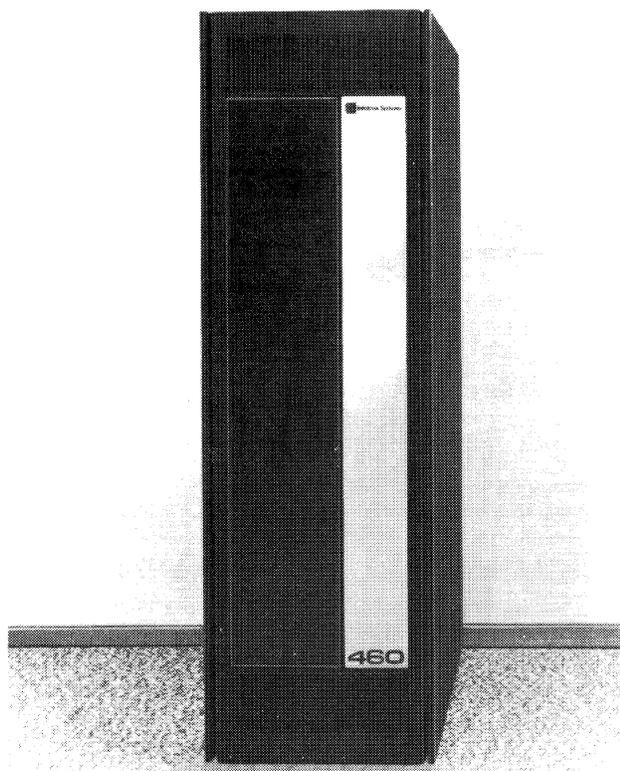


Infotron TL460 Data Switch



Behind the front door of the TL460 cabinet pictured above are racks of printed circuit boards that provide interfacing for up to 312 I/O channels. Multiple cabinets can be cabled together chain-style, permitting one TL460 to service a maximum of 4000 channels and maintain up to 2000 cross-connects.

MANAGEMENT SUMMARY

The TL460 Data Switch currently represents the top of Infotron's line of data communications products. Although the TL460's basic purposes—port contention and multiple-computer access—are identical to those of Infotron's smaller TL450 Port Selector, its capabilities significantly exceed those of the TL450 in terms of versatility, capacity, and line speed.

The primary concept behind the operation of a data switch, as opposed to a port selector, is that of matrix switching. No distinction exists between "port" and "line" sides of the data switch, and any connected device may operate as a source or a destination of transmissions to/from any other compatible device in the system's network. This means not only that a terminal can communicate with any of several hosts, but that a terminal can communicate with another terminal, a computer with another computer, etc. In addition, because of special features built into the logic of the data switch, such as automatic speed recognition, devices with dissimilar transmission characteristics may be connected; e.g., a terminal using dial-up facilities may access a computer port set up for dedicated line usage.

A general-purpose, high-speed electronic switching system that handles contention, sends busy signals, establishes priorities, sets up queuing, and establishes connections between various computers and/or I/O devices in a network.

Up to 4000 I/O channels can be interfaced to the system, and up to 2000 simultaneous cross-connects maintained. Each channel may be provided with a unique address, permitting up to 4000 different service classes to be assigned. Asynchronous or synchronous transmission is supported up to 19,200 bps.

A minimum configuration, with interfacing for 24 asynchronous bit-oriented I/O channels, is priced at \$11,000.

A larger configuration, with interfacing for 88 bit-oriented channels and 504 character-oriented channels, is priced at \$99,800. Factory maintenance under a one-year warranty is included.

CHARACTERISTICS

VENDOR: Infotron Systems Corporation, Cherry Hill Industrial Center, Cherry Hill, New Jersey 08003. Telephone: (609) 424-9400.

DATE OF ANNOUNCEMENT: April 1980.

DATE OF FIRST DELIVERY: September 1980.

NUMBER DELIVERED TO DATE: —.

SERVICED BY: Infotron Systems Corporation.

CONFIGURATION

The TL460 Data Switch is a large-scale, multi-microprocessor-controlled, interactive data communications switching system. The base unit, or "master nest," consists of a set of printed circuit boards, which are rack-mounted inside the upper portion of a 72-inch-high cabinet; a power supply, which is mounted on the back door of the cabinet; four control ports; and four cassette tape unit interfaces (optional).

The basic set of boards includes two central logic boards, two cassette tape interface control boards (optional), a slave controller module, and two asynchronous service modules. In addition, six slots are provided for the first six channel adapter boards.

The central logic boards consist of a master control module and a switch bus interface, which together supervise all other system functions, such as maintaining control over all slave controller modules, maintaining the "busy" queue, supervising system diagnostics, managing the four control ports, and managing the data flow between the system and the cassette tape units.

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▷ Physically, the data switch is modular in design, and both hardware and software are partitioned to perform specific tasks. A large proportion of the hardware consists of LSI boards that provide interfacing to the devices making up the network. Three board types provide for three basic modes of data transmission: asynchronous, bit-by-bit; asynchronous, character-by-character; and synchronous. An internal bus structure interfaces the boards with central logic by scanning for board activity in a circular loop.

The operating system of the data switch is a parameterized, PROM-stored program that permits the user to display configurational choices on the system's console and select those that are appropriate for the particular system being configured. Normally, the parameters, which must be reloaded upon power-up, are stored on tape and loaded into RAM via integrated tape cassette units, but they can also be downloaded from a computer or, in small systems, keyed from the console or stored in PROM. Once loaded, the parameters may be temporarily or permanently changed from the console, even while calls are in progress. Among the characteristics programmable on a per-channel basis are connect and disconnect criteria, transmission speed, and automatic speed recognition convention.

Naturally, it is not likely that every connection possible via the matrix will be authorized. The data switch's logic provides an address assignment/selection scheme that sets up specific "classes of service" available to each incoming device. Each class of service may authorize users to access—or restrict them from using—any of the other channels in the network. The scheme calls for designation of an address for each channel in the system using two four-digit alphanumeric codes. The codes are designed hierarchically, so that a specific port on a computer, a group of ports, or a whole computer can be authorized or restricted. The address by which each device may be accessed as a destination, and the acceptable destinations to which it can request service, are stored with the channel's other configurational parameters.

When one device in the network needs to communicate with another device, the data switch prompts the incoming caller to designate the class of service desired as a part of the log-on procedure. If the requested address is invalid or unauthorized, the user is prompted for a new address. If the addressed destination is busy, the call is placed in a busy queue and the caller is notified as to what place the call occupies in the queue.

The capacity of the TL460 Data Switch greatly exceeds that of the TL450 Port Selector. The TL460 can provide interfacing for up to 4000 I/O channels and maintain up to 2000 simultaneous connections between channel pairs. Because addressing data is stored on a per-channel basis, up to 4000 different service class assignments can be handled. The busy queue can hold up to 256 calls in order of their arrival at the data switch. There is no limit on contention ratio.

▶ The slave controller module monitors the channel interfaces under its control for changes in control signals or data on the line, and, under the control of the master control module, passes data and signals to and from the switch bus interface.

The asynchronous service modules each provide four independent interfaces that are assigned to I/O channels to perform specialty services on an as-needed basis, before data and signals are passed to the slave controller module. Each interface can operate concurrently with the others and can perform any or all of four one-time tasks, as required by operating system logic for that channel: automatic speed recognition, keyboard-select routing, control signal simulation, and "busy" message transmission to the channel's user. Additional asynchronous service modules may be added to the master nest, occupying slots otherwise available to channel adapter boards. (In the typical system, only a minority of the total number of channels are programmed to require the specialty services of an asynchronous service adapter, and it is rare that every channel in this minority requires service simultaneously; therefore, far fewer asynchronous service modules than channel adapter boards are required per system.)

Each channel adapter board provides four interfaces for incoming communications lines and computer ports and can handle up to five control signals per channel in either direction. Infotron provides three types of channel adapter boards, which may be added to the system in any configuration; asynchronous bit-sensing boards, asynchronous character-sensing boards, and synchronous boards. Maximum supported transmission speed is 19,200 bps per interface on any board type.

Redundancy options are offered for four system modules. The dual power supply option supports two power supplies that split the current drain under normal circumstances, but each supply is capable of carrying the entire load if the other fails. No mechanical switching or interruption of service occurs when one of the units fails because both supplies are on-line; the failed supply is automatically isolated. An optional second master control module, slave controller module, and switch bus interface can be added to the system to serve the base unit on a stand-by basis, ready to be switched on-line by the operator if failure occurs in their primary-board counterparts. (The optional slave controller module can also be automatically switched in by the master control module.)

Additional "expansion nests" may be added to the base unit until system capacity is reached. Each nest provides its own power supply, one slave controller module, and slots for 16 channel adapter boards and asynchronous service modules. Any combination of channel adapter board types and/or asynchronous service modules may be placed in any nest. Each additional asynchronous service module increases the system's capability to handle simultaneous requests for service by four calls, up to the maximum cross-connect capacity of the system. A second slave controller module and a dual power supply option may be added to each nest for redundancy.

The base unit's cabinet can accommodate 4 expansion nests, for a total of 280 channel interfaces. However, in systems that utilize the tape cassette option, the cassette units occupy the racks immediately below the master nest, leaving room for only three expansion nests in the base unit's cabinet. Additional cabinets, each accommodating up to 5 expansion nests, may be added to the system. The system can handle a maximum of 64 nests (including the master nest), or up to a maximum total of 4000 interfaces. Two asynchronous service modules per cabinet are provided as standard equipment; the remaining capacity provides for a total of 312 channel interfaces per cabinet. One cabinet is connected to the nest, chain-style, using a cable of up to 100 feet in length; cabinets may be located in different areas of the computer room, or

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▷ In terms of line speed, the data switch can handle asynchronous character-by-character transmission at up to 9600 bps for each of 2000 simultaneous cross-connects. The highest data speed it can support is 19,200 bps; however, when even one communications line operates at this higher speed, the number of simultaneous cross-connects is reduced to 1000. When asynchronous bit-oriented data or synchronous data is used, fewer cross-connects are possible at these speeds.

The system also provides statistical information for use by network managers. For every successful and unsuccessful request for service by an incoming device, the system records the date, user and destination identification, transmission speed, time in queue, connect time, disconnect time, and reason for termination. The statistics can be used to identify bottlenecks, provide accounting and billing information, and plan future system growth, and can be output to any device in the network that the user wishes.

A set of diagnostic aids is also provided with the TL460. Maintenance and repair routines are designed to be relatively simple and are generally performed by the user. Repairing the system usually entails replacing a faulty board with a spare and sending the faulty board back to Infotron for repair. However, Infotron will provide on-call service and contract maintenance for those users who require it. □

▶ even on different floors, as long as cable constraints are not exceeded.

The maximum number of concurrent connections between pairs of channel interfaces, or "cross-connects," that can be logically executed by a TL460 system depends on the type of channel interfacing selected for the highest line speed used. The range of maximum capacity varies as follows:

Asynchronous bit-sensing boards:

Speed (bps)	Max. no. of cross-connects
1200	2000
2400	1000
4800	500
9600	250
19,200	125

Asynchronous character-sensing boards:

Speed (bps)	Max. no. of cross-connects
9600	2000
19,200	1000

Synchronous boards:

Speed (bps)	Max. no. of cross-connects
2400	2000
4800	1000
9600	500
19,200	250

Unlike a port selector, a data switch makes no distinction between "lines" and "ports." Any communicative device (computer, terminal, etc.) may be connected to any other compatible device in nearly any pattern. For example, a port on one computer can be linked with the port on another computer, a dial-up line can be connected to a port set up to dedicated line usage, an incoming call using a Carriage Return speed convention can access a Memorex port, etc. Connection assignments, or "service classes," are controlled by user-selected parameters in the operating logic and determine which cross-connects are valid. The TL460 can handle up to 4000 unique port addresses; the service classes are structured on a hierarchical basis using these addresses, permitting the system to authorize or prohibit connection of an incoming line requesting service to a selected port, a group of ports, or an entire computer. Users are prompted to key the service class as a part of sign-on procedures, using two four-digit alphanumeric codes, each followed by a carriage return.

Acceptable connect and disconnect service sequences for each line are pre-determined by operating logic parameters. An incoming request for service can be recognized by the switch under any of the following conditions:

- Detection of data on an incoming line, or detection of a change in the state of the data line for a pre-specified length of time.
- Detection of the leading edge of a pre-selected inbound control signal, e.g. Request-To-Send (RTS), or detection of a change in the state of a control signal for a pre-specified length of time.
- Receipt of a forced-connect command from the console or from a console-assigned port to force a connection not automatically authorized by a service class.

When the connect condition for which the channel was programmed occurs, the asynchronous service module performs any specialty services, such as automatic speed recognition, keyboard-select service class routing, or control signal simulation, required for that channel.

The TL460 permits user-designation of any of three speed recognition conventions for each channel or group of channels: the standard Carriage Return convention, a high-speed Carriage Return convention, and the Memorex convention. The standard CR convention recognizes ASCII code at 110, 300, 500 and 1200 bps, and Correspondence code at 134.5 and 300 bps. The Memorex convention recognizes ASCII code at 110, 150, 300, and 1200 bps, and Correspondence code at 134.5, 300, and 600 bps. The high-speed CR convention recognizes ASCII code only, at 300, 600, 1200, 2400, 4800, and 9600 bps. (Other conventions may be implemented on a custom basis.)

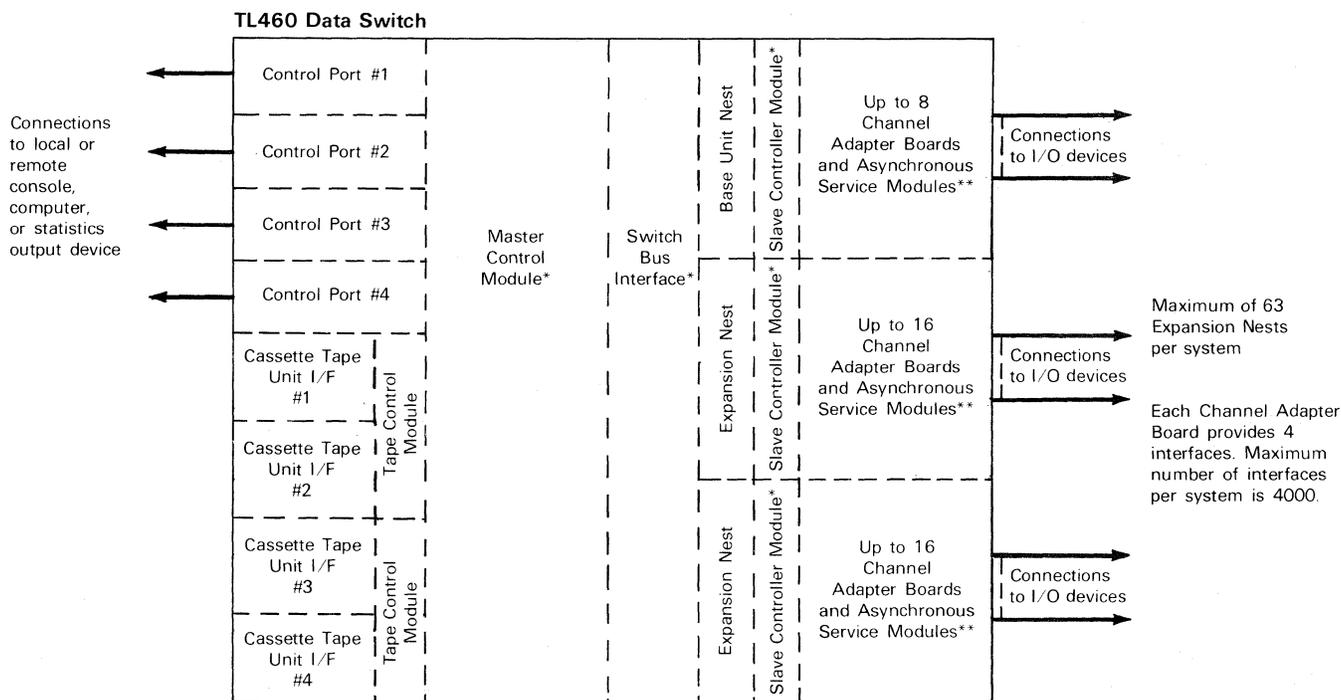
Control signal simulation permits control signals not automatically passed on to the receiving port to be modified appropriately so that they can be passed. (Normally, most control signals are automatically passed from one channel to the other.)

Upon completion of all specialty services (if any), the slave controller module raises the appropriate "bid" flag to be recognized by central logic on its next scan. Upon detection of the "bid," central logic immediately begins to search for an available port and, having found one, makes the connection. Thereafter, all data and control signals are passed in both directions transparently (except for a negligible time delay).

Central logic will continue to search for an available port until successful, or until the incoming request for service is discontinued. If a port is not found immediately, a "camp-on," or queuing, routine holds the inbound call until a port is available, eliminating the need for redialing; the TL460 can ▶

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Configuration



*System provides slots for two boards, one for normal use and one for back-up.

**Two Asynchronous Service Modules per cabinet are provided as standard equipment.

► handle up to 256 callers queued in the order of their arrival at the switch. Meanwhile, the channel's asynchronous service module notifies the caller that the connection was not made, and indicates what place the call occupies in the queue line. Either of two different 64-character busy messages can be generated, depending on why the connection was not made; the messages may be changed at any time via the console keyboard to reflect current operating status.

A disconnect is initiated under any of the following conditions:

- Absence of data in either direction for a pre-specified time from 50 milliseconds to 59 minutes.
- Detection of the "off condition" of the pre-selected inbound control signal for a pre-specified time of 50 milliseconds to 59 seconds.
- Absence of a Data Terminal Ready (DTR) signal for a pre-specified time of 50 milliseconds to 59 minutes.
- Detection of a long-space disconnect (Break) signal on either data path.
- Initiation of a forced disconnect using the busy or disable switch located on the channel adapter board.
- Detection of a "high" on pin 25 of the EIA connector, indicating a busy-out condition on either end of the connection.
- Receipt of a forced-disconnect command from the console or from a console-assigned port to force a disconnect on selected ports or groups of ports. The forced disconnect may be designated as immediate or delayed; a delayed disconnect permits calls in progress to be completed but no subsequent calls to be connected.

The TL460 can also handle call transfers for both dedicated and dial-up connections. Reassignment of a call to another destination occurs without disconnection, eliminating the need for redialing. Once the transfer is initiated, all standard call connect procedures are initiated as if a new call had been placed.

Additional devices may be added to the system via four control ports provided on the basic unit. The use of each port, and what data it receives, is controlled by the user-selected parameters in the operating program. Each of the ports may be used to connect any customer-supplied Teletype-compatible device operating at 9600 bps or less. Infotron recommends that the four ports be used for connection of a command console, an I/O device on which to record statistical information, the operator's local computer, and a remote console. The connection to the computer can be used to interface with mainframe accounting and billing routines, to download parameter sets to the TL460, and to handle other tasks under control of the TL460's operating logic. The remote console access can provide the user with an on-line trouble-shooting aid: if a problem in the system occurs that cannot be resolved by the operator, partial control of the system can be turned over to a remote console in an Infotron field service office so that Infotron people can assist in pinpointing the problem.

The TL460 can also optionally support one to four cassette tape units. Up to two units can be interfaced to the master control module by each of two cassette tape interface control boards. The units are used to load cassette-stored operating system parameters into RAM upon power-up and to record usage statistics.

System self-diagnostic tools are provided in the form of operator-initiated test routines, review of system parameters at the console, and line monitoring. The status of

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every channel in the system is constantly monitored and reported via a series of LED indicators located on the channel adapter boards, which flash on and off in response to signals on the interface leads. The other boards in the system also report operational status via LED indicators. If a failure occurs, the faulty board will ordinarily be pinpointed quickly by the system. Channels connected to the faulty board can be temporarily "busied out" via the board's Busy switch and the board replaced with a spare without powering the system down or interrupting other service.

In addition, the system gathers statistics regarding switch usage that can be used by the network managers to identify bottlenecks, to plan future system growth, and to provide information for accounting and billing. For every successful and unsuccessful access attempt, the system logs the date, user and destination identification, transmission speed, time in queue, connect time, disconnect time, and reason for termination. Compiled statistical information may be selected for transfer to any device attached to the system via any of the system's control on I/O ports, or recorded on magnetic tape.

CONNECTION TO HOST COMPUTER

There is no host computer for the data switch; connection is possible to multiple devices, and no single unit has control. The only control a connected device has is granting, denying, and terminating the service of its ports. No changes to mainframe or front-end software need to be made when a data switch is added to the communications network.

TRANSMISSION SPECIFICATIONS

The TL460 Data Switch accepts any combination of asynchronous or synchronous traffic transmitted at 110 bps to 19,200 bps. Once a connection is made, the data switch is completely transparent to data and controls except for a negligible time delay. Devices may be connected to the data switch via dial-up, dedicated, or directly-connected lines. A choice of EIA RS-232-C, CCITT V.24/V.28, or 20/60 mA current loop interfacing is provided for the data switch ports.

SOFTWARE

The TL460 Data Switch's basic operating system is a parameterized firmware program that resides in PROM and

performs all system functions. Programming is accomplished by selecting from the available parameters those that match the configurational and operating characteristics desired. Under normal circumstances, the selected parameters are recorded on a magnetic tape cassette and loaded into RAM memory via the TL460's integral cassette tape unit. Multiple tapes may be recorded for multiple applications and changed by the operator as needed. Parameters may also be stored on a computer attached to the TL460 via one of its control ports and downline loaded; for small configurations, they may be stored internally in PROM, or keyed from the console. Parameters must be reloaded upon power-up and may be temporarily or permanently changed from the operator's console at any time, even while calls are in progress. In addition, the parameters may be overridden by console commands when specific connections require routing on an exception basis.

Among the functions controlled by user-selected parameters are: assignment of service classes and definition of the related address sequences used by incoming callers to designate the service class needed; specification of connect and disconnect criteria, transmission speed, and automatic speed recognition convention on an individual channel basis; and designation of the text of prompting instructions, status messages, and busy messages.

PRICING

The TL460 can be obtained by purchase, full payout lease (generally 24 months), or short-term rental. Under the lease agreement, conversion to purchase entails the fulfillment of the lease contract plus the payment of 10 percent of the total lease value. Under the rental agreement, 50 percent of all rental payments made are accrued toward purchase. The accompanying price list shows purchase prices. Contact Infotron for rental and lease prices. Installation charges vary depending on the size and configuration of the system.

Maintenance and repair service is usually accomplished by the customer and entails replacing faulty boards with spares. Faulty boards are returned to the factory for repair at no charge if within the one-year warranty period; out-of-warranty boards are repaired for a flat fee of \$40 per board for I/O channel boards and \$140 per board for micro-processor-based boards. On-call and contract maintenance service are also available.

	Purchase Price*
TL460 Base Unit; includes master control module, switch bus interface, slave controller module, two asynchronous service modules, capacity for six channel adapter boards, power supply, four control ports, four cassette tape unit interfaces, and two tape interface control modules; requires cabinet	\$6,200
Cabinet; includes front door and two asynchronous service modules (except in base unit cabinet); provides rack-mounting for up to five nests of boards	3,000
Expansion Nest; includes power supply and one slave controller module; supports up to 16 channel adapter boards and asynchronous service modules	2,700
Channel Adapter Boards:	
Asynchronous, Bit-Sensing	300
Asynchronous, Character-Sensing	450
Synchronous	Contact Vendor
Asynchronous Service Module	600
Redundancy Options:	
Dual Power Supply; max. 1 per nest	900
Redundant Master Control Module; max. 1 per system	1,400
Redundant Switch Bus Interface; max. 1 per system	800
Redundant Slave Controller Module; max. 1 per nest	1,200

*Includes one-year warranty and factory maintenance. ■

