SENDER ATTACHMENT DELAY RECORDER 4A, 4M, AND CROSSBAR TANDEM OFFICES GENERAL DESCRIPTIVE INFORMATION

1. GENERAL

1.01 This practice describes the sender attachment delay recorder (SADR) and its function as a measuring facility in obtaining data on the delays encountered by trunks in securing senders. The SADR is arranged for use with the following systems: 4A Crossbar, 4M Crossbar, and Crossbar Tandem.

1.02 The sender attachment delay recorder is an automatic device which initiates test calls and measures the delays encountered in gaining access to senders. Registers are provided to record the delay data for each sender group and also to total the delay data for all groups of each type of sender (ie, for all DP senders, all MF senders, etc).

1.03 ***Recording:*** Data is recorded on pairs of registers, one pair being provided for each sender group or sender type. One register of each pair records the number of bids for a sender, in a particular group or type, placed by the SADR; the other register of each pair records the number of sender attachment delays that are longer than a preselected timing interval.

1.04 ***Operation Control:*** The SADR is started manually by first selecting a timing interval of either 3 or 7 seconds by means of the 3S-7S key and then operating the sender attachment delay (SAD) key. Operation will continue until the SAD key is restored to normal. If an automatic program of operation is desired, the SADR may be controlled by the traffic usage recorder program timer.

1.05 ***Lead Connections:*** A crossbar switch is used as a connector to extend the necessary leads toward each sender link frame. Each crosspoint on the switch is connected to a vacant termination on a sender link frame.

1.06 ***Capacity:*** A maximum of 100 (or, optionally, 200) sender link frames may be scanned by the sender attachment delay recorder.

1.07 ***Scanning Cycle:*** All sender link frames to which the SADR has access are scanned automatically. A programmed timer causes each utilized crosspoint on the crossbar scan switch to close in numerical sequence placing bids for senders. The time required to close one crosspoint, making a single bid for a sender, is a scanning (or timing) interval. A scanning cycle is defined as the sum of all scanning intervals necessary to scan all assigned sender link frames once.

2. OPERATING PRINCIPLES

2.01 The SADR records delays per sender group and per sender type (3 max); by initiating test calls. A test call involves the SADR placing a bid for a sender through its assigned appearance on a sender link frame and, simultaneously, starting to measure a 3- or 7-second interval. A delay is scored if a sender has not been connected by the end of the 3- or 7-second interval. The number of test calls placed and the number of delays scored are accumulated for each sender group and for each sender type. At the end of any period of time, the proportion of delays for a sender group or sender type can be determined by dividing the number of delays recorded by the number of calls placed.

3. EQUIPMENT ELEMENTS

3.01 The sender attachment delay recorder is a relay rack-mounted unit.

3.02 This unit consists basically of one 100-point crossbar switch, approximately 50 wire spring relays, a synchronous-type timer, two 22-point rotary selectors, and several keys and lamps. A second crossbar switch is added when more than 100 sender link frame terminations are required. Fig. 1 shows a simplified schematic of the SADR.

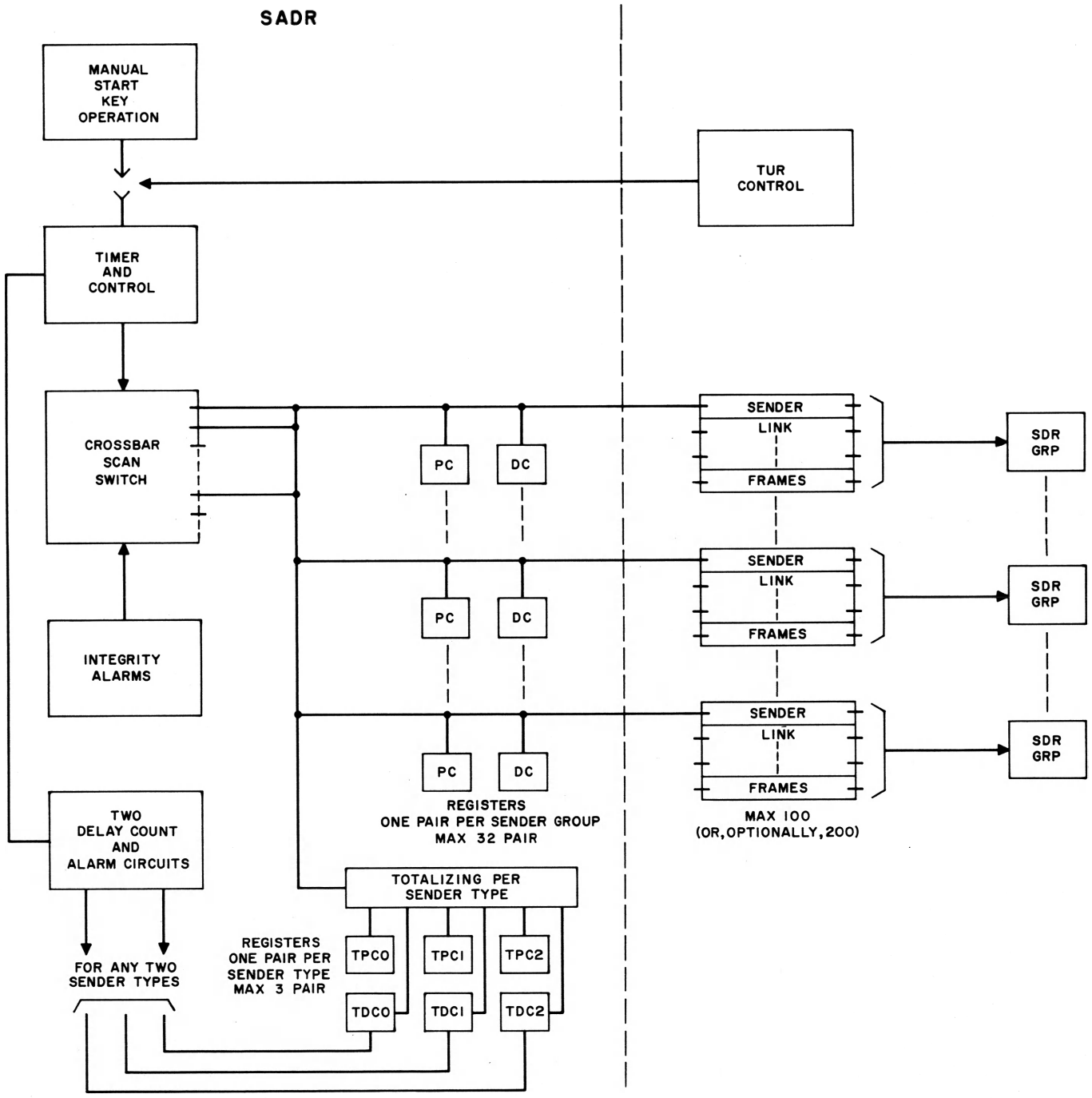

Fig. 1 — Sender Attachment Delay Recorder

3.03 Keys are provided for starting the operation and selecting the 3- or 7-second delay interval.

3.04 Keys also are provided on the equipment unit for convenience in starting the operation for maintenance purposes, for repeated testing on a particular sender link frame, and for manually advancing the crosspoint sequence to any desired location.

3.05 Two delay alarm circuits, each of which contains two delay alarm switches, are provided. The delay alarm switches are 10-position manually-set rotary switches used to establish the number of 3- or 7-second delays required to initiate a delay alarm. A set of tens and units switches for each alarm circuit permits them to be set independently for any number of counts from 1 to 43. Each delay alarm circuit is assigned to a sender type.

3.06 Peg count registers are provided on a sender group (PC) and on a totalized sender type (TPC) basis to record the number of calls initiated by the measuring device.

3.07 Delay count registers are similarly provided on a sender group (DC) and on a totalized sender type (TDC) basis to record the number of sender attachment delays in excess of 3 or 7 seconds.

3.08 A maximum of 32 sets of PC and DC registers and three sets of TPC and TDC registers may be furnished.

4. METHOD OF OPERATION

4.01 The sender attachment delay recorder simulates a trunk placing a bid for a sender by operating each crosspoint of the crossbar switch in turn and through it connecting to a vacant termination on each sender link frame in turn. The calls will be initiated every 4 or 8 seconds, depending on the timing interval selected. A 100-crosspoint, 6-wire crossbar switch with associated steering circuits, which steer the switch through successive crosspoints, serves as a scanning device.

4.02 For multitype sender link frames, two crosspoints of the scanning switch are assigned to each sender attachment delay recorder appearance on the sender link frames; on all other sender link frames one crosspoint is assigned per sender attachment delay recorder appearance. In No. 4-type crossbar offices, only one vacated trunk position is assigned to the circuit in any one sender link frame. In crossbar tandem offices, two trunk positions must be vacated when it is desired to measure delays for both types of senders in a multitype sender link frame.

4.03 When the recorder is placed in operation, select and hold magnet steering relays cause the crosspoints to be closed progressively from 00 to 99 at 4-second intervals when testing for 3-second delays and at 8-second intervals when testing for 7-second delays. When less than the full 100 crosspoints are utilized, the circuit automatically resets after the last assigned crosspoint is tested and begins a new cycle at 00. When more than 100 terminations are required, a second crossbar switch is provided and the cycle is extended to include the assigned crosspoints on both switches.

4.04 The closure of a crosspoint causes a bid for a sender and requires one scanning interval of 4 or 8 seconds duration.

4.05 Each 4- or 8-second interval is divided into three parts. The first 3 or 7 seconds are used to initiate and time the sender bid. The next 0.5 seconds are used to score this attempt on the count of tests initiated and to register the resulting sender attachment delay, if any. The final 0.5 seconds are used to advance the steering circuits in preparation for closing the next crosspoint.

4.06 At the end of each 3- or 7-second interval, one count is scored on a PC register, which records the number of tests started on a sender group. If a sender has not yet been connected at this time, one count also is scored on a DC register, which accumulates the count of delays encountered exceeding 3 or 7 seconds.

4.07 Total test calls and total delays per type of sender are accumulated on TPC and TDC registers, respectively. Three pairs of TPC-TDC registers are provided for three types of senders.

4.08 Circuit operation is initiated by operation of two keys. A choice of timing interval, 3 or 7 seconds, is first made by operation of the 3S-7S key provided for this purpose. Subsequent operation of the SAD key will start operation. Both of these keys are in the same location, either the operating room or traffic administrative quarters. Once started, the circuit will continue operating until the SAD key is restored to normal, at which time the scanning cycle in progress will continue until the last sender link frame has been scanned. Operation also may be initiated for maintenance testing by means of a START key, which is located on the sender attachment delay recorder relay equipment frame, and a 3S-7S key.

4.09 Each 3- or 7-second delay encountered during one cycle on the particular type of sender assigned to one of the alarm circuits will be counted by advancing an associated rotary selector one step. If the total count on one cycle reaches the number set on the tens and units switches, the alarm lamp will be lighted at the maintenance and traffic administrative centers. The counting circuit will be reset to zero at the end of each cycle, but the alarm will remain lighted until some subsequent cycle is completed with fewer than the preset number of delays encountered.

4.10 Successive test calls on the same sender group are avoided by spreading the terminations for a particular sender group evenly throughout the test cycle. This is achieved by providing a cross-connection field on the recorder unit which permits the flexible association of sender link frame terminations and SADR crosspoints.

5. TESTING FEATURES

5.01 Four integrity alarm circuits are provided to check the operation of the recorder. If the recorder fails to function properly, the ON lamp on the relay equipment frame and the SAD lamp in traffic quarters flash. The four alarm circuits are described in 5.02 through 5.05.

5.02 The start alarm circuit monitors the start lead continuity into the sender link frame during maintenance operation of the recorder. This test in canceled during regular operation because the start lead may appear open for short periods as a normal traffic condition. The start alarm also is operated if the sender attachment leads failed to clear prior to the initiation of a new sender bid.

5.03 The synchronization alarm will operate as an indication that the synchronizing relays failed to operate in proper sequence.

5.04 The select steering alarm circuit checks that the select magnet steering relays operate in the proper sequence, which requires that two and only two numerically consecutive steering relays be operated during each 0.5-second registration period. The failure of a select magnet to function when its operate path is completed by the steering circuit also is recognized by the alarm circuit.

5.05 The hold steering alarm circuit is similar to the select steering alarm circuit in providing corresponding checks on the hold magnet operation.

5.06 All four alarms operate a common circuit-block relay which prevents the steering circuits from advancing beyond the crosspoint on which the alarm was initiated. Normal operation may be restored, after the condition which caused the alarm has been corrected, by operation of the ALARM RELEASE key, which is located on the equipment frame.

5.07 Manual testing of the sender attachment delay recorder may be made by means of the REPEAT key and ADVANCE CROSSPOINTS key, both of which are located on the equipment frame.

5.08 The REPEAT key, when operated, will prevent the scanning circuits from advancing beyond the crosspoint which is closed at the time the key is operated. When the REPEAT key is restored, normal operation will resume.

5.09 The ADVANCE CROSSPOINTS key is used in conjunction with the operated REPEAT key to manually advance the scan crosspoint sequence, one step at a time, to any desired location for maintenance purposes.