

READ ME FIRST!

READ ME FIRST!

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SX-50™ DPABX COURSE CHART

INTRODUCTION

Welcome to the SX-50™ Installation and Maintenance Course. This course is a “self study” format based on reading assignments with video presentations and written exercises.

You will track your progress through the course using the course chart located in this document.

You should schedule 40 hours of your time to complete this course.

CERTIFICATION

If you are an authorized Mitel Dealer and in need of certification, you will be required to register for the final examination (see the “How do I register?” form).

ABOUT THE COURSE CHART

On the following pages you will find the course chart. The course chart shows you the sequence in which you should watch the videos and complete the written exercises. Check the items off as you complete them.

When you have completed all the self study activities in the course chart and are confident that you can find the required information and perform the required tasks, you should then be ready to install your first Mitel SX-50™ DPABX system.

Good Luck!

SX-50™ DPABX INSTALLATION AND MAINTENANCE COURSE CHART

SX-50™ DPABX COURSE CHART

The course chart shows the sequence in which the course should be taken. As you complete an activity, check it off.

<u>ACTIVITY</u>	<u>CHECK-OFF</u>
View the video segment "SX-50™ Course Introduction"	_____
Complete Documentation Written Exercise	_____
View the video segment "Static Control"	_____
View the video segment "Hardware Overview"	_____
Complete Hardware Written Exercise	_____
Complete Hardware Lab Project	_____
View the video segment "Hardware Installation"	_____
Complete Installation Written Exercise	_____
Complete Grounding Information Written Exercise	_____
Complete Installation Lab Project	_____
View the video segment "Basic Cabling"	_____
Complete Cabling & Cross Connections Written Exercise	_____
Complete Cabling & Cross Connections Lab Project	_____
View the video segment "Default Data"	_____
Complete Default Data Written Exercise	_____

SX-50™ DPABX INSTALLATION AND MAINTENANCE COURSE CHART

View the video segment "Loading Default Data" _____

Complete Default Data Lab Project _____

View the video segment "Maintenance Commands" _____

Complete Maintenance and Troubleshooting Written Exercise _____

Complete Maintenance and Troubleshooting Lab Project I _____

View the video segment "Single Line Features" _____

Complete Single Line Features Written Exercise _____

Complete Single Line Features Lab Project _____

View the video segment "Superset 4 Prestige Plus Performance" _____

Complete Superset 4 Written Exercise _____

Complete Superset 4 Lab Project _____

View the video segment "Basic Console Operation" _____

Complete Attendant Console Written Exercise _____

Complete Attendant Console Lab Project _____

View the video segment "Introduction to CDE" _____

Complete Customer Data Entry Written Exercise _____

View the video segment "Customer Data Entry" _____

Complete Customer Data Entry Lab Project _____

SX-50™ DPABX INSTALLATION AND MAINTENANCE COURSE CHART

View the video segment "System Options & Feature Access Codes" _____

Complete System Options Written Exercise _____

Complete System Options Lab Project _____

Complete Feature Access Codes Written Exercise _____

Complete Feature Access Codes Lab Project _____

View the video segment "Extension Programming" _____

Complete Extension Programming Written Exercise _____

Complete Extension Programming Lab Project _____

View the video segment "Class of Service" _____

Complete Class of Service Written Exercise _____

Complete Class of Service Lab Project _____

View the video segment "Block Programming" _____

Complete Block Programming Written Exercise _____

Complete Block Programming Lab Project _____

View the video segment "Ring Group" _____

Complete Ring Group Written Exercise _____

Complete Ring Group Lab Project _____

View the video segment "Hunt Group Programming" _____

Complete Hunt Group Written Exercise _____

SX-50™ DPABX INSTALLATION AND MAINTENANCE COURSE CHART

Complete Hunt Group Lab Project	_____
View the video segment "Introduction to Trunks"	_____
Complete Introduction to Trunks Written Exercise	_____
View the video segment "Trunk Groups"	_____
Complete Trunk Group Programming Written Exercise	_____
Complete Trunk Group Programming Lab Project	_____
View the video segment "Trunks"	_____
Complete Trunk Programming Written Exercise	_____
Complete Trunk Programming Lab Project	_____
Complete TAFAS Written Exercise	_____
Complete TAFAS Lab Project	_____
View the video segment "DISA"	_____
Complete DISA Trunk Programming Written Exercise	_____
Complete DISA Trunk Programming Lab Project	_____
View the video segment "E&M Trunks"	_____
Complete E&M Trunk Written Exercise	_____
Complete E&M Trunk Lab Project	_____
View the video segment "DID Trunk"	_____
Complete DID Trunk Written Exercise	_____

SX-50™ DPABX INSTALLATION AND MAINTENANCE COURSE CHART

Complete DID Trunk Lab Project	_____
View the video segment "SUPERSET Programming"	_____
Complete SUPERSET Programming Written Exercise	_____
Complete SUPERSET Programming Lab Project	_____
View the video segment "Introduction to ARS"	_____
Complete Introduction to ARS Written Exercise	_____
View the video segment "ARS North American Number Plan and Carriers"	_____
View the video segment "ARS Example"	_____
Complete ARS Example Written Exercise	_____
Complete Miscellaneous Programming Written Exercise	_____
Complete Miscellaneous Lab Project	_____
View the video segment "Maintenance Commands II"	_____
Complete Maintenance Functions Lab Project II	_____
View the video segment "RMATS Operation"	_____
Complete RMATS Written Exercise	_____
Complete RMATS Lab Project	_____
View the video segment "SMDR Operation"	_____
Complete SMDR Written Exercise	_____
Complete SMDR Lab Project	_____

SX-50™ DPABX INSTALLATION AND MAINTENANCE COURSE CHART

Complete Data Dump/Load Written Exercise _____

Complete Data Dump/Load Lab Project _____

View the video segment "SX-50™ Applications" _____

Complete Small Business Application Lab Project _____

Complete Health Care Application Lab Project _____

Complete Hotel Application Lab Project _____

View the video segment "Programming Scenario" _____

View the video segment "Course Summary" _____

**DIRECT ALL REGISTRATION/SCHEDULE INQUIRIES TO
MITEL TRAINING, KANATA ONTARIO, CANADA
(613) 592-2122 EXT. 4037**

HOW DO I REGISTER ?

CUSTOMERS PAYING BY CHEQUE:

- 1) Complete a Mitel Registration Form
- 2) Fax a copy of the completed form and cheque to:
(613) 592-4784
Attention: Holly Ross/Debbie Devlin
- 3) Mail the completed form and cheque to:
Mitel Corporation
350 Legget Drive, Box 13089
Kanata, Ontario
K2K 1X3

**Please write your Mitel Account # and the word "Training"
on the back of your cheque.**

CUSTOMERS PAYING WITH A PURCHASE ORDER:

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Attention: Holly Ross/Debbie Devlin

Purchase orders are conditional on Mitel Credit Department Approval.

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fax to (613)592-4784
Attention: Holly Ross/Debbie Devlin

REGISTRATION FORM FOR SX-50 CERTIFICATION

**ATTENTION: EDUCATIONAL SERVICES REGISTRAR
FAX# 613-592-4784**

Certification Cost: \$200.00 (Per Student Certification)

STUDENT'S COMPANY NAME _____

STUDENT'S BIRTHDATE **MONTH** _____ **DAY** _____ **(FOR TECHNICIAN NUMBER VERIFICATION)**

COMPANY ADDRESS _____

STREET _____

CITY _____

STATE/PROVINCE _____ **ZIP/POSTAL CODE** _____

TELEPHONE NUMBER _____ **FAX NUMBER** _____

STUDENT NAME _____

SUPERVISOR/ CONTACT NAME _____

CHECK #/P.O. # _____

(REMEMBER TO FAX COPY OF PAYMENT WITH REGISTRATION)

COURSE REQUIRED _____

DATE & LOCATION _____

CHECK TO BE MAILED TO:

**Mitel Corp.
350 Legget Dr.
Kanata, Ontario
K2K 1X3
Attn: Training Registrar**

PLEASE WRITE YOUR MITEL ACCOUNT # AND THE WORD "TRAINING" ON THE BACK OF YOUR CHEQUE (CHECK).

__ VISA __ MASTERCARD

CARD NUMBER: _____

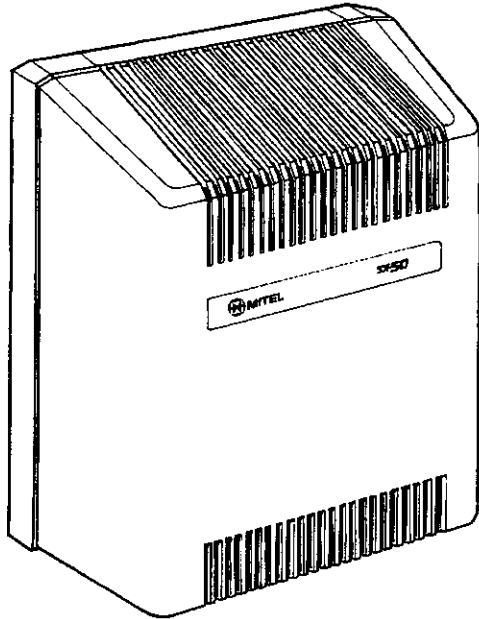
CREDIT CARD EXPIRY DATE: _____ **AMOUNT** _____

CARDHOLDERS NAME: _____

CARDHOLDERS SIGNATURE: _____

SX-50TM

**SX-50TM I&M
SELF STUDY GUIDE**



**EDUCATIONAL SERVICES
MITEL CORPORATION
KANATA, ONTARIO**

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SX-50™ DPABX: DOCUMENTATION

INSTRUCTIONS:

The following exercise is a self-teaching assignment introducing you to the SX-50™ DPABX Documentation.

THE MITEL TECHNICAL PRACTICES – PART I

The MITEL documentation department publishes a single volume of information called the SX-50™ DPABX Technical Practice. This will be your prime source of information throughout the course and as you work with the SX-50™ DPABX in the field.

- **Locate the SX-50™ DPABX Technical Practice from your course package.**
- **Locate the CONTROL SHEET (a Table of Contents) located at the beginning of the Practice volume. It is located just after the notices for Canadian and U.S. customers.**

The CONTROL SHEET is a table of contents for the Practice volume.

The Practice volume is separated into SECTIONS using blue pages.

- **Scan through the volume and locate a blue page.**
- **Note the new section begins with a title page.**

On the control sheet each section has a unique Section Number, Title, and Issue Number. The issue number is the number of versions of the document that have been published.

- **What is the title and issue of Section Number 9104-091-105-NA?**
-

- **Locate the Features Description section in the Technical Practices.**
- **Locate the CONTENTS page of the Features Description section.**
- **Note the Section Number appears in the top left corner of the left page.**
- **Note the Title appears in the top right corner of the right page.**

Each section starts with a Contents page. Subjects are listed alphabetically.

- **Which page contains information on Automatic Diagnostics?**
-

At the end of the contents is a List of Tables and a List of Illustrations.

- **Locate these two lists.**

ANSWERS

- **Features Description, Issue 4**
- **Page 41**

**ASSIGNMENT #1 – INTRODUCTION TO THE SX-50™ DPABX
TECHNICAL PRACTICES**

1. **Name the location where the contents of a volume are listed.**

2. **What is the purpose of the blue pages?**

3. **If you were in the middle of a section, how could you find the title of that section?**

4. **What is the purpose CONTROL SHEET?**

5. **What is the purpose CONTENTS SHEET at the beginning of each section?**

ANSWERS

- 1. In the Control Sheet of the Practice.**
- 2. The blue pages separate the sections.**
- 3. By looking at the top of the page, each section identifies itself by Title and Part Number.**
- 4. The CONTROL SHEET the contents of the volume.**
- 5. The CONTENT SHEET lists the information of the section.**

THE MITEL TECHNICAL PRACTICES – PART II

Each section of the practices describes a specific portion of the SX-50™ DPABX. In Part II of the exercise, key sections are reviewed.

Features Description

- **Locate the Features Description section.**

The Features Description section lists all the features a telephone, SUPERSET™, and Attendant Console may perform. Each feature is listed alphabetically in the Contents page and throughout the document.

- **Locate information on CAMP-ON in the Features Description section.**

Each feature that is listed has 4 sub-headings; Description, Conditions, Programming, and Operation.

The Description explains the feature.

Conditions lists situations where the feature may operate differently or not at all.

Programming informs technical staff on the areas that must be programmed to make the feature available.

Operation informs the end user on how to invoke the feature from the applicable station.

Shipping, Receiving, and Installation Information

- **Locate the Shipping, Receiving, and Installation section**

Like the title implies, this section contains the procedures and information necessary to install the SX-50™ DPABX hardware.

- **Locate the Contents page for this section**

The contents of this section are sequenced in the order the job is performed. The Shipping and Receiving information is listed first followed by Installation Requirements, Installation Procedures, and Cabling and Cross Connections.

- **Locate Shipping and Receiving Information.**

This information lists the pieces to be expected.

- **Locate Installation Requirements.**

Location, environment, and grounding conditions are listed here.

- **Locate Installation Procedures**

The Installation Procedures contains installation charts used to install the SX-50™ DPABX hardware.

- **Locate the Unpacking and Inspection of Equipment table.**

Each table contains a step-by-step procedure. Figures are referenced where applicable.

- **Locate Cabling and Cross Connections.**

This portion begins with overview information. The actual wiring for the system is listed in the TIP and RING ASSIGNMENTS Table. Figures of wiring requirements such as Power Fail Transfer and E&M Trunks are also included.

Customer Data Entry

- **Locate the Customer Data Entry section**

The Customer Data Entry section lists all the procedures and programming forms for editing the SX-50™ DPABX database.

- **Locate System Initialization and Data Entry Information**

The first 9 pages of this section detail loading the default database and methods of editing the database.

- **Locate System Options Programming**

System Options Programming is one of several parts of the database. A written record of the default database is listed here.

- **Note: The rest of the Customer Data Entry section contains a written record of the default database.**

Troubleshooting and General Maintenance Information

- **Locate the Troubleshooting Procedures and General Maintenance Information section.**

This section has information on how the system indicates a fault and the necessary troubleshooting procedures.

Engineering Information

- **Locate the Engineering Information section.**

Engineering Information has very detailed explanations of system and card operation.

- **Locate the System Parameters table**

This table indicates maximum/minimum parameters of system attributes.

- **Locate the Station Loop Length tables.**

These tables indicate the maximum distance a device may be located from the SX-50™ DPABX.

ASSIGNMENT # 2 – LOCATING INFORMATION

This assignment requires you to locate information with the Technical Practices. Here are some hints;

- **Always start with the Control Sheet located at the beginning of the volume.**
- **When you have located the section, use the Contents Sheet of the section to locate the specific information.**
- **If you have access to tabs, use these to separate the sections.**

1. Where is information found on the Automatic Callback feature?

2. According to the Technical Practice, what happens if a user has the Data Line Security feature?

3. According to the Installation Chart, what size should the screws be when mounting the backplane?

4. What table lists the wiring for telephones?

5. When loading default data, which switch on the control card is switched to closed then back to open?

6. Which section details information on Self Diagnostic Tests?

ANSWERS

1. **The Features Description Section**
2. **No tones (beeps) are heard during a camp on. See Features Description section.**
3. **According to the Shipping, Receiving and Installation section, table 5-3 states 1 1/4 inch #14 or #16.**
4. **Table 6-1 in the Shipping, Receiving and Installation section lists the wiring for telephones.**
5. **Information on default data is located in table 2-1 of the Customer Data Programming section. It states switch 1 must be set to closed then back to open.**
6. **Self Diagnostic Tests information is located in the Troubleshooting Procedures and General Maintenance information section.**

SX-50™ DPABX: HARDWARE

INSTRUCTIONS:

The following exercise is a self-teaching assignment introducing you to the SX-50™ DPABX Hardware.

THE SX-50™ DPABX HARDWARE

the SX-50™ DPABX is comprised of components that house the hardware and the actual circuit cards. A detailed description of the hardware is contained in the General Description section of the Practice.

- **Read the General Description section up to and including Software Overview. Answer the questions below.**

Note: Some of the information in this section is very detailed. Concentrate on 2 objectives;

- 1) What is the purpose of the card?
- 2) What variants of a particular card are available?

ASSIGNMENT # 1 – HARDWARE OVERVIEW

1. **Where do cables enter the SX-50™ DPABX cabinet?**

2. **How many peripheral cards fit into the card frame?**

3. **Name 2 locations where fuses may be found on the Power Supply.**

4. **How does the Control Card fit into the Card Frame?**

5. Explain how power is distributed from the Power Supply to the Peripheral Cards.

6. Name the 6 types of Peripheral Cards.

7. Which card has the DTMF receivers?

8. Which card has the Night Bell output?

9. Which card has the RS-232-C interface?

10. Which card has the Digital Signal Processors?

11. Which card has the Attendant Console connector?

12. Which types of telephones may be connected to an ONS Line Card?

13. What are the two configurations of ONS Line Cards?

14. Which hardware feature of the OPS line card makes it suitable for connection to telephones outside the building?

15. Which types of telephones may be connected to an OPS Line Card?

16. What are the two configurations of OPS Line Cards?

17. Which types of telephones may be connected to a COV Line Card?

18. How many devices may connect to a COV Line card?

19. Which types of telephones may be connected to a COV Line Card?

20. How many devices may connect to a DNIC Line card?

21. What are the two configurations of LS/GS Trunk Cards?

22. How many Power Fail Transfer Circuits are there on either trunk card?

23. How is a trunk made Loop Start or Ground Start?

24. What are the two configurations of DID Trunk Cards?

25. How many modules fit on to a single Universal Card?

26. Name the modules that will fit on to the Universal Card.

27. Which function does the Generic module perform?

28. What is the battery on the Generic Module used for?

29. How many Attendant Consoles can be connected?

30. Where does the Attendant Console connect to the SX-50™ DPABX?

31. What is the maximum number ONS lines on the SX-50™ DPABX?

32. What is the maximum number OPS lines on the SX-50™ DPABX?

33. What is the maximum number COV lines on the SX-50™ DPABX?

34. What is the maximum number of combined lines on the SX-50™ DPABX?

35. What is the maximum number of LS/GS trunks on the SX-50™ DPABX?

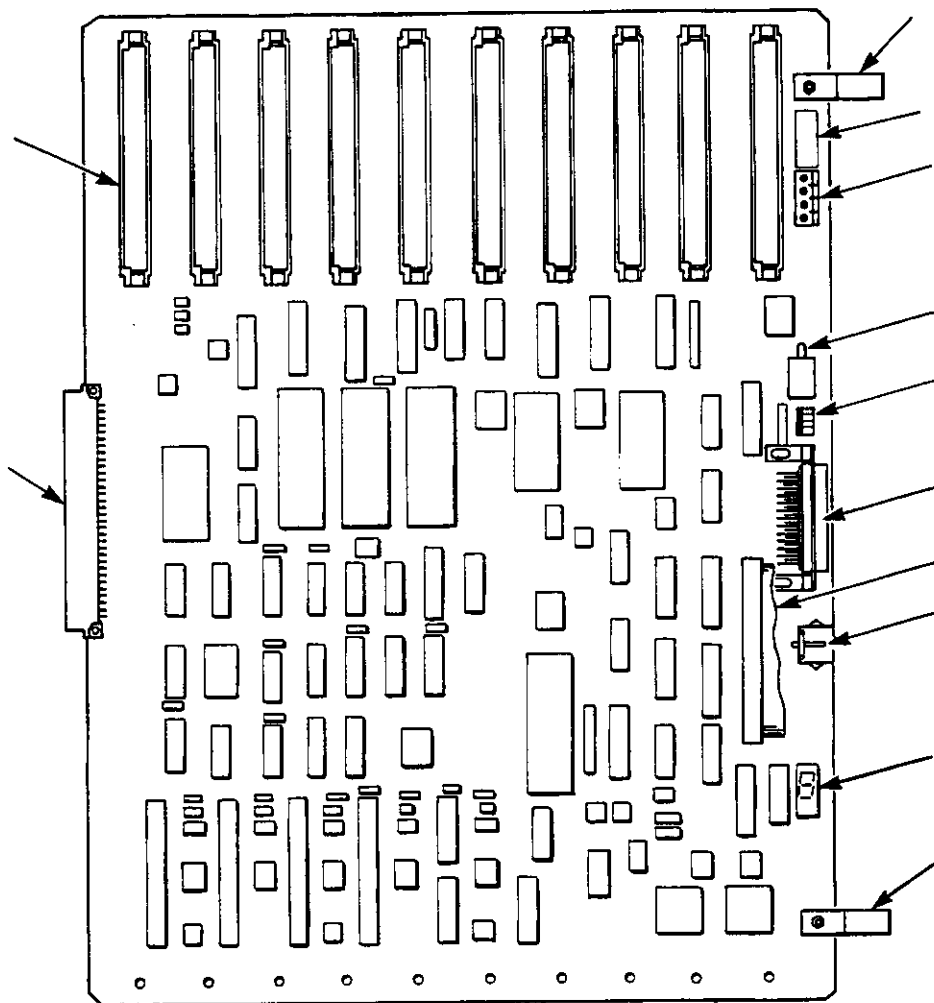
36. What is the maximum number of E&M trunks on the SX-50™ DPABX?

37. What is the maximum number of DID trunks on the SX-50™ DPABX?

38. What is the maximum number of combined trunks on the SX-50™ DPABX?

39. List the minimum number of cards required to satisfy the following requirements; 43 DTMF telephones, 12 SUPERSET telephones, 6 LS/GS trunks, 4 E&M Trunks, Music on Hold.

40. Label the arrows.



41. Explain the purpose of the following chips on the control card. Use information in the General Description and Engineering Sections.

DTMF Receivers

Digital Signal Processors

DX Matrix

- 42. Other sections in the Technical Practices also offer information on the circuit cards. To make this information easier to find in the future make these notes in your practices for the following cross references.**
- **General Description – Make a note in this section that Circuit Card Operation information is in the Engineering Section and LED indicators are described in the Troubleshooting section.**
 - **Make complimentary cross reference notes in the Engineering and Troubleshooting section.**

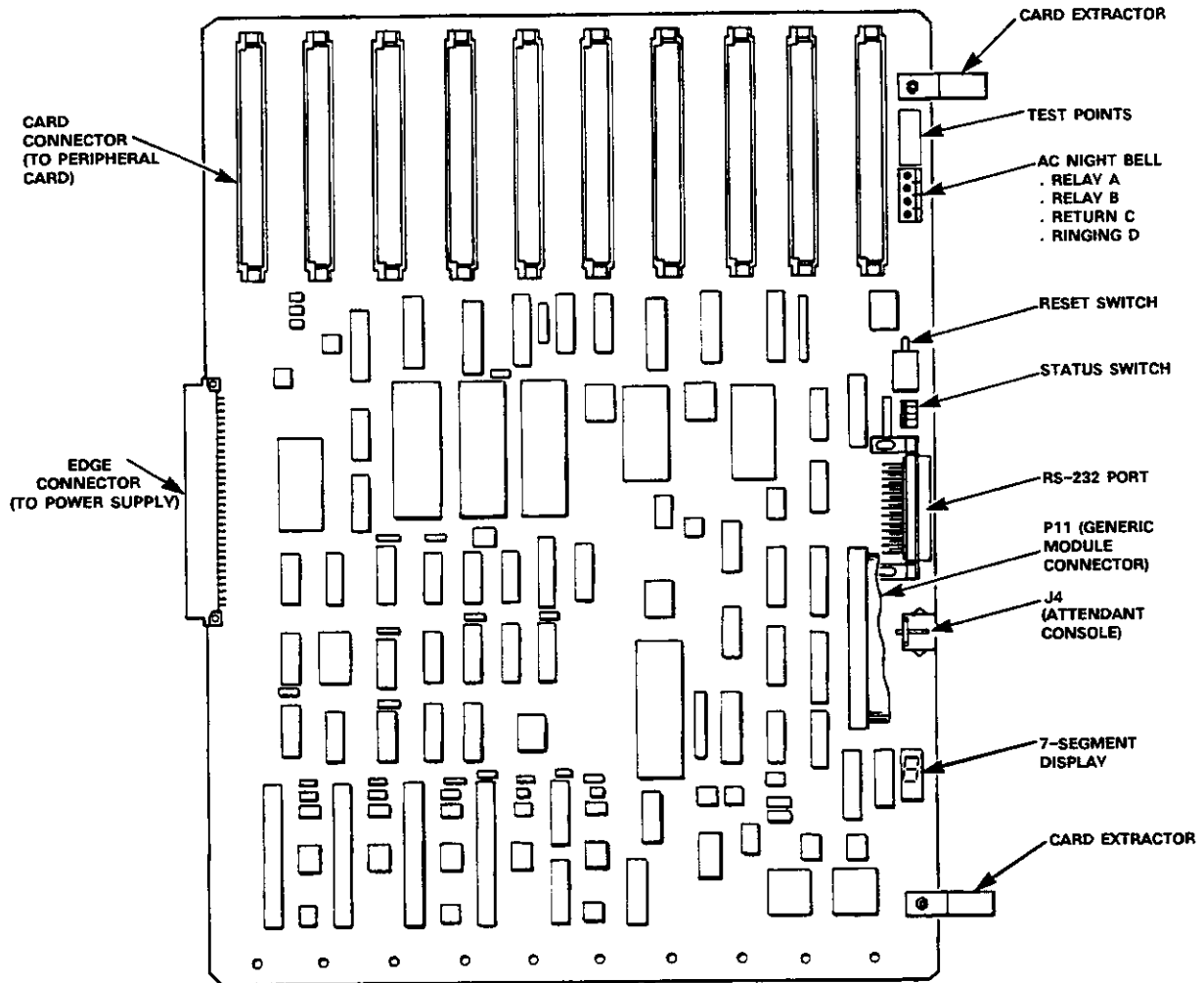
ANSWERS

1. **Cables enter the cabinet at the bottom of the system through a cut-away in the cover.**
2. **The system can accommodate 10 peripheral cards.**
3. **Fuses are found at the front and the side of the power supply.**
4. **The control card slides into the card frame and connects to the power supply.**
5. **Power is distributed to the peripheral cards by way of the Control Card.**
6. **ONS Line Card, COV Line Card, Universal Card, LS/GS Trunk Card, DID Card, OPS Line card.**
7. **The control card has the DTMF Receivers**
8. **The control card has the Night Bell Output**
9. **The control card has the RS-232-C interface (printer port)**
10. **The control card has the Digital Signal Processors**
11. **The control card has the Attendant Console Connector.**
12. **DTMF or Rotary dial telephones connect to the ONS Line Card.**
13. **8 circuit and 16 circuit**
14. **The OPS Line Card contains line protection circuitry making it suitable for connection to telephones outside the building.**

15. **DTMF or Rotary dial telephones connect to the OPS Line Card.**
16. **4 circuit and 8 circuit**
17. **SUPERSET 3 or SUPERSET 4 telephones connect to the COV Line card.**
18. **The COV Line card has 8 circuits.**
19. **The SUPERSET 410 & 420 sets connect to the DNIC Line card.**
20. **The DNIC Line card has 8 circuits.**
21. **The LS/GS Trunk Card is either 4 circuit or 8 circuit.**
22. **Both configurations of the trunk card have 2 power fail transfer circuits each.**
23. **A trunk is made ground start or loop start through programming – there are no switches.**
24. **The DID card is either 4 circuit or 8 circuit.**
25. **Up to 4 modules may fit on a Universal Card.**
26. **E&M Trunk Module, RMATS Module, MUSIC-ON-HOLD/Pager Module.**
27. **The Generic Module stores the memory which contains the operating software and customer database.**
28. **The battery retains the customer database memory in the event of a power failure.**
29. **1 console may be connected**

- 30. The console connects to the jack on the control card**
- 31. Physically the system can support 160 ONS lines.**
- 32. The maximum number of OPS lines is 80.**
- 33. The maximum number of COV lines is 64.**
- 34. Physically the system can 160 lines. However, for guaranteed stable system performance and an acceptable grade of service, the recommended maximum is 112 lines made up from a maximum 128 single lines, a maximum 64 SUPERSET™ lines, and a maximum 80 OPS lines.**
- 35. The maximum number of LS/GS circuits is 80.**
- 36. The maximum number of E&M circuits is 36; limited by the maximum number of Universal cards (9) and module positions (4 per Universal card).**
- 37. The maximum number of DID circuits is 16.**
- 38. Physically the system can 80 trunks. However, for guaranteed stable system performance and an acceptable grade of service, the recommended maximum is 32 trunks made up from a maximum 32 LS/GS trunks, a maximum 32 E&M trunks, and a maximum 16 DID trunks.**
- 39. 3 ONS Line Cards, 2 COV cards, 1 LS/GS Trunk Card, 2 Universal Cards if a Control card is installed, 1 Universal Card if a Control Card 2 (MCC2) is installed.**

40.



NOTE: Due to space limitations, the grounding bracket is not shown.

41. **DTMF Receivers: Section -100, Paragraph 6.10, Section -180, Paragraph 4.03**
Digital Signal Processors: Section -100, Paragraphs 6.05 through 6.07,
DX Matrix: Section -100, Paragraph 6.03, Section -180, Paragraph 9.01 through 9.12

SX-50™ DPABX: HARDWARE LAB PROJECT

INSTRUCTIONS:

Complete the following lab project if you have access to an SX-50™ DPABX.

USE THE STATIC STRAP AT ALL TIMES WHEN HANDLING CIRCUIT CARDS!

ASSIGNMENT # 1 – HARDWARE IDENTIFICATION

Identify and check-off the following components.

Cover

Lock _____

Upper Vent _____

Lower Vent _____

Sticker showing slots, etc _____

Cut-away for cables _____

Backplate

4 Screw holes for wall mounting _____

Upper Horizontal Frame Guide _____

Lower Horizontal Frame Guide _____

Energy Dumping Ground bar _____

Support for Power Supply _____

Cable Guides (for tie wraps) _____

Card Frame

10 Peripheral Card Slots _____

Control Card Slot _____

Card Frame Latch (slides into Backplate) _____

Upper and Lower grounding braid. _____

Mounting holes for Power Supply _____

Mounting holes for Generic Module _____

Insulating sheet for slots 1 & 10 _____

Connections for ground wires (see Grounding figure in Shipping, Receiving, and Installation section) _____

Power Supply

Signal Ground Connector _____

Chassis Ground _____

Ground Lug _____

On/Off Switch _____

AC Power Supply Input _____

Input Fuse _____

Output Fuses _____

4 Mounting Holes _____

Control Card Connector

Note: Fuse ratings are listed in the Troubleshooting section. Power Supply information is documented in the Engineering section. Make cross reference notes in these sections. Also note that Voltage Test Points are on the Control Card.

Control Card

USE A STATIC STRAP!

Card Extractor _____

Edge Connector to Power Supply _____

10 Card Connectors for Peripheral Cards _____

Voltage Test Points _____

AC Night Bell connections _____

Reset Switch _____

4 Status Switches _____

RS-232-C Connector _____

Generic Module Connector _____

Ground Wire for Generic Module (not on all systems) _____

Attendant Console Connector _____

7 Segment Display _____

MOH/Pager connections on an MCC2

5 DTMF Receivers 8870 chips _____

Digital Signal Processor 7720 chip _____

DX Matrix 8980 chips _____

ONS Line Card

Upper and Lower Card Extractors _____

Cable Connector _____

Screw hole to attach cable _____

Tie Wrap connector to secure cable _____

Red LED indicators _____

Green LED indicators _____

What are these LEDs used for? - See Troubleshooting

Edge Connector for Control Card _____

Is this a 8 circuit or 16 circuit ONS Card? How can you tell? _____

COV Line Card and DNIC Line Card

Upper and Lower Card Extractors _____

Cable Connector _____

Screw hole to attach cable _____

Tie Wrap connector to secure cable _____

Red LED indicators _____

Green LED indicators _____

Edge Connector for Control Card _____

OPS Line Card

Upper and Lower Card Extractors _____

Cable Connector _____

Screw hole to attach cable _____

Tie Wrap connector to secure cable _____

Red LED indicators _____

Green LED indicators _____

Is this a 4 circuit or 8 circuit OPS Card? How can you tell? _____

LS/GS Trunk Card

Upper and Lower Card Extractors _____

Cable Connector _____

Screw hole to attach cable _____

Tie Wrap connector to secure cable _____

Red LED indicators _____

Green LED indicators _____

What are these LEDs used for? – See Troubleshooting

Power Fail Transfer Relays _____

Edge Connector for Control Card _____

Is this a 4 circuit or 8 circuit LS/GS Trunk Card? How can you tell? _____

DID Trunk Card

Upper and Lower Card Extractors _____

Cable Connector _____

Screw hole to attach cable _____

Tie Wrap connector to secure cable _____

Red LED indicators _____

Green LED indicators _____

What are these LEDs used for? – See Troubleshooting

Edge Connector for Control Card _____

Is this a 4 circuit or 8 circuit DID Trunk Card? How can you tell? _____

Universal Card

Upper and Lower Card Extractors _____

Cable Connector _____

Screw hole to attach cable _____

Tie Wrap connector to secure cable _____

Red LED indicators _____

Green LED indicators _____

Edge Connector for Control Card _____

Connections for 4 modules _____

Identify any modules installed by reading the labels attached.

Generic Module

4 Mounting holes _____

Connector for Control Card _____

Lithium Battery - DO NOT REMOVE OR PROGRAMMED MEMORY WILL BE LOST! _____

Ground Lug for Control Card Ground wire (not on all Generic Modules) _____

Attendant Console

Handset Connector _____

Console to Control Card connector _____

Dial Pad _____

SX-50™ DPABX: GROUNDING INFORMATION

INSTRUCTIONS:

This information on grounding is not contained in the Technical Practices.

- **Read this Grounding Information document.**
- **Copy key notes into your Technical Practices.**
- **Attach a photocopy to your Troubleshooting section.**

GROUNDING INFORMATION

1.0 THE IMPORTANCE OF SYSTEM GROUNDING

Mitel recommends that a ground independent of the Electrical Facility be connected to all PBX's. The purpose of this ground is to prevent lethal voltage potentials on the PBX that enter on faulted tip/ring cabling, even if the PBX is disconnected from the power source. A large diameter cable is used to carry potentially large fault currents.

It is extremely important that this independent ground does in fact provide a low resistance ground path.

2.0 GROUNDING PROBLEMS

A low resistance ground is also desirable from an operational point of view. To prevent operational problems, the independent ground should be the best possible ground.

Grounding problems disrupt the operation of PABX's in three different ways.

1) The telephone network uses DC signals to supervise the state of telephone circuits. These signals are interpreted by comparing them to known voltage reference points, either ground potential, or a voltage referenced to ground. These signals may not be properly interpreted if a DC ground differential exists between the PABX and the CO.

- Ground start trunks will not seize when the ring lead is grounded
- The Central Office does not release trunks when the PABX removes its termination

2) Low frequency AC ground differentials can disrupt the operation of logic circuits, causing incorrect operation, or system failures.

3) AC ground differentials at Radio Frequency can cause audio interference, and less often, disrupt logic circuits.

3.0 GROUNDING THEORY

Ground Potential is defined as the AVERAGE potential of the Earth's surface.

Any ground reference point can be considered as connected to Ground Potential through a resistance.

Four factors determine the resistive component:

- suitability of the method of connection to the ground point
- make-up of the soil where ground is connected
- area of soil contact
- moisture content of the soil

The DC potential of the ground reference point will be determined by the value of the resistive component, and the amount of ground current conducted by the ground point.

A "good" ground (suitable as a safety ground) will have a very low value resistance to ground potential.

A DC ground reference suitable to a PABX will have a voltage potential nearly equal to the ground reference of the serving CO.

A good DC ground will also be suitable for low frequency AC. (Low frequency AC is not affected by the inductance of the cable connected to the ground point.)

If an electrical system is installed following normal North American rules, the ground reference point will usually be a "good" quality ground. This grounding point is connected to the frame of the PABX's.

Mitel Standard Practices specify the addition of an independent ground because:

- a ground return path must be provided for the safety of users and maintenance people should the AC supply be disconnected for any reason
- even a "good" ground can be unsuitable to the PABX due to the accumulated ground current generated by all of the devices connected to the electrical system

The independent ground connected to the PBX will divide the ground current conducted by the AC facility ground, reducing the voltage potential compared to ground potential.

The independent ground, if properly selected, will serve three purposes:

- offer a high current capacity safety ground
- bring the ground reference of the PABX closer to ground potential, and reduce the ground differential to the connected CO
- reduce or remove low frequency AC ground potentials

4.0 DETERMINING GROUND SUITABILITY

In North America, Central Offices have elaborate ground systems that keep their ground reference close to ground potential. This test assumes that the Central Office is using an ideal ground.

A suitable ground is accomplished when the current conducted from the ring lead to ground is equal to double the loop current.

4.1 Procedure to Determine Ground Suitability

1. Disconnect the PABX from the independent ground.
2. Disconnect a Loop start or ground start trunk from the PABX.
3. Measure the Loop Current -- (I Loop).

METER SETTING:

Milliamperes: D.C.

Range: 200 Milliamperes.

Connect the Ampmeter between T & R. If testing a Ground Start trunk, apply a ground momentarily to the ring (R) side to start the dial tone. Allow sufficient time for the current to stabilize.

Record the I Loop.

4. Measure the Ring to local Ground Current (I R - G)

METER SETTING: Same as Loop Current Test

Connect the Ampmeter between Ring (R) and Local Ground (G). Be sure to remove local ground from the equipment ground stud. Allow sufficient time for the current to stabilize. If no current is measured, the Ground is unacceptable.

Record the I R - G.

5. Divide the Local Ground current by the Loop current. An ideal ground, one that has the exact ground potential of the Central Office ground, will give a result of exactly 2.0

An acceptable ground will give a result that ranges from 1.85 to 2.15.

$$\frac{I_{R-G}}{I_{Loop}} = 1.85 \text{ to } 2.15$$

4.2 INTERPRETING AN UNACCEPTABLE RESULT

Assuming a low resistance connection to your ground point, an unacceptable result will be caused by one of two factors (both impossible to measure from a customer site):

- a "good" quality ground (suitable as a safety ground) is conducting a significant amount of DC ground current from other devices (or is located very close to a ground point conducting a large amount of ground current) causing a DC ground differential
- the ground point selected offers a high resistance path to ground potential, **MAKING THIS GROUND CONNECTION UNSUITABLE AS A SAFETY GROUND**, as well as operationally unsuitable.

TAKE NO CHANCES WITH SAFETY. FIND A SUITABLE GROUND POINT.

NOTE: Ground related operational problems may still occur with a ground that passes this test. If you suspect ground related problems, try to find an alternate ground point that also passes this test.

5.0 FINDING AN ACCEPTABLE GROUND POINT

A connection to the cold water system where it enters a building (street side of the water meter) will usually give an acceptable ground. The water pipes must be metallic (iron or copper), and must be buried in the ground to establish ground potential.

A connection to the cold water system must establish solid metal to metal contact -- all paint and corrosion must be scraped away from the ground point, and the ground wire must be securely clamped to the bare metal. The water in the pipes is not a part of the grounding system.

You can connect to cold water pipes on the building side of the water meter if you provide a metallic path around the water meter.

ASSIGNMENT #1 - GROUNDING

1. Name 3 ways in which poor grounding can cause problems to a PBX.

2. Should the difference in potential between CO ground and PBX ground be great or small? Why?

ANSWERS

1. Poor grounds cause;

1) The telephone network uses DC signals to supervise the state of telephone circuits. These signals are interpreted by comparing them to known voltage reference points, either ground potential, or a voltage referenced to ground. These signals may not be properly interpreted if a DC ground differential exists between the PABX and the CO.

2) Low frequency AC ground differentials can disrupt the operation of logic circuits, causing incorrect operation, or system failures.

3) AC ground differentials at Radio Frequency can cause audio interference, and less often, disrupt logic circuits.

2. The CO and PABX should have identical ground potential for reliable operation.

SX-50™ DPABX: INSTALLATION

INSTRUCTIONS:

The following exercise is a self-teaching assignment introducing you to the installation of the SX-50™ DPABX.

SX-50™ DPABX INSATALLATION

A detailed step-by-step procedure for installing the SX-50™ DPABX is located in the Shipping, Receiving, and Installation section.

- **Read this section up to and including Installation Requirements.**

ASSIGNMENT #1 – Preparation for Installation

1. **When should circuit cards be removed from their static bags?**

2. **How should circuit cards be handled?**

- **READ THE WARNING ABOUT THE LITHIUM BATTERY**

3. **How should lithium batteries be disposed?**

4. **What is the acceptable environmental temperature range for operation of the SX-50™ DPABX.**

5. **How much space is required for installation and operation of the SX-50™ DPABX.**

6. **Where must an SX-50™ DPABX NOT be located?**

7. What thickness must the wall/backboard be?

8. What are the power requirements for the SX-50™ DPABX?

9. How should it be wired and fused?

10. Where should warning tags be placed?

11. Where is the Chassis ground located on the SX-50™ DPABX?

12. Why should all sources of external grounds connect to a single ground point?

- **Continue reading up to and including the Card and Module Installation table.**

ASSIGNMENT #2 – Installation Procedures

1. How many installation charts are there?

2. Name 2 conditions where MITEL reserves the right to void a warranty.

3. What is the first piece of hardware to be mounted?

4. Name 3 points that secure the Card Frame into place.

5. How is the Power Supply secured to the Card Frame?

- Review the System Grounding Procedures table

6. What size should the ground wire be?

7. What is the difference between an AC Ground and a DPABX Chassis Ground? (See Appendix B)

8. What is the maximum acceptable voltage between the AC ground and the chassis ground?

9. Why should the voltage be as low as possible?

10. What is the maximum acceptable resistance between the AC ground and the chassis ground?

11. Why should the resistance be as low as possible?

12. Why is the voltage measured before the resistance?

- **Study the System Grounding figure.**

13. What size wire is used for connection from the Energy Dumping Ground Bar to the Chassis Ground lug?

14. How is the ground connection verified?

15. Why must the system be grounded before a technician handles the circuit cards?
-

- NOTE -

STEP 2 IN THE CARD AND MODULE INSTALLATION TABLE IS INCORRECT. DO NOT REMOVE CARDS FROM THEIR ANTISTATIC BAGS UNTIL THEY ARE READY TO BE INSTALLED. MAKE A NOTE IN YOUR PRACTICE TO CORRECT THIS.

16. What does the Control Card plug in to?
-

17. What card does the Generic Module connect to?
-

- NOTE -

Make a note in the Generic Module installation step: NOT ALL CONTROL CARDS HAVE A GROUND WIRE FOR THE GENERIC MODULE.

18. When a Universal Card is installed how can you tell which type of module is in each position?
-

19. Where is Module Position 1 on the Universal Card?
-

20. How are peripheral cards connected to the EDG bar?

-
- Locate the CONTROL CARD STATUS SWITCHES Table.

- NOTE -
Beside Switch 4 write - IF THIS IS CLOSED IT WILL STOP THE PRINTER

ASSIGNMENT #1 ANSWERS

- 1. Cards should only be removed from their static bags when they are required to be installed.**
- 2. Circuit cards should be held by their edges to reduce the chance of static damage.**
- 3. Lithium batteries should be disposed according to locally approved procedures for hazardous waste. DO NOT THROW THE BATTERY OUT IN THE REGULAR TRASH.**
- 4. 0-40C, 32-104F**
- 5. Space required is 1.5m height, 103 cm width, including 40 cm on the right side to allow the control card to slide in.**
- 6. Do not install the SX-50 near a sprinkler, a copier or in the area of exhaust from machines.**
- 7. The thickness of the backboard must be at least 3/4 inch (plywood preferred).**
- 8. The SX-50 requires regular service: 115 VAC, 60 Hz, 5A.**
- 9. The system should be the only device connected on the line and should be separately fused.**
- 10. "DO NOT DISCONNECT" warning tags should be placed at the wall jack and the circuit breaker.**
- 11. The Chassis Ground is located on the power supply.**
- 12. Minimizes ground loops and related grounding faults.**

ASSIGNMENT #2 ANSWERS

1. **There are 8 installation charts.**
2. **MITEL reserves the right to void a warranty if warranty seals are broken or if the MITEL equipment has been modified.**
3. **The first piece of hardware to be mounted is the backplate.**
4. **The card frame is secure by the Top Card Frame Guide, Bottom Card Frame Guide, and the Card Frame Latch.**
5. **The power supply is secured with the push-in fasteners.**
6. **The ground wire should be 6 AWG.**
7. **AC Ground comes with electrical supply and is used for safety purposes. Chassis ground is customer supplied and is used to provide a clean, noiseless ground for the PABX.**
8. **1 VAC**
9. **The two grounds should be at the same potential for reliable operation.**
10. **5 ohms.**
11. **The two grounds should have no resistance between them for reliable operation.**
12. **The voltage is measured first to prevent accidental damage to the meter.**
13. **12 AWG**
14. **By a continuity test.**

15. **So the static strap will work.**
16. **The Control Card plugs into the power supply**
17. **The Generic Module plugs into the Control Card.**
18. **The Universal Card must be labelled on the outside to identify the modules.**
19. **Position 1 is at the top of the Universal Card.**
20. **Peripheral cards contain a metal probe that connects to the EDG bar when the card is installed.**

HANDS-ON EXERCISE:

- **Review the Shipping, Receiving, and Installation section.**
- **If you have access to an idle system, install it following the instructions in this section.**
- **If you have access to a system that is currently installed follow the instructions and verify that the system was installed correctly.**
- **IN BOTH CASES INSURE THE SYSTEM IS GROUNDED ACCORDING TO THE SPECIFICATIONS LISTED.**

SX-50™ DPABX: CABLING AND CROSS CONNECTIONS

INSTRUCTIONS:

The following exercise is a self-teaching assignment introducing you to the SX-50™ DPABX Cabling and Cross Connections.

SX-50™ DPABX CABLING OVERVIEW

Cabling and Cross Connection information is located in the Shipping, Receiving, and Installation section.

Each peripheral card has an amphenol connector dedicated to the circuits on that card.

- **Locate the Tip and Ring Assignment table in this section.**

This chart is used for all types peripheral cards.

ONS Line Card Connections

Recall that the ONS Line card is used for connecting single line telephones (DTMF or Rotary Dial). These telephones only require 2 connections – Tip and Ring – to function.

The leftmost column lists the pins while the next column lists the colour pairs. This is the standard 25 pair cable.

- **Locate the ONS line column**

1. **What is the colour of the the first Tip/Ring pair?**

To find the answer locate Tip 1 & Ring 1 in the ONS Column and look immediately to the left under the Pair Colour chart.

2. Why are there only 16 Tip/Ring pairs listed?

If this was an 8 circuit ONS Line Card then only the first 8 Tip/Ring pairs would be used.

COV Line Card & DNIC Line Card Connections

Recall that only SUPERSET 3™ and SUPERSET 4™ telephones interface to the COV Line Card. Similarly, only the SUPERSET 410 & 420 telephones connect to the DNIC Line Card. Like single line telephones, SUPERSET sets only require 2 connections, Tip and Ring, to function.

- **Locate the COV/DNIC Line Column**

3. Why are only 8 Tip/Ring pairs listed under the COV/DNIC Line column.

4. **What is the difference in pin numbers and pair colours between the first 8 COV/DNIC and ONS connections?**
-

LS/GS Trunk Connections

Like telephones, trunks connect to the SX-50™ DPABX via a Tip Ring pair. Polarity is extremely important for correct operation of the trunk circuit.

- **Locate the LS/GS Trunk column.**

Each trunk circuit is equipped with the ability to monitor Meter Pulses. These will be explained later in the Trunk Programming module. Briefly, metering is a very rare option used for signalling from the CO.

Towards the bottom of the chart are some different types of connections used for Power Fail Transfer (PFT). If power is lost the power fail transfer relays will automatically connect selected telephones directly to trunks. There will be more on Power Fail Transfer connections in this exercise.

DID and OPS lines

Although these cards perform different functions the Tip/Ring pair connections are identical.

Note: DID and OPS lines do not use the MM / M metering leads or the power fail transfer connections.

Universal Card Connections

Recall that the Universal Card has 4 module positions. There are 3 types of modules and they will function in any module position.

- **Locate the Universal Card Lead Designation column**
- **Note the column is separated into 3 divisions: Module Position, MOH Pager and E&M**

The RMATS module integrates directly to the system and does not require any wired connections.

MOH/Pager Module Connections

- **Read about Music on Hold in the Features Description section**

Although the system only accomodates 1 MOH/Pager module, it could be stuffed in any of the 4 positions.

- NOTE -

If an Main Control Card 2 (MCC2) is installed, the MOH/Pager circuit on the control card will override the function of an installed MOH/Pager module. Therefore, you **MUST** connect the MOH and Paging circuits to the connector locatted on the MCC2.

- **Study the Music/Paging Connections figure in the Shipping, Receiving, and Installation section**

5. **What would be the Music In connections if the module was located in position 3?**

6. **What would be the Pager Output connections if the module was located in position 3?**

7. **What would be the Pager Control connections if the module was in position 3?**
-

E&M Module Connections

The E&M Trunk is a private line between 2 PBXs. These trunks are discussed in a separate E&M trunk section. As there may be many E&M trunks on a system they may be stuffed into any or all of the 4 available modules on Universal Cards.

Attendant Console Connections

The SX-50™ DPABX supports one console which connects directly to a jack on the Control Card.

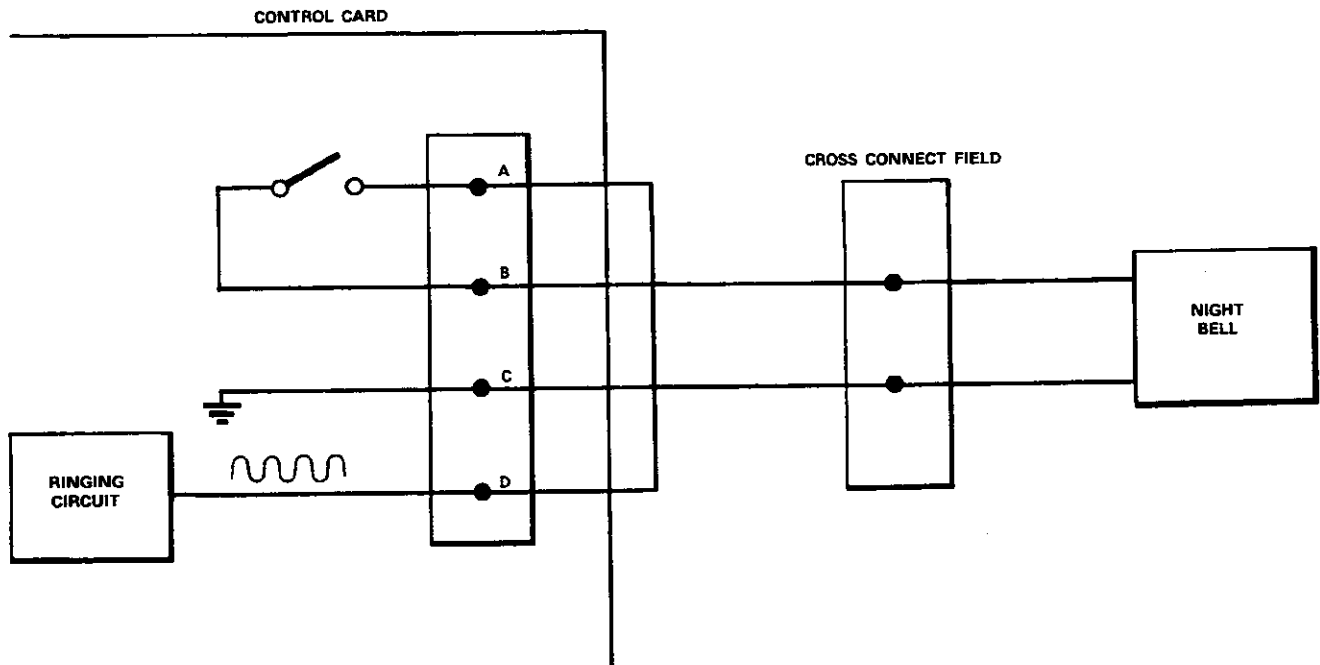
- **Locate the Remote Attendant Console Cable Installation figure.**

Although a cable is included for the console it may not be long enough to reach a console located some distance away. This diagram shows the console being wired via an MDF.

8. **How many pairs are there in the Console Cable?**
-

Night Bell Connections

The most common type of Night Bell behaves exactly like the ringer in a telephone. A simplified version of a night bell connection is shown below.



Circuit action is as follows.

By tracing the circuit path we can see that this is a series circuit.

The ringing signal is transmitted from the Ringing Circuit through connection D on the control card. Connection D is wired directly to connection A.

Between connection A and B there is a relay. This relay closes to allow the ringing signal to reach the night bell.

The return path from the night bell is connected to ground via connection C.

- **Starting at Connect D draw arrows on the diagram tracing the circuit path.**

There are other types of night bells that may be connected.

- **Locate the Night Bell Connections figure in the Shipping, Receiving, and Installation section.**

The top diagram is identical to the one just discussed.

The middle diagram is a variation of the top diagram but without a capacitor.

The bottom diagram shows another type of night bell. This night bell doesn't need a Ringing Signal as it has its own ringing generator. The bell only has to be switched on - via relay contacts - when ringing is required.

Power Fail Transfer Connections

In the event of a power failure selected telephones can be directly connected to trunks. These telephones will be capable of handling incoming and outgoing calls. As the telephones will be connected directly to trunks SUPERSETS will NOT work. Also, if the trunks are ground start, telephones must be equipped with a ground start button or ground-start-to-loop-start converter.

- **Locate the Power Fail Transfer Connections figure**
- **Mark at the top of the page "Diagram shows normal operation - no power fail"**

There are 2 telephones shown in the diagram. Operation of the upper telephone will be discussed.

- **To simplify the explanation, cover up the lower telephone circuit.**

Recall that the LS/GS Trunk card also contains the Power Fail Transfer relays. The diagram shows these relays – not the actual trunk circuits.

Normal Operation

Regular telephone connections go from the telephone to a circuit on an ONS line. However, PFT telephones go through a relay first before connecting to an ONS circuit.

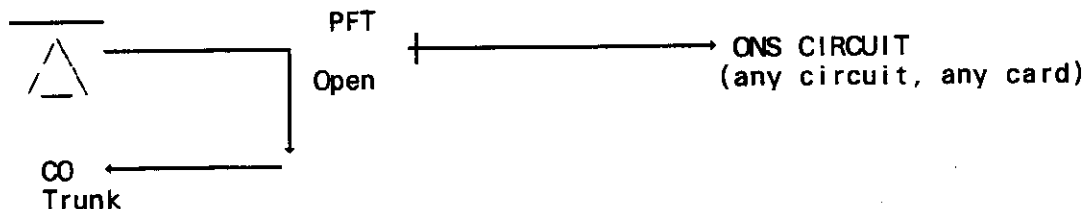
- Trace the path from the telephone through the PFT circuit (solid arrows) to an unnamed circuit on the ONS line.



In normal operation this telephone connects to an ONS circuit and functions as a regular extension.

Power Fail Mode

If power is lost, the telephone connects directly to a trunk. Power Fail mode is shown with the relay in the dotted arrows position.



In power fail mode the trunk rings in directly to the telephone. To make outgoing calls the telephone goes offhook and receives dial tone directly from the Central Office.

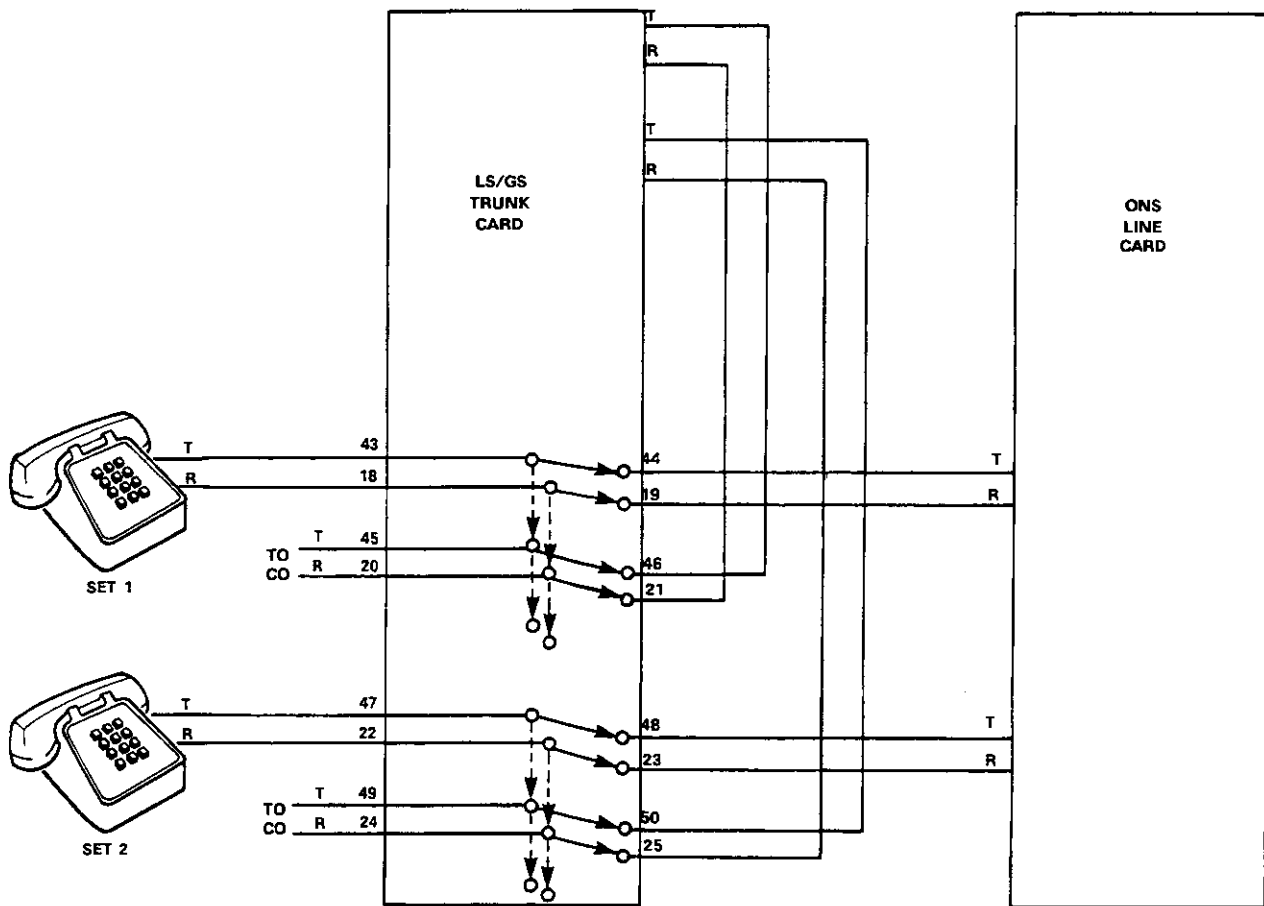
The trunk relays work similarly to the telephone relays. Normally, a CO trunk is connected directly to a LS/GS Trunk circuit.

- Trace the circuit path from the CO trunk (pins 45/20) through the PFT circuit to a unnamed trunk circuit on the LS/GS card.

Any trunk circuit may be used. In power fail mode (dotted arrows) it can be seen from the diagram that the LS/GS trunk circuit is disconnected.

The other PFT circuit work in identical fashion.

9. Label the diagram below showing the upper telephone going to the first circuit on the ONS Line Card and the Trunk connected to the first trunk circuit on the LS/GS trunk card.



NOTE: DOTTED LINES SHOW POWER FAIL TRANSFER MODE

ANSWERS

1. **W-BL/BL-W**
2. **The largest line card (ONS Card) only has 16 circuits.**
3. **The COV line card only has 8 circuits**
4. **No difference. Both the COV and ONS are single pairs.**
5. **R-BR, BR-R**
6. **R-S, S-R**
7. **BK-BL, BL-BK**
8. **The console has 3 pairs.**
9. **LS/GS trunk connection from pins 46, 21 to leads 1, 26 respectively on the trunk card, and ONS card connection from trunk card pins 44, 19 to ONS card pins 1, 26 respectively.**

HANDS-ON EXERCISE

The purpose of this exercise is to allow you an opportunity to perform the wiring associated with the SX-50™ DPABX. Further explanation of these devices will be contained in other exercises.

- **Connect the following devices to an SX-50™ DPABX.**

2 Single Lines

Use any available ONS line circuits. If the system is currently operating then connections can be verified by going offhook and watching the corresponding LED light.

1 Night Bell

If you do not have a night bell use a regular telephone.

3 SUPERSET Telephones

Use any available COV line circuits. If the system is currently operating then connection can be verified by going offhook and watching the corresponding LED light.

2 LS/GS Trunks

If you do not have available trunk lines connect the LS/GS Trunk circuit to an ONS Line circuit.

Music on Hold

Use the EAR connection from a radio, tape recorder, walkperson, etc

1 DID Trunk

Connect to a Rotary Dial telephone.

2 E&M Trunks Back to Back

Connect these according to the 2 Wire Configuration chart. If you have access to another PBX then use it. If you only have the SX-50™ DPABX then use 2 E&M trunks.

Note: There is separate sections on Trunks which will examine the programming, installation and operation of the various trunk types.

Power Fail Transfer

Connect a telephone and trunk to a PFT circuit.

SX-50™ DPABX: DEFAULT DATA

INSTRUCTIONS:

The following exercise is a self-teaching assignment introducing you to the Default Data of the SX-50™ DPABX.

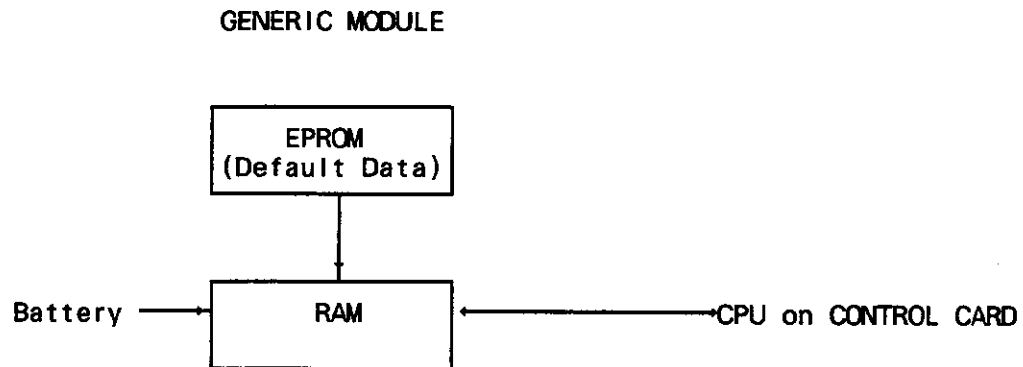
SX-50™ DPABX DEFAULT DATA

Introduction

The SX-50™ DPABX is equipped with a default database that, when loaded, makes the system completely functional.

Default Data is stored in EPROM on the Generic Module. It cannot be erased and does not require any battery to save it.

When the system is turned on it waits for A short time for the technician to give the signal to load default data. If the technician gives the signal then the contents of the EPROM are copied into the RAM.



Note the CPU on the Control Card operates according to the programming in the RAM. The RAM is also supported by a battery so the contents are saved in the event of a power failure.

Any modifications to the database are saved in RAM. If a functional system with a modified database lost power, the battery would save the contents of the RAM. When the system is powered up again it would offer the opportunity to load default data. If the technician did load default data, the contents (modifications) of the RAM would be DESTROYED as the EPROM would overwrite everything.

In the event of power failure the technician does not have to do anything. As long as no signal is given to load default data the contents of the RAM will be saved and the system will operate as before the power failure.

ASSIGNMENT #1 – Introduction to Default Data

- 1. What is purpose of the Default Database.**

- 2. Typically how often would Default Data be loaded on a system?**

- 3. Where is Default Data permanently stored?**

- 4. Where is Default Data loaded if required?**

- Read about Default Data in the Features Description section.
- Read about the Generic Module in the General Description section.

Single Lines & SUPERSET™ Telephones

Starting at the first line circuit the extension numbering plan begins with 100.

COV 8cct	DNIC 8cct		ONS 8cct		ONS 16cct				
-------------	--------------	--	-------------	--	--------------	--	--	--	--

The COV lines (connected to SUPERSETS) would number Extensions 100-107 in slot 1.

Slot 2 would have extension numbers 108-115.

Slot 3 is empty and ignored.

The ONS in slot 4 would have extension numbers 116-123.

Slot 5 is ignored.

Slot 6 would have extension numbers 124-139.

All telephones on the system are assigned Class of Service 1. Class of Service is a list of features that a telephone may or maynot perform. Default data determines that class of service 1 can perform many but not all features.

Trunks

By default, all incoming trunks ring at the console during the day and the night bell during the night.

All the LS/GS trunks are made Loop Start and are gathered into Trunk Group 1.

Trunk Group 1 is given "9" as an access code in default data.

If a user dials "9" the system will automatically select an available trunk from trunk group 1.

ASSIGNMENT #2

COV	COV	DNIC	ONS	ONS	ONS				
8cct	8cct	8cct	8cct	16cct	16cct				

1. Write the default extension numbers for the cards in the diagram.

Slot 1 -

Slot 2 -

Slot 3 -

Slot 4 -

Slot 5 -

Slot 6 -

Loading Default Data

The procedure to load default data is listed in the Shipping, Receiving, and Installation section and the Customer Data Entry section.

The procedure to load default data takes about 1 minute.

- **Read the System Power-up and Load Default Data table in the Shipping, Receiving, and Installation section.**

ASSIGNMENT #1 ANSWERS

1. **The Default Database is the foundation to which is enhanced to suit the customer. It makes the system completely functional.**
2. **Default Data is load once when the system is first installed.**
3. **Default Data is permanently stored in EPROM on the Generic Module – it doesn't require battery backup.**
4. **Default Data is loaded into RAM on the Generic Module for use by the CPU on the Control Card.**

ASSIGNMENT #2 ANSWERS

5. **SLOT 1 Extension 100 – 107,
SLOT 2 Extension 108 – 115,
SLOT 3 Extension 116 – 123,
SLOT 4 Extension 124 – 131,
SLOT 5 Extension 132 – 147,
SLOT 6 Extension 148 – 163.**

HANDS-ON EXERCISE

- **Load default data in to your system.**
- **On paper, determine the default extension numbers for the telephones and SUPERSETS you have connected.**
- **Verify the extension numbers are as you determined.**

SX-50™ DPABX: MAINTENANCE AND TROUBLESHOOTING

INSTRUCTIONS:

The following exercise is a self-teaching assignment introducing you to Maintenance and Troubleshooting procedures of the SX-50™ DPABX.

SX-50™ DPABX MAINTENANCE AND TROUBLESHOOTING

Introduction

In the unlikely event that the SX-50™ DPABX should go faulty, the technician has some good information and options available to quickly find the fault.

The field replaceable items are generally the circuit cards. There is very little need to troubleshoot beyond that point.

Both the Attendant Console and the Test Line (a selected SUPERSET 4™ set) are capable of performing maintenance functions during the troubleshooting process.

Alarm Indicators

If there is a hardware fault it can be quickly identified by the visual indications from the system.

- **Read the STATUS AND ALARM INDICATIONS in the Troubleshooting Procedures and General Maintenance Information section pages 3 through 8.**

ASSIGNMENT #1 – STATUS AND ALARM INDICATORS

1. **What color is the Circuit Status LED?**

2. **How many Circuit Status LEDS are there per card?**

3. **What does it mean if this is a) On b) Off c) Rapid Flashing d) Slow Flashing?**

a) On _____

b) Off _____

c) Rapid Flashing _____

d) Slow Flashing _____

4. What color is the Card Status LED?

5. How many Card Status LEDs are there per card?

6. What does it mean if this is a) On b) Off c) Flashing ?

a) On _____

b) Off _____

c) Slow Flashing _____

7. What should the 7 segment display be flashing to indicate a completely functional system?

8. What are the 6 functions of the STATUS key on the Attendant Console?

9. How does the Attendant know the system has an Alarm?

Self-Diagnostics

The system reports an alarm whenever it fails a self-diagnostic routine. Depending on the severity of the fault, the system may busy out a device or go into Power Fail Transfer mode.

- **Read the Self-Diagnostic Tests information pages 9 through 12.**
- **Locate the Troubleshooting – Alarm Codes Table pages 16 through 18.**

This table lists all the possible alarms along with the type of diagnostic test that failed and a procedure for correcting the problem.

- NOTE -

Add Alarm Code "50 -- Contact Monitor" to the table. The cause is "A contact monitor circuit has closed". The procedure is "Check the contact monitor circuit contacts."

10. Give a reason why Alarm Code 10 is very common just after an SX-50™ DPABX is installed.

- **Locate the Troubleshooting Aids information on page 21.**

This section lists the commands available to the Attendant Console and Test Line for troubleshooting a fault.

After the basic Maintenance-Related Attendant Functions are listed some more involved commands are shown. These are called Maintenance Equipment Status Display Functions. They begin with #9XX.

These #9XX commands take a "snapshot" of a station, SUPERSET, Trunk, etc to allow for detailed troubleshooting.

- **Read the descriptions of the Maintenance-Related Attendant Functions on page 21 through 23.**

Note: Some commands that deal with trunks require a Trunk Equipment Number.

Recall there are a maximum of 8 circuits on a LS/GS Trunk Card. Multiply this by the number of slots (10) and the total number of trunk positions is 80. The trunk equipment numbers are from 01-80 as shown in the chart.

Trunk Equipment Numbers

Circuit Number	Slot Number									
	1	2	3	4	5	6	7	8	9	10
01	01	09	17	25	33	41	49	57	65	73
02	02	10	18	26	34	42	50	58	66	74
03	03	11	19	27	35	43	51	59	67	75
04	04	12	20	28	36	44	52	60	68	76
05	05	13	21	29	37	45	53	61	69	77
06	06	14	22	30	38	46	54	62	70	78
07	07	15	23	31	39	47	55	63	71	79
08	08	16	24	32	40	48	56	64	72	80

E&M Trunks use ODD Equipment Numbers only.

The Test Line

Maintenance Commands can be issued from a SUPERSET 4™ set used as a Test Line. The technician does not have to interrupt the attendant.

There is one Test Line per system.

- **Read the Description, Conditions, and Operation of the test line on pages 222 and 223 in the Features Description section. Programming the test line will be covered later.**

The MITEL Repair Tag

In order to insure you have prompt service from MITEL repair centers, the repair tag must be COMPLETELY filled out.

- **Read about the MITEL Repair Tag in Appendix C in the Troubleshooting Procedures and General Maintenance section.**

ASSIGNMENT #2 – Maintenance Codes

1. **What is the code to busy out a trunk in slot 8 circuit 4?**

2. **What is the code that allows a technician to read an alarm without deleting it from the log?**

3. **What code would be used to release a latched trunk in slot 5 circuit 2?**

4. **What code can be used to access the trunk in slot 7 circuit 8?**

5. **Which diagnostic test checks that tones may be sent and retrieved from a line or trunk?**

6. How does the system ensure that users do not access trunks that fail a diagnostic routine?

7. Name the 8 types of background diagnostic routines.

8. What piece of hardware should be replaced if ALARM CODE 26 appears?

9. What piece of hardware should be replaced if ALARM CODE 40 appears?

10. What piece of hardware should be replaced if ALARM CODE 42 appears?

11. How can a technician determine if the incoming trunk is Loop Start or Ground Start? (Hint: See Appendix B)

ASSIGNMENT #1 ANSWERS

1. **Red**

2. **There is a circuit status LED for every circuit.**

3. **ON = in use,
OFF = idle,
Rapid Flashing = rotary dial flashing,
Slow Flashing = busied out.**

4. **Green**

5. **One**

6. **ON = Card recognized and passed background diagnostics,
OFF = Card not recognized (programmed),
Flashing = Fault found on the card.**

7. **0**

8. **Software Identity,
Engineering Information,
Configuration,
Busy-outs,
Bell Volume and LCD contrast,
LCD Display Test.**

9. **The ALARM LED lights on the console when there is an alarm.**

10. **Alarm code 10 is popular because default data automatically places ALL LS/GS trunks in Trunk Group 1 whether they are connected or not. Unconnected trunks will fail background diagnostics when accessed via a trunk group access code.**

ASSIGNMENT #2 ANSWERS

1. ***41 60**

2. ***13 OR ALARM KEY**

3. ***20 34**

4. ***19 56**

5. **Line/Trunk Diagnostics**

6. **The system will busyout those trunks**

7. **Memory Test,
Tone Detector,
Tone Generator,
DX Chip,
Console,
Line/Trunk,
Conferencing,
DTMF Receiver Diagnostic Test Routines.**

8. **Control Card**

9. **Console**

10. **Universal Card**

11. **Read procedure in Appendix B**

PART I – SX-50™ DPABX MAINTENANCE FUNCTIONS

1. OVERVIEW

Maintenance Functions are used to correct faults on the SX-50™ DPABX. Extensive information on these commands is located in the Troubleshooting Procedures and General Maintenance Information section.

- **Locate Maintenance-related Attendant Functions in the Troubleshooting Procedures and General Maintenance Information section**

This section lists the maintenance functions that can be performed by the Attendant Console or Test Line.

ALARMS

If an alarm is raised on the system the [ALARM] Key LED will light until pressed. When pressed the Console Display will display the alarm.

- **Create an Alarm by calling an unconnected trunk (ie keep dialing 9)**
- **Once the [ALARM] Key LED is lit, identify and store the alarm by pressing *13.**

To find out more information about the alarm locate the Troubleshooting – Alarm Codes table.

- NOTE -

Add Alarm Code "50 -- Contact Monitor" to the table. The cause is "A contact monitor circuit has closed". The procedure is "Check the contact monitor circuit contacts."

An Attendant can Identify and Store the alarms in a log. There is a command that will recall the last 8 entries from the log. The entries are deleted as they are recalled.

- **Display Alarm and Delete it by pressing *31.**
- **Repeat the procedure until the display reads;**

NO ALARMS

The present alarm message and stored alarm entries in the log can be cancelled.

- **Cancel All Alarms by pressing *32**

Note – This command also cancels any Busy-Outs on the system.

An Attendant can cause the system to send alarm reports to the system printer as they occur, by pressing “*901”. “*90#” will print any stored alarms.

2. BUSYING CIRCUITS

Suspect circuits may be removed from service by Busying.

- **Busy-Out a Dial Tone Detector by pressing *44**

The system asks;

DIAL TONE DETECTOR TO BUSY OUT ?

- **Enter 1,2,3, or 4**

Of course the circuit may be Unbusied.

- **Unbusy a Dial Tone Detector by pressing *54**

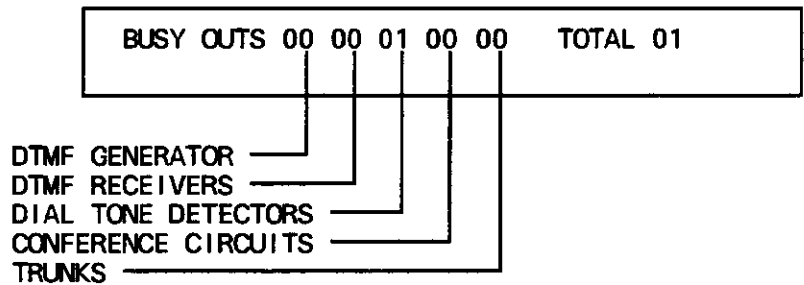
The system asks;

DIAL TONE GENERATOR TO UNBUSY?

- Enter the number of the busied circuit.

The console can display number of all the busied circuits on the system.

- Busy-Out Tone Detector circuit 4.
- Repeatedly press the [STATUS] Key until the following display appears.



- Press *32 to Cancel Busy-Outs.
- Recall the Busy-Out display and ensure the Total Busy-Outs is 0.

As the display indicates DTMF Receivers, DTMF Generators, and Trunks may also be busied-out.

- Busy-Out and Unbusy the following;
- DTMF Generator
- DTMF Receiver
- One LS/GS Trunk Circuit (Observe flashing circuit LED)

3. TRUNKS

For troubleshooting suspect trunks, or for selecting a route, a trunk is accessed by its Equipment Number.

- **Access Trunk by Equipment Number by pressing *19 + the Equipment Number.**

Dial tone is received if the trunk is free OR Busied-Out. Busy tone is received if the trunk is engaged.

Problems with call supervision or inferior Public Network trunks may cause SX-50™ trunk circuits to stay seized after call termination. Should a trunk remain seized it can be released from the console.

- **Simulate a latched trunk by Accessing a Trunk by Equipment Number and completing an external call.**
- **Trunk Force Release the trunk by pressing *20 and the Trunk Equipment Number.**

Used this command with care as it will disconnect any calls in process.

Other Maintenance-Related Attendant Functions

The Data Dump/load is used for creating paper or soft copies of the database. Data Dump/Load is covered in a separate module.

The printer-related options will be covered during the SMDR module.

[STATUS] KEY

Earlier you used the [STATUS] key to determine the number of Busy-outs. However, this key also performs other status functions.

- **Locate Console STATUS key in the Troubleshooting Procedures and General Maintenance Information section**
- **Use the [STATUS] key to determine the Configuration, Set Volume/Contrast, and Test the LCD.**

SX-50™ DPABX: SINGLE LINE FEATURES

SX-50™ DPABX: SINGLE LINE FEATURES

INSTRUCTIONS:

The following exercise is a self-teaching assignment introducing you to some of the features available to users with single line telephones on the SX-50™ DPABX.

SX-50™ DPABX SINGLE LINE FEATURES

Introduction

The SX-50™ DPABX has a large number of features available for users with single line (regular) telephones.

Depending on the application of the telephone some features will be used more often than others. In this exercise, you will become familiar with the terminology, documentation, and application of the popular single line features.

Documentation

All features available are documented in the Features Description section. Recall that features are listed in the Contents page. Also, they appear in alphabetical order throughout the document.

ASSIGNMENT #1 – INTRODUCTION TO FEATURES

- **Locate the Features Description Section**

Review the following features:

Automatic Callback _____

Call Forwarding _____

Call Hold (Extensions) _____

Call Transfer _____

Camp-on _____

Clear All Features _____

Conference _____

Do Not Disturb _____

Executive Busy Override _____

Last Number Redial _____

Paging Access _____

1. Name 6 situations where a telephone with Do Not Disturb will ring.

2. What is the difference between Local and Remote Retrieve for calls on hold?

3. How many people can there be in a conference call?

4. Name the 4 types of Call Forwarding.

5. Which feature would be used if you urgently wanted to speak with someone who was presently on the telephone?

- 6. Which feature signals a person presently on the telephone that another caller is waiting?**

- 7. Which feature automatically calls to indicate that the previously busy destination party is now idle?**

1. **Calls employing Executive Busy Override**
Calls to a Night Answer point
Trunk recalls
Automatic Wake-up calls
Callbacks
Call Hold recalls

2. **Local Retrieve from hold retrieves a call from the holding station; Remote Retrieve from hold retrieves a call from a station other than the the holding station.**

3. **Three.**

4.
 - a. **Call Forward -- Follow Me (Always)**
 - b. **Call Forward -- Busy**
 - c. **Call Forward -- No Answer**
 - d. **Call Forward -- Busy/No Answer**

5. **Executive Busy Override if available provides immediate connection**

6. **Camp-on indicates to the called party that another caller (that's you) is waiting.**

7. **Callback.**

HANDS-ON EXERCISE

Try the following features from a single line set:

- **Automatic Callback, Call Forwarding, Call Transfer, Camp-on, Conference, Last Number Redial, Call Pickup, and Retrieve.**

SX-50™ DPABX: SUPERSET 4™ FEATURES

INSTRUCTIONS:

The following exercise is a self-teaching assignment introducing you to some of the features available to users with SUPERSET 4™ telephones on the SX-50™ DPABX.

SX-50™ DPABX SUPERSET 4™ FEATURES

Introduction

The SX-50™ DPABX has a large number of features available for users with SUPERSET 4™ telephones.

Depending on the application of the telephone some features will be used more often than others. In this exercise, you will become familiar with the terminology, documentation, and application of the most popular SUPERSET 4™ features.

Documentation

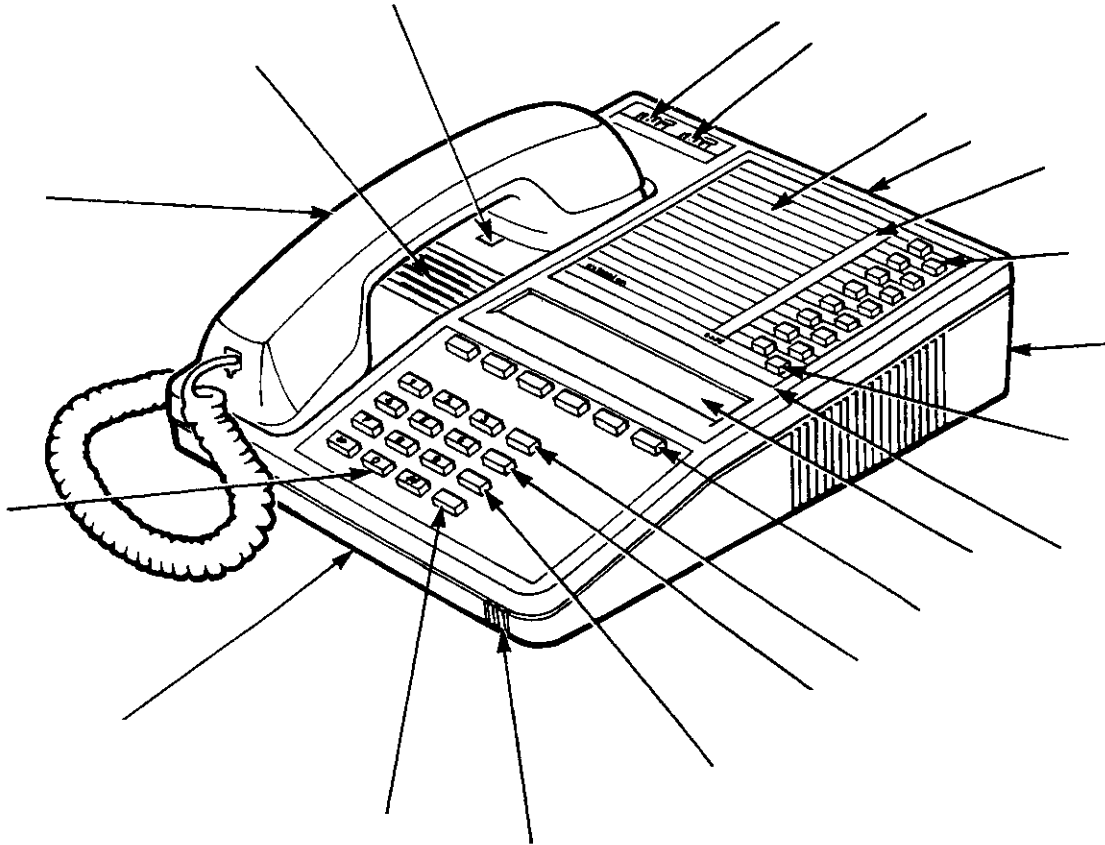
Look through 9174-953-003-NA -- Superset 4 Guide.

All features available are documented in the Features Description Practice section.

- **Read the SUPERSET 4™ Telephone Set information.**

SX-50™ DPABX: SUPERSET 4™ FEATURES

1. Label the arrows.



7131R3

Features

Any feature available to a single line telephone is also available to a SUPERSET 4™ telephone. The features examined in this exercise are unique to the SUPERSET 4™ telephone.

Review the following features in the Features Description section.

Auto-Answer _____

Auto-Hold _____

Call Split _____

Display _____

Handsfree Operation _____

Headset Operation _____

Help Function _____

Immediate Line Selection _____

Line Status Display _____

Messaging - Advisory _____

Messaging - Call Me Back _____

Name _____

Speed Dial _____

2. What type of Call Forwarding will not work when the SUPERSET™ set is in Auto Answer mode.

3. What is dialled to view a speed dial number?

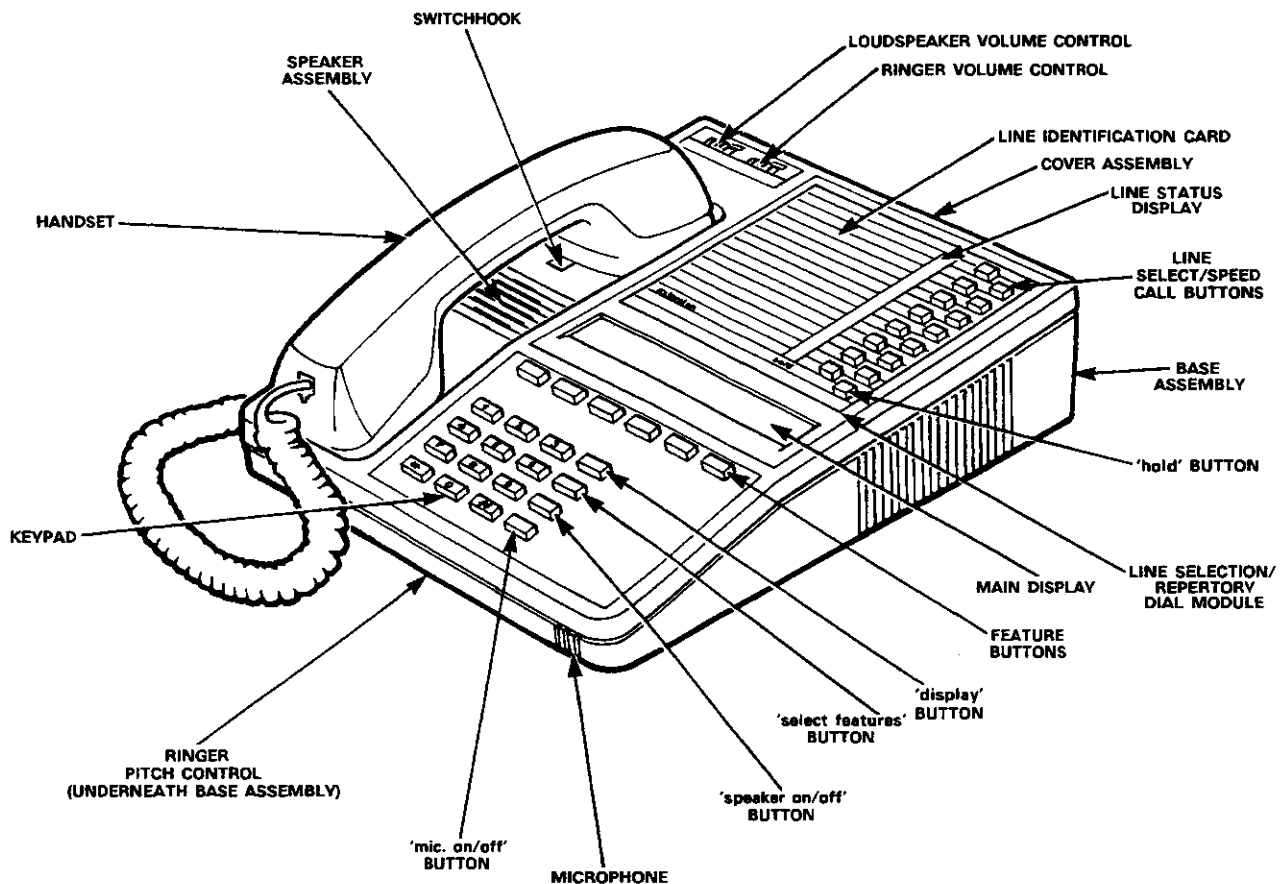
4. Can Advisory Messages be sent to another telephone? Explain your answer.

5. In Handsfree Mode what feature may be used to momentarily stop transmission from the SUPERSET™ set?

6. What is the exact key sequence required to enter the name BOB on a SUPERSET 4™ Set?

ANSWERS

1.



7131E3R3

2. **Call Forwarding -- No Answer**

3. **Press the DISPLAY hard key, then the desired Speed Dial key.**

4. **Yes, but only if that other station has a display; this includes the Attendant Console and other SUPERSET 4™ sets.**

5. **The MIC.ON/OFF key.**

6. **Press PROGRAM softkey**
 Press NAME softkey
 Press dial key 2 (B)
 Press NAME softkey
 Press dial key 6 (O)
 Press NAME softkey
 Press dial key 2 (B)
 Press SAVE softkey

HANDS-ON EXERCISE

Try the following features on the SUPERSET™ 4 telephone:

- Program your name on the display, handsfree call/auto answer, call forwarding programming, camp-on, speed calls, and conference.

SX-50™ DPABX: DNIC CARD & PERIPHERALS

SX-50™ DPABX: DNIC CARD & PERIPHERALS

SX-50™ DNIC CARD & PERIPHERALS

The DNIC Card is introduced in the software load MS-55. The card allows the SX-50™ to support the new Superset 410™ and 420™ telephones.

DNIC Card Overview

The DNIC card is added to the SX-50™ to provide an interface to the Superset 410™ and 420™ sets. The card has 8 circuits (same as COV) and can handle any mixture of the new sets. Note the 401 and 430 sets are not supported.

Co Existence with COV

There are no restrictions for installations which use both COV and DNIC cards.

Configuration Restrictions

A maximum of 4 DNIC cards may be installed in slots 1 to 8.

Programming

The DNIC sets are programmed the same as COV Supersets. The programmer must be aware that the line appearances for the 410 and 420 sets are limited to 6 and 12 respectively.

Set Information

Information about Superset 410 and 420 telephones is available in their associated user guides.

SX-50™ DPABX: ATTENDANT CONSOLE

INSTRUCTIONS:

The following exercise is a self-teaching assignment introducing you to the Attendant Console telephones on the SX-50™ DPABX.

SX-50™ DPABX ATTENDANT CONSOLE

Introduction

The Attendant Console is used as the main incoming answer point for callers coming into the SX-50™ DPABX. Also, the Attendant Console has a number of options available to invoke system-wide features or features on a particular telephone.

Documentation

A physical description of the Attendant Console is documented in the General Information section.

All features available are documented in the Features Description section.

An invaluable book for the actual attendant is the Attendant Console Guide.

Physical Overview

- **Locate the General Information section.**
- **Read the Attendant Console information.**

Features

Attendant Console features are described in the Features Description section. Further information may be located in the Attendant Console User's Guide.

1. **Review the following features in the Features Description section.**

Attendant-Switchable COS _____

Attendant Tone Signalling _____

Automatic Night Service _____

Automatic Wake-up _____

Bell Off _____

Call Block _____

Call Hold (Attendant) _____

Do Not Disturb _____

Executive Busy Override (Console) _____

Flexible Night Service _____

Message Waiting _____

Night/Day Switching _____

Paging Access _____

Restrictive Station Control _____

Overflow _____

2. **How is the volume of the bell adjusted on the console?**

3. **How many wires connect the console to the SX-50™ DPABX?**

4. **How far can the console be from the SX-50™ DPABX? (Hint: See the Shipping, Receiving and Installation section)**

5. **What happens if the handset is unplugged?**

6. **What displays the number of calls queued to be answered at the console?**

7. What digit represents the FUNCTION key?

8. How can the attendant determine if the call is internal or external prior to answering the call?

Room Status

The attendant and the cleaning staff can use the Room Status feature of the SX-50™ DPABX to control the room status of a hotel.

The system sets all the occupied rooms to NOT CLEAN status at midnight. As the maid cleans the rooms a code is dialled from the room phone which automatically sets the room status to clean.

The attendant can view the status of one room or all the rooms on a printout. For frequent views a monitor may be used.

- **Read Room Status description of the Features Description section.**

9. Can the maid set a room status to vacant?

10. Can the maid set a room status to not clean?

11. When are all occupied rooms changed to not clean?

- 12. What command would the maid program to indicate the room has serious damage and will not be ready for some time?**

- 13. What would the attendant enter to view the status of a single room?**

- 14. If a monitor was connected to the RS-232 connector, how could the attendant view the status of all rooms?**

ANSWERS

1. **As per instruction.**
2. **Adjusted by holding selecting VOLUME ADJUST on the STATUS KEY and repeatedly pressing the VOL keys up or down.**
3. **There are 3 pair of wires that connect the console.**
4. **The console may be connected up to 200m from the Control Card.**
5. **If the handset is unplugged, the console becomes none-functional and the system goes into night service.**
6. **The CW (Calls Waiting) prompt in the LCD display shows the number of calls in the queue waiting to be answered.**
7. **Dialling a * or 71 is the same as pressing the FUNCTION key.**
8. **Incoming internal calls are displayed as DIAL 0. Incoming external calls are displayed as LDN 1, LDN 2, or LDN 3.**
9. **Only the Attendant can set the room status to vacant.**
10. **No.**
11. **Rooms are set NOT CLEAN by the attendant or automatically by the system at midnight.**
12. **The maid dials 747 4 from a room to show it is out of service.**
13. **The attendant would press the FUNCTION or * or 71 or the ROOM STATUS key and the extension number of the room.**

14. The attendant would press **FUNCTION** or ***** or **71** or the **ROOM STATUS** key then press the **PRINT** softkey.

SX-50™ DPABX: ATTENDANT CONSOLE LAB PROJECT

SX-50™ DIGITAL PABX ATTENDANT CONSOLE LAB PROJECT

INSTRUCTIONS

Perform this self paced exercise at your work station. The Attendant Console User Guide (9104-953-101-NA), General Information section, and Features Description section are excellent references.

WHAT YOU'LL NEED

To do the exercise you'll need a functional SX-50™ DPABX, the SX-50™ Practices, 2 telephones, an external line, and an attendant console.

SX-50™ DPABX ATTENDANT CONSOLE OPERATION

1. INTRODUCTION

The SX-50™ DPABX Attendant Console can perform Maintenance, Data Entry, and Call Handling functions. However, this exercise will only concentrate on the Call Handling functions of the Attendant.

2. GETTING STARTED

There's a few things you have to get sorted out before you actually do any work.

First you'll need a coffee.

Second you'll need to be at a work station armed with the SX-50™ DPABX ATTENDANT CONSOLE GUIDE.

Third make sure the telephones at your station are clearly marked A, B, C, etc. and they all have extension numbers.

Of course these requirements have been listed in order of importance.

3. FINDING THE DO-DADS

There's a few bits and pieces to the console and you're going to find them.

Locate the following items;

The Handset and where it plugs in.

The Cable that connects the console to the DPABX.

The Dial Pad

The Liquid Crystal Display (LCD)

4. BUT WHAT IF IT RINGS?

If someone is trying to reach the Attendant (that's you) you can either answer the call or panic.

This portion of the exercise will only deal with answering the call since people panic well without coaching. Besides, there is no PANIC button.

Let's set up the scenario.

5. Ext A call the Console by dialing 0

Answer the incoming call by lifting the Handset and pressing the [ANSWER] key

Notice the console displays the number of the calling party.

EXT 123 TALK

Well now that you've answered the call how do you hang-up? You can't do it by replacing the Handset. And you can't panic.

Disconnect the call by pressing [RELEASE].

6. PEOPLE WILL USE YOU

Now all too often in life people just use you to get where they want to go. And as an Attendant you'll be continually asked by someone to connect them to another person far more interesting than yourself.

You shouldn't take this personally.

Perhaps the best thing you can do is learn how to handle these requests efficiently so you'll have more time to chat with those people that really do want to talk to you.

Now suppose Extension A calls the console but really wants to talk to Extension B.

Let's see how this is done.

Call the console from Ext A

Answer the call

Dial Ext B from the console and let it ring

The console displays;

EXT 123 RING	EXT 321 HELD
--------------	--------------

Answer the call.

The console displays;

EXT 123 TALK	EXT 321 HELD
--------------	--------------

Now after informing Extension B that yet another person is using you, you can connect the two parties.

Announce the call to Ext B

Connect the two parties by pressing the [RELEASE] key

The console display will become idle.

7. A SHORT CUT

Suppose you're really busy or you need a coffee. How can you handle these requests faster?

Well you don't have to Announce the call.

Ext A call the Console

Console answer the call

Console dial Ext B then press the [RELEASE] key

Ext B answer the call

Confirm the connection between Ext A and Ext B

8. NOBODY HOME

Sometimes when you extend a call without announcing it the line may not be answered.

In a No Answer situation the call will recall the console.

Let's set up the scenario.

Ext A call the console.

Answer the call.

Extend the call to Ext B but do not answer

After a time the call will be rerouted to the console as well as Ext B.

The console displays;

12:00 JAN 1	BELL CW1 RECALL
-------------	--------------------

To answer this call press the key directly under the word RECALL.

You are now reconnected to the original calling party. The console displays this and also the fact that it was recalled.

Inform the Calling party that there was No Answer

Calling party requests a second attempt

Try a second attempt by simply pressing [RELEASE]

Complete the call

All extensions hang-up.

9. THE BUSY LINE

When you extend a call to a line that is engaged you can inform the calling party of the situation and then offer a Camp On.

A Camp On will connect the calling party as soon as the line becomes free.

The party trying to be reached is informed of this by a beep.

Let's try the scenario.

Ext B completes a call to Ext C

Ext A calls the console

Console answers and attempts to extend the call to Ext B

The console display indicates Ext B is busy

At this point the Attendant is connected to the caller and can suggest a Camp On.

The console RELEASEs the call

Ext B hears a beep indicating a Camp On

Ext B hangs up and is called automatically by Ext A

10. MESSAGES

As an Attendant you will occasionally be asked to take messages. You can inform the person of a message by sending a "message waiting" indicator. This could appear as a periodic ring, a flashing lamp, or a MSG display on a SUPERSET 4 telephone.

Let's try it out.

Call Ext A from the console

Press the [MESSAGE] key

Press the [RELEASE] key

After a short period the extension will ring in three short bursts. This ringing will continue until the extension calls the console.

Ext A call the console

Console answer

Note the display indicates there is a message waiting

EXT-123 MSG

You can also review all the extensions that have messages or cancel them.

Set messages on extensions A, B, and C.

Press and Hold down the [MESSAGE] key

The console displays;

EXT-NUMBER?	TOTAL MSG	3
123 456 789		

Now that the messages are set try removing them.

Press and Hold [MESSAGE]

Dial the Extension Number to be cancelled

Dial 0

Release [MESSAGE]

Confirm the message indicator has been removed by reviewing the console display.

11. TWO MORE KEYS

Sometimes you may have to bounce back and forth between the extension and the held caller. This is done using the [SWAP] key.

Ext A call the console

Console answer the call and call Ext B

Ext B answer

Press the [SWAP] key

Who are you connected to? _____

Press the [SWAP] key again

Who are you connected to? _____

Press the [BOTH] key

All parties should be connected.

To remove yourself from the conversation press the [RELEASE] or [CANCEL] key.

12. MAKE YOURSELF FEEL IMPORTANT

When you can't access an extension because it is busy you have the option of barging into the conversation and having your say anyway.

And why shouldn't you? Did those people care that they used you to set up a call?

Likely not.

Let's do it.

Ext A call Ext B

Console attempt to call Ext A

Don't take no for an answer.

Force your way into the conversation by pressing [OVERRIDE]

Actually it's best to save this option for emergencies.

The guy you barge in on could be your boss.

13. REVIEW

Take some time now and try a few of the things you've learned. When you feel confident continue to the next section.

14. EXTERNAL CALLS

So far you've looked at internal situations. This section will highlight some of the differences between internal and external call handling.

15. HOW CAN YOU TELL THE DIFFERENCE?

The best way to see the difference is to set up a scenario. Oh, by the way if the sound of the bell is driving you crazy you can disable it by pressing the [BELL] key.

Call the console from Ext A – Don't answer

Call the console from an outside line – Don't answer

The console displays;

LDN1	BELL CW2 DIAL 0
------	--------------------

The "LDN" means Listed Directory Number.

If you press the [ANSWER] key then you will be connected to the first caller.

Press the [ANSWER] key

Confirm communication then [CANCEL]

Pressing the [ANSWER] key again will connect you to the next caller.

Press [ANSWER]

The console displays;

TRNK-70 TALK

The "TRNK-70" indicates a connection to an external line through trunk number 70.

16. PICK AND CHOOSE

The [ANSWER] key works on a "first come, first served" basis. However, there are situations where you may give priority to incoming calls.

For instance in the previous situation it is likely that the external call would receive priority over the internal call as it's not nice to keep customers waiting.

Let's see how this is done.

Call the console from Ext A – Don't answer

Call the console from an outside line – Don't answer

The console displays;

LDN1	BELL CW2 DIAL 0
------	--------------------

Press the key under LDN1

Confirm communication then hang up

Press the key directly under DIAL 0

Confirm Communication the hang up

Keys that have different functions depending on the task are called SOFTKEYS.

17. GETTING OUT

To call an outside number you must first access a trunk group then dial the number desired.

Typically you would dial 9 to access a trunk group.

Dial 9

The console displays;

TRNK-42 9

The display shows you've selected Trunk 42 and that you've dialed 9.

Complete a call to the outside line

Note the complete number is shown on the console

18. LAST NUMBER REDIAL

If the number you attempted to reach is busy or has no answer you can use the Last Number Redial Feature as a quick recall.

Press # for Last Number Redial

19. SETTING UP A CALL

You can set up a call for somebody too lazy to do it themselves.

Ext A ask the console for the outside line then hang up

Dial the outside number

Dial Ext A

Press [RELEASE]

That's it. Extension A will now be connected to the ringing outside line.

20. THE TRAFFIC JAM

There will be occasions when the rate of incoming calls will be faster than you can process them.

Under these tense conditions you may choose to use the HOLD facility or throw your arms in the air and scream unfair labor practice.

This section will only deal with the HOLD facility as any preconceived obscenities that we could offer would fall miserably short of the ones you're likely to conjure and spew during your rebellion.

So let's make a traffic jam.

Ext A, B, and C call the console

Console answer the first call then press [HOLD 1]

Repeat for other calls using [HOLD 2] and [HOLD 3]

With all three calls on hold confirm that the console is free to make or receive other calls.

After a time a held call will be recalled to the console. For multiple hold conditions this will also be a "first come, first served" basis.

Alternately you can select a held caller by pressing the associated hold key.

21. ATTENDANT FUNCTIONS

Well you've looked at how to process calls and I'm sure you're an expert. Now you're going to see all the petty tasks you'll be told to do.

Don't worry about memorizing all the special codes in this section.

As the following tasks are not always used frequently the important thing here is to realize that the facilities are available.

Use your SX-50™ DPABX ATTENDANT CONSOLE GUIDE as a reference.

22. IT'S TOO LOUD AND I CAN'T SEE IT

You can adjust the volume of the bell or the contrast of the LCD to suit you.

Press the [STATUS] key repeatedly until the display reads

BELL VOLUME & LCD CONTRAST CONTROL

While holding the [STATUS] key make your adjustments using the [VOLUME] and [CONTRAST] keys.

23. ALARMS

If a problem develops on the system the [ALARM] key will flash. It will be your job to view the alarm and report the information to your communications department.

View the alarm by pressing and holding the [ALARM] key

Record all the information

24. BACKGROUND MUSIC

The SX-50™ DPABX has the ability to play background music over the paging system. This feature may be turned ON or OFF from the console.

Turn Background Music ON by pressing [FUNCTION] and dialing 17

MUSIC-ON

Turn Background Music OFF by pressing [FUNCTION] and dialing 18

MUSIC-OFF

25. MESSAGE REGISTER

The system keeps track of external calls from each extension. This information can be viewed on the console.

Press and Hold [MES REG]

Dial Ext A

The message register can be cleared by dialling 0 after the extension number has been dialled.

26. WAKE-UP

Occasionally an extension user may request a Wake-up. The most common use is as a Wake-up call about 4pm.

Wake-up calls can be set and cancelled at the console.

Press and Hold [WAKE-UP]

Dial Ext A

The console displays;

EXT NUMBER 123 -----

Enter a time about 2 minutes from now (24 hr Format)

Release [WAKE-UP]

Relax for 120 seconds and wait for Ext A to ring.

Answer Ext A and listen to the Wake-Up tone

Program another Wake-Up for Ext A

Cancel the Wake-up by dialing 9999 instead of the time

27. SETTING TIME AND DATE

The Time and Date may be set from the console in 12 hr or 24 hr format.

For 12 hr clock;

Press [FUNCTION]

Dial 14

Enter the time in 24 hr format

For 24 hr clock

Press [FUNCTION]

Dial 15

Enter the time in 24 hr format

For the Date

Press [FUNCTION]

Dial 80

Dial day month year

These codes and others are listed under Attendant and Maintenance Functions in the Features Description section.

- **Locate and read the Attendant and Maintenance Functions in the Features Description section.**

28. CONGRATULATIONS !

You've finished all the structured exercises. Now's your chance to go over the things you've learned.

You may also want to try a few of the things in the SX-50™ DPABX ATTENDANT CONSOLE GUIDE that weren't covered here.

SX-50™ DPABX: CUSTOMER DATA ENTRY INTRODUCTION

INSTRUCTIONS:

The following exercise is a self-teaching assignment introducing you to programming of the SX-50™ DPABX.

SX-50™ DPABX CUSTOMER DATA ENTRY

Introduction

The SX-50™ DPABX is equipped with a default database that, when loaded, makes the system completely functional.

The database may be modified to satisfy the requirements of a particular site. This process is called Customer Data Entry.

Accessing the Database

The database may be accessed from either the Attendant Console or the Test line. If switch 1 on the control card is closed then a security code will be required in order to edit the database.

Database Layout

Common areas of programming are divided into sections (known as COMMANDS). Each unique section also has a unique Command Number. For example, all the system options are in the System Options section – Command 100. (see diagram on the next page)

The information contained in each section (command number) is stored in registers. Once the desired command number is accessed, the register number is then accessed.

The diagram shows the sections (command numbers) and some registers within the section.

The Customer Data Entry section lists the contents of each register.

- **Locate the CONTENTS of the Customer Data Entry section.**

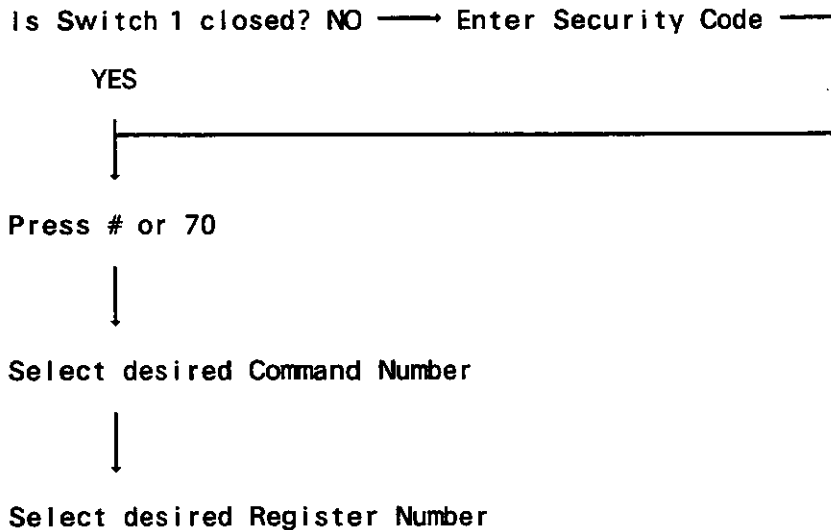
Now find the System Options programming information.

CMD 100	CMD 110	CMD 121 -129	CMD 151 -156	CMD 301 -310	CMD 401 -480	CMD 501 -580	CMD 700
System Options	Feature Access Codes	Class of Service	Trunk Groups	Extension Programming	Superset Programming	Trunks	Automatic Route Selection
R1 R2 R3 R4 R5 R6 R7 * * * R17	R1 R2 R3 R4 R5 R6 R7 * * * R41	R1 R2 R3 R4 R5 R6 R7 R8	R1 R2 R3 R4	R1 R2 R3 R4 R5 R6 R7 * * R16	R1 R2 R3 R4 R5 R6 R7 * * * R15	R1 R2 R3 R4 R5 R6 R7	R1 R2 R3 R4 R5 R6 R7 * * * R800

Notice that different commands may have varying numbers of registers.

- **Read about Programming in the Features Description section.**

Accessing the Database Flowchart.



- **Read the Customer Data Entry section pages 1 through 10.**

ASSIGNMENT #1 – Introduction to CDE

1. Where must switch 1 be set to force programmers to use the security code?

2. If no security codes are used what forms can a programmer not view?

3. What switch enables the Test Line?

4. What is the default system security code?

5. If “#” is being used as Last Number Redial can it also be used for entering the database?

6. When the database is first entered which command number is flashing?

7. What are the exact key strokes to go from CMD 100 Reg 01 to CMD 110 Reg 06?

ANSWERS

- 1. Switch 1 must be set to OPEN to force the use of a security code.**

- 2. Without using the security codes, Commands 190, 191, 192 and 193 cannot be viewed.**

- 3. Switch 2 set to CLOSED enables the test line.**

- 4. 7772**

- 5. # cannot be used as both Last Number Redial and accessing the database.**

- 6. Command 100**

- 7. QUIT, 110, 06**

SX-50™ DPABX: CDE-INTRO LAB PROJECT

INSTRUCTIONS:

The following exercise is a self-teaching assignment on the SX-50™ DPABX Customer Data Entry.

- COMMENT -

If you do not have access to an SX-50™ DPABX perform this lab project on paper. If programming is required, complete the necessary programming forms.

1. **INTRODUCTION**

Customer Data Entry is the task of providing a database that is tailored to the customer. This process is made especially simple on the SX-50™ DPABX as a default database is already in place.

This work project is designed to be a self-teaching approach to performing the tasks associated with Customer Data Entry. When you've completed this work project, you'll be able to access and edit the database using the attendant console.

2. **COMMANDS and REGISTERS**

As mentioned earlier, the Default Database provides the customer with a functional system. The entire default database is documented on "forms" in the Customer Data Entry section. Forms associated with similar tasks are grouped under Command Numbers and given individual Register Numbers.

Confusing?

Let's look at an example.

One group of forms is the System Options Command 100 group. Within that group there are 17 forms (01-17).

eg.

System Options Command 100

Register 01	System Maintenance
Register 02	Attendant Functions
Register 03	Tone & Ringing Control

ETC.

There are many of these groups - some with only one form - and each has a different Command Number.

Find the Systems Options Command 100 Register 03 form in the practice. Use the Index.

Is Transfer Dial Tone enabled in Default Data? _____

The contents of this register can be read from the console.

Let's try that now.

3. READING FORMS on the CONSOLE

To read this form on the console you must first access the database and then locate a particular form. Follow this procedure.

Press the # key on the console to access the database.

The display will be:

```
COMMAND 100? (Flashing)
ENTER          EXIT
```

By flashing the Command Number the system is asking you a question. In this case if you simply press the key under the ENTER prompt, the console displays all the data in COMMAND 100 REGISTER 1.

Press the ENTER prompt.

The display will be:

```
(a)01110010          CMD 100 R1
NEXT          QUIT          EXIT
```

The numeric information that appears is the data programmed into COMMAND 100 REGISTER 1.

Find Command 100 Register 1 in the Customer Data Entry section.

Field "c" controls Automatic Diagnostics.

Are Automatic Diagnostics enabled in default data? _____

On your display the two flashing fields are "a" and "b".

Locate field "c" on your display.

Are Automatic Diagnostics enabled on your system? _____

4. SOFTKEYS

Note the NEXT key was previously called ENTER. Keys that have their functions change with application are called SOFTKEYS.

Press the QUIT softkey.

Note the NEXT softkey is now ENTER and the QUIT softkey is not available.

Press the ENTER softkey.

You are now back in COMMAND 100 REGISTER 01.

To look at COMMAND 100 REGISTER 02 press the NEXT softkey.

Note the Register number in the right hand corner of the screen is now R2. Fields a & b also indicate register 2 (02).

Locate this form in the Customer Data Entry Section.

Is Executive Busy Override enabled or disabled on your system? _____

5. CONFESSIONS

Did you have any problem finding the answer? If you did, start at the beginning and see if it becomes any clearer. It won't take long to repeat now that you're familiar with the console.

But if you think you've got it, try this next exercise.

**Find out what the Station Switchhook Flash Timing range is on your system.
This information is found in COMMAND 100 REGISTER 06.**

Station Switchhook Flash Timing _____

Many of these options are listed in the Features Description section.

Read about Station Switchhook Flash Timing in the Features Description section.

6. OTHER COMMAND GROUPS

OK. So you've conquered jumping around between registers and looking at the database. But that was only in COMMAND 100. What about all those other Command Groups? Well based on what you know, let's see if you can find out information in another Command group.

Find out what the Ring Group Access Code is on your system. This information is found in COMMAND 110.

What is the Ring Group Access Code? _____

7. The SHORT CUT

Did you find it?

Here's what you had to do.

- 1) First you had to locate COMMAND 110 in the practice and search for Ring Group Access Code
- 2) Then you had to leave the COMMAND 100 group. (Press QUIT)
- 3) When the display flashed COMMAND 100? you had to type in 110. Remember, a flashing display is waiting for you to type in information.
- 4) After you entered COMMAND 110 you had to locate REGISTER 25 and view the data. There are two ways to do this. Your way and the simple way. Your way is to press NEXT repeatedly until you arrive at REGISTER 25. The simple way is to type in 25 when you see fields a) & b) flashing.

Sorry about not telling you the simple way but you're here to learn, right?

Try that again using the SHORT CUT

What is a Ring Group, anyway? (Hint: Try the Features Description section)

If you managed to complete the exercise then practice going to the different Command Groups and their registers.

8. **WARNING**

It's very important that you know how to access the database and read this information so make sure you feel comfortable with it before you continue.

9. **A NEW KEY !**

Now the only softkey you haven't played with is EXIT.

Go ahead. Press it.

That's right. It took you right out of the database.

Do you remember how to get back in?

Ya. I thought so.

Try re-entering the database several times.

When you think you're familiar with accessing the database, finding a Command Group, finding a Register, locating data, and leaving the database then perform the Big Quiz at the end of this section.

THE BIG QUIZ

See if you can answer these questions.

B.Q. #1

What key do you use to access the database? _____

B.Q. #2

What is a SOFTKEY?

B.Q. #3

What does the NEXT softkey do?

B.Q. #4

Circle fields "c" and "f" in the example below.

0 6 1 0 0 4 1 1

B.Q. #5

Name the two places where the register number appears on the console.

B.Q. #6

What is the difference between QUIT and EXIT?

B.Q. #7

This is a practical test.

Make sure you have EXITed from the database.

Without using the books or looking at the work project, use the console to find the contents of COMMAND 110 REGISTER 28.

BQ #1 ANSWERS

1. #
2. Softkeys have their function change according to the application.
3. NEXT displays the next register.
4. c = 1 f = 4
5.
 - a) Beside the Command number. CMD 100 R2
 - b) In fields a) or fields a) & b) of the data.
6. EXIT takes you right out of the database. Quit removes you from the register.
7. 2875

CDE PART 2

10. SYSTEM SECURITY CODES

Well now that you know your way around the console you're going to get a chance to do some serious damage. In this part of the exercise you'll actually change the database and test the changes at your work station.

Let's get started.

The database may only be changed if a security code is entered prior to accessing the database. Until now you were capable of reading but not altering the data.

The system security code is entered in this fashion;

Press and Hold the STATUS key on the console.

While holding the key type in the security code (7772)

Note the word "SX-50" flashes to acknowledge the correct security code.

Release the STATUS key and access the database in the usual way. (Press #)

ENTER Command 100

What is different on the display?

An arrow is present. Find out what the arrow does.

What happened to the NEXT softkey? _____

EXIT from the database.

11. CHANGING the DATABASE

OK. Now you're going to change the database.

You have two telephones at your work station.

Program a Call Forward – Busy (Dial 59 + ext) from extension "A" to extension "B"

Leave extension "A" off-hook.

Call extension "A" from the console.

Look up Command 110 Register 11 in the practice.

What is the code listed for Call Forward – Busy? _____

Change this code to be 77 and test to see the change has worked. NOTE – Don't forget to SAVE your changes.

EXIT from the database.

Congratulations! You are now capable of entering the database and editing the data. Shortly you'll be doing heavy-duty changes to the database but first let's look at this Security Code stuff.

12. MORE ABOUT SECURITY CODES

Security Codes are used to limit access to qualified personnel. If you access the database without entering a security code then you may only read the data.

There are two levels of security on the SX-50™ DPABX. The level you used is the highest. This is call the System Security Code. The lower level is called the User Security Code. Here's what they can do along with their default codes.

System Security Code 7772 – Read or Edit any form.

User Security Code 1234 – Read any form (except the System Security Code from) and Edit the forms in Command 180.

No Security Code – Read any form except the System SecurityCode and User Security Code forms.

Access the database without using a security code.

Try to read the System Security Code form COMMAND 190 REGISTER 1.

Why couldn't you view this form?

How could you view this form?

13. CHANGING the SECURITY CODE

Edit the System Security Code form so the code is 4321.

Exit from the database.

Try to access the database using the old code and the new code.

Return the System Security Code to 7772.

If you're a little confused then go get a coffee, come back and try it again.

14. REVIEW

Let's look at what you've covered.

- Accessing the database using a security code
- Using the ----> and SAVE softkeys
- Editing forms
- Accessing the database using different security levels

This is very important stuff. If you want to reinforce this information take some time now and practice.

15. ANOTHER SHORT CUT

Remember the time when you had to press the NEXT softkey over and over and then you found out there was an easier method? Well, it seems this situation has occurred again.

Yes, the security code may be bypassed if Switch 1 on the control card is closed. When it is closed the database may be accessed on a System Security level by simply pressing #.

However this technique may be hazardous if you forget to return Switch 1 to the open position as unauthorized personnel will have access to the entire database.

Compare entering the database with Switch 1 in the closed and open positions.

By looking at the console display, how can you tell if you are able to edit the data?

When you think you've had enough, test yourself with BIG QUIZ # 2.

BIG QUIZ #2

B.Q. #1 What are the 2 steps involved in entering a security code?

B.Q. #2 What is the function of the -----> and SAVE function keys.

B.Q. #3 Under what circumstances may you edit the database without entering an access code?

B.Q. #4 Here's a practical test. Change the Dial Access to the Attendant feature code to 33 in form COMMAND 110. Test this feature to make sure it works.

BQ #2 ANSWERS

#1. a) Hold the STATUS key b) Type in the Security Code

#2. Each time the -----> key is pressed the cursor is moved to the next field.

The SAVE key saves any changes performed on the database.

#3 The database may be edited by not entering a security code if Switch 1 is in the closed position.

#4 To test, dial 3 from either of your telephones and insure the console rings.

SX-50™ DPABX: CDE-INTRO LAB PROJECT -- PART II

CDE PART 3

You've had quite a field of stuff thrown at you in the first 2 parts of this self-paced course. You deserve a break so there will be no text, questions, exercises, or Big Quizzes in Part 3.

CDE PART 4

EXTENSION PROGRAMMING

Back to work.

Each extension on the system is programmed by default data to have a unique number. It works as follows:

Working from slots 1 to 10, (left to right) each circuit that connects ONLY to a telephone or SUPERSET™ set is assigned an extension number starting from 100.

That does not mean Slot 1 Circuit 1 is always extension 100.

Working from left to right, if the first Line Card installed is in Slot 3. That makes Slot 3 circuit 1 is extension 100. Circuit 2 = extension 101, circuit 3 = extension 102, etc.

Guess the extension of every extension circuit on your system by using the following technique.

- Working from left to right, find your first card that has telephone circuits.
- The first circuit on that card will be EXT 100.
- Start counting!

The data for each extension circuit is listed in Commands 301-310.

There is a Command Number for each card slot. If there is a Line Card in slot 2 then the Command is 302, where 02 is the slot number.

Which slot on your system contains an ONS Line Card?

What is the Command Number for that slot? _____

Locate Commands 301-310 in the CDE Forms "210" section.

Shown here is one of 16 registers. There is a register for EACH circuit on the card.

Confusing?

Suppose you have a telephone connected to an ONS card in Slot 5 Circuit 6. The command would be Command 305 Register 6.

Find the Command 301-310 forms in the BLANK CDE forms. (In your student handout)

In which slot is your ONS card installed?

Find the appropriate form for the ONS card.

Determine the Command and Register number for each telephone on the ONS Card.

Change the extension number on each telephone to begin with a "2".

The SUPERSET™ Prime Line is programmed the same way.

Change the extension number of each SUPERSET™ set to begin with a "4".

CDE PART 5

CLASS OF SERVICE

Another field in Command 301 - 310 is Class of Service number.

Each extension on the system is given a class of service that will determine the features and options available to that telephone.

There are 9 Classes of Service (COS) which are totally programmable. The Commands are 121-129, where 121 = COS 1, 122 = COS 2, ... 129 = COS 9.

What is the COS for your extensions? _____

Is Do Not Disturb enabled for your extensions? _____

Give 1 telephone the ability to perform Do Not Disturb and deny all other telephones from performing Do Not Disturb. (This will require creating a different class of service)

CDE PART 6

TRUNK FORMS

Trunks are used to connect the SX-50™ DPABX to the outside world. Because the SX-50™ DPABX can originate or receive calls, trunks can be looked at in outgoing or incoming situations.

1. INCOMING TRUNKS

For incoming trunks there is an answer point. Most of the time a trunk terminates at the Attendant Console. However, the answer point may be a station, hunt group, ring group etc.

In default data incoming trunks ring the Attendant Console during the day and the night bell during the night.

This information is programmed in Trunk Programming forms Command 501-580, where 01-80 is the trunk equipment number.

Locate Command 501-580 in the book

Locate Register 4

Note field "d"=1 which means an incoming call during Day Service will ring LDN1 on the console.

What would be programmed to make incoming calls ring LDN 3? _____

Instead of ringing the console, the trunk can be programmed as a Direct In Line point.

This is accomplished by making field "d"=0 (Direct In Line) and then programming fields efg as the new answer point.

What programming would be necessary to make a trunk ring a Ring Group during the day? _____

Register 5 determines the Night Answer Point. Where do calls go during Night Service? _____

The LS/GS trunk card contains 8 circuits or trunks. Each circuit is assigned a Trunk Equipment Number. The Trunk Equipment Number is determined by finding the crosspoint of the circuit and the slot where the card is located. See the chart below.

Trunk Equipment Numbers

Circuit Number	Slot Number									
	1	2	3	4	5	6	7	8	9	10
01	01	09	17	25	33	41	49	57	65	73
02	02	10	18	26	34	42	50	58	66	74
03	03	11	19	27	35	43	51	59	67	75
04	04	12	20	28	36	44	52	60	68	76
05	05	13	21	29	37	45	53	61	69	77
06	06	14	22	30	38	46	54	62	70	78
07	07	15	23	31	39	47	55	63	71	79
08	08	16	24	32	40	48	56	64	72	80

If there was a trunk card in slot 9 what would be the Trunk Equipment Number of circuit 6?

The answer is Equipment # 70. The Command for that trunk would be CMD 570.

Find the Command number for a trunk circuit on your system.

Program your trunk to ring LDN 3 during the day and the Ring Group at night.

2. OUTGOING

Outgoing calls are routed to different types of trunk facilities such as Local COs, WATS, FX, and Tie lines.

Therefore there are trunks dedicated to servicing each type of facility. Trunks performing identical tasks are programmed into a Trunk Group. Each Trunk Group is then given a unique access code.

If Trunk Group 1 connects to the local CO then the users dial the Trunk Group Access code (9) followed by the external number to make a regular call.

There are 6 programmable Trunk Groups on the SX-50™ DPABX. They are programmed in Commands 151-156, where 151=Trunk Group 1, 152=Trunk Group 2, etc

Information for Trunk Groups may be found in the "105 Features Description" and the document "An Explanation of Trunk Groups"

3. REVIEW

- **Each circuit has an Trunk Equipment Number which is determined by the circuit number and card location**
- **The Command number for a circuit is 5XX where XX is the Trunk Equipment Number**
- **Discriptions of all options on the forms are located in the "105" practice and "An Explanation of Trunks"**

If you're satisfied that you can program Trunks and place them into Trunk Groups, then proceed to the next section.

CDE PART 7

SUPERSET™ SETS

The only part of station programming that hasn't been covered is the SUPERSET 3™ and SUPERSET 4™ telephones.

This is a two stage process.

First an extension number and class of service is assigned in Command 301-310.

Then each key on the SUPERSET™ set is programmed for a Line Appearance Type, Ringing Type, Call Direction, and Directory or Trunk Equipment Number. This information is programmed in Command 401-480.

Locate these forms in the practice.

Use the SUPERSET™ equipment number chart (same as trunks) to determine the command number for one of your SUPERSET™ sets.

SUPERSET™ set programming is different than single line programming as there is a Command for EACH SUPERSET™ set.

Keys that will not be used as speed call keys may be used as Appearances of other telephones. When a telephone is called, a SUPERSET™ set with an appearance of that telephone is also called. There are 2 different types of appearances, Key Line and Multicall.

Using the information in the "105" section, program a SUPERSET 4™ telephone to have the following options;

- 1 Key Line Appearance of an extension with Ring Immediately and Bothway Calling

A Key Line Appearance works the same way as a key system. When someone dials the number all the phones with an appearance ring. Once the call is answered no other calls can be made on the line. A visual prompt on the LCD show the line being busy.

- 1 Multicall Line Appearance of an extension with Delayed Ring and Bothway Calling

When someone dials the number all the phones with a multicall appearance of that number will ring. However, any SUPERSET™ sets that also have a multicall appearance of that number can still be called! The line will remain free until every SUPERSET™ set is engaged.

- 2 Speed Dial Keys
- 1 Direct Trunk Select

A direct trunk select connects a SUPERSET™ set directly to a trunk. The trunk always ring in to the SUPERSET™ set. The same DTS trunk may be used by several SUPERSET™ sets.

NOTE: DTS Trunks must be placed into a trunk group. They will assume the programmed parameters for that group but will be skipped in the hunting process.

CDE PART 8

CALL RESTRICTIONS

The SX-50™ DPABX has different methods of restricting users of making internal and external calls.

You've already seen some of the restrictions in the Class of Service forms.

This portion of the project will cover all of the call restrictions available on the SX-50™ DPABX.

1. TRUNK GROUP ACCESS

Remember that each trunk is placed into one of 6 Trunk Groups.

Now suppose Trunk Group 3 has WATS lines connected to it. The customer would want to restrict the use of that facility to authorized personnel. This is done by providing the authorized personnel with a Class of Service that allows this access.

Let's see how this is done.

Locate Command 121-129 Register 1 in the Practice

Program Class of Service 1 (Command 121) to allow access to every Trunk Group

Program Class of Service 2 (Command 122) to allow access to every Trunk Group except Trunk Group 3

Now any user with a Class of Service 2 is restricted from accessing the WATS facility.

2. ACCESS TO TRUNK GROUP OVERFLOW

Persons with this option enabled in their Class of Service will automatically access a predetermined Trunk Group if the Trunk Group selected has no available trunks.

The programming for this is in Class of Service and Trunk Groups.

Locate Command 121-129 Register 1 in the Practice

Enable Access to Trunk Group Overflow in Class of Service 1

Locate Command 151-156 Register 1 in the Practice

Set Trunk Group Overflow so Trunk Group 1 overflows into Trunk Group 2

3. RECEIVE / TRANSMITT / BOTHWAY

Call direction abilities may be programmed for each extension in Command 121-129 Register 2.

The extension may be programmed to make or receive calls, only receive calls, or only make calls.

Locate Command 121-129 Register 2 in the Practice

Program Class of Service 1 to be Originate Only

Attempt to call a telephone with Class of Service 1

Now any user with Class of Service 1 cannot receive calls.

4. CALL BLOCK

If Call Block is enabled in a Class of Service then users are restricted from contacting any other users having Call Block enabled in their COS.

Locate Command 121-129 Register 3

Enable Call Block in COS 4

The Call Block feature must be turned on by the Attendant by pressing the [CALL BLOCK] key.

5. **RESTRICTIVE STATION CONTROL**

With this option enabled, stations can be blocked from making calls unless the Attendant allows it.

Generally this feature is used in situations where a telephone should not be in use unless authorized.

An example of this would be a Conference Room telephone which could be put in use only for the duration of the conference.

Locate Command 121-129 Register 2

Enable Restrictive Station for COS 5

Make a call from a station with COS 5

The console can now restrict that station from making calls.

Press [FUNCTION] 22

Enter extension number

Enter 9999 to restrict calls

Attempt to make a call form that extension

Remove restriction by entering 0000 where 9999 was previously entered

6. **ROOM STATUS**

With this option enabled, stations can be blocked from making calls unless the Attendant allows it. This like Restrictive Station Control.

Generally this feature is used in Hotel/ Motel environments situations where a telephone should not be in use unless authorized.

It is also used to provide control of the occupancy STATUS of the room.

Locate Command 121-129 Register 3

Enable Room Status for COS 6

Make a call from a station with COS 6

The console can now control the ROOM STATUS of that station including restricting it from making external or long distance calls.

Press [FUNCTION] 81

Enter extension number

Press [OCCUP] softkey; the room is now occupied

Press [TRK-BAR] softkey; the display reads ALLOW1. This means that RCS 1 applies to the extension.

Attempt to make a call form that extension

7. CONNECTIONS TO CO

Users with this option enabled in their COS cannot access a CO Trunk.

Locate Command 121-129 Register 6

8. CONNECTIONS TO TIE TRUNKS

Users with this option enabled in their COS cannot access a Tie Trunk.

Locate Command 121-129 Register 6

CONGRATULATIONS !

You've now completed the Introduction to CDE Lab Project.

The next step is to complete one (or more) of the application projects – Small Business Application, Hotel/Motel Application, and Health Care Application.

Other related projects are the CDE Work Project and Reference Chart Work Project.

SX-50™ DPABX: SYSTEM OPTIONS - COMMAND 100

INSTRUCTIONS:

The following exercise is a self-teaching assignment on System Options programming, Command 100.

SX-50™ DPABX -- SYSTEM OPTIONS

Parameters and features that effect the entire system are controlled in System Options - Command 100. There are 17 registers in System Options.

- **Locate the beginning of System Options programming on page 23 in the Customer Data Entry section.**

The Features Description section describes most of the options available.

- **Locate Register 09.**

Field "c" in this register enables Abbreviated Dial.

- **Locate Abbreviated Dial information in the Features Description section. Read the programming requirements for Command 100.**
- **Read through the Command 100 forms in the Customer Data Entry section.**
- **Most of these options will be discussed as their applications are examined in further assignments.**

ANSWER

1.
 - a) Press and Hold STATUS key while entering the security code (7772).
 - b) With COMMAND 100 flashing press the ENTER softkey.
 - c) In register 01 use the arrow key to select field "c".
 - d) With field "c" flashing, press "1" to enable Automatic Diagnostics.

Note: This is an exercise only. Automatic Diagnostics is already enabled by default data.

HANDS-ON EXERCISE

- Insure the following System Options are enabled in your database:
Executive Busy Override (Console),
Transfer Dial Tone,
SUPERSET Auto Answer,
Music on Hold.
- Locate more information on these options in the Features Description section.

SX-50™ DPABX: FEATURE ACCESS CODES - COMMAND 110

INSTRUCTIONS:

The following exercise is a self-teaching assignment on Feature Access Codes programming, Command 110.

SX-50™ DPABX -- FEATURE ACCESS CODES

Introduction

All features codes used by single lines or SUPERSET™ sets are programmed in Comand 110 Feature Access Code programming.

- **Locate the Feature Access Code Programming forms in the Customer Data Entry section.**

Fields "ab" list the register number. Fields "cdef" contain the feature code.

1. **What is the default feature access code for Dial Access to the Attendant?**

Note that field c is occupied while fields def are blank.

- **Locate the feature access code for Call Hold in the Features Description section.**
- **Locate the feature access code for Call Hold in the Feature Access Code form.**

ANSWER

1. The default code for the Attendant is 0.

HANDS-ON EXERCISE

- Scan through the registers in Command 110 and ensure they agree with those programmed on your system.

INSTRUCTIONS:

The following exercise is a self-teaching assignment on Extension programming, Commands 301-10.

SX-50™ DPABX -- EXTENSION PROGRAMMING

Both single line and SUPERSET™ sets are programmed in Command 301-310. All telephones are assigned an extension number, class of service, pickup group membership plus some other parameters.

- **Locate the Command 301 - 310 programming form in the Customer Data Entry section.**

The form shown is a blank register. There is a register like this for EVERY line circuit (single line or SUPERSET™) on the SX-50™ DPABX.

To locate the register for a particular extension, the slot number and circuit number must be known. The slot number (01-10) is used to determine the Command number. The circuit number matches the register number.

For example, if we wanted to program the telephone connected to circuit 6 in slot 2 the command would be:

Command 302 (3 + slot number)

Register 06 (circuit 6)

The "3" in command 302 is a constant and signifies extension programming.

- 1. Determine the command and register numbers for extensions in the following positions; Slot 1 Circuit 1, Slot 5 Circuit 16, Slot 7 Circuit 5**

Register Information

The Extension Programming form shows default programming where possible.

Field "ab" is the register or circuit number. This is determined by the programmer.

Field "c" determines the type of use that the line circuit is assigned; an extension, a contact monitor, or hotline. Contact monitor and hotline will be discussed later in the course.

Field "d" determines which Class of Service is applied to the telephone. A class of service is a programmable list of features available to a telephone. Class of service will be studied in the next module.

Field "e" allows or denies the attendant the ability to change the class of service.

Field "f" determines which pickup group the telephone belongs to. Generally, telephones in the same area should be placed in the same pickup group.

Fields g & h will be discussed later.

Field "ijkl" sets the extension number. The extension number can be 1, 2, 3 or 4 digits long. By default you have seen that the digits are 3 digits. They are programmed starting from field "i" and field "l" is left blank.

- **Review Pickup Groups in the Features Description section.**

Blank Programming forms

In order to plan a customer database, use the blank forms in this lesson.

- **Locate Command 3----- blank forms.**

Prior making any changes to the database these forms should be completed to serve as a guide and paper record.

- **Complete the forms to satisfy the following programming.**

- **Use the sample forms included.**

COV Card Slot 2 - Give all SUPERSET™ sets 3 digit extension numbers that begin with a 4. ie 400, 401, 402, etc. Make them members of pickup group 2.

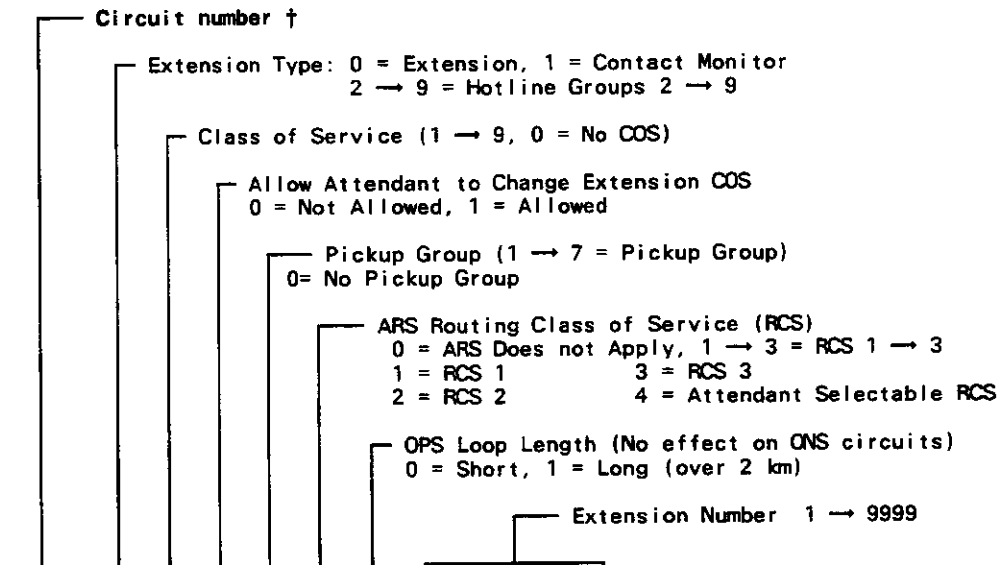
ONS Card (16cct) Slot 4 - Give all single lines 4 digit extension numbers beginning with 2. ie 2000, 2001, 2002, etc.

- **Hint: Make notes right on the form so you can immediately tell which form is used for the COV and which is for the ONS.**

SX-50™ DPABX: EXTENSION PROGRAMMING - COMMANDS 301-310

EXTENSION PROGRAMMING

COMMAND 3

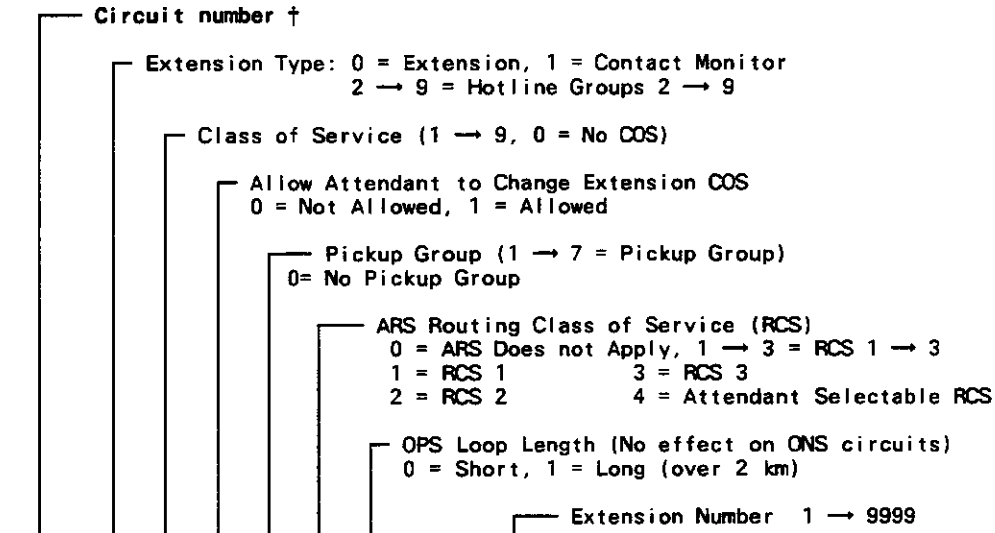


a	b	c	d	e	f	g	h	i	j	k	l	comment
0	1											
0	2											
0	3											
0	4											
0	5											
0	6											
0	7											
0	8											
0	9											
1	0											
1	1											
1	2											
1	3											
1	4											
1	5											
1	6											
Default	0	1	0	1	0	0						

† Only odd numbered circuits are valid for OPS extensions.

EXTENSION PROGRAMMING

COMMAND 3__



a	b	c	d	e	f	g	h	i	j	k	l	comment
0	1											
0	2											
0	3											
0	4											
0	5											
0	6											
0	7											
0	8											
0	9											
1	0											
1	1											
1	2											
1	3											
1	4											
1	5											
1	6											
Default	0	1	0	1	0	0						

† Only odd numbered circuits are valid for OPS extensions.

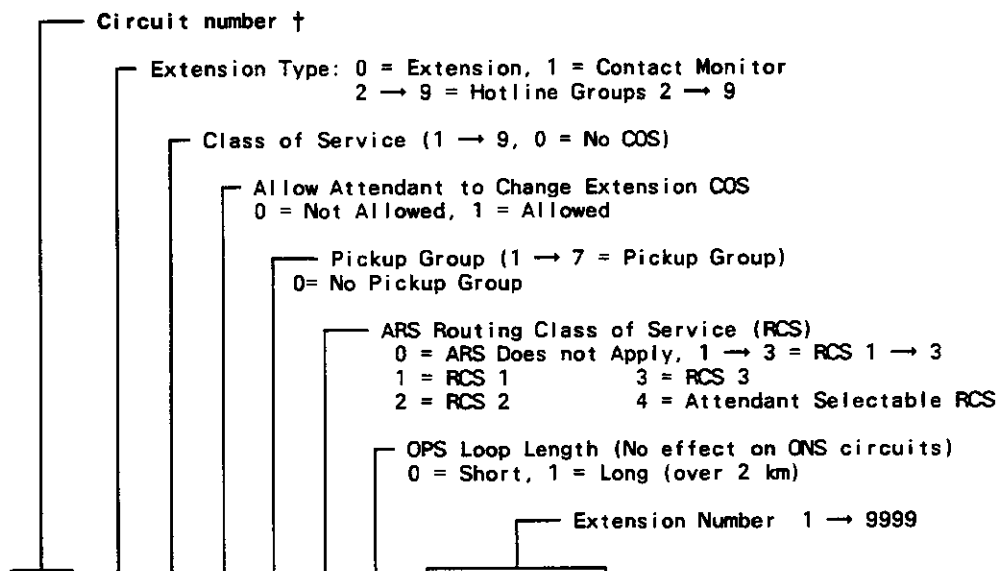
ANSWERS

- 1. Slot 1 Circuit 1 = Command 301 Register 1,
Slot 5 Circuit 16 = Command 305 Register 16,
Slot 7 Circuit 5 = Command 307 Register 5,**

2.

EXTENSION PROGRAMMING

COMMAND 302



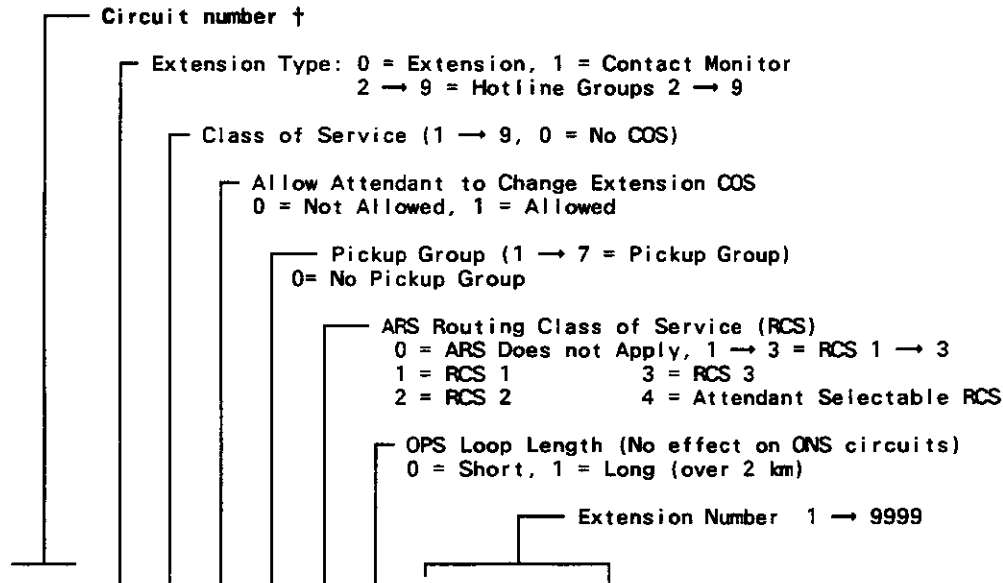
a	b	c	d	e	f	g	h	i	j	k	l	comment
0	1	0	1	0	2	0	0	4	0	0		
0	2	0	1	0	2	0	0	4	0	1		
0	3	0	1	0	2	0	0	4	0	2		
0	4	0	1	0	2	0	0	4	0	3		
0	5	0	1	0	2	0	0	4	0	4		
0	6	0	1	0	2	0	0	4	0	5		
0	7	0	1	0	2	0	0	4	0	6		
0	8	0	1	0	2	0	0	4	0	7		
0	9											
1	0											
1	1											
1	2											
1	3											
1	4											
1	5											
1	6											
Default	0	1	0	1	0	0						

† Only odd numbered circuits are valid for OPS extensions.

3.

EXTENSION PROGRAMMING

COMMAND 304



a	b	c	d	e	f	g	h	i	j	k	l	comment
0	1	0	1	0	1	0	0	2	0	0	0	
0	2	0	1	0	1	0	0	2	0	0	1	
0	3	0	1	0	1	0	0	2	0	0	2	
0	4	0	1	0	1	0	0	2	0	0	3	
0	5	0	1	0	1	0	0	2	0	0	4	
0	6	0	1	0	1	0	0	2	0	0	5	
0	7	0	1	0	1	0	0	2	0	0	6	
0	8	0	1	0	1	0	0	2	0	0	7	
0	9	0	1	0	1	0	0	2	0	0	8	
1	0	0	1	0	1	0	0	2	0	0	9	
1	1	0	1	0	1	0	0	2	0	1	0	
1	2	0	1	0	1	0	0	2	0	1	1	
1	3	0	1	0	1	0	0	2	0	1	2	
1	4	0	1	0	1	0	0	2	0	1	3	
1	5	0	1	0	1	0	0	2	0	1	4	
1	6	0	1	0	1	0	0	2	0	1	5	
Default	0	1	0	1	0	0						

† Only odd numbered circuits are valid for OPS extensions.

HANDS-ON EXERCISE

After loading default data you should be able to predict the extension numbers of each line circuit.

- **Determine your extension numbers on paper**
- **Confirm your results by viewing the contents of the actual programming in commands 301-310.**

After confirming that your extension numbers appear as you predicted, perform the following programming. **DO THE WORK ON PAPER FORMS FIRST.**

- **Give 2 SUPERSET™ sets extension numbers 401 and 402.**
- **Make them members of Pickup Group 2.**
- **Verify your programming by calling the SUPERSET™ sets and insuring that they can only be picked up by another member of that pickup group.**

SX-50™ DPABX: CLASS OF SERVICE - COMMANDS 121-129

SX-50™ DPABX: CLASS OF SERVICE - COMMANDS 121-129

INSTRUCTIONS:

The following exercise is a self-teaching assignment on Class of Service programming, Commands 121-129.

SX-50™ DPABX -- CLASS OF SERVICE

Introduction

A class of service is list of options that may or may not be available to certain telephones. There are 9 different classes of service, each one of them programmable to create different levels of flexibility.

An application of class of service would be as follows.

Suppose a business required several telephones for general use (ie lobby phone, wallphones for anyone's use). As these telephones could be accessed by anyone, it would be wise to restrict the telephone to calling internally only. Also, features like Call Forwarding and Do Not Disturb would not be required.

To solve this problem a Class of Service would be created that blocks all access to trunk groups and features. Once this class of service was created it would be applied to the desired extensions in Command 301-310.

Both single line and SUPERSET™ sets are assigned a class of service.

- **Read about class of service in the Features Description section.**

Default Class of Service

By default all extensions (single line and SUPERSET™ sets) are given class of service 1. The features enabled in Class of Service 1 by default are shown in the Customer Data Entry section.

- **Read the default Class of Service programming in the Customer Data Entry section.**

There are 9 classes of service. By default they are all created the same.

The command number for a particular class of service is 12X, where X is the COS number (1-9). For example COS 1 is Command 121, COS 7 is Command 127, etc.

- **Review the contents of register 1**

Register 1 enables or disables access to trunk groups for outgoing calls. By default, access to all trunk groups is enabled.

- **Locate the blank Class of Service forms in the Customer Data Entry Forms section.**

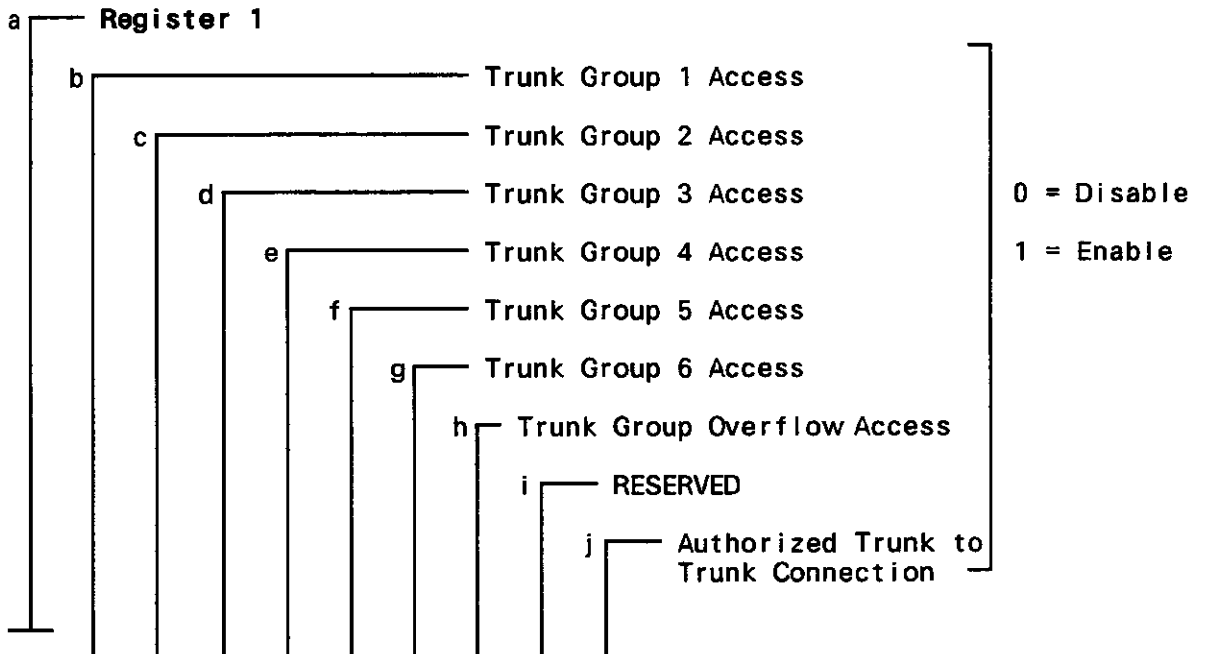
In the blank forms, all 9 classes of service are shown. Default programming is shown along the bottom of the form.

- **Recall the problem of creating telephones for general use.**
- **On the forms that follow below, make the extensions connected to circuits 1 & 2 restricted from all trunk groups (ie outgoing calls). Write over any areas that need changing.**
- **The forms are located on the next pages.**

Hint: Create a new class of service with trunk group restrictions then apply the new COS to the stations.

COMMANDS 121 → 129

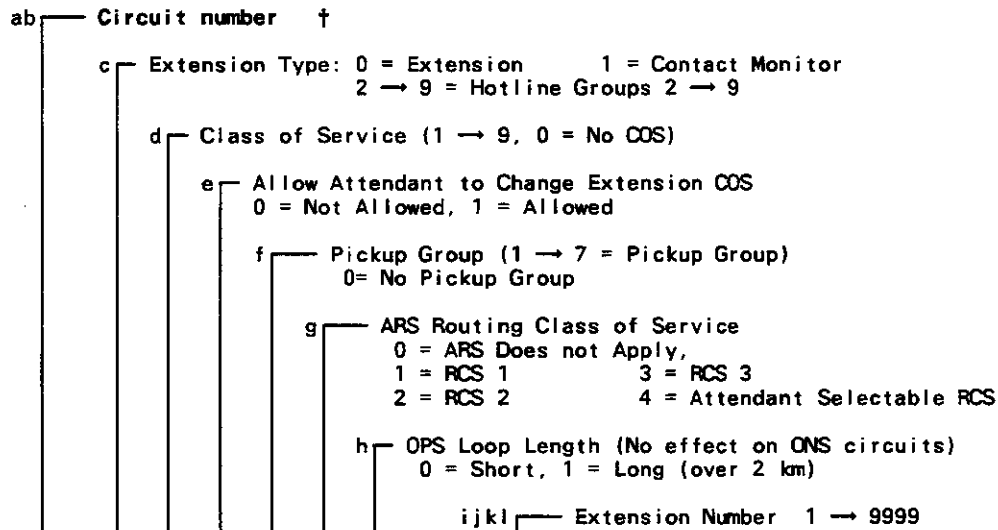
COS 1 → COS 9 PROGRAMMING



Command	a	b	c	d	e	f	g	h	i	j	
121	1								0		COS 1
122	1								0		COS 2
123	1								0		COS 3
124	1								0		COS 4
125	1								0		COS 5
126	1								0		COS 6
127	1								0		COS 7
128	1								0		COS 8
129	1								0		COS 9
Default	1	1	1	1	1	1	1	0	0	1	

COMMAND 3XX

STATION PROGRAMMING - SLOT X



a	b	c	d	e	f	g	h	i	j	k	l	comment
0	1	0	1	0	1	0	0	2	0	0		
0	2	0	1	0	1	0	0	2	0	1		
0	3	0	1	0	1	0	0	2	0	2		
0	4	0	1	0	1	0	0	2	0	3		
0	5	0	1	0	1	0	0	2	0	4		
0	6	0	1	0	1	0	0	2	0	5		
0	7	0	1	0	1	0	0	2	0	6		
0	8	0	1	0	1	0	0	2	0	7		
0	9											
1	0											
1	1											
1	2											
1	3											
1	4											
1	5											
1	6											
Default	0	1	0	1	0	0						

† Only odd-numbered circuits are valid for OPS extensions.

System Options and COS

Often options must be enabled in either System Options or Class of Service or both. Rather than trying to remember where an option is enabled it is strongly suggested that technicians use the Features Description section as a reference.

- **State what programming effects the operation of these options.**

1. Do Not Disturb

2. Auto Answer

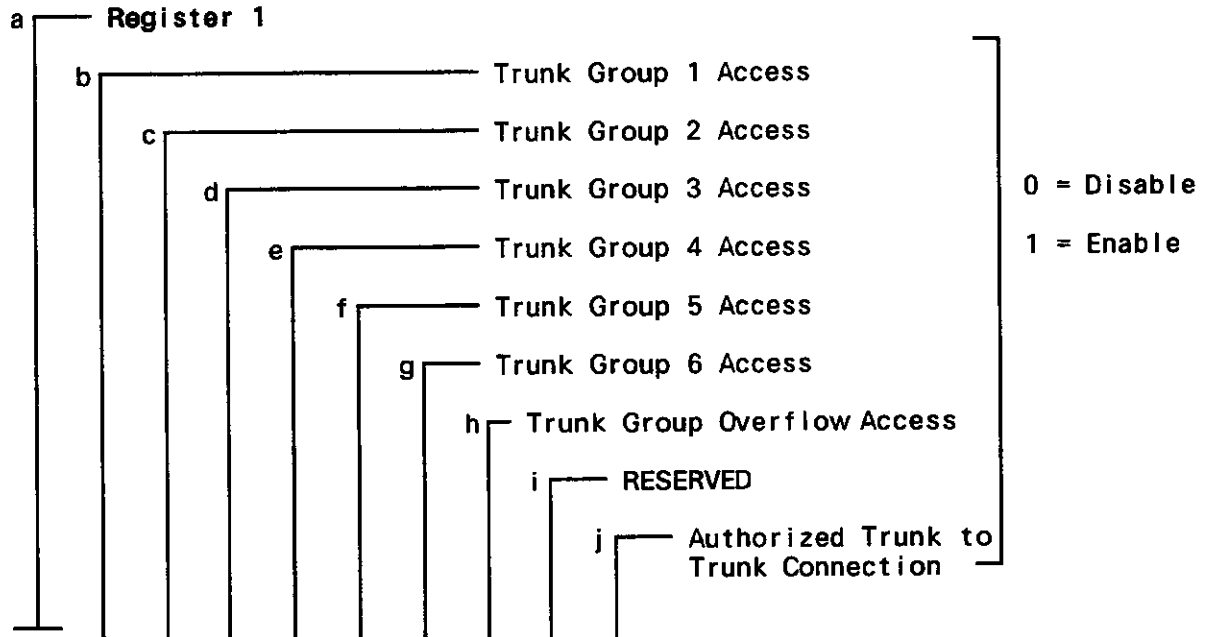
3. Call Hold (stations)

4. Last Number Redial

ANSWERS

COMMANDS 121 → 129

COS 1 → COS 9 PROGRAMMING



Command	a	b	c	d	e	f	g	h	i	j
121	1								0	
122	1	0	0	0	0	0	0	0	0	
123	1								0	
124	1								0	
125	1								0	
126	1								0	
127	1								0	
128	1								0	
129	1								0	
Default	1	1	1	1	1	1	1	0	0	1

COS 1

COS 2 COS 2 NOW RESTRICTED

COS 3

COS 4

COS 5

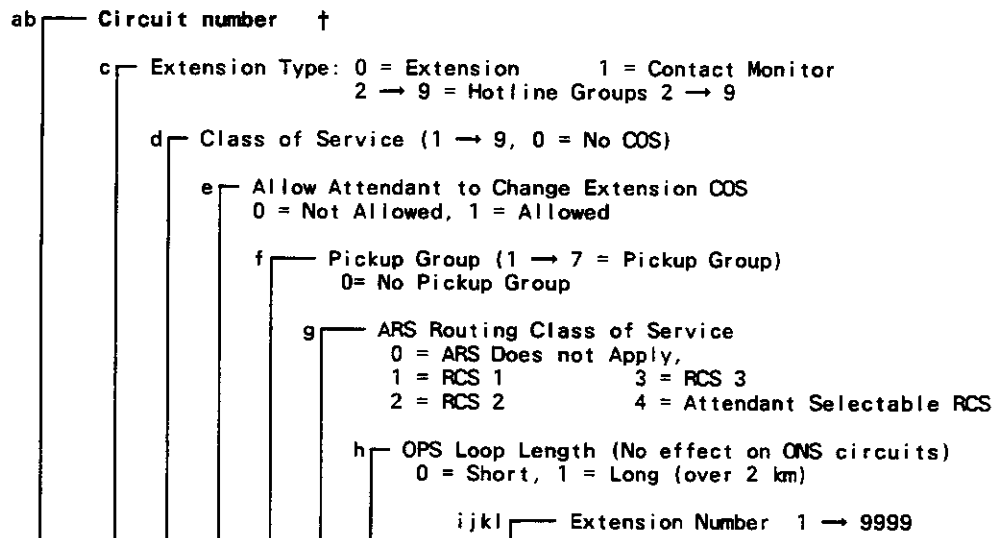
COS 6

COS 7

COS 8

COS 9

COMMAND 3XX EXTENSION PROGRAMMING - SLOT X



a	b	c	d	e	f	g	h	i	j	k	l	comment
0	1	0	2	0	1	0	0	2	0	0		These circuits are now COS 2
0	2	0	2	0	1	0	0	2	0	1		
0	3	0	1	0	1	0	0	2	0	2		
0	4	0	1	0	1	0	0	2	0	3		
0	5	0	1	0	1	0	0	2	0	4		
0	6	0	1	0	1	0	0	2	0	5		
0	7	0	1	0	1	0	0	2	0	6		
0	8	0	1	0	1	0	0	2	0	7		
0	9											
1	0											
1	1											
1	2											
1	3											
1	4											
1	5											
1	6											
Default	0	1	0	1	0	0						

† Only odd-numbered circuits are valid for OPS extensions.

1. **Command 110 Register 33,
Command 121-9 Register 2,
Command 185**

2. **Command 100 Register 07**

3. **Command 100 Register 09,
Command 100 Register 11,
Command 110 Registers 03, 04, 05,
Command 121-9 Register 3.**

4. **Command 100 Register 09,
Command 121-9 Register 5,
Command 151-6 Register 2**

HANDS-ON EXERCISE

- **Give the SUPERSET™ sets the ability to perform Last Number Redial, Do Not Disturb, Auto Answer, and Executive Busy Override.**

- **Use the Features Description section as a guide.**

- **Do your work on paper forms first!**

- **Test your programming by making sure ONLY SUPERSET™ sets can perform the features.**

SX-50™ DPABX: BLOCK PROGRAMMING

INSTRUCTIONS:

The following exercise is a self-teaching assignment on Block Programming.

SX-50™ DPABX – BLOCK PROGRAMMING

When programming an entire card, a "short cut" called Block Programming may be used.

- **Read Block Programming in the Features Description Section.**
- **Review the block programming forms in the Customer Data Entry section.**

1. How many cards may be programmed at once?

2. How many circuits may be programmed at once?

ANSWERS

1. 1
2. 16

HANDS-ON EXERCISE

- Practice block programming for Commands 321–330 and 341–350.

Note: Be careful to choose extension numbering plans that do not presently exist. For example, block programming could not start at extension 100 as it exists already (it's the very first line circuit).

- Verify that your programming worked, by viewing the appropriate Command 301–10.

SX-50™ DPABX: RING GROUP PROGRAMMING – COMMAND 381

INSTRUCTIONS:

The following exercise is a self-teaching assignment on Ring Group programming, Command 381.

SX-50™ DPABX – RING GROUP PROGRAMMING

The Ring Group is a group of telephones that ring simultaneously when an access code is dialed.

The Ring Group is used for a department that wishes all its telephones to ring at once. For example, a service department may have several technicians each working on different types of equipment. If you knew which technician you needed you could call the telephone directly. However, if you didn't know any of the technicians, you could call the Ring Group Access Code and ALL the technician phones would ring.

- **Read about the Ring Group in the Features Description section.**

1. **How many Ring Groups can there be on the SX-50™ DPABX?**

2. **Where is the Ring Group Access Code programmed?**

3. **What type of telephones CANNOT be members of a Ring Group?**

4. **How many members can there be in a Ring Group?**

Programming

To program a Ring Group enter the extension numbers of the members in fields "bcde".

Note: Always start from field "b" when entering extension numbers. If the extension is less than 4 digits long then leave the last fields blank.

EXAMPLE:

COMMAND 381 STATION RING GROUP PROGRAMMING

Ring Group Member Number

Station Number (1 → 9999)

a	b	c	d	e
1	3	0	1	
2	4	1	0	
3	4	5	5	5
4	1	0	0	
5				
6				
7				
8				
9				

5. How many members are in this ring group?

6. What are the extension numbers of the members in the ring group of the example above?

7. **What code is dialed to make all these telephones ring simultaneously?**
-

ANSWERS

1. 1
2. Command 110 Register 25
3. SUPERSET™ sets
4. 9
5. 4
6. 301, 410, 4555, 100
7. 497 (default)

HANDS-ON EXERCISE

- Create a Ring Group using telephones that are connected.
- Plan your work on paper first.

SX-50™ DPABX: HUNT GROUP PROGRAMMING – COMMANDS
361-366

INSTRUCTIONS:

The following exercise is a self-teaching assignment on Hunt Group programming, Commands 361-366.

SX-50™ DPABX – HUNT GROUP PROGRAMMING

A Hunt Group is used where a department wishes to have a general access number but only have 1 telephone ring.

Members of sales department would belong to a circular hunt group. Circular hunting insures an equal number of calls are distributed among the hunt group members. The action is as follows;

Step 1 – All telephones are idle

Step 2 – An extension dials the Hunt Group Access Code

Step 3 – The system remembers which station received the last Hunt Group call

Step 4 – The system directs the incoming call to the next station programmed

Members of a security team may belong to a terminal hunt group. Terminal hunt groups always ring the first staion programmed. The action is as follows;

Step 1 – All telephones are idle

Step 2 – An extension dials the Hunt Group Access Code

Step 3 – The system routes the call to the first station programmed.

Step 4 – If the first station is busy the call is routed to the second station programmed.

Step 5 – If the first AND second station are busy the call is routed to the third station programmed.

Step 6 – etc.

Programming

There are 6 Hunt Groups. Stations may belong to more than 1 hunt group. The Command Numbers are 361–366.

- **Read Hunt Groups in the Features Description section.**

1. **How many members can there be in a single hunt group?**

2. **How can hunt groups be expanded?**

3. **Where are the access codes located for hunt groups 1–6?**

4. **What are the default hunt group access codes?**

ANSWERS

- 1. 8**
- 2. By LINKing – all hunt groups could be linked to create 1 large group of 48.**
- 3. Command 110 Registers 19–24**
- 4. 491 through 496**

HANDS-ON EXERCISE

In this exercise you will create a terminal and circular hunt group. DO THE WORK ON PAPER FORMS FIRST.

- **Review Hunt Groups in the Features Description section.**
- **Recall stations can be members of more than 1 hunt group.**
- **Create a circular hunt group.**
- **Create a terminal hunt group.**

INTRODUCTION TO TRUNKS

INTRODUCTION TO TRUNKS

LINES AND TRUNKS

LINE is the term used to indicate a facility that extends from a switching device (Central Office or PABX) to a terminating device (such a telephone set).

Therefore, you can get a residence **LINE** or a business **LINE** that extends from the **CO** to a residence telephone or business telephone, respectively.

Similarly, you can get a line that extends from a **PABX** to an extension telephone.

These **LINEs** may terminate on a **KEY SYSTEM**, but remember that a key system does not provide any switching functionality.

TRUNK is the term used to indicate a facility that extends from one switching device (Central Office or PABX) to a second switching device (Central Office or PABX).

In North America, **LINEs** usually provide a **LOOP START** operation, while **CO TRUNKS** usually provide a **GROUND START** operation.

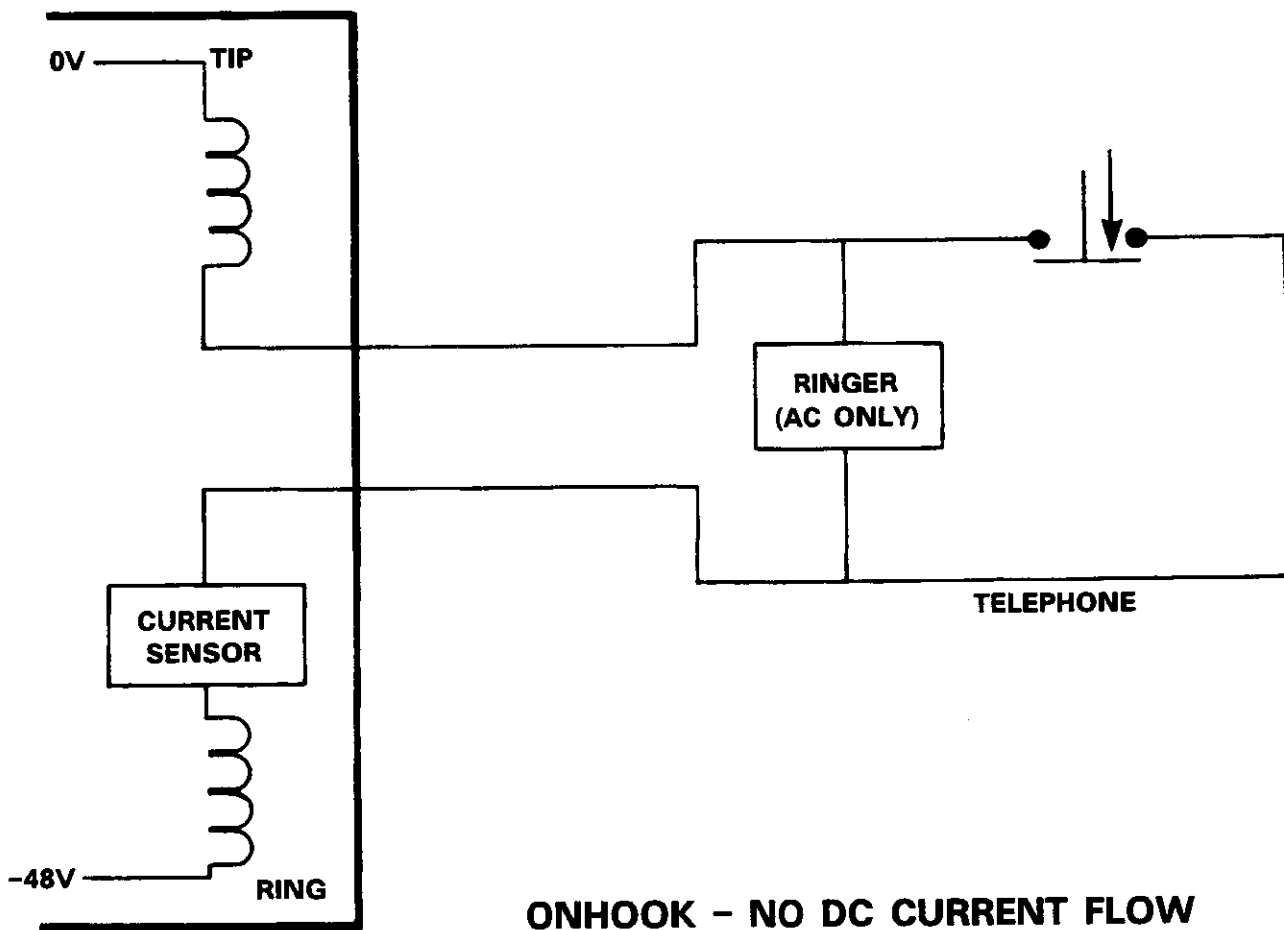
In some countries, both **LINEs** and **TRUNKS** can be provided for either **LOOP START** or **GROUND START** operation.

LOOP START AND GROUND START TRUNKS

Loop Start Trunks

The Loop Start circuitry of a PABX trunk card behaves the same as a telephone, so a telephone is used below for explanations.

The diagram shows a CO Loop Start line connected to a standard telephone. Note the CO has a RING lead connected to -48V and a TIP lead connected to 0V.



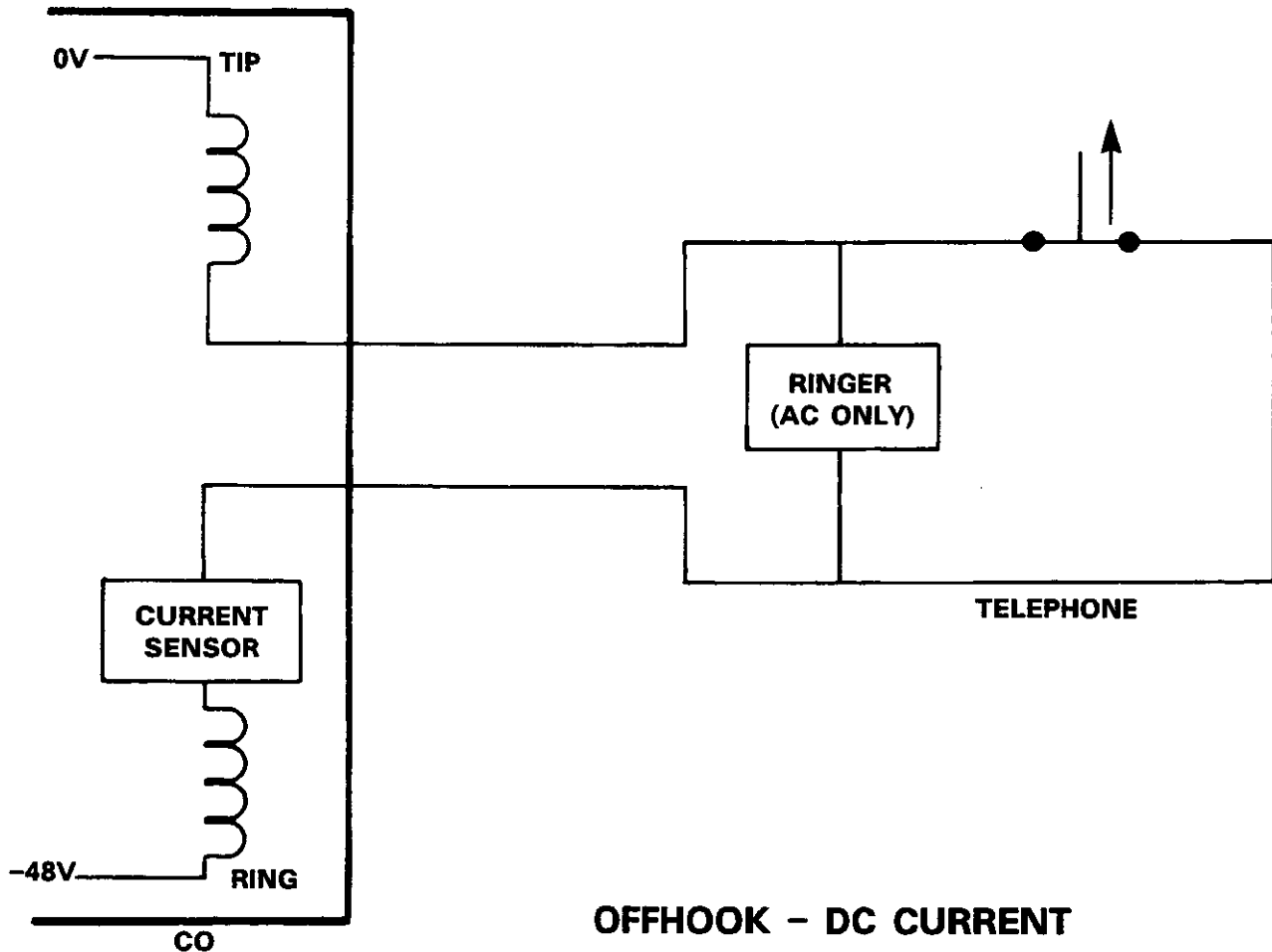
EXT0762R0

The telephone in the diagram above represents the Loop Start Trunk circuitry found in a PABX. If the CO loop is connected to a PABX it becomes a Loop Start trunk.

Initiating a Call

Before making a call the telephone must get the attention of the CO. It does this as follows;

- With the telephone onhook (switch open) there is no DC current flow.
- With the telephone offhook the switch is closed and a "loop" is formed from RING through the telephone to the TIP.
- The closed loop draws a current which is detected by the CO.
- When the CO detects a current it places dial tone on TIP and RING then prepares itself to receive dialled digits from the telephone.



EXT0761R0

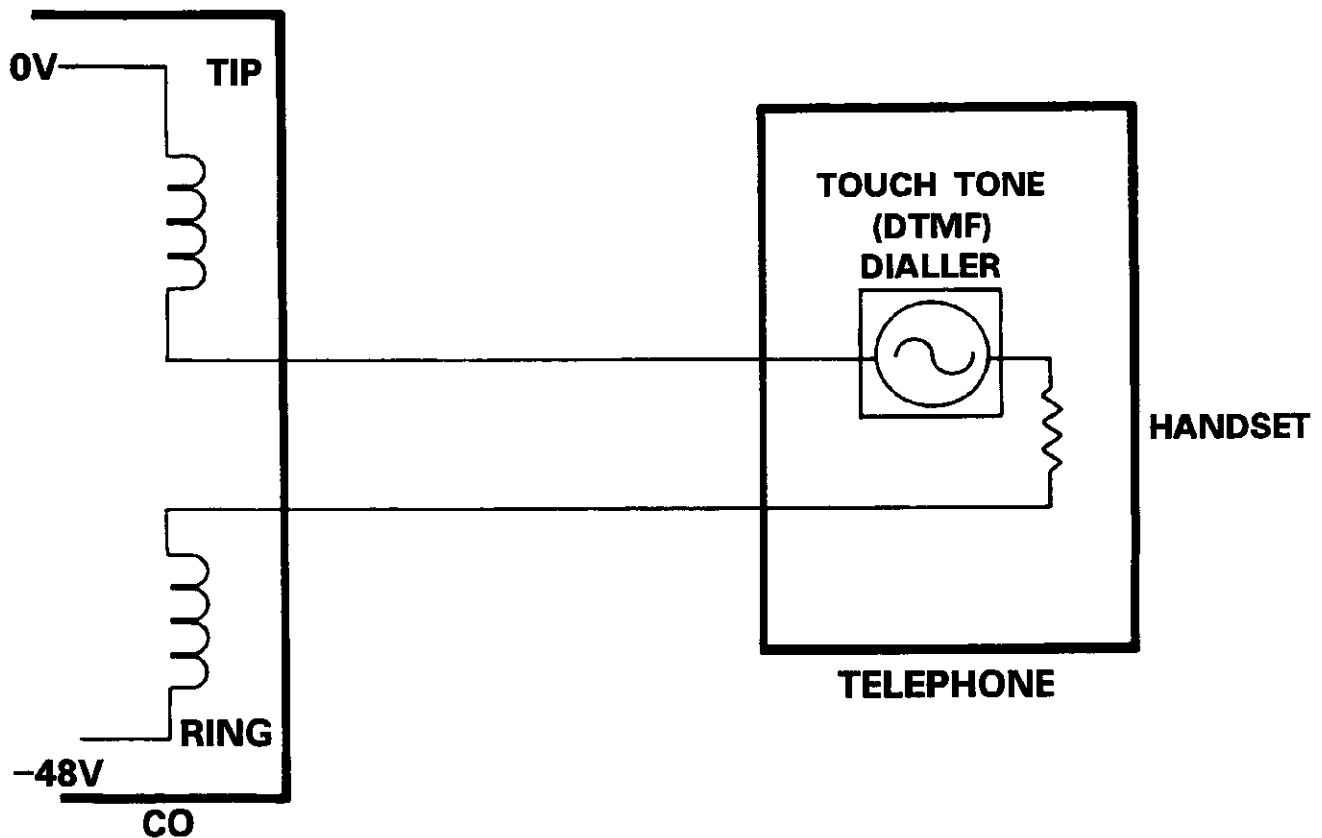
INTRODUCTION TO TRUNKS

Dialling Digits

There are 2 methods of sending digits to a CO - Rotary Dialling and DTMF Dialling.

Rotary dialling is simply a making and breaking of the loop. When the digit 8 is dialled the loop is broken 8 times. The CO merely counts the breaks to determine which number has been dialled.

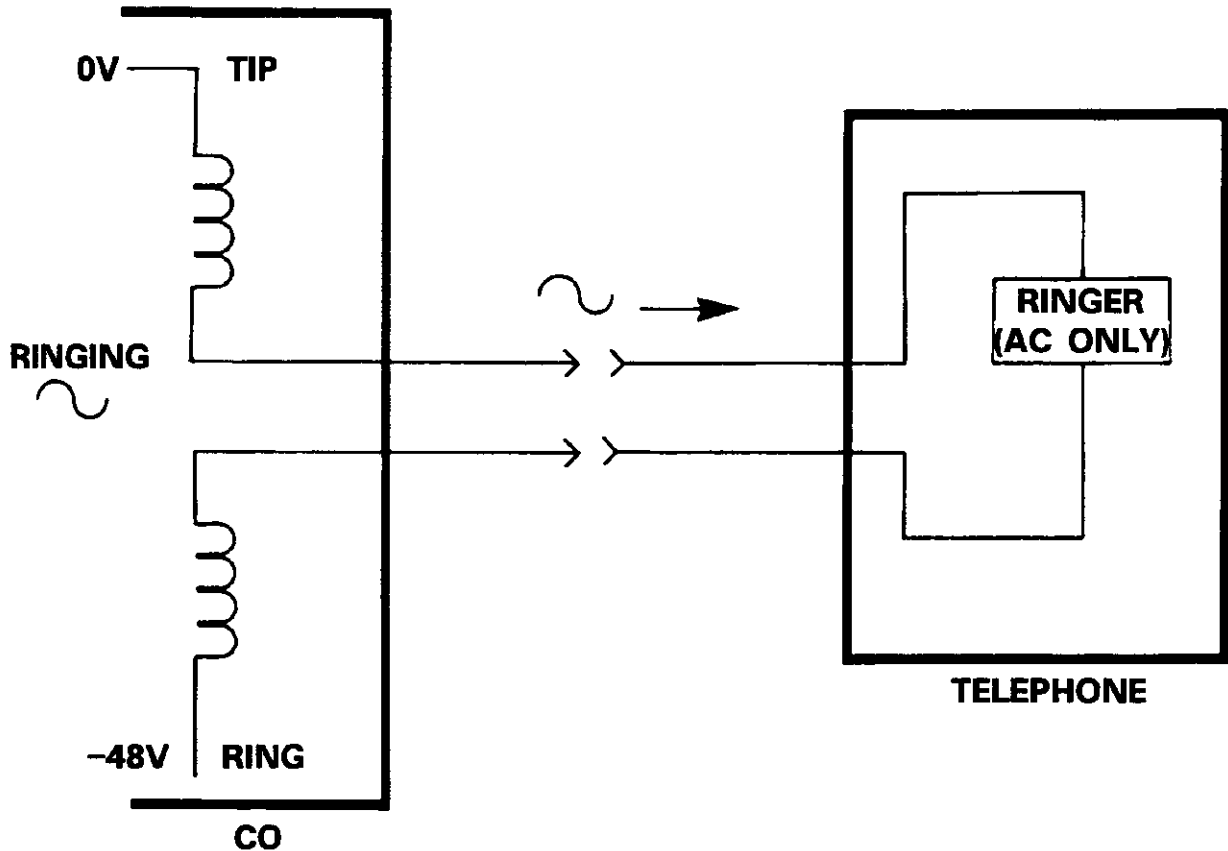
DTMF dialling consists of a different tone for each digit. Although the tones may sound similar there is enough difference that the CO can distinguish one digit from the next.



EXT0763R0

Ringling the Called Telephone

The diagram below shows a CO ringing a telephone.



CO RINGS A TELEPHONE

EXT0566R0

The CO rings a telephone by sending an AC voltage to the ringer within the telephone.

When the telephone goes offhook the DC loop is formed. The CO detects the loop and stops sending the ringing voltage.

Disconnecting

When the telephone is onhook the loop is broken and the current flow stops. The CO detects this and drops the call.

The main problem with the Loop Start facility (either Line or Trunk) is GLARE or CALL COLLISION. This is the name given to the situation where you go offhook at the same time someone is calling you. In a residential installation this is not a major problem but in commercial situations this is a very undesirable situation.

INTRODUCTION TO TRUNKS

The Ground Start Trunk to a PABX is used to eliminate glare.

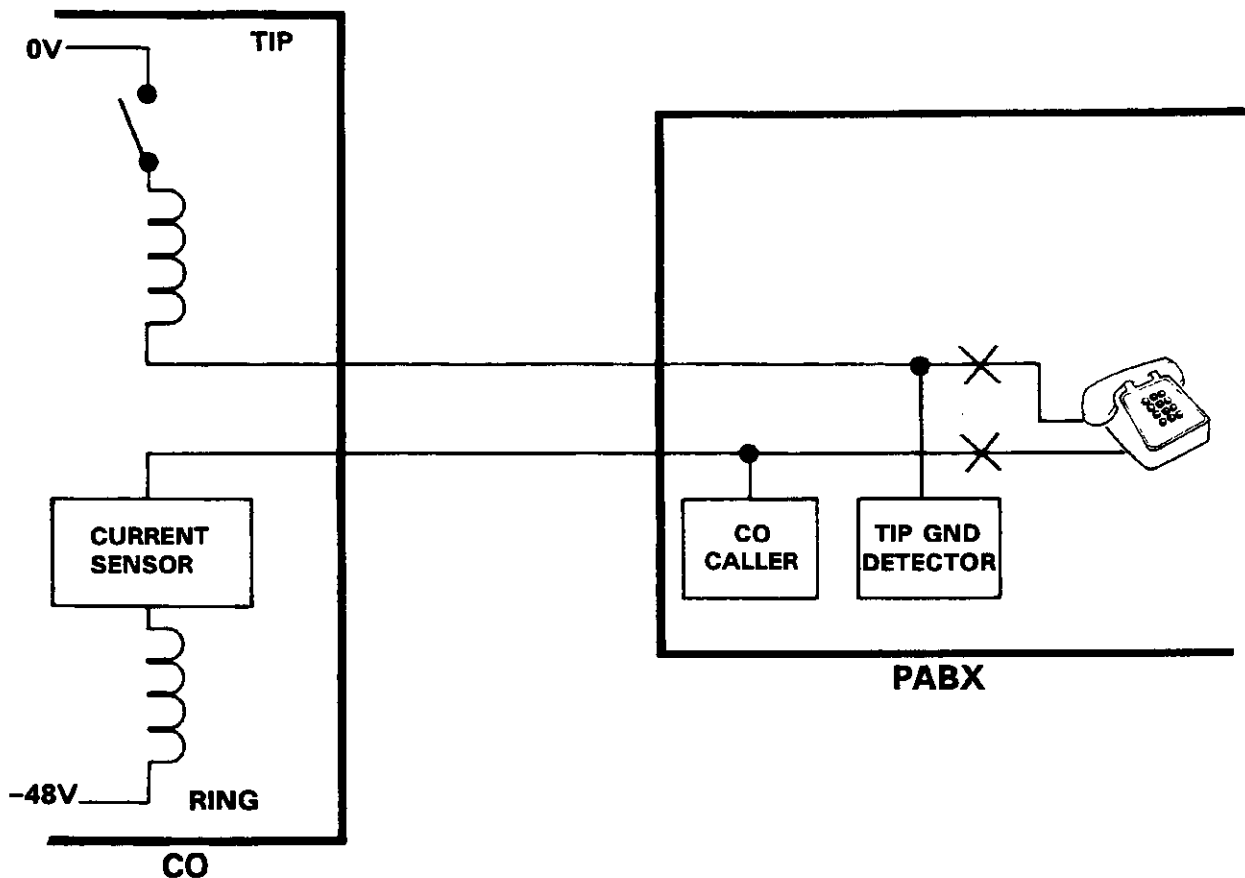
Ground Start Trunks

Ground Starting is a handshaking routine that is performed by the CO and the PABX prior to making a phone call. The CO and PABX agree to dedicate a path so glare cannot occur.

The Ground Start trunk handles conversation (a connected call) and dialling digits (indication of destination) the same way as a Loop Start trunk. However, ground start trunks differ from loop start trunks when it comes to setting up the path for signalling (dialling) and communication (the end-to-end connection).

Ground Start PABX to CO Call

In a Loop Start Trunk the only break in the loop is the switch where the handset rests. When the telephone is offhook the circuit is complete.



EXT0760R0

In a Ground Start Trunk there is another break in the TIP lead at the CO. A relay remains open if the trunk is not in use, and closes if the trunk is in use.

When the PABX wishes to make a call the Ground Start Trunk works as follows;

- PABX checks busy/idle status of CO Trunk.

The PABX checks to see if the CO trunk is idle by measuring the voltage on the TIP. If the TIP is not grounded by the CO (i.e. relay open) the trunk is idle.

- PABX calls the CO.

The PABX gets the attention of the CO by activating the CO Caller. The CO Caller circuitry grounds the RING lead which causes a current flow from RING to ground. Like a loop start the CO detects the current flow and proceeds to dedicate the trunk.

- CO dedicates trunk.

The CO informs the PABX that the trunk has been dedicated by closing the relay. This grounds the TIP which is detected by the PABX's Tip Ground Detector. The PABX then removes the ground on the RING.

With the handshaking complete a conventional PABX to CO call can be made.

Ground Start CO to PABX Call

When a CO wishes to make a call it informs the PABX by grounding the TIP.

The handshaking works as follows.

- The CO informs the PABX of its intention to make a call by closing the relay and grounding the TIP.
- The Tip Ground Detector sees this and the PABX dedicates this trunk to the incoming call.
- The CO then sends ringing and a conventional CO to PABX call is made.

Release of the Call (Disconnect or Release Supervision)

When either the CO or the PABX wishes to release the call, it informs the other switch by removing the ground it applied.

The handshaking works as follows.

INTRODUCTION TO TRUNKS

When a CO wishes to release the call it informs the PABX by removing the ground it applied (provides disconnect supervision).

- The Tip Ground Detector sees this and the PABX removes its ground and the loop is once more idle and available for another call.

CHECK YOUR UNDERSTANDING

1. How does a CO Loop trunk know when a PABX is seizing the facility (is offhook)?

2. How does a rotary dial telephone send digits to the CO?

3. How does a CO know to stop ringing a telephone that has been answered?

4. How does a PABX check to see if a CO Ground Start trunk has been dedicated?

5. How does a PABX indicate to the CO that it requires the trunk?

ANSWERS

1. When a PABX seizes the trunk it completes a circuit or "loop". The complete circuit draws current which is detected by the CO and interpreted as an offhook condition.
2. Rotary dial telephones momentarily break the circuit (stop current flow) to represent digits. The circuit is broken 3 times for the digit 3. The CO counts these evenly-spaced breaks and determines which digit has been dialed.
3. When a CO rings a telephone it is onhook and there is no DC current flow. When the telephone is answered the offhook condition completes the DC loop. The CO detects the flow of current and interprets it as a signal to stop ringing the telephone.
4. To see if the trunk has been dedicated, the PABX checks to see if the TIP lead is grounded. An undedicated Ground Start Trunk has an open relay between 0v (ground) and the TIP lead connected to the PABX. If the trunk has been dedicated the CO will close the relay and ground the TIP lead.
5. A CO Ground Start Trunk is called by the PABX CO Caller circuit. This circuit briefly grounds the RING lead causing DC current to flow. The CO detects the current flow and interprets it as a request for service from the PABX.

SOME DEFINITIONS

Supervision:

the means to seize, release and answer the other end of the circuit.

Signalling:

the digits dialled, either DTMF tones or dial pulsing.

Information:

status tones; dial tone, ringback tone, etc.

E & M TRUNKS

E & M Trunks are used to interface two PABXs. The PABXs may be located in the same building or be distant.

The E & M trunks come in 5 types of configurations. Each type may have 2 or 4 wires for voice, and 2 or 4 wires for signalling. These are defined as;

E Lead

Commonly called the EAR Lead. It is used to receive supervision from the far-end PABX.

M Lead

Commonly called the MOUTH Lead. It is used to send supervision to the far-end PABX.

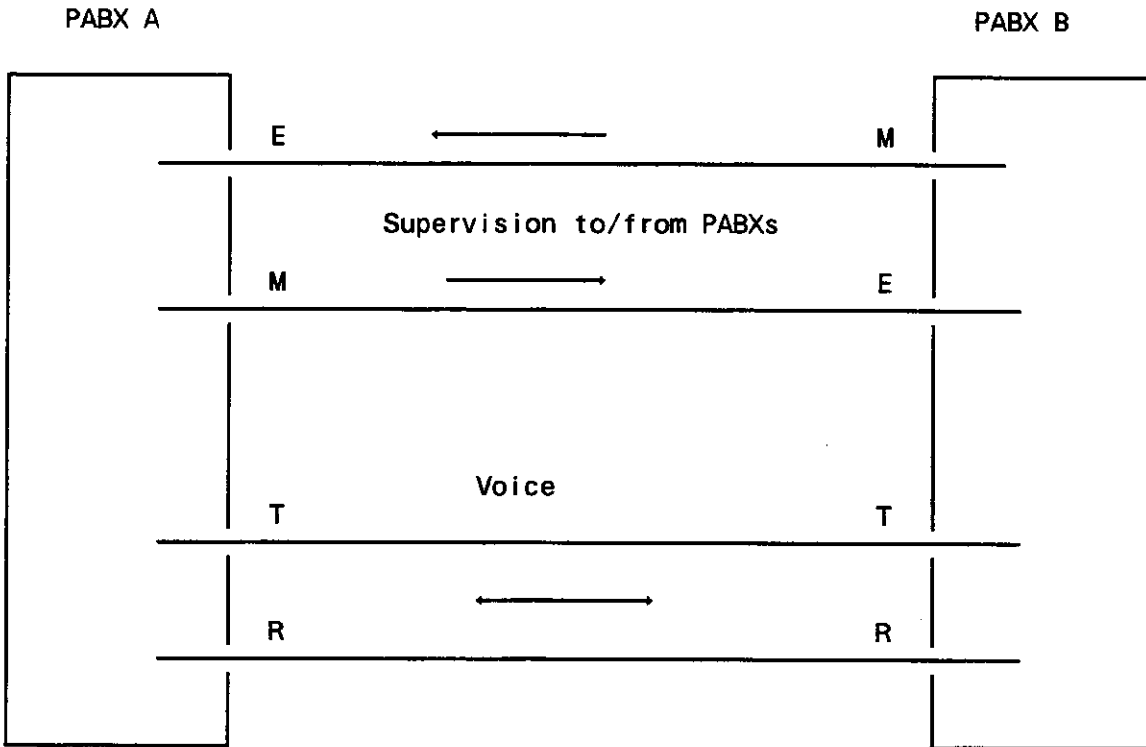
Tip & Ring

In a 2 wire configuration these wires are used to send and receive voice. In a 4 wire configuration these wires are used to send voice to the far-end PABX.

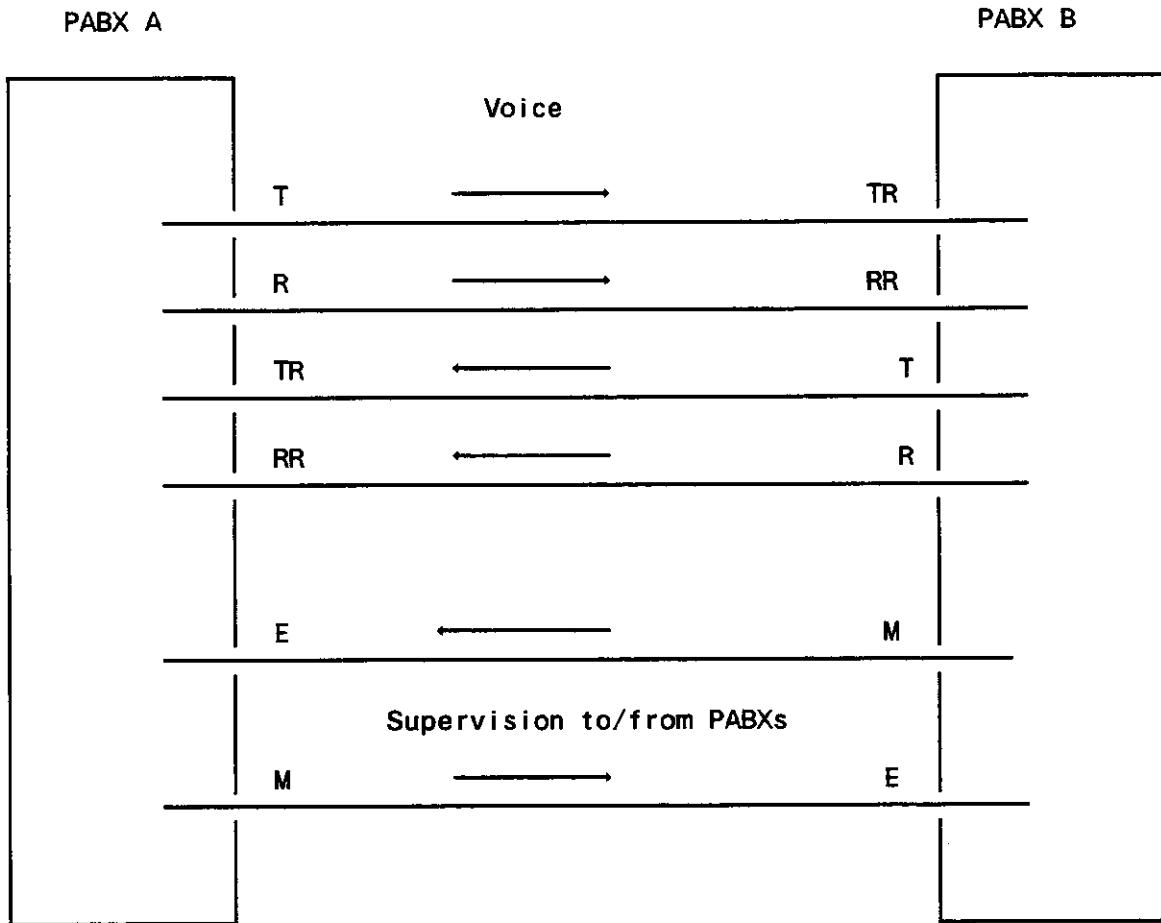
TR & RR

Used in 4 wire configurations to receive voice from the far-end PABX.

2 WIRE E & M TYPE 1



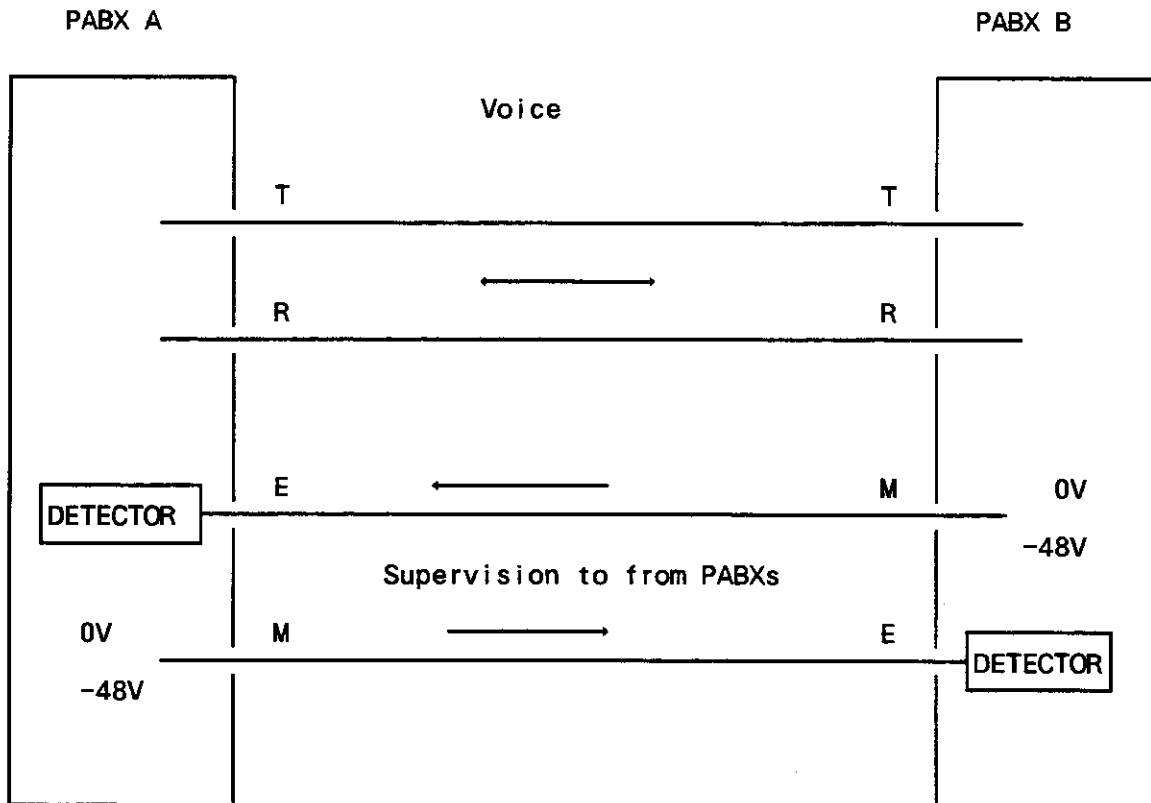
4 WIRE E & M TYPE 1



Back to Back (Co-located) E & M Connection

A Back to Back Connection is a direct connection between 2 PABXs without going through the public telephone network.

**BACK TO BACK
2 WIRE E & M TYPE 1**



INTRODUCTION TO TRUNKS

A call is made as follows.

- Extension A from PABX A wishes to call Extension B in PABX B.
- Extension A dials the trunk access code for PABX A
- PABX A informs PABX B of an incoming call by grounding the M Lead.
- PABX B detects the ground on its E lead
- PABX B prepares for incoming dialled digits.
- PABX A sends DTMF digits across Tip and Ring. Rotary dial digits are sent by pulsing the M lead.
- PABX B grounds its M Lead to inform PABX A that Extension B has answered. This is called Answer supervision.

CHECK YOUR UNDERSTANDING

1. What leads are used for sending or receiving supervision between PABXs?

2. What leads are used for voice between PABXs in 2 wire E & M trunk configurations?

3. What leads are used to receive voice between PABXs in 4 wire E & M trunk configurations?

4. In a back to back connection how are rotary dialled digits sent from PABX A to PABX B?

CHECK YOUR UNDERSTANDING

1. E & M Leads. E lead receives, M lead transmits
2. Tip and Ring
3. TR and RR
4. Rotary dial digits are sent by pulsing the relay on the M lead on PABX A.

DIRECT INWARD DIAL (DID) TRUNK

The purpose of the DID trunk is to eliminate the need for the switchboard operator to handle incoming calls. If you know the extension number of the person you want to speak with the DID trunk allows you to dial that extension number directly from anywhere in the world!

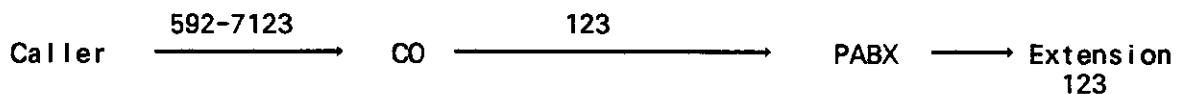
Unlike Loop Start/Ground Start trunks the DID trunk does not have a fixed answer point. The LS/GS trunks are programmed to always ring at a console or station or night bell etc., while DID trunks determine their ultimate destination based on the digits dialed by the caller.

Recall that for regular CO trunks, the CO sends a ringing voltage to the PABX to establish the call. The PABX then answers the call and connects the trunk to a predefined answer point. In the case of a DID trunk, the CO seizes the trunk (goes off-hook), the PABX prepares to receive digits and the CO sends digits.

The number of digits that the CO sends is determined by the range of numbers served by the DID trunk; typically the CO sends the last 1 to 9 digits that the caller has dialed.

It works like this.

An extension connected to the PABX has the extension number 123. This extension can be reached directly from anyone by dialling 592-7123.



The CO strips the 592-7 and passes on the digits 123 to the PABX. The PABX then connects the incoming caller to extension 123.

The DID Trunk is capable of monitoring an onhook/offhook condition (when the CO wants to send digits), and it is capable of collecting digits.

One final note: DID trunks are used for incoming calls only; outgoing calls cannot be made on DID trunks.

DIRECT INWARD SYSTEM ACCESS (DISA)

The DISA trunk is a programmable feature of a PABX. It uses a regular Loop Start or Ground Start CO trunk.

Usually a CO trunk will ring in to the console or a station, etc.

INTRODUCTION TO TRUNKS

When programmed as a DISA, the PABX does not route an incoming caller to a destination. Instead, it returns dial tone to the incoming caller. The caller can then choose the destination – internal or external.

One of the main uses for a DISA trunk is to allow employees to make a long distance call while being out of the building. The employee calls up the DISA line, enters a security code, then makes the call. The PABX is then charged for the long distance call.

FOREIGN EXCHANGE (FX) TRUNKS

The FX trunk is a regular Loop Start or Ground Start CO trunk.

An FX trunk terminates in a distant or 'Foreign' CO exchange.

This means that when you place an outgoing call, you seize the trunk and connect directly to the distant CO which returns dial tone.

Therefore, a call placed from your PABX over the FX trunk to a number served by the distant office is effectively a 'local' call instead of a long distance call. This means that you do not need the long distance call identifier "1", for the call and it must not be outpulsed over the trunk.

Similarly, a call placed to your PABX over the FX trunk from a number served by the distant office is effectively a 'local' call for the caller instead of a long distance call.

Telcos provide FX trunks at a fixed monthly rate that is higher than the rate for a standard CO trunk, and is usually based on the distance to the distant CO.

WIDE AREA TELEPHONE SERVICE (WATS) TRUNKS

The WATS trunk is a regular Loop Start or Ground Start CO trunk.

WATS trunks are used only for long distance calls.

OUT-WATS trunks connect an outgoing caller directly to the toll network, bypassing the local CO. This means that you do not need the long distance call identifier "1", for the call.

Some COs will ignore the "1" if you outpulse it over the trunk, while other older COs will reject the call if the "1" is outpulsed.

Telcos provide WATS trunks at a fixed monthly rate that is sold in blocks of 'hours of use'. You pay for the service in advance, so your money is spent whether or not calls are made to use up the leased time.

A call placed to your PABX over an IN-WATS (800 service) trunk, from a number served by a distant office is effectively a 'local' call for the caller instead of a long distance call because you pay for the trunk service.

A call placed to your PABX over an IN-WATS (900 service) trunk is a reduced rate long distance call for the caller. This means that while you pay for part of the service, the caller is charged a reduced long distance rate, for example, 50 cents per call.

SX-50™ DPABX: TRUNK GROUPS - COMMANDS 151-156

INSTRUCTIONS:

The following exercise is a self-teaching assignment on Trunk Group programming, Commands 151-156.

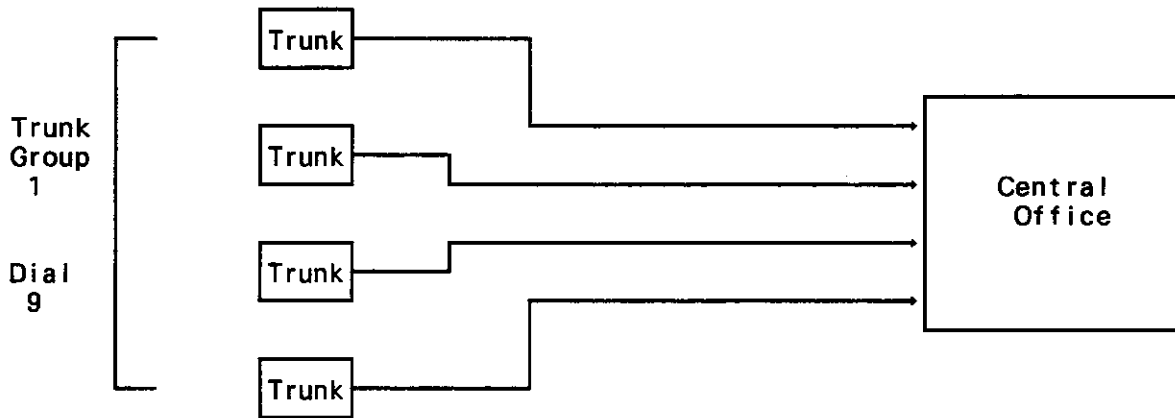
SX-50™ DPABX – TRUNK GROUP PROGRAMMING

Introduction

What is a Trunk Group?

A trunk group is a number of trunks that handle OUTGOING calls in identical fashion. For example, all regular CO trunks would be placed in trunk group 1. The access code for Trunk Group 1 is "9" (i.e. dial 9, then the number to make an external call).

When a user dials 9 the system selects one of the trunks in the trunk group. The trunk is connected to the CO where the call will be processed.



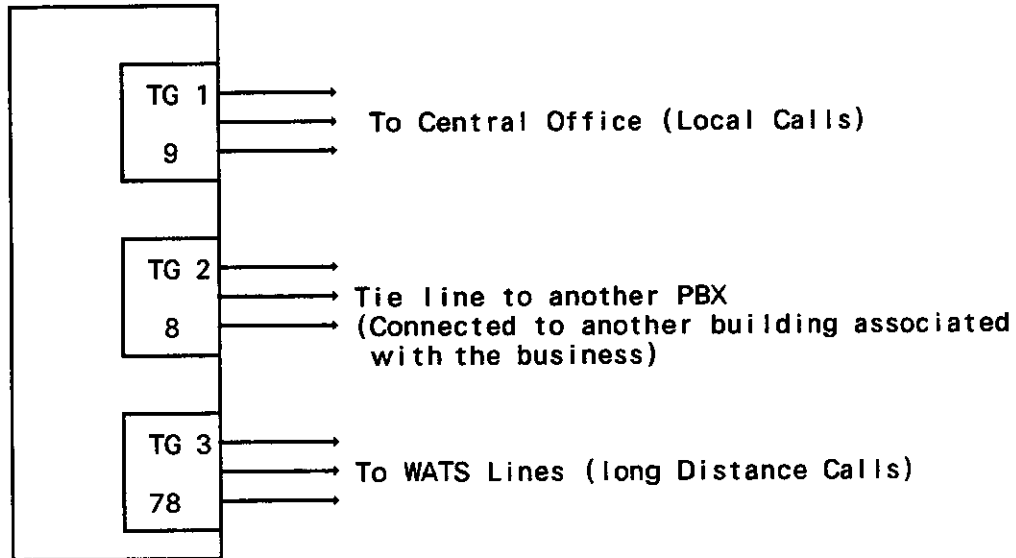
Remember that TRUNK GROUPS are used for outgoing calls only. When the Central Office wishes to call the PBX on one of the trunks, an answer point (usually the console) must be programmed. Answer points are covered in the next module.

Trunk Group Programming

Different trunk groups are required when different trunk services are used.

For example, most businesses will have the local CO trunks in Trunk Group 1. However, they may also have Tie Trunks in Trunk Group 2, and special long distance trunks in Trunk Group 3.

PABX



If a user connected to the PBX in the diagram wanted to make an outgoing call there would be a choice of 3 Trunks Groups.

If it was a local call, the user would select Trunk Group 1 by dialling "9" + the external number.

If it was a to the other PBX, the user would select Trunk Group 2 by dialling "8".

If it was a long distance call, the user would select Trunk Group 3 by dialling "78" + the external number.

Programming Trunk Groups

There are 6 trunk groups available. The commands used to program trunk groups are Commands 151-156. Command 151 is used for Trunk Group 1, CMD 152 is for Trunk Group 2, CMD 153 is for Trunk Group 3, etc.

By default, all LS/GS Trunks are programmed into Trunk Group 1. All E&M Tie trunks are programmed into trunk group 2.

- **Locate the Trunk Group forms in the Customer Data Entry section.**

A brief explanation of some of the registers is listed.

- **Read through the following section, An Explanation of Trunk Group Forms Commands 151 - 156.**
- **You may wish to remove or photocopy this document and keep it with your Customer Data Entry section.**
- **More information is found in the Features Description section.**

ASSIGNMENT #1 – Trunk Groups

1. **The actual trunk circuit is used for both incoming and outgoing calls. Which does Trunk Group programming effect? Explain your answer.**

2. **Why do most PBXs require more than 1 Trunk Group?**

3. **How many trunk groups are there on the SX-50™ DPABX?**

4. **What are the default Trunk Group Access Codes?**

- 5. Where are the Trunk Group Access Codes programmed? Give command and register numbers for each trunk group.**

- 6. What is the recommended method for trunk hunting? Why?**

- 7. What is the recommended programming for Wait for Dial Tone? Why?**

- 8. What feature allows a Rotary Dial telephone to outpulse to a DTMF Only CO?**

ANSWERS

- 1. Trunk Groups effect OUTGOING calls as trunk groups are accessed by devices connected to the PABX (ie dial 9 to get out).**
- 2. A trunk group is required when differnt types of trunks or trunk services are used.**
- 3. The SX-50™ DPABX can accommodate up to 6 different trunk groups.**
- 4. The default access codes are:
Trunk Group 1 - 9,
Trunk Group 2 - 8,
Trunk Group 3 - 78,
Trunk Group 4 - 79,
Trunk Group 5 - None
Trunk Group 6 - None**
- 5. Command 151-6 Register 1 Field fghi (up to 4 digit code)**
- 6. Terminal Hunting is reccommended in the opposite direction from the CO hunt to reduce the chance of call collision.**
- 7. Use No Wait if the CO is reasonably fast in reacting to an offhook signal.**
- 8. Rotary Dial to Dial Pulse conversion can be achieved by setting Command 151-6 Register 2 Field g = 0.**

HANDS-ON EXERCISE

With default data loaded, all LS/GS trunks are in Trunk Group 1, all E&M trunks are in Trunk Group 2, and all DID trunks are not in any trunk groups.

- **NOTE: Alarms will be raised when a user attempts to call out on a trunk that is not connected. Since all trunks are placed into Trunk Group 1, this situation will likely occur both in your lab and in the field. The solution in the field is to make unconnected trunks Incoming Only (ie not members of a trunk group). You will learn about this in the next module. For now, change the hunting to terminal and insure the first trunk is connected. Use your maintenance commands to clear any busy-outs, alarms, etc.**
- **View the Trunk Group Access Codes on your PBX. Insure they match the codes as described in the Customer Data Entry section.**
- **Connect a Butt Set to a connected trunk circuit.**
- **Set the outpulsing to Rotary – Inhibit DTMF Until Answer.**
- **Using a DTMF telephone, outpulse a number and prove that the numbers are being outpulsed in rotary format.**
- **Change the programming to insure that DTMF tones are always outpulsed – even if a rotary dial telephone is used.**

- **Change the default Trunk Group 1 Access Code to 7623. Prove that it works.**
- **Change the code back to 9.**

SX-50™ DPABX: AN EXPLANATION OF TRUNK GROUP FORMS

SX-50™ DPABX: AN EXPLANATION OF TRUNK GROUP FORMS

AN EXPLANATION OF TRUNK GROUP FORMS

COMMANDS 151-156

REGISTER 1

1. TRUNK SELECT

This is not programmable and is always Automatic.

2. TRUNK HUNTING

This option lists the two methods that a trunk may be selected.

Circular

The selection of a trunk is the next one available after the last trunk used.

Terminal

The selection of a trunk is the first one available starting from the beginning of the entries in the trunk group.

Hint: To help eliminate glare use Terminal Hunting starting from the opposite end from where the CO hunts.

3. TRUNK GROUP OVERFLOW

When all the trunks in one group are busy users may be routed to the trunks in another trunk group. Enter the trunk group number that will handle the overflow.

4. IDENTIFIED TRUNK GROUP

Used for E&M Trunks.

In back to back PABX installations it may be desirable to outpulse the Trunk Group Access code along with the other digits to the far-end PABX. The Access Code matches the first digit of the far-end numbering plan making the two systems appear as one PABX.

Example;

User wants to call person on the other PABX.

User dials other persons extension number – 237

The "2" is the E&M Trunk Group Access Code

The E&M outpulses 237 and the far end extension rings

5. TRUNK GROUP ACCESS CODE

Each trunk group has a separate access code that is programmable.

Default programming is:

Dial 9 – Trunk Group 1 (All LS/GS Trunks)

Dial 8 – Trunk Group 2 (All E&M Trunks)

Dial 78 – Trunk Group 3 (No trunks assigned in default programming)

Dial 79 – Trunk Group 4 (No trunks assigned in default programming)

Trunk Groups 5&6 have no default access code.

REGISTER 2

1. WAIT FOR DIAL TONE

No Wait – Outpulse After Delay

This option may be used for COs that immediately return dial tone.

Also, this option is used for trunks that do not provide dial tone (E&M Tie) or where service is deplorable and the central office dial tone resembles the sound of a lawnmower cutting through a giant blob of marshmallow. The system may not be able to recognize the noise as dial tone.

Wait For 5 Seconds

The trunk will wait for dial tone or 5 seconds then outpulse.

Unlimited Wait With Polling

Where service is very slow and dial tone may not be received for minutes a trunk may be seized without a timeout if this option is enabled.

Unlimited Wait With Manual Verification

With this option enabled the user can listen for dial tone and then manually inform the system by flashing the switchhook.

2. DIAL TONE DETECTION TIMING

This timer states the length of time dial tone must be present before the DPABX will accept it as valid dial tone detection.

3. DELAY BEFORE OUTPUTSING

This timer is active ONLY if the WAIT FOR DIAL TONE option is set to 0, No Wait – Outpulse After Delay

This timer will determine the duration that the SX-50™ DPABX will wait before outputting.

4. ANSWER SUPERVISION (FAR-END ANSWER SUPERVISION TYPE)

No Answer Supervision

This option is the one most often selected as most North American COs do not provide answer supervision.

Supervision is Meter Pulse or Reversal

Select this option for E&M Trunks. When a pulse is seen on the "E" lead the E&M trunk will assume the call is answered and will drop the DTMF receiver.

Ignore Supervision except for Toll Restriction

If the next option "RESTRICT EXTERNAL CALLS ON REVERSAL" is enabled calls will be barred if the CO provides a reversal.

Supervision is Meter Pulse Only, Ignore Reversals

The CO provides answer supervision by supplying a meter pulse. Reversals will be ignored.

5. RESTRICT EXTERNAL CALLS ON REVERSAL

This option gives restriction for calls to COs that provide a reversal on toll calls.

6. DTMF OR ROTARY DIALING

DTMF

This option converts Rotary Pulses to DTMF signals for use with COs that are not capable of accepting Rotary Pulses.

Rotary

This option converts DTMF Tones to rotary dial signals for use with COs that are not capable of accepting DTMF tones. The DTMF Tones appear on the trunk as well as the rotary signals.

Rotary, Disable Outgoing Audio Until Answer

If the presence of audio causes problems on the trunk line before a call is established then this option may be used.

Rotary, Inhibit DTMF Until Answer

If the presence of DTMF on the trunk causes problems before a call is established this option may be used. After answer supervision is received, DTMF tones may be used to outpulse to a device at the far end.

7. SIMULATE CO DIAL TONE

With this enabled a system-generated dial tone is provided immediately after a Trunk Group Access Code is dialed.

8. TRUNK GROUP SMDR ENABLE

Enables SMDR for the Trunk Group. This must be enabled to record SMDR for calls using this trunk group.

9. TRUNK GROUP LAST NUMBER REDIAL

This option must be enabled in every trunk group desiring the Last Number Redial option.

10. TRUNK GROUP MANUAL E&M TRUNK

Enable this option if the Tie Line is routed to a fixed answer point (ie. Attendant Console) at the far end. This will ensure an immediate audio path as soon as the Trunk Group Access Code is dialed.

REGISTER 3

1. MESSAGE REGISTRATION

This option is enabled when it is desirable to track the cost of calls.

The SX-50™ DPABX keeps a tally of the number of units a station has against it. A unit is worth X cents (determined by the customer). For each call there is an initial unit charge plus length-of-call unit charge.

Initial Units + Length-of-Call Units = Total Units

If a station has this option enabled in COS, message registration units will be tallied according to the Initial Message Registration Unit (base units) plus the Count Additional Message Units (call length).

2. MESSAGE REGISTRATION ENABLE

Enable this feature if message registration is required for the trunk.

3. COUNT ADDITIONAL MESSAGE UNITS

Enable (CO provides the meter pulses)

Select Enable if Meter Pulses are provided from the Public Network.

Enable, Insert Pseudo Message Unit every 6 Seconds

Select this option if the SX-50™ DPABX is to provide a meter pulse every 6 seconds.

Enable, Insert Pseudo Message Unit every 60 Seconds

Select this option if the SX-50™ DPABX is to provide a meter pulse every 60 seconds.

4. INITIAL MESSAGE UNIT CHARGE

00 to 99

Select the initial charge the caller will be debited after the when Answer Supervision is received or the Pseudo Answer Timer Expires.

5. ADDITIONAL MESSAGES UNIT CHARGE

00 to 99

Select the rate to be applied to the caller after each meter pulse or psuedo meter pulse.

6. PSEUDO ANSWER TIMER

1-7 x 10 sec

If no answer supervision signal is received this timer determines the delay time before the psuedo meter pulses will start being applied to the caller.

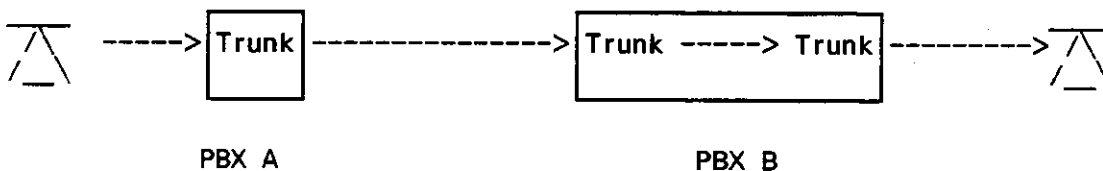
REGISTER 4

1. SENDING ANSWER ON INCOMING DIAL TRUNKS

This option is used for incoming calls that come in to the PABX and then are routed externally on another trunk. This may happen under a Tie, DISA or External Call Forwarding condition.

Originating Station

Far End



Send Answer When Answer is Received

The SX-50™ DPABX returns an answer indication to the originating station only when the far end answers. If the originating station calls in on an E&M line then the DTMF receiver is kept until the far end answers.

Send Answer After End of Dialing

The SX-50™ DPABX returns an answer indication after the originating station dials the last digit. In this case the PBX is reacting after an End of Dialing timer has expired (fixed at 10 sec). If the outgoing trunk is busy then busy tone is returned.

Use this option if the far end trunk does not provide answer supervision but the originating trunk does (ie. E&M to CO).

Send Answer Upon Accessing Outgoing Trunk

The SX-50™ DPABX returns an answer indication when successfully seizes a CO Trunk. If the outgoing trunk in PBX B is busy then no answer supervision is provided.

2. BEHIND PABX OPERATION

In Behind PBX configurations a loop start trunk is connected to a line circuit of another PBX. To exercise features from one PBX to the other the ability to perform a switchhook flash is required.

The most popular type of flash is a Loop Disconnect which is a momentary disconnect. Select this option if the line circuit accepts a momentary onhook condition as a flash.

In European installations the Ring Ground is a common method of signalling. Select this option if the line circuit accepts a ground pulse on the ring as a flash.

Normally a trunk is not required to perform a switchhook flash. This feature would be disabled in regular CO configurations.

3. BEHIND PABX RECALL SIGNAL DURATION

This feature determines the length of the flash.

4. CREDIT CARD CALLING OPERATION

Enable this feature for using Credit Card calls.

When enabled the system applies a DTMF receiver to the trunk in anticipation of receiving a tone from the CO. If a user dials 0 + a number then the CO will respond with the # DTMF tone (enter credit card number).

NOTE: Limit the use of this feature as it requires 2 of the 5 DTMF receivers per call. See SMDR - Credit Card Calls for more information.

INSTRUCTIONS:

The following exercise is a self-teaching assignment on Trunk programming, Commands 501-580.

SX-50™ DPABX – TRUNK PROGRAMMING

Introduction

There are 3 types of trunk hardware types available on the SX-50™ DPABX: LS/GS, E&M, & DID. This section concentrates on the LS/GS trunk although much of the information is applicable to all trunk types.

In trunk programming 2 main things are accomplished:

- 1) Trunk Answer Point – When the CO rings in to the PBX on a particular trunk, which device – console, station, night bell – rings?
- 2) Trunk Group Membership – Which Trunk Group does the trunk belong to?

Also in trunk programming the operation of the various types of trunk circuits are determined.

Trunk Numbering

Each trunk has a unique command number is programmed separately. The command number is a 5 followed by the trunk equipment number. Trunk equipment numbers are shown in the chart below.

Trunk Equipment Numbers

Circuit Number	Slot Number									
	1	2	3	4	5	6	7	8	9	10
01	01	09	17	25	33	41	49	57	65	73
02	02	10	18	26	34	42	50	58	66	74
03	03	11	19	27	35	43	51	59	67	75
04	04	12	20	28	36	44	52	60	68	76
05	05	13	21	29	37	45	53	61	69	77
06	06	14	22	30	38	46	54	62	70	78
07	07	15	23	31	39	47	55	63	71	79
08	08	16	24	32	40	48	56	64	72	80

E&M Trunks use ODD Equipment Numbers only.

For example, programming for the 5th LS/GS trunk circuit in slot 6 would be 545 (5 + Equipment Number 45).

This is the same chart used for maintenance commands that apply to trunks.

ASSIGNMENT #1 – Trunk Equipment Numbers

1. **What is the maximum number of trunk circuits on an LS/GS Trunk card?**

2. **Name the command numbers for LS/GS trunks in the following positions;**

Slot 1 Circuit 1

Slot 3 Circuit 2

Slot 4 Circuit 8

Slot 7 Circuit 7

Slot 8 Circuit 3

Slot 10 Circuit 5

Slot 6 Circuit 3

Slot 1 Circuit 9

Trunk Programming

- **Locate the default programming in the Customer Data Entry section.**

The Trunk Programming information begins with an explanation of the registers.

- **Locate the default programming for register 1.**

Note that field "b" determines which trunk group the trunk belongs to.

- 3. What is the default programming for field "b" for LS/GS, E&M, and DID trunks.**

4. What should the programming for field "b" be for trunks that are not connected to a CO? Why?

Trunk Answer Points – Console

The trunk circuit itself must be programmed to ring a destination within the PBX. Usually trunk circuits ring in to the console. Alternately, a trunk may be programmed to ring into a station, a recording, the night bell, a hunt group, the ring group, etc.

Trunks may have a Day Answer Point and a Night Answer Point.

By default, LS/GS Trunks ring in to the Attendant Console during the day and to the Night Bell during the night.

- **Locate the programming for register 4 of the Customer Data Entry section.**

This register contains the programming for the Day Answer Mode

By default field "d" is a 1 (LDN 1). If field d = 1, 2, or 3 then the trunk will ring the console. The console will indicate LDN 1, LDN 2 or LDN 3 corresponding to what is programmed. LDN stands for Listed Directory Number.

The reason multiple LDN numbers are required is for greeting different types of incoming callers.

For example, suppose 3 professionals (family doctor, dentist, optometrist) shared the PBX in one office. Each professional would have their own trunk(s) and publish separate telephone numbers in the telephone book. By directing the doctor's trunks to LDN 1, the dentist's trunks to LDN 2, and the optometrist's trunks to LDN 3, the attendant can handle all calls and greet incoming callers accordingly.

ASSIGNMENT #2 - Trunk Answer Points

1. **Show the command number, register number, and programming required to satisfy the following requirements.**

LS/GS Trunk Slot 5 Circuit 3 rings to Attendant Console LDN 1 during the day.

LS/GS Trunk Slot 10 Circuit 8 rings to Attendant Console LDN 2 during the day.

LS/GS Trunk Slot 2 Circuit 6 rings to Attendant Console LDN 3 during the day.

Trunk Answer Points - Direct-in Line

Rather than ring a console, trunks may be programmed to ring directly to an alternate location. When a trunk is programmed this way it is termed a Direct In Line.

An example of a direct-in line is a sales department.

The sales division of a business could publish its own telephone number. When someone dialed that number the trunk would route the caller to a Hunt Group which contained the sales people.

This is the situation that occurs for television commercials that offer you the opportunity to purchase by dialling the number on the screen. The number you call will ring directly in to a hunt group. The hunt group programming will insure you are connected to an idle station.

Programming Direct-in Lines

- **Locate register 4 in the Customer Data Entry section**

The programming for a direct-in line is done in 2 stages.

First, the trunk has to be programmed to be a Direct-in Line (i.e. not ring the console). This is accomplished by setting field "d" = 0.

If and ONLY IF field "d" = 0, will the PBX consider the programming for field "efg". Field "efg" determines where the trunk will ring in.

- **Read Direct-In Lines in the Features Description Section**

If an individual station is used as a answer point (single line or SUPERSET™ set) the equipment number is programmed NOT the extension number. The equipment number is taken from the chart below:

Station Equipment Numbers

***Use for Test Line, Day Answer Points, Night Answer Points, ONS Stations**

Circuit Number	Slot Number									
	1	2	3	4	5	6	7	8	9	10
01	001	017	033	049	065	081	097	113	129	145
02	002	018	034	050	066	082	098	114	130	146
03	003	019	035	051	067	083	099	115	131	147
04	004	020	036	052	068	084	100	116	132	148
05	005	021	037	053	069	085	101	117	133	149
06	006	022	038	054	070	086	102	118	134	150
07	007	023	039	055	071	087	103	119	135	151
08	008	024	040	056	072	088	104	120	136	152
09	009	025	041	057	073	089	105	121	137	153
10	010	026	042	058	074	090	106	122	138	154
11	011	027	043	059	075	091	107	123	139	155
12	012	028	044	060	076	092	108	124	140	156
13	013	029	045	061	077	093	109	125	141	157
14	014	030	046	062	078	094	110	126	142	158
15	015	031	047	063	079	095	111	127	143	159
16	016	032	048	064	080	096	112	128	144	160

ASSIGNMENT #3 – Direct-in Line Programming

1. What are the 5 destinations a trunk may ring if programmed as a Direct-In Line.

2. State the command number, register number and programming required to satisfy the following requirements.

LS/GS Trunk Slot 5 Circuit 3 rings to Hunt Group 1 during the day.

LS/GS Trunk Slot 7 Circuit 5 rings to the Ring Group during the day.

LS/GS Trunk Slot 2 Circuit 2 rings to the Night Bell during the day.

LS/GS Trunk Slot 6 Circuit 3 rings to the station in Slot 1 Circuit 16 during the day.

LS/GS Trunk Slot 10 Circuit 7 rings to the station in Slot 8 Circuit 11 during the day.

LS/GS Trunk Slot 7 Circuit 4 rings to the station in Slot 2 Circuit 6 during the day.

Night Answer Points

Night Answer Points for trunks are programmed in register 5 of CMD 501-580.

- **Locate register 5 in the Customer Data Entry section.**

Night answer points are programmed in identical method to the day answer point. If field "b" is a 1, 2, or 3 it will ring the attendant console under the corresponding LDN number.

If and ONLY IF field "b" is a 0, will the PBX consider field "cde". Field "cde" determines where the trunk will ring in.

ASSIGNMENT # 1 ANSWERS

1. **Max 8 circuits on an LS/GS Trunk Card**
2. **Command 501,
Command 518,
Command 532,
Command 555,
Command 559,
Command 577,
Command 543,
impossible.**
3. **LS/GS b = 1, E&M b = 2, DID b = 0**
4. **For unused (unconnected) trunks b should be set to 0 or the trunk will be accessed when the Trunk Group Access Code is dialed. The trunk will fail diagnostics and cause an alarm (likely AL 10 NO LOOP CURRENT).**

ASSIGNMENT #2 ANSWERS

1. **Command 535 Register 4 Field d = 1,
Command 580 Register 4 Field d = 2,
Command 514 Register 4 Field d = 3,**

ASSIGNMENT #3 ANSWERS

1. **Station, Hunt Group, Ring Group, Night Bell, RMATS**
2. **Command 535 Register 4 Field d = 0, Field efg = 161,
Command 553 Register 4 Field d = 0, Field efg = 167,
Command 510 Register 4 Field d = 0, Field efg = 000,
Command 543 Register 4 Field d = 0, Field efg = 016,
Command 579 Register 4 Field d = 0, Field efg = 123,
Command 552 Register 4 Field d = 0, Field efg = 022**

- **Review the following section AN EXPLANATION OF TRUNK FORMS**

SX-50™ DPABX: TRUNK PROGRAMMING - COMMANDS 501-580
LAB PROJECT

INSTRUCTIONS:

The following exercise is a self-teaching assignment on Trunk programming, Commands 501-580.

SX-50™ DPABX - TRUNK PROGRAMMING

Trunk Group Membership

Recall that default programming places all LS/GS Trunks in Trunk Group 1. Trunks that are not connected a CO line will cause an alarm when they are selected in the trunk hunting process. That is, if a user dials 9 and gets a trunk circuit that is not connected, an alarm will be raised.

In the Trunk Group programming assignment this was temporarily resolved by making the trunk group terminal hunting (i.e. always circuit 1 unless busy).

The best way to resolve this situation in the field is to remove unconnected trunks from any trunk group.

- **Remove all your unconnected trunks from trunk groups by making them Incoming Only.**
- **Make 1 trunk circuit a member of Trunk Group 3. Make a call on this trunk by dialling the access code for Trunk Group 3 (78) plus the desired number.**

Trunk Answer Points

By default LS/GS Trunks ring in to the console (LDN 1) during day service and to the Night Bell during night service. However, the day and night answer points for each trunk are programmable.

- **Provide the following answer points:**

	DAY	NIGHT
Trunk Circuit #1	LDN 1	Night Bell
Trunk Circuit #2	Hunt Group 1	Ring Group
Trunk Circuit #3	Ring Group	Extension 100
Trunk Circuit #4	Extension 100	LDN 2

SX-50™ DPABX: AN EXPLANATION OF TRUNK FORMS

SX-50™ DPABX: AN EXPLANATION OF TRUNK FORMS

AN EXPLANATION OF TRUNK FORMS

COMMANDS 501 – 580

REGISTER 1

1. TRUNK GROUP MEMBERSHIP

Incoming Calls Only

Select this option if a trunk is to be used for incoming calls only.

Trunk Groups 1-6

Use this option to place trunks in a trunk group. Any trunk that makes outgoing calls, including Direct Trunk Select and Direct Line Select, must be placed in a Trunk Group. Note: DTS trunks will be skipped in hunting.

2. TRUNK ALARM CONTROL

With this option enabled, NO RELEASE ACKNOWLEDGE and NO SEIZE ACKNOWLEDGE problems with a trunk will cause the ALARM indicator on the console to ring.

3. TRUNK HARDWARE TYPE

Short Analog CO Trunk

Use this option for Behind PABX connections or if the distance to the CO is less than 2Km.

Long Analog CO Trunk

This is the most common option. Use this option when connecting to a CO over 2Km away.

Analog Toll Office Trunk

Select this option if the CO is a Long Distance Central Office.

Analog Tie Trunk

Select this option for interfacing E&M Trunks to the Public System.

Satellite Tie Trunk

Select this option for behind PABX tie connections.

Short Analog DID Trunk

Used for DID Trunks less than 2Km from the SX-50™ DPABX

Long Analog DID Trunk

Used for DID Trunks more than 2Km from the SX-50™ DPABX

4. TRUNK CLASS OF SERVICE (INWARD DIAL)

0 = Not Inward Dial Trunk

Select this option if the trunk will NOT be used as a DISA or E&M trunk.

COS 1 to 9

This option applies a Class of Service to an incoming trunk call (is to be treated as an extension). This applies to DISA or E&M tie trunks.

5. INWARD DIAL DELAY BEFORE ANSWER

With delay enabled the calling party will receive ringback (8 sec) before the system answers the call. Do not enable for E&M if it is used as a transparent tie.

6. CONNECT TO OUTGOING TRUNK WITHOUT THIRD PARTY

With this feature enabled DISA and E&M users may access a trunk without going through the Attendant Console.

7. INWARD DIALING ARS ROUTING CLASS OF SERVICE

This option sets the RCS number of the incoming trunk.

When a DISA or E&M Call comes into the SX-50™ DPABX and selects an outgoing route (i.e. Trunk-to-Trunk) the call is treated under the conditions of ARS and the RCS number of the incoming trunk.

8. TRUNK USE

This option specifies the type of trunk service type. If the trunk is unused then select option 0 = Disabled.

9. TRUNK DIALING TYPE

For the type of service for incoming call type.

REGISTER 2

1. TRUNK OUTPULSING BREAK/MAKE RATIO

This feature allows the trunk to conform to different Central Office rotary dial specifications.

2. DISCONNECT SUPERVISION GUARANTEED

If this option is set to Yes then the SX-50™ DPABX will look for a disconnect signal from the Central Office. If it set to No then disconnect supervision is not expected, however, the SX-50™ will still acknowledge a disconnect signal from the CO. In order to connect two trunks together, this option must be enabled for at least one of the trunks.

3. DISAPPEARANCE OF REVERSAL IS A DISCONNECT

The PABX treats the disappearance of a Reversal from the Central Office as a disconnect signal. The PABX will then disconnect the trunk.

4. REVERSAL MEANING ON CALL ORIGINATION

Enable this feature if a Reversal from the Central Office means a call is incoming to the PABX.

5. DISCONNECT TIMING

Select a time which the PABX considers a far end on-hook condition to be a disconnect.

6. START TYPE

Select Loop start or Ground start to match trunk to facilities.

7. TRUNK HANG-UP DELAY (GUARD) TIMER

No Delay

With this option enabled the trunk is free to accept internal or external calls immediately after the previous call has been disconnected.

1 to 16 Seconds

With this option enabled the trunk is busied-out for a selectable period after a call is disconnected. This prevents accidental connections for calls using that trunk immediately after.

REGISTER 3

1. **TIE LINE DISCONNECT TIMER**

Select this option if the far end is to be monitored for disconnect.

2. **E&M TRUNK LEAD INVERSION**

Select "M" inversion for Type I Back-to-Back connections. Select No inversion for connecting E&M Trunks to the Public Network or to Type V E&M trunks.

3. **E&M DELAY DIAL OUTGOING**

The far end may send a signal telling the PABX to cease outpulsing of digits. This delay signal may be sent before or during outpulsing.

4. **E&M WINK START INCOMING ENABLE**

Select this option if the receiving PABX is required to send a signal to the transmitting PABX indicating that a trunk has been seized.

5. **E&M WINK START OUTGOING ENABLE**

Select this option if the transmitting PABX must receive a signal from the receiving PABX before outpulsing digits.

REGISTER 4

1. DICTATION TRUNKS (FOR LS/GS TRUNKS)

Select this option if the trunk is used to interface to dictation equipment.

NOTE: When this option is enabled, any outgoing calls on this trunk will retain a DTMF Receiver for the duration of the call. The DTMF Receiver is used for tone-to-pulse conversion.

2. INTER-RINGING DELAY (FOR LS/GS TRUNK)

This option is used to specify the duration during which the system tries to detect the minimum ring burst, indicating the persistence of an incoming call.

3. DAY ANSWER MODE DAY ILLEGAL NUMBER INTERCEPT MODE (DID/DISA)

Incoming trunk calls that are NOT DISA, Tie or DID must have an answer point.

Incoming DISA, Tie or DID calls that misdial, dial an illegal number, or dial an extension with "Inward Restriction DID" enabled in its COS can be routed (intercepted) to an answer point instead of receiving busy tone. (Register 4 Illegal/VACANT Number Intercept must be enabled)

LDN 1, LDN 2, LDN 3

Select this option to make incoming calls or intercepts ring the console.

Direct-In Line

Select this option if the trunk is to be directly routed to a destination other than the console. NOTE: If this option is selected, the answer point will be as determined in DAY ANSWER POINT below.

4. DAY ANSWER POINT (DAY ANSWER MODE = 0)

DAY INWARD DIAL TRUNK INTERCEPT ANSWER POINT (DID/DISA)

If a Direct-In Line is selected as an Answer point in day mode then the answer point must be selected from one of the following options.

Night Bell

Select this option if the incoming call has been routed to a night bell (or equivalent) and Trunk Answer From Any Station is desired.

Stations 001 to 160

Select this option if the Direct-In Line is to be routed to a station. NOTE: USE the 001-160 Station Equipment Number for telephones and SUPERSETS.

Hunt Group 1 to 6

Select this option if the Direct-In Line is to be routed to one of the six Hunt Groups.

Ring Group

Select this option if the Direct-In Line is to be routed to the Ring Group.

RMATS

Select this option if the Direct-In Line is to be routed to the RMATS line.

5. BUSY INTERCEPT

If this option is ENABLED, incoming DISA and DID calls to a busy extension are routed to the Intercept Point. Otherwise busy tone is returned.

6. DO NOT DISTURB INTERCEPT

If this option is ENABLED, incoming DISA and DID calls to a DND extension are routed to the Intercept Point. Otherwise busy tone is returned.

7. NO ANSWER INTERCEPT

If this option is ENABLED, incoming DISA and DID calls to an unanswered extension are routed to the Intercept Point unless overridden by the extension's Call Forward -- No Answer programming. Otherwise busy tone is returned.

8. ILLEGAL/VACANT NUMBER INTERCEPT

If this option is disabled, incoming DISA and DID callers that misdial or dial an invalid number will receive busy tone.

When enabled, incoming DISA and DID callers that misdial or dial an invalid number will be routed to a destination as determined in the Day or Night Illegal number intercept point (registers 4 or 5).

REGISTER 5

**1. NIGHT ANSWER MODE
NIGHT ILLEGAL NUMBER INTERCEPT (DID/DISA)**

This works very similar to the Day Answer Point programming.

LDN 1, LDN 2, LDN 3

Select this option to make incoming calls or intercepts ring the console during Night Service.

Flexible Night Service

Select this option if calls are to be routed to a Station, Hunt Group, Ring Group, Attendant Console, or Night Bell (TAFAS).

**2. NIGHT ANSWER POINT (NIGHT ANSWER MODE = 0)
NIGHT INWARD DIAL TRUNK INTERCEPT ANSWER POINT (DID/DISA)**

If Flexible Night Service is selected as an Answer point in Night Answer Mode the answer point must be selected from one of the following options.

Night Bell

Select this option if the incoming call is to be routed to a night bell (or equivalent) and Trunk Answer From Any Station is desired.

Stations 001 to 160

Select this option if the call is to be routed to a station.

Hunt Group 1 to 6

Select this option if the call is to be routed to one of the six Hunt Groups.

Ring Group

Select this option if the call is to be routed to the Ring Group.

RMATS

Select this option if the call is to be routed to the RMATS line.

NOTE: The Attendant can override the Night Answer Point programming using Flexible Night Service commands.

3. DID NIGHT ANSWER POINT

DID calls will be automatically routed to the Night Answer Point if this option is selected.

REGISTER 6

1. DID START TYPE

DID are incoming calls that send digits to the PBX. Some COs provide an opportunity for the PBX to prepare itself for incoming digits. Older Step by Step COs do not provide this service and pulse digits immediately after seizing the PBX trunk.

Immediate Dial

Enable this option if the CO will seize the PABX trunk and outpulse the digits immediately.

Wink Start

Enable this option if after the CO seizes the trunk, it waits for a Wink (reversal–return to normal of 140 to 290 msec) from the PABX before the CO begins pulsing digits.

Delay Dial

Enable this option if after the CO seizes the trunk, and the SX-50™ DPABX reverses Tip and Ring, the CO will send the digits only after the PBX returns to normal polarity (after a delay of 100 to 150 ms after the trunk seizure).

2. INCOMING ADDRESS SIGNALLING

The DID trunk circuit can be programmed to accept 3 types of dialing: Loop–Dial Pulsing, Battery and Ground Pulsing and DTMF.

Loop–Dial Pulsing

Enable this option if the CO dials digits by making and breaking the DC loop.

Battery and Ground Pulsing

Enable this option if the CO sends digits by applying battery to the Tip and ground to the Ring. Since the PABX is already applying battery to the Ring and Ground to the Tip, this doubles the current flow in the circuit during a dialled digit. This dialling type is used for longer loop lengths (i.e. greater than 3000 ohms loop resistance).

DTMF

Enable this option if the CO sends DTMF digits.

3. NUMBER OF DIGITS EXPECTED

State the number of digits the CO will send. (1-9)

4. NUMBER OF DIGITS TO BE ABSORBED

Starting from the beginning of the digit string the PBX will ignore a specified number of digits. (0-8)

5. DIGITS TO BE INSERTED

The actual digits programmed here will be inserted prior to digits that were not absorbed. (1-4)

REGISTER 7

1. INCOMING SEIZURE DEBOUNCE TIMER

This feature states the minimum time a seizure signal must be stable prior to being recognized as a incoming call. This timer may be set to 150 msec to guard against CO lines that intermittantly have glitches and spikes.

2. WINK TIMER

If the trunk is programmed as a Wink Start (register 6) this timer is used to match the wink start requirements of the CO.

3. PERMANENT-SIGNAL PARTIAL DIAL TIMER

This timer determines the maximum length of time the SX-50™ DPABX will wait for the CO to complete the dialing sequence. The PABX will wait up to 30 sec.

4. DID DISCONNECT TIMER

This timer determines the length of time the SX-50™ DPABX requires a disconnect signal before dropping the call. If CO lines intermittently drop out, set this timer to its maximum of 300ms.

5. RELEASE ACKNOWLEDGE TIMER

This timer determines the maximum amount of time the SX-50™ DPABX will wait for an open loop signal from the CO. This timer starts when the SX-50™ disconnects the call. If the CO does not respond with an open loop condition within the specified time, an alarm is raised.

SX-50™ DPABX: OVERFLOW & TAFAS

INSTRUCTIONS:

The following exercise is a self-teaching assignment on the Trunk Answer From Any Station feature.

SX-50™ DPABX – OVERFLOW & TAFAS

Introduction

Often it is desirable to allow a trunk to ring in to the night bell and let the call be answered by someone other than the attendant. There are 2 main reasons for this;

- 1) If the attendant is swamped with calls, another station can be used to answer incoming calls.
- 2) At night only a security guard is on duty. When the call comes in the security guard hears the bell and can answer the call from any station by dialling a code.

The first feature is called OVERFLOW.

The second feature is called Trunk Answer From Any Station (TAFAS)

- **Read about OVERFLOW and TAFAS in the Features Description section.**

OVERFLOW CONTROL System Option Programming

This programming is performed in System Options, Register 8.

- **Read OVERFLOW CONTROL in the Customer Data Entry section.**

As indicated overflowed calls can also ring the night bell during the day or night, immediately or after a timeout.

Field "c" controls the Overflow Mode during day service.

Field "d" controls the Overflow Mode during night service.

Field "e" sets the timer to determine how long the console will ring before the calls will overflow.

- **Read Automatic Night Service in the Features Description section.**

If it is desirable to have an internal call to the console (dial 0) overflow, then field "f" can be programmed.

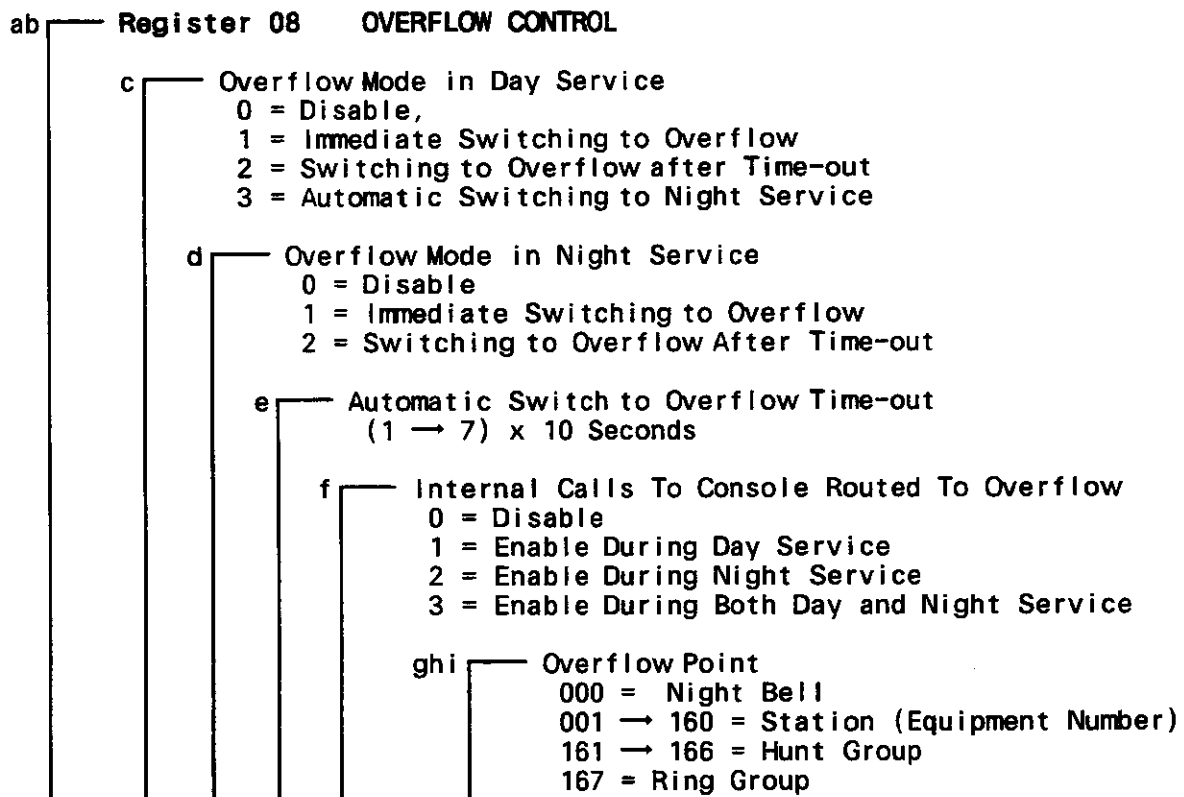
Field "ghi" set the overflow call answer point.

The night bell may be programmed as an answer point for a trunk. However, the night bell may also be programmed to ring for incoming calls that overflow from the console.

- Program CMD 100 Register 08 so that:

- 1) During the Day - Trunk calls to the console overflow after 10 seconds,
- 2) During the Night -Trunk calls to the console overflow immediately.
- 3) Internal Calls to the console ring the both the console and the overflow point at night.
- 4) The overflow point is the night bell.

COMMAND 100 SYSTEM OPTIONS PROGRAMMING



a	b	c	d	e	f	g	h	i
0	8							
Default	2	1	3	2	0	0	0	

ANSWERS

COMMAND 100 SYSTEM OPTIONS PROGRAMMING

ab Register 08 OVERFLOW CONTROL

c Overflow Mode in Day Service
 0 = Disable,
 1 = Immediate Switching to Overflow
 2 = Switching to Overflow after Time-out
 3 = Automatic Switching to Night Service

d Overflow Mode in Night Service
 0 = Disable
 1 = Immediate Switching to Overflow
 2 = Switching to Overflow After Time-out

e Automatic Switch to Overflow Time-out
 (1 → 7) x 10 Seconds

f Internal Calls To Console Routed To Overflow
 0 = Disable
 1 = Enable During Day Service
 2 = Enable During Night Service
 3 = Enable During Both Day and Night Service

ghi Overflow Point
 000 = Night Bell
 001 → 160 = Station (Equipment Number)
 161 → 166 = Hunt Group
 167 = Ring Group

a	b	c	d	e	f	g	h	i
0	8	2	1	1	2	0	0	0
Default		2	1	3	2	0	0	0

HANDS-ON EXERCISE

OVERFLOW and TAFAS Operation

From the previous lab project trunk circuit #1 was programmed to ring in to the night bell during the night.

- **Use TAFAS to answer an incoming trunk call that rings the night bell.**

Ringling the Console and Night Bell

- **Program CMD 100 Register 08 so that:**

1) During the Day – Trunk calls to the console also ring the night bells after 10 seconds,

2) During the Night –Trunk calls to the console also ring the night bell immediately.

Internal Calls to the console ring the both the console and the night bell at night.

Prove your programming works by calling in on a trunk programmed to ring the console. The night bell should ring accordingly.

SX-50™ DPABX: DISA TRUNKS

INSTRUCTIONS:

The following exercise is a self-teaching assignment on DISA Trunk programming.

SX-50™ DPABX – DISA TRUNK PROGRAMMING

Introduction

Usually, a LS/GS trunk is programmed to ring in to a fixed point. Using the Direct Inward System Access feature, the SX-50™ DPABX will answer with dial tone. The incoming caller can then dial and choose the destination.

- **Read Direct Inward System Access in the Customer Data Entry section.**

Note that the DISA trunk is given a class of service. The class of service applied to the trunk determines which PBX features the incoming caller may access. Typically this would be used to restrict outgoing access to trunk groups.

If a caller performs an illegal or invalid function the caller will receive reorder tone. The caller will then have to call the DISA trunk again.

A better solution is to route the caller to a destination (typically the console) when a violation occurs. The caller can then ask the destination for a transfer, etc. This is called Trunk Illegal Number Intercept.

- **Read about Trunk Intercepts in the Features Description section.**

Programming Trunk Illegal Number Intercept

The programming is done in 3 phases.

- 1) Enable Illegal/Vacant Number Intercept CMD 501 Register 4 Field k
- 2) Determine Trunk Illegal Number Intercept Point for the day CMD 501 Register 4 Field d, efg
- 3) Determine Trunk Illegal Number Intercept Point for the night CMD 501 Register 5 Field b, cde.

ASSIGNMENT #1 – DISA Operation

1. How many rings will an incoming caller hear before the system answers?

2. When is the DISA security code entered?

3. Where is the DISA security code programmed?

4. What condition must be in effect if the DISA trunk is a loop start and the caller wishes to call back out of the PABX on another trunk?

5. State the programming required so a caller on DISA trunk number 12 will ring the console on LDN 3 during the day, upon dialling an illegal number.

ANSWERS

1. **1 ring**
2. **Immediately after the system answers.**
3. **Command 193**
4. **The other trunk must have Disconnect Supervision Guaranteed; i.e. it must be a ground start CO trunk, or an E&M trunk.**
5. **Command 512 (for the DISA Trunk)
Register 4 k = 1,
Register 4 d = 3.**

HANDS-ON EXERCISE

Presently you should have trunks programmed with fixed answer points from previous assignments. You will use one of these as a DISA.

To make a trunk a DISA set CMD 5XX Register 1 Field j = 1 (DISA).

- **Create a DISA trunk by following the programming in the Features Description section.**
- **Make the day illegal number answer point LDN 1.**
- **Make the night illegal number answer point the night bell.**
- **Force incoming DISA callers to use the DISA security code.**
- **Change the security code.**

SX-50™ DPABX: E&M TRUNKS

INSTRUCTIONS:

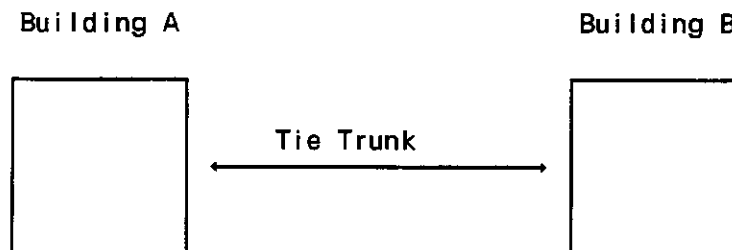
The following exercise is a self-teaching assignment on E&M Trunk programming and installation.

SX-50™ DPABX – E&M Trunks

Introduction

Often businesses have divisions that are located in separate buildings. The buildings may be situated side by side or in another city.

When telephone traffic is high between the divisions, a dedicated trunk (or trunks) to and from these buildings may be used. The dedicated trunk is called a Tie Trunk.



Only the Tie Trunk is shown in the diagram. Each building would have its own PBX with access to regular CO trunks.

Because the tie trunk is not connected to a central office, all signalling is the responsibility of the two PBXs. Loop Start or Ground Start trunks can't be used as they rely on the central office for battery, dial tone, ringing, and collection of dialled digits.

A DID trunk card circuit that is set to expect 0 digits becomes a Loop tie circuit. It provides battery and can collect digits, however, four problems may be encountered:

- It does not provide dial tone (making it difficult for the caller to determine if the circuit has been seized);
- It does not provide ringing (and can therefore only be used for one way calling);
- The loop length between the buildings may exceed the limits of the card's circuitry (2240 ohms);
- Call supervision signals are not provided by the Loop tie circuit.

In these cases, the type of trunk used is the E&M trunk as it is capable of complete call processing without assistance from a Central Office.

Wiring

The wiring for E&M trunks is ALWAYS M ==> E. The M lead transmits supervision and the E lead receives. If the far end is in a different city then the local telco will inform you where to connect your E&M wires. No matter what, your M lead MUST connect to the E lead of the far end trunk. The far end M lead MUST connect to your E lead.

For superior audio, a 4-wire configuration may be used. In a 4-wire connection, your Tip lead is connected to the far end Tip-Receive and your Ring lead is connected to the far end Ring-Receive lead.

- **Review E&M trunks in the module Introduction to Trunks**
- **Review E&M trunk wiring in the Shipping, Receiving, and Installation section.**
- **Read E&M Trunks in the Features Description section**

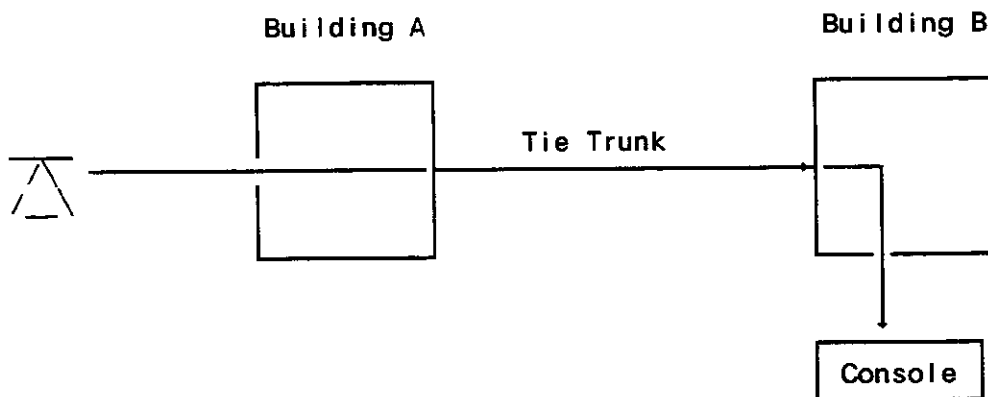
Accessing the E&M Trunk

Because E&M trunks serve a different purpose than LS/GS trunks, they are placed in a different trunk group. By default they are placed into trunk group 2 which has an access code of "8".

Like the LS/GS Trunk, the answer point may be fixed or determined via dialed in digits (DISA functionality).

Fixed Answer Points

In the diagram below, a user from Building A dials 8 and is connected to an E&M trunk. The M lead in PBX A signals the E lead in PBX B. The E&M trunk in PBX B has the console as a day and night answer point.



Programming for this is identical to LS/GS answer points.

- Review CMD 501-580 Registers 4 & 5 Day/Night Answer Points.

DISA functionality

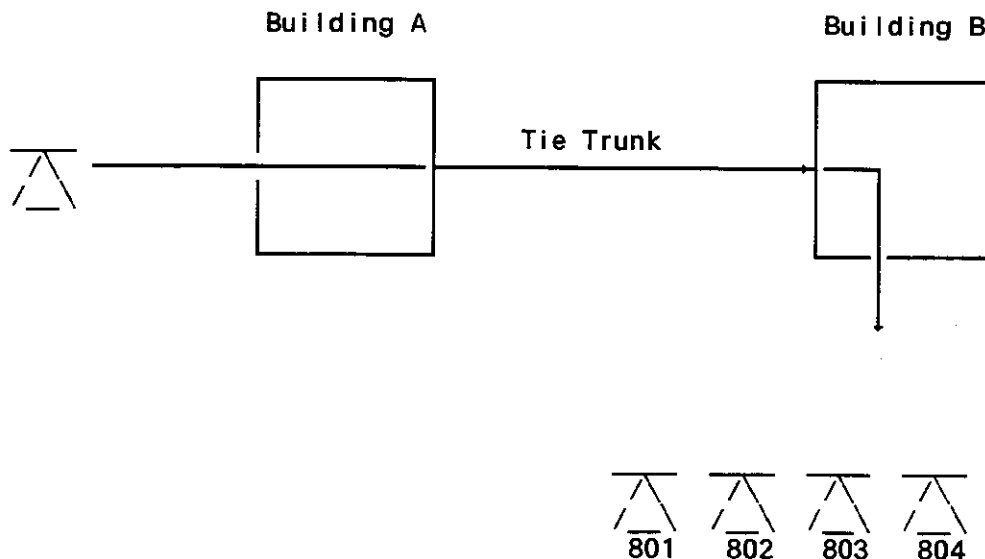
A very popular configuration of E&M trunks is DISA. The caller dials 8 + the user's extension number and reaches the far end directly. There are two advantages to this method;

- 1) The far end attendant is not required to process the call
- 2) The call appears internal to the caller.

Identified Trunk Group

To enhance the DISA feature, the Identified Trunk Group feature is used.

Normally, the trunk group access code is NOT outputted. That is, if the caller dials 8 235 then only the 235 is outputted to the far end. With identified trunk group enabled, the 8 is also outputted. Consider the example below.



If the telephones at the far end start with an "8" then a caller from building A can dial 801 and extension 801 will ring at the far end. Without Identified Trunk Group enabled, the "8" would be stripped and the 01 would be outputted.

This method is also used for joining PBXs together for expansion purposes.

- **Read Identified Trunk Groups in the Features Description section**
- **Read Identified Trunk Group in the section of this manual, An Introduction to Trunk Groups.**

Programming

CMD 501–580 Register 3 is used for E&M trunk programming. See the section in this manual, An Explanation of Trunk Forms, for more information.

Inverting the M lead

When using Type I in a back to back configuration, the M lead must be inverted. This means that the voltages normally associated with an offhook and onhook are reversed. It does NOT effect the M ==> E wiring!

ASSIGNMENT # 1 – E&M Trunks

1. State the function of the connections. Indicate if they are Transmit, Receive or bothway.

M Lead

E Lead

T Lead

R Lead

TR Lead

RR Lead

2. What digits get outpulsed if 8 253 is dialed and Identified Trunk Group is NOT enabled?

3. What digits get outpulsed if 8 253 is dialed and Identified Trunk Group is enabled?

4. What card has the E&M trunk?

5. Why can't LS/GS trunks work back-to-back?

6. What programming determines if an E&M trunk is DISA or Direct-in Line (ie fixed answer point)?

ANSWERS

1. **SEE ANSWERS IN INTRODUCTION TO TRUNKS**
2. **253 (The 8 is dropped like a usual call)**
3. **8 253 (Identified Trunk group will prevent the trunk group access code from being deleted).**
4. **The Universal Cards hold the E&M Trunk modules.**
5. **LS/GS trunks behave like telephones – they have no battery, cannot provide tones, and cannot collect digits.**
6. **Command 5XX Register 1 Field j**

HANDS-ON EXERCISE

In this lab project you will require 2 E&M trunks. If you have access to an E&M trunk in another PBX you can cross-connect them in a back to back situation as shown below.



If you only have access to the SX-50™ DPABX, use 2 E&M trunks and cross-connect them together in a back to back configuration. Unfortunately, identified trunk group cannot be demonstrated in this configuration.

Switch Settings

The E&M module has switches to be set.

- **Locate the E&M Switch Setting table on page 30 of the Shipping, Receiving, and Installation section.**

Use the following settings for the lab.

Switch 1 CLOSED - In a back to back configuration a high gain is not required.

Switch 2 OPEN - A high transmission level is not anticipated

Switch 3 CLOSED - Use Complex Signalling impedance

Switch 4 CLOSED - Use Complex Signalling impedance

Switch 5 - your choice, wire accordingly

Switch 6 CLOSED - Use Type I

Switch 7 NOT USED -

Switch 8 NOT USED -

- **Make 2 E&M trunks work back to back with the console LDN 3 as a fixed answer point day and night.**
- **To check your programming, dial "8". The console should ring on LDN 3.**

If it doesn't work check the following;

Wiring - M to E, E to M, T to T, R to R (2 wire)

Both E&M modules have identical switch settings

Both E&M modules have identical programming

M lead is programmed for inversion for BOTH E&M trunks

- **After you get the basic E&M trunk working, program them for DISA.**

SX-50™ DPABX: DID TRUNKS

INSTRUCTIONS:

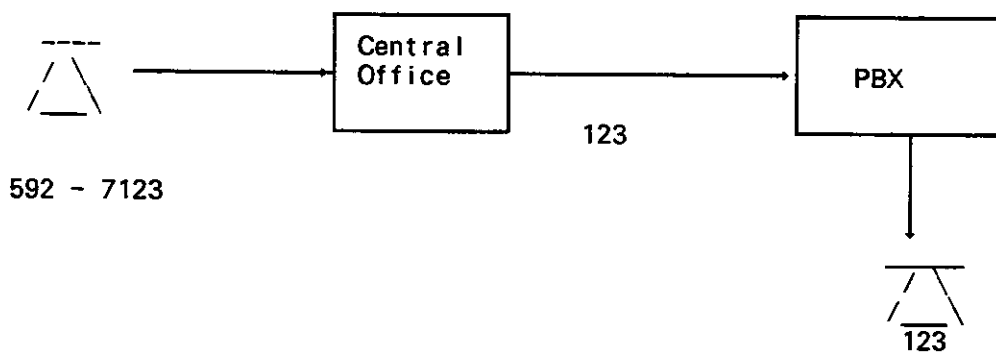
The following exercise is a self-teaching assignment on DID Trunk programming and installation.

SX-50™ DPABX – DID Trunks

Introduction

The DID trunk is used to reduce the traffic at the attendant by allowing external callers to directly access the desired destination. The CO seizes the trunk instead of sending ringing voltage, and actually sends digits to the PBX.

It works as follows.



- 1) An outside caller dials 592 - 7123.
- 2) The CO knows that 592 is a DID office code and will treat the call accordingly.
- 3) The CO strips the 592 7 and passes along the 123.
- 4) The PBX reads the incoming digits and routes the call to extension 123.

Wiring the DID Trunk

The connections for a DID Trunk are shown on page 46 of the Shipping, Receiving and Installation section.

- Review the wiring for DID trunks.

Programming the DID Trunk

The programming for DID trunks is completed in CMD 501-580.

- **Review the section of this manual -- An Explanation of Trunk Forms**
- **Read Direct Inward Dial trunks in the Feature Description section.**
- **Read DID Night Answer Point in the Feature Description section.**
- **Read DID Restriction in the Feature Description section.**
- **Read Attendant Controlled DID Restriction in the Feature Description section.**
- **Read Trunk Illegal Number Intercept in the Feature Description section.**

DID Applications

The DID trunk may be used in any situation where it is advantageous to inform external callers of internal extension numbers. One of the most popular applications is in a hospital.

Inquiring calls about patients can be routed directly to the patient's telephone, thus eliminating the need for the attendant. The telephone can be programmed to have its extension number match the room number. So that the telephone does not disturb other patients at night, a DID Night Answer point may be programmed (likely a nurse's station).

- **Read DID Trunk Card Operation on page 24 of the Engineering Information section.**

ASSIGNMENT #1 – DID Trunks

1. What is the function of the N, M, and X fields in Command 501-80, register 6?

2. A PBX has extension numbers that range from 100-130. The CO sends 4 digits to the SX-50™ DPABX (7 + XXX). State the programming for the N, M, and X leads.

3. Where does the battery feed originate in a DID trunk?

4. Where does the battery feed originate in a LS/GS trunk?

5. In a lab, what device could be used to simulate a DTMF-dialing CO connecting to a DID trunk?

ANSWERS

1. **N = Number of digits expected,
M = Number of digits to be absorbed,
X = Digits to be inserted.**

2. **N = 4,
M = 1,
X = blank**

3. **From the DID trunk in the PABX.**

4. **From the CO**

5. **A DTMF telephone (battery is supplied from the DID card)**

HANDS-ON EXERCISE

For the DID trunk to function, the CO must be capable of sending digits. The DID trunk actually supplies the battery so no power is required from the CO.

A device that can make/break a loop (send digits) without power is called an old-fashioned rotary dial telephone!

- **Connect a rotary dial telephone to a DID trunk.**

 - **Program the DID trunk to be immediate start, battery-and-ground pulsing.**

 - **Program N, M, and X in the following 3 configurations. Test each one.**
- 1) **N = 3, M = 0, X = 0 (ie just dial desired 3 digit extension number)**

 - 2) **N = 4, M = 1, X = 0 (ie absorb first digit, act on the next 3 digits)**

 - 3) **N = 4, M = 2, X = 1 (ie absorb the first 2 digits, insert the digit "1" in front of the last 2 digits)**

INSTRUCTIONS:

The following exercise is a self-teaching assignment on SUPERSET™ programming, Commands 401-80.

SX-50™ DPABX – SUPERSET™ PROGRAMMING

Introduction

Recall that SUPERSET™ sets are assigned extension numbers, Class of Service, Pickup group membership, etc in command 301-10.

The SUPERSET telephone may be further enhanced to have Line Appearances of other telephones or trunks. That is, if another telephone rings, the SUPERSET™ set can also be made to ring.

Appearances of other lines are programmed against the Speed Dial Keys.

Line Appearances

When a SUPERSET™ set has a line appearance of another telephone, BOTH telephones will ring. There are several types of appearances of other telephones that may be programmed.

Prime Line

The Prime Line is the usual extension number of the SUPERSET™ set. The prime line is programmed as Extension Number in Command 301-10.

- **Review command 301-10 and locate where the prime line (extension number) is programmed.**

The prime line is always the first line select/speed dial key.

- **Press DISPLAY and the first button. The prime line number will be shown on the display.**

Personal Outgoing Line

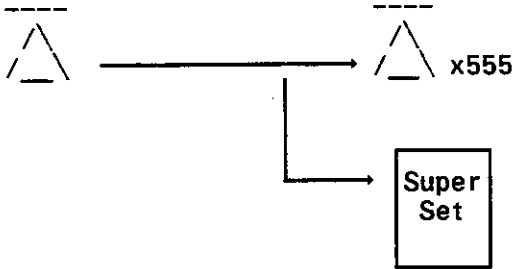
A Personal Outgoing Line is used for outgoing calls only. This allows the SUPERSET™ set user to make an outgoing call and still keep the SUPERSET™ set free for incoming calls.

Any key may be programmed as a Personal Outgoing Line line appearance

Key Line

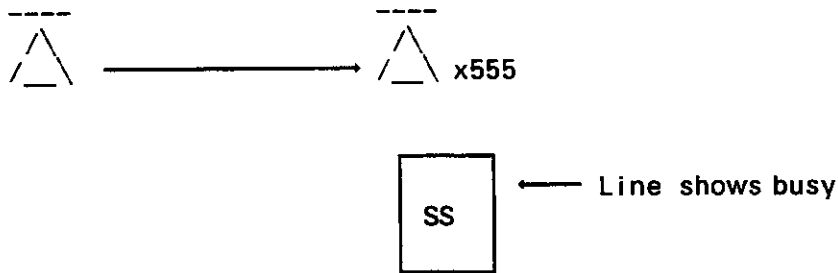
If a SUPERSET™ set has a Key Line appearance of another telephone then an incoming call to that telephone will ring both telephones. Either telephone can answer the call.

For example, a telephone dials extension 555. Extension 555 rings and so does the SUPERSET™ set.



Assume x555 answers the call. Anyone else trying to call 555 will receive a busy tone.

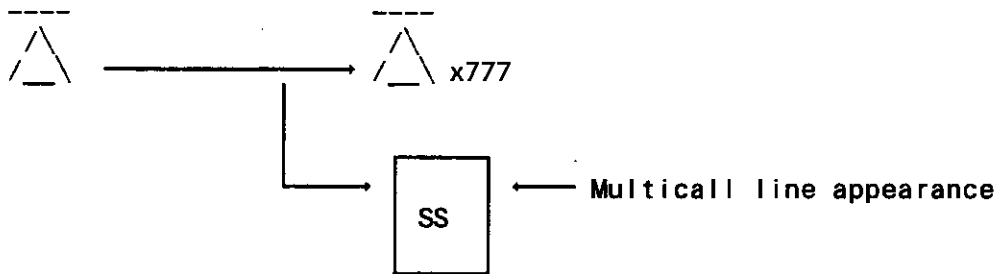
The SUPERSET™ Line Appearance of x555 shows a solid circle to indicate the line is busy. If the SUPERSET™ set user pressed the key, the user would be connected to the conversation.



Multicall Line

As the name suggests a multicall line will accept more than one call simultaneously to the same number. Like the Key Line, if a SUPERSET™ set has an appearance of another telephone both telephones will ring. Either may answer the call.

For example, a telephone calls extension 777. Both x777 and the SUPERSET™ set ring. Assume x777 answers the call. If another user dials 777 then the SUPERSET™ set will still ring.



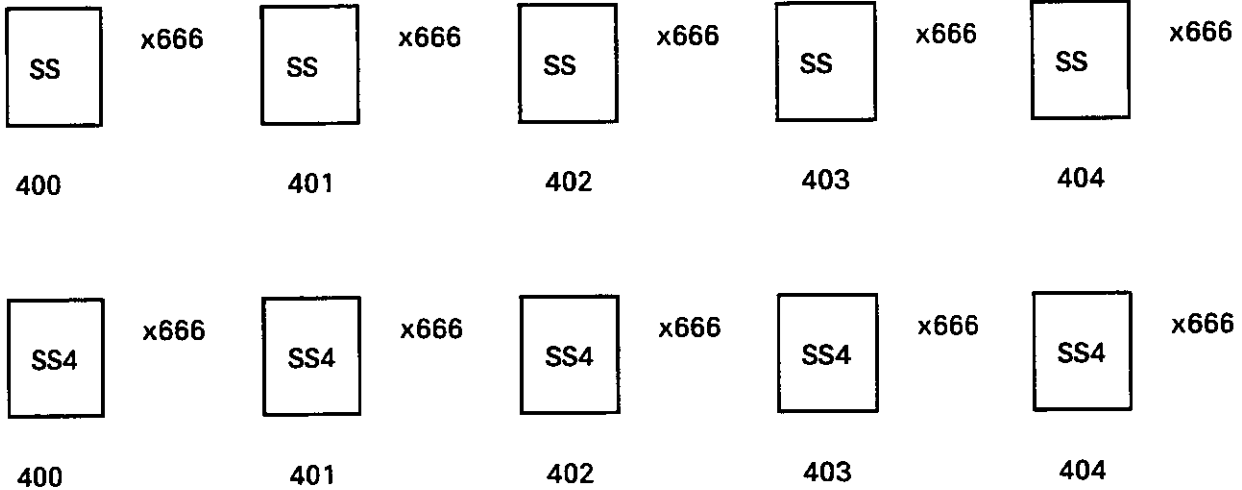
If there were 10 SUPERSET™ sets with appearances of 777 then there could be a total of 11 (x777 + the SUPERSET™ sets) calls to that extension number.

This feature makes SUPERSET™ sets very popular where a department is concerned.

If a Sales Department published the 777 as its number then anyone dialling 777 would ring every sales telephone. There could be as many simultaneous calls to 777 as there were line appearances.

The extension used as an appearance does NOT have to be an actual extension number. The number could be a "phantom" number. That is, it is not assigned to any telephone on the system and only appears in SUPERSET™ set programming.

The diagram shows 10 SUPERSET™ sets with an appearance of x666. There is no actual extension 666 on the system. Up to 10 people can access x666 simultaneously. Any idle SUPERSET™ sets will ring.



Programming Line Appearances

As any SUPERSET™ set may be programmed there is a Command number for each SUPERSET™ set. The Command Number is a 4 + the equipment number corresponding to the SUPERSET™ set (01-80).

- **Locate the SUPERSET™ Equipment Number Chart on page 18 of the Customer Data Entry section**
- **Locate Command 401-80 of the Customer Data Entry section.**

As shown in the form there are other types of programming for the line select keys. These will be discussed later.

- **Locate field "ab"**

Field "ab" determines the register and key number.

Except for the Prime Line, line appearances may be programmed on any of the keys 02-15.

- **Locate field "c"**

Once the particular key is selected, field "c" determines the type of line appearance. By default it is 0 = Speed Dial, 1 = Prime Line, 2 = Key Line, 3 = Multicall, and 7 = Personal Outgoing line.

- **Locate field "d"**

The line appearance can be programmed to ring immediately, after a delay, or not at all.

- **Locate field "e"**

Calls can be Originate Only, Receive Only or Bothway.

- **Locate field "fghi"**

The extension number of the telephone to appear is entered here. If the extension number is less than 4 digits long then leave the last fields blank.

- **Read Line Appearances in the Features Description section.**
- **Read Multiple Line Appearances in the Features Description section.**
- **Read Line Status Display in the Features Description section.**

ASSIGNMENT #1 – Line Appearances

Complete the following form.

Command Number – The SUPERSET™ circuit is located in Slot 4, circuit 6

Prime Line – The prime line is 345

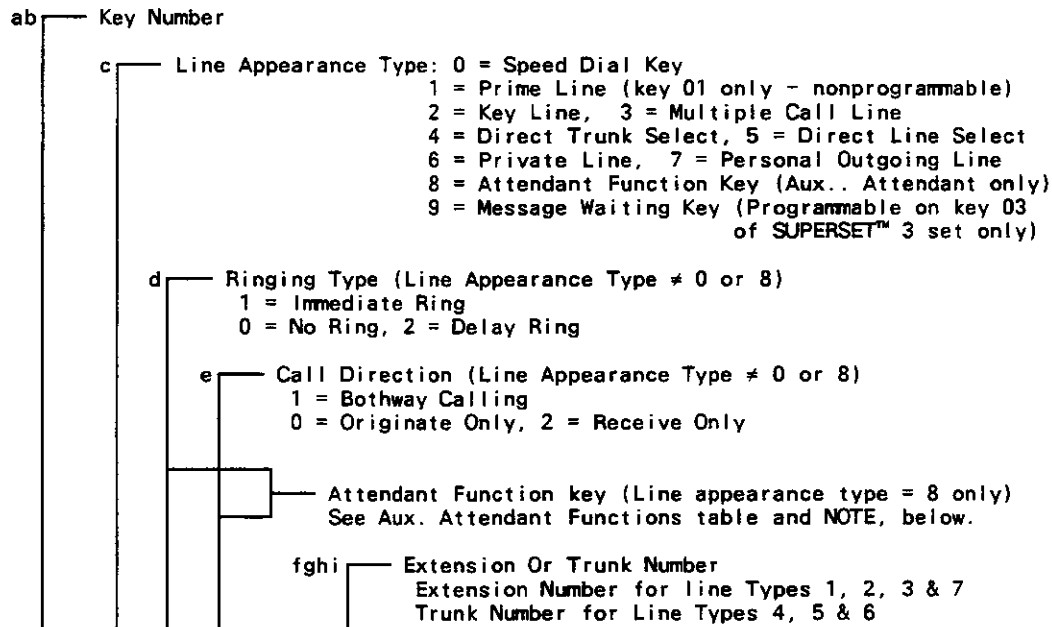
Personal Outgoing Line – Make key #2 the personal outgoing line

**Key Line Appearance – Make key #3 a key line appearance of extension 222.
Immediate ring, bothway calling.**

**Multicall Line Appearance – Make key #4 a multicall line appearance of extension
333. Immediate ring, bothway calling.**

COMMANDS 401 → 480 SUPERSET SETS 01 → 80 PROGRAMMING

COMMAND _____



a	b	c	d	e	f	g	h	i
0	1	1	1	1				
0	2							
0	3							
0	4							
0	5							
0	6							
0	7							
0	8							
0	9							
1	0							
1	1							
1	2							
1	3							
1	4							
1	5							

If field "c" = 8 (Attendant Function Key) then fields "d" and "e" work together to determine the type of function the key will perform. Use the chart below as a reference:

AUX. ATTENDANT FUNCTIONS	
01	= Dial 0
02	= Do Not Disturb
03	= Recall
04	= Hold 1
05	= Hold 2
06	= Hold 3
07	= LDN 1
08	= LDN 2
09	= LDN 3
10	= MESSAGE WAITING
11	= MSG Register
12	= Night Service
13	= Overflow

NOTE: A maximum of FIVE appearances of each Auxiliary Attendant function key can be programmed on the SX-50 system.

Direct Trunk Connections

As well as appearances of other telephones, the SUPERSET™ set can have direct access to trunks. There are 3 types of trunk connections. Two types are discussed in the Feature Description section.

- **Read Direct Trunk Select and Direct Line Select in the Features Description section.**

The other type is called a Private Line. The Private line is a DLS line except that it cannot transfer or conference the outside line. It appears on only one SUPERSET™ set.

Programming

Programming Direct Trunk connections is performed in identical fashion to line appearances. Follow the instructions on the form.

ASSIGNMENT #2 – Direct Trunk Connections

Complete the following form.

Command Number – The SUPERSET™ set is located in Slot 2, circuit 5

Prime Line – The prime line is 432

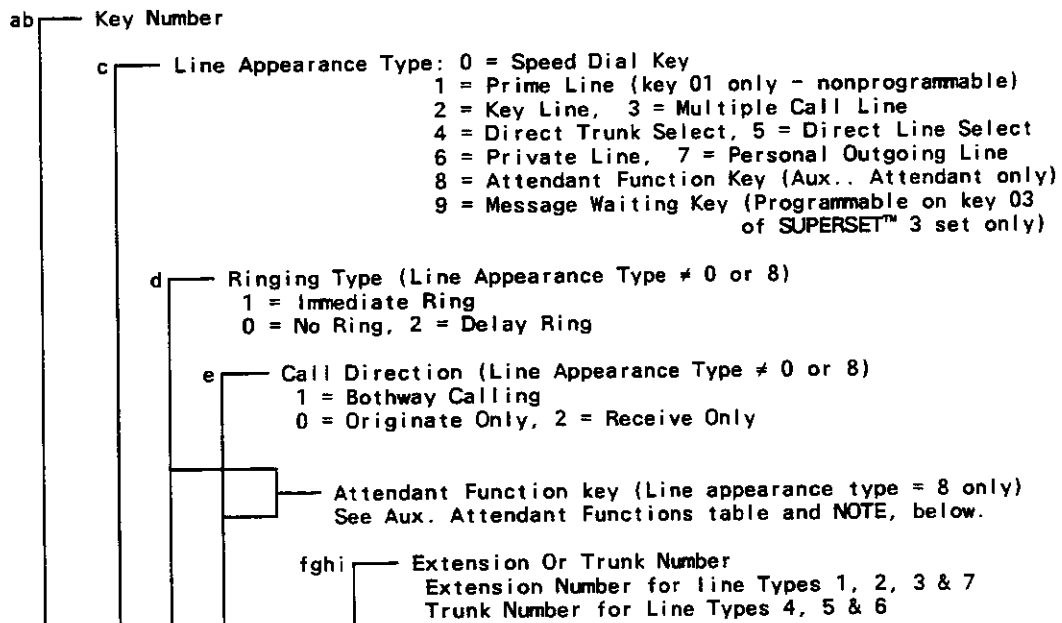
Direct Trunk Select – Make key 15 a DTS line of the trunk in Slot 10 circuit 8

Direct Line Select – Make key 14 a DLS line of the trunk in Slot 9 circuit 4

Private Line – Make key 13 a Private Line of the trunk in Slot 8 circuit 3

COMMANDS 401 → 480 SUPERSET SETS 01 → 80 PROGRAMMING

COMMAND _____



a	b	c	d	e	f	g	h	i
0	1	1	1	1				
0	2							
0	3							
0	4							
0	5							
0	6							
0	7							
0	8							
0	9							
1	0							
1	1							
1	2							
1	3							
1	4							
1	5							

If field "c" = 8 (Attendant Function Key) then fields "d" and "e" work together to determine the type of function the key will perform. Use the chart below as a reference:

AUX. ATTENDANT FUNCTIONS	
01	= Dial 0
02	= Do Not Disturb
03	= Recall
04	= Hold 1
05	= Hold 2
06	= Hold 3
07	= LDN 1
08	= LDN 2
09	= LDN 3
10	= MESSAGE WAITING
11	= MSG Register
12	= Night Service
13	= Overflow

NOTE: A maximum of FIVE appearances of each Auxiliary Attendant function key can be programmed on the SX-50 system.

Auxillary Attendant

The SUPERSET™ may serve as an Auxillary Attendant that works with the main attendant.

- **Read Auxillary Attendant in the Features Description section.**

Note: Keys may be programmed by the technician OR by the user at the actual SUPERSET™ set.

ASSIGNMENT #3 – Auxillary Attendant

Complete the following form.

Command Number – The SUPERSET™ set is located in Slot 3, Circuit 8

Prime Line – The prime line is 133

LDN 1 – Make LDN 1 ring on key 15

LDN 2 – Make LDN 2 ring on key 14

LDN 3 – Make LDN 3 ring on key 13

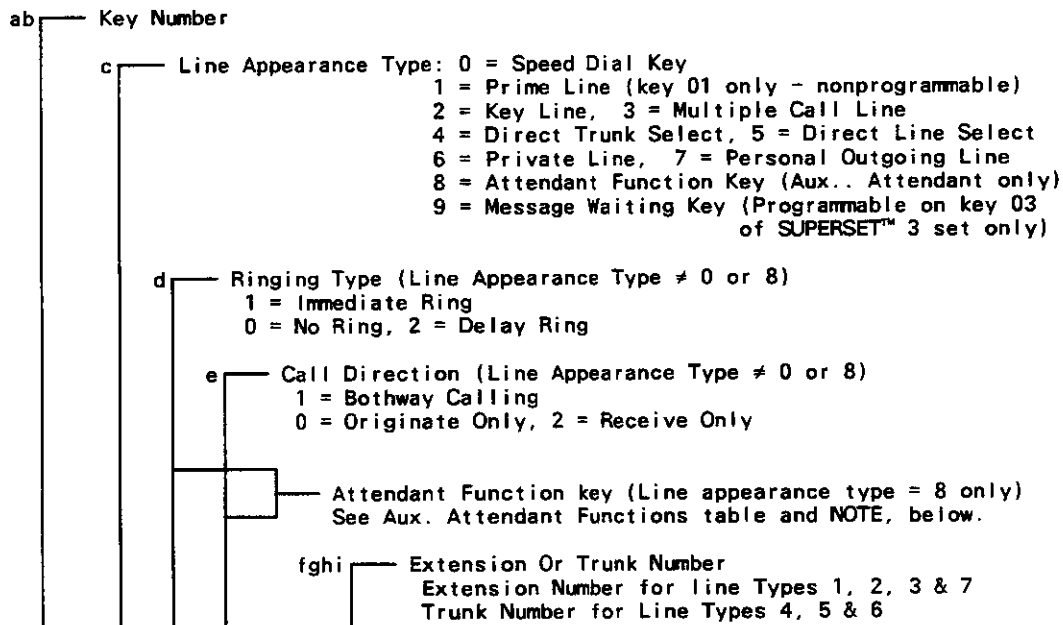
DIAL 0 – Make internal calls ring on key 12

HOLD 3 – Make key 11 HOLD 3

SX-50™ DPABX: SUPERSET™ PROGRAMMING - COMMAND 401-80

COMMANDS 401 → 480 SUPERSET SETS 01 → 80 PROGRAMMING

COMMAND _____



a	b	c	d	e	f	g	h	i
0	1	1	1	1				
0	2							
0	3							
0	4							
0	5							
0	6							
0	7							
0	8							
0	9							
1	0							
1	1							
1	2							
1	3							
1	4							
1	5							

If field "c" = 8 (Attendant Function Key) then fields "d" and "e" work together to determine the type of function the key will perform. Use the chart below as a reference:

AUX. ATTENDANT FUNCTIONS	
01	= Dial 0
02	= Do Not Disturb
03	= Recall
04	= Hold 1
05	= Hold 2
06	= Hold 3
07	= LDN 1
08	= LDN 2
09	= LDN 3
10	= MESSAGE WAITING
11	= MSG Register
12	= Night Service
13	= Overflow

NOTE: A maximum of FIVE appearances of each Auxiliary Attendant function key can be programmed on the SX-50 system.

ATTENDANT FUNCTION KEY PROGRAMMING

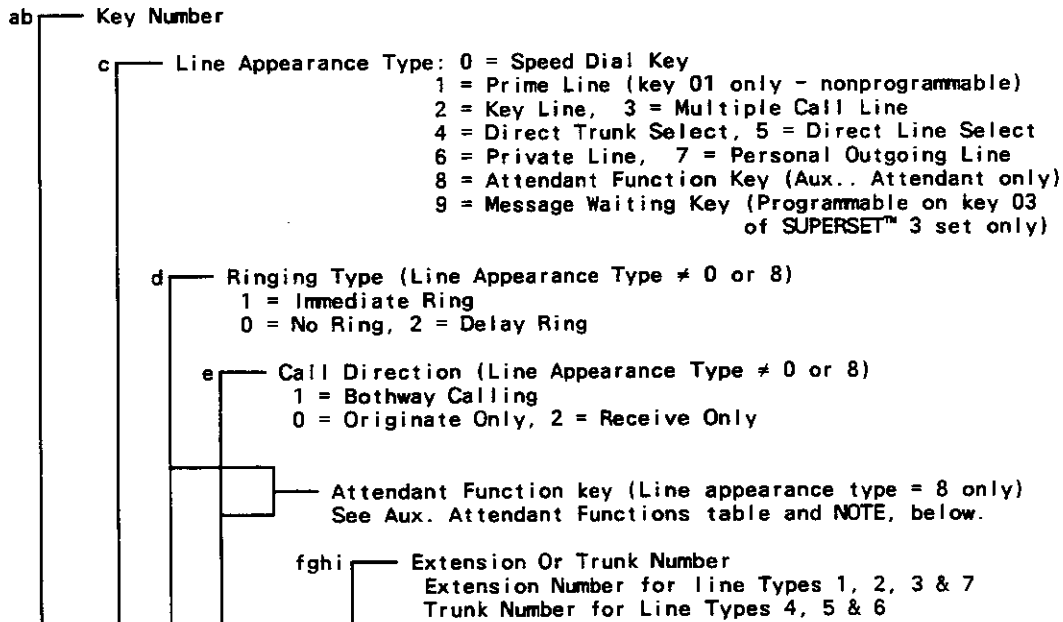
If field "c" = 8 (Attendant Function Key) then fields "d" and "e" work together to determine the type of function the key will perform. Use the chart below as a reference:

d	e		FUNCTION
0	1	=	Dial 0
0	2	=	Do Not Disturb
0	3	=	Recall
0	4	=	Hold 1
0	5	=	Hold 2
0	6	=	Hold 3
0	7	=	LDN 1
0	8	=	LDN 2
0	9	=	LDN 3
1	0	=	Message Waiting
1	1	=	MSG Register
1	2	=	Night Service
1	3	=	TAFAS Overflow

ASSIGNMENT #1 ANSWERS

COMMANDS 401 → 480 SUPERSET SETS 01 → 80 PROGRAMMING

COMMAND 430



a	b	c	d	e	f	g	h	i
0	1	1	1	1	3	4	5	
0	2	7						
0	3	2	1	1	2	2	2	
0	4	3	1	1	3	3	3	
0	5							
0	6							
0	7							
0	8							
0	9							
1	0							
1	1							
1	2							
1	3							
1	4							
1	5							

If field "c" = 8 (Attendant Function Key) then fields "d" and "e" work together to determine the type of function the key will perform. Use the chart below as a reference:

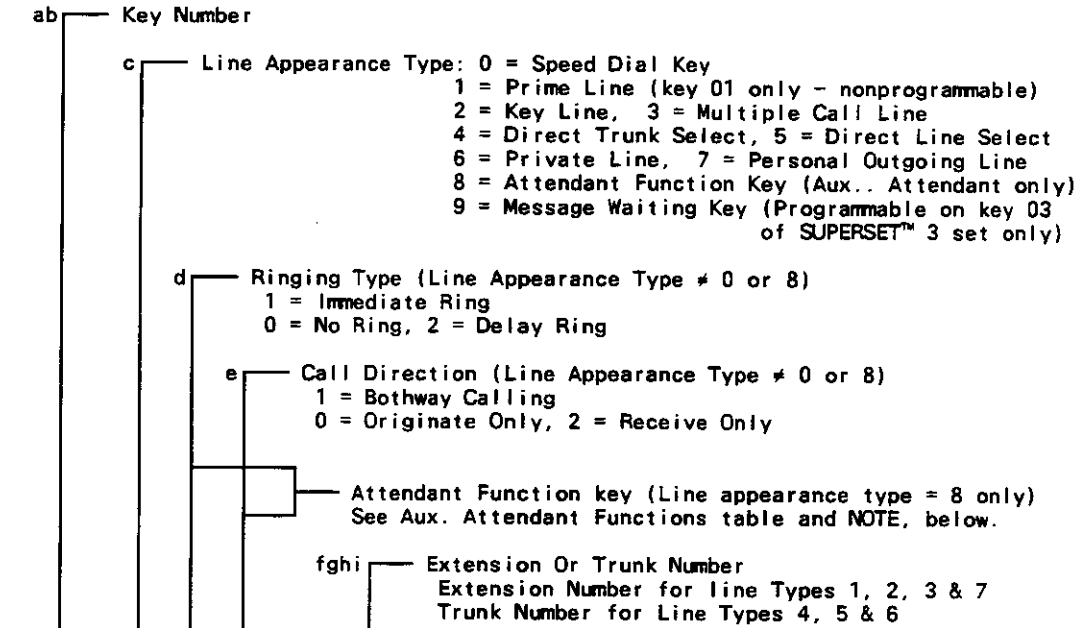
AUX. ATTENDANT FUNCTIONS	
01	= Dial 0
02	= Do Not Disturb
03	= Recall
04	= Hold 1
05	= Hold 2
06	= Hold 3
07	= LDN 1
08	= LDN 2
09	= LDN 3
10	= MESSAGE WAITING
11	= MSG Register
12	= Night Service
13	= Overflow

NOTE: A maximum of FIVE appearances of each Auxiliary Attendant function key can be programmed on the SX-50 system.

ASSIGNMENT #2 ANSWERS

COMMANDS 401 → 480 SUPERSET SETS 01 → 80 PROGRAMMING

COMMAND 413



a	b	c	d	e	f	g	h	i
0	1	1	1	1	4	3	2	
0	2							
0	3							
0	4							
0	5							
0	6							
0	7							
0	8							
0	9							
1	0							
1	1							
1	2							
1	3	6	1	1	5	9		
1	4	5	1	1	6	8		
1	5	4	1	1	8	0		

If field "c" = 8 (Attendant Function Key) then fields "d" and "e" work together to determine the type of function the key will perform. Use the chart below as a reference:

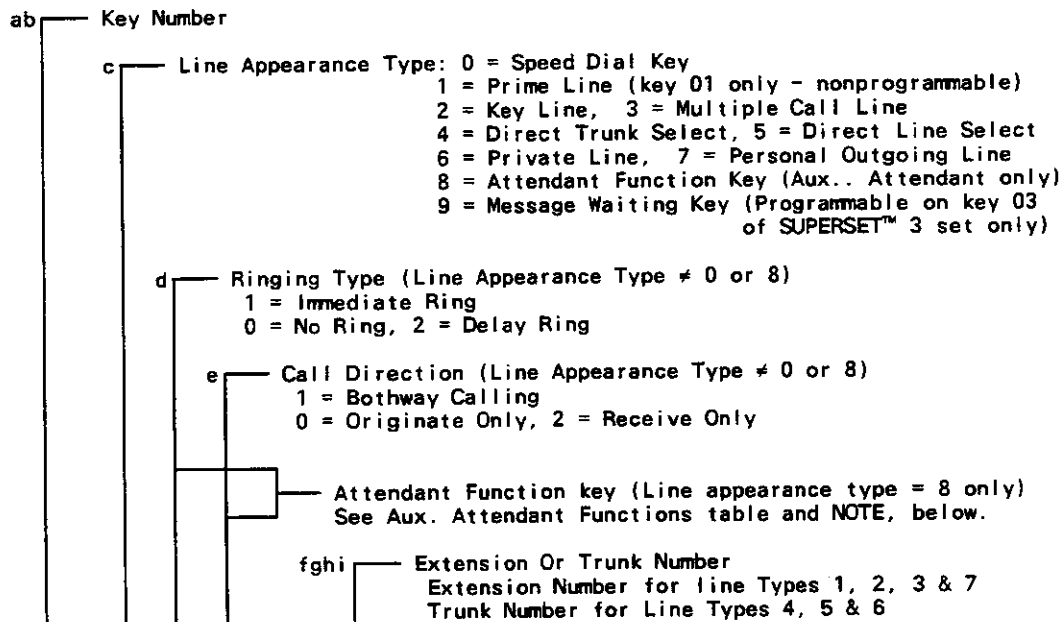
AUX. ATTENDANT FUNCTIONS	
01	= Dial 0
02	= Do Not Disturb
03	= Recall
04	= Hold 1
05	= Hold 2
06	= Hold 3
07	= LDN 1
08	= LDN 2
09	= LDN 3
10	= MESSAGE WAITING
11	= MSG Register
12	= Night Service
13	= Overflow

NOTE: A maximum of FIVE appearances of each Auxiliary Attendant function key can be programmed on the SX-50 system.

ASSIGNMENT #23 ANSWERS

COMMANDS 401 → 480 SUPERSET SETS 01 → 80 PROGRAMMING

COMMAND 424



a	b	c	d	e	f	g	h	i
0	1	1	1	1	1	3	3	
0	2							
0	3							
0	4							
0	5							
0	6							
0	7							
0	8							
0	9							
1	0							
1	1	8	0	6				
1	2	8	0	1				
1	3	8	0	9				
1	4	8	0	8				
1	5	8	0	7				

If field "c" = 8 (Attendant Function Key) then fields "d" and "e" work together to determine the type of function the key will perform. Use the chart below as a reference:

AUX. ATTENDANT FUNCTIONS	
01	= Dial 0
02	= Do Not Disturb
03	= Recall
04	= Hold 1
05	= Hold 2
06	= Hold 3
07	= LDN 1
08	= LDN 2
09	= LDN 3
10	= MESSAGE WAITING
11	= MSG Register
12	= Night Service
13	= Overflow

NOTE: A maximum of FIVE appearances of each Auxiliary Attendant function key can be programmed on the SX-50 system.

HANDS-ON EXERCISE

Program a SUPERSET™ set to have the following line appearances;

- Key #2 – Personal Outgoing Line
- Key #3 – Multicall Appearance of extension 100 (immediate)
- Key #4 – Key Line Appearance of extension 101 (delayed)
- Key #5 – DTS of the first LS/GS trunk circuit
- Key #6 – DLS of the second LS/GS trunk circuit

Prove that the Prime Line can be changed from Command 301-10 or Command 401-80.

Prove that a DTS or DLS trunk will not be accessed by dialling the trunk group access code to which it belongs.

Program a SUPERSET™ set to be an Auxillary Attendant. Include all possible function keys. Insure each function key works.

SX-50™ DPABX: INTRODUCTION TO ARS

INTRODUCTION

The SX-50™ DPABX has the flexibility of a programmable Automatic Route Select (ARS) feature which provides efficient use of trunks and controlled access to Long Distance facilities.

This self-paced introduction to ARS is designed to provide you with an overview of the abilities of ARS, and how ARS is programmed.

As well as gaining an appreciation for ARS you will perform a work project on ARS that includes designing a solution to an ARS problem.

- COMMENT -

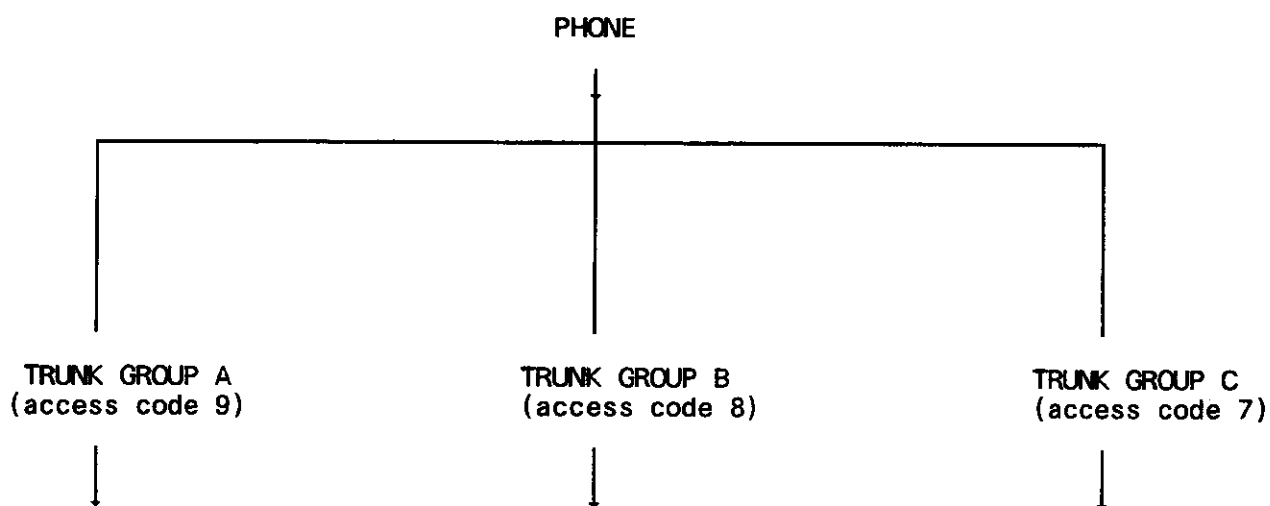
ARS is worth 50% of the Final Examination. Make sure you fully understand how the programming works. Information and assistance is available by calling the TRAINING HOTLINE.

TRADITIONAL EXTERNAL LINE SETUP

A PABX without ARS is usually set up so that Trunks are grouped into Trunk Groups.

The usual procedure for making external calls on PABXs without ARS is done by manually selecting the trunk group and then dialling the desired telephone number.

Typically this means dial a "9" followed by a 7 digit string.



So if a user dials 9 857 2405 then a trunk in Trunk Group A will be used to make a call.

This system has several disadvantages when it comes to long distance calls.

Suppose Trunk Group C is a special common carrier (SCC) that offers a reduced rate for certain long distance calls. The cost of calls will be reduced if users remember to access this specific trunk group when making a long distance call. However, it is up to the user to remember to select the cheaper route.

The situation becomes more complicated if Trunk Group B also connects to a special common carrier. The user must then remember when to use these SCCs as well as their trunk group access codes.

Finally, these SCCs often have Account Codes which must be dialled prior to making the call.

So to make sure the the cheapest route is always selected, the user must:

- Remember which SCC provides the cheapest route in a given situation
- Remember the Trunk Group Access Code for the SCC
- Remember the Account Code for each SCC

All the emphasis placed on the user to ensure that efficient and cost effective use of the SCCs is made.

EXTERNAL DIALLING WITH ARS

On the SX-50™ DPABX all the “memory work” is done by the DPABX. The user simply dials the number and the DPABX connects the call to the cheapest route.

For example, if a user dials 9 1 857 2405 during business hours, an SCC may provide a cheaper service than the public network. But after hours the public network may be cheaper. To make the most of this situation the DPABX would route the call to an SCC during the day and to the public network any other time.

Even though the user originally dialled “9” and selected Trunk Group A the DPABX may automatically connect the call to a DIFFERENT Trunk Group if it means a cheaper call.

But the ARS on the SX-50™ DPABX can do much more than that.

For long distance toll control ARS may be programmed to provide different levels of restriction for different users.

An example of this would be an Executive / Secretary situation.

An Executive would have access to all long distance numbers but certain restrictions may be placed on a secretary.

Some of the restriction scenarios could be:

- No Long Distance Calls or
- Long Distance Calls during the day only or
- Long Distance Calls using the cheapest route only or
- No Long Distance Calls with specific exceptions or...

SX-50™ DPABX: INTRODUCTION TO ARS

These different levels of restriction are accomplished by placing telephones into 1 of 4 Routing Class of Service (RCS) groups.

The groups are then programmed to have specific restrictions which apply to users in that group.

	RCS 0	RCS 1	RCS 2	RCS 3
CONDITIONS	ARS does not apply	Long Distance all day	In Area Long Distance	No Long Distance
MEMBERS	EXT 121 EXT 329 EXT 243 EXT 112	EXT 305 EXT 451 EXT 144 EXT 265	EXT 235 EXT 335 EXT 161 EXT 187	EXT 143 EXT 249 EXT 365 EXT 455

Which user groups can dial an In-Area long distance call?

RCS 3 is restricted from making any long distance calls.

Members in the groups RCS 0, RCS 1, and RCS 2 can make In-Area long distance calls. RCS 0 is a special group which bypasses ARS.

All the conditions (except RCS 0) are programmable. That is, any type of restrictions may be placed on any of the 3 groups.

MORE ARS FEATURES

During an ARS call if all trunks are busy in a Trunk Group, the call may be routed to a different Trunk Group. There may be up to 3 alternate routes. An Expensive Route warning tone is heard if the most expensive route has been selected.

Some SCCs have account codes that must be entered prior to using the facility. ARS will automatically outpulse programmed digits prior to sending the dialling digits – this means that no “memory work” is required.

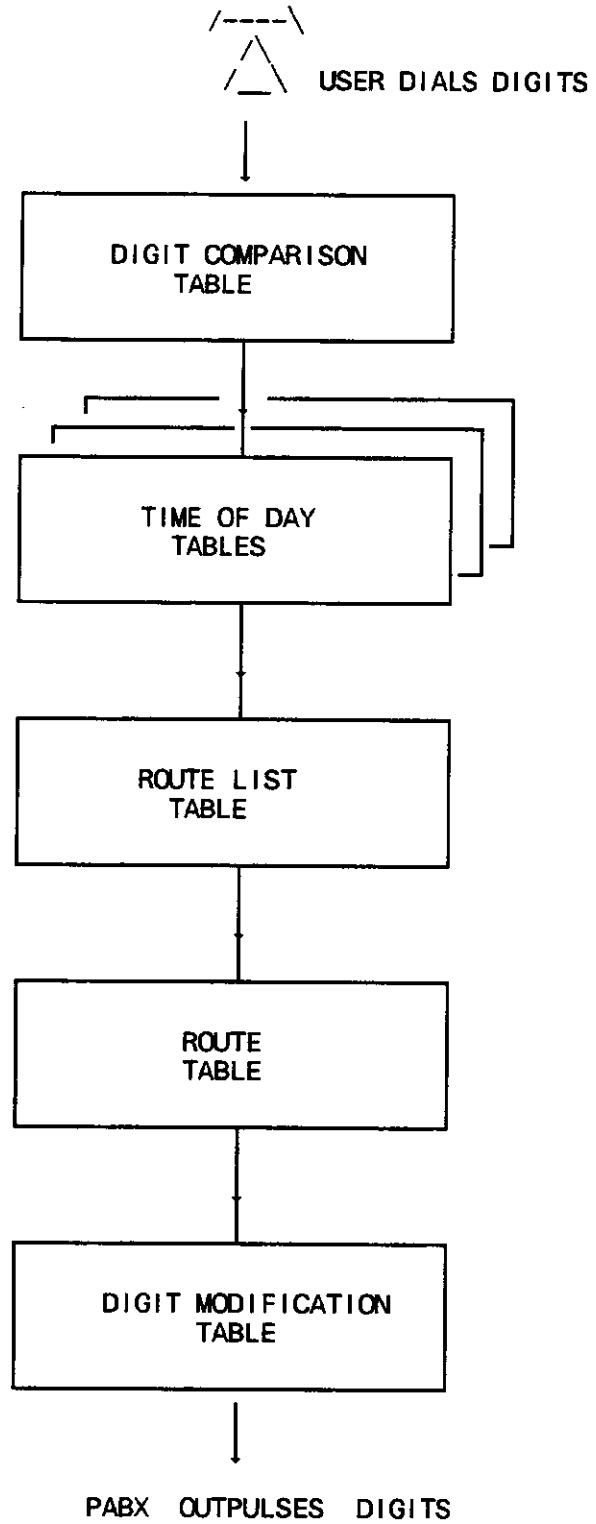
PROGRAMMING ARS

An ARS call is treated by the 5 Box Flowchart of programming as illustrated on the facing page.

ALL ARS calls follow through this flowchart.

For each box there is a form or forms.

Each box (except the last one, Digit Modification Table) points to an entry in the next table.



According to the 5 Box Flowchart the first box is the DIGIT COMPARISON TABLE.

To start an ARS call 2 things must be present.

- #1 The number must start with a valid Trunk Group Access Code

Suppose a user dials 9 1 857 2405.

In this case the "9" is programmed as a Trunk Group Access Code. This programming is not done in the ARS section so it will not be discussed here. Also, because ARS will automatically route the call, the number "9" does not actually select the trunk group to be used. The "9" only "wakes-up" ARS.

- #2 The number must match an entry in the ARS DIGIT COMPARISON TABLE.

The DIGIT COMPARISON TABLE checks to see that the number dialed matches an entry in the table. Consider the table below.

DIGIT COMPARISON TABLE

DIALED DIGIT STRING		WHICH TIME OF DAY TABLE?
9	—————>	19
9 0	—————>	02
* 9 1	—————>	03 *
9 1 3 0 3	—————>	07

Remember that the number 9 1 857 2405 must start with a Trunk Group Access Code and also match an entry in the DIGIT COMPARISON TABLE.

Let's assume that the Trunk Group Access Code (9) is correct. What about the number match?

The table does not show an exact match to the number 9-1-857-2405. But a partial match is made using the "9 1" entry.

A partial match is what the ARS program will use. Note the entry with a "9" is also a match. But the "9 1" is a closer number match so ARS uses this entry.

ARS DIGIT COMPARISON TABLE

Entry#	TOD#	Dialed Digits String
↓	↓	↓
0 0 1	1 9	[9]
0 0 2	0 2	[9 0]
0 0 3	0 3	[9 1]
0 0 4	0 7	[9 1 3 0 3]
0 0 5		[]
0 0 6		[]
0 0 7		[]
0 0 8		[]

↓

8 0 0		[]
-------	--	-----

Shown above is the actual DIGIT COMPARISON TABLE form.

Find the highlighted entry. Note that it has three sections: Entry #, TOD# and Dialed Digit String. The highlighted entry is shown below.

Entry #	TOD#	DIALED DIGIT STRING
0 0 3	0 3	[9 1]

The DIALED DIGIT STRING is programmed to specifically match or partially match a number dialed.

The TOD# stands for Time of Day Number. The TIME OF DAY tables are the next tables in the 5 Box Flowchart. In this case if somebody dials 91 XXX XXXX then they will be routed to Time of Day form # 03.

The ENTRY number is not programmable.

The Time of Day table(s) is the next box in the 5 box flowchart.

There are 45 of these tables.

TIME-OF-DAY 03

Hr Min RCS 1 RCS 2 RCS 3

1	0 0	0 0	0 0 6	0 0 6	0 0 0
2	0 0	0 0	0 0 0	0 0 0	0 0 0
3	0 0	0 0	0 0 0	0 0 0	0 0 0
4	0 0	0 0	0 0 0	0 0 0	0 0 0
5	0 0	0 0	0 0 0	0 0 0	0 0 0
6	0 0	0 0	0 0 0	0 0 0	0 0 0

This is 1 of the 45 tables. This table, 03, was selected by the DIGIT COMPARISON TABLE for the " 9 1" entry.

The TIME OF DAY form routes users depending on the time of day and the user's RCS number. If no route is listed then THE CALL IS BLOCKED.

Basic Blocking

In the example above there are no time of day restrictions but an RCS number is blocked.

- Which RCS number is blocked?

RCS 1 and RCS 2 both are given route list #006. RCS 3 is given route list 000 so it is blocked.

Time of Day Blocking

At certain times of the day (after hours) telephones may be blocked. This is accomplished using the other registers in the Time of Day form.

- Note there are 6 registers in the time of day table. These are used if routing/blocking based on the time of day is required.

TIME-OF-DAY 03

Hr Min RCS 1 RCS 2 RCS 3

1	0 8	0 0	0 0 6	0 0 6	0 0 0
2	1 7	0 0	0 0 6	0 0 0	0 0 0
3	0 0	0 0	0 0 0	0 0 0	0 0 0
4	0 0	0 0	0 0 0	0 0 0	0 0 0
5	0 0	0 0	0 0 0	0 0 0	0 0 0
6	0 0	0 0	0 0 0	0 0 0	0 0 0

Time of Day table 03 has been modified so that the following restrictions are in place;

When 9 1 857 2405 is dialled ...

RCS 1	RCS 2	RCS 3
Can make the call all day	Can make the call from 8 am to 4:59 pm	Is always blocked.

- Locate the Hr and Min columns.

This determines when the conditions to the right of the entry apply. There is an entry for 8 am (08 00) and one for 5 pm (17 00).

- Cover up the 5pm entry by placing your pencil along the row with 17 00.

- Locate the Route List Column for RCS 1, 2, and 3.

At 8 am who can make a call?

Looking to the right of entry #1 (08 00), RCS 1 & 2 can make a call on route list #6 but RCS 3 is blocked.

This condition will be in effect until 4:59.

- **Now cover up the 8 am entry by placing your pencil along the row with 08 00.**

At 5 pm who can make a call?

Looking to the right of entry #2 (17 00), RCS 1 can make a call on route list #6 but RCS 2 & 3 are blocked.

This condition will stay in effect until 7:59 am the next day.

Registers 3-6 aren't required.

(This page is left blank intentionally.)

The diagram on the facing page shows how the 2 forms work together.

- A user dials 9 1 857 2405
- The number matches the "9 1" entry in the Digit Comparison Table. The "9 1" entry points to TOD #03 or Time Of Day Table 03.
- Time of Day Table #03 treats the call according to the time of day and the users RCS number.

In this example assume the call is made at 8:30 am.

- If the user was in RCS 1 he is treated according to the conditions of Route List 006.
- If the user was in RCS 2 he is treated according to the conditions of Route List 006.
- If the user was in RCS 3 he was blocked.

Now what happens if it is after 5 pm (17:00)?

- RCS 1 gets routed according to the conditions of Route List 6
- RCS 2 has Route 000 which means the call is blocked
- RCS 3 has Route 000 which means the call is blocked

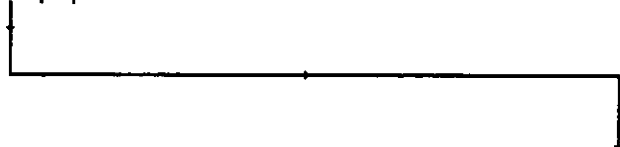
These conditions will remain until 8 am the next day.

ARS DIGIT COMPARISON TABLE

Entry# TOD# Dialed Digits String

↓ ↓ ↓

0 0 1	1 9	[9]
0 0 2	0 2	[9 0]
0 0 3	0 3	[9 1]



TIME-OF-DAY 03

Hr Min RCS 1 RCS 2 RCS 3

1	0 8	0 0	0 0 6	0 0 6	0 0 0
2	1 7	0 0	0 0 6	0 0 0	0 0 0

ASSIGNMENT

Fill in the blank ARS forms to satisfy the following conditions:

	RCS 1	RCS 2	RCS 3
Local Calls (9 +)	All Day Route 010	All Day Route 010	All Day Route 010
Long Distance Calls (9 + 1)	All Day Route 010	8 - 5 Only Route 010	None

ARS DIGIT COMPARISON TABLE

Entry#	TOD#	Dialed Digits String	
001	01-45		
-800			
0 0 1		[]
0 0 2		[]
0 0 3		[]
0 0 4		[]

ARS TIME-OF-DAY # ____

#	Per Start		Route List for		
	Hr	Min	RCS 1	RCS 2	RCS 3
1	00	00			
2	-23	-59			
3					

ARS TIME-OF-DAY # ____

1					
2					
3					

ANSWERS

ARS DIGIT COMPARISON TABLE

Entry#	TOD#	Dialed Digits String
001	01-45	[9
-800		[9 1
		[
		[
		[
		[
		[
		[
		[
		[

ARS TIME-OF-DAY #01

Per Start 701 → 745

#	Hr	Min	Route List for		
	-23	-59	RCS 1	RCS 2	RCS 3
1	0 0	0 0	0 1 0	0 1 0	0 1 0
2					
3					

ARS TIME-OF-DAY # 02

1	0 8	0 0	0 1 0	0 1 0	0 0 0
2	1 7	0 0	0 1 0	0 0 0	0 0 0
3					

For long distance calls ARS works as follows:

DIGIT COMPARISON TABLE

- 9 1 XXX XXXX is dialed by any user.
- This matches entry 002 which is " 9 1 ".
- When " 9 1" is matched it points to TOD# 02 or Time of Day Table 2.

TIME OF DAY TABLE # 02

After 8am RCS 1 can make calls on Route List 010, and RCS 2 can make calls on Route List 010. RCS 3 is not given a route (000) and cannot make long distance calls.

After 5pm RCS 1 can make calls on Route List 010. RCS 2 and RCS 3 are not given routes (000) and cannot make long distance calls.

For local calls ARS works as follows:

DIGIT COMPARISON TABLE

- 9 XXX XXXX is dialed by any user.
- This matches entry 001 which is " 9 ".

Note: The first X cannot be a "1" or it will match the "9 1" entry.

- When " 9 " is matched it points to TOD# 01 or Time of Day Table 1.

TIME OF DAY TABLE # 01

Note the time is 00 00. This time can be used if there is no change during the day. Alternately it could be programmed as below.

ARS TIME-OF-DAY # 01

1	0	8	0	0	0	1	0	0	1	0	0	1	0
2	1	7	0	0	0	1	0	0	1	0	0	1	0
3													

In this case the ARS behaves the same at 8am and 5pm.

REVIEW

You have been exposed to the first 2 (and most difficult) "boxes" of the ARS 5 Box Flowchart.

The next 3 boxes will be discussed as examples.

It is extremely important that you have a good comprehension of these first 2 forms before proceeding. Review this section and then modify your example to solve the following condition.

Number	RCS 1	RCS 2	RCS 3
9 0	All Day Route 010	8 - 5 Only Route 010	Not Allowed

Hint: The routing conditions required for this problem and the routing conditions that appear in TOD#02 are identical!

THE LAST 3 BOXES

As mentioned earlier the final 3 boxes will be shown as examples. We'll use the first two forms as previously programmed.

Remove or photocopy the next 2 pages which contain the programming example and follow the step by step explanation that starts on the page following.

ARS DIGIT COMPARISON TABLE

Entry#	TOD#	Dialed Digits String
001	01-45	
-800		
0 0 1	0 1	[9]
0 0 2	0 2	[9 1]
		[]
		[]
		[]
		[]
		[]
		[]
		[]

ARS TIME-OF-DAY #01

Per Start 701 → 745

#	Hr	Min	Route List for		
	00	00	RCS 1	RCS 2	RCS 3
	-23	-59			
1	0 0	0 0	0 1 0	0 2 0	0 3 0
2					
3					

ARS TIME-OF-DAY # 02

1	0 8	0 0	0 1 0	0 2 0	0 0 0
2	1 7	0 0	0 1 0	0 0 0	0 0 0
3					

ARS ROUTE LIST TABLE

Route List #	Route Number For Choice			
	1st	2nd	3rd	4th
0 0 1				
0 0 2				
0 0 3				
0 0 4				
0 0 5				
0 0 6				
0 0 7				
0 0 8				
0 0 9				
0 1 0	0 0 1	0 0 2	0 0 3	0 0 4
0 1 1				
0 1 2				
↓		↓		↓
0 1 9				
0 2 0	0 0 1	0 0 2	0 0 3	
0 2 1				
↓		↓		↓
0 2 9				
0 3 0	0 0 1			
0 3 1				

ROUTE TABLE

Route #	Trk	Digit	Grp	Mod #	Toll
					↓
					1-6
0 0 1	1	0	0	1	
0 0 2	2	0	0	1	
0 0 3	3	0	0	1	
0 0 4	4	0	0	1	
0 0 5	5	0	0	1	

DIGIT MOD TABLE

Digit Mod'n # ↓

Quantity to Delete 00-32 ↓

Digits to Insert maximum of 32

Digit Mod'n #	Quantity to Delete	Digits to Insert
0 0 1	0 1	[]
0 0 2		[]
0 0 3		[]
0 0 4		[]
0 0 5		[]

STEP BY STEP EXAMPLE

From left to right these forms are the boxes in the 5 Box Flowchart.

- Locate the forms on the pages and the 5 Box Flowchart.

Note the first 2 forms are similar to those programmed in the Assignment.

Recall what happens if a user with RCS 1 dials 9 1 857 2405.

- Since the number starts with a valid Trunk Group Access code "9" then ARS will process the call.
- Since a match can be made with the "9 1" entry, TOD# 2 or Time Of Day Table # 2 is used.
- In TOD#2 RCS 1 will always be pointed to Route List 010 no matter what the time of day.

What is a Route List?

The next form (Box 3) is the Route List form. Each entry on the list may contain up to 4 choice of Routes.

- Find Route List 010 on the ARS ROUTE LIST TABLE.

Note the choices are 001, 002, 003, and 004 in that order. The choices work as follows:

The first choice 001 will be used unless it is busy. If busy the second choice 002 will be used. This process continues on for choices 3 and 4.

But what are these choices?

The Route Choice is listed in the next form (4th box). The route actually determines which Trunk Group is used, how the dialed digits must be modified to meet the requirements of the trunk type the call is connected to, and whether or not the call will need an account or authorization code prior to connection (the toll field).

From the beginning the process is this:

- Box 1 - A user with RCS 1 dialed a number that matched the "9 1" entry. The "9 1" match is pointed to TOD#2.
- Box 2 - For RCS 1 TOD#2 points to Route List 010.

- Box 3 – Route List 010 has 4 choices. The first choice points to Route 001.
- Box 4 – Route 001 uses Trunk Group 1 and points to Digit Modification Entry 001.
- Box 5 – Digit Modification Entry 001 deletes 1 digit and allows the rest to be outputted.

The Digit Modification Entry Table deletes or adds digits to the beginning of the original number. In this case 1 number was deleted from the beginning.

Example

Number Dialed	9 1 857 2405
Number of Digits Deleted	1
Digits Added	(blank)
<hr/>	
Actually Digits Outputted	1 857 2405

Study the step by step process.

What path does a user with RCS 2 take when 9 1 857 2405 between 8am and 5pm?

Since ARS follows the 5 Box Flowchart, the best place to start is at the beginning.

- Box 1 – 9 1 857 2405 matches "9 1" so TOD#2 is used.
- Box 2 – For RCS 2 Route List 020 is used between 8am and 5pm
- Box 3 – Route List 020 has three choices: 001, 002, and 003
- Box 4 – If Route 001 is used then the call is routed to Trunk Group 1.
- Box 4 – If Route 002 is used then the call is routed to Trunk Group 2.
- Box 4 – If Route 003 is used then the call is routed to Trunk Group 3.
- Box 4 – No matter which Route is used they all point to Digit Mod Entry 001.
- Box 5 – Entry 001 deletes 1 digit ("9") and allows the rest to be outputted.

To gain a further understanding of ARS trace the pathes for the following calls:

RCS 1 dials	9 457 3093	@ 3pm
RCS 2 dials	9 457 3093	@ 10am
RCS 3 dials	9 457 3093	@ 5pm
RCS 1 dials	9 1 820 8364	@ 5pm
RCS 2 dials	9 1 820 8364	@ 6pm
RCS 1 dials	9 1 820 8364	@ 9am

ARS DOCUMENTATION

The MITL9104-091-220-NA AUTOMATIC ROUTE SELECTION section of the MITEL SX-50™ DPABX Practices has a complete overview of ARS including examples.

The next section has a typical ARS programming application which can be used in the field.

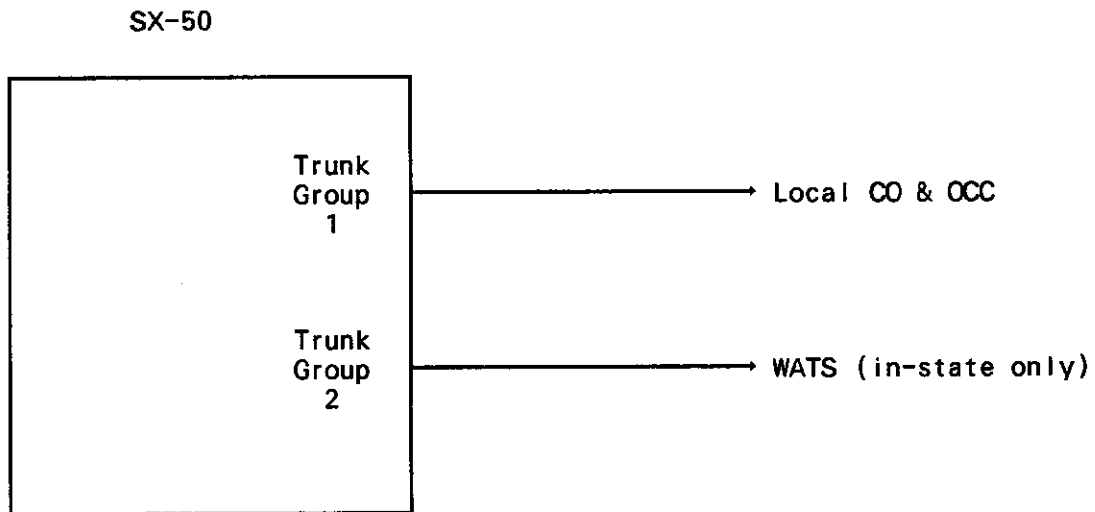
SX-50™ DPABX: ARS EXAMPLE

SX-50™ DPABX – ARS EXAMPLE

Introduction

This module contains an example ARS program as it would be applied to a typical business. Like most businesses, there is a variety of trunk services which offer reduced rates for long distance calls. Also, some telephones are completely or partially restricted from making external calls.

The Business



As shown in the diagram there are 3 trunk services used by the SX-50™ DPABX - Local CO, OCC-provided trunks, and WATS - and 2 trunk groups.

Local and toll-free calls are handled by the local CO. Out of area (inter LATA) calls are sent an OCC. The OCC is reached by dialing 10 266. This is followed by an account code - 8874563 - which identifies the customer for billing purposes.

A WATS trunk is used for in area (inter LATA) calls that are long distance. These calls are dialed by starting with a "1" that is followed by an office code. However, the CO will reject any call that is prefixed with a "1", so the "1" must be stripped before outpulsing.

Requirements

There are several requirements for the business. They are;

- All calls will start with 9 ONLY
- RCS 3 cannot dial long distance or any call where a toll applies
- RCS 2 can only dial long distance from 8am to 5pm.

The text below shows explains the purpose of each line in the programming.

Follow along with the example programming on page 33-6 of this manual.

Local Call

Local calls are designed to go out Trunk Group 1 (i.e. the local CO). All RCS numbers are permitted to dial locally all day. To dial a local call, a user dials "9" followed by a number that is NOT a "1" or a "0".

So, if a user dials 9 followed by a number from 2-9, it will be treated as a local call. This matches entry #001 in CMD 700 ARS Digit Comparison Table.

Entry #001 points to Time of Day table 01 which is programmed as CMD 701. As only one time is programmed (ab cd = 00 hours 00 minutes = midnight), the programming will apply all day. RCS 1, 2, and 3 all have the same route list, #001.

In CMD 750, route list #001 has only 1 choice, route #001.

CMD 751 indicates that route #001 will route the user to trunk group #1 and modify the digit string according to Digit Mod Plan #001.

CMD 752 Digit Mod plan #001 deletes the first digit (i.e. the 9 is dropped).

In Area Call

Toll calls that are within the user's home area code go out Trunk Group 2 (i.e. the in-area WATS service). For this example the WATS is only used for in-area calls. An in-area call would be 9 1 XXX - XXXX . No Area Codes are dialed . In-area calls are accessible by RCS 1&2 only. If Trunk Group 2 is busy the call should automatically route to Trunk Group 1.

A 9 1 XXX - XXXX matches entry #002 in CMD 700 ARS Digit Comparison Table.

It will NOT match entry 003-017 because all in area calls will NOT have a 0 or a 1 as a middle digit in the office code.

Entry #002 points to Time of Day table 02 which is programmed as CMD 702. At 8 am RCS 1 & 2 will go out route list #002. RCS 3 is blocked. At 5pm only RCS 1 may make a call.

In CMD 750, route list #002 has 2 choices, route #002 and route #003.

CMD 751 indicates that route #002 will route the user to trunk group #2 and modify the digit string according to Digit Mod Plan #002.

CMD 752 Digit Mod plan #002 will strip the "9" (the ARS access code) and the "1" (the long distance identifier) that the CO does NOT want to receive.

If route #002 was busy then the second choice (from CMD 750) is route #003. This is programmed as the 4th choice so the Expensive Route Warning Tone will sound. Route #003 works exactly as described in Local Calls, except that if the caller has COS option "Account Code Required for Toll Calls" (Cmd 121-129, Reg 7, field c = 2) then the system will reject the call unless the caller has dialed an Account code or a Verified Authorization code.

Out of Area Call

Like in-area calls only RCS 1 & 2 can make an out of area call. Trunk Group 1 is used.

Out of area calls are 9 1 Area Code XXX - XXXX. Recall that ALL area codes have a 0 or a 1 for a middle digit. Because of this, the programming of CMD 700 entries #003 - 017 will capture all out of area calls.

CMD 700 Registers #003 - 017 all point to Time of Day table 03.

CMD 703 has identical blocking to CMD 702 except that a different route is used. At 8 am RCS 1 & 2 go out route #003. RCS 3 is blocked. After 5pm only RCS 1 may make an out of area call.

CMD 750 #003 has 1choice, route #004.

CMD 751 #004 will route out of area calls to the OCC via trunk group 1. It also points to Digit Modification plan #003.

CMD 752 #003 deletes the "9" (delete 01 digit) and inserts the OCC code (10266), pauses (*5), then inserts the authorization code (8874563) for billing purposes.

Toll Free 1-800 Call

If a 9 1 800 entry was not programmed these calls would be routed over the OCC trunks. As these calls are free the ARS program routes them to the local CO trunks.

911 Emergency Call

In a panic situation someone would dial 9 911 for emergency assistance. This type of call would match entry #001.

However, if someone did NOT dial 9 911 but only dialled 911 the ARS program will still route the call.

CMD 700 entry 019 lists 911. This routes to time of day table 4 which selects route list #004 all day.

CMD 750 entry 004 has 1 choice, route #005.

CMD 751 routes the call to trunk group 1 and modifies it according to CMD 752 entry #100.

Entry #100 is blank. That is, NO digits are deleted. The 911 will be outpulsed.

Blocking Calls

There are several types of calls that must be blocked. Any call to be blocked is stopped in Time of Day table 45.

The trunk group access codes 8, 78, 79 are all blocked. This forces users to dial 9 to make an external call. It also stops users from bypassing ARS and choosing a trunk group directly.

Calls to the operator are blocked with the 90 entry.

Local and in area 976 numbers are blocked. However, 9 1 Area Code 976 - XXXX will still route. To block these calls EVERY area code must be entered followed by 976. This is a large amount of programming but has to be entered to block all 976 calls.

Other Considerations

Overseas calls route through an international operator by dialling 9011XXXXXXXXXX. The 9011 can be entered and the call can be routed over local CO trunks.

As a business decision, RCS 2 could be restricted to making calls only over the cheap routes. If the cheap routes were busy then they would NOT be offered an alternative route.

The North American directory information standard (1 Area Code 555-1212) should be considered. (see USING 555 in ARS in this document)

COMMAND 750 -- ARS ROUTE LIST TABLE

Route List #	Route Number For Choice													
	1st	2nd	3rd	4th										
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
0	0	2	0	0	2	0	0	0	0	0	0	0	0	3
0	0	3	0	0	4	0	0	0	0	0	0	0	0	0
0	0	4	0	0	5	0	0	0	0	0	0	0	0	0
0	0	5												

COMMAND 751 ROUTE TABLE

	Route #	Trk	Digit	Grp Mod #				
	001-200	↓	001-100					
	1-6			Toll				
a	b	c	d	e	f	g	h	
local	0	0	1	1	0	0	1	0
WATS0	0	0	2	2	0	0	2	1
DDD	0	0	3	1	0	0	1	1
OCC	0	0	4	1	0	0	3	1
9911	0	0	5	1	1	0	0	0

COMMAND 752 -- DIGIT MOD TABLE

Digit Mod'n	Quantity	Digits to Delete	Digits to Insert						
001-100	00-32	maximum of 32							
a	b	c	d	e	f	g	h	i	m
0	0	1	0	1	[]
0	0	2	0	2	[]
0	0	3	0	1	[10266*58874563]
↓	1	0	0		[]

Note: The entire forms are not used or shown.

ASSIGNMENT #1 - ARS Routing

State the exact route taken when the following numbers are dialed. Indicate all the forms that effect the routing.

1. RCS 1 dials 9 574-1375 10:56 am.

Which entry number will this match in Command 700?

Which Time of Day Table (01-45) is used?

According to the Time of Day table, which Route List is used?

How many choices does this route list offer?

The first trunk group tried is: _____

The actual digits outpulsed are: _____

If busy the second trunk group tried is: _____

2. RCS 2 dials 9 1 376-1270 4pm.

Which entry number will this match in Command 700?

Which Time of Day Table (01-45) is used?

According to the Time of Day table, which Route List is used?

How many choices does this route list offer?

The first trunk group tried is:

The actual digits outpulsed are:

If busy the second trunk group tried is:

3. RCS 2 dials 9 1 376-1270 10pm.

Which entry number will this match in Command 700?

Which Time of Day Table (01-45) is used?

According to the Time of Day table, which Route List is used?

How many choices does this route list offer?

The first trunk group tried is: _____

The actual digits outpulsed are: _____

If busy the second trunk group tried is: _____

4. RCS 3 dials 9 1 376-1270 4pm.

Which entry number will this match in Command 700?

Which Time of Day Table (01-45) is used?

According to the Time of Day table, which Route List is used?

How many choices does this route list offer?

The first trunk group tried is: _____

The actual digits outputted are: _____

If busy the second trunk group tried is: _____

5. **RCS 2 dials 78 1 376-1270 4pm.**

Which entry number will this match in Command 700?

Which Time of Day Table (01-45) is used?

According to the Time of Day table, which Route List is used?

How many choices does this route list offer?

The first trunk group tried is: _____

The actual digits outpulsed are: _____

If busy the second trunk group tried is: _____

6. RCS 1 dials 9 1 406 677-1879 10pm.

Which entry number will this match in Command 700?

Which Time of Day Table (01-45) is used?

According to the Time of Day table, which Route List is used?

How many choices does this route list offer?

The first trunk group tried is: _____

The actual digits outpulsed are: _____

If busy the second trunk group tried is: _____

7. RCS 2 dials 8 1 376-1270 4pm.

Which entry number will this match in Command 700?

Which Time of Day Table (01-45) is used?

According to the Time of Day table, which Route List is used?

How many choices does this route list offer?

The first trunk group tried is: _____

The actual digits outpulsed are: _____

If busy the second trunk group tried is: _____

8. RCS 3 dials 9 1 800-576-4273 4pm.

Which entry number will this match in Command 700?

Which Time of Day Table (01-45) is used?

According to the Time of Day table, which Route List is used?

How many choices does this route list offer?

The first trunk group tried is: _____

The actual digits outputted are: _____

If busy the second trunk group tried is: _____

9. Explain how users could beat the ARS restrictions if Command 700 Entry 022, and 023 were NOT programmed.

ARS System Options Programming

Some overall options for ARS are located in System Options programming.

- **Locate ARS programming in the Customer Data Entry section. The options there are explained in the Automatic Route Selection section.**
- **Read ARS and Toll Control section of the Practice.**

ASSIGNMENT #2 – ARS Programming

- 1. What are the possible middle digits for all area codes in North America? How many area codes are there in North America?**

- 2. In most cases what is dialled to signify a toll call?**

3. Explain the following:

WATS

FX

OCC

4. What must the digit string start with in Command 700, the Digit Comparison table?

5. How many time of day periods are there per Time of Day table?

6. Where must the most expensive route be programmed for the Expensive Route Warning Tone to work?

- **Study the Application Example in ARS and Toll Control section of the Practice.**
- **Practice tracing calls through the programmed forms.**

ASSIGNMENT #1 ANSWERS

1. RCS 1 dials 9 574-1375 10:56 am.

Which entry number will this match in Command 700?
ENTRY 001 (9)

Which Time of Day Table (01-45) is used?
TOD 01 (COMMAND 701)

According to the Time of Day table, which Route List is used?
RCS 1 GETS ROUTE 001 ALL DAY

How many choices does this route list offer?
1 CHOICE

The first trunk group tried is:
TRUNK GROUP 1

The actual digits outpulsed are:
574 1375

If busy the second trunk group tried is:
NO SECOND CHOICE

2. RCS 2 dials 9 1 376-1270 4pm.

Which entry number will this match in Command 700?

ENTRY 002 (9 1)

Which Time of Day Table (01-45) is used?

TOD 02 (COMMAND 702)

According to the Time of Day table, which Route List is used?

RCS 2 GETS ROUTE 002 FROM 8 AM TO 4:59:59 PM.

How many choices does this route list offer?

2

The first trunk group tried is:

2

The actual digits outputted are:

376 1270

If busy, the second trunk group tried is:

1

3. RCS 2 dials 9 1 376-1270 10pm.

Which entry number will this match in Command 700?

ENTRY 002 (9 1)

Which Time of Day Table (01-45) is used?

TOD 02 (COMMAND 702)

According to the Time of Day table, which Route List is used?

RCS 2 GETS ROUTE 000 (BLOCKED) FROM 5 PM TO 7:59:59 AM

How many choices does this route list offer?

0

The first trunk group tried is:

NONE

The actual digits outputted are:

NONE

If busy the second trunk group tried is:

NONE

4. RCS 3 dials 9 1 376-1270 4pm.

Which entry number will this match in Command 700?

ENTRY 002 (9 1)

Which Time of Day Table (01-45) is used?

TOD 02 (COMMAND 702)

According to the Time of Day table, which Route List is used?

RCS 3 GETS ROUTE 000 (BLOCKED) ALL DAY

How many choices does this route list offer?

0

The first trunk group tried is:

0

The actual digits outpulsed are:

0

If busy the second trunk group tried is:

0

5. RCS 2 dials 78 1 376-1270 4pm.

Which entry number will this match in Command 700?
ENTRY 023 (78)

Which Time of Day Table (01-45) is used?
TOD 45 (COMMAND 745)

According to the Time of Day table, which Route List is used?
ALL RCS NUMBERS ARE BLOCKED - ROUTE 000 - ALL DAY.

How many choices does this route list offer?
0

The first trunk group tried is:
0

The actual digits outpulsed are:
0

If busy the second trunk group tried is:
0

6. RCS 1 dials 9 1 406 677-1879 10pm.

Which entry number will this match in Command 700?

ENTRY 007 (9 1 4 0)

Which Time of Day Table (01-45) is used?

TOD 03 (COMMAND 703)

According to the Time of Day table, which Route List is used?

RCS 1 GETS ROUTE 003 ALL DAY

How many choices does this route list offer?

2

The first trunk group tried is:

3

The actual digits outputted are:

8874563 1 406 677 1879

If busy the second trunk group tried is:

1

7. RCS 2 dials 8 1 376-1270 4pm.

Which entry number will this match in Command 700?

ENTRY 022 (8)

Which Time of Day Table (01-45) is used?

TOD 45 (COMMAND 745)

According to the Time of Day table, which Route List is used?

ALL RCS NUMBERS GET ROUTE 000 - BLOCKED - ALL DAY.

How many choices does this route list offer?

0

The first trunk group tried is:

0

The actual digits outputted are:

0

If busy the second trunk group tried is:

0

8. RCS 3 dials 9 1 800-576-4273 4pm.

Which entry number will this match in Command 700?

020 (9 1 800)

Which Time of Day Table (01-45) is used?

TOD 01 (COMMAND 701)

According to the Time of Day table, which Route List is used?

RCS 3 GETS ROUTE 001 ALL DAY

How many choices does this route list offer?

1

The first trunk group tried is:

1

The actual digits outpulsed are:

1 800 576 4273

If busy the second trunk group tried is:

NO SECOND CHOICE

9. Explain how users could beat the ARS restrictions if Command 700 Entry 022, and 023 were NOT programmed.

If these entries are not programmed ALL users could dial 8 or 78 and manually access a trunk group to make a long distance call.

ASSIGNMENT #2 ANSWERS

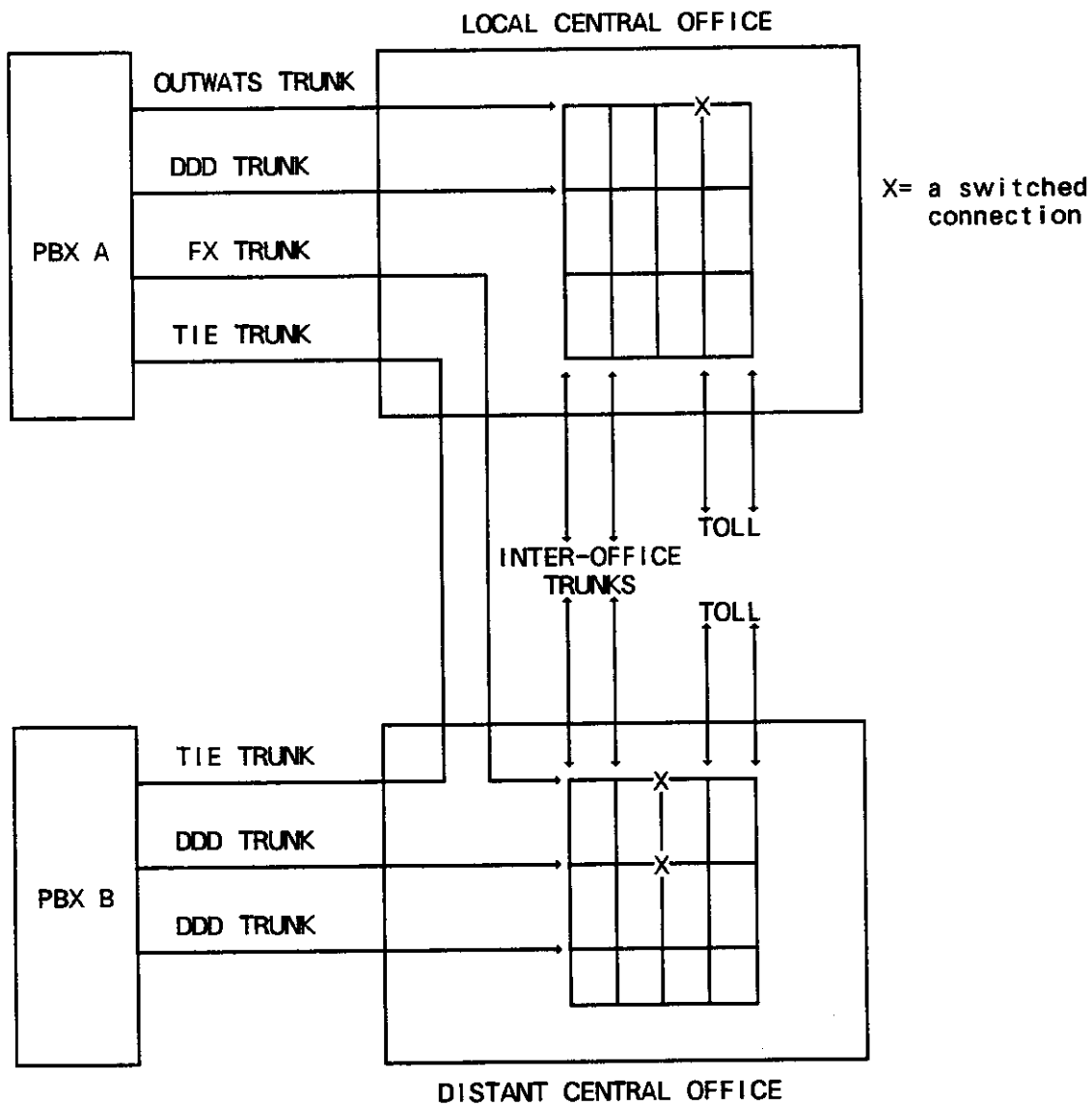
1. 0 or 1
2. 1 + number
3. See ARS section Volume 1.
4. **IMPORTANT!** In Command 700 the number **MUST** begin with a trunk group access code to "wake-up" ARS. Usually the number is a "9" but it could be 8, 78, 79 or any other number used as a trunk group access code.
5. Although only 3 are shown on the example sheets, up to 6 time of day periods are available per TOD.
6. To get the most expensive route "beep", the choice must be programmed as the 4th choice – even if there are only two choices.

SX-50™ DPABX: CREATING AN ARS PROGRAM

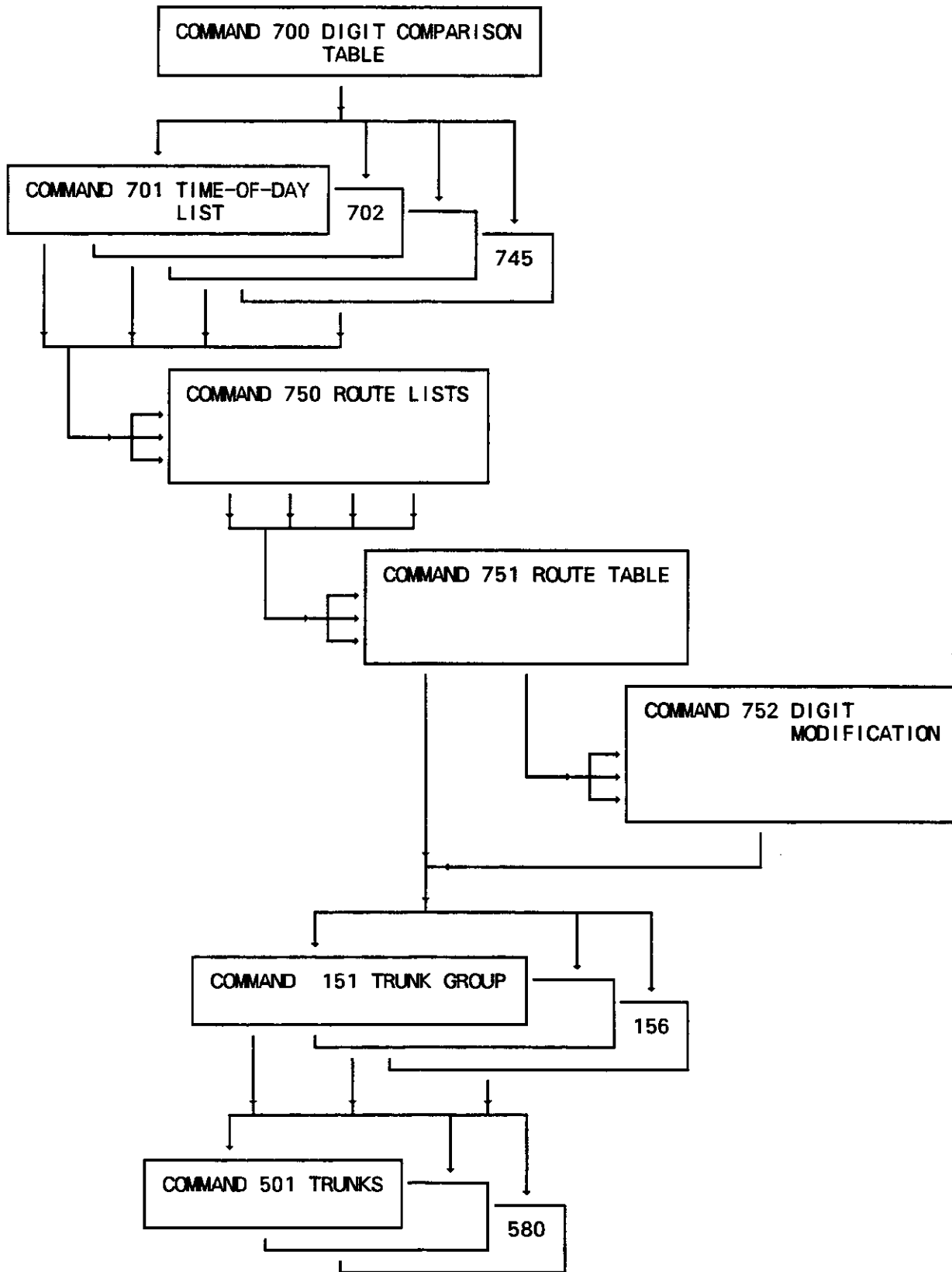
TRUNK FACILITY TYPES

The following are the most common types of trunk facilities used for access that is external to the PABX.

TYPE:	CONNECTS THE PABX TO:	IS USED TO:
DDD	THE LOCAL CENTRAL OFFICE	Make calls on the public network, local, in-area long distance, out-of-area long distance, and overseas at the rate set for the time of day, and day of the week
FX	A DISTANT CENTRAL OFFICE	Make calls on the public network. Dial tone heard on seizing the trunk originates at the distant CO. Calls over this facility that are local to the distant CO are free. The facility has a fixed monthly charge, unless calls are made that are long distance from the distant CO.
OUTWATS	A TOLL OFFICE	Make long distance calls on the public network. Provides access to preset bands or zones of numbers. Cost of a call may vary with the time and day that the call is made. The facility has a fixed charge for an initial period of usage, with a decreasing cost-per-call rate for usage beyond the initial period (block of hours).
TIE	ANOTHER PABX	Make calls to another pabx on a private network. Calls may be connected to the public network at the far end PABX. The facility has a fixed monthly charge.



ARS TRUNK ACCESS COMMAND TABLE HIERARCHY



SX-50™ DPABX: CREATING AN ARS PROGRAM

TABLE 1: NORTH AMERICAN DIALED NUMBER PLAN

CALL TYPE	DIALED NUMBER	DESTINATION	REASONS FOR RESTRICTION	CHECK COLUMN
OPERATOR CALLS	0(+) 01+	LOCAL OPERATOR OVERSEAS OPERATOR-HANDLED	OPERATOR-HANDLED CALLS: † NO CHARGE FOR CREDIT CARD, 3RD NUMBER, AND COLLECT CALLS CHARGE FOR ALL OTHER CALL TYPES	
SERVICE CALLS	211 (911)/(NXX-XXXX) (611)/(0)/(4104) 411 (1)-555-1212 (1)-N0/1X-555-1212	REBATE (US ONLY) EMERGENCY SERVICES REPAIR SERVICE LOCAL INFORMATION AREA INFORMATION LD INFORMATION	NO CHARGE NO CHARGE †† POTENTIALLY CHARGEABLE ††† CHARGEABLE NO CHARGE NO CHARGE	
LOCAL CALLS	NXX-XXXX	LOCAL CALLS	NO CHARGE	
NO CHARGE LD	(1)-800-NXX-XXXX	NO-CHARGE LD	NO CHARGE	
LOW CHARGE LD	(1)-900-NXX-XXXX	LOW CHARGE LD	LOW CHARGE	
IN-AREA LD	(1)-NXX-XXXX	LD CALLS WITHIN AREA	CHARGEABLE	
OUT-AREA LD	(1)-N0/1X-NXX-XXXX	LD CALLS OUTSIDE AREA	CHARGEABLE	
OVERSEAS LD	011+	DIRECT-DIAL OVERSEAS	CHARGEABLE	
EQUAL ACCESS	10XXX+	ALTERNATE CARRIER SELECTION	CHARGEABLE	
FX CALLS	(1-N0/1X-)NXX-XXXX	IF AVAILABLE, MAY BE LOCAL OR LD	NO CHARGE	
WATS CALLS	(1)-N0/1X-NXX-XXXX	IF AVAILABLE	CHARGEABLE	
TIE TRUNK	(1-N0/1X-)NXX-XXXX	IF AVAILABLE, MAY BE LOCAL OR LD	NO CHARGE	
OCC CALLS	(1-N0/1X-)NXX-XXXX	IF AVAILABLE	CHARGEABLE	

NOTE: BRACKETED () NUMBERS MAY NOT APPLY.

† RESTRICT ALL USERS EXCEPT ATTENDANT?

†† ACCESS MAY BE REQUIRED BY LAW.
REDIRECT TO CUSTOMER EMERGENCY DEPARTMENT?

††† RESTRICT ALL USERS EXCEPT ATTENDANT AND TEST LINE?
REDIRECT TO SERVICE COMPANY?

ARS VERSUS CLASS OF SERVICE

ARS programming overrides Trunk Group Access programming in the extension's class of service (Cmd 121-9 Reg 1). That means if ARS routes a caller to a trunk group, the call will NOT be blocked if the caller's Class of Service denies access to the trunk group. Also, any overflow that is programmed in class of service is overridden by ARS programming.

USING 555 IN ARS

The Long Distance information number standard in North America is 1 + Area Code + 555 + 1212. There is usually a minimum or no charge for this call but it is treated by the ARS program as a long distance call because of the 1 + Area Code dialling format.

What is usually desired is this type of call be routed over local lines. To achieve this, the ARS programming requires that EVERY area code be typed out (ie 1 201 555 1212 to 1 919 555 1212). This would take forever.

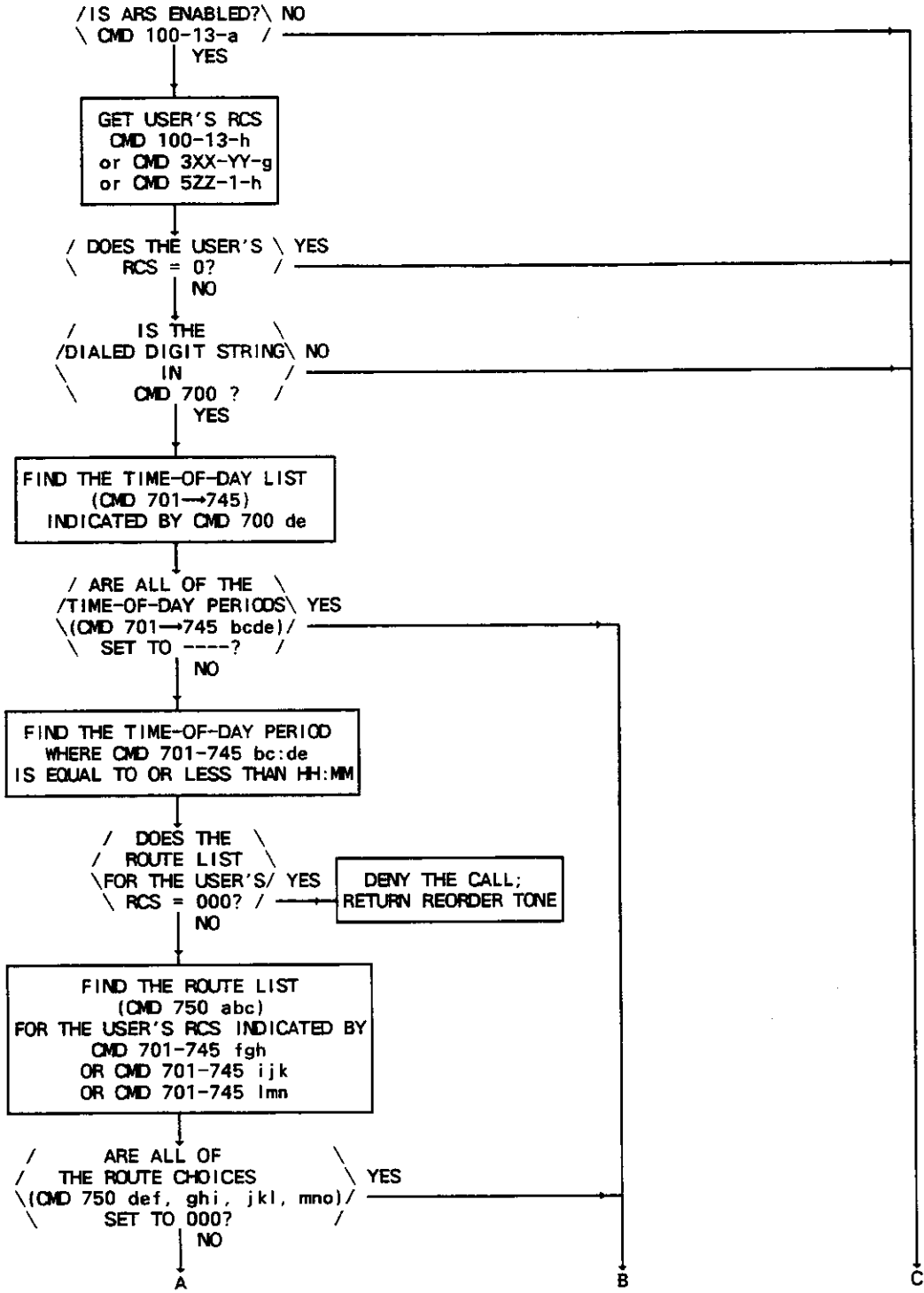
A "trick" used on the SX-50™ DPABX is to store the call as an Abbreviated Dial number which asks the caller to insert the area code. This means only one entry in ARS is required. It works as follows:

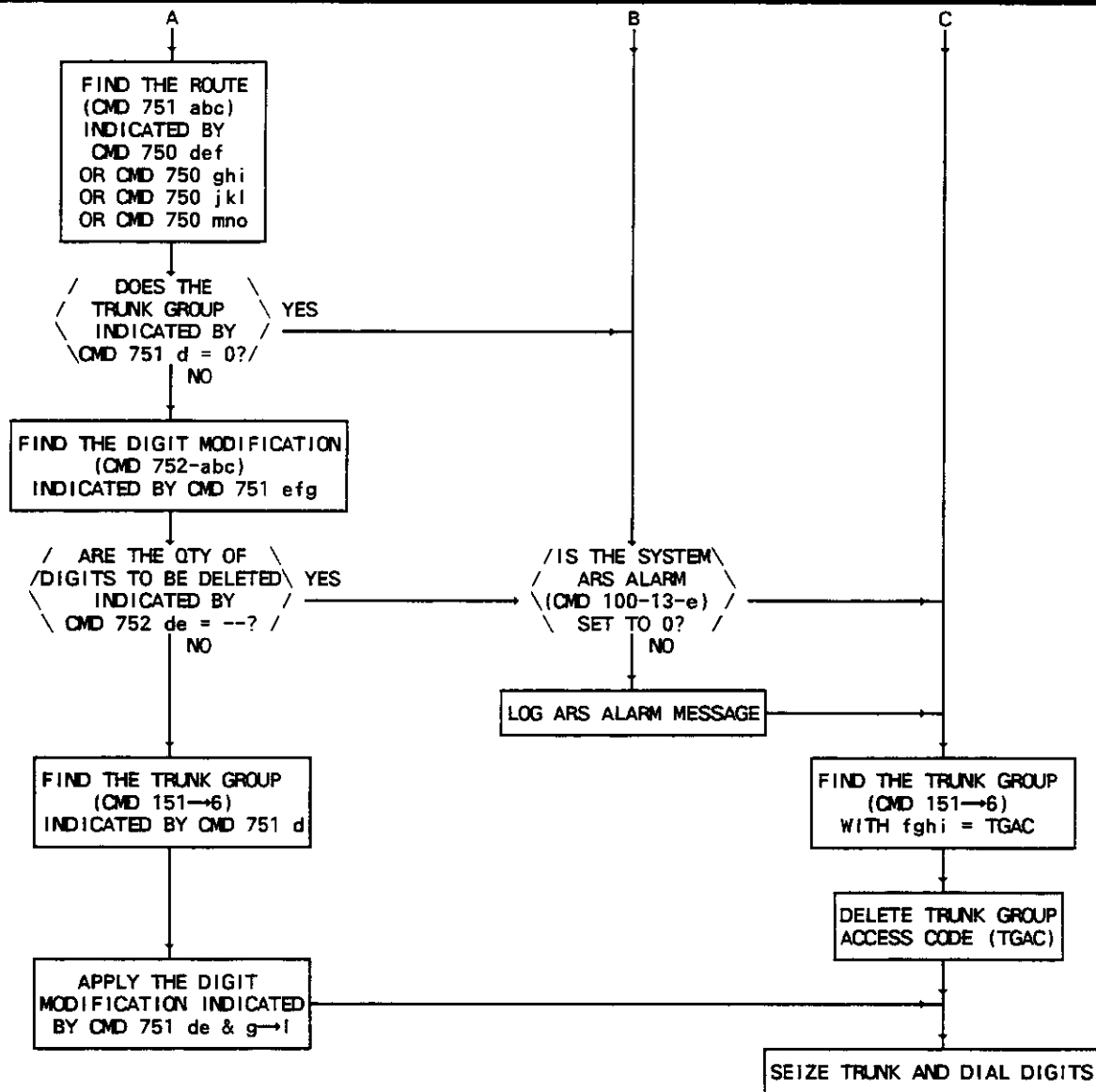
- 1) The Abbreviated Dial number 79 *3 3 555 1212 is stored in the system (e.g. dialling 5510 = 79 *3 3 555 1212). The 79 is a trunk group access code that will be used in step 2). The *3 means wait for digits, the 3 means the number of digits to wait for.
- 2) In ARS Digit Comparison Table make an entry 79 which routes to the local trunk group.

ACTION: The user dials 5510 which pauses and waits for the area code to be inserted. After the 3 digit code is inserted the number is routed by ARS.

SX-50™ DPABX: CREATING AN ARS PROGRAM

EXTERNAL CALL FLOWCHART





Notes:

The only way ARS can deny trunk access to a call is by setting the ROUTE LIST to "000" in the TIME-OF-DAY LIST table for the restricted RCS(s).

If a call cannot be completed through ARS due to a lack of programmed information, the system abandons its attempt to process the call via ARS, and treats the call as a standard trunk group access call.

The ARS ALARM (if enabled) indicates both the table and table entry which is not programmed.

Use of the ARS ALARM output and this chart will simplify troubleshooting ARS.

ARS PLANNER

This work sheet can be used to plan your ARS programs. With a complete plan in place the task of creating an ARS plan is easier.

1. Trunk Group Types

List the Trunk Group types being used on your PABX.

TG 1 is _____

TG 2 is _____

TG 3 is _____

TG 4 is _____

TG 5 is _____

TG 6 is _____

2. Routing Class of Service

Describe who belongs to which Routing Class of Service (i.e. RCS 1 = Managers, RCS 2 = Restricted Usage, etc.)

RCS 0 is _____

RCS 1 is _____

RCS 2 is _____

RCS 3 is _____

3. Call Routes

Determine the route for each call type.

Call Type	1st Trunk Group	Modify	2nd Trunk Group	Modify	3rd Trunk Group	Modify	4th Trunk Group	Modify
LOCAL								
9911								
911								
1-800								
1-AREA-555-1212								
91 AREA								
91 OFFICE								
9 10 ____								
9 10 ____								
9 10 ____								
9 10 ____								
9 0								
8, 78, 79								

SX-50™ DPABX: ARS WORKSHEET -- FOR TRAINING PURPOSES ONLY

SX-50™ DPABX: ARS WORKSHEET -- FOR TRAINING PURPOSES ONLY

COMMAND 700 -- ARS DIGIT COMPARISON TABLE

Entry# TOD# Dialed Digits String
 001 01-45 0-9, #, *; maximum of 32 digits
 -800

a	b	c	d	e	f	g											m
0	0	1				[]
0	0	2				[]
0	0	3				[]
0	0	4				[]
0	0	5				[]
0	0	6				[]
0	0	7				[]
0	0	8				[]
0	0	9				[]
0	1	0				[]
0	1	1				[]
0	1	2				[]
0	1	3				[]
0	1	4				[]
0	1	5				[]
0	1	6				[]
0	1	7				[]
0	1	8				[]
0	1	9				[]
0	2	0				[]
0	2	1				[]
0	2	2				[]
0	2	3				[]
0	2	4				[]
0	2	5				[]
0	2	6				[]
0	2	7				[]
0	2	8				[]
8	0	0				[]

COMMAND 7__ ARS TIME-OF-DAY

Per Start 701 → 745
 # Hr Min Route List for
 00 00 -23 -59 RCS 1 RCS 2 RCS 3

	a	b	c	d	e	f	g	h	i	j	k	l	m	o
1														
2														
3														

COMMAND 7__ ARS TIME-OF-DAY

1														
2														
3														

COMMAND 7__ ARS TIME-OF-DAY

1														
2														
3														

COMMAND 7__ ARS TIME-OF-DAY

1														
2														
3														

COMMAND 7__ ARS TIME-OF-DAY

1														
2														
3														

COMMAND 7__ ARS TIME-OF-DAY

1														
2														
3														

SX-50™ DPABX: ARS WORKSHEET -- FOR TRAINING PURPOSES ONLY

COMMAND 750 -- ARS ROUTE LIST TABLE

Route List # Route Number For Choice
 001-200 1st 2nd 3rd 4th

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
0	0	1												
0	0	2												
0	0	3												
0	0	4												
0	0	5												
0	0	6												
0	0	7												
0	0	8												
0	0	9												
0	1	0												
0	1	1												
0	1	2												
0	1	3												
0	1	4												
0	1	5												
0	1	6												
0	1	7												
0	1	8												
0	1	9												
0	2	0												
0	2	1												
0	2	2												
0	2	3												
0	2	4												
0	2	5												
0	2	6												
0	2	7												
0	2	8												
2	0	0												

COMMAND 751 ROUTE TABLE

Route Trk Digit # Grp Mod #
 001-200 | 001-100
 1-6 Toll

a	b	c	d	e	f	g	h
0	0	1					
0	0	2					
0	0	3					
0	0	4					
0	0	5					
0	0	6					
0	0	7					
0	0	8					
0	0	9					
0	1	0					
0	1	1					
0	1	2					
0	1	3					
0	1	4					
0	1	5					
0	1	6					
0	1	7					
0	1	8					
0	1	9					
0	2	0					
0	2	1					
0	2	2					
0	2	3					
0	2	4					
0	2	5					
0	2	6					
0	2	7					
0	2	8					
2	0	0					

COMMAND 752 -- DIGIT MOD TABLE

Digit Quantity Digits
 Mod'n Digits to
 # to Delete Insert
 001-100 00-32 maximum of 32

a	b	c	d	e	f	g	h	i	j	k	l	m
0	0	1										
0	0	2										
0	0	3										
0	0	4										
0	0	5										
0	0	6										
0	0	7										
0	0	8										
0	0	9										
0	1	0										
0	1	1										
0	1	2										
0	1	3										
0	1	4										
0	1	5										
0	1	6										
0	1	7										
0	1	8										
0	1	9										
0	2	0										
0	2	1										
0	2	2										
0	2	3										
0	2	4										
0	2	5										
1	0	0										

SX-50™ DPABX: ARS WORKSHEET -- FOR TRAINING PURPOSES ONLY

COMMAND 700 -- ARS DIGIT COMPARISON TABLE

Entry# TOD# Dialed Digits String
 001 01-45 0-9, #, *; maximum of 32 digits
 -800

a	b	c	d	e	f	g											l	m
0	0	1																
0	0	2																
0	0	3																
0	0	4																
0	0	5																
0	0	6																
0	0	7																
0	0	8																
0	0	9																
0	1	0																
0	1	1																
0	1	2																
0	1	3																
0	1	4																
0	1	5																
0	1	6																
0	1	7																
0	1	8																
0	1	9																
0	2	0																
0	2	1																
0	2	2																
0	2	3																
0	2	4																
0	2	5																
0	2	6																
0	2	7																
0	2	8																
8	0	0																

COMMAND 7 ARS TIME-OF-DAY

Per Start 701 → 745

Hr Min
 00 00 Route List for
 -23 -59 RCS 1 RCS 2 RCS 3

a	b	c	d	e	f	g	h	i	j	k	l	m	n
1													
2													
3													

COMMAND 7 ARS TIME-OF-DAY

1													
2													
3													

COMMAND 7 ARS TIME-OF-DAY

1													
2													
3													

COMMAND 7 ARS TIME-OF-DAY

1													
2													
3													

COMMAND 7 ARS TIME-OF-DAY

1													
2													
3													

COMMAND 7 ARS TIME-OF-DAY

1													
2													
3													

SX-50™ DPABX: ARS WORKSHEET -- FOR TRAINING PURPOSES ONLY

COMMAND 750 -- ARS ROUTE LIST TABLE

Route List # Route Number For Choice
 001-200 1st 2nd 3rd 4th

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
0	0	1												
0	0	2												
0	0	3												
0	0	4												
0	0	5												
0	0	6												
0	0	7												
0	0	8												
0	0	9												
0	1	0												
0	1	1												
0	1	2												
0	1	3												
0	1	4												
0	1	5												
0	1	6												
0	1	7												
0	1	8												
0	1	9												
0	2	0												
0	2	1												
0	2	2												
0	2	3												
0	2	4												
0	2	5												
0	2	6												
0	2	7												
0	2	8												
2	0	0												

COMMAND 751 ROUTE TABLE

Route Trk Digit # Grp Mod #
 001-200 1-6 Toll

a	b	c	d	e	f	g	h
0	0	1					
0	0	2					
0	0	3					
0	0	4					
0	0	5					
0	0	6					
0	0	7					
0	0	8					
0	0	9					
0	1	0					
0	1	1					
0	1	2					
0	1	3					
0	1	4					
0	1	5					
0	1	6					
0	1	7					
0	1	8					
0	1	9					
0	2	0					
0	2	1					
0	2	2					
0	2	3					
0	2	4					
0	2	5					
0	2	6					
0	2	7					
0	2	8					
2	0	0					

COMMAND 752 -- DIGIT MOD TABLE

Digit Quantity Digits
 Mod'n Digits to
 # to Delete Insert
 001-100 00-32 maximum of 32

a	b	c	d	e	f	g	h	i	j	k	l	m
0	0	1										
0	0	2										
0	0	3										
0	0	4										
0	0	5										
0	0	6										
0	0	7										
0	0	8										
0	0	9										
0	1	0										
0	1	1										
0	1	2										
0	1	3										
0	1	4										
0	1	5										
0	1	6										
0	1	7										
0	1	8										
0	1	9										
0	2	0										
0	2	1										
0	2	2										
0	2	3										
0	2	4										
0	2	5										
1	0	0										

SX-50™ DPABX: ARS WORKSHEET -- FOR TRAINING PURPOSES ONLY

COMMAND 700 -- ARS DIGIT COMPARISON TABLE

Entry# TOD# Dialed Digits String
 001 01-45 0-9, #, *: maximum of 32 digits
 -800

a	b	c	d	e	f	g											l	m
0	0	1																
0	0	2																
0	0	3																
0	0	4																
0	0	5																
0	0	6																
0	0	7																
0	0	8																
0	0	9																
0	1	0																
0	1	1																
0	1	2																
0	1	3																
0	1	4																
0	1	5																
0	1	6																
0	1	7																
0	1	8																
0	1	9																
0	2	0																
0	2	1																
0	2	2																
0	2	3																
0	2	4																
0	2	5																
0	2	6																
0	2	7																
0	2	8																
8	0	0																

COMMAND 7 ARS TIME-OF-DAY

Per Start 701 → 745
 # Hr Min
 00 00 Route List for
 -23 -59 RCS 1 RCS 2 RCS 3

	a	b	c	d	e	f	g	h	i	j	k	l	m	o
1														
2														
3														

COMMAND 7 ARS TIME-OF-DAY

1														
2														
3														

COMMAND 7 ARS TIME-OF-DAY

1														
2														
3														

COMMAND 7 ARS TIME-OF-DAY

1														
2														
3														

COMMAND 7 ARS TIME-OF-DAY

1														
2														
3														

COMMAND 7 ARS TIME-OF-DAY

1														
2														
3														

SX-50™ DPABX: ARS WORKSHEET -- FOR TRAINING PURPOSES ONLY

COMMAND 750 -- ARS ROUTE LIST TABLE

COMMAND 751 ROUTE TABLE

COMMAND 752 -- DIGIT MOD TABLE

Route List # Route Number For Choice
001-200 1st 2nd 3rd 4th

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
0	0	1												
0	0	2												
0	0	3												
0	0	4												
0	0	5												
0	0	6												
0	0	7												
0	0	8												
0	0	9												
0	1	0												
0	1	1												
0	1	2												
0	1	3												
0	1	4												
0	1	5												
0	1	6												
0	1	7												
0	1	8												
0	1	9												
0	2	0												
0	2	1												
0	2	2												
0	2	3												
0	2	4												
0	2	5												
0	2	6												
0	2	7												
0	2	8												
2	0	0												

Route Trk Digit # Grp Mod #
001-200 ↓ 001-100
1-6 Toll

a	b	c	d	e	f	g	h
0	0	1					
0	0	2					
0	0	3					
0	0	4					
0	0	5					
0	0	6					
0	0	7					
0	0	8					
0	0	9					
0	1	0					
0	1	1					
0	1	2					
0	1	3					
0	1	4					
0	1	5					
0	1	6					
0	1	7					
0	1	8					
0	1	9					
0	2	0					
0	2	1					
0	2	2					
0	2	3					
0	2	4					
0	2	5					
0	2	6					
0	2	7					
0	2	8					
2	0	0					

Digit Quantity Digits
Mod'n Digits to Delete Insert
to Delete Insert
001-100 00-32 maximum of 32

a	b	c	d	e	f	g	h	i	j	k	l	m
0	0	1				[]
0	0	2				[]
0	0	3				[]
0	0	4				[]
0	0	5				[]
0	0	6				[]
0	0	7				[]
0	0	8				[]
0	0	9				[]
0	1	0				[]
0	1	1				[]
0	1	2				[]
0	1	3				[]
0	1	4				[]
0	1	5				[]
0	1	6				[]
0	1	7				[]
0	1	8				[]
0	1	9				[]
0	2	0				[]
0	2	1				[]
0	2	2				[]
0	2	3				[]
0	2	4				[]
0	2	5				[]
1	0	0				[]

SX-50™ DPABX: MISCELLANEOUS PROGRAMMING

INSTRUCTIONS:

The following exercise is a self-teaching assignment on some miscellaneous programming.

SX-50™ DPABX – Miscellaneous Programming

Some of programming options available on the SX-50™ DPABX but not previously discussed is covered in this module.

1. Abbreviated Dialling

This is also known as System Speed Dial. Numbers are stored in the system for access by anyone permitted by class of service. Abbreviated dial numbers will store lengthy, often-used numbers which may contain account codes, pauses, and wait for dial tone signals.

Note that the SX-50™ DPABX can support 90 2-digit (or 900 3-digit) abbreviated dial entries, as determined by Command 100, Register 09, Field h.

Any calls originated by using the Abbreviated Dial entries can be allowed to bypass ARS by having an RCS 0 applied to the call (Command 100, Register 13, Field j). If RCS 0 is applied the entry must include a trunk group access code.

- Read Abbreviated Dial in the Features Description section of the Practice.

2. Contact Monitor

Unused ONS/OPS circuits may be used as Contact Monitor circuits. When Tip and Ring are shorted on these circuits an alarm is raised at the console the equipment number of the contact monitor circuit is displayed. The alarm is also saved in the Alarm register and can be printed out, either manually or automatically as it occurs. The contact monitor may be used for windows and doors or for panic buttons, etc.

- Read Contact Monitor in the Features Description section of the Practice.

1. Explain the programming necessary to make the 4th circuit of the ONS card in slot 7 a contact monitor.
-

3. Manual Line

The manual line rings the console immediately after going offhook. It is also called a Housephone and is atype of Automatic Ring Down circuit. The manual line may be used in an elevator, lobby, or anywhere a telephone is required for general public access to the attendant.

- **Read Manual Line in the Features Description section of the Practice.**

2. State the programming required to make a telephone a manual line.

4. Hotline

The hotline rings a selected answer point immediately after going offhook. It is also a type of Automatic Ring Down circuit. The hotline may be used in an elevator, lobby, or anywhere a telephone is required for general public access to a particular answer point other than the attendant console.

Up to EIGHT hotline answer points can be programmed, and are determined by abbreviated dial entries 12 through 19 (for a 2-digit abbreviated dial plan), or abbreviated dial entries 102 through 109 (for a 3-digit abbreviated dial plan).

- **Read Hotline in the Features Description section of the Practice.**

3. Explain the programming necessary to make the 4th circuit of the ONS card in slot 7 a hotline to extension 130, using hotline group 4.

5. **Associated Modem Line**

Associated Modem Line (AML) uses a SUPERSET™ set associated with an ONS port for setting up data calls.

- **Read Associated Modem Line in the Features Description section of the Practice.**

6. **Conflict Dialling**

Often it is required that a mixed dialling plan be used. This creates a potential for a conflict in the extension numbering. For example, suppose you have extensions 100, 101, 102, etc AND you also have extension 10. The PBX will have difficulty handling this. Here's why.

A user goes offhook, dials 10. At this point the PBX doesn't know if it should route the user to extension 10 or wait for another digit to be dialled.

To fix the problem the Conflict Dialling Timer is turned on. It will allow the user a few seconds to enter the next digit.

Note - For conflicts, the conflicting number MUST be programmed followed with a #. In the example it would be 10# in command 301-310. Also, if the extension is in a Hunt Group, Ring Group or an appearance of a SUPERSET the # must be entered in the associated programming.

- **Read Conflict Dialling in the Features Description section of the Practice.**

4. **State the exact programming required to make an ONS card in slot 2 have circuit 01 extension 10 and circuit 02 extension 100. Include Command 100 and Command 300 programming.**

7. User Security Code

The User Security code is a second-level (System Security Code is top) code which will allow user partial access to the database. This code could be offered to customers for adding basic extensions, etc.

The actual areas of the database that may be programmed are determined by the programming in Command 180.

- **Read User Security Code in the Features Description section of the Practice.**

8. Attendant Console Programmable Function Keys

Some of the keys on the Attendant Console are programmable. These keys are shown in the programming forms.

- **Read Attendant Console Function Key Programming in the Customer Data Entry section of the Practice.**

ANSWERS

1. **Command 100 Register 17 = 000; CONTACT MONITOR NIGHT ANSWER POINT (default value)**
Command 307 Register 04 Field c = 1; Extension Type is CONTACT MONITOR
2. **Set the set's COS (command 121-9) Register 2 Field d = 1; enable Automatic Ringdown circuit**
Command 3xx Register yy Field c = 0; Extension Type is EXTENSION (default value), where xx is the slot and yy is the circuit.
3. **Set the set's COS (command 121-9) Register 2 Field d = 1; enable Automatic Ringdown circuit**
Command 307 Register 04 Field c = 4; Extension Type is Hotline Group 4.
Program Abbreviated Dial entry 14 (or 104 as required), to 130.
4. **Command 100 Register 9 Field e = 1, 2, or 3**
Command 302 Register 01 Field ijkl = 10#
Command 302 Register 02 Field ijkl = 100

HANDS-ON EXERCISE

Program the following features.

Contact Monitor

Manual Line

Make one telephone a manual line.

Abbreviated Dialling

Enter some abbreviated dial numbers on the system. They may be internal or external destinations. Ensure they work.

Conflict Dialling

Make extension 100 extension 10.

Attendant Console Programmable Function Keys

Change the function of some of the keys on the console.

SX-50™ DPABX: MAINTENANCE FUNCTIONS LAB PROJECT – PART II

SX-50™ DPABX: MAINTENANCE FUNCTIONS LAB PROJECT – PART II

INSTRUCTIONS:

The following exercise is a self-teaching assignment on the SX-50™ DPABX Maintenance Functions – Status Display Commands.

– COMMENT –

If you do not have access to an SX-50™ DPABX perform this lab project on paper. If programming is required, complete the necessary programming forms.

SX-50™ DPABX STATUS DISPLAY COMMANDS

INTRODUCTION

This exercise is designed to introduce you to the Status Display Commands available on the SX-50™ DPABX.

WHAT YOU'LL NEED

To do the exercise have the Troubleshooting Procedures and General Maintenance Information section handy as well as access to an SX-50™ DPABX system.

PART II – SYSTEM STATUS

System Status functions are used to take a “snapshot” of activity in the system. Information is located in the Troubleshooting Procedures and General Maintenance Information section.

[STATUS] KEY

Earlier you used the [STATUS] key to determine the number of Busy-outs. However, this key also performs other status functions.

- **Locate Console STATUS key in the Troubleshooting Procedures and General Maintenance Information section**
- **Use the [STATUS] key to determine the Configuration, Set Volume/Contrast, and Test the LCD.**

STATUS COMMANDS

The Status Commands are used for a detailed snapshot of system activity.

- **Locate Maintenance Equipment Status Display Functions in the Troubleshooting Procedures and General Maintenance Information section**

Station Status Display – Command #982

- **Set up a call between 2 single line extensions.**
- **Enter #982**

At this point the contents of register 1 are shown.

- **Determine the equipment number of one of the stations .**
- **Enter the equipment number in register 1**
- **Advance to register 4.**
- **Determine the following from register 4 – Source Device Type, Source Device Equipment Number, Destination Device Type, Destination Device Equipment Number.**

Much of the information contained in these registers is beyond the needs of technicians. However, there are some key applications such as determining the 2 conversing parties.

- **Examine the remaining Status Display Commands.**
- **Note: If a field is blank then likely the device being monitored is not in use. ie DTMF receivers are ionly used during call setup, Dial Tone Detectors are only used for outgoing trunk call setup, etc.**

SX-50™ DPABX: RMATS

INSTRUCTIONS:

The following exercise is a self-teaching assignment on the RMATS feature.

SX-50™ DPABX – RMATS

The SX-50™ DPABX can be accessed by technicians using a PC or dumb terminal to make database and maintenance changes while offsite. The process involves a terminal with a modem offsite and a RMATS module onsite.

The process is called Remote Maintenance and Administration System.

- **Read the Remote Maintenance and Administration System section of the Practice.**

ASSIGNMENT #1 – RMATS

1. **What are the two types of codes and their default values required to access the SX-50™ DPABX via RMATS?**

2. **What must the modem characteristics be?**

3. **Where can the RMATS module be installed?**

4. **What are the cross-connections to the RMATS module?**

5. Name 4 ways to access RMATS.

6. What is the code to select Attendant Functions mode?

7. What is the code to switch to Night Service?

ANSWERS

1. **RMATS ACCESS CODE (like an extension number) 498,
RMATS SECURITY CODE - 0246813579,
(then system asks for 7772)**

2. **Modem must be 300 baud,
even parity,
7 data bits,
2 stop bits,
full duplex,
originate mode.**

3. **The RMATS module may be installed in any position on the Universal Card.**

4. **There are no cross connections to the RMATS module. Just dial 498 and you are connected.**

5. **1 - From inside, dial 498,
2 - From outside ask the attendant for extension 498,
3 - From outside dial 498 on a DISA,
4 - make a trunk DIL to the RMATS module,
5 - From a DID trunk .**

6. **Type "A" (followed by carriage return)**

7. **11**

HANDS-ON EXERCISE

Connect the RMATS module and configure a terminal as described in the RMAT section of the Practice. Follow the instructions to log on to RMATS.

1. RMATS FUNCTIONS

From the terminal you can perform Attendant Functions or Programming Functions.

2. ATTENDANT FUNCTIONS

Enter A for ATTENDANT FUNCTIONS

The Menu for Attendant Functions offers the following selections;

HELP

S SUMMARY OF PBX COMMANDS

[ESC] EXIT PBX COMMANDS

E EXIT

Enter S

The terminal displays all Attendant Functions available.

Enter 15 to change the Time

Enter a new time and confirm the change by looking at the console

Set the correct Time

There are some maintenance commands available too.

Enter 41

BUSY a Trunk

Confirm the trunk is busy by looking at the LED

Enter 51 to UNBUSY the trunk

3. Programming Mode

To get to Programming Mode you must first leave Attendant Function Mode and return to the Primary Menu. From there you can select Programming Mode.

Enter E to Exit from Attendant Mode

The Primary Menu appears on the terminal

Select P for Programming Mode

The terminal displays the Programming Menu.

E EXIT

H HELP

N NEXT COMMAND

R REGISTER DISPLAY

S SUMMARY DISPLAY

[CR] ENTER COMMAND

[DEL] RUBOUT

4. SYSTEM OPTION PROGRAMMING

5. COMMAND 100 > >

At this point you can enter [CR] to go into Command 100 or enter another Command number.

Enter 110

The system responds with;

FEATURE ACCESS CODE PROGRAMMING

A B C D E F G H I J

0 1 0

The A B C heading is the bit locations and the 0 1 0 is the information programmed.
The 0 1 part means Register 01.

Register 06 contains the Feature Access Code for a Dial Pickup.

Enter 06 to view the information in Register 06

The Dial Pickup Code is 54

Change the Dial Pickup Code to be 64 by entering 64 [CR]

Set up a Dial Call Pickup to prove the change has been made

Return the Dial Call Pickup Code to 54

To leave that command enter E.

The system responds with;

FEATURE ACCESS CODE PROGRAMMING

COMMAND 110 > >

At this point you can enter E to view the Primary Selection Menu or enter another Command number to do further editing of the database.

Enter 100

Enter R (All Registers)

The system responds with the information programmed into all the registers of Command 100.

Enter E to Exit to the Primary Selection Menu

Enter E to Exit from RMATS

6. REVIEW

Now that you've had an introduction to RMATS, practice Signing-on and entering Attendant Function Mode and Programming Mode. If you're not sure of your options try the Help command (H) for assistance.

SX-50™ DPABX: SMDR

INSTRUCTIONS:

The following exercise is a self-teaching assignment on Station Message Detail Recording.

SX-50™ DPABX – SMDR

The RS-232-C port on the control card can feed a printer with external call information. The information states the time and duration of the call as well as the facilities used by the PBX.

The process of collecting this information is called Station Message Detail Recording.

- **Read the Station Message Detail Recording section.**

1. Where are the parameters for the printer port programmed?

2. Name the 3 Commands that require programming to insure SMDR works.

3. Why should Overwrite Queued Printer buffer always be enabled?

4. Name 3 conditions when SMDR will not record.

5. Review the **EXAMPLE SMDR RECORDS** in the **Station Message Detail Recording** section of the Practice.

ANSWERS

- 1. COMMAND 100 REGISTER 16**

- 2. 1 - COMMAND 100 REGISTER 14, COMMAND 121-129 REGISTER 3, COMMAND 151-6 REGISTER 2**

- 3. If this not enabled it will cause major problems if the printer stops working. All outgoing calls will be blocked as soon as the SMDR buffer on the SX-50™ DPABX is full .**

- 4. 1 - Station or Attendant gets busy when trying to access a Trunk Group,
2 - The system is in Power Fail Transfer mode,
3 - ARS blocks the call.**

HANDS-ON EXERCISE

Use information from the SMDR section of the practice to complete the following steps:

Connect the printer.

Match the Printer Port to the Printer by editing Command 100 Register 16.

Edit Command 100 Register 14 to Enable SMDR for Both Incoming and Outgoing Trunk Calls.

Test the system by completing an external call.

1. SMDR Scenarios

Create the following scenarios and interpret all the information given in the SMDR printout using the SUMMARY OF SMDR RECORD FIELDS in the MITL9120-091-221- NA Practice.

- Station to External Destination
- External Source to Attendant to Station
- Credit Card Call
- Station using Abbreviated Dial to External Destination
- Station using Abbreviated Dial to External Destination and Transferring call to another Station

SX-50™ DPABX: DATA DUMP / LOAD LAB PROJECT

WARNING

For accurate data transfer ALWAYS use a cassette that has never been used before.
Never use a cassette that has data recorded on the other side.

SX-50™ DPABX DATA DUMP / DATA LOAD

1. INTRODUCTION

The Data Dump/Load feature on the SX-50™ DPABX is used to keep hard or soft copies of the database.

read Data Dump in the features section of the Practice.

2. GETTING STARTED

The exercise will be split into three parts.

- DUMPing Data to a printer
- DUMPing data to a cassette recorder
- LOADING the data from a cassette recorder

DUMPING DATA TO A PRINTER

To dump data to a printer the Printer Port must be set up to match the printer then the DUMP command must be issued.

Match the Printer Port to the Printer by editing Command 100 Register 16

Enter * or 71 or press FUNCTION

Enter 97

Enter System Security Code

The system will send a copy of the database to the printer.

Insure that Call Processing is not lost by attempting a station to station call.

Note that the Console is unavailable for call processing.

DUMPING DATA TO A CASSETTE RECORDER

To dump data to a cassette recorder the recorder must be running before the dump command is issued.

Press the RECORD or WRITE button on the recorder

Enter * or 71 or press FUNCTION

Enter 97

Enter System Security Code

The system will send a copy of the database to the recorder.

Insure that Call Processing is not lost by attempting a station to station call.

Note that the Console is unavailable for Call Processing.

LOADING DATA FROM A CASSETTE RECORDER

To load data from a cassette recorder the Printer Port must be programmed then the LOAD command must be issued.

Set the Printer Port to 300 Baud by editing Command 100 Register 16

Enter * or 71 or press FUNCTION

Enter 98

Enter System Security Code

The cassette recorder will send a copy of the database to the SX-50™ DPABX.

Note that all Call Processing is halted during the Data Load procedure.



SX-50™ DPABX: APPLICATIONS

SX-50™ DPABX: APPLICATIONS

SMALL BUSINESS APPLICATION

INTRODUCTION

The SX-50™ DPABX has many options and features that make it ideal for use in the small business market. In this lab project you will install and program the SX-50™ DPABX to satisfy the requirements of a business that includes management, manufacturing and sales departments.

1. GETTING STARTED

Here are a few hints that will make the exercise easier.

- Read the entire exercise first
- Plan the entire database on paper prior to entering data
- Record all your changes – no matter how slight – on paper. This will make troubleshooting easier.

USER REQUIREMENTS

MANAGER – SUPERSET 4™ set

- Enable all business-related features
- Executive Busy Override
- Do Not Disturb
- Can call anywhere she likes (Access to all Trunk Groups)
- Account Codes
- Direct Trunk Select
- Personal Outgoing Line

SECRETARY – SUPERSET 4™ set

- Enable all business-related features
- Multicall Appearances of Manager, Manufacturing Supervisor, Sales Supervisor

MANUFACTURING SUPERVISOR – Single Line

- No external Access
- Travelling Class of Service
- Same pickup group as employees

MANUFACTURING EMPLOYEES – Single Line

- No External Access
- No business features
- Same pickup group as supervisor

SALES AGENTS – Single Line

- Hunt Group member (Login)
- Music-on-Hold

SALES MANAGER – SUPERSET 4™ set

- Multicall Line Appearances of all Sales Agents

ATTENDANT

- Attendant Tone Signalling

AUXILIARY ATTENDANT – SUPERSET 4™ set

- Dial 0, LDN 1, 2, 3, Recall, Hold 3

TRUNK REQUIREMENTS

CO TRUNK #1

- Day Answer Point is LDN 1
- Night Answer Point is Night Bell
- Loop Start

CO TRUNK #2

- Day Answer Point is Direct-In Line to Sales Group
- Night Answer Point is Direct-In Line to Sales Group
- Loop Start

CO Trunk #3

- Direct Trunk Select for Manager

WATS

- Answer Point is LDN 3
- Night Answer Point is Night Bell

DID

- Every telephone can be accessed by DID during the day
- DID night answer point is the auxiliary console prime line.

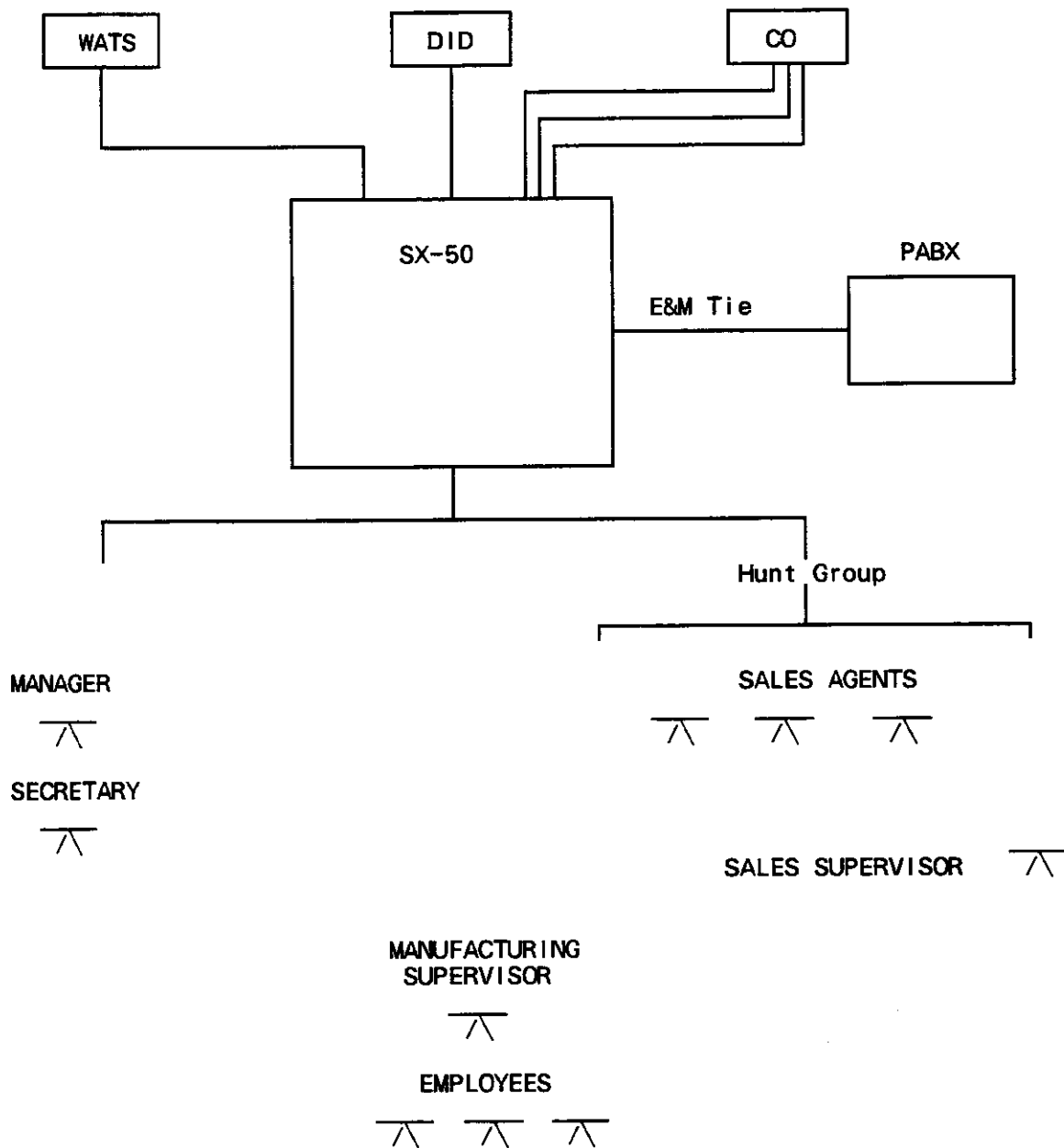
E&M Tie Trunk

- Dial-In
- Type I
- M-Lead Invert

ARS

3 Trunk Groups - CO, WATS, E&M

- Managers can make all calls,
- all others are restricted from long distance
- Long distance calls go to WATS. If the WATS is busy CO trunks are used.



- List the Trunk Equipment Number, Trunk Group and Trunk Group Access Code beside each trunk on the diagram
- List Station and SUPERSET™ set Equipment Number, COS and Extension Number beside each telephone on the diagram.

NOTES ON THE APPLICATION

Like many small business there is a variety of requirements that must be satisfied to ensure effective communication. Many features required by the users and the trunks must first be enabled in System Options programming. Other features are desirable for the system even though they are not specifically listed in the lab assignment.

Abbreviated Dial

Abbreviated dial numbers can be used to hold numbers frequently dialed by the users of the system. Restriction from Abbreviated dial numbers is done in Class of Service.

- Create 3 Abbreviated Dial Numbers
- Allow access by the SUPERSET 4™ set users only

SMDR

Station Message Detail Recording may be selected on any or all Trunk Groups for the purpose of tracking external calls. When used with account codes, users may charge a call to a client's account.

- Enable SMDR for all calls
- Enable SMDR on all Trunk Groups
- Enable Account Codes fixed length = 4

Partial Flash Inhibit

Users may complain that they receive phantom ringing after they hangup on an external call.

When users hang up abruptly on an external call it causes a bounce in the hookswitch of the telephone. The system interprets this as a hookswitch flash and attempts to place the trunk on hold. When the hookswitch finally stops bouncing, the system thinks the user has hung up on the held party. The system then rings the station causing the phantom ring.

By enabling this feature the system will require that a hookswitch flash be a minimum length on trunk calls. The brief bounce will not be sufficient to be interpreted as a hookswitch flash.

- Enable Partial Flash Inhibit

Trunk to Trunk Connections

There are several trunk to trunk connection possibilities that are possible and each type is listed in System Options. Trunk to trunk connections occur when an external user comes in and is routed externally (External Call Forward, DISA, Tie). Some trunk to trunk connections are not desirable because there is no disconnect supervision.

- Enable E&M to E&M connections
- Disable all other Trunk to Trunk Connections

Trunk Answer From Any Station (TAFAS)

During Night Service incoming calls may ring directly to the night bell. Extensions with the ability to perform TAFAS may dial a code and answer the incoming call.

In a small business the night staff may consist of only a security staff that wander the premises. If night bells are placed within earshot then incoming calls could be answered anywhere thus eliminating the need for an attendant.

- Enable TAFAS on the SUPERSET™ sets.

Contact Monitor

Unused ONS circuits can be configured into a basic security package. Closing a switch (offhook) across Tip and Ring will cause the console to ring with an alarm and the extension number. The switches may be placed at doors, windows, etc. of the business.

- Configure a telephone as a contact monitor point

MANAGER

As the manager runs the company she is provided with the ability to perform such features as Do Not Disturb, Executive Busy Override and Account Codes. Basic business related features would include Call Forwarding, Conferencing, Transfer, Camp-on, etc.

The secretary has a multicall line appearance of manager and will answer the incoming calls while the manager is in DND mode.

Preferred business acquaintances are supplied with the Direct Trunk Select number of to ensure direct and personal contact with the manager.

A second appearance of the prime line (Personal Outgoing line) allows the manager to make outgoing calls but still keep the prime line free.

SECRETARY

The secretary has multicall appearances of the Manager, Manufacturing Supervisor and Service Supervisor. The ringing is delayed so that the line appearances only ring when the manager or supervisors do not answer within the first 3 rings.

MANUFACTURING SUPERVISOR

Because of the difficulty in preventing unauthorized users from making long distance telephone calls, the telephone has No External Access.

Should the Supervisor wish to make an external call, Traveling COS is employed to allow external access.

MANUFACTURING EMPLOYEES

This telephone is internal access only and will always ring unless in use. Features such as call forwarding and do not disturb should be denied.

SALES AGENTS

The inside sales agents are members of a Hunt Group. Callers enter on a Direct-In Line and are routed directly to the Hunt Group.

When agents are going to be away from the telephone they can log out of the hunt group so their telephone will be skipped in the hunting. If they forget to logout the supervisor can answer the call with the multicall appearance.

Should an agent need help from a supervisor then the Remote Hold Retrieve feature should be used. This would allow the agent to place a caller on hold and let the supervisor remotely retrieve the call. Held callers hear Music on hold.

SALES SUPERVISOR

With a multicall appearance of each telephone the supervisor is available to handle any calls that go unanswered. For this reason delayed ringing should be programmed.

AUXILLARY ATTENDANT

The Auxillary Attendant can be used as an answer point if the attendant becomes too busy or will be absent for a period of time. The auxillary uses Hold 3 while the attendant uses Hold 1 and Hold 2 to avoid confusion.

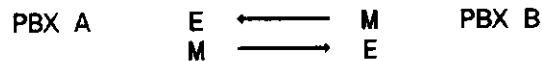
CO and WATS TRUNKS

CO, WATS, and private long distance carriers (Sprint, MCI) typically connect to a ground start trunk circuit on the LS/GS trunk card. Default programming is set for this application.

Note: In the lab assignment loop start trunks must be used. If there are insufficient incoming trunks then vacant ONS circuits may be used to simulate a CO Trunk.

E&M DIAL-IN

In a Back to Back configurations the M lead always transmits to the other PBX's E lead. The connections are;



For type 1 the Invert M option DOES NOT make it an E lead. Rather it just changes the voltage on it so the far end can interpret the signals the M lead will send. (See CMD 501-580 Register 3)

The trunk hardware type is Analog Tie Trunk and trunk dialling type is DIL.

To call from one PBX to the other the E&M Trunk Group Access code is dialed plus the extension number in the far end PBX. To make the caller unaware that he is being routed across 2 PBXs no ringback should be given (CMD 501-580 Register 1 Inward Dial Delay Before Answer).

Both this PBX and the far end PBX are programmed to expect incoming callers to dial digits immediately. To allow the PBXs an opportunity to prepare for incoming digits wink start incoming/outgoing can be used or delay dial.

When the caller enters the PBX, the Class of Service assigned is determined in Trunk Class of Service.

DID TRUNKS

In a DID trunk, battery is provided by the PBX. There is no dial tone.

For the lab a DID call can be simulated by using a telephone. If a rotary telephone is used then set Incoming Signalling to Loop Dial Pulsing. If a DTMF telephone is used then set Incoming Signalling to DTMF. Answer supervision is not required. (See CMD 501-580 Register 6&7)

If an incorrect number is dialled then re-order tone will be provided. However, both Night and Day illegal number intercept points can be programmed to insure human contact whenever a user dials a DID number. (See CMD 501-580 Registers 4&5)

HEALTH CARE APPLICATION

INTRODUCTION

The SX-50™ DPABX has many options and features that make it ideal for use in the health care market. In this lab project you will install and program the SX-50™ DPABX to satisfy the requirements of a small hospital that includes reception, doctor's offices, nurses' station and patient rooms.

1. GETTING STARTED

Here are a few hints that will make the exercise easier.

- Read the entire exercise first
- Plan the entire database on paper prior to entering data
- Record all your changes – no matter how slight – on paper. This will make troubleshooting easier.

USER REQUIREMENTS

DOCTOR PHONE – SUPERSET 4™ set

- **Code Blue Speed Call key**
- **Attendant Call Hold Pickup**
- **Direct Trunk Select**
- **External Call Forward**
- **Executive Busy Override**
- **Do Not Disturb**
- **Access to all Trunk Groups**

NURSES' STATION – SUPERSET 4™ set

- **Dial 0 appearance**
- **Code Blue Speed Call key**
- **Delayed Multicall Appearances of the Doctors and Patient Room phones**
- **Access to pager**

PATIENT ROOM PHONES – Single Lines

- **Code Blue Abbreviated Dial Code**
- **These are the only stations that can be reached by DID**
- **DID calls at night are routed to the console**
- **Room Status is applied to deny external calls for unoccupied beds**
- **Do Not Disturb**
- **Message Waiting**

BEDSIDE SWITCH

- **Contact Monitor is used as an emergency bedside switch**

LAB PHONE – SUPERSET 4™ set

- **Code Blue Speed Call key**
- **Direct Trunk Select**

ATTENDANT

- **Not Dial 0 !! Make it a different number**
- **Code Blue Abbreviated Dial Code**
- **Pager Access**
- **Call Hold**
- **Do Not Disturb**
- **Message Waiting**
- **Room Status Control**
- **Call Block**
- **Message Registration**

AUXILIARY ATTENDANT & CODE BLUE CONTROL POINT – SUPERSET 4™ set

- Code Blue line key
- LDN 1
- LDN 2
- HOLD 3
- Pager Access speed dial key
- Do Not Disturb Function key
- Message Waiting Function key
- Call Block Function speed dial key
- Message Registration Function key

TRUNK REQUIREMENTS

CO TRUNK #1

- Day Answer Point is LDN 1
- Night Answer Point is LDN 1
- Loop Start

CO Trunk #2

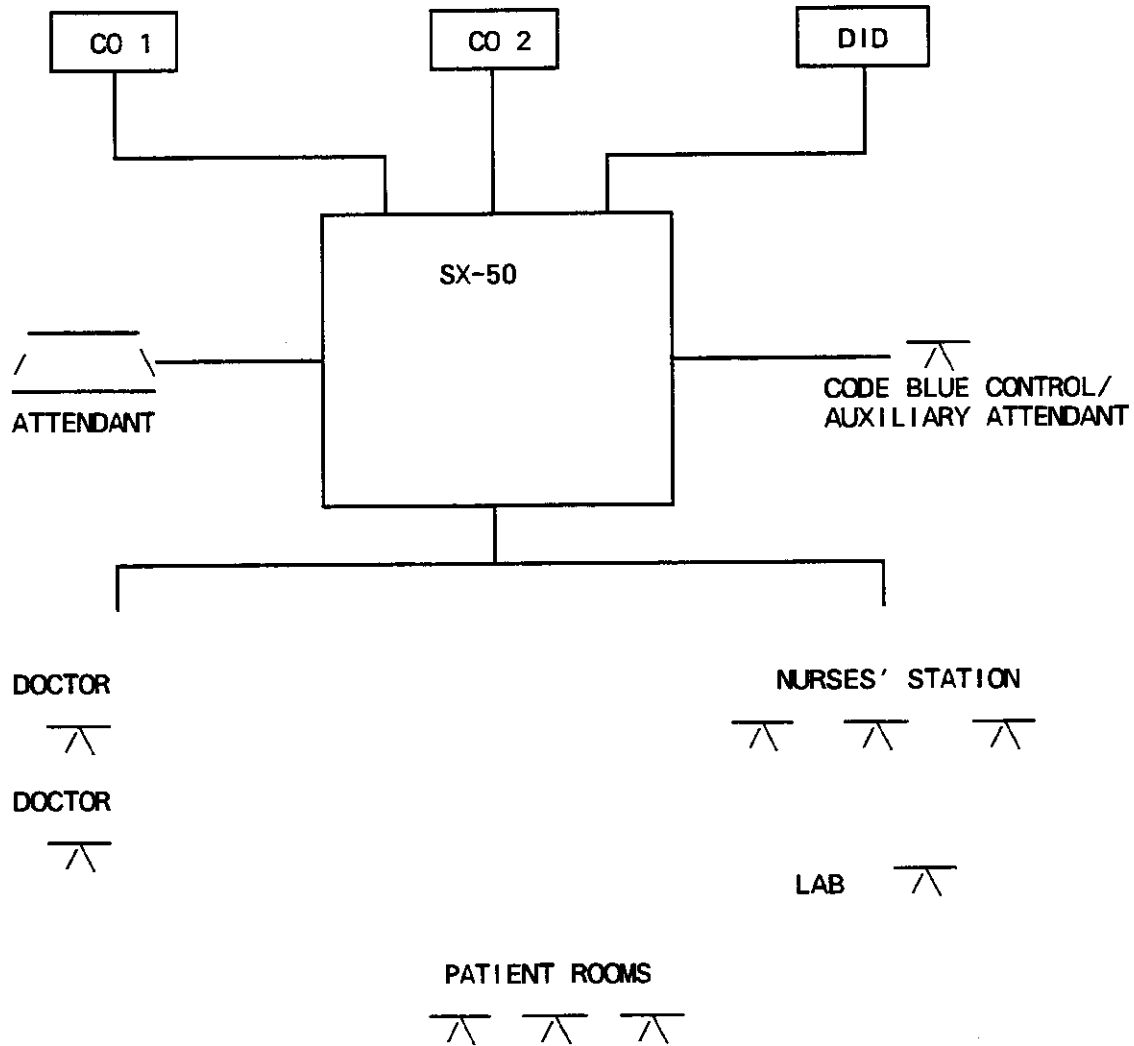
- Direct Trunk Select for doctor/lab

DID

- Day Answer Point is as dialed
- Night Answer Point is the console LDN 2

ARS

- All calls through Trunk Group 1
- Unoccupied Patient phones are restricted from external calls



- List the Trunk Equipment Number, Trunk Group and Trunk Group Access Code beside each trunk on the diagram
- List Station and Superset Equipment Number, COS and Extension Number beside each telephone on the diagram.

NOTES ON THE APPLICATION

Many features required by the users and the trunks must first be enabled in System Options programming. Other features are desirable for the system even though they are not specifically listed in the lab assignment.

CO to CO Connection

If loop start trunks are used, then a CO to CO connection cannot be made. This situation could occur if a doctor set an external Call Forward.

Conflict Dialling

A popular feature is to make the Room Numbers match the extension numbers ie. For room 16, dial 16. However, this could create a number conflict as the system wouldn't know what to do for room 1 when compared to room 10 - 19. By enabling the conflict dialling timer this type of numbering plan may be used.

NOTE: When programming a conflicting number, first enable the timer in System Options. Then enter the conflicting number in 301-310 or 401-480 followed by a #.

- Change the extension numbers of the Room Phones to be Ext 2 & Ext 20.

Pager

For emergency, the pager should be accessible from every telephone except the patient rooms.

- Enable Pager

SMDR

For calculating the cost of external calls SMDR must be enabled for all patient rooms. Should the patients use a credit card to make a long distance call the SMDR Credit Card option must be enabled to suppress the card number in the SMDR printout.

- Enable SMDR for all calls
- Enable Credit Card for Trunk Groups

Messenger Registration

Message Registration is enabled on Room telephones for external call billing. A printout of message units/room phone is available.

- Enable Message Registration

Contact Monitor

Unused ONS circuits can be configured into a bedside emergency switch. Closing a switch (offhook) across Tip and Ring will cause the console to ring with an alarm and the extension number.

DOCTOR

A speed call key is programmed with the Code Blue extension number.

When away from the telephone doctors can be reached by paging. For incoming calls the attendant would place the call on hold and announce "Dr. Jones please call 45X " where X = 1 for Hold 1, X = 2 for Hold 2 and X = 3 for Hold 3 on the console. (see Call Hold Attendant). If the nurse accepts a call for the doctor she can also place the call on hold and announce the call on the pager. The doctor would dial the Call Hold Remote Retrieve code plus the nurse's extension number. (See Call Hold - Extensions).

The doctor is provided with the ability to perform such features as Do Not Disturb and Executive Busy Override. The nurses station has a multicall line appearance of the doctors and will answer the incoming calls while the doctor is in DND mode.

In an emergency the Do Not Disturb programming can be overridden by stations with the ability to perform Executive Busy Override.

NURSES' STATION

Executive busy override must be enabled in order to contact a doctor in DND mode. This would be used in emergencies.

For patient inquiries, the nurse's station should be given a line appearance of the phantom extension 0. The console local could be changed to another number. This would leave the console available for incoming calls only and occasional calls from hospital staff that knew the local code.

A speed call key is programmed with the Code Blue extension number.

Access to the pager is provided for announcing emergencies or paging the doctor.

The nurse phones have multicall appearances of the Doctor and the Lab. The ringing is delayed so that the line appearances only ring when they do not answer within the first 3 rings.

PATIENT ROOM PHONES

Typically most features will be denied from the telephone to avoid confusing the patients. However, Do Not Disturb and Last Number redial and message waiting would be desirable.

Room-to-room calls can be blocked. This is accomplished when the attendant enables Call Block. With this feature enabled, stations with Call Block enabled in their COS will be barred from communicating with each other.

Room Status is applied to deny external calls for unoccupied beds.

BEDSIDE SWITCH

By using extra ONS ports as Contact Monitors, patients in critical condition will have the ability to press a button for attention in the case of an emergency.

ATTENDANT

Like a hotel/motel the attendant will be involved with processing calls and attending to any charges that are associated with patients. The Room Status, Message Registration/Audit, and SMDR features could be used in this application.

With the local of the attendant NOT being 0, the console is free to handle incoming external calls. The DID calls for rooms also help to keep the console traffic down.

CODE BLUE CONTROL POINT / AUXILIARY ATTENDANT

CODE BLUE is a convention used to indicate a 'life-in-danger' condition that may occur anywhere in the hospital. A special CODE BLUE team is made up of selected doctors, nurses and support personnel. This team responds immediately upon hearing a code blue announcement.

In order to determine the location of the Code Blue condition, a call can be made from any telephone in the hospital to the Code Blue Control Point. The caller's phone number is displayed at the Code Blue Control Point SUPERSET 4™ set, and hence the caller's location (the scene of the crisis) can be determined without any voice communication. The Code Blue condition and location can be announced over the paging system.

A receive only extension number can be used as a Code Blue number that will ring on a line appearance key at the Code Blue Control Point. The extension number used must be longer than the number of digits received for DID calls. This will prevent external DID callers from accidentally calling the Code Blue extension number.

All SUPERSET™ sets will have a speed call key programmed with the Code Blue extension number.

CO Trunks

In the lab 2 CO Trunks are used. One is used exclusively for direct trunk select by the doctors and lab. This helps to keep the console traffic down.

Note: In the lab assignment loop start trunks must be used. If there are insufficient incoming trunks then vacant ONS circuits may be used to simulate a CO Trunk.

DID TRUNKS

In a DID trunk battery is provided by the PBX. There is no dial tone.

For the lab a DID call can be simulated by using a telephone. If a rotary telephone is used then set Incoming Signalling to Loop Dial Pulsing. If a DTMF telephone is used then set Incoming Signalling to DTMF. Answer supervision is not required. (See CMD 501-580 Register 6 & 7)

If an incorrect number is dialled then re-order tone will be provided. However, both Night and Day illegal number intercept points can be programmed to insure human contact whenever a user dials a DID number. (See CMD 501-580 Registers 4 & 5)

HOTEL / MOTEL APPLICATION

INTRODUCTION

The SX-50™ DPABX has many options and features that make it ideal for use in the HOTEL MOTEL market. In this lab project you will install and program the SX-50™ DPABX to satisfy the requirements of a Hotel that includes management, reception, guest rooms, a seaside bar, conference rooms and a reservation department.

1. GETTING STARTED

Here are a few hints that will make the exercise easier.

- Read the entire exercise first
- Plan the entire database on paper prior to entering data
- Record all your changes - no matter how slight - on paper. This will make troubleshooting easier.

USER REQUIREMENTS

MANAGER – SUPERSET 4™ set

- **Enable all business-related features**
- **Executive Busy Override**
- **Do Not Disturb**
- **Access to all Trunk Groups**
- **Account Codes**
- **Direct Trunk Select**
- **Personal Outgoing Line**

SECRETARY PHONE – SUPERSET 4™ set

- **Enable business-related features**
- **Account Codes**
- **Do Not Disturb**
- **Delayed Multicall Appearances of the Manager and Seaside Bar**

GUEST ROOM PHONES – Single Lines

- **Controlled by Room Status**
- **Do Not Disturb**
- **Message Waiting with Lamps**
- **Automatic Wake Up with Intercept to RAD**
- **Set Wake Up from Extension**

CONFERENCE ROOM PHONES – Single Lines

- **Controlled by Restrictive Station Control**

SEASIDE BAR PHONE – Single Line

- **No External Access**
- **No business features**
- **Account Codes for all external calls**
- **Travelling COS**
- **OPS**

RESERVATION AGENTS – Single Line

- **Hunt Group member (Login)**
- **Music-on-Hold**

LOBBY PHONE, INFORMATION PHONES – Single Lines

- **Automatically rings the console.**

ATTENDANT

- Do Not Disturb
- Automatic Wake Up
- Message Waiting
- Call Block
- Restrictive Station Control
- Room Status
- Message Registration

AUXILIARY ATTENDANT - SUPERSET 4™ set

- Do Not Disturb
- Automatic Wake Up
- Message Waiting
- Call Block
- Message Registration

TRUNK REQUIREMENTS

CO TRUNK #1

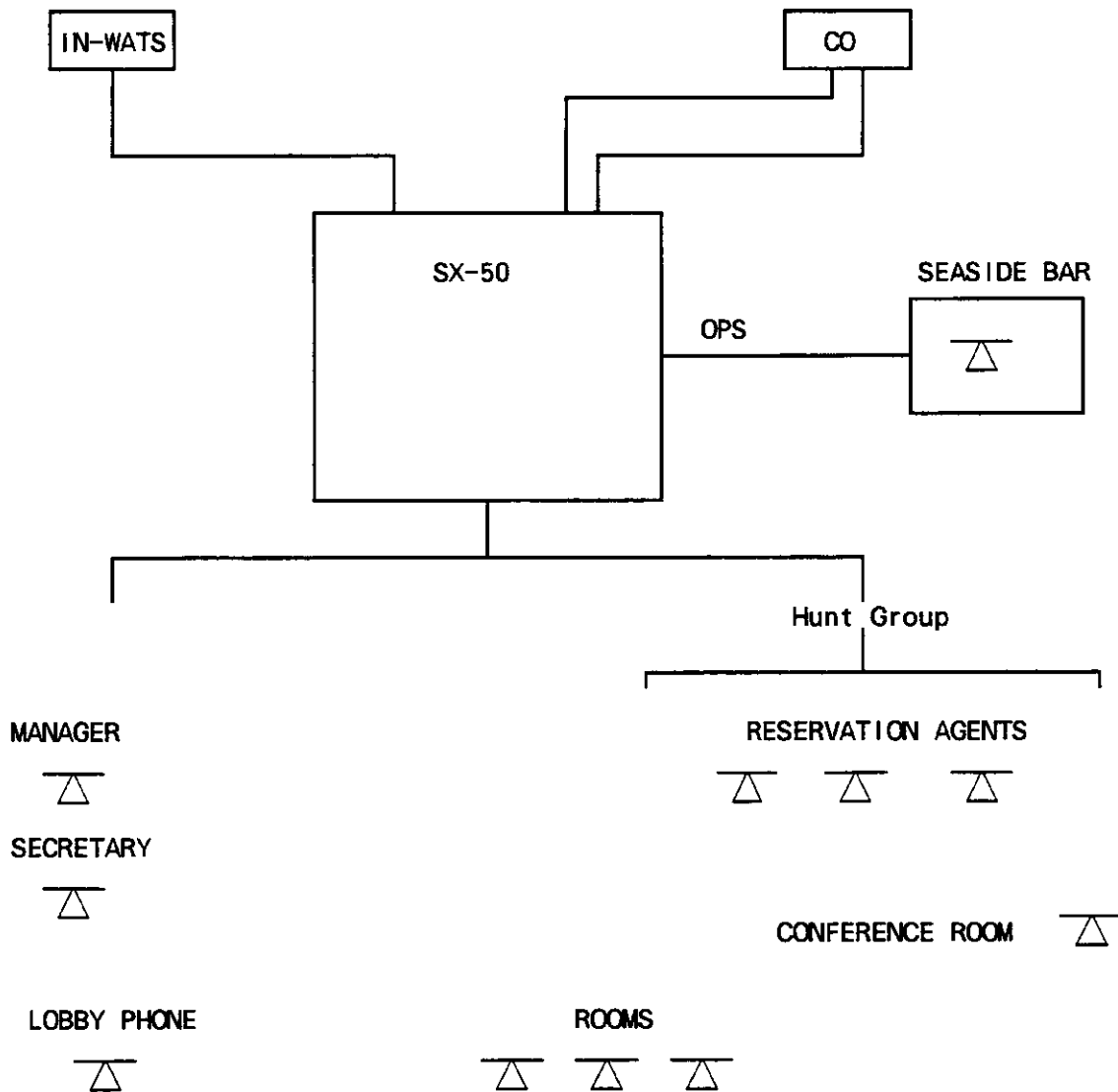
- Day Answer Point is LDN 1
- Night Answer Point is Night Bell
- Loop Start

CO Trunk #2

- DISA
- Day Illegal Intercept is Console
- Night Illegal Intercept is Console

IN-WATS

- Day Answer Point is Direct-In Line to Reservations Group
- Night Answer Point is Direct-In Line to Reservations Group
- Loop Start



- List the Trunk Equipment Number, Trunk Group and Trunk Group Access Code beside each trunk on the diagram
- List Station and SUPERSET set Equipment Number, COS and Extension Number beside each telephone on the diagram.

NOTES ON THE APPLICATION

There is a variety of requirements that must be satisfied to ensure effective communication. Many features required by the users and the trunks must first be enabled in System Options programming. Other features are desirable for the system even though they are not specifically listed in the lab assignment.

CO to CO Connection

If loop start trunks are use in a CO to CO connection, then the outgoing trunk will become latched as disconnect supervision is not provided. This situation could occur with the DISA line.

Automatic Wakeup

This feature is a must for a hotel. A printout of wakeup call information is available to cool irrate customers who swear that the phone didn't ring.

When the guests answer the wake up call, they will be presented with a recorded message that greets them and lists the dining room specials for the day.

- Enable Auto Wakeup with intercept to a RAD.
- Enable Auto Wakeup Printout
- Enable Set Wake Up from Extension

SMDR

For calculating the cost of external calls SMDR must be enabled for all rooms. Should the guests use a credit card to make a long distance call the SMDR Credit Card option must be enabled to suppress the card number in the SMDR printout.

- Enable SMDR for all calls
- Enable Credit Card for Trunk Groups

Message Registration

Message Registration is enabled on Room telephones for external call billing. A printout of message units/room phone is available.

- Enable Message Registration

Room Status

Between the console and the maid the VACANT/OCCUPIED and CLEAN/NOT CLEAN Status of a room is determined. A printout of the room status is available.

Data Demultiplexer

With different types of printouts (SMDR, WAKEUP, MESSAGE REGISTRATION, ROOM STATUS, ALARMS, DATA DUMP) on the same printer, the process of collecting information is confusing. The MITEL Data Demultiplexer can be used to connect up to 4 printers and will automatically route ALARMS to printer 0, SMDR to printer 1, ROOM STATUS, MESSAGE REGISTRATION, WAKEUP to printer 2, and DATA DUMP to printer 4.

Contact Monitor

Unused ONS circuits can be configured into a basic security package. Closing a switch (offhook) across Tip and Ring will cause the console to ring with an alarm and the extension number. The switches may be placed at doors, windows, etc. of the business.

- Configure a telephone as a contact monitor point.

MANAGER

As the manager runs the hotel he is provided with the ability to perform such features as Do Not Disturb, Executive Busy Override and Account Codes. Basic business related features would include Call Forwarding, Conferencing, Transfer, Camp-on, etc.

The secretary has a multicall line appearance of manager and will answer the incoming calls while the manager is in DND mode.

SECRETARY

The secretary has multicall appearances of the Manager and the Seaside Bar. The ringing is delayed so that the line appearances only ring when the manager or supervisors do not answer within the first 3 rings.

GUEST ROOM PHONES

Typically most features will be denied from the telephone to avoid confusing the guests. However, Do Not Disturb, Message Waiting with Lamps option, setting Wake Up from the extensions and Last Number redial would be desirable.

Late at night it is desirable to stop prank calls between rooms. This is accomplished when the attendant enables Call Block. With this feature enabled stations with Call Block enabled in their COS will be barred from communicating with each other.

These phones are barred from external access if the attendant sets the room status to VACANT. External local and long distance calling privileges and room status are done by enabling Room Status in the phone's COS.

The maid updates the clean/not clean status of the room by dialing a code on the room phone.

The Vacant/Occupied status is set by the console.

CONFERENCE ROOM

This telephone is for internal calls only when the room is not booked. Features such as call forwarding and do not disturb should be denied.

Restrictive Station Control should be applied to this phone to provide authorized long distance calls when the room is in use.

LOBBY PHONE

By enabling the Manual Line option in COS this telephone will always ring the console after going offhook.

SEASIDE BAR

This telephone is used to communicate with the bar staff but is readily available for use by the guests. For this reason the phone is restricted from external access since calls can not be charged back to the guests' rooms. However, the bar staff can use "Travelling Class of Service" to allow themselves to place outgoing calls.

RESERVATIONS

The reservation agents are members of a Hunt Group. Callers enter on a Direct-In Line and are routed directly to the Hunt Group.

When agents are going to be away from the telephone they can log out of the hunt group so their telephone will be skipped in the hunting.

ATTENDANT and AUXILLARY ATTENDANT

In a Hotel/Motel the Attendant is extremely important as it is the center of both communications and registration of guests.

The console controls the ability for the Conference Room and Guest Room phones to make external calls by employing Restrictive Station Control, Room Status respectively. Room to room calls can be restricted by enabling Call Block.

As a service to guests the attendant can set Automatic Wake-up, Message Waiting and Do Not Disturb.

When checking out, the attendant can provide the customer with a detailed SMDR report of any external calls along with a corresponding charge calculated from the Message Registration.

CO and WATS TRUNKS

CO, WATS, and private long distance carriers (Sprint, MCI) typically connect to a ground start trunk circuit on the LS/GS trunk card. Default programming is set for this application.

In this case an IN-WATS number is provided to out-of-area customers who wish to make a reservation.

Note: In the lab assignment loop start trunks must be used. If there are insufficient incoming trunks then vacant ONS circuits may be used to simulate a CO Trunk.

DISA

The DISA trunk is used so an external caller can call into the PBX and access the external trunking facilities. The manager may use this feature to make long distance business calls, from his home or other outside location, and the PBX will be billed. For protection the DISA security code should be used.

SX-50™ DPABX: HISTORY

SX-50™ DPABX: HISTORY

SUMMARY OF MS55 UPDATES

MS55 introduces the DNIC line card. Up to 4 cards may be installed. MS55 supports only the 410DN and the 420DN sets. There have been no changes in the CDE. The new sets are programmed in identical fashion to a COV Line Card.

SUMMARY OF MS53/54 UPDATES

The following section provides a short description of the MS53/54 changes.

1. Account Codes

Account codes can be selectively required for toll calls.

- Program command 121-9, register 7, field "c" with a value of 2.

Toll calls are identified to the system in command 751.

- Program command 751, field "h" of any register with a value of 1.

2. Attendant Call Pickup Key

This gives the attendant a function key that is equivalent to dialing the Directed Call Pickup access code. Once pressed, the attendant must enter the directory number of the ringing extension

- Program an Attendant Console key in a register of command 185, field "cd" with option 21 (Attendant Call Pickup).

3. Attendant Selectable RCS (MS51 MR2)

This feature permits the attendant to control external calling by extensions.

The attendant selects the ROOM STATUS feature to change the Routing Class of Service on a per extension basis. With proper ARS programming, you can use the feature for Hotel/Motel applications to allow or deny the extensions from dialing local, long distance or even overseas calls through control of their active Routing Class of Service.

A vacant room extension, by default, is restricted to DIAL 0 calls only. An occupied room extension, by default, is allowed to make internal calls. However, after pressing the Room Status key, the attendant can press the "TRK BAR" softkey to successively change the Routing Class of Service to ALLOW1, ALLOW2, ALLOW3, and DENY, where:

- ALLOW1 = RCS 1
- ALLOW2 = RCS 2
- ALLOW3 = RCS 3

ROOM STATUS is not available from an Auxiliary Attendant position.

- Program command 121-129, register 3, field "h" with 1 (Enable ROOM STATUS for the extension's Class of Service).
- Program command 301-310, register 01-16, field "g" with 4 (Attendant Selectable RCS)

4. Auto Line Disconnect (MS52)

Use this feature to have the system send a signal to a Voice Mail/Auto Attendant or dictation system when the caller hangs up.

- Program command 100, register 3, field "h" for the type of Disconnect tone that will be used.
- Program command 100, register 3, field "ij" for the specific tone.
- SEE also, Voice Mail Port.

5. Automatic Ringdown Circuit

SEE HOTLINE.

6. Automatic Wake-up

Two new features have been added:

- Wake up calls can be answered by a Recorded Announcement Device (RAD)
- Extensions can program the wake up call time.

6.1 Wake up calls can be answered by a Recorded Announcement Device (RAD)

- Program command 100, register 10, field "c" with option 3 (Wake-Up with Intercept to RAD)
- The RAD is the first Programmed ONS circuit that the system can find in the database (e.g. Slot 1, circuit 1; equipment number 001).
- Extensions are connected to the RAD in a listen-only mode (like the Music On Hold feature).

6.2 Extensions can program the wake up call time.

- Program command 110, register 41 with a WakeUp From Extension access Code; default = 69
- Program command 121-9, register 4, field "j" to 1 (WakeUp From Extension).

7. Data Dump/Load

Speed Call numbers are included in the data dump.

8. Hotline

A Hotline call means that when an extension goes off-hook, the system automatically connects it to a predetermined destination.

Three types of hotline arrangements can be programmed:

- **Hotline:**
 - The system connects the extension to a destination determined by an abbreviated dial entry. These are hotline groups 2 to 9 for entries 12 to 19 for 2-digit (or 102 to 109 for 3-digit) abbreviated dial plans, respectively.
- **Manual Line:**
 - The system connects the extension to the Attendant console via a "Dial 0" call.
- **Contact Monitor:**
 - The system raises a Contact Monitor alarm at the Attendant console (Dial 0) in Day Service Mode. During Night Service Mode, the system will also ring a destination programmed in comand 100 register 17 and deliver a special warning tone.
 - Contacy monitor CANNOT be assigned to a COV card circuit.

Hotline destinations

When the extension's COS option for Automatic Ringdown Circuit is: (command 121-9, reg 2, field "d")	AND the Extension Type is: (command 301-310, reg 1-16, field "c")		
	0 (Extension)	1 (Contact Monitor)	2-9 (Hotline Group)
0	NORMAL EXTENSION OPERATION	Alarm sent to console (Contact Monitor)	NORMAL EXTENSION OPERATION
1	the system Dials "0" (Manual Line)	Alarm sent to console (Contact Monitor)	dials Abbreviated Dial entry (Hotline Group)

9. Lockout Alarm

After 10 seconds of dial tone, and 20 seconds of reorder tone, a Lockout Alarm is generated at the console.

- Program command 121-9, register 7, field "h" to 1 (Lockout Alarm).

10. Message Waiting

Four new Message Waiting features have been added:

- ONS Message Waiting Callback feature access code (MS51 MR2)
- ONS Msg Waiting Cancel feature access code
- Message Waiting Indicator programmable on key 3 of SUPERSET 3 sets
- "MESSAGE WAITING" key for Auxiliary Attendant

10.1 An access code can be dialed from an ONS set to call the sender of the Call Me Back message. (MS51 MR2)

- Program command 110, register 38 for the ONS Msg Waiting Callback feature access code; default = 65

10.2 An access code can be dialed from an ONS set to cancel all Call Me Back message indications.

- Program command 110, register 39 for the ONS Msg Waiting Cancel feature access code; default = 66

10.3 A Message Waiting Indicator is programmable on key 3 of SUPERSET 3™ sets. The SUPERSET 3™ user can press this key to send a Call Me Back message to another set, or to respond to a Call Me Back request.

- Program command 401-480, register 3, field "c" with Option 9 (Message Waiting Indicator for key 3 on SUPERSET 3™ sets)

10.4 An Auxiliary Attendant can apply and remove message waiting on an extension.

- Program command 401-480, register 2 to 15, field "de" with Option 10 (MESSAGE WAITING key for Auxiliary Attendant)

11. Overflow

Calls that are unanswered at the Attendant Console can be OVERFLOWED to a programmed answer point.

- Program command 100, register 8, field "ghi" with the desired overflow point.
- Field option "000" is the night bell.
- Field options "001" through "160" are Station Equipment numbers.
- Field options "161" through "166" (hunt groups), and option "167" (ring group) have been added.

12. Special DISA

SEE Verified Authorization Codes

13. Trunk Intercepts

Busy Intercept, Do Not Disturb Intercept, No Answer Intercept have been added. Vacant/Illegal Number Intercept has been moved to Command 501, register 4, field "k".

- Program command 501, register 4, field "h" for Busy Intercept
- Program command 501, register 4, field "i" for Do Not Disturb Intercept
- Program command 501, register 4, field "j" for No Answer Intercept
- Program command 501, register 4, field "k" for Vacant/Illegal Number Intercept

14. Traveling COS

SEE Verified Authorization Codes

15. Verified Authorization Code

Use Verified Authorization Codes to selectively apply a new COS and/or COR to a call. When a VAC is dialed on a DISA trunk, Special DISA occurs. When a VAC is dialed at an extension, Travelling Class of Service occurs.

- Program command 100, register 14, field "k" for VAC Overwrite Account Code
- Program command 100, register 15, field "e" for VAC Enable/length
- Program command 121, register 2, field "e" for Special DISA/VAC Required
- Program command 110, register 40 with the Verified Authorization Code access code; default = 67
- Program command 180, register 2, field "h" for User Verified Authorization Code programming
- Program command 185, field "cd" Option 20 (Verified Authorization Code Entry function key)
- Program command 600 with the Verified Authorization Code assignments to link the VACs to COS and/or COR values.

16. Voice Mail Port (MS52)

The system supports special COV message protocol and timing for COV Voice Mail ports.

- Program command 121-9, register 3, Field "k" with option 2 (Msg Optimization Control).
- Use this setting for interface to the VX™ Voice Processor.
- SEE ALSO, Auto Line Disconnect

Release MS53 has ALL of the functionality provided in MS54 except COV voice mail port support. In MS53, command 121-9, register 3, field "k" (Voice Mail Port) option 1 "Message Optimization Control" is masked, and is therefore NOT available.

This option controls the COV Messaging format required for a COV Voice Mail port.

RELEASE MS50

1. MS50 MR1

- * command 700 uses 32 digits
- * command 752 uses 32 digits
- * command 100-13-e default set = 0

2. MS50 MR2

credit card calling

- * command 151-4-e (additional DTMF RCVR connected to call to detect CO tone for start of credit card number)

DND removes members from hunt group

headset operation

- * command 121-2-j

3. MS50 MR3

Abbreviated dial ARS bypass

- * command 100-13-j

ARS interdigit timeout

- * command 100-13-i

MS51

1. MS51 MR1

Abbreviated dial access - increase to 900 entries

- * command 100-9-h

Attendant switchable COS - switches all stns in COS to new COS

- * command 301-e
- * Function codes 25,26

attendant tone signalling

- * command 185-cd = 18

automatic callback busy/no answer

- * command 110-ab = 32
- * command 121-b

Auto switching to night service

- * command 100-8-c = 3

auxiliary attendant

- * command 121-7-d
- * command 401-c = 8
- * command 401-d,e = 01-09, 11-13

behind PABX recall signal duration

- * command 151-4-d

contact monitor

- * command 100-17 contact monitor night answer point
- * command 301-c = 1

Conference warning tone - all conferences

- * command 100-5-f

dial tone detection timing

- * command 151-2-c

DID

- * command 121-8-e
- * command 501-1-d = 5 or 6 Short/Long DID trunk
- * command 501-1-i = 3 Trunk Use
- * command 501-1-j = 2 Trunk Dialing Type
- * command 501-5-f DID Night Answer point
- * command 501-6-all DID descriptor part 1
- * command 501-7-all DID descriptor part 2

directed call pickup

- * command 110-ab = 30

Display trunk meter

- * Attendant Function code "**27"

DND

- * command 121-2-k
- * command 110-ab = 33

French

- * Function code 91, 92

Function key programming

- * command 185-bc = 8-14 added

Login Hunt Groups

- * command 110-ab = 34
- * command 121-7-g

OPS

- * command 301-1-h

Proportional call charging

- * command 100-10-g

Room Status

- * command 100-10-i Room Status Printout
- * command 121-3-i Room Status
- * Function code 81

SMDR "x" digits dialed

- * command 100-14-j

SS4 Pickup Prompt

- * automatic when Pickup enabled

Trunk dialing type (indicates need for DTMF RCVR for incoming calls)

- * command 501-1-j

Trunk Use (selects programming defaults for the trunk register)

- * command 501-1-i

Use of HASH (#) for trunks

- * command 100-10-f

2. MS51 MR2

ARS Callback Busy

- * No new programming

Delayed Ring for Auxiliary Attendant

- * Select RING TYPE at SUPERSET via SELECT FEATURES key option = 6

Message Waiting Calls Originator of Message

- * command 110-38; default = 65

Room Status -- Attendant Selectable RCS

- * command 301-g = 4
- * RCS selected at Attendant Console only
- * RCS selected in Room Status function

Room Status -- Maid not in room/room clean code

- * Maid in room condition code "5" added

Room Status Print from Auxiliary Attendant and test line

- * No new programming

3. MS51 MR2

Authorized Trunk to Trunk connect

- * Command 121/9, register 1, field j provides COS-based trk-to-trk connection control

MS52

1. MS52 MR1

- * command 121/9-3-k COV Voice mail port enable/disable

MS53

1. MS53 MR1

- * THIS RELEASE IS FOR US ONLY
- * THIS RELEASE IS IDENTICAL TO MS54 LESS:
- command 121-3-k Voice mail port (option 1 is masked)

MS54

1. MS54 MR1

Abbreviated Dial

- * accepts feature access codes

Account Codes

- * command 121-7-c Option 3 changed from option 2
Option 2 = Required for Toll Call
- * command 751-all-h Toll / non-Toll call
- * command 151-2-f Field name = RESTRICT EXTERNAL CALLS ON REVERSAL

Auto Line Disconnect

- * command 100-3-h Disconnect tone
- * command 100-3-ij Tones Selected
- * See also Voice Mail Port

Automatic Ringdown Circuit

- * SEE HOTLINE

Automatic Wake-up

- * command 100-10-c Field option 3= Wake-Up with Intercept to RAD
- * command 110-41-all WakeUp From Extension access Code; default = 69
- * command 121-4-j Set WakeUp From Extension

Call Pickup

- * command 185-all-cd Option 21= Attendant Call Pickup key

Data Dump/Load

- * Speed Call numbers included

Hotline

- * command 301-all-c Field name = EXTENSION TYPE
Option 0 = EXTENSION
Options 2-9 = Hotline Group

Lockout Alarm

- * command 121-7-h Lockout Alarm

Message Waiting

- * command 110-39-all ONS Msg Waiting Cancel feature access code; default = 66
- * command 401-all-c Option 9= Message Waiting Indicator (key 3 on SUPERSET 3 sets)
- * command 401-all-de Option 10= "MESSAGE WAITING" key for Aux. Attendant

Overflow

- * command 100-8-all Register name = OVERFLOW CONTROL
- * command 100-8-ghi Register name = OVERFLOW POINT
Field options 161-166 and 167 added

Special DISA

- * See Verified Authorization Codes

Trunk Intercepts

- * command 501-4-h Busy Intercept
- * command 501-4-i Do Not Disturb Intercept
- * command 501-4-j No Answer Intercept
- * command 501-4-k Vacant/Illegal Number Intercept

Traveling COS

- * See Verified Authorization Codes

Verified Authorization Code

- * command 100-14-k VAC Overwrite Account Code
- * command 100-15-e VAC Enable/length
- * command 121-2-e Special DISA/VAC Required
- * command 110-40-all Verified Authorization Code access code; default = 67
- * command 180-2-h User Verified Authorization Code programming
- * command 185-all-cd Option 20 = Verified Authorization Code Entry function key
- * command 600-all-all Verified Authorization Code programming

Voice Mail Port

- * command 121-3-k Option 2= Msg Optimization Control (for VX Voice Processor)
3= Send Msg Disconnect tone
- * See also Auto Line Disconnect

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**SIGNALLING AND
SUPERVISION
ALL MITEL SYSTEMS**

This technical education bulletin is intended for

Customer Service and Installation Personnel

involved in the service of all Mitel PABX systems.

This bulletin describes standard telephony

signalling and supervision in use throughout the

network.

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1 OVERVIEW

This document is intended for use by technical personnel as an aid in better understanding how communication switching systems interface with one another. The topics discussed include the different types of interfaces used and the signals that are either generated or received by each type of interface in the processing of a call.

2 INTRODUCTION

Telephone signalling is the language used by telephone systems to talk to each other. Different signalling methods can be likened to different languages spoken by people. Instructions from one person to another are never understood unless both people understand the language being spoken. Similarly, instructions from machine to machine are never understood unless both machines are using the same signalling method.

Telephone systems must "talk" to each other to know when and between what points to connect a communications path. Telephone systems not only communicate between themselves, but the parts within a system must also communicate with each other. Since each system has its own unique internal signalling method, an interface signalling method is required when two systems are interconnected. The two standard interfacing methods, Loop Signalling and E&M Signalling, as well as the common transmission system signalling methods are covered by this report.

2.1 REPORT STRUCTURE

This report is structured so that each section can be read independently of the other sections. For example, to learn about E&M Signalling you only need to read Section 2, Introduction, and Section 6, E&M Signalling.

2.2 SIGNALLING TERMS

Many signalling terms have multiple meanings. The definitions given here are those generally in use today in the telephone industry and are those used throughout this report. Each end of a telephone circuit may signal one of two conditions which are called on-hook or off-hook. The names are derived from the two states of a telephone; one with the receiver on its mounting and one with the receiver off its mounting.

The signalling method is the way in which on-hook/off-hook signals are sent over a circuit.

A telephone circuit is always in one of three states:

1. When a circuit is not in use and is available for use, it is said to be idle.
2. The time during which the call connections are being made is the call setup state.
3. When both ends of the communication path are connected together and communication is possible, the circuit is in the connected state.

Signals which initiate the transfer from one state to another are called supervisory signals or supervision. There are three supervisory signals:

1. A seizure signal is sent from the calling end to signal that the calling end wishes to set up a call.
2. An answer signal is sent from the called end when the call end answers the call.
3. A release signal is sent from either end when that end wishes to terminate the call. Modern switching equipment will disconnect a call when a release signal is received from either the calling or the called end. However, some older switching equipment will recognize a release signal only from one end, and will ignore a release from the other end. When release signals from the called end are recognized, it is called called party control, and when release signals from the calling end are recognized, it is called calling party control.

The transmission of the terminating number is called pulsing.

2.3 GENERAL INTERPRETATION OF SIGNALS

The direction of transmission, duration, and the relative time of occurrence determine the meaning of on-hook or off-hook signals. For example, when a circuit is in the idle state a one second off-hook is a seizure signal. However, when in the call setup state, the same off-hook signal from the called end can be interpreted as a stop outputting signal. Similarly, an off-hook of different duration may have a different meaning. The recognized duration time limits for any signal will vary within set standards from switching system to switching systems.

3 SUBSCRIBER LOOP SIGNALLING

The signalling between the central office (CO) and the attached terminal equipment, such as telephones and PABX's, is called subscriber loop signalling. On the subscriber loops, signals are sent by both DC current and by tones.

There are two types of subscriber loop signalling called loop start and ground start. Loop start is the most common operation, and is used with telephones and most other terminal equipment. Ground start has two applications - with a PBX to minimize simultaneous seizure of the loop from the CO and the PABX, and with coin telephones for coin control signalling.

Because the most common terminal equipment on a subscriber loop is a telephone, subscriber loop signalling was designed for use with a telephone. The telephone is a simple device and is limited in what signals it can send and receive. For a rotary dial telephone all signals are sent by opening and closing a set of contacts. A telephone equipped with a key pad, can in addition, send pulsing signals by tones. The only signal the telephone can recognize is ringing and any other receive signals must be interpreted by the user of the telephone.

3.1 LOOP START OPERATION

Figure 3-1 shows a simple subscriber loop signalling (loop start) circuit. The following table relates how various signals are sent with loop start subscriber loop signalling.

SIGNAL	
Seizure (off-hook) of calling end	Contact closure and DC current flows on originating loop
The CO is ready to receive the called number	Dial tone on originating loop
Pulsing	Originating loop current is interrupted by opening and closing contacts (Dial Pulse) or tones are sent (DTMF)
Seizure of called end	Ringing on terminating loop, ringback tone on originating loop
Answer (called end)	Contact closure and DC current flows on terminating loop. Ringing and ringback tone removed. Some CO's reverse current flow on originating loop
Called end on-hook	Contacts are opened and DC current stops on terminating loop.
Calling end on-hook	Contacts are opened and DC current stops on originating loop.

TABLE 3-1 LOOP START SUBSCRIBER LOOP SIGNALLING

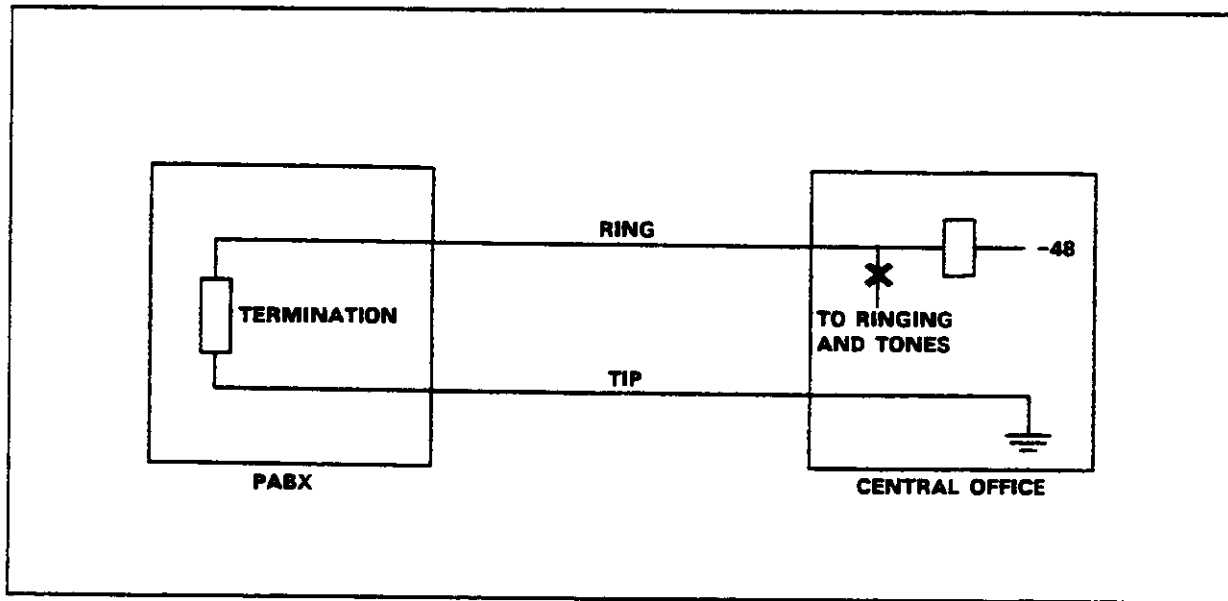


Figure 3-1 Subscriber Loop Signalling (Loop Start)

The frequency of tones, other than DTMF tones, on a subscriber loop have in the past varied from one type of switching machine to another. The Bell System have adopted a standard called "The Precise Tone Plan" in which each progress tone is either one of, or a pair of, the frequencies 350, 440, 480, and 620 Hz. Newer offices have been converted to conform. Under the precise tone plan, dial tone is 350 plus 440 Hz and ringback tone is 440 plus 480 Hz.

3.2 GROUND START OPERATION

When a PABX is connected to a subscriber loop, the ground start option is usually added to overcome the possibility of an incoming call being connected to an outgoing call, (collisions). For loop start operation, the only seizure signal from the C.O. is ringing. However, ringing cycles through a silent period and a ringing period. During the silent period, no signal is sent. If during the silent period the loop is seized for an incoming call, no ringing seizure signal is immediately sent, allowing the circuit to be also seized for an outgoing call, causing a collision connection. With the ground start option, an incoming call is immediately signalled by a ground on the Tip, preventing seizure of the loop for an outgoing call.

Many electronic central offices today apply ringing immediately upon seizure (immediate ringing). If ringing is applied immediately, most collisions are eliminated thus, lessening the need for the ground start option.

Ground start lines are also used to ensure a release signal is sent from the CO to the PABX when the CO releases the far end connection. When the CO releases, the ground is removed from the Tip and loop current will stop. A release signal from the CO is necessary to release a CO trunk to CO trunk connection after the connecting parties have disconnected.

Figure 3-2 shows a simplified ground start circuit. The CO signals a seizure by immediately making the normally opened contact "A" and grounding the Tip (T) lead. Similarly, the PABX signals a seizure by immediately making the normally opened "B" contact and grounding the Ring (R) lead. After the initial "start" signal, operation is identical to loop start.

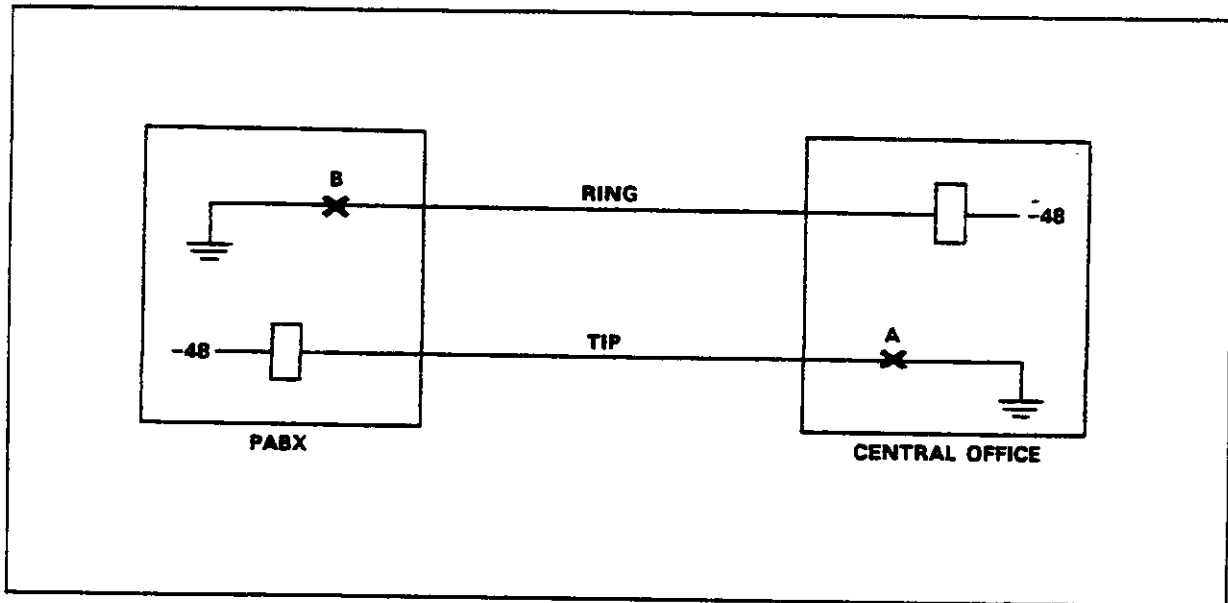


Figure 3-2 Ground Start Operation

4 LOOP SIGNALLING

Loop signalling is used on cable transmission systems with a total loop resistance of less than 3000 ohms. This loop resistance restriction limits the use of loop signalling to short distances (typically between switching systems within the same community or between adjacent communities).

4.1 OPERATION

DC current is used to represent three possible states. The three states and the corresponding DC signals are shown in the following table:

STATE	DC SIGNAL
Both ends idle (on-hook)	No current
Originating end off-hook	Forward current
Terminating end off-hook	Reverse current

TABLE 4-1 LOOP SIGNALLING CONDITIONS

A simple loop signalling circuit is shown in Figure 4-1. For a call set up from trunk 1 to trunk 2 the circuit operates as follows:

1. In the idle state, contacts A are closed and B and R are open in both trunks, Battery and Ground is connected to Ring and Tip, and no DC current flows.
2. When trunk 1 seizes the circuit, contacts A opens and B closes; closing the loop and allowing DC current to flow from the battery in trunk 2.
3. When trunk 2 answers, contacts A open and R close, reversing both the battery polarity and the DC current.
4. Both trunks return to the idle state when either the originating end breaks the loop, or the terminating end changes the battery polarity back to the forward direction.

Note that, in loop signalling, the battery supply for loop current is always provided from the terminating trunk.

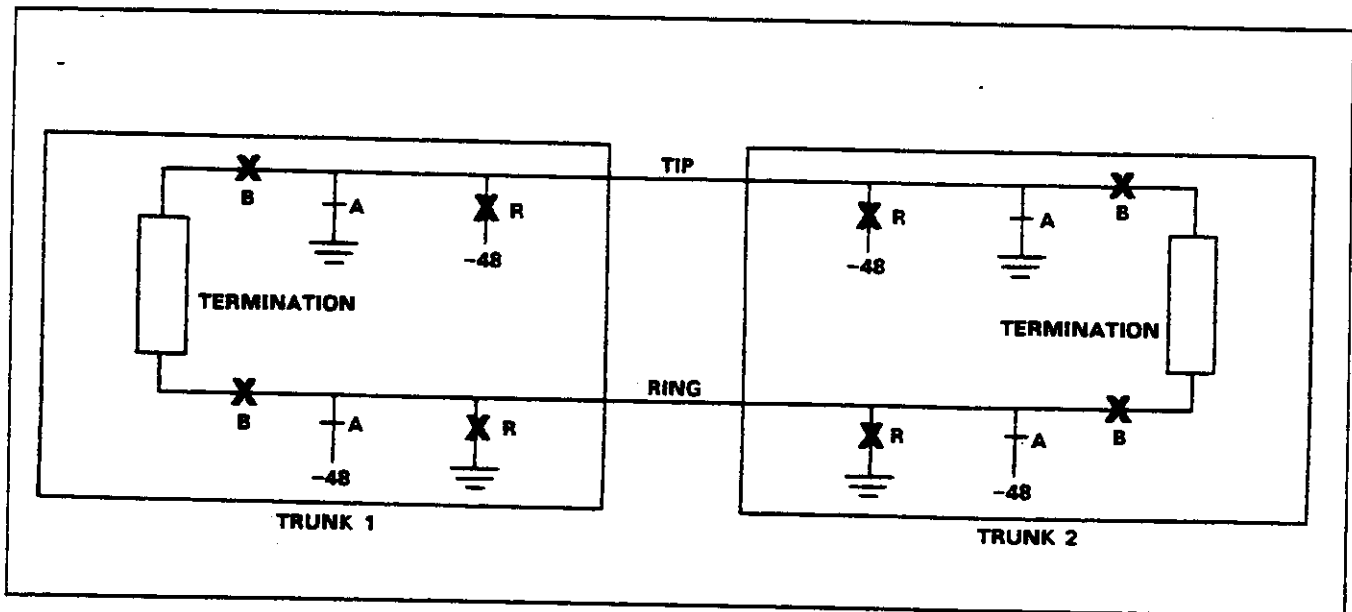


Figure 4-1 Loop Signalling

5 E&M SIGNALLING

E&M signalling is the most common interface signalling method used to interconnect switching signalling systems with transmission signalling systems.

The name E&M is derived from the initial use of two dedicated signalling leads called the E lead and the M lead. The E lead (ear) receives signals and the M (mouth) sends signals.

With the coming of electronic switching equipment there became a need for a more balanced E&M system. Three additional types were developed using four leads for signalling rather than two (the four lead signalling interface should not be confused with the 4-wire transmission interface). The original two lead method is now called Type I E&M and the three new methods are called Types II to IV. The original two lead method used extensively in Europe is referred to as Type V.

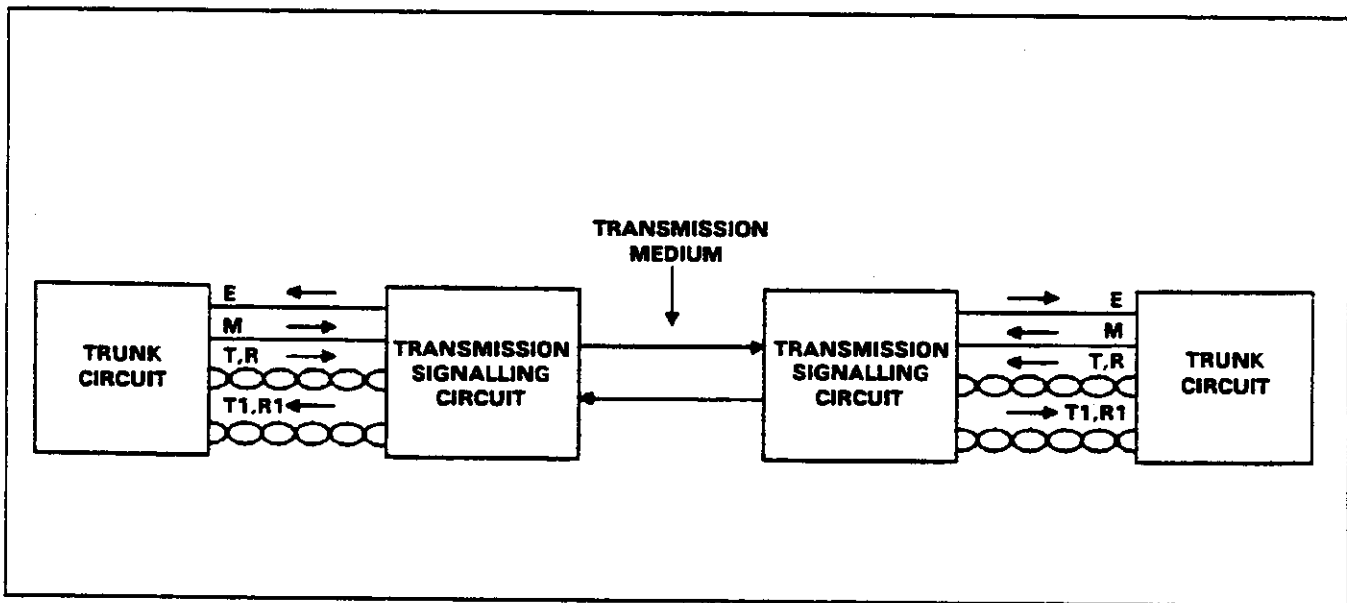


Figure 5-1 E&M Signalling

5.1 TYPE I OPERATION

A simplified Type I E&M signalling interface is shown in Figure 5-2. Only one end of the transmission interface is shown; an identical configuration is at the other end. The switching circuit (trunk) receives the idle/busy status of the signalling circuit on the E lead by either an open (on hook) or a ground (off hook) signal. The trunk sends the on/off hook status of the trunk by a ground (on hook) or a battery (off hook) signal on the M lead.

Because battery is supplied from the trunk circuit for both the E and M lead there is a high return current through the trunk grounding system. This high return current is a source of interference in some electronic switching systems. As a result, the more balanced 4 wire E&M signalling systems were developed.

Without changing the signalling conditions on the signalling leads, two trunks or two transmissions cannot be directly interconnected using Type I E&M signalling. Interface circuits called Pulse Link Repeaters (PLR) provide the necessary signalling compatibility. Direct trunk to trunk interconnection is possible if both trunks invert the "M" lead signalling (Batt-idle, ground-busy).

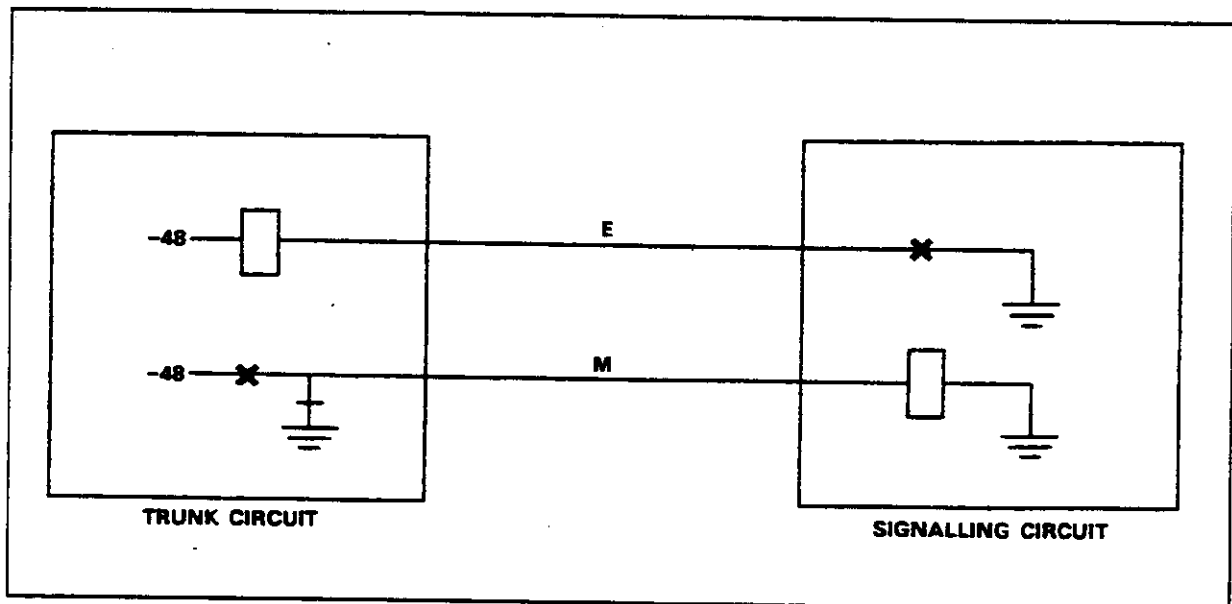


Figure 5-2 E&M Type I

5.2 TYPE II OPERATION

The Type II E&M lead interface is shown in Figure 5-3. Type II signalling is a four wire fully looped arrangement in which, open and closure of the contacts in their respective sending unit, signal the appropriate on-hook or off-hook. On-hook signals are opens and off-hook signals are closures. This interface provides complete separation between the trunk and transmission signalling battery supplies, eliminating return ground currents and the resulting interference. With the Type II interface the signalling leads of two switching trunks or two transmission systems can be directly interconnected without any interface circuitry.

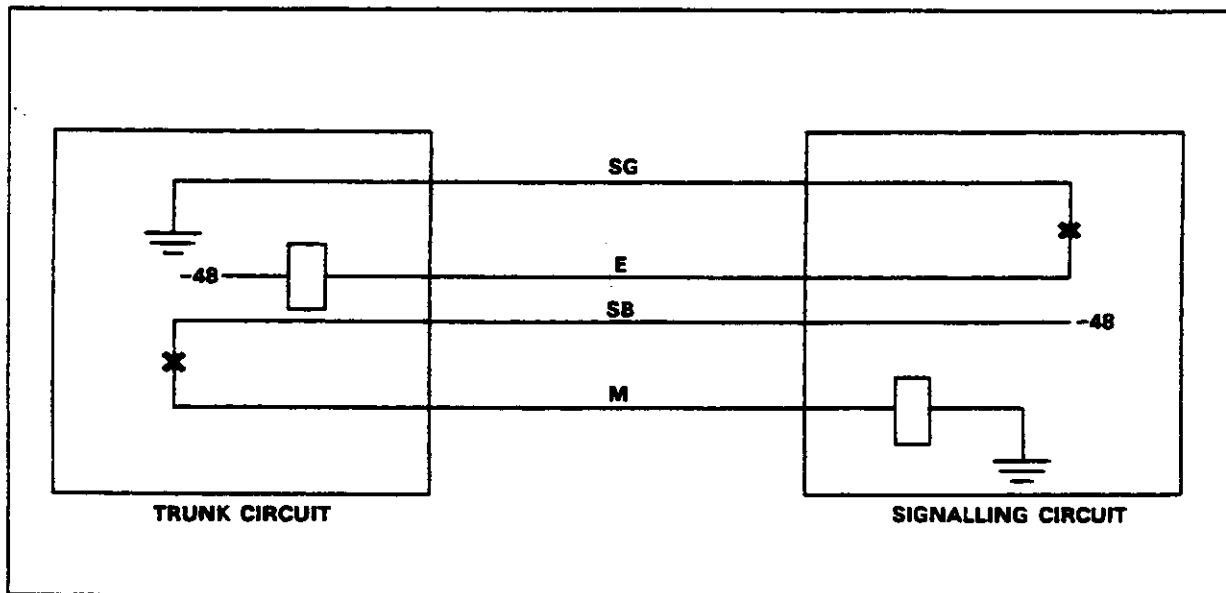


Figure 5-3 E&M Type II

5.3 TYPE III OPERATION

The Type III E&M lead interface is shown in Figure 5-4. The signalling over the E&M lead is exactly the same as described for a Type I interface except that the source of battery and ground for the M lead is obtained over the SB and SG leads respectively. The use of SB and SG eliminates return current interference from the M lead which is the chief cause of interference problems. Similar to the Type I interface, either a pulse link repeater (PLR) or modification of the signal conditions on the signalling leads is required for direct interconnection of two switching trunks or two transmission systems.

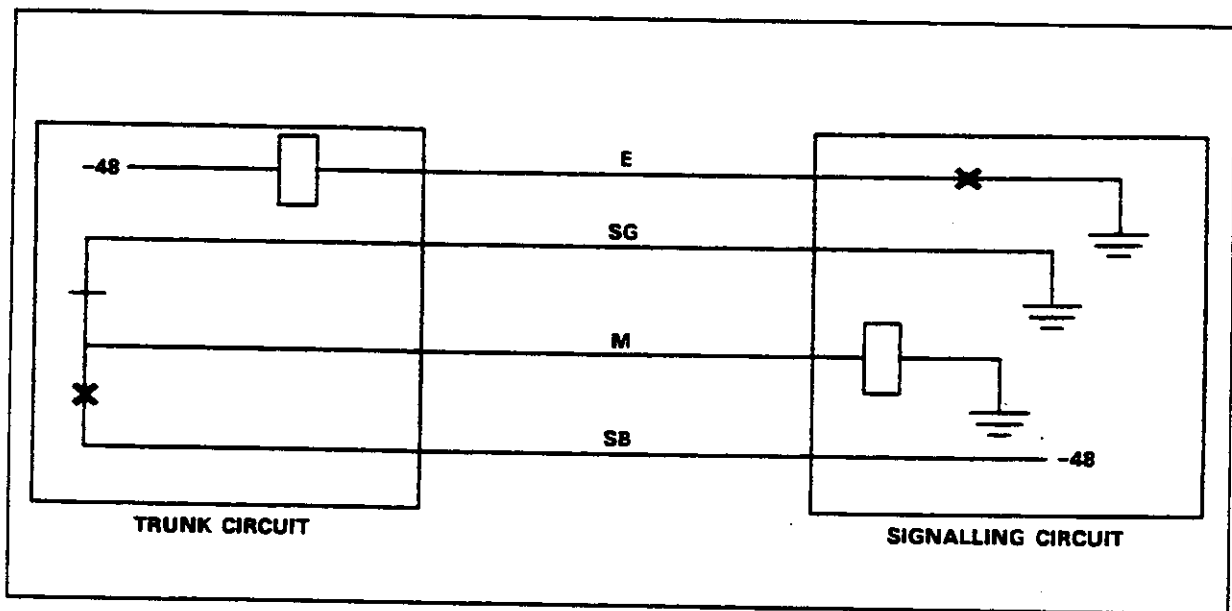


Figure 5-4 E&M Type III

5.4 TYPE IV OPERATION

The Type IV E&M lead interface is shown in Figure 5-5. The operation is identical to the Type II interface except the battery/ground feeds on the SG and M leads are reversed. Type IV has all the advantages of the Type II interface but is seldom used in North America.

Type IV may be connected back to back with no interface circuitry.

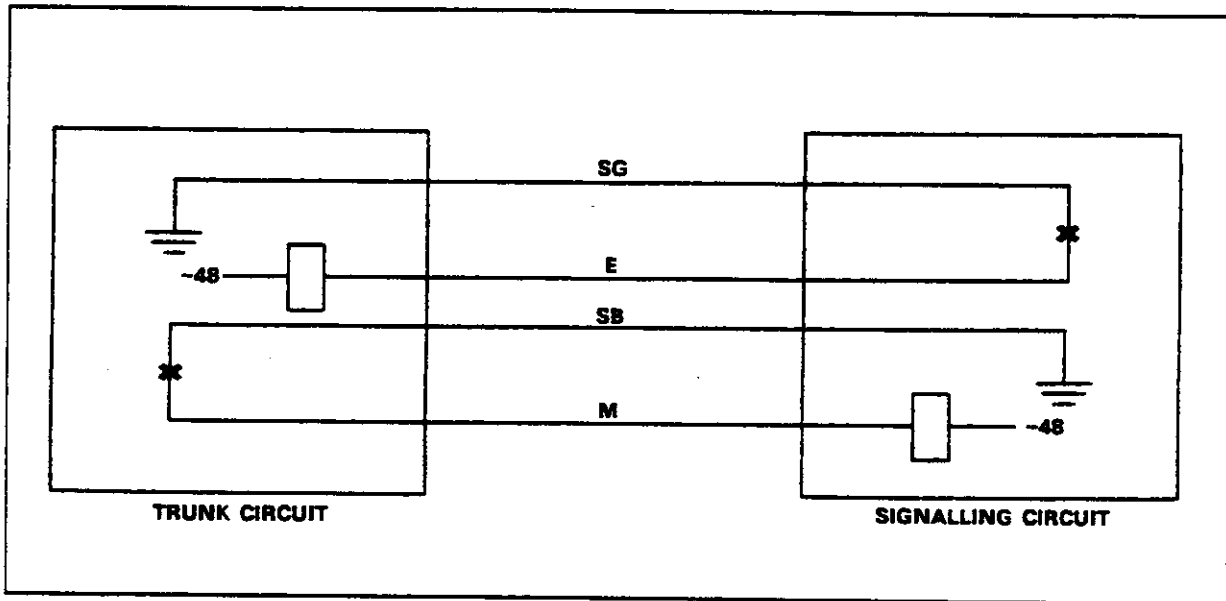


Figure 5-5 E&M Type IV

5.5 TYPE V OPERATION

The Type V E&M lead interface is shown in Figure 5-6. This is a 2 lead interface similar to the Type I interface. E lead operation is identical with Type 1. M lead signalling differs in that the battery feed is supplied by the transmission circuit.

Type V is the original 2 lead E&M signalling used outside North America. Type IV is the balanced 4 wire version of Type V as Type II is the balanced 4 wire version of Type I.

Type V systems may be directly connected back to back with no interfacing circuitry.

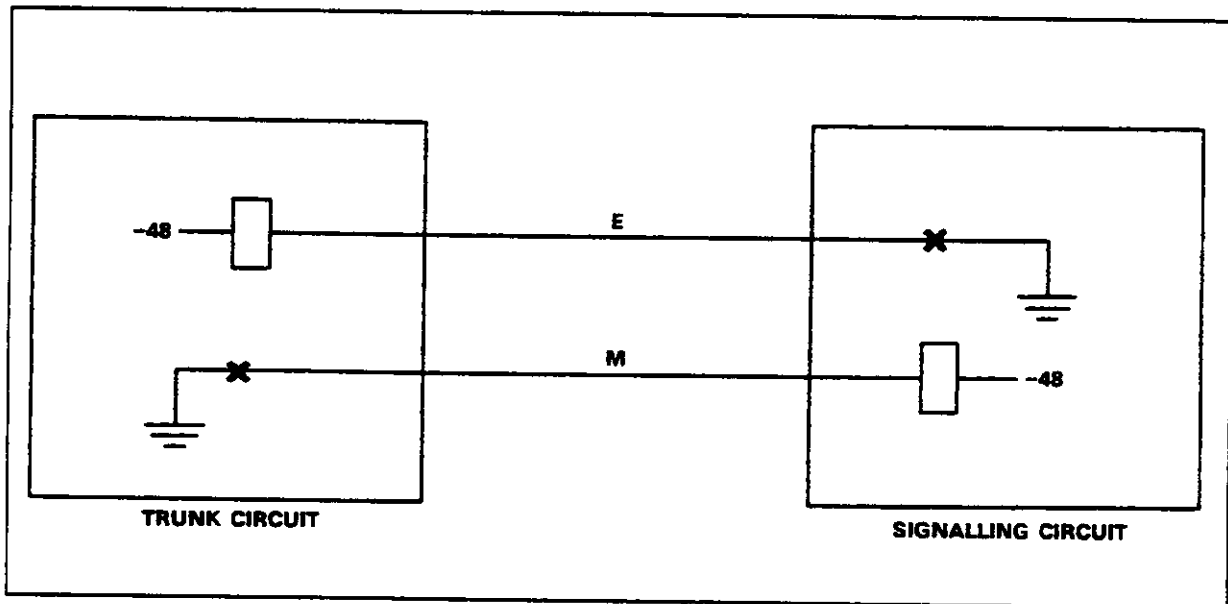


Figure 5-6 E&M Type V

5.6 E&M SUMMARY

TYPE	LEAD	ON-HOOK	OFF-HOOK
I	E	OPEN	GRD
	M	GRD	BATT
II	SG	GRD	GRD
	E	OPEN	GRD
	SB	BATT	BATT
	M	OPEN	BATT
III	SG	GRD	GRD
	E	OPEN	GRD
	SB	BATT	BATT
	M	GRD	BATT
IV	SG	GRD	GRD
	E	OPEN	GRD
	SB	GRD	GRD
	M	OPEN	GRD
V	E	OPEN	GRD
	M	OPEN	GRD

TABLE 5-1 E&M SIGNALLING CONDITIONS

6 DX, CX, AND SX SIGNALLING

Duplex (DX), Composite (CX), and Simplex (SX) signalling methods are used on cable transmission systems with a resistance greater than 3000 ohms. However, today, most long cable routes have been replaced by carrier systems so this application is seldom found.

A secondary use of the DX method is to interconnect E&M trunks located in separate buildings. E&M signalling has been designed to operate only over short distances. So when E&M trunks, located in separate buildings, are interconnected by cable, DX signalling is used on the cable to provide the longer distance signalling.

6.1 OPERATION

Externally, DX, CX, and SX methods appear the same and are only different in the detailed operation of the signalling unit. All three methods are DC signalling systems which can simultaneously signal in both directions. The detailed operation of each is complex and is not covered here.

Figure 6-1 shows how the signalling units for all three types are interconnected. Only one end of the circuit is shown; identical circuit interconnections are used on the opposite end.

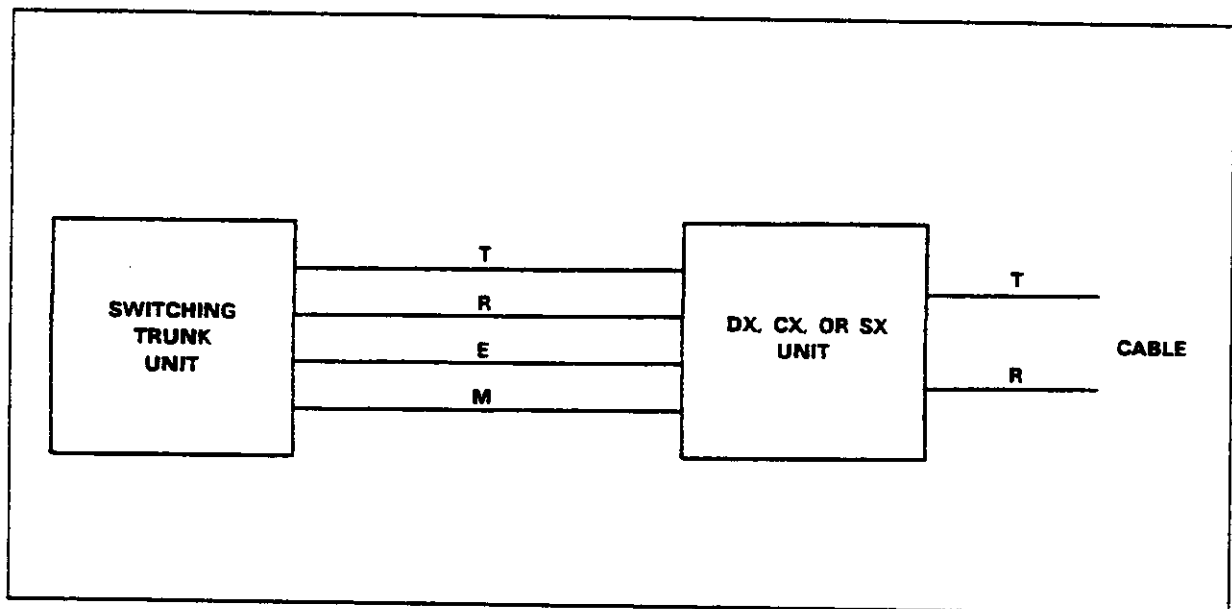


Figure 6-1 DX, SX, or CX Signalling

7 SF SIGNALLING

Transmission systems using the single frequency (SF) signalling method pass signals by using a single frequency tone either within or adjacent to the voice frequency band (0-3600Hz.). Loop or E&M signals are transformed to a SF signal on the transmission line and vice versa. SF signalling is used on analogue carrier transmission systems including microwave radio as well as cable carrier.

7.1 OPERATION

A block diagram of one end of a typical SF signalling system is shown in Figure 7-1. The same circuitry is duplicated on the far end. The E&M signals for the various on-hook/off-hook conditions are shown in the following table.

CONDITION	E&M LEAD	E&M SIGNAL	SF TONE	SEND/RECEIVE
Near end on-hook	M	Ground	On	Send
Far end on-hook	E	Open	On	Receive
Near end off-hook	M	Battery	Off	Send
Far end off-hook	E	Ground	Off	Receive

TABLE 7-1 SF SIGNALLING CONDITIONS

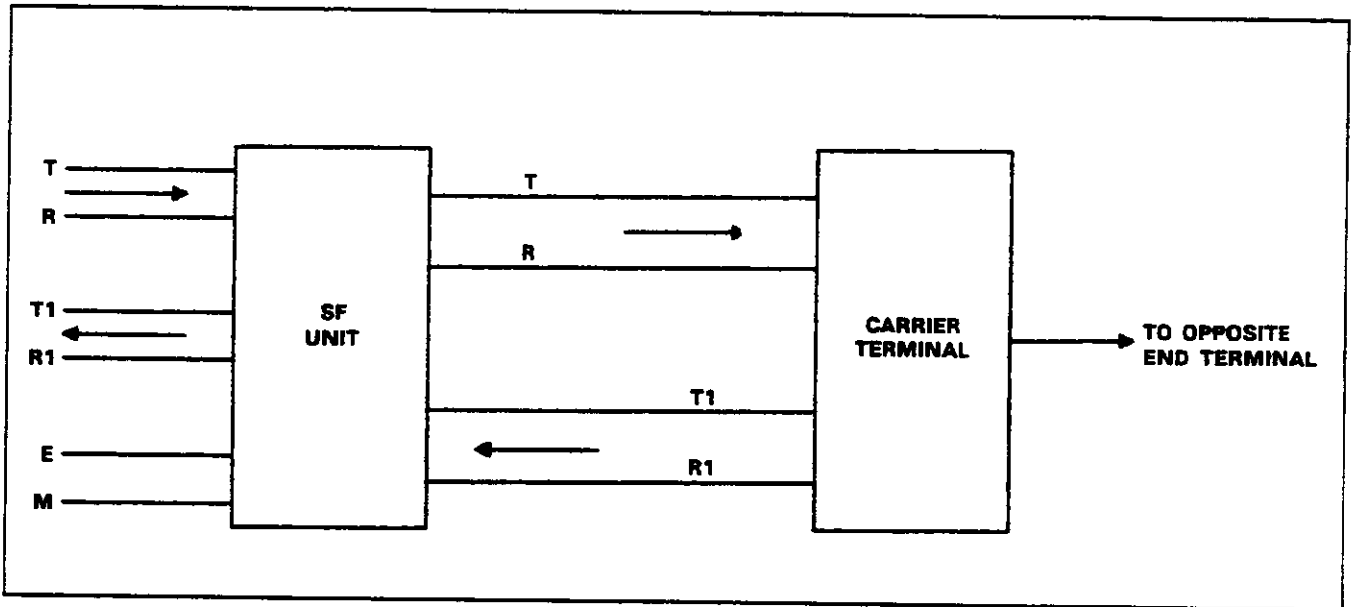


Figure 7-1 SF Signalling

One of three tones, 1600 Hz, 2600 Hz, or 3700 Hz is used in SF signalling systems. The 1600 Hz tone systems have not been manufactured for several years so are seldom found in use today. Systems using the tones 2600 Hz and 3700 Hz are referred to as in-band and out-of-band systems respectively. Because the in-band signalling tone is within the voice frequency band, normal conversation can generate an on-hook tone causing the transmission path to be prematurely disconnected (called talkoff). To prevent talkoff the SF tone detector circuitry is desensitized during the talking state so that the presence of several hundred milliseconds of SF tone is required before an on-hook signal is recognized. As a result, dial pulsing, which is sent as a series of short bursts of SF tone, is not accurately reproduced during the talking state. Therefore, the far end must be signalling on-hook to reliably dial pulse over a SF signalling system.

Out-of-band SF signalling overcomes the talkoff problem of in-band signalling. However, it has an additional disadvantage of not being passed by voice band amplifiers. As a result, out-of-band signalling is used on carrier systems which do not need to use voice band amplifiers.

8 PCM CARRIER SIGNALLING SYSTEMS

Pulse code modulation (PCM) carrier is the most common type of digital transmission systems. In PCM carrier, signalling is encoded in the transmitted digital code. The same method of signalling is used on both digital radio and digital cable carrier systems.

8.1 OPERATION

The PCM carrier terminal accepts either loop or E&M signals and transforms them into digital codes. In newer North American PCM systems, the least significant bit of each channel in the sixth and twelfth frames is used to provide two signalling bits. These two signalling bits can represent four possible signalling states. These states can have different interpretations depending on the originating and terminating equipment used. European PCM systems dedicate two voice channels to carry the signalling for all the other voice channels on the PCM system

9 COMMON CHANNEL SIGNALLING

Common channel signalling is a system of exchanging signalling information between processor controlled switching systems over a network of data links. In North America common channel signalling is presently used between some toll switching central offices. However, it is expected that this method of signalling will become the standard method for all processor control switching systems including PABX'S.

By using a separate high speed signalling link, calls can be set up and disconnected quicker. A separate signalling link also allows signalling during communication which will allow more sophisticated features to be added to the telephone network.

9.1 OPERATION

All signalling data, necessary to control call set up and take down, is exchanged over data links instead of being sent over the voice path, as is done using conventional signalling techniques. (Refer to Figures 9-1 & 9-2). There are different types of common channel signalling systems. The CCITT specified the CCITT #6 system for the analogue network and the CCITT #7 for the evolving integrated digital network. In North America, AT&T uses Common Channel Interoffice signalling (CCIS) which is based on the CCITT #6 system. A common channel signalling system (CCS7) based on the CCITT #7 specification will be used in the networks of Telecom Canada and the Bell Operating Companies (BOC). The basic philosophy of these two systems is the same and they only differ in the form of the signalling in the protocol on the data link.

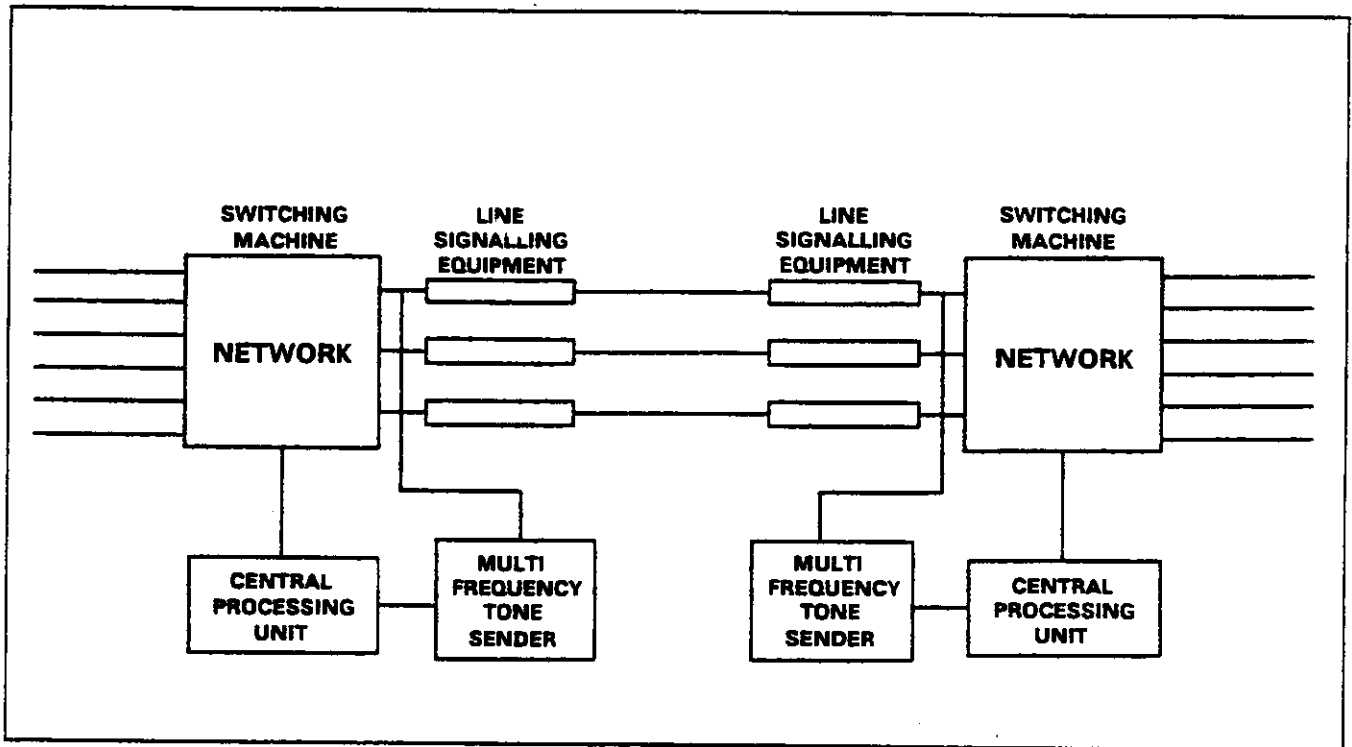


Figure 9-1 Conventional Signalling

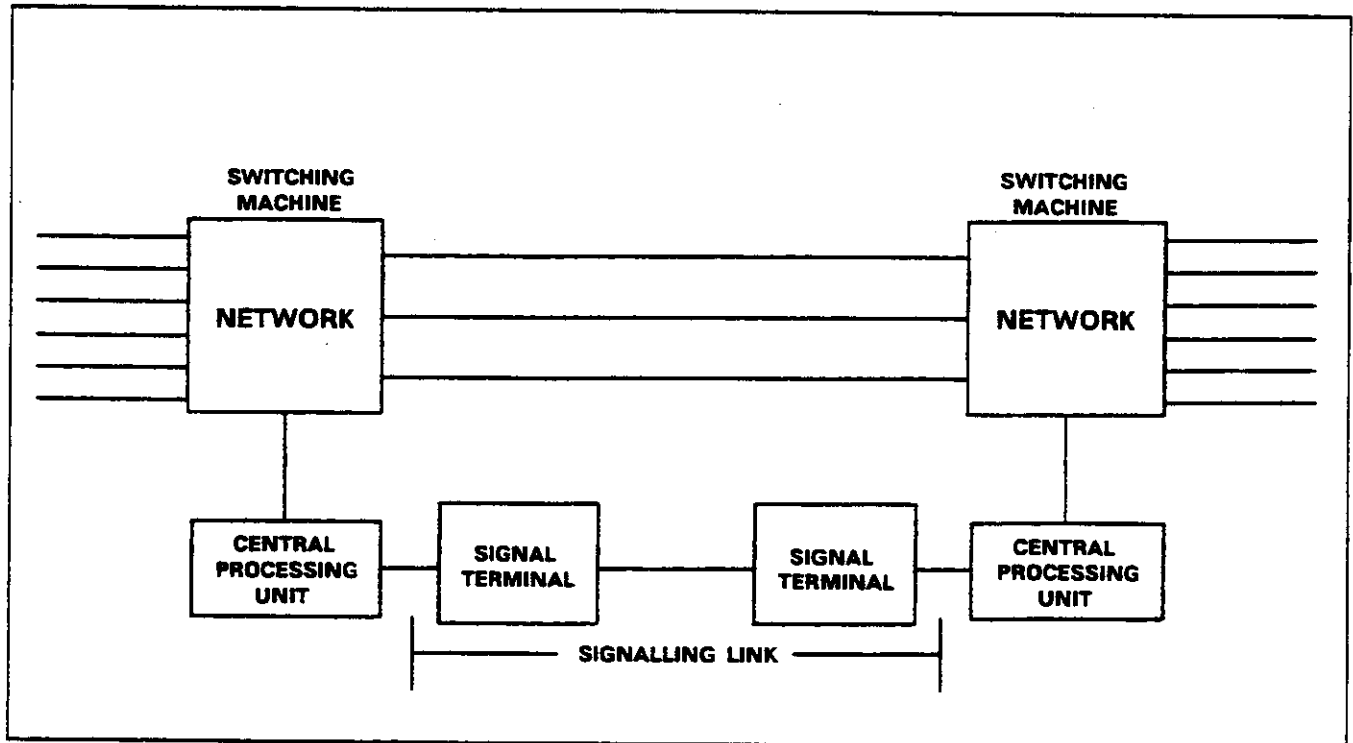


Figure 9-2 Common Channel Signalling

9.2 CCIS

This system was developed for the existing analogue network and uses 2.4/4.8 kbit/s signalling links between the signalling points. The signalling link consists of two signalling terminals, two modems, and a Voice-Frequency Link (VFL). The signalling terminals store both outgoing signalling messages awaiting transmission and incoming messages until ready to be processed. The terminals also perform error control through redundant coding and retransmission of messages found to be in error. Each modem acts as a digital to analogue interface between the signalling terminal and the VFL. The VFL is a conventional 4-wire message grade transmission facility. The Terminal Access Circuit (TAC) enables the processor to access the various signalling links, provides an interface between processor and terminal, and performs certain maintenance functions. Signal messages are generated by the processor of the switching system in the form of 28 bit signal units (SU). The signalling terminal compiles twelve of these into a block for transmission.

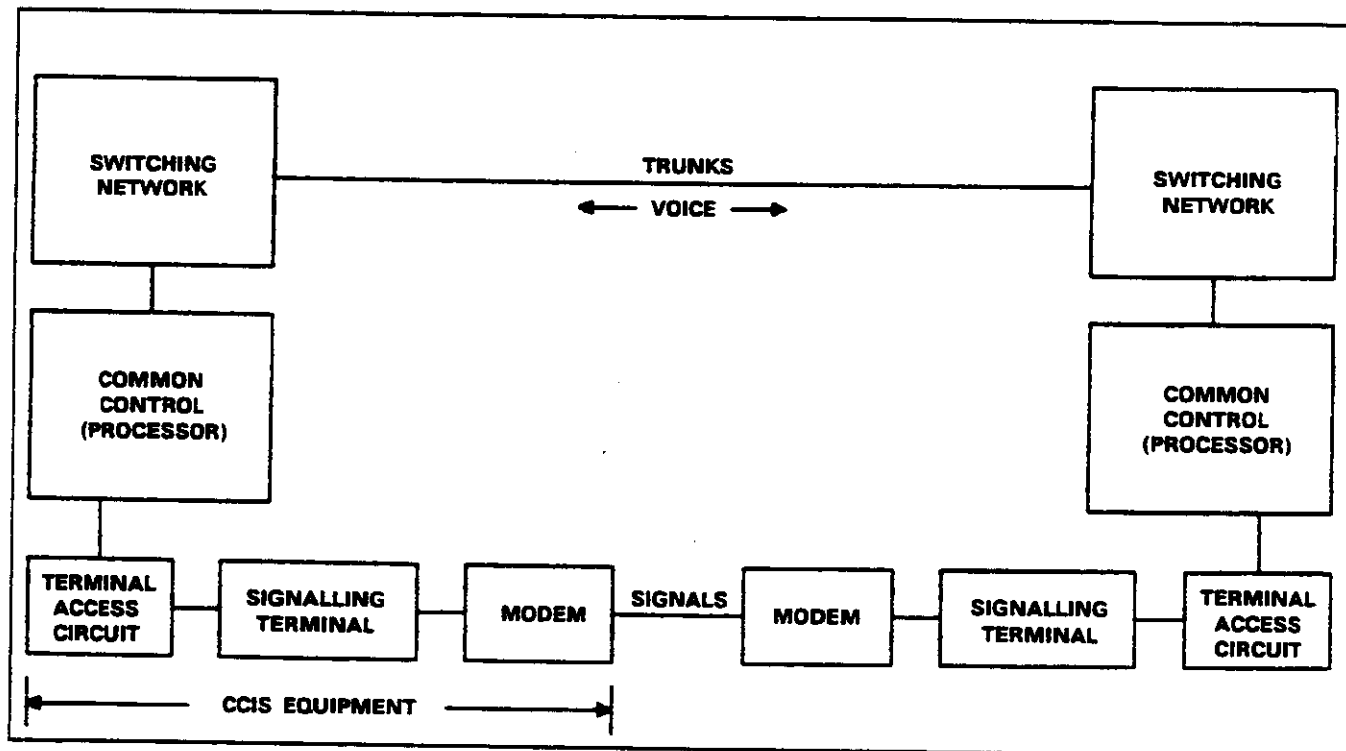


Figure 9-3 CCIS

9.3 CCS7

This digital system was optimized for use over 56/64 kbit/s signalling links. The modem and voice frequency link of CCIS will be replaced by a digital link in the CCS7 system. This system provides a variable length signalling unit (SU) which allows a greater flexibility and easily accommodates the transfer of additional information which is necessary for the introduction of new service offerings. The SU length varies in multiples of bytes (8 bits) from a minimum of 6 bytes to a maximum of 279 bytes.

10 PULSING

Pulsing is the transmission of digits which uniquely identify the terminating end of a call. There are three common types of pulsing; dial pulse (DP), dual tone multifrequency (DTMF), and multifrequency (MF).

10.1 DIAL PULSE OPERATION

Dial pulsing (DP) is a method of transmitting digits by a series of momentary on-hooks. Dial pulsing is used on subscriber loops, when a subscriber has a rotary dial phone, and between switching systems.

The numerical value of each digit is represented by a series of momentary openings (pulses) of the loop. Each pulse cycle is made up of a break interval (B) and a make interval (M). Dial pulses are best described by their pulses per second (PPS) and % break. In North America the % break is standardized at 60%. The rate at which pulses are sent is usually 10 pulses per second although some newer systems are designed to send and receive at 20 PPS.

The digits themselves are separated by a relatively long make interval called the interdigit time. Older electromechanical systems (SxS) require a minimum interdigit time of 700 ms but most newer systems are designed for a minimum interdigit time of 300 ms.

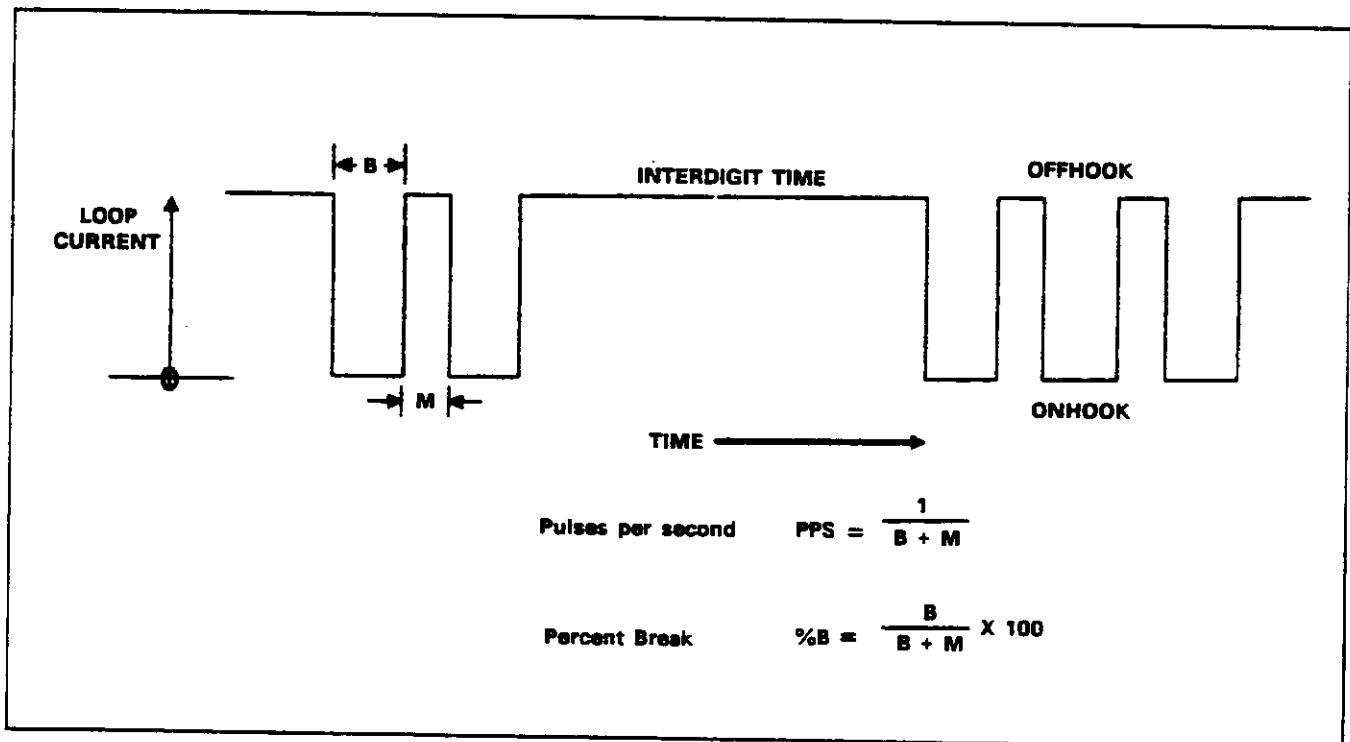


Figure 10-1 Dial Pulses

Series resistance in the circuit connecting the pulsing contact and the relay winding reduces the maximum current that can flow and the rate at which the current increases from zero to maximum. The net effect of adding series resistance (LOOP) is the same as increasing the percent break of the pulsing contact.

Shunt capacitance and shunt resistance have the opposite effect. Instead of ceasing to flow abruptly when the pulsing contact is opened, relay winding current continues flowing at a steady rate through a shunt resistance and then at an exponentially decreasing rate until the capacitance is charged to the signalling voltage. The net effect of adding shunt capacitance or shunt resistance (LEAK) is the same as decreasing the percent break at the pulsing contact.

Long cable transmission systems sometimes use a variation of the normal DP method called battery and ground pulsing to improve the recognition of dial pulses. With Battery and ground pulsing, battery is supplied from both ends of the loop, doubling the loop current. The loop current is doubled only during the pulsing period.

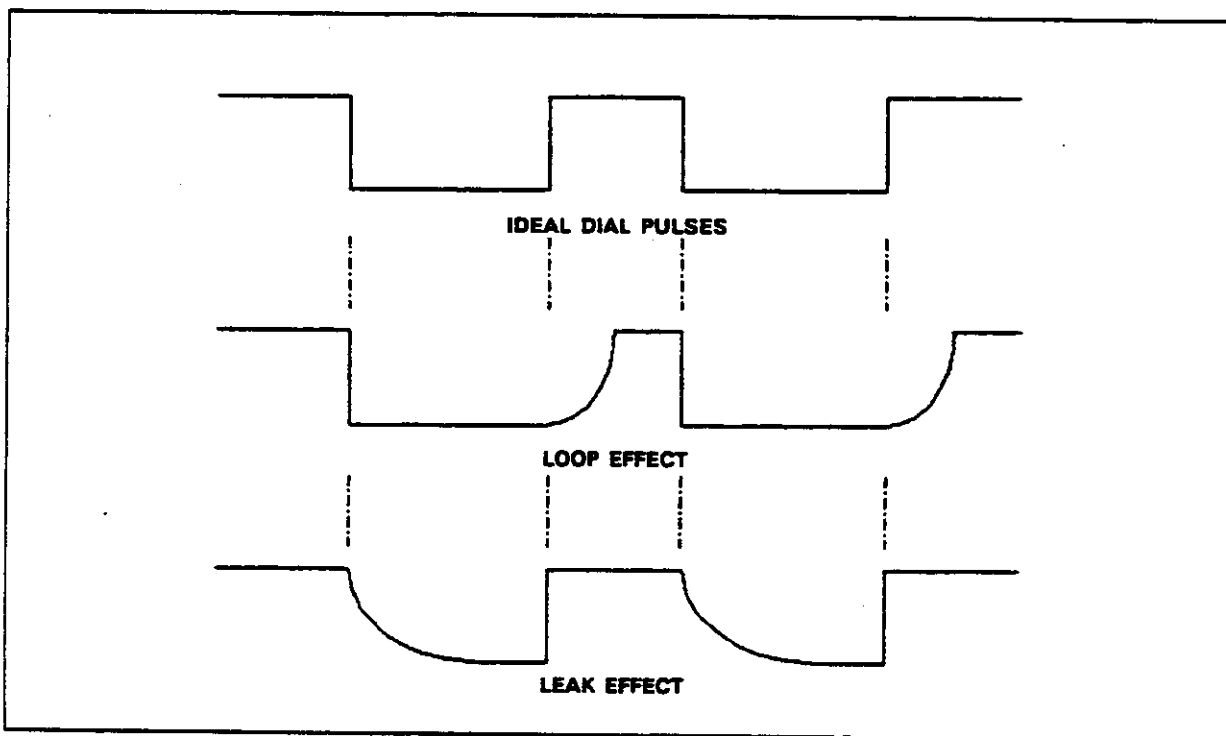


Figure 10-2 Dial Pulse Distortion

10.2 DTMF OPERATION

Dual tone multi-frequency (DTMF) pulsing sends a unique pair of frequencies within the voice band to represent digits. DTMF pulsing is used on subscriber loops, but is never used for pulsing between central offices.

Each digit is represented by one frequency from each of two mutually exclusive frequency groups. Table 10-1 or Figure 10-3 shows the frequency assignment. For example, should you wish to signal the digit 4, then frequencies 770 Hz and 1209 Hz would simultaneously be transmitted. In addition to the digits, another 6 characters have been assigned for special features. The characters shown as "A", "B", "C", and "D" are not found on a normal DTMF keypad.

DIGIT	FREQUENCY (HZ)
1	697 + 1209
2	697 + 1336
3	697 + 1477
4	770 + 1209
5	770 + 1336
6	770 + 1477
7	852 + 1209
8	852 + 1336
9	852 + 1477
0	941 + 1209
*	941 + 1336
#	941 + 1477
A	697 + 1633
B	770 + 1633
C	852 + 1633
D	941 + 1633

TABLE 10-1 DTMF FREQUENCY ASSIGNMENTS

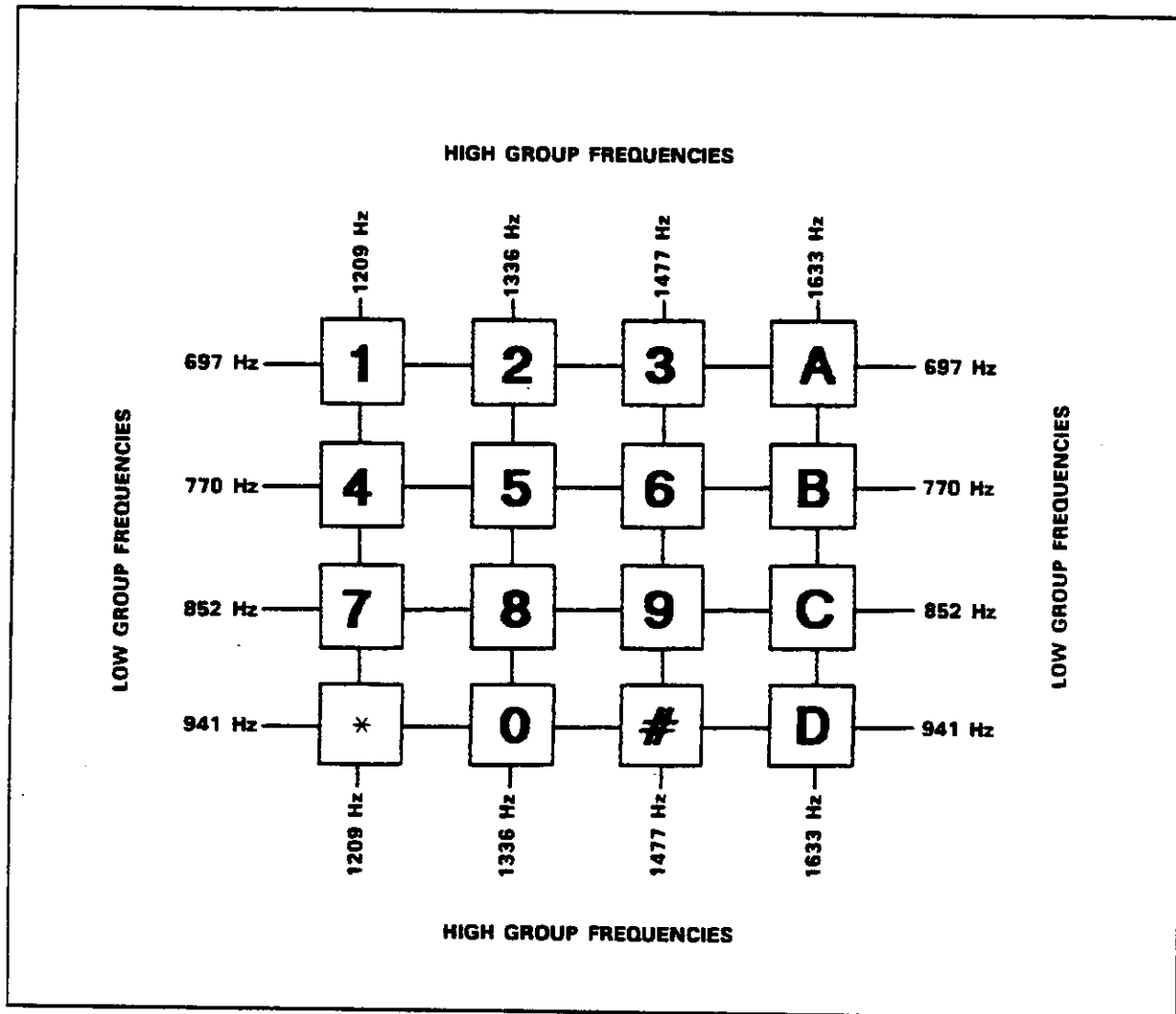


Figure 10-3 DTMF Frequency Assignments

The steady state amplitude of DTMF pulses generated by a transmitter powered from a local power source shall be as follows :

per frequency nominal	-6 to -4 dBm
per frequency minimum, low group	-10 dBm
per frequency minimum, high group	-8 dBm
per frequency pair maximum	+2 dBm

The maximum difference in levels between the frequency components of the DTMF pulse shall not exceed 4 dB and the level of the high frequency component shall equal or exceed the level of the low frequency component.

These values are used when measuring into a 600 ohm resistive test termination across the tip and ring at the PABX trunk interface.

The Central Office receiver should register DTMF digits with a power per frequency of -25 to 0 dBm and with the high frequency tone power of +4 to -8 dB relative to that of the low frequency tone as measured with a 900 ohm termination bridged across the receiver.

The receivers in Mitel switches should register DTMF digits with a power per frequency minimum of -17 dBm on the line circuit. The high frequency tone power should be +4 to -8 dB relative to that of the low frequency tone.

10.3 MF OPERATION

Multi frequency (MF) pulsing is similar to DTMF pulsing but differs in the frequency assignment for each digit. MF pulsing is usually associated with pulsing between central offices. Table 10-2 shows the frequency assignment for MF pulsing. MF pulsing has an additional two characters "KP" (beginning of pulsing) and "ST" (end of pulsing).

DIGIT	FREQUENCY (Hz)
1	700 + 900
2	700 + 1100
3	900 + 1100
4	700 + 1300
5	900 + 1300
6	1100 + 1300
7	700 + 1500
8	900 + 1500
9	1100 + 1500
0	1300 + 1500
KP	1100 + 1700
ST	1500 + 1700

TABLE 10-2 MF FREQUENCY ASSIGNMENTS

11 OUTPUTSING CONTROL SIGNALS

Switching machines, which are not immediately ready to receive digits upon seizure, need a method to stop outputting of digits from the far end until ready. The methods for outputting control are called: Delay Dial, Wink Start, and Stop Dial.

11.1 WHEN IS CONTROLLED OUTPUTTING USED

Digit decoding equipment (receivers) in a switching machine are usually available for use by any circuit, and are only connected to circuits when digits are being received. Those switching systems which take over 50 ms. to connect a receiver to a circuit, must signal the far end when the receiver is connected to prevent outputting, and losing some of the outputted information.

Those switching systems which take less than 50 ms. to connect a receiver, and those switching systems which always have digit receiving equipment connected, such as step by step switching systems, do not need to control outputting from the far end. These switches never send delay dial, wink start, or stop dial signals. However, these switches may be required to receive and respond to these signals.

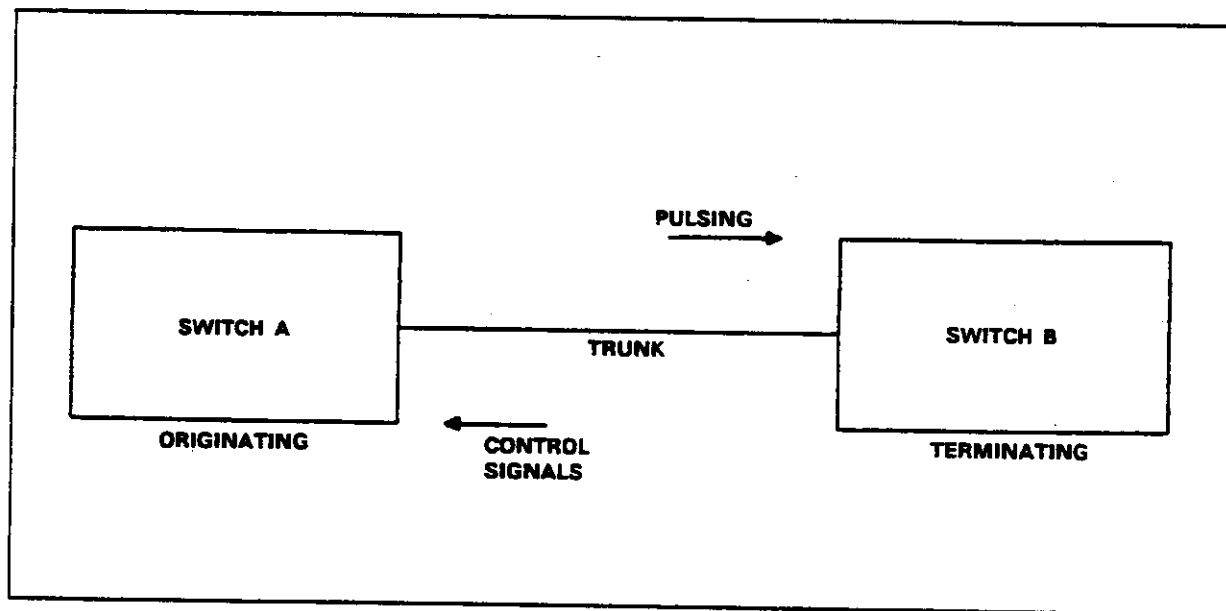


Figure 11-1 Pulsing Control Signals

11.2 DELAY DIAL AND STOP DIAL OPERATION

The following steps describe the operation of Delay Dial and Stop Dial. The Stop Dial method is an additional option which may be added to either the Delay Dial or Wink Start methods, and is described here as an addition to Delay Dial. The Stop Dial description begins with Step 3. Reference can be made to Figure 11-2.

1. Immediately after receiving an off-hook (seizure) signal from switch A, switch B sends an off-hook signal to switch A, preventing switch A from outpulsing.
2. When a receiver is connected, switch B sends an on-hook signal, and switch A outpulses.

If the stop dial option is enabled, then:

3. If switch B sends an on-hook to switch A during outpulsing, then switch A will complete outpulsing the current digit and stop.
4. When switch B is again ready to receive digits, an on-hook signal is sent to switch A and outpulsing continues.

The stop dial option is used for example in a tandem call where only a portion of the digits are received by the first switch and the remaining digits are received by a second switch.

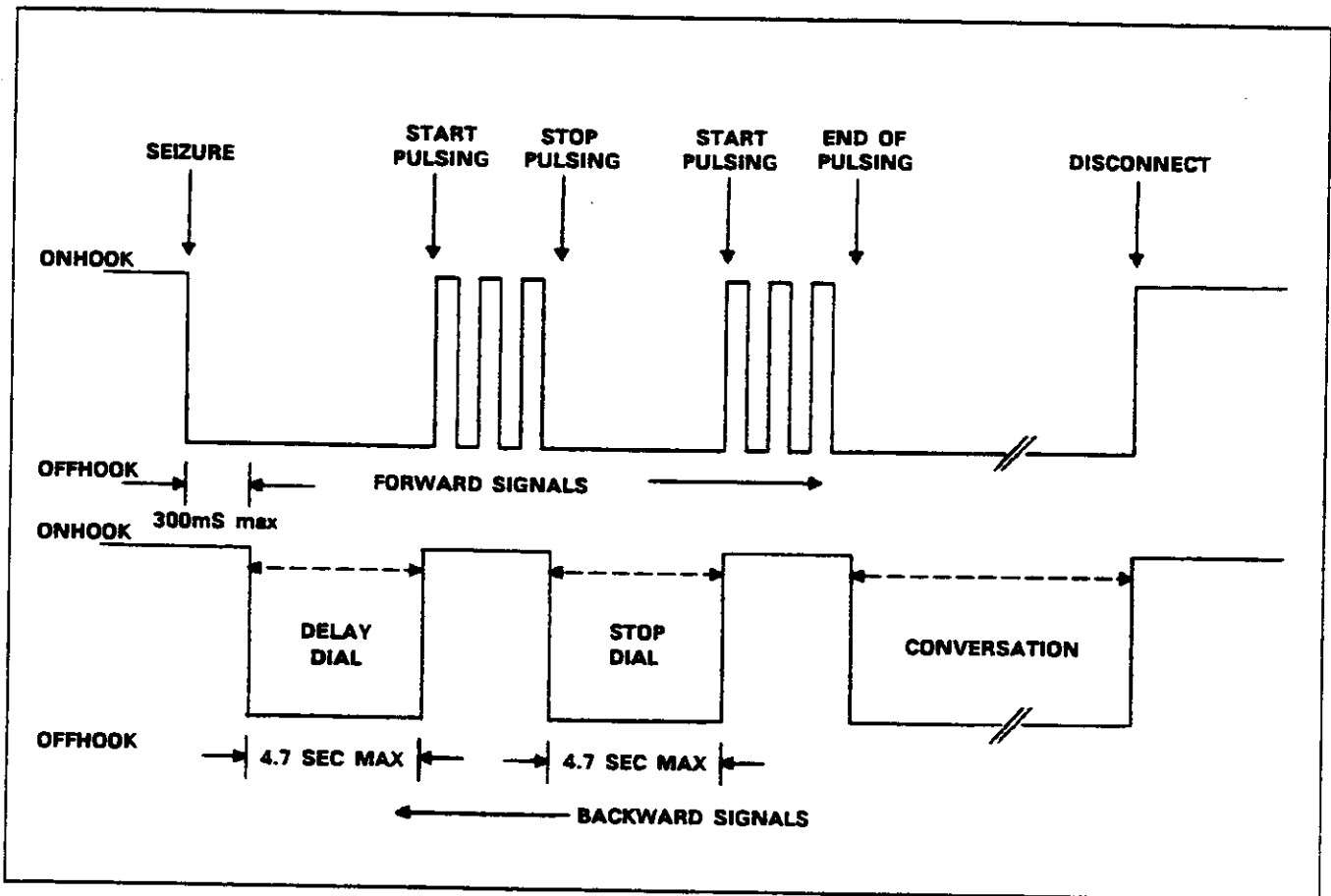


Figure 11-2 Delay Dial Signalling

11.3 WINK START OPERATION

Wink start operation can be described as follows (refer to Figure 11-3).

1. Upon receiving an off-hook signal from switch A, switch B does nothing until it is ready to receive.
2. When ready to receive digits switch B sends an off-hook signal of approximately 200 ms and switch A outputs.

Subsequent delays in outpulsing are accomplished by switch B using the stop dial signal as previously described.

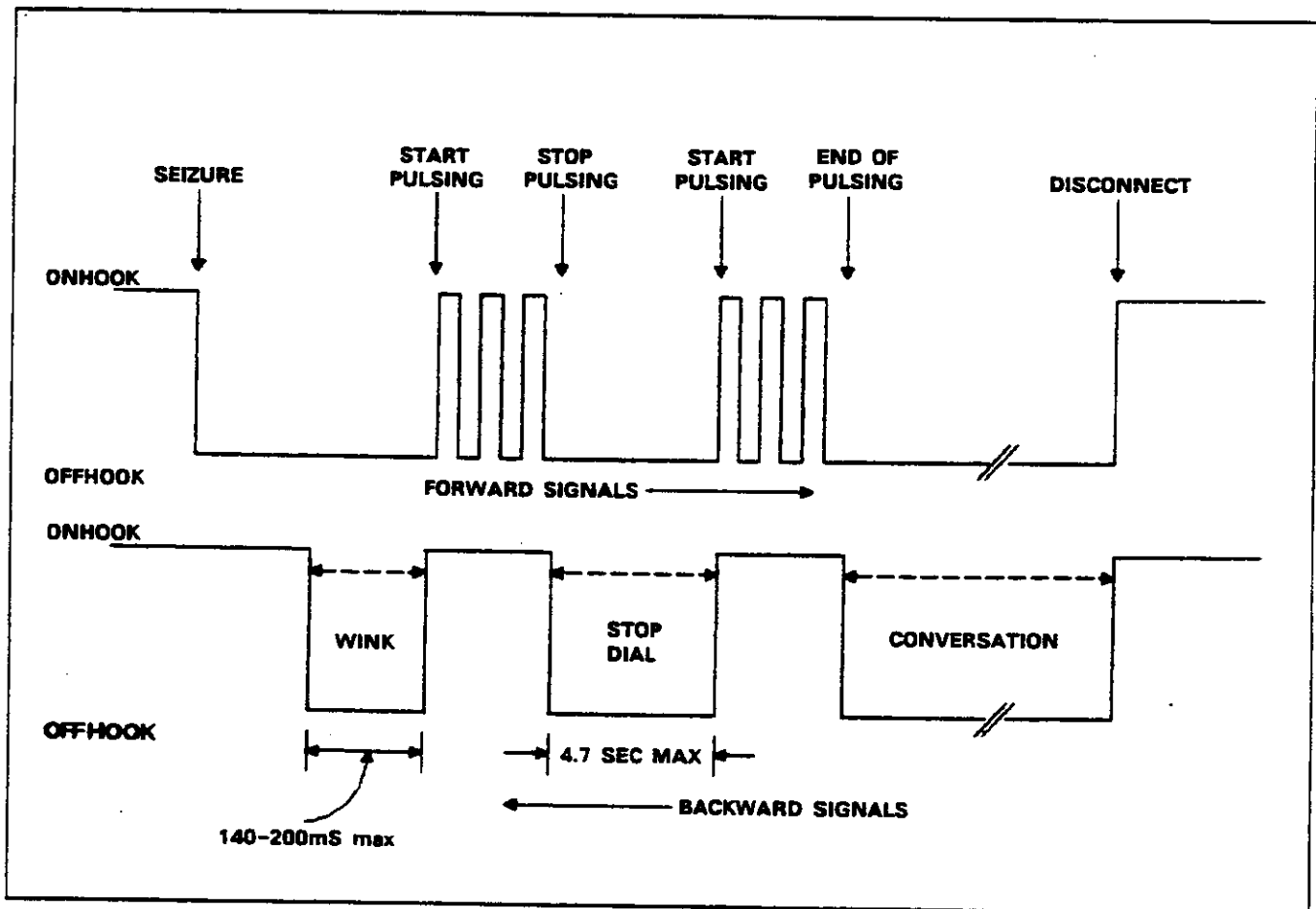


Figure 11-3 Wink Start Signalling

11.4 SUMMARY

Figures 11-2 and 11-3 show the relationship of the on-hook/off-hook signals sent from each end for delay dial and wink start. The stop dial option is shown in each figure. Forward signals are sent from the originating end and backward signals are sent from the terminating end.

12 CONCLUSION

Signalling between central offices and telephone sets or PBX's is called Subscriber Loop Signalling.

There are two signalling methods that interface switching and transmission signalling systems, called Loop Signalling and E&M Signalling. There are five types of E&M signalling of which two are primarily used in the European Telephone network.

Loop signalling is used for a cable transmission system of short distances. However, for longer distances DX, CX, or SX signalling is used.

Signalling over analogue carrier systems with a single tone is called SF signalling. PCM carrier system encode signals into the transmitted digital code.

Common channel signalling is a signalling system using data links directly connecting switching processors. Although this method has minimum use today it is expected to be used extensively in the future.

Digits are transmitted by one of three methods called DP, DTMF, MF. The MF method is primarily used between central offices. Delay Dial, Wink start, and Stop Dial signalling methods are used by electromechanical common control switching systems to control outpulsing.

