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ATX-101

Decentralized Switching System



The ATX-101 Decentralized Switching Systems are versatile, common control, automatic branch exchange telephone systems, utilizing frequency division switching and multiplexed distribution. They are designed to be readily increased in size from any desired minimum to a nominal 200 terminals in the ATX-101A or 1000 or more in the ATX-101B. The exceptionally small size of the central equipment group and the variety of power and signaling interface options make the ATX-101 equally suited for government or commercial airborne, shipboard, or ground applications.



Handbase Subscriber Set

description

The ATX-101 derives its switching and signal distribution functions by single-sideband frequency division multiplexing techniques using a twin coaxial bus system. Switching is accomplished in the subscriber sets by selecting a discrete frequency division channel for each interconnection. Decentralization of the switching function to the subscriber sets results in a significant reduction of switching components compared to space or time division central switching systems of equivalent capacity and allows growth in single station increments rather than in block of lines. It also results in an exceptionally small and lightweight central equipment group consisting only of the common control unit, the system frequency standard, information tone equipment, the coaxial bus terminating circuits and trunk equipment.

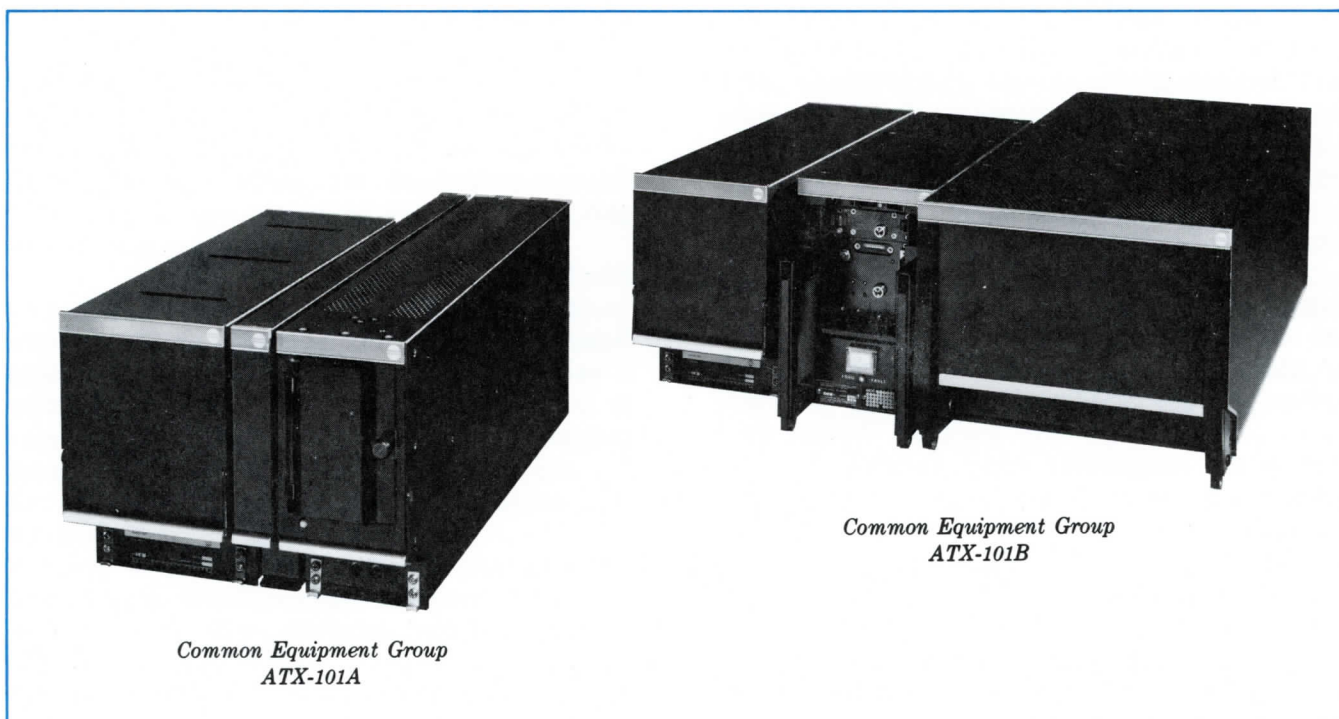
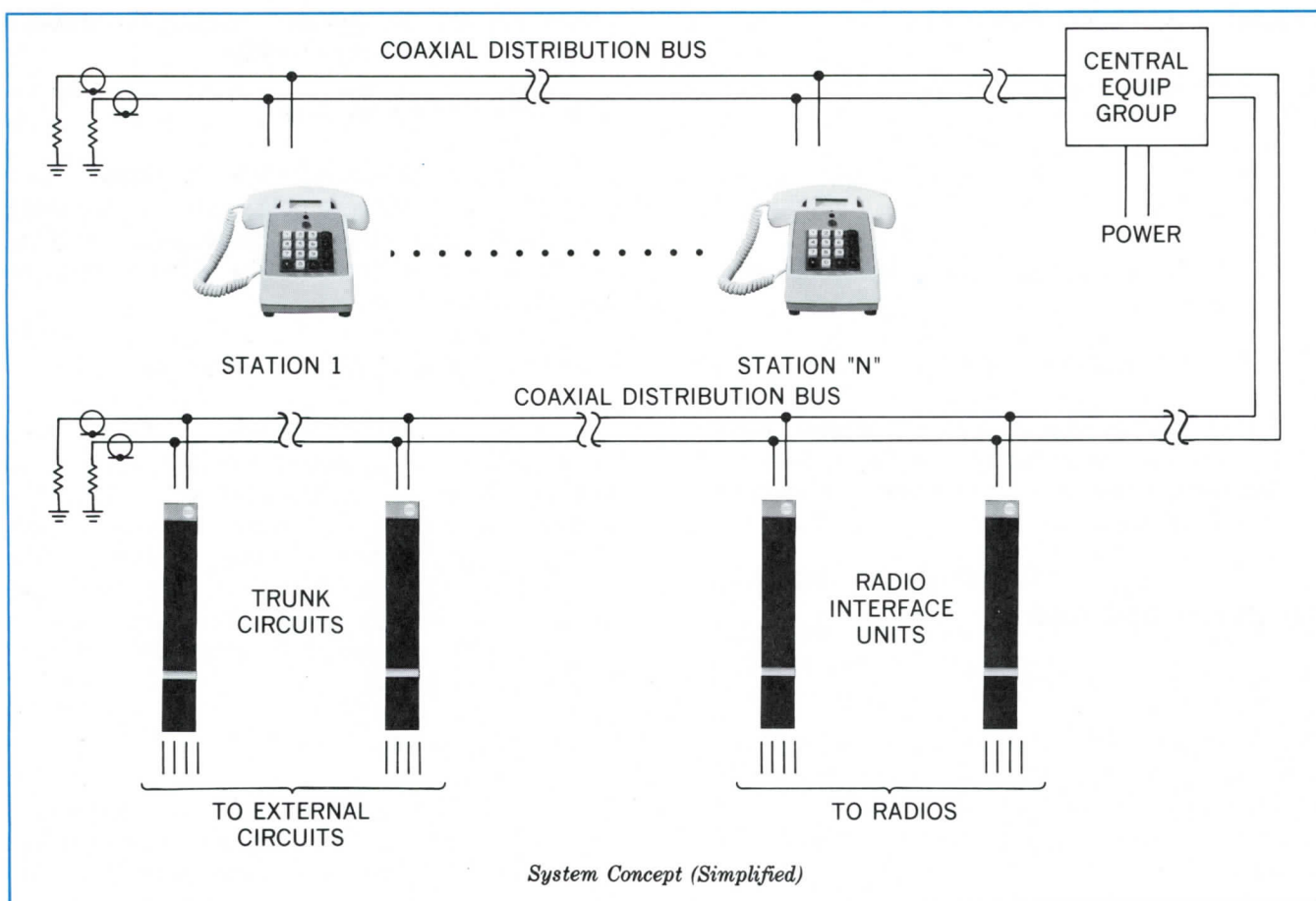
The ATX-101 uses a simplified multiplexing scheme providing 200 frequency stacked nominal 4-kHz voice channels. Since each channel

may serve as a 4-wire equivalent interconnecting path between two stations, the ATX-101 will provide nonblocking service for up to 400 terminals. In larger systems and, based on Molina's equation, which assumes infinite traffic sources, full availability, Poisson call arrivals, and lost calls held, the ATX-101 will accommodate a traffic intensity of 159.5 erlangs with a probability of 1 in 1000 offered calls being blocked.

Information signals (dial tone, busy tone, etc) are in-band. Supervisory, addressing, and station control signals are time division multiplexed on a common signaling channel and are independent of the voice channels.

Through multiplexing, significant savings in distribution wiring are obtained. The ATX-101 offers a 20-100-to-1 reduction in wiring by pair count with resulting reductions in system complexity and weight. Multiplexed distribution has many advantages compared with conventional distribution wiring. The usual main distributing frame and multiple junction boxes are eliminated. Bulkhead penetrations are reduced. Installation is simple and installation time significantly shortened. Perhaps most important for military applications is the fact that multiplexing offers practical approaches to system design for battle damage and electromagnetic pulse survivability.

The ATX-101 system characteristics make possible unlimited conferencing and multiparty monitoring without the need of separate conferencing bridges or conference trunks. System loading is constant. No change of audio level is experienced regardless of the number of conferees on a single channel. This capability makes the ATX-101 especially suitable for use in air traffic control centers, aircraft control and warning centers, command control centers, and similar locations where conferencing and multiparty monitoring of hot lines and radios are requirements.



regular service features

The following features are offered in the basic package.

Nonblocking telephone service for up to 400 stations.

Dial tone, busy tone, and unassigned number tone.

Pushbutton address sending.

Either station disconnect on internal calls. The last station remaining off hook receives dial tone when the other station or stations (in a conference) hang up.

program options

Class of Service Marking

The following listed optional features may be provided to all stations. By class of service marking, any of these service features may be denied to selected stations or groups of stations.

Call Transfer (Add-on)

This feature allows an internal station to transfer a call to another station, an attendant, or a station in another exchange. A consultation hold feature allows private conversations with the third station before adding it to the call. Any station may hang up without disrupting the call.

Progressive Conferencing

This feature is an extension of call transfer/add on feature. Any number of stations may be added in turn to a call in progress. Any station in the conference may add another station. Any station may hang up without disrupting the conference. Any number of independent conferences may be conducted simultaneously.

Meet-me Conferencing

One or more channels may be reserved for meet-me conferencing. This feature allows any number of stations to call a prescribed

conference channel without ringing the channel or encountering a busy condition.

Automatic Call Forwarding

By dialing a prescribed code, a station may arrange for automatic diversion of incoming calls to another station. Subsequent outgoing calling is not affected. The service may be canceled at any time.

Automatic Off-hook (Hot Line) Service

By dialing a prescribed code, a station may arrange for automatic off-hook service to another station or to an attendant. After the initial call, subsequent lifting of the handset automatically rings the other station. The service may be either 1-way or 2-way and may be canceled at any time. Incoming calls to stations with automatic outgoing off-hook service are not affected.

Preset Conferencing

This feature permits a caller to conference designated stations by dialing a conference access code. Stations in the conference are rung automatically. Busy stations are bypassed. Means are provided for changing the conference list to meet changing requirements.

Executive Override

Stations provided with this feature may override a call in progress. A distinctive one second tone is placed on the connection to alert talking parties of the presence of the third party.

Single-Level Preemption

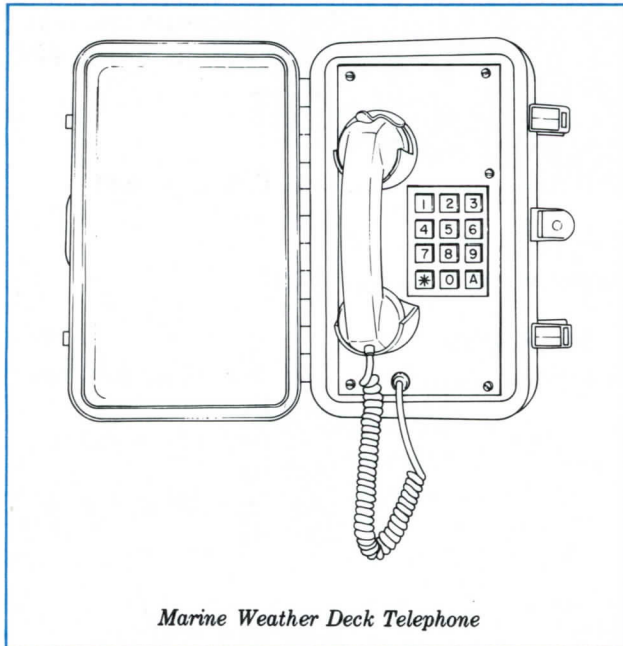
Selected stations may preempt a station from a call in progress. A distinctive 1-second tone is placed on the established connection prior to preemption to alert the talking parties.

Four-Level Preemption

This feature, similar to single-level preemption and intended for military applications, provides selected stations with up to four levels of preemption. AUTOVON type push-button key sets are provided in the subscriber sets.

Abbreviated Dialing

Abbreviated dialing is used with automatic central office or AUTOVON trunks to permit a caller to use an abbreviated address to call stations in a distant exchange. The common control unit is programmed to send addresses of up to 14 digits on receipt of the abbreviated address.



Marine Weather Deck Telephone

trunk and line circuit options

The flexibility inherent in frequency division switching and in its programmable common control unit allows the ATX-101 to satisfy virtually any type of line or trunk requirement. The following are typical of the trunk and line circuits that can be provided.

Two-wire 2-way local battery 20-Hz ringdown circuits. Calls are handled through an attendant.

Four-wire tie lines with ac supervision-direct access from and to special operating positions for air traffic control centers and similar applications.

Two-wire manual central office subscriber lines with dc supervision and 20-Hz ringing. This trunk circuit allows direct outward calls from subscriber sets. Inward calls are handled through an attendant.

Two-wire automatic central office subscriber lines with dc supervision and 20-Hz ringing. Direct outward dialing from subscriber sets. Inward calls are handled through an attendant. The trunk circuit translates internal pushbutton address signals to dial pulse or DTMF signals.

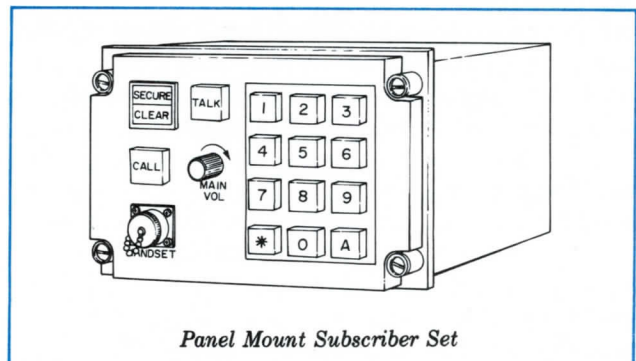
Four-wire automatic central office lines with dc or ac supervision, dial pulse or DTMF inward address signaling, and dial pulse or DTMF outward address signaling. Calling may be direct to and from subscriber sets. These trunk circuits are compatible with North American direct distance dialing (DDD) and AUTOVON signaling requirements including preemption.

station equipment

Subscriber sets can be provided in handbase, wall mount, aircraft panel mount, marine weather deck, or other configurations as required for specific applications. The design plan includes multiline sets, monitor panels, display/control panels, and similar terminal equipment.

interface options

Terminal units can be provided for interfacing public address loudspeaker systems, interphone systems, data modems, and radio equipment. The radio interface units include provisions for transmitter keying and, in special applications, means for power, frequency, and mode control of the radio. With this capability, the radio may be controlled remotely from any telephone equipped with a 16-pushbutton address key set. This feature may be further extended by programming the common control unit to recognize certain addresses in the system numbering plan as preset radio/frequency/mode combinations.



Panel Mount Subscriber Set

optional security feature

The ATX-101 design includes provisions for secure transmission of plain language voice signals between stations and between stations and voice security equipment. A separate coaxial distribution system is used and special switching circuits and shielding are included in the subscriber sets to provide the isolation specified by the United States Government.

EMP survivability

The system has been expressly designed for electromagnetic pulse survivability. The central equipment group and the subscriber sets and other terminal devices are coupled to the distribution buses through high impedance circuits equipped with fast-acting surge protection. All circuit elements are extensively shielded. Preliminary tests indicate that adequate margin can be provided for postulated threat levels.

specifications

Capacities

200 traffic channels (nonblocking service for 400 stations).

Up to 300 stations/trunks with the ATX-101A common control unit (depending on features).

Up to 2000 stations/trunks with the ATX-101B common control unit (depending on desired grade of service, calling rate, and traffic intensity).

Transmission

Transmission characteristics apply to a complete connection through the system.

Transmission

level..... -4 dBm

Measurement

test tone..... 1000 Hz \pm 25 Hz at -4 dBm

Limiting..... None with test tone at +4 dBm

Idle channel

noise..... Less than -40 dBm in 3-kHz bandwidth

Crosstalk

coupling loss..... Greater than 50 dB

Longitudinal

balance..... 40 dB over a 300- to 3500-Hz band

Input and output

impedance..... 600 \pm 10 ohms with 20-dB minimum return loss

Amplitude

response..... +1.0 dB from 200 to 3400 Hz -3 dB points less than 70 Hz and more than 4000 Hz

Harmonic

distortion..... Less than 3 percent

Frequency

displacement..... None

Envelope delay

distortion..... Less than 50 μ s 1000 to 2600 Hz
Less than 125 μ s 800 to 2800 Hz
Less than 250 μ s 600 to 3000 Hz

Absolute

delay..... Less than 1000 μ s

Environmental Characteristics

Altitude..... 50,000 feet

Temperature

Sea level..... -40 to +55 °C continuous
+71 °C intermittent for 30 minutes maximum

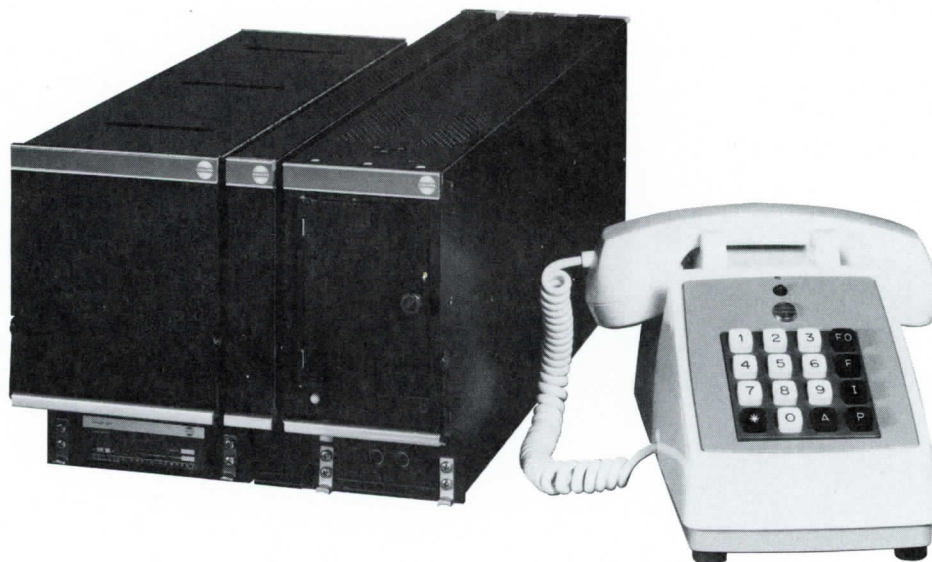
50,000 feet..... -40 to +20 °C continuous
+35 °C intermittent for 30 minutes maximum

Storage..... -62 to +85 °C

Vibration

5 to 20 Hz..... 0.10 inch, double amplitude

20 to 500 Hz..... \pm 2 g (except during IPL of CCU)



ATX-101 Decentralized Switching System

Physical Characteristics.

The central equipment group may be rack or cabinet mounted. The common control units and other common equipments are housed in standard Collins ATR boxes, thus facilitating replacement.

System size and weight will depend on packaging and other requirements of the application. The central equipment group with redundant common equipment for a typical 200-station -10 trunk ground system could be accommodated with redundant power supplies in a space 26 inches wide, 28 inches deep, and 55 inches high, and would weigh 350 pounds in a standard cabinet. The handbase telephone sets are of conventional design and weigh a nominal 6 pounds each.

Power Supply Options.

Power source input options include 115-volt single-phase 60-Hz ac, 115/200-volt, 3-phase 47- to 420-Hz ac, and 115-volt single-phase 400-Hz ac. The system equipment is designed as category "B" utilization equipment per MIL-STD-704A. The power requirements will vary with the features and station/terminal complement. A 200-station 10-trunk ground system would require 1600 watts of power.

Reliability.

The ATX-101 offers high reliability in adverse environments. The predicted mean time between failures (MTBF) for individual system components exceeds 5,000 hours. The system incorporates a number of fail soft provisions. The common control units have an automatic power-down/power-up feature that prevents disruption of calls in progress during momentary power failures. Failures of subscriber sets, trunk circuits, or interface units impact only the failed units. All common equipment can be redundant with automatic transfer to backup equipment on failure. Catastrophic failure of the common equipment (other than power supplies will not disrupt established connections nor preclude the placing of calls between subscribers).

The very small amount of distribution cabling required and the flexibility offered by decentralized frequency division switching allow system design for battle damage survivability without excessive cost or weight penalties. Redundant coaxial buses with automatic alternate routing and redundant dispersed central equipment groups can be provided for military applications where battle damage poses a threat.

The data contained in this bulletin is provisional and subject to change as improvements and refinements are introduced into the system during its introductory life.

