To check the diode pick-up, energize the aural and visual sections, using a 400-cycle sound input and a composite picture input not exceeding two volts peak-to-peak.

Adjust the probe for a peak-to-peak visual signal of approximately 1.75 volts. If there is objectionable sound interference in the picture, as indicated by a fine herringbone cross-hatch pattern on the kinescope, and a thickening of all horizontal traces on the CRO, de-energize the transmitter and drill a second hole for the probe. This hole should be located nine inches from the first hole for channels 2 to 6, and three inches away for channels 7 to 13.

Again energize the transmitter and check the interference. Drill additional holes as required, using the relative amount of pick-up in the various holes as a guide in arriving at the sound null location. Do not, under any circumstances, permit the diode probe to touch the transmission line inner conductor during operation.

OPERATION

ROUTINE PROCEDURE

After completion of all preliminary adjustments and tuning and when ready to initiate regular broadcasts, it is desirable to follow a routine procedure for putting the transmitter on the air.

The TT-5A transmitter control circuit design incorporates automatic starting wherein, if all other controls are left in the ON position, operation of the Transmitter ON switches will place the transmitter on the air with full modulation. In this starting procedure the proper sequence for air, water, filaments, screen, and plate power is automatically controlled.

It has been found that nearly all operators prefer a more cautious start, with greater, manually-controlled, delay between the various steps. This procedure is desirable particularly in high channel transmitters where the following daily warm-up and shut-down schedules are recommended.

DAILY WARM-UP SCHEDULE

At the beginning of each operating day, make sure that the water- and air-cooling systems are functioning properly before applying any voltages to the 8D21. Then apply the regular operating voltage to the filament (see filament operating voltage) for ten minutes with no voltages on the other electrodes. After this period, apply the regular operating plate voltage, grid No. 2 voltage, and excitation. Adjust the grid No. 1 bias or excitation to give a plate current of about 500 milliamperes. Operate at this value for about ten minutes, after which the tube is ready for the day's operation.

DAILY SHUT-DOWN SCHEDULE

At the close of each operating day, remove all d-c voltages and excitation from the 8D21 tube. Then reduce the a-c filament voltage to a value as low as the filament control will permit, and operate the filament at this value for five minutes. Filament power may then be turned off, but continue the water cooling for an additional 30 seconds. Air cooling may be stopped with removal of the d-c voltages and excitation. If, however, the air-cooling system is interlocked with the water-cooling system, continue both the water and air cooling for 30 seconds.

On the visual side, it is assumed that the Black Level control remains at the pedestal level setting used in the previous day's operation. Therefore, as an important check on the proper amplitude of excitation, the Ampl Plate Current should be observed and the reading should be approximately 1.4 amperes. To make an additional check on the excitation, rotate the Black Level control until a bias of 820 volts is indicated on the Ampl Grid Voltage meter and adjust the Excitation control, if required, for a reading of 0.1 ampl plate current. Return the Black Level control to its correct pedestal level setting.

The visual transmitter is now ready for modulation with a composite picture signal. At schedule time, advance the Picture Gain control at either the console or the transmitter until the reflectometer reads the logged value. Advance the Sound Gain control. Station programming may now proceed.

The Tower Lights switch on the console provides control of this circuit.

MONITORING AT CONSOLE

Selection of sound or picture circuits for monitoring is achieved by operation of the pushbuttons on the VU Meter, Sound Monitor, Kinescope, and CRO switches. The power output meters provide a check on the sound and picture outputs, while the sound and picture gain controls provide console regulation of these transmitter input levels.

The console master monitor controls require a minimum of attention on the part of the operator. Adjustment of the Hold controls may be necessary, however, when starting operation. Slight readjustment of kinescope brightness and focus controls may also be necessary to compensate for tube aging or variations in room lighting.

To check the waveform of a picture signal, place the master monitor frequency switch on Vertical frequency to obtain a double pattern (two fields) of the vertical frame pulses. Then move the switch to the Horizontal position to obtain a double pattern of the horizontal line.

To check the signal voltage level move the calibrating switch to the Calibrate position. A comparison can now be made with the signal and the calibrating voltage.

In both of these sweep positions the relative values of signal voltage components may be determined. When the signal waveform is observed in conjunction with the picture monitor, the CRO aids in analyzing performance of the transmitting system and determining necessary corrective action. Such analysis is facilitated by experience and familiarity with the equipment.

OPERATING CHECKS

The following is a suggested list of routine checks to be made during program time:

(a) Check and maintain reflectometer reading at its calibrated value for required power output. A decrease in reading caused by line voltage may be corrected by advancing the Excitation Control or by slight repeaking of the Driver Plate and PA grid tuning controls. The correction is obvious if a change in reading is due to variation of the peak-to-peak amplitude of the composite signal from the studio.

(b) Check and maintain all filament voltages to proper values.

(c) Keep constant check on depth of modulation. If reflectometer is reading correctly, indicating synchronizing pulse amplitude is right, but picture whites are driving beyond 90% modulation, advise studio that a reduction of picture content is necessary.

(d) Keep constant check on "set-up." The "set-up" as seen on the CRO is the distance between the blackest blacks in the picture and the pedestal level. It is generally accepted practice to maintain a distance of from 5% to 10% of the total peak-to-peak amplitude as "set-up". If the blacks are squaring off against the pedestal line, advise the studio that a reduction is necessary.

SHUT-DOWN PROCEDURE

To stop transmitter operation without affecting the control console, move the Transmitter On-Off switch to the OFF position. Transmitter plate power alone is removed when the Plate Power-Off switch is operated. To shut down the control console, throw the Console switch to the OFF position. Although it is possible to de-energize individual units in the monitoring rack equipment when desired, when the CONSOLE switch is turned to OFF, this also removes the power from all rack equipment except the frequency monitors.

The automatic overload reset circuits will place the transmitter back on the air after one or two overloads of short duration. After a third overload or after a continuing overload all plate voltages will be removed from the section at fault.

Restoration of operation after a station has been taken off the air by overload requires first that the difficulty be corrected. When this has been done, the transmitter or console Overload switch should be depressed.

MONITORING PROCEDURE, VISUAL

VISUAL INPUT MONITORING

Depress the Trans-Input pushbuttons on the console to obtain an indication of the input signal on the Master Monitor. If the Brightness controls are operated high enough a trace will be noticed on the screen of the CRO and a raster on the kinescope. With a composite picture signal such as that supplied by a Monoscope camera at the input to the racks and the controls of the Stabilizing Amplifier properly adjusted, the transmitter input signal may be observed on the kinescope screen and CRO.

Adjust the controls of the Stabilizing Amplifier and Master Monitor as described in the instruction books furnished with the units.

DEMODULATED R-F CARRIER MONITORING

The output of the WM-13 Visual Modulation Converter is used to provide the following measurements:

(a) Per cent amplitude of synchronizing pulses.

(b) Per cent depth of modulation.

(c) Set-up (per cent difference between blackest portion of picture and blanking, referred to the excursion between reference white and blanking).

(d) Hum, noise, and variation in output power during a frame.

(e) Other tests at the transmitter location where the sweeps and response of the CRO are suitable. Such tests include overall system linearity when the input is a calibrated step-wedge chart.

(f) Sweep response of the transmitter or system.

To make the first four measurements, the KEYER of the WM-13 Visual Modulation Converter must be in the ON position and the Test switch OFF.

With the various controls properly adjusted, the signal at the input of the CRO, when the Transm – Output button is depressed, consists of the demodulated output wave of the transmitting system, but with alternate vertical synchronizing pulses "chopped out." The CRO sweep should be set at vertical and a composite signal from the transmitter input, modulator output, or transmitter output, must be supplied to the kinescope input of the master monitor. This signal is required to synchronize the sweep for the CRO since this sweep is derived from the synchronizing signals in the kinescope amplifier circuit.

When observed on the CRO, the output of the WM-13 unit during the time of the chopped pulse corresponds in position on the CRO screen to zero power output of the transmitter. The length of the chopped out pulse relation to the CRO sweep may be adjusted so that the chopped pulse occurs during the retrace time of the CRO sweep. At vertical sweep rate, the vertical synchronizing pulses which are not chopped will appear in the center of the pattern. The return trace forms a reference line corresponding to zero power and the rest of the pattern appears below it.

If for any reason the WM-13 Keyer is turned off, or the signal removed from the kinescope, or WM-13, and a return is made to the transmitter output monitoring condition just described, the probability of the chopped pulse occurring at the center of the pattern instead of during the return trace is 50 per cent. If the chopped pulse does occur at the center of the pattern it may be caused to change to proper position by depressing a spare pushbutton and then quickly pressing the desired pushbutton. This will remove the input from the kinescope and permit the sweep circuits to "roll" or "slip" half a frame. The vertical sweep speed control on the monitor may be maladjusted momentarily to accomplish the same result.

The chopped waveform may, if desired, be observed with the CRO sweep at horizontal rate.

The sweep response of the transmitter, or system, may be observed at the console by depressing the proper pushbuttons. Because of sweep limitations in the CRO a more easily interpreted pattern may usually be obtained by use of a suitable portable oscilloscope, connected by a cable to the WM-13 unit through connections at the jack panel.

VISUAL R-F CARRIER FREQUENCY MONITORING

The meter on the WF-49B Frequency Meter indicates a beat frequency between a harmonic of the crystal in the WF-50A Frequency Monitor and the transmitter carrier. The indicating meter is duplicated at the top of the Picture Monitor Rack and may be read with the front door closed.

MONITORING PROCEDURE AURAL

AURAL INPUT MONITORING

Depress the Transmitter Input pushbuttons on the console and monitor the transmitter input visually on the VU meter, or aurally by means of the loudspeaker.

Reference should be made to "Incoming Live Adjustments, Console" under TUNING where the effects of the pre-emphasis network are discussed.

AURAL OUTPUT MONITORING

Depress the Trans – Output pushbuttons on the console and monitor the transmitter output visually on the VU meter, or aurally by means of the loudspeaker.

AURAL R-F CARRIER FREQUENCY AND MODULATION LEVEL MONITORING

Adjust and operate the F-M Monitor according to directions in the instruction book for that unit. The indicating meters on the F-M Monitor are duplicated at the top of the aural Monitor rack and may be read with the front door closed.