Color Camera Chain, Type TK-41C

Description

The RCA TK-41C Color Camera Chain provides the television broadcast station with the ideal means of originating beautiful, full-color programs. Live color programming permits maximum realization of the benefits of color—adding a brilliant new dimension to programming techniques and presenting commercial products in thrilling reality. Local color origination of studio programs and commercials, sporting events, community parades and festivals can build station prestige and stimulate sponsor interest. Live color commercial inserts and station breaks between color network and color film features hold and strengthen viewer interest by maintaining color program continuity.

Color mobile units, designed to handle up to five color cameras, are available to extend the use of color cameras to a broad variety of field programming applications.

Dependable and Economical Performance

Designed with the objective of providing an easily operated, space-conserving and economical color television pick-up system, the TK-41 series of cameras have earned wide acceptance throughout the broadcast industry. Their performance and reliability have been thoroughly proven by extensive use under daily operating conditions. The camera is easily handled and is designed for operation by a single cameraman.

A cradle type camera mounting head, which accurately maintains the camera in balance about its own center of gravity, results in maneuverability and convenience of operation comparable to that of monochrome studio camera equipment.

The TK-41G camera employs the same complement of standard lenses as monochrome camera equipment. The camera control equipment includes a processing amplifier which is identical with that used with the RCA Type TK-26C 3-Vidicon Color Film Chain. Centralized controls provide minimum setup time. During "on-air" operation, the camera control operator can control signal processing for...
best picture quality by the use of only one knob. Control operations can be located at a console or rack position as desired.

**Camera Chain Components**

The TK-41C Color Camera Chain is functionally similar to monochrome camera chains in that it consists of a live pick-up camera in addition to signal processing, control and monitor units. The major equipment units include the color camera, viewfinder, camera control panel, processing amplifier, TM-21D color monitor, TX-ID Colorplexer with aperture compensator and automatic carrier balance, TM-4C master monitor, and power supplies.

The color camera proper contains a light splitting prism 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, regulated high voltage and negative voltage circuit, image orthicon protection circuit, and three plug-in video preamplifiers, one for each of the three color channels. The electronic viewfinder includes 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 setup 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 R, G, and B 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 in series with the luminance channel of the colorplexer. The output of the colorplexer is fed to the studio video switching system. A TM-21D Color Monitor is also included in the chain and is utilized at the camera control position to provide a check on the quality of the final color picture.

**TK-41C Color Camera**

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

The camera is entirely self-contained with the exception of the DC power supplies, video processing amplifier and certain electrical controls which are located for operating convenience at the camera control panel. All electrical connections to the camera are made through a single eighty-two conductor camera cable attached by a connector in such manner as to permit the cable 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-41C Color Camera is 141/4 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 the local electrical setup 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.

**Improved Operational Stability**

The TK-41C incorporates a number of design improvements for ease of operation and assurance of highest picture quality. A new focus current regulator holds focus current to within 0.1 percent for accurate and stable registration. A low impedance blanking circuit provides immunity to horizontal deflection crosstalk. The addition of temperature compensation to the vertical deflection coils has reduced the required camera warmup period and assures long term stability of registration. Vernier adjustments are provided for horizontal and vertical size, linearity, skew and centering adjustments. Excellent stability of color balance has resulted from stabilization of the image orthicon multiplier gain. Through “super regulation” techniques the image orthicon electrode voltages are maintained to 0.25 percent, thereby virtually eliminating electrical focus drift. A stabilized beam current supply assures optimum signal-to-noise ratio and proper shading of the picture over long periods without touchup.

**Electro-Mechanical Lens Cap**

A remote-controlled douser type optical lens cap permits precise adjustment of black level and precision adjustment of color balance for precise matching of cameras. An improved field lens holder maintains precise alignment of the field lenses on the optical axis and avoids vignetting, while a new turret and detent mechanism provides noise-free rotation of the lens turret. Camera test facilities have been centralized with test probe points and selector switches grouped on a convenient test panel within the camera. New full-length side doors provide substantially improved access to the camera interior.

**Transistor Intercom System**

Two sets of communication and program sound and associated volume controls jacks are mounted on a strip installed below the back operating panel at the rear of the camera. A transistor intercom system provides high level voice communications between the camera operator, the camera control operator, and the program director or other studio personnel. Variable volume controls allow individual adjustment of sound level. 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 skews, with polarity reversing switch, height, width, and vertical and horizontal Q adjustment. An on-off switch operates the blower motors. An overscan switch is also provided. The C-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.

**Complete Accessibility**

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 degrees from its normal position, permitting replacement of tubes and 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 degrees. It permits further access to elements of the optical plate assembly, and the blue and green channel yoke assemblies. The Type 4415 or 4416 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. The yoke assemblies

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Set-up controls shown above are all conveniently located behind hinged doors. Only two handle controls are needed for on-air operation of camera.
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 DC).

**Filtered Forced-Air Ventilation**

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. Replaceable air filters reduce the necessity for frequent cleaning of the optical system. 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 AC that may be used for test equipment.

**Stabilized Camera Viewfinder**

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-pushbutton 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 uhr and focus voltages of the kinescope are regulated with corona type regulators. It provides a wide range of kinescope brightness change without defocusing of the kinescope image.
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 of these tubes 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. A DC restorer is included to maintain optimum contrast and brightness of the viewfinder over a wide range of scene content and compositions.

The viewfinder is designed to slide in guides and lock in position directly above the camera. All signal and operating voltages are led 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 is a thumb latch to release the unit from a locked position. The viewfinder is covered by a multi-leafed hood which can be raised to facilitate ease in servicing the unit. A detachable viewing hood (MI-40592) is attached to the viewfinder control panel for shielding the viewing screen from extraneous light.

**Camera Mounting Equipment**

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-41C is provided with a TD-9C Motor Driven Pedestal for general studio use.

The TK-41C 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 with the Video Level Control Panel, 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-inch Camera Control Panel in the inclined section of the console desk and the Processing Amplifier in the top sloping portion of the console. The camera control equipment also includes a TM-21D Color Monitor. This may be suspended from the wall or ceiling or set upon a stand.

If desired, a wall mounted control panel may be rack mounted with the exception of the color monitor. In this case a Rack Mounted Control Desk and Accessory Kit, MI-40415, is available to provide desk space at the rack location.

**Simplified Control Panel**

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-inch 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 only two controls protrude. These are the Pedestal and Iris Control knobs. The
Complete accessibility to all circuits and controls makes maintenance and servicing of RCA color camera a pleasure for both operators and technicians.

latter operates the remote iris selsyn motor in the optical system, and is the only control required during program origination. 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 master pedestal control provides simultaneous adjustment of the pedestal voltage in the three channels. Setup 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 and target voltage. 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.

**Video Level Control Panel**

The Video Level Control Panel is mounted adjacent to the MI-40535 Camera Control Panel. The Video Level Control Panel consists of three attenuator pads located in the video line between the Processing Amplifier and the Colorplexer to allow precise settings of the white balance, thereby completely eliminating pedestal-riding during programming. The control may also be used to introduce color shifts of precisely controlled amplitude into the picture to compensate for minor color differences between cameras. The pads are thus used as trimmer adjustments to achieve true color picture uniformity between cameras.

**Compact Processing Amplifier**

The Processing Amplifier of the TK-41C 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 setup 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.

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.

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 color-plexer output. A staircase signal for the CRO circuit is provided for a sequential display of red, blue, and green channels.

**Precision Color Monitor**

The Color Control Monitor, Type TM-21D, provides an accurate, stabilized color picture display at high brightness level and is extremely useful in pinpointing parts of the color chain requiring adjustment. The equipment offers the control operator precision checks on camera registration, color balance, shading, deflection and transmission system transients, and effects of pedestal adjustments, as well as camera deflection linearity, chroma level and phase of hue adjustments. It greatly simplifies camera matching and provides a standard against which color performance can be evaluated. Long term stability of the monitor is assured by liberal use of feedback. Time devoted to monitor adjustments is negligible.

**Optional Rack Mounting of Camera Controls**

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 Color-plexer, aperture compensator, automatic carrier balance, focus current regulator and a set of two WP-16B power supplies also mount in standard 84-inch cabinet racks.

### Television Color Camera Chain

<table>
<thead>
<tr>
<th>Equipment</th>
<th>MI</th>
<th>Tubes</th>
<th>DC mA</th>
<th>AC Watts</th>
<th>Total Heat</th>
<th>Rack Space</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color Camera—Defl.</td>
<td>40534</td>
<td>40</td>
<td>225 + (210 at 360 V)</td>
<td>132</td>
<td>277</td>
<td>—</td>
<td>250</td>
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<tr>
<td>—Preamp.</td>
<td></td>
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<tr>
<td>Viewfinder</td>
<td>40501-A</td>
<td>22</td>
<td>125 + (65 at 360 V)</td>
<td>58</td>
<td>117</td>
<td>—</td>
<td>45</td>
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<tr>
<td>Processing Amplifier</td>
<td>40520-A</td>
<td>55</td>
<td>360</td>
<td>175</td>
<td>200</td>
<td>10½&quot;</td>
<td>50½</td>
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<tr>
<td>Focus Current Regulator</td>
<td>40524-B</td>
<td>4</td>
<td>12</td>
<td>85</td>
<td>90</td>
<td>5½&quot;</td>
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<tr>
<td>Focus Voltage Regulator</td>
<td>40541</td>
<td>6</td>
<td>12</td>
<td>17</td>
<td>5</td>
<td>3½&quot;</td>
<td>7½</td>
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<tr>
<td>Color-plexer</td>
<td>40209-C</td>
<td>29</td>
<td>280</td>
<td>90</td>
<td>180</td>
<td>21&quot;</td>
<td>34</td>
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<tr>
<td>Automatic Carrier Balance</td>
<td>40416-A</td>
<td>5</td>
<td>20</td>
<td>15</td>
<td>—</td>
<td>3½&quot;</td>
<td>10</td>
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<tr>
<td>Aperture Compensator</td>
<td>40414</td>
<td>2</td>
<td>33</td>
<td>10</td>
<td>15</td>
<td>1½&quot;</td>
<td>3</td>
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<tr>
<td>TM-21D Color Monitor</td>
<td>40226-D</td>
<td>61</td>
<td>—</td>
<td>900</td>
<td>900</td>
<td>—</td>
<td>213</td>
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<tr>
<td>WP-16B Power Supply (2 Units)</td>
<td>26048-B</td>
<td>—</td>
<td>&quot;1600 each&quot;</td>
<td>700 ea.</td>
<td>—</td>
<td>7&quot; ea.</td>
<td>50 ea.</td>
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<tr>
<td>WP-16B Centering Current Unit</td>
<td>26083-A</td>
<td>—</td>
<td>1000</td>
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<td>—</td>
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<tr>
<td>WP-16B Unregulated High Voltage Unit</td>
<td>26082-A</td>
<td>230</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<td>3</td>
</tr>
</tbody>
</table>

* 1600 mA with no unregulated current; 1350 mA with 250 mA unregulated current.
Specifications

**Electrical**

**Camera:**
- **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
- **DC Power (from power supplies):**
  - Regulated: 280 Volts, 245 mA
  - Unregulated: 280 Volts, (5x10) mA
- **Camera and Deflection:** 360 Volts, 210 mA
- **Focus Coil Current:** 2.7 mA
- **Tally Lights (Relay Controls):** 24 mA DC
- **AC Power:** Heaters, Blowers: 117 V, 50/60 Hz, 1 phase, 132 Watts
- **Output:**
  - Video Response: Flat to 6 MHz
  - Video Signals (black negative): 0.3 Volt peak-to-peak
  - Video Signals to Viewfinder: 0.5 Volt, peak-to-peak
  - Video Gain: 15 dB
- **Viewfinder:**
  - 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
  - DC Power (from power supply): Regulated: 280 Volts, 125 mA
    - Unregulated: 360 Volts, 65 mA
    - Tally Lights (Relay Controls): 24 mA DC
    - AC Power: 50/60 Hz, single phase, 117 Volts, 58 Watts
- **Processing Amplifier:**
  - Input:
    - Video (red, blue, green and test): 0.3 Volt peak-to-peak
    - Horizontal Drive (high impedance): 1.5 to 5 Volts peak-to-peak
    - Vertical Drive (high impedance): 1.5 to 5 Volts peak-to-peak
    - Blanking Pulse (high impedance): 15 kHz sq. wave
    - Calibration Pulse (high impedance): 0.7 Volt peak-to-peak
  - Output:
    - Video to Colorplexer (red, blue and green): 0.7 Volt peak-to-peak
    - Video to Monitor: 0.7 Volt peak-to-peak
    - Blanking Pulse: 15 kHz sq. wave
    - Calibration Pulse: 0.7 Volt peak-to-peak
    - Horizontal Drive: 8.5 microseconds ±5%
    - Amplitude: 3.5 Volts peak-to-peak
    - Impedance: 75 Ohms

**Vertical Drive:**
- Width: 800 microseconds ±20%
- Amplitude: 3.5 Volts peak-to-peak
- Impedance: 75 Ohms

**Blanking Pulse:**
- Width: Equal to input pulse width ±1%
- Amplitude: 2 Volts peak-to-peak
- Impedance: 75 Ohms

**Calibration Pulse:**
- Width: Equal to input pulse width
- Amplitude: 0.7 Volt peak-to-peak ±1%
- Impedance: Low

**Twenty Cycle Step Voltage to Master Monitor:**
- Amplitude (maximum): 22 Volts peak-to-peak
- Impedance: High
- DC Supply Voltage: 280 Volts DC
- DC Current: 360 mA
- AC Power Input: 175 Watts
- Dimensions: 11/32" high x 17 9/16" wide x 201/4" long
- Weight: 50 lbs.

**NOTE:** For specifications on Master Monitor, Color Monitor, Colorplexer and Power Supply see separate catalog description of these items.

**Overall Mechanical**

- **Camera:** Length: 44" Width: 21" Height: 14 1/4" Weight: 268 lbs.
- **Viewfinder:** Length: 34 1/2" Width: 13 3/4" Height: 11 1/4" Weight: 45 lbs.
- **Control Panel:** Length: 18" Width: 8" Height: 8" Weight: 18 lbs.

**Accessories**

- **Neutral Density Slide Mechanism for TK-41C:** M-40628
- **Spare Video Preamplifier for TK-41:** M-40629-A
- **Pulse Delay Line:** M-40845
- **TA-4A Pulse Distribution Amplifier:** M-40658
- **Interphone Connection Unit (Transistorized):** M-11764
- **Interphone Retardation Coil:** M-11774
- **Mounting Plate for Interphone Connection Unit:** M-11775
- **Interphone Retardation Coil:** M-11776-A
- **Gamma Corrector (5.2):** M-40812-A
- **Field Lens Test Pattern Jig:** M-40873
- **100 Ft. Camera Cable:** M-40888-3
- **200 Ft. Camera Cable:** M-40895-4
- **EIA Linearity Test Chart:** M-2582-21
- **EIA Resolution Test Chart:** M-2582-22
- **EIA Registration Test Chart:** M-2582-23
- **EIA Linear Gray Scale:** M-2582-24
- **EIA Logarithmic Gray Scale Chart:** M-2582-25
- **Type BA-64D Cabinet Rack:** M-3951-084
- **WAVC Linearity Checker:** M-3951-084
- **Viewfinder:** M-40501-A
- **Viewfinder Hood:** M-40502
- **TM-210 Color Monitor:** M-4026-3
- **Image Orthicon Tube, Type 4415:** M-40819
- **Image Orthicon Tube, Type 4116:** M-40891

**NOTE:** The TK-41C Camera equipment is also available for operation on 60 Hz, 50-Hz standards and from 60 Hz, 115-Volt or 220-Volt power source.

Ordering Information

**RCA CORPORATION OF AMERICA**

Broadcast and Communications Products Division, Camden, N.J. 08102 - RCA International Division, Central and Terminal Avenues, Clark, New Jersey, U.S.A. 08026

**Accessories**

- **TK-41C Color Camera:** M-40534
- **TK-41C Color Camera, Console-Mounted Control:** Order per Schedule RA
- **TK-41C Color Camera, Rack-Mounted Control:** Order per Schedule RA