**General Description**

The Model 3381 TV is a combination television receiver, camera, and monitor, with built-in facilities for color and stereo sound. The set uses a 20-inch panel of the color television picture tube, and has a monaural audio system. The following features are included:

1. **Power Supply:** A central power supply for the various stages.
2. **Chassis:** All components are mounted on the underside of the cabinet, which is designed for easy access to the components.
3. **Automatic Tuning:** The set has automatic tuning for both color and monaural sound.
4. **Audio System:** The set has a built-in automatic equalizer for improved sound quality.

**Specifications**

- **Overall Dimensions:**
  - Height: 36\(\frac{1}{2}\) in (91.4 mm)
  - Width: 22 in (55.9 cm)
  - Depth: 21\(\frac{1}{2}\) in (54.6 cm)

- **Electrical Ratings:**
  - Line Voltage: 110-120 volts, 60 cycle AC
  - Power Consumption: 280 watts

- **Tuning Frequency Range:**
  - Channel 1-12: 65 to 88 MHz
  - Full Channel: 45 to 88 MHz

- **Video Power Output:**
  - Maximum: 2.5 watts
  - Unbalanced: 2.5 watts

**Circuit Description**

The picture tube of the Model 3381 TV may be divided into two basic sections. These are:

1. **RF Amplifier, Converter, and Oscillator:**
2. **Picture RF Amplifier, Driver, and Automatic Gain Control:**
3. **Sound IF Amplifier and Detector:**
4. **Vertical Sweep:**
5. **Horizontal Sweep:**
6. **Light Valve:**
7. **Audio Amplifier and Speaker:**
8. **Filter Band Amplifier:**
9. **Automatic Gain Control:**

**Block Diagram**

- The block diagram shows the various stages of the TV set, including the RF amplifier, sound IF amplifier, and automatic gain control.
- The diagram also shows the audio and video signal paths, including the picture tube and speaker.

**Section 1: RF Amplifier and Converter**

- The RF amplifier and converter are essential components for amplifying the video signal and converting it to a form suitable for the receiver.

**Section 2: Picture Amplifier and Automatic Gain Control**

- The picture amplifier and automatic gain control work together to ensure that the picture is clear and consistent, regardless of the signal strength.

**Section 3: Sound Amplifier and Speaker**

- The sound amplifier and speaker are responsible for converting the audio signal to a form that can be heard by the listener.

**Section 4: Vertical and Horizontal Sweep**

- The vertical and horizontal sweep circuits are responsible for controlling the movement of the picture tube to display the image.

**Section 5: Light Valve**

- The light valve controls the brightness of the image on the picture tube.

**Section 6: Audio Amplifier and Speaker**

- The audio amplifier and speaker are responsible for amplifying the audio signal and converting it to a form that can be heard by the listener.

**Section 7: Filter Band Amplifier**

- The filter band amplifier is used to remove unwanted frequencies from the audio signal.

**Section 8: Automatic Gain Control**

- The automatic gain control circuit maintains a constant gain, ensuring that the audio signal is clear and consistent.

**Section 9: Picture Tube**

- The picture tube is the component that displays the image on the screen.

**Section 10: Speaker**

- The speaker converts the audio signal to sound waves that can be heard by the listener.

**Section 11: Vertical Oscillator Drive**

- The vertical oscillator drive circuit is responsible for controlling the movement of the picture tube in the vertical direction.

**Section 12: Horizontal Oscillator Drive**

- The horizontal oscillator drive circuit is responsible for controlling the movement of the picture tube in the horizontal direction.

**Section 13: High Voltage Power Supply**

- The high voltage power supply provides the high voltage necessary to operate the picture tube.
and applying the resultant D.C. voltage with correct polarity to the picture tube grid.

5. Sync Amplifier and Separators
As the picture signal contains pulses which control the horizontal and vertical sweep, and blanking, it is necessary to separate these pulses from the picture and from each other. It is the purpose of the Sync Amplifier to amplify the vertical, horizontal, and blanking pulses, and to reduce the effect of extraneous pulses. The Sync Separator is used to remove the video and blanking pulses from the horizontal and vertical signals. The Sync pulses are then further amplified and separated by means of amplifying and differentiating networks.

6. Vertical Sweep Circuits
Vertical Synchronising of a magnetically controlled picture tube requires a saw-tooth waveform of current through the vertical deflection coil. A voltage of the proper waveform and frequency is obtained in the vertical oscillator and discharge tube.

7. Horizontal Sweep Circuits
This portion of the Model 3391 TV is more complex than the Vertical Sweep Circuit and is made up of the following interrelated circuits:
1. Horizontal Sweep Generator
2. Horizontal Amplifier
3. Horizontal Oscillator
4. Horizontal Oscillator Control
5. Horizontal Discharge Output
6. Horizontal Output
7. Resonant Oscillator
The Horizontal Oscillator is a 665-GT connected in a very stable Hartley oscillator circuit. In order to maintain the proper frequency (15.750 C.P.S.) and phase relations between this oscillator and the transmitted picture signal, a radio-frequency (R.F.) circuit is connected across the oscillator circuit and controlled by means of the Horizontal Sync Discriminator (HSD) which produces a D.C. voltage proportional to the phase displacement between the oscillator saw-tooth output and the horizontal sync pulses.

The Horizontal Discharge, Output, and Resonant Oscillating circuits control the saw-tooth wave output of the controlled Horizontal Oscillator into a "smooth" output in the Horizontal Deflection coils to provide horizontal scanning for the picture tube.

8. High Voltages
The picture tube requires between eight and ten kilovolts on its 2nd anode to give proper picture brilliance. Use is made of the return, or "sweep-back" portion of the horizontal trace voltage. The output of the Horizontal Output tube (6SN7-G) is connected through a transformer to both a high voltage rectifier and to the Resonant Scanning tube. The high voltage winding of the transformer steps up the voltage to the required value. The resultant voltage is then rectified by the 6BQ7 tube and applied to the 2nd anode of the picture tube. Because of the magnitude and frequency, very little capacitance filtering is necessary to sufficiently "smooth" out this voltage.

The small amount of capacitance in the high voltage circuits does not affect the storage of much energy, thus making the circuit less dangerous than conventional high voltage circuits.

9. Audio Amplifier and speakers
A high-Q audio stage (6AL6) is coupled to a 665-GT type output tube, which in turn is connected to a permanent magnet dynamic speaker. A "feedback" circuit from the voice coil to the saddle of the output tube controls the load of the amplifier and speaker.

10. FM Band Tuner
In addition to receiving television signals, the Model 3391 TV also permits reception of the FM band. This is done by means of a tuner consisting of an R.F. Amplifier, and a Connetvator which amplifies and converts the incoming FM signal to 21.25 MC. This signal then passes through the same RF channel on the picture tube.

A plug is located on the rear of the chassis which permits connecting the output of the audio output of the R.F. Detector to an external amplifier and speaker system.

HIGH VOLTAGE WARNING
OPERATION OF THIS RECEIVER WITHOUT THE COVER REMOVED INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WORK ON THE RECEIVER SHOULD NOT BE ATTEMPTED BY ANYONE WHO IS NOT THOROUGHLY FAMILIAR WITH THE PRECAUTIONS MEASURED WHEN WORKING ON HIGH VOLTAGE EQUIPMENT. DO NOT OPERATE THE RECEIVER WITH THE HIGH VOLTAGE COMPONENT SHIELD REMOVED.

Non-operating Controls:
Alignment and trap circuit adjustments are not included in this list.
1. Height (down, extreme left)
2. Vertical Hold (right)
3. Vertical Linearity (right)
4. Horizontal Hold (right)
5. Focus (center)
6. Horizontal Drive (right)
7. Vertical Centering (down)
8. Horizontal Centering (up)
9. Horizontal Phase (center, inside chassis)
10. Horizontal Linearity (high voltage control)
11. Width (high voltage control)
12. Focus (out of picture tube, wiring not adjustable)
13. Deflection Coil (check of picture tube, wiring not adjustable)
14. (In Trap (back of picture tube).

*NOTE: No test tap is used on Raudland, type 10FP4.

FIG. 3—N.C.M.—OPERATING CONTROLS

TELEVISION TUBE INSTALLATION
The Model... is delivered with the picture tube ready for installation. If for any reason, it becomes necessary to remove this tube, the following procedure is recommended:
1. Remove chassis from cabinet and place on a bench or table so that the face of the tube and the control arm of the chassis reaches the table edge by about three inches.

PRECAUTION: Make certain that the bench or table is sufficiently solid to support the load.

FM OPERATING INSTRUCTIONS
The FM tuner... permits reception of stations within the 88 to 108 MC band.

To receive these stations, push the FM Tuning control until the engagement of the switch causes the FM tuning dial to light up. The receiver can now be tuned in the usual manner by means of the tuning control and the volume control for desired station and sound level.

FIG. 4—F.M. BLOCK DIAGRAM

TELEVISION OPERATING INSTRUCTIONS
The operation of the television section of the Model 3391 TV is accomplished by means of the controls listed and shown below.

FIELDS: VOLUME—Brillionance and Contrast
CONTRAST—Brillianace and Contrast
FM TUNING—For varying the brightness level of the picture
Channel Selector—For selecting the desired television station
Fine Tuning Control—For obtaining the best sound and picture quality.

VOLUME—For adjusting the sound level, both on Tele- vision and FM.
Brillianace Control—For varying the brightness level of the picture.
Contrast Control—For varying the contrast of the picture grading of black and white.

FM TUNING AND FM TV Switch—Turning this control tunes the FM section. Pushing the control to the "FM" position, push the control again to cause a "catch" to engage, permits switching from TV to FM position. Pushing this control again, releases the catch and operation returns to TV position.
Channel Selector—For selecting desired television station.
Fine Tuning Control—For obtaining the best sound and picture quality.
### ALIGNMENT CHART

#### (1) SOUND I F AND RATIO DETECTOR ALIGNMENT

<table>
<thead>
<tr>
<th>Step No.</th>
<th>Component Symbol</th>
<th>Signal Path</th>
<th>Connectors</th>
<th>Missed Tone Connections</th>
<th>Adjust</th>
<th>Value (Volts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lower coupling grid to V1.3</td>
<td>Signal path</td>
<td>V1.3, V1.4, and C12, Point C</td>
<td></td>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>2</td>
<td>Lower coupling grid to V1.3</td>
<td>Signal path</td>
<td>V1.3, V1.4, and C12, Point C</td>
<td></td>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>3</td>
<td>Lower coupling grid to V1.3</td>
<td>Signal path</td>
<td>V1.3, V1.4, and C12, Point C</td>
<td></td>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>4</td>
<td>Lower coupling grid to V1.3</td>
<td>Signal path</td>
<td>V1.3, V1.4, and C12, Point C</td>
<td></td>
<td></td>
<td>3.0</td>
</tr>
</tbody>
</table>

#### (2) PRELIMINARY PICTURE I F AND TRAP ADJUSTMENT

<table>
<thead>
<tr>
<th>Step No.</th>
<th>Component Symbol</th>
<th>Signal Path</th>
<th>Connectors</th>
<th>Missed Tone Connections</th>
<th>Adjust</th>
<th>Value (Volts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lower coupling grid to V1.3</td>
<td>Signal path</td>
<td>V1.3, V1.4, and C12, Point C</td>
<td></td>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>2</td>
<td>Lower coupling grid to V1.3</td>
<td>Signal path</td>
<td>V1.3, V1.4, and C12, Point C</td>
<td></td>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>3</td>
<td>Lower coupling grid to V1.3</td>
<td>Signal path</td>
<td>V1.3, V1.4, and C12, Point C</td>
<td></td>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>4</td>
<td>Lower coupling grid to V1.3</td>
<td>Signal path</td>
<td>V1.3, V1.4, and C12, Point C</td>
<td></td>
<td></td>
<td>3.0</td>
</tr>
</tbody>
</table>

#### (3) FINAL PICTURE I F CURVE SHAPING ADJUSTMENT

<table>
<thead>
<tr>
<th>Step No.</th>
<th>Component Symbol</th>
<th>Signal Path</th>
<th>Connectors</th>
<th>Missed Tone Connections</th>
<th>Adjust</th>
<th>Value (Volts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lower coupling grid to V1.3</td>
<td>Signal path</td>
<td>V1.3, V1.4, and C12, Point C</td>
<td></td>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>2</td>
<td>Lower coupling grid to V1.3</td>
<td>Signal path</td>
<td>V1.3, V1.4, and C12, Point C</td>
<td></td>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>3</td>
<td>Lower coupling grid to V1.3</td>
<td>Signal path</td>
<td>V1.3, V1.4, and C12, Point C</td>
<td></td>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>4</td>
<td>Lower coupling grid to V1.3</td>
<td>Signal path</td>
<td>V1.3, V1.4, and C12, Point C</td>
<td></td>
<td></td>
<td>3.0</td>
</tr>
</tbody>
</table>

#### (4) R F AND CONVERTER ADJUSTMENT TUNE 10280

<table>
<thead>
<tr>
<th>Step No.</th>
<th>Component Symbol</th>
<th>Signal Path</th>
<th>Connectors</th>
<th>Missed Tone Connections</th>
<th>Adjust</th>
<th>Value (Volts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lower coupling grid to V1.3</td>
<td>Signal path</td>
<td>V1.3, V1.4, and C12, Point C</td>
<td></td>
<td></td>
<td>3.0</td>
</tr>
</tbody>
</table>

---

**SERCISING EQUIPMENT**

In order to properly service the following equipment is required:

1. An RF Signal Generator with the following ranges:
   - 21.25 MHz, Sound I F and Sound Trap.
   - 40 to 90 MHz, 10 MC sweep width.
   - 170 to 225 MHz, 10 MC sweep width.
   - 3.2 to 5.0 MHz, 10 MC sweep width.

2. An RF Sweep Generator with the following ranges:
   - 18 to 30 MC, 10 MC sweep width.
   - 40 to 90 MC, 10 MC sweep width.
   - 170 to 225 MC, 10 MC sweep width.

### HIGH VOLTAGE MEASUREMENT

The potential applied to the 2nd set of vanes of the picture tube should be in the order of 10 kilovolts. This is well outside the range of any voltmeter used by the average radio technician. The range of a Polywin or similar type meter can readily be extended. Voltsimeters are commercially available for this purpose. In measuring this voltage, all precautions of high voltage handling should be observed.

### PRODUCTION MODIFICATIONS

Several modifications have been made since the last unit was produced. The schematic diagram incorporates all of these changes. It is to be noted that the service technician may reconcile any variations between the choice he is servicing and the schematic diagram. A list of these modifications is included with these notes. It is not advised that these changes be made unless there is an apparent justification for it, or delay.

1. An 8.2 kohm resistor was added across C8, the 6th Pin I F transformer.
2. R46, the 6th Pin I F cathode resistor was used and changed to 180 ohms.
3. Early versions of this model incorporated anode in the Automatic Gain Control circuit. Because of the poor sensitivity resulting in weak signal energy, it was deemed advisable to add delay so that the AGC would not be operative until a certain minimum signal was received. The output of the Control circuit which went to ground has been connected to a positive voltage source as indicated in the schematic diagram.
4. The 6th Pin I F cathode bypass condenser which was originally, 1500 pF, has been changed to 5000 pF.
5. A certain number of receivers were built with the polarity of the secondary of the 1st Sound I F reversed, Terminal "A", instead of being connected to the grid, is connected to VCC. For these receivers, this method of connections is correct.
6. A 1500 pF, capacitor was added to the 135 volt bus to the Sound I F.
7. The limiting resistor in series with the Horizontal Drive Control may be seen in a series of several values, 10,000 ohms, 6800 ohms, 4700 ohms.

### ALIGNMENT PROCEDURE

For convenience, the alignment procedure is given in the form of a chart.

In the alignment of the Picture I F Amplifier, care must be taken to prevent the input circuit of one tube becoming tuned to the same frequency as its output circuit. Violent oscillations will occur which will manifest themselves in an abnormally high bias voltage. This voltage will drive subsequent amplifier tubes to cut off and an action will appear on the oscilloscope screen. The technician should observe both oscilloscope and voltmeter, detuning each stage until a signal appears on the oscilloscope screen and for the bias voltages become lower values (read at point F1). The alignment procedure outlined in Step 10 can then be followed. Lowering the oscillator to one tube that normally is troubleshooted for abnormal response.

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ALIGNMENT CHART

MODEL 3301TV

(5) R.F OSCILLATOR ALIGNMENT TUNER No. 10932

1. Antenna terminals 215.75

2. R.F. Oscillator

3. Channel 2

4. Channel 3

5. Channel 4

6. Channel 5

7. Channel 6

8. Channel 7

9. Channel 8

10. Channel 9

11. Channel 10

12. Channel 11

(6) R.F OSCILLATOR ALIGNMENT TUNER No. 10923

1. Antenna terminals 87.75

2. Receiver on Channel 2

3. Receiver on Channel 3

4. Receiver on Channel 4

5. Receiver on Channel 5

6. Receiver on Channel 6

7. Receiver on Channel 7

8. Receiver on Channel 8

9. Receiver on Channel 9

10. Receiver on Channel 10

11. Receiver on Channel 11

12. Receiver on Channel 12

NOTE: The oscillator alignment for Tuner 10923 should not be attempted if all stations fall within range of the Fine Tuning Control. There are no oscillator adjustments for each channel, hence the adjustment is a compromise. The following procedure is only recommended when some station or stations fall outside the range of the Fine Tuning Control.

(2) FM TRAP ADJUSTMENT

1. Between A and ground (1000 ohms) 2. Between other A terminals (1000 ohms)

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**SERVICE SUGGESTIONS**

*BASED ON PICTURE TUBE OBSERVATION*

**No Raster on Picture Tube:**
1. V-29 or V-30 inoperative. Check voltages at trim, and continuity of T-14.
2. No high voltage. If horizontal deflection is operating, the trouble can be isolated to the 8016 circuit. Check:
   a. The 8016 tube (V-30).
   c. R116 and R174 for open circuit.
3. V-27 or V-217 circuits inoperative. Check:
   b. For pulse on terminal 5 (grid of V-217 SS444, S, 110 V, 0.2 ampere).
   c. For saw-tooth on terminal 5 (grid of V-219 SS566, 110 V, 0.2 ampere).

**See Schematic Diagram, Figure 30.**

4. Resistor across tube inoperative (V-31; V-42).
5. Defective picture tube.
7. No receiver plate voltage. Check filter condenser for short circuit.

**No Vertical Deflection:**
1. V-23 or V-24 inoperative. Check:
   a. Voltages and waveforms on grid (terminals 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16).
   b. Vertical Output Transformer (T-11) open.
   c. Vertical Deflection Coils (L-97 and L-98) open.

**No Horizontal Deflection:**
1. Horizontal Deflection Coil (L-103) open. Any other failure in the Horizontal Oscillator circuits will cause loss of high voltage with consequent loss of picture tube beam.

**Raster and Signal on Picture Tube, But No Sound:**
1. RF Oscillator off frequency.
2. Sound 1F, Raster Detector, or Audio Amplifier inoperative. Check voltages on all tubes in these circuits.
3. T-9 or C63 defective.
4. Speaker defective.

**Sound and Raster, But No Picture or Sync:**
1. Picture 1F, Detector, or Audio Amplifier inoperative. Check voltages on all tubes in these circuits.
2. Check contact to picture tube grid.

---

**FM ALIGNMENT PROCEDURE**

The Model 3301 TV is equipped with an FM receiver. The TV sound channel is being used as the IF Amplifier and Detector. The alignment of this portion of the receiver is covered in the TV alignment instructions.

**FM ALIGNMENT CHART**

<table>
<thead>
<tr>
<th>Step</th>
<th>Contact</th>
<th>Test Out.</th>
<th>Pointer</th>
<th>Adjust</th>
<th>For Max. Output*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Antenna</td>
<td>21.25</td>
<td>—</td>
<td>SS4</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>108 MC.</td>
<td>108 MC.</td>
<td>C63 &amp; C66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>88 MC.</td>
<td>88 MC.</td>
<td>C63 &amp; C66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Report Dsp No. 2</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Antenna</td>
<td>56 MC.</td>
<td>96 MC.</td>
<td>SS2</td>
<td></td>
</tr>
</tbody>
</table>

*Connect a 400-ohm load or equivalent to point “C” on schematic."

**SERVICE INSTRUCTIONS—FM**

The Model 3301 TV may be used for the reception of FM stations on the FM band which extends from 88 to 108 MC. A block diagram shows how this is accomplished:

- The unit consists of an R-F Amplifier (SM646) and a Convector (SM883) which changes the FM signal from its original frequency (88 to 108 MC) to the IF frequency (460 to 540 KC). The IF frequency is the same as used for the Picture sound and the same IF channel is used in both cases. A two-gap variable capacitor serves to tune the R-F Amplifier and Convector across the band. The convector circuit is not tuned. The antenna coil is resonated at the middle of the band and is designed to perform across the entire band with uniform gain.

---

**FIG. 10—PICTURE TUBE YOKE**

Lightness. Loosen the Focus Coil wing nut and rotate the tube around the horizontal and vertical axis until the entire raster is visible on the face of the tube. The raster should be centered and there should be no dark corners visible. Tighten Focus Coil wing nut with colt in this position.

**FIG. 15—WAVEFORMS**

**FIG. 24—IF RESPONSE CURVE**

**FIG. 23—WAVEFORMS**

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Recently a few cases of vertical jitter in the picture have been reported in Models 3381 and 1291 TV. It has been found in most cases that a redressing of the white lead which runs from the deflection yoke to the plate of the picture damper tube will remedy this effect. Dress this lead as far as possible from the vertical blocking oscillator transformer which is located between the tube support brackets and directly beneath the deflection yoke.

Where it is found necessary to make adjustments to the vertical control during the first hour of operation, this condition can usually be rectified by recoupling the long green wire which runs from the center tap of the vertical hold control, to the tip point, located near the center of the chassis. During the warm-up period this drift is due to a high resistance leak developing between ground and plate of the tap 550,000 impedance insulating wire. This is suggested replacing this wire or routing straight from the control to the tip point without touching any of the other circuit components or chassis.

The two speed LF model of the "GI" changer, occasionally some slipage of the table wheel has occurred in the 78 RPM position. In most cases this has been traced to the 78 RPM idler wheel being slightly undersized. By selecting from your stock a wheel slightly larger this condition can be corrected.

The drop in output level when playing micro-groove records is a normal condition due to the recording level being 4 DB lower on this type record.

Sometimes an occasional case of vertical instability resulting in a continuous roll of the picture occurs after the television receiver has been on for a period of one or two hours. The condition is traceable to the 400 mfd ceramic condenser in the control grid circuit of the 6SN7 vertical oscillator tube and apparently is the result of a change in capacitance as the temperature increases in the chassis. To correct this, the 400 mfd ceramic should be replaced with a 125 mfd condenser for the values of 0.707 mfd. A 125 mfd condenser is required to correct the condition, however, the value is not critical. Mounting the condenser on full length leads in a position approximately one inch from the metal chassis panel will probably make for best results.

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