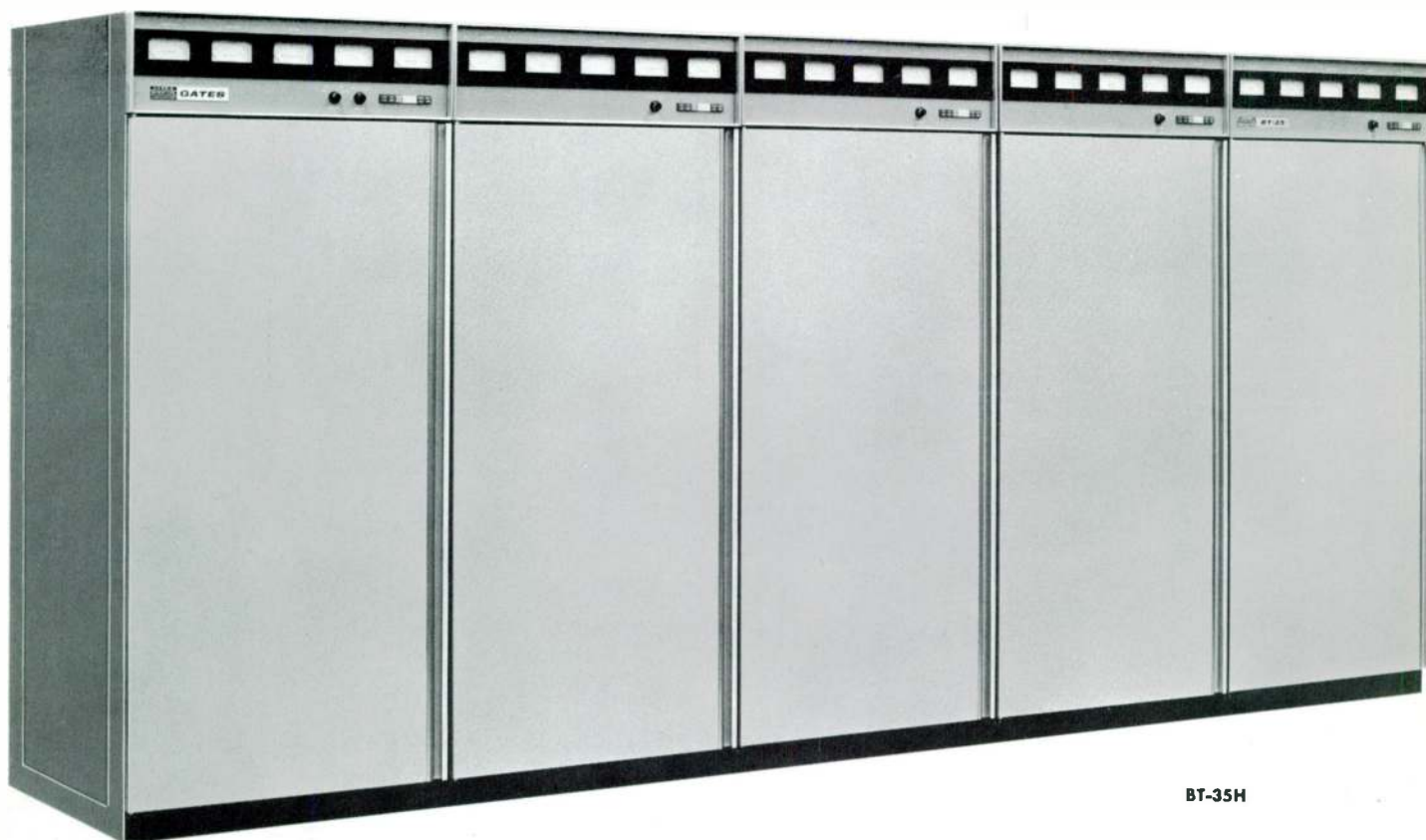


GATES

VHF — UHF COLOR TELEVISION TRANSMITTERS AND ACCESSORIES



35,000 Watt VHF Color Television Transmitters



BT-35H

MODEL BT-35L LOW BAND

MODEL BT-35H HIGH BAND

With the introduction of its advanced line of color VHF television transmitters, featuring IF MODULATION, Gates made available to the broadcasting industry the first VHF equipment specifically developed and designed for color telecasting. The FCC type accepted BT-35H is the 35 kW high band model in this outstanding line. The 35 kW low band model is the BT-35L.

These 35 kW transmitters set new standards of excellence for color transmission through the achievement of four design objectives. These are: IF MODULATION, low-level vestigial side-band filtering, true linear operation of power amplifiers, and solid state visual and aural exciters.

IF MODULATION: Low-level IF MODULATION is a system wherein the picture and sound signals are processed, modulated and corrected at very low power levels (milliwatts) for proper transmission to the antenna. These signals are then increased in power through the use of extremely linear power amplifier tubes to the 35 kW power level.

Because it occurs at much lower power levels, intermediate frequency modulation needs fewer circuits in order to produce a fully processed, quality picture signal. Gates' system takes less than 1.0 volt of video signal to modulate the RF carrier, where other recent designs need as much as 200 volts for carrier modulation.

The simplicity of IF MODULATION results in nearly perfect signal linearity. Thus, predistortion circuitry which degrades color fidelity is practically eliminated.

The ring-modulator used in the BT-35 (and all Gates' VHF transmitters) allows modulation percentages to approximately 2%. This exceptional color performance, even with such colors as highly saturated yellow and cyan, is the result of excellent linearity and depth of modulation.

In addition, equalization of envelope delay occurs at the IF carrier frequency. This delay function is not fixed but continuously variable.

35,000 Watt VHF Color Television Transmitters

LOW-LEVEL VESTIGIAL SIDEBAND FILTERING: Another advantage of IF MODULATION is that in this system visual sidebands are shaped at the IF frequency, rather than "on frequency" at the full output power of the transmitter. This completely eliminates the need for a conventional bulky sideband filter which can cause a power loss, can sometimes arc over, and takes up valuable space in the transmitter building. The sideband filter used by Gates is a removable module housed in the visual exciter.

VISUAL AND AURAL EXCITERS: Picture and sound modulation take place in the independent solid-state visual and aural exciters. Both exciters produce fully processed carriers "on channel", leaving the stages which follow exclusively for power amplification. One knob on each exciter controls the visual or aural power of the transmitter without retuning of any kind.

In the visual and aural exciters, the carriers are generated by a system of three different signal frequencies. One is a reference signal whose frequency is determined by that of the assigned TV channel. It is combined with two fixed frequencies. The video information is amplitude modulated on an IF carrier and the audio is frequency modulated on a carrier spaced 4.5 MHz from the visual IF carrier. Mixing or up-converting the visual and aural signals with the reference signal results in the proper "on channel" frequency.

LONG-TERM STABILITY: The use of conservatively rated Type 8806 and 8807 ceramic tetrodes as VHF linear amplifiers, operating in a grounded grid and grounded screen configuration, provides true linearity and maximum stability and reliability.

CONTROL LOGIC AND PROTECTIVE CIRCUITRY: In the BT-35, each cabinet has its own independent control logic. Complete and fool-proof control of all transmitter functions is achieved through the use of solid-state memory, timing and logic circuits. An emergency battery supply is provided to maintain control logic memory during periods of power line failure.

REMOTE CONTROL: All transmitter control and monitoring circuits are designed for remote control and automatic logging. The power controls are motor driven and the necessary remote control sampling points are built in on accessible terminal boards.

POWER SUPPLY: The high-voltage power supply, including the transformer, is one externally-mounted assembly. The power supply circuit consists of two 3-phase full-wave 3500 volt rectifying systems in series, each system being driven by a separate secondary. Both systems combined have a total of twelve conduction periods in which the peaks of one system coincide with the troughs of the other. This 12-phase rectification has a very low ripple content of approximately 42 dB below the DC output before filtering takes place.

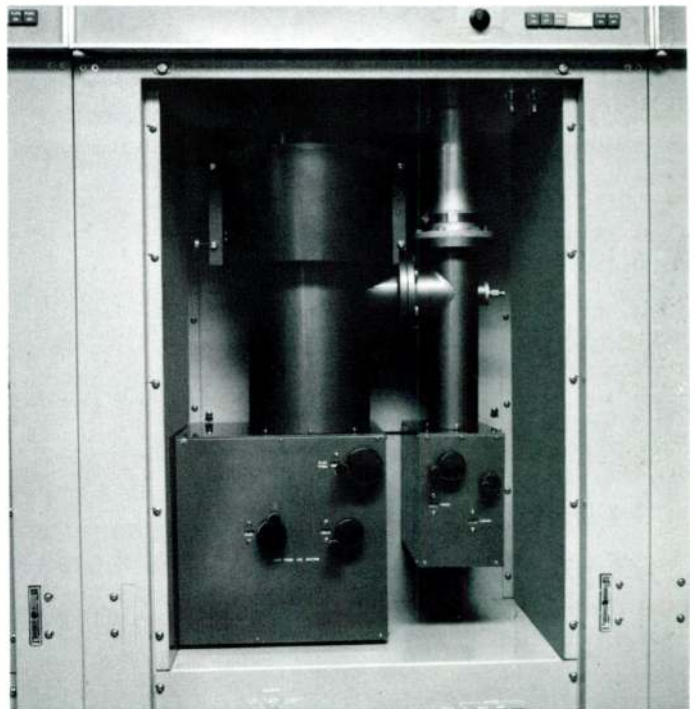
MODULAR TRANSMITTER DESIGN: Gates' BT-35 consists of five cabinets: (1) a complete 1.3 kilowatt transmitter (BT-1300) which serves as a driver for high power RF amplifiers (this is the basic unit for all Gates' higher powered VHF transmitters); (2) an aural power amplifier; (3) a visual driver; (4 & 5) two 18 kilowatt visual power amplifiers connected to an antenna through a combining network.

The building-block concept in Gates' line of VHF transmitters permits parallel operation for high power in the most economical and reliable manner possible.

EASE OF MAINTENANCE: The entire BT-35 is easily accessible from the front and back. Both visual and aural exciters slide out and can operate independently from the other transmitter stages outside the main cabinet. The various exciter circuits such as reference oscillator, visual oscillator, aural oscillator and modulator are of modular construction and can be removed for maintenance.

Tubes in the driver, and the visual and aural amplifiers can be removed by one man from the front of the transmitter.

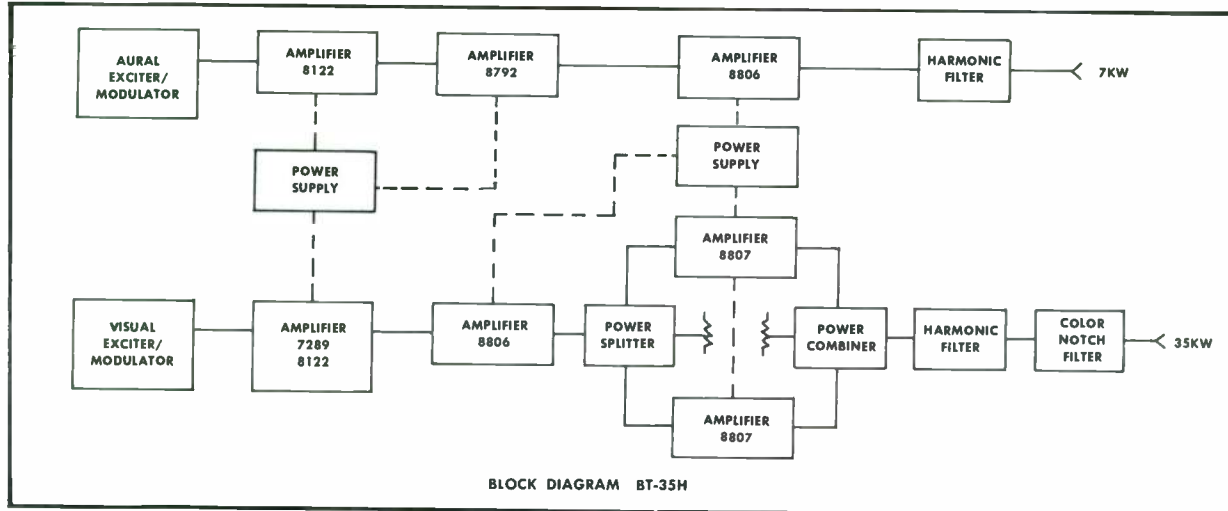
Easy-to-read 4-inch meters are used in the meter panel located at the top of each cabinet. All meter panels are hinged for easy access.



BT-35H 35 kW high bond transmitter high-power cavity assembly with visual output coupler. Complete tuning controls are readily accessible from the front of the transmitter.

HARRIS
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35,000 Watt VHF Color Television Transmitters



SPECIFICATIONS (CCIR specifications available)

VISUAL PERFORMANCE

- POWER OUTPUT:** 35 kW peak (FCC and CCIR "B").
- OUTPUT IMPEDANCE:** 50 ohms. Output connector: 3/8" EIA standard.
- FREQUENCY RANGE:** (BT-35L) 48 to 88 MHz (Channels 2 to 6). (BT-35H) 174 to 230 MHz (Channels 7 to 13).
- CARRIER STABILITY:** ± 250 Hz (maximum variation over 30 days).
- REGULATION OF RF OUTPUT POWER** (Black to white picture): Less than 3%.
- VARIATION OF OUTPUT:** Over one frame: less than 2%.
- VISUAL SIDEBAND RESPONSE:**
- | | | |
|----------------------|-------|-------------------|
| +4.75 MHz and higher | ----- | -20 dB or better. |
| Carrier to +4.18 MHz | ----- | +0.5, -1 dB. |
| Carrier | ----- | 0 dB reference. |
| Carrier to -0.5 MHz | ----- | +0.5, -1 dB. |
| -1.25 MHz and lower | ----- | -20 dB or better. |
| -3.58 MHz | ----- | -42 dB or better. |
- FREQUENCY RESPONSE VS. BRIGHTNESS:** ± 0.75 dB (measured at 65% and 15% of modulation. Reference 100% = peak of sync).
- VISUAL MODULATION CAPABILITY:** 3% or better.
- DIFFERENTIAL GAIN:** 0.5 dB or better (maximum variation of sub-carrier amplitude from 75% to 10% of modulation. Sub-carrier modulation percentage: 10% peak to peak.)
- LINEARITY (LOW FREQUENCY):** 0.5 dB or better.
- DIFFERENTIAL PHASE:** $\pm 3^\circ$ or better (maximum variation of sub-carrier phase with respect to burst for modulation percentage from 75% to 10%. Sub-carrier modulation percentage: 10% peak to peak.)
- SIGNAL-TO-NOISE RATIO:** -50 dB or better (RMS) below sync level.
- K FACTORS:** 2 \pm 2%, 20 \pm 3%.
- ENVELOPE DELAY:**
- | | | | |
|-----------------|-------------|---|----------------------------------|
| .05 to 2.1 MHz: | ± 70 ns | } | Reference to standard curve—FCC. |
| at 3.58 MHz: | ± 35 ns | | |
| at 4.18 MHz: | ± 70 ns | | |

VIDEO INPUT: Bridging, loop through input with -30 dB or better return loss up to 5.5 MHz, 75 ohm system.

HARMONIC RADIATION: -80 dB.

AURAL PERFORMANCE

- POWER OUTPUT:** 9 kW at diplexer output.
- AUDIO INPUT:** +10 dBm, ± 2 dB into 600 ohms.
- INPUT IMPEDANCE:** 600/150 ohms.
- PRE-EMPHASIS:** 75 microseconds.
- FREQUENCY RESPONSE:** ± 0.5 dB relative to pre-emphasis (30-15,000 Hz).
- DISTORTION:** 0.5% or less after 75 microseconds de-emphasis with ± 25 kHz deviation. 0.7% after 50 microseconds de-emphasis with ± 50 kHz deviation.
- FM NOISE:** -60 dB relative to ± 25 kHz deviation.
- AM NOISE:** -52 dB relative to 100% modulation (measured after de-emphasis).
- OUTPUT IMPEDANCE:** 50 ohms, output connector 3/8" EIA standard.
- FREQUENCY STABILITY:** ± 250 Hz (maximum variation over 30 days).

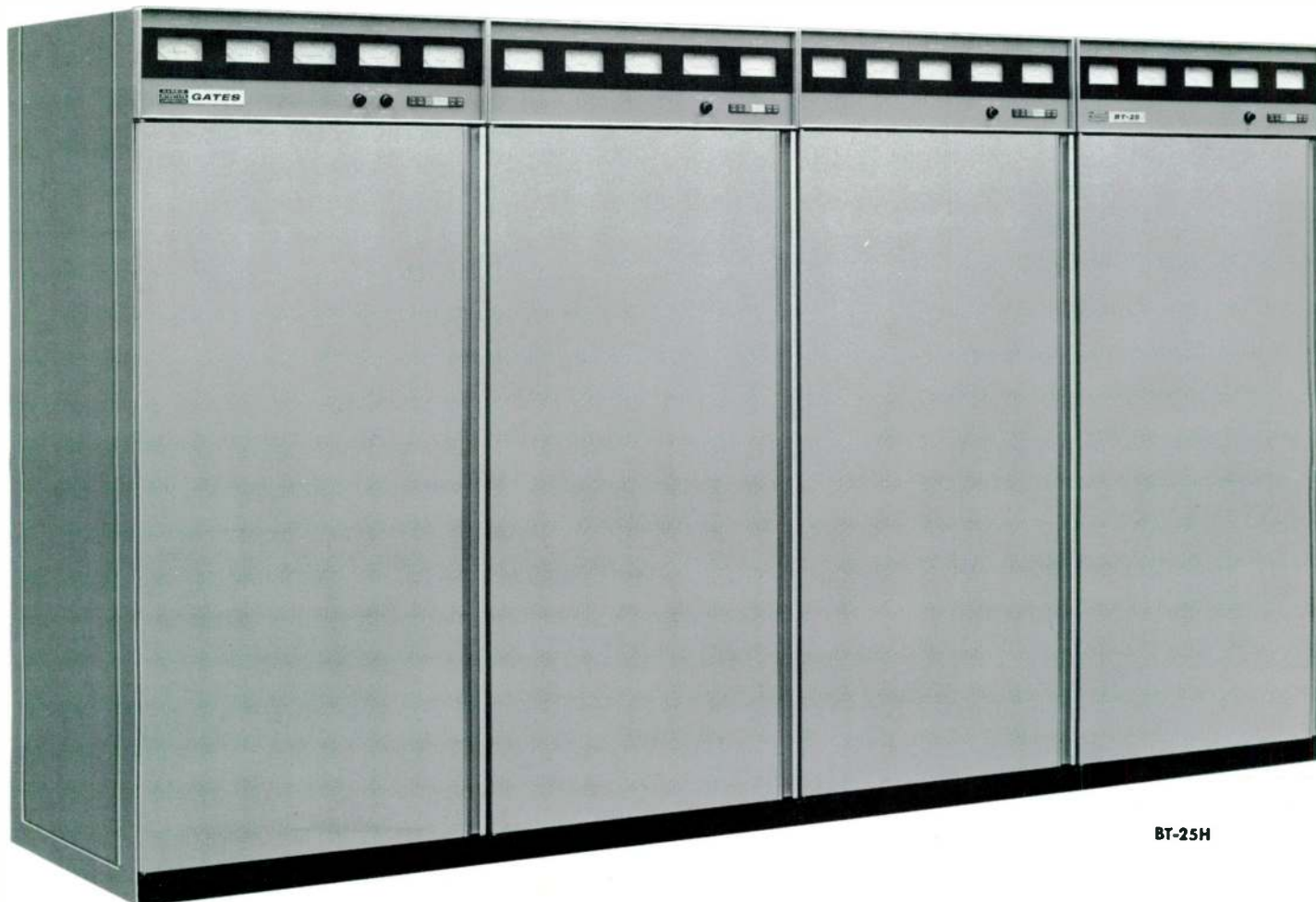
SERVICE CONDITIONS

- AMBIENT TEMPERATURE:** -18° to +50°C. (0° to 122°F.).
- AMBIENT HUMIDITY RANGE:** 0 to 100% relative humidity.
- ALTITUDE:** Sea level to 7500 feet.
- PHYSICAL AND MECHANICAL DIMENSIONS:** Size: 157 1/2" wide x 31 1/2" deep x 72" high. (Power supply: 43" wide x 42" deep x 34" high.) Weight: 4515 lbs. (approximate). (Power supply: 1950 lbs. approximate.)
- ELECTRICAL REQUIREMENTS:** 440/460/480 volts, 3 phase, 60 Hz. (380 volts, 50 Hz available.)

ORDERING INFORMATION

- BT-35L 35 kW VHF-TV transmitter (for Channels 2 to 6) with operating tubes, transistors, IC's, solid-state rectifiers, crystals, required pre-correction circuitry, low-level vestigial sideband filter, harmonic and color notch filters.....994-6697-001
- BT-35H 35 kW VHF-TV transmitter (for Channels 7 to 13) with all of above included.....994-6657-001

25,000 Watt VHF Color Television Transmitters



BT-25H

MODEL BT-25L LOW BAND

MODEL BT-25H HIGH BAND

Featuring IF MODULATION for superb color transmission, the BT-25L and BT-25H are the FCC type accepted 25 kilowatt models in Gates' advance-design lineup of VHF color television transmitters. The BT-25L is for operation on Channels 2 to 6, the BT-25H for Channels 7 to 13.

IF MODULATION of the visual carrier, low-level sideband filtering, true linear operation of power amplifiers and solid-state visual and aural exciters combine to set new standards of color performance for VHF transmitters. Operating specifications far exceed anything possible with conventional transmitters, even those using solid-state exciters.

In these 25 kW transmitters, as in Gates' entire VHF line, there are no excessive video envelope delay or phase matching networks to burden the generation and transmission of the color signal. Transmitter operation is simple and reliable.

Frequency adjustment, power output control and amplifier tuning are straightforward.

IF MODULATION: The outstanding feature of Gates' television transmitters, including the BT-25, is the low-level IF MODULATION design. For color transmission IF MODULATION excels in electrical performance, reliability and simplicity of operation.

Occurring at much lower power levels than conventional designs, intermediate frequency modulation needs fewer circuits to produce a fully processed, quality picture signal. Less than one volt of video signal is needed to modulate the RF carrier, as compared to the several hundred volts required by other recent designs.

Due to the low-level techniques, which include the use of devices such as an extremely linear broadband diode ring



25,000 Watt VHF Color Television Transmitters

modulator, active delay compensation, low-level sideband filtering and very linear broadband amplifiers, the broadcast signal is a faithful reproduction of the signal applied to the transmitter input. IF MODULATION results in the elimination of many transmission problems at their source, rather than using half-way measures to eliminate the effects of these problems later on.

LOW-LEVEL VESTIGIAL SIDEBAND FILTERING: Visual sidebands are shaped at the IF frequency, rather than "on frequency" at the full output power of the transmitter. Thus, there is no need for a bulky, conventional sideband filter, which can cause a power loss and takes up valuable space in the transmitter building. The sideband filter employed in the BT-25 is a removable module housed in the visual exciter.

VISUAL AND AURAL EXCITERS: Solid-state, self-contained visual and aural exciters furnish fully processed 1.0-watt visual and 10-watt aural signals. The output of these exciters is a complete TV signal ready for further amplification and "on channel" transmission for any specified channel.

A single knob on each exciter will set the level of transmitter power without any retuning. A similar procedure is used for adjusting the carrier frequency. The frequency of the master oscillator (located in the visual exciter) can be varied ± 500 Hz by means of a front panel control. With one knob the station engineer can make precise frequency adjustments to both the visual and aural carriers.

A switch mounted on the visual exciter panel permits readings of all parameters. A separate meter on the aural exciter permits monitoring of aural parameters.

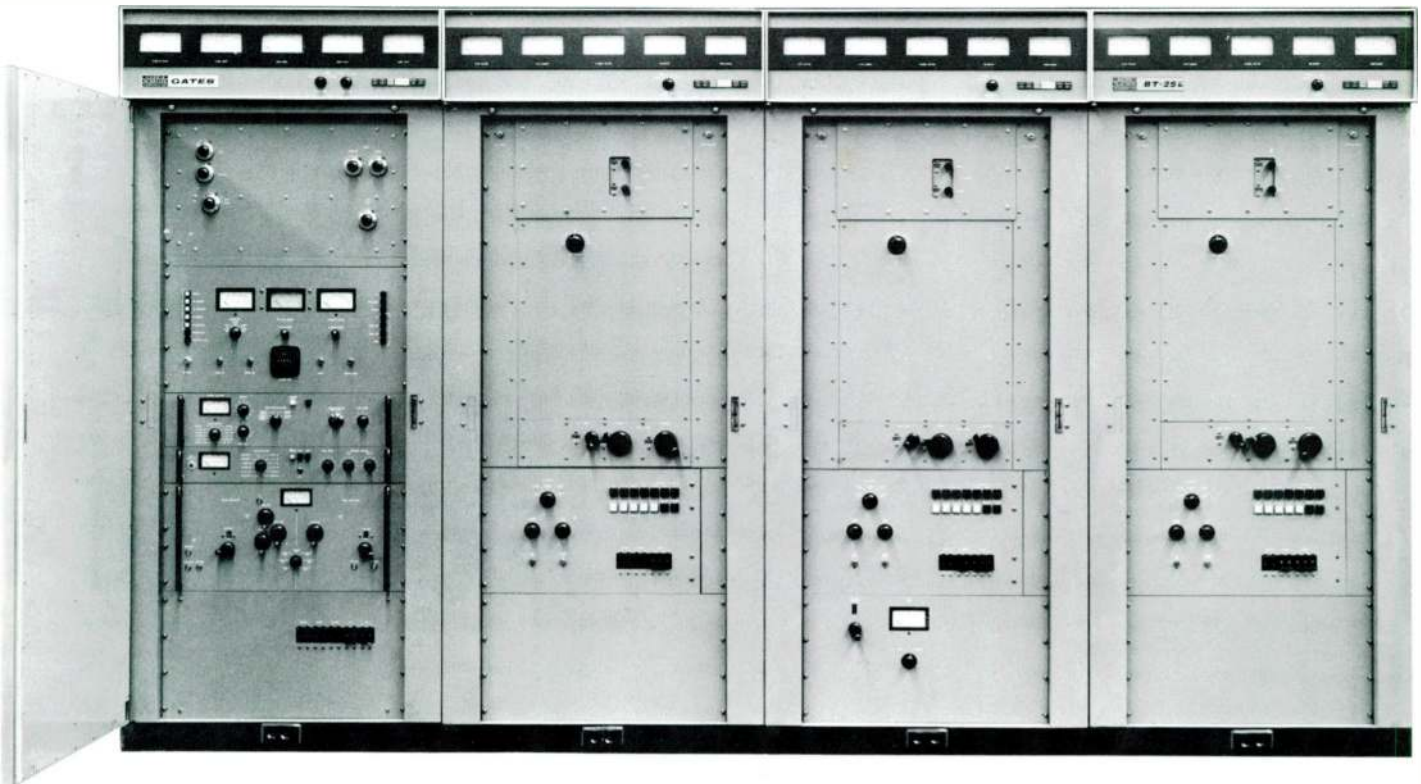
CONTROL LOGIC AND PROTECTIVE CIRCUITRY: Solid-state memory, timing and logic circuits are employed for complete, fool-proof control of all transmitter functions. Each transmitter cabinet has its own independent control logic.

STABILITY: One factor insuring RF stability is the use of conservatively rated Type 8806 ceramic tetrodes operating as VHF linear amplifiers. These amplifier stages operate in a grounded grid and grounded screen configuration and tube neutralization is not required.

REMOTE CONTROL: Control circuit functions, metering and monitoring have all been designed specifically for remote control operation.

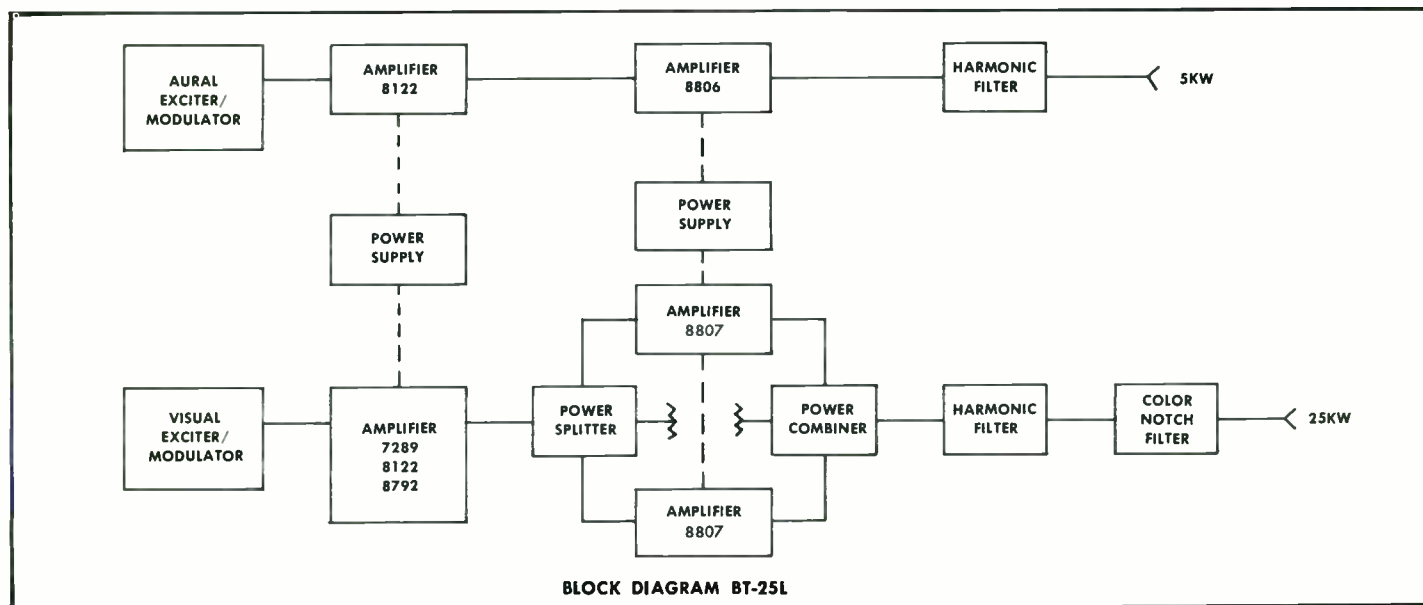
POWER SUPPLY: The unitized high-voltage power supply (including the transformer) is housed in a single assembly, mounted externally from the transmitter. Routine maintenance access is provided by a removable panel.

EASE OF MAINTENANCE: The BT-25 provides for quick accessibility to all components. Visual and aural exciters slide out, and various exciter circuits such as reference oscillator, visual oscillator, aural oscillator and modulator are modular in design for easy removal for maintenance.



BT-25L 25 kW low band transmitter cabinet lineup, from left to right, includes: 1300-watt exciter/driver, aural power amplifier, and paralleled visual power amplifiers.

25,000 Watt VHF Color Television Transmitters



SPECIFICATIONS

(CCIR specifications available.)

VISUAL PERFORMANCE

POWER OUTPUT: 25 kW peak (FCC). 20 kW peak (CCIR "B").

OUTPUT IMPEDANCE: 50 ohms. Output connector: 3/8" EIA standard.

FREQUENCY RANGE: (BT-25L) 48 to 88 MHz (Channels 2 to 6). (BT-25H) 174 to 230 MHz (Channels 7 to 13).

CARRIER STABILITY: ± 250 Hz (maximum variation over 30 days).

REGULATION OF RF OUTPUT POWER (Black to white picture): Less than 3%.

VARIATION OF OUTPUT: Over one frame: less than 2%.

VISUAL SIDEBAND RESPONSE:

+4.75 MHz and higher	-----	-20 dB or better.
Carrier to +4.18 MHz	-----	+0.5, -1 dB.
Carrier	-----	0 dB reference.
Carrier to -0.5 MHz	-----	+0.5, -1 dB.
-1.25 MHz and lower	-----	-20 dB or better.
-3.58 MHz	-----	-42 dB or better.

FREQUENCY RESPONSE VS. BRIGHTNESS: ± 0.75 dB (measured at 65% and 15% of modulation. Reference 100% = peak of sync).

VISUAL MODULATION CAPABILITY: 3% or better.

DIFFERENTIAL GAIN: 0.5 dB or better (maximum variation of sub-carrier amplitude from 75% to 10% of modulation. Sub-carrier modulation percentage: 10% peak to peak).

LINEARITY (LOW FREQUENCY): 0.5 dB or better.

DIFFERENTIAL PHASE: $\pm 3^\circ$ or better (maximum variation of sub-carrier phase with respect to burst for modulation percentage from 75% to 10%. Sub-carrier modulation percentage: 10% peak to peak).

SIGNAL-TO-NOISE RATIO: -50 dB or better (RMS) below sync level.

K FACTORS: 2t 2%, 20t 3%.

ENVELOPE DELAY:

.05 to 2.1 MHz:	± 70 ns	} Reference to standard curve—FCC.
at 3.58 MHz:	± 35 ns	
at 4.18 MHz:	± 70 ns	

VIDEO INPUT: Bridging, loop through input with -30 dB or better return loss up to 5.5 MHz, 75 ohm system.

HARMONIC RADIATION: -80 dB.

AURAL PERFORMANCE

POWER OUTPUT: 5 kW at diplexer output.

AUDIO INPUT: +10 dBm, ± 2 dB into 600 ohms.

INPUT IMPEDANCE: 600/150 ohms.

PRE-EMPHASIS: 75 microseconds.

FREQUENCY RESPONSE: ± 0.5 dB relative to pre-emphasis (30-15,000 Hz).

DISTORTION: 0.5% or less after 75 microseconds de-emphasis with ± 25 kHz deviation. 0.7% after 50 microseconds de-emphasis with ± 50 kHz deviation.

FM NOISE: -60 dB relative to ± 25 kHz deviation.

AM NOISE: -52 dB relative to 100% modulation (measured after de-emphasis).

OUTPUT IMPEDANCE: 50 ohms, output connector 3/8" EIA standard.

FREQUENCY STABILITY: ± 250 Hz (maximum variation over 30 days).

SERVICE CONDITIONS

AMBIENT TEMPERATURE: -18° to +50°C. (0° to 122° F.).

AMBIENT HUMIDITY RANGE: 0 to 100% relative humidity.

ALTITUDE: Sea level to 7500 feet.

PHYSICAL AND MECHANICAL DIMENSIONS: Size: 126" wide x 31 1/2" deep x 72" high. (Power supply: 36" wide x 24" deep x 40" high). Weight: 3775 lbs. (approximate). (Power supply: 870 lbs. approximate.)

ELECTRICAL REQUIREMENTS: 208/240 volts ± 11 volts, 3 phase, 50/60 Hz.

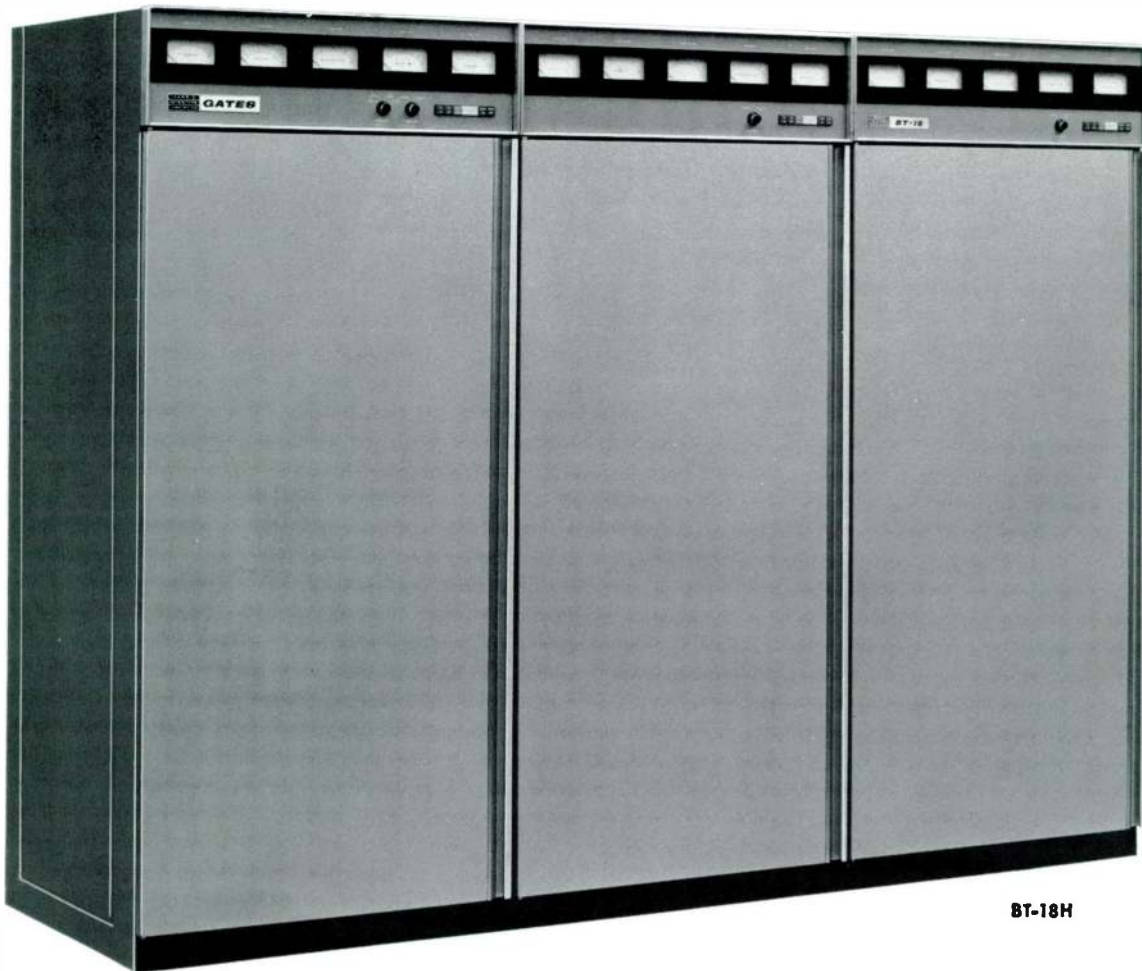
ORDERING INFORMATION

BT-25L 25 kW VHF-TV transmitter (for Channels 2 to 6) with operating tubes, transistors, IC's, solid-state rectifiers, crystals, required pre-correction circuitry, low-level vestigial sideband filter, harmonic and color notch filters.....994-6696-001

BT-25H 25 kW VHF-TV transmitter (for Channels 7 to 13) with all of above included.....994-6656-001



18,000 Watt VHF Color Television Transmitters



BT-18H

MODEL BT-18L LOW BAND MODEL BT-18H HIGH BAND

The Gates system of IF MODULATION employed in the FCC type accepted BT-18H (and in the BT-18L, the 18 kW low band model) provides the highest degree of color quality available today. Low power solid-state circuitry is used in a simple, straightforward system to achieve outstanding color fidelity.

Only three cabinets are required to house each of these 18 kilowatt models. Gates' unique modularized building block concept allows a maximum utilization of valuable floor space.

IF MODULATION: In Gates' exclusive modulation system a fully processed video signal, along with an IF carrier signal, is applied to a balanced modulator. At the output of the modulator an ultra-linear, fully modulated double sideband signal appears. This signal is a perfect reproduction of the video input signal, raised to the IF frequency.

The modulated signal then passes through active color delay compensation circuitry and a low power sideband filter. The sideband filter shapes the visual signal so that it exhibits required bandpass characteristics. Not only is the lower sideband filtered but the upper sideband is also limited so that energy above 4.2 MHz does not pass through the sideband filter.

After the fully processed and modulated IF signal is generated it is simply inserted into an upconverter to arrive at the desired "on channel" output signal. This signal then passes through several stages of amplification and appears at the output of the transmitter at the 18 kW power level.

A direct FM 32.5 MHz IF system is used to generate the aural carrier. This IF signal is upconverted to the desired output channel.

18,000 Watt VHF Color Television Transmitters

VISUAL AND AURAL EXCITERS: Both the visual and aural exciters are mounted in pull-out drawers and may be operated outside the main transmitter for test purposes.

Each exciter constitutes a complete miniature "on channel" transmitter. The exciter output power may be adjusted at any level up to one watt visual and 10 watts aural with a front-panel control. Changing power level results only in an actual power change and does not influence signal modulation depth or linearity.

The visual and aural exciters both contain frequency determining circuitry which is housed in temperature controlled ovens. Digital phase-locked loops guarantee absolute frequency stability.

CONTROL LOGIC: Individual solid-state control and protective circuitry is provided for each transmitter cabinet. Semiconductors are used to eliminate conventional electro-mechanical devices. Extremely simple circuit design results in simulation of all relay-type contact arrangements without the normal maintenance and reliability problems associated with relay-type control logic.

STABILITY: Exclusive coaxial cavities are used in all high-level amplifier stages. The cavity design has inherently high isolation between input and output circuitry. High-efficiency, broadband ceramic tetrodes, operating grounded grid, are used in the cavities. These tubes are designed for full power operation up to 400 MHz. The excellent cavity isolation, coupled with the high frequency ceramic tetrodes, results in very stable operation, not requiring neutralization.

REMOTE CONTROL: Provision is made for convenient access to terminals for interfacing control and metering functions to a remote control system.

POWER SUPPLY: A highly efficient polyphase power supply, including silicon rectifiers, transient suppressors, filter capacitors, and transformers, is contained within a single externally-mounted cabinet.

The power supply circuit consists of two 3-phase full-wave rectifier systems in series, each system being driven by a set of three secondaries. Both systems combined have a total of twelve conduction periods in which the peaks of one system coincide with the troughs of the other.

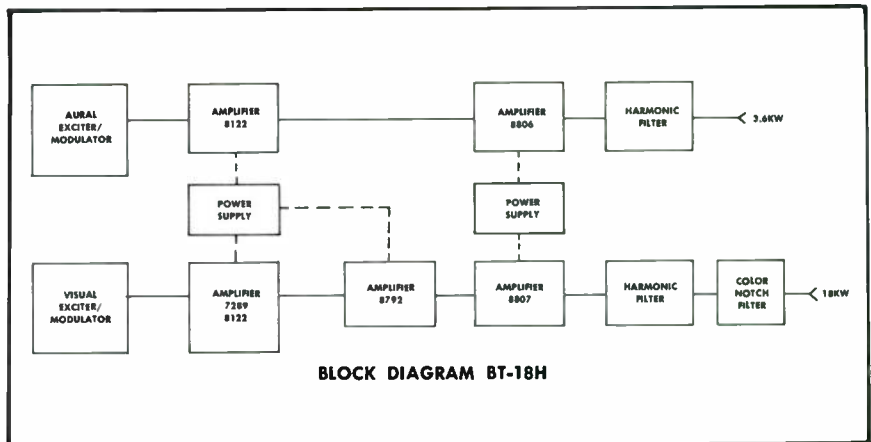
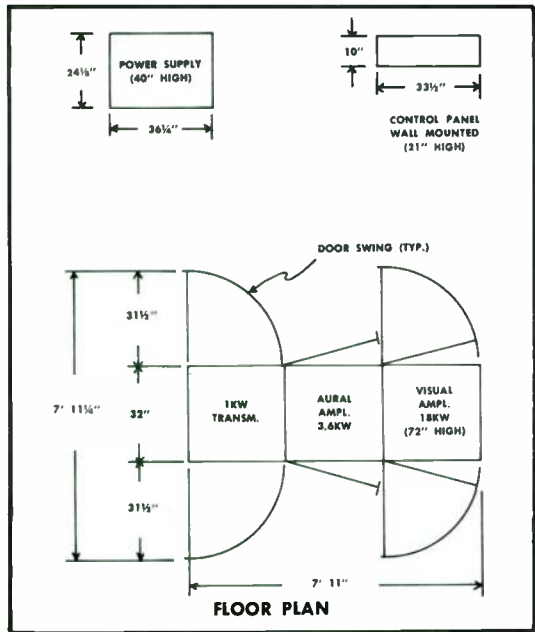
INDICATORS: A complete system of meters and overload indicators is provided in each cabinet for monitoring transmitter operation. In the event of a transmitter malfunction, an examination of the indicators provided will locate the problem area.

ACCESSIBILITY: The entire transmitter is easily accessible, front and back. All components may be reached quickly through removable panels. Both the visual exciter and the aural exciter slide out, and various exciter circuits such as the reference oscillator, visual oscillator, aural oscillator and modulator are of modular construction and can be removed for maintenance. Tubes in the visual and aural high power amplifiers can be removed by one man from the front of the transmitter. Meter panels at the top of all cabinets are hinged for quick access.



Front view, BT-18L, 18 kW low band transmitter, showing from left to right, the 1300-watt exciter/driver, the aural power amplifier and the 18 kilowatt visual power amplifier.

18,000 Watt VHF Color Television Transmitters



SPECIFICATIONS

(CCIR specifications available.)

VISUAL PERFORMANCE

- POWER OUTPUT:** 18 kW peak (FCC and CCIR "B")
- OUTPUT IMPEDANCE:** 50 ohms. Output connector: 3 1/4" EIA standard.
- FREQUENCY RANGE:** (BT-18L) 48 to 88 MHz (Channels 2 to 6). (BT-18H) 174 to 230 MHz (Channels 7 to 13).
- CARRIER STABILITY:** ±250 Hz (maximum variation over 30 days).
- REGULATION OF RF OUTPUT POWER (Black to white picture):** Less than 3%.
- VARIATION OF OUTPUT:** Over one frame: less than 2%.
- VISUAL SIDEBAND RESPONSE:**
 - +4.75 MHz and higher.....-20 dB or better.
 - Carrier to +4.18 MHz.....+0.5, -1 dB.
 - Carrier.....0 dB reference.
 - Carrier to -0.5 MHz.....+0.5, -1 dB.
 - 1.25 MHz and lower.....-20 dB or better.
 - 3.58 MHz.....-42 dB or better.
- FREQUENCY RESPONSE VS. BRIGHTNESS:** ±0.75 dB (measured at 65% and 15% of modulation. Reference 100% = peak of sync.)
- VISUAL MODULATION CAPABILITY:** 3% or better.
- DIFFERENTIAL GAIN:** 0.5 dB or better (maximum variation of sub-carrier amplitude from 75% to 10% of modulation. Sub-carrier modulation percentage: 10% peak to peak.)
- LINEARITY (LOW FREQUENCY):** 0.5 dB or better.
- DIFFERENTIAL PHASE:** ±3° or better (maximum variation of sub-carrier phase with respect to burst for modulation percentage from 75% to 10%. Sub-carrier modulation percentage: 10% peak to peak.)
- SIGNAL-TO-NOISE RATIO:** -50 dB or better (RMS) below sync level.
- K FACTORS:** 2t 2%, 20t 3%.
- ENVELOPE DELAY:**
 - .05 to 2.1 MHz: ±70 ns
 - at 3.58 MHz: ±35 ns
 - at 4.18 MHz: ±70 ns

Reference to standard curve—FCC.

VIDEO INPUT: Bridging, loop through input with -30 dB or better return loss up to 5.5 MHz, 75 ohm system.

HARMONIC RADIATION: -80 dB.

AURAL PERFORMANCE

- POWER OUTPUT:** 3.6 kW at diplexer output.
- AUDIO INPUT:** +10 dBm, ±2 dB into 600 ohms.
- INPUT IMPEDANCE:** 600/150 ohms.
- PRE-EMPHASIS:** 75 microseconds.
- FREQUENCY RESPONSE:** ±0.5 dB relative to pre-emphasis (30-15,000 Hz).
- DISTORTION:** 0.5% or less after 75 microseconds de-emphasis with ±25 kHz deviation, 0.7% after 50 microseconds de-emphasis with ±50 kHz deviation.
- FM NOISE:** -60 dB relative to ±25 kHz deviation.
- AM NOISE:** -52 dB relative to 100% modulation (measured after de-emphasis).
- OUTPUT IMPEDANCE:** 50 ohms, output connector 3 1/4" EIA standard.
- FREQUENCY STABILITY:** ±250 Hz (maximum over 30 days).

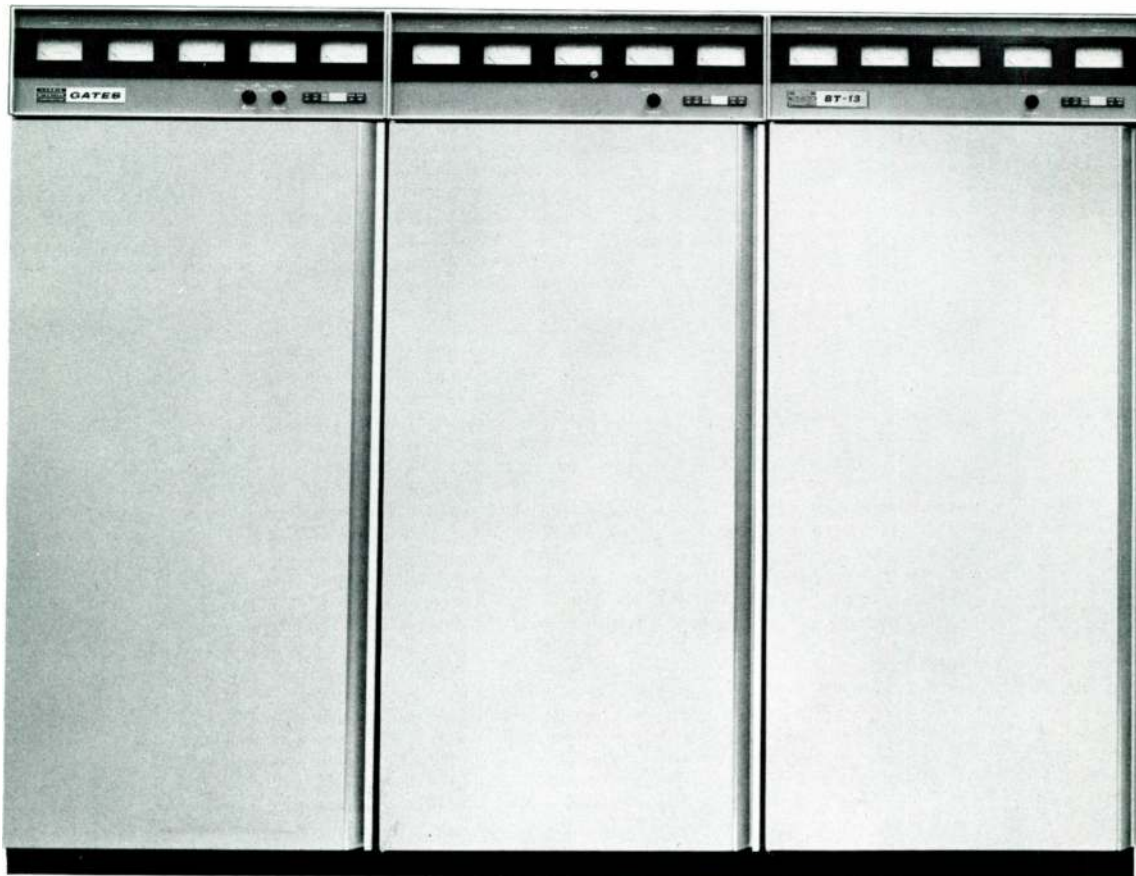
SERVICE CONDITIONS

- AMBIENT TEMPERATURE:** -18° to +50°C. (0° to 122°F.).
- AMBIENT HUMIDITY RANGE:** 0 to 100% relative humidity.
- ALTITUDE:** Sea level to 7500 feet.
- PHYSICAL AND MECHANICAL DIMENSIONS:** Size: 94 1/2" wide x 31 1/2" deep x 72" high. (Power supply: 36 1/4" wide x 24 1/2" deep x 40" high.) Weight: 3035 lbs. (approximate). (Power supply: 870 lbs. approximate.)
- ELECTRICAL REQUIREMENTS:** 208/240 volts ±11 volts, 3 phase, 50/60 Hz. (380 volts, 50 Hz available.)

ORDERING INFORMATION

- BT-18L 18 kW VHF-TV transmitter (for Channels 2 to 6) with operating tubes, transistors, IC's, solid-state rectifiers, crystals, pre-correction circuitry, low-level vestigial sideband filter, harmonic and color notch filters.....994-6695-001
- BT-18H 18 kW VHF-TV transmitter (for Channels 7 to 13) with all of above included.....994-6655-001

13,000 Watt VHF Color Television Transmitters



MODEL BT-13L LOW BAND MODEL BT-13H HIGH BAND

Utilizing Gates' advanced IF MODULATION concept, the BT-13L low band and FCC type accepted BT-13H high band 13 kW VHF TV transmitters provide superb color reproduction and highest reliability.

Controls are designed for simplicity of operation. Although each cabinet contains completely independent control logic, only one pushbutton, located on the front panel of the exciter/driver cabinet, need be depressed to place the transmitter on complete operational status.

Circuit design is straightforward, using a "building block" concept for ease of installation and maintenance. Extensive use of silicon transistors provides highly reliable, drift-free operation.

IF MODULATION: The modulation system employed in the transmitters uses advance-design techniques coupled with

solid-state circuitry for the finest color performance available today.

In IF MODULATION, all signal processing and shaping occurs at an extremely low power level. This eliminates many of the problems encountered with systems where less stable high power circuits are required for signal generation. Less than one volt is used in the visual modulation process, as compared to the much higher voltages required by other systems.

LINEAR AMPLIFIERS: The rugged ceramic coaxial tetrodes employed as grounded grid linear amplifiers provide truly linear operation, with extremely low intermodulation products. The tubes utilize a special internal element design which prevents them from being power limited.

ORDERING INFORMATION

BT-13L 13 kW VHF-TV transmitter (for Channels 2 to 6) with operating tubes, transistors, IC's, solid-state rectifiers, crystals, pre-correction circuitry, low-level vestigial sideband filter, harmonic and color notch filters..... 994-6694-001
BT-13H 13 kW VHF-TV transmitter (for Channels 7 to 13) with all of above included..... 994-6654-001



5,000 Watt VHF Color Television Transmitters



BT-5L
5 kW
low band VHF
TV transmitter.

MODEL BT-5L LOW BAND

MODEL BT-5H HIGH BAND

Gates' BT-5, 5 kW VHF television transmitter, featuring IF MODULATION for the highest quality color transmission, is available in two models. The BT-5L is for low band (Channels 2-6) service; the FCC type accepted BT-5H is for high band (Channels 7-13).

Providing 5000 watts visual and 1000 watts aural output, the BT-5 is contained in two cabinets, plus external power supply,

and occupies a total of less than 21 square feet of floor space. Visual power output is also 5 kW for CCIR "B" (Band I or Band III).

With the achievement of four design objectives—IF MODULATION, low-level vestigial sideband filtering, true linear operation of the power amplifier, and solid-state visual and aural exciters—Gates has provided the only truly modern television transmitter available today.

5,000 Watt VHF Color Television Transmitters

IF MODULATION: The use of IF MODULATION results in extremely efficient generation of a completely processed television signal at milliwatt power levels. In this system, picture and sound signals are processed, modulated and corrected at very low power levels for proper transmission to the antenna. These signals are then increased in power through the use of extremely linear power amplifiers to the 5 kW power level.

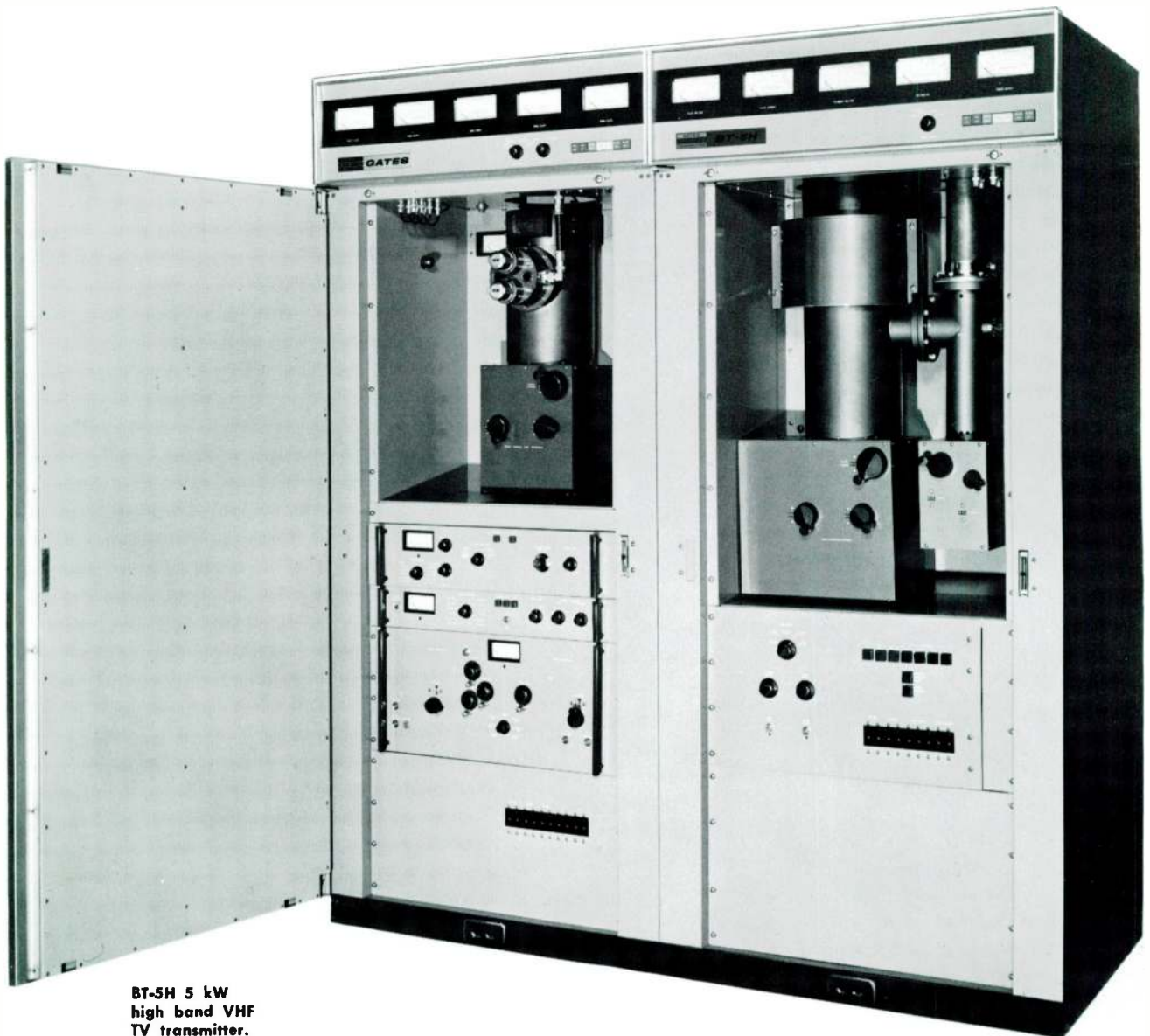
Because it occurs at milliwatt power levels, intermediate frequency modulation needs fewer circuits to produce a fully processed, quality picture signal. Gates' system takes less than 1.0 volt of video signal to modulate the RF carrier,

where other recent designs need as much as 200 volts for carrier modulation.

The simplicity of IF MODULATION results in nearly perfect signal linearity. Thus, predistortion circuitry which degrades color fidelity is practically eliminated.

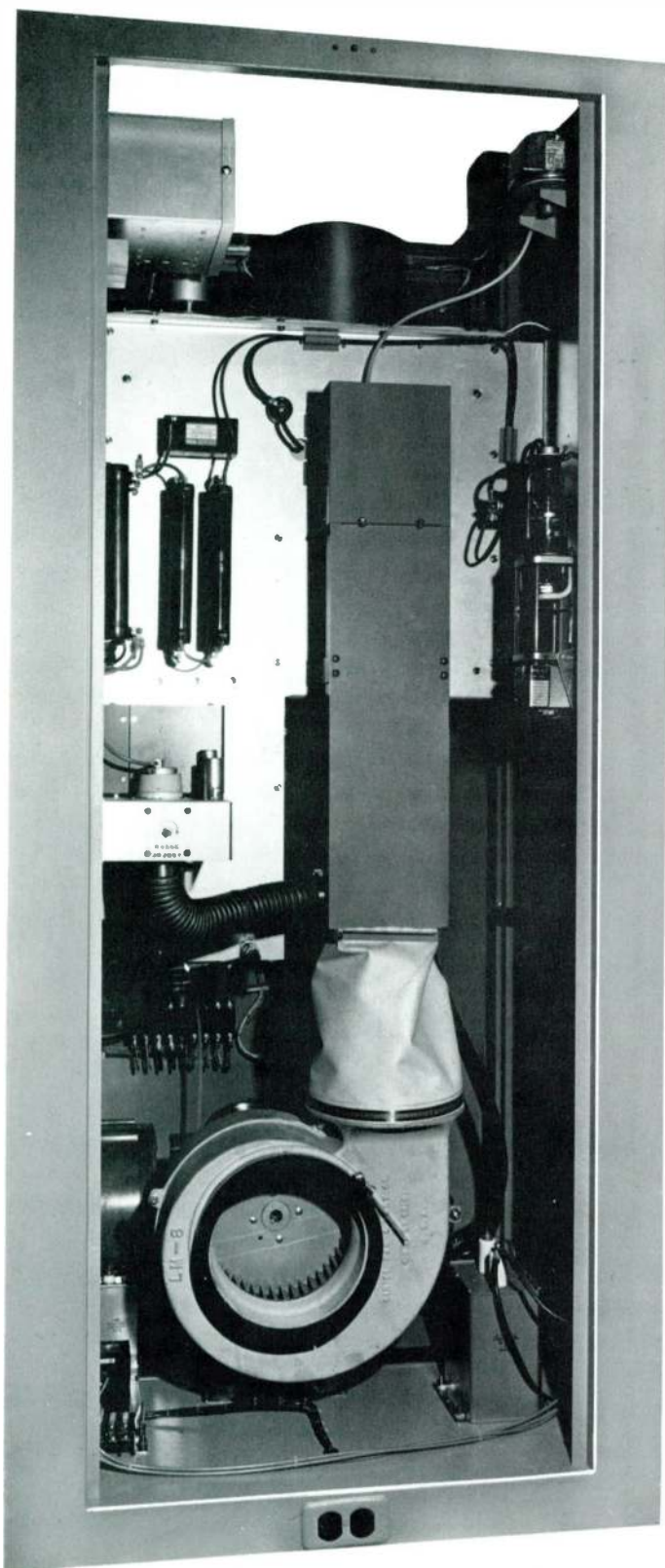
The ring modulator used in the BT-5 allows modulation percentages to approximately 2%. The excellent linearity and depth of modulation results in exceptional color performance even with such colors as highly saturated yellow and cyan.

In addition, equalization of envelope delay occurs at the IF carrier frequency. This delay function is not fixed but continuously variable.

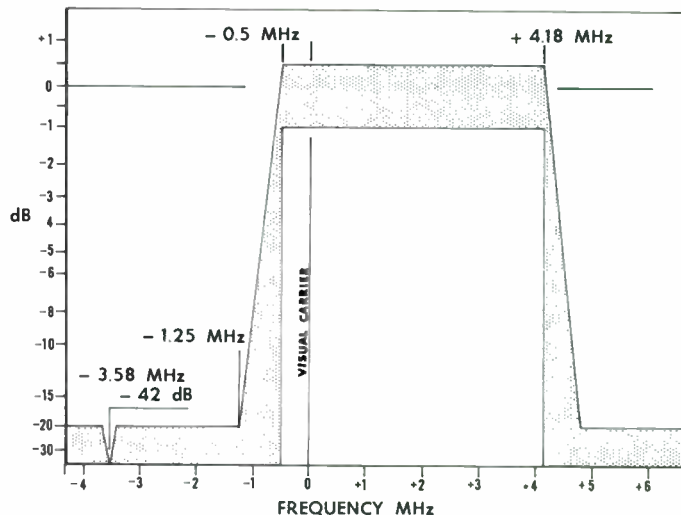


**BT-5H 5 kW
high band VHF
TV transmitter.**

5,000 Watt VHF Color Television Transmitters



Rear view, visual power amplifier, BT-5H, 5 kW high band transmitter.



LOW-LEVEL VESTIGIAL SIDEBAND FILTERING: Another advantage of IF MODULATION is that in this system visual sidebands are filtered out at the IF frequency, rather than "on frequency" at the full output power of the transmitter. This completely eliminates the need for a conventional bulky sideband filter which can cause a power loss, can sometimes arc over, and takes up valuable space in the transmitter building. The sideband filter used by Gates is a removable module housed in the visual exciter.

VISUAL AND AURAL EXCITERS: Both the visual and aural exciters are mounted in pull-out drawers and may be operated outside the main transmitter for test purposes.

Each exciter constitutes a complete miniature "on channel" transmitter. The exciter output power may be adjusted at any level up to one watt visual and 10 watts aural with a front panel control. Changing power level results only in an actual power change and does not influence signal modulation depth or linearity.

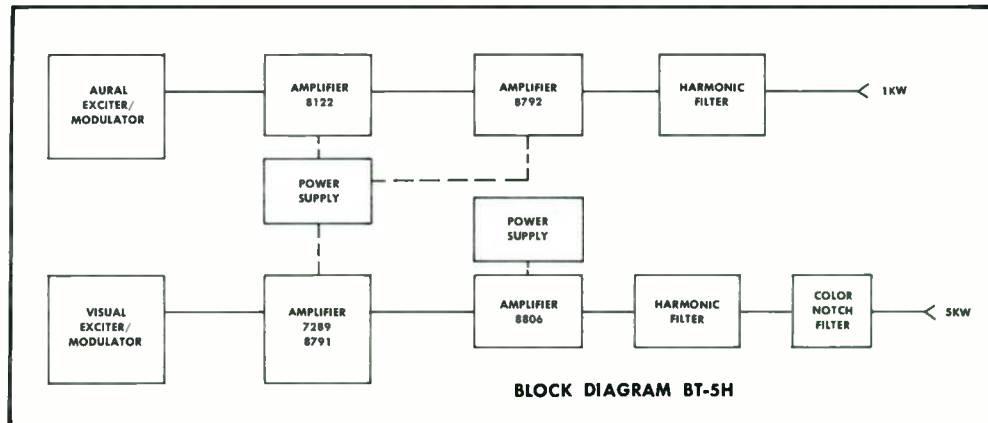
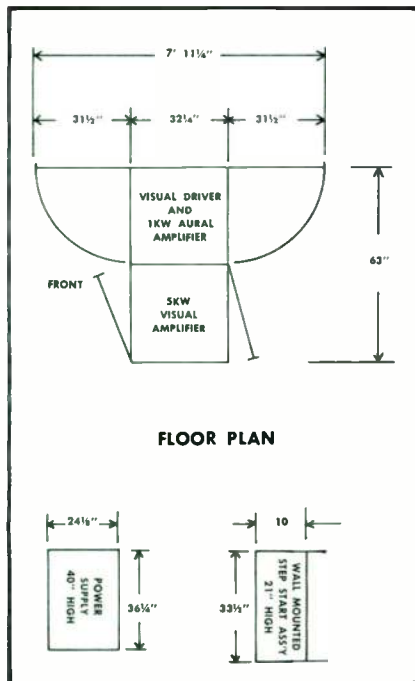
CONTROL LOGIC: Individual solid-state control and protective circuitry is provided for each transmitter cabinet. Semiconductors are used to eliminate conventional electro-mechanical relays. Extremely simple circuit design results in simulation of all relay-type contact arrangements without the normal maintenance and reliability problems associated with relay-type control logic.

REMOTE CONTROL: Control circuit functions, metering and monitoring have all been designed specifically for remote control operation.

POWER SUPPLY: The unitized high-voltage power supply (including the transformer) is housed in a single assembly, mounted externally from the transmitter. Routine maintenance access is provided by a removable panel.

ACCESSIBILITY: The BT-5 provides for quick accessibility to all components. Visual and aural exciters slide out, and various exciter circuits such as reference oscillator, visual oscillator, aural oscillator, and modulator are modular in design for easy removal for maintenance.

5,000 Watt VHF Color Television Transmitters



SPECIFICATIONS

(CCIR specifications available.)

VISUAL PERFORMANCE

- POWER OUTPUT:** 5 kW peak (FCC and CCIR "B").
- OUTPUT IMPEDANCE:** 50 ohms. Output connector: 1 1/2" EIA standard.
- FREQUENCY RANGE:** (BT-5L) 48 to 88 MHz (Channels 2-6). (BT-5H) 174 to 230 MHz (Channels 7-13).
- CARRIER STABILITY:** ±250 Hz (maximum variation over 30 days).
- REGULATION OF RF OUTPUT POWER** (Black to white picture): Less than 3%.
- VARIATION OF OUTPUT:** Over one frame: less than 2%.
- VISUAL SIDEBAND RESPONSE:**
 - +4.75 MHz and higher.....-20 dB or better.
 - Carrier to +4.18 MHz.....+0.5, -1 dB.
 - Carrier.....0 dB reference.
 - Carrier to -0.5 MHz.....+0.5, -1 dB.
 - 1.25 MHz and lower.....-20 dB or better.
 - 3.58 MHz.....-42 dB or better.
- FREQUENCY RESPONSE VS. BRIGHTNESS:** ±0.75 dB (measured at 65% and 15% of modulation. Reference 100% = peak of sync).
- VISUAL MODULATION CAPABILITY:** 3% or better.
- DIFFERENTIAL GAIN:** 0.5 dB or better (maximum variation of sub-carrier amplitude from 75% to 10% of modulation. Sub-carrier modulation percentage: 10% peak to peak).
- LINEARITY (LOW FREQUENCY):** 0.5 dB or better.
- DIFFERENTIAL PHASE:** ±3° or better (maximum variation of sub-carrier phase with respect to burst for modulation percentage from 75% to 10%. Sub-carrier modulation percentage: 10% peak to peak).
- SIGNAL-TO-NOISE RATIO:** -50 dB or better (RMS) below sync level.
- K FACTORS:** 2† 2%, 20† 3%.

ENVELOPE DELAY:

- .05 to 2.1 MHz: ±70 ns
 - at 3.58 MHz: ±35 ns
 - at 4.18 MHz: ±70 ns
- } Reference to standard curve—FCC.

VIDEO INPUT: Bridging, loop through input with -30 dB or better, return loss up to 5.5 MHz, 75 ohm system.

HARMONIC RADIATION: -80 dB.

AURAL PERFORMANCE

- POWER OUTPUT:** 1 kW at diplexer output.
- AUDIO INPUT:** +10 dBm, ±2 dB into 600 ohms.
- INPUT IMPEDANCE:** 600/150 ohms.
- PRE-EMPHASIS:** 75 microsecands.
- FREQUENCY RESPONSE:** ±0.5 dB relative to pre-emphasis (30-15,000 Hz).
- DISTORTION:** 0.5% or less after 75 microsecands de-emphasis with ±25 kHz deviation, 0.75% after 50 microsecands de-emphasis with ±50 kHz deviation.
- FM NOISE:** -60 dB relative to ±25 kHz deviation.
- AM NOISE:** -50 dB relative to 100% modulation (measured after de-emphasis).
- OUTPUT IMPEDANCE:** 50 ohms. Output connector: HN female.
- FREQUENCY STABILITY:** ±250 Hz relative to frequency offset by 4.5 MHz from the visual carrier.

SERVICE CONDITIONS

- AMBIENT TEMPERATURE:** -18° to +50°C. (0° to 122°F.)
- AMBIENT HUMIDITY RANGE:** 0 to 100% relative humidity.
- ALTITUDE:** Sea level to 7500 feet.
- PHYSICAL AND MECHANICAL DIMENSIONS:** Size: 63" Wide x 31 1/2" Deep x 72" High. (Power supply: 36 1/4" W x 24 1/2" D x 40" H.) Weight 1424 lbs. (approximate). (Power supply: 800 lbs. approximate.)
- ELECTRICAL REQUIREMENTS:** 208/240 volts ±11 volts, 3 phase, 50/60 Hz.

ORDERING INFORMATION

- BT-5L 5 kW VHF-TV transmitter (for Channels 2 to 6) with operating tubes, transistors, IC's, solid-state rectifiers, crystals, required pre-correction circuitry, low-level vestigial sideband filter, harmonic and color notch filters.....994-6807-001
- BT-5H 5 kW VHF-TV transmitter (for Channels 7 to 13) with all of above included. Specify994-6765-001



1300 Watt VHF Color Television Transmitters



BT-1300H
1300-watt
high band
VHF TV
Transmitter.

MODEL BT-1300L LOW BAND

MODEL BT-1300H HIGH BAND

Gates' BT-1300 is a completely self-contained, one-cabinet, 1300-watt VHF television transmitter, featuring IF MODULATION for true color transmission. For low band (Band I) service, specify BT-1300L, and for high band (Band III), BT-1300H. Both models are FCC type accepted, and meet or exceed CCIR requirements.

The unsurpassed fidelity of the transmitter's fully processed carriers stems from the achievement of four design objectives: IF MODULATION of the visual and aural carriers; solid-state

visual and aural exciters; low-level vestigial sideband filtering; and true linear operation of amplifier stages.

With Gates' advanced circuitry, delay equalizers and differential phase and gain correctors are an integral part of the transmitter. There are no external video filter networks.

Operation of the transmitter—frequency adjustment, power output control and amplifier tuning—is simple and reliable. The result is outstanding color picture quality and power output stability.

1300 Watt VHF Color Television Transmitters

IF MODULATION: True low-level IF MODULATION provides unsurpassed modulation capability with precise linearity, offering color quality not found in other equipment available today.

In the BT-1300 (which is the basic driver unit for all Gates' higher powered VHF transmitters), the visual and aural exciters generate fully modulated low-level IF signals. The output of a common crystal controlled reference oscillator is used to raise the individual IF signal to the desired "on channel" output frequency. Less than 1.0 volt of video is needed to fully modulate the RF carrier.

The Gates ring modulator permits modulation percentages to approximately 2% without compromising transmitter performance—and eliminates most pre-distortion circuitry. This results in exceptional color performance and nearly perfect signal linearity. Even such colors as highly saturated as cyan and yellow are faithfully reproduced with IF MODULATION.

Another Gates engineering first is envelope delay compensation at the IF frequency. Continuously variable controls allow a precise delay correction not possible with conventional fixed-step systems.

VISUAL SIDEBAND FILTERING: Visual sideband filtering is performed on the IF frequency at milliwatt power levels. This contrasts with inefficient conventional high level methods accomplished "on channel" at kilowatt power levels, with associated performance and maintenance problems.

The sideband filter used by Gates is a small removable module housed in the visual exciter. It completely eliminates the conventional, space-consuming filtering device, with its inherent insertion losses.

VISUAL EXCITER: A totally solid-state, self-contained one-watt unit, the visual exciter incorporates a ring modulator and furnishes a fully processed visual signal ready for further amplification "on channel". A single knob, located on the front panel, is provided for adjusting both the visual and aural carrier frequencies ± 500 Hz. A 12-position switch permits readings of operating parameters.

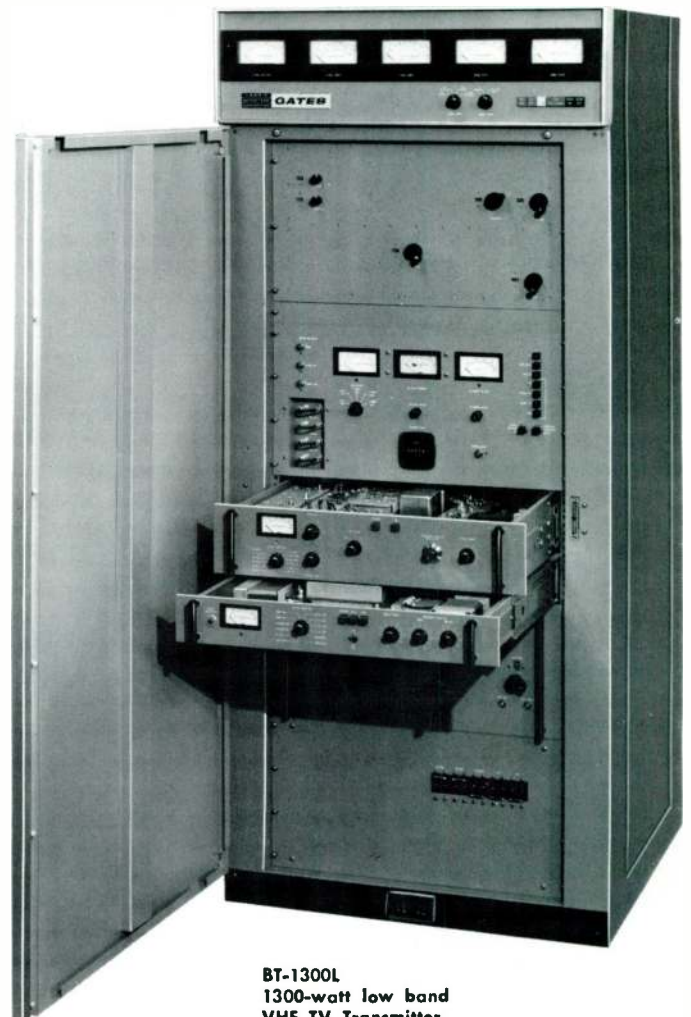
The vestigial sideband filter and envelope delay circuit in the visual exciter can be by-passed by a switch mounted on the exciter control panel. This is useful in obtaining a visual display of the overall bandwidth during maintenance and tuning operations.

AURAL EXCITER: The aural exciter is 100% solid state. Its 10-watt output is an "on channel" carrier controlled by phase lock for maximum frequency stability. A meter permits monitoring of operating parameters.

A front panel control on both visual and aural exciters sets the transmitter power, without need for subsequent modulation adjustment or retuning.

SIGNAL FLOW: The visual exciter signal goes through two IPA stages: a type 7289 planar triode and a type 8122 tetrode, giving an output of approximately 100 watts. It then goes to the final power amplifier, an 8792 coaxial tetrode, that delivers 1300 watts peak power output.

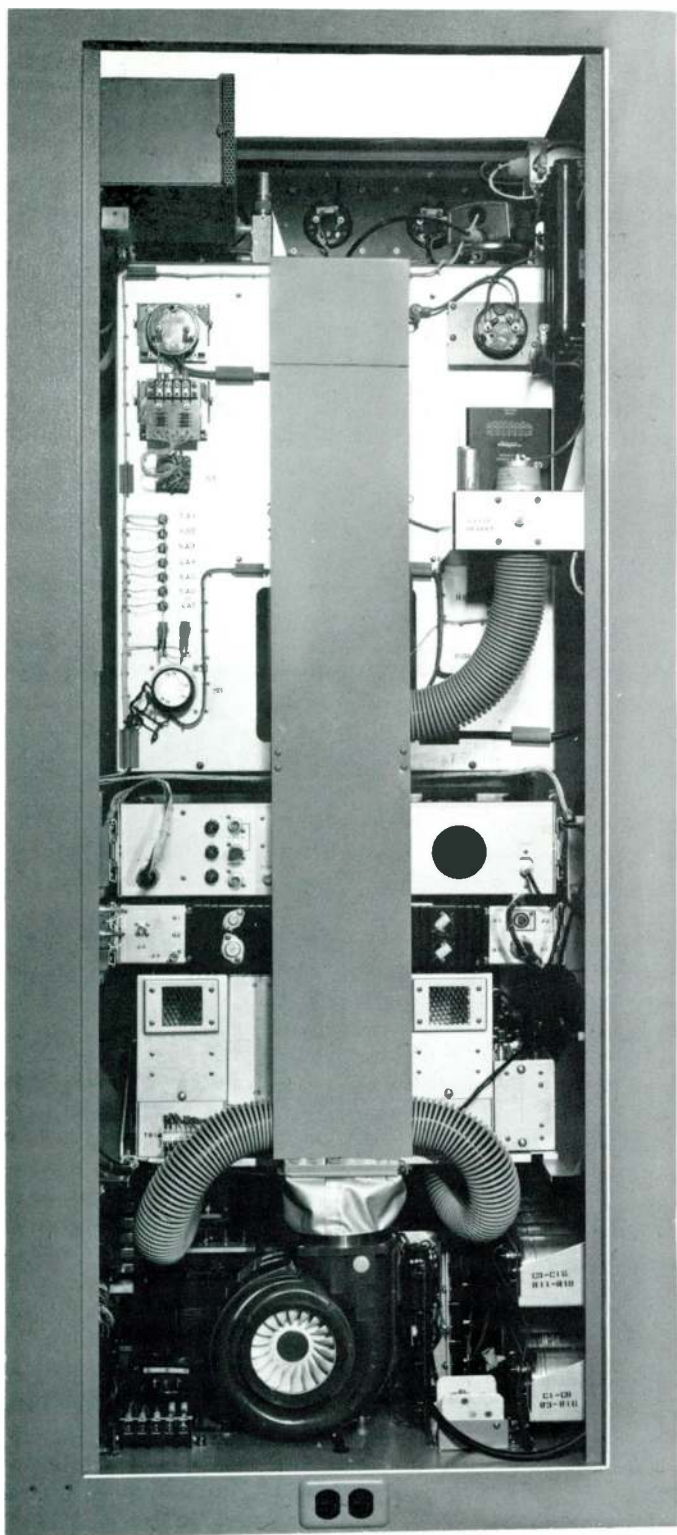
The 10-watt output of the aural exciter drives an 8122 final amplifier, delivering 260 watts average power output.



BT-1300L
1300-watt low band
VHF TV Transmitter

HARRIS
INTERTYPE
CORPORATION **GATES**

1300 Watt VHF Color Television Transmitters



Rear view, door removed, BT-1300H, 1300-watt high band VHF transmitter.

CONTROL LOGIC: Complete and fool-proof control of all transmitter functions is achieved through the use of solid-state memory, timing and logic circuits. A self-charging emergency power source is provided to maintain control logic memory during periods of power-line failure.

The solid-state control logic and protective circuitry, in addition to commanding normal AC control functions, is also used to visually indicate, through pilot lights, the operating status of the transmitter system. The indicator lights allow easy isolation of circuit faults.

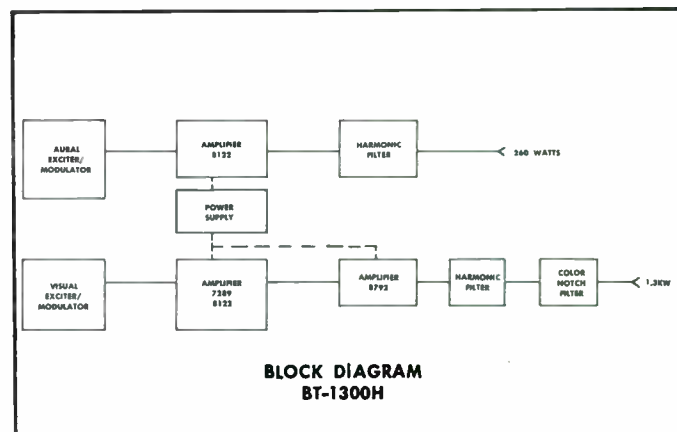
REMOTE CONTROL: All control, metering and monitoring circuits have been designed specifically for remote control operation. The power controls are motor driven and the necessary remote control sampling points are built-in on accessible terminal boards.

STABILITY: Advance-design ceramic tetrodes offer ultra-linear, inherently stable high power output.

ACCESSIBILITY: All components of the BT-1300—including visual and aural exciters, intermediate power amplifiers, final power amplifiers, sideband filter and power supply—are contained in a single cabinet, with total component accessibility provided front and back.

Visual and aural exciters slide out and can operate independently from the transmitter outside the main cabinet. Various exciter circuits, such as oscillators, modulators and processing circuitry, are of modular construction and can be removed for maintenance or replacement.

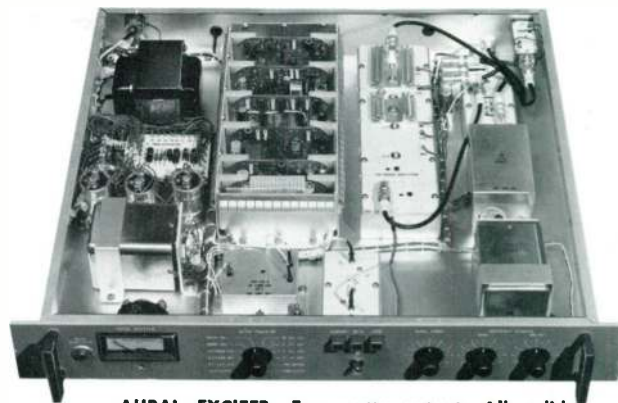
Easy-to-read, eye-level 4-inch meters are used to monitor required transmitter functions. The meter panel is of double-hinged construction for convenient fold-down access during maintenance.



1300 Watt VHF Color Television Transmitters



VISUAL EXCITER. Complete, self-contained one-watt, "on channel" signal source. Totally solid state. Modular construction.



AURAL EXCITER. Ten watts output. All solid state. Phase-locked direct FM. Contains EBS carrier muting facilities.

SPECIFICATIONS

(CCIR specifications available.)

VISUAL PERFORMANCE

POWER OUTPUT: 1.3 kW peak (FCC). 1.0 kW peak (CCIR "B").

OUTPUT IMPEDANCE: 50 ohms. Output connector (Visual) Type "HN".

FREQUENCY RANGE:

BT-1300L: 48 to 88 MHz (channels 2-6). (48.25 to 62.25 MHz for CCIR channels E2 to E4.)

BT-1300H: 174 to 230 MHz (channels 7-13). (175.25 to 224.25 MHz for CCIR channels E5 to E12.)

CARRIER STABILITY: ± 250 Hz (maximum variation over 30 days).

REGULATION OF RF OUTPUT POWER (Black to White Picture): Less than 3%.

VARIATION OF OUTPUT: Over one frame: less than 2%.

VISUAL SIDEBAND RESPONSE:

+4.75 MHz and higher.....	-20 dB or better.
Carrier to +4.18 MHz.....	+0.5, -1 dB.
Carrier.....	0 dB reference.
Carrier to -0.5 MHz.....	+0.5, -1 dB.
-1.25 MHz and lower.....	-20 dB or better.
-3.58 MHz.....	-42 dB or better.

FREQUENCY RESPONSE VS. BRIGHTNESS: ± 0.75 dB (measured at 65% and 15% of modulation. Reference 100% = peak of sync).

VISUAL MODULATION CAPABILITY: 3% or better.

DIFFERENTIAL GAIN: 0.5 dB or better (Maximum variation of sub-carrier amplitude from 75% to 10% of modulation. Sub-carrier modulation percentage: 10% peak to peak.)

LINEARITY (Low Frequency): 0.5 dB or better.

DIFFERENTIAL PHASE: $\pm 3^\circ$ or better (Maximum variation of sub-carrier phase with respect to burst for modulation percentage from 75% to 10%. Sub-carrier modulation percentage: 10% peak to peak.)

SIGNAL-TO-NOISE RATIO: -50 dB or better (RMS) below sync level.

K FACTOR: 2 \pm 2%. 20 \pm 3%.

ENVELOPE DELAY:

.05 to 2.1 MHz:	± 70 ns
at 3.58 MHz:	± 35 ns
at 4.18 MHz:	± 70 ns

} Reference to standard curve—FCC.

VIDEO INPUT REQUIREMENTS: 1.0 volt peak to peak, sync negative ± 3 dB. Bridging, loop through input with -30 dB or better return loss up to 5.5 MHz, 75 ohm system.

HARMONIC RADIATION: -80 dB.

AURAL PERFORMANCE

POWER OUTPUT: 260 watts at diplexer output.

AUDIO INPUT: +10 dBm, ± 2 dB.

INPUT IMPEDANCE: 600/150 ohms.

PRE-EMPHASIS: 75 microseconds.

FREQUENCY RESPONSE: ± 0.5 dB relative to pre-emphasis (30-15,000 Hz).

DISTORTION: .5% or less after 75 microsecond de-emphasis with ± 25 kHz deviation.

FM NOISE: -60 dB relative to ± 25 kHz deviation.

AM NOISE: -52 dB relative to 100% modulation (measured after de-emphasis).

RF OUTPUT IMPEDANCE: 50 ohms, Type "N" connector.

FREQUENCY STABILITY: ± 250 Hz over a 30-day period.

SERVICE CONDITIONS

AMBIENT TEMPERATURE: -10° to +50°C. (14° to 122°F.)

AMBIENT HUMIDITY RANGE: 0 to 100% relative humidity.

ALTITUDE: Sea level to 10,000 ft. (3048 meters).

PHYSICAL AND MECHANICAL DIMENSIONS: Size: 72" H x 31½" W x 31½" D. (182.9 cm x 80 cm x 80 cm). Weight: Approximately 800 lbs. or 360 kg.

ELECTRICAL REQUIREMENTS: 208/240 volts (± 11 volts) 50/60 Hz, single phase.

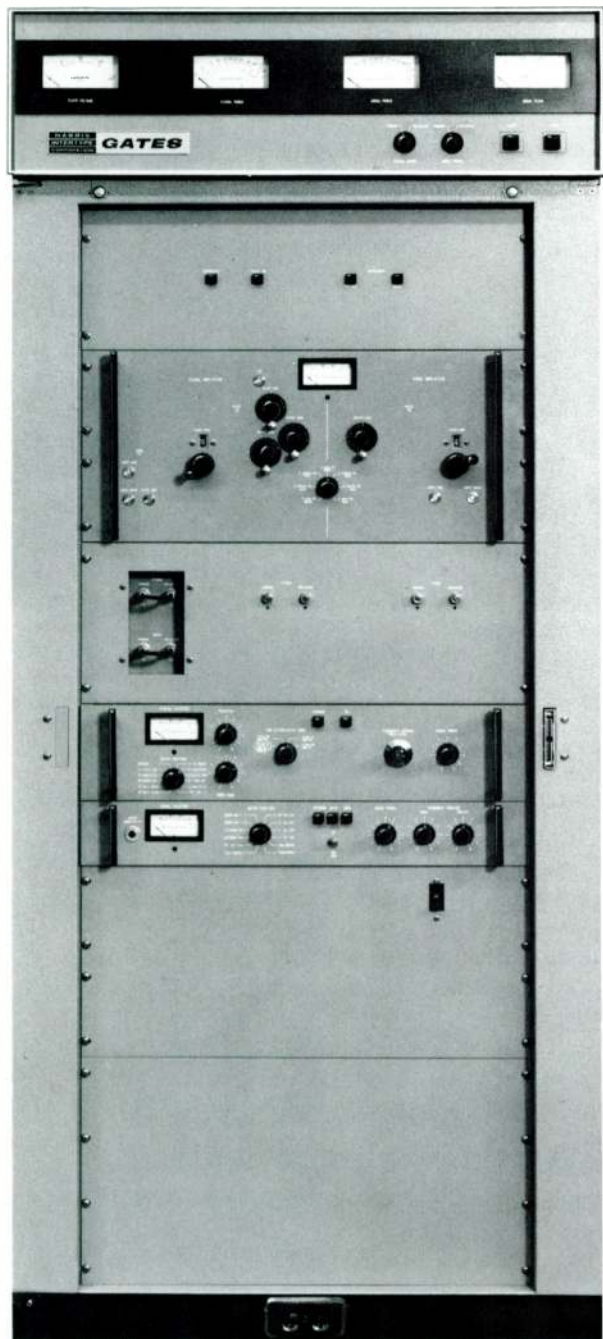
ORDERING INFORMATION

BT-1300L 1300-watt VHF TV transmitter for Channels 2-6 (CCIR Channels E2 to E4), with operating tubes, transistors, IC's, solid-state rectifiers, crystals, required pre-correction circuitry, low-level vestigial sideband filter, harmonic and color notch filters 994-6693-001

BT-1300H 1300-watt VHF TV transmitter for Channels 7-13 (CCIR Channels E2 to E4), with all of above included 994-6653-001



120 Watt VHF Color Television Transmitters



MODEL BT-100L LOW BAND

MODEL BT-100H HIGH BAND

Gates' BT-100 VHF color television transmitter, featuring IF MODULATION, is available in two models—BT-100L for low band (Band I) service, and BT-100H for high band (Band III) operation.

Both models will deliver 120 watts peak of sync visual (FCC) and 50 watts aural. Both fully meet or exceed CCIR requirements, and are FCC type accepted.

IF MODULATION: Low-level IF MODULATION, employed in the BT-100L and BT-100H, excels in electrical performance, reliability and simplicity of operation.

Due to the low-level techniques, which include the use of devices such as an extremely linear broadband diode ring modulator, active delay compensation, low-level sideband filtering and a very linear broadband amplifier, the broadcast signal is a faithful reproduction of the signal applied to the transmitter input.

The ring modulator allows modulation percentages to approximately 2%. This unusually good color performance, even with such colors as highly saturated yellow and cyan, is the result of excellent linearity and depth of modulation. Picture quality is superior to that provided by any other equipment currently available.

VISUAL AND AURAL EXCITERS: Both exciters are completely solid-state and have a drawer-like design for easy, slide-out accessibility. One knob on each exciter controls the visual and aural power output of the transmitter without retuning of any kind. A station engineer can also make precise frequency adjustments on both the visual and aural exciters by means of front-panel controls.

The visual and aural exciters furnish fully processed 1.0-watt visual and 10-watt aural signals. The output of these exciters is a complete TV signal that is ready for further amplification and "on channel" transmission.

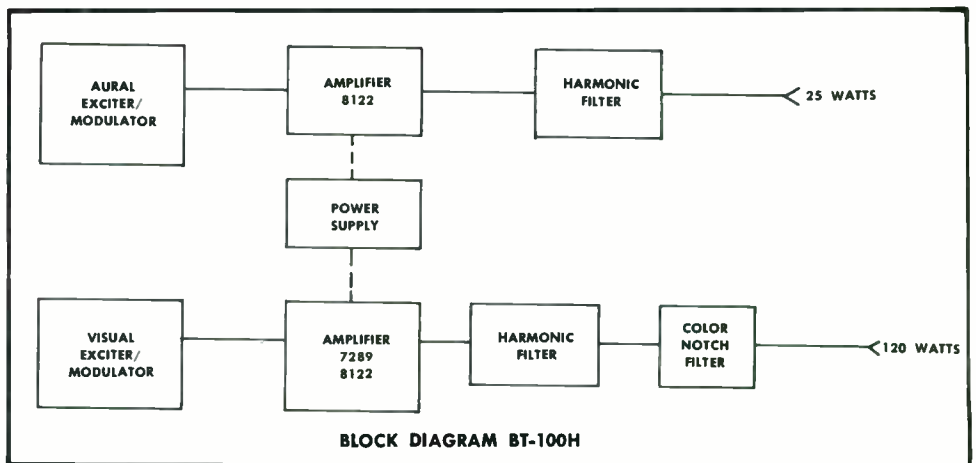
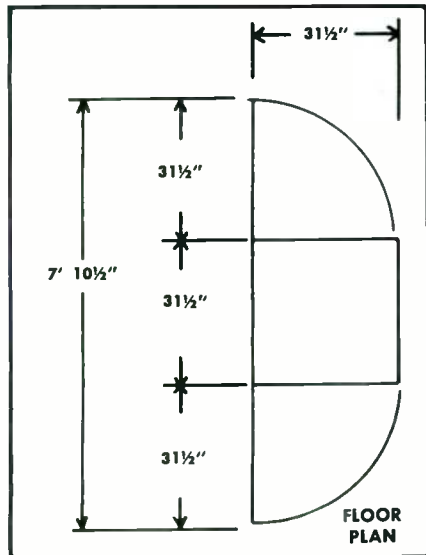
In addition to the visual and aural exciters, amplifiers and power supplies, the cabinet also contains harmonic filters, color notch filter (external in the BT-100L), directional couplers and frequency monitor probes.

Separate aural and visual RF outputs are provided. If it is desired to feed a common antenna and transmission line with both visual and aural outputs, a diplexer will be required.

ACCESSIBILITY: The entire transmitter is easily accessible, front and back. Both visual and aural exciters slide out and can operate independently from the other transmitter stages outside the cabinet. Various exciter circuits such as reference oscillator, visual oscillator, aural oscillator and modulator are of modular construction and can be removed for maintenance.

Easy-to-read 4-inch meters are used in the meter panel located at the top of the cabinet. The meter panel is hinged for quick access.

120 Watt VHF Color Television Transmitters



SPECIFICATIONS

(CCIR specifications available.)

VISUAL PERFORMANCE

POWER OUTPUT: 120 watts peak (FCC). 100 watts peak (CCIR "B").

OUTPUT IMPEDANCE: 50 ohms. Type "N" connector.

FREQUENCY RANGE:

BT-100L: 48 to 88 MHz (48.25 to 62.25 MHz for CCIR channels E2 to E4).
BT-100H: 174 to 230 MHz. (175.25 to 224.25 MHz for CCIR channels E5 to E12).

CARRIER STABILITY: ± 250 Hz (Maximum variation over 30 days).

REGULATION OF RF OUTPUT POWER (Black to White picture): Less than 3%.

VARIATION OF OUTPUT: Over one frame, less than 2%.

VISUAL SIDEBAND RESPONSE:

+4.75 MHz and higher	-----	-20 dB or better.
Carrier to +4.18 MHz	-----	+0.5, -1 dB.
Carrier	-----	0 dB reference.
Carrier to -0.5 MHz	-----	+0.5, -1 dB.
-1.25 MHz and lower	-----	-20 dB or better.
-3.58 MHz	-----	-42 dB or better.

(Response for system other than FCC to be scaled to appropriate corner frequencies of the applicable system.)

FREQUENCY RESPONSE VS. BRIGHTNESS: ± 0.75 dB.

VISUAL MODULATION CAPABILITY: 3% or better.

DIFFERENTIAL GAIN: 4% or better.

LINEARITY (LOW FREQUENCY): 0.5 dB or better.

DIFFERENTIAL PHASE: $\pm 3^\circ$ or better (Maximum variation of sub-carrier phase with respect to burst for modulation percentage from 75 to 10%. Sub-carrier modulation percentage: 10% peak to peak.)

SIGNAL-TO-NOISE RATIO: -50 dB or better (RMS).

K FACTOR: 2 \pm 2%; 20 \pm 3%.

ENVELOPE DELAY:

.05 to 2.1 MHz:	± 70 ns	} Reference to standard FCC curve. Comparable CCIR performance.
at 3.58 MHz:	± 35 ns	
at 4.18 MHz:	± 70 ns	

VIDEO INPUT: 1.0 volt peak to peak, sync negative ± 3 dB, bridging input with -30 dB or better return loss up to 5.5 MHz, 75 ohm system.

HARMONIC RADIATION: -60 dB.

AURAL PERFORMANCE

POWER OUTPUT: 50 watts.

OUTPUT IMPEDANCE: 50 ohms, type "N" connector.

AUDIO INPUT: +10 dBm, ± 2 dB into 600 ohms.

INPUT IMPEDANCE: 600/150 ohms, $\pm 10\%$ (30-15,000 Hz).

PRE-EMPHASIS: 50/75 or zero microseconds.

FREQUENCY RESPONSE: ± 0.5 dB relative to pre-emphasis (30-15,000 Hz).

DISTORTION: .5% or less after 75 microsecond de-emphasis with ± 25 kHz deviation. .7% after 50 microsecond de-emphasis with ± 50 kHz deviation.

FM NOISE: -60 dB relative to ± 25 kHz deviation.

AM NOISE: -52 dB relative to 100% modulation (measured after de-emphasis).

RF OUTPUT IMPEDANCE: 50 ohms. Type "N" connector. VSWR less than 1.3.

FREQUENCY STABILITY: ± 250 Hz over a 30-day period.

SERVICE CONDITIONS

AMBIENT TEMPERATURE: -10° to +50°C.

AMBIENT HUMIDITY RANGE: 0 to 100% relative humidity.

ALTITUDE: Sea level to 7500 ft., or 2300 meters.

SIZE: 72" H x 31 1/2" W x 31 1/2" D. 182.9 cm H x 80 cm W x 80 cm D.

WEIGHT: Approximately 800 pounds or 360 kg.

ELECTRICAL REQUIREMENTS: 208/240 volts (± 11 volts) 50/60 Hz, single phase. (115 volts available on special order.)

ORDERING INFORMATION

BT-100L VHF TV transmitter for Channels 2-6 (CCIR Channels E2 to E4), with operating tubes, transistors, IC's, solid-state rectifiers, crystals, required pre-correction circuitry, low-level vestigial sideband filter, harmonic and color notch filters..... 994-6692-001

BT-100H VHF TV transmitter for Channels 7-13 (CCIR Channels E5 to E12), with all of above included..... 994-6652-001

UHF Television Exciter/Driver



VISUAL EXCITER



AURAL EXCITER

MODEL TD-2U

The TD-2U provides a nominal 2-watt television signal on any UHF channel, and is employed as the exciter/driver unit in all Gates' UHF transmitters. It consists of two drawer-mounted units, a visual exciter/modulator and an aural exciter/modulator, each employing a broadband stripline power amplifier.

These solid-state units may be used to drive amplifiers for any desired power output in updating older UHF transmitters, or may be used as a complete low power UHF transmitter.

Both exciters employ Gates' exclusive system of IF MODULATION to provide unsurpassed signal fidelity.

VISUAL EXCITER: This unit contains all the necessary sub-assemblies to generate, process and amplify video signals. Modulation, delay correction, linearity correction and vestigial sideband filtering occur at an IF frequency. An upconverter and a broadband, solid-state power amplifier provide the "on channel" output signal.

The signal system operates in the following manner: the video input is applied to a differential amplifier which provides cancellation of common mode signals. The differential amplifier drives several stages, which provide signal processing and clamping. Two identical, fully processed video signals are developed. One signal drives the ring modulator, the other signal provides output for monitoring video system performance.

The fully modulated double sideband IF signal that appears at the output of the ring modulator passes through the delay compensator, sideband filter, and linearity corrector before arriving at the "on channel" upconverter.

A precision crystal oscillator, operating in a temperature controlled environment, is used in conjunction with a digital harmonic generator, to develop a signal which drives the "on channel" upconverter.

Once the IF signal and the upconverter signal are mixed together, a bandpass filter is used to separate the desired signal from other mixing products. At this point a standard "on channel" vestigial sideband signal appears at a milliwatt power level. The signal then passes through an untuned, broadband, solid-state stripline amplifier, which provides the final two-watt, "on channel" output signal.

AURAL EXCITER: A direct FM varicap modulator generates the aural IF signal at 32.5 MHz. The entire aural modulator is housed in a temperature controlled oven to insure stability. A digital phase lock system is used to precisely control aural frequency.

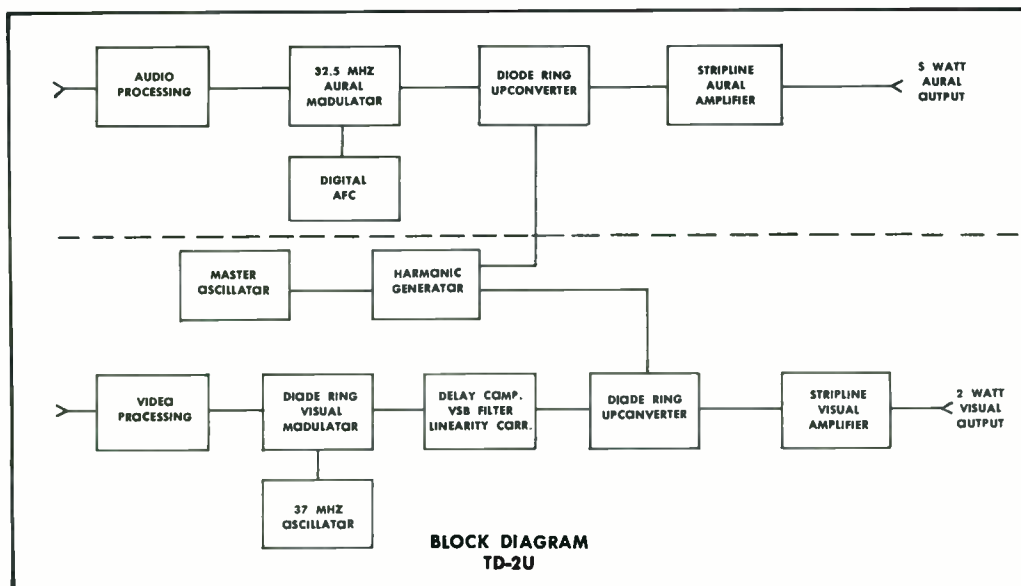
The aural IF signal is combined with an upconversion signal supplied by the visual exciter to generate the "on channel" aural carrier. The signal is then amplified to a power level of five watts by an untuned, broadband, solid-state stripline amplifier. Special circuitry is provided to disable the aural amplifier during EBS tests.

OPERATING CONTROLS: Both exciters are provided with a full complement of operating controls. Motor driven video gain, pedestal, visual power and aural power controls are standard for remote control operation. The unique miniature motor drive used on the controls allows the use of auxiliary control knobs on the front panels.

Multi-turn indicating knobs are used on both the visual and aural exciters for adjusting frequency. The control on the visual exciter changes the master oscillator frequency, which results in an identical change in both visual and aural output frequencies. The control on the aural exciter adjusts the aural frequency for proper intercarrier separation of 4.5 MHz.

Front panel multimeters are used on both exciters for monitoring operating parameters.

UHF Television Exciter/Driver



SPECIFICATIONS

VISUAL PERFORMANCE

OUTPUT POWER: 2 watts nominal (peak of sync).
OUTPUT IMPEDANCE: 50 ohms. Output connector: BNC.
FREQUENCY RANGE: 470-890 MHz (Channels 14-83). (CCIR bands IV, V.)
CARRIER STABILITY: ± 250 Hz (Maximum variation over 30 days).
REGULATION OF RF OUTPUT POWER (Black to white picture): Less than 3%.
VARIATION OF OUTPUT: Over one frame: less than 2%.
VISUAL SIDEBAND RESPONSE:
 +4.75 MHz and higher.....-20 dB or better.
 Carrier to +4.18 MHz.....+0.5, -1 dB.
 Carrier.....0 dB reference.
 Carrier to -0.5 MHz.....+0.5, -1 dB.
 -1.25 MHz and lower.....-20 dB or better.
FREQUENCY RESPONSE VS. BRIGHTNESS: ± 0.75 dB (Measured at 65% and 15% of modulation. Reference 100% = peak of sync.)
VISUAL MODULATION CAPABILITY: 3% or better.
DIFFERENTIAL GAIN: 0.2 dB or better (Maximum variation of sub-carrier amplitude from 75 to 10% of modulation. Sub-carrier modulation percentage: 10% peak to peak).
LINEARITY (LOW FREQUENCY): 0.1 dB or better.
DIFFERENTIAL PHASE: $\pm 2^\circ$ or better (Maximum variation of sub-carrier phase with respect to burst for modulation percentage from 75 to 10%. Sub-carrier modulation percentage: 10% peak to peak).
SIGNAL-TO-NOISE RATIO: -50 dB or better (RMS) below sync level.
K FACTORS: 2: 2%, 20: 3%.
ENVELOPE DELAY:

.05 to 2.1 MHz:	± 70 ns	} Reference to standard curve—FCC.
at 3.58 MHz:	± 35 ns	
at 4.18 MHz:	± 70 ns	

VIDEO INPUT LEVEL: 1.0 volt peak to peak ± 3 dB, sync negative.
HARMONIC RADIATION: -60 dB.

AURAL PERFORMANCE

AUDIO INPUT: +10 dBm, ± 2 dB into 600 ohms.
INPUT IMPEDANCE: 600/150 ohms.
PRE-EMPHASIS: 75 microsecands.
FREQUENCY RESPONSE: ± 0.5 dB relative to pre-emphasis (30-15,000 Hz).
DISTORTION: 0.5% or less after 75 microsecands de-emphasis with ± 25 kHz deviation.
FM NOISE: -60 dB relative to ± 25 kHz deviation.
AM NOISE: -60 dB relative to 100% modulation (measured after de-emphasis).
OUTPUT IMPEDANCE: 50 ohms, output connector BNC.
FREQUENCY STABILITY: ± 250 Hz (maximum variation over 30 days).
OUTPUT POWER: 5 watts.

SERVICE CONDITIONS

AMBIENT TEMPERATURE: -10° to $+50^\circ\text{C}$. (14° to 122°F .)
AMBIENT HUMIDITY RANGE: 0 to 100% relative humidity.
PHYSICAL DIMENSIONS: Visual exciter: $5\frac{3}{8}$ " H. x $22\frac{1}{2}$ " D. x 24" W.
 Aural exciter: $3\frac{1}{2}$ " H. x $20\frac{1}{4}$ " D. x 24" W.
WEIGHT: Visual exciter: 37 lbs. Aural exciter: 27 lbs.
AC INPUT POWER: 110/130 volts, single phase, 60 Hz.
AC POWER CONSUMPTION: Visual: 200 watts. Aural: 160 watts.

ORDERING INFORMATION

Model TD-2U UHF exciter/driver, includes visual exciter and aural exciter.....994-6806-001

55,000 Watt UHF Color Television Transmitter



MODEL BT-55U

Employing IF MODULATION for the finest color reproduction available today, Gates' FCC type accepted BT-55U 55 kW UHF transmitter is entirely solid state, except for klystron visual and aural output amplifiers.

Modulation of the visual and aural carriers occurs at a relatively low IF frequency, where all signal processing and shaping is accomplished at extremely low power levels. This exclusive Gates IF system establishes absolute control over all critical signal characteristics to provide superb transmission quality.

VISUAL AND AURAL EXCITERS: The BT-55U utilizes Gates' TD-2U exciter/driver, consisting of two drawer-mounted solid-state units. These units directly drive the visual and aural klystron amplifiers with a nominal 2-watt visual output and a 5-watt aural output. (See TD-2U, previous pages.)

KLYSTRONS: Two identical five-cavity vapor-cooled klystrons are used in the BT-55U. Each klystron requires less than one watt of drive power to develop full power output. The kly-

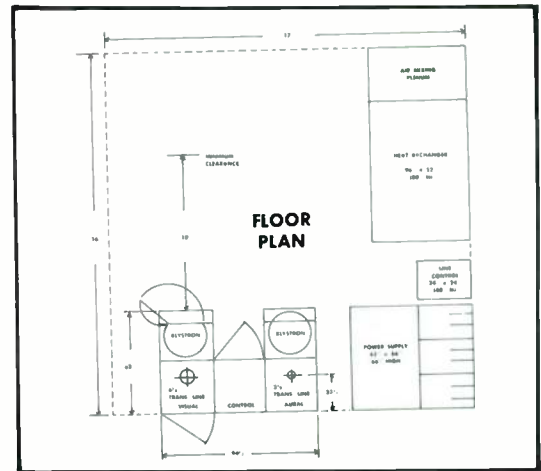
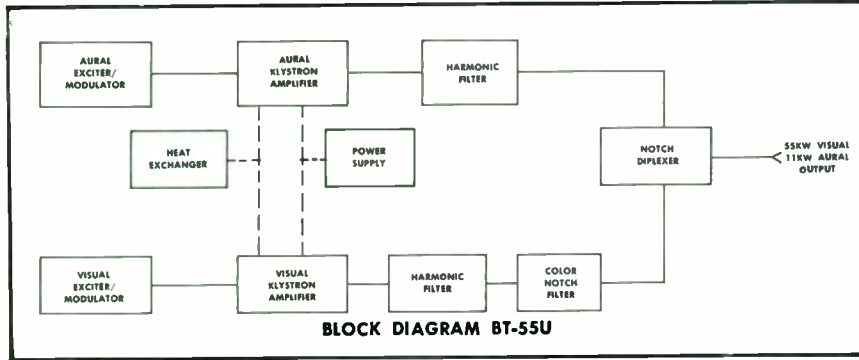
strons are housed in separate cabinets, containing identical control logic, magnet supplies and overload sensors, and operate independently of one another. Installation or replacement of klystrons can be accomplished rapidly by one man.

HEAT EXCHANGER: The BT-55U employs a unitized heat exchanger, which contains the cooling cores, blower and motor, circulating pump, storage tank, and control devices. The cooling system is a departure from conventional designs that use individual components that must be installed separately.

REMOTE CONTROL: All control circuitry in the BT-55U is of solid-state digital logic design, which simplifies remote control operation. All control commands require only a momentary contact closure. Remote metering samplers are provided for monitoring operating parameters. Several readily accessible terminal strips allow convenient connection to a remote control system.

INSTALLATION: The Gates "building block" concept of transmitter construction simplifies installation and minimizes floor space requirements.

55,000 Watt UHF Color Television Transmitter



SPECIFICATIONS

VISUAL PERFORMANCE

OUTPUT POWER: 55 kW (Peak of Sync). (FCC and CCIR systems B, M.)
OUTPUT IMPEDANCE: 50 ohms. Output connector: 6 1/8" EIA std.
FREQUENCY RANGE: 470-890 MHz, (Channels 14-83). (CCIR bands IV, V.)
CARRIER STABILITY: ±250 Hz (Maximum variation over 30 days).
REGULATION OF RF OUTPUT POWER (Black to White Picture): Less than 3%.
VARIATION OF OUTPUT: Over one frame: less than 2%.
VISUAL SIDEBAND RESPONSE:
 +4.75 MHz and higher -20 dB or better.
 Carrier to +4.18 MHz +0.5, -1 dB.
 Carrier 0 dB reference.
 Carrier to -0.5 MHz +0.5, -1 dB.
 -1.25 MHz and lower -20 dB or better.
 -3.58 MHz -42 dB or better.
 Corner frequencies scaled to meet CCIR standards.

FREQUENCY RESPONSE VS. BRIGHTNESS: ±0.75 dB (Measured at 65% and 15% of modulation. Reference 100% = peak of sync.)

VISUAL MODULATION CAPABILITY: 3% or better.

DIFFERENTIAL GAIN: 0.5 dB or better (Maximum variation of sub-carrier amplitude from 75 to 10% of modulation. Sub-carrier modulation percentage: 10% peak to peak).

LINEARITY (LOW FREQUENCY): 0.5 dB or better.

DIFFERENTIAL PHASE: ±4° or better (Maximum variation of sub-carrier phase with respect to burst for modulation percentage from 75 to 10%. Sub-carrier modulation percentage: 10% peak to peak).

SIGNAL-TO-NOISE RATIO: -50 dB or better (RMS) below sync level.

K FACTORS: 2t 2%, 20t 3%.

ENVELOPE DELAY:

.05 to 2.1 MHz:	±70 ns	} Reference to standard curve—FCC.
at 3.58 MHz:	±35 ns	
at 4.18 MHz:	±70 ns	

VIDEO INPUT: Bridging, loop through input with -30 dB or better return loss up to 5.5 MHz, 75 ohm system.

VIDEO INPUT LEVEL: 1.0V Peak to Peak ±3 dB, sync negative.

HARMONIC RADIATION: -80 dB.

AURAL PERFORMANCE

AUDIO INPUT: +10 dBm, ±2 dB into 600 ohms.

INPUT IMPEDANCE: 600/150 ohms.

PRE-EMPHASIS: 75 microseconds.

FREQUENCY RESPONSE: ±0.5 dB relative to pre-emphasis (30-15,000 Hz).
DISTORTION: 0.5% or less after 75 microseconds de-emphasis with ±25 kHz deviation.

FM NOISE: -59 dB relative to ±25 kHz deviation.

AM NOISE: -55 dB relative to 100% modulation (measured after de-emphasis).

OUTPUT IMPEDANCE: 50 ohms, output connector 3 1/8" EIA std.

FREQUENCY STABILITY: ±250 Hz (Maximum variation over 30 days).

OUTPUT POWER: 5.5 kW to 11 kW (Measured at the output of the Diplexer).

SERVICE CONDITIONS

AMBIENT TEMPERATURE: +2° to +50°C. (36° to 122°F.)

AMBIENT HUMIDITY RANGE: 0 to 100% relative humidity.

ALTITUDE: Sea level to 7500 ft.

KLYSTRONS

TYPES:

Low Band (Channels 14-29) (470-566 MHz), VA 953B.
 Mid Band (Channels 30-51) (566-698 MHz), VA 954B.
 High Band (Channels 52-83) (698-890 MHz), VA 955B.

ELECTRICAL

AC INPUT POWER: 440/460/480 Volts, 3 Phase 60 Hz. (380 Volts 50 Hz available).

AC POWER CONSUMPTION (Black Picture): 20% Aural, 230 kW; 10% Aural, 210 kW. Power Factor: 100%. Regulation: 3%. Phase Unbalance: 2%.

DIMENSIONS

TRANSMITTER: 94 1/2" W. x 63" D. x 72" H. Weight: 4100 lbs.

POWER SUPPLY: 66" W. x 62" D. x 66" H. Weight: 9200 lbs.

HEAT EXCHANGER: 96" W. x 52" D. x 80" H. Weight 4000 lbs.

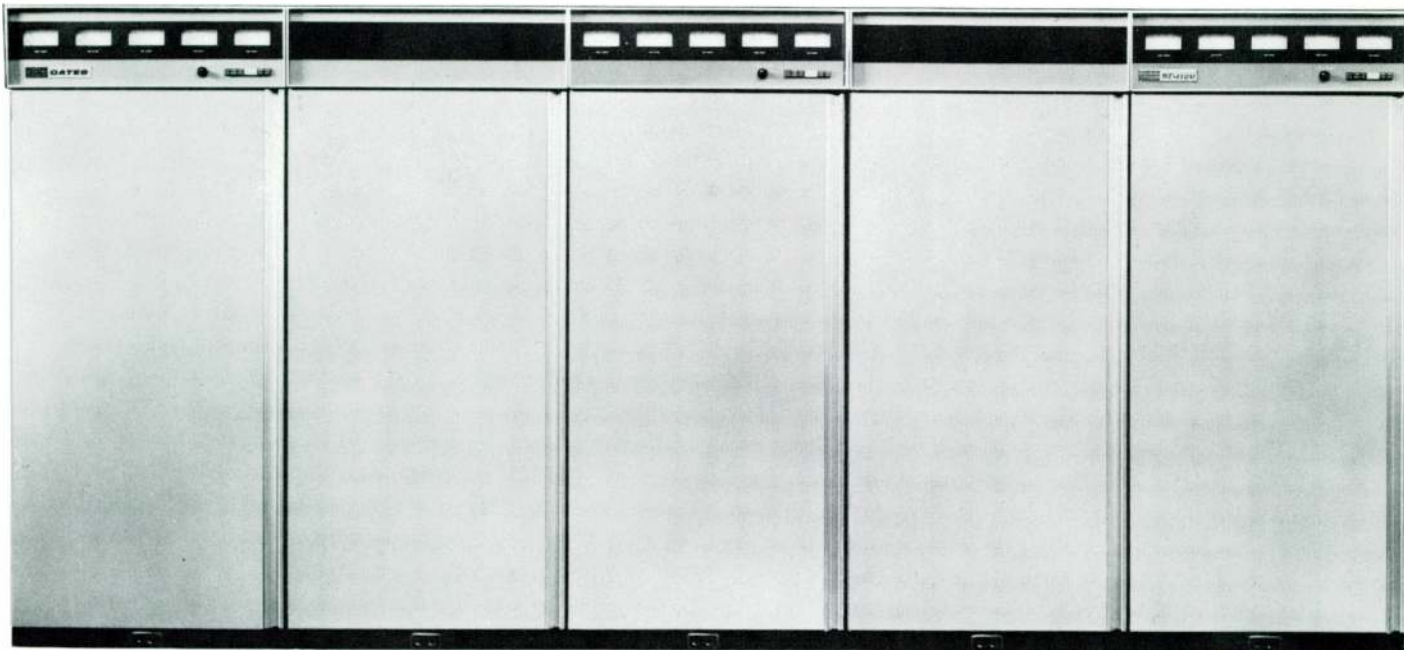
ORDERING INFORMATION

BT-55U 55 kW UHF-TV transmitter, with operating klystrons, transistors, IC's, solid-state rectifiers, crystals, required pre-correction circuitry, low-level vestigial sideband filter, harmonic and color notch filters and notch diplexer..... 994-6748-001

*Gates BT-30u 30kW Transmitter Same as above
 Power consumption 160 kW AT 20% Aural
 147 kW AT 10% Aural*



110,000 Watt UHF Color Television Transmitter



MODEL BT-110U

Gates' BT-110U includes two visual klystron cabinets, one aural klystron cabinet, two control cabinets, two high voltage power supplies and two unitized heat exchangers.

Three identical klystrons are used for the high power visual and aural amplifiers. Each of the visual amplifiers operates at a 55 kW power level, and the outputs are added together in a hybrid combiner to produce a total output of 110 kW. The aural klystron is capable of producing up to 22 kW at the output of the diplexer.

The paralleled visual amplifiers provide redundancy. If one visual stage should fail, output power will automatically drop to 25% of the total output power with no carrier interruption. The defective stage may be repaired with no loss of air time. Should the aural amplifier stage fail, the aural and visual exciters can be multiplexed through the visual amplifiers for emergency operation.

VISUAL AND AURAL EXCITERS (TD-2U): The visual exciter employs IF MODULATION and IF bandpass shaping to generate a standard vestigial sideband signal at an IF frequency of 37 MHz. A special corrector, operating at the IF frequency, compensates for inherent klystron non-linearities.

The diode ring modulator, exhibiting exceptionally good phase and linearity characteristics, modulates the IF carrier at low power levels for unsurpassed color performance. Modulation capability exceeds 3% for all video frequencies, so that even highly saturated yellow or cyan may be transmitted with no loss of fidelity.

A varicap modulated direct FM system generates a standard television aural signal at an IF frequency of 32.5 MHz in the aural exciter. Frequency response and distortion characteristics are excellent.

Both exciters utilize a common master oscillator to convert the IF signals up to the desired UHF channel. (For more complete information see pages on Gates' TD-2U exciter/driver.)

KLYSTRONS: High gain klystrons, containing five internal cavities, amplify the exciter outputs to the proper power levels. The klystrons are mounted in special mechanical assemblies which pivot to allow easy installation. Vapor cooling is used with two completely self-contained heat exchangers provided.

POWER SUPPLIES: Two unitized supplies are employed to power the BT-110U. Each polyphase supply contains a high voltage transformer, filter choke, filter capacitor, solid-state rectifiers and transient protectors—all sealed in oil for cooling and insulation. An access plate is provided for inspection and maintenance.

GENERAL: Gates' unique "building block" concept, in which major components are housed in functional modules, greatly simplifies transmitter assembly and installation, while providing total redundancy.

110,000 Watt UHF Color Television Transmitter

SPECIFICATIONS

VISUAL PERFORMANCE

OUTPUT POWER: 110 kW (peak of sync). (FCC and CCIR systems B, M.)
OUTPUT IMPEDANCE: 50 ohms. Output connector: 6 $\frac{1}{8}$ " EIA std.
FREQUENCY RANGE: 470-890 MHz, (Channels 14-83). (CCIR bands IV, V.)
CARRIER STABILITY: ± 250 Hz (Maximum variation over 30 days).
REGULATION OF RF OUTPUT POWER (Black to White Picture): Less than 3%.
VARIATION OF OUTPUT: Over one frame: less than 2%.
VISUAL SIDEBAND RESPONSE:
 +4.75 MHz and higher ----- -20 dB or better.
 Carrier to +4.18 MHz ----- +0.5, -1 dB.
 Carrier ----- 0 dB reference.
 Carrier to -0.5 MHz ----- +0.5, -1 dB.
 -1.25 MHz and lower ----- -20 dB or better.
 -3.58 MHz ----- -42 dB or better.
 Corner frequencies scaled to meet CCIR standards.

FREQUENCY RESPONSE VS. BRIGHTNESS: ± 0.75 dB (Measured at 65% and 15% of Modulation. Reference 100% = peak of sync).

VISUAL MODULATION CAPABILITY: 3% or better.

DIFFERENTIAL GAIN: 0.5 dB or better (Maximum variation of sub-carrier amplitude from 75 to 10% of modulation. Sub-carrier modulation percentage: 10% peak to peak).

LINEARITY (LOW FREQUENCY): 0.5 dB or better.

DIFFERENTIAL PHASE: $\pm 4^\circ$ or better (Maximum variation of sub-carrier phase with respect to burst for modulation percentage from 75 to 10%. Sub-carrier modulation percentage: 10% peak to peak).

SIGNAL-TO-NOISE RATIO: -50 dB or better (RMS) below sync level.

K FACTORS: 2t 2%, 20t 3%.

ENVELOPE DELAY:

.05 to 2.1 MHz: ± 70 ns	} Reference to standard curve—FCC.
at 3.58 MHz: ± 35 ns	
at 4.18 MHz: ± 70 ns	

VIDEO INPUT: Bridging, loop through input with -30 dB or better return loss up to 5.5 MHz, 75 ohm system.

VIDEO INPUT LEVEL: 1.0V Peak to Peak ± 3 dB, sync negative.

HARMONIC RADIATION: -80 dB.

AURAL PERFORMANCE

AUDIO INPUT: +10 dBm, ± 2 dB into 600 ohms.

INPUT IMPEDANCE: 600/150 ohms.

PRE-EMPHASIS: 75 microsecands.

FREQUENCY RESPONSE: ± 0.5 dB relative to pre-emphasis (30-15,000 Hz).

DISTORTION: 0.5% or less after 75 microsecands de-emphasis with ± 25 kHz deviation.

FM NOISE: -59 dB relative to ± 25 kHz deviation.

AM NOISE: -55 dB relative to 100% modulation (measured after de-emphasis).

OUTPUT IMPEDANCE: 50 ohms, output connector 6 $\frac{1}{8}$ " EIA std.

FREQUENCY STABILITY: ± 250 Hz (Maximum variation over 30 days).

OUTPUT POWER: 11 kW to 22 kW (Measured at the output of the Diplexer).

SERVICE CONDITIONS

AMBIENT TEMPERATURE: +2° to +50°C. (36° to 122°F.)

AMBIENT HUMIDITY RANGE: 0 to 100% relative humidity.

ALTITUDE: Sea level to 7500 ft.

KLYSTRONS

TYPES:

Low Band (Channels 14-29) (470-566 MHz), VA 953B.

Mid Band (Channels 30-51) (566-698 MHz), VA 954B.

High Band (Channels 52-83) (698-890 MHz), VA 955B.

ELECTRICAL

AC INPUT POWER: 440/460/480 Volts, 3 phase 60 Hz. (380 Volts 50 Hz available).

AC POWER CONSUMPTION (Black Picture): 20% Aural, 460 kW. 10% Aural, 430 kW. Power Factor: 100%. Regulation: 3%. Phase Unbalance: 2%.

DIMENSIONS

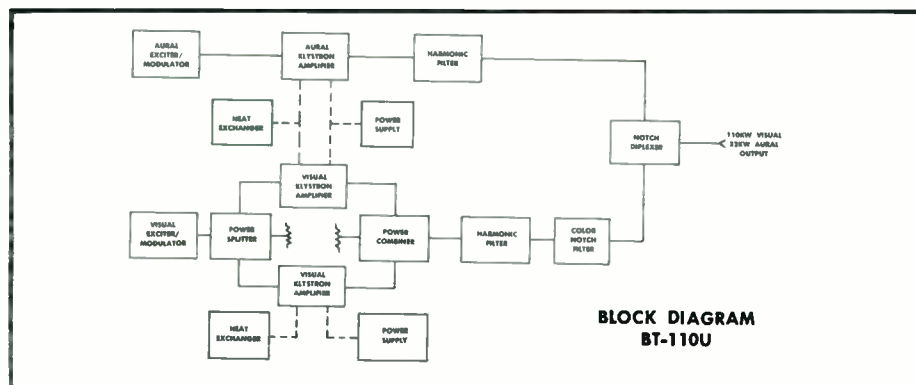
TRANSMITTER: 157 $\frac{1}{2}$ " W. x 63" D. x 72" H. Weight: 6550 lbs.

POWER SUPPLIES (2): Each 66" W. x 62" D. x 66" H. Weight of each: 9200 lbs.

HEAT EXCHANGERS (2): Each: 96" W. x 52" D. x 80" H. Weight of each: 4000 lbs.

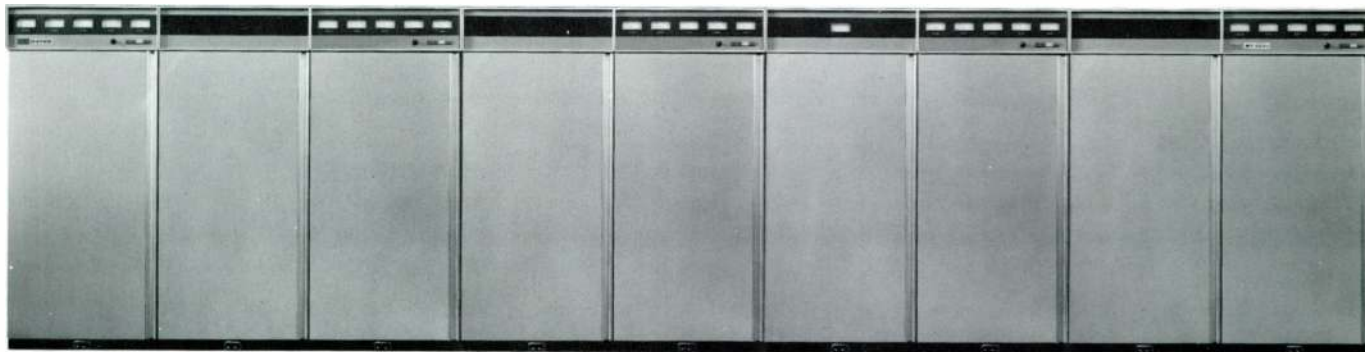
ORDERING INFORMATION

BT-110U 110 kW UHF-TV transmitter, with operating klystrons, transistors, IC's, solid-state rectifiers, crystals, required pre-correction circuitry, low-level vestigial sideband filter, harmonic and color notch filters and notch diplexer.....994-6749-001



**BLOCK DIAGRAM
BT-110U**

220,000 Watt UHF Color Television Transmitter



MODEL BT-220U

The BT-220U is the first 220 kW UHF television transmitter ever built. Featuring Gates' exclusive IF MODULATION for outstanding color performance, this transmitter provides 220,000 watts visual and 22,000 watts aural output with only five high gain klystron amplifiers. Except for the klystrons, all other circuitry in the BT-220U is solid-state for stable operation and highest reliability.

VISUAL: The visual amplifier system consists of four 55 kW klystrons operating in a parallel tandem configuration. Two klystrons are paralleled to produce a 110 kW output, which is combined with the output of the other two paralleled klystrons to produce a total output of 220 kW. Should one klystron fail, the transmitter will stay on the air, although the output power will automatically drop to 56% of its operating level.

Each klystron has completely independent control logic and high voltage switching so that one klystron may be removed from the system without disabling the transmitter. Individual klystron installation or replacement can be accomplished rapidly by one man.

Low level IF MODULATION is used to generate a high quality IF signal in the visual exciter. A unique linearity corrector processes the IF signal to compensate for inherent klystron non-linearities. This allows transmitter output power to be varied without requiring complete readjustment of the signal processing system.

AURAL: A single vapor-cooled klystron, with five internal cavities, is used as the aural amplifier. This klystron is identical to those used in the visual amplifier system. A solid-state direct FM exciter, with up to 5 watts output, provides the aural drive power.

For a complete description of the visual and aural exciters, see pages on Gates' TD-2U.

PROTECTIVE CIRCUITRY: Maximum transmitter protection is provided by a complete system of voltage, current and temperature sensors. Solid-state control logic is used to drive high speed vacuum contactors, which provide instantaneous interruption of primary power to prevent transmitter damage due to an overload condition. The transmitter will automatically recycle three times. If a fourth overload occurs within a 60-second time period, the transmitter will shut down until the overload condition is corrected and the protective circuitry is reset.

METERING: Complete metering is provided to monitor transmitter operating parameters. The eye-level 4-inch meters are located on the front of the transmitter cabinets for easy reading. All meter panels are hinged to allow instant access for inspection and maintenance.

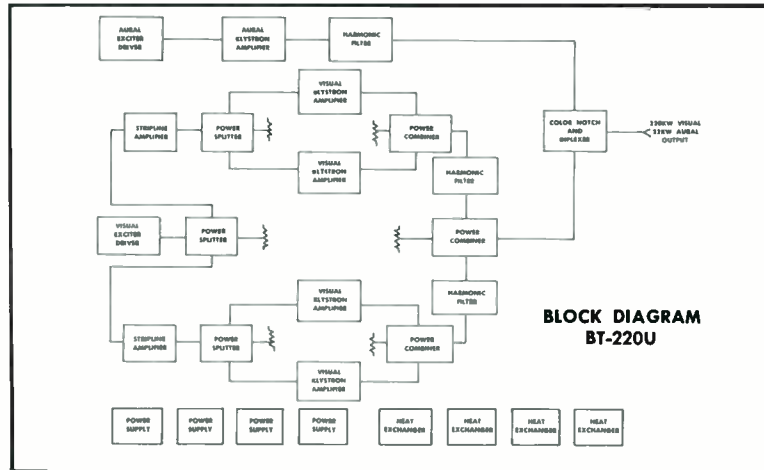
GENERAL: Individual unitized power supplies and heat exchangers are furnished for each visual klystron amplifier. The oil-filled power supplies contain a high voltage transformer, rectifier diodes, filter capacitor, filter choke and transient protective circuitry. The supplies utilize a polyphase rectifier system which provides an extremely pure DC output.

The heat exchangers are self-contained cooling systems. Each houses the cooling cores, a circulating pump, a blower, a storage tank, and temperature sensing control circuitry.

All connections for interfacing the BT-220U with a remote control system are provided on readily accessible terminal strips.

The entire transmitter is easily accessible from the front and back. Both visual and aural exciters slide out and can operate independently from the other transmitter stages outside the main cabinet.

220,000 Watt UHF Color Television Transmitter



SPECIFICATIONS

VISUAL PERFORMANCE

OUTPUT POWER: 220 kW (peak of sync). (FCC and CCIR systems B, M.)
OUTPUT IMPEDANCE: 50 ohms. Output connector: 6 $\frac{1}{8}$ " EIA std.
FREQUENCY RANGE: 470-890 MHz, (Channels 14-83). (CCIR bands IV, V.)
CARRIER STABILITY: ± 250 Hz (Maximum variation over 30 days).
REGULATION OF RF OUTPUT POWER (Black to White Picture): Less than 3%.

VARIATION OF OUTPUT: Over one frame: less than 2%.

VISUAL SIDEBAND RESPONSE:

+4.75 MHz and higher	-----	-20 dB or better.
Carrier to +4.18 MHz	-----	+0.5, -1 dB.
Carrier	-----	0 dB reference.
Carrier to -0.5 MHz	-----	+0.5, -1 dB.
-1.25 MHz and lower	-----	-20 dB or better.
-3.58 MHz	-----	-42 dB or better.

Corner frequencies scaled to meet CCIR standards.

FREQUENCY RESPONSE VS. BRIGHTNESS: ± 0.75 dB (Measured at 65% and 15% of Modulation. Reference 100% = peak of sync).

VISUAL MODULATION CAPABILITY: 3% or better.

DIFFERENTIAL GAIN: 0.5 dB or better (Maximum variation of sub-carrier amplitude from 75 to 10% of modulation. Sub-carrier modulation percentage: 10% peak to peak).

LINEARITY (LOW FREQUENCY): 0.5 dB or better.

DIFFERENTIAL PHASE: $\pm 4^\circ$ or better (Maximum variation of sub-carrier phase with respect to burst for modulation percentage from 75 to 10%. Sub-carrier modulation percentage: 10% peak to peak).

SIGNAL-TO-NOISE RATIO: -50 dB or better (RMS) below sync level.

K FACTORS: 2 \pm 2%, 20 \pm 3%.

ENVELOPE DELAY:

.05 to 2.1 MHz:	± 70 ns	} Reference to standard curve—FCC.
at 3.58 MHz:	± 35 ns	
at 4.18 MHz:	± 70 ns	

VIDEO INPUT: Bridging, loop through input with -30 dB or better return loss up to 5.5 MHz, 75 ohm system.

VIDEO INPUT LEVEL: 1.0V Peak to Peak ± 3 dB, sync negative.

HARMONIC RADIATION: -80 dB.

AURAL PERFORMANCE

AUDIO INPUT: +10 dBm, ± 2 dB into 600 ohms.

INPUT IMPEDANCE: 600/150 ohms.

PRE-EMPHASIS: 75 microseconds.

FREQUENCY RESPONSE: ± 0.5 dB relative to pre-emphasis (30-15,000 Hz).

DISTORTION: 0.5% or less after 75 microseconds de-emphasis with ± 25 kHz deviation.

FM NOISE: -59 dB relative to ± 25 kHz deviation.

AM NOISE: -55 dB relative to 100% modulation (measured after de-emphasis).

OUTPUT IMPEDANCE: 50 ohms, output connector 6 $\frac{1}{8}$ " EIA std.

FREQUENCY STABILITY: ± 250 Hz (Maximum variation over 30 days).

OUTPUT POWER: 22 kW (Measured at the output of the diplexer).

SERVICE CONDITIONS

AMBIENT TEMPERATURE: +2° to +50°C. (36° to 122° F.)

AMBIENT HUMIDITY RANGE: 0 to 100% relative humidity.

ALTITUDE: Sea level to 7500 ft.

KLYSTRONS

TYPES:

- Low Band (Channels 14-29) (470-566 MHz), VA 953B.
- Mid Band (Channels 30-51) (566-698 MHz), VA 954B.
- High Band (Channels 52-83) (698-890 MHz), VA 955B.

ELECTRICAL

AC INPUT POWER: 440/460/480 Volts, 3 Phase 60 Hz. (380 Volts 50 Hz available.)

AC POWER CONSUMPTION (Black Picture): 10% aural, 920 kW. Power factor: 100%. Regulation: 3%. Phase Unbalance: 2%.

DIMENSIONS

TRANSMITTER: 29 $\frac{1}{2}$ " W. x 63" D. x 72" H. Weight: 12,000 lbs.

POWER SUPPLIES (4): Each 66" W. x 62" D. x 66" H. Weight of each: 9200 lbs.

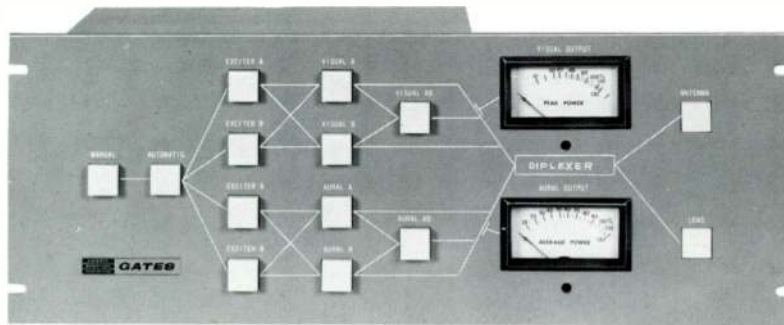
HEAT EXCHANGERS (4): Each 96" W. x 52" D. x 80" H. Weight of each: 4000 lbs.

ORDERING INFORMATION

BT-220U 220 kW UHF-TV transmitter, with operating klystrons, transistors, IC's, solid-state rectifiers, crystals, required pre-correction circuitry, low-level vestigial sideband filter, harmonic and color notch filters and notch diplexer.....

994-6777-001

Television Accessory Equipment



MULTIPLE TV TRANSMITTER SYSTEM CONTROL AND SWITCHING PANEL

The Transmitter System Control and Switching Panel is designed for use with multiple transmitter system installations:

- A. Main and standby transmitters.
- B. Parallel transmitters operating full power.
- C. Parallel transmitters operating half power.

(Similar control systems are available for: three transmitters—two operating full power with a spare third transmitter; or, three transmitters—two operating half power, and a spare third for full power or half power operation.)

A unique system control panel is used to select on-air transmitter combinations and show transmitter status by lighted pushbuttons. It also contains two meters for monitoring visual and aural combined transmitter output powers.

When used in a parallel transmitter system, one exciter will drive the transmitter or transmitters selected for operation

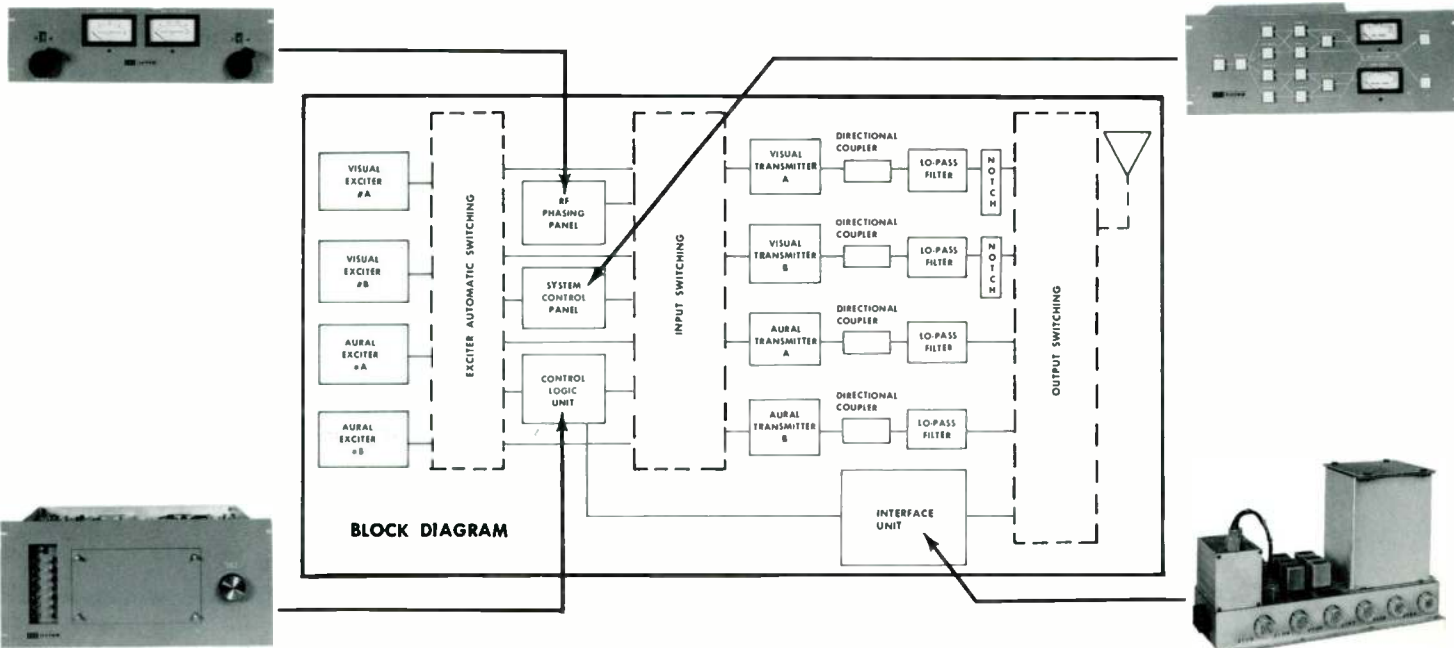
while the other exciter will be fed into a dummy load or the inoperative transmitter for testing.

Transmitter A, B or A+B can be selected for on-air operation by depressing the appropriate pushbutton and the desired system will be in operation in less than two seconds. If transmitter A is selected for operation, transmitter B is automatically routed to the dummy load and may be operated with the unused exciter for test purposes. Selecting transmitter B for on-air operation will allow A to be tested.

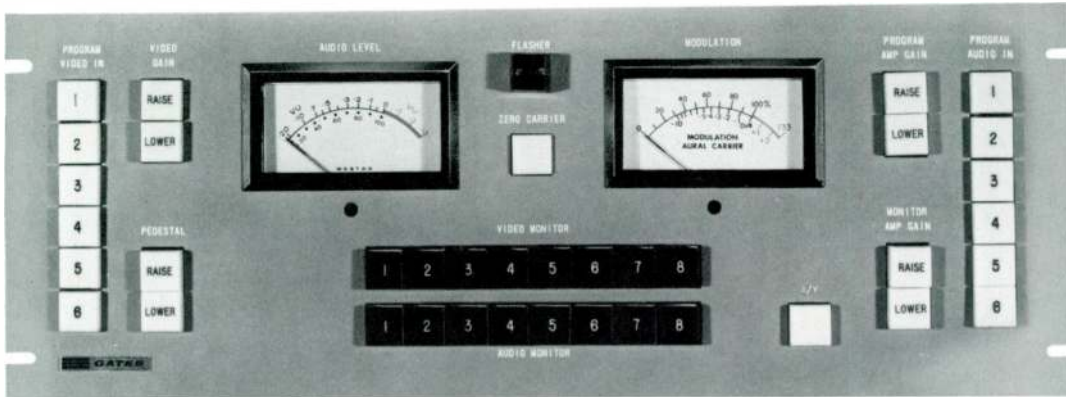
The system utilizes low power coaxial transmitter input switching; high power coaxial RF output switching; solid-state input and output switching control logic; RF phasing controls; and system interconnection circuitry.

ORDERING INFORMATION

Multiple TV Transmitter System Control and Switching Panel. Includes: system control panel, RF phasing panel, input switching and control logic housing, interconnecting cables and output combining and switching assembly.....994-6798-000



Television Accessory Equipment



TV TRANSMITTER AUDIO/VIDEO PROGRAM CONTROL AND MONITORING PANEL

Gates' TV Transmitter Audio/Video Program Control Panel consists of a control panel and a rack-mounted electronics frame. The control panel contains pushbuttons for the control of six audio inputs, six video inputs, eight audio and eight video monitoring points as well as control of video level, pedestal level, audio gain and audio monitor gain. The panel

also contains meters for audio input and percentage of modulation along with an over-modulation percentage indicator.

The rack-mounted electronics frame houses all of the active circuit components to control the signals as commanded from the control panel.

SPECIFICATIONS

INPUTS: Six, 75 ohm video; six, high impedance audio; eight, 75 ohm video monitoring; eight, high impedance audio monitoring; VU meter; modulation percentage meter; over-modulation percentage indicator.

OUTPUTS: Two, 75 ohm video; two, 600 ohm audio; two, 75 ohm video monitor; and an 8 ohm, 10 watt audio monitor.

VIDEO INPUT LEVEL: 1.0 volt peak to peak.

AUDIO INPUT LEVEL: 0 dBm.

VIDEO MONITOR INPUT: 1.0 volt peak to peak.

AUDIO MONITOR INPUT: 0 dBm.

VIDEO OUTPUT: 1.0 volt peak to peak.

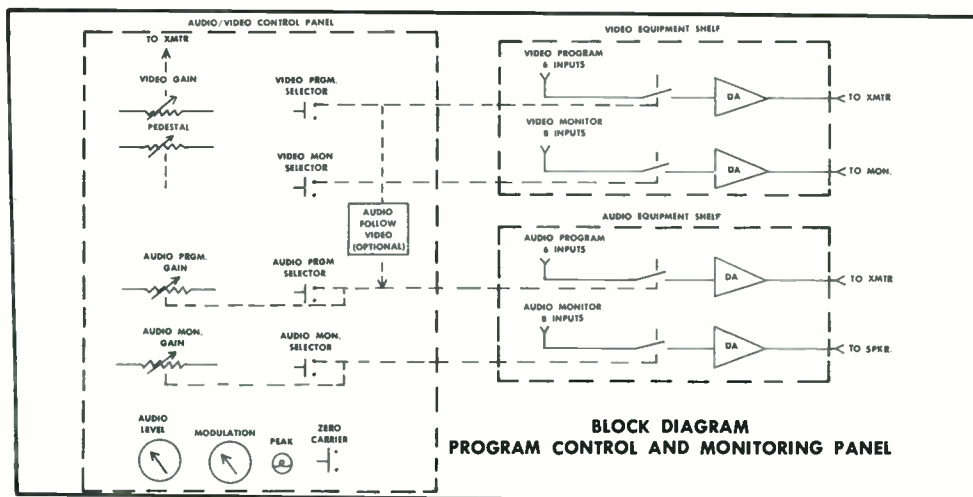
AUDIO OUTPUT: +10 dBm.

VIDEO MONITOR OUTPUT: 1.0 volt peak to peak.

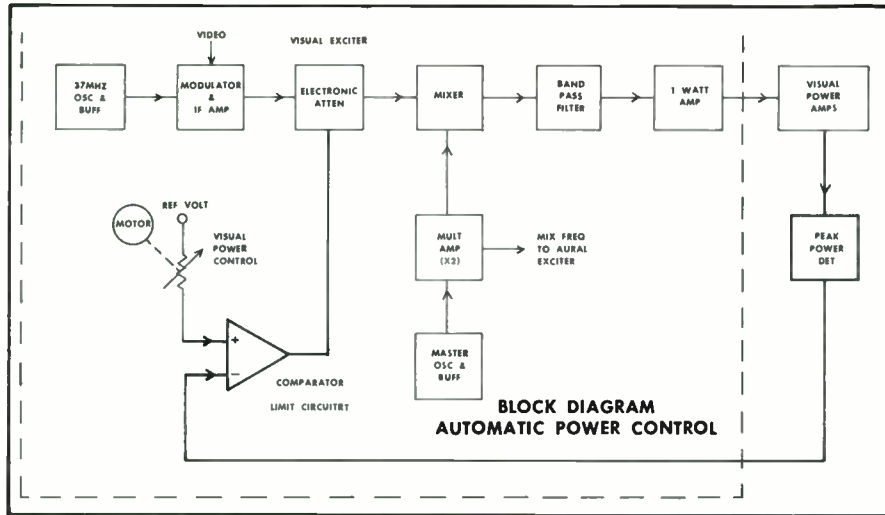
AUDIO MONITOR OUTPUT: 10 watts into 8 ohms.

ORDERING INFORMATION

TV Transmitter Audio/Video Program Control and Monitoring Panel.....994-6795-000



Television Accessory Equipment



TV TRANSMITTER AUTOMATIC POWER CONTROL

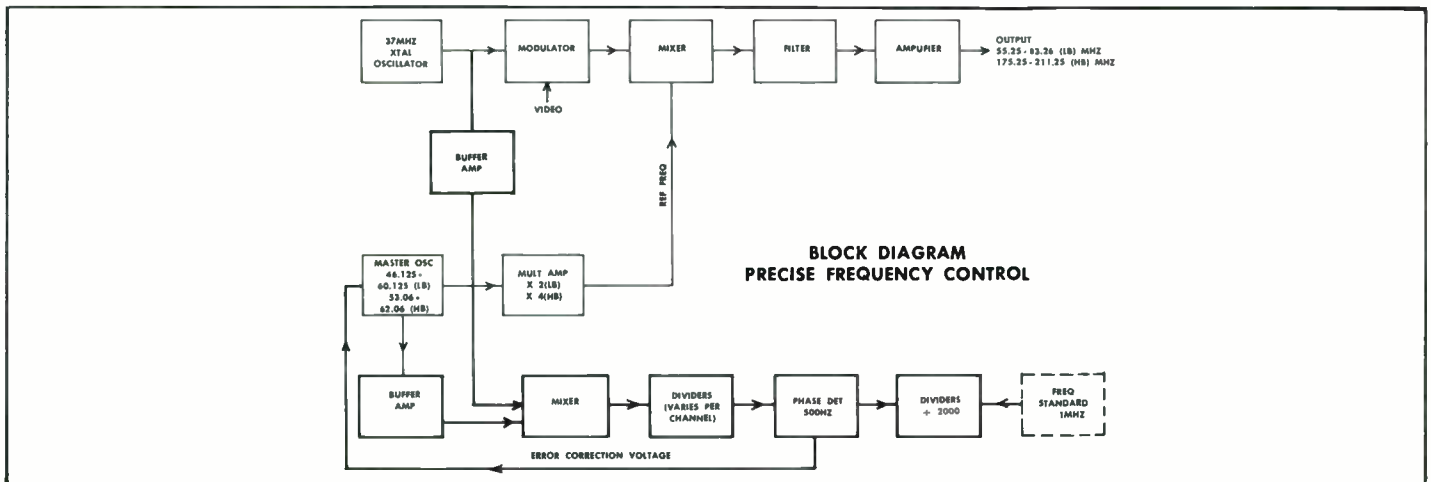
Gates' TV transmitter Automatic Power Control will automatically maintain transmitter output power at a predetermined level. It may be used with either visual or aural transmitters in single or paired transmitter installations.

The device, by means of an electronic attenuator located in the IF signal path, automatically adjusts system gain so that the sample voltage from the peak power detector is exactly the same as the reference voltage from the power control.

Automatic control is limited to approximately 2 dB in the positive direction to warn of abnormal decreases in system gain. Once the upper limit is reached, the control supplies a contact closure or a voltage to trigger an alarm. The response time for power corrections is 100 milliseconds.

ORDERING INFORMATION

TV Transmitter Automatic Power Control.....994-6797-000



TV TRANSMITTER PRECISE FREQUENCY CONTROL

Extremely accurate control of the visual carrier is provided by the Gates Precise Frequency Control to minimize co-channel interference.

The visual carrier is phase locked to a customer-provided external standard reference oscillator. The reference standard operates near 1 MHz and is divided to approximately 15 kHz to control the carrier phase lock circuitry. The stability of the reference standard determines the final visual carrier stability.

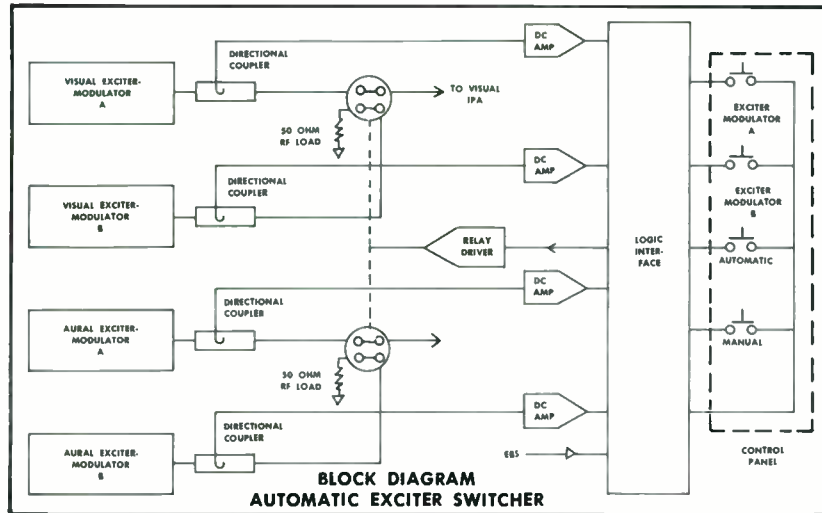
The phase lock circuitry is designed so that a failure of the external reference will only result in the exciter returning to its original frequency-determining elements and there will be no loss of carrier.

Systems using dual visual exciters require separate precise offset control modules in each exciter.

ORDERING INFORMATION

TV Transmitter Precise Frequency Control.....994-6760-000

Television Accessory Equipment



TV TRANSMITTER AUTOMATIC EXCITER SWITCHER

Gates' Automatic Exciter Switcher is designed to operate with two visual and two aural excitors. Exciter outputs are continuously monitored to detect operational status. Should the "on air" excitors fail, the standby exciter is immediately transferred to drive the transmitter. Complete switching is accomplished during one field of a standard television signal or in less than 20 milliseconds.

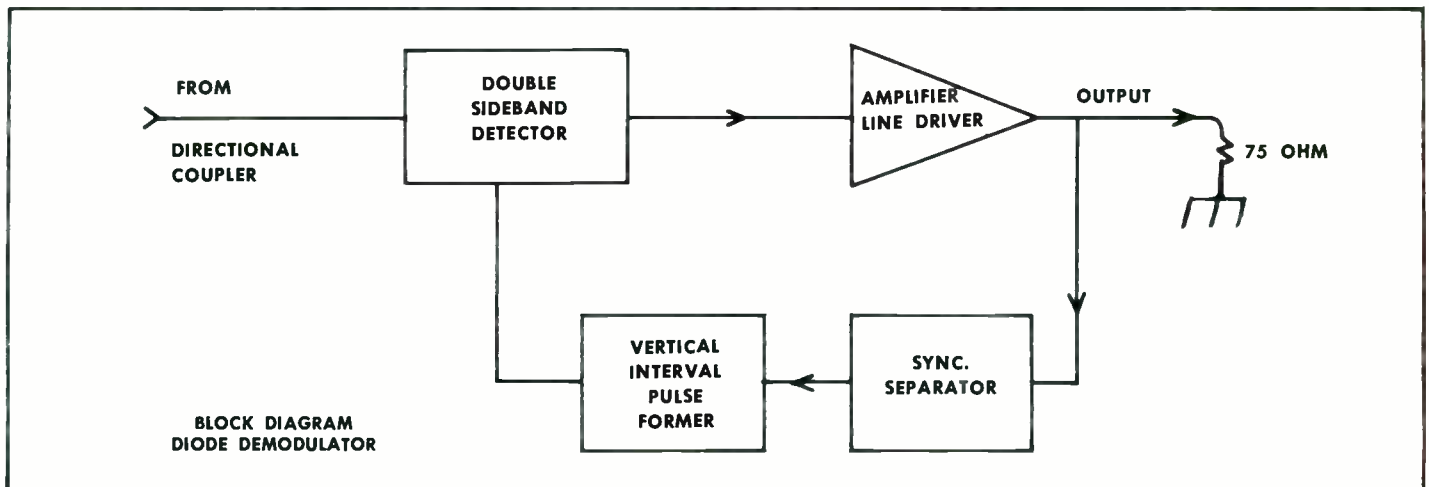
Only Gates can offer a system which will automatically and instantaneously switch a spare modulator, sideband filter,

delay compensator and phase-locked oscillator to an "on air" status without causing prolonged carrier interruptions.

Standby excitors are terminated in a small 50 ohm load which may be removed to connect the standby excitors to test or monitoring equipment.

ORDERING INFORMATION

Automatic Exciter Switcher.....994-6799-000



DIODE DEMODULATOR

This unit is a self-contained solid-state video detector. The video presentation from Gates' Diode Demodulator is a detected RF envelope for measuring modulation depth and for monitoring the RF output of a UHF or VHF visual television transmitter.

The depth of modulation is measured by comparing the instantaneous video waveform with a zero carrier reference pulse which occurs during the vertical blanking interval. The

reference pulse may be switched on or off manually or from a remote location.

A 4.5 MHz aural filter is provided to suppress the aural carrier. This filter may be switched in or out of the circuit. The Diode Demodulator is designed for continuous 24-hour-a-day operation.

ORDERING INFORMATION

Diode Demodulator.....994-6789-000



Television Accessory Equipment

RAK-80



Designed to complement Gates' television transmitter cabinetry, the RAK-80 is a highly flexible unit that can be used as a rack only, or as a complete cabinet with all accessories. Construction is extremely rugged, and there is not the slightest torsion in the doors or cabinet framework.

The basic RAK-80 cabinet assembly includes: two panel mounting angles; an air filter mounted in the rear of the cabinet base; convenient knock-outs for wiring in the bottom and sides of the base; and new EIA standard panel-mounting hole spacing.

The following are optional accessories with the RAK-80, and must be ordered separately: side panels; rear door with or without louvers; fan kit (includes 150-cfm base-mounted fan to maintain a constant, positive pressure inside the cabinet); and rear mounting angles.

SPECIFICATIONS

HEIGHT OVERALL: 72"
PANEL MOUNTING SPACE: 63"
WIDTH: 22 $\frac{1}{4}$ " without side panels; 23 $\frac{1}{2}$ " with side panels.
DEPTH: 23 $\frac{5}{8}$ " with rear door; 24 $\frac{1}{8}$ " with front and rear door.
FINISH: Dark beige.
WEIGHT: (Maximum) 170 lbs.

ORDERING INFORMATION

Basic rack.....	994-6713-001
Side panel (fits right or left side).....	994-6714-001
Louvered top.....	994-6665-001
Door with louvers (fits front or rear, may be mounted to open right or left hand).....	994-6715-001
Door without louvers (fits front or rear, may be mounted to open right or left hand).....	994-6715-002
Fan kit.....	994-6717-001
Air filter (replacement).....	448-0288-001
Rear mounting angle kit (2 angles, No. 10 screws).....	994-6716-001

4 BY 1 RF MATRIX SWITCHER

The RF Matrix Switcher is designed to handle low level RF monitoring signals from 40 to 220 MHz. It contains relays to route signals from up to four RF monitoring probes into a common output.

Signals to the four inputs loop through the matrix and appear at the output only when a particular crosspoint is energized.

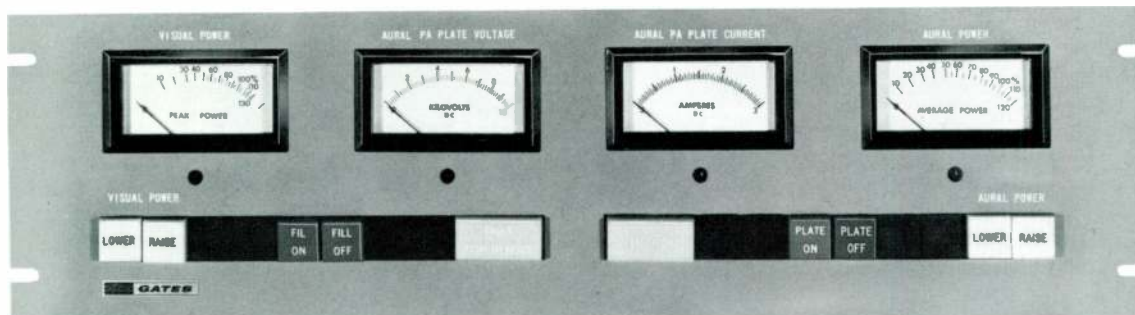
This enables RF probes to normally feed peak power indicators or test and monitoring equipment if the matrix crosspoints are activated.

The matrix may also be connected in reverse for feeding up to four test or monitoring inputs from one RF probe.

ORDERING INFORMATION

4 by 1 Matrix Switcher.....	994-6800-000
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Television Accessory Equipment



POWER CONTROL AND METERING PANEL

The Gates Power Control and Metering Panel affords complete operating control and monitoring of a television transmitter.

The panel allows the operator to control the aural and visual transmitters and make the required FCC meter readings at a point removed from the immediate transmitter location.

Four meters are included: visual power output meter, aural power output meter, PA plate voltage meter and aural PA plate current meter.

The control panel functions as an extension of the transmitter control logic and readily adapts itself for interfacing with a remote control system.

ORDERING INFORMATION

Power Control and Metering Panel.....

994-6796-000

TOTAL SYSTEMS ENGINEERING

Gates not only manufactures the most modern television transmitters available today, but also supplies complete transmitter systems. Gates is ready to provide every item needed in a transmitter installation from antenna to STL, along with highly qualified technical support.

Each television transmitter installation includes tower, antenna, transmission line, transmitter, input, terminal and test equipment. These items must be compatible to function as a successful installation.

Tower, antenna and transmission line equipment should be carefully chosen to form a matched system. Tower height, antenna radiation characteristics and transmitter power determine station coverage, and must be optimized to efficiently reach a maximum number of viewers. Test, input, terminal and STL equipment should be selected to provide highly efficient operation and maximum control of the transmitter input signal. Gates' professional team of system engineers will provide assistance in selecting a tailored system to meet specific installation requirements and budgetary limits.

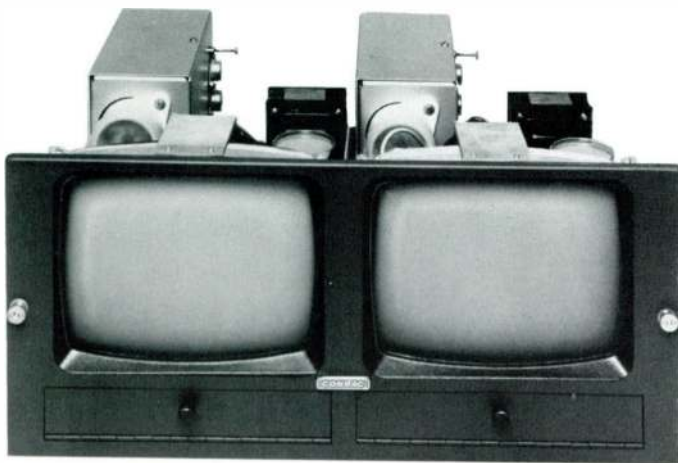
It is standard Gates procedure to test all television transmitters "on channel" at full rated power before shipment from the factory. After installation, every television transmitter receives on-site checkout by a field service engineer to certify proper installation and performance, and station engineers are given personalized instruction on transmitter operation.

Gates' staff of television field service engineers is immediately available to perform any on-site service from proof of performance to complete installation supervision. These engineers are equipped with the most modern test and measurement equipment to make complete on-site tests, including sophisticated antenna and transmission line measurements and analyses.

An extensive inventory of replacement parts is maintained throughout equipment service life. Emergency replacement parts and technical service are available on a continuous twenty-four hour basis.

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Television Monitors



RND9/2R

Conrac RND9 series 9-inch transistorized monitors have high reliability, low power drain, small size, and generate a minimum of heat which could affect other equipment. They are full broadcast quality video monitors designed for continuous duty operation from broadcast, industrial or computer generated signals.

The RND9 series features a 9-inch Conrac-manufactured rectangular tube with excellent geometry and small spot size, assuring crisp 800 line center resolution and 700 line corner resolution.

SPECIFICATIONS

INPUT POWER: 65 watts at 120/240 volts 60 Hz (525/60 U.S.) or 50 Hz (625/50 CCIR). All performance specifications will be met while the line voltage varies from 105 to 130 or 210 to 260 volts AC. A three-wire line cord, 6 feet long, is provided.

VIDEO SIGNAL: 0.3 volt p-p (minimum for 50 volts at kinescope). Sync negative at monitor input.

VIDEO INPUT IMPEDANCE: High impedance bridging (equivalent to 100K in parallel with 22 pF) can be terminated by an internal 75 ohm load ($\pm 1\%$) through a switch located on rear apron.

VIDEO RESPONSE: 10 MHz ± 1 dB. Differential gain below 5% with 75 volts kinescope drive.

DC RESTORATION: 100% or zero, sync tip clamp.

EXTERNAL SYNC: 1 to 8 volts. Parallel connectors. Monitor will operate from either composite video and sync signals or separate external composite sync.

LINEARITY: Within 2% of picture height.

TRANSISTORS: The RND9 monitors utilize 30 transistors and 26 diodes on glass epoxy circuit boards. The high voltage rectifier is a 1B3/1G3.

KINESCOPE: 9SP4, 9-inch kinescope with laminated safety shield.

WEIGHT: Net, 50 lbs. Shpg. wt. 60 lbs.



RHA19

Conrac's RHA19 is a compact, 100% solid-state, professional color monitor designed to meet rigid broadcast studio requirements. It is available in a cabinet model, for mounting on slides in 19" racks (taking up only 21" of vertical space), or for pedestal or ceiling mounting. Its all solid-state circuitry provides maximum stability, long life, low power drain (250 watts) and a minimum of heat. Its modular design and quick-disconnect circuit boards permit rapid replacement of circuits and ease of maintenance.

A precision decoder allows reduction in operating controls to "Contrast" and "Brightness", while calibrated controls offer "pre-set" chroma and brightness positions. Both features make the RHA19 a standard for color setup.

SPECIFICATIONS

INPUT POWER: 250 watts at 120/240 volts 60 Hz (525/60 N.T.S.C.) or 50 Hz power input optional. All performance specifications will be met while the line voltage varies from 105 to 130 or from 210 to 260 volts AC. A three-wire line cord, six feet long, with twist lock disconnect, is furnished.

VIDEO SIGNAL: 0.35 volts p-p minimum. Sync negative at monitor input.

VIDEO INPUT IMPEDANCE: Two, high impedance bridging. Each can be terminated by an internal 75 ohm load through a switch located on the rear apron.

EXTERNAL SYNC: High impedance, 1-8 volts p-p, sync negative. Parallel co-ax input connectors.

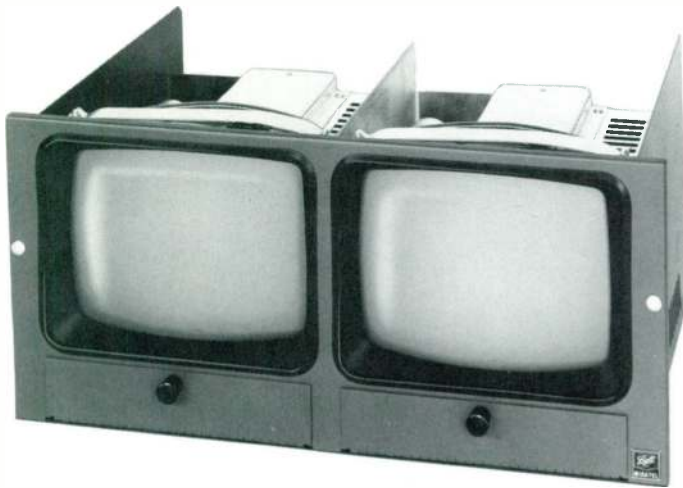
VIDEO RESPONSE: Flat to 5 MHz in black and white position. A 3.58 MHz trap is automatically switched in during color operation while frequencies above 3.58 MHz are rolled off. Variable aperture correction from front panel controls.

LINEARITY: Within 2% of picture height.

KINESCOPE: A 19GWP22 tube, incorporating an etched laminated safety shield.

WEIGHT: Net, 101 lbs. Shpg. wt. 127 lbs.

Television Monitors



TE-9

Ball Brothers Research Corporation's TE-9 black and white monitor is a low cost, solid-state video monitor designed for utility applications in broadcast television, instructional television, visual information display and security television systems where reliability and high quality video reproduction are desired. The monitors feature a 9-inch "T-banded" cathode ray tube, with the remaining circuitry of solid-state construction.

SPECIFICATIONS

ELECTRICAL

Video Amplifier

INPUT IMPEDANCE: 15K ohms HI-Z—75 ohms LOW-Z.

INPUT CONNECTOR: UHF—looping.

INPUT LEVEL: 0.3 V to 2.0 V p-p.

DIFFERENTIAL GAIN: 5% maximum (linear mode) at 20 V p-p output.

DC RESTORER: Diode type.

VIDEO OUTPUT AMPLIFIER: Adjustable for different levels of gray scale definition or normal television signals.

BANDWIDTH: 10 MHz (—3 dB).

Synchronization

EXTERNAL SYNC CONNECTOR: Optional (UHF looping with rear panel external/internal switch; input level, 1.0 V to 4.5 p-p).

Display

PICTURE TUBE: 9-inch rectangular aluminized.

RESOLUTION: 600 lines at 40 ft. Lamberts.

GEOMETRIC DISTORTION: 2% maximum.

Power Supply

INPUT VOLTAGE: 105 V to 130 V rms., 60 Hz.

INPUT POWER: 45 watts.

MECHANICAL

CHASSIS SIZE WITH CRT (NOMINAL): Height, 8 $\frac{3}{4}$ " ; Width, 8 $\frac{3}{8}$ " ; Depth, 9 $\frac{5}{8}$ " .

CABINET SIZE (NOMINAL): Height, 9 $\frac{3}{8}$ " (includes $\frac{1}{4}$ " for handle and $\frac{3}{8}$ " for feet); Width, 8 $\frac{1}{16}$ " ; Depth, 10 $\frac{1}{16}$ " .

WEIGHT: Approximately 12 lbs. for chassis with CRT. Approximately 15 $\frac{1}{2}$ lbs. for chassis with CRT and cabinet.



TCB-14R

Ball Brothers' TCB-14R color broadcast monitor is a transistorized, high performance monitor designed to solve two of the studio engineer's basic problems: placement and accessibility of controls. Brightness, contrast and on/off controls are located on the front panel of the TCB-14R. All other controls are located on an extendible printed circuit card located immediately behind the front control panel. A lock on the front control panel makes the controls on the extendible PC card virtually tamper-proof.

SPECIFICATIONS

VIDEO

INPUT LEVEL: 0.3 to 2.0 V p-p, sync negative.

INPUT IMPEDANCE: Switch selectable—15K ohms looping or 75 ohms terminated.

FREQUENCY RESPONSE: Amplifiers compensated for flat frequency response at face of CRT. For color, a trap is switched in to attenuate all frequencies above 3.58 MHz.

APERTURE CORRECTION: Variable.

DISPLAY

CRT: 15LP22, high brightness phosphors.

INTERLACE: 2:1 positive.

GEOMETRIC DISTORTION: Less than two percent.

FILAMENT: DC, regulated.

POWER

INPUT: 120 volts ± 10 percent 60 Hz and 400 Hz. 170 watts nominal.

GENERAL

TALLY LIGHT: Panel lamp with numbering provisions (external power required.)

EXTERNAL SYNC: Bridging internal/external switch selected, 4.0 volt nominal, ± 6 dB.

ENVIRONMENTAL

TEMPERATURE: 10°C to 45°C.

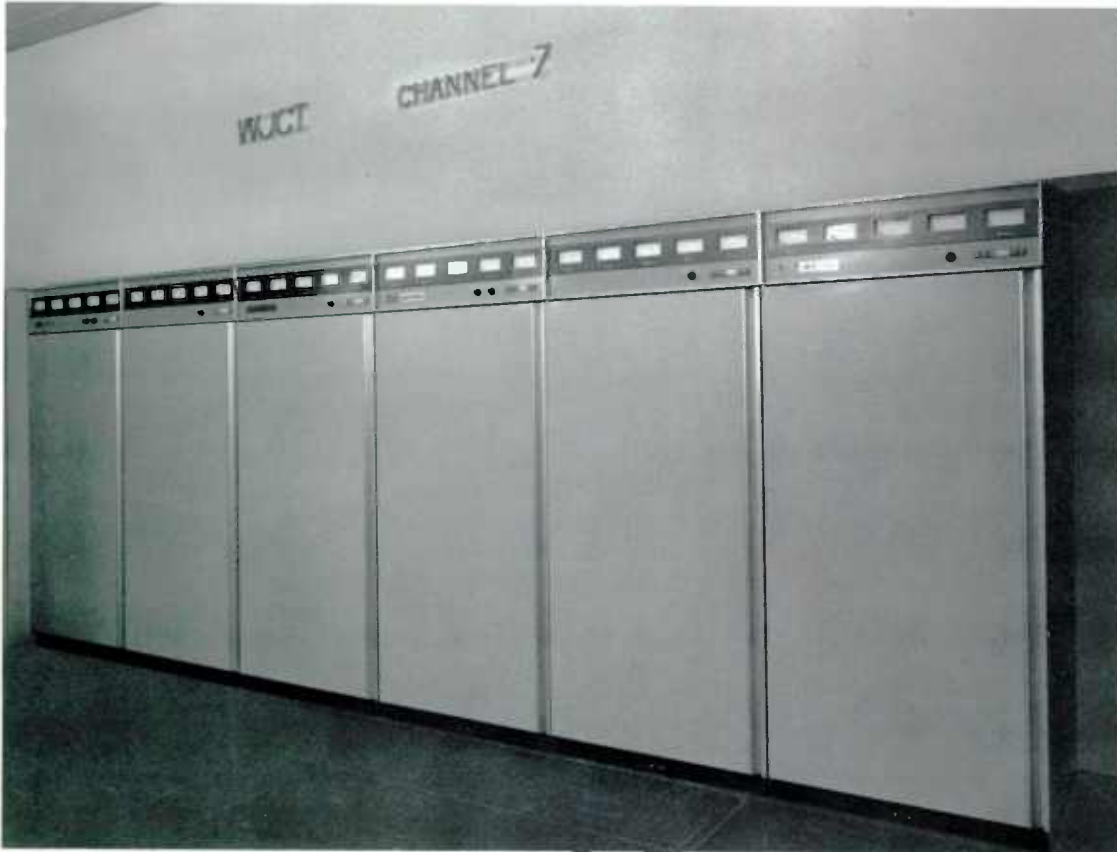
DIMENSIONS

SIZE: Height, 10 $\frac{1}{2}$ " ; Width, 19" ; Depth, 17 $\frac{1}{2}$ " excluding connectors.

WEIGHT: 60 pounds.



Television Installations



▲
A typical dual transmitter installation of parallel Gates BT-18H, 18 kW high band television transmitters at WJCT-TV, Jacksonville, Florida. The visual and aural sections of both transmitters operate in parallel for normal operation. Either transmitter may be operated independently into the antenna or a test load during an emergency condition by selecting the desired configuration on a push-button panel.



▶
Gates BT-35H, 35 kW high band television transmitter installation at WGEM-TV, Quincy, Illinois. Gates' compact modular construction allows maximum utilization of valuable floor space. Independent visual power amplifiers and solid-state IF exciters provide highly reliable operation.

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