SWITCHING SYSTEMS MANAGEMENT

CROSSBAR TANDEM

TRAFFIC MEASUREMENTS—GENERAL DESCRIPTION

CONTENTS PAGE

1. GENERAL

1.01 This section is intended to give the machine administrator and the network manager an understanding of the different types of traffic registers available in Crossbar Tandem Switching Systems. It also covers the importance of traffic measurements in assuring effective utilization of the switching equipment and trunks.

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

1.03 The title for each figure includes a number(s) in parentheses which identifies the paragraph(s) in which the figure is referenced.

1.04 This section covers the various classes of traffic measurements recorded on crossbar tandem mechanical registers such as overflow peg

count, group-busy, group-busy time duration, delay, usage, load meters, and pen recorders.

2. NEED FOR TRAFFIC MEASUREMENTS

2.01 Technological advances in toll switching equipment to meet the increasing demand for telephone service have united the nation into a single interconnected and interdependent network. This network includes the collective total of the switching machines and trunk circuits used to switch both customer direct distance dialed (DDD) and operator handled calls. Along with these technical advances and the demand for additional switching equipment came new service problems and increased customer dialing which have resulted in decreased control over the traffic offered to the network. Information concerning traffic flow characteristics and conditions affecting customer service is made available in the crossbar tandem traffic measurement devices which include traffic registers and other load and service indicating devices.

2.02 To ensure the maximum flow of traffic in the tandem switcher under all conditions, traffic registers provide the means of obtaining data on various components of the switching machine. The data received from these traffic registers, when validated for reasonableness and when there is a clear understanding of the information recorded, will be used for load balancing, equipment engineering, trunk engineering, service reports, and special studies. The information derived from traffic registers will assist the following groups:

Network Administration Group

(a) To keep the network administrator aware of the capabilities, limitations, and functions of the equipment administered and to constantly keep the network administrator alert to conditions affecting customer service.

(b) To ensure a balanced load of machine components when making assignments.

(c) To initiate corrective action when service is unsatisfactory.

(d) To keep management and other company groups informed of service conditions.

Network Design Group

(a) To provide accurate data for the design of equipment and trunk circuits to satisfactorily meet the current demands for communication services.

(b) To provide data for long range planning of equipment requirements and for management decisions concerning implementation of the long range plan and its economic considerations.

(c) To establish busy-hour patterns and data on other traffic-related components that may not fall within the busy pattern of the office.

Network Management Group

(a) To keep the network manager aware of the status of the network on a near real-time basis and ensure the early detection of impending overload conditions.

(b) To provide information to coordinate, initiate, and evaluate traffic controls, as required, to prevent or relieve traffic congestion.

(c) To initiate other activities which will improve the performance of the network, secure better utilization of facilities, and provide improved customer service.

(d) To keep system management informed of network conditions.

3. CROSSBAR TANDEM TRAFFIC REGISTERS

3.01 The traffic measurement capability in crossbar tandem switching machines is limited in flexibility when compared with the advanced software controlled traffic measurements systems such as the No. 4A/4M crossbar systems equipped with electronic translator systems (ETS) and the newer electronic switching system (ESS) machines. The traffic measurement capability of the crossbar tandem hardware (electromechanical) registers is similar to the hardware registers in non-ETS No. 4 crossbar offices.

3.02 The method of operation of the various crossbar tandem traffic registers and the basis for providing these registers is described in this section and in DFMP, Division H, Section 12e(2), Traffic Measurements Register Operation.

A knowledge of this information, particularly the method of operation, is a prerequisite to good data analysis and sound administrative techniques. Attempts to analyze traffic data without this knowledge will frequently lead to erroneous conclusions. Thus, a thorough study of this section should be made by all personnel who are responsible for analysis of traffic register data.

3.03 All of the traffic registers used in the crossbar tandem are either No. 14 (4-digit) or KS-16493 magnetic counters (5-digit). In addition, the KS-15947 electronic counting device, commonly known as a totalizer, may be used in conjunction with the above registers. The totalizer provides a total count of events occurring to a maximum of 120 different points within the crossbar tandem. Since the totalizer scores once for each 10 counts received, the register reading must be multiplied by 10.

3.04 Some crossbar tandems also have multiples of frequently read registers (eg, marker peg count, SADR, major circuit group) on resettable registers (KS-19798) located outside of the camera fields. These registers facilitate data gathering because they can be reset to "0000" after each reading thus eliminating the need for making subtractions.

3.05 Traffic registers are used to measure various occurrences or conditions in the crossbar tandem. The following are the kinds of data which registers normally furnish:

- ***Peg Count:*** The usual connotation of the term "peg count" is the seizure of a piece of equipment. It is important to note that marker peg count is scored when an outgoing trunk is seized on both first and second trials.

- ***Overflow:*** Scores when a call finds all trunks in a group (or channels in the case of link frames) busy.

- ***Group Busy:*** Scores once every 1.3 seconds when associated groups of equipment are in use.

- ***Usage—Common Control Equipment:*** Crossbar tandem common control equipment usage is measured with two registers; one register reads total usage (traffic plus maintenance) while another register reads maintenance only. Thus, traffic usage is derived by subtracting the maintenance usage from the total usage.

  (a) Equipment components having holding times of less than 10 seconds (eg, marker, transverters) are connected to the traffic usage recorder (TUR) in such a manner that they will be "scanned" by the TUR at the 10-second (fast scan) rate. When measured in this manner, the resultant register readings must have the decimal point moved one place to the left in order to read usage in hundred call seconds (CCS).

  (b) Maintenance usage, as well as the usage on any equipment item having a holding time greater than 10 seconds, is measured at the 100-second (slow scan) rate and the register readings are made directly in CCS.

  (c) An adequate analysis of usage data requires a knowledge on scan rates, the interrelationship of maintenance to traffic usage holding time limits and, in the case of mechanized programs, how the program utilizes the data in producing the end product.

- ***Sample Usage—Link Frame.*** Because the cost of measuring the total usage on trunk and office link frames would be prohibitive, four of the twenty links on each switch are measured and total usage is computed. Register grouping keys may be used to reduce register requirements by permitting reading of trunk link and office link frame usage on the same registers.

- ***Usage—Trunks.*** Only total usage, which includes trunks plugged busy, is provided on 2-way and 1-way trunks. Incoming trunks (CAMA, intertoll, tandem, etc) do ***not*** score plugged busy usage because they are associated with open busy detectors.

3.06 Additional detailed information which outlines the recommended basis for providing traffic registers for crossbar tandems and explains why each of these registers scores can be found in Part 6 of this section and in Dial Facilities Management Practice (DFMP) Division H, Section 12e(2), Crossbar Tandem Traffic Measurements Register Operation.

4. TRAFFIC REGISTER EQUIPMENT COMPONENTS

A. Traffic Register Racks and Cabinets

4.01 The registers, magnetic counters, control keys, patching jacks, meters, camera power receptacles, and camera control relays are located on the traffic register racks or in cabinets.

4.02 The traffic register rack or the floor-supported traffic register cabinet will accommodate 300 No. 14 registers and the wall-supported cabinet will accommodate 90 No. 14 registers. When magnetic counters are mixed with the No. 14 registers, the capacity for No. 14 registers is reduced in proportion to the mounting spaces occupied by the magnetic counters.

B. Traffic Register Relay Rack

4.03 The registers and alarm relays, battery supply relays, meters, and test jacks are located on the traffic register relay rack. The relay circuits are used to connect the various circuits to be studied in the crossbar tandem to the associated registers.

C. Traffic Register Distributing Frame

4.04 The traffic register distributing frame provides a cross-connecting point which allows flexibility in associating registers and register relay circuits to meet traffic requirements.

D. Traffic Register Types

4.05 Mechanical traffic registers provide a means of obtaining data on various components of the crossbar tandem office.

(a) ***No. 14***—This register can be employed whenever the number of counts of any one item or group of items will not exceed 9999 during the reading period.

(b) ***KS-19798 L1 (Resettable)***—This register can be used in place of the No. 14 register to eliminate the need for subtracting the previous reading from the present reading. This register can be manually set to 0 after each reading.

(c) ***KS-16493***—This register is used when the capacity of the No. 14 register is exceeded. This register will record up to 99,999 counts.

(d) ***KS-15947 Totalizer Circuit***—The totalizer circuit is an electronic counting device which will provide on one traffic register the total count accumulated by many individual traffic registers. This register will be incremented by one for every ten inputs to this circuit.

E. Traffic Register Camera

4.06 The KS-14776 camera is arranged for attachment to the traffic register relay rack and the floor-supported traffic register cabinet. Photographs can be taken automatically at desired intervals under control of the TUR frame or the traffic register camera control circuit. The camera can also be operated manually if desired.

5. CROSSBAR TANDEM TRAFFIC MEASUREMENT EQUIPMENT

A. General

5.01 Various facilities are provided to give load measurement on circuit groups, common control and other crossbar tandem equipment. Sender attachment delay recorders (SADRs), pen recorders and traffic usage recorders (TURs) are available. These facilities are the same as used in No. 4 crossbar offices and are covered in detail in this section. The crossbar tandem may also be provided with sender load registers and load meter registers to give measured load on sender groups.

B. Traffic Registers

5.02 Traffic registers are described in detail in Part 3 and Part 6 of this section.

C. Traffic Usage Recorder

5.03 The traffic usage recorder (TUR), as shown in Fig. 1, scans numerous crossbar tandem office circuits once every 100 seconds or 36 scan cycles each hour. During this period, each circuit scanned is checked for busy, and if busy, the busy condition is recorded on the usage register shown in Fig. 2. Provision can be made to measure units of equipment on a 10-second scan basis. This arrangement is referred to as fast scan. Also, an alternate scan feature is optional to increase the TUR scan interval from 100-second to 200-second scan.

D. Detector Group Usage Register

5.04 The detector group usage (DGU) feature of the TUR permits the totalization of up to 300 usage leads on a single No. 14 traffic register. It is of particular value both as an administrative and engineering tool in that it provides a means of accumulating usage counts on a minimum of registers without affecting the simultaneous registration of individual group usage scorings. The detector group usage feature may be applied to incoming trunk link frames by train.

E. Sender Attachment Delay Recorder

5.05 In crossbar tandem offices, one sender attachment delay recorder (SADR) is provided per office. Its purpose is to sample the interval experienced by trunks in getting access to a sender and to record delays in excess of 3 or 7 seconds. The equipment will connect consecutively to each assigned sender link frame and will time for sender attachment exceeding a 3- or 7-second interval. When the last sender link frame has been tested, the equipment resets and starts a new cycle.

5.06 Two registers are provided for each sender group, where required, and for each type of sender. A peg count register is provided to record sender bids. A delay count register is provided to record the number of 3- or 7-second delays encountered.

F. Load Meter Equipment

5.07 A load meter is provided to give a quick check of loads being carried through various parts or selected components of the switching machine.

5.08 TUR registers give more accurate engineering and load balance data than load meter equipment. Most of the load meters provided on earlier crossbar tandem installations are now rated "manufacture discontinued" and are not recommended for new installations. The load meters that may be found at crossbar tandem locations are as follows:

(a) ***"Recording Ammeter":*** This load meter uses a pen tracing on a circular chart to record the load fluctuations on trunk link frames or sender groups.

(b) ***"Train Load Meter":*** These load meters are permanently associated with some of the incoming trunk link frames of each train. These meters are graphic recording devices which indicate the total train load on a continuously moving tape in terms of percent of engineered trunk link frame capacity.

(c) ***"Instantaneous Ammeter":*** This load meter secures readings of the loads on the trunk link frames or sender groups on a patching basis.

G. Pen Recorder

5.09 Most crossbar tandem offices are provided with Esterline-Angus 20-pen recorders. These recorders are portable types, used by the network administrator to secure holding time data on common control equipment, as well as to indicate equipment reactions not otherwise disclosed. The 20-pen recorder is also used by the Network Manager to record current machine and network performance data. Peg count, overflow, SADR delay, or other mechanical registers can be connected to pens. Lamps such as short sender timing, SADR alarm, or all-senders-busy may also be connected.

6. CROSSBAR TANDEM REGISTERS AND METHOD OF OPERATION

6.01 The following paragraphs outline the recommended basis for providing traffic registers for crossbar tandems and explain what causes each of these registers to score.

A. Common Control Equipment Registers

Marker

Total Marker Peg Count—One register per marker. Scored by marker after marker connector release provided a trunk on the office link frame has been selected, whether or not an idle channel is available. Scores on all trial calls, but not on test calls.

Total Marker Usage—One register per marker. Scores total usage for each marker, including maintenance usage on fast scan (10 second) basis. The sum of these registers is divided by 10 to convert to CCS.

Marker Maintenance Usage—One register per office. Scores test frame and plugged busy maintenance usage on slow scan (100 second) basis. Usage in CCS is read directly from this register.

Note: Total Traffic Usage is total marker usage minus maintenance usage.

Foreign Area Translator

Foreign Area Translator Peg Count—One register per pair or translator frames for each foreign area which requires six digit translation. Scores each time an area relay is operated, calling in the associated foreign area translator. Scores on both first and second trials.

Sender

MF Sender Peg Count—One register per trunk link frame. Scores each time a connection is established through an idle channel between an incoming MF trunk and any outgoing trunk on both first and second trials. This item is also part of trunk link frame peg count.

DP Sender Peg Count—One register per trunk link frame. Scores each time a connection is established through an idle channel between an incoming DP trunk and any outgoing trunk on both first and second trial. This item is also part of trunk link frame peg count.

Total MF Sender Usage—One register per subgroup of 25 senders. Scores total usage, including maintenance, for each subgroup, on fast scan basis. These registers are provided on a one per 25 senders basis in order to stay within the digit capacity of a No. 14 register for fast scan items. Results must be divided by 10 to convert to CCS.

Total DP Sender Usage—One register per group of DP senders. Scores total usage, including maintenance, for each group, on a slow scan basis. These registers are provided on a one per group of 80 senders basis because the volume of numerals required to be registered on slow scan items is less than on fast scan items, and thus more DP senders may be scored on one register. Results are read directly in CCS.

MF Sender Maintenance Usage—One register per office. Scores test frame and plugged busy maintenance usage on slow scan basis. Results are read directly in CCS.

DP Sender Maintenance Usage—One register per office. Scores test frame and plugged busy maintenance usage on slow scan basis. Results are read directly in CCS.

MF Sender Partial Digits Peg Count—One register per group of MF senders. Scored by the sender each time the operator's keyset start key is depressed before the sender receives the required number of digits. This is a "Partial Digits" condition for non-universal type (Non-DDD) senders, such as SD-25978-01. Registers for MF universal type senders (used by both CAMA and non-CAMA type traffic), such as SD-27024-01, score each time the sender times out while awaiting complete registration of digits. Locations employing only universal type senders for both MF and DP operation may provide only one register, if desired, for the total combined scoring of both MF and DP partial digits. However, in locations where all CAMA traffic is DP, it may be helpful to maintain DP registrations on a separated basis.

Awaiting Registration Peg Count—MF Senders—One register per group of MF senders. Scores the number of times an MF sender times out after the first digit is registered but fails to get complete registration.

DP Senders Partial Digits Peg Count—One register per group of DP senders. Scored by the sender each time the sender times out while awaiting complete registration of digits. This is a partial digit condition for DP universal type senders (used by both CAMA and non-CAMA traffic), such as SD-25999-01.

Note: Locations employing only universal type senders for both MF and DP operation

may provide only one register, if desired, for the total combined scoring of both MF and DP partial digits.

MF Sender Permanent Signal Peg Count—One register per group of MF senders. Scores each time a sender is seized, but receives no digits and times out (20 to 36 seconds). Scored by the sender.

MF Sender Group Busy Peg Count—One register per group of MF senders. Scores initially when all senders in a group are busy and continues to make subsequent scorings at 1.3 second intervals for the duration of the group busy condition.

DP Sender Group Busy Peg Count—One register per group of DP senders. Scores initially when all senders in a group are busy and continues to make subsequent scorings at 1.3 second intervals for the duration of the group busy condition.

Stuck Sender Peg Count—One register for each sender (incoming—outgoing) combination (MF, DP, RP). Scores when sender times out waiting for distant office. Does not score when originating office senders are in reduced timing. With priming keys operated on master test frame, an alarm will identify the stuck sender. This feature is for plant maintenance purposes.

Intersender Timing Control Peg Count—One register per office. Scores when the sender times out during the interval that reduced intersender timing is in effect.

DP and MF Sender Attachment Delay Recorder Total Peg Count—One register for each type of sender. Scores each time an attempt is made to seize a sender regardless of whether or not the sender is attached.

DP and MF Sender Attachment Delay Recorder Total Delay Count—One register for each type of sender. Scores each time a sender is not attached within three (or seven) seconds after the attempt is made.

B. Link Frame Registers

Trunk Link Frame

Trunk Link Frame Peg Count—One register for each trunk link frame for each type of sender. Scored on the trunk link frame by the marker when it establishes a connection through an idle channel between an incoming and an outgoing trunk. The marker peg count should always be greater than the trunk link frame peg count. (This is the same as MF and DP sender peg count; registers should not be duplicated.)

Trunk Link Frame Overflow—One register for each trunk link frame. Scores the number of times (per trunk link frame) the marker fails to find an idle channel between an incoming trunk and an idle outgoing trunk.

Second Failure to Match—One register for each office. Scores the number of times the marker, on a second trial basis, fails to find an idle channel between the incoming and outgoing trunks.

Percent Matching Loss—No registers provided since this is a derived figure.

Percent Matching Loss equals:

$$\frac{\text{2nd failure to match} \times 100}{\text{Mkr. P.C.} - \text{Total failures (O.L.F.Ofl.)}}$$

Sample Link Peg Count—One register per marker. Scores each time the marker establishes a connection between an incoming and an outgoing trunk over links 0 or 5 left and 2 or 7 right of each switch of a trunk link frame.

Total Link Peg Count—One per marker. Scores each time the marker establishes a connection between an incoming trunk and an outgoing trunk.

Sample Link Usage—One register per switch per trunk link frame. Records usage on links 0 and 5 left and 2 and 7 right of

each switch which are designated as "sample links." Through the use of the detector group usage (DGU) feature of the TUR, totalization of up to 300 leads may be used to score total sample link usage for the trunk link frames.

Total Trunk Link Frame Usage—No registers provided since this is derived figure. Usage is obtained by the following formula:

$$\frac{\text{Total link peg count x Total sample link usage}}{\text{Sample link peg count}}$$

Office Link Frame

Office Link Frame Peg Count—One register per pair of office link frames. Scores each time a marker seizes a pair of office link frames to look for an outgoing trunk, including all trial and test calls. When trunk group busy relays are provided, the marker will not seize the office link frames and score this register if all trunks in a group with a group busy relay assigned are in use.

Office Link Frame Overflow—One register per pair of office link frames. Scores each time the marker fails to find an idle channel between an incoming trunk and an idle outgoing trunk on all trials. Even after scoring on this register on first trial, a call may be completed on second trial. Thus, an office link frame overflow registration is not necessarily an indication that a call failed to complete. (See second failure to match register.)

Sample Link Usage—One register per switch per office link frame. Measures usage in the same fashion as described for trunk link frames. Registers associated with trunk link frames may be converted by means of a register grouping key to reflect the usage on office link frame switches.

C. CAMA Equipment Registers

Transverter

Transverter Peg Count—Two registers per transverter. One register will record operator number identified (ONI) calls and the other register will record automatic number identified (ANI) calls. The sum of these registers equals total transverter peg count. Scored upon seizure of billing indexer.

Total Transverter Usage—One register per transverter. Records total transverter usage, including maintenance at the 10-second (fast scan) rate.

Transverter Maintenance Usage—One register per transverter group. Records maintenance usage at the 100-second (slow scan) rate.

Incoming Register

Peg Count—One register per group of incoming registers. Scores when an incoming register is seized. In areas having the digit "1" as a DDD access code, a scoring would also be made each time an "11" service code (113, 114, etc) is dialed in a step-by-step office.

Group Busy Peg Count—One register per group of incoming registers. Scores each time all registers in the group are busy. Continues to make subsequent scorings at 1.3 second intervals for the duration of the group busy condition.

Partial Digits—One register per incoming register group. Scores each time a register times out when only one or two digits have been received.

Permanent Signal—One register per group of incoming registers. Scores each time a register is seized but times out before any digits are received.

No Sender Attached—One register per incoming register group. Scores number of times a sender is not attached to an incoming register by the time the third digit is registered in the incoming register.

Total Incoming Register Usage—One register per incoming register group. Records total usage, including maintenance, at the 10-second (fast scan) rate.

Incoming Register—One register for total incoming register groups. Records maintenance usage at the 100-second (slow scan) rate.

CAMA Position

CAMA Position Peg Count—One register per CAMA position. Scores each time the position is seized by a sender.

CAMA Position Disconnect—One register for each operating unit. Scored by the CAMA position circuit each time the CAMA operator depresses the position disconnect key to free the position. The operation of this key signals the sender to release the position link and position. The call is then routed to ROA.

No Position Attached Peg Count—One register per sender type. Scores the number of times a sender times out while awaiting connection to a CAMA position.

Wrong Calling Code Peg Count—One register per transverter group. Scores each time the billing indexer recognizes that the calling number keyed by the CAMA operator is a vacant office code, or a wrong calling office code (not in proper recorder group). The CAMA operator receives a reorder signal from the sender.

Match Check Peg Count—One register per transverter group. Scores the number of times the CAMA operator receives a reorder signal from the sender when the called office code instead of the calling office code is given by the customer. The match check is made by the billing indexer. Where match check equipment is not provided, these calls will be scored as described for wrong calling code.

CAMA Position—ATR—Three registers per office (D—N—S). Scores the number of calls observed (for speed of answer), the number of delays (over 5.5 seconds) and the number of calls timed. The calls are observed from the time the sender requests a CAMA position to the connection of a position.

D. Trunk Group Registers

Outgoing and 2-way Trunk Groups

Peg Count—One register per outgoing and 2-way trunk group. Records the number of attempts to seize a trunk out of the crossbar tandem, regardless of whether or not a trunk is available. (Peg count on incoming trunk groups is not available.)

Overflow—One register for each outgoing and 2-way group. Scored by the marker when testing for an idle trunk out of the crossbar tandem and finds all the trunks in the group are busy. (Overflow on incoming trunk groups is not available.)

Incoming, Outgoing and 2-Way Trunk Groups

Trunk Group Usage—One register per trunk group. Records total usage on trunk groups; intertoll, toll connecting, and toll completing.

WATS

Usage—One register per zone. Scores usage for each WATS zone.

Tone and Announcement Trunk Groups

FRA (Reorder Tone) Peg Count—One register per marker pair. Scores the number of calls routed to the reorder tone (120 IPM) trunk group when an all-trunk-busy condition is encountered.

FRA (Reorder Tone) Overflow—One register per marker pair. Scored by the marker when all reorder tone trunks are busy. Overflow of these trunks returns no audible sound, called a "high and dry" conditon.

Reorder Announcement (ROA) Peg Count—One register per marker pair. Scores the number of times a call is routed to the ROA trunk group for one of the following reasons:

(a) Sender time out (except for reduced intersender timing).

(b) Second failure to match.

(c) Marker and transverter second trial.

(d) Keypulsing irregularities.

Sender Overload (SOA) Peg Count—One register for the office. Scores the number of times a call is routed to the SOA trunk group. Calls are routed to SOA only when senders are in short time, i.e., waiting for senders at the distant office. Scored by the marker.

Vacant Code (VCA) Peg Count—One register for the office. Scores the number of times a call is routed to the VCA trunk group on an attempt by a customer or operator to a non-working NPA or NNX code.

No Circuit Announcement (NCA) Peg Count—One register per marker pair. Scores the number of times a call is routed to the NC-NCA-RO trunk group when a no circuit condition is encountered on a final intertoll or toll completing circuit group. In ring marker offices using three separate route advancing groups—NC (TONE), NCA, RO—the peg count register should be associated with the NC (TONE) group. (See NCA overflow.)

Misrouted Non-CAMA (MCA) Peg Count—One register for the office. Scores the number of times a call is routed to the MCA trunk group when a customer dials a DDD access code on a local call. Scored by the marker. Call may advance to the billing indexer if class switching is not done in the marker.

Unauthorized Code (UCA) Peg Count—One register for the office. Scores the number of times a call is routed to the UCA trunk group on an attempt by a customer or operator to an unauthorized code point.

ROA, SOA, VCA, MCA, UCA Overflow—One register for each group. Scored by the marker each time a call is offered to these announcement trunks and finds all trunks busy. Calls overflow to RO tone trunks.

NCA Overflow—One register per marker pair in ring marker offices using three separate route advancing groups—NC (TONE), NCA, RO. This register should be associated with the NCA group. (See NCA peg count.) This information cannot be secured in route relay marker offices.

WATS Announcement—One register for each office. Scores the number of times a call is routed to the WATS announcement when a WATS subscriber attempts to dial a code to which he/she does not have access.

E. Other Registers

Traffic Separation—One register per marker for each source-destination combination. Scores when the marker establishes a connection between an incoming trunk (having the proper source indication for the particular register) and an outgoing trunk (also having the destination indication for that register). Used for division of revenue purposes in measuring the amounts of interstate and intrastate traffic served by the tandem. Second trial and test calls do not score.

Directional Reservation Trigger—One register per DRE unit. Scores each time the DRE unit operates to restrict traffic.

Directional Reservation Timing—One register per DRE unit. Scores every 1.3 seconds during the interval in which the reservation equipment is triggered to restrict traffic.

Cycle Register—One register per field of 150 registers. This register operates in synchronism with the master cycle TUR register and indicates the number of TUR cycles included in the period of study. Thirty-six cycles scored on this register indicate a full hour of operation. Where grouping registers are included in the register field, more than one cycle register may be required.

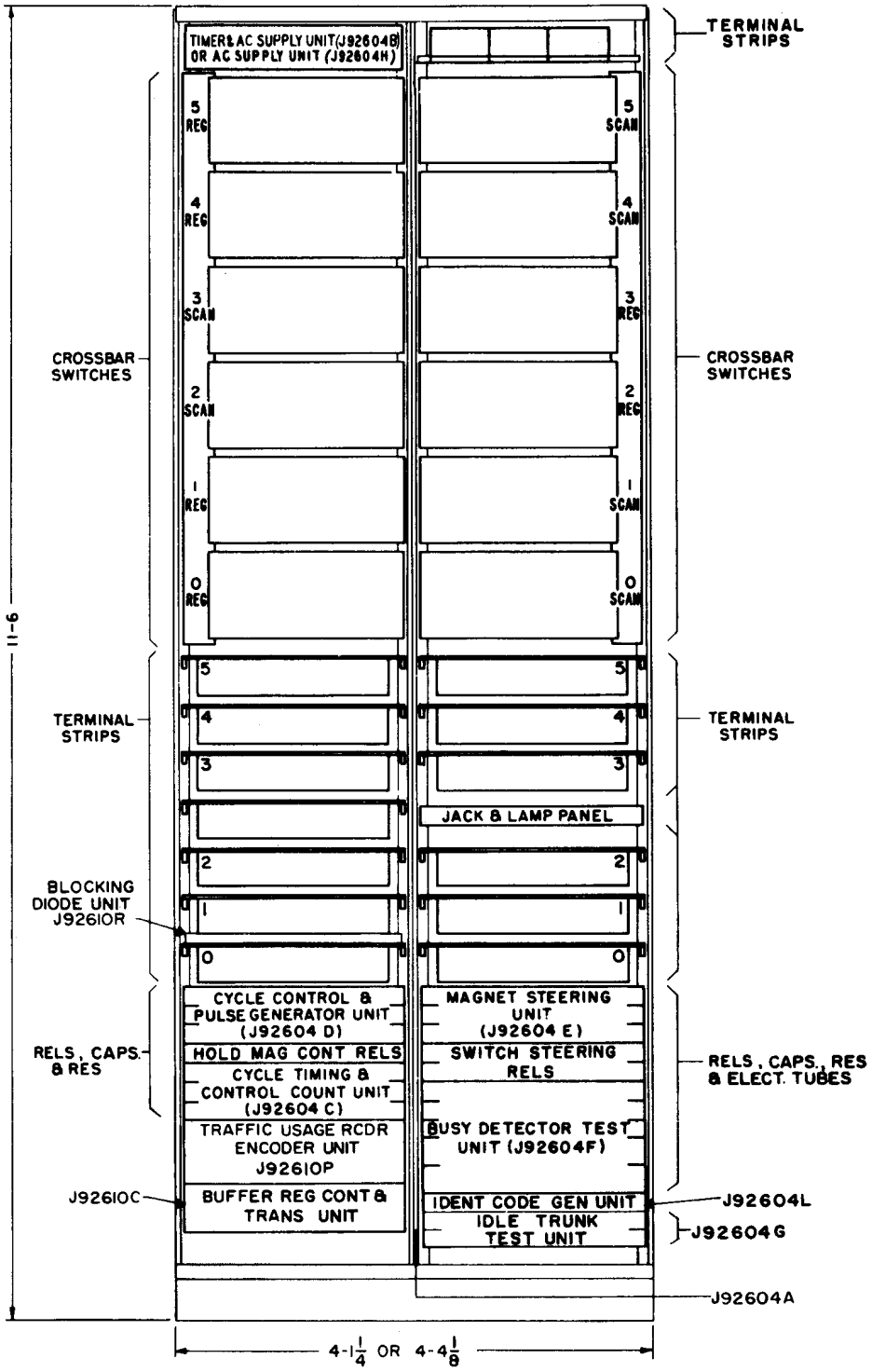

Fig. 1—Traffic Usage Recorder Frame (5.03)

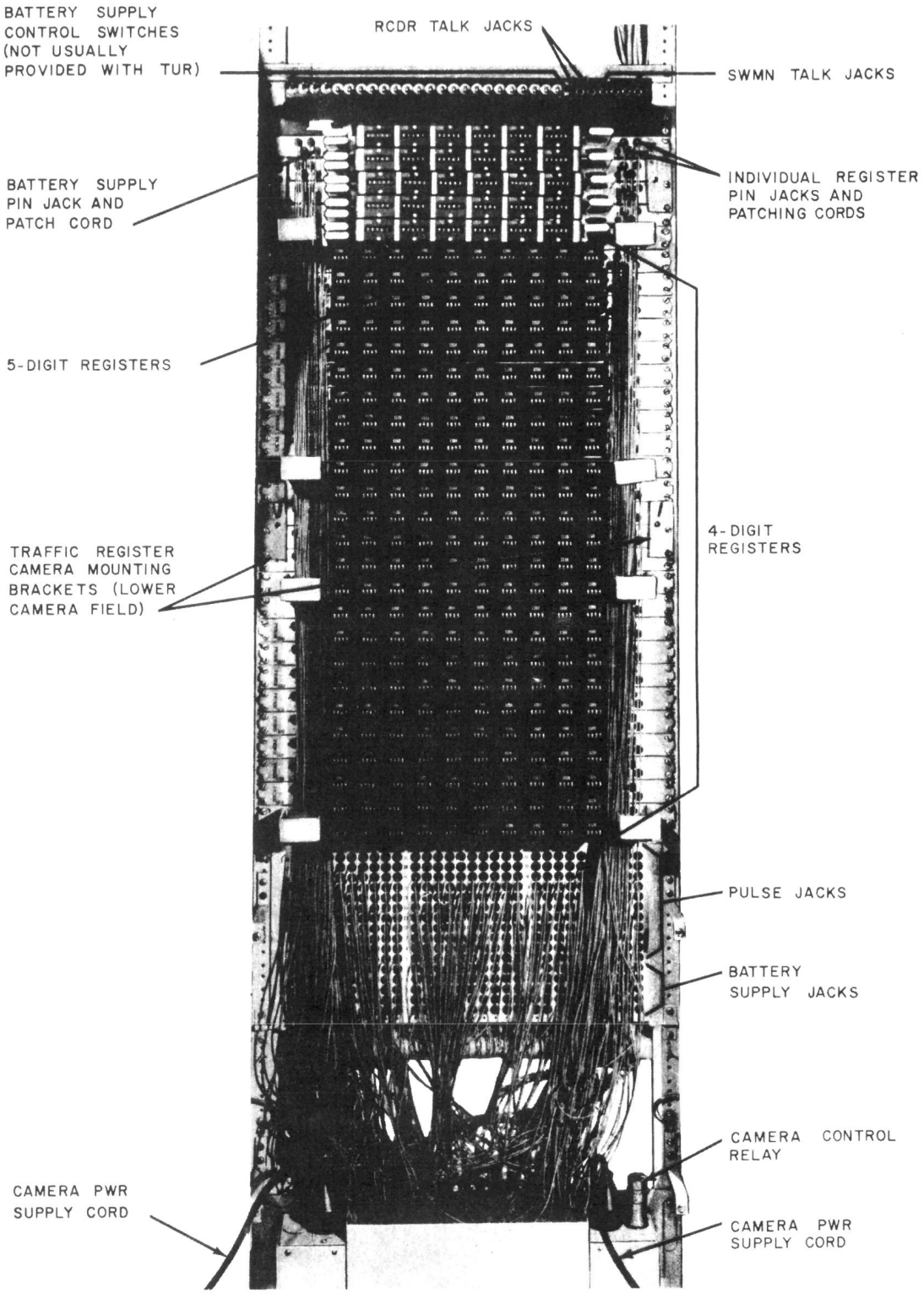

Fig. 2—TUR Register Cabinet (5.03)