NORTHERN TELECOM
a Northern Electric company

Contents

Northern manufactures common control switching systems for central office requirements of up to 40,000 lines; from pre-engineered, packaged, unattended offices to large installations engineered to exact specifications for location in mobile trailers, temporary or permanent buildings. These systems are fully compatible with the North American switching network and have been interfaced successfully with other telephone systems in many parts of the world.

Northern's crossbar switching systems all have the same service characteristics so that even the smallest rural areas can have access to the same comprehensive range of services as the largest metropolitan centers. The high degree of reliability attained by these systems is largely attributable to design which is based on the common control principle, incorporating extremely reliable circuitry with built-in trouble detection capability. Essential circuits are duplicated as further reliability insurance. Maintenance routines are such that troubles are generally cleared before service can be affected.

More specific information concerning each of the electro-mechanical switching systems is contained in the following pages.

PRINTED IN CANADA January 1975

NORTHERN TELECOM
a Northern Electric company

NE-5 Crossbar System

Versatile
The NE-5 is the common control machine that can be used in both rural and metropolitan areas as a local office or as a combined local, toll, and tandem center. The system can include many revenue-producing features such as Centrex business services; it is easily arranged for local and centralized automatic message accounting with automatic number identification. And NE-5 is compatible with all vintages of switching equipment, from magneto switchboards to electronic switching systems.

Operating Features
- Single- and multi-party lines.
- Revertive calling.
- Immediate ring.
- Intercept service.
- "911" emergency service.
- Coin free access — dial tone first.
- Full number translation flexibility.
- Traffic measuring and sampling.
- Service observation.
- Wide Area Telephone Service (WATS).
- Local overload announcement.
- Line load control.
- Local Automatic Message Accounting (LAMA).
- Centralized Automatic Message Accounting (CAMA).
- Centrex CO or CU.
- Calling line identification.
- Alternate routing.
- Wideband data transmission.
- Extended Area Service (EAS).
- PBX hunting (non-consecutive).
- Direct inward dialing (line link pulsing) to PBX's.
- Direct Distance Dialing (DDD).
- Adaptable to International or any National toll dialing network.

PRINTED IN CANADA January 1975

NORTHERN TELECOM
a Northern Electric company

NE-5 Crossbar System

Test and Maintenance Features

- Automatic trouble recording.
- Office alarm system with remote reporting facilities.
- Message register test.
- Station ringer test.
- Outgoing trunk test.
- Automatic line insulation test.
- Automatic progression trunk testing.
- Second trial with change of preference.
- Trouble detection in common equipment.
- Portable test apparatus.

Self-contained

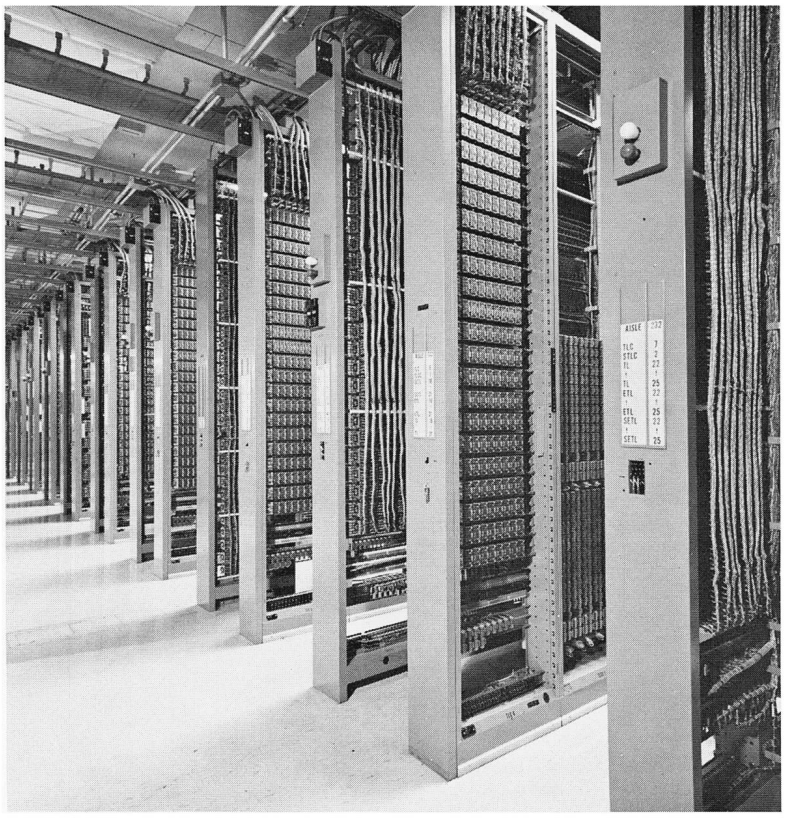
A single switching train handles all types of calls: incoming, outgoing, or switched-through local and toll calls. NE-5's common control element supervises and directs all switching functions by receiving, storing, translating, and converting information to determine and establish the required paths through the switching train. The NE-5's highly reliable circuitry includes self-checking and service-protection features. NE-5 accommodates new services and optional features, easily and economically, by simple cross-connections. Line and directory number assignments are completely flexible because there is no direct relationship between the switch positions on the line link frame and directory number assignments. Changes are made simply by making new cross-connections at the distribution frame and in the number group cross-connection fields.

NORTHERN TELECOM
a Northern Electric company

NE-5 Crossbar System

Expandable
The system's line capacity ranges from 1960 to 35,400 lines depending on traffic conditions and other operating parameters. Several NE-5 systems can be put into the same building to enhance traffic-handling capabilities and operating flexibility. NE-5 helps telephone companies to meet the service demands of rapidly growing regions.

And more traffic capacity
A new feature — Increased Marker Capacity — can expand the standard call-carrying capacity of an NE-5 by nearly 50%. By adding two dial tone markers and four completing markers, full network capacity is restored to offices which have developed an imbalance of network and marker capacity due to either shorter call-holding time or increased marker usage for Centrex operation.



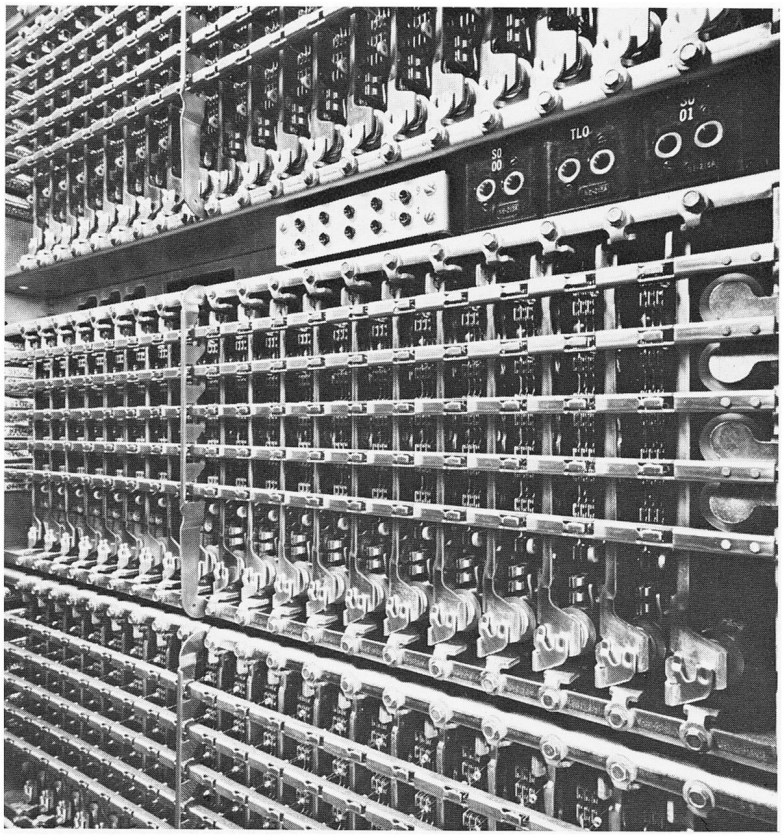
PRINTED IN CANADA January 1975

NORTHERN TELECOM
a Northern Electric company

NE-5 Crossbar System

Reliable
High quality performance and trouble-free operation owe much to the inherent reliability of NE-5's basic components: crossbar switches and wire-spring relays. Crossbar switches are used throughout the NE-5; they are fast operating, dependable, and need minimal maintenance. The meticulous design of the wire-spring relay has eliminated chatter and rebound; pre-tensioned springs overcome vibration; precious metals spot-welded on the contacts reduce noise. Wire-wrapping provides fast connections and removes the hazards due to solder splashes and wire-clippings.

Self-checking
Built-in maintenance and test operations contribute to the system's efficiency. Routine tests are programmed for automatic running. Test facilities include: monitoring; trunk testing; and the means to remove equipment from service. A trouble recorder provides punched card records of troubles detected, and analysis of the cards permits fast trouble-shooting. An automatic office alarm provides immediate notification of all trouble conditions. Alarms can be transmitted to a remote maintenance center from unattended NE-5 offices. Traffic measuring and service observation facilities can be provided to any specification. The data obtained helps users gain maximum productivity from each element in the NE-5 system, now and in the future.



NORTHERN TELECOM
a Northern Electric company

NE-5 Crossbar System

Technical Data

Office Parameters

Office Class 3, 4 or 5	**Subscriber Lines** 35,400 per marker group	**Line Link Frame Capacity** 190 lines or 290 lines up to 590 lines in increments of 50 lines	**Directory Numbers** 40,000 per marker group in 6 office codes
Call-carrying Capacity 41,000 calls at 180-second average subscriber holding time	**System Traffic Capacity** 75,000 CCS (approx. 2080 Erlangs)	**CCS/Line** 2.1 to 6.7 (See Note)	**Trunking Capacity** 4,800 appearances
Trunk Numbers (Toll Tandem) 2,000	**Inter-exchange Signaling** DP and MF	**Subscriber Signaling Device** Rotary dial and DIGITONE* pushbutton	**Subscriber Loop Resistance** 1840 Ω (including telephone set)
Subscriber Line Leakage 10,000 Ω	**Classes of Service** 100	**Rate Treatments** 20	**Coin Service** Prepay

Ambient Service Conditions

Operating Temperature Range 4.5°C to 38°C (40°F to 100°F)	**Relative Humidity** 15% to 55%	**Operating Voltages** 48 Vdc 130 Vdc 22 Vac 115 Vac

Building Data

Framework Dimensions

Height	11 ft 6 in (3.51 m)
Depth	10½ in (266.7 mm)
Width	20½ in to 45 in (520.1 mm to 1142 mm)

Aisle Spacing

Maintenance	2 ft 6 in (762 mm)
Wiring	1 ft 11 in (584.2 mm)

Floor Loading (Switching Equipment)
150 lb/ft² (732.3 kg/m²)

Color Scheme
Green and Ivory

Recommended Ceiling Height
14 ft 1 in (4.5 m)

Note: The traffic capacity (CCS per line) is entirely dependent on the number of lines terminated on a Line Link Frame (LLF) since each handles 1260 CCS on the average ten high day data.

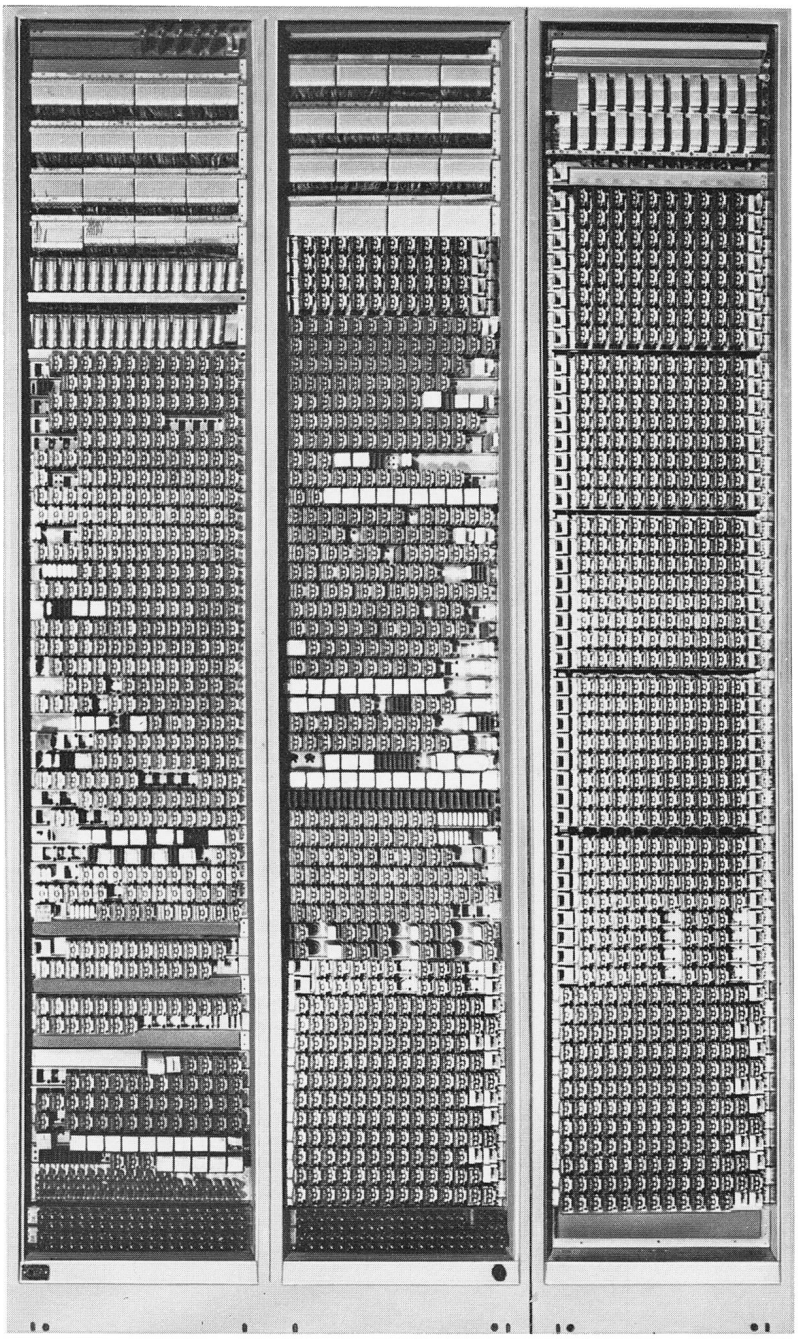
For further information contact our nearest sales office

January 1975

NORTHERN TELECOM
a Northern Electric company

N5-3 Crossbar System

The N5-3 Crossbar switching system is designed for use in small towns or large cities as a local switching office, or as a combined local, tandem, and toll switching system. The N5-3 is adaptable to most types of signaling, and is capable of operating with most vintages and makes of switching equipment from magneto switchboards to highly sophisticated electronic switching systems.



Operating Features

- Full number translation flexibility.
- Alternate routing.
- Direct distance dialing.
- Intercept service.
- Extended area service.
- PBX hunting.
- Traffic measurement equipment.
- Line load control.
- Adaptable to international or national toll dialing networks.
- Inter-marker group sending.
- Time-zone metering for long distance calling.

Test and Maintenance Features

- Master test frame.
- Automatic trouble recording.
- Attended or unattended office operation.
- Message register test.
- Station ringer test.
- Outgoing trunk test.
- Audible and visual signal system.
- Automatic line insulation test.
- Portable test sets.
- Trouble-detecting facilities in all common equipment.

The N5-3 is a common control system using the marker principle. The flexibility of common control and the relatively small amount of control equipment required make the addition of new features easier and more economical than with comparable equipment. Only the features required need to be supplied initially, as it is designed to grow with the community.

PRINTED IN CANADA January 1975

NORTHERN TELECOM
a Northern Electric company

N5-3 Crossbar System

The N5-3 can serve up to 35,400 lines distributed over 40,000 directory numbers, dependent on traffic conditions. The numbering plan can be arranged to handle up to 8, 11, or 14 digits. Equipment for 30 classes of service is provided and up to 100 classes of service are available on an optional basis. Service features may include single- or two-party lines, flat- or message-rate service, coin-box, local or toll, terminal hunting PBX, and complete flexibility in assignment of lines and directory numbers.

Features that contribute to long life with low maintenance include wire-spring relays with precious metal contacts and an automatic rotation of equipment operation to evenly distribute traffic throughout the system.

N5-3 operation is supervised by test and maintenance equipment concentrated in a maintenance center. Included are monitoring circuits, a master test circuit for simulating calls under controlled conditions, trunk testing equipment, and a punched-card type automatic trouble recorder. An audible and visual alarm system is used to indicate and assist in locating trouble; circuit schematic diagrams utilize line sequence charts to facilitate maintenance.

For traffic studies, a traffic usage recorder and traffic registers can be included.

For further information contact our nearest sales office

Technical Data

Office Parameters

Directory Numbers
40,000 per Marker Group (in 6 office codes)

Line Link Traffic Capacity
68,400 CCS (1900 Erlangs) (for 60 Line Link Frames, 2% matching loss)

AC Power Requirements
(dependent on commercial power available)
Any standard ac voltage ±10%, 50 or 60 Hz, ±2%; 1-phase 3-wire, 3-phase 3-wire, or 3-phase 4-wire.

Subscriber Lines
35,400 per Marker Group (theoretical max.)

Station Signaling
Rotary or DIGITONE* Dial

DC Power Requirements
−48 V (nominal): normal range −48 to −50 emergency limits −45 to −50
+130 V (nominal): range 125 to 135
When required:
+48 V (nominal): range 45 to 54
−130 V (nominal): range −125 to −135

Rotary Dial Speed
7 to 21 pps

Classes of Service
100; and 20 message-rate treatment

Ringing and Tone Supplies
Ringing 20 or 25 Hz, 75 or 86 V
Dial Tone 400, 440 or 450 Hz (Special tone plants supplied as required)

Office Impedance
600 Ω or 900 Ω at 1000 Hz

PBX Services
Terminal hunting over the PBX group

Ambient Service Conditions
Recommended Temperature Range: 21°C to 26.5°C (70°F to 80°F)
Relative Humidity: 35% to 65%

Building Data

Floor Loading
Equipment Area:
150 lb/ft² (735 kg/m²)
MDF/Powerboard Area:
175 lb/ft² (855 kg/m²)
Battery Area/Diesel Room:
300 lb/ft² (1470 kg/m²)

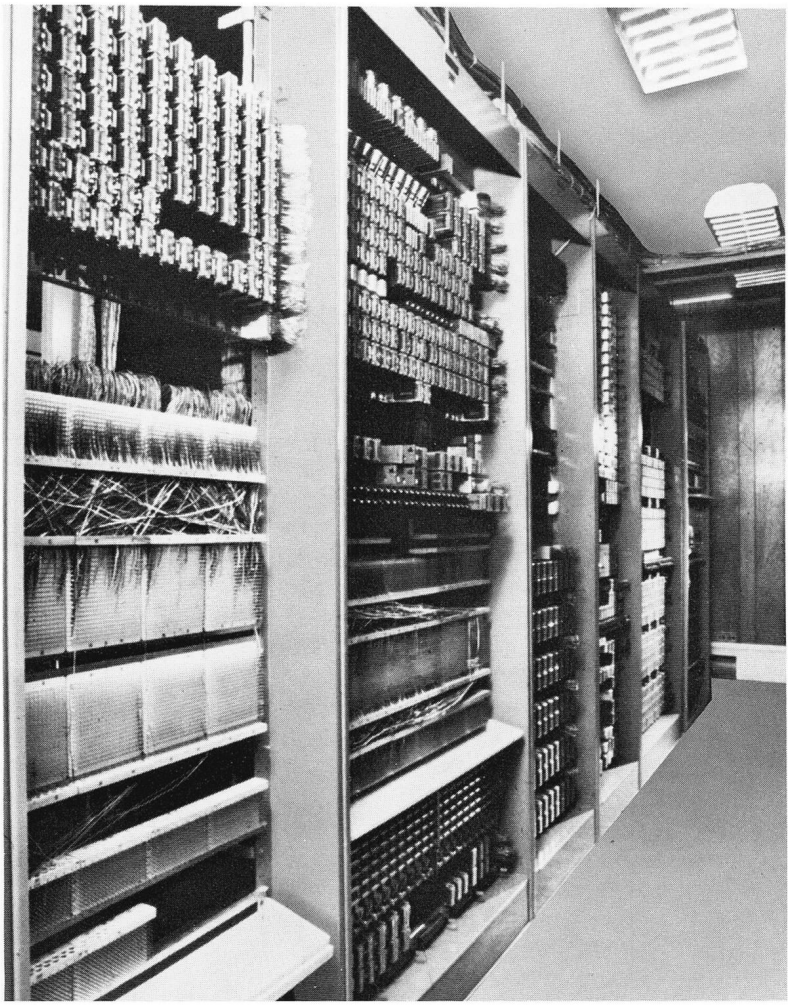
Minimum Ceiling Height
13 ft (3.97 m)

Equipment Entrance
8 ft x 4 ft (2.44 m x 1.22 m)

*Registered Trademark of Northern Electric Company, Limited.

NORTHERN TELECOM
a Northern Electric company

SA-1 Crossbar System



The Small Community Switcher with Big City Features

The SA-1 is a common control Crossbar system designed to provide local two-wire switching service. This compact, flexible machine provides Class 5 end office operations and easily accommodates features such as automatic number identification, direct distance dialing, extended area service, and many other subscriber services. The system is intended for use on new installations as unattended community dial offices and is also employed in manual conversions or the replacement of outdated switching systems.

Operating Features

- Extended area service.
- Direct distance dialing.
- "911" emergency service.
- Automatic number identification.
- Frequency ringing.
- Revertive calling.
- Office alarms — remote maintenance control.
- Semi- or full number translation flexibility.
- Coin control — semi-postpay; prepay, inband or line number.
- Traffic metering.
- PBX hunting.
- Intercept service.
- DIGITONE*
- Coin free access (dial tone first).
- Line lockout.

Installs Easily into Permanent Buildings, Portable Units

Each SA-1 office is custom-engineered to exact customer needs. The versatility of the framework and equipment arrangement permits economical installation of SA-1 systems into commercial buildings, existing switchrooms, and huts. Systems are also provided in mobile units that serve as permanent installations or for temporary on-the-spot switching service requirements.

January 1975

NORTHERN TELECOM
a Northern Electric company

SA-1 Crossbar System

A System for Economical, Flexible Expansion
The system is highly suitable for service in areas where low density traffic dictates modest plant expenditure. An SA-1 office can be started with as few as 40 lines, growing in easy-to-add units of 20 lines, up to a maximum of 1500 lines. Initially, lines can be distributed over 1000 directory numbers, and later increased to 2800 numbers with complete flexibility in the assignment of numbers.

Network Design Assures Continuous, Reliable Service
The network consists of a two-stage switching pattern employing reliable, trouble-free crossbar switches under the direction of a single controller. The controller performs the system's common control functions and is used to establish the interconnection between subscribers' lines, trunks and registers, to supervise operation of the system, translate directory numbers, and in the completion of every call. To ensure a high level of reliability and dependable service, essential circuits in the controller are duplicated.

Unattended Operation Lowers Operating Expense
Maintenance facilities available for use with an SA-1 comprise a test unit, an incoming test trunk, an alarm system, and means for removing equipment from service for testing purposes. The test unit is linked to the controller frame via plug-ended connector cords and performs maintenance tests on controller operations, system circuitry, and subscribers' lines. The unit can be relay rack mounted or employed on a portable basis between SA-1 exchanges.

Office alarms are provided, as required, in an SA-1 exchange. Facilities are available to transfer alarm indications to a centralized maintenance center or an operator, and by dialing an assigned directory number from these remote points, to determine the type of alarm existing in the office and effect the release of temporary alarm conditions.

Traffic Measuring Facilities
Metering apparatus, available on an optional basis, permits analysis of various paths and common equipment units to determine usage and forecast future needs. Registers are employed to record peg counts, overflows, group busy, and controller trouble conditions. A portable recorder is used to measure the amount of traffic usage on any trunk or register at specified time intervals.

A Service Proven System
The SA-1 Crossbar system is compatible with known standard switching systems. Field experience gained with the 850 systems presently in service has proven the SA-1 reliability. Also, components such as the wire-spring relay and crossbar switch, as well as the circuit principles used, meet exacting requirements. Statistics provided by one of our major customers indicate that maintenance costs for SA-1 are about one half that of an equivalent Step-by-Step operation.

NORTHERN TELECOM
a Northern Electric company

SA-1 Crossbar System

Technical Data

Office Parameters

Office Class 5	**Office Capacity** 1500 lines; 280 trunk switch vertical appearances	**Directory Numbers** 2800 fully flexible	**Basic Switching Unit** 20-line Crossbar switch
Traffic Capacity (Line and Trunk) 5475 CCS (approx. 150 Erlangs)	**CCS/Line** 3.6 (maximum for full usage of physical line appearance)	**Subscriber Loop Resistance** 1500 Ω	**Loop Range for Trunking** Up to 2400 Ω
Loop Leakage 15,000 Ω (between conductors and between each conductor and ground)	**Inter-exchange Signaling** DP	**Station Signaling Device** Rotary dial and DIGITONE* pushbutton dial	**Classes of Service** Individual, 2-party, multi-party, terminal hunting, message rate, coin box, one spare class
Coin Prepay or semi-postpay			

Building Data

Framework Dimensions Height 7 ft 6¾ in (2.3 m) Width 21⅜ in (542.9 mm) 25⅜ in (644.5 mm) 37 in (939.8 mm) Depth 14 in (355.6 mm) baseplate	**Aisle Spacing** 30 in (762 mm) maintenance 20 in (508 mm) wiring	**Color Scheme** Green and Ivory	**Recommended Ceiling Height** 9 ft (2.74 m) minimum

Ambient Service Conditions

Temperature Range 5°C to 37.8°C (40°F to 100°F)	**Operating Voltage** —48 Vdc nominal	**Relative Humidity** 15% to 55%

For further information contact our nearest sales office

January 1975

*Registered Trademark of Northern Electric Company, Limited

NORTHERN TELECOM
a Northern Electric company

SF-1 Crossbar System

The SF-1 Crossbar System is a common control switching system for local 2-wire switching. It is designed to serve small communities as an unattended Community Dial Office and provides the same range of services as the full size common control system used in high-density metropolitan areas. The system can be installed in permanent buildings or portable custom-built trailers. Portability allows operating telephone companies to meet special needs or cope with emergency situations requiring the rapid provision of temporary telephone services.

Operating Features

- Full number translation flexibility.
- Alternate routing.
- Direct Distance Dialing (DDD).
- Line lockout.
- Traffic metering.
- Intercept service.
- Extended Area Service (EAS).
- PBX hunting.
- Automatic number identification.
- Call screening.
- Reverting call.

Maintenance Features

- Plug-in line cards.
- Office test bay with trouble recorder.
- Test trunk circuits.
- Alarm reporting system.
- Automatic trouble detection.
- Portable trouble analyzer.
- Permanent trouble record.

The SF-1 system is designed on a building-block basis, with equipment housed in double-sided, floor-supported, steel cabinets. This approach permits simplified initial installation with economical and progressive expansion from 256 lines to a maximum of 3,584 in increments of 256 lines. Every office is engineered to meet specific requirements and achieve maximum use of equipment.

PRINTED IN CANADA January 1975

NORTHERN TELECOM
a Northern Electric company

SF-1 Crossbar System

Plug-in line cards enable the rapid provision and expansion of service along with simplified maintenance. This helps operating companies to avoid having investment capital tied up in idle plant. Maintenance costs are also minimized.

The SF-1 has inherent reliability, assured by the use of MINIBAR* switches and exceptionally dependable circuitry which includes well-proven components such as wire-spring type relays.

Built-in test facilities eliminate the need for portable test units. The system tests itself while processing telephone calls. Any troubles encountered are automatically recorded on paper tape for subsequent analysis and action.

SF-1 Crossbar is compatible with known standard switching systems.

For further information contact our nearest sales office

Technical Data

Office Parameters

Basic Switching Unit
512-Line Group consisting of two 256-line Networks

Maximum Office Capacity
3584 Lines

Directory Numbers
5000

System Traffic Capacity (Line and Trunk)
22,000 CCS (610 Erlangs)

Call Capacity (4 Decoders)
13,000 per hour

CCS/Line (Originating and Terminating)
4.2

Subscribers' Loop Resistance
1500 Ω

Loop Leakage
15,000 Ω

Operating Voltage
−48 Vdc nominal

Outpulsing
DP/MF

Inpulsing
DP/MF

MINIBAR* Switch Cycle Time
45 ms

Station Signaling
Rotary and DIGITONE* Dial

Classes of Service
21 Classes including individual, 2-party, multi-party, message rate, terminal hunting, and coin

Coin
Prepay or semi-postpay

Office Class
5

MINIBAR* Switch Dimensions
Height 5¾ in (146.0 mm)
Width 26 in (660.4 mm)
Depth 5½ in (139.7 mm)

*Registered Trademark of Northern Electric Company, Limited.

Building Data

Color Scheme
Green and Ivory

Frame Dimensions
Height 7 ft 6 in (2.29 m)
Width 33⅞ in (860.4 mm)
Depth 20 in (508.0 mm)

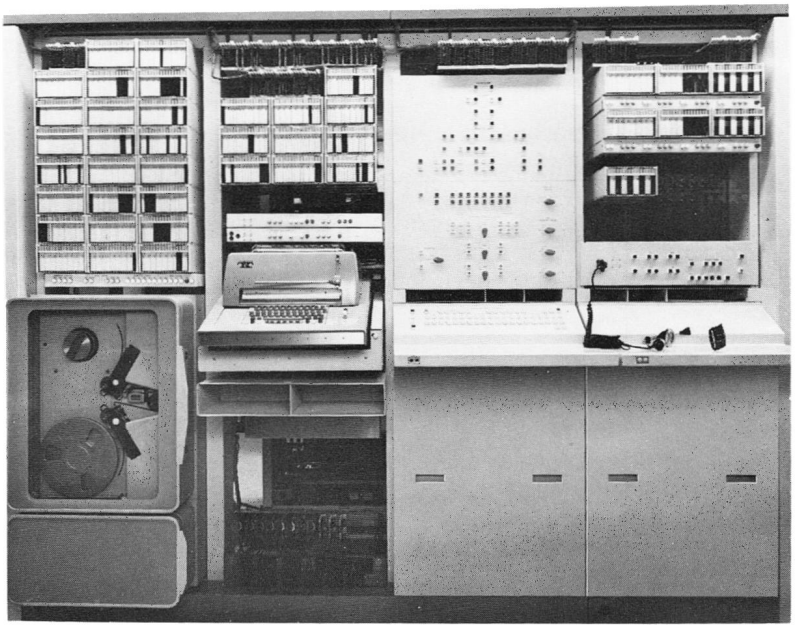
Recommended Ceiling Height
9 ft 6 in (2.90 m)

Maintenance Aisle
Recommended 3 ft (914.4 mm)

NORTHERN TELECOM
a Northern Electric company

NE-4A Toll Crossbar System

The NE-4A is a 4-wire common control toll switching system capable of handling inward, through, toll tandem, overseas, and CAMA traffic to and from dial lines, including through and tandem traffic from dial to ringdown. In offices with an electronic translator, information for routing calls is stored in the memory store portion of a stored-program control complex. Route translation information is stored on metal cards in a card translator office.



Operating Features

- Full control switching point (CSP) operation.
- Centralized Automatic Message Accounting (CAMA) arranged for operator and automatic number identification.
- Variable spilling of digits (deletes none, 3, or 6 digits).
- Prefixing of digits (1, 2, or 3 digits).
- Code conversion (deletes first 3 or 6 digits and replaces with any 1, 2, or 3).
- Blocking of unauthorized codes.
- Second trial with change of preference.
- Sender retrial and automatic trunk lockout.
- 3- to 6-digit translation for routing.
- Foreign area translation.
- Sixteen screening classes for incoming trunks.
- Automatic trunk transmission pad switching.
- Recorded announcement.
- Traffic measuring equipment.
- Automatic overload control.
- Network control (route cancellation, route shipping, code blocking, and preprogrammed reroutes).
- Adaptable for future service developments, e.g. common channel inter-office signaling (CCIS).

Test and Maintenance Features

- Automatic trouble recording.
- Auxiliary recording control (recorder trap).
- Emergency alarm system.
- Audible and visual alarm system.

PRINTED IN CANADA January 1975

NORTHERN TELECOM
a Northern Electric company

NE-4A Toll Crossbar System

- Teletypewriter print-out of traffic-data collection and administration.
- Automatic testing of incoming registers and senders.
- Automatic progression trunk testing.

The electronic translator is a high-speed stored-program processor and digital electronic control system which uses piggyback twistors for program and data storage, and low-level transistor-diode logic signal processing and control. For reliability, major subsystems are duplicated and automatic switching between units is provided.

Incoming and outgoing switching frames, interconnected by junctors, are grouped together with common control units to form switching trains. An NE-4A office may be provided with one or two trains, with the second switching train usually installed in offices where the number of incoming trunks exceeds 8000.

The automatic switching ability of the NE-4A system permits rapid testing of up to seven different routes (5 routes in card translator offices) and automatically placing a call over an alternate route when the preferred route is busy.

Switching equipment maintenance facilities feature automatic test and punched card trouble-recording. Toll line maintenance equipment includes test boards and patch bays for testing and maintaining inter-toll trunks. The electronic translator facilities consist of teletypewriters that automatically provide a print-out of faults and system diagnostics, and a program tape facility which permits basic data and program changes in the store. A control and display panel for alarm and system indications forms part of the electronic translator complex.

For further information contact our nearest sales office

Technical Data

Office Parameters

Office Class	Outpulsing	Inpulsing
1 to 4	DP/MF	DP/MF

Capacity

	Single-Train	Two-Train
In terminations	8,000	16,000
Out terminations	12,000	24,000
CCS/Frame	2800-3200†	2800-3200†
CCS/Total	128,000	256,000
Marker Attempts	58,000	116,000

†At the end of growth, the link frames can handle 3200 CCS

Operating Voltages
±24 Vdc; −48 Vdc
±130 Vdc
20 Hz, 105 Vac
60 Hz, 55 Vac
60 Hz, 22 Vac

Ambient Service Conditions

Temperature Range
5°C to 38°C (40°F to 100°F)

Relative Humidity
NE-4A Equipment Area:
15% to 55%
Electronic Translator Area:
20% to 55%

Building Data

Framework Height
Switching Equipment Frames
11 ft 6 in (3.5 m)
Electronic Translator Frames
7 ft (2.1 m)

Color
Green and Ivory