8. OPERATIONAL DESCRIPTION - MODEL Axcera-325A

8.1 General Description

The 325A is a complete 500-watt VHF solid-state internally diplexed television transmitter. It operates at a nominal visual output power of 500 watts peak sync and an average aural output power of 50 watts, at an A/V ratio of 10 dB, 10% sound, or 25 watts at 13 dB, 5% sound.

8.2 Technical Specifications

Type of Emissions:
- Visual 5M75C3F
- Aural 250KF3E

Frequency Range ..... 54 MHz to 88 MHz (any 6-MHz channel)

Output Power
- Visual .....250 to 500 watts peak sync (front panel adjustable)
- Aural ..... ≤50 watts average

Maximum Power Rating
- Visual .....500 watts peak visual
- Aural .....50 watts average aural

Power Consumption .....3500 watts

8.3 Performance Specifications

Visual Performance

Operating Frequency Range .....54 MHz to 88 MHz

RF output - Nominal:
- Power..... 500 watts peak sync
- Impedance..... 50 ohms
- Connector.....Type N

Video Input:
- Level..... 1 volt peak to peak
- Impedance.....75 ohms bridging

Visual Sideband Response:
- From -0.5 MHz to +3.58 MHz..... ±0.5 dB
- 3.58 MHz to 4.18 MHz..... +.5, -1.0 dB
- Below -1.25 MHz .....-20 dB
- Above +4.75 MHz .....-30 dB

Variation of Frequency Response with Brightness ..... +0.5 dB
Differential Phase..... ±3°
Incidental Phase Modulation..... ±3°
Differential Gain.....5%
Low Frequency Linearity 5%

Intermodulation Distortion .....-52 dB
Amplitude Variation Over One Field.....2%
Regulation Of Output.....3%
Envelope Delay vs. Frequency ..... Per FCC curves
2T Pulse.....2%
12.5T Pulse 5%
Modulation Capability 1%
AM Noise ..... -55 dB
Harmonic Emission.....-60 dB
Spurious Emission.....-60 dB
Carrier Frequency Stability..... ±250 Hz

Aural Performance

RF Output – Nominal
Power.....≤50 watts
Impedance..... 50 ohms
Connector.....Type N
Aural Input:
Impedance..... 600 ohms
Level..... +10 dBm
Amplitude vs. Frequency Response ..75 microseconds pre-emphasis ±0.5 dB
Audio Harmonic Distortion 0.5%
Noise:
AM.....-55 dB
FM .....-60 dB
Aural to Visual Carrier Separation .....4.5 MHz, ±100 Hz
Modulation Capability .....±100 kHz
Subcarrier Input .....+10 dBm for 25 kHz deviation

Electrical Requirements

Power Line Voltage.....208 volts to 240 volts, 50/60 Hz
Power Consumption .....3500 watts, black picture

Environmental

Maximum Altitude.....8,500 feet
Ambient Temperature.....0°C to +50°C

Mechanical

Dimensions:
Width ..... 19 inches
Depth..... 22 inches
Height ..... 14 inches
Weight ..... 65 lbs

8.4. System Overview

The 325A (1063850) is made up of the trays and assemblies listed in Table 8-1.

Table 8-1. 425A Major Trays and Assemblies

MAJOR ASSEMBLY DESIGNATOR	TRAY/ASSEMBLY NAME	DRAWING NUMBER
A2	AC distribution panel	1265-1600
A4	VHF exciter	1070820
A6 and A7	Two VHF amplifier trays	1198-1600
A8	VHF combiner assembly	1198-1010 (ch. 2-4) 1122-1002 (ch. 5-6)
A9	Bandpass filter assembly	1088669
A12	Remote interface assembly	1083510

The (A4) VHF exciter can operate using either the baseband audio and video inputs alone or, if the (optional) 4.5-MHz composite input kit is purchased, the 4.5-MHz composite input or the baseband video and audio inputs to produce a diplexed, modulated, and on-channel frequency visual + aural RF output. The switching is accomplished by a relay on the sync tip clamp/modulator board that uses a baseband select to control a relay that chooses either the 4.5 MHz generated from the baseband inputs or from the 4.5-MHz composite input.

To operate the transmitter with the (optional) 4.5-MHz composite input kit using baseband inputs, the baseband video must be connected to J1 or J2; the baseband audio must be connected to the proper input jack; and a baseband select must be connected from J7-6 and J7-7. To operate the transmitter with the (optional) 4.5-MHz composite input kit using the 4.5-MHz composite input, the 4.5-MHz composite input must be connected to J1 or J2 and the baseband select must be removed from J7-6 and J7-7.

The RF output of the VHF exciter is split two ways in (A5) the 2-way power splitter assembly (ZFSC-2-2). The outputs of the splitter feed the two (A6 and A7) VHF amplifier trays that amplify the RF signals to approximately 300 watts each. The outputs of the two VHF amplifier trays are combined in (A8) the VHF combiner that provides approximately 500 watts peak of sync output. The 500-watt output is connected to (A9) a bandpass filter assembly. The bandpass filter is tuned to provide the high out-of-band rejection of unwanted products. The filtered signal is connected to A9-A5, a coupler assembly that provides a forward and a reflected power sample to the visual/aural metering board in the VHF exciter. The forward sample is processed to provide peak detected visual and aural power output samples to the transmitter control board in the VHF exciter. The reflected power sample is also peak detected and wired to the transmitter control board. The transmitter control board connects the visual, aural, and reflected power output samples to the front panel meter to monitor the system.

In the VHF amplifier tray, a forward power sample and a reflected power sample from the 4-way combiner board are connected to the dual peak detector board, single supply. This board provides peak-detected forward samples to the amplifier control board and supplies the samples to the front panel meter of the tray.

8.5 Control and Status

Control and status information for the transmitter is provided by the meter and LED indicators on the front panel of the VHF exciter. The switches and LED indicators are

part of (A17) the transmitter control board that is mounted so that the switches and LEDs can be operated or viewed from the front panel of the VHF exciter.

Switch S1 is an Operate/Standby switch that controls the output of the transmitter by providing the enables that, when the transmitter is in Operate, are needed to turn on the switching power supplies in the two VHF amplifier trays. In Operate, the green LED DS2 is on and in Standby the amber LED DS1 is on. If the transmitter does not switch to Operate when S1 is switched to Operate, check that a dummy jumper plug, with a jumper between pins 23 and 24, is connected to jack J11 on the back of the tray. The jumper plug must be connected to A12-J9 when the (optional) remote interface panel is used. This jumper provides the interlock needed for the transmitter to operate. If the interlock is present, the green LED DS5 should be lit.

Switch S2 is an Automatic/Manual switch that controls the operation of the transmitter by the presence of the video input signal. When the switch is in Automatic, the green LED DS3 is lit and, if the video input signal to the transmitter is lost, the transmitter will automatically switch to Standby. When the video input signal returns, the transmitter will automatically switch back to Operate. In Manual, the amber LED DS4 is lit and the operation of the transmitter is controlled by the front panel switches. During normal operation of the transmitter, switch S2 should be in the Auto position. The front panel of the VHF exciter also has LEDs that indicate a Video Fault (Loss; red LED DS9) and VSWR Cutback (amber LED DS7).

8.5.1 VHF Exciter Tray

Table 8-2. VHF Exciter Tray Meters

METER	FUNCTION	
Meter (A4-A18)	This meter reads power in terms of a percentage of the calibrated output power level on the upper scale. The voltage level or frequency level is read on one of the bottom two scales. A full-scale reading on the top scale is 120%. 100% is equivalent to the full-rated 500 watts peak of sync visual. The meter also reads % Aural Power, % Exciter Power, % Reflected Power, audio levels, video levels, and the ALC reading.	
	With Switch S3 in Position	*Display*
	Switch S3, Meter	Selects the desired ALC voltage reading, % Exciter Power, % Reflected Power, % Visual Power, % Aural Power, video level, or audio level.
	Audio (0 to 100 kHz)	Reads the audio level, ±25 kHz balanced or ±75 kHz composite, on the 0 to 10 scale. Will indicate baseband audio, if it is connected to the transmitter, even with the video + 4.5-MHz SCA input selected.
	ALC (0 to 10 volts)	Reads the ALC voltage level, .8 VDC, on the 0 to 10 scale.
	% Exciter (0 to 120)	Reads the % Exciter Output Power Level needed to attain 100% output of the transmitter on the top scale.
	% Aural Power (0 to 120)	Reads the % Aural Output Power of the transmitter, 100% = 100 watts at 10 dB A/V ratio, on the top scale.
	% Visual Power (0 to 120)	Reads the % Visual Output Power of the transmitter, 100% = 500 watts peak of sync, on the top scale.
	% Reflected (0 to 120)	Reads the % Reflected Output Power, <5%, on the top scale.
	Video (0 to 1 volt)	Reads the video level, at white, on the bottom 0 to 10 scale.

Table 8-3. VHF Exciter Tray Switches

SWITCH	FUNCTION
Transmitter S1 Operate/Standby	The momentary switch S1 applies a ground to K1, a latching relay on the transmitter control board. K1 will switch either to Operate or to Standby depending on which direction S1 is pushed. When switched to Operate, the low, Enable commands are applied to the four VHF amplifier trays. These enables will turn on the VHF amplifier trays. The opposite occurs when the switch is turned to Standby.
Mode Select S2 Auto/Manual	The momentary switch S2 applies a ground to K2, a latching relay on the transmitter control board. K2 will switch the transmitter to Automatic or Manual depending on which direction S2 is pushed. In Automatic, the video fault command from the ALC board will control the operation of the transmitter. The transmitter will switch to Standby, after a slight delay, if the input video is lost and will switch back to Operate, quickly, when the video is restored. In Manual, the transmitter is controlled by the operator using the front panel Operate/Standby switch or by remote control.
Power Adjust (R1)	The 5-kΩ pot A20 sets the ALC level on the ALC board that sets the output power of the transmitter.

Table 8-4. VHF Exciter Tray Fault Indicators

INDICATOR	DESCRIPTION
Video Loss (DS9 Red)	Indicates that the video input to the transmitter has been lost. The fault is generated on the ALC board in the VHF exciter tray.
VSWR Cutback (DS7 Amber)	Indicates that the reflected power level of the transmitter has increased above 20%; this automatically cuts back the output power level to 20%. The fault is generated on the transmitter control board in the VHF exciter tray.

Table 8-5. VHF Exciter Tray Samples

SAMPLE	DESCRIPTION
f(IF)	A sample of the visual IF that is taken from the sample jack on the IF carrier oven oscillator board.
f(IC)	A sample of the intercarrier signal that is taken from the sample jack on the aural IF synthesizer board.
f(s)	A sample of the channel oscillator output that is taken from the sample jack of the channel oscillator assembly.
Exciter O/P	An output power sample of the exciter that is taken from the VHF filter/amplifier board.
Transmitter O/P	A forward power sample of the transmitter that is taken from the visual/aural metering board.

8.5.2 600-Watt Amplifier Tray

Table 8-6. 600-Watt Amplifier Tray Switches

SWITCH	FUNCTION	
On/Off Circuit Breaker CB1	Switches 220 VAC through a 7.5-amp circuit breaker-type protection device. The switch lights if AC is present. The AC is applied to the switching power supply in the tray.	
Switch S1, Meter	Selects the desired % Visual Forward Output Power, % Visual Reflected Power reading, AGC Voltage, Power Supply Voltage, or Current	
	With Switch S1 in Position	***Display***
	% Forward	Reads the % Forward Output Power of the tray (100% = 300 watts peak of sync + aural)
	% Refl (Reflected)	Reads the % Reflected Output Power (<10%)
	AGC Voltage	Reads the AGC level of the tray (1 to 2 VDC)
	Power Supply	Reads the voltage from the switching power supply (+48 VDC)
	Current	Uses switch S2 to indicate the current of transistor devices
Switch S2, Meter	Selects the current of the transistor devices on the high band amplifier boards. S1 must be in the Current position.	
	With Switch S2 in Position	***Display***
	I_1	Reads the current of (A4-A1) the high band amplifier board (idling current ≈ 2 amps and operating current ≈ 5 amps [black picture])
	I_2	Reads the current of (A4-A2) the high band amplifier board (idling current ≈ 2 amps and operating current ≈ 5 amps)
	I_3	Reads the current of (A4-A3) the high band amplifier board (idling current ≈ 2 amps and operating current ≈ 5 amps)
	I_4	Reads the current of (A4-A4) the high band amplifier board (idling current ≈ 2 amps and operating current ≈ 5 amps)

Table 8-7. 600-Watt Amplifier Tray Fault Indicators

INDICATOR	DESCRIPTION
Overdrive (DS1)	Indicates that the level of drive is too high. The protection circuit will limit the drive level to the set threshold. The fault is generated on the overdrive protection board.
Enable (DS2)	Indicates that the enable supplied by the exciter tray is present
Module Status (DS3)	Indicates that the forward power sample level is lower than the set reference level
VSWR Cutback (DS4)	Indicates that the reflected level of the tray has increased above 20%; this will automatically cut back the output power of the tray. The fault is generated on the AGC control board.
Overtemp (DS5)	Indicates that the temperature of (A4-A5, A4-A6, or A5-A2) the thermal switch is above 80° C. When this fault occurs, the enable to the switching power supply is immediately removed.

Table 8-8. 600-Watt Amplifier Tray Control Adjustments

ADJUSTMENT	DESCRIPTION
Phase (A7-R2)	Adjusts the phase of the RF output by approximately 70%
Gain (A6-R3)	Adjusts the gain of the RF output when the amplifier control board is in the AGC mode

Table 8-9. 600-Watt Amplifier Tray Sample

SAMPLE	DESCRIPTION
RF Front Panel Sample	Forward power sample of the tray from the AGC control board

8.6 Input and Remote Connections

The baseband video and audio inputs alone or, if the (optional) 4.5-MHz composite input kit is purchased, the 4.5-MHz composite input or the baseband video input and audio input to the transmitter, connect to the rear of the VHF exciter tray. The baseband video input or the 4.5-MHz composite input connects to jacks J1 or J2, which are loop-through connected. The baseband audio input connects to TB1 for balanced audio or to jacks J3 or J13, which are loop-through connected, for composite, stereo, audio. To use the 4.5-MHz composite input kit, the baseband audio can remain connected to the VHF exciter even if the 4.5-MHz composite input kit is used, but the baseband video must be disconnected from J1 or J2 and the 4.5-MHz composite input must be connected to J1 or J2. The baseband select command must be removed from J7-6 and J7-7.

The remote connections listed in Table 8-10 are made to (A12) the A/V input and remote interface assembly. The remote connections are made to jacks J9 and J10 on the assembly. Refer to the interconnect drawing (1076203) for the proper pin remote connections.

Table 8-10. VHF Exciter Remote Interface Connections with the A/V Input and Remote Interface Assembly

FUNCTION	REMOTE JACK/PIN NUMBER	INTERFACE TYPE
Transmitter Enable Interlock	J9-21	J9-21 and J9-22 must be jumpered together for normal operation; (1176-1038) the jumper jack should be used.
Transmitter Enable Interlock Rtn.	J9-22	
Remote Control Commands		
Transmitter Standby (Disable)	J9-9	Contact closure
Transmitter Standby/Operate Rtn.	J9-10	
Transmitter Operate (Enable)	J9-11	Contact closure
Transmitter Manual	J9-15	Contact closure
Transmitter Auto/Manual Rtn.	J9-16	
Transmitter Auto	J9-17	Contact closure
Power Level Raise (Optional)	J9-27	Contact closure
Pwr Lvl Raise/Lower Rtn (Optional)	J9-28	
Power Level Lower (Optional)	J9-29	Contact closure
Modulator Select (Optional)	J9-31	Contact closure
Modulator Select Rtn (Optional)	J9-32	
Remote Status Indications		
Transmitter Operate (Enable) Ind.	J9-12	50 mA max current sink
Operate/Standby Ind. Return	J9-13	
Transmitter Standby (Disable) Ind.	J9-14	50 mA max current sink
Transmitter Auto Indicator	J9-18	50 mA max current sink

FUNCTION	REMOTE JACK / PIN NUMBER	INTERFACE TYPE
Auto/Manual Indicator Return	J9-19	
Transmitter Manual Indicator	J9-20	50 mA max current sink
VSWR Cutback Indicator	J9-23	50 mA max current sink
VSWR Cutback Indicator Return	J9-24	
Video Loss (Fault) Indicator	J9-25	50 mA max current sink
Video Loss (Fault) Ind. Rtn.	J9-26	
Receiver Fault (Optional)	J9-30	
Remote Metering		
Visual Output Power	J9-1	1V full scale at 1kΩ source resistance
Visual Output Power Rtn	J9-2	
Aural Output Power	J9-3	1V full scale at 1kΩ source resistance
Aural Output Power Rtn	J9-4	
Reflected Power	J9-5	1V full scale at 1kΩ source resistance
Reflected Power Rtn	J9-6	
Exciter Output Power	J9-7	1V full scale at 1kΩ source resistance
Exciter Output Power Rtn	J9-8	

The remote connections shown in Table 8-11 are made to (A12) the A/V input and remote interface assembly. These remote connections are made to jacks J9 and J10 on the assembly. Refer to the interconnect drawing (1076203) for the proper pin remote connections.

Table 8-11. VHF Amplifier Tray Remote Interface Connections with the A/V Input and Remote Interface Assembly

FUNCTION	REMOTE JACK / PIN NUMBER	INTERFACE TYPE
Forward Output Power (A6) VHF Amp	J10-1	1V full scale at 1kΩ source resistance
Forward Output Power (A6) Rtn	J10-2	
Reflected O/P Power (A6) VHF Amp	J10-3	1V full scale at 1kΩ source resistance
Reflected O/P Power (A6) Rtn	J10-4	
Forward Output Power (A7) VHF Amp	J10-6	1V full scale at 1kΩ source resistance
Forward Output Power (A7) Rtn	J10-7	
Reflected O/P Power (A7) VHF Amp	J10-8	1V full scale at 1kΩ source resistance
Reflected O/P Power (A7) Rtn	J10-9	

8.7 AC Input

The transmitter needs an AC input of 220 VAC at 40 amps connected to it in order to operate. The 220 VAC input connects to (A2) the AC distribution panel in the upper-middle rear of the cabinet. The panel contains terminal block TB1 that connects to the 220 VAC.

The AC distribution panel contains four circuit breakers that supply the AC to the rest of the transmitter. The input AC is connected to the main AC circuit breaker CB1 (40 amps) that distributes the 220 VAC to the terminal block TB2. TB2 has three metal-oxide varistors (MOVs), VR1, VR2, and VR3, mounted to the terminal block: one MOV is connected from each leg of the input AC to ground and another is connected across the two legs. The input AC is wired from TB2 through three circuit breakers, CB2, CB3, and CB4, to the rest of the transmitter. CB2 is a 10-amp circuit breaker that supplies the AC voltage to (A2-A1) the IEC outlet strip that is connected into the VHF exciter, the (optional) receiver tray, and any other optional accessories. CB3 is a 20-amp circuit breaker that supplies AC through J5 to (A6) the VHF amplifier tray. CB4 is a 20-amp circuit breaker that supplies AC through J6 to (A7) the VHF amplifier tray. When the VHF exciter circuit breaker is switched on, +12 VDC is supplied to the VHF amplifier trays for the operation of the LED status indicators in the tray.