

**STROMBERG-CARLSON CORP.
ANI IV C AUTOMATIC NUMBER IDENTIFIER
GENERAL DESCRIPTION**

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1. GENERAL

1.01 This section contains the descriptive information for the ANI IV C Automatic Number Identifier manufactured by the Stromberg-Carlson Corp.

1.02 Whenever this section is reissued, the reason for reissue will be noted in this paragraph.

1.03 The installation and maintenance information for the automatic number identifier equipment is provided in Section 227-500-900PN.

2. DESCRIPTION

2.01 The ANI IV C automatic identifier provides the calling-party number identification to the automatic message accounting (AMA) centers and traffic service position systems (TSPS). Standard toll 2/6 (2-out-of-6) tone frequencies are outputted as required to the centralized AMA (CAMA), TSPS, and similar systems. The storage and verification of the calling number is provided prior to outputting to reduce the holding time of the AMA office equipment and eliminate partially identified calls.

2.02 The automatic identification of single-party, 2-party, or 4-party (when provided) calling numbers is optionally provided for the Terminal Per Station (TPS) or Terminal Per Line (TPL) operation.

2.03 The ANI IV C identifier effectively serves offices ranging in size from a few hundred terminals up to 20,000 terminals. The modular concept permits identifier expansion when dictated by increases in the traffic volume. The identifier is expanded by installing additional matrix gates, the B identifier gate, and the associated trunk/access equipment. The gate equipment in front of the identifier is hinged to provide swingout access for easier testing and maintenance. The gate connections are accomplished using flexible cables with keyed and/or marked plug-in connectors.

2.04 The limiting factor for a single output ANI is the number of busy-hour calls (BHC) that the ANI will process before service deteriorates to the recording office. This capacity is controlled by the percentage of calls that are delayed 2 or more seconds before the identification occurs with varying identifier traffic loads. If 10 percent of the calls are delayed 2 or more seconds, the average delay on all calls is a nominal 600 milliseconds. The result is less than 0.5 percent of the calls are routed to the operator number identification (ONI) because of ANI trunk failure to access the identifier within the required 2 to 5 seconds.

2.05 The ANI IV C criteria for the busy-hour call (BHC) capacity is 880 calls identified by the single identifier; 1760 calls by a dual identifier on a chain basis; and 2700 calls by a dual identifier on an access-2 basis. These figures are based on 10 percent of the calls being delayed 2 or more seconds. Table A shows the call delay percentages at various traffic volumes based on a call holding time (CHT) of 150 seconds.

2.06 Dual identifiers operate simultaneously, except that during the millipulse detection state, the program of one is inhibited until detection by the other is completed.

2.07 The capacity of the dual identifiers is controlled by the percentage of calls experiencing a delay of 2 seconds or more with different volumes of identifier usage. The identifier holding time for an

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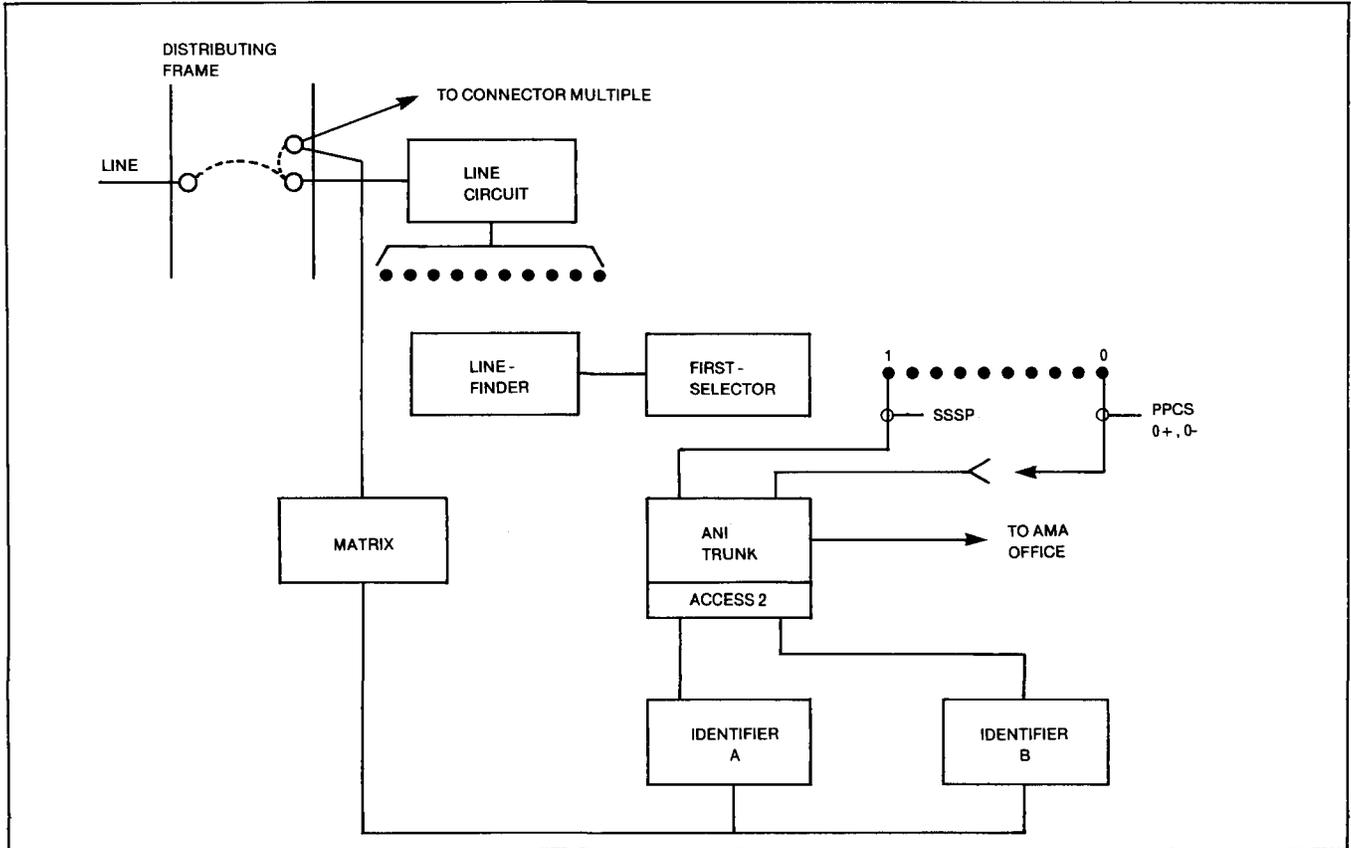


Fig. 1 — Simplified Block Diagram ANI IV C Identifier, Step-by-Step Office

identified call is 1.732 seconds from seizure to release for either the single or the dual identifier. The traffic capacity can be increased by using an access-2 coupler to provide full access to either identifier by the trunk circuits. Table B shows the chain-access capacity. Table C shows the access-2 capacity.

2.08 Auxiliary matrix cards may be provided optionally in each identifier. An auxiliary matrix is required for marking terminals for special service, such as TPL, ONI, COIN, CANCEL (PBXs equipped with ANI), DENIED SERVICE (DS), and TPL units determination. In small offices that have more than one office code, with no thousands digit distinction, auxiliary matrix terminals can be used for the office code distinction. Five auxiliary matrix cards may be equipped in each identifier gate with each card providing 40 terminals (400 terminals for dual identifiers). An 800-terminal auxiliary matrix gate can also be mounted on a frame, if more terminals are required. Auxiliary matrix terminals are not required for TPS ONI, which is accomplished by a strapping on the matrix card.

2.09 The test module provides the system test capability. Light-emitting diodes (LEDs) monitor the program sequence. A lighted display indicates the identified calling station number. Fuse and alarm indicators for the system are located on a separate panel, along with the multifrequency (MF) test access and controls. A test cycle may be run continuously, if desired. However, normal traffic has priority over test-cycle seizure. When the BUSY key is operated the test will wait until the circuit is normal. Register devices are not advanced during a test cycle.

2.10 Each matrix gate supplies 1000 terminals, split into two groups of 500 terminals each. Plug-in matrix cards provide for 20 terminals per card.

2.11 A full line of electronic (card-mounted) trunks is available to provide CAMA (1+ noncoin) or TSPS service (0± noncoin, 0± postpay coin, 1+, 0± combined noncoin and postpay coin, 1+, 0± prepay coin or 1+, 0± noncoin and prepay coin).

2.12 Where traffic dictates the need for dual identifiers, access-2 circuits are used to provide access to either identifier from any trunk. The trunks are chained in groups of five (one access-2 circuit per five trunks) to assure maximum efficiency and hardware economy. The access-2 circuits are card-mounted and can be mounted on the identifier bay, along with card trunks, for optimum packaging density.

3. PHYSICAL CHARACTERISTICS

3.01 The basic identifier bay is equipped with one identifier gate and may be arranged for a number of optional configurations, as indicated in Table D.

3.02 The identifier gate is equipped with the following equipment required for operation: identifier test module, MF supply, traffic registers, internal power supplies for desired logic voltages, etc. The ANI IV C identifier system is designed for maximum packaging density and may be provided with a maximum of 3000 terminals and 45 card-mounted trunks on a single 9-foot (3-m) bay.

3.03 The system is tested at the factory before shipment and is designed for ease of installation utilizing plug-in cables. Plug-in cables are used to connect the gates. Matrix cables which connect to the distributing frame are plug-in connected at the identifier bay.

3.04 The identifier gate consists of four levels into which the printed wiring board assemblies (PWBAs) are installed. The identifier gate also includes the test module and the fuse panel mounted on the identifier gate. The PWBAs are keyed to prevent insertion into the wrong position. The identifier gate is also arranged for plug-in cables interconnecting with matrix gates. Position numbers are marked horizontally for each level to indicate the mounting position coordination of PWBAs and cable connectors.

4. BASIC IDENTIFICATION OPERATION

4.01 A 228-Hz oscillator (master clock) in the identifier runs continuously to supply the identifier timing pulses. When the identifier is available, an identifier request signal from the trunk is applied to the ST lead of the identifier. This sets the seize flip-flop to start the program clock, thus starting the identifier program in the following sequence:

- (a) A single-party, 2-party, 4-party or party test (PT) is made.
- (b) The millipulse (MP) is applied to the matrix.
- (c) A two-out-of-five (2/5) digit register check is made and is repeated twice more upon failure to detect a digit before outputting the KP, INF digit, and ST signals to indicate ANIF.

TABLE A — SINGLE IDENTIFIER CHAIN OPERATION — CALL DELAY PERCENTAGES

PERCENTAGE OF CALLS DELAYED 2 OR MORE SECONDS	IDENTIFIER BUSY-HOUR LOAD (CCS)	EQUATED BUSY-HOURS CALLS	EQUIVALENT TRUNK TRAFFIC (CCS)
1	5.4	314	471
5	11.4	660	990
10	15.2	880	1320

TABLE B — DUAL IDENTIFIER CHAIN ACCESS OPERATION CALL — DELAY PERCENTAGES

PERCENTAGE OF CALLS DELAYED 2 OR MORE SECONDS	IDENTIFIER BUSY-HOUR LOAD (CCS)	EQUATED BUSY-HOURS CALLS	EQUIVALENT TRUNK TRAFFIC (CCS)
1	10.8	628	942
5	22.9	1320	1980
10*	30.5	1760	2640

* With this delay, a maximum of 5 of 1000 ($P = 0.005$) calls can time out and need ONI service.

TABLE C — DUAL IDENTIFIER ACCESS-2 OPERATION — CALL DELAY PERCENTAGES

PERCENTAGE OF CALLS DELAYED 2 OR MORE SECONDS	IDENTIFIER BUSY-HOUR LOAD (CCS)	EQUATED BUSY-HOURS CALLS	EQUIVALENT TRUNK TRAFFIC (CCS)
1	28.8	1660	2490
5	39.8	2300	3450
10*	46.8	2700	4050

* With this delay, a maximum of 5 of 1000 ($P = 0.005$) calls can time out and need ONI service.

TABLE D — ANI IV C IDENTIFIER BAY ASSEMBLIES AND BASIC EQUIPMENT

ASSEMBLY NO.	FRAME COLOR	HEIGHT	DEPTH	ARRANGED FOR
476130-035	Gray	7-1/2 feet 2.3 m)	1-1/3 feet (41 cm)	2 identifier gates and 4 matrix gates (4000 terminals) or 3 matrix gates and 1 or 2 trunk panels (3000 terminals and up to 30 trunks)
476130-025	Gray	9 feet (3 m)		2 identifier gates and 4 matrix gates (4000 terminals) or 3 matrix gates and 3 trunk panels (3000 terminals and up to 45 trunks)
476130-055	Gray	9 feet (3 m)	1 foot (30.5 cm)	2 identifier gates and 4 matrix gates (4000 terminals) or 2 matrix gates and 3 trunk panels (2000 terminals and up to 45 trunks)
476130-015	Gray	11-1/2 feet (3.5 m)	1-1/3 feet (41 cm)	2 identifier gates and 6 matrix gates (6000 terminals) or 4 matrix gates and 4 trunk panels (4000 terminals and up to 60 trunks)
476130-045	Gray	11-1/2 feet (3.5 m)	1 foot (30.5 cm)	2 identifier gates and 6 matrix gates (6000 terminals) or 2 matrix gates and 4 trunk panels (2000 terminals and up to 60 trunks)

Note. Each identifier gate also provides space for up to 200 auxiliary matrix terminals (auxiliary matrix is used for marking of special service lines, such as coin, hotel/motel, etc) If additional auxiliary matrix capacity is required, an auxiliary matrix gate (providing 800-terminal capacity) can be mounted in place of a regular matrix gate.

- (d) The KP signal is sent to the recording office to unlock the MF signal detectors for the reception of MF digits.
- (e) The INF digit 0, 1, 3, or 6 is outputted in MF to indicate a valid identification. Refer to Table E for the MF tone assignments. The A, B, and C digits of the office code and the TH, H, T, and U digits of the station number are MF outputted sequentially to provide the calling station identification.
- (f) The ST signal is then outputted to end the program.

4.02 In the case of CA or DENIED SERVICE, the calling number information is not forwarded; the identifier is released and the trunk returns a busy tone. The identifier is also released after MF outputting the following the INF digits and ST:

- 1: ONI
- 2: ANIF

4.03 When the recording center receives an ANIF digit 2, the call is routed to an operator for manual servicing. A trouble report is prepared automatically or manually, depending upon the provisions at the center. ONI digit 1 is also routed to an operator.

5. BYPASS OR RANGE EXTENDER SWITCHTHROUGH

5.01 If the office is equipped with range extenders and automatic 2-party or 4-party identification is provided, the T and R leads of the range extender may have to be switched through to permit the party test to be made. A positive 50-volt pulse is applied to the sleeve lead, causing the bypass circuit to operate during the party test cycle. The bypass circuits are card-mounted.

6. TWO-PARTY IDENTIFICATION

6.01 Automatic 2-party identification circuitry is provided by optional PWBAs in each identifier. The output of the party identification circuit causes gating relays to operate before the station is identified. The output of the party identification circuit also provides tone on the trunk to indicate to the station installer that the station has been correctly marked.

- (a) The operated party gating relays cause ground to be removed from a TPS matrix or identifier so that the proper units-digit register can be set in the identifier. The other party is connected to ground to short out (inhibit) the millipulse. TPS gating is arranged so that SG leads 0, 1, and 2 are assigned to party 1; SG leads 3, 4, and 5 are assigned to party 2 (Fig. 2).
- (b) With TPL party gating (Fig. 3), the office code and first three digits TH, H, and T are obtained from the line matrix when the millipulse is applied. The gating relays for the 2-party detector operate to apply the millipulse through the external auxiliary matrices, and the units-digit translator to the units register. External auxiliary matrices are required for each unit digit (party) associated with that line.
- (c) During the program party test, an output opposite to the correct party identification is applied to a latch circuit that should not set. If the party test identification is incorrect, the latch circuit sets. On the test panel, the PARTY TEST lamp lights, an alarm signal is sent, and the INF digit 2 (ANIF) and an ST signal are outputted, after which the identifier is released.

7. FOUR-PARTY IDENTIFICATION

7.01 Four-party detection is made during program steps 2 and 3. Outputs from both the negative high current flip-flop and the positive high current flip-flop are necessary to operate the party gating relay to determine the calling party. During program steps 4, 5, and 6, tone is returned to the station installation personnel to indicate the correct identification of party 1, 2, 3, or 4.

7.02 Both flip-flops are cleared at the end of program step 6 by the input on lead R2P. Although this provides a logic high (1) at output terminals E and K (party 1), it is immaterial because the party gating relay operation has been completed. The identification proceeds as described in subsequent paragraphs.

TABLE E — MULTIFREQUENCY SIGNALS

DIGIT/SYMBOL	RELAY	TIP OF LINE FREQUENCY (HZ)	RELAY	RING OF LINE FREQUENCY (HZ)
KP □	2T	1100	10	1700
1	OT	700	1R	900
2	OT	700	2R	1100
3	2T	1100	1R	900
4	OT	700	4R	1300
5	1T	900	4R	1300
6	2T	1100	4R	1300
7	7	1500	OR	700
8	7	1500	1R	900
9	7	1500	2R	1100
0	7	1500	4R	1300
ST □	7	1500	10	1700
ST1 —	1T	900	10	1700
ST2 ≡	4T	1300	10	1700
ST3 ≡≡	OT	700	10	1700

Note: Format for ST signals is as follows:

TYPE OF TRUNK GROUP

TSPS	—	ST (ST: 1500 Hz and 1700 Hz)	1 + Coin
		ST1 (ST1: 900 Hz and 1700 Hz)	0± Coin
		STP (ST3: 700 Hz and 1700 Hz)	0± Noncoin
CAMA	—	ST (ST: 1500 Hz and 1700 Hz)	1 + Noncoin

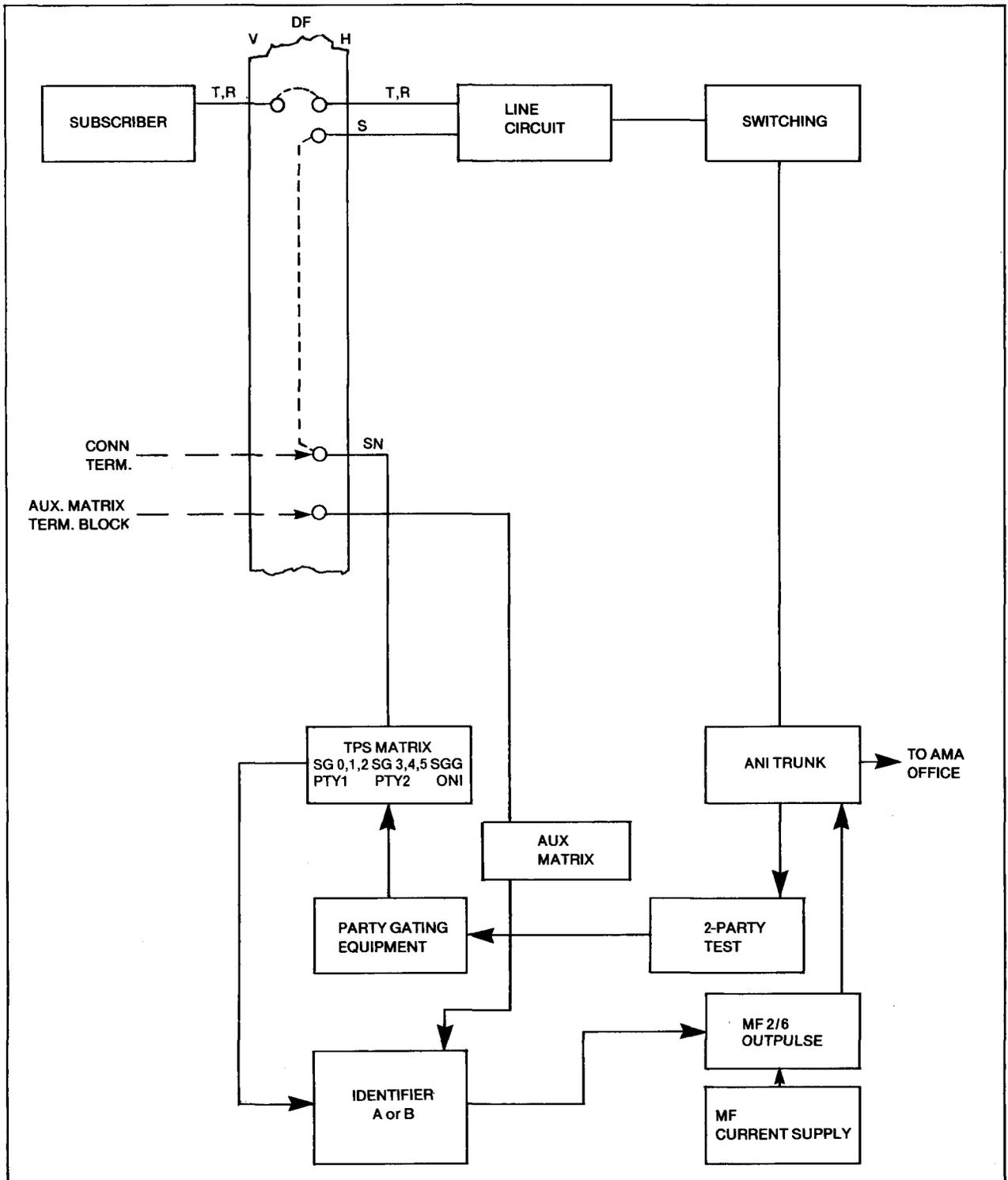


Fig. 2 — TPS 2-Party Automatic Identification Block Diagram

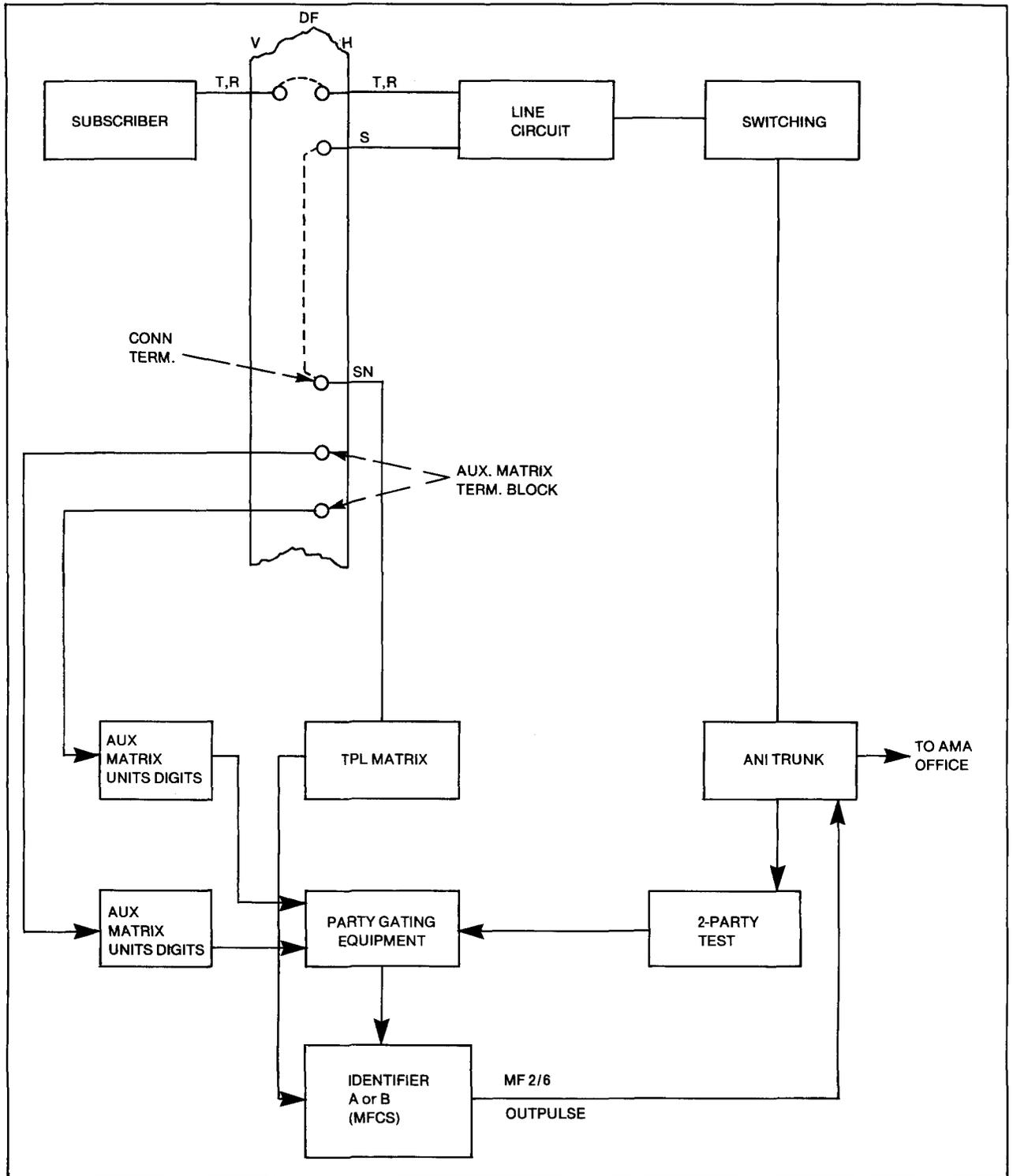


Fig. 3 — TPL 2-Party Automatic Identification Block Diagram

7.03 At program step 2, a logic low on lead PT operates the negative party test relay (NEG PT) and enables one lead to the AND gate at terminal S of the negative high current flip-flop. Positive party test relay operation is inhibited until program step 3 when a high input on lead PS3 occurs.

- (a) During program step 2, the off-hook telephone is checked for negative current to ground. A negative current is detected by the negative current detector if either party 2 or party 4 is off-hook. This provides the second high to the AND gate at terminal S of the negative high current flip-flop to produce a logic high (1) from terminal 4. (Note that the negative current path is by way of the closed contacts of the nonoperated positive party test relay in the PWBA in position BTI.) The high from terminal 4 is applied to one of two leads for the AND gates controlling the party gating relays for parties 2 and 4.
- (b) For parties 3 and 4, relays control contacts for application of power ground to the -48 volt power gating relays. For parties 1 and 2, an interface PWBA provides switching to apply ground P (power) to the party gating relays.
- (c) If negative current is not detected for the off-hook telephone, the negative high current flip-flop has no logic high applied to the AND gate at terminal S. The flip-flop change of state is inhibited, and a logic high from terminal E is applied to the AND gates for parties 1 and 3.

7.04 At program step 3, the input high is inverted to a low, causing the positive party test relays in position BTI to operate. An off-hook telephone current detection is then applied to terminal E of the positive current detector. A lead from the inverted low for the positive party test relay is applied through an inverter to the AND gate connected to terminal S of the positive high current flip-flop. If a positive current is detected, the logic low output from the positive current detector is inverted to a high and applied as the other high to the AND gate connected to terminal S of the flip-flop.

- (a) When party 2 or party 3 is off-hook, a positive current is detected causing a logic high (1) at output terminal 9 of the flip-flop. The logic 1 is applied to the AND control gates for the party 2 and party 3

party gating relays. Depending upon which AND gate has a logic 1 applied during the negative current detection in program step 2, the appropriate party gating relay operates. Note that the output of the AND gates is inverted to provide logic low (ground) to operate the relay or interface controls for the party gating relays.

- (b) If party 1 or party 4 is off-hook, no positive current is detected so that a logic high is the output at terminal K of the flip-flop. The high is applied to the control gates for party 1 and 4. Depending upon which AND gate has a logic 1 applied during the negative current detection in program step 2, the enabled party gating relay operates. The following chart shows the flip-flop setting and current detection for each party:

	NEG HIGH CUR. F-F TERM. LOGIC 1	POS HIGH CUR. F-F TERM. LOGIC 1
PARTY 1	E	K
PARTY 2	4	9
PARTY 3	E	9
PARTY 4	4	K

7.05 The operated party gating relays cause ground to be removed from a TPS matrix or identifier to allow the millipulse to set the proper unit digit registers in the identifier. The other three parties are connected to ground to inhibit the millipulse. TPS gating is arranged so that SG leads 0, 1, and 2 are assigned to party 1; SG leads 3, 4, and 5 to party 2; 6 and 7 to party 3; and 8 and 9 to party 4.

7.06 The party gating relays operate similarly for TPL identification to remove ground from one of the four lines. The calling party unit digit is obtained from the auxiliary matrix to set the proper unit digit registers.

8. MULTIPARTY (CIRCLE DIGIT) IDENTIFICATION

8.01 When TPS Circle Digit (refer to Fig. 4) identification is required, the digit is stored in the trunk. During the first portion of program step 4, the decimal digit causes circle digit party gating relays

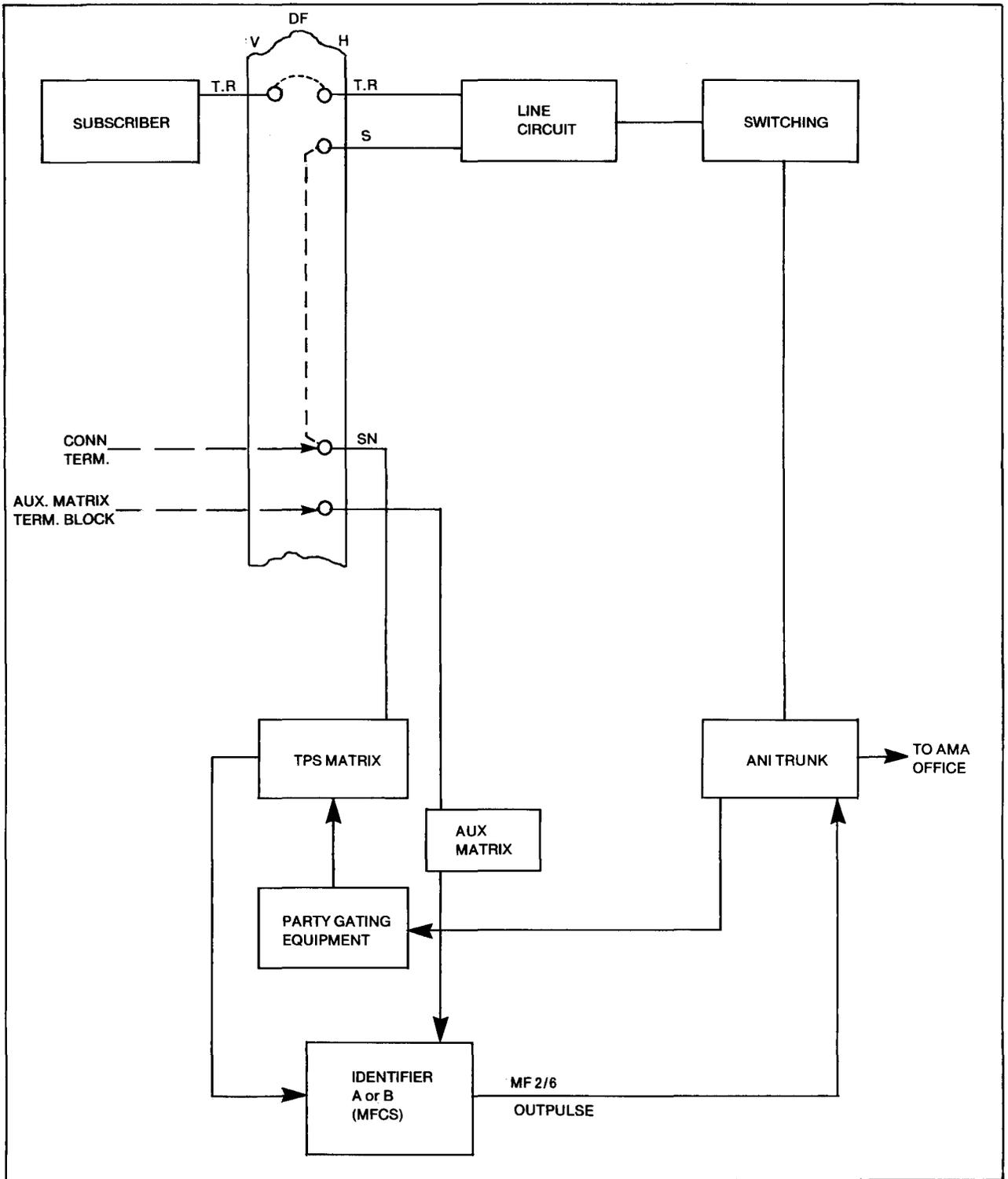


Fig.4 — TPS Circle Digit Identification Block Diagram

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to operate to ground (inhibit) the millipulse for all but the calling party unit digit. The millipulse that is not inhibited sets the unit digit register in the identifier in the same manner as for a single station.

8.02 The units digit for TPL is the same as the dialed circle digit. The circle digit is stored in the AMA trunk circuit. This unit is translated to 2/5 code and marked into the unit digit registers by way of input buffers and gates. Party gating relays are not required.

9. ALARM CIRCUITS

9.01 Alarm conditions are indicated on the test module by lighted red lamps. An audible alarm may be equipped as an option, if desired. The identifier alarms are:

- MF FAIL - Lights when only one frequency is generated (two frequencies must be present)
- TIME OUT - Lights when identifier does not return to SZ (idle) condition within a nominal 5-1/2 seconds after program completion
- PARTY FAIL - Lights when integrity check of party does not agree with party identified.

9.02 The following alarm condition is indicated on the fuse panel:

- FA - Lights when a +5V or -48V fuse blows.

Note: Operation of the RESET switch returns the identifier to normal condition, and the alarm lamp goes dark. Provisions are made for remote reset when the ANI equipment is located in an unattended office.

9.03 Circuits are provided for extending the battery, resistance-battery, or ground alarm circuits to supervisory positions, wherever located or required for the office.

9.04 Matrix fuse alarms may be equipped as an option on each matrix gate. The normal use of this fuse is related to the battery clamping diodes as used in No. 5 crossbar offices. A fuse operation does not affect the matrix circuits, unless battery transients are present.

10. TRAFFIC REGISTERS

10.01 Four message registers (peg-count meters) are provided as part of the ANI IV C Identifier. The function and operation of each register is as follows:

- ANI - Advances one count for each ANI call processed by identifier
- ANI FAIL - Advances one count each time identifier fails to identify the calling number (outpulses ANI fail indication)
- ONI - Advances one count for each call from number requiring ONI
- ISF - Advances one count each time trunk is seized where trunk fails to seize identifier (identifier seizure fail).