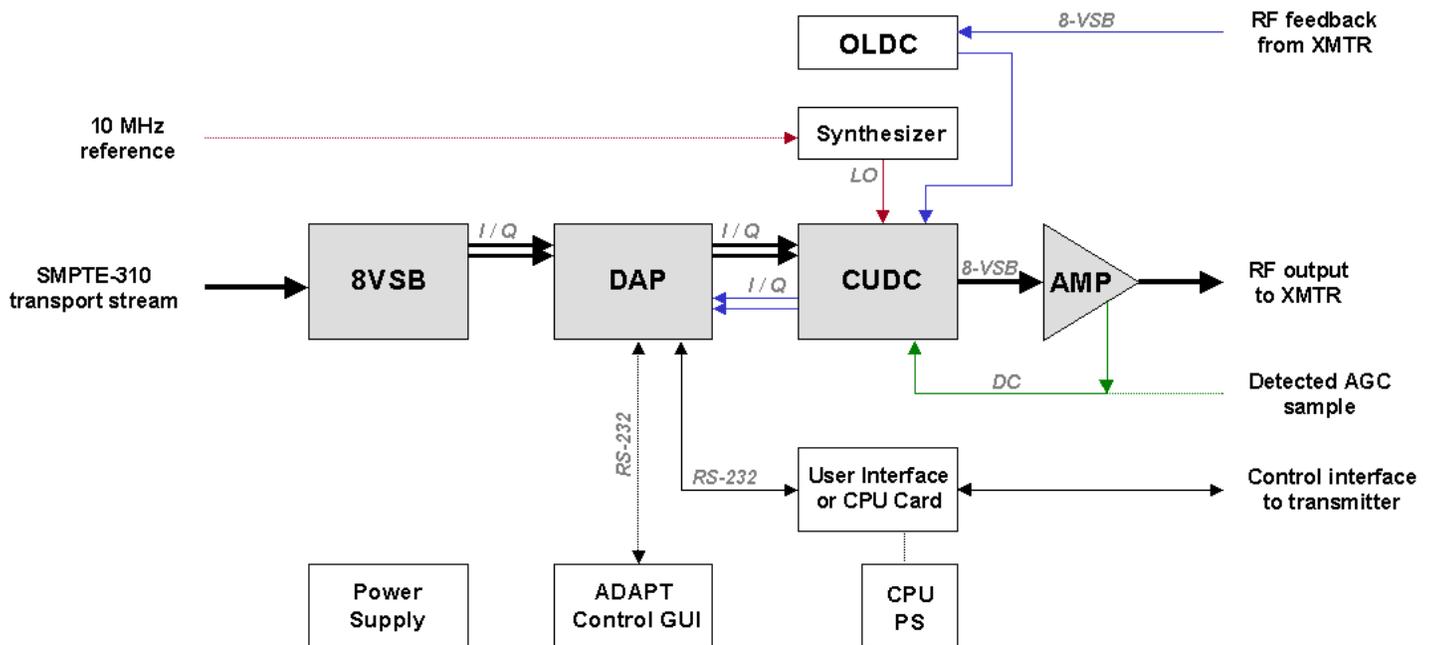


COMARK

Communications

ADAPT™ USER'S GUIDE



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ADAPT User's Guide

This ADAPT User's guide contains information and instructions necessary to safely operate the ADAPT exciter. This section provides an overall physical description of the ADAPT exciter, a theory of operation, and operational procedures.

1 Introduction

The ADAPT™ Advanced Digital Adaptive Pre-correction Technology exciter converts an MPEG digital signal stream into a low-power 8-VSB modulated RF signal compliant to Advanced Television Standards Committee (ATSC) standards. This low-power RF signal is used to drive subsequent power amplification stages in the transmitter. The ADAPT exciter incorporates Digital Adaptive Precorrection (DAP) technology, which applies complementary pre-distortion to the RF drive signal to effectively cancel the linear and non-linear distortions produced by the transmitter power amplifier and channel filter systems.

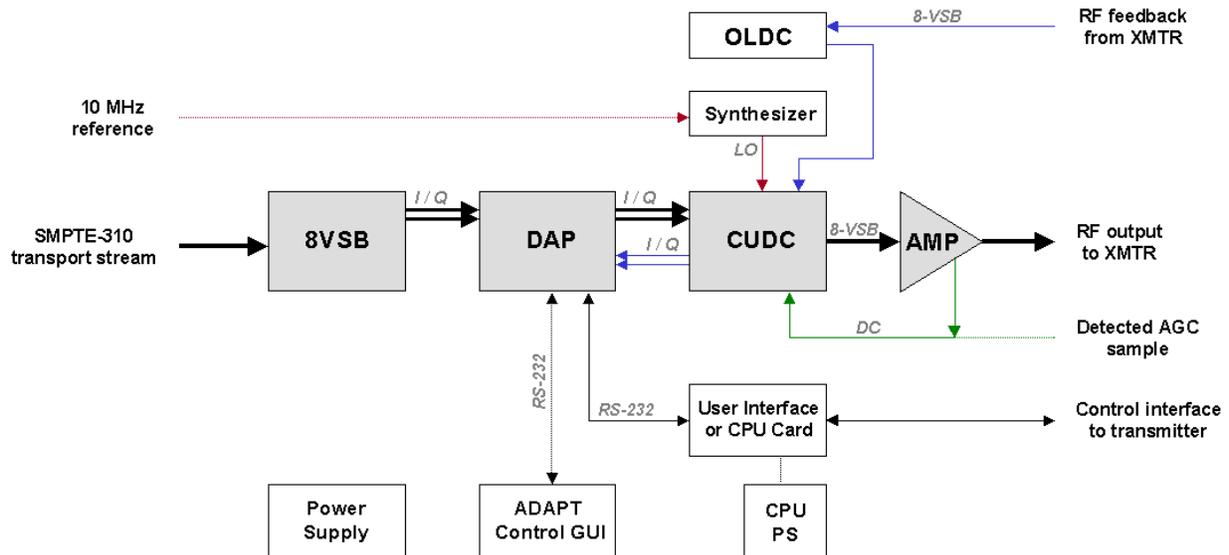
2 Physical Description

The ADAPT exciter is comprised of a series of plug-in modules packaged in a standard 19" rack mount chassis with a 6U height. Access to the module adjustments and indications are gained by opening the front cover. Connectivity to the transmitter is via connectors on a series of backplane circuit boards. The backplanes, covered by ground planes on both sides act as RF shielding for the chassis.

CAUTION: The ADAPT Exciter is designed to operate with external cooling. This cooling is typically provided by a fan tray located immediately above or immediately below the exciter in the transmitter cabinet. If the exciter must be operated outside of the cabinet, a single rack fan-pack unit should be mounted above or beneath the ADAPT. These racks are available for purchase from Comark.

The exciter may ship with perforated top and bottom metal covers. These covers should be removed upon installation to maximize airflow for cooling. Consult Service Bulletin 030413 for more details.

3 Theory of Operation



An encoded MPEG video signal, in the form of a SMPTE-310 compliant 19.39 Mbit/sec serial data stream, is input to the ADAPT exciter at the rear of the 8-VSB module via rear panel connector J9.

The **8-VSB** module takes the input signal and performs the following processes as required by the ATSC television standard:

- Removal of the MPEG sync byte
- Data randomization
- Reed-Solomon encoding
- Data interleaving
- Trellis coding
- Segment and field sync insertion
- Symbol mapping
- Pilot insertion
- VSB filtering

The symbol clock of the exciter is locked to the input transport stream by the 8VSB module. A front panel LED indicates if this lock fails to occur due to clock tolerance problems in the incoming stream.

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The 8-VSB module outputs two digital baseband signals, each representing one half of the full 8-VSB signal: the in-phase (I) and quadrature (Q) signals. When properly combined, these two signals form the complete two-dimensional 8-VSB signal constellation. The I and Q baseband signals are passed to the DAP module for further signal processing. These signals are still in the digital domain, but analog samples are available for monitoring purposes via rear panel connectors J12 and J13.

The **Digital Adaptive Precorrection (DAP)** module is the heart of the ADAPT exciter. It receives the I and Q output of the 8-VSB modulator as well as a digitized transmitter output feedback sample in baseband I and Q format from the CUDC module. These signals are compared in order to calculate the correction required to compensate for the overall transmitter system distortion. This pre-correction takes the form of *non-linear* correction, based on a transfer curve look-up table (LUT) algorithm, and *linear* correction, based on a transversal delay line equalizer known as the Adaptive Linear Equalizer (ALE). The **non-linear LUT corrector** minimizes adjacent channel sidebands by compensating for non-linearities in the amplifying stages of the transmitter. The **linear ALE corrector** maximizes demodulated Signal to Noise Ratio (SNR) by compensating for the linear distortions in frequency response and group delay caused by the RF mask filter at the transmitter output. The outputs of the DAP module are pre-corrected I and Q baseband signals, which are sent to the CUDC module for up-conversion to RF frequencies.

In addition to the application of signal pre-correction, the DAP acts as the main controller for the rest of the ADAPT Exciter. The DAP microprocessor is used for a variety of measurements and diagnostics. The **ADAPT Control** GUI software program operates on an external PC and connects to the DAP microprocessor via a front panel RS232 connection. ADAPT Control allows the user access to many advanced features in the ADAPT exciter.

The **Complex Up/Down Converter (CUDC)** module performs two functions: Firstly, it receives the precorrected I and Q baseband signals from the DAP module and upconverts them to VHF or UHF frequencies to form a single on-channel 8-VSB RF signal. Secondly, it receives an RF feedback signal from a transmitter output sample and converts it to digital baseband I and Q signals to send back to the DAP module. The on-channel RF signal from the CUDC module is sent to the Output Amplifier module for final amplification.

The **Output Amplifier** module amplifies the on-channel RF signal from the CUDC module to an appropriate output level. There are three amplifier types depending on the frequency band and transmitter power level. The output amplifier will have either 24dB or 36dB gain depending on the application. The final on-channel signal exits the exciter at rear panel connector J23.

The **RF LO Synthesizer** module provides a local oscillator (LO) RF carrier to the CUDC module at a frequency equal to the center frequency of the desired channel. It is locked to a 10MHz reference signal, which may come from an internal reference oscillator or an external GPS (Global Positioning Satellite) precision reference.

The **On-Line Demodulator Calibration (OLDC)** module (optional) automatically fine tunes the modulator and demodulator sections of the CUDC module, via the **OLDC and OLMC correction routines**, to optimize the results obtained from the LUT and ALE pre-correctors and maximize the overall transmitted signal quality. When the OLDC module is not present, the CUDC modulator and demodulator sections may still be optimized by manual means via the ADAPT Control GUI, supplied free of charge by Comark.

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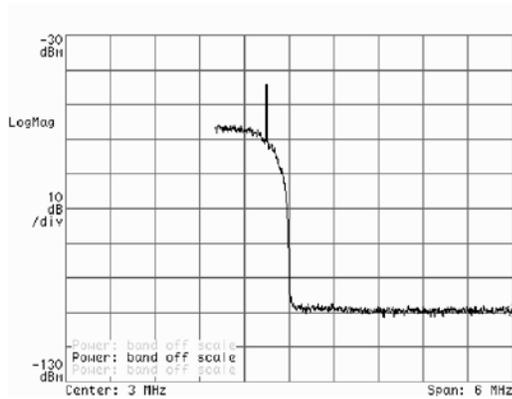
The **Power Supply** module supplies three separate DC voltages (+5V +12V, and -12V) to each module (except the output amplifier) in the ADAPT. The supply automatically switches to 120VAC/50-60Hz or 220VAC/50-60Hz.

Unlike other exciter modules, the Output Amplifier module has its own internal power supply.

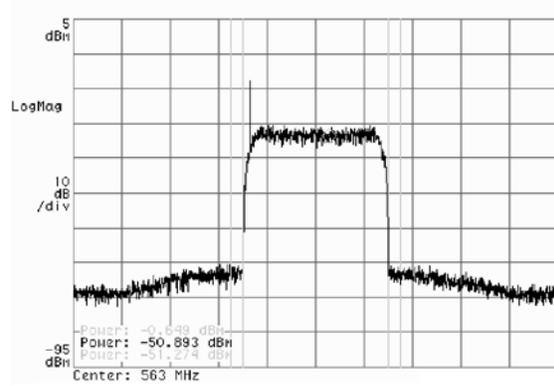
For IOT-equipped and Affinity solid state transmitters, the **User Interface** module provides local control of exciter operations such as an on/off and power raise/lower. This module acts as a control interface between the exciter and the rest of the transmitter.

For the Optimum and Ultimate family of solid state transmitters, a **Central Processor Unit (CPU)** card provides control of the entire transmitter. User control of the exciter and entire transmitter is via an illuminated control screen, external to the exciter chassis. An additional **CPU Power Supply** module provides +5V and +24V voltages to the CPU card.

A series of backplane boards connect all system components together both mechanically and electrically. Most external interfaces are made through these boards. The main exciter backplane is common to all transmitter types, while the CPU (module) or User Interface (module) backplane boards will vary according to transmitter type.



I or Q baseband sample at J12 or J13.

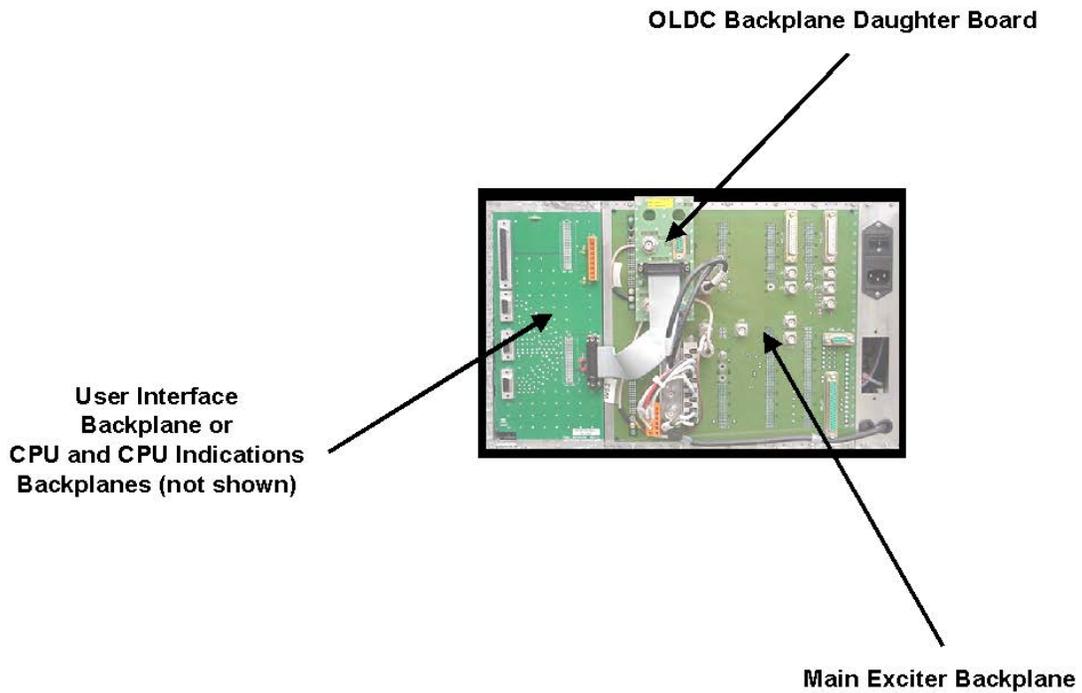
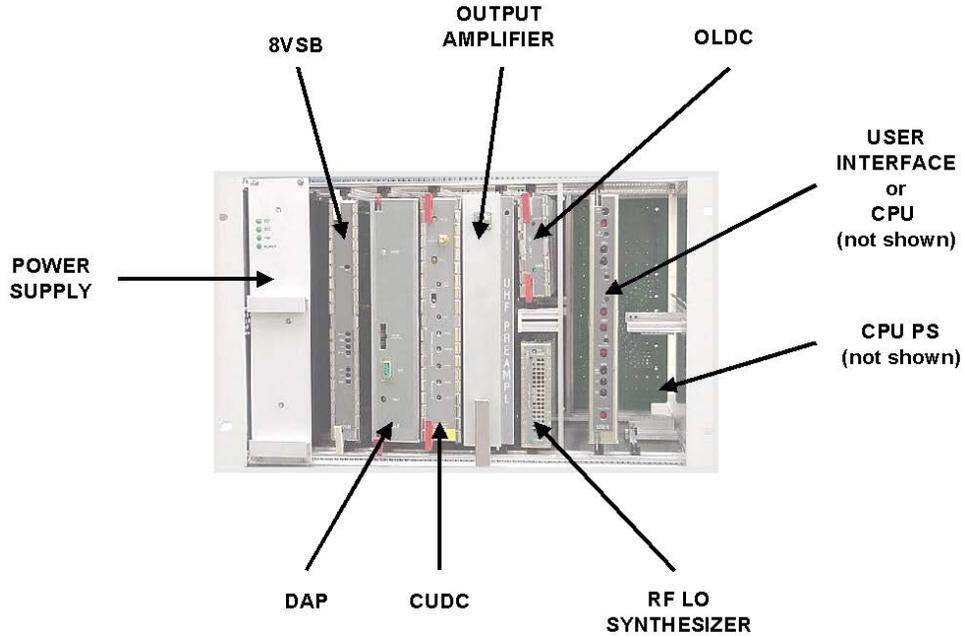


Final exciter output at J23 with non-linear LUT precorrection applied.

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3.1 ADAPT Sub-Assemblies:

The following major sub-assemblies are part of the ADAPT exciter:



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Table of Sub-Assembly Part Numbers:

Description	Notes	Part Number
Exciter chassis		45 325 195
Power Supply module (exciter)		96 170 637
8VSB module		46 744 373
DAP module		45 335 219.05
Complex Up/Down Converter module (CUDC HQ VHF)	1	45 335 221.23
Complex Up/Down Converter module (CUDC HQ UHF)	2	45 335 221.01
CUDC module with remote power control (CUDC HQ UHF)	3	46744204
Output Amplifier module (VHF)	1	45 335 393
Output Amplifier module (UHF type 233)	3	45 335 233
Output Amplifier module (UHF type 390)	2, 3	45 335 390
RF LO Synthesizer module (VHF DDAS-1030)	1	NPN (Band I)
RF LO Synthesizer module (VHF DDAS-3020)	1	91 789 912 (Band III)
RF LO Synthesizer module (UHF DDAS-3010)	2, 3	607401-01 (obsolete) 607529-01
On-Line Demodulator Calibration (OLDC) module (VHF)	1	45 335 404 (Band I) 45 335 403 (Band III)
On-Line Demodulator Calibration (OLDC) module (UHF)	2, 3	45 335 246
OLDC Backplane Daughter Board card		45 324 370
Main Backplane card		45 324 212
User Interface module	3	46 745 160
User Interface Backplane card	3	46 745 129
Central Processor Unit (CPU) card	1, 2	45 324 273
CPU Power Supply module	1, 2	91 769 975
CPU-ADAPT Backplane card	1, 2	45 324 300
CPU Indications Backplane Daughter Board card	1, 2	45 324 058

1 = VHF Optimum transmitters only

2 = UHF Ultimate transmitters only

3 = DCX, DCX Paragon, and Affinity transmitters only

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3.1.1 Controls and Indicators

This section identifies and explains each of the controls and indicators on the front panel of the ADAPT exciter. Each module is addressed separately, from left to right in the ADAPT exciter chassis.

Power Supply Module



V01 Indicator (green)

ON: Indicates the +5V supply is on.

OFF: Indicates the +5V supply is not functioning properly.

V02 Indicator (green)

ON: Indicates the +12V supply is on.

OFF: Indicates the +12V supply is not functioning properly.

V03 Indicator (green)

ON: Indicates the -12V supply is on.

OFF: Indicates the -12V supply is not functioning properly.

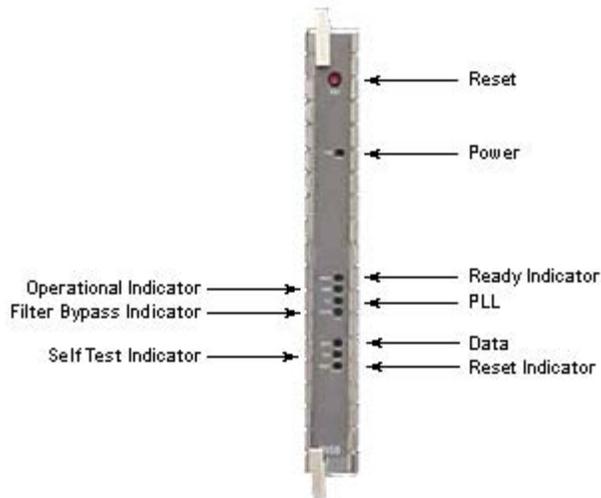
Power Indicator (green)

ON: Indicates AC power is supplied to the exciter, and the exciter is turned on.

OFF: Indicates AC power is not supplied to the exciter or, the exciter is turned off.

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8VSB Module



Reset Button

The reset button is a momentary switch, which initiates a reset of the entire 8VSB modulator, including the input PLL, FEC, formatting, filtering, and SPI control functions. Upon completion of the reset, the modulator initiates a self-test before waiting for a command from the DAP board to come back on line. The reset command is also issued when the DAP board itself is reset.

CAUTION: Performing a reset on this module while the transmitter is on-air may cause an overpower-condition resulting in damage to the transmitter equipment. ***Do not reset this button without removing RF drive from the transmitter.**

Power Indicator (green)

ON: Power is applied

OFF: Power is not applied

Ready Indicator (green)

ON: 8VSB Modulator has completed self-test

OFF: Modulator is performing self-test

Operational Indicator (green)

ON: Modulator is in operational mode

OFF: Modulator is in self-test mode

PLL Indicator (green)

ON: If a SMPTE310M signal is applied to J9 on the backplane, a lit LED indicates that a locally generated symbol clock has been locked to the input data clock. If there is no transport stream input, the LED should remain on since the modulator clock will lock to its internal fallback oscillator.

OFF (or flashing): The locally generated symbol clock has not been locked to the input data clock, either because the input clock has too much jitter, or the input clock is out of frequency tolerance.

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Filter Bypass Indicator (yellow)

ON: Root-raised cosine FIR pulse shaping filter is bypassed and the modulator output is comprised of a pseudo random sequence of values.

OFF: FIR root-raised cosine filter is enabled (normal operating condition).

Data Indicator (green)

ON: 8VSB modulator has detected and locked to a valid MPEG transport stream at its input.

OFF: 8VSB modulator has not detected a valid MPEG transport stream at its input.

Self-test Indicator (green)

ON: First pass of 8VSB modulator self-test has been completed successfully. This is the normal operating condition.

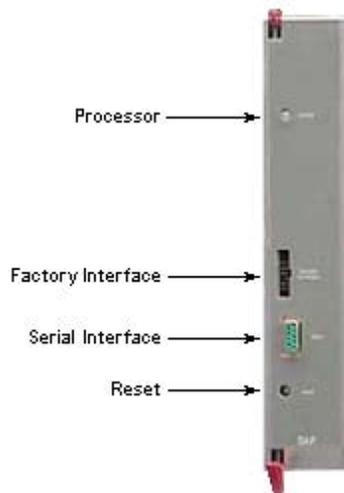
OFF: The module has failed self-test mode.

Reset Indicator (red)

ON: 8VSB modulator is in a reset condition.

OFF: 8VSB modulator is not in reset mode (normal operating condition).

DAP Module



Processor Indicator (bicolor)

ON (green): Processor is on and operating normally. This is the normal operating mode.

ON (red): Correction was attempted without a feedback signal. Reconnecting feedback signal and re-correcting will return the LED to green.

ON (red): Internal failure of DAP module. In some cases, resetting the DAP board will clear a failure condition due only to a software malfunction.

OFF: There is no power to the DAP module or the processor is not functioning.

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Factory Interface

The factory interface is provided for authorized service personnel to access firmware within the DAP. A user should not connect anything to this connector.

Serial Interface

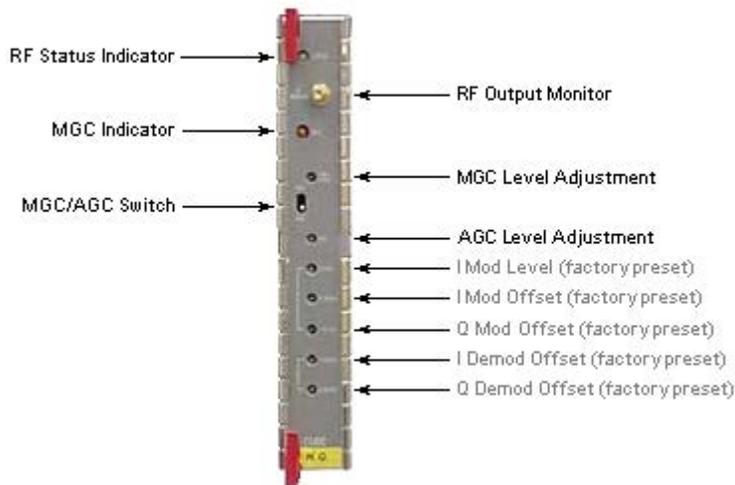
The Serial Interface is provided so that a laptop computer or terminal can be connected to the DAP. The interface is a standard RS-232 port that may be connected to a computer COM port using a null modem adapter.

Reset Button

The reset button is a momentary button that initiates a reset of the DAP board. After a reset, the board will initiate a "reboot" that will cause other boards in the ADAPT to be initialized.

CAUTION: Performing a reset on this module while the transmitter is on-air may cause an overpower-condition resulting in damage to the transmitter equipment. ***Do not reset this button without removing RF drive from the transmitter.**

CUDC Module



RF Status Indicator (tricolor)

ON (green): Module is operating normally in Automatic Gain Control (AGC) mode and that RF output is present. This is the first possible normal operating condition.

ON (yellow): Module is operating normally in Manual Gain Control (MGC) mode and that RF output is present. This is the second possible normal operating mode.

ON: (red): No RF present at output of CUDC module. Module either has internal fault or RF LO signal from synthesizer is not present. This is a failure condition.

OFF: No power to the CUDC module.

RF Output Monitor

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The RF output monitor is a SMA connector. This supplies an on-channel monitor signal for diagnostic purposes. This is the best place to verify that there is an output from the CUDC module.

NOTE: This signal will be pre-distorted if there is correction applied to the signal from the DAP board. Accordingly, measured SNR and sideband levels will be quite poor if LUT and ALE precorrections are active.

MGC Indicator (yellow)

ON (yellow): The CUDC module is in MGC mode.

OFF: The CUDC module is in AGC mode.

MGC Level Adjustment

In Optimum and Ultimate type transmitters, this potentiometer allows the user to adjust the output power of the exciter while operating in MGC mode. There is a large range of adjustment, and the user should operate the control with care, and only while constantly verifying the output power of the system. This potentiometer is disabled in IOT-equipped and Affinity type transmitters (P/N 46744204); the output power level in these transmitters is digitally controlled via the user interface module or transmitter remote control.

MGC/AGC Switch

This switch allows the user to select between MGC and AGC modes via hardware. In the top position, the CUDC is forced into MGC mode. In the lower position, the CUDC is in nominally in AGC mode, but may be externally switched between the MGC and AGC modes via the user interface module or transmitter control system.

AGC Level Adjustment

This potentiometer allows the user to adjust the output power of the ADAPT in its AGC mode. There is a large range of adjustment, and the user should operate the control with care, and only while constantly verifying the output power of the system.

CAUTION

The following five adjustments are factory preset. The user should not attempt to alter these adjustments. Failure to comply may result in improper operation of the ADAPT.

I Modulator Level Adjustment

This potentiometer allows the amplitude of the in-phase baseband signal to be adjusted. Normally this is adjusted to match the Q signal amplitude to allow for the correct formation of the 8-VSB signal constellation.

I Modulator Offset Adjustment

This potentiometer adjusts the DC offset of the in-phase baseband signal to minimize LO leakage into the RF signal. This adjustment is preset in the factory to center the range of the digital **I Mod Offset** adjustment.

Q Modulator Offset Adjustment

This potentiometer adjusts the DC offset of the quadrature baseband signal to minimize LO leakage into the RF signal. This adjustment is preset in the factory to center the range of the digital **Q Mod Offset** adjustment.

I Demodulator Offset Adjustment

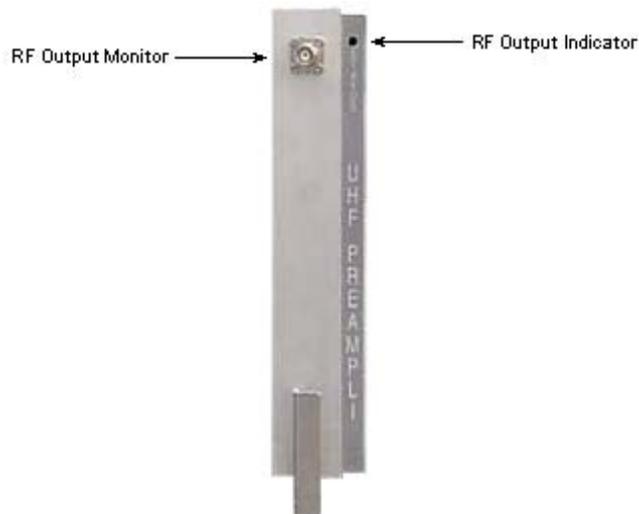
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This potentiometer adjusts the DC offset of the in-phase signal from the transmitter feedback demodulator. This adjustment is preset in the factory to center the range of the digital **I Demod Offset** adjustment.

Q Demodulator Offset Adjustment

This potentiometer adjusts the DC offset of the in-phase signal from the transmitter feedback demodulator. This adjustment is preset in the factory to center the range of the digital **Q Demod Offset** adjustment.

Output Amplifier Module



RF Output Indicator (green)

ON: RF signal is present at output of amplifier module.

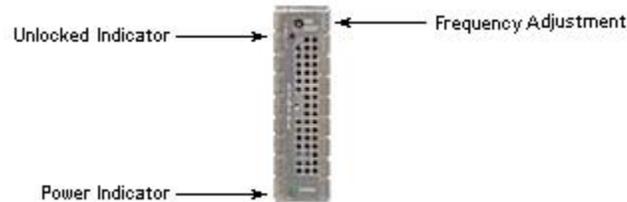
OFF (or blinking): No power to unit or no RF signal present at module output. This is a failure condition.

RF Output Monitor

The RF output monitor is a BNC connector. This supplies an on-channel monitor signal for diagnostic purposes. This is the best place to verify that there is an output from the output amplifier module.

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RF LO Synthesizer Module



Frequency Adjustment

This potentiometer allows the user to fine adjust the frequency of the synthesizer's internal 10 MHz reference. This will affect the output frequency of the synthesizer.

NOTE: When an external 10 MHz reference is connected to J10 of the backplane, the frequency adjustment potentiometer will not affect the output frequency of the ADAPT.

Unlocked Indicator (red)

ON: Indicates that the synthesizer has not been locked to its internal (or external) reference frequency. This is a fault condition.

OFF: Indicates that the unit is locked to its reference frequency. This is the normal operating mode.

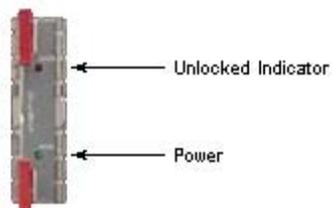
NOTE: The unlocked indicator will come on momentarily each time the unit is switched on, and whenever a change in frequency command is sent.

Power Indicator (green)

ON: Power is applied to the module.

OFF: No power is applied to the module.

OLDC Module (optional)



Unlocked Indicator (red)

ON: Indicates that the internal PLL is unable to generate the test signal. This is a fault condition.

OFF: Indicates that the locally generated signal is locked to the RF carrier signal. This is the normal operating mode.

NOTE: The unlocked indicator will come on momentarily each time OLDC correction routine is run.

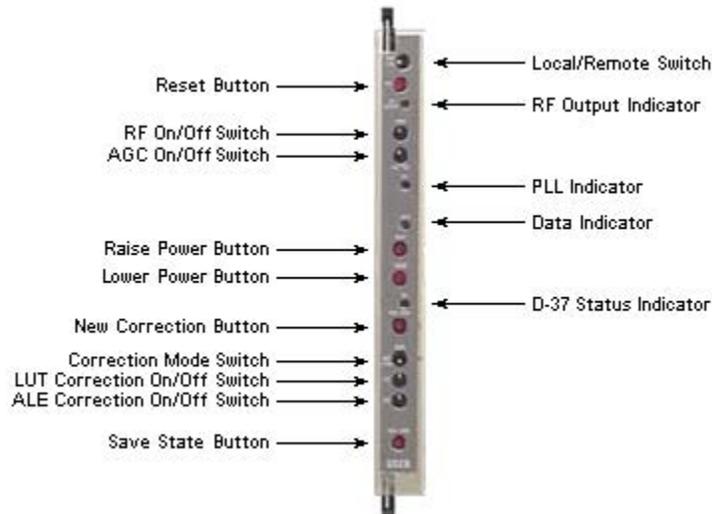
Power Indicator (green)

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ON: Power is applied to the module.

OFF: No power is applied to the module.

User Interface Module (DCX, DCX Millennium, DCX Paragon, and Affinity transmitters)



Local/Remote Switch

The Local/Remote Switch toggles between the local switches and buttons on the front panel of this module (local mode) and the D-37 connector on the user interface back plane (remote mode). In the LCL mode, commands may be sent by any of the nine switches on the front of the user control module, and any commands sent through the backplane D-37 connector are ignored. In the RMT mode, the D-37 connector is active, and any commands sent by the nine switches on the user control module are ignored.

NOTE: To ensure correct exciter operation, the positions of the nine switches on the User Interface module and the remote control commands entering through the D-37 connector must result in the same settings whenever the control mode is changed from LCL to REM or vice versa. Otherwise, a temporary condition may result in which the exciter is in LCL mode, but the exciter settings do not match the User Interface module switch positions. Actuating a switch will cause it to re-send its corresponding command to the DAP module and sync up the exciter state with the switch position.

Reset Button

The reset button is a momentary button that initiates a reset of the User Interface module. After a reset, the board will initiate a "reboot" of its microprocessor. While this interrupts the communication to and from the ADAPT Exciter, it will not disturb the RF output. However, based on switch positions, and/or the remote control commands present on the D-37 connector, some changes may be observed due to the initialization of the various modes controlled by the board.

RF Output Indicator (green)

ON: RF is present at the exciter output.

OFF: No RF is present at the exciter output.

RF On/Off

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ON (up): The RF output of the exciter is turned on.

OFF (down): The RF output of the exciter is turned off. This acts as a “drive kill” command.

AGC On/Off

ON (up): Places exciter in Automatic Gain Control (AGC) mode. The RF output level of the exciter is regulated by the detected feedback sample entering J17 of the back plane. The AGC/MGC switch on the CUDC module must also be in the AGC mode for AGC to be activated.

OFF (down): Places exciter in Manual Gain Control (MGC) mode. The RF output level of the exciter is not regulated by the AGC function.

PLL Indicator (green)

ON: The 8VSB module is locked to the incoming data stream.

OFF: The 8VSB module is not locked to the incoming data stream.

NOTE: The PLL indicator LED has a dual purpose; it also functions as a communication error indicator. When twenty erroneous commands are received within fifty seconds, a critical error condition is acknowledged and the PLL LED will blink for fourteen seconds. As soon as the LED stops blinking the User Interface module will re-initialize. The module will not communicate until the re-initialization process is complete (approximately nine seconds).

Data Indicator (yellow)

ON: The 8VSB module has not yet detected a valid MPEG transport stream at its input.

OFF: The 8VSB module has detected and locked to a valid MPEG transport stream at its input.

Raise Power Button

Depressing button causes the ADAPT exciter to raise its output level by modifying the digital power control values “AGC (cag) level” or “MGC (cmg) level” internal to the DAP module. The value of *cag level* or *cmg level* is increased by one each time the button is pressed. Both *cag level* and *cmg level* have a nominal range of 40 to 128. The selection of which power control value is modified is dictated by the current gain control mode of the exciter (AGC vs. MGC). The current value of *cag level* or *cmg level* may be checked by issuing the commands in the ADAPT Control GUI software program: **Get > CUDC > All**.

Lower Power Button

Depressing button causes the ADAPT exciter to lower its output level by modifying the digital power control values “AGC (cag) level” or “MGC (cmg) level” internal to the DAP module. The value of *cag level* or *cmg level* is decreased by one each time the button is pressed. Both *cag level* and *cmg level* have a nominal range of 40 to 128. The selection of which power control value is modified is dictated by the current gain control mode of the exciter (AGC vs. MGC). The current value of *cag level* or *cmg level* may be checked by issuing the commands in the ADAPT Control GUI software program: **Get > CUDC > All**.

D-37 Status Indicator (green)

ON: The remote control D-37 connector plugged in at the exciter rear panel.

OFF: The remote control D-37 connector is not plugged in at the exciter rear panel.

New Correction Button

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Depressing this button causes the exciter to initiate one iteration of linear (ALE) and non-linear (LUT) correction. This is useful when an operator is in fixed correction mode and desires to improve the correction of the system.

Correction Mode

ADP (Up): Places the exciter in its **adaptive mode** of operation. Exciter constantly checks the RF feedback sample from the transmitter and initiates new linear and non-linear correction when it detects that the signal has exceeded a preset threshold.

FXD (Down): Places the exciter in its **fixed mode** of operation. In this mode, the exciter will not initiate new correction unless commanded by the operator (see "*New Correction Button*" above).

NOTE: If ADAPT is running in adaptive mode, there must not be any other commands sent to ADAPT except to return ADAPT back to fixed mode. In addition, after sending the fixed mode command there must be a four-minute waiting period before the next command is sent to ADAPT. The ADAPT receives the command, but does not act on it until it has completed the linear correction portion of the adaptive mode process. Do not attempt to raise or lower power when the exciter is in adaptive mode.

LUT On/Off

ON (Up): The non-linear corrector is switched into the circuit.

OFF (Down): Switching to this position will cause the non-linear correction to be erased, and a "linear transfer curve" to be loaded into the corrector. This effectively clears the corrector. This can cause an increase in power. Care should be taken when placing the switch in the OFF position during transmitter operation.

NOTE: LUT is an acronym for Look-Up Table. This term is used interchangeably with non-linear corrector. The nonlinear corrector minimizes adjacent channel sidebands by compensating for non-linearities in the amplifying stages of the transmitter.

ALE On/Off

ON (Up): The linear corrector is switched into the circuit.

OFF (Down): Switching to this position will cause the linear correction to be erased and a "flat filter" loaded. This effectively clears the corrector.

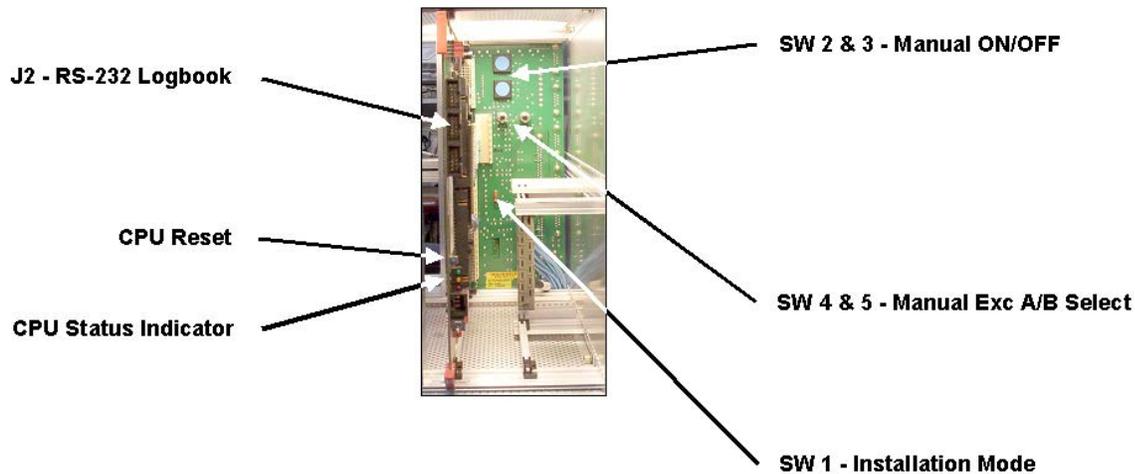
NOTE: ALE is an acronym for Adaptive Linear Equalizer. This term is used interchangeably with linear corrector. The linear corrector maximizes Signal to Noise Ratio (SNR) by compensating for the linear distortions in frequency response and group delay caused by the RF mask filter at the transmitter output.

Save State Button

Depressing this button causes the current exciter configuration, including the correction values for the linear and non-linear correctors, to be stored in the "restart configuration state." The exciter will return to the restart state upon boot up after an AC power interruption. This allows a baseline of satisfactory correction to be saved in memory for use after a power outage.

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CPU Card and CPU Backplane Controls (Optimum and Ultimate transmitters)



J2 - RS-232 Logbook

This connector allows a RS-232 serial link to the CPU card. This link may be used to retrieve the contents of the transmitter "logbook." Consult Service Bulletin 030326 or Optimum/Ulimate transmitter manuals for more details.

CPU Status Indicators

CPU activity indicator (green): Flashes to indicate CPU activity. This is the normal operating condition.

Power supply presence indicator (yellow). Power is supplied to the CPU card.

CPU fault indicator (red): CPU is not working properly

CPU Reset

This button initiates a complete reboot of the CPU, in case of soft malfunction.

SW 2 & 3 - Manual ON/OFF

These buttons may be used to manually switch the transmitter on and off if the CPU is faulty or missing.

SW 4 & 5 - Manual Exciter A/B Select

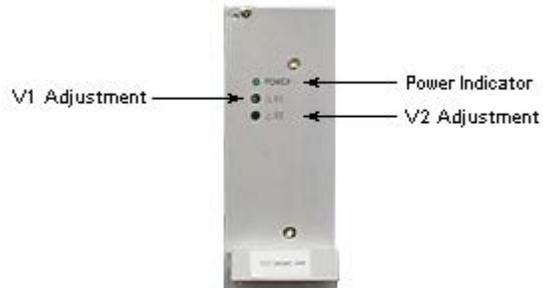
These buttons may be used to manually switch between exciter A and exciter B in dual drive transmitters if the CPU is faulty or missing.

SW 1 - Installation Mode

This switch, along with SW1 on the CPU Indications Backplane Daughter Board, places the transmitter in a special installation mode, in which certain set-up parameters may be modified.

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CPU Power Supply Module (Optimum and Ultimate transmitters)



Power Indicator (green)

The power supply is functioning correctly.

V1 Adjustment

This potentiometer adjusts the +5V supplied to the CPU card.

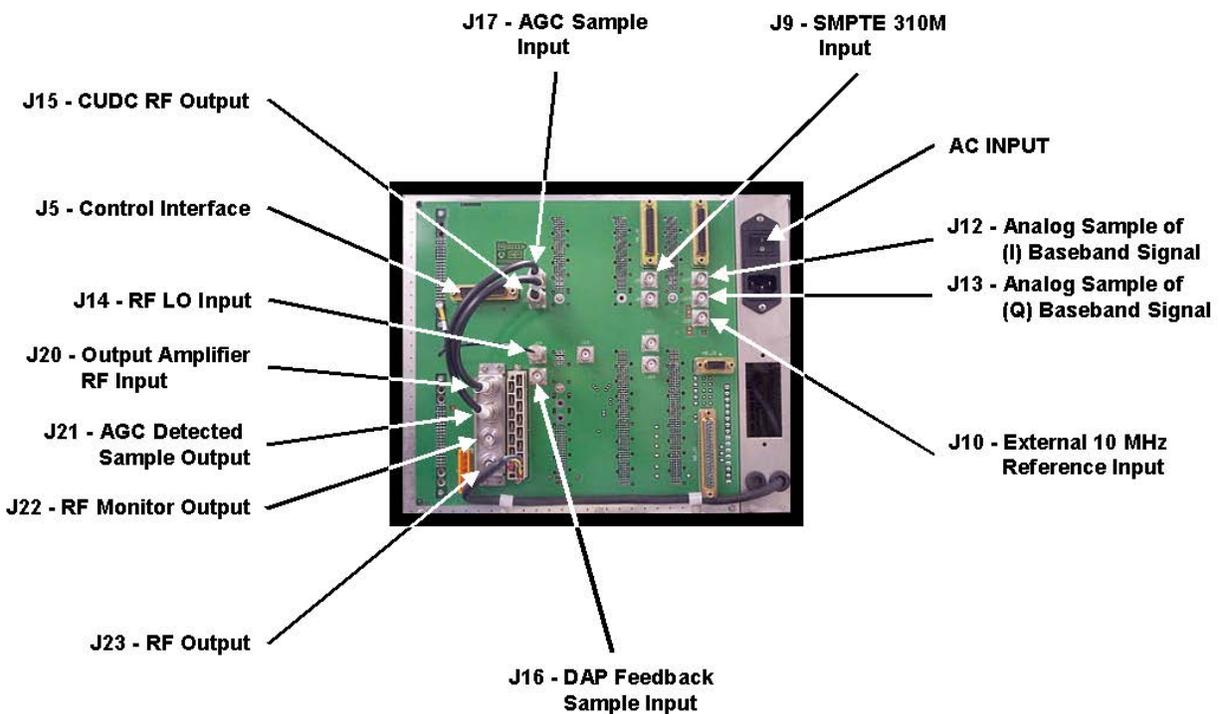
V2 Adjustment

This potentiometer adjusts the +24V supplied to the CPU card.

3.1.2 ADAPT Connectivity

Connectivity for the ADAPT is accomplished through the **Main Backplane** assembly, the **OLDC Backplane Daughter Board (optional)**, and the **User Interface Backplane** or **CPU Backplanes** (according to transmitter type).

The **Main Backplane** assembly provides the following connection points for the ADAPT exciter:



AC input: This is a standard IEC AC power connector. The ADAPT exciter requires either 120VAC 50-60Hz or 220VAC 50-60Hz. Included in the connector assembly is a power ON/OFF switch, which enables or disables the ADAPT power supply.

J5 – Control Interface: This D-25 type RS-232 connector is an access point to provide direct control over the ADAPT in those exciter that do **NOT** have the OLDC module installed.

J9 – SMPTE310M Input: The main input to the ADAPT exciter is the MPEG-2 transport stream containing video, audio and in some cases, auxiliary data. The SMPTE310M interface is the industry standard interface for the ATSC system. This connection must be at a precise 19.392568 Mbps rate. The nominal peak-to-peak level is 800mV. For more details, refer to the SMPTE310M standard document.

J10 – External 10 MHz Reference Input: Allows exciter LO to be locked to an external precision reference such as GPS. The nominal input level for this signal is +13dBm. Adding a fixed attenuator pad can modify this level. Normally, the RF LO synthesizer has its own internal reference frequency. With early vintage exciters, the use of an external reference required that the synthesizer module's internal reference be permanently disabled during installation. Newer vintage synthesizers will automatically fold back to the internal reference should the external reference be interrupted. A red LED lights on the front of the synthesizer if it is not locked to a reference signal (either internal or external).

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J12 – Analog Sample of (I) Baseband Signal: monitoring point of the in-phase baseband signal at the output of the 8VSB module. The signal should be band limited to 3MHz with a small pilot at 2.69MHz. This is an ideal place to monitor the quality of the baseband 8VSB signal. This signal can be used, in conjunction with the analog Q sample from J13, to make signal quality measurements using the complex mode of a Vector Signal Analyzer (VSA) with the two channel input option.

J13 – Analog Sample of (Q) Baseband Signal: monitoring point of the quadrature baseband signal at the output of the 8VSB module. The signal should be band limited to 3MHz with a small pilot at 2.69MHz. This is an ideal place to monitor the quality of the baseband 8VSB signal. This signal can be used, in conjunction with the analog I sample from J12, to make signal quality measurements using the complex mode of a Vector Signal Analyzer (VSA) with the two channel input option.

J14 – RF LO Input: This BNC connector is the RF LO input to the CUDC module for those exciters that do **NOT** have the OLDC module installed. This input comes from the RF LO synthesizer module via the small coax jumper cable, W1.

J15 – CUDC RF Output: The main output of the CUDC module, an on-channel 8VSB signal with a 6 MHz bandwidth. Normally, this signal is jumpered to the RF output amplifier's input, J20. If there is a need to bypass the output amplifier, the ADAPT output can be taken directly from this connector. The nominal output level at this connector can vary depending on the transmitter power required. Typically, it will be between -3dBm and -13dBm, as measured on an average power meter.

J16 – DAP Feedback Sample Input: Input connector for the RF feedback signal from the transmitter output for those exciters that do **NOT** have the OLDC module installed. This signal is used by the DAP to calculate its correction. The sample signal must be free of any signals other than the one being transmitted, e.g. an adjacent NTSC signal. The nominal level of this signal is -12dBm average power. Fixed attenuator pads may be used to set the feedback input level. A command in the ADAPT Control GUI interface may be used to measure the feedback level.

J17 – AGC Sample Input: Input connector for detected (DC) feedback signal to exciter automatic gain control system. Depending on the transmitter type, this DC signal may come from J21 at the output of the exciter or from the output of the entire transmitter.

J20 – Output Amplifier RF Input: RF input to the output amplifier of ADAPT. Normally, the amplifier receives the output from the CUDC module. This connection is made with a coax jumper cable to J15.

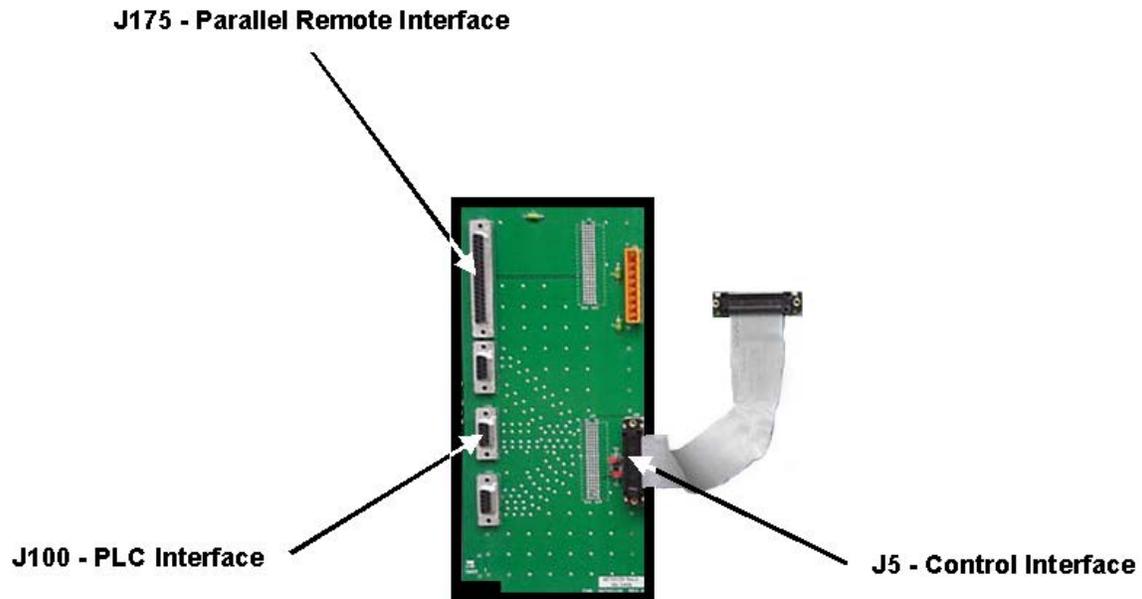
J21 – AGC Detected Sample Output: This BNC connector supplies a detected output sample from the output amplifier. Depending on transmitter type, this sample signal may be used to regulate the automatic gain control (AGC) circuit of the exciter and to keep the output power of the exciter constant. A coax cable jumper usually connects the signal to J17.

J22 – RF Monitor Output: A monitor point that allows the user to check the output of the DAP. If pre-correction is being applied, the signal quality will not be ideal. In normal operation, this is the best point to verify that the output of the ADAPT is OK. The nominal level of this output signal is approximately 30dB below the main RF output at J23 (-13dBm to -23dBm).

J23 – RF Output: The main output of the ADAPT Exciter. In a transmitter system, this output is connected to the input of the driver amplifiers. The level can vary depending on the transmitter output power that is required. Normally, the level will be between +7dB, and +17dBm.

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The **User Interface Backplane**, located adjacent to the Main Backplane assembly, provides additional connection points for the ADAPT in DCX, DCX Millennium, DCX Paragon, and Affinity transmitters.



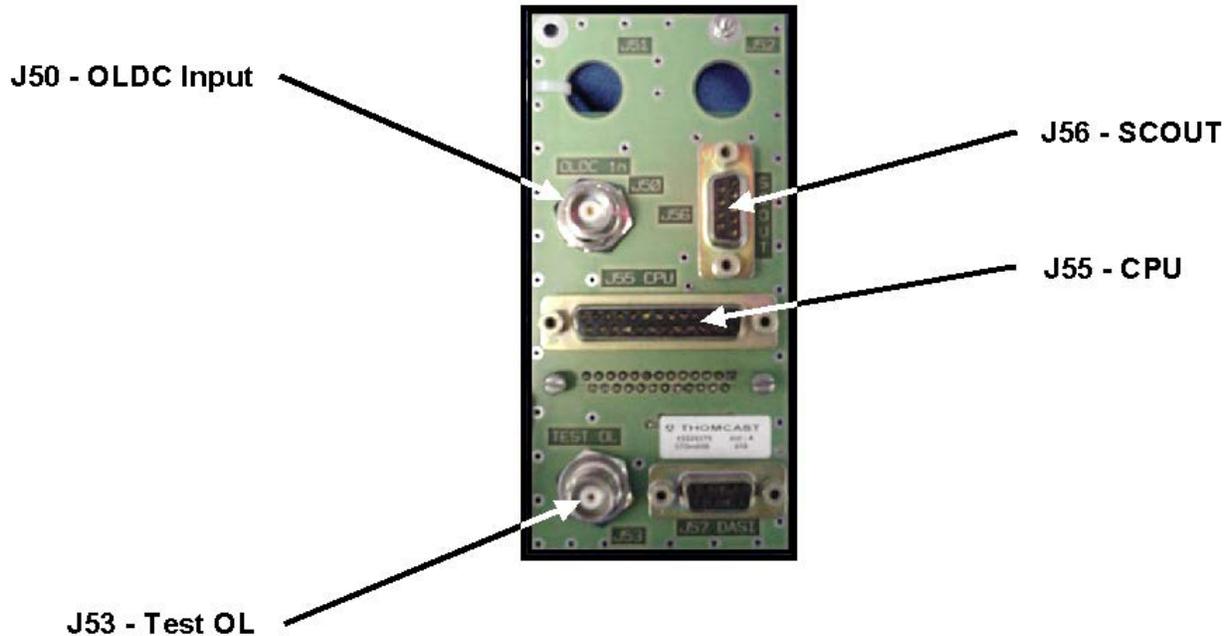
J175 – Parallel Remote Interface: This D-37 type connector is an interface for external control systems.

J100 – PLC Interface: This connector allows the transmitter system control (PLC) to issue text commands directly to the DAP module using an RS-232 interface. This interface is only active when the User Interface module is switched to remote operating mode.

J5 – Control Interface: This D-25 type connector provides an interface to the Main Backplane. This allows the DAP to be controlled via an RS-232 interface.

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The **OLDC Backplane Daughter Board** plugs into the Main Backplane Assembly and contains additional ADAPT connection points for those exciters equipped with the OLDC module.



J50 – OLDC Input (Feedback Sample Input): Input connector for the RF feedback signal from the transmitter output for those exciters with the OLDC module installed. This signal is used by the DAP to calculate its correction. The sample signal must be free of any signals other than the one being transmitted, e.g. an adjacent NTSC signal. The nominal level of this signal is -12dBm average power. Fixed attenuator pads may be used to set the feedback input level. A command in the ADAPT Control GUI interface may be used to measure the feedback level.

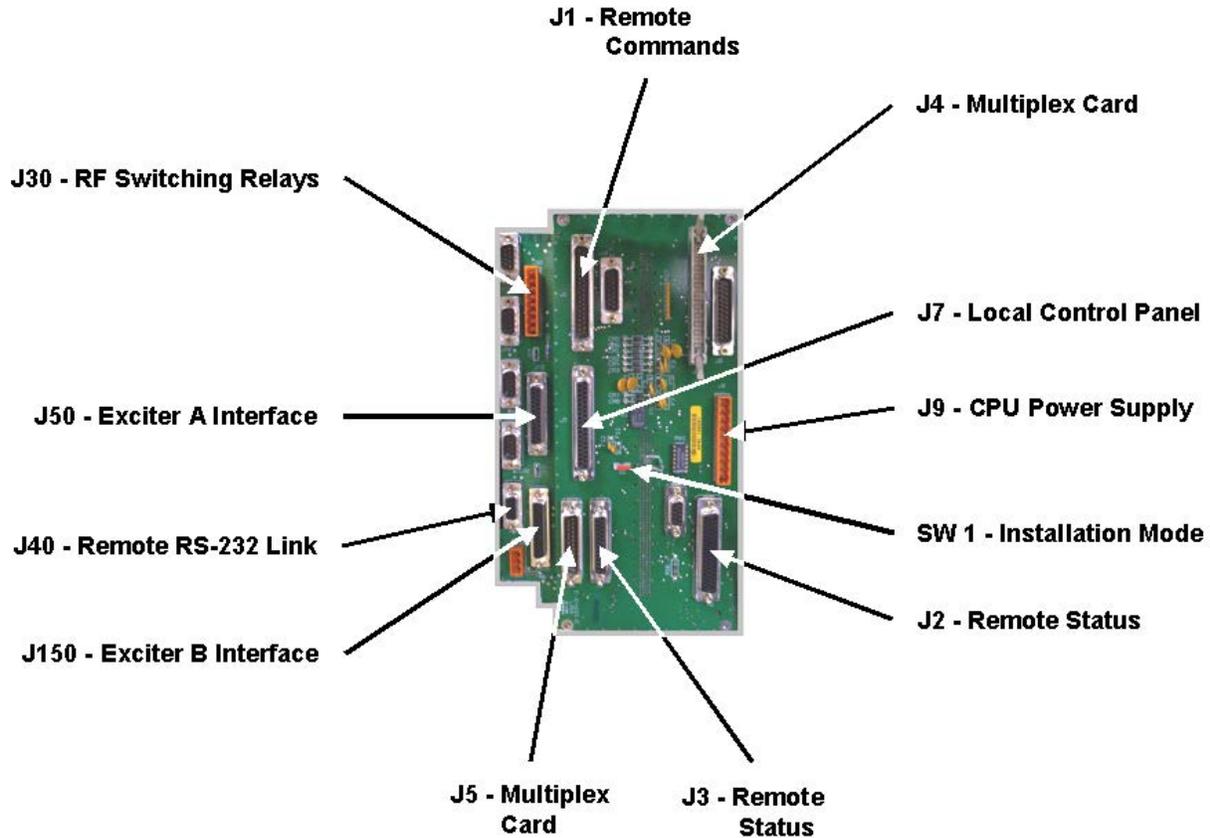
J55 – CPU: This D-25 type RS-232 connector is an access point to provide direct control over the ADAPT.

J53 – TEST OL (LO): This BNC connector is used to verify the LO signal generated by the RF LO Synthesizer Module.

J56 – SCOUT: This D-9 connector provides an interface to the SCOUT product.

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The **CPU and CPU Indications Backplane Boards**, located adjacent to the Main Backplane assembly, provide additional connection points for the ADAPT in Optimum and Ultimate transmitters.



J1 – Remote Commands: This connector inputs commands from a parallel remote control interface at the top of the transmitter cabinet.

J2 – Remote Status: This connector outputs status information to a parallel remote control interface at the top of the transmitter cabinet.

J3 – Remote Status: This connector outputs status information to a parallel remote control interface at the top of the transmitter cabinet.

J4 – Multiplex Card: This connector provides an interface for commands, status, and fault signals to and from the multiplex card(s) in the transmitter cabinet.

J5 – Multiplex Card: This connector inputs fault messages from the multiplex card(s) in the transmitter cabinet.

J7 – Local Control Panel: This connector provides data and power supply voltage to the transmitter local control panel (PCL).

J9 – CPU Power Supply: This connector accepts the +5V and +24V power feeds coming from the CPU power supply.

J30 – RF Switching Relays: This connector serves as an interface between the CPU and the exciter RF switching relays.

J40 – Remote RS-232 Link: This connector provides an access point for a remote RS-232 serial link.

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J50 – Exciter A Interface: This connector provides interconnection between the CPU and the exciter.

J150 – Exciter B Interface: This connector provides interconnection between the CPU and a second exciter in dual drive transmitters.

SW1 – Installation Mode: This switch, along with SW1 on the front of the CPU Backplane, places the transmitter in a special installation mode, in which certain set-up parameters may be modified.

4 ADAPT Correction Procedures

Procedure 040123: Basic ADAPT Correction Procedure with ADAPT Control GUI	
Applicability	All ATSC transmitters with ADAPT exciter.
Prerequisites	Transmitter operating at 100% power. Transmitter in AGC mode (<i>strongly recommended</i>).
Equipment Required	HP89441 Vector Signal Analyzer or suitable 8-VSB test measurement set. PC with ADAPT Control software RS-232 null modem cable
Comments	Consult Service Bulletin 040126 <i>Advanced ADAPT Correction Procedure</i> if this procedure does not produce a successful outcome. *Instructions with asterisk should be disregarded for those exciters that do NOT have the OLDC module installed. Procedure may also be used in conjunction with local control panel (PCL) in Optimum and Ultimate transmitters by invoking required correction routines via corresponding command buttons on appropriate PCL screens. Users should consult Optimum/Ulimate transmitter manuals for more information on location of affected correction settings in PCL menu structure.

1. Connect RF sample from transmitter system output (near DAP feedback sample point) to input of vector signal analyzer or other 8-VSB test measurement set.
2. Measure adjacent channel sideband suppression with regard to FCC spectral mask. Measure 8-VSB signal to noise ration (SNR) with regard to nominal ≥ 27 dB ATSC specification. If transmitter performance in either area is unsatisfactory, continue with this procedure. Otherwise, modification of transmitter correction settings is not required and procedure is complete.
3. Connect serial port from laptop PC comm port to RS-232 port on front of DAP module.
4. Launch ADAPT Control GUI Software (Version 2.0 or higher).
5. Select pull-down menu **Comm Ports** and select appropriate number comm port from selections.
6. Issue commands **Comm Ports > Open Link** to establish communication with DAP module. The words "ecco umberto calixtinus" or other text should appear in the Received window at the right of screen. If a stream of junk characters appears in Received window, issue commands **Comm Ports > ADAPT Baud** and **Computer Baud**. Ensure that both are set to 9600.
7. Set all correctors to adaptive mode by issuing commands: **Correction Commands > OLDC Adaptive***, **OLMC Adaptive***, **Non-Linear Adaptive**, and **Linear Adaptive** in this order.

NOTE: The exciter output power level may drop as much as 2dB when the nonlinear (LUT) corrector is engaged. For this reason, it is strongly encouraged that the exciter be in AGC mode while this procedure is performed. Otherwise, it will be necessary to readjust power once the LUT correction is finished and repeat the entire procedure at the new power level. For more information on engaging the exciter AGC system in DCX and Advantage transmitters for the first time, consult Service Bulletin 040125 ADAPT Exciter AGC Setup. Note that all Affinity transmitters ship from the factory already in the Upconverter ALC (AGC) mode.

8. Follow these steps if linear (ALE) correction does not run successfully and the following message appears: **INADEQUATE MODULATOR ADJUSTMENT FOR ALE CORRECTION**. Otherwise, skip to step 5.
 - a. Set all correctors to fixed mode by issuing commands: **Correction Commands > OLDC Fixed***, **OLMC Fixed***, **Non-Linear Fixed**, and **Linear Fixed**.
 - b. Run new Non-Linear and New Linear correction by issuing commands: **Correction Commands > New Non-Linear** and **New Linear**.
 - c. Set all correctors to adaptive mode by issuing commands: **Correction Commands > OLDC Adaptive***, **OLMC Adaptive***, **Non-Linear Adaptive**, and **Linear Adaptive**, in this order.
9. Wait approximately five minutes to allow corrections to be completed.
10. Set all correctors to fixed mode by issuing commands: **Correction Commands > OLDC Fixed***, **OLMC Fixed***, **Non-Linear Fixed**, and **Linear Fixed**.
11. Verify that adjacent channel sidebands are suppressed to levels required by FCC spectral mask. Verify that 8-VSB signal to noise ratio (SNR) is ≥ 27 dB. If not, repeat step 7.
12. Once signal is within specifications, save new correction settings by issuing commands: **Correction Commands > Save Correction**. Correction settings are saved as baseline for use after an AC power failure.
13. Procedure complete.

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Procedure 040124: Basic ADAPT Correction Procedure with User Interface Module	
Applicability	DCX, DCX Millennium, DCX Paragon, and Affinity transmitters.
Prerequisites	Transmitter operating at 100% power. Transmitter in AGC mode (<i>strongly recommended</i>).
Equipment Required	HP89441 Vector Signal Analyzer or suitable 8-VSB test measurement set.
Comments	Consult Service Bulletin 040126 <i>Advanced ADAPT Correction Procedure</i> if this procedure does not produce a successful outcome.

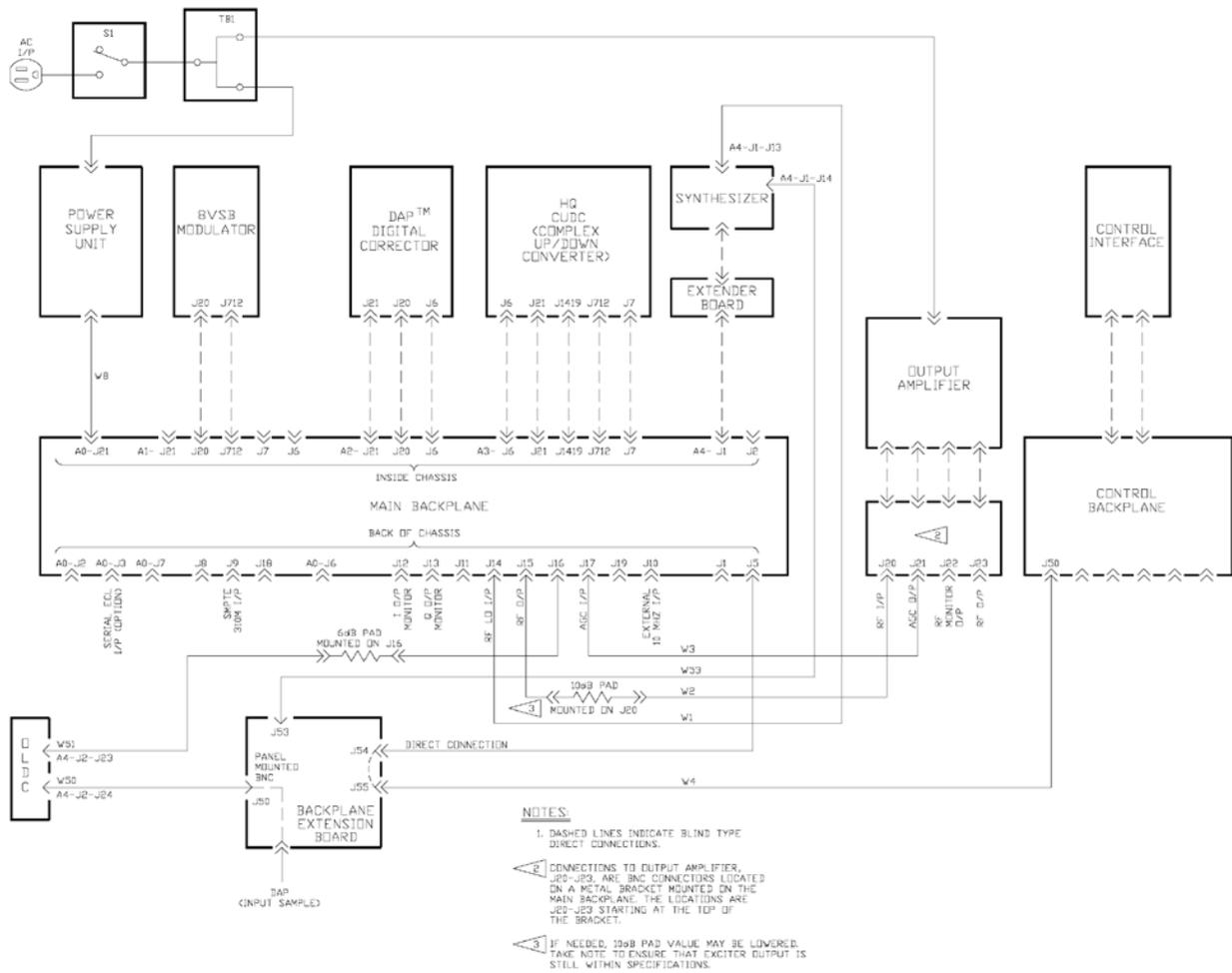
NOTE: The exciter output power level may drop as much as 2dB when the nonlinear (LUT) corrector is engaged. For this reason, it is strongly encouraged that the exciter be in AGC mode while this procedure is performed. Otherwise, it will be necessary to readjust power once the LUT correction is finished and repeat the entire procedure at the new power level. For more information on engaging the exciter AGC system in DCX and Advantage transmitters for the first time, consult Service Bulletin 040125 ADAPT Exciter AGC Setup. Note that all Affinity transmitters ship from the factory already in the Upconverter ALC (AGC) mode.

1. Connect RF sample from transmitter system output (near DAP feedback sample point) to input of vector signal analyzer or other 8-VSB test measurement set.
2. Measure adjacent channel sideband suppression with regard to FCC spectral mask. Measure 8-VSB signal to noise ratio (SNR) with regard to nominal ≥ 27 dB ATSC specification. If transmitter performance in either area is unsatisfactory, continue with this procedure. Otherwise, modification of transmitter correction settings is not required and procedure is complete.
3. Press **New Corr** button on User Interface module. This will run one iteration of linear (ALE) and non-linear (LUT) correction routines.
4. Wait approximately 45 seconds for correction routines to complete execution.
5. Connect RF sample from transmitter system output to input of vector signal analyzer or other 8-VSB test measurement set.
6. Verify that adjacent channel sidebands are suppressed to levels required by FCC spectral mask. Verify that 8-VSB signal to noise ratio (SNR) is ≥ 27 dB.
7. If signal does not meet specifications, press **New Corr** button again to start new iteration of correction. Several iterations may be required to achieve acceptable results.
8. When signal is within specifications, press **Save Corr** button on User Interface module. Correction settings are saved as baseline for use after an AC power failure.
9. Procedure complete.

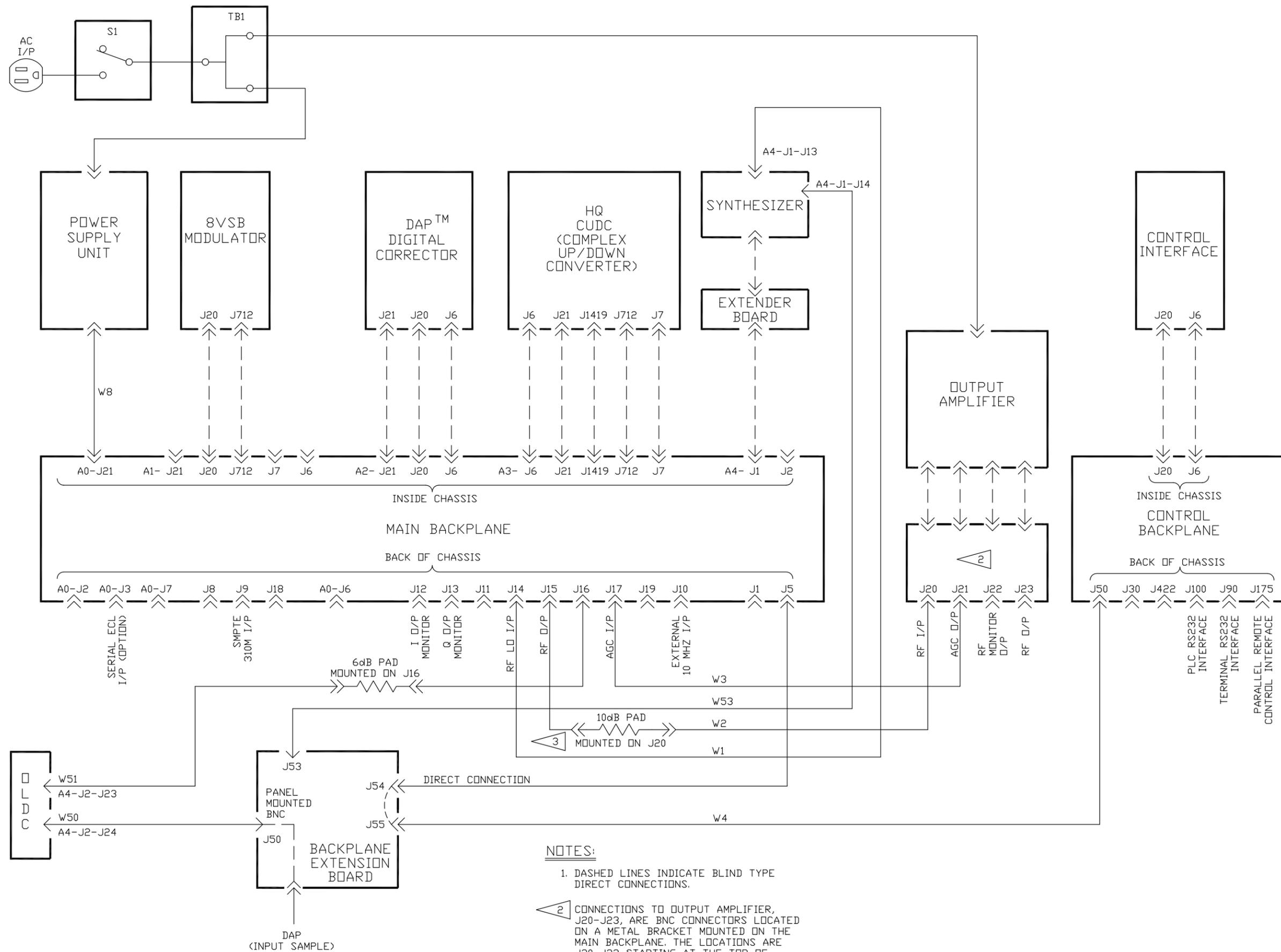
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4.1 Schematics

The following section contains basic signal interconnect schematics for the ADAPT exciter both with and without the OLDC option installed.

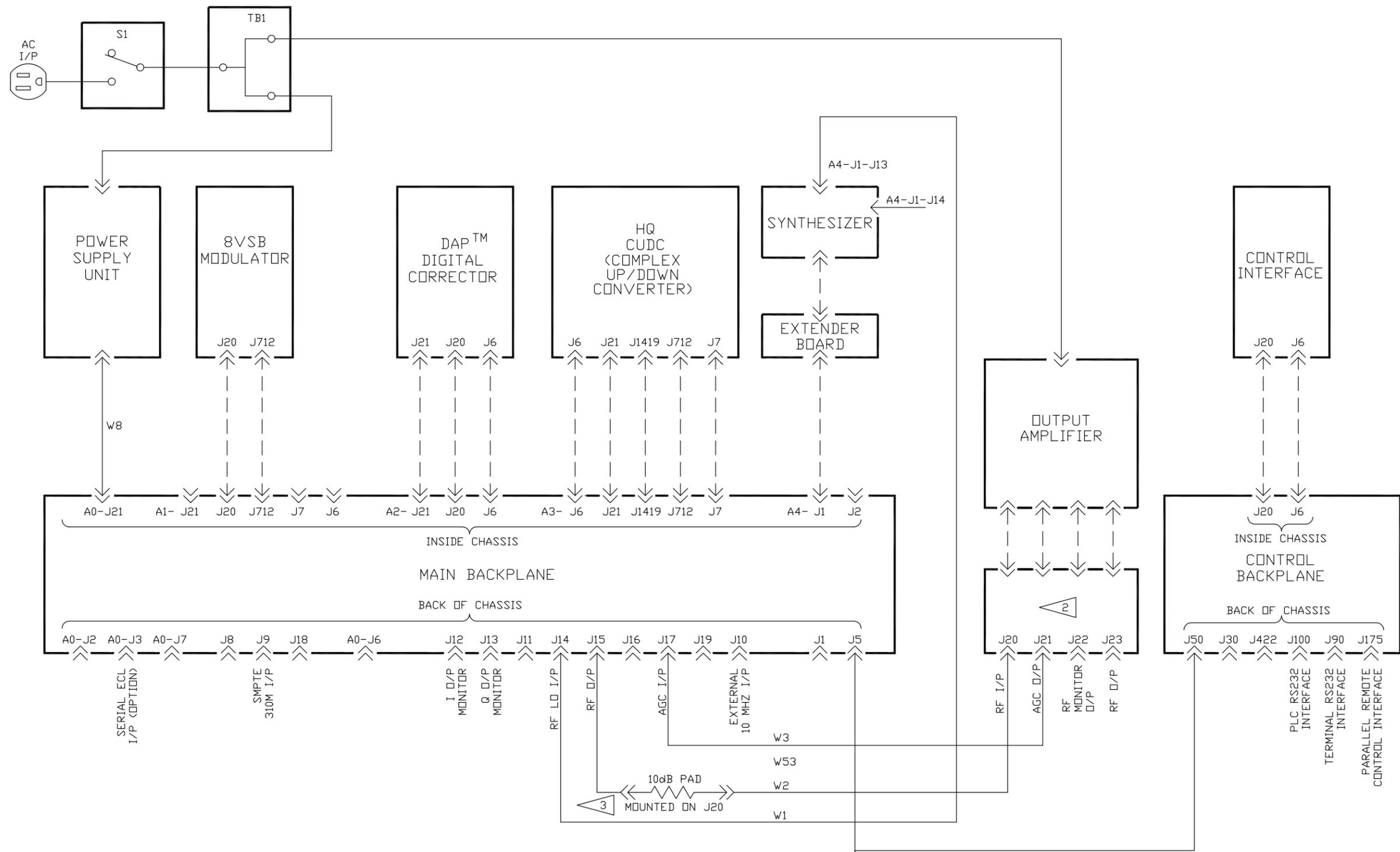


Interconnect schematic with OLDC option installed



NOTES:

1. DASHED LINES INDICATE BLIND TYPE DIRECT CONNECTIONS.
- 2 CONNECTIONS TO OUTPUT AMPLIFIER, J20-J23, ARE BNC CONNECTORS LOCATED ON A METAL BRACKET MOUNTED ON THE MAIN BACKPLANE. THE LOCATIONS ARE J20-J23 STARTING AT THE TOP OF THE BRACKET.
- 3 IF NEEDED, 10dB PAD VALUE MAY BE LOWERED. TAKE NOTE TO INSURE THAT EXCITER OUTPUT IS STILL WITHIN SPECIFICATIONS.



NOTES:

1. DASHED LINES INDICATE BLIND TYPE DIRECT CONNECTIONS.

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Communications

Comark Communications
104 Feeding Hills Road
Southwick, MA 01077 U.S.A.
(800) 345-9295
www.comarktv.com