NO. 1A TRAFFIC DATA PROCESSOR

GENERAL DESCRIPTIVE INFORMATION

CONTENTS PAGE

1. GENERAL

1.01 This section describes the No. 1A traffic data processor which uses two basic groups of equipment: the traffic data converter and the traffic data summarizer. The traffic data processor provides an immediate and accurate summary of data from traffic register circuits. The summarizer provides a permanent storage of summarized traffic totals and a mechanized access to the stored records.

1.02 The traffic data processing equipment, when properly planned and used, contributes to improved engineering and administrative procedures as follows:

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

(b) A greater amount of traffic data is collected at a substantially lower cost.

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

(d) More reliable traffic data is provided.

1.03 Two types of traffic data converters are available, one for use with the traffic usage recorder and another for use with traffic register circuits, such as peg count, overflow, all trunks busy, etc. Both converters encode, buffer, and transmit data for recording on magnetic tape.

1.04 The traffic data summarizer records the data from converters on magnetic tape input recorders. The magnetic tape is arranged for 40 channels, of which 39 are data channels. A traffic data converter may be associated with each channel. An input recorder is capable of recording data simultaneously from 39 sources. The other data channel on the tape records the time and date information. The summarizer can process and display data continuously for a selected time interval.

1.05 The summarizer can also be used to process data from an electronic switching system (ESS) office using a different procedure. Each ESS office totals its own traffic counts. Output circuits of a converter are used to prepare each count for transmission over a voice channel to the summarizer. The summarizer may request the total counts from ESS offices. More than one group of registers may be assigned to one channel from an ESS office.

1.06 A partial area layout of a summarizer and how it may be associated with converters and remote recorders is shown in Figure 1. Remote recorders are added as necessary. Tapes recorded on remote recorders are transported manually to the summarizer location for processing.

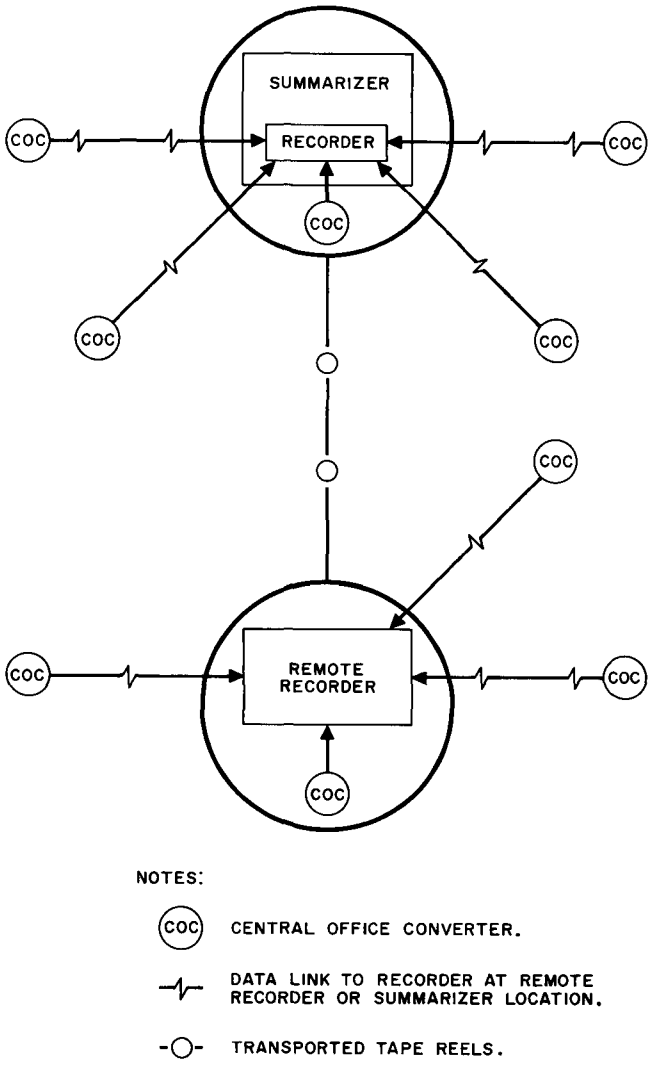


Fig. 1 — No. 1A Traffic Data Processor — Partial Area Layout

1.07 A remote recorder may be used at a remote location when data links to the summarizer are either not available or are not economical to utilize. This unit is arranged for 20 channels, of which 19 are data channels. Each of the data channels may be associated with a converter. The other channel records the time and date information. In areas with less than ten converters associated with a tape recorder, a second pass would allow recording up to 9 data and 1 time and date channel for each pass on one tape. All channel inputs including the time channel are automatically reassigned for the second pass. The tape reel must be marked to indicate these conditions. Tape reels from the remote recorder must be transported to the summarizer location for processing.

1.08 An auxiliary data receiver cabinet, which includes an auxiliary recorder, may be provided on an optional basis at the traffic summarizer to provide an additional 40 channels. This unit is arranged for 40 channels, of which 39 are data channels and the other the time and date channel. Each data channel is associated with a converter. This recorder has direct access to the input of the summarizer, thus it is not necessary to transfer the auxiliary tape to one of the regular input recorders for processing.

1.09 The traffic data processing equipment replaces the manual and photographic methods of collecting traffic data, thereby reducing the clerical and analysis effort. The traffic counts will be more accurate and provide more data for engineering and quick look data for management. This results in better use of equipment and provides better service for the customers.

2. EQUIPMENT ELEMENTS

A. Traffic Usage Recorder Converter

2.01 The traffic usage recorder converter is used for encoding traffic counts at the traffic usage recorder and transmitting the coded information in binary code to a recorder at either a remote location or the summarizer location.

2.02 The converter (Fig. 2) is essentially three separate panels of equipment mounted on the existing traffic usage recorder frame.

B. Peg Count Converter

2.03 The peg count converter is used for encoding peg count traffic counts and transmitting the coded information in binary code to a remote recorder or the summarizer.

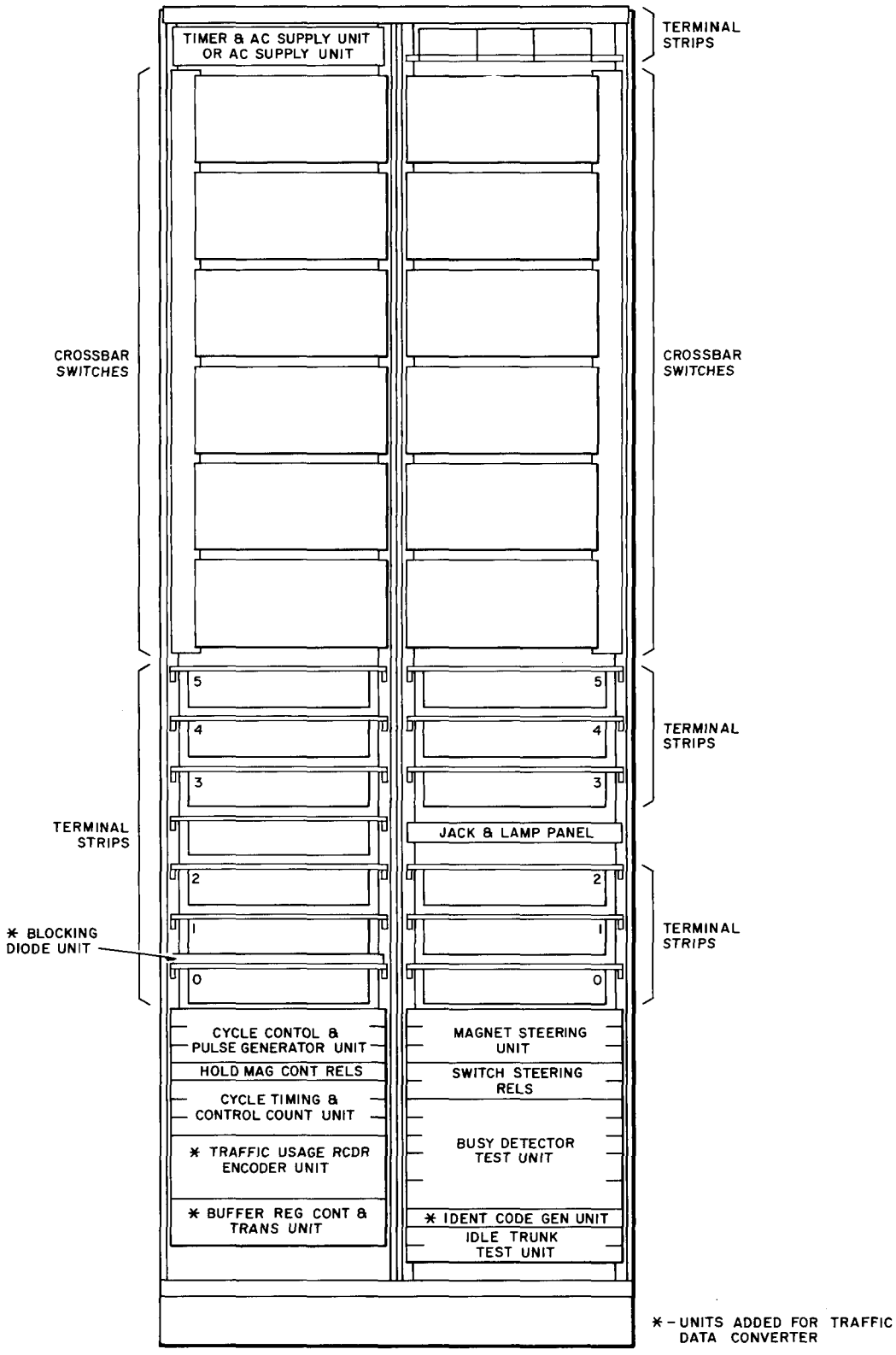


Fig. 2 — Traffic Usage Recorder Converter

2.04 The converter (Fig. 3) is essentially one bay of equipment mounted on a J-coded frame.

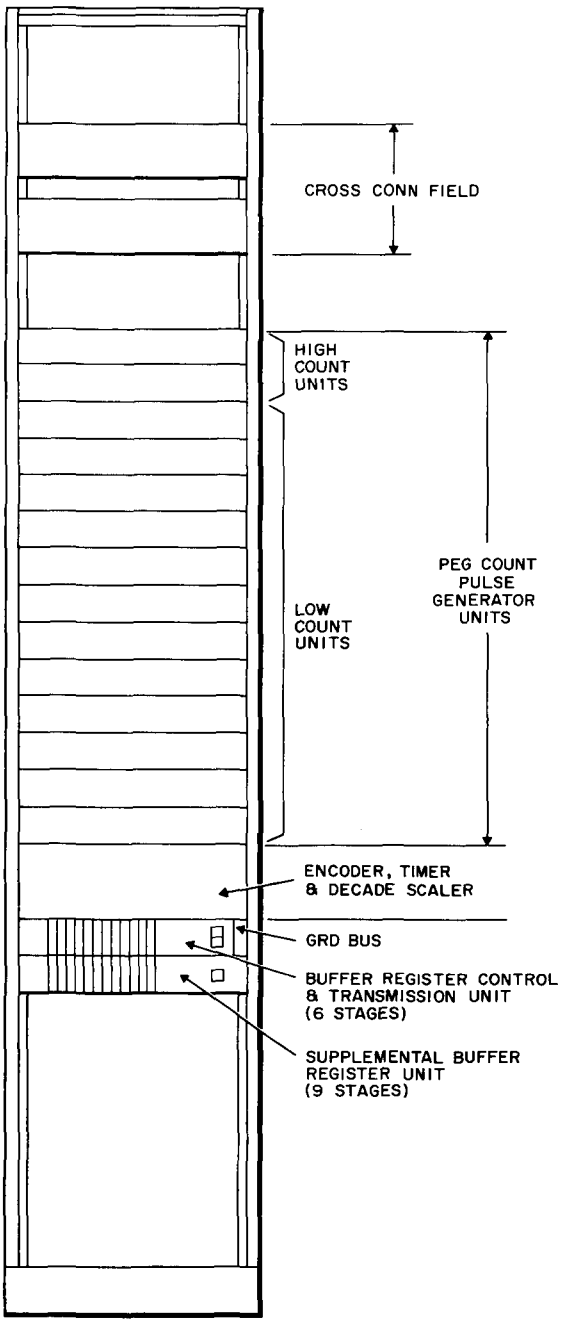


Fig. 3 — Peg Count Converter

C. Traffic Data Summarizer

2.05 The traffic data summarizer is installed in metal cabinets which are approximately 6-1/2 feet high, 25 inches deep, and 21 inches wide, except the power cabinet which is 27 inches wide (Fig. 4). Normally, eight cabinets are required to house the two input recorders, the storage recorder, punched paper tape facilities, the power supplies, and the solid state processing and control circuits of the summarizer. Equipment housed individually includes an 026 IBM card punch, and 024 IBM card reader, and a teletypewriter. Approximately 300 square feet of floor space is required for a summarizer system.

D. Remote Recorder

2.06 A remote recorder (Fig. 5), which may be used at remote locations for recording traffic data in the surrounding area, occupies approximately one-half section of a J-coded frame.

E. Auxiliary Recorder

2.07 An auxiliary recorder may be used at summarizer locations for recording data from an additional 39 converters other than the 39 associated with the two input recorders of the summarizer. The auxiliary recorder will be housed in one of the existing equipment cabinets, but an additional cabinet is required to house the additional 39 receivers.

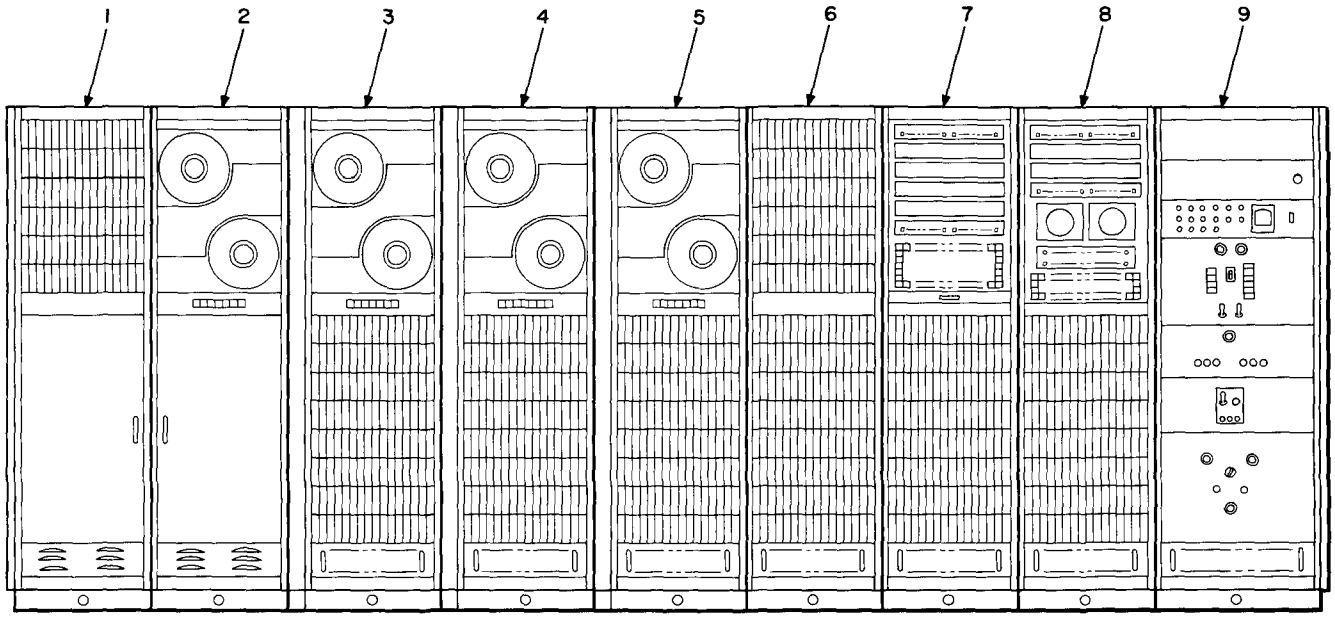
F. Additional Summarizer Output Facilities

2.08 An output magnetic tape recorder may be provided in addition to the storage recorder, card punch, teletypewriter, and punched paper tape. This unit, which will use one additional cabinet to house the recorder and its associated circuits, will record the summarizer output in a form suitable for computer analysis.

3. FUNCTIONS

3.01 The basic functions of the converter used with the traffic usage recorder are:

(a) To respond to a momentary current pulse on an input by generating an 11-bit binary code unique to the input.



1. AUXILIARY DATA RECEIVER CABINET.
2. DATA RECEIVER CABINET.
3. ACCESS REGISTER ARITHMETIC AND CHANNEL SELECTOR CABINET.
4. ADDRESS REGISTER, CHANNEL SELECTOR, INPUT READER AND ENCODER CABINET.
5. STORE, INPUT DATA MATCH, INTERNAL PROGRAM AND TAPE TRANSPORT CONTROL CABINET.
6. INTERNAL PROGRAM AND TIME OF DAY CABINET.
7. CARD READER, MAIN CONTROL AND TROUBLE RECORD REGISTER CABINET.
8. TAPE CONTROL & ALARM CABINET.
9. POWER PLANT CABINET.

Fig. 4 — Traffic Data Summarizer

(b) To provide identity (scan) codes every 100 seconds.

(c) To provide even parity for all codes.

3.02 The basic functions of the peg count converter are:

(a) To respond to a momentary ground on an input by generating a unique 11-bit binary code unique to the input.

(b) To provide 10:1 scaledown for selected input groups.

(c) To provide for generation of a converter identity (scan) code every 100 seconds.

(d) To guard against multiple signals due to relay chatter and bounce.

(e) To provide means for generating an 11-bit code for test purposes.

(f) To provide even parity for all codes, except the test code.

3.03 The basic functions of the converter buffer registers and output circuits are:

(a) Provides for temporary storage of 11-bit binary words and advances these words through the buffer storage register in an asynchronous mode. Each word is transferred from register to register if the subsequent registers are empty.

(b) Provides for parallel to serial conversion of the stored binary word.

(c) Generates bit synchronization and information pulses.

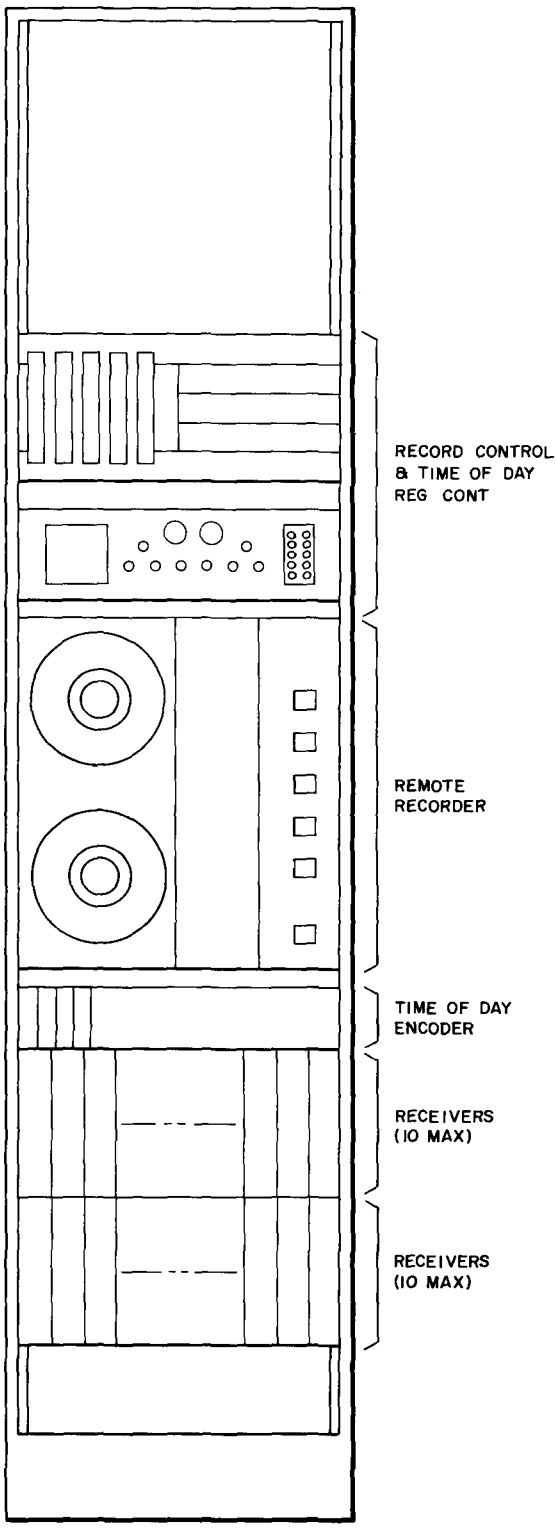


Fig. 5 — Remote Recorder Frame

(d) Provides for transmission of binary words over voice transmission facilities by converting output amplifier states to a frequency-shift signal. Bipolar transmission is used where recording facilities are in the same building.

3.04 The basic functions of the summarizer are:

(a) Provides continuous receiving and recording of input information from as many as 39 converters. When an auxiliary recorder is used, an additional 39 converters may be served.

(b) Provides high speed tape readout, sorts and sums the traffic counts, and records the results on magnetic storage tape.

(c) Provides an immediate class summary printout of the results during processing and provides a detailed printout when the processing equipment is not occupied by the input tape readout mode of operation.

(d) Checks for correct parity and counts the number of error words that are received.

(e) Uses internal wired logic to sort and store information on the storage tape.

(f) Provides a group of high count registers, each capable of counting to 999,999.

(g) Provides for conditioning the summarizer with a punched card input for automatic operation and also for manually conditioning certain functions, when desired, by the use of keys.

4. METHOD OF OPERATION

A. Converter (Fig. 6)

4.01 The converter is added to the existing traffic measuring facilities which may consist of a traffic usage recorder or a peg count measuring facility. The TUR converter has an input representing each monitored source to its encoder. The encoder input leads are threaded through magnetic cores in such a way as to distinguish it from all other register leads. Each peg count lead operates a relay which produces a pulse that is applied to the encoder. The en-

coder develops from this pulse a unique binary code which identifies the input and represents one unit of traffic usage.

4.02 The binary code is transferred from the encoder in parallel form through multistage buffer registers. The operation of the buffer register is sequential, and the code is passed from one set of cores to the next in parallel form as each storage position of the register is emptied. The code is read out of the last register in serial form by the readout circuit.

4.03 The output from the serial readout circuit drives the output amplifier, which provides for local recording or transmission to the summarizer location. Transmission is provided over voice channel trunks to either the recorder at the summarizer or to a centrally located remote recorder.

B. Summarizer (Fig. 7)

4.04 The data transmission link connects the traffic data converter to the summarizer, where the information is recorded on slow moving magnetic tape. Two input recorders are used at the summarizer so that data may be processed from one while the other is recording additional input data. A third input recorder, or auxiliary recorder for a summarizer serving more than 39 channels, may be used to record inputs from another group of 39 converters. This recorder may be switched over for applying its output to the summarizer at chosen time intervals on an off-line basis.

4.05 All operations of the summarizer are controlled by wired logic and punched card instructions. The punched cards will designate the order in which converter channels will be summarized. The channel selector will select the appropriate position for the first channel of data to be processed. The magnetic tape of the input recorder will have its speed changed from a write speed of 1-1/4 inches per second to a read speed of 75 inches per second. The tape can be read in a forward or backward direction and will cycle to read data from one channel after another as the summarizer action continues. The readout speed allows time to complete the readout cycle of all 39 channels of one recorder while the other recorder is recording input data.

4.06 The data on each channel consists of an 11-bit binary coded word for each traffic count encoded and transmitted by the traffic converter. The first assignment of the summarizer is to add like words and accumulate them as traffic totals for each converter. Each 11-bit word identifies one of 1024 possible codes. Of the 1024 codes, 886 can be used for traffic count. Of

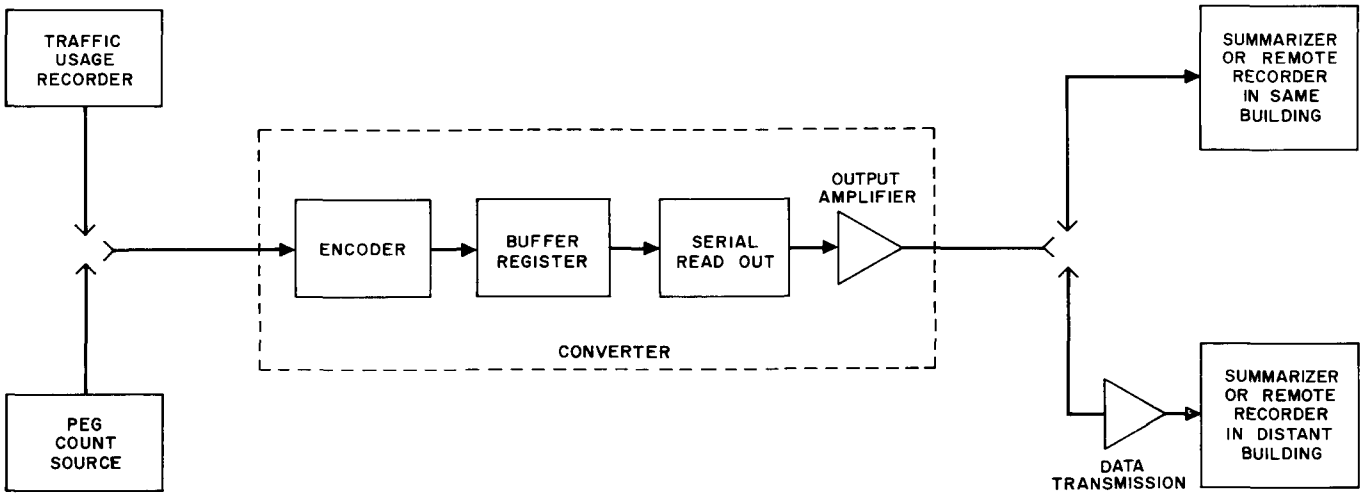


Fig. 6 — Converter — Block Diagram

the remaining codes, 80 are used for scan codes which identify the converters. The remaining codes are used for bookkeeping and control functions. The scan code assigned a particular converter is sent once every 100 seconds. Ten of the 11 bits in a code are information bits. The eleventh bit is a parity bit. Between any one information word and the next, there will be always at least 2-bit space. The parity and spaces are both used for checking purposes.

4.07 Reading amplifiers in the channel selector circuit detect magnetic transitions on the input tape and generate corresponding voltage pulses. These pulses are passed to the input reader which determines bit value, checks for missing bits, makes a parity check, and steers bits to the address register. The input reader determines when a complete word is received and sends a word-complete signal to the internal program circuit. If any of the checks fail, the word will not be passed to the address register, but will be dropped. An error count register in the store will be increased by one for each error detected. Scan codes are detected and counted on a special register in the magnetic core store.

4.08 Each time a code is received by the address register, the register, under control of the internal program circuit, addresses the store and causes a total existing in the store at the address indicated by the contents of the address register to appear in the access register. At this time, the arithmetic unit performs the add function and adds "1" to the previously stored total and returns the new total to the store at the same address. The operation continues until the desired portion is read from the input tape. The next mode of operation is to process the information read into the store from this channel of the input tape.

4.09 The address register is also a binary counter. It is now set to zero and used as a counter driven by a pulse source. It counts to 1024 thus generating a code for all possible store locations. The store is scanned and emptied one location at a time. Each total is read out to the access register and passed into the storage tape register. The outputs are written at a designated location on the magnetic storage tape.

4.10 While operation of the summarizer is in progress, the processing steps are being controlled by orders read by a card reader from a punched instruction card. The card furnishes identifying information for the converter, processing information, and store location on the output storage tape. The storage tape positions itself to the assigned location while group totals are being accumulated. At a signal from the control circuit, the tape starts to move just before the store is to be emptied. When the tape reaches speed, the accumulated data from the store is spilled in approximately 1-1/2 seconds to the storage tape.

4.11 The storage tape is organized into 40 channels. Thirty-nine of these channels are divided into blocks called data storage blocks. Each 3600-foot reel of tape consists of 220 storage blocks per channel. Each block is sufficient to receive all data from one converter for a given processing period.

4.12 The fortieth channel of the storage tape is used for class summaries to provide "quick look" data. A class group indicates the total registrations for a particular group of circuits such as markers, senders, trunk groups, etc. On the first pass through the magnetic core store, when block summary information is recorded on the storage tape, the contents of the store is read back into the store by the arithmetic unit. When the recording of block summary data is complete, a second pass through the store is initiated by the control circuits. On this pass, totals from groups of registers are added together to form class summaries. Class marks are placed in the store to group the registers in classes. These totals are placed on the class summary or "scratch pad" channel. The overflow block summary may be used instead of the block summary. This form provides for high traffic counts by pairing all the data registers of the store to form all high count registers.

4.13 After class summary totals are stored on the storage tape, the results read from the storage tape are recorded on one or more of the output facilities described in 4.14. While the class summaries are being recorded on the output facilities, the next input channel is being read into the store.

C. Summarizer Outputs

4.14 There are five methods by which output data may be obtained from the summarizer. The storage tape provides a permanent record of block summary data. This detailed summary may be printed out on an off-line basis. Printout facilities for both block and class summaries include the teletypewriter, the card punch, punched paper tape, and output magnetic tape.

4.15 The class summary printout provides the following information:

(a) Total number of traffic counts in each class.

(b) Number of error counts.

(c) Number of scan codes detected.

(d) Class number.

(e) Converter number.

(f) Channel number (storage).

(g) Block number (storage).

(h) Date.

(i) Start and stop time.

(j) Trouble code.

(k) Job number.

4.16 The block summary and overflow block summary printouts provide the following information:

(a) Total number of traffic counts for each register.

(b) Number of error counts.

(c) Number of scan codes detected.

(d) Register numbers.

(e) Class numbers.

(f) Card numbers.

(g) Converter number.

(h) Number of blocks summed.

(i) Date.

(j) Start and stop time of last block.

(k) Trouble code.

(l) Total number of counts in summary.

(m) Job number.

D. Programming the Summarizer

4.17 The summarizer is basically a wired logic machine and therefore must receive orders for its basic operations. An IBM card reader is the basic device used for instructing the summarizer. The order cards contain 80 spaces. Each order requires 4 spaces, therefore 16 orders with a blank space between each can be placed on each card. Two order cards are required for each converter or channel processed. Various methods may be used to reduce the number of cards required. For example, if the date is loaded manually each day by means of keys, the same set of cards may be used daily. Class marks are placed in the store from cards. Each class mark constitutes an order.

E. Trouble Indications

4.18 To assist in locating trouble in the solid state circuits of the summarizer, each flip-flop has a status lamp associated with its "SET" output. These lamps light when the associated flip-flop is "SET." In addition, there is a group of trouble indicating lamps which light to indicate specific troubles.

F. Alarms

4.19 Audible and visual alarms are provided for fuse alarms, no voltage alarms, tape transport alarms, and data transmission failure alarms. An alarm is also provided for indicating trouble conditions in key portions of the summarizer logic circuits.

4.20 An operator call bell is provided in the summarizer to signal the operator before all punched cards in the card reader have been

read. Additional cards may then be placed in the card reader to provide continuous operation of the summarizer.

4.21 In offices arranged for remote recording, the associated converters are provided with an alarm to indicate failure of the converter circuit to generate traffic data words.

4.22 Major alarms may be arranged to be transmitted to a distant office if required.

5. MAINTENANCE

5.01 The converter and summarizer have been designed to be maintained by the usual complement of central office personnel.

5.02 A portable test set is provided for testing the converters. The test set contains 11 keys by which any code may be selected. The test set monitors the converter and provides a register indication when the selected code appears at the converter.

5.03 Locating trouble in the summarizer has been simplified by incorporating into it certain automatic testing features. The general area of the trouble can be located by means of alarms, trouble indicating lamps, numerical indicator lamps, and the printed output of the teletypewriter containing error counts, trouble codes, and trouble indications such as question marks. By further analysis and test routines, the trouble can be localized to a few circuit packs. At this point, by circuit pack substitutions, the defective pack can be found. Storage space is provided in one of the cabinets for spare circuit packs.

5.04 To gain access to the circuit pack for oscilloscope testing, test points are provided on the front of the card, and card extenders are provided so that the package may be tested while actively connected in the circuit.

5.05 Control keys are provided to enable the maintenance personnel to operate the summarizer in slow motion. Instruction orders normally read in rapid succession from order cards can be manually keyed into the system one at a time. As each order is keyed, the action of the summarizer can be observed before the next order is keyed.

5.06 A receiver alarm monitors the incoming data links to check that incoming data is being received.

5.07 For routine testing of the system, a test tape is available. This tape contains significant data which, when processed, would aid in locating trouble conditions that may exist. The printed output of the test tape could be compared with the known recorded data to determine how the system is performing.

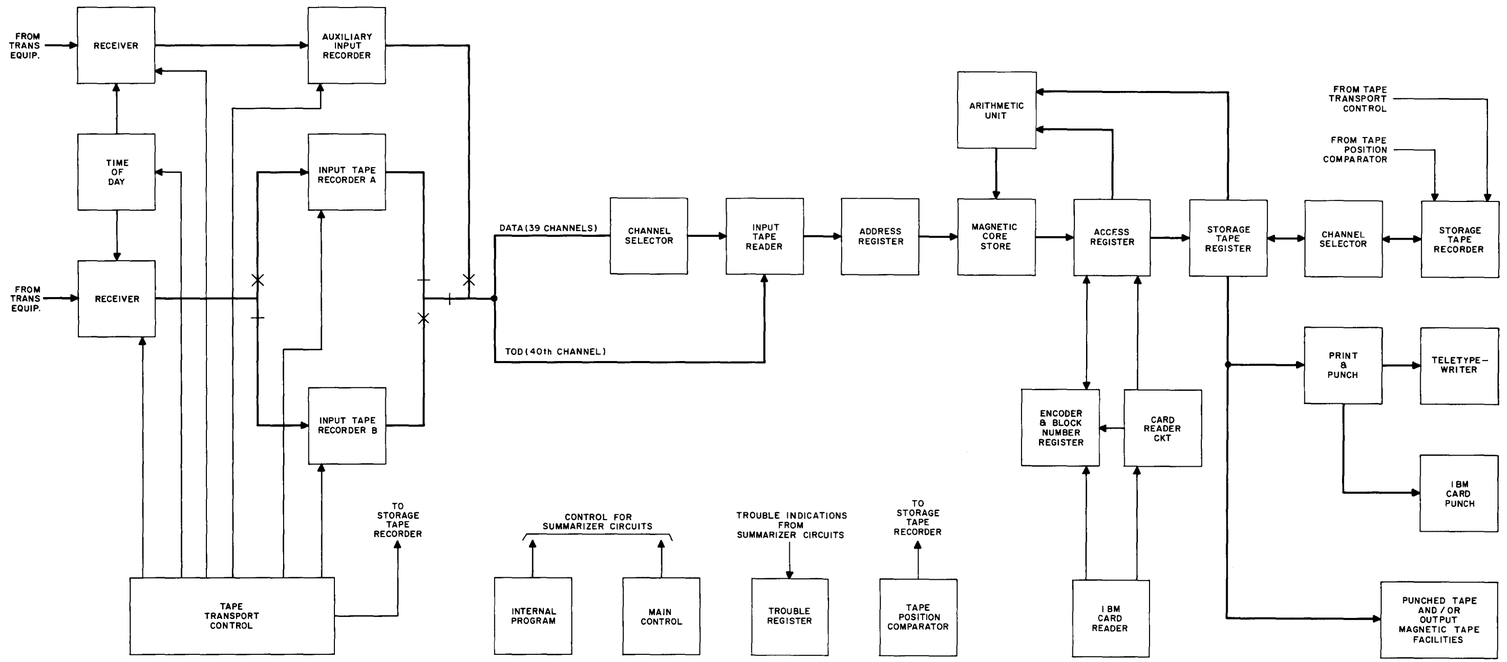


Fig. 7 — Summarizer — Block Diagram