Kineplex®

COLLINS

HIGH SPEED DATA TRANSMISSION SYSTEM

kinep

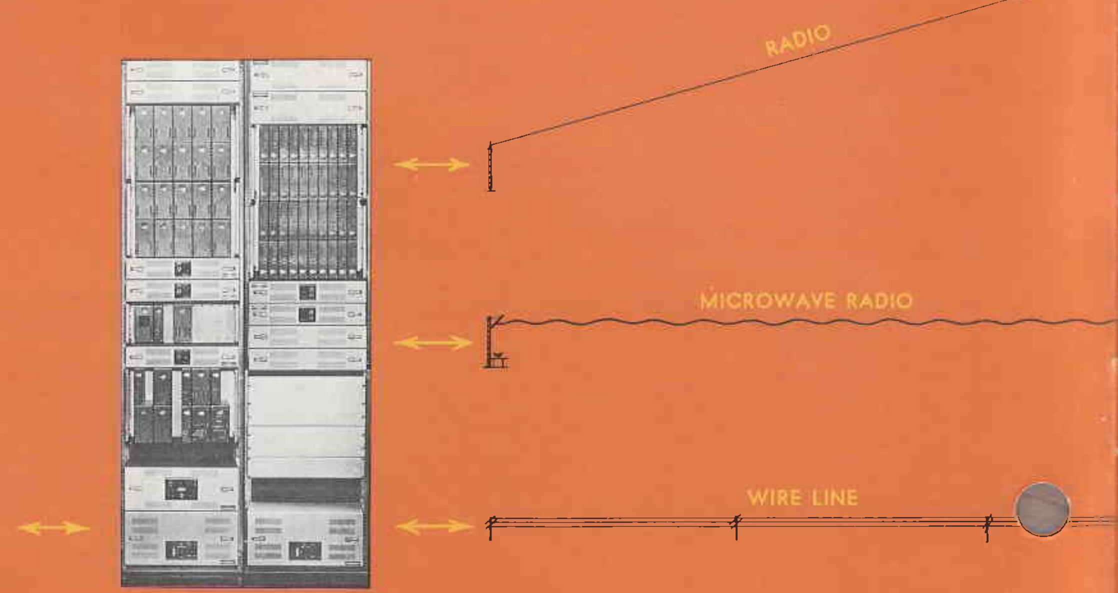
COLLINS high speed data

foreword

Collins Kineplex® Data System is a flexible, high capacity synchronous data system for the transmission of binary information such as teletypewriter, business machine, telemetering, supervisory control and facsimile signals over wire line, cable, radio and microwave facilities. The new signalling technique provides superior signal-to-noise performance and more efficient spectrum utilization than standard frequency shift keyed pulse signalling systems. It provides for the transmission of data up to 3000 bits per second in a 3 kc bandwidth which on teletypewriter applications, provides 40 channels at 60, 75 or 100 words per minute operation.

DATA

3000 bits per second or 40 teletypewriter channels of 100 words per minute in a 3 kc bandwidth, or a combination of the two.



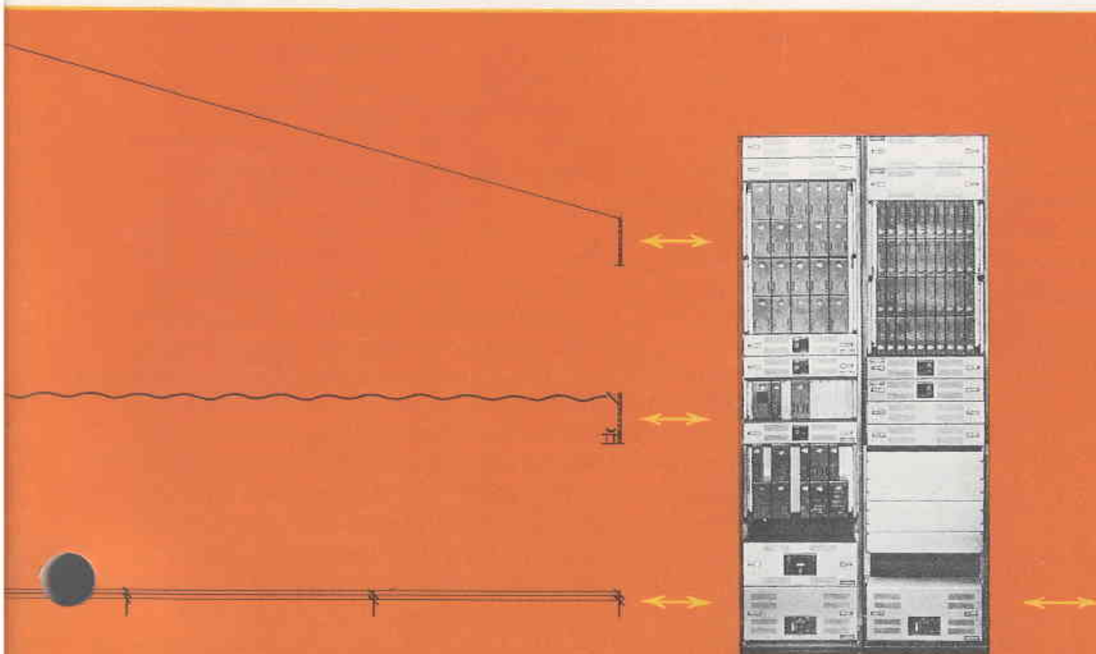
Kineplex Data System

® Registered U. S. Patent Office. The name Kineplex was given this equipment because predicted wave signalling makes use of kinematic filtering and is used generally for providing multi-channel or multiplex operation.

lex®

transmission system

contents



Kineplex Data System

DATA

3000 bits per second or 40 teletypewriter channels of 100 words per minute in a 3 kc bandwidth, or a combination of the two.

Kineplex

RESEARCH and DEVELOPMENT

Collins Creative Pioneering Has Produced a New Advanced and Highly Efficient Technique for Transmission of Binary Information. Incorporated in the Kineplex Data System, the Technique Allows Over 100 Percent Increase in Spectrum Usage Over Standard Signalling Methods and Provides a Much Superior Signal to Noise Performance.

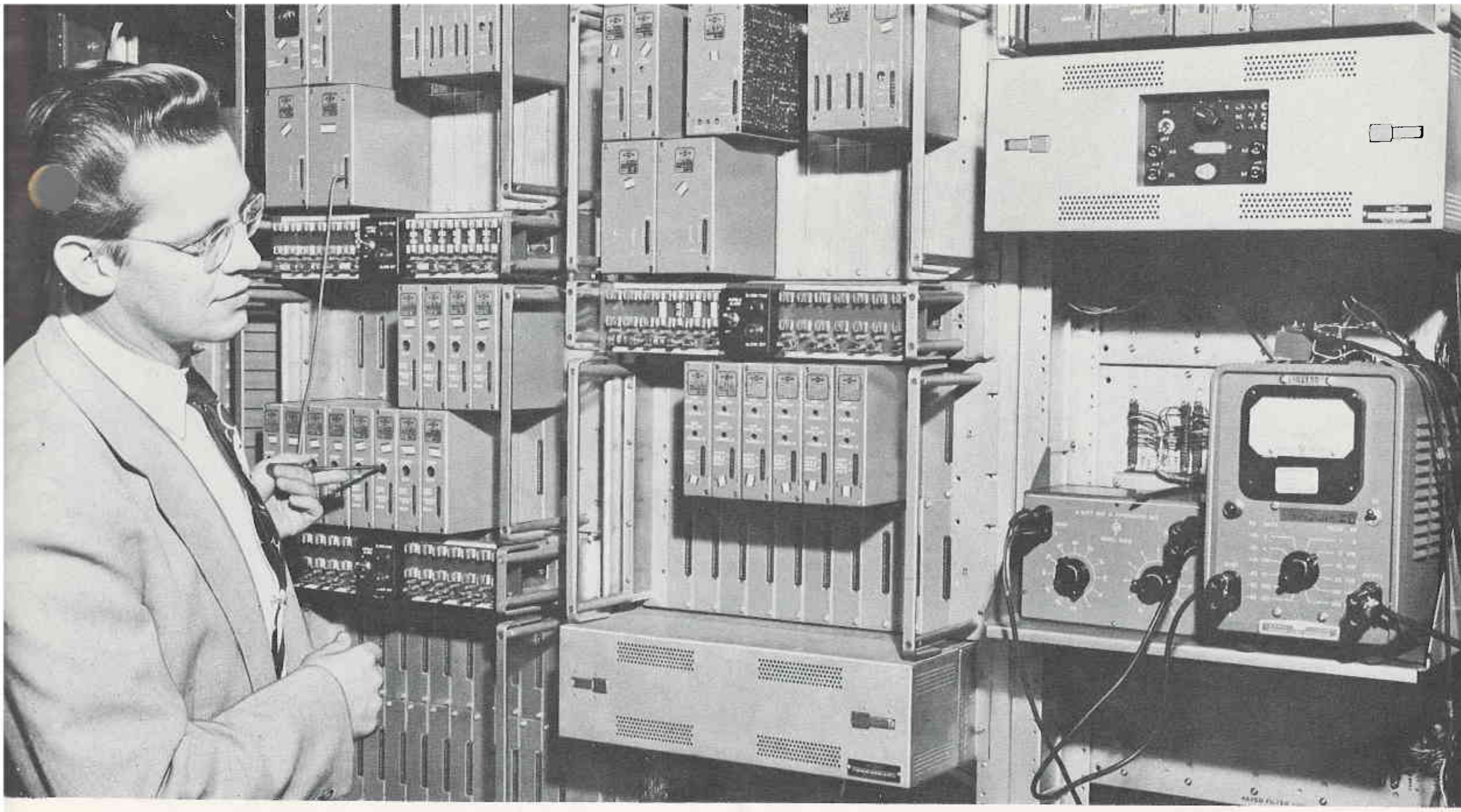
The tremendous growth of industry has resulted in an increasingly greater demand for better communication. To satisfy this demand there has been a large scale expansion of radio and wire facilities to provide additional communication channels. Aside from the consideration of the heavy investment attendant with such expansion, the paramount problem in long range radio communication is congestion of the frequency spectrum. The steady demand for new circuits has rapidly diminished the availability of frequency spectrum for additional channels. For the past ten years Collins has conducted a broad research and development program devoted to providing integrated communication systems. A major effort of this program has been directed toward developing a new signalling and detection technique for the transmission of binary information which would have much greater efficiency in regard to power and spectrum utilization as compared to standard signalling practices. A new signalling and detection technique accomplishing this objective has been achieved and is incorporated in the new Collins Kineplex Data System.

Record communication such as teletypewriter service is normally accomplished by pulse or two condition signalling. Business machine signalling also uses this method, and it is expected that pulse code modulation may be widely used for continuous signalling functions in voice and facsimile. Due to the wide acceptance of this type of signalling, it was important to find methods of accomplishing it with a minimum signal power and within a minimum bandwidth.

Originally, teletypewriter service was transmitted by using an "on-off" type of signalling. In recent years the advantages of frequency shift keying transmission were realized, and at the present time most teletypewriter transmitting and receiving equipment employs standard FSK.

A study of standard nonsynchronous FSK pulse signalling indicates that a much greater improvement in signal-to-noise ratio performance can be gained. Improved frequency stability, improved integration, and synchronization can be utilized to improve signal-to-noise ratio performance and gain more efficient utilization of frequency spectrum.

Collins first interest in teletypewriter synchronous techniques were expressed through an engineering paper, "Radio-telegraphy," written by one of its engineers, W. H. Wirkler, in April, 1949. A second paper written in March, 1951, "Communications Systems Analyses," by M. L. Doelz, Collins Western Division Manager, stimulated further interest. In 1951, Collins embarked on an extensive research and development program to develop new signalling and detection methods based upon improved frequency stability, improved integration and synchronization. The result of this development effort was a new signalling method called predicted wave signalling. This method was incorporated in early developmental equipment and was subjected to extensive laboratory testing, the results proved the new signalling technique had significantly improved performance characteristics as compared to conventional pulse signalling methods and was in agreement with anticipated performance as predicted by theory. A series of field tests beginning in 1951 and continuing to the present have been conducted to evaluate the predicted wave signalling principle on HF, VHF and UHF radio circuits and on wire line facilities. Initial field tests were carried out in conjunction with the Air Force in 1952. From June, 1952, to July, 1953, an experimental



Collins Engineers maintain a constant check on Kineplex Data System equipment at the Company's Burbank facilities.

teletypewriter radio circuit employing predicted wave signalling was operated between Collins Cedar Rapids and Dallas facilities. Portions of this test were conducted under Signal Corps sponsorship. The initial field tests confirmed laboratory test results which demonstrated the superior performance of predicted wave signalling.

In another test, the Collins predicted wave signalling technique proved itself in comparison with standard FSK systems. This test conducted in 1954 over a 30 mc radio link from telephone facilities at Holmdel, New Jersey, to Streator, Illinois, demonstrated the error rate versus signal-to-noise ratio advantage of the predicted wave signalling over a standard nonsynchronous FSK system. Predicted wave signalling showed an improvement of 6 to 8 db over standard FSK thus demonstrating the practicability of the theory and equipment. In 1954 Collins began quantity production of teletypewriter terminal equipment employing predicted wave signalling. These terminal equipments were a part of the complete VHF Transhorizon Communication System supplied for DEWline by Collins.

Using the basic principles of predicted wave signalling and incorporating phase shift keying, Collins early in 1955 developed its new all-transistorized Kineplex Data System for supplying 40 teletypewriter channels of 100 words per minute in a standard voice channel.

In February, 1956, a Kineplex System was put in operation between Cedar Rapids and Burbank. This circuit, which is still in use, is operated at 13.140 mc using 5 kilowatts of peak envelope power. Results from this test circuit have conclusively proven the effectiveness of Kineplex as a highly reliable teletypewriter communication system.

During October and November, 1956, engineering personnel conducted tests with a Collins Kineplex System in Collins Burbank facilities by transmitting to several cities over different telephone lines employing various voice carrier systems and looping the circuit back to Burbank. Among the points used in the tests were San Diego, Santa Barbara, Las Vegas, Nevada and Denver. Operation of the Kineplex equipment proved most satisfactory on all typical types of voice carrier equipments.

The end results of the mentioned and continuing tests show that the Collins Kineplex Data System incorporates features which will provide a greater number of communication channels on existing facilities than presently possible, and with superior performance in noise. Major Kineplex features include near absolute frequency stability so that the bandwidth may be reduced to a minimum; synchronization so that the detector is given information on the time of arrival of the start and finish of each pulse data; gated infinite Q integrating circuits, employing mechanical resonators, the response of which matches perfectly the energy distribution of the transmitted pulse; sampling of the detector outputs at the end of each pulse so that full integration of the received pulse may be utilized; encoding of binary information so that the theoretical minimum bandwidth for a given binary signalling rate may be approached.

Kineplex

FUNDAMENTAL THEORY AND OPERATION

Complete Functioning of New Predicted Wave Signalling Technique and Prominent Features Are Fully Described in Systematic View of Operation.

Current practice in frequency-modulated carrier telegraph equipment demands the use of a frequency-measuring technique for conversion of the received signal to a form suitable for operation of land-line telegraph equipment. Circuits usually include bandpass filtering, a limiting amplifier and a discriminator. Refinement of these methods does not always lead to the best utilization of received signal energy. In Kineplex, the transmission of the signal is similar to the form currently used. However, the intelligence is obtained from this signal by a means of filtering in both time and frequency which leads to much greater utilization of the received signal energy and of frequency spectrum. The Kineplex System makes use of the following features: rectangularly pulsed sine waves, encoding of two bits of information on each pulse by resolution of phase into quadrature components and infinite Q resonators at the detector suitably gated to provide a perfect weighting function.

The signal source at the transmitter is a constant amplitude sine wave of high stability. Information is encoded by sending a different phase in successive equal intervals or pulses. Figure one illustrates the four quadrature phase combinations used so that each pulse may carry two bits of information. It will be seen that projection of the signal vector of the X axis yields one bit of information (either M_x or S_x) and projection of the same vector on the Y axis yields a second bit (either M_y or S_y). It is assumed that the phase is changed rapidly in the transition from pulse to pulse and that the length of the vector and its relative phase is constant during each pulse. It is evident that simple circuitry can be used in transmitter to generate the desired successive pulses which will only be shifted in phase with respect to each other.

For a square pulse of constant frequency the signal integrated over the length of the pulse as a function of frequency will vary as illustrated in figure two. Figure two shows that at a frequency removed 1/T from the signal frequency, where T is the length of the pulse in seconds, the integrated signal or energy is zero. It would be confusing to try to visualize a transmitted signal of the type considered in terms of carrier and sidebands. This energy versus frequency relation should be kept in mind instead, even though pulses at times may be repetitive in pattern.

Four different pulses are applied to the receiving circuitry. One timing pulse gates a feedback amplifier, which provides positive feedback around the resonator and amplifier combination. During the time that this positive feedback is gated around the resonator and amplifier the circuit is regenerative just to the point of oscilla-

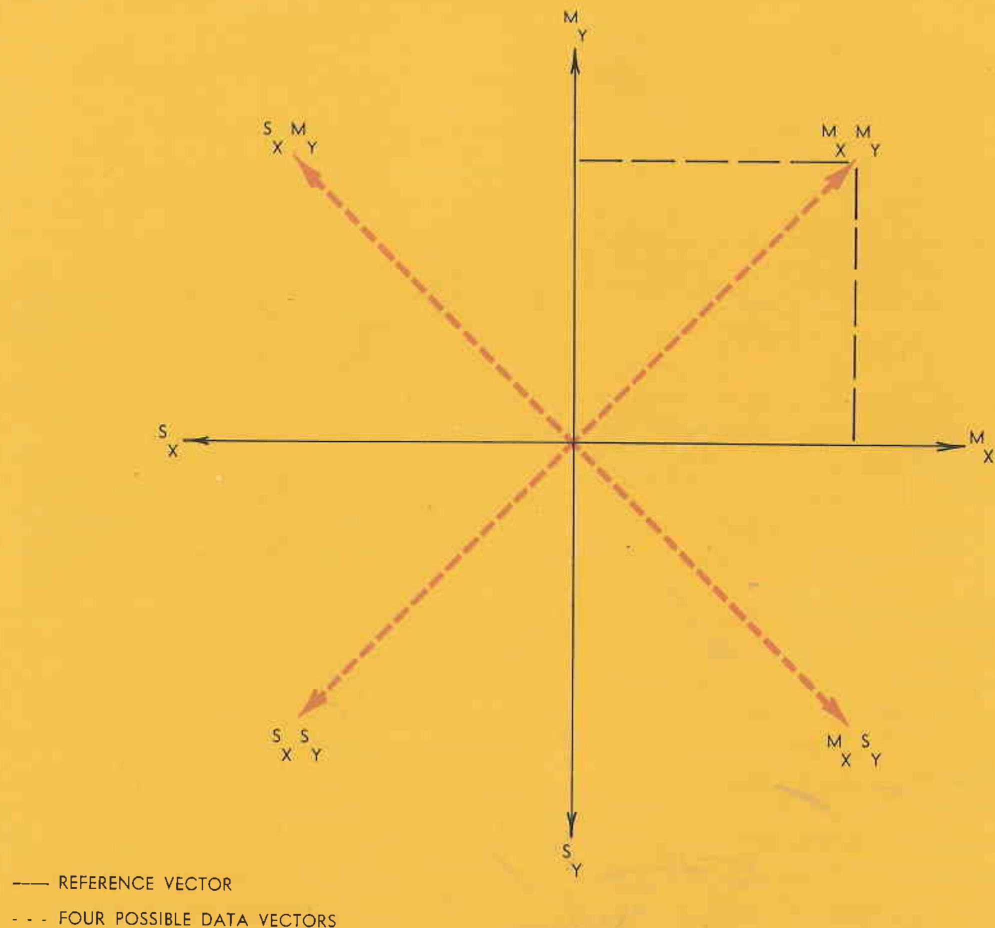


FIGURE 1

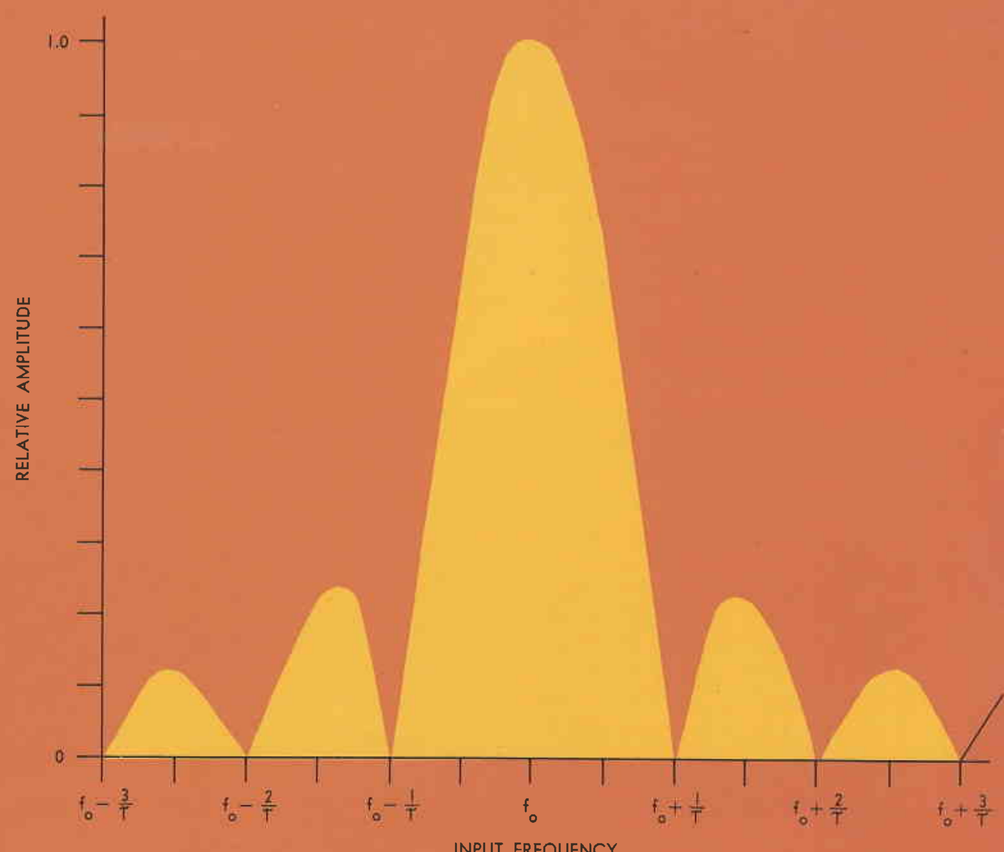


FIGURE 2

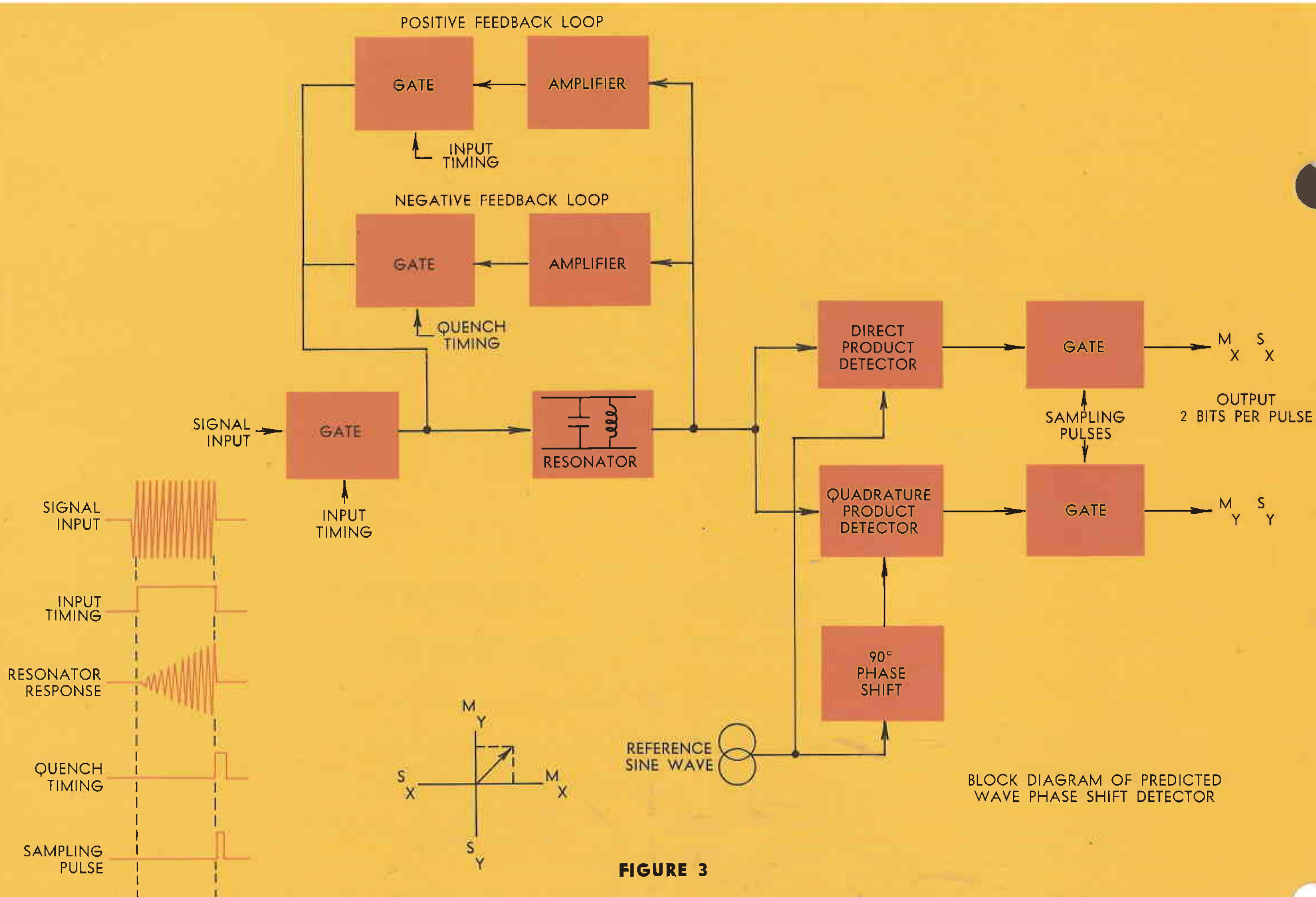


FIGURE 3

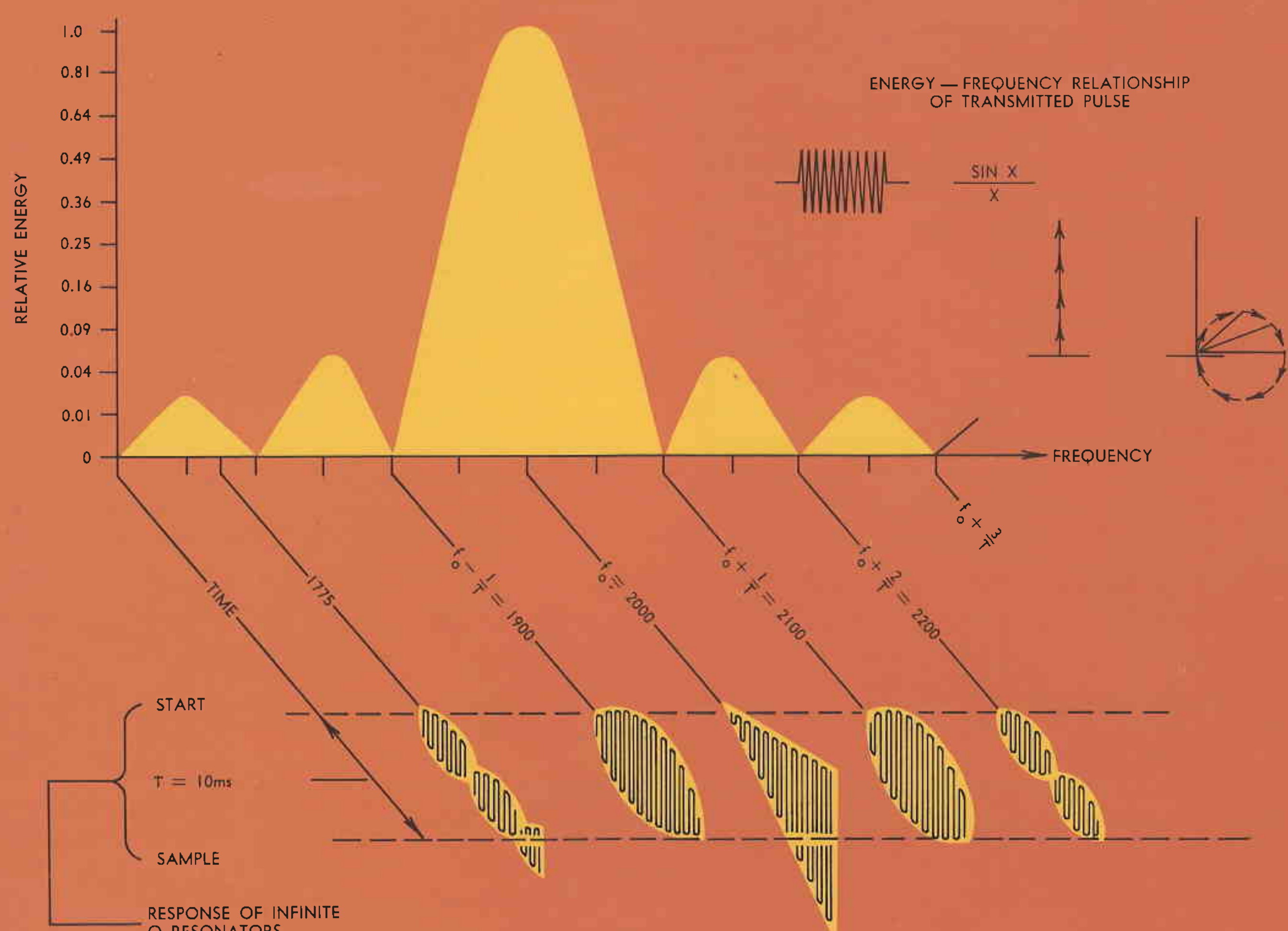


FIGURE 4

tion. Under this condition, the resonator will appear to have infinite Q. When the negative feedback is gated around the resonator-amplifier and the positive feedback is gated closed, the effective Q of the resonator will be low and as a result the oscillation in the resonator will be completely damped in less than 1 ms.

The resonator is an electromechanical transducer with a Q of approximately 1000. It is constructed to resonate in the audio range. Figure three shows the various timing gates and signal conditions throughout the receiving circuitry. When a pulse is expected from the transmitter, the input timing gate acts to open the resonator amplifier to the input signal which consists of a rectangular pulse at the resonator frequency. This pulse is applied to the resonator. The frequency of the pulse is assumed to be exactly the resonant frequency of the resonator. During the length of the pulse, the oscillation in the resonator will build up linearly with time. This comes about because of the fact that effectively no energy is dissipated in the resonator because it has infinite Q. However, during each cycle of the received pulse a given amount of energy is delivered to the resonator — producing a linear build-up with time. The output of the resonator is fed to two phase detectors. The phase detector outputs are sampled only at the end of the pulse at which time the pulse will have been integrated over its entire length to provide a maximum signal-to-noise ratio. Coincident with the sampling period, the negative feedback gate acts to quench the oscillation in the resonator so that the oscillation will decrease to zero in less than one milliseconds at which time the resonator will be ready to receive the next pulse.

It is assumed that a perfect phase reference is present at the receiver. This reference sine wave is coupled into one phase detector to provide its reference voltage. Also the reference sine wave is shifted 90 degrees in phase and applied to a second phase detector. The outputs of these two phase detectors at the time of sampling will give the projection of the received pulse on the x and y axes as indicated in figure three. In this manner, the output of the phase detector for the "x" channel will be positive when the signal transmitted in that channel is a mark and will be negative for a space. Similarly the polarity of the output of the other phase detector will indicate whether the signal transmitted in the "y" channel is a mark or a space. Accordingly, two bits of information per pulse will be obtained.

Predicted wave detection, as employed in Kineplex, makes use of a perfect weighting function for the rectangularly pulsed sine wave in the form of an infinite Q resonator gated in synchronism with the pulse. This resonator provides perfect integration over the length of the pulse.

An important consideration is the bandwidth required for each predicted wave channel. If T equals the time of duration of each pulse the bandwidth required per channel is equal to 1/T. That W=1/T is not immediately obvious. To prove that W=1/T, it must be shown that channels may be arranged in a frequency multiplex system spaced 1/T cycles apart in successive frequency intervals without crosstalk. If it is shown that there is no crosstalk, the effective band W per channel may be regarded as 1/T. Demonstration of the freedom from crosstalk is possible by reference to the energy-frequency diagram of the pulse and by examination of the response of the gated resonator as its frequency is varied.

The upper curve, figure four, is the energy vs frequency distribution of the transmitted pulse which appeared in figure two. The resonators are constructed at an audio frequency, and in order to provide a numerical example, the center frequency is shown as 2000 cps. Also for illustration the pulse length is indicated as being 1/100 second, giving 1/T=100 cps. At f_0 the amplitude response of the resonator at the desired frequency, 2000 cps, is indicated. It will be observed that the resonator amplitude builds up linearly to the sampling time at the end of the pulse.

At $f_0 - 1/T$ and $f_0 + 1/T$, 1900 and 2100 cps, the response of a resonator tuned to each of these frequencies is shown during the 2000 cps pulse; the amplitude first builds up and then decreases to zero at readout. Note that the upper curve which represents the energy distribution of the 2000 cps pulse has a null or "orthogonality" at each of these frequencies.

A similar result, namely zero output at readout time, is obtained at 2200 cps, except that at this frequency the resonator is displaced two channels and its amplitude goes through two maxima and two zeroes. Corresponding results will be obtained if the resonator frequency is displaced by additional 100 cycle increments with the number of maxima and number of zeroes corresponding the number of such increments the frequency is displaced.

The curve for a 1775 cps indicates the response of a resonator which is not accurately centered at F=2/T. There is a residual voltage at sampling time corresponding to the energy distribution indicated on the upper curve.

Of interest is the response of a resonator when both the desired and adjacent channel signals are transmitted. The output at the sample time will be the same as it would be if the desired channel had been transmitted alone. However, during the pulse interval the resonator stored energy will vary as the vector addition of the signals for the channels taken individually. Similarly, if there are a large number of channels operating at once, the resonator will respond in complex fashion during the pulse, but at sampling time will reach a value corresponding to the correct value for the desired channel alone.

Figure five A and B are a series of oscillograms showing actual resonator responses corresponding to the conditions examined in the previous figure. Each oscillogram was taken with the same resonator input power and oscilloscope sensitivity. The decrease in maximum stored energy in the resonator with increase in Δf is demonstrated.

Practical use of a system constructed in the manner just described is limited to a few special cases, principally due to the specification for a local reference wave at the receiver which is in exact phase synchronism with the transmitter RF. Although modern stable frequency sources could be used to approximate this result, operation would still be degraded due to phase instability frequently present in the transmission medium due to Doppler and multipath effects, layer height changes, etc. As a result, another method of obtaining the phase reference for the receiver was devised.

Before showing this practical arrangement as is incorporated in Kineplex a few of the prominent features of the system will be considered.

1. Although a frequency multiplex arrangement was used to demonstrate that $W=1/T$, the performance is basically identical with either time or frequency division. Signal-to-noise ratio performance of a single channel is the same whether flanking channels are present or not.

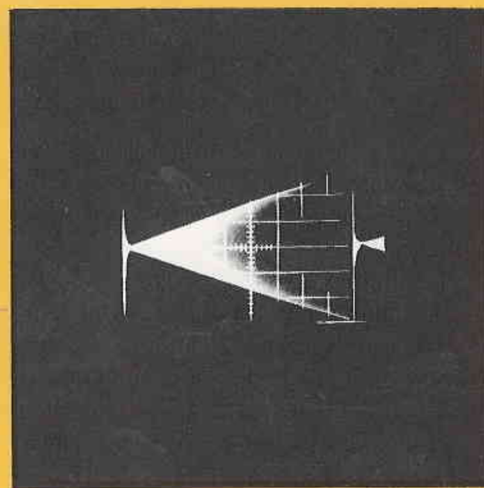
2. It is permissible to restrict the band emission of the transmitter by filtering to eliminate the side energy beyond about $\pm 3/T$. The amount of energy contained in the signal beyond this third orthogonality is so small that it can be filtered out with small effect on operation. This feature is of importance in limiting intersystem interference.

3. Adjustment of resonator feedback for "infinite" Q is not critical because of the initial high Q resonator and normal circuit tolerances are sufficient.

4. It should be noted that receiver selectivity is basically determined only by the quenched resonator with additional IF and RF selectivity being required only for strong signal protection.

5. Predicted wave detection yields a gain in signal-to-noise ratio performance accompanied by a *lowering* of the threshold and a *narrowing* of the band. This is in marked contrast to the usual result in systems such as FM where a gain in signal-to-noise ratio performance is attained only by *raising* the threshold and *widening* the band.

The only important difficulty in applying the laboratory system just described to practical transmission links, is that of maintaining a reference wave in exact phase synchronism with the transmitter reference and adjusting for variations in phase delay which occur in the medium. One solution would be to transmit a pilot reference signal at low relative power, clean it up by filtering or AFC methods and then establish a local reference. The question arises, however, as to whether the pilot channel would suffer the same disturbances as the signal channels. Because of this uncertainty and to simplify the system, it has been found more convenient to use each pulse as a reference for the following pulse. This procedure is a good engineering solution because the pulse length may be selected such that the phase changes expected in the medium will be small over one pulse length and, hence, will be nearly correct for analysis of the following pulse.

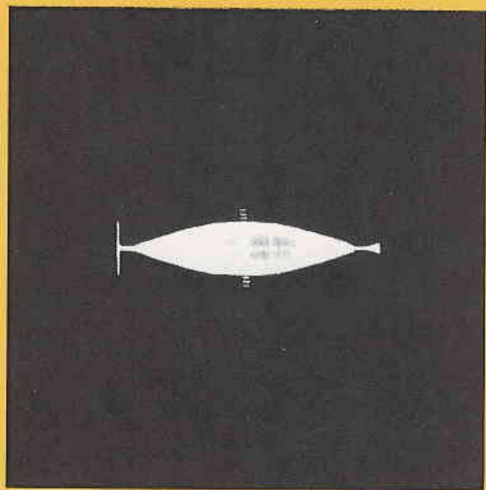


$\Delta f = 0$

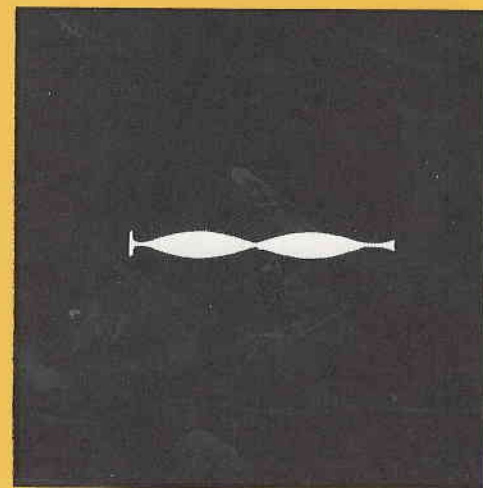
The block diagram of the predicted wave phase shift detectors incorporated in the Kineplex System is shown in figure six A and B. This system has the following basic features:

1. Information is encoded as phase reversals (or non-reversals) in each of the two quadrature components, rather than as absolute phase values.

RESPONSE OF KEYED FILTER WITH 10 MS. GATE



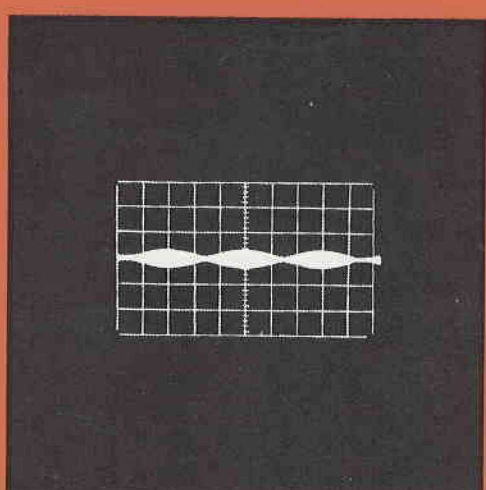
$\Delta f = 100$ cps



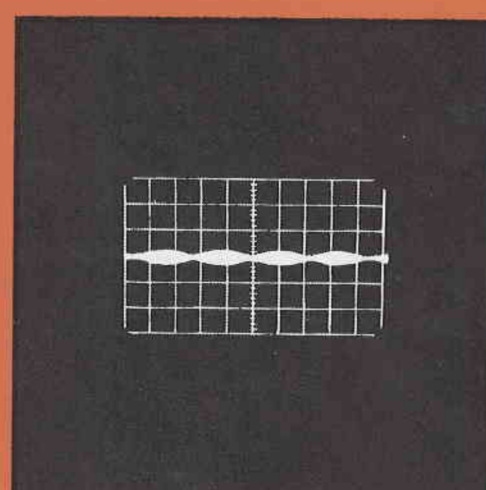
$\Delta f = 200$ cps

FIGURE 5A

(Δf DIFFERENCE BETWEEN SIGNAL AND RESONATOR CENTER FREQUENCIES)



$\Delta f = 300$ cps



$\Delta f = 400$ cps

FIGURE 5B

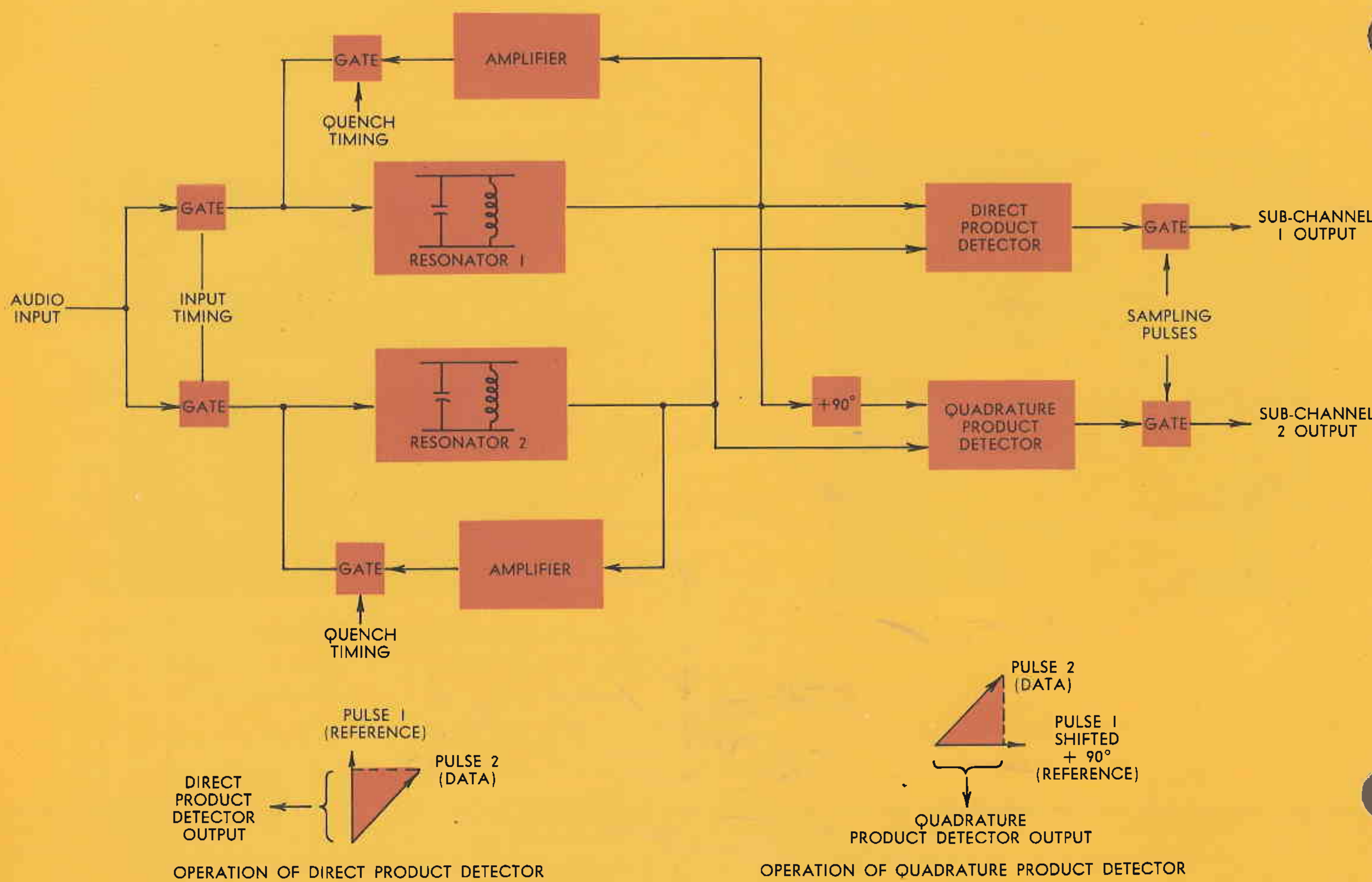


FIGURE 6A

2. Two resonators are used alternately at the detector. Each resonator is permitted to "ring" for one pulse interval as a means of storing a phase reference for analysis of the following pulse. It is then quenched and re-used.

3. Phase measurements so obtained are decoded by phase detectors so arranged as to interpret the reversals from pulse to pulse as originally encoded.

A comparison of the signal-to-noise ratio performance of signalling employed in Kineplex with standard FSK teletype is shown in figure seven. At the threshold the predicted wave is seen to be 6 db superior to FSK.

The capacity of the Kineplex system is illustrated by the fact that it is possible to multiplex 40 100-wpm teletypewriter circuits (total information rate 3000 bits per second) in a single voice band even after allowing suitable margins for delay distortion such as would be expected on long haul land lines on HF radio systems. The signal-to-noise ratio in the 3 kc voice band required to exceed threshold (bit error rate less than 0.00001 percent) for a signalling rate of 3000 bits per second is only 15 db.

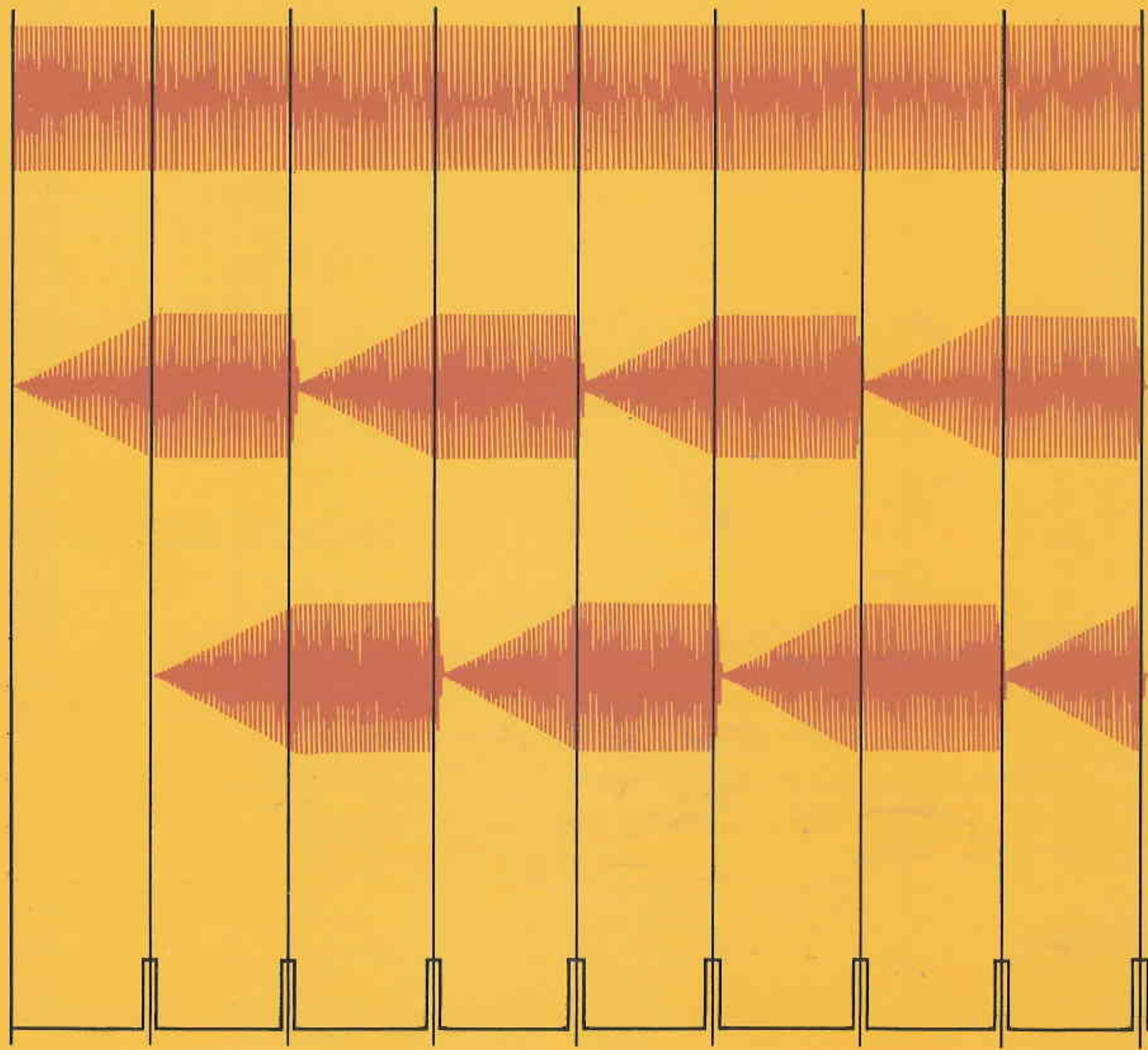
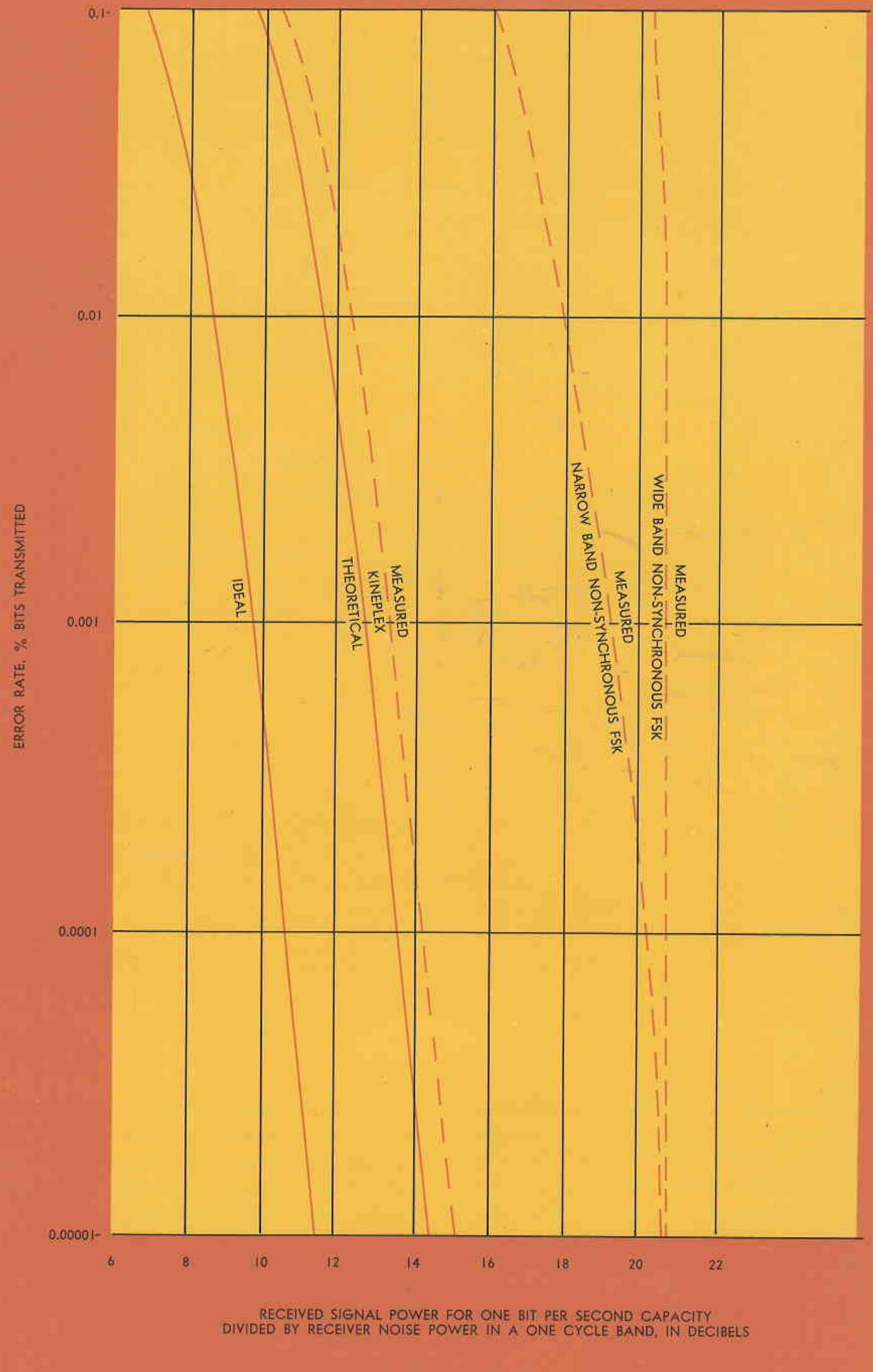


FIGURE 6B

Kineplex uses a simple code and narrows down the bandwidth and yet has a substantial signal-to-noise ratio gain. Modern theory teaches that we should move in exactly the opposite direction by using a complex, noise-like code and wider bands to gain in signal-to-noise ratio. This seeming paradox can be resolved when it is realized that most of the new theory deals with information and coding alone. It has neglected largely the matter of detection which is in many aspects a separate subject. Improved detection is the object of Kineplex — a need which has existed for a long time and which will continue to be of vital importance with any coding scheme, however complex. It is quite proper to think of using Kineplex detection principles and going on to build a complex wideband code system when it is useful to exploit the wideband techniques. It must be remembered, however, that in many communication systems it is undesirable or impractical to think of band widening. For example, much of our useful radio spectrum is likely to remain on a narrow band basis, because of allocation considerations or because of the physical limitations imposed by nature in the form of multipath distortion.



COMPARISON OF DIFFERENT TYPES OF SIGNALLING SYSTEMS

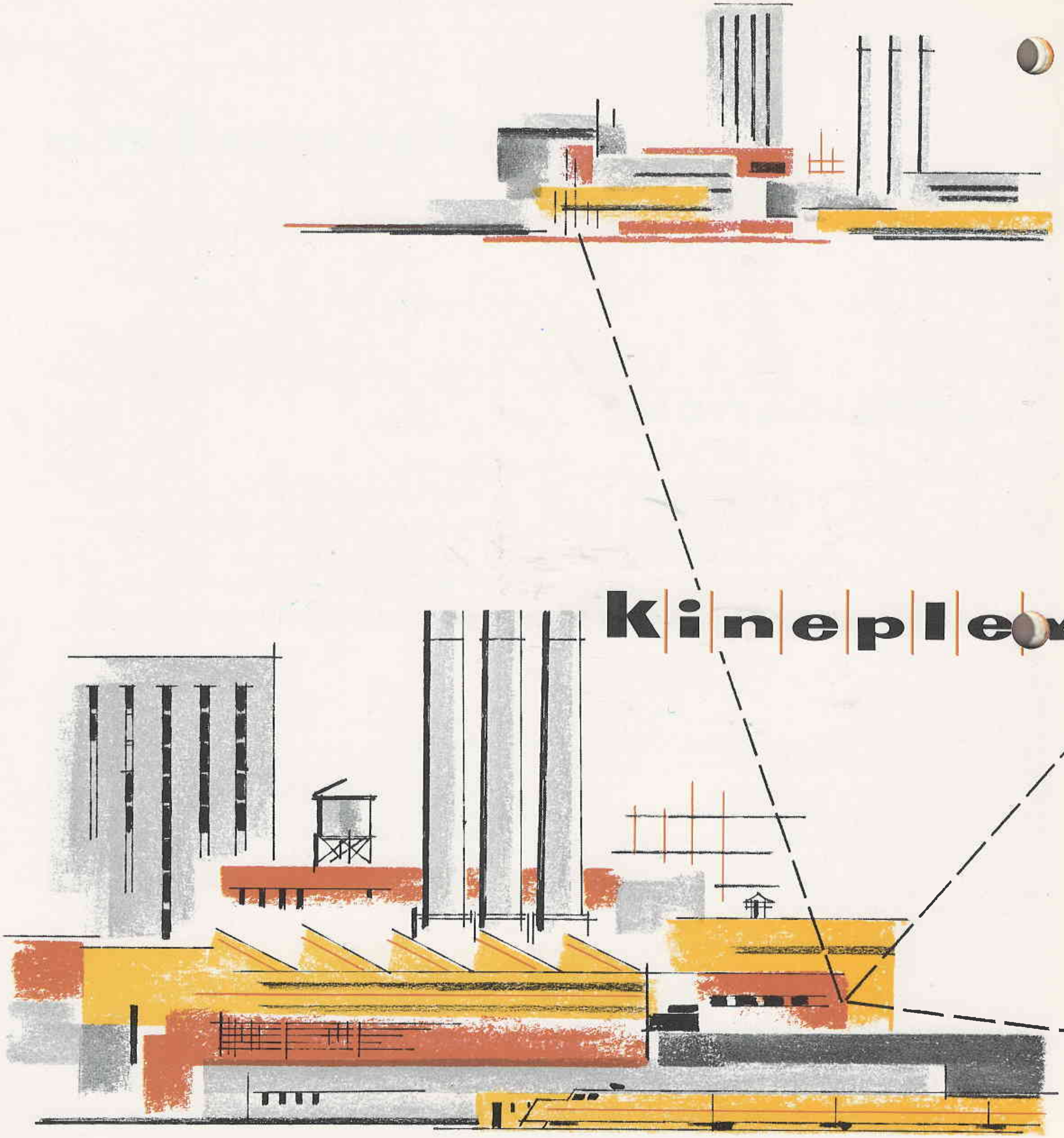
FIGURE 7

Kineplex

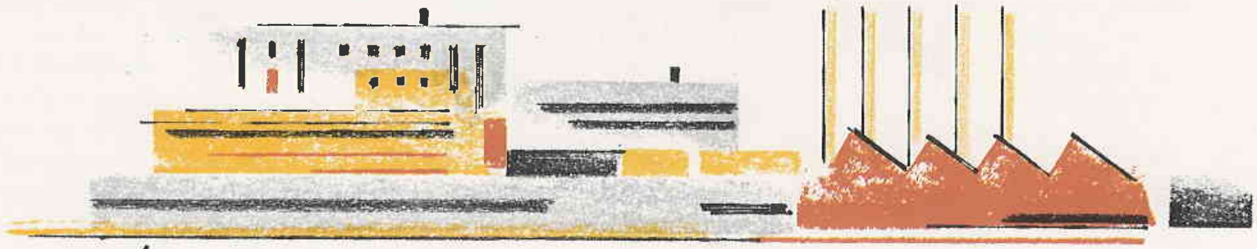
APPLICATION

Collins Kineplex Data System With Suitable Converter Provides Transmission of 3000 Bits Per Second in a Standard Voice Channel, or Will Provide 40 Channels of Teletypwriter Service in the Same Bandwidth Making it an Efficient Method of Communication For Telephone, Business Machine and Industrial Applications.

The completely transistorized Collins Kineplex Data System is a high capacity and flexible system for the transmission of binary information over wire line, cable, radio or microwave facilities. When employed with appropriate conversion units, the Kineplex Data System will accept and transmit binary information for various services such as teletypewriter, business machine, telemetering, supervisory control and facsimile. The basic communication channel on wire line and radio facilities has a nominal bandwidth of 3 kc. The Kineplex Data System has been designed to maximize the utilization of this basic channel. The system allows the transmission of data up to 3000 bits per second in the 3 kc band, this data rate on teletypewriter service affording 40 channels at 100 words per minute. On teletypewriter service this represents more than twice as many channels on a 3 kc band as compared with present day carrier telegraph systems. This two to one increase in spectrum utilization presents a straight forward approach for doubling the number of teletypewriter circuits on existing 3 kc channel facilities. Integrated data processing centers incorporating high speed electronic computers are presently being applied to a wide range of business record keeping functions. These centralized data centers in a typical application will require a communication network for connecting the data center to remote plants and sales offices. The efficiency of the data center will be dependent on the fast transmission of business data to the data processing center from the remote points. The Kineplex Data System provides an efficient and flexible high speed data link for transmitting this information. For this application, the Kineplex System may be supplied with the Collins Data Converters which enables the system to accept information in serial or parallel form from business data storage mediums at a 3000 bit per second rate and transmit it over a 3 kc channel. At the destination, the data may be provided in either serial or parallel form. Magnetic tape input/output storage is ideally suited for these applications; however, punched card, paper tape and other types of storage may be adapted for use with the Kineplex System. The total data transmission capacity of the Kineplex System may be divided between different services as best satisfies a specific application. As an example, a single system may be conveniently arranged to provide for the simultaneous transmission of 20 channels of teletypewriter service and a 1500 bit/sec data signal.

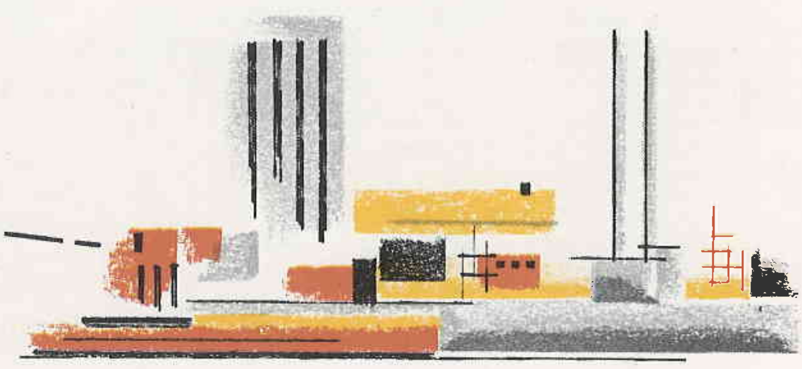


Kineplex



PROVIDES RAPID INTERPLANT DATA COMMUNICATION

A Collins Kineplex Data System may be utilized to transmit information from branch plant data processing centers to and from a main center at a rate of 3000 bits per second. By connecting data processing centers, a firm could have control over production planning, disbursements, costs, tabulating, records, territorial operations, marketing, production services, accounting, market research and many other areas.



Kineplex

EQUIPMENT

Kineplex Data System Includes a Rack of Synchronous Data Transmission Equipment and Rack of Either Teletypewriter or Series-Parallel Converters to Allow Transmission of Teletypewriter Service or Bit Per Second Information With the System Easily Tailored to Meet any Customer Requirements.

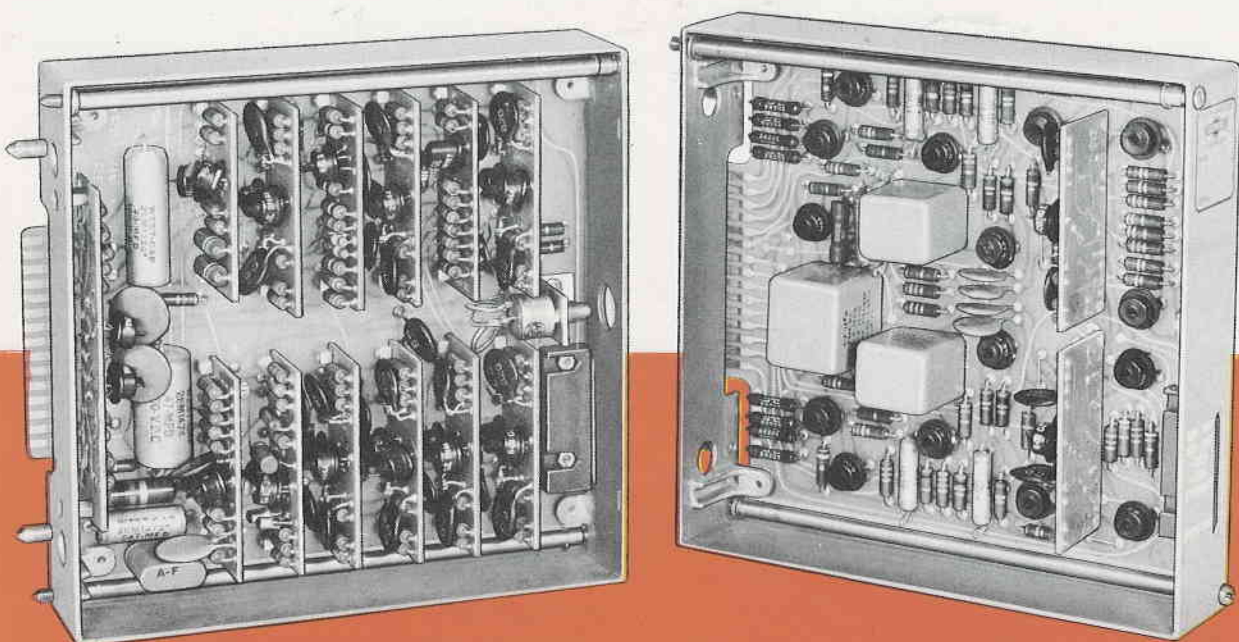
The Collins TE-202 Kineplex Data System consists of one rack of synchronous data transmission equipment and one rack of converter equipment as required for teletypewriter or business data applications. The equipment employs plug-in modular construction and utilizes printed wire circuitry. The module mounting plates, which fit standard 19-inch relay racks, are used to assemble the individual modules in this integrated system. The Kineplex Data System uses no vacuum tubes as the equipment is completely transistorized. The basic synchronous data transmission equipment is comprised of channeling equipment that may be added in multiples of two channels to a maximum of 40. The basic system provides wiring and mounting for 40 channels. A single channel will transmit at 45, 56, or 75 bits per second and channels may be connected in a series parallel or parallel series arrangement to provide for transmission of data up to a maximum of 3000 bits per second. Synchronous data as received from the associated converter equipment are translated to audio tones with two channels per tone. Twenty tones are spaced at 110 cycle increments from 605 to 2695 cycles per second. The separate tones are combined for transmission to voice frequency transmission equipment. In the receiving portion of the basic synchronous data transmission equipment, the tones are distributed to the detection units. Completely regenerated synchronous data are transmitted to the associated converter equipment.

The synchronization of the transmitting and receiving timing circuits may be accomplished by the use of a 2915 cps synchronizing tone. A frequency synthesizer may be provided to derive all timing from a precision frequency standard (Collins 40K-1) and thus eliminate the need for continuous transmission of synchronizing information. Automatic gain and frequency control functions are provided in the Kineplex Data System and may be employed in the event that the communication facilities transmitting the signal has poor level regulation or introduces frequency error.

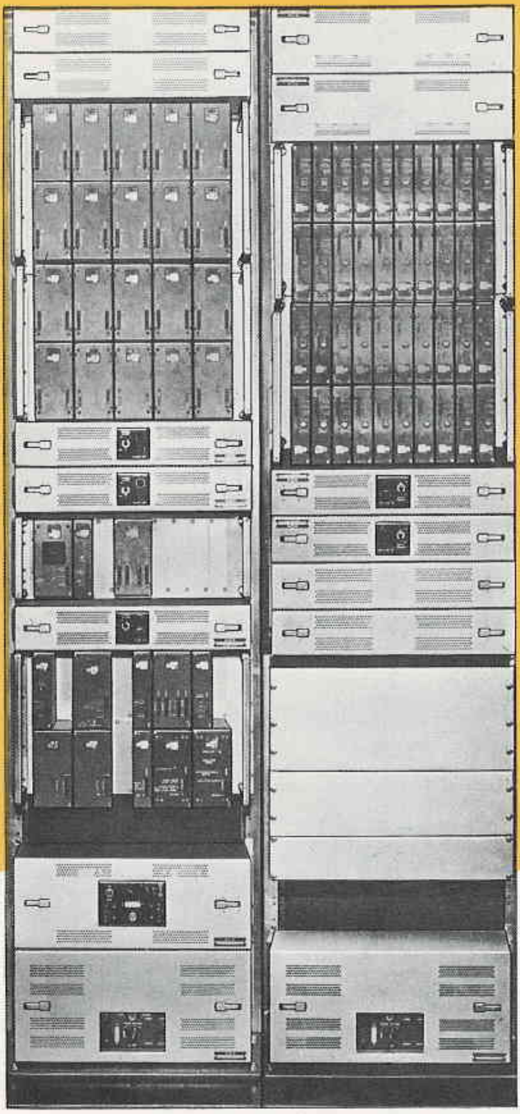
The TE-202 Kineplex Data System may be provided with conversion equipment to provide for a variety of services. Conversion equipment for teletypewriter service provides for the transmission of DC teletypewriter information. Nonsynchronous telegraph "start-stop" signals from a teletypewriter circuit are converted to synchronous data in the code converters. The synchronous data is then applied to the basic synchronous data transmission equipment for conversion to an audio tone. Forty channels of 60, 75 or 100 words per minute start-stop teletypewriter may be transmitted simultaneously on the 20 tones (2 channels per tone). At the receiving equipment the completely regenerated synchronous data is applied to the keyer units from the predicted wave signalling equipment. The keyer units provide the standard 60 ma neutral output to the teletypewriter line. No relays are used to provide the DC signals to the teletypewriter line. The transmission of data from sources having a high-rate serial output may be accomplished with series-parallel and parallel-series data converters associated with the Kineplex Data System. The series-parallel converter units will convert between high speed serial data at speeds to 3000 bits per second and the 75 bit/sec rate of each of the 40 channel inputs of the basic predicted wave signalling equipment. At the receive equipment, the 40 synchronous outputs from the basic system may be converted by a parallel-to-series converter to the original high speed time sequential rate of 3000 bits per second.

A single Kineplex Data System can be provided with different types of converters so that the system may be employed for the simultaneous transmission of data from several different types of input sources. Standby arrangements for the system units common to the 40 channels are available.

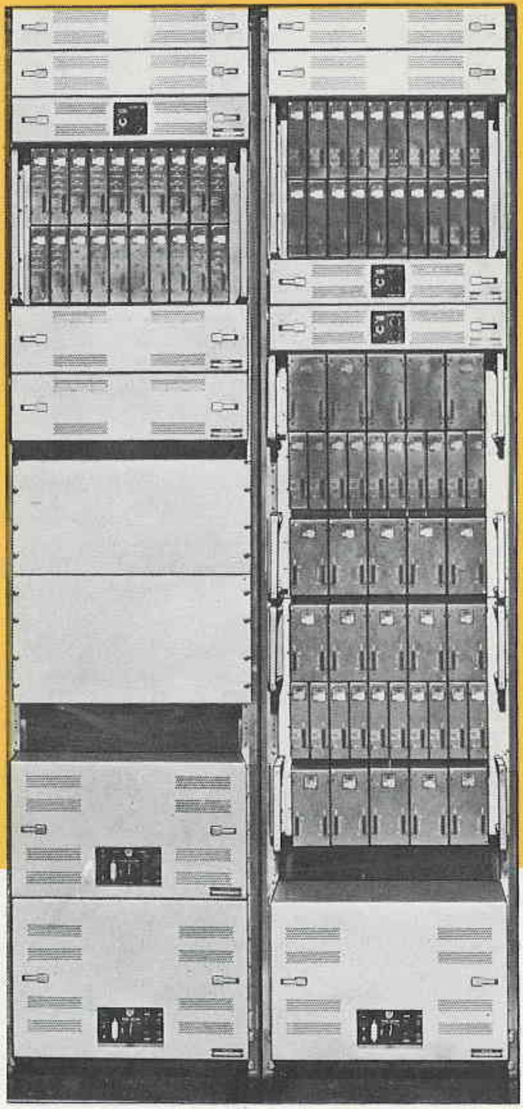
The equipment is designed to operate from DC power at 21 to 31 volts. Power supplies are also available which derive the DC power from 115 volts 60 cps lines.



Standardized modules are used in the Collins Kineplex Data System equipment, which is completely transistorized.



Collins TE-202 Kineplex Data System with Teletypewriter Converters (Front View)



Collins TE-202 Kineplex Data System with Teletypewriter Converters (Rear View)

EQUIPMENT SPECIFICATIONS

WEIGHT: 700 pounds

DIMENSIONS: 86⅛″ high, 41″ wide, 20″ deep

SIGNALS:

TRANSMIT INPUT: Non-synchronous dc telegraph "start-stop" signals, —60 ma for a "mark," 0 for a "space."

TRANSMIT OUTPUT: Composite signal of 21 audio tones with a range from 605 cps to 2915 cps and a level of +4 dbm.

RECEIVE INPUT: Composite signal of 21 audio tones with a range from 605 cps to 2915 cps and a level of —13 dbm.

RECEIVE OUTPUT: Non-synchronous dc telegraph "start-stop" signals, ungrounded, 120 volts across 2000 ohms for a "mark," 0 for a "space."

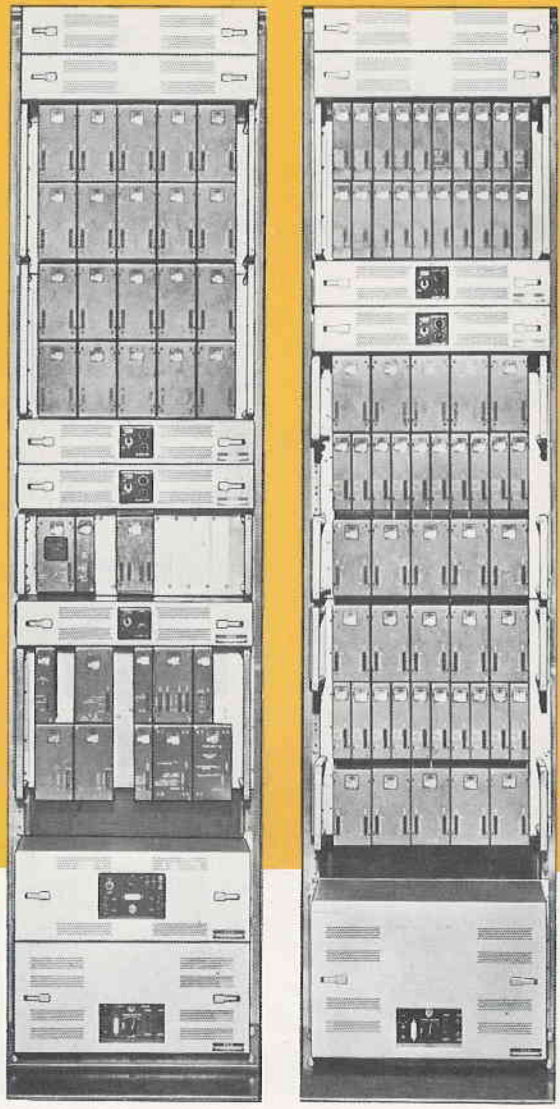
CHANNELS: 40 channels maximum, 60, 75 or 100 wpm each.

POWER INPUT:

Synchronous data transmission equipment:
9 amperes at — 27.5 volts dc or 700 watts at 115 volts, 60 cycle single-phase.

Teletypewriter converter equipment:
3 amperes at — 27.5 volts dc or 250 watts at 115 volts, 60 cycle single-phase.

Total power input:
950 watts 115 volts 60 cycles, single-phase or 22 amperes at — 27.5 volts dc.



Front View **Rear View**

Collins TE-202 Kineplex Data System

EQUIPMENT SPECIFICATIONS

WEIGHT: 400 pounds

DIMENSIONS: 86⅛″ high, 20½″ wide, 20″ deep

SIGNALS:

TRANSMIT INPUT: 40 parallel synchronous data signals each operating at 75 bits per second, —23 volts dc for a "mark," — 13 volts dc for a "space," balance ungrounded, 10,000 ohms input circuit.

TRANSMIT OUTPUT: Composite signal of 21 audio tones with a range from 605 cps to 2915 cps and a level of +4 dbm.

RECEIVE INPUT: Composite signal of 21 audio tones with a range from 605 cps to 2915 cps and a level of —13 dbm.

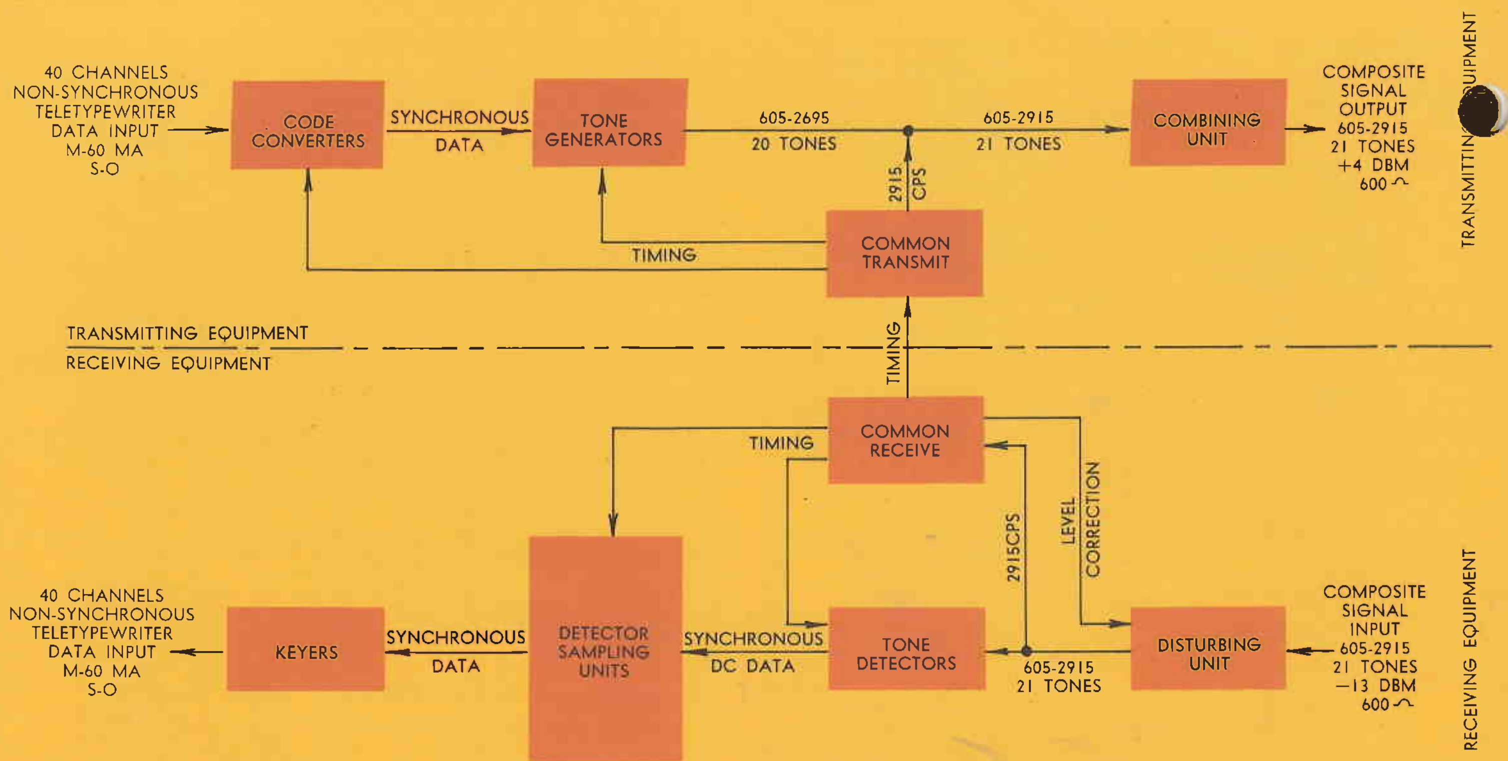
RECEIVE OUTPUT: 40 parallel synchronous data signals each operating at 75 bits per second, —23 volts dc for a "mark," —13 dc for a "space," unbalanced grounded.

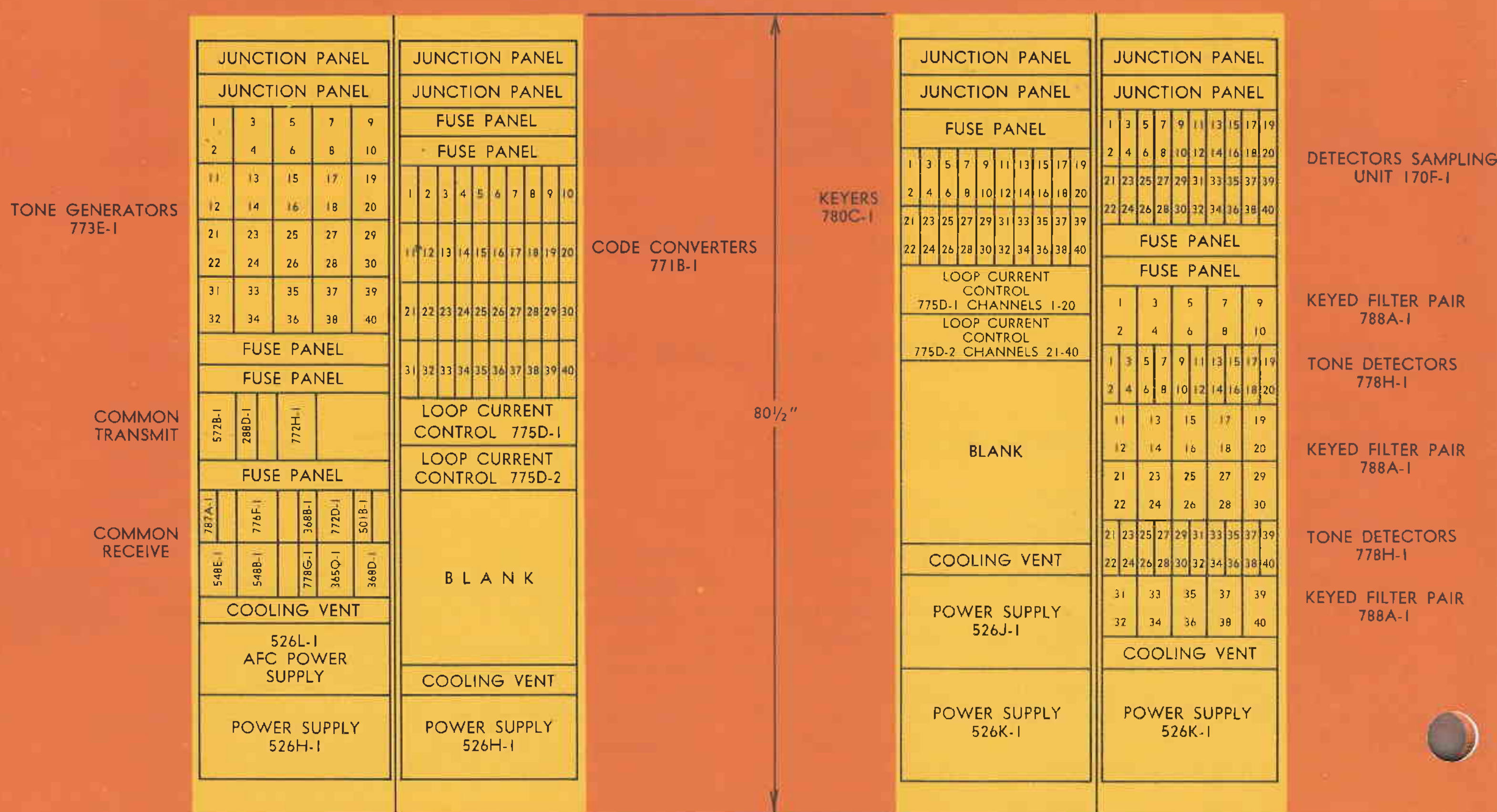
POWER INPUT:

Synchronous data transmission equipment:

9 amperes at —27.5 volts dc or 700 watts at 115 volts, 60 cycle single-phase.

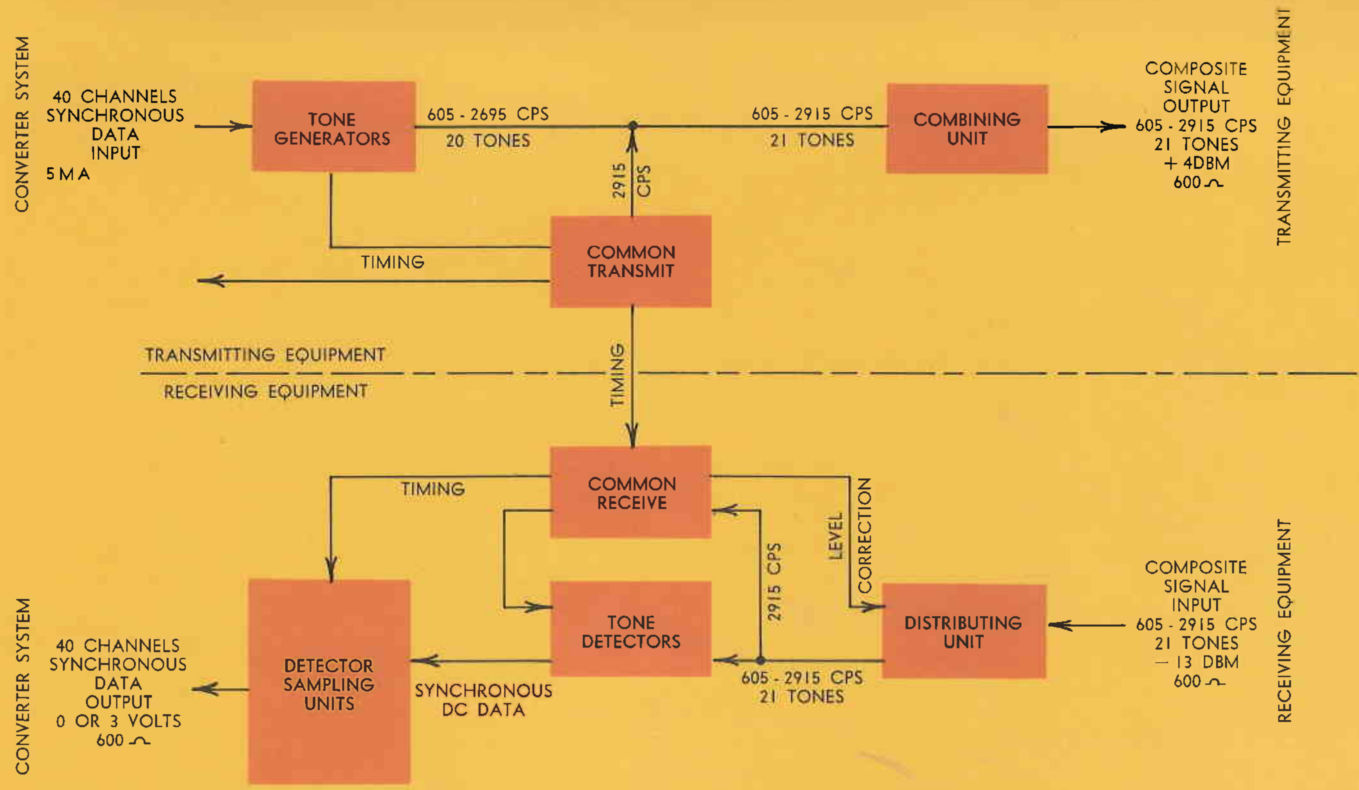
OPERATING CONDITIONS: Fixed station 0-45° C ambient, humidity to 95 percent.

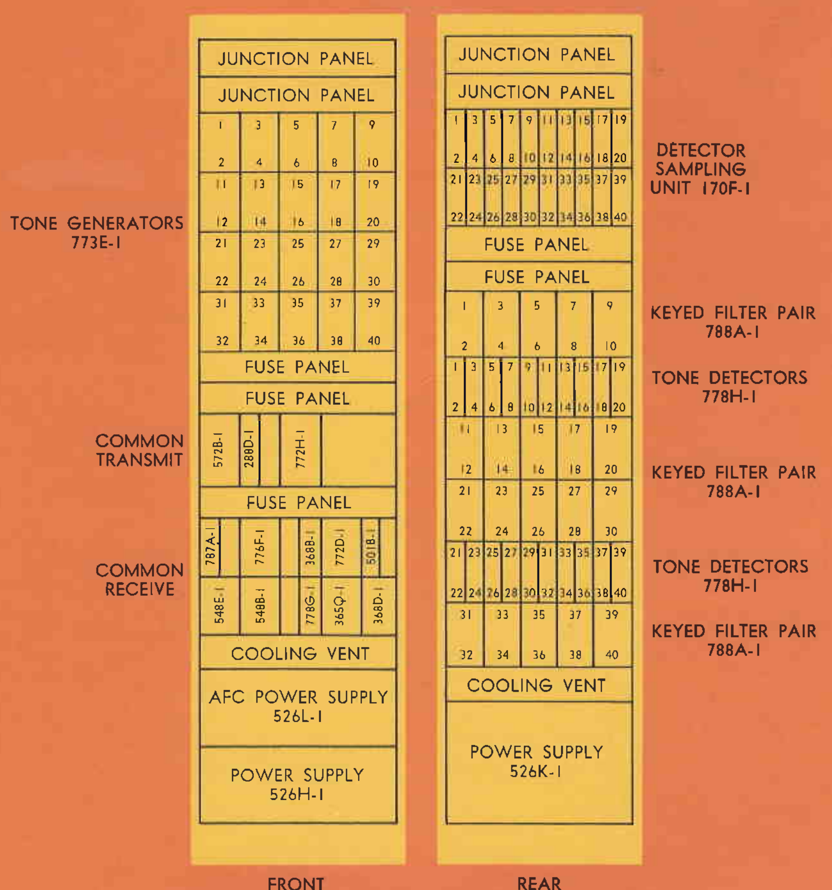




EQUIPMENT LAYOUT FRONT
KINEPLEX DATA SYSTEM WITH TELETYPEWRITER CONVERTERS

EQUIPMENT LAYOUT REAR
KINEPLEX DATA SYSTEM WITH TELETYPEWRITER CONVERTERS





EQUIPMENT LAYOUT KINEPLEX DATA SYSTEM

315 Second Avenue, CEDAR RAPIDS, IOWA • EMpire 3-2661
261 Madison Avenue, NEW YORK 16, NEW YORK • MUrray Hill 7-6740
1200 - 18th Street N.W., WASHINGTON, D. C. • NAtional 8-5415
1930 Hi-Line Drive, DALLAS 2, TEXAS • RIverside 7-5151
4471 - 36th St. N.W., MIAMI 48, FLORIDA • TUxedo 8-2407
2700 W. Olive Avenue, BURBANK, CALIFORNIA • THornwall 5-1751
1318 Fourth Avenue, SEATTLE, WASHINGTON • MAin 8278

COLLINS RADIO COMPANY

COLLINS RADIO COMPANY OF CANADA, LTD.
11 Bermondsey Road, Toronto 16, Ontario • PLymouth 7-1101

COLLINS RADIO COMPANY OF ENGLAND, LTD.
242 London Road, Staines, Middlesex, England • STaines 4128

5M—2/57—WP Part No. C-109-56

Printed in U. S. A.

315 Second Avenue, CEDAR RAPIDS, IOWA • EMpire 3-2661
261 Madison Avenue, NEW YORK 16, NEW YORK • MUrray Hill 7-6740
1200 - 18th Street N.W., WASHINGTON, D. C. • NAtional 8-5415
1930 Hi-Line Drive, DALLAS 2, TEXAS • RIverside 7-5151
4471 - 36th St. N.W., MIAMI 48, FLORIDA • TUxedo 8-2407
2700 W. Olive Avenue, BURBANK, CALIFORNIA • THornwall 5-1751
1318 Fourth Avenue, SEATTLE, WASHINGTON • MAin 8278

COLLINS RADIO COMPANY

COLLINS RADIO COMPANY OF CANADA, LTD.
11 Bermondsey Road, Toronto 16, Ontario • PLymouth 7-1101

COLLINS RADIO COMPANY OF ENGLAND, LTD.
242 London Road, Staines, Middlesex, England • STaines 4128

5M—2/57—WP Part No. C-109-56

Printed in U. S. A.