

With a total capacity of 15,360 TDM ports that allow connections to Basic and Primary Rate ISDN terminal equipment, analog telephone and fax, and analog and digital lines and trunks, and thousands of H.323 entities such as terminals, gateways and gatekeepers for VoIP calls, the X1 is the perfect solution if you are looking into expanding or updating an existing telecommunications network, migrating to IP Telephony or building a network that is ready for the future. The trunks support a wide range of signaling types, including SS No. 7, V5.2, DSS1 Euro ISDN, QSIG, R1, R2, CL-1B, OCL-1B, TCL-1B, CL-1VF, OCL-1VF, TCL-1VF, SL/ZSL, SLM, and other various CAS signaling. The built-in 10/100 BaseT ethernet interface supports H.323 protocol. The X1 is capable of routing TDM calls to VoIP calls and vice versa.

The Telesis X1 can be configured as a Central Office exchange, rural exchange, transit telephone exchange, Private Branch Exchange (PABX), or signaling converter.

Technical Specifications

Applications

- Central Office exchange
- Rural exchange
- Transit telephone exchange
- Private Branch Exchange (PABX)

- ITU-T G.703
- Number of E1 interfaces : up to 120
- Connection type : 120 ohm twisted and 75 ohm coaxial cable

Maximum subscriber loop impedance

- 3,000 ohms, including terminal equipment

Subscriber cards

- Eight circuits per card

ISDN BRI cards

- Four or eight BRI circuits per card

BHCA

- 300,000

CO trunk cards

- Eight circuits per card

Ethernet interface

- 10/100 BaseT

CPU

- 450 MHz Pentium or better

E&M trunk cards

- Four circuits per card

Maximum ports

- 15,360 TDM circuits, thousands of H.323 entities (endpoints and gatekeepers)

Operating voltage

- 48V DC or 220V A

E1 interfaces

Signaling and Interface Types

SIGNALING TYPES

- On analog subscriber lines
- Dial-pulse reception
- DTMF reception
- Calling-Party Information Presentation (Caller ID) as specified in ETSI ETS 300 659-1 standard (FSK signal during the first long silent period)
- One-ring message waiting indication
- Visual message-waiting indication (Feed denial mode for low-voltage LED circuits)

On analog trunk lines

- DC-loop signaling
- Caller ID detection
- DTMF and dial-pulse signaling
- Charge-pulse and answer detection (12kHz or 16kHz or polarity reversal)
- Ring Down Tie Trunk (RD TT, local battery)

On analog E&M trunk lines

- Pulsed line with decadic-address signaling
- Continuous line with DTMF, MFC-R2, MF-R1 register signaling
- Signaling types widely employed in CIS countries:
 - ANI (Automatic Number Identification) detection and query
 - Address signaling
 - Dial Pulse
 - MFC-R1.5
 - Pulse Packet 1
 - Pulse Packet 2
 - Pulse Packet 3a
 - Pulse Packet 3b

Line signaling

- CL-1B
- OCL-1B
- TCL-1B
- CL-1VF
- OCL-1VF
- TCL-1VF

On Basic Rate ISDN (BRI) S0, T0, Uk0 interfaces

- DSS1 (EuroISDN)

On 2.048 Mbit E1 (ITU-T G.703) interfaces

Channel-Associated Signaling (CAS)

- Single-bit E&M emulation
- Two-bit ITU-T R1
- Two-bit ITU-T R2
- Many variations of signaling types (such as CL-1B, OCL-1B, TCL-1B, CL-1VF, OCL-1VF, TCL-1VF, SL/ZSL, SLM) widely employed in CIS countries

Common-Channel Signaling (CCS)

- DSS1 (EuroISDN in the TE direction)
- DSS1 (EuroISDN in the NT direction)
- ECMA QSIG (in the TE direction)
- ECMA QSIG (in the NT direction)
- ITU-T Signaling System No.7 ISUP
- V5.2 LE and AN protocol

On 10/100 BaseT Ethernet interface

- H.323 protocol with H.225.0 version 5, H.235 version 3 H.245 version 12, H.450, AES FIPS PUB 197

INTERFACE TYPES

Telesis PX24 is a hybrid voice communication system, which combines various TDM interfaces and IP components. It is all-in-one solution with integrated gatekeeper, softswitch capability, IP-TDM routing functions, and numerous IP and traditional PABX features. TDM interfaces and IP components are listed below in brief.

The PX24's analog subscriber line card has 16 subscriber-loop interface circuits. The subscriber interface can drive loops up to 3,000 ohm resistance (including the terminal equipment) and is capable of sending Caller ID information according to the ETSI ETS 300 659-1 standard as an FSK signal burst where the data transmission occurs during the first long silent period between two ring patterns. Each subscriber card is available for both 600 ohm resistive and complex input impedances. The subscriber ports have overvoltage protection, conforming to ITU-T K.20/K.21 recommendations. Additional primary protection devices to those residing in the main distribution frame may also be employed for further protection.

The analog DC loop trunk card has eight line circuits that can detect line DC feed, polarity reversal, and 12 or 16 kHz charge pulses and are capable of receiving Caller ID information transmitted according to the ETSI ETS 300 659-1 standard as an FSK signal burst. The analog DC loop trunk cards are available for both 600 ohm resistive and complex reference impedances. Overvoltage and overcurrent protection on analog trunks conforms to ITU-T K.20/K.21 recommendations.

The **analog E&M trunk** board has four line circuits that satisfy conditions for AT&T Type-V connections. Each port may individually be set to either a two- or four-wire interface by appropriate configuration of the on-the-board jumpers. The software supports many different line and register signaling types over the E&M lines. An additional detector on the M-wire checks the DC feed on the line for faulty conditions at far-end equipment. The analog E&M trunk card is available for 600 ohm resistive reference impedance. Each E&M port can be programmed as incoming, outgoing, bothway trunk, or unavailable.

The Basic Rate ISDN card supports S0/T0 or Uk0 interfaces. Each S0/T0 or Uk0 BRI card supports up to eight interfaces. Point-to-point and point-to-multipoint connection schemes are possible. The line code on U interfaces is 2B1Q.

The **2.048 Mbit E1 digital interface** card has up to four E1s. Each E1 can connect to either 120 ohm balanced or 75 ohm unbalanced terminations. The clock of the PX24 can be programmed to synchronize with any of the four E1 ports that may be present in the system or it may run freely. The line code is programmable as AMI or HDB3. Cyclic redundancy check (CRC4) can be enabled or disabled for each E1 interface individually. The direction of each channel of every E1 present in the system can be programmed as incoming, outgoing, bothway, or unavailable and therefore yields fractional E1 connections.

A **10/100 BaseT ethernet interface** provides numerous IP Telephony solutions. The PX24 supports up to 512 H.323 entities which can be either terminals, gatekeepers, or gateways. Furthermore, up to 32 simultaneous calls may be placed in an IP-TDM gateway application. For media encryption, AES-256 can be selected.

Resources and Modularity

SYSTEM RESOURCES

The exchange's common-control function is implemented in a centralized manner. An industrial PC-104 type computer is employed as the main processor and memory elements; consequently, ever-increasing power from microprocessors can readily be incorporated into the system when needed, keeping the PX24 in the vanguard of advances in microcomputer technology. Improved speed, security, and reliability are guaranteed by the placement of the generic programs and operating parameters in non-volatile semiconductor memory elements (DiskOnChips).

The core of the PX24 and the essence of its technological sophistication is the control and switching unit, which includes:

- PC-104 type CPU
- Program and parameter memories
- Operating memories
- Non-volatile call-record memory
- Switching circuits
- Tone generator/synthesizer
- HDLC circuits (for CCS and system control)
- Conference channels
- Codecs for VoIP calls
- G.168 echo canceller for VoIP calls
- Integrated gatekeeper
- Integrated voice cipher for VoIP calls (AES-256)
- Real-Time Clock (RTC)
- System message (announcement) memories
- Integrated voice mail
- Integrated modem (14400 bps, V.32 bis)
- Ethernet interface for the IP Telephony and administration purposes
- Serial port for administration purposes (can be programmed to connect PC, printer, external modem, Micros Fidelio PMS)
- Serial port for the consoles (Telesis NPS and FPS consoles)
- Other service components, such as timing circuits and signaling circuits

MODULAR STRUCTURE

The PX24 has a modular mechanical structure. The installation of the system or expanding an already operating one by adding subscriber and/or trunk line interfaces is simple and fast.

A PX24 system has a main cabinet and may have up to three auxiliary cabinets. Each auxiliary

cabinet in the PX24 system has eight slots to accommodate up to eight interface cards, whereas the main cabinet, in which the control and switching unit occupies two slots, has six slots for the interface cards. The main and the auxiliary cabinets have the same mechanical structure except for their backplanes.

The cabinets are stacked in vertical manner and hence the system footprint remains unchanged when the capacity is increased. A flat cable carrying control signals and communication paths connects each backplane of the auxiliary cabinets to the central control and switching unit. Each cabinet has its own power supply and ring generator.

Larger networks with the same numbering plan can be realized by connecting several PX24 systems together through 2.048 Mbit E1 interfaces.

The PX24 allows up to 512 H.323 endpoints to be registered into its integrated gatekeeper. These endpoints may be IP trunk routes and/or H.323 hard/soft phones with their own IP addresses.

The PX24 can also register multiple gatekeepers simultaneously. In a PX24, TDM circuits and H.323 endpoints exist altogether.

Software and Management **SOFTWARE**

The X1 is a Stored-Program-Controlled (SPC) system. Its leading-edge operational software, Xymphony, has been developed by Telesis specifically for this exchange. Among the many aspects of Xymphony is its advanced algorithm for creating routing tables, complete with options for Least-Cost Routing (LCR), real-time charging tables, and various subscriber/trunk classes. With many programmable features, Xymphony makes the traffic management highly efficient and versatile. The convenience of dealing with all-in-one standard software allows the user to support as many features as desired, up to the maximum capacity: thus, an organization's capacity can grow without necessarily updating the software. Upgrading the Xymphony operating system in the field is accomplished simply by downloading a new version of it directly onto the X1's disc from a PC without interruption to any of the exchange's services.

TRAFFIC-HANDLING CAPACITY

The X1 has been tested with over 300,000 Busy Hour Call Attempts (BHCA) without any loss in the quality of service. The X1 employs a high-capacity switching matrix. The advanced design incorporates state-of-the-art Digital Signal Processors that are capable of executing hundreds of millions of instructions a second. Such highly efficient use of the system's resources, with the help of intelligent algorithms, leaves very little, if any, possibility that an overload condition will arise.

The X1 allows thousands of H.323 endpoints to be registered into its integrated gatekeeper. These endpoints may be IP trunk routes and/or H.323 hard/soft phones with their own IP addresses. Furthermore, the X1 can register to multiple gatekeepers simultaneously. For an IP to

IP call, the media is direct from an H.323 endpoint to another, such a call does not use a system channel resource (i.e., PCM channel from the switching matrix). The X1 provides the address resolution and some other services according to the predefined profile of every registered endpoint. For such calls, the X1 acts as a softswitch. There can be any number of simultaneous IP to IP calls.

Furthermore, the X1 is with IP-TDM gateway capability. Up to 32 simultaneous calls may be routed from the IP network to the TDM (PSTN) network and vice versa.

SYSTEM MANAGEMENT AND BILLING

XMan is the name of Telesis's software package for managing an exchange and is run on a PC. System programming, downloading call-detail reports, and updating the Xymphony operating system can easily be managed either on site or remotely, through dial-up connection to the embedded modem of the X1. All system-management operations are performed without interrupting the functions of the system. The XMan exchange manager has the following features:

- Subscriber administration
- Routing administration
- Trunk-circuit administration
- Call-charging administration
- Detailed monitoring of signaling
- Traffic measurement including collecting detailed call-data records

A powerful feature of Xymphony concerns call charging. It is capable of prefix digit analysis of up to 16 digits. Destination-based tariff tables can be constructed to define:

- Unit-charge periods depending on destination
- Unit-charge periods depending on the day of the week and time of day
- Vacations and other special days for separate unit-charge periods
- Fixed-charge calls
- Charge-free calls

All unit-charge periods are specified in multiples of 100 msec. Hence, a unit-charge period may take a value from 100 msec to several minutes in multiples of 100 msec. Furthermore, call-charging information generated by far-end equipment can also be used.

Each Subscriber service (such as call forwarding, reminder) can have a separate fixed fee charge for using, activating, deactivating, or querying the service.

Call charging is processed in real time during the call. Pre-paid status within a certain amount of credit can be defined for each subscriber.

A detailed record for each call and service use may be generated by Xymphony and is transmitted to XMan. Each record in the database holds details of a call, including:

- Exchange identifier
- Date and time stamp
- Calling-party number
- Called-party number
- Duration of the call
- Charge pulses received
- Charge pulses generated

XMan can send call records to a printer or a text file in a user-defined line format. Its database also has a table that keeps a separate charge counter with multiple registers for accumulating data for Local, NWD, ISD calls, Subscriber Services, and Total (sum of all the other registers) for each subscriber.

The X1 has no hardware parts that require periodic maintenance. However, the call data accumulated in the exchange disc should periodically be downloaded through XMan to its database to create space on the exchange's semiconductor disc.

SUBSCRIBER AND TRUNK FEATURES

Xymphony allows all the following features to be used by all subscriber and trunk ports. Access to certain features can be disallowed for each port individually by appropriate formulations of routing tables:

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| <ul style="list-style-type: none"> • Call forwarding unconditional (to any number that the subscriber has authorization for, such as a mobile phone number) • Call forwarding busy • Call forwarding no reply • Override diversions • Delayed hot line • Password login • Password update • User authorizations update • Call hold • Multiple hold • Call transfer • Three-party conference • Call pickup • Call suspend • Call resume • Forced release | <ul style="list-style-type: none"> • Call intrusion • Callback • Answer camped call • Reject diverted call activation • Reject diverted call deactivation • Routed call pickup • Last number redial • Dial from user pool • Dial from common pool • Reminder service activation • Reminder service deactivation • Do not disturb activation • Do not disturb deactivation • Malicious call trace • Voice mail send • Voice mail receive • Credit edit • Hotel room status modifications |
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SYSTEM FEATURES

- A-Party (calling-party) analysis
- B-Party (called-party) analysis
- Route definitions
- Alternate route definitions
- Real-time charging facility
- Generating call and log records
- Statistics reporting
- Various tariff definitions
- Flexibility in synchronization
- Programmable tone-ring cadences
- Programmable frequencies and levels for tones
- Programmable signaling parameters
- Programmable timing parameters
- Detailed charging options
- Unlimited subscriber categories
- ISDN supplementary services
- Remote maintenance
- Signaling analyzer
- Flexible numbering
- Recorded announcements
- Voice mail features
- Hotel features
- Credited subscribers
- Micros Fidelio PMS protocol support
- Parameter backup