WEGENER

iPump 6420

Professional Audio Server

User's Manual

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The **WEGENER iPump 6420** is approved under **FCC Part 15B Class A**, **UL1950**, **CSA**, and **CE**.

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TABLE OF CONTENTS

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Chapter 1: GENERAL INFORMATION

This chapter gives a general overview of this Manual and of the iPump 6420.

Table of Contents

1.1. Manual Overview

This manual provides instructions and reference information for the proper installation and operation of the **WEGENER iPump 6420 Professional Audio Server**, referred to throughout the manual as the **iPump 6420**.

This manual is divided into these chapters:

Chapter 1 General Information –an overview of the **iPump 6420** missions, its functions and specifications, and a glossary of terms.

Chapter 2 Installation – instructions for initial installation and setup of the **iPump 6420**.

Chapter 3 Operation-detailed discussion of **iPump 6420** operation.

Chapter 4 Maintenance and Troubleshooting - information on maintaining the **iPump 6420** and resolving possible operating difficulties.

Chapter 5 Customer Service - our warranty and information on obtaining help.

Index - list of keywords to help you quickly locate information.

Please e-mail any suggestions or comments concerning this manual to **manuals@wegener.com**. If you prefer to post through the mail, please send your comments to the address below. If you have substantial or complex changes to recommend, our preference is that you copy the page(s) in question, mark your changes on that copy, and fax or mail us the copy. We always appreciate constructive criticism.

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1.2. iPump 6420 Overview

The **WEGENER iPump 6420** is an integrated, digital satellite receiver, decoder, and audio server designed to provide the most cost effective method of delivering and storing content for radio network operations. In tandem with WEGENER Compel/MediaPlan, the **iPump 6420** is a key part of the WEGENER Digital Media Delivery System, which combines secure MPEG and IP digital transmission with media management and server storage, to provide the most modern Store/Forward solution now possible in the radio network market.

1.2.1. Basic Store/Forward Mission

A technological goal in current satellite-based radio network design is to concentrate more control at a central management point, while retaining and expanding the "local" feel. WEGENER is a leader in moving its radio network customers toward this goal.

A "linear" satellite network is one where all media content, aggregated at the central uplink, is instantaneously delivered at the edge receivers. To deliver a greater variety of content, more channels, using more bandwidth, was needed. Localization, the origination of unique material from each of many local affiliates, was only possible with some cooperation between the central managing authority and the local operators. The central network could deliver closure or DTMF pulses in the satellite control or media streams, signaling "avails" to the local affiliates. At those avail points, the local affiliates could use their own ad insertion equipment to switch in local programming with minimal conflict.

The WEGENER Store/Forward (S/F) solution for satellite-based radio networks provides localization by borrowing and storing bandwidth ahead of its use. Media content is delivered in spare bandwidth, not needed for the linear network "mission", to the edge receivers. This content may be unique for each of the edge receivers, where it is stored for later and repeated use. Then, using the indirection of "playlists", the central control system can signal for the local content to be inserted in the programming stream at the proper "avail" points.

WEGENER's S/F solution for radio networks uses the WEGENER COMPEL/MediaPlan control system in tandem with WEGENER iPump6420 Audio Servers. This equipment, along with other components, is shown in a typical radio network application in ***Figure 1-1***. This figure shows the three key components of the application: 1) The real-time linear media streaming sub-system, 2) the non-real-time portion of the S/F sub-system, and 3) the real-time portion of the S/F sub-system. Each of these may now be introduced.

The real-time linear media streaming sub-system accepts the aggregated audio feeds from the customer traffic systems and compresses them in an array of MPEG audio encoders. These are then multiplexed together into an MPEG Transport stream. That Transport is then passed through the WEGENER UMX5010, where the network (Compel) control stream is injected. The resulting Transport is fed to the RF system where the information is impressed on a DVB carrier, and then uplinked to the satellite. From there it is distributed to the satellite downlinks and thence to the edge iPump6420s, who are tuned to the proper carrier, Program, and audio stream, to deliver the desired live audio feed. The Compel network control system can support this portion of the overall mission by tuning the edge receivers (which may be i6420s, or other linear receivers, such as WEGENER Unity4600), setting their audio stream assignments, sending the RBDS data traffic, ordering local relay closures, and supporting the logical grouping of the edge receivers.

The non-real-time portion of the S/F sub-system accepts a schedule file, on a regular basis, for each supported affiliate site. This schedule will define local spots, as files, to be played in each available segment of the day. These segments are defined by the radio network management as those portions of each hour where specific spots will be eligible for play at the remote receiving i6420 sites. And for each segment of each hour of each day, a playlist name is defined. For each affiliate, that playlist may define a different file, or no file at all. The Compel network control system then orders the building of those playlists on the affiliate i6420s. In addition, the referenced files are also ordered for downloading. The file will be pulled (or pushed) from a file server in the customer traffic system, and then broadcast by UDP to a "satellite" IP address. The emitted UDP messages are encapsulated by MPE protocol, creating a Transport stream which is re-multiplexed with the main Transport and sent over the satellite to the receiving i6420s. The Compel control stream bears control commands that instruct which i6420s, or which groups of i6420s, will receive each file. While setting up the affiliate i6420s, the Compel system also sets up it's internal scheduling mechanism to re-assign known incoming customer closures, for the supported networks, each to a new playlist-execution command on each segment's time boundary. This sets up the real-time portion of the S/F system.

In real-time, ***Figure 1-2*** represents a method by which the S/F system creates localization under central control. On a PIO input assigned for spots on a specific supported networks, the Compel system receives a closure from the customer's traffic system. The customer's traffic system sends this closure to coincide with the start of a network-wide spot, the default play for any "linear" edge receiver. At the time that closure is received by Compel, it causes a playlist-execution command to be emitted to the entire network of i6420s. The name of the playlist has been assigned by the Compel scheduler for that network, day, hour, and segment. The remote affiliate iPumps either have that playlist defined or not. If not, they continue decoding the live network feed, playing out the "network" spot. If they do have that playlist defined, those i6420s each mute the live network feed, and instead, insert the audio for the referenced file, a local spot. As the spot concludes, the live network feed unmutes and resumes on the i6420 audio output.

Figure 1-1: Store/Forward System overview

1.2.2.

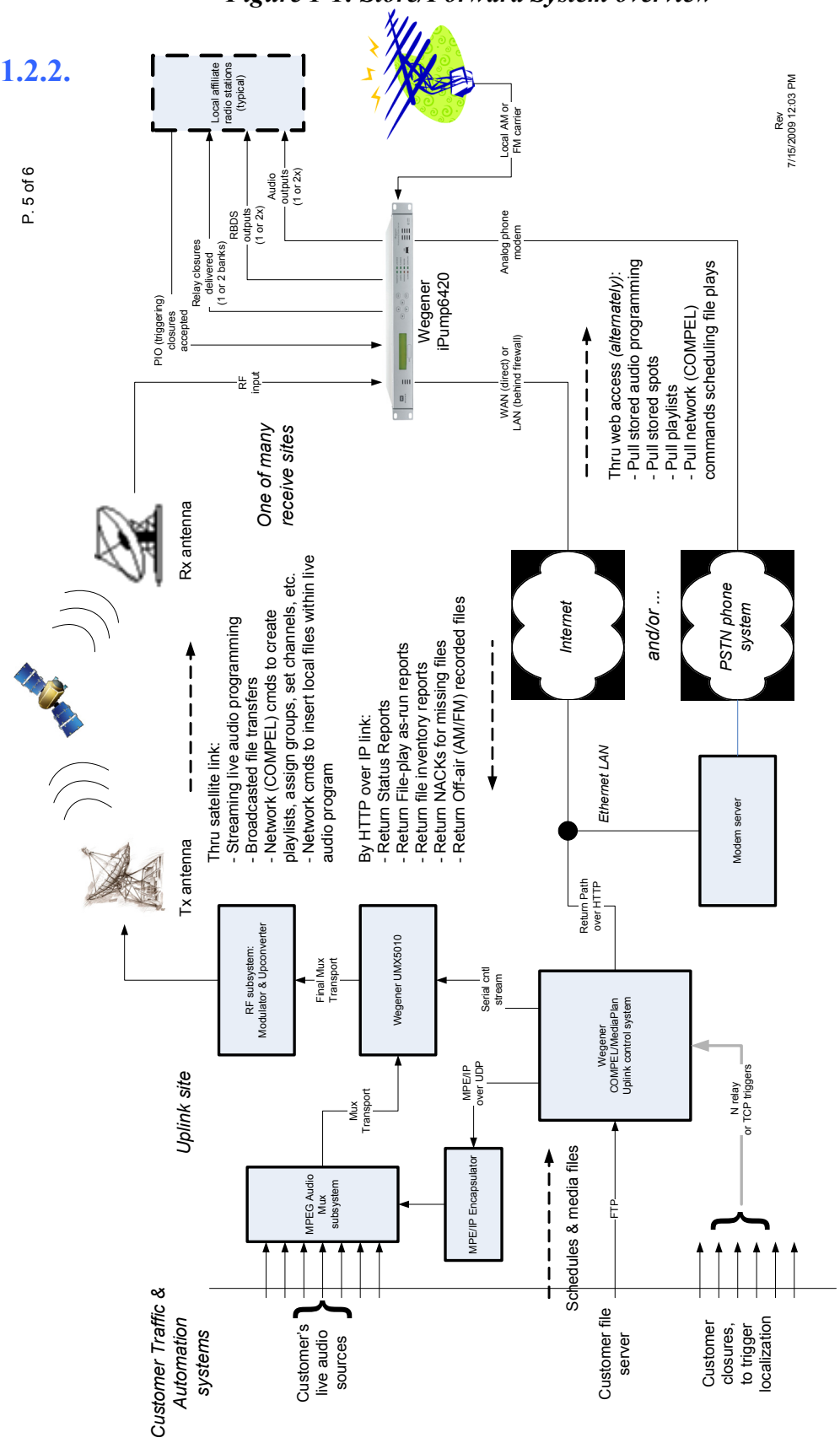


Figure 1: Overview, Store/Forward Radio Networks featuring iPump6420

Figure 1-2: Using Playlists as indirection

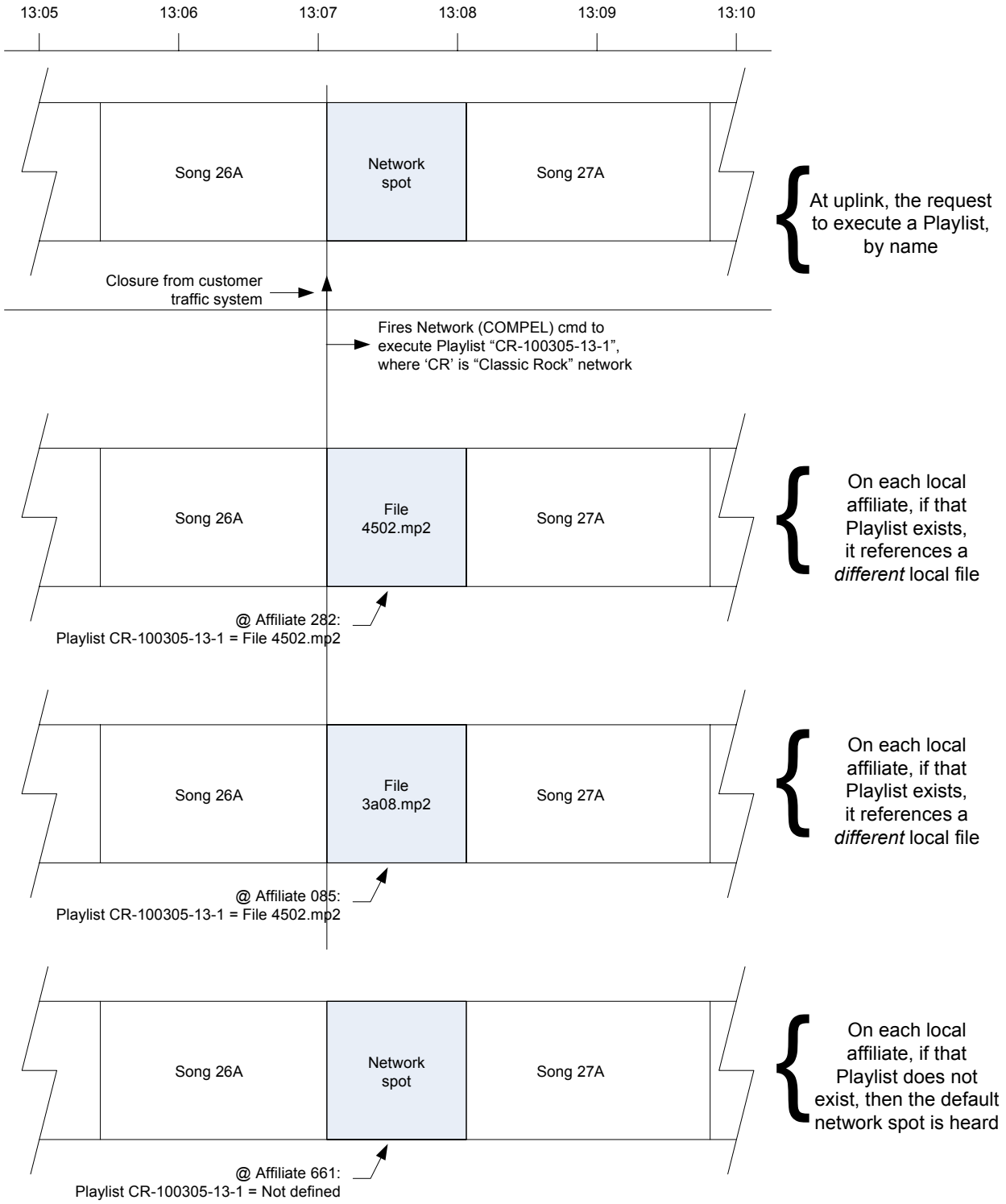


Figure 1-2: Using "Playlists" as indirection, for local inserts

1.2.3. Supplemental capabilities

Along with the above basic S/F system functions, certain supplemental capabilities are beneficial to the radio network mission. As shown in Figure 1, Return Path provides a general tool to request and receive low-bandwidth status and logging information from edge i6420s back to the uplink control system. Return Path is implemented with HTTP protocol, allowing the i6420s to communicate with the uplink control system with through either dial-up connections (if modem equipped) or with broadband IP connection. Because HTTP is used, most i6420s should have little problems with corporate firewalls at affiliates sites. With the Return Path tool, several other functions are possible.

The function that assures that the satellite-bandwidth-intensive process of MPE/IP file download is working efficiently is called "Asset Healing". In this function, the uplink control system maintains a database showing what each Compel address (either individual i6420s or groups of such) should have in it's own file repository. Xml files showing the expected list is then sent to that i6420 or group of i6420s. The i6420s, in turn, delete local files no longer required and request, through Return Path, any files that are still missing. The uplink control system then re-orders the missing files, maintaining synchronism between the files as captured in the Compel/MediaPlan subsystem, and the files resident on each edge i6420.

Two functions allow the customer to audit the radio networks to ensure that the local spots have properly played, for audit and billing purposes. Through Return Path, the Compel control system requests returned reports showing spot "as-run" logs for the edge i6420s. From this information, specific reports may be prepared for the customer comparing the original scheduled spot-play requests against the returned logs. Additionally, iPump6420 features an two on-board AM/FM tuners. These can be used to provide true Off-Air Reporting (OAR). When the uplink control system requests the play of local spots, it can also request simultaneous recording of audio demodulated from the local AM or FM radio broadcast. Presumably, this recording will show evidence of the local airing of the requested spot. The i6420 then compresses the recorded material, and when requested by the uplink control system, returns those OAR audit files to through Return Path.

To enhance the true "local experience", WEGENER S/F systems also implement a feature called "DJ Liners". With this feature, all local affiliates in a radio network share a single on-duty DJ, and that DJ's liner "greetings" are customized for each and every affiliate. This is done by having the control system maintain a database of all DJs assigned and their on-duty hours. The DJ prepares liner greetings for all the member affiliates in the particular network. These files are then downloaded to special Liner Assets, one at each affiliate, but all "aliased" to the network's name. When the DJ on-duty wishes to send a liner greeting, of a certain length in seconds, to all the affiliates, he pushes a button that creates an incoming closure to the Compel control system. This causes a request to be sent out to all affiliate i6420s to play one of the liner files of that length, under that "aliased" network name, chosen as a semi-random "shuffle" from all files available. This generates a local DJ liner greeting to be generated at each affiliate, often with mixing where the live network feed continues, but at a "ducked" audio level. The result is the perception, in the final radio audience, that the DJ works their affiliate alone (e.g. "This is Ron Baylor here on your Rock Classics station, WKLS Atlanta!!").

In addition to the above special functions, the system may allow certain i6420s to operate more autonomously. Instead of receiving its network control command through the satellite channel, it may also be setup to receive it's commands by doing HTTP polls of the uplink control

system. This is called "Compel-over-Internet". Along with this capability, the i6420 may also poll for and then pull in it's local spot files over the same internet connections. This is called "Internet File Delivery". This allows the i6420 to easily implement a premium radio network feature called "Automation Mode", to be discussed.

Compel commands, either directly addressed, or addressed as groups, or "indirectly addressed" based on current unit settings, are one method of controlling iPump6420 Audio Servers. Because of timing-delay functions built into Compel, the network operator can accurately overlay network "avails" with local spots. In addition to real-time Compel commands, the network operator can exploit the network-wide time synchronization of all Wegener edge receivers when being fed from a single Compel control system. Just as events may be *scheduled* in the Compel control system, those same schedules may also be loaded to the remote field iPump6420s. These schedules can create a model for iPump 6420 automatic behavior, guaranteeing that critical commands are executed on target i6420s precisely at expected times.

1.2.4. Premium Features

Automation Mode

In Automation Mode, the i6420 is totally removed from the need for a satellite downlink connection. In this mode, the i6420 functions as a "radio station in a box". All its content, from local spots to the music or talk-format material, is downloaded to the unit as audio files. Daily schedule files, which give traffic-system instructions to the unit, are regularly downloaded to the unit. The unit is directed to an NTP time source through its LAN IP connection. With the time reference and the traffic schedule, the unit then autonomously plays it's files, delivers closures and sends RBDS messages to the local radio network affiliate.

ShowShifting

Many syndicated radio shows originate at a specific time in the broadcast day. For a radio-network to resell that show, it often has to record the original feed and then re-broadcast over satellite later at times convenient for the subscribing affiliates. This is a waste of satellite bandwidth when the iPump6420's ShowShifting feature is purchased and made available. This feature allows the central radio network manager, or a local user, to schedule local recording of the original show episodes, then subsequent planned playback times. These recordings are, unlike a "Tivo", include more than the streamed audio feed, but *also* include a capture of the timestamped track of associated Compel commands that went out with the original program episode: Commands for local spot plays, RBDS messages, and for local relay closure outputs. This whole effort is done so seamlessly that, at playback, the local affiliate cannot distinguish between the original show episode broadcast and the ShowShifted episode playback.

TimeZone Delay

Most radio networks span several time zones. Because of this, to keep the same scheduled "feel" at all affiliates through all those time zones, they, once again must do their own recording and re-broadcasts, using extra satellite bandwidth. The iPump6420 TimeZone Delay (TZD) feature allows the central radio network manager to avoid these complexities. Using TZD, the radio network manager can broadcast one feed over the satellite, with all the correct localization. At those sites in "later" time zones, the i6420, implementing TZD, will hold the entire compressed audio feed, along with all associated Compel commands (like ShowShifting) in a rolling recorded buffer. At the precise buffer depth corresponding to the hour difference in time, the original feed is heard, sounding and feeling the same as the live feed in the most eastern zone.

MP3 Codec

In addition to the standard wave (PCM only), mp2, and mpg files, iPump6420 may also support the popular mp3 (MPEG1 L3) files. This is convenient for the extra flexibility in file types for the local spots. And it is also required in order to make use of OAR, since files must be compressed as mp3.

1.3. Functional Description

This section is to describe the functional theory of operation of the iPump 6420. The iPump 6420 is basically a Linux-based x86 computer with advanced peripheral devices. How this hardware works together to fulfill the i6420's missions is shown in ***Figure 1-3***.

The RF input from the satellite antenna LNB is brought in to a DVB receiver subsystem. This stage takes the incoming L-band carrier, demodulates the carrier to FEC-encoded data, then decodes and de-interleaves the FEC data into the original MPEG Transport stream. This stage also provides the main Local Controller function with key status information, including carrier lock, error'd-second data quality, and RF signal level.

After this, the Transport stream is brought in as a serial byte-stream to the Linux-based application software that runs the iPump 6420. There, a software Transport demultiplexer recovers the PSI tables, the COMPEL command packets, MPE/IP data streams, and the desired live audio PES streams. The PSI tables are used to determine the locations of audio streams, finding their Packet IDs (PIDs) from the user-designated Program number and Audio Language Descriptor (LD). The COMPEL packets are parsed to find addressed commands for execution. The MPE/IP data streams are captured and recorded to the HDD storage, as commanded. The desired audio PES streams are identified by their PID, and then fed to software-based MPEG decoders (*not* to be confused with the unit's audio outputs).

The "Local Controller" shown in the Figure is, functionally, the application software running on the Linux-based x86 processor. The Linux OS and this software boots from a Compact Flash card installed to all iPump 6420s. (This way, in the event of HDD failure, the unit can still continue operation as a traditional IRD.) All the functional blocks not associated with specific hardware are executed, in real-time, in this software system.

As stated, the Compact Flash is the booting device, from which first Linux, then the operating application will boot. The writes to the Compact Flash are limited to downloads of

new versions of application software, and the maintenance of the basic non-volatile unit parametric settings.

The Hard-drive (HDD) storage is provided to store all the media and objects needed for the full Store/Forward mission. From the satellite, media file content, transmitted in the MPE/IP encapsulation, is extracted and the file then stored to the HDD. The database which captures the location, playability, and lengths, of all audio files is also resident on that HDD. Later, on command, those same audio files must be read from the HDD and passed to audio decoders for mixing into the output audio track. When playlists of audio files are built, the results are stored to the HDD. As new events are added, and old ones executed or deleted, the internal scheduler database on the HDD is read and written. As new OAR recordings are captured, the new compressed mp3 files are stored to the HDD. As the unit performs its basic functions, depending on its Log Level, various status data is logged to the HDD.

To provide the ability to seamlessly splice or overlap audio sources, the iPump6420 supports up to three instances of software-based audio decompression per audio Output. These software decoder stages may actually decompress live classical MPEG audio, or they may operate on wave (16b PCM), mp2, or (optionally) mp3 audio files. Their outputs feed an audio re-sampling stage, which translates their sample rates to the final user-set sample rate for that audio Output. Then the audios are muted or attenuated, as required, and fed to an audio mixer. The mixer output then feeds the final digital and analog audio outputs. Note that the entire structure shown is duplicated for both the two main audio outputs, as well as the "Aux" audio #3, though only one example is shown in the Figure.

As companions to each of the two main audio outputs, a bank of 16 cue relays and an RBDS serial output is associated with each. These are logically grouped together as a "Port", for purposes of control and advanced operations. The cue relays are used to provide the synchronizing signals to local station equipment. The RBDS serial output, along with the main audio output, may feed the local radio station exciter. This provides the local station listeners with the added experience of station, song, and artist identification.

In addition to the main audio, cue relays, and RBDS, each "Port" may also be provided an associated (optional) AM/FM tuner. This tuner is connected to an external radio antenna and is used to pick up the local radio station driven by that Port of the iPump 6420. Under network COMPEL control, the audio feed from the local station is captured, compressed to mp3 file format, and then recorded to the HDD storage. This "Off Air Recording" (OAR) feature is expected to be executed during spot file insertions, so that the uplink control may request return of the recorded file (method to be discussed) for commercial audits.

Moving on in Figure TBD, the iPump 6420 features two 100 base-T Ethernet adaptors, the "LAN" and "WAN" ports. The LAN port is used to transmit various Return Path reports (or OAR files) back to the uplink control system via HTTP. It also supports its own web interface, for local user control. It also provides various other network services, such as SMB or FTP access to the folder containing all audio files. It also provides access to a telnet server, which allows either Terminal control, or diagnostic access to Linux. For advanced users, an SSH server is also provided for diagnostic access. Of all these services, only the Return Path capability is also provided in the WAN port. This is a more secure port, as it only allows the outbound HTTP connection and blocks all inbound services, even Ping.

Where internet connections are not available from the LAN or WAN ports, an optional modem may be installed to allow dial-up connections back to the uplink control systems. This

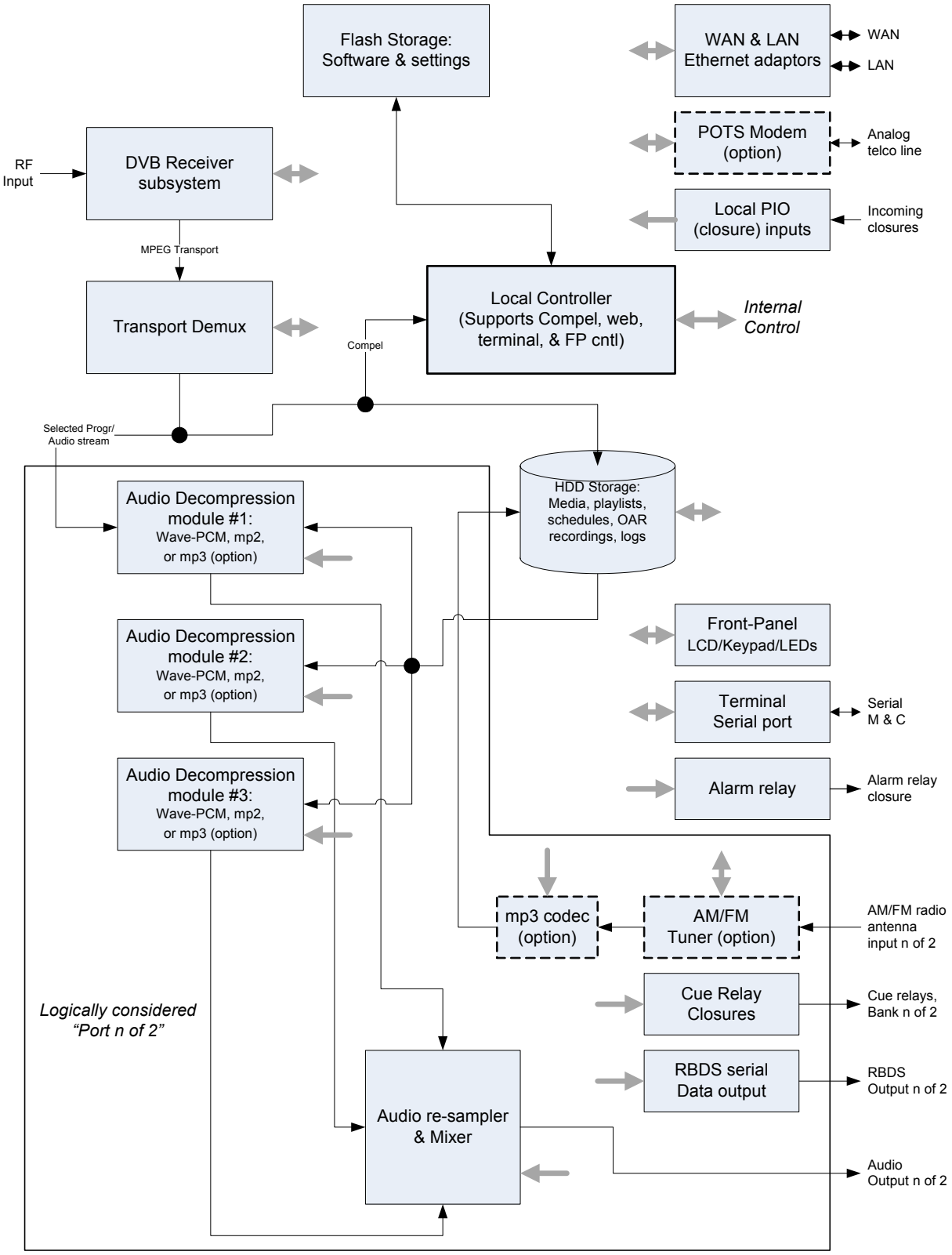
modem requires a simple analog "POTS" telco line for operation. It would be used as a first alternative to the LAN or WAN ports for attempted Return Path reporting.

Moving on in Figure TBD, the Local PIO closures are inputs provided to allow local automation equipment to cue the iPump6420 to deliver specific operations at precise times. These are fully balanced wire pairs, optically isolated from the i6420 chassis. Under Compel network or local user control, specific programmed events (commands) may be associated with any of the seven PIO inputs. When a closure is detected, that command is then immediately executed, whether an order to play an audio file, or to switch the live satellite audio feed.

Two more functional blocks not yet discussed are used for unit Monitor and Control. This is the Front-Panel system and the Serial M&C port. The Front-Panel features LEDs for indications, a 2x20 character LCD for status and control menus, and a keypad interface for user control. The Serial M&C port allows the user a local Terminal control session.

Lastly, the iPump6420 features an alarm relay contact closure, to allow use of the unit in redundant fail-safe configurations. This closure indicates "Fail" when the unit is in an Alarm state, or when AC power is removed.

Figure 1-3: iPump6420 Functional Block Diagram



1.4. iPump 6420 Specifications

Characteristic	Specification
DVB-S1-QPSK Tuner	
RF Input	
Input Impedance	75 Ω unbalanced
Input VSWR, 75 Ω system	< 2:1 (9.0 dB R.L. min), 950-1450 MHz < 3:1 (6.0 dB R.L. min), 1450-2150 MHz
Surge Resistance	Survives up to 10 direct-coupled 8kV discharges (per IEC 801-2)
RF Tuning	
Input Frequency Range	950 to 2150 MHz
LO Leakage at Input	≤ -50 dBm
Symbol-rate Range	2 to 45 Msps (may be limited by Transport Rate Limits)
Tuning Resolution	10 kHz
Input Signal Level Range	-25 to -65 dBm
Signal Level Warning Limits	Warns within +10/-5 dB of upper limit and +5/-10 of lower limit
Maximum Aggregate Input Power	-8 dBm min
Demodulator/FEC	
Modulation	QPSK (α=.35) per DVB (EN300 421)
Carrier acquisition range	±1 MHz or ±10% of symbol-rate QPSK, whichever is greater
Max Eb/No @ Quasi-error-free threshold (less than one uncorrected error-event per hour)	Per EN300 421: QPSK R=1/2: 4.5 dB, QPSK R=2/3: 5.0 dB, QPSK R=3/4: 5.5 dB, QPSK R=5/6: 6.0 dB, QPSK R=7/8: 6.4 dB,
RF Power Level Estimator (locked to carrier or not)	Unitless metric SIGNAL corresponds to input power as follows: Above -25dBm: Extrapolated up to 100+ -25dBm: 90 -55dBm: 30 -35dBm: 70 -65dBm: 10 -45dBm: 50 no signal <0 Below -65dBm: Extrapolated from 10 down to <0
	Accuracy: unit to unit <±5 dB; over frequency <±10 dB
LNB DC POWER	(supplied on RF center conductor)
Activation	User or network controlled selectable: ON or OFF
Voltage	~ +18.7 VDC nominal at no loading, +18.0 VDC min. at max loading
Current (full load)	350 mA max.
Short circuit protection	Thermal fuse, tripping at ~500 mA.
European "Universal LNB"	Implements LNB polarization & frequency-band control, per ASTRA recommendation

Characteristic	Specification
ASI Transport Input *Option*	
DVB-ASI Input	One input per DVB-ASI per EN50083-9 Annex B
Physical layer	270 Mbaub signaling on 75Ω coax cable
Minimum byte gap	Down to 5-byte interbyte gaps
Transport data rate	60 Mbps max.
Transport Demux	**MPEG/DVB**
Max Supported Rate	60 Mbps
Programs	Unlimited
Audio streams per program	Unlimited
MPE/IP File Downloads	
Types	1) By MPE/UDP/IP in satellite Transport 2) By HTTP over Internet
Max aggregate data-rate over satellite	10 Mbps
Audio Decoders	**One live, and up to two file-based audio decoders may be assigned per audio output**
Compressed modes, live satellite audio streams	MPEG-1 Layers 1 and 2, MPEG-2 Layer 2
File playback	MPEG-1 Layers 1 & 2, PES or Program (recordings only) MPEG-2 Layer 2, PES or Program (recordings only) 16-bit PCM wave MPEG-1 Layer 3 ("mp3" option, see below)
Compressed data-rates	Up to 384kbps ES rate
Input Sample rates/formats Supported	32, 44.1 and 48 kHz *only*; mono or stereo
User-set output sample rates	32, 44.1 and 48 kHz
MP3 codec	Constant bit rate *only* Max ES bit rate 256 kbps ID3 tags: v1 (file-end), v2 (file-start), both, or *neither* OK.
File insertion tools	
Playlists	1) Quantity: Unlimited 2) Length: Unlimited number of files, spec'd literally by name or using keyword selection from folders *(see next)* 3) Execution options: (i) play once as temporary insert; (ii) loop N times as temporary insert; or (iii) loop indefinitely as permanent Port setting ("virtual channel")

Characteristic	Specification
File selection keywords (used in any file-play specification for an insert)	1) SHUFFLE—select files to play from folder such that each plays once before any repeat, but order is different each time through 2) RANDOM—select files to *randomly* play from folder, but without any repeats 3) SEQUENTIAL—Like SHUFFLE, but maintains same play order each time through file list in folder
Insertion "Profiles"	1) Pre-silence mutes live for programmable period before file insert starts 2) Post-silence mutes live for programmable period after file insert ends 3) Programmable attenuation of file audio during insert 4) "Duck" allows live to mix with file audio during insert at programmable attenuation
Transitions on file insertions	Seemless. No *inserted* silence.
Synchronization of inserts to live audio track	1) Compel NETCON DELAY 2) Compel Extended Syntax command delay
Analog Audio Output	**Measured at 256 kbps audio ES rate, stereo mode**
Output Level-MAX PPL	+18.0 dBm into 600 ohms @ 0 dB attenuation +24.0 dBm is optional
Output level adjust range	0 to 20 dB attenuation in 1 dB steps from Output Levels above
Output Impedance	Balanced: < 60 Ω
Frequency Response	20Hz to 20 kHz, + 0.5/-1.5 dB 50 Hz to 15 kHz, ± 0.5 dB
Phase Accuracy	50 Hz to 15 kHz, ≤ ±2° from linear phase
SNR	≥ 88 dB (22 Hz to 20 kHz) unweighted
Harmonic Distortion *(1KHz test-tone, 1dB below PPL)*	≤ 0.1%
Dynamic Range	16-Bit Delta Sigma DAC
Muting	Muting control of each Audio Decoder (port) is available, muting both analog & digital outputs in tandem
Digital Audio Output	***Supplied for two main audios***
Protocol	Balanced 16-bit AES3 audio, Sample rate per each audio output
Output Impedance	Differential pair, 110 ohms
Output level	Non-adjustable 5 VP-P
Muting	Muting control of each Audio Decoder (port) is available, muting both analog & digital outputs in tandem

Characteristic	Specification
LAN/WAN Ethernet Ports	
Physical Layer LAN & WAN	Full-duplex, auto-negotiating 10baseT, 100base TX (twisted pair) on RJ45 jack
Media Access and Link Layers	Per IEEE 802.3 (Ethernet)
Network and Transport Layers	Binds to TCP/IP stack
Network Services	Telnet, SMB, FTP, SSH (for diagnostics), HTTP (web) server, HTTP client (for Return Path)
WAN port security	All inbound TCP connections blocked; inbound ICMP messages (e.g. PING) blocked
Cue Relays	
Arrangement	Two banks of 16, each bank may be logically associated with a main audio output
Type	Form A relay 30VDC @ 100mA. Commons may be wired together (by factory-set jumper), or each wire pair left "floating".
Alarm/User relay	One relay dedicated to indicate ALARMS and one relay dedicated to user control. The ALARM relay automatically de-energizes for alarm conditions so that power loss to unit indicates as an alarm.
Type	Form C, wiper contacts NC contact when de-energized and NO contact when energized
Polarity	Common, NC and NO contacts supplied externally
Rating	30VDC open circuit, 100mA max current closed
RBDS Serial Ports	
Arrangement	Two serial ports, each may be logically associated with a main audio output
Baud/protocols	Programmable to 1200, 2400, 4800, or 9600 baud, fixed at 8N1; *output* only
Serial M&C Port	
Assignment	Terminal (default) or Compel email
Baud/protocol-- Terminal	Programmable to 2400, 9600, or 19.2 k baud; fixed at 8N1; full duplex
Baud/protocol—Printer email	Programmable to 1200, 2400, 4800, or 9600; fixed at 8N1; *output* only
PIO Inputs	
Physical	7 balanced wire pairs, triggering on closure
Logical	Closures may be programmed to trigger stored Compel cmds

Characteristic	Specification
Off-Air Recording ***(optional)***	**Audio captured from demodulated radio carriers. Audio compressed into mp3 files and returned to uplink control system via Return Path.**
Arrangement	**Two AM/FM inputs, each logically associated with one of the two main Audio Decoders (ports), either #1 or #2**
AM (domestic US)	**Frequency 520 to 1720 kHz** **Sensitivity 5.0 uV for S/N= 10dB**
FM (domestic US)	**Frequency 87.9 to 107.9 MHz** **Sensitivity 2.0 uV for S/N = 30 dB**
Extended worldwide support option ***(contact WEGENER sales)***	**In *addition* to US commercial bands, add these bands:** **AM (Long Wave) 153 to 279 kHz** **AM (Medium Wave) 520 to 1710 kHz** **AM (Short Wave) 2.3 to 21.85 MHz** **FM 64-108 MHz**
Compression System	**Real-time compression to mp3 during file capture**
MP3 file compression parameters	**ES bit-rate: 8, 16, 24, 32, 64 kbps** **Audio sample rate: 8, 16, and 32 kHz** **Stereo/mono selection** **Sample depth 8 or 16 bit**
Total recording time per hour	**For *best stability*, unit must record 12 minutes or less per hour, from all sources**
Time Synchronization	**Compel TOD messages or NTP**
Unit Control	
Local User	**1) Front-panel** **2) Terminal (thru serial port or under Telnet)** **3) Web** **4) SNMP *(status only)***
Compel	**1) Real-time COMPEL command stream in Transport** **2) Polled Compel commands (by HTTP, over internet)** **3) Stored Compel commands in Scheduler (fixed time or Triggered, either by Compel cmd or PIO input)**
Power	
AC Voltage	**90-132 or 175-264 VAC, auto-selected**
AC Frequency	**60/50 Hz ± 2%**
Current	**0.8A @ 115VAC *typical*, with full LNB load**
Chassis	
Height	**Std. 1RU 1.75 inches (4.45cm)**
Width	**EIA std. 19 inches (48.26cm)**
Depth	**Back of rack-ears to rear panel: 19.4 inches (49.27 cm)** **Back of rack-ears to end of connectors: 20.2 inches (cm)**
Weight	**~18.2 Pounds (8.27 kg)**
Cooling	**Fan-cooled with front-side and right-side inlets with back-side and left-side exhausts (viewed from the front).** **Continuous fan cooling.**

Characteristic	Specification
Environmental	
Use	Indoor only
Heat dissipation	48 watts *typical*, with full LNB DC load
Operating Temperature	+10°C to +40°C (+50°F to +104°F) Unit gives warning indication for over-temperature conditions
Storage Temperature	-20°C to +70°C (-4°F to +158°F)
Humidity	To 93% non-condensing
Altitude	Up to 10,000 ft (3048 m)
Agency Approvals	
UL	UL 60950-1:2003, First Edition CSA C22.2 No. 60950-1-03 1st Ed. April 1, 2003
FCC	EN55022, EN61000-3-2, EN61000-3-3 and FCC, Part 15, Subpart B Rules and regulations, Class A
CE	EN60950-1(02), EN55022, EN55024(98)A2(03)-tested per EN61000-4-2(95), -4-3(02), -4-4(95), -4-5(95), -4-6(96) and -4-11(94)

1.5. Safety Summary

The **iPump 6420** is designed for safe use with few special precautions required of the user. The following items are basic precautions to use when installing and working with your **iPump 6420**:

Do not open the **iPump 6420** chassis cover.

The **iPump 6420** incorporates security labels over some of the screws. There are no user-serviceable components within the **iPump 6420**. Tampering with these security labels or opening the unit may void your warranty. If you have questions, contact Wegener's Customer Service Department at the address or numbers listed in **Chapter 5 Customer Service** on page TBD.

CAUTION

As this unit is intended to interface with other electrical/electronic systems, proper engineering practices must be adhered to during installation and check-out.

All AC power and ground must be installed in accordance with National Electric Code Standards as to conductor size and limitations (see NFPA 70, articles 200-280, as amended, if required), and lightning protection must be provided.

All RF interconnections must be properly shielded to prevent ingress or egress of potential interfering sources to existing services.

Any damage to this unit caused by improper wiring/interconnections will void any warranty extended.

1.6. Glossary of Terms and Abbreviations

Term	Definition
AFD	Assured File Delivery, the WEGENER system for file downloads through satellite channels
Alarm	An indication of a serious fault, generally expected to prevent the i6420 from fulfilling a basic mission
Application	Term used to describe the controlling software that runs on top of an Linux Operating System, and that provides most i6420 functionality.
ASI	A physical interface for MPEG Transport streams, featuring bit-serial transmission on a baseband signal with 270 MHz signaling rate. The data is sent asynchronously, meaning the interface conveys a data byte when available at the sender, and padding bytes otherwise.
Boot Loader	A small program that briefly runs on top of the Linux OS in the i6420 that loads and runs the main application.
Carrier	An RF signal whose envelope and phase is modulated (manipulated) in an defined fashion in order to convey information.
Client	A program that can be started and ran on a computer that seeks services from server programs. Usually human operators will interface directly with the client to seek these services.
Compel	WEGENER's trademark Control system, optimized for control of media distribution systems using edge devices such as WEGENER's iPump 6420.
DVB	Digital Video Broadcast. Term used to represent the methods and protocols using MPEG Transport streams to distribute media content over satellite
Eb/No	In digital carrier systems, the energy per information-bit divided by the channels noise density per Hertz. This is the key figure of merit for signal-to-noise ratio.
Ethernet	The widely-used LAN technology specified by IEEE standard 802.3
FEC	Forward Error Correction. A transformation done on a stream or block of information, expressed in bits, bytes, or frames, where some small amount of redundancy is added. This is done in a manner such that, when the transformed (FEC-encoded) stream of data is conveyed over error-prone communication links, such as satellite channels, the errors can be removed and the original information message recovered.
FTP	File Transfer Protocol. Industry-standard method for transferring files between host computers over IP networks.
HTTP	Hypertext Transfer Protocol. This is the protocol supported by web servers and clients. It actually describes a set of methods to upload and download, not only web pages, but any kind of file. The i6420 uses the HTTP POST method to upload files to remote servers, and uses the GET method to download files from remote servers.
IP	Internet Protocol. The internetworking protocol that allows host computers to communicated over local networks or over the internet.
IRD	Integrated Receiver-Decoder. A product which features a "receiver" to extract Transport streams from satellite-borne carriers & a companion "decoder" to decompress MPEG elementary streams (from within said transport streams) in order to recreate the original audio/video/data signals. The WEGENER Unity 4600 is an IRD.

Term	Definition
Language Descriptor or LD	Identifier for a *single* component compressed audio stream under an MPEG Program within a Transport stream.
Linux	A modern, open-source (free) operating system (OS). The OS provides these standardized services to the i6420 application software: 1) access to the hardware, 2) rations access to the microprocess for the application's multiple processes, 3) interrupts the application with events and messages, 4) ration computer resources, and 4) allows standard communication methods to external hosts.
LAN	Local area network. An IP/Ethernet network to which either the i6420 LAN or WAN ports may be connected.
LCD	Liquid Crystal Display. Text display technology for i6420 front-panel.
LED	Light emitting diode. Display lamps for i6420 front-panel.
LNB	Low-noise block downconverter - equipment (generally at the antenna) that converts the incoming satellite signal to the appropriate frequency for reception by the iPump 6420.
MPEG	Moving Pictures Experts Group. Often used to describe a set of specifications based on ISO 13818-x.
PAT	Program Allocation Table. A single metadata structure provided in all MPEG Transport streams that show what Programs are available.
Permanent Setting	A non-volatile setting of the i6420, which has no time limit.
PID	Packet ID. Identifies a specific single data stream within an aggregate MPEG Transport stream.
PMT	Program Map Table. A single metadata structure that is provided in MPEG Transport streams, one such "table" per Program. Gives information about the media components (video, audios, data, etc.) within the Program.
Playlist	In an i6420, an ordered set of playable media files. When used, the entire set is played or executed in its entirety.
Program	Under MPEG, these are the basic channels under which media is conveyed in MPEG Transports. Typically, all media services within a Program share a single time-base.
Program Number	An identifier unique to each Program within a Transport.
PPP	PPP (Point-to-Point Protocol) is a protocol for communication between two computers using a serial interface, typically a personal computer connected by phone line to a server.
QPSK	Quadrature-phase-shift-keying. Term usually used to imply the specific carrier protocol (modulation and FEC) described in DVB specifications and used world-wide to convey MPEG Transports over satellites.
RF	Radio Frequency. Often used as a noun to mean any RF signal, such as the satellite downlink signal, or the IF signal emitted from the antenna LNB.
Server	A computing program that constantly runs, while waiting to deliver, and then performing the delivery of services to other programs running on the same or other computers. Also used to describe the computer upon which a server program is running.
SMB	Server message block - a protocol for requesting services from and reading and writing to a file server. An SMB server can present its files for easy viewing by Windows Explorer.
Telnet	Industry-standard method for communicating between host computers over IP networks.

Term	Definition
Temporary Setting	**A volatile setting of the i6420, which is limited in time. After this expires, the unit returns to a permanent setting.**
Transport	**The aggregate satellite-borne data stream defined by MPEG and DVB.**
Warning	**An indication of a minor fault, or perhaps early warning about an imminent major fault. At the point the Warning is displayed, it is for user information only and does not mean that a basic i6420 mission may not be fulfilled.**

Chapter 2: INSTALLATION

This chapter provides instructions on unpacking, mounting, and connecting the **iPump 6420,** as well as providing connector information, including detailed pinouts.

Table of Contents

2.1. Unpacking and Inspection

Carefully unpack the unit and its ac power cord and inspect for obvious signs of physical damage that might have occurred during shipment. Also locate the bag of accessories, including special cable pigtails and adaptors. Any damage claims must be reported to the carrier immediately. Be sure to check the package contents carefully for important documents and materials.

Note: Please save the packing materials and original shipping containers in case you must later return the unit for repair. Packing these units in other containers in such a way that they are damaged will void your warranty.

2.2. Location and Mounting

The **iPump 6420** should be mounted in a standard 19-inch equipment rack. After mounting, maintain a clean, dry environment for the unit.

Precautions

WARNING: FCC-Mandated Suppression of Radio Frequency Emissions

This is a **Class A** product. In a domestic environment this product may cause radio interference for which the user may need to take mitigating action.

If the Ethernet port has a cable connected to it, that cable must be properly shielded and grounded to minimize RF emissions that could interfere with nearby equipment.

DANGER To avoid damage to this and other equipment, or personal injury, the following items should be strictly observed.

Elevated Operating Ambient

When equipment is installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than the room ambient temperature. Therefore, consideration should be given to the ambient air temperature within the rack, and not just inside the room, when deciding if the maximum recommended ambient operating temperature (T_{MRA}) is being met.

Reduced Air Flow

Equipment should be installed such that airflow required for safe operation of the equipment is not compromised. To ensure adequate air flow, the **iPump 6420** should be arranged in a rack with at least one empty rack unit between it and adjacent equipment and with adequate clearance around both side vents.

Mechanical Loading

Mounting of the equipment in a rack should be such that a hazardous condition is not produced by uneven loading. This unit is moderately heavy, so total rack loading must be considered. Also, do **not** rest any unsupported equipment on your **iPump 6420**.

DANGER Circuit Overloading

Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of circuits could have on overcurrent protection and supply wiring. Ensure that the total rack or breaker power consumption does not exceed the limits of the ac branch circuit. Appropriate consideration of equipment ratings should be used when addressing this concern.

Reliable Earthing

Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (use of power strips, chassis ground lugs, etc.).

Rack Installation

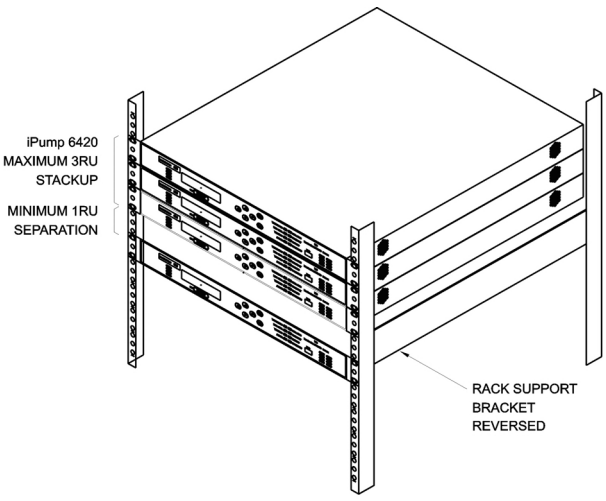
The iPump 6420 is sized at 1 RU and should be mounted in an EIA-standard, 19-inch-wide equipment rack. After mounting, maintain a clean, dry environment for the unit.

1) **First, install angle brackets or cross-supports capable of supporting both the unit and its connecting cables. Screw or bolt the supports securely to the equipment rack.**
   NOTE: Use of rack supports with cutouts on the sides that allow air circulation are also permitted.(Wegener P/N 26429-07, 26429-08)
2) **Place the iPump 6420 on its supports and use four anchor screws or bolts and nuts to secure the unit's front brackets to the rack.**
3) **Do not block any of the ventilation or fan opening on the front, side, or rear of the unit. Support arrangements that do not allow adequate air flow or that block the openings on front, side and rear vents may result in overheating and damage to the iPump 6420.**
4) **The front brackets must be secured to the rack. If front brackets are left unsecured, the unit may shift forward and fall from the rack during installation or operation. Failure to secure the front brackets may result in personal injury and/or damage to the equipment.**
5) **Locate the iPump 6420 and its cables to avoid impacts, spills, and pulling cables and to ensure sufficient air flow. Failure to locate the iPump 6420 in a proper environment may result in damage to the equipment.**
6) **No more than 3 iPump6420s may be stacked contiguously, after that, there needs to be a 1RU buffer space before any other heat-generating equipment. This may be repeated indefinitely, so long as the local ambient temperature requirements are observed (temperature of air at side and front ventilation points).**

Figure 2-1: Proper rack installation for iPump6420

Note:
Use of rack supports with cutouts on the sides that allow air circulation are also permitted. (Wegener P/N 26429-07, 26429-08)

Caution:
Do not block any of the front, side, or rear ventilation holes



2.3. Equipment Setup

2.3.1. iPump 6420 Rear Panel Connections

Before applying power, make the following connections, as necessary, to your iPump 6240. For connector details, refer to Table 2-1**Error! Reference source not found.**. For help deciding which connectors and signals to use, consult Chapter 3.

1) **Connect the L-band output from your antenna's LNB to your** iPump 6240's input RF port, **OR**, if supplied with ASI Input interface, connect a coax cable to your ASI Transport source (such as another satellite IRD).C**onnect your balanced analog audio ports (1, 2, or 3 [Aux]) to your analog audio distribution system (DA). *Or* connect the AES3 digital audio outputs (for 1 & 2 only) to your digital audio distribution system (DA).**
2) **Connect a CAT5 cable from the** iPump 6240's LAN port to the desired LAN segment in order to access the iPump 6240's web control screen. If that LAN segment can reach the internet, then this may be the only adaptor needed (see next).
3) **If you wish to have your iPump 6420 be able to send Return Path over internet to the uplink control system, then the LAN segment connected to the LAN port must be allowed to make outbound HTTP connections, and you must protect the iPump 6420 from inbound connections from the internet. *If so, then you may skip the next step*.**
4) **Connect a CAT5 cable from the** iPump 6240's WAN port to an external broadband internet connection. Remember, this is used only for connections unprotected by NAT router and/or firewall.
5) **Connect the Modem jack to a local analog phone line, if using Return Path, but where the Ethernet adaptors cannot be wired to have access to the internet.**
6) **Connect one of more of your** iPump 6240 Cue Relays ports to the local commercial insertion equipment (if used).
7) **Connect one or more of your iPump 6420 RBDS output ports to the radio station exciter's RBDS input, if supporting RBDS distribution in this radio network.**
8) **Connect one or more of your iPump 6420 AM/FM tuner inputs to appropriate radio antenna, if supplied and using Off-Air Recording audits. You must be using Return Path to support return transmission of recorded OAR files.**
9) **Connect the local automation systems's relay closure outputs to the PIO Input connector.**
10) **For diagnostics, you may connect a text-based monitor to the Serial M&C port.**
11) **Connect the Alarm port to downstream redundancy control or alarm monitoring system.**
12) **Connect the supplied ac power cord to the** iPump 6240's IEC receptacle and then to a 100-to-120 VAC or 200-to-240 VAC source. **Once all of the ports are connected and power is supplied, the** iPump 6240 begins the startup process and will require about 2 ½ minutes to complete.

2.3.2. iPump6420 Connector Details

Figure 2-2: iPump 6420 Rear Panel View

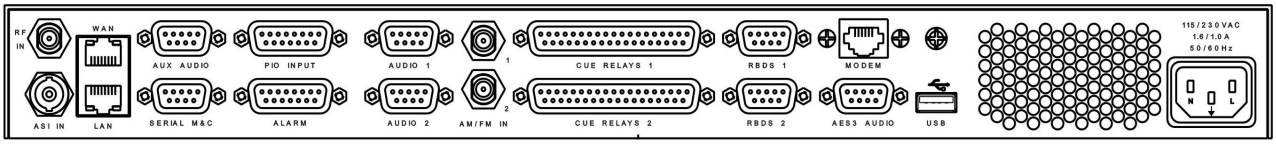


Table 2-1: iPump6420 External Connector Information

Connector Designation (Options shown in red)	***Type***	***Pin #***	***Signal Description***
On rear panel			
RF IN	Type F coax jack		L-band RF from external LNB. LNB-DC ***output*** on center-pin.
ASI IN	BNC jack		DVB-ASI Transport input
WAN	RJ-45 jack	1 (Rightmost as viewed from rear of unit)	EN_Out +
		2	EN_Out -
		3	EN_In +
		4	NC
		5	NC
		6	EN_In -
		7	NC
		8	NC
LAN	RJ-45 jack	(Same pin numbering but spatially reversed because of connector inversion)	(***Same as WAN***)
AUX AUDIO	9-pin D male jack	1	Left '+'
		2	Ground
		3	N.C.
		4	Ground
		5	Right '+'
		6	Left '-'
		7	Ground
		8	N.C.
		9	Right '-'

Connector Designation (Options shown in red)	***Type***	***Pin #***	***Signal Description***
SERIAL M&C	9-pin D female jack	1	DCD (internally pulled to +5V)
		2	RxD (data output)
		3	TxD (data input)
		4	DTR (not connected)
		5	GND
		6	DSR (internally pulled to +5V)
		7	RTS (not connected)
		8	CTS (internally pulled to +5V)
		9	RI (internally pulled to +5V, with weak current limiting)
PIO INPUT	15-pin D male jack	1	PIO #1 In
		2	PIO #2 In
		3	PIO #3 In
		4	PIO #4 In
		5	PIO #5 In
		6	PIO #6 In
		7	PIO #7 In
		8	Ground
		9	PIO #1 Return
		10	PIO #2 Return
		11	PIO #3 Return
		12	PIO #4 Return
		13	PIO #5 Return
		14	PIO #6 Return
		15	PIO #7 Return
ALARM	15-pin D male jack	1	Ground
		2	RxD (spare data output)
		3	TxD (spare data input)
		4	Ground
		5	Ground
		6	Cue Relay #1: Common contact
		7	Alarm (COM closes here on alarm or when power is off)
		8	OK (COM closes here when OK)
		9	Ground
		10	Ground
		11	Ground
		12	Ground
		13	Cue Relay #1: N.C. contact
		14	Cue Relay #1: N.O. contact
		15	COM

Connector Designation (Options shown in red)	***Type***	***Pin #***	***Signal Description***
AUDIO 1	9-pin D male jack	1	Left '+'
		2	Ground
		3	N.C.
		4	Ground
		5	Right '+'
		6	Left '-'
		7	Ground
		8	N.C.
		9	Right '-'
AUDIO 2	9-pin D male jack	(same pin numbering)	(***Same as AUDIO 1***)
AM/FM IN 1	BNC jack		AM or FM antenna unbalanced input (corresponding to port 1 audio)
AM/FM IN 2	BNC jack		AM or FM antenna unbalanced input (corresponding to port 2 audio)
CUE RELAYS 1	37-pin D male jack	1	Cue Relay #1-1: N.O. contact
		2	Cue Relay #1-2: N.O. contact
		3	Cue Relay #1-3: N.O. contact
		4	Cue Relay #1-4: N.O. contact
		5	Ground
		6	Cue Relay #1-5: N.O. contact
		7	Cue Relay #1-6: N.O. contact
		8	Cue Relay #1-7: N.O. contact
		9	Cue Relay #1-8: N.O. contact
		10	Ground
		11	Cue Relay #1-9: N.O. contact
		12	Cue Relay #1-10: N.O. contact
		13	Cue Relay #1-11: N.O. contact
		14	Cue Relay #1-12: N.O. contact
		15	Ground
		16	Cue Relay #1-13: N.O. contact
		17	Cue Relay #1-14: N.O. contact
		18	Cue Relay #1-15: N.O. contact
		19	Cue Relay #1-16: N.O. contact
		20	Cue Relay #1-1: Common contact
		21	Cue Relay #1-2: Common contact
		22	Cue Relay #1-3: Common contact
		23	Cue Relay #1-4: Common contact
		24	Ground

Connector Designation (Options shown in red)	***Type***	***Pin #***	***Signal Description***
CUE RELAYS 1 ***(continued)***		25	Cue Relay #1-5: Common contact
		26	Cue Relay #1-6: Common contact
		27	Cue Relay #1-7: Common contact
		28	Cue Relay #1-8: Common contact
		29	Cue Relay #1-9: Common contact
		30	Cue Relay #1-10: Common contact
		31	Cue Relay #1-11: Common contact
		32	Cue Relay #1-12: Common contact
		33	Ground
		34	Cue Relay #1-13: Common contact
		35	Cue Relay #1-14: Common contact
		36	Cue Relay #1-15: Common contact
		37	Cue Relay #1-16: Common contact
CUE RELAYS 2	37-pin D male jack	(same pin numbering)	(***Same as CUE RELAYS 1***, numbered #2-1 to 2-16)
RBDS 1	9-pin D female jack	1	DCD (internally pulled to +5V)
		2	RxD (data output)
		3	TxD (data input)
		4	DTR (not connected)
		5	GND
		6	DSR (internally pulled to +5V)
		7	RTS (not connected)
		8	CTS (internally pulled to +5V)
		9	RI (internally pulled to +5V, with weak current limiting)
RBDS 2	9-pin D female jack	(same pin numbering)	(***Same as RBDS 1***)
MODEM	RJ-11 phone jack		Standard analog telco phone line
AES3 AUDIO	9-pin D female jack	1	AES3 dig audio port 1 '+'
		2	AES3 dig audio port 2 '+'
		3	AES3 dig audio spare '+'
		4	Ground
		5	Ground
		6	AES3 dig audio port 1 '-'
		7	AES3 dig audio port 2 '-'
		8	AES3 dig audio spare '-'
		9	Ground

Connector Designation (Options shown in red)	*Type*	*Pin #*	*Signal Description*
USB	USB type A jack		Universal Serial Bus host-end
115/230 VAC	Std IEC receptacle		AC Line In
On Front-Panel			
USB	USB type A jack		Universal Serial Bus host-end

2.4. Establishing Compel Network Control

After racking and cabling your iPump6420, it is now time to bring it up on the satellite carrier (if applicable) or get it connected to the internet (if applicable), such that full Compel network control may be implemented. This will allow your iPump 6420 to fully participate in the rich feature set of WEGENER's MediaPlan-based Store/Forward system.

In many cases, your unit was already pre-set at the factory per the instructions from your network provider, and require no setup operations by the local user. In that case, see ***Section 2.5*** Unit Indications, to confirm unit operation. If, however, your unit is not fully configured for your site, then continue reading.

To start, check with your network operator to find out how your iPump6420 will be controlled. Typical satellite networks require network control over the satellite channel. However, special Microcasting sites will pull their network control commands and media file downloads solely over the internet. After you have decided how you need to get network control, then you need to configure, or check configuration of your i6420 unit. If you are going to use local web control, then you are going to need to network a working computer, with approved web browser (See Specifications, Chapter 1) to your i6420, and then, from the Front-Panel, set the i6420's LAN IP address. ***Subsection 2.4.1*** covers this issue.

If you are ***not*** using web control to setup the i6420, but need to do some configuration through the Front-Panel user interface, then see ***subsection 2.4.2***.

2.4.1. Getting Local Web Control

The user web interface is the preferred method of local control. If it has been enabled at the factory, then this subsection should allow you to properly setup and verify. Even if enabled, you probably may need to setup the iPump6420 LAN network parameters to get it to work. Perform the following steps to accomplish this. If any questions about using the i6420 Front-Panel, please refer to a more thorough discussion in Chapter 3. Note that these quick install instructions cannot go into details about setting up modern IP networks. Please consult your IT department, or, *even better*, a good book on networking to help you there.

Steps to setup LAN port networking in iPump6420:

1. On the front LCD, confirm that you are at the "Home" screen (see Chapter 3), by pressing <ESC> button several times.
2. Press the <←> button twice to get the "Unit Setup" screen.
3. Press <ENT>, then press either <←> or <→> several times, until you get to the "IP Setup" screen.
4. Press <ENT> and then you should see the "LAN IP Settings" screen. (If you were *actually* looking for the "WAN IP Settings" screen, then press the <→> button once.)
5. Press <ENT> again and then you should see the "LAN Addressing Mode" screen.
6. The choices are either "STATIC" or "DHCP". If you wanted DHCP, and that is what is shown, then you are done: Press <ESC> several times until you return to the original Home screen; then cycle power on the unit to force a reboot and request for an IP address from the network's DHCP server. Otherwise, if you wanted LAN and that is what is shown, then skip to step #10.
7. While still at the "LAN Addressing Mode" screen, if you need to change the setting, then press <ENT> to get an "edit session".
8. Use the <↑> or <↓> button to modify the value, then press <ENT> to 'save' it. If you do not wish to make changes, exit by pressing <ESC>.
9. If you were changing to DHCP, then press <ESC> several times to return to the Home screen; then cycle power on the unit to force a reboot and request for an IP address from the network's DHCP server (you are done).
10. If the desired mode was STATIC, and that is what you now have, then press the <→> button once to get the "LAN Static IP Addr" screen.
11. If you want to change the IP address shown, press <ENT> to get an edit screen.
12. Press the <→> or <←> buttons to move the cursor under the digit you wish to edit. Then press the <↑> or <↓> button to modify the value.
13. Repeat above as often as necessary, remembering that all octets (numbers between the periods) less than '100' will be shown with leading '0's (so to show the value ''3', the screen must show '003'). When done, press <ENT> to save the change, or press <ESC> to leave the edit screen without saving.
14. Next, press the <→> button once to get the "LAN Static Netmask" screen.
15. If you want to change the Netmask shown, press <ENT> to get an edit screen.
16. As done above, finish editing the netmask, then press <ENT> to leave the edit session and save the results, or press <ESC> to leave without saving.
17. Next press the <→> button once to get the "LAN Static Gateway" screen.

18. If you want to change the Gateway IP address shown, press <ENT> to get an edit screen.
19. As done above, finish editing the Gateway IP address, then press <ENT> to leave the edit session and save the results, or press <ESC> to leave without saving. Remember, that this *must* be the address of the router that allows you to connect to remote IP networks. If it is not set correctly, you will not be able to reach your iPump from remote networks, *nor will you be able to do Return Path to the uplink control system using this LAN port*.
20. When done, press <ESC> repeatedly until back at the Home screen. Now you are ready to access the iPump 6420 from your web browser.

2.4.2. Setup through the Front-Panel

This subsection gives you a checklist of items to setup or check to get your iPump 6420 on the carrier and ready for satellite-based network control. Very few items are suggested for user setup, because normally Compel will control must unit settings, and the web interface is much more fully-featured (and thus recommended). These instructions are fairly terse, and, if any difficulty, please refer to the general guide on the Front-Panel interface in **Chapter 3**. In some cases, control of some or all of the following parameters has been disabled by a factory setting. In this case, it was assumed that the unit was setup well enough to lock onto the carrier and receive Compel network commands when first supplied the correct antenna connection. You may then reference **section 2.5** to see if the indications all show OK, and, if not, use the Troubleshooting guide in **Chapter 4**.

Check/set LNB LO:

1. Start or return to the LCD Home screen is reached (see **subsection 2.5.1**).
2. Move to *Unit Setup* same level; select that
3. Move to *Transport In Setup* same level; select that
4. Move to *LNB Setup* same level; select that
5. For *LNB Type*, select either "Local Osc" (which is typical) or "Universal/ASTRA" for special European satellites
6. Leave LO Type set to *Custom Freq*, all versions below 420
7. Move to *LO Custom Freq* and set it to either 5150 or 10750 MHz, if domestic (consult with satellite provider outside US)

Check/set RF carrier settings:

1. Start or return to the LCD Home screen is reached (see **subsection 2.5.1**).
2. Move to *Unit Setup* same level; select that
3. Move to *Transport In Setup* same level; select that
4. Move to *Current Channel*; select that
5. Move to *Symbol Format*; select and edit as necessary. "QPSK" is std DVB-S1-QPSK.
6. Move to *FEC Ratio*; select and edit as necessary.
7. Move to *Downlink Frequency*; select and edit as necessary
8. Move to *Transp. Data Rate*; select and edit as necessary ***OR***
9. Move to *Transp. Symb Rate*; select and edit as necessary

10. Move to *Program Number*; select and edit as necessary. Use '*' to use the first Program available
11. Move to *Tag Site*; select and edit as necessary. Site '15' is the do-not-use choice.
12. If any changes you wish to keep, move to *Done* and select

Check/set audio port settings:

1. Start or return to the LCD Home screen is reached (see **subsection 2.5.1**).
2. Move to *Unit Setup* same level; select that
3. Move to *Decoder Setup*; select that
4. Select the audio output, 1, 2, or 3 (Aux) under *Decoder Number*
5. Move to *Decoder Setup*; select and edit as necessary. Set to "Follow Tune" if the DVB Program assigned in the RF setup is acceptable; set to "Program" to set the DVB Program; set to "Off" if not using that Audio Port.
6. Move back up to *Decoder Setup*; then move to *Audio Setup*; select that
7. Select the audio output, 1, 2, or 3 (Aux) under *Decoder Number*
8. Move to *Audio Lang Setting*; select and edit that. Use '***' to use the first-available audio stream in the Program (OK if only one audio!).
9. Repeat as necessary for multiple audio ouptuts

Check/set LAN and/or WAN Ethernet port settings:

1. Start or return to the LCD Home screen is reached (see **subsection 2.5.1**).
2. Move to *Unit Setup* same level; select that
3. Move to *Decoder Setup*; select that
4. Move to *IP Setup*; select that
5. Move to *LAN IP Settings*; select that
6. Move to LAN Addressing Mode; select and edit to be either "Static" or "DHCP". If "DHCP, you are done with this port.
7. If "Static", move to *LAN Static IP Addr*; select and edit
8. If "Static", move to *LAN Static Netmask*; select and edit
9. If "Static", move to *LAN Static Gateway*; select and edit
10. If the WAN port is to be checked and set, follow similar steps, but substitute 'WAN' for 'LAN' in instructions

Check/set Terminal port settings:

1. Start or return to the LCD Home screen is reached (see **subsection 2.5.1**).
2. Move to *Unit Setup* same level; select that
3. Move to *Serial Port Setup*; select that
4. Move to *Device Assigment*; the default is "Terminal". If not set there, select and edit, if you wish to use the Serial M&C port for monitor and control.
5. Move to *Term Baud*; select and edit the baud rate needed.

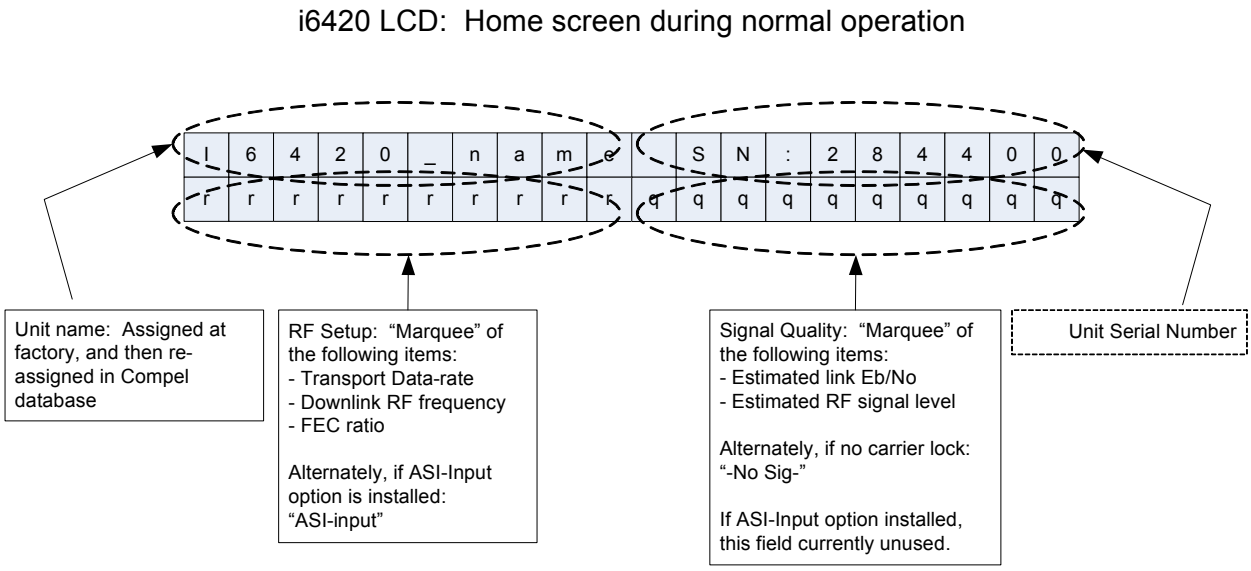
2.5. Unit Indications

This section discusses what the user can see and learn from the iPump 6420 front-panel LCD screen and LED indicators.

2.5.1. Front-panel LCD Home Screen

What you are expecting: The RF setup parameters that you programmed, and valid signal quality indications. After the unit is entered into the uplink control system Compel database, the name will show as assigned in Compel.

Figure 2-3: i6420 Home Screen



2.5.2. Front-panel LED Indications

What you are expecting: If locked on the satellite carrier, then the green TRANSPORT LED should be **ON**, and if receiving Compel command stream, the COMPEL LED should be **ON**. For a unit working exclusively over the internet, you still want to see the COMPEL LED **ON**, showing that the unit can find the remote Compel server and pull its commands.

Glossary of the terms:

- **Blink** is alternating ON for ~200 mS and OFF for ~2 seconds.
- **Flash** is alternating ON for ~600mS and OFF for ~600mS.
- **Flutter** is like flash but shorter ~200mS ON and OFF times.

TRANSPORT	**LIVE SVCS**
• GREEN if acquired *valid* Transport Stream from either carrier or terrestrial input. • *Flashes* GREEN if physical layer detects data (from carrier lock and/or Transport framing), but no valid PSI or Services. This is indication for physical layer lock if no CA Authorization. Note that there may be a fault indication (ALARM or WARNING) if no CA Authorization. • OFF if no physical-layer detection of incoming Transport stream, from any source.	• GREEN if playing (decompressing) services selected from incoming Transport stream, on *any* port. • OFF if no live streaming media playing at *any* port.
COMPEL	**PLAYBACK**
• *GREEN* if incoming COMPEL packets (incl "keep alives") are detected from *any* source in last 2 minutes. • *Flutter* GREEN if addressed COMPEL packet received in last 5 seconds, from *any* source. • OFF otherwise.	• GREEN if playing services from stored media on *any* port. This includes all "time shifted" or "delayed live" services. • *Flutter* GREEN when *any* cue-relay state has changed in previous 5 seconds. • OFF if no media playback at *any* port.
WARNING	**RECORD**
• AMBER for one or more current unit Warning conditions. • OFF otherwise.	• GREEN if recording Program Streams direct from Transport Stream. • OFF if no current storage operations.
ALARM	**DOWNLOAD**
• RED for one or more current unit Alarm conditions (and one or more latched Alarms, which is implied, since any current Alarm *must* also be "latched"). • OFF *with RED blink* if no current Alarm, but un-cleared latched (past) Alarms. • OFF otherwise.	• GREEN if receiving/storing media files downloaded over IP (either under MPE within Transport or thru WAN port). • OFF if no current download operations from the specified locations.

Chapter 3: OPERATION

This chapter provides information on the operation and functions of the iPump 6420.

Table of Contents

3.1. Monitor & Control Interfaces

3.1.1. Compel

The Compel control system is the premiere control method in the iPump 6420. It is the only *user* control method that can overrule and lock out control from other sources. In particular, it may set the edge devices, the remote iPump6420s, to have their local control *disabled*. This will not disable all control capability, but it will essentially prevent the local user from changing the unit settings in order to access some other audio programming. Once disabled by Compel, only Compel itself, or a secured user with debugging access, or a unit that has reverted to Local Control re-enable as part of unit Auto Recovery (see **Section 3.1.8**), can see it re-enabled.

In-channel Compel Control

Compel is the name of the system used for control of most WEGENER products. It is used in a "star" (point-to-many-point) control structure, where Compel will be controlling many "edge" devices (called "receivers") that deliver media content at remote locations. It is a one-way control system that essentially depends on a command redundancy in a moderate-reliability channel, with refreshes to maintain synchronism between its database and the actual state of the receivers. WEGENER's Return Path product, at this writing, is not yet used to *fully* synchronize the remote receivers to the database, except in some special cases (to be discussed). In this section, Compel commands are presumed to be borne in-channel, that is, in a designated "ghost PID" in the MPEG Transport stream, injected by WEGENER UMX5010s. This in-channel control system presumes that receivers will execute their received commands immediately, and that they will be executed in order of arrival, with the last command always taking precedence, if the receiver setting is to be changed.

This Manual cannot discuss Compel to exhaustion. The user is referred to their Compel Manual and associated Informative Bulletins. However, the basic types of Compel commands, their structure and basic applied rules, and their addressing rules may be briefly reviewed herein.

Command Types:

- **Grouping commands**: Commands that assign a receiver to a logical group, which, in turn, may be used as an address for other commands, including other grouping commands. A more advanced grouping mechanism, the Group Page, may also be employed. While a receiver may be a member of up to 10,000 groups, it may have only one Group Page membership (generally a value between 1 and 255).
- **Receiver state commands**: Commands that change a receiver setting and whose new value is retained in Compel's internal database.
- **Meta commands** that are a special set of the above state commands: These affect the unit's ability to process control from Compel or other sources. An examples is the Compel LOCK command, which prevents the receivers from executing any other command except the companion UNLOCK command. Another example is the LOCAL CONTROL enable/disable commands. These serve to block the local user from innocently changing critical receiver settings that would directly affect revenue (though they cannot block *malicious* actions).
- **Receiver action commands**: Commands that stimulate a receiver to execute a particular function, usually limited in time. It is assumed that the long-term state of

the receiver is unaffected by command execution (or the lack thereof). These commands must often be synchronized to other external events. For example, a closure arriving from a customer's media automation system, requesting the play of a commercial spot must cause a command to edge iPump6420s to insert a particular file, to be aligned precisely with a network "avail" (local spot opportunity).

- **Time-of-day commands**: Non-addressed commands that signal the date/time to all listening receivers. Receivers that must know the precise time will interpolate over many such commands to maintain accurate TOD tracking.
- **Satellite File download operations**: A special command and functions to go with it that allow the download of media files to edge receivers. This is discussed more thoroughly in **Section 3.3**.
- **HTTP File download operations**: A special command to request that receivers pull media file content from Compel, by HTTP, over the internet.
- **Playlist build commands**: Commands to build playlists on edge receivers who support that function. Playlists are discussed more thoroughly in **Section 3.4.2**.
- **Miscellaneous commands**: Commands that affect the remote receiver state, but are not retained in the Compel database. For example, a command to pipe a terminal command to iPump6420 may be sent using the Compel SCRIPT TERMINAL command.
- **Scheduling commands**: Commands to add or delete line items in receiver's Local Scheduler, where supplied. See the discussion following on **Local Scheduler**.
- **Refreshes**: Not formally a type of "command". This is a special Compel function to keep remote receiver settings equal to that specified in the Compel database. It uses many receiver state commands to do this. There is an "immediate" version, where a fairly complete refresh is done on command of a human user. And there is a "background" version, where, as time permits, Compel will regularly and automatically refresh edge receivers on a rolling basis.

Command Structure:

Compel commands are structured as Header, Sequence number, Address, Device, Command, and Data fields. The Header may be a generic 4-character string, or it may be a string unique to a customer. If unique, then it imposes special security measures on all listening receivers, where the receiver's own Compel header setting must match that of the Compel messages to avoid going into **Recovery Mode** (see below). The Sequence number is the way the Compel hardware tags each unique command, allowing them to be double-transmitted to avoid data loss. Addressing will be discussed below. The Device is a general command grouping. The Command is a specific command within that grouping. The Data field is interpreted by the receiver based on the Device and Command.

Addressing Rules:

Except for the Time-of-Day commands, the receivers will only accept and execute those commands that are addressed to them. They may be addressed by four different addressing modes. One is the rarely-used command to "All". The other is a command directly addressed by unit serial number (though, in the Compel GUI, the user may direct the command by the receiver's unique name). The truly powerful addressing mode is by Group, where only receivers who know themselves to be members of the addressed Group, will respond. The last mode, which is not truly independent, adds on an additional requirement for an address match: This is called **Associated Audio**. This last command, part of the complement of Extended Syntax

capabilities, allows a receiver to be addressed as a logical AND of a basic address (all, group, or SN) and the unit "state". In the case of iPump6420, this "state" is the assignment of specific audio streams, by Language Descriptor (LD), to one or more of its constituent Audio Ports. If the base address matches, ***and*** the audio stream is assigned to any of the Audio Ports, then that command is executed, and, moreover, directed specifically to *that* Port. A prime example is a command to pulse a relay. If associated with an audio stream STR, and if STR is only assigned to Port #2, then a relay associated with Port #2 is pulsed.

Note that the basic Compel address field may actually be a Boolean expression, combining groups and AND and OR operators, to create more complex addresses.

Timing

Because Compel commands frequently must be aligned, or synchronized, to events occurring in the live audio streams, Compel provides some methods to assist. For example, the audio track and a closure may originate from a customer automation system "in sync", where the closure occurs at the moment a local spot is to be inserted. Because the audio track will be delayed in the MPEG compression system, the Compel command created by the Compel Event handler will also need to be delayed. This may be done with the legacy Compel NETCON DELAY command (see **Compel Manual**). But this affects *all* commands coming from Compel during the delay period. A superior tool is another capability found in the Compel Extended Syntax: *Command Delay*. With this, only that one Compel command will see its execution delayed after receipt. The delay can then be fine-tuned to tightly align the overlay of the local spot with the network "avail" (default network spot).

When fine-tuning the alignment of switches, inserts, or relay closures, at i6420 outputs, to the live audio track, the system implementer should also be aware that the i6420 will implement an automatic delay in all Compel commands that are timing critical, relative to the audio track. This is called Compel Command Delay. For more details on the i6420 timing model, see **section 3.4.3**.

For Compel control, the unit indications are:

1. COMPEL LED (some units "NETWORK") **ON** if Compel command stream is being received, flashing briefly when "personally" addressed commands are received

For Compel, the following unit controls are applicable. For most, the user (with debug access) or the factory is the preferred command method:

1. Compel PID (Transport packet ID conveying Compel messages)
2. Compel Header (must match between Compel and receiving i6420s)
3. Local Control Enable (generally set by Compel)
4. Compel sharing flag (if set to "Share" and Compel is a shared Compel, then the unit is allowed to accept the command stream, regardless of conflicting Headers)
5. Compel Command Delay (factory set, defaults to 500 mS)
6. Compel-required factory setting

Internet-delivered Compel Control

The iPump6420 may be set to receive its Compel commands, not through a satellite channel, but over the internet. In this method, the i6420 will do scheduled HTTP polling of the Compel server (which must, in turn, be set to support this method). At each poll, the set of pending commands that would be addressed to the i6420 are downloaded from Compel. (This is a complex operation in Compel to decode all the Group addresses back to direct by-serial-number addresses.) The commands are then processed in order. Because of the expected latency in this

process, some of the "satellite-delivered" Compel commands would not make sense and are not supplied, such as many of the Action commands, the Time-of-Day command, and satellite File Download operations.

For Compel control, the unit indications are:

1. COMPEL LED (some units "NETWORK") **ON** if Compel server is responding, flashing briefly when "personally" addressed commands are received

The user control interfaces feature the following controls. The user (with debug access) or the factory is the preferred command method:

1. Compel internet server IP address
2. Poll time

Local Scheduler

The Local Scheduler is a database that holds and stores Compel commands each for execution at a pre-specified date and time. This allows Compel to assure itself that receiver's will all execute a particular function at a specific time, regardless of the availability of Compel command stream at that time. To distinguish the different missions that sets of Compel command might perform, each stored Command has a "priority" code.

The user control interfaces feature the following controls. Compel is the preferred command method:

1. Add schedule line (Compel command, date/time, and command priority)
2. Delete schedule lines (by command priority)
3. Delete all schedule lines

Triggers

Triggers are similar to the Local Scheduler, but instead of executing stored Compel command at a specific time, the commands are executed at the moment a special Event occurs. Two types of such events apply: One are closures on the iPump6420s PIO inputs, the other is the Compel TRIGGER command. In each case, the Trigger is assigned ahead of time, by local user or Compel, then the event forces the execution through the Trigger mechanism. Triggers may be Temporary ("one-shot") or Permanent. A Temporary Trigger will accept the triggering event, execute the stored command, and then will no longer respond on subsequent triggering events. The Permanent Trigger, on the other hand will cause stored Compel command execution on each and every triggered event.

Triggers are assigned a simple number codes, 0 to 255. Any number code from 0 to 6 may be assigned to the local PIO trigger closures. Any number from 1 to 255 may be assigned to Compel TRIGGER commands. Note that numbers from 1 to 6 have a dual role, and either local PIO or Compel TRIGGER commands will "fire" them.

The user control interfaces features the following commands. Compel is the preferred command method:

1. Create Temporary or Permanent Triggers, 0 to 255, assigning them to a specific Compel command.
2. Compel trigger command or PIO closure
3. Delete Triggers
4. Abort temporary trigger.

3.1.2. Return Path

Return Path is a set of return-channel reporting methods which allow the field iPump6420s, as network "edge" devices, to report back status information to the uplink control system. Its position in the entire Store/Forward system is illustrated in **Figure 1-1** in **Chapter 1** of this Manual.

Physical Delivery Methods

The Return Path reports are returned using the POST HTTP method to the listening CGI scripts in the CSM software subsystem. (CSM is a subsystem of the Compel uplink control system, installed exclusively for the Store/Forward missions.). The HTTP connections may be made using IP over the internet or by IP/PPP using the (optional) telephone modem and an analog telco line.

Report Types

At this writing, the following report types are supported:

1. General Status (Report type #0)
2. Asset Inventory
3. As-run Logs
4. As-run Logs (without local deletion)
5. Operation Logs
6. Operational Logs (without local deletion)
7. ShowShift Show definitions
8. ShowShift Shifted (episode definitions)
9. ShowShift event file
10. OAR capture files

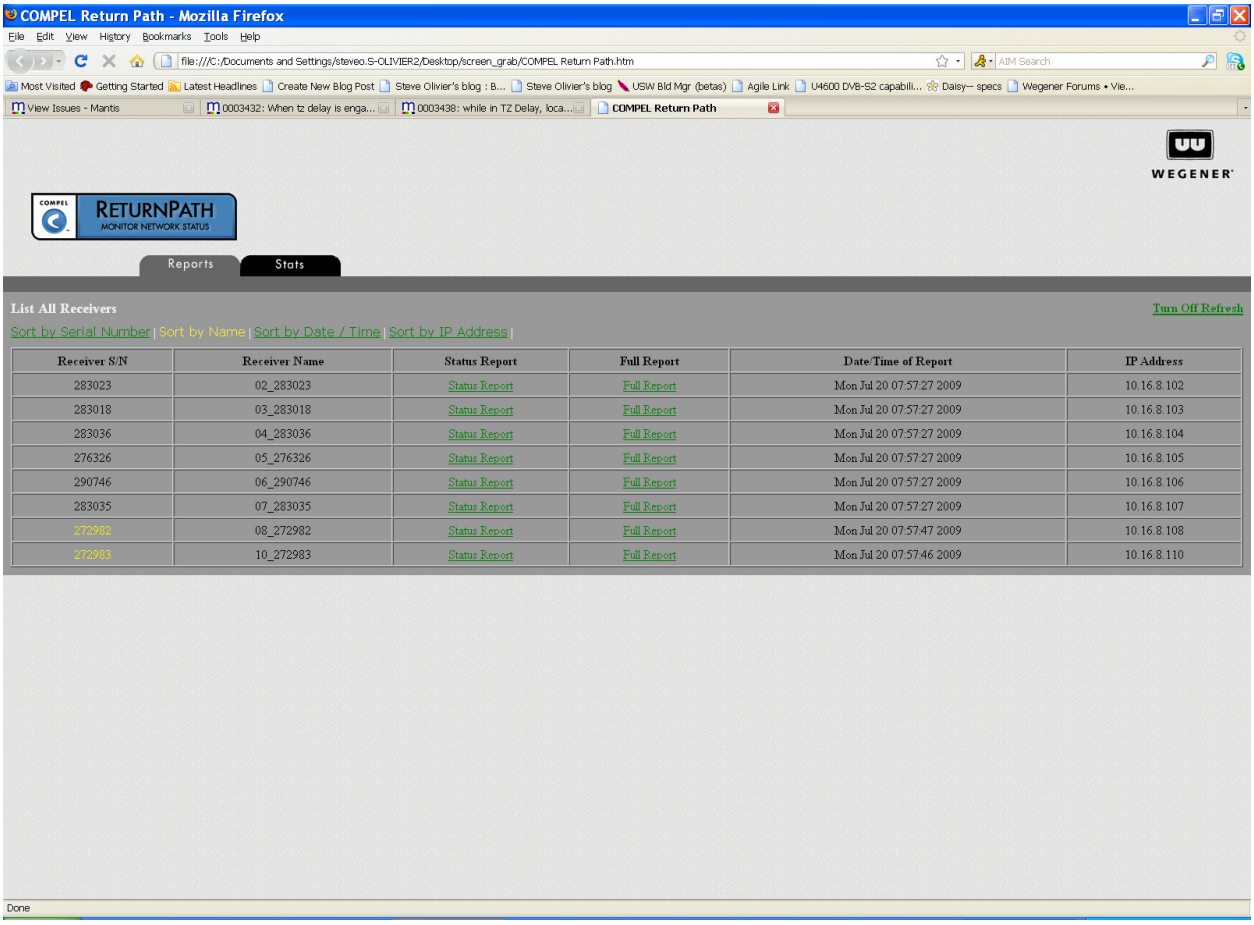
In addition to these reports, which are directly user-accessable, there is a higher report type for the NACKs used in Asset Healing, the file modeling and management utility (see **Section 3.3.6**).

With the reports sent in by Return Path, the uplink control system may provide the system operator with access to several processed reports. See **Figure 3-1** for an example of the receiver Status web screen, available in the CSM subsystem.

The relevant user controls are:

1. WAN or LAN IP settngs (IP address, netmask, and Gateway)
2. Return Path server IP address
3. Return Path backup server IP address
4. Return Path modem phone number
5. Return Path modem PPP login
6. Return Path modem PPP password
7. Return Path modem remote phone number
8. Return Path modem backup remote phone number
9. Commands to request Return Path reports (see above)
10. Action Tag requests to send Return Path file NACKs to support Asset Healing (see **Section 3.3.6**)

Figure 3-1: Typical Status report screen at uplink control system



3.1.3. Local Web

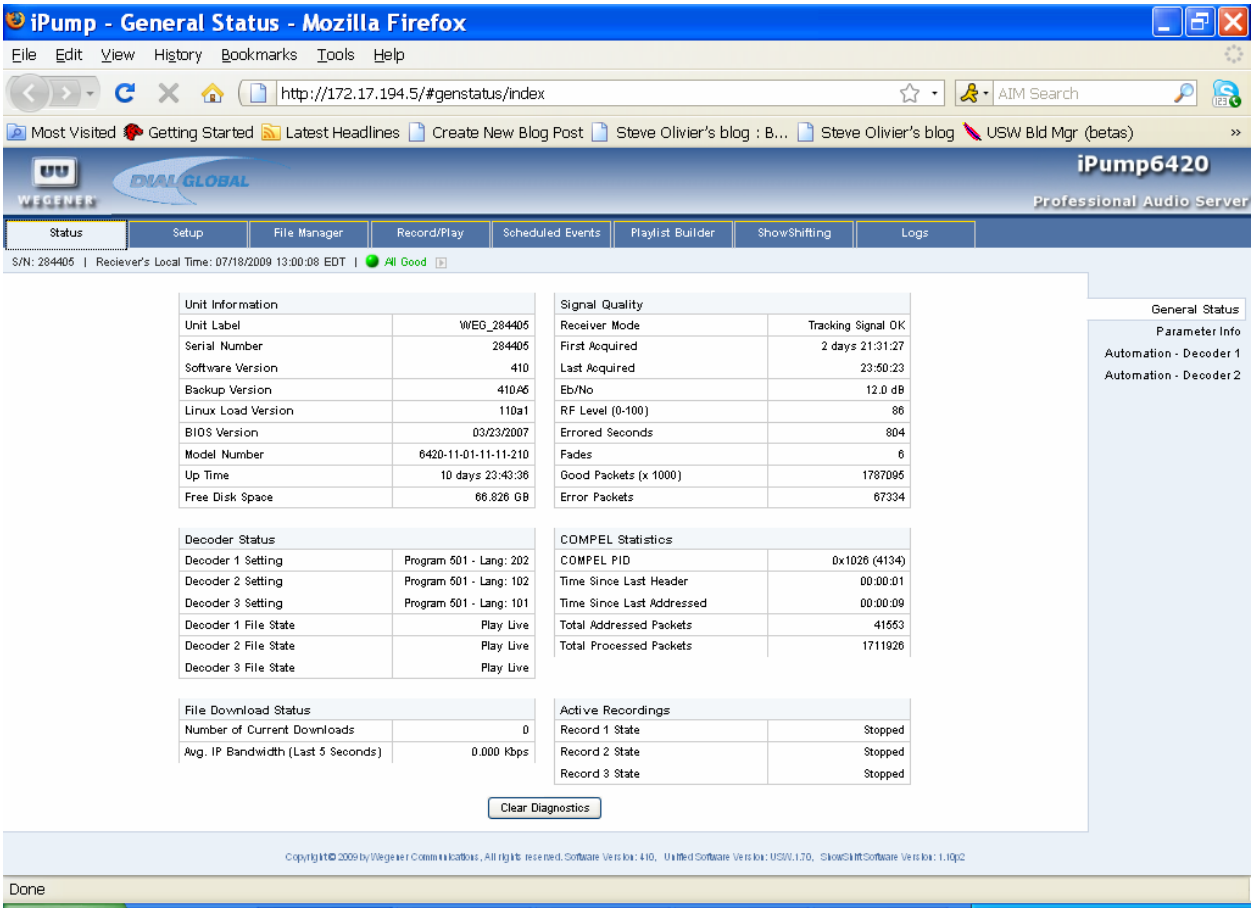
The web interface is the premier local user interface. All other modes of *local user* control, where duplicated, are deprecated in favor of this interface.

In the next few paragraphs, several of the web screens will be introduced. Note that if Local Control is *disabled* by Compel, that some of the user edit capabilities will be blocked.

Home Status screen

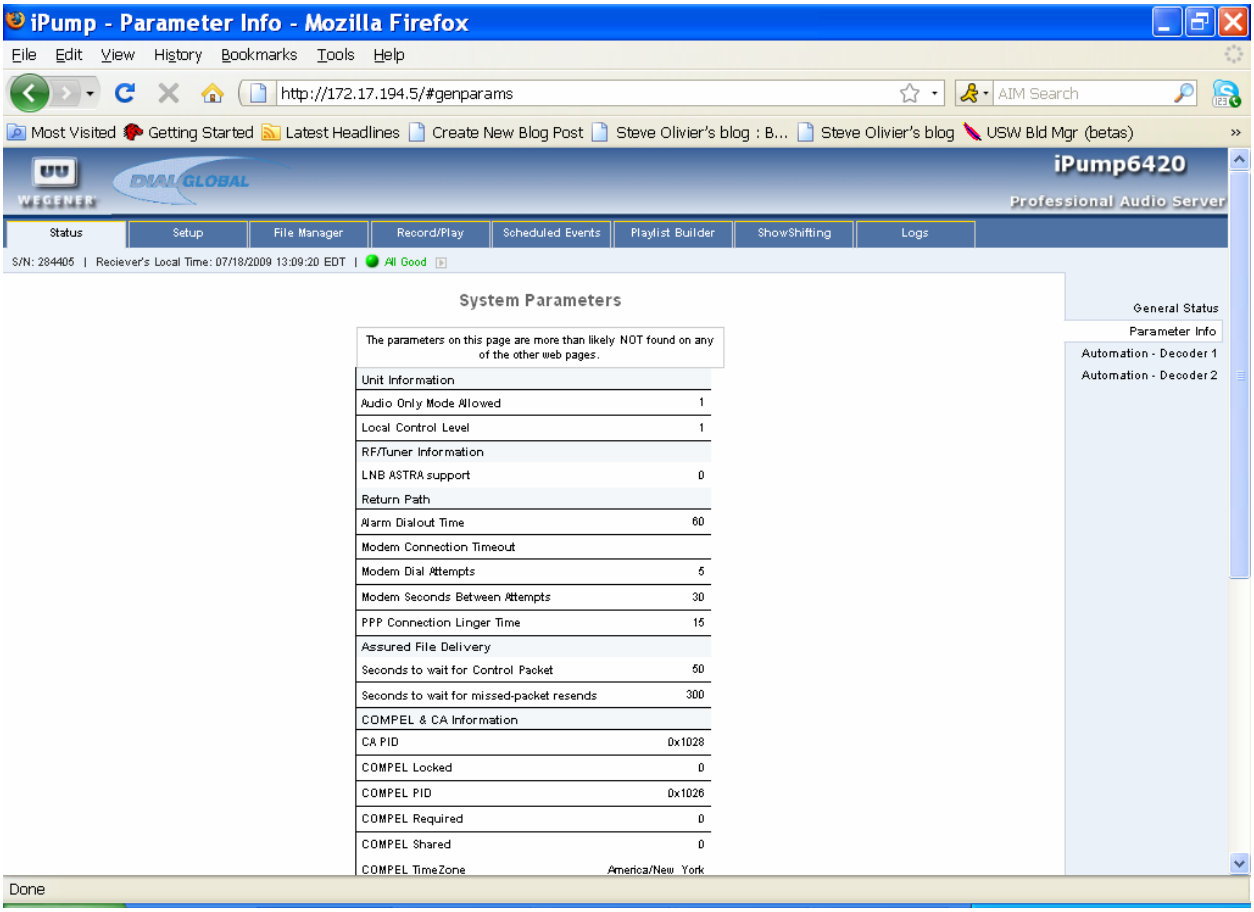
This is the default home screen the user encounters on entry of the unit IP address into the browser. It has basic unit information, such as unit name, serial number, unit status, and key metrics, such as the total unit operation time. See **Figure 3-2** for an example "General Status" screen.

Figure 3-2: Typical Home Status screen, web interface



Under this tab, a side control allows access to "Parameter Info", a read-only screen to check basic unit settings. See **Figure 3-3** for an example.

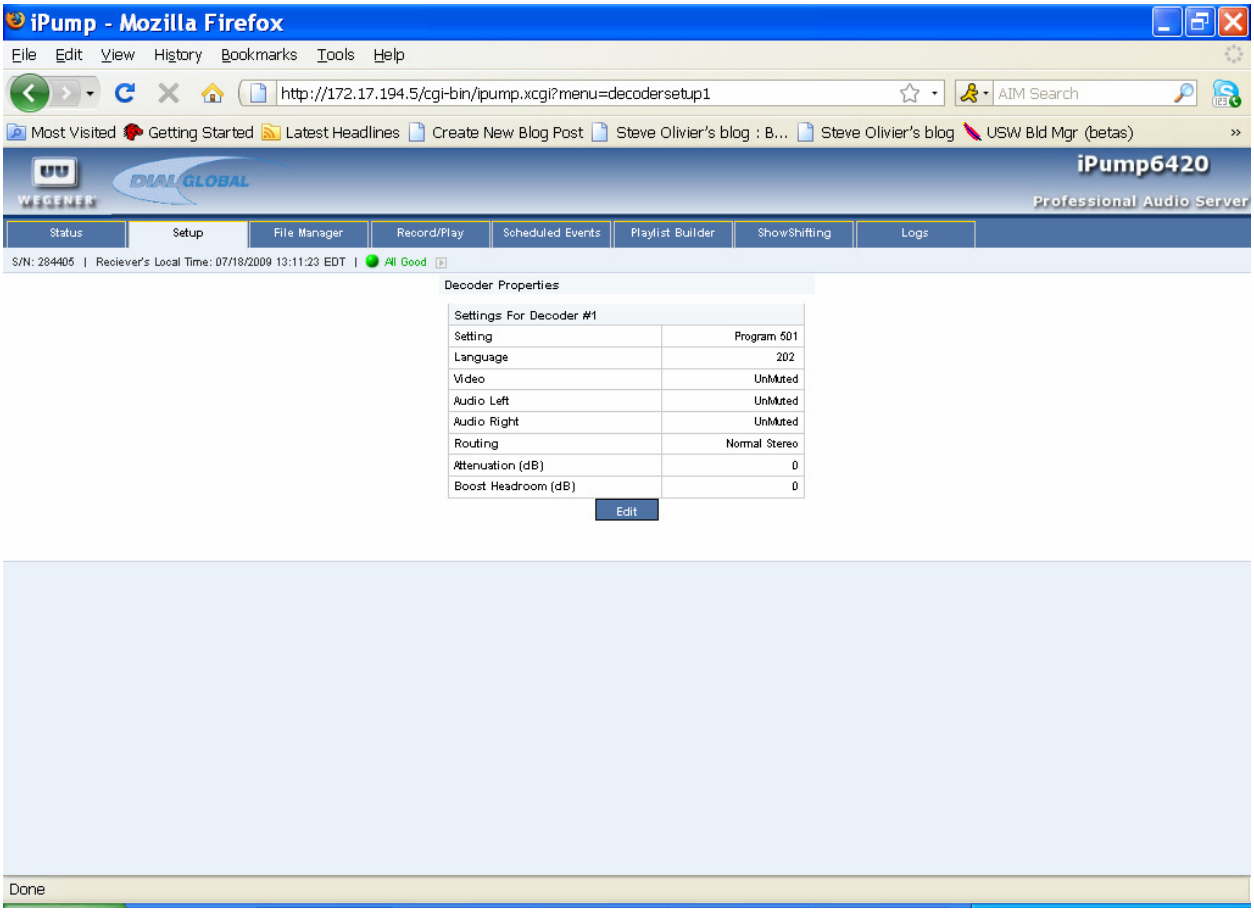
Figure 3-3: Parameter info screen, web interface



Setup screens

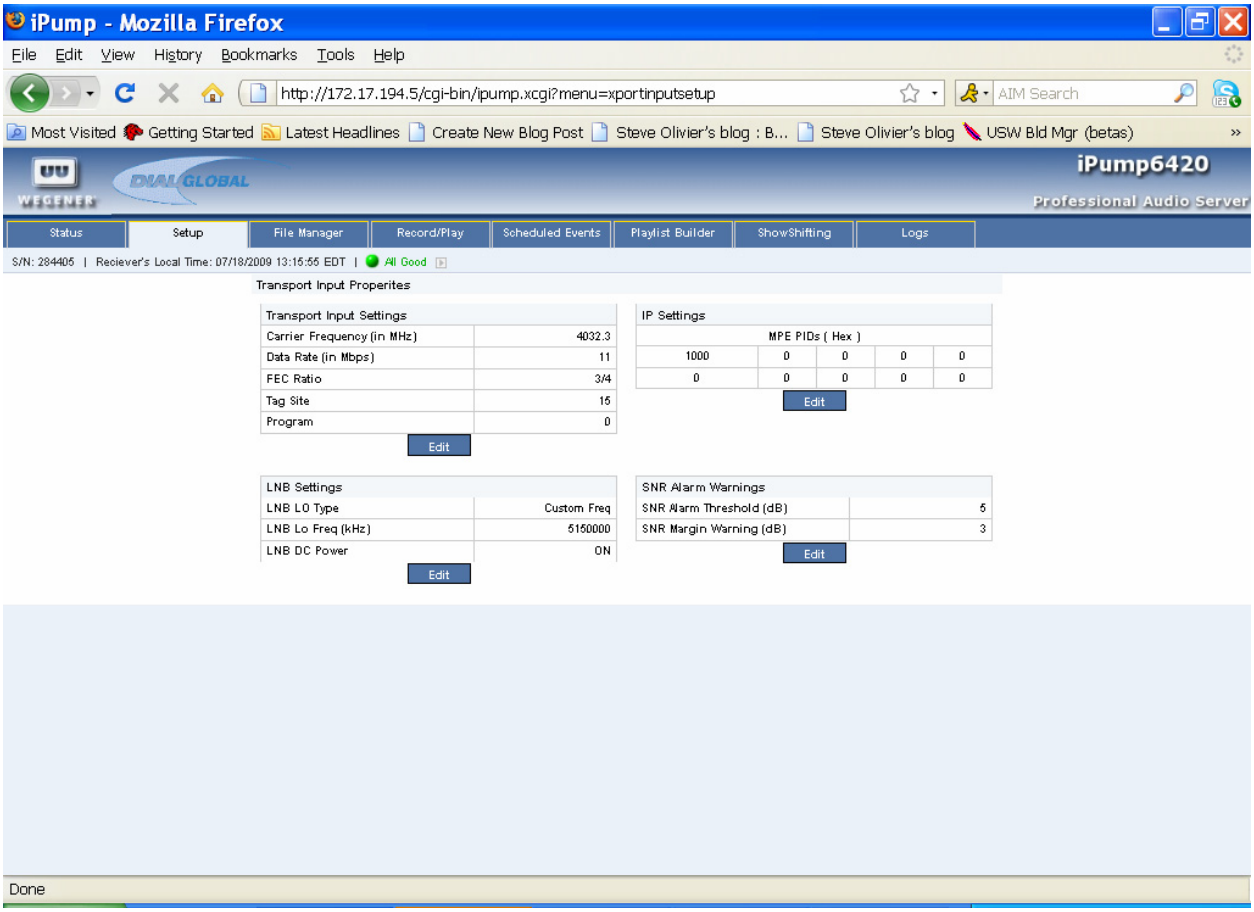
This is a set of screens that allow the user to check and make changes to basic unit settings. The top 3 choices are the "Audio Decoder (Port) setup" screens. **Figure 3-4** gives an example of one.

Figure 3-4: Audio Decoder setup screen, web interface



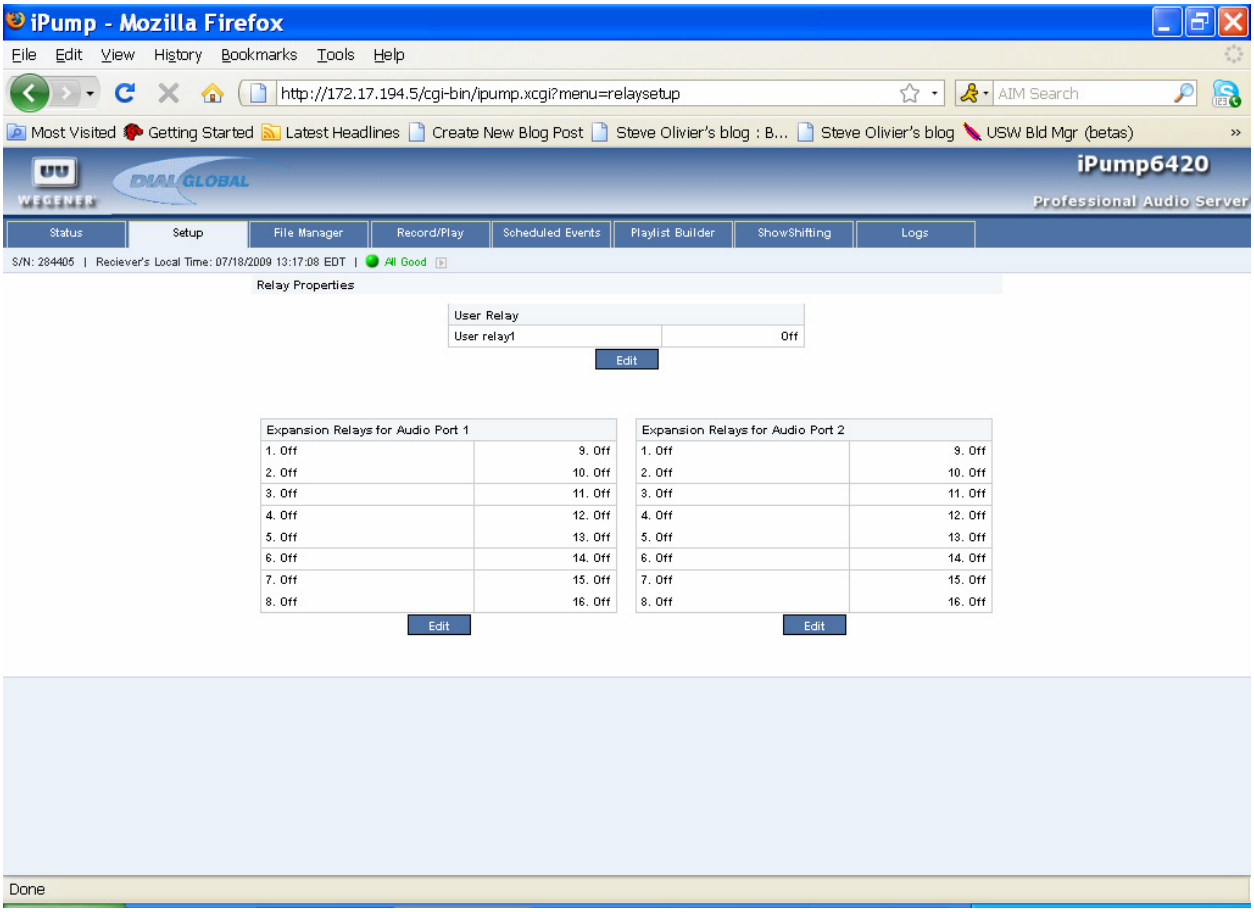
The "Transport Input" screen allows the user to check or setup important carrier and Transport operating parameters. **Figure 3-5** gives an example.

Figure 3-5: Transport Input, web interface



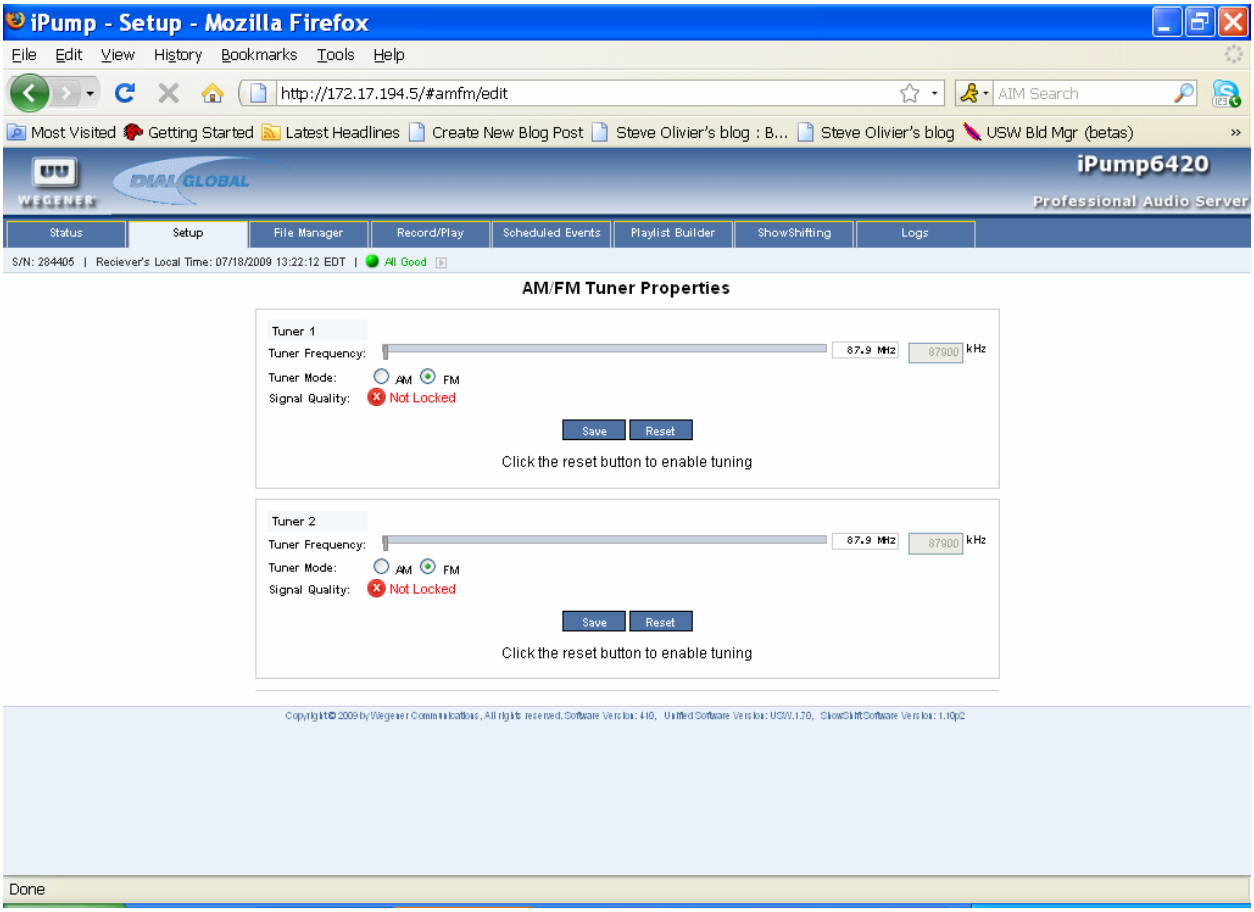
The "Exp. Relay" screen allows the two sets of Port #1 and #2 cue relay to be checked and tested. **Figure 3-6** gives an example.

Figure 3-6: Expansion Relay screen, web interface



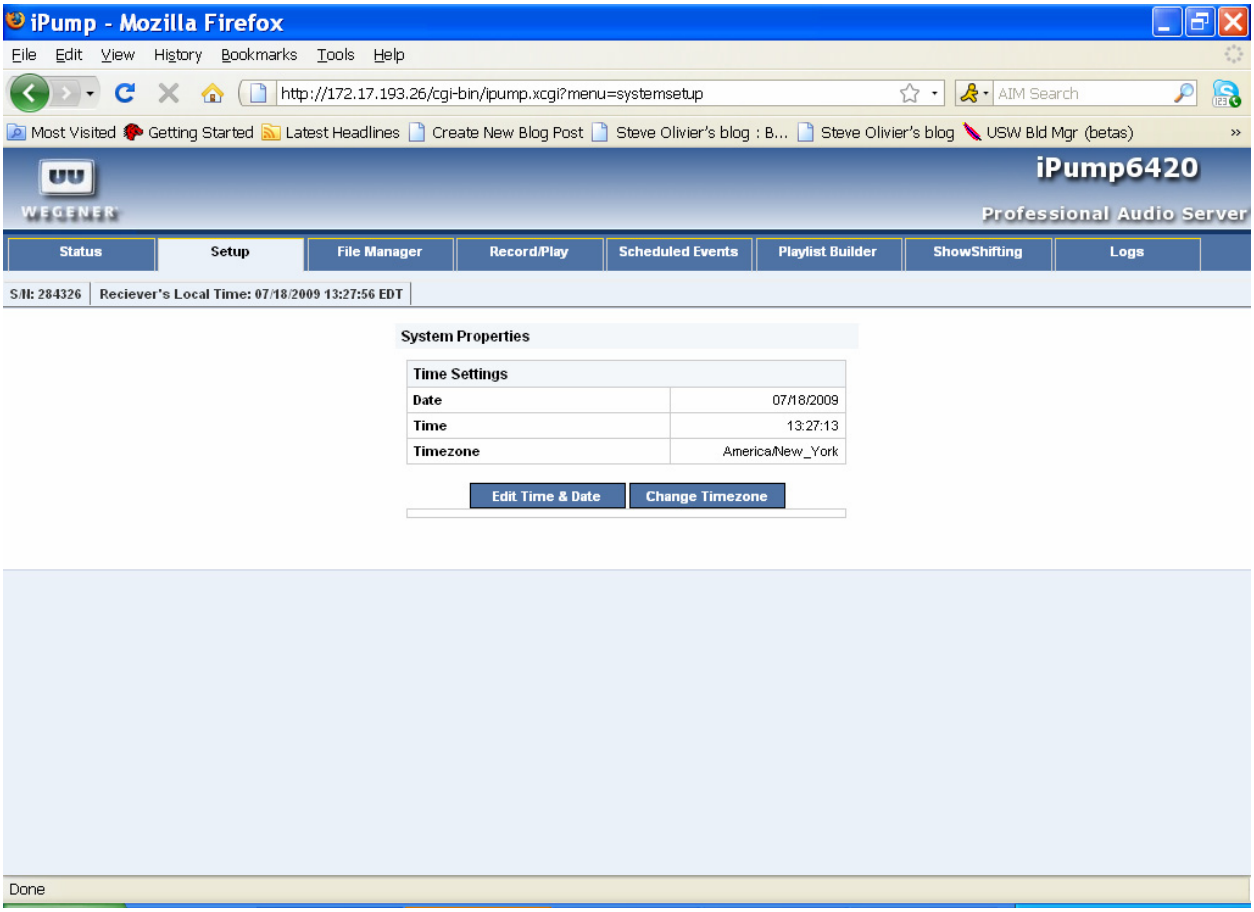
The "AM/FM tuning" screen allows the user to check or change AM/FM tuner settings (if the option is installed) and also check the reception. **Figure 3-7** gives an example.

Figure 3-7: AM/FM tuning screen, web interface



The "System" screen allows the user to view and set time settings. **Figure 3-8** gives an example.

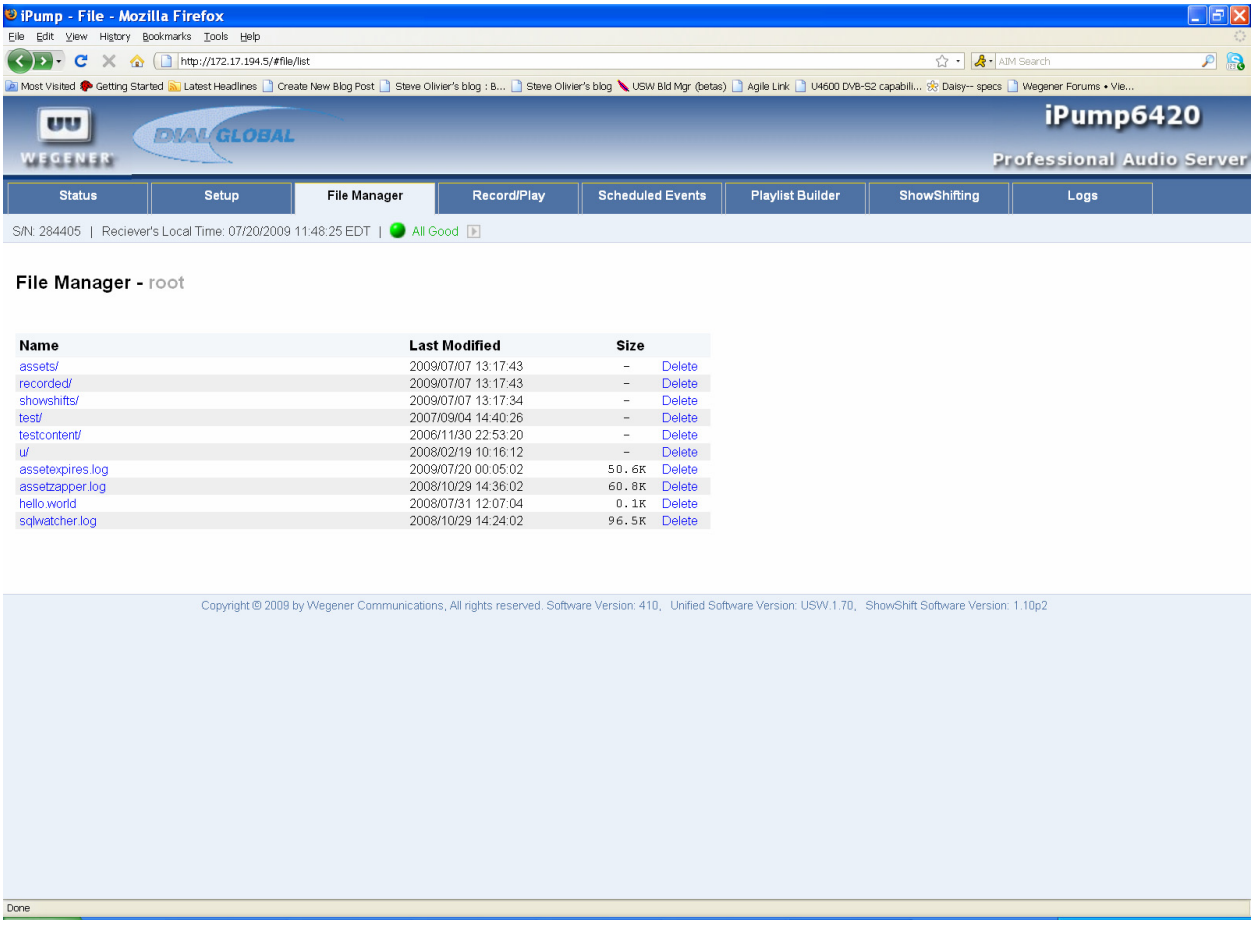
Figure 3-8: System screen, web interface



File Manager screen

The "File Manager" screen allows the user to view and delete stored files (as "assets" or individually, see **Section 3.3**). **Figure 3-9** gives an example.

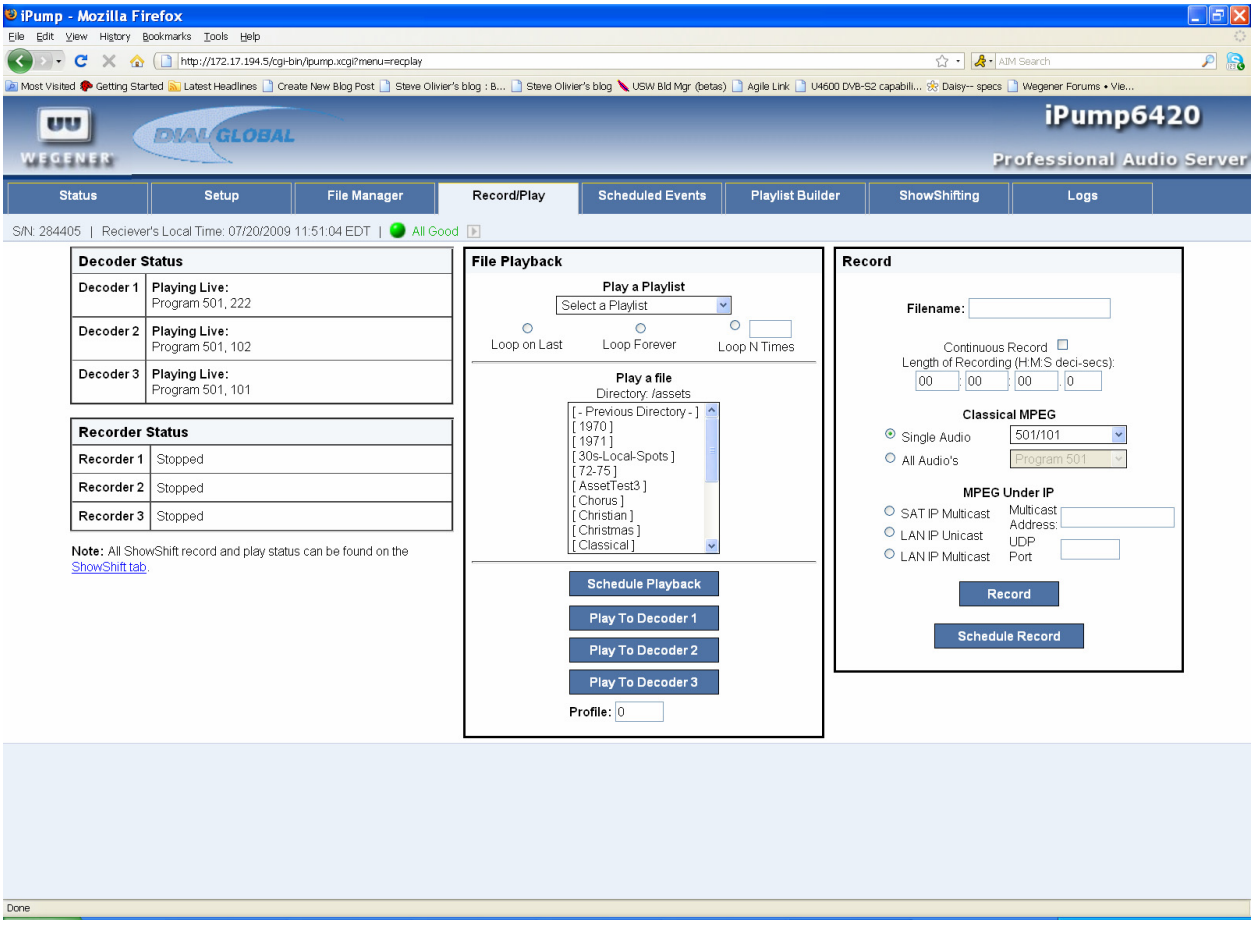
Figure 3-9: File Manager screen, web interface



Record/play screen

The "Record/Play" screen allows the user to view the status of a file or playlist play, and request others, either as temporary inserts or as permanent virtual channels (see **Section 3.4**). **Figure 3-10** gives an example.

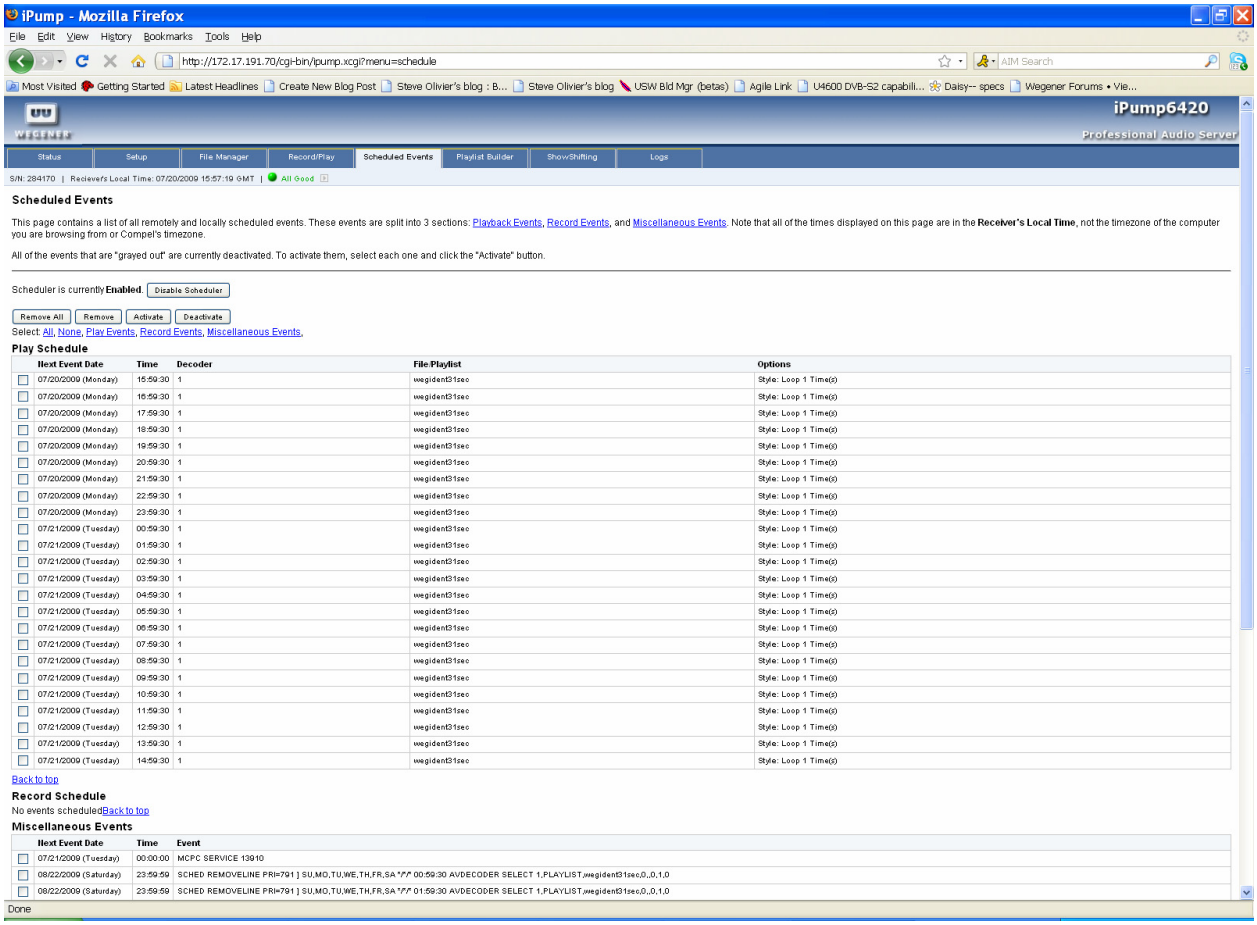
Figure 3-10: Record/Play screen, web interface



Scheduled Events screen

The "Scheduled Events" screen shows the status of all current scheduled events in the Local Scheduler. These are divided up into "Play events" (file or playlist inserts), "Record events" (file recordings from audio streams in Transport), and "Miscellaneous events" (requests to deleted schedule entries, permanent audio switches, etc.). Note that Triggered events will be listed under "Play events". **Figure 3-11** gives an example.

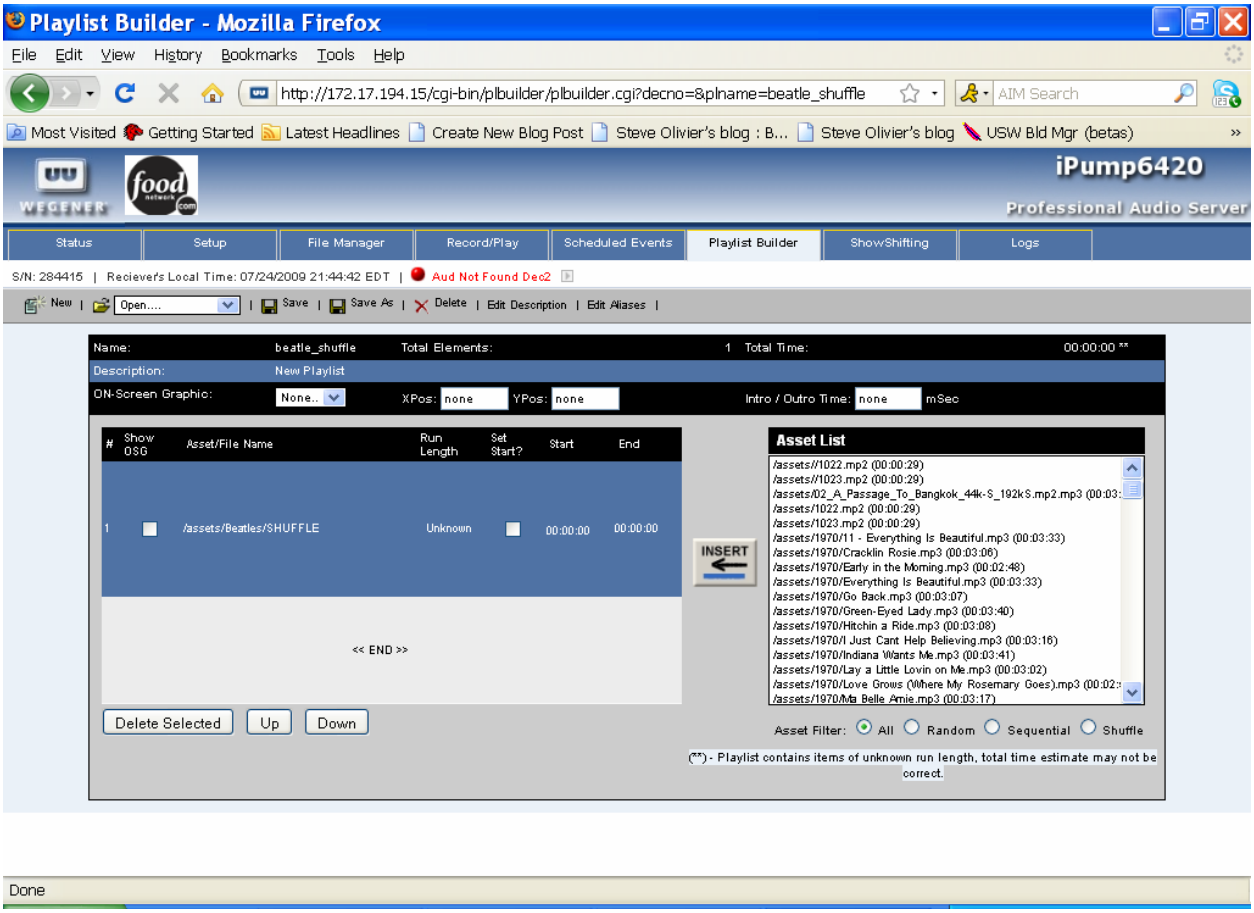
Figure 3-11: Scheduled Events screen, web interface



Playlist Builder screen

The "Playlist Builder" screen allows the user to view, build, edit, and delete resident playlists. **Figure 3-12** gives an example.

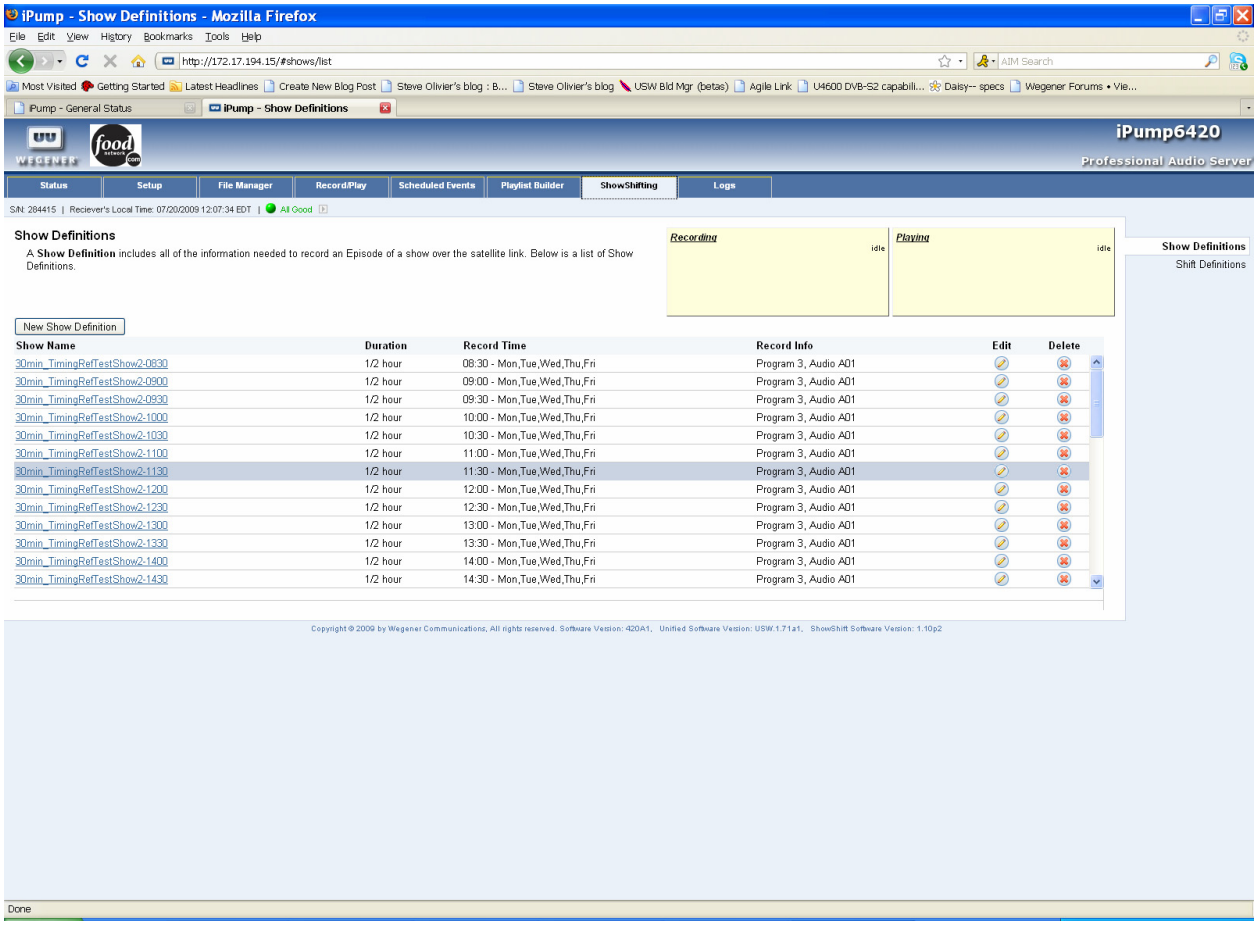
Figure 3-12: Playlist Builder screen, web interface



ShowShifting screen

The "ShowShift" screen is an entry point to viewing and editing the setup of ShowShifting, if this premium feature is authorized. It also shows the status of shows in record or playback, as well as upcoming events in a show episode playback. **Figure 3-13** shows the initial screen.

Figure 3-13: ShowShifting initial screen, web interface



Logs screen

The "Logs" screen is actually a set of two subscreens, the "As-run log" screen and the "Ops Log" screen. The As-run Log shows file and playlist insertion history, while the Ops log shows other events, such as relay closures, and audio stream switches. **Figures 3-14 & 3-15** give examples.

Figure 3-14: As-run Log screen, web interface

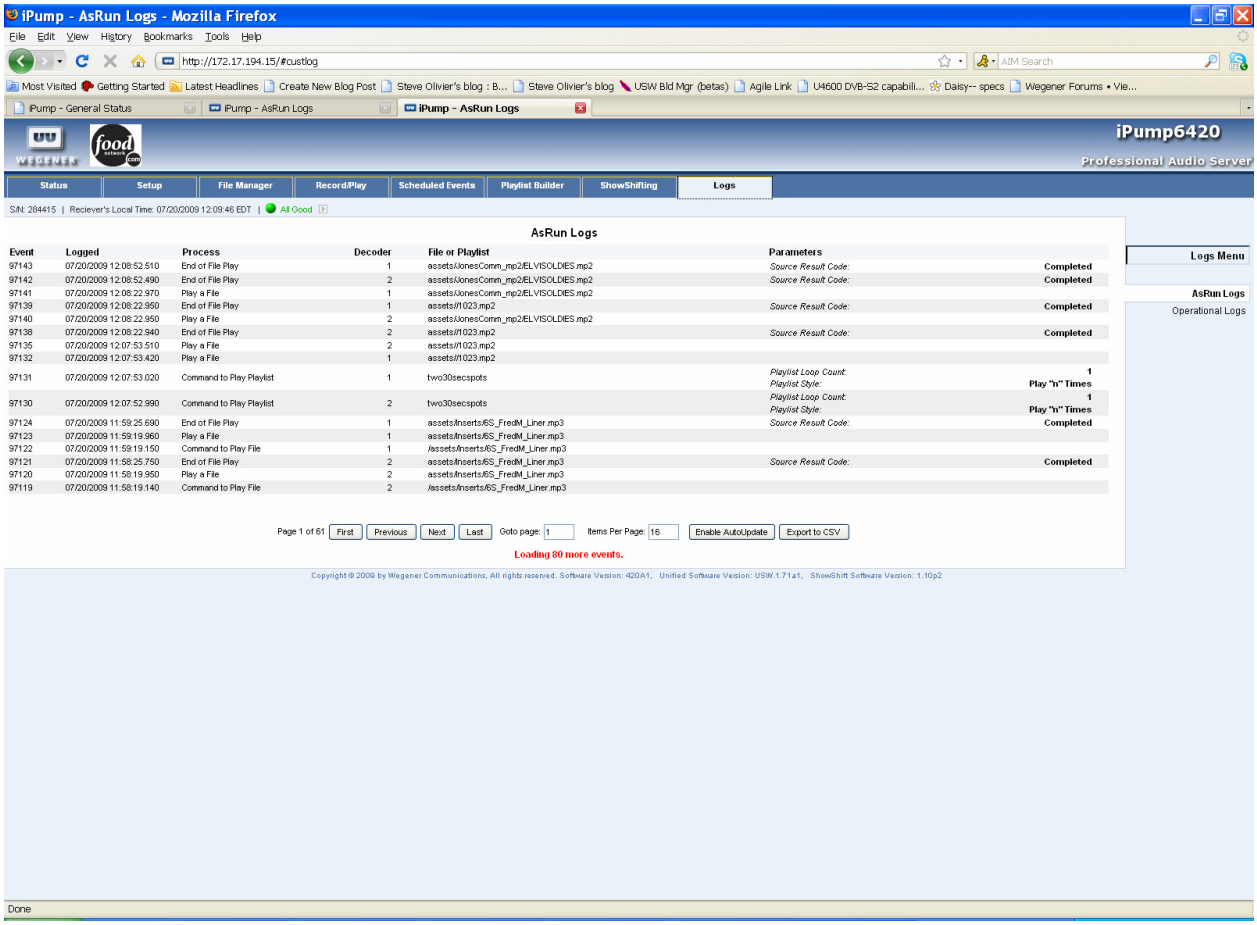
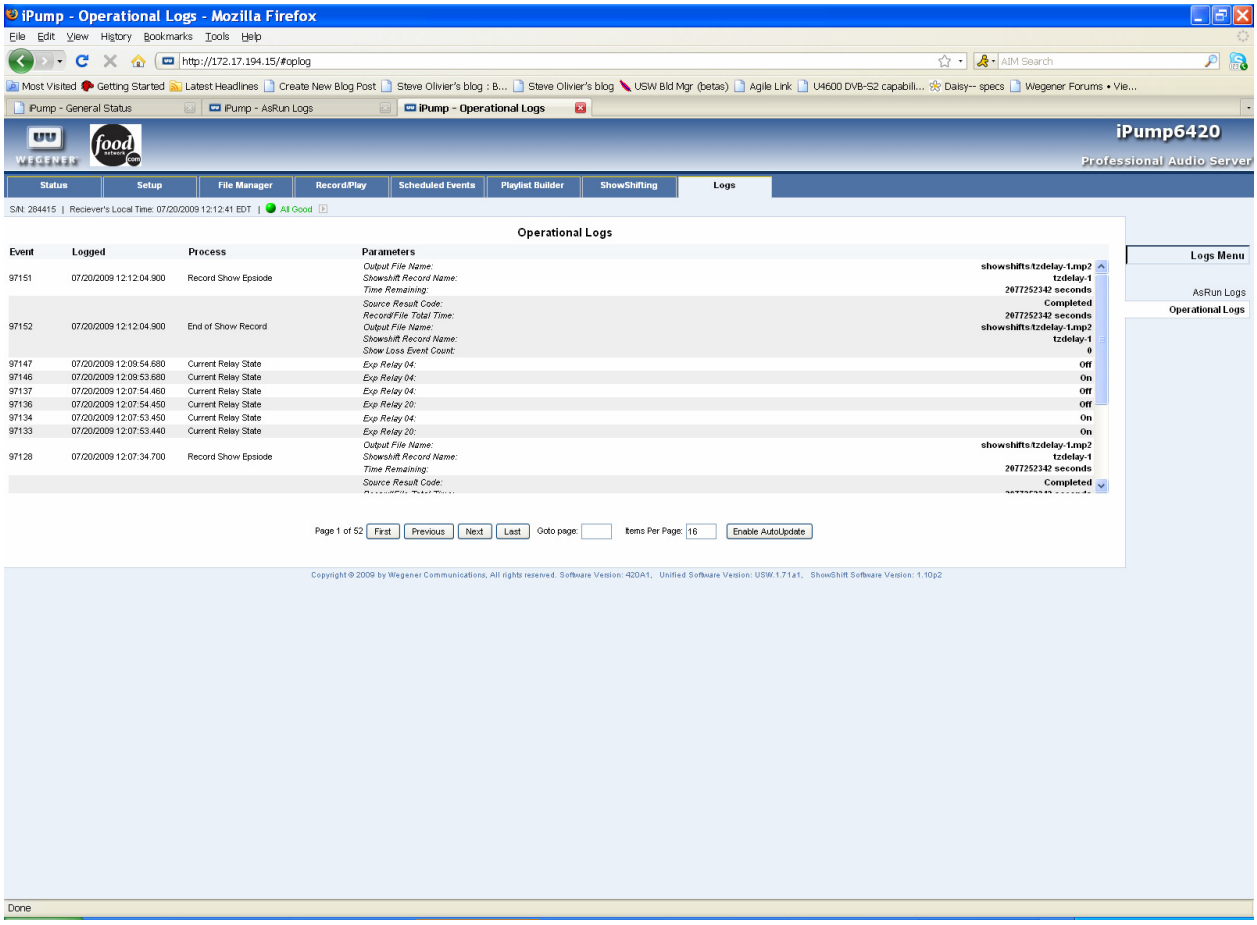


Figure 3-15: Ops Logs screen, web interface



Diagnostic screen

From any of the normal web screens, if the user clicks on the WEGENER logo, in the upper left corner, while pressing CRTL, then the user is sent to the web Diagnostics screen. This is a fairly powerful diagnostic and debugging tool, and only advanced users should access this screen. No other information is supplied in this publicly-accessible Manual about this screen. If you are an advanced user, and you have questions, please contact WEGENER Customer Service for more information.

User Controls

The user controls affecting the web interface are listed. Compel is the preferred command method:

1. LAN IP settngs (IP address, netmask, and Gateway)
2. Allow or disallow local control. This affects many parameters needed to deliver the audio output payload. Set by Compel or the factory.
3. Allow or disallow HTTP (web) access. Set by Compel or the factory.
4. Content access permission on/off. If ON, then local users may modify or delete stored files.

3.1.4. Front-Panel Monitor and Control

The front panel interface consists of 8 LEDs, a 2 X 20 character LCD, and six push buttons. With this, a hierarchical M&C structure is implemented. This means that all monitor and control objects (or "screens") are grouped with related screens under parent menus. Further levels of abstraction are implemented by ordering those parent menus, perhaps with child-less screens under higher parent menus and so forth. Note that the highest level screens are called the "top level screens" and these are peers to the Home Screen, a special screen to which an IRD usually defaults.

LED Indications

Please see **Section 2.5.2**.

LCD Screen Modes

Eligible LCD screens can be in one of the following modes:

Mode	***Description***
VIEW	Information is being displayed on the LCD for the user to view. None of the push buttons can be used for editing in this mode.
EDIT	This mode is entered from the VIEW mode. This is where the users has the ability to edit a parameter. The LCD cursor is on the edit field when in this mode. In the i6420, the cursor will be a flashing underscore.

LCD Screen Types

The following table lists the screen types:

Type	***Description***
MENU	This is a read-only screen that displays the menu name for a command group. This command group is a set of lower-level screens. The level "beneath" a menu screen type might contain any of the other screen types (i.e. menus, info, parameter). This type of screen is read-only.
STATIC INFO	This is a read-only screen that displays information and is NOT editable—though the unit may or may not refresh it dynamically. The Home Screen is considered this type of a screen. *Screens of this type have no children, so they are "leaf nodes."*
SCROLL INFO	Same as STATIC INFO except that the right and left arrow keys are active to scroll through a message more extensive than can be displayed on a 20 character line. Because of this, these screens must be "lone children" of a parent Menu screen.
PARAMETER	This type of screen displays a specific parameter associated with a command group that CAN be edited (if the correct authority has been established). The *initial* value displayed is always the current unit setting. This is the only type of screen that can enter the EDIT mode. A PARAMETER screen will contain a field that can be different types (alpha-numeric or list select). There will be no carries or borrows when wrapping on a numeric field (i.e. to go from 0999 to 1000, 4 digits have to be edited). *Screens of this type have no children, so they are "leaf nodes."*

Push Button Definitions

The push buttons react differently based on what mode the user is in and what screen type is currently being displayed. The following table describes this interaction. Note that this is a general guideline. Exceptions will be noted in the individual IRD specifications.

LCD Mode	*Push Button*	*LCD Screen Type*	*Function*
VIEW	ENTER	MENU	Go to next lower level and display the first screen on that level.
		INFO	N/A
		PARAMETER	Enter EDIT mode and set cursor on first digit if alpha-numeric or blink entire field if field type is list select. EDIT mode is only entered if the user has the authorization to edit the parameter.
	ESCAPE	(All)	Go to previous (higher) level and display the current screen OR display the first screen at the current level if at the highest level. The first screen at the top level is the HOME screen. Therefore, pressing ESCAPE numerous times (or pressing and holding) will eventually return the user to the HOME screen.
	UP	(All)	N/A
	DOWN	(All)	N/A
	LEFT	(All, *except SCROLL INFO*)	Display the previous screen at the current level OR wrap to the last screen if currently on the first screen.
	RIGHT	(All, *except SCROLL INFO*)	Display the next screen at the current level OR wrap to the first screen if currently on the last screen.
	LEFT	SCROLL INFO	Scrolls to the left in a scrolled information screen.
	RIGHT	SCROLL INFO	Scrolls to the right in a scrolled information screen.
EDIT	ENTER	PARAMETER	If the user input is valid, the IRD accepts the changes that were made and enters the VIEW mode. *If the input was invalid*, the IRD flashes an "Invalid Entry" message on the LCD momentarily before returning to the same screen in the EDIT mode again.
	ESCAPE	PARAMETER	Abort any changes made to the parameter and enter the VIEW mode.
	UP	PARAMETER	*List Select*: Scrolls up to next value in the list or wraps if currently on the last item in the list. *Alpha-numeric*: Increases the value of the current field. If numeric and the current value is 9 (if decimal) or 0xF (if hex), the value will wrap to a 0. If alpha-numeric, the value will wrap to the first ASCII value when at 0x7F.
	DOWN	PARAMETER	*List Select*: Scrolls down to previous value in the list or wraps to the last item if currently on the first item in the list. *Alpha-numeric*: Decreases the value of the current field. If numeric and the current value is 0, the value will wrap to 9 (if decimal) or to 0xF (if hex). If alpha-numeric, the value will wrap to the last ASCII value when at the first.
	LEFT	PARAMETER	*List Select*: N/A *Alpha-numeric*: Moves to the previous digit. Wraps to the last digit if currently on the first.
	RIGHT	PARAMETER	*List Select*: N/A *Alpha-numeric*: Moves to the next digit. Wraps to the first digit if currently on the last.

Default LCD Screen

No matter where a user may be in the LCD menu hierarchy, if no front-panel keypress is made for more than a factory-set time (typically ~5 minutes), and if the screen is not "parked", then the LCD menu state reverts to the default screen.* The default screen is always a "Top Level" screen. Typically, this is the "Home Screen". Layout of the Home Screen is given in **Figure 2-3** in **Section 2.5**.

* See **User Controls**.

Front-panel Menu structure

Table 3-1 shows the current menu structure for the iPump6420 Front-panel interface. If local control is disabled, some of these screens may be hidden.

Table 3-1: i6420 Front-panel Menus

Main Level	Second Level	Third Level	Fourth Level	Fifth Level
Home Screen				
Download Screen(if applicable)				
Alarm/Warning (if applicable)	Current Alarms (if applicable) Current Warnings (if applicable) Clear Indications (if applicable)			
Request DHCP Update				
Unit Setup	Decoder Setup	Decoder Number n: (n = 1,2 OR 3)		
		Decoder Setting Select:	OFF PROGRAM FOLLOW TUNE LAN UNICAST	Program Number : Port Number: ACTIVATE? <Yes/No>
			SAT MULTICAST	MULTICAST Addr : Port Number: ACTIVATE? <Yes/No>
			LAN MULTICAST	MULTICAST Addr : Port Number: ACTIVATE? <Yes/No>
	Audio Setup	Decoder Number n: (n = 1,2 OR 3)		
		Audio Lang Setting: (if Availlable)	<Availlabel Lang list>	
		Audio Routing	Stereo Left on Both Right on Both Reverse Stereo	

Main Level	Second Level	Third Level	Fourth Level	Fifth Level
		Attenuation Level	0 - 20	
		Headroom Level	0 -20	
	IP Setup	LAN IP Settings	Lan Addressing Mode: < STATIC >	Lan Static IP Address Lan Static Netmask Lan Static Gateway
			Lan Addressing Mode: < DHCP >	
		WAN IP Settings	Wan Addressing Mode: < STATIC >	Wan Static IP Address Wan Static Netmask Wan Static Gateway
			Wan Addressing Mode: < DHCP >	
	HTTP Proxy Setup	HTTP Proxy Enable Mode:	DISABLE	
			ENABLE	HTTP PROXY IP: HTTP PROXY PORT:
	Transport In Setup	Transport In Status:< >		
		Current Channel	Select Preset:	Permament Last Commanded Last Success Current # (Stored Channels)
			Symbol Format: <QPSK> FEC Ratio: <1/2,2/3,3/4,5/6,7/8> Download Frequency: Transport Data Rate: Transport Symbol Rate: Program Number: Tag Site: Done	
		LNB Setup	LNB Type: <LOCAL OSC.,UNIVERSAL> LO type: (If Type= LOCAL OSC.)	 CUSTOM FREQ STD C-BAND US KU-BAND EURO LOW KU-BAND EURO HI KU-BAND
			LO Custom Freq: (If LO=CUSTOM FREQ)	<xxxxx.xx> MHZ
		LNB DC Power (If	<ON, OFF>	

Main Level	Second Level	Third Level	Fourth Level	Fifth Level
		LNB type=LO)		
		LNB Polarity (If LNB=Universal/Astra)	<HORIZONTAL,VERTICAL>	
		SNR Margin Warning: < > dB		
		Signal Quality Setup	Indicator Thresholds	Errored Seconds Rate
	Return Path Setup	Main Server IP: Backup Server IP:		
	Content Access Setup	Content Access Control:	<FULL ACCESS, READ ONLY>	
	File Control	RENAME Files	Rename which file?	Dir:/ …
		DELETE Files	Delete which file?	Dir:/ … : Are you sure? Y/N
	Modem/PPP Setup	Phone number: Dial-Out Prefix: PPP Username: PPP Password:		
	Serial Port Setup	Device Assignment: Term BAUD: Printer BAUD:	<TERMINAL, PRINTER> <2400,9600,19200,38400,57600> <1200,2400,4800,9600>	
	RDBS Settings	RDBS 1 BAUD Rate: RDBS 2 BAUD Rate:	<1200,2400,4800,9600> <1200,2400,4800,9600>	
	User Relay Setup	User Relay 1:	<ON, OFF>	
	Expansion Relay Setup	Exp Relay 1 - 32 (Select)	<ON, OFF>	
	AM/FM Tuner Setup	AM/FM Tuner <1 , 2> Setup	Tuner <1,2> Mode: Tuner <1,2> Frequency:	
	Date/Time Setup	Current Date: <YYYY,MM,DD> Current Time: <HH:MM:SS> TIMEZONE selection: <CITY>	<AREA>	<COUNTRY>
	Unit Label			
	S/W Switch to Backup	From <'Current Ver' to 'Backup Ver'>		
	MUTING Setup	MUTE On Reset:<Enabled, Disabled>		
Unit Status Detail	Current Operation (Normal, OR Normal after Recovery, OR In Auto Recovery)			
	Service Status (Acquiring carrier, OR Services BAD OR Services OK)			
	Active Recordings			

Main Level	Second Level	Third Level	Fourth Level	Fifth Level
	File Playback			
	Signal Quality	Current Quality	Eb/No Estimate Signal Strength	
		History this Setting	Loss from Fades Errored Seconds	
		Elapsed Times	Signal First Acquired Signal Last Acquired	
	AM/FM Tuner Status	AM/FM Tuner 1 - 2 Status	Tuner 1 - 2 Mode Tuner 1 - 2 Frequency Tuner 1 - 2 Quality	
	Network History	COMPEL Lock Status: COMPEL Reqired : Local control : Total Addressed PKTS : Total Valid PKTS : Last Addressed PKT: Last Valid PKT: UNIT Uptime:		
	Current IP Info	Current LAN Info	LAN Current IP Address: LAN Current Netmask LAN Current Gateway: LAN has link? LAN MAC Address:	
		Current WAN Info	WAN Current IP Address: WAN Current Netmask WAN Current Gateway: WAN has link? WAN MAC Address:	
	EXP Relay Status	Exp Relay Port 1 { ON = #, OFF = -} Exp Relay Port 2 { ON = #, OFF = -}	- - - - - - - 8 - - - - - - - G { 8 , 16 are ON } 1 - - - - - - - - A - - - - - - {17 , 26 are ON}	
	Unit Temperature (in C)			
	Version Info	Software Version Backup Version USW Version CPU/BIOS Info Core OS Version Installed OS Patches		
	Clear Diagnostic Counters	Clear Signal Counters?		

User Controls

The user controls affecting the Front-panel interface are listed. Compel is the preferred command method:

1. Allow or disallow local control. This affects many parameters needed to deliver the audio output payload. Set by Compel or the factory.
2. Freeze (or "park") a front-panel screen. Press in the < ↓ > and the <ENT> buttons at the same time. Press any button later to release.

3.1.5. Terminal

The Terminal interface is a interactive, text-based control method, somewhat deprecated in favor of the web interface. It may be accessed from the Serial M&C port using a text-based terminal. This can be a legacy VT100, or it can be a PC equipped with a serial port, said PC running Procomm or Teraterm (Hyperterminal is *not* the best choice). Or it may be accessed from a Telnet session, using the User=*term* and the Password=*termterm*.* From the web diagnostic page, the "Terminal Command" text box may also be used to send Terminal commands, with replies posted to the same web page.

* To exit out of your terminal session, enter the terminal command *exit*.

A listing of the available user-accessible Terminal commands is given in Appendix 1. However, it is fairly easy to access information about Terminal commands using the 'apropos *searchword*' command, where *searchword* is a keyword clue with no whitespace. An example would be using 'wan' if you are trying to get WAN port setup commands.

The user controls affecting the Terminal interface are listed:

1. Assign Terminal to the Serial M&C port.
2. Terminal baud rate.
3. Allow or disallow local control. This affects many parameters needed to deliver the audio output payload. Set by Compel or the factory.

3.1.6. SNMP Status

Simple Network Management Protocol (SNMP) is used in network management systems to monitor network-attached devices for conditions that warrant administrative attention. It consists of a set of standards for network management, including an Application Layer protocol, a database schema, and a set of data objects. SNMP exposes management data in the form of variables on the managed systems, which describe the system configuration. These variables can then be queried (and sometimes set) by managing applications. In the Wegener implementation of SNMP, variables will be available for *query only*.

See **Appendix 2** for the root and PCMI MIBs.

The user controls affecting the Terminal interface are listed:

1. Set the system MIB values of *sysName* and *sysLocation* via SNMP.
2. Allow or disallow HTTP (web) access. Set by Compel or the factory.
3. Set the Community String. Set at the factory.

3.1.7. PIO Inputs

The local PIO inputs, 1 to 7 may be assigned to Compel Triggers, unfortunately numbered 0 to 6. To assign Triggers, see the discussion on **Triggers** above in **Section 3.1.1**. To view the settings, see the Scheduled Events local web page (**Figure 3-11**).

3.1.8. Automatic Restoral of Audio

Loss-of-Signal

After loss of a valid MPEG Transport, or more precisely, when an i6420 audio port loses its audio stream, the unit can supply the end listener some relief from the silence that will appear. If the loss is continuous for a user-set interval, then a specific user-created playlist, always with the standard name 'LOS' will start to play on that audio port. If the LOS playlist does not exist, then no Loss-of-Signal restoral will be attempted. Of course, if the entire Transport is lost, then all audio ports, whose assignments were not OFF, will play LOS. The LOS playlist will play to completion and then repeat indefinitely for all applicable audio ports, until the expected audio streams are restored, the audio assignments changed, or the unit is reset.

The user controls affecting the Loss-of-Signal feature are listed:

1. LOS timeout. Set at the factory.

Auto Recovery Modes

After the iPump6420 unit loses its source of MPEG Transport from an RF carrier, it will repeatedly attempt to re-acquire that carrier, and relock to the Transport. In the event that this process exceeds some user-set timeout, then the unit will enter an Auto-Recovery mode called **Services Recovery**. Also, if the Compel network control stream is lost, when it is required, then likewise, the unit will enter a similar Auto-Recovery mode called **Network Recovery**. In each case, the unit will use an alternate set of carrier Presets in order to attempt to replace the "missing" item, whether the carrier (and all the audio streams) or the Compel network control stream. Each 30 seconds, the unit will attempt to get carrier acquisition on another of the official carrier Presets (see **Section 3.2.1**). If successful on carrier acquisition while in Services Recovery, then the search is declared a success. If in Network Recovery, it will wait another

user-set timeout to get Compel network control commands. If not successful on any of the list of Preset, before repeating on that List, it will first re-attempt at the Last Commanded and Last Successful carrier settings. This cycle will continue indefinitely until success, *or* an authorized user changes the carrier setting. If a unit does eventually acquire and remain on a new carrier setting because of an Auto Recovery, the local user is, if local control is enabled, authorized to abort the newly-acquired carrier and force a re-attempt at the original authorized carrier settings.

Note that a unit may also be forced into Auto Recovery when encountering a Compel network command that bears a Header which does not match the internal Header setting, and whose security does not allow "Sharing". See **Section 3.1.1** for more details.

Once the unit enters Auto Recovery, then another timer, called "Local Control Re-enable" may begin counting down. This timer can only be aborted if Auto Recovery is vacated. If this timer expires while the unit is still in active Auto Recovery, the unit will automatically clear the "Local Control Disabled" flag, so that local users now have *full* local control. This will allow networks, in the ultimate disaster scenario where all backup carrier settings are unusable, to use local personnel to re-program the units to new settings.

Entry into Auto Recovery will show both as an indication to the user on the Front-panel, and it will be logged to the Ops Log. If recovery is made to a new carrier setting, that will continue to be a maskable fault condition, a Warning.

The user controls affecting Auto Recovery Modes are listed below. The primary method for setting these values will be Compel or the factory:

1. Services Recovery timeout (used for loss of carrier)
2. Compel Recovery timeout (used for loss of Compel)
3. Recovery Iteration timeout (linger time on each carrier, after lock, while waiting to get Compel, if required)
4. Local Control Re-enable timeout
5. Abort Auto Recovery
6. Compel required yes/no flag, factory setting

3.1.9. Fault Indications

The iPump6420 interprets fault conditions as either 1) failures in i6420 operation, 2) problems detected in incoming signals, or 3) inability to honor command requests. Typically, fault conditions may be allowed to show as an Alarm, a Warning, or not to indicate at all. Control of this is set by a programmable fault indication mask, usually set at the factory.

Fault conditions allowed by the mask to indicate as Alarms will 1) de-energize the rear-panel Alarm contacts, 2) show on the front-panel ALARM LED, 3) show in local web screens, and 4) show on Compel Return Path Status reports. Similarly, Warning indications will show in the same manner, though there is no rear-panel closure.

The Fault Indications will usually show for the length of time that the fault exists. In some cases, the fault indication is transitory. In these cases, the indication may be lengthened to several seconds or a few minutes, to allow user recognition and monitoring. In other cases, the indication may last until there is a *successful* instance of the same operation that had previously faulted (or the unit reboots).

Appendix 3 gives a complete list of all the Fault conditions.

The relevant user control is only the debug command to edit the fault indication mask.

3.2. Basic IRD Functions

3.2.1. Transport Front-end

DVB Tuner

The standard configuration of the iPump6420 features a front-end DVB RF tuner. The unit will, at initial reboot, or after a user (local or Compel) changes the applicable setting, attempt to acquire "lock" on an RF carrier, presented at its RF Input. In this case, "lock" is an intricate series of recursive steps, starting with carrier frequency lock, symbol-rate lock, inner convolutional FEC pattern lock, de-interleaver pattern lock, and finally outer Reed-Solomon FEC pattern lock. When all these are achieved, the DVB tuner hardware signals the unit software that "carrier lock" is achieved. In some cases, before "lock" is accepted, the unit must further verify the validity of the carrier. If WEGENER Carrier ID Tags are in use and required, then the carrier Tag must match that expected by the unit software. If not, then the acquisition process resumes.*

* Carrier ID Tags are generally only needed for very narrow-band carriers and/or situations with large LNB frequency offsets.

In addition to the permanent unit carrier settings, the i6420 provides the user with a Preset Table, an internal list of alternate carrier tuning settings. These may be used as canned shorthands for users to use, rather than remember all the individual settings for alternate carriers. The Preset Table is also significant for support of Automated Recovery (see **Section 3.1.8**).

For an ASI-input option, a much more limited set of steps is needed to detect the ASI Transport timing, and then find symbol and frame-timing lock on the incoming baseband signal. At any rate, the result, for either Transport option, is that a valid MPEG Transport stream is presented to the unit's internal software Demultiplexer.

Key unit indicators, at this stage are:

1. TRANSPORT LED on for good Transport, flashes if RF carrier lock OK, but Transport not usable (such as if encrypted)
2. Estimated RF signal level (shown as a unit-less metric 0 to 100 where 100 is highest)
3. Estimated link Eb/No in dB, a metric for signal-to-noise ratio
4. Error'd Seconds (one second intervals with Transport packets with errors)

Tuning Parameters

The unit has a primary set of DVB tuning parameters needed to get carrier lock, plus some supporting data structures. This list includes the following:

1. ASTRA Universal LNB On/off (generally a factory or local user setting)
2. LNB LO frequency (generally a factory or local user setting)
3. Carrier downlink frequency
4. Carrier modulation
5. Carrier Transport data-rate (or Symbol-rate, for modern DVB-S2 systems)
6. Carrier inner FEC ratio (may be omitted for modern DVB-S2 systems)
7. Carrier ID Tag ('15' means "do not use")
8. Program number (Significant only when any audio port is assigned as "Follow Tune", used to remain compatible with legacy systems)
9. Add Preset Table entry
10. Edit Preset Table entry

11. Delete Preset Table entry
12. Select tuning by Preset Table entry

LNB DC output

To simplify site setup, the i6420 features an LNB DC output source fed outward on the RF Input center conductor. This powers the electronics in the LNB on the satellite antenna. It is protected against shorted loads with an over-current thermal fuse.

The user controls are:

1. LNB DC ON/OFF

Transport Demux

The incoming Transport stream from the tuner (or alternately, ASI-input card) is de-multiplexed in a software module. This module recovers the Program Allocation Table (PAT), and for each of the Programs listed, a Program Map Table (PMT). It also recovers the PID assigned to COMPEL, as well as all the PIDs assigned for MPE/IP channels. Using the Tables (see **Section 3.2.2**), the unit controller then identifies the PIDs bearing the live audio streams, and those are passed to decompression stages assigned to the appropriate audio Port.

Key indicators are:

1. No PAT fault indication
2. No PMT fault indication

3.2.2. Live Audio play

Live audio decode and playout from the satellite signal is the most important single unit function. There are three audio ports in the iPump6420, with each assigned multiple "MPEG decoders" (see **Figure 1-3** in **Section 1.3**). However, the user is cautioned to be careful here: In most of the user control interfaces, and in other i6420 literature, each port itself is called a "**Decoder**".

With this caution in mind, the operation of each of the Audio Decoders (ports) may be described.

Audio Stream Selection

For each Audio Decoder, the Compel or local user may select an audio PES stream, from the Transport, to decode and output. The selection is by Program, and then, within that Program, an audio Language Descriptor. Using the PSI Tables, the unit software identifies the PID bearing the audio PES stream. This is then passed to the correct Audio Decoder (or Decoders, since the same live audio may be played on multiple outputs). Where simple audio stream switches are requested, the command is executed immediately, *but the old audio signal runs on until the audio buffer is cleared*, *and then the new audio signal appears in the output* (see **Audio Buffer delay**, following).

Key indicators are:

1. SERVICES LED on during live audio playout on *any* Decoder
2. "No Audio found" fault indication

The user controls, for *each* Audio Decoder (Port) are:

1. Program number (select OFF, follow-tune, Program number, or use the first available in the PAT

2. Audio Language descriptor (select Language Descriptor from list as found in the PMT, or use the first available in the PMT as indicated by the '*' wildcard)

Codec, resamplers, timing adjustments (buffer-locked loop)

The live audio PES stream is decomposed into separate audio ES frames, and the compressed data is passed to a software codec. In the i6420, an award-winning, industry-standard audio codec is used. The resulting linear data is passed to an output buffer to prepare for further processing.

At this point, the linear audio samples are output by the codec at the sample rate used within the uplink compression system. The i6420, however, does not use the PCR or PTS timing signals normally conveyed in DVB/MPEG Transport streams. Instead, the output timing is set by a fixed oscillator in the i6420. Now, this would normally cause the buffer capturing the data from the codec to eventually over or under-flow, since the uplink is creating and the i6420 audio output consuming the audio samples at different rates. So the i6420 maintains a (fairly) constant buffer by dropping or repeating samples. This is done with an innovative algorithm which seeks out periods of low-complexity audio, either quiet moments or simple tones. Then samples are dropped and added in groups which neatly match the cycle period. Thus, samples are dropped or repeated less often, and when it is done, it is hidden in such a way as to render it inaudible to even professional listeners.

After this step, the audio data stream must be passed to an audio mixer where it may be summed with the outputs of codec stages which have processed audio files. The mixer must output the audio samples at a *user-set sample-rate*, so it requires all its inputs to be the same rate. The software supplies re-sampling to all mixer inputs as needed. Again, this is performed by an industry-standard 3rd party software module.

The user controls, for *each* Audio Decoder (Port) are:

1. Output audio sample rate

Audio Buffer delay

User should be aware that the decoded live audio is delayed in an audio buffer with a nominal factory-set depth of 500 mS. As file audio is pulled and decoded, it too is passed to the same buffer and encounters the same delay. This must be taken into account when constructing an overall system timing model (see **Section 3.4.3**).

The user controls are:

1. Audio buffer delay (factory set, but may be adjusted with debug access).

Audio Settings: Muting, Stereo Routing & Attenuation

The two main Audio Decoders (Ports), #1 and #2, feature both digital and analog audio outputs. The auxiliary Audio Decoder, #3, only features an analog audio output. Any of those three sets of outputs may be muted, as an entire signal or by stereo component (Left or Right). After this, the audio signals may then also have their stereo components re-routed. The current routes, as of this writing, are 1) to pass the Left and Right channels to the output, as decoded; 2) to reverse them, Left for Right; 3) to put Left on both as a mono; or 4) put Right on both as a mono. Following this, the audio passed to the AES3 digital audio outputs gets no further processing. But the analog outputs for each of the three Decoders (Ports) may also be programmed for a fixed attenuation. This will reduce the audio output, at clip level, from either the factory-set +18 or +24 dBm levels,* in 1 dB steps.

* Levels set by jumpers, not programmable!

Note that all the processing described in this subsection would apply to both the audio output decoded from live satellite audio as well as file-based audio, either as used in inserts or as permanent "virtual channels" (see **Section 3.4**).

The user controls, for *each* Audio Decoder (Port) are:

1. Mute (Off, L, or R, or both)
2. Stereo route (Normal stereo, reverse stereo, L to both, R to both)
3. Analog attenuation (0 to 20 dB, in 1 dB steps, only local control)

3.2.3. Delivery of Relay closures

The iPump6420 features two banks each of 16 form A relays, each of which are assigned to, or "**associated** with", one of the two main audio Decoders (Ports). These relays are generally used to deliver cueing closures to local affiliates radio stations, signaling the precise time point where local spots may be inserted into the audio feed by downstream ad insertion gear. So that the i6420 may support two different local affiliate missions, such as two different radio stations, one audio and a bank of relays, along with an RBDS signal (see next), may be directed to each. To properly enforce this, it is best to use Compel **Associated Audio** commands (part of Compel Extended Syntax) to do all the cue relay pulses. This will ensure that the relay number is properly indexed in the bank of relays associated with that audio feed.

Note that, to ensure good time alignment with events in the audio feed, Compel Extended Syntax may also invoke an additional delay to the relay pulse command. Along with the fixed Compel Command Delay, the net delay should be set equal to the audio compression system delay, thus allowing the closure to line up precisely on the start of the local avail (see Timing Model, **section 3.4.3**).

One additional user cue relay is provided in the standard iPump6420. This appears on the same rear-pane connector as the Alarm relay contacts. It may be controlled similar to the relays discussed above, but it is not logically associated with any Audio Decoder.

All relay activity is logged to the Operational Log (see **Section 3.6.3**).

The user controls, primarily set from Compel, are:

1. Permanent relay setting, on/off
2. Temporary (non-volatile) relay setting, on/off
3. Pulse relay command

3.2.4. Delivery of RBDS data

The iPump6420 features two serial ports to perform Radio Broadcast Data Services (RBDS) data output, each assigned and dedicated to one of the two main Audio Decoders (Ports). RBDS is used to deliver metadata to the local affiliate, such as information about the current song, the artist, the station call sign, etc. This output is generally wired directly into the RBDS input of the station's AM or FM radio exciter. So that the i6420 may support two different local affiliate missions, such as two different radio stations, one audio and a bank of relays (see above), along with this RBDS signal, may be directed to each. To properly enforce this, it is best to use Compel **Associated Audio** commands (part of Compel Extended Syntax) to do all the RBDS messages. This will ensure that the RBDS data strings are properly associated with that audio feed.

The user controls, are:

1. RBDS serial port baud settings, ports #1 and #2
2. RBDS message output (from Compel)

3.3. Stored File Creation and Management

The Store/Forward mission of the iPump6420 requires that file-based audio content be pre-positioned on the unit before use, and stored there for subsequent repeated uses. This section discusses the delivery (or creation), and then management of that audio content.

3.3.1. File Storage and Management database

Basic File and Asset Management

All files positioned on the iPump6420 for later use must be registered in a local management database. This database logs in the file and notes its playability, its play-time (length), its location, and its parent "asset". A key concept in the management of these audio files is this "asset". Assets are objects in the WEGENER MediaPlan-based Store/Forward system that may encapsulate any number of files, whether playable audio files or not, along with useful metadata. They are all created in the uplink control system and managed by the MediaPlan Content Manager, which is outside the scope of this Manual (see the **MPcm User's Manual**). Then they are downloaded to the edge receivers, the iPump6420s, for storage. All downloaded assets are stored in the i6420 filesystem in the **/u/user/assets** directory. They are usually single-layer folders with the folder name equal to the asset, and all files located directly under that level. However, assets may now have multiple folder layers. When downloaded to the iPump6420 from Compel/MediaPlan, they included a special metadata file called "**metadata.xml**". This file tells the i6420 what playable audio files should be included in the asset, what their path is, the asset expiration date, and also will indicate the asset's "alias", if any (see **section 3.4.6**).

Generally, the "asset" concept is only used for the management of files and is usually not relevant to the problem of playing single audio files or of building playlists to play one or more such files at a time. However, there is one exception to this, and it is the concept of the "asset alias". The alias for an asset becomes an alternate name for an asset. So a network may put a different asset in any of many local affiliates, all loaded with content exclusively for that locality. However, if they are all given the same "alias", then the network can then request a play from that asset at each local affiliate, with one single command. Because of the similarity of use with playlists, the discussion will focus on this in **Section 3.4**.

Note that files may be placed on the iPump6420 by any of several methods. One is WEGENER's Assured File Delivery (AFD), performed in an MPE/IP channel from Compel, over the satellite. Another is Kencast FAZZT, a 3rd party satellite-based file distribution system. Another is HTTP file download over internet. Other methods are also available to the local user: FTP or SMB upload, and file recording. In the cases of FTP or SMB upload, be aware that the file management database must still be given time to locate and "register" all newly placed files. Those files must be located somewhere in the **/u/user/** file structure, though the **/u/user/assets** directory is *strongly* recommended for all files placed on, and not recorded by, the i6420.

Automatic File and Asset Deletion

If an asset is downloaded to the i6420 with an **Expiration Date** showing in its **metadata.xml** file, then the file management database will schedule that *entire* asset for automatic deletion one calendar day after the Expiration Date. Just after midnight, on the day following that Date, all files and the asset folder itself are quietly deleted, if they still exist.*

* Advanced users may verify this using logs in the web diagnostics page.

Another method whereby files in the **/u/user** folder structure may be *automatically* deleted is under those conditions where the HDD storage appears to be insufficient for new asset/file downloads. In this case, the i6420 performs a **TBS** algorithm to find candidate files for deletion. As new downloads are made, the candidate files are deleted to make room.

User Controls:

The user controls are:

1. Delete individual files, by name or by using wildcard (Compel only)
2. Move, copy, or rename folders and file (local user only)
3. Delete entire assets
4. Register all new files in database (debugging command only)

3.3.2. Assured File Delivery over satellite

Assured File Delivery (AFD) over satellite is the premier method for file distribution in WEGENER MediaPlan-based Store/Forward networks. In those networks, AFD distributes the files to the edge receivers, the iPump6420s. It does this by breaking those files into fixed-size frames, and then using a special "ghost" PID in the Transport stream as the "pipe" to convey those frames to the waiting i6420s. The protocol used to send the frames of data to the i6420s is MPE/UDP/IP (usually called just "**MPE/IP**"). The data is sent from Compel CSM, by UDP, to the "satellite" IP address used in WEGENER S/F systems (173.16.200.222). Uplink equipment called an **IP Encapsulator** then "forwards" those UDP packets, encapsulated per MPE protocol, within a small Transport stream. This small stream is then multiplexed within the main Satellite Transport by the main uplink **MPEG Multiplexer**. Thence, it goes out over the satellite to the waiting iPump6420s. Meanwhile, if any of those i6420s has been set to use an MPE PID which is correct, then that data stream is demultiplexed and fed to the IP stack at the satellite IP address, which is assigned to the virtual "DVB adaptor" in all iPump6420s. Those UDP packets, of course, are sent to a specific **port number**. As part of AFD, before the file is sent out as UDP packets, Compel had instructed the target i6420s with a command to listen on that port. If it *is* listening, and the packets are received, the i6420 reads the very first packet, a "**control**" packet, to get the file name, its size, destination path, and its checksum. Then, if all the other packets are received OK, the file is re-assembled and checksummed, said checksum then compared to that

sent in the first packet. If OK, the file is copied into the i6420 HDD filesystem at **/u/user**, creating new folders as necessary. This completes the *immediate* file delivery process. However, to keep the i6420 from wasting time accepting files not intended for it, it will receive a follow-on command from Compel ordering it to stop listening on the original UDP port. This completes the *actual* AFD process for that file.

Currently, AFD may send as many as ten files at once, conceivably all directed to the same iPump6420s. So 10 different UDP ports may be simultaneously opened on the i6420's satellite IP address. At each, the i6420 may be receiving and buffering all or part of a file in process of being downloaded.

The relevant indicators are:

DOWNLOAD LED on during file downloads

The relevant user controls are:

1. Set or edit MPE PID
2. Listen to the UDP port in satellite IP address (MADD in Compel)
3. Stop listening to the above UDP port (MREMOVE in Compel)
4. First packet timeout (timeout waiting for control packet, after MADD; factory-set)
5. File send timeout (timeout waiting for entire file delivery; factory-set)

3.3.3. Kencast File Delivery over satellite

WEGENER's iPump6420 also supports an industry-standard 3rd party server/client application for satellite-based file distribution, Kencast's FAZZT product (kencast.com). This system utilizes a similar MPE/IP download technique as used in WEGENER's AFD. The FAZZT client is built into the i6420 standard. However, it is beyond the scope of *this* Manual to introduce the user to FAZZT, so please reference that product's literature for help. To do file distribution from Compel, through a FAZZT server, through the satellite Transport stream, to waiting iPump6420s, the implementer must have this setup: The i6420s must have an authorizing FAZZT serial number and key-file, be listening on the correct MPE/IP PID, and be properly assigned to one or more Kencast "channels". The i6420 will *then* accept files properly transmitted on those channels by the FAZZT server.

Relevant user controls are:

1. Kencast channel assignment
2. Set or edit MPE PID

3.3.4. HTTP File Delivery over internet

An alternate method of file delivery from Compel, that does not require a continuous satellite connection, is HTTP File Delivery over Internet. Here, the i6420 is commanded by Compel to request a file download from the Compel server using HTTP messages over IP. If a path to the server can be found, and the file is ready to send, then the i6420 may "pull" packets of file data by HTTP from Compel, using the WGET utility. Again, the first packet delivered is a "control" packet, and any following packets are used to complete the file. The file is then checksummed, and, if OK, placed in the designated path under **/u/user**, building new folders as necessary.

The relevant user controls are:

1. COMPEL server IP address
2. Compel command (scheduled, over internet, or by satellite) to request HTTP file download
3. First packet timeout
4. File send timeout

3.3.5. Other file creation & delivery mechanisms

The remaining mechanisms used to either create or place files on the iPump6420 is File Recording, FTP placement, or SMB placement. File recording is a process where an audio stream is designated by Program and Language Descriptor, then it is converted into an **MPEG program stream** and stored to the i6420 HDD as an **mpg** file. The files are recorded at the stream rates as they appear in the incoming Transport. The resulting recorded files are stored into **/u/user/recorded** directory.

For SMB placement, the user must access the i6420 over a network at the LAN port as if it were a Windows share location, giving Windows the ***\\LAN-ip-address*** format in the Windows Explorer address bar, where '*LAN-ip-address*' is the IP address of the LAN port. Then the user may PUT the file to the desired location under **/u/user.*** Meanwhile, for FTP placement, the user, again, access the i6420 at the LAN port. When accessing from text-based FTP programs, the i6420 supplies the user an anonymous FTP login. Then the user may PUT the file to the desired location under **/u/user**.* However they are placed, about 15 minutes or less after placing files on the iPump6420, the file management database should have located the file, established playability, and made them available for selection in the web File Manager and Playlist Builder views.

* Putting the files to /u/user/assets is preferred.

The relevant indicators are:

1. RECORD LED ***on*** during file recordings

The relevant user controls are:

1. FTP access on/off
2. SMB access on/off
3. Content access on/off. Allows access to modify or delete files through web or SMB.
4. Start file recording (by Program/Audio LD) for a specified time duration to a specified file path and name
5. Abort file recording

3.3.6. "Asset Healing", a content modeling & recovery utility

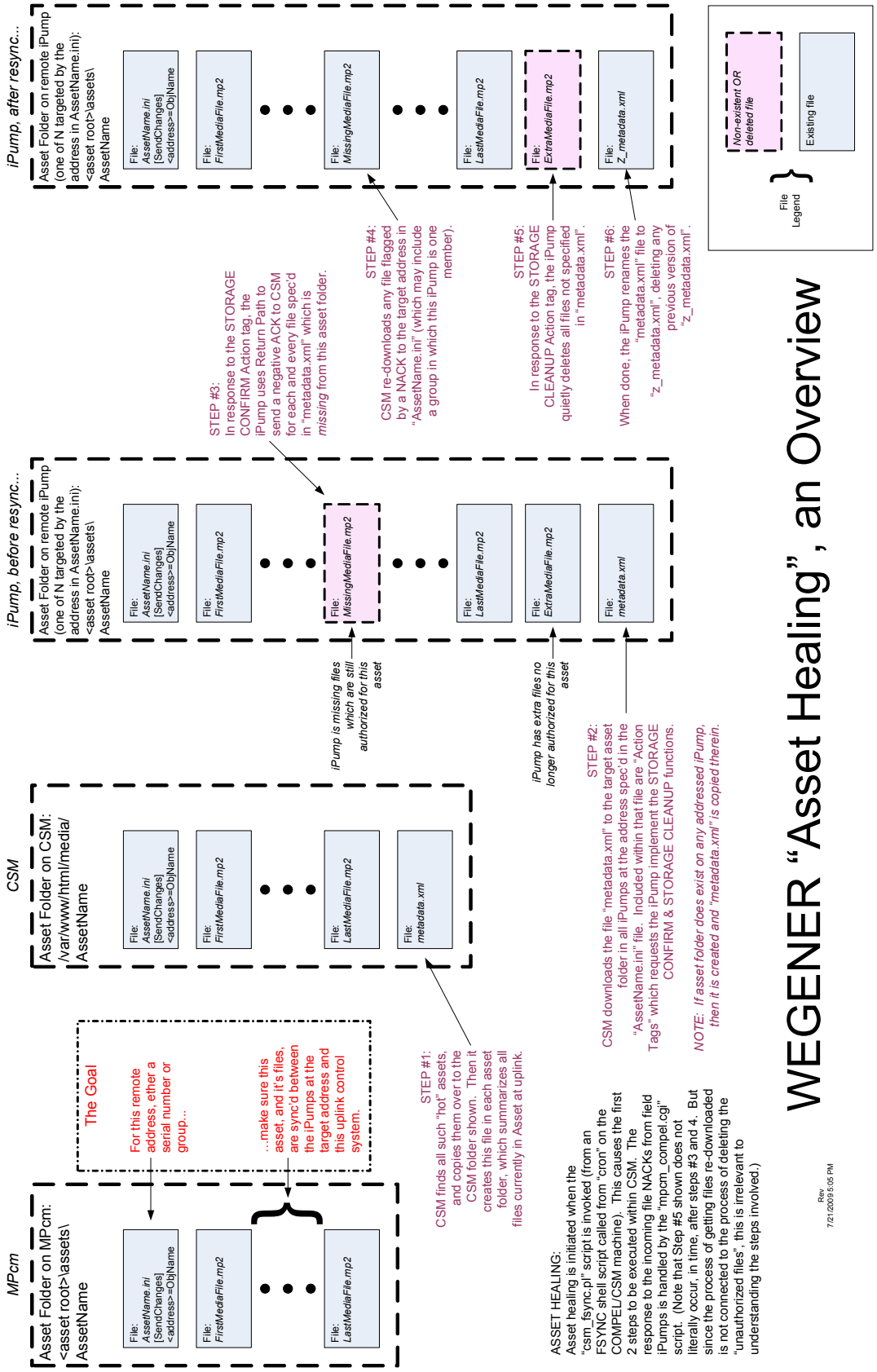
After delivering files using AFD, WEGENER has a utility to allow the customers to model the files loaded to the field iPump6420s. This utility includes a function in the uplink control system and within the i6420. To work, the user must have Compel version 5.07 or later, with MediaPlan and CSM. A Return Path system (see **Section 3.1.2**) must also be available. "**Asset Healing**" is a regularly scheduled function which looks at the field iPump6420s and orders them to delete files they are not supposed to have, while requesting NACK messages, through the physical Return path mechanism, to flag files that they lack. Then the uplink control system re-downloads the missing files. Because of the complexity of Asset Healing, **Figure 3-16** is provided to assist understanding.

In the uplink control system MPcm machine, models of all assets are held in a database. Included in each asset, at this location only, is a Compel address tag in an ***assetname*.ini** file (where *assetname* is the name of the asset). This may be a unit serial number or a Compel group number. When the regularly scheduled script requests Asset Healing, CSM copies over the entire asset, and holds the address. It then scours through the asset, building a new **metadata.xml** file with a correct file list, showing the path for each. It is not limited to a single-level folder, but will scan the structure of even deeply-nested folder trees. When done with that, it adds Action Tags (STORAGE CONFIRM and STORAGE CLEANUP) to the **metadata.xml** file. It then uses AFD to download the **metadata.xml** file to the address specified in the ***assetname*.ini** file.

At the iPump6420s, their part of the task begins. The i6420 will take the newly downloaded **metadata.xml** file and place it in the correct asset, if it exists, or creates a new one if not. It then proceeds to analyse the files it has and compare the resulting list to the files it is *supposed* to have. Files it is *not* supposed to have are deleted. For files that are missing, it uses Return Path to send a NACK which flags the file identity and the corresponding asset name. This tells Compel's CSM program which group (for grouped addresses) needs a particular file. Each file is then re-downloaded by Compel, using either satellite or internet download. When the process is complete, the i6420 renames the **metadata.xml** file to be **z_metadata.xml**. Since the i6420 is constantly watching its asset files for **metadata.xml** files, the rename prevents it from duplicating work already done.

The above process is optimum for very large assets, with multiple layers, as is often used for "DJ Liner" assets. In fact, it may not be necessary to ever *explicitly* request download of this asset. The network operator merely places the asset folder correctly to the MPcm machine, adds files, then posts the correct address file to the asset. The Asset Healing function, running late at night, then does the work of downloading files automatically.

Figure 3-16: Asset Healing in operation



3.4. Insertion of Audio from Stored Files

This section discusses the reason Store/Forward implementers have purchased and deployed WEGENER iPump6420s. The essential function is to allow local file-based content to play in place of the live audio stream, synchronized to overlay specific time epochs we call "spot avails". These avails are those time periods a default network commercial is playing in the live audio track, as originating in the customer's automation system, and usually co-located with the uplink compression and control system. The **avail** becomes the opportunity to play out a locally-relevant commercial spot in substitution, thus offering true "localization".

3.4.1. Simple File inserts

The iPump6420 can, under Compel or local user command, *seamlessly* insert the decoded audio from valid files into the decoded audio track from the live satellite PID streams. When a Decoder is set to play live audio from the satellite Transport, defined by Program and Audio LD, then that is called *permanent* setting, because it is non-volatile, surviving unit resets. File audio *inserts*, with only special exceptions, are *temporary*.

The i6420 can execute 1) simple file plays of named files; 2) simple file plays of named files, but with asset alias indirection in the path; 3) or file plays based on keyword indirection into a folder containing a selection of files. It can also play one or more files as part of a *playlist*, also using the same methods of file identification as just described (see next subsection). For *all* these file insertions, whether discrete or as part of a playlist, the currently-supported file types are 1) the recorded MPEG program stream files with **mpg** extensions, 2) MPEG elementary stream files with **mp2** extensions, 3) 16-bit PCM wave files with **wav** extensions, and 4) MPEG I layer 3 files with **mp3** extensions (if option is installed, see **Section 3.7.4**).

When a file is requested to play, its compressed file data will be passed to the audio codec after a time interval following the command, depending on the source. If that source is in-channel Compel, a **Command Delay** is applied and then decoding begins. For all other sources, the decoding begins virtually immediately, probably less than 50 mS. Remembering the model for the i6420 internal functions (see **Figure 1-3**), the *decoded* linear audio data is then passed to a 500 mS deep buffer, creating an automatic 500 mS latency on file plays.* So the system implementer *must* keep this in mind to avoid confusion: After a Compel file (or playlist) play command, there will be a **Compel Command Delay** *before* execution. Then, *after* execution begins, the old live audio will *continue* to play for 500 mS before the new file-based audio is heard. The same applies on exiting the file play and return to the live satellite audio stream.

* For purposes of this discussion, it makes no difference whether the file audio is actually compressed-audio data or linear PCM wave-file data.

Logging: All *temporary* file plays are logged to the As-run Log.

Relevant indicators are:

1. PLAYBACK LED ***on*** during play of any file-based audio, whether temporary or permanent
2. "File-not-found" fault indication

Relevant user controls are:

1. File insertion by named file, by indirection with asset alias (see **section 3.4.6**), and/or by indirection with keyword-based selection from folder (see **section 3.4.5**)
2. Abort file play (only a local operation)

3.4.2. Playlists

"**Playlists**" give the user the opportunity for insertion command indirection that makes localization convenient (see **Figure 1-2**), while allowing for more powerful file-based audio functions. By defining the same playlist name on many field iPump6420s, but each pointing to its own local files, the network, by requesting an audio insert with that playlist, can get a group of field i6420s to do a synchronized local insert. These inserts execute simultaneously at all sites, with each unit using *its own* local content.

In the iPump6420, a **playlist** is an ordered set of one or more audio file specifications. Each of those file specifications may 1) explicitly name a file by path and filename, 2) name a file as before but using an asset alias in the path (see **section 3.4.6**), or 3) use a keyword to select a file from an asset folder (see **section 3.4.5**). Any or all playable file types may be used in a single playlist. When a playlist play is invoked as a *temporary* insert, the typical use, the live audio feed is muted and then all the files are played, in order, once, and then the audio decoder (port) output returns to the live satellite audio feed. This is a non-volatile operation, and, if the unit reboots, that audio decoder (port) will resume on the *permanent* live satellite audio feed. The *temporary* playlist insert aborts not only after resets, but also after any change to a Decoder permanent setting or by special Abort command.

The alternative to the temporary playlist insertion is to *permanently* assign an i6420 Audio Decoder (port) to be a "virtual channel". This is a *permanent* non-volatile setting. It is done by assigning a playlist to play under the rule "Loop Forever". Under this assignment, the audio output from that Decoder will play one file after another until the playlist is complete, then repeat from the top. This repeats endlessly, even through unit reboots, as long as power is applied. It only stops when the Decoder receives a command to go to another permanent setting (e.g. play live audio from the incoming Transport, if available).

Playlists are often built in the Compel/MediaPlan system and either 1) downloaded to the field iPump6420s as discrete ***playlistname*.xml** files into the **/u/user/.system/playlists** folder, or 2) built on the i6420 using Compel playlist build commands. The local user, through the web Playlist tab, may also build, edit, and delete playlists. Note that the names of playlists *are* allowed to contain whitespace.

Logging: All *temporary* playlist plays are logged to the As-run Log.

Relevant indicators are:

1. PLAYBACK LED ***on*** during play of playlist audio, whether temporary or permanent
2. "Playlist does not exist" fault indication
3. "File-not-found" fault indication

Relevant user controls are:

1. Create a playlist (local, or using Compel playlist build command)
2. Download a playlist as a file
3. Edit a playlist: Adding, removing, moving, changing line items (only a local operation)
4. Delete a playlist: by name, using wildcards (Compel only), or "all"
5. Temporary File insertion by named playlist, with *optional* Profiles (see **section 3.4.4**)
6. Permanent virtual channel using loop-forever playlist
7. Abort playlist play (explicitly, only a local operation, but any perm setting of the Decoder will abort temp or perm playlist play)

3.4.3. Timing Model

The timing model for insertion of file audio into the live audio stream is illustrated by the example shown in **Figure 3-17**. From the audio feed and companion closures emitted by the customer's automation system looking forward, WEGENER's Compel and iPump6420 both provide tools to align the local file insertion onto a network "avail". This is, in a non-hard-time system, the opportunity to substitute local file content for network-wide audio material, usually a default network commercial spot.

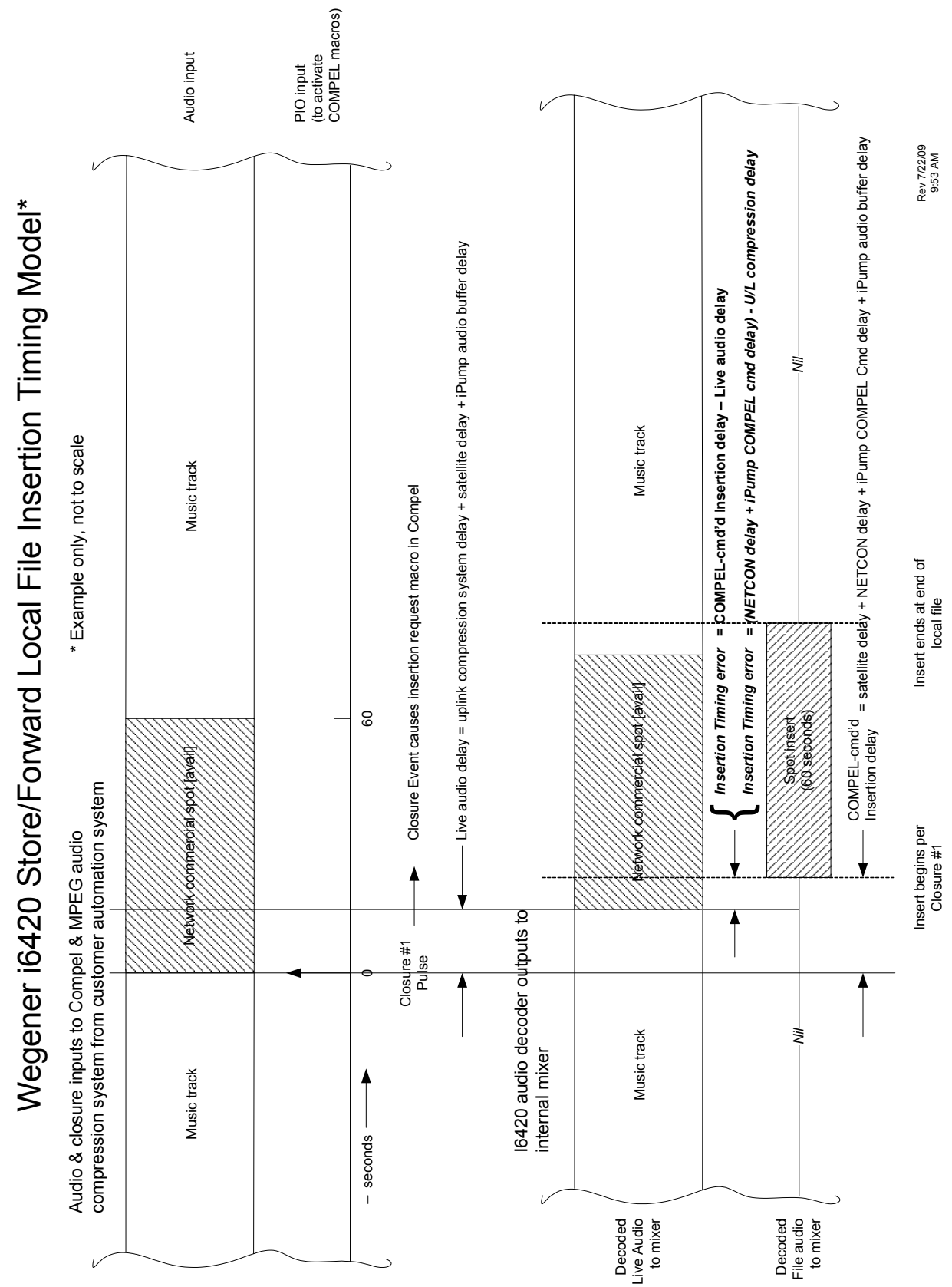
Viewing the figure, we see the sum total of all significant delays to the live audio stream. This is shown as "**Live audio delay**". Meanwhile, we can see the sum total of all significant delays, in the system, to actual insertion of the file audio content. This is shown as "**COMPEL-cmd'd Insertion delay**". The *difference* between the two terms is called the "**Insertion Timing Error**". Note that this value is minimized when the *sum* of "**NETCON delay**" and "**iPump COMPEL cmd delay**" *equals* the delay through the uplink MPEG audio compression system. The first term can mean the traditional legacy **NETCON DELAY** command used in Compel macros, or it can mean the newer **Delay** term in the Compel Command **Extended Syntax**. The **iPump Compel Cmd Delay** is an i6420 setting, usually set by the factory, but WEGENER can advise customers on how to adjust this in their field i6420s.

The non-hard-time system shown is not the only example for using local file insertions. In some hard-time systems, file inserts may be scheduled in the iPump6420 Local Scheduler. In these cases, if an insert is scheduled for a specific time, then the file insertion command is executed instantly per the i6420's real-time clock, and the only delay to seeing the file audio appearing in the final audio output is the standard 500 mS audio buffer delay.

Relevant user controls are:

1. Compel Cmd Delay setting (factory setting)
2. NETCON DELAY Compel command ***OR***
3. Compel Extended Syntax command delay

Figure 3-17: iPump6420 File Insertion Timing Model



3.4.4. Insertion Profiles

Overview

Insertion "**profiles**" are optional modifiers that are applied to an entire *temporary* insert, whether a discrete file or a playlist. This is invoked *only* by in-channel Compel commands. A field in the insertion command may specify a profile. Zero ('0') is the normal default in Compel commands and means "use no profile". But a value between 1 and 255 requires a user-specified profile be used, if found. Remember that the effects of the profiles last only as long as the applicable insert, and have no meaning after the end of the file/playlist insert (or any meaning after said insert is aborted). The profiles themselves are defined in special files that reside in the i6420's **/u/user/.sysconfig/profiles** directory. The files are named ***n***.def where '**n**' is the profile number code, between 1 and 255 inclusive. Any kind of profile design may be assigned any number, though it is advised that all i6420s in a network use the same profile number code for the same profile design.

The profile files themselves are simple text files of the form:
return { key_1 = value_1 , key_2 = value_2, … } where ***key_1*** is one of the possible keywords, and ***value_1*** is a value selection for that keyword, and so on. Note that a profile file may contain any or all of the legal keywords. But if a keyword appears *twice* in a profile file, or there are other spelling or format errors, the profile will not be used when the Compel insertion command is received. It is best that implementers "try out" their profiles first, in a controlled environment, to be sure that the desired behavior results.

Current Profile Keywords

preSilence: This forces the *start* of the file/playlist insert to be delayed by the value given, with audio silence inserted between the end of live and the delayed position of the insert. Values are in mS, 0 to 5000.

postSilence: This forces the resumption of the live audio, after the file/playlist insert ends, to be delayed by the value given, with audio silence inserted. Values are in mS, 0 to 5000.

ducking: This allows the live *permanent* audio to continue to mix with the file/playlist insert at the audio output, during the entire time of the insert. The *value* specifies the amount of attenuation, from normal level, experienced by the live audio while mixing "into" the insert. This value is in dB, and may be specified down to tenths of a dB (e.g. '6.2' for 6.2 dB).

atten: This attenuates the file/playlist audio during the insert. The *value* specifies the amount of attenuation. This value is in dB, and may be specified down to tenths of a dB.

User Controls

The relevant user controls are:

1. Create a profile file
2. Delete a profile file

3.4.5. File Selection Keywords

File selection keywords give the user the ability to play files in "random" order. These are typically used in *temporary* inserts ordered by Compel commands. However, they can be used as file specs in loop-forever playlist plays, a *permanent* Decoder (port) setting. The "keyword" signals to the playback process a method to select an audio file from a specified i6420 asset folder, whether top level, or deep in the directory tree. The keywords apply to the file path description, whether in a discrete file play command, or in a single file spec (line item) of a larger playlist. In the path syntax, they *literally* take the place of a discrete file name. Each keyword assumes that some memory of previous plays is retained. However, this memory is non-volatile, and is not retained through unit resets.

As of this writing, three (3) keyword selectors are defined, SHUFFLE, RANDOM, and SEQUENTIAL:

1. **SHUFFLE**: This keyword means that all files in a directory are each played once, without any repeats, as file insert requests, using this keyword, are made. When all files have played, then the order in the directory is re-shuffled and a new file play order is remembered. The only exception is that the last file from the previous shuffle is not the first in the next, if there is more than one file in the directory. This continues for all file plays called for a particular Decoder (port), until the unit resets or the directory has files added or removed. So the remembered state is: Ordered file list, current position in list, applicable Decoder, and the type of call (from discrete file play, a file spec in a std. playlist, or file spec in a LOA playlist [used for ShowShifting or Time
   Zone Delay, see **sections 3.7.2 & 3.7.3**]).
2. **RANDOM**: This keyword means that a file is randomly selected from a directory as file insert requests, using this keyword, are made. If there is more than one playable file in the directory, then no file is repeated, through repeated requests. This continues for all file plays called for a particular Decoder (port), until the unit resets. So the remembered state is: Last file played, applicable Decoder, and the type of call (from discrete file play, a file spec in a std. playlist, or file spec in a LOA playlist [used for ShowShifting or Time Zone Delay, see **sections 3.7.2 & 3.7.3**]).
3. **SEQUENTIAL**: This keyword means that all files in a directory are each played once, without any repeats, in alphanumeric order, as file insert requests, using this keyword, are made. When all files have played, then it repeats in the *same* order. This continues for all file plays called for a particular Decoder (port), until the unit resets or the directory has files added or removed. So the remembered state is: Alphanumeric file list, current position in list, applicable Decoder, and the type of call (from discrete file play, a file spec in a std. playlist, or file spec in a LOA playlist [used for ShowShifting or Time Zone Delay, see **sections 3.7.2 & 3.7.3**]).

As files are added or deleted from the target folders, the behavior of the unit is this: As files are added, then the new files are "picked up" each time SHUFFLE or SEQUENTIAL finishes the current file list and starts again. As files are deleted, the keywords would skip those file positions in their lists, if any.

An example of the use of the SHUFFLE keyword is given in **Figure 3-18**.

There are no relevant ***user controls*** for this automatic process, beyond use of these keywords in the standard file and playlist play commands.

Figure 3-18: Example of using the SHUFFLE file selection keyword

Use of SHUFFLE keyword, a simple playlist example:

Consider the following playlist definition:

```
/assets/Song/Song_A.mp2
/assets/Spots/SHUFFLE
/assets/Song/Song_B.mp2
/assets/Spots/SHUFFLE
/assets/Song/Song_C.mp2
/assets/Spots/SHUFFLE
```

Note that each time this playlist is invoked, it will play 3 files, each randomly selected from the /assets/Spots directory using the SHUFFLE keyword.

1. A command is received to play this playlist on decoder 1. When the first SHUFFLE keyword is reached, the Spots directory listing is shuffled randomly in the following order with the first item (HomeDepot_2.mp2) returned as the file to play:

```
HomeDepot_2.mp2
CocaCola_2.mp2
HomeDepot_1.mp2
CocaCola_1.mp2
```

2. For the remainder of the playlist, the next 2 files (CocaCola_2.mp2 and HomeDepot_1.mp2) will be played.
3. The next time the receiver is commanded to play this playlist, when it reaches the first SHUFFLE keyword it will play the last unplayed file CocaCola_1.mp2 .
4. When control reaches to the next entry with the SHUFFLE keyword, the /assets/Spots directory listing is reshuffled and the new first item is returned (HomeDepot_1.mp2). This is then played:

```
HomeDepot_1.mp2
CocaCola_1.mp2
HomeDepot_2.mp2
CocaCola_2.mp2
```

5. To finish on *this* execution of the playlist, the last SHUFFLE entry file is played (CocaCola_1.mp2). Notice that within this ***particular*** playlist execution, the same file is played twice because of the reshuffle. However, the same file is *not* allowed to play back-to-back.

3.4.6. Asset Aliases

Asset "**aliases**" are another simple method of indirection used to get localization. To use this, one must use asset-based files downloaded and managed from the uplink control system. In any file spec, whether used in a discrete file insert, or used in a line item of a playlist being inserted, the top level asset directory *name* must appear in the path. However, an asset alias allows an alternative name to be used for an asset. Usually, the real asset name is particular to a specific locality, and the alias is a name used network-wide for a similar class of assets. By using an alias in the file spec for an insert, Compel can use one command to request many different field i6420s to each insert a different local file.

For example, a typical full file pathname for a SHUFFLEd DJ Liner insertion request might be: **/assets/WKLS-Rock/Fred_McMurray/5-second/SHUFFLE**. In this example, the network-wide alias assigned to the "WKLS-Rock" asset was "**Rock**". With the alias loaded to the i6420, Compel can request the file insert by asking for **/assets/Rock/Fred_McMurray/5-second/SHUFFLE**. This will then randomly play a 5-second Liner for Fred McMurray in all stations in the "Rock" network, that is, the network where all i6420s share the alias "**Rock**".

The method to install an asset alias is by using the **metadata.xml** file traditionally downloaded with each new asset built on field iPump6420s by Compel. The "alias" tag of the xml file will define the alias. This then creates a logical link in the i6420 file system. So the creation of asset aliases is an uplink control system function, usually done with special scripts. If a user wishes to implement this in a network, please contact WEGENER Customer Service.

The relevant user controls are: None.

3.5. Off-Air Recording (option)

An *optional* feature in iPump6420 is Off-Air Recording (**OAR**) capability. OAR capability gives the network operator the power to *audit* field i6420s to ensure that the correct commercial spots are being played on the air by the local radio stations. One should note that, using Return Path alone, the operator already had the power to confirm the i6420's "opinion" that a spot was air'd, using returned As-run Logs. However, using OAR, the operator is provided an added level of assurance that nothing else in the system prevented the actual airing of the spot, such as failures in the local radio station equipment.

To get OAR capability, the system must be setup for Compel Return Path (see **Section 3.1.2**). Meanwhile, the i6420s must come equipped with the onboard AM/FM tuners, and be authorized for the mp3 audio codec (see **Section 3.7.4**). The AM/FM tuners installed must be specified to work in the common commercial bands in use where the i6420s will be deployed. In the US, this would be the well-known 520-1720 kHz AM band, and the 88-109 MHz FM band. This is the standard package shipped if ordering i6420s with AM/FM tuners. But several world-wide bands may *optionally* be supported as well (see spec in **Section 1.4**). If any questions, please contact your WEGENER Sales Dept for assistance.

To avoid confusion, the local user should observe that the AM/FM ports, #1 and #2 should remain physically associated with the i6420 Audio Decoder (port) numbers 1 and 2, respectively. That way, audio captured "off the air" on AM/FM tuner #2 should be the same signal as output on Audio #2, and thence sent to the local radio transmission system.

3.5.1. AM/FM tuner setup

Compel or the local user may setup the AM/FM tuners. The setup consists of programming the desired band and frequency. Once an external antenna connection has been provided, a user may use either the local user web or front-panel interface in order to check for received signal quality. This "signal quality" is also reported to Compel's CSM program using the standard iPump6420 Return Path Status report.

Again, the **relevant user controls are**:

1. Tuner band, each port
2. Tuner frequency, each port

3.5.2. Off-Air Capture

To prepare for an off-air capture, the compression settings must be programmed. The audio signal, once demodulated by the AM/FM tuner section, is captured and digitized, then the linear audio data is compressed to mp3 file format for storage. The compression settings needed will specify to the mp3 codec just how this will be done. The user settings are 1) MPEG elementary stream bit rate (called just "bit rate"), 2) Audio sample rate, 3) Stereo/mono selection, and 4) Sample depth (1 or 2 bytes per sample). *Note that there is some advantage for the user to set the compression settings to minimize the resulting mp3 file size, since the bandwidth available to the Return Path function may be limited.*

After the tuners and the compression system are setup, an audio capture may be executed. This may be done with a simple manual Compel or user command. However, to automate the system, it may be best to combine the OAR-capture command with the playlist-play command into one single Compel macro, fired when the customer automation system requests the local insert. The OAR-capture command itself supplies the Port #, a "tag", and a capture time amount to the i6420. Immediately after the command, the i6420 will capture the demodulated audio from the requested AM/FM tuner port number, for that specified time. As the audio is captured, it is compressed into an mp3 file and that is written to local HDD storage. The name of the file captured will be of the form "**YYYYMMDD_HHMMSS_tag_port_sn_label.mp3**", where '**YYYMMDD**' is a date code, '**HHMMSS**' is a 24-hour time code, '**tag**' is a user-provided identifying "tag", '**port**' is the Port number, '**sn**' is the unit serial number, and '**label**' is the unit name. The resulting OAR capture file will be stored into the **/u/user/.system/oar** directory.

Again, **the relevant user controls are**:

1. Capture bit-rate, each port
2. Capture sample rate, each port
3. Capture stereo mode, each port
4. Capture Sample depth
5. Capture audio level (factory set)
6. OAR capture command: Port, Tag, Time length
7. OAR file-capture status request

3.5.3. File Return for Audit

As the captured OAR files accumulate on field i6420s, the Compel system may regularly request that they be returned so that they are available for auditing. This is done through the Return Path OAR file return report. This will cause the field iPump6420 to upload all OAR files, by HTTP POST, to the CSM function in the Compel system. The CSM function, in turn, will place the files to a directory for that unit serial number. After the request has been accepted and executed, the iPump6420 will move the OAR files that were sent to a hidden folder **/u/user/.system/oar/.to_be_deleted**. All files therein are watched by another internal maintenance process. When their age exceeds the automatic deletion time, then they are quietly deleted.

The relevant user controls are:

1. OAR Return Path request
2. OAR file auto-deletion time, in days
3. OAR file auto-deletion time of day

3.6. Miscellaneous Functions

3.6.1. Application Management

The Linux OS and the linux application that implements the Local Controller, per **Figure 1-3**, both have their code stored in a flash memory card. The code is stored there, rather than the hard-drive (HDD), so that the unit will function, albeit as a more limited "IRD", in the event that the unit's HDD fails. Storage of the application software is done in two redundant locations. This allows the network operator some measure of security when trying to control many remote, field iPump6420s, especially when local users are unable to, unwilling to, or restricted from assisting in the proper management of the unit.

Redundant Application Images

Normally, the unit holds two versions of the application code and one is specified to be the "**commanded**" application. At unit reboot, a boot loader function evaluates the non-volatile instructions specifying which application to load, and the stored flags indicating the status of those application images. If an application image is known to be "good", and it is the currently commanded (or "**primary**") version, then it is loaded and run without further qualification. If the currently commanded (primary) application image is not known to be good, for any of several reasons, then the boot loader will load the alternate ("**backup**") version, if it is known to be good. Also, if the boot loader attempts to load and run the commanded application, and if, for any reason, the application cannot be run, then the boot loader, after a few attempts, can revert to the backup application, loading and running that. It will also mark the failing application image as "bad", avoiding later re-attempts to load and run it. The exceptions to these scenarios can be discussed shortly, after describing the application upgrade process.

Software Upgrade process

To upgrade software in unit, Compel, or the local web user, may download a new application image to the running system. This is in a special format which uses a *.dl extension, and it is downloaded to the **/u/user/.system/dlfiles** directory, which is a "hot folder".* There,

the currently-running application will checksum the received image, and if OK, process and load it to the non-volatile Flash storage, *in the backup position*. It will also mark the application image status flags. If the file was installed by a local user, the flags are always set to "OK" and that is the end of it. If the download was done under Compel management, the flags are set to indicate "OK, but testing". Regardless of these flags, the download task itself does not complete the upgrade process. Later, Compel or the local user (if local control is enabled), must request that the new application version be loaded and run. This is called the application switch, probably because it can be done as a command to "use the backup application" or as a command to "switch to a particular application version ***nnn***". The second method is actually preferred, except in a panic situation, because it forces the operator to know what he/she is doing and think about what application the field iPump6420s will be switching to. Regardless of how it is ordered, the incumbent application software first marks the non-volatile storage flags to show the backup (new application version) as the new "primary" (commanded), and *its own* flag to show as the new backup. Then it jumps to reset, eventually giving control of the unit over to the new application version, as the boot loader loads and runs that new version.

* Being a "hot folder", after the follow-on processing, the downloaded images shall be deleted from *dlfiles*.

Recall that i6420s downloaded from Compel have their newly downloaded application images marked as "OK but testing". The meaning of the "testing" flag is this: If the user later requests an application switch to this newly-downloaded application, then, if it is "testing", it will undergo a special performance self-review. In this self-review, the unit must, if Compel is required, acquire the Compel command stream in some short, but reasonable, time interval. It must also not reset more than a couple of times in the first hour of operation. If either criteria fails, the application must mark the application management flags reversing the sense of primary and backup, and then mark *itself* as "bad". Then it will jump to reset to allow the old backup to take over. Otherwise, if all is still OK after the "test", the application marks itself as "good" and continues running normally.

Relevant user controls:

1. Application file downloads
2. Application switch, either as a toggle, or directed to specific application string (preferred)
3. Several debugging commands to monitor and manipulate the application flags exist, but contact WEGENER Customer Service before contemplating such actions!

3.6.2. Non-volatile Parameter Management

All non-volatile unit settings (NV parameters) are retained in the internal flash memory storage, the same physical location as the Linux OS and the application images. At unit boot-up, these NV parameters are read into volatile memory for use. As these parameters changes, new values are written to the NV storage. These parameters include many factory and user settings. The full set of parameters can be stored, downloaded, and re-loaded. This allows duplication of unit settings in production and service.

To facilitate testing of the product, tools are provided to save off and restore the complete set of non-volatile settings. This can be done from or two any of three different storage locations, in addition to the current operating storage position (so there are four total). The "production default" is that used to do standardized tests in production and service. The "customer default" is the ship configuration requested for all the i6420s ordered for a particular network by the customer. A "backup" position is where the current settings might be temporarily stored.

Relevant user controls:

1. Store current NV settings to backup
2. Store current NV setting as Production default
3. Store current NV setting as customer default
4. Restore current NV setting from backup, Production, or customer default positions

3.6.3. Logging

The iPump6420 is constantly logging many different types of events to non-volatile storage on the hard-drive (HDD). The amount logged can vary considerably based on the current log levels. Most of these logs are only useful to advanced users with debugging access. No other information is supplied in this publicly-accessible Manual about these logs. If you are an advanced user, and you have questions, please contact WEGENER Customer Service for more information.

However, two important logs are available at all times to local web users. One is the As-run Log, a log of all *temporary* file/playlist insertion events, including results entries stating whether the insert was successful or not. The other is the Operational Log ("Ops Log"), a log of miscellaneous events such as relay closure changes, error'd second events in the Transport, audio file and OAR recordings, carrier and/or audio stream switches, and other events.

Note that the As-run Log may be requested as a Return Path report by Compel (see section), and a *.csv file with the same info may be requested by the local web user. As of this writing, the Ops Log is only available for display on the local web, though that page may be saved to the PC running the browser.

The relevant user controls are:

1. Clear logs
2. Set log limits (factory setting)
3. Request Return Path As-run Log
4. Request As-run CSV file (local web only)

3.6.4. Time Management

Master Time Reference

The iPump6420 makes use of a real-time clock (**RTC**) for many different functions, not just elapsed time. In most missions, the i6420 RTC *must* be synchronized to some other reference. In the majority of missions, this is the Compel clock. The way this is done is to make use of the Compel time-of-day messages (also called "keep alives", see **Section 3.1.1**). These are messages sent to "all" devices which convey a UTC time/date stamp. The i6420 uses these messages to implement a low-bandwidth timebase-tracking loop. Therefore, the i6420 must see at least one such message each second for the most effective time tracking, that is to make guarantees on time tracking for the Local Scheduler and for premium features (see **Section 3.7**). Of course, if the Compel system itself has its clock synchronized by NTP to a precision local or internet source, then the field i6420s, due to the satellite transit delay seen by the Compel stream (~ 250 mS), will see their current time value lag behind those same NTP sources by the same amount.

As an alternate to using the in-channel Compel command stream for synchronizing the i6420 RTC, the unit may also be set to use NTP direct to a specified source. This is recommended for the non-satellite-based installations, which will receive Compel control over the internet and will execute timed events based on a Local Scheduler and its RTC.

The relevant user controls are:

1. Time source control (Compel or NTP)
2. NTP time source, *by IP address only*
3. Set time (if not using Compel or NTP, generally a test scenario only)

Time Zone management

All timed events loaded into the Local Scheduler show the time of the event *as it was set in the Compel system*. To set a local Scheduler line, Compel must tell the iPump6420 what time, in local Compel time, that the event must occur. Along with this, Compel communicates its own "**timezone rule**" to the listening i6420. In turn, the i6420 must translate this command to setup its Scheduler to show the command execution time in terms of the i6420's *own* time. This is done by translating the Compel time to UTC using Compel's timezone rule, then translating UTC to its own time, using its own timezone rule. The "timezone rule" is a logical concatenation of a time zone offset from GMT, a logical Boolean stating whether a daylight savings is observed, and the legal dates of that observance in that locality. For instance, the eastern US uses the America/New_York timezone rule, which implies that the offset from GMT is -5, and that DST *is* observed between the 2nd Sunday in March and the 1st Sunday in November.*

* The set of possible rules are also called the **Olson database strings**.

Since the local web interface displays the time in terms of the i6420's own timezone rules, users monitoring the Scheduler must be aware of the opportunity for confusion. In the event that the web user's browser is not running on a PC in the *same* time zone as the target iPump6420, then the time values shown in the Scheduler may appear to be in error to the observing user. When checking the Scheduler, the user is cautioned to check *both* the time and the timezone rule setting of the i6420.

The relevant user controls are:

1. Set timezone rule (web or front-panel)

3.6.5. HDD Failure

The iPump6420 features an internal metal hard-drive (HDD) for storage of media files, playlists, databases, and logs. It also includes a small partition called the "Install partition", but this is only useful to advanced users who may need, under WEGENER supervision, to rebuild or replace their Compact Flash memory cards. The HDD is critical to all the Store/Forward operations, but is *not* needed in order to provide basic IRD functions. Therefore, the i6420 was designed to continue this limited IRD operation in the event of HDD failure.

The application software will basically declare the HDD as failed and unavailable only if it is not allowed, by the Linux OS, to mount partitions on the HDD for both reading and writing. This will set off a *permanent* Alarm indication for "HDD Failure". The unit may or may not reboot at that time, but it will eventually settle down to operate as a simple IRD, continuing to play out the live satellite audio, if commanded and available. This state will continue indefinitely until an advanced user, with debug access, clears the indication and replaces the HDD.

A possible interim condition may also exist, if, during routine diagnostic scans, the HDD is found to indicate legitimate pre-failure indicators. The scan for these indicators is based on extensive research on hundreds of thousands of HDD failures, as carried out by Google and Carnegie Mellon University.* In this research, these indicators were found to accurately predict nearly 50% of imminent HDD failures, usually weeks or months before the actual failures occurred. When the i6420 sees any of these indicators, then it will, if not masked, set a Warning of "HDD failure imminent".

* Valid customers may request this information from WEGENER Engineering.

3.7. Premium Features

In order to setup and access any of the iPump6420 premium features listed below, the units must have been installed with the proper authorizing key-files. These are small text files that each authorize a specific unit serial number for a specific feature. Their file names are formed as ***serialnumber-featurename*.pem**, where *serialnumber* is the numeric unit serial number, and *featurename* is a text mnemonic representing the feature (see below). As of this writing, Compel versions 5.07 and higher supply controls to either manually authorize individual units, or to authorize an entire network. This is all done by simple MPE/IP file downloads to a secure, hidden directory in the i6420. Within 5 minutes of the file download, the application will recognize its new authorizations, and be ready to perform the new premium functions.

For information on how to order premium features, and acquire authorizing key files, for your iPump6420, please contact the WEGENER Sales Department. For assistance in installing the authorizing keys, please contact the WEGENER Customer Service Department.

3.7.1. Microcasting (aka "Automation Mode")

Microcasting is a new premium feature offered in the WEGENER iPump6420.* This allows the functions of the customer automation system to be embedded in the remote field i6420. Because of this, i6420s with no satellite access may provide operating radio stations with the same rich set of centrally-controlled services provided by their satellite brethren: live media (music/talk/news etc.) play, local spot insertion, cueing closures, RBDS messages, etc.

* Microcasting is often called by its former name, "Automation Mode", in many WEGENER user interfaces and documents.

In order to implement Microcasting, the network must first place schedules, playlists, and media content on the target iPump6420s. Because remote i6420s "doing" Microcasting may have no satellite access, this often must be done using Compel-over-Internet and HTTP file downloads. Also, since Microcasting requires an accurate time-of-day clock reference, the unit will need to be set for NTP and be given the IP address of an accessible time source. To support this, the local implementer must ensure *permanent, reliable* internet access for the i6420.

The schedules are simple text files. Within them, are sets of instruction primitives, written in a special automation language. Some of these primitives give instructions for various operations, such as file plays, playlist plays, relay closures, and RBDS outputs, all such outputs being directed to the correct Port. Other primitives supply metadata about 1) how to chain the various operations together (including overlap of multiple audio files), 2) where to wait on external events (such as a PIO input closure), or 3) whether to start operations at fixed times. Suffice it to say, that these sequence files feature all the tools necessary to simulate a working radio station. But it is not within the scope of this Manual to give more detailed information about how to create such files. So if you are implementing Microcasting, and need to build your own sequence files, please contact WEGENER Customer Service for help.

The playlists and audio content placed on a Microcasting i6420 are the same things used by traditional iPump6420 functions. After the network properly positions these playlists and content, then one or more of the i6420 Audio Decoders (ports) must be *permanently* assigned to do the Microcasting task (again, also called "Automation" in many user interfaces). After that, operation begins and continues, automatically, so long as schedules, playlists, and content are supplied to the i6420 well ahead of their needed use. To later disable Microcasting on a Decoder, a user only needs to issue a command to go to some other permanent setting, whether live audio, loop-forever playlist, or to just turn OFF.

Microcasting is initiated and run in the following manner. Initialization always begins after Microcasting is permanently assigned (started) on a Decoder. Once started, it also re-initializes 1) 5 minutes *before* midnight (per local timezone rules), or 2) after unit reboot. At all those times, the unit looks for a file named **YYYY-MM-DD-n.seq** in the **/u/user/.sysconfig/sequences** directory, where the first part is the date code, and '**n**' is the Decoder (port) number assigned to do Microcasting.* If found, then the unit begins processing the file, executing the instructions therein. If not found, then the unit looks in the same directory for another file named **default-n.seq**. If that is found, where '**n**' matches, then the i6420 proceeds to use that file for its daily schedule. If neither file is found, that Decoder remains silent until the next opportunity for re-initialization.

* Note that there is a soft link to another location under **/u/user/assets,** so that sequence files may be downloaded and managed in the same fashion as other assets.

Note that if content is missing from the i6420 at the time the running schedule calls for it to play, then the unit will do its best good-faith effort to skip that content and continue running

normally. What this means in practice is that operations will be moved up in time until the next "hard time marker", at which time the unit should return to normal operations.

To monitor a Microcasting session, the local web interface features an (Automation) sub-tab under Status for each Decoder. When Microcasting is enabled for that screen's Decoder, the screen will feature a list of all the current day's operations, past and future (if desired), with a marker showing the current position in the list. See **Figure 3-19** for an example. In addition to the web status screen, the operator should observe that the front-panel's PLAYBACK LED is lit during Microcasting operation.

Note that *all* operations in Microcasting are logged, just the same as "normal" operations. For each file or playlist play, there will be a pair of As-run Log entries. For the starting and stopping of Microcasting, as well as every relay closure, there will be an Ops Log entry.

Microcasting authorizing keyfiles are named ***serialnumber*-automation.pem**.

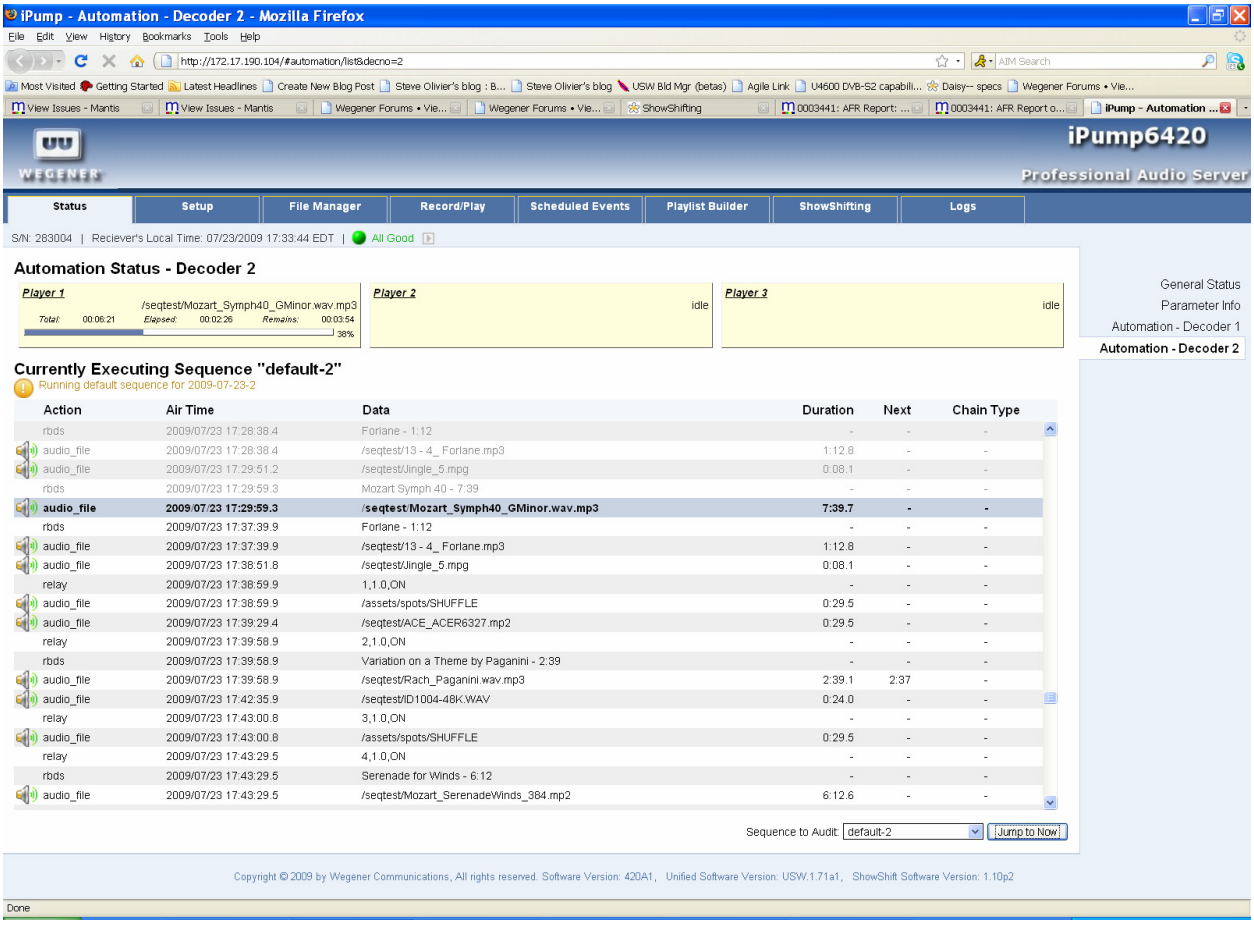
The relevant indicators are:

1. PLAYBACK LED on while Microcasting is running with a valid sequence file

The relevant *new* user controls are:

1. Command to start Microcasting on a Decoder
2. Any permanent Audio Decoder command to go to some other perm setting
3. Use the terminal command 'cert report' to check for "Automation" authorization

Figure 3-19: Automation monitor screen, local web interface



3.7.2. ShowShifting

Overview

ShowShifting is an exciting new premium feature in iPump6420 which allows satellite network operators to reduce the daily satellite bandwidth, and uplink storage, needed to distribute syndicated radio shows. In ShowShifting, a syndicated talk show (for example) can be air'd on the satellite a single time each day, but, at each of many field i6420s, that show episode can air on the respective local radio stations any number of times, with no start-time necessarily occurring at the original satellite air time. This not just a simple recording and re-play of the live audio feed, but a capture and replay of *every* component of the show: The audio track and *associated* Compel commands for local file or playlist plays, cueing relay closures, and RBDS strings.

To make use of ShowShifting, the user must use a few simple concepts. A **Show** is defined as live audio programming that is available on the same Transport Program number, and within that Program, the same audio stream (indentified by Language Descriptor, "LD"), at the same start-time and duration each day, for one or more specified days of the week.* A show **episode** is one single day's airing of that Show. A **shift** (or **Showshift**) of a show **episode** is an instance where an episode is recorded and then played back on one of the Decoders (ports) at some later time, lasting for the same duration. The only restriction on the time for playback is that it must start after, but less than one full week after, the original recording of the episode. Note that a **shift** *definition* may define shifts of *one or more* episodes, but all must be from the same **Show**.

* Note that these show definitions, understood correctly, provide much flexibility on re-airing all or portions of syndicated shows. For instance, a Show could be defined as the air'ing of Clark Howard on the satellite on Program 2, Audio LD =204, M-F at 1:00pm Eastern for 3 hours duration. But since Mr. Howard starts each hour somewhat independently of the others, a **Show** definition like this would also be valid: Program 2, Audio LD =204, Mon-Tues only, 2:00pm Eastern for 1 hour. It is only the imagination of the user which limits how the actual syndicated shows can be defined as **Shows** for purposes of i6420 ShowShifting.

Setup

ShowShifting, is a friendly interface to the iPump6420 Local Scheduler. It allows users to setup Shows and Showshift *definitions*. These definitions become *.json files stored to the i6420 **/u/user/.sysconfig/shows** and **…showshifts** directories, respectively. These definitions are then processed into Local Scheduler events. These Scheduler events can be seen in the local web interface. Later, the Scheduler directs the episode recordings and playbacks. During these recordings and playbacks, the local web ShowShift interface allows the user to monitor their status.

Figure 3-13 shows an example of a local web Showshift **show definition** screen, while **Figure 3-20** (below) shows a **showshift definition** screen. A similar interface is also provided to the Compel uplink control system. By creating and downloading *.json files defining shows and shifts, Compel may control ShowShifting on remote i6420s. While doing this, Compel may allow local users the right only to monitor progress, or the local user may be given permission to both setup and monitor the ShowShift functions. However they are created, Compel defines new Return Path reports that allows those definitions to be returned to the uplink for diagnostics and audits.

Operation

In operation, the Showshift episode recordings always create two files: An MPEG-audio *.mp2 file for the recorded audio track, and a text *.evt file for the Events file. These are both

stored to the **/u/user/showshifts** directory. In the Events file, all Compel commands which were associated with the audio stream while being recorded are themselves recorded. These are stored with precise timestamps indicating the exact time the command is to be executed, relative to the beginning of the episode. For instance, if a Associated Audio Compel command to play a playlist is encountered, and if the playlist and its referenced files exist, then a playlist insert is done in the live audio track. This is done during the playback, just as is done in normal operation if receiving the original live satellite broadcast. In addition, for every audio outage seen in the audio stream *during recording*, an Event is listed, showing the start and duration of the outage. The significance of this on *playback* is this: For short outages, the Decoder will output silence. For outages exceeding a threshold ("**LOS threshold**"), the Decoder will, after a delay ("**LOS delay**"), play audio from a playlist named "**LOA**".* Note that the audio outages may be from *any* source, whether the unit is reboot, the satellite carrier fades out, uplink failure, or any other event that prevents valid MPEG audio from being available to the record process.

* Called LOA only to differentiate from the already used "LOS".

The limits on ShowShift capabilities are as follows: Even while all three Decoders (ports) may be busy playing live audio, or playing back shifted Showshift episodes, or playing other file audio, the i6420 may support *two* simultaneous Showshift episode recordings. This restriction should be enforced in the user web interface, but if an expected Show episode fails to record, the user should check for conflicts. Note that a showshift playback is considered *permanent* while it is in progress. If the unit should reboot during a showshift playback, then playback resumes if not completed. But because Showshifting depends on the Local Scheduler, the unit must be up and running at the show episode record start time and at the shift playback start time. If either is missed, the episode may not record, or it may not play back. When Showshift episode playback finally does end, on a Decoder, then that Decoder resumes its normal permanent activities. If any Compel commands arrive during playback that are Associated with the audio stream which is the normal permanent setting for that Decoder, then these are discarded (if no other recording is taking place). Compel commands directed to the unit itself are always obeyed, regardless of ShowShift activities, except that if the permanent assignment for the Decoder doing playback changes, that change only takes affect after the episode playback is completed.

Note that it is the showshift definitions that end up driving iPump6420 actions. For any episode of a defined Show, if there are no showshifts defined at the start time of the episode, then that episode is not recorded!

During ShowShift ongoing operations, many recorded files will be created, both *.mp2 and *.evt. The name of each will include the creation-date. A cleanup function will run each day, using that date and a user-set expiration time. Those files that exceed the allowed age will be automatically deleted.

Logging of ShowShift operations is similar to normal operation. When a record or playback starts or ends, there will be an Ops Log entry. During playback, if any cue relay closures, those are also logged. During playback, if any local file or playlist inserts, those are logged to the As-run log.

ShowShifting authorizing keyfile names

ShowShifting authorizing keyfiles are named ***serialnumber*-showshift.pem**.

User Indications and controls

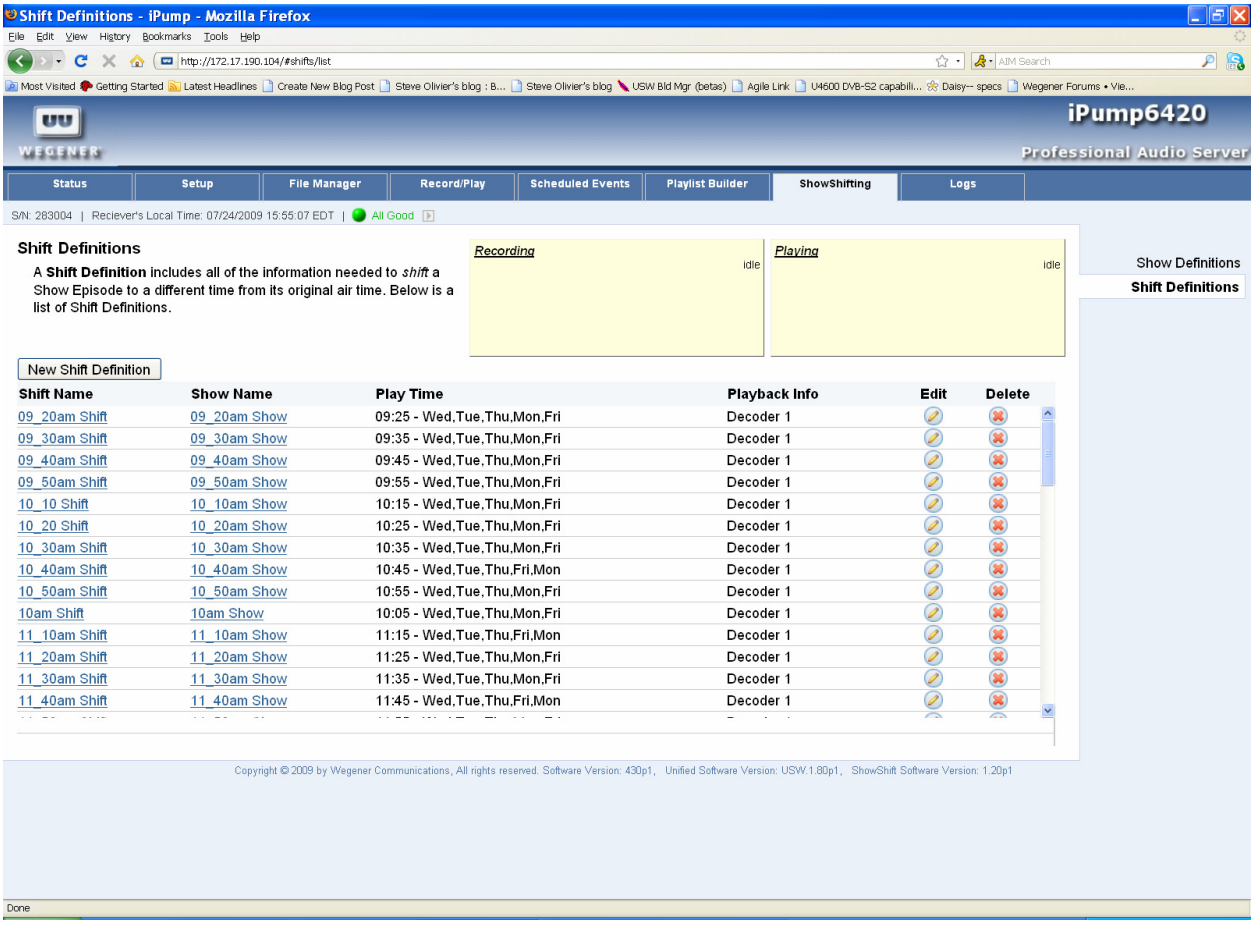
The relevant indicators are:

1. The RECORD LED is ***on*** during ShowShift episode recordings
2. The PLAYBACK LED is ***on*** during ShowShift episode playback on any Decoder

The new relevant user controls are:

1. Create a show definition
2. Edit a show definition
3. Delete a show definition (not allowed if showshifts depend on this!)
4. Create a showshift definition (the ref'd *Show* must be defined first!)
5. Edit a showshift definition
6. Delete a showshift definition
7. Abort a show episode playback (debug only)
8. Auto-deletion expiration time
9. Use the terminal command 'cert report' to check for ShowShift authorization

Figure 3-20: ShowShift Shift-definition screen, local web interface



3.7.3. Time Zone Delay

The new premium Time Zone Delay (TZD) feature allows network operators to save satellite bandwidth by only having to transmit the feed for the easternmost time zone in his coverage area. With Time Zone Delay, iPump6420s in the time zones further west can store and replay the same audio track, with associated Compel commands, at the *same local time everywhere*. In operation, this feature operates as a large rolling time-delay buffer, which can be set to delay and play on any delay up to 4 hours.*

* Contact WEGENER Sales Dept about the option for larger time delay settings.

To operate, either of the two main Audio Decoders (ports) on the i6420, #1 or #2, needs to have a *permanent* assignment to a valid audio stream in the currently-received Transport. Then Time Zone Delay acts like a permanent "add-on" setting. When first activated, the normal live audio track will continue to play and the associated Compel commands for inserts and relay closures will continue to execute. However, the unit will also begin recording that audio and the associated Compel commands, in a manner similar to that done with ShowShifting (see **Section 3.7.2**). When the total content recorded reaches the value of the **TZ delay time**, then the i6420

will switch from playing out the "live" content to playing out "**live delayed**" content. From that point on, the unit will continue to play audio from that stream and execute Compel commands associated with that audio, but both delayed, by the TZ delay time, from their original transmission over the satellite.

If the user wishes to change the TZ delay value, or change the audio stream assigned to that Decoder (port), then the TZD system re-initializes from the top, starting over. Again, it plays true live audio while "charging up" its buffer, and then, when that buffer is full, resumes on live delayed audio. If the unit reboots during operation, then the recording process will note the outage, but the playback process will resume working on the content that is still exactly the TZ Delay in age. For that unit reboot, or any other such outages (e.g. carrier fades), an Event will be written into the rolling event buffer, and, when the unit comes around to the time to play that, it will operate in the same manner as a shifted show episode (see ShowShifting **section 3.7.2**), using either silence and/or the LOA playlist as a filler. In addition to this recovery mechanism, TZ Delay features another level of protection. At user-set intervals, an audit is done over the content recorded for the previous interval.* If the amount of audio content lost exceeds a user-set threshold, then TZ Delay re-initializes from the top, starting over.

* These intervals must divide evenly into a 24 hour day and should be set equal to or less than the TZ delay time.

Timezone Delay authorizing keyfiles are named ***serialnumber*-tzdelay.pem**.

The relevant indicators are:

1. The RECORD LED is ***on*** during TZ Delay
2. The PLAYBACK LED is ***on*** once TZ Delay has a full buffer and is playing delayed content

The new relevant user controls are:

1. Set TZ Delay on a Decoder (port)
2. Set content audit interval
3. Set content audit threshold (some portion of the above interval)
4. Use the terminal command 'cert report' to check for TimeZone Delay authorization

3.7.4. MP3 Codec

For a small added license fee, standard iPump6420s may be upgraded to support MPEG 1, Layer 3 audio files, commonly called "mp3" files. These files are treated no differently than the normally-supported mp2 and wave files. They are playable discretely, or as part of playlists, where they may be combined with the other audio file types. Note that all forms of ID3 tags are supported, either Version 1, or 2, both, or no Tag at all (see spec **Section 1.4**).

MP3 authorizing keyfiles are named ***serialnumber*-mp3.pem**.

The new relevant user controls are:

1. Use the terminal command 'cert report' to check for mp3 authorization

Chapter 4: MAINTENANCE AND TROUBLESHOOTING

This chapter gives information on maintenance and troubleshooting of the iPump 6420.

Table of Contents

4.1. Maintenance

Maintenance of the iPump 6420 is limited to keeping the chassis clean and ensuring that cables remain firmly connected. Occasionally wipe the exterior with soft, damp cloth to remove any accumulated dust and dirt, in order to keep the air vents clear.

Occasionally monitor the unit's temperature indication to see that it remains fairly constant while in use in a static location. A sudden increase in the baseline daily temperature, with no other explanation, may indicate a failure in an internal ventilation fan. If the unit temperature increases, and this may be attributable to a hotter ambient environment, then it is suggested that some effort be made to improve the local cooling. The iPump 6420 will give a much longer operating lifetime if kept cool.

Occasionally monitor the unit for any Warnings about over-temperature or HDD problems. This is especially important if the HDD has seen more than 5 years of operation.

The iPump 6420 incorporates security labels over some of the chassis screws. There are no user-serviceable components within the iPump 6420. Tampering with security labels or opening the unit will void your warranty, *unless you are given written permission by **WEGENER Customer Service** or some other authorized **WEGENER** representative*. If you have any questions, contact **WEGENER's Customer Service Department** at the street address, email address, or phone numbers listed under Customer Service.

4.2. Troubleshooting

When the common system problems occur, and they will, it is best to first consult the first three chapters of *this* Manual. After that, look for your problem in the following subsections and then review the checklists given. Following that, if there is *still* a problem, call **WEGENER Customer Service** for assistance.

4.2.1. Failure to acquire a carrier

1. Sure you do not have carrier lock? Check CARRIER LED.
2. Is signal level displayed on Front-panel between 10 and 90? If only 0, then *functioning* LNB is probably not connected to the i6420, or i6420 internal receiver card is failed.
3. RF input cable securely attached?
4. External LNB powered with DC? Is LNB DC from unit ON?
5. Correct tuning parameters: Carrier frequency, data-rate, FEC ratio?
6. Are carrier ID tags required? Is carrier tag set correctly in i6420?
7. Can other receivers on same antenna lock to this carrier?

8. Can other receivers *anywhere* lock to this carrier? Any of these i6420s?
9. Does i6420 Compel header setting match to Compel header borne on this carrier?
10. Is carrier encrypted?
11. Does it have compatible modulation. If DVB-S2, is your i6420 compatible? Is it a DVB carrier at all?

4.2.2. Failure to get Compel control over satellite

1. Sure you have carrier lock? Check CARRIER LED.
2. Sure you are not getting Compel? Check COMPEL (or "NETWORK") LED.
3. Compel PID set correctly?
4. Does i6420 Compel header setting match to Compel header borne on this carrier?
5. Can Compel control other receivers on this carrier? Other i6420s? Other i6420s right on Transport output from WEGENER UMX5010?

4.2.3. Failure to get Compel control over internet

1. Sure you have internet connection?
2. Are you set to receive Compel over internet of over satellite? This setting, the poll-time, and the server IP addresses are all factory settings that can be changed by advanced users with debug access.
3. Sure you are not really getting Compel over internet? It is a polled system. Have Compel send a dummy command, such as a grouping command, and wait for the polling interval to expire. Does the COMPEL LED ever flash?
4. Which port, LAN or WAN, are you using to connect to remote Compel server?
5. Check IP address, netmask, and Gateway of port you are using. IP address filtered by netmask must match Gateway address. And Gateway address must be assigned to a router that an "reach" the internet.
6. Can other devices on same local network reach Compel server by telnet on port 80?
7. Can other i6420s anywhere get Compel-over-internet?
8. If not using direct IP connection, but modem, is phone number, PPP username, and PPP password correct?
9. If using a modem, can you manually dial the number for the uplink modem server?
10. Can *other* i6420s dial in and connect by PPP through this modem server for Compel-over-internet?

4.2.4. Failure to get live audio play on a Decoder output

1. Sure you have carrier lock? Check CARRIER LED.
2. Sure you are on the correct carrier?
3. Is your audio output wired correctly to be able to listen?
4. Have you connected up AES3 digital audio instead of analog audio, ***OR*** vice versa?
5. Are you playing live audio to any of the 3 Decoders? Check SERVICES LED. Check the other audio outputs.
6. Are you set to correct Program?
7. If Program is OK, are you set to correct Audio Language Descriptor (LD)?
8. Is your audio output command muted?
9. Are you in Recovery Mode, waiting on the Compel stream?
10. Can *any* i6420 monitor this audio stream?

11. Can *any IRD* of any kind monitor this audio stream?
12. On a stream analyzer, is there any activity on that audio PID?

4.2.5. Failure to get file downloads over satellite

1. Sure you have carrier lock? Check CARRIER LED.
2. Are getting Compel? Check COMPEL LED.
3. Sure you are on the correct carrier?
4. Check MPE/IP PID setting matches your uplink.
5. When Compel sends the MADD command, does your COMPEL LED flash? If not, it may not be getting addressed to your i6420.
6. Does your DOWNLOAD LED come on at all? If not, the i6420 is probably not seeing the first file packet with the metadata.
7. Sure you are not actually getting the file download? Check with uplink control on the path/filename used.
8. Can any *other* i6420 get file downloads, especially the same downloads? Make sure to address another known-working unit at the same time with a download and observe both.

4.2.6. Failure to get file downloads over internet (HTTP)

1. Because of the similarities in the missions, do the same checks as in **sections 4.2.3** and **4.2.10**. Can you get Compel over internet (if applicable) and send Return Path reports OK?
2. Are you getting Compel commands to request HTTP downloads? When the uplink says it sends the command, verify the COMPEL LED flashes (or flashes when the unit polls the Compel server, for Compel-over-internet).
3. Can *other* i6420s receive HTTP file downloads OK?

4.2.7. Failure to play file inserts on a Decoder

1. Are you listening to live satellite audio on this decoder now? If not, your wiring may be wrong, or Decoder turned OFF or muted.
2. Sure that the file insert did not actually play? The PLAYBACK LED comes on during play.
3. Sure you are getting Compel, if that is where the command originated?
4. If not playing from Compel, can you play the file from local web?
5. Check that you actually have the file resident on the unit, and you have path/filename correct in the command?
6. Did the file get loaded to the i6420 very recently? If so, it may not yet be registered in the database.
7. When *other* i6420s are commanded to play this file, are they OK?
8. Is the file playable? Can *other* i6420s play this file? Can you play this file from Windows Media Player? See spec **section 1.4** for playable file limitations.
9. If the file is mp3, are you authorized?
10. If you are using a random keyword selector, are there *playable* files in the target i6420 directory?

4.2.8. Failure to play playlists

1. Use the list for file inserts *above* to first check for basic file insertion problems.
2. Double-check the playlist play command for the playlist name. It must match up precisely on the i6420, whitespace and all.
3. Check that your playlist exists. Use the Playlist tab in local web interface.
4. If the playlist play is commanded from Compel, try to play it from the local web.
5. Check that the files you expect to hear are *actually* in the playlist and resident on the i6420.
6. Check the Profile that might be used to play the playlist from Compel. Is the **atten** profile used? If so, make sure that the attenuation is not set too high!

4.2.9. Failure to get local web connection

1. Sure that you are trying to access the i6420 at the LAN port? The WAN port does not allow *inbound* connections.
2. Check the IP address setting on the LAN port, using the front-panel. Did you enter this correctly into your browser?
3. Check that the LAN port is connected to the local Ethernet switch by checking cable connection and looking at the small LEDs on the rear connector. Are they lit? Flashing?
4. Can you PING the i6420 LAN port from the PC hosting your browser? If not, there is no network connection.
5. If no network connection, check that your PC and i6420 are on the same network, as defined by their respective IP addresses and netmasks.
6. If no network connection, and the PC and i6420 are on differing networks, then they must communicate through a router. Is each set to reach the correct gateway router? Is there a network path between the routers, if they are different? After this and the above 2 steps, you are still unable to reach the i6420 from your PC, consult with appropriate IT personnel.
7. Is HTTP access turned OFF in your i6420? Double-check by asking Compel to turn it ON. If you are an advanced user, and can get a serial text terminal on the SERIAL M&C port, then set it ON using the debug 'netsrvs http on' command. (It is beyond this Manual scope to inform how to get debug access.)

4.2.10. Failure to get Return Path reports

1. If requested from Compel, are you *sure* you are getting Compel? Check COMPEL LED is ON. Check that you can address the i6420 from Compel by sending some other command, such as a grouping command. Verify COMPEL LED flashes.
2. When Compel requests the Return Path Status report, does the COMPEL LED flash? If not, the i6420 *still* never received the command. There may be a Compel/CSM problem.
3. Can you manually send a Return Path report by requesting using the 'rpath sendrpt 0' terminal command? This will send a Status report to the CSM function in Compel. Have the uplink personnel check for the incoming Status report (see **Figure 3-1**).

4. Can Compel order and receive Return Path Status reports from *any other* i6420s? If not, then the problem may be in the uplink control system or its IP setup.
5. Can a browser running on a PC on the *same* network with the i6420 reach an internet HTTP server, such as www.wegener.com (or, if no DNS, reach IP address 63.246.5.127)? If not, there is either no connectivity, or no connectivity on the HTTP port 80 *from* your site back to the internet. In this case, consult with appropriate IT personnel.
6. If internet connection is OK from the local Ethernet network, check that the i6420 has a good connection at the LAN or WAN port (whichever you are trying to use). Is there a connection causing the LEDs to light on the rear connector?
7. If the internet connection is OK from the local Ethernet network, is the i6420s IP address, netmask, and gateway set correctly? The gateway *must* be a router with internet access.
8. If not using direct IP connection, but modem, is phone number, PPP username, and PPP password correct?
9. If using a modem, can you manually dial the number for the uplink modem server?
10. Can *other* i6420s dial in and connect by PPP through this modem server for Compel-over-internet?

4.2.11. Failure to upgrade application software

1. Is the problem with application file downloads or switching to the downloaded (now backup) application?
2. If application file download problem, can you get content file downloads? If not, consult **section 4.2.5**.
3. If you can get other content file downloads, then application file downloads are only not accepted if the same app version is being loaded to the backup that is already resident in one of the two positions, primary or backup. To load the same version to both slots, consult **WEGENER Customer Service**.
4. If the problem is *switching* to the backup, be sure you have requested it by the correct version string, the preferred method to load the new application.
5. If the problem is switching to the backup, it may be marked as "bad". If this version had been downloaded by Compel, and failed its self-test, then it will be marked "bad" and cannot be run. Re-download the application and, when you switch over to it, please be sure it can see Compel quickly and do not reboot the unit, at least for the first hour of operation!

Chapter 5: CUSTOMER SERVICE

This chapter gives information on the warranty and technical support available for the iPump 6420.

Table of Contents

5.1. Warranty

The following warranty applies to all **Wegener Communications** products including the **iPump 6420 Professional Audio Server**:

All **Wegener Communications** products are warranted against defective materials and workmanship for a period of **one year** after shipment to customer. **Wegener Communications'** obligation under this warranty is limited to repairing or, at **Wegener Communications'** option, replacing parts, subassemblies, or entire assemblies. **Wegener Communications** shall not be liable for any special, indirect, or consequential damages. This warranty does not cover parts or equipment which have been subject to misuse, negligence, or accident by the customer during use. All shipping costs for warranty repairs will be prepaid by the customer. There are no other warranties, express or implied, except as stated herein.

5.2. Technical Support

If the unit should fail to perform as described, if you need help resolving problems with your **iPump 6420**, or for questions about obtaining service for your **iPump 6400**, please contact **Wegener Communications Customer Service** at **(770) 814-4057**, Fax **(678) 624-0294**, or email service@wegener.com.

To return a product for service:

1. Obtain a **Return Material Authorization (RMA)** number by completing and faxing a copy of the **RMA Request Form** to **(678) 624-0294**. Or you may call or e-mail WEGENER at the contact information given just above. To get an RMA number, you must give us this information: 1) Unit model number (see pre-printed label, usually on the bottom of the unit; 2) Unit serial number (in running i6420, see front-panel Home LCD screen, or also see same label displaying model number; and 3) Brief description of the problem.
2. To help us identify and control returned units, plainly write the RMA number on the outside of the product-shipping container. This will help us return your unit to you as quickly as possible.
3. Return the product, freight prepaid, to the address given below. It is best to use the *original* shipping container to optimally protect the unit. If unable to do so, then any substitute container must adequately protect the unit. ***WEGENER** is not responsible for additional damage to the unit resulting from the use of an unsuitable shipping container.*

Service Department RMA# _____
Wegener Communications, Inc.
359 Curie Drive
Alpharetta, GA 30005

Note: All returned material must be shipped freight prepaid. C.O.D. shipments will not be accepted.

Appendix 1: TERMINAL COMMANDS

Terminal Command Listing

Note, this list in process of cleanup.

Complete Listing of Available Diagterm Commands:
Command - dec 1 audiosamplerate: Sets the output audio sample rate for the decoder
Command - dec 2 audiosamplerate: Sets the output audio sample rate for the decoder
Command - dec 3 audiosamplerate: Sets the output audio sample rate for the decoder
Command - errors: type threshold - Set alarm threshold
type: 'E' for Errored Seconds or 'C' for Continuity Errors
(C is not supported in this release)
threshold: Threshold when to decalre an alarm
Command - HTTP PROXY addr: proxy_ip_addr Sets/displays the HTTP Proxy Address
Command - HTTP PROXY enabled: 0|1 Disables/Enables the use of the HTTP proxy info
Command - HTTP PROXY port: proxy_port Sets/displays the HTTP proxy port
Command - ifconfig: Displays the current ethernet device(s) configuration
Command - ipconfig: Displays the current ethernet device(s) configuration
Command - lan gateway: Sets the network gateway for the LAN interface
Command - lan ip: Set the unit's static LAN IP Address
Command - lan mode: Sets the LAN addressing mode. DHCP, STATIC
Command - lan setup: [ip] [subnet] Sets up IP address and subnet mask for the LAN port
Command - lan subnet: Sets the unit's static LAN Subnet Mask
Command - localtimezone: Set or display the local timezone.
To set: Parameter must be a path to an exisitng binary
zoneinfo timezone relative to the zoneinfo top-level directory.
Command - margin: margin_offset - Set SNR margin offset

Usage: MARGIN margin_offset

margin_offset Range: 1.0 - 10.5 dB

Command - MODEM passwd: passwd Sets the PPP password
Command - MODEM phone: number Sets the dialout phone number
Command - MODEM prefix: string Sets the dialout phone number prefix
Command - MODEM user: name Sets the PPP user name
Command - net dhcpupdate: Tell devices in DHCP mode to poll for DHCP connection
Command - net dns: [primary] [secondary] Sets the primary or secondary dns servers
Command - net forcedns: Force specified dns servers to take precedence over dhcp dns servers
Command - OAR report: Status of Current Active Recording
Command - port: [number]> Select RBDS port

RBDS Command:
Select RBDS DB9 connector
sets DataRate {Databits,Parity,Stopbits}.

Usage:
PORT [number] [datarate] [settings]

number = 1 or 2 for the two RBDS DB9 connectors
datarate = 1200, 2400, 9600
settings = (7|8)(N|E|O|M|S)(0|1|2)

Command - PROFILE report: Reports all profile definitions
Command - pw: passwd Sets the PPP password
Command - RBDS report: Report RBDS Status
Command - RD asi: Report ASI Diagnostics
Command - RD ca: Conditional Access
Command - RD rf: Report Carrier Acquisition/Tracking Diagnostics
Command - RPATH relay: addr, Sets the address of the ReturnPath or mail proxy server.
Command - rpath sendrpt: [report_id] Sends the specified report to the ReturnPath server. See addtional help for id values
report_id: 0 - Health & Status Report (default)
1 - Asset Inventory Report
2 - As-run Log Report (with delete)
3 - As-run Log Report (no delete)
5 - Operational Log Report (with delete)
6 - Operational Log Report (no delete)
7 - Return ShowShift Show Definitions
8 - Return ShowShift Shift Definitions
10 - Return OAR files
Command - RPATH send: [report_id] Sends the specified report to the ReturnPath server. See addtional help for id values
report_id: 0 - Health & Status Report (default)
1 - Asset Inventory Report
2 - As-run Log Report (with delete)
3 - As-run Log Report (no delete)
5 - Operational Log Report (with delete)
6 - Operational Log Report (no delete)
7 - Return ShowShift Show Definitions
8 - Return ShowShift Shift Definitions
10 - Return OAR files
Command - rpath srvraddrbackup: addr, Sets the backup address of the ReturnPath or mail proxy server.
Command - rpath srvraddr: addr, Sets the address of the ReturnPath or mail proxy server.
Command - RP ca: Conditional Access
Command - RP rec: Report Auto Recovery status
Command - RP rf: Report RF Parameters
Command - rrbds: Report RBDS Status
Command - R c: Report Carrier Status
Command - r groups: Report list of groups (not entire table)
Command - r g: [pagel] Report COMPEL Group Table (or page of it)

```
Command - R http: Report HTTP Information
Command - R ns: Report Network Services Status
Command - r oar: Status of Current Active Recording
Command - R profile: Reports all profile definitions
Command - R p: Report Configuration Information
Command - R r: Report Relays Status
Command - r sched: Scheduler status
Command - R st: Report Preset Table
Command - R s: Report Settings Status
Command - r trigger:              Trigger report
Command - sched stat: Scheduler status
Command - setlnb: Set the LNB LO Frequency
 LO_freq   : 0 - 14000.00 MHz
 LO_alias  : C, KU, ELKU, EHKU
Command - SNMP community: Set SNMPv2 Community Access String
Command - snr: margin_offset - Set SNR margin offset
 margin_offset: 1.0 - 10.5
Command - stat sched: Scheduler status
Command - trigger report:              Trigger report
Command - wan gateway: Sets the network gateway for the WAN interface
Command - wan ip: Set the unit's static WAN IP Address
Command - wan mode: Sets the WAN addressing mode. DHCP, STATIC, or WEG
Command - wan setup: [ip] [subnet] Sets up IP address and subnet mask for the WAN port
Command - wan subnet: Sets the unit's static WAN Subnet Mask

addTermCmd( {"playlist", "delete"}, luaterm_delPlaylist )
addTermCmd( {"lua", "cmdargs"}, luaterm_dumpArgs  )
addTermCmd( {"lua", "test1"}, (function (argv) print("lua command, test1!!!\n"); end) )
addTermCmd( {"core","config"}, (function (argv) table.foreach(SYS._hidden_vals,print);
end ) );
addTermCmd( {"core","build"}, (function (argv)
addTermCmd( {"core","luaopts"}, function (argv)
addTermCmd( "ver",       luaterm_verReport )
addTermCmd( "APPSTAT",       luaterm_verReport )
addTermCmd( "sp.",       luaterm_sp )
addTermCmd( "decoff",    luaterm_withDecoder( __decoff    ) )
addTermCmd( "decabort",  luaterm_withDecoder( __decabort  ) )
addTermCmd( "decrejoin", luaterm_withDecoder( __decrejoin ) )
addTermCmd( "decfollowtune", luaterm_withDecoder( __decfollowtune ) )
addTermCmd( "playfile",      luaterm_withDecoder( __playfile ) )
addTermCmd( { "playlist", "play" }, luaterm_withDecoder( playPlaylist ) )
addTermCmd( { "record", "start" }, function( argv )
addTermCmd( "rec1" , function( argv )
addTermCmd("date", function() print(os.date()) end)
addTermCmd( { "seq", "print" },
addTermCmd( { "seq", "validate" },
```

```
addTermCmd( 'syscmd', function(argv) print(os.backticks(unpack(argv))) end )
addTermCmd( { 'group', 'add' }, function( argv ) term_group_cmd( 2, argv[1] ) end )
addTermCmd( { 'group', 'del' }, function( argv ) term_group_cmd( 3, argv[1] ) end )
addTermCmd( {'r', 'dec'},
```

Appendix 2: SNMP MIBS

A2.1. Root MIB

```
WEGENER-ROOT-MIB DEFINITIONS ::= BEGIN

IMPORTS MODULE-IDENTITY, enterprises FROM SNMPv2-SMI;

wegener MODULE-IDENTITY
   LAST-UPDATED "200710312000Z"
   ORGANIZATION "Wegener Communications"
   CONTACT-INFO "Wegener Communications Customer Service
            359 Curie Drive
            Alpharetta, GA 30005
            service@wegener.com
            http://www.wegener.com"

   DESCRIPTION
      "This MIB Contains the root of the Wegener MIB tree"

   REVISION     "200710312000Z"
   DESCRIPTION  "V1.01 PCMI Release"
::= { enterprises 18137 }

cable OBJECT IDENTIFIER ::= { wegener 1 }
broadcast OBJECT IDENTIFIER ::= { wegener 2 }
business OBJECT IDENTIFIER ::= { wegener 3 }
pcmiData OBJECT IDENTIFIER ::= { wegener 4 }
pcmiInfo OBJECT IDENTIFIER ::= { wegener 5 }

dtv7xx OBJECT IDENTIFIER ::= { cable 1 }

END
```

A2.2. PCMI MIB

```
WEGENER-PCMI-MIB DEFINITIONS ::= BEGIN

      IMPORTS
            MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE, FROM SNMPv2-SMI
            MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP FROM SNMPv2-
CONF
            TEXTUAL-CONVENTION          FROM SNMPv2-TC
            DisplayString, INTEGER      FROM RFC1213-MIB
            TRAP-TYPE                   FROM RFC-1215
            wegener                     FROM WEGENER-ROOT-MIB ;

----------------------
-- PCMI Data Module --
----------------------

pcmiData MODULE-IDENTITY
    LAST-UPDATED "200710312000Z"
    ORGANIZATION "Wegener Communications"
    CONTACT-INFO "Wegener Communications Customer Service
                  359 Curie Drive
                  Alpharetta, GA 30005
                  service@wegener.com
                  http://www.wegener.com"

    DESCRIPTION
        "This MIB contains information exported by the common product PCMI
framework"

    REVISION     "200710312000Z"
    DESCRIPTION  "V1.01 PCMI Release"

::= { wegener 4 }


-- PCMI_GRP_UNIT (indexes: 0)

unitGroup OBJECT IDENTIFIER ::= { pcmiData 1 }

-- M_SERIAL_NO
serialNo OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { unitGroup 1 }

-- M_SOFTWARE_VERSION
softwareVersion OBJECT-TYPE
      SYNTAX     DisplayString (SIZE (0..255))
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { unitGroup 2 }

-- M_BACKUP_SOFTWARE_VERSION
```

```
backupsoftwareVersion OBJECT-TYPE
      SYNTAX     DisplayString (SIZE (0..255))
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { unitGroup 3 }

-- M_LOCAL_CONTROL_STATUS
localControlStatus OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      DESCRIPTION
            "Local control allows the local user to change unit settings.  If
Local control is not enabled, certain unit settings may only be modified by
the uplink controls stream (Compel)."
      ::= { unitGroup 5 }

-- M_UNIT_LABEL
unitLabel OBJECT-TYPE
      SYNTAX     DisplayString (SIZE (0..255))
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { unitGroup 6 }

-- M_INTERN_TEMP
internTemp OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { unitGroup 8 }

-- M_MODEL_NUM
modelNum OBJECT-TYPE
      SYNTAX     DisplayString (SIZE (0..255))
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { unitGroup 9 }

-- M_USW_VERSION
uswVersion OBJECT-TYPE
      SYNTAX     DisplayString (SIZE (0..255))
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { unitGroup 17 }



-- PCMI_GRP_TUNER (indexes: 0)

tunerGroup OBJECT IDENTIFIER ::= { pcmiData 2 }

-- M_AGC_STATUS
agcStatus OBJECT-TYPE
      SYNTAX     INTEGER {
                           good(0)
                           high(1)
                           low(2)
```

```
                        unknown(3)
                        goodHigh(4)
                        goodLow(5)
                        noRF(6)
                        rfPresent(7)
                      }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { tunerGroup 1 }

-- M_AVAILABILITY
availability OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      DESCRIPTION
            "In tenths of a percentage"
      ::= { tunerGroup 2 }

-- M_FADES
fades OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { tunerGroup 3 }

-- M_GLITCHES_SINCE_SIGNAL_LOSS
glitchesSinceSignalLoss OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { tunerGroup 4 }

-- M_AVG_EBNO
avgEbno OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      DESCRIPTION
            "Average EbNo in tenth of a dB"
      ::= { tunerGroup 5 }

-- M_INSTANT_EBNO
instantEbno OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      DESCRIPTION
            "Instant EbNo in tenth of a dB"
      ::= { tunerGroup 6 }

-- M_TIME_SINCE_FIRST_ACQ
timeSinceFirstAcq OBJECT-TYPE
      SYNTAX      TimeTicks
      MAX-ACCESS read-only
      STATUS     mandatory
      DESCRIPTION
```

```
            "Time since first Acquisition"
      ::= { tunerGroup 9 }

-- M_TIME_SINCE_LAST_ACQ
timeSinceLastAcq OBJECT-TYPE
      SYNTAX      TimeTicks
      MAX-ACCESS read-only
      STATUS     mandatory
      DESCRIPTION
            "Time since last Acquisition"
      ::= { tunerGroup 10 }

-- M_M_RF_LVL_0_100
rfLvl0100 OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { tunerGroup 14 }

-- M_GLITCHES_IN_1_MIN
glitchesIn1Min OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      DESCRIPTION
            "Num. Glitches over last Minute"
      ::= { tunerGroup 16 }

-- M_M_GLITCHES_IN_5_MIN
glitchesIn5Min OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      DESCRIPTION
            "Num. Glitches over Last 5 Minutes"
      ::= { tunerGroup 17 }

-- M_HI_EBNO
hiEbno OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { tunerGroup 18 }

-- M_LO_EBNO
loEbno OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { tunerGroup 19 }

-- M_RF_HIGH_ERROR_RATE
rfHighErrorRate OBJECT-TYPE
      SYNTAX     INTEGER {
                           false(0)
                           true(1)
                         }
```

```
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { tunerGroup 195 }

-- M_EBNO_AT_MARGIN_LVL
ebnoAtMarginLvl OBJECT-TYPE
      SYNTAX     INTEGER {
                           false(0)
                           true(1)
                         }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { tunerGroup 199 }

-- M_CARRIER_STATUS
carrierStatus OBJECT-TYPE
      SYNTAX     INTEGER {
                           locked(0)
                           notLocked(1)
                           noSignal(2)
                           signalOverload(3)
                         }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { tunerGroup 64 }



-- PCMI_GRP_SETTINGS (indexes: 1)

settingsGroupTable OBJECT-TYPE
      SYNTAX     SEQUENCE OF settingsGroupEntry
      MAX-ACCESS not-accessible
      STATUS     mandatory
      ::= { pcmiData 3 }

settingsGroupEntry OBJECT-TYPE
      SYNTAX      settingsGroupEntry
      MAX-ACCESS  not-accessible
      STATUS            mandatory

      INDEX { settingsGroupIndex }

      ::= { settingsGroupTable 1 }

settingsGroupEntry ::= SEQUENCE {
              settingsGroupIndex INTEGER (0..65535) }

-- index 0 (main)
settingsGroupIndex OBJECT-TYPE
      SYNTAX     INTEGER {
                           commanded(1)
                                                lastsuccess(253)
                                                perm(254)
                                                current(255)
                                                temp(256)
                         }
```

```
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { settingsGroupEntry 1 }

-- M_SYMBOL_FORMAT
symbolFormat OBJECT-TYPE
      SYNTAX     INTEGER {
                           asi(0)
                           qpsk(2)
                           psk8(3)
                           qam16(4)
                           turboqpsk(5)
                           turbopsk8(6)
                           turboqam16(7)
                           dvbs2qpsk(8)
                           dvbs2psk8(9)
                         }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { settingsGroupEntry 2 }

-- M_INPUT_NUMBER
inputNumber OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { settingsGroupEntry 3 }

-- M_CARRIER_FREQUENCY
carrierFrequency OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      DESCRIPTION
            "Units (Mhz) / Factor (.001)"
      ::= { settingsGroupEntry 4 }

-- M_DATA_RATE
dataRate OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { settingsGroupEntry 5 }

-- M_FEC_RATE
fecRate OBJECT-TYPE
      SYNTAX     INTEGER {
                           fec12(0)
                           fec23(1)
                           fec34(2)
                           fec56(3)
                           fec78(4)
                           fec89(5)
                           fec14(6)
                           turbo1fec34(7)
                           turbo2fec34(8)
                           fec13(9)
```

```
                          fec25(10)
                          fec35(11)
                          fec45(12)
                          fec910(13)
                        }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { settingsGroupEntry 6 }

-- M_TAG_SITE
tagSite OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { settingsGroupEntry 7 }

-- M_PROGRAM_NUMBER
programNumber OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { settingsGroupEntry 8 }

-- M_LABEL
label OBJECT-TYPE
      SYNTAX     DisplayString (SIZE (0..255))
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { settingsGroupEntry 9 }

-- M_VALID
valid OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { settingsGroupEntry 10 }

-- M_SETTINGS_LAST_UPDATE
settingsLastUpdate OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { settingsGroupEntry 11 }

-- M_POLARIZATION
polarization OBJECT-TYPE
      SYNTAX     INTEGER {
                          horizontal(0)
                          vertical(1)
                        }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { settingsGroupEntry 14 }

-- M_SYMBOL_RATE
symbolRate OBJECT-TYPE
      SYNTAX     INTEGER
```

```
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { settingsGroupEntry 15 }


srchAcqGroup OBJECT IDENTIFIER ::= { pcmiData 4 }

-- M_IN_RECOVERY
inRecovery OBJECT-TYPE
      SYNTAX     INTEGER {
                           false(0)
                           true(1)
                         }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { srchAcqGroup 192 }

-- M_USING_BACKUP_SETTING
usingBackupSetting OBJECT-TYPE
      SYNTAX     INTEGER {
                           false(0)
                           true(1)
                         }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { srchAcqGroup 193 }


netconGroup OBJECT IDENTIFIER ::= { pcmiData 5 }

-- M_COMPEL_DATA_STATUS
compelDataStatus OBJECT-TYPE
      SYNTAX     INTEGER {
                           inactive(0)
                           unknown(1)
                           haveCompel(2)
                           noCompel(3)
                           noContainer(4)
                           lostContainer(5)
                         }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { netconGroup 64 }




alarmsWarningsGroup OBJECT IDENTIFIER ::= { pcmiData 11 }

-- M_NUM_ALARMS
numAlarms OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
```

```
      ::= { alarmsWarningsGroup 32 }

-- M_NUM_WARNINGS
numWarnings OBJECT-TYPE
      SYNTAX     INTEGER
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { alarmsWarningsGroup 33 }



storageInfoGroup OBJECT IDENTIFIER ::= { pcmiData 15 }

-- M_DISK_USAGE_GT_90
diskUsageGt90 OBJECT-TYPE
      SYNTAX     INTEGER {
                           false(0)
                           true(1)
                         }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { storageInfoGroup 192 }

-- M_DISK_FAILURE
diskFailure OBJECT-TYPE
      SYNTAX     INTEGER {
                           false(0)
                           true(1)
                         }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { storageInfoGroup 193 }



descramGroup OBJECT IDENTIFIER ::= { pcmiData 18 }

-- M_AUTHORIZED_STATUS
authorizedStatus OBJECT-TYPE
      SYNTAX     INTEGER {
                           notEncrypted(0)
                           authorized(1)
                           notAuthorized(2)
                         }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { descramGroup 14 }



swDloadGroup OBJECT IDENTIFIER ::= { pcmiData 19 }

-- M_REVERTED_TO_BACKUP
revertedToBackup OBJECT-TYPE
      SYNTAX     INTEGER {
                           false(0)
                           true(1)
```

```
                        }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { swDloadGroup 193 }



progListGroup OBJECT IDENTIFIER ::= { pcmiData 24 }

-- M_PROG_NOT_IN_PAT
progNotInPat OBJECT-TYPE
      SYNTAX     INTEGER {
                          false(0)
                          true(1)
                        }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { progListGroup 196 }

-- M_PAT_STATUS
patStatus OBJECT-TYPE
      SYNTAX     INTEGER {
                          inactive(0)
                          unknown(1)
                          havePAT(2)
                          noPAT(3)
                          lostPAT(4)
                        }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { progListGroup 64 }



-- PCMI_GRP_PROG_INFO (indexes: 1)

progInfoGroupTable OBJECT-TYPE
      SYNTAX     SEQUENCE OF progInfoGroupEntry
      MAX-ACCESS not-accessible
      STATUS     mandatory
      ::= { pcmiData 25 }

progInfoGroupEntry OBJECT-TYPE
      SYNTAX      progInfoGroupEntry
      MAX-ACCESS  not-accessible
      STATUS            mandatory

      INDEX { progInfoGroupIndex }

      ::= { progInfoGroupTable 1 }

progInfoGroupEntry ::= SEQUENCE {
              progInfoGroupIndex INTEGER (0..65535) }

-- index 0 (main)
progInfoGroupIndex OBJECT-TYPE
      SYNTAX     INTEGER (0..65535)
```

```
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { progInfoGroupEntry 1 }

-- M_PMT_STATUS
pmtStatus OBJECT-TYPE
      SYNTAX     INTEGER {
                           inactive(0)
                           unknown(1)
                           havePMT(2)
                           noPMT(3)
                           lostPMT(4)
                           badPMT(5)
                         }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { progInfoGroupEntry 129 }


----------------------
-- PCMI Info Module --
----------------------

pcmiInfo MODULE-IDENTITY
    LAST-UPDATED "200710312000Z"
    ORGANIZATION "Wegener Communications"
    CONTACT-INFO "Wegener Communications Customer Service
                  359 Curie Drive
                  Alpharetta, GA 30005
                  service@wegener.com
                  http://www.wegener.com"

    DESCRIPTION
        "This MIB contains auxiliary information exported by the common
product PCMI framework"

    REVISION     "200710312000Z"
    DESCRIPTION  "V1.01 PCMI Release"

::= { wegener 5 }









unitInfoTable OBJECT-TYPE
      SYNTAX     SEQUENCE OF unitInfoEntry
      MAX-ACCESS not-accessible
      STATUS     mandatory
      DESCRIPTION
            "A table containing PCMI meta information."
      ::= { pcmiInfo 1 }
```

```
unitInfoEntry OBJECT-TYPE
      SYNTAX      unitInfoEntry
      MAX-ACCESS  not-accessible
      STATUS            mandatory

      INDEX { unitInfoMember unitInfoIndex unitInfoSubIndexOne }

      ::= { unitInfoTable 1 }

unitInfoEntry ::= SEQUENCE {
              unitInfoMember INTEGER (0..255) }

unitInfoMember OBJECT-TYPE
      SYNTAX     INTEGER {
                           serialNo(1)
                           softwareVersion(2)
                           backupSoftwareVersion(3)
                           unitId(4)
                           localControlStatus(5)
                           unitLabel(6)
                           productId(7)
                           internTemp(8)
                           modelNum(9)
                           ac3Support(10)
                           osdDecoderToUse(11)
                           biosVersion(12)
                           cpuType(13)
                           dstObserved(14)
                           localTimezoneOffset(15)
                           featureSupported(16)
                           uswVersion(17)
                           unitPower(18)
                         }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { unitInfoEntry 1 }

unitInfoLastUpdated OBJECT-TYPE
      SYNTAX     TimeTicks
      MAX-ACCESS read-only
      STATUS     mandatory

      DESCRIPTION
            "Last update time for this member/index entry"
      ::= { unitInfoEntry 4 }

unitInfoCmdSource OBJECT-TYPE
      SYNTAX     INTEGER { unknown(1)
                           compel(2)
                           terminal(3)
                           frontPanel(4)
                           osd(5)
                           recovery(6) }
      MAX-ACCESS read-only
      STATUS     mandatory

      DESCRIPTION
```

```
            "Source of the last update"
      ::= { unitInfoEntry 5 }
```

```
settingsInfoTable OBJECT-TYPE
      SYNTAX     SEQUENCE OF settingsInfoEntry
      MAX-ACCESS not-accessible
      STATUS     mandatory
      DESCRIPTION
            "A table containing PCMI meta information."
      ::= { pcmiInfo 3 }

settingsInfoEntry OBJECT-TYPE
      SYNTAX      settingsInfoEntry
      MAX-ACCESS  not-accessible
      STATUS            mandatory

      INDEX { settingsInfoMember settingsInfoIndex settingsInfoSubIndexOne }

      ::= { settingsInfoTable 1 }

settingsInfoEntry ::= SEQUENCE {
              settingsInfoMember INTEGER (0..255),
              settingsInfoIndex INTEGER (0..65535) }

settingsInfoMember OBJECT-TYPE
      SYNTAX     INTEGER {
                           symbolFormat(1)
                           inputNumber(2)
                           carrierFrequency(3)
                           dataRate(4)
                           fecRate(5)
                           tagSite(6)
                           programNumber(7)
                           label(8)
                           valid(9)
                           settingsLastUpdate(10)
                           polarization(13)
                           symbolRate(14)
                         }
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { settingsInfoEntry 1 }

settingsInfoIndex OBJECT-TYPE
      SYNTAX     INTEGER (0..65535)
```

```
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { settingsInfoEntry 2 }

settingsInfoLastUpdated OBJECT-TYPE
      SYNTAX     TimeTicks
      MAX-ACCESS read-only
      STATUS     mandatory

      DESCRIPTION
            "Last update time for this member/index entry"
      ::= { settingsInfoEntry 4 }

settingsInfoCmdSource OBJECT-TYPE
      SYNTAX     INTEGER { unknown(1)
                           compel(2)
                           terminal(3)
                           frontPanel(4)
                           osd(5)
                           recovery(6) }
      MAX-ACCESS read-only
      STATUS     mandatory

      DESCRIPTION
            "Source of the last update"
      ::= { settingsInfoEntry 5 }

settingsInfoIndication OBJECT-TYPE
      SYNTAX     DisplayString (SIZE (0..255))
      MAX-ACCESS read-only
      STATUS     mandatory
      ::= { settingsInfoEntry 6 }




END
```

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Appendix 3: FAULT CONDITIONS

The following list is a compendium of the possible fault *conditions*. Where it makes sense, any of these may be masked to indicate as Alarms, Warning, or give no indication at all:

Front Panel Message	Possible Cause
App Self-testing	New application in self-test
App SW D-load fail	Download of application software failed so backup flash space still shows INCOMPLETE [until good download]
App SW switch fail	Switch to backup application not allowed; either requested app version does not exist or the code image is corrupt or not available
Audio Underrun Dec#	Audio PES data becomes unavailable (buffer underflow) for decoder number-#
Aud not found Dec#	Audio PID not found for decoder number-#
Aud not in PMT Dec#	No audio PID found in PMT with assigned language descriptor for decoder number-#
Aud CMD muted Dec#	Audio output is command muted for decoder number-#
Bad PMT	PMT PID not found or data corrupt
Bad Sec Micro SN	Serial number reported by the internal Secure Micro does not match unit serial number
Cannot Open File	File to play/stream can't be opened
Disk Usage > 90%	Storage device is approaching maximum capacity
Eb/No Margin	Eb/No value less than sum of Threshold + Margin-evaluated over 10 sec. intervals
File Doesn't Exist	File to play doesn't exist
High Error rate	Number of incoming Error'd seconds in Transport exceeds fault threshold
High RF level	RF level may be too high for reliable operation
ID Tags lost	Valid ID tags had been detected and used to allow carrier lock, but now are unavailable, preventing carrier re-acquisition after fades or reboots
ID Tag mismatch	Carrier ID tag in satellite Transport does not match unit tag setting; may have acquired incorrect carrier
Invalid COMPEL Hdr	Compel header in satellite Transport does not match unit Compel header setting; may have acquired incorrect carrier
Invalid File Format	File to play/stream is an unsupported format
IP address conflict	LAN or WAN IP address conflicts with pre-existing host
Lost COMPEL PID	COMPEL PID packets lost (if valid COMPEL seen since signal acquisition and COMPEL disappeared for >2 minutes)
Low RF level	RF level may be too low for reliable operation
Modem Busy Signal	Got busy signal
Modem Failure	Defective Modem or unacceptable connection to Modem
No Answer on Dialout	Called number didn't answer
No ASI stream	ASI Transport stream not detected on ASI Input
No audio for Dec#	No audio allocated to wildcard assigned to decoder number-#
No Carrier lock	Carrier not yet acquired
No COMPEL PID	No COMPEL PID packets received >2 minutes, since signal acquisition

Front Panel Message	Possible Cause
No ID Tag found	No carrier ID tag found on newly-acquired carrier; if carrier ID tag match is required, cannot access this Transport
No LAN detected	No Ethernet network detected at LAN port
No Modem Dial Tone	No dial tone on phone line
No PAT	No PAT (Program Association Table) found in initial Verify Transport [if a warning, while occurring & carrier/ASI still locked]
No PMT	No PMT (Program Map Table) found for Program listed in PAT
No PPP Connection	PPP connection couldn't be established.
No Signal	No carrier lock and no RF power detected at RF input
No valid software	At unit boot-up, boot loader detects no valid application present to load and run; unit will be inoperative & needs to be returned for service
PAT Disappeared	PAT lost after first being verified
Playlist Doesn't Exist	Playlist to play doesn't exist
PMT Disappeared	PMT disappears or becomes corrupt
Program not found	Requested program number not listed in current PAT
Recovery	Auto-Recovery in progress
Reverted to B-up app	User-requested application failed self-test and Unit reverted to Backup application [until next commanded app switch]
Sec Micro no resp	Secure micro cannot be accessed at bootup in order to verify unit serial number
Using backup setting	Current settings derived from successful Auto- Recovery [until local or network user setting command]
Unit overheating	Unit temperature sensor detects very high internal temperature; operator needs to check that ventilation fans have not failed, vents are clear, and ambient temperature is not exceeded

800070-01 Rev. B
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