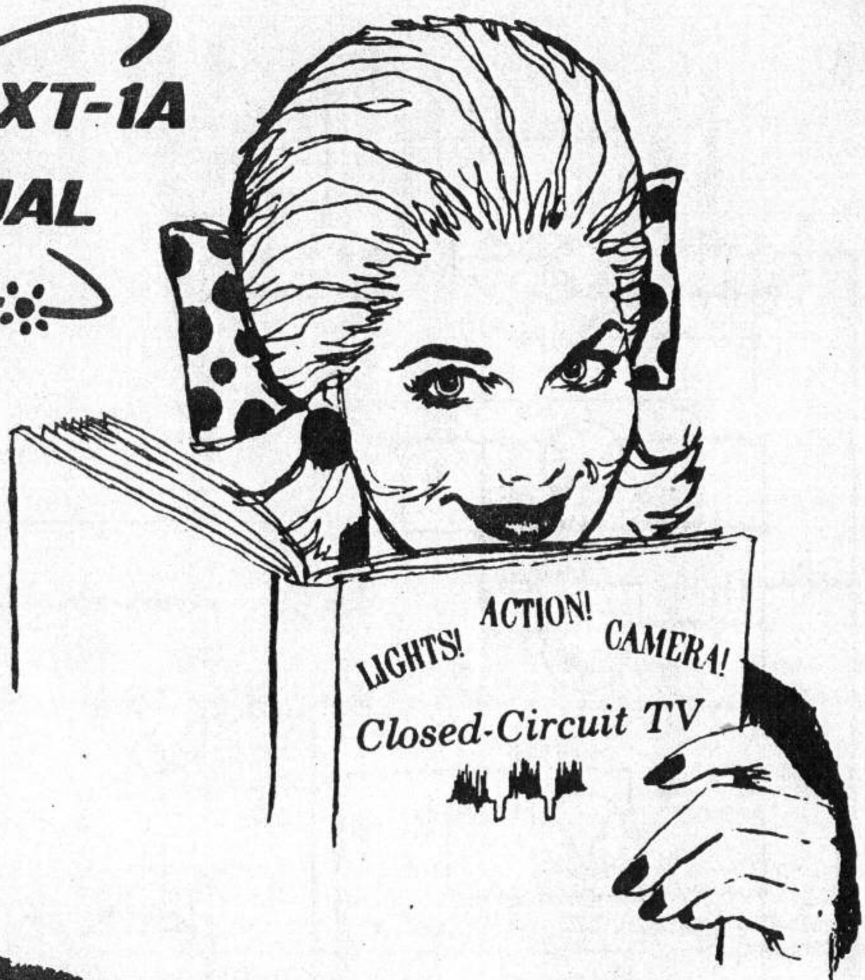
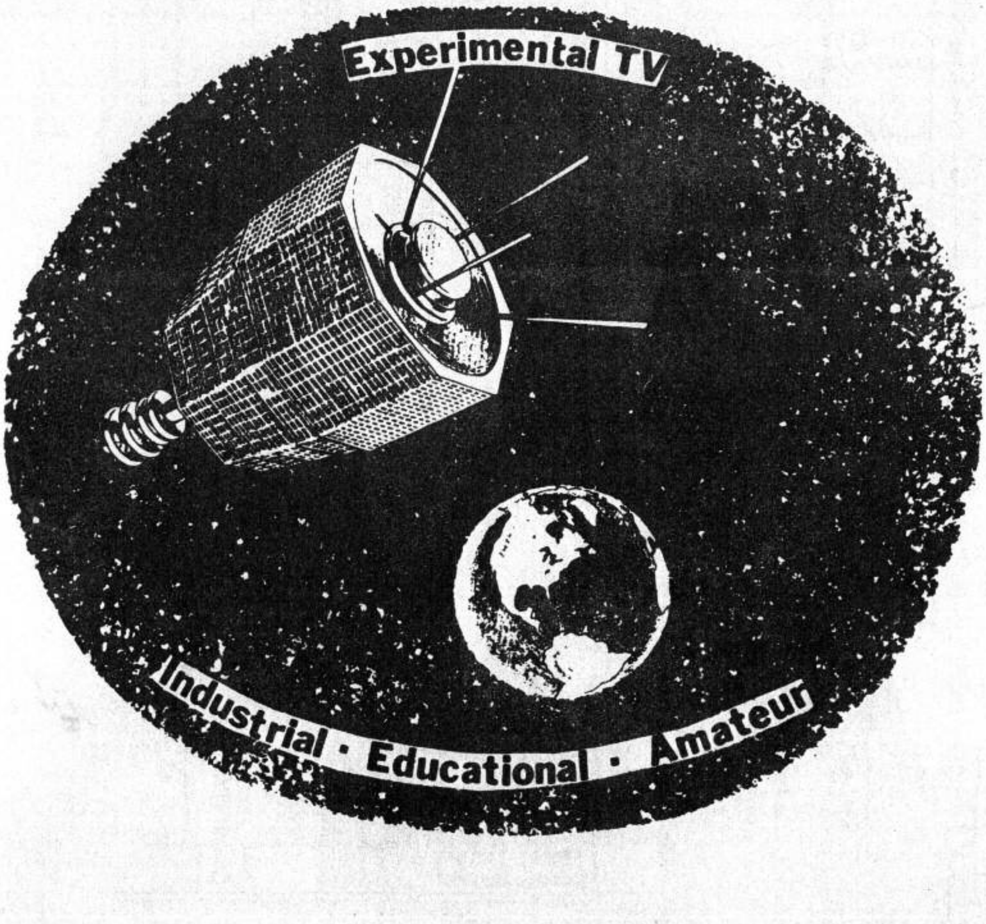
ATV RESEARCH XT-1A CAMERA MANUAL



COMPLETE DETAILS FOR ASSEMBLING, TESTING AND OPERATING THE MODEL XT-1A SOLID STATE VIDICON CAMERA



NEW IMPROVED VERSION SERIES 'D'

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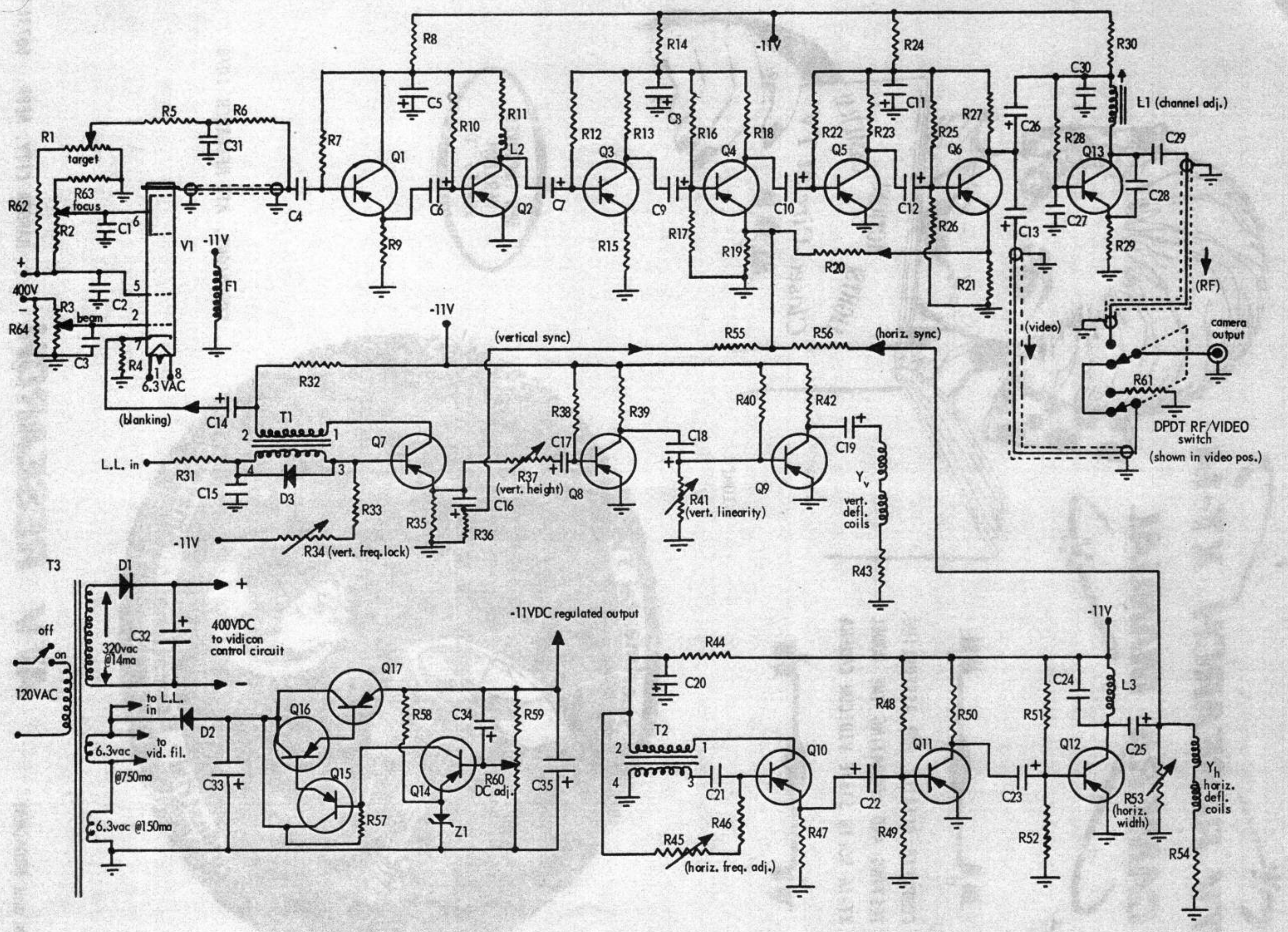
17 transistors

13th and BROADWAY **ATV RESEARCH** DAKOTA CITY, NEBR. 68731


R1
target
R5
R6
C31
R62
R63
focus
R2
C1
V1
-11V
F1
+
400V
-
C2
R3
beam
R64
C3
R4
6.3VAC
R7
R8
C5
R10
R11
L2
Q1
Q2
R9
C4
C6
C7
R12
R13
R14
C8
R16
R18
Q3
Q4
C9
R15
R17
R19
-11V
R24
C11
R22
R23
R25
R27
Q5
Q6
C10
C12
R26
R20
R21
R30
C30
L1 (channel adj.)
C26
R28
Q13
C29
C28
C27
C13
R29
(RF)
(video)
camera
output
R61
DPDT RF/VIDEO
switch
(shown in video pos.)
-11V
(vertical sync)
R55
R56
(horiz. sync)
R32
(blanking)
C14
T1
Q7
L.L. in
R31
C15
D3
R33
-11V
R34 (vert. freq. lock)
R35
C16
R36
R37
(vert. height)
C17
R38
R39
Q8
C18
R41
(vert. linearity)
R40
R42
C19
Q9
Y_v
vert.
defl.
coils
R43
T3
D1
+
400VDC
to vidicon
control circuit
C32
320vac
@14ma
off
on
120VAC
to L.L.
in
D2
6.3vac
to
vid. fil.
@750ma
6.3vac @150ma
C33
Q16
Q17
Q15
R57
R58
C34
Q14
Z1
R59
R60
DC adj.
C35
-11VDC regulated output
-11V
R44
C20
T2
C21
R45
R46
(horiz. freq. adj.)
Q10
R47
C22
R48
R49
Q11
R50
C23
R51
C24
L3
Q12
R52
C25
R53
(horiz.
width)
Y_h
horiz.
defl.
coils
R54

INTRODUCTION

The ATV RESEARCH Model XT-1A is a completely transistorized vidicon camera specifically designed to satisfy the needs of amateurs, experimenters, students and low budget industrial users. As a successor to our now widely acclaimed tube model camera, the XT-1A exhibits improved signal to noise ratio, higher sensitivity, superior temperature stability, lower power consumption...and of course, excellent picture quality!

Straightforward circuitry and printed circuit construction makes this camera very easy to assemble, tune and put into operation.

To gain a better insight into the principles of operation and to save considerable time during construction, it's recommended that you take a few extra minutes and read through the entire manual——cover to cover.

NOTES

UNPACK YOUR KIT CAREFULLY and check each item against the parts list in the Manual. Be especially careful that all items have been removed from the packing material before discarding!

Construction will be greatly facilitated if, prior to assembly, all parts are separated according to convenient categories (resistors, capacitors, pots, hardware, etc) and placed in sectionalized containers such as an egg carton or muffin tin.

ALL SOLDERING MUST BE DONE WITH A GOOD GRADE OF ROSIN CORE SOLDER!...preferably one containing activated flux such as Ersin "Multicore", Kester "Resin-Five" or similar types. Under no circumstances should acid-core solder be used! A low wattage soldering pencil or small iron (25 or 35 watts) is ideal for circuit board soldering. If a higher wattage iron or gun is used, take care to solder all printed circuit connections as quickly as possible. Remember, too much heat causes damage to components and may result in the copper foil separating from the board. On the other hand, too little heat results in a weak and possibly a cold solder joint——a connection which is neither electrically or mechanically acceptable.

If an excessive amount of solder should cause a short between two points on the board it can be removed by reheating the connection and quickly tapping the board against the side of the workbench. The excess solder will fall to the floor. A damaged foil can be repaired by soldering a small piece of bare wire across the break.

All components, except the transistors, should be mounted tightly to the board, keeping the leads as short as possible to minimize the effects of stray capacity, etc. In the case of the transistors, insert to within ¼" of the board. When soldering, be sure to not overheat! As an extra safety precaution hold the lead between the transistor and the board with a pair of long nose pliers. The pliers will act as a heat sink and conduct away most of the heat, thus avoiding possible damage to the transistor. It should be noted that leads on most components are longer than necessary...always trim off any excess after soldering.

RESISTOR-CAPACITOR CODING

All of the fixed resistors are color coded with color bands around the body of the resistor. To determine the value of each resistor, use the color code chart shown on the next page. The band nearest the outside edge of the resistor body is always the one used to represent the first digit...the next band is for the second digit and the third band represents the multiplier. The fourth band, if present, indicates the tolerance rating. Usually the latter is silver, representing a ± 10% tolerance.

RESISTOR COLOR CODE CHART

COLOR	1st DIGIT	2nd DIGIT	MULTIPLY BY
Black	0	0	1
Brown	1	1	10
Red	2	2	100
Orange	3	3	1,000
Yellow	4	4	10,000
Green	5	5	100,000
Blue	6	6	1,000,000
Violet	7	7	10,000,000
Gray	8	8	100,000,000
White	9	9	1,000,000,000

Capacitors are easier to identify since they are generally numerically labeled. The important thing to remember about capacitors is that they may not be labeled in the same basic unit as is shown in the parts list. To convert from microfarads to picofarads or the reverse use the chart shown below.

CAPACITOR CONVERSION CHART

TO CONVERT	TO	MULTIPLY BY
MFD (microfarad)	MMFD	1,000,000
MMFD (micro-microfarad)	MFD	0.000001

THEORY OF OPERATION

For a more thorough understanding of the description to follow refer to the block diagram of fig. 1 and the schematic diagrams on the inside front cover.

Basically, the camera can be divided into five sections;

1. Vidicon and associated control circuit.
2. Video amplifiers including sync/video mixer.
3. Vertical deflection.
4. Horizontal deflection.
5. Power supply.

Let's take one section at a time.

VIDICON AND ASSOCIATED CONTROL CIRCUIT: The vidicon is a "low velocity" scanning type camera tube. It utilizes a photoconducting signal electrode more commonly referred to as the "target". This electrode is both a light sensitive element and a storage medium.

Since the photoconductor has a relatively low secondary emission factor and the applied target voltage is quite low, the scanning beam lands at nearly zero velocity. When this occurs the scanned surface is driven to the potential of the cathode. Thus, the charge pattern developed by the light image (formed by the camera lens) is neutralized point by point and line by line as the beam scans across the back side of the target.

The capacitive coupling of this change in charge causes a signal current to flow through the target signal load resistor, R6. This current is electrically equivalent to the scanned image. Immediately following the scanning beam, each point on the target surface recharges to the potential as determined by the light striking that particular area. This minute charge is stored until the scanning beam returns on the next sweep cycle.

The electron scanning beam is caused to come into sharp focus on the scanned side of the target with one loop of focus by means of an axial magnetic field developed by the focus coil, F1 and the electrical field of the accelerating electrodes, G2 & G3. Contrary to what you might first assume, the focusing of the vidicon is not "fine adjusted" by varying the current through the focus coil. Instead, the "fine adjustment" is accomplished with the electrostatic control R2, connected to pin 6 of the vidicon focus grid.

Beam current is controlled by a variable negative voltage applied to the BEAM GRID, G1, from pot R3. This pot is on the same shaft as the on/off switch and wired such that G1 receives maximum negative voltage when the pot is in its counterclockwise position. In this manner, the beam is biased to cutoff when the camera is first turned on. Once the vidicon filament has warmed up and it has been asserted that normal scanning is present, the negative voltage is decreased until sufficient beam current is obtained to JUST DISCHARGE the entire target. Too high a beam current can result in poor focus, shading and possible damage to the tube. Too low a beam current, on the other hand, will result in insufficient discharge of the target on each scan.... causing a "washed out" appearance in the televised picture.

Target voltage is obtained from pot R1 through an R/C network composed of R5 and C31. In addition to acting as a filter this network also serves as an instantaneous automatic light circuit. With this compensating circuit you will be able to televise outdoors on a bright sunny afternoon or indoors under poor ambient light without manually re-adjusting lens iris or target voltage! In short it will fully compensate for all normal lighting variations and still provide you with manual override adjustment for extreme conditions.

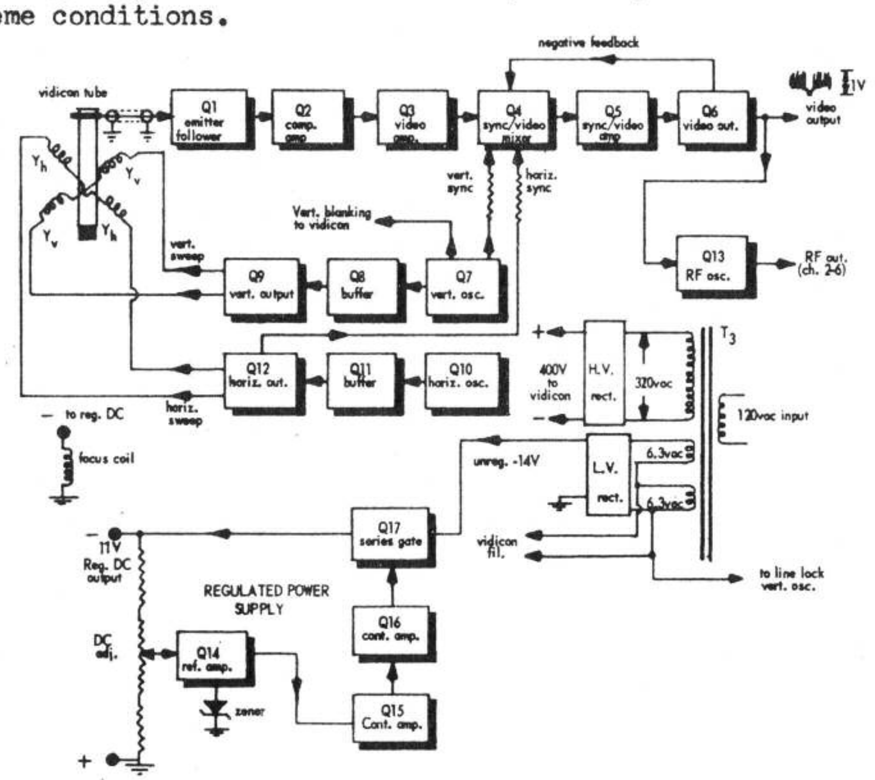


Fig. 1 Block Diagram of the ATV RESEARCH Model XT-1A transistor camera.

Looking briefly at the theory of operation we find that the vidicon target current, under normal conditions will vary from about 0.02µamp under no illumination to about 0.2 µamp under maximum illumination. This variation of current flowing through the series 1000 megohm (R5) resistor will result in a voltage drop being developed across it which is proportional to the amount of light falling on the surface of the target. Thus as the light increases so does the drop across R5. The result is a decrease of target voltage as measured from the target to ground. Since sensitivity of the vidicon is directly proportional to the target voltage it is evident that we have an instantaneous self-regulating light circuit. Following through on this theory you will note that as the light begins to decrease so will the target current and likewise the voltage drop across R5. The result being an increase in target voltage and a subsequent increase in vidicon sensitivity which offsets the decreasing illumination. All time constants in the vidicon target circuit (R5, C31 and C4) have been selected for a response time of approximately 1 second.

Any of the standard 1" electromagnetic vidicons can be used in your XT-1A camera.... however, when using the older 6326A tube, be sure pins 3 and 6 are tied together, otherwise proper focus cannot be obtained.

VIDEO AMPLIFIERS INCLUDING SYNC/VIDEO MIXER: The impedance of the vidicon target is on the order of several megohms. Total shunt capacitance to ground and to the other elements (including short length of shielded output cable) is in the neighborhood of 5-8 mmfd. The normal recommended values of target load resistance under these conditions ranges between 40K and 70K.

Such high impedance eliminates the use of a common emitter for the first video stage since the loading effects would be prohibitive. Instead, the first stage, Q1, is connected as an emitter follower. This stage provides the necessary impedance transformation from the high output impedance of the vidicon to the low input impedance of Q2.

The signal out of Q1 is composed primarily of low frequency energy since most of the high frequency components were lost by the shunt capacity effects in the vidicon and associated wiring. This is compensated by a frequency/phase correction network in the collector circuit of Q2. This network consists of the load resistor R11 in series with peaking coil L2. From here the video is fed to a conventional amplifier stage, Q3 and then on to a three stage feedback stabilized video/sync mixer amplifier.

Sync pulses (both vertical and horizontal) are fed in at the emitter of Q4 through resistors R55 and R56 from appropriate points in the vertical and horizontal deflection stages. These pulses serve two purposes; (1) they provide the synchronizing signal required to make the receiver scan out the televised picture at precisely the same rate as the camera, and (2) they function as a blanking signal extinguishing the beam in the TV picture tube during retrace periods.

The output signal from Q6 is capacitively coupled via C13 to the DPDT RF/VIDEO switch and also to Q13 collector circuit via C26. When the switch is in the "VIDEO" position the output signal is fed directly to the coaxial output connector. This signal is the correct polarity and level (1V p-p) to feed any standard video monitor, transmitter or distribution amplifier. When the switch is in the "RF" position, the output is connected to the output of Q13, a video modulated RF oscillator. This signal is tunable between channels 2 and 6 on any ordinary TV receiver and permits monitoring the televised pictures merely by connecting the output of the camera to the antenna terminals of the TV receiver and tuning L1 to the desired blank channel. This system has the advantage of permitting video monitoring without modifying the "family" TV.

VERTICAL DEFLECTION: This portion of the camera, made up of Q7, 8 and 9, serves three purposes;

1. Vertical sweep for the vidicon tube.
2. Sync for the video/sync mixer.
3. Blanking for the vidicon cathode.

Vertical scanning occurs at the rate of 60 frames (pictures) per second. This means the vertical blocking oscillator, Q7, is operating at a frequency of 60 Hz. This is the same frequency as the AC power line. To prevent hum bars (residual or stray 60 Hz) from slowly drifting through the picture it is conventional to lock the oscillator to the line. This is accomplished by feeding a small amount of AC from power transformer, T3, to the primary winding of blocking transformer, T1, via R31. Correct synchronization is obtained by adjustment of frequency pot, R34.

The output signal developed across the emitter resistor R35 is converted into a sawtooth signal by an RC discharge network consisting of R36 and C16. This signal is fed through height pot, R37, to Q8. The primary purpose of this stage is to provide isolation between the oscillator and output amplifier. The linearity of the signal present at the output of this stage is further corrected by a variable bias adjustment in the base circuit of Q9. This signal is then amplified to the required level by this stage...the output of which is capacitively coupled to the vertical deflection coils, Y_v, via C19.

R43 inserted in series with the vertical deflection coils, is for test purposes only. The signal developed across this resistor is a TRUE representation of the current flowing through the inductive deflection coils. It serves to check linearity and scanning level. Under normal operation a jumper is soldered across this resistor.

The discharge network, R36 and C16, in addition to providing the sawtooth signal for sweep, also provides a negative pulse of the correct amplitude and shape to be used as a vertical sync pulse to feed the video/sync mixer amplifier. This pulse is coupled to the emitter of Q4 via isolation resistor, R55.

A positive pulse developed across R32 is capacitively coupled by C14 to the cathode circuit of the vidicon tube. This pulse is required to cut off the beam during vertical retrace. If this were not done, approximately 6 to 10 diagonal lines would be present in the televised picture. These lines represent the number of horizontal scans which occur during the relatively long vertical retrace period.

HORIZONTAL DEFLECTION: As in the vertical section, three stages are required—these being Q10, 11 and 12. This portion of the camera serves two purposes;

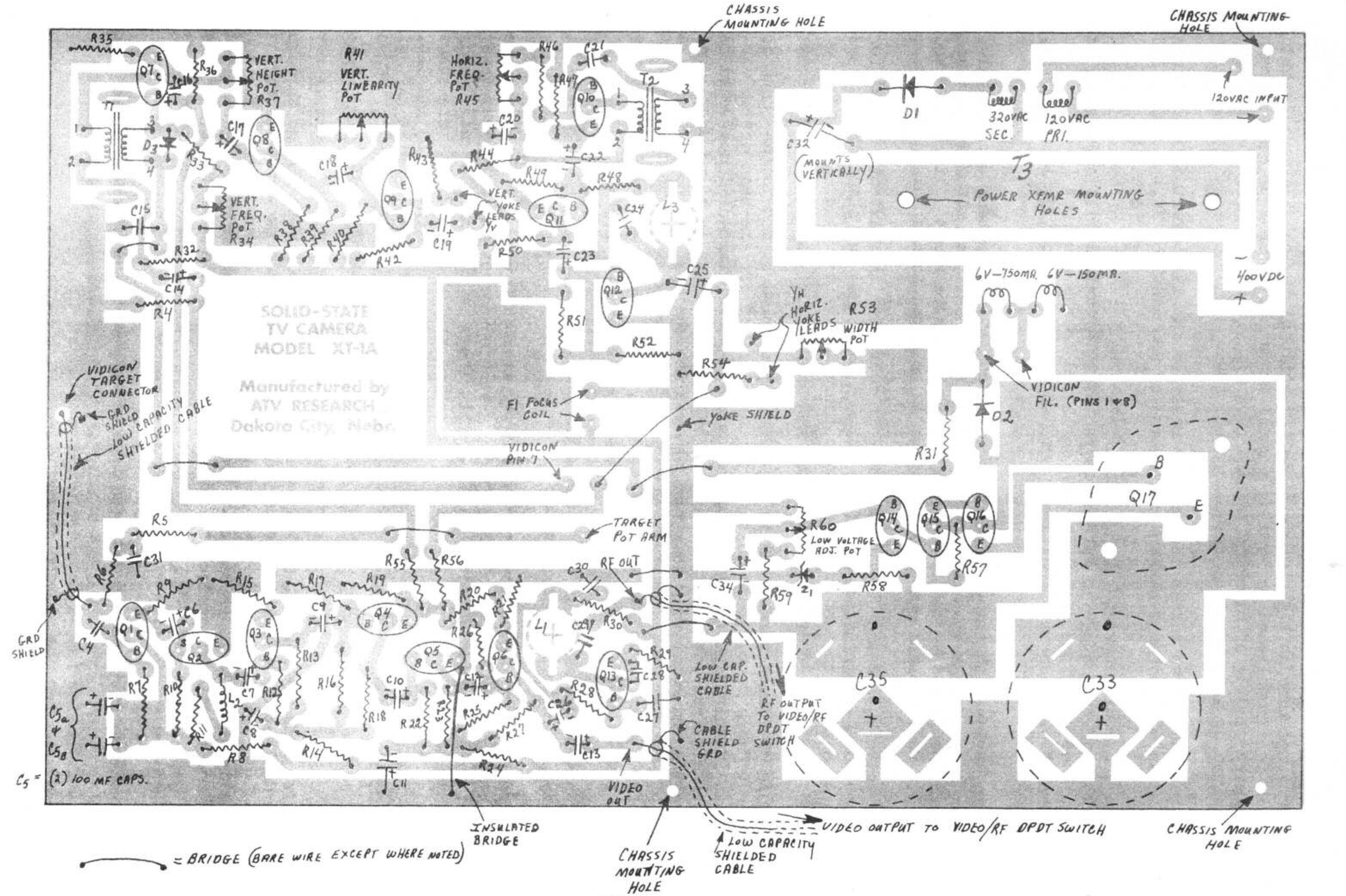
1. Horizontal sweep for the vidicon tube.
2. Sync for the video/sync mixer.

Q10, a standard blocking oscillator is free running at 15,750 Hz—the frequency being adjusted by R45. The output of this stage, developed across the emitter resistor R47, is capacitively coupled directly to Q11. This stage is both a buffer and a clipper amplifier. From here, the signal is fed to the output amplifier, Q12. In this stage the output pulse is developed across a resonant LC circuit consisting of L3 and C24. This signal, as in the vertical stage, is capacitively coupled to the horizontal deflection coils, Y_h. Width adjustment is provided by pot R53 in shunt with Y_h. Horizontal linearity is fixed by the circuit constants...no adjustment being necessary.

R54 in series with the horizontal coils, again, is for test purposes only. The signal developed across this resistor is a TRUE representation of the current flowing through the inductive deflection coils. Under normal operation a jumper is soldered across this resistor. It is important to remember that the signal applied across the deflection coils is NOT a sawtooth signal...instead, it is a predistorted signal required to produce a sawtooth current through the inductive coils. This is far more predominant in the higher frequency horizontal circuit than in the lower frequency vertical circuit. See fig. 2.

POWER SUPPLY: Three voltages are required to operate your XT-1A camera. These are;

1. 400 VDC for the vidicon control circuit.
2. 6.3 VAC for the vidicon filament.
3. 11 VDC (regulated) for video amps, sweep circuits and focus coil.



XT-1A

PRINTED CIRCUIT LAYOUT

Viewed from copper side of board

The 320 VAC from the high voltage winding of T3 is rectified by a half-wave rectifier D1. Filtering is accomplished by C32. Note the minus side of the rectified output is floating above ground. In this manner, a single voltage is applied to the vidicon control circuit to provide both the positive and negative voltage required by the vidicon tube.

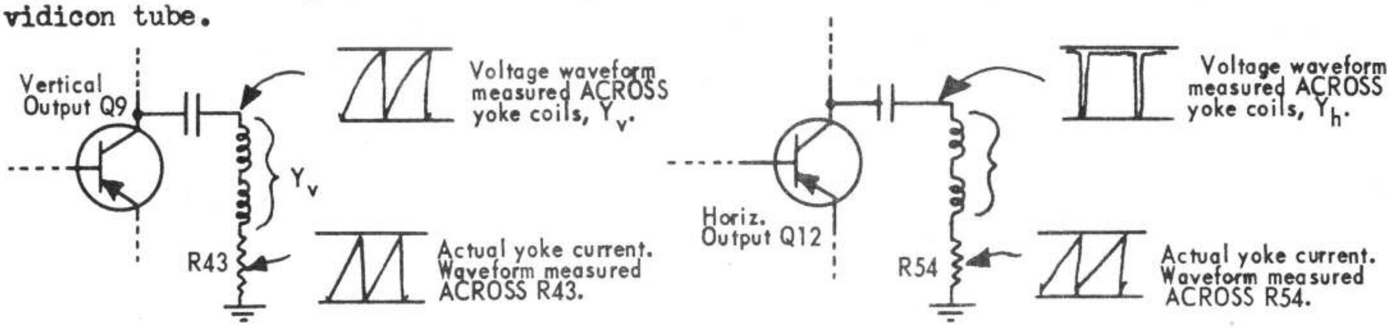


Fig. 2 Comparison of voltage waveforms across vertical and horizontal deflection coils representing a sawtooth current flowing through the coils.

Two 6.3 VAC low voltage windings (of dissimilar current ratings) are also provided by T3. These two windings are connected in series to provide 12.6 VAC to feed the half-wave rectifier D2. The vidicon filament connects across the 750 ma winding. In addition, R31 from the vertical oscillator connects to one side of this winding. This, as explained earlier, provides a sync signal to lock the vertical oscillator to the 60 Hz power line.

The output of the low voltage rectifier is fed to a series regulator circuit consisting of a series gate Q17, reference amplifier Q14 and a beta multiplier control amp consisting of Q15 and Q16. A zener diode in the emitter circuit of Q14 provides a constant reference source of approximately 6.8 volts. The output voltage is adjusted to the required level by pot R60.

P.C. BOARD ASSEMBLY

Notice that two copies each, of the layout and schematic diagrams and parts list have been included in the manual. The extra copies are your "work sheets" and should be removed before starting to insert parts on the board. As a component is inserted on the board, mark off the corresponding part on the "work" copies using a colored pencil. This procedure will allow you to keep an accurate check on your progress and also permit parts to be inserted in any sequence you desire. Once all components have been mounted, the "work" sheets can be discarded.

To avoid confusion during P.C. assembly, the following components DO NOT MOUNT ON THE BOARD: R1, R2, R3, R61, R62, R63, R64, C1, C2 and C3. These parts are used in the control circuit mounted on the rear panel of the camera cabinet.

( ) 1. Drill all the required holes on the P.C. board using a .042" bit, with the following exceptions; use 1/8" for the two mounting holes for Q17, the two power transformer mounting holes, the target connector and the 4 mounting holes used to secure the board to the case. Use a 1/16" bit for all the trim adjustment pots. Drill out the holes for L1 and L3 to the size that will just allow the terminal end of the coils to slip through the openings. (File out the slots—as marked on the board—to allow the terminals to slip through also.) The slits required for mounting the two 3000 mfd can capacitors, C33 and C35, can be made by drilling several 1/16" holes side by side.

NOTE: If a .042" drill bit is not readily available a 1/16" bit can be substituted. The .042" bit merely gives a better fit when initially installing the components.

( ) 2. After drilling all the holes be sure to wipe off all the loose copper filings that could cause a possible short. It is not necessary to polish the board prior to parts insertion (a former practice) since oxidation of the copper is prevented by a protective resin coating which is compatible with solder.

( ) 3. Although your camera has been designed for the transistors to be soldered directly to the board, some constructors have indicated an interest to experiment with different types to check effects on performance, etc. In this case, you may install sockets at this time. (Note: Sockets are not provided with the kit.)

VERY IMPORTANT: ALL PARTS MOUNT ON THE SIDE OF THE BOARD OPPOSITE THE COPPER PRINTING! The layout sheets show parts placement "as viewed from the copper side of the board" in order that you become acquainted with the "wiring" side as you insert the parts. DO NOT MAKE THE MISTAKE OF MOUNTING PARTS ON COPPER SIDE!!

( ) 4. Install all bridges. These are short lengths of wire connecting two points on the board. Unless otherwise stated on the layout diagram, use solid bare wire cut to the required length.

( ) 5. Install all $\frac{1}{2}$ watt resistors. Insert about 6 or 10 at a time, then solder and clip excess pigtails. Use color code chart towards the front of the manual to identify the different values.

( ) 6. Install L2 peaking coil. Solder and clip off excess pigtails. This is the coil that looks like a $\frac{1}{2}$ watt resistor...the wire being wound around the resistor body. It is the smallest of the three coils used in the camera.

( ) 7. Install all capacitors including the two 3000 mfd capacitors in the power supply. Again, a number of capacitors can be inserted before soldering. Be sure to WATCH POLARITY on the electrolytics! When installing the 3000 mfd capacitors be sure to twist the three ground tabs prior to soldering.

Once again, we remind you to be sure and pull all components FIRMLY against the board keeping the pigtails as short as possible!

( ) 8. Install all six of the miniature trim adjustment pots on the board. NOTE: These pots may be of two different types. Refer to fig. 3 for proper preparation prior to mounting on board.

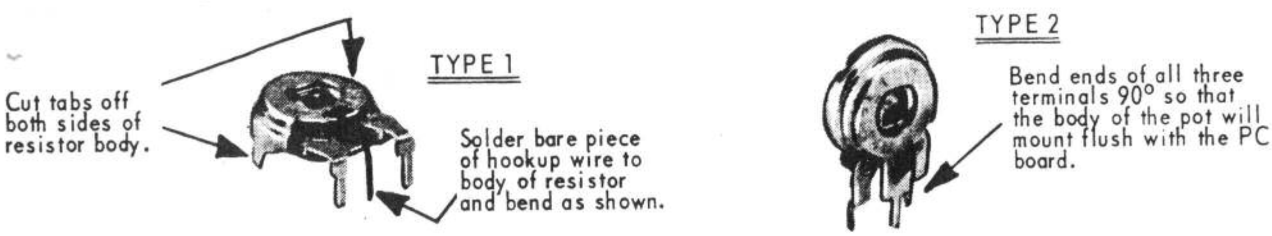


Fig. 3 Preparation of miniature pots prior to installing on board.

( ) 9. Install all diodes. This includes the two used in the power supply as well as the zener diode Z1...and also D3 across T1. WATCH POLARITY! A red dot on the diode indicates the cathode except in the case of D3. In the latter, the cathode is indicated by black bands.

( ) 10. Install T1 and T2 taking care to insert the leads in the proper holes. Use the basing diagram packaged with these transformers. To prevent vibration from causing damage to the lead connections on the transformers it is suggested that the mounting tabs be used. Location points are provided on the board and are to be drilled out using a small bit to just allow the tabs to slip through the board. They can then be bent over and soldered in place.

( ) 11. Install L1 and L3. Insert the coils (lug end first) from the component side of the board. Position the lugs so they are in the slotted portion of the hole and extending through to the copper side of the board far enough to solder. Apply adequate solder to make a good rigid connection but do not get so hot as to damage the terminal portion of the coil which is glued to the body of the coil form. NOTE: If lugs appear to be too tight of a fit they can be trimmed down slightly with diagonal cutters.
L1 is easily identified from L3 since it is the one with just a few turns of relatively heavy wire. Also, it is the one that has a slug adjustment where as L3 has no adjustment.

( ) 12. Install power transformer T3 using two 6-32 screws and nuts. First though, temporarily connect the line cord (supplied with the kit) to the primary winding. Next connect one of the leads of the 150 ma filament winding to one of the leads of the 750 ma filament winding. Connect an AC meter across the remaining two filament leads and apply 120 vac power to the primary. You should read approximately 14-16 volts open circuit. If not, you probably have the wrong two leads connected together and the windings are bucking each other. Once the correct two leads are located, mark them with a piece of tape and be sure they are inserted in the right holes on the P.C. board. Once all leads have been trimmed to the correct length and the ends bared, bolt the transformer in place and insert all leads in their respective holes and solder.
BE VERY CAREFUL NOT TO TUG ON THE TRANSFORMER LEADS WHEN STRIPPING OFF THE INSULATION! DAMAGE COULD RESULT TO THE WINDINGS.

( ) 13. If transistor sockets weren't used the transistors should be soldered in now. Use only enough heat to make a good solder connection. If sockets were used, plug in all transistors at this time. Q17 bolts in place with two 4-40 x ¼" screws and nuts. Scrape the protective coating from the PC board around the mounting nuts in order that the transistor collector will make good contact to the copper circuit.

IT IS MOST IMPORTANT THAT YOU TAKE YOUR TIME ON THIS STEP SINCE MANY CONSTRUCTORS DO NOT FOLLOW THE BASING DIAGRAM CAREFULLY ENOUGH, THE RESULT BEING INCORRECTLY INSTALLED TRANSISTORS.

Set the P.C. board aside for now and prepare the cabinet and focus/deflection coil assembly according to the instructions that follow.

CAMERA CABINET

An aluminum channel notched and bent as shown in fig. 5 forms the main body of the cabinet—6¼" wide by 10" long by 3" high. Matching top and bottom covers, secured in place by self-tapping metal screws, completes the cabinet. NOTE: The aluminum has been anodized. This gives it a nice finished appearance and at the same time is considerably more durable than a painted surface.

Before mounting parts be certain to scrape away the anodized layer around the mounting holes in order to properly ground all components!

( ) 14. Carefully position the two ends of the cabinet channel together and drill two 1/8" holes through the rear panel and the "Cabinet Securing Tab" (See fig. 5) Temporarily bolt together. Tighten sufficiently to hold the cabinet in place while marking and drilling holes. (These screws will have to be later removed to allow the cabinet to be spread apart for insertion of the P.C. board.)

( ) 15. Cut out the 1¼" lens opening as shown in fig. 6. (Alter slightly, if necessary, to accommodate the particular lens mount included with your kit... keeping in mind the opening must be large enough to allow insertion of the vidicon tube.) Next, using the lens mount as a template, mark and drill the three mounting holes, using a 1/8" bit. BE CERTAIN to position the holes in manner shown in fig. 6 otherwise one of the screws will interfere with the target connector in the front end plate of the focus coil. Also, it should be emphasized that when cutting out the 1¼" lens opening that you MUST NOT CENTER the opening up and down on the cabinet. Allow 1/8" more on the bottom than on the top as shown in fig. 6. In so doing, the focus coil and P.C. board will be positioned slightly higher in the cabinet and thereby prevent any shorting of the target connector to the bottom cabinet panel.

DRILL CABINET HOLES AND MOUNT COMPONENTS NEATLY! Both performance and appearance will suffer if you work too quickly.

( ) 16. Using the focus coil as a template, mark and drill the four mounting holes used to secure it to the front panel. Take care to line up the coil with the lens opening hole. Remember, the end plates must be kept parallel with the cabinet lips otherwise the P.C. board will not mount properly.

( ) 17. Next, mark and drill the holes on the rear of the cabinet as shown in fig. 7. Also mark and drill four small holes in both the top and the bottom covers as well as in the cabinet lips for securing covers to the cabinet. Use slightly smaller drill bit for the lip holes in order that you will have a tight fit for the tapping screws.

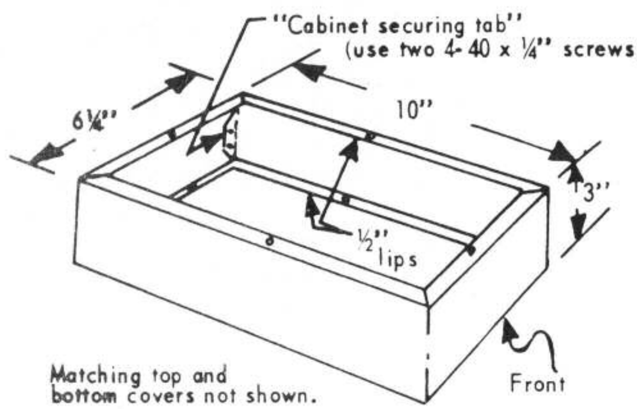


Fig. 5 XT-1A camera cabinet.

( ) 18. Mount the following components at this time;

1. lens mount (use 4-40 x 3/8" screws and nuts)
2. coax output connector (use (2) 4-40 x ¼" screws and nuts)
3. beam, target and focus pots (R1, R2 and R3...beam pot has spst switch on the rear. Before mounting, cut off excess shaft length leaving them only long enough to accept the knobs. Position the pot terminals such that the focus and beam terminals are facing towards the center of the cabinet and the target terminals facing towards the focus terminals. This will make for easier wiring of the control circuit later on.
4. DPDT RF/VIDEO slide switch (use (2) 4-40 x ¼" screws and nuts)

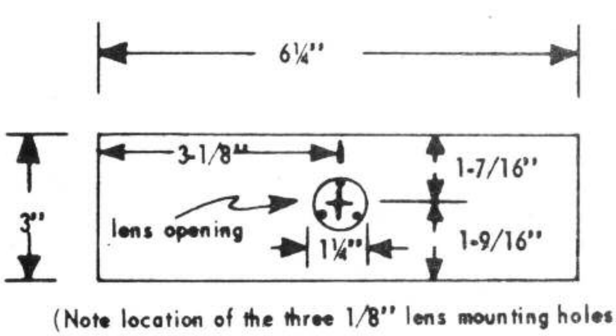


Fig. 6 Front of camera cabinet.

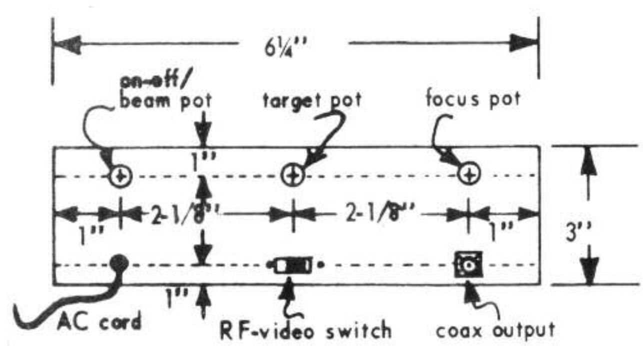


Fig. 7 Rear of camera cabinet.

( ) 19. In order that the three lens mounting nuts do not prevent the focus coil from mounting flush to the cabinet it is necessary to file small indentations in the front end plate of the focus coil to correspond with the positions of these nuts. This can be done with a small round file. See fig. 8 below. Do not modify or omit this step. The result would be a poorly mounted focus coil which would not be light tight against the inside of the cabinet, thereby causing possible "fogging" of the televised picture from stray light falling on the vidicon target. Also it would alter the correct lens-to-vidicon distance.

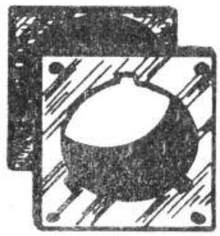


Fig. 8 Indentations filed into front end plate of focus coil using a small round file.

VIDICON and CONTROL WIRING

( ) 20. Cut 6 pieces of hookup wire to the following lengths;

2 pieces each $3\frac{1}{4}$"
2 pieces each 4"
1 piece 5"
1 piece $5\frac{1}{2}$"

Strip $\frac{1}{4}$" of insulation from each end of all 6 wires. Connect one end of each lead to the vidicon socket as follows; One of the $3\frac{1}{4}$" leads to pin 1 and the other to pin 8 (filaments). One of the 4" leads to pin 5 and the other to pin 6 (G2 and G3). The 5" lead to pin 2 (G1). The $5\frac{1}{2}$" lead to pin 7 (cathode). Twist the two filament wires together for a distance of about $2\frac{1}{2}$".

( ) 21. Wire up the control circuit components mounted on the rear panel following the pictorial shown in fig. 9 and the pointers listed below.

(a) Make ground connections directly from the terminals on the target and beam pots to the cases themselves...using a short length of bare wire.
(b) Use insulated hookup wire when connecting to the target, focus and beam pots. Cut to the length required.
(c) Connect bypass capacitors C1, C2 and C3 directly from the beam and focus pot terminals to the case (grd).

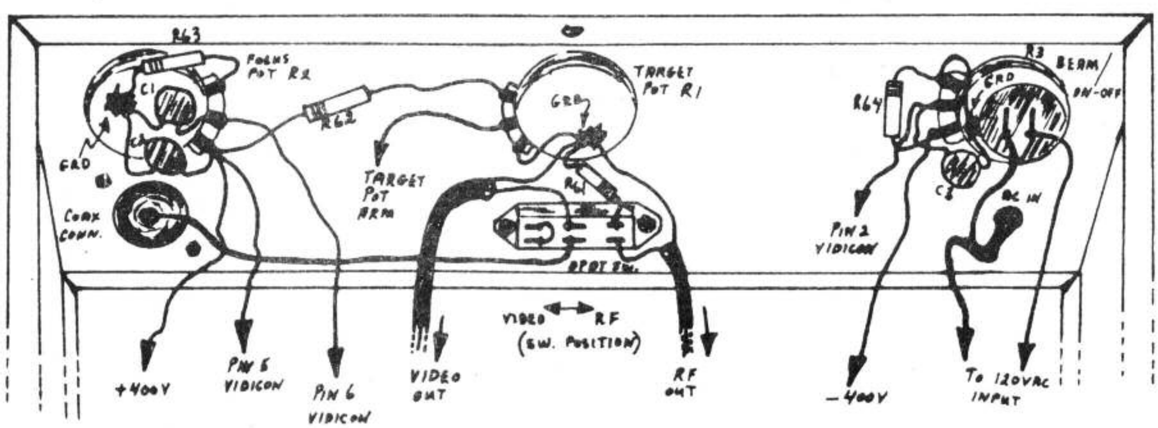


Fig. 9 Rear panel control circuit pictorial.

(d) Use insulated hookup wire to connect the two sections of the DPDT RF/VIDEO switch together and also to connect the coaxial connector to the one arm of the DPDT switch. Cut two lengths of shielded cable (about 8" each) and strip the braid back about ½" on each end of both cables. Connect both cables to the correct terminals on the DPDT switch and solder the braids to the nearby ground (target pot case).

(e) Solder one end of the 68 ohm resistor (R61) to the appropriate terminal on the DPDT switch. Solder the other end to the target pot case (grd).

(f) Connect the free ends of the wires soldered to the vidicon socket to the following points;

Pin 2 to the arm of the beam pot.
Pin 6 to the arm of the focus pot.
Pin 5 to the +400V terminal of the focus pot.

(NOTE: Center terminal on pots connect to arm.)

Pins 1, 7 and 8 remain free at this time—they will be connected to the P.C. board once it is mounted in the cabinet. The free ends of the shielded cables connected to the DPDT RF/VIDEO switch will also be connected to the P.C. board once it is mounted in the cabinet.

FOCUS-DEFL. COIL ASSEMBLY

( ) 22. Assemble the focus/deflection coils according to the instructions packed with the kit. FOLLOW THE INSTRUCTIONS CAREFULLY! Do not omit steps and/or modify since this will only result in a poor performance system. It is very important to tape the coils carefully, shim properly and phase the leads correctly. It is not difficult but constructors tend to get anxious about this stage of the project and consequently rush through the steps too fast, thus making mistakes that will later be regretted.

NOTE: The yoke form now being supplied with your kit has a rolled edge on the one end. This is the rear of the form and is to accomodate the vidicon tube variations, which occur from manufacturer to manufacturer. Should it be a little tight for your particular tube simply compress it slightly using a pair of long nose pliers. DO NOT cut it off! This might result in a loose fitting vidicon which would not remain seated properly in the yoke and in the target connector.

( ) 23. Once the coil assembly is finished, mount the focus coil to the P.C. board with two self-tapping screws...one to hold the front end plate to the board and one for the rear end plate. Take care to position the coil such that the front end plate is flush with the front edge of the board and parallel to it...also the target connector must drop into the hole provided on the board. Solder the target connector outside shield to the board. Apply heat for only a few seconds at a time to avoid damage to the board and the connector. When drilling into the end plates for the self-tapping screws be very careful to not let the drill drift into the winding itself! The drill size should be just large enough to provide a tight fit for the screws.

( ) 24. Next, insert the assembled yoke into the focus coil...it should fit fairly tight. Don't be concerned about the positioning now, this will be taken care of during the tune up. Insert the yoke and focus coil leads in the appropriate holes and solder. DON'T FORGET THE YOKE ELECTROSTATIC SHIELD!

The proper grounding of the focus coil and yoke electrostatic shields can not be emphasized too much. Your camera will not work correctly at all without these shields being grounded to the P.C. board.

( ) 25. Connect the target connector to the input of the video amplifier via a short length of low capacity shielded cable connected on the copper side of the board. Route directly along the front of the board over to the amplifier input. Ground both ends of the cable shielding to the P.C. board.

FINAL ASSEMBLY

( ) 26. The P.C. board can now be installed in the cabinet. To do this it will be necessary to first remove the two 4-40 screws which secure the two ends of the cabinet together. Once this has been done, spread the cabinet apart sufficiently to allow the board to be inserted. Once inserted, it can be held in place by bolting the front end plate of the focus coil to the front panel of the cabinet using the four 4-40 x 3/8" screws and nuts provided in your kit. Next, bolt the cabinet back together.

( ) 27. Once the board has been properly held in position by the focus coil the four P.C.-to-chassis mounting holes can be marked and drilled out on the bottom lip of the cabinet. These holes secure the center and rear of the board. See fig.10a. Use a 1/8" drill bit.

( ) 28. Use a taper reamer on these holes so that the taper head screws will mount flush with the lip and not obstruct installation of the bottom cover. Mount each of the four taper headed screws with two nuts on the underside and one on the top side. (See fig.10b) The first nut is used to secure the screw tight to the cabinet lip. The second one is adjusted to the proper height and serves as a "stop" for the P.C. board to rest on. The third one on the top side holds the board in place.

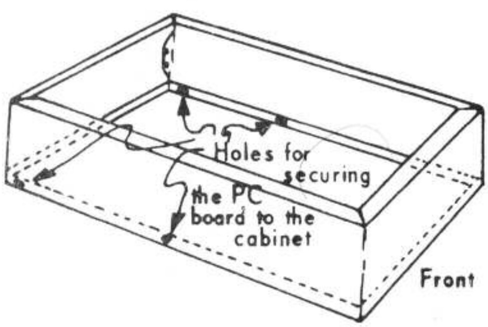


Fig. 10a Holes in bottom lip for mounting P.C. board to cabinet.

( ) 29. Complete the control circuit wiring by connecting the leads from pins 1, 7 and 8 of the vidicon socket to the appropriate spots on the board. Connect two short pieces of insulated hookup wire between the board (+ and - 400V. points on board) and the beam and focus pots. Be sure the plus lead is connected to the focus pot and the negative to the beam pot! Connect the two shielded cables to the video and RF outputs on the board making certain to connect the correct cable to the correct output! Insert the AC line cord through the chassis opening for the required distance and secure with a knot to prevent tugging on the line from damaging the board. Connect one end of the cord to one terminal on the SPST ON/OFF switch (mounted on the rear of the beam pot). Connect the other lead to one of the AC INPUT points on the P.C. board. From the other AC INPUT point on the board, connect a short length of insulated hookup wire... the other end of which connects to the remaining terminal on the AC power switch. And finally, cut a 6½" length of hookup wire and connect it between the arm of the target pot and the appropriate point on the P.C. board as shown on the layout diagram.

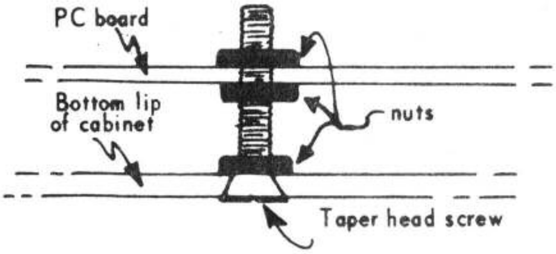


Fig. 10b P.C. mounting.

( ) 30. This completes the camera construction, other than mounting the handle on the top cover plate,(taking care to properly center it) and adding the decals to the rear panel.

( ) 31. Remove the inter ring from the lens mount and insert the vidicon tube through the opening. Carefully plug the tube into the socket. Make very sure the target ring is correctly "cradled" in the target connector indentation! Keep the front edge of the yoke coils about ½" from the target ring. If the yoke has not been sufficiently shimmed the target ring will not remain in tight contact with the connector. Should this be the case more shimming should be added to the yoke at this time. Next, screw the lens tightly into the inter lens mount ring and install into the other half of the mount. Put the knobs on the beam, target and focus pots.

( ) 32. RECHECK ALL WIRING to make sure you have made no omissions or errors prior to applying power. A few moments spent checking over your work now can save much grief later.

TUNE-UP

( ) 1. Begin by setting all pots as follows;
Beam pot arm to maximum negative voltage.
Target pot mid-range.
Focus pot mid-range.
Reg. DC Adj. (R60) mid-range.
Horizontal width pot maximum resistance.
Horizontal frequency adj. pot mid-range.
Vertical height pot at minimum resistance.
Vertical frequency adj. pot mid-range.
Vertical linearity pot maximum resistance.

(See fig. 11 below for the location of all pots mounted on P.C. board.)

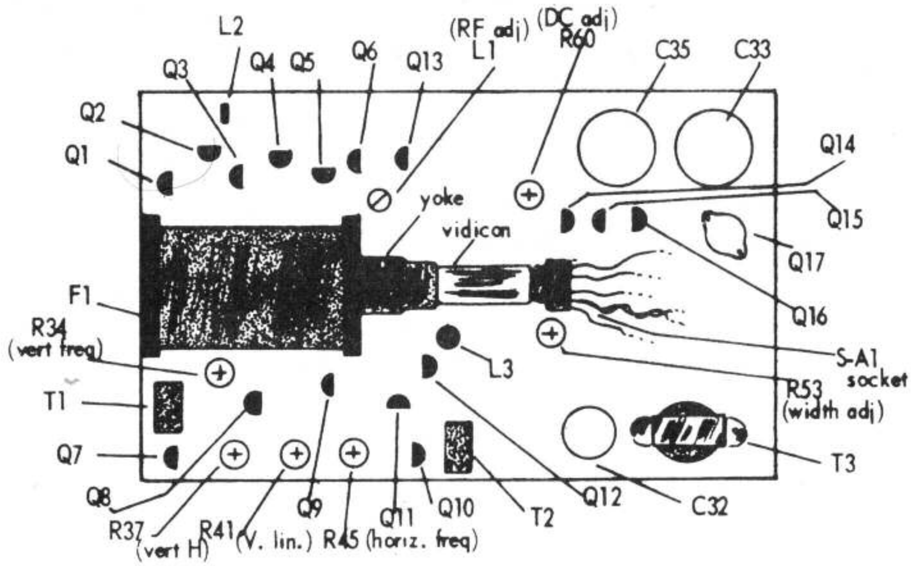


Fig. 11 Location of the major components on the P.C. board.

( ) 2. Prepare a simple test card as shown in fig. 12. Don't use complicated patterns yet—this test card was purposely designed to be as plain as possible. There's plenty of time for the more sophisticated patterns once an image has been obtained.

If you have yet to read the section on video monitors, (at the end of this section) we suggest you do so at this time. Once you've decided which monitor system to use, continue with the tune-up instructions.

( ) 3. Connect the camera to the TV set via RG-59/U coaxial cable. If you're using a regular unmodified TV set, switch to RF OUTPUT and connect to the antenna terminals on the TV. If you're using the video monitor system, switch to VIDEO OUTPUT and connect directly to the 1st video amplifier stage in the set. If available, a scope connected to the video output of the camera will be helpful in checking video and sync levels.

NOTE: When using the video output, the camera MUST BE TERMINATED at the monitor before it will function correctly. The termination resistor can be any value near 70 ohms. (A 68 or 82 ohm ½ watt resistor will serve nicely).

( ) 4. Before turning on the camera, tune in a local broadcast station on your set and make certain the horizontal and vertical hold controls are correctly adjusted. (For best results, the linearity, width and height controls should also be checked. This can be most accurately performed with the aid of a test pattern—usually broadcast shortly after the station signs on in the morning.)

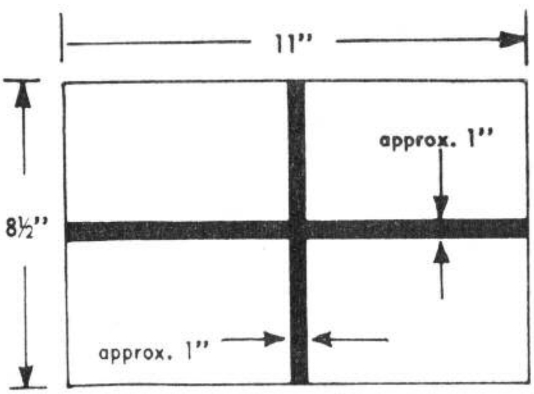


Fig. 12. "Cross" test card used for preliminary tune-up of camera.

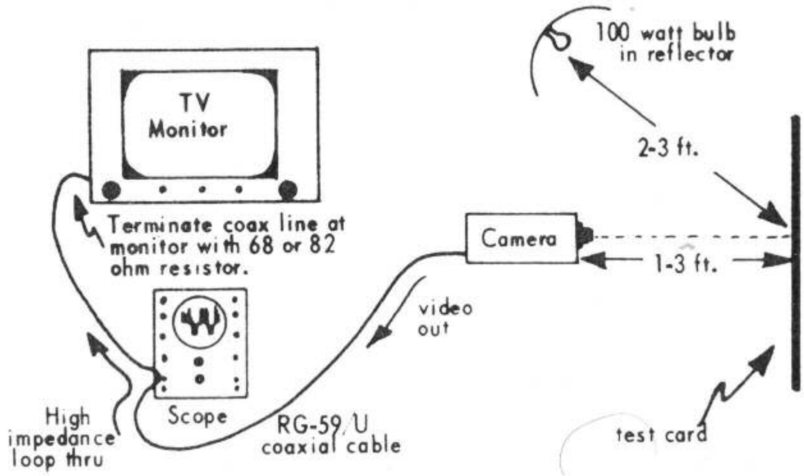


Fig. 13. Recommended tune-up arrangement.

( ) 5. Turn on the power and allow about 1 minute for the vidicon heater to reach operating temperature. DO NOT ADVANCE BEAM POT! KEEP BEAM GRID AT MAXIMUM NEGATIVE VOLTAGE!

( ) 6. Set the REG. DC ADJ. pot (R60) for -11 volts as measured from the negative terminal of C35 to ground. (NOTE: The XT-1A camera has been designed to operate between -10 and -13 volts, however, best results will be obtained when operated at -11V.)

( ) 7. Set the target pot arm to +80 volts and the focus pot arm to +120 volts... both readings being measured to ground.

If the RF OUTPUT is being used, set the TV receiver to a blank channel between 2 and 6...preferably a mid-channel. i.e., Channel 4 or 5. Adjust L1 until black sync bars appear on the screen.

( ) 8. Adjust the horizontal frequency pot in the camera until the sync bars lock on the monitor.

NOTE: Occasionally variations in components and transistors result in controls operating "out of range" or all the way to one end. Although the greatest of care has been taken during design to prevent this situation from occurring it still is a possibility. This is due to the fact that once in awhile a whole group of components in a given circuit will all be high (or low) in value by say 10%. Normally this would cause no problem, however, when all the components in a circuit are 10% off in the same direction the error is additive and could result in "out of range" operation.

Although this is not considered a problem we do point it out in case you should run into this type of a situation. The most likely control to be effected is the horizontal frequency pot. To correct the problem simply alter the value of the fixed series resistor.

( ) 9. Next, adjust the vertical frequency adj. pot until the vertical oscillator in the camera is locked to the 60 Hz power frequency. When not locked, either the sync pulses will appear to roll vertically on the monitor—or in the case of very near lock-in, you will notice vertical jitter and/or faint hum bars rolling slowly through the raster.

( ) 10. If you have availability to a scope connect it across R54 and make certain that you have a waveform of the shape and amplitude shown below in fig. 14a. Also check to see if you have a waveform across R43 of the shape and amplitude shown in fig. 14b. These represent the horizontal and vertical sawtooth signal currents flowing in the yoke coils. These signals must be present prior to continuing with the tune up.

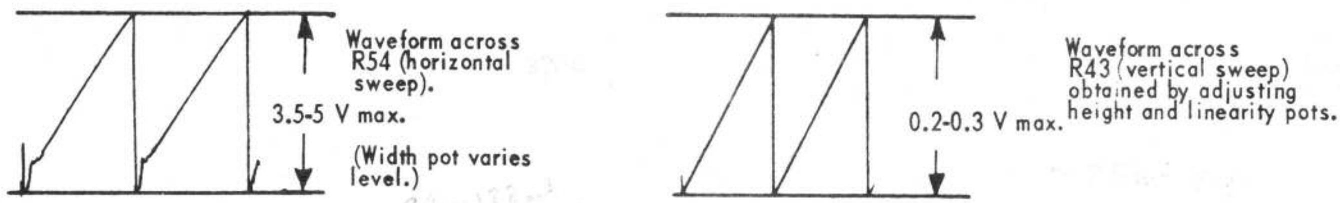


Fig. 14. Waveforms of horizontal and vertical sawtooth sweep currents flowing in the deflection yoke coils. Failure to obtain similar waveforms prior to completing the tune up may result in damage to the vidicon tube!

Generally speaking, the horizontal signal across R54 is fixed by the circuit constants and requires no adjustment other than minor touching up of the width pot to obtain the correct sweep amplitude. Do not do this now however, as long as it is within 15% of the peak-to-peak voltage shown in fig. 14a. Leave it at MAXIMUM horizontal sweep. The vertical sweep on the other hand requires adjustment of both the height and linearity pots in order to obtain a pattern similar to fig. 14b. The vertical has a great deal of reserve gain and will overload and be very distorted until the two adjustment pots are properly set. Adjust both until the most linear waveform is obtained at the peak-to-peak voltage shown. Once assured that good sawtooth signals (both horizontal and vertical) are present connect jumpers across both test resistors on the copper side of the board. They no longer serve any purpose.

( ) 11. (OMIT THIS STEP IF SCOPE ADJUSTMENTS HAVE BEEN MADE AS PER STEP 10 ABOVE.) If a scope is not available it will be necessary to determine the presence of sweep in an entirely different manner. With the lens CAPPED, advance the beam pot (decreasing the negative bias voltage on G1 of the vidicon). Go very slow. Assuming all controls were pre-set as described in step 1 of the tune-up you should first note a darkening of the lower or upper portion of the monitor screen once the tube begins to conduct. The important thing at this point is not what the exact shapes are, but that a shading effect occurs over part of the screen as you adjust the beam pot. This indicates that we have a vidicon that is responding to bias variations and also that the video amplifier strip is amplifying. Continuing to advance the beam pot SLOWLY you should note a further darkening of this portion of the screen changing from a grey to a black.

Once the beam pot has been advanced to the point where shading variations are occurring on the screen you will find that very little additional rotation is necessary to make drastic changes on the screen. This is why we stress advancing the pot SLOWLY! Continuing to advance the control should ultimately result in a bright white band, horizontally, across the center of the screen with the remainderof the screen, above and below it, black. See fig. 15. (NOTE: Reduce the target voltage, if necessary, to prevent overloading of the video amplifier strip and causing tearing and/or rolling of the picture.) As mentioned in step 10, the horizontal sweep is very close to the desired amplitude as determined by the circuit constants, whereas the vertical sweep has a great deal of reserve gain and consequently will over sweep the vidicon and distort, until it is properly adjusted. This bright white bar represents the highly distorted and compressed target pattern. It is now necessary to adjust the vertical height pot, R37, to expand it to fill out the upper portion of the screen. The bright white bar will become more grey as it is stretched out. Next, adjust the linearity pot, R41, to fill out the bottom portion of the picture (which should be still black prior to adjusting R41). The entire screen should now be a light grey. These adjustments will not yield a linear sweep but are sufficient to obtain an indication of a picture. The target voltage can now be returned to +80 volts.

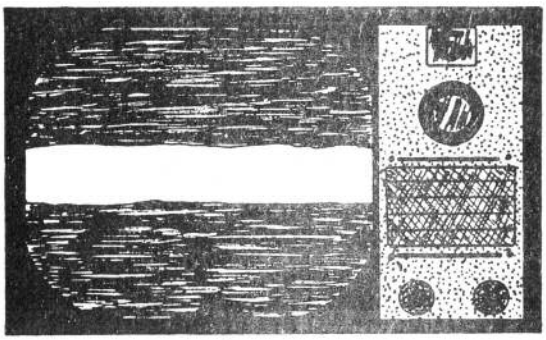


Fig. 15 Initial target pattern to be expected as beam pot is adjusted.

WARNING: WHEN CONDUCTING THE TEST DESCRIBED IN STEP 11 BE SURE TO IMMEDIATELY TURN THE BEAM CONTROL OFF IF A PATTERN LIKE THAT SHOWN IN FIG. 15 IS NOT OBTAINED. RECHECK YOUR CIRCUITS TO DETERMINE WHAT IS WRONG, THEN TRY AGAIN. Lack of sweep generally does not harm the vidicon tube if the beam is not left on for more than a few seconds at a time.

( ) 12. Next, with the camera test card and light arranged as shown in fig. 13, uncap the lens and set the iris to F2.7. Advance the beam pot until a "wiping" effect occurs across the screen indicating that the vidicon is no longer in a biased-off condition. A very crude image should now be visible. Don't be concerned if it's non-linear, tilted, upside down, etc. The important thing at this point is that you have an image and that you get it in sharp focus by adjusting both the lens and the focus pot. After doing this, recheck the beam pot to make sure it is correctly set. It should JUST discharge the entire scanned target.

( ) 13. Grasping the rear end of the yoke form, notice that a slight up and down, or sideway movement of the yoke will cause the scanned target image to shift position on the monitor screen. Insert additional shims between the yoke and focus coil, if necessary, to obtain proper centering of the scanned target...both vertically and horizontally. Any insulator material, such as paper, cardboard, plastic or small pieces of wood can be used for shims. Be sure to make a tight fit inorder that the correct orientation is maintained no matter what position the camera will be operated in. See fig. 17.

NOTE: If the picture tears, pulls or goes out of sync it is most likely due to excessive target voltage for the particular amount of light you are using. The ALC (automatic light circuit) will handle all normal variations once the target pot has been adjusted to the sensitivity of your vidicon tube. For now, reduce it just to the point where the sync instability disappears. If a scope is available, it is recommended that the video/sync ratio out of Q6 be adjusted for a ratio of approximately 75% video and 25% sync. (See fig. 16.) Overscanning can also cause pulling of the picture.

( ) 14. If the picture is tilted, rotate the yoke until it appears straight on the monitor screen. (BE SURE front of yoke is kept about ½" from the target to prevent extraneous flyback pulses from being picked up and amplified through the video strip.)

( ) 15. If the picture is upside down and/or inside out, reverse the polarity of the yoke leads.

Upon completion of steps 14 and 15 it probably will be necessary to make minor corrections on the yoke shims for proper centering of the target scan. Fig. 17 shows how the picture will appear when miscentered. Recheck optical and electrical focus before continuing.

( ) 16. Make a simple linearity chart as per fig. 18. Place it in front of the camera and adjust the height and vertical linearity controls until all the bars are as close to the same spacing as possible.

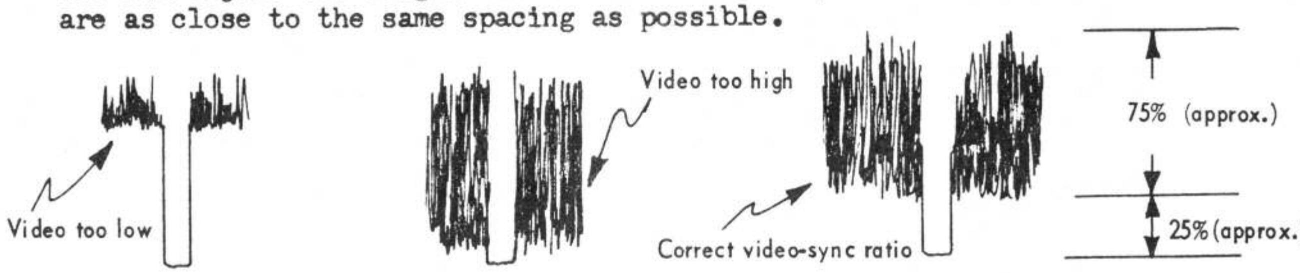


Fig. 16. Oscilloscope patterns show various ratios of video to sync.

( ) 17. This concludes the tune up procedure. For optimum results go back now and carefully recheck each adjustment. This is necessary due to the fact that some of the alignment tests interact to a certain degree with others.

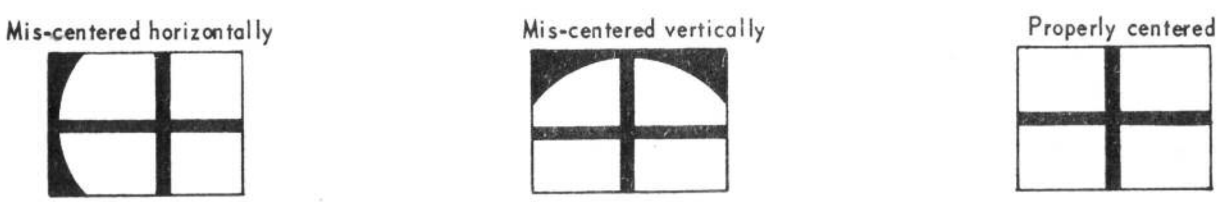


Fig. 17. Effects of centering on vidicon scanning.

When completed with the tune up and satisfied that all is working correctly, secure the top and bottom covers in place using the remaining 8 self-tapping screws.

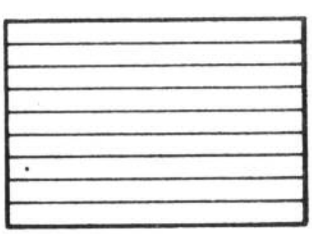


Fig. 18. Vertical linearity test pattern. Number of lines is not critical...between 8 to 12 is best.

Be sure to reread Appendix 1 to refresh your memory on the care of your vidicon tube. If properly followed you should easily get from 5,000 to 10,000 hour average life from your tube. Also, appendix 1 provides other useful hints which you may find helpful.

Anyone needing to troubleshoot their camera should refer to Appendix 2 for voltage and waveform charts as well as servicing procedures.

THE TV MONITOR

Basically two choices exist when it comes to the TV monitor. In either case all that is required is a reasonably good TV receiver.

THE VIDEO MONITOR: If you have no objection to making a minor modification on your receiver, you can convert it to a direct-feed video monitor much like those used by TV stations and most industrial CCTV users. With this system you connect the "VIDEO OUTPUT" from your camera directly to the video amplifier in your TV set via an appropriate length of RG-59/U 72 ohm coaxial cable. Fig. 19 can be used as a representative guide when making this modification on your set. Whether your set is a tube or a transistor model doesn't matter. The important thing is to determine the correct point in the circuit to make the modification. Only three parts are required; a coax connector, a terminating resistor and a SPST switch. When the switch is in one position, the set performs as a video monitor——when in the other position it functions as a normal receiver.

Two points should be kept in mind when considering this system; (1) Stay away from AC/DC sets. They are too dangerous when interconnecting to other equipment! (2) If possible, select a set inwhich the 1st video amplifier is taken from the anode of the detector. This insures you that the signal from the camera is the correct polarity to feed this point in the TV set. Otherwise, an additional stage will be required to achieve a positive picture on the TV screen. If you should encounter any difficulty check with a local TV serviceman and have him look up the schematic of your set in his Sam's Photofact file.

THE RF MONITOR: Although the video monitor approach is by far the most desirable from the standpoint of consistant performance and overall frequency response there are many instances when it's necessary to use the modulated RF oscillator system. Several instances when this might be necessary are; (1) when you're using an AC/DC set, or, (2) when the video polarity feeding the 1st video amplifier is incorrect, or, (3) when it's undesirable to modify the family receiver.

Under these circumstances, connect the RF OUTPUT of your camera to the antenna terminals of your receiver. Tune to a blank channel between 2 and 6 and follow the adjustment procedure outlined previously in the TUNE UP section.

NOTE: Some TV receivers may tend to overload if the RF output is connected directly to the antenna terminals. This can be corrected either with a swamping resistor connected across the RF OUTPUT point on the DPDT RF/VIDEO slide switch; or, by gimmick coupling to the antenna input of the receiver. The value of the swamping resistor should be whatever size is required to prevent receiver overloading.

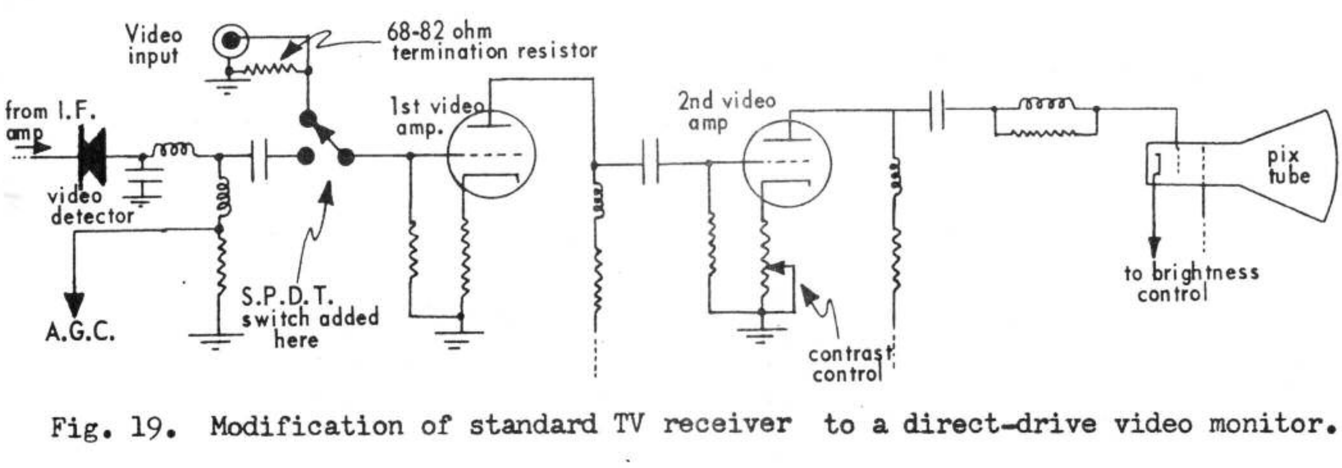


Fig. 19. Modification of standard TV receiver to a direct-drive video monitor.

APPENDIX -I-

To insure maximum life from your vidicon tube as well as the best possible performance, observe the following VIDICON rules;

1. DON'T operate or ship tube in vertical position with the target facing down. (Operation in this position is permissible when special applications demand it, however one runs the risk of small cathode flakings falling and lodging on the target or the mesh screen located directly behind the target. The result will be white spots appearing in the televised picture.)
2. DON'T increase the target voltage any higher than required for good pictures. (Do not exceed 100 volts as measured from the target pot arm to ground in all ALC designed XT-1A cameras.) Excessive target voltage results in poor shading.
3. DON'T underscan the target. This can cause a target burn which will appear in the televised picture once normal scan is resumed.
4. DON'T overscan the target. This can cause flare (background shading) as well as sync instability.
5. DON'T change scanning size and/or centering once the scanned area of the target has been properly positioned. Old raster may be visible in the televised picture.
6. DON'T turn up the beam without normal scanning.
7. DON'T leave the lens uncapped when the camera is not in operation.
8. DON'T allow an image from any extremely bright source (such as flood lamps or the sun) to ever be focused on the target.

* * * * * * * * * * * * *

OPERATING THE XT-1A IN THE VICINITY OF STRONG AM BROADCAST STATIONS: When operating your camera in the vicinity of a very strong AM broadcast station, a severe herring-bone type interference may appear in the televised picture should you attempt to operate your camera with the bottom cover removed (such as for servicing purposes). In such a case use a small piece of metal to shield the first two video stages...usually a shield as small as 3 or 4 inches square is sufficient. Ground it to a nearby point on the cabinet or P.C. board.

* * * * * * * * * * * * *

DEMAGNETIZING CAMERA: It is possible to magnetize different items in the vicinity of the vidicon tube during the process of soldering, if a transformer type soldering gun was used. To demagnetize your camera simply take the same soldering gun and while it is on, slowly wave it all around the camera (especially the front end around the lens and focus coil) starting very close and gradually moving away. DO NOT TURN OFF GUN UNTIL YOU ARE AT LEAST TWO FEET AWAY! A magnetized item in the vicinity of the vidicon is characterized by miscentering of the scanned target as seen on the monitor.

* * * * * * * * * * * * *

OPTIONAL HIGH FREQUENCY BOOST PROVISION: Additional high frequency peaking (resulting in an increase in horizontal resolution) can be added, if desired, but at a slight sacrifice in signal-to-noise ratio. Two points are provided in the circuit.....from the emitter of Q3 to ground and from the emitter of Q4 to ground. In each case merely add a small disc ceramic capacitor of any value between 470 mmfd and .001 mfd. The exact value will depend on the amount of peaking desired. If only a small amount of boost is required use only one of the points.

* * * * * * * * * * * * *

NOTATION ON ALC CIRCUITRY: Due to the very high resistance of R5 it is not possible to directly measure target voltage, even with a VTVM. Should troubleshooting of this circuitry ever be necessary, continuity tests (with power off) can be made to determine the source of the problem.

APPENDIX -II-

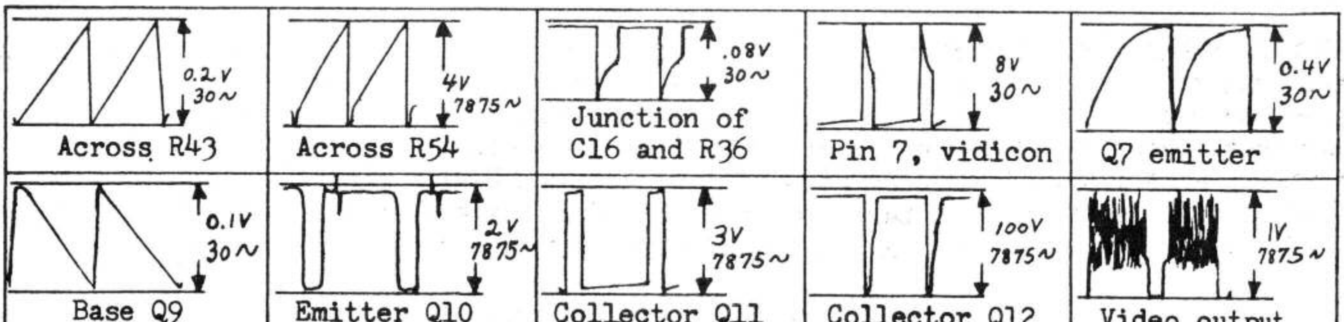
VOLTAGE AND WAVEFORM MEASUREMENTS

TABLE 1 Typical voltage readings. Taken with VTVM. All measurements taken from ground. Readings taken with camera set up for normal televising except beam pot in **maximum** negative position and lens capped. Supply voltage set at -11 volts. ± 15% variations can be expected.

TRANSISTOR	EMITTER	COLLECTOR	BASE
Q1	-0.37	-1.06	-0.95
Q2	0	-1.06	-0.60
Q3	-0.12	-3.25	-0.73
Q4	-0.05	-5.50	-0.58
Q5	0	-2.0	-0.63
Q6	-0.04	-2.8	-0.22
Q7	-2.0	-10.1	+0.90 *
Q8	0	-0.06	-0.65
Q9	0	-4.5*	-0.65
Q10	-4.5	-10.5	-3.10
Q11	0	-1.85	+0.42
Q12	0	-7.5	-0.43
Q13	-4.3	-6.5	-4.5
Q14	-6.0	-12.3**	-6.5**
Q15	-11.9**	-12.5**	-12.3**
Q16	-11.2**	-12.5**	-11.9**
Q17	-11.0	-12.5**	-11.2**

*Varies considerably with different settings of associated circuit adjustment pots.
**These readings vary considerably from camera to camera depending on line voltage, component tolerances and setting of R60. Generally the low voltage power supply (Q14-Q17) can be assumed to be working if R60 will vary the output voltage in the -9 to -11 volt range.

TABLE 2 Typical waveform readings taken with camera set up for normal televising. All readings taken from ground. Supply voltage set at -11 volts. ± 15% variations are considered normal.



APPENDIX -III-

TROUBLESHOOTING AND SERVICING

Should you have difficulty with you camera it is suggested that you first recheck ALL your construction steps for obvious errors. Then continue as follows;

1. After setting up camera as per the tune up instructions measure all voltages and compare against Table 1 shown in Appendix II. Small variations do not necessarily indicate the source of trouble; however, large ones do.

2. If trouble can not be determined from voltage readings compare scope readings against those shown in Table 2 in Appendix II. Generally start with the reading taken at the collector of Q12 followed by R54 reading, Q11, Q10, R43, Q9 base, Q7 emitter, Junction of C16 and R36, pin 7 of vidicon and concluding with the video output. This sequence will usually isolate the defective stage or stages with the least difficulty.

3. Should the problem appear to be due to a coil or transformer use an ohmmeter to compare readings against those shown below;

   F1- 315 ohms
   Y_v- 205 ohms (total series res.)
   Y_h- 33 ohms (total series res.)

   T1- (pins 1 to 2 = 165 ohms
   (pins 3 to 4 = 560 ohms
   T2- same as T1
   NOTE: ALL RESISTANCES ± 15%

   T3 120v pri. = 95 ohms
   320v sec. = 1200 ohms
   6.3v/750ma = 1 ohm
   6.3v/150ma = 3 ohms

   L1- near zero resistance
   L2- 1.8 ohms
   L3- 95 ohms

4. To determine video amplifier operation, remove the lens and while watching the TV monitor slowly advance a finger towards the front of the vidicon tube, but don't actually touch the tube. You should observe a very drastic increase in noise and bars in the picture. Also sync instability. This is due to the pickup of local RF energy in the video bandpass (such as AM radio stations, etc) caused by the antenna action of your body. Failure to pickup such RF with the finger about ½" from the vidicon is an indication that the video stages Q1 through Q6 are not functioning correctly. Steps 1 and 3, above, should locate almost any problem in this section of your camera. If the RF mode is being used it could of course indicate a problem in this stage.

TECHNICAL ASSISTANCE: Should the above information not be sufficient to locate your trouble you can write or phone our Technical Assistance Dept., 13th & Broadway St., Dakota City, Nebr. 68731 (Phone # 402-987-3771) and we will be glad to help you in the necessary manner. Please give us as much information as possible, such as voltage readings, scope patterns, resistance measurements, things you have done in an attempt to correct the difficulty, etc. The more detailed information you can give us, the better chance we have in making a correct diagnosis.

FACTORY REPAIR SERVICE: When needed, factory repair service is available with the following restrictions; No service will be provided for cameras assembled using acid core solder or to which unreasonable modifications have been made. Also, extremely poor constructor workmanship may be grounds for our refusing to perform service. Service fee is $10 for the first hour and $5 for each hour thereafter to a maximum of $50. No service will be performed which is anticipated to exceed this amount without first receiving authorization. Average service runs between 2 and 3 hours.

NEW SERVICE RATES
Effective 8/1/72
$12.50/1st hr; $10/hr
thereafter.

(Appendix -III- cont. next page)

SHIPPING INSTRUCTIONS FOR RETURNING CAMERA FOR FACTORY SERVICE: Check the camera completely over and make certain all parts and screws are securely in place. If desired, the lens and vidicon can be omitted. Equivalent test units can be provided by our service department upon receipt of the camera. Prior to wrapping it up, remove the top and bottom covers and insert pieces of cardboard between the PC board and the bottom cover and between the focus coil and power transformer and the top cover. These are for strain relief and prevent the PC board from flexing too much when subjected to rough handling. Failure to prepare your camera in this manner almost always results in a broken PC board. Next, wrap your entire camera in at least 3 inches of resilient packing material and seal inside a good sturdy corrugated cardboard box. DO NOT SHIP VIA PARCEL POST!! Postal service is not an acceptable method of shipping ASSEMBLED cameras. SHIP VIA GREYHOUND EXPRESS or RAILWAY EXPRESS. INSURE FOR $250. (Allow about 3-5 days for Greyhound Express and about 4-6 weeks each way for Railway Express.) Ship it prepaid to:

ATV RESEARCH
13th & Broadway St.
Dakota City, Nebr. 68731
(Express Agent: Route to Sioux City, Ia. for pickup)

ATV RESEARCH WARRANTY

ATV RESEARCH warrants that all parts shall be free of all defects in materials and workmanship under normal useage for a period of 90 days from the date of shipment and will replace any part upon verification that it is defective. No replacement shall be made on parts damaged by the buyer during the course of handling or assembling.

The foregoing warranty shall apply only to the original buyer, and is and shall be in lieu of all other warranties, whether express or implied and of all other obligations or liabilities on the part of ATV RESEARCH. In no event shall ATV RESEARCH be liable for any consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase, assembly or operation of its kits or components.

Kits or parts under warranty must not be returned for replacement or adjustment without first obtaining permission from ATV RESEARCH. In addition, the foregoing warranty is completely void if corrosive solder or fluxes have been used in wiring the equipment.

ATV Research 13TH & BROADWAY DAKOTA CITY, NEBR. 68731 "Extending your vision through Applied TV"	INFORMATION BULLETIN NO. 105A RELEASE DATE: 4/24/73 SUBJECT MATTER: XT-1A, SERIES D MANUAL CHANGES WHEN INCORPORATING #TC-2A TARGET CONNECTOR

All focus/Deflection Coil Kits and XT-1A Camera Kits packaged after 4/24/73 incorporate a new, improved type target connector (#TC-2A). When using this item in conjunction with the Model XT-1A, Series D Construction Manual it will be necessary to make the following changes in the manual;

STEP #1: Alter the size of the target hole on the PC board from 1/8" to 9/64" to allow the shielded cable to be more easily inserted through it.

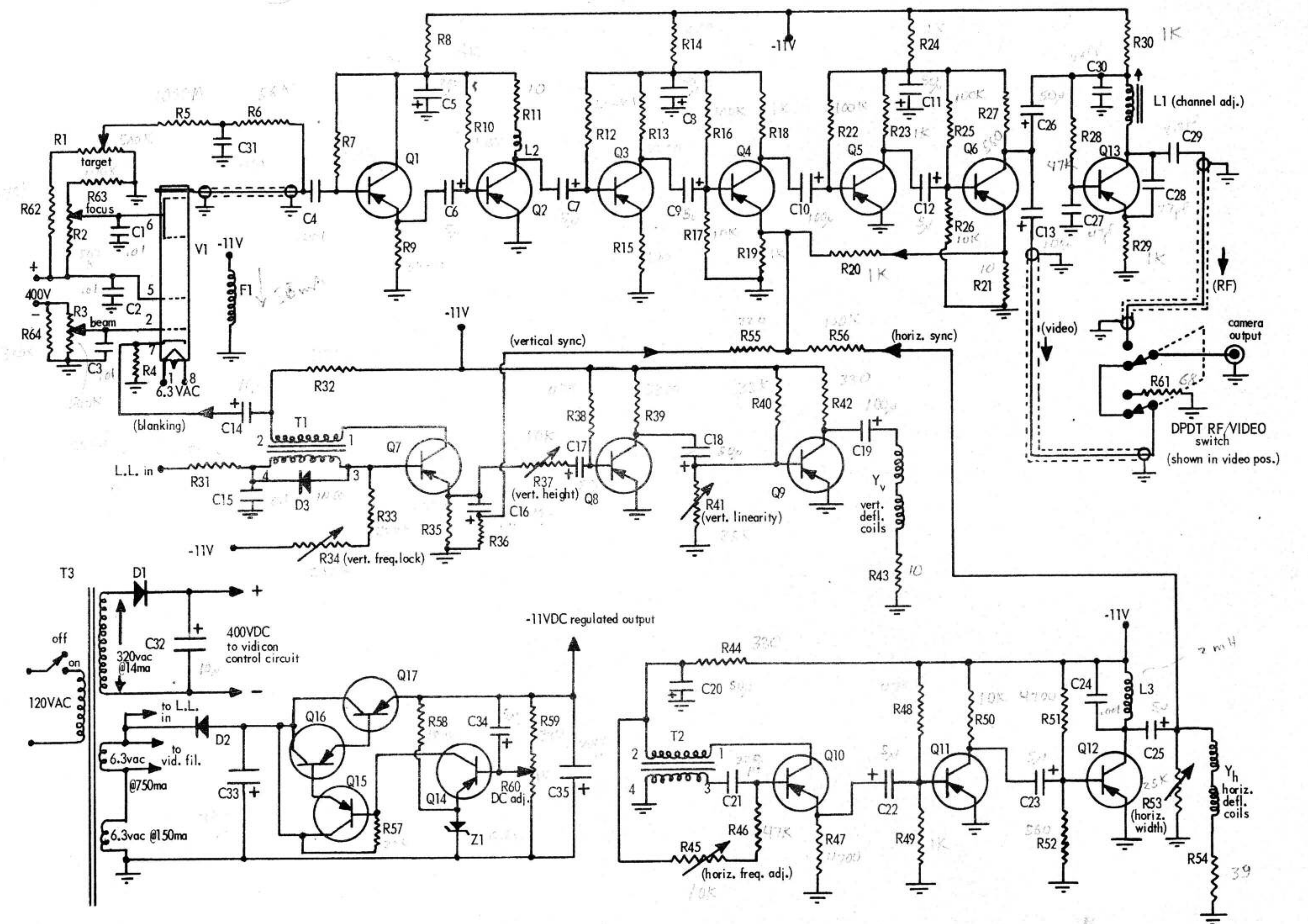
STEP #15: In the last sentence revise to read, "In so doing, the focus coil and PC board will be positioned slightly higher in the cabinet and thereby prevent any shorting of the PC board to the bottom cabinet cover."

STEP #23: Revise the last part of the second sentence to read, "...also the target cable must drop into the hole provided on the board." Omit the third and fourth sentences.

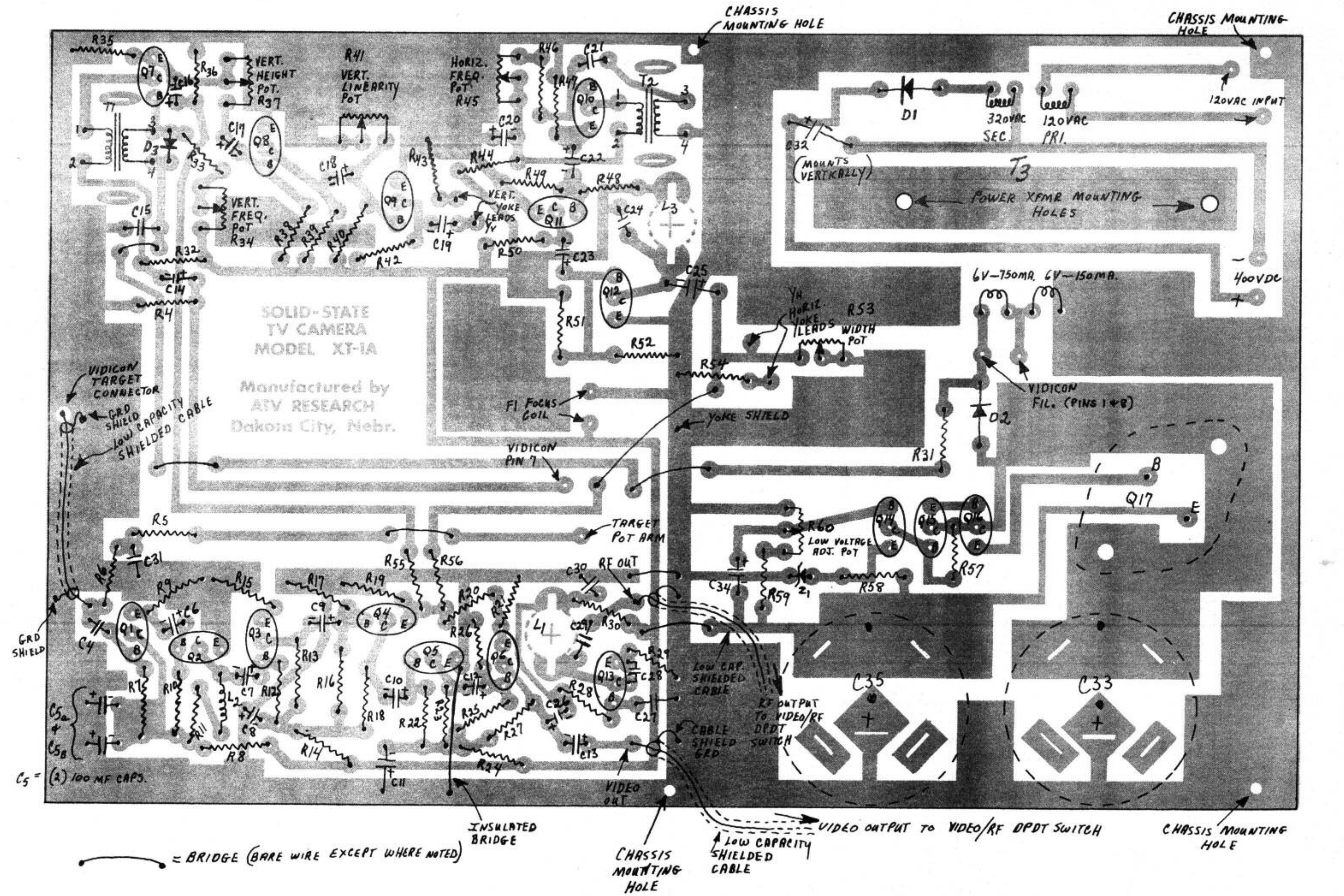
STEP #25: Revise the entire step to read, "Route the cable from the connector directly to the input of the video amplifier on the copper side of the board and solder both the shield and the center conductor into the proper holes provided."

STEP #31: Revise the second sentence to read, "Make certain the target ring portion of the tube is completely inserted into the target connector collar."

THANK YOU!



R1
target
R62
R63
focus
R2
C1
V1
-11V
F1
R3
beam
R64
C2
C3
R4
6.3 VAC
R5
R6
C31
C4
R7
R8
Q1
R9
C5
R10
R11
L2
C6
Q2
C7
R12
R13
R14
C8
Q3
R15
C9
R16
R17
R18
Q4
R19
R20
-11V
C10
R22
R23
R24
C11
Q5
C12
R25
R26
R27
Q6
R21
C26
C13
R28
C30
R30
L1 (channel adj.)
Q13
C27
R29
C29
C28
(RF)
(video)
camera
output
R61
DPDT RF/VIDEO
switch
(shown in video pos.)
(vertical sync)
R55
R56
(horiz. sync)
R32
(blanking)
C14
T1
L.L. in
R31
C15
D3
Q7
R33
R34 (vert. freq. lock)
R35
C16
R36
R37
(vert. height)
C17
R38
R39
Q8
C18
R40
R41
(vert. linearity)
Q9
R42
C19
Y_v
vert.
defl.
coils
R43
T3
D1
C32
320vac
@14ma
400VDC
to vidicon
control circuit
off
on
120VAC
to L.L.
in
D2
to
vid. fil.
6.3vac
@750ma
6.3vac @150ma
C33
Q16
Q17
Q15
R57
R58
Q14
Z1
C34
R59
R60
DC adj.
C35
-11VDC regulated output
R44
C20
T2
C21
R45
(horiz. freq. adj.)
R46
Q10
R47
C22
R48
R49
Q11
R50
C23
R51
R52
Q12
C24
L3
C25
R53
(horiz.
width)
Y_h
horiz.
defl.
coils
R54



XT-1A

PRINTED CIRCUIT LAYOUT

Viewed from copper side of board

PARTS LIST FOR ATV RESEARCH TRANSISTOR CAMERA MODEL XT-1A

R1-500K target pot
R2-500K focus pot
R3-500K beam pot & on/off sw.
R4-2200
R5-1000 meg. ALC resistor
R6-56K
R7-100K
R8-15K
R9-3300
R10-100K
R11-10
R12-470K
R13-2200
R14-3300
R15-100
R16-100K
R17-10K
R18-1K
R19-1K
R20-1K
R21-10
R22-100K
R23-1K
R24-1K
R25-100K
R26-10K
R27-560
R28-47K
R29-1K
R30-1K
R31-330K
R32-3300
R33-220K
R34-250K vert. freq. pot
R35-6800
R36-10
R37-10K vert. height pot
R38-47K
R39-3300
R40-33K
R41-25K vert. linearity pot
R42-330
R43-10
R44-330
R45-10K horiz. freq. pot
R46-47K
R47-4700
R48-47K
R49-1K
R50-10K
R51-4700
R52-560
R53-25K horiz. width pot
R54-39
R55-220
R56-100K
R57-22K
R58-1800
R59-330
R60-1K Reg. DC adj. pot
R61-68
R62-470K
R63-100K
R64-330K

C1-.01 disc
C2-.01 disc
C3-.01 disc
C4- .001 disc
C5-200mfd (two 100mfd's) 6V
C6-5mfd
C7-5mfd
C8-50mfd
C9-5mfd
C10-100mfd 6V
C11-50mfd
C12-5mfd
C13-100mfd 6V
C14-10mfd
C15-0.1mfd
C16-10mfd
C17-50mfd
C18-50mfd
C19-100mfd 6V
C20-50mfd
C21-220mmfd disc
C22-5mfd
C23-5mfd
C24-.001 disc
C25-5mfd
C26-50mfd
C27-47mmfd disc
C28-27mmfd disc
C29-2.2mmfd disc or tubular ceramic
C30-220mmfd disc
C31-.001 disc
C32-16mfd, 450V
C33-3000mfd, 15V can
C34-5mfd
C35-3000mfd, 15V can

Z1-6.8V zener diode
D1-Silicon diode, 600 PIV
D2-Silicon diode, 100 PIV
D3-1N60

V1-7038, 7735A, or any equiv. 1" diameter vidicon with electromagnetic deflection and focus.

F1-focus coil
Y_v-Vertical deflection coils
Y_h-Horizontal deflection coils

Q1-ATV #TQ-1222
Q2-ATV #TQ-2632
Q3-ATV #TQ-3177
Q4-ATV #TQ-4525
Q5-ATV #TQ-5525
Q6-ATV #TQ-6301
Q7-ATV #TQ-71
Q8-ATV #TQ-8205
Q9-ATV #TQ-92
Q10-ATV #TQ-10205
Q11-ATV #TQ-11205
Q12-ATV #TQ-12370
Q13-ATV #TQ-13205
Q14-ATV #TQ-14205
Q15-ATV #TQ-15205
Q16-ATV #TQ-16205
Q17-ATV #TQ-17155

NOTES:

1. All resistors 10% tolerance and ½ watt.
2. All electrolytics 15 volt rating unless otherwise stated.
3. Component changes or substitutions, if any, will be so designated in each kit.
4. Resistor values followed by the letter "K" must be multiplied by 1000 to determine actual value. I.e., 1K = 1000 ohms.

T1-ATV #TMI-2 vertical osc. transformer
T2-ATV #TMI-2 horizontal osc. transformer
T3-ATV #SP-506 power transformer

L1-ATV #8-20 RF osc. coil
L2-ATV #100-36 peaking coil
L3-ATV #2K-36 horiz. output coil

1-25mm lens ATV #L-64
1-lens mount ATV #FCM
1-S0239A coax connector
1-AC line cord
3-knobs
1- printed circuit board ATV #XT-PC1
1-camera case ATV #XT-C1
1-vidicon socket ATV #S-A1
1-DPDT slide switch
1-handle
Hookup wire
Low capacity shielded cable
Hardware
Pressure sensitive cabinet labels

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