SWITCHING SYSTEMS MANAGEMENT
NO. 5 CROSSBAR—2-WIRE
TRAFFIC MEASUREMENTS
GENERAL DESCRIPTION

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1. GENERAL

1.01 This section describes the various No. 5 crossbar (2-wire) traffic measurement facilities. The measured traffic data are required by such groups as Network Design, Network Administration, and Division of Revenue.

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

1.03 Traffic registers are used to record events and conditions (data) as traffic (calls) flows through an office or encounters delays or blockages. Traffic may be outgoing, incoming, tandem, or interoffice.

1.04 The various types of traffic registers are as follows:

(a) ***Peg Count***—Scores each seizure of an idle piece of equipment and each call offered to an outgoing trunk group.

(b) ***Overflow***—Scores each call which finds all trunks in a group busy, all channels busy or all common control equipment busy.

(c) ***Group Busy***—Scores when the last trunk in a group becomes busy. It does not indicate an overflow since a trunk in the group may become idle before the next call is offered. It counts the number of times an ***all trunks busy*** condition is reached.

(d) ***Group Busy Timing***—Scores once each predetermined time interval while all units of a component are busy.

(e) ***Load***—Scores when a predetermined number of circuits are found busy. For instance, this could indicate that eight out of ten circuits of a particular type are busy.

(f) ***Usage***—Measures the time that equipment and trunks are in use, expressed in hundred call seconds (CCS).

(1) ***Common Control Equipment***—This type of usage is normally measured with two registers; one for total usage (traffic plus maintenance) and the other for maintenance only.

(2) ***Sample Link Usage***—One register per link frame horizontal group. Measures usage on two sample links out of the ten in each line link frame (LLF) horizontal group and four sample links out of the ten in each trunk link frame (TLF) horizontal group.

(3) ***Trunk Usage***—Normally measured at the originating end on one register per trunk group. Measured usage excludes ***plug busy*** usage for most types of trunks, but trunk circuits will be modified selectively to measure total usage.

(4) ***Subscriber Line Usage***—Sufficient registers are provided to measure each subscriber line usage individually in any two horizontal groups on a flexible basis.

1.05 Division of Revenue separation studies are made in selected dial offices to determine the allocation of telephone company investment in dial central office equipment, subscriber plant (loop and station equipment) and exchange trunk plant with toll use. These studies entail the collection of various traffic measurement data to establish a distribution of the originating calls and total measured usage between toll, exchange, and other services such as Centrex-CO, Common Control Switching Arrangement (CCSA), and Western Union TWX. Originating call factors of the composite holding time are developed using annual volumes for each class of call and applied to annual volumes at nonsample offices in the same classification. Where exchange and/or toll switched traffic is served, separate factors are developed for that office. These data are then employed to develop study area holding times, which are used in conjunction with monthly call volumes to reconstruct the relative use of the subscriber plant and central office equipment for monthly settlements of interstate revenues among the Bell System companies.

2. TRAFFIC MEASUREMENT FACILITIES

A. General

2.01 Mechanized data recording and processing systems, such as the Traffic Data Recording System No. 1A (TDRS) and the more recent Engineering and Administrative Data Acquisition System (EADAS), were designed to replace the manual and photographic methods requiring traffic registers. These electronic, software controlled systems, when properly planned and used, will contribute to improved engineering and administrative procedures as follows:

(a) The cost of collecting data to meet present and future requirements is reduced.

(b) A greater amount of traffic data can be collected at a substantially lower cost per unit of data.

(c) The time required for data collection and analysis is reduced considerably.

(d) More reliable traffic data is provided.

2.02 Before traffic engineering any major installation of traffic registers, it is recommended that consideration be given to the use of EADAS. A description of the system appears in Division D, Section 4.

B. Traffic Registers

2.03 For simplicity of administration, traffic registers should be grouped together according to the kind of information being registered. To retain this grouping when the office grows, it is necessary to provide changeable cross connections between the registers and the scoring leads. The leads come from their associated relay units or directly from the equipment requiring registrations. Because the total number of registers required in different offices varies widely, it is necessary to provide facilities for mounting together either a

few registers or a large number of registers, both initially and ultimately.

2.04 The traffic register cabinet satisfies the foregoing requirements (Fig. 1). Three hundred 14-type registers may be provided in groups of ten on coded units. The 14-type registers are 4-digit counters used for scoring counts which do not exceed 10,000 per study period. On each unit mounting plate are ten registers, ten register pin jacks, and one battery supply jack. One end of each register winding is surface wired to its individual pin jack. The other ends of the ten registers are strapped together and connected to the battery supply pin jack on the unit. The register units are mounted on the same cabinet framework that contains a field of 330 ***pulse*** pin jacks to which leads are permanently connected from equipment requiring traffic registrations. By means of No. 26 cords, any traffic register pin jack can be patched to any pulse pin jack. Thus, any register can be connected to any equipment requiring traffic registrations.

2.05 The battery supply jack of each unit of ten registers may be patched to its related S, S1, or S2 jack in the supply field of 90 jacks. The S jacks (direct battery) are connected directly to fuses. The S1 and S2 jacks (controlled battery) are connected to fuses through relay contacts, the relays being under control of the cutoff switches S1 and S2 mounted at the top of the cabinet. This cutoff arrangement allows heavily used registers to be turned off during periods when readings are not being taken, thus prolonging the life of the registers. The S3 and S4 jacks are not used in No. 5 crossbar offices.

2.06 Where one traffic register cabinet will not accommodate all of the traffic registers associated with a marker group, two or more cabinet frameworks may be provided adjacent to each other. When so provided, it is suggested that at least ten ***pulse field*** pin jacks on each cabinet framework be designated and wired as common jacks. Then, if necessary, a traffic register in one cabinet may be associated with a working pulse field pin jack in another cabinet.

2.07 In place of a unit of ten 14-type registers, one or more units of 5-digit magnetic counters (KS-16493) may be mounted. Each unit mounting plate is arranged for six magnetic counters which are preferably mounted in the upper portion of the first traffic register cabinet. These registers are recommended for use in those peg count circuits that may score more than 10,000 counts during a given study period. A 4-digit register that scores more than 10,000 times per period may have its reading misinterpreted. A 5-digit register should be utilized in such cases.

2.08 To eliminate difficulties encountered in taking manual readings from traffic register cabinets equipped with cameras, provision has been made for a multiple appearance of a select group of registers. The multipled registers may be located in a wall supported traffic register cabinet. In offices equipped with a traffic usage recorder (TUR), these registers may have a multiple appearance on a TUR register bay.

2.09 When a switchboard or an automatic intercept system (AIS) No. 1 trunk concentrator is located in the same building with a No. 5 crossbar office, the various registers required to engineer and administer the switchboard or concentrator may be located in the traffic register cabinet provided for the central office equipment.

2.10 Each traffic register cabinet is equipped with a clock pulse register which operates once every 6 seconds. When read along with other registers, the scorings indicate the elapsed time between successive readings. This register is not required when traffic registers are photographed.

2.11 Traffic registers may be photographed automatically by means of the traffic register camera KS-14776. This provides an accurate and convenient means of obtaining data at precise intervals. It should be noted that computerized methods of collecting traffic data (such as EADAS) are available. Such methods reduce the error rate of the data gathering process considerably by eliminating a series of manual operations.

2.12 Some traffic registers presently installed in an office may no longer be required for traffic engineering or administration. This may be due to the addition of a TUR, the development of new registers, improved methods of traffic engineering, etc. Those registers which no longer serve a useful purpose may be reassigned to other functions in lieu of providing additional registers. A detailed description of each traffic register appears in Division H, Section 5e(2).

C. Traffic Usage Recorder

2.13 The standard usage measuring device for the No. 5 crossbar system is the No. 4A TUR. The TUR scans a maximum of 3600 circuits and flexibly accesses a maximum of 1200 usage registers to record the measured data. A detailed description of the No. 4A TUR is covered in Bell System Practices Section 984-503-100.

2.14 This section describes how usage is measured by the TUR and discusses in general concepts the categories of the usage measured. A description of the individual usage register appears in Division H, Section 5e(2).

Usage Measurement

2.15 Usage registers record the time equipment and trunks are in usage, expressed in hundred call seconds (CCS). The TUR is designed (a) to scan each circuit at one of two predetermined intervals, depending on the holding time of the particular circuit, and (b) to record the results on usage registers. Slow scan is used for those circuit items having a holding time of more than 10 seconds. Fast scan is used for those circuit items having a holding time of 10 seconds or less.

2.16 The slow scan interval is generally 100 seconds. At this rate, the traffic registers record usage directly in CCS. An optional alternate, a 200-second scan interval, is recommended, because it reduces TUR equipment wear. When the 200-second scan is utilized, the traffic register results must be multiplied by two to arrive at usage in terms of CCS.

2.17 The fast scan interval is generally 10 seconds, achieved by multipling the measured circuit items over 10 scan switch terminals, coincident with a slow scan interval of 100 seconds. Traffic register results must be divided by ten to arrive at usage in terms of CCS. An optional auxiliary scanner may be utilized for fast scan circuit items. Up to 380 items may be connected directly to the auxiliary scanner without consuming scan switch terminals on the 4A TUR. It should be noted that the auxiliary scanner can be utilized only with alternate, or 200-second, scan. This means that the fast scan interval (for the auxiliary scanner or the standard scan switch arrangement, whichever is provided) becomes 20 seconds and the traffic register results must be divided by five to arrive at usage in terms of CCS. The auxiliary scanner is recommended when it can be proven economically more attractive than the alternative method of placing fast scan circuit items on the scan switch terminals, which uses up ten terminals per item.

Register Grouping

2.18 Register grouping is an optional feature that reduces the quantity of usage registers required. For example, subscriber line usage and trunk link frame usage may be measured on the same group of registers, depending on the position of the register grouping (RG) key. It should be noted that with this arrangement, either subscriber line usage or trunk link frame usage (not both) is measured. For this reason, ***register grouping is not recommended because of inherent administrative problems and the possibility of missing some critical traffic engineering data.***

Usage Registers

2.19 ***Common Control Equipment Registers***— For measuring the usage of common control equipment, such as markers, transverters, senders, and registers, two leads per unit are normally provided. One lead measures the total usage and the other measures the maintenance usage. Traffic usage is obtained by subtracting the maintenance usage from the total usage. It is more precise to measure certain of these circuits having a holding time of 10 seconds or less at the fast scan rate. The leads indicating maintenance busy will always be measured at slow scan.

2.20 ***Sample Link Usage***—For measuring line link frame and horizontal group loads in the No. 5 crossbar system, provision has been made for connecting to only two links (No. 0 and 5) in each horizontal group of ten line links. Statistical theory indicates that (a) with normal engineered frame loads, these two links together afford approximately a 25 percent sample of the load carried by the whole group and (b) the correlation is sufficiently accurate to permit judging the rotative loading of groups or the frame to maintain satisfactory balance. For engineering purposes, however, since the total office load is desired with a relatively high degree of accuracy, the total load measured on the No. 0 and 5 links must be increased by the ratio of the number of calls completed to the number completed on all

channels to the number completed on channels No. 0 and 5. Total and sample channel peg count registers should be provided to obtain the data necessary for computing this ratio. The total office load (sample line link usage) is recorded on detector group usage (DGU) registers. By means of the DGU feature, the sample line link usage may be totalized, thereby eliminating the need to total the usage recorded on the individuul sample link registers. For example, two 5-digit DGU registers will record the total usage of 600 sample link registers. DGU does not ordinarily replace the recording of individual usage; it is supplementary to and occurs coincidently with the individual recordings. In those installations having register grouping, the DGU feature is a necessity. For example, total sample line link frame usage may be measured and recorded on the DGU registers when the position of the RG key prevents recording the individual horizontal group usage.

2.21 For measuring trunk link frame and horizontal group loads, provision has been made for connecting to four links (No. 0 and 5 left and No. 0 and 5 right) in each group of twenty. The horizontal group registers provide for load balancing, while the DGU registers record the total sample trunk frame usage. The DGU registers (a) may be used to verify the total line link frame sample link usage (it should be within 2 percent) or (b) may be used as engineering data when line link frame data are invalid.

2.22 ***Subscriber Line Usage (SLU)***—Facilities may be provided for temporarily connecting on a flexible basis to all subscriber lines in an office, in limited groups, so that the total usage of each line can be recorded individually. Usage leads for this purpose are cabled to jacks on the line link frame bays with access to the line circuit sleeve leads. Cords equipped with contacting devices can be used to connect the usage leads to the desired lines. Usually, 100 leads are cabled—50 each to all the odd and even line link frames in a multiple arrangement. In this way, any 50 lines on each of two horizontal groups (one on an odd frame and one on an even frame) may be measured simultaneously.

2.23 The same multiple of leads used for subscriber line usage measurements may be multipled to jacks on other frames so that temporary connections may be established to miscellaneous circuits, or multiconductor extension cords may be provided to reach equipment frames on relay racks containing circuits which will be measured too infrequently to justify permanent connections to a TUR.

2.24 ***Trunk Usage***—The Network Design engineer and the network administrator should be familiar with the trunk tables described in Bell System Practices Section 819-600-150. These tables, which are used in the preparation of the equipment order (traffic order), are also a valuable reference for trunk administration and engineering. The type of designation (1C6, etc) and the SD drawing number are listed for every No. 5 crossbar trunk. Each trunk on which usage can be measured is identified simply by having a TUR note.

2.25 Generally, trunk circuits used in local office operation are wired to exclude plug-busy usage; however, it has been recommended that total usage be measured on all trunks with the exception of those that are usage sensitive with regard to customer tariffs, such as CCSA and centrex trunks. Until all trunk types are modified, the measured usage of a particular trunk group may be total (including plug-busy) or traffic (excluding plug busy). To verify this, reference is made to the latest issue off the proper SD drawing, and the equipment then is tested for agreement.

2.26 One register is provided for each group of trunks to be measured. Generally, trunk usage is measured at the outgoing end; but where warranted, it can be measured at the incoming end.

D. Traffic Totalizer KS-15947

2.27 Provision is made for connections to the KS-15947 traffic totalizer. This electronic unit is capable of receiving peg counts from a maximum of 340 sources and totalizing them on a single traffic register. The individual peg count registers are usually provided so that an accuracy check of the totalizer may be made periodically. The totalizer reduces work operations in the data gathering process, but its capital and maintenance costs should be carefully considered before ordering. The totalizer peg count register is provided on the basis of one register per totalizer circuit and may be either a 14-type or a 5-digit type register, as required. This register is scored by the KS-15947 totalizer circuit over the TR lead and records the total peg count generated on a multiplicity of peg

count leads (for example, the total peg count of markers or trunks). The totalizer peg counter register is described in Division H, Section 5e(2).

E. Traffic Register Translator

2.28 The traffic register translator circuit (SD-27616-01) should be provided when centrex customer group traffic data are required. This circuit connects between a marker circuit and the traffic register circuit to translate marker information into traffic register data for centrex customer group traffic studies. Eleven types of calls may be recorded for traffic studies of each centrex customer group. Eleven traffic registers are therefore required to record the traffic of each customer group under study on a peg per type of call basis. This circuit allows a maximum of any ten customer groups in one marker group to be studied simultaneously.

2.29 The traffic register data are derived when the marker circuit is processing a call. If the originating or terminating class of service number of the call being processed is that of a centrex customer group selected for study, this circuit directs the type of call information to peg the proper traffic register of that customer group.

2.30 Each marker circuit requires a separate translator circuit and the outputs of these translators multiple to the traffic register circuit. A complete description of the registers scored by this circuit appears in Division H, Section 5e(2).

F. Answering Time Recorder (ATR)

2.31 The ATR is used to measure the grade of service at a switchboard or console. It is designed to automatically measure the operator answering time and record the results on traffic registers. The registers record the total number of calls in a given group of lines or trunks associated with the ATR and the number of these calls that are not answered by the operator in a predetermined time interval. A traffic weighting applique circuit may be provided that will also count the number of calls actually timed by the ATR. A description of these registers appears in Division H, Section 5e(2).

G. Dial Tone Speed Machine

2.32 The dial tone speed machine is a supplemental device designed specifically to make sample dial tone tests, recording the number of tests made and the number of delays encountered. A delay is scored when dial tone is not received within 3 seconds. One test and one delay register are required per loading divison for which separate dial tone speed measurements are desired. These registers record data from which the "percent of calls not receiving dial tone within 3 seconds" is calculated. Not only are these data an important service indicator, but also an important check of the adequacy of dial tone markers and originating registers. The dial tone tone speed measuring equipment is covered in Division H, Section 1d.

3. PLANT REGISTERS

3.01 Registers and counters are provided for the use of the plant force in trouble analysis and central office administration. On occasion these plant registers may assist the Network Design engineer who is investigating missed load service objectives or problems of equipment utilization. The following list of plant registers is not all inclusive; rather, it includes registers considered as basic for a typical local office equipped with AMA (paper tape), a master test frame, and features for coin service operation. Plant registers are included in this section as a general reference and ***should not*** be included in the traffic order.

(a) ***Combined or Completing Marker Calls (TPC Register)***—Scores on each marker seizure.

(b) ***Combined or Completing Marker First Trial Failure (MTR Register)***—Scores each time trouble is encountered on first trial calls excepting party mismatch, permanent signal, ground, loop or continuity test failures, and test calls.

(c) ***Combined or Completing Marker Second Trial Failure (CMST Register)***—Scores each time trouble is encountered on second trial calls excepting party mismatch, permanent signal, ground, loop or continuity test failure, and test calls.

(d) ***Dial Tone Marker Calls (DTPC Register)***—Scores each time a combined or dial tone marker is seized on a dial tone call.

(e) ***Dial Tone Marker First Trial Failure (DMTR Register)***—Scores each time trouble is encountered on first trial calls excepting continuity test failures and test calls.

(f) ***Dial Tone Marker Second Trial Failure (DMST Register)***—Scores each time trouble is encountered on second trial calls excepting continuity test failures and test calls.

(g) ***Incoming Register Calls (TRPC Register)***—Scores the number of incoming register seizures. Each type (MF, RP, DP, etc) has a separate register.

(h) ***Incoming Register Link Release (LR Register)***—Scores each time a trouble develops on a service call in the incoming register link causing the combined or completing marker to release the call.

(i) ***Outgoing Sender Group Calls (OSG Register)***—Scores when a combined or completing marker selects a sender in a particular group on a service call. Each group has a separate register.

(j) Sender Time-Out Hand Trunk Guard Test Failure ("SS" Stuck Sender Register)—Scores when a sender within a group fails to complete its functions within its allotted operating time (all calls) or detects trunk guard test failure on a service call. Each group has a separate register.

(k) ***Pretranslator First Trial Failure (PTR Register)***—Scores when the pretranslator encounters trouble on first trial calls.

(l) ***Pretranslator Second Trial Failure (PST Register)***—Scores when the pretranslator encounters trouble on second trial calls.

(m) ***AMA Recorder Calls (REC PC Register)***—Scores when the AMA recorder is seized for use.

(n) ***AMA Recorder Trouble Entry (RTR Register)***—Scores when the AMA recorder is unable to complete its functions within an allotted time interval following a request for a trouble record card at the master test frame (MTF).

(o) ***LAMA Transverter Calls (TVPC Register)***—Scores when service call encounters trouble on a first trial basis and a trouble record is requested before disconnect.

(p) ***AMA Transverter First Trial Failure*** **(TTR Register)**—Scores when a service call encounters trouble on a first trial basis and a trouble record is requested before disconnect.

(q) ***AMA Transverter Second Trial Failure (TST Register)***—Scores when a service call encounters trouble on a second trial basis and a trouble record is requested before disconnect.

(r) ***AMA 2-Line Entry Peg Count (2LLPC Register)***—Scores on all AMA calls, other than message billing index 9 calls, resulting in a 2-line AMA recorder entry.

(s) ***AMA Bulk Billing Trouble (LBBF Register)***—Scores on all AMA calls, other than message billing index 9 calls, encountering second trial trouble release conditions.

(t) ***Coin Supervisory Trouble (CSTR Register)***—Scores when a link alarm or time-out alarm condition exists with the HLD key normal or when a premature trunk release signal is received.

(u) ***Coin Zone Sender Timed Release Awaiting Operator (CZSR Register)*** —Scores when a marker encounters an ***all senders busy*** condition on MF senders after one (or more) sender has timed out awaiting the operator.

(v) ***Coin Overtime Announcement Failure (OTM Register)***—Scores when a call is transferred to an operator due to machine announcement failure, following overtime deposit check with a ***no coin present*** detector.

(w) ***Stuck Coin Recycle Attempt (RC Register)***—Scores when a coin collect or coin return recycle attempt by the coin supervisory circuit is due to a stuck coin condition at a coin box station.

(x) ***Stuck Coin Recycle Failure (RCF Register)***—Scores when a coin supervisory circuit recycle attempt is not successful and the call is transferred to an operator.

(y) ***Ground Test Failure (GTF Register)***—Scores when a combined or completing marker encounters a ground test failure on service calls.

(z) ***Master Timing Trouble-MTTRO (Odd Master Timing Circuit), MTTRE (Even Master Timing Circuit) Registers***—Scores when there is (a) a time-out failure when connecting to a recorder or (b) a difficulty in completing end-of-tape perforations while connected to a recorder (except on a recorder test call with no recorder waiting for the odd master timing circuit).

(1) ***Incoming Register Recorder Request (RO Register)***—Scores when a marker encounters a recorder request from an incoming register on service calls.

(2) ***Trouble Recorder Entries (TRE Register)***—Scores when a trouble record card is perforated, except during a trouble recorder test.

4. TRAFFIC ORDER PREPARATION

4.01 A traffic order is prepared for all initial installations, additions and rearrangements of central office equipment. The network administrator, Network Design engineer, and equipment engineer, and at times, a trunk engineer and Network Maintenance representative, should discuss the following in a conference:

(a) Traffic register frame configuration

(b) Traffic register layout

(c) Traffic register multipling

(d) TUR frame features

(e) Requirements for administration of the dial machine or other facility

(f) Requirements for Network Design and trunk engineering through the engineered period

(g) Special register requirements due to transitions or equipment rearrangements

(h) Ultimate register requirements

(i) Plans for a computerized data acquisiton system

(j) Division of Revenue requirements.

4.02 Following the conference, the Network Design engineer, who should be familiar with the TUR, will prepare the traffic order. Quantities, features, and arrangements shold be sufficiently detailed to permit the equipment engineer to complete the E-8000 questionnaire. A detailed description of the No. 4A TUR can be found in Bell System Practices Section 984-503-100.

4.03 To insure a complete and accurate TUR installation, a summary of all facilities to be measured should be included with the traffic order (Fig. 2). Coupled with the summary should be the scan switch assignments shown on a form similar to Fig. 3. Although both Figures 2 and 3 are in agreement, they should be considered as illustrations only. The equipment items and quantities selected are not recommendations, as these will depend upon the central office covered by the traffic order.

4.04 The assignment of equipment items to the scan switch terminals should be made after considering the initial size of the office, its growth rate, and if possible, its ultimate size. It may be obvious that two TUR frames are required initially or with the first addition to the office. With this knowledge, the scan switch assignments can be made with terminals properly reserved for orderly growth. In the long run, this "orderliness" will reduce unusuable data caused by faulty assignments and rearrangements.

4.05 Four basic restrictions apply to the assignment of circuits to the scan and register switches as follows:

(a) All circuits assigned to like-numbered contacts of a switch are associated with the same detector.

(b) Not more than one circuit in a group can be assigned to a crosspoint (consisting of six

contacts) when one usage register is furnished for the group.

(c) A circuit group appearing on two or more TUR frames and having a common traffic register must have the switch appearances on these frames located on scanning switches having different numbers; these appearances must be separated by at least 100 crosspoints to prevent overlap scoring of the register by the various frames.

(d) All circuits assigned to like-numbered contacts of a switch associated with the same detector must be either limited scanning circuits or nonlimited scanning circuits.

A. Scan Switch Assignments

4.06 ***Common Control Equipment***—Two connections to the TUR are normally required for each marker, transverter, sender, and register; one to measure total (traffic plus maintenance) usage and one to measure maintenance (busied out of service) usage. Some originating registers are wired so that one connection measures traffic usage and the other one measures maintenance usage. Total usage for all markers and transverters, and for senders and registers having holding times of 10 seconds or less will be measured on the fast scan basis and will require one lead (ten contacts per lead) per item of equipment. The number of TUR contacts required for fast scanning, therefore, is ten times the total number of common equipment components having holding times of 10 seconds or less. This total is then raised to the nearest multiple of 600, up to a maximum of 1800 per TUR frame.

4.07 Some fast scan items (such as AMA recorders) do not have a maintenance usage measurement, and consequently have only one connection to the TUR (ten contacts per lead).

4.08 Since TUR contacts for fast scan items must be provided in multiples of 600, requiring ten times as many contacts as slow scan items, these requirements must be determined prior to other requirements. Because of the flexibility with the terminal strip cross-connection field, there is no necessity for including spare contacts in these requirements. Spare terminals sufficient to allow for unequipped senders and registers on existing frames should be reserved. Fig. 4 shows the details of fast scan assignments. The 44 fast scan circuit items listed in Fig. 2 will terminate on SHT 00-43 punchings. No spare terminals have been reserved because full frames of senders and incoming registers will be installed.

4.09 As discussed in Part 2 of this section, an auxiliary scanner may be provided to measure fast scan items. If so, the traffic order should specify the assignments.

4.10 All maintenance usage, as well as total usage, for senders and registers with holding times greater than 10 seconds will be measured on the slow scanning interval basis and will require one lead (one contact per lead) per item of equipment. In determining the number of contacts required for senders and registers to be measured on a slow scanning interval basis, sufficient additional adjacent contacts should be reserved to meet the requirements of a full frame. This should reduce the cabling costs between sender frames and the TUR when additional senders are provided. When new frames are added, however, the new senders or registers need not necessarily be assigned to adjacent contacts or even the same switch on the TUR as the initial senders; but again sufficient contacts should be reserved for a full sender or register frame.

4.11 ***Trunks***—One connection to the TUR is required for each trunk equipment on which a usage measurement is required. To determine the TUR contact requirements, the number of trunks to be measured for usage should be raised to the next higher multiple of 100.

4.12 One-way outgoing and 2-way intertoll trunks (Table K in Bell System Practices Section 819-600-150) arranged to multiple at 3C or 3CL switchboards must be assigned to a contact number that uses a detector arranged to recognize an open busy condition.

4.13 ***Link Frames***—The total number of contacts required to measure link frame usage must be specified in the traffic order. To determine the number of contacts required, multiply the number of line link frames by 20 (two contacts per switch for 0 and 5 links) and trunk link frames by 40 (four contacts per switch for 0 and 5 links, left and right). Since these are the maximum number of contacts required per frame, spare contacts are not necessary. However, if additional

line link or trunk link frames are contemplated in future additions, sufficient contacts having the same number should be reserved to care for the ultimate number of line link or trunk link frames. This is done to make full use of the detector group usage feature for obtaining total office usage. The detector group usage (DGU) feature is discussed in 2.10 of this section.

4.14 ***Subscriber Line Usage (SLU)***—Sufficient contacts are normally assigned for subscriber line usage purposes to permit measuring lines of two horizontal groups. For example, an office having 490 size line link frames would require 98 contacts reserved for this purpose. Normally, 100 contacts are reserved for the subscriber line usage measurement, regardless of the line link frame size. Fifty of the contacts multiple to all odd numbered frames, and the other 50 contacts multiple to all even numbered frames. In offices with 590 size line link frames, 118 contacts may be assigned; but it is desirable to limit the number of scan switch terminations to 100, particularly in those cases where split DGU could not otherwise be provided.

4.15 To insure that the line with the highest or lowest usage in a particular horizontal group is determined, usage on all lines in the group must be recorded. In many offices, however, it is possible to determine lines of sufficiently high or low usage for balancing purposes by selecting a sample of lines in each group based on class of service or other knowledge of traffic characteristics. Such sampling procedures make possible coincident subscriber line use studies on more than two horizontal groups. In offices with 540 or 590 size line link frames, sampling methods will permit limiting the number of scan switch terminations arranged for SLU to 100. However, a decision must be made locally on the adequacy of sampling procedures for administration before specifying the reduced number of terminations.

B. Register Terminal Assignments

4.16 The association of traffic registers with circuits or circuit groups is accomplished by means of cross-connections on the TUR register switch terminal strip. The 600 movable crosspoint contacts on each register switch are connected to terminal punchings on a pair of terminal strips. Punchings 000 to 299 (representing contacts 0, 1 and 2) appear on terminal strips in bay 0, and punchings 300 to 599 (representing contacts 3, 4 and 5) appear on the matching terminal strips in bay 1. Each of these terminal strips also contains 100 register punchings to which the traffic register leads are cabled in accordance with local company assignments. All register switch terminal punchings associated with circuits requiring a single traffic register are strapped together and connected to the associated traffic register punching.

4.17 To minimize the number of interterminal strip jumpers, the assignments should be made to the register terminal group appearing on the same terminal strip as the register switch crosspoint contact. In those cases where the traffic register punching appears on a different terminal strip than the switch punchings it is to serve (or where a traffic register punching serves switch punchings on two terminal strips), a limited number of interterminal strip cross-connection facilities are provided.

5. REFERENCES

Bell System Practices

252-115-101	Traffic Management Practices—EADAS—Description
751-100-700	Common Language—Equipment Measurement Code (EMC)
819-600-150	General Information and Index Section for Trunk Tables—Equipment Design Requirements—No. 5 Crossbar System
984-503-100	4A TUR—General Description

Traffic Facilities Practices

Division A, Section 1

Division B, Sections 1a and 4

Division D, Sections 8-m(1), 8-m(2) and 9-a

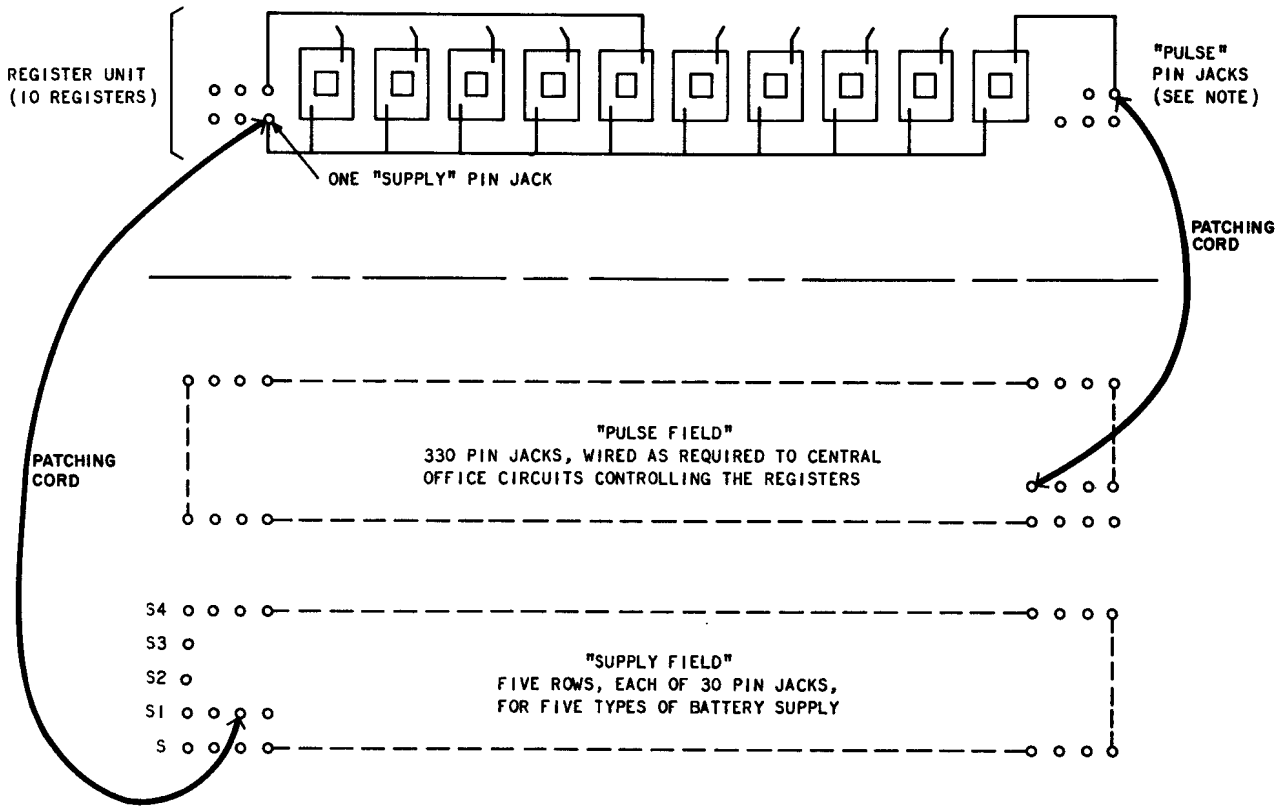
Circuit Description Drawings

CD-25892-01

CD-27616-01

Other

E-8000 Questionaire for No. 5 Crossbar



THE ABOVE ARRANGEMENT SHOWS ONE (OF A POSSIBLE 30) REGISTER UNIT OF 10 REGISTERS. ALL REGISTERS OF THIS UNIT MUST BE FED FROM THE SAME BATTERY SUPPLY, AND PREFERABLY SHOULD BE OF THE SAME TYPE (IE, PEG COUNT, OR OVERFLOW, ETC).

THE PATCHING CORD AT THE LEFT SHOWS THAT THIS UNIT HAS BEEN PATCHED TO THE S1 BATTERY SUPPLY, WHICH IS UNDER THE CONTROL OF A BATTERY CUTOFF KEY AT THE TOP OF THE CABINET. THE FACT THAT THE THIRD JACK IN THE S1 ROW IS USED INDICATES THAT THE THIRD REGISTER UNIT IN THE CABINET IS INVOLVED. ANY OTHER REGISTER UNIT SIMILARLY PATCHED TO ANY OTHER S1 BATTERY SUPPLY JACK WOULD ALSO BE UNDER CONTROL OF THE SAME BATTERY CUTOFF KEY. S3 AND S4 ROWS ARE NOT USED IN NO. 5 CROSSBAR.

THE PATCHING CORD AT THE RIGHT SHOWS THAT THE LAST REGISTER OF THE UNIT HAS BEEN PATCHED TO A PARTICULAR PIN JACK IN THE "PULSE FIELD"; THUS SCORING ON THAT REGISTER WHATEVER CENTRAL OFFICE REGISTER CIRCUIT HAS BEEN WIRED TO THAT PIN JACK IN THE PULSE FIELD.

NOTE: EACH REGISTER UNIT HAS 11 PIN JACKS. ONE, FOR BATTERY SUPPLY, IS WIRED TO ALL 10 REGISTERS AS ILLUSTRATED. THE OTHER 10 "PULSE" JACKS (5 AT EACH END) ARE INDIVIDUALLY WIRED TO EACH REGISTER AS ILLUSTRATED FOR THE 5TH AND LAST REGISTERS.

Fig. 1—Schematic of Patching Arrangement for One Traffic Register Cabinet

	QUANTITY	SCAN SWITCH TERM	USAGE REG
FAST SCAN ITEMS			
Completing Markers — Tot Usage	4	40	4
Dial Tone Markers — Tot Usage	2	20	2
Outsenders, RP — Tot Usage	8 (1 group)	80	1
Outsenders, MF — Tot Usage	4 (1 group)	40	1
Incoming Reg, RP — Tot Usage	9 (1 group)	90	1
Incoming Reg, MF — Tot Usage	6 (1 group)	60	1
Transverters	3	30	3
AMA Recorders	8	80	8
	Total	440	21
SLOW SCAN ITEMS			
Common Control			
Completing Markers — Mtce	4	4	1
Dial Tone Markers — Mtce	2	2	1
Outsenders, RP — Mtce	8 (1 group)	8	1
Outsenders, MF — Mtce	4 (1 group)	4	1
Incoming Reg, RP — Mtce	9 (1 group)	9	1
Incoming Reg, MF — Mtce	6 (1 group)	6	1
Transverters — Mtce	3	3	1
Orig Reg, DP — Tot Usage	64	64	1
Orig Reg, DP — Mtce	64	64	1
	Total	164	9
Line Link Frame — Hor Group	24 frames	480	240
Trunk Link Frame — Hor Group	12 frames	480	120
Subscriber Line Usage (SLU)	100 leads	100	100
Detector Group Usage (DGU)	2 circuits	—	2*
	Total	1060	462
Trunks — Type A	100 (5 groups)	100	5
Trunks — Type C	600 (41 groups)	600	41
Trunks — Type K	40 (2 groups)	40	2
	Total	740	48
	Grand Total	2404	540ϕ

Note: All No. 5 Crossbar circuit items use ground busy detectors except as noted in paragraph 4.12.

* 5-digit registers

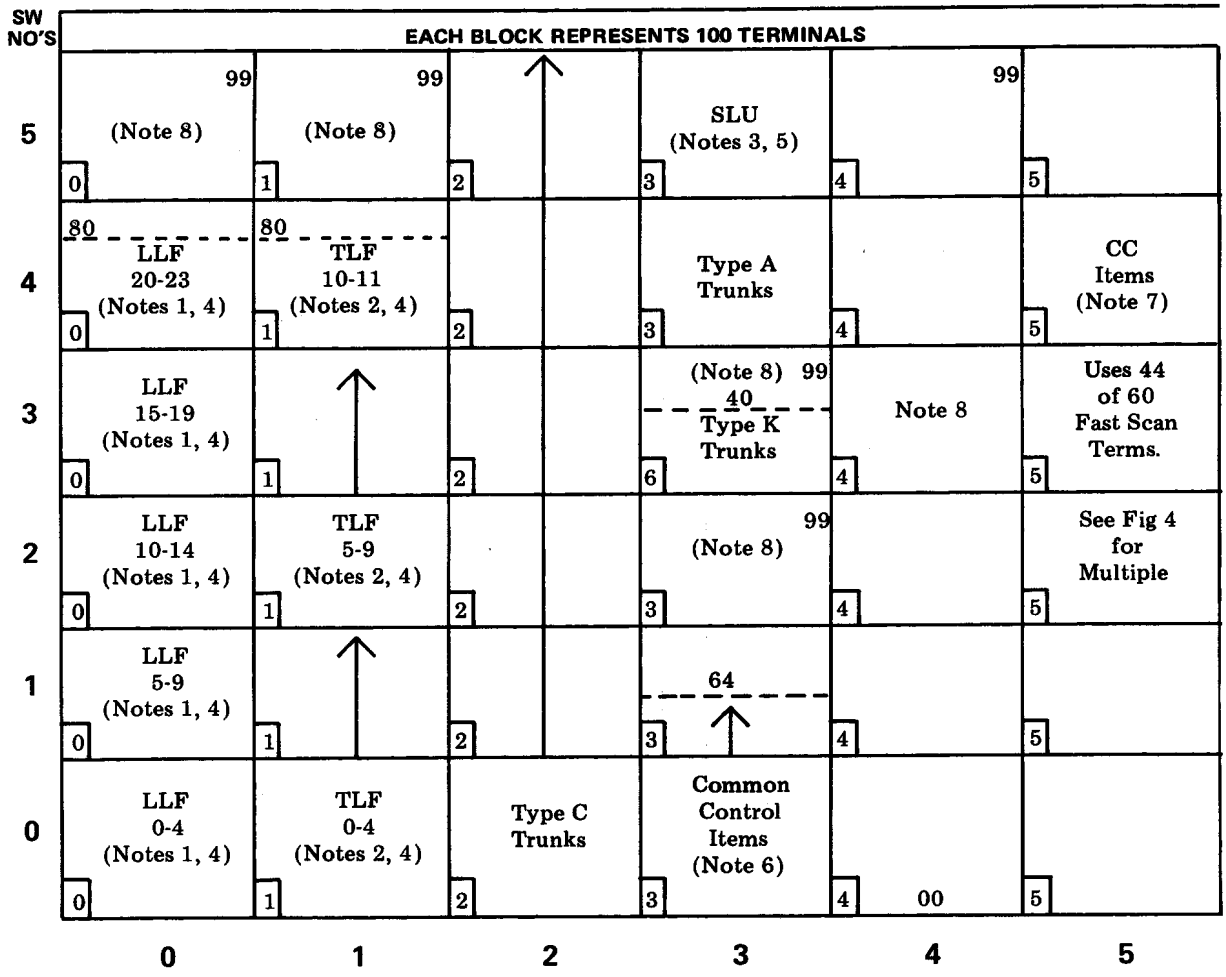
ϕ Provide an additional 5% for administration.

Fig. 2—Summary of Measured Items

TRAFFIC USAGE RECORDER
SCAN SWITCH ASSIGNMENTS

BUILDING _____ TEL CO. ORDER _____ TUR NO. _____

OFFICE _____ WE ORDER _____ DATE _____



Note 1: 0 and 5 links of each horizontal group of line link frames.

Note 2: 0 and 5 links left, 0 and 5 links right of each horizontal group of trunk link frames.

Note 3: 2 horizontal groups (maximum of 118 lines; normally 100 terminals provided).

Note 4: Arranged for detector group usage.

Note 5: Arranged for split detector group usage.

Note 6: Arranged for slow scan.

Note 7: Arranged for fast scan.

Note 8: Unassigned terminals

Note 9: Small block [2] indicates detector number.

Fig. 3—Scan Switch Assignments

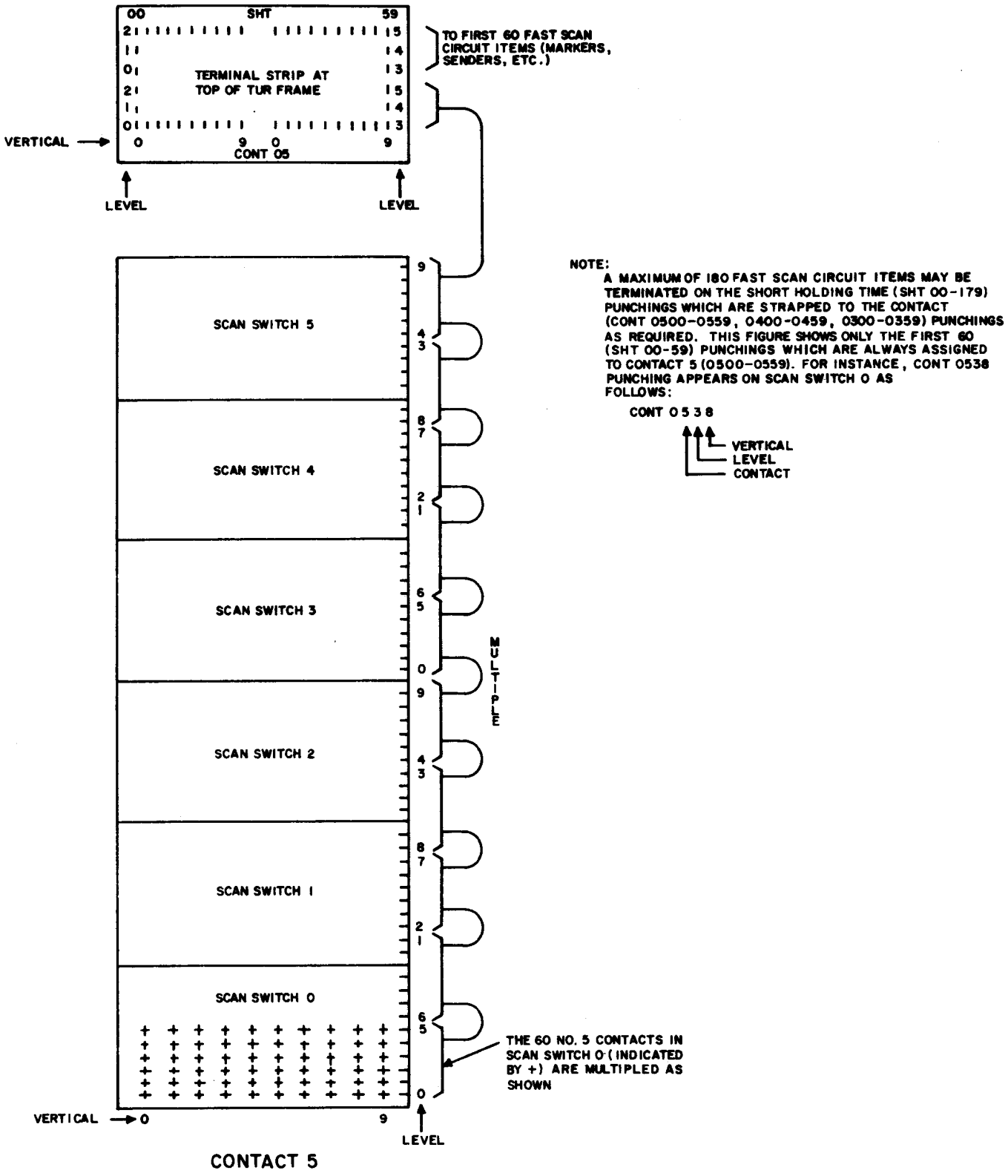


Fig. 4—Fast Scan Details