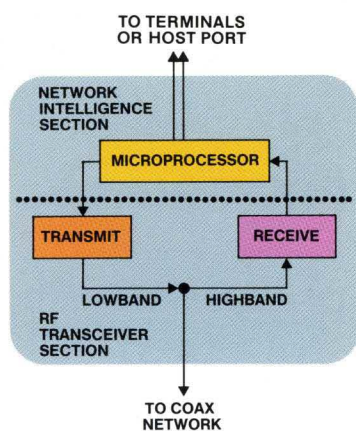
LocalNet 20/100 supports two user ports. Where several terminal/computer ports are in close physical proximity, a multiplexer, the LocalNet

20/200, is available. The LocalNet 20/200 provides eight user ports with a single RF transceiver. Where multiple terminals or host ports are co-located, several LocalNet 20/200's may be used to interface more than eight devices.

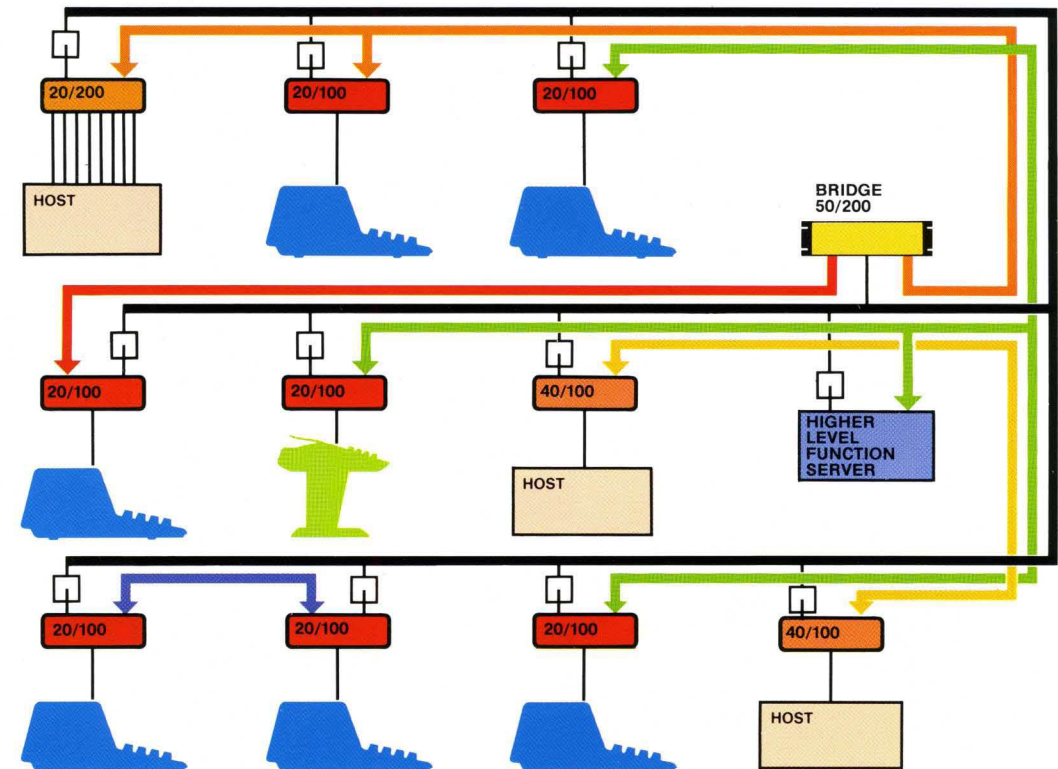
In network applications where a single channel approaches its maximum capacity, or where a connection (bridge), between channels (or their associated logical groups) is desired, an interchannel bridge is available. This device, the LocalNet 50/200, permits selective data forwarding between channels.

The LocalNet 50/200, functioning as a store and forward packet switch, consists of up to eight independent, frequency-agile modems integrated with a microprocessor control unit. This device monitors up to eight software selected channels for data packets requiring inter-channel transfers. These packets are transparently buffered, routed, and re-transmitted on the appropriate channel.

LocalNet 20/100



LocalNet 20 Logical Layout with Interconnections



**Interface Layer:
The User Interface**

The third layer of the LocalNet architecture is the User Interface Layer. It provides a user-friendly interface to the internal LocalNet services. The connection to the standard LocalNet packet communications unit (either LocalNet 20/100 or 20/200) is EIA RS-232-C, providing support for serial asynchronous or synchronous devices at selectable rates to 19200 bits per second. The interface provides the standard RS-232 data, clock, and modem control signals.

The user command language is based upon the international standard for packet-switching networks, CCITT Recommendation X.28 and X.3, employing enhancements that exploit the unique properties of LocalNet. This interface provides two levels of virtual control operations to the user.

The first level supports initialization of individual PCUs.

This mode provides the ability to set the logical channel number, unit address (source address), several functional packet parameters, the data rate at the user interface, pin functionality at the user interface, and the menu of functions available to the user. For units supporting the end-to-end encryption option, the unit master encryption key is initialized at this level. Normally, a privileged user, known as the Network Manager, performs these tasks before PCU installation, in conjunction with the users' overall network plan.

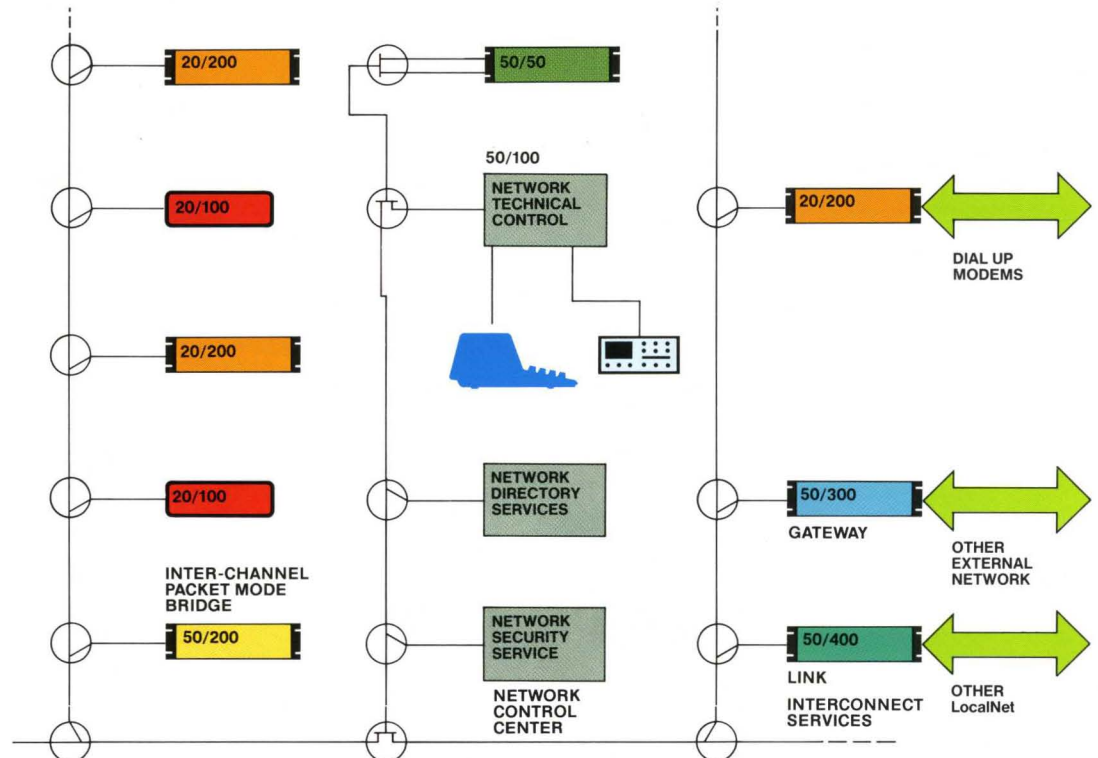
The second level user control functions are a subset of the initialization operations. These control functions allow the user to establish, interrupt and terminate sessions.

Additional parameters for flow control, echoplexing and packetization control can also be set and examined. Once a

session is established, data flow occurs transparently.

Speed matching is a particularly valuable feature provided by the Interface Layer of LocalNet 20. For each session, LocalNet 20 packet communications units internally buffer the user data and control the transmission rate of the data to match that of the receiving user equipment. For example, a 9600 baud user device has the ability to access a 300 baud device without changing network parameters or requiring user interaction at either the sending or receiving PCUs. This is a direct benefit of the distributed intelligence provided by the LocalNet 20/100 and 20/200 units of LocalNet 20. LocalNet 20 also supports standard modem interfaces, thus allowing interconnection between devices on LocalNet and those operating over public or private telephone circuits.

LocalNet 20 Physical Layout with Enhancements



LocalNet Enhancements

Planned LocalNet enhancements provide substantially increased capabilities for network interconnection, user device interfaces, security and privacy, and network management and control.

LocalNet 20 products provide gateways between not only multiple LocalNet installations, but also to external networks including X.25 packet networks. These products both extend the size and geographical coverage of LocalNet 20 networks as well as supporting their interconnection with other types of networks.

LocalNet's distributed intelligence and layered protocol architecture supports interfaces to a wide variety of user devices. These include not only asynchronous but also synchronous terminals and host interfaces. Thus diverse user devices can be effectively interconnected through LocalNet.

A compatible LocalNet upgrade provides substantial security features through incorporation of end-to-end encryption for those users requiring such protection. The optional encryption capability utilizes the 50/100 Network Control Center as a Key Distribution Server. The encryption algorithm utilized is the DES (Data Encryption Standard) developed by the National Bureau of Standards. Only those LocalNet 20/100 or LocalNet 20/200 PCUs requiring higher level of security need be equipped with the option. This capability requires no change to existing terminals and, further, secure terminals and non-secure terminals may coexist on the same network. LocalNet's advanced security options also allow secure and non-secure users to communicate by providing a compatible unencrypted mode. Thus, data security requirements are easily and cost effectively met.

The 50/100 Network Control

Center provides a wide range of high level network management and control services: logical addressing, call queuing, access control and other operational functions, designed to enhance LocalNet's efficiency and operation. The provision of distributed intelligence within each LocalNet PCU provides unequalled capability for network operation, reliability and maintainability. LocalNet 50/100 provides the tools for network managers to easily diagnose and solve network problems through the provision of network traffic, node status and performance monitoring, as well as a full range of tools for monitoring cable connectivity and signal quality.

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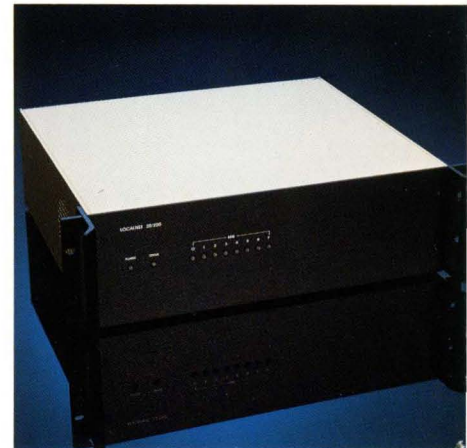
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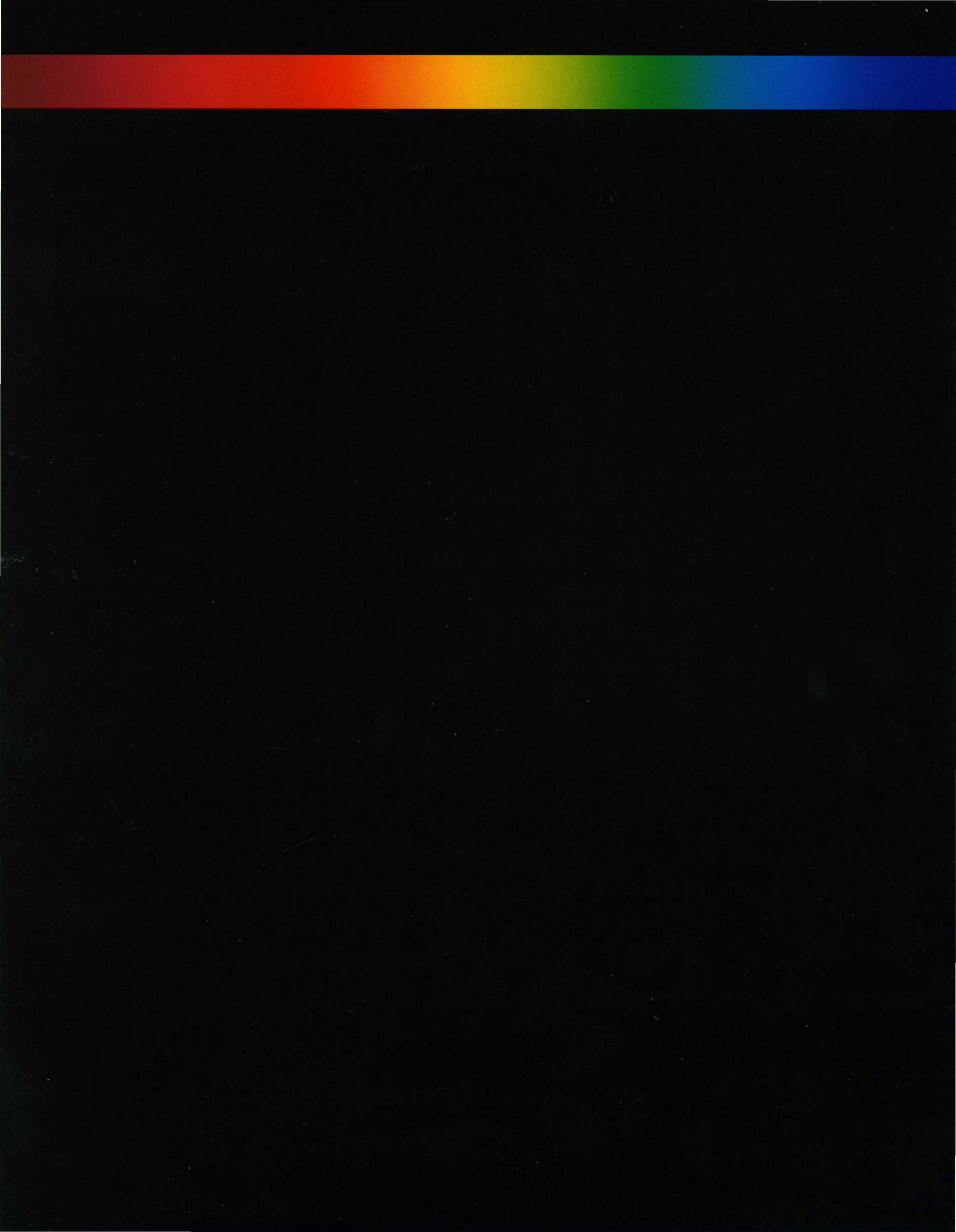
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