ENGINEERING AND IMPLEMENTATION METHODS FOR DATA LINE CONCENTRATOR SERVICE

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1. INTRODUCTION

1.01 This Engineering and Implementation Methods System (EIMS) on Data Line Concentrator System (DLCS) is a collection of methods for planning, designing, and implementing a DLCS system (or assembly). It is designed to provide Telephone Company Engineering personnel with references to sources of information and a procedure sufficient to engineer, order, install, test, and maintain a DLCS installation.

1.02 A flow chart is included to indicate a suggested sequence of methods to be used in the procedure.

1.03 The EIMS identifies sources of information. It does not contain the depth or detail of information that exists in the sources that it

references. It does identify the sources that contain the minimum amount of information necessary to accomplish each engineering task.

1.04 The EIMS will be kept current by adding methods for new equipment or techniques as they become available. These will be put in a form for attaching to the EIMS. If the additions constitute a major change in the planning, design, or implementation philosophy, then the EIMS will be reissued to include the change.

1.05 The EIMS is divided into nine parts. Part 1 describes the EIMS structure. Part 2 describes the service features designed into the system and contains a complete description of the functional equipment arrangements available. Part 3 contains methods for the planning necessary to set a Due Date for a DLCS customer. Part 4 contains methods for designing the system, including quidelines for fitting the available equipment to a customer's service requirements.

1.06 Part 5 references information on interfaces for other systems, such as the DDD network, and for customer provided equipment. Part 6 provides a suggested installation and test sequence with preservice tests. Part 7 contains references for the system maintenance plan. Part 8 is a list of the available Bell System documents on equipment, apparatus, and systems for providing DLCS service. Finally, Part 9 references the computer programs designed for operating company use that assist in implementing the service.

1.07 Equipment arrangements are mentioned in the design chapter. They are based on efficient use of equipment designed for the system. They do not reflect tariffed arrangements since these are now being defined. Therefore, throughout the planning, design, and implementation stages, one should consult the tariffs and the various data specialists for the most recent tariffs and authorized arrangements.

2. DATA LINE CONCENTRATION SYSTEM DESCRIPTION

2.01 DLCS is a private line data communications service for connecting clusters of data stations, such as teletypewriter stations, through a concentrator to a smaller number of data terminals including time-shared computers. There are arrangements for providing this service in a geographically small area, such as a college campus, or over a much larger area using a frequency multiplexing system for efficient long distance transmission. This service can make more efficient use of computer ports by sharing port access among several users. It can also make more efficient use of originating stations by providing simple, rapid access to the computer.

Service Intent

2.02 Some user needs met by DLCS features are:

(1) Concentration of traffic for efficient use of computer ports.

(2) Simple one way originate, where calls are originated by a station and terminated at a computer port.

(3) Access to more than one computer if desired.

(4) Private line and DATA-PHONE Service access to the DLCS Systems.

(5) Access from properly equipped DLCS stations to DATA-PHONE Service.

(6) Data transmission rates up to 150 baud.

(7) Low cost transmission schemes.

(8) A non-blocking concentration.

(9) A signal to the station when all trunks are busy and a holding pattern until a trunk becomes available.

(10 Half or Full duplex operation.

(11) No interstation traffic.

Other features are described in the following paragraphs.

System Description

2.03 DLCS features, options, and equipment arrangements are described in the technical reference entitled, "Initial DLCS Service Arrangements with Bell System Teletypewriters, Computer Port Interface," July 1970. Another technical reference entitled, "Data Line Concentrator System (DLCS) Arrangements," is in preparation and will include more service features than those in July 1970 version. It is advisable to be familiar with the

information in the most recent issue before proceeding with a system design.

2.04 The technical reference provides a general description of the system. Methods for determining the proper equipment items for a particular customer's service requirements are covered in Part 4.

3. PLANNING CUSTOMER SERVICE

3.01 This section contains methods for planning a customer service. Its intent is to fit the implementation of DLCS systems into the ISC plan. It also provides considerations for planning growth, customer training, and service evaluation.

3.02 Included here is a flow chart (Fig. 1) that suggests an implementation procedure using the BSPs that have been prepared on DLCS system components. The flow is from left to right, and the numbers in each box refer to the written part of the EIMS that identifies the BSPs or methods.

A. Engineering Support

3.03 Engineering responsibilities fall into one or more of planning, design, implementation, and administration phases involved is providing a customer service. Basically, the goal is to provide the best available combination of equipment, facilities, and design, consistent with customer needs by the most economical means.

3.04 As described in the Bell System Practices covering the Intercompany Service Coordination (ISC) plan, the Marketing Department coordinates service provided to customers and ensures the intent of the ISC plan. The Engineering Department may be required to furnish support for system design or detailed ordering information during the initial planning stage. The system design support may be aimed at (1) determining an optimum system layout, (2) converting already determined service requirements to equipment requirements, or (3) verifying that adequate space and power exists for customer premises located equipment. Methods for accomplishing these are provided in Part 4.

3.05 The result of this combined effort will allow the sales office to prepare (a) a service inquiry to verify tariff and equipment availability, (b) a complete proposal to the customer, or (c) a system service order.

B. ISC Planning and Scheduling

3.06 This section identifies the information sources that allow Associated Companies to coordinate a DLCS service. The simplest systems can be coordinated using local company procedures. However, the more complex systems will require the use of the Intercompany Service Coordination (ISC) plan.

3.07 The ISC plan is described fully in the following sections:

BSP 010-520-100—ISC Plan Description
BSP 010-520-101—ISC Plan Coordination of Private Line Services
BSP 010-502-102—ISC Plan Coordination of Special Exchange Services
BSP 010-520-103—ISC Plan Control Team Assignment
BSP 010-520-104—ISC Plan Interval Guides
BSP 010-520-105—ISC Plan Measurement Plan
BSP 010-520-110—ISC Plan Planning Services and Preparing Project Schedules
BSP 010-520-111—ISC Plan Service Inquiries and SSOs with About Dates
BSP 010-520-112—ISC Plan System Service Order Worksheet
BSP 010-520-113—ISC Plan System Service Order
BSP 010-520-114—ISC Plan Engineering Reports
BSP 010-520-115—ISC Plan System Status Reports
BSP 010-520-116—ISC Plan Service Analysis Reports
BSP 010-520-135—ISC Plan Marketing (Sales) Responsibilities
BSP 010-520-136—ISC Plan Engineering Responsibilities
BSP 010-520-137—ISC Plan Plant Responsibilities
BSP 010-520-138—ISC Plan Traffic Responsibilities
BSP 010-520-139—ISC Plan Western Electric Co., Inc. Member Responsibilities
BSP 010-520-149—ISC Plan Codes and Abbreviations

3.08 All services covered by System Service Orders (SSO) must have a Control ISC Team. Control is assumed by the team of the associated selling sales office unless other arrangements are made. Control Team Assignment and SSO distribution are described in the above BSPs.

3.09 At the time of the ISC team meeting, it is suggested that Engineering call to the attention of Traffic that the service may include customer assisted maintenance features. These are covered in Par 3.19 and 3.20. This information will assist

in providing proper customer training and assigning maintenance responsibility.

C. Planning For Growth

3.10 This section provides guidelines for growth planning in DLCS systems. It assumes that the customer's future service needs can be predicted. It identifies those DLCS features that lend themselves to growth, restricts growth, or are expensive to expand. Basically, the cost of larger-than-necessary initial installations must be compared to the cost of replacing equipment with larger sizes at a later time.

3.11 It is expected that a DLCS customer's service requirements will call for more stations to be added after a period of operating the initial system. As more stations are added, each has a greater difficulty accessing the computer, and the grade of service is lower. In most systems, an increase in number of stations connected to one concentrator lowers the grade of service to all stations in the system.

3.12 Grade of service can be improved by adding more trunks and computer ports to handle the increased traffic volume.

3.13 There are two limitations to adding stations (or lines) and trunks to a concentrator. First, line and switch modules are designed for use with a specific maximum number of trunks; ie, 8, 16, or 32. Modules can be added to a concentrator in groups of 32 lines to a maximum of 128 lines per concentrator. Lines can be added singly, up to the limit of module, and all lines will have access to that concentrator's single trunk module. Another concentrator with separate lines and trunks must be added if the number of lines exceeds 128.

3.14 Second, trunks can be added singly to any trunk module up to the limit set by the line and switch module; ie, 8, 16, or 32 trunks. Trunk modules are available in two* maximum sizes, 16 or 32 trunks, and they are not interchangeable.

This means that a line and switch module designed for use with 32 trunks cannot be added to a concentrator with line and switch modules designed for use with 16 trunks (or 8 trunks). Therefore, if a concentrator has been designed with an 8 trunk size module and if it is necessary to increase the number of trunks over 8, then all line and switch modules and the trunk module must be replaced by those designed for the larger trunk module size.

3.15 In summary, the number of lines is limited to 128 per concentrator for any specific trunk group size. The number of trunks per concentrator is limited to the specific size selected, 8, 16, or 32. It is necessary to replace all line and switch modules and the trunk module to change the trunk group size.

3.16 The number of trunks is also restricted by (a) the number of metallic pairs available (for local service), and (b) the 1A Data Station restriction of eight channels per four-wire Multi-Channel Arrangement (for remote service). In the latter case, another 1A system must be added when the number of multiplexed trunks exceeds eight. The total number of systems necessary after growth should be considered when selecting the initial cabinet size (see Part 4D).

3.17 Space and power requirements should also be considered (see Part 4E) to verify their future availablility. Additional concentrators and additional 1A Data Stations will require more cabinet space, customer accessibility to all cabinets, and more 115 volt power.

3.18 Another growth planning method applies to a small (less than eight) cluster of remote stations that will eventually grow to more than eight stations. When the cluster is small, stations can be connected to a 1A Data Station Frequency Multiplexing System to gain access to a distant concentrator or computer. When the number of stations exceeds eight, a concentrator can be added at the 1A Data Station Location to allow more stations access to the eight channels of the 1A System. This is described in Par 4.05. No additional equipment, other than the concentrator, is necessary to serve the initial eight stations.

D. Customer Training Information

3.19 There are several maintenance features designed into DLCS system components that can be used by the customer. Some can be used by the customer prior to making a trouble report,

*Note: 16 size trunk module is used with the 32 by 8 and 32 by 16 lines and switch module.

and some can be used in conjunction with Telephone Company Personnel.

3.20 The following section describes the locations of the maintenance features and provides reference to detailed information on each.

3.21 ***Locations and References***

(a) 1A Data Station—Multi-Channel Arrangements; BSP 591-813-100, -180, -200, -300, -500

—Single Channel Arrangement; BSP 591-813-101, -181, -201, -301, -501

These references cover:

(1) Alarm Indicators—Lamps and Contacts

(2) Voice Band Loop-Around Test Key

(3) Base Band Loop-Around Test Key

(4) Channel Check Test Set

(b) Data Set 109-Type Multiple Data Set Arrangement BSP 591-029-101, -181, -201, -301, -501-covers the customer operated switch that controls connection of terminal equipment to data sets.

(c) 10-Type Data Line Concentrator BSP 591-811-100, 180, 200, 300, 500-none unless engineered locally to display an external alarm lamp under the control of a provided relay contact.

(d) TTY Stations

(1) With 108-Type Data Sets BSP 591-023-110, 510-covers Test Key use in Loop Back Test.

(2) With 109-Type Data Sets BSP 591-031-101, -301, -501-none unless engineered locally.

(3) As part of 1A-SCA - Same as Part (a)

(4) As part of 1A-MCA - Same as Part (a)

E. Service Evaluation

3.22 The ISC Plan provides a method for determining the adequacy of facilities and equipment serving the customer. (See BSP 010-520-102.) Engineering involvement will usually be at the request of Marketing, Plant, or Traffic.

3.23 It will be particularly appropriate to evaluate DLCS systems because many customers have difficulty specifying traffic parameters at the DLCS stations. This can lead to incorrect concentration ratios for the desired grade of service.

3.24 The Engineering Department should be prepared to provide engineering information necessary to perform the evaluation. This is expected to include: (a) assistance to Marketing to verify engineering design and equipment application, (b) assistance to Plant to overcome operational or maintenance difficulties, and (c) assistance to Traffic in engineering for traffic measurement studies. Information for (a) and (b) are included in Parts 4 and 7, respectively. For part (c), assistance to Traffic, Engineering can be expected to provide advice on applying Traffic Measurement System 1A Recorders to concentrator trunks for trunk usage recording. This information can be found in the BSP 984-500-100 series.

3.25 If a design problem is suspected in any portion of the DLCS system, it should be referred at once to the Engineering group responsible for that portion of the system and to Engineering Control.

4. SYSTEM DESIGN PLAN

4.01 This is a method for designing a system to match a particular customer's service requirements.

4.02 The first three sections constitute the three part system layout plan. Paragraph 4.05 provides considerations for converting the requirements to a block diagram system layout. It will be apparent that the system will consist of equipment or blocks, arranged at three kinds of locations; the originating (or TTY) locations, the concentrator location, and the terminating (computer) location. Paragraph 4.10 provides a method for identifying data equipment and facilities necessary for the point-to-point connections between locations. Then Paragraph 4.13 provides a method for engineering the equipment at each location. Paragraph 4.60 identifies the information sources necessary to use the 1A Data Station Arrangements, Multichannel and Single-Channel.

4.03 Other sections provide methods for identifying space and power requirements, facility requirements, and transmission design.

4.04 It is the intent of these sections to identify the arrangements that are suited to the particular service requirements. The availability of the arrangements will depend on the particular tariffs in each operating company (or Long Lines), therefore, the most recent tariffs should be consulted for restrictions or recommended arrangements.

A. Converting Service Requirements to a System Layout for Locations

4.05 This is the first part of the three-part system layout plan. It provides guidelines for converting customer service requirements into a system layout. The layout will include the location of all major equipment, such as terminals, concentrators, and multiplex systems.

Service requirements defined by the Sales Department are:

(a) Location, number, and features of Teletypewriter stations.

(b) System features such as HDX or FDX option, disconnect option, interface locations, and rotary or TOUCH-TONE dial options for DDD access.

(c) Grade of service desired at terminals.

(d) Location of computers.

(e) Number of computer ports available.

(f) Data Speed, code format, and telegraph distortion of CPTs.

(g) Space and power availability.

The System Layout is defined as:

(a) Concentrator locations and types.

(b) Concentrator sizes.

(c) Multiplexer locations.

(d) Stations to be served by dc loops.

(e) Stations to be served by single ac loops.

(f) Lines to be multiplexed.

(g) Trunks to be multiplexed.

4.06 The systems layout procedure is based on the efficient use of the equipment designed for the DLCS system. It does not reflect any tariffed arrangements (except for PL Telegraph and PL Voice facility use) since these arrangements are now being defined. Therefore, the system designer should consult both local and Long Line tariffs to identify any restrictions.

4.07 DLCS hardware was designed to economically serve clusters of TTY or similar stations that require less than full time access to one or more computers. The system layout can be accomplished by understanding the situations for which the hardware arrangements were designed. This section describes these service situations and shows how they can be combined into a complete system layout.

4.08 The ISC Traffic Control should be consulted to determine the proper trunk size on every concentrator application. The trunk size should be based on anticipated growth of traffic (additional lines) with time. This is particularly important in DLCS because concentrators are equipped with fixed size trunk groups of 8, 16, or 32, and all line and switch modules and the trunk module must be replaced if that size is exceeded. (See Part 3C, Planning for Growth.)

4.09 There are six service situations used here to exemplify the use of DLCS hardware:

(1) ***One Cluster, One Local Computer***—In this situation, most stations are near enough to the computer so that the concentrator can interconnect the stations and the computer site with metallic (or dc) pairs that do not exceed the 109-type data sets resistance limits. These stations are defined here as local stations. The concentrator (10A) can be located: (a) within the cluster to reduce the number of cable pairs going to the computer site, or (b) at the computer site. The choice of concentrator location depends on space availability, power availability, and accessibility. The concentrator will accept up to 128 lines from stations and may be equipped with a trunk size of up to 8, 16, or 32.

Some metallic pairs between station and computer site may be beyond the data set resistance limit. In this case, those single remote stations can be served by PL Voice or PL Telegraph facilities between station and concentrator site. This situation is described in Fig. 2. The concentrator should be located to reduce the number of single remote stations.

Therefore, a suggested system design procedure is:

(a) Locate all stations, the concentrator, and the computer site,

(b) Determine necessary concentrator size,

(c) Check cable pair resistance between the stations and the concentrator, and between the concentrator and the computer site.

(d) Determine class of service (local or remote) for each station.

The resistance of the 10A concentrator (see appropriate BSP) must be added to the cable resistance before comparing total resistance to the data set limit.

(2) ***One Cluster, One Remote Computer***—If most stations in the cluster of Fig. 2 would require metallic facilitie beyond the 109-type data set resistance limit, then a different configuration is necessary. In this situation, the cluster is first connected through a 10A Concentrator and then to a 1A Data Station Frequency Division Multiplexing System utilizing a 3002 or similar Voicegrade facility. The 1A System provides the low cost, long haul transmission of up to eight trunks per system and requires a 1A Data Station at each end of the 3002 channel. It is assumed that the 1A Data Station is located at the same site as the concentrator. This situation is shown in Fig. 3.

The TTY stations are defined as local in this cluster if they can be connected through the concentrator to its 1A Data Station with metallic facilities within the resistance limit of 109-type data sets. The 1A Data Station properly terminates the metallic facilities. The single remote stations use PL Voice or PL Telegraph facilities between the stations and the concentrator.

The concentrator location here should be based on the same consideration as in (1) above. Also, it should be placed in the cluster in such a way as to minimize the number of single remote stations.

(3) ***One Cluster, More Than One Computer***—In this situation, only one cluster of stations has need to access two separate computers (or terminals). The 10B Concentrator is equipped with two trunk groups for this purpose, trunk groups A and B. The sum total of trunks in the two trunk groups is still fixed at 8, 16, or 32 but they can be divided in any ratio between the groups. The second trunk group can contain as few as one trunk or as many as one less than the total.

Only local stations have the option for selecting either trunk group. All other stations must be assigned to only one. Either trunk side of the concentrator can be equipped for local or remote service as in the previous situations. This situation is described in Fig. 4. The stations that are darkened have access to only one trunk group. Local stations have access to both.

(4) ***Multiple Clusters, One Computer***—The first two situations can be combined. In this situation two or more clusters require access to one computer, where one cluster is local as shown in Fig. 2 and the second is remote as shown in Fig. 3. The concentrators are in tandem, interconnected by the 1A Data Station System. This is shown in Fig. 5. The stations in Local Areas No. 2 and No. 3 must now communicate through two concentrators to the computer. Traffic volumes from each area should be considered to provide the proper grade of service to each station.

Only two concentrators are allowed in tandem in a DLCS system. (Check most recent Technical Reference for latest rules.) However, additional clusters, like Local Areas No. 2 and No. 3, can be delivered to the concentrator in Local Area #1, limited only by the 128 maximum line size to the concentrator in Area No. 1 and the desired grade of service.

(5) ***Multiple Clusters, More Than One Computer***—In this situation, the stations are arranged in several clusters, and some stations require access to more than one computer.

Situations 3 and 4 can be combined to meet this case.

Those local stations requiring access to two computers must be served by the 10B Concentrator with its two trunk groups. Again, local means that the data equipment in the clustered stations and in the 1A Data Station (within the local area) can be interconnected by the concentrator with metallic facilities that do not exceed the 109-type data set resistance limits. Figure 6 shows this situation. The DLCS/DATA-PHONE interconnection arrangement will be described later.

(6) ***Eight 150 Baud or Seventeen 75 baud Remote Stations, One Destination****—In this situation eight or fewer stations require access to one concentrator or to one computer. The stations may be in a cluster or may be scattered.

In Fig. 5 for instance, if there are eight or fewer data stations in the cluster described as Local Area No. 2, then the concentrator is not necessary. The stations and the local 1A Data Station can be connected with dc facilities within the 109-type data set resistance limit. This cluster then acquires access to the concentrator in Area No. 1 via the 1A Data Station System. If the number of data stations later exceeds eight, then the local concentrator in Area No. 2 can be added.

A variation of the 1A Data Station, called the single channel arrangement, provides for the situation where the stations are widely scattered and cannot be connected as described above. Here, the frequency multiplexing is done at each station and the signal from each is bridged onto the voice band channel. The composite signal is then delivered to a single 1A Data Station at the terminating site, either a concentrator, or a computer. See Part 4D. These arrangements are shown in Fig. 7.

Those are the configurations that are expected to be most prevalent in the Bell System. Teletypewriters were used as examples of station and computers as examples of terminals. In both cases other equipment can be used, particularly with the interface arrangements referenced in Part 5. Many other arrangements are possible but they are expected to be minor variations of these six.

One can understand the necessity for careful traffic engineering and growth planning for each concentrator by observing Fig. 6. For instance, if local stations are added in the cluster near computer No. 2, then all other lines to that concentrator will have greater difficulty accessing a trunk to the computer. Some of those lines are from remote clusters, thus the stations in those clusters experience access difficulty. The same effect will occur if traffic volumes increase in any cluster.

Grade of service at any station is influenced by the traffic volumes into any concentrator in the system.

There is one more optional system feature for DLCS that allows interconnection with DATA-PHONE service. Hardware items to accomplish this are located at the concentrator site and consist of:

(a) DLCS/DATA-PHONE Interconnection Arrangement ***Line Side,*** for allowing access from the DDD Network to a DLCS System. This is applicable to any 10-type concentrator, and,

(b) DLCS/DATA-PHONE Interconnection Arrangement ***Trunk Side,*** for allowing access from DLCS stations to the DDD Network. This is only applicable to one trunk group of a 10B Data Line Concentrator.

The use of the ***Line Side*** arrangement is restricted to locations described in Part 5.

The use of the ***Trunk Side*** arrangements is restricted to use by stations that are directly connected to a concentrator through dc metallic loop facilities, ie, local stations. Those stations desiring DATA-PHONE access must be equipped with a rotary or TOUCHTONE dial. Such stations will then have access to both the DLCS system and DATA-PHONE service by selecting the proper trunk group. One arrangement must be used for each trunk that accesses the DATA-PHONE service. See Part 5 for further information.

The system layout procedure can be summarized as follows:

(a) Identify clusters of stations including the obviously remote clusters (ie, interstate).

* This example uses eight (or fewer) 150 baud stations. The same principles apply for the seventeen (or fewer) 75 baud stations.

(b) Identify the locations of all stations in each cluster, the location of the concentrator in the cluster, and the location of the computers.

(c) Identify the location of 1A Data Stations in the obviously remote clusters.

(d) Check cable pair resistance between each station and its concentrator, and between the concentrator and the computer (or between the concentrator and the 1A Data Station for remote clusters).

(e) Determine class of service (local or remote) for each station in each cluster.

(f) Determine necessary concentrator size.

This results in a system layout of the type in Fig. 2 through 6.

B. Location Interconnecting Arrangements

4.10 This is the second part of the three-part system layout procedure. It covers the major items required to provide a connection between any two of the three types of locations (originating, concentrator, and terminating locations).

4.11 Each connecting arrangement should be examined to identify its major items. These will consist of; (a) the connecting facility and, (b) major data equipment items at each end. All items at each location should be tabulated for each location and the facility availability should be checked.

4.12 All available interconnections that follow are keyed to Fig. 8. This information should be used until BSP AB27.426 is reissued to include it. After that time, current data items for each arrangement should be obtained. The interconnections are:

(a) Local Station to Concentrator*

(b) Single Remote Station to Concentrator

(c) Multiple Remote Stations to Concentrator

(d) Concentrator* to Local Terminating Location

(e) Concentrator to Remote Terminating Location

(f) DDD Network to Concentrator

(g) Concentrator to DDD Network

(h) Remote Tandem Concentrator to Concentrator

Each type of interconnection is identified by letter on Fig. 8. The necessary major data items and facilities in the interconnection are identified by number. They are:

(1) ***Concentrator***

10A Data Line Concentrator—Single trunk group.

or

10B Data Line Concentrator—Two trunk groups.

128 Lines maximum
Designer must select line and switch module of trunk size 8, 16, or 32.
Designer must select trunk module of trunk size 16 or 32.
AC or DC power source options.
Central office or customer premises located mounting options.

BSP: 10A 591-811-100, -200, -300, -500, -180; 10B 591-811-101, -201, -301, -501, -181

(2) ***Local Station***

TTY

Data Set 109C-L1 (HDX)

or

Data Set 109F-L1 (HDX/FDX)

Options:

—L 1/2 EOT Motor Stop, Send Space Timer (SST)

—L 1/3 Rotary Dialing

—L 1/4 TOUCH-TONE Dialing

—L 1/2/3 EOT, SST, Rotary Dialing

* Note that metallic facilities require no additional data equipment at the concentrator.

—L 1/2/4 EOT, SST, TOUCH-TONE Dialing
BSP: D/S 109C 591-031-101, -201, -301, -501, -180

D/S 109F 591-035-101, 201, 301, 501, 180

TTY 574-010-100

Station 591-810-110, 210

(2) ***C.P.T.***

Data Set 109H-L1 (HDX/FDX)

Options:

—L 1/2 Rotary Dial and receiver to monitor call progress tones

—L 1/3 TOUCH-TONE Dial and receiver to monitor call progress tones.

—L 1/4 On-Off Control Via CD Lead and carrier squelch indication

—L 1/5 Off Via Carrier Fail

—L 1/2/4 Rotary Dial and CD Lead Control

—L 1/3/4 TOUCH-TONE Dial and Off Via Carrier Fail

—L 1/2/4/5 Those combinations listed above

—L 1/3/4/5 Those combinations listed above

Power Source—115V, 60 Hz.
BSP: 591-037-101, -201, -301, -501, -180

(3) ***Multi Data Set 109-Type Arrangement***

1 Data Set per port.

109D-L1 (HDX)

or

109E-L1 (HDX/FDX)

A.C. power source—KS-20575

DC power source—J-87308B

EIA Interface.

BSP: HDX (Multiple 109D-Type) 591-029-101, -201, -301, -501, -181

FDX (Multiple 109E-Type) 591-036-101, -201, -301, -501, -181

Computer Port Interface—See Part 5

(4) ***Single Remote P.L. Stations***

TTY

Data Set 108C1

Other equipment identified later in Part 4C

Model 33 or 35 TTY.

BSP: TTY 574-010-100

Data Set 591-023-110, -210, -310, -510, -180, -100, -300

BSP: Station 591-810-110, -210

(4) ***C.P.T.***

DAS 820D-L1

AR430 Ckt. Pack

Data Set 108C1

60440 Type Key (if key control required)

Power Source—115V, 60 Hz

BSP 811-023-111, -211, -311, -511

(5) ***TTY***

Same as (4) TTY except D/S 108C1 is replaced by D/S 108A1.

(5) ***C.P.T.***

Same as (4) C.P.T. except D/S 108C1 is replaced by D/S 108A1.

(6) ***TTY***—HDX Only

Same as (2) TTY except options -L3, -L4 not applicable.

(6) ***C.P.T.***—HDX Only

Same as 2 C.P.T. except options -L2, -L3, -L5 not applicable.

(7) ***DLCS/Private Line Interconnection Arrangement*** (For Line Side)

(a) ***AC Telegraph Loop or Voice Grade Line as Facility***

Designer must note whether system is HDX or FDX.

Performs supervisory timing and AC to DC signal conversion to operate concentrator.

AC power source KS-20575L1

DC power source J-87308B

28A1 Data Mounting accomodates up to three arrangements

BSP: 591-811-102, 202, 302, 502, 182

(b) ***DC Telegraph Loop—HDX Only***

Performs supervisory timing and DC to DC signal conversion

BSP: 591-811-102 Series, same as above.

(8) (9) ***1A Data Station Multichannel Arrangement***

Multiplexes up to 8—150 Baud Channels or 17—75 Baud on one 4-wire 3002 conditioned facility.

AC power source—KS-20575L1, DC source J-87308B

Customer premises or central office located

(8) Furnishes EIA interface C.P.T.

(9) Furnishes Balanced Interface required for concentrator.

EIA and Balanced Station Interfaces can be mixed in one Data Station.

75 and 150 Baud Channels can be mixed in one Data Station.

BSP: See Part 8

(10) ***1A Data Station Single Channel Arrangement***

For model 33 or 35 TTY installation.

Can be bridged on multichannel system to obtain 8 channels maximum.

Total 1A system design necessary for frequency assignment.

Power Source In TTY.

BSP: See Part 8 for 1A and bridging references.

(11) ***DLCS/DATA-PHONE Interconnection Arrangement—LINE SIDE***

Performs DATA-PHONE function and AC to DC signal conversion to operate concentrator.

One per line

Designer must note whether system is HDX or FDX.

AC power source—KS-20575L1 DC power source J-87308B

113-Type Data Station for multiple mounting.

See Part 5 for location restrictions.

BSP: Interconnection Arrangement 591-811-103, -203,-303,-503,-183. 113-Type Data Station 591-814-100,-200,-300,-500.

(12) ***DLCS/DATA-PHONE Interconnection Arrangement—TRUNK SIDE***

Performs DATA-PHONE function and DC to AC signal conversion for DDD transmission

Designer must note whether system is HDX or FDX (Station data sets 109C or 109F Type in TTY)

Designer must note whether all stations have Rotary or TOUCH-TONE Dials (not both)

AR73 Circuit Pack adds equipment in arrangement for rotary dialing to operate with L 1/3 station data sets.

AR74 Circuit Pack adds equipment in arrangement for TOUCH-TONE dialing to operate with L 1/4 station data sets.

One per trunk

Restricted to use on one trunk group of 10B concentrators by properly equipped local stations. See Part 5 for restrictions. AC power source 115V, 60 Hz. KS-20575L1; DC power source J-87308B

BSP: 591-811-104, -204, -304, -504, -184

C. Equipment Engineering and Ordering by Locations

4.13 This is the third part of the three-part system layout plan. It consists of methods and references sufficient to engineer, order from WE Co, install and test, and mount in cabinets or on racks all arrangements that can be located at (a) the concentrator locations, (b) the originating (customer) locations, and (c) the terminating (computer) location. It covers all equipment available for use in DLCS service.

4.14 It is assumed here that the procedure of Part 4A has resulted in a system block layout and that of Part 4B has identified the major functional pieces of equipment in the system. Those pieces will be clustered at three kinds of locations mentioned above. Note that a system may include more than one concentrator location.

4.15 The methods are described briefly for each block in the system layout. Each description states the information necessary before the method can be used and identifies the minimum amount of reference material required to accomplish the task.

Data Station (Originating) Arrangements—Local and Remote

4.16 This covers the Bell System teletypewriter terminals that can be used as originating stations. Stations can be classified by system layout into the following types:

(a) Local* Stations—Metallic connection from station to terminating data set is within the resistance limit of 109-type data sets.

(b) Single Remote* Stations—Connection uses Private Line (PL) Telegraph or PL Voice Service with appropriate data sets and options in the station, or,

(c) Multiple Remote* Stations—Connection requires multichannel arrangements (MCA) or single channel arrangements (SCA) of the 1A data station with appropriate facility and station interface.

4.17 Description and operation of these stations are covered in BSP 591-810-100, the System Description and in BSP 591-810-110, the Station Descriptions.

4.18 Stations may be arranged to operate with single or dual access 10-type concentrators. Local Stations can be used with dual access concentrators to access the DDD network as well as the normal DLCS network. In this case, the station must include the additional system access options for rotary or TOUCH-TONE dial (see Part 4B).

4.19 The information necessary to define the particular terminal to be used in a system layout is:

(a) Data Set Type—defined by the station classification above, interconnection restrictions of Part 4B, and the use of full or half duplex transmission mode.

(b) System Access Options—Rotary dial, TOUCH-TONE Dial, or normal.

(c) TTY Type—Model 33 or 35

(d) TTY Options—KSR, ASR, etc.

4.20 These subjects and others are covered in the following sequence of information to

* Local and remote are used here to identify electrical connections. These should not be confused with tariff definitions which may identify geographical locations.

engineer, order, install, test, and maintain the stations. (See Fig. 9.)

4.21 The Station Description describes applicable data sets and options. The Intercity Service Manual identifies USOC codes for a particular station arrangement. The Bell System TTY Station Engineering Arrangements provides ordering, assembling, and wiring information. The Station Installation practice covers assembly of data sets to the 33 and 35 TTY sets and also covers the checkout procedure.

4.22 The Bell System provided ***local*** stations are composed of data set 109C or 109F and call control unit UCC-29 installed in a Model 33 or 35 teletypewriter. A customer provided ***local*** terminal requires a 109H data set with its EIA interface for connection to the terminal.

4.23 Data set 109C is half duplex, 109F is full duplex or half duplex, and 109H is full duplex or half duplex. The applicable list numbers are in Part 4B.

4.24 The Bell System provided single ***remote*** station is composed of Model 33 or 35 type teletypewriters equipped with a 108-type data set and other equipment described in the above references.

4.25 The applications of these data sets and arrangements in the DLCS system are described in the references of Part 4 under data sets.

Customer Provided Terminals

4.26 The EIA interface with customer provided terminals is provided for by using the 109H-type data set in local service and the 108C or A-type (with 820DL1 and other equipment) in single station remote service. See Part 4B.

4.27 The 109H data set can be equipped with rotary or TOUCH-TONE dials, a receiver to monitor call progress tones, and other optional control functions. BSP 594-037-180 contains a description of the set and a listing of orderable equipment. Power is derived from a 115V ac receptacle. The set can operate in half-duplex (HDX) or full-duplex modes. BSP 591-037-101 series is devoted to use of this set in a DLCS application.

4.28 The use of the 108A or C-type data sets in conjunction with a Data Auxiliary Set 820D, L1 at a remote location is covered in BSP 591-028-111 series (including -191). Remote stations will not have access to the DDD Network in a DLCS system; therefore, no dial options or call progress monitoring options are provided.

Arrangements at the Concentrator Location

4.29 The methods contained here cover the concentrator and the equipment that interconnects the concentrator to the lines and trunks, both local and remote. Multiplexing equipment at this location is covered in Part 4D.

4.30 The concentrator location can be on a customer's premises or in a Telephone Company central office.

Data Line Concentrator Arrangements

4.31 The 10-type Data Line Concentrator is composed of four to seven interconnected modules each of which requires specific plug-in circuit packs. These can be mounted on 23- or 25-inch relay racks, for central office locations, or in a cabinet such as the KS-20093, L1 for customer premises locations. The four modules are interconnected by cords, adapters, and plug-in cables. The modules are:

(a) Power module; 115 volts ac or −48 volts dc

(b) Control module; houses clock, scanners, alarms, manual test equipment, camp-on circuitry, and pulsing circuitry

(c) Trunk module; houses trunk circuits

(d) Line and switch module; houses line circuits and switching matrix.

4.32 The modules for a particular concentrator can be specified by knowing only the number of lines and trunks in that concentrator design and the source of power, 115 volts ac or −48 volts dc. Care should be taken to allow lines and trunks for system expansion, as described in Part 3C.

4.33 Typical installations and installation procedures for several concentrator sizes are described in the following sequence along with wiring methods and cautions.

4.34 A sequence of information, in order of increasing complexity, to engineer, order equipment, install, and test the 10A Data Line Concentrator is as shown in Fig. 10.

BSP 591-811-100—10A Data Line Concentrator Description
BSP 591-810-100—10-Type Data Line Concentrator System (DLCS) Description BSP 591-811-200—10A Data Line Concentrator Installation
BSP 591-811-300—10A Data Line Concentrator Maintenance
BSP 591-810-300—10-Type Data Line Concentrator System (DLCS) Maintenance
BSP 591-811-500—10A Data Line Concentrator Tests
BSP 591-811-180—10A Data Line Concentrator Summarizing Specification
E.L. 308—10A Data Line Concentrator—DLCS Service
E.L. 311—10A Data Line Concentrator System—DLCS Service
SD&CD 73055-01—10A Data Line Concentrator
BSP 598-075-100—Data Auxiliary Set 803E1, Identification

4.35 A sequence of information, in order of increasing complexity, to engineer, order equipment, install, and test the 10B Data Line Concentrator is as shown in Fig. 11.

4.36 Additional information on concentrator apparatus and arrangements can be found in the following list and in the sources listed in Part 8 under Data Line Concentrator System, Data Mountings, Power System, Cabinets, and Installation.

BSP 591-811-101—10B Data Line Concentrator Description
BSP 591-810-100—10-Type Data Line Concentrator System Description
BSP 591-811-201—10B Data Line Concentrator Installation
BSP 591-811-301—10B Data Line Concentrator Maintenance
BSP 591-810-300—10-Type Data Line Concentrator System Maintenance
BSP 591-811-501—10B Data Line Concentrator Tests
BSP 591-811-181—10B Data Line Concentrator Summarizing Specification
Drawing—SD-1D212-01—10B Data Line Concentrator
Drawing—CD-1D212-01—10B Data Line Concentrator
E.L. 634—10B Data Line Concentrator—DLCS Service
E.L. 635—10-type Data Line Concentrator System Expanded Features—DLCS Service
BSP 802-218-154—Power Systems, DC to DC Converter
KS-20093-01—Cabinet and Accessories
KS-201129—Power Strip
71B—Apparatus Mounting
J87308—Power Converter DC Supply
71A1—Apparatus Mounting
KS-20575L1—Rectifier AC Supply
BSP 590-010-200—Data Sets, General Installation and Connection Information
BSP 590-010-200—Data Sets, Multiple Installation Information (Cabinet Information)

Line Connections to the Concentrator

4.37 Line Loop appearances at the concentrator site can be from local stations which require no additional interface equipment to access the concentrator circuit packs, or from remote stations which do require interface equipment. Connections to the data mountings housing the interfaces and to the concentrator line and switch modules are by plug-in cables.

4.38 Connections between the line loops and the equipment at the concentrator site use standard connection and mounting hardware described in BSP 590-010-200.

4.39 The following identifies the connecting arrangements and the necessary interfaces.

Lines From Local DLCS Stations

4.40 Local line loops are 2-wire from originating stations to the concentrator. The concentrator cable and the line loop circuits are interconnected using standard mounting and connection hardware referenced above. The particular cables necessary were identified in Par 4.31.

4.41 The proper cable wiring and the circuit pack connections to the cable are listed in BSP 591-811-200 and -201 on concentrator installation. The sequence of information in Par. 4.31 provides additional information that may be useful.

Lines From Single Remote DLCS Stations—Private Line Interconnecting Arrangements

4.42 A Private Line Connecting Arrangement provides an interface between one line from

a station with Long Haul Teletype (150 Baud) service or Short Haul Voice Grade Service, and one line input to the Data Line Concentrator. In these cases the line signal is either ac (frequeny shift) or binary dc, while the concentrator requires dc input signals timed for supervision. Data sets and a logic circuit pack are available for use in this arrangement to receive either dc or ac signals, to accomplish the conversion, and to perform timing of supervisory signals. (Long range developement plans consider an ac data line concentrator.)

4.43 The connecting arrangement is described in BSP 591-811-102, -202, -302, -502, and -182. Up to three arrangements and power supplies can be mounted in one 28A1 Data Mounting which can in turn be mounted in the KS-20093 cabinets (or a co rack) or in a separate cabinet (or co rack). The 28A1 Data Mounting is designed for 23 or 25 inch racks. The equipment and apparatus required for the arrangements can be specified by knowing the number of single station remote lines and the power source.

4.44 Connections to the arrangements are by cable and 50 pin connectors on the 28A1 Data Mounting. Information on apparatus and equipment for implementing these arrangements can be found in the following sources in addition to the list in Part 8 under Interconnecting Arrangements.

BSP 590-102-124—28A1 Data Mounting Identification
BSP 591-023-100—Data Set 108-Type Private Line System Description
BSP 591-029-100—Data Set 109DL1 Description
BSP 591-024-100—Data Set 109A—Type Identification

71A1 Apparatus Mounting—Separate AC Supply. Normally, KS-20575 Rectifier—Rectifier only is mounted in 28A1 Mounting.

71B Apparatus Mounting—Separate Mounting J87308 Power Converter and DC Supply.

BSP 591-811-102—
BSP 591-811-202—Private Line Interconnection Arrangements for
BSP 591-811-302—Line Side of 10-Type Data Line Concentrator
BSP 591-811-502—System (DLCS)
BSP 591-811-182—

Lines From 1A Data Station, Multichannel

4.45 The 1A Data Station at the concentrator site terminates a conditioned line carrying frequency multiplexed, voiceband data signals. Up to 17 single width (75 baud) or 8 double width (150 baud) plus 1 single width channel can be multiplexed over a conditioned 4-wire voice grade channel. For a 2-wire facility, a maximum of 8 single width or 4 double width channels may be multiplexed. See Part 4D for further information.

4.46 An interim arrangement of equipment is described in E.L. 311 to be used until two apparatus pieces (DP63 Circuit Pack and 811JL1 DAS) become available. This interim arrangement requires additional mounting space for a nest of 109DL1 Data Sets.

Lines From 1A Data Stations, Single Channel

4.47 Another method for providing remote service uses the 1A Data Section Single Channel arrangement. This system allows up to eight separate stations to be ac bridged and the composite signal delivered to a termination site. See Part 4D.

Lines From DATA-PHONE Service on the DDD Network

4.48 A DLCS/DATA-PHONE Interconnecting Arrangement—Line Side provides the required interconnection between a line from DATA-PHONE stations on the DDD Network and one line input to the Data Line Concentrator. The arrangement is described in BSP 591-811-103, -203, -303, -503, and -183.

4.49 For eight or fewer arrangements, all equipment can be mounted in one 28A1 data mounting. The data equipment in the arrangement may consist of Data Set 103-type or the 113-type data station.

4.50 The equipment and apparatus for the arrangements can be specified by: (a) knowing the number of lines with DATA-PHONE service from the DDD network and the power source, and (b) following the procedure described in BSP 591-811-183.

4.51 Information on apparatus and equipment for implementing the arrangement can be found in the following sources in addition to the

information in Part 8 under Interconnecting Arrangements, Data Sets, and Power Systems.

BSP 591-811-103—DLCS/DATA-PHONE Interconnecting Arrangement for Data Concentrator High Line Side Description
BSP 591-811-203—Installation
BSP 591-811-303—Maintenance
BSP 591-811-503—Tests
BSP 591-811-183—Summarizing
CD and SD 1D208-01—Data Set 113B-L1 and 32A1 Data Mounting
CD and SD 1D197-01—DDD Incoming Circuit for the DLCS Concentrator

Trunk Connections to the Concentrator

4.52 Trunks from a concentrator go (a) to local terminals, (b) to remote terminals, or (c) to the DDD network. The local trunks are metallic loops that can be connected directly to the concentrator. Trunks to remote terminals use a 1A Data Station Frequency Multiplex or (MCA) to place several trunks on a voiceband facility. The operational features and frequency assignments for the 1A Data Station must be determined by a system design that includes both far end and near end data stations. The system is described in Part 4D.

DLCS/DATA-PHONE Interconnecting Arrangement—Trunk Side

4.53 The DLCS/DATA-PHONE Interconnection Arrangement—Trunk side consists of four interconnected printed circuit cards. These circuit cards are housed in a data mounting and are interconnected by an adapter. The circuit cards are:

(a) Control Logic

(b) Telephone Loop Interface

(c) FSK Data Set

(d) DC Data Set

4.54 BSP Section 591-811-184, DLCS/DATA-PHONE Summarizing Specification, contains a table that allows the proper selections of circuit packs, data sets, adapter, and data mounting to form a complete interconnection arrangement.

4.55 Information on the interconnection apparatus and arrangements can be found in the following sources:

BSP 591-811-104—DLCS/DATA-PHONE Interconnection Arrangement Description
BSP 591-811-204—DLCS/DATA-PHONE Interconnection Arrangement Installation
BSP 591-811-304—DLCS/DATA-PHONE Interconnection Arrangement Maintenance
BSP 591-811-504—DLCS/DATA-PHONE Interconnection Arrangement Test Procedures
BSP 591-034-100—113B Data Set Description
BSP 591-026-100 Series—Data Set 103G-Type
BSP 591-814-100 Series —113-Type Data Station
BSP 312-805-100—Data Set 108D-Type Description
BSP 591-029-100 Series—Data Set 109D
BSP 591-036-100 Series—Data Set 109E
BSP 590-102-124—29A1 Data Mounting Identification
KS-20575L1—Rectifier
E.L. 590—Data Set 113B and 113-Type Data Station

Data Station (Terminating) Arrangements

4.56 This covers equipment that can be located at the terminating (computer) location. The equipment terminates local trunks and trunks from remote locations and also provides the EIA interface to the customer-provided terminal. See Part 8 for identification of the technical reference that describes the interface.

Terminating Trunks From a Local Concentrator

4.57 Local trunks are terminated in a multiple 109-type data set arrangement. This data equipment is located at the computer site as depicted in Fig. 1. The 109D-type data sets are used in half-duplex arrangements and 109E-type in full-duplex arrangements. Sixteen data sets are mounted in a single 28A1 data mounting. Two 27A1 data units per mounting provide plug-in EIA connectors for CPT equipment. Plugs and cables from the CPT are provided by the customer. Space is provided on the mounting for a KS-20575L1 rectifier which must be ordered separately. Alternately, a J87308B DC Power Source can be engineered separately.

4.58 Information on the Multiple Data Set Arrangement and Apparatus can be found in the following sources:

BSP 591-029-101—Data Set 109D-Type Multiple Data Set Arrangement

BSP 591-029-201—Data Set 109D-Type Multiple Data Set Arrangement
BSP 591 029-301—Data Set 109D-Type Multiple Data Set Arrangement
BSP 591-029-501—Data Set 109D-Type Multiple Data Set Arrangement
BSP 591-036-101—Series Data Set 109E-Type Multiple Data Set Arrangement
BSP 591-029-100—Data Set 109D-L1 Description
BSP 591-029-180—Data Set 109D-Summarizing Specification
SD 1D172-01—Data Set 109D-Type
CD 1D172-01—Data Set 109D-Type
SD 1D198-01—Data Set 109E-Type
CD 1D198-01—Data Set 109E-Type
BSP 590-100-114—27A1 Data Unit—Identification (SD 1D183-01)
BSP 590-102-124—28A1 Data Mounting Identification (SD 1D176-01)
BSP 591-029-100—Data Set 109DL1 Description
BSP 591-036-100—Data Set 109EL1
71B Apparatus Mounting
Separate DC Supply
J87308 Power Converter

Terminating Trunks From a Remote Location

4.59 Trunks from remote locations are provided by the 1A Data Station, Frequency Multiplexing System. The termination at the computer site is a 1A Data Station with the EIA interface option to the CPT. See Part 4D for information.

D. 1A Data Station Arrangements, Multichannel and Single Channel 1A Data Station, Multichannel Arrangements

GENERAL

4.60 The 1A Data Station is capable of frequency multiplexing up to 17 single width (75 baud) or 8 double width (150 baud) channels and 1 single width channel on a suitably condition 4-wire voice grade facility. For a 2-wire facility, a maximum of 8 single-width or 4 double-width channels may be multiplexed. Each system consists of the voice-grade facility with a 1A Data Station at each end. See Fig. 7 for a sketch of an application of each type.

4.61 The 1A Data Station, Multichannel Arrangements (MCA),* is modeled after and employs the same system organization as the 43B1 Voice Frequency Carrier Data System and is identical to it except for these major differences:

(a) the option of two transmission modes, binary or ternary

(b) the options of several station interface connect channel terminals to data station equipment, and

(c) mounting arrangements for installation on customer premises.

The ternary transmission mode provides for the transmission and the detection of a supervisory signal in addition to the normal binary data signal.

4.62 A channel terminal consists of four plug-in circuit packs; eg, a transmitter, demodulator, receive interface, and station interface. The receive interface may be one of two types, depending upon which transmission mode, binary, or ternary is desired. The station interfaces provide operation with data terminal equipment having one of four baseband interfaces; eg, an interface per EIA Standard RS-232B, a 20 milliampere neutral current interface (3-wire), a 62.5 milliampere neutral current interfaces (2-wire), or a ± 3 ma balanced polar interface.

4.63 A 1A Data Station, MCA, when used in a DLCS system must be arranged to operate in the ternary transmission mode. Also, only the EIA and the ± 3 ma balanced interfaces are applicable in a DLCS system.

4.64 The 1A Data Station, Multichannel Arrangements makes use of only two data mountings. The 29A1 Data Mounting houses the common equipment (line circuit, test circuitry, alarm circuitry), two channel terminals, and a KS-20575 rectifier. The 29B1 Data Mounting may house either four channel terminals, or three channel terminals and a KS-20575 rectifier, and is used to add additional channel positions to a system. Each channel terminal contains a transmitter, receive interface, demodulator and station interface circuit pack. The data mountings can be mounted on a 23- or 25-inch frame or in a cabinet such as the KS-20093, L1 or the KS-20018, L7.

* The Multichannel Arrangement is also referred to as the Limited-Two-Point Arrangement.

4.65 The configuration for a particular 1A Data Station, MCA, can be specified by knowing (a) the required number of systems, (b) the number of channel terminals in each system, and (c) the desired types of interface operation. With this information BSP 591-813-180, 1A Data Station, Multichannel Arrangements, Summarizing Specification, contains ordering information for the data mountings, data auxiliary sets, adapter cards, circuit packs, cables, and cabinets. The flexibility of the 1A Data Station, MCA, mounting arrangement allows for future system changes or expansion with little disruption or reconfiguration necessary.

MAINTENANCE

4.66 Certain features have been incorporated into the design of the 1A Data Station, MCA, to facilitate fault location once an alarm is given. The SYSTEM ALARM circuit provided with the common equipment looks for both excessive changes in signal level and poor signal-to-noise ratios. Both major and minor alarm outputs are capable of operating audible and visual alarms on customer premises or at the central office.

4.67 Built-in test features will allow customers on 2-point channelizing service to test data signals from end-to-end or looped back, in order to help isolate trouble. When arranged for 4-wire operation, the send pair may be connected to the receive pair permitting a check of the intergrity of the 4-wire facility from the other end. When arranged for 2-wire operation, the transmission pair is terminated in an open circuit and appears as tip and ring on screw terminals. Thus, a known impedance may be used to terminate the pair to permit testing from the other end.

4.68 A channel check circuit, consisting of a signal generator and a signal detector, is capable of keying any desired channel modulator in a number of ways. A meter then indicates the transmission capability of the data channel. The channel terminal may be aligned and tested with only an AC and a DC voltmeter, using two employees, one at each end of a system. These features are described in BSP 591-813-200, 1A Data Station, Multichannel Arrangements.

Data Auxiliary Sets

4.69 In order to provide a distinct separation between Bell System equipment and those items to which the customer must have access, three data auxiliary sets are available. One, designated Data Auxiliary Set 811G-L1, is associated with the 29A1 Data Mounting. A second, designated Data Auxiliary Set 811H-L1, is associated with the 29B1 Data Mounting. A third, designated the 811J-L1, is associated with both the 29A1 and 29B1 Data Mounting. The data auxiliary sets are designed to mount at the rear of their respective data mountings. Alternatively, they may be located in the customer access section of the KS-20093-L1 cabinet, or on a submounting bar mounted on the same frame as the data mountings. Refer to BSP 598-073-100, Data Auxiliary Set 811G-L1; BSP 598-074-100, Data Auxiliary Set 811H-L1; and BSP 598-078-100, Data Auxiliary Set 811J-L1.

4.70 A listing of information, to engineer, order equipment, install, test, and maintain the 1A Data Station, MCA is listed below:

SD-1D148-01—1A Data Station, Multichannel Arrangement
E.L. 310—1A Data Station, Multichannel Arrangements
ED-1D159-01—1A Data Station, Multi- and Single-Channel Arrangements, CPT and Teletypewriter Applications
BSP 591-813-100—1A Data Station, Description and Operation
BSP 591-813-180—1A Data Station, MCA, Summarizing Specification
BSP 590-102-125—29A1 and 29B1 Data Mountings
BSP AB82.026—Telegraph Transmission Coefficients
BSP AB83.048.01—1A Data Station, Transmission Engineering Considerations
BSP AB83.048.02—1A Data Station, Transmission Engineering Considerations, Line Connection Circuits
BSP AB83.048.04—1A Data Station, Line Facilities Engineering Considerations
BSP AB83.048.1—1A Data Station, Transmission Losses
BSP 598-073-100—Data Auxiliary Set 811G-L1
BSP 598-074-100—Data Auxiliary Set 811H-L1
BSP 598-078-100—Data Auxiliary Set 811J-L1
BSP 591-813-200—1A Data Station, MCA, Installation
BSP 591-813-300—1A Data Station, MCA, Maintenance
BSP 591-813-500—1A Data Station, MCA, Test Procedure

THE 1A DATA STATION, SINGLE CHANNEL ARRANGEMENTS

GENERAL

4.71 The 1A Data Station, Single Channel Arrangements (SCA), are designed to provide a single 75 baud or 150 baud voiceband channel for use with a teletypewriter terminal or other customer provided terminal. The channel consists of four plug-in circuit packs; eg, a transmitter, a demodulator, a receive interface, and a line station interface. The transmitter, demodulator, and receive interface circuit packs are identical to those used in the 1A Data Station, MCA. The receive interface may be one of two types depending upon whether the binary or the ternary transmission mode is desired. The line station interface may be one of three types depending upon whether the data output desired is voltage per EIA Standard RS-232B, 20 milliampere neutral current (3-wire), or 62.5 milliampere nuetral current (2-wire).

4.72 The four circuit packs that make up a channel terminal can be plugged into one of two data mountings which includes a power supply. The two data mountings used are the 31A2 and the 37A1. The 31A2 data mounting is used in an arrangement designed to mount within a Bell System provided teletypewriter. The 37A1 data mounting is designed for desk top use with customer provided data terminal equipment.

MAINTENANCE CONSIDERATIONS

4.73 Inasmuch as the 1A Data Staion, SCA, is meant to be installed outside of the central office environment means for looping the baseband interface leads and the voiceband leads are provided. All that is required for maintenance, testing, and calibration are a DC and an AC voltmeter with an employee at each end of a system, provided one end terminates in a 1A Data Station, MCA.

4.74 A list of information to engineer, order equipment, install, test, and maintain the 1A Data Station, Single Channel Arrangements is listed below:

E.L. 507—1A Data Station SCA for Bell System Teletypewriters
ED-1D159-01—1A Data Station, Multi- and Single-Channel Arrangements, CPT and Teletypewriter Applications
SD-1D184-01—1A Data Station, SCA
BSP 591-813-101,—201, -301, -501, -181—1A Data Station, Single Channel Arrangements
BSP590-102-127—31A2 Data Mounting
BSP 590-102-129-q37A1 Data Mouting

Also see A, B Sections listed under MCA.

ALARM

4.75 To permit prompt recognition of transmission interruptions due to signal fading, line opens, etc, a channel terminal in either the MCA or SCA, and whether operating in binary or ternary mode, is capable of detecting when the received carrier has dropped 12 dB. Upon detecting a decrease in received carrier signal strength by an amount equal to or greater than 12 dB for approximately 140 milliseconds, the channel terminal (binary or ternary unless otherwise specified) responds as follows:

(a) Provides a loss of carrier indication on the CF lead (pin 8) of the 25 pin connector.

(b) Causes a lamp to light in the individual channel equipment (31A2 and 37A1 Data Mounting) as well as providing through a terminal strip, means for operating a remotely located lamp (31A2 Data Mounting only).

(c) Clamps the data output of the demodulator (circuit BB, pin 3) optionally marking or spacing in the binary transmission mode or marking in the ternary transmission mode.

(d) Provides means, through an installer option, to squelch the output of the channel modulator.

(e) Clamps the received supervision lead (circuit CC, pin 6) to the on-hook state in the ternary transmission mode.

(f) Causes CENTER frequency to be transmitted when the ternary transmission mode is employed.

(g) Monitors for the presence of incoming carrier.

Detection of incoming carrier above the failure threshold for approximately 140 milliseconds nominal will restore the channel terminal to its normal mode of operation.

AC BRIDGING ARRANGEMENTS

4.76 Multiplexing or combining several 1A Data Stations, SCA, onto one voiceband facility

may be accomplished by one of several commonly used ac bridging techniques employed with the 43B1 Voice Frequency Carrier System. In general, these methods employ resistive networks, bridging filters, or hybrids. The bridging technique used will depend upon number of channels being bridged, signal levels, and the type of facility (2-wire or 4-wire).

4.77 Multipoint service arrangements* utilizing AC bridging techniques are covered in the following materials:

FOUR BRANCH 44 TYPE BRIDGE
SD-55647-01 and AB23.050

SIX BRANCH 44 TYPE BRIDGE
SD-55647-01

C-2 BRIDGES—VARIOUS NUMBER OF LEGS
AB23.050 and BSP 310-405-100

FILTER BRIDGES
AB83.047.02
AB83.048.02

TANDEM CONCENTRATION WITH THE 1A DATA STATION, MCA

4.78 A representation of tandem concentration with the 1A Data Station, MCA, is shown in Fig. 12.

4.79 Each channel terminal in the 1A Data Station, MCA, located on the trunk side (A) of the remote data line concentrator contains a tandem trunk timer supplied by the ± 3 ma balanced polar interface. The 1A Data Station channel terminals located at the line side of the local data line concentrator (B) have the timer function removed. Mark crossover shift is utilized in the channel terminals at the trunk side of the remote data line concentrator (A) whereas space crossover shift is utilized at the line side (B). Space crossover shift at the line side of the local data line concentrator enables the 1A Data Station, MCA, to receive a camp-on signal. Mark crossover shift provides a mark output from the channel transmitter when loop current is near zero.

4.80 Additional information can be found in CD and SD-1D148-01, 1A Data Station, MCA and in BSP 591-813-200, 1A Data Station, MCA, Installation.

* This is also referred to as the Expanded Two-Point Arrangement.

E. Space and Power Requirements

4.81 This section contains considerations for installation sites of DLCS equipment.

4.82 ***Space Requirements***—The concentrator is designed on a modular basis, the number and type of modules required being determined by the numbers of lines and trunks involved. However, regardless of size, the modules comprising a concentrator are for customer's premises installations mounted in a KS-20093-21 cabinet. The cabinet is designed to be free, standing on four adjustable levelers. Arrangements involving 8- or 16-trunk modules or less than four 32-trunk modules (for 97 to 128 lines) do not use all of the space available in the cabinet. The unused space may be used to house other associated equipments as discussed below. Concentrators will vary in weight from about 400 to 1000 pounds depending upon size.

4.83 The cabinet has doors on both the front and back for access to the equipment. Therefore, space must be provided in front and in back of the cabinet for installation and maintenance personnel.

4.84 Trunks in local arrangements where the concentrator is close to the computer are terminated in 109-type data sets. These data sets may be mounted in the concentrator cabinet or in a separate KS-20018-L7. More than 32 data sets can be mounted in one of these separate cabinets with a total weight of approximately 60 pounds.

4.85 Multiplexed line and trunk arrangements involve the use of 1A Data Station equipment located at the concentrator. 1A Data Station equipment may be mounted in the concentrator cabinet, in a separate cabinet identical to the concentrator cabinet, or in a KS-20018-L7 cabinet. The small cabinet will house 1A Data Station equipment for up to 8 data channels. The larger KS-20093-L1 can house 1A Data Station equipment for up to 32 data channels. The weight of this large cabinet installation (total occupancy) is about 700 pounds.

4.86 Equipment required for remote stations served on a private line data channel may be mounted in the concentrator cabinet, if space

is available, or in KS-20018-L7 cabinet. Space must be available for both front and rear access to the cabinet. The maximum weight of a separate cabinet full of this equipment of the above size is about 150 pounds.

4.87 ***Power Requirement***—All equipment used requires ac power of 60Hz ±13Hz at 105 to 129 volts. The ac power drain is up to 115 watts for concentrators having 1 or 2 switch modules and serving up to 64 lines with up to 32 trunks. The power drain is up to 345 watts for larger concentrators. The ac power drain is:

(a) Per derived 1A channel about 7.5 watts.

(b) For 16 or fewer 109-type data sets up to 75 watts.

(c) Each interface arrangement about 75 watts.

4.88 ***BSP Information*** on space and power can be found in the following practices:

591-811-180—10A Data Line Concentrator

591-811-181—10B Data Line Concentrator

591-811-182—DLCS/Private Line Interconnection

591-811-183—DLCS/DATA-PHONE Interconnection (Line Side)

591-811-184—DLCS/DATA-PHONE Interconnection (Trunk Side)

591-813-180—1A Data Station MCA

591-813-181—1A Data Station SCA

591-031-180—Station-109C

591-035-180—Station-109F

591-029-181—Multi Data Set 109D

591-036-181—Multi Data Set 109E

591-023-190—Station 108C

591-023-191—Station-CPT-108C1

591-037-180—Station-CPT-109H

591-814-180—113-Type Data Station

F. Facility Requirements

4.89 Transmission facilities used for lines and trunks may be any of the following four types, depending upon the service required and distance involved:

(a) Metallic pairs terminated in 109-type data sets

(b) Narrowband 150-baud channels—1006 series

(c) Voiceband channels (3002-type) terminated in 108-type data sets

(d) Voiceband channels (3002-type) terminated in 1A data stations

4.90 While each of these facilities is used for services other than DLCS, their use in DLCS involves some special considerations. These special considerations are described in BSP AB 27.426, 10-Type Data Line Concentration System Transmission Engineering Considerations, and EL 311, 10A Data Line Concentrator System—DLCS service.

4.91 ***Metallic loops*** are used to implement short (local) lines and trunks. The basic requirements for metallic loops are given in BSPs for the 109-type data sets. Reference should be made to the BSPs for data set code that terminates the trunk or the particular line involved. (See Part 8.) However, as described in BSP AB 27.426, the loop resistance limits for DLCS are more restrictive because the concentrator introduces some resistance into the connection.

4.92 ***Narrowband 150-baud channels*** (1006 series) may be used to implement station lines that are so long that they cannot be implemented with metallic loops. The terminating data set at the concentrator end of each line mounts in and is a part of a DLCS/private-line channel interconnection arrangement. The data set can be of the 108- or 109-type for AC or DC data signals. Basic channel requirements for such facilities are the same as for 150-baud private line telegraph service arrangements. The special engineering considerations for DLCS described in BSP AB 27.426 are primarily

* These facilities are used to provide lines to remote stations only, not long haul trunks.

concerned with restricting telegraph carrier channels to those provided with 43A1 and 43B1 equipments and ***restricting the number of such links*** that may be included to assure satisfactory transmission performance.

4.93 ***Voiceband channels*** (3002-type) terminated in 108-type data sets may also be used to implement station lines that are so long that they cannot be implemented with metallic loops. As described in the previous paragraph, the channel terminating data set at the concentrator end of each channel mounts in and is a part of a DLCS/private-line interconnection arrangement. Channel requirements are the same as those specified for 100 series data sets in AB 27.350 except for special consideration concerning ***received level*** which is specified in AB 27.426.

4.94 ***Voiceband channels*** (3002-type) terminated in 1A Data Station equipments are used to implement trunks that are so long that they cannot be implemented with metallic loops. Such arrangements may also be used to implement lines to small clusters of stations. Small diffuse clusters (stations not within about 50 feet of one another) require multipoint arrangements. (Also called Single Channel Arrangements.) Voiceband channel requirements are specified in AB 27.350. Other Transmission Engineering Considerations are found in the BSP references for the 1A Data Station in Part 8. These refer to facility restrictions, line connection circuits, etc.

G. Transmission Design

Distortion

4.95 Equipment arrangements that will yield satisfactory transmission performance are described in AB 27.426. The most basic restrictions are (a) no more than two concentrators in a tandem connection, and (b) no more than three 150-baud channels (1A Data Stations and PL-Voice or Telegraph) in a tandem connection. If these basic restrictions are followed, and if the 150 baud links are installed and tested according to their BSP requirements, then the transmission distortion will be satisfactory from end-to-end. Also, no regeneration will be necessary in links made up of 1A systems and facilities.

> ***Note:*** See the most recent Technical Reference for restrictions.

Levels

4.96 Local stations, lines, and trunks are designed on the resistive basis described in AB 27.426.

4.97 Transmission level objectives are covered in AB 27.350 for the PL Voice connections to remote stations using 108-type data sets. However, there is one exception to that practice. At the concentrator end, the input to the Private Line Interconnection arrangement is not a fixed transmission level point. The receive levels can vary over the acceptable range of 108A data sets.

4.98 The 1A Data Station systems have separate line level requirements specified in BSP sections on that subject (see Index, Part 8).

4.99 Bell Telephone Laboratories is continuing to put strong effort on improving the Transmission Design plan in AB 27.426. This will result in a reissue of the practice in the second quarter of 1971.

5. SYSTEM INTERFACES

5.01 This section covers information on interfaces for other systems and for customer provided equipment.

A. Interface With Other Systems

5.02 This section identifies information on other telephone company systems that can be interfaced with the DLCS system. It identifies those systems that can be used to interconnect with (a) the concentrator line side DATA-PHONE interconnection circuit, (b) the concentrator trunk side DATA-PHONE interconnection circuit, and (c) the concentrator line side Private Line Interconnecting Arrangement. It also identifies the technical limitations that limit the interconnections.

DDD Network and DATA-PHONE Service

5.03 DLCS service arrangements include provisions for interconnection with the DDD network (and DATA-PHONE service) through either a concentrator line or a trunk interface. A line from a local PBX or Central Office, terminated in a data set type 103G (or a data set 113B in a 113-type data station), can be interconnected with a DLCS service arrangement or system on the line side of a concentrator. A special line side DLCS/DATA-PHONE

interconnection arrangement is required for each concentrator line involved. The DATA-PHONE data set appears as a data terminal to the concentrator. With this feature, calls originated at DATA-PHONE equipped stations on the DDD network can access computer communication ports associated with the DLCS service arrangement.

5.04 Lines to a local PBX or Central Office may also be interconnected with the trunks of one group of a dual access concentrator. Each concentrator trunk must be equipped with a special DLCS/DATA-PHONE interconnection arrangement which includes a DATA-PHONE-service-compatible data set to terminate the PBX or Central Office line. With this interconnection, appropriately equipped DLCS stations can dial through the special trunk arrangement and the DDD network to any DATA-PHONE station.

5.05 The ***line side*** interconnection arrangement is described in Bell System Practice 591-811-103 series. The interconnection should not place any special requirements on DATA-PHONE service provided that the interconnection is not used with DLCS arrangements in which the connections with computer ports involves more than ***one concentrator or more than 1A-Data-Station-multiplexed voiceband channel.*** (See AB 27.426.) However, it may be significant that when all DLCS trunks are busy, calls from DATA-PHONE stations will be answered and the stations will be "camped-on" as for any DLCS station.

5.06 The ***trunk side*** interconnection arrangement is described in Bell System Practice 591-811-104 series. The interconnection may involve either rotary or TOUCH-TONE dial pulsing; though all DLCS stations and trunks involved in a system must be equipped for the same kind of dial pulsing. However, there are several limitations on the use of the interconnection that are of particular significance. While DLCS stations equipped to use the interconnection capability include provisions for users to hear call-progress tones, they do not include provision for an alternative voice mode. Therefore, where the interconnection involves a PBX or Central Office arrangement with operator number identification (ONI), it will only be possible for calls to be originated to local DATA-PHONE stations and not to stations that require operator action. A second limitation is concerned with Central Office or PBX lines when TOUCH-TONE dial pulsing is used. The requirements on the line specified in BSP 591-811-104 series are equivalent to those for PBX trunks. Since lines to DLCS stations that can be equipped to use the interconnection must be metallic loops, transmission from the station to the interconnection arrangement is with 109-type data sets and should be nearly distortionless so that satisfactory performance should be achieved without any special restriction on DATA-PHONE service arrangements involved.

Private Line Systems—Telegraph and Voice

5.07 Another DLCS service arrangement provides interconnection with Private Line Telegraph and Private Line Voice systems. The Private Line Interconnection Arrangement is described in the BSP 591-811-102 series. There are arrangements for binary or FSK signals. These are referenced in Par. 4.37 through 4.51 and in Part 4F. The arrangements provide ac-to-dc conversion, when necessary, and concentrator supervisory signals.

5.08 One Interconnection Arrangement is required for each line implemented in this fashion. The restrictions for their use in DLCS are described in AB 27.426. The principal restriction is the number of tandem derived channels and private line systems.

B. Interfaces with Customer Provided Equipment

5.09 There are basically two interfaces with customer provided equipment in DLCS service arrangements. These are a ***line interface*** for a data terminal like a teletypewriter and a ***trunk interface*** for a computer communication port. The line or trunk terminating customer provided equipments can be other than data terminals and computer communication ports. They may be communication facilities, but the line and trunk interfaces are the same. The interfaces are described in:

Bell System Data Communications Technical Reference

DLCS Service Arrangements

Date (to be issued)

5.10 Both interfaces conform to the "Electrical Signal Characteristics" requirements of Electronics Industries Standard RS 232B and are designed to be functionally compatible with customer

equipments that meet the standards in RS 232B. However, the interfaces include several options. The correct options depend upon the service features involved and the detailed characteristics of the terminal equipment interface. Required interface leads and their connector pin assignments are among the more important interface characteristics that should be reviewed. It may also be particularly significant that available interface options and other interface characteristics for local (metallic loops) line and trunks are different from those for long lines or trunks.

5.11 The interface leads with EIA or RS 232B designations and optional connections are as follows:

CIRCUIT	FUNCTION
AA	Protective Ground
BA	Transmitted Data
BB	Received Data
CA2	Request to Send
CB2, 3	Clear to Send
CC	Data Set Ready
AB1	Signal Ground
CF	Data Carrier Detector
+P	Data Set Test
−P	Data Set Test
CD4	Data Terminal Ready

Options: (1) AB may optionally be connected to AA.

(2) CA may optionally be connected to CB.

(3) CA may optionally be connected to CC.

(4) Provision of CD is optional.

5.12 Additional information may be found in the following Technical References and Bell System Practices:

Bell System Data Communications Technical References:

Data Set Interface Connectors, July 1963

150 Baud Private Line Channels—Interface Specifications, February 1968

1A Data Stations—(to be issued)

BSP 591-037-100, -101—Data Set Type 109H

BSP 591-029-100—Data Set Type 109D-Type

BSP 591-025-100—Data Set Type 109E-Type

BSP 591-023-111—108A, C-Type Single Private Line Station using DAS 820D L1 for CPTs in 10-Type Data Line Concentrator System (DLCS)

BSP 591-813-100—1A Data Station

BSP 591-029-101 Series—Data Set 109D-Type Multiple Data Set Arrangement Using 28A Data Mounting and 27A Data Unit.

BSP 591-036-101 Series—Data Set 109E-Type used in DLCS Service

6. IMPLEMENTING THE SYSTEM

6.01 This section covers a suggested installation and test procedure and a description of the preservice system tests.

A. Installation and Test Sequence

6.02 This section is a suggested general procedure for installing and testing the major equipment items in a DLCS system. It assumes that the procedures in Part 4C are used to install the individual hardware items in the order described by this procedure.

6.03 The general procedure is (a) install and test all equipment at the concentrators locations, (b) install and test facilities, (c) install and test 1A Data Station Systems, and (d) install and test TTY stations starting with those nearest the terminating equipment at the computer site. The stations that make up part of the 1A Data Station Single Channel Arrangement are installed and tested as a system in (d).

6.04 The advantage of this procedure is that by installing the stations last, the TTY stations can be tested and a system test can be performed during one visit by the TTY installer.

6.05 This procedure is indicated on Fig. 13. The circled numbers indicate the sequence of installation and test. The facilities, such as metallic pairs, Private Line channels, 3002-type channels, can be installed and tested at the same time as the concentrator located equipment. These are marked 1 and 2. Then, the 1A Data Station Systems marked 3 can be aligned and tested. Now the various stations can be installed and tested with access to the computer site. This should start with the stations closest to the computer marked 4, and progress to those farther away marked 5 and 6.

B. Preservice Tests

6.06 Each of the components of the DLCS system (ie, lines, trunks, concentrators, and stations) is to be given the normal preservice installation tests specified in their respective BSP sections.

6.07 Overall end-to-end preservice tests are not required between the teletypewriter stations and the computer interfaces for the arrangements described in AB 27.426. However, it is recommended that the stations be installed last so that overall operation can be verified with a connection test made at that time.

6.08 If further tests are considered necessary, the list in Part 7 will provide tests for proper equipment operation and the ability to transmit and receive data.

7. MAINTENANCE PLAN

7.01 This section references the maintenance method for testing and trouble locating in a Data Line Concentrator system.

Maintenance With the ISC Plan

7.02 It is assumed here that the system is large enough so that the ISC Plan has been used to implement the system and will be used to resolve system problems. However, smaller Data Line Concentrator installations may use local procedures for both implementation and maintenance.

In the ISC Plan the responsibility for satisfactory operation of the service after it is established belongs to ISC Plant Control with assistance from all Plant noncontrol members. The Plan provides for Plant Control to collect service analysis reports from noncontrol members when a customer's service is under complaint. Therefore, a circuit layout record and the network trouble reports should be available to assist in trouble analyzing.

System Structure

7.03 As indicated in Par. 2.02, Data Line Concentrator configurations are composed of 10-type Data Line Concentrators together with a variety of line, trunk, and station arrangements.

The lines and trunk are composed of transmission facilities which are similar to those used in other services. Facilities frequently will be assigned from available private line or exchange plant installed to handle other services such as private line telegraph services.

Data Line Concentrator stations may include Bell System teletypewriters or CPT interfaces. These stations are similar to those used in other private line services.

Maintenance Strategy

7.04 Because of the structure and operation of the Data Line Concentrator arrangements, most troubles are expected to have identifiable symptoms. The initial trouble reports should contain all the symptons that a customer is experiencing. As an aid to gathering trouble reports, the customer should be provided with information as to what symptoms to look for, and any tests that he can perform.

Once a trouble report is received, the information is compared with other reports to see if any similarity exists. A check is made against the circuit layout record to determine if similar reports indicate trouble in a common piece of apparatus or common facility.

By having a Central Control collect all trouble reports and compare them against the circuit record it should be possible to classify the trouble into four categories with their associated trouble possibilities.

(1) A single station reporting trouble (station or line problem)

(2) Multiple stations reporting troubles

(a) Stations on a concentrator with trunks direct to computer (concentrator, trunks, common line arrangement, or alternate-access-to-DDD problem)

(b) Stations on more remote concentrator of tandem pair (common line arrangement, remote concentrator, interconcentrator trunks, or alternate-access-to-DDD problem)

(c) Some stations on each concentrator of tandem pair (concentrator nearest computer or trunks to computer ports problem)

(3) Computer Center detected troubles (concentrator or trunk problems)

(4) DDD-In arrangement troubles.

The strategy for isolating a trouble to a section of the system is described in the System Maintenance Practice, BSP 591-810-300. It provides a method for estimating the most likely section in trouble and describes a logical testing procedure. The System Maintenance Practice specifies tests which make optimum use of dispatched craftsmen and also of any customer assistance which might hasten repair. Where the problems have been isolated to a section with specific equipment or facilities, reference is made to the proper BSP.

Maintenance BSPs

7.05 The BSP sections that provide maintenance and test information for the system and its various parts are listed below.

SYSTEM AND SECTIONALIZATIONS	BSP REFERENCE
(A) System	591-810-300, -500
(B) Single Remote Station, Line Section, and Interconnection Arrangement.	591-023-510, 591-028-511, and 591-811-102 Series
(C) Multiple Remote Stations Via 1A SCA	591-813-301, -501
(D) Link Including 1A Data Station and VF Facility	591-813-300, -500
(E) Concentrator with Local Terminals	591-811-301, -501 591-811-301, -501
(F) Individual Trunk and Terminal	591-029-501, 591-036-501
(G) Metallic Pair Line Tests, Loop Around at FDX Station, and Data Set Tests.	591-035-301, -501

The BSP reference for (A) describes the maintenance strategy for the system and describes methods for checking various links in the system using standard test equipment (911DTS) in conjunction with other available apparatus (109H D/S).

Methods are also described which allow Data Test Centers like the 904-type to perform some tests on systems which have DDD access.

7.06 The BSP references for (B) describe a test method for verifying operation of a single remote station, its facility, and its associated Private Line interconnection arrangements using standard test equipment (902 and 903 DTS or 911 DTS). Those for (C) and (D) describe the test methods for 1A links using standard test equipment and built-in test features. BSP references for (E) describe test methods for the concentrators which verify their ability to interconnect lines with trunks. The BSP reference for (F) covers test methods for multiple data set 109-type arrangement at the computer site. It also describes an end-to-end test between originating and terminating stations in a local system.

7.07 The BSP references in (G) cover maintenance and tests of data sets used in local stations which use metallic pairs between the station and the concentrator. It also describes a loop around transmission test for the FDX sets.

7.08 The BSP references given in (H) cover testing of the DDD access package. It also describes a loop around transmission test. The BSP references in (I) cover testing and maintenance of the DDD-IN package.

7.09 The above BSP references are adequate to test for the proper equipment operation and for the ability to transmit and receive data. Methods are also described to measure distortion on different links of the system using standard test equipment with the concentrator as the focal point for testing. (See 591-810-300.)

7.10 Maintenance of a system where all equipment is furnished by the Bell System will differ from maintenance of an assembly with some customer owned and maintained (COAM) equipment. Telephone Company responsibility is to maintain only the services purchased by the customer. Wherever possible loop back tests are provided in maintenance testing to isolate a customer's equipment from that of the telephone company's. Information on maintenance of systems and assemblies is contained in a joint Engineering, Marketing, Plant and Traffic letter entitled "Data Operation on Private Line and Foreign Exchange Service," dated February 20, 1969.

8. INFORMATION INDEX—REFERENCES ON DLCS EQUIPMENT, SYSTEMS, AND OTHER INFORMATION SOURCES

SUBJECT	REFERENCES	TITLES
Assembly vs Service Definition	AT&T Letter to Marketing Heads, Chief Engineers, General Plant Managers, General Traffic Managers, all Data Specialists from Marketing Director — Data Communications, Engineering Director — Data Communications, Plant Toll and Switching Administrator, Traffic Results Administrator, February 20, 1969.	
Bell System Data Communications Technical References	DLCS	(PRELIMINARY) Initial DLCS Service Arrangements with Bell System Teletypewriters-Computer Port Interface DATE (TO BE ISSUED). ***Note:*** Final Reference to follow.
	1A Data Stations	1A Data Station, Multichannel and Single Channel Arrangements used in the provision of two point Channelizing Service, September 1971.
	Interface Connectors	Data Set Interface Connectors, July 1963. 150 Baud Private Line Channels — Interface Specifications, February 1968.
	Voice Grade Channels	Transmission Specifications for Voice Grade Private Line Data Channels, March 1969.
	DDD Network	Data Communications using the Switched Telecommunications Network, August 1970.
Cabinets and Accessories	BSP 590-010-201 E.L. 53	Data Sets Multiple Installation Information Data Services — Cabinets and Accessories for Multiple Data Set Installations.
Computer Programs	NONE AVAILABLE YET	
Data Aux. Sets (820D)	BSP 598-058-100 E.L. 334	Data Auxiliary Set 820D Type Telegraph Systems
(811G)	BSP 598-073-100 E.L. 310	108- and 109-Type Data Sets Data Auxiliary Set 811G 1A Data Station (MCA)

SUBJECT	REFERENCES	TITLES
(811H)	BSP 598-074-100 E.L. 310	Data Auxiliary Set 811H 1A Data Station (MCA)
(811J)	BSP 598-078-100 E.L. (to be issued)	Data Auxiliary Set 811J
(803E1)	BSP 598-075-100 E.L. 308	Data Auxiliary Set 803E1 10A Data Line Concentrator- DLCS Service
(804T-Type)	BSP 598-076-100 E.L. 590	804T-type Data Auxiliary Set Data Set 113B and 113-type Data Station
Data Line Concentrators (10A)	BSP 591-811-100, -200,-300,-500	10A Data Line Concentrator
	BSP 591-811-180	10A Data Line Concentrator Summarizing Specification
	E.L. 308	10A Data Line Concentrator DLCS Service
	CD- & SD-73055-01	10A Data Line Concentrator
(10B)	BSP 591-811-101, -201,-301,-501	10B Data Line Concentrator
	BSP 591-811-181	10B Data Line Concentrator- Summarizing Specification
	E.L. 634	10B Data Line Concentrator- DLCS Service
	CD- & SD-1D212-01	10B Data Line Concentrator
Data Mountings and Data Units	BSP 590-102-110	18A1 Data Mounting
	590-102-111	19A1 Data Mounting
	590-102-112 SD- & CD-73055-01	20A1 Data Mounting Data Concentrator (20A1 Data Mounting)
	590-102-113,-113-1	21A1 and 21B1 Data Mounting
	590-102-114,-114-1	22A1 and 22B1 Data Mounting
	590-102-119,-119-1	23A1 and 23B1 Data Mounting
	590-102-124 SD- & CD-1D176-01	28A1 Data Mounting Data Systems Station — 28 Type Data Mounting
	590-100-114 CD- SD-1D183-01	27A1 Data Unit 27A1 Data Unit
	590-102-125 CD- & SD-1D148-01	29-type Data Mounting 29A1 and 29B1 Data Mounting

SUBJECT	REFERENCES	TITLES
	590-102-127	31A Data Mounting
	591-102-113	21B Data Mounting
	591-102-114	22B Data Mounting
	591-102-119	23B Data Mounting
Data Sets and Applications	BSP 591-031-101, -201,-301,-501	Data Set 109C-Type used in 10-Type Data Line Concentrator System (DLCS)
	E.L. 334	Telegraph Systems-108 and 109 Type Data Sets
	BSP 591-031-180	Data Set 109C-Type-Summarizing Specifications
(109C)	BSP 591-031-100	Data Set 109C-Type Description
	SD- & CD-1D164-01	Data Set 109C-Type Data Set 109D-Type Multiple
	BSP 591-029-101 -201,-301,-501	Data Set Arrangement using 28A Data Mounting and 27A Data Unit.
	BSP-591-029-100	Data Set 109D-Type Description
(109D)	BSP 591-029-180	Data Set 109D-Summarizing Specification
	CD- & SD-1D172-01	Data Set 109D-Type
	E.L. 334	Telegraph Systems-108 and 109 Type Data Sets
	BSP 591-036-101, -201,-301,-501	Data Set 109E-Type used in DLCS Service
	BSP 591-036-100	Data Set 109E-Type Description
(109E)	BSP 591-036-180	Data Set 109E-Type Summarizing Specification
	CD- & SD-1D198-01	Data Set 109E
	E.L. 635	10 Type Data Line Concentrator System
	E.L. 636	Full Duplex 109-Type Data Sets
	BSP 591-035-101,-201 -301,-501	Data Set 109F-Type used in DLCS Service
(109F)	BSP 591-035-100	Data Set 109F-Type Identification
	BSP 591-035-180	Data Set 109F-Type Summarizing Specification
	CD- & SD-1D199-01	Data Set 109F
	E.L. 635	10-Type Data Line Concentrator System
	E.L. 636	Telegraph Systems- New Codes of 109-Type Data Sets

SUBJECT	REFERENCES	TITLES
(109H)	BSP 591-037-101, -201,-301,-501,-180	Data Set 109H-Type used in the Data Line Concentrator System (DLCS)
	BSP 591-037-100	Data Set 109H-Type Identification
	BSP 591-037-180	Data Set 109H-Type Summarizing Specification
	CD- & SD-1D220-01	Data Set 109H-Type
	E.L. 635	10-Type Data Line Concentrator System
	E.L. 935	Telegraph Systems-Data Set 109H-Type
(108A or C)	BSP 591-023-110 -210,-310,-510 (Bell System Stations)	Data Set 108A or C-Type Single Private Line Station using Data Auxiliary Set
	BSP 591-023-111, -211,-311,-511,-191 (Customer Provided Terminals)	820D-LIA in the 10-Type Data Line Concentrator (DLCS) System
	BSP 591-023-100 -200,-300,-500	Data Set 108-Type Private Line System Station Application
	CD- & SD-3D032-01	Data Set 108C
	CD- & SD-3D024-01	Data Set 108A
	E.L. 334	Telegraph Systems, 108- and 109-Type Data Sets.
(113B)	BSP 591-034-100	113B Data Set Description
	CD- & SD-1D208-01	Data Set 113B-L1 and 32A1 Data Mounting
	E.L. 590	Data Set 113B and Data Station 11A.
Facilities	BSP 314-410-500	Private Line Data Circuits, Voice Bandwidth Circuits for Miscellaneous Data, Overall Tests and Requirements
	AB27.350 and Point Sections	Voice Bandwidth Circuits for Private Line Data use, 2000 Series and 3002 Channels.
Interconnecting Arrangements (DLCS/Private-Line)	BSP 591-811-102, -202,-302,-502,-182	Private Line Interconnection Arrangements for Line Side of 10-Type Data Line Concentrator Systems (DLCS)
	CD- & SD-1D200-01	Same as above
	E.L. 311	10A Data Line Concentrator System-DLCS Service

SUBJECT	REFERENCES	TITLES
(DLCS/DATA-PHONE Line Side)	BSP 591-811-103, -203,-303,-503,-183	(DLCS/DATA-PHONE Interconnection Arrangement for 10-Type Concentrator-Line Side.
	CD- & SD-1D197-01	DDD Incoming Circuit for the DLCS Concentrator
	E.L. 635	10-Type Data Line Concentrator System
(DLCS/DATA-PHONE Trunk Side)	BSP 591-811-104, -204,-304,-504,-184	(DLCS/DATA-PHONE Interconnection Arrangement for 10-Type Concentrator-Trunk Side
	CD- & SD-1D201-01	(DLCS/DATA-PHONE Interconnection Circuit
	E.L. 635	10-Type Data Line Concentrator System
ISC Plan	BSP 010-520-100	ISC Plan, Description
	BSP 010-520-101	ISC Plan, Coordination of Private Line Services
	BSP 010-520-102	ISC Plan, Coordination of Special Exchange Services
	BSP 010-520-103	ISC Plan, Control Team Assignment
	BSP 010-520-104	ISC Plan, Interval Guides
	BSP 010-520-105	ISC Plan, Measurement Plan
	BSP 010-520-110	ISC Plan, Planning Services and Preparing Project Schedule
	BSP 010-520-111	ISC Plan, Service Inquiries and SSOs with About Dates
	BSP 010-520-112	ISC Plan, System Service Order Worksheet
	BSP 010-520-113	ISC Plan, System Service Order
	BSP 010-520-114	ISC Plan, Engineering Reports
	BSP 010-520-115	ISC Plan, System Status Reports
	BSP 010-520-116	ISC Plan, Service Analysis Reports
	BSP 010-520-135	ISC Plan, Marketing (Sales) Responsibilities
	BSP 010-520-136	ISC Plan, Engineering Responsibilities
	BSP 010-520-137	ISC Plan, Plant Responsibilities

SUBJECT	REFERENCES	TITLES
ISC Plan	BSP 010-520-138	ISC Plan, Traffic Resopnsibilities
	BSP 010-520-139	ISC Plan, Western Electric Company, Inc Member Responsibilities
	BSP 010-520-149	ISC Plan, Codes, and Abbreviations
Power Systems (AC)	KS-20575 and Mounting	AC Power System 71A1 Apparatus Mounting
	KS-201129	AC Power Strip
(DC)	BSP 802-218-154	J87308 Converter DC to DC Regulated ±24 volt, 3 Ampere, DC output, —48 or —24 Volt DC input Equipment Design Requirements
	Mounting	71B Apparatus Mounting
System	BSP 591-810-100	10-Type Data Line Concentrator System (DLCS) Description
	BSP 591-810-300,-500	10-Type Data Line Concentrator System (DLCS) Maintenance and Testing
	E.L. 311	10A Data Line Concentrator System-DLSC Service
	E.L. 635	10-Type Data Line Concentrator System
(Engineering BSPs)	AB27.426	10-Type Data Line Concentrator System (DLCS) Transmission Engineering Considerations
	BSP 591-010-100	Model 33 and 35 Teletypewriter Set for DLCS — Description
	BSP 591-810-110,210	Model 33 and 35 Teletypewriter Stations for DLCS
	BSP 574-123-100	Model 33 Call Control Unit Description
	BSP 574-100-401	33 Actual and Schematic WDs
	BSP 574-202-400	35 ASR Actual and Schematic WDs
	BSP 574-201-400	35 KSR Actual and Schematic WDs

SUBJECT	REFERENCES	TITLES
Teletypewriters and Stations (New and Revised)	***5000-Specifications***	
	50693S	UCC-29 and 186630 Modification Kit to provide Break Detector and Indicator on 33 and 35 Sets
	50694S	186627 Set Logic Assembly to connect TTY to Data Set on 33 and 35 Sets
	50696S	Answer-Back Modification Kit on 33 and 35 Sets equipped with 186627 Logic Assembly
	50695S	336474 Modification Kit to adapt M35 Set for UCC29
	E.L. 332, E.L. 637	Teletypewriter Station Arrangements for DLCS Service
Traffic Recording Systems	BSP 984-500-100	Traffic Data Recording System No. 1A-General Description
1A Data Station	BSP 591-813-100, -200,-300,-500	1A Data Station, Multi-Channel Arrangement (MCA)
	CD- & SD-10148-01	1A Data Station MCA
(Multichannel)	E.L. 310	1A Data Station MCA
	BSP 591-813-180	1A Data Station MCA, Summarizing Specification
	BSP 312-711-100	Description of 1A Data Station ((MCA)
	BSP 312-711-201	Connections of 1A Data Station (MCA)
	BSP 312-711-500	Testing of 1A Data Station (MCA)
(Single Channel)	BSP 591-813-101, -201,-301,-501	1A Data Station, Single-Channel Arrangement (SCA)
	CD- & SD-1D184-01	1A Data Station SCA
	SD-70958-01	43B1 Voice Frequency Carrier Data System
	BSP 591-813-181	1A Data Station SCA, Summarizing Specification
	E.L. 507	1A Data Station SCA for Bell System Teletypewriters
	AB82.026	Telegraph Transmission Coefficients
	AB83.048.01	Transmission Engineering Considerations

SUBJECT	REFERENCES	TITLES
(Engineering BSPs)	AB83.048.02	Line Connections Circuits
	AB83.048.04	Line Facilities Engineering Considerations
	AB83.048.1	Transmission Losses
	AB23.050	44 Type Bridge
	AB23.050	C-2 Bridges
	AB83.040.02	Filter Bridges
113-Type Data Station	BSP 591-814-100, -200,-300,-500	113-Type Data Station
	BSP 598-076-100	804T-Type Data Auxiliary Set
	E.L. 590	Data Set 113B and 113-Type Data Station

9. COMPUTER PROGRAMS FOR OPERATING COMPANY USE

9.01 This section references the computer programs that are provided to assure the optimum application of Bell System service offerings to meet a customer's service requirements. They are interactive programs designed for use on time-shared systems. DLCS, DATA-PHONE, and PBX services are compared to determine the lowest cost service offering that meets the service requirements. If DLCS is selected, then the program provides a system layout.

9.02 Bell Telephone Laboratories is expected to begin development of these programs in the first quarter of 1971. They will not be available for operating company use before the fourth quarter in 1971.

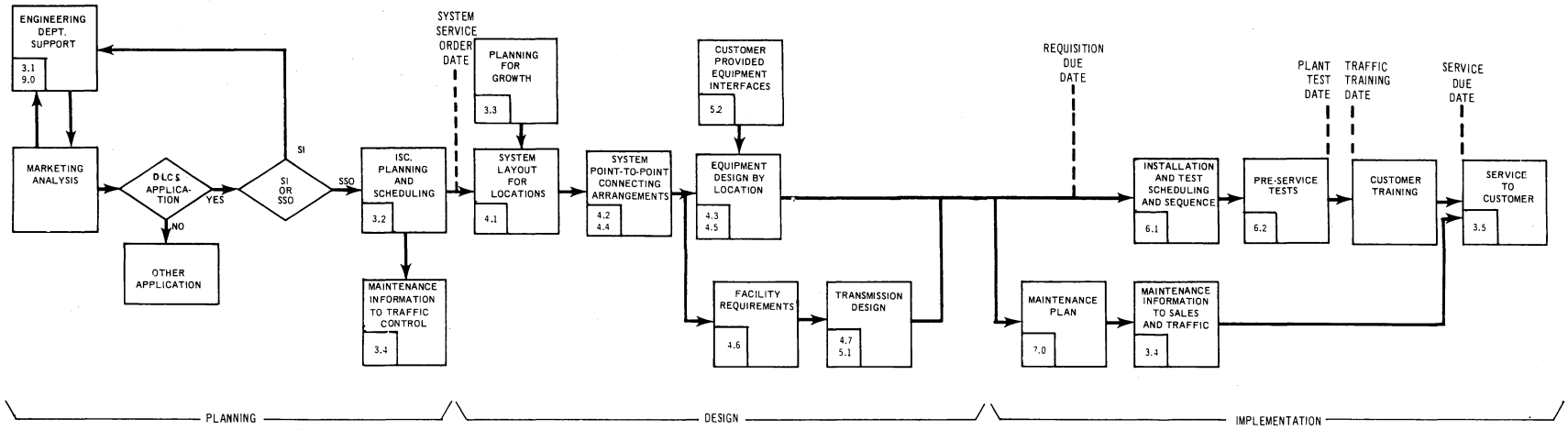


Fig. 1—Engineering Methods System

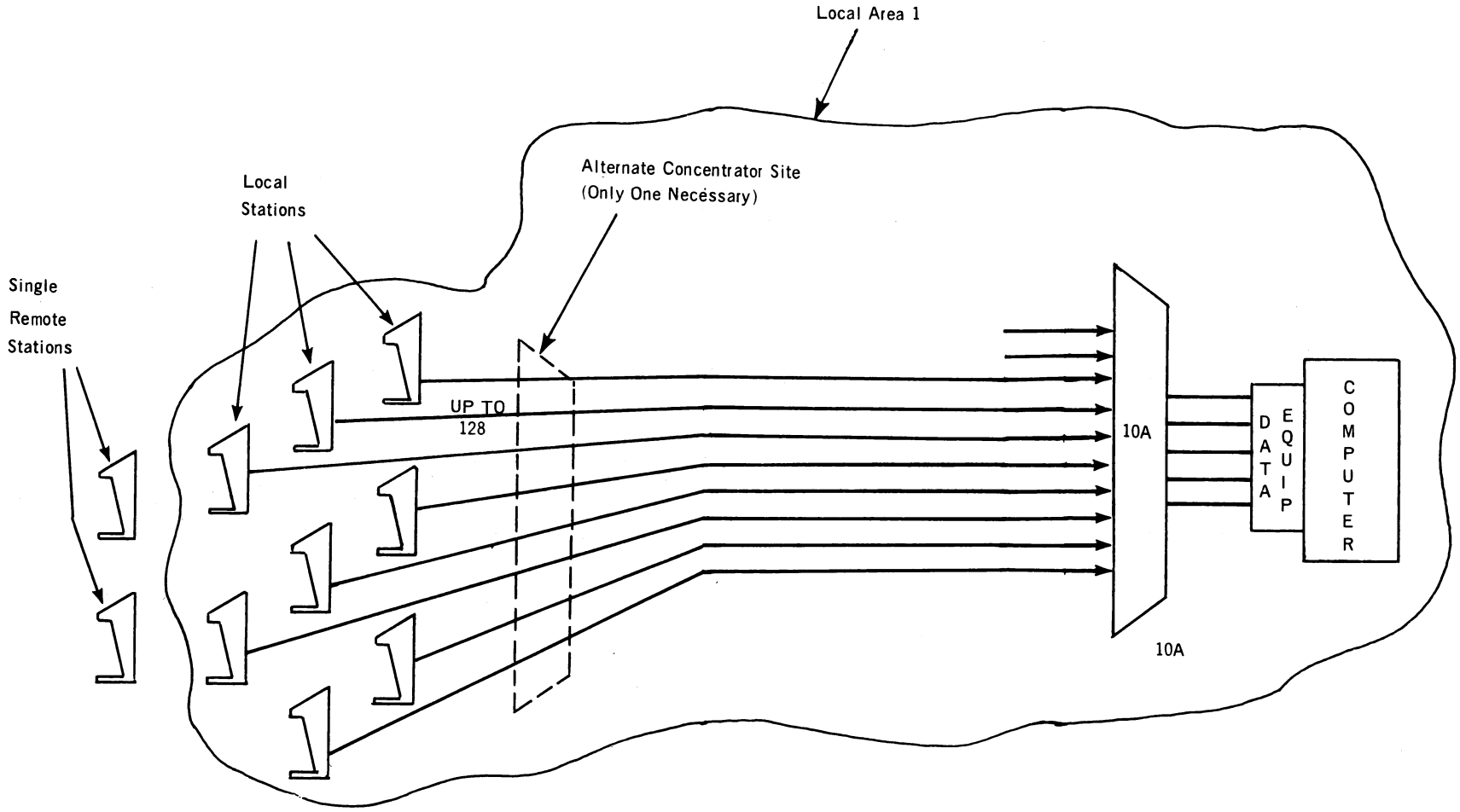


Fig. 2—One Cluster, One Local Computer

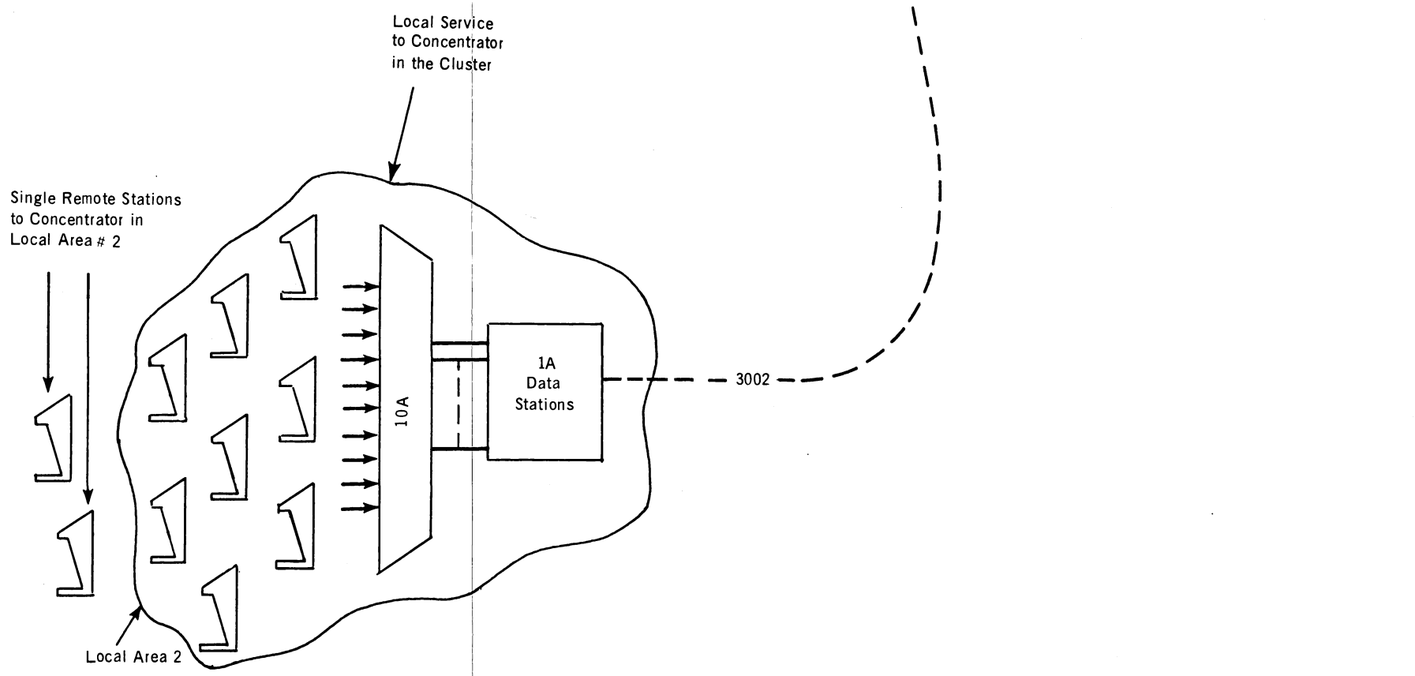


Fig. 3—One Cluster, One Remote Computer

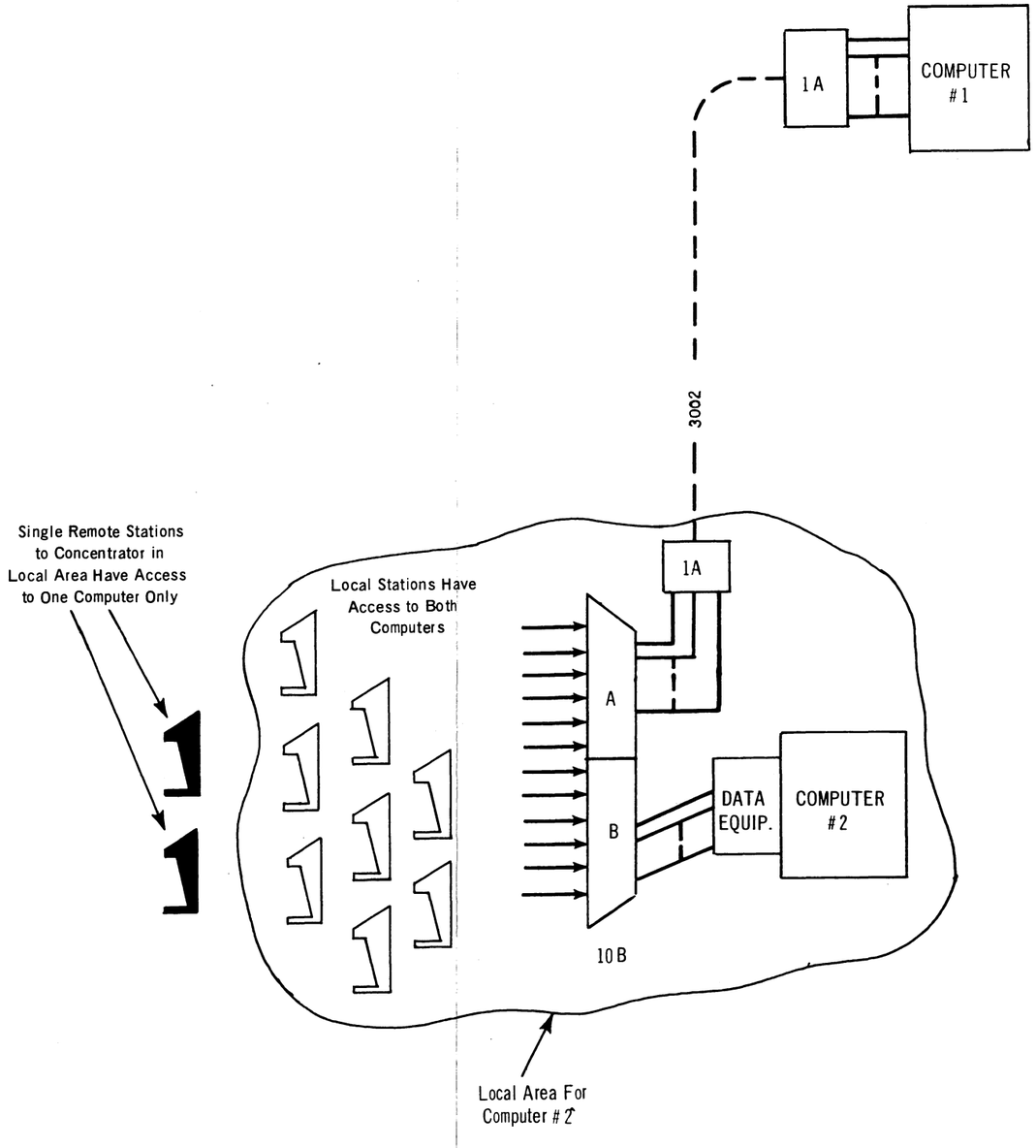


Fig. 4—One Cluster, More Than One Computer

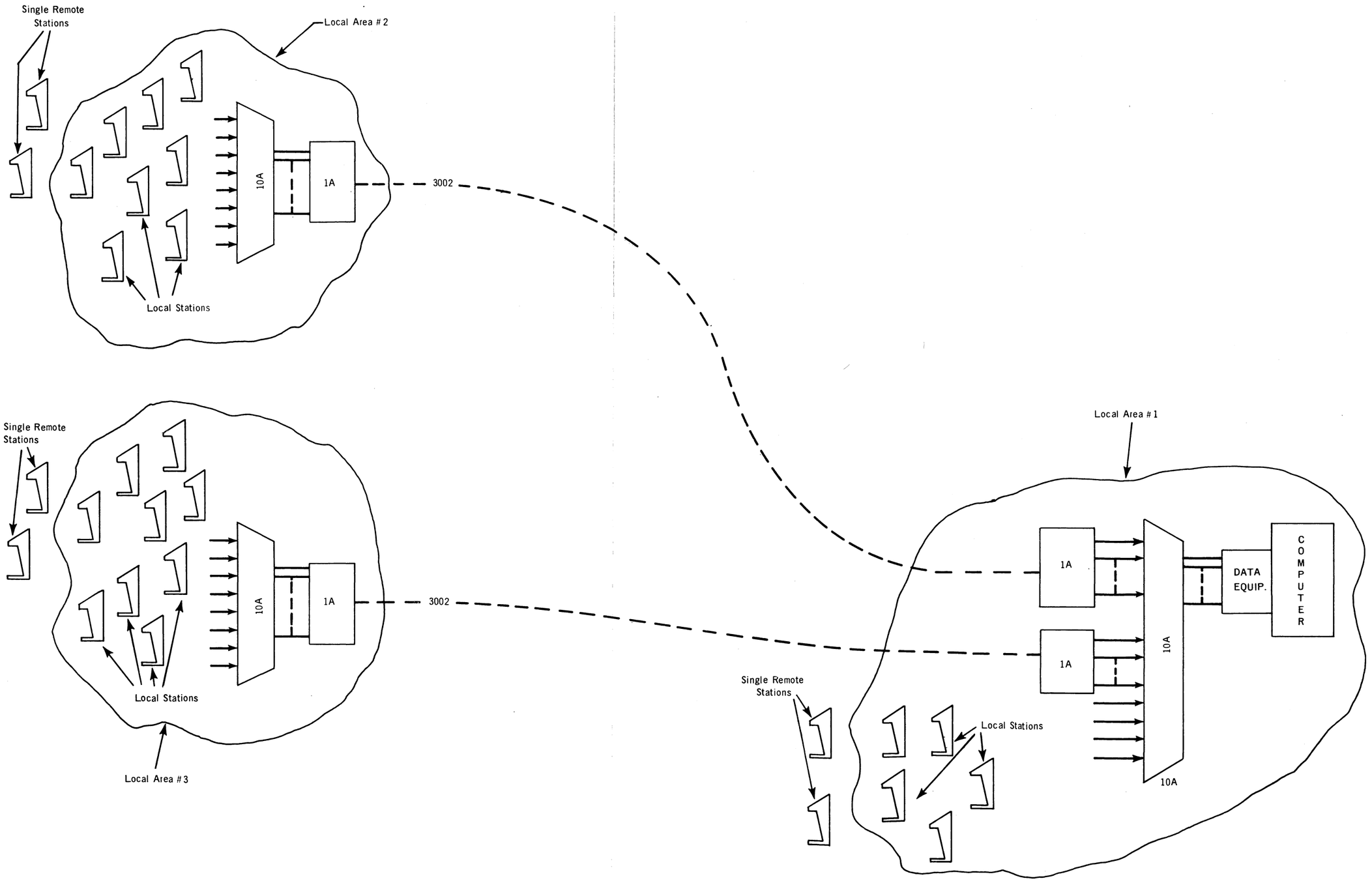


Fig. 5—Multiple Clusters, One Computer

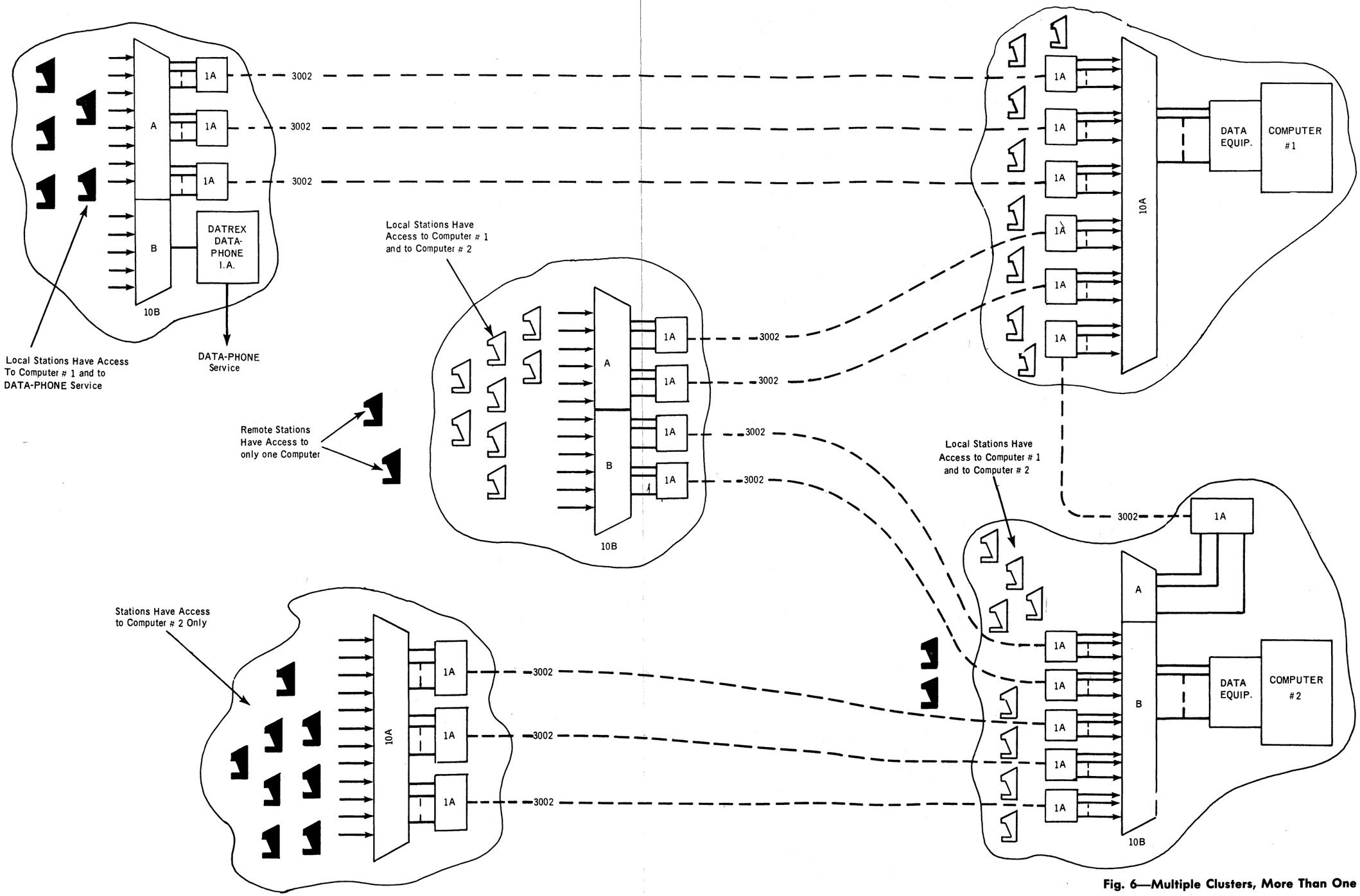


Fig. 6—Multiple Clusters, More Than One Computer

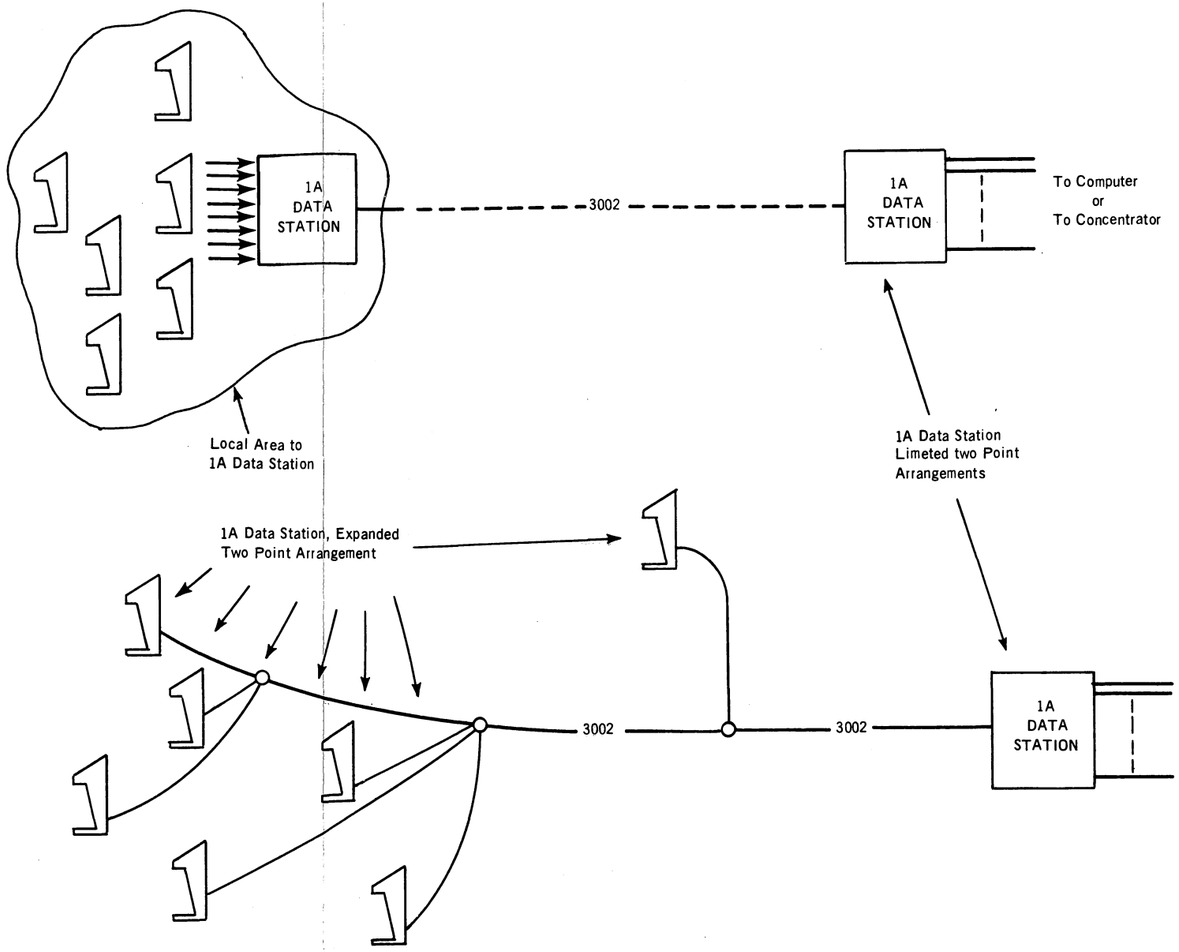
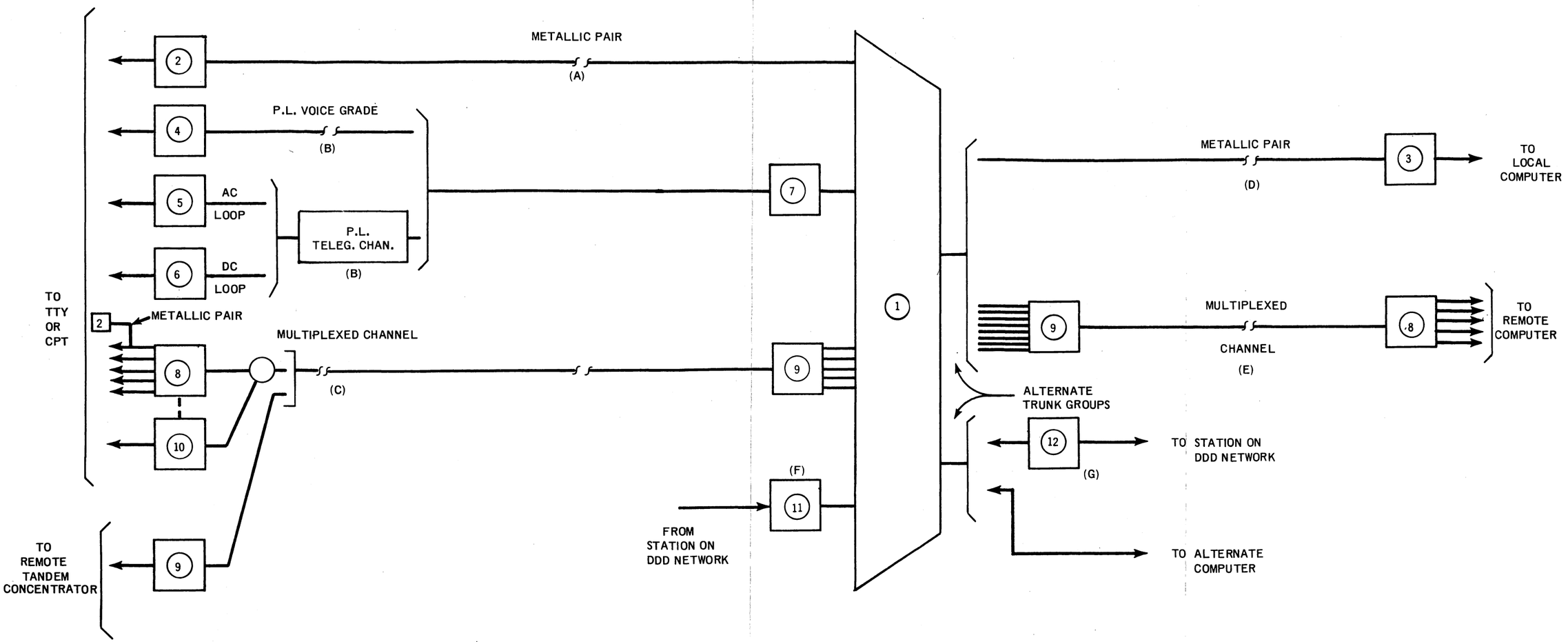


Fig. 7—Eight or Fewer Stations Remote From One Destination

DLCS SYSTEM



NOTE: This symbol covers optional types of possible connections to a single line or trunk.

Fig. 8—Arrangements for Interconnecting the Locations of Equipment

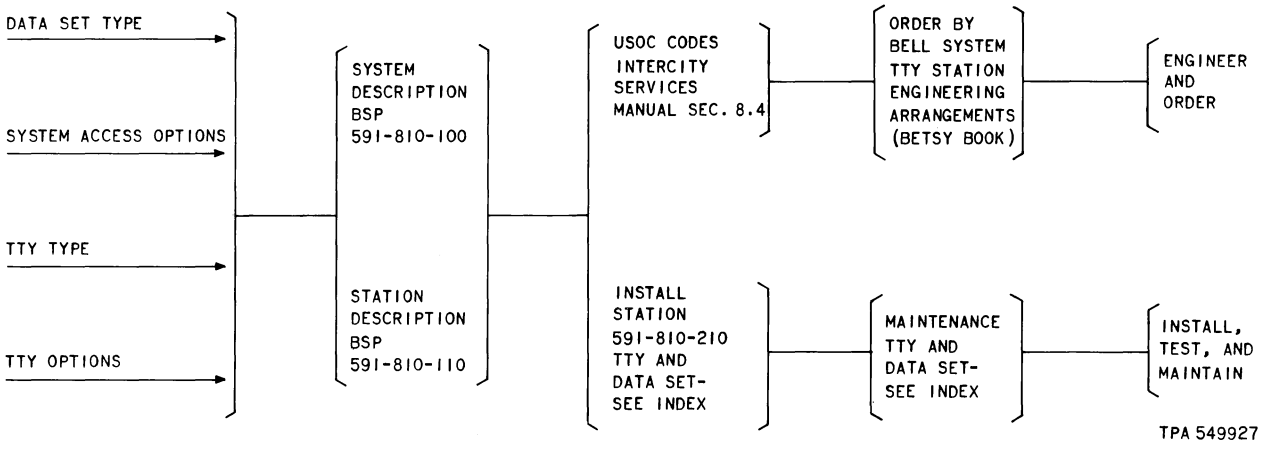


Fig. 9—Information to Engineer, Order, Test, and Maintain Stations

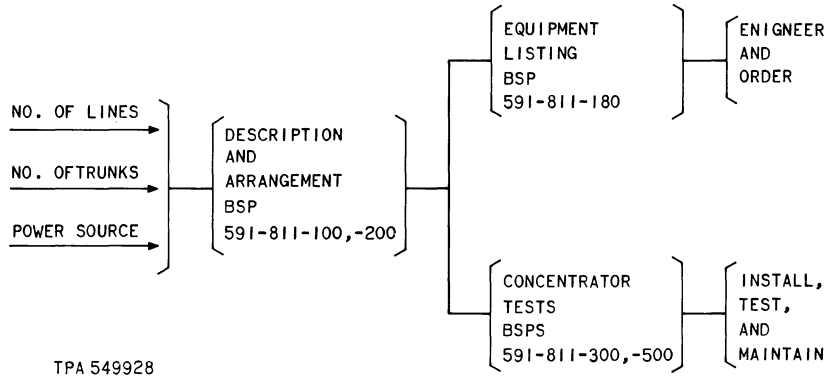


Fig. 10—10A Data Line Concentrator

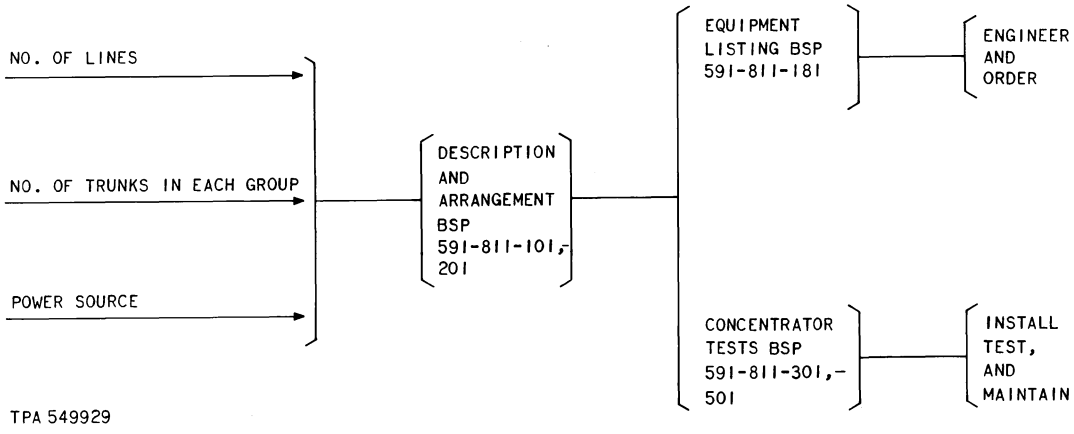


Fig. 11—10B Data Line Concentrator

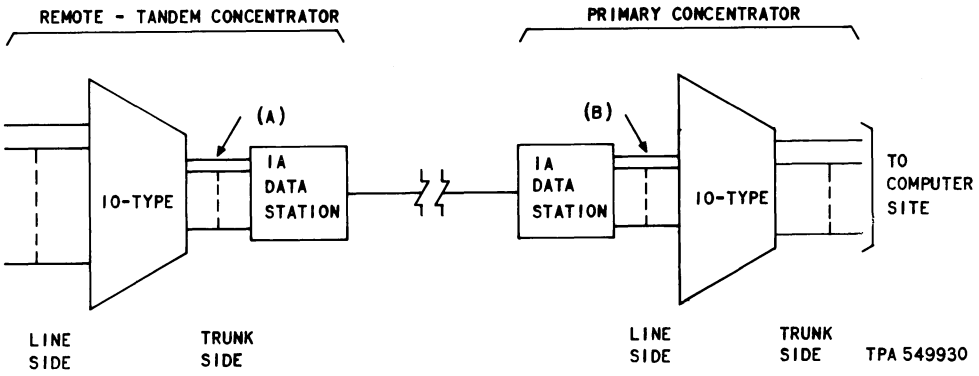


Fig. 12—Tandem Concentration with the 1A Data Station, MCA

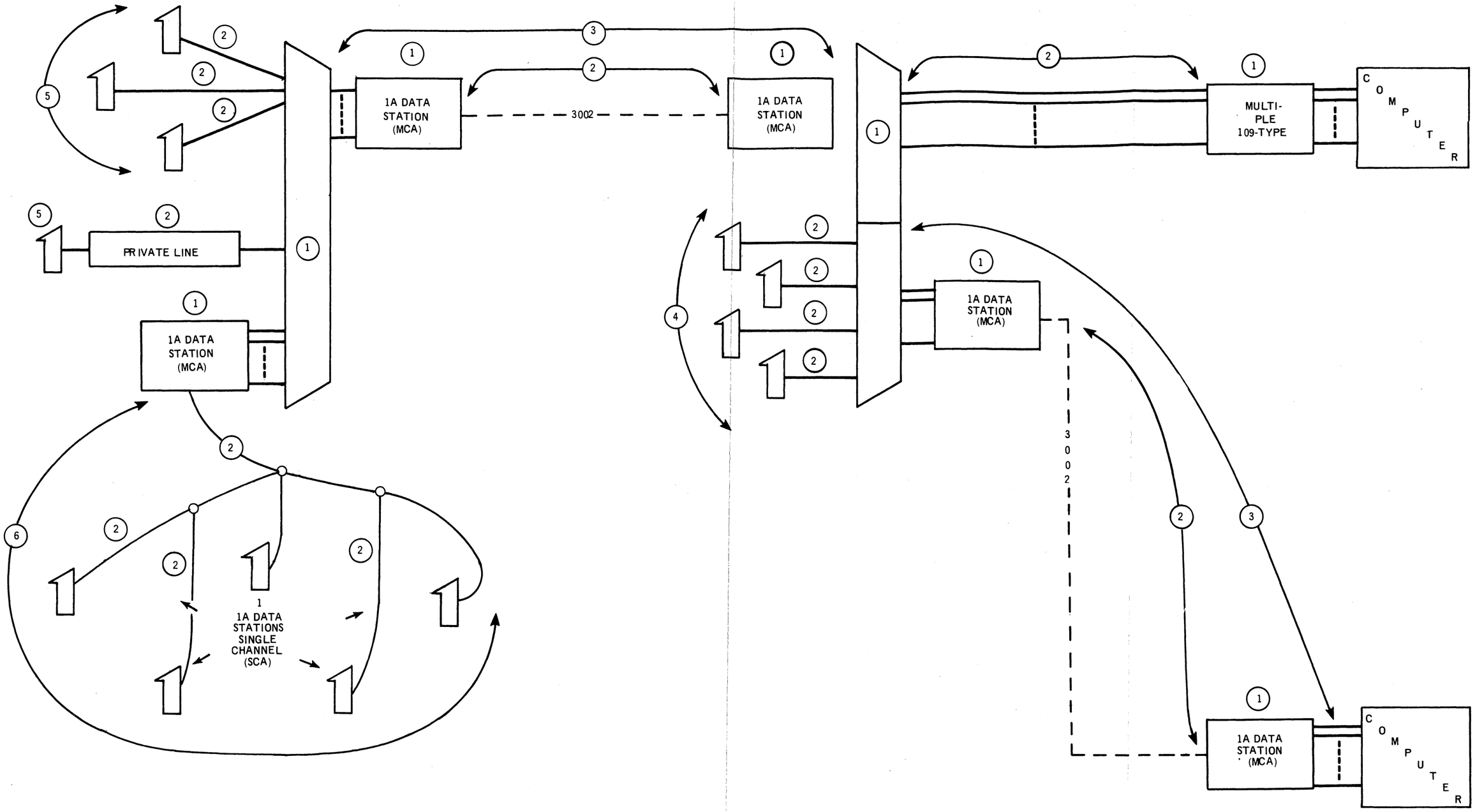


Fig. 13—Installation and Test Sequence