AUTOMATIC NUMBER IDENTIFICATION SYSTEM—TYPE C FOR USE IN SMALL STEP-BY-STEP OFFICES OF LESS THAN 10,000 MAIN STATIONS GENERAL DESCRIPTIVE INFORMATION

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1. INTRODUCTION

1.01 This section describes the Automatic Number Identification (ANI) System Type C for use in local step-by-step offices of less than 10,000 main stations.

1.02 This section is reissued to add descriptive information on the call data accumulator (CDA). Paragraphs 1.04, 1.06 through 1.08, 2.09 through 2.20, 3.36 through 3.42, and 6.08 are added. Paragraphs 1.01, 1.10, 1.11, 2.01, 3.01, 3.03, and 4.08 are changed to add additional information. Figure 2 and Table A are added.

1.03 On calls, ▶other than local calls,◀ requiring automatic number identification, the system is designed to determine and outpulse automatically to a CAMA office the calling directory number for calls on PBX, individual, and 2-party lines for both coin and noncoin calls.

1.04 ▶The CDA provides a means for gathering billing data on local calls in step-by-step central offices. It provides flexible usage sensitive pricing features which are otherwise unavailable in step-by-step offices.◀

1.05 The types of calls that can be served by the ANI-C System are station, person, special toll, and dial assistance. In addition to obtaining and outpulsing the calling customer's directory number on the above calls, the ANI-C System has the following features:

(a) Indicates when a call originates on a 4-party, multiparty, or any line requiring operator identification

(b) Indicates when service observing is employed

(c) Provides "theoretical" 3-digit office codes

(d) Provides listed number billing for PBX trunks when required

(e) Provides ANI service marks

(f) Indicates an automatic number identification failure so that operator identification may be made.

1.06 ▶The CDA, in conjunction with the No. 1 AMA Recording Center (No. 1 AMARC), provides the following information on each answered local call placed by individual party, measured rate customers:

(a) Calling number

(b) Time of day of answer

(c) Time of day of disconnect

(d) Message billing index (optional)

(e) Called number (optional).

1.07 Records on answered local calls are forwarded by data link to the No. 1 AMARC. This information is recorded at the No. 1 AMARC on magnetic tape, which is sent to an accounting center for billing processing. Based on these call records, customers can be billed according to number of calls, duration of calls, distances of calls, and use during peak hours. Detailed billing (where the customer is given a listing of calls, including the called number) can be provided.

1.08 No routine maintenance at local offices or visits to local offices for data collection are required. Manual billing operations such as those associated with the use of message register photographs are eliminated. There is no time-of-day clock at the CDA. Answer and disconnect times are assigned at the No. 1 AMARC.◀

1.09 The ANI-C equipment mounts on standard 23-inch frames and arrangements are available for both 11-foot 6-inch and 9-foot heights. The only battery source required is 48 volts.

1.10 There are three basic frames of equipment: the number network and identifier frame; the outpulser, test and line verification frame; and the ANI outgoing trunk frame. There may be up to five number network frames and as many ANI outgoing trunk frames as necessary to satisfy local requirements. Only one outpulser and test frame is installed. ▶The CDA comprises several modular units which can be mounted on frames containing other equipment or on its own frame.◀

1.11 Figure 1 shows a simplified block diagram of the ANI-C System. ▶Figure 2 shows a simplified block diagram with CDA.◀

2. METHOD OF OPERATION

2.01 When a customer originates a call requiring automatic number identification, an ANI outgoing trunk is seized by the central office switching equipment and a connection is set up to the CAMA office. ▶Paragraphs 2.09 through 2.20 describe the operation using the CDA.◀

2.02 A party test is made after seizure or during dialing to determine if the customer is a tip party subscriber.

2.03 After dialing is completed and the called number digits have been received by CAMA,

the call is partially switched through the CAMA equipment, but completion of the connection is delayed until the necessary calling number information has been registered. To get this information, the ANI trunk in the local office, upon receipt of a start identification signal from the CAMA office, connects to the identifying equipment by bidding for an outpulser. The outpulser is part of the ANI system and is the unit that transmits the calling number information to the CAMA office. Connection of the outpulser to the ANI trunk is established through an outpulser. Upon seizure by the trunk, the outpulser connects to the identifier portion of a number network-identifier circuit to which it passes party test information received from the ANI trunk. The outpulser then directs the pulse generator to apply an identification pulse through the ANI trunk and switch train to the sleeve of the customer line circuit and to apply the gate pulse.

2.04 The identification pulse is applied through the sleeve to a customer number network. The output of the number network, together with a service mark pulse, is applied to detectors which in turn operate register relays in the outpulser. The service mark detector which has been operated also causes the outpulser to supply the appropriate 3-digit calling office code necessary to complete the registration of all digits required by the AMA recording equipment at the CAMA office. At this time, the identifier releases and the outpulser is now ready to transmit all seven digits of the calling number together with three additional bits of coded information. All outpulser information is transmitted on a multifrequency basis.

2.05 If the calling number has been successfully identified, a KP signal, an information digit, the seven digits of the calling number, and an ST signal are outpulsed to CAMA. The KP and ST signals indicate the beginning and end of pulsing to the CAMA MF receiver. If the calling line was recognized as a 4-party or multiparty line or if trouble was encountered during identification and the number could not be identified, then only the KP pulse and the information digit and ST signal are outpulsed. The information digit, which is outpulsed immediately after the KP signal on all calls, informs the CAMA equipment that the calling number has been automatically identified; that the calling number is to be operator identified; or that trouble has been encountered in identifying the number. It also indicates whether the calling line is connected for service observing. If the office is not arranged for TSP operation, no ST signal will be outpulsed following the information digit.

2.06 After transmitting to CAMA, the calling customer number and the appropriate information digit, operator identified digit, or failure digit, the outpulser releases and restores to normal. The CAMA equipment, simultaneously with these operations, registers the calling number information or calls in an operator to make the identification. When the AMA recording functions have been completed, the talking path through the CAMA office is set up. The supervisory and timing functions for the call are thereafter handled by the CAMA equipment.

2.07 When the conversation is completed and disconnect occurs, the originating line proceeds to restore to normal unless the call was made by a 2-party message rate line or by a tip-party or a 2-party flat-rate line. At the completion of these calls, the ANI trunk holds up the connection until it makes a ground removal test to guard against a false charge.

2.08 No ground removal test is made if the trunk circuit releases as a result of time-out in the CAMA incoming trunk when the calling party fails to disconnect. Under this condition, the guard feature is canceled and the ANI trunk winks off the originating switches, placing the calling party in a permanent signal condition.

◗*Local Call Using CDA*

2.09 The input network and multiplexer sequentially scans the tip, ring and sleeve leads of step-by-step first selector switches. Each set of three leads, called a scan port, is scanned every 5 milliseconds. The input network and multiplexer uses a voltage thresholding circuit to determine whether the loop is open or closed, whether there is normal or reverse (answer) supervision voltage on the tip and ring, and whether the sleeve is at battery or ground potential. This information is sent to the scan control.

2.10 The scan control has a shift register memory, with one word dedicated to each scan port. This word is used to store the status of the call, timing counts, dial pulse counts and dialed digits. The scan control uses the information received from the multiplexer on each scan port and the data in

the associated shift register word to perform a digital filtering operation to detect seizure of a line finder, dial pulses, dialed digits, answer supervision, and disconnect.

2.11 When a customer goes off-hook and the line finder is seized, the scan control notes the threshold change on the sleeve lead. It then will interpret appropriate sequences of threshold changes as dial pulses. The count of dial pulses is stored in memory as a 4-bit binary count. After an interdigit interval is sensed, further pulses are counted in another 4-bit field of the dedicated word.

2.12 While and after accumulating dial pulses, the scan control also detects either answer supervision or disconnect. A disconnect without answer erases all memory of the call.

2.13 If the answer condition is detected for at least 695 milliseconds (7 counts of a 100 millisecond clock after a 95 millisecond delay), the call data, including the scan port number, is placed in an ANI buffer. A request for identification is sent from the scan control, through the line identification control to the ANI equipment.

2.14 When the request is honored, the ANI equipment sends the last four digits of the calling line's directory number, and one digit representing the central office code, back to the ANI buffer in the scan control. It also sends the class of service mark (flat or measured rate).

2.15 When all pertinent data is received in the scan control, it is formatted into an answer message and loaded into a data block buffer for transmission to the No. 1 AMARC.

2.16 When a call disconnects after answer, a disconnect message (containing the scan port number) is loaded into the scan control's data block buffer.

2.17 The data block buffer, which can store 256 bits, can hold up to 4 answer messages or up to 16 disconnect messages. It holds the data until the first poll command is received from the No. 1 AMARC and then transmits it. At least 3 data blocks per second are transmitted under normal conditions.

2.18 Since each scan port has a dedicated memory word, and the scanning method is sequential, most monitoring functions take place without interference between the billing data collection of calls in progress. However, only one ANI request can be performed at one time; furthermore, it is also possible for the data block buffer to fill, thereby preventing further use of the ANI buffer, since it cannot empty. If the scan control recognizes an answer, but cannot enter the call in the ANI buffer, it will hold the call in the dedicated memory until the buffer frees. If the scan control senses a disconnect, but cannot enter the message in the data block buffer, it marks the call as a delayed disconnect in the dedicated memory word. This bit will ultimately be transmitted with the disconnect message so that the No. 1 AMARC can treat it appropriately.

2.19 The No. 1 AMARC assembles the double entry data into a single message, using the scan port number to associate the answer and disconnect messages. Normally, the No. 1 AMARC assigns the time of answer and disconnect when it receives the associated messages. If a disconnect is delayed, the No. 1 AMARC protects the customer from overcharge by setting the disconnect time to the start of the period of data link outage or overload.

2.20 The messages sent to the No. 1 AMARC contain a status code. Different values of this seven bit code are used to distinguish answer from disconnect messages, different classes of service, and convey failure indications of automatic data integrity and hardware detection tests.◀

3. EQUIPMENT ELEMENTS

3.01 This part describes the central office equipment, except for testing and maintenance facilities which are covered in Part 6, required when local step-by-step offices are arranged for ANI-C operation, ▶with and without the CDA. CDA equipment is described in paragraphs 3.36 through 3.42.◀

3.02 The ANI-C equipment mounts on standard 23-inch bulb-angle frameworks and arrangements are available for both 11-foot 6-inch and 9-foot heights. The only battery source required is -48 volts.

3.03 The ANI-C System includes up to five number-network and identifier frames; an outpulser, test and line verification frame; and ANI outgoing trunk frames. ▶The CDA comprises several modular units which can be mounted on frames containing other equipment or on its own frame.◀

A. ANI Outgoing Trunks

3.04 ANI outgoing trunks provide access to the identifying equipment and initiate the identification process after recognizing the request for calling number information from the CAMA office. The trunks provide a path for outpulsing the calling number after it has been identified. After release of the outpulsing equipment, the trunks provide a transmission path with talking battery and supervision toward the calling customer and trunk supervision toward the CAMA end. Also, they furnish means for "holding" the originating switch train for the duration of the call.

3.05 ANI trunks are of four types: (1) loop signaling noncoin, station; (2) E and M signaling noncoin, station; (3) loop or E and M signaling noncoin special toll or operator assistance; (4) loop or E and M signaling coin, station, special toll, and operator assistance. All noncoin trunks are arranged to make party tests during dialing and to forward this information to the outpulser when it is seized. Also, these trunks make a ground removal test at the end of tip-party calls or calls from 2-party message rate lines to guard against false charging in the event of a trouble ground on the line.

B. Outpulser Connector Equipment

3.06 Connection of a trunk to an outpulser is established through an outpulser connector. This connector equipment is divided into three main parts as follows:

(a) Trunk connector unit

(b) Outpulser connector unit

(c) Outpulser busy unit.

3.07 The trunk connector unit for ANI trunks is arranged to serve one trunk subgroup and is mounted on the same frame as the trunks.

3.08 The outpulser connector unit is arranged to connect any trunk of any subgroup to one of the two outpulsers. It is mounted on a miscellaneous relay rack.

3.09 The outpulser busy unit is arranged to serve both outpulsers and is also mounted on a miscellaneous relay rack.

C. Outpulser

3.10 The outpulser is the equipment unit that controls the identification process. It is designed to receive party test information from outgoing trunks. It makes a test to verify that the calling customer has not disconnected before proceeding further with the identification. When these functions have been completed, the outpulser seizes an identifier to which it passes the party test information.

3.11 When the digits of the directory number have been identified, they are passed on parallel leads and registered in the outpulser. The outpulser translates the office identity it receives from the identifier into the three digits of the calling office code. When all seven digits of the calling customer directory number have been obtained, they are outpulsed along with the appropriate information digit to the CAMA office by means of MF signaling.

3.12 Usually only one 3-digit office code is assigned to each series of 10,000 numbers, but there are cases where additional codes, known as "theoretical codes," are assigned to some numbers within the number series. In such instances, the outpulser uses the service mark to determine the 3-digit office code.

3.13 An MF signal generator is required per outpulser if an office MF current supply is not available.

D. The Number Network Frame

3.14 The number network frame can accommodate up to 2000 number networks on the 9-foot frame or 2600 number networks on the 11-foot 6-inch frame. Each frame also accommodates a resistor matrix and party discrimination unit. If more than one number network frame is used, the first frame always accommodates the identifier detectors.

3.15 For each customer number, there is a number network. This network is composed of three neon glow lamps and a resistor clustered in a sleeve. One hundred of these networks, representing one hundred consecutively numbered directory numbers with identical thousands and hundreds digits, are grouped into a 100-number network assembly.

3.16 In the physical arrangement of this circuit, each cluster is mounted on a punching which, together with three other associated punchings, are molded into a 10-number network strip. There are ten clusters per a 10-number network strip. Ten of these strips are assembled in a column to form a 100-number network assembly.

3.17 Two of these 100-number network assemblies are mounted side by side with two plug-in isolation cards and a cross-connection field physically located between. Complete isolation of a 200-number unit from the rest of the ANI-C System can be achieved only by removal of both isolation cards. It is important to note that both isolation cards are required even when only one of the 100-number network assemblies is furnished since wiring paths common to both units appear on each isolation card.

3.18 The cross-connection field provides the means of making the proper thousands and hundreds connections. No relation need exist between the thousands and hundreds digits of the left and right units. Service mark cross connections are also made in the cross-connection field.

3.19 Resistance networks for the thousands and hundreds, tens, and units digits, and the service mark are mounted near the top of each frame. These are used to convert the decimal output of the right and left 100-number network assemblies into 2-out-of-5 form for presentation to the detectors.

3.20 The number network frame can also accommodate 20 number networks in addition to, and identical to, those having assigned regular directory numbers. The purpose of these additional networks is to provide identification for lines arranged to make outgoing calls only. These networks are cross-connected to the number network assigned to a working directory number. In this manner, any call made on a one-way originating line will be billed to a working directory number. Cross connections between number networks of one-way originating lines and number networks assigned to directory number may be made only when both number networks are on the same frame. This restriction is necessary because of capacitance limitations on the cross connections.

3.21 When a start identification signal is received from the CAMA office, the outpulser causes a positive pulse to be applied to the ANI trunk sleeve. This pulse is passed via the switch train to the number network assigned to the calling customer's directory number. The three glow lamps in this network fire, causing the registration of the calling number by the identifier detectors. The 2-out-of-5 encoding is accomplished by a resistor network in the pulse path between the number network and detectors. Number treatment information is passed to the service mark detectors. This information may be tip, ring, operator identification, or special, depending on the cross-connection pattern.

3.22 The 4-digit directory number plus service mark is passed on a parallel basis to the outpulser register relays. The information is then outpulsed to the CAMA office on an MF basis.

3.23 On an observed line, the identification pulse appearing on a customer sleeve lead is also passed through the service observing shoe to the service observing network, firing one of two glow lamps, depending upon which party is making the call. When the appropriate lamp fires, the pulse is applied to the service observing detector which in turn operates the service observing relay in the outpulser.

3.24 The number network for a one-way originating line is identical to that used for a regular directory number. Appropriate cross connections must be made, however, between the one-way line number network and the desired billing number network. When a call is originated by a one-way originating line, it is the directory number to which the cross connections were made that is identified.

E. Number Network

3.25 The number network as shown in Figure 3 is made up of three neon glow lamps and a resistor clustered in a plastic sleeve and mounted on a punching. There are 100 number network clusters combined in a 100-number network assembly.

3.26 When the identification pulse is applied to the sleeve lead, the number network glow lamps fire, causing the pulse to appear on the output lead of each of the glow lamps. One of these output leads (C-) connects to the units bus, another (D-) connects to the tens bus, and the third (NT-) connects to a number treatment bus. The pulses on these buses are passed on to the isolation networks.

F. Isolation Network

3.27 There are two isolation network cards on each 100-number network assembly. These cards provide straight-through circuit paths for the pulses from the tens and units buses to the tens and units resistor networks and for the operator identification (OI) pulse. The number treatment pulse is applied through cross connections to diodes in the isolation network. The purpose of the diodes is to provide isolation between the ANI common equipment and the number network assemblies. A second cross-connection field provides a path for the pulses to the thousands, hundreds, and service mark resistance networks.

G. Resistance Network

3.28 The resistance networks associated with the four digits of the directory number convert the pulses applied to their inputs from decimal to 2-out-of-5 form. The resistance networks associated with the various service marks and OI function are straight through and perform no translation.

3.29 The resistance networks associated with the digits of the directory number each have ten inputs and five outputs. When a pulse is applied to one of the inputs, it is routed into two paths through a resistor in each path and appears on two of the five output leads of the networks.

H. Detectors

3.30 Each output lead of all the resistance networks is permanently connected to a detector. The detector is a transistorized switch. It has two inputs: one accepts the identification pulse from the resistance network; the other accepts a gating pulse from the pulse generator. When these two pulses are applied simultaneously to the detector, a low impedance path is closed causing operation of the appropriate outpulser register relay. The gating is provided to prevent false operation of the detector at any time other than when an identification pulse is present.

I. Party Discrimination

3.31 On 2-party flat rate lines, two number networks are connected to the same customer line sleeve. The party discrimination feature prevents registration of the unwanted directory number but permits registration of the calling party directory number. Since the pulse appears on the inputs of both number networks connected to the sleeve of a 2-party flat rate line, both number networks will fire unless a method is provided to inhibit the firing of the unwanted number network. The party discrimination feature provides a voltage which will prevent the firing of the UNIT and TENS lamps of the unwanted number network.

3.32 The party discrimination feature does not affect 2-party message rate lines as both parties have their number network connected as ring parties.

J. Service Mark Detector

3.33 Service mark information is provided to the outpulser in the same manner as the directory number except that there is no translation in the resistance network ahead of the detector. The operation of the service mark detector is the same as described in paragraph 3.30.

K. Pulse Generator

3.34 In the ANI-C System, a pulse generator provides the identification pulse. On request from the outpulser, 340-volt, 175-microsecond pulses are delivered on the sleeve lead through the ANI trunk and switch train to a customer connector terminal. Pulses continue to appear on the sleeve lead as long as the outpulser pulse request exists. In normal operation, two or three pulses will be sent.

3.35 The pulse supplied by the pulse generator is also used as a gating pulse. The path of this gating pulse is from the pulse generator output through the test and line verification circuit to the gating transistor of each detector circuit. The gating pulse is applied to every detector circuit each time it is produced by the pulse generator.

L. ▶Call Data Accumulator

3.36 Each multiplexer provides up to 256 scan ports (248 for service and 8 for maintenance) which are cabled to the tip, ring and sleeve leads of first selector switches. The multiplexer derives the address of the scan port to be sampled by counting advance pulses from the scan control circuit and connects each scan port in turn to thresholding circuitry where an analog to digital conversion occurs. A binary word describing the line state of the customer's call is then passed on to the scan control.

3.37 The scan control coordinates the actions of all other units, provides the clock signal to the multiplexer, requests to the ANI equipment (through the line identification control for ANI-C), and exchanges data with this unit and with the No. 1 AMARC. The scan control contains a 202T data set for a dedicated private line and a 202S data set for a receive-only dial-up line. The scan control receives poll commands from the No. 1 AMARC and decodes them.

3.38 The line identification control provides the calling number for the CDA. It is capable of serving four scan control circuits. Upon receipt of an ANI request from a scan control circuit, the line identification control coordinates the functions of the local pulse generators and the modified number network and identifier to obtain the office code, thousands, hundreds, tens and units digits, and the class of service of the calling number. The class of service is encoded as two separate bits, one for measured rate and one for flat rate. The validity of this information is then checked and if necessary, a second identification attempt is made before the calling number or a report of a failure is transmitted to the scan control circuit. Toll requests are also routed through the line identification control, to avoid interference between toll and local identifications.

3.39 A sleeve relay is mounted on the rear of each line finder. It is operated by the identification relay selector when the scan control has an ANI request on the associated scan port. When operated, the sleeve relay transfers the line finder sleeve lead from the first selector to the ANI signal distributing network (M lead) which is a tree-organized multiple connected to all sleeve relays in an entity. The M lead holds the line finder busy by keeping a ground or positive voltage on the sleeve lead at all times. The ANI local pulse generators place the ANI signal on the M lead.

3.40 The identification relay selector circuit provides a means of addressing 1 out of 512 relay drivers, each of which operates a sleeve relay.

3.41 When functioning with CDAs, two local pulse generators are added to the one for toll. The line identification control commands the two new pulse generators and the existing toll pulse generator, interleaving the pulses upon demand from CDAs and/or toll outpulsers to prevent interference.

3.42 The ANI number network frames are each equipped with a new set of detectors, wired in series with the existing toll detectors to determine the class mark, office code digit and thousands, hundreds, tens and units digits. These detectors provide their data to an interfacing circuit in the master number network frame. This interfacing circuit transmits the data to the line identification control.◀

4. OPERATING FEATURES

A. Party Test

4.01 On station and person noncoin calls a party test is made between the first and second digits dialed into the ANI trunk. This test is made by the trunk which registers the party information for later use by the identifier. On operator assistance calls, however, the party test is made upon seizure of the trunk.

4.02 The 2-party message rate lines in step-by-step offices require a 2-party message rate trunk between the line finder and first selector. On local calls, this trunk serves to identify the calling party by making a party test when seized and functions to score the proper party message register on completed charge calls. On ANI calls, this trunk is not a cut-through condition at the time the party test is made by the ANI trunk. As a result, the ANI trunk always registers a ring party identification on these lines. For this reason, number networks associated with both parties of message rate lines must be strapped to the ring (R) terminal on the number treatment cross-connection board. The message rate trunk connects the identification pulse to the proper number network for identification.

In the case of calls from 2-party message rate customers, the ANI trunk signals the message rate trunk at the end of outpulsing of the calling number, causing it to cut through.

B. Ground Removal Test

4.03 A ground removal failure test is made at the end of calls made by tip-party customers. This test is made to insure against charging a customer falsely because of a trouble ground on the line. If the call was made by a 2-party message rate customer, the ANI trunk makes a ground removal test, whether the ring party or tip party on the line made the call.

4.04 If a ground is detected on the line during the ground removal test, an outpulser is recalled by the trunk so that the calling number may be registered on the lamp display panel located in the line test and verification circuit. In addition, a ground removal failure register is scored.

C. Outpulser Failure

4.05 In the event the outpulser fails, it times out and releases, allowing the CAMA equipment to time out and call in an operator. Also, a lead is grounded which operates an outpulser failure alarm and scores the outpulser failure register.

D. Cross Connections

4.06 There are three sets of cross connections in the number network circuit of the ANI-C System. Two of these are interrelated, the number treatment cross connections and the service mark cross connections. The third is the thousands and hundreds digits cross connections.

4.07 The purpose of the first two sets of cross connections functioning together is to provide a pulse path from the NT- punching of a customer number network to the appropriate service mark detectors. These detectors in turn operate service mark register relays in the outpulser.

4.08 The number treatment cross connections are made from the NT- punching of the customer number network to one of eight vertical buses centered on the front of the 100-number network assembly. The service mark cross connections are made from appearances of the R, T, A, and B buses to the appropriate service mark punching on a cross-connection field. This cross-connection field is located between the two 100-number network assemblies. ⧫With the CDA, two new class marks are provided in each number network unit. Measured rate lines are strapped to the individual party measured rate bus (IM) and flat rate lines to the individual party flat rate bus (IF).⧫

4.09 Whenever any service mark bus is cross-connected to a given service mark punching, two conditions are determined with regard to the customers connected to that bus: the particular service mark function, for example, ring party, tip party, etc, and the office code. Thus, in an office where there may be both physical and theoretical office codes and ring and tip parties in both, there is a service mark ring party bus for each office code. No service mark bus is common to more than one office code.

4.10 All directory numbers assigned to a given 100-number network assembly have the same thousands and hundreds digits. The thousands and hundreds digit cross connections for both right and left 100-number network assemblies are made on the same cross-connection field as were the service mark cross connections.

4.11 Whenever any customer number network fires, a pulse is applied to the thousands and hundreds digit punchings of the associated 100-number network assembly. This will cause a pulse to be applied through both the thousands and hundreds resistance networks and detectors. The detectors will then cause the thousands and hundreds digit to be registered in the outpulser.

E. PBX Cross Connections

4.12 Calls from all lines of a PBX are ordinarily billed to the listed PBX directory number. Therefore only one network, that of the listed PBX number, is connected at its location to the number buses. The networks representing the other lines in the PBX are not connected to the number buses at the locations where they are mounted, but are multipled to the terminals of the directory number. Effectively, therefore, they act as if they were all connected to the number buses at the same location as the billing directory number network. In this way, all calls originating from the PBX are identified as the listed PBX directory number.

4.13 The directory numbers associated with the networks serving the lines of a PBX need not be in consecutive order, but rather may be a group of nonconsecutive numbers representing networks located on the same number network frame. Cabling between number networks of PBX lines is accomplished on the front of the frame. Since the tens and units number networks are bare strapped to the buses, it is necessary on all but the listed PBX directory number network to remove the existing strap prior to wiring the PBX multiple.

F. Information Digits

4.14 Included in the information outpulsed to the CAMA office is the information digit. The purpose of the information digit is to furnish to the CAMA office the status of the call; whether it is service observed, whether the call has been automatically identified, is normally operator identified, or must be operator identified because of identification failure.

4.15 Tabulated below are the information digits used and their significance.

	INFORMATION DIGIT	
	NONOBSERVED	SERVICE OBSERVED
Automatic identification	0	3
Operator identification (4-party or multiparty line)	1	4
Operator identification (identification failure)	2	5

G. Identification Failure

4.16 Certain conditions in local office switching may interfere with the identifying signal pulse. This may result in failure to identify one or more digits of the calling number. To take care of such situations, the outpulser checks the registration of the digits and causes the identifier to make a second attempt if the check is not satisfactory. If the second attempt is successful, the outpulser transmits the calling number information to CAMA. In the event that the second attempt should fail, the outpulser transmits the proper information digit to CAMA in order that the call may be operator identified.

H. Timed Disconnect

4.17 When the calling party does not disconnect and the called party does, the trunk circuit at the CAMA office will time out after an interval of 13 seconds minimum and signal the outgoing ANI trunk. This will cause the sleeve ground to open momentarily, releasing the preceding circuits in the local central office. The sleeve ground will again close, holding the trunk busy until the slow release relays in the trunk have been released. The trunk will then become idle.

5. TRAFFIC MEASURING FACILITIES

A. Observing Facilities

5.01 Observing facilities provide a separate identification channel, distinct from the one provided for directory number identification, so that supplementary information may be obtained when a line originating a call is being observed. A service observing mark is supplied by the service observing detector in the identifier during the identification process and passed to the outpulser. This causes the information digit transmitted to the CAMA office to be modified, ie, it indicates to the AMA equipment that a service observed record is to be perforated on the AMA tape. The service observing detector in the identifier will be operated when a call is originated by a customer connected for observing and when the associated equipment has been able to complete a connection to the service observing equipment. The observed information digit is transmitted to CAMA on calls originated by any party on the observed line.

B. Traffic Registers

5.02 Connections have been provided to the following traffic measuring facilities.

(a) A register per ANI-C System is provided to count the total number of calls handled by the outpulsers.

(b) A register per ANI-C System is provided to record the number of calls requiring the service of a CAMA operator including calls not only from 4-party and multiparty customers but also ANI failure calls.

(c) Outpulsers are arranged to connect, by means of two separate leads, to the traffic usage

recorder circuit. One lead indicates all traffic, test, and maintenance usage except plugged-busy condition. The other lead indicates the plugged-busy condition only.

(d) Offices using ANI trunks are arranged to score a register whenever one of these trunks fails to seize an outpulser during its timing interval.

(e) For graded and nongraded groups, a last trunk busy (LTB) register is connected to the register lead in the last choice trunk unit in each group.

(f) Where rotary out-trunk switches are used, each ROTS subgroup is arranged to provide means for all trunks busy (ATB) registrations.

6. TESTING AND MAINTENANCE FACILITIES

A. Test Procedures

6.01 The facility for testing ANI-C equipment is the test and line verification circuit as shown in Figure 1.

6.02 The test and line verification circuit does the following:

(a) Tests ANI outgoing trunks

(b) Verifies that a customer line has been correctly connected to the ANI equipment for identification on ANI calls

(c) Provides operational tests of the outpulser, number network identifier, and pulse generator circuits

(d) Registers and displays on lamps the subscriber line number when the ANI trunk detects a ground removal failure on a service call

(e) Permits originating a call for making a call-through check of the ANI equipment.

6.03 Trunk selection is made by the operation of a selection switch. The test circuit simulates the signals to the originating and terminating ends of the trunk circuit. Marginal tests are applied to the calling and called end supervisory relays and a continuity and polarity check of the tip and ring circuit is made. Party test and calling customer identification features of the trunk are checked by dialing two digits from the test circuit dial into the trunk (except for operator assistance trunks) and, after the digits are dialed, by signaling the trunk to call in an outpulser. The outpulser connects test leads to the test circuit for indicating on lamps the party identified by the trunk, the progress of the outpulser, and the test line number. It is during the check of the trunk line identification feature that an operational test of the outpulser, number network identifier, and pulse generator circuits is made.

6.04 A marginal test can be made on the glow lamps and transistors in the number network-identifier circuit. This is accomplished by attenuating the identifying pulse in the test circuit before it is applied to customer number for identification.

6.05 A glow lamp is provided at the test circuit to check that the pulse generator is generating a pulse when identification is required. The lamp is connected to the gate pulse (PLS) lead, and it should fire on all service and test calls.

6.06 Optional equipment in the test and line verification circuit is required to test trunk circuits that handle dial assistance and special toll traffic originated by noncoin customers and station sent paid, dial assistance, and special toll traffic orginated by coin customers. With this additional equipment, the test circuit will test the ringback feature in these trunk circuits and the coin collect and coin return features of the coin trunk circuit. The other features of these trunks are tested in the manner described above.

6.07 The in-band receiver circuit associated with the trunk is used in making the coin collect, coin return, and ringback tests on coin trunks with E and M lead signaling.

6.08 The CDA is designed for efficient maintenance by a central force of craft with CDA and electronic training, and access to No. 1 AMARC terminals and spare pack kits. The CDA contains no duplicate units because of the high level of reliability of integrated circuits. The primary responsibility for detecting, reporting, and alarming on CDA troubles lies with the No. 1 AMARC. However, strong detection tests are built into the CDA itself, usually with reporting capability through the No. 1 AMARC. Diagnosis and correction of

CDA faults must be carried out at the CDA itself, with help from No. 1 AMARC printouts only if the scan control is working well enough to communicate with the No. 1 AMARC.

B. Plant Registers

6.09 The following plant registers have been provided:

(a) A register per outpulser to count first attempt identifier failures

(b) A register per outpulser to count second attempt identifier failures

(c) A register per outpulser to count outpulser failures

(d) A register per installation to count ground removal failures experienced on service calls.

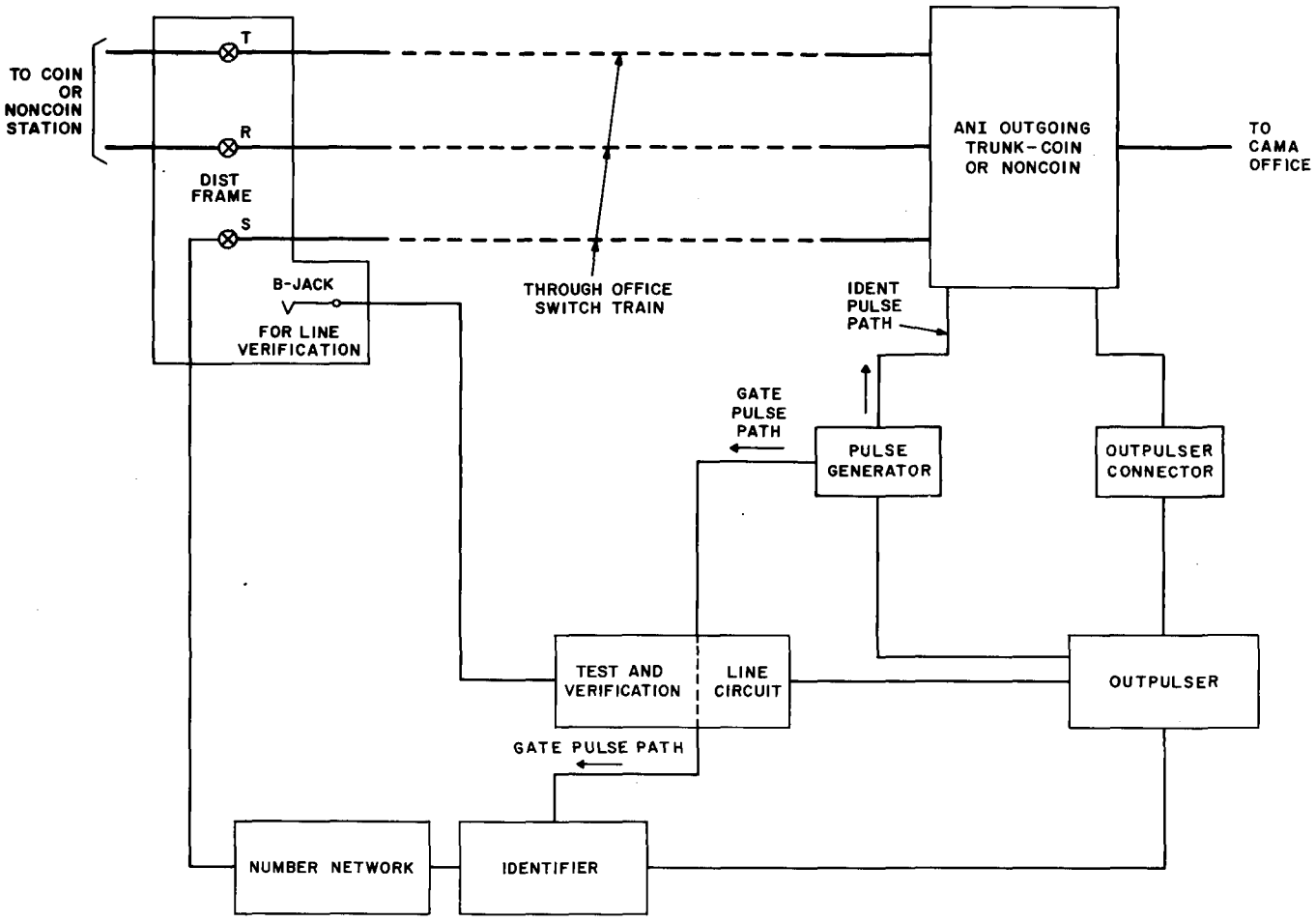

Fig. 1—Simplified System—Block Diagram ANI-C

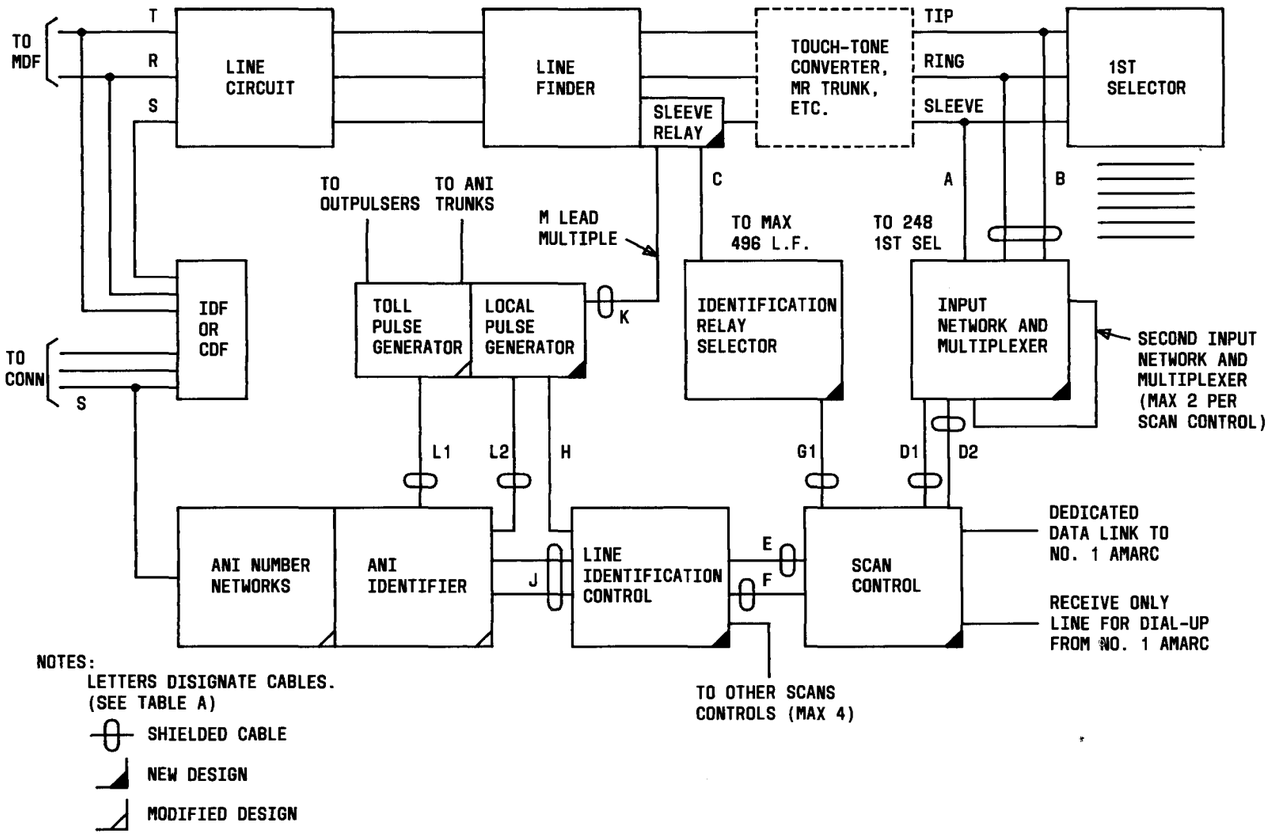

Fig. 2—Call Data Accumulator With ANI-C

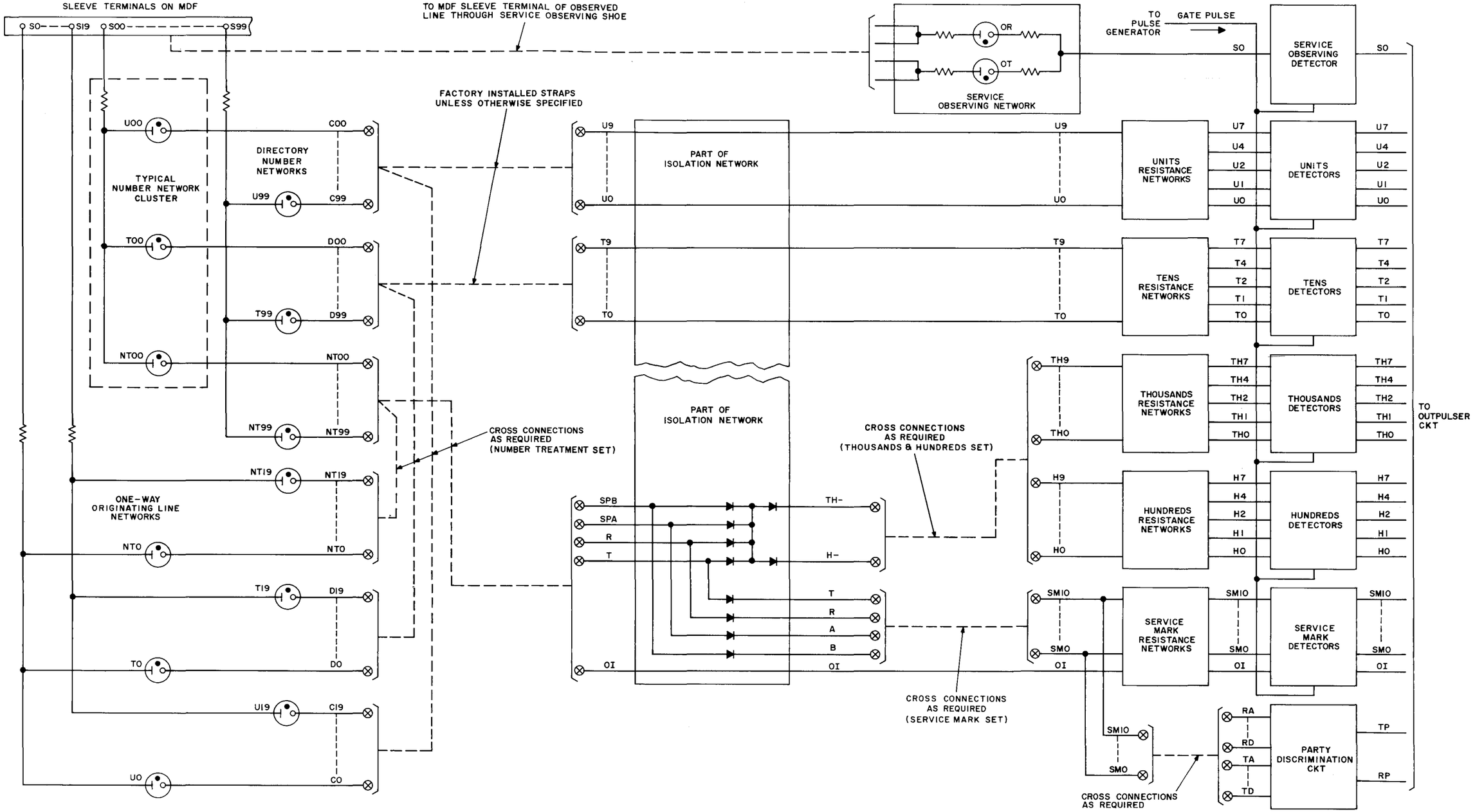

Fig. 3—ANI-C System-Simplified Schematic of Number Network-Identifier Circuit

TABLE A

CABLE SUMMARY

CABLE DESIG	CONDUCTOR REQUIREMENTS	MAX LENGTH IN FEET	GRD FOR SHIELDED CABLE*
A	As Req Per Selector Bay	200	SD-32554-01
B	As Req Per Selector Bay	200	SD-32554-01
C	As Req Per Line Finder Bay	1000	No Shield
D1	32 Per Multiplexer	1000	SD-32555-01
D2	12 Per Multiplexer	1000	SD-32554-01
E	8 Per Scan Control	1000	SD-32555-01
F	32 Per Scan Control	1000	SD-32556-01
G1	32 Per Scan Control	1000	SD-32555-01
H	12 Per Line ID Control	1000	No Shield
J	82 Per ANI System	1000	SD-32556-01
K	1 Per Line Finder Line-Up	1000	C.O.
L1	1 Per ANI Interface	1000	C.O.
L2	1 Per ANI Interface	1000	C.O.

*All cables 800-type grounded and shielded and jacketed.