

AUTOMATIC NUMBER IDENTIFICATION SYSTEM—TYPE D
FOR USE IN SMALL STEP-BY-STEP OFFICES
OF 0 TO 5000 LINES
GENERAL DESCRIPTIVE INFORMATION

CONTENTS	PAGE	CONTENTS	PAGE
1. INTRODUCTION	1	E. Information Digits	11
2. METHOD OF OPERATION	2	F. Identification Failure	11
3. EQUIPMENT ELEMENTS	7	G. Timed Disconnect	11
A. ANI Outgoing Trunks	7	H. Call Data Accumulator	11
B. Outpulser	8	5. TRAFFIC MEASURING FACILITIES	12
C. Number Network Nest	8	A. Traffic Registers	12
D. Number Network Card	9	6. TESTING AND MAINTENANCE FACILITIES	12
E. Diode Isolation and Programming Card	9	A. Test Procedures	12
F. Resistance Network	9	B. Plant Registers	13
G. Detectors	9	1. INTRODUCTION	
H. Party Discrimination	9	1.01 This section describes the Automatic Number Identification (ANI) System Type D for use in local step-by-step offices of 0 to 5,000 lines.	
I. Service Mark Detector	9	1.02 This section is reissued to provide descriptive information on the call data accumulator (CDA). Paragraphs 1.05, 2.08 through 2.19, 3.23 through 3.27, 4.10 through 4.16, 6.06, Fig. 2 and Table A, are added. Paragraphs 1.01, 1.03, 1.07, 1.08, 3.01, 3.03, 3.17, 3.21, 4.02 and 4.04 are revised to provide additional information.	
J. Pulse Generator	10	1.03 On calls requiring automatic number identification, the system is designed to determine and outpulse automatically to a CAMA/TSPS office the calling directory number for calls on	
K. Call Data Accumulator	10		
4. OPERATING FEATURES	10		
A. Party Test	10		
B. Outpulser Failure	11		
C. Cross-Connections	11		
D. Pilot Number Billing	11		

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PBX, individual, and 2-party lines for both coin and noncoin calls. ♦The CDA provides the means for gathering billing data on local calls originated by individual party, measured rate customers.♦

1.04 The types of calls that can be served by the ANI-D 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-D System has the following features:

- (a) Indicates when a call originates on a 4-party, multiparty, or any line requiring operator identification
- (b) Provides "theoretical" 3-digit office codes
- (c) Provides listed number billing for PBX trunks when required
- (d) Indicates an automatic number identification failure so that operator identification may be made.

1.05 ♦The CDA, in conjunction with the No. 1 AMA recording center (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).♦

1.06 The ANI-D equipment mounts on standard 23-inch frames, and arrangements are available for both 11-foot 6-inch and 9-foot heights. The battery sources required is 48 volts and coin control voltages.

1.07 The basic frame will mount all the equipment necessary for the ANI-D System. A basic frame will contain an outpulser, test and line verification circuit, number network and identifier circuits, and trunk circuits. Supplementary frames may be provided for additional equipment. ♦The CDA consists of several modular units which can

be mounted on frames containing other equipment or on their own frame.♦

1.08 Fig. 1 shows a simplified block diagram of the ANI-D System. ♦Fig. 2 shows the ANI System with the 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/TSPS office. ♦Paragraphs 2.08 through 2.19 describe the operation with the CDA.♦

2.02 After dialing is completed and the called number's digits have been received by CAMA/TSPS, the call is partially switched through the CAMA/TSPS 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/TSPS 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/TSPS office. Connection of the outpulser to the ANI trunk is established through preference relays. Upon seizure by the trunk, the outpulser connects to the identifier portion of a number network-identifier circuit. 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.

2.03 The identification pulse is applied through the sleeve to a customer number network. The output of the number network is applied to detectors which in turn operate register relays in the outpulser. The service mark detector which has been operated causes the outpulser to supply the appropriate 3-digit calling office code and, if the subscriber is on a 2-party line, to make a party test. If a ring party is detected, the outpulser has its digits registered; if a tip party is detected, the registered digits are dropped and a second identification is made to register the tip-party number. On individual party identification, no party test is made. At this time, the outpulser is now ready to transmit all seven digits of the calling number together with three additional control digits.

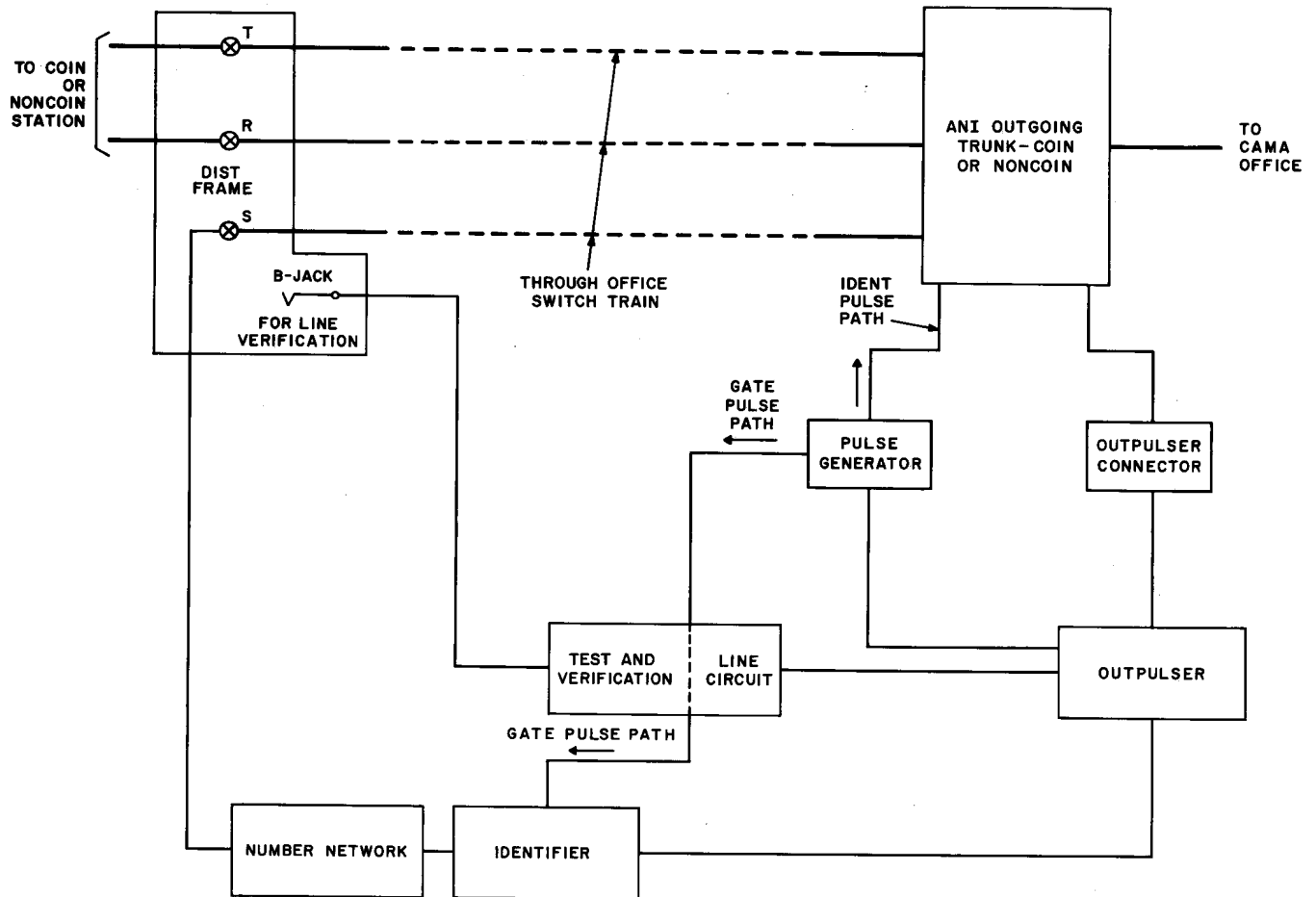


Fig. 1—ANI-D System—Simplified Block Diagram

All outpulser information is transmitted on a multifrequency basis.

2.04 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/TSPS. The KP and ST signals indicate the beginning and end of pulsing to the CAMA/TSPS MF receiver. The ST digit signifies type of call such as 1+, 0±, coin, noncoin to TSPS. 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/TSPS 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.

2.05 After transmitting to CAMA/TSPS the calling customer number and the appropriate information digit, operator identified digit, or failure digit, the outpulser releases and restores to normal. The CAMA/TSPS 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/TSPS office is set up. The supervisory and timing functions for the call are thereafter handled by the CAMA/TSPS equipment.

2.06 When the conversation is completed and disconnect occurs, the originating line restores to normal.

2.07 If the trunk circuit releases as a result of time-out in the CAMA/TSPS incoming trunk when the calling party fails to disconnect, the ANI trunk winks off the originating switches, placing the calling party in a permanent signal condition.

2.08 The input network and multiplexer sequentially scan the tip, ring, and sleeve leads of the 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 use 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.

2.09 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.

2.10 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.

2.11 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.

2.12 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.

2.13 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).

2.14 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.

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

2.16 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 three data blocks per second are transmitted under normal conditions.

2.17 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 can not 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 can not 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.

2.18 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.

2.19 The messages sent to the No. 1 AMARC contain a status code. Different values of

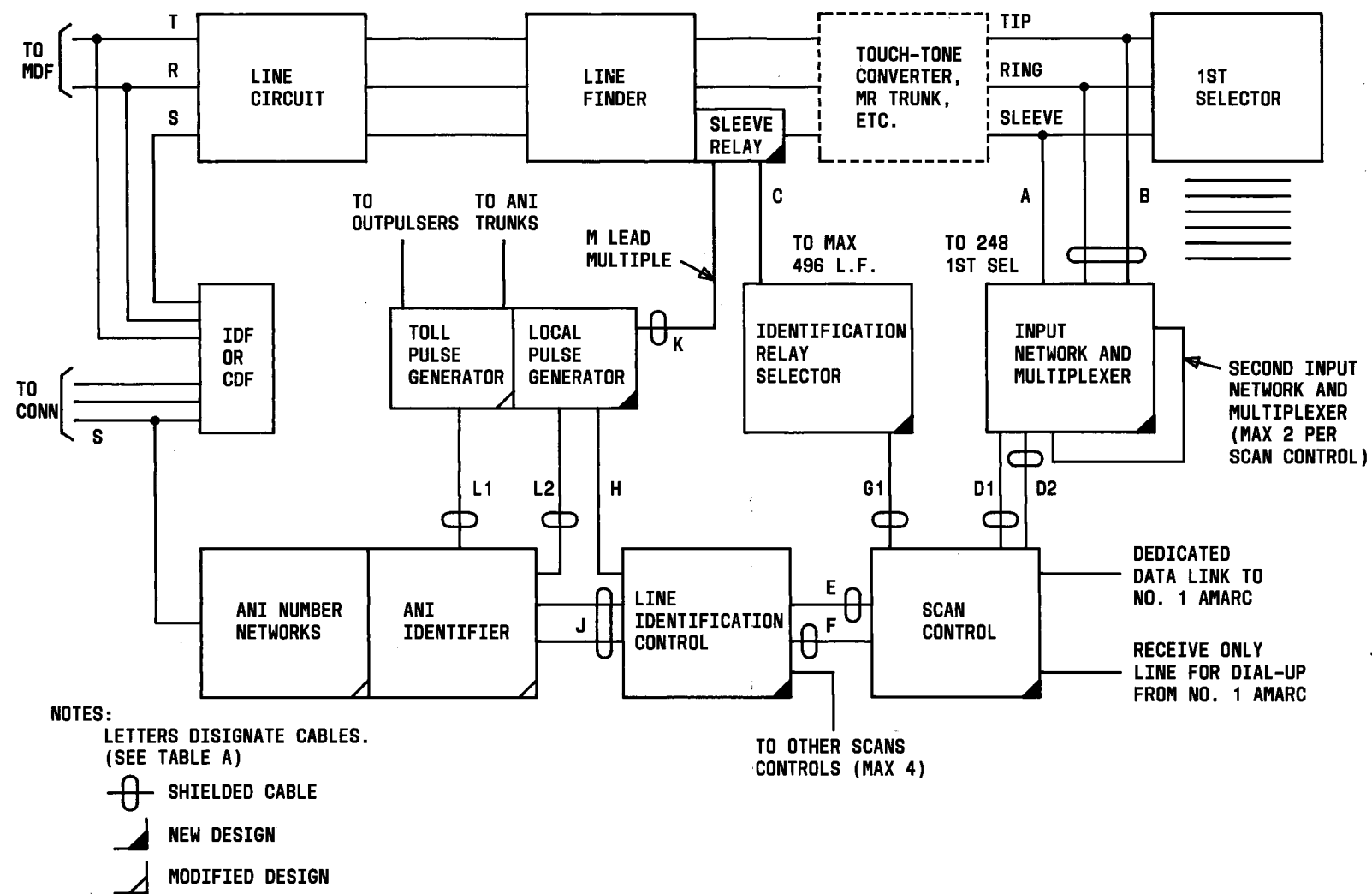


Fig. 2—Call Data Accumulator With ANI-D

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.

this 7-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-D operation. ♦Paragraphs 3.23 through 3.28 describe the CDA equipment.♦

3.02 The ANI-D equipment mounts on standard 23-inch bulb-angle frameworks and arrangements are available for both 11-foot 6-inch and 9-foot heights. The battery sources required are -48 volts and coin control voltages.

3.03 A basic 9-foot frame will always contain one outpulser and test equipment. In addition, the frame may be arranged for 1800 number networks and eight 1+ trunks, or 1200 number networks and ten 1+ trunks, or 1800 number networks with a second outpulser. A basic 11-foot 6-inch frame will be similarly equipped with the number network capacity increased to a maximum

of 4200 and ten 1+ type trunks, or 4200 number networks, a second outpulser and six 1+ type trunks. In addition, supplementary frames can be ordered to provide any combination of additional trunks or number networks as required for an individual office. ♦The CDA equipment may 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/TSPS 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/TSPS end. Also, they furnish means for "holding" the originating switch train for the duration of the call.

3.05 The ANI-D trunks are available in five types and may be used as noted in Table B.

TABLE B

	Loop	E&M	1+	0+	0-	Coin	Non-Coin	SxS CAMA	(TSP) X-Bar Tandem	#5 Xbar CAMA	TSPS	#4 CAMA
SD-35020-01	X	X	X				X	X	X	X	X	X
SD-35021-01	X	X		X	X		X		X		X	
SD-35022-01		X	X	X	X		X				X	
SD-35023-01	X	X	X	X	X	X			X		X	
SD-35024-01		X	X	X	X	X	X				X	

B. Outpulser

3.06 The outpulser controls the identification process. Only one trunk at a time within a subgroup has access to the outpulser through trunk preference relays. Only one subgroup at a time has access to the outpulser through trunk connector relays. If two outpulsers are provided, a trunk bidding for an outpulser will be routed to the idle outpulser if its preferred outpulser is busy.

3.07 When the CAMA/TSPS office is ready for the calling party number, it signals the trunk which bids for an outpulser. The outpulser causes the pulse generator to send a high voltage short duration pulse on the calling party sleeve for identification. If the call is from a 2-party flat-rate line, the outpulser will make a party test after the first identification, which registers the ring party number.

3.08 The digits of the directory number are simultaneously identified 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 registered and checked, they are outpulsed along with the appropriate information digit to the CAMA office by means of MF signaling.

3.09 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.

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

C. Number Network Nest

3.11 A fully equipped number network nest provides the cross-connect fields on number network cards and diode isolation cards for programming 600 numbers.

3.12 Five number network cards, representing 100 consecutively-numbered directory numbers with identical thousands and hundreds digits, are grouped into a 100 number unit. The 100 number unit is inserted into the number network card nest and is associated with a diode isolation and programming card. This card is used to assign the thousands (TH) and hundreds (H) digits along with a service mark (SM) program to that 100 number unit. Since the diode card is capable of serving two 100 number units, a left 100 number unit and a right 100 number unit are assembled in the card nest with the diode card for both units located between them. Three such 200 number units, each composed of left 100 number unit, diode card, and right 100 number unit, may be used to completely equip a number network card nest. If a 100 number unit is only partially used,

only the necessary number network cards need be equipped. However, a diode isolation and programming card is required whenever any part of a 200 number unit is equipped.

D. Number Network Card

3.13 One number network consisting of three neon glow lamps and a resistor is required for each directory number. Each number network card is arranged for 20 number networks and a cross-connect field. A cross-connect field on each card provides programming for several different number treatments: individual party (IP), flat-rate ring party (RP), flat-rate tip party (TP) (associated with initial or primary office), operator identified (OI), and special treatment (SPA, SPB, SPC, SPD). SPA, SPB, and SPE can be used to generate treatments for a second office code or PBX AIOD within the same hundreds group. SPC and SPD are to be used with the AMARS.

E. Diode Isolation and Programming Card

3.14 The diode isolation and programming card contains a cross-connection field where the proper thousands and hundreds connections are made for each of the hundred number units. All numbers in a hundred number unit must have the same thousands and hundreds digits. No relation need exist between the thousands and hundreds digits of the left and right units. Cross-connections between number treatments and service marks are made on another cross-connect field on the card. The removal of a diode isolation and programming card disables the TH, H, and SM connections to the 200 number unit associated with that card.

F. Resistance Network

3.15 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.

3.16 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.

G. Detectors

3.17 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. ♦A new set of detectors is provided for the CDA. They are wired in series with the existing toll detectors to determine the class mark, office code digit, and thousands, hundreds, tens, and units digits.♦

H. Party Discrimination

3.18 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. On the first identification, the party discrimination blocks the tip-party networks so the ring-party number can be registered. If the party test detects a tip party, the second identification will block the ring-party network so the tip-party number can be registered.

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

I. Service Mark Detector

3.20 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 3.17.

J. Pulse Generator

3.21 In the ANI-D System, a pulse generator provides the identification pulse. On request from the outpulser, 340-volt, 200-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, six or seven pulses will be sent. When functioning with the CDA, two local pulse generators are added. The line identification control commands the local and toll pulse generators.

3.22 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.

K. Call Data Accumulator

3.23 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.

3.24 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, and exchanges data with these units and with the No. 1 AMARC.

3.25 The line identification control provides the calling number for the CDA. 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.

3.26 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.

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

3.28 The dedicated data links must fulfill requirements for a 3002 unconditioned private line. Either two- or four-wire operation may be used. The count of block errors on the data link is reported hourly at the No. 1 AMARC. The dialed backup line must be arranged for terminating (receive) only service. If it is inadvertently connected to a line finder group terminal, a permanent busy condition will follow the first access.

4. OPERATING FEATURES

A. Party Test

4.01 The party test is made by the outpulser and is performed on lines with RP or TP cross-connects on the number network card. The initial identification will always register the ring-party directory number. A party test is made and if a ring party is detected, outpulsing is started immediately. If a tip party is detected, the outpulser releases the digits that are registered, and a second identification is made to register the tip-party number; outpulsing is then started.

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 if office is not equipped with the CDA, on completed charge calls. On ANI calls, this trunk makes the party test and switches the sleeve lead to the correct tip-party or ring-party number network. For this reason, number networks associated with both parties of message-rate lines must be strapped to the individual (IP) terminal on the number network card. The message-rate trunk connects the identification pulse to the proper number network for identification.

B. Outpulser Failure

4.03 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. If an outpulser fails due to a blown fuse, the outpulser is automatically made busy, and subsequent calls will be routed to CAMA or TSPS on a trunk time-out basis. If equipped with two outpulsers, the second outpulser will continue to function.

C. Cross-Connections

4.04 Cross-connections are made on two cross-connect fields. The thousands, hundreds, and service mark cross-connections are made on the diode isolation card and are common to a group of 100 consecutive numbers. The number treatment cross-connections are made on the number network card and are individual to each directory number. With the CDA, two class mark buses are provided on the number network. Measured-rate lines are strapped to the individual party measured-rate bus (1M) and flat-rate lines to the individual party flat-rate bus (1F).

D. Pilot Number Billing

4.05 Pilot number billing is an accounting function performed by the CAMA/TSPS office and is described in GL-73-02-110.

E. Information Digits

4.06 Included in the information outpulsed to the CAMA/TSPS office is the information digit. The purpose of the information digit is to furnish to the CAMA/TSPS office the status of the call: whether the call has been automatically identified,

is normally operator identified, or must be operator identified because of identification failure.

4.07 The information digits used and their significance are tabulated as follows:

INFORMATION DIGIT

0	Automatic identification
1	Operator identification (4-party or multiparty line)
2	Operator identification (identification failure).

F. Identification Failure

4.08 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/TSPS. If the second attempt fails, the outpulser transmits the proper information digit to CAMA/TSPS in order that the call may be operator identified.

G. Timed Disconnect

4.09 When the calling party does not disconnect and the called party does, the trunk circuit at the CAMA/TSPS 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 then will become idle.

H. Call Data Accumulator

4.10 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.

4.11 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.

4.12 In order to distinguish individual flat-rate lines from measured-rate lines, two class mark buses are provided on the number network. Measured-rate lines are strapped to the individual party measured-rate bus (1M) and flat-rate lines to the individual party flat-rate bus (1F). Two-party lines are strapped to the 2T and 2R buses for tip-and ring-party lines, as at present. Multiparty lines remain strapped to the OI bus, as at present, for operator identification.

4.13 A diode isolation circuit board in each number network unit provides two new class marks for the IM and IF buses. These class marks are transmitted through the line identification control to the scan control as two separate bits of data.

4.14 When a local pulse generator operates, the pulse travels onto the M lead multiple, through the sleeve relay trunk circuit operated by the identification relay selector, onto the calling customer's sleeve, into the number network connected to that sleeve and the CDA detectors. The detector outputs are stored and transmitted to the line identification control, where they are checked and sent on to the scan control.

4.15 A display unit and control key added to the line verification unit allows verification of the ANI cross-connection for CDA operation by making a trial identification on any designated line.

4.16 The CDA pulse generators contain a monitor feature which will energize a local minor alarm if the selected pulse generator does not produce an identification pulse. The local pulse generators are used alternately and the failure of one of them does not affect CDA operation.◀

5. TRAFFIC MEASURING FACILITIES

A. Traffic Registers

5.01 Connections to the following traffic measuring facilities have been provided:

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

(b) A register per ANI-D System 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 outpulsor 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 ROTTS subgroup is arranged to provide means for all trunks busy (ATB) registrations.

6. TESTING AND MAINTENANCE FACILITIES

A. Test Procedures

6.01 The test and line verification circuit performs line verification and operational tests for all ANI-D outgoing trunks. It provides complete testing of ANI-D noncoin station-to-station trunks and partial testing of coin, operator assist, or special toll trunks. When coin trunks or operator trunks are provided, the trunk test circuit, SD-35038-01, is required to provide supplemental testing of these trunks.

6.02 The test and line verification circuit (and the Trunk Test Circuit SD-35038-01 when needed) has the following features:

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

6.03 Trunk selection is made by connecting the jacks of the test circuit to the jacks of the trunk with patch cords. The test circuit simulates the signals to the originating and terminating ends of the trunk circuit. Party test and calling customer identification features of the trunk are checked by signaling the trunk to call in an outpulser. The outpulser connects leads to the test circuit for indicating on lamps the party identified, 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 circuit 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 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

6.07 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.