



**B R O A D C A S T**

**COLOR**

**E Q U I P M E N T**

*for*

**TELEVISION**



**NETWORK**

**TEST**

**COLOR PLANS**

**STUDIO CAMERA**

**LOCAL ORIGINATING**

**FILM AND SLIDE CAMERA**



# BROADCAST COLOR EQUIPMENT CATALOG



BROADCAST EQUIPMENT SECTION

**RADIO CORPORATION OF AMERICA**

Engineering Products Division

Camden, N. J.

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## **ABOUT THIS CATALOG**

This Catalog is devoted solely to information on RCA color television equipment. Other RCA Broadcast Equipment Catalogs contain similar information on audio equipment, video equipment, test equipment, AM, FM and TV transmitters, antennas and transmission line equipment.

This Catalog contains descriptions and specifications of RCA color equipment—for network, film/slide, and live operation. Described here are the principal equipments used in color systems. Other system components equally useful for monochrome or color can be found in the RCA Video Catalog, Books 1 and 2.

The information contained in this catalog is intended to serve as a buying guide for the users of this type of equipment. In the belief that broadcast engineers want facts, rather than generalities, the content has purposely been kept brief and factual. Readers who desire more information or individual bulletins on particular equipment items are invited to write to the RCA Broadcast Representative in the RCA Regional Office nearest them (see opposite page).

## **OTHER RCA TECHNICAL PRODUCTS**

The RCA equipment described in this catalog is specifically designed for broadcast station use. In similar manner RCA builds electronic equipment for many other industries. These include: a complete line of equipment for theatres; optical and magnetic film recording equipment; sound systems of all types; 16mm projectors and magnetic recorders; high-fidelity components for home music systems; 2-way radio and microwave communication equipment; industrial inspection equipment; scientific equipment, such as the electron microscope; industrial television systems; intercoms; tape recorders; TV Eye; Antenaplex systems; and many types of custom-built equipment for industry and the military services. Information, and catalogs or bulletins, describing these may be obtained from RCA Regional Offices.



# HOW TO ORDER

The RCA Broadcast Color Equipment shown in this catalog is sold directly through RCA Broadcast Representatives, who are familiar with broadcast equipment and related problems. One or more of these RCA Representatives are located in each of the RCA Regional Offices listed

below. Orders for equipment shown in this catalog, or requests for additional information, should be directed to the nearest one of these offices. Complete information on the conditions under which RCA sells broadcast equipment is given on the following page.

## PRICES

The prices of the various equipment units shown in this catalog are given in a separate price list. Prices are listed in the order in which they are shown in the catalog. To determine the price of any equipment first note the page

on which it is shown in the catalog, then consult the price list in accordance with this page number. Equipments are identified by type and MI (Master Item) numbers which are used to identify apparatus on invoices and packing slips.

**YOU CAN LOCATE YOUR NEAREST RCA REPRESENTATIVE FROM THIS LIST**

## REGIONAL OFFICES

**ATLANTA 3, GEORGIA**  
522-533 Forsyth Building  
Lamar 7703

**CLEVELAND 15, OHIO**  
718 Keith Building  
Cherry 1-3450

**NEW YORK 20, NEW YORK**  
36 West 49th Street  
Circle 6-4030

**BOSTON 16, MASSACHUSETTS**  
200 Berkeley Street  
Hubbard 2-1700

**DALLAS 1, TEXAS**  
1907-11 McKinney Avenue  
Riverside 1371-2-3

**SAN FRANCISCO 3, CALIFORNIA**  
1355 Market Street  
Hemlock 1-8300

**CAMDEN 2, NEW JERSEY**  
Front and Cooper Streets  
Woodlawn 3-8000

**HOLLYWOOD 28, CALIFORNIA**  
1560 North Vine Street  
Hollywood 9-2154

**SEATTLE 4, WASHINGTON**  
2250 First Avenue, South  
Main 8350

**CHICAGO 11, ILLINOIS**  
666 North Lake Shore Drive  
Delaware 7-0700

**KANSAS CITY 6, MISSOURI**  
1006 Grand Avenue  
Harrison 6480-1-2

**WASHINGTON 6, D. C.**  
1625 K Street, N. W.  
District 7-1260



# BROADCAST EQUIPMENT SALES POLICY

## FOREWORD

The present statement sets forth basic conditions under which RCA sells broadcast equipment as described in our catalog, and notes certain supplemental information. This statement does not apply to the sale of tubes or sound film recording equipment, for which separate standard sales and lease policies are in effect.

RCA broadcast equipment is sold directly through RCA Regional Representatives, who are familiar with broadcast equipment and related problems.

## CONTRACT PROCEDURE

All sales based on orders for transmitters, antennas and custom built or special apparatus and on orders over \$5,000 are made in accordance with the conditions of the RCA Standard Proposal Form for the sale of broadcast equipment and with any agreement stipulated thereon for individual customers.

## PRICES

RCA broadcast equipment domestic prices are net f.o.b. factory or warehouse, which is Camden, New Jersey, for most items. These prices do not include any federal, state or local taxes based upon use or measured by sale or use and unless otherwise noted do not include federal excise tax. Any such taxes in effect at the time of shipment will be billed separately or will be included in the prices when required and will be due and payable upon delivery.

RCA's prices do not include installation or installation supervision unless specifically mentioned in a written condition or proposal. Purchaser assumes responsibility for installation and operation of the equipment as well as for obtaining all necessary licenses, permits, etc.

NOTE: The service of factory trained personnel who are specialists in the supervision of the installation of broadcast equipment and in its maintenance and repair may be obtained through an order placed with the RCA Service Company, Inc. It is recommended that the advantages of this service be considered at the time of purchase of any major broadcast equipment.

In the case of orders under the Standard Proposal Form the billing prices are based on those prices effective at the date of the order to the extent indicated in the final contract. In the case of orders not under the Standard Proposal Form the billing prices are those prices in effect on the date of shipment.

RCA endeavors to keep its published prices current; however, all published prices are subject to change without notice.

Prices for items marked with a symbol (e) in the price column are estimates only and are subject to adjustment to those in effect on the date of shipment.

In the event the estimated prices quoted herein are exceeded by more than 10% and the billing price cannot be established by mutual agreement prior to shipment, such items may be cancelled without liability to RCA or Purchaser by either party giving written notice to the other.

## PAYMENT

Terms of payment are subject to approval of RCA's Credit Department at Camden, New Jersey.

## DELIVERY

RCA's delivery of broadcast equipment will be f.o.b. factory or warehouse, which is Camden, New Jersey for most items. The Purchaser shall be responsible for all transportation charges, and shipments will normally be forwarded with shipping charges "collect". As an accommodation, when specifically requested to do so by the Purchaser's order, RCA will prepay transportation charges and invoice them to the Purchaser as a separate item.

Delivery will be made to a carrier specified by the Purchaser, unless none is specified, in which event it will be to common carrier selected by RCA. In the absence of specific routing instructions from the purchaser, RCA's judgment with respect to the selection of a route will be final.

As a special service with respect to shipments overland, by inland waterways or by air we carry All Risk Transportation Insurance for the benefit of our Broadcast Equipment customers, and your interests will be amply protected in all shipments of equipment while in transit by the methods indicated above, at no additional expense to you, provided that you inspect all shipments upon receipt and report any shortages or damages at once, in writing, to the carrier and to RCA.

RCA will endeavor to meet delivery schedules but it assumes no liability for damages of whatever kind for delays in delivery. No delays in delivery shall relieve the purchaser of his obligation of performance.

## PATENT LICENSES

RCA broadcast equipment is licensed for radio telephone or television broadcast transmission under United States patents owned by RCA or under United States patents under which RCA is licensed.

## PATENT PROTECTION

RCA, at its own expense, will defend any suit which may be brought against purchaser for infringement of United States patents by the equipment furnished when sold or used for radio telephone or television broadcast transmission, and in any such suit will satisfy any final award for such infringement. This is upon the condition that purchaser gives RCA prompt notice of such suit and full right and opportunity to conduct the defense thereof, together with full information and all reasonable cooperation, and upon the further condition that the claimed infringement does not result from the combination of the equipment furnished with other equipment, apparatus, or devices not furnished by RCA. No costs or expenses shall be incurred for the account of RCA without its written consent. If purchaser's sale or use of such equipment for radio telephone or television broadcast shall be prevented by permanent injunction, RCA shall substitute for the infringing equipment or parts other equally suitable equipment or parts, or at RCA's option obtain for purchaser the right to sell or continue the use of such equipment, or at RCA's option take back such equipment and refund any sums purchaser has paid RCA therefor, less a reasonable amount for use, damage and obsolescence.

## WARRANTY

We warrant the equipment of our manufacture (except electron tubes) purchased by you hereunder to be free from defects in material and workmanship under normal use and service for a period of one (1) year, our obligations under this warranty being limited to the repair or replacement of such parts which our examination shall disclose to our satisfaction to have been thus defective and to the shipment of the repaired or replacement part or parts to you f.o.b. our factory. This warranty shall not apply to, and RCA shall not be responsible for, any equipment or part which has been repaired or altered in any way that, in our judgment, affects its stability or its reliability, nor which has been subject to misuse, negligence or accident, nor which has had any serial number altered, defaced or removed. Electron tubes shall bear only the warranty accompanying them at the time of delivery to you and equipment furnished by us but listed herein as manufactured by another shall bear only the warranty given by such other manufacturer. No warranties other than those set forth in this paragraph are given or are to be implied with respect to the equipment furnished hereunder.

## REPAIRED AND RETURNED APPARATUS

Before an apparatus is returned to RCA for repairs or adjustments shipping instructions and an identifying number should be obtained from the nearest RCA Regional Office. RCA assumes no responsibility for unauthorized returns.

## EQUIPMENT MODIFICATIONS AND WITHDRAWALS

RCA reserves the right to make, without notice, modifications of the equipment described in this catalog without affecting its right to sell such equipment under orders based on the catalog description, provided, however, that the modifications shall not materially affect performance. These modifications of equipment may be made by RCA or its suppliers from time to time for reasons such as improvement in performance, simplification in design, or availability of material. RCA also reserves the right to withdraw from sale, without notice, any equipment described in our catalog.

## ACCEPTANCE OF ORDER

No order shall be binding upon RCA until accepted by it in writing at Camden, New Jersey, and the banking, negotiation or other use of the down payment shall not constitute an acceptance by RCA. Orders received by Regional Offices will be forwarded promptly to RCA's Camden office.



# PHASE EQUALIZER EQUIPMENT

ES - 34034 - A

## FEATURES

- Permits variable envelope delay of both high and low video frequencies
- Simple switching system permits selection of optimum phase correction
- Employs passive elements only—no tubes or power supplies
- No internal adjustments necessary—factory sealed to prevent accidental changes



## USES

The RCA Phase Equalizer Equipment, Type ES-34034-A, is designed to compensate for various distortions introduced in video transmission systems by such components as the color receiver, transmitter, vestigial sideband filter, notch diplexer and terminal equipment. The equipment greatly improves color edges and color transitions, and provides better time correspondence between luminance and chrominance information. It is required by all TV transmitters to meet FCC color specifications.

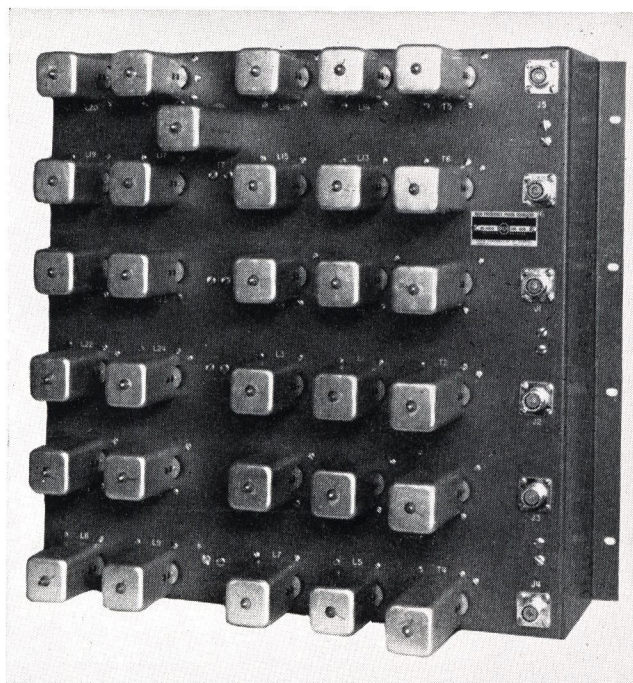
The equipment consists essentially of two elements—a High Frequency Phase Equalizer, MI-34026, and a Low Frequency Phase Equalizer, MI-34025. The High Frequency Equalizer is designed for insertion in the video input to a color television transmitter to compensate for envelope delay distortion due to such factors as high frequency cut-off of a color receiver, a sound notch filter, and for any additional envelope delay distortions in the high video part of the spectrum which is introduced by the transmitter or terminal equipment. The Low Frequency Phase Equalizer rectifies envelope delay distortion at low frequencies caused by the vestigial sideband filter, and improves overall transient response of the entire transmitter-to-receiver system.

## DESCRIPTION

Both the High and Low Frequency Phase Equalizers consist of passive, all-pass, constant resistance bridged-T networks composed entirely of reactive elements. Both are mounted on bathtub-type chassis designed for standard 19-inch rack-mounting.

The MI-34025 Low Frequency Phase Equalizer requires 5¼ inches of rack space. The front panel contains only two switches: (1) a rotary switch which enables selection of any one of four envelope delay characteristics, and (2) a toggle switch which connects the equalizer in or out of the video circuit as desired. The unit is designed to have an amplitude response flat within  $\pm 0.5$  db to 4.2 mc, and circuit attenuation of approximately 0.5 db. Both factors are independent of delay compensation settings. Four degrees of delay compensation are provided for the region below 2.0 mc. A section of Type RG-11/U 75-ohm coaxial cable is supplied to connect the equalizer into the transmitter video system in series with the Receiver Equalizer section of the High Frequency Phase Equalizer. The unit has been properly adjusted at the factory and all internal adjustments have been sealed in to prevent accidental changes. Proper functioning of the equalizer can be checked by observing, with an oscilloscope, the input amplitude of a video sweep signal.





Rear view of High Frequency Phase Equalizer.

The RCA High Frequency Phase Equalizer, MI-34026, consists of three circuit networks requiring 17½ inches of rack space. The first is the receiver equalizer section which provides the envelope delay curve to meet the FCC color specification, and compensates for the high frequency cut-off of an average color receiver. Correction is required above 3 megacycles. A toggle switch is provided for switching the receiver equalizer in or out of the circuit. The second network is the notch equalizer section which must be used if a sound notch filter (such as a Filterplexer) is used in the transmitter. There are provisions for selection of one or two basic envelope delay curves by means of a toggle switch, and another switch allows cutting the notch equalizer in or out of the circuit. Finally, there is the variable equalizer section which compensates for small system variations. A five-position rotary switch selects one of five degrees of variation in combination with the selection of an optional fixed section. Thus there are ten possible delay curves provided. A separate toggle switch allows this network to be switched in or out of the circuit.

The notch and variable equalizer networks are designed for insertion in series between distribution amplifiers,

whereas, the receiver equalizer should be patched in series with the Low Frequency Phase Equalizer, between distribution amplifiers. The High Frequency Phase Equalizer is supplied with one precision 75 ohm  $\pm 1\%$  coaxial termination which is color coded with a red band. All controls, consisting of six switches, are mounted on the front panel. The unit has been carefully adjusted at the factory for correct operation, and the adjustments have been sealed to prevent accidental change.

## SPECIFICATIONS

### Performance Specifications

Type of Circuit.....	Non-minimum phase reactance network (No tubes or power supply required)
Impedance.....	Input and output: 75 ohms
Type of Signal.....	Composite video; color or monochrome
Circuit Attenuation.....	Approx. 5 db
Sweep Frequency Response.....	$\pm 5$ db to 4.2 mc
Phase Response:	
Low Frequency Phase Equalizer.....	Constant envelope delay from 2.0 mc to 4.2 mc; four envelope delay ranges; frequency range of envelope delay adjustment 0 to 2.0 mc.
High Frequency Phase Equalizer:	
Receiver Equalizer.....	Follows FCC specified curve
Notch Equalizer.....	Zero delay from 0 to 3 mc; choice of 2 curves above 3 mc
Variable Equalizer.....	Zero delay from 0 to 2 mc; choice of 10 curves above 2 mc

### Mechanical Specifications

Low Frequency Phase	
Equalizer.....	19" wide, 5¼" high, 10" deep; wt. 9 lbs.
High Frequency Phase	
Equalizer.....	19" wide, 17½" high, 10" deep; wt. 22 lbs.

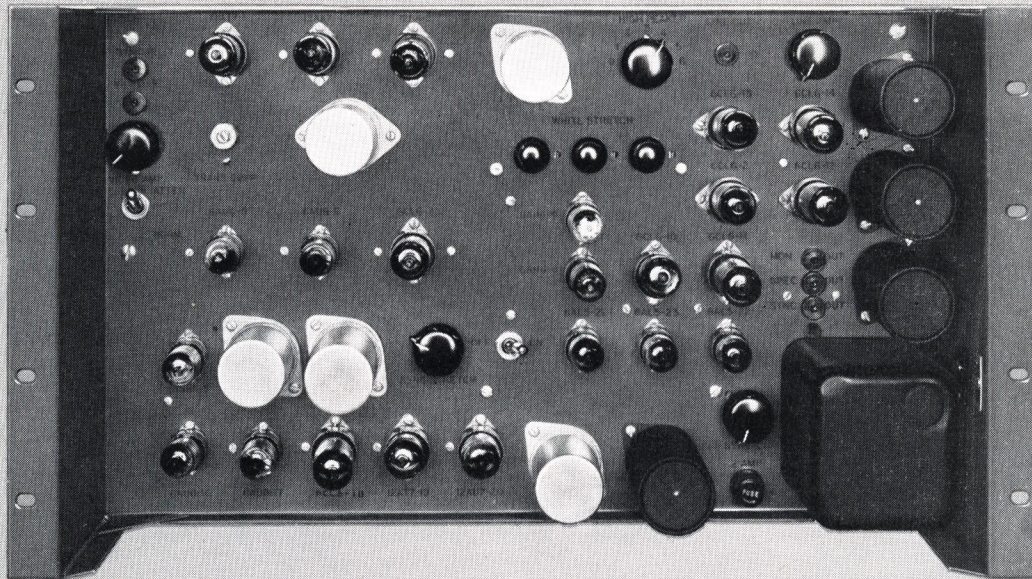
### Equipment Supplied

Low Frequency Phase Equalizer on Rack-mounting Chassis, including 1 75-ohm coaxial termination, 2 connectors for RG-11/U coaxial cable, and Instruction Book (IB-36195) .....	MI-34025
High Frequency Phase Equalizer on Rack-mounting Chassis, including 1 75-ohm coaxial termination, 2 connectors for RG-11/U coaxial cable, and Instruction Book (IB-36196) .....	MI-34026



# COLOR STABILIZING AMPLIFIER

## TYPE TA-7B



### FEATURES

- Excellent performance with either color or monochrome signals
- Compensates for transmitter compression of white signal and sync
- Removes low frequency disturbances from video signals
- All miniature tubes
- Output internally terminated in 75 ohms
- Adjustable increase of color subcarrier and monochrome high frequencies up to 40% to compensate for transmission loss
- Special monitor output for monitoring signal before white stretch
- Permits external sync to be mixed with video signal when desired
- Provision for remote control of gain, sync stretch, and sync clip in small ranges

### USES

The RCA Type TA-7B Color Stabilizing Amplifier is a versatile unit designed to correct either color or monochrome video signals for hum, low frequency distortion, and other random disturbances commonly encountered in long transmission lines or in microwave transmissions. It also pre-compensates for the compression of sync pulses and of the white portions of the picture by television transmitters.

The amplifier finds varied use in the television studio, since it may be used: (1) on a studio incoming line handling remotes or networks; (2) on the studio output line; or (3) at the output of a microwave receiver. Its principal functions in the studio are to remove hum and low frequency disturbances, and to restore sync and video to

normal amplitude. It will also clip noise in the region between the tip of burst and sync. The TA-7B will maintain constant sync output despite surges causing loss of the proper picture-to-sync ratio, and can also be adjusted to change picture to sync ratio. External sync may be mixed in the unit and interlocked with the signal switching. Separated sync at a four volt level (75 ohms) is available at an output connector for Genlock operation and to synchronize oscilloscopes.

At the transmitter location, the Color Stabilizing Amplifier functions primarily to maintain proper video levels and to pre-compensate for the compression of sync pulses and the white portions of the picture by the transmitter.



## DESCRIPTION

The Color Stabilizing Amplifier is mounted on a recessed chassis 10½ inches high and designed for standard rack-mounting either in the transmitter or studio control room. All operating controls are located on the front panel. These regulate the output signal level to the video line, the amount of high frequency boost required for the correct chrome-monochrome ratio, cancellation of switching transients when inserting external sync, input signal level, amount of sync stretch, the sync clipping level, and levels at which three degrees of white stretch become effective. In addition, three capacitor controls are available on the back of the chassis to correct the phase angles of the three white stretching levels selected to compensate for any particular transmitter compression. Provision has also been made for remote control of gain, sync stretch, and sync clip in small ranges.

The TA-7B requires a separate power supply to deliver 350 ma at a well-regulated 280 volts. The RCA Type 580-D power supply is recommended. The filament transformer is mounted on the chassis and requires 1 ampere at 115 volts. Signal and input and output lines must be 75 ohm coaxial cable, connected to the jacks with coaxial plugs furnished with the equipment.

The Color Stabilizing Amplifier is designed to have an overall amplification of 10 db. The minimum input signal voltage, black to white, is .45 volt, and maximum recommended output level 1 volt black to white at all three video outputs. Higher output levels can be used with the white stretcher in operation.

Circuitwise, the video signal is amplified in three stages after which it separates into two channels. One channel is band limited to remove the burst signal thereby permitting the sync portion to be amplified or stretched and reinserted with the original signal which is delayed in time to coincide with the signal from the band limited channel. After the stretched sync and amplified video signals are recombined in their proper ratios, the signal is fed to a special monitor output. This same signal is also fed to the grid of the white stretcher, a 6CL6, which also serves as a sync clipper. The signal at this point has been amplified, sync stretched, white stretched, and clipped. The composite signal is then fed to the video output stages which drive a 75-ohm

line and 600-ohm monitor output. In a third channel sync is separated from the composite video signal and clipped to provide a standard sync signal to the sync output jack. This 4-volt signal may be fed to an RCA Type TG-45A Genlock or TG-2A Sync Generator which serves to lock a local sync generator in phase with the incoming remote signal. The separated sync is also used to derive local clamp pulses which are applied at the sync stretch grid, the white stretch grid, and the video amplifier following the delay line.

## SPECIFICATIONS

### Performance Specifications

#### Input Signal Requirements:

Composite Video (minimum).....	0.45 volt peak-to-peak, negative
Local Sync (when required).....	4.0 volts peak-to-peak, negative

#### Output Signal Amplitudes:

Line (variable).....	0-1.9 volts, peak-to-peak
Monitor .....	0-1.7 volts, peak-to-peak
Sync .....	4.0 volts, peak-to-peak
Special Monitor .....	1.7 volts, peak-to-peak

#### Input Impedances:

Video .....	75 ohms
Sync .....	1 megohm

#### Output Impedances:\*

Line .....	75 ohms
Monitor.....	Approximately 600 ohms
Special Monitor .....	Approximately 75 ohms
Separated Sync .....	75 ohms

#### Power Requirements:

Heater Supply.....	117 volts, 50/60 cycles, 75 watts
Plate Supply.....	280 volts, d-c, 350 milliamperes

### Tube Complement

8—6CL6	3—6AU6	1—12AU7
3—6AH6	1—12B4	1—12AX7
3—6AL5	2—12AT7	1—6AS6

Dimensions.....	19" wide, 10½" high, 10¼" deep
Weight .....	20 lbs.
Finish .....	Umber gray

### Equipment Supplied

TA-7B Color Stabilizing Amplifier, complete with tubes in place, power plug, set of connectors and coaxial terminations, and Instruction Book (IB-36227).....	MI-40205-A
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### Optional and Accessory Equipment

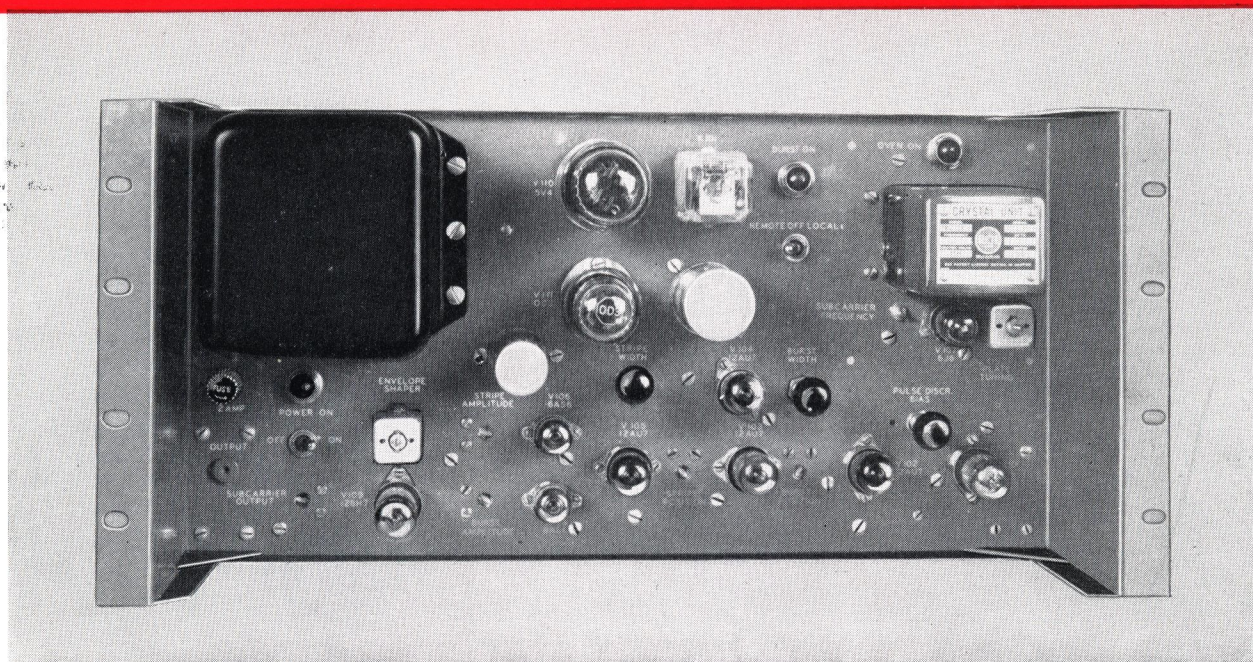
Remote Control Panel.....	MI-40250
580-D Regulated D-C Power Supply.....	MI-21523-C

\* All output cables to be terminated in 75 ohms.



# COLOR STRIPE GENERATOR

TYPE WA-8A



## FEATURES

- Provides inexpensive means of broadcasting test color signal to determine if home receivers are picking up color picture
- Broadcasts color test signal along with regular Monochrome signal
- Provisions for local or remote operation
- Crystal controlled oscillator maintains extreme frequency stability
- Accessible front-panel controls—fits standard broadcast equipment racks
- Self-contained power supply
- Separate controls to adjust color burst width, amplitude, and position with respect to sync

## USES

The RCA WA-8A Color Stripe Generator is an inexpensive color signal generating device providing an unobtrusive color test stripe on home receivers. It makes it possible to determine that a particular color receiver installation will be able to reproduce color programs from a specific TV station when no actual color program is being broadcast. Under certain conditions of multipath reception or improper orientation of the receiver antenna it is quite possible to pick up a satisfactory monochrome picture but to have the color subcarrier almost completely cancelled. The WA-8A prevents such faulty home receiver installations.

The Color Stripe Generator is designed to be loosely coupled to the video line feeding the television transmitter in such a way that the normal system operation is not changed in any way. Any TV station which is equipped to transmit network color can use it to add a narrow color stripe to its regular black and white television signal. This stripe is practically unnoticeable on ordinary black and white receivers, but produces a greenish-yellow color at the right hand edge of the color receivers when the horizontal oscillator controls are adjusted slightly off horizontal frequency.





Station test pattern revealing how WA-8A Color Stripe Generator enables any TV station which is equipped to transmit network color to add a narrow color stripe to its regular black and white television signal. On color home receiver tube a thin vertical stripe of greenish yellow color appears at the right edge of the picture as shown here

## DESCRIPTION

The WA-8A Color Stripe Generator is a completely self-contained instrument designed to be loosely coupled to the video line feeding the television transmitter in such a way that the normal system operation is not changed in any way. The normal signal at this point in the system is the composite (video and sync) monochrome signal. The inserted color stripe generator does not change this basic signal at all but simply adds to it a small amount of color information. This information consists of two "bursts" of subcarrier frequency (3.58 mc). The first "burst" is positioned immediately following horizontal blanking (or  $9.2 \pm 0.6$  microseconds following the leading edge of horizontal sync). This is the information used to "lock-in" the color receiver to the proper phase as does the standard color synchronizing burst in a standard color television signal. The second "burst" is positioned such that its leading edge is 3 microseconds preceding the leading edge of horizontal picture blanking. This "burst" will produce a greenish yellow stripe on the right hand edge of the kinescope on a properly adjusted color receiver. Since they are not generated with any luminance component, they ride up or position themselves on the average of the luminance value present in the monochrome signal at that particular time.

The ordinary viewer will not be annoyed by the extra color stripe and by the color noise when viewing a monochrome program. When a color program is being broadcast, the local broadcasting station should turn off the Type WA-8A color stripe generator signal so as not to cause color interference. On a monochrome receiver the addition of the color stripe signal will have little or no effect because the subcarrier (3.6 mc) is frequency interlaced and essentially cancels out because of the persistence of vision of the eye. In addition, most monochrome receivers have relatively low response at 3.6 mc making the stripe even less visible.

## Circuit Description

The circuitry of the WA-8A Stripe Generator is indicated in the block diagram. The first block indicates the sync separator and pulse discriminator. Its purpose is to "strip" the sync from the composite monochrome signal. An additional function has been added, however. No bursts or stripes should appear for 9 lines during the vertical blanking interval, so a "burst eliminate" circuit has been added to prevent the separation of pulses during the vertical sync and equalizing pulse intervals. The output of this stage, therefore, is a series of pulses at horizontal rate with a 9-line gap during the vertical interval. This information is differentiated and applied to the burst position multi-



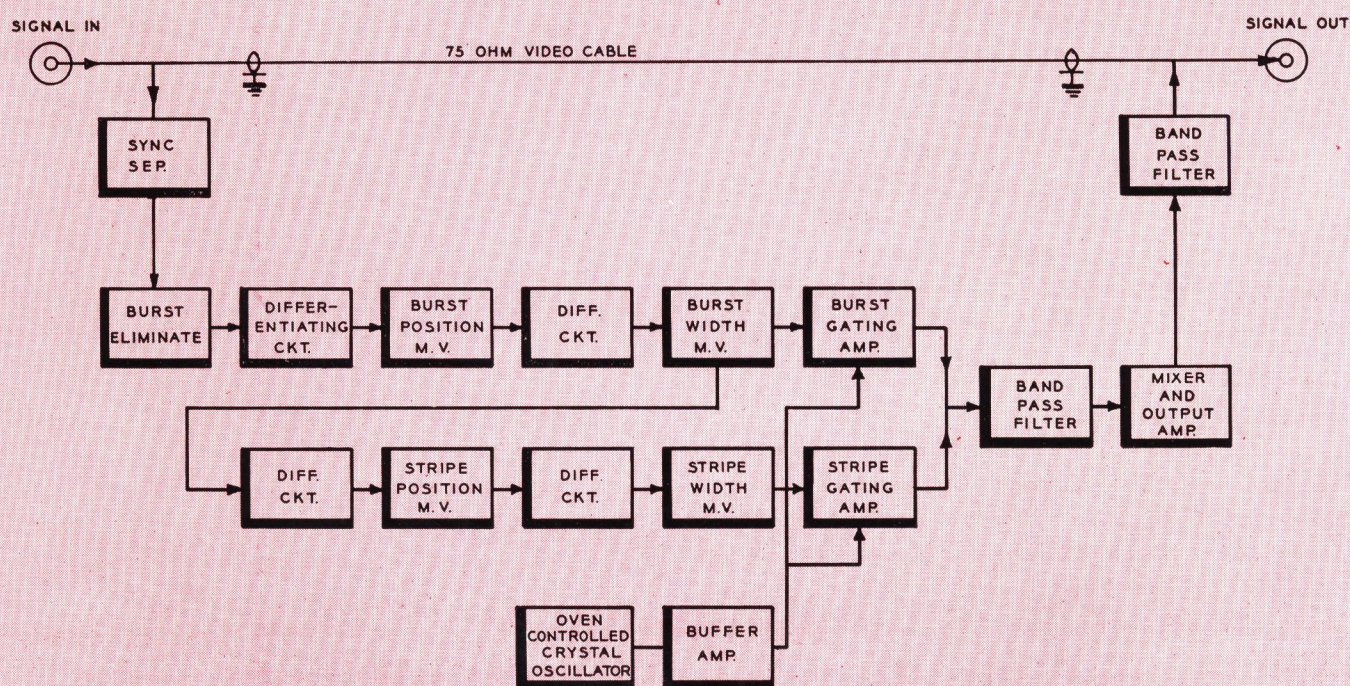
vibrator which in turn drives the burst width multivibrator. Its output is the positive pulse necessary to trigger the burst gating amplifier. A second output drives the stripe position multivibrator which in turn drives the stripe width multivibrator. Its output is also a positive pulse necessary to trigger the stripe gating amplifier. The subcarrier signal at 3.579545 mc, necessary for the gating amplifiers, is produced by a stable oven-controlled crystal oscillator. Its output is supplied to the gating amplifiers. The outputs of the gating amplifiers are fed to the mixer and output stage. Its output is in turn fed back to the video line. The video line is never broken. If failure of the stripe generator should occur the monochrome signal would not be affected. Coupling of the output signal to the video line is so loose that the monochrome signal is essentially unaffected but the color bursts or envelopes are added or superimposed on it.

The WA-8A color stripe generator is built on an 8 $\frac{3}{4}$ -inch high bathtub chassis designed for standard rack mounting. It employs 11 tubes, 2 of which are used in the self-contained power supply. The only unusual component involved is the thermostatically controlled oven for the oscillator crystal. Two video jacks are provided on the rear of the

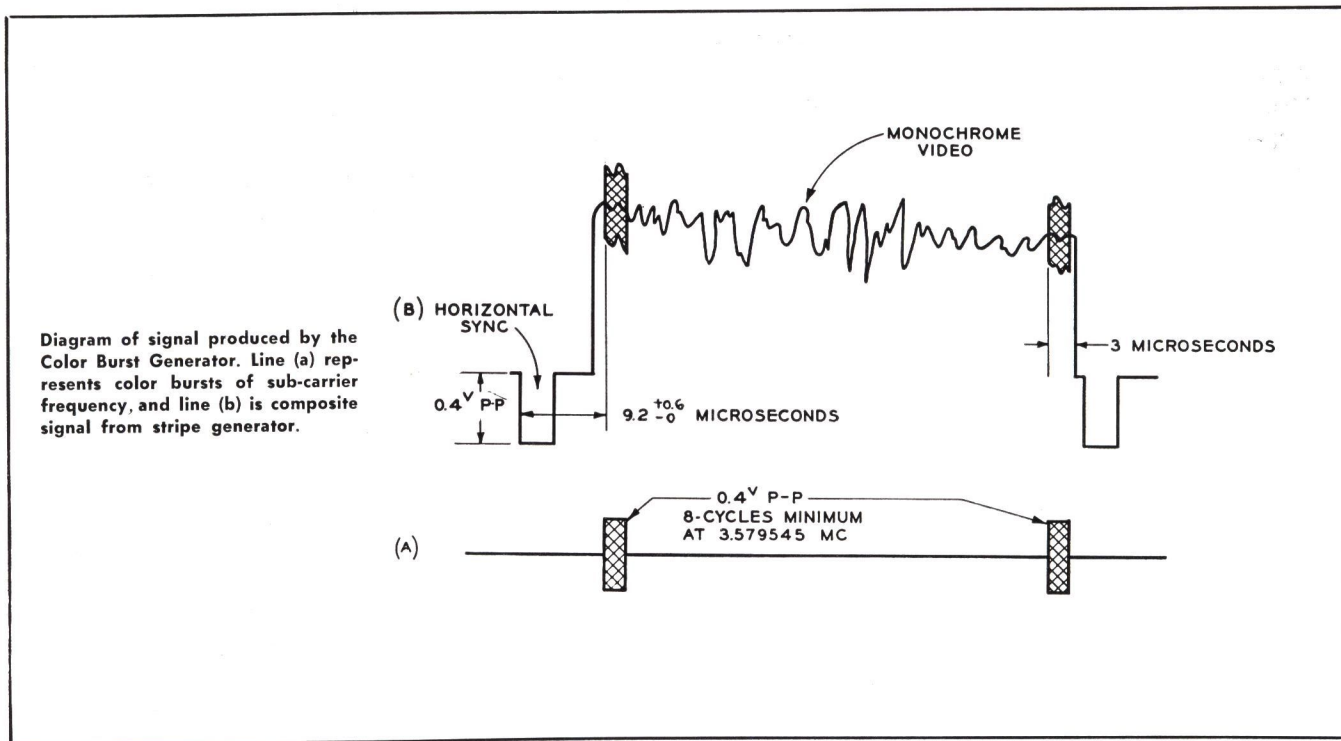
chassis for video input and output. The only power connection required is to a standard 117 volt, 60 cycle a-c line through a six-pin Jones plug. Two pins of this same plug are used for connection to a remote switch for adding or removing the color bursts from the monochrome signal at some location remote to the actual stripe generator. The unit weighs approximately 20 pounds and is finished in standard umber gray comparable to other RCA equipments.

All controls for the generator are accessible from the front. Front panel controls consist of the Remote-Off-Local switch which applies +B to the subcarrier oscillator and mixer output tubes in the remote and local positions and removes it from the tubes in the off position; pulse discriminator bias pot for adjusting the clipping level so that under all values of picture information nine lines or bursts are eliminated during the vertical blanking interval; subcarrier frequency control—a trimmer to adjust the oscillating frequency of the oven controlled crystal to exactly 3.579545 megacycles; subcarrier output control—a level setting control common to both burst and stripe for adjusting their amplitudes with respect to the monochrome signal; three separate controls associated with the color

Simplified block diagram of Color Stripe Generator WA-8A.







burst for adjusting its width, its amplitude and its position with respect to sync; envelope shaper control—essentially a control to adjust a bandpass filter (a low Q resonant circuit) for best shape of the burst and stripe envelopes; oscillator plate tuning—an inductance control for adjustment of the crystal oscillator plate circuit for maximum frequency stability; and an on-off power switch removing the a-c power input to all of the unit except the heaters used in the crystal oven. In addition to the above controls, there are three panel lights. One is used to indicate power on or off; one is paralleled with the crystal oven heaters to indicate off-on cycling of this unit; the third panel light illuminates when +B is applied to all parts of the generator (when the Remote-Off-Local switch is in the local or remote position).

The WA-8A Color Stripe Generator is supplied with all tubes in place. It can be installed in a standard 19-inch rack without further preparation. A position in the rack can be selected that will permit convenient operation of the controls and provide access to the rear of the chassis for servicing. It can be housed conveniently with the stabilizing amplifier in the transmitter location, or in the studio with other terminal equipment somewhere near the output line to the transmitter.

## SPECIFICATIONS

### Performance Specifications

Signal Input Frequency.....	Composite monochrome video
Signal Input.....	1.4 volts, peak-to-peak; 0.4 volt peak-to-peak sync
Input Impedance.....	75 ohms
Signal Output Frequency.....	Composite monochrome video with added color sync burst and stripe
Signal Output Voltage.....	1.4 volts, peak-to-peak; 0.4 volt, peak-to-peak sync
	0.4 volt, peak-to-peak color synchronizing burst
	0.4 volt, peak-to-peak color stripe
Output Impedance.....	75 ohms
Power Line Requirements.....	105-125 volts, 50/60 cycles, single phase
Power Input.....	125 watts at 0.9 PF
Operating Conditions:	
Ambient Temperature.....	5° C to 45° C
Humidity.....	0 to 95% relative

### Tube Complement

1—12AT7	1—12BH7
4—12AU7	1—5V4
2—6AS6	1—OD3
1—6J6	

Dimensions.....	19" wide, 8¾" high, 7¾" deep
Weight .....	20 lbs.
Finish.....	Light umber gray

### Equipment Supplied

WA-8A Color Stripe Generator.....	MI-40214
(Complete with tubes in place, 2 type PL-259 connectors, 1 Cinch-Jones connector, and Instruction Book IB-36232)	

### Accessory Equipment

524D Tektronix Oscilloscope  
WV-97A or WV-75A VoltOhmyst



# COLOR MONITOR

## TYPE TM-10B

### FEATURES

- High circuit stability—low video compression
- Cabinet or rack mounting
- Utilizes RCA 15" Tri-Color Kinescope
- All operating controls on front of monitor—convenient test jacks
- Forced air ventilation
- Tally lights for "on air" operation
- AFC subcarrier regeneration
- Self contained power supply
- Color killer circuit to disable color channel on monochrome signals



### USES

The RCA Type TM-10B Color Monitor is a general purpose, self-contained video monitor used for analyzing the picture quality of standard color television signals. The monitor is a precision instrument for use in the control room, with the transmitter, or for special viewing purposes. It reproduces the televised picture, within the limits of present FCC standards, on a 15-inch RCA Tri-Color Kinescope. The picture size is 8 $\frac{5}{8}$  inches by 11 $\frac{1}{2}$  inches with rounded sides.

The color monitor is normally housed in a cabinet that has an unobstructed flat top and sides permitting the units to be stacked vertically or placed side by side. The monitors can either be used as portable instruments or, by using special rack mounting hardware, mounted in standard RCA 19-inch cabinet racks.

### DESCRIPTION

The Color Monitor, Type TM-10B, is portable and housed in a sturdy wooden cabinet approximately 22 inches wide, 26 inches high, and 31 inches deep. An optional Rack Mounting Adaptor Kit (MI-40407) allows mounting the monitor in standard 19-inch wide cabinet racks. The equipment is air cooled by means of an exhaust fan in the rear of the monitor cabinet close to the top. An intake air vent is located at the bottom of the rear cabinet panel. This

vent area allows access to signal and power input connectors as well as set-up controls located on the rear of the monitor chassis.

A 15-inch, three-gun, shadow-mask kinescope, RCA Type 15GP22, is used in the monitor. The tube is mounted on a supporting mask assembly which is a part of the monitor chassis forming an integral unit. All operating controls are located on the front panel just below the face of the kinescope. Below the operating controls is a hinged cover, which, when open, gives access to a series of set-up controls. These may be conveniently adjusted while viewing the image on the face of the kinescope. Nine convenient test jacks on the rear of the monitor chassis facilitate testing and aligning of the monitor.

The TM-10B will operate with separate picture and sync signals, or with a composite signal input. A switch at the rear of the chassis provides a means of making the proper connections for the selected type of input signal. Picture and sync inputs are connected through standard coaxial fittings. Each input has two paralleled connectors to permit bridging the monitor or terminating the cable.

A crystal controlled subcarrier oscillator insures faithful color reproduction. Subcarrier regeneration is provided by an AFC type circuit, affording improved stability and ease of adjustment. When using a monochrome video signal, a "color killer" circuit operates to disable the color channel.



The monitor circuit consists basically of five principal sections: video, color sync, deflection and high voltage, the low voltage power supplies, and the tricolor kinescope. Circuit functions and features are shown in the block diagram. The TM-10B is completely self-contained, operating directly from a regulated or unregulated 110-volt a-c source. The line voltage regulator, supplied with the unit unless otherwise specified, minimizes the effect of line voltage surges on the picture.

The color monitor has a tally light relay circuit which may be connected to the switching system which serves to indicate when the monitor is switched into the program line. A numeral at the top of the front panel will glow white (stand-by) or red (on-air) depending on the control signal from the switcher. The tally light relay operates from a source of 6.3 volts a-c. A three way power connector and an a-c outlet, used for connecting power to the blower, are provided at the rear of the chassis.

## SPECIFICATIONS

### Performance Specifications

#### Input Signal Voltage Range:

Video (composite).....0.4 to 1.75 volts, peak-to-peak, high impedance  
(without sync).....0.3 to 1.2 volts, peak-to-peak, high impedance  
Sync.....3.5 to 5.0 volts, peak-to-peak (neg.), high impedance

Input Power.....115 volts, 60 cycles, 500 watts

#### Power Connections:

Chassis.....Male twist-lock plug  
Power Cord (supplied).....Female twist-lock plug and male conventional plug  
Tally Light Input.....6.3 volts, 60 cycles (can be changed with a different plug-in relay)  
Resolution.....250 to 275 lines  
Kinescope.....15", 3-gun, shadow-mask 15GP22  
Picture size.....8 5/8" by 11 1/2" with rounded sides

## Tube Complement

3-6AH6	1-6SN7-GT	1-12BH7
2-6AS6	2-6U8	1-6BD4
1-6AU4-GT	1-12AU7	6-6AN8
1-6BC7	5-6CL6	1-3A3
1-6BQ7A	1-6AL5	1-15GP22
1-6CD6	1-1X2B	1-12AT7

## Mechanical

	(With Cabinet)	(Chassis for Rack)
Width .....	22 1/8"	21 7/8"
Length (overall) .....	31 1/4"	30"
Height .....	26"	26 1/4"
Weight .....	180 lbs.	138 lbs.

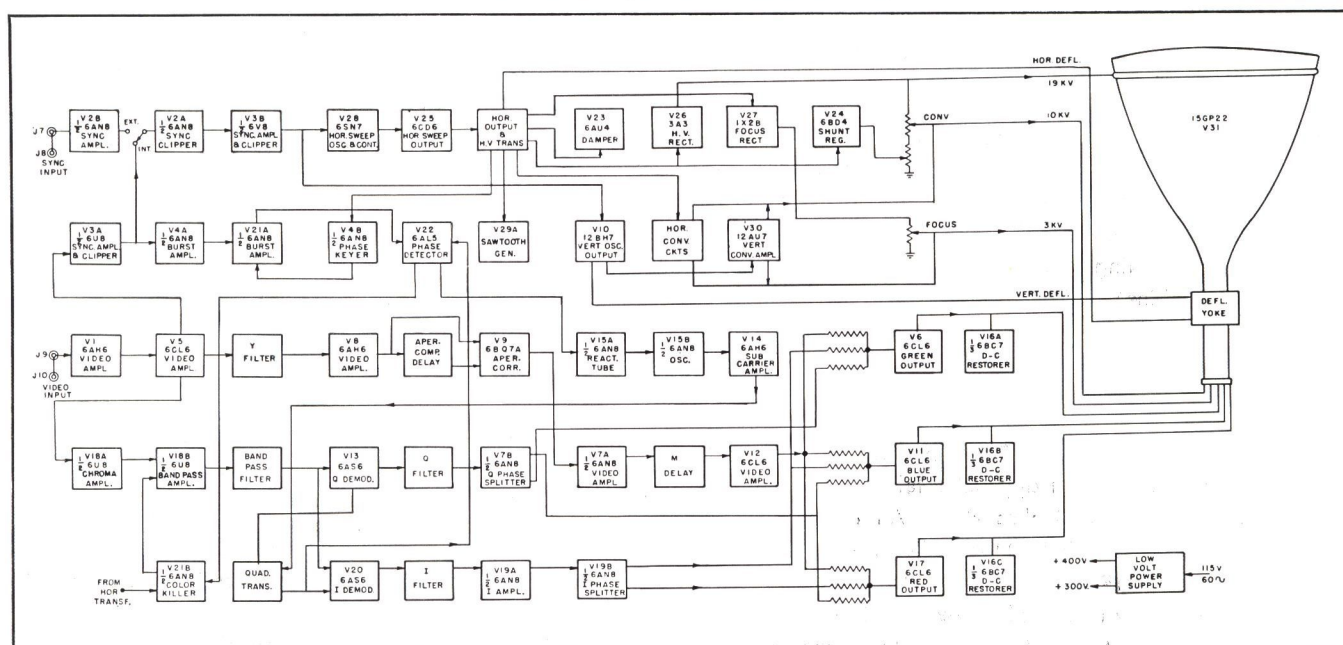
## Equipment Supplied

TM-10B Color Monitor, complete with tubes and  
Instruction Book (IB-36228).....MI-40206-A  
Line Voltage Stabilizing Transformer.....MI-40213  
Cabinet .....

## Accessories

Rack Adaptor Kit.....MI-40407  
Rack Extension Kit.....MI-40408

Functional block diagram of TM-10B Color Monitor.





# LINEARITY CHECKER

TYPE WA-7B



## FEATURES

- Generates synthetic television signal with horizontal sync and blanking
- Duty cycle of test signal variable over range of 5% to 95%
- Permits highly sensitive measurement of differential gain
- Provision for optional external triggering
- Can be used with Color Signal Analyzer to make differential phase measurements
- Provision for external R-F input (100 kc to 5 mc)
- Optional internally generated R-F output (3,579,545 mc or 1 mc)
- Self-contained regulated power supply

## USES

The RCA WA-7B Linearity Checker provides a test signal which facilitates rapid measurements of differential gain and differential phase distortion in video amplifiers and transmission systems. This instrument is especially useful for testing equipment intended to handle compatible color television signals to assure that color signals can be handled without distortion. Differential gain measurements can be made with the Linearity Checker alone, and differential phase measurements can be made by employing a Color Signal Analyzer (RCA MI-34016-A) to serve as a phase detector to analyze the Linearity Checker signal at the output of the device under test.

The need for linearity in video circuits can best be appreciated by considering the requirements for color video

signals. A composite color signal consists of a luminance component (similar to a standard monochrome signal) on which is superimposed a 3.58 mc color subcarrier. This subcarrier is modulated in such a way that its amplitude controls the saturation of the reproduced colors and its phase controls the hue. This subcarrier signal is transmitted in various parts of the signal amplitude range, since it is superimposed on the luminance signal which controls brightness in the reproduced image.

For distortionless transmission, neither the phase nor the amplitude of the subcarrier should be altered as a function of the luminance level. If there is compression or non-linear distortion in some part of the signal range, the saturation of the reproduced colors will be altered. If there is a phase shift associated with the non-linear distortion, hues may also be altered.



## DESCRIPTION

The linearity checker is actually a signal generator providing a simulated color video signal. In use, this signal is fed through the device under test and a filter unit supplied with the checker to an external oscilloscope. The filter has a three position switch that makes it possible to connect it as a high pass or low pass filter, or to by-pass the filter entirely.

The output signal of the Linearity Checker consists of four components, (1) sync occurring at a nominal 15,750 cycle repetition rate, (2) an adjustable blanking signal occurring for 9 out of 10 lines, (3) the stair-step signal consisting of ten steps of equal height between black and white level, occurring one line in ten, (4) an r-f sine wave at 3.58 mc color subcarrier frequency or 1 mc (100 kc to 5 mc also available from external input) superimposed on the stair-step signal. Adjusting the blanking from 0 to 100% enables the operator to vary the duty cycle of the picture portion of the composite signal from approximately 5% to 95%.

If the circuit under test is linear between black level and white level, the amplitude of the r-f envelope as seen on the oscilloscope will be the same on each step. If the circuit is non-linear, the r-f amplitude will vary. To permit accurate comparison between the r-f heights, the step signal can be filtered out by placing the filter switch in the Hi position. All the sections of the sine wave will then be on the same horizontal axis. To observe very bad non-linearities, the r-f signal can be filtered out by placing the filter switch in the Low position. Non-linearity will then show up as variations in step height.

To measure phase intermodulation, an MI-34016-A Color Signal Analyzer is required in addition to the linearity checker. This instrument makes it possible to observe the phase difference between two r-f signals of the same frequency.

To produce the composite output signal, the WA-7B Linearity Checker contains circuits that generate the r-f, blanking, sync, and step signals separately, and gating circuits that remove the adjustable blanking signal and replace it with the combined step and r-f signals every tenth line. Provision is also made for using the step and r-f signal on every line if so desired.

The Linearity Checker has a self-contained regulated power supply and is designed for either table top or rack mounting. It is normally furnished in a table model cabinet. For rack mounting the panel space required is 8¾ by 19 inches, and standard relay-rack mounting slots are provided in the panel. Both housings are finished in standard umber gray. Controls are located on the front panel and the input and output connectors are on the rear of the equipment. Each equipment is provided with a cross filter, MI-34021, which is necessary for making differential gain measurements, without a color signal analyzer.

The crossover filter supplied with the linearity checker permits filtering out either the step or r-f signals as explained before. The filter is contained in a small rectangular box with a coaxial jack on one end and a coaxial plug on the other end. A three-position lever switch on the top of the box permits bypassing the filter completely or connecting it as a high- or low-pass filter. It is effective only at an r-f frequency of 3.58 mc.

## SPECIFICATIONS

### Performance Specifications

#### Input Signals:

Horizontal Drive (optional).....4 volts peak-to-peak negative  
(Internal Drive—nominal 15.75 kc may be used if desired)

R-F Signal (optional).....100 kc to 5 mc (2 volt max.)

#### Output Signals:

Composite Signal.....Sync Blanking, Step Signal (1 line in 10), White Signal (9 lines in 10) R-F superimposed on Blanking and Step Signal. Adjustable levels 0 to 1 volt except Sync Level 0 to 0.5 volt. It can also be adjusted to have sync and step only every line.

R-F Output .....2 volts

Sync Output for Oscilloscope.....15 volts

Power Requirement.....117 volts, 60 cycle, 210 watts

### Tube Complement

4—6AU6	1—6AH6
2—6AS6	2—6AL5
3—5687	1—6AS7
8—12AT7	1—6SJ7
2—12AU7	1—5R4GY
1—6CL6	1—OC3

Dimensions (Unit only for cabinet or rack mounting):

Height .....8¾"

Width .....19"

Weight .....40 lbs.

Finish .....Umbur gray

### Equipment Supplied

WA-7B Linearity Checker.....MI-34017-A  
Linearity Checker Chassis, including all tubes in place, one Cross-Over Filter, MI-34021, Termination and Coaxial Plugs, five RG-59/U Adaptors, and Instruction Book (IB-24958-1)



# COLOR SIGNAL ANALYZER

TYPE WA-6A



## FEATURES

- Facilitates precise adjustment of Colorplexer modulation circuits
- Accurate measurement of phase relationships of various components of the Composite Color Signal
- Can be permanently installed for rapid measurements of system characteristics
- Phase Shifter Panel permits insertion of delays at 3.58 mc increments from 0° to 210°
- Differential phase measurements to less than 1° with Linearity Checker or Bar Generator signal
- Remote phase measurements (with Burst Controlled Oscillator)
- Self-contained power supply
- Measurements can be made on one amplifier stage or on an entire system



## USES

The MI-34016-A Color Signal Analyzer is a test instrument for studying the components of a composite color video and subcarrier signal. It facilitates adjustments of the Colorplexer, and when used in conjunction with a Color Bar Generator and an Oscilloscope, permits accurate measurement of the phase relationships existing between the subcarrier "burst" reference and the various components of the composite color signal. It can also be used in conjunction with the WA-7B Linearity Checker, MI-34017-A, for making differential phase measurements (phase intermodulation).

The analyzer is designed to utilize a composite color video or linearity test signal input, at a nominal level of one volt p/p (white). If desired, this signal can be passed directly through the instrument to the output. A reference subcarrier signal which may be from one to three volts amplitude is also required. Both coaxial and binding post type terminals are provided for the connection of a cathode ray oscilloscope upon which the output signals are displayed.

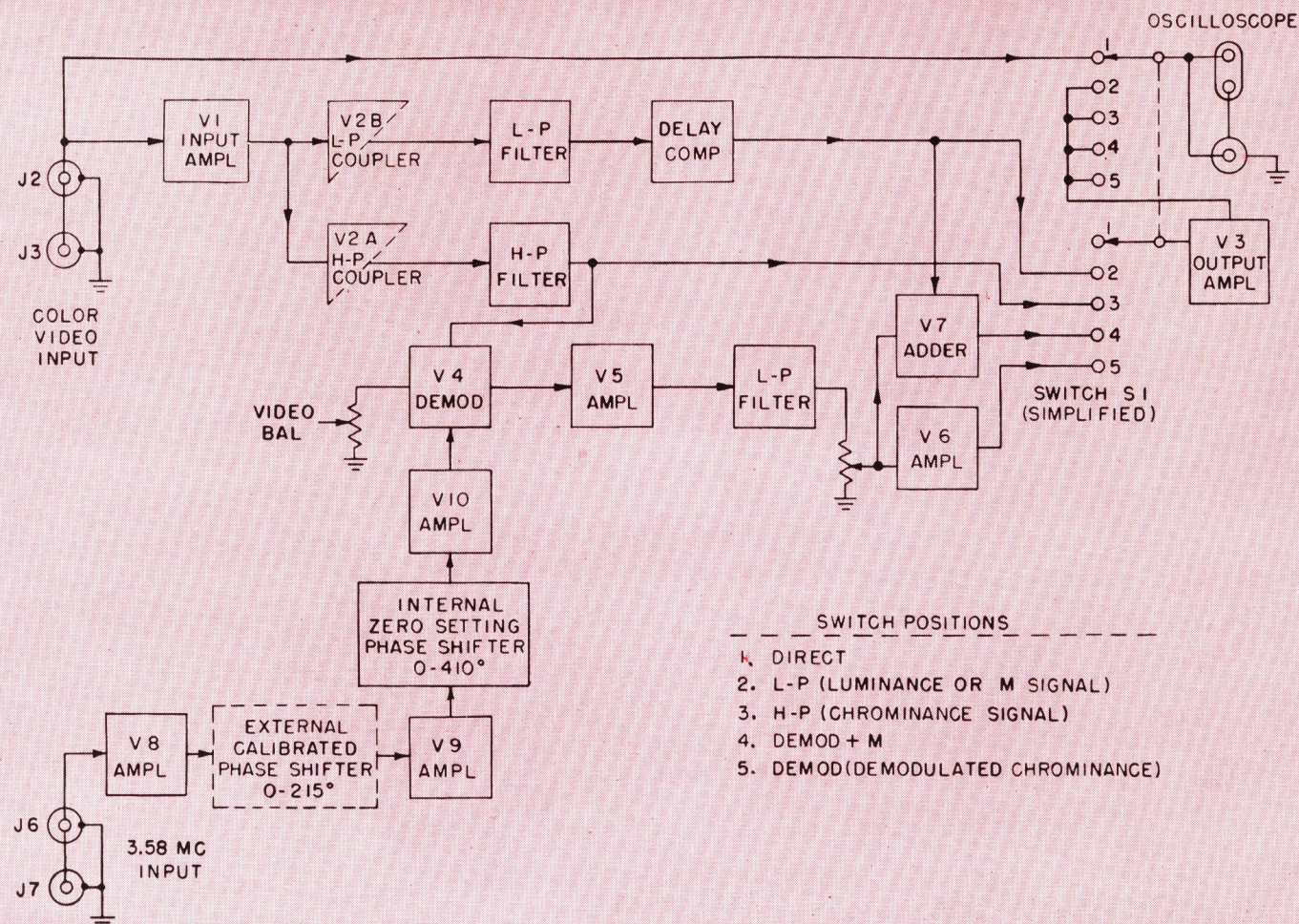
## DESCRIPTION

The Color Signal Analyzer is housed in a bench type cabinet of 17½ inch panel space and comprises three units: the Phase Shift Panel, the Control Panel, and the Regulated Power Supply.

The Phase Shift Panel permits insertion in the 3.58 mc reference signal circuit, of calibrated delays equivalent to 90°, 50°, 30°, 20°, 10°, 5° and plus or minus 5° in steps of 1°. The unit is provided with toggle switches permitting insertion of the delay sections singly or in series in any desired combination, in the manner of an attenuation box, representing a possible total of 205° delay. These delay sections which are made up of RG-59/U cable of nominal 73-ohms impedance are provided with compensating attenuators in the "OUT" position so that attenuation is held constant to 1%. Coax input and output terminals are provided.

The Analyzer proper contains a delay network, low pass and high pass filters, a synchronous detector and switching circuitry which permits analysis of the composite color

Block diagram of the WA-6A Color Signal Analyzer.





signal as supplied by a color bar generator or a linearity checker.

The delay network or phase shifter within this unit provides delay range in excess of  $360^\circ$ —at 3.58 megacycles—to provide a reference for the calibrated phase shift network in the phase shift panel. The demodulator or synchronous detector, which is the heart of the instrument, is excited by the 3.58 mc reference subcarrier signal fed through both phase shifters or delay networks, and by that part of the composite color video signal passed by the high-pass filter. A low pass filter following the demodulator insures that the output will consist only of video components of the demodulated composite color signal.

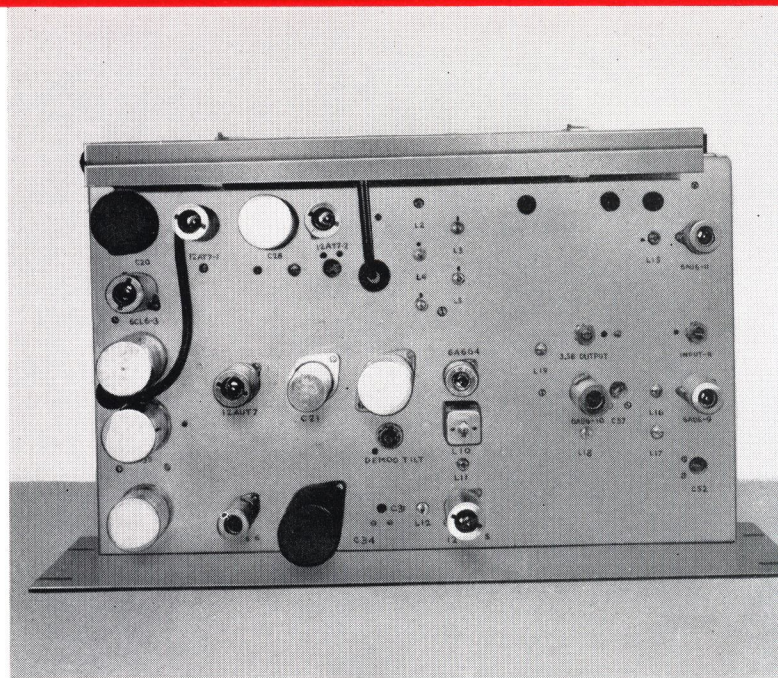
The Output Selector Switch permits a choice of the following output signals:

Direct—Position 1—in which the input signal is fed through directly to the output terminals without intervening amplifiers.

Low Pass—Position 2—in which the signal is coupled through a low-pass filter, having a nominal bandwidth of 2 mc (flat to 1 mc, down 50% at 2 mc, and essentially zero at 3.58 mc). This as well as all other positions except Direct has a cathode follower output stage.

High Pass—Position 3—in which a high pass filter, having substantially zero response at 1.9 mc and flat response from 2.8 to beyond 4.5 mc, is inserted in the signal path from input to output.

Demodulator—Position 5—in which the signal passed by the high-pass filter is applied to the demodulator or synchronous detector tube and fed through the two phase shifters. A low-pass filter following the demodulator output tube has substantially zero response for signals passed by the high pass filter, so that the output from this channel comprises only that part of the composite signal representing the demodulated components of the color subcarrier or the chrominance signal. A control, marked Video Bal, is provided for adjusting d-c grid potentials to obtain the most linear operation of the demodulator tube. This adjustment is made with the subcarrier removed, by throwing the toggle switch S-3 on the control panel to the OFF position. A gain control, marked Demod Gain, permits variation of the channel gain from zero to a maximum of at least four volts pulse output for one volt envelope



Top view of Control Panel.

amplitude input, when the demodulator or synchronous detector phase is adjusted for maximum output.

Demodulator +M—Position 4—in which the demodulator signal is added to the signal passed by the low-pass filter. Approximately unity overall gain is provided for the M signal passed by the low-pass filter and the gain control in the demodulator output provides for at least two volts pulse amplitude for a one volt envelope, with the synchronous detector phase adjusted for maximum output.

The Regulated Power Supply is mounted on the third panel, and is housed in the lower portion of the cabinet. It insures constant B+ voltage in the analyzer and hence stability of levels during tests.

The WA-6A equipment may be mounted, if desired, in any standard 19-inch rack. The equipment occupies  $17\frac{1}{2}$  vertical inches of panel space. Allowing for connectors and cable clearance a maximum depth of  $13\frac{1}{2}$  inches is required when rack mounting the units. All connections to the several panels are made in the rear of the cabinet or rack, except the oscilloscope connections which are made to the front of the control panel. Video and subcarrier connections are made by cable to the threaded connectors at the rear of the control panel and filament and plate power connections are made to the four pin female receptacle also in the rear of the control panel.



## SPECIFICATIONS

### Control Panel Performance

Plate Power Requirements.....280 volts, 110 milliamperes

Filament Power Requirements.....6.3 volts a-c, 3.25 amperes

#### Input Signals:

Composite Color Video.....1 volt p/p (white)

\*Color Subcarrier 3.579545 mc.....1-3 volts p/p

#### Output Signals for Composite Input of 1 volt p/p:

Direct.....1 volt p/p (white)

L-P Luminance (M).....Approx. equal to this component of input

H-P Chrominance.....Approx. equal to this component of input

Demodulator +M.....2 volts p/p approx.

Demodulator.....4 volts p/p approx.

Phase Shift Impedance.....73 ohms

### Tube Complement

3-12AT7

1-6CL6

1-6AS6

1-12AU7

4-6AU6

### Power Supply Performance

Power Line Requirements.....105-125 volts, 50/60 cycles, single phase

Power Input.....140 watts

D-C Output.....280 volts, regulated, 110 milliamperes

A-C Output.....6.3 volts, unregulated, 3.25 amperes

Noise and Ripple.....Less than 10 millivolts rms for above ratings

### Tube Complement

1-5V4G

2-6Y6G

1-6SJ7

1-OA3/VR-75

### Overall Mechanical Specifications

Dimensions.....19 1/2" high, 21 3/4" wide, 15 1/2" deep, overall

Weight.....80 lbs.

#### Finish:

Cabinet.....Umber gray wrinkle

Panels.....Umber gray plain

### Equipment Supplied

WA-6A Color Signal Analyzer.....MI-34016-A  
(Including tubes in place and Instruction Book IB-24955-1)

## PLATE CURRENT METER

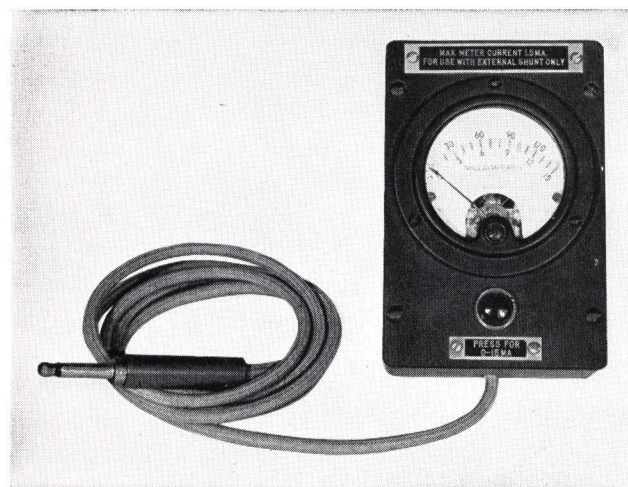
### MI-21200-C1

#### FEATURES

- High precision—accurate within  $\pm 2\%$  of full scale reading
- Two scales provided (0-150 ma., 0-15 ma.)
- Compact, small in size
- Quick means of checking regulated power supplies

#### USES

Plate Current Meter, MI-21200-C1, is a two scale (0-15 ma. and 0-150 ma.) meter for checking the plate current of the regulator tubes of the 580-D and WP-33B regulated power supplies. It is also suitable for use in checking field power supply MI-26091. In addition it may be used to check total current drain and voltage output of the above-mentioned circuit, as well as alignment coil current of the studio camera supplied by the current regulator MI-26090, and for signal level calibration on the TM-6B Master Monitor and Field Camera Control.



#### DESCRIPTION

The Plate Current Meter is furnished in a bakelite case of convenient size (3 5/8" x 5 7/8" x 2 3/8") and has a 5' 9" cord complete with plug-in jack for use in checking power supply panels. A momentary-contact meter push-button switch changes the 0-150 ma. scale to 0-15 ma., when desired.

#### SPECIFICATIONS

Stock Identification.....MI-21200-C1  
Approximate Size.....3 5/8" x 5 7/8" x 2 3/8"  
Net Weight.....3 lbs.  
Range Scales.....0-150 ma., 0-15 ma.

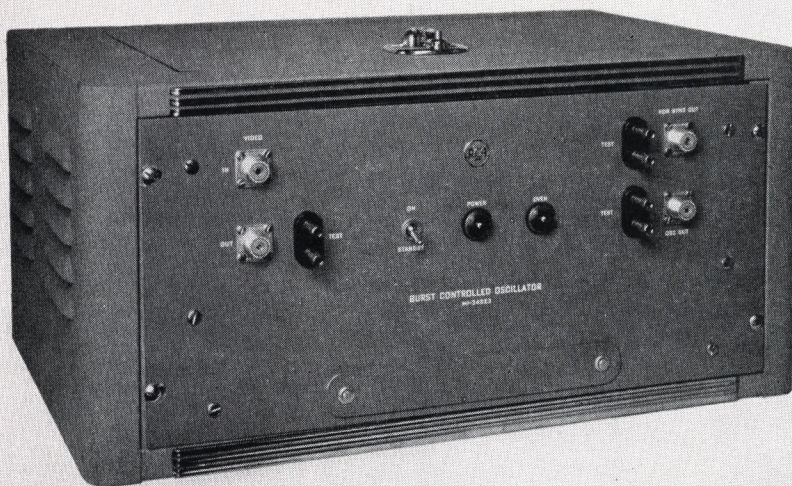


# BURST CONTROLLED OSCILLATOR

TYPE WA-4A

## FEATURES

- Regenerates subcarrier signal from composite color signal
- Used with color signal analyzer for measurement at points remote from studio signals
- Temperature controlled crystal for maximum stability
- Provides sync output for oscilloscope
- Self-contained regulated power supply



## USES

The Burst Controlled Oscillator, MI-34023, is designed to provide a continuous wave color subcarrier in locations where the composite color signal only is available. This equipment regenerates the subcarrier signal from the composite color signal with the phase of the regenerated signal constant with respect to that of the subcarrier burst. This equipment is necessary to supply a reference subcarrier signal for use with the color signal analyzer and other applications where a source of subcarrier is not available.

## DESCRIPTION

The RCA Type WA-4A Burst Controlled Oscillator is a useful video test instrument able to regenerate subcarrier signal from the composite color signal. Maximum stability of the c-w output signal is obtained by use of a temperature controlled crystal. The phase relationship is maintained by comparing the output of the crystal oscillator with the burst signal in a phase comparator circuit. Any tendency toward drift in phase results in a correction voltage being applied to the crystal oscillator pulling it in step with the burst phase.

Horizontal sync is also extracted from the composite Color signal and supplied externally for oscilloscope syncing.

The instrument is designed for either table top or rack mounting. It is normally furnished in a table model cab-

inet. For rack mounting the panel space required is  $8\frac{3}{4}$  by 19 inches, and standard relay-rack mounting slots are provided in the panel. Both units are finished standard umber gray wrinkle. The front panel contains the on-standby power switch, and two output jacks including the horizontal sync and sub-oscillator output. There is also provision for bridging the composite video signal.

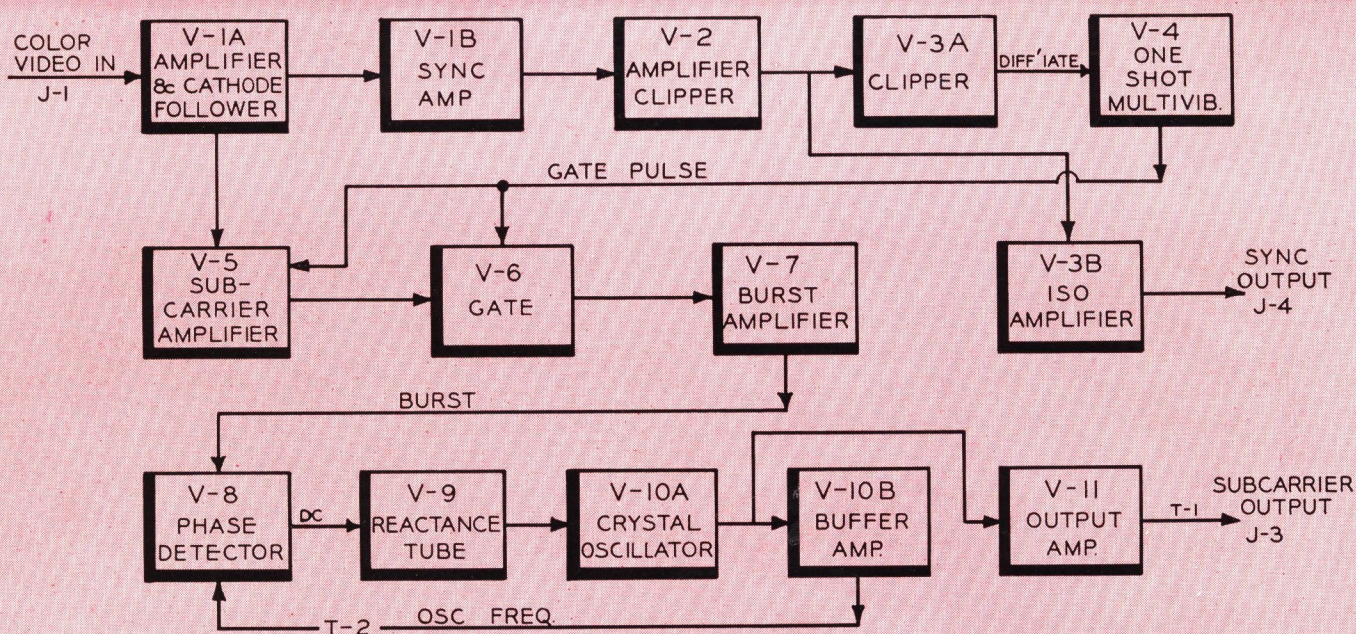
A removable front cover gives access to four screw driver controls for the burst gain, gate width, phase detector balance, and attenuation control.

## Circuit Description

The composite video or blanking negative signal is fed at J-1 into an isolation cathode follower and burst frequency amplifier (V-1) whose output goes to two channels. One channel consists of V-1B, V-2, V-3 and V-4. Here the composite video has its sync stripped by amplification and clipping. Output tube V-3B couples the stripped sync to a high impedance output at J-4. The signal level here is 4 volts peak to peak with no load. After V-3A plate the sync is differentiated and the positive (or trailing edge) pulses trip the one shot multivibrator (V-4) to produce a positive gate pulse, the duration of which is adjustable to admit the color burst signal.

In channel two, the plate of V-1A is broadly resonant to the subcarrier frequency, where some gain is obtained. The signal, being mostly subcarrier frequency is coupled





Simplified schematic, WA-4A Burst Controlled Oscillator.

## DESCRIPTION (Continued)

through an attenuator to the grid of the subcarrier amplifier (V-5). This tube serves a dual purpose. It acts as an amplifier for the burst frequency and it is gated in conjunction with gate V-6. The screen grid acts as the gate electrode, the gate pulse being coupled by a capacitor from the one shot multivibrator plate of V-4. Gating this amplifier prevents the following tube from being overloaded by color components of the video signal. The signal at the plate of V-5 is coupled to another gate tube, V-6.

Gate V-6 is normally cut off by suppressor grid. Grid 3 bias is produced at the cathode by B+ bleed current. The output of the one shot multivibrator mentioned previously is capacity coupled to grid 3. This signal is large enough to draw some grid 3 current so it is biased even more negatively depending on the amplitude of the gate pulse. Grid 3 is pushed to zero bias during the interval of the gate pulse, the tube amplifies the signal on grid 1, V-6 plate load is broadly resonant to color subcarrier, the signal here is enough to drive the burst amplifier (V-7). The output of V-7 is applied to the phase detector (V-8).

V-10A is a crystal oscillator. Crystal X-1 is at the subcarrier frequency. The output of this oscillator is attenuated and coupled to the output amplifier (V-11), and buffer amplifier (V-10B). V-11 amplifies the signal and it is coupled to a 75 ohm line (J-3) through transformer T-3. V-10B amplifies the signal and couples it to phase detector (V-8) through transformer T-2.

The output of the phase detector is a d-c voltage proportional to the phase difference between signal from V-7

and V-10B. This d-c voltage is filtered and applied to reactance tube (V-9) which acts like a variable reactance shunting the oscillator crystal. The bias at the grid of V-9 is adjusted by a potentiometer in the phase detector so that the crystals free running frequency is the same as the burst frequency. Adjustment of the potentiometer may be accomplished by coupling an oscilloscope probe near the plate of the burst amplifier (V-7) with attenuator "in", both local oscillator feed-through and burst will be seen, the beat and very "soft" AFC action will be evident as the potentiometer is adjusted. The attenuator is switched "out" and the oscillator will lock in phase with the burst frequency.

The power supply is a conventional regulated supply with 280 volt output at 180 ma.

## SPECIFICATIONS

### Performance Specifications

Input Required.....117 volts, 60 cycles, single phase, 165 watts  
Composite color signal

#### Output:

C-W Subcarrier Signal.....2 volts, peak-to-peak  
Horizontal Sync.....4 volts, peak-to-peak, neg.

### Tube Complement

5-12AT7	3-6AU6	1-OB2
1-6CL6	1-6AL5	1-6AS7
1-6AS6	1-6SJ7	1-5U4

#### Dimensions (Unit for rack mounting):

Height .....8 3/4"  
Width .....19"  
Weight .....39 lbs.  
Finish.....Umber gray wrinkle

### Equipment Supplied

Burst Controlled Oscillator Chassis.....MI-34023



# SERVICE COLOR-BAR GENERATOR

TYPE WR-61A

## FEATURES

- Provides overall check on operations of color receivers and monitors
- Color phasing is inherently accurate
- Color sub-carrier, picture carrier, sound carrier, horizontal sync and bar frequencies are crystal controlled to insure utmost accuracy and stability
- Lightweight, portable, convenient
- Provides color video signals of either positive or negative polarity for both low and high impedance circuits

## USES

The RCA WR-61A Service Color-Bar Generator is a compact, lightweight instrument designed for use in checking the overall operation of color television receivers and monitors, and for adjusting their color phasing and matrixing circuits. It generates the signals for producing the bar patterns needed in testing, and provides a separate video output of either positive or negative polarity. The instrument permits removal of the sound carrier from the output signal. This provides quick identification of sound interference in the bar pattern. A built-in rectifier circuit, for use with an external VoltOhmyst, facilitates measurement and adjustment of sync and subcarrier amplitudes. Luminance signals are provided to check the "fit" or registration of the luminance and chrominance signals.

The RCA serviceman's Type WR-61A Color-Bar Generator, which supercedes the WA-2A Color Monitor Analyzer, is useful for testing TV station color monitors. The WR-61A is not to be confused with the RCA Type WA-1D Color-Bar Generator described on page 15, which is used to supply a color test signal for general maintenance and measurements in a color television station.

## DESCRIPTION

The Color-Bar Generator, Type WR-61A generates the signals for producing 10 bars of different colors simultaneously (without switching), including the bars corresponding to the R-Y, B-Y, G-Y, I and Q signals. The bars are accurately spaced at 30-degree phase intervals. The out-

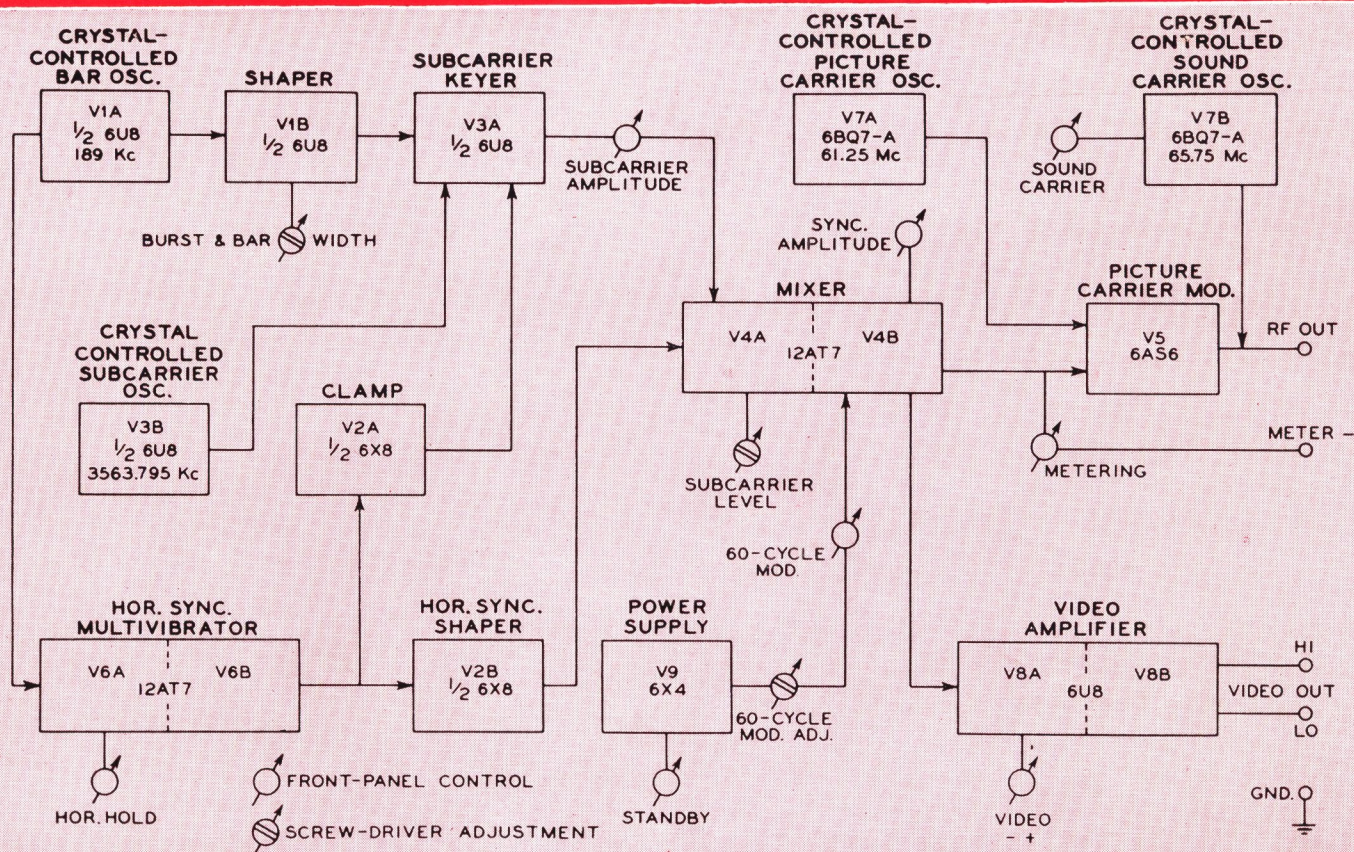


put signal from the instrument, fixed at channel 3, consists of an unmodulated sound carrier, and a picture carrier modulated by a color subcarrier, and horizontal synchronizing pulses at 15,750 cps. The picture carrier, color subcarrier, sound carrier, bar frequency, and horizontal sync pulses are crystal controlled for accuracy and stability.

A separate video output of either positive or negative polarity is available at a front-panel terminal for troubleshooting color receivers. The video output is useful, for example, in determining whether the defective stage is ahead of or after the second detector. Video output is provided for high-impedance circuits (3000-5000 ohms) and for low-impedance circuits (75 ohms). R-F output is approximately 0.01 volt peak-to-peak across a balanced 300-ohm load; video output at the HI terminal is approximately 8 volts peak-to-peak across 4700 ohms.

A front-panel switch on the WR-61A permits removal of the sound carrier from the output signal. This feature makes possible quick identification of sound interference in the bar pattern. The sound carrier is provided to insure precise tuning of the receiver, and to check sound rejection and beat interference between the color subcarrier and the sound carrier. Luminance signals are provided at the edges





Block diagram of WR-61A Service Color Bar Generator.

of the color bars to check the registration of the luminance and chrominance signals. A 60-cps brightness signal, applied to the output by means of a front-panel switch produces a horizontal area of increased brightness to check for possible change of hue in the bright areas or highlights of the color picture. The amplitude of the color subcarrier and color-burst signal is adjustable by means of another front-panel control to facilitate checking of the color-sync lock in the receiver.

Circuitwise, the WR-61A feeds a 189-kc signal from the crystal-controlled bar oscillator through the shaper tube to the keyer stage, which keys the 3.56-mc oscillator to produce an output signal composed of 8-cycle blocks. The 189-kc oscillator also controls the repetition rate of the horizontal sync generator. The horizontal sync waveform from the horizontal sync multivibrator is shaped to have a time duration of approximately 5 microseconds. The pulse then is fed into the mixer. The subcarrier blocks also are fed into the mixer. The output of the mixer in turn is fed into a modulator, which modulates the picture carrier. The modulated picture carrier and the unmodulated sound carrier are both fed into the r-f output circuit. The metering circuit is provided for use in setting correct sync and subcarrier signal levels. A clamp stage serves to eliminate every twelfth block of the subcarrier signal, and the horizontal-sync pulse occupies the resultant gap.

The WR-61A is supplied with a shielded r-f output cable for connection to balanced 300-ohm inputs, and a shielded video cable for connection to 75-ohm video circuits. The color-bar generator is readily portable as it weighs only 13 pounds. The case is attractively styled in blue-gray hammeroid finish with a brushed-aluminum panel.

## SPECIFICATIONS

### Performance Specifications

R-F Output:	
Frequencies.....	61.25 mc, 65.75 mc (TV Channel 3)
Voltage.....	At least 0.01 volt peak-to-peak
Composite Picture Signal.....	61.25-mc picture carrier; 15,750-cps horizontal sync pulses; 3563.795-kc color subcarrier keyed at 189 kc
Sound Carrier Frequency.....	65.75 mc, unmodulated
Impedance (at end of r-f output cable).....	Approx. 300 ohms
Video Output Voltage:	
HI Terminal.....	8 volts peak-to-peak across 4700 ohms
LO-Connector.....	0.25 volt peak-to-peak across 75 ohms
Number of Color Bars.....	10
Power Supply.....	105-125 volts, 60 cycles, single phase
Power Input.....	50 watts

### Tube Complement

1—6AS6	1—6X4	1—6X8
1—6BQ7-A	3—6U8	2—12AT7
Dimensions.....	13 1/2" wide, 10" high, 7 1/2" deep	
Weight.....	13 lbs.	
Finish.....	Blue-gray hammeroid case, brushed-aluminum panel	

### Equipment Supplied

WR-61A Service Color-Bar Generator.....RCA WR-61A  
Complete with tubes, 4 control crystals, 1 r-f output cable, 1 TV input adapter, 1 video output cable, 1 ground cable, registration card, and instruction book.



# GRATING AND DOT GENERATOR

TYPE WA-3B

## FEATURES

- Produces grating pattern for rapid monitor deflection adjustments
- Number and width of horizontal and vertical lines adjustable for screen size
- Provides dot pattern for accurate beam convergence adjustment of color monitors
- Number and size of dots is adjustable
- Output voltage is switchable, either positive or negative
- Assures uniform distribution of picture detail — color or monochrome



## USES

The RCA Grating and Dot Generator, Type WA-3B, is designed for checking linearity of television deflection circuits in either color or monochrome cameras, monitors, and receivers to assure faithful reproduction. This instrument provides a means of determining the linearity of scanning velocity in both the receiver kinescope and the camera pickup tube. Should the scanning beam in either of these devices deviate from the standard rates of speed, the picture on the kinescope will be compressed over some areas and expanded over others. Through use of the WA-3B, even small degrees of non-linearity may be detected and readily adjusted.

Television receivers may also be tested, either by injecting the grating pattern signal into the receiver video circuit or by remote pickup of a transmitter modulated with the composite signal. The WA-3B may be employed in any system for speeding accurate alignment of deflection circuits.

## DESCRIPTION

The WA-3B Grating and Dot Generator produces a timing signal, which is synchronized by standard television sync pulses, for precise adjustment of scanning linearity. The resultant pattern on the kinescope consists of horizontal and vertical bars, which give the appearance of a grating. The horizontal bars serve for vertical alignment, while the vertical bars serve for horizontal alignment. Equal spacing between bars means perfect linearity. Packing or spreading of the bars indicates nonlinearity. Curvature of the bars reveals the effect of stray magnetic fields. Thus the scanning velocity may be conveniently adjusted to produce uniform distribution of picture detail. In addition to horizontal and vertical bar signals, a dot signal or pattern especially suitable for Color TV tests is also produced by the WA-3B. The dot pattern has been found to be more desirable than a bar pattern for color convergence tests.

The WA-3B generates the test signal as follows: A negative driving pulse of 15,750 cycles is amplified, clipped, and differentiated to synchronize a multivibrator. The pulse

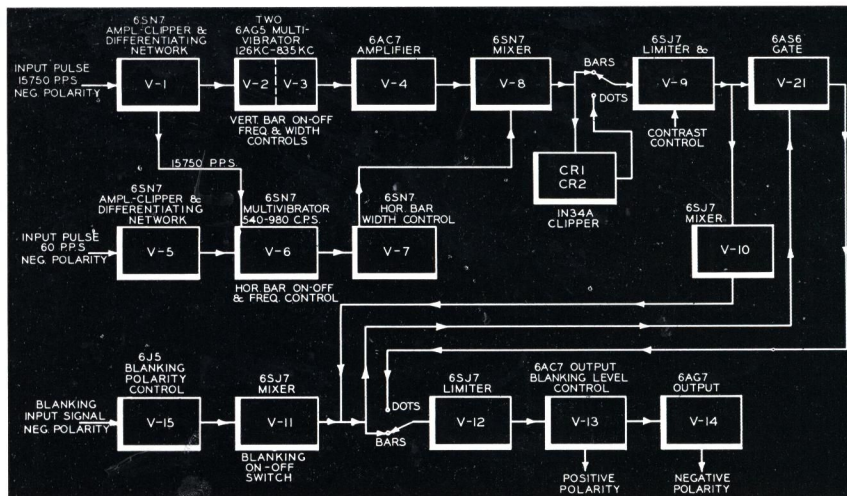


output of the multivibrator constitutes the vertical bar signal. It is amplified, then fed to a mixer stage. A negative driving pulse of 60 cycles is amplified, clipped, and differentiated to synchronize another multivibrator. The output is a multiple of 60 cycles. It is fed to a width control circuit, by means of which the pulse width may be adjusted to 10 per cent of the cycle over the entire frequency range. This pulse constitutes the horizontal bar signal, which is mixed with the vertical bar signal. A germanium diode circuit functioning as a clipper in the output circuit of mixer tube and a 6AS6 tube functioning as a blanking controlled dot pulse gate provides the alternate dot signal pattern. A four-circuit-two-position switch is provided for selecting bars or dot output. The mixed signals are held to approximately equal levels by a limiter stage. Output is adjustable to provide for control of contrast.

Standard 60 cycles and 15,750 cycle signals from a video sync generator are employed for synchronizing the WA-3B. The standard blanking signal from the sync generator is connected to a polarity control stage, with output taken from either cathode or plate circuit, depending upon desired polarity. Separate tubes having a common load combine the bar and blanking signals. A limiter stage prevents the bar or dot signal from exceeding the blanking signal level.

Separate switches are provided for independent operation of the horizontal, vertical, and blanking signal circuits. The number of bars or dots is adjustable for convenient spacing on different screens. Horizontal bars are adjustable from 12 to 36 bars; vertical bars are adjustable from 10 to 40. Bar width is adjustable to 10 per cent of space between bars. Bar pulse level can be controlled independently of blanking level to give desired degree of contrast. Polarity of blanking signal can be changed to permit use of the WA-3B in any video system.

The dot generator is designed for optimum operation with a pattern of 12 horizontal by 9 vertical dots, 12 lines (horizontal scan) square; to 20 horizontal by 15 vertical dots, 6 lines square. The number and size of the dots is adjustable. Operation of the generator requires standard horizontal drive, vertical drive, and blanking signals, fed into the corresponding input circuits of the generator. The procedure for setting the number of dots is the same as for setting the number of bars.



Block diagram, WA-3B Grating and Dot Generator.

## SPECIFICATIONS

### Performance Specifications

Grating Output.....	Horizontal and vertical bar pulses, combined with blanking pulses when desired
Dot Output.....	Dot size variable from 6 to 12 lines
Output Amplitude.....	Adjustable from 0 to 2 volts peak to peak (75 ohm load)
Output Impedance.....	75 ohms
Output Polarity.....	Bars, positive or negative; dots, positive
Vertical Sync Signal.....	60 cycles standard (2 volts minimum)
Horizontal Sync Signal.....	15,750 cycle standard (2 volts minimum)
Blanking Signal.....	RETMA standard (2 volts minimum)
Horizontal Bars.....	Adjustable from 9 to 31 bars, bar width adjustable
Vertical Bars.....	Adjustable from 10 to 40 bars (minimum width control setting). Bar width adjustable
Horizontal Dots.....	20 nominal, adjustable
Vertical Dots.....	15 nominal, adjustable
Power Source.....	105-125 volts, 60 cycles, single phase
Power Consumption.....	180 watts

### Tube Complement

5 6SN7GT	2 6AG5	2 6AC7
5 6SJ7	2 6Y6G	1 6J5
1 6AS6	1 6AG7	1 OC3
	1 5R4GY	

Dimensions.....	19" wide, 8¾" high, 14" deep
Weight .....	42 lbs.
Finish .....	Umber gray

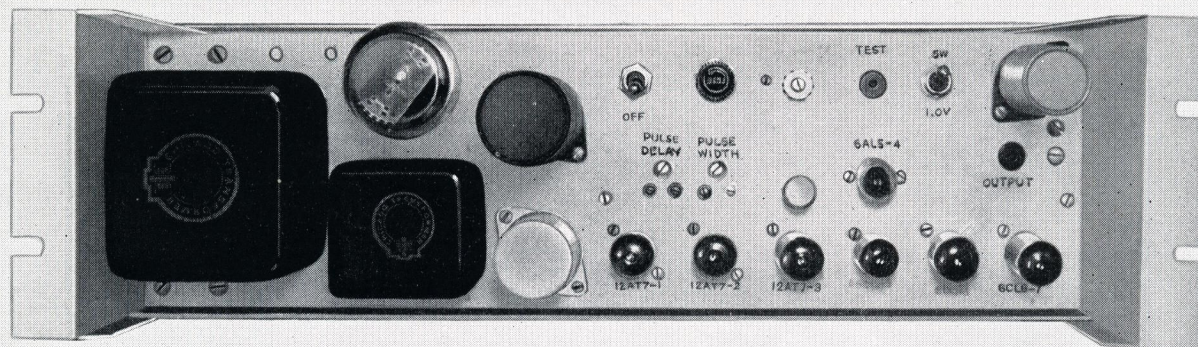
### Equipment Supplied

WA-3B Grating and Dot Generator.....	MI-30003-B
(Including power cord and electron tubes in place, and four cable plug connectors, three 75-ohm termination resistors, and Instruction Book IB-4003-7 including addenda IB-4003-7A)	



# CALIBRATION PULSE GENERATOR

TYPE WA-9A



## FEATURES

- Affords precise calibration of studio signal voltages
- Extremely low output impedances
- Signal readily passed through clamp circuits
- Self-contained power supply, all units mounted on chassis designed for standard rack mounting
- Extremely stable circuitry
- Choice of 0.5 or 1 volt output voltage

## USES

The RCA Type WA-9A Calibration Pulse Generator is designed for the precise calibration of studio signal voltages. The generator can be installed in a television system as one input to a switcher or it may be made available at a jack panel so that it can be patched to any part of the system as desired.

For permanent installation, it is convenient to have the WA-9A installed in master control and on one cable fed to all studios or other sources of signal so that operating personnel can have it available at any time. It can also be

used to calibrate all master monitors and oscilloscopes by merely substituting it for the normal input signal. When it is used as a video input to a switcher, it can be rapidly switched in and out for precise matching of video signals from various sources.

The most important application is in setting up the processing amplifier in the 3V color film chain. Here the WA-9A makes possible an accurate match between all three color channels. Switches are provided on the processing amplifier for rapidly switching between the signal voltages and the calibration pulse signal.



## DESCRIPTION

The WA-9A Calibration Pulse Generator is designed to provide a horizontal-frequency square wave which is precisely controlled for amplitude to produce a one volt or half volt output pulse. Its output impedance is approximately 0.6 ohms, sufficiently low so that several outputs can be provided at the same time without appreciable change of its output level. In addition, the square wave is timed so that this positive half-cycle is centered in the period between horizontal blanking pulses. This allows the signal to pass through clamps and provides a recognizable bar centered on the raster of a picture monitor.

The circuit design is straight forward. Horizontal drive from the sync generator is amplified and used to trigger a stabilized cathode-coupled multivibrator for the delay needed to phase the calibrated pulse in the center of the monitor. The delayed pulse triggers a square-wave multivibrator (see block diagram) which provides timing for the actual output pulse. The output of this multivibrator is clipped by a current-regulating circuit whose output level is controlled by a 5651 voltage-reference tube. This accurately controlled pulse drives a low-impedance output feedback amplifier having precisely unity gain.

The circuits of the WA-9A are extremely stable. As the line voltage of the WA-9A is changed from 110 volts to 125 volts, the output level will not change more than 1%. Rapid changes of line voltage of 5 volts will not cause noticeable bouncing of the output signal. Output voltage level change in going from no termination to one 75-ohm termination, or from one to two 75-ohm terminations is never more than 0.5%. The square wave has a horizontal

frequency and a pulse width of  $31.75 \mu$  sec. with positive polarity. The rise time is less than 1 second. The tilt is less than 1%. It is adjustable for exact symmetry in positioning with respect to horizontal blanking pulses, and adjustable in width.

The unit is controlled by an output level potentiometer in the form of a locking type screwdriver control on the front panel. A toggle switch which provides switching to 0.5 volt or 1.0 volt output, is the only other control. The unit is mounted on a standard  $5\frac{1}{4}$ " bathtub chassis suitable for standard rack mounting. Driving and output signals are connected to coax connectors mounted on the rear of the chassis.

## SPECIFICATIONS

### Performance Specifications

#### Input Requirements:

Power Source.....105 to 125 volts, 60 cycles, 50 watts  
Horizontal Drive Pulse.....3.5 to 5.0 volts, negative polarity, bridging input

#### Output Requirements:

Output Impedance.....Approx. 0.6 ohms  
Output Voltage Level.....Less than 0.5% change in going from no termination to one 75-ohm termination, or from one to two 75-ohm terminations.  
Output Voltage.....Square wave, adjustable to 0.5 volt and 1.0 volt, P/P; leading edge adjustable for nominal  $21.5 \mu$  sec. from leading edge of horizontal drive pulse; width nominally  $31.75 \mu$  sec.

### Tube Complement

3-12AT7	1-6U8
1-6AL5	1-6CL6
1-5651	1-5U4G

Dimensions.....19" wide,  $5\frac{1}{4}$ " high, 9" deep

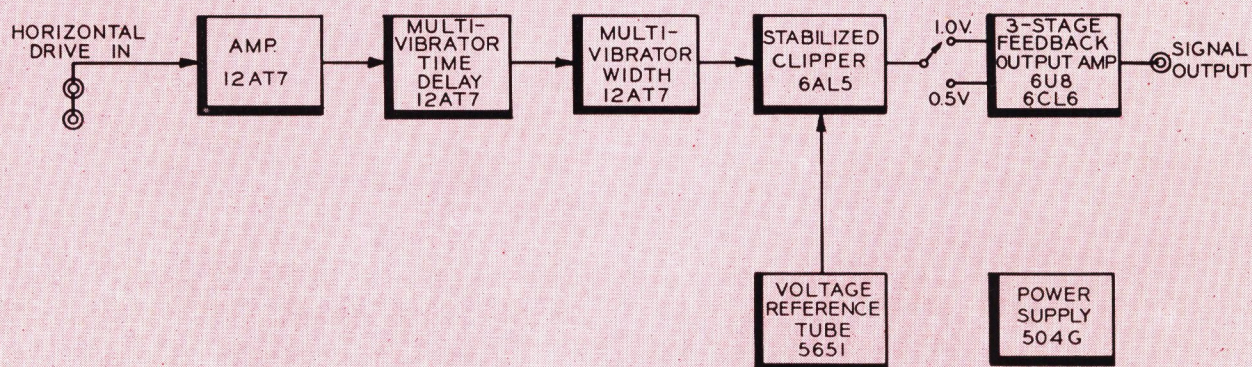
Weight .....14 lbs.

Finish .....Umber gray

### Equipment Supplied

WA-9A Calibration Pulse Generator complete, including tubes in place and instruction book (IB-24959).....MI-26070

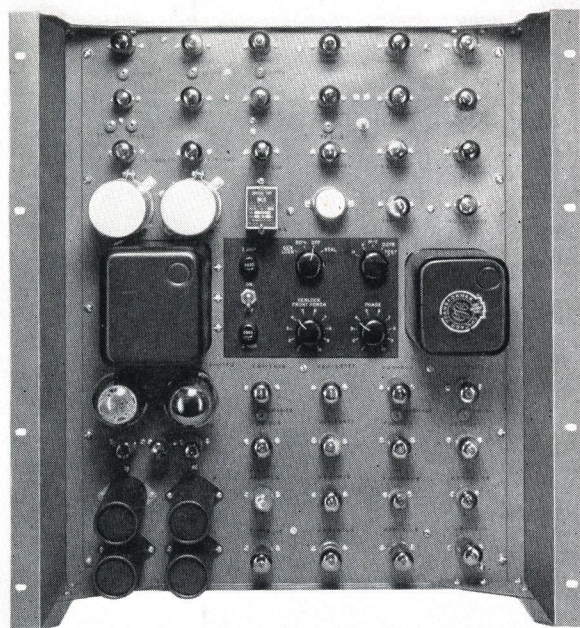
Block Diagram of the WA-9A Calibration Pulse Generator.





# STUDIO SYNC GENERATOR

TYPE TG-2A



## FEATURES

- Built-in Genlock, grating and dot generator, and regulated power supply
- Color sync without modification
- Stabilized circuit design requires only four operating controls
- Pulse output voltages adjustable
- Pulse outputs have sending end terminations
- Front porch width readily adjustable
- Remote Genlock operation
- All pulse widths are established by precision components and require no adjustment
- Number of equalizing pulses, and a number of vertical pulses are fixed, by counting circuits
- All controls may be operated from wiring side of chassis to facilitate maintenance
- Only 21 inches rack space

## USES

The TG-2A Studio Sync Generator is an ultra-stable instrument for generating the RETMA Television Synchronizing Signal as well as Vertical and Horizontal Drive pulses and Blanking. Circuitry for Genlock operation and for generation of a grating or dot pattern is included. The TG-2A Studio Sync Generator in a field carrying case is designated as the TG-12A Field Sync Generator. Both of these equipments have been designed for synchronization to an RCA Color Frequency Standard for use in color systems.

## DESCRIPTION

The TG-2A Synchronizing Generator includes a built-in regulated power supply, Genlock, and grating and dot generator. Only 28 of the 40 tubes are required for the synchronizing function. The other tubes are used in the

Genlock and grating and dot circuitry. It is constructed on a standard bathtub chassis requiring only 21 inches of rack mounted space. Necessary AC power and remote control connections are made through a conveniently located multi-pin connector on the rear of the chassis. All signal connections are made through coaxial jacks mounted on a readily accessible jack strip at the bottom of the unit. Only four operating controls are required. They are: (1) a frequency control switch for locking the master oscillator to a 60-cycle, crystal, off, Genlock, or an external source such as the Color Frequency Standard; (2) a switch for selecting the desired output of the grating generator, either horizontal lines, vertical lines, horizontal and vertical lines, or dots; (3) a control for adjusting the width of the front porch of the blanking signal when the generator is on Genlock operation; and (4) a vertical phasing control, also for use when the generator is on Genlock operation. A relay makes it possible to exercise remote control of the selection of Genlock or local operation. The four operating



controls, together with the line fuses and on-off switch are conveniently mounted in the center of the front panel. Test jacks are provided at all the necessary points for checking circuit operation. The use of double ended potentiometers and switches makes all controls operable from the rear of the chassis. The power transformer is tapped to accommodate line voltages ranging from 102 to 125 volts.

Circuits for the generation of driving, blanking, and synchronizing pulses are designed for maximum stability and long life. Pulse widths and delays are accurately stabilized against tube aging. Output circuits for all pulses provide fast rise times and clean baselines. All pulse outputs are internally terminated in 75 ohms to minimize reflections on long lines.

Any one of five methods of controlling the basic frequencies of the synchronizing generator may be selected with the FREQUENCY CONTROL switch on the front panel. These are:

- (1) **Crystal.** The sync generator is locked in to a precision 94.5 kc crystal oscillator, for use when the 60 cycle power line frequency is not stable enough to use as a reference for the television system.
- (2) **"OFF".** The sync generator is allowed to run free; primarily for testing purposes.
- (3) **60-Cycle.** The 60-cycle vertical pulse output from the sync generator is locked in phase with the a-c power line frequency. On this position the 60-cycle phase control on the front panel is operative to allow adjustment of the relative phase of the sync generator vertical pulse and the a-c power line.
- (4) **External.** On this position an external triggering signal may be brought in through a connector on the coaxial jack strip to lock the sync generator to an external frequency-control system, such as a compatible color system frequency standard.
- (5) **Genlock.** The sync generator is synchronized both horizontally and vertically with an RETMA synchronizing signal from a remote sync generator. On this position the GENLOCK FRONT PORCH control is operative to adjust the relative phasing of the local and remote horizontal blanking signals.

Genlock circuits feature horizontal afc synchronization for best noise immunity, and stabilized design to eliminate set-up adjustments. A relay in the frequency control circuits allows remote control switching to genlock.

Grating generator circuits built into the TG-2A provide a stable pattern of 13 x 17 bars, white on black background with blanking added, which may be used for linearity testing purposes in camera and monitoring equipment. A selector switch in the grating circuits allows choice of horizontal bars, vertical bars, both horizontal and vertical bars, dots at the intersections of the bars or a test position where sync and blanking are mixed for observation of the front porch.

## SPECIFICATIONS

### Output Voltages:

Sync, Hor. Driving, Vert. Driving  
and Blanking Pulse.....4.0 volts peak-to-peak across 75 ohms  
Grating Signal.....1 volt peak-to-peak across 75 ohms

### Signal Input Provisions:

Remote Synchronizing Signal.....4.0 volts peak-to-peak, high impedance, for Genlock operation  
External Frequency Control Signal.....31.5 kc sine wave, 90 volts rms

Power Requirements.....102-125 volts, 60 cycles, single phase, 275 watts

### Dimensions:

TG-2A .....21" high x 19" wide x 8<sup>3</sup>/<sub>8</sub>" deep  
TG-12A .....16" high x 8<sup>1</sup>/<sub>2</sub>" wide x 24<sup>1</sup>/<sub>2</sub>" long

### Weight:

TG-2A .....50 lbs.  
TG-12A .....60 lbs.

### Stock Identification:

TG-2A .....MI-26102  
TG-12A .....ES-26921

## Tube Complement

13 RCA 6U8	1 RCA 6AS7-G
13 RCA 12AT7	1 RCA 5R4GY
5 RCA 6CL6	3 RCA 6AS6
1 RCA 6AL5	1 RCA 6BQ7-A
1 RCA 12AX7	1 RCA 0B2

## Accessories

Sync Generator Changeover Switch .....MI-26289  
Sync Generator Changeover Switch Remote Control Panel.....MI-26267  
TA-4A Pulse Distribution Amplifier.....MI-26158  
Pulse Distribution Box.....MI-26757-A

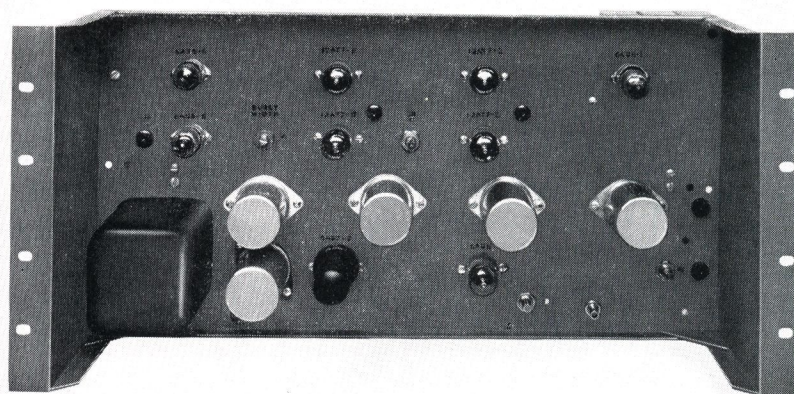


# BURST FLAG GENERATOR

MI-40202-A

## FEATURES

- Generates keying pulse to inject subcarrier bursts in the Colorplexer
- Burst position, burst width, and keying pulse amplitude are all accurately adjustable
- Burst may be eliminated as desired



## DESCRIPTION

The RCA Burst Flag Generator MI-40202-A is a drive-controlled unit which provides keying pulses to the RCA Colorplexer, permitting the insertion, into a composite color television signal, of the burst flag. To avoid distorting the serrated vertical sync pulses, burst flag keying pulses are eliminated during the vertical sync period. Adjustments are provided to insure accurate placement and width of the burst flag in the composite signal, and to gate out the necessary number of pulses at vertical sync time. In addition, the amplitude of the pulses at the output is controllable.

## SPECIFICATIONS

### Input Power:

#### From A-C Line for Tube Heaters:

Line Rating.....105-125 volts, 25 watts  
Line Frequency.....50 to 60 cycles

#### From Regulated Power Supply: (580-D or equivalent)

Plate Voltage.....280 volts d-c  
Plate Current .....130 ma

### Synchronizing Signals:

Vertical Drive.....4 volts peak-to-peak  
Horizontal Drive .....4 volts peak-to-peak

Output Signal .....4 volts peak-to-peak  
width adjustable from 1.8 to 3.0 microseconds

### Dimensions:

Width .....19"  
Height .....8 3/4"  
Depth (overall) .....9"

Weight (approx.).....13 1/2 lbs.

Stock Identification .....MI-40202-A

## Tube Complement

2—6AU6	1—6AS6
4—12AT7	1—6L6

## Equipment Supplied

The following items comprise the RCA Burst Flag Generator, MI-40202-A:

Burst Flag Generator Chassis, including all tubes

Set of Cable Connectors

## Recommended Test Equipment

VoltOhmyst, RCA Type WV-97A

Oscilloscope, RCA Type TO-524D

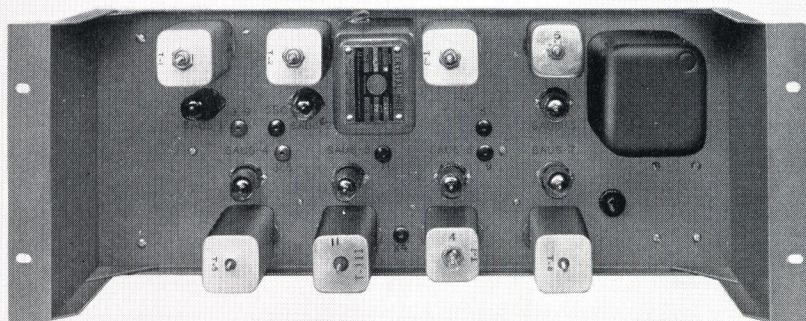


# COLOR FREQUENCY STANDARD

MI-40201

## FEATURES

- Basic oscillator for the RCA Color TV System
- Contains divider chain to produce 31kc signal for locking sync generator to frequency standard
- Crystal controlled for maximum stability
- Adapts any sync generator for color



## DESCRIPTION

The RCA Color Frequency Standard MI-40201 is a dual-function unit, including on one chassis a crystal oscillator for subcarrier generation and a divider chain for dividing the frequency of the subcarrier to 31.4685 kc, which is used to lock the sync generator oscillator to the crystal oscillator.

The chassis of the Color Frequency Standard is designed to be installed in a standard cabinet rack adjacent to that holding the station's sync generator.

### Output Signals:

Frequencies (nominal).....3.58 mc and 31.5 kc

### Impedances:

3.58 mc (two independent outputs).....75 ohms

31.5 kc (one output).....1 megohm

### Voltages:

3.58 mc.....2 volts peak-to-peak

31.5 kc.....90 volts peak-to-peak

### Dimensions:

Width .....19"

Height .....7"

Depth (overall) .....7 1/2"

Weight .....12 1/2 lbs.

Stock Identification .....MI-40201

## Tube Complement

7-6AU6

1-6J6

## Equipment Supplied

The following items comprise the RCA Color Frequency Standard, MI-40201:

Color Frequency Standard Chassis, including all tubes

Crystal Unit MI-19400K, 3.579545 mc

Set of Cable Connectors

## Recommended Test Equipment

The following test equipment is recommended to facilitate adjustment and maintenance of the RCA Color Frequency Standard:

VoltOhmyst, RCA Type WV-97A

Oscilloscope, RCA Type TO-524D

## SPECIFICATIONS

### Input Power:

#### From A-C Line:

For Tube Heaters.....105-125 volts, 30 watts

For Crystal Oven .....105-125 volts, 14 watts

Line Frequency.....50 to 60 cycles

#### From Regulated Power Supply: (580-D or equivalent)

Plate Voltage.....280 volts d-c

Plate Current.....60 ma

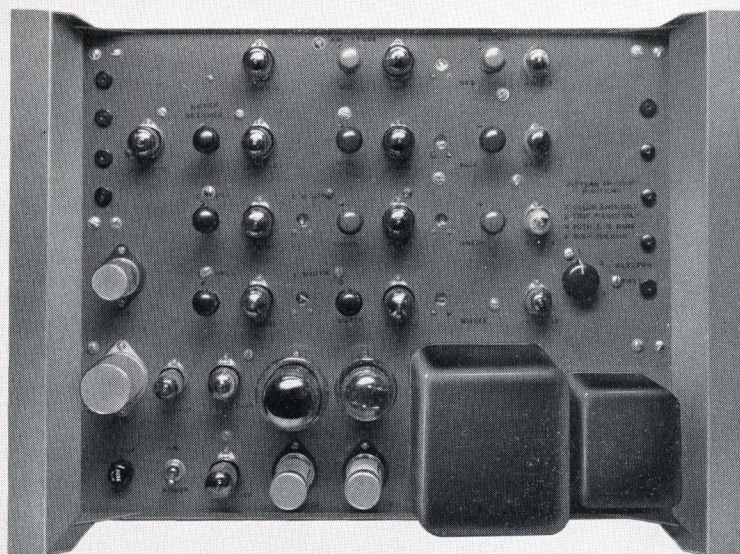


# COLOR BAR GENERATOR

TYPE WA-1D

## FEATURES

- Supplies signals required for adjusting the Colorplexer
- Provides ideal signal for color parameter measurements
- Self-contained regulated power supply
- Special Q and I pulses provided to simplify phase adjustment of the Colorplexer modulator circuits
- Color bars occur in descending order of luminance—white, yellow, cyan, green, magenta, red, blue
- Limiting action insures a constant output level of all bar signals of 1 volt peak-to-peak
- Bar Signals interlocked so that each succeeding bar is triggered by the preceding bar, providing improved stability
- Sharper rise times reduce color edging effects at the color bars
- A special white pulse is provided to facilitate white balance adjustments



## USES

The Color Bar Generator is designed to facilitate adjustment of the Colorplexer and with it to supply a color test signal for general maintenance and measurements in a color broadcasting installation. It generates rectangular pulses which, when fed to the green, red and blue input circuits of the Colorplexer result in the formation of a color bar test signal at the output of the Colorplexer.

In addition, it is capable of providing a split field color bar pattern with standard color bars at the top of the raster, and two special "Q" and "I" test bars, and a white bar in the bottom half of the raster. This field splitting is accomplished by electronic switching. The special "Q" and "I" pulses are provided to simplify phase adjustment of the subcarrier signals, and a white signal is provided to facilitate white balance adjustments in the Colorplexer.

This studio type Color Bar Generator is not to be confused with portable service type instrument described on Pg. 23.

## DESCRIPTION

The Color Bar Generator, Type WA-1D, is assembled upon a bath-tub type chassis 14 inches high and designed to mount in a standard 19-inch wide rack. Input and output connectors are mounted on brackets in the rear of the chassis. An integral regulated power supply and stabilized circuit design insure stability of operation of the unit.

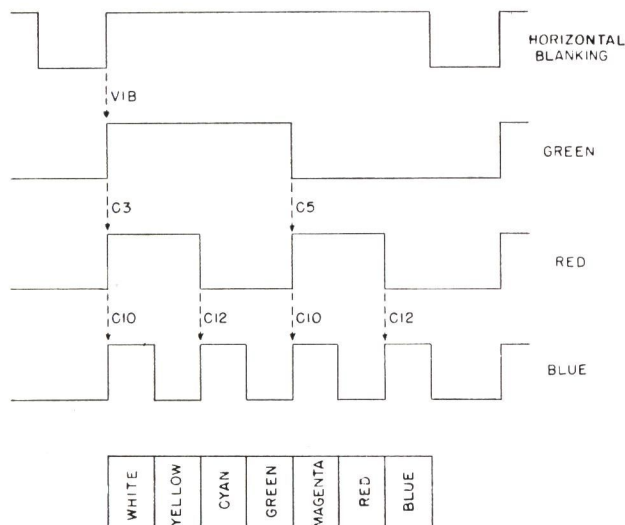


In operation, the trailing edge of the horizontal blanking pulse triggers the green multivibrator; the firing of the green multivibrator trips the red multivibrator, and the firing of the red multivibrator trips the blue multivibrator. In this manner, the first pulse for each of the primary colors is produced in each color circuit. The trailing edge of the red pulse initiates the second blue pulse; the trailing edge of the green pulse triggers the second red and the third blue pulse, and the trailing edge of the second red pulse triggers the fourth blue pulse.

The trailing edge of the horizontal blanking pulse initiates the "Q" pulse, the trailing edge of the "Q" pulse triggers the "I" pulse and the trailing edge of the "I" pulse triggers the white pulse. Field splitting is accomplished by electronic switching, triggered by the leading edge of the vertical drive, so that the color bars will appear in the top half of the picture while the test bars appear in the lower half, whenever the pattern selector switch is in either position 3 or 4.

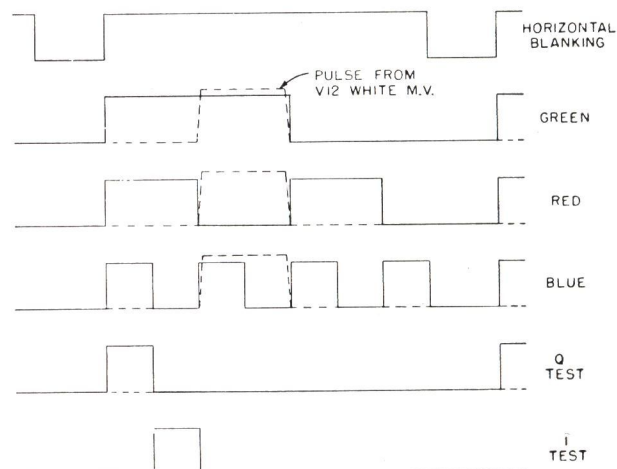
The equipment is so designed that the color bars occur in the descending order of their luminance content, i.e., white, yellow, cyan, green, magenta, red, and blue. Limiting action insures a constant output level for all of the color bar signals, of one volt, peak to peak.

All connections are made at the rear of the unit. Input connections are made to four bracket mounted connectors on the right hand side of the chassis—rear view. Blanking lines are connected to the upper pair of connectors, and vertical drive lines to the lower pair. Five output connectors are bracket mounted on the left side of the chassis. These outputs are connected to the corresponding receptacles on the Colorplexer. A two pronged male connector connects



Color Bar Pulses and Pattern.

A-88 63 822



W	Y	C	G	M	R	B
Q TEST	I TEST	W TEST	BLACK			

A-88 63 824

Composite Color Bar, Test Pulses, and Pattern.

the unit to any 117 volt, 60 cycle, single-phase current. The generator may be turned on and off by a power switch, conveniently mounted at the lower left side, on the front of the chassis. A four position pattern selector switch, mounted on the right side of the chassis, provides the four differing types of outputs described before.

## SPECIFICATIONS

### Performance Specifications

Power Input.....117 volts a-c, 60 cycle, single phase, 135 watts

Signal Voltage Required:

Inputs (high impedance, bridged):

Mixed Blanking.....4 volts, peak-to-peak, neg.

Vertical Drive .....4 volts, peak-to-peak, neg.

Outputs:

A four position selector switch provides outputs as follows:

Pos. 1: Full raster—red, blue, green output pulses at a 1 volt level.

Pos. 2: Full raster Q and I pulses at a 1 volt level from separate output jacks and a pulse of 1 volt level from each of the red, blue and green output jacks producing white.

Pos. 3: Split pattern consisting of the outputs provided by Pos. 1 and Pos. 2.

Pos. 4: Same as Pos. 3 except red, blue and green outputs reduced to 75% level. (Note: The reduced level of Color Bars is provided to prevent overmodulation of the transmitter when using the Bar Pattern. (Saturated yellow would exceed 100% modulation.)

### Tube Complement

1—5V4	1—12AX7	1—5678
1—6AS7	1—6CL6	6—6U8
1—OB2	4—6AL5	3—12AT7

Dimensions (Unit for rack mounting):

Height .....14"

Width .....19"

Depth .....9"

Weight .....30 lbs.

### Equipment Supplied

WA-1D Color Bar Generator.....MI-34001-D

(Complete with tubes in place and Instruction Book IB-24957-1)



# COLORPLEXER EQUIPMENTS

Type TX-1B Colorplexer, MI-40209-A, Aperture Compensator, MI-40414  
Automatic Carrier Balance, MI-40416

## FEATURES

- "Heart" of the RCA Color Television System
- Automatic carrier balance available
- Precision matrixing of the color signal
- Choice of input signals
- 360° subcarrier phase shifter
- Automatic sync delay
- Multiple low impedance outputs
- Aperture Compensation

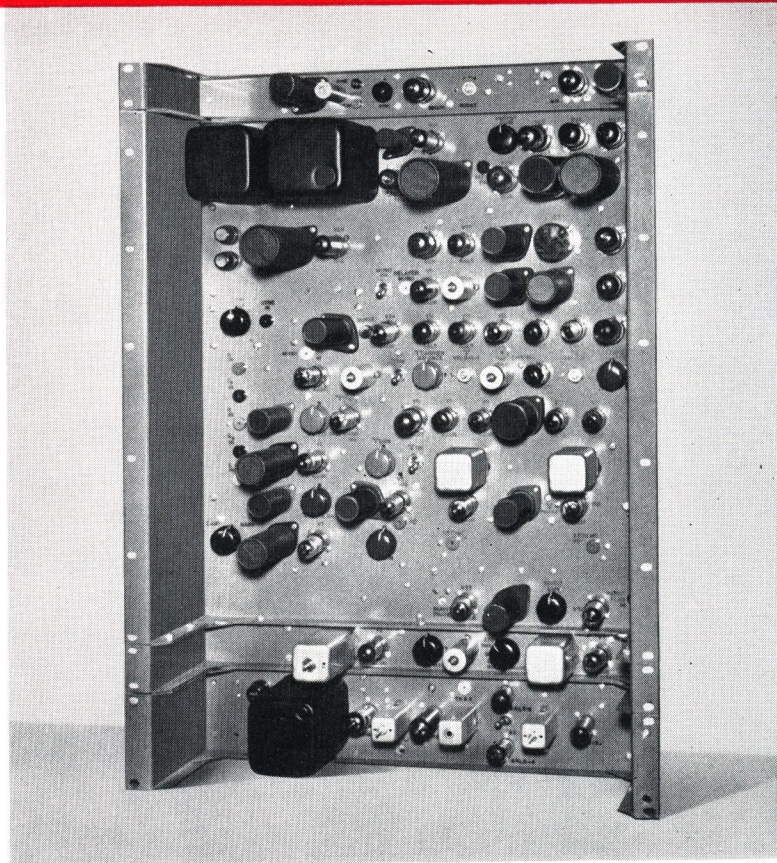
## USES

The RCA Type TX-1B Colorplexer, MI-40209-A, is the heart of the RCA Color Television System. The complex circuits of the unit perform three essential functions necessary for transmission of the TV signal according to FCC specifications. In the matrix and filter section, the red, green, and blue signals fed to the unit are transformed to luminance (M), and two color-difference (I and Q) signals which are then adjusted with respect to bandwidth and delay. In the modulator section the two color difference signals are modulated on two carriers in phase quadrature. In the adder section the operation needed to produce a composite signal for the chrominance, luminance and synchronizing signals is accomplished.

An Aperture Compensator, MI-40414, is provided with the unit to compensate for the finite size of the electron scanning beam in the pickup camera. Though housed on a separate chassis, it is connected electrically with the TX-1B Colorplexer. Controls are provided for adjusting the degree of compensation and sync level. A useful accessory, an Automatic Carrier Balance designed to eliminate carrier instability, is now available for use with the TX-1B Colorplexer. The addition of this unit reduces the warm-up time previously required before on-air operation. (All three units shown in illustration.)

## DESCRIPTION

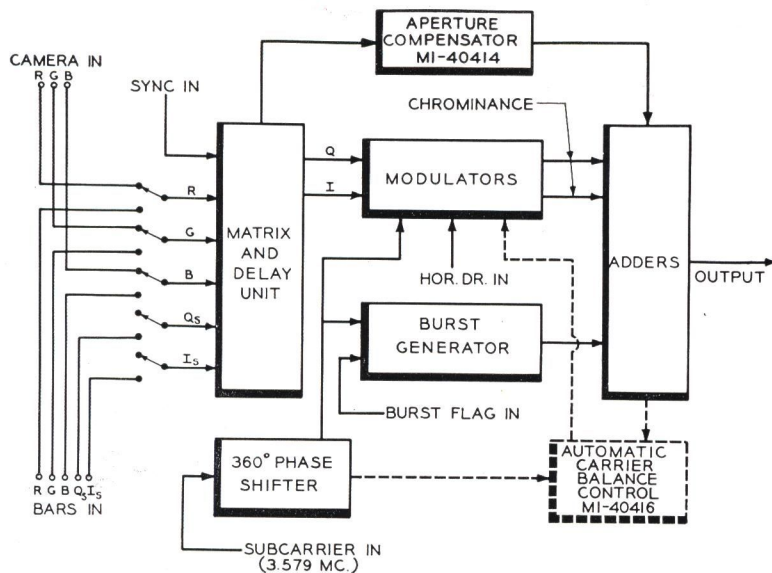
The Type TX-1B Colorplexer consists of two units, the Colorplexer proper which is mounted on a 21-inch chassis designed for rack mounting in standard 19-inch broadcasting racks, and an Aperture Compensator, MI-40414, housed on a separate 1¾-inch high chassis, designed to mount above the Colorplexer in the racks.



The functions of the colorplexer circuits are:

- (1) Cross-mixing, or matrixing, red, blue, and green video signals from a color television camera chain, from a color-slide scanner, or from a color-bar generator, in proper proportion to produce a luminance signal (which is equivalent to a monochrome video signal) and to produce two color-difference or chrominance signals.
- (2) Suppressed carrier modulation in phase quadrature of the two color difference signals.
- (3) Adding RETMA sync signals to the video and color information.
- (4) Producing a burst signal for color synchronization.
- (5) Filtering the chrominance signals to maintain their required bandwidth.
- (6) Compensation for delays in the signals introduced by filtering the chrominance signals.
- (7) Providing suppression of spurious signals during horizontal blanking or retrace time before addition of sync and burst.
- (8) Shifting phase of incoming 3.58 mc subcarrier through 360° to allow matching of several Colorplexer outputs with respect to subcarrier phase.





Simplified block diagram of TX-1B Colorplexer.

The unit features a special selector switch which gives the operator a choice of inserting either camera signals or test signals from a color bar generator. The color bar generator provides five signals instead of the usual three. In addition to the red, green, and blue video signals, special test pulses are provided which can be inserted directly into the I and Q channels by means of the circuit paths indicated in the block diagram. These pulses have been found to be very useful for checking the phase adjustments of the I and Q modulators.

Sync pulses are added to the monochrome signal prior to the delay line so as to avoid the need for a separate sync delay line. The subcarrier signal is fed to the doubly-balanced modulators in the multiplexing circuits. An adjustable phase shifter with a range of 360° is provided at the subcarrier input. It permits the signals from all the colorplexers in a studio or plant installation to be "lined-up" with respect to subcarrier phase at some common point, such as the output of the switching system. Additional phase-shifting networks are used to provide appropriate phases for the two modulators and the burst-keyer.

The complete color signal—formed by adding the M component (with sync, if desired) the two subcarrier components, and the burst—is passed through two feedback pair amplifiers. The first of these provides most of the required voltage gain, and drives a low-impedance gain control. The second feedback amplifier is the output stage, having a sufficiently low output impedance to drive three separate 75-ohm outputs.

The Automatic Carrier Balance is mounted on its own 3½-inch chassis and designed for rack mounting with the Colorplexer. No adjustments of the Colorplexer should be required throughout the course of the day when this unit is used, since it automatically maintains carrier balance at better than 1%. The Automatic Control Balance Unit operates from the same power supply as the Colorplexer. All other voltages and signals except external horizontal drive are obtained from the Colorplexer.

## SPECIFICATIONS

### Electrical Specifications

#### (COLORPLEXER)

Camera Signal Inputs.....75 ohms, 1.0 volt, peak-to-peak  
 Color Bar Generator Signal Inputs.....75 ohms, 1.0 volt, peak-to-peak  
 Sync Generator Signals:  
   3.58 Mc Subcarrier.....High impedance bridged, 2.0 volts  $\pm 10\%$   
   Burst Flag Signal.....High impedance bridged, 4.0 volts negative  
   Horizontal Drive.....High impedance bridged, 4.0 volts negative  
   RETMA Sync.....75 ohms, 4.0 volts negative  
 Output Signals.....Three composite video, low impedance, sync negative,  
   0-1 volt sync to peak white, across 75 ohm load  
 Power Requirements.....110-125 volts, 50/60 cycles, 90 watts  
   +280 volts d-c, 325 ma, -150 volts d-c, internal bias supply

#### (APERTURE COMPENSATOR)

Sync Input Signal.....High impedance, bridged, 3.5 to 4 volts  
   peak-to-peak, negative  
 Monochrome Video Input.....1000 ohms impedance, 0.5 volt  
   black-to-white (approx.)  
 Composite Monochrome and Sync Output.....1000 ohms impedance,  
   0.5 volt peak-to-peak (approx.)  
 Power Requirements.....117 volts, 50/60 cycles, 10 watts  
   +280 volts regulated d-c, 33 ma

#### (AUTOMATIC CARRIER BALANCE CONTROL)

Horizontal Drive.....High impedance bridged, 4.0 volts negative  
 Power Requirements.....110 volts, 50/60 cycles, +280 volts d-c, 20 ma

### Tube Complement

Colorplexer.....11-6AU6, 1-OA2, 2-6BQ7, 2-6AH6, 5-6AS6, 2-5687,  
   4-6U8, 1-OB2, 6-6AL5, 2-12AU7  
 Aperture Compensator.....1-6BQ7A, 1-6U8  
 Automatic Carrier Balance.....2-6AL5, 1-6AN8, 1-6AW8, 1-6AU6

### Mechanical Specifications

	Colorplexer	Aperture Compensator	Carrier Balance
Height .....	21"	1¾"	3½"
Width .....	19"	19"	19"
Depth .....	9"	7"	3"
Weight .....	34 lbs.	3 lbs.	10 lbs.
Finish .....	Umber gray	Umber gray	Umber gray

### Equipment Supplied

- 1 Type TX-1B Colorplexer, chassis with tubes in place, two Delay Lines, set of cable connectors and Instruction Books (IB-26224 and IB-26224-A).....MI-40209-A  
 1 Aperture Compensator complete with tubes in place and cable assembly, and Instruction Book (IB-36243).....MI-40414

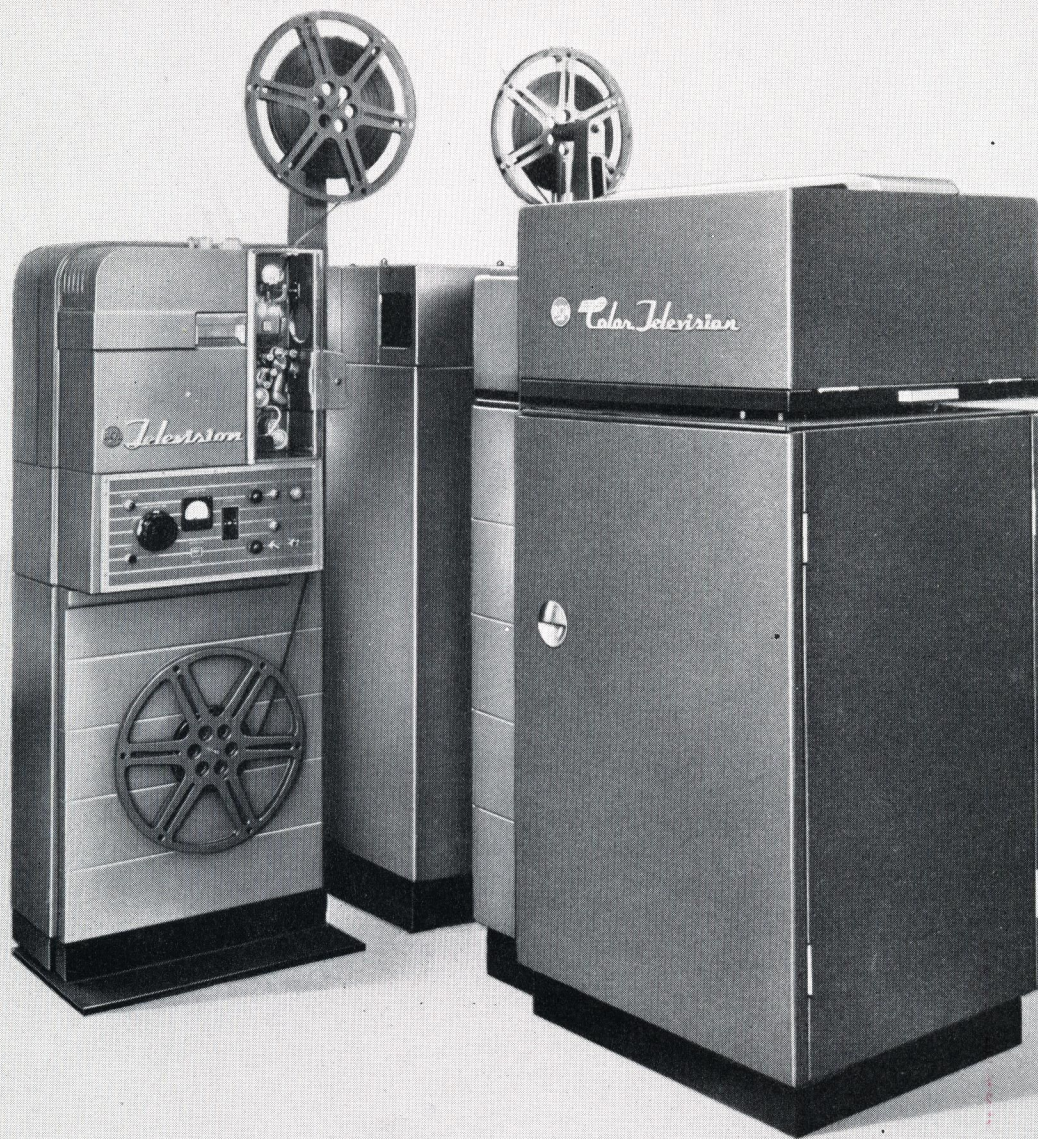
### Accessory Equipment

- Automatic Carrier Balance Control, complete with Instruction Book (IB-36256).....MI-40416



# 3-VIDICON COLOR FILM CHAIN

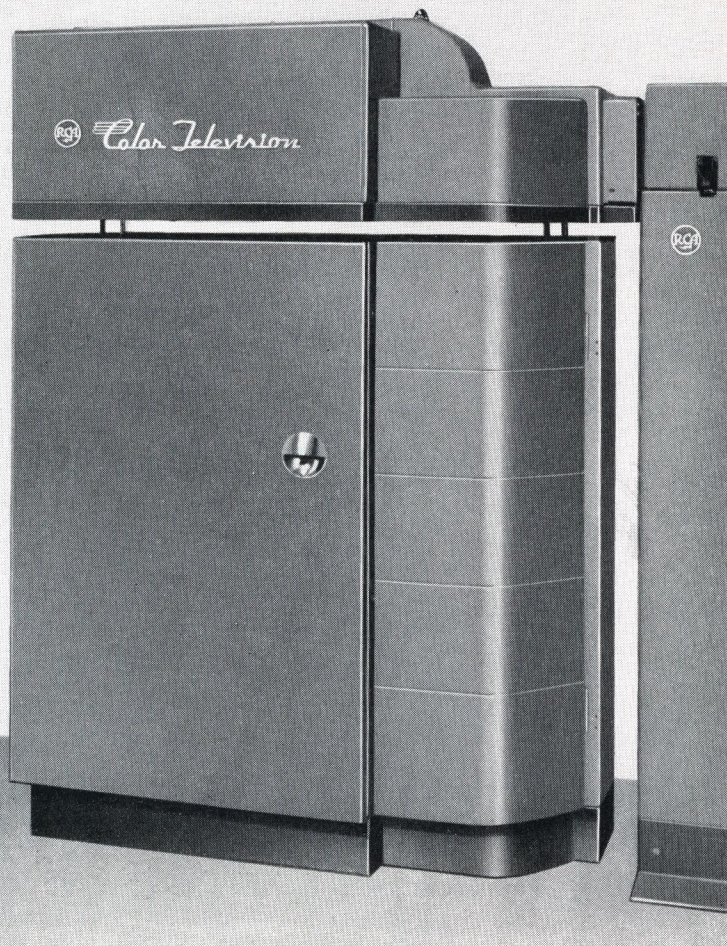
TYPE TK-26A



## FEATURES

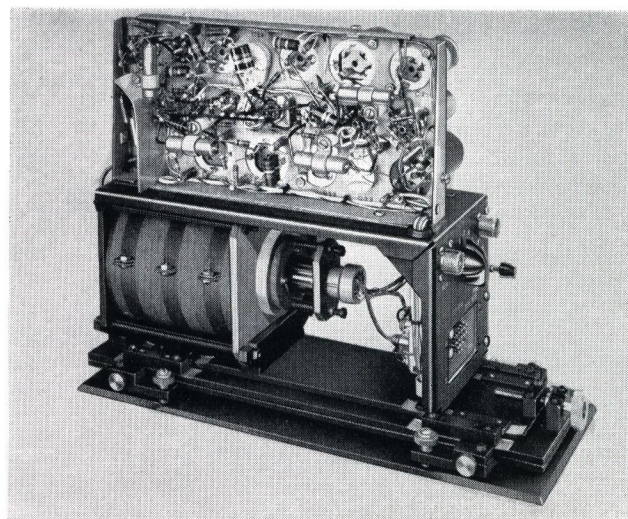
- Multiplexing of projectors into a single camera makes possible low cost film system
- High signal-noise ratio picture
- Resolution and gamma excellent
- Adequate reserve for dense films
- Easy to obtain and maintain registry of images
- Operates with intermittent long application projectors such as the RCA TP-6BC directly from the power lines without the necessity of lock-in with the sync generator
- Color fidelity as good as image orthicon
- Compatible monochrome picture has excellent S/N ratio, gamma and resolution
- Stable operation—system stays put





The 3-Vidicon Color Camera housing. Included in the top part of the housing are the three individual vidicon camera sub-chassis and the light splitting optical system. In the bottom pedestal portion of the housing is the camera auxiliary chassis.

A single Vidicon Camera Sub-chassis. Three identical sub-chassis are used in the 3-Vidicon Color Camera. These sub-chassis are mounted atop the camera pedestal and are mechanically aligned by means of the thumb-screw adjustments shown.



## USES

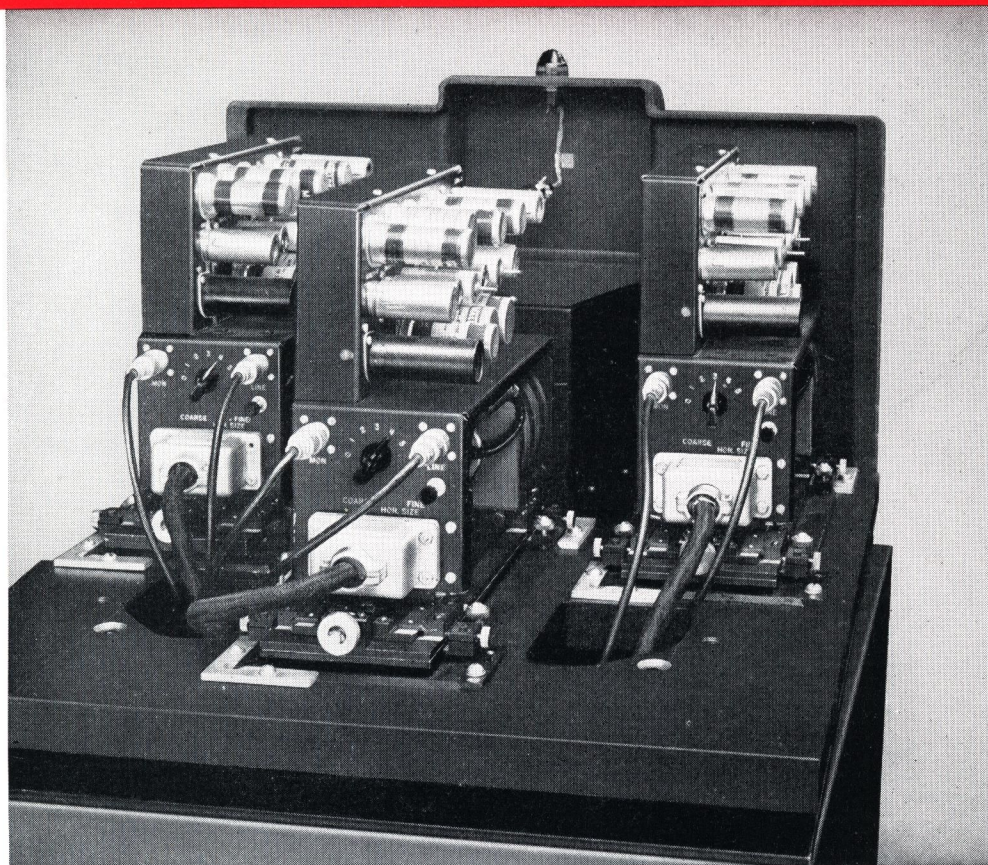
The 3-Vidicon Color Film Camera Equipment enables the broadcaster to include color commercials and color films in his Color Program schedule. Multiplexed operation of this color film system offers a selection of 16mm and 35mm color films as well as 2" x 2" color slides to be used as color program material. Many of the excellent design features of present monochrome vidicon techniques have been incorporated in this 3-Vidicon Color Film Chain to obtain greatest reliability and color picture quality.

The high resolution and maximum stability of the vidicon tube is retained in this 3-Vidicon system. Color fidelity equals the high quality standards set by RCA's Color Studio Camera. Use of the vidicon tube also provides a very high signal-to-noise ratio in both the color and the com-

patible monochrome picture. This feature is particularly important, especially in the transition when color programs will be viewed on a great number of monochrome sets. The RCA 3-Vidicon Color Film System provides highest quality black-and-white as well as color pictures. The black-and-white picture is superior to that obtained with present iconoscope film chains.

Precise picture registration and exceptional stability assure simplicity and ease of operation and a minimum of maintenance. Standard intermittent, long application projectors such as the RCA TP-6BC are used. These provide an ample reserve of light to produce the best possible pictures from films of high density. They may be operated directly from power lines without necessity of lock-in with the sync generator.





View of the three camera sub-chassis mounted atop the camera pedestal. The light-splitting optical system is completely enclosed in a dust-proof housing and each of three color images is directed to the face of one of the vidicon tubes.

View of 3-Vidicon Camera pedestal showing location of major elements—camera sub-chassis atop pedestal and camera auxiliary including local control panel mounted in the rack-like base. The camera auxiliary may be mounted on either side of the camera pedestal. The local control panel essentially duplicates the setup controls of the camera control panel. This is of convenience to the operator in the initial setup of the camera chain, after which the control functions are switched to the console or rack mounted camera control panel position.

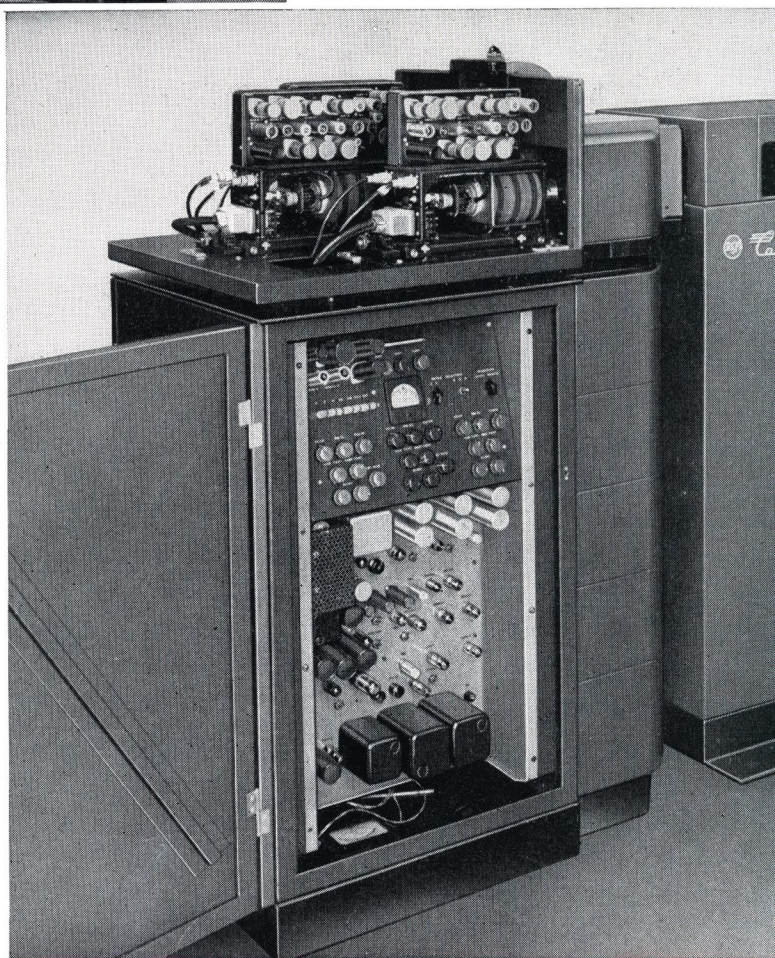
## DESCRIPTION

### TK-26A Color Film Camera

The RCA TK-26A Color Film Camera employs three RCA 6326 vidicon tubes, one for each of the primary colors of the color picture being transmitted. These vidicons "look" at a real image produced by the projector at a field lens in the camera. By use of a separate lens at each vidicon and appropriate choice of dichroics and color shaping filters, each vidicon sees only the red, the green, or the blue component of the color image.

The three identical vidicon camera sub-chassis are located together with the light splitting optics in the upper portion of the camera pedestal. Mechanical alignment of the three camera sub-chassis is easily achieved by thumbscrew adjustment of each chassis. The "in-line" arrangement of the cameras also simplifies this initial set-up. Final precise registration is easily achieved electronically, and once registered, excellent stability of registration results. In day-to-day operation, only minor touch-up of controls is necessary.

Deflection voltage for all three vidicons is generated from a single camera auxiliary chassis located in the lower portion of the 3-vidicon camera pedestal.





## Control Console

The 3-Vidicon Camera Control Units may be conveniently mounted in the Control Console. This control position includes: (1) a TM-6C Master Monitor mounted in its Console Housing, MI-26266-B, and (2) a Master Console Housing, MI-26276, in which the Camera Control Panel and the Processing Amplifier may be mounted (see illustration, facing page). This MI-26276 Master Console Housing is designed to mount the 19" Camera Control Panel in the indented section of the console desk and the Processing Amplifier in the top sloping portion of the console. The camera control position also includes a TM-10B Color Monitor. This may be suspended from the wall or ceiling or set upon the flat top of the Master Console Housing as space requirements dictate.

If preferred, all of the 3-Vidicon Color Film Control equipment may be rack mounted. In this case a Rack Mounted Control Desk provides mounting facilities for the Camera Control Panel and desk space at the rack location. Here it is recommended that the TM-10B Color Monitor be mounted in an adjoining rack at approximately the level of the monochrome TM-6C Master Monitor.

The newly designed Processing Amplifier mounted in the control console has incorporated many space saving features. This compact unit provides a great number of signal processing functions in a single chassis. For instance, a monitor auxiliary circuit as part of the processing amplifier provides for precise electronic switching of the video signals to be monitored on the TM-6C. This Processing Amplifier is discussed in detail in the following paragraphs.

## Space and Power Requirements for a 3-V Camera Chain

Approx. Space\*

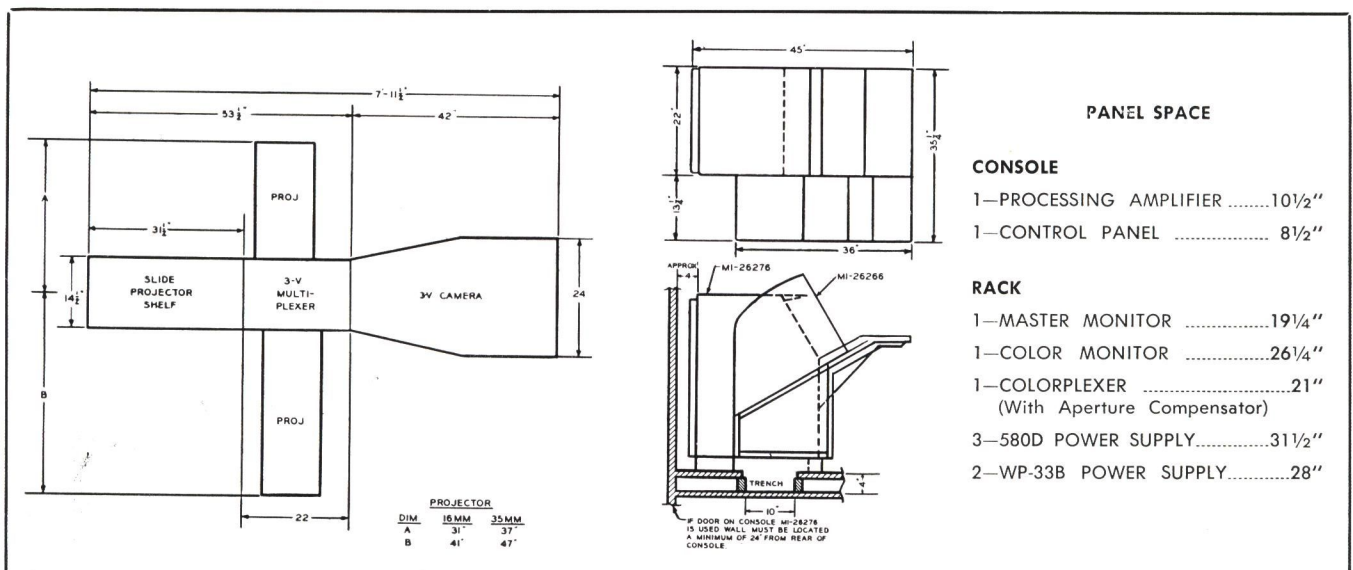
1. RACK . . . . Two 84" Cabinets . 20" x 44"
2. CONSOLE . . Console Housings . 45" x 36" \*\*
3. CAMERA . . Pedestal . . . . 24" x 42"
4. MULTIPLEXER . Pedestal . . . . 14½" x 53½"

5. Total Power Required (approximate and exclusive of the projector power) 3.5 kw for chain

\* These dimensions represent overall maximum and are issued for planning purposes.

\*\* If the control equipment is to be rack mounted, the Console Housings are omitted from the system. For such installations, it is necessary to add another rack.

Sketch showing floor space required for the TK-26A 3-Vidicon Color Film Chain and console mounted control equipment.

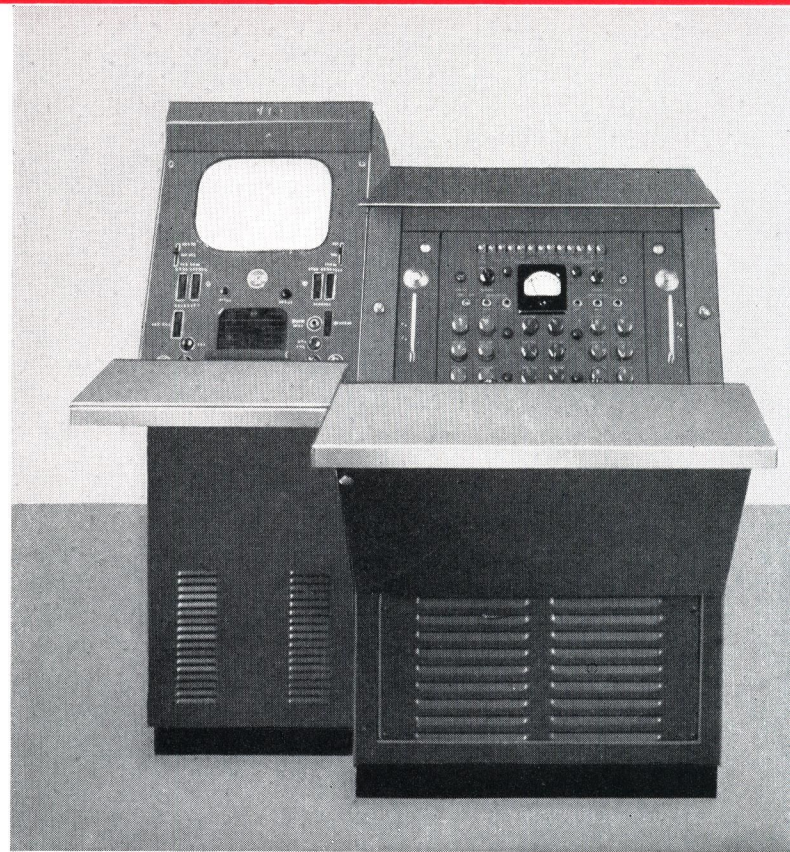




## Processing Amplifier

The Processing Amplifier, MI-40520, has been designed to perform a great number of functions in a single versatile unit. Integration of these electrical functions in a single unit results in a simple, space-conserving, low cost system. Use of this design allows set-up time to be substantially reduced and requires fewer video operators and control room engineers for programming. Hence considerable savings in operating costs can be realized. A large reduction in power consumption as well as increased tube life due to extremely conservative operation of tubes further reduce costs, at the same time improving performance and overall quality.

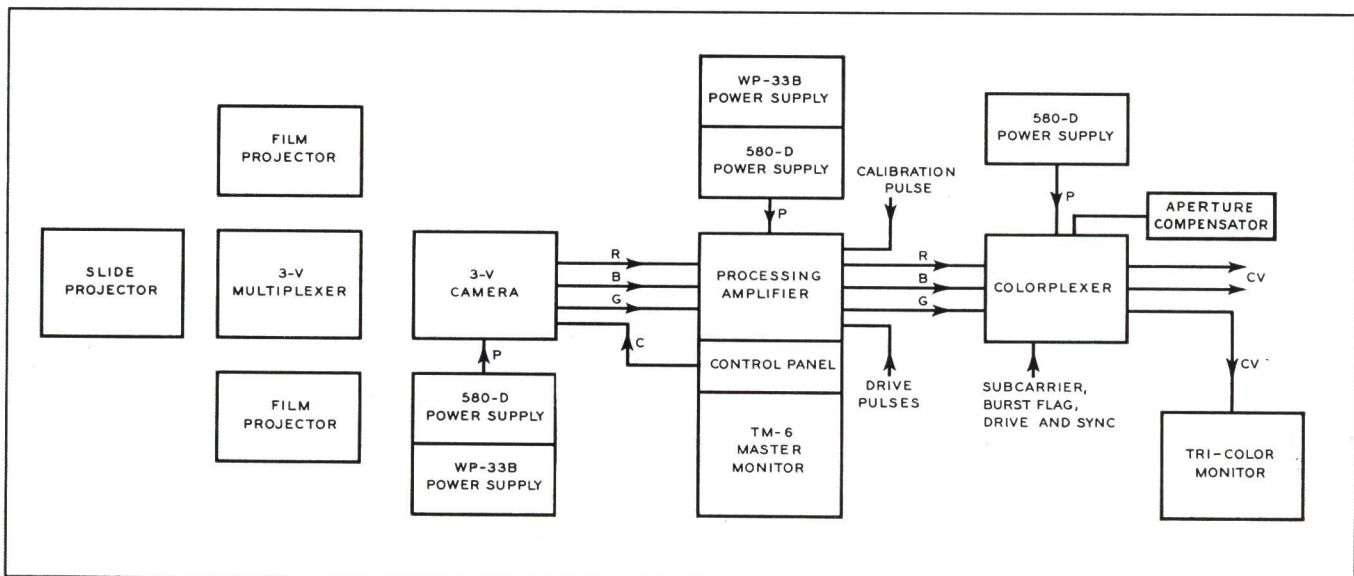
The basic circuit elements in the Processing Amplifier are three plug-in video amplifiers which very accurately and with extreme stability perform the following functions: cable compensation, video amplification, blanking insertion, shading insertion, feedback clamping, linear clipping, gamma correction, and output amplification. Pulse circuitry needed for the camera and shading generators, is obtained from stabilized multi-vibrators. These multi-vibrators provide pulses of constant amplitude and width independent of the incoming pulse. These circuits require no tube selection and are completely stable. Shading generators are provided for insertion of either horizontal or vertical shading. A fourth plug-in unit serves as the video section of an electronic switcher which is an integral part of



The 3-Vidicon Camera Control position. Pictured here, left to right, are the TM-6C Master Monitor and the Processing Amplifier. The Camera Control Panel is mounted in the indented section of the console desk.

the main chassis. The switcher, used with Master Monitor, TM-6C, provides an individual or combined presentation of red, blue and green video.

Block diagram showing major components of the TK-26A 3-Vidicon Color Film Chain and associated projector equipment.







### Rack Equipment

All the units normally housed in the Master Console—Master Monitor, Control Panel and Processing Amplifier may be rack mounted. To complete the camera chain, a Colorplexer, Aperture Compensator, and a set of power supplies (two WP-33B's and three 580-D's) also mount in standard 84" cabinet racks. The Colorplexer accepts the red, green and blue signals from the three vidicon cameras and transforms them to M, I, and Q signals. These are adjusted with respect to bandwidth and delay and then multiplexed to produce one composite signal from the three input signals. The Aperture Compensator is a 1 $\frac{3}{4}$ " high unit which mounts above the Colorplexer and connects to its luminance (M) channel. A Color Monitor is also included in the chain and can be rack mounted or placed in a cabinet at a convenient location.

Rack mounting option for the 3-Vidicon Color Film Control Equipment. Here the Master Monitor, Processing Amplifier and Control Panel are placed at the rack location. In this case a Rack Mounted Control Desk provides mounting facilities for the Camera Control Panel and convenient desk space. See Equipment List for a complete outline of equipment required for this rack mounting option.

### 3-Vidicon Multiplexer

This Multiplexer, TP-12, provides the optical system required to project a number of film sources into a single 3-Vidicon Camera input. Using mirrors, the Multiplexer provides for two film projectors (16mm or 35mm) and a single 2" x 2" dual-disk slide projector. Selection of any of the film sources can be remotely controlled. Each of the two mirrors in the multiplexer is hinged so that they will fold out of the way as required (see the block diagram on these pages). The movement is activated by electric motors so that the proper combination can be obtained by push-button controls. The image from any of the projectors can thus be relayed to the field lens in the 3-Vidicon Camera Unit.

The multiplexer optics are housed in a completely self-contained pedestal which is designed to stand directly in front of the 3-Vidicon Camera Unit. Highest quality optics with front surface mirrors are used throughout.

### Projectors

In film reproduction the TK-26A 3-Vidicon Film Camera system utilizes the excellent storage characteristic of the vidicon tube. This allows operation with intermittent type film projectors with which most television operators are already familiar. Use of the intermittent type projector means that, while the sync generator is phased from the color subcarrier crystal as required in a color system, the projectors can operate directly from the power line and be synchronized with it. It is necessary, however, that the projectors be capable of long application. The RCA TP-6BC Professional Projectors used with the 3-Vidicon system include this long application feature. The RCA TP-35CC is a long application, 35mm projector that may also be used as part of the chain.

The 3-Vidicon system requires that the optical axis of each projector be coincident with the optical axis of the camera. A single lens slide projector such as the TP-3C Dual-Disk Slide Projector is therefore required.



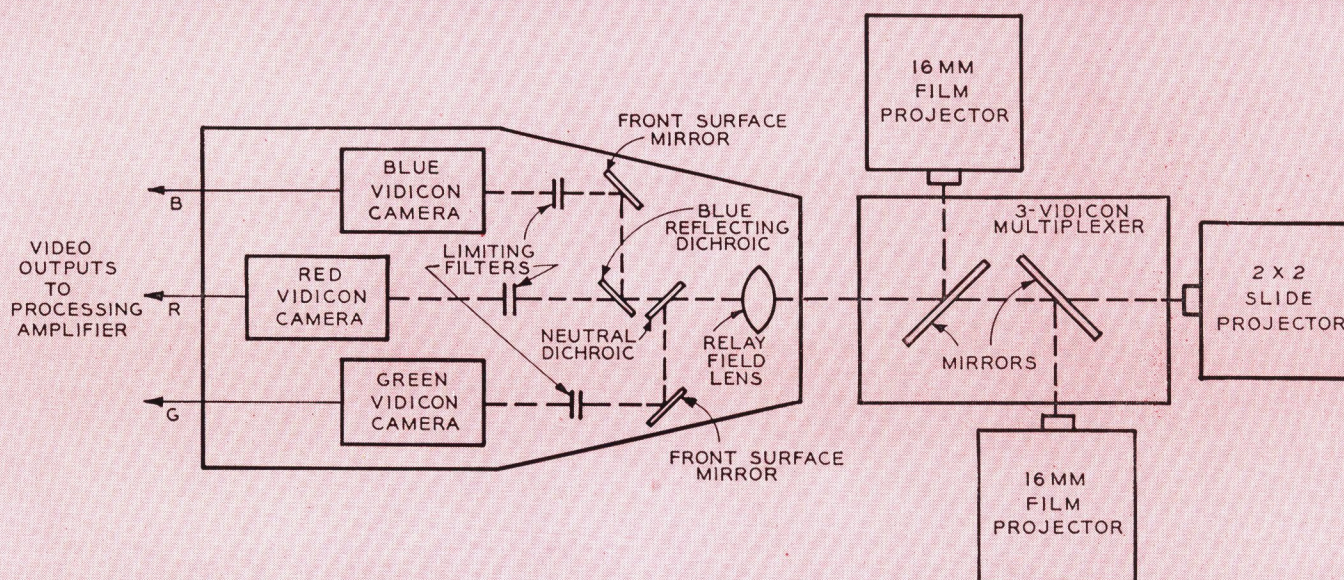


Diagram showing 3-Vidicon optical system. Light from either one of the selected projectors passes into the Multiplexer. A remotely-controlled mirror arrangement reflects the incoming image through a field lens to the 3-Vidicon Camera. Here dichroic mirrors and color trimming filters "split" the light into three color components—green, red and blue. Each of these components produces a video signal in a separate vidicon camera sub-chassis. Video output from each sub-chassis is fed to the processing amplifier in the camera control console or at the rack location.

## SPECIFICATIONS

### Electrical Specifications

#### VIDICON CAMERAS

##### Input:

D-C Power (from 580D)	+280 volts, 280 ma
Bias Voltage (from Auxiliary Unit)	—105 volts, 30 ma
Deflection, Alignment and Focus Currents (from Auxiliary Unit)	
A-C Power	50/60 cycles, single phase, 6.3 volts, 9.75 amps

##### Output:

Picture Response	Essentially flat to 8 mc
Picture Signal (black is negative)	0.4 volts peak-to-peak
Monitor Signal (black is negative)	0.4 volts peak-to-peak

#### CAMERA AUXILIARY UNIT

##### Input:

Horizontal Drive (negative)	3.0 volts peak-to-peak
Vertical Drive (negative)	3.0 volts peak-to-peak
Blanking (negative)	2.0 volts peak-to-peak
External Video Signal	1.0 volts peak-to-peak
Monitor Signals (from Cameras)	0.4 volts peak-to-peak
D-C Power (from WP-33B):	
Regulated	280 volts, 500 ma
Unregulated	360 volts, 40 ma
A-C Power	50/60 cycles, single phase, 117 volts, 6.3 volts, 11.8 amps
Tally Circuits	24 volts D-C, 3 ma

##### Output:

Monitor Output (regardless of output selected):	
Response	Essentially flat to 8 mc
Amplitude (system blanking added)	0.7 volts peak-to-peak

### Mechanical Specifications

(Overall system space requirements are discussed in preceding pages)

Unit	Height	Width	Depth	Weight
Complete Camera — 3 Camera Sub-chassis, Optical Assem. Pedestal Cam., Aux. Front and Rear Covers	57"	23 1/4"	41 1/2"	525 lbs.
TP-12 Multiplexer	54"	14 3/4"	53 1/2"	250 lbs.

### Tube Complement

#### VIDICON CAMERA

Qty.	Type	Qty.	Type	Qty.	Type
1	6326	1	12B4	2	6AH6
1	417A	1	6U8	1	6BQ7A

#### PROCESSING AMPLIFIER

10	12AT7	1	6CL6	1	6BX7
3	6U8	3	6BQ7A	1	12AX7
		1	12BH7		

#### CAMERA AUXILIARY

1	6AH6	1	5963	1	12B4
3	6BQ7A	1	6AS6	2	OB2
3	12AX7	1	12BH7	1	6BX7
4	12AT7	1	12AU7	1	6X4
		2	6CD6		

#### PLUG-IN VIDEO AMPLIFIER

3	6BQ7A	2	12AX7	1	6AL5
		2	6CL6		



## TYPE TK-26A 3-VIDICON FILM CAMERA CHAIN (Equipment Supplied)

### CONSOLE MOUNTED CONTROL

Qty.	MI Number	Description
1		Type TK-26A, Three Vidicon Color Film Camera Equipment to include:
3	40516	Vidicon Camera (less Vidicon Tube).....
1	40517	Camera Auxiliary .....
1	40518-A	Optical Assembly .....
1	40519	Pedestal .....
1	40520	Processing Amplifier (less Gamma Correctors).....
3	40833-1	Gamma Corrector (0.70).....
1	40833-2	Gamma Corrector (1.0).....
1	40522	Camera Control Panel.....
1	40209-A	TX-1B Colorplexer .....
1	40414	Aperture Compensator (for TX-1B).....
1	40416	Automatic Carrier Balance Control.....
1	26136-B	TM-6C Master Monitor.....
1	26544	Sync Interlock Relay (for TM-6C).....
1	40206-A	TM-10B Color Monitor (including 15GP22 Tube).....
1	40213	Line Regulator (for TM-10B).....
3	26671	Vidicon Tube, Type 6326.....
1	26655	Kinescope Tube, Type 10SP4 (for TM-6C).....
1	26667	CRO Tube, Type 5ABP1 (for TM-6C).....
1	40406	Cabinet (for TM-10B).....
1	26266-B	Console Housing, 13-inch (for TM-6C).....
1	26579-B	Blower (for TM-6C).....
1	26276	Console Housing, 19-inch (for Processing Amp.).....
—	—	Rack Mounting Desk (for Control Panel).....
—	—	Rack Mount (for TM-6C).....
—	—	Rack Mount (for TM-10B).....
—	—	Rack Extension (for TM-10B and TM-6C).....
3	21523-C	580-D Power Supply.....
2	26085-B	WP-33B Power Supply.....
1	40831-1	Control Cable, 33 Conductor, 50 ft. ....
3	40835	Set of Interconnecting Cables.....
1	26759-41	Power Cable .....
1	26759-42	Power Cable .....
—	—	Power Cable .....
1	40846	16mm Color Test Film.....
1	40849	2 x 2 Color Test Slides.....
NOTE: The following items are not included but are required.		
2	30951-D84	Type BR-84D Cabinet Racks.....
1	26070	Type WA-9A Calibration Pulse Generator.....

### RACK MOUNTED CONTROL

Qty.	MI Number
1	
3	40516
1	40517
1	40518-A
1	40519
1	40520
3	40833-1
1	40833-2
1	40522
1	40209-A
1	40414
1	40416
1	26136-B
1	26544
1	40206-A
1	40213
3	26671
1	26655
1	26667
—	—
—	—
—	—
1	40415
1	26526
1	40407
2	40408
3	21523-C
2	26085-B
1	40831-1
3	40835
1	26759-41
—	—
1	26759-6
1	40846
1	40848
3	30951-D84
1	26070

## OTHER EQUIPMENT ITEMS FOR USE WITH A TK-26A COLOR FILM CAMERA CHAIN

1	26919	TP-12 Three Vidicon Multiplexer.....	1	26919
2	26922-BC	Type TP-6BC Film Projectors, 16mm, for Color.....	2	26922-BC
1	11729	Audio Changeover Relay (required only if 2 projectors are used).....	1	11729
1	26924	TP-3C Dual Disc Slide Projector.....	1	26924

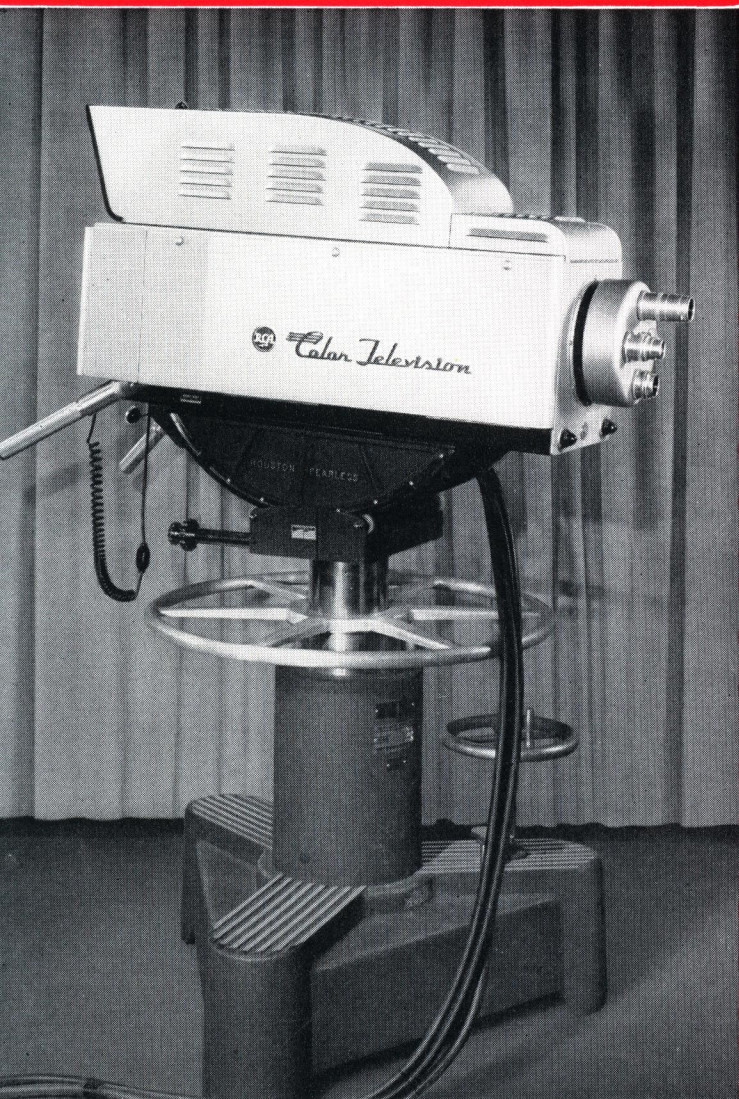
### Accessories

WA-1D Color Bar Generator.....	MI-34001-D
TA-3A Distribution Amplifier.....	MI-26157-A
Left End Panel for 19-inch Console Housing.....	MI-26283-1
Right End Panel for 19-inch Console Housing.....	MI-26283-2
Left End Bell for 13-inch Console Housing.....	MI-26265-1
Right End Bell for 13-inch Console Housing.....	MI-26265-2
Video Jack Panel (Coaxial connectors provided).....	MI-26245
Video Jack Panel (Solder cable directly to jack).....	MI-26244



# LIVE COLOR CAMERA CHAIN

## TYPE TK-41



### FEATURES

- All-purpose live color TV camera providing low noise, high resolution picture in full, natural color
- All controls conveniently located—only two master controls needed for on-air operation of camera chain
- Optional console mounting or rack mounting available for camera control equipment
- Utilizes new processing amplifier control equipment identical with 3-V color film camera control equipment
- Improved, high quality color monitor included
- Built-in camera cable equalization
- All electronic viewfinder with improved 7-inch aluminized kinescope
- Performance independent of line voltage variation over wide range
- Simplicity of mechanical design provides easy access to all circuits and controls
- Forced-air ventilation of pick-up tubes
- Stable, fixed, plug-in gamma corrector units
- Standard TV lenses including zoom-type
- Can be used for film pick-up with screen and long application projector

### USES

The RCA Type TK-41 Live Color Camera Chain provides the television broadcasting station with an ideal means of getting on the air with locally originated color programs either from the studio or from out-door sites. It can operate as a temporary film camera and also be used to pick-up opaques.

The new camera chain is designed as a simple, space-conserving and low operating cost color TV origination system. It picks up and separates a color image into its primary red, blue and green component images and converts them to signals required for FCC standard color transmission. Components in the chain enable the camera-

man to view the scene and control the picture content, while the camera control operator can control signal processing for best picture quality, and monitor the entire operation.

The new camera chain is one of the finest, high-quality equipments ever designed by RCA for TV station use. It employs the latest in circuitry such as the unique processing amplifier which has resulted in compact auxiliary equipment, improved operating stability and economical operation. This processing amplifier is identical with that used with the RCA Type TK-26A 3-Vidicon Color Film Chain.



## DESCRIPTION

The TK-41 Color Camera Chain is similar in many respects to monochrome camera chains now in use in that it contains a live pickup camera as well as signal processing and control units. The major equipment units include the color camera, viewfinder, camera control panel, processing amplifier, TM-10B color monitor, TX-1B Colorplexer with aperture compensator, TM-6C master monitor, and power supplies.

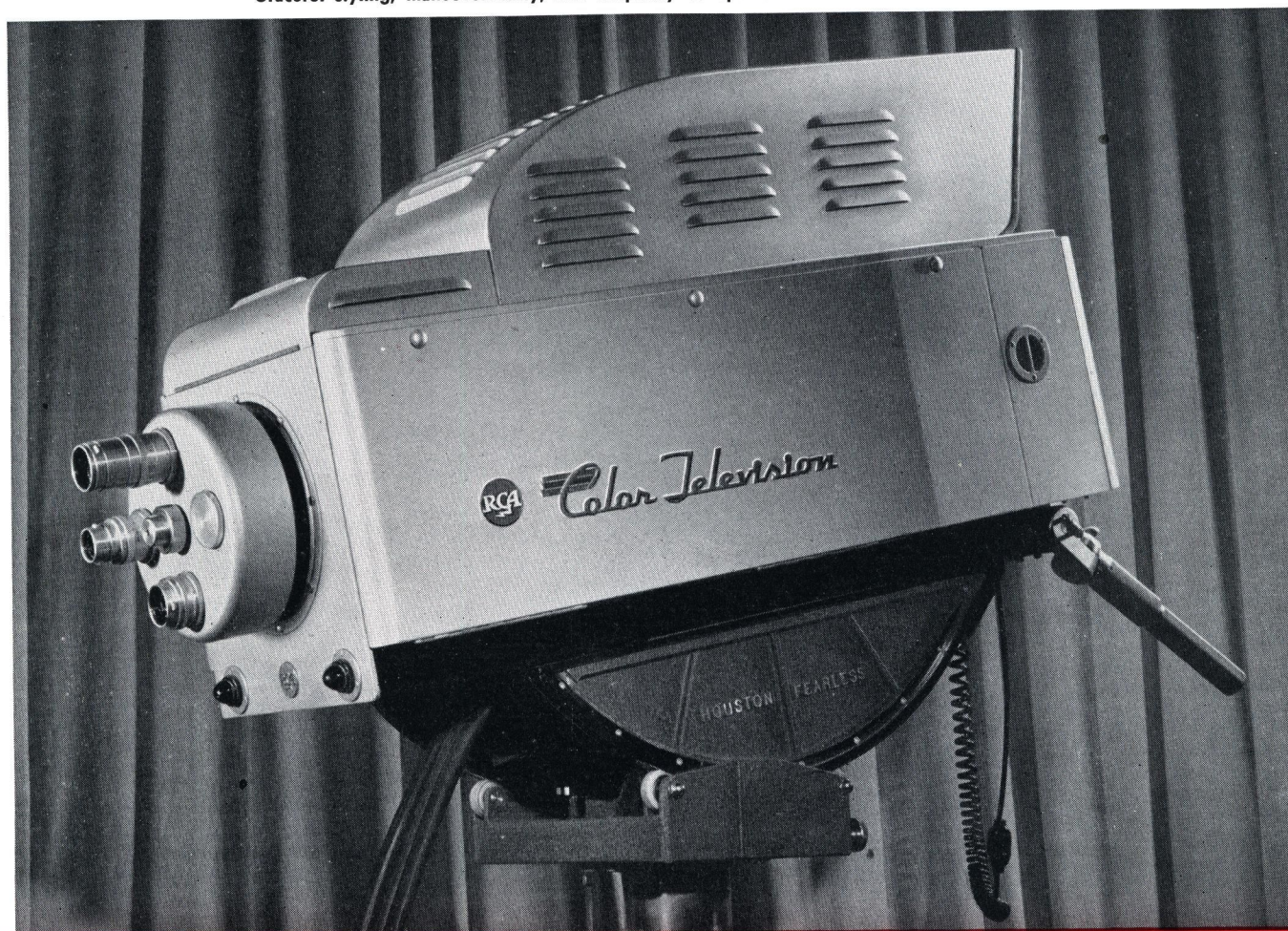
The color camera proper contains a light splitting optical system, three image orthicon tubes to provide red, blue and green signals, horizontal and vertical deflection circuits for the image orthicons, a target blanking circuit, high voltage circuit, image orthicon protection circuit, and three plug-in video preamplifiers, one for each of the three color channels. The electronic viewfinder is comprised of a 7TP4 kinescope with necessary deflection and video circuits to provide a picture for the camera operator.

The three video signals from the color camera are fed directly to the camera control panel on which both operating and selected set-up controls are located. These

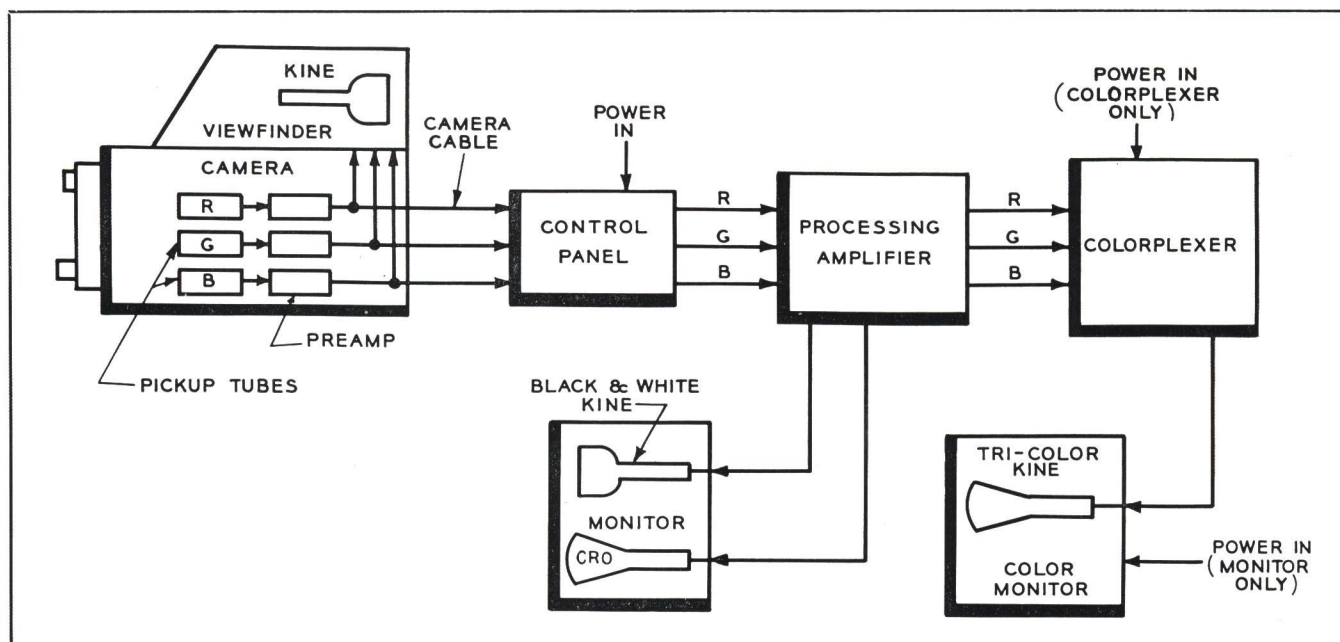
signals are in turn fed to the processing amplifier which performs the functions of cable compensation, video amplification, blanking and shading insertion, feedback clamping, linear clipping, gamma correction and output amplification as well as providing auxiliary switching for the master monitor kinescope and CRO.

The processing amplifier feeds a monochrome master monitor, which provides both kinescope and CRO displays of signals at various vital points in the system, selected by push-button. A colorplexer combines the processed video signals into a single FCC standard color signal. The colorplexer feeds a tri-color monitor and the camera switching system. This unit accepts the red, green and blue signals from the image orthicons and transforms them to M, I, and Q signals. These are adjusted with respect to bandwidth and delay and then multiplexed to produce one composite signal from the three input signals. An aperture compensator connects to the luminance channel of the colorplexer. A TM-10B Color Monitor is also included in the chain and can be rack mounted or placed in a cabinet at a convenient location.

Graceful styling, maneuverability, and simplicity of operation are featured in new TK-41.







Simplified diagram showing major components of the TK-41 Color Camera Chain. The lineup features considerable space and cost saving advantages over previous color chains.

### TK-41 Color Camera (MI-40500-A)

The RCA Color Camera comprises a mounting for the three image orthicon pick-up tubes with their focus, deflection and beam-alignment coils, complete horizontal and vertical deflection circuits, the video preamplifiers, blower ducts, light-splitting optical system, turret with four lens positions, and means for adjusting optical focus and iris openings.

The camera is entirely self-contained except for d-c power supplies and certain electrical controls which are located for operating convenience at the camera control panel. All electrical connections are made through three standard twenty-eight conductor camera cables attached by connectors in such manner as to permit the cables to be brought toward the front of the camera, drawn through a special cable clamping bracket, and then draped in a gradual curve to the floor out of way of the cameraman.

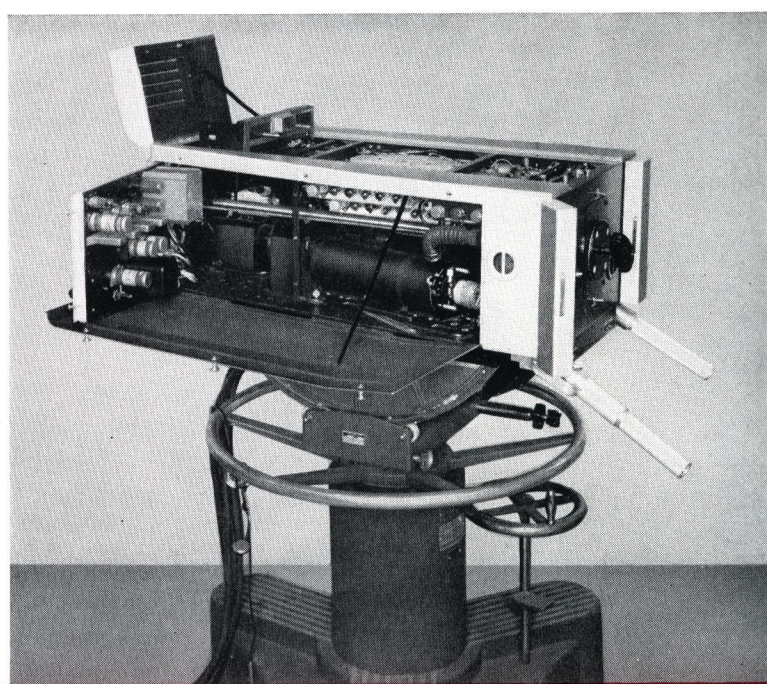
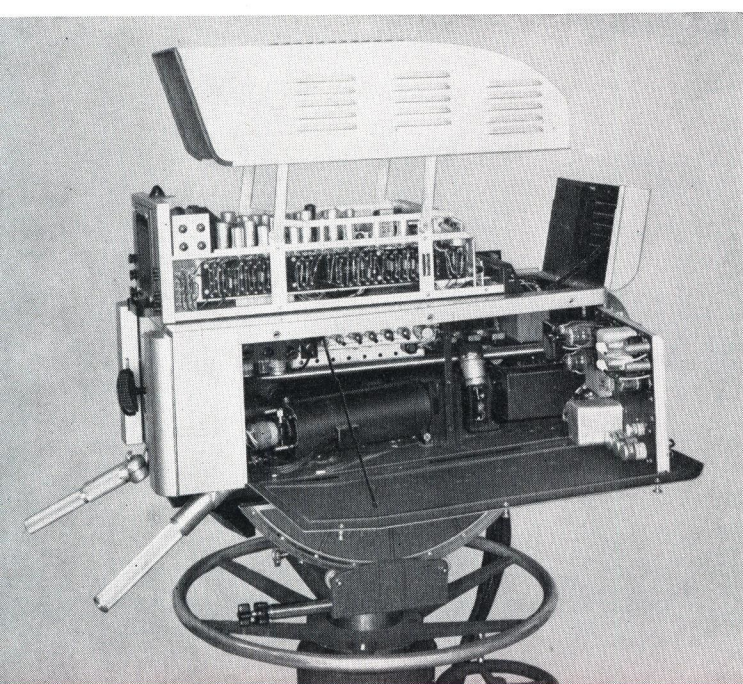
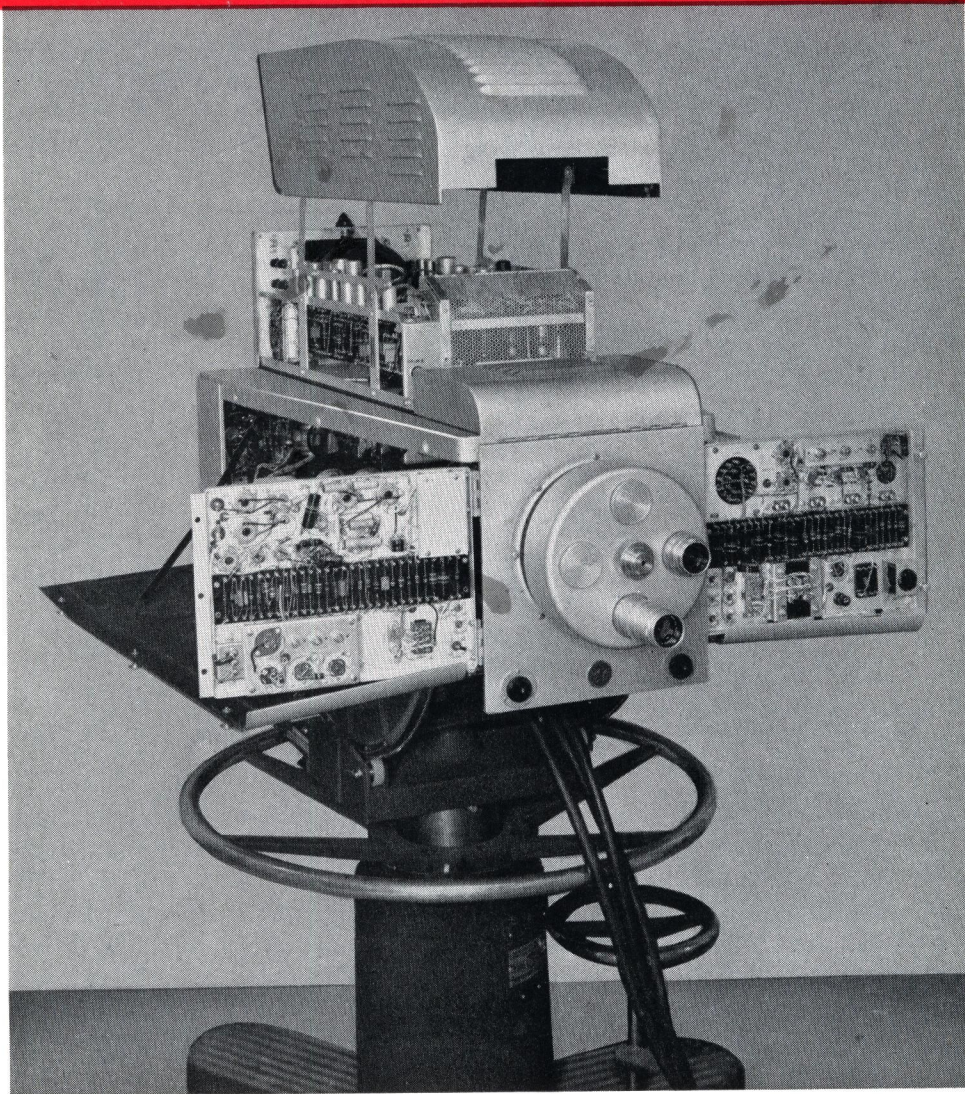
Physically the TK-41 Color Camera is 15 inches high, 44 inches long, and the width tapers from 16 inches at the front to a maximum of 21 inches at the rear edges of the side door covers. On the front end of the camera is the lens turret, and on the rear are some of the electrical controls and the control handle for rotating the turret. The optical focus handle is located on the right. This focus control and the turret handle are normally the only two controls which require the attention of the cameraman during a television program.

Two sets of communication and program sound jacks are mounted on a strip installed below the back operating

panel of the camera. They provide voice communications between the camera operator, dolly operator, the camera control operator, and the program director or other studio personnel. Electrical registration controls are also located on the rear plate of the camera behind hinged covers. They include the following independent controls: red and blue skew, with polarity reversing switch, height, width, and vertical and horizontal Q adjustment. An off-on switch operates the blower motors. An overscan switch is also provided. The G-5 controls are located just inside the left side cover near the rear of the camera. Dynode gain controls are similarly located on the right side.

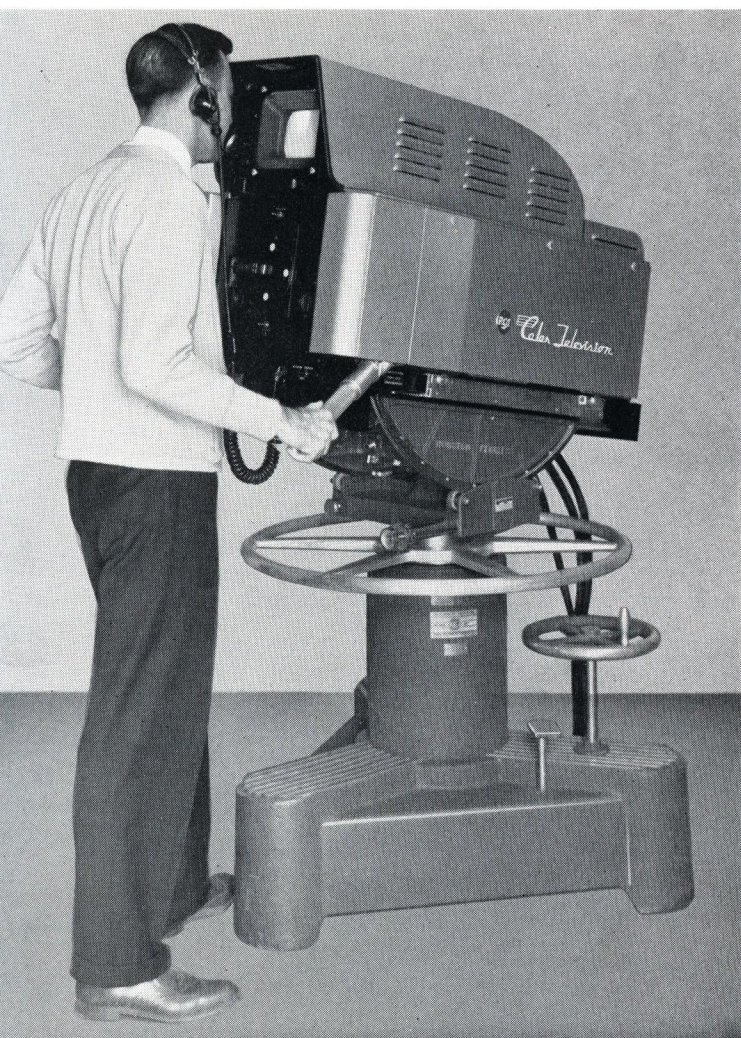
The side door panels of the camera housing swing outward making all components readily accessible for servicing. From the cameraman's position, the right side door exposes the hinged horizontal deflection chassis, which may be swung 180° from its normal position, permitting replacement of tubes, access to the remote iris synchro motor driving mechanism and other parts of the optical system. The yoke assembly of the red channel and the tube side of the red channel video preamplifier are also exposed. When the left side panel is dropped, the hinged vertical deflection chassis can also be swung outward 180°. It permits further access to elements of the optical plate assembly, and the blue and green channel yoke assemblies. The Type 6474/1854 image orthicon tubes can be replaced by removing a single holding screw of each yoke assembly and swinging the yoke assembly out the sides of the camera.





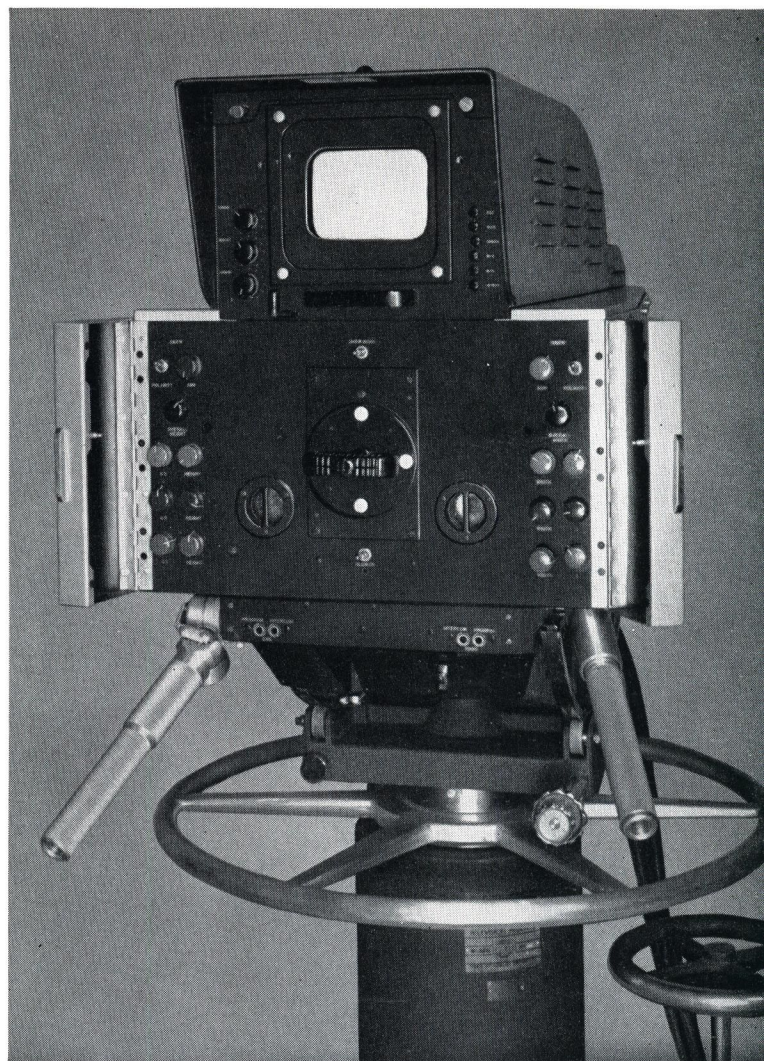


◀ **COMPLETE ACCESSIBILITY** to all circuits and controls makes maintenance and servicing of RCA color camera a pleasure for both operators and service technicians.



Raising the ventilation hood at the front of the camera gives access to the connections of two heater transformers in this area as well as the relay lens and vertical compensator elements of the optical system. The elapsed time indicator is visible when the hood is raised. Viewfinder component and circuit tests together with tube replacements may be made with the viewfinder cover in the raised position.

The viewfinder may be removed from the camera to provide access to wiring of the hinged shelf type chassis at



**EASE OF MANIPULATION** will delight the studio cameraman and practically assures smooth program performance. Set-up controls shown above are all conveniently located behind hinged doors. Only two handle controls are needed for on-air operation of camera.

the rear of the camera. This shelf is used for tie points for the image orthicon sockets, and for filtering components of the deflection circuits. Included here are the three video preamplifier input coupling and filter circuits. The image orthicon protection circuit with its associated tube and relay is also mounted here. Loss of either the vertical or horizontal deflection to the yokes of any of the image orthicons in the camera causes the circuit to bias off the image orthicons. This prevents the beam from being concentrated in a single line or spot which might cause permanent damage.



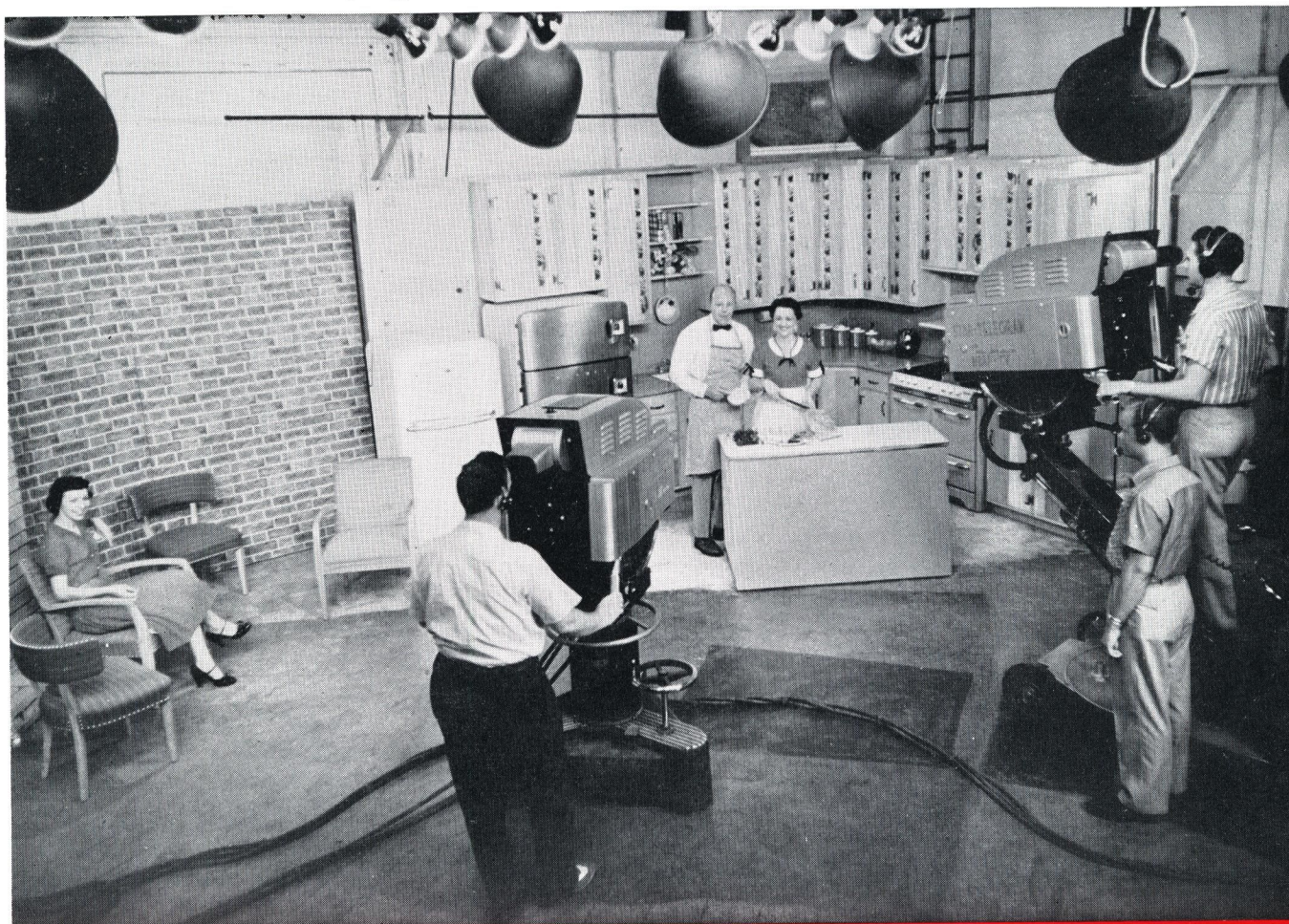
Removing the viewfinder also gives access to the plug-in preamplifiers located just ahead of the top shelf. These supply the red, blue and green signals to the camera cables and the camera viewfinder. Each of the preamplifiers includes six stages. The first four are simple shunt-peaked stages. The second stage has a screwdriver adjusted cathode peaking circuit for adjusting tilt in the low-frequency end of the response curve of the amplifiers. In the cathode of the third stage there is a similar circuit with a knob type control which may be adjusted to give minimum streaking for the associated image orthicon. The last two stages are a feed-back pair, providing cathode output to the 51-ohm camera cables and to the viewfinder. There is an adjustable trimmer in this stage which affects the response curve tilt at the high-frequency end. Each of the preamplifiers is shock mounted and bonded to the cross members of the upper camera framing.

Two tally lights are mounted on the front face of the camera. They serve to indicate to the actors when the

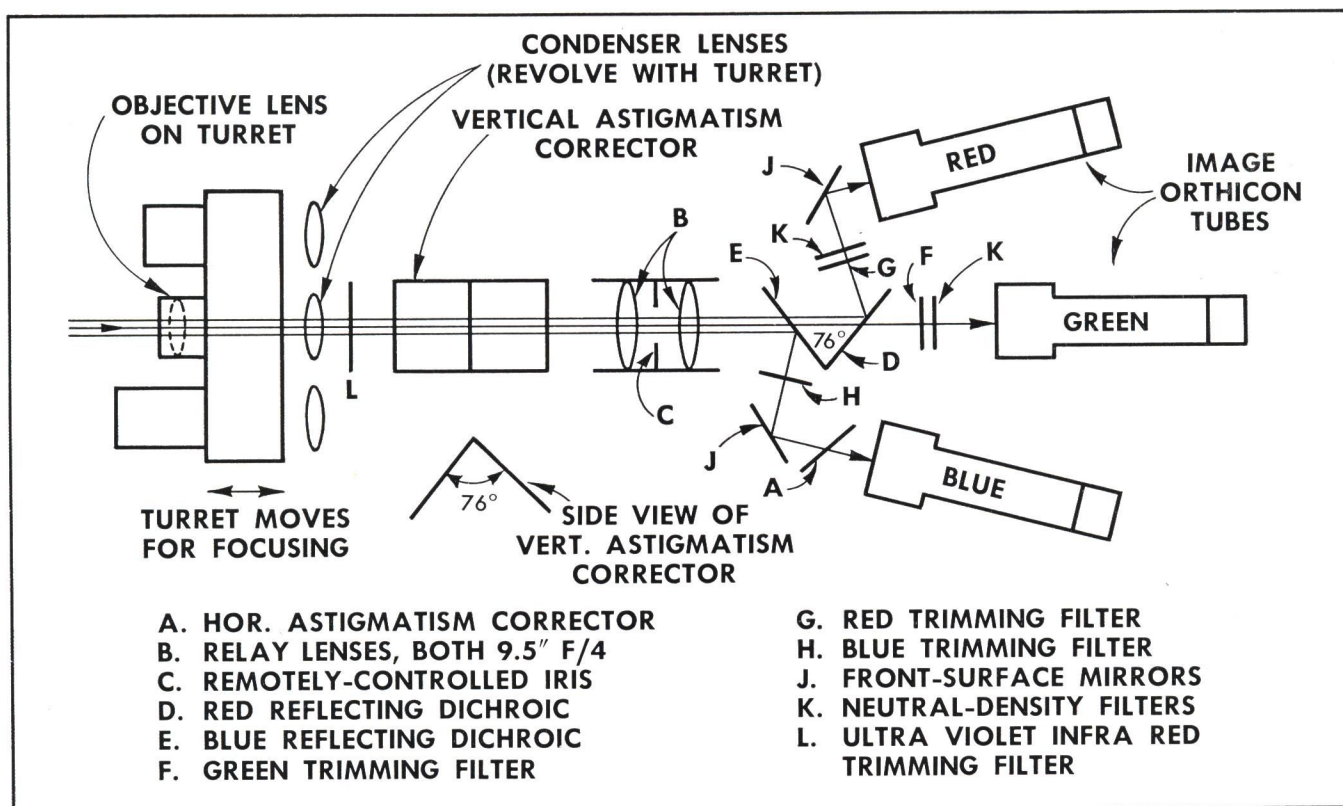
camera is in actual use. In addition, there is one on top of the viewfinder for directors and one on the kinescope bezel plate for the operator. The latter are operative, however, only when used in conjunction with a camera switching unit. The lights are normally off until a tally relay is actuated by a control voltage (24 volts d-c).

The individual image orthicon tubes and the area within the camera housing are forced-air cooled. Separate blowers are used to cool the individual image orthicon tubes. Cooling air is brought into the socket end of each yoke assembly by means of flexible hose leading from its associated blower. All external areas of the camera and viewfinder have an aluminum finish to further aid in maintaining optimum temperature conditions within the camera. Two utility outlets and a fuse are mounted on the under side at the back end of the camera. They provide facilities for an independent source of a-c that may be used for test equipment.

WBAP-TV studio scene showing a typical color telecast. Note that the color cameras are used with standard studio equipment.







## Optical System

The rotatable lens turret accommodates four objective lenses. A set of Ektar lenses having focal lengths of 50, 90, and 135 mm is supplied. Telephoto lenses may also be mounted on the turret. The optical axis of the taking lens is at the bottom section of the turret. The turret is attached to a shaft that protrudes through a stationary drum. The drum serves as a light trap as well as a support for the lens turret shaft. Each objective lens has a matching field lens mounted on a "spider" support housed within the drum. The objective lenses and the associated field lenses remain properly matched at each selected position of the lens turret. This lens selection is achieved by means of a handle type manual control on the back panel of the camera.

Optical focus is accomplished by moving the lens turret longitudinally along the optical axis. This is done by rotating the focus handle located at the right rear of the camera. Focusing the secondary image on each of the red, blue and green image orthicons is achieved by sliding the individual image orthicon yoke assemblies backward or forward along their respective optical axis during initial set-up.

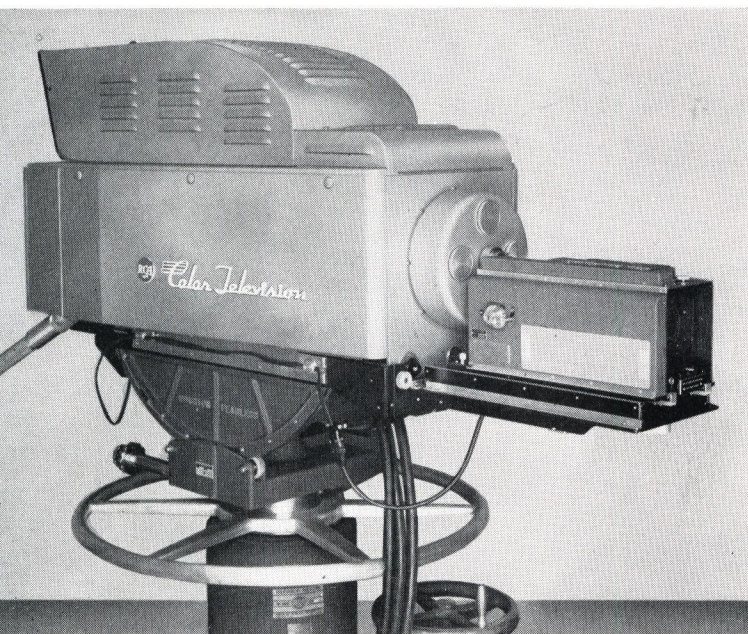
A complete relay optical system is mounted behind the field lenses. It consists of a vertical astigmatism corrector, relay lenses, remote control iris, dichroic mirrors, light filters, front surface reflective mirrors and horizontal astigmatism corrector.

The purpose of this system is to separate the light image into three primary color images and direct each to the photo-sensitive cathode of an individual image orthicon tube. The individual components in this system are mounted on a supporting base plate. The complete unit can be taken from the camera by removing four screws that secure the base plate to the camera frame and then disconnecting the cable attached to the iris control selsyn.

Color correcting filters are used in conjunction with the dichroic mirrors to adjust the overall spectral sensitivity curves as desired for the color camera. All filters are inserted in recessed grooves in frames that are secured to the dichroic block with spring clips. A filter in the common optical path eliminates spurious effects of undesirable infra-red and ultra violet wavelengths, and also aids in trimming the red channel. The three image orthicon tubes are mounted within focus and scanning coil assemblies. They are located at the rear of the optical assembly.

A cradle type tilt head, designed especially for use with the color camera, provides ease of maneuverability in both tilting and panning of the camera and viewfinder, comparable to that of the RCA monochrome camera. The TK-41 is provided with a TD-4A Heavy Duty Pedestal for studio and general purpose use. Alternate mountings for special camera work may be provided, especially the Panoram Camera Dolly (MI-40823) or the Type TD-30B Studio Crane (MI-26037-1).





Telephoto or zoom-type lenses can be accompanied on the TK-41 rotatable lens turret when desired.

### Camera Viewfinder (MI-40501)

The viewfinder is used by the operator of the color camera to frame the scene, to aid in focusing the camera, and to facilitate in setting up the camera registration. The viewfinder consists of a monochrome kinescope provided with deflection, blanking and video circuits required to provide a picture for the camera operator. A six push-button selector switch at the right of the viewing screen enables the operator to view any channel separately, to view the red or the blue superimposed on the green, or to view all three images superimposed. The focus, brightness, and contrast controls are mounted to the left of the viewing screen.

The single channel positions are used when making adjustments on individual channels; the red on green and blue on green are useful for registration adjustments. The switching is accomplished by altering the bias on the input amplifier tubes; each tube is kept at cutoff except when it is desired to view the particular signal connected to its input. Blanking pulses of adjustable duration are produced by two multivibrators (triggered by horizontal and vertical drive) and added to the video signal before application to the viewfinder kinescope.

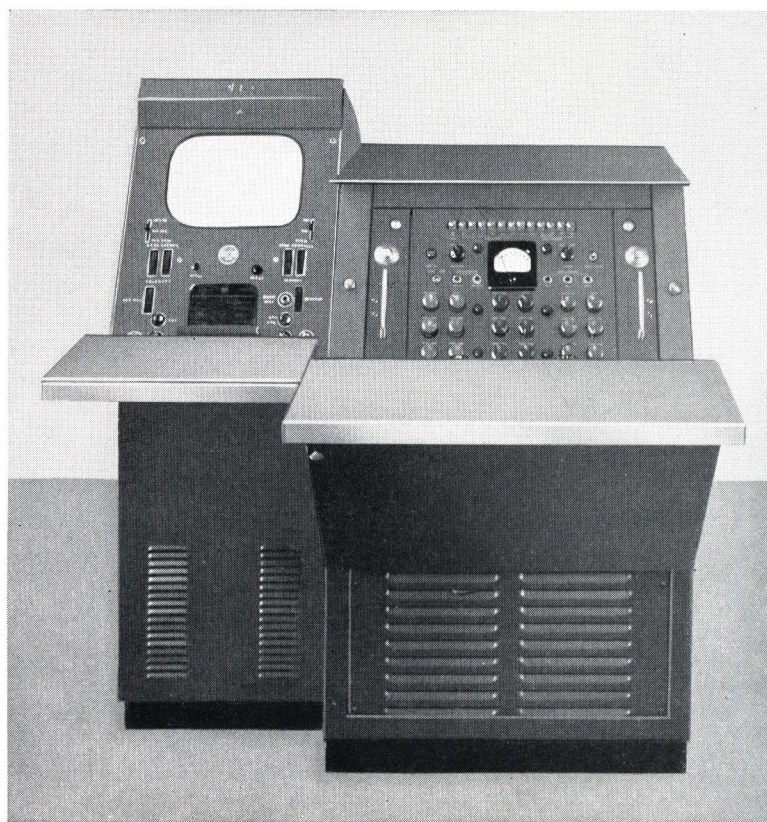
The viewfinder is designed to slide in guides and lock in position directly above the camera. All signal and operating voltages are fed to the unit through a self-aligning socket connection that automatically engages when the

unit slides into place. A pull handle to facilitate the installation and removal of the viewfinder is located on its operating panel just below the viewing screen. To the left of this handle there is a thumb latch to release the unit from a locked position. The viewfinder is covered by a multilouvered hood which can be raised to facilitate ease in servicing the unit. A detachable viewing hood (MI-40502) is attached to the viewfinder control panel for shielding the viewing screen from extraneous light.

### Control Console

The TK-41 camera control units may be conveniently mounted in the Control Console. This control position includes: (1) a TM-6C Master Monitor mounted in its Console Housing, and (2) a Master Console Housing in which the Camera Control Panel and the Processing Amplifier may be mounted. This Master Console Housing is designed to mount the 19" Camera Control Panel in the indented section of the console desk and the Processing Amplifier in the top sloping portion of the console. The camera control position also includes a TM-10B Color Monitor. This may be suspended either from the wall or ceiling or set upon a stand.

Processing Amplifier and Camera Control Panel are conveniently housed in console shown below.





If preferred, all of the TK-41 Control equipment may be rack mounted. In this case a Rack Mounted Control Desk and Accessory Kit, MI-40415, is available to provide desk space at the rack location. Here it is recommended that the TM-10B Color Monitor be mounted in an adjoining rack at approximately the level of the monochrome TM-6C Master Monitor.

### Camera Control Panel (MI-40523)

The camera control panel, on which the remote control adjustments of the color camera are mounted, is located in the sloping portion of the desk section of the 19" console which houses the processing amplifier. It lies below and in front of the processing amplifier front panel, and has a cover plate through which the two program operating controls protrude. These are the Pedestal and Iris Control knobs. The latter operates the remote iris selsyn motor in the optical system, and is conveniently operated by the right hand. Mounted directly above this control, in the processing amplifier panel, is the iris f stop indicator meter. In normal operation, the remote iris control performs the function of overall gain control for the complete color camera chain. The left hand operates a master pedestal control which provides simultaneous adjustment of the pedestal voltage in the three channels. Set-up controls for each of the three image orthicons may be reached by lifting the cover plate.

Colored knobs identify the three video channels. The individual channel controls include horizontal and vertical centering, alignment, orthicon focus, multiplier focus, image focus, image accelerator voltage, target voltage, multiplier gain, and beam current. Also provided is a target test knob to aid in setting target voltage accurately and rapidly, as well as a selector switch which permits the metering of: target, orth focus, image focus and multiplier focus voltage settings in each color channel.

### Processing Amplifier

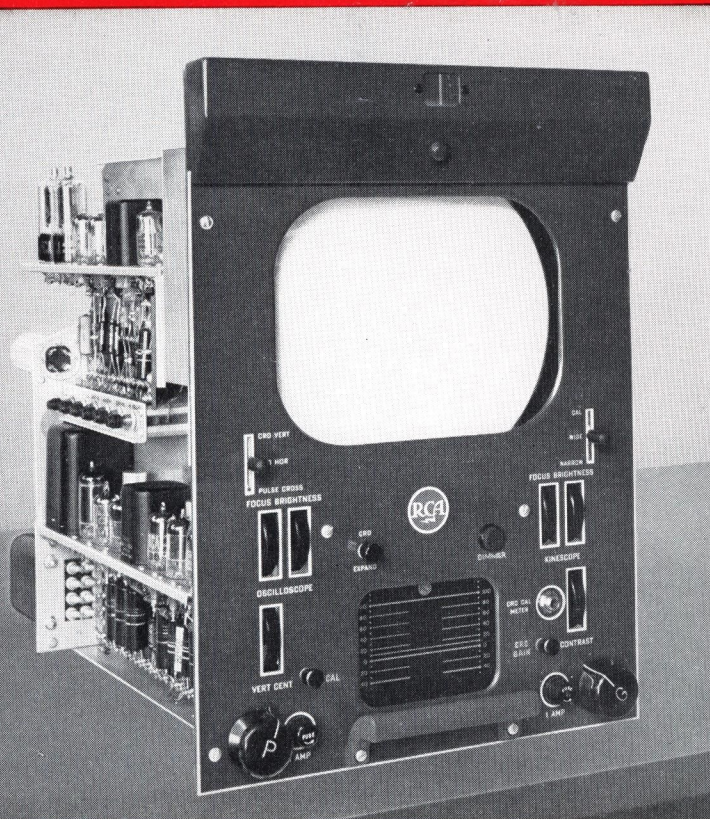
The processing amplifier, MI-40520, has been designed to perform a great number of functions in a single versatile unit. Integration of these electrical functions in a single unit results in a simple, space-conserving system. Use of this design allows set-up time to be substantially reduced and requires fewer video operators and control room engineers for programming. Hence considerable savings in operating costs can be realized. A large reduction in power required as well as increased tube life due to extremely conservative operation of tubes further reduce costs, at the same time improving performance and overall quality.



Optional rack mounting for the TK-41 control equipment may be specified. A convenient desk with top panel removed to reveal set-up controls is shown above.

The basic circuit elements in the processing amplifier are three plug-in video amplifiers which perform accurately and with extreme stability the following functions: cable compensation, video amplification, blanking insertion, shading insertion, feedback clamping, linear clipping, gamma correction, and output amplification. Pulse circuitry needed for the camera and shading generators, is obtained from stabilized multi-vibrators. These multi-vibrators provide pulses of constant amplitude and width independent of the incoming pulse. These circuits require no tube selection and are completely stable. Shading signals are provided for insertion of either horizontal or vertical shading. A fourth plug-in unit serves as the video section of an electronic switcher which is an integral part of the main chassis. The switcher, used with Master Monitor, TM-6C, provides an individual or combined presentation of red, blue and green video.





TM-6C Color Master Monitor provides both picture and waveform information.

The entire chassis of the processing amplifier is drawer-slide mounted for easy pull-out for servicing. The front panel is hinged, thus permitting it to be opened to facilitate removal of tubes and servicing of other components behind the panel.

An edge-lighted translucent plastic escutcheon is mounted on the outside surface of the panel to provide illumination of the nomenclature for the various controls when the unit is operated in semi-darkness. All controls are conveniently mounted on the panel. Thirteen lucite pushbuttons at the

top of the panel control the switching arrangement which permits separate Master Monitor Kinescope or CRO observation of important test points, including individual channels, various channels superimposed, and colorplexer output. A staircase signal for the CRO circuit is provided for a sequential display of red, blue, and green channels.

### Type TM-6C Master Monitor

The Type TM-6C Master Monitor provides in a compact form a complete monitoring unit for the observation of the camera chain's video signals. It is used to show both picture (kinescope) and waveform (oscilloscope) monitoring of signals at any stage of transmission from the camera to the output of the colorplexer. Careful scrutinization of a number of details of the video signal may be performed which will aid in maintaining proper level and color balance, as well as obtaining registration during set-up.

The unit employs a special ten-inch aluminized, straight gun, electro-statically focused kinescope for direct picture monitoring and a five-inch, flat faced, cathode ray tube for waveform presentation. When used with the processing amplifier of the color camera, the wide band CRO display consists of three adjacent waveforms corresponding to the red, blue, and green video signals.

The primary operating controls are located on the front panel. Other frequently used controls are mounted under a cover at the top of the panel. Controls used only for initial set-up are mounted on the left side of the chassis. All monitor components are readily accessible for servicing.

### Rack Mounted Equipment

All the units normally housed in the consoles—Master Monitor, Control Panel and Processing Amplifier may be rack mounted. To complete the camera chain, a Colorplexer, aperture compensator, focus current regulator and centering current supply, and a set of power supplies (three WP-33B's and two 580-D's) also mount in standard 84" cabinet racks.

### Television Color Camera Chain Power, Space, Tube and Weight Information

Equipment	MI	Tubes	D-C ma	A-C Watts	Total Heat	Rack Space	Weight
Color Camera—Defl. ....	40500-A	37	225+(210at 360 v.)	132	277	—	250
—Preamp. ....			330				
Viewfinder .....	40501	20	125 + (65at 360 v.)	58	117	—	45
Processing Amplifier .....	40520	55	360	180	200	10 1/2"	50 1/2
Focus Current Regulator.....	40524	4	12	85	90	5 1/4"	22
Centering Current Regulator.....	40839	—	—	40	40	5 1/4"	22
Colorplexer .....	40209-A	36	300	95	180	21"	34
Automatic Carrier Balance .....	40416	5	20	—	—	3 1/2"	10
Aperture Compensator .....	40414	2	33	10	15	1 3/4"	3
TM-6C Master Monitor.....	26136-B	31	450	90	220	18"	55
580-D Power Supply (2 Units)....	21523-C	22	—	370	—	21"	116
WP-33B Power Supply (3 Units)	26085-B	33	—	400	—	42"	246
TM-10B Color Monitor.....	40206-A	31	—	500	500	26 1/4"	138 rack unit 180 in cabinet



## SPECIFICATIONS

## Camera Electrical Specifications

Input:	
Horizontal Drive from Processing Amp-51 Ohm.....	Min. 2 volts, (neg.) peak-to-peak
Vertical Drive from Processing Amp-51 Ohm.....	Min. 2 volts, (neg.) peak-to-peak
D-C Power (from power supplies):	
Regulated	
Camera.....	280 volts, 245 ma
Preamplifiers.....	280 volts, (3x110) ma
Unregulated	
Camera and Deflection.....	360 volts, 210 ma
Focus Coil Current.....	75 ma
Tally Lights.....	24 volts d-c
A-C Power:	
Heaters, Blowers.....	117 v., 50/60 cycle, 1 phase, 132 watts
Output:	
Video Response.....	Essentially flat to 8 mc
Video Signals (black negative) 51 Ohm.....	0.3 volt, peak-to-peak
Video Signals to Viewfinder.....	0.6 volt, peak-to-peak

## Viewfinder Electrical Specifications

Input:	
Video Signals (negative).....	0.6 volt, peak-to-peak
Horizontal Drive (negative—Hi-impedance).....	2 volts, peak-to-peak
Vertical Drive (negative—Hi-impedance).....	2 volts, peak-to-peak
D-C Power (from power supply):	
Regulated.....	280 volts, 125 ma
Unregulated.....	360 volts, 65 ma
Tally Lights.....	24 volts, d-c
A-C Power.....	50/60 cycles, single phase, 117 volts, 58 watts

## Processing Amplifier Electrical Specifications

Input:	
Video (red, blue, green and test).....	0.3 volt peak-to-peak
Impedance (red, blue, green and test).....	75 ohm $\pm 5\%$
Horizontal Drive (high impedance).....	2 to 5 volts peak-to-peak
Vertical Drive (high impedance).....	2 to 5 volts peak-to-peak
Blanking Pulse (high impedance).....	2 to 5 volts peak-to-peak
Calibration Pulse (high impedance).....	15 kc sq. wave 1 volt peak-to-peak
Output:	
Video to Colorplexer (red, blue and green).....	1 volt peak-to-peak
Impedance.....	75 ohms
Video to Monitor CRO.....	1 volt peak-to-peak
Impedance..... (Sending end 75 ohms, receiving end unterminated)	
Video to Monitor Kinescope.....	1 volt peak-to-peak
Impedance.....	75 ohms
Horizontal Drive:	
Width.....	8.0 microseconds $\pm 20\%$
Amplitude.....	3.5 volts peak-to-peak
Impedance.....	75 ohms
Vertical Drive:	
Width.....	800 microseconds $\pm 20\%$
Amplitude.....	3.5 volts peak-to-peak
Impedance.....	75 ohms
Blanking Pulse:	
Width.....	Equal to input pulse width $\pm 1\%$
Amplitude.....	2 volts peak-to-peak
Impedance.....	75 ohms
Calibration Pulse:	
Width.....	Equal to input pulse width
Amplitude.....	1 volt peak-to-peak $\pm 1\%$
Impedance.....	Low
Twenty Cycle Staircase Voltage to Master Monitor:	
Amplitude (maximum).....	20 volts peak-to-peak
Impedance.....	High
Regulated D-C Supply Voltage.....	280 volts
D-C Current.....	360 ma
Filament Voltage.....	6.3 volts a-c
Filament Current.....	25.0 amps
Regulated D-C Voltage.....	130 volts
Dimensions.....	10 15/32" high x 17 5/8" wide x 20 3/4" long
Weight.....	50 1/2 lbs.

## Tube Complement

CAMERA:	
3—RCA 6474/1854	4—6U8
Image Orthicon	5—12AT7
1—6AL5	2—12AU7
3—6CD6-G	12—6AH6
2—6V6-GT	3—5687
2—1B3-GT	
VIEWFINDER:	
2—6AB4	1—6CB6
1—6AG7	1—6BQ6-GT
1—6AH6	2—1X2A
1—6AL5	3—12AT7
1—6AQ5	5—12AY7
1—6AS7-G	1—7TP4
PROCESSING AMPLIFIER:	
9—12AT7	3—6U8
3—12AU7	1—6CL6
1—12BH7	1—6BX7
1—12AX7	4—6BQ7A
VIDEO AMPLIFIERS:	
12—6BQ7A	8—6CL6
8—12AX7	4—6AL5
FOCUS CURRENT REGULATOR:	
1—5R4GY	1—12AX7
2—6BX7	
COLORPLEXER:	
11—6AU6	5—6AS6 (Stock #204603)
2—6AH6	1—0A2
2—12AU7	6—6AL5
4—6U8	1—0B2
2—6BQ7	2—5687
APERTURE COMPENSATOR:	
1—6BQ7A	1—6AU8
COLOR UTILITY MONITOR:	
1—156GP22 kinescope	6—6AN8
3—6AH6	1—6AL5
1—6BQ7A	1—1X2B
2—6U8	1—6CD6-G
2—6AS6	1—6SN7-GT
1—12BH7	1—12AU7
1—6BC7	1—6BD4
5—6CL6	1—3A3
1—6A44	1—12AT7
MASTER MONITOR:	
1—12BH7	1—10SP4 kinescope
3—6AH6	(not supplied)
7—12AT7	1—6BQ7A
1—6AL5	4—1X2A
2—6BQ6-GT	1—6L6
1—12AU7	2—6BC6
2—12AX7	4—6CL6
1—5ABP1 CRO	
(not supplied)	
REGULATED POWER SUPPLIES:	
12—5R4GY	6—OD3
9—6AS7-G	3—GE NE32
3—6SL7-GT	
580-D POWER SUPPLIES:	
4—5R4GY	4—OD3
10—6Y6-G	2—GE NE32
2—6SL7-GT	

## Mechanical Specifications—Overall

	Camera	Viewfinder	Camera Control Panel
Length.....	44"	34 1/8"	18"
Width.....	21"	13 5/16"	13 1/8"
Height.....	14 1/2"	11 1/8"	8"
Weight.....	250 lbs.*	45 lbs.	10 lbs.

\* Camera weight less objective lens, panning and focus handles.



## SPECIFICATIONS (Continued)

## Equipment Supplied

CONSOLE-MOUNTED CONTROL			RACK-MOUNTED CONTROL		
Qty.	MI Number	Description	Qty.	MI Number	
1	40500-A	Color Camera (less Image Orthicons).....	1	40500-A	
1	40501	Viewfinder (including Kinescope).....	1	40501	
1	40502	Hood .....	1	40502	
1	40520	Processing Amplifier (less Gamma Correctors).....	1	40520	
3	40833-1	Gamma Corrector (0.7).....	3	40833-1	
1	40833-2	Gamma Corrector (1.0).....	1	40833-2	
1	40523	Camera Control Panel.....	1	40523	
1	40524	Focus Current Regulator.....	1	40524	
1	40839	Centering Current Supply.....	1	40839	
1	40829	Neutral Density Filters, Set of.....	1	40829	
1	26550-1	Lens, 50mm Objective.....	1	26550-1	
1	26550-2	Lens, 90mm Objective.....	1	26550-2	
1	26550-3	Lens, 135mm Objective.....	1	26550-3	
1	40802-1	Field Lens (for 50mm Objective Lens).....	1	40802-1	
2	40802-2	Field Lens (for 90mm and 135mm Objective Lens).....	2	40802-2	
1	40209-A	TX-1B Colorplexer .....	1	40209-A	
1	40414	Aperture Compensator (for TX-1B) .....	1	40414	
1	26136-B	TM-6C Master Monitor.....	1	26136-B	
1	26544	Sync Interlock Relay (for TM-6C).....	1	26544	
1	40206-A	TM-10B Color Monitor.....	1	40206-A	
1	40213	Line Voltage Regulator (for TM-10B).....	1	40213	
1	40406	Cabinet (for TM-10B).....	—	—	
1	26266-B	Console Housing, 13-inch (for TM-6C).....	—	—	
1	26276	Console Housing, 19-inch (for MI-40520 and 40523).....	—	—	
1	26579-B	Blower (for TM-6C).....	—	—	
—	—	Rack Mounting Desk for Control Panel.....	1	40415	
—	—	Rack Mount Adaptor for TM-6C.....	1	26526	
—	—	Rack Mount Adaptor for TM-10B.....	1	40407	
—	—	Rack Extension Kit.....	2	40408	
1	26655	Kinescope Tube, Type 10SP4 (for TM-6C).....	1	26655	
1	26667	CRO Tube, Type 5ABP1 (for TM-6C).....	1	26667	
3	40825	Image Orthicon Tube, Type 6474/1854.....	3	40825	
2	21523-C	580-D Power Supply.....	2	21523-C	
3	26085-B	WP-33B Power Supply.....	3	26085-B	
3	26725-A5	Camera Cable, 50-ft. (with Connectors).....	3	26725-A5	
1	40834	Cable Harness and Barrier Strips.....	1	40834	
1	26759-41	Power Cable .....	1	26759-41	
1	26759-42	Power Cable .....	1	26759-6	
1	26646	Adjustable Transformer .....	1	26646	
1	26647	Transformer Mounting Plate (for MI-26646).....	1	26647	
2	30951-D84	Type BR-84D Cabinet Rack each consisting of:	3	30951-D84	
		1 30951-F84 Rack.....			
		1 30535-G84 Door.....			
		1 30521-G1 Top Cover.....			
1	40824	Cradle Head .....	1	40824	
1	40826	TD-4A Heavy Duty Pedestal.....	1	40826	
(Complete with operating tubes including those listed)					
NOTE: The following bulk cable is required and should be ordered separately					
to meet individual installation requirements:					
83	RG-11/U 75 Ohm Coaxial Cable.....		83		
75	RG-59/U 75 Ohm Coaxial Cable.....		75		
80	12-Conductor Shielded Cable.....		80		
82	8-Conductor Shielded Cable.....		82		

## Accessory Equipment

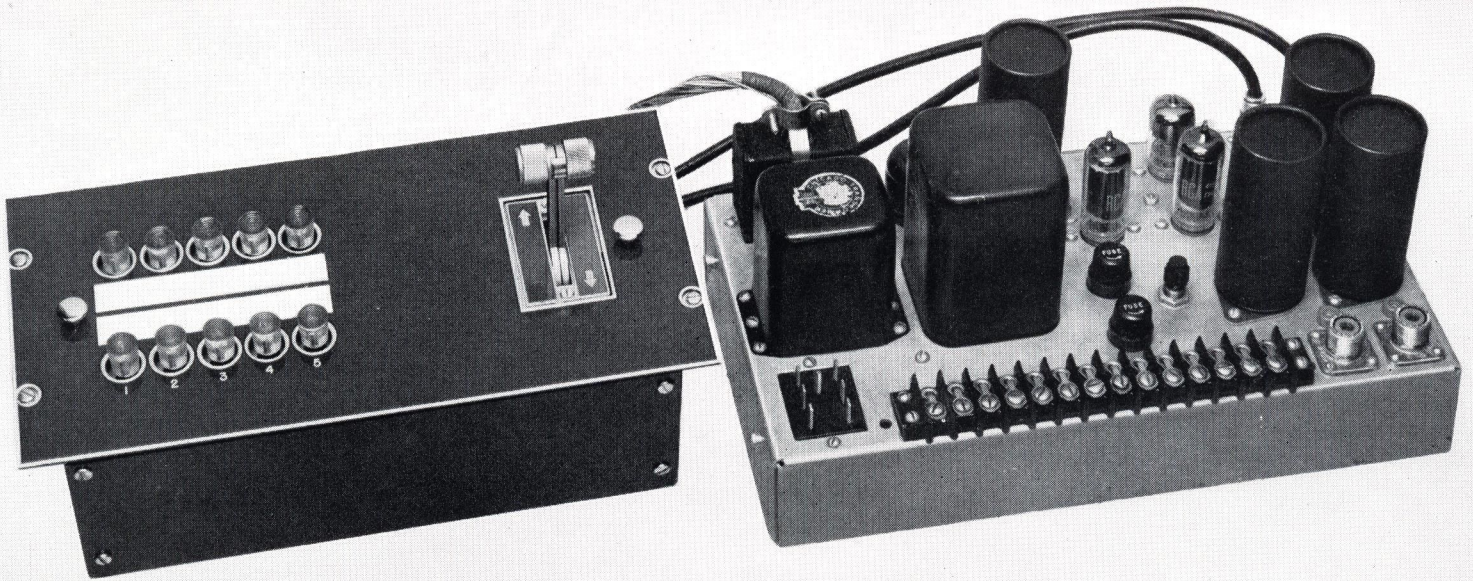
Left End Section for 19" Console Housing.....	MI-26283-1	*WA-9A Calibration Pulse Generator.....	MI-26070
Right End Section for 19" Console Housing.....	MI-26283-2	*WA-1D Color Bar Generator.....	MI-34001
Left End Section for 13" Console Housing.....	MI-26265-1	WA-7B Linearity Checker.....	MI-34017-A
Right End Section for 13" Console Housing.....	MI-26265-2	WA-21B Video Sweep Generator.....	MI-30021-B
Single Headset .....	MI-11743	TO-524D Oscilloscope .....	MI-26500
Double Headset .....	MI-11744	WA-3B Grating Generator.....	MI-30003-B
Interphone Connection Unit.....	MI-11734	Automatic Carrier Balance Control.....	MI-40416
Interphone Retardation Coil.....	MI-11737		
Mounting Plate for Interphone Connection Unit.....	MI-11735		
Mounting Panel for Retardation Coil.....	MI-11736		

\* If not already available, one each of the above starred equipments is necessary for operation of the TK-41 Color Studio Camera Chain.

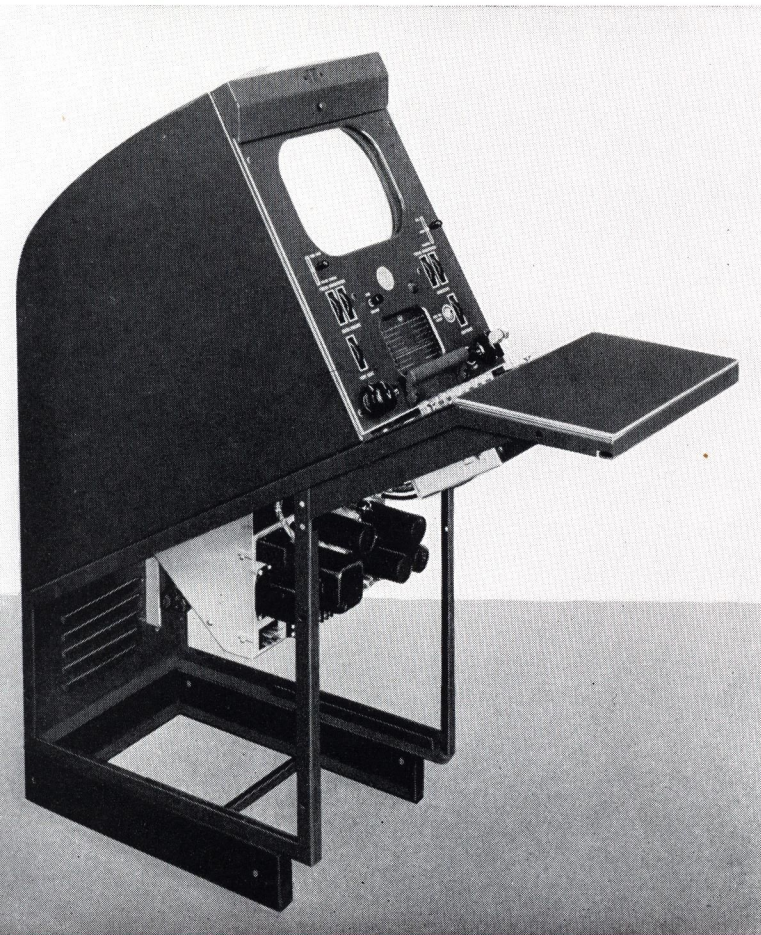


# VIDEO SWITCHER

**TYPE TS-5A**



The TS-5A Switcher is shown below with its control panel and amplifier unit mounted with a TM-6B Master Monitor in a standard console housing.



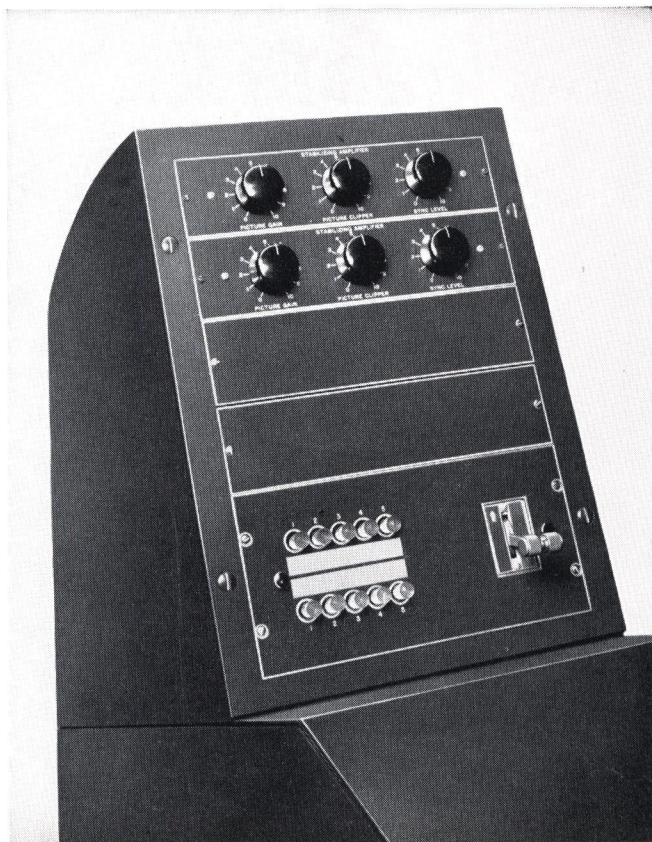
## FEATURES

- Ideal for use in minimum color operations . . . expansion to local color origination
- System will accommodate maximum five signal inputs, two outputs
- Provisions for fades, lap dissolves, superimpositions
- Choice of mounting locations
- Provides economical expansion facilities when used with other switching systems

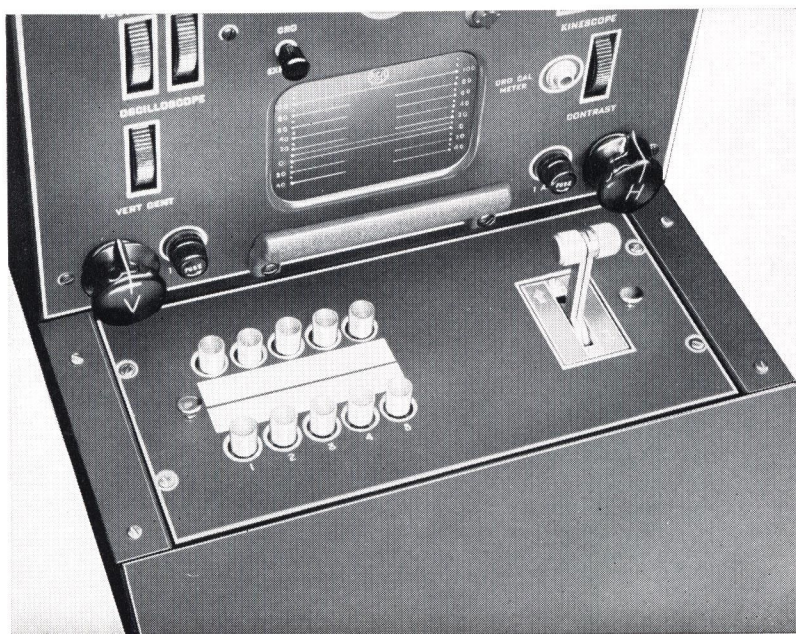
## USES

The TS-5A Video Switcher is designed for use by television stations either as an independent switching system or in conjunction with existing systems such as the TC-4A, TS-10A, or similar switchers. In either of these applications, the equipment substantially increases station programming flexibility. Briefly, the TS-5A will allow a single





The TS-5A control panel may be mounted in a standard remote control basic frame in the upper face of a console (see above) or in the sloping desk area of the control console (see below).



## USES (Cont'd)

video operator to do these things: (1) select any signal from five input lines; (2) switch the desired signal into the on-the-air line; (3) fade or dissolve two signals simultaneously at any speed; (4) fade-in or fade-out any one signal; (5) switch instantaneously from one signal to another; (6) superimpose two signals with any desired degree of magnitude for each signal. The switcher is equally adaptable to color.

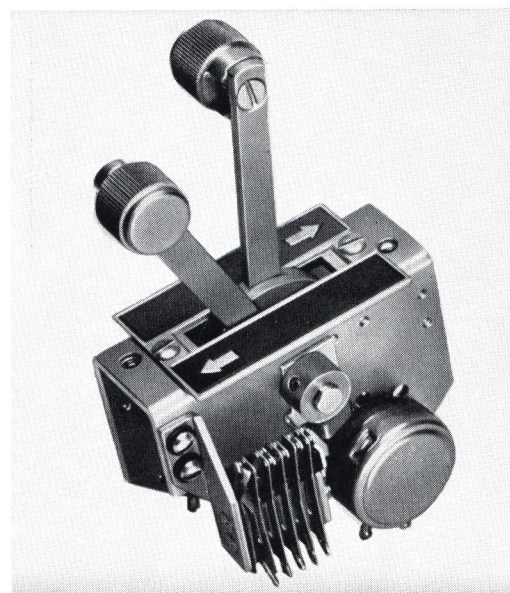
## DESCRIPTION

The TS-5A Video Switcher is a flexible two-unit equipment designed to fit in a single standard console housing. The pushbutton and fader panel may be located either in the sloping desk area or in a standard remote control basic frame placed in the upper face of the console. The amplifier chassis remains in the lower portion of the console and is within reach of the interconnecting cables supplied, for either location of the control panel.

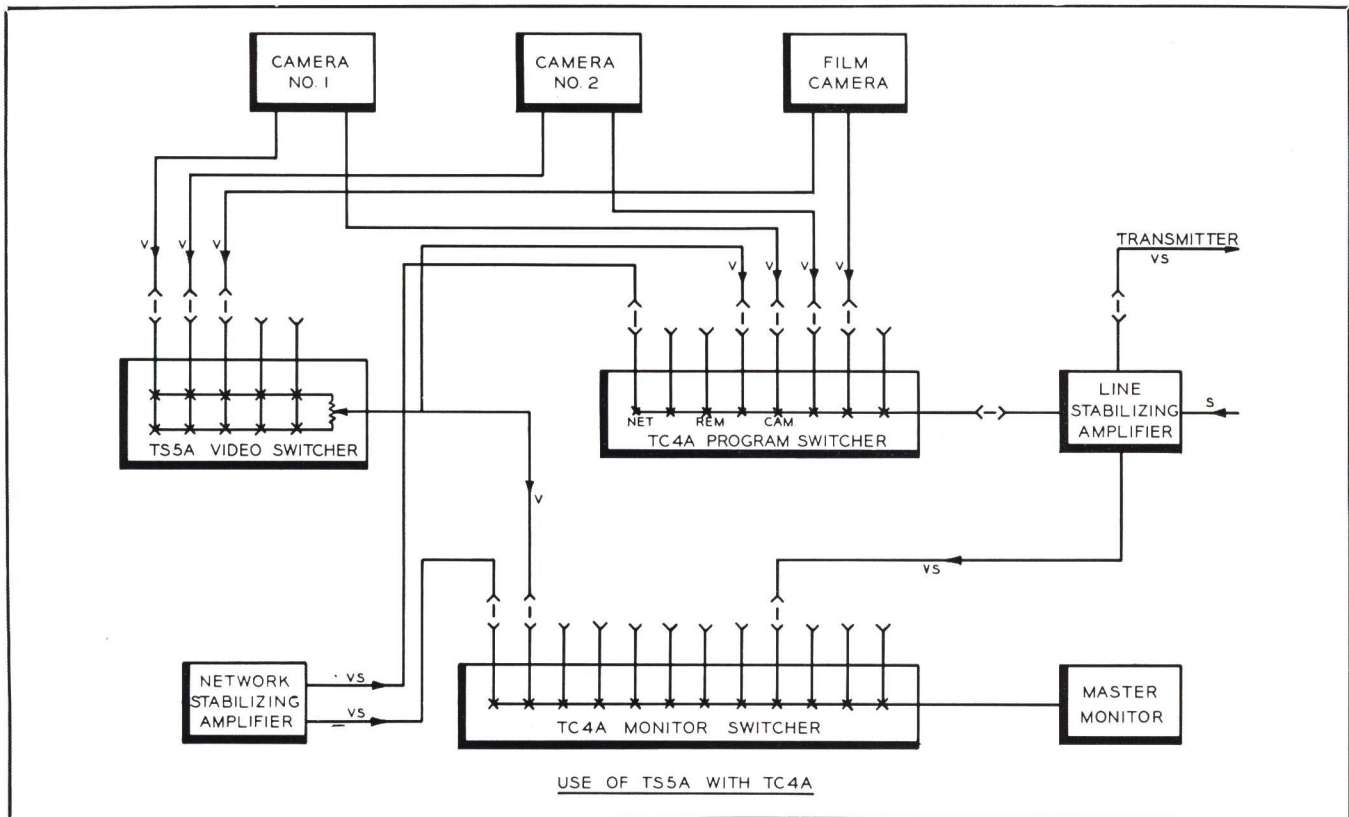
The TS-5A, when used at studio control points for camera switching, permits such additional programming features as fades, lap dissolves, and superimpositions. Means are provided for pushbutton selection of input channels whose signals are fed in turn through a manual fader control, a mixing circuit and then to twin output line amplifiers.

Primarily intended for a small studio installation, the TS-5A may also be used to advantage in conjunction with other switching systems to expand facilities with a minimum

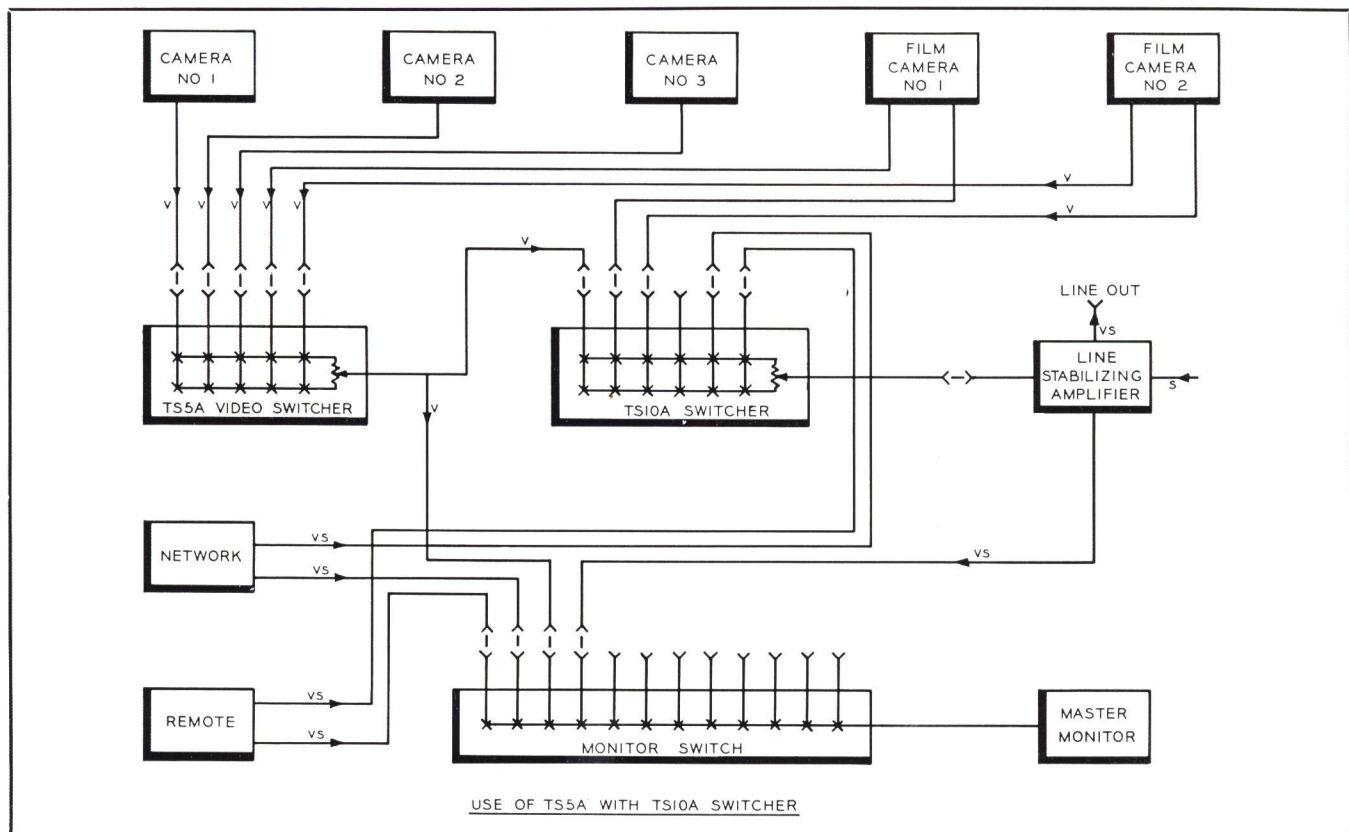
Close-up view of the fader mechanism located in the control panel of the TS-5A.







The TS-5A is primarily intended for use in a small studio installation. However, it may be used to advantage to expand facilities of a TC-4A basic-buy console (see block diagram above) or a TS-10A Switching System (see block diagram below).





## DESCRIPTION (Cont'd)

of expense. For example, it may be used in conjunction with the TC-4A Audio/Video Control Console to provide for fading and mixing when the station expands to include additional cameras. Also, by proper arrangement of inputs to both switching units, it is possible to use the TS-5A for one program and then to carry the next program through the TC-4A and free the TS-5A for a rehearsal.

Similar applications may be carried out with the TS-10A and other switchers. As an accessory, a relay MI-26275 will be available for the purpose of disconnecting the tally light circuits related to the TS-5A when it is not in use. All controls are mounted on the fader control panel. Two rows of five buttons each, rear-illuminated, are mechanically interlocked. Illumination to rows is controlled by fader lever position to give "on-air" indication. The fader mechanism incorporates new design features including split-lever, optional lock, manual control for video gain potentiometers, and twin-contact relay type limit switches. The equipment operates from 117 volts, 50/60 cycles, 30 watts a-c source. D-c power may be derived from a type 580-D regulated power supply. When the equipment is used in conjunction with another switching system, the existing power supply may be used.

## SPECIFICATIONS

Input Circuits:	
Impedance.....	75 ohms, internally terminated
Number.....	5, one normally used for "Black"
Level .....	1.4 volts "peak-to-peak"
Output Circuits:	
Load Impedance .....	75 ohms
Number.....	2 (designed to feed single terminated lines, may be connected in parallel to feed one double-terminated line)
Voltage.....	1.4 volts "peak-to-peak" composite video
Gain.....	Adjustable for gain of one from any input to either output
Isolation Between Outputs.....	55 db at 1000 cycles; 55 db at 4 mc
Frequency Response.....	+0.3 db from 4 cycles to 8 mc +1 db from 2 cycles to 10 mc
Hum and Noise Level.....	-50 db referred to 1 volt
Power Required:	
A-c.....	117 volts, 50/60 cycles, 30 watts
D-c.....	280 volts, regulated, 125 ma

## Tube Complement

1 RCA 6U8      1 6201      2 RCA 6CL6

### Dimensions:

Amplifier Chassis.....11 $\frac{5}{8}$ " long, 6 $\frac{7}{8}$ " wide, 6 $\frac{3}{8}$ " high  
Fader Panel.....11 $\frac{1}{8}$ " long, 5 $\frac{3}{8}$ " wide, 3 $\frac{1}{2}$ " deep

Net Weight .....18 lbs.

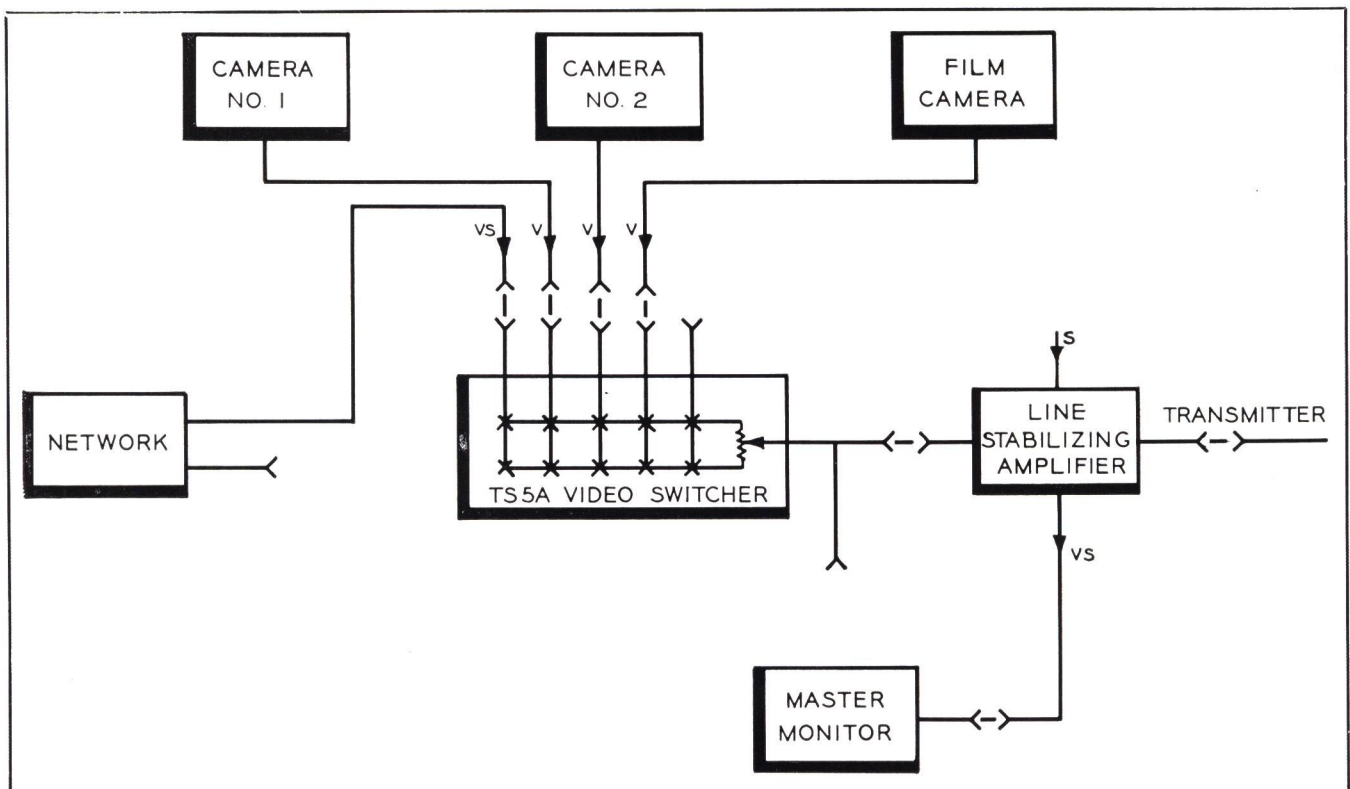
### Stock Identification:

TS-5A Video Switcher, including Amplifier and Fader  
Control Panel Assembly, with tubes in place.....MI-26229

## Available Accessory

Relay (6 volts).....MI-26275  
Relay (24 volts).....MI-26284

This block diagram describes the facilities of the TS-5A when used as an independent switcher.





# VIDEO SWITCHER

TYPE TS-11A



## FEATURES

- Both colorplexed and monochrome signals can be handled simultaneously
- Full preview facilities
- Program transfer switch for previewing fades and lap dissolves
- Sync addition in all output amplifiers
- Sending-end termination for color use
- Switch for "Off-the-air" monitoring
- Extended low frequency roll-off provides bounce-free operation
- Switches composite or non-composite signals
- Contacts for audio-tie facilities built-in on preview channel

## USES

The TS-11A is a nine input switcher for use in either studio or master control applications. Five of these inputs are for non-composite signals such as from studio and film cameras. Three of the inputs are for non-composite or composite signals. These may be used for network or remote sources, or, if desired, additional studio or film cameras. The final input can be used for "black" or as a spare. The preview channel contains a tenth input which is used for monitoring the line or off-the-air signal.

Three rows of push buttons, a program transfer switch, and a manual fader are used to carry out the switching functions. Two rows of push buttons feed the manual fader which in turn feeds the program channel. A third row of push buttons feeds the preview channel. Signals from the fader and the preview channels are fed to a program transfer switch which enables the preview channel to be used as the program channel while the two fader channels are being used for previewing rehearsals or pre-setting of lap-dissolves, super-positions and fades.



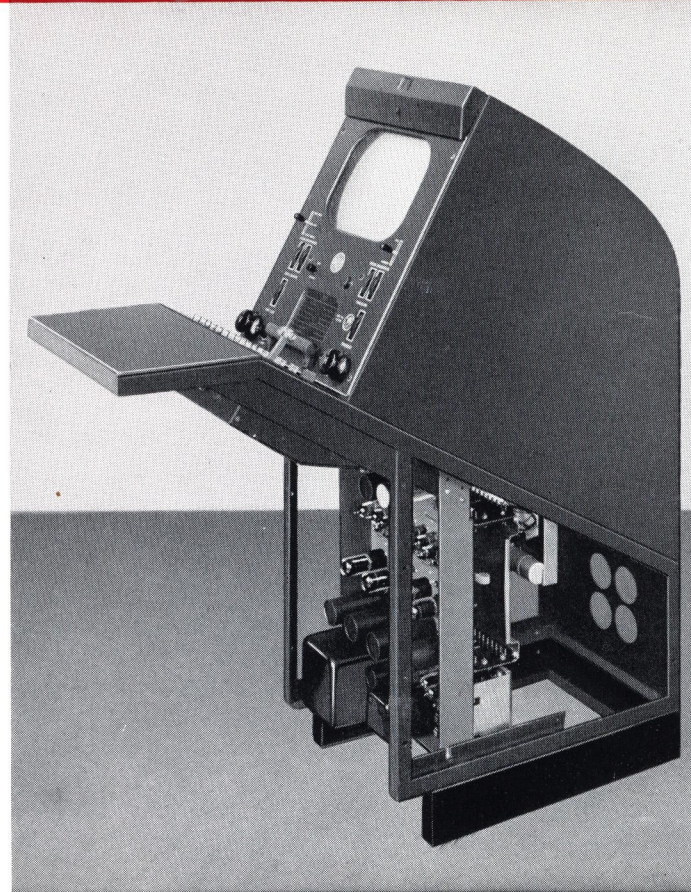
## DESCRIPTION

A single console housing contains the TS-11A control panel, mixing circuits, output line amplifiers and terminal connections for power, tally, and video circuits. A Master Monitor may be installed in the same console as a preview or line monitor.

Vertically mounted in the lower portion of the console section is the chassis which contains the output amplifiers; sync mixing and interlock circuits; filament and bias supplies; and all power, tally, and video co-ax connections.

The complete switching unit is mounted as one hinged assembly. First the control panel hinges down to permit removal of a Master Monitor from the console without interfering with the pushbuttons and fader lever for access to wiring and terminal connections. Next, the entire unit, both panel and chassis, hinges down to floor level for access to wiring and terminal connections. Finally, the whole assembly may be lifted out after un-plugging the cables.

A stage of isolation is provided between each pushbutton switch and the circuits following to minimize the effects of wiring capacity and to permit the use of a direct video fader circuit. The output of the fader circuit is fed to a gain stage which in turn feeds a cathode follower used to drive cables to the program transfer switch. The circuits for program and for preview are symmetrical to this point to permit switching in the program transfer switch to occur without level or response change. Four output amplifiers are then fed from the program transfer switch. Each amplifier is an independent line amplifier. The feedback circuit used provides for sending end termination of the outgoing lines with excellent frequency response and amplitude linearity. Also, each output amplifier is provided with a sync mixing stage. The addition of sync to a particular output is controlled by the sync interlock circuits.



TS-11A Switching System mounted in a single RCA console housing along with TM-6 Master Monitor.

Special care has been taken to minimize any microphonics which appear in the switcher output due to pushbutton operation or to the various disturbances normal to console operation of equipment. This has been accomplished by the use of a shock-mounted pre-amplifier chassis and ruggedized tubes in the main chassis where required.

The low frequency response of all of the amplifier circuits is designed for smooth roll-off to a very low cut-off point, thereby providing bounce-free operation without the complexity of clamp circuits.

Additional contacts are provided on the preview switching channel pushbuttons for use with audio tie relays. This can be used when simultaneous audio-video switching of remote or network circuits is necessary, and particularly when the TS-11A is used in conjunction with an audio consolette.



## SPECIFICATIONS

## Electrical Specifications

## Input Circuits:

- 5—for "local" sources—#1 to #5
- 2—for "local" or "remote" sources—#6 and #7
- 1—for "remote" source—#8
- 1—for "black" (may be used for local picture) #9
- 1—for "line" or "off-the-air" (fed to preview circuit only)

## Input Signal Level:

- 1.0 v. (peak-to-peak, composite video)

## Output Circuits:

- 3—for program output (one normally used for "line" monitor)
- 1—for preview output

## Output Signal Level:

- 1.0 v. (peak-to-peak, composite video)

## Tally Circuits:

- "On Air" to Studio Cameras.....+280 v. d-c (through series resistor)  
or 24 v. d-c (ext. supply)

Inputs #1 to #5 (arc suppression supplied)

- "On Air" to Studio or Film Cameras.....6.3 v. a-c (inputs #1 to #9)  
or 24 v. d-c (ext. supply)

(No arc suppression supplied—normally required  
only for 24 v. operation)

## Amplifier Circuits—Tube Complement

- 3—6CL6 Pre-amplifiers—switching panel
- 2—5670 Gain stage, cathode followers—amplifier chassis
- 4—5670 Output amplifiers for program and  
preview channels
- 4—6BX7 Sync mixers for output amplifiers
- 1—6X4 Bias supply rectifier
- 1—OB2 Voltage regulator
- 1—12AX7 Regulator
- 1—6CL6 Regulator

21 Total

## Amplifier Circuits Overall Transmission Specifications

## 1. Gain:

Video Inputs (#1—#9).....1 (adjustable  $\pm 5\%$ )

Monitor Input (#10).....1 (adjustable 0 to 1.05)

## 2. Frequency Response (values shown for signals fed from sending end terminated lines):

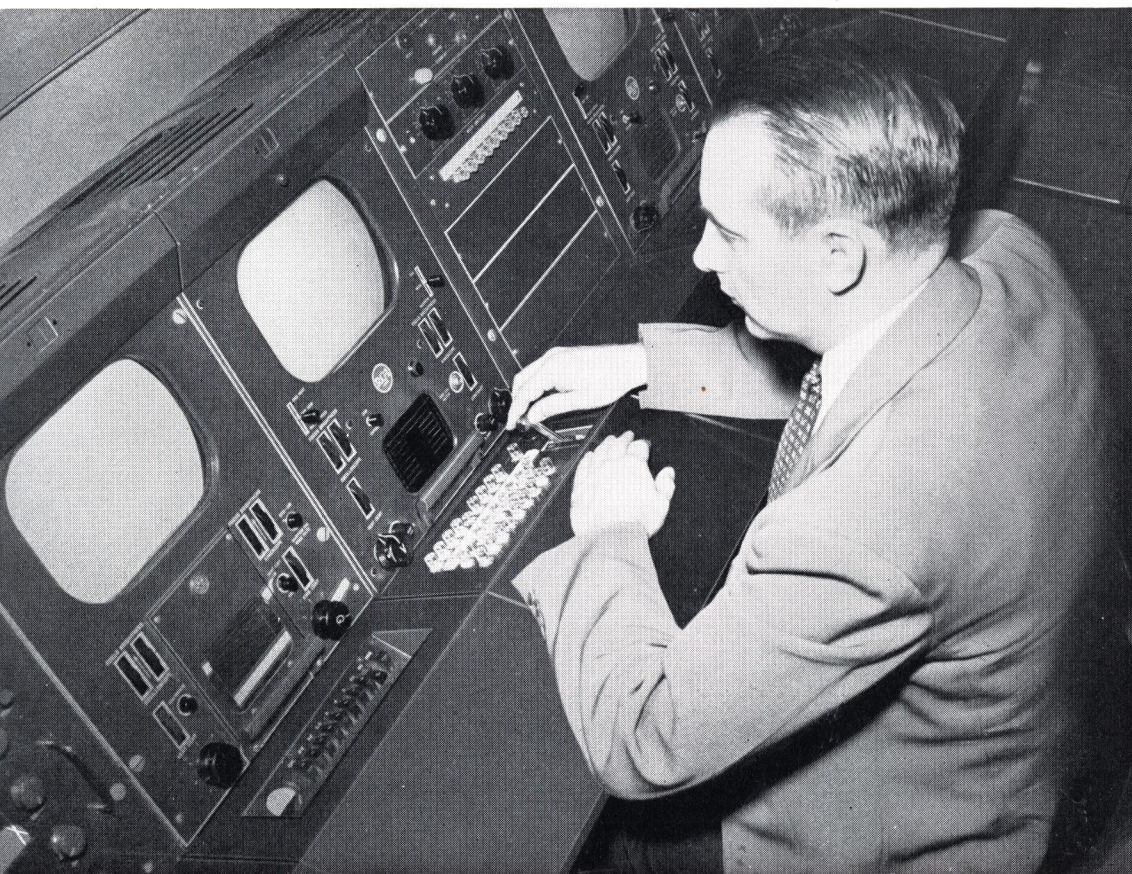
4 cycles to 8 mc..... $\pm 3$  db

3.58 mc referred to 15,750 cycles..... $\pm 1$  db

## 3. Tilt—60 Cycle Square Wave.....3% max.

## 4. Hum and Noise:

(Peak-to-peak noise relative to 1 volt).....—50 db



TS-11A Switcher Control Panel  
installed at a studio control  
location.



## SPECIFICATIONS (Continued)

5. Cross-talk Attenuation:  
 1000 cycles ..... 55 db  
 3.58 mc ..... 45 db
6. Output Impedance..... 75 ohms  $\pm 10\%$ , sending-end terminated
7. Input Circuits:

Resistance  
 Video Inputs (#1—#9)..... 75 ohms  $\pm 5\%$   
 (non-bridging)  
 Monitor Input (#10)..... 75 ohms  $\pm 5\%$

8. Isolation Between Program Outputs:  
 1000 cycles ..... 50 db  
 3.58 mc ..... 40 db
9. Sync Channel:  
 Input Level..... 3.5 to 5.0 v. peak-to-peak  
 Input Impedance..... 75 ohms  $\pm 5\%$  (normally non-bridging)  
 Output Level..... 0.1 to 0.5 v. peak-to-peak (adjustable at each output separately, sync-add condition)

## Power Required:

A-c..... 109, 117, 125 v. a-c 120 watts  
 D-c..... 280 volts regulated, 300 ma (normal)  
 65 ma (max. demand for tally system)  
 Required Supply Rating..... 400 ma

## Dimensions:

Main Chassis..... 18" x 11 1/2" x 9 1/2"  
 Control Panel..... 12 7/8" x 5 5/8" x 3 1/2"

## Equipment Supplied

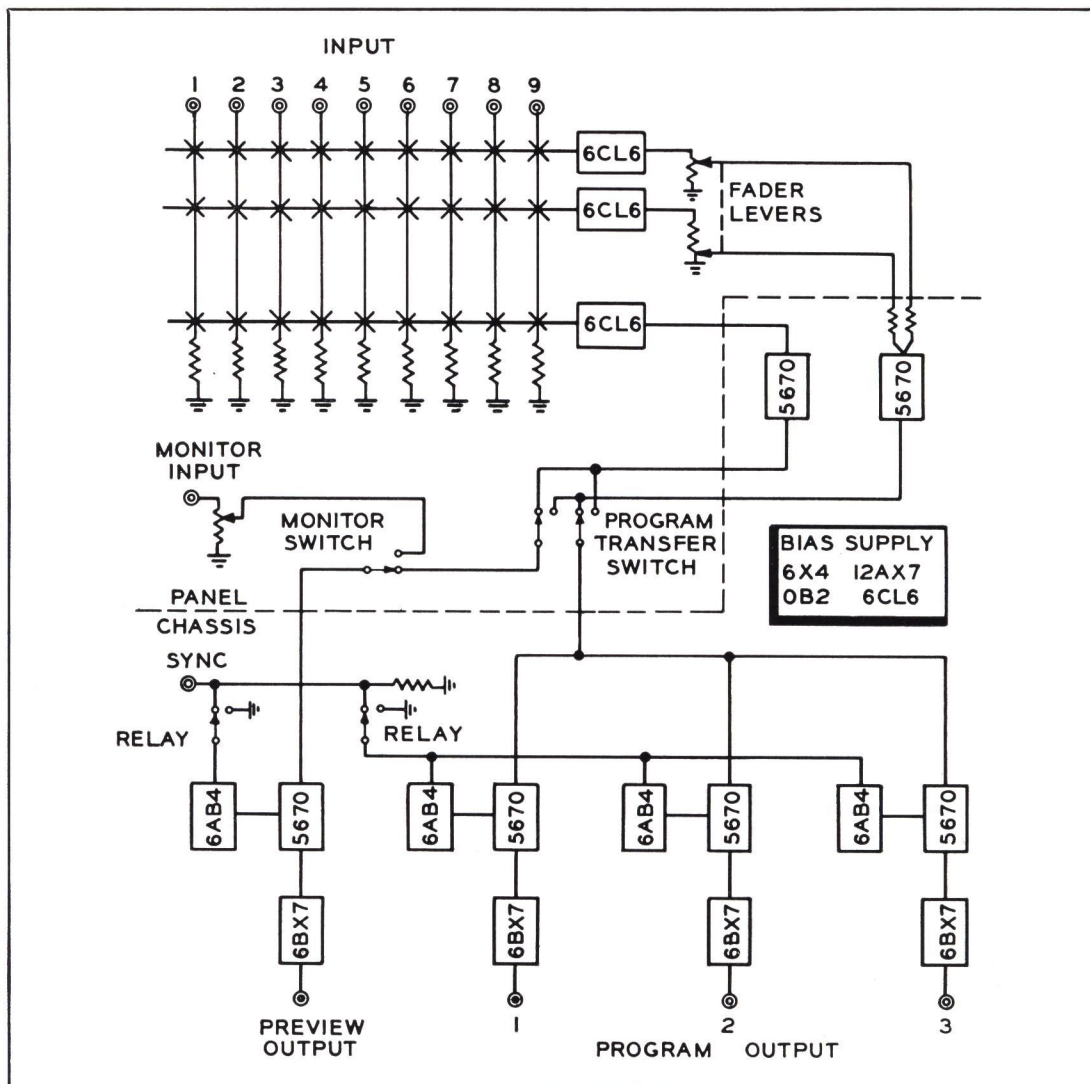
TS-11A Switching System, ES-26966, including:

Switcher ..... MI-26226  
 Master Monitor, TM-6B, including ..... MI-26136-A  
 Kinescope Tube, 10SP4 ..... MI-26655  
 CRO, 5UP1 ..... MI-26665  
 Blower ..... MI-26579-B  
 Power Supply, WP-33B (For TM-6B)..... MI-26085-B  
 Power Supply, 580-D (For TS-11A)..... MI-21523-C  
 Console Housing ..... MI-26266-B

## Accessory

TV Broadcast Intercom Equipment..... ES-11981

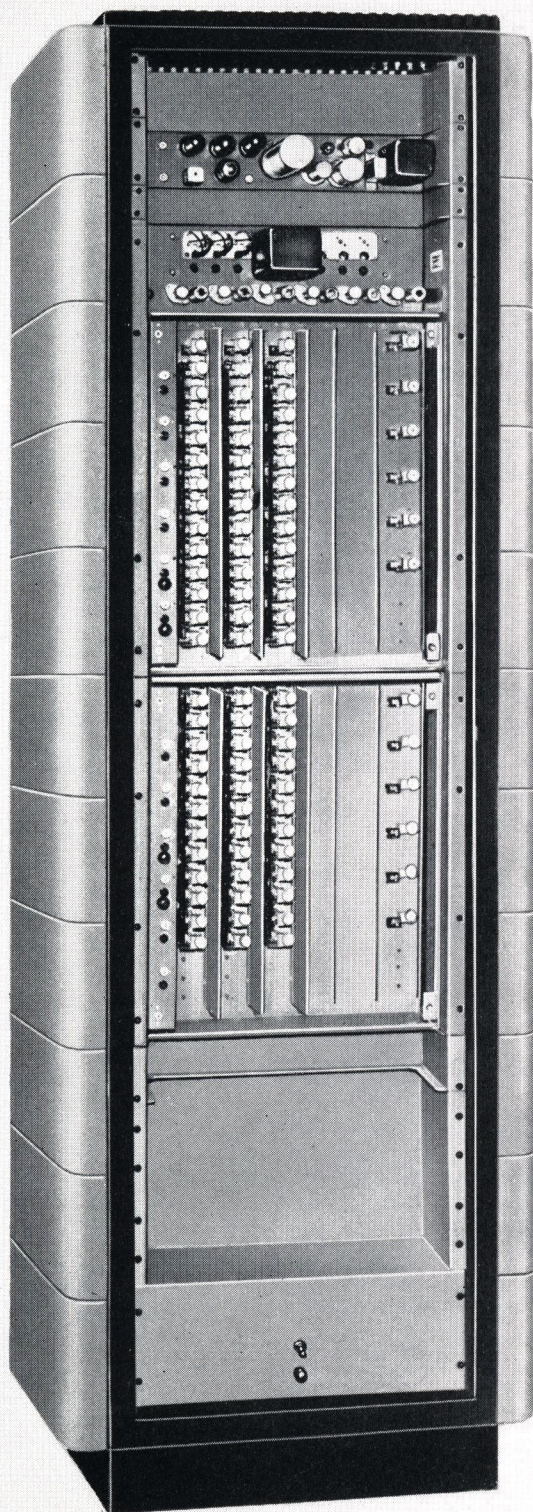
BLOCK DIAGRAM OF TS-11A SWITCHER





# REMOTE CONTROL SWITCHING SYSTEM

TYPE TS-20A



## FEATURES

- Remote control switching for monochrome or color use
- Both colorplexed and monochrome signals can be handled simultaneously
- Can be used for studio or master control switching
- Permits use of all programming techniques such as fading and lap-dissolving between local signals
- Centralizes coaxial cable connections
- Coaxial cable connections not required at operating positions
- Provides circuits for tally light operation
- Provides control circuits for sync interlocks
- Design permits expansion of facilities without obsolescence of original equipment

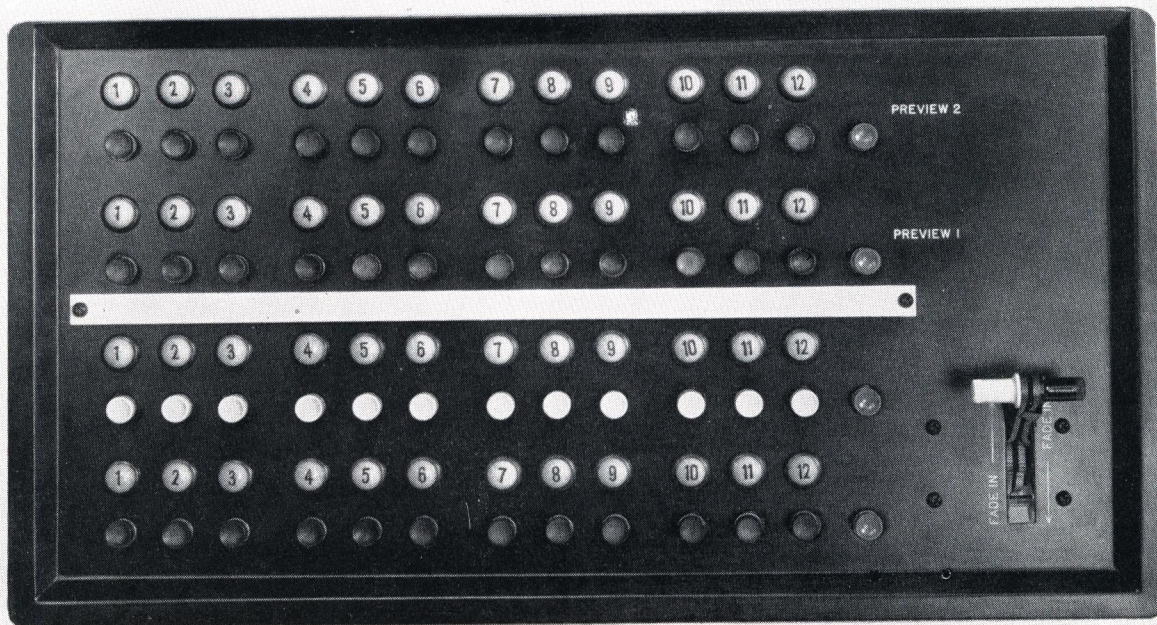
## USES

The RCA Type TS-20A Remote Control Switching System is designed for use in television studio control and master control rooms. It consists of different types and quantities of equipment depending upon the size and type of switching operation desired. The equipment may be used for switching a minimum of six inputs to two outputs or a maximum of twelve inputs to six outputs (five outputs if tally light relay panel is used).

For the studio control room the system can be set up to provide complete facilities for program monitoring, video switching between television studio cameras, film cameras, remote pick-ups or network programs. Controls can be provided for fading and lap-dissolving between local studio video signals. The system can provide for program pre-viewing and many other monitoring functions.

Standard rack containing relay chassis, amplifiers and power supplies.





Push Button Panel MI-26220-1. This is one of four different panels available for Relay Switching.

For the master control room the system can be set up to provide complete video switching and monitoring facilities within the limits noted above.

The push-button control panels designed for the system can be housed in consoles in convenient position for monitoring the video facilities. Actual switching is accomplished remotely by d-c relays which are housed in racks at any desired location in the control room. By installing a panel of jacks and video patch cords in adjacent rack equipment, switching of all sources of signals to this position and to the master control console, or directly to the transmitter, can be accomplished quickly and efficiently. Special high-speed transfer relays almost completely eliminate picture disturbance caused by switching.

The use of d-c relays in the TS-20A system adds to the overall flexibility of television stations layouts and simplifies the addition of studio facilities when expanded operating schedules require the use of more than one control room. The RCA Remote Control Switching System permits the broadcaster to eliminate the costly expense of installing intricate video lines to interconnect the television studios and control rooms.

## DESCRIPTION

The complete TS-20A Remote Control Switching System consists of several types of individual units which fall in the following categories. (For break-down see equipment listing under "Specifications".)

- A. The video relay switching chassis and panels used to extend functions of basic units.
- B. The push-button panels (for operating the video relays) which are available for several switching schemes and mounting arrangements.
- C. The utility or master monitors, for use in conjunction with push-button panels.
- D. Standard components.

## Relay Switching

The basic relay switching chassis supplied with the TS-20A System provides for switching six video input channels to two output lines. All six inputs can be used for local signals. However, two channels may be used for remote signals since they are equipped with automatic circuits which remove the local sync addition. Following are the



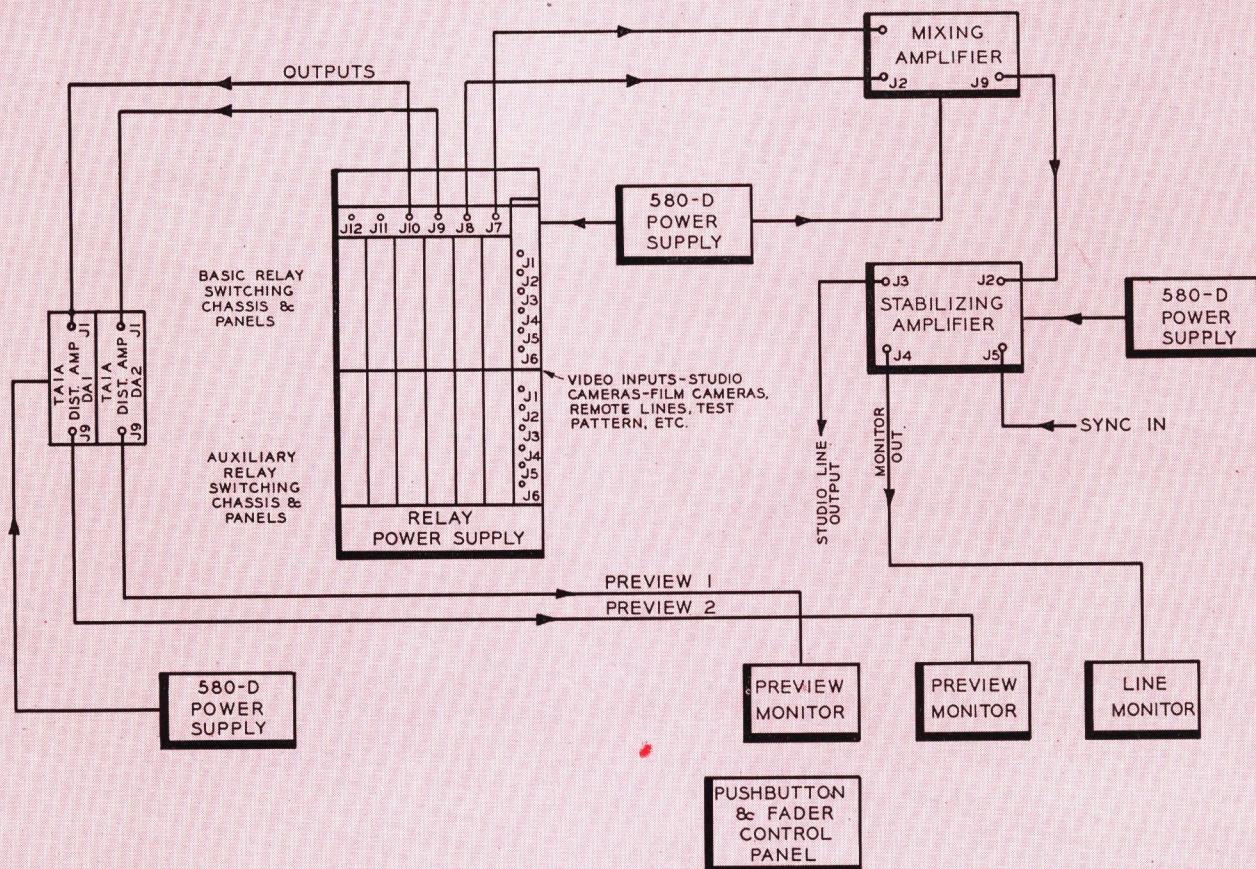
units included: (A) Basic Relay Chassis (MI-26231); (B) Two Basic Relay Panels (MI-26233). The number of outputs may be increased to a maximum of six (five if tally light relay panel is used) by the addition of Basic Relay Panels (MI-26233)—one panel for each output. The Basic Relay Chassis contains a cathode coupled output tube for each channel to isolate the source signal from any output line. The Auxiliary Relay Chassis (MI-26230) which is designed for installation directly below the Basic Relay Chassis, provides six additional inputs for two output channels. Here the number of outputs can be increased to six (five, if tally relay panel is used) by mounting four Auxiliary Relay

Panels (MI-26232) in the Auxiliary Chassis. The Tally Relay Panel (MI-26234) can be mounted in the Basic or in the Auxiliary Relay Chassis. This panel is designed for mounting where the sixth relay panel would be located.

### Push-button Panels

RCA has designed three different push-button video control panels to handle all or only a few of the switching and fading functions. Two of the units include switching and fading and two of the units include only switching. MI-26220-A1 handles twelve inputs and four outputs with fader; MI-26221-A, six inputs and two outputs with fader;

Layout diagram showing typical equipment employed in one version of TS-20A system.





and MI-26223 each handle six inputs and two outputs only. MI-26220-A1 was designed primarily for custom built console mounting. The MI-26221-A, and 26223 switch panels have been designed for use in console sections for master switching. All the buttons are of the push type and a tally light is associated with each one. A release button is located in each row of channel buttons.

## Monitors

Both Master Monitors or Utility Monitors may form a part of the TS-20A system. The push-button switch panel (MI-26220-A1) is mounted in a custom built console. The MI-26221-A switch panel is designed for mounting in a single console section (sloped portion) which is at right angles to the panel on which remote control panels are located. The MI-26223 switch panel mounts in the upper section and space required is equal to that of two small remote control panels. With the MI-26221-A panel, a Master Monitor may be mounted in the same console. With the MI-26223, other remote panels may be mounted in the same console and a master monitor in an adjacent console housing.

## Amplifiers and Power Supplies

The amplifiers associated with the system include Types TA-1A or TA-3A Distribution Amplifiers and Type TA-10B Mixing Amplifiers. The number required, of course, depends on the size of the installation. The TA-1A Distribution Amplifier makes possible multiple distribution of video signals, and the TA-3A has the added advantage of a sync addition circuit which eliminates the need for an extra mixing amplifier. The Mixing Amplifier has two input channels and a common output channel. This is the unit which provides for lap-dissolving and fading of two input signals. Two levers mounted on the switching panel operate gain controls in the amplifier—one gain control for each channel. Thus, two signals fed into the amplifier can be superimposed with any relative degree of amplitude for each. A driven clamp eliminates low frequency switching transients.

The TS-20A Switching System uses regulated power supplies and 24-volt supplies for the d-c relays. The equipment has been designed so that it is possible to employ the units in a great number of different combinations to meet the requirements of the individual stations. Station plans can be obtained from RCA upon request.

## SPECIFICATIONS

### Power Requirements:

Relays .....	24 volts d-c
Amplifiers .....	280 volts d-c
Filaments .....	115 volts a-c
Video Input Channels.....	6 min., 12 max.
Video Output Channels.....	2 min., 6 max.*
Input Impedance.....	75 ohms**
Output Impedance .....	High***
Video Transfer Relay Adjustments for.....	Overlap switching Gap switching

### Dimensions:

Basic Relay Chassis.....	26 1/4" high, 19" wide, 9 1/2" deep
Auxiliary Relay Chassis.....	21" high, 19" wide, 8 3/4" deep

## Tube Complement

Basic Relay Chassis.....6 RCA 6J6 output tubes  
(For complement tube listings refer to catalog pages on individual equipments.)

## Equipment Available

The TS-20A System includes the following equipment which may be used in many different combinations determined by individual station requirements:

### A. Relay Switching Units:

Basic Relay Chassis.....	MI-26231
Basic Relay Panel .....	MI-26233
Auxiliary Relay Chassis.....	MI-26230
Auxiliary Relay Panel.....	MI-26232
Tally Light Relay Panel .....	MI-26234

### B. Push-button Panels:

Program Control Panel (with fader).....	MI-26221-A
Master Control Panel .....	MI-26223
Program Control Panel.....	MI-26220-A1

### C. Monitors:

Master Monitor:	
Monochrome .....	MI-26136-A
Color .....	MI-26136-B
Utility Monitors .....	MI-26149 or MI-26152
Color Monitor .....	MI-40206-A

### D. Console Units:

Console Housing .....	MI-26266-B
Blower for Master Monitor.....	MI-26579-B

### E. Standard Components:

Relay Power Supply .....	MI-11316
Plus MI-11598-B Panel; MI-11599 Shelf.	
Cabinet Rack .....	MI-30951-C84
Type 580D Power Supply.....	MI-21523-C
WP-33A Power Supply.....	MI-26085-B
Distribution Amplifier .....	MI-26155
Mixing Amplifier TA-10B.....	MI-26281-A

\* 5 max. when tally relay panel is used.

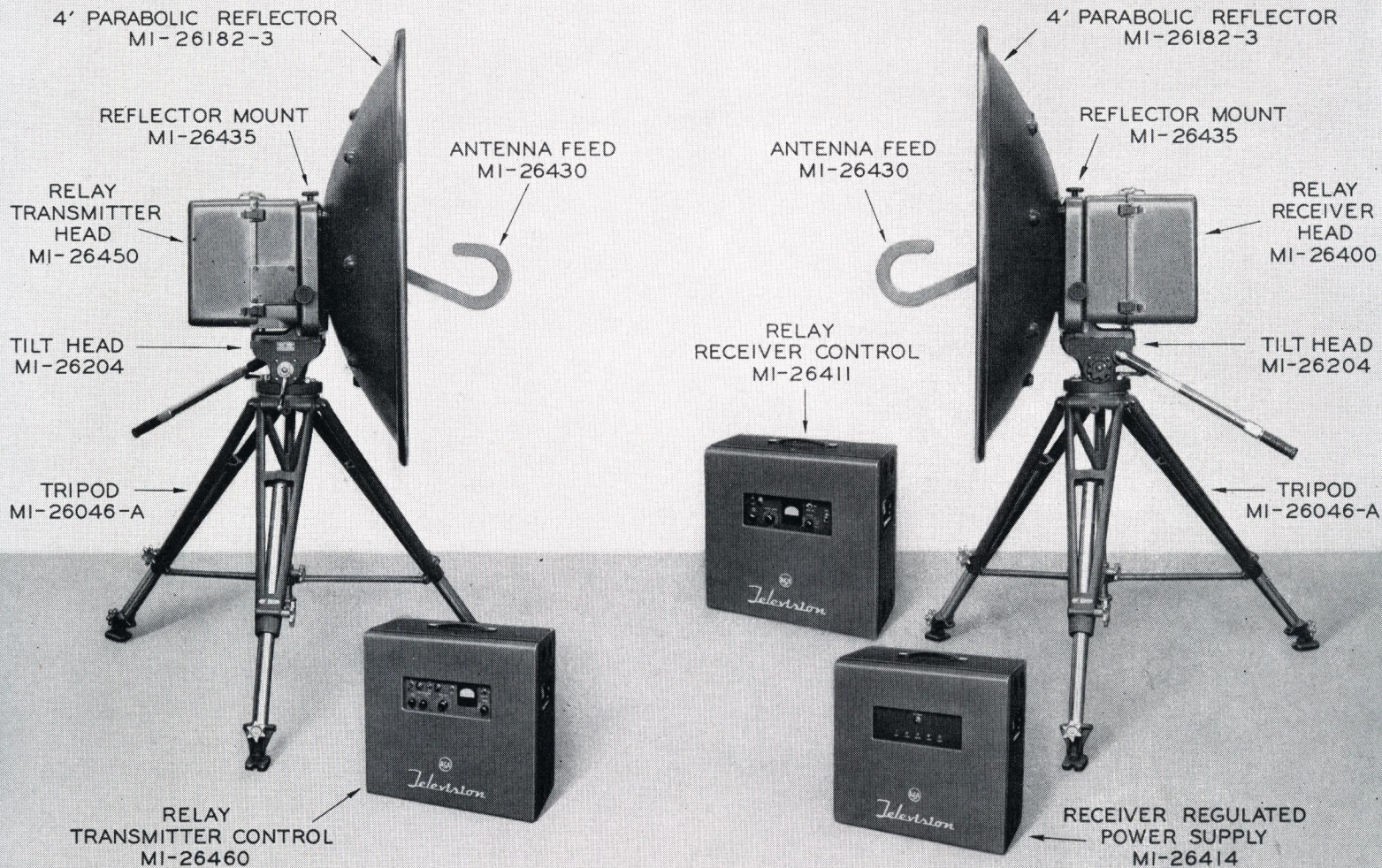
\*\* Adjustable between 60-87 ohms.

\*\*\* For capacity coupled inputs.



# COLOR MICROWAVE EQUIPMENT

## TYPE TVM-1A



\* Portable Carrying Case, MI-26417.

## FEATURES

- Completely new design
- Ideal for color use
- High power (1 watt Klystron) more than doubles effective range
- Approximately 10,000 watts ERP with a 6 ft. dish
- Greater system stability—free of critical tuning
- Superior performance in multihop systems
- Unitized construction for easy maintenance
- Transmitter AFC and transmitter picture monitoring output available for use in multihop systems
- Sound channel included



## USES

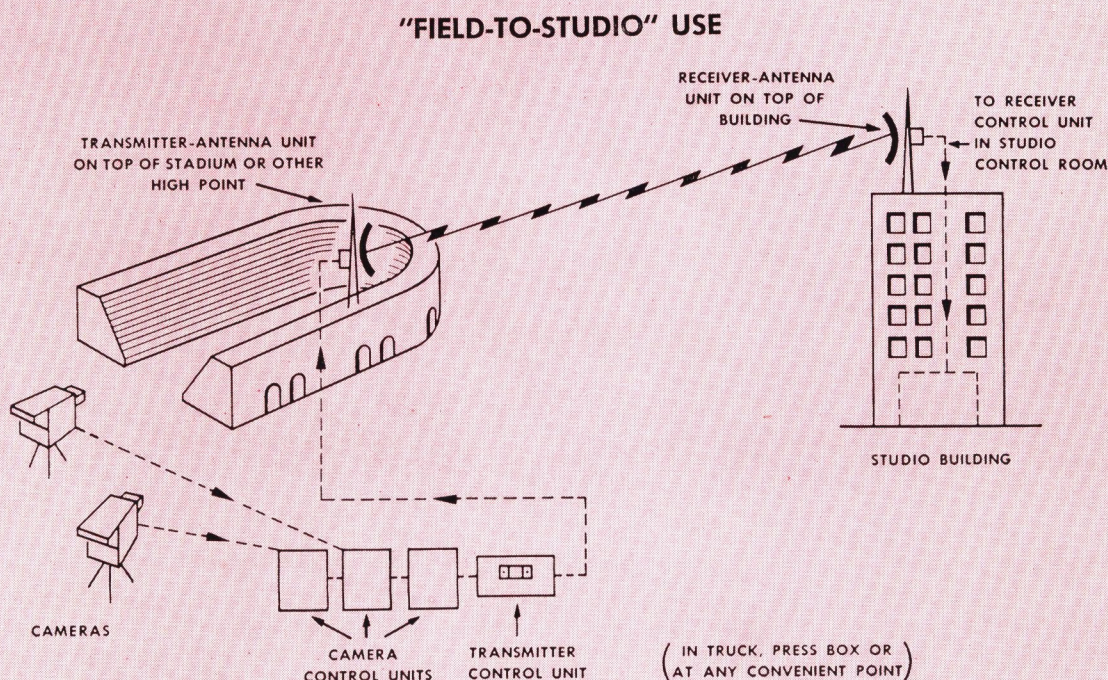
The completely new RCA color television microwave equipment, Type TVM-1A, represents the first major advance in television microwave techniques since the introduction of the RCA TTR-TRR series of microwave equipment for broadcasters. It includes new functional and styling features to provide flexibility in meeting individual needs. Functional features include about 1 watt of transmitter power (10,000 watts ERP with a 6-foot dish), high receiver sensitivity, 6 megacycles video bandwidth, multihop operation, a sound channel and accommodation for transmitter AFC and transmitter picture monitoring. Styling features include completely new r-f head assemblies and unitized construction for easy servicing.

The complete microwave system is comprised of a Relay Transmitter used with a Relay Receiver. This combination results in a highly directional wideband relay link especially suited to the transmission or reception of television video signals, color or monochrome. Such a system has the following important applications:

(a) For STUDIO-TO-TRANSMITTER use (STL) which is usually a permanent installation. For this use, transmitter and parabolic antenna units can be permanently mounted on the roof or other high location near the studio and the transmitter control unit will be mounted,

ordinarily, in equipment racks at the studio location. The receiving equipment will be permanently located at the transmitter site. Passive reflectors can be used in conjunction with parabolic antennas to facilitate maintenance and servicing.

- (b) For FIELD or PORTABLE PICKUPS as a means of transmitting video signal from field pickup cameras or similar sources to a television control for broadcasting. In this case, the field mounting accessories will ordinarily be used. The antenna will be located on some high point, such as the top of a stadium where a line-of-sight path with sufficient clearance is available. The transmitter control unit will be located with the camera control equipment as, for instance, in the radio booth or in the field truck or mobile unit.
- (c) As a REPEATER STATION, when distances or intervening obstacles necessitate one or more additional links to reach the picture signal destination. The intermediate transmitters and receivers can be situated on a building or other suitable support. Under standard path conditions several hops can be used for either monochrome or color with high picture quality. Transmitter AFC and the transmitter picture monitoring output can be included at extra cost.





## SYSTEM ADVANTAGES

The RCA TVM-1A Microwave Equipment features several outstanding system advantages available for the first time to television operators:

### Maximum Dependability

An increase of 10 in transmitter power and about 3 db in receiver sensitivity offers in effect 20 times the power margin of the RCA TTR-TRR series of microwave equipment. This adds up to greater operational reliability with an increased fading margin.

### High Quality Signal for Color Systems

Color systems demand the superior performance of this new RCA microwave system. The extra high stability of this equipment is a must for color transmission. Color signal distortion has been reduced to a minimum so that a complete television system (transmitter, microwave link, terminal and studio equipment) can be operated well within FCC requirements for such an overall television system. New functional features such as the direct reading variable wavemeter and the transmitter radiation switch make it easy for operators to adjust and maintain the microwave system to meet rigid color specifications.

### Unattended Operation

The TVM-1A equipment has been designed to require minimum service. This is a highly desirable feature especially at repeater stations. For use in repeater stations the optional transmitter AFC is particularly recommended. This transmitter AFC, along with low phase distortion and extra video amplifier stability in the receiver, offers a highly stable system which is initially easy to set up and requires but occasional attention to maintain.

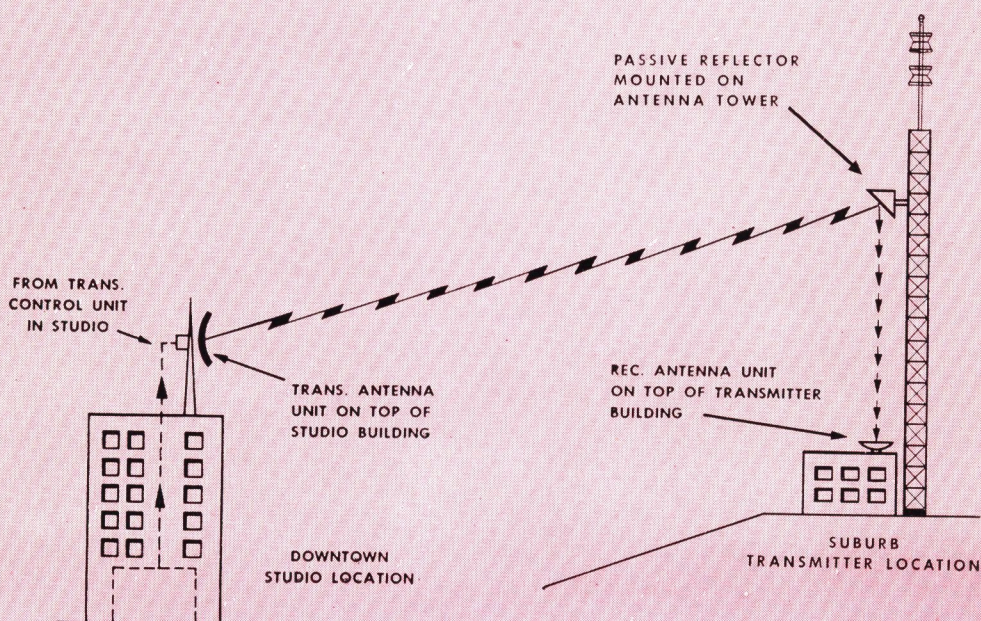
### Sound Channel

Included in the TVM-1A Microwave System is a high quality audio channel for the simultaneous transmission of program sound along with picture information. This sound channel is well within FCC requirements for a studio-to-transmitter link (STL).

### Extended Frequency Range

The increased range in frequency of this new equipment (5850-7125 megacycles) introduces new uses for RCA microwave equipment. This extended frequency range finds application in both common carrier and industrial use. Klystrons are supplied for broadcast application only, unless otherwise specified.

### "STUDIO-TO-TRANSMITTER" USE





## RELAY TRANSMITTER

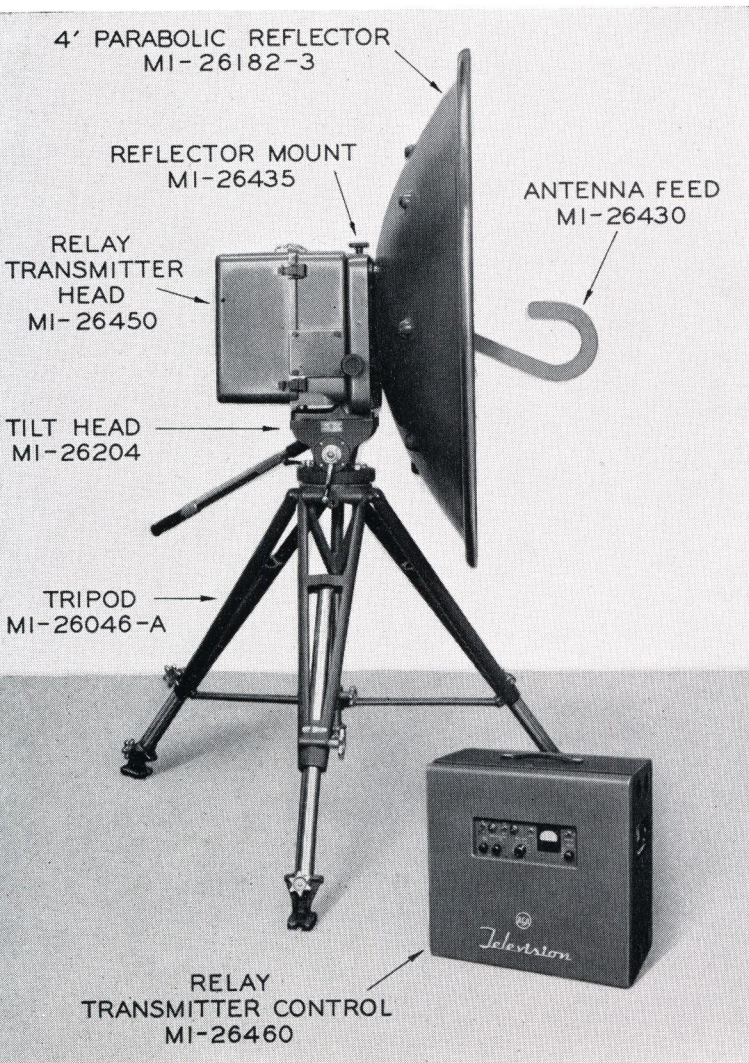
### DESCRIPTION

The Relay Transmitter is a complete, portable transmitting system consisting of (1) a transmitter, (2) a high gain antenna, (3) an antenna mounting unit capable of wide adjustment in the horizontal and vertical plane, and (4) a transmitter control unit.

The transmitter is contained in a weather proof housing attached to the rear of a parabolic reflector. Contained in the unit is a Klystron oscillator which is frequency-modulated by variations of a negative voltage on the repeller plate. Power output is 1 watt at any selected frequency between 5850 and 7125 megacycles. A newly designed air-cooled Klystron is used to provide exceptionally good frequency stability, even without transmitter AFC. Proper Klystron operation is indicated on a meter which shows a reading proportional to the power output. This permits simplified initial transmitter setup and offers ease of maintenance and servicing.

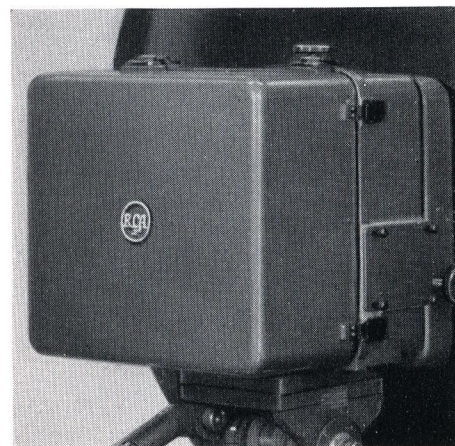
A radiation control has been included in the transmitter. Use of this control permits the Klystron to be operated normally while the equipment is in a standby condition. Radiation is reduced by about 40 db by means of this radiation switch.

Optional transmitter facilities include transmitter AFC and provision for monitoring the transmitter picture signal. Transmitter AFC offers high stability as well as superior frequency response. It shortens recovery time in case of primary power failure. The transmitter picture monitoring facility simplifies trouble-shooting. It is also extremely useful in the operation of repeater stations.



Relay Transmitter Control.

Rear Loading Transmitter Head.





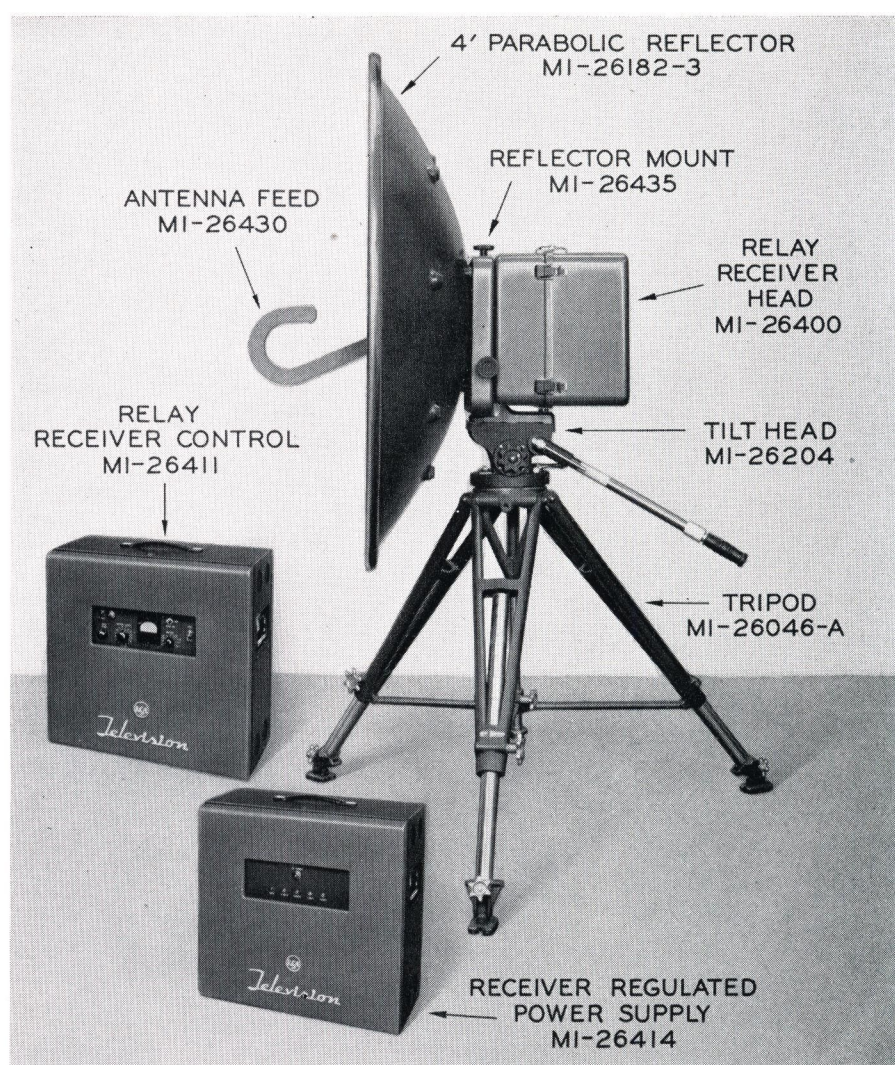
# RELAY RECEIVER

## DESCRIPTION

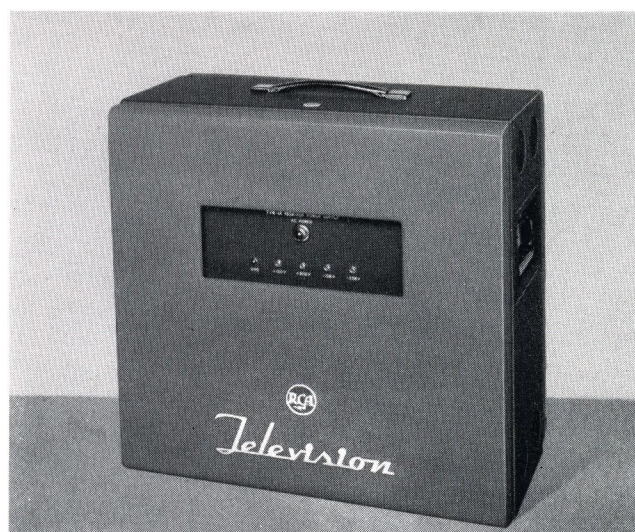
The Relay Receiver is a complete, portable FM receiving system which may be operated at any selected frequency in the range of 5850 to 7125 megacycles. It consists of (1) a receiver, (2) a high-gain antenna, (3) an antenna mounting unit capable of wide adjustment in the horizontal and vertical plane, (4) a receiver control unit, and (5) a regulated power supply unit.

The signal is picked up on the high gain antenna and fed into the receiver, which is contained in a weather proof housing attached to the back of the parabolic reflector. This Relay Receiver incorporates newly designed r-f circuits to provide a receiver noise figure of about 16 db. Use of a special receiver klystron plus improved i-f circuitry results in high stability, easy initial setup, and a minimum of operator attention.

The wavemeter, MI-26405, which is provided for in the transmitter can be used in the receiver to tune the receiver without the need for an associated transmitter signal. For convenience in operation, this wavemeter is available as an optional receiver accessory. Special electrical shielding in the receiver effectively reduces interference from the local transmitting equipment.



Relay Receiver Control.



Relay Receiver Power Supply.



# SPECIFICATIONS

## RELAY TRANSMITTER

Frequency Range.....5925-7125 mc  
 Power Output, Nominal.....1.0 watts  
 Antenna Gain, approximate:  
     4 ft. Reflector.....5,000  
     6 ft. Reflector.....11,000  
 Video Input (at Transmitter Control):  
     Complete Modulation.....1.0 volts, peak-to-peak  
 Video Input Impedance.....75 ohms  
 Power Supply Requirements (Transmitter  
     and Control).....117 volt, 60/50 cycles, a-c

### Mechanical Specifications

Transmitter Control (in carrying  
     case).....20" high, 19 $\frac{7}{8}$ " wide, 10 $\frac{1}{4}$ " deep  
     Weight.....66 lbs.  
 Transmitter (in housing).....16 $\frac{3}{4}$ " high, 17" wide, 14 $\frac{1}{2}$ " deep  
     Weight.....60 lbs.  
 Parabolic Reflectors...Dia. 4 ft., 14 $\frac{1}{2}$ " deep, weight 30 lbs.  
     Dia. 6 ft., 15 $\frac{1}{2}$ " deep, weight 70 lbs.  
 Finish.....Two-tone umber gray

### Tube Complement

Transmitter Head (MI-26450):  
     2-404A/5847                      1-6AL5  
     1-OA2                              1-1N160 crystal  
     1-6CL6                            1-VA220 Series  
     1-12AX7                            klystron  
 Transmitter Control (MI-26460):  
     3-12AX7                           1-5Y3GT  
     4-5U4G                            2-OB2  
     5-6AS7G                           1-OA2  
     2-6AU6  
 Transmitter AFC Equipment (MI-26643):  
     3-12AX7                           1-6AL5  
     1-12AU7  
 Transmitter Monitoring Equipment (MI-26644):  
     1-OA2                              3-404A/5847  
     1-2C51                              1-6BX7  
 Transmitter Monitoring/AFC Cavity Equipment (MI-26645):  
     1-1N160 crystal                  1-1N160R crystal

## RELAY RECEIVER

Frequency Range .....5925-7125  
 Receiver I-F Centered About.....130 mc  
 Receiver I-F and Discriminator Bandwidth, approx.....20 mc  
 Antenna Gain, approximate:  
     4-ft Reflector .....5,000  
     6-ft. Reflector .....11,500

Video Output of Receiver.....1.4 volts, peak-to-peak  
 Video Output Impedance.....75 ohms  
 Power Supply Requirements (Receiver and  
     Receiver Control).....117 volt, 60 cycles

### Mechanical Specifications

Receiver Control (in carrying  
     case).....20" high, 19 $\frac{7}{8}$ " wide, 10 $\frac{1}{4}$ " deep  
     Net Weight.....52 lbs.  
 Receiver (in housing).....16 $\frac{3}{4}$ " high, 17 $\frac{1}{4}$ " wide, 14 $\frac{1}{2}$ " deep  
     Weight.....53 lbs.  
 Receiver Power Supply  
     (in housing).....20" high, 19 $\frac{7}{8}$ " wide, 10 $\frac{1}{4}$ " deep  
     Net Weight.....58 lbs.  
 Parabolic Reflectors...Dia. 4 ft., 14 $\frac{1}{2}$ " deep, weight 30 lbs.  
     Dia. 6 ft., 15 $\frac{1}{2}$ " deep, weight 75 lbs.  
 Finish.....Two-tone umber gray

### Tube Complement

Receiver Head (MI-26400):  
     1-6J4                                      1-1N150R crystal  
     3-404A/5847                          1-VA221 Series  
     1-1N150 crystal                      klystron  
 Receiver Control (MI-26411):  
     2-6J4                                      1-6CL6  
     4-12AX7                                  2-2C51  
     13-404A/5847                          2-6BX7  
     1-6AK5                                   1-12AU7  
     1-OA2                                    1-6AL5  
     1-6X4  
 Receiver Power Supply (MI-26413):  
     4-5U4G                                  1-5Y3GT  
     5-6AS7G                                  2-OB2  
     2-6AU6                                  1-OA2  
     2-12AX7

## SYSTEM SPECIFICATIONS

Note: The following specifications apply to a single transmitter and receiver and provide excellent performance on color signals. These excellent performance characteristics also result in a superior system for monochrome use.

Differential Gain (Linearity).....0.5 db max.  
 Differential Phase Distortion (at 3.58 mc).....Less than 1°  
 Amplitude Frequency Response.....60 cycles to 6 mc  
     Flat within .3 db  
 Synchronizing Signal Compression.....Negligible  
 Low Frequency Square Wave  
     Response.....Less than 1% tilt at 60 cycles

### Equipment Supplied

(Components of relay system should be ordered to individual requirements. See Table on last page for suggested items for portable and fixed applications.)



## RELAY SYSTEMS ACCESSORIES

A number of accessories complement the relay transmitter and relay receiver. These provide a high degree of adaptability to suit broadcasters' particular needs. In the RELAY EQUIPMENT and ACCESSORIES table, complete relay equipment systems are outlined. Accessories matched to fit these systems are described here briefly.

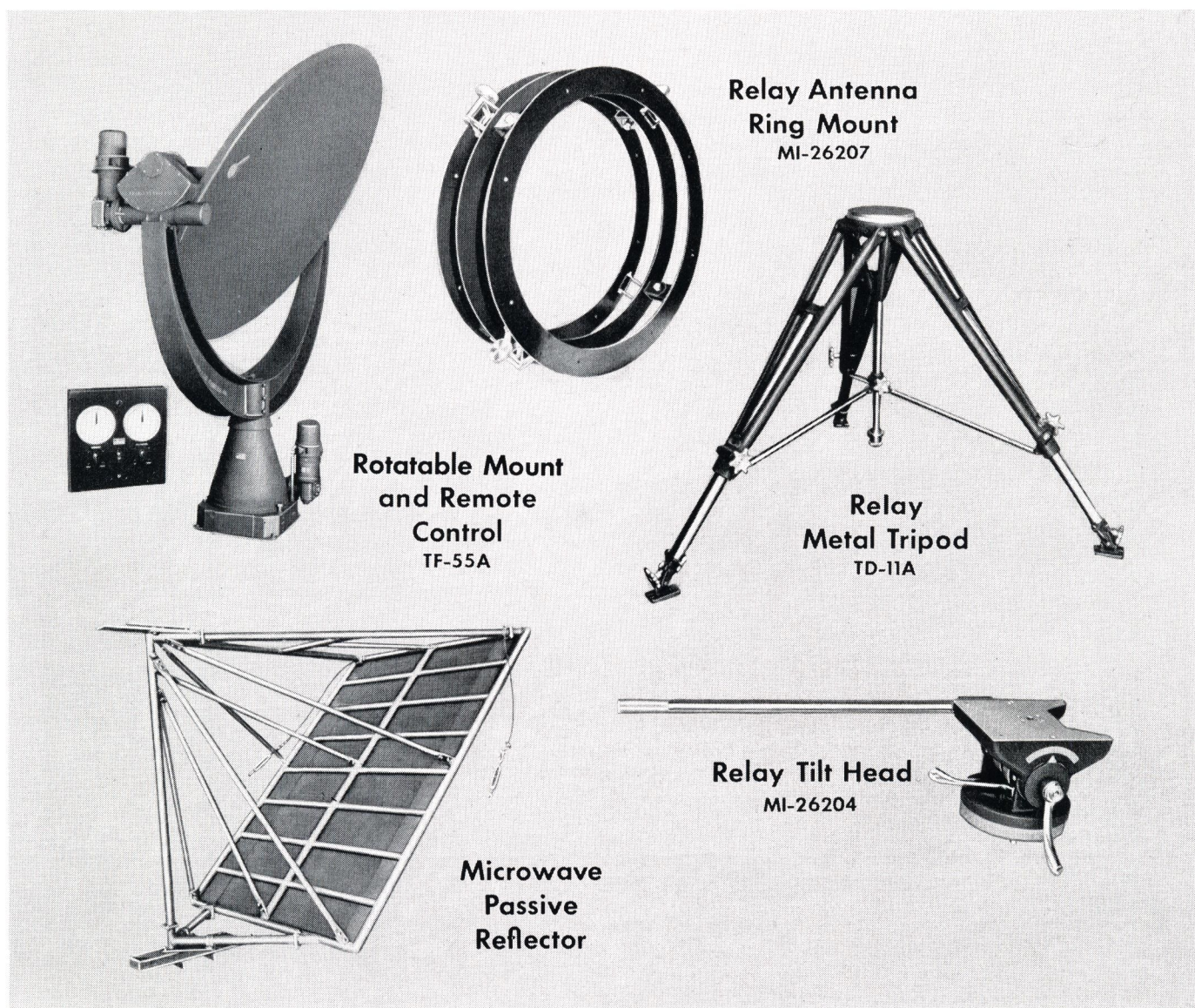
In FIELD PICKUPS, a tripod mounting and four-foot parabolic reflector usually serve best. An antenna reflector mount and tilt head are also required. A six-foot reflector can also be used in field pickup. In this case a long legged tripod is necessary.

For FIXED SERVICE, such as in a studio-to-transmitter link,

two types of mounts are available. A gimbal ring provides a fixed service mount for "wall-mounting" both four-foot and six-foot reflectors. Passive reflectors are also available so that the antenna can be located at ground level in fixed installations.

Six-foot reflectors direct a more narrow beam than do four-foot reflectors, and therefore, are more effective at greater distances.

Antenna waveguide feeds are available for providing either horizontally or vertically polarized signals. When using a combination of two links, interference between the two can thus be minimized.





## COLOR RELAY EQUIPMENT AND ACCESSORIES

(Items suggested for complete relay systems)

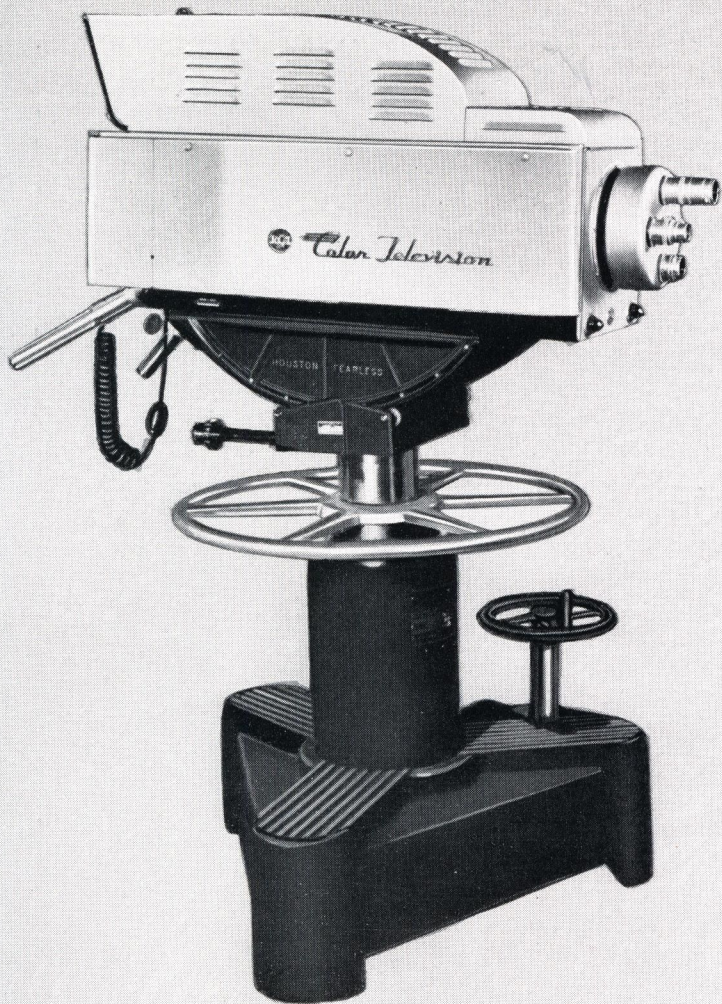
RELAY SYSTEM EQUIPMENT	GROUP A 4-Foot Paraboloid System for Portable Use	GROUP B 4-Foot Paraboloid System for Fixed Installation	GROUP C 6-Foot Paraboloid System for Portable Use	GROUP D 6-Foot Paraboloid System for Fixed Installation
Relay Transmitter Head, including set of tubes in place.....	(1) MI-26450	(1) MI-26450	(1) MI-26450	(1) MI-26450
Relay Transmitter Control, including set of tubes in place.....	(1) MI-26460	(1) MI-26460	(1) MI-26460	(1) MI-26460
Wavemeter .....	(1) MI-26405	(1) MI-26405	(1) MI-26405	(1) MI-26405
Relay Receiver Head, including set of tubes in place.....	(1) MI-26400	(1) MI-26400	(1) MI-26400	(1) MI-26400
Relay Receiver Control, including set of tubes in place.....	(1) MI-26411	(1) MI-26411	(1) MI-26411	(1) MI-26411
Receiver Regulated Power Supply.....	(1) MI-26414	(1) MI-26414	(1) MI-26414	(1) MI-26414
Sound Diplexer .....	TSD-2A	TSD-2A	TSD-2A	TSD-2A
Headset (Single) .....	(4) MI-11743	(4) MI-11743	(4) MI-11743	(4) MI-11743
Interconnecting Cable (10 ft.).....	(1) MI-26759-46	(1) MI-26759-46	(1) MI-26759-46	(1) MI-26759-46
Power Cable (10 ft.).....	(2) MI-26759-47	(2) MI-26759-47	(2) MI-26759-47	(2) MI-26759-47
Camera Cable (20 ft.).....	(2) MI-26725-A11	(2) MI-26726-A11	(2) MI-26725-A11	(2) MI-26725-A11
Portable Carrying Case for Trans- mitter and Receiver Control and Receiver Power Supply.....	(3) MI-26417		(3) MI-26417	
Reflector, Paraboloid, 4-ft. ....	(2) MI-26182-3	(2) MI-26182-3		
Antenna Feed for 4-ft. Reflector, Horizontal Polarization .....	(2) MI-26430	(2) MI-26430		
Reflector, Paraboloid, 6-ft. ....			(2) MI-26182-4	(2) MI-26182-4
Antenna Feed for 6-ft. Reflector, Horizontal Polarization .....			(2) MI-26432	(2) MI-26432
Metal Tripod, TD-11A.....	(2) MI-26046-A			
Reflector Mount .....	(2) MI-26435	(2) MI-26435	(2) MI-26435	(2) MI-26435
Tilt Head .....	(2) MI-26204		(2) MI-26204	
Metal Tripod, Long-legged.....			(2) MI-26048	
Tie Rod Assembly.....			(2) MI-26188	
Antenna Ring Mount Gimbal Ring.....		(2) MI-26207		(2) MI-26207
<b>Optional Transmitter and Receiver Accessories</b>				
Transmitter AFC equipment	MI-26643	MI-26643	MI-26643	MI-26643
Transmitter Picture Monitoring Equipment .....	MI-26644	MI-26644	MI-26644	MI-26644
*AFC/Picture Monitoring Cavity.....	MI-26645	MI-26645	MI-26645	MI-26645
Variable Wavemeter (for use with receiver) .....	MI-26405	MI-26405	MI-26405	MI-26405

\* The cavity is required when Transmitter AFC or Transmitter Picture Monitoring is used.  
However, if both facilities are used, only one cavity is required.



**COLOR PLANNING**  
**IN**  
**3 EASY STEPS**



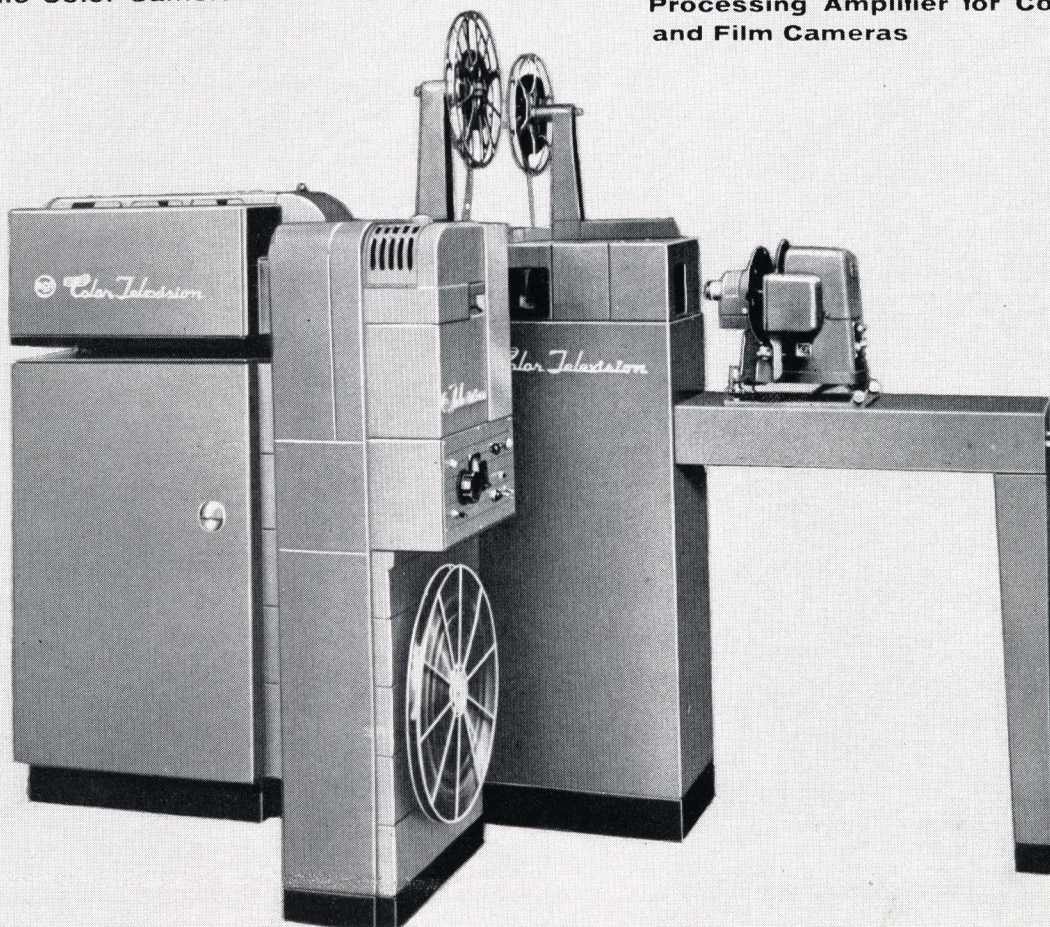


**TK-41 Studio Color Camera**

FIG. 1. New RCA color equipment is less expensive, requires much less space, and is easy to install.



**Processing Amplifier for Color Studio and Film Cameras**



**TK-26A Color Film and Slide Camera**



# COLOR EQUIPMENT PLANNING

## Availability of 3-V Film Camera and New Studio Camera Simplifies Color Equipment Problems — New Plans Described Here Provide for Color Installation in Three Easy Steps

Color equipment is fairly complex and relatively expensive. It, therefore, behooves the station engineer to make his color equipment plans very carefully so that he will have everything necessary to obtain high-quality color pictures, and yet avoid unnecessary duplication of expensive equipment items. Such caution is needed whether the station is just starting in color, or already has some color equipment and is now planning additions.

The single most important factor in color planning is to make sure that the individual equipment units fit together properly into a "system". Although RCA color equipment units have been designed to provide for considerable flexibility in arrangement it is, nevertheless, preferable to use them in "equipment groups" which have been carefully worked out and tested in the laboratory.

In the "color issue" of BROADCAST NEWS (Jan.-Feb. 1954), which was published soon after the FCC authorized compatible color, lists of "equipment groupings" for various types of services were included as part of a color planning article. Most of

the stations which have started color operation during the past year are using these "color equipment groupings".

The experience of these early color stations indicates that the groupings recommended were basically correct. However, since the first equipment lists were made up there have been a number of developments which effect individual items and thus make it desirable to revise these equipment lists and bring them up-to-date.

### 3-V Camera Eliminates One Step

The color equipment plans described previously envisaged the installation of color equipment in four progressive steps. These steps provided, respectively, for network, slide, film and live color programming. The slide and film "steps" projected in these early plans called for equipments of the "flying-spot" scanner type. As it turned out, these equipments were obsoleted, even before production, by the development of the RCA TK-26A ("3-V") Film and Slide Camera.

The "3-V" Camera, in addition to its quality and simplicity features, has the

great advantage of being easily multiplexed. Thus a single camera, with a relatively simple optical multiplexer, may be used for slides, 16mm films, and 35mm films, interchangeably. This makes it possible to eliminate one of the "steps" in the original plan and thereby to effect a considerable saving in cost as well as in space required.

### New Designs Effect Space Savings

During the past year RCA engineers, in addition to developing the 3-V camera, have redesigned many of the items in the RCA color equipment line. These new equipments simplify color installation and effect an additional, and very considerable, reduction in space required. One of the most important of these is the new Processing Amplifier which combines in a single unit the functions previously performed by four units. Additionally, this unit has been designed so that it can be mounted in a console type housing (see illustration on opposite page) which also contains the camera control panel. This not only saves rack space, but also makes operating more convenient by concentrating the controls.

**Fig. 2**  
**THREE-STEP PROGRAM FOR COLOR**

<i>Step No.</i>	<i>Equipment Added</i>	<i>Program Sources Provided</i>
Step #1	Network color equipment	Provides for transmission of color programs received from network source
	Color test equipment	Needed by all stations for checking, controlling and maintaining a high quality picture
Step #2	Color bar and local origination equipment	Provides for local generation of color sync signals plus color bar signal for system checking and advance training of personnel
	Color vidicon (3-V) film and slide camera equipment	Provides for origination of color pictures from color motion picture film and color slides
Step #3	Color studio camera equipment	Provides for origination of live studio pictures in color



The new Processing Amplifier is an important part of the new RCA TK-41A Studio Camera Chain. The camera proper of the TK-41A is identical in appearance to TK-40 and only minor changes have been made internally. However, the associated auxiliary equipment has been completely redesigned around the new Processing Amplifier. In addition to improving performance this has reduced the required rack space from four racks to two.

The new Processing Amplifier is also used in the TK-26A "3-V" Film Camera Chain. This is important in standardizing the equipment in the station. Also it reduces the rack space required for film camera auxiliary equipment from three racks to two.

Another unit which has been completely redesigned is the sync generator. The new TG-2A Generator (for color and monochrome) provides improved performance and requires only one-third the space of the old Type TG-1A. Two of these new sync generators, a changeover switch, the frequency standard and the color subcarrier generator can now be housed in one rack.

The savings in rack space effected by these redesigns, plus the saving in eliminating the slide camera equipment, have reduced the equipment space needed for a complete color operation (all three steps) to approximately half that originally required. Where eleven racks previously were required for auxiliary equipment it is found that six (in some cases only five) will now suffice. This, together with the fact that only one camera-projector group is now required for film and slides (instead of two separate groups) should do much to

alleviate the space problem which confronts almost all stations.

### The New 3-Step Plan for Color

The changes in required equipment occurring as a result of equipment design changes, plus minor changes indicated by field experience, have been incorporated in a new "3-step" plan for color. The steps in the new plan are:

- Step 1*—Installation of equipment for telecasting network programs.
- Step 2*—Addition of equipment for telecasting color slides and color films.
- Step 3*—Addition of equipment for telecasting live color studio programs.

It will be noted that these steps are clearly defined. They permit a station to start on a modest basis with *Step 1* and to take additional steps whenever desirable. They have been carefully planned so that no unnecessary duplication or extra cost will be involved in doing this.

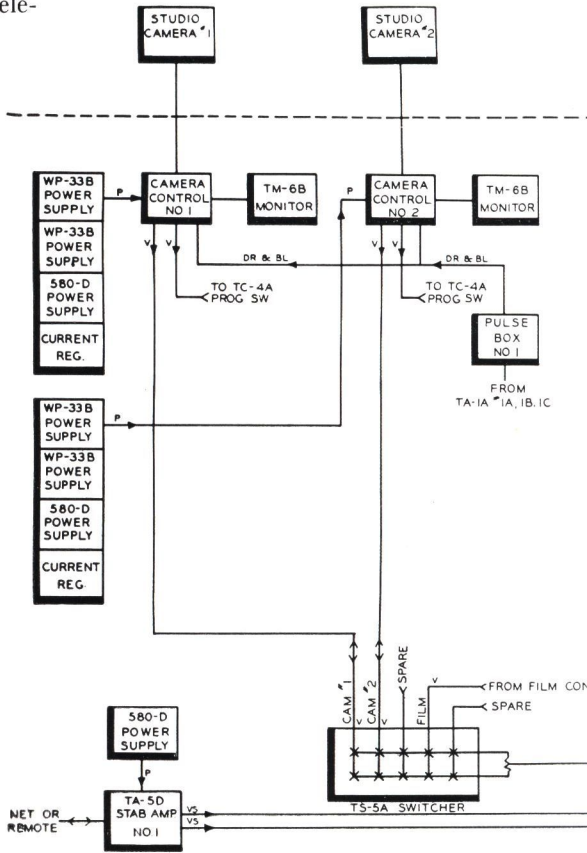
Each step is described in detail in the following pages. Included in these descriptions are lists of equipment. It should be noted that there are five groups of equipment. Three of these groups represent the particular equipment needed for each type of programming. The other two groups are the color bar and local color origination equipment group and the color test equipment group. The table (Fig. 2) indicates the equipment groups ordinarily needed for each step. However, in some cases the Color Test Equipment or the Color Bar and Local Origination Equipment may be

ordered separately, or in different steps. They are, therefore, listed separately here, as well as in RCA equipment proposals.

### Integration With Monochrome

It is felt that most stations will wish to keep their color programming facilities more or less separate from their monochrome facilities (at least during the transition period). However, smooth station

STUDIO



WP-33B POWER SUPPLY (MONO. CAM. NO. 1)	WP-33B POWER SUPPLY (MONO. CAM. NO. 2)	TA- 1A DIST. AMP.	BLANK
WP-33B POWER SUPPLY (MONO. CAM. NO. 1)	WP-33B POWER SUPPLY (MONO. CAM. NO. 2)	TG-2A SYNC. GENERATOR	TA-3A D.A.NO.2
580-D POWER SUPPLY (MONO. CAM. NO. 1)	580-D POWER SUPPLY (MONO. CAM. NO. 2)		TA-3A D.A.NO.3
CURRENT REGULATOR (MONO. CAM. NO. 1)	CURRENT REGULATOR (MONO. CAM. NO. 2)		TA-3A D.A.NO.4
WP-33B POWER SUPPLY (FILM CAMERA MONO.)	WP-33B POWER SUPPLY (TA-3A'S)	BLANK	TA-5D NO.1 STAB. AMP. (NET)
WP-33B POWER SUPPLY (FILM CAMERA MONO.)	WP-33B POWER SUPPLY (PV MON)	580-D POWER SUPPLY (STAB. AMP. NO. 1) NET	BLANK
		580-D POWER SUPPLY (STAB. AMP. NO. 2) LINE	VIDEO JACK PANEL
		580-D POWER SUPPLY (TA- 1A)	VIDEO JACK PANEL
			BLANK
			TA-5D NO.2 STAB. AMP. (LINE)
			FILM CAMERA CONTROL CHASSIS
			FILM CAMERA DEFLECTION CHASSIS

FIG. 3. Arrangement of the rack-mounted units of a typical monochrome station of the type indicated in the block diagram of Fig. 4. On following pages are similar rack diagrams showing how the rack-mounted color equipment units of each step may be added to the rack assembly shown here. It should be noted that these rack layouts are intended to indicate the general approach only. Details will vary according to individual station requirements.

DISTRIBUTION AMPLIFIER  
POWER SUPPLIES



TA-3A #2  
TA-3A #4



TA-1A #1



DR & BL



operation will require some provision for switching between the two facilities. This means that parts, at least, of the switching system, and some items associated with it (such as stabilizing amplifiers, distribution amplifiers, etc.) will have to function for both monochrome and color. Other items, such as sync generator, should preferably be able to function in emergency for either color or monochrome. If a microwave link

to the transmitter is used it must, of course, be good for either service. To provide these "cross-overs" requires a certain amount of integration. To show how this can be worked out the color equipment steps described in the following pages have been related to a typical monochrome equipment setup such as might be found in an existing station. As each succeeding color equipment group is added a func-

tional diagram is shown which includes not only the color equipment (at that stage) but also the original monochrome equipment. A simplified diagram of the monochrome setup which serves as a starting point is shown in Fig. 3. While existing stations will differ from this in some degree it is felt that the general arrangement is sufficiently typical to illustrate the basic considerations.

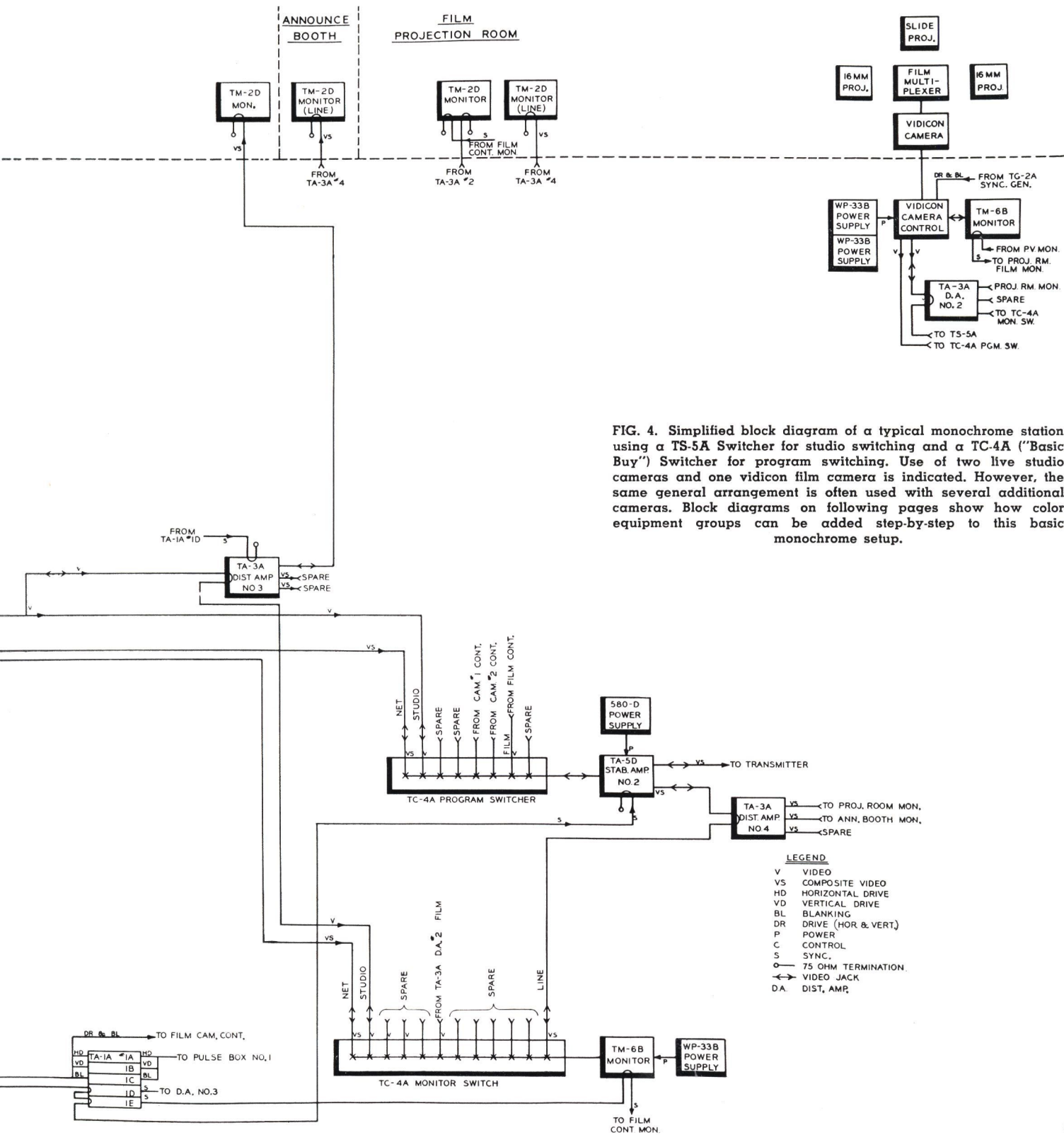


FIG. 4. Simplified block diagram of a typical monochrome station using a TS-5A Switcher for studio switching and a TC-4A ("Basic Buy") Switcher for program switching. Use of two live studio cameras and one vidicon film camera is indicated. However, the same general arrangement is often used with several additional cameras. Block diagrams on following pages show how color equipment groups can be added step-by-step to this basic monochrome setup.



# STEP 1 - Installation of Equipment for Telecasting of Network Color Programs (No Local Origination)

Many television stations have made a start in color programming by installing just the equipment needed for telecasting color programs received from the network. The amount of equipment required is relatively small and consists of units all stations will require, regardless of whether they start with just this step or simultaneously install more elaborate color programming facilities.

A list of major equipment items for *Step 1* is shown in the box below. This consists of two equipment groups. The first includes all video equipment (amplifiers, phase-correcting networks and monitors) needed to transmit color. The second includes the test equipment items necessary to be certain of high-quality operation.

## Equipment Modifications at Studio

The equipment listed in *Step 1* assumes that no additional equipment will be needed at the studio. If the existing mono-

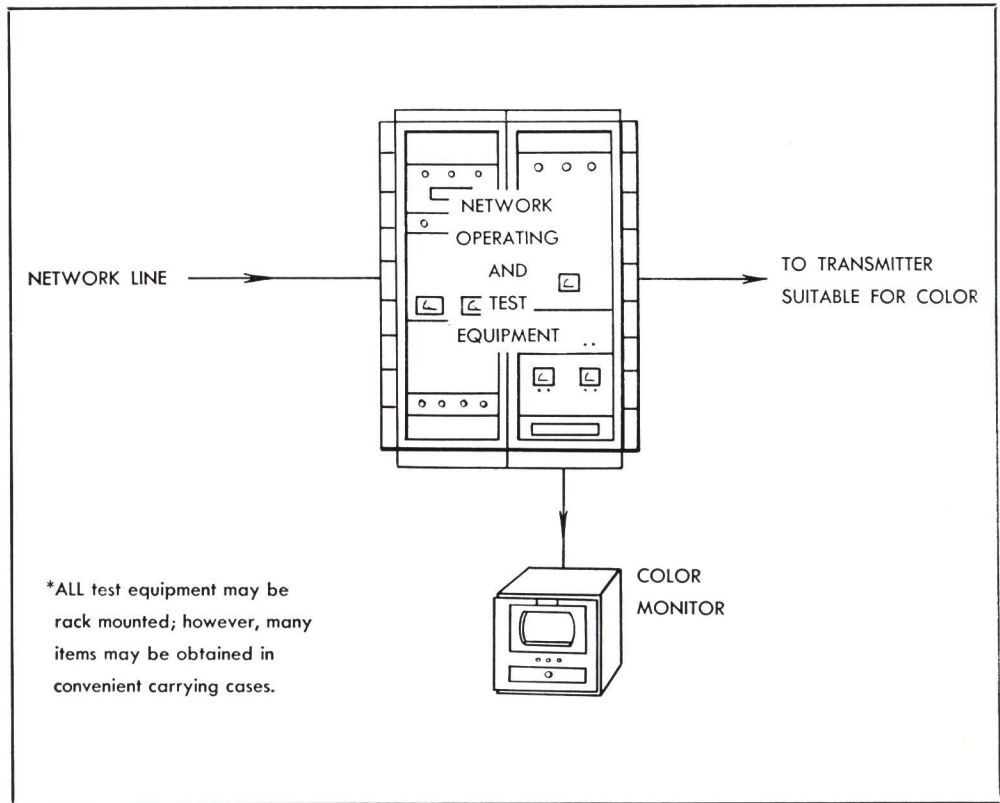


FIG. 5. The major equipment items added in Step 1 include rack-mounted video and test equipment, and a color monitor which may be either rack or cabinet mounted. Ordinarily this equipment will be located in the transmitter control room. Use of two racks is indicated but in many instances one rack will provide sufficient space to house all the equipment.

## Step #1 Equipment

### COLOR NETWORK OPERATING EQUIPMENT

Qty.	Description
1	Type TA-7B, Color Stabilizing Amplifier
1	580-D Power Supply
1	Type TM-10B Color Monitor
1	Set of Phase Correction Equalizers
1	Color Correction Kit for Demodulator
3	TA-3A Distribution Amplifiers
1	WP-33-B Power Supply
2	Type BR-84 Cabinet Racks
1	Type WA-8A, Color Stripe Generator

### COLOR TEST EQUIPMENT FOR NETWORK OPERATION

1	Type WA-7B Linearity Checker
1	Type WA-6B Color Signal Analyzer
1	Type WA-4A Burst Controlled Oscillator
1	Type WR-61A Service Color Bar Generator (for adjusting monitors and receivers)
1	WA-9A Calibration Pulse Generator
1	Type TO-524-D Television Oscilloscope
1	Type 500 Scopemobile for MI-26500
1	*Type WA-3B Grating and Dot Generator

\* Grating and dot patterns are included as output signals of the TG-2A Sync Generator. Therefore, the WA-3B is not needed unless a separate source of signal may be desired.

chrome equipment is arranged as shown in Fig. 4 (preceding page) it can be used for color with very minor modifications. These would consist of minor changes in the two stabilizing amplifiers (color modification kits are available for the RCA TA-5B, TA-5C and TA-5D) plus checking, and possibly minor changes in, interconnecting lines. The Type TC-4A Switcher shown is satisfactory for color switching, as are RCA Types TS-5A, TS-10A, TS-11A and TS-20A (also the MI-26277 Monitoring Switch). If other types are used they will require checking and possible modification.

## Video Equipment at Transmitter

A complete set of video input equipment for the transmitter location is included in *Step 1*. The suggested arrangement of this equipment is shown in Fig. 6. The composite color signal from the studio (or directly from the net) is fed first to a Type TA-3A Distribution Amplifier. This distribution amplifier, which was particularly designed for color systems, provides sending end termination, variable gain from 0 to 2, and a sync addition circuit. (The

older TA-1A Distribution Amplifier can be used for color if two sections are paralleled to provide necessary sending end termination).

From the distribution amplifier the color signal is fed to a Type TA-7B Color Stabilizing Amplifier. This amplifier differs from the monochrome models (5B, C, D) in that it is designed to pass the color sub-carrier "burst" and in addition incorporates a non-linear amplifier. Its use at this point in the system is necessary in order to provide setup and white stretch adjustments for proper operation of the transmitter.

## Phase Correction Equalizers

In order to comply with the FCC standards, two phase correction equalizers must be installed in the input line to the transmitter as shown in Fig. 6. These provide a calculated amount of phase predistortion to make up for phase distortion in the rest of the system. The low-frequency network compensates for the phase shift in the vestigial side-band filter. The high-frequency network compensates for the defi-



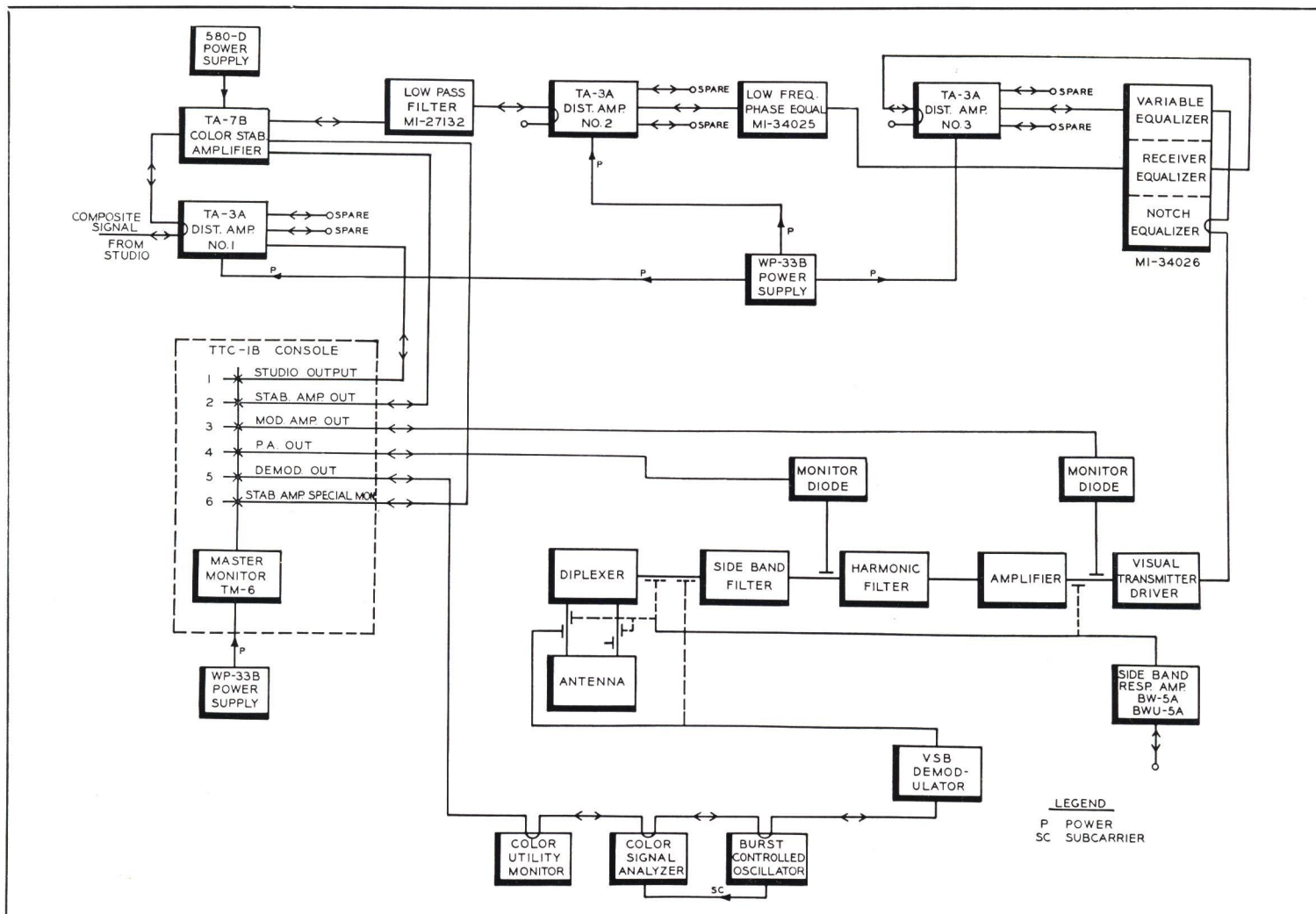


FIG. 6. Simplified block diagram showing how Step 1 color equipment can be integrated with existing monochrome equipment at the transmitter location. The several components of the transmitter and antenna systems are indicated as separate blocks in order to show the arrangement of switching and monitoring circuits which are needed for good color operation.

ciency in high-frequency response of the receiver. This equipment is rack mounted external to the transmitter with other items such as the color stabilizing amplifier and distribution amplifiers.

### Monitoring Equipment

In order to be able to visually monitor the picture transmitter, a Type TM-10B color monitor is required. The color monitor must be fed from a high-quality demodulator. Most stations presently have either a BW-4A or BWU-4A Demodulator. With minor modifications either of these may be used. A demodulator conversion kit is supplied as part of *Step 1* equipment for making the necessary changes. A standard monochrome monitor is used (in addition to the tri-color monitor); however, this unit is not listed in the "required equipment" since the monitor which is part of the standard transmitter control console can be used for this purpose.

### Color Stripe Generator

In areas where color programs are tele-

cast only occasionally it is difficult for servicemen to check color receiver installations. Most servicemen have a portable bar and dot generator with which they can check the operation of the color receiver itself. However, if there is no color signal on the air they are unable to check the antenna and transmission line. In color transmission it has been found that in some cases multi-path effects have a tendency to cancel the color burst. Faulty transmission lines also sometimes result in loss of color. For this reason the serviceman should make an "on-air" check of every color installation.

Stations can help the serviceman by using a WA-8A Color Stripe Generator. This unit, when inserted in the video line feeding the transmitter, generates two color bursts, one at the beginning and one at the end of each horizontal scanning line. This produces a vertical yellow-green stripe at the right-hand edge of the monochrome picture. The stripe is imperceptible on a monochrome receiver but is easily observed

on color sets by adjusting the horizontal frequency control until the color circuits of the receiver are actuated by the burst at the beginning of each line.

By using the WA-8A stations can transmit color information all day long without interfering with regular commercial monochrome operations. This enables the serviceman to determine that the transmission path is passing the color burst and that the overall installation is satisfactory.

### Equipment Cabinet Racks

Two 84-inch cabinet racks are included in the *Step 1* equipment list (box on opposite page). In most cases the equipment units added in *Step 1* will all be located at the transmitter. If there is some existing rack space available probably only one additional rack will be needed for the color equipment. The second rack may be deleted or it may be installed at the studio for color test equipment or color video distribution units which will be added as the color operation grows.



# Color Test Equipment for Step 1

High-quality color telecasting requires close adherence to carefully specified transmission standards. This can be accomplished only with an adequate amount of test equipment of the proper type. Because the color system is much more complex than monochrome a relatively large amount of test equipment is needed. Much of it is of new and unique design.

Test equipment is used in a color station for three important purposes. These are: (a) adjusting color origination equipment, such as studio and film cameras, colorplexers, etc.; (b) checking "system" elements such as distribution amplifiers, stabilizing amplifiers, switching equipment, S-T-L's and the main transmitter; (c) adjusting color monitoring equipment.

The first operation does not occur in a Step 1 color station since no "origination" equipment is involved. (Thus the WA-1D Color Bar Generator, which is the key unit for this purpose, is not included in required equipment until Step 2.)

A Step 1 station will have to check all system units and adjust its color monitors for proper operation. To do this, it will require nearly as many different test equipment units as a larger installation. For this reason it is strongly recommended that every station purchase a fairly complete set of test equipment as a part of its first step in color. The recommended units are listed in the box on Pg. 82, and are described below.

## How It Is Used

Fig. 7 shows in chart form the test equipment setups necessary to make all basic color equipment measurements. The list of equipment included in Step 1 includes only the items necessary to make the tests shown in the top four boxes. The lower two boxes are included to show how the same units are used later (with the addition of a color bar generator) to make adjustments on local origination equipment.

Before attempting to put color pictures on the air every piece of equipment in the station system should be checked to be sure the transmission characteristics are satisfactory. Each piece of equipment through which the signal must pass introduces some distortion. Even though this distortion may be very small, it is still there and the cumulative effects of many units in series may well prevent the proper transmission of color video. Four param-

eters must be contained well within reasonable limits. These parameters are amplitude vs. frequency, phase vs frequency, differential gain, and differential phase. Differential gain is defined as the change in gain measured against the increase in signal amplitude. Differential phase is defined as the change in phase shift measured against signal amplitude.

Four instruments are provided for the precise measurement of these parameters. They are the linearity checker, the color signal analyzer, the burst controlled oscillator and the television oscilloscope.

## WA-7B Linearity Checker

The differential gain characteristics of any unit of the system, or the system itself, can be measured with the WA-7B Linearity Checker and the TO-524-D Oscilloscope. The linearity checker has an output signal consisting of a low-frequency step wave with an RF signal superimposed on it. This signal is fed into the system under test and the output is observed on the 524-D oscilloscope after being passed through a high-low filter which is a part of the WA-7B. When the filter switch is in the high position the step wave is removed from the output signal and only the RF components remain. Any change in amplitude of the RF envelope from beginning to end of sweep indicates differential gain distortion and the percent change in amplitude of the RF pattern is the measure of differential gain distortion in the system.

## WA-6A Color Signal Analyzer

The WA-6A Color Signal Analyzer is used with the linearity checker and scope (as shown in second box, Fig. 7) to measure the subcarrier phase shift and the differential phase of the system. Two input signals are required for operation of the Color Signal Analyzer: (1) the composite color signal to be measured and (2) a continuous reference subcarrier signal. For making phase measurements, both these signals are provided by the Linearity Checker. In Steps 2 and 3 the Color Signal Analyzer is used (in conjunction with the WA-1D Color Bar Generator) for precise alignment of the colorplexers (as shown in fifth box, Fig. 7).

## WA-4A Burst Controlled Oscillator

In many instances a source of subcarrier for use with the signal analyzer may not be available such as at a transmitter loca-

tion remote from the studio facilities. To measure the four parameters involved in color transmission of a studio transmitter link, it would be necessary to have available a source of subcarrier. The WA-4A Burst Controlled Oscillator fulfills this requirement. The color burst is picked off the incoming signal and used to precisely control a crystal oscillator, the output of which is a continuous subcarrier signal. This item is not needed if the studio and transmitter are at the same location and if test measurements are not required at a point remote from the location of the Linearity Checker.

## WA-3B Grating and Dot Generator

The WA-3B Grating and Dot Generator is used (as shown in box four, Fig. 7) to adjust the deflection linearity of any monitor by means of the grating pattern signal output. This signal produces a grid pattern on the monitor consisting of horizontal and vertical lines. Any difference in the spacing of the lines over the face of the monitor represents non-linear deflection.

The dot output of the WA-3B is used for checking the beam convergence adjustment of color monitors. The dots are really rectangles about 9 lines in each dimension, but adjustable in size to suit the individual using the instrument. If the convergence is not set properly, dots of three different colors appear displaced from one another by the divergence of the respective beams. If properly adjusted, only white dots appear on the monitor with a minimum of color fringing.

Grating and dot patterns similar to those generated by the WA-3B are included as output signals of the TG-2A Sync Generator. Therefore, the WA-3B is not needed with the TG-2A unless a separate source of signals is desired.

## WA-9A Calibration Pulse Generator

This unit, although not used in the tests shown in Fig. 7, is strongly recommended as a part of every color station's test equipment. Designed for the accurate calibration of studio signal voltages it can be installed in a television system as one input to a switcher or it may be made available at a jack panel so that it can be patched to any part of the system as desired.

For permanent installation, it is convenient to have the WA-9A installed in master control and on one cable fed to all



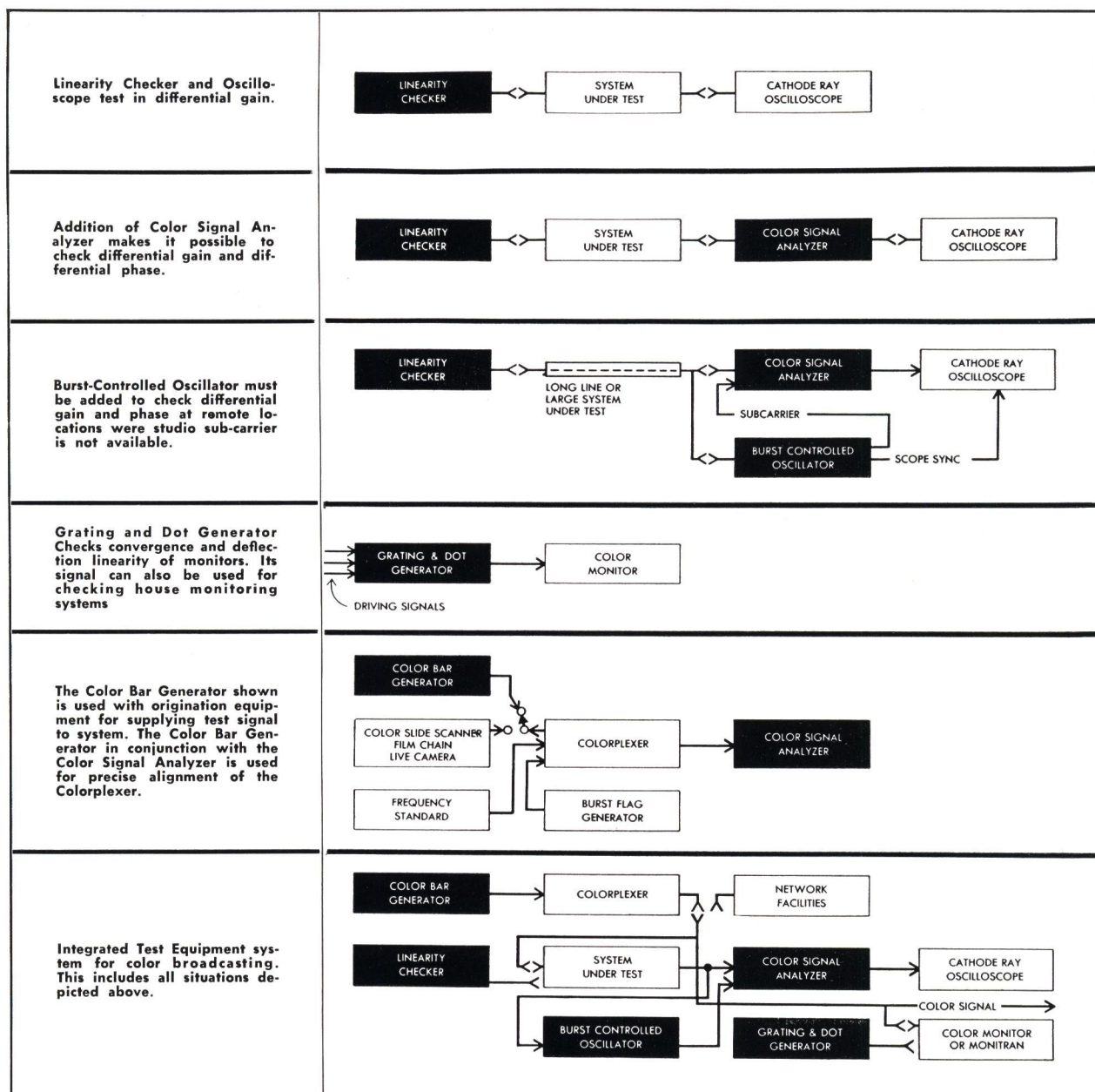


FIG. 7. Chart showing how various units of color test equipment (solid black blocks) are used to test the several parameters of the system. The tests indicated in the top four boxes are required in all steps and can be made with the test equipment units listed in the box on page 82. The tests indicated in the lower two boxes are required in Steps 2 and 3. For these a color bar generator is required in addition to the original list of test equipment.

studios or other sources of signal so that operating personnel can have it available at any time. It can also be used to calibrate all master monitors and oscilloscopes by merely substituting it for the normal input signal. When it is used as a video input to a switcher, it can be rapidly switched in and out for precise matching of video signals from various sources.

The WA-9A is also very useful in setting up the processing amplifier in the 3-V color film chain. Here the WA-9A makes possible an accurate match between all three color channels. Switches are provided on the processing amplifiers for rapidly switching between the signal voltages and the calibration pulse signal.

### TO-524-D Oscilloscope

The 524-D oscilloscope is an instrument designed especially for television applications. The wide bandwidth coupled with the precisely controlled sweep circuits provide for observing almost every conceivable point of interest in a composite signal. The trigger circuits make it possible to examine very minutely the vertical synchronizing interval as well as each horizontal line. This is useful when determining the position of the burst with respect to horizontal sync and blanking signals.

### WA-2B Video Sweep Generator

This unit is not included in the Step 1 list of equipment because most stations already have one. The WA-2B is a very

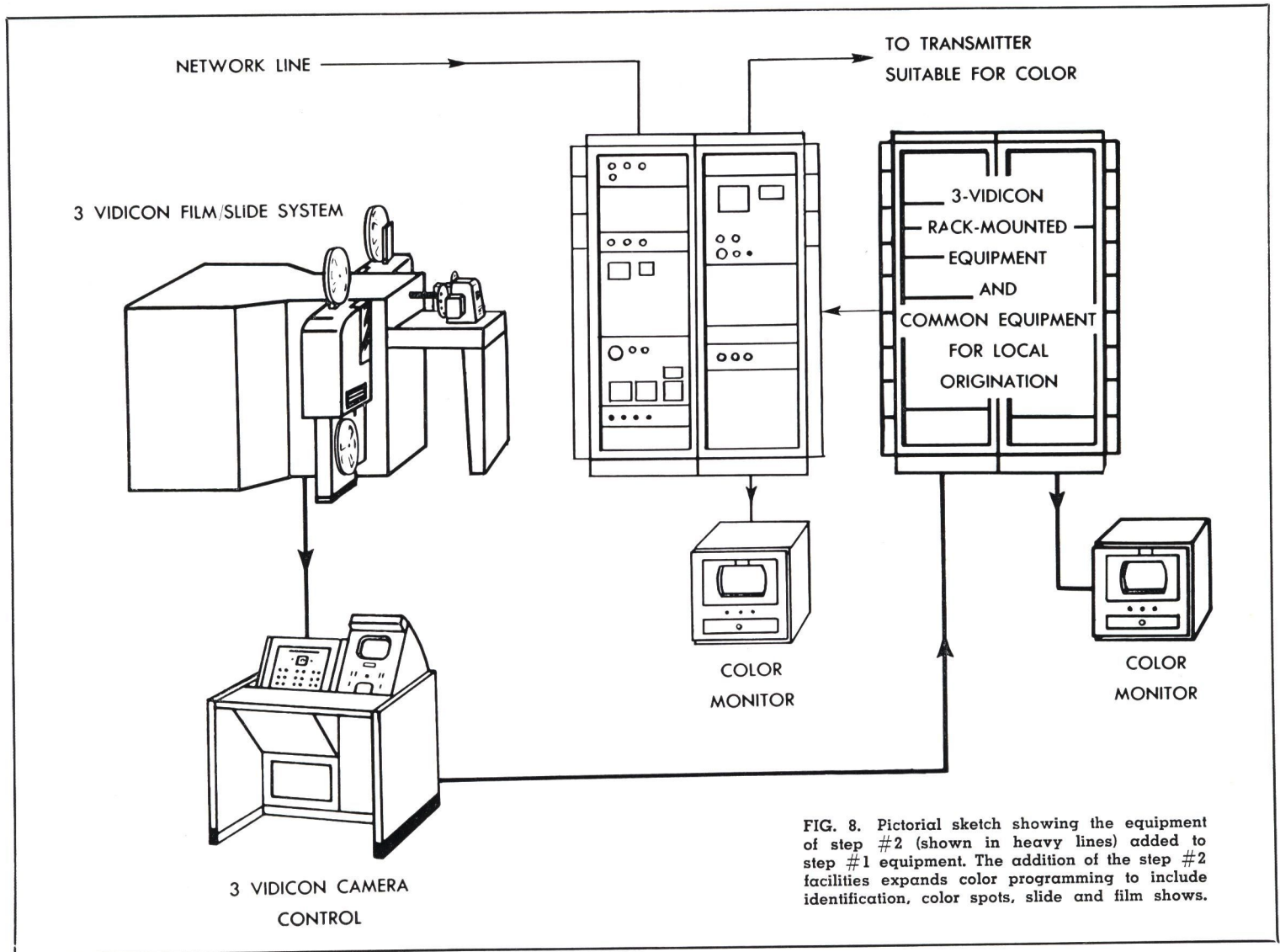
versatile instrument which has a sweep output from 100 kc to 10 mc. It is used for determining amplitude-frequency characteristics of the system.

### WR-61A Service Color Bar Generator

This unit, which should not be confused with the WA-1D Color Bar Generator furnished in Step 2, is a portable service-type instrument designed to be used by servicemen in adjusting color receivers in home installations. It produces on the color receiver screen a series of vertical color bars, ten in number and evenly spaced over the spectrum. It cannot be used for generating "on-air" signals. However, it is very useful in Step 1 for making quick checks on color monitors and receivers.



# STEP 2-Addition of Equipment For Telecasting Color Slides and Color Films from Your Own Studios



For most stations the second step in color will be the addition of equipment for telecasting color slides and color film.

Color films provide the simplest means of originating color programs at the local level. It is expected that before long many of the syndicated film programs will be made available in color. Color films are also of great interest to the advertiser. One of the big attractions of color is the much greater interest it will lend to product advertising. At the present time many "commercials" are supplied on short film strips. With the growth of color this trend will undoubtedly increase. In addition, there are many short subjects that are available in 16mm color film which program departments will be anxious to use.

Availability of equipment for telecasting their own color slides will enable stations to make station breaks in color (definitely desirable when telecasting network programs in color) and to sell color "spots" to local and national advertisers. Color slide programs are relatively easy to make up because 35mm color transparencies can be used as color slides.

## Equipment Required

The equipment for televising color slides and films does not require a large amount of additional space and operating cost is reasonable. Thus it represents a much smaller and less expensive step than installation of live studio color. The arrangement of such equipment is indicated pictorially in Fig. 8. A list of the equipment

items which must be added (in order to make a *Step 1* station into a *Step 2* station) is shown in the box on the opposite page.

It will be noted that this equipment is divided into two groupings. The first group, referred to as "Color Bar and Local Origination Equipment", includes the units necessary to generate color sync signals locally plus a studio-type color bar generator and a colorplexer. The second group includes the film/slide camera chain plus associated projectors, multiplexer, etc.

A station which telecasts only network color (*Step 1*) does not require a local sync generator because the color signal received over the network line is a complete



composite signal (i.e., it includes all necessary sync pulses as well as picture signals). However, when a station decides to start local color programming, (no matter how simple) the color sync signals, as well as the color picture signals, must be generated locally. Thus before a station can start color slide programming it must install its own color sync generating equipment.

The color bar generator is required in order to correctly adjust the colorplexer used with film and studio cameras. Thus it is a necessary prerequisite to Step 2 operation. It also provides a convenient means of generating a color test signal which is very useful in testing and measuring of studio and transmitter systems. In addition the color bar signal can be used as an on-the-air signal during periods when regular commercial transmission is not in progress so that servicemen may utilize this signal for the adjustment of color receivers.

In order to familiarize and train station personnel in advance with color TV equipment and principles, some stations may wish to install the color bar generator and local origination equipment well ahead of the film and slide camera facilities. In order to show how this may be done the following description of the Step 2 equipment has been divided into two parts. Part I covers

installation of the Color Bar and Local Origination Equipment only. Part II describes installation of the film and slide camera chain, projectors and associated equipment.

**STEP 2 — PART I**  
**Color Bar and Local Origination Equipment**

The list of equipment units included in this grouping is shown in the box below. The functional arrangement of these units (when added to the station described in Step 1) is shown in Fig. 12. All of these equipments have been described in detail elsewhere. However, a short description is included here in order that overall operation may be better understood.

**Color Sync Signal Requirements**

Color sync signals differ from monochrome sync signals in two major respects. One is that they have a "burst" of subcarrier frequency (3.6 mc) superimposed on the "back porch" of the horizontal sync pulse. This "burst" is supplied by a Burst Flag Generator.

The second difference in color sync signals is that they are controlled by the subcarrier oscillator (rather than the 60-cycle supply). This thermostatically controlled 3.6 mc oscillator is contained in the Color Frequency Standard.

Although these units could be used with the sync generator originally installed for monochrome transmission this is not recommended because changing from monochrome to color, or vice versa, would cause a break in the sync signals fed the receiver. For this reason a new TG-2A Sync Generator has been included in the list.

**Color Frequency Standard (MI-40201)**

This unit provides the color synchronizing information necessary for proper color operation. The subcarrier output of the frequency standard is fed to each colorplexer where it is modulated with the chroma information. Another output from the frequency standard is used to synchronize the sync generator to the frequency standard. The frequency of this output is the subcarrier frequency divided by 455/2. This frequency has been selected to eliminate cross-talk between the horizontal scanning frequency and the color subcarrier.

**Burst Flag Generator (MI-40202-A)**

This unit is used for keying in the color subcarrier burst. Its output consists of a series of horizontal pulses which key the burst of subcarrier onto the back porch of the blanking signal in the colorplexer. These pulses are suppressed during the vertical synchronizing interval so that no burst is keyed at this time.

Step #2 Equipment	
COLOR BAR AND LOCAL ORIGATION EQUIPMENT	
Qty.	Description
1	Color Frequency Standard
1	Burst Flag Generator
2	Type 580-D Power Supplies
1	Type TG-2A Studio Sync Generator (includes Dot and Gating outputs)
2	Type BR-84D Cabinet Rack
1	Type WA-1D Studio Color Bar Generator
1	TX-1B Colorplexer
1	Sync Generator Changeover Switch
1	Changeover Switch Remote Control Panel
1	Aperture Compensator (for TX-1B)
3-VIDICON 16MM COLOR FILM AND SLIDE EQUIPMENT	
1	Type TK-26A Three-Vidicon Color Film & Slide Camera Chain (Includes: camera proper, camera auxiliary, control panel, processing amplifier, colorplexer, master monitor, color monitor, power supplies, console housings and cables)
1	Type TP-12 Three-Vidicon Multiplexer, including control panel
2	Type TP-6BC Film Projectors, 16mm, including pedestal, lens and accessories
1	TP-3C Dual Disc Slide Projector
1	TA-3A Video Distribution Amplifier
1	TA-4A Video Distribution Amplifier
2	Type BR-84D Cabinet Rack

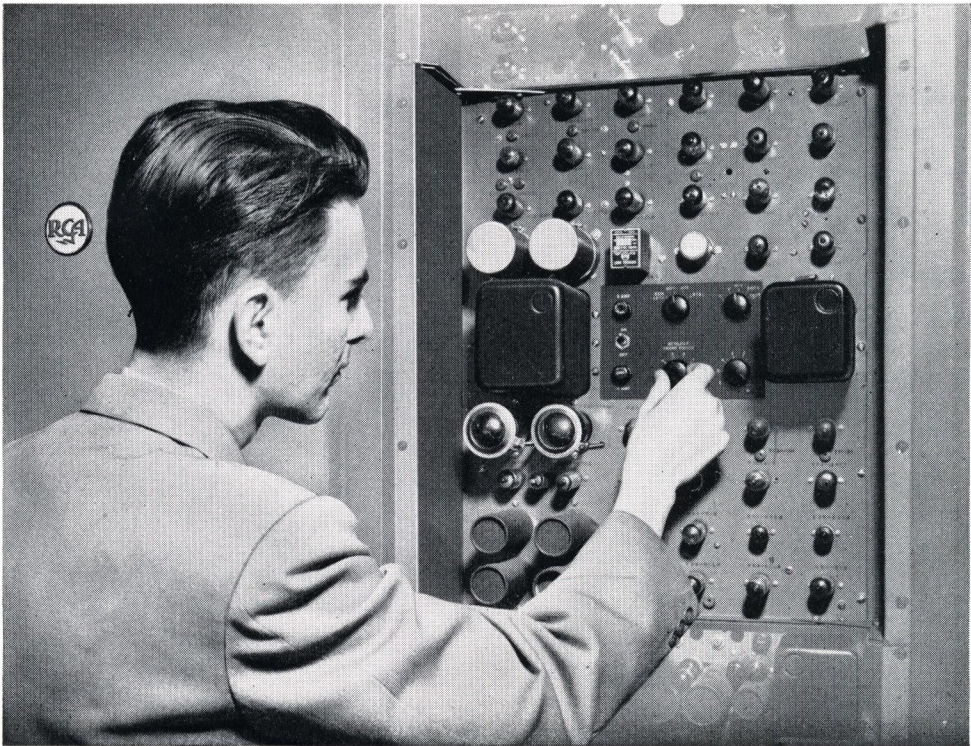


FIG. 9. View of the advanced design Sync Generator which has reduced the rack space to one-third that occupied by former designs. Providing extra stability, small size and combining all sync functions in a single chassis, it is ideal for color TV applications. It includes a built-in Genlock, dot generator, grating generator and regulated power supply.



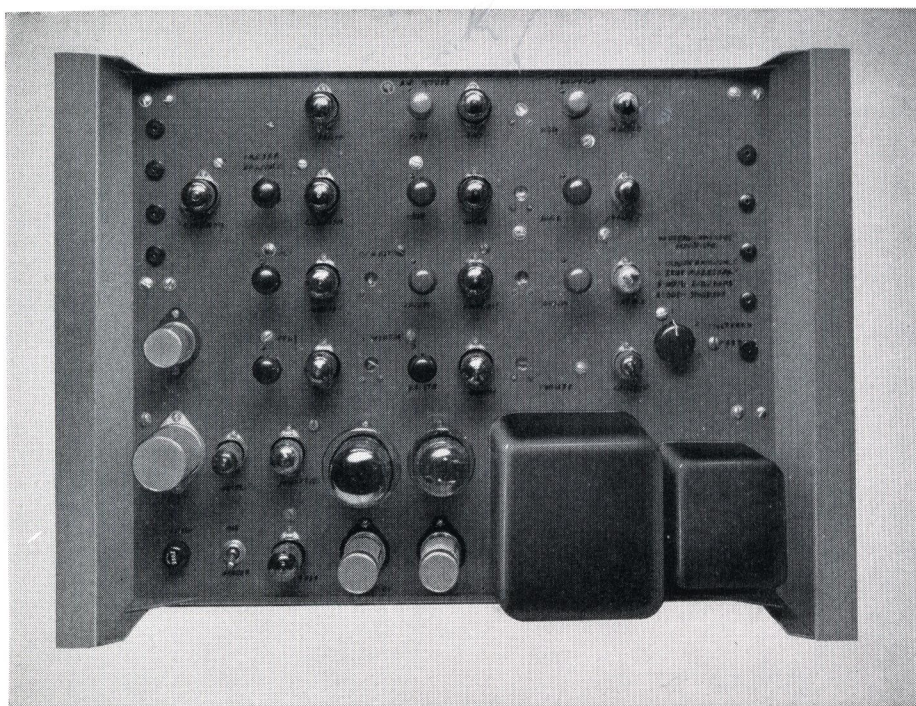


FIG. 10. The Color Bar Generator is required for steps #2 and #3 and is just as important to Color TV as the Monoscope Camera is for Monochrome. The Color Bar Generator provides a standard signal free of residual imperfections.

### TG-2A Sync Generator

The TG-2A is an entirely new Synchronizing Generator designed especially for color operation. Miniature tubes and other miniaturization techniques have been used to reduce the size of this new unit to approximately one-third that of previous models. Providing extra stability, small size and combining all sync functions in a single chassis, it is ideal for color TV applications. It includes a built-in Genlock, dot generator, grating generator and regulated power supply.

### Sync Generator Changeover

Most stations operating today are equipped with one or more TG-1A Generators. It is possible to modify the TG-1A Sync Generator for color operation by means of modification kit, MI-40405. This kit contains all of the necessary parts and a complete set of instructions for making this modification. By modifying the station's original generator for color it is possible to use either it or the newly installed sync generator for either monochrome or color. This provides for emergency opera-

WP-33B POWER SUPPLY (MONO CAM. NO.1)	WP-33B POWER SUPPLY (MONO CAM. NO.2)	TA-1A DIST. AMP.	BLANK TA-3A D.A. NO.2 TA-3A D.A. NO.3 TA-3A D.A. NO.4	COLOR BAR GENERATOR
WP-33B POWER SUPPLY (MONO CAM. NO.1)	WP-33B POWER SUPPLY (MONO CAM. NO.2)	TG-2A SYNC. GENERATOR	TA-5D NO.1 STAB. AMP MODIFIED (NET)	APERTURE COMP.
580-D POWER SUPPLY (MONO CAM. NO.1)	580-D POWER SUPPLY (MONO CAM. NO.2)	BLANK	BLANK VIDEO JACK PANEL VIDEO JACK PANEL BLANK	TX-1B COLORPLEXER (COLOR) BARS
CURRENT REGULATOR (MONO CAM. NO.1)	CURRENT REGULATOR (MONO CAM. NO.2)		TA-5D NO.2 STAB. AMP MODIFIED (LINE)	COLOR SIGNAL ANALYZER
WP-33B POWER SUPPLY (FILM CAMERA MONO)	WP-33B POWER SUPPLY (TA-3A'S)	580-D POWER SUPPLY (STAB. AMP. NO.1) NET	FILM CAMERA CONTROL CHASSIS	LINEARITY CHECKER
WP-33B POWER SUPPLY (FILM CAMERA MONO.)	WP-33B POWER SUPPLY (PV MON.)	580-D POWER SUPPLY (STAB. AMP. NO.2) LINE	FILM CAMERA DEFLECTION CHASSIS	BLANK
		580-D POWER SUPPLY (TA-1A)		580-D POWER SUPPLY (COLORPLEXER) TEST

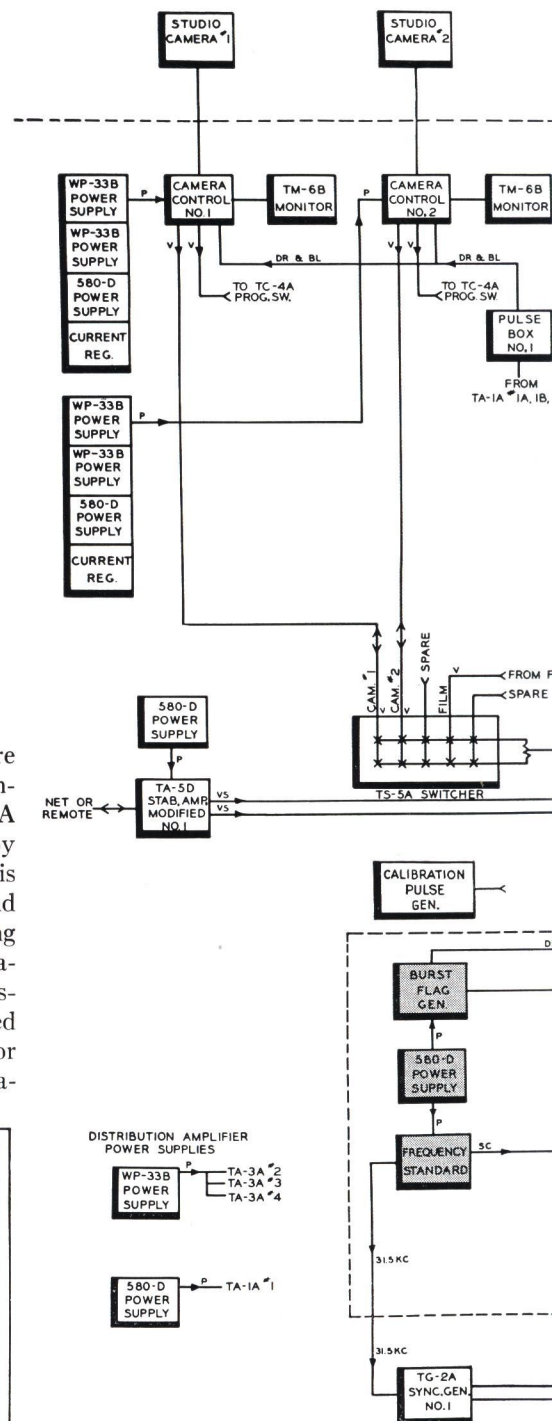


FIG. 11 (left). Rack layout for the equipment shown in Fig. 12. As shown here the color units added in Part I of Step 2 are all mounted in one rack. If a new TG-2A Sync Generator is added at this time (as suggested in the equipment list) it will be necessary to add a sixth rack.



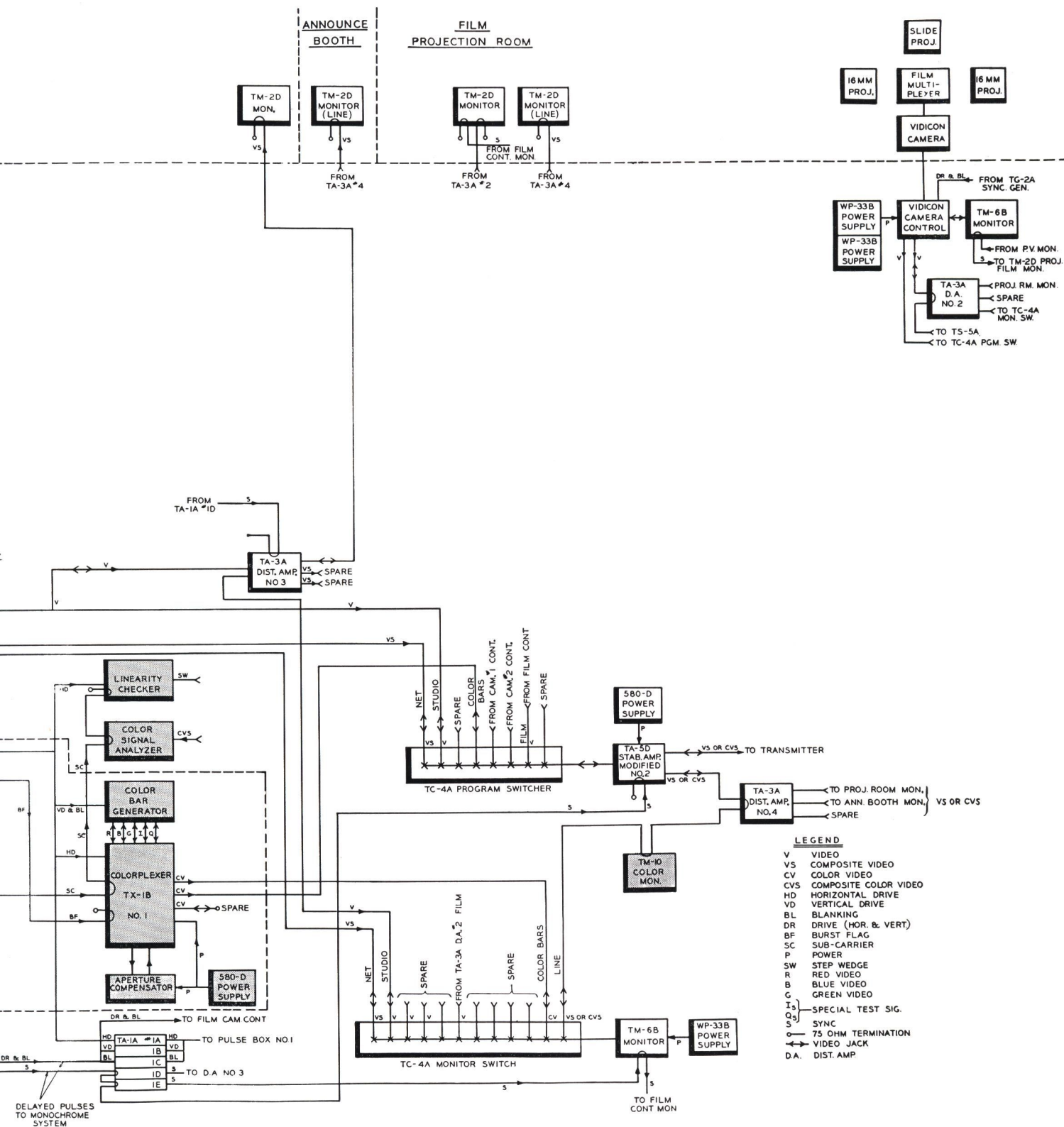


FIG. 12. Block diagram showing how the Color Bar and Local Origination equipment added in Part I, Step 2, can be integrated with the monochrome and color facilities of a Step 1 station. The units added in this step are indicated by shaded blocks. Only one TG-2A Sync Generator (the one originally installed for monochrome) is shown in this diagram. A second TG-2A is included in the list of equipment and is recommended when the color bar pattern is to be put on the air. Its use provides for easier change between monochrome and color programming, as well as providing a spare for emergency. The block diagram on page 93 shows how the second sync generator may be inserted in the system. It will be noted that the output of the TG-2A Sync Generator must feed delayed pulses to the monochrome system if smooth switching between color and monochrome is to be accomplished. The proper handling of pulse signals in a color system will be discussed in detail in a forthcoming article.



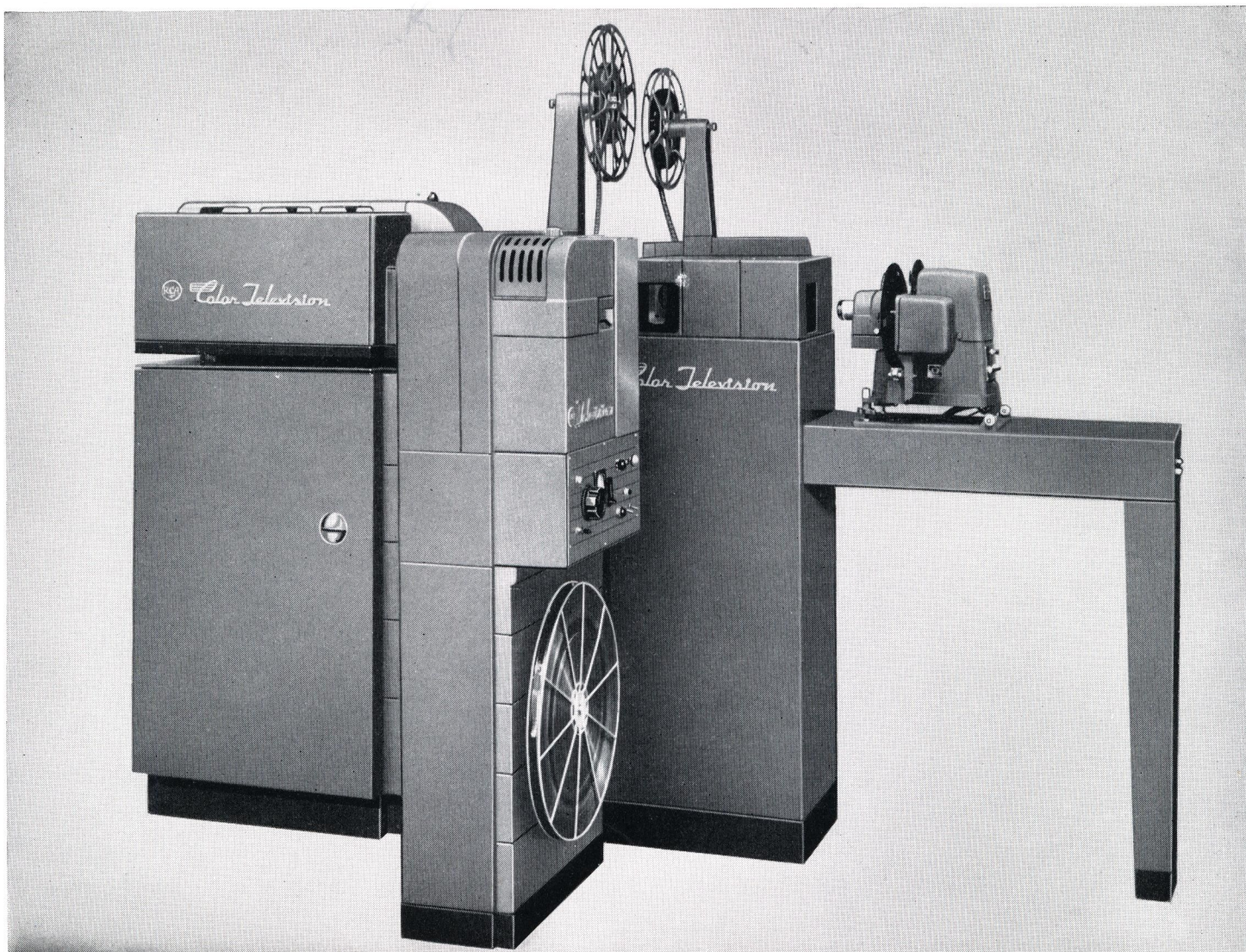


FIG. 13. Grouping of camera and projector equipment for telecasting color slides and films. At the left is the TK-26A "3-V" Color Film Camera; in the center is the TP-12 Optical Multiplexer; at the right is a TP-3C Dual Slide Projector; in the foreground is one TP-6BC 16mm Film Projector; a second TP-6BC is on the other side of the multiplexer and only the reel-arm is visible.

tion in case of failure in either while on the air. To facilitate changeover a special Sync Generator Changeover Switch is included in the list of equipment as well as a Remote Panel for controlling the switch from the console.

#### WA-1D Studio Color Bar Generator

The WA-1D, when fed into a standard color system which includes a TX-1B Colorplexer, produces a standard color signal pattern containing bars of various identified colors (white, yellow, blue, green, cyan, magenta, purple) plus patterns corresponding to I and Q signals. This signal pattern, which corresponds somewhat to that of the Monoscope Camera in monochrome, is of great usefulness in checking the whole color system. In conjunction with the signal analyzer it is used for precise alignment of the colorplexer modulator circuits. As a source of color signal for

routine measurements throughout the system it is unsurpassed.

The WA-1D Generator has five output channels—green, red, blue, I and Q. These outputs are fed to corresponding inputs on the RCA TX-1B colorplexer. The matrixing section of the colorplexer combines these signals and feeds them to the I and Q modulators at the proper polarity and amplitude to produce a colorplexed bar signal at the output of the colorplexer.

The test pattern from the color bar generator can be used most effectively by viewers in their homes as well as by station engineers and servicemen. In order to adjust his set for best color balance, the viewer merely has to adjust the color or chroma control until the color bars in the top row are vivid and pleasing to the eye. Then he must adjust the phase or hue control to achieve the best yellow hue in the second bar from the left. If the hue control

is out of adjustment on one side or the other, the yellow bar will appear either greenish or too orange. If the yellow bar is set properly in this way, all the other colors normally fall into correct adjustment.

#### TX-1B Colorplexer

The TX-1B Colorplexer is the "heart" of the RCA Color system. It performs all the matrixing and multiplexing operations necessary to process the red, green, and blue signals provided by a color camera to produce a signal conforming to the FCC signal specifications.

The colorplexer has inputs for color signal sources such as a color bar generator, a live camera, or a film chain. A switch on the colorplexer enables the operator to switch between the live or film camera and the bar generator. An automatic "carrier balance" unit which largely eliminates color "drift" problems is furnished with each colorplexer.



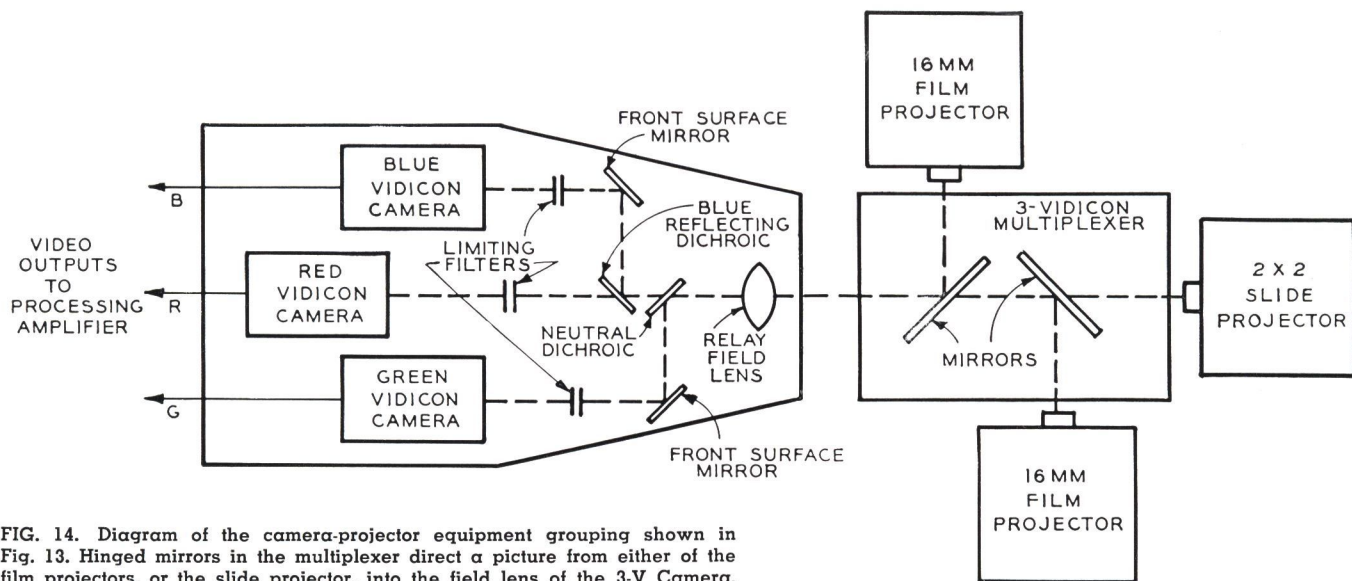


FIG. 14. Diagram of the camera-projector equipment grouping shown in Fig. 13. Hinged mirrors in the multiplexer direct a picture from either of the film projectors, or the slide projector, into the field lens of the 3-V Camera. Position of mirrors can be controlled from a remote point thus allowing push-button selection of picture sources. Dichroic mirrors and color filters in the 3-V camera divide the light into three color components and direct these components into three vidicon cameras as shown. Registration is relatively easy to achieve and the system is very stable in operation.

## STEP 2 — PART II

### Color Film and Slide Equipment

The major equipment units needed for originating color slide and film pictures are listed in the lower part of the box on Pg. 87. The list includes not only the 3-V Camera Chain but also a multiplexer, two film projectors, a slide projector and video distribution equipment. The functional arrangement of this equipment with the monochrome equipment, and the color equipment installed in previous steps, is indicated in the block diagram of Fig. 17. The 3-V Camera could, of course, be used with just one film projector or a single slide projector, in which case the multiplexer is not required. Or it might, if desired, be

installed originally with one film projector and one slide projector. However, the provision of two film projectors provides for continuity on multi-reel shows as well as adding flexibility in programming.

The ease with which the 3-V Camera can be multiplexed is one of its outstanding features. Color cameras of the flying spot scanner type are usually difficult to multiplex. Also they require a special type of projector using a complicated arrangement of rotating mirrors or prisms. The 3-V Camera can be multiplexed with the same ease as a monochrome film camera. And it can be used with the same type of projectors as used for monochrome. Stations having RCA TP-6 Projectors can use

these for color by slightly modifying them for long light application. (The new RCA TP-6BC Projector is designed for long light application—can be used for either color or monochrome.)

### TK-26A Color Film Camera

The RCA TK-26A color film camera employs three RCA 6326 Vidicons, one for each of the primary colors of the color film being transmitted. These vidicons "look" at a real image produced by the projector and reflected by the multiplexer to a field lens in the camera. By use of a separate lens at each camera and appropriate choice of dichroics and color shaping filters, one camera sees only the red component, the second camera sees only the

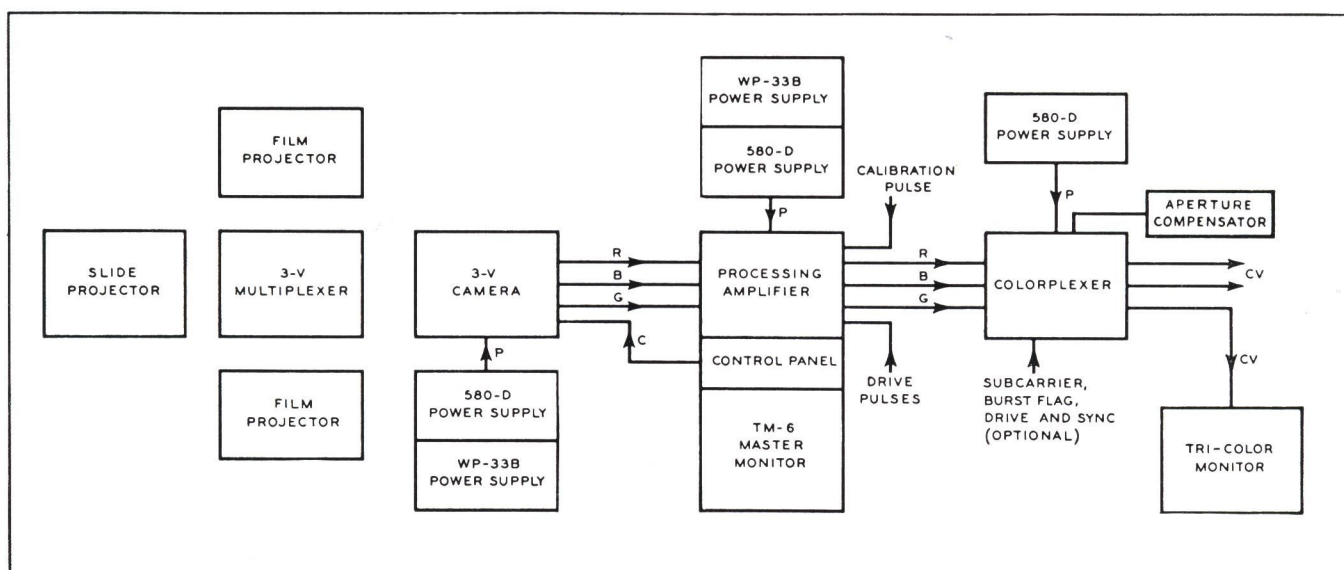


FIG. 15. Simplified block diagram showing the elements of the 3-Vidicon Color Film system.



green component, and the third the blue component of the color image. (See diagram of Fig. 14.)

The three identical vidicon camera sub-chassis are located, together with the light-splitting optics, in the top part of the camera cabinet. Mechanical alignment of the three sub-chassis is easily achieved by thumbscrew adjustment. The "in line" arrangement of the camera sub-chassis also simplifies this initial set-up. Final precise registration is easily achieved electronically, and once registered, there is excellent stability of registration. In day-to-day operation, only minor touch-up of controls will be necessary.

High resolution and maximum stability is obtained in this 3-vidicon system.

Gamma is ideal—needs virtually no correction; color fidelity approaches the high quality standards set by RCA's color studio camera. Use of the vidicon tube also provides a very high signal-to-noise ratio in both the color and the compatible monochrome picture. This feature is particularly important, especially in the first few years of color operation when color programs will be viewed on a great number of monochrome sets.

### Camera Control Console

The 3-V Camera Control Equipment is normally mounted in a control console as shown in Fig. 16. The control position includes (1) a

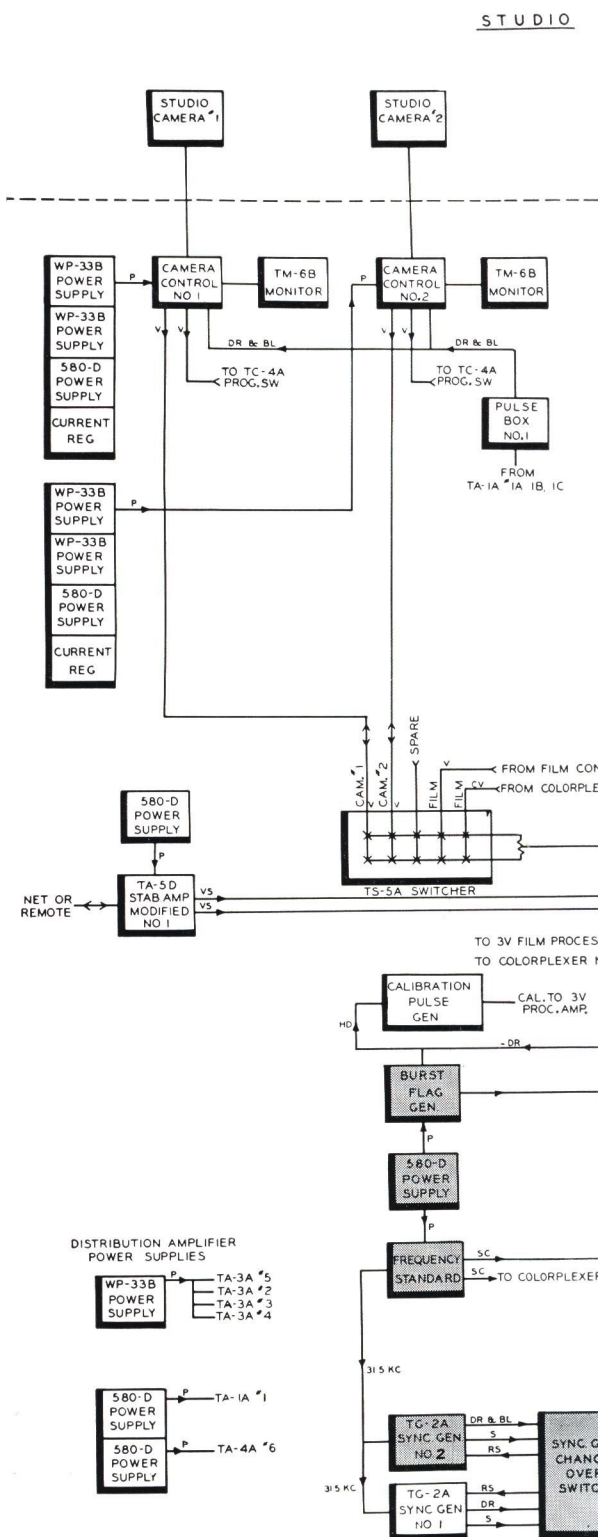
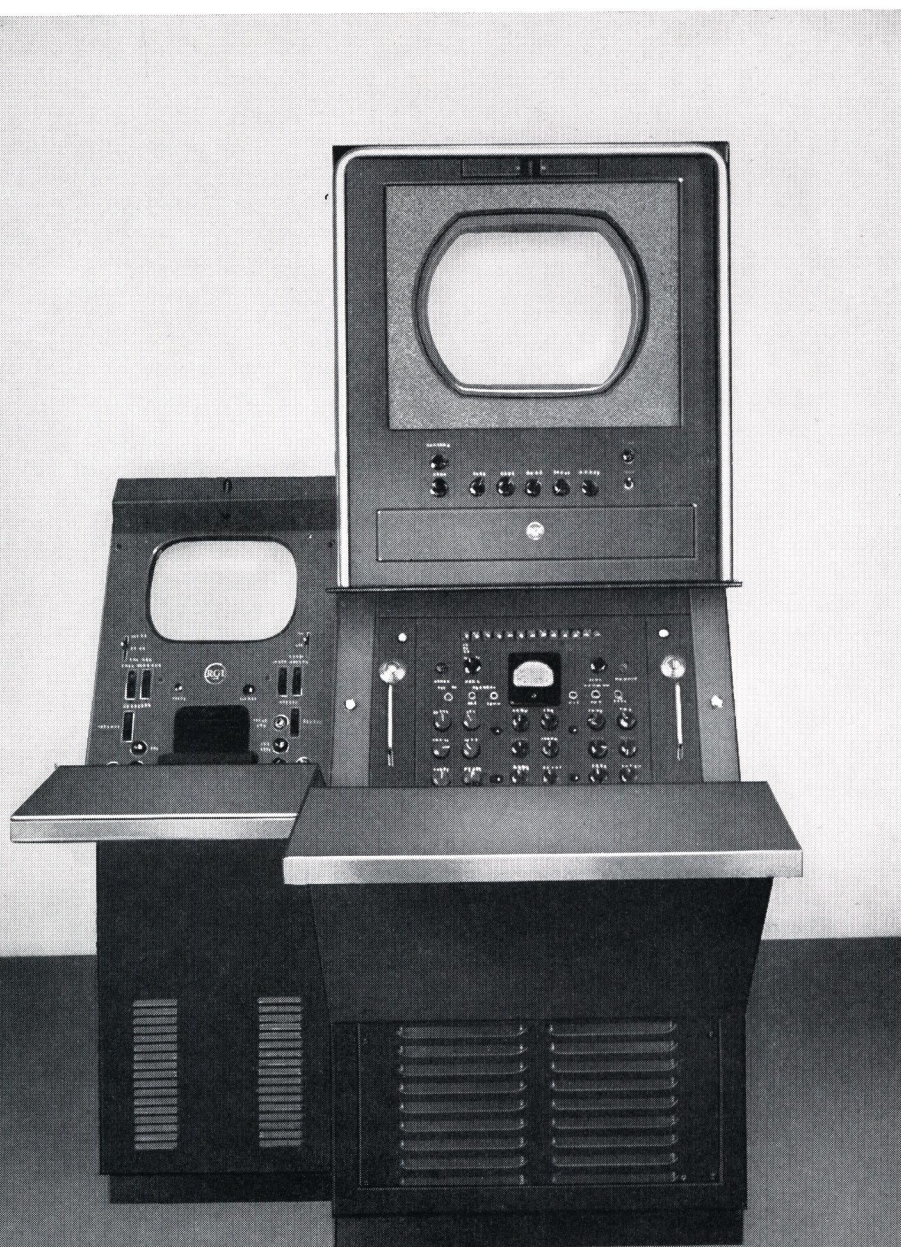


FIG. 16 (left). The complete 3-V Camera Control equipment includes a TM-6C Monochrome Monitor, a 19-inch Console containing the camera control panel and processing amplifier and a Type TM-10B Color Monitor. These three units may be grouped together as shown here. Or the color monitor may be suspended from the wall or ceiling for better visibility (by producer, technical director, etc.). The two console units can be located separate from the monochrome control units or mounted in line with them. When desired the control panels can be furnished for rack mounting as shown in Fig. 28, page 101.



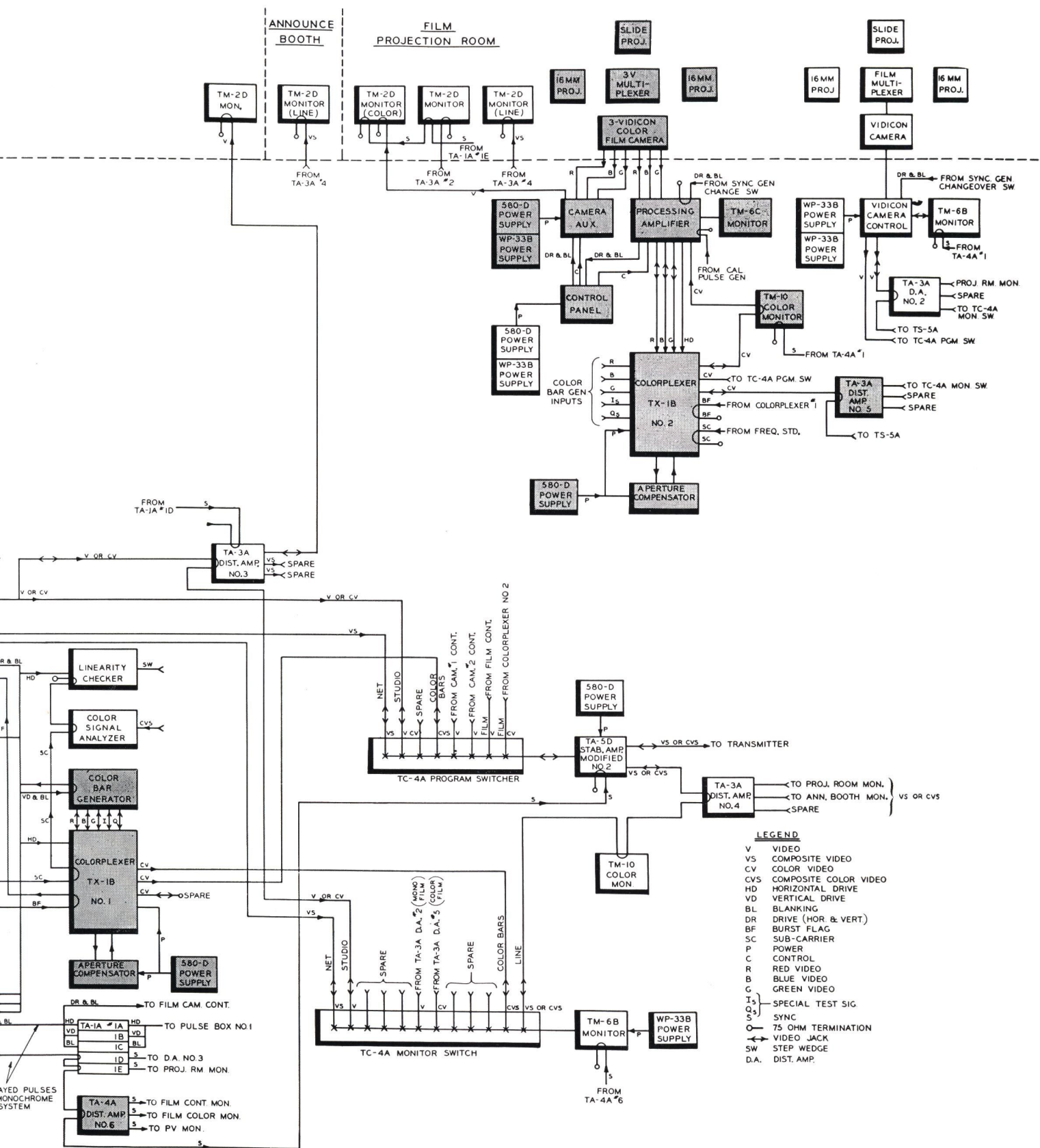


FIG. 17. Simplified block diagramming showing how the color equipment added in Step 2 can be integrated with the original monochrome equipment (and the Step 1 color equipment) of the typical station. Equipment of both Part I and Part II of Step 2 is shown in shaded blocks. Two colorplexers are included in Step 2, one with the "Color Bar Equipment" and a second with the 3-V Film Equipment. Although it would be possible to operate with one colorplexer, a second is recommended so that (a) bar output will be available for system checking without having to shut down film operation, and (b) so that an emergency spare is always available. An aperture compensator is provided with each colorplexer in order to facilitate emergency operation. This, together with the provision of a second sync generator and emergency changeover switch, provides a large degree of protection against loss of air time due to equipment failures.



580-D POWER SUPPLY (STAB AMP NO 1)	WP-33B POWER SUPPLY (3V FILM)	WP-33B POWER SUPPLY (MONO CAM NO 1)	WP-33B POWER SUPPLY (MONO CAM NO 2)	TA-1A DIST. AMP.	TA-3A D.A. NO 5 TA-3A D.A. NO 2 TA-3A D.A. NO 3 TA-3A D.A. NO 4	COLOR BAR GENERATOR	APERTURE COMP
580-D POWER SUPPLY (STAB AMP NO 2)	WP-33B POWER SUPPLY (3V FILM)	WP-33B POWER SUPPLY (MONO CAM NO 1)	WP-33B POWER SUPPLY (MONO CAM NO 2)	TG-2A SYNC. GENERATOR	TA-5D NO 1 STAB. AMP. MODIFIED (NET)	APERTURE COMP	TX-1B COLORPLEXER (3V)
580-D POWER SUPPLY (TA-1A)	580-D POWER SUPPLY (3V FILM)	580-D POWER SUPPLY (MONO CAM NO 1)	580-D POWER SUPPLY (MONO CAM NO 2)	TG-2A SYNC. GENERATOR	BLANK VIDEO JACK PANEL VIDEO JACK PANEL BLANK	TX-1B COLORPLEXER (COLOR BARS)	BLANK VIDEO JACK PANEL VIDEO JACK PANEL
BLANK	580-D POWER SUPPLY (3V FILM)	CURRENT REGULATOR (MONO CAM NO 1)	CURRENT REGULATOR (MONO CAM NO 2)	FREQUENCY STANDARD	TA-5D NO 2 STAB. AMP. MODIFIED (LINE)	COLOR SIGNAL ANALYZER	BLANK
	580-D POWER SUPPLY (COLORPLEXER 3V)	WP-33B POWER SUPPLY (FILM CAMERA MONO.)	WP-33B POWER SUPPLY (TA-3A'S)	BURST FLAG GENERATOR	FILM CAMERA CONTROL CHASSIS	LINEARITY CHECKER	
	580-D POWER SUPPLY (COLORPLEXER TEST)	WP-33B POWER SUPPLY (FILM CAMERA MONO.)	WP-33B POWER SUPPLY (PV MON)	BLANK	FILM CAMERA DEFLECTION CHASSIS	TA-4A D.A. NO 6	
	BLANK			SYNC. GEN. CHANGE SWITCH		BLANK	
						CALIB PULSE GENERATOR WA-9A	



FIG. 18. A. R. Hopkins, Manager of RCA Broadcast Equipment Marketing and C. G. Nopper, Chief Engineer of WMAR-TV, Baltimore, are inspecting the control panel of the "3-V" Color Film Camera. This view of the 3-Vidicon Camera pedestal shows the location of vidicon enclosure atop pedestal, local control panel, and camera auxiliary panel.

FIG. 19 (above). Rack layout of the equipment shown in Fig. 17. At this point four racks have been added (to the original monochrome layout) to house the color equipment. Actually this equipment could have been mounted in three racks (note blanks). However, the arrangement shown has the advantage of isolating the power supplies and is advantageous when further expansion is undertaken.

TM-6C Master Monitor mounted in a 13-inch console housing, and (2) a 19-inch console housing, in which the camera control panel and the processing amplifier may be mounted. This 19-inch master console housing is designed to mount the camera control panel in the indented desk section and the processing amplifier in the top sloping portion of the console. The processing amplifier performs a number of functions previously requiring several other units. Integration of these electrical functions in a single unit results in a simple, space-conserving, low cost system. Use of this design allows set-up time to be substantially reduced. A large reduction in power required as well as increased tube life due to extremely conservative operation of tubes reduces costs, at the same time improving performance and overall system quality.

The basic circuit elements in the processing amplifier are three plug-in video amplifiers which perform the following functions: cable compensation, video amplification, blanking insertion, shading insertion, feedback clamping, linear clipping, gamma correction and output amplification.



FIG. 20. Floor layout for the 3-V Camera and Projector grouping shown in Fig. 13. This diagram is useful in planning the necessary space for this equipment. Outlines of equipment units are shown as well as a suggested system of trenches for interconnecting cables. Physical dimensions and weights of all RCA color equipment units are shown in the table on page 105.

A fourth plug-in unit serves as the video section of an electronic switcher which is an integral part of the main chassis. The switcher, used with the TM-6C Master Monitor, provides an individual or combined presentation of red, blue and green video.

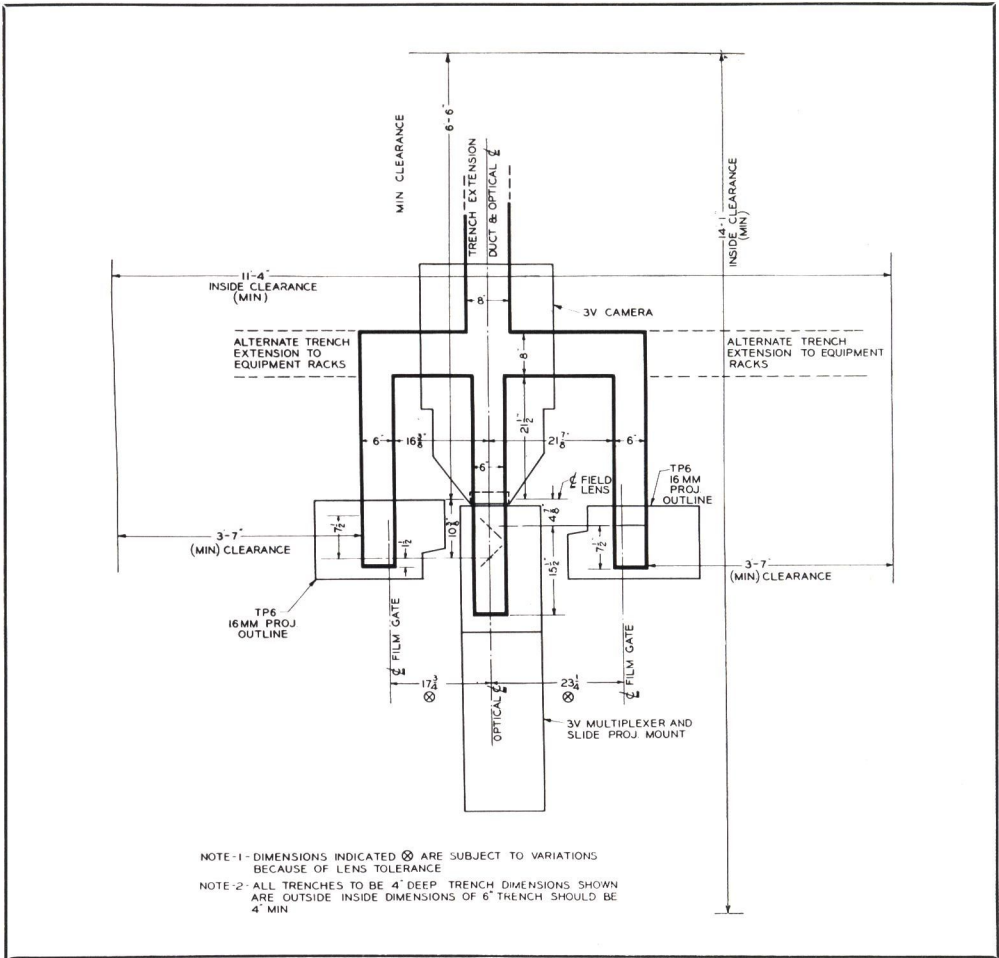
To complete the control function a TM-10B Color Monitor is needed. This may be suspended either from the wall or ceiling or set upon the flat top of the master console housing as space requirements dictate.

Several alternative arrangements are available to stations that wish to integrate their color and monochrome equipment or are otherwise limited by space. For example, all of the 3-V color film control equipment may be rack mounted. In this case a rack mounted control desk and accessory kit, MI-40415, is available to provide desk space at the rack location. In this case it is recommended that the TM-10B Color Monitor be mounted in an adjoining rack at approximately the level of the monochrome TM-6C Master Monitor. (See Fig. 28, Pg. 101.)

### Rack Equipment

Rack-mounted units which complete the 3-V Camera Chain include a TX-1B Colorplexer, an associated aperture compensator and a set of power supplies (two WP-33B's and three 580-D's). The colorplexer combines the outputs from the processing amplifier with the subcarrier to form a composite video signal. It does this in two operations as follows: (1) it cross-mixes the R, G, and B signals to form the luminance (or monochrome) signal and the two chrominance signals and (2) it multiplexes these signals with the subcarrier to produce a composite color signal suitable for feeding the transmitter.

Two video jack panels are also provided. These, together with the rack-mounted units of the 3-V Camera Chain, including power supplies can be mounted in two



standard cabinet racks. A typical rack arrangement for a Step 2 station is shown in Fig. 19.

### TP-6BC Film Projectors

Two TP-6BC Film Projectors are listed in the equipment to be added in Step 2. One of the important features of the TK-26A 3-vidicon film camera system is that it utilizes the excellent storage characteristic of the vidicon tube. This allows operation with intermittent type film projectors of the type with which most television operators are already familiar. Use of the intermittent type projector means that, while the sync generator is phased from the color subcarrier crystal as required in a color system, the projectors can operate directly from the power line. If available projectors are used it is necessary to modify these projectors for long application. The RCA TP-6BC professional projectors, however, can be used in the 3-vidicon system without modification since the long application feature has been incorporated in its design.

The RCA TP-6BC projectors provide an ample reserve of light to produce the best possible pictures from films of the highest density.

### TP-3C Slide Projector

A TP-3C Slide Projector is recommended for use with the Step 2 equipment. It allows the station to make station breaks in color and to present color commercials on standard 2 x 2 color slides. These are easily made up by mounting Kodachrome color transparencies in standard mountings. The TP-3C Projector accommodates 12 slides in two discs arranged for optical fade between slides.

### TP-12 Multiplexer

The TP-12 Multiplexer (which can be seen in the center of the assembly in Fig. 13) provides the optical system required to project a number of film sources into a single 3-V camera. Using mirrors, the multiplexer provides for two film projectors (16mm or 35mm) and a single 2 x 2-inch dual-disc slide projector. Selection of film or slide sources can be remotely controlled. Each of the two mirrors in the multiplexer is hinged so that they will fold out of the way as required (see the block diagram, Fig. 14). The movement is electrically activated so that the proper combination is obtained by operation of projector controls. The image from any of the projectors can thus be relayed to the field lens in the 3-vidicon camera.



# STEP 3 - Addition of Equipment For Telecasting Live Color Programs Originated in Your Own Studios

The third and final step in color is the installation of equipment for telecasting live studio color programs. Eventually, nearly every station will need such equipment, not only for studio color originations but also for pickup of local events. Many stations will want a live color camera immediately in order to be able to do local commercials in color. Experience of stations now operating with local color indicates that many color commercials are best when done "live".

Most stations, however, will not immediately need elaborate color studio setups. The equipment recommended in Step 3 provides the very minimum in live studio

## Step #3 Equipment

### COLOR STUDIO CAMERA EQUIPMENT

Qty.	Description
1	TK-41 Color Studio Camera Chain (Includes: color camera, viewfinder, processing amplifier, colorplexer, master monitor, color monitor, power supplies, console housings and cables)
1	Cradle Head
1	TD-4A Heavy Duty Pedestal
2	Type BR-84 Cabinet Racks
1	TA-4A Pulse Distribution Amplifier

facilities, viz., a single camera and necessary associated equipment. With this equipment simple studio shows and live commercials can be telecast in color and experience gained by station personnel in all phases of color operation.

The equipment listed in the box at left provides the ideal "minimum" setup for live studio color. When this equipment is added to Steps #1 and #2 facilities, the station can program from four different sources, (1) network, (2) films, (3) slides and, (4) studio. The arrangement of a Step #3 station is shown pictorially in Fig. 21 and functionally in Fig. 25.

The major item added in Step #3 is a

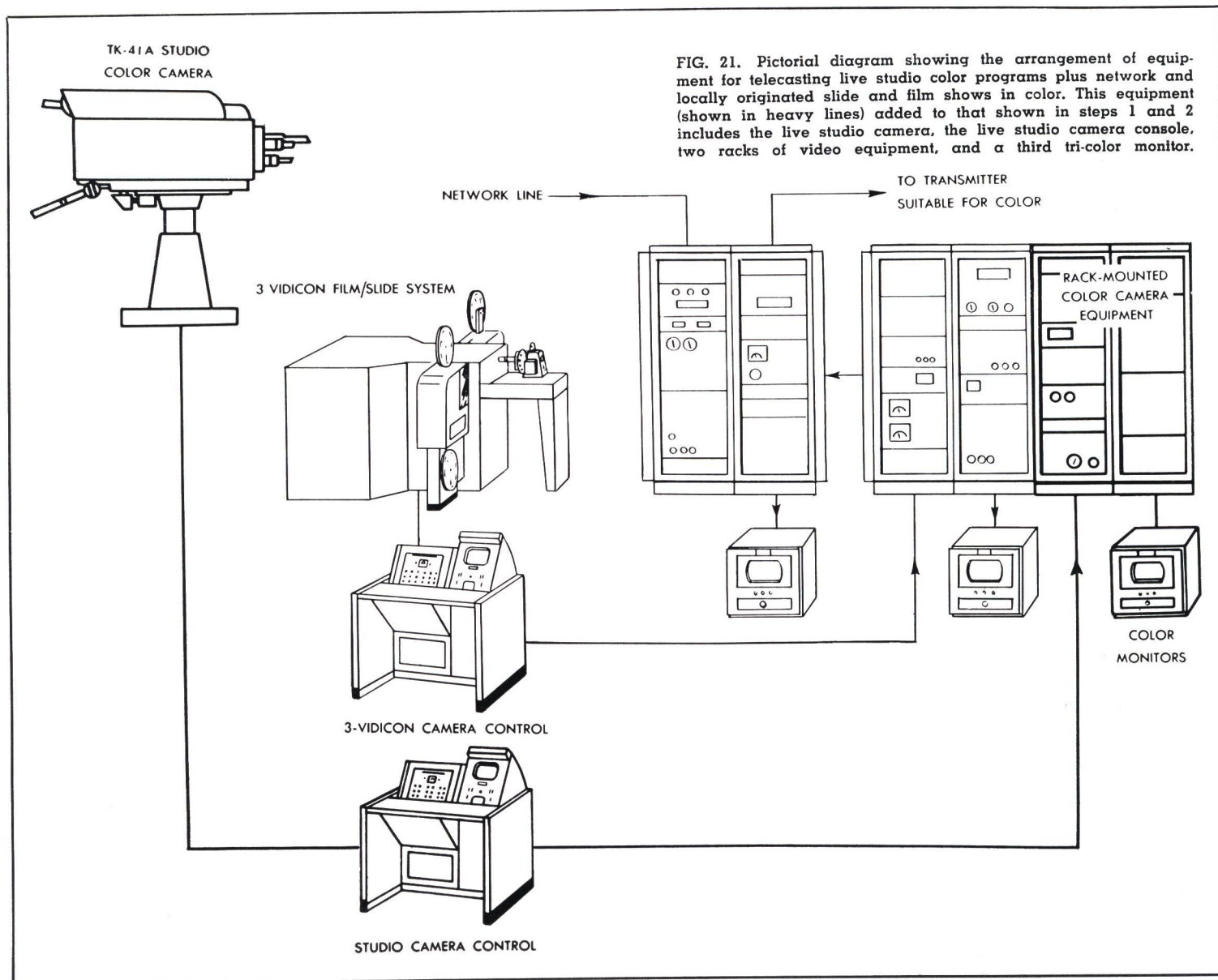
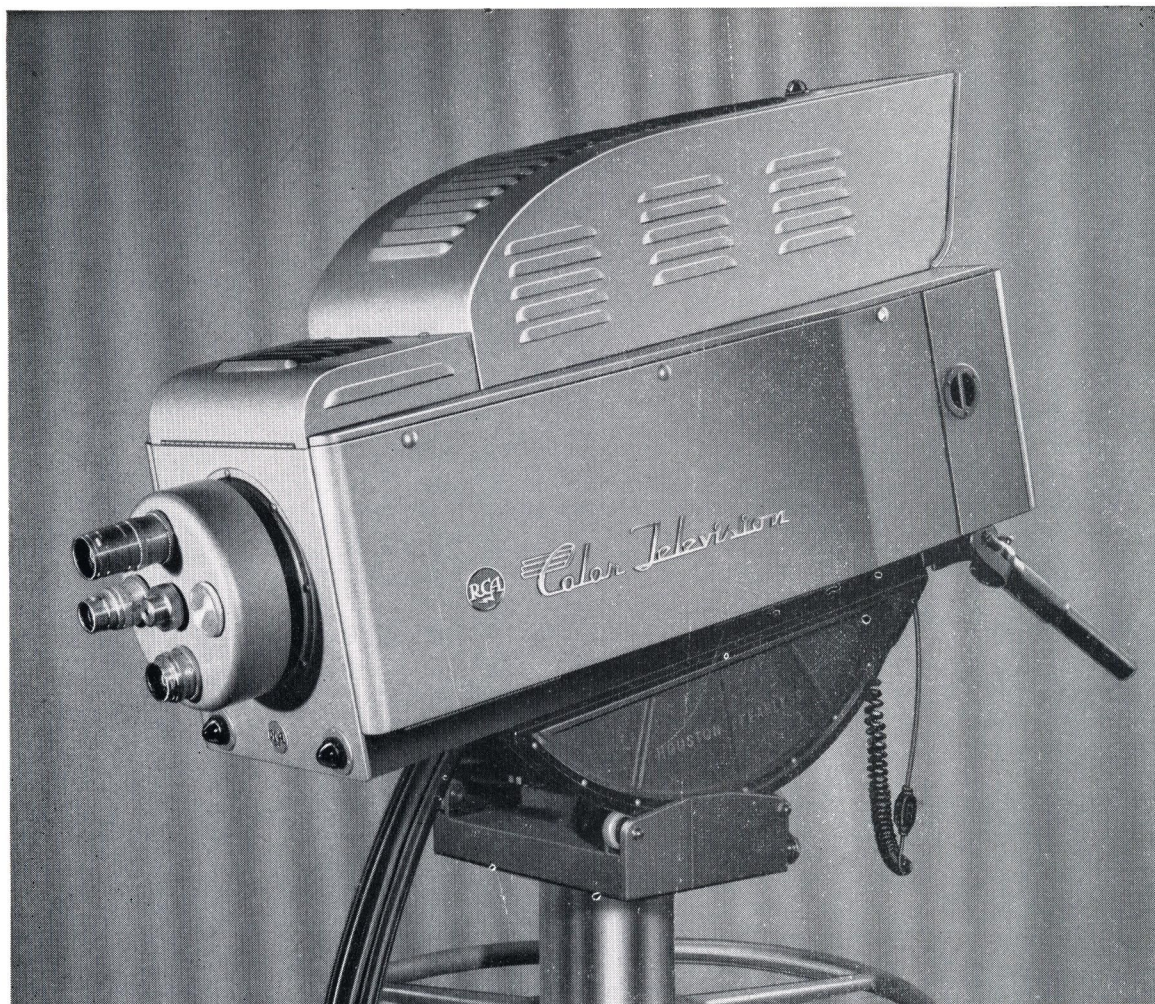


FIG. 21. Pictorial diagram showing the arrangement of equipment for telecasting live studio color programs plus network and locally originated slide and film shows in color. This equipment (shown in heavy lines) added to that shown in steps 1 and 2 includes the live studio camera, the live studio camera console, two racks of video equipment, and a third tri-color monitor.



FIG. 22. Closeup view of the "all electronic" RCA Color Camera, now in regular use at TV stations. This color camera is unsurpassed in the picture quality and detail it provides. The TK-41 camera chain is the major item in step #3.



TK-41 Color Studio Camera. The complete color camera chain includes color camera, viewfinder, camera control, processing amplifier, color monitor, colorplexer and necessary rack mounted equipment.

The camera equipment supplied in Step #3 is identical in every respect with that used in the largest multiple camera setups. Thus the station starting with just one studio camera is nevertheless assured of the very highest quality, and has assurance of being able to add more cameras as desired without obsolescence of any previously purchased equipment.

TV stations desiring to install Step #3 live facilities, ahead of the film facilities of Step #2, can do so anytime after the color bar and local origination (sync generator) equipment of Step #2 is installed. This is mentioned since some stations may choose to start programming with live color and add color film facilities later.

### TK-41 Color Camera

The TK-41 color camera is certainly one of the finest, high-quality equipments ever designed for TV station use. It is all-electronic, and employs the latest in circuitry such as the unique processing amplifier which has resulted in compact auxiliary equipment, improved operating stability and economical operation.

The principal components of the TK-41 Color Studio Camera Chain are shown in the block diagram of Fig. 23. The TK-41 features considerable space and cost saving advantages over previous color chains.

As in the standard monochrome camera, the optical system, the deflection circuits, the pickup tubes and the preamplifiers are located in the three-tube color camera. The

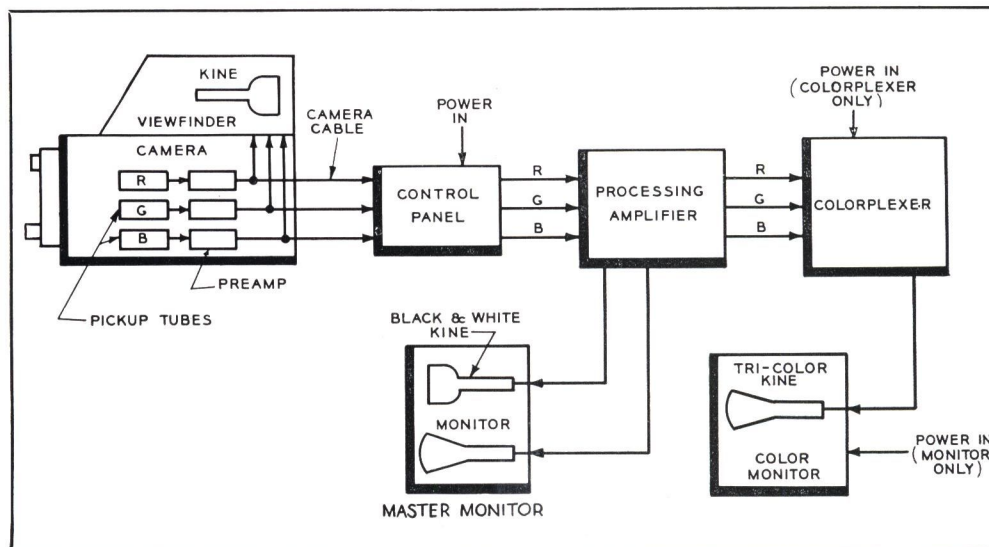


FIG. 23. Block diagram of the TK-41 Color Camera Chain. The chain incorporates the newly designed Processing Amplifier which combines all signal processing functions, thereby saving more than half the rack space formerly required.



turret on the camera is designed to accommodate four standard television lenses (the same as those used on monochrome cameras).

The color camera proper contains a light splitting optical system and three separate image orthicon tubes to provide red, blue, and green signals, three video preamplifiers, horizontal and vertical deflection circuits for the image orthicons, and power supplies for these deflection chassis. A selsyn-operated iris control is also part of the optical system and serves as a gain control as well. The electronic viewfinder is comprised of a 7TP4 kinescope with necessary deflection and video circuits to provide a picture for the camera operator. The plug-in video preamplifiers and the deflection circuits are arranged for accessibility, ease-in-operation and maintenance.

The camera proper, with attached viewfinder can be mounted on the TD-4A studio pedestal. The weight of the camera is accurately balanced on a new heavy-

duty cradle-type tilt-head. This enables it to be panned and tilted easily in any direction.

Proper control of the camera is simple and straight forward. Once initial set-up is completed only two operating controls are needed: (1) remote iris control used as a master gain control and (2) master pedestal control which causes all three pedestals to track up and down together. Station operators and engineers familiar with monochrome camera control will find it easy to master these color television controls.

### Viewfinder

The viewfinder provides the cameraman with a high quality monochrome picture on a 7-inch kinescope for checking picture composition and optical focus during operation. The camera registration may be checked at the camera position since it is possible to view the primary color

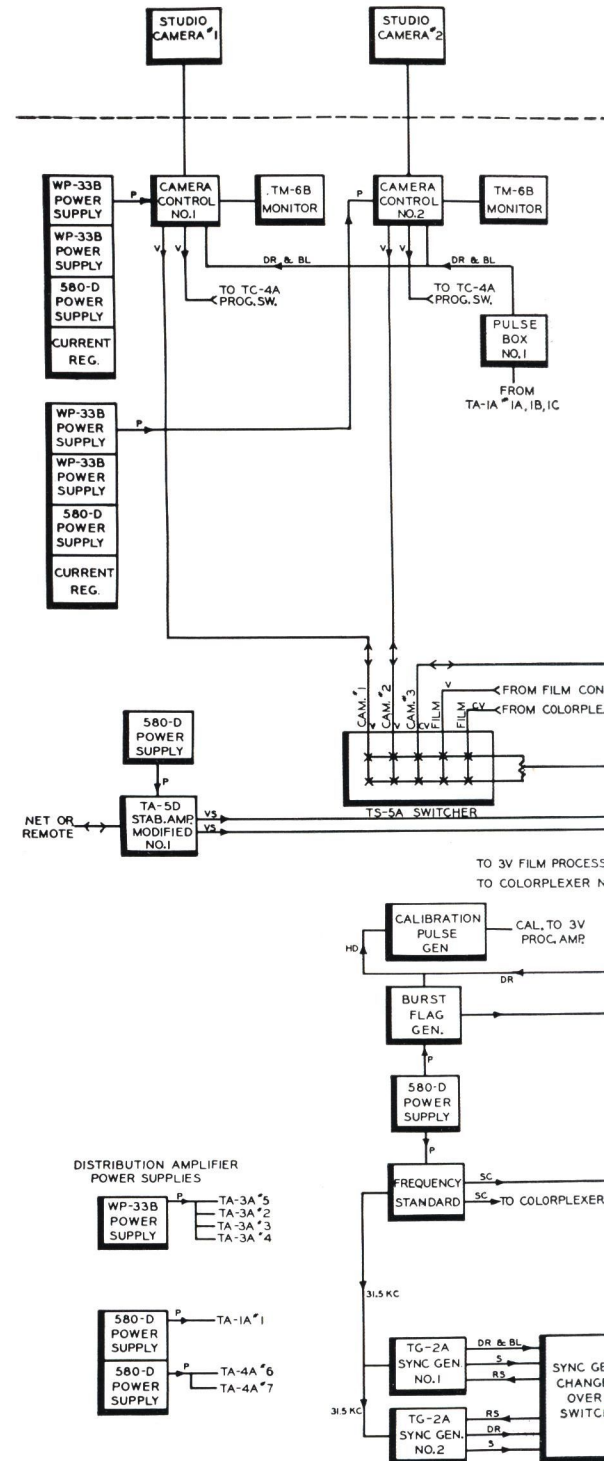
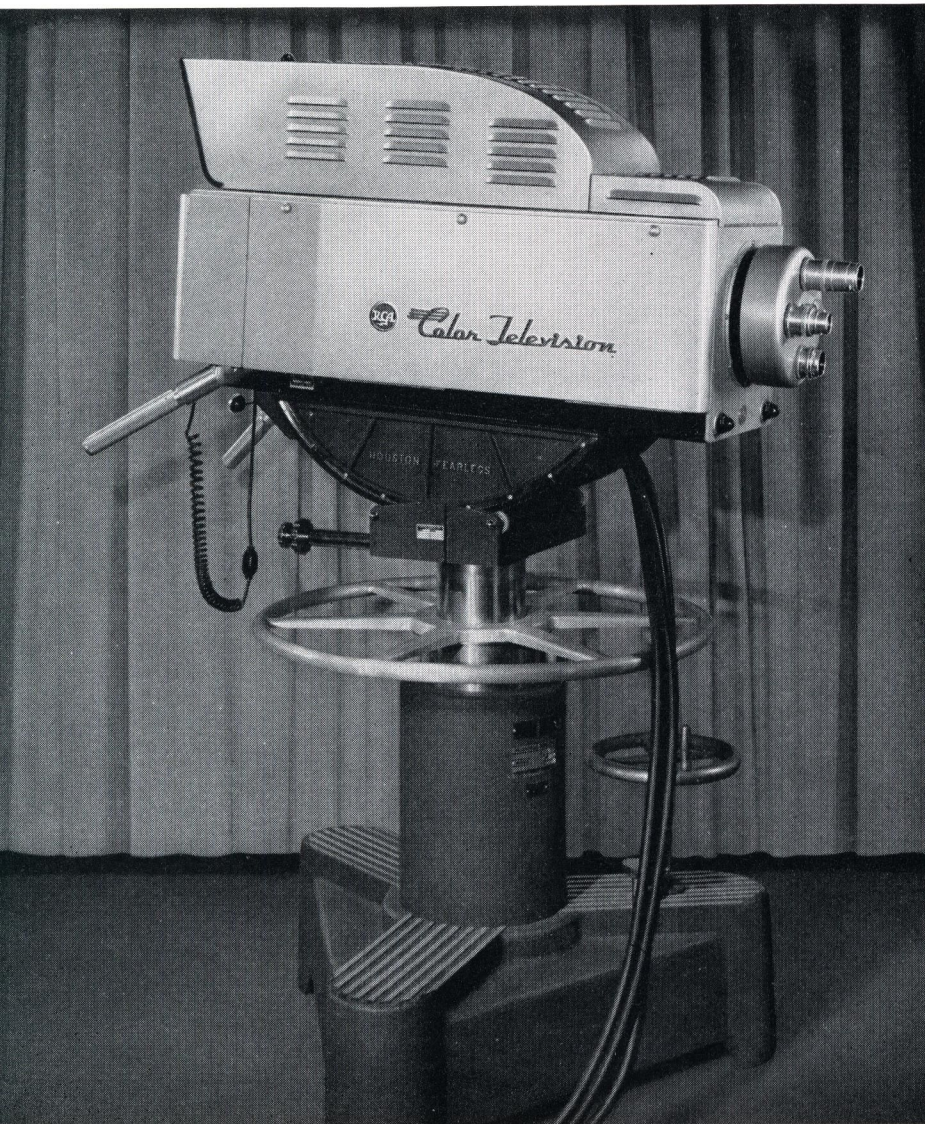
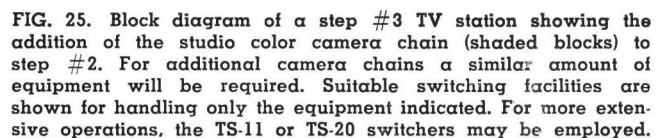


FIG. 24 (left). The TK-41 Studio Color Camera mounted on a TD-4A Studio-type Pedestal. The weight of the camera is carefully balanced on a new heavy-duty cradle-type head. This enables it to be panned and tilted easily. Although the color camera is heavier and somewhat larger than the standard monochrome camera it is almost as maneuverable. On limited action shows it is easily handled by one man.







WP-33B POWER SUPPLY (COLOR CAMERA)	580-D POWER SUPPLY (STAB. AMP. NO.1)	WP-33B POWER SUPPLY (3V FILM)	WP-33B POWER SUPPLY (MONO. CAM. NO.1)	WP-33B POWER SUPPLY (MONO. CAM. NO.2)	TA-1A DIST. AMP.	TA-3A D.A. NO.5 TA-3A D.A. NO.2 TA-3A D.A. NO.3 TA-3A D.A. NO.4	COLOR BAR GENERATOR	APERTURE COMP.	TX-1B COLORPLEXER (3V)
WP-33B POWER SUPPLY (COLOR CAMERA)	580-D POWER SUPPLY (STAB. AMP. NO.2)	WP-33B POWER SUPPLY (3V FILM)	WP-33B POWER SUPPLY (MONO. CAM. NO.1)	WP-33B POWER SUPPLY (MONO. CAM. NO.2)	TG-2A SYNC. GENERATOR	TA-5D NO.1 STAB. AMP. MODIFIED (NET)	APERTURE COMP.	TX-1B COLORPLEXER (COLOR BARS)	VIDEO JACK PANEL
WP-33B POWER SUPPLY (COLOR CAMERA)	580-D POWER SUPPLY (TA-1A)	580-D POWER SUPPLY (3V FILM)	580-D POWER SUPPLY (MONO. CAM. NO.1)	580-D POWER SUPPLY (MONO. CAM. NO.2)	TG-2A SYNC. GENERATOR	BLANK VIDEO JACK PANEL VIDEO JACK PANEL BLANK	COLOR SIGNAL ANALYZER	VIDEO JACK PANEL	VIDEO JACK PANEL
580-D POWER SUPPLY (COLOR CAMERA)	BLANK	580-D POWER SUPPLY (3V FILM)	CURRENT REGULATOR (MONO. CAM. NO.1)	CURRENT REGULATOR (MONO. CAM. NO.2)	FREQUENCY STANDARD	TA-5D NO.2 STAB. AMP. MODIFIED (LINE)	LINEARITY CHECKER	APERTURE COMP.	TX-1B COLORPLEXER (COLOR CAMERA)
FOCUS CURRENT REGULATOR		580-D POWER SUPPLY (COLORPLEXER) 3V	WP-33B POWER SUPPLY (FILM CAMERA) MONO	WP-33B POWER SUPPLY (TA-3A'S)	BURST FLAG GENERATOR	FILM CAMERA CONTROL CHASSIS	TA-4A D.A. NO.6		
CENTERING CURRENT GENERATOR		580-D POWER SUPPLY (COLORPLEXER) TEST	WP-33B POWER SUPPLY (FILM CAMERA) MONO	WP-33B POWER SUPPLY (PV MON)	BLANK	FILM CAMERA DEFLECTION CHASSIS	TA-4A D.A. NO.7		
580-D POWER SUPPLY (COLORPLEXER) CAMERA		BLANK			SYNC. GEN. CHANGE SWITCH		BLANK		
							CALIB. PULSE GENERATOR WA-9A		

FIG. 26 (above). Suggested rack layout of the complete monochrome and color equipment shown in Fig. 25. The rack-mounted color equipment items added in Step 3 require about one and a half racks. However, by placing the colorplexer in space left blank in Step 2 (see Fig. 19, page 94) it is possible to accommodate all equipment on just one rack more than used in Step 2. All of the color equipment added to this point will easily fit in five racks.

FIG. 27 (left). The studio color camera console includes a monochrome monitor (left) and a 19-inch console housing the processing amplifier and camera control panel. These units may be located at a separate position or assembled with the monochrome control consoles. The color monitor may be suspended from wall or ceiling (for easy viewing) or placed on the flat top of the 19-inch console (see Fig. 16, page 92). Alternatively both monochrome and color monitors, as well as camera controls, may be rack-mounted as shown in Fig. 28.

picture signals, both separately or in various combinations on the viewfinder.

### Studio Camera Control

The studio camera control equipment is similar to the film camera control supplied in step #2 and includes the same processing amplifier and master monitor. Mechanically, this equipment is housed in two console housing units and may be mounted next to the film camera control to form a single console, if desired. The advantages of standardizaion such as common tubes, panels and circuits are realized.

Electrically, the three video signals from the camera are fed directly to the camera control panel on which both operating and selected set-up controls are located. These signals are fed in turn to the processing amplifier which performs the functions of cable compensation, video amplification, blanking and shading insertion, feedback clamping, linear clipping, gamma correc-

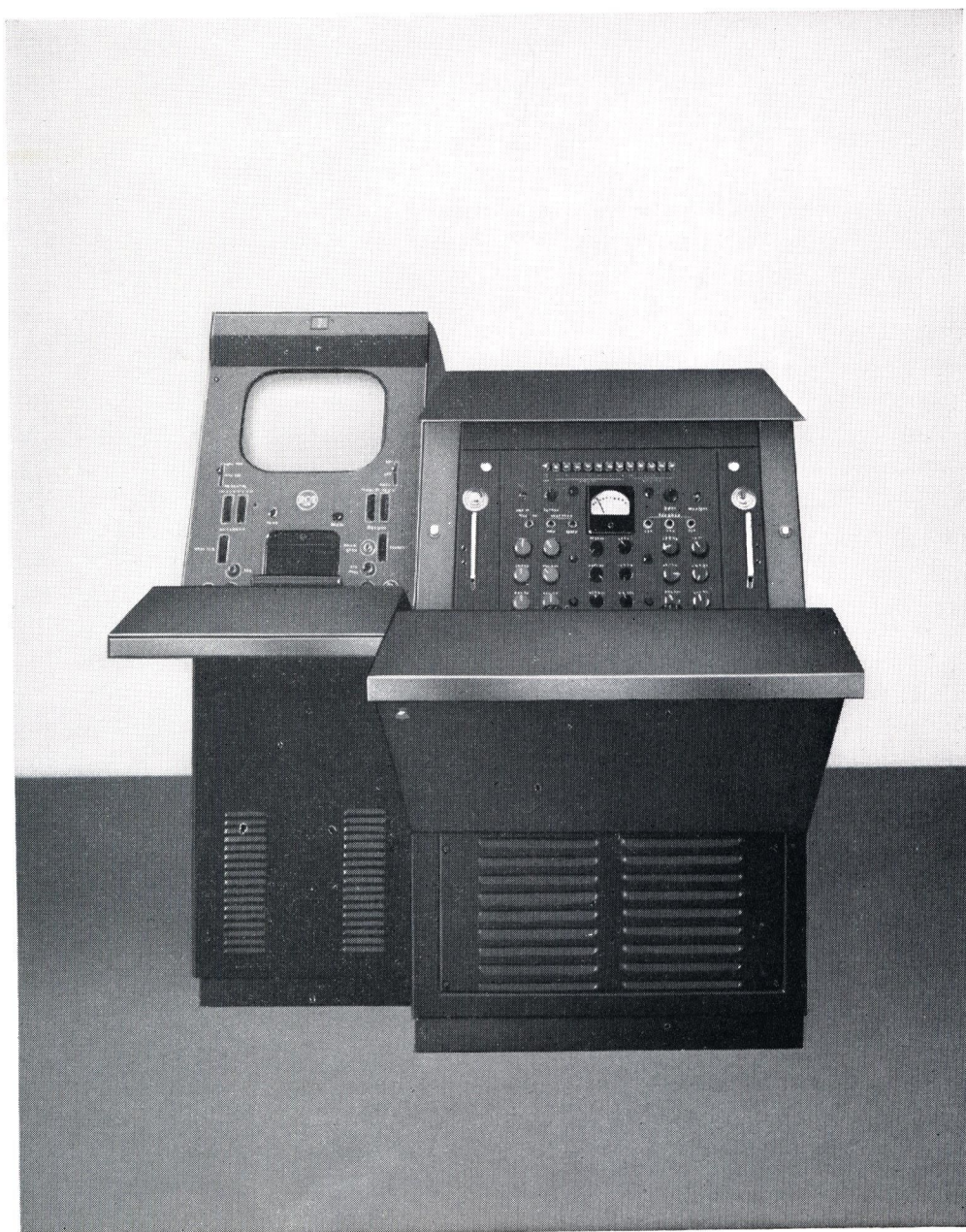




FIG. 28. Either the film or studio camera controls may be mounted in a standard rack shelf as shown here. When this is done the monochrome monitor is usually mounted directly above the camera control position and the color monitor in the adjacent rack at about the same eye-level. An arrangement of this kind saves floor space and is convenient for setup and maintenance. It is particularly useful in installations where the camera control position is in a room separate from the studio control room.



tion, and output amplification as well as providing auxiliary switching for the master monitor. The processing amplifier takes the place of numerous rack equipment items formerly required to perform the functions mentioned above.

It feeds a master monitor, which provides both kinescope and CRO displays of the processed camera signals, and a colorplexer, which combines the processed video signals into a single FCC standard color signal. The colorplexer feeds a tri-color monitor so that the color picture may be viewed by the video operator.

#### Colorplexer and Rack Equipment

The colorplexer, distribution amplifier, aperture compensator and miscellaneous power supplies are the step #3 items rack mounted. All of the equipment requiring

rack mounting can easily be accommodated by the two racks furnished.

The colorplexer operation is similar to that previously described in step #2. The R, G and B signal outputs of the studio color camera are fed into a colorplexer, just as are the outputs of the film camera. A colorplexer is supplied as part of each camera chain. The video signal from each chain is an independent compatible color signal. The color bar generator is used to align the colorplexer which can be adjusted for perfect matrixing. Using this adjustment as a reference, and color monitor for observing, the elements of the camera chain can be lined up for the best possible picture. An aperture compensator, a 2-inch high unit, is mounted above the colorplexer and connected to function as part of the colorplexer's luminance channel.

#### Monitoring

In step #3 (as in step #2) a monochrome master monitor (TM-6C) and a color monitor (TM-10) are furnished. The master monitor which is mounted in the console housing permits the checking of levels of individual color signals and camera registration. The video operator sees the picture in black-and white on the camera control monitor and he may select a black-and-white presentation of a separate red, green or blue signal or any combination (red plus green, green plus blue or red plus green plus blue). A color picture presentation can be seen on the color monitors. The color monitor is a separate unit and may be mounted in a rack, suspended, or placed atop the flat deck of the control console. Since both camera control operators and directors need to see the monitor it should be placed at some vantage point.



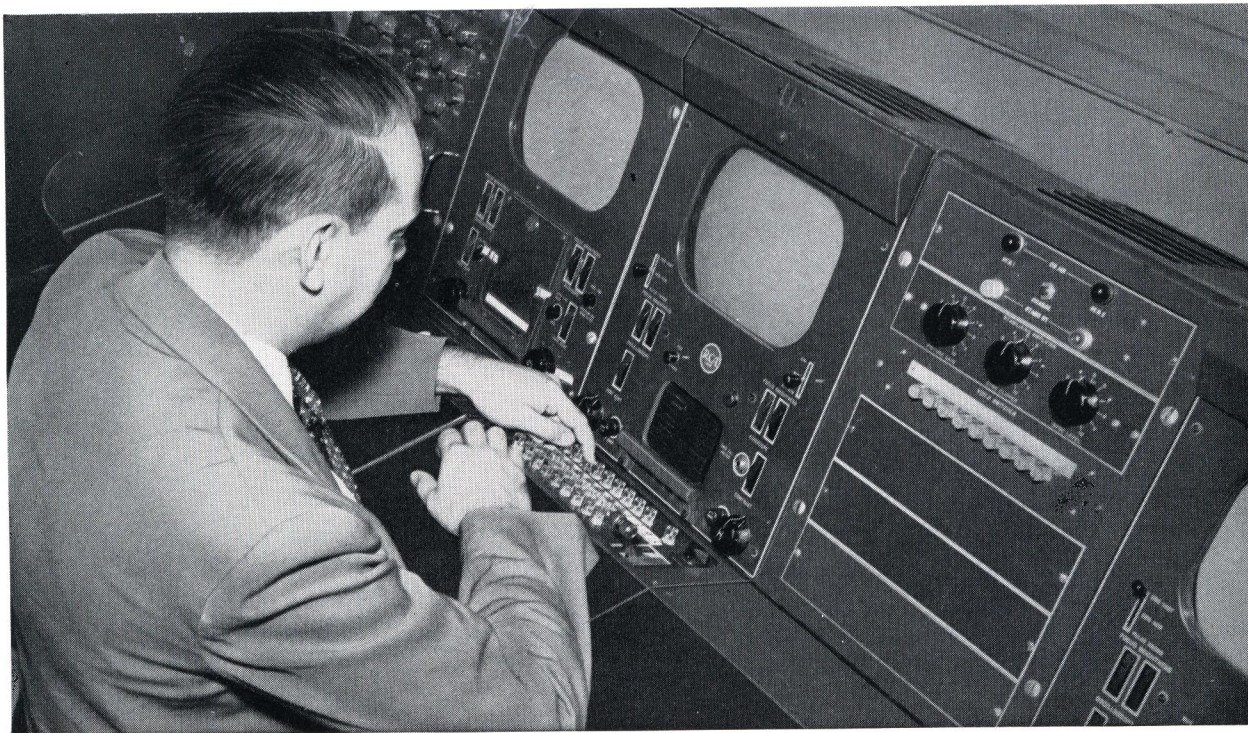


FIG. 29. View of the new TS-11A Video Switching Panel shown mounted in the sloping desk section of a typical Control Console. The TS-11A provides 9 inputs and 3 rows of push buttons for fades, lap dissolves and super-positions.

## FACILITIES FOR COLOR PROGRAM SWITCHING

The description on preceding pages has indicated how unit equipment groupings may be added step-by-step to increase the color video facilities of a TV station. Further increases can be made by installing additional film and/or studio cameras.

In most cases it will be desirable to add a complete equipment grouping for each camera (film or slide) which is added. This

arrangement (i.e., of making each camera chain a complete system in itself) is of enormous advantage in providing flexibility, facilitating maintenance and avoiding loss of air time because of failure in a single color coding equipment. It also makes for much simpler switching between cameras and between cameras and other program sources.

### Only One Signal to Switch

Each camera chain (film or live) in the RCA system includes a colorplexer in which the red, green and blue signals from the camera are combined with the subcarrier to form a composite color signal. This eliminates the need for three identical sets of switching equipment (to switch the three separate colors). Because the output is a single signal (containing a subcarrier component), it is possible to handle all switching operations in the usual way, and to use any of the standard RCA monochrome switching equipment. (Note: minor modifications in existing switching equipment may be necessary in some cases.)

To insure that color synchronizing bursts are always in the proper phase relative to the subcarrier components of the video signal, burst keys are provided within each colorplexer. This adds the bursts to the rest of the subcarrier signal as soon as possible after modulation, giving no opportunity to drift in relative phase.

The synchronizing signal is added at a common point after switching, so that control information to the deflection circuits of home receivers is never interrupted.

### Standard Switching Equipment Used

The fact that any of the standard RCA monochrome switching systems can be used for color provides the color equipment planner with a wide choice. He may use the TC-4A, the TS-5A, or the TS-11A

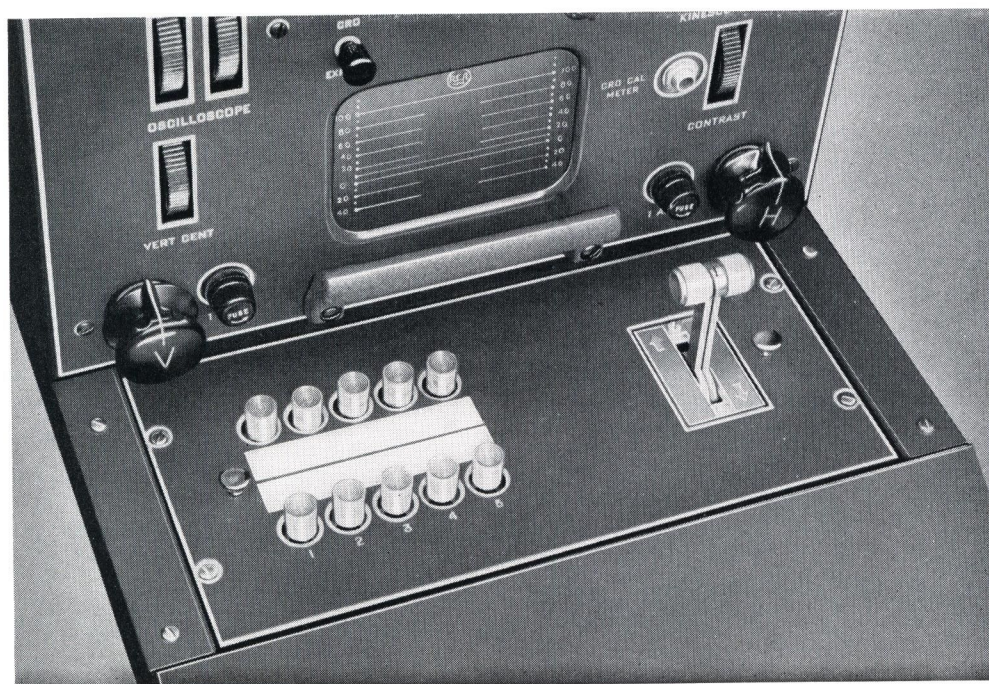


FIG. 30. View of the TS-5A Switching and Control Panel shown mounted in the sloping desk area of a standard control housing. The switcher may also be mounted above this level with other remote control panel mounted items.



mechanical switching systems or the TS-20 Relay Switching equipment.

**The TC-4A Basic Buy**

Many TV stations have already installed and are familiar with the RCA TC-4A ("Basic Buy") audio/video switcher. This provides video control and program switching selection of any of 8 signals, as well as audio control of 8 inputs to 4 mixer positions. Stations having this equipment will find it satisfactory for color as well as monochrome.

**The TS-5A Five-Position Switcher**

Stations which require more inputs than provided by the TC-4A can add the five-position TS-5A Switcher (see Fig. 30). This will provide five additional inputs as well as fading facilities and will make possible independent studio rehearsal. Such an arrangement is indicated in the diagram (Fig. 3, Pg. 81) of a "typical" monochrome station to which the color steps previously described are assumed to be added. As Fig. 17 and Fig. 25 indicate, the combination of the TC-4A and the TS-5A will provide switching of basic color facilities in addition to regular monochrome operations. If it is desired to have greater flexibility (for rehearsals, etc.) a second TS-5A might be added to be used for color only.

**The TS-11A Nine-Position Switcher**

For larger installations the new deluxe nine-position TS-11A Switcher is a good choice. This switcher (see Fig. 31) has nine input positions with three rows of push-buttons so that "preview" is available in addition to normal fades, lap dissolves and superimpositions. It will handle composite and non-composite video switching and fading, either color or monochrome.

Two of the three rows of push buttons feed a manual fader assembly and the third row is the preview channel. A program transfer switch is provided to interchange the preview and fader busses so that the fader section can be used for previewing fades, lap dissolves and superpositions. This also makes it possible to use the fader channel for rehearsals while the preview channel handles the on-the-air signal. The fader assembly feeds a mixing circuit and three program line output amplifiers, eliminating the need for elaborate distribution amplifier systems on the output of the switcher. Sync is also mixed in this new switcher which is free of microphonics and low frequency tilt and bounce. Thus a stabilizing amplifier is not required as part of the switching system.

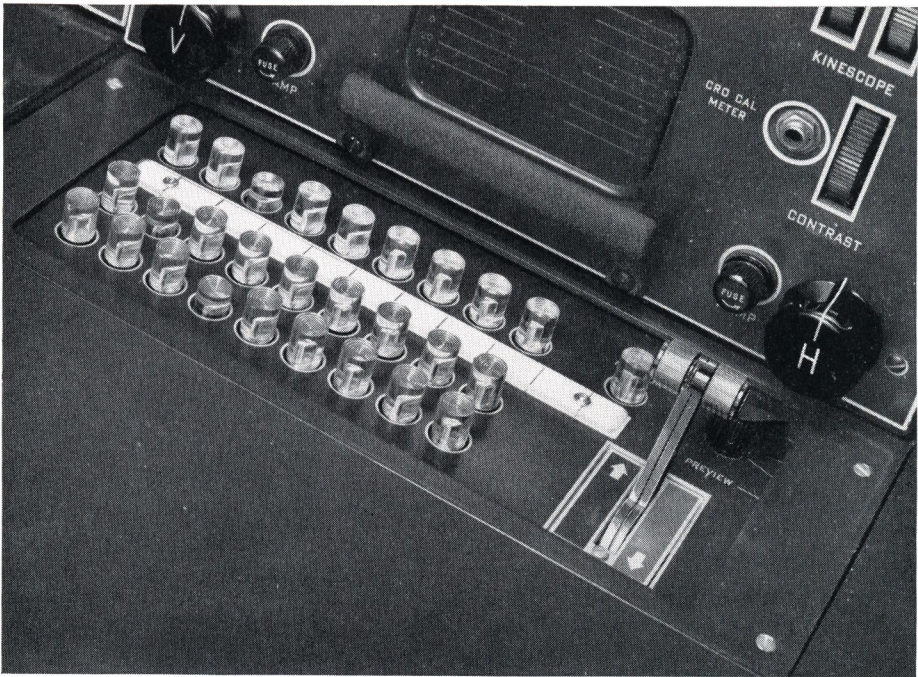


FIG. 31. A close-up view of the nine-position TS-11A Switcher. For deluxe installations, or those which have outgrown the TS-5A, this new switcher is the ideal choice.

**TS-20 Relay Switching System**

Where requirements dictate a still more flexible switching system or where more than nine video inputs are used, it is recommended that a relay switching system be considered. The TS-20 Relay Switching System is designed for use in television studio control and master control rooms. It consists of different types and quantities of equipment depending upon the size and type of switching operation desired. The equipment may be used for switching a minimum of six inputs to two outputs or

a maximum of twelve inputs to six outputs (see simplified schematic, Fig. 32).

For the studio control room the system can be set up to provide complete facilities for program monitoring, video switching between television studio cameras, film cameras, remote pick-ups or network programs. Controls can be provided for fading and lap-dissolving between local studio video signals. The system can provide for program previewing and many other monitoring functions.

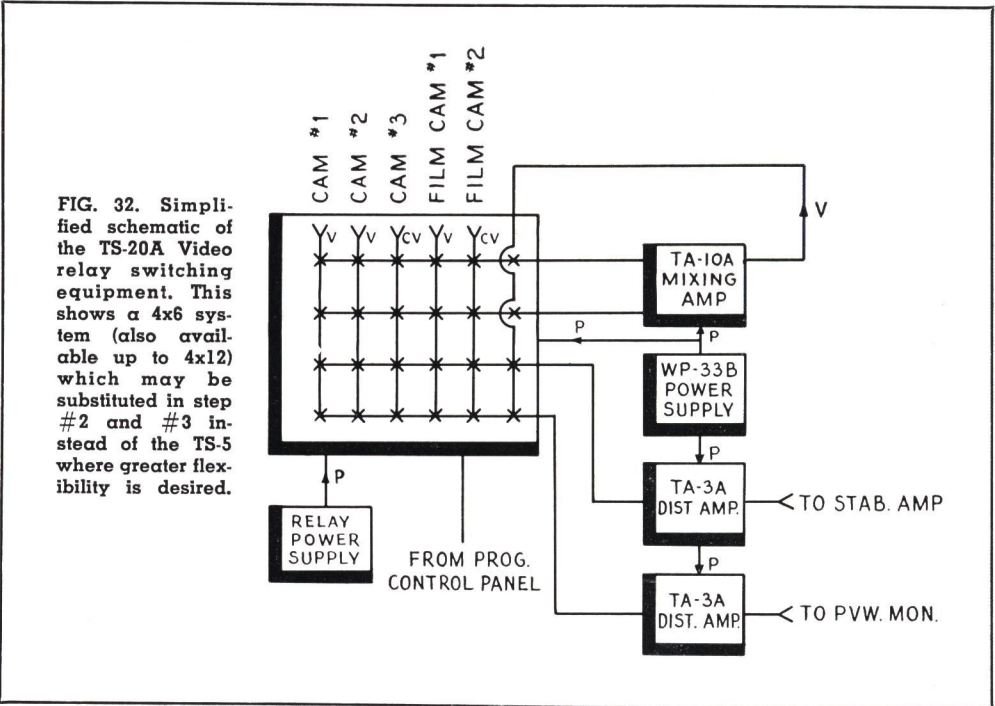


FIG. 32. Simplified schematic of the TS-20A Video relay switching equipment. This shows a 4x6 system (also available up to 4x12) which may be substituted in step #2 and #3 instead of the TS-5 where greater flexibility is desired.



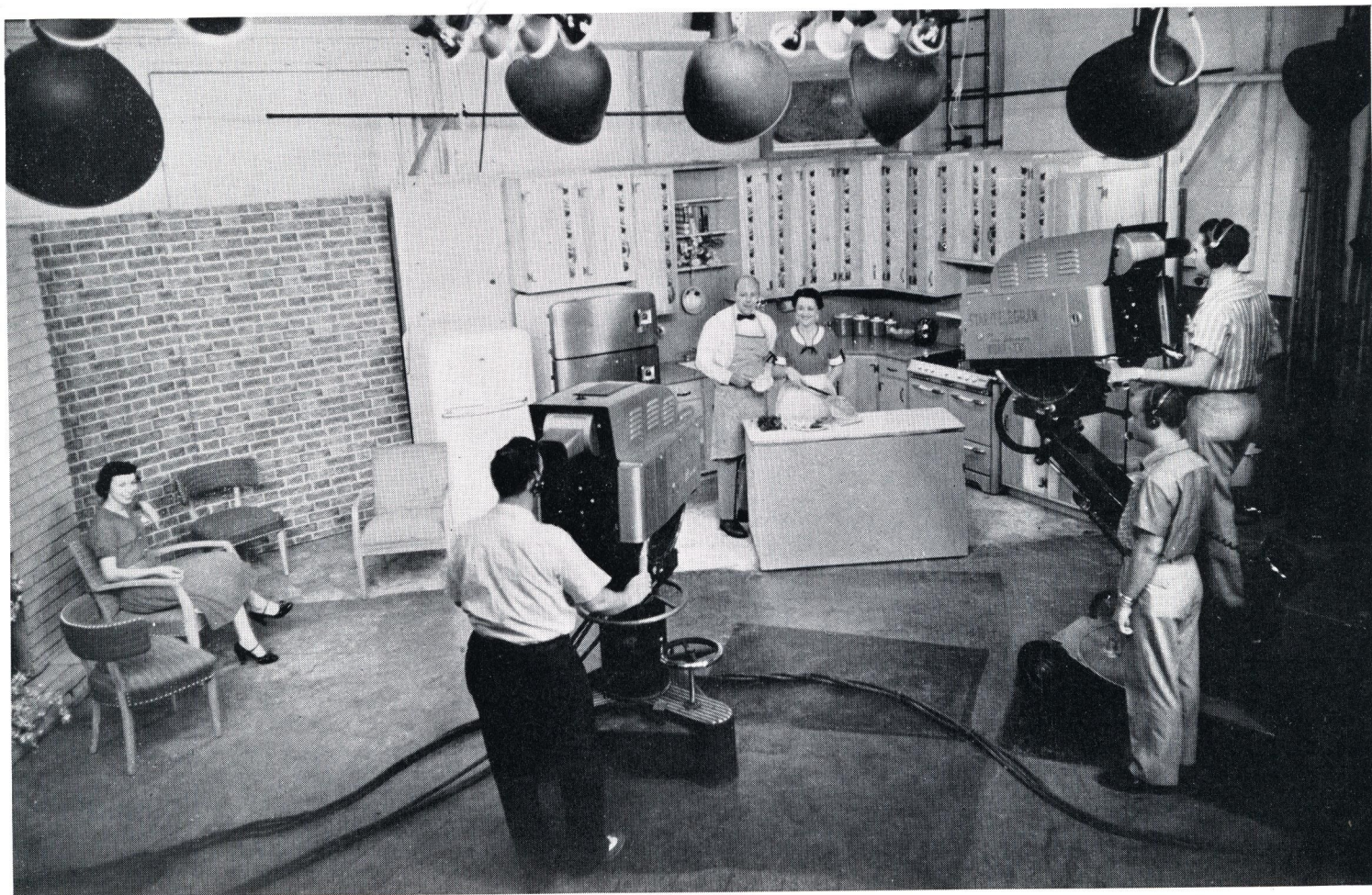


FIG. 33. WBAP-TV studio scene showing a typical color telecast. Note that the color cameras are used with standard type equipment such as two-man dolly and lighting equipment. Cooking demonstrations are in kitchen and interviews are held at left part of set.

## SPACE CONSIDERATIONS FOR COLOR

Some present monochrome equipment may be adapted for color use—while other items will be retained solely for black and white use. In any case, a certain amount of additional space will be required. The total space a Broadcaster must provide for Color TV operations will vary according to the scope of the proposed operation. For example, “network color only” stations will require very little additional space—while those stations who plan to use slide, film and live camera facilities must do more serious planning.

From observations of many existing stations it is obvious that most will either have to hunt for additional space, build it, or take existing space for color use such as present AM space or even doubling up in present monochrome studios.

There are undoubtedly many ideas which may occur to individuals concerning their own requirements, as for example providing a second deck for a control room where ceiling height is not limited. The

description given here deals with space requirements as they apply only to items of equipment furnished in the three plans—and not on a general or overall basis. The reader is referred to BROADCAST NEWS No. 81 for descriptions of how operating TV stations have handled their space problems (see Fig. 33).

### Rack Space Required

Fig. 26 shows a typical Step #3 rack layout for a station with slide, film, studio and “network” facilities. The units shown on the racks are the same as those shown on the functional diagram of Fig. 25. A station with no live cameras will have less equipment and, therefore, will require fewer equipment racks. Similarly, a station planning to use more cameras can easily estimate the additional rack space required.

### Console and Camera Space Required

Each camera chain—whether slide, film or studio—includes two units designed for

console mounting. One of these is a master monitor and the other unit, a 19-inch unit, contains the color camera controls. The two units are mounted in standard console housings similar to those used in the RCA monochrome installations. These units, of course, can be combined with other camera units to form a control console of the standard type.

The color studio camera is larger than a standard monochrome camera. However, it is moved by similar type dollies and, therefore, does not in itself require more floor space. The film and slide camera space is indicated in the floor plan of Fig. 20. Here also space must be left for access and convenient working room on both sides.

The studio space required will depend, of course, on the scope of programming, number of cameras and other factors. Here again the reader is referred to BROADCAST NEWS No. 81 for description of operating TV stations color studios.



# CHARTS SHOWING SPACE, WEIGHT AND POWER

## Step #1—Color Network Operating Equipment

DESCRIPTION	HT.	DIMENSIONS		DP.	APPROX. WEIGHT	POWER REQUIREMENTS	
		WD.				AC (WATTS)	DC (MA)
Color Stabilizing Amplifier, TA-7B	10½	19		10¼	20	60	350
Color Monitor, TM-10B	26	22½		31¼	180	450	—
Low Frequency Phase Correction Equalizer	5¼	19		10	9	—	—
High Frequency Phase Correction Equalizer	17½	19		10	30	—	—
Video Distribution Amplifier, TA-3A	3½	19		10¾	12	55	140
Power Supply, 580-D	10½	19		12	58	370	—
Power Supply, WP-33B	14	19		9	82	400	—
Cabinet Rack, BR-84D	84	22		24¼	225	—	—
Video Jack Panel	3 15/32	19		9¼	8	—	—
Color Stripe Generator, WA-8A	8¾	19		7¾	20	125	—
<b>Color Test Equipment for Network Operation</b>							
Linearity Checker, WA-7B	8¾	19		14	40	210	—
Color Signal Analyzer, WA-6B	17½	19		14	80	140	—
Burst Controlled Oscillator, WA-4A	8¾	19		14	40	165	—
Service Color Bar Generator, WR-61A	10	13½		7½	13	50	—
TV Oscilloscope, TO-524-D	15½	12¾		22¾	61	500	—
Grating and Dot Generator, WA-3B	8¾	19		14	42	180	—
Calibration Pulse Generator, WA-9A	5¼	19		9	14	50	—

## Step #2—Color Bar and Local Origination Equipment

Color Frequency Standard	7	19		7½	12	44	60
Burst Flag Generator	8¾	19		9	13	25	130
Power Supply, 580-D	10½	19		12	58	370	—
Studio Sync Generator, TG-2A	21	19		8¾	50	275	—
Cabinet Rack, BR-84D	84	22		24¼	225	—	—
Studio Color Bar Generator, WA-1D	14	19		9	30	135	—
Colorplexer, TX-1B	21	19		9	35	180	325
Sync Generator Changeover Switch	5¼	19		6	6	—	—
Changeover Switch Remote Control Panel	2¾	11		—	2	—	—
Aperture Compensator	1¾	19		7	3	10	33

## 3-V Color Film and Slide Equipment

3-V Color Film and Slide Camera, TK-26A	57	41½		23¼	525	135	780
Multiplexer and 24 Volt Power Supply, TP-12	54	53		14	320	225	—
16mm Film Projector, TP-6BC	54¼	22½		13¾	450	1500	—
Dual Disk Slide Projector, TP-3C	14½	16		18½	30	300	—

(see Fig. 12 for complete Film Room floor space and ductwork plan)

Console Housing for Master Monitor	41	13¼		36	50	—	—
Console Housing for Processing Amp.	36	22		45	150	—	—
Master Monitor, TM-6C	18	13½		20	55	90	450
Processing Amplifier	10½	17½		21	35	50	350
Color Monitor, TM-10B	26	22½		31¼	180	450	—
Colorplexer, TX-1B	21	19		9	35	180	325
Aperture Compensator (for TX-1B)	1¾	19		7	3	10	33
Power Supply, 580-D	10½	19		12	58	370	—
Power Supply, WP-33B	14	19		9	82	400	—
Cabinet Rack, BR-84D	84	22		24¼	225	—	—
Video Jack Panel	3 15/32	19		9¼	8	—	—
Video Distribution Amplifier TA-3A	3½	19		10¾	12	55	140
Pulse Distribution Amplifier TA-4A	3½	19		10¾	12	55	120

## Step #3—Color Studio Camera Equipment

Color Studio Camera, TK-41	27	44		21	300	190	975
Processing Amplifier	10½	17½		21	35	50	350
Focus Current Regulator	5¼	19		9	22	85	12
Centering Current Supply	5¼	19		9	40	40	—
Colorplexer, TX-1B	21	19		9	35	180	325
Aperture Compensator (for TX-1B)	1¾	19		7	3	10	33
Master Monitor, TM-6C	18	13½		20	55	90	350
Color Monitor TM-10B	26	22½		31¼	180	450	—
Console Housing for Master Monitor	41	13¼		36	50	—	—
Console Housing for Processing Amp.	36	22		45	150	—	—
Power Supply, 580-D	10½	19		12	58	370	—
Power Supply, WP-33B	14	19		9	80	400	—
Cabinet Rack, BR-84D	84	22		24¼	225	—	—
Heavy Duty Pedestal, TO-4A	58	39		39	500	—	—
Video Jack Panel	3 15/32	19		9¼	8	—	—
Pulse Distribution Amplifier, TA-4A	3½	19		10¾	12	55	120



## Intercom for Color

In any TV setup, a good *intercom system* is a necessity. The first significant step is when film facilities are added. In most existing stations some form of intercom system is in use, and the addition of color film into the same area may not require any additional talk circuits.

However, the addition of a color studio camera which has an intercom circuit built in, will require terminal equipment for communication in accordance with the number of cameras and control points involved.

Inasmuch as the intercom circuit constants are the same as those used in the RCA monochrome cameras they may be easily integrated with an existing monochrome system.

Fig. 34 shows typical RCA intercom items which may be used for a color camera studio arrangement and a film projection room. A six station talk-listen intercom and amplifier set is shown operating between the control room and projection booth. This unit is quite effective because it does not require that the projectionist use a set of headphones and he can answer from almost any spot in the room.

## Audio for Color

In general, audio equipment facilities for color are the same as those used for black

and white. For a complete description of such facilities, refer to BROADCAST NEWS No. 73 (March-April 1953, "Four Versatile TV Station Equipment Plans").

## House Monitoring

Two new types of RCA Monitran units have been designed for color. The type TM-40 monitran is an all channel unit which permits the user to select any TV channel from 2 to 13. The type TM-41 monitran is a factory tuned unit which will operate on any single channel specified for the user. These units may be used to distribute a modulated r-f signal to color receivers for house or studio monitoring purposes.

## Microwave Equipment for Color

A new microwave system, type TVM-1A, has been designed to transmit both color and monochrome. The specifications of this equipment are such that it is capable of adequately meeting the requirements of a Color Television system. In the TVM-1A microwave transmitter, power has been increased over that of previous models to give more reliable transmission over longer distances. This increased power makes economical multi-hop operation feasible for both color and monochrome transmission. In monochrome use, the TVM-1A is a substantial, superior system offering increased stability, ease of operation and excellent performance characteristics.

It is possible that the broadcaster already may have an RCA TTR-1A/ TRR-1B in monochrome operation. While the new TVM-1A microwave is recommended for the step to color, it should be remembered that the RCA TTR-1A and TRR-1B microwave equipment may be modified for this purpose.

## HELP IN MAKING YOUR COLOR PLANS

Every television station will have its own special problems in converting to color. RCA Field Sales Engineers have been provided with the information needed to help stations solve these problems. They have detailed information on all RCA Color TV Equipment, including suggested arrangements for every size station. In the case of stations needing special switching arrangements, or other custom built equipment, they can call on the RCA TV Systems Engineering Group for assistance. This help is available to all stations without obligation.

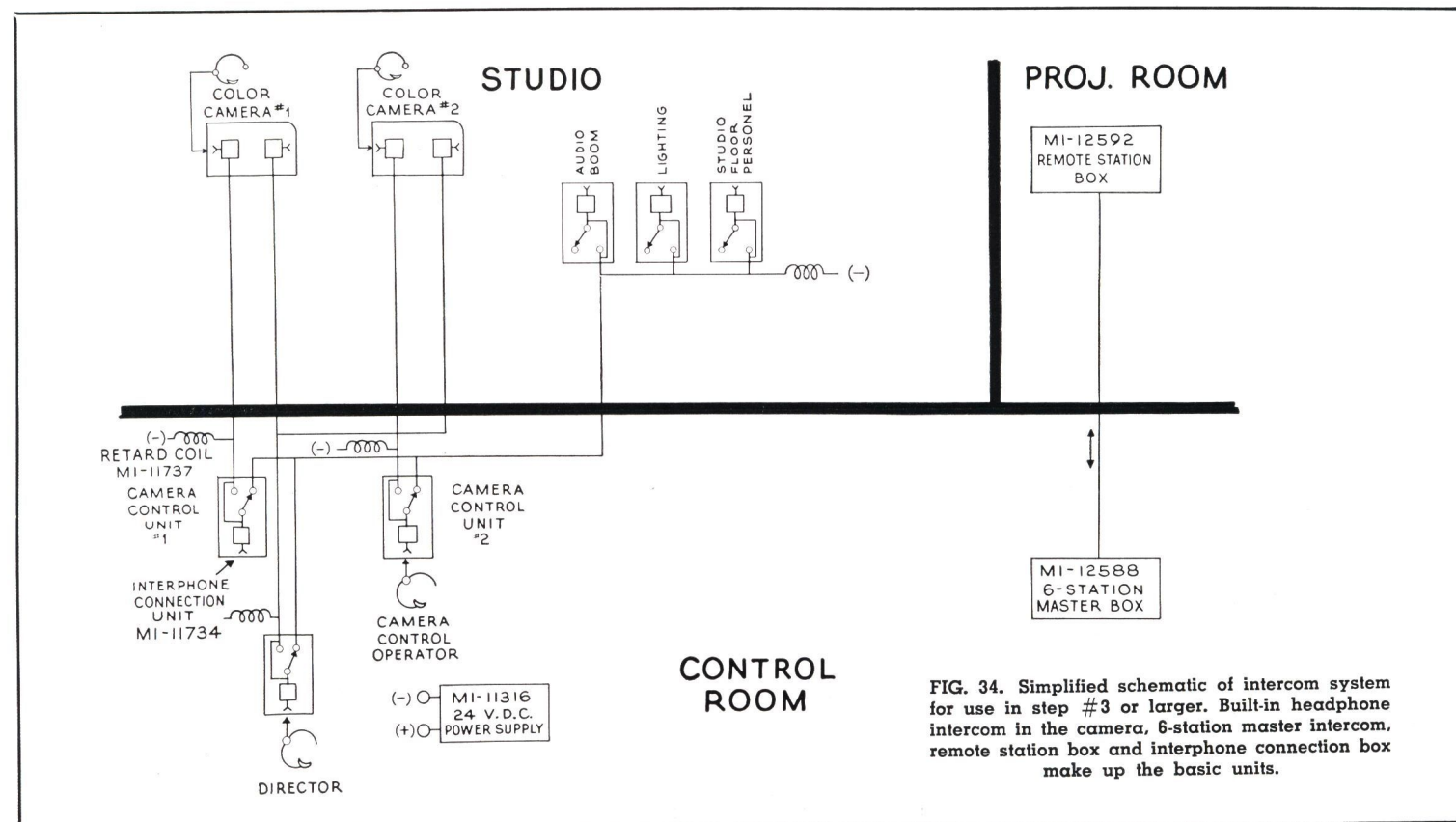


FIG. 34. Simplified schematic of intercom system for use in step #3 or larger. Built-in headphone intercom in the camera, 6-station master intercom, remote station box and interphone connection box make up the basic units.



## NETWORK EQUIPMENT

Page	Type Number	Description	MI Number
5-6	.....	Low Frequency Phase Equalizer.....	MI-34025
5-6	.....	High Frequency Phase Equalizer .....	MI-34026
7-8	TA-7B	Color Stabilizing Amplifier.....	MI-40205-A
8	.....	Remote Control Panel (for Stab. Amp.) .....	MI-40250
9-12	WA-8A	Color Stripe Generator.....	MI-40214
13-14	TM-10B	Color Monitor .....	MI-40206-A

## TEST EQUIPMENT

15-16	WA-7B	Linearity Checker .....	MI-34017-A
17-20	WA-6A	Color Signal Analyzer (including cabinet) .....	ES-40950
21-22	WA-4A	Burst Controlled Oscillator.....	MI-34023
23-24	WR-61A	Service Color-Bar Generator.....	RCA WR-61A
25-26	WA-3B	Grating and Dot Generator.....	MI-30003-B
27-28	WA-9A	Calibration Pulse Generator.....	MI-26070

## SYNC GENERATOR EQUIPMENT

29-30	TG-2A	Studio Sync Generator .....	MI-26102
29-30	TG-12A	Field Sync Generator .....	ES-26921
31	.....	Burst Flag Generator .....	MI-40202-A
32	.....	Color Frequency Standard.....	MI-40201

## LOCAL ORIGATION EQUIPMENT

33-34	WA-1D	Color Bar Generator.....	MI-34001-D
35-36	TX-1B	Colorplexer (including the following:)	MI-40209-A
35-36	.....	Aperture Compensator .....	MI-40414
35-36	.....	Automatic Carrier Balance .....	MI-40416

## 3-VIDICON FILM AND SLIDE CHAIN

37-44	TK-26A	3-Vidicon Color Film Camera Equipment	
42-43	TP-12	3-Vidicon Multiplexer .....	ES-26919

## LIVE CAMERA EQUIPMENT

45-56	TK-41	Live Color Camera Chain	
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## VIDEO SWITCHING

57-60	TS-5A	Video Switcher .....	MI-26299
61-64	TS-11A	Video Switcher .....	MI-26226
65-68	TS-20A	Remote Control Switching System	

## COLOR MICROWAVE

69-76	TVM-1A	Color Microwave Equipment	
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## COLOR PLANNING IN THREE EASY STEPS

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